desidatamodel Documentation

Release 23.1

DESI

Jun 13, 2023

CONTENTS

CHAPTER

ONE

THE DESI DATA TREE

These pages define the directory structure and file formats for DESI data products relative to a root directory `DESI_ROOT`. Each data release has its own `DESI_ROOT`, e.g. the Early Data Release at https://data.desi.lbl.gov/public/edr.

1.1 Data Directories

Directories under `DESI_ROOT`:

- *spectro/data/NIGHT/EXPID/*: Raw data
- *spectro/redux/SPECPROD/*: Processed spectra, classifications, and redshifts
- *target/*: Target selection and fiber assignment catalogs
- *vac/RELEASE/*: Value Added Catalogs

The following directories are more expert-level (e.g. pipeline calibration inputs) and are documented for DESI collaboration internal use and may not be included in data releases:

- *survey/ops/surveyops/*: Data files used for day-to-day survey operations
- *spectro/desi_spectro_calib/*: Spectrograph calibration data
- *protodesi/*: Data and logs from the ProtoDESI campaign (no spectra)
- *$DESISURVEY_OUTPUT*: Outputs from desisurvey and surveysim
- *$DESI_SPECTRO_SIM*: Simulated spectro data
- *$DESIMODEL*: Data used for simulating DESI

1.1.1 vac

`${DESI_ROOT}/vac` contains Value Added Catalogs (VAC). These are typically associated with a specific `RELEASE` such as Early Data Release (EDR).

Subdirectories:

RELEASE

${DESI_ROOT}/vac/RELEASE contains the Value Added Catalogs (VAC) associated with a particular data release. The value of RELEASE will typically be edr, dr1, and so on.

Within this directory, each VAC will have a unique name.

Only some VACs include data model descriptions here; see https://data.desi.lbl.gov/doc/releases/edr/#value-added-catalogs for a full list of DESI Early Data Release VACs and their data models.

lss

$DESI_ROOT/vac/RELEASE/lss contains LSS catalogs reading from most other DESI products, ready for archiving with the early data release. Intermediate files are saved, until we build the clustering-ready catalogs (including weights).

VERSION contains different possible versions of the LSS catalogs, given a production run and a tile selection. As of the EDR release date, there is one single version named v2.0 (we use v2.0 in order to distinguish these catalogs from an internal DESI earlier v1.0 version).

The final clustering-ready catalogs can be found under *LSScats/clustering*, together with the random samples for the same target types. Information about the different target types and the use of the different weights can be found in EDR. DESI Collaboration (in prep.) and in the explanation of *LSScats* subdirectory.

The catalogs are generated using tools from github_lss_repository. For EDR we use the github release tag v2.0.0-EDR

VERSION

$DESI_ROOT/vac/RELEASE/lss/VERSION contains directories for the end-products LSS catalogs (LSScats), inputs based on processing of the spectroscopic reductions (inputs_wspec) and from processing of fiberassign information (potential_assignments), as well as the Alternative Merged Target List (MTL) ledgers (altmtl).

altmtl

$DESI_ROOT/vac/RELEASE/lss/SPECPROD/SURVEY/VERSION/altmtl contains the Merged Target List (MTL) ledgers (*see, e.g.,*) with subpriorities re-seeded, but following the fiber-specific observational information on whether the target assigned to a particular positioner was successful. There are 128 realizations, each in a separate Univ{UNUM} directory, each of which is split into dark and bright programs.

UnivUNUM

$DESI_ROOT/vac/RELEASE/lss/SPECPROD/SURVEY/VERSION/altmtl/UnivUNUM refers to 128 Univ {UNUM} directories. Each contains a dark and a bright directory. Each of these contains the alternative MTL history for the particular seeding of subpriorities.

dark

Each of the `dark` directories associated with each `{UNUM}` hosts an alternative MTL ledger for the DESI dark-time program, with a data format matching that used for actual observations. These ledgers are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles sv3mtl-dark-hp-HPX.ecsv, where HPX is the healpixel number.

sv3mtl-dark-hp-HPX

Summary
MTL ledgers for the DESI dark-time program.

Naming Convention
`sv3mtl-dark-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`sv3mtl-dark-hp-[0-9]+.ecsv`

File Type
ecsv, 0-10 MB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
DR	9	int	Legacy Surveys Data Release used to produce the targets (should always be 9)
FILEHPX	4447	int	HEALPixel integer for the file
FILEN-EST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILEN-SID	32	int	HEALPixel nside used for the file (should always be 32)
INDIR	dr9/1.1.1/targets/main/resolve/dark	str	Location of the directory of targets used to produce the file
OB-SCON	DARK	str	DESI program (DARK, BRIGHT or BACKUP)
SCND	False	bool	Whether the file is a ledger of primary or secondary targets
SURVEY	main	str	DESI survey phase (main, sv2 or sv3)
TS-FORCED	2021-05-13T08:15:37+00:00	str	UTC/ISO TIMESTAMP that was specified to produce initial ledgers

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
TARGETID	int64		Unique DESI targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDI-TIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target’s initial priority from target selection bitmasks and OBSCONDI-TIONS
NUMOBS_INIT	int64		Target’s initial desired number of observations
SCND_TARGET	int64		Target selection bitmask for secondary programs
NU-MOBS_MORE	int64		Desired number of observations given target’s current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target’s state
Z_QN	float64		Redshift measured by QuasarNET
IS_QSO_QN	int16		Classification determined by QuasarNET (1=QSO)
DELTACHI2	float64		Delta-chi-squared for template fit from Redrock
TARGET_STATE	char[18]		Combination of target’s class and its current observational state
TIMESTAMP	char[25]	s	UTC/ISO time at which the target’s state was updated
VERSION	char[5]		Version of desitarget code used to update target’s state
PRIORITY	int64		Target’s current priority

bright

Each of the `bright` directories associated with each `{UNUM}` hosts an alternative MTL ledger for the DESI bright-time program, with a data format matching that used for actual observations. These ledgers are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles sv3mtl-dark-hp-HPX.ecsv, where HPX is the healpixel number.

sv3mtl-bright-hp-HPX

Summary
MTL ledgers for the DESI bright-time program.

Naming Convention
`sv3mtl-bright-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`sv3mtl-bright-hp-[0-9]+.ecsv`

File Type
ecsv, 0-10 MB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
DR	9	int	Legacy Surveys Data Release used to produce the targets (should always be 9)
FILEHPX	4447	int	HEALPixel integer for the file
FILENEST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILENSID	32	int	HEALPixel nside used for the file (should always be 32)
INDIR	dr9/1.1.1/targets/main/resolve/bright	str	Location of the directory of targets used to produce the file
OBSCON	BRIGHT	str	DESI program (DARK, BRIGHT or BACKUP)
SCND	False	bool	Whether the file is a ledger of primary or secondary targets
SURVEY	main	str	DESI survey phase (main, sv2 or sv3)
TSFORCED	2021-05-13T08:15:37+00:00	str	UTC/ISO TIMESTAMP that was specified to produce initial ledgers

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
TARGETID	int64		Unique DESI targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
SCND_TARGET	int64		Target selection bitmask for secondary programs
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
Z_QN	float64		Redshift measured by QuasarNET
IS_QSO_QN	int16		Classification determined by QuasarNET (1=QSO)
DELTACHI2	float64		Delta-chi-squared for template fit from Redrock
TARGET_STATE	char[18]		Combination of target's class and its current observational state
TIMESTAMP	char[25]	s	UTC/ISO time at which the target's state was updated
VERSION	char[5]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

LSScats

`$DESI_ROOT/vac/RELEASE/lss/SPECPROD/SURVEY/VERSION/LSScats` contains the directories for `full` (including information on all targets) and `clustering` (only information needed for clustering measurements and weights/cuts to optimize those clustering measurements). Files detailing the estimated n(z) in units of (h/Mpc)^3 are also here.

Catalogs were created for the four extra-galactic DESI target types: LRG, ELG, QSO, and BGS. For all except QSO, catalogs are produced for additional sub-type definitions. In the cases where the sub-type corresponds to a bitname from SV3 targeting, we use that name:

- The additional LRG selection, named LRG_main, keeps only targets that satisfy the main survey selection (see Zhou et al. (2022) for details).
- The ELG sample is cut in three additional ways. First, ELG_HIP contains only the ~75% of the ELG sample that is at higher priority (see Raichoor et al. (2022) for more details). Then, for each of ELG and ELG_HIP, we also remove QSO targets.
- QSO targets have the highest priority and one may wish to therefore treat any targets that satisfy both the QSO and ELG selections within the QSO analysis.

- Finally, there are two BGS samples: BGS_ANY and BGS_BRIGHT. BGS_ANY is the combination of both the BGS_BRIGHT and BGS_FAINT BGS selections. See Hahn et al. (2022) for more details.

nz

Summary
Contains target densities, as a function of redshift.

Naming Convention
`{TARGET}_{PHOTSYS}_nz.txt`, where `{TARGET}` is `QSO`, `ELG`, `ELGnotqso`, `ELG_HIP`, `ELG_HIPnotqso`, `LRG`, `LRG_main`, for dark or `BGS_ANY`, `BGS_BRIGHT` for bright. `{PHOTSYS}` is the photometric region N or S

Regex
`[a-zA-Z_]+_[NS]_nz\.txt`

File Type
ASCII

Contents

These ASCII files contain data in 6 columns. In the header the area is indicated.

Required Data Table Columns

Name	Type	Units	Description
zmid	float64		Redshift center at the given redshift bin
zlow	float64		Lower limit at the given redshift bin
zhigh	float64		Upper limit at the given redshift bin
n(z)	float64	h^3 Mpc^-3	The comoving number density of the tracer at the given redshift, assuming complete sample
Number_in_bin	float64		Number of tracers at the given redshift bin, including weights
Volume_of_bin	float64	Mpc^3 h^-3	Comoving volumne at the given redshift bin

clustering

`clustering` contains LSS catalogs, separated by target types (*see here for references*), that have been prepared to be used directly to obtain clustering statistics. It includes both data for randoms (separated into 18 files given `{RANN}`).

Descriptions on how to use these to obtain clustering measurements are fully given in EDR. DESI Collaboration (in prep.) and in Lasker et al (in prep.). Any cuts applied to the data catalogs should be equally applied to the random catalogs.

Any number of the random catalogs, `{RANN}` can be used (with the impact only on statistical precision). Large-scale clustering measurements can be accurately obtained via the columns `RA`, `DEC`, `Z`, `WEIGHT`.

For small-scales, pairwise inverse-probability (PIP) weights can be obtained via the BITWEIGHTS column and we further recommend angular up-weighting (as in Mohammad et al. (2020)). If using PIP weights, the `WEIGHT` column should still be used for the random counts (but not used for the data counts).

Clustering LSS catalogs for randoms

Summary
For each target type, LSS catalogs for the randoms, ready to be used for clustering measurements, are provided.

Naming Convention
`{TARGET}_{PHOTSYS}_{RANN}_clustering.ran.fits`, where `{TARGET}` is the target type: `QSO`, `ELG`, `ELGnotqso`, `ELG_HIP`, `ELG_HIPnotqso`, `LRG`, `LRG_main`, for dark or `BGS_ANY`, `BGS_BRIGHT` for bright. `{PHOTSYS}` is the photometric region `N` or `S` and `{RANN}` is the number for the random file (18 total, numbered 0 through 17). Each are random with respect to each other.

Regex
`[a-zA-Z_]+\_[NS]_[0-9]+\_clustering.ran.fits`

File Type
FITS, 193 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	LSS	BINTABLE	Catalog data

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = LSS

Random catalog for clustering statistics

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	115	int	width of table in bytes
NAXIS2	1763774	int	number of rows in table
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Target Right Ascension
DEC	float64	deg	Target declination
TARGETID	int64		Unique DESI target ID
NTILE	int64		Number of tiles target was available on
TILES	char[*]		TILEIDs of those tile, in string form separated by '-'
Z	float64		Redshift measured by Redrock
COMP_TILE	float64		Assignment completeness for all targets of this type with the same value for TILES
ROSETTE_NUMBER	int32		Rosette number ID [0-19]
ROSETTE_R	float64	deg	Radius from the center of the rosette to the target
WEIGHT	float64		The combination of all weights to use
FLUX_G_DERED[1]	float32	nanomaggy	Flux in the g-band after correcting for Galactic extinction (AB system)
FLUX_R_DERED[1]	float32	nanomaggy	Flux in the r-band after correcting for Galactic extinction (AB system)
FLUX_Z_DERED[1]	float32	nanomaggy	Flux in the z-band after correcting for Galactic extinction (AB system)
FLUX_W1_DERED[1]	float32	nanomaggy	Flux in the WISE W1-band after correcting for Galactic extinction (AB system)
FLUX_W2_DERED[1]	float32	nanomaggy	Flux in the WISE W2-band after correcting for Galactic extinction (AB system)
REST_GMR_0P1[1]	float64		Rest-frame g-r colour at redshift=0.1
KCORR_R0P1[1]	float64		r-band k-correction at redshift=0.1
KCORR_G0P1[1]	float64		g-band k-correction at redshift=0.1
KCORR_R0P0[1]	float64		r-band k-correction at redshift=0.0
KCORR_G0P0[1]	float64		g-band k-correction at redshift=0.0
REST_GMR_0P0[1]	float64		Rest-frame g-r colour at redshift=0.0
EQ_ALL_0P0[1]	float64		e-correction at redshift=0.0
EQ_ALL_0P1[1]	float64		e-correction at redshift=0.1
ABSMAG_R[1]	float64		Absolute magnitude in the r-band after k-correction
NZ	float64	h^3 Mpc^-3	The comoving number density of the tracer at the given redshift, assuming complete sample
WEIGHT_FKP	float64		1/(1+NZ*P0), with P0 different for each tracer

Clustering LSS catalogs for data

Summary
For each target type, LSS catalogs for the data, ready to be used for clustering measurements, are provided.

Naming Convention
`{TARGET}_{PHOTSYS}_clustering.dat.fits`, where `{TARGET}` is the target: `QSO`, `ELG`, `ELGnotqso`, `ELG_HIP`, `ELG_HIPnotqso`, `LRG`, `LRG_main`, for dark or `BGS_ANY`, `BGS_BRIGHT` for bright. `{PHOTSYS}` is the photometric region `N` or `S`.

Regex
`[a-zA-Z_]+_[NS]_clustering.dat.fits`

File Type
FITS, 8 MB

[1] Only present in BGS samples

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	LSS	BINTABLE	Catalog data

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = LSS

LSS catalogs for clustering measurements

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	123	int	width of table in bytes
NAXIS2	71051	int	number of rows in table
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Target Right Ascension
DEC	float64	deg	Target declination
TARGETID	int64		Unique DESI target ID
NTILE	int64		Number of tiles target was available on
TILES	char[*]		TILEIDs of those tile, in string form separated by '-'
Z	float64		Redshift measured by Redrock
COMP_TILE	float64		Assignment completeness for all targets of this type with the same value for TILES
ROSETTE_NUMBER	int32		Rosette number ID [0-19]

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Table 1 – continued from previous page

Name	Type	Units	Description
ROSETTE_R	float64	deg	Radius from the center of the rosette to the target
FRACZ_TILELOCID	float64		The fraction of targets of this type at this TILELOCID that received an observation (after forcing each target to a unique TILELOCID)
BITWEIGHTS	int64[2]		A size of two 64 bit masks that encodes which of the alternative assignment histories that the target was assigned in
PROB_OBS	float64		The number alternative assignment histories that the target was assigned in divided by 128
WEIGHT_ZFAIL	float64		Should be all 1 at this point for main survey
WEIGHT	float64		The combination of all weights to use
FLUX_G_DERED[1]	float32	nanomaggy	Flux in the g-band after correcting for Galactic extinction (AB system)
FLUX_R_DERED[Page 12, 1]	float32	nanomaggy	Flux in the r-band after correcting for Galactic extinction (AB system)
FLUX_Z_DERED[Page 12, 1]	float32	nanomaggy	Flux in the z-band after correcting for Galactic extinction (AB system)
FLUX_W1_DERED[Page 12, 1]	float32	nanomaggy	Flux in the WISE W1-band after correcting for Galactic extinction (AB system)
FLUX_W2_DERED[Page 12, 1]	float32	nanomaggy	Flux in the WISE W2-band after correcting for Galactic extinction (AB system)
REST_GMR_0P1[Page 12, 1]	float64		Rest-frame g-r colour at redshift=0.1
KCORR_R0P1[Page 12, 1]	float64		r-band k-correction at redshift=0.1
KCORR_G0P1[Page 12, 1]	float64		g-band k-correction at redshift=0.1
KCORR_R0P0[Page 12, 1]	float64		r-band k-correction at redshift=0.0
KCORR_G0P0[Page 12, 1]	float64		g-band k-correction at redshift=0.0
REST_GMR_0P0[Page 12, 1]	float64		Rest-frame g-r colour at redshift=0.0

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Table 1 – continued from previous page

Name	Type	Units	Description
EQ_ALL_0P0[Page 12, 1]	float64		e-correction at redshift=0.0
EQ_ALL_0P1[1]	float64		e-correction at redshift=0.1
ABSMAG_R[1]	float64		Absolute magnitude in the r-band after k-correction
NZ	float64	h^3 Mpc^-3	The comoving number density of the tracer at the given redshift, assuming complete sample
WEIGHT_FKP	float64		1/(1+NZ*P0), with P0 different for each tracer

full

`full` contains information on all targets identified as reachable by DESI fiberassign, split by target types (LRG, ELG, QSO and BGS), including many columns of photometrically and spectroscopically derived information. These files are available before (`{VETO}` = `_noveto` in the file name) and after vetos related to angular coordinates are applied.

It includes both data for randoms (given `{RANN}` number) and data. These files are created from the *inputs_wspec* files.

The catalogs that are prepared for clustering measurements in the `clustering` directory are derived from these catalogs.

The 'full' LSS catalogs for randoms

Summary
LSS catalogs containing information on all of the random targets identified as reachable by DESI fiberassign, for one of the input randoms. The files are split by target type, random file number, and whether of not vetos for angular positions have been applied.

Naming Convention
`{TARGET}_{RANN}_full{VETO}.ran.fits`, where `{TARGET}` is the target type: `QSO`, `ELG`, `ELGnotqso`, `ELG_HIP`, `ELG_HIPnotqso`, `LRG`, `LRG_main`, for dark or `BGS_ANY`, `BGS_BRIGHT` for bright. `{RANN}` is the number between 0 and 17 designating the given random file, and `{VETO}` is _noveto if vetos have not been applied and blank otherwise.

Regex
`[a-zA-Z_]+\_[0-9]+\_full[a-z_]{0,7}.ran.fits`

File Type
FITS, 1 GB

[1] Only present in BGS samples

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty HDU
HDU1	LSS	BINTABLE	Catalog data

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = LSS

Catalog of randoms

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	259	int	width of table in bytes
NAXIS2	4469949	int	number of rows in table
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
TARGETID	int64		Unique DESI target ID
RA	float64	deg	Target Right Ascension
DEC	float64	deg	Target declination
TILEID	int64		Unique DESI tile ID
ZWARN	int64		Redshift warning bitmask from Redrock
COADD_FIBERSTATUS	int32		bitwise-AND of input FIBERSTATUS
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane

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Table 2 – continued from previous page

Name	Type	Units	Description
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
COADD_NUMEXP	int16		Number of exposures in coadd
COADD_EXPTIME	float32	s	Summed exposure time for coadd
COADD_NUMNIGHT	int16		Number of nights in coadd
MEAN_DELTA_X	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 X location on focal plane
RMS_DELTA_X	float32	mm	RMS (over exposures) of the fiber difference between measured and requested CS5 X location on focal plane
MEAN_DELTA_Y	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 Y location on focal plane
RMS_DELTA_Y	float32	mm	RMS (over exposures) of the fiber difference between measured and requested CS5 Y location on focal plane
MEAN_PSF_TO_FIBER_SPECFLUX	float32		Mean of input exposures fraction of light from point-like source captured by 1.5 arcsec diameter fiber given atmospheric seeing
TSNR2_ELG_B	float32		ELG B template (S/N)^2
TSNR2_LYA_B	float32		LYA B template (S/N)^2
TSNR2_BGS_B	float32		BGS B template (S/N)^2
TSNR2_QSO_B	float32		QSO B template (S/N)^2
TSNR2_LRG_B	float32		LRG B template (S/N)^2
TSNR2_ELG_R	float32		ELG R template (S/N)^2
TSNR2_LYA_R	float32		LYA R template (S/N)^2
TSNR2_BGS_R	float32		BGS R template (S/N)^2
TSNR2_QSO_R	float32		QSO R template (S/N)^2
TSNR2_LRG_R	float32		LRG R template (S/N)^2
TSNR2_ELG_Z	float32		ELG Z template (S/N)^2
TSNR2_LYA_Z	float32		LYA Z template (S/N)^2
TSNR2_BGS_Z	float32		BGS Z template (S/N)^2
TSNR2_QSO_Z	float32		QSO Z template (S/N)^2
TSNR2_LRG_Z	float32		LRG Z template (S/N)^2
TSNR2_ELG	float32		ELG template (S/N)^2 summed over B,R,Z

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Table 2 – continued from previous page

Name	Type	Units	Description
TSNR2_LYA	float32		LYA template (S/N)^2 summed over B,R,Z
TSNR2_BGS	float32		BGS template (S/N)^2 summed over B,R,Z
TSNR2_QSO	float32		QSO template (S/N)^2 summed over B,R,Z
TSNR2_LRG	float32		LRG template (S/N)^2 summed over B,R,Z
TILELOCID	int64		Is 10000*TILEID+LOCATION
GOODHARDLOC	logical		True/False whether the fiber had good hardware
ZPOSSLOC	logical		True/False whether the location could have been assigned to the given target class
NTILE	int64		Number of tiles target was available on
TILES	char[51]		TILEIDs of those tile, in string form separated by '-'
TILELOCIDS	char[159]		TILELOCIDs that the target was available for, separated by '-'
RELEASE	int16		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
NOBS_G	int16		Number of images for central pixel in g-band
NOBS_R	int16		Number of images for central pixel in r-band
NOBS_Z	int16		Number of images for central pixel in z-band
PSFDEPTH_G	float32	nanomaggy^-2	PSF-based depth in g-band
PSFDEPTH_R	float32	nanomaggy^-2	PSF-based depth in r-band
PSFDEPTH_Z	float32	nanomaggy^-2	PSF-based depth in z-band
GALDEPTH_G	float32	nanomaggy^-2	Galaxy model-based depth in g-band
GALDEPTH_R	float32	nanomaggy^-2	Galaxy model-based depth in r-band
GALDEPTH_Z	float32	nanomaggy^-2	Galaxy model-based depth in z-band

continues on next page

Table 2 – continued from previous page

Name	Type	Units	Description
PSFDEPTH_W1	float32	nanomaggy^-2	PSF-based depth in WISE W1
PSFDEPTH_W2	float32	nanomaggy^-2	PSF-based depth in WISE W2
PSFSIZE_G	float32	arcsec	Median PSF size evaluated at the BRICK_PRIMARY objects in this brick in g-band
PSFSIZE_R	float32	arcsec	Median PSF size evaluated at the BRICK_PRIMARY objects in this brick in r-band
PSFSIZE_Z	float32	arcsec	Median PSF size evaluated at the BRICK_PRIMARY objects in this brick in z-band
APFLUX_G	float32	nanomaggy	Total flux in nanomaggies extracted in a 0.75 arcsec radius in the g band at this location
APFLUX_R	float32	nanomaggy	Total flux in nanomaggies extracted in a 0.75 arcsec radius in the r band at this location
APFLUX_Z	float32	nanomaggy	Total flux in nanomaggies extracted in a 0.75 arcsec radius in the z band at this location
APFLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of APFLUX_G
APFLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of APFLUX_R
APFLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of APFLUX_Z
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blending
WISEMASK_W1	binary		Bitwise mask for WISE W1 data
WISEMASK_W2	binary		Bitwise mask for WISE W2 data
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S' for DECaLS

continues on next page

Table 2 – continued from previous page

Name	Type	Units	Description
HPXPIXEL	int64		HEALPixel containing this location at NSIDE=64 in the NESTED scheme
GOODPRI	logical		True/False whether the priority of what was assigned to the location was <= the base priority of the given target class
GOODTSNR	logical		True/False whether the TSNR_<class> value used was above the minimum threshold for the given target class
ROSETTE_NUMBER	int32		Rosette number ID [0-19]
ROSETTE_R	float64	deg	Radius from the center of the rosette to the target
COMP_TILE	float64		Assignment completeness for all targets of this type with the same value for TILES
LRG_MASK[1]	binary		Imaging mask bits relevant to LRG targets

The "full" LSS catalogs for data

Summary
LSS catalogs containing information on all targets identified as reachable by DESI fiberassign, with one entry for each. The files are split by target type and whether of not vetos for angular positions have been applied.

Naming Convention
`{TARGET}_full{VETO}.dat.fits`, where `{TARGET}` is the target type: `QSO`, `ELG`, `ELGnotqso`, `ELG_HIP`, `ELG_HIPnotqso`, `LRG`, `LRG_main`, for dark or `BGS_ANY`, `BGS_BRIGHT` for bright. `{VETO}` is _noveto if vetos have not been applied and blank otherwise

Regex
`[a-zA-Z_]+\_full[a-z_]{0,7}.dat.fits`

File Type
FITS, 1 GB (size varies considerably depending on target type)

[1] Only present in LRG samples

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty HDU
HDU1	LSS	BINTABLE	Catalog data

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = LSS

Catalog data for the given target type; one entry per unique TARGETID

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	712	int	width of table in bytes
NAXIS2	1781907	int	number of rows in table
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Target Right Ascension
DEC	float64	deg	Target declination
TARGETID	int64		Unique DESI target ID
SV3_DESI_TARGET	int64		DESI (dark time program) target selection bitmask for SV3
SV3_BGS_TARGET	int64		BGS (bright time program) target selection bitmask for SV3
SV3_MWS_TARGET	int64		MWS (bright time program) target selection bitmask for SV3
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCONDITIONS

continues on next page

Table 3 – continued from previous page

Name	Type	Units	Description
TARGET_STATE	char[30]		Combination of target class and its current observational state
TIMESTAMP	char[25]	s	UTC/ISO time at which the target state was updated
ZWARN_MTL	int64		The ZWARN from the zmtl file (contains extra bits)
PRIORITY	int64		Target current priority
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
TILEID	int64		Unique DESI tile ID
TILELOCID	int64		Is 10000*TILEID+LOCATION
Z	float64		Redshift measured by Redrock
Z_HP	float64		Redshift from Healpix coadd
ZERR	float64		Redshift error from redrock
ZWARN	int64		Redshift warning bitmask from Redrock
CHI2	float64		Best fit chi squared
COEFF	float64[10]		Redrock template coefficients
NPIXELS	int64		Number of unmasked pixels contributing to the Redrock fit
SPECTYPE	char[6]		Spectral type of Redrock best fit template (e.g. GALAXY, QSO, STAR)
SUBTYPE	char[20]		Spectral subtype
NCOEFF	int64		Number of Redrock template coefficients
DELTACHI2	float64		chi2 difference between first- and second-best redrock template fits
FIBER	int32		Fiber ID on the CCDs [0-4999]
COADD_FIBERSTATUS	int32		bitwise-AND of input FIBERSTATUS
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
COADD_NUMEXP	int16		Number of exposures in coadd

continues on next page

Table 3 – continued from previous page

Name	Type	Units	Description
COADD_EXPTIME	float32	s	Summed exposure time for coadd
COADD_NUMNIGHT	int16		Number of nights in coadd
MEAN_DELTA_X	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 X location on focal plane
RMS_DELTA_X	float32	mm	RMS (over exposures) of the fiber difference between measured and requested CS5 X location on focal plane
MEAN_DELTA_Y	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 Y location on focal plane
RMS_DELTA_Y	float32	mm	RMS (over exposures) of the fiber difference between measured and requested CS5 Y location on focal plane
MEAN_PSF_TO_FIBER_SPECFLUX	float32		Mean of input exposures fraction of light from point-like source captured by 1.5 arcsec diameter fiber given atmospheric seeing
TSNR2_ELG_B	float32		ELG B template (S/N)^2
TSNR2_LYA_B	float32		LYA B template (S/N)^2
TSNR2_BGS_B	float32		BGS B template (S/N)^2
TSNR2_QSO_B	float32		QSO B template (S/N)^2
TSNR2_LRG_B	float32		LRG B template (S/N)^2
TSNR2_ELG_R	float32		ELG R template (S/N)^2
TSNR2_LYA_R	float32		LYA R template (S/N)^2
TSNR2_BGS_R	float32		BGS R template (S/N)^2
TSNR2_QSO_R	float32		QSO R template (S/N)^2
TSNR2_LRG_R	float32		LRG R template (S/N)^2
TSNR2_ELG_Z	float32		ELG Z template (S/N)^2
TSNR2_LYA_Z	float32		LYA Z template (S/N)^2
TSNR2_BGS_Z	float32		BGS Z template (S/N)^2
TSNR2_QSO_Z	float32		QSO Z template (S/N)^2
TSNR2_LRG_Z	float32		LRG Z template (S/N)^2
TSNR2_ELG	float32		ELG template (S/N)^2 summed over B,R,Z
TSNR2_LYA	float32		LYA template (S/N)^2 summed over B,R,Z
TSNR2_BGS	float32		BGS template (S/N)^2 summed over B,R,Z
TSNR2_QSO	float32		QSO template (S/N)^2 summed over B,R,Z

continues on next page

Table 3 – continued from previous page

Name	Type	Units	Description
TSNR2_LRG	float32		LRG template (S/N)^2 summed over B,R,Z
GOODHARDLOC	logical		True/False whether the fiber had good hardware
RELEASE	int16		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
MW_TRANSMISSION_G	float32		Milky Way dust transmission in LS g-band
MW_TRANSMISSION_R	float32		Milky Way dust transmission in LS r-band
MW_TRANSMISSION_Z	float32		Milky Way dust transmission in LS z-band
NOBS_G	int16		Number of images for central pixel in g-band
NOBS_R	int16		Number of images for central pixel in r-band
NOBS_Z	int16		Number of images for central pixel in z-band
PSFDEPTH_G	float32	nanomaggy^-2	PSF-based depth in g-band
PSFDEPTH_R	float32	nanomaggy^-2	PSF-based depth in r-band
PSFDEPTH_Z	float32	nanomaggy^-2	PSF-based depth in z-band
GALDEPTH_G	float32	nanomaggy^-2	Galaxy model-based depth in g-band
GALDEPTH_R	float32	nanomaggy^-2	Galaxy model-based depth in r-band

continues on next page

Table 3 – continued from previous page

Name	Type	Units	Description
GALDEPTH_Z	float32	nanomaggy^-2	Galaxy model-based depth in z-band
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
MW_TRANSMISSION_W1	float32		Milky Way dust transmission in WISE W1
MW_TRANSMISSION_W2	float32		Milky Way dust transmission in WISE W2
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from all sources at this location in 1 arcsec Gaussian seeing
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from all sources at this location in 1 arcsec Gaussian seeing
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from all sources at this location in 1 arcsec Gaussian seeing
WISEMASK_W1	binary		Bitwise mask for WISE W1 data
WISEMASK_W2	binary		Bitwise mask for WISE W2 data
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blending

continues on next page

Table 3 – continued from previous page

Name	Type	Units	Description
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S' for DECaLS
NTILE	int64		Number of tiles target was available on
TILES	char[51]		TILEIDs of those tile, in string form separated by '-'
TILELOCIDS	char[151]		TILELOCIDs that the target was available for, separated by '-'
LOCATION_ASSIGNED	logical		True/False for assigned/unassigned for the target in question
TILELOCID_ASSIGNED	int64		0/1 for unassigned/assigned for TILELOCID in question (it could have been assigned to a different target)
GOODTSNR	logical		True/False whether the TSNR_<class> value used was above the minimum threshold for the given target class
COMP_TILE	float64		Assignment completeness for all targets of this type with the same value for TILES
ROSETTE_NUMBER	int32		Rosette number ID [0-19]
ROSETTE_R	float64	deg	Radius from the center of the rosette to the target
FRACZ_TILELOCID	float64		The fraction of targets of this type at this TILELOCID that received an observation (after forcing each target to a unique TILELOCID)
BITWEIGHTS	int64[2]		A size of two 64 bit masks that encodes which of the alternative assignment histories that the target was assigned in
PROB_OBS	float64		The number alternative assignment histories that the target was assigned in divided by 128

continues on next page

Table 3 – continued from previous page

Name	Type	Units	Description
LRG_MASK[1]	binary		Imaging mask bits relevant to LRG targets
OII_FLUX[Page 24, 1]	float32		Fitted flux for the [OII] doublet
OII_FLUX_IVAR[1]	float32		Inverse variance of the fitted flux for the [OII] doublet
O2C[1]	float64		The criteria for assessing strength of OII emission for ELG observations
Z_RR[1]	float64		Redshift collected from redrock file

inputs_wspec

`$DESI_ROOT/vac/RELEASE/lss/SPECPROD/SURVEY/VERSION/inputs_wspec` contains directories for data and randoms including the precursor files of the LSScats. It includes files with information about the observed location+tile, merged files between mtl files, spectroscopic information and potential assigments, as well as other suplementary output files, for example, a list of bad fibers in the LRG and BGS samples and the ELG dark time emission line outputs.

data

This directory contains intermediate files, including the concatenation of potential assigments with observations, statistics on tiles, redRock results for data.

Alltiles_tilelocs

Summary
Information on the tiles and locations each target appears on.

Naming Convention
`Alltiles_{PROGRAM}_tilelocs.dat.fits`, where `{PROGRAM}` denotes the observing program, either `dark` or `bright`.

Regex
`Alltiles_[a-z]{4,6}_tilelocs.dat.fits`

File Type
FITS, 544 MB

[1] Optional. LRG_MASK only available for LRG samples. OII_FLUX, OII_FLUX_IVAR and O2C only present in ELG samples. Z_RR only present in QSO samples

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	TLINFO	BINTABLE	Catalog data

FITS Header Units

HDU0

Empty

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TLINFO

Information on the tiles and locations each target appears on

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	66	int	width of table in bytes
NAXIS2	8645218	int	number of rows in table
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
NTILE	int64		Number of tiles target was available on
TILES	char[*]		TILEIDs of those tile, in string form separated by '-'
TILELOCIDS	char[*]		TILELOCIDs that the target was available for, separated by '-'

emline_darkallhealpix

Summary
Concatenation of all of the dark time emission line healpix file outputs

Naming Convention
`emline_darkallhealpix.fits`

Regex
`emline_darkallhealpix.fits`

File Type
FITS, 372 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	LSS	BINTABLE	Catalog data

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = LSS

Concatenation of all of the dark time emission line healpix file outputs

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	312	int	width of table in bytes
NAXIS2	1252151	int	number of rows in table
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask from Redrock
SPECTYPE	char[6]		Spectral type of Redrock best fit template (e.g. GAL
DELTACHI2	float64		chi2 difference between first- and second-best redroc
TARGET_RA	float64	deg	Target right ascension
TARGET_DEC	float64	deg	Target declination
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
OII_FLUX	float32	10**-17 erg/(s cm2)	Fitted flux for the [OII] doublet
OII_FLUX_IVAR	float32	10**+34 (s2 cm4) / erg2	Inverse variance of the fitted flux for the [OII] double
OII_SIGMA	float32	Angstrom	Fitted line width (in the observed frame) for the [OII
OII_SIGMA_IVAR	float32	Angstrom^-2	Inverse variance of the fitted line width (in the obser

Table 4 – continued from previous page

Name	Type	Units	Description
OII_CONT	float32	10**-17 erg/(s cm2 Angstrom)	Continuum used for the fitting (fixed value) for the [C
OII_CONT_IVAR	float32	10**+34 (s2 cm4 Angstrom2) / erg2	Inverse variance of the continuum for the [OII] doubl
OII_SHARE	float32		Fitted F1/(F0+F1) for the [OII] doublet, where F0 an
OII_SHARE_IVAR	float32		Inverse variance of the fitted F1/(F0+F1) for the [OII
OII_EW	float32	Angstrom	Fitted rest-frame equivalent width for the [OII] doubl
OII_EW_IVAR	float32	Angstrom^-2	Inverse variance of the fitted rest-frame equivalent w
OII_CHI2	float32		Reduced chi2 of the fit for the [OII] doublet
OII_NDOF	int32		Number of degrees of freedom of the fit for the [OII]
HDELTA_FLUX	float32	10**-17 erg/(s cm2)	Fitted flux for the HDELTA line
HDELTA_FLUX_IVAR	float32	10**+34 (s2 cm4) / erg2	Inverse variance of the fitted flux for the HDELTA lin
HDELTA_SIGMA	float32	Angstrom	Fitted line width (in the observed frame) for the HDE
HDELTA_SIGMA_IVAR	float32	Angstrom^-2	Inverse variance of the fitted line width (in the observ
HDELTA_CONT	float32	10**-17 erg/(s cm2 Angstrom)	Continuum used for the fitting (fixed value) for the H
HDELTA_CONT_IVAR	float32	10**+34 (s2 cm4 Angstrom2) / erg2	Inverse variance of the continuum for the HDELTA l
HDELTA_SHARE	float32		NaN (SHARE not relevant for HDELTA line)
HDELTA_SHARE_IVAR	float32		NaN (SHARE not relevant for HDELTA line)
HDELTA_EW	float32	Angstrom	Fitted rest-frame equivalent width for the HDELTA l
HDELTA_EW_IVAR	float32	Angstrom^-2	Inverse variance of the fitted rest-frame equivalent w
HDELTA_CHI2	float32		Reduced chi2 of the fit for the HDELTA line
HDELTA_NDOF	int32		Number of degrees of freedom of the fit for the HDE
HGAMMA_FLUX	float32	10**-17 erg/(s cm2)	Fitted flux for the HGAMMA line
HGAMMA_FLUX_IVAR	float32	10**+34 (s2 cm4) / erg2	Inverse variance of the fitted flux for the HGAMMA
HGAMMA_SIGMA	float32	Angstrom	Fitted line width (in the observed frame) for the HGA
HGAMMA_SIGMA_IVAR	float32	Angstrom^-2	Inverse variance of the fitted line width (in the observ
HGAMMA_CONT	float32	10**-17 erg/(s cm2 Angstrom)	Continuum used for the fitting (fixed value) for the H
HGAMMA_CONT_IVAR	float32	10**+34 (s2 cm4 Angstrom2) / erg2	Inverse variance of the continuum for the HGAMMA
HGAMMA_SHARE	float32		NaN (SHARE not relevant for HGAMMA line)
HGAMMA_SHARE_IVAR	float32		NaN (SHARE not relevant for HGAMMA line)
HGAMMA_EW	float32	Angstrom	Fitted rest-frame equivalent width for the HGAMMA
HGAMMA_EW_IVAR	float32	Angstrom^-2	Inverse variance of the fitted rest-frame equivalent w
HGAMMA_CHI2	float32		Reduced chi2 of the fit for the HGAMMA line
HGAMMA_NDOF	int32		Number of degrees of freedom of the fit for the HGA
HBETA_FLUX	float32	10**-17 erg/(s cm2)	Fitted flux for the HBETA line
HBETA_FLUX_IVAR	float32	10**+34 (s2 cm4) / erg2	Inverse variance of the fitted flux for the HBETA line
HBETA_SIGMA	float32	Angstrom	Fitted line width (in the observed frame) for the HBE
HBETA_SIGMA_IVAR	float32	Angstrom^-2	Inverse variance of the fitted line width (in the observ
HBETA_CONT	float32	10**-17 erg/(s cm2 Angstrom)	Continuum used for the fitting (fixed value) for the H
HBETA_CONT_IVAR	float32	10**+34 (s2 cm4 Angstrom2) / erg2	Inverse variance of the continuum for the HBETA lin
HBETA_SHARE	float32		NaN (SHARE not relevant for HBETA line)
HBETA_SHARE_IVAR	float32		NaN (SHARE not relevant for HBETA line)
HBETA_EW	float32	Angstrom	Fitted rest-frame equivalent width for the HBETA lin
HBETA_EW_IVAR	float32	Angstrom^-2	Inverse variance of the fitted rest-frame equivalent w
HBETA_CHI2	float32		Reduced chi2 of the fit for the HBETA line
HBETA_NDOF	int32		Number of degrees of freedom of the fit for the HBE
OIII_FLUX	float32	10**-17 erg/(s cm2)	Fitted flux for the [OIII] doublet
OIII_FLUX_IVAR	float32	10**+34 (s2 cm4) / erg2	Inverse variance of the fitted flux for the [OIII] doubl
OIII_SIGMA	float32	Angstrom	Fitted line width (in the observed frame) for the [OII
OIII_SIGMA_IVAR	float32	Angstrom^-2	Inverse variance of the fitted line width (in the observ
OIII_CONT	float32	10**-17 erg/(s cm2 Angstrom)	Continuum used for the fitting (fixed value) for the [C

Table 4 – continued from previous page

Name	Type	Units	Description
OIII_CONT_IVAR	float32	10**+34 (s2 cm4 Angstrom2) / erg2	Inverse variance of the continuum for the [OIII] doub
OIII_SHARE	float32		F1/(F0+F1) for the [OIII] doublet, where F0 and F1 a
OIII_SHARE_IVAR	float32		Infinite value, as SHARE is fixed during the fit
OIII_EW	float32	Angstrom	Fitted rest-frame equivalent width for the [OIII] doub
OIII_EW_IVAR	float32	Angstrom^-2	Inverse variance of the fitted rest-frame equivalent w
OIII_CHI2	float32		Reduced chi2 of the fit for the [OIII] doublet
OIII_NDOF	int32		Number of degrees of freedom of the fit for the [OIII
HALPHA_FLUX	float32	10**-17 erg/(s cm2)	Fitted flux for the HALPHA line
HALPHA_FLUX_IVAR	float32	10**+34 (s2 cm4) / erg2	Inverse variance of the fitted flux for the HALPHA li
HALPHA_SIGMA	float32	Angstrom	Fitted line width (in the observed frame) for the HAL
HALPHA_SIGMA_IVAR	float32	Angstrom^-2	Inverse variance of the fitted line width (in the obser
HALPHA_CONT	float32	10**-17 erg/(s cm2 Angstrom)	Continuum used for the fitting (fixed value) for the H
HALPHA_CONT_IVAR	float32	10**+34 (s2 cm4 Angstrom2) / erg2	Inverse variance of the continuum for the HALPHA l
HALPHA_SHARE	float32		NaN (SHARE not relevant for HALPHA line)
HALPHA_SHARE_IVAR	float32		NaN (SHARE not relevant for HALPHA line)
HALPHA_EW	float32	Angstrom	Fitted rest-frame equivalent width for the HALPHA l
HALPHA_EW_IVAR	float32	Angstrom^-2	Inverse variance of the fitted rest-frame equivalent w
HALPHA_CHI2	float32		Reduced chi2 of the fit for the HALPHA line
HALPHA_NDOF	int32		Number of degrees of freedom of the fit for the HAL

datcomb_tarspecwdup_Alltiles

Summary
Match of targets (with duplicates after FA) with spectroscopic data from the specprod (fuji/guadalupe for SV3/DA02).

Naming Convention
`datcomb_{PROGRAM}_tarspecwdup_Alltiles.fits`, where `{PROGRAM}` denotes the observing program, either `dark` or `bright`.

Regex
`datcomb_[a-z]{4,6}_tarspecwdup_Alltiles.fits`

File Type
FITS, 2 GB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	ZCATALOG	BINTABLE	Catalog data

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = ZCATALOG

Match catalog between spectroscopic information and duplicate targets after running fiber assigments

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	499	int	width of table in bytes
NAXIS2	4461559	int	number of rows in table
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Target Right Ascension
DEC	float64	deg	Target declination
REF_EPOCH[1]	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gaia
PARALLAX[Page 32, 1]	float32	mas	Reference catalog parallax
PMRA[Page 32, 1]	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec))
PMDEC[Page 32, 1]	float32	mas yr^-1	Proper motion in the +Dec direction
TARGETID	int64		Unique DESI target ID
OBSCONDITIONS[Page 32, 1]	int32		Bitmask of allowed observing conditions

continues on next page

Table 5 – continued from previous page

Name	Type	Units	Description
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT[Page 32, 1]	int64		Initial number of observations for target calculated across target selection bitmasks and OBSCONDITIONS
NUMOBS_MORE[Page 32, 1]	int64		Number of additional observations needed
NUMOBS[Page 32, 1]	int64		Number of spectroscopic observations (on this specific, single tile)
ZWARN_MTL	int64		The ZWARN from the zmtl file (contains extra bits)
ZTILEID[Page 32, 1]	int32		ID of tile that most recently updated target's state
TARGET_STATE	char[30]		Combination of target class and its current observational state
TIMESTAMP	char[25]	s	UTC/ISO time at which the target state was updated
VERSION[Page 32, 1]	char[14]		Tag of desitarget used to create the target catalog
PRIORITY	int64		Target current priority
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
TILEID	int64		Unique DESI tile ID
TILELOCID	int64		Is 10000*TILEID+LOCATION
Z	float64		Redshift measured by Redrock
ZERR	float64		Redshift error from redrock
ZWARN	int64		Redshift warning bitmask from Redrock
CHI2	float64		Best fit chi squared
COEFF	float64[10]		Redrock template coefficients
NPIXELS	int64		Number of unmasked pixels contributing to the Redrock fit
SPECTYPE	char[6]		Spectral type of Redrock best fit template (e.g. GALAXY, QSO, STAR)
SUBTYPE	char[20]		Spectral subtype

continues on next page

Table 5 – continued from previous page

Name	Type	Units	Description
NCOEFF	int64		Number of Redrock template coefficients
DELTACHI2	float64		chi2 difference between first- and second-best redrock template fits
FIBER	int32		Fiber ID on the CCDs [0-4999]
COADD_FIBERSTATUS	int32		bitwise-AND of input FIBERSTATUS
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
COADD_NUMEXP	int16		Number of exposures in coadd
COADD_EXPTIME	float32	s	Summed exposure time for coadd
COADD_NUMNIGHT	int16		Number of nights in coadd
MEAN_DELTA_X	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 X location on focal plane
RMS_DELTA_X	float32	mm	RMS (over exposures) of the fiber difference between measured and requested CS5 X location on focal plane
MEAN_DELTA_Y	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 Y location on focal plane
RMS_DELTA_Y	float32	mm	RMS (over exposures) of the fiber difference between measured and requested CS5 Y location on focal plane
MEAN_PSF_TO_FIBER_SPECFLUX	float32		Mean of input exposures fraction of light from point-like source captured by 1.5 arcsec diameter fiber given atmospheric seeing
TSNR2_ELG_B	float32		ELG B template (S/N)^2
TSNR2_LYA_B	float32		LYA B template (S/N)^2
TSNR2_BGS_B	float32		BGS B template (S/N)^2
TSNR2_QSO_B	float32		QSO B template (S/N)^2
TSNR2_LRG_B	float32		LRG B template (S/N)^2
TSNR2_ELG_R	float32		ELG R template (S/N)^2
TSNR2_LYA_R	float32		LYA R template (S/N)^2
TSNR2_BGS_R	float32		BGS R template (S/N)^2

continues on next page

Table 5 – continued from previous page

Name	Type	Units	Description
TSNR2_QSO_R	float32		QSO R template (S/N)^2
TSNR2_LRG_R	float32		LRG R template (S/N)^2
TSNR2_ELG_Z	float32		ELG Z template (S/N)^2
TSNR2_LYA_Z	float32		LYA Z template (S/N)^2
TSNR2_BGS_Z	float32		BGS Z template (S/N)^2
TSNR2_QSO_Z	float32		QSO Z template (S/N)^2
TSNR2_LRG_Z	float32		LRG Z template (S/N)^2
TSNR2_ELG	float32		ELG template (S/N)^2 summed over B,R,Z
TSNR2_LYA	float32		LYA template (S/N)^2 summed over B,R,Z
TSNR2_BGS	float32		BGS template (S/N)^2 summed over B,R,Z
TSNR2_QSO	float32		QSO template (S/N)^2 summed over B,R,Z
TSNR2_LRG	float32		LRG template (S/N)^2 summed over B,R,Z
SV3_DESI_TARGET	int64		DESI (dark time program) target selection bitmask for SV3
SV3_BGS_TARGET	int64		BGS (bright time program) target selection bitmask for SV3
SV3_MWS_TARGET	int64		MWS (bright time program) target selection bitmask for SV3

bad_fibers

Summary
Contains list of bad fibers in LRG + BGS samples.

Naming Convention
There is one single file called `lrg+bgs_3sig_bad_fibers.txt`

Regex
`lrg\+bgs_3sig_bad_fibers\.txt`

File Type
ASCII

[1] Optional

Contents

These ASCII files contain 1 column as the list of bad fibers, defined as the column `FIBER` in the datamodel.

random

This directory contains intermediate files for randoms, precursors of the LSScats files. It includes the concatenation of potential assigments with observations and statistics on tiles.

rancomb_Alltilelocinfo

Summary
For a random associated with `{RANN}`, the list of unique TARGETIDs with number of appearances as reachable according to fiber assigment and details on those appearances.

Naming Convention
`rancomb_{RANN}{PROGRAM}_Alltilelocinfo.fits`, where `{RANN}` is the number of the random file (0 through 17) and `{PROGRAM}` is the observing program, either `dark` or `bright`.

Regex
`rancomb_[0-9]+(dark|bright)_Alltilelocinfo.fits`

File Type
FITS, 327 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	TLINFO	BINTABLE	Catalog data

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TLINFO

Information on the tiles and locations that a given random appears on.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	66	int	width of table in bytes
NAXIS2	5196355	int	number of rows in table
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
NTILE	int64		Number of tiles target was available on
TILES	char[*]		TILEIDs of those tile, in string form separated by '-'
TILELOCIDS	char[*]		TILELOCIDs that the target was available for, separated by '-'

rancomb_wdupspec

Summary
Match of potential assignments from randoms with information from the observed spectroscopic and target sample given the tile and the location.

Naming Convention
`rancomb_{RANN}{PROGRAM}wdupspec__Alltiles.fits`, where `{RANN}` is the number of the random file (0 through 17) and `{PROGRAM}` is the observing program, either `dark` or `bright`.

Regex
`rancomb_[0-9]+(dark|bright)wdupspec_Alltiles.fits`

File Type
FITS, 1 GB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	ZCATALOG	BINTABLE	Catalog data

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = ZCATALOG

Main data HDU. Merger of randoms to target info in given fibers

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	184	int	width of table in bytes
NAXIS2	6045226	int	number of rows in table
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
TARGETID	int64		Unique DESI target ID
RA	float64	deg	Target Right Ascension
DEC	float64	deg	Target declination
TILEID	int64		Unique DESI tile ID
ZWARN	int64		Redshift warning bitmask from Redrock
COADD_FIBERSTATUS	int32		bitwise-AND of input FIBERSTATUS
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
COADD_NUMEXP	int16		Number of exposures in coadd
COADD_EXPTIME	float32	s	Summed exposure time for coadd
COADD_NUMNIGHT	int16		Number of nights in coadd
MEAN_DELTA_X	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 X location
RMS_DELTA_X	float32	mm	RMS (over exposures) of the fiber difference between measured and requ
MEAN_DELTA_Y	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 Y location
RMS_DELTA_Y	float32	mm	RMS (over exposures) of the fiber difference between measured and requ
MEAN_PSF_TO_FIBER_SPECFLUX	float32		Mean of input exposures fraction of light from point-like source captured
TSNR2_ELG_B	float32		ELG B template (S/N)^2
TSNR2_LYA_B	float32		LYA B template (S/N)^2
TSNR2_BGS_B	float32		BGS B template (S/N)^2
TSNR2_QSO_B	float32		QSO B template (S/N)^2
TSNR2_LRG_B	float32		LRG B template (S/N)^2
TSNR2_ELG_R	float32		ELG R template (S/N)^2
TSNR2_LYA_R	float32		LYA R template (S/N)^2
TSNR2_BGS_R	float32		BGS R template (S/N)^2
TSNR2_QSO_R	float32		QSO R template (S/N)^2
TSNR2_LRG_R	float32		LRG R template (S/N)^2
TSNR2_ELG_Z	float32		ELG Z template (S/N)^2
TSNR2_LYA_Z	float32		LYA Z template (S/N)^2
TSNR2_BGS_Z	float32		BGS Z template (S/N)^2

Table 6 – continued from previous page

Name	Type	Units	Description
TSNR2_QSO_Z	float32		QSO Z template (S/N)^2
TSNR2_LRG_Z	float32		LRG Z template (S/N)^2
TSNR2_ELG	float32		ELG template (S/N)^2 summed over B,R,Z
TSNR2_LYA	float32		LYA template (S/N)^2 summed over B,R,Z
TSNR2_BGS	float32		BGS template (S/N)^2 summed over B,R,Z
TSNR2_QSO	float32		QSO template (S/N)^2 summed over B,R,Z
TSNR2_LRG	float32		LRG template (S/N)^2 summed over B,R,Z
TILELOCID	int64		Is 10000*TILEID+LOCATION

potential_assignments

`$DESI_ROOT/vac/RELEASE/lss/SPECPROD/SURVEY/VERSION/potential_assignments` contains directories for the potential assigment outputs from fiber assigment, reading from *$DESI_TARGET/fiberassign* and concatenated into single files, for data and randoms separately. In the case of randoms, it also contains the complete fiber assigment files run with the same configuration as with the data.

data

This directory contains the concatenated potential assigments outputs for data.

datcomb_tarwdup

Summary
File with information about all targets after match with potential assigment from FA.

Naming Convention
`datcomb_{PROGRAM}_tarwdup_Alltiles.fits`, where `{PROGRAM}` refers to the observing program, either `dark` or `bright`.

Regex
`datcomb_(dark|bright)_tarwdup_Alltiles.fits`

File Type
FITS, 1 GB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	POTENTIAL_ASSIGNMENTS	BINTABLE	Catalog data

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = POTENTIAL_ASSIGNMENTS

Merge between potential assigments from fiber assigment and input targets

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	151	int	width of table in bytes
NAXIS2	10117500	int	number of rows in table
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Target Right Ascension
DEC	float64	deg	Target declination
TARGETID	int64		Unique DESI target ID
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCONDITIONS
ZWARN_MTL	int64		The ZWARN from the zmtl file (contains extra bits)
TARGET_STATE	char[30]		Combination of target class and its current observational state
TIMESTAMP	char[25]	s	UTC/ISO time at which the target state was updated
PRIORITY	int64		Target current priority
FIBER	int32		Fiber ID on the CCDs [0-4999]
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
TILEID	int64		Unique DESI tile ID
SV3_DESI_TARGET[1]	int64		DESI (dark time program) target selection bitmask for SV3
SV3_MWS_TARGET[1]	int64		MWS (bright time program) target selection bitmask for SV3
SV3_BGS_TARGET[1]	int64		BGS (bright time program) target selection bitmask for SV3

[1] Optional, only in dark sample. For the bright sample, they are recoverable from the target catalogs

random

This directory contains directories for the individual potential assigments for randoms in {RANN} going from 0 to 17 (18 randoms).

RANN

This directory contains a directory to the original fiber assigment files for randoms, under *fba* and the concatenated potential assigments file.

rancomb_wdup_Alltiles

Summary
It is a file with information about all random targets after match with potential assigment in fiber assigment.

Naming Convention
`rancomb_{PROGRAM}wdup_Alltiles.fits`, where `{PROGRAM}` is either `dark` or `bright`.

Regex
`rancomb_[a-z]{4,6}wdup_Alltiles.fits`

File Type
FITS, 145 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	FAVAIL	BINTABLE	Catalog data

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = FAVAIL

Merge between potential assigments from fiber assigment and random targets

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	40	int	width of table in bytes
NAXIS2	3825185	int	number of rows in table
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
TARGETID	int64		Unique DESI target ID
RA	float64	deg	Target Right Ascension
DEC	float64	deg	Target declination
TILEID	int64		Unique DESI tile ID

rancomb_Alltilelocinfo

Summary
For random associated with `RANN` given in the directory, the list of unique TARGETIDs with number of appearances as reachable according to fiber assigment and details on those appearances.

Naming Convention
`rancomb_{PROGRAM}_Alltilelocinfo.fits`, where `{PROGRAM}` denotes the observing program, either `dark` or `bright`.

Regex
`rancomb_[a-z]{4,6}_Alltilelocinfo.fits`

File Type
FITS, 100 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	TILELOC	BINTABLE	Catalog data

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TILELOC

Table for randoms with RANN, given by the directory with unique TARGETIDS (randoms) associated with tiles where it has potentially being observed after fiber assigment

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	226	int	width of table in bytes
NAXIS2	465355	int	number of rows in table
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
NTILE	int64		Number of tiles target was available on
TILES	char[51]		TILEIDs of those tile, in string form separated by '-'
TILELOCIDS	char[159]		TILELOCIDs that the target was available for, separated by '-'

fba

This directory contains the individual fiber assigment for randoms, separated by tiles.

fba

Summary
The fiberassign file contains the fiber positioner configuration information for each exposure for the given randoms.

Naming Convention
`fba-{TILEID}.fits`, where *{TILEID}* is the 8-digit exposure ID.

Regex
`fba-[0-9]{6}.fits`

File Type
FITS, 1 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Headers
HDU1	FASSIGN	BINTABLE	Target assignments for each fiber
HDU2	FTARGETS	BINTABLE	List of targets that are reachable by a positioner
HDU3	FAVAIL	BINTABLE	All possible (TARGETID, FIBER, LOCATION) assignments

FITS Header Units

HDU0

EXTNAME = PRIMARY

No data, but some useful header keywords

This HDU has no non-standard required keywords.

Empty HDU.

Required Header Keywords

KEY	Example Value	Type	Comment
TILEID	30	int	
TILERA	179.719	float	
TILEDEC	-0.016	float	
FIELDROT	0.000298543513740412	float	
FA_PLAN	2022-07-01T00:00:00.000	str	
FA_HA	0.0	float	
FA_RUN	2021-04-10T21:28:37+00:00	str	
REQRA	179.719	float	
REQDEC	-0.016	float	
FIELDNUM	0	int	
FA_VER	2.3.0	str	
FA_SURV	sv3	str	

HDU1

EXTNAME = FASSIGN

The target assignments for each fiber of this tile

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	66	int	width of table in bytes
NAXIS2	5020	int	number of rows in table
TILEID	30	int	
TILERA	179.719	float	
TILEDEC	-0.016	float	
FIELDROT	0.000298543513740412	float	
FA_PLAN	2022-07-01T00:00:00.000	str	
FA_HA	0.0	float	
FA_RUN	2021-04-10T21:28:37+00:00	str	
REQRA	179.719	float	
REQDEC	-0.016	float	
FIELDNUM	0	int	
FA_VER	2.3.0	str	
FA_SURV	sv3	str	
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
FIBER	int32		Fiber ID on the CCDs [0-4999]
TARGETID	int64		Unique DESI target ID
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBERSTATUS	int32		Fiber status mask. 0=good
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
DEVICE_TYPE	char[3]		Device type
TARGET_RA	float64	deg	Target right ascension
TARGET_DEC	float64	deg	Target declination
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky)
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane

HDU2

EXTNAME = FTARGETS

Unique list of targets reachable by a positioner

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	49	int	width of table in bytes
NAXIS2	16584	int	number of rows in table
TILEID	30	int	
TILERA	179.719	float	
TILEDEC	-0.016	float	
FIELDROT	0.000298543513740412	float	
FA_PLAN	2022-07-01T00:00:00.000	str	
FA_HA	0.0	float	
FA_RUN	2021-04-10T21:28:37+00:00	str	
REQRA	179.719	float	
REQDEC	-0.016	float	
FIELDNUM	0	int	
FA_VER	2.3.0	str	
FA_SURV	sv3	str	
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
TARGET_RA	float64	deg	Target right ascension
TARGET_DEC	float64	deg	Target declination
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky)
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions

HDU3

EXTNAME = FAVAIL

A list of targets that could have been assigned to each fiber

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	16	int	width of table in bytes
NAXIS2	18420	int	number of rows in table
TILEID	30	int	
TILERA	179.719	float	
TILEDEC	-0.016	float	
FIELDROT	0.000298543513740412	float	
FA_PLAN	2022-07-01T00:00:00.000	str	
FA_HA	0.0	float	
FA_RUN	2021-04-10T21:28:37+00:00	str	
REQRA	179.719	float	
REQDEC	-0.016	float	
FIELDNUM	0	int	
FA_VER	2.3.0	str	
FA_SURV	sv3	str	
DESIDR	edr	str	DESI Data Release

Required Data Table Columns

Name	Type	Units	Description
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
TARGETID	int64		Unique DESI target ID

lya

This value-added catalog contains the measured Lyman-alpha forest fluctuations from DESI data. For more details see the data documentation

SPECPROD

`SPECPROD` refers to the spectroscopic production run. For DESI EDR, this is `fuji`. It forms part of the catalog version.

VERSION

`VERSION` refers to the version number of the Lyman-alpha catalog, *e.g.* `v0.3`.

Delta

This directory contains the flux-transmission field files.

delta-HEALPIX

Summary
This file contains the main output from the picca delta extraction: the lyman alpha transmission fluctuations for all analysed quasars in a given healpix

Naming Convention
`delta-HEALPIX.fits`, where `HEALPIX` is the healpix id.

Regex
`delta-[0-9]+\.fits\.gz`

File Type
FITS

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	PRIMARY	Empty
HDU1	LAMBDA	IMAGE	Wavelength grid
HDU2	METADATA	BINTABLE	Per forest metadata
HDU3	DELTA	IMAGE	Flux transmission field
HDU4	WEIGHT	IMAGE	Weights
HDU5	CONT	IMAGE	Quasar continua

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = LAMBDA

Wavelength grid

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2716	int	number of wavelength pixels
WAVE_SOLUTION	lin	str	chosen wavelength solution
DELTA_LAMBDA	0.8	float	pixel step
BUNIT	Angstrom	str	wavelength units
CHECKSUM	UZ3aaZ2aVZ2aaZ2a	str	HDU checksum
DATASUM	1634060384	str	HDU data checksum

Data: FITS image [float64, 2716]

HDU2

EXTNAME = METADATA

Per-forest metadata

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	84	int	table width
NAXIS2	340	int	number of forests
BLINDING	none	str	blinding scheme used
CHECKSUM	UZ3aaZ2aVZ2aaZ2a	str	HDU checksum
DATASUM	1634060384	str	HDU data checksum

Required Data Table Columns

Name	Type	Units	Description
LOS_ID	int64		PICCA unique target ID
RA	float64	rad	Target Right Ascension [radians]
DEC	float64	rad	Target declination [radians]
Z	float64		Redshift
MEANSNR	float64		mean signal-to-noise ratio
TARGETID	int64		Unique target ID
NIGHT	char[12]		Observation night(s)
PETAL	char[12]		Observation petal(s)
TILE	char[12]		Observation tile(s)

HDU3

EXTNAME = DELTA

Flux transmission field in wavelength bins

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2716	int	number of wavelength pixels
NAXIS2	340	int	number of forests
BUNIT		str	delta units (unitless)
CHECKSUM	UZ3aaZ2aVZ2aaZ2a	str	HDU checksum
DATASUM	1634060384	str	HDU data checksum

Data: FITS image [float64, 2716x340]

HDU4

EXTNAME = WEIGHT

Weights in wavelength bins

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2716	int	number of wavelength pixels
NAXIS2	340	int	number of forests
CHECKSUM	UZ3aaZ2aVZ2aaZ2a	str	HDU checksum
DATASUM	1634060384	str	HDU data checksum

Data: FITS image [float64, 2716x340]

HDU5

EXTNAME = CONT

Quasar continuum in wavelength bins

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2716	int	number of wavelength pixels
NAXIS2	340	int	number of forests
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	quasar continuum units
CHECKSUM	UZ3aaZ2aVZ2aaZ2a	str	HDU checksum
DATASUM	1634060384	str	HDU data checksum

Data: FITS image [float64, 2716x340]

Notes and Examples

These files are generated with https://github.com/igmhub/picca/blob/master/bin/picca_delta_extraction.py The code was run twice:

```
picca_delta_extraction.py config/delta_extraction_ciii_step_1.ini
picca_delta_extraction.py config/delta_extraction_lya.ini
```

Log

This directory contains attributes files and rejection logs.

delta_attributes

Summary
This file contains auxiliar output from the picca delta extraction: summary statistics of the computed deltas.

Naming Convention
`delta_attributes.fits.gz` or `delta_attributes_iterationITERATION.fits.gz`, where `ITERATION` is the iteration step.

Regex
`delta_attributes(_iteration[0-9]+)?\.fits\.gz`

File Type
FITS

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	PRIMARY	Empty
HDU1	STACK_DELTAS	BINTABLE	Delta mean properties
HDU2	VAR_FUNC	BINTABLE	Variance fitted functions
HDU3	CONT	BINTABLE	Mean quasar continuum
HDU4	FIT_METADATA	BINTABLE	Extra fit metadata

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = STACK_DELTAS

Delta mean properties

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	table width
NAXIS2	2716	int	number of wavelenght pixels
FITORDER	1	int	order of the fit
CHECKSUM	UaQGWRQDUXQDUXQD	str	HDU checksum updated 2023-05-20T00:44:43
DATASUM	288651377	str	data unit checksum updated 2023-05-20T00:44:43

Required Data Table Columns

Name	Type	Units	Description
LOGLAM	float64	log(Angstrom)	log(wavelength)
STACK	float64		mean(1+delta)
WEIGHT	float64		Mean weight

HDU2

EXTNAME = VAR_FUNC

Variance fitted functions

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	48	int	table width
NAXIS2	20	int	number of wavelenght pixels
CHECKSUM	9l7aGj7V9j7ZGj7Z	str	HDU checksum updated 2023-05-20T00:44:43
DATASUM	2321635470	str	data unit checksum updated 2023-05-20T00:44:43

Required Data Table Columns

Name	Type	Units	Description
LOGLAM	float64	log(Angstrom)	log(wavelength)
ETA	float64		Intrinsic variace of fluctuations
VAR_LSS	float64		Mean weight
FUDGE	float64		ad-hoc term correcting varianc of high SNR quas
NUM_PIXELS	int32		Number of pixels in the fit
VALID_FIT	logical		Indicates valid fit

HDU3

EXTNAME = CONT

Mean quasar continuum

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	84	int	table width
NAXIS2	206	int	number of rest-frame pixels
CHECKSUM	nadFnWaFnaaFnUaF	str	HDU checksum updated 2023-05-20T00:44:43
DATASUM	2310375264	str	data unit checksum updated 2023-05-20T00:44:43

Required Data Table Columns

Name	Type	Units	Description
LOGLAM_REST	float64	log(Angstrom)	Logarithm of the rest-frame wavelength
MEAN_CONT	float64	10**-17 erg/(s cm2 Angstrom)	Mean quasar continuum
WEIGHT	float64		mean weight

HDU4

EXTNAME = FIT_METADATA

Mean quasar continuum

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	43	int	table width
NAXIS2	23168	int	number of forests
CHECKSUM	WIaqZHaoWHaoWHao	str	HDU checksum updated 2023-05-20T00:44:43
DATASUM	179646866	str	data unit checksum updated 2023-05-20T00:44:43

Required Data Table Columns

Name	Type	Units	Description
LOS_ID	int64		PICCA unique target ID
ZERO_POINT	float64		Continuum zero-point paramter
SLOPE	float64		Continuum slope parameter
CHI2	float64		Continuum fit chi2
NUM_DATAPOINTS	int64		Number of wavelenth pixels
ACCEPTED_FIT	logical		Fit acceptance

Notes and Examples

These files are generated with https://github.com/igmhub/picca/blob/master/bin/picca_delta_extraction.py The code was run twice:

```
picca_delta_extraction.py config/delta_extraction_ciii_step_1.ini
picca_delta_extraction.py config/delta_extraction_lya.ini
```

rejection_log

Summary
This file contains auxiliary output from the picca delta extraction: statistics on rejected forests

Naming Convention
`rejection_log.fits.gz`

Regex
`rejection_log\.fits\.gz`

File Type
FITS

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	PRIMARY	Empty
HDU1	REJECTION_LOG	BINTABLE	Rejected forest statistics

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = REJECTION_LOG

Rejected forest statistics

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	104	int	table width
NAXIS2	24719	int	number of rejected forests
CHECKSUM	D7nUD5lTD5lTD5lT	str	HDU checksum updated 2023-05-20T00:44:44
DATASUM	231153411’	str	data unit checksum updated 2023-05-20T00:44:44

Required Data Table Columns

Name	Type	Units	Description
LOS_ID	int64		PICCA unique target ID
RA	float64	rad	Target Right Ascension [radians]
DEC	float64	rad	Target declination [radians]
Z	float64		Redshift
MEANSNR	float64		mean signal-to-noise ratio
TARGETID	int64		Unique target ID
NIGHT	char[12]		Observation night(s)
PETAL	char[12]		Observation petal(s)
TILE	char[12]		Observation tile(s)
FOREST_SIZE	int64		Number of pixels in the forest
REJECTION_STATUS	char[12]		Rejection status of forest

Notes and Examples

These files are generated with https://github.com/igmhub/picca/blob/master/bin/picca_delta_extraction.py The code was run twice:

```
picca_delta_extraction.py config/delta_extraction_ciii_step_1.ini
picca_delta_extraction.py config/delta_extraction_lya.ini
```

1.1.2 DESI_ROOT

`DESI_ROOT` represents the top level of the DESI directory tree. Files described in this section are not associated with a more specific environment variable of their own.

Subdirectories:

DESI_SPECTRO_REDUX

Default $DESI_ROOT/spectro/redux

This directory contains production runs of the spectroscopic data reduction pipeline. Each different run is contained in different SPECPROD subdirectory.

The desispec code refers to this location with the environment variable $DESI_SPECTRO_REDUX . The canonical location is $DESI_ROOT/spectro/redux, but changing the environment variable allows the code to write to other test directories.

SPECPROD

Default $DESI_ROOT/spectro/redux/SPECPROD

DESI spectroscopic data processing productions are grouped by spectroscopic production names (SPECPROD), named after mountains for data releases, e.g. "fuji" for the Early Data Release.

Files in the top-level production directory:

- *exposures-SPECPROD.fits*: summary of exposures
- *tiles-SPECPROD.fits*: summary of tiles

Subdirectories under a spectroscopic production:

- *zcatalog/*: summary redshift catalogs
- *healpix/SURVEY/PROGRAM/PIXGROUP/PIXNUM*: spectra, classifications, and redshifts coadded across tiles, grouped by survey, program, and healpixel.
- *tiles/GROUPTYPE/TILEID/GROUPID/index*: spectra, classifications, and redshifts coadded per tile.
- *calibnight/NIGHT/*: nightly calibrations
- *preproc/NIGHT/EXPID*: preprocessed spectrograph CCD images
- *exposures/NIGHT/EXPID*: per-exposure intermediate files

calibnight

NIGHT

badcolumns-CAMERA-NIGHT

Summary
Auxilliary file listing bad columns.

Naming Convention
`badcolumns-CAMERA-NIGHT.csv`, where `CAMERA` is *e.g.*, "b0", "r5", etc. and `NIGHT` is the observation night in YYYYMMDD format.

Regex
`badcolumns-[brz][0-9]-[0-9]{8}\.csv`

File Type
CSV, 1 KB

Contents

A list of unmasked bad columns identified from a 300 sec calibration dark frame.

Note: file may contain no data if all bad columns are already masked.

The file should have these columns:

Name	Type	Description
CAMERA	char[*]	Camera identifier. Passband and SPECGRPH ([brz][0-9]).
COLUMN	int	CCD column number
ELEC_PER_SEC	float	median electrons/sec in column
SIGMA	float	statistical significance as non-zero

biasnight-CAMERA-NIGHT.fits

Summary
Master bias frame for the preprocessing of the night data

Naming Convention
`biasnight-CAMERA-NIGHT.fits.gz`, where `CAMERA` is *e.g.*, "b0", "r5", etc. and `NIGHT` is the observation night in YYYYMMDD format.

Regex
`biasnight-[brz][0-9]-[0-9]{8}\.fits\.gz`

File Type
FITS, 20 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	BIAS	IMAGE	bias image

FITS Header Units

HDU0

EXTNAME = BIAS

2D image with the master bias to subtract to the raw images of the night.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	4256	int	
NAXIS2	4194	int	
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
INSTRUME	DESI	str	Instrument name
SPECGRPH	8	int	Spectrograph logical name (SP)
SPECID	2	int	Spectrograph serial number (SM)
DETECTOR	M1-42	str	Detector (ccd) identification
CAMERA	z8	str	Camera name
CCDNAME	CCDSM2Z	str	CCD name
CCDPREP	purge,clear	str	CCD prep actions
CCDSIZE	4194,4256	str	CCD size in pixels (rows, columns)
CCDTEMP	-136.0659	float	[deg C] CCD controller CCD temperature
CPUTEMP	57.3633	float	[deg C] CCD controller CPU temperature
CASETEMP	57.3533	float	[deg C] CCD controller case temperature
CCDTMING	flatdark_lbnl_timing.txt	str	CCD timing file
CCDCFG	default_lbnl_20210128.cfg	str	CCD configuration file
SETTINGS	detectors_sm_20210128.json	str	Name of DESI CCD settings file
VESSEL	9	int	Cryostat serial number
FEEVER	v20160312	str	CCD Controller version
FEEBOX	lbnl055	str	CCD Controller serial number
PRESECA	[1:7, 2:2065]	str	Prescan section for quadrant A
PRRSECA	[8:2064, 1:1]	str	Row prescan section for quadrant A
DATASECA	[8:2064, 2:2065]	str	Data section for quadrant A
TRIMSECA	[8:2064, 2:2065]	str	Trim section for quadrant A
BIASSECA	[2065:2128, 2:2065]	str	Bias section for quadrant A
ORSECA	[8:2064, 2066:2097]	str	Row overscan section for quadrant A
CCDSECA	[1:2057, 1:2064]	str	CCD section for quadrant A
DETSECA	[1:2057, 1:2064]	str	Detector section for quadrant A
AMPSECA	[1:2057, 1:2064]	str	AMP section for quadrant A
PRESECB	[4250:4256, 2:2065]	str	Prescan section for quadrant B
PRRSECB	[2193:4249, 1:1]	str	Row prescan section for quadrant B
DATASECB	[2193:4249, 2:2065]	str	Data section for quadrant B

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Table 7 – continued from previous page

KEY	Example Value	Type	Comment
TRIMSECB	[2193:4249, 2:2065]	str	Trim section for quadrant B
BIASSECB	[2129:2192, 2:2065]	str	Bias section for quadrant B
ORSECB	[2193:4249, 2066:2097]	str	Row overscan section for quadrant B
CCDSECB	[2058:4114, 1:2064]	str	CCD section for quadrant B
DETSECB	[2058:4114, 1:2064]	str	Detector section for quadrant B
AMPSECB	[4114:2058, 1:2064]	str	AMP section for quadrant B
PRESECC	[1:7, 2130:4193]	str	Prescan section for quadrant C
PRRSECC	[8:2064, 4194:4194]	str	Row prescan section for quadrant C
DATASECC	[8:2064, 2130:4193]	str	Data section for quadrant C
TRIMSECC	[8:2064, 2130:4193]	str	Trim section for quadrant C
BIASSECC	[2065:2128, 2130:4193]	str	Bias section for quadrant C
ORSECC	[8:2064, 2098:2129]	str	Row overscan section for quadrant C
CCDSECC	[1:2057, 2065:4128]	str	CCD section for quadrant C
DETSECC	[1:2057, 2065:4128]	str	Detector section for quadrant C
AMPSECC	[1:2057, 4128:2065]	str	AMP section for quadrant C
PRESECD	[4250:4256, 2130:4193]	str	Prescan section for quadrant D
PRRSECD	[2193:4249, 4194:4194]	str	Row prescan section for quadrant D
DATASECD	[2193:4249, 2130:4193]	str	Data section for quadrant D
TRIMSECD	[2193:4249, 2130:4193]	str	Trim section for quadrant D
BIASSECD	[2129:2192, 2130:4193]	str	Bias section for quadrant D
ORSECD	[2193:4249, 2098:2129]	str	Row bias section for quadrant D
CCDSECD	[2058:4114, 2065:4128]	str	CCD section for quadrant D
DETSECD	[2058:4114, 2065:4128]	str	Detector section for quadrant D
AMPSECD	[4114:2058, 4128:2065]	str	AMP section for quadrant D
DAC0	-9.0002,-9.0331	str	[V] set value, measured value
DAC1	-9.0002,-8.9816	str	[V] set value, measured value
DAC2	-9.0002,-8.961	str	[V] set value, measured value
DAC3	-9.0002,-8.9816	str	[V] set value, measured value
DAC4	5.9998,6.0437	str	[V] set value, measured value
DAC5	5.9998,6.0595	str	[V] set value, measured value
DAC6	5.9998,5.9964	str	[V] set value, measured value
DAC7	5.9998,6.0069	str	[V] set value, measured value
DAC8	-25.0003,-25.0796	str	[V] set value, measured value
DAC9	-25.0003,-25.3467	str	[V] set value, measured value
DAC10	-25.0003,-25.0648	str	[V] set value, measured value
DAC11	-25.0003,-25.3467	str	[V] set value, measured value
DAC12	0.0,-0.0148	str	[V] set value, measured value
DAC13	0.0,-0.0297	str	[V] set value, measured value
DAC14	0.0,-0.0297	str	[V] set value, measured value
DAC15	0.0,-0.0148	str	[V] set value, measured value
DAC16	39.9961,39.4548	str	[V] set value, measured value
DAC17	20.0008,12.2854	str	[V] set value, measured value
CLOCK0	9.9999,0.0	str	[V] high rail, low rail
CLOCK1	9.9999,0.0	str	[V] high rail, low rail
CLOCK2	9.9999,0.0	str	[V] high rail, low rail
CLOCK3	-2.0001,3.9999	str	[V] high rail, low rail
CLOCK4	9.9999,0.0	str	[V] high rail, low rail
CLOCK5	9.9999,0.0	str	[V] high rail, low rail
CLOCK6	9.9999,0.0	str	[V] high rail, low rail

continues on next page

Table 7 – continued from previous page

KEY	Example Value	Type	Comment
CLOCK7	-2.0001,3.9999	str	[V] high rail, low rail
CLOCK8	9.9992,2.9993	str	[V] high rail, low rail
CLOCK9	9.9992,2.9993	str	[V] high rail, low rail
CLOCK10	9.9992,2.9993	str	[V] high rail, low rail
CLOCK11	9.9992,2.9993	str	[V] high rail, low rail
CLOCK12	9.9992,2.9993	str	[V] high rail, low rail
CLOCK13	9.9992,2.9993	str	[V] high rail, low rail
CLOCK14	9.9992,2.9993	str	[V] high rail, low rail
CLOCK15	9.9992,2.9993	str	[V] high rail, low rail
CLOCK16	9.9999,3.0	str	[V] high rail, low rail
CLOCK17	9.0,0.9999	str	[V] high rail, low rail
CLOCK18	9.0,0.9999	str	[V] high rail, low rail
OFFSET0	0.4000000059604645,-9.0434	str	[V] set value, measured value
OFFSET1	0.4000000059604645,-8.9816	str	[V] set value, measured value
OFFSET2	0.4000000059604645,-8.961	str	[V] set value, measured value
OFFSET3	0.4000000059604645,-8.9713	str	[V] set value, measured value
OFFSET4	2.0,6.0385	str	[V] set value, measured value
OFFSET5	2.0,6.0648	str	[V] set value, measured value
OFFSET6	2.0,6.0017	str	[V] set value, measured value
OFFSET7	2.0,6.0017	str	[V] set value, measured value
DELAYS	20, 20, 25, 40, 7, 3000, 7, 7, 400, 7	str	[10] Delay settings
CDSPARMS	400, 400, 8, 2000	str	CDS parameters
PGAGAIN	3	int	Controller gain
OCSVER	1.2	float	OCS software version
DOSVER	trunk	str	DOS software version
CONSTVER	DESI:CURRENT	str	Constants version
BUNIT	adu	str	
NIGHT	20210407	int	

Data: FITS image [float32, 4256x4194]

biasnighttest-CAMERA-NIGHT.fits

Summary
The biasnight code first writes these files and then tests if they are better than the default biases. If they are better, they are renamed to the final `biasnight-*.fits.gz`; if they aren't better, they are left behind for comparison but not otherwise used by the pipeline.

Naming Convention
`biasnighttest-CAMERA-NIGHT.fits.gz`, where `CAMERA` is *e.g.*, "b0", "r5", etc. and `NIGHT` is the observation night in YYYYMMDD format.

Regex
`biasnighttest-[brz][0-9]-[0-9]{8}\.fits\.gz`

File Type
FITS, 30 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	BIAS	IMAGE	bias image

FITS Header Units

HDU0

EXTNAME = BIAS

2D image with the master bias to subtract to the raw images of the night.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	4232	int	
NAXIS2	4162	int	
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
INSTRUME	DESI	str	Instrument name
SPECGRPH	1	int	Spectrograph logical name (SP)
SPECID	10	int	Spectrograph serial number (SM)
DETECTOR	sn22822	str	Detector (ccd) identification
CAMERA	b1	str	Camera name
CCDNAME	CCDSM10B	str	CCD name
CCDPREP	purge,clear	str	CCD prep actions
CCDSIZE	4162,4232	str	CCD size in pixels (rows, columns)
CCDTEMP	850.0	float	[deg C] CCD controller CCD temperature
CPUTEMP	59.209	float	[deg C] CCD controller CPU temperature
CASETEMP	58.9529	float	[deg C] CCD controller case temperature
CCDTMING	flatdark_sta_timing.txt	str	CCD timing file
CCDCFG	CMV_22805_sta_revd_tuned-may2018_20210128.cfg	str	CCD configuration fi
SETTINGS	detectors_sm_20210128.json	str	Name of DESI CCD settings file
VESSEL	29	int	Cryostat serial number
FEEVER	v20160312	str	CCD Controller version
FEEBOX	lbnl088	str	CCD Controller serial number
PRESECA	[1:4, 2:2049]	str	Prescan section for quadrant A
PRRSECA	[5:2052, 1:1]	str	Row prescan section for quadrant A
DATASECA	[5:2052, 2:2049]	str	Data section for quadrant A
TRIMSECA	[5:2052, 2:2049]	str	Trim section for quadrant A
BIASSECA	[2053:2116, 2:2049]	str	Bias section for quadrant A
ORSECA	[5:2052, 2050:2081]	str	Row overscan section for quadrant A
CCDSECA	[1:2048, 1:2048]	str	CCD section for quadrant A
DETSECA	[1:2048, 1:2048]	str	Detector section for quadrant A
AMPSECA	[1:2048, 1:2048]	str	AMP section for quadrant A
PRESECB	[4229:4232, 2:2049]	str	Prescan section for quadrant B
PRRSECB	[2181:4228, 1:1]	str	Row prescan section for quadrant B
DATASECB	[2181:4228, 2:2049]	str	Data section for quadrant B

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Table 8 – continued from previous page

KEY	Example Value	Type	Comment
TRIMSECB	[2181:4228, 2:2049]	str	Trim section for quadrant B
BIASSECB	[2117:2180, 2:2049]	str	Bias section for quadrant B
ORSECB	[2181:4228, 2050:2081]	str	Row overscan section for quadrant B
CCDSECB	[2049:4096, 1:2048]	str	CCD section for quadrant B
DETSECB	[2049:4096, 1:2048]	str	Detector section for quadrant B
AMPSECB	[2049:4096, 2048:1]	str	AMP section for quadrant B
PRESECC	[1:4, 2114:4161]	str	Prescan section for quadrant C
PRRSECC	[5:2052, 4162:4162]	str	Row prescan section for quadrant C
DATASECC	[5:2052, 2114:4161]	str	Data section for quadrant C
TRIMSECC	[5:2052, 2114:4161]	str	Trim section for quadrant C
BIASSECC	[2053:2116, 2114:4161]	str	Bias section for quadrant C
ORSECC	[5:2052, 2082:2113]	str	Row overscan section for quadrant C
CCDSECC	[1:2048, 2049:4096]	str	CCD section for quadrant C
DETSECC	[1:2048, 2049:4096]	str	Detector section for quadrant C
AMPSECC	[2048:1, 2049:4096]	str	AMP section for quadrant C
PRESECD	[4229:4232, 2114:4161]	str	Prescan section for quadrant D
PRRSECD	[2181:4228, 4162:4162]	str	Row prescan section for quadrant D
DATASECD	[2181:4228, 2114:4161]	str	Data section for quadrant D
TRIMSECD	[2181:4228, 2114:4161]	str	Trim section for quadrant D
BIASSECD	[2117:2180, 2114:4161]	str	Bias section for quadrant D
ORSECD	[2181:4228, 2082:2113]	str	Row bias section for quadrant D
CCDSECD	[2049:4096, 2049:4096]	str	CCD section for quadrant D
DETSECD	[2049:4096, 2049:4096]	str	Detector section for quadrant D
AMPSECD	[4096:2049, 4096:2049]	str	AMP section for quadrant D
DAC0	15.9998,15.9547	str	[V] set value, measured value
DAC1	15.9998,15.759	str	[V] set value, measured value
DAC2	15.9998,15.8105	str	[V] set value, measured value
DAC3	15.9998,15.9238	str	[V] set value, measured value
DAC4	0.0,-0.0158	str	[V] set value, measured value
DAC5	0.0,-0.021	str	[V] set value, measured value
DAC6	0.0,-0.0158	str	[V] set value, measured value
DAC7	0.0,-0.021	str	[V] set value, measured value
DAC8	26.9998,27.0088	str	[V] set value, measured value
DAC9	26.9998,27.0385	str	[V] set value, measured value
DAC10	26.9998,27.0978	str	[V] set value, measured value
DAC11	26.9998,26.5042	str	[V] set value, measured value
DAC12	0.0,5.0752	str	[V] set value, measured value
DAC13	0.0,-5.0232	str	[V] set value, measured value
DAC14	0.0,0.8008	str	[V] set value, measured value
DAC15	19.9997,19.8328	str	[V] set value, measured value
DAC16	0.0,0.1386	str	[V] set value, measured value
DAC17	-0.0,0.0732	str	[V] set value, measured value
CLOCK0	3.9999,-4.0002	str	[V] high rail, low rail
CLOCK1	3.9999,-4.0002	str	[V] high rail, low rail
CLOCK2	3.9999,-4.0002	str	[V] high rail, low rail
CLOCK3	6.9999,-2.0001	str	[V] high rail, low rail
CLOCK4	3.9999,-4.0002	str	[V] high rail, low rail
CLOCK5	3.9999,-4.0002	str	[V] high rail, low rail
CLOCK6	3.9999,-4.0002	str	[V] high rail, low rail

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Table 8 – continued from previous page

KEY	Example Value	Type	Comment
CLOCK7	6.9999,-2.0001	str	[V] high rail, low rail
CLOCK8	3.0,-8.0001	str	[V] high rail, low rail
CLOCK9	3.0,-8.0001	str	[V] high rail, low rail
CLOCK10	3.0,-8.0001	str	[V] high rail, low rail
CLOCK11	0.0,0.0	str	[V] high rail, low rail
CLOCK12	3.0,-8.0001	str	[V] high rail, low rail
CLOCK13	3.0,-8.0001	str	[V] high rail, low rail
CLOCK14	3.0,-8.0001	str	[V] high rail, low rail
CLOCK15	0.0,0.0	str	[V] high rail, low rail
CLOCK16	0.0,0.0	str	[V] high rail, low rail
CLOCK17	3.9999,-4.0002	str	[V] high rail, low rail
CLOCK18	3.9999,-4.0002	str	[V] high rail, low rail
OFFSET0	-1.5,15.9547	str	[V] set value, measured value
OFFSET1	-1.5,15.7796	str	[V] set value, measured value
OFFSET2	-1.5,15.7899	str	[V] set value, measured value
OFFSET3	-1.5,15.9341	str	[V] set value, measured value
OFFSET4	-1.2599999904632568,-0.0105	str	[V] set value, measured value
OFFSET5	-1.309999942779541,-0.0158	str	[V] set value, measured value
OFFSET6	-1.5199999809265137,-0.0105	str	[V] set value, measured value
OFFSET7	-1.4700000286102295,-0.021	str	[V] set value, measured value
DELAYS	13, 13, 25, 25, 8, 3000, 7, 7, 400, 7	str	[10] Delay settings
CDSPARMS	350, 350, 8, 1000	str	CDS parameters
PGAGAIN	5	int	Controller gain
OCSVER	1.2	float	OCS software version
DOSVER	trunk	str	DOS software version
CONSTVER	DESI:CURRENT	str	Constants version
BUNIT	adu	str	
NIGHT	20210407	int	

Data: FITS image [float32, 4232x4162]

fiberflatnight-CAMERA-NIGHT.fits

Summary
Relative fiber-to-fiber variations (“fiberflat”) as measured by continuum lamp calibration spectra, combined across multiple exposures. Corrected flux = original flux / fiberflat.

Naming Convention
`fiberflatnight-CAMERA-NIGHT.fits`, where `CAMERA` is *e.g.*, “b0”, “r5”, etc. and `NIGHT` is the observation night in YYYYMMDD format.

Regex
`fiberflatnight-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 10 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	FIBERFLAT	IMAGE	Relative fiber-to-fiber variation
HDU1	IVAR	IMAGE	Inverse variance of fiberflat
HDU2	MASK	IMAGE	Mask of fiberflat (0=good)
HDU3	MEANSPEC	IMAGE	Average spectrum
HDU4	WAVELENGTH	IMAGE	Wavelength
HDU5	FIBERMAP	BINTABLE	fibermap

FITS Header Units

HDU0

EXTNAME = FIBERFLAT

Fiber flat field correction to homogeneize the response among fibers of the same camera, for each wavelength. 2D array of dimension [nspec, nwave]. nspec is the number of fibers per camera. nwave in the length of the wavelength array. The fiber flat field of all fibers share the same wavelength grid (given in HDU WAVELENGTH). This file is the fiber flat derived from a series of flat field exposures. It is the one used for the science observations during the night.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	
NAXIS2	500	int	
EXPID	91342	int	Exposure number
EXPFRAME	0	int	Frame number
FLAVOR	science	str	Observation type
SEQUENCE	Spectrographs	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	CALIB DESI-CALIB-00 LEDs only	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	DESIObserver	str	Names of observers
LEAD	RunManager	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20210606	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs

continues on next page

Table 9 – continued from previous page

KEY	Example Value	Type	Comment
DATE-OBS	2021-06-07T00:37:22.927269888	str	[UTC] Observation data and start tim
TIME-OBS	2021-06-06T00:37:22.927269888	str	[UTC] Observation start time
MJD-OBS	59372.02595981	float	Modified Julian Date of observation
OPENSHUT	2021-06-07T00:37:23.710751	Unknown	Time shutter opened
ST	10:13:31.760000	str	Local Sidereal time at observation start (HH:MM
EXPTIME	120.04	float	[s] Actual exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.0	float	[arcsec] Offset], declination, observer input
VCCD	ON	str	True (ON) if CCD voltage is on
VCCDON	2021-05-19T22:18:47.035384	str	Time when CCD voltage was turned on
VCCDSEC	1563696.6	float	[s] CCD on time in seconds
EQUINOX	2000.0	float	Epoch of observation
SPECGRPH	0	int	Spectrograph logical name (SP)
SPECID	4	int	Spectrograph serial number (SM)
FEEBOX	lbnl081	str	CCD Controller serial number
VESSEL	15	int	Cryostat serial number
FEEVER	v20160312	str	CCD Controller version
FEEPOWER	ON	str	FEE power status
FEEDMASK	2134851391	int	FEE dac mask
FEECMASK	1048575	int	FEE clk mask
CCDTEMP	850.0	float	[deg C] CCD controller CCD temperature
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
CLOCK0	3.9999,-4.0002	str	[V] high rail, low rail
CCDSECD	[2049:4096, 2049:4096]	str	CCD section for quadrant D
CLOCK17	3.9999,-4.0002	str	[V] high rail, low rail
DELAYS	13, 13, 25, 25, 8, 3000, 7, 7, 400, 7	str	[10] Delay settings
BIASSECD	[2117:2180, 2114:4161]	str	Bias section for quadrant D

continues on next page

Table 9 – continued from previous page

KEY	Example Value	Type	Comment
DATASECD	[2181:4228, 2114:4161]	str	Data section for quadrant D
CLOCK14	3.0,-7.0002	str	[V] high rail, low rail
PRRSECC	[5:2052, 4162:4162]	str	Row prescan section for quadrant C
CCDSECC	[1:2048, 2049:4096]	str	CCD section for quadrant C
CPUTEMP	56.0097	float	[deg C] CCD controller CPU temperature
BIASSECA	[2053:2116, 2:2049]	str	Bias section for quadrant A
DAC13	-5.0006,-4.9816	str	[V] set value, measured value
OFFSET5	-1.100000023841858,0.0105	str	[V] set value, measured value
DAC0	15.9998,15.965	str	[V] set value, measured value
DAC11	26.9998,26.9049	str	[V] set value, measured value
OFFSET6	-1.100000023841858,0.0158	str	[V] set value, measured value
OFFSET2	-1.5,15.8311	str	[V] set value, measured value
CLOCK15	0.0,0.0	str	[V] high rail, low rail
TRIMSECB	[2181:4228, 2:2049]	str	Trim section for quadrant B
ORSECC	[5:2052, 2082:2113]	str	Row overscan section for quadrant C
BIASSECB	[2117:2180, 2:2049]	str	Bias section for quadrant B
OFFSET1	-1.5,15.8208	str	[V] set value, measured value
ORSECA	[5:2052, 2050:2081]	str	Row overscan section for quadrant A
CAMERA	b0	str	Camera name
CLOCK1	3.9999,-4.0002	str	[V] high rail, low rail
DETSECC	[1:2048, 2049:4096]	str	Detector section for quadrant C
DAC5	0.0,0.0158	str	[V] set value, measured value
TRIMSECC	[5:2052, 2114:4161]	str	Trim section for quadrant C
DAC7	0.0,0.0105	str	[V] set value, measured value
DAC3	15.9998,15.965	str	[V] set value, measured value
ORSECD	[2181:4228, 2082:2113]	str	Row bias section for quadrant D
CCDSECB	[2049:4096, 1:2048]	str	CCD section for quadrant B

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Table 9 – continued from previous page

KEY	Example Value	Type	Comment
DAC1	15.9998,15.8208	str	[V] set value, measured value
DAC8	26.9998,26.6081	str	[V] set value, measured value
CCDSIZE	4162,4232	str	CCD size in pixels (rows, columns)
CASETEMP	56.3689	float	[deg C] CCD controller case temperature
PRESECA	[1:4, 2:2049]	str	Prescan section for quadrant A
CLOCK3	6.9999,-2.0001	str	[V] high rail, low rail
SETTINGS	detectors_sm_20210128.json	str	Name of DESI CCD settings file
OFFSET3	-1.5,15.965	str	[V] set value, measured value
OFFSET0	-1.5,15.965	str	[V] set value, measured value
DETSECD	[2049:4096, 2049:4096]	str	Detector section for quadrant D
AMPSECB	[2049:4096, 2048:1]	str	AMP section for quadrant B
DATASECA	[5:2052, 2:2049]	str	Data section for quadrant A
CLOCK2	3.9999,-4.0002	str	[V] high rail, low rail
BLDTIME	0.3504	float	[s] Time to build image
CCDNAME	CCDSM4B	str	CCD name
PRRSECA	[5:2052, 1:1]	str	Row prescan section for quadrant A
DAC14	0.0,0.8216	str	[V] set value, measured value
CCDCFG	default_sta_20210128.cfg	str	CCD configuration file
PRESECB	[4229:4232, 2:2049]	str	Prescan section for quadrant B
CDSPARMS	400, 400, 8, 1000	str	CDS parameters
CRYOTEMP[1]	162.97	float	[deg K] Cryostat CCD temperature
CLOCK6	3.9999,-4.0002	str	[V] high rail, low rail
DATASECB	[2181:4228, 2:2049]	str	Data section for quadrant B
CLOCK11	0.0,0.0	str	[V] high rail, low rail
DAC9	26.9998,26.9346	str	[V] set value, measured value
DAC2	15.9998,15.8208	str	[V] set value, measured value
DAC6	0.0,0.0158	str	[V] set value, measured value
DETSECA	[1:2048, 1:2048]	str	Detector section for quadrant A
CLOCK13	3.0,-7.0002	str	[V] high rail, low rail

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Table 9 – continued from previous page

KEY	Example Value	Type	Comment
DATASECC	[5:2052, 2114:4161]	str	Data section for quadrant C
CLOCK16	0.0,0.0	str	[V] high rail, low rail
CLOCK9	3.0,-7.0002	str	[V] high rail, low rail
TRIMSECA	[5:2052, 2:2049]	str	Trim section for quadrant A
DAC15	19.9997,20.0616	str	[V] set value, measured value
AMPSECD	[4096:2049, 4096:2049]	str	AMP section for quadrant D
DAC17	-0.0,0.0366	str	[V] set value, measured value
DETSECB	[2049:4096, 1:2048]	str	Detector section for quadrant B
PRRSECD	[2181:4228, 4162:4162]	str	Row prescan section for quadrant D
PRRSECB	[2181:4228, 1:1]	str	Row prescan section for quadrant B
CLOCK8	3.0,-7.0002	str	[V] high rail, low rail
OFFSET4	-1.100000023841858,0.0053	str	[V] set value, measured value
AMPSECC	[2048:1, 2049:4096]	str	AMP section for quadrant C
CCDTMING	flatdark_sta_timing.txt	str	CCD timing file
TRIMSECD	[2181:4228, 2114:4161]	str	Trim section for quadrant D
CCDPREP	purge,clear	str	CCD prep actions
CLOCK18	3.9999,-4.0002	str	[V] high rail, low rail
PRESECD	[4229:4232, 2114:4161]	str	Prescan section for quadrant D
DAC4	0.0,0.0105	str	[V] set value, measured value
DAC16	0.0,65.6502	str	[V] set value, measured value
BIASSECC	[2053:2116, 2114:4161]	str	Bias section for quadrant C
ORSECB	[2181:4228, 2050:2081]	str	Row overscan section for quadrant B
CLOCK10	3.0,-7.0002	str	[V] high rail, low rail
DETECTOR	sn22797	str	Detector (ccd) identification
CLOCK7	6.9999,-2.0001	str	[V] high rail, low rail
DAC10	26.9998,26.8456	str	[V] set value, measured value
CLOCK5	3.9999,-4.0002	str	[V] high rail, low rail
AMPSECA	[1:2048, 1:2048]	str	AMP section for quadrant A
CLOCK12	3.0,-7.0002	str	[V] high rail, low rail
PRESECC	[1:4, 2114:4161]	str	Prescan section for quadrant C

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Table 9 – continued from previous page

KEY	Example Value	Type	Comment
CRYOPRES[Page 74, 1]	1.002e-07	str	[mb] Cryostat pressure (IP)
DAC12	4.9997,22.62	str	[V] set value, measured value
OFFSET7	-1.100000023841858,0.0105	str	[V] set value, measured value
CLOCK4	3.9999,-4.0002	str	[V] high rail, low rail
DIGITIME	54.7987	float	[s] Time to digitize image
PGAGAIN	5	int	Controller gain
CCDSECA	[1:2048, 1:2048]	str	CCD section for quadrant A
REQTIME	120.0	float	[s] Requested exposure time
OBSID	kp4m20210607t003722	str	Unique observation identifier
PROCTYPE	RAW	str	Data processing level
PRODTYPE	image	str	Data product type
CHECKSUM	9aCgFaCZ9aCdCaCZ	str	HDU checksum updated 2022-02-06T08:13:11
DATASUM	4268167737	str	data unit checksum updated 2022-02-06T08:13:11
GAINA	1.133	float	e/ADU (gain applied to image)
SATULEVA	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPA	1.2530904947198	float	ADUs (max-min of median overscan per row)
OMETHA	AVERAGE	str	use average overscan
OVERSCNA	1209.671055084825	float	ADUs (gain not applied)
OBSRDNA	4.085456675058811	float	electrons (gain is applied)
SATUELEA	72880.5976945889	float	saturation or non lin. level, in electrons
GAINB	1.117	float	e/ADU (gain applied to image)
SATULEVB	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPB	1.01353762880899	float	ADUs (max-min of median overscan per row)
OMETHB	AVERAGE	str	use average overscan
OVERSCNB	1198.692841450332	float	ADUs (gain not applied)
OBSRDNB	2.953525302217383	float	electrons (gain is applied)
SATUELEB	71863.65509609997	float	saturation or non lin. level, in electrons
GAINC	1.122	float	e/ADU (gain applied to image)
SATULEVC	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPC	1.285695178230526	float	ADUs (max-min of median overscan per row)

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Table 9 – continued from previous page

KEY	Example Value	Type	Comment
OMETHC	AVERAGE	str	use average overscan
OVERSCNC	1190.789779784249	float	ADUs (gain not applied)
OBSRDNC	3.539433190358737	float	electrons (gain is applied)
SATUELEC	72194.20386708208	float	saturation or non lin. level, in electrons
GAIND	1.122	float	e/ADU (gain applied to image)
SATULEVD	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPD	0.9090212500377675	float	ADUs (max-min of median overscan per row)
OMETHD	AVERAGE	str	use average overscan
OVERSCND	1181.653571158484	float	ADUs (gain not applied)
OBSRDND	3.286804241230265	float	electrons (gain is applied)
SATUELED	72204.4546931602	float	saturation or non lin. level, in electrons
FIBERMIN	0	int	
LONGSTRN	OGIP 1.0	str	The OGIP Long String Convention may be used.
MODULE	CI	str	Image Sources/Component
FRAMES	None	Unknown	Number of Frames in Archive
COSMSPLT	F	bool	Cosmics split exposure if true
MAXSPLIT	0	int	Number of allowed exposure splits
OBSTYPE	FLAT	str	Spectrograph observation type
MANIFEST	F	bool	DOS exposure manifest
OBJECT		str	Object name
NTSSURVY[Page 74, 1]	na	str	NTS survey name
SEQID	3 requests	str	Exposure sequence identifier
SEQNUM	1	int	Number of exposure in sequence
SEQTOT	3	int	Total number of exposures in sequence
SEQSTART[Page 74, 1]	2021-06-07T00:37:19.875612	str	Start time of sequence processing
CAMSHUT	open	str	Shutter status during observation
WHITESPT[Page 74, 1]	T	bool	Telescope is at whitespot
ZENITH[Page 74, 1]	F	bool	Telescope is at zenith
SEANNEX[Page 74, 1]	F	bool	Telescope is at SE annex
BEYONDP[Page 74, 1]	F	bool	Telescope is beyond pole
FIDUCIAL[Page 74, 1]	off	str	Fiducials status during observation
AIRMASS[Page 74, 1]	1.521278	float	Airmass

continues on next page

Table 9 – continued from previous page

KEY	Example Value	Type	Comment
FOCUS[Page 74, 1]	1143.6,-727.1,-829.6,5.1,35.1,-0.0	str	Telescope focus settings
PMREADY[Page 74, 1]	T	bool	Primary mirror ready
DOMEAZ[Page 74, 1]	106.784	float	[deg] Dome azimuth angle
DOMINPOS[Page 74, 1]	T	bool	Dome is in position
GUIDOFFR[Page 74, 1]	0.0	float	[arcsec] Cummulative guider offset (RA)
GUIDOFFD[Page 74, 1]	-0.0	float	[arcsec] Cummulative guider offset (dec)
SUNRA[Page 74, 1]	75.340488	float	[deg] Sun RA at start of exposure
SUNDEC[Page 74, 1]	22.752292	float	[deg] Sun declination at start of exposure
MOONDEC[Page 74, 1]	11.86839	float	[deg] Moon declination at start of exposure
MOONRA[Page 74, 1]	37.518292	float	[deg] Moon RA at start of exposure
MOONSEP[Page 74, 1]	56.776	float	[deg] Moon Separation
MOUNTAZ[Page 74, 1]	286.506397	float	[deg] Mount azimuth angle
MOUNTDEC[Page 74, 1]	31.963302	float	[deg] Mount declination
MOUNTEL[Page 74, 1]	41.036698	float	[deg] Mount elevation angle
MOUNTHA[Page 74, 1]	58.478595	float	[deg] Mount hour angle
INCTRL[Page 74, 1]	F	bool	DESI in control
INPOS[Page 74, 1]	T	bool	Mount in position
MNTOFFD[Page 74, 1]	-0.0	float	[arcsec] Mount offset (dec)
MNTOFFR[Page 74, 1]	-0.0	float	[arcsec] Mount offset (RA)
PARALLAC[Page 74, 1]	73.493607	float	[deg] Parallactic angle
SKYDEC[Page 74, 1]	31.963302	float	[deg] Telescope declination (pointing on sky)
SKYRA[Page 74, 1]	94.904717	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC[Page 74, 1]	31.963305	float	[deg] Target declination (to TCS)
TARGTRA[Page 74, 1]	88.232751	float	[deg] Target right ascension (to TCS)
TARGTAZ[Page 74, 1]	288.686999	float	[deg] Target azimuth
TARGTEL[Page 74, 1]	35.641227	float	[deg] Target elevation
TRGTOFFD[Page 74, 1]	0.0	float	[arcsec] Telescope target offset (dec)
TRGTOFFR[Page 74, 1]	0.0	float	[arcsec] Telescope target offset (RA)
ZD[Page 74, 1]	48.963302	float	[deg] Telescope zenith distance
TCSST[Page 74, 1]	10:13:31.995	str	Local Sidereal time reported by TCS (HH:MM:SS)

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Table 9 – continued from previous page

KEY	Example Value	Type	Comment
TCSMJD[Page 74, 1]	59372.026394	float	MJD reported by TCS
SEEING[Page 74, 1]	None	Unknown	[arcsec] ETC/PM seeing
TRANSPAR[Page 74, 1]	None	Unknown	ETC/PM transparency
ADCCORR	F	bool	Correct pointing for ADC setting if True
ADC1PHI[Page 74, 1]	123.200072	float	[deg] ADC 1 angle
ADC2PHI[Page 74, 1]	151.330141	float	[deg] ADC 2 angle
ADC1HOME[Page 74, 1]	F	bool	ADC 1 at home position if True
ADC2HOME[Page 74, 1]	F	bool	ADC 2 at home position if True
ADC1NREV[Page 74, 1]	0.0	float	ADC 1 number of revs
ADC2NREV[Page 74, 1]	-1.0	float	ADC 2 number of revs
ADC1STAT[Page 74, 1]	STOPPED	str	ADC 1 status
ADC2STAT[Page 74, 1]	STOPPED	str	ADC 2 status
HEXPOS[Page 74, 1]	1143.6,-727.1,-829.6,5.1,35.1,-0.0	str	Hexapod position
HEXTRIM[Page 74, 1]	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
ROTOFFST[Page 74, 1]	0.0	float	[arcsec] Rotator offset
ROTENBLD[Page 74, 1]	F	bool	Rotator enabled
ROTRATE[Page 74, 1]	0.0	float	[arcsec/min] Rotator rate
RESETROT	F	bool	DOS Control: reset hex rotator
GUIDMODE	catalog	str	Guider mode
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating spectrograph
ILLSPECS[Page 74, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating illuminate s
CCDSPECS[Page 74, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating ccd spectrog
UPSSTAT[Page 74, 1]	SUCCESS	str	UPS Status
FILENAME	/exposures/desi/20210606/00091342/desi-00091342.fits.fz	str	Name of (F
EXCLUDED		str	Components excluded from this exposure
TCSKRA[Page 74, 1]	1.5 0 0	str	TCS Kalman (RA)
TCSKDEC[Page 74, 1]	1.5 0 0	str	TCS Kalman (dec)
TCSGRA[Page 74, 1]	0.3	float	TCS simple gain (RA)
TCSGDEC[Page 74, 1]	0.3	float	TCS simple gain (dec)
TCSMFRA[Page 74, 1]	1	int	TCS moving filter length (RA)
TCSMFDEC[Page 74, 1]	1	int	TCS moving filter length (dec)
TCSPIRA[Page 74, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
TCSPIDEC[Page 74, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
NSPEC	500	int	Number of spectra
WAVEMIN	3600.0	float	First wavelength [Angstroms]
WAVEMAX	5800.0	float	Last wavelength [Angstroms]

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Table 9 – continued from previous page

KEY	Example Value	Type	Comment
WAVESTEP	0.8	float	Wavelength step size [Angstroms]
SPECTER	0.10.0	str	https://github.com/desihub/specter
IN_PSF	SPECPROD/exposures/20210606/00091342/psf-b0-00091342.fits	str	Input sp
IN_IMG	SPECPROD/preproc/20210606/00091342/preproc-b0-00091342.fits	str	
ORIG_PSF	SPECPROD/calibnight/20210606/psfnight-b0-20210606.fits	str	
CHI2PDF	1.102403823484989	float	
BUNIT		str	adimensional quantity to divide to flatfield a frame
USEAOS[Page 74, 1]	F	bool	DOS Control: AOS data available if true
SPLITIDS[Page 74, 1]	80644	str	List of expids for split exposures
SHACKC[Page 74, 1]	13.9	float	[deg C] temperature at shack ceiling
TTRUSTTT[Page 74, 1]	9.2	float	[deg] Telescope truss STT temperature
UTILWALL[Page 74, 1]	9.0	float	[deg C] temperature at utility room wall
DOMERLOW[Page 74, 1]	9.1	float	[deg C] temperature at dome right, lower
TPMNIBT[Page 74, 1]	4.6	float	[deg] Telescope mirror NIB temperature
TPMEITT[Page 74, 1]	4.7	float	[deg] Telescope mirror EIT temperature
PLATFORM[Page 74, 1]	12.4	float	[deg C] temperature at platform
THINGEW[Page 74, 1]	9.0	float	[deg] Telescope hinge W temperature
HUMIDITY[Page 74, 1]	32.0	float	[%] (outside) humidity
DOMSHUTU[Page 74, 1]	not open	str	Upper dome shutter
FLOOR[Page 74, 1]	11.1	float	[deg C] temperature at floor (LCR)
DOMELLOW[Page 74, 1]	9.3	float	[deg C] temperature at dome left, lower
TCSOTEMP[Page 74, 1]	7.1	float	[deg] Telescope center section out temperature
OUTTEMP[Page 74, 1]	0.0	float	[deg C] outside temperature
TGLYCOLO[Page 74, 1]	-0.8	float	[deg] Telescope glycol out temperature
TTRUNTTT[Page 74, 1]	8.8	float	[deg] Telescope truss NTT temperature
PMCOOL[Page 74, 1]	on	str	Primary mirror cooling
TTRUSTBT[Page 74, 1]	8.3	float	[deg] Telescope truss STB temperature

continues on next page

Table 9 – continued from previous page

KEY	Example Value	Type	Comment
CFLOOR[Page 74, 1]	5.8	float	[deg C] temperature on C floor
TCITTEMP[Page 74, 1]	0.0	float	[deg] Telescope chimney IT temperature
TSERVO[Page 74, 1]	4.4	float	Telescope servo setpoint
WINDDIR[Page 74, 1]	298.0	float	[deg] wind direction
TTRWTEMP[Page 74, 1]	9.9	float	[deg] Telescope top ring W temperature
TPMRTDT[Page 74, 1]	4.52	float	[deg] Telescope mirror RTD temperature
DOMLIGHL[Page 74, 1]	off	str	Low dome lights
AMBIENTS[Page 74, 1]	13.1	float	[deg C] ambient temperature south
TPMSTAT[Page 74, 1]	soft air	str	Telescope mirror status
TPMSITT[Page 74, 1]	4.5	float	[deg] Telescope mirror SIT temperature
SHACKW[Page 74, 1]	11.6	float	[deg C] temperature at shack wall
TTRUWTBT[Page 74, 1]	8.0	float	[deg] Telescope truss WTB temperature
NWALLIN[Page 74, 1]	12.1	float	[deg C] temperature at north wall inside
DOMERUP[Page 74, 1]	10.3	float	[deg C] temperature at dome right, upper
TPMWOTT[Page 74, 1]	5.4	float	[deg] Telescope mirror WOT temperature
DOMEBUP[Page 74, 1]	14.6	float	[deg C] temperature at dome back, upper
TPMDESIT[Page 74, 1]	4.4	float	[deg] Telescope mirror desired temperature
TPCOTEMP[Page 74, 1]	4.7	float	[deg] Telescope primary cell out temperature
TTRUTSTT[Page 74, 1]	9.8	float	[deg] Telescope truss TST temperature
TPMWIBT[Page 74, 1]	4.5	float	[deg] Telescope mirror WIB temperature
TPMEOBT[Page 74, 1]	4.5	float	[deg] Telescope mirror EOB temperature
OUTWATTS[Page 74, 1]	4600.0,6900.0,4200.0	str	[W] UPS Phase A, B, C output watts
COMPDEW[Page 74, 1]	-7.2	float	[deg C] Computer room dewpoint
ROOF[Page 74, 1]	7.3	float	[deg C] temperature on roof
AMNIENTN[Page 74, 1]	11.6	float	[deg C] ambient temperature north
TAIRTEMP[Page 74, 1]	8.712	float	[deg] Telescope air temperature
COMPAMB[Page 74, 1]	17.2	float	[deg C] Computer room ambient temperature

continues on next page

Table 9 – continued from previous page

KEY	Example Value	Type	Comment
TPR1HUM[Page 74, 1]	0.0	float	Telescope probe 1 humidity
TRUSTEMP[Page 74, 1]	10.133	float	[deg] Average Telescope truss temperature (only
WINDSPD[Page 74, 1]	6.0	float	[m/s] wind speed
PMCOVER[Page 74, 1]	open	str	Primary mirror cover
TDEWPNT[Page 74, 1]	-8.51	float	Telescope air dew point
TELBASE[Page 74, 1]	6.2	float	[deg C] temperature at telescope base
TPMWITT[Page 74, 1]	4.7	float	[deg] Telescope mirror WIT temperature
COMPHUM[Page 74, 1]	13.3	float	[%] Computer room humidity
TTRUTSMT[Page 74, 1]	10.4	float	[deg] Telescope truss TSM temperature
NWALLOUT[Page 74, 1]	6.3	float	[deg C] temperature at north wall outside
TAIRITMP[Page 74, 1]	7.9	float	[deg] Telescope air in temperature
TPMNOBT[Page 74, 1]	4.8	float	[deg] Telescope mirror NOB temperature
TPCITEMP[Page 74, 1]	4.7	float	[deg] Telescope primary cell in temperature
TTRUNTBT[Page 74, 1]	8.1	float	[deg] Telescope truss NTB temperature
TFLOWIN[Page 74, 1]	9.8	float	Telescope flow rate in
EWALLCMP[Page 74, 1]	7.8	float	[deg C] temperature at east wall, computer room
TDBTEMP[Page 74, 1]	5.1	float	[deg] Telescope dec bore temperature
TCASITMP[Page 74, 1]	0.0	float	[deg] Telescope Cass Cage in temperature
TCSITEMP[Page 74, 1]	4.7	float	[deg] Telescope center section in temperature
STAIRSU[Page 74, 1]	10.1	float	[deg C] temperature at stairs, upper
TPMNITT[Page 74, 1]	4.8	float	[deg] Telescope mirror NIT temperature
TPMSOBT[Page 74, 1]	4.6	float	[deg] Telescope mirror SOB temperature
TCOWTEMP[Page 74, 1]	0.0	float	[deg] Telescope chimney OW temperature
TTRUWTTT[Page 74, 1]	8.8	float	[deg] Telescope truss WTT temperature
STAIRSL[Page 74, 1]	9.2	float	[deg C] temperature at stairs, lower
WWALLOUT[Page 74, 1]	6.9	float	[deg C] temperature at west wall outside
INAMPS[Page 74, 1]	66.0	float	[A] UPS total input current

continues on next page

Table 9 – continued from previous page

KEY	Example Value	Type	Comment
DEWPOINT[Page 74, 1]	20.1	float	[deg C] (outside) dew-point
PMIRTEMP[Page 74, 1]	4.787	float	[deg] Average primary mirror temperature (nit,e
TPR1TEMP[Page 74, 1]	0.0	float	[deg] Telescope probe1 temperature
UTILROOM[Page 74, 1]	9.4	float	[deg C] temperature in utilitiy room
TAIRFLOW[Page 74, 1]	1.121	float	Telescope air flow
WWALLIN[Page 74, 1]	11.2	float	[deg C] temperature at west wall inside
EWALLCOU[Page 74, 1]	7.0	float	[deg C] temperature at east wall, Coude room
BATTERY[Page 74, 1]	100.0	float	[%] UPS Battery left
TGLYCOLI[Page 74, 1]	-2.2	float	[deg] Telescope glycol in temperature
PRESSURE[Page 74, 1]	795.0	float	[torr] (outside) air pressure
DOMSHUTL[Page 74, 1]	not open	str	Lower dome shutter
TCIBTEMP[Page 74, 1]	0.0	float	[deg] Telescope chimney IB temperature
ROOFAMB[Page 74, 1]	7.3	float	[deg C] ambient temperature on roof
SECLEFT[Page 74, 1]	5604.0	float	[s] UPS Seconds left
DOMELUP[Page 74, 1]	12.8	float	[deg C] temperature at dome left, upper
STAIRSM[Page 74, 1]	9.7	float	[deg C] temperature at stairs, mid
TFLOWOUT[Page 74, 1]	10.0	float	Telescope flow rate out
TTRUETTT[Page 74, 1]	8.8	float	[deg] Telescope truss ETT temperature
DOMLIGHH[Page 74, 1]	off	str	High dome lights
TPR2HUM[Page 74, 1]	0.0	float	Telescope probe 2 humidity
TPMEOTT[Page 74, 1]	4.7	float	[deg] Telescope mirror EOT temperature
ALARM-ON[Page 74, 1]	F	bool	UPS active alarm condition
TCOSTEMP[Page 74, 1]	0.0	float	[deg] Telescope chimney OS temperature
THINGES[Page 74, 1]	9.7	float	[deg] Telescope hinge S temperature
TTRSTEMP[Page 74, 1]	9.8	float	[deg] Telescope top ring S temperature
TTRUSTST[Page 74, 1]	10.8	float	[deg] Telescope truss STS temperature
TTRUTSBT[Page 74, 1]	10.2	float	[deg] Telescope truss TSB temperature
TPMSIBT[Page 74, 1]	4.5	float	[deg] Telescope mirror SIB temperature

continues on next page

Table 9 – continued from previous page

KEY	Example Value	Type	Comment
TTRUETBT[Page 74, 1]	-7.9	float	[deg] Telescope truss ETB temperature
TAIROTMP[1]	3.7	float	[deg] Telescope air out temperature
TPMNOTT[1]	4.9	float	[deg] Telescope mirror NOT temperature
COMPTEMP[1]	22.3	float	[deg C] Computer room hygrometer temperature
ALARM[1]	F	bool	UPS major alarm or check battery
TCIMTEMP[1]	0.0	float	[deg] Telescope chimney IM temperature
TPMWOBT[1]	4.8	float	[deg] Telescope mirror WOB temperature
TPMEIBT[1]	4.6	float	[deg] Telescope mirror EIB temperature
TPMSOTT[1]	4.6	float	[deg] Telescope mirror SOT temperature
TCASOTMP[1]	6.8	float	[deg] Telescope Cass Cage out temperature
GUST[1]	4.5	float	[m/s] Wind gusts speed
TPR2TEMP[1]	0.0	float	[deg] Telescope probe2 temperature
TPMAVERT[1]	4.781	float	[deg] Telescope mirror av-eragetemperature
DOMEBLOW[1]	11.8	float	[deg C] temperature at dome back, lower
SKYLEVEL[1]	8.153	float	counts?] ETC sky level

Data: FITS image [float32, 2751x500]

HDU1

EXTNAME = IVAR

Inverse variance (1/sigma^2) of the fiber flat field in HDU0.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	
NAXIS2	500	int	
BUNIT		str	inverse variance, adimensional
CHECKSUM	75OIA2LF92LFA2LF	str	HDU checksum updated 2021-07-07T19:21:58
DATASUM	2784291411	str	data unit checksum updated 2021-07-07T19:21:58

Data: FITS image [float32, 2751x500]

[1] Optional

HDU2

EXTNAME = MASK

Mask of the fiberflat; 0=good. See the *bitmask documentation* page for the definition of the bits. Prior to desispec/0.24.0 and software release 18.9, the MASK HDU was compressed.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelengths
NAXIS2	500	int	Number of spectra (number of rows)
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	TDeFWDbFTDbFTDbF	str	HDU checksum updated 2021-07-07T19:21:58
DATASUM	687822	str	data unit checksum updated 2021-07-07T19:21:58

Data: FITS image [int32, 2751x500]

HDU3

EXTNAME = MEANSPEC

Average flat lamp spectrum of fibers in this camera frame. The fiber flat field is in first approximation the ratio of the measured spectra to this mean spectrum (in practice we use a deconvolved mean spectrum and reconvolve it with the resolution of each fiber). The units are electrons per Angstrom.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelengths
BUNIT	electron/Angstrom	str	
CHECKSUM	nXJGnXGFnXGFnXGF	str	HDU checksum updated 2021-07-07T19:21:58
DATASUM	2097385325	str	data unit checksum updated 2021-07-07T19:21:58

Data: FITS image [float32, 2751]

HDU4

EXTNAME = WAVELENGTH

Wavelength grid in Angstrom used by this fiber flat field. Note that contrary to the science frame, this wavelength array is in the observer frame. In consequence, one has to first convert its wavelength to the solar barycenter frame before using this data to flat field a science exposure. See the frame *WAVELENGTH documentation* for more details.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelengths
BUNIT	Angstrom	str	
CHECKSUM	4nG56kG34kG34kG3	str	HDU checksum updated 2021-07-07T19:21:58
DATASUM	2458411755	str	data unit checksum updated 2021-07-07T19:21:58

Data: FITS image [float32, 2751]

HDU5

EXTNAME = FIBERMAP

Fibermap with information about the fiber status.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	373	int	length of dimension 1
NAXIS2	500	int	length of dimension 2
ENCODING	ascii	str	
CHECKSUM	2imG4ZkE2fkE2ZkE	str	HDU checksum updated 2021-07-07T19:21:58
DATASUM	508954227	str	data unit checksum updated 2021-07-07T19:21:58

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		
PETAL_LOC	int16		
DEVICE_LOC	int32		
FIBER	int32		
LOCATION	int64		
FIBERSTATUS	int32		
TARGET_RA	float64		
TARGET_DEC	float64		
PMRA	float32		
PMDEC	float32		
REF_EPOCH	float32		
LAMBDA_REF	float32		
FA_TARGET	int64		
FA_TYPE	binary		
OBJTYPE	char[3]		
FIBERASSIGN_X	float32		
FIBERASSIGN_Y	float32		
PRIORITY	int32		

continues on next page

Table 10 – continued from previous page

Name	Type	Units	Description
SUBPRIORITY	float64		
OBSCONDITIONS	int32		
RELEASE	int16		
BRICKNAME	char[8]		
BRICKID	int64		
BRICK_OBJID	int64		
MORPHTYPE	char[4]		
EBV	float32		
FLUX_G	float32		
FLUX_R	float32		
FLUX_Z	float32		
FLUX_W1	float32		
FLUX_W2	float32		
FLUX_IVAR_G	float32		
FLUX_IVAR_R	float32		
FLUX_IVAR_Z	float32		
FLUX_IVAR_W1	float32		
FLUX_IVAR_W2	float32		
FIBERFLUX_G	float32		
FIBERFLUX_R	float32		
FIBERFLUX_Z	float32		
FIBERTOTFLUX_G	float32		
FIBERTOTFLUX_R	float32		
FIBERTOTFLUX_Z	float32		
MASKBITS	int16		
SERSIC	float32		
SHAPE_R	float32		
SHAPE_E1	float32		
SHAPE_E2	float32		
REF_ID	int64		
REF_CAT	char[2]		
GAIA_PHOT_G_MEAN_MAG	float32		
GAIA_PHOT_BP_MEAN_MAG	float32		
GAIA_PHOT_RP_MEAN_MAG	float32		
PARALLAX	float32		
PHOTSYS	char[1]		
PRIORITY_INIT	int64		
NUMOBS_INIT	int64		
DESI_TARGET	int64		
BGS_TARGET	int64		
MWS_TARGET	int64		
SCND_TARGET	int64		
PLATE_RA	float64		
PLATE_DEC	float64		
NUM_ITER	int64		
FIBER_X	float64		
FIBER_Y	float64		
DELTA_X	float64		
DELTA_Y	float64		

continues on next page

Table 10 – continued from previous page

Name	Type	Units	Description
FIBER_RA	float64		
FIBER_DEC	float64		
EXPTIME	float64		

Notes and Examples

Corrected flux = original flux / fiberflat.

```
fiberflat = desispec.fiberflat.compute_fiberflat(flatframe)
desispec.fiberflat.apply_fiberflat(scienceframe, fiberflat)
```

psfnight-CAMERA-NIGHT.fits

Summary
PSF model for the night derived from combining multiple arc lamp calibration exposures.

Naming Convention
`psfnight-CAMERA-NIGHT.fits`, where `CAMERA` is *e.g.*, "b0", "r5", etc. and `NIGHT` is the observation night in YYYYMMDD format.

Regex
`psfnight-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 1 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	XTRACE	IMAGE	Legendre coefficient of the fiber trace X CCD coordinates
HDU1	YTRACE	IMAGE	Legendre coefficient of the fiber trace Y CCD coordinates
HDU2	PSF	BINTABLE	Table with PSF shape parameters

FITS Header Units

HDU0

EXTNAME = XTRACE

Encodes the X coordinate of the fiber traces in the CCD. X is in units of pixels, along the cross-dispersion axis (perpendicular to the fiber traces) and increases with increasing fiber number.

XTRACE is a 2D array of size [nfiber,ncoef]. Each row contains the Legendre polynomial coefficients for a fiber trace. The polynomial applies to a reduced wavelength = (2*wavelength-(WAVEMIN+WAVEMAX))/(WAVEMAX-WAVEMIN) where WAVEMIN and WAVEMAX are header keywords.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	7	int	length of data axis 1
NAXIS2	500	int	length of data axis 2
FIBERMIN	0	int	
FIBERMAX	499	int	
WAVEMIN	7339.0	float	
WAVEMAX	9915.0	float	
PSFTYPE	GAUSS-HERMITE	str	
PSFVER	3	int	

Data: FITS image [float64, 7x500]

HDU1

EXTNAME = YTRACE

Encodes the Y coordinate of the fiber traces in the CCD. Y is in units of pixels, along the dispersion axis and increases with increasing wavelength.

YTRACE is a 2D array of size [nfiber,ncoef]. Each row contains the Legendre polynomial coefficients for a fiber trace. The polynomial applies to a reduced wavelength = (2*wavelength-(WAVEMIN+WAVEMAX))/(WAVEMAX-WAVEMIN) where WAVEMIN and WAVEMAX are header keywords.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	7	int	length of data axis 1
NAXIS2	500	int	length of data axis 2
FIBERMIN	0	int	
FIBERMAX	499	int	
WAVEMIN	7339.0	float	
WAVEMAX	9915.0	float	

Data: FITS image [float64, 7x500]

HDU2

EXTNAME = PSF

Binary table with the PSF shape parameters encoded as Legendre polynomials of wavelength, per fiber.

Each row of the table addresses a parameter. The column PARAM provides its name. The column COEFF contains a 2D array of size [nfiber,ncoef] with its associated Legendre polynomial coefficients.

As for XTRACE and YTRACE, each row of the COEFF array provided the Legendre coefficients of a fiber. The polynomial applies to the reduced wavelength = (2*wavelength-(WAVEMIN+WAVEMAX))/(WAVEMAX-WAVEMIN) where WAVEMIN and WAVEMAX are header keywords.

The additional columns LEGDEGX and LEGDEGW are the degrees along the cross-dispersion and dispersion axes used during the fit.

This format can apply to several PSF models. For the one currently used in DESI, based on Gauss-Hermite polynomials, the parameters are the following:

- 'GHSIGX' Gauss-Hermite Gaussian sigma along X
- 'GHSIGY' Gauss-Hermite Gaussian sigma along Y
- 'GH-I-J' with I and J in the range 0 to 6: Gauss-Hermite polynomial coefficient of degree I along X and J along Y
- 'TAILAMP' PSF tail amplitude
- 'TAILCORE' PSF tail core size
- 'TAILXSCA' relative scaling along X
- 'TAILYSCA' relative scaling along Y
- 'TAILINDE' PSF tail asymptotic power law index
- 'BUNDLE' Index of fiber bundle (or fiber block)
- 'STATUS' Not used currently (values = 0)
- 'CONT' Value of continuum at this fiber and wavelength

PSF(X,Y) = PSF_CORE(X,Y) + PSF_TAIL(X,Y)

PSF_CORE(X,Y) = [SUM_ij (GH-i-j)*HERM(i,X/GHSIGX)*HERM(j,Y/GHSIGY)*GAUS(X,GHSIGX)*GAUS(Y,GHSIGY)

PSF_TAIL(X,Y) = TAILAMP*R^2/(TAILCORE^2+R^2)^(1+TAILINDE/2) with R^2=(X/TAILXSCA)^2+(Y/TAILYSCA)^2')

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8016	int	width of table in bytes
NAXIS2	59	int	number of rows in table
PSFTYPE	GAUSS-HERMITE	str	
PSFVER	3	str	
MJD	0	int	MJD of arc lamp exposure
PLATEID	0	int	plate ID of arc lamp exposure
CAMERA	'r9 '	str	camera ID
ARCEXP	0	int	ID of arc lamp exposure used to fit PSF
NPIX_X	4114	int	number of columns in input CCD image
NPIX_Y	4128	int	number of rows in input CCD image
HSIZEX	8	int	Half size of PSF in fit, NX=2*HSIZEX+1
HSIZEY	5	int	Half size of PSF in fit, NY=2*HSIZEY+1
FIBERMIN	0	int	first fiber (starting at 0)

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Table 11 – continued from previous page

KEY	Example Value	Type	Comment
FIBERMAX	499	int	last fiber (included)
NPARAMS	57	int	number of PSF parameters
LEGDEG	1	int	degree of Legendre pol.(wave) for parameters
GHDEGX	6	int	degree of Hermite polynomial along CCD columns
GHDEGY	6	int	degree of Hermite polynomial along CCD rows
WAVEMIN	5546.0	float	minimum wavelength (A), used for the Legendre p
WAVEMAX	7835.0	float	maximum wavelength (A), used for the Legendre p
PSFERROR	0.0	float	assumed PSF fractional error in chi2
READNOIS	0.0	float	assumed read out noise in chi2
GAIN	1.0	float	assumed gain in chi2
B00RCHI2	1.265121999136178	float	best fit chi2/ndf for fiber bundle 0
B00NDATA	140488	int	number of pixels in fit for fiber bundle 0
B00NPAR	1746	int	number of parameters in fit for fiber bundle 0
B01RCHI2	1.244445290488158	float	best fit chi2/ndf for fiber bundle 1
B01NDATA	141467	int	number of pixels in fit for fiber bundle 1
B01NPAR	1786	int	number of parameters in fit for fiber bundle 1
B02RCHI2	1.287672518525548	float	best fit chi2/ndf for fiber bundle 2
B02NDATA	142582	int	number of pixels in fit for fiber bundle 2
B02NPAR	1802	int	number of parameters in fit for fiber bundle 2
B03RCHI2	1.297067743767708	float	best fit chi2/ndf for fiber bundle 3
B03NDATA	140419	int	number of pixels in fit for fiber bundle 3
B03NPAR	1793	int	number of parameters in fit for fiber bundle 3
B04RCHI2	1.28304830748024	float	best fit chi2/ndf for fiber bundle 4
B04NDATA	138599	int	number of pixels in fit for fiber bundle 4
B04NPAR	1785	int	number of parameters in fit for fiber bundle 4
B05RCHI2	1.269246986023668	float	best fit chi2/ndf for fiber bundle 5

continues on next page

Table 11 – continued from previous page

KEY	Example Value	Type	Comment
B05NDATA	136603	int	number of pixels in fit for fiber bundle 5
B05NPAR	1778	int	number of parameters in fit for fiber bundle 5
B06RCHI2	1.299512103689112	float	best fit chi2/ndf for fiber bundle 6
B06NDATA	137571	int	number of pixels in fit for fiber bundle 6
B06NPAR	1807	int	number of parameters in fit for fiber bundle 6
B07RCHI2	1.347344727978646	float	best fit chi2/ndf for fiber bundle 7
B07NDATA	135041	int	number of pixels in fit for fiber bundle 7
B07NPAR	1788	int	number of parameters in fit for fiber bundle 7
B08RCHI2	1.222211322234266	float	best fit chi2/ndf for fiber bundle 8
B08NDATA	130583	int	number of pixels in fit for fiber bundle 8
B08NPAR	1737	int	number of parameters in fit for fiber bundle 8
B09RCHI2	1.283488581543704	float	best fit chi2/ndf for fiber bundle 9
B09NDATA	127868	int	number of pixels in fit for fiber bundle 9
B09NPAR	1716	int	number of parameters in fit for fiber bundle 9
B10RCHI2	1.275975791937288	float	best fit chi2/ndf for fiber bundle 10
B10NDATA	131593	int	number of pixels in fit for fiber bundle 10
B10NPAR	1770	int	number of parameters in fit for fiber bundle 10
B11RCHI2	1.250307604266956	float	best fit chi2/ndf for fiber bundle 11
B11NDATA	133944	int	number of pixels in fit for fiber bundle 11
B11NPAR	1778	int	number of parameters in fit for fiber bundle 11
B12RCHI2	1.231315819103986	float	best fit chi2/ndf for fiber bundle 12
B12NDATA	134637	int	number of pixels in fit for fiber bundle 12
B12NPAR	1767	int	number of parameters in fit for fiber bundle 12
B13RCHI2	1.238502289060944	float	best fit chi2/ndf for fiber bundle 13
B13NDATA	134287	int	number of pixels in fit for fiber bundle 13

continues on next page

Table 11 – continued from previous page

KEY	Example Value	Type	Comment
B13NPAR	1761	int	number of parameters in fit for fiber bundle 13
B14RCHI2	1.296845822866915	float	best fit chi2/ndf for fiber bundle 14
B14NDATA	139568	int	number of pixels in fit for fiber bundle 14
B14NPAR	1818	int	number of parameters in fit for fiber bundle 14
B15RCHI2	1.319475598189398	float	best fit chi2/ndf for fiber bundle 15
B15NDATA	139759	int	number of pixels in fit for fiber bundle 15
B15NPAR	1802	int	number of parameters in fit for fiber bundle 15
B16RCHI2	1.2373008163902	float	best fit chi2/ndf for fiber bundle 16
B16NDATA	139822	int	number of pixels in fit for fiber bundle 16
B16NPAR	1778	int	number of parameters in fit for fiber bundle 16
B17RCHI2	1.262409294037498	float	best fit chi2/ndf for fiber bundle 17
B17NDATA	140633	int	number of pixels in fit for fiber bundle 17
B17NPAR	1770	int	number of parameters in fit for fiber bundle 17
B18RCHI2	1.270007569982172	float	best fit chi2/ndf for fiber bundle 18
B18NDATA	143004	int	number of pixels in fit for fiber bundle 18
B18NPAR	1790	int	number of parameters in fit for fiber bundle 18
B19RCHI2	1.275991847448398	float	best fit chi2/ndf for fiber bundle 19
B19NDATA	143320	int	number of pixels in fit for fiber bundle 19
B19NPAR	1780	int	number of parameters in fit for fiber bundle 19
EXPID[1]	0.0	float	
IN_IMAGE[Page 83, 1]	SPECPROD/preproc/20210508/00087672/preproc-z6-00087672.fits	str	
IN_PSF[1]	SPECPROD/calibnight/20210508/psfnight-z6-20210508.fits	str	
MEANDY[1]	1.53486325871199e-12	float	
MEANDX[1]	-0.02150255816129912	float	
MINDY[1]	-3.6379788070917e-12	float	
MINDX[1]	-0.02509807125352381	float	
MAXDY[1]	1.00044417195022e-11	float	
MAXDX[1]	-0.01113212858444967	float	

[1] Optional

Required Data Table Columns

Name	Type	Units	Description
PARAM	char[8]		Parameter name
COEFF	float64[1000]		Legendre coefficients[nfiber,ncoeff]
LEGDEGX	int32		Legendre polynomial degree in the X (Fiber) direction
LEGDEGW	int32		Legendre polynomail degree in the Y (Wavelength) direction

The dimensionality of `COEFF` is `[nfiber,ncoeff]` where `nfiber` is the number of fibers (always 500 for standard production runs) and `ncoeff` is the maximum value of any row of `LEGDEGX` or `LEGDEGY`.

exposures

NIGHT

EXPID

calibstars-EXPID

Summary
Auxilliary file with information on calibration stars.

Naming Convention
`calibstars-{EXPID}.csv`, where `{EXPID}` is the 8-digit exposure ID.

Regex
`calibstars-[0-9]{8}\.csv`

File Type
CSV, 50 KB

Contents

The file should have these columns:

Name	Type	Description
FIBER	int	Fiber ID on the CCDs [0-4999]
RCALIBFRAC	float	Ratio of r-band spectro flux / model flux
EBV	float	Galactic extinction E(B-V) reddening from SFD98
MODEL_COLOR	float	G-R color of best fit model
DATA_COLOR	float	G-R color of data
X	float	X location on focal plane [mm]
Y	float	Y location on focal palne [mm]
VALID	int	stdstar selected as good

Standard stars are selected as valid to use by comparing the scatter of the flux to the model fits for all stdstars across petals. 3-sigma outliers in RCALIBFRAC are rejected, as are stars whose G-R color differs by more than 0.2*EBV from their best fit model.

cframe-CAMERA-EXPID.fits

Summary
This holds the calibrated spectra for a given camera and exposure. See the datamodel for *frame-CAMERA-EXPID.fits* files for details of the format.

Naming Convention
`cframe-{CAMERA}-{EXPID}.fits`, where `{CAMERA}` is one of the spectrograph cameras (*e.g.* `z1`) and `{EXPID}` is the 8-digit exposure ID.

Regex
`cframe-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 82 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	FLUX	IMAGE	Flux, 10^{-17} erg/s/cm2/A
HDU1	IVAR	IMAGE	Inverse variance, (10^{-17} erg/s/cm2/A)^-2
HDU2	MASK	IMAGE	Mask (0 = good)
HDU3	WAVELENGTH	IMAGE	wavelength in Angstrom
HDU4	RESOLUTION	IMAGE	Resolution Matrix
HDU5	FIBERMAP	BINTABLE	Fibermap
HDU6	CHI2PIX	IMAGE	chi2 of fit of PSF model to CCD image
HDU7	SCORES	BINTABLE	Quality Assurance scores

FITS Header Units

HDU0

EXTNAME = FLUX

2D array of calibrated spectral flux of dimension [nspec, nwave] in units of 1e-17 erg / (s cm2 Angstrom). nspec is the number of fibers per camera. nwave in the length of the wavelength array. The spectra of all fibers share the same wavelength grid (given in HDU WAVELENGTH). cframe.flux = (frame.flux / flatfield - sky) / fluxcalib. This calibration of the total flux is valid for point sources only. For extended sources, one may consider the ‘fiber flux’, which is the flux one would collect in a 1.5 arcsec diameter aperture centered on the object when observed with a 1 arcsec FWHM Gaussian seeing. The ‘fiber flux’ can be obtained by multiplying the flux array of each fiber by the corresponding entry in fibermap table column ‘PSF_TO_FIBER_SPECFLUX’. This is the quantity to use for comparison with the photometric FIBERFLUX values given for several band passes in the fibermap.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
NAXIS2	500	int	
EXPID	69022	int	Exposure number
EXPFRAME	0	int	Frame number
TILEID	80616	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/080/fiberassign-080616.fits	str	Fiber assign fil
FLAVOR	science	str	Observation type
SEQUENCE	DESI	str	OCS Sequence name
PURPOSE	Commissioning	str	Purpose of observing night
PROGRAM	SV1 BGS+MWS tile 80616	str	Program name
PROPID	2019B-5000	str	Proposal ID
OBSERVER	DESIObserver	str	Names of observers
LEAD	RunManager	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20201220	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2020-12-21T02:36:32.099838	str	[UTC] Observation data and start time
TIME-OBS	02:39:11.845920	str	[UTC] Observation start time
MJD-OBS	59204.10870486	float	Modified Julian Date of observation
OPENSHUT	2020-12-21T02:36:32.099838	str	Time shutter opened
ST	01:10:39.210	str	Local Sidereal time at observation start (HH:MM
EXPTIME	300.007	float	[s] Actual exposure time
REQRA	356.0	float	[deg] Requested right ascension (observer input
REQDEC	29.0	float	[deg] Requested declination (observer input)
FOCUS	1426.5,-501.4,81.0,-2.6,42.3,169.2	str	Telescope focus settings
VCCD	ON	str	True (ON) if CCD voltage is on
VCCDON	2020-12-09T21:23:19.307761	str	Time when CCD voltage was turned on

continues on next page

Table 12 – continued from previous page

KEY	Example Value	Type	Comment
VCCDSEC	969702.2	float	[s] CCD on time in seconds
TRUSTEMP	11.767	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	8.925	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Epoch of observation
MOUNTAZ	266.70224	float	[deg] Mount azimuth angle
MOUNTDEC	28.999221	float	[deg] Mount declination
MOUNTEL	71.039837	float	[deg] Mount elevation angle
MOUNTHA	21.769281	float	[deg] Mount hour angle
SKYDEC	28.999221	float	[deg] Telescope declination (pointing on sky)
SKYRA	355.996551	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	28.999221	float	[deg] Target declination (to TCS)
TARGTRA	355.996551	float	[deg] Target right ascension (to TCS)
USEETC	F	bool	ETC data available if true
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	167.1	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.0	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
SPECGRPH	8	int	Spectrograph logical name (SP)
SPECID	2	int	Spectrograph serial number (SM)
FEEBOX	lbnl050	str	CCD Controller serial number
VESSEL	8	int	Cryostat serial number
FEEVER	v20160312	str	CCD Controller version
FEEPOWER	ON	str	FEE power status
FEEDMASK	2134851391	int	FEE dac mask
FEECMASK	1048575	int	FEE clk mask
CCDTEMP	-135.3315	float	[deg C] CCD controller CCD temperature
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
FILENAME	/exposures/desi/specs/20201220/00069022/sp1-00069022.fits.fz	str	Name

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Table 12 – continued from previous page

KEY	Example Value	Type	Comment
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
AMPSECB	[4114:2058, 1:2064]	str	AMP section for quadrant B
DAC16	39.9961,39.3162	str	[V] set value, measured value
CLOCK8	9.9992,2.9993	str	[V] high rail, low rail
PRRSECD	[2193:4249, 4194:4194]	str	Row prescan section for quadrant D
CCDPREP	purge,clear	str	CCD prep actions
CLOCK10	9.9992,2.9993	str	[V] high rail, low rail
DAC17	20.0008,12.2732	str	[V] set value, measured value
ORSECB	[2193:4249, 2066:2097]	str	Row overscan section for quadrant B
DAC15	0.0,0.0148	str	[V] set value, measured value
ORSECD	[2193:4249, 2098:2129]	str	Row bias section for quad-rant D
DIGITIME	47.5899	float	[s] Time to digitize image
BIASSECA	[2065:2128, 2:2065]	str	Bias section for quadrant A
CLOCK9	9.9992,2.9993	str	[V] high rail, low rail
CLOCK18	9.0,0.9999	str	[V] high rail, low rail
CAMERA	r8	str	Camera name
CLOCK17	9.0,0.9999	str	[V] high rail, low rail
CLOCK5	9.9999,0.0	str	[V] high rail, low rail
TRIMSECD	[2193:4249, 2130:4193]	str	Trim section for quadrant D
DETSECD	[2058:4114, 2065:4128]	str	Detector section for quad-rant D
DAC0	-9.0002,-8.9507	str	[V] set value, measured value
CLOCK15	9.9992,2.9993	str	[V] high rail, low rail
TRIMSECA	[8:2064, 2:2065]	str	Trim section for quadrant A
BIASSECB	[2129:2192, 2:2065]	str	Bias section for quadrant B
CLOCK11	9.9992,2.9993	str	[V] high rail, low rail
CLOCK12	9.9992,2.9993	str	[V] high rail, low rail
AMPSECD	[4114:2058, 4128:2065]	str	AMP section for quadrant D
CLOCK4	9.9999,0.0	str	[V] high rail, low rail
PRRSECB	[2193:4249, 1:1]	str	Row prescan section for quadrant B
CCDSECD	[2058:4114, 2065:4128]	str	CCD section for quadrant D

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Table 12 – continued from previous page

KEY	Example Value	Type	Comment
CCDTMING	default_lbnl_timing_20180905.txt	str	CCD timing file
TRIMSECB	[2193:4249, 2:2065]	str	Trim section for quadrant B
CCDSIZE	4194,4256	str	CCD size in pixels (rows, columns)
PGAGAIN	3	int	Controller gain
PRESECD	[4250:4256, 2130:4193]	str	Prescan section for quadrant D
CLOCK6	9.9999,0.0	str	[V] high rail, low rail
CLOCK13	9.9992,2.9993	str	[V] high rail, low rail
DAC7	5.9998,6.028	str	[V] set value, measured value
DATASECA	[8:2064, 2:2065]	str	Data section for quadrant A
CRYOTEMP[1]	162.97	float	[deg K] Cryostat CCD temperature
OFFSET2	0.4000000059604645,-8.9198	str	[V] set value, measured value
OFFSET6	2.0,6.0437	str	[V] set value, measured value
DELAYS	20, 20, 25, 40, 7, 3000, 7, 7, 7, 7	str	[10] Delay settings
BIASSECD	[2129:2192, 2130:4193]	str	Bias section for quadrant D
PRRSECA	[8:2064, 1:1]	str	Row prescan section for quadrant A
TRIMSECC	[8:2064, 2130:4193]	str	Trim section for quadrant C
CLOCK3	-2.0001,3.9999	str	[V] high rail, low rail
CCDNAME	CCDSM2R	str	CCD name
DAC9	-25.0003,-24.768	str	[V] set value, measured value
CCDSECC	[1:2057, 2065:4128]	str	CCD section for quadrant C
ORSECA	[8:2064, 2066:2097]	str	Row overscan section for quadrant A
DAC5	5.9998,6.0543	str	[V] set value, measured value
CCDSECB	[2058:4114, 1:2064]	str	CCD section for quadrant B
DETSECB	[2058:4114, 1:2064]	str	Detector section for quadrant B
OFFSET0	0.4000000059604645,-8.9507	str	[V] set value, measured value
SETTINGS	detectors_sm_20191211.json	str	Name of DESI CCD settings file
DAC11	-25.0003,-24.8422	str	[V] set value, measured value

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Table 12 – continued from previous page

KEY	Example Value	Type	Comment
BIASSECC	[2065:2128, 2130:4193]	str	Bias section for quadrant C
CASETEMP	59.8142	float	[deg C] CCD controller case temperature
DAC10	-25.0003,-24.7086	str	[V] set value, measured value
DAC1	-9.0002,-8.9198	str	[V] set value, measured value
DAC14	0.0,0.0594	str	[V] set value, measured value
DETECTOR	M1-46	str	Detector (ccd) identification
CDSPARMS	400, 400, 8, 2000	str	CDS parameters
OFFSET3	0.4000000059604645,-8.9095	str	[V] set value, measured value
DATASECB	[2193:4249, 2:2065]	str	Data section for quadrant B
ORSECC	[8:2064, 2098:2129]	str	Row overscan section for quadrant C
CRYOPRES[Page 104, 1]	8.897e-08	str	[mb] Cryostat pressure (IP)
AMPSECA	[1:2057, 1:2064]	str	AMP section for quadrant A
OFFSET7	2.0,6.028	str	[V] set value, measured value
DAC4	5.9998,6.028	str	[V] set value, measured value
DATASECC	[8:2064, 2130:4193]	str	Data section for quadrant C
PRESECC	[1:7, 2130:4193]	str	Prescan section for quadrant C
CLOCK16	9.9999,3.0	str	[V] high rail, low rail
CLOCK1	9.9999,0.0	str	[V] high rail, low rail
PRESECB	[4250:4256, 2:2065]	str	Prescan section for quadrant B
DAC12	0.0,0.0297	str	[V] set value, measured value
DAC8	-25.0003,-24.9312	str	[V] set value, measured value
OFFSET4	2.0,6.0332	str	[V] set value, measured value
DAC2	-9.0002,-8.9198	str	[V] set value, measured value
CCDCFG	default_lbnl_20190717.cfg	str	CCD configuration file
BLDTIME	0.3547	float	[s] Time to build image
PRESECA	[1:7, 2:2065]	str	Prescan section for quadrant A
DATASECD	[2193:4249, 2130:4193]	str	Data section for quadrant D

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Table 12 – continued from previous page

KEY	Example Value	Type	Comment
DETSECC	[1:2057, 2065:4128]	str	Detector section for quadrant C
PRRSECC	[8:2064, 4194:4194]	str	Row prescan section for quadrant C
DAC6	5.9998,6.0437	str	[V] set value, measured value
DETSECA	[1:2057, 1:2064]	str	Detector section for quadrant A
CLOCK2	9.9999,0.0	str	[V] high rail, low rail
DAC3	-9.0002,-8.9095	str	[V] set value, measured value
OFFSET1	0.4000000059604645,-8.9198	str	[V] set value, measured value
AMPSECC	[1:2057, 4128:2065]	str	AMP section for quadrant C
CLOCK7	-2.0001,3.9999	str	[V] high rail, low rail
DAC13	0.0,0.0148	str	[V] set value, measured value
CCDSECA	[1:2057, 1:2064]	str	CCD section for quadrant A
OFFSET5	2.0,6.049	str	[V] set value, measured value
CLOCK14	9.9992,2.9993	str	[V] high rail, low rail
CLOCK0	9.9999,0.0	str	[V] high rail, low rail
CPUTEMP	60.8086	float	[deg C] CCD controller CPU temperature
REQTIME	300.0	float	[s] Requested exposure time
OBSID	kp4m20201221t023911	str	Unique observation identifier
PROCTYPE	RAW	str	Data processing level
PRODTYPE	image	str	Data product type
CHECKSUM	OUDTPU9ROUCROU9R	str	HDU checksum updated 2022-02-14T08:25:01
DATASUM	737508938	str	data unit checksum updated 2022-02-14T08:25:01
GAINA	1.627	float	e/ADU (gain applied to image)
SATULEVA	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPA	0.5704803307307884	float	ADUs (max-min of median overscan per row)
OMETHA	AVERAGE	str	use average overscan
OVERSCNA	1984.679589024373	float	ADUs (gain not applied)
OBSRDNA	2.48375231913931	float	electrons (gain is applied)
SATUELEA	103396.3713086573	float	saturation or non lin. level, in electrons
GAINB	1.482	float	e/ADU (gain applied to image)

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Table 12 – continued from previous page

KEY	Example Value	Type	Comment
SATULEVB	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPB	0.5242006066837348	float	ADUs (max-min of median overscan per row)
OMETHB	AVERAGE	str	use average overscan
OVERSCNB	1980.885980481041	float	ADUs (gain not applied)
OBSRDNB	2.179252294581384	float	electrons (gain is applied)
SATUELEB	94187.1969769271	float	saturation or non lin. level, in electrons
GAINC	1.581	float	e/ADU (gain applied to image)
SATULEVC	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPC	0.6303264842863427	float	ADUs (max-min of median overscan per row)
OMETHC	AVERAGE	str	use average overscan
OVERSCNC	1966.11973127108	float	ADUs (gain not applied)
OBSRDNC	2.455388696359903	float	electrons (gain is applied)
SATUELEC	100502.3997048604	float	saturation or non lin. level, in electrons
GAIND	1.589	float	e/ADU (gain applied to image)
SATULEVD	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPD	0.6243009115278255	float	ADUs (max-min of median overscan per row)
OMETHD	AVERAGE	str	use average overscan
OVERSCND	1987.970298453192	float	ADUs (gain not applied)
OBSRDND	2.518301447806098	float	electrons (gain is applied)
SATUELED	100976.2301957579	float	saturation or non lin. level, in electrons
FIBERMIN	4000	int	
LONGSTRN	OGIP 1.0	str	The OGIP Long String Convention may be used.
MODULE	CI	str	Image Sources/Component
COSMSPLT	F	bool	Cosmics split exposure if true
MAXSPLIT	0	int	Number of allowed exposure splits
SPLITIDSPage 104, 1	69022	str	List of expids for split exposures
OBSTYPE	SCIENCE	str	Spectrograph observation type
MANIFEST	F	bool	DOS exposure manifest
OBJECT		str	Object name
SEQNUM	1	int	Number of exposure in sequence
CAMSHUT	open	str	Shutter status during observation

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Table 12 – continued from previous page

KEY	Example Value	Type	Comment
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
FOCSTIME[Page 104, 1]	60.0	float	[s] focus GFA exposure time
SKYTIME[Page 104, 1]	60.0	float	[s] sky camera exposure time (acquisition)
WHITESPT	F	bool	Telescope is at whitespot
ZENITH	F	bool	Telescope is at zenith
SEANNEX	F	bool	Telescope is at SE annex
BEYONDP	F	bool	Telescope is beyond pole
FIDUCIAL	off	str	Fiducials status during observation
BACKLIT	off	str	Fibers are backlit if True
AIRMASS	1.060311	float	Airmass
PMREADY	T	bool	Primary mirror ready
PMCOVER	open	str	Primary mirror cover
PMCOOL	off	str	Primary mirror cooling
DOMSHUTU	open	str	Upper dome shutter
DOMSHUTL	open	str	Lower dome shutter
DOMLIGHH	off	str	High dome lights
DOMLIGHL	off	str	Low dome lights
DOMEAZ	255.166	float	[deg] Dome azimuth angle
DOMINPOS	T	bool	Dome is in position
GUIDOFFR	-0.052283	float	[arcsec] Cummulative guider offset (RA)
GUIDOFFD	0.136634	float	[arcsec] Cummulative guider offset (dec)
MOONDEC	-8.975162	float	[deg] Moon declination at start of exposure
MOONRA	352.538429	float	[deg] Moon RA at start of exposure
INCTRL	T	bool	DESI in control
INPOS	T	bool	Mount in position
MNTOFFD	-15.76	float	[arcsec] Mount offset (dec)
MNTOFFR	29.32	float	[arcsec] Mount offset (RA)
PARALLAC	75.635085	float	[deg] Parallactic angle
TARGTAZ	267.074049	float	[deg] Target azimuth
TARGTEL	70.563787	float	[deg] Target elevation
TRGTOFFD	0.0	float	[arcsec] Telescope target offset (dec)
TRGTOFFR	0.0	float	[arcsec] Telescope target offset (RA)
ZD	19.436213	float	[deg] Telescope zenith distance
TILERA	356.0	float	RA of tile given in fiberassign file

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Table 12 – continued from previous page

KEY	Example Value	Type	Comment
TILEDEC	29.0	float	DEC of tile given in fiberassign file
TCSST	01:13:18.668	str	Local Sidereal time reported by TCS (HH:MM:SS)
TCSMJD	59204.110981	float	MJD reported by TCS
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM[Page 104, 1]	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM[Page 104, 1]	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
REQADC	65.78,85.28	str	[deg] requested ADC angles
ADCCORR	T	bool	Correct pointing for ADC setting if True
ADC1PHI	65.780005	float	[deg] ADC 1 angle
ADC2PHI	85.279991	float	[deg] ADC 2 angle
ADC1HOME	F	bool	ADC 1 at home position if True
ADC2HOME	F	bool	ADC 2 at home position if True
ADC1NREV	-1.0	float	ADC 1 number of revs
ADC2NREV	0.0	float	ADC 2 number of revs
ADC1STAT	STOPPED	str	ADC 1 status
ADC2STAT	STOPPED	str	ADC 2 status
HEXPOS	1426.5,-501.3,81.0,-2.6,42.3,171.9	str	Hexapod position
RESETROT	F	bool	DOS Control: reset hex rotator
USEPOS	T	bool	Fiber positioner data available if true
PETALS	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9	str	Participating petals
POSCYCLE	1	int	Number of current iteration
POSONTGT	3626	int	Number of positioners on target
POSONFRC	0.8613	float	Fraction of positioners on target
POSDISAB	37	int	Number of disabled positioners
POSENABL	4210	int	Number of enabled positioners
POSRMS	0.0171	float	[micron] RMS of positioner accuracy
POSITER	1	int	Positioning Control: max. number of pos. cycles
POSFRACT	0.95	float	

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Table 12 – continued from previous page

KEY	Example Value	Type	Comment
POSTOLER	0.01	float	Positioning Control: in_position tolerance (mm)
POSMVALL	T	bool	Positioning Control: move all positioners
GUIDMODE	catalog	str	Guider mode
USEAOS[Page 104, 1]	F	bool	DOS Control: AOS data available if true
USESPCTR	T	bool	DOS Control: use spectrographs
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating spectrograph
ILLSPECS[Page 104, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating illuminate s
CCDSPECS[Page 104, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating ccd spectrog
TDEWPNT	-16.043	float	Telescope air dew point
TAIRFLOW	0.0	float	Telescope air flow
TAIRITMP	11.8	float	[deg] Telescope air in temperature
TAIROTMP	11.7	float	[deg] Telescope air out temperature
TAIRTEMP	10.65	float	[deg] Telescope air temperature
TCASITMP	0.0	float	[deg] Telescope Cass Cage in temperature
TCASOTMP	10.8	float	[deg] Telescope Cass Cage out temperature
TCSITEMP	9.3	float	[deg] Telescope center section in temperature
TCSOTEMP	10.8	float	[deg] Telescope center section out temperature
TCIBTEMP	0.0	float	[deg] Telescope chimney IB temperature
TCIMTEMP	0.0	float	[deg] Telescope chimney IM temperature
TCITTEMP	0.0	float	[deg] Telescope chimney IT temperature
TCOSTEMP	0.0	float	[deg] Telescope chimney OS temperature
TCOWTEMP	0.0	float	[deg] Telescope chimney OW temperature
TDBTEMP	9.3	float	[deg] Telescope dec bore temperature
TFLOWIN	0.0	float	Telescope flow rate in
TFLOWOUT	0.0	float	Telescope flow rate out
TGLYCOLI	9.9	float	[deg] Telescope glycol in temperature
TGLYCOLO	9.8	float	[deg] Telescope glycol out temperature
THINGES	11.4	float	[deg] Telescope hinge S temperature

continues on next page

Table 12 – continued from previous page

KEY	Example Value	Type	Comment
THINGEW	11.2	float	[deg] Telescope hinge W temperature
TPMAVERT	8.931	float	[deg] Telescope mirror averagetemperature
TPMDESIT	7.0	float	[deg] Telescope mirror desired temperature
TPMEIBT	8.6	float	[deg] Telescope mirror EIB temperature
TPMEITT	8.6	float	[deg] Telescope mirror EIT temperature
TPMEOBT	8.5	float	[deg] Telescope mirror EOB temperature
TPMEOTT	9.0	float	[deg] Telescope mirror EOT temperature
TPMNIBT	8.4	float	[deg] Telescope mirror NIB temperature
TPMNITT	8.9	float	[deg] Telescope mirror NIT temperature
TPMNOBT	8.8	float	[deg] Telescope mirror NOB temperature
TPMNOTT	9.1	float	[deg] Telescope mirror NOT temperature
TPMRTDT	9.0	float	[deg] Telescope mirror RTD temperature
TPMSIBT	8.6	float	[deg] Telescope mirror SIB temperature
TPMSITT	8.8	float	[deg] Telescope mirror SIT temperature
TPMSOBT	8.2	float	[deg] Telescope mirror SOB temperature
TPMSOTT	8.9	float	[deg] Telescope mirror SOT temperature
TPMSTAT	ready	str	Telescope mirror status
TPMWIBT	8.2	float	[deg] Telescope mirror WIB temperature
TPMWITT	9.1	float	[deg] Telescope mirror WIT temperature
TPMWOBT	8.3	float	[deg] Telescope mirror WOB temperature
TPMWOTT	8.9	float	[deg] Telescope mirror WOT temperature
TPCITEMP	8.5	float	[deg] Telescope primary cell in temperature
TPCOTEMP	8.6	float	[deg] Telescope primary cell out temperature
TPR1HUM	0.0	float	Telescope probe 1 humidity
TPR1TEMP	0.0	float	[deg] Telescope probe1 temperature

continues on next page

Table 12 – continued from previous page

KEY	Example Value	Type	Comment
TPR2HUM	0.0	float	Telescope probe 2 humidity
TPR2TEMP	0.0	float	[deg] Telescope probe2 temperature
TSERVO	40.0	float	Telescope servo setpoint
TTRSTEMP	11.4	float	[deg] Telescope top ring S temperature
TTRWTEMP	11.0	float	[deg] Telescope top ring W temperature
TTRUETBT	-4.2	float	[deg] Telescope truss ETB temperature
TTRUETTT	11.2	float	[deg] Telescope truss ETT temperature
TTRUNTBT	10.9	float	[deg] Telescope truss NTB temperature
TTRUNTTT	11.2	float	[deg] Telescope truss NTT temperature
TTRUSTBT	10.7	float	[deg] Telescope truss STB temperature
TTRUSTST	10.8	float	[deg] Telescope truss STS temperature
TTRUSTTT	11.1	float	[deg] Telescope truss STT temperature
TTRUTSBT	11.8	float	[deg] Telescope truss TSB temperature
TTRUTSMT	11.8	float	[deg] Telescope truss TSM temperature
TTRUTSTT	11.8	float	[deg] Telescope truss TST temperature
TTRUWTBT	10.5	float	[deg] Telescope truss WTB temperature
TTRUWTTT	10.9	float	[deg] Telescope truss WTT temperature
ALARM	F	bool	UPS major alarm or check battery
ALARM-ON	F	bool	UPS active alarm condition
BATTERY	100.0	float	[%] UPS Battery left
SECLEFT	5178.0	float	[s] UPS Seconds left
UPSSTAT	System Normal - On Line(7)	str	UPS Status
INAMPS	70.4	float	[A] UPS total input current
OUTWATTS	5000.0,7200.0,4800.0	str	[W] UPS Phase A, B, C output watts
COMPDEW	-12.9	float	[deg C] Computer room dewpoint
COMPHUM	7.4	float	[%] Computer room humidity

continues on next page

Table 12 – continued from previous page

KEY	Example Value	Type	Comment
COMPAMB	19.5	float	[deg C] Computer room ambient temperature
COMPTEMP	24.5	float	[deg C] Computer room hygrometer temperature
DEWPOINT	11.5	float	[deg C] (outside) dew-point
HUMIDITY	10.0	float	[%] (outside) humidity
PRESSURE	795.0	float	[torr] (outside) air pressure
OUTTEMP	0.0	float	[deg C] outside temperature
WINDDIR	55.0	float	[deg] wind direction
WINDSPD	27.3	float	[m/s] wind speed
GUST	20.6	float	[m/s] Wind gusts speed
AMNIENTN	13.5	float	[deg C] ambient temperature north
CFLOOR	8.9	float	[deg C] temperature on C floor
NWALLIN	13.9	float	[deg C] temperature at north wall inside
NWALLOUT	9.6	float	[deg C] temperature at north wall outside
WWALLIN	12.9	float	[deg C] temperature at west wall inside
WWALLOUT	10.6	float	[deg C] temperature at west wall outside
AMBIENTS	14.8	float	[deg C] ambient temperature south
FLOOR	12.6	float	[deg C] temperature at floor (LCR)
EWALLCMP	10.8	float	[deg C] temperature at east wall, computer room
EWALLCOU	10.6	float	[deg C] temperature at east wall, Coude room
ROOF	10.3	float	[deg C] temperature on roof
ROOFAMB	10.6	float	[deg C] ambient temperature on roof
DOMEBLOW	10.4	float	[deg C] temperature at dome back, lower
DOMEBUP	10.7	float	[deg C] temperature at dome back, upper
DOMELLOW	10.8	float	[deg C] temperature at dome left, lower
DOMELUP	10.8	float	[deg C] temperature at dome left, upper
DOMERLOW	10.6	float	[deg C] temperature at dome right, lower
DOMERUP	10.5	float	[deg C] temperature at dome right, upper

continues on next page

Table 12 – continued from previous page

KEY	Example Value	Type	Comment
PLATFORM	10.4	float	[deg C] temperature at platform
SHACKC	14.4	float	[deg C] temperature at shack ceiling
SHACKW	13.7	float	[deg C] temperature at shack wall
STAIRSL	10.5	float	[deg C] temperature at stairs, lower
STAIRSM	10.4	float	[deg C] temperature at stairs, mid
STAIRSU	10.6	float	[deg C] temperature at stairs, upper
TELBASE	9.6	float	[deg C] temperature at telescope base
UTILWALL	11.1	float	[deg C] temperature at utility room wall
UTILROOM	10.9	float	[deg C] temperature in utilitiy room
TNFSPROC[Page 104, 1]	8.1963	float	[s] PlateMaker NFSPROC processing time
TGFAPROC[Page 104, 1]	7.9212	float	[s] PlateMaker GFAPROC processing time
SIMGFAP	F	bool	DOS Control: simulate GFAPROC
USEFVC	T	bool	DOS Control: use fvc
USEFID	T	bool	DOS Control: use fiducials
USEILLUM	T	bool	DOS Control: use illuminator
USEXSRVR	T	bool	DOS Control: use exposure server
USEOPENL	T	bool	DOS Control: use open loop move
STOPGUDR	T	bool	DOS Control: stop guider
STOPFOCS	T	bool	DOS Control: stop focus
STOPSKY	T	bool	DOS Control: stop sky monitor
KEEPGUDR	F	bool	DOS Control: keep guider running
KEEPFOCS	F	bool	DOS Control: keep focus running
KEEPSKY	F	bool	DOS Control: keep sky mon. running
REACQUIR	F	bool	DOS Control: reacquire same files
EXCLUDED		str	Components excluded from this exposure
FVCTIME[Page 104, 1]	2.0	float	[s] FVC exposure time
SIMGFACQ	F	bool	

continues on next page

Table 12 – continued from previous page

KEY	Example Value	Type	Comment
POSCNVGD[Page 104, 1]	F	bool	Number of positioners converged
GUIEXPID	69022	int	Guider exposure id at start of spectro exp.
IGFRMNUM	12	int	Guider frame number at start of spectro exp.
FOCEXPID	69022	int	Focus exposure id at start of spectro exp.
IFFRMNUM	1	int	Focus frame number at start of spectro exp.
SKYEXPID	69022	int	Sky exposure id at start of spectro exp.
ISFRMNUM	1	int	Sky frame number at start of spectro exp.
FGFRMNUM	46	int	Guider frame number at end of spectro exp.
FFFRMNUM	6	int	Focus frame number at end of spectro exp.
FSFRMNUM	5	int	Sky frame number at end of spectro exp.
HELIOCOR	0.9999115198216216	float	
NSPEC	500	int	Number of spectra
WAVEMIN	5760.0	float	First wavelength [Angstroms]
WAVEMAX	7620.0	float	Last wavelength [Angstroms]
WAVESTEP	0.8	float	Wavelength step size [Angstroms]
SPECTER	0.10.0	str	https://github.com/desihub/specter
IN_PSF	SPECPROD/exposures/20201220/00069022/psf-r8-00069022.fits	str	Input sp
IN_IMG	SPECPROD/preproc/20201220/00069022/preproc-r8-00069022.fits	str	
ORIG_PSF	SPECPROD/calibnight/20201220/psfnight-r8-20201220.fits	str	
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	
TSNRALPH	1.469972702034016	float	
IN_FRAME	SPECPROD/exposures/20201220/00069022/frame-r8-00069022.fits	str	
FIBERFLT	SPECPROD/exposures/20201220/00069022/fiberflatexp-r8-00069022.fits	str	
IN_SKY	SPECPROD/exposures/20201220/00069022/sky-r8-00069022.fits	str	
IN_CALIB	SPECPROD/exposures/20201220/00069022/fluxcalib-r8-00069022.fits	str	
BBKGMINC[Page 104, 1]	-0.3364347403909462	float	
BBKGMAXB[Page 104, 1]	0.8957266211094218	float	
BBKGMINB[Page 104, 1]	-0.04275468459496062	float	

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Table 12 – continued from previous page

KEY	Example Value	Type	Comment
BBKGMIND[Page 104, 1]	-0.6146250452424397	float	
BBKGMAXA[Page 104, 1]	0.6126625684320178	float	
BBKGMAXC[Page 104, 1]	0.4926723425188555	float	
BBKGMINA[Page 104, 1]	-0.4336472364870191	float	
BBKGMAXD[Page 104, 1]	0.8117108701207832	float	
SP2REDP[Page 104, 1]	6.448e-08	float	[mb] SP2 red pressure
SP8BLUP[Page 104, 1]	8.153e-08	float	[mb] SP8 blue pressure
SP9NIRT[Page 104, 1]	139.96	float	[K] SP9 NIR temperature
SP4REDP[Page 104, 1]	5.168e-08	float	[mb] SP4 red pressure
TCSKDEC[Page 104, 1]	0.3 0.003 0.00003	str	TCS Kalman (dec)
TCSPIRA[Page 104, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
SP4BLUT[Page 104, 1]	163.02	float	[K] SP4 blue temperature
TCSMFDEC[Page 104, 1]	1	int	TCS moving filter length (dec)
SP4REDT[Page 104, 1]	140.03	float	[K] SP4 red temperature
SP9REDP[Page 104, 1]	8.485e-08	float	[mb] SP9 red pressure
SP9NIRP[Page 104, 1]	5.579e-08	float	[mb] SP9 NIR pressure
SP5REDP[Page 104, 1]	4.908e-08	float	[mb] SP5 red pressure
SP1REDT[Page 104, 1]	139.96	float	[K] SP1 red temperature
SUNRA[Page 104, 1]	21.738482	float	[deg] Sun RA at start of exposure
SP3BLUT[Page 104, 1]	163.02	float	[K] SP3 blue temperature
SP8NIRP[Page 104, 1]	4.831e-08	float	[mb] SP8 NIR pressure
SP9BLUP[Page 104, 1]	1.208e-07	float	[mb] SP9 blue pressure
SKYLEVEL[Page 104, 1]	1.133	float	counts?] ETC sky level
TCSKRA[Page 104, 1]	0.3 0.003 0.00003	str	TCS Kalman (RA)
SP4BLUP[Page 104, 1]	6.109e-08	float	[mb] SP4 blue pressure
SP2NIRT[Page 104, 1]	139.96	float	[K] SP2 NIR temperature
SP7BLUP[Page 104, 1]	9.938e-08	float	[mb] SP7 blue pressure
SP0NIRP[Page 104, 1]	5.934e-08	float	[mb] SP0 NIR pressure
FRAMES[Page 104, 1]	47	int	Number of Frames in Archive
SP4NIRP[Page 104, 1]	7.072e-08	float	[mb] SP4 NIR pressure
SP1BLUT[Page 104, 1]	162.97	float	[K] SP1 blue temperature
SP6NIRP[Page 104, 1]	2.873e-07	float	[mb] SP6 NIR pressure
SP2REDT[Page 104, 1]	139.99	float	[K] SP2 red temperature
SP6REDT[Page 104, 1]	139.96	float	[K] SP6 red temperature
TCSPIDEC[Page 104, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
MOONSEP[Page 104, 1]	147.894	float	[deg] Moon Separation
TOTTEFF[Page 104, 1]	1403.0837	float	[s] Total effective exposure time for visit
SP6NIRT[Page 104, 1]	139.96	float	[K] SP6 NIR temperature
SP5NIRT[Page 104, 1]	139.99	float	[K] SP5 NIR temperature
SPLITEXP[Page 104, 1]	T	bool	Split exposure part of a visit
SP4NIRT[Page 104, 1]	139.96	float	[K] SP4 NIR temperature
SP7BLUT[Page 104, 1]	162.97	float	[K] SP7 blue temperature

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KEY	Example Value	Type	Comment
SP1BLUP[Page 104, 1]	8.153e-08	float	[mb] SP1 blue pressure
SP0REDT[Page 104, 1]	139.99	float	[K] SP0 red temperature
SP2BLUP[Page 104, 1]	7.737e-08	float	[mb] SP2 blue pressure
SUNDEC[Page 104, 1]	9.120592	float	[deg] Sun declination at start of exposure
SP3REDP[Page 104, 1]	7.227e-08	float	[mb] SP3 red pressure
SP5BLUP[Page 104, 1]	1.126e-07	float	[mb] SP5 blue pressure
TCSGRA[Page 104, 1]	0.3	float	TCS simple gain (RA)
ACTTEFF[Page 104, 1]	621.6407	float	[s] Actual effective exposure time
SEEING[Page 104, 1]	1.0943	float	[arcsec] ETC seeing
SP5BLUT[Page 104, 1]	162.97	float	[K] SP5 blue temperature
SP8BLUT[Page 104, 1]	162.97	float	[K] SP8 blue temperature
SP3REDT[Page 104, 1]	139.99	float	[K] SP3 red temperature
SP2NIRP[Page 104, 1]	9.168e-08	float	[mb] SP2 NIR pressure
SP1REDP[Page 104, 1]	6.17e-08	float	[mb] SP1 red pressure
VISITIDS[Page 104, 1]	84509,84510	str	List of expids for a visit (same tile)
SP0REDP[Page 104, 1]	1.14e-07	float	[mb] SP0 red pressure
SP1NIRP[Page 104, 1]	7.269e-08	float	[mb] SP1 NIR pressure
SP0BLUT[Page 104, 1]	162.97	float	[K] SP0 blue temperature
SP9REDT[Page 104, 1]	139.99	float	[K] SP9 red temperature
SP7REDT[Page 104, 1]	139.99	float	[K] SP7 red temperature
REQTEFF[Page 104, 1]	1400.0	float	[s] Requested effective exposure time
SP5NIRP[Page 104, 1]	6.289e-08	float	[mb] SP5 NIR pressure
SP6BLUT[Page 104, 1]	162.97	float	[K] SP6 blue temperature
SP7REDP[Page 104, 1]	6.326e-08	float	[mb] SP7 red pressure
SP1NIRT[Page 104, 1]	139.96	float	[K] SP1 NIR temperature
TCSMFRA[Page 104, 1]	1	int	TCS moving filter length (RA)
SP6BLUP[Page 104, 1]	7.215e-08	float	[mb] SP6 blue pressure
SP2BLUT[Page 104, 1]	163.02	float	[K] SP2 blue temperature
SP3NIRT[Page 104, 1]	139.99	float	[K] SP3 NIR temperature
SEQSTART[Page 104, 1]	2021-04-13T04:52:57.031162	str	Start time of sequence processing
SP8REDP[Page 104, 1]	8.415e-08	float	[mb] SP8 red pressure
SP6REDP[Page 104, 1]	6.486e-08	float	[mb] SP6 red pressure
SP7NIRT[Page 104, 1]	139.99	float	[K] SP7 NIR temperature
USESPLIT[Page 104, 1]	T	bool	Exposure splits are allowed
SP9BLUT[Page 104, 1]	163.02	float	[K] SP9 blue temperature
SP8NIRT[Page 104, 1]	139.96	float	[K] SP8 NIR temperature
SP0BLUP[Page 104, 1]	7.565e-08	float	[mb] SP0 blue pressure
SP5REDT[Page 104, 1]	139.99	float	[K] SP5 red temperature
SP3NIRP[Page 104, 1]	3.653e-08	float	[mb] SP3 NIR pressure
SP8REDT[Page 104, 1]	139.99	float	[K] SP8 red temperature
NTSSURVY[Page 104, 1]	sv3	str	NTS survey name
TCSGDEC[Page 104, 1]	0.3	float	TCS simple gain (dec)

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KEY	Example Value	Type	Comment
SP7NIRP[Page 104, 1]	1.329e-07	float	[mb] SP7 NIR pressure
SP3BLUP[Page 104, 1]	7.078e-08	float	[mb] SP3 blue pressure
SP0NIRT[Page 104, 1]	139.96	float	[K] SP0 NIR temperature
PMSEEING[Page 104, 1]	2.33	float	[arcsec] PlateMaker GFAPROC seeing
PMTRANS[Page 104, 1]	108.64	float	[%] PlateMaker GFAPROC transparency
SEQTOT[Page 104, 1]	2	int	Total number of exposures in sequence
SEQID[Page 104, 1]	2 requests	str	Exposure sequence identifier
TRANSPAR[Page 104, 1]	74.6046588181844	float	ETC transparency
SLEWANGL[Page 104, 1]	0.13	float	[deg] Slew Angle
CONVERGD[Page 104, 1]	F	bool	Positioning loop converged (CNFRC>0.95)
POSCVFRC[Page 104, 1]	0.4153	float	Fraction of converged positioners
SBPROF[Page 104, 1]	BGS	str	Profile used by ETC
ETCVERS[Page 104, 1]	0.1.12-3-g12b54bb	str	ETC version
MAXTIME[Page 104, 1]	5400.0	float	[s] Maximum exposure time for entire visit (fro
MINTIME[Page 104, 1]	60.0	float	[s] Minimum exposure time (from NTS, used by ET
ETCTEFF[Page 104, 1]	68.498291	float	[s] ETC effective exposure time
ESTTIME[Page 104, 1]	1088.936	float	[s] Estimated exposure time for visit (from ETC
NTSPROG[Page 104, 1]	BACKUP	str	NTS program name
ACQFWHM[Page 104, 1]	1.080625	float	[arcsec] FWHM of guide star PSF in acquisition
PMTRANSP[Page 104, 1]	96.38	float	[%] PlateMaker GFAPROC transparency
ETCFRACE[Page 104, 1]	0.460059	float	ETC transparency weighted average of FFRAC (ELG
ETCTRANS[Page 104, 1]	0.931484	float	ETC averaged TRANSP normalized to 1
ETCREAL[Page 104, 1]	145.539062	float	[s] ETC real open shutter time
ETCSPLIT[Page 104, 1]	1	int	ETC split sequence number for this visit
ETCTHRUP[Page 104, 1]	1.079734	float	ETC averaged thruput (PSF profile)
ETCSKY[Page 104, 1]	1.606062	float	ETC averaged, normalized sky camera flux
ETCSEENG[Page 104, 1]	1.0806	float	[arcsec] ETC seeing
ETCPROF[Page 104, 1]	PSF	str	ETC source brightness profile

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KEY	Example Value	Type	Comment
ETCFRACB[Page 104, 1]	0.204095	float	ETC transparency weighted average of FFRAC (BGS
ETCFRACP[1]	0.651421	float	ETC transparency weighted average of FFRAC (PSF
ETCTHRUB[1]	1.001377	float	ETC averaged thruput (BGS profile)
ETCPREV[1]	0.0	float	[s] ETC cummulative t_eff for visit
ETCTHRUE[1]	1.039635	float	ETC averaged thruput (ELG profile)
USESPLITS[1]	T	bool	Exposure splits are allowed

Data: FITS image [float32, 2881x500]

HDU1

EXTNAME = IVAR

Inverse variance of flux (1/sigma^2) in units of (10^{-17} erg/s/cm2/A)^-2. Uncertainties comprise statistical uncertainties from the error propagation of the initial CCD pixel variance, the calibration uncertainties, plus an additional term on bright sky lines to account for the imperfect sky subtraction.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	
NAXIS2	500	int	
CHECKSUM	ZhXFagUETgUEZgUE	str	HDU checksum updated 2021-07-16T15:54:37
DATASUM	1428281379	str	data unit checksum updated 2021-07-16T15:54:37

Data: FITS image [float32, 2881x500]

HDU2

EXTNAME = MASK

Mask of spectral data; 0=good. See the *bitmask documentation* page for the definition of the bits. Prior to desispec/0.24.0 and software release 18.9, the MASK HDU was compressed.

[1] Optional

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	
NAXIS2	500	int	
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	UA8FU87FUA7FU77F	str	HDU checksum updated 2021-07-16T15:54:38
DATASUM	413756347	str	data unit checksum updated 2021-07-16T15:54:38

Data: FITS image [int32, 2881x500]

HDU3

EXTNAME = WAVELENGTH

1D array of wavelengths. See the frame *WAVELENGTH documentation* for more details.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	
BUNIT	Angstrom	str	
CHECKSUM	jbdTkaZRjabRjaZR	str	HDU checksum updated 2021-07-16T15:54:38
DATASUM	3106662670	str	data unit checksum updated 2021-07-16T15:54:38

Data: FITS image [float64, 2881]

HDU4

EXTNAME = RESOLUTION

Resolution matrix stored as a 3D sparse matrix. See the frame *RESOLUTION documentation* for more details.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	
NAXIS2	11	int	
NAXIS3	500	int	
CHECKSUM	fiDjhZAiffAifZAi	str	HDU checksum updated 2021-07-16T15:54:41
DATASUM	2514154349	str	data unit checksum updated 2021-07-16T15:54:41

Data: FITS image [float32, 2881x11x500]

HDU5

EXTNAME = FIBERMAP

Fibermap information combining fiberassign request with actual fiber locations. See also the *fibermap documentation* page.

Required Header Keywords

KEY	Example Value
NAXIS1	393
NAXIS2	500
TILEID	80616
TILERA	356.0
TILEDEC	29.0
FIELDROT	-0.00962199210064233
FA_PLAN	2022-07-01T00:00:00.000
FA_HA	0.0
FA_RUN	2020-03-06T00:00:00
FA_M_GFA[1]	0.4
FA_M_PET[Page 104, 1]	0.4
FA_M_POS[Page 104, 1]	0.05
REQRA	356.0
REQDEC	29.0
FIELDNUM	0
FA_VER	2.0.0.dev2618
FA_SURV	sv1
LONGSTRN	OGIP 1.0
GFA	/data/target/catalogs/dr9/0.47.0/gfas
SKY	/data/target/catalogs/dr9/0.47.0/skies
SKYSUPP	/data/target/catalogs/gaiadr2/0.47.0/skies-supp
TARG	/data/target/catalogs/dr9/0.47.0/targets/sv1/resolve/bright/
FAFLAVOR	sv1bgsmws
FAOUTDIR	/software/datasystems/users/raichoor/fiberassign-test/desi-sv1-20201218/
PMTIME[Page 104, 1]	2020-12-18T00:00:00.000
RUNDATE	2020-03-06T00:00:00
SCTARG[Page 104, 1]	STD_WD,BGS_ANY,MWS_ANY
OBSCON	DARK|GRAY|BRIGHT
MODULE	CI
EXPID	69022
EXPFRAME	0
COSMSPLT	F
MAXSPLIT	0
SPLITIDS[Page 104, 1]	69022
FIBASSGN	/data/tiles/SVN_tiles/080/fiberassign-080616.fits
FLAVOR	science
OBSTYPE	SCIENCE
SEQUENCE	DESI
MANIFEST	F
OBJECT	

KEY	Example Value
PURPOSE	Commissioning
PROGRAM	SV1 BGS+MWS tile 80616
PROPID	2019B-5000
OBSERVER	DESIObserver
LEAD	RunManager
INSTRUME	DESI
OBSERVAT	KPNO
OBS-LAT	31.96403
OBS-LONG	-111.59989
OBS-ELEV	2097.0
TELESCOP	KPNO 4.0-m telescope
CORRCTOR	DESI Corrector
SEQNUM	1
NIGHT	20201220
TIMESYS	UTC
DATE-OBS	2020-12-21T02:36:32.099838
MJD-OBS	59204.10870486
OPENSHUT	2020-12-21T02:36:32.099838
CAMSHUT	open
ST	01:10:39.210
ACQTIME	15.0
GUIDTIME	5.0
FOCSTIME	60.0
SKYTIME	60.0
WHITESPT	F
ZENITH	F
SEANNEX	F
BEYONDP	F
FIDUCIAL	off
BACKLIT	off
AIRMASS	1.060311
FOCUS	1426.5,-501.4,81.0,-2.6,42.3,169.2
VCCD	ON
TRUSTEMP	11.767
PMIRTEMP	8.925
PMREADY	T
PMCOVER	open
PMCOOL	off
DOMSHUTU	open
DOMSHUTL	open
DOMLIGHH	off
DOMLIGHL	off
DOMEAZ	255.166
DOMINPOS	T
EQUINOX	2000.0
GUIDOFFR	-0.052283
GUIDOFFD	0.136634
MOONDEC	-8.975162
MOONRA	352.538429

KEY	Example Value
MOUNTAZ	266.70224
MOUNTDEC	28.999221
MOUNTEL	71.039837
MOUNTHA	21.769281
INCTRL	T
INPOS	T
MNTOFFD	-15.76
MNTOFFR	29.32
PARALLAC	75.635085
SKYDEC	28.999221
SKYRA	355.996551
TARGTDEC	28.999221
TARGTRA	355.996551
TARGTAZ	267.074049
TARGTEL	70.563787
TRGTOFFD	0.0
TRGTOFFR	0.0
ZD	19.436213
TCSST	01:13:18.668
TCSMJD	59204.110981
USEETC	F
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9
SKYCAM	SKYCAM0,SKYCAM1
REQADC	65.78,85.28
ADCCORR	T
ADC1PHI	65.780005
ADC2PHI	85.279991
ADC1HOME	F
ADC2HOME	F
ADC1NREV	-1.0
ADC2NREV	0.0
ADC1STAT	STOPPED
ADC2STAT	STOPPED
USESKY	T
USEFOCUS	T
HEXPOS	1426.5,-501.3,81.0,-2.6,42.3,171.9
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0
USEROTAT	T
ROTOFFST	167.1
ROTENBLD	T
ROTRATE	0.0
RESETROT	F
USEPOS	T
PETALS	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9
POSCYCLE	1
POSONTGT	3626
POSONFRC	0.8613

KEY	Example Value
POSDISAB	37
POSENABL	4210
POSRMS	0.0171
POSITER	1
POSFRACT	0.95
POSTOLER	0.01
POSMVALL	T
USEGUIDR	T
GUIDMODE	catalog
USEAOS[Page 104, 1]	F
USEDONUT	T
USESPCTR	T
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
ILLSPECS[Page 104, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
CCDSPECS[Page 104, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
TDEWPNT	-16.043
TAIRFLOW	0.0
TAIRITMP	11.8
TAIROTMP	11.7
TAIRTEMP	10.65
TCASITMP	0.0
TCASOTMP	10.8
TCSITEMP	9.3
TCSOTEMP	10.8
TCIBTEMP	0.0
TCIMTEMP	0.0
TCITTEMP	0.0
TCOSTEMP	0.0
TCOWTEMP	0.0
TDBTEMP	9.3
TFLOWIN	0.0
TFLOWOUT	0.0
TGLYCOLI	9.9
TGLYCOLO	9.8
THINGES	11.4
THINGEW	11.2
TPMAVERT	8.931
TPMDESIT	7.0
TPMEIBT	8.6
TPMEITT	8.6
TPMEOBT	8.5
TPMEOTT	9.0
TPMNIBT	8.4
TPMNITT	8.9
TPMNOBT	8.8
TPMNOTT	9.1
TPMRTDT	9.0
TPMSIBT	8.6
TPMSITT	8.8

KEY	Example Value
TPMSOBT	8.2
TPMSOTT	8.9
TPMSTAT	ready
TPMWIBT	8.2
TPMWITT	9.1
TPMWOBT	8.3
TPMWOTT	8.9
TPCITEMP	8.5
TPCOTEMP	8.6
TPR1HUM	0.0
TPR1TEMP	0.0
TPR2HUM	0.0
TPR2TEMP	0.0
TSERVO	40.0
TTRSTEMP	11.4
TTRWTEMP	11.0
TTRUETBT	-4.2
TTRUETTT	11.2
TTRUNTBT	10.9
TTRUNTTT	11.2
TTRUSTBT	10.7
TTRUSTST	10.8
TTRUSTTT	11.1
TTRUTSBT	11.8
TTRUTSMT	11.8
TTRUTSTT	11.8
TTRUWTBT	10.5
TTRUWTTT	10.9
ALARM	F
ALARM-ON	F
BATTERY	100.0
SECLEFT	5178.0
UPSSTAT	System Normal - On Line(7)
INAMPS	70.4
OUTWATTS	5000.0,7200.0,4800.0
COMPDEW	-12.9
COMPHUM	7.4
COMPAMB	19.5
COMPTEMP	24.5
DEWPOINT	11.5
HUMIDITY	10.0
PRESSURE	795.0
OUTTEMP	0.0
WINDDIR	55.0
WINDSPD	27.3
GUST	20.6
AMNIENTN	13.5
CFLOOR	8.9
NWALLIN	13.9

KEY	Example Value
NWALLOUT	9.6
WWALLIN	12.9
WWALLOUT	10.6
AMBIENTS	14.8
FLOOR	12.6
EWALLCMP	10.8
EWALLCOU	10.6
ROOF	10.3
ROOFAMB	10.6
DOMEBLOW	10.4
DOMEBUP	10.7
DOMELLOW	10.8
DOMELUP	10.8
DOMERLOW	10.6
DOMERUP	10.5
PLATFORM	10.4
SHACKC	14.4
SHACKW	13.7
STAIRSL	10.5
STAIRSM	10.4
STAIRSU	10.6
TELBASE	9.6
UTILWALL	11.1
UTILROOM	10.9
RADESYS	FK5
TNFSPROC	8.1963
TGFAPROC[Page 104, 1]	7.9212
SIMGFAP	F
USEFVC	T
USEFID	T
USEILLUM	T
USEXSRVR	T
USEOPENL	T
STOPGUDR	T
STOPFOCS	T
STOPSKY	T
KEEPGUDR	F
KEEPFOCS	F
KEEPSKY	F
REACQUIR	F
FILENAME	/exposures/desi/20201220/00069022/desi-00069022.fits.fz
EXCLUDED	
DOSVER	trunk
OCSVER	1.2
CONSTVER	DESI:CURRENT
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini
REQTIME	300.0
FVCTIME[Page 104, 1]	2.0
SIMGFACQ	F

KEY	Example Value
POSCNVGD[Page 104, 1]	F
GUIEXPID	69022
IGFRMNUM	12
FOCEXPID	69022
IFFRMNUM	1
SKYEXPID	69022
ISFRMNUM	1
FGFRMNUM	46
FFFRMNUM	6
FSFRMNUM	5
FRAMES[Page 104, 1]	47
DELTARA[Page 104, 1]	None
DELTADEC[Page 104, 1]	None
GSGUIDE0[Page 104, 1]	(980.05,685.98),(878.97,731.68)
GSGUIDE2[Page 104, 1]	(372.65,939.43),(784.50,1529.96)
GSGUIDE3[Page 104, 1]	(365.22,1423.83),(249.12,411.52)
GSGUIDE5[Page 104, 1]	(848.52,78.26),(516.16,1410.54)
GSGUIDE7[Page 104, 1]	(540.95,1848.95),(504.68,831.62)
GSGUIDE8[Page 104, 1]	(720.29,552.69),(499.80,465.13)
ARCHIVE[Page 104, 1]	/exposures/desi/20201220/00069022/guide-00069022.fits.fz
GUIDEFIL	guide-00069022.fits.fz
COORDFIL	coordinates-00069022.fits
TIME-OBS	02:39:11.845920
EXPTIME	300.007
VCCDON	2020-12-09T21:23:19.307761
VCCDSEC	969702.2
SPECGRPH	8
SPECID	2
FEEBOX	lbnl050
VESSEL	8
FEEVER	v20160312
FEEPOWER	ON
FEEDMASK	2134851391
FEECMASK	1048575
CCDTEMP	-135.3315
AMPSECB	[4114:2058, 1:2064]
DAC16	39.9961,39.3162
CLOCK8	9.9992,2.9993
PRRSECD	[2193:4249, 4194:4194]
CCDPREP	purge,clear
CLOCK10	9.9992,2.9993
DAC17	20.0008,12.2732
ORSECB	[2193:4249, 2066:2097]
DAC15	0.0,0.0148
ORSECD	[2193:4249, 2098:2129]
DIGITIME	47.5899
BIASSECA	[2065:2128, 2:2065]
CLOCK9	9.9992,2.9993
CLOCK18	9.0,0.9999

KEY	Example Value
CAMERA	r8
CLOCK17	9.0,0.9999
CLOCK5	9.9999,0.0
TRIMSECD	[2193:4249, 2130:4193]
DETSECD	[2058:4114, 2065:4128]
DAC0	-9.0002,-8.9507
CLOCK15	9.9992,2.9993
TRIMSECA	[8:2064, 2:2065]
BIASSECB	[2129:2192, 2:2065]
CLOCK11	9.9992,2.9993
CLOCK12	9.9992,2.9993
AMPSECD	[4114:2058, 4128:2065]
CLOCK4	9.9999,0.0
PRRSECB	[2193:4249, 1:1]
CCDSECD	[2058:4114, 2065:4128]
CCDTMING	default_lbnl_timing_20180905.txt
TRIMSECB	[2193:4249, 2:2065]
CCDSIZE	4194,4256
PGAGAIN	3
PRESECD	[4250:4256, 2130:4193]
CLOCK6	9.9999,0.0
CLOCK13	9.9992,2.9993
DAC7	5.9998,6.028
DATASECA	[8:2064, 2:2065]
CRYOTEMP[Page 104, 1]	162.97
OFFSET2	0.4000000059604645,-8.9198
OFFSET6	2.0,6.0437
DELAYS	20, 20, 25, 40, 7, 3000, 7, 7, 7, 7
BIASSECD	[2129:2192, 2130:4193]
PRRSECA	[8:2064, 1:1]
TRIMSECC	[8:2064, 2130:4193]
CLOCK3	-2.0001,3.9999
CCDNAME	CCDSM2R
DAC9	-25.0003,-24.768
CCDSECC	[1:2057, 2065:4128]
ORSECA	[8:2064, 2066:2097]
DAC5	5.9998,6.0543
CCDSECB	[2058:4114, 1:2064]
DETSECB	[2058:4114, 1:2064]
OFFSET0	0.4000000059604645,-8.9507
SETTINGS	detectors_sm_20191211.json
DAC11	-25.0003,-24.8422
BIASSECC	[2065:2128, 2130:4193]
CASETEMP	59.8142
DAC10	-25.0003,-24.7086
DAC1	-9.0002,-8.9198
DAC14	0.0,0.0594
DETECTOR	M1-46
CDSPARMS	400, 400, 8, 2000

KEY	Example Value
OFFSET3	0.4000000059604645,-8.9095
DATASECB	[2193:4249, 2:2065]
ORSECC	[8:2064, 2098:2129]
CRYOPRES[Page 104, 1]	8.897e-08
AMPSECA	[1:2057, 1:2064]
OFFSET7	2.0,6.028
DAC4	5.9998,6.028
DATASECC	[8:2064, 2130:4193]
PRESECC	[1:7, 2130:4193]
CLOCK16	9.9999,3.0
CLOCK1	9.9999,0.0
PRESECB	[4250:4256, 2:2065]
DAC12	0.0,0.0297
DAC8	-25.0003,-24.9312
OFFSET4	2.0,6.0332
DAC2	-9.0002,-8.9198
CCDCFG	default_lbnl_20190717.cfg
BLDTIME	0.3547
PRESECA	[1:7, 2:2065]
DATASECD	[2193:4249, 2130:4193]
DETSECC	[1:2057, 2065:4128]
PRRSECC	[8:2064, 4194:4194]
DAC6	5.9998,6.0437
DETSECA	[1:2057, 1:2064]
CLOCK2	9.9999,0.0
DAC3	-9.0002,-8.9095
OFFSET1	0.4000000059604645,-8.9198
AMPSECC	[1:2057, 4128:2065]
CLOCK7	-2.0001,3.9999
DAC13	0.0,0.0148
CCDSECA	[1:2057, 1:2064]
OFFSET5	2.0,6.049
CLOCK14	9.9992,2.9993
CLOCK0	9.9999,0.0
CPUTEMP	60.8086
OBSID	kp4m20201221t023911
PROCTYPE	RAW
PRODTYPE	image
GAINA	1.627
SATULEVA	65535.0
OSTEPA	0.5704803307307884
OMETHA	AVERAGE
OVERSCNA	1984.679589024373
OBSRDNA	2.48375231913931
SATUELEA	103396.3713086573
GAINB	1.482
SATULEVB	65535.0
OSTEPB	0.5242006066837348
OMETHB	AVERAGE

KEY	Example Value
OVERSCNB	1980.885980481041
OBSRDNB	2.179252294581384
SATUELEB	94187.1969769271
GAINC	1.581
SATULEVC	65535.0
OSTEPC	0.6303264842863427
OMETHC	AVERAGE
OVERSCNC	1966.11973127108
OBSRDNC	2.455388696359903
SATUELEC	100502.3997048604
GAIND	1.589
SATULEVD	65535.0
OSTEPD	0.6243009115278255
OMETHD	AVERAGE
OVERSCND	1987.970298453192
OBSRDND	2.518301447806098
SATUELED	100976.2301957579
FIBERMIN	4000
CHECKSUM	jfN5jZK5jdK5jZK5
DATASUM	2198099738
BBKGMINC[Page 104, 1]	-0.3364347403909462
BBKGMAXB[Page 104, 1]	0.8957266211094218
BBKGMINB[Page 104, 1]	-0.04275468459496062
BBKGMIND[Page 104, 1]	-0.6146250452424397
BBKGMAXA[Page 104, 1]	0.6126625684320178
BBKGMAXC[Page 104, 1]	0.4926723425188555
BBKGMINA[Page 104, 1]	-0.4336472364870191
BBKGMAXD[Page 104, 1]	0.8117108701207832
SP2REDP[Page 104, 1]	6.448e-08
SP8BLUP[Page 104, 1]	8.153e-08
SP9NIRT[Page 104, 1]	139.96
SP4REDP[Page 104, 1]	5.168e-08
TCSKDEC[Page 104, 1]	0.3 0.003 0.00003
TCSPIRA[Page 104, 1]	1.0,0.0,0.0,0.0
SCND[Page 104, 1]	DESIROOT/target/catalogs/dr9/0.57.0/targets/sv3/secondary/dark/sv3targets-dark-secondary.fits
SP4BLUT[Page 104, 1]	163.02
TCSMFDEC[Page 104, 1]	1
SP4REDT[Page 104, 1]	140.03
SP9REDP[Page 104, 1]	8.485e-08
FAPRGRM[Page 104, 1]	DARK
SP9NIRP[Page 104, 1]	5.579e-08
SP5REDP[Page 104, 1]	4.908e-08
SP1REDT[Page 104, 1]	139.96
SUNRA[Page 104, 1]	21.738482
SP3BLUT[Page 104, 1]	163.02
SP8NIRP[Page 104, 1]	4.831e-08
SP9BLUP[Page 104, 1]	1.208e-07
SBPROF[Page 104, 1]	ELG
TCSKRA[Page 104, 1]	0.3 0.003 0.00003

KEY	Example Value
SKYLEVEL[Page 104, 1]	1.133
FAARGS[Page 104, 1]	–doclean n –dr dr9 –dtver 0.57.0 –gaiadr gaiadr2 –goaltime 1200.0 –mintfrac 0.9 –pmcorr n –pmtime 2021-
SP4BLUP[Page 104, 1]	6.109e-08
SCNDMTL[Page 104, 1]	DESIROOT/survey/ops/surveyops/trunk/mtl/sv3/secondary/dark
SP2NIRT[Page 104, 1]	139.96
SP7BLUP[Page 104, 1]	9.937999999999999e-08
EBVFAC[Page 104, 1]	1.04684301894635
SP0NIRP[Page 104, 1]	5.934e-08
SP4NIRP[Page 104, 1]	7.072e-08
SP1BLUT[Page 104, 1]	162.97
SP6NIRP[Page 104, 1]	2.873e-07
SURVEY[Page 104, 1]	sv3
SP2REDT[Page 104, 1]	139.99
GOALTIME[Page 104, 1]	1200.0
GOALTYPE[Page 104, 1]	DARK
PMCORR[Page 104, 1]	n
MTL[Page 104, 1]	DESIROOT/survey/ops/surveyops/trunk/mtl/sv3/dark
SP6REDT[Page 104, 1]	139.96
TCSPIDEC[Page 104, 1]	1.0,0.0,0.0,0.0
MOONSEP[Page 104, 1]	147.894
TOTTEFF[Page 104, 1]	1403.0837
SP6NIRT[Page 104, 1]	139.96
SP5NIRT[Page 104, 1]	139.99
SPLITEXP[Page 104, 1]	T
SP4NIRT[Page 104, 1]	139.96
DESIROOT[Page 104, 1]	/global/cfs/cdirs/desi
SP7BLUT[Page 104, 1]	162.97
SP1BLUP[Page 104, 1]	8.153e-08
SP0REDT[Page 104, 1]	139.99
SP2BLUP[Page 104, 1]	7.737e-08
SUNDEC[Page 104, 1]	9.120592
SP3REDP[Page 104, 1]	7.227e-08
SP5BLUP[Page 104, 1]	1.126e-07
TCSGRA[Page 104, 1]	0.3
ACTTEFF[Page 104, 1]	621.6407
SEEING[Page 104, 1]	1.0943
SP5BLUT[Page 104, 1]	162.97
SP8BLUT[Page 104, 1]	162.97
SP3REDT[Page 104, 1]	139.99
SP2NIRP[Page 104, 1]	9.168e-08
SP1REDP[Page 104, 1]	6.17e-08
VISITIDS[Page 104, 1]	84509,84510
SP0REDP[Page 104, 1]	1.14e-07
SP1NIRP[Page 104, 1]	7.269e-08
SP0BLUT[Page 104, 1]	162.97
SP9REDT[Page 104, 1]	139.99
SP7REDT[Page 104, 1]	139.99
REQTEFF[Page 104, 1]	1400.0
SP5NIRP[Page 104, 1]	6.289e-08

KEY	Example Value
SP6BLUT[Page 104, 1]	162.97
SP7REDP[Page 104, 1]	6.326e-08
SP1NIRT[Page 104, 1]	139.96
MTLTIME[Page 104, 1]	2021-04-10T21:28:37
TCSMFRA[Page 104, 1]	1
SP6BLUP[Page 104, 1]	7.21499999999999e-08
SP2BLUT[Page 104, 1]	163.02
SP3NIRT[Page 104, 1]	139.99
SEQSTART[Page 104, 1]	2021-04-13T04:52:57.031162
SP8REDP[Page 104, 1]	8.415e-08
SP6REDP[Page 104, 1]	6.486e-08
SP7NIRT[Page 104, 1]	139.99
MINTFRAC[Page 104, 1]	0.9
USESPLIT[Page 104, 1]	T
SP9BLUT[Page 104, 1]	163.02
SP8NIRT[Page 104, 1]	139.96
SP0BLUP[Page 104, 1]	7.565e-08
SP5REDT[Page 104, 1]	139.99
SP3NIRP[Page 104, 1]	3.653e-08
SP8REDT[Page 104, 1]	139.99
NTSSURVY[Page 104, 1]	sv3
TCSGDEC[Page 104, 1]	0.3
SP7NIRP[Page 104, 1]	1.329e-07
SP3BLUP[Page 104, 1]	7.078e-08
SP0NIRT[Page 104, 1]	139.96
PMSEEING[Page 104, 1]	2.33
PMTRANS[Page 104, 1]	108.64
SEQTOT[Page 104, 1]	2
SEQID[Page 104, 1]	2 requests
SCSTD[Page 104, 1]	STD_WD,STD_BRIGHT
TARG2[Page 104, 1]	DESIROOT/target/catalogs/gaiadr2/0.50.0/targets/sv1/resolve/supp
SIMGFAQ[Page 104, 1]	F
USESPLITS[Page 104, 1]	T
TRANSPAR[Page 104, 1]	74.6046588181844
TOO[Page 104, 1]	/data/afternoon_planning/surveyops/trunk/mtl/sv3/ToO/ToO.ecsv
SLEWANGL[Page 104, 1]	0.13
CONVERGD[Page 104, 1]	F
POSCVFRC[Page 104, 1]	0.4153
FASCRIPT[Page 104, 1]	/software/datasystems/desiconda/20200924/code/fiberassign/2.5.0/bin/fba_launch
SVNDM[Page 104, 1]	136362
SVNMTL[Page 104, 1]	476
ETCVERS[Page 104, 1]	0.1.12-3-g12b54bb
MAXTIME[Page 104, 1]	5400.0
MINTIME[Page 104, 1]	60.0
ETCTEFF[Page 104, 1]	68.498291
ESTTIME[Page 104, 1]	1088.936
NTSPROG[Page 104, 1]	BACKUP
ACQFWHM[Page 104, 1]	1.080625
PMTRANSP[Page 104, 1]	96.38

KEY	Example Value
ETCFRACE[Page 104, 1]	0.460059
ETCTRANS[Page 104, 1]	0.931484
ETCREAL[Page 104, 1]	145.539062
ETCSPLIT[Page 104, 1]	1
ETCTHRUP[Page 104, 1]	1.079734
ETCSKY[Page 104, 1]	1.606062
ETCSEENG[Page 104, 1]	1.0806
ETCPROF[Page 104, 1]	PSF
ETCFRACB[Page 104, 1]	0.204095
ETCFRACP[Page 104, 1]	0.651421
ETCTHRUB[Page 104, 1]	1.001377
ETCPREV[Page 104, 1]	0.0
ETCTHRUE[Page 104, 1]	1.039635
SHFTFOCS[Page 104, 1]	220.0
TARG3[Page 104, 1]	DESIROOT/target/catalogs/dr9/0.51.0/targets/sv1/resolve/bright
ROLE[Page 104, 1]	GUIDERMAN
DR[Page 104, 1]	dr9
PRIORITY[Page 104, 1]	default
DTVER[Page 104, 1]	0.50.0
M31CEN[Page 104, 1]	n

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gai
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick

Table 14 – continued from previous page

Name	Type	Units	Description
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blending
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; “sourceid” for Gaia DR
REF_CAT	char[2]		Reference catalog source for star: “T2” for Tycho-2, “G2” for Gaia D
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
BRICKNAME	char[8]		Brick name from tractor input
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from this
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from this
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from all s
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from all s
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from all s
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE=”SER”
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORPHTY
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORPHTY
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCOND
NUMOBS_INIT	int64		Initial number of observations for target calculated across target sele
SV1_DESI_TARGET[Page 104, 1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_BGS_TARGET[Page 104, 1]	int64		BGS (bright time program) target selection bitmask for SV1
SV1_MWS_TARGET[Page 104, 1]	int64		MWS (bright time program) target selection bitmask for SV1
SV1_SCND_TARGET[Page 104, 1]	int64		Secondary target selection bitmask for SV1
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SCND_TARGET[Page 104, 1]	int64		Target selection bitmask for secondary programs
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position

Table 14 – continued from previous page

Name	Type	Units	Description
FIBER_DEC	float64	deg	DEC of actual fiber position
EXPTIME	float64	s	Length of time shutter was open
PSF_TO_FIBER_SPECFLUX	float64		fraction of light from point-like source captured by 1.5 arcsec diamet
SV3_MWS_TARGET[Page 104, 1]	int64		MWS (bright time program) target selection bitmask for SV3
SV3_SCND_TARGET[Page 104, 1]	int64		Secondary target selection bitmask for SV3
SV3_DESI_TARGET[Page 104, 1]	int64		DESI (dark time program) target selection bitmask for SV3
SV3_BGS_TARGET[Page 104, 1]	int64		BGS (bright time program) target selection bitmask for SV3
SV2_DESI_TARGET[Page 104, 1]	int64		DESI (dark time program) target selection bitmask for SV2
SV2_BGS_TARGET[Page 104, 1]	int64		BGS (bright time program) target selection bitmask for SV2
SV2_MWS_TARGET[Page 104, 1]	int64		MWS (bright time program) target selection bitmask for SV2
SV2_SCND_TARGET[Page 104, 1]	int64		Secondary target selection bitmask for SV2
CMX_TARGET[Page 104, 1]	int64		Target selection bitmask for commissioning

HDU6

EXTNAME = CHI2PIX

chi^2 of PSF fit to CCD data per flux bin. Large values indicate poor fits, *e.g.* due to unmasked cosmics or other CCD defects.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	Number of wavelengths
NAXIS2	500	int	Number of spectra
CHECKSUM	cBAJe94GcAAGc93G	str	HDU checksum updated 2021-07-16T15:54:42
DATASUM	3947425746	str	data unit checksum updated 2021-07-16T15:54:42

Data: FITS image [float32, 2881x500]

HDU7

EXTNAME = SCORES

Scores / metrics measured from the spectra for use in QA and systematics studies.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	160	int	length of dimension 1
NAXIS2	500	int	length of dimension 2
CHECKSUM	YanYbZkXZakXaYkX	str	HDU checksum updated 2021-07-16T15:54:42
DATASUM	3675881366	str	data unit checksum updated 2021-07-16T15:54:42

Required Data Table Columns

Although all of the columns below are marked as optional, each file will have the complete set of `_C` columns where `_C` (for camera) represents `_B`, `_R`, or `_Z`. These are designed such that the SCORES tables from individual frames can be later combined into a summary table for the exposure.

Name	Type	Units	Description
SUM_RAW_COUNT_Z[Page 104, 1]	float64		Sum of raw counts in Z camera
MEDIAN_RAW_COUNT_Z[Page 104, 1]	float64		Median of raw counts in Z camera
MEDIAN_RAW_SNR_Z[Page 104, 1]	float64		Median(raw signal/noise) in Z camera
SUM_FFLAT_COUNT_Z[Page 104, 1]	float64		Sum of fiber-flatfielded counts Z camera
MEDIAN_FFLAT_COUNT_Z[Page 104, 1]	float64		Median of fiber-flatfielded counts in Z camera
MEDIAN_FFLAT_SNR_Z[Page 104, 1]	float64		Median(S/N) of fiberflatfielded counts in Z camera
SUM_SKYSUB_COUNT_Z[Page 104, 1]	float64		Sum of sky-subtracted counts in Z camera
MEDIAN_SKYSUB_COUNT_Z[Page 104, 1]	float64		Median of sky-subtracted counts in Z camera
MEDIAN_SKYSUB_SNR_Z[Page 104, 1]	float64		Median(S/N) of sky-subtracted counts in Z camera
SUM_CALIB_COUNT_Z[Page 104, 1]	float64		Sum of calibrated flux in Z camera
MEDIAN_CALIB_COUNT_Z[Page 104, 1]	float64		Median of calibrated flux in Z camera
MEDIAN_CALIB_SNR_Z[Page 104, 1]	float64		Median(S/N) of calibrated flux in Z camera
TSNR2_GPBDARK_Z[Page 104, 1]	float64		template (S/N)^2 for dark targets in guider pass band on Z
TSNR2_ELG_Z[Page 104, 1]	float64		ELG Z template (S/N)^2
TSNR2_GPBBRIGHT_Z[Page 104, 1]	float64		template (S/N)^2 for bright targets in guider pass band on Z
TSNR2_LYA_Z[Page 104, 1]	float64		LYA Z template (S/N)^2
TSNR2_BGS_Z[Page 104, 1]	float64		BGS Z template (S/N)^2
TSNR2_GPBBACKUP_Z[Page 104, 1]	float64		from calc_frame_tsnr
TSNR2_QSO_Z[Page 104, 1]	float64		QSO Z template (S/N)^2
TSNR2_LRG_Z[Page 104, 1]	float64		LRG Z template (S/N)^2
TSNR2_LRG_B[Page 104, 1]	float64		LRG B template (S/N)^2
TSNR2_GPBDARK_B[Page 104, 1]	float64		template (S/N)^2 for dark targets in guider pass band on B
MEDIAN_SKYSUB_SNR_B[Page 104, 1]	float64		Median(S/N) of sky-subtracted counts in B camera
MEDIAN_FFLAT_SNR_B[Page 104, 1]	float64		Median(S/N) of fiberflatfielded counts in B camera
TSNR2_ELG_B[Page 104, 1]	float64		ELG B template (S/N)^2
TSNR2_BGS_B[Page 104, 1]	float64		BGS B template (S/N)^2
MEDIAN_CALIB_SNR_B[Page 104, 1]	float64		Median(S/N) of calibrated flux in B camera
MEDIAN_FFLAT_COUNT_B[Page 104, 1]	float64		Median of fiber-flatfielded counts in B camera
TSNR2_QSO_B[Page 104, 1]	float64		QSO B template (S/N)^2
MEDIAN_SKYSUB_COUNT_B[Page 104, 1]	float64		Median of sky-subtracted counts in B camera
MEDIAN_RAW_COUNT_B[Page 104, 1]	float64		Median of raw counts in B camera
TSNR2_GPBBRIGHT_B[Page 104, 1]	float64		template (S/N)^2 for bright targets in guider pass band on B
TSNR2_LYA_B[Page 104, 1]	float64		LYA B template (S/N)^2
SUM_SKYSUB_COUNT_B[Page 104, 1]	float64		Sum of sky-subtracted counts in B camera
MEDIAN_CALIB_COUNT_B[Page 104, 1]	float64		Median of calibrated flux in B camera
TSNR2_GPBBACKUP_B[Page 104, 1]	float64		from calc_frame_tsnr
SUM_FFLAT_COUNT_B[Page 104, 1]	float64		Sum of fiber-flatfielded counts B camera
SUM_RAW_COUNT_B[Page 104, 1]	float64		Sum of raw counts in B camera
SUM_CALIB_COUNT_B[Page 104, 1]	float64		Sum of calibrated flux in B camera
MEDIAN_RAW_SNR_B[Page 104, 1]	float64		Median(raw signal/noise) in B camera
SUM_CALIB_COUNT_R[Page 104, 1]	float64		Sum of calibrated flux in R camera
MEDIAN_RAW_COUNT_R[Page 104, 1]	float64		Median of raw counts in R camera
TSNR2_QSO_R[Page 104, 1]	float64		QSO R template (S/N)^2
TSNR2_LRG_R[Page 104, 1]	float64		LRG R template (S/N)^2

continues on next page

Table 15 – continued from previous page

Name	Type	Units	Description
TSNR2_LYA_R[Page 104, 1]	float64		LYA R template (S/N)^2
TSNR2_GPBBRIGHT_R[Page 104, 1]	float64		template (S/N)^2 for bright targets in guider pass band on R
SUM_SKYSUB_COUNT_R[Page 104, 1]	float64		Sum of sky-subtracted counts in R camera
SUM_RAW_COUNT_R[Page 104, 1]	float64		Sum of raw counts in R camera
SUM_FFLAT_COUNT_R[Page 104, 1]	float64		Sum of fiber-flatfielded counts R camera
MEDIAN_FFLAT_SNR_R[Page 104, 1]	float64		Median(S/N) of fiberflatfielded counts in R camera
TSNR2_BGS_R[Page 104, 1]	float64		BGS R template (S/N)^2
TSNR2_GPBBACKUP_R[Page 104, 1]	float64		from calc_frame_tsnr
MEDIAN_SKYSUB_SNR_R[Page 104, 1]	float64		Median(S/N) of sky-subtracted counts in R camera
MEDIAN_CALIB_SNR_R[Page 104, 1]	float64		Median(S/N) of calibrated flux in R camera
MEDIAN_FFLAT_COUNT_R[Page 104, 1]	float64		Median of fiber-flatfielded counts in R camera
MEDIAN_RAW_SNR_R[Page 104, 1]	float64		Median(raw signal/noise) in R camera
MEDIAN_SKYSUB_COUNT_R[Page 104, 1]	float64		Median of sky-subtracted counts in R camera
MEDIAN_CALIB_COUNT_R[Page 104, 1]	float64		Median of calibrated flux in R camera
TSNR2_GPBDARK_R[Page 104, 1]	float64		template (S/N)^2 for dark targets in guider pass band on R
TSNR2_ELG_R[Page 104, 1]	float64		ELG R template (S/N)^2

Notes and Examples

The TSNR2 columns are for "template signal-to-noise squared". These measure the signal-to-noise squared weighted by which wavelengths matter most for different target types, e.g. QSOs weight blue wavelengths more while ELGs weight redder wavelengths more due to the wavelengths of the observed emission lines. For more details, see section 4.14 of Guy et al 2023.

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

exposure-qa-EXPID.fits

Summary
These files contain the per-exposure QA measurements. Those are propagated when making coadd reductions, and helps to decide during operations if the observation is valid or not.

Naming Convention
`exposure-qa-{expid}`, where `{expid}` is the 8-digit exposure ID.

Regex
`exposure-qa-[0-9]{8}\.fits`

File Type
FITS, 441 KB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Keywords only
HDU1	FIBERQA	BINTABLE	Per-fiber information table
HDU2	PETALQA	BINTABLE	Per-petal information table

FITS Header Units

HDU0

No data, checksum/datasum header keywords only.

Required Header Keywords

KEY	Example Value	Type	Comment
CHECKSUM	C4gFE4Z9C4fCC4Z9	str	HDU checksum updated 2021-07-16T14:31:54
DATASUM	0	str	data unit checksum updated 2021-07-16T14:31:54

Empty HDU.

HDU1

EXTNAME = FIBERQA

This table contains the per-fiber information which helps to decide if the observation is valid or not. That information is also used to define some column content of the PETALQA extension.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	86	int	length of dimension 1
NAXIS2	5000	int	length of dimension 2
NIGHT	20210514	int	Exposure night
EXPID	88364	int	Exposure ID
NGOODFIB	4611	int	Number of fibers with EFFTIME_SPEC above the threshold
NGOODPET	10	int	Number of petals with good fibers
WORSTRDN	5.072375888924774	float	Worst read noise for all amplifiers of all cameras

continues on next page

Table 16 – continued from previous page

KEY	Example Value	Type	Comment
FPRMS2D	0.01157238915902728	float	[mm] RMS of the positioners accuracy (measured-requested) in the CS5 location of the focal plane
PMINEXPF[1]	0.8370916420971888	float	Deprecated
PMAXEXPF[Page 124, 1]	1.27911264193688	float	Deprecated
EFFTIME	217.9705047607422	float	[s] Spectroscopic effective time
TILEID	21181	int	Tile ID
EXPTIME	589.277	float	[s] Tile exposure time
MJD-OBS	59349.20075297	float	[d] Modified Julian Date of observation
TARGTRA	199.993521	float	[deg] Target right ascension (to TCS)
TARGTDEC	32.447031	float	[deg] Target declination (to TCS)
MOUNTEL	84.320435	float	[deg] Mount elevation angle
MOUNTHA	-6.689017	float	[deg] Mount hour angle
AIRMASS	1.004188	float	Airmass
ETCTEFF[1]	1015.311096	float	[s] Effective time computed (on-the-fly) by the ETC
TILERA	199.992	float	[deg] Tile center Right Ascension
TILEDEC	32.447	float	[deg] Tile center Declination
GOALTIME[1]	180.0	float	[s] Aimed EFFTIME_SPEC
GOALTYPE[1]	BRIGHT	str	Sky conditions used for some noise estimation
FAPRGRM[1]	bright	str	Program to which this tile belongs
SURVEY[1]	main	str	Survey of origin of the targets
EBVFAC[1]	1.02512649227135	float	10.0 ** (2.165 * median(EBV) / 2.5))
MINTFRAC[1]	0.85	float	Fraction of GOALTIME to be reached by EFFTIME_SPEC to consider the tile has completed
CHECKSUM	YP2AYM16YM1AYM13	str	HDU checksum updated 2021-07-16T14:31:54
DATASUM	2084006317	str	data unit checksum updated 2021-07-16T14:31:54

[1] Optional

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
TARGET_RA	float64	deg	Target Right Ascension
TARGET_DEC	float64	deg	Target Declination
FIBER_X	float64	mm	Fiber CS5 X location on focal plane
FIBER_Y	float64	mm	Fiber CS5 Y location on focal plane
DELTA_X	float64	mm	Fiber difference between measured and requested CS5 X location on focal plane
DELTA_Y	float64	mm	Fiber difference between measured and requested CS5 Y location on focal plane
EBV	float32	mag	Galactic extinction E(B-V) reddening
QAFIBERSTATUS	int32		Fiber status bitmask, inflated with further QA diagnoses
EFFTIME_SPEC	float32	s	Spectroscopic effective time, based on template-based squared signal-to-noise ratio

HDU2

EXTNAME = PETALQA

This table contains some per-petal QA information which helps to decide if the observation is valid or not, and if a petal should be considered as “bad” (i.e. as if it would not have been observed), because of a too-low quality.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	62	int	length of dimension 1
NAXIS2	10	int	length of dimension 2
CHECKSUM	8aaf9WRc8aXc8WXc	str	HDU checksum updated 2021-07-16T14:31:54
DATASUM	666368269	str	data unit checksum updated 2021-07-16T14:31:54

Required Data Table Columns

Name	Type	Units	Description
PETAL_LOC	int16		Petal location [0-9]
WORSTREADNOISE	float32		Worst read noise (each individual value being the worst across amplifiers)
NGOODPOS	int16		Number of valid positioners
NGOODFIB	int16		Number of good fibers
NSTDSTAR	int16		Number of standard stars used by the spectroscopic pipeline for calibration
STARRMS	float32		RMS of the r-band flux ratio of standard stars
TSNR2FRA[Page 124, 1]	float32		Deprecated
EFFTIME_SPEC	float32	s	Median of the EFFTIME_SPEC values for all good fibers from that petal
NCFRAME	int16		Number of cframe files for that petal
BSKYTHRURMS	float32		Sky throuput RMS for the b-camera
BSKYCHI2PDF	float32		Reduced chi2 for the sky fibers for the b-camera
RSKYTHRURMS	float32		Sky throuput RMS for the r-camera
RSKYCHI2PDF	float32		Reduced chi2 for the sky fibers for the r-camera
ZSKYTHRURMS	float32		Sky throuput RMS for the z-camera
ZSKYCHI2PDF	float32		Reduced chi2 for the sky fibers for the z-camera
BTHRUFRAC	float32		Relative (single petal vs. all petals) throughput for the b-camera
RTHRUFRAC	float32		Relative (single petal vs. all petals) throughput for the r-camera
ZTHRUFRAC	float32		Relative (single petal vs. all petals) throughput for the z-camera

Notes and Examples

- These `exposure-qa-{expid}` files are used to compute several of the *tile-qa-TILEID-GROUPID* entries.
- The QAFIBERSTATUS bitmasks are defined here *bitmasks*.
- Some FIBERQA extension header keywords are originally coming from the *fiberassign-TILEID* file (TILEID, TILERA, TILEDEC, GOALTIME, GOALTYPE, FAPRGRM, SURVEY, EBVFAC, MINTFRAC).
- The FIBERQA EFFTIME_SPEC is proportional to the TSNR2 values in the TSNR2 extension of the *redrock-SPECTROGRAPH-TILEID-GROUPID* file; for the BACKUP and BRIGHT programs, the TSNR2_BGS is used; for the DARK program, the TSNR2_ELG or TSNR2_LRG is used.
- For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

fiberflat-CAMERA-EXPID.fits

Summary
This file contains the fiberflat such that newflux = rawflux/fiberflat.

Naming Convention
`fiberflat-{CAMERA}-{EXPID}.fits`, where `{camera}` is the camera name (*e.g.* b0, r1, z9) and `{EXPID}` is the zero padded 8-digit exposure ID.

Regex
`fiberflat-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 16 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	FIBERFLAT	IMAGE	fiberflat[nspec, nwave]
HDU1	IVAR	IMAGE	inverse variance of fiberflat
HDU2	MASK	IMAGE	bitmask of fiberflat (0=good)
HDU3	MEANSPEC	IMAGE	average spectrum[nwave]
HDU4	WAVELENGTH	IMAGE	wavelength grid[nwave] in Angstroms
HDU5	FIBERMAP	BINTABLE	fibermap

Note: the FIBERMAP HDU may be dropped from future versions

FITS Header Units

HDU0

EXTNAME = FIBERFLAT

Fiber flat field correction to homogeneize the response among fibers of the same camera, for each wavelength. 2D array of dimension [nspec, nwave]. nspec is the number of fibers per camera. nwave in the length of the wavelength array. The fiber flat field of all fibers share the same wavelength grid (given in HDU WAVELENGTH). This file is the fiber flat derived for the flat exposure EXPID. It is an intermediate file used as input for the nightly fiber flat.

Required Header Keywords

Header keywords are inherited from the input Frame file.

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
NAXIS2	500	int	
EXPID	68979	int	Exposure number
EXPFRAME	0	int	Frame number
FLAVOR	science	str	Observation type
SEQUENCE	Spectrographs	str	OCS Sequence name
PURPOSE	Commissioning	str	Purpose of observing night
PROGRAM	CALIB DESI-CALIB-00 LEDs only	str	Program name
PROPID	2019B-5000	str	Proposal ID
OBSERVER	DESIObserver	str	Names of observers
LEAD	RunManager	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude

continues on next page

Table 17 – continued from previous page

KEY	Example Value	Type	Comment
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20201220	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2020-12-20T22:24:15.672815	str	[UTC] Observation data and start time
TIME-OBS	22:24:15.672815	str	[UTC] Observation start time
MJD-OBS	59203.93351473	float	Modified Julian Date of observation
ST	20:57:41.340	str	Local Sidereal time at observation start (HH:MM
EXPTIME	120.037	float	[s] Actual exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.0	float	[arcsec] Offset], declination, observer input
VCCD	ON	str	True (ON) if CCD voltage is on
VCCDON	2020-12-09T21:23:19.307761	str	Time when CCD voltage was turned on
VCCDSEC	954226.0	float	[s] CCD on time in seconds
EQUINOX	2000.0	float	Epoch of observation
SPECGRPH	8	int	Spectrograph logical name (SP)
SPECID	2	int	Spectrograph serial number (SM)
FEEBOX	lbnl050	str	CCD Controller serial number
VESSEL	8	int	Cryostat serial number
FEEVER	v20160312	str	CCD Controller version
FEEPOWER	ON	str	FEE power status
FEEDMASK	2134851391	int	FEE dac mask
FEECMASK	1048575	int	FEE clk mask
CCDTEMP	-135.3315	float	[deg C] CCD controller CCD temperature
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
FILENAME	/exposures/desi/specs/20201220/00068979/sp9-00068979.fits.fz	str	Name
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration

continues on next page

Table 17 – continued from previous page

KEY	Example Value	Type	Comment
AMPSECB	[4114:2058, 1:2064]	str	AMP section for quadrant B
DAC16	39.9961,39.3162	str	[V] set value, measured value
CLOCK8	9.9992,2.9993	str	[V] high rail, low rail
PRRSECD	[2193:4249, 4194:4194]	str	Row prescan section for quadrant D
CCDPREP	purge,clear	str	CCD prep actions
CLOCK10	9.9992,2.9993	str	[V] high rail, low rail
DAC17	20.0008,12.2488	str	[V] set value, measured value
ORSECB	[2193:4249, 2066:2097]	str	Row overscan section for quadrant B
DAC15	0.0,0.0148	str	[V] set value, measured value
ORSECD	[2193:4249, 2098:2129]	str	Row bias section for quadrant D
DIGITIME	47.5846	float	[s] Time to digitize image
BIASSECA	[2065:2128, 2:2065]	str	Bias section for quadrant A
CLOCK9	9.9992,2.9993	str	[V] high rail, low rail
CLOCK18	9.0,0.9999	str	[V] high rail, low rail
CAMERA	r8	str	Camera name
CLOCK17	9.0,0.9999	str	[V] high rail, low rail
CLOCK5	9.9999,0.0	str	[V] high rail, low rail
TRIMSECD	[2193:4249, 2130:4193]	str	Trim section for quadrant D
DETSECD	[2058:4114, 2065:4128]	str	Detector section for quadrant D
DAC0	-9.0002,-8.9507	str	[V] set value, measured value
CLOCK15	9.9992,2.9993	str	[V] high rail, low rail
TRIMSECA	[8:2064, 2:2065]	str	Trim section for quadrant A
BIASSECB	[2129:2192, 2:2065]	str	Bias section for quadrant B
CLOCK11	9.9992,2.9993	str	[V] high rail, low rail
CLOCK12	9.9992,2.9993	str	[V] high rail, low rail
AMPSECD	[4114:2058, 4128:2065]	str	AMP section for quadrant D
CLOCK4	9.9999,0.0	str	[V] high rail, low rail
PRRSECB	[2193:4249, 1:1]	str	Row prescan section for quadrant B
CCDSECD	[2058:4114, 2065:4128]	str	CCD section for quadrant D
CCDTMING	default_lbnl_timing_20180905.txt	str	CCD timing file
TRIMSECB	[2193:4249, 2:2065]	str	Trim section for quadrant B

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Table 17 – continued from previous page

KEY	Example Value	Type	Comment
CCDSIZE	4194,4256	str	CCD size in pixels (rows, columns)
PGAGAIN	3	int	Controller gain
PRESECD	[4250:4256, 2130:4193]	str	Prescan section for quadrant D
CLOCK6	9.9999,0.0	str	[V] high rail, low rail
CLOCK13	9.9992,2.9993	str	[V] high rail, low rail
DAC7	5.9998,6.028	str	[V] set value, measured value
DATASECA	[8:2064, 2:2065]	str	Data section for quadrant A
CRYOTEMP[1]	162.97	float	[deg K] Cryostat CCD temperature
OFFSET2	0.4000000059604645,-8.9198	str	[V] set value, measured value
OFFSET6	2.0,6.0437	str	[V] set value, measured value
DELAYS	20, 20, 25, 40, 7, 3000, 7, 7, 7, 7	str	[10] Delay settings
BIASSECD	[2129:2192, 2130:4193]	str	Bias section for quadrant D
PRRSECA	[8:2064, 1:1]	str	Row prescan section for quadrant A
TRIMSECC	[8:2064, 2130:4193]	str	Trim section for quadrant C
CLOCK3	-2.0001,3.9999	str	[V] high rail, low rail
CCDNAME	CCDSM2R	str	CCD name
DAC9	-25.0003,-24.768	str	[V] set value, measured value
CCDSECC	[1:2057, 2065:4128]	str	CCD section for quadrant C
ORSECA	[8:2064, 2066:2097]	str	Row overscan section for quadrant A
DAC5	5.9998,6.0543	str	[V] set value, measured value
CCDSECB	[2058:4114, 1:2064]	str	CCD section for quadrant B
DETSECB	[2058:4114, 1:2064]	str	Detector section for quadrant B
OFFSET0	0.4000000059604645,-8.9507	str	[V] set value, measured value
SETTINGS	detectors_sm_20191211.json	str	Name of DESI CCD settings file
DAC11	-25.0003,-24.8422	str	[V] set value, measured value
BIASSECC	[2065:2128, 2130:4193]	str	Bias section for quadrant C
CASETEMP	60.4294	float	[deg C] CCD controller case temperature

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Table 17 – continued from previous page

KEY	Example Value	Type	Comment
DAC10	-25.0003,-24.7086	str	[V] set value, measured value
DAC1	-9.0002,-8.9198	str	[V] set value, measured value
DAC14	0.0,0.0594	str	[V] set value, measured value
DETECTOR	M1-46	str	Detector (ccd) identification
CDSPARMS	400, 400, 8, 2000	str	CDS parameters
OFFSET3	0.4000000059604645,-8.8992	str	[V] set value, measured value
DATASECB	[2193:4249, 2:2065]	str	Data section for quadrant B
ORSECC	[8:2064, 2098:2129]	str	Row overscan section for quadrant C
CRYOPRES[Page 140, 1]	9.084e-08	str	[mb] Cryostat pressure (IP)
AMPSECA	[1:2057, 1:2064]	str	AMP section for quadrant A
OFFSET7	2.0,6.028	str	[V] set value, measured value
DAC4	5.9998,6.028	str	[V] set value, measured value
DATASECC	[8:2064, 2130:4193]	str	Data section for quadrant C
PRESECC	[1:7, 2130:4193]	str	Prescan section for quadrant C
CLOCK16	9.9999,3.0	str	[V] high rail, low rail
CLOCK1	9.9999,0.0	str	[V] high rail, low rail
PRESECB	[4250:4256, 2:2065]	str	Prescan section for quadrant B
DAC12	0.0,0.0297	str	[V] set value, measured value
DAC8	-25.0003,-24.9312	str	[V] set value, measured value
OFFSET4	2.0,6.028	str	[V] set value, measured value
DAC2	-9.0002,-8.9198	str	[V] set value, measured value
CCDCFG	default_lbnl_20190717.cfg	str	CCD configuration file
BLDTIME	0.3585	float	[s] Time to build image
PRESECA	[1:7, 2:2065]	str	Prescan section for quadrant A
DATASECD	[2193:4249, 2130:4193]	str	Data section for quadrant D
DETSECC	[1:2057, 2065:4128]	str	Detector section for quadrant C
PRRSECC	[8:2064, 4194:4194]	str	Row prescan section for quadrant C

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Table 17 – continued from previous page

KEY	Example Value	Type	Comment
DAC6	5.9998,6.0437	str	[V] set value, measured value
DETSECA	[1:2057, 1:2064]	str	Detector section for quadrant A
CLOCK2	9.9999,0.0	str	[V] high rail, low rail
DAC3	-9.0002,-8.9095	str	[V] set value, measured value
OFFSET1	0.4000000059604645,-8.9198	str	[V] set value, measured value
AMPSECC	[1:2057, 4128:2065]	str	AMP section for quadrant C
CLOCK7	-2.0001,3.9999	str	[V] high rail, low rail
DAC13	0.0,0.0148	str	[V] set value, measured value
CCDSECA	[1:2057, 1:2064]	str	CCD section for quadrant A
OFFSET5	2.0,6.0543	str	[V] set value, measured value
CLOCK14	9.9992,2.9993	str	[V] high rail, low rail
CLOCK0	9.9999,0.0	str	[V] high rail, low rail
CPUTEMP	60.4394	float	[deg C] CCD controller CPU temperature
REQTIME	120.0	float	[s] Requested exposure time
OBSID	kp4m20201220t222415	str	Unique observation identifier
PROCTYPE	RAW	str	Data processing level
PRODTYPE	image	str	Data product type
CHECKSUM	bSeTbScSbScSbScS	str	HDU checksum updated 2022-01-29T01:14:36
DATASUM	1818512066	str	data unit checksum updated 2022-01-29T01:14:36
GAINA	1.627	float	e/ADU (gain applied to image)
SATULEVA	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPA	0.632482737491955	float	ADUs (max-min of median overscan per row)
OMETHA	AVERAGE	str	use average overscan
OVERSCNA	1984.644911356943	float	ADUs (gain not applied)
OBSRDNA	2.480943789810065	float	electrons (gain is applied)
SATUELEA	103396.4277292223	float	saturation or non lin. level, in electrons
GAINB	1.482	float	e/ADU (gain applied to image)
SATULEVB	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPB	0.5400817486224696	float	ADUs (max-min of median overscan per row)

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KEY	Example Value	Type	Comment
OMETHB	AVERAGE	str	use average overscan
OVERSCNB	1980.886896481526	float	ADUs (gain not applied)
OBSRDNB	2.179271146346672	float	electrons (gain is applied)
SATUELEB	94187.19561941437	float	saturation or non lin. level, in electrons
GAINC	1.581	float	e/ADU (gain applied to image)
SATULEVC	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPC	0.6331518428269192	float	ADUs (max-min of median overscan per row)
OMETHC	AVERAGE	str	use average overscan
OVERSCNC	1965.76250622263	float	ADUs (gain not applied)
OBSRDNC	2.484447923351728	float	electrons (gain is applied)
SATUELEC	100502.964477662	float	saturation or non lin. level, in electrons
GAIND	1.589	float	e/ADU (gain applied to image)
SATULEVD	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPD	0.6401253297517542	float	ADUs (max-min of median overscan per row)
OMETHD	AVERAGE	str	use average overscan
OVERSCND	1987.590453491951	float	ADUs (gain not applied)
OBSRDND	2.576419983467696	float	electrons (gain is applied)
SATUELED	100976.8337694013	float	saturation or non lin. level, in electrons
FIBERMIN	4000	int	
LONGSTRN	OGIP 1.0	str	The OGIP Long String Convention may be used.
MODULE	CI	str	Image Sources/Component
FRAMES	None	Unknown	Number of Frames in Archive
COSMSPLT	F	bool	Cosmics split exposure if true
MAXSPLIT	0	int	Number of allowed exposure splits
SPLITIDSPage 140, 1	68979	str	List of expids for split exposures
OBSTYPE	FLAT	str	Spectrograph observation type
MANIFEST	F	bool	DOS exposure manifest
OBJECT		str	Object name
SEQID	3 requests	str	Exposure sequence identifier
SEQNUM	2	int	Number of exposure in sequence
SEQTOT	3	int	Total number of exposures in sequence

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KEY	Example Value	Type	Comment
OPENSHUT	None	Unknown	Time shutter opened
CAMSHUT	open	str	Shutter status during observation
WHITESPT[Page 140, 1]	T	bool	Telescope is at whitespot
ZENITH[Page 140, 1]	F	bool	Telescope is at zenith
SEANNEX[Page 140, 1]	F	bool	Telescope is at SE annex
BEYONDP[Page 140, 1]	F	bool	Telescope is beyond pole
FIDUCIAL[Page 140, 1]	off	str	Fiducials status during observation
AIRMASS[Page 140, 1]	1.521306	float	Airmass
FOCUS[Page 140, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0	str	Telescope focus settings
TRUSTEMP[Page 140, 1]	13.267	float	[deg] Average Telescope truss temperature (only
PMIRTEMP[Page 140, 1]	7.35	float	[deg] Average primary mirror temperature (nit,e
PMREADY[Page 140, 1]	F	bool	Primary mirror ready
PMCOVER[Page 140, 1]	open	str	Primary mirror cover
PMCOOL[Page 140, 1]	on	str	Primary mirror cooling
DOMSHUTU[Page 140, 1]	not open	str	Upper dome shutter
DOMSHUTL[Page 140, 1]	not open	str	Lower dome shutter
DOMLIGHH[Page 140, 1]	off	str	High dome lights
DOMLIGHL[Page 140, 1]	off	str	Low dome lights
DOMEAZ[Page 140, 1]	253.289	float	[deg] Dome azimuth angle
DOMINPOS[Page 140, 1]	F	bool	Dome is in position
GUIDOFFR[Page 140, 1]	0.0	float	[arcsec] Cummulative guider offset (RA)
GUIDOFFD[Page 140, 1]	-0.0	float	[arcsec] Cummulative guider offset (dec)
MOONDEC[Page 140, 1]	-9.830944	float	[deg] Moon declination at start of exposure
MOONRA[Page 140, 1]	350.511461	float	[deg] Moon RA at start of exposure
MOUNTAZ[Page 140, 1]	73.49407	float	[deg] Mount azimuth angle
MOUNTDEC[Page 140, 1]	31.962703	float	[deg] Mount declination
MOUNTEL[Page 140, 1]	41.035778	float	[deg] Mount elevation angle
MOUNTHA[Page 140, 1]	-58.479517	float	[deg] Mount hour angle
INCTRL[Page 140, 1]	F	bool	DESI in control
INPOS[Page 140, 1]	T	bool	Mount in position
MNTOFFD[Page 140, 1]	-0.0	float	[arcsec] Mount offset (dec)
MNTOFFR[Page 140, 1]	-0.0	float	[arcsec] Mount offset (RA)
PARALLAC[Page 140, 1]	-73.492813	float	[deg] Parallactic angle
SKYDEC[Page 140, 1]	31.962703	float	[deg] Telescope declination (pointing on sky)

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KEY	Example Value	Type	Comment
SKYRA[Page 140, 1]	12.901561	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC[Page 140, 1]	31.963299	float	[deg] Target declination (to TCS)
TARGTRA[Page 140, 1]	6.305086	float	[deg] Target right ascension (to TCS)
TARGTAZ[Page 140, 1]	75.558672	float	[deg] Target azimuth
TARGTEL[Page 140, 1]	46.429343	float	[deg] Target elevation
TRGTOFFD[Page 140, 1]	0.0	float	[arcsec] Telescope target offset (dec)
TRGTOFFR[Page 140, 1]	0.0	float	[arcsec] Telescope target offset (RA)
ZD[Page 140, 1]	48.964222	float	[deg] Telescope zenith distance
TCSST[Page 140, 1]	20:57:41.291	str	Local Sidereal time reported by TCS (HH:MM:SS)
TCSMJD[Page 140, 1]	59203.933945	float	MJD reported by TCS
ADCCORR	F	bool	Correct pointing for ADC setting if True
ADC1PHI[Page 140, 1]	114.980003	float	[deg] ADC 1 angle
ADC2PHI[Page 140, 1]	162.869907	float	[deg] ADC 2 angle
ADC1HOME[Page 140, 1]	F	bool	ADC 1 at home position if True
ADC2HOME[Page 140, 1]	F	bool	ADC 2 at home position if True
ADC1NREV[Page 140, 1]	0.0	float	ADC 1 number of revs
ADC2NREV[Page 140, 1]	-1.0	float	ADC 2 number of revs
ADC1STAT[Page 140, 1]	STOPPED	str	ADC 1 status
ADC2STAT[Page 140, 1]	STOPPED	str	ADC 2 status
HEXPOS[Page 140, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0	str	Hexapod position
HEXTRIM[Page 140, 1]	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
ROTOFFST[Page 140, 1]	0.0	float	[arcsec] Rotator offset
ROTENBLD[Page 140, 1]	T	bool	Rotator enabled
ROTRATE[Page 140, 1]	0.0	float	[arcsec/min] Rotator rate
RESETROT	F	bool	DOS Control: reset hex rotator
GUIDMODE	catalog	str	Guider mode
USEAOS[Page 140, 1]	F	bool	DOS Control: AOS data available if true
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating spectrograph
ILLSPECS[Page 140, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating illuminate s
CCDSPECS[Page 140, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating ccd spectrog
TDEWPNT[Page 140, 1]	-18.2	float	Telescope air dew point
TAIRFLOW[Page 140, 1]	1.121	float	Telescope air flow
TAIRITMP[Page 140, 1]	10.5	float	[deg] Telescope air in temperature

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KEY	Example Value	Type	Comment
TAIROTMP[Page 140, 1]	5.5	float	[deg] Telescope air out temperature
TAIRTEMP[Page 140, 1]	11.86	float	[deg] Telescope air temperature
TCASITMP[Page 140, 1]	0.0	float	[deg] Telescope Cass Cage in temperature
TCASOTMP[Page 140, 1]	9.6	float	[deg] Telescope Cass Cage out temperature
TCSITEMP[Page 140, 1]	7.4	float	[deg] Telescope center section in temperature
TCSOTEMP[Page 140, 1]	10.2	float	[deg] Telescope center section out temperature
TCIBTEMP[Page 140, 1]	0.0	float	[deg] Telescope chimney IB temperature
TCIMTEMP[Page 140, 1]	0.0	float	[deg] Telescope chimney IM temperature
TCITTEMP[Page 140, 1]	0.0	float	[deg] Telescope chimney IT temperature
TCOSTEMP[Page 140, 1]	0.0	float	[deg] Telescope chimney OS temperature
TCOWTEMP[Page 140, 1]	0.0	float	[deg] Telescope chimney OW temperature
TDBTEMP[Page 140, 1]	7.4	float	[deg] Telescope dec bore temperature
TFLOWIN[Page 140, 1]	7.7	float	Telescope flow rate in
TFLOWOUT[Page 140, 1]	8.3	float	Telescope flow rate out
TGLYCOLI[Page 140, 1]	-1.8	float	[deg] Telescope glycol in temperature
TGLYCOLO[Page 140, 1]	0.0	float	[deg] Telescope glycol out temperature
THINGES[Page 140, 1]	12.9	float	[deg] Telescope hinge S temperature
THINGEW[Page 140, 1]	11.7	float	[deg] Telescope hinge W temperature
TPMAVERT[Page 140, 1]	7.304	float	[deg] Telescope mirror averagetemperature
TPMDESIT[Page 140, 1]	7.0	float	[deg] Telescope mirror desired temperature
TPMEIBT[Page 140, 1]	7.3	float	[deg] Telescope mirror EIB temperature
TPMEITT[Page 140, 1]	7.3	float	[deg] Telescope mirror EIT temperature
TPMEOBT[Page 140, 1]	7.4	float	[deg] Telescope mirror EOB temperature
TPMEOTT[Page 140, 1]	7.2	float	[deg] Telescope mirror EOT temperature
TPMNIBT[Page 140, 1]	7.4	float	[deg] Telescope mirror NIB temperature
TPMNITT[Page 140, 1]	7.3	float	[deg] Telescope mirror NIT temperature

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KEY	Example Value	Type	Comment
TPMNOBT[Page 140, 1]	7.7	float	[deg] Telescope mirror NOB temperature
TPMNOTT[Page 140, 1]	7.6	float	[deg] Telescope mirror NOT temperature
TPMRTDT[Page 140, 1]	6.96	float	[deg] Telescope mirror RTD temperature
TPMSIBT[Page 140, 1]	7.4	float	[deg] Telescope mirror SIB temperature
TPMSITT[Page 140, 1]	7.0	float	[deg] Telescope mirror SIT temperature
TPMSOBT[Page 140, 1]	7.4	float	[deg] Telescope mirror SOB temperature
TPMSOTT[Page 140, 1]	7.2	float	[deg] Telescope mirror SOT temperature
TPMSTAT[Page 140, 1]	soft air	str	Telescope mirror status
TPMWIBT[Page 140, 1]	7.2	float	[deg] Telescope mirror WIB temperature
TPMWITT[Page 140, 1]	7.1	float	[deg] Telescope mirror WIT temperature
TPMWOBT[Page 140, 1]	7.6	float	[deg] Telescope mirror WOB temperature
TPMWOTT[Page 140, 1]	8.1	float	[deg] Telescope mirror WOT temperature
TPCITEMP[Page 140, 1]	7.7	float	[deg] Telescope primary cell in temperature
TPCOTEMP[Page 140, 1]	7.7	float	[deg] Telescope primary cell out temperature
TPR1HUM[Page 140, 1]	0.0	float	Telescope probe 1 humidity
TPR1TEMP[Page 140, 1]	0.0	float	[deg] Telescope probe1 temperature
TPR2HUM[Page 140, 1]	0.0	float	Telescope probe 2 humidity
TPR2TEMP[Page 140, 1]	0.0	float	[deg] Telescope probe2 temperature
TSERVO[Page 140, 1]	7.0	float	Telescope servo setpoint
TTRSTEMP[Page 140, 1]	13.2	float	[deg] Telescope top ring S temperature
TTRWTEMP[Page 140, 1]	13.4	float	[deg] Telescope top ring W temperature
TTRUETBT[Page 140, 1]	-4.8	float	[deg] Telescope truss ETB temperature
TTRUETTT[Page 140, 1]	11.5	float	[deg] Telescope truss ETT temperature
TTRUNTBT[Page 140, 1]	10.9	float	[deg] Telescope truss NTB temperature
TTRUNTTT[Page 140, 1]	11.8	float	[deg] Telescope truss NTT temperature
TTRUSTBT[Page 140, 1]	11.1	float	[deg] Telescope truss STB temperature

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KEY	Example Value	Type	Comment
TTRUSTST[Page 140, 1]	10.8	float	[deg] Telescope truss STS temperature
TTRUSTTT[Page 140, 1]	12.4	float	[deg] Telescope truss STT temperature
TTRUTSBT[Page 140, 1]	13.6	float	[deg] Telescope truss TSB temperature
TTRUTSMT[Page 140, 1]	13.7	float	[deg] Telescope truss TSM temperature
TTRUTSTT[Page 140, 1]	12.5	float	[deg] Telescope truss TST temperature
TTRUWTBT[Page 140, 1]	10.9	float	[deg] Telescope truss WTB temperature
TTRUWTTT[Page 140, 1]	11.6	float	[deg] Telescope truss WTT temperature
ALARM[Page 140, 1]	F	bool	UPS major alarm or check battery
ALARM-ON[Page 140, 1]	F	bool	UPS active alarm condition
BATTERY[Page 140, 1]	100.0	float	[%] UPS Battery left
SECLEFT[Page 140, 1]	5772.0	float	[s] UPS Seconds left
UPSSTAT[Page 140, 1]	System Normal - On Line(7)	str	UPS Status
INAMPS[Page 140, 1]	64.3	float	[A] UPS total input current
OUTWATTS[Page 140, 1]	4500.0,6800.0,4100.0	str	[W] UPS Phase A, B, C output watts
COMPDEW[Page 140, 1]	-12.0	float	[deg C] Computer room dewpoint
COMPHUM[Page 140, 1]	7.8	float	[%] Computer room humidity
COMPAMB[Page 140, 1]	19.4	float	[deg C] Computer room ambient temperature
COMPTEMP[Page 140, 1]	24.9	float	[deg C] Computer room hygrometer temperature
DEWPOINT[Page 140, 1]	5.7	float	[deg C] (outside) dewpoint
HUMIDITY[Page 140, 1]	7.0	float	[%] (outside) humidity
PRESSURE[Page 140, 1]	794.7	float	[torr] (outside) air pressure
OUTTEMP[Page 140, 1]	0.0	float	[deg C] outside temperature
WINDDIR[Page 140, 1]	82.0	float	[deg] wind direction
WINDSPD[Page 140, 1]	23.3	float	[m/s] wind speed
GUST[Page 140, 1]	18.1	float	[m/s] Wind gusts speed
AMNIENTN[Page 140, 1]	13.3	float	[deg C] ambient temperature north
CFLOOR[Page 140, 1]	8.1	float	[deg C] temperature on C floor
NWALLIN[Page 140, 1]	13.6	float	[deg C] temperature at north wall inside

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KEY	Example Value	Type	Comment
NWALLOUT[Page 140, 1]	8.8	float	[deg C] temperature at north wall outside
WWALLIN[Page 140, 1]	12.8	float	[deg C] temperature at west wall inside
WWALLOUT[Page 140, 1]	9.4	float	[deg C] temperature at west wall outside
AMBIENTS[Page 140, 1]	14.6	float	[deg C] ambient temperature south
FLOOR[Page 140, 1]	12.3	float	[deg C] temperature at floor (LCR)
EWALLCMP[Page 140, 1]	10.2	float	[deg C] temperature at east wall, computer room
EWALLCOU[Page 140, 1]	9.5	float	[deg C] temperature at east wall, Coude room
ROOF[Page 140, 1]	10.0	float	[deg C] temperature on roof
ROOFAMB[Page 140, 1]	9.9	float	[deg C] ambient temperature on roof
DOMEBLOW[Page 140, 1]	12.1	float	[deg C] temperature at dome back, lower
DOMEBUP[Page 140, 1]	12.5	float	[deg C] temperature at dome back, upper
DOMELLOW[Page 140, 1]	14.4	float	[deg C] temperature at dome left, lower
DOMELUP[Page 140, 1]	19.3	float	[deg C] temperature at dome left, upper
DOMERLOW[Page 140, 1]	12.3	float	[deg C] temperature at dome right, lower
DOMERUP[Page 140, 1]	12.8	float	[deg C] temperature at dome right, upper
PLATFORM[Page 140, 1]	15.3	float	[deg C] temperature at platform
SHACKC[Page 140, 1]	15.2	float	[deg C] temperature at shack ceiling
SHACKW[Page 140, 1]	13.2	float	[deg C] temperature at shack wall
STAIRSL[Page 140, 1]	12.6	float	[deg C] temperature at stairs, lower
STAIRSM[Page 140, 1]	13.3	float	[deg C] temperature at stairs, mid
STAIRSU[Page 140, 1]	13.6	float	[deg C] temperature at stairs, upper
TELBASE[Page 140, 1]	8.5	float	[deg C] temperature at telescope base
UTILWALL[Page 140, 1]	11.6	float	[deg C] temperature at utility room wall
UTILROOM[Page 140, 1]	12.4	float	[deg C] temperature in utilitiy room
EXCLUDED		str	Components excluded from this exposure

continues on next page

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KEY	Example Value	Type	Comment
NSPEC	500	int	Number of spectra
WAVEMIN	5760.0	float	First wavelength [Angstroms]
WAVEMAX	7620.0	float	Last wavelength [Angstroms]
WAVESTEP	0.8	float	Wavelength step size [Angstroms]
SPECTER	0.10.0	str	https://github.com/desihub/specter
IN_PSF	SPECPROD/exposures/20201220/00068979/psf-r8-00068979.fits	str	Input sp
IN_IMG	SPECPROD/preproc/20201220/00068979/preproc-r8-00068979.fits	str	
ORIG_PSF	SPECPROD/calibnight/20201220/psfnight-r8-20201220.fits	str	
CHI2PDF	1.081598530118078	float	
BUNIT		str	adimensional quantity to divide to flatfield a frame
SUNDEC[Page 140, 1]	18.640139	float	[deg] Sun declination at start of exposure
TCSKRA[1]	0.3 0.003 0.00003	str	TCS Kalman (RA)
SEQSTART[1]	2021-05-14T01:11:54.263801	str	Start time of sequence processing
TCSGDEC[1]	0.3	float	TCS simple gain (dec)
MOONSEP[1]	9.334	float	[deg] Moon Separation
TCSMFDEC[1]	1	int	TCS moving filter length (dec)
TCSMFRA[1]	1	int	TCS moving filter length (RA)
TCSGRA[1]	0.3	float	TCS simple gain (RA)
SUNRA[1]	51.089577	float	[deg] Sun RA at start of exposure
NTSSURVY[1]	na	str	NTS survey name
TCSKDEC[1]	0.3 0.003 0.00003	str	TCS Kalman (dec)
TCSPIDEC[1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
TCSPIRA[1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
TRANSPAR[1]	None	Unknown	ETC/PM transparency
SEEING[1]	None	Unknown	[arcsec] ETC/PM seeing
SKYLEVEL[1]	8.153	float	counts?] ETC sky level

Data: FITS image [float32, 2881x500]

[1] Optional

HDU1

EXTNAME = IVAR

Inverse variance (1/sigma^2) of the fiber flat field in HDU0.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	
NAXIS2	500	int	
BUNIT		str	inverse variance, adimensional
CHECKSUM	9PWhCOTZ9OTfAOTZ	str	HDU checksum updated 2021-07-07T18:12:11
DATASUM	1188137300	str	data unit checksum updated 2021-07-07T18:12:11

Data: FITS image [float32, 2881x500]

HDU2

EXTNAME = MASK

Mask of the fiberflat; 0=good. See the *bitmask documentation* page for the definition of the bits. Prior to desispec/0.24.0 and software release 18.9, the MASK HDU was compressed.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	Number of wavelengths
NAXIS2	500	int	Number of spectra
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	EGfjGGdhEGdhEGdh	str	HDU checksum updated 2021-07-07T18:12:11
DATASUM	722182	str	data unit checksum updated 2021-07-07T18:12:11

Data: FITS image [int32, 2881x500]

HDU3

EXTNAME = MEANSPEC

Average flat lamp spectrum of fibers in this camera frame. The fiber flat field is in first approximation the ratio of the measured spectra to this mean spectrum (in practice we use a deconvolved mean spectrum and reconvolve it with the resolution of each fiber). The units are electrons per Angstrom.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	Number of wavelengths
BUNIT	electron/Angstrom	str	
CHECKSUM	CcfOCceNCceNCceN	str	HDU checksum updated 2021-07-07T18:12:12
DATASUM	1452506388	str	data unit checksum updated 2021-07-07T18:12:12

Data: FITS image [float32, 2881]

HDU4

EXTNAME = WAVELENGTH

Wavelength grid in Angstrom used by this fiber flat field. Note that contrary to the science frame, this wavelength array is in the observer frame. In consequence, one has to first convert its wavelength to the solar barycenter frame before using this data to flat field a science exposure. See the frame *WAVELENGTH documentation* for more details.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	
BUNIT	Angstrom	str	
CHECKSUM	kRaDlRa9kRaCkRa9	str	HDU checksum updated 2021-07-07T18:12:12
DATASUM	153633556	str	data unit checksum updated 2021-07-07T18:12:12

Data: FITS image [float32, 2881]

HDU5

EXTNAME = FIBERMAP

Fibermap with information about the fiber status.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	369	int	length of dimension 1
NAXIS2	500	int	length of dimension 2
EXPID	68979	int	
EXPFRAME	0	int	
FLAVOR	science	str	
SEQUENCE	Spectrographs	str	
PURPOSE	Commissioning	str	
PROGRAM	CALIB DESI-CALIB-00 LEDs only	str	
PROPID	2019B-5000	str	

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KEY	Example Value	Type	Comment
OBSERVER	DESIObserver	str	
LEAD	RunManager	str	
INSTRUME	DESI	str	
OBSERVAT	KPNO	str	
OBS-LAT	31.96403	str	
OBS-LONG	-111.59989	str	
OBS-ELEV	2097.0	float	
TELESCOP	KPNO 4.0-m telescope	str	
CORRCTOR	DESI Corrector	str	
NIGHT	20201220	int	
TIMESYS	UTC	str	
DATE-OBS	2020-12-20T22:24:15.672815	str	
TIME-OBS	22:24:15.672815	str	
MJD-OBS	59203.93351473	float	
ST	20:57:41.340	str	
EXPTIME	120.037	float	
DELTARA	0.0	float	
DELTADEC	0.0	float	
VCCD	ON	str	
VCCDON	2020-12-09T21:23:19.307761	str	
VCCDSEC	954226.0	float	
EQUINOX	2000.0	float	
SPECGRPH	8	int	
SPECID	2	int	
FEEBOX	lbnl050	str	
VESSEL	8	int	
FEEVER	v20160312	str	
FEEPOWER	ON	str	
FEEDMASK	2134851391	int	
FEECMASK	1048575	int	
CCDTEMP	-135.3315	float	
RADESYS	FK5	str	
FILENAME	/exposures/desi/specs/20201220/00068979/sp9-00068979.fits.fz	str	
DOSVER	trunk	str	
OCSVER	1.2	float	
CONSTVER	DESI:CURRENT	str	
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	
AMPSECB	[4114:2058, 1:2064]	str	
DAC16	39.9961,39.3162	str	
CLOCK8	9.9992,2.9993	str	
PRRSECD	[2193:4249, 4194:4194]	str	
CCDPREP	purge,clear	str	
CLOCK10	9.9992,2.9993	str	
DAC17	20.0008,12.2488	str	
ORSECB	[2193:4249, 2066:2097]	str	
DAC15	0.0,0.0148	str	
ORSECD	[2193:4249, 2098:2129]	str	
DIGITIME	47.5846	float	
BIASSECA	[2065:2128, 2:2065]	str	

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KEY	Example Value	Type	Comment
CLOCK9	9.9992,2.9993	str	
CLOCK18	9.0,0.9999	str	
CAMERA	r8	str	
CLOCK17	9.0,0.9999	str	
CLOCK5	9.9999,0.0	str	
TRIMSECD	[2193:4249, 2130:4193]	str	
DETSECD	[2058:4114, 2065:4128]	str	
DAC0	-9.0002,-8.9507	str	
CLOCK15	9.9992,2.9993	str	
TRIMSECA	[8:2064, 2:2065]	str	
BIASSECB	[2129:2192, 2:2065]	str	
CLOCK11	9.9992,2.9993	str	
CLOCK12	9.9992,2.9993	str	
AMPSECD	[4114:2058, 4128:2065]	str	
CLOCK4	9.9999,0.0	str	
PRRSECB	[2193:4249, 1:1]	str	
CCDSECD	[2058:4114, 2065:4128]	str	
CCDTMING	default_lbnl_timing_20180905.txt	str	
TRIMSECB	[2193:4249, 2:2065]	str	
CCDSIZE	4194,4256	str	
PGAGAIN	3	int	
PRESECD	[4250:4256, 2130:4193]	str	
CLOCK6	9.9999,0.0	str	
CLOCK13	9.9992,2.9993	str	
DAC7	5.9998,6.028	str	
DATASECA	[8:2064, 2:2065]	str	
CRYOTEMP[1]	162.97	float	
OFFSET2	0.4000000059604645,-8.9198	str	
OFFSET6	2.0,6.0437	str	
DELAYS	20, 20, 25, 40, 7, 3000, 7, 7, 7, 7	str	
BIASSECD	[2129:2192, 2130:4193]	str	
PRRSECA	[8:2064, 1:1]	str	
TRIMSECC	[8:2064, 2130:4193]	str	
CLOCK3	-2.0001,3.9999	str	
CCDNAME	CCDSM2R	str	
DAC9	-25.0003,-24.768	str	
CCDSECC	[1:2057, 2065:4128]	str	
ORSECA	[8:2064, 2066:2097]	str	
DAC5	5.9998,6.0543	str	
CCDSECB	[2058:4114, 1:2064]	str	
DETSECB	[2058:4114, 1:2064]	str	
OFFSET0	0.4000000059604645,-8.9507	str	
SETTINGS	detectors_sm_20191211.json	str	
DAC11	-25.0003,-24.8422	str	
BIASSECC	[2065:2128, 2130:4193]	str	
CASETEMP	60.4294	float	
DAC10	-25.0003,-24.7086	str	
DAC1	-9.0002,-8.9198	str	
DAC14	0.0,0.0594	str	

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KEY	Example Value	Type	Comment
DETECTOR	M1-46	str	
CDSPARMS	400, 400, 8, 2000	str	
OFFSET3	0.4000000059604645,-8.8992	str	
DATASECB	[2193:4249, 2:2065]	str	
ORSECC	[8:2064, 2098:2129]	str	
CRYOPRES[Page 140, 1]	9.084e-08	str	
AMPSECA	[1:2057, 1:2064]	str	
OFFSET7	2.0,6.028	str	
DAC4	5.9998,6.028	str	
DATASECC	[8:2064, 2130:4193]	str	
PRESECC	[1:7, 2130:4193]	str	
CLOCK16	9.9999,3.0	str	
CLOCK1	9.9999,0.0	str	
PRESECB	[4250:4256, 2:2065]	str	
DAC12	0.0,0.0297	str	
DAC8	-25.0003,-24.9312	str	
OFFSET4	2.0,6.028	str	
DAC2	-9.0002,-8.9198	str	
CCDCFG	default_lbnl_20190717.cfg	str	
BLDTIME	0.3585	float	
PRESECA	[1:7, 2:2065]	str	
DATASECD	[2193:4249, 2130:4193]	str	
DETSECC	[1:2057, 2065:4128]	str	
PRRSECC	[8:2064, 4194:4194]	str	
DAC6	5.9998,6.0437	str	
DETSECA	[1:2057, 1:2064]	str	
CLOCK2	9.9999,0.0	str	
DAC3	-9.0002,-8.9095	str	
OFFSET1	0.4000000059604645,-8.9198	str	
AMPSECC	[1:2057, 4128:2065]	str	
CLOCK7	-2.0001,3.9999	str	
DAC13	0.0,0.0148	str	
CCDSECA	[1:2057, 1:2064]	str	
OFFSET5	2.0,6.0543	str	
CLOCK14	9.9992,2.9993	str	
CLOCK0	9.9999,0.0	str	
CPUTEMP	60.4394	float	
REQTIME	120.0	float	
OBSID	kp4m20201220t222415	str	
PROCTYPE	RAW	str	
PRODTYPE	image	str	
GAINA	1.627	float	
SATULEVA	65535.0	float	
OSTEPA	0.632482737491955	float	
OMETHA	AVERAGE	str	
OVERSCNA	1984.644911356943	float	
OBSRDNA	2.480943789810065	float	
SATUELEA	103396.4277292223	float	
GAINB	1.482	float	

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KEY	Example Value	Type	Comment
SATULEVB	65535.0	float	
OSTEPB	0.5400817486224696	float	
OMETHB	AVERAGE	str	
OVERSCNB	1980.886896481526	float	
OBSRDNB	2.179271146346672	float	
SATUELEB	94187.19561941437	float	
GAINC	1.581	float	
SATULEVC	65535.0	float	
OSTEPC	0.6331518428269192	float	
OMETHC	AVERAGE	str	
OVERSCNC	1965.76250622263	float	
OBSRDNC	2.484447923351728	float	
SATUELEC	100502.964477662	float	
GAIND	1.589	float	
SATULEVD	65535.0	float	
OSTEPD	0.6401253297517542	float	
OMETHD	AVERAGE	str	
OVERSCND	1987.590453491951	float	
OBSRDND	2.576419983467696	float	
SATUELED	100976.8337694013	float	
FIBERMIN	4000	int	
LONGSTRN	OGIP 1.0	str	
MODULE	CI	str	
FRAMES	None	Unknown	
COSMSPLT	F	bool	
MAXSPLIT	0	int	
SPLITIDS[Page 140, 1]	68979	str	
OBSTYPE	FLAT	str	
MANIFEST	F	bool	
OBJECT		str	
SEQID	3 requests	str	
SEQNUM	2	int	
SEQTOT	3	int	
OPENSHUT	None	Unknown	
CAMSHUT	open	str	
WHITESPT[Page 140, 1]	T	bool	
ZENITH[Page 140, 1]	F	bool	
SEANNEX[Page 140, 1]	F	bool	
BEYONDP[Page 140, 1]	F	bool	
FIDUCIAL[Page 140, 1]	off	str	
AIRMASS[Page 140, 1]	1.521306	float	
FOCUS[Page 140, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0	str	
TRUSTEMP[Page 140, 1]	13.267	float	
PMIRTEMP[Page 140, 1]	7.35	float	
PMREADY[Page 140, 1]	F	bool	
PMCOVER[Page 140, 1]	open	str	
PMCOOL[Page 140, 1]	on	str	
DOMSHUTU[Page 140, 1]	not open	str	
DOMSHUTL[Page 140, 1]	not open	str	

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KEY	Example Value	Type	Comment
DOMLIGHH[Page 140, 1]	off	str	
DOMLIGHL[Page 140, 1]	off	str	
DOMEAZ[Page 140, 1]	253.289	float	
DOMINPOS[Page 140, 1]	F	bool	
GUIDOFFR[Page 140, 1]	0.0	float	
GUIDOFFD[Page 140, 1]	-0.0	float	
MOONDEC[Page 140, 1]	-9.830944	float	
MOONRA[Page 140, 1]	350.511461	float	
MOUNTAZ[Page 140, 1]	73.49407	float	
MOUNTDEC[Page 140, 1]	31.962703	float	
MOUNTEL[Page 140, 1]	41.035778	float	
MOUNTHA[Page 140, 1]	-58.479517	float	
INCTRL[Page 140, 1]	F	bool	
INPOS[Page 140, 1]	T	bool	
MNTOFFD[Page 140, 1]	-0.0	float	
MNTOFFR[Page 140, 1]	-0.0	float	
PARALLAC[Page 140, 1]	-73.492813	float	
SKYDEC[Page 140, 1]	31.962703	float	
SKYRA[Page 140, 1]	12.901561	float	
TARGTDEC[Page 140, 1]	31.963299	float	
TARGTRA[Page 140, 1]	6.305086	float	
TARGTAZ[Page 140, 1]	75.558672	float	
TARGTEL[Page 140, 1]	46.429343	float	
TRGTOFFD[Page 140, 1]	0.0	float	
TRGTOFFR[Page 140, 1]	0.0	float	
ZD[Page 140, 1]	48.964222	float	
TCSST[Page 140, 1]	20:57:41.291	str	
TCSMJD[Page 140, 1]	59203.933945	float	
ADCCORR	F	bool	
ADC1PHI[Page 140, 1]	114.980003	float	
ADC2PHI[Page 140, 1]	162.869907	float	
ADC1HOME[Page 140, 1]	F	bool	
ADC2HOME[Page 140, 1]	F	bool	
ADC1NREV[Page 140, 1]	0.0	float	
ADC2NREV[Page 140, 1]	-1.0	float	
ADC1STAT[Page 140, 1]	STOPPED	str	
ADC2STAT[Page 140, 1]	STOPPED	str	
HEXPOS[Page 140, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0	str	
HEXTRIM[Page 140, 1]	0.0,0.0,0.0,0.0,0.0,0.0	str	
ROTOFFST[Page 140, 1]	0.0	float	
ROTENBLD[Page 140, 1]	T	bool	
ROTRATE[Page 140, 1]	0.0	float	
RESETROT	F	bool	
GUIDMODE	catalog	str	
USEAOS[Page 140, 1]	F	bool	
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	
ILLSPECS[Page 140, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	
CCDSPECS[Page 140, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	
TDEWPNT[Page 140, 1]	-18.2	float	

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KEY	Example Value	Type	Comment
TAIRFLOW[Page 140, 1]	1.121	float	
TAIRITMP[Page 140, 1]	10.5	float	
TAIROTMP[Page 140, 1]	5.5	float	
TAIRTEMP[Page 140, 1]	11.86	float	
TCASITMP[Page 140, 1]	0.0	float	
TCASOTMP[Page 140, 1]	9.6	float	
TCSITEMP[Page 140, 1]	7.4	float	
TCSOTEMP[Page 140, 1]	10.2	float	
TCIBTEMP[Page 140, 1]	0.0	float	
TCIMTEMP[Page 140, 1]	0.0	float	
TCITTEMP[Page 140, 1]	0.0	float	
TCOSTEMP[Page 140, 1]	0.0	float	
TCOWTEMP[Page 140, 1]	0.0	float	
TDBTEMP[Page 140, 1]	7.4	float	
TFLOWIN[Page 140, 1]	7.7	float	
TFLOWOUT[Page 140, 1]	8.3	float	
TGLYCOLI[Page 140, 1]	-1.8	float	
TGLYCOLO[Page 140, 1]	0.0	float	
THINGES[Page 140, 1]	12.9	float	
THINGEW[Page 140, 1]	11.7	float	
TPMAVERT[Page 140, 1]	7.304	float	
TPMDESIT[Page 140, 1]	7.0	float	
TPMEIBT[Page 140, 1]	7.3	float	
TPMEITT[Page 140, 1]	7.3	float	
TPMEOBT[Page 140, 1]	7.4	float	
TPMEOTT[Page 140, 1]	7.2	float	
TPMNIBT[Page 140, 1]	7.4	float	
TPMNITT[Page 140, 1]	7.3	float	
TPMNOBT[Page 140, 1]	7.7	float	
TPMNOTT[Page 140, 1]	7.6	float	
TPMRTDT[Page 140, 1]	6.96	float	
TPMSIBT[Page 140, 1]	7.4	float	
TPMSITT[Page 140, 1]	7.0	float	
TPMSOBT[Page 140, 1]	7.4	float	
TPMSOTT[Page 140, 1]	7.2	float	
TPMSTAT[Page 140, 1]	soft air	str	
TPMWIBT[Page 140, 1]	7.2	float	
TPMWITT[Page 140, 1]	7.1	float	
TPMWOBT[Page 140, 1]	7.6	float	
TPMWOTT[Page 140, 1]	8.1	float	
TPCITEMP[Page 140, 1]	7.7	float	
TPCOTEMP[Page 140, 1]	7.7	float	
TPR1HUM[Page 140, 1]	0.0	float	
TPR1TEMP[Page 140, 1]	0.0	float	
TPR2HUM[Page 140, 1]	0.0	float	
TPR2TEMP[Page 140, 1]	0.0	float	
TSERVO[Page 140, 1]	7.0	float	
TTRSTEMP[Page 140, 1]	13.2	float	
TTRWTEMP[Page 140, 1]	13.4	float	

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KEY	Example Value	Type	Comment
TTRUETBT[Page 140, 1]	-4.8	float	
TTRUETTT[Page 140, 1]	11.5	float	
TTRUNTBT[Page 140, 1]	10.9	float	
TTRUNTTT[Page 140, 1]	11.8	float	
TTRUSTBT[Page 140, 1]	11.1	float	
TTRUSTST[Page 140, 1]	10.8	float	
TTRUSTTT[Page 140, 1]	12.4	float	
TTRUTSBT[Page 140, 1]	13.6	float	
TTRUTSMT[Page 140, 1]	13.7	float	
TTRUTSTT[Page 140, 1]	12.5	float	
TTRUWTBT[Page 140, 1]	10.9	float	
TTRUWTTT[Page 140, 1]	11.6	float	
ALARM[Page 140, 1]	F	bool	
ALARM-ON[Page 140, 1]	F	bool	
BATTERY[Page 140, 1]	100.0	float	
SECLEFT[Page 140, 1]	5772.0	float	
UPSSTAT[Page 140, 1]	System Normal - On Line(7)	str	
INAMPS[Page 140, 1]	64.3	float	
OUTWATTS[Page 140, 1]	4500.0,6800.0,4100.0	str	
COMPDEW[Page 140, 1]	-12.0	float	
COMPHUM[Page 140, 1]	7.8	float	
COMPAMB[Page 140, 1]	19.4	float	
COMPTEMP[Page 140, 1]	24.9	float	
DEWPOINT[Page 140, 1]	5.7	float	
HUMIDITY[Page 140, 1]	7.0	float	
PRESSURE[Page 140, 1]	794.7	float	
OUTTEMP[Page 140, 1]	0.0	float	
WINDDIR[Page 140, 1]	82.0	float	
WINDSPD[Page 140, 1]	23.3	float	
GUST[Page 140, 1]	18.1	float	
AMNIENTN[Page 140, 1]	13.3	float	
CFLOOR[Page 140, 1]	8.1	float	
NWALLIN[Page 140, 1]	13.6	float	
NWALLOUT[Page 140, 1]	8.8	float	
WWALLIN[Page 140, 1]	12.8	float	
WWALLOUT[Page 140, 1]	9.4	float	
AMBIENTS[Page 140, 1]	14.6	float	
FLOOR[Page 140, 1]	12.3	float	
EWALLCMP[Page 140, 1]	10.2	float	
EWALLCOU[Page 140, 1]	9.5	float	
ROOF[Page 140, 1]	10.0	float	
ROOFAMB[Page 140, 1]	9.9	float	
DOMEBLOW[Page 140, 1]	12.1	float	
DOMEBUP[Page 140, 1]	12.5	float	
DOMELLOW[Page 140, 1]	14.4	float	
DOMELUP[Page 140, 1]	19.3	float	
DOMERLOW[Page 140, 1]	12.3	float	
DOMERUP[Page 140, 1]	12.8	float	
PLATFORM[Page 140, 1]	15.3	float	

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Table 18 – continued from previous page

KEY	Example Value	Type	Comment
SHACKC[Page 140, 1]	15.2	float	
SHACKW[Page 140, 1]	13.2	float	
STAIRSL[Page 140, 1]	12.6	float	
STAIRSM[Page 140, 1]	13.3	float	
STAIRSU[Page 140, 1]	13.6	float	
TELBASE[Page 140, 1]	8.5	float	
UTILWALL[Page 140, 1]	11.6	float	
UTILROOM[Page 140, 1]	12.4	float	
EXCLUDED		str	
ENCODING	ascii	str	
CHECKSUM	94VhG2Tf92TfG2Tf	str	HDU checksum updated 202
DATASUM	3660988593	str	data unit checksum updated
SUNDEC[Page 140, 1]	18.640139	float	
TCSKRA[Page 140, 1]	0.3 0.003 0.00003	str	
SEQSTART[Page 140, 1]	2021-05-14T01:11:54.263801	str	
TCSGDEC[Page 140, 1]	0.3	float	
MOONSEP[Page 140, 1]	9.334	float	
TCSMFDEC[Page 140, 1]	1	int	
TCSMFRA[Page 140, 1]	1	int	
TCSGRA[Page 140, 1]	0.3	float	
SUNRA[Page 140, 1]	51.089577	float	
NTSSURVY[Page 140, 1]	na	str	
TCSKDEC[Page 140, 1]	0.3 0.003 0.00003	str	
TCSPIDEC[Page 140, 1]	1.0,0.0,0.0,0.0	str	
TCSPIRA[Page 140, 1]	1.0,0.0,0.0,0.0	str	
TRANSPAR[Page 140, 1]	None	Unknown	
SEEING[Page 140, 1]	None	Unknown	
SKYLEVEL[Page 140, 1]	8.153	float	

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gai
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD

Table 19 – continued from previous page

Name	Type	Units	Description
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKNAME	char[8]		Brick name from tractor input
BRICKID	int64		Brick ID from tractor input
BRICK_OBJID	int64		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from this
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from this
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from all
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from all
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from all
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blending
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE=&#x2
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORPHTY
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORPHTY
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; `sourceid` for Gaia DR
REF_CAT	char[2]		Reference catalog source for star: 'T2' for Tycho-2, &#
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCOND
NUMOBS_INIT	int64		Initial number of observations for target calculated across target sele
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SCND_TARGET	int64		Target selection bitmask for secondary programs
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker

Table 19 – continued from previous page

Name	Type	Units	Description
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
EXPTIME	float64	s	Length of time shutter was open

fiberflatexp-CAMERA-EXPID.fits

Summary
This file contains the fiberflat to use for a specific exposure such that newflux = rawflux/fiberflat.

Naming Convention
`fiberflatexp-{CAMERA}-{EXPID}.fits`, where `{camera}` is the camera name (*e.g.* b0, r1, z9) and `{EXPID}` is the zero padded 8-digit exposure ID.

Regex
`fiberflatexp-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 15 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	FIBERFLAT	IMAGE	fiberflat[nspec, nwave]
HDU1	IVAR	IMAGE	inverse variance of fiberflat
HDU2	MASK	IMAGE	bitmask of fiberflat (0=good)
HDU3	MEANSPEC	IMAGE	average spectrum[nwave]
HDU4	WAVELENGTH	IMAGE	wavelength grid[nwave] in Angstroms
HDU5	FIBERMAP	BINTABLE	Target photometry, metadata, and what fibers they are assigned to

FITS Header Units

HDU0

EXTNAME = FIBERFLAT

Fiber flat field correction to homogeneize the response among fibers of the same camera, for each wavelength. 2D array of dimension [nspec, nwave]. nspec is the number of fibers per camera. nwave in the length of the wavelength array. The fiber flat field of all fibers share the same wavelength grid (given in HDU WAVELENGTH). This file is valid for a specific exposure as it comprises a correction based on the humidity in the spectrograph enclosure.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
NAXIS2	500	int	
EXPID	68978	int	Exposure number
EXPFRAME	0	int	Frame number
FLAVOR	science	str	Observation type
SEQUENCE	Spectrographs	str	OCS Sequence name
PURPOSE	Commissioning	str	Purpose of observing night
PROGRAM	CALIB DESI-CALIB-00 LEDs only	str	Program name
PROPID	2019B-5000	str	Proposal ID
OBSERVER	DESIObserver	str	Names of observers
LEAD	RunManager	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20201220	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2020-12-20T22:21:08.680251	str	[UTC] Observation data and start time
TIME-OBS	22:21:08.680251	str	[UTC] Observation start time
MJD-OBS	59203.93135047	float	Modified Julian Date of observation
ST	20:54:33.840	str	Local Sidereal time at observation start (HH:MM
EXPTIME	120.042	float	[s] Actual exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.0	float	[arcsec] Offset], declination, observer input
VCCD	ON	str	True (ON) if CCD voltage is on
VCCDON	2020-12-09T21:23:19.320868	str	Time when CCD voltage was turned on
VCCDSEC	954038.9	float	[s] CCD on time in seconds
EQUINOX[1]	2000.0	float	Epoch of observation
SPECGRPH	0	int	Spectrograph logical name (SP)
SPECID	4	int	Spectrograph serial number (SM)

continues on next page

Table 20 – continued from previous page

KEY	Example Value	Type	Comment
FEEBOX	lbnl078	str	CCD Controller serial number
VESSEL	14	int	Cryostat serial number
FEEVER	v20160312	str	CCD Controller version
FEEPOWER	ON	str	FEE power status
FEEDMASK	2134851391	int	FEE dac mask
FEECMASK	1048575	int	FEE clk mask
CCDTEMP	-142.1871	float	[deg C] CCD controller CCD temperature
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
FILENAME	/exposures/desi/specs/20201220/00068978/sp0-00068978.fits.fz	str	Name
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
CASETEMP	57.3533	float	[deg C] CCD controller case temperature
OFFSET1	0.4000000059604645,-8.858	str	[V] set value, measured value
CLOCK18	9.0,0.9999	str	[V] high rail, low rail
BIASSECC	[2065:2128, 2130:4193]	str	Bias section for quadrant C
CLOCK12	9.9992,2.9993	str	[V] high rail, low rail
CLOCK9	9.9992,2.9993	str	[V] high rail, low rail
AMPSECC	[1:2057, 4128:2065]	str	AMP section for quadrant C
DAC9	-25.0003,-24.5305	str	[V] set value, measured value
CLOCK15	9.9992,2.9993	str	[V] high rail, low rail
CLOCK8	9.9992,2.9993	str	[V] high rail, low rail
PRESECA	[1:7, 2:2065]	str	Prescan section for quadrant A
CCDPREP	purge,clear	str	CCD prep actions
DAC16	39.9961,39.5934	str	[V] set value, measured value
OFFSET3	0.4000000059604645,-8.9095	str	[V] set value, measured value
DETSECB	[2058:4114, 1:2064]	str	Detector section for quadrant B
BIASSECA	[2065:2128, 2:2065]	str	Bias section for quadrant A
PGAGAIN	3	int	Controller gain
DAC13	0.0,0.0148	str	[V] set value, measured value
CLOCK6	9.9999,0.0	str	[V] high rail, low rail
DAC10	-25.0003,-24.3376	str	[V] set value, measured value

continues on next page

Table 20 – continued from previous page

KEY	Example Value	Type	Comment
DAC7	5.9998,6.028	str	[V] set value, measured value
CLOCK1	9.9999,0.0	str	[V] high rail, low rail
CLOCK5	9.9999,0.0	str	[V] high rail, low rail
CLOCK11	9.9992,2.9993	str	[V] high rail, low rail
ORSECC	[8:2064, 2098:2129]	str	Row overscan section for quadrant C
DAC15	0.0,-0.0148	str	[V] set value, measured value
DETSECA	[1:2057, 1:2064]	str	Detector section for quadrant A
CDSPARMS	400, 400, 8, 2000	str	CDS parameters
PRRSECC	[8:2064, 4194:4194]	str	Row prescan section for quadrant C
BLDTIME	0.3509	float	[s] Time to build image
DAC11	-25.0003,-24.3673	str	[V] set value, measured value
OFFSET2	0.4000000059604645,-8.9301	str	[V] set value, measured value
BIASSECB	[2129:2192, 2:2065]	str	Bias section for quadrant B
DELAYS	20, 20, 25, 40, 7, 3000, 7, 7, 7, 7	str	[10] Delay settings
CLOCK0	9.9999,0.0	str	[V] high rail, low rail
OFFSET5	2.0,6.028	str	[V] set value, measured value
CLOCK10	9.9992,2.9993	str	[V] high rail, low rail
DATASECD	[2193:4249, 2130:4193]	str	Data section for quadrant D
DAC1	-9.0002,-8.858	str	[V] set value, measured value
DIGITIME	47.5334	float	[s] Time to digitize image
CAMERA	r0	str	Camera name
CCDNAME	CCDSM4R	str	CCD name
DAC6	5.9998,6.0017	str	[V] set value, measured value
CCDSIZE	4194,4256	str	CCD size in pixels (rows, columns)
CLOCK4	9.9999,0.0	str	[V] high rail, low rail
CCDSECD	[2058:4114, 2065:4128]	str	CCD section for quadrant D
CCDSECB	[2058:4114, 1:2064]	str	CCD section for quadrant B
DAC8	-25.0003,-24.9164	str	[V] set value, measured value
CLOCK14	9.9992,2.9993	str	[V] high rail, low rail
CLOCK2	9.9999,0.0	str	[V] high rail, low rail
CCDCFG	default_lbnl_20190717.cfg	str	CCD configuration file

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Table 20 – continued from previous page

KEY	Example Value	Type	Comment
PRESECD	[4250:4256, 2130:4193]	str	Prescan section for quadrant D
DETSECD	[2058:4114, 2065:4128]	str	Detector section for quadrant D
DATASECA	[8:2064, 2:2065]	str	Data section for quadrant A
CLOCK13	9.9992,2.9993	str	[V] high rail, low rail
ORSECB	[2193:4249, 2066:2097]	str	Row overscan section for quadrant B
DATASECC	[8:2064, 2130:4193]	str	Data section for quadrant C
AMPSECA	[1:2057, 1:2064]	str	AMP section for quadrant A
ORSECD	[2193:4249, 2098:2129]	str	Row bias section for quadrant D
PRRSECA	[8:2064, 1:1]	str	Row prescan section for quadrant A
CCDSECA	[1:2057, 1:2064]	str	CCD section for quadrant A
DAC3	-9.0002,-8.9095	str	[V] set value, measured value
SETTINGS	detectors_sm_20191211.json	str	Name of DESI CCD settings file
AMPSECB	[4114:2058, 1:2064]	str	AMP section for quadrant B
CRYOTEMP[Page 166, 1]	163.044	float	[deg K] Cryostat CCD temperature
DAC17	20.0008,11.9804	str	[V] set value, measured value
CLOCK7	-2.0001,3.9999	str	[V] high rail, low rail
TRIMSECB	[2193:4249, 2:2065]	str	Trim section for quadrant B
CCDSECC	[1:2057, 2065:4128]	str	CCD section for quadrant C
PRRSECB	[2193:4249, 1:1]	str	Row prescan section for quadrant B
DATASECB	[2193:4249, 2:2065]	str	Data section for quadrant B
PRESECC	[1:7, 2130:4193]	str	Prescan section for quadrant C
DAC5	5.9998,6.028	str	[V] set value, measured value
DAC14	0.0,-0.0148	str	[V] set value, measured value
PRESECB	[4250:4256, 2:2065]	str	Prescan section for quadrant B
PRRSECD	[2193:4249, 4194:4194]	str	Row prescan section for quadrant D
AMPSECD	[4114:2058, 4128:2065]	str	AMP section for quadrant D

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Table 20 – continued from previous page

KEY	Example Value	Type	Comment
DAC12	0.0,0.0	str	[V] set value, measured value
TRIMSECC	[8:2064, 2130:4193]	str	Trim section for quadrant C
CLOCK17	9.0,0.9999	str	[V] high rail, low rail
TRIMSECD	[2193:4249, 2130:4193]	str	Trim section for quadrant D
DETSECC	[1:2057, 2065:4128]	str	Detector section for quadrant C
CRYOPRES[Page 166, 1]	9.322e-08	str	[mb] Cryostat pressure (IP)
OFFSET0	0.4000000059604645,-8.9198	str	[V] set value, measured value
CPUTEMP	56.9941	float	[deg C] CCD controller CPU temperature
CLOCK16	9.9999,3.0	str	[V] high rail, low rail
OFFSET4	2.0,6.0174	str	[V] set value, measured value
CCDTMING	default_lbnl_timing_20180905.txt	str	CCD timing file
TRIMSECA	[8:2064, 2:2065]	str	Trim section for quadrant A
DAC4	5.9998,6.0174	str	[V] set value, measured value
OFFSET7	2.0,6.0332	str	[V] set value, measured value
CLOCK3	-2.0001,3.9999	str	[V] high rail, low rail
ORSECA	[8:2064, 2066:2097]	str	Row overscan section for quadrant A
OFFSET6	2.0,6.0017	str	[V] set value, measured value
DETECTOR	M1-49	str	Detector (ccd) identification
DAC0	-9.0002,-8.9198	str	[V] set value, measured value
DAC2	-9.0002,-8.9301	str	[V] set value, measured value
BIASSECD	[2129:2192, 2130:4193]	str	Bias section for quadrant D
REQTIME	120.0	float	[s] Requested exposure time
OBSID	kp4m20201220t222108	str	Unique observation identifier
PROCTYPE	RAW	str	Data processing level
PRODTYPE	image	str	Data product type
CHECKSUM	oo3Aon02on08on08	str	HDU checksum updated 2022-01-29T01:26:43
DATASUM	424075550	str	data unit checksum updated 2022-01-29T01:26:43

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Table 20 – continued from previous page

KEY	Example Value	Type	Comment
GAINA	1.655	float	e/ADU (gain applied to image)
SATULEVA	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPA[Page 166, 1]	0.7301409887440968	float	ADUs (max-min of median overscan per row)
OMETHA[Page 166, 1]	AVERAGE	str	use average overscan
OVERSCNA	1978.069214285938	float	ADUs (gain not applied)
OBSRDNA	2.798159188935688	float	electrons (gain is applied)
SATUELEA	105186.7204503568	float	saturation or non lin. level, in electrons
GAINB	1.488	float	e/ADU (gain applied to image)
SATULEVB	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPB[Page 166, 1]	0.7607557420124067	float	ADUs (max-min of median overscan per row)
OMETHB[Page 166, 1]	AVERAGE	str	use average overscan
OVERSCNB	1987.133968648987	float	ADUs (gain not applied)
OBSRDNB	2.557416670656615	float	electrons (gain is applied)
SATUELEB	94559.2246546503	float	saturation or non lin. level, in electrons
GAINC	1.583	float	e/ADU (gain applied to image)
SATULEVC	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPC[Page 166, 1]	0.6293911971442867	float	ADUs (max-min of median overscan per row)
OMETHC[Page 166, 1]	AVERAGE	str	use average overscan
OVERSCNC	1966.939262512987	float	ADUs (gain not applied)
OBSRDNC	2.703494293725218	float	electrons (gain is applied)
SATUELEC	100628.2401474419	float	saturation or non lin. level, in electrons
GAIND	1.507	float	e/ADU (gain applied to image)
SATULEVD	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPD[Page 166, 1]	0.6596786995360162	float	ADUs (max-min of median overscan per row)
OMETHD[Page 166, 1]	AVERAGE	str	use average overscan
OVERSCND	1994.41783538263	float	ADUs (gain not applied)
OBSRDND	2.441905057216482	float	electrons (gain is applied)
SATUELED	95755.65732207838	float	saturation or non lin. level, in electrons
FIBERMIN	0	int	
LONGSTRN[Page 166, 1]	OGIP 1.0	str	The OGIP Long String Convention may be used.
MODULE	CI	str	Image Sources/Component

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Table 20 – continued from previous page

KEY	Example Value	Type	Comment
FRAMES	None	Unknown	Number of Frames in Archive
COSMSPLT	F	bool	Cosmics split exposure if true
MAXSPLIT	0	int	Number of allowed exposure splits
SPLITIDS[Page 166, 1]	68978	str	List of expids for split exposures
OBSTYPE	FLAT	str	Spectrograph observation type
MANIFEST	F	bool	DOS exposure manifest
OBJECT		str	Object name
SEQID	3 requests	str	Exposure sequence identifier
SEQNUM	1	int	Number of exposure in sequence
SEQTOT	3	int	Total number of exposures in sequence
OPENSHUT	None	Unknown	Time shutter opened
CAMSHUT	open	str	Shutter status during observation
WHITESPT[Page 166, 1]	T	bool	Telescope is at whitespot
ZENITH[Page 166, 1]	F	bool	Telescope is at zenith
SEANNEX[Page 166, 1]	F	bool	Telescope is at SE annex
BEYONDP[Page 166, 1]	F	bool	Telescope is beyond pole
FIDUCIAL[Page 166, 1]	off	str	Fiducials status during observation
AIRMASS[Page 166, 1]	1.521306	float	Airmass
FOCUS[Page 166, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0	str	Telescope focus settings
TRUSTEMP[Page 166, 1]	13.2	float	[deg] Average Telescope truss temperature (only
PMIRTEMP[Page 166, 1]	7.3	float	[deg] Average primary mirror temperature (nit,e
PMREADY[Page 166, 1]	F	bool	Primary mirror ready
PMCOVER[Page 166, 1]	open	str	Primary mirror cover
PMCOOL[Page 166, 1]	on	str	Primary mirror cooling
DOMSHUTU[Page 166, 1]	not open	str	Upper dome shutter
DOMSHUTL[Page 166, 1]	not open	str	Lower dome shutter
DOMLIGHH[Page 166, 1]	off	str	High dome lights
DOMLIGHL[Page 166, 1]	off	str	Low dome lights
DOMEAZ[Page 166, 1]	253.289	float	[deg] Dome azimuth angle
DOMINPOS[Page 166, 1]	F	bool	Dome is in position
GUIDOFFR[Page 166, 1]	0.0	float	[arcsec] Cummulative guider offset (RA)
GUIDOFFD[Page 166, 1]	-0.0	float	[arcsec] Cummulative guider offset (dec)
MOONDEC[Page 166, 1]	-9.840963	float	[deg] Moon declination at start of exposure

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Table 20 – continued from previous page

KEY	Example Value	Type	Comment
MOONRA[Page 166, 1]	350.487504	float	[deg] Moon RA at start of exposure
MOUNTAZ[Page 166, 1]	73.494042	float	[deg] Mount azimuth angle
MOUNTDEC[Page 166, 1]	31.962725	float	[deg] Mount declination
MOUNTEL[Page 166, 1]	41.035784	float	[deg] Mount elevation angle
MOUNTHA[Page 166, 1]	-58.479517	float	[deg] Mount hour angle
INCTRL[Page 166, 1]	F	bool	DESI in control
INPOS[Page 166, 1]	T	bool	Mount in position
MNTOFFD[Page 166, 1]	-0.0	float	[arcsec] Mount offset (dec)
MNTOFFR[Page 166, 1]	-0.0	float	[arcsec] Mount offset (RA)
PARALLAC[Page 166, 1]	-73.492831	float	[deg] Parallactic angle
SKYDEC[Page 166, 1]	31.962725	float	[deg] Telescope declination (pointing on sky)
SKYRA[Page 166, 1]	12.118172	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC[Page 166, 1]	31.9633	float	[deg] Target declination (to TCS)
TARGTRA[Page 166, 1]	6.305085	float	[deg] Target right ascension (to TCS)
TARGTAZ[Page 166, 1]	75.317651	float	[deg] Target azimuth
TARGTEL[Page 166, 1]	45.786076	float	[deg] Target elevation
TRGTOFFD[Page 166, 1]	0.0	float	[arcsec] Telescope target offset (dec)
TRGTOFFR[Page 166, 1]	0.0	float	[arcsec] Telescope target offset (RA)
ZD[Page 166, 1]	48.964216	float	[deg] Telescope zenith distance
TCSST[Page 166, 1]	20:54:33.277	str	Local Sidereal time reported by TCS (HH:MM:SS)
TCSMJD[Page 166, 1]	59203.93178	float	MJD reported by TCS
ADCCORR	F	bool	Correct pointing for ADC setting if True
ADC1PHI[Page 166, 1]	114.980003	float	[deg] ADC 1 angle
ADC2PHI[Page 166, 1]	162.869907	float	[deg] ADC 2 angle
ADC1HOME[Page 166, 1]	F	bool	ADC 1 at home position if True
ADC2HOME[Page 166, 1]	F	bool	ADC 2 at home position if True
ADC1NREV[Page 166, 1]	0.0	float	ADC 1 number of revs
ADC2NREV[Page 166, 1]	-1.0	float	ADC 2 number of revs
ADC1STAT[Page 166, 1]	STOPPED	str	ADC 1 status
ADC2STAT[Page 166, 1]	STOPPED	str	ADC 2 status
HEXPOS[Page 166, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0	str	Hexapod position

continues on next page

Table 20 – continued from previous page

KEY	Example Value	Type	Comment
HEXTRIM[Page 166, 1]	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
ROTOFFST[Page 166, 1]	0.0	float	[arcsec] Rotator offset
ROTENBLD[Page 166, 1]	T	bool	Rotator enabled
ROTRATE[Page 166, 1]	0.0	float	[arcsec/min] Rotator rate
RESETROT	F	bool	DOS Control: reset hex rotator
GUIDMODE	catalog	str	Guider mode
USEAOS[Page 166, 1]	F	bool	DOS Control: AOS data available if true
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating spectrograph
ILLSPECS[Page 166, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating illuminate s
CCDSPECS[Page 166, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating ccd spectrog
TDEWPNT[Page 166, 1]	-18.063	float	Telescope air dew point
TAIRFLOW[Page 166, 1]	1.121	float	Telescope air flow
TAIRITMP[Page 166, 1]	10.5	float	[deg] Telescope air in temperature
TAIROTMP[Page 166, 1]	5.7	float	[deg] Telescope air out temperature
TAIRTEMP[Page 166, 1]	11.843	float	[deg] Telescope air temperature
TCASITMP[Page 166, 1]	0.0	float	[deg] Telescope Cass Cage in temperature
TCASOTMP[Page 166, 1]	9.6	float	[deg] Telescope Cass Cage out temperature
TCSITEMP[Page 166, 1]	7.4	float	[deg] Telescope center section in temperature
TCSOTEMP[Page 166, 1]	10.2	float	[deg] Telescope center section out temperature
TCIBTEMP[Page 166, 1]	0.0	float	[deg] Telescope chimney IB temperature
TCIMTEMP[Page 166, 1]	0.0	float	[deg] Telescope chimney IM temperature
TCITTEMP[Page 166, 1]	0.0	float	[deg] Telescope chimney IT temperature
TCOSTEMP[Page 166, 1]	0.0	float	[deg] Telescope chimney OS temperature
TCOWTEMP[Page 166, 1]	0.0	float	[deg] Telescope chimney OW temperature
TDBTEMP[Page 166, 1]	7.3	float	[deg] Telescope dec bore temperature
TFLOWIN[Page 166, 1]	8.0	float	Telescope flow rate in
TFLOWOUT[Page 166, 1]	8.3	float	Telescope flow rate out
TGLYCOLI[Page 166, 1]	-1.9	float	[deg] Telescope glycol in temperature
TGLYCOLO[Page 166, 1]	0.0	float	[deg] Telescope glycol out temperature
THINGES[Page 166, 1]	12.9	float	[deg] Telescope hinge S temperature
THINGEW[Page 166, 1]	11.9	float	[deg] Telescope hinge W temperature

continues on next page

Table 20 – continued from previous page

KEY	Example Value	Type	Comment
TPMAVERT[Page 166, 1]	7.295	float	[deg] Telescope mirror averagetemperature
TPMDESIT[Page 166, 1]	7.0	float	[deg] Telescope mirror desired temperature
TPMEIBT[Page 166, 1]	7.4	float	[deg] Telescope mirror EIB temperature
TPMEITT[Page 166, 1]	7.3	float	[deg] Telescope mirror EIT temperature
TPMEOBT[Page 166, 1]	7.4	float	[deg] Telescope mirror EOB temperature
TPMEOTT[Page 166, 1]	7.1	float	[deg] Telescope mirror EOT temperature
TPMNIBT[Page 166, 1]	7.5	float	[deg] Telescope mirror NIB temperature
TPMNITT[Page 166, 1]	7.2	float	[deg] Telescope mirror NIT temperature
TPMNOBT[Page 166, 1]	7.7	float	[deg] Telescope mirror NOB temperature
TPMNOTT[Page 166, 1]	7.5	float	[deg] Telescope mirror NOT temperature
TPMRTDT[Page 166, 1]	7.09	float	[deg] Telescope mirror RTD temperature
TPMSIBT[Page 166, 1]	7.4	float	[deg] Telescope mirror SIB temperature
TPMSITT[Page 166, 1]	7.0	float	[deg] Telescope mirror SIT temperature
TPMSOBT[Page 166, 1]	7.4	float	[deg] Telescope mirror SOB temperature
TPMSOTT[Page 166, 1]	7.1	float	[deg] Telescope mirror SOT temperature
TPMSTAT[Page 166, 1]	soft air	str	Telescope mirror status
TPMWIBT[Page 166, 1]	7.3	float	[deg] Telescope mirror WIB temperature
TPMWITT[Page 166, 1]	7.1	float	[deg] Telescope mirror WIT temperature
TPMWOBT[Page 166, 1]	7.6	float	[deg] Telescope mirror WOB temperature
TPMWOTT[Page 166, 1]	8.1	float	[deg] Telescope mirror WOT temperature
TPCITEMP[Page 166, 1]	7.7	float	[deg] Telescope primary cell in temperature
TPCOTEMP[Page 166, 1]	7.7	float	[deg] Telescope primary cell out temperature
TPR1HUM[Page 166, 1]	0.0	float	Telescope probe 1 humidity
TPR1TEMP[Page 166, 1]	0.0	float	[deg] Telescope probe1 temperature
TPR2HUM[Page 166, 1]	0.0	float	Telescope probe 2 humidity

continues on next page

Table 20 – continued from previous page

KEY	Example Value	Type	Comment
TPR2TEMP[Page 166, 1]	0.0	float	[deg] Telescope probe2 temperature
TSERVO[Page 166, 1]	7.0	float	Telescope servo setpoint
TTRSTEMP[Page 166, 1]	13.0	float	[deg] Telescope top ring S temperature
TTRWTEMP[Page 166, 1]	13.4	float	[deg] Telescope top ring W temperature
TTRUETBT[Page 166, 1]	-4.8	float	[deg] Telescope truss ETB temperature
TTRUETTT[Page 166, 1]	11.6	float	[deg] Telescope truss ETT temperature
TTRUNTBT[Page 166, 1]	11.0	float	[deg] Telescope truss NTB temperature
TTRUNTTT[Page 166, 1]	11.8	float	[deg] Telescope truss NTT temperature
TTRUSTBT[Page 166, 1]	11.2	float	[deg] Telescope truss STB temperature
TTRUSTST[Page 166, 1]	10.8	float	[deg] Telescope truss STS temperature
TTRUSTTT[Page 166, 1]	12.4	float	[deg] Telescope truss STT temperature
TTRUTSBT[Page 166, 1]	13.5	float	[deg] Telescope truss TSB temperature
TTRUTSMT[Page 166, 1]	13.6	float	[deg] Telescope truss TSM temperature
TTRUTSTT[Page 166, 1]	12.5	float	[deg] Telescope truss TST temperature
TTRUWTBT[Page 166, 1]	11.0	float	[deg] Telescope truss WTB temperature
TTRUWTTT[Page 166, 1]	11.7	float	[deg] Telescope truss WTT temperature
ALARM[Page 166, 1]	F	bool	UPS major alarm or check battery
ALARM-ON[Page 166, 1]	F	bool	UPS active alarm condition
BATTERY[Page 166, 1]	100.0	float	[%] UPS Battery left
SECLEFT[Page 166, 1]	5682.0	float	[s] UPS Seconds left
UPSSTAT[Page 166, 1]	System Normal - On Line(7)	str	UPS Status
INAMPS[Page 166, 1]	65.7	float	[A] UPS total input current
OUTWATTS[Page 166, 1]	4700.0,6900.0,4100.0	str	[W] UPS Phase A, B, C output watts
COMPDEW[Page 166, 1]	-12.1	float	[deg C] Computer room dewpoint
COMPHUM[Page 166, 1]	7.7	float	[%] Computer room humidity
COMPAMB[Page 166, 1]	19.3	float	[deg C] Computer room ambient temperature

continues on next page

Table 20 – continued from previous page

KEY	Example Value	Type	Comment
COMPTEMP[Page 166, 1]	24.9	float	[deg C] Computer room hygrometer temperature
DEWPOINT[Page 166, 1]	5.7	float	[deg C] (outside) dew-point
HUMIDITY[Page 166, 1]	7.0	float	[%] (outside) humidity
PRESSURE[Page 166, 1]	795.0	float	[torr] (outside) air pressure
OUTTEMP[Page 166, 1]	0.0	float	[deg C] outside temperature
WINDDIR[Page 166, 1]	87.0	float	[deg] wind direction
WINDSPD[Page 166, 1]	19.1	float	[m/s] wind speed
GUST[Page 166, 1]	14.4	float	[m/s] Wind gusts speed
AMNIENTN[Page 166, 1]	13.4	float	[deg C] ambient temperature north
CFLOOR[Page 166, 1]	8.1	float	[deg C] temperature on C floor
NWALLIN[Page 166, 1]	13.6	float	[deg C] temperature at north wall inside
NWALLOUT[Page 166, 1]	8.8	float	[deg C] temperature at north wall outside
WWALLIN[Page 166, 1]	12.8	float	[deg C] temperature at west wall inside
WWALLOUT[Page 166, 1]	9.4	float	[deg C] temperature at west wall outside
AMBIENTS[Page 166, 1]	14.6	float	[deg C] ambient temperature south
FLOOR[Page 166, 1]	12.4	float	[deg C] temperature at floor (LCR)
EWALLCMP[Page 166, 1]	10.2	float	[deg C] temperature at east wall, computer room
EWALLCOU[Page 166, 1]	9.5	float	[deg C] temperature at east wall, Coude room
ROOF[Page 166, 1]	9.9	float	[deg C] temperature on roof
ROOFAMB[Page 166, 1]	9.9	float	[deg C] ambient temperature on roof
DOMEBLOW[Page 166, 1]	12.1	float	[deg C] temperature at dome back, lower
DOMEBUP[Page 166, 1]	12.5	float	[deg C] temperature at dome back, upper
DOMELLOW[Page 166, 1]	14.4	float	[deg C] temperature at dome left, lower
DOMELUP[Page 166, 1]	19.4	float	[deg C] temperature at dome left, upper
DOMERLOW[Page 166, 1]	12.3	float	[deg C] temperature at dome right, lower
DOMERUP[Page 166, 1]	12.8	float	[deg C] temperature at dome right, upper
PLATFORM[Page 166, 1]	15.3	float	[deg C] temperature at platform

continues on next page

Table 20 – continued from previous page

KEY	Example Value	Type	Comment
SHACKC[Page 166, 1]	15.2	float	[deg C] temperature at shack ceiling
SHACKW[Page 166, 1]	13.2	float	[deg C] temperature at shack wall
STAIRSL[Page 166, 1]	12.6	float	[deg C] temperature at stairs, lower
STAIRSM[Page 166, 1]	13.3	float	[deg C] temperature at stairs, mid
STAIRSU[Page 166, 1]	13.6	float	[deg C] temperature at stairs, upper
TELBASE[Page 166, 1]	8.5	float	[deg C] temperature at telescope base
UTILWALL[Page 166, 1]	11.6	float	[deg C] temperature at utility room wall
UTILROOM[Page 166, 1]	12.4	float	[deg C] temperature in utilitiy room
EXCLUDED		str	Components excluded from this exposure
NSPEC	500	int	Number of spectra
WAVEMIN	5760.0	float	First wavelength [Angstroms]
WAVEMAX	7620.0	float	Last wavelength [Angstroms]
WAVESTEP	0.8	float	Wavelength step size [Angstroms]
SPECTER	0.10.0	str	https://github.com/desihub/specter
IN_PSF	SPECPROD/exposures/20201220/00068978/psf-r0-00068978.fits	str	Input sp
IN_IMG	SPECPROD/preproc/20201220/00068978/preproc-r0-00068978.fits	str	Input image
ORIG_PSF[Page 166, 1]	SPECPROD/calibnight/20201220/psfnight-r0-20201220.fits	str	
CHI2PDF	1.088304575350556	float	
BUNIT		str	adimensional quantity to divide to flatfield a frame
TCSPIDEC[Page 166, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
TCSPIRA[Page 166, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
CALTHUM[Page 166, 1]	15.32	float	dome flat humidity from telemetry
TCSGRA[Page 166, 1]	0.3	float	TCS simple gain (RA)
EXPFHUM[Page 166, 1]	17.64312009333441	float	exposure humidity from flat fit
TCSMFRA[Page 166, 1]	1	int	TCS moving filter length (RA)
SEQSTART[Page 166, 1]	2021-03-09T00:34:23.379721	str	Start time of sequence processing
TCSKRA[Page 166, 1]	0.3 0.003 0.00003	str	TCS Kalman (RA)

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KEY	Example Value	Type	Comment
MOONSEP[Page 166, 1]	171.522	float	[deg] Moon Separation
NTSSURVY[1]	na	str	NTS survey name
TCSKDEC[1]	0.3 0.003 0.00003	str	TCS Kalman (dec)
TCSMFDEC[1]	1	int	TCS moving filter length (dec)
TCSGDEC[1]	0.3	float	TCS simple gain (dec)
SUNDEC[1]	-4.488284	float	[deg] Sun declination at start of exposure
SUNRA[1]	349.569123	float	[deg] Sun RA at start of exposure
CALFHUM[1]	14.32350765258646	float	dome flat humidity from flat fit
EXPTHUM[1]	16.63	float	exposure humidity from telemetry
EPOCH[1]	2000.0	float	Epoch of observation
SKYLEVEL[1]	6.268	float	counts?] ETC sky level
TRANSPAR[1]	None	Unknown	ETC/PM transparency
SEEING[1]	None	Unknown	[arcsec] ETC/PM seeing

Data: FITS image [float32, 2751x500]

HDU1

EXTNAME = IVAR

Inverse variance (1/sigma^2) of the fiber flat field in HDU0.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	
NAXIS2	500	int	
BUNIT		str	inverse variance, adimensional
CHECKSUM	kdmLldmJkdmJkdmJ	str	HDU checksum updated 2022-02-01T22:58:01
DATASUM	4118276244	str	data unit checksum updated 2022-02-01T22:58:01

Data: FITS image [float32, 2751x500]

[1] Optional

HDU2

EXTNAME = MASK

Mask of the fiberflat; 0=good. See the *bitmask documentation* page for the definition of the bits. Prior to desispec/0.24.0 and software release 18.9, the MASK HDU was compressed.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	
NAXIS2	500	int	
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	RHdLRGcIRGcIRGcI	str	HDU checksum updated 2022-02-01T22:58:02
DATASUM	687834	str	data unit checksum updated 2022-02-01T22:58:02

Data: FITS image [int32, 2751x500]

HDU3

EXTNAME = MEANSPEC

Average flat lamp spectrum of fibers in this camera frame. The fiber flat field is in first approximation the ratio of the measured spectra to this mean spectrum (in practice we use a deconvolved mean spectrum and reconvolve it with the resolution of each fiber). The units are electrons per Angstrom.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	
BUNIT	electron/Angstrom	str	
CHECKSUM	4TMJ6RKJ4RKJ4RKJ	str	HDU checksum updated 2022-02-01T22:58:02
DATASUM	2617283155	str	data unit checksum updated 2022-02-01T22:58:02

Data: FITS image [float32, 2751]

HDU4

EXTNAME = WAVELENGTH

Wavelength grid in Angstrom used by this fiber flat field. Note that contrary to the science frame, this wavelength array is in the observer frame. In consequence, one has to first convert its wavelength to the solar barycenter frame before using this data to flat field a science exposure. See the frame *WAVELENGTH documentation* for more details.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	
BUNIT	Angstrom	str	
CHECKSUM	5qI85oG75oG75oG7	str	HDU checksum updated 2022-02-01T22:58:02
DATASUM	2458411755	str	data unit checksum updated 2022-02-01T22:58:02

Data: FITS image [float32, 2751]

HDU5

EXTNAME = FIBERMAP

Fibermap with information about the fiber status.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	369	int	length of dimension 1
NAXIS2	500	int	length of dimension 2
ENCODING	ascii	str	
CHECKSUM	aBFAbA93aAE9aA99	str	HDU checksum updated 2022-02-01T22:58:02
DATASUM	3386980400	str	data unit checksum updated 2022-02-01T22:58:02

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(d
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered or
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe,
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority

Table 21 – continued from previous page

Name	Type	Units	Description
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKNAME[1]	char[8]		Brick name from tractor input
BRICKID	int64		Brick ID from tractor input
BRICK_OBJID	int64		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec fr
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec fro
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec fr
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec fr
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec fro
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec fr
MASKBITS[Page 166, 1]	int16		Bitwise mask from the imaging indicating potential issue or
SERSIC[Page 166, 1]	float32		Power-law index for the Sersic profile model (MORPHTYPE
SHAPE_R[Page 166, 1]	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1[Page 166, 1]	float32		Ellipticity component 1 of galaxy model for galaxy type MO
SHAPE_E2[Page 166, 1]	float32		Ellipticity component 2 of galaxy model for galaxy type MO
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; `sourceid` for
REF_CAT[Page 166, 1]	char[2]		Reference catalog source for star: 'T2' for Tych
GAIA_PHOT_G_MEAN_MAG[Page 166, 1]	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG[Page 166, 1]	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG[Page 166, 1]	float32	mag	Gaia RP band magnitude
PARALLAX[Page 166, 1]	float32	mas	Reference catalog parallax
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, &
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBS
NUMOBS_INIT	int64		Initial number of observations for target calculated across tar
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SCND_TARGET[Page 166, 1]	int64		Target selection bitmask for secondary programs
PLATE_RA[Page 166, 1]	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMa
PLATE_DEC[Page 166, 1]	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X[Page 166, 1]	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y[Page 166, 1]	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X[Page 166, 1]	float64	mm	CS5 X requested minus actual position
DELTA_Y[Page 166, 1]	float64	mm	CS5 Y requested minus actual position

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Name	Type	Units	Description
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
EXPTIME[Page 166, 1]	float64	s	Length of time shutter was open
NUMOBS_MORE[Page 166, 1]	int32		Number of additional observations needed
NUMTARGET[Page 166, 1]	int16		Total number of targets that this positioner covered
SPECTROID[Page 166, 1]	int32		Hardware ID of spectrograph (not used)
HPXPIXEL[Page 166, 1]	int64		HEALPixel containing this location at NSIDE=64 in the NE
PMDEC_IVAR[Page 166, 1]	float32	yr^2 mas^-2	Inverse variance of PMDEC
MW_TRANSMISSION_Z[Page 166, 1]	float32		Milky Way dust transmission in LS z-band
MW_TRANSMISSION_G[Page 166, 1]	float32		Milky Way dust transmission in LS g-band
MW_TRANSMISSION_R[Page 166, 1]	float32		Milky Way dust transmission in LS r-band
PMRA_IVAR[Page 166, 1]	float32	yr^2 mas^-2	Inverse variance of PMRA

fit-psf-CAMERA-EXPID.fits

Summary
PSF (point spread function) files model the mapping of fibers and wavelengths to pixels on spectrograph CCDs.

Naming Convention
`fit-psf-CAMERA-EXPID.fits`, where `CAMERA` is *e.g.*, “b0”, “r5”, etc. and `EXPID` is 8-digit exposure number.

Regex
`fit-psf-[brz][0-9]-[0-9]{8}(_[0-9][0-9]|)\.fits`

File Type
FITS, 998 KB

See *psfnight-CAMERA-NIGHT documentation* for a description of the PSF file content.

Four different PSF files are written per camera for each arc lamp exposure:

1. *shifted-input-psf-CAMERA-EXPID.fits*: Input PSF with spectral trace coordinates and wavelength calibration adjusted to the current CCD image, used as a starting guess for the PSF shape fit.
2. *fit-psf-before-listed-fix-CAMERA-EXPID.fits*: Result of the specex PSF fit before adjusting the PSF model of problematic fibers not included in the fit.
3. *fit-psf-fixed-listed-CAMERA-EXPID.fits*: Result of the specex PSF fit with the PSF model of problematic fibers interpolated from neighboring fibers.
4. `fit-psf-CAMERA-EXPID.fits`: Final PSF fit (which is the same as *fit-psf-fixed-listed-CAMERA-EXPID.fits* if there are problematic fibers)

The `fit-psf-*.fits` files from individual exposures are combined into the *psfnight* files for each night.

Flat and science exposures have a single PSF file per camera:

psf-CAMERA-EXPID.fits: psfnight file with spectral trace coordinates and wavelength solution adjusted to match this exposure. Flat exposures are adjusted only in x (cross dispersion = fiber direction), while science exposures are adjusted in both x and y (wavelength direction).

fit-psf-before-listed-fix-CAMERA-EXPID.fits

Summary
PSF (point spread function) files model the mapping of fibers and wavelengths to pixels on spectrograph CCDs.

Naming Convention
`fit-psf-before-listed-fix-CAMERA-EXPID.fits`, where `CAMERA` is *e.g.*, "b0", "r5", etc. and `EXPID` is 8-digit exposure number.

Regex
`fit-psf-before-listed-fix-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 998 KB

See *psfnight-CAMERA-NIGHT documentation* for a description of the PSF file content.

Four different PSF files are written per camera for each arc lamp exposure:

1. *shifted-input-psf-CAMERA-EXPID.fits*: Input PSF with spectral trace coordinates and wavelength calibration adjusted to the current CCD image, used as a starting guess for the PSF shape fit.
2. `fit-psf-before-listed-fix-CAMERA-EXPID.fits`: Result of the specex PSF fit before adjusting the PSF model of problematic fibers not included in the fit.
3. *fit-psf-fixed-listed-CAMERA-EXPID.fits*: Result of the specex PSF fit with the PSF model of problematic fibers interpolated from neighboring fibers.
4. *fit-psf-CAMERA-EXPID.fits*: Final PSF fit (which is the same as *fit-psf-fixed-listed-CAMERA-EXPID.fits* if there are problematic fibers)

The `fit-psf-*.fits` files from individual exposures are combined into the *psfnight* files for each night.

Flat and science exposures have a single PSF file per camera:

psf-CAMERA-EXPID.fits: psfnight file with spectral trace coordinates and wavelength solution adjusted to match this exposure. Flat exposures are adjusted only in x (cross dispersion = fiber direction), while science exposures are adjusted in both x and y (wavelength direction).

fit-psf-fixed-listed-CAMERA-EXPID.fits

Summary
PSF (point spread function) files model the mapping of fibers and wavelengths to pixels on spectrograph CCDs.

Naming Convention
`fit-psf-fixed-listed-CAMERA-EXPID.fits`, where `CAMERA` is *e.g.*, "b0", "r5", etc. and `EXPID` is 8-digit exposure number.

Regex
`fit-psf-fixed-listed-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 998 KB

See *psfnight-CAMERA-NIGHT documentation* for a description of the PSF file content.

Four different PSF files are written per camera for each arc lamp exposure:

1. *shifted-input-psf-CAMERA-EXPID.fits*: Input PSF with spectral trace coordinates and wavelength calibration adjusted to the current CCD image, used as a starting guess for the PSF shape fit.

2. *fit-psf-before-listed-fix-CAMERA-EXPID.fits*: Result of the specex PSF fit before adjusting the PSF model of problematic fibers not included in the fit.
3. `fit-psf-fixed-listed-CAMERA-EXPID.fits`: Result of the specex PSF fit with the PSF model of problematic fibers interpolated from neighboring fibers.
4. *fit-psf-CAMERA-EXPID.fits*: Final PSF fit (which is the same as *fit-psf-fixed-listed-CAMERA-EXPID.fits* if there are problematic fibers)

The `fit-psf-*.fits` files from individual exposures are combined into the *psfnight* files for each night.

Flat and science exposures have a single PSF file per camera:

psf-CAMERA-EXPID.fits: psfnight file with spectral trace coordinates and wavelength solution adjusted to match this exposure. Flat exposures are adjusted only in x (cross dispersion = fiber direction), while science exposures are adjusted in both x and y (wavelength direction).

fluxcalib-CAMERA-EXPID.fits

Summary
This holds the flux calibration model for a given camera and exposure.

Naming Convention
`fluxcalib-{CAMERA}-{EXPID}.fits`, where `{CAMERA}` is one of the spectrograph cameras (*e.g.* `z1`) and `{EXPID}` is the 8-digit exposure ID.

Regex
`fluxcalib-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 13 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	FLUXCALIB	IMAGE	Flux calibration model
HDU1	IVAR	IMAGE	Inverse variance of flux
HDU2	MASK	IMAGE	Mask (0 = good)
HDU3	WAVELENGTH	IMAGE	wavelength in Angstrom
HDU4	FIBERCORR	BINTABLE	Correction factors for fiber size input losses
HDU5	STDSTAR_FIBERMAP	BINTABLE	stdstar photometry and target:fiber mapping

FITS Header Units

HDU0

EXTNAME = FLUXCALIB

Flux calibration array 'fluxcal', such that calibrated flux = uncalibrated flux / fluxcal. 2D array of dimension [nspec, nwave]. nspec is the number of fibers per camera. nwave in the length of the wavelength array. The flux calibration of all fibers share the same wavelength grid (given in HDU WAVELENGTH). The units are electrons / (10^{-17} ergs/s/cm2), such that the calibrated flux has units of 10^{-17} ergs/s/cm2/Angstrom. The flux calibration is obtained by comparing the sky subtracted and flat-fielded flux from standard stars in the *sframe file* with stellar models from the *stdstars file*. This calibration of the total flux is valid for point sources only. For extended sources, one may consider using a 'fiber flux', which is the flux one would collect in a 1.5 arcsec diameter aperture centered on the object when observed with a 1 arcsec FWHM Gaussian seeing. The 'fiber flux' can be obtained by multiplying the calibrated flux array of each fiber by the corresponding entry in the *FIBERCORR* table column 'PSF_TO_FIBER_SPECFLUX'.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	
NAXIS2	500	int	
EXPID	69022	int	Exposure number
EXPFRAME	0	int	Frame number
TILEID	80616	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/080/fiberassign-080616.fits	str	Fiber assign fil
FLAVOR	science	str	Observation type
SEQUENCE	DESI	str	OCS Sequence name
PURPOSE	Commissioning	str	Purpose of observing night
PROGRAM	SV1 BGS+MWS tile 80616	str	Program name
PROPID	2019B-5000	str	Proposal ID
OBSERVER	DESIObserver	str	Names of observers
LEAD	RunManager	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20201220	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2020-12-21T02:36:32.099838	str	[UTC] Observation data and start time
TIME-OBS	02:39:11.845920	str	[UTC] Observation start time
MJD-OBS	59204.10870486	float	Modified Julian Date of observation
OPENSHUT	2020-12-21T02:36:32.099838	str	Time shutter opened
ST	01:10:39.210	str	Local Sidereal time at observation start (HH:MM
EXPTIME	300.007	float	[s] Actual exposure time
REQRA	356.0	float	[deg] Requested right ascension (observer input
REQDEC	29.0	float	[deg] Requested declination (observer input)

continues on next page

Table 22 – continued from previous page

KEY	Example Value	Type	Comment
FOCUS	1426.5,-501.4,81.0,-2.6,42.3,169.2	str	Telescope focus settings
VCCD	ON	str	True (ON) if CCD voltage is on
VCCDON	2020-12-09T21:23:25.472733	str	Time when CCD voltage was turned on
VCCDSEC	969696.0	float	[s] CCD on time in seconds
TRUSTEMP	11.767	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	8.925	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Epoch of observation
MOUNTAZ	266.70224	float	[deg] Mount azimuth angle
MOUNTDEC	28.999221	float	[deg] Mount declination
MOUNTEL	71.039837	float	[deg] Mount elevation angle
MOUNTHA	21.769281	float	[deg] Mount hour angle
SKYDEC	28.999221	float	[deg] Telescope declination (pointing on sky)
SKYRA	355.996551	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	28.999221	float	[deg] Target declination (to TCS)
TARGTRA	355.996551	float	[deg] Target right ascension (to TCS)
USEETC	F	bool	ETC data available if true
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	167.1	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.0	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
SPECGRPH	6	int	Spectrograph logical name (SP)
SPECID	7	int	Spectrograph serial number (SM)
FEEBOX	lbnl061	str	CCD Controller serial number
VESSEL	21	int	Cryostat serial number
FEEVER	v20160312	str	CCD Controller version
FEEPOWER	ON	str	FEE power status
FEEDMASK	2134851391	int	FEE dac mask
FEECMASK	1048575	int	FEE clk mask

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Table 22 – continued from previous page

KEY	Example Value	Type	Comment
CCDTEMP	-134.1517	float	[deg C] CCD controller CCD temperature
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
FILENAME	/exposures/desi/specs/20201220/00069022/sp1-00069022.fits.fz	str	Name
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
PRESECC	[1:7, 2130:4193]	str	Prescan section for quadrant C
CLOCK13	9.9992,2.9993	str	[V] high rail, low rail
DETECTOR	M1-51	str	Detector (ccd) identification
SETTINGS	detectors_sm_20191211.json	str	Name of DESI CCD settings file
PRRSECA	[8:2064, 1:1]	str	Row prescan section for quadrant A
CLOCK11	9.9992,2.9993	str	[V] high rail, low rail
OFFSET2	0.4000000059604645,-8.9507	str	[V] set value, measured value
AMPSECC	[1:2057, 4128:2065]	str	AMP section for quadrant C
DAC11	-25.0003,-25.0351	str	[V] set value, measured value
CLOCK1	9.9999,0.0	str	[V] high rail, low rail
DAC7	5.9998,6.0017	str	[V] set value, measured value
DAC16	39.9961,39.5472	str	[V] set value, measured value
CCDSECB	[2058:4114, 1:2064]	str	CCD section for quadrant B
CLOCK17	9.0,0.9999	str	[V] high rail, low rail
CLOCK5	9.9999,0.0	str	[V] high rail, low rail
AMPSECB	[4114:2058, 1:2064]	str	AMP section for quadrant B
CLOCK4	9.9999,0.0	str	[V] high rail, low rail
DETSECB	[2058:4114, 1:2064]	str	Detector section for quadrant B
BIASSECA	[2065:2128, 2:2065]	str	Bias section for quadrant A
CRYOPRES[1]	2.938e-07	str	[mb] Cryostat pressure (IP)
CCDTMING	default_lbnl_timing_20180905.txt	str	CCD timing file
CLOCK9	9.9992,2.9993	str	[V] high rail, low rail
PGAGAIN	3	int	Controller gain
CLOCK6	9.9999,0.0	str	[V] high rail, low rail

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Table 22 – continued from previous page

KEY	Example Value	Type	Comment
OFFSET3	0.4000000059604645,-8.8889	str	[V] set value, measured value
PRRSECB	[2193:4249, 1:1]	str	Row prescan section for quadrant B
DAC5	5.9998,6.0174	str	[V] set value, measured value
CLOCK3	-2.0001,3.9999	str	[V] high rail, low rail
DAC14	0.0,-0.0297	str	[V] set value, measured value
CLOCK15	9.9992,2.9993	str	[V] high rail, low rail
AMPSECD	[4114:2058, 4128:2065]	str	AMP section for quadrant D
CCDSECA	[1:2057, 1:2064]	str	CCD section for quadrant A
DAC9	-25.0003,-25.0351	str	[V] set value, measured value
DAC10	-25.0003,-24.8273	str	[V] set value, measured value
CCDPREP	purge,clear	str	CCD prep actions
DAC4	5.9998,6.0437	str	[V] set value, measured value
OFFSET4	2.0,6.049	str	[V] set value, measured value
BLDTIME	0.3499	float	[s] Time to build image
CLOCK16	9.9999,3.0	str	[V] high rail, low rail
DAC2	-9.0002,-8.961	str	[V] set value, measured value
OFFSET1	0.4000000059604645,-8.9507	str	[V] set value, measured value
CLOCK10	9.9992,2.9993	str	[V] high rail, low rail
OFFSET7	2.0,6.0017	str	[V] set value, measured value
ORSECD	[2193:4249, 2098:2129]	str	Row bias section for quadrant D
OFFSET0	0.4000000059604645,-8.9713	str	[V] set value, measured value
CLOCK0	9.9999,0.0	str	[V] high rail, low rail
CRYOTEMPPage 191, 1	139.986	float	[deg K] Cryostat CCD temperature
DATASECB	[2193:4249, 2:2065]	str	Data section for quadrant B
DAC6	5.9998,6.049	str	[V] set value, measured value
DAC12	0.0,-0.0148	str	[V] set value, measured value
CLOCK2	9.9999,0.0	str	[V] high rail, low rail
TRIMSECC	[8:2064, 2130:4193]	str	Trim section for quadrant C
PRRSECD	[2193:4249, 4194:4194]	str	Row prescan section for quadrant D

continues on next page

Table 22 – continued from previous page

KEY	Example Value	Type	Comment
DAC15	0.0,0.0	str	[V] set value, measured value
DATASECA	[8:2064, 2:2065]	str	Data section for quadrant A
DAC3	-9.0002,-8.8889	str	[V] set value, measured value
CCDSIZE	4194,4256	str	CCD size in pixels (rows, columns)
AMPSECA	[1:2057, 1:2064]	str	AMP section for quadrant A
PRESECD	[4250:4256, 2130:4193]	str	Prescan section for quadrant D
ORSECA	[8:2064, 2066:2097]	str	Row overscan section for quadrant A
CCDSECC	[1:2057, 2065:4128]	str	CCD section for quadrant C
CLOCK18	9.0,0.9999	str	[V] high rail, low rail
DETSECD	[2058:4114, 2065:4128]	str	Detector section for quadrant D
CCDSECD	[2058:4114, 2065:4128]	str	CCD section for quadrant D
CPUTEMP	57.1172	float	[deg C] CCD controller CPU temperature
DELAYS	20, 20, 25, 40, 7, 3000, 7, 7, 7, 7	str	[10] Delay settings
DATASECD	[2193:4249, 2130:4193]	str	Data section for quadrant D
BIASSECC	[2065:2128, 2130:4193]	str	Bias section for quadrant C
CCDCFG	default_lbnl_20190717.cfg	str	CCD configuration file
DATASECC	[8:2064, 2130:4193]	str	Data section for quadrant C
BIASSECD	[2129:2192, 2130:4193]	str	Bias section for quadrant D
PRESECA	[1:7, 2:2065]	str	Prescan section for quadrant A
OFFSET6	2.0,6.0543	str	[V] set value, measured value
DETSECC	[1:2057, 2065:4128]	str	Detector section for quadrant C
DAC13	0.0,-0.0297	str	[V] set value, measured value
DETSECA	[1:2057, 1:2064]	str	Detector section for quadrant A
PRRSECC	[8:2064, 4194:4194]	str	Row prescan section for quadrant C
CLOCK12	9.9992,2.9993	str	[V] high rail, low rail
CASETEMP	56.8611	float	[deg C] CCD controller case temperature

continues on next page

Table 22 – continued from previous page

KEY	Example Value	Type	Comment
BIASSECB	[2129:2192, 2:2065]	str	Bias section for quadrant B
OFFSET5	2.0,6.0174	str	[V] set value, measured value
CLOCK7	-2.0001,3.9999	str	[V] high rail, low rail
CLOCK8	9.9992,2.9993	str	[V] high rail, low rail
CAMERA	z6	str	Camera name
PRESECB	[4250:4256, 2:2065]	str	Prescan section for quadrant B
TRIMSECB	[2193:4249, 2:2065]	str	Trim section for quadrant B
DAC17	20.0008,11.9316	str	[V] set value, measured value
DIGITIME	47.5453	float	[s] Time to digitize image
TRIMSECD	[2193:4249, 2130:4193]	str	Trim section for quadrant D
DAC8	-25.0003,-24.6196	str	[V] set value, measured value
TRIMSECA	[8:2064, 2:2065]	str	Trim section for quadrant A
CLOCK14	9.9992,2.9993	str	[V] high rail, low rail
DAC0	-9.0002,-8.9713	str	[V] set value, measured value
CDSPARMS	400, 400, 8, 2000	str	CDS parameters
DAC1	-9.0002,-8.9507	str	[V] set value, measured value
ORSECC	[8:2064, 2098:2129]	str	Row overscan section for quadrant C
ORSECB	[2193:4249, 2066:2097]	str	Row overscan section for quadrant B
CCDNAME	CCDSM7Z	str	CCD name
REQTIME	300.0	float	[s] Requested exposure time
OBSID	kp4m20201221t023911	str	Unique observation identifier
PROCTYPE	RAW	str	Data processing level
PRODTYPE	image	str	Data product type
CHECKSUM	LfaELdXDLdaDLdUD	str	HDU checksum updated 2022-02-14T08:22:45
DATASUM	1867608608	str	data unit checksum updated 2022-02-14T08:22:45
GAINA	1.387	float	e/ADU (gain applied to image)
SATULEVA	61000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPA	0.7319095199345611	float	ADUs (max-min of median overscan per row)
OMETHA	AVERAGE	str	use average overscan
OVERSCNA	1966.054034223049	float	ADUs (gain not applied)

continues on next page

Table 22 – continued from previous page

KEY	Example Value	Type	Comment
OBSRDNA	2.176414404248625	float	electrons (gain is applied)
SATUELEA	81880.08305453263	float	saturation or non lin. level, in electrons
GAINB	1.518	float	e/ADU (gain applied to image)
SATULEVB	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPB	0.5937273930649098	float	ADUs (max-min of median overscan per row)
OMETHB	AVERAGE	str	use average overscan
OVERSCNB	1987.334317960662	float	ADUs (gain not applied)
OBSRDNB	2.29569819578003	float	electrons (gain is applied)
SATUELEB	96465.35650533572	float	saturation or non lin. level, in electrons
GAINC	1.534	float	e/ADU (gain applied to image)
SATULEVC	40000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPC	0.9199855706829112	float	ADUs (max-min of median overscan per row)
OMETHC	AVERAGE	str	use average overscan
OVERSCNC	1980.643479043017	float	ADUs (gain not applied)
OBSRDNC	2.511180716174036	float	electrons (gain is applied)
SATUELEC	58321.69290314802	float	saturation or non lin. level, in electrons
GAIND	1.554	float	e/ADU (gain applied to image)
SATULEVD	62000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPD	1.375711494358256	float	ADUs (max-min of median overscan per row)
OMETHD	AVERAGE	str	use average overscan
OVERSCND	1982.563334159938	float	ADUs (gain not applied)
OBSRDND	2.417154801423475	float	electrons (gain is applied)
SATUELED	93267.09657871546	float	saturation or non lin. level, in electrons
FIBERMIN	3000	int	
LONGSTRN	OGIP 1.0	str	The OGIP Long String Convention may be used.
MODULE	CI	str	Image Sources/Component
COSMSPLT	F	bool	Cosmics split exposure if true
MAXSPLIT	0	int	Number of allowed exposure splits
SPLITIDS[Page 191, 1]	69022	str	List of expids for split exposures
OBSTYPE	SCIENCE	str	Spectrograph observation type
MANIFEST	F	bool	DOS exposure manifest

continues on next page

Table 22 – continued from previous page

KEY	Example Value	Type	Comment
OBJECT		str	Object name
SEQNUM	1	int	Number of exposure in sequence
CAMSHUT	open	str	Shutter status during observation
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
FOCSTIME[Page 191, 1]	60.0	float	[s] focus GFA exposure time
SKYTIME[Page 191, 1]	60.0	float	[s] sky camera exposure time (acquisition)
WHITESPT	F	bool	Telescope is at whitespot
ZENITH	F	bool	Telescope is at zenith
SEANNEX	F	bool	Telescope is at SE annex
BEYONDP	F	bool	Telescope is beyond pole
FIDUCIAL	off	str	Fiducials status during observation
BACKLIT	off	str	Fibers are backlit if True
AIRMASS	1.060311	float	Airmass
PMREADY	T	bool	Primary mirror ready
PMCOVER	open	str	Primary mirror cover
PMCOOL	off	str	Primary mirror cooling
DOMSHUTU	open	str	Upper dome shutter
DOMSHUTL	open	str	Lower dome shutter
DOMLIGHH	off	str	High dome lights
DOMLIGHL	off	str	Low dome lights
DOMEAZ	255.166	float	[deg] Dome azimuth angle
DOMINPOS	T	bool	Dome is in position
GUIDOFFR	-0.052283	float	[arcsec] Cummulative guider offset (RA)
GUIDOFFD	0.136634	float	[arcsec] Cummulative guider offset (dec)
MOONDEC	-8.975162	float	[deg] Moon declination at start of exposure
MOONRA	352.538429	float	[deg] Moon RA at start of exposure
INCTRL	T	bool	DESI in control
INPOS	T	bool	Mount in position
MNTOFFD	-15.76	float	[arcsec] Mount offset (dec)
MNTOFFR	29.32	float	[arcsec] Mount offset (RA)
PARALLAC	75.635085	float	[deg] Parallactic angle
TARGTAZ	267.074049	float	[deg] Target azimuth
TARGTEL	70.563787	float	[deg] Target elevation
TRGTOFFD	0.0	float	[arcsec] Telescope target offset (dec)

continues on next page

Table 22 – continued from previous page

KEY	Example Value	Type	Comment
TRGTOFFR	0.0	float	[arcsec] Telescope target offset (RA)
ZD	19.436213	float	[deg] Telescope zenith distance
TILERA	356.0	float	RA of tile given in fiberassign file
TILEDEC	29.0	float	DEC of tile given in fiberassign file
TCSST	01:13:18.668	str	Local Sidereal time reported by TCS (HH:MM:SS)
TCSMJD	59204.110981	float	MJD reported by TCS
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM[Page 191, 1]	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM[Page 191, 1]	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
REQADC	65.78,85.28	str	[deg] requested ADC angles
ADCCORR	T	bool	Correct pointing for ADC setting if True
ADC1PHI	65.780005	float	[deg] ADC 1 angle
ADC2PHI	85.279991	float	[deg] ADC 2 angle
ADC1HOME	F	bool	ADC 1 at home position if True
ADC2HOME	F	bool	ADC 2 at home position if True
ADC1NREV	-1.0	float	ADC 1 number of revs
ADC2NREV	0.0	float	ADC 2 number of revs
ADC1STAT	STOPPED	str	ADC 1 status
ADC2STAT	STOPPED	str	ADC 2 status
HEXPOS	1426.5,-501.3,81.0,-2.6,42.3,171.9	str	Hexapod position
RESETROT	F	bool	DOS Control: reset hex rotator
USEPOS	T	bool	Fiber positioner data available if true
PETALS	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9	str	Participating petals
POSCYCLE	1	int	Number of current iteration
POSONTGT	3626	int	Number of positioners on target
POSONFRC	0.8613	float	Fraction of positioners on target
POSDISAB	37	int	Number of disabled positioners
POSENABL	4210	int	Number of enabled positioners

continues on next page

Table 22 – continued from previous page

KEY	Example Value	Type	Comment
POSRMS	0.0171	float	[micron] RMS of positioner accuracy
POSITER	1	int	Positioning Control: max. number of pos. cycles
POSFRACT	0.95	float	
POSTOLER	0.01	float	Positioning Control: in_position tolerance (mm)
POSMVALL	T	bool	Positioning Control: move all positioners
GUIDMODE	catalog	str	Guider mode
USEAOS[Page 191, 1]	F	bool	DOS Control: AOS data available if true
USESPCTR	T	bool	DOS Control: use spectrographs
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating spectrograph
ILLSPECS[Page 191, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating illuminate s
CCDSPECS[Page 191, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating ccd spectrog
TDEWPNT	-16.043	float	Telescope air dew point
TAIRFLOW	0.0	float	Telescope air flow
TAIRITMP	11.8	float	[deg] Telescope air in temperature
TAIROTMP	11.7	float	[deg] Telescope air out temperature
TAIRTEMP	10.65	float	[deg] Telescope air temperature
TCASITMP	0.0	float	[deg] Telescope Cass Cage in temperature
TCASOTMP	10.8	float	[deg] Telescope Cass Cage out temperature
TCSITEMP	9.3	float	[deg] Telescope center section in temperature
TCSOTEMP	10.8	float	[deg] Telescope center section out temperature
TCIBTEMP	0.0	float	[deg] Telescope chimney IB temperature
TCIMTEMP	0.0	float	[deg] Telescope chimney IM temperature
TCITTEMP	0.0	float	[deg] Telescope chimney IT temperature
TCOSTEMP	0.0	float	[deg] Telescope chimney OS temperature
TCOWTEMP	0.0	float	[deg] Telescope chimney OW temperature
TDBTEMP	9.3	float	[deg] Telescope dec bore temperature
TFLOWIN	0.0	float	Telescope flow rate in
TFLOWOUT	0.0	float	Telescope flow rate out
TGLYCOLI	9.9	float	[deg] Telescope glycol in temperature

continues on next page

Table 22 – continued from previous page

KEY	Example Value	Type	Comment
TGLYCOLO	9.8	float	[deg] Telescope glycol out temperature
THINGES	11.4	float	[deg] Telescope hinge S temperature
THINGEW	11.2	float	[deg] Telescope hinge W temperature
TPMAVERT	8.931	float	[deg] Telescope mirror av-eragetemperature
TPMDESIT	7.0	float	[deg] Telescope mirror de-sired temperature
TPMEIBT	8.6	float	[deg] Telescope mirror EIB temperature
TPMEITT	8.6	float	[deg] Telescope mirror EIT temperature
TPMEOBT	8.5	float	[deg] Telescope mirror EOB temperature
TPMEOTT	9.0	float	[deg] Telescope mirror EOT temperature
TPMNIBT	8.4	float	[deg] Telescope mirror NIB temperature
TPMNITT	8.9	float	[deg] Telescope mirror NIT temperature
TPMNOBT	8.8	float	[deg] Telescope mirror NOB temperature
TPMNOTT	9.1	float	[deg] Telescope mirror NOT temperature
TPMRTDT	9.0	float	[deg] Telescope mirror RTD temperature
TPMSIBT	8.6	float	[deg] Telescope mirror SIB temperature
TPMSITT	8.8	float	[deg] Telescope mirror SIT temperature
TPMSOBT	8.2	float	[deg] Telescope mirror SOB temperature
TPMSOTT	8.9	float	[deg] Telescope mirror SOT temperature
TPMSTAT	ready	str	Telescope mirror status
TPMWIBT	8.2	float	[deg] Telescope mirror WIB temperature
TPMWITT	9.1	float	[deg] Telescope mirror WIT temperature
TPMWOBT	8.3	float	[deg] Telescope mirror WOB temperature
TPMWOTT	8.9	float	[deg] Telescope mirror WOT temperature
TPCITEMP	8.5	float	[deg] Telescope primary cell in temperature
TPCOTEMP	8.6	float	[deg] Telescope primary cell out temperature

continues on next page

Table 22 – continued from previous page

KEY	Example Value	Type	Comment
TPR1HUM	0.0	float	Telescope probe 1 humidity
TPR1TEMP	0.0	float	[deg] Telescope probe1 temperature
TPR2HUM	0.0	float	Telescope probe 2 humidity
TPR2TEMP	0.0	float	[deg] Telescope probe2 temperature
TSERVO	40.0	float	Telescope servo setpoint
TTRSTEMP	11.4	float	[deg] Telescope top ring S temperature
TTRWTEMP	11.0	float	[deg] Telescope top ring W temperature
TTRUETBT	-4.2	float	[deg] Telescope truss ETB temperature
TTRUETTT	11.2	float	[deg] Telescope truss ETT temperature
TTRUNTBT	10.9	float	[deg] Telescope truss NTB temperature
TTRUNTTT	11.2	float	[deg] Telescope truss NTT temperature
TTRUSTBT	10.7	float	[deg] Telescope truss STB temperature
TTRUSTST	10.8	float	[deg] Telescope truss STS temperature
TTRUSTTT	11.1	float	[deg] Telescope truss STT temperature
TTRUTSBT	11.8	float	[deg] Telescope truss TSB temperature
TTRUTSMT	11.8	float	[deg] Telescope truss TSM temperature
TTRUTSTT	11.8	float	[deg] Telescope truss TST temperature
TTRUWTBT	10.5	float	[deg] Telescope truss WTB temperature
TTRUWTTT	10.9	float	[deg] Telescope truss WTT temperature
ALARM	F	bool	UPS major alarm or check battery
ALARM-ON	F	bool	UPS active alarm condition
BATTERY	100.0	float	[%] UPS Battery left
SECLEFT	5178.0	float	[s] UPS Seconds left
UPSSTAT	System Normal - On Line(7)	str	UPS Status
INAMPS	70.4	float	[A] UPS total input current
OUTWATTS	5000.0,7200.0,4800.0	str	[W] UPS Phase A, B, C output watts

continues on next page

Table 22 – continued from previous page

KEY	Example Value	Type	Comment
COMPDEW	-12.9	float	[deg C] Computer room dewpoint
COMPHUM	7.4	float	[%] Computer room humidity
COMPAMB	19.5	float	[deg C] Computer room ambient temperature
COMPTEMP	24.5	float	[deg C] Computer room hygrometer temperature
DEWPOINT	11.5	float	[deg C] (outside) dewpoint
HUMIDITY	10.0	float	[%] (outside) humidity
PRESSURE	795.0	float	[torr] (outside) air pressure
OUTTEMP	0.0	float	[deg C] outside temperature
WINDDIR	55.0	float	[deg] wind direction
WINDSPD	27.3	float	[m/s] wind speed
GUST	20.6	float	[m/s] Wind gusts speed
AMNIENTN	13.5	float	[deg C] ambient temperature north
CFLOOR	8.9	float	[deg C] temperature on C floor
NWALLIN	13.9	float	[deg C] temperature at north wall inside
NWALLOUT	9.6	float	[deg C] temperature at north wall outside
WWALLIN	12.9	float	[deg C] temperature at west wall inside
WWALLOUT	10.6	float	[deg C] temperature at west wall outside
AMBIENTS	14.8	float	[deg C] ambient temperature south
FLOOR	12.6	float	[deg C] temperature at floor (LCR)
EWALLCMP	10.8	float	[deg C] temperature at east wall, computer room
EWALLCOU	10.6	float	[deg C] temperature at east wall, Coude room
ROOF	10.3	float	[deg C] temperature on roof
ROOFAMB	10.6	float	[deg C] ambient temperature on roof
DOMEBLOW	10.4	float	[deg C] temperature at dome back, lower
DOMEBUP	10.7	float	[deg C] temperature at dome back, upper
DOMELLOW	10.8	float	[deg C] temperature at dome left, lower
DOMELUP	10.8	float	[deg C] temperature at dome left, upper

continues on next page

Table 22 – continued from previous page

KEY	Example Value	Type	Comment
DOMERLOW	10.6	float	[deg C] temperature at dome right, lower
DOMERUP	10.5	float	[deg C] temperature at dome right, upper
PLATFORM	10.4	float	[deg C] temperature at platform
SHACKC	14.4	float	[deg C] temperature at shack ceiling
SHACKW	13.7	float	[deg C] temperature at shack wall
STAIRSL	10.5	float	[deg C] temperature at stairs, lower
STAIRSM	10.4	float	[deg C] temperature at stairs, mid
STAIRSU	10.6	float	[deg C] temperature at stairs, upper
TELBASE	9.6	float	[deg C] temperature at telescope base
UTILWALL	11.1	float	[deg C] temperature at utility room wall
UTILROOM	10.9	float	[deg C] temperature in utilitiy room
TNFSPROC[Page 191, 1]	8.1963	float	[s] PlateMaker NFSPROC processing time
TGFAPROC[Page 191, 1]	7.9212	float	[s] PlateMaker GFAPROC processing time
SIMGFAP	F	bool	DOS Control: simulate GFAPROC
USEFVC	T	bool	DOS Control: use fvc
USEFID	T	bool	DOS Control: use fiducials
USEILLUM	T	bool	DOS Control: use illuminator
USEXSRVR	T	bool	DOS Control: use exposure server
USEOPENL	T	bool	DOS Control: use open loop move
STOPGUDR	T	bool	DOS Control: stop guider
STOPFOCS	T	bool	DOS Control: stop focus
STOPSKY	T	bool	DOS Control: stop sky monitor
KEEPGUDR	F	bool	DOS Control: keep guider running
KEEPFOCS	F	bool	DOS Control: keep focus running
KEEPSKY	F	bool	DOS Control: keep sky mon. running
REACQUIR	F	bool	DOS Control: reacquire same files

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Table 22 – continued from previous page

KEY	Example Value	Type	Comment
EXCLUDED		str	Components excluded from this exposure
FVCTIME[Page 191, 1]	2.0	float	[s] FVC exposure time
SIMGFACQ	F	bool	
POSCNVGD[Page 191, 1]	F	bool	Number of positioners converged
GUIEXPID	69022	int	Guider exposure id at start of spectro exp.
IGFRMNUM	12	int	Guider frame number at start of spectro exp.
FOCEXPID	69022	int	Focus exposure id at start of spectro exp.
IFFRMNUM	1	int	Focus frame number at start of spectro exp.
SKYEXPID	69022	int	Sky exposure id at start of spectro exp.
ISFRMNUM	1	int	Sky frame number at start of spectro exp.
FGFRMNUM	46	int	Guider frame number at end of spectro exp.
FFFRMNUM	6	int	Focus frame number at end of spectro exp.
FSFRMNUM	5	int	Sky frame number at end of spectro exp.
HELIOCOR	0.9999115198216216	float	
NSPEC	500	int	Number of spectra
WAVEMIN	7520.0	float	First wavelength [Angstroms]
WAVEMAX	9824.0	float	Last wavelength [Angstroms]
WAVESTEP	0.8	float	Wavelength step size [Angstroms]
SPECTER	0.10.0	str	https://github.com/desihub/specter
IN_PSF	SPECPROD/exposures/20201220/00069022/psf-z6-00069022.fits	str	Input sp
IN_IMG	SPECPROD/preproc/20201220/00069022/preproc-z6-00069022.fits	str	
ORIG_PSF	SPECPROD/calibnight/20201220/psfnight-z6-20201220.fits	str	
BUNIT	10**+17 cm2 count s / erg	str	i.e. (elec/A) / (1e-17 erg/s/cm2/A)
IN_FRAME	SPECPROD/exposures/20201220/00069022/frame-z6-00069022.fits	str	
IN_SKY	SPECPROD/exposures/20201220/00069022/sky-z6-00069022.fits	str	
FIBERFLT	SPECPROD/exposures/20201220/00069022/fiberflatexp-z6-00069022.fits	str	
STDMODEL	SPECPROD/exposures/20201220/00069022/stdstars-6-00069022.fits	str	

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KEY	Example Value	Type	Comment
NTSSURVY[Page 191, 1]	sv2	str	NTS survey name
SP8NIRP[Page 191, 1]	4.941e-08	float	[mb] SP8 NIR pressure
TCSPIDEC[Page 191, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
SP3REDP[Page 191, 1]	5.506e-08	float	[mb] SP3 red pressure
USESPLITS[Page 191, 1]	T	bool	Exposure splits are allowed
SP9NIRP[Page 191, 1]	5.207e-08	float	[mb] SP9 NIR pressure
SP0REDT[Page 191, 1]	139.96	float	[K] SP0 red temperature
SP8REDT[Page 191, 1]	139.94	float	[K] SP8 red temperature
SP2REDT[Page 191, 1]	139.99	float	[K] SP2 red temperature
SEQSTART[Page 191, 1]	2021-04-04T06:46:24.391377	str	Start time of sequence processing
SP0NIRP[Page 191, 1]	5.865e-08	float	[mb] SP0 NIR pressure
SP3NIRP[Page 191, 1]	5.524e-08	float	[mb] SP3 NIR pressure
SP7REDT[Page 191, 1]	139.99	float	[K] SP7 red temperature
PMSEEING[Page 191, 1]	0.85	float	[arcsec] PlateMaker GFAPROC seeing
SP6REDT[Page 191, 1]	139.94	float	[K] SP6 red temperature
SP7NIRT[Page 191, 1]	139.96	float	[K] SP7 NIR temperature
SP4BLUT[Page 191, 1]	163.02	float	[K] SP4 blue temperature
ACTTEFF[Page 191, 1]	1513.0686	float	[s] Actual effective exposure time
SP2NIRT[Page 191, 1]	139.91	float	[K] SP2 NIR temperature
SP5NIRT[Page 191, 1]	139.94	float	[K] SP5 NIR temperature
SP2BLUT[Page 191, 1]	163.02	float	[K] SP2 blue temperature
SP1BLUP[Page 191, 1]	7.808e-08	float	[mb] SP1 blue pressure
SP4REDP[Page 191, 1]	4.72e-08	float	[mb] SP4 red pressure
SP8BLUP[Page 191, 1]	8.119e-08	float	[mb] SP8 blue pressure
SP5BLUT[Page 191, 1]	163.02	float	[K] SP5 blue temperature
SP2REDP[Page 191, 1]	5.348e-08	float	[mb] SP2 red pressure
SP0REDP[Page 191, 1]	5.012e-08	float	[mb] SP0 red pressure
SP2BLUP[Page 191, 1]	7.391e-08	float	[mb] SP2 blue pressure
SP9NIRT[Page 191, 1]	139.89	float	[K] SP9 NIR temperature
SP6NIRT[Page 191, 1]	139.89	float	[K] SP6 NIR temperature
SP5BLUP[Page 191, 1]	1.125e-07	float	[mb] SP5 blue pressure
TCSKDEC[Page 191, 1]	0.3 0.003 0.00003	str	TCS Kalman (dec)
VISITIDS[Page 191, 1]	89039	str	List of expids for a visit (same tile)
SP6BLUT[Page 191, 1]	163.02	float	[K] SP6 blue temperature
SP1BLUT[Page 191, 1]	163.02	float	[K] SP1 blue temperature
TCSGRA[Page 191, 1]	0.3	float	TCS simple gain (RA)
SP5REDP[Page 191, 1]	5.121e-08	float	[mb] SP5 red pressure
TCSKRA[Page 191, 1]	0.3 0.003 0.00003	str	TCS Kalman (RA)
SP4REDT[Page 191, 1]	140.01	float	[K] SP4 red temperature
SP8NIRT[Page 191, 1]	139.99	float	[K] SP8 NIR temperature
SP0NIRT[Page 191, 1]	139.89	float	[K] SP0 NIR temperature
SP6NIRP[Page 191, 1]	2.811e-07	float	[mb] SP6 NIR pressure
SP6BLUP[Page 191, 1]	7.054e-08	float	[mb] SP6 blue pressure

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KEY	Example Value	Type	Comment
SP9BLUT[Page 191, 1]	163.02	float	[K] SP9 blue temperature
SP4BLUP[Page 191, 1]	4.868e-08	float	[mb] SP4 blue pressure
TCSPIRA[Page 191, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
SP7REDP[Page 191, 1]	4.279e-08	float	[mb] SP7 red pressure
SP8BLUT[Page 191, 1]	162.9	float	[K] SP8 blue temperature
SP8REDP[Page 191, 1]	8.401e-08	float	[mb] SP8 red pressure
SP3BLUT[Page 191, 1]	163.02	float	[K] SP3 blue temperature
SPLITEXP[Page 191, 1]	F	bool	Split exposure part of a visit
SP3REDT[Page 191, 1]	139.96	float	[K] SP3 red temperature
SUNDEC[Page 191, 1]	5.800279	float	[deg] Sun declination at start of exposure
SP1NIRP[Page 191, 1]	8.133e-08	float	[mb] SP1 NIR pressure
SP2NIRP[Page 191, 1]	5.339e-08	float	[mb] SP2 NIR pressure
SUNRA[Page 191, 1]	13.554748	float	[deg] Sun RA at start of exposure
SP6REDP[Page 191, 1]	6.486e-08	float	[mb] SP6 red pressure
MOONSEP[Page 191, 1]	113.991	float	[deg] Moon Separation
TCSGDEC[Page 191, 1]	0.3	float	TCS simple gain (dec)
TCSMFDEC[Page 191, 1]	1	int	TCS moving filter length (dec)
SP3NIRT[Page 191, 1]	140.01	float	[K] SP3 NIR temperature
FRAMES[Page 191, 1]	47	int	Number of Frames in Archive
SP0BLUT[Page 191, 1]	162.99	float	[K] SP0 blue temperature
SP9REDP[Page 191, 1]	4.354e-08	float	[mb] SP9 red pressure
SEEING[Page 191, 1]	0.8607	float	[arcsec] ETC seeing
SP9BLUP[Page 191, 1]	1.208e-07	float	[mb] SP9 blue pressure
SP7BLUP[Page 191, 1]	9.947e-08	float	[mb] SP7 blue pressure
SP4NIRT[Page 191, 1]	139.96	float	[K] SP4 NIR temperature
SP9REDT[Page 191, 1]	140.01	float	[K] SP9 red temperature
TCSMFRA[Page 191, 1]	1	int	TCS moving filter length (RA)
SP1NIRT[Page 191, 1]	139.89	float	[K] SP1 NIR temperature
SP3BLUP[Page 191, 1]	9.345e-08	float	[mb] SP3 blue pressure
PMTRANS[Page 191, 1]	93.76	float	[%] PlateMaker GFAPROC transparency
SP1REDT[Page 191, 1]	139.89	float	[K] SP1 red temperature
SKYLEVEL[Page 191, 1]	0.933	float	counts?] ETC sky level
SP4NIRP[Page 191, 1]	6.915e-08	float	[mb] SP4 NIR pressure
REQTEFF[Page 191, 1]	1000.0	float	[s] Requested effective exposure time
SP7BLUT[Page 191, 1]	163.02	float	[K] SP7 blue temperature
SP5REDT[Page 191, 1]	139.99	float	[K] SP5 red temperature
SP7NIRP[Page 191, 1]	6.211e-08	float	[mb] SP7 NIR pressure
SP1REDP[Page 191, 1]	6.567e-08	float	[mb] SP1 red pressure
SP5NIRP[Page 191, 1]	9.462e-08	float	[mb] SP5 NIR pressure
SP0BLUP[Page 191, 1]	9.115e-08	float	[mb] SP0 blue pressure
BBKGMAXC[Page 191, 1]	0.4492153969301811	float	

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KEY	Example Value	Type	Comment
BBKGMIND[Page 191, 1]	-0.3135937336084521	float	
BBKGMAXB[Page 191, 1]	0.5049607921526409	float	
BBKGMINA[Page 191, 1]	-0.2211057823638513	float	
BBKGMINB[Page 191, 1]	-0.3689821920680901	float	
BBKGMINC[Page 191, 1]	-0.3614105403549326	float	
BBKGMAXA[Page 191, 1]	0.7513851072600307	float	
BBKGMAXD[Page 191, 1]	0.3423400768828577	float	
SBPROF[Page 191, 1]	ELG	str	Profile used by ETC
CONVERGD[Page 191, 1]	F	bool	Positioning loop converged (CNFRC>0.95)
TOTTEFF[Page 191, 1]	1214.7279	float	[s] Total effective exposure time for visit
SLEWANGL[Page 191, 1]	49.575	float	[deg] Slew Angle
POSCVFRC[Page 191, 1]	0.4393	float	Fraction of converged positioners
USESPLIT[Page 191, 1]	T	bool	Exposure splits are allowed
SEQID[Page 191, 1]	2 requests	str	Exposure sequence identifier
SEQTOT[Page 191, 1]	2	int	Total number of exposures in sequence
ETCFRACB[Page 191, 1]	0.13642	float	ETC transparency weighted average of FFRAC (BGS
ETCFRACP[Page 191, 1]	0.390556	float	ETC transparency weighted average of FFRAC (PSF
ETCTEFF[Page 191, 1]	61.258228	float	[s] ETC effective exposure time
ETCFRACE[Page 191, 1]	0.300922	float	ETC transparency weighted average of FFRAC (ELG
NTSPROG[Page 191, 1]	BACKUP	str	NTS program name
ETCTHRUB[Page 191, 1]	0.535631	float	ETC averaged thruput (BGS profile)
ETCSPLIT[Page 191, 1]	1	int	ETC split sequence number for this visit
ETCTRANS[Page 191, 1]	0.745415	float	ETC averaged TRANSP normalized to 1
ETCREAL[Page 191, 1]	348.878632	float	[s] ETC real open shutter time
ETCVERS[Page 191, 1]	0.1.12-3-g12b54bb	str	ETC version
ETCTHRUP[Page 191, 1]	0.518037	float	ETC averaged thruput (PSF profile)
MAXTIME[Page 191, 1]	5400.0	float	[s] Maximum exposure time for entire visit (fro
ETCSKY[Page 191, 1]	1.60973	float	ETC averaged, normalized sky camera flux
ESTTIME[Page 191, 1]	1500.571	float	[s] Estimated exposure time for visit (from ETC

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KEY	Example Value	Type	Comment
TRANSPAR[Page 191, 1]	None	float	ETC/PM transparency
ETCPROF[1]	PSF	str	ETC source brightness profile
MINTIME[1]	60.0	float	[s] Minimum exposure time (from NTS, used by ET
PMTRANSP[1]	115.88	float	[%] PlateMaker GFAPROC transparency
ETCSEENG[1]	2.1165	float	[arcsec] ETC seeing
ACQFWHM[1]	2.116458	float	[arcsec] FWHM of guide star PSF in acquisition
ETCTHRUE[1]	0.544181	float	ETC averaged thruput (ELG profile)
ETCPREV[1]	0.0	float	[s] ETC cummulative t_eff for visit

Data: FITS image [float32, 2326x500]

HDU1

EXTNAME = IVAR

Inverse variance of flux calibration array.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
NAXIS2	500	int	
CHECKSUM	YXHMcU9JZUGJaU9J	str	HDU checksum updated 2021-07-08T16:29:44
DATASUM	2925906445	str	data unit checksum updated 2021-07-08T16:29:44

Data: FITS image [float32, 2326x500]

HDU2

EXTNAME = MASK

Mask of flux calibration model; 0=good. See the *bitmask documentation* page for the definition of the bits. Prior to desispec/0.24.0 and software release 18.9, the MASK HDU was compressed.

[1] Optional

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
NAXIS2	500	int	
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	WHahaERgZEXgaEXg	str	HDU checksum updated 2021-07-08T16:29:44
DATASUM	68479139	str	data unit checksum updated 2021-07-08T16:29:44

Data: FITS image [int32, 2326x500]

HDU3

EXTNAME = WAVELENGTH

Wavelengths at which the flux calibration is evaluated, in Angstrom. Note the wavelength is in the solar system barycenter frame, so that the calibration can be directly applied to the science frame fluxes which are on the same wavelength grid. In order to compare the calibration from different exposures, one has to convert back the wavelength array to the observer frame, by dividing it by Doppler factor saved in header keyword HELIOCOR in HDU0. See also the frame *WAVELENGTH documentation* for more details.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
BUNIT	Angstrom	str	
CHECKSUM	PAF9Q8D6PAD6P5D6	str	HDU checksum updated 2021-07-08T16:29:44
DATASUM	1502044794	str	data unit checksum updated 2021-07-08T16:29:44

Data: FITS image [float32, 2326]

HDU4

EXTNAME = FIBERCORR

Table with the following adimentional scaling factors for each fiber:

FLAT_TO_PSF_FLUX = normalized ratio of the flat-fielded flux to the total flux for point sources; **already** included in the flux calibration array.

PSF_TO_FIBER_FLUX = ratio of total flux to 'fiber flux'; **not** included in the flux calibration array.

A 'fiber flux' is the flux one would collect in a 1.5 arcsec diameter aperture centered on the object when observed with a 1 arcsec FWHM Gaussian seeing. The variation of plate scale in the focal plane, the seeing condition of the observations, the fiber positioning errors, and the intrinsic angular size of the sources have been considered to compute those scaling factors.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	16	int	length of dimension 1
NAXIS2	500	int	length of dimension 2
ENCODING	ascii	str	
CHECKSUM	GgA3Gg60GgA0Gg50	str	HDU checksum updated 2021-07-08T16:29:44
DATASUM	2049692696	str	data unit checksum updated 2021-07-08T16:29:44

Required Data Table Columns

Name	Type	Units	Description
FLAT_TO_PSF_FLUX	float64		adimentional factor applied to calib to convert flat to psf flux
PSF_TO_FIBER_FLUX	float64		adimentional factor to apply to convert psf to fiber flux

HDU5

EXTNAME = STDSTAR_FIBERMAP

Fibermap of what targets were assigned to what fibers.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1[1]	385	int	length of dimension 1
NAXIS2[Page 191, 1]	18	int	length of dimension 2
TILEID[Page 191, 1]	80616	int	
TILERA[Page 191, 1]	356.0	float	
TILEDEC[Page 191, 1]	29.0	float	
FIELDROT[Page 191, 1]	-0.00962199210064233	float	
FA_PLAN[Page 191, 1]	2022-07-01T00:00:00.000	str	
FA_HA[Page 191, 1]	0.0	float	
FA_RUN[Page 191, 1]	2020-03-06T00:00:00	str	
FA_M_GFA[Page 191, 1]	0.4	float	
FA_M_PET[Page 191, 1]	0.4	float	
FA_M_POS[Page 191, 1]	0.05	float	
REQRA[Page 191, 1]	356.0	float	
REQDEC[Page 191, 1]	29.0	float	
FIELDNUM[Page 191, 1]	0	int	
FA_VER[Page 191, 1]	2.0.0.dev2618	str	
FA_SURV[Page 191, 1]	sv1	str	
LONGSTRN[Page 191, 1]	OGIP 1.0	str	
GFA[Page 191, 1]	/data/target/catalogs/dr9/0.47.0/gfas	str	
SKY[Page 191, 1]	/data/target/catalogs/dr9/0.47.0/skies	str	

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KEY	Example Value	Type	Comment
SKYSUPP[Page 191, 1]	/data/target/catalogs/gaiadr2/0.47.0/skies-supp	str	
TARG[Page 191, 1]	/data/target/catalogs/dr9/0.47.0/targets/sv1/resolve/bright/	str	
FAFLAVOR[Page 191, 1]	sv1bgsmws	str	
FAOUTDIR[Page 191, 1]	/software/datasystems/users/raichoor/fiberassign-test/desi-sv1-20201218/	str	
PMTIME[Page 191, 1]	2020-12-18T00:00:00.000	str	
RUNDATE[Page 191, 1]	2020-03-06T00:00:00	str	
SCTARG[Page 191, 1]	STD_WD,BGS_ANY,MWS_ANY	str	
OBSCON[Page 191, 1]	DARK|GRAY|BRIGHT	str	
MODULE[Page 191, 1]	CI	str	
EXPID[Page 191, 1]	69022	int	
EXPFRAME[Page 191, 1]	0	int	
COSMSPLT[Page 191, 1]	F	bool	
MAXSPLIT[Page 191, 1]	0	int	
SPLITIDS[Page 191, 1]	69022	str	
FIBASSGN[Page 191, 1]	/data/tiles/SVN_tiles/080/fiberassign-080616.fits	str	
FLAVOR[Page 191, 1]	science	str	
OBSTYPE[Page 191, 1]	SCIENCE	str	
SEQUENCE[Page 191, 1]	DESI	str	
MANIFEST[Page 191, 1]	F	bool	
OBJECT[Page 191, 1]		str	
PURPOSE[Page 191, 1]	Commissioning	str	
PROGRAM[Page 191, 1]	SV1 BGS+MWS tile 80616	str	
PROPID[Page 191, 1]	2019B-5000	str	
OBSERVER[Page 191, 1]	DESIObserver	str	
LEAD[Page 191, 1]	RunManager	str	
INSTRUME[Page 191, 1]	DESI	str	
OBSERVAT[Page 191, 1]	KPNO	str	
OBS-LAT[Page 191, 1]	31.96403	str	
OBS-LONG[Page 191, 1]	-111.59989	str	
OBS-ELEV[Page 191, 1]	2097.0	float	
TELESCOP[Page 191, 1]	KPNO 4.0-m telescope	str	
CORRCTOR[Page 191, 1]	DESI Corrector	str	
SEQNUM[Page 191, 1]	1	int	
NIGHT[Page 191, 1]	20201220	int	
TIMESYS[Page 191, 1]	UTC	str	
DATE-OBS[Page 191, 1]	2020-12-21T02:36:32.099838	str	
MJD-OBS[Page 191, 1]	59204.10870486	float	
OPENSHUT[Page 191, 1]	2020-12-21T02:36:32.099838	str	
CAMSHUT[Page 191, 1]	open	str	
ST[Page 191, 1]	01:10:39.210	str	
ACQTIME[Page 191, 1]	15.0	float	
GUIDTIME[Page 191, 1]	5.0	float	

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KEY	Example Value	Type	Comment
FOCSTIME[Page 191, 1]	60.0	float	
SKYTIME[Page 191, 1]	60.0	float	
WHITESPT[Page 191, 1]	F	bool	
ZENITH[Page 191, 1]	F	bool	
SEANNEX[Page 191, 1]	F	bool	
BEYONDP[Page 191, 1]	F	bool	
FIDUCIAL[Page 191, 1]	off	str	
BACKLIT[Page 191, 1]	off	str	
AIRMASS[Page 191, 1]	1.060311	float	
FOCUS[Page 191, 1]	1426.5,-501.4,81.0,-2.6,42.3,169.2	str	
VCCD[Page 191, 1]	ON	str	
TRUSTEMP[Page 191, 1]	11.767	float	
PMIRTEMP[Page 191, 1]	8.925	float	
PMREADY[Page 191, 1]	T	bool	
PMCOVER[Page 191, 1]	open	str	
PMCOOL[Page 191, 1]	off	str	
DOMSHUTU[Page 191, 1]	open	str	
DOMSHUTL[Page 191, 1]	open	str	
DOMLIGHH[Page 191, 1]	off	str	
DOMLIGHL[Page 191, 1]	off	str	
DOMEAZ[Page 191, 1]	255.166	float	
DOMINPOS[Page 191, 1]	T	bool	
EQUINOX[Page 191, 1]	2000.0	float	
GUIDOFFR[Page 191, 1]	-0.052283	float	
GUIDOFFD[Page 191, 1]	0.136634	float	
MOONDEC[Page 191, 1]	-8.975162	float	
MOONRA[Page 191, 1]	352.538429	float	
MOUNTAZ[Page 191, 1]	266.70224	float	
MOUNTDEC[Page 191, 1]	28.999221	float	
MOUNTEL[Page 191, 1]	71.039837	float	
MOUNTHA[Page 191, 1]	21.769281	float	
INCTRL[Page 191, 1]	T	bool	
INPOS[Page 191, 1]	T	bool	
MNTOFFD[Page 191, 1]	-15.76	float	
MNTOFFR[Page 191, 1]	29.32	float	
PARALLAC[Page 191, 1]	75.635085	float	
SKYDEC[Page 191, 1]	28.999221	float	
SKYRA[Page 191, 1]	355.996551	float	
TARGTDEC[Page 191, 1]	28.999221	float	
TARGTRA[Page 191, 1]	355.996551	float	
TARGTAZ[Page 191, 1]	267.074049	float	
TARGTEL[Page 191, 1]	70.563787	float	
TRGTOFFD[Page 191, 1]	0.0	float	
TRGTOFFR[Page 191, 1]	0.0	float	
ZD[Page 191, 1]	19.436213	float	
TCSST[Page 191, 1]	01:13:18.668	str	
TCSMJD[Page 191, 1]	59204.110981	float	
USEETC[Page 191, 1]	F	bool	

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KEY	Example Value	Type	Comment
ACQCAM[Page 191, 1]	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	
GUIDECAM[Page 191, 1]	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	
FOCUSCAM[Page 191, 1]	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	
SKYCAM[Page 191, 1]	SKYCAM0,SKYCAM1	str	
REQADC[Page 191, 1]	65.78,85.28	str	
ADCCORR[Page 191, 1]	T	bool	
ADC1PHI[Page 191, 1]	65.780005	float	
ADC2PHI[Page 191, 1]	85.279991	float	
ADC1HOME[Page 191, 1]	F	bool	
ADC2HOME[Page 191, 1]	F	bool	
ADC1NREV[Page 191, 1]	-1.0	float	
ADC2NREV[Page 191, 1]	0.0	float	
ADC1STAT[Page 191, 1]	STOPPED	str	
ADC2STAT[Page 191, 1]	STOPPED	str	
USESKY[Page 191, 1]	T	bool	
USEFOCUS[Page 191, 1]	T	bool	
HEXPOS[Page 191, 1]	1426.5,-501.3,81.0,-2.6,42.3,171.9	str	
HEXTRIM[Page 191, 1]	0.0,0.0,0.0,0.0,0.0,0.0	str	
USEROTAT[Page 191, 1]	T	bool	
ROTOFFST[Page 191, 1]	167.1	float	
ROTENBLD[Page 191, 1]	T	bool	
ROTRATE[Page 191, 1]	0.0	float	
RESETROT[Page 191, 1]	F	bool	
USEPOS[Page 191, 1]	T	bool	
PETALS[Page 191, 1]	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9	str	
POSCYCLE[Page 191, 1]	1	int	
POSONTGT[Page 191, 1]	3626	int	
POSONFRC[Page 191, 1]	0.8613	float	
POSDISAB[Page 191, 1]	37	int	
POSENABL[Page 191, 1]	4210	int	
POSRMS[Page 191, 1]	0.0171	float	
POSITER[Page 191, 1]	1	int	
POSFRACT[Page 191, 1]	0.95	float	
POSTOLER[Page 191, 1]	0.01	float	
POSMVALL[Page 191, 1]	T	bool	
USEGUIDR[Page 191, 1]	T	bool	
GUIDMODE[Page 191, 1]	catalog	str	
USEAOS[Page 191, 1]	F	bool	
USEDONUT[Page 191, 1]	T	bool	
USESPCTR[Page 191, 1]	T	bool	
SPCGRPHS[Page 191, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	
ILLSPECS[Page 191, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	
CCDSPECS[Page 191, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	
TDEWPNT[Page 191, 1]	-16.043	float	
TAIRFLOW[Page 191, 1]	0.0	float	
TAIRITMP[Page 191, 1]	11.8	float	
TAIROTMP[Page 191, 1]	11.7	float	

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KEY	Example Value	Type	Comment
TAIRTEMP[Page 191, 1]	10.65	float	
TCASITMP[Page 191, 1]	0.0	float	
TCASOTMP[Page 191, 1]	10.8	float	
TCSITEMP[Page 191, 1]	9.3	float	
TCSOTEMP[Page 191, 1]	10.8	float	
TCIBTEMP[Page 191, 1]	0.0	float	
TCIMTEMP[Page 191, 1]	0.0	float	
TCITTEMP[Page 191, 1]	0.0	float	
TCOSTEMP[Page 191, 1]	0.0	float	
TCOWTEMP[Page 191, 1]	0.0	float	
TDBTEMP[Page 191, 1]	9.3	float	
TFLOWIN[Page 191, 1]	0.0	float	
TFLOWOUT[Page 191, 1]	0.0	float	
TGLYCOLI[Page 191, 1]	9.9	float	
TGLYCOLO[Page 191, 1]	9.8	float	
THINGES[Page 191, 1]	11.4	float	
THINGEW[Page 191, 1]	11.2	float	
TPMAVERT[Page 191, 1]	8.931	float	
TPMDESIT[Page 191, 1]	7.0	float	
TPMEIBT[Page 191, 1]	8.6	float	
TPMEITT[Page 191, 1]	8.6	float	
TPMEOBT[Page 191, 1]	8.5	float	
TPMEOTT[Page 191, 1]	9.0	float	
TPMNIBT[Page 191, 1]	8.4	float	
TPMNITT[Page 191, 1]	8.9	float	
TPMNOBT[Page 191, 1]	8.8	float	
TPMNOTT[Page 191, 1]	9.1	float	
TPMRTDT[Page 191, 1]	9.0	float	
TPMSIBT[Page 191, 1]	8.6	float	
TPMSITT[Page 191, 1]	8.8	float	
TPMSOBT[Page 191, 1]	8.2	float	
TPMSOTT[Page 191, 1]	8.9	float	
TPMSTAT[Page 191, 1]	ready	str	
TPMWIBT[Page 191, 1]	8.2	float	
TPMWITT[Page 191, 1]	9.1	float	
TPMWOBT[Page 191, 1]	8.3	float	
TPMWOTT[Page 191, 1]	8.9	float	
TPCITEMP[Page 191, 1]	8.5	float	
TPCOTEMP[Page 191, 1]	8.6	float	
TPR1HUM[Page 191, 1]	0.0	float	
TPR1TEMP[Page 191, 1]	0.0	float	
TPR2HUM[Page 191, 1]	0.0	float	
TPR2TEMP[Page 191, 1]	0.0	float	
TSERVO[Page 191, 1]	40.0	float	
TTRSTEMP[Page 191, 1]	11.4	float	
TTRWTEMP[Page 191, 1]	11.0	float	
TTRUETBT[Page 191, 1]	-4.2	float	
TTRUETTT[Page 191, 1]	11.2	float	
TTRUNTBT[Page 191, 1]	10.9	float	

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KEY	Example Value	Type	Comment
TTRUNTTT[Page 191, 1]	11.2	float	
TTRUSTBT[Page 191, 1]	10.7	float	
TTRUSTST[Page 191, 1]	10.8	float	
TTRUSTTT[Page 191, 1]	11.1	float	
TTRUTSBT[Page 191, 1]	11.8	float	
TTRUTSMT[Page 191, 1]	11.8	float	
TTRUTSTT[Page 191, 1]	11.8	float	
TTRUWTBT[Page 191, 1]	10.5	float	
TTRUWTTT[Page 191, 1]	10.9	float	
ALARM[Page 191, 1]	F	bool	
ALARM-ON[Page 191, 1]	F	bool	
BATTERY[Page 191, 1]	100.0	float	
SECLEFT[Page 191, 1]	5178.0	float	
UPSSTAT[Page 191, 1]	System Normal - On Line(7)	str	
INAMPS[Page 191, 1]	70.4	float	
OUTWATTS[Page 191, 1]	5000.0,7200.0,4800.0	str	
COMPDEW[Page 191, 1]	-12.9	float	
COMPHUM[Page 191, 1]	7.4	float	
COMPAMB[Page 191, 1]	19.5	float	
COMPTEMP[Page 191, 1]	24.5	float	
DEWPOINT[Page 191, 1]	11.5	float	
HUMIDITY[Page 191, 1]	10.0	float	
PRESSURE[Page 191, 1]	795.0	float	
OUTTEMP[Page 191, 1]	0.0	float	
WINDDIR[Page 191, 1]	55.0	float	
WINDSPD[Page 191, 1]	27.3	float	
GUST[Page 191, 1]	20.6	float	
AMNIENTN[Page 191, 1]	13.5	float	
CFLOOR[Page 191, 1]	8.9	float	
NWALLIN[Page 191, 1]	13.9	float	
NWALLOUT[Page 191, 1]	9.6	float	
WWALLIN[Page 191, 1]	12.9	float	
WWALLOUT[Page 191, 1]	10.6	float	
AMBIENTS[Page 191, 1]	14.8	float	
FLOOR[Page 191, 1]	12.6	float	
EWALLCMP[Page 191, 1]	10.8	float	
EWALLCOU[Page 191, 1]	10.6	float	
ROOF[Page 191, 1]	10.3	float	
ROOFAMB[Page 191, 1]	10.6	float	
DOMEBLOW[Page 191, 1]	10.4	float	
DOMEBUP[Page 191, 1]	10.7	float	
DOMELLOW[Page 191, 1]	10.8	float	
DOMELUP[Page 191, 1]	10.8	float	
DOMERLOW[Page 191, 1]	10.6	float	
DOMERUP[Page 191, 1]	10.5	float	
PLATFORM[Page 191, 1]	10.4	float	
SHACKC[Page 191, 1]	14.4	float	
SHACKW[Page 191, 1]	13.7	float	

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KEY	Example Value	Type	Comment
STAIRSL[Page 191, 1]	10.5	float	
STAIRSM[Page 191, 1]	10.4	float	
STAIRSU[Page 191, 1]	10.6	float	
TELBASE[Page 191, 1]	9.6	float	
UTILWALL[Page 191, 1]	11.1	float	
UTILROOM[Page 191, 1]	10.9	float	
RADESYS[Page 191, 1]	FK5	str	
TNFSPROC[Page 191, 1]	8.1963	float	
TGFAPROC[Page 191, 1]	7.9212	float	
SIMGFAP[Page 191, 1]	F	bool	
USEFVC[Page 191, 1]	T	bool	
USEFID[Page 191, 1]	T	bool	
USEILLUM[Page 191, 1]	T	bool	
USEXSRVR[Page 191, 1]	T	bool	
USEOPENL[Page 191, 1]	T	bool	
STOPGUDR[Page 191, 1]	T	bool	
STOPFOCS[Page 191, 1]	T	bool	
STOPSKY[Page 191, 1]	T	bool	
KEEPGUDR[Page 191, 1]	F	bool	
KEEPFOCS[Page 191, 1]	F	bool	
KEEPSKY[Page 191, 1]	F	bool	
REACQUIR[Page 191, 1]	F	bool	
FILENAME[Page 191, 1]	/exposures/desi/20201220/00069022/desi-00069022.fits.fz	str	
EXCLUDED[Page 191, 1]		str	
DOSVER[Page 191, 1]	trunk	str	
OCSVER[Page 191, 1]	1.2	float	
CONSTVER[Page 191, 1]	DESI:CURRENT	str	
INIFILE[Page 191, 1]	/data/msdos/dos_home/architectures/kpno/desi.ini	str	
REQTIME[Page 191, 1]	300.0	float	
FVCTIME[Page 191, 1]	2.0	float	
SIMGFACQ[Page 191, 1]	F	bool	
POSCNVGD[Page 191, 1]	F	bool	
GUIEXPID[Page 191, 1]	69022	int	
IGFRMNUM[Page 191, 1]	12	int	
FOCEXPID[Page 191, 1]	69022	int	
IFFRMNUM[Page 191, 1]	1	int	
SKYEXPID[Page 191, 1]	69022	int	
ISFRMNUM[Page 191, 1]	1	int	
FGFRMNUM[Page 191, 1]	46	int	
FFFRMNUM[Page 191, 1]	6	int	
FSFRMNUM[Page 191, 1]	5	int	
FRAMES[Page 191, 1]	47	int	
DELTARA[Page 191, 1]	None	float	
DELTADEC[Page 191, 1]	None	float	
GSGUIDE0[Page 191, 1]	(980.05,685.98),(878.97,731.68)	str	
GSGUIDE2[Page 191, 1]	(372.65,939.43),(784.50,1529.96)	str	
GSGUIDE3[Page 191, 1]	(365.22,1423.83),(249.12,411.52)	str	
GSGUIDE5[Page 191, 1]	(848.52,78.26),(516.16,1410.54)	str	

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KEY	Example Value	Type	Comment
GSGUIDE7[Page 191, 1]	(540.95,1848.95),(504.68,831.62)	str	
GSGUIDE8[Page 191, 1]	(720.29,552.69),(499.80,465.13)	str	
ARCHIVE[Page 191, 1]	/exposures/desi/20201220/00069022/guide-00069022.fits.fz	str	
GUIDEFIL[Page 191, 1]	guide-00069022.fits.fz	str	
COORDFIL[Page 191, 1]	coordinates-00069022.fits	str	
TIME-OBS[Page 191, 1]	02:39:11.845920	str	
EXPTIME[Page 191, 1]	300.007	float	
VCCDON[Page 191, 1]	2020-12-09T21:23:25.472733	str	
VCCDSEC[Page 191, 1]	969696.0	float	
SPECGRPH[Page 191, 1]	6	int	
SPECID[Page 191, 1]	7	int	
FEEBOX[Page 191, 1]	lbnl061	str	
VESSEL[Page 191, 1]	21	int	
FEEVER[Page 191, 1]	v20160312	str	
FEEPOWER[Page 191, 1]	ON	str	
FEEDMASK[Page 191, 1]	2134851391	int	
FEECMASK[Page 191, 1]	1048575	int	
CCDTEMP[Page 191, 1]	-134.1517	float	
PRESECC[Page 191, 1]	[1:7, 2130:4193]	str	
CLOCK13[Page 191, 1]	9.9992,2.9993	str	
DETECTOR[Page 191, 1]	M1-51	str	
SETTINGS[Page 191, 1]	detectors_sm_20191211.json	str	
PRRSECA[Page 191, 1]	[8:2064, 1:1]	str	
CLOCK11[Page 191, 1]	9.9992,2.9993	str	
OFFSET2[Page 191, 1]	0.4000000059604645,-8.9507	str	
AMPSECC[Page 191, 1]	[1:2057, 4128:2065]	str	
DAC11[Page 191, 1]	-25.0003,-25.0351	str	
CLOCK1[Page 191, 1]	9.9999,0.0	str	
DAC7[Page 191, 1]	5.9998,6.0017	str	
DAC16[Page 191, 1]	39.9961,39.5472	str	
CCDSECB[Page 191, 1]	[2058:4114, 1:2064]	str	
CLOCK17[Page 191, 1]	9.0,0.9999	str	
CLOCK5[Page 191, 1]	9.9999,0.0	str	
AMPSECB[Page 191, 1]	[4114:2058, 1:2064]	str	
CLOCK4[Page 191, 1]	9.9999,0.0	str	
DETSECB[Page 191, 1]	[2058:4114, 1:2064]	str	
BIASSECA[Page 191, 1]	[2065:2128, 2:2065]	str	
CRYOPRES[Page 191, 1]	2.938e-07	str	
CCDTMING[Page 191, 1]	default_lbnl_timing_20180905.txt	str	
CLOCK9[Page 191, 1]	9.9992,2.9993	str	
PGAGAIN[Page 191, 1]	3	int	
CLOCK6[Page 191, 1]	9.9999,0.0	str	
OFFSET3[Page 191, 1]	0.4000000059604645,-8.8889	str	

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KEY	Example Value	Type	Comment
PRRSECB[Page 191, 1]	[2193:4249, 1:1]	str	
DAC5[Page 191, 1]	5.9998,6.0174	str	
CLOCK3[Page 191, 1]	-2.0001,3.9999	str	
DAC14[Page 191, 1]	0.0,-0.0297	str	
CLOCK15[Page 191, 1]	9.9992,2.9993	str	
AMPSECD[Page 191, 1]	[4114:2058, 4128:2065]	str	
CCDSECA[Page 191, 1]	[1:2057, 1:2064]	str	
DAC9[Page 191, 1]	-25.0003,-25.0351	str	
DAC10[Page 191, 1]	-25.0003,-24.8273	str	
CCDPREP[Page 191, 1]	purge,clear	str	
DAC4[Page 191, 1]	5.9998,6.0437	str	
OFFSET4[Page 191, 1]	2.0,6.049	str	
BLDTIME[Page 191, 1]	0.3499	float	
CLOCK16[Page 191, 1]	9.9999,3.0	str	
DAC2[Page 191, 1]	-9.0002,-8.961	str	
OFFSET1[Page 191, 1]	0.4000000059604645,-8.9507	str	
CLOCK10[Page 191, 1]	9.9992,2.9993	str	
OFFSET7[Page 191, 1]	2.0,6.0017	str	
ORSECD[Page 191, 1]	[2193:4249, 2098:2129]	str	
OFFSET0[Page 191, 1]	0.4000000059604645,-8.9713	str	
CLOCK0[Page 191, 1]	9.9999,0.0	str	
CRYOTEMP[Page 191, 1]	139.986	float	
DATASECB[Page 191, 1]	[2193:4249, 2:2065]	str	
DAC6[Page 191, 1]	5.9998,6.049	str	
DAC12[Page 191, 1]	0.0,-0.0148	str	
CLOCK2[Page 191, 1]	9.9999,0.0	str	
TRIMSECC[Page 191, 1]	[8:2064, 2130:4193]	str	
PRRSECD[Page 191, 1]	[2193:4249, 4194:4194]	str	
DAC15[Page 191, 1]	0.0,0.0	str	
DATASECA[Page 191, 1]	[8:2064, 2:2065]	str	
DAC3[Page 191, 1]	-9.0002,-8.8889	str	
CCDSIZE[Page 191, 1]	4194,4256	str	
AMPSECA[Page 191, 1]	[1:2057, 1:2064]	str	
PRESECD[Page 191, 1]	[4250:4256, 2130:4193]	str	
ORSECA[Page 191, 1]	[8:2064, 2066:2097]	str	
CCDSECC[Page 191, 1]	[1:2057, 2065:4128]	str	
CLOCK18[Page 191, 1]	9.0,0.9999	str	
DETSECD[Page 191, 1]	[2058:4114, 2065:4128]	str	
CCDSECD[Page 191, 1]	[2058:4114, 2065:4128]	str	
CPUTEMP[Page 191, 1]	57.1172	float	
DELAYS[Page 191, 1]	20, 20, 25, 40, 7, 3000, 7, 7, 7, 7	str	
DATASECD[Page 191, 1]	[2193:4249, 2130:4193]	str	
BIASSECC[Page 191, 1]	[2065:2128, 2130:4193]	str	
CCDCFG[Page 191, 1]	default_lbnl_20190717.cfg	str	
DATASECC[Page 191, 1]	[8:2064, 2130:4193]	str	

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KEY	Example Value	Type	Comment
BIASSECD[Page 191, 1]	[2129:2192, 2130:4193]	str	
PRESECA[Page 191, 1]	[1:7, 2:2065]	str	
OFFSET6[Page 191, 1]	2.0,6.0543	str	
DETSECC[Page 191, 1]	[1:2057, 2065:4128]	str	
DAC13[Page 191, 1]	0.0,-0.0297	str	
DETSECA[Page 191, 1]	[1:2057, 1:2064]	str	
PRRSECC[Page 191, 1]	[8:2064, 4194:4194]	str	
CLOCK12[Page 191, 1]	9.9992,2.9993	str	
CASETEMP[Page 191, 1]	56.8611	float	
BIASSECB[Page 191, 1]	[2129:2192, 2:2065]	str	
OFFSET5[Page 191, 1]	2.0,6.0174	str	
CLOCK7[Page 191, 1]	-2.0001,3.9999	str	
CLOCK8[Page 191, 1]	9.9992,2.9993	str	
CAMERA[Page 191, 1]	z6	str	
PRESECB[Page 191, 1]	[4250:4256, 2:2065]	str	
TRIMSECB[Page 191, 1]	[2193:4249, 2:2065]	str	
DAC17[Page 191, 1]	20.0008,11.9316	str	
DIGITIME[Page 191, 1]	47.5453	float	
TRIMSECD[Page 191, 1]	[2193:4249, 2130:4193]	str	
DAC8[Page 191, 1]	-25.0003,-24.6196	str	
TRIMSECA[Page 191, 1]	[8:2064, 2:2065]	str	
CLOCK14[Page 191, 1]	9.9992,2.9993	str	
DAC0[Page 191, 1]	-9.0002,-8.9713	str	
CDSPARMS[Page 191, 1]	400, 400, 8, 2000	str	
DAC1[Page 191, 1]	-9.0002,-8.9507	str	
ORSECC[Page 191, 1]	[8:2064, 2098:2129]	str	
ORSECB[Page 191, 1]	[2193:4249, 2066:2097]	str	
CCDNAME[Page 191, 1]	CCDSM7Z	str	
OBSID[Page 191, 1]	kp4m20201221t023911	str	
PROCTYPE[Page 191, 1]	RAW	str	
PRODTYPE[Page 191, 1]	image	str	
GAINA[Page 191, 1]	1.387	float	
SATULEVA[Page 191, 1]	61000.0	float	
OSTEPA[Page 191, 1]	0.7319095199345611	float	
OMETHA[Page 191, 1]	AVERAGE	str	
OVERSCNA[Page 191, 1]	1966.054034223049	float	
OBSRDNA[Page 191, 1]	2.176414404248625	float	
SATUELEA[Page 191, 1]	81880.08305453263	float	
GAINB[Page 191, 1]	1.518	float	
SATULEVB[Page 191, 1]	65535.0	float	
OSTEPB[Page 191, 1]	0.5937273930649098	float	
OMETHB[Page 191, 1]	AVERAGE	str	
OVERSCNB[Page 191, 1]	1987.334317960662	float	
OBSRDNB[Page 191, 1]	2.29569819578003	float	
SATUELEB[Page 191, 1]	96465.35650533572	float	
GAINC[Page 191, 1]	1.534	float	
SATULEVC[Page 191, 1]	40000.0	float	
OSTEPC[Page 191, 1]	0.9199855706829112	float	
OMETHC[Page 191, 1]	AVERAGE	str	

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Table 23 – continued from previous page

KEY	Example Value	Type	Comment
OVERSCNC[Page 191, 1]	1980.643479043017	float	
OBSRDNC[Page 191, 1]	2.511180716174036	float	
SATUELEC[Page 191, 1]	58321.69290314802	float	
GAIND[Page 191, 1]	1.554	float	
SATULEVD[Page 191, 1]	62000.0	float	
OSTEPD[Page 191, 1]	1.375711494358256	float	
OMETHD[Page 191, 1]	AVERAGE	str	
OVERSCND[Page 191, 1]	1982.563334159938	float	
OBSRDND[Page 191, 1]	2.417154801423475	float	
SATUELED[Page 191, 1]	93267.09657871546	float	
FIBERMIN[Page 191, 1]	3000	int	
ENCODING[Page 191, 1]	ascii	str	
CHECKSUM[Page 191, 1]	aRITbQHRaQHRaQHR	str	HDU checksum updated 2022-02-14T08:22:46
DATASUM[Page 191, 1]	3195504281	str	data unit checksum updated 2022-02-14T08:22:46
NTSSURVY[Page 191, 1]	sv2	str	
SP8NIRP[Page 191, 1]	4.941e-08	float	
TCSPIDEC[Page 191, 1]	1.0,0.0,0.0,0.0	str	
SP3REDP[Page 191, 1]	5.506e-08	float	
USESPLITS[Page 191, 1]	T	bool	
SBPROF[Page 191, 1]	ELG	str	
SP9NIRP[Page 191, 1]	5.207e-08	float	
SP0REDT[Page 191, 1]	139.96	float	
SP8REDT[Page 191, 1]	139.94	float	
SP2REDT[Page 191, 1]	139.99	float	
SEQSTART[Page 191, 1]	2021-04-04T06:46:24.391377	str	
SP0NIRP[Page 191, 1]	5.865e-08	float	
SP3NIRP[Page 191, 1]	5.524e-08	float	
SP7REDT[Page 191, 1]	139.99	float	
GOALTYPE[Page 191, 1]	DARK	str	
PMSEEING[Page 191, 1]	0.85	float	
SP6REDT[Page 191, 1]	139.94	float	
SP7NIRT[Page 191, 1]	139.96	float	
SP4BLUT[Page 191, 1]	163.02	float	
ACTTEFF[Page 191, 1]	1513.0686	float	
SP2NIRT[Page 191, 1]	139.91	float	
SP5NIRT[Page 191, 1]	139.94	float	
SP2BLUT[Page 191, 1]	163.02	float	
SP1BLUP[Page 191, 1]	7.808e-08	float	
SP4REDP[Page 191, 1]	4.72e-08	float	
SP8BLUP[Page 191, 1]	8.119e-08	float	
SP5BLUT[Page 191, 1]	163.02	float	
SP2REDP[Page 191, 1]	5.348e-08	float	
SP0REDP[Page 191, 1]	5.012e-08	float	
SP2BLUP[Page 191, 1]	7.391e-08	float	
SP9NIRT[Page 191, 1]	139.89	float	

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KEY	Example Value	Type	Comment
SURVEY[Page 191, 1]	sv2	str	
MTL[Page 191, 1]	DESI-ROOT/target/mtl/0.53.0/mtl/sv2/dark	str	
SP6NIRT[Page 191, 1]	139.89	float	
FAARGS[Page 191, 1]	–doclean n –dr dr9 –dtver 0.53.0 –gaiadr gaiadr2 –goaltime 1000.0 –mintfrac 0.9 –pmcorr n –pmtime 2021-04-03T00:00:00.000 –program DARK –rundate 2021-03-17T23:20:01 –sbprof ELG –sky_per_petal 80 –standards_per_petal 40 –survey sv2 –tiledec 57.924 –tileid 81014 –tilera 190.731	str	
SP5BLUP[Page 191, 1]	1.125e-07	float	
TCSKDEC[Page 191, 1]	0.3 0.003 0.00003	str	
VISITIDS[Page 191, 1]	89039	str	
SP6BLUT[Page 191, 1]	163.02	float	
SP1BLUT[Page 191, 1]	163.02	float	
TCSGRA[Page 191, 1]	0.3	float	
SP5REDP[Page 191, 1]	5.121e-08	float	
TCSKRA[Page 191, 1]	0.3 0.003 0.00003	str	
USESPLIT[Page 191, 1]	T	bool	
SP4REDT[Page 191, 1]	140.01	float	
SP8NIRT[Page 191, 1]	139.99	float	
SP0NIRT[Page 191, 1]	139.89	float	
SP6NIRP[Page 191, 1]	2.811e-07	float	
SP6BLUP[Page 191, 1]	7.054e-08	float	
SP9BLUT[Page 191, 1]	163.02	float	
SP4BLUP[Page 191, 1]	4.868e-08	float	
TCSPIRA[Page 191, 1]	1.0,0.0,0.0,0.0	str	
SP7REDP[Page 191, 1]	4.279e-08	float	
GOALTIME[Page 191, 1]	1000.0	float	
SP8BLUT[Page 191, 1]	162.9	float	
SP8REDP[Page 191, 1]	8.401e-08	float	
SP3BLUT[Page 191, 1]	163.02	float	
SPLITEXP[Page 191, 1]	F	bool	
SP3REDT[Page 191, 1]	139.96	float	
SUNDEC[Page 191, 1]	5.800279	float	
SP1NIRP[Page 191, 1]	8.133e-08	float	
SCND[Page 191, 1]	•	str	
SP2NIRP[Page 191, 1]	5.339e-08	float	
SUNRA[Page 191, 1]	13.554748	float	
SP6REDP[Page 191, 1]	6.486e-08	float	

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Table 23 – continued from previous page

KEY	Example Value	Type	Comment
MOONSEP[Page 191, 1]	113.991	float	
TCSGDEC[Page 191, 1]	0.3	float	
EBVFAC[Page 191, 1]	1.02038914440859	float	
PMCORR[Page 191, 1]	n	str	
TCSMFDEC[Page 191, 1]	1	int	
FAPRGRM[Page 191, 1]	DARK	str	
DESIROOT[Page 191, 1]	/global/cfs/cdirs/desi	str	
SP3NIRT[Page 191, 1]	140.01	float	
SP0BLUT[Page 191, 1]	162.99	float	
SP9REDP[Page 191, 1]	4.354e-08	float	
SEEING[Page 191, 1]	0.8607	float	
MTLTIME[Page 191, 1]	2021-04-03T20:57:07	str	
SP9BLUP[Page 191, 1]	1.208e-07	float	
SP7BLUP[Page 191, 1]	9.947e-08	float	
SP4NIRT[Page 191, 1]	139.96	float	
SP9REDT[Page 191, 1]	140.01	float	
TCSMFRA[Page 191, 1]	1	int	
SP1NIRT[Page 191, 1]	139.89	float	
SP3BLUP[Page 191, 1]	9.345e-08	float	
PMTRANS[Page 191, 1]	93.76	float	
MINTFRAC[Page 191, 1]	0.9	float	
SP1REDT[Page 191, 1]	139.89	float	
SKYLEVEL[Page 191, 1]	0.933	float	
SP4NIRP[Page 191, 1]	6.914999999999999e-08	float	
REQTEFF[Page 191, 1]	1000.0	float	
SP7BLUT[Page 191, 1]	163.02	float	
SP5REDT[Page 191, 1]	139.99	float	
SP7NIRP[Page 191, 1]	6.211e-08	float	
SP1REDP[Page 191, 1]	6.567e-08	float	
SP5NIRP[Page 191, 1]	9.462e-08	float	
SP0BLUP[Page 191, 1]	9.115e-08	float	
BBKGMAXC[Page 191, 1]	0.4492153969301811	float	
BBKGMIND[Page 191, 1]	-0.3135937336084521	float	
BBKGMAXB[Page 191, 1]	0.5049607921526409	float	
BBKGMINA[Page 191, 1]	-0.2211057823638513	float	
BBKGMINB[Page 191, 1]	-0.3689821920680901	float	
BBKGMINC[Page 191, 1]	-0.3614105403549326	float	
BBKGMAXA[Page 191, 1]	0.7513851072600307	float	
BBKGMAXD[Page 191, 1]	0.3423400768828577	float	
TOO[Page 191, 1]	DESI-ROOT/survey/ops/surveyops/trunk/mtl/sv3/ToO/ToO.ecsv	str	
SVNDM[Page 191, 1]	unknown	str	
CONVERGD[Page 191, 1]	F	bool	
TOTTEFF[Page 191, 1]	1214.7279	float	
SLEWANGL[Page 191, 1]	49.575	float	
SCNDMTL[Page 191, 1]	DESI-ROOT/survey/ops/surveyops/trunk/mtl/sv3/secondary/dark	str	
POSCVFRC[Page 191, 1]	0.4393	float	
SVNMTL[Page 191, 1]	unknown	str	

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Table 23 – continued from previous page

KEY	Example Value	Type	Comment
FASCRIPT[Page 191, 1]	/software/datasystems/desiconda/20200924/code/fiberassign/3.0.0/bin/fba_launch	str	
TARG2[Page 191, 1]	DESIROOT/target/catalogs/gaiadr2/0.50.0/targets/sv1/resolve/supp	str	
SCSTD[Page 191, 1]	STD_WD,STD_BRIGHT	str	
SEQID[Page 191, 1]	5 requests	str	
SEQTOT[Page 191, 1]	5	int	
SIMGFAQ[Page 191, 1]	F	bool	
ETCFRACB[Page 191, 1]	0.13642	float	
ETCFRACP[Page 191, 1]	0.390556	float	
ETCTEFF[Page 191, 1]	61.258228	float	
ETCFRACE[Page 191, 1]	0.300922	float	
NTSPROG[Page 191, 1]	BACKUP	str	
ETCTHRUB[Page 191, 1]	0.535631	float	
ETCSPLIT[Page 191, 1]	1	int	
ETCTRANS[Page 191, 1]	0.745415	float	
ETCREAL[Page 191, 1]	348.878632	float	
ETCVERS[Page 191, 1]	0.1.12-3-g12b54bb	str	
ETCTHRUP[Page 191, 1]	0.518037	float	
MAXTIME[Page 191, 1]	5400.0	float	
ETCSKY[Page 191, 1]	1.60973	float	
ESTTIME[Page 191, 1]	1500.571	float	
TRANSPAR[Page 191, 1]	None	float	
ETCPROF[Page 191, 1]	PSF	str	
MINTIME[Page 191, 1]	60.0	float	
PMTRANSP[Page 191, 1]	115.88	float	
ETCSEENG[Page 191, 1]	2.1165	float	
ACQFWHM[Page 191, 1]	2.116458	float	
ETCTHRUE[Page 191, 1]	0.544181	float	
ETCPREV[Page 191, 1]	0.0	float	
PRIORITY[Page 191, 1]	default	str	
DR[Page 191, 1]	dr9	str	
M31CEN[Page 191, 1]	n	str	
DTVER[Page 191, 1]	0.50.0	str	
ROLE[Page 191, 1]	GUIDERMAN	str	
SHFTFOCS[Page 191, 1]	500.0	float	
TARG3[Page 191, 1]	DESIROOT/target/catalogs/dr9/0.51.0/targets/sv1/resolve/bright	str	

Required Data Table Columns

Name	Type	Units	Description
TARGETID[Page 191, 1]	int64		Unique DESI target ID
PETAL_LOC[Page 191, 1]	int16		Petal location [0-9]
DEVICE_LOC[Page 191, 1]	int32		Device location on focal plane [0-523]
LOCATION[Page 191, 1]	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_
FIBER[Page 191, 1]	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS[Page 191, 1]	int32		Fiber status mask. 0=good

Table 24 – continued from previous page

Name	Type	Units	Description
TARGET_RA[Page 191, 1]	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC[Page 191, 1]	float64	deg	Barycentric declination in ICRS
PMRA[Page 191, 1]	float32	mas yr^-1	proper motion in the +RA direction (already including cos(d
PMDEC[Page 191, 1]	float32	mas yr^-1	Proper motion in the +Dec direction
REF_EPOCH[Page 191, 1]	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.
LAMBDA_REF[Page 191, 1]	float32	Angstrom	Requested wavelength at which targets should be centered or
FA_TARGET[Page 191, 1]	int64		Targeting bit internally used by fiberassign (linked with FA_
FA_TYPE[Page 191, 1]	binary		Fiberassign internal target type (science, standard, sky, safe,
OBJTYPE[Page 191, 1]	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X[Page 191, 1]	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y[Page 191, 1]	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY[Page 191, 1]	int32		Target current priority
SUBPRIORITY[Page 191, 1]	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS[Page 191, 1]	int32		Bitmask of allowed observing conditions
RELEASE[Page 191, 1]	int16		Imaging surveys release ID
BRICKNAME[Page 191, 1]	char[8]		Brick name from tractor input
BRICKID[Page 191, 1]	int32		Brick ID from tractor input
BRICK_OBJID[Page 191, 1]	int32		Imaging Surveys OBJID on that brick
MORPHTYPE[Page 191, 1]	char[4]		Imaging Surveys morphological type from Tractor
EBV[Page 191, 1]	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_G[Page 191, 1]	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R[Page 191, 1]	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z[Page 191, 1]	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_W1[Page 191, 1]	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2[Page 191, 1]	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_G[Page 191, 1]	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R[Page 191, 1]	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z[Page 191, 1]	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
FLUX_IVAR_W1[Page 191, 1]	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2[Page 191, 1]	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G[Page 191, 1]	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec fr
FIBERFLUX_R[Page 191, 1]	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec fro
FIBERFLUX_Z[Page 191, 1]	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec fr
FIBERTOTFLUX_G[Page 191, 1]	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec fr
FIBERTOTFLUX_R[Page 191, 1]	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec fro
FIBERTOTFLUX_Z[Page 191, 1]	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec fr
MASKBITS[Page 191, 1]	int16		Bitwise mask from the imaging indicating potential issue or
SERSIC[Page 191, 1]	float32		Power-law index for the Sersic profile model (MORPHTYPE
SHAPE_R[Page 191, 1]	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1[Page 191, 1]	float32		Ellipticity component 1 of galaxy model for galaxy type MO
SHAPE_E2[Page 191, 1]	float32		Ellipticity component 2 of galaxy model for galaxy type MO
REF_ID[Page 191, 1]	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; `sourceid` for
REF_CAT[Page 191, 1]	char[2]		Reference catalog source for star: 'T2' for Tych
GAIA_PHOT_G_MEAN_MAG[Page 191, 1]	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG[Page 191, 1]	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG[Page 191, 1]	float32	mag	Gaia RP band magnitude
PARALLAX[Page 191, 1]	float32	mas	Reference catalog parallax
PHOTSYS[Page 191, 1]	char[1]		'N' for the MzLS/BASS photometric system, &
PRIORITY_INIT[Page 191, 1]	int64		Target initial priority from target selection bitmasks and OBS

Table 24 – continued from previous page

Name	Type	Units	Description
NUMOBS_INIT[Page 191, 1]	int64		Initial number of observations for target calculated across tar
DESI_TARGET[Page 191, 1]	int64		DESI (dark time program) target selection bitmask
BGS_TARGET[Page 191, 1]	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET[Page 191, 1]	int64		Milky Way Survey targeting bits
SCND_TARGET[Page 191, 1]	int64		Target selection bitmask for secondary programs
PLATE_RA[Page 191, 1]	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMa
PLATE_DEC[Page 191, 1]	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER[Page 191, 1]	int64		Number of positioner iterations
FIBER_X[Page 191, 1]	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y[Page 191, 1]	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X[Page 191, 1]	float64	mm	CS5 X requested minus actual position
DELTA_Y[Page 191, 1]	float64	mm	CS5 Y requested minus actual position
FIBER_RA[Page 191, 1]	float64	deg	RA of actual fiber position
FIBER_DEC[Page 191, 1]	float64	deg	DEC of actual fiber position
EXPTIME[Page 191, 1]	float64	s	Length of time shutter was open
SV2_BGS_TARGET[Page 191, 1]	int64		BGS (bright time program) target selection bitmask for SV2
SV2_SCND_TARGET[Page 191, 1]	int64		Secondary target selection bitmask for SV2
SV2_MWS_TARGET[Page 191, 1]	int64		MWS (bright time program) target selection bitmask for SV2
SV2_DESI_TARGET[Page 191, 1]	int64		DESI (dark time program) target selection bitmask for SV2
SV1_DESI_TARGET[Page 191, 1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_SCND_TARGET[Page 191, 1]	int64		Secondary target selection bitmask for SV1
SV1_BGS_TARGET[Page 191, 1]	int64		BGS (bright time program) target selection bitmask for SV1
SV1_MWS_TARGET[Page 191, 1]	int64		MWS (bright time program) target selection bitmask for SV1
SV3_MWS_TARGET[Page 191, 1]	int64		MWS (bright time program) target selection bitmask for SV3
SV3_DESI_TARGET[Page 191, 1]	int64		DESI (dark time program) target selection bitmask for SV3
SV3_SCND_TARGET[Page 191, 1]	int64		Secondary target selection bitmask for SV3
SV3_BGS_TARGET[Page 191, 1]	int64		BGS (bright time program) target selection bitmask for SV3

Notes and Examples

We may add an additional HDU with `EXTNAME=METADATA` containing a binary table with one row per standard star giving the details of which model was used, etc. This is not yet implemented and details TBD.

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

frame-CAMERA-EXPID.fits

Summary
Frame files contain the raw extracted electrons from DESI data, without any further calibration.

Naming Convention
`frame-{CAMERA}-{EXPID}.fits`, where `{CAMERA}` is one of the spectrograph cameras (*e.g.* `z1`) and `{EXPID}` is the 8-digit exposure ID.

Regex
`frame-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 70 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	FLUX	IMAGE	Extracted flux in electrons per Angstrom
HDU1	IVAR	IMAGE	Inverse variance of the extracted flux
HDU2	MASK	IMAGE	Bad value mask; 0=good
HDU3	WAVELENGTH	IMAGE	Wavelength grid of the extraction (Angstrom)
HDU4	RESOLUTION	IMAGE	Resolution matrix
HDU5	FIBERMAP	BINTABLE	Fibermap
HDU6	CHI2PIX	IMAGE	chi2 of PSF fit to CCD pixels

FITS Header Units

HDU0

EXTNAME = FLUX

2D array of extracted flux[nspec, nwave] in units of electrons per Angstrom. nspec is the number of fibers per camera. nwave in the length of the wavelength array. The spectra of all fibers share the same wavelength grid (given in HDU WAVELENGTH).

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
NAXIS2	500	int	
EXPID	68979	int	Exposure number
EXPFRAME	0	int	Frame number
FLAVOR	science	str	Observation type
SEQUENCE	Spectrographs	str	OCS Sequence name
PURPOSE	Commissioning	str	Purpose of observing night
PROGRAM	CALIB DESI-CALIB-00 LEDs only	str	Program name

continues on next page

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KEY	Example Value	Type	Comment
PROPID	2019B-5000	str	Proposal ID
OBSERVER	DESIObserver	str	Names of observers
LEAD	RunManager	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20201220	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2020-12-20T22:24:15.672815	str	[UTC] Observation data and start time
TIME-OBS	22:24:15.672815	str	[UTC] Observation start time
MJD-OBS	59203.93351473	float	Modified Julian Date of observation
ST	20:57:41.340	str	Local Sidereal time at observation start (HH:MM
EXPTIME	120.037	float	[s] Actual exposure time
DELTARA[1]	0.0	float	[arcsec] Offset], right ascension, observer inp
DELTADEC[Page 227, 1]	0.0	float	[arcsec] Offset], declination, observer input
VCCD	ON	str	True (ON) if CCD voltage is on
VCCDON	2020-12-14T04:22:19.522101	str	Time when CCD voltage was turned on
VCCDSEC	583485.8	float	[s] CCD on time in seconds
EQUINOX	2000.0	float	Epoch of observation
SPECGRPH	5	int	Spectrograph logical name (SP)
SPECID	9	int	Spectrograph serial number (SM)
FEEBOX	lbnl057	str	CCD Controller serial number
VESSEL	26	int	Cryostat serial number
FEEVER	v20160312	str	CCD Controller version
FEEPOWER	ON	str	FEE power status
FEEDMASK	2134851391	int	FEE dac mask
FEECMASK	1048575	int	FEE clk mask
CCDTEMP	-135.8073	float	[deg C] CCD controller CCD temperature
RADESYS	FK5	str	Coordinate reference frame of major/minor axes

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KEY	Example Value	Type	Comment
FILENAME	/exposures/desi/specs/20201220/00068979/sp9-00068979.fits.fz	str	Name
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
DAC3	-9.0002,-8.9919	str	[V] set value, measured value
CLOCK5	9.9999,0.0	str	[V] high rail, low rail
BLDTIME	0.3522	float	[s] Time to build image
CLOCK2	9.9999,0.0	str	[V] high rail, low rail
BIASSECD	[2129:2192, 2130:4193]	str	Bias section for quadrant D
PGAGAIN	3	int	Controller gain
OFFSET5	2.0,5.9964	str	[V] set value, measured value
BIASSECB	[2129:2192, 2:2065]	str	Bias section for quadrant B
CLOCK4	9.9999,0.0	str	[V] high rail, low rail
ORSECD	[2193:4249, 2098:2129]	str	Row bias section for quadrant D
DAC2	-9.0002,-8.9404	str	[V] set value, measured value
DAC6	5.9998,6.0437	str	[V] set value, measured value
CCDPREP	purge,clear	str	CCD prep actions
CASETEMP	59.322	float	[deg C] CCD controller case temperature
DAC15	0.0,-0.0148	str	[V] set value, measured value
DAC16	39.9961,39.8706	str	[V] set value, measured value
DAC9	-25.0003,-24.6344	str	[V] set value, measured value
AMPSECB	[4114:2058, 1:2064]	str	AMP section for quadrant B
DAC11	-25.0003,-24.5157	str	[V] set value, measured value
DELAYS	20, 20, 25, 40, 7, 3000, 7, 7, 7, 7	str	[10] Delay settings
CLOCK13	9.9992,2.9993	str	[V] high rail, low rail
PRESECD	[4250:4256, 2130:4193]	str	Prescan section for quadrant D
CDSPARMS	400, 400, 8, 2000	str	CDS parameters
DATASECD	[2193:4249, 2130:4193]	str	Data section for quadrant D
CLOCK15	9.9992,2.9993	str	[V] high rail, low rail
CLOCK18	9.0,0.9999	str	[V] high rail, low rail
CLOCK8	9.9992,2.9993	str	[V] high rail, low rail

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KEY	Example Value	Type	Comment
OFFSET7	2.0,6.0122	str	[V] set value, measured value
DAC8	-25.0003,-24.946	str	[V] set value, measured value
CCDSECC	[1:2057, 2065:4128]	str	CCD section for quadrant C
CLOCK14	9.9992,2.9993	str	[V] high rail, low rail
CLOCK3	-2.0001,3.9999	str	[V] high rail, low rail
DIGITIME	47.5948	float	[s] Time to digitize image
CLOCK1	9.9999,0.0	str	[V] high rail, low rail
PRRSECD	[2193:4249, 4194:4194]	str	Row prescan section for quadrant D
CLOCK9	9.9992,2.9993	str	[V] high rail, low rail
CCDNAME	CCDSM9R	str	CCD name
DETSECB	[2058:4114, 1:2064]	str	Detector section for quadrant B
CCDSECA	[1:2057, 1:2064]	str	CCD section for quadrant A
DETSECD	[2058:4114, 2065:4128]	str	Detector section for quadrant D
DATASECB	[2193:4249, 2:2065]	str	Data section for quadrant B
CRYOPRES[Page 227, 1]	1.166e-07	str	[mb] Cryostat pressure (IP)
CAMERA	r5	str	Camera name
PRRSECA	[8:2064, 1:1]	str	Row prescan section for quadrant A
DAC1	-9.0002,-8.9507	str	[V] set value, measured value
PRESECC	[1:7, 2130:4193]	str	Prescan section for quadrant C
TRIMSECA	[8:2064, 2:2065]	str	Trim section for quadrant A
TRIMSECD	[2193:4249, 2130:4193]	str	Trim section for quadrant D
CCDCFG	default_lbnl_20190717.cfg	str	CCD configuration file
PRRSECB	[2193:4249, 1:1]	str	Row prescan section for quadrant B
CLOCK12	9.9992,2.9993	str	[V] high rail, low rail
CCDSECB	[2058:4114, 1:2064]	str	CCD section for quadrant B
TRIMSECB	[2193:4249, 2:2065]	str	Trim section for quadrant B
DATASECA	[8:2064, 2:2065]	str	Data section for quadrant A
DAC17	20.0008,12.3342	str	[V] set value, measured value
CLOCK17	9.0,0.9999	str	[V] high rail, low rail

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KEY	Example Value	Type	Comment
PRESECB	[4250:4256, 2:2065]	str	Prescan section for quadrant B
CLOCK0	9.9999,0.0	str	[V] high rail, low rail
PRESECA	[1:7, 2:2065]	str	Prescan section for quadrant A
ORSECA	[8:2064, 2066:2097]	str	Row overscan section for quadrant A
BIASSECC	[2065:2128, 2130:4193]	str	Bias section for quadrant C
DETSECC	[1:2057, 2065:4128]	str	Detector section for quadrant C
DAC14	0.0,-0.0148	str	[V] set value, measured value
DAC4	5.9998,6.0595	str	[V] set value, measured value
CLOCK16	9.9999,3.0	str	[V] high rail, low rail
AMPSECA	[1:2057, 1:2064]	str	AMP section for quadrant A
OFFSET4	2.0,6.0595	str	[V] set value, measured value
CCDSIZE	4194,4256	str	CCD size in pixels (rows, columns)
OFFSET2	0.4000000059604645,-8.9301	str	[V] set value, measured value
DAC13	0.0,-0.0148	str	[V] set value, measured value
CRYOTEMP[Page 227, 1]	163.02	float	[deg K] Cryostat CCD temperature
OFFSET6	2.0,6.0437	str	[V] set value, measured value
CLOCK6	9.9999,0.0	str	[V] high rail, low rail
DETSECA	[1:2057, 1:2064]	str	Detector section for quadrant A
CCDTMING	default_lbnl_timing_20180905.txt	str	CCD timing file
DETECTOR	M1-52	str	Detector (ccd) identification
OFFSET3	0.4000000059604645,-8.9816	str	[V] set value, measured value
AMPSECC	[1:2057, 4128:2065]	str	AMP section for quadrant C
CLOCK10	9.9992,2.9993	str	[V] high rail, low rail
ORSECC	[8:2064, 2098:2129]	str	Row overscan section for quadrant C
SETTINGS	detectors_sm_20191211.json	str	Name of DESI CCD settings file
CPUTEMP	58.9629	float	[deg C] CCD controller CPU temperature
OFFSET0	0.4000000059604645,-8.755	str	[V] set value, measured value

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Table 25 – continued from previous page

KEY	Example Value	Type	Comment
DAC12	0.0,0.0	str	[V] set value, measured value
DATASECC	[8:2064, 2130:4193]	str	Data section for quadrant C
AMPSECD	[4114:2058, 4128:2065]	str	AMP section for quadrant D
DAC10	-25.0003,-25.0054	str	[V] set value, measured value
CLOCK7	-2.0001,3.9999	str	[V] high rail, low rail
DAC0	-9.0002,-8.7653	str	[V] set value, measured value
CLOCK11	9.9992,2.9993	str	[V] high rail, low rail
DAC7	5.9998,6.0122	str	[V] set value, measured value
OFFSET1	0.4000000059604645,-8.9507	str	[V] set value, measured value
DAC5	5.9998,5.9964	str	[V] set value, measured value
ORSECB	[2193:4249, 2066:2097]	str	Row overscan section for quadrant B
CCDSECD	[2058:4114, 2065:4128]	str	CCD section for quadrant D
PRRSECC	[8:2064, 4194:4194]	str	Row prescan section for quadrant C
TRIMSECC	[8:2064, 2130:4193]	str	Trim section for quadrant C
BIASSECA	[2065:2128, 2:2065]	str	Bias section for quadrant A
REQTIME	120.0	float	[s] Requested exposure time
OBSID	kp4m20201220t222415	str	Unique observation identifier
PROCTYPE	RAW	str	Data processing level
PRODTYPE	image	str	Data product type
CHECKSUM	WdnaWcnXWcnaWcnU	str	HDU checksum updated 2022-01-29T01:11:31
DATASUM	3935488568	str	data unit checksum updated 2022-01-29T01:11:31
GAINA	1.684	float	e/ADU (gain applied to image)
SATULEVA	33000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPA	0.6500495005602716	float	ADUs (max-min of median overscan per row)
OMETHA	AVERAGE	str	use average overscan
OVERSCNA	1972.92976646288	float	ADUs (gain not applied)
OBSRDNA	3.218229918807175	float	electrons (gain is applied)
SATUELEA	52249.58627327651	float	saturation or non lin. level, in electrons

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KEY	Example Value	Type	Comment
GAINB	1.655	float	e/ADU (gain applied to image)
SATULEVB	47000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPB	0.6179795354764792	float	ADUs (max-min of median overscan per row)
OMETHB	AVERAGE	str	use average overscan
OVERSCNB	1975.23548556518	float	ADUs (gain not applied)
OBSRDNB	3.153470147761547	float	electrons (gain is applied)
SATUELEB	74515.98527138963	float	saturation or non lin. level, in electrons
GAINC	1.467	float	e/ADU (gain applied to image)
SATULEVC	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPC	0.5848174212296726	float	ADUs (max-min of median overscan per row)
OMETHC	AVERAGE	str	use average overscan
OVERSCNC	1959.467167892971	float	ADUs (gain not applied)
OBSRDNC	2.894849081776217	float	electrons (gain is applied)
SATUELEC	93265.30666470101	float	saturation or non lin. level, in electrons
GAIND	1.509	float	e/ADU (gain applied to image)
SATULEVD	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPD	0.4709297982626595	float	ADUs (max-min of median overscan per row)
OMETHD	AVERAGE	str	use average overscan
OVERSCND	1992.393350767962	float	ADUs (gain not applied)
OBSRDND	2.694583892275785	float	electrons (gain is applied)
SATUELED	95885.79343369114	float	saturation or non lin. level, in electrons
FIBERMIN	2500	int	
LONGSTRN	OGIP 1.0	str	The OGIP Long String Convention may be used.
MODULE	CI	str	Image Sources/Component
FRAMES[Page 227, 1]	None	Unknown	Number of Frames in Archive
COSMSPLT	F	bool	Cosmics split exposure if true
MAXSPLIT	0	int	Number of allowed exposure splits
SPLITIDS[Page 227, 1]	68979	str	List of expids for split exposures
OBSTYPE	FLAT	str	Spectrograph observation type
MANIFEST	F	bool	DOS exposure manifest
OBJECT		str	Object name

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KEY	Example Value	Type	Comment
SEQID[Page 227, 1]	3 requests	str	Exposure sequence identifier
SEQNUM	2	int	Number of exposure in sequence
SEQTOT[Page 227, 1]	3	int	Total number of exposures in sequence
OPENSHUT	None	Unknown	Time shutter opened
CAMSHUT	open	str	Shutter status during observation
WHITESPT[Page 227, 1]	T	bool	Telescope is at whitespot
ZENITH[Page 227, 1]	F	bool	Telescope is at zenith
SEANNEX[Page 227, 1]	F	bool	Telescope is at SE annex
BEYONDP[Page 227, 1]	F	bool	Telescope is beyond pole
FIDUCIAL[Page 227, 1]	off	str	Fiducials status during observation
AIRMASS[Page 227, 1]	1.521306	float	Airmass
FOCUS[Page 227, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0	str	Telescope focus settings
TRUSTEMP[Page 227, 1]	13.267	float	[deg] Average Telescope truss temperature (only
PMIRTEMP[Page 227, 1]	7.35	float	[deg] Average primary mirror temperature (nit,e
PMREADY[Page 227, 1]	F	bool	Primary mirror ready
PMCOVER[Page 227, 1]	open	str	Primary mirror cover
PMCOOL[Page 227, 1]	on	str	Primary mirror cooling
DOMSHUTU[Page 227, 1]	not open	str	Upper dome shutter
DOMSHUTL[Page 227, 1]	not open	str	Lower dome shutter
DOMLIGHH[Page 227, 1]	off	str	High dome lights
DOMLIGHL[Page 227, 1]	off	str	Low dome lights
DOMEAZ[Page 227, 1]	253.289	float	[deg] Dome azimuth angle
DOMINPOS[Page 227, 1]	F	bool	Dome is in position
GUIDOFFR[Page 227, 1]	0.0	float	[arcsec] Cummulative guider offset (RA)
GUIDOFFD[Page 227, 1]	-0.0	float	[arcsec] Cummulative guider offset (dec)
MOONDEC[Page 227, 1]	-9.830944	float	[deg] Moon declination at start of exposure
MOONRA[Page 227, 1]	350.511461	float	[deg] Moon RA at start of exposure
MOUNTAZ[Page 227, 1]	73.49407	float	[deg] Mount azimuth angle
MOUNTDEC[Page 227, 1]	31.962703	float	[deg] Mount declination
MOUNTEL[Page 227, 1]	41.035778	float	[deg] Mount elevation angle
MOUNTHA[Page 227, 1]	-58.479517	float	[deg] Mount hour angle
INCTRL[Page 227, 1]	F	bool	DESI in control
INPOS[Page 227, 1]	T	bool	Mount in position
MNTOFFD[Page 227, 1]	-0.0	float	[arcsec] Mount offset (dec)

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KEY	Example Value	Type	Comment
MNTOFFR[Page 227, 1]	-0.0	float	[arcsec] Mount offset (RA)
PARALLAC[Page 227, 1]	-73.492813	float	[deg] Parallactic angle
SKYDEC[Page 227, 1]	31.962703	float	[deg] Telescope declination (pointing on sky)
SKYRA[Page 227, 1]	12.901561	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC[Page 227, 1]	31.963299	float	[deg] Target declination (to TCS)
TARGTRA[Page 227, 1]	6.305086	float	[deg] Target right ascension (to TCS)
TARGTAZ[Page 227, 1]	75.558672	float	[deg] Target azimuth
TARGTEL[Page 227, 1]	46.429343	float	[deg] Target elevation
TRGTOFFD[Page 227, 1]	0.0	float	[arcsec] Telescope target offset (dec)
TRGTOFFR[Page 227, 1]	0.0	float	[arcsec] Telescope target offset (RA)
ZD[Page 227, 1]	48.964222	float	[deg] Telescope zenith distance
TCSST[Page 227, 1]	20:57:41.291	str	Local Sidereal time reported by TCS (HH:MM:SS)
TCSMJD[Page 227, 1]	59203.933945	float	MJD reported by TCS
ADCCORR	F	bool	Correct pointing for ADC setting if True
ADC1PHI[Page 227, 1]	114.980003	float	[deg] ADC 1 angle
ADC2PHI[Page 227, 1]	162.869907	float	[deg] ADC 2 angle
ADC1HOME[Page 227, 1]	F	bool	ADC 1 at home position if True
ADC2HOME[Page 227, 1]	F	bool	ADC 2 at home position if True
ADC1NREV[Page 227, 1]	0.0	float	ADC 1 number of revs
ADC2NREV[Page 227, 1]	-1.0	float	ADC 2 number of revs
ADC1STAT[Page 227, 1]	STOPPED	str	ADC 1 status
ADC2STAT[Page 227, 1]	STOPPED	str	ADC 2 status
HEXPOS[Page 227, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0	str	Hexapod position
HEXTRIM[Page 227, 1]	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
ROTOFFST[Page 227, 1]	0.0	float	[arcsec] Rotator offset
ROTENBLD[Page 227, 1]	T	bool	Rotator enabled
ROTRATE[Page 227, 1]	0.0	float	[arcsec/min] Rotator rate
RESETROT	F	bool	DOS Control: reset hex rotator
GUIDMODE	catalog	str	Guider mode
USEAOS[Page 227, 1]	F	bool	DOS Control: AOS data available if true
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating spectrograph
ILLSPECS[Page 227, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating illuminate s
CCDSPECS[Page 227, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating ccd spectrog

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KEY	Example Value	Type	Comment
TDEWPNT[Page 227, 1]	-18.2	float	Telescope air dew point
TAIRFLOW[Page 227, 1]	1.121	float	Telescope air flow
TAIRITMP[Page 227, 1]	10.5	float	[deg] Telescope air in temperature
TAIROTMP[Page 227, 1]	5.5	float	[deg] Telescope air out temperature
TAIRTEMP[Page 227, 1]	11.86	float	[deg] Telescope air temperature
TCASITMP[Page 227, 1]	0.0	float	[deg] Telescope Cass Cage in temperature
TCASOTMP[Page 227, 1]	9.6	float	[deg] Telescope Cass Cage out temperature
TCSITEMP[Page 227, 1]	7.4	float	[deg] Telescope center section in temperature
TCSOTEMP[Page 227, 1]	10.2	float	[deg] Telescope center section out temperature
TCIBTEMP[Page 227, 1]	0.0	float	[deg] Telescope chimney IB temperature
TCIMTEMP[Page 227, 1]	0.0	float	[deg] Telescope chimney IM temperature
TCITTEMP[Page 227, 1]	0.0	float	[deg] Telescope chimney IT temperature
TCOSTEMP[Page 227, 1]	0.0	float	[deg] Telescope chimney OS temperature
TCOWTEMP[Page 227, 1]	0.0	float	[deg] Telescope chimney OW temperature
TDBTEMP[Page 227, 1]	7.4	float	[deg] Telescope dec bore temperature
TFLOWIN[Page 227, 1]	7.7	float	Telescope flow rate in
TFLOWOUT[Page 227, 1]	8.3	float	Telescope flow rate out
TGLYCOLI[Page 227, 1]	-1.8	float	[deg] Telescope glycol in temperature
TGLYCOLO[Page 227, 1]	0.0	float	[deg] Telescope glycol out temperature
THINGES[Page 227, 1]	12.9	float	[deg] Telescope hinge S temperature
THINGEW[Page 227, 1]	11.7	float	[deg] Telescope hinge W temperature
TPMAVERT[Page 227, 1]	7.304	float	[deg] Telescope mirror averagetemperature
TPMDESIT[Page 227, 1]	7.0	float	[deg] Telescope mirror desired temperature
TPMEIBT[Page 227, 1]	7.3	float	[deg] Telescope mirror EIB temperature
TPMEITT[Page 227, 1]	7.3	float	[deg] Telescope mirror EIT temperature
TPMEOBT[Page 227, 1]	7.4	float	[deg] Telescope mirror EOB temperature
TPMEOTT[Page 227, 1]	7.2	float	[deg] Telescope mirror EOT temperature

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KEY	Example Value	Type	Comment
TPMNIBT[Page 227, 1]	7.4	float	[deg] Telescope mirror NIB temperature
TPMNITT[Page 227, 1]	7.3	float	[deg] Telescope mirror NIT temperature
TPMNOBT[Page 227, 1]	7.7	float	[deg] Telescope mirror NOB temperature
TPMNOTT[Page 227, 1]	7.6	float	[deg] Telescope mirror NOT temperature
TPMRTDT[Page 227, 1]	6.96	float	[deg] Telescope mirror RTD temperature
TPMSIBT[Page 227, 1]	7.4	float	[deg] Telescope mirror SIB temperature
TPMSITT[Page 227, 1]	7.0	float	[deg] Telescope mirror SIT temperature
TPMSOBT[Page 227, 1]	7.4	float	[deg] Telescope mirror SOB temperature
TPMSOTT[Page 227, 1]	7.2	float	[deg] Telescope mirror SOT temperature
TPMSTAT[Page 227, 1]	soft air	str	Telescope mirror status
TPMWIBT[Page 227, 1]	7.2	float	[deg] Telescope mirror WIB temperature
TPMWITT[Page 227, 1]	7.1	float	[deg] Telescope mirror WIT temperature
TPMWOBT[Page 227, 1]	7.6	float	[deg] Telescope mirror WOB temperature
TPMWOTT[Page 227, 1]	8.1	float	[deg] Telescope mirror WOT temperature
TPCITEMP[Page 227, 1]	7.7	float	[deg] Telescope primary cell in temperature
TPCOTEMP[Page 227, 1]	7.7	float	[deg] Telescope primary cell out temperature
TPR1HUM[Page 227, 1]	0.0	float	Telescope probe 1 humidity
TPR1TEMP[Page 227, 1]	0.0	float	[deg] Telescope probe1 temperature
TPR2HUM[Page 227, 1]	0.0	float	Telescope probe 2 humidity
TPR2TEMP[Page 227, 1]	0.0	float	[deg] Telescope probe2 temperature
TSERVO[Page 227, 1]	7.0	float	Telescope servo setpoint
TTRSTEMP[Page 227, 1]	13.2	float	[deg] Telescope top ring S temperature
TTRWTEMP[Page 227, 1]	13.4	float	[deg] Telescope top ring W temperature
TTRUETBT[Page 227, 1]	-4.8	float	[deg] Telescope truss ETB temperature
TTRUETTT[Page 227, 1]	11.5	float	[deg] Telescope truss ETT temperature
TTRUNTBT[Page 227, 1]	10.9	float	[deg] Telescope truss NTB temperature

continues on next page

Table 25 – continued from previous page

KEY	Example Value	Type	Comment
TTRUNTTT[Page 227, 1]	11.8	float	[deg] Telescope truss NTT temperature
TTRUSTBT[Page 227, 1]	11.1	float	[deg] Telescope truss STB temperature
TTRUSTST[Page 227, 1]	10.8	float	[deg] Telescope truss STS temperature
TTRUSTTT[Page 227, 1]	12.4	float	[deg] Telescope truss STT temperature
TTRUTSBT[Page 227, 1]	13.6	float	[deg] Telescope truss TSB temperature
TTRUTSMT[Page 227, 1]	13.7	float	[deg] Telescope truss TSM temperature
TTRUTSTT[Page 227, 1]	12.5	float	[deg] Telescope truss TST temperature
TTRUWTBT[Page 227, 1]	10.9	float	[deg] Telescope truss WTB temperature
TTRUWTTT[Page 227, 1]	11.6	float	[deg] Telescope truss WTT temperature
ALARM[Page 227, 1]	F	bool	UPS major alarm or check battery
ALARM-ON[Page 227, 1]	F	bool	UPS active alarm condition
BATTERY[Page 227, 1]	100.0	float	[%] UPS Battery left
SECLEFT[Page 227, 1]	5772.0	float	[s] UPS Seconds left
UPSSTAT[Page 227, 1]	System Normal - On Line(7)	str	UPS Status
INAMPS[Page 227, 1]	64.3	float	[A] UPS total input current
OUTWATTS[Page 227, 1]	4500.0,6800.0,4100.0	str	[W] UPS Phase A, B, C output watts
COMPDEW[Page 227, 1]	-12.0	float	[deg C] Computer room dewpoint
COMPHUM[Page 227, 1]	7.8	float	[%] Computer room humidity
COMPAMB[Page 227, 1]	19.4	float	[deg C] Computer room ambient temperature
COMPTEMP[Page 227, 1]	24.9	float	[deg C] Computer room hygrometer temperature
DEWPOINT[Page 227, 1]	5.7	float	[deg C] (outside) dewpoint
HUMIDITY[Page 227, 1]	7.0	float	[%] (outside) humidity
PRESSURE[Page 227, 1]	794.7	float	[torr] (outside) air pressure
OUTTEMP[Page 227, 1]	0.0	float	[deg C] outside temperature
WINDDIR[Page 227, 1]	82.0	float	[deg] wind direction
WINDSPD[Page 227, 1]	23.3	float	[m/s] wind speed
GUST[Page 227, 1]	18.1	float	[m/s] Wind gusts speed
AMNIENTN[Page 227, 1]	13.3	float	[deg C] ambient temperature north

continues on next page

Table 25 – continued from previous page

KEY	Example Value	Type	Comment
CFLOOR[Page 227, 1]	8.1	float	[deg C] temperature on C floor
NWALLIN[Page 227, 1]	13.6	float	[deg C] temperature at north wall inside
NWALLOUT[Page 227, 1]	8.8	float	[deg C] temperature at north wall outside
WWALLIN[Page 227, 1]	12.8	float	[deg C] temperature at west wall inside
WWALLOUT[Page 227, 1]	9.4	float	[deg C] temperature at west wall outside
AMBIENTS[Page 227, 1]	14.6	float	[deg C] ambient temperature south
FLOOR[Page 227, 1]	12.3	float	[deg C] temperature at floor (LCR)
EWALLCMP[Page 227, 1]	10.2	float	[deg C] temperature at east wall, computer room
EWALLCOU[Page 227, 1]	9.5	float	[deg C] temperature at east wall, Coude room
ROOF[Page 227, 1]	10.0	float	[deg C] temperature on roof
ROOFAMB[Page 227, 1]	9.9	float	[deg C] ambient temperature on roof
DOMEBLOW[Page 227, 1]	12.1	float	[deg C] temperature at dome back, lower
DOMEBUP[Page 227, 1]	12.5	float	[deg C] temperature at dome back, upper
DOMELLOW[Page 227, 1]	14.4	float	[deg C] temperature at dome left, lower
DOMELUP[Page 227, 1]	19.3	float	[deg C] temperature at dome left, upper
DOMERLOW[Page 227, 1]	12.3	float	[deg C] temperature at dome right, lower
DOMERUP[Page 227, 1]	12.8	float	[deg C] temperature at dome right, upper
PLATFORM[Page 227, 1]	15.3	float	[deg C] temperature at platform
SHACKC[Page 227, 1]	15.2	float	[deg C] temperature at shack ceiling
SHACKW[Page 227, 1]	13.2	float	[deg C] temperature at shack wall
STAIRSL[Page 227, 1]	12.6	float	[deg C] temperature at stairs, lower
STAIRSM[Page 227, 1]	13.3	float	[deg C] temperature at stairs, mid
STAIRSU[Page 227, 1]	13.6	float	[deg C] temperature at stairs, upper
TELBASE[Page 227, 1]	8.5	float	[deg C] temperature at telescope base
UTILWALL[Page 227, 1]	11.6	float	[deg C] temperature at utility room wall

continues on next page

Table 25 – continued from previous page

KEY	Example Value	Type	Comment
UTILROOM[Page 227, 1]	12.4	float	[deg C] temperature in utilitiy room
EXCLUDED		str	Components excluded from this exposure
NSPEC	500	int	Number of spectra
WAVEMIN	5760.0	float	First wavelength [Angstroms]
WAVEMAX	7620.0	float	Last wavelength [Angstroms]
WAVESTEP	0.8	float	Wavelength step size [Angstroms]
SPECTER	0.10.0	str	https://github.com/desihub/specter
IN_PSF	SPECPROD/exposures/20201220/00068979/psf-r5-00068979.fits	str	Input sp
IN_IMG	SPECPROD/preproc/20201220/00068979/preproc-r5-00068979.fits	str	
ORIG_PSF	SPECPROD/calibnight/20201220/psfnight-r5-20201220.fits	str	
BUNIT	electron/Angstrom	str	
TCSPIRA[Page 227, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
SEQSTART[Page 227, 1]	2021-02-24T01:22:15.381414	str	Start time of sequence processing
TCSPIDEC[Page 227, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
MOONSEP[Page 227, 1]	8.81573236983626	float	[deg] Moon Separation
TCSKRA[Page 227, 1]	0.3 0.003 0.00003	str	TCS Kalman (RA)
TCSMFRA[Page 227, 1]	1	int	TCS moving filter length (RA)
TCSGRA[Page 227, 1]	0.3	float	TCS simple gain (RA)
TCSKDEC[Page 227, 1]	0.3 0.003 0.00003	str	TCS Kalman (dec)
TCSGDEC[Page 227, 1]	0.3	float	TCS simple gain (dec)
TCSMFDEC[Page 227, 1]	1	int	TCS moving filter length (dec)
FOCSTIME[Page 227, 1]	60.0	float	[s] focus GFA exposure time
KEEPSKY[Page 227, 1]	F	bool	DOS Control: keep sky mon. running
PMTRANS[Page 227, 1]	94.62	float	[%] PlateMaker GFAPROC transparency
USESPCTR[Page 227, 1]	T	bool	DOS Control: use spectrographs
SUNRA[Page 227, 1]	12.514241	float	[deg] Sun RA at start of exposure
SP3BLUP[Page 227, 1]	8.133e-08	float	[mb] SP3 blue pressure
BACKLIT[Page 227, 1]	off	str	Fibers are backlit if True
SP6REDT[Page 227, 1]	139.94	float	[K] SP6 red temperature
USEILLUM[Page 227, 1]	T	bool	DOS Control: use illuminator

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KEY	Example Value	Type	Comment
SP8REDP[Page 227, 1]	3.96e-08	float	[mb] SP8 red pressure
NTSSURVY[Page 227, 1]	na	str	NTS survey name
POSCYCLE[Page 227, 1]	1	int	Number of current iteration
POSTOLER[Page 227, 1]	0.005	float	Positioning Control: in_position tolerance (mm)
SP7REDT[Page 227, 1]	140.01	float	[K] SP7 red temperature
SP0NIRT[Page 227, 1]	139.89	float	[K] SP0 NIR temperature
SP7NIRP[Page 227, 1]	4.311e-08	float	[mb] SP7 NIR pressure
SP0NIRP[Page 227, 1]	5.998e-08	float	[mb] SP0 NIR pressure
SP6NIRT[Page 227, 1]	139.89	float	[K] SP6 NIR temperature
SP1BLUT[Page 227, 1]	163.02	float	[K] SP1 blue temperature
SP3REDT[Page 227, 1]	139.99	float	[K] SP3 red temperature
SP4NIRP[Page 227, 1]	6.683e-08	float	[mb] SP4 NIR pressure
SP5NIRT[Page 227, 1]	139.94	float	[K] SP5 NIR temperature
TGFAPROC[Page 227, 1]	9.0024	float	[s] PlateMaker GFAPROC processing time
SP7BLUP[Page 227, 1]	9.947e-08	float	[mb] SP7 blue pressure
SKYLEVEL[Page 227, 1]	1.364	float	counts?] ETC sky level
SP0REDT[Page 227, 1]	139.96	float	[K] SP0 red temperature
USEOPENL[Page 227, 1]	T	bool	DOS Control: use open loop move
SP0BLUT[Page 227, 1]	163.02	float	[K] SP0 blue temperature
SP2BLUP[Page 227, 1]	8.492e-08	float	[mb] SP2 blue pressure
SP0BLUP[Page 227, 1]	8.499e-08	float	[mb] SP0 blue pressure
POSCNVGD[Page 227, 1]	F	bool	Number of positioners converged
USEFOCUS[Page 227, 1]	T	bool	DOS Control: use focus
ACQCAM[Page 227, 1]	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIEXPID[Page 227, 1]	83129	int	Guider exposure id at start of spectro exp.
SP3NIRP[Page 227, 1]	3.566e-08	float	[mb] SP3 NIR pressure
SP5BLUT[Page 227, 1]	162.99	float	[K] SP5 blue temperature
SP9NIRP[Page 227, 1]	5.211e-08	float	[mb] SP9 NIR pressure
USEFVC[Page 227, 1]	T	bool	DOS Control: use fvc
USEGUIDR[Page 227, 1]	T	bool	DOS Control: use guider
IGFRMNUM[Page 227, 1]	14	int	Guider frame number at start of spectro exp.
FGFRMNUM[Page 227, 1]	45	int	Guider frame number at end of spectro exp.
SP4BLUP[Page 227, 1]	6.248e-08	float	[mb] SP4 blue pressure
SP5BLUP[Page 227, 1]	1.115e-07	float	[mb] SP5 blue pressure
SP1REDT[Page 227, 1]	139.89	float	[K] SP1 red temperature
SP9BLUT[Page 227, 1]	163.02	float	[K] SP9 blue temperature
IFFRMNUM[Page 227, 1]	1	int	Focus frame number at start of spectro exp.
SP1NIRT[Page 227, 1]	139.89	float	[K] SP1 NIR temperature
USEFID[Page 227, 1]	T	bool	DOS Control: use fiducials

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KEY	Example Value	Type	Comment
REQDEC[Page 227, 1]	32.375	float	[deg] Requested declination (observer input)
SP9REDP[Page 227, 1]	5.108e-08	float	[mb] SP9 red pressure
SP2REDP[Page 227, 1]	6.944e-08	float	[mb] SP2 red pressure
USESKY[Page 227, 1]	T	bool	DOS Control: use Sky Monitor
SP6NIRP[Page 227, 1]	2.809e-07	float	[mb] SP6 NIR pressure
SP4NIRT[Page 227, 1]	139.94	float	[K] SP4 NIR temperature
USEPOS[Page 227, 1]	T	bool	Fiber positioner data available if true
SP2BLUT[Page 227, 1]	163.02	float	[K] SP2 blue temperature
ISFRMNUM[Page 227, 1]	0	int	Sky frame number at start of spectro exp.
FOCEXPID[Page 227, 1]	83129	int	Focus exposure id at start of spectro exp.
POSENABL[Page 227, 1]	4056	int	Number of enabled positioners
SUNDEC[Page 227, 1]	5.365754	float	[deg] Sun declination at start of exposure
TILEDEC[Page 227, 1]	32.375	float	DEC of tile given in fiberassign file
POSFRACT[Page 227, 1]	0.95	float	
SP9NIRT[Page 227, 1]	139.86	float	[K] SP9 NIR temperature
SPLITEXP[Page 227, 1]	F	bool	Split exposure part of a visit
SP8REDT[Page 227, 1]	139.94	float	[K] SP8 red temperature
SKYEXPID[Page 227, 1]	83129	int	Sky exposure id at start of spectro exp.
SP4REDT[Page 227, 1]	140.01	float	[K] SP4 red temperature
TILERA[Page 227, 1]	127.7	float	RA of tile given in fiberassign file
KEEPGUDR[Page 227, 1]	F	bool	DOS Control: keep guider running
SP3BLUT[Page 227, 1]	163.02	float	[K] SP3 blue temperature
SP0REDP[Page 227, 1]	6.295e-08	float	[mb] SP0 red pressure
SP6BLUT[Page 227, 1]	163.02	float	[K] SP6 blue temperature
SIMGFAP[Page 227, 1]	F	bool	DOS Control: simulate GFAPROC
TILEID[Page 227, 1]	80873	int	DESI Tile ID
SP1NIRP[Page 227, 1]	4.585e-08	float	[mb] SP1 NIR pressure
USEDONUT[Page 227, 1]	T	bool	DOS Control: use donuts
FIBASSGN[Page 227, 1]	/data/tiles/SVN_tiles/080/fiberassign-080873.fits.gz	str	Fiber assign
SP8NIRT[Page 227, 1]	139.99	float	[K] SP8 NIR temperature
SP2NIRT[Page 227, 1]	139.89	float	[K] SP2 NIR temperature
KEEPFOCS[Page 227, 1]	F	bool	DOS Control: keep focus running
VISITIDS[Page 227, 1]	83129	str	List of expids for a visit (same tile)

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KEY	Example Value	Type	Comment
FFFRMNUM[Page 227, 1]	5	int	Focus frame number at end of spectro exp.
SP8BLUP[Page 227, 1]	7.959e-08	float	[mb] SP8 blue pressure
ACTTEFF[Page 227, 1]	112.2149	float	[s] Actual effective exposure time
POSMVALL[Page 227, 1]	T	bool	Positioning Control: move all positioners
SP6BLUP[Page 227, 1]	6.3e-08	float	[mb] SP6 blue pressure
GUIDTIME[Page 227, 1]	5.0	float	[s] guider GFA exposure time
SEEING[Page 227, 1]	1.3508	float	[arcsec] ETC seeing
SP3REDP[Page 227, 1]	7.919e-08	float	[mb] SP3 red pressure
USEETC[Page 227, 1]	T	bool	ETC data available if true
SP5REDT[Page 227, 1]	139.99	float	[K] SP5 red temperature
SP6REDP[Page 227, 1]	6.337e-08	float	[mb] SP6 red pressure
SP8NIRP[Page 227, 1]	4.827e-08	float	[mb] SP8 NIR pressure
USEROTAT[Page 227, 1]	T	bool	DOS Control: use rotator
SP2NIRP[Page 227, 1]	6.984e-08	float	[mb] SP2 NIR pressure
POSONFRC[Page 227, 1]	0.4768	float	Fraction of positioners on target
PETALS[Page 227, 1]	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9	str	Participating petals
STOPSKY[Page 227, 1]	T	bool	DOS Control: stop sky monitor
SP7REDP[Page 227, 1]	6.038e-08	float	[mb] SP7 red pressure
GUIDECAM[Page 227, 1]	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
SP8BLUT[Page 227, 1]	162.9	float	[K] SP8 blue temperature
TNFSPROC[Page 227, 1]	25.9483	float	[s] PlateMaker NFSPROC processing time
HELIOCOR[Page 227, 1]	0.9999087550219705	float	
ACQTIME[Page 227, 1]	15.0	float	[s] acqusition image exposure time
REQADC[Page 227, 1]	92.63,97.66	str	[deg] requested ADC angles
SP4BLUT[Page 227, 1]	163.02	float	[K] SP4 blue temperature
SP7NIRT[Page 227, 1]	139.96	float	[K] SP7 NIR temperature
SP9REDT[Page 227, 1]	139.99	float	[K] SP9 red temperature
POSRMS[Page 227, 1]	0.0076	float	[micron] RMS of positioner accuracy
REACQUIR[Page 227, 1]	F	bool	DOS Control: reacquire same files
SP5REDP[Page 227, 1]	5.487e-08	float	[mb] SP5 red pressure
STOPGUDR[Page 227, 1]	T	bool	DOS Control: stop guider
POSONTGT[Page 227, 1]	1934	int	Number of positioners on target
FOCUSCAM[Page 227, 1]	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SP5NIRP[Page 227, 1]	6.003e-08	float	[mb] SP5 NIR pressure
SP1BLUP[Page 227, 1]	7.992e-08	float	[mb] SP1 blue pressure
PMSEEING[Page 227, 1]	1.33	float	[arcsec] PlateMaker GFAPROC seeing

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KEY	Example Value	Type	Comment
SP9BLUP[Page 227, 1]	1.231e-07	float	[mb] SP9 blue pressure
SKYTIME[Page 227, 1]	60	float	[s] sky camera exposure time (acquisition)
POSITER[Page 227, 1]	1	int	Positioning Control: max. number of pos. cycles
USESPLITS[Page 227, 1]	T	bool	Exposure splits are allowed
SP1REDP[Page 227, 1]	5.506e-08	float	[mb] SP1 red pressure
SP3NIRT[Page 227, 1]	140.01	float	[K] SP3 NIR temperature
SP2REDT[Page 227, 1]	139.96	float	[K] SP2 red temperature
SKYCAM[Page 227, 1]	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
SP4REDP[Page 227, 1]	4.945e-08	float	[mb] SP4 red pressure
SP7BLUT[Page 227, 1]	163.02	float	[K] SP7 blue temperature
FSFRMNUM[Page 227, 1]	3	int	Sky frame number at end of spectro exp.
SIMGFACQ[Page 227, 1]	F	bool	
REQRA[Page 227, 1]	127.7	float	[deg] Requested right ascension (observer input
USEXSRVR[Page 227, 1]	T	bool	DOS Control: use exposure server
POSDISAB[Page 227, 1]	925	int	Number of disabled positioners
STOPFOCS[Page 227, 1]	T	bool	DOS Control: stop focus
REQTEFF[Page 227, 1]	1000.0	float	[s] Requested effective exposure time
USESPLIT[Page 227, 1]	T	bool	Exposure splits are allowed
TOTTEFF[Page 227, 1]	838.56	float	[s] Total effective exposure time for visit
BBKGMINA[Page 227, 1]	-0.3947016321413652	float	
BBKGMINC[Page 227, 1]	-0.2673014085831243	float	
BBKGMIND[Page 227, 1]	-0.4786751204310712	float	
BBKGMAXA[Page 227, 1]	0.6036115648904081	float	
BBKGMAXD[Page 227, 1]	0.2858693184663221	float	
BBKGMAXB[Page 227, 1]	0.2978123984653912	float	
BBKGMAXC[Page 227, 1]	0.3636081010150568	float	
BBKGMINB[Page 227, 1]	-0.2841325038108138	float	
POSCVFRC[Page 227, 1]	0.3467	float	Fraction of converged positioners
ETCSPLIT[Page 227, 1]	1	int	ETC split sequence number for this visit
ACQFWHM[Page 227, 1]	1.71791	float	[arcsec] FWHM of guide star PSF in acquisition
TRANSPAR[Page 227, 1]	None	Unknown	ETC/PM transparency
NTSPROG[Page 227, 1]	BRIGHT	str	NTS program name
SLEWANGL[Page 227, 1]	28.856	float	[deg] Slew Angle
ESTTIME[Page 227, 1]	2231.315	float	[s] Estimated exposure time for visit (from ETC

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KEY	Example Value	Type	Comment
ETCPREV[Page 227, 1]	0.0	float	[s] ETC cummulative t_eff for visit
ETCTRANS[1]	0.719235	float	ETC averaged TRANSP normalized to 1
MINTIME[1]	120.0	float	[s] Minimum exposure time (from NTS, used by ET
ETCTHRUP[1]	0.442956	float	ETC averaged thruput (PSF profile)
ETCTEFF[1]	222.548355	float	[s] ETC effective exposure time
ETCSKY[1]	1.43154	float	ETC averaged, normalized sky camera flux
ETCVERS[1]	0.1.12-3-g12b54bb	str	ETC version
ETCFRACE[1]	0.271983	float	ETC transparency weighted average of FFRAC (ELG
ETCREAL[1]	1054.206299	float	[s] ETC real open shutter time
ETCPROF[1]	BGS	str	ETC source brightness profile
CONVERGD[1]	F	bool	Positioning loop converged (CNFRC>0.95)
ETCSEENG[1]	1.7179	float	[arcsec] ETC seeing
ETCTHRUB[1]	0.469155	float	ETC averaged thruput (BGS profile)
PMTRANSP[1]	104.71	float	[%] PlateMaker GFAPROC transparency
ETCFRACB[1]	0.123838	float	ETC transparency weighted average of FFRAC (BGS
SBPROF[1]	BGS	str	Profile used by ETC
ETCFRACP[1]	0.346107	float	ETC transparency weighted average of FFRAC (PSF
ETCTHRUE[1]	0.474574	float	ETC averaged thruput (ELG profile)
MAXTIME[1]	5400.0	float	[s] Maximum exposure time for entire visit (fro
FVCTIME[1]	2.0	float	[s] FVC exposure time
UPSSTAT[1]	17826.0	float	UPS Status

Data: FITS image [float32, 2751x500]

[1] Optional

HDU1

EXTNAME = IVAR

Inverse variance of the flux values in HDU0. The unit is 1/(electrons/Angstrom)^2. The noise from neighboring spectral pixels is uncorrelated.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelengths
NAXIS2	500	int	Number of spectra
CHECKSUM	YgRiaZOfTdOfYZOf	str	HDU checksum updated 2021-07-08T12:56:13
DATASUM	2402704670	str	data unit checksum updated 2021-07-08T12:56:13

Data: FITS image [float32, 2751x500]

HDU2

EXTNAME = MASK

Mask of spectral data; 0=good. See the *bitmask documentation* page for the definition of the bits. Prior to desispec/0.24.0 and software release 18.9, the MASK HDU was compressed.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelengths
NAXIS2	500	int	Number of spectra
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	9GbI9FbG9FbG9FbG	str	HDU checksum updated 2021-07-08T12:56:14
DATASUM	688701	str	data unit checksum updated 2021-07-08T12:56:14

Data: FITS image [int32, 2751x500]

HDU3

EXTNAME = WAVELENGTH

1D array of wavelengths in Angstrom, in vacuum (not in air). For science exposures (in opposition to calibration exposures), the wavelength in is the rest frame of the solar system barycenter. The Doppler factor applied to the observed wavelength at the telescope to convert them to the barycentric frame is saved in header keyword HELIOCOR in HDU0. In other words, WAVELENGTH = BARYCENTRIC_FRAME_WAVELENGTH = HELICOR * OBSERVER_FRAME_WAVELENGTH. Note a single factor has been applied to all fibers despite a small difference in pointing.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelengths
BUNIT	Angstrom	str	
CHECKSUM	9GQG9DPE9DPE9DPE	str	HDU checksum updated 2021-07-08T12:56:14
DATASUM	979185614	str	data unit checksum updated 2021-07-08T12:56:14

Data: FITS image [float64, 2751]

HDU4

EXTNAME = RESOLUTION

Resolution matrix stored as the diagonals of a 3D sparse matrix:

Rdata[nspec, ndiag, nwave]

To convert this into sparse matrices for convolving a model that is sampled at the same wavelengths as the extractions (HDU EXTNAME='WAVELENGTH'):

```
from scipy.sparse import spdiags
from astropy.io import fits
import numpy as np

#- read a model and its wavelength vector from somewhere
#- IMPORTANT: cast them to .astype(np.float64) to get native endian

#- read the resolution data
resdata = fits.getdata(framefile, 'RESOLUTION').astype(np.float64)

nspec, nwave = model.shape
convolvedmodel = np.zeros((nspec, nwave))
diags = np.arange(10, -11, -1)

for i in range(nspec):
    R = spdiags(resdata[i], diags, nwave, nwave)
    convolvedmodel[i] = R.dot(model)
```

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	
NAXIS2	11	int	
NAXIS3	500	int	
CHECKSUM	YGfeaGcdSGcdYGcd	str	HDU checksum updated 2021-07-08T12:56:17
DATASUM	307167897	str	data unit checksum updated 2021-07-08T12:56:17

Data: FITS image [float32, 2751x11x500]

HDU5

EXTNAME = FIBERMAP

Fibermap information combining fiberassign request with actual fiber locations. See also the *fibermap documentation* page.

Required Header Keywords

KEY	Example Value
NAXIS1	369
NAXIS2	500
EXPID	68979
EXPFRAME	0
FLAVOR	science
SEQUENCE	Spectrographs
PURPOSE	Commissioning
PROGRAM	CALIB DESI-CALIB-00 LEDs only
PROPID	2019B-5000
OBSERVER	DESIObserver
LEAD	RunManager
INSTRUME	DESI
OBSERVAT	KPNO
OBS-LAT	31.96403
OBS-LONG	-111.59989
OBS-ELEV	2097.0
TELESCOP	KPNO 4.0-m telescope
CORRCTOR	DESI Corrector
NIGHT	20201220
TIMESYS	UTC
DATE-OBS	2020-12-20T22:24:15.672815
TIME-OBS	22:24:15.672815
MJD-OBS	59203.93351473
ST	20:57:41.340
EXPTIME	120.037
DELTARA[1]	0.0
DELTADEC[Page 227, 1]	0.0
VCCD	ON
VCCDON	2020-12-14T04:22:19.522101
VCCDSEC	583485.8
EQUINOX	2000.0
SPECGRPH	5
SPECID	9
FEEBOX	lbnl057
VESSEL	26
FEEVER	v20160312
FEEPOWER	ON
FEEDMASK	2134851391
FEECMASK	1048575
CCDTEMP	-135.8073

Table 26

KEY	Example Value
RADESYS	FK5
FILENAME	/exposures/desi/specs/20201220/00068979/sp9-00068979.fits.fz
DOSVER	trunk
OCSVER	1.2
CONSTVER	DESI:CURRENT
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini
DAC3	-9.0002,-8.9919
CLOCK5	9.9999,0.0
BLDTIME	0.3522
CLOCK2	9.9999,0.0
BIASSECD	[2129:2192, 2130:4193]
PGAGAIN	3
OFFSET5	2.0,5.9964
BIASSECB	[2129:2192, 2:2065]
CLOCK4	9.9999,0.0
ORSECD	[2193:4249, 2098:2129]
DAC2	-9.0002,-8.9404
DAC6	5.9998,6.0437
CCDPREP	purge,clear
CASETEMP	59.322
DAC15	0.0,-0.0148
DAC16	39.9961,39.8706
DAC9	-25.0003,-24.6344
AMPSECB	[4114:2058, 1:2064]
DAC11	-25.0003,-24.5157
DELAYS	20, 20, 25, 40, 7, 3000, 7, 7, 7, 7
CLOCK13	9.9992,2.9993
PRESECD	[4250:4256, 2130:4193]
CDSPARMS	400, 400, 8, 2000
DATASECD	[2193:4249, 2130:4193]
CLOCK15	9.9992,2.9993
CLOCK18	9.0,0.9999
CLOCK8	9.9992,2.9993
OFFSET7	2.0,6.0122
DAC8	-25.0003,-24.946
CCDSECC	[1:2057, 2065:4128]
CLOCK14	9.9992,2.9993
CLOCK3	-2.0001,3.9999
DIGITIME	47.5948
CLOCK1	9.9999,0.0
PRRSECD	[2193:4249, 4194:4194]
CLOCK9	9.9992,2.9993
CCDNAME	CCDSM9R
DETSECB	[2058:4114, 1:2064]
CCDSECA	[1:2057, 1:2064]
DETSECD	[2058:4114, 2065:4128]
DATASECB	[2193:4249, 2:2065]
CRYOPRESPage 227, 1	1.166e-07
CAMERA	r5

Table 26

KEY	Example Value
PRRSECA	[8:2064, 1:1]
DAC1	-9.0002,-8.9507
PRESECC	[1:7, 2130:4193]
TRIMSECA	[8:2064, 2:2065]
TRIMSECD	[2193:4249, 2130:4193]
CCDCFG	default_lbnl_20190717.cfg
PRRSECB	[2193:4249, 1:1]
CLOCK12	9.9992,2.9993
CCDSECB	[2058:4114, 1:2064]
TRIMSECB	[2193:4249, 2:2065]
DATASECA	[8:2064, 2:2065]
DAC17	20.0008,12.3342
CLOCK17	9.0,0.9999
PRESECB	[4250:4256, 2:2065]
CLOCK0	9.9999,0.0
PRESECA	[1:7, 2:2065]
ORSECA	[8:2064, 2066:2097]
BIASSECC	[2065:2128, 2130:4193]
DETSECC	[1:2057, 2065:4128]
DAC14	0.0,-0.0148
DAC4	5.9998,6.0595
CLOCK16	9.9999,3.0
AMPSECA	[1:2057, 1:2064]
OFFSET4	2.0,6.0595
CCDSIZE	4194,4256
OFFSET2	0.4000000059604645,-8.9301
DAC13	0.0,-0.0148
CRYOTEMPPage 227, 1	163.02
OFFSET6	2.0,6.0437
CLOCK6	9.9999,0.0
DETSECA	[1:2057, 1:2064]
CCDTMING	default_lbnl_timing_20180905.txt
DETECTOR	M1-52
OFFSET3	0.4000000059604645,-8.9816
AMPSECC	[1:2057, 4128:2065]
CLOCK10	9.9992,2.9993
ORSECC	[8:2064, 2098:2129]
SETTINGS	detectors_sm_20191211.json
CPUTEMP	58.9629
OFFSET0	0.4000000059604645,-8.755
DAC12	0.0,0.0
DATASECC	[8:2064, 2130:4193]
AMPSECD	[4114:2058, 4128:2065]
DAC10	-25.0003,-25.0054
CLOCK7	-2.0001,3.9999
DAC0	-9.0002,-8.7653
CLOCK11	9.9992,2.9993
DAC7	5.9998,6.0122
OFFSET1	0.4000000059604645,-8.9507

Table 26

KEY	Example Value
DAC5	5.9998,5.9964
ORSECB	[2193:4249, 2066:2097]
CCDSECD	[2058:4114, 2065:4128]
PRRSECC	[8:2064, 4194:4194]
TRIMSECC	[8:2064, 2130:4193]
BIASSECA	[2065:2128, 2:2065]
REQTIME	120.0
OBSID	kp4m20201220t222415
PROCTYPE	RAW
PRODTYPE	image
GAINA	1.684
SATULEVA	33000.0
OSTEPA	0.6500495005602716
OMETHA	AVERAGE
OVERSCNA	1972.92976646288
OBSRDNA	3.218229918807175
SATUELEA	52249.58627327651
GAINB	1.655
SATULEVB	47000.0
OSTEPB	0.6179795354764792
OMETHB	AVERAGE
OVERSCNB	1975.23548556518
OBSRDNB	3.153470147761547
SATUELEB	74515.98527138963
GAINC	1.467
SATULEVC	65535.0
OSTEPC	0.5848174212296726
OMETHC	AVERAGE
OVERSCNC	1959.467167892971
OBSRDNC	2.894849081776217
SATUELEC	93265.30666470101
GAIND	1.509
SATULEVD	65535.0
OSTEPD	0.4709297982626595
OMETHD	AVERAGE
OVERSCND	1992.393350767962
OBSRDND	2.694583892275785
SATUELED	95885.79343369114
FIBERMIN	2500
LONGSTRN	OGIP 1.0
MODULE	CI
FRAMES[Page 227, 1]	None
COSMSPLT	F
MAXSPLIT	0
SPLITIDS[Page 227, 1]	68979
OBSTYPE	FLAT
MANIFEST	F
OBJECT	
SEQID[Page 227, 1]	3 requests

Table 26

KEY	Example Value
SEQNUM	2
SEQTOT[Page 227, 1]	3
OPENSHUT	None
CAMSHUT	open
WHITESPT[Page 227, 1]	T
ZENITH[Page 227, 1]	F
SEANNEX[Page 227, 1]	F
BEYONDP[Page 227, 1]	F
FIDUCIAL[Page 227, 1]	off
AIRMASS[Page 227, 1]	1.521306
FOCUS[Page 227, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0
TRUSTEMP[Page 227, 1]	13.267
PMIRTEMP[Page 227, 1]	7.35
PMREADY[Page 227, 1]	F
PMCOVER[Page 227, 1]	open
PMCOOL[Page 227, 1]	on
DOMSHUTU[Page 227, 1]	not open
DOMSHUTL[Page 227, 1]	not open
DOMLIGHH[Page 227, 1]	off
DOMLIGHL[Page 227, 1]	off
DOMEAZ[Page 227, 1]	253.289
DOMINPOS[Page 227, 1]	F
GUIDOFFR[Page 227, 1]	0.0
GUIDOFFD[Page 227, 1]	-0.0
MOONDEC[Page 227, 1]	-9.830944
MOONRA[Page 227, 1]	350.511461
MOUNTAZ[Page 227, 1]	73.49407
MOUNTDEC[Page 227, 1]	31.962703
MOUNTEL[Page 227, 1]	41.035778
MOUNTHA[Page 227, 1]	-58.479517
INCTRL[Page 227, 1]	F
INPOS[Page 227, 1]	T
MNTOFFD[Page 227, 1]	-0.0
MNTOFFR[Page 227, 1]	-0.0
PARALLAC[Page 227, 1]	-73.492813
SKYDEC[Page 227, 1]	31.962703
SKYRA[Page 227, 1]	12.901561
TARGTDEC[Page 227, 1]	31.963299
TARGTRA[Page 227, 1]	6.305086
TARGTAZ[Page 227, 1]	75.558672
TARGTEL[Page 227, 1]	46.429343
TRGTOFFD[Page 227, 1]	0.0
TRGTOFFR[Page 227, 1]	0.0
ZD[Page 227, 1]	48.964222
TCSST[Page 227, 1]	20:57:41.291
TCSMJD[Page 227, 1]	59203.933945
ADCCORR	F
ADC1PHI[Page 227, 1]	114.980003
ADC2PHI[Page 227, 1]	162.869907

Table 26

KEY	Example Value
ADC1HOME[Page 227, 1]	F
ADC2HOME[Page 227, 1]	F
ADC1NREV[Page 227, 1]	0.0
ADC2NREV[Page 227, 1]	-1.0
ADC1STAT[Page 227, 1]	STOPPED
ADC2STAT[Page 227, 1]	STOPPED
HEXPOS[Page 227, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0
HEXTRIM[Page 227, 1]	0.0,0.0,0.0,0.0,0.0,0.0
ROTOFFST[Page 227, 1]	0.0
ROTENBLD[Page 227, 1]	T
ROTRATE[Page 227, 1]	0.0
RESETROT	F
GUIDMODE	catalog
USEAOS[Page 227, 1]	F
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
ILLSPECS[Page 227, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
CCDSPECS[Page 227, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
TDEWPNT[Page 227, 1]	-18.2
TAIRFLOW[Page 227, 1]	1.121
TAIRITMP[Page 227, 1]	10.5
TAIROTMP[Page 227, 1]	5.5
TAIRTEMP[Page 227, 1]	11.86
TCASITMP[Page 227, 1]	0.0
TCASOTMP[Page 227, 1]	9.6
TCSITEMP[Page 227, 1]	7.4
TCSOTEMP[Page 227, 1]	10.2
TCIBTEMP[Page 227, 1]	0.0
TCIMTEMP[Page 227, 1]	0.0
TCITTEMP[Page 227, 1]	0.0
TCOSTEMP[Page 227, 1]	0.0
TCOWTEMP[Page 227, 1]	0.0
TDBTEMP[Page 227, 1]	7.4
TFLOWIN[Page 227, 1]	7.7
TFLOWOUT[Page 227, 1]	8.3
TGLYCOLI[Page 227, 1]	-1.8
TGLYCOLO[Page 227, 1]	0.0
THINGES[Page 227, 1]	12.9
THINGEW[Page 227, 1]	11.7
TPMAVERT[Page 227, 1]	7.304
TPMDESIT[Page 227, 1]	7.0
TPMEIBT[Page 227, 1]	7.3
TPMEITT[Page 227, 1]	7.3
TPMEOBT[Page 227, 1]	7.4
TPMEOTT[Page 227, 1]	7.2
TPMNIBT[Page 227, 1]	7.4
TPMNITT[Page 227, 1]	7.3
TPMNOBT[Page 227, 1]	7.7
TPMNOTT[Page 227, 1]	7.6
TPMRTDT[Page 227, 1]	6.96

Table 26

KEY	Example Value
TPMSIBT[Page 227, 1]	7.4
TPMSITT[Page 227, 1]	7.0
TPMSOBT[Page 227, 1]	7.4
TPMSOTT[Page 227, 1]	7.2
TPMSTAT[Page 227, 1]	soft air
TPMWIBT[Page 227, 1]	7.2
TPMWITT[Page 227, 1]	7.1
TPMWOBT[Page 227, 1]	7.6
TPMWOTT[Page 227, 1]	8.1
TPCITEMP[Page 227, 1]	7.7
TPCOTEMP[Page 227, 1]	7.7
TPR1HUM[Page 227, 1]	0.0
TPR1TEMP[Page 227, 1]	0.0
TPR2HUM[Page 227, 1]	0.0
TPR2TEMP[Page 227, 1]	0.0
TSERVO[Page 227, 1]	7.0
TTRSTEMP[Page 227, 1]	13.2
TTRWTEMP[Page 227, 1]	13.4
TTRUETBT[Page 227, 1]	-4.8
TTRUETTT[Page 227, 1]	11.5
TTRUNTBT[Page 227, 1]	10.9
TTRUNTTT[Page 227, 1]	11.8
TTRUSTBT[Page 227, 1]	11.1
TTRUSTST[Page 227, 1]	10.8
TTRUSTTT[Page 227, 1]	12.4
TTRUTSBT[Page 227, 1]	13.6
TTRUTSMT[Page 227, 1]	13.7
TTRUTSTT[Page 227, 1]	12.5
TTRUWTBT[Page 227, 1]	10.9
TTRUWTTT[Page 227, 1]	11.6
ALARM[Page 227, 1]	F
ALARM-ON[Page 227, 1]	F
BATTERY[Page 227, 1]	100.0
SECLEFT[Page 227, 1]	5772.0
UPSSTAT[Page 227, 1]	System Normal - On Line(7)
INAMPS[Page 227, 1]	64.3
OUTWATTS[Page 227, 1]	4500.0,6800.0,4100.0
COMPDEW[Page 227, 1]	-12.0
COMPHUM[Page 227, 1]	7.8
COMPAMB[Page 227, 1]	19.4
COMPTEMP[Page 227, 1]	24.9
DEWPOINT[Page 227, 1]	5.7
HUMIDITY[Page 227, 1]	7.0
PRESSURE[Page 227, 1]	794.7
OUTTEMP[Page 227, 1]	0.0
WINDDIR[Page 227, 1]	82.0
WINDSPD[Page 227, 1]	23.3
GUST[Page 227, 1]	18.1
AMNIENTN[Page 227, 1]	13.3

Table 26

KEY	Example Value
CFLOOR[Page 227, 1]	8.1
NWALLIN[Page 227, 1]	13.6
NWALLOUT[Page 227, 1]	8.8
WWALLIN[Page 227, 1]	12.8
WWALLOUT[Page 227, 1]	9.4
AMBIENTS[Page 227, 1]	14.6
FLOOR[Page 227, 1]	12.3
EWALLCMP[Page 227, 1]	10.2
EWALLCOU[Page 227, 1]	9.5
ROOF[Page 227, 1]	10.0
ROOFAMB[Page 227, 1]	9.9
DOMEBLOW[Page 227, 1]	12.1
DOMEBUP[Page 227, 1]	12.5
DOMELLOW[Page 227, 1]	14.4
DOMELUP[Page 227, 1]	19.3
DOMERLOW[Page 227, 1]	12.3
DOMERUP[Page 227, 1]	12.8
PLATFORM[Page 227, 1]	15.3
SHACKC[Page 227, 1]	15.2
SHACKW[Page 227, 1]	13.2
STAIRSL[Page 227, 1]	12.6
STAIRSM[Page 227, 1]	13.3
STAIRSU[Page 227, 1]	13.6
TELBASE[Page 227, 1]	8.5
UTILWALL[Page 227, 1]	11.6
UTILROOM[Page 227, 1]	12.4
EXCLUDED	
CHECKSUM	9IArAH5o2HAo9H5o
DATASUM	1239529649
TCSPIRA[Page 227, 1]	1.0,0.0,0.0,0.0
SEQSTART[Page 227, 1]	2021-02-24T01:22:15.381414
TCSPIDEC[Page 227, 1]	1.0,0.0,0.0,0.0
MOONSEP[Page 227, 1]	8.81573236983626
TCSKRA[Page 227, 1]	0.3 0.003 0.00003
TCSMFRA[Page 227, 1]	1
TCSGRA[Page 227, 1]	0.3
TCSKDEC[Page 227, 1]	0.3 0.003 0.00003
TCSGDEC[Page 227, 1]	0.3
TCSMFDEC[Page 227, 1]	1
FIELDROT[Page 227, 1]	0.116773054960708
FOCSTIME[Page 227, 1]	60.0
KEEPSKY[Page 227, 1]	F
SKY[Page 227, 1]	DESIROOT/target/catalogs/dr9/0.51.0/skies
PMTRANS[Page 227, 1]	94.62
GUIDEFIL[Page 227, 1]	guide-00083129.fits.fz
USESPCTR[Page 227, 1]	T
SUNRA[Page 227, 1]	12.514241
SP3BLUP[Page 227, 1]	8.133e-08
BACKLIT[Page 227, 1]	off

Table 26

KEY	Example Value
SP6REDT[Page 227, 1]	139.94
USEILLUM[Page 227, 1]	T
SP8REDP[Page 227, 1]	3.96e-08
NTSSURVY[Page 227, 1]	na
POSCYCLE[Page 227, 1]	1
COORDFIL[Page 227, 1]	coordinates-00083129.fits
POSTOLER[Page 227, 1]	0.005
SP7REDT[Page 227, 1]	140.01
SP0NIRT[Page 227, 1]	139.89
SP7NIRP[Page 227, 1]	4.311e-08
SP0NIRP[Page 227, 1]	5.998e-08
SP6NIRT[Page 227, 1]	139.89
SP1BLUT[Page 227, 1]	163.02
SP3REDT[Page 227, 1]	139.99
SP4NIRP[Page 227, 1]	6.683e-08
SP5NIRT[Page 227, 1]	139.94
TGFAPROC[Page 227, 1]	9.0024
SP7BLUP[Page 227, 1]	9.947e-08
GFA[Page 227, 1]	DESIROOT/target/catalogs/dr9/0.51.0/gfas
GSGUIDE5[Page 227, 1]	(806.92,578.08),(449.53,1063.99)
SKYLEVEL[Page 227, 1]	1.364
TARG[Page 227, 1]	DESIROOT/target/catalogs/dr9/0.51.0/targets/sv1/resolve/dark
SP0REDT[Page 227, 1]	139.96
USEOPENL[Page 227, 1]	T
SP0BLUT[Page 227, 1]	163.02
SP2BLUP[Page 227, 1]	8.492e-08
GSGUIDE7[Page 227, 1]	(884.73,992.68),(494.79,1738.49)
SP0BLUP[Page 227, 1]	8.499e-08
POSCNVGD[Page 227, 1]	F
USEFOCUS[Page 227, 1]	T
ACQCAM[Page 227, 1]	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8
GSGUIDE0[Page 227, 1]	(954.26,900.15),(752.14,1756.37)
SP3NIRP[Page 227, 1]	3.566e-08
SP5BLUT[Page 227, 1]	162.99
GUIEXPID[Page 227, 1]	83129
SP9NIRP[Page 227, 1]	5.211e-08
USEFVC[Page 227, 1]	T
USEGUIDR[Page 227, 1]	T
GSGUIDE2[Page 227, 1]	(722.18,832.33),(237.62,150.28)
GSGUIDE3[Page 227, 1]	(49.91,660.39),(398.91,1892.18)
IGFRMNUM[Page 227, 1]	14
FGFRMNUM[Page 227, 1]	45
SP4BLUP[Page 227, 1]	6.248e-08
SP5BLUP[Page 227, 1]	1.115e-07
SP1REDT[Page 227, 1]	139.89
SP9BLUT[Page 227, 1]	163.02
FA_VER[Page 227, 1]	2.1.1.dev2706
IFFRMNUM[Page 227, 1]	1
SCSTD[Page 227, 1]	STD_WD,STD_FAINT

Table 26

KEY	Example Value
SP1NIRT[Page 227, 1]	139.89
USEFID[Page 227, 1]	T
REQDEC[Page 227, 1]	32.375
SP9REDP[Page 227, 1]	5.108e-08
SP2REDP[Page 227, 1]	6.944e-08
FAARGS[Page 227, 1]	–doclean n –dr dr9 –dtver 0.51.0 –faflavor sv1lrgqso2 –m31cen n –pmtime 2021-03-16T00:00:00.000
USESKY[Page 227, 1]	T
SP6NIRP[Page 227, 1]	2.809e-07
SP4NIRT[Page 227, 1]	139.94
SCTARG[Page 227, 1]	STD_WD,LRG,QSO_RF_4PASS,QSO_RF_8PASS,WISE_VAR_QSO,QSO_RED,WD_BINARIES_
FA_RUN[Page 227, 1]	2019-09-16T00:00:00
USEPOS[Page 227, 1]	T
SP2BLUT[Page 227, 1]	163.02
ARCHIVE[Page 227, 1]	/exposures/desi/20210402/00083129/guide-00083129.fits.fz
ISFRMNUM[Page 227, 1]	0
SKYSUPP[Page 227, 1]	DESIROOT/target/catalogs/gaiadr2/0.51.0/skies-supp
FOCEXPID[Page 227, 1]	83129
POSENABL[Page 227, 1]	4056
SUNDEC[Page 227, 1]	5.365754
TILEDEC[Page 227, 1]	32.375
POSFRACT[Page 227, 1]	0.95
SP9NIRT[Page 227, 1]	139.86
SPLITEXP[Page 227, 1]	F
SP8REDT[Page 227, 1]	139.94
SKYEXPID[Page 227, 1]	83129
FAOUTDIR[Page 227, 1]	/global/cfs/cdirs/desi/survey/fiberassign/SV1/20210316/
RUNDATE[Page 227, 1]	2019-09-16T00:00:00
SP4REDT[Page 227, 1]	140.01
TILERA[Page 227, 1]	127.7
KEEPGUDR[Page 227, 1]	F
POSDISAB[Page 227, 1]	925
SP3BLUT[Page 227, 1]	163.02
SP0REDP[Page 227, 1]	6.295e-08
SP6BLUT[Page 227, 1]	163.02
SCND[Page 227, 1]	DESIROOT/target/catalogs/dr9/0.51.0/targets/sv1/secondary/dark
SIMGFAP[Page 227, 1]	F
USESPLIT[Page 227, 1]	T
TILEID[Page 227, 1]	80873
TARG2[Page 227, 1]	DESIROOT/target/catalogs/gaiadr2/0.51.0/targets/sv1/resolve/supp
SP1NIRP[Page 227, 1]	4.585e-08
USEDONUT[Page 227, 1]	T
FIBASSGN[Page 227, 1]	/data/tiles/SVN_tiles/080/fiberassign-080873.fits.gz
SP8NIRT[Page 227, 1]	139.99
PMTIME[Page 227, 1]	2021-03-16T00:00:00.000
SP2NIRT[Page 227, 1]	139.89
KEEPFOCS[Page 227, 1]	F
VISITIDS[Page 227, 1]	83129
FA_SURV[Page 227, 1]	sv1
FFFRMNUM[Page 227, 1]	5

Table 26

KEY	Example Value
SP8BLUP[Page 227, 1]	7.959e-08
ACTTEFF[Page 227, 1]	112.2149
POSMVALL[Page 227, 1]	T
SP6BLUP[Page 227, 1]	6.3e-08
GUIDTIME[Page 227, 1]	5.0
SEEING[Page 227, 1]	1.3508
SP3REDP[Page 227, 1]	7.919e-08
USEETC[Page 227, 1]	T
FIELDNUM[Page 227, 1]	0
SP5REDT[Page 227, 1]	139.99
SP6REDP[Page 227, 1]	6.337e-08
SP8NIRP[Page 227, 1]	4.827e-08
USEROTAT[Page 227, 1]	T
FA_PLAN[Page 227, 1]	2022-07-01T00:00:00.000
SP2NIRP[Page 227, 1]	6.984e-08
POSONFRC[Page 227, 1]	0.4768
PETALS[Page 227, 1]	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9
STOPSKY[Page 227, 1]	T
SP7REDP[Page 227, 1]	6.038e-08
GUIDECAM[Page 227, 1]	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8
SP8BLUT[Page 227, 1]	162.9
TNFSPROC[Page 227, 1]	25.9483
ACQTIME[Page 227, 1]	15.0
REQADC[Page 227, 1]	92.63,97.66
SP4BLUT[Page 227, 1]	163.02
FAFLAVOR[Page 227, 1]	sv1lrgqso2
OBSCON[Page 227, 1]	DARK|GRAY|BRIGHT
SP7NIRT[Page 227, 1]	139.96
SP9REDT[Page 227, 1]	139.99
POSRMS[Page 227, 1]	0.0076
REACQUIR[Page 227, 1]	F
SP5REDP[Page 227, 1]	5.487e-08
STOPGUDR[Page 227, 1]	T
POSONTGT[Page 227, 1]	1934
FOCUSCAM[Page 227, 1]	FOCUS1,FOCUS4,FOCUS6,FOCUS9
SP5NIRP[Page 227, 1]	6.003e-08
SP1BLUP[Page 227, 1]	7.992e-08
PMSEEING[Page 227, 1]	1.33
SP9BLUP[Page 227, 1]	1.231e-07
SKYTIME[Page 227, 1]	60
POSITER[Page 227, 1]	1
USESPLITS[Page 227, 1]	T
SP1REDP[Page 227, 1]	5.506e-08
SP3NIRT[Page 227, 1]	140.01
FA_HA[Page 227, 1]	0.0
SP2REDT[Page 227, 1]	139.96
SKYCAM[Page 227, 1]	SKYCAM0,SKYCAM1
SP4REDP[Page 227, 1]	4.945e-08
SP7BLUT[Page 227, 1]	163.02

Table 26

KEY	Example Value
FSFRMNUM[Page 227, 1]	3
SIMGFACQ[Page 227, 1]	F
REQRA[Page 227, 1]	127.7
GSGUIDE8[Page 227, 1]	(364.80,1645.04),(69.26,1479.25)
DESIROOT[Page 227, 1]	/global/cfs/cdirs/desi
USEXSRVR[Page 227, 1]	T
STOPFOCS[Page 227, 1]	T
REQTEFF[Page 227, 1]	1000.0
GOALTIME[Page 227, 1]	1200.0
SBPROF[Page 227, 1]	ELG
EBVFAC[Page 227, 1]	1.07122550132983
MTLTIME[Page 227, 1]	2021-04-17T20:00:39
GOALTYPE[Page 227, 1]	DARK
MTL[Page 227, 1]	DESIROOT/survey/ops/surveyops/trunk/mtl/sv3/dark
SURVEY[Page 227, 1]	sv3
SCNDMTL[Page 227, 1]	DESIROOT/survey/ops/surveyops/trunk/mtl/sv3/secondary/dark
FAPRGRM[Page 227, 1]	DARK
TOTTEFF[Page 227, 1]	838.56
PMCORR[Page 227, 1]	n
MINTFRAC[Page 227, 1]	0.9
BBKGMINA[Page 227, 1]	-0.3947016321413652
BBKGMINC[Page 227, 1]	-0.2673014085831243
BBKGMIND[Page 227, 1]	-0.4786751204310712
BBKGMAXA[Page 227, 1]	0.6036115648904081
BBKGMAXD[Page 227, 1]	0.2858693184663221
BBKGMAXB[Page 227, 1]	0.2978123984653912
BBKGMAXC[Page 227, 1]	0.3636081010150568
BBKGMINB[Page 227, 1]	-0.2841325038108138
FVCTIME[Page 227, 1]	2.0
POSCVFRC[Page 227, 1]	0.3467
ETCSPLIT[Page 227, 1]	1
ACQFWHM[Page 227, 1]	1.71791
TRANSPAR[Page 227, 1]	None
NTSPROG[Page 227, 1]	BRIGHT
SLEWANGL[Page 227, 1]	28.856
TOO[Page 227, 1]	/data/afternoon_planning/surveyops/trunk/mtl/sv3/ToO/ToO.ecsv
ESTTIME[Page 227, 1]	2231.315
ETCPREV[Page 227, 1]	0.0
ETCTRANS[Page 227, 1]	0.719235
MINTIME[Page 227, 1]	120.0
ETCTHRUP[Page 227, 1]	0.442956
ETCTEFF[Page 227, 1]	222.548355
ETCSKY[Page 227, 1]	1.43154
ETCVERS[Page 227, 1]	0.1.12-3-g12b54bb
ETCFRACE[Page 227, 1]	0.271983
ETCREAL[Page 227, 1]	1054.206299
ETCPROF[Page 227, 1]	BGS
CONVERGD[Page 227, 1]	F
ETCSEENG[Page 227, 1]	1.7179

Table 26

KEY	Example Value
ETCTHRUB[Page 227, 1]	0.469155
PMTRANSP[Page 227, 1]	104.71
ETCFRACB[Page 227, 1]	0.123838
ETCFRACP[Page 227, 1]	0.346107
ETCTHRUE[Page 227, 1]	0.474574
MAXTIME[Page 227, 1]	5400.0
SIMGFAQ[Page 227, 1]	F
SHFTFOCS[Page 227, 1]	220.0
FASCRIPT[Page 227, 1]	../bin/fba_launch
ROLE[Page 227, 1]	GUIDERMAN
SVNDM[Page 227, 1]	unknown
SVNMTL[Page 227, 1]	unknown
TARG3[Page 227, 1]	DESIROOT/target/catalogs/dr9/0.51.0/targets/sv1/resolve/bright
DR[Page 227, 1]	dr9
M31CEN[Page 227, 1]	n
PRIORITY[Page 227, 1]	default
DTVER[Page 227, 1]	0.50.0
UPSSTAT.undefined[Page 227, 1]	17826.0
FA_M_GFA[Page 227, 1]	0.4
FA_M_PET[Page 227, 1]	0.4
FA_M_POS[Page 227, 1]	0.05

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique target ID
PETAL_LOC	int16		Focal plane petal location 0-9
DEVICE_LOC	int32		Device location 0-5xx
LOCATION	int64		1000*PETAL_LOC + DEVICE_LOC
FIBER	int32		Fiber number 0-4999
FIBERSTATUS	int32		Fiber status mask; 0=good
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gai
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKID	int64		Brick ID from tractor input

Table 27 – continued from previous page

Name	Type	Units	Description
BRICK_OBJID	int64		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blending
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; “sourceid” for Gaia DR
REF_CAT	char[2]		Reference catalog source for star: “T2” for Tycho-2, “G2” for Gaia D
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
BRICKNAME	char[8]		Brick name from tractor input
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from this
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from this
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from all s
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from all s
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from all s
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE=”SER’
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORPHTY
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORPHTY
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCOND
NUMOBS_INIT	int64		Initial number of observations for target calculated across target sele
CMX_TARGET[Page 227, 1]	int64		Target selection bitmask for commissioning
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SCND_TARGET[Page 227, 1]	int64		Target selection bitmask for secondary programs
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
EXPTIME	float64	s	Length of time shutter was open

Table 27 – continued from previous page

Name	Type	Units	Description
SV1_BGS_TARGET[Page 227, 1]	int64		BGS (bright time program) target selection bitmask for SV1
SV1_MWS_TARGET[Page 227, 1]	int64		MWS (bright time program) target selection bitmask for SV1
SV1_DESI_TARGET[Page 227, 1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_SCND_TARGET[Page 227, 1]	int64		Secondary target selection bitmask for SV1
SV3_BGS_TARGET[Page 227, 1]	int64		BGS (bright time program) target selection bitmask for SV3
SV3_DESI_TARGET[Page 227, 1]	int64		DESI (dark time program) target selection bitmask for SV3
SV3_SCND_TARGET[Page 227, 1]	int64		Secondary target selection bitmask for SV3
SV3_MWS_TARGET[Page 227, 1]	int64		MWS (bright time program) target selection bitmask for SV3
SV2_DESI_TARGET[Page 227, 1]	int64		DESI (dark time program) target selection bitmask for SV2
SV2_SCND_TARGET[Page 227, 1]	int64		Secondary target selection bitmask for SV2
SV2_MWS_TARGET[Page 227, 1]	int64		MWS (bright time program) target selection bitmask for SV2
SV2_BGS_TARGET[Page 227, 1]	int64		BGS (bright time program) target selection bitmask for SV2

HDU6

EXTNAME = CHI2PIX

χ^2 of PSF fit to CCD pixels per spectrum wavelength bin.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelengths
NAXIS2	500	int	Number of spectra
CHECKSUM	SCE8VAB5SAB5SAB5	str	HDU checksum updated 2021-07-08T12:56:18
DATASUM	3693165584	str	data unit checksum updated 2021-07-08T12:56:18

Data: FITS image [float32, 2751x500]

Notes and Examples

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

psf-CAMERA-EXPID.fits

Summary
PSF (point spread function) files model the mapping of fibers and wavelengths to pixels on spectrograph CCDs.

Naming Convention
`psf-CAMERA-EXPID.fits`, where `CAMERA` is *e.g.*, "b0", "r5", etc. and `EXPID` is 8-digit exposure number.

Regex
`psf-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 998 KB

See *psfnight-CAMERA-NIGHT documentation* for a description of the PSF file content.

Four different PSF files are written per camera for each arc lamp exposure:

1. *shifted-input-psf-CAMERA-EXPID.fits*: Input PSF with spectral trace coordinates and wavelength calibration adjusted to the current CCD image, used as a starting guess for the PSF shape fit.
2. *fit-psf-before-listed-fix-CAMERA-EXPID.fits*: Result of the specex PSF fit before adjusting the PSF model of problematic fibers not included in the fit.
3. *fit-psf-fixed-listed-CAMERA-EXPID.fits*: Result of the specex PSF fit with the PSF model of problematic fibers interpolated from neighboring fibers.
4. *fit-psf-CAMERA-EXPID.fits*: Final PSF fit (which is the same as *fit-psf-fixed-listed-CAMERA-EXPID.fits* if there are problematic fibers)

The `fit-psf-*.fits` files from individual exposures are combined into the *psfnight* files for each night.

Flat and science exposures have a single PSF file per camera:

`psf-CAMERA-EXPID.fits`: psfnight file with spectral trace coordinates and wavelength solution adjusted to match this exposure. Flat exposures are adjusted only in x (cross dispersion = fiber direction), while science exposures are adjusted in both x and y (wavelength direction).

sframe-CAMERA-EXPID.fits

Summary
fiber-flatfielded and sky-subtracted but not flux calibrated per-camera spectra.

Naming Convention
`sframe-{CAMERA}-{EXPID}.fits`, where `{CAMERA}` is one of the spectrograph cameras (*e.g.* `z1`) and `{EXPID}` is the 8-digit exposure ID.

Regex
`sframe-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 70 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	FLUX	IMAGE	flatfielded sky subtracted photons
HDU1	IVAR	IMAGE	Inverse variance of FLUX
HDU2	MASK	IMAGE	Bad value mask; 0=good
HDU3	WAVELENGTH	IMAGE	Wavelength grid of the extraction
HDU3	RESOLUTION	IMAGE	Resolution matrix
HDU5	FIBERMAP	BINTABLE	Fibermap
HDU6	CHI2PIX	IMAGE	chi2 of PSF fit to CCD pixels

FITS Header Units

HDU0

EXTNAME = FLUX

2D array of fiber flat-fielded and sky subtracted flux of dimension [nspec, nwave] in units of electrons per Angstrom. nspec is the number of fibers per camera. nwave in the length of the wavelength array. The spectra of all fibers share the same wavelength grid (given in HDU WAVELENGTH). sframe.flux = frame.flux / flatfield - sky .

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
NAXIS2	500	int	
EXPID	69022	int	Exposure number
EXPFRAME	0	int	Frame number
TILEID	80616	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/080/fiberassign-080616.fits	str	Fiber assign fil
FLAVOR	science	str	Observation type
SEQUENCE	DESI	str	OCS Sequence name
PURPOSE	Commissioning	str	Purpose of observing night
PROGRAM	SV1 BGS+MWS tile 80616	str	Program name
PROPID	2019B-5000	str	Proposal ID
OBSERVER	DESIObserver	str	Names of observers
LEAD	RunManager	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification

continues on next page

Table 28 – continued from previous page

KEY	Example Value	Type	Comment
NIGHT	20201220	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2020-12-21T02:36:32.099838	str	[UTC] Observation data and start time
TIME-OBS	02:39:11.845920	str	[UTC] Observation start time
MJD-OBS	59204.10870486	float	Modified Julian Date of observation
OPENSHUT	2020-12-21T02:36:32.099838	str	Time shutter opened
ST	01:10:39.210	str	Local Sidereal time at observation start (HH:MM
EXPTIME	300.007	float	[s] Actual exposure time
REQRA	356.0	float	[deg] Requested right ascension (observer input
REQDEC	29.0	float	[deg] Requested declination (observer input)
FOCUS	1426.5,-501.4,81.0,-2.6,42.3,169.2	str	Telescope focus settings
VCCD	ON	str	True (ON) if CCD voltage is on
VCCDON	2020-12-14T17:48:28.296248	str	Time when CCD voltage was turned on
VCCDSEC	550592.7	float	[s] CCD on time in seconds
TRUSTEMP	11.767	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	8.925	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Epoch of observation
MOUNTAZ	266.70224	float	[deg] Mount azimuth angle
MOUNTDEC	28.999221	float	[deg] Mount declination
MOUNTEL	71.039837	float	[deg] Mount elevation angle
MOUNTHA	21.769281	float	[deg] Mount hour angle
SKYDEC	28.999221	float	[deg] Telescope declination (pointing on sky)
SKYRA	355.996551	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	28.999221	float	[deg] Target declination (to TCS)
TARGTRA	355.996551	float	[deg] Target right ascension (to TCS)
USEETC	F	bool	ETC data available if true
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values

continues on next page

Table 28 – continued from previous page

KEY	Example Value	Type	Comment
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	167.1	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.0	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
SPECGRPH	3	int	Spectrograph logical name (SP)
SPECID	6	int	Spectrograph serial number (SM)
FEEBOX	lbnl074	str	CCD Controller serial number
VESSEL	11	int	Cryostat serial number
FEEVER	v20160312	str	CCD Controller version
FEEPOWER	ON	str	FEE power status
FEEDMASK	2134851391	int	FEE dac mask
FEECMASK	1048575	int	FEE clk mask
CCDTEMP	-140.2798	float	[deg C] CCD controller CCD temperature
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
FILENAME	/exposures/desi/specs/20201220/00069022/sp1-00069022.fits.fz	str	Name
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
CRYOPRES[1]	7.233e-08	str	[mb] Cryostat pressure (IP)
CLOCK7	-2.0001,3.9999	str	[V] high rail, low rail
TRIMSECA	[8:2064, 2:2065]	str	Trim section for quadrant A
CCDNAME	CCDSM6R	str	CCD name
TRIMSECD	[2193:4249, 2130:4193]	str	Trim section for quadrant D
OFFSET2	0.4000000059604645,-8.961	str	[V] set value, measured value
CPUTEMP	56.625	float	[deg C] CCD controller CPU temperature
DAC11	-25.0003,-24.7086	str	[V] set value, measured value
AMPSECA	[1:2057, 1:2064]	str	AMP section for quadrant A
CCDCFG	M1-50_lbnl_20190719.cfg	str	CCD configuration file
TRIMSECB	[2193:4249, 2:2065]	str	Trim section for quadrant B
CLOCK3	-2.0001,3.9999	str	[V] high rail, low rail

continues on next page

Table 28 – continued from previous page

KEY	Example Value	Type	Comment
CCDSECA	[1:2057, 1:2064]	str	CCD section for quadrant A
CLOCK4	9.9999,0.0	str	[V] high rail, low rail
DAC0	-9.0002,-8.9095	str	[V] set value, measured value
CLOCK10	9.9992,2.9993	str	[V] high rail, low rail
BIASSECA	[2065:2128, 2:2065]	str	Bias section for quadrant A
PRRSECA	[8:2064, 1:1]	str	Row prescan section for quadrant A
DAC7	6.4999,6.4856	str	[V] set value, measured value
AMPSECB	[4114:2058, 1:2064]	str	AMP section for quadrant B
DAC10	-25.0003,-24.9906	str	[V] set value, measured value
DELAYS	20, 20, 25, 30, 7, 3000, 7, 7, 7, 7	str	[10] Delay settings
CCDSECD	[2058:4114, 2065:4128]	str	CCD section for quadrant D
CASETEMP	56.4919	float	[deg C] CCD controller case temperature
CLOCK6	9.9999,0.0	str	[V] high rail, low rail
CLOCK13	9.9992,2.9993	str	[V] high rail, low rail
CLOCK9	9.9992,2.9993	str	[V] high rail, low rail
DAC8	-25.0003,-25.0202	str	[V] set value, measured value
DAC9	-25.0003,-24.6789	str	[V] set value, measured value
ORSECB	[2193:4249, 2066:2097]	str	Row overscan section for quadrant B
CLOCK1	9.9999,0.0	str	[V] high rail, low rail
DETSECC	[1:2057, 2065:4128]	str	Detector section for quadrant C
AMPSECD	[4114:2058, 4128:2065]	str	AMP section for quadrant D
CLOCK5	9.9999,0.0	str	[V] high rail, low rail
ORSECA	[8:2064, 2066:2097]	str	Row overscan section for quadrant A
DAC15	0.0,0.0297	str	[V] set value, measured value
DATASECA	[8:2064, 2:2065]	str	Data section for quadrant A
CCDPREP	purge,clear	str	CCD prep actions
OFFSET7	2.0,6.4908	str	[V] set value, measured value
DAC5	5.9998,6.028	str	[V] set value, measured value
CLOCK12	9.9992,2.9993	str	[V] high rail, low rail

continues on next page

Table 28 – continued from previous page

KEY	Example Value	Type	Comment
CCDSECB	[2058:4114, 1:2064]	str	CCD section for quadrant B
OFFSET6	2.0,6.0332	str	[V] set value, measured value
DAC4	5.9998,6.028	str	[V] set value, measured value
PRESECC	[1:7, 2130:4193]	str	Prescan section for quadrant C
OFFSET5	2.0,6.028	str	[V] set value, measured value
DAC2	-9.0002,-8.9713	str	[V] set value, measured value
CRYOTEMPPage 264, 1	162.97	float	[deg K] Cryostat CCD temperature
PRESECB	[4250:4256, 2:2065]	str	Prescan section for quadrant B
DIGITIME	47.1031	float	[s] Time to digitize image
DAC3	-10.5005,-10.3824	str	[V] set value, measured value
CAMERA	r3	str	Camera name
DETSECB	[2058:4114, 1:2064]	str	Detector section for quadrant B
OFFSET1	0.4000000059604645,-8.8065	str	[V] set value, measured value
DATASECD	[2193:4249, 2130:4193]	str	Data section for quadrant D
SETTINGS	detectors_sm_20191211.json	str	Name of DESI CCD settings file
CLOCK11	9.9992,2.9993	str	[V] high rail, low rail
DAC13	0.0,0.0	str	[V] set value, measured value
CLOCK14	9.9992,2.9993	str	[V] high rail, low rail
CCDSECC	[1:2057, 2065:4128]	str	CCD section for quadrant C
DATASECC	[8:2064, 2130:4193]	str	Data section for quadrant C
CLOCK0	9.9999,0.0	str	[V] high rail, low rail
CLOCK15	9.9992,2.9993	str	[V] high rail, low rail
DAC12	0.0,0.0297	str	[V] set value, measured value
CCDSIZE	4194,4256	str	CCD size in pixels (rows, columns)
OFFSET0	0.4000000059604645,-8.9095	str	[V] set value, measured value
ORSECD	[2193:4249, 2098:2129]	str	Row bias section for quadrant D
DAC16	48.0,46.7082	str	[V] set value, measured value
PRRSECC	[8:2064, 4194:4194]	str	Row prescan section for quadrant C

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Table 28 – continued from previous page

KEY	Example Value	Type	Comment
PRRSECD	[2193:4249, 4194:4194]	str	Row prescan section for quadrant D
BIASSECB	[2129:2192, 2:2065]	str	Bias section for quadrant B
DETSECD	[2058:4114, 2065:4128]	str	Detector section for quadrant D
CLOCK18	9.0,0.9999	str	[V] high rail, low rail
DAC17	20.0008,14.274	str	[V] set value, measured value
CCDTMING	default_lbnl_timing_20180905.txt	str	CCD timing file
DETECTOR	M1-50	str	Detector (ccd) identification
PRRSECB	[2193:4249, 1:1]	str	Row prescan section for quadrant B
TRIMSECC	[8:2064, 2130:4193]	str	Trim section for quadrant C
DAC14	0.0,0.0148	str	[V] set value, measured value
BIASSECD	[2129:2192, 2130:4193]	str	Bias section for quadrant D
CDSPARMS	400, 400, 8, 2000	str	CDS parameters
OFFSET3	0.4000000059604645,-10.3721	str	[V] set value, measured value
PRESECA	[1:7, 2:2065]	str	Prescan section for quadrant A
ORSECC	[8:2064, 2098:2129]	str	Row overscan section for quadrant C
DAC6	5.9998,6.0332	str	[V] set value, measured value
PGAGAIN	3	int	Controller gain
DAC1	-9.0002,-8.8065	str	[V] set value, measured value
DATASECB	[2193:4249, 2:2065]	str	Data section for quadrant B
CLOCK2	9.9999,0.0	str	[V] high rail, low rail
CLOCK16	9.9999,3.0	str	[V] high rail, low rail
PRESECD	[4250:4256, 2130:4193]	str	Prescan section for quadrant D
OFFSET4	2.0,6.0332	str	[V] set value, measured value
CLOCK17	9.0,0.9999	str	[V] high rail, low rail
AMPSECC	[1:2057, 4128:2065]	str	AMP section for quadrant C
CLOCK8	9.9992,2.9993	str	[V] high rail, low rail
DETSECA	[1:2057, 1:2064]	str	Detector section for quadrant A
BIASSECC	[2065:2128, 2130:4193]	str	Bias section for quadrant C
BLDTIME	0.3504	float	[s] Time to build image

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Table 28 – continued from previous page

KEY	Example Value	Type	Comment
REQTIME	300.0	float	[s] Requested exposure time
OBSID	kp4m20201221t023911	str	Unique observation identifier
PROCTYPE	RAW	str	Data processing level
PRODTYPE	image	str	Data product type
CHECKSUM	jjGAmi92jiE8ji98	str	HDU checksum updated 2022-02-14T06:14:04
DATASUM	3075256975	str	data unit checksum updated 2022-02-14T06:14:04
GAINA	1.681	float	e/ADU (gain applied to image)
SATULEVA	28000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPA	0.7048677125421818	float	ADUs (max-min of median overscan per row)
OMETHA	AVERAGE	str	use average overscan
OVERSCNA	1979.586454500641	float	ADUs (gain not applied)
OBSRDNA	2.618213792981265	float	electrons (gain is applied)
SATUELEA	43740.31516998442	float	saturation or non lin. level, in electrons
GAINB	1.625	float	e/ADU (gain applied to image)
SATULEVB	57000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPB	0.6850349189899134	float	ADUs (max-min of median overscan per row)
OMETHB	AVERAGE	str	use average overscan
OVERSCNB	1997.289875350671	float	ADUs (gain not applied)
OBSRDNB	3.12518985733541	float	electrons (gain is applied)
SATUELEB	89379.40395255515	float	saturation or non lin. level, in electrons
GAINC	1.477	float	e/ADU (gain applied to image)
SATULEVC	59000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPC	0.6403308619337622	float	ADUs (max-min of median overscan per row)
OMETHC	AVERAGE	str	use average overscan
OVERSCNC	1974.691977751432	float	ADUs (gain not applied)
OBSRDNC	2.344388520757958	float	electrons (gain is applied)
SATUELEC	84226.37994886114	float	saturation or non lin. level, in electrons
GAIND	1.492	float	e/ADU (gain applied to image)
SATULEVD	62000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPD	0.6246898852550657	float	ADUs (max-min of median overscan per row)

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KEY	Example Value	Type	Comment
OMETHD	AVERAGE	str	use average overscan
OVERSCND	1998.214476179268	float	ADUs (gain not applied)
OBSRDND	2.301320302261815	float	electrons (gain is applied)
SATUELED	89522.66400154053	float	saturation or non lin. level, in electrons
FIBERMIN	1500	int	
LONGSTRN	OGIP 1.0	str	The OGIP Long String Convention may be used.
MODULE	CI	str	Image Sources/Component
COSMSPLT	F	bool	Cosmics split exposure if true
MAXSPLIT	0	int	Number of allowed exposure splits
SPLITIDS[Page 264, 1]	69022	str	List of expids for split exposures
OBSTYPE	SCIENCE	str	Spectrograph observation type
MANIFEST	F	bool	DOS exposure manifest
OBJECT		str	Object name
SEQNUM	1	int	Number of exposure in sequence
CAMSHUT	open	str	Shutter status during observation
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
FOCSTIME[Page 264, 1]	60.0	float	[s] focus GFA exposure time
SKYTIME[Page 264, 1]	60.0	float	[s] sky camera exposure time (acquisition)
WHITESPT	F	bool	Telescope is at whitespot
ZENITH	F	bool	Telescope is at zenith
SEANNEX	F	bool	Telescope is at SE annex
BEYONDP	F	bool	Telescope is beyond pole
FIDUCIAL	off	str	Fiducials status during observation
BACKLIT	off	str	Fibers are backlit if True
AIRMASS	1.060311	float	Airmass
PMREADY	T	bool	Primary mirror ready
PMCOVER	open	str	Primary mirror cover
PMCOOL	off	str	Primary mirror cooling
DOMSHUTU	open	str	Upper dome shutter
DOMSHUTL	open	str	Lower dome shutter
DOMLIGHH	off	str	High dome lights
DOMLIGHL	off	str	Low dome lights
DOMEAZ	255.166	float	[deg] Dome azimuth angle
DOMINPOS	T	bool	Dome is in position

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KEY	Example Value	Type	Comment
GUIDOFFR	-0.052283	float	[arcsec] Cummulative guider offset (RA)
GUIDOFFD	0.136634	float	[arcsec] Cummulative guider offset (dec)
MOONDEC	-8.975162	float	[deg] Moon declination at start of exposure
MOONRA	352.538429	float	[deg] Moon RA at start of exposure
INCTRL	T	bool	DESI in control
INPOS	T	bool	Mount in position
MNTOFFD	-15.76	float	[arcsec] Mount offset (dec)
MNTOFFR	29.32	float	[arcsec] Mount offset (RA)
PARALLAC	75.635085	float	[deg] Parallactic angle
TARGTAZ	267.074049	float	[deg] Target azimuth
TARGTEL	70.563787	float	[deg] Target elevation
TRGTOFFD	0.0	float	[arcsec] Telescope target offset (dec)
TRGTOFFR	0.0	float	[arcsec] Telescope target offset (RA)
ZD	19.436213	float	[deg] Telescope zenith distance
TILERA	356.0	float	RA of tile given in fiberassign file
TILEDEC	29.0	float	DEC of tile given in fiberassign file
TCSST	01:13:18.668	str	Local Sidereal time reported by TCS (HH:MM:SS)
TCSMJD	59204.110981	float	MJD reported by TCS
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM[Page 264, 1]	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM[Page 264, 1]	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
REQADC	65.78,85.28	str	[deg] requested ADC angles
ADCCORR	T	bool	Correct pointing for ADC setting if True
ADC1PHI	65.780005	float	[deg] ADC 1 angle
ADC2PHI	85.279991	float	[deg] ADC 2 angle
ADC1HOME	F	bool	ADC 1 at home position if True
ADC2HOME	F	bool	ADC 2 at home position if True
ADC1NREV	-1.0	float	ADC 1 number of revs
ADC2NREV	0.0	float	ADC 2 number of revs
ADC1STAT	STOPPED	str	ADC 1 status

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KEY	Example Value	Type	Comment
ADC2STAT	STOPPED	str	ADC 2 status
HEXPOS	1426.5,-501.3,81.0,-2.6,42.3,171.9	str	Hexapod position
RESETROT	F	bool	DOS Control: reset hex rotator
USEPOS	T	bool	Fiber positioner data available if true
PETALS	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9	str	Participating petals
POSCYCLE	1	int	Number of current iteration
POSONTGT	3626	int	Number of positioners on target
POSONFRC	0.8613	float	Fraction of positioners on target
POSDISAB	37	int	Number of disabled positioners
POSENABL	4210	int	Number of enabled positioners
POSRMS	0.0171	float	[micron] RMS of positioner accuracy
POSITER	1	int	Positioning Control: max. number of pos. cycles
POSFRACT	0.95	float	
POSTOLER	0.01	float	Positioning Control: in_position tolerance (mm)
POSMVALL	T	bool	Positioning Control: move all positioners
GUIDMODE	catalog	str	Guider mode
USEAOS[Page 264, 1]	F	bool	DOS Control: AOS data available if true
USESPCTR	T	bool	DOS Control: use spectrographs
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating spectrograph
ILLSPECS[Page 264, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating illuminate s
CCDSPECS[Page 264, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating ccd spectrog
TDEWPNT	-16.043	float	Telescope air dew point
TAIRFLOW	0.0	float	Telescope air flow
TAIRITMP	11.8	float	[deg] Telescope air in temperature
TAIROTMP	11.7	float	[deg] Telescope air out temperature
TAIRTEMP	10.65	float	[deg] Telescope air temperature
TCASITMP	0.0	float	[deg] Telescope Cass Cage in temperature
TCASOTMP	10.8	float	[deg] Telescope Cass Cage out temperature
TCSITEMP	9.3	float	[deg] Telescope center section in temperature

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KEY	Example Value	Type	Comment
TCSOTEMP	10.8	float	[deg] Telescope center section out temperature
TCIBTEMP	0.0	float	[deg] Telescope chimney IB temperature
TCIMTEMP	0.0	float	[deg] Telescope chimney IM temperature
TCITTEMP	0.0	float	[deg] Telescope chimney IT temperature
TCOSTEMP	0.0	float	[deg] Telescope chimney OS temperature
TCOWTEMP	0.0	float	[deg] Telescope chimney OW temperature
TDBTEMP	9.3	float	[deg] Telescope dec bore temperature
TFLOWIN	0.0	float	Telescope flow rate in
TFLOWOUT	0.0	float	Telescope flow rate out
TGLYCOLI	9.9	float	[deg] Telescope glycol in temperature
TGLYCOLO	9.8	float	[deg] Telescope glycol out temperature
THINGES	11.4	float	[deg] Telescope hinge S temperature
THINGEW	11.2	float	[deg] Telescope hinge W temperature
TPMAVERT	8.931	float	[deg] Telescope mirror averagetemperature
TPMDESIT	7.0	float	[deg] Telescope mirror desired temperature
TPMEIBT	8.6	float	[deg] Telescope mirror EIB temperature
TPMEITT	8.6	float	[deg] Telescope mirror EIT temperature
TPMEOBT	8.5	float	[deg] Telescope mirror EOB temperature
TPMEOTT	9.0	float	[deg] Telescope mirror EOT temperature
TPMNIBT	8.4	float	[deg] Telescope mirror NIB temperature
TPMNITT	8.9	float	[deg] Telescope mirror NIT temperature
TPMNOBT	8.8	float	[deg] Telescope mirror NOB temperature
TPMNOTT	9.1	float	[deg] Telescope mirror NOT temperature
TPMRTDT	9.0	float	[deg] Telescope mirror RTD temperature
TPMSIBT	8.6	float	[deg] Telescope mirror SIB temperature
TPMSITT	8.8	float	[deg] Telescope mirror SIT temperature

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KEY	Example Value	Type	Comment
TPMSOBT	8.2	float	[deg] Telescope mirror SOB temperature
TPMSOTT	8.9	float	[deg] Telescope mirror SOT temperature
TPMSTAT	ready	str	Telescope mirror status
TPMWIBT	8.2	float	[deg] Telescope mirror WIB temperature
TPMWITT	9.1	float	[deg] Telescope mirror WIT temperature
TPMWOBT	8.3	float	[deg] Telescope mirror WOB temperature
TPMWOTT	8.9	float	[deg] Telescope mirror WOT temperature
TPCITEMP	8.5	float	[deg] Telescope primary cell in temperature
TPCOTEMP	8.6	float	[deg] Telescope primary cell out temperature
TPR1HUM	0.0	float	Telescope probe 1 humidity
TPR1TEMP	0.0	float	[deg] Telescope probe1 temperature
TPR2HUM	0.0	float	Telescope probe 2 humidity
TPR2TEMP	0.0	float	[deg] Telescope probe2 temperature
TSERVO	40.0	float	Telescope servo setpoint
TTRSTEMP	11.4	float	[deg] Telescope top ring S temperature
TTRWTEMP	11.0	float	[deg] Telescope top ring W temperature
TTRUETBT	-4.2	float	[deg] Telescope truss ETB temperature
TTRUETTT	11.2	float	[deg] Telescope truss ETT temperature
TTRUNTBT	10.9	float	[deg] Telescope truss NTB temperature
TTRUNTTT	11.2	float	[deg] Telescope truss NTT temperature
TTRUSTBT	10.7	float	[deg] Telescope truss STB temperature
TTRUSTST	10.8	float	[deg] Telescope truss STS temperature
TTRUSTTT	11.1	float	[deg] Telescope truss STT temperature
TTRUTSBT	11.8	float	[deg] Telescope truss TSB temperature
TTRUTSMT	11.8	float	[deg] Telescope truss TSM temperature
TTRUTSTT	11.8	float	[deg] Telescope truss TST temperature

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KEY	Example Value	Type	Comment
TTRUWTBT	10.5	float	[deg] Telescope truss WTB temperature
TTRUWTTT	10.9	float	[deg] Telescope truss WTT temperature
ALARM	F	bool	UPS major alarm or check battery
ALARM-ON	F	bool	UPS active alarm condition
BATTERY	100.0	float	[%] UPS Battery left
SECLEFT	5178.0	float	[s] UPS Seconds left
UPSSTAT	System Normal - On Line(7)	str	UPS Status
INAMPS	70.4	float	[A] UPS total input current
OUTWATTS	5000.0,7200.0,4800.0	str	[W] UPS Phase A, B, C output watts
COMPDEW	-12.9	float	[deg C] Computer room dewpoint
COMPHUM	7.4	float	[%] Computer room humidity
COMPAMB	19.5	float	[deg C] Computer room ambient temperature
COMPTEMP	24.5	float	[deg C] Computer room hygrometer temperature
DEWPOINT	11.5	float	[deg C] (outside) dewpoint
HUMIDITY	10.0	float	[%] (outside) humidity
PRESSURE	795.0	float	[torr] (outside) air pressure
OUTTEMP	0.0	float	[deg C] outside temperature
WINDDIR	55.0	float	[deg] wind direction
WINDSPD	27.3	float	[m/s] wind speed
GUST	20.6	float	[m/s] Wind gusts speed
AMNIENTN	13.5	float	[deg C] ambient temperature north
CFLOOR	8.9	float	[deg C] temperature on C floor
NWALLIN	13.9	float	[deg C] temperature at north wall inside
NWALLOUT	9.6	float	[deg C] temperature at north wall outside
WWALLIN	12.9	float	[deg C] temperature at west wall inside
WWALLOUT	10.6	float	[deg C] temperature at west wall outside
AMBIENTS	14.8	float	[deg C] ambient temperature south
FLOOR	12.6	float	[deg C] temperature at floor (LCR)

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Table 28 – continued from previous page

KEY	Example Value	Type	Comment
EWALLCMP	10.8	float	[deg C] temperature at east wall, computer room
EWALLCOU	10.6	float	[deg C] temperature at east wall, Coude room
ROOF	10.3	float	[deg C] temperature on roof
ROOFAMB	10.6	float	[deg C] ambient temperature on roof
DOMEBLOW	10.4	float	[deg C] temperature at dome back, lower
DOMEBUP	10.7	float	[deg C] temperature at dome back, upper
DOMELLOW	10.8	float	[deg C] temperature at dome left, lower
DOMELUP	10.8	float	[deg C] temperature at dome left, upper
DOMERLOW	10.6	float	[deg C] temperature at dome right, lower
DOMERUP	10.5	float	[deg C] temperature at dome right, upper
PLATFORM	10.4	float	[deg C] temperature at platform
SHACKC	14.4	float	[deg C] temperature at shack ceiling
SHACKW	13.7	float	[deg C] temperature at shack wall
STAIRSL	10.5	float	[deg C] temperature at stairs, lower
STAIRSM	10.4	float	[deg C] temperature at stairs, mid
STAIRSU	10.6	float	[deg C] temperature at stairs, upper
TELBASE	9.6	float	[deg C] temperature at telescope base
UTILWALL	11.1	float	[deg C] temperature at utility room wall
UTILROOM	10.9	float	[deg C] temperature in utilitiy room
TNFSPROC[Page 264, 1]	8.1963	float	[s] PlateMaker NFSPROC processing time
TGFAPROC[Page 264, 1]	7.9212	float	[s] PlateMaker GFAPROC processing time
SIMGFAP	F	bool	DOS Control: simulate GFAPROC
USEFVC	T	bool	DOS Control: use fvc
USEFID	T	bool	DOS Control: use fiducials
USEILLUM	T	bool	DOS Control: use illuminator

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KEY	Example Value	Type	Comment
USEXSRVR	T	bool	DOS Control: use exposure server
USEOPENL	T	bool	DOS Control: use open loop move
STOPGUDR	T	bool	DOS Control: stop guider
STOPFOCS	T	bool	DOS Control: stop focus
STOPSKY	T	bool	DOS Control: stop sky monitor
KEEPGUDR	F	bool	DOS Control: keep guider running
KEEPFOCS	F	bool	DOS Control: keep focus running
KEEPSKY	F	bool	DOS Control: keep sky mon. running
REACQUIR	F	bool	DOS Control: reacquire same files
EXCLUDED		str	Components excluded from this exposure
FVCTIME[Page 264, 1]	2.0	float	[s] FVC exposure time
SIMGFACQ	F	bool	
POSCNVGD[Page 264, 1]	F	bool	Number of positioners converged
GUIEXPID	69022	int	Guider exposure id at start of spectro exp.
IGFRMNUM	12	int	Guider frame number at start of spectro exp.
FOCEXPID	69022	int	Focus exposure id at start of spectro exp.
IFFRMNUM	1	int	Focus frame number at start of spectro exp.
SKYEXPID	69022	int	Sky exposure id at start of spectro exp.
ISFRMNUM	1	int	Sky frame number at start of spectro exp.
FGFRMNUM	46	int	Guider frame number at end of spectro exp.
FFFRMNUM	6	int	Focus frame number at end of spectro exp.
FSFRMNUM	5	int	Sky frame number at end of spectro exp.
HELIOCOR	0.9999115198216216	float	
NSPEC	500	int	Number of spectra
WAVEMIN	5760.0	float	First wavelength [Angstroms]
WAVEMAX	7620.0	float	Last wavelength [Angstroms]
WAVESTEP	0.8	float	Wavelength step size [Angstroms]
SPECTER	0.10.0	str	https://github.com/desihub/specter

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KEY	Example Value	Type	Comment
IN_PSF	SPECPROD/exposures/20201220/00069022/psf-r3-00069022.fits	str	Input sp
IN_IMG	SPECPROD/preproc/20201220/00069022/preproc-r3-00069022.fits	str	
ORIG_PSF	SPECPROD/calibnight/20201220/psfnight-r3-20201220.fits	str	
BUNIT	electron/Angstrom	str	
IN_SKY	SPECPROD/exposures/20201220/00069022/sky-r3-00069022.fits	str	
FIBERFLT	SPECPROD/exposures/20201220/00069022/fiberflatexp-r3-00069022.fits	str	
SP6BLUP[Page 264, 1]	7.899e-08	float	[mb] SP6 blue pressure
TCSMFDEC[Page 264, 1]	1	int	TCS moving filter length (dec)
SLEWANGL[Page 264, 1]	15.646	float	[deg] Slew Angle
SEQTOT[Page 264, 1]	2	int	Total number of exposures in sequence
MOONSEP[Page 264, 1]	111.881	float	[deg] Moon Separation
SP5REDP[Page 264, 1]	9.742e-08	float	[mb] SP5 red pressure
SEQSTART[Page 264, 1]	2021-05-08T10:26:00.785886	str	Start time of sequence processing
CONVERGD[Page 264, 1]	F	bool	Positioning loop converged (CNFRC>0.95)
SP9NIRP[Page 264, 1]	5.455e-08	float	[mb] SP9 NIR pressure
SP3REDP[Page 264, 1]	5.899e-08	float	[mb] SP3 red pressure
SP1BLUT[Page 264, 1]	162.97	float	[K] SP1 blue temperature
SP0BLUT[Page 264, 1]	162.97	float	[K] SP0 blue temperature
SP8REDT[Page 264, 1]	139.99	float	[K] SP8 red temperature
SP3BLUP[Page 264, 1]	7.952e-08	float	[mb] SP3 blue pressure
SP9REDT[Page 264, 1]	139.99	float	[K] SP9 red temperature
SP4NIRP[Page 264, 1]	7.251e-08	float	[mb] SP4 NIR pressure
SP4REDP[Page 264, 1]	5.049e-08	float	[mb] SP4 red pressure
PMSEEING[Page 264, 1]	0.93	float	[arcsec] PlateMaker GFAPROC seeing
SP1NIRP[Page 264, 1]	6.18e-08	float	[mb] SP1 NIR pressure
SP2REDT[Page 264, 1]	139.99	float	[K] SP2 red temperature
SP5REDT[Page 264, 1]	140.06	float	[K] SP5 red temperature
SP4NIRT[Page 264, 1]	139.99	float	[K] SP4 NIR temperature
SP7BLUT[Page 264, 1]	162.99	float	[K] SP7 blue temperature
USESPLIT[Page 264, 1]	T	bool	Exposure splits are allowed
SP1BLUP[Page 264, 1]	7.999e-08	float	[mb] SP1 blue pressure
SP1NIRT[Page 264, 1]	139.96	float	[K] SP1 NIR temperature
SP1REDT[Page 264, 1]	139.99	float	[K] SP1 red temperature
SP8REDP[Page 264, 1]	3.96e-08	float	[mb] SP8 red pressure
SP5BLUT[Page 264, 1]	163.02	float	[K] SP5 blue temperature
TCSGRA[Page 264, 1]	0.3	float	TCS simple gain (RA)
SUNDEC[Page 264, 1]	17.206123	float	[deg] Sun declination at start of exposure
SP7NIRP[Page 264, 1]	4.416e-08	float	[mb] SP7 NIR pressure

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Table 28 – continued from previous page

KEY	Example Value	Type	Comment
PMTRANS[Page 264, 1]	95.5	float	[%] PlateMaker GFAPROC transparency
SP0NIRT[Page 264, 1]	139.99	float	[K] SP0 NIR temperature
SP5NIRP[Page 264, 1]	6.573e-08	float	[mb] SP5 NIR pressure
POSCVFRC[Page 264, 1]	0.3845	float	Fraction of converged positioners
SP7BLUP[Page 264, 1]	1.04e-07	float	[mb] SP7 blue pressure
NTSSURVY[Page 264, 1]	na	Unknown	NTS survey name
SP7REDT[Page 264, 1]	139.99	float	[K] SP7 red temperature
SP2REDP[Page 264, 1]	6.15e-08	float	[mb] SP2 red pressure
SP4REDT[Page 264, 1]	140.06	float	[K] SP4 red temperature
SP6BLUT[Page 264, 1]	162.97	float	[K] SP6 blue temperature
SP7REDP[Page 264, 1]	3.404e-08	float	[mb] SP7 red pressure
SP8NIRP[Page 264, 1]	4.941e-08	float	[mb] SP8 NIR pressure
SP9REDP[Page 264, 1]	5.113e-08	float	[mb] SP9 red pressure
SP8NIRT[Page 264, 1]	139.99	float	[K] SP8 NIR temperature
TCSKRA[Page 264, 1]	0.3 0.003 0.00003	str	TCS Kalman (RA)
TCSMFRA[Page 264, 1]	1	int	TCS moving filter length (RA)
SP0BLUP[Page 264, 1]	7.565e-08	float	[mb] SP0 blue pressure
SP3NIRP[Page 264, 1]	4.105e-08	float	[mb] SP3 NIR pressure
SP1REDP[Page 264, 1]	7.239e-08	float	[mb] SP1 red pressure
SP4BLUP[Page 264, 1]	6.689e-08	float	[mb] SP4 blue pressure
SP3NIRT[Page 264, 1]	140.01	float	[K] SP3 NIR temperature
SP8BLUP[Page 264, 1]	8.311e-08	float	[mb] SP8 blue pressure
SP0REDT[Page 264, 1]	139.99	float	[K] SP0 red temperature
SEQID[Page 264, 1]	2 requests	str	Exposure sequence identifier
SP2BLUP[Page 264, 1]	8.297e-08	float	[mb] SP2 blue pressure
SP2BLUT[Page 264, 1]	163.02	float	[K] SP2 blue temperature
FRAMES[Page 264, 1]	47	int	Number of Frames in Archive
SP2NIRP[Page 264, 1]	4.884e-08	float	[mb] SP2 NIR pressure
SP9BLUP[Page 264, 1]	1.237e-07	float	[mb] SP9 blue pressure
TCSGDEC[Page 264, 1]	0.3	float	TCS simple gain (dec)
SP8BLUT[Page 264, 1]	162.97	float	[K] SP8 blue temperature
SP9BLUT[Page 264, 1]	162.97	float	[K] SP9 blue temperature
SP4BLUT[Page 264, 1]	162.97	float	[K] SP4 blue temperature
TCSPIDEC[Page 264, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
SP3REDT[Page 264, 1]	139.99	float	[K] SP3 red temperature
SP6NIRT[Page 264, 1]	139.99	float	[K] SP6 NIR temperature
SP6REDT[Page 264, 1]	139.99	float	[K] SP6 red temperature
SP5NIRT[Page 264, 1]	140.08	float	[K] SP5 NIR temperature
TCSKDEC[Page 264, 1]	0.3 0.003 0.00003	str	TCS Kalman (dec)
SP0NIRP[Page 264, 1]	7.886e-08	float	[mb] SP0 NIR pressure
VISITIDS[Page 264, 1]	87615	str	List of expids for a visit (same tile)
SP0REDP[Page 264, 1]	4.265e-08	float	[mb] SP0 red pressure

continues on next page

Table 28 – continued from previous page

KEY	Example Value	Type	Comment
SUNRA[Page 264, 1]	45.595565	float	[deg] Sun RA at start of exposure
SP5BLUP[Page 264, 1]	1.153e-07	float	[mb] SP5 blue pressure
SKYLEVEL[Page 264, 1]	0.83	float	counts?] ETC sky level
SP2NIRT[Page 264, 1]	139.99	float	[K] SP2 NIR temperature
SP6REDP[Page 264, 1]	6.491e-08	float	[mb] SP6 red pressure
TCSPIRA[Page 264, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
SP7NIRT[Page 264, 1]	139.99	float	[K] SP7 NIR temperature
SP9NIRT[Page 264, 1]	139.99	float	[K] SP9 NIR temperature
SPLITEXP[Page 264, 1]	F	bool	Split exposure part of a visit
SP6NIRP[Page 264, 1]	2.807e-07	float	[mb] SP6 NIR pressure
SP3BLUT[Page 264, 1]	162.99	float	[K] SP3 blue temperature
SBPROF[Page 264, 1]	ELG	str	Profile used by ETC
TOTTEFF[Page 264, 1]	1406.4226	float	[s] Total effective exposure time for visit
REQTEFF[Page 264, 1]	1400.0	int	[s] Requested effective exposure time
ACTTEFF[Page 264, 1]	1406.4226	float	[s] Actual effective exposure time
BBKGMINB[Page 264, 1]	-0.5249611468569187	float	
BBKGMAXA[Page 264, 1]	1.179777031725897	float	
BBKGMIND[Page 264, 1]	-0.5599583904094981	float	
BBKGMINA[Page 264, 1]	-0.9489741260224904	float	
BBKGMAXD[Page 264, 1]	0.2726660093392476	float	
BBKGMAXB[Page 264, 1]	0.6927871978458614	float	
SEEING[Page 264, 1]	1.291	float	[arcsec] ETC seeing
BBKGMAXC[Page 264, 1]	1.270526827094756	float	
BBKGMINC[Page 264, 1]	-0.8627791108943093	float	
USESPLITS[Page 264, 1]	T	bool	Exposure splits are allowed
ETCTHRUB[Page 264, 1]	0.575924	float	ETC averaged thruput (BGS profile)
ACQFWHM[Page 264, 1]	1.469225	float	[arcsec] FWHM of guide star PSF in acquisition
ESTTIME[Page 264, 1]	1374.714	float	[s] Estimated exposure time for visit (from ETC
ETCSPLIT[Page 264, 1]	1	int	ETC split sequence number for this visit
ETCFRACE[Page 264, 1]	0.302117	float	ETC transparency weighted average of FFRAC (ELG
ETCFRACP[Page 264, 1]	0.392042	float	ETC transparency weighted average of FFRAC (PSF
ETCTHRUP[Page 264, 1]	0.556996	float	ETC averaged thruput (PSF profile)
ETCPREV[Page 264, 1]	0.0	float	[s] ETC cummulative t_eff for visit

continues on next page

Table 28 – continued from previous page

KEY	Example Value	Type	Comment
ETCTHRUE[Page 264, 1]	0.585204	float	ETC averaged thruput (ELG profile)
ETCREAL[1]	1120.375	float	[s] ETC real open shutter time
TRANSPAR[1]	None	Unknown	ETC/PM transparency
PMTRANSP[1]	101.86	float	[%] PlateMaker GFAPROC transparency
ETCPROF[1]	BGS	str	ETC source brightness profile
ETCVERS[1]	0.1.12-3-g12b54bb	str	ETC version
ETCFRACB[1]	0.136941	float	ETC transparency weighted average of FFRAC (BGS
ETCSKY[1]	2.674912	float	ETC averaged, normalized sky camera flux
NTSPROG[1]	BRIGHT	str	NTS program name
ETCTRANS[1]	0.798438	float	ETC averaged TRANSP normalized to 1
ETCTEFF[1]	223.989487	float	[s] ETC effective exposure time
ETCSEENG[1]	1.4692	float	[arcsec] ETC seeing
MAXTIME[1]	5400.0	float	[s] Maximum exposure time for entire visit (fro
MINTIME[1]	120.0	float	[s] Minimum exposure time (from NTS, used by ET

Data: FITS image [float32, 2326x500]

HDU1

EXTNAME = IVAR

Inverse variance of the flux in HDU0. The unit is 1/(electrons/Angstrom)^2. The noise from neighboring spectral pixels is uncorrelated.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	Number of wavelengths
NAXIS2	500	int	Number of spectra
CHECKSUM	9UJ3CTG29TG2ATG2	str	HDU checksum updated 2021-07-08T15:52:36
DATASUM	3074959512	str	data unit checksum updated 2021-07-08T15:52:36

Data: FITS image [float32, 2326x500]

[1] Optional

HDU2

EXTNAME = MASK

Mask of spectral data; 0=good. See the *bitmask documentation* page for the definition of the bits. Prior to desispec/0.24.0 and software release 18.9, the MASK HDU was compressed.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	Number of wavelengths
NAXIS2	500	int	Number of spectra
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	ZGp6dDn5ZDn5bDn5	str	HDU checksum updated 2021-07-08T15:52:36
DATASUM	47035306	str	data unit checksum updated 2021-07-08T15:52:36

Data: FITS image [int32, 2326x500]

HDU3

EXTNAME = WAVELENGTH

1D array of wavelengths. See the frame *WAVELENGTH documentation* for more details.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	Number of wavelengths
BUNIT	Angstrom	str	
CHECKSUM	9MZDCMZA9MZAAMZA	str	HDU checksum updated 2021-07-08T15:52:37
DATASUM	456732359	str	data unit checksum updated 2021-07-08T15:52:37

Data: FITS image [float64, 2326]

HDU4

EXTNAME = RESOLUTION

Resolution matrix stored as a 3D sparse matrix. the frame *RESOLUTION documentation* for more details.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
NAXIS2	11	int	
NAXIS3	500	int	
CHECKSUM	LiPqNgMnLgMnLgMn	str	HDU checksum updated 2021-07-08T15:52:39
DATASUM	2191513558	str	data unit checksum updated 2021-07-08T15:52:39

Data: FITS image [float32, 2326x11x500]

HDU5

EXTNAME = FIBERMAP

Fibermap information combining fiberassign request with actual fiber locations. See also the *fibermap documentation* page.

Required Header Keywords

KEY	Example Value
NAXIS1	385
NAXIS2	500
TILEID	80616
TILERA	356.0
TILEDEC	29.0
FIELDROT	-0.00962199210064233
FA_PLAN	2022-07-01T00:00:00.000
FA_HA	0.0
FA_RUN	2020-03-06T00:00:00
FA_M_GFA[1]	0.4
FA_M_PET[Page 264, 1]	0.4
FA_M_POS[Page 264, 1]	0.05
REQRA	356.0
REQDEC	29.0
FIELDNUM	0
FA_VER	2.0.0.dev2618
FA_SURV	sv1
LONGSTRN	OGIP 1.0
GFA	/data/target/catalogs/dr9/0.47.0/gfas
SKY	/data/target/catalogs/dr9/0.47.0/skies
SKYSUPP	/data/target/catalogs/gaiadr2/0.47.0/skies-supp
TARG	/data/target/catalogs/dr9/0.47.0/targets/sv1/resolve/bright/
FAFLAVOR	sv1bgsmws
FAOUTDIR	/software/datasystems/users/raichoor/fiberassign-test/desi-sv1-20201218/
PMTIME[Page 264, 1]	2020-12-18T00:00:00.000
RUNDATE	2020-03-06T00:00:00
SCTARG[Page 264, 1]	STD_WD,BGS_ANY,MWS_ANY

Table 29

KEY	Example Value
OBSCON	DARK|GRAY|BRIGHT
MODULE	CI
EXPID	69022
EXPFRAME	0
COSMSPLT	F
MAXSPLIT	0
SPLITIDSPage 264, 1	69022
FIBASSGN	/data/tiles/SVN_tiles/080/fiberassign-080616.fits
FLAVOR	science
OBSTYPE	SCIENCE
SEQUENCE	DESI
MANIFEST	F
OBJECT	
PURPOSE	Commissioning
PROGRAM	SV1 BGS+MWS tile 80616
PROPID	2019B-5000
OBSERVER	DESIObserver
LEAD	RunManager
INSTRUME	DESI
OBSERVAT	KPNO
OBS-LAT	31.96403
OBS-LONG	-111.59989
OBS-ELEV	2097.0
TELESCOP	KPNO 4.0-m telescope
CORRCTOR	DESI Corrector
SEQNUM	1
NIGHT	20201220
TIMESYS	UTC
DATE-OBS	2020-12-21T02:36:32.099838
MJD-OBS	59204.10870486
OPENSHUT	2020-12-21T02:36:32.099838
CAMSHUT	open
ST	01:10:39.210
ACQTIME	15.0
GUIDTIME	5.0
FOCSTIME	60.0
SKYTIME	60.0
WHITESPT	F
ZENITH	F
SEANNEX	F
BEYONDP	F
FIDUCIAL	off
BACKLIT	off
AIRMASS	1.060311
FOCUS	1426.5,-501.4,81.0,-2.6,42.3,169.2
VCCD	ON
TRUSTEMP	11.767
PMIRTEMP	8.925
PMREADY	T

Table 29

KEY	Example Value
PMCOVER	open
PMCOOL	off
DOMSHUTU	open
DOMSHUTL	open
DOMLIGHH	off
DOMLIGHL	off
DOMEAZ	255.166
DOMINPOS	T
EQUINOX	2000.0
GUIDOFFR	-0.052283
GUIDOFFD	0.136634
MOONDEC	-8.975162
MOONRA	352.538429
MOUNTAZ	266.70224
MOUNTDEC	28.999221
MOUNTEL	71.039837
MOUNTHA	21.769281
INCTRL	T
INPOS	T
MNTOFFD	-15.76
MNTOFFR	29.32
PARALLAC	75.635085
SKYDEC	28.999221
SKYRA	355.996551
TARGTDEC	28.999221
TARGTRA	355.996551
TARGTAZ	267.074049
TARGTEL	70.563787
TRGTOFFD	0.0
TRGTOFFR	0.0
ZD	19.436213
TCSST	01:13:18.668
TCSMJD	59204.110981
USEETC	F
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9
SKYCAM	SKYCAM0,SKYCAM1
REQADC	65.78,85.28
ADCCORR	T
ADC1PHI	65.780005
ADC2PHI	85.279991
ADC1HOME	F
ADC2HOME	F
ADC1NREV	-1.0
ADC2NREV	0.0
ADC1STAT	STOPPED
ADC2STAT	STOPPED
USESKY	T

Table 29

KEY	Example Value
USEFOCUS	T
HEXPOS	1426.5,-501.3,81.0,-2.6,42.3,171.9
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0
USEROTAT	T
ROTOFFST	167.1
ROTENBLD	T
ROTRATE	0.0
RESETROT	F
USEPOS	T
PETALS	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9
POSCYCLE	1
POSONTGT	3626
POSONFRC	0.8613
POSDISAB	37
POSENABL	4210
POSRMS	0.0171
POSITER	1
POSFRACT	0.95
POSTOLER	0.01
POSMVALL	T
USEGUIDR	T
GUIDMODE	catalog
USEAOS[Page 264, 1]	F
USEDONUT	T
USESPCTR	T
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
ILLSPECS[Page 264, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
CCDSPECS[Page 264, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
TDEWPNT	-16.043
TAIRFLOW	0.0
TAIRITMP	11.8
TAIROTMP	11.7
TAIRTEMP	10.65
TCASITMP	0.0
TCASOTMP	10.8
TCSITEMP	9.3
TCSOTEMP	10.8
TCIBTEMP	0.0
TCIMTEMP	0.0
TCITTEMP	0.0
TCOSTEMP	0.0
TCOWTEMP	0.0
TDBTEMP	9.3
TFLOWIN	0.0
TFLOWOUT	0.0
TGLYCOLI	9.9
TGLYCOLO	9.8
THINGES	11.4
THINGEW	11.2

Table 29 -

KEY	Example Value
TPMAVERT	8.931
TPMDESIT	7.0
TPMEIBT	8.6
TPMEITT	8.6
TPMEOBT	8.5
TPMEOTT	9.0
TPMNIBT	8.4
TPMNITT	8.9
TPMNOBT	8.8
TPMNOTT	9.1
TPMRTDT	9.0
TPMSIBT	8.6
TPMSITT	8.8
TPMSOBT	8.2
TPMSOTT	8.9
TPMSTAT	ready
TPMWIBT	8.2
TPMWITT	9.1
TPMWOBT	8.3
TPMWOTT	8.9
TPCITEMP	8.5
TPCOTEMP	8.6
TPR1HUM	0.0
TPR1TEMP	0.0
TPR2HUM	0.0
TPR2TEMP	0.0
TSERVO	40.0
TTRSTEMP	11.4
TTRWTEMP	11.0
TTRUETBT	-4.2
TTRUETTT	11.2
TTRUNTBT	10.9
TTRUNTTT	11.2
TTRUSTBT	10.7
TTRUSTST	10.8
TTRUSTTT	11.1
TTRUTSBT	11.8
TTRUTSMT	11.8
TTRUTSTT	11.8
TTRUWTBT	10.5
TTRUWTTT	10.9
ALARM	F
ALARM-ON	F
BATTERY	100.0
SECLEFT	5178.0
UPSSTAT	System Normal - On Line(7)
INAMPS	70.4
OUTWATTS	5000.0,7200.0,4800.0
COMPDEW	-12.9

Table 29

KEY	Example Value
COMPHUM	7.4
COMPAMB	19.5
COMPTEMP	24.5
DEWPOINT	11.5
HUMIDITY	10.0
PRESSURE	795.0
OUTTEMP	0.0
WINDDIR	55.0
WINDSPD	27.3
GUST	20.6
AMNIENTN	13.5
CFLOOR	8.9
NWALLIN	13.9
NWALLOUT	9.6
WWALLIN	12.9
WWALLOUT	10.6
AMBIENTS	14.8
FLOOR	12.6
EWALLCMP	10.8
EWALLCOU	10.6
ROOF	10.3
ROOFAMB	10.6
DOMEBLOW	10.4
DOMEBUP	10.7
DOMELLOW	10.8
DOMELUP	10.8
DOMERLOW	10.6
DOMERUP	10.5
PLATFORM	10.4
SHACKC	14.4
SHACKW	13.7
STAIRSL	10.5
STAIRSM	10.4
STAIRSU	10.6
TELBASE	9.6
UTILWALL	11.1
UTILROOM	10.9
RADESYS	FK5
TNFSPROC	8.1963
TGFAPROCPage 264, 1	7.9212
SIMGFAP	F
USEFVC	T
USEFID	T
USEILLUM	T
USEXSRVR	T
USEOPENL	T
STOPGUDR	T
STOPFOCS	T
STOPSKY	T

Table 29 -

KEY	Example Value
KEEPGUDR	F
KEEPFOCS	F
KEEPSKY	F
REACQUIR	F
FILENAME	/exposures/desi/20201220/00069022/desi-00069022.fits.fz
EXCLUDED	
DOSVER	trunk
OCSVER	1.2
CONSTVER	DESI:CURRENT
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini
REQTIME	300.0
FVCTIME[Page 264, 1]	2.0
SIMGFACQ	F
POSCNVGD[Page 264, 1]	F
GUIEXPID	69022
IGFRMNUM	12
FOCEXPID	69022
IFFRMNUM	1
SKYEXPID	69022
ISFRMNUM	1
FGFRMNUM	46
FFFRMNUM	6
FSFRMNUM	5
FRAMES[Page 264, 1]	47
DELTARA[Page 264, 1]	None
DELTADEC[Page 264, 1]	None
GSGUIDE0[Page 264, 1]	(980.05,685.98),(878.97,731.68)
GSGUIDE2[Page 264, 1]	(372.65,939.43),(784.50,1529.96)
GSGUIDE3[Page 264, 1]	(365.22,1423.83),(249.12,411.52)
GSGUIDE5[Page 264, 1]	(848.52,78.26),(516.16,1410.54)
GSGUIDE7[Page 264, 1]	(540.95,1848.95),(504.68,831.62)
GSGUIDE8[Page 264, 1]	(720.29,552.69),(499.80,465.13)
ARCHIVE[Page 264, 1]	/exposures/desi/20201220/00069022/guide-00069022.fits.fz
GUIDEFIL	guide-00069022.fits.fz
COORDFIL	coordinates-00069022.fits
TIME-OBS	02:39:11.845920
EXPTIME	300.007
VCCDON	2020-12-14T17:48:28.296248
VCCDSEC	550592.7
SPECGRPH	3
SPECID	6
FEEBOX	lbnl074
VESSEL	11
FEEVER	v20160312
FEEPOWER	ON
FEEDMASK	2134851391
FEECMASK	1048575
CCDTEMP	-140.2798
CRYOPRES[Page 264, 1]	7.233e-08

Table 29

KEY	Example Value
CLOCK7	-2.0001,3.9999
TRIMSECA	[8:2064, 2:2065]
CCDNAME	CCDSM6R
TRIMSECD	[2193:4249, 2130:4193]
OFFSET2	0.4000000059604645,-8.961
CPUTEMP	56.625
DAC11	-25.0003,-24.7086
AMPSECA	[1:2057, 1:2064]
CCDCFG	M1-50_lbnl_20190719.cfg
TRIMSECB	[2193:4249, 2:2065]
CLOCK3	-2.0001,3.9999
CCDSECA	[1:2057, 1:2064]
CLOCK4	9.9999,0.0
DAC0	-9.0002,-8.9095
CLOCK10	9.9992,2.9993
BIASSECA	[2065:2128, 2:2065]
PRRSECA	[8:2064, 1:1]
DAC7	6.4999,6.4856
AMPSECB	[4114:2058, 1:2064]
DAC10	-25.0003,-24.9906
DELAYS	20, 20, 25, 30, 7, 3000, 7, 7, 7, 7
CCDSECD	[2058:4114, 2065:4128]
CASETEMP	56.4919
CLOCK6	9.9999,0.0
CLOCK13	9.9992,2.9993
CLOCK9	9.9992,2.9993
DAC8	-25.0003,-25.0202
DAC9	-25.0003,-24.6789
ORSECB	[2193:4249, 2066:2097]
CLOCK1	9.9999,0.0
DETSECC	[1:2057, 2065:4128]
AMPSECD	[4114:2058, 4128:2065]
CLOCK5	9.9999,0.0
ORSECA	[8:2064, 2066:2097]
DAC15	0.0,0.0297
DATASECA	[8:2064, 2:2065]
CCDPREP	purge,clear
OFFSET7	2.0,6.4908
DAC5	5.9998,6.028
CLOCK12	9.9992,2.9993
CCDSECB	[2058:4114, 1:2064]
OFFSET6	2.0,6.0332
DAC4	5.9998,6.028
PRESECC	[1:7, 2130:4193]
OFFSET5	2.0,6.028
DAC2	-9.0002,-8.9713
CRYOTEMP[Page 264, 1]	162.97
PRESECB	[4250:4256, 2:2065]
DIGITIME	47.1031

Table 29

KEY	Example Value
DAC3	-10.5005,-10.3824
CAMERA	r3
DETSECB	[2058:4114, 1:2064]
OFFSET1	0.4000000059604645,-8.8065
DATASECD	[2193:4249, 2130:4193]
SETTINGS	detectors_sm_20191211.json
CLOCK11	9.9992,2.9993
DAC13	0.0,0.0
CLOCK14	9.9992,2.9993
CCDSECC	[1:2057, 2065:4128]
DATASECC	[8:2064, 2130:4193]
CLOCK0	9.9999,0.0
CLOCK15	9.9992,2.9993
DAC12	0.0,0.0297
CCDSIZE	4194,4256
OFFSET0	0.4000000059604645,-8.9095
ORSECD	[2193:4249, 2098:2129]
DAC16	48.0,46.7082
PRRSECC	[8:2064, 4194:4194]
PRRSECD	[2193:4249, 4194:4194]
BIASSECB	[2129:2192, 2:2065]
DETSECD	[2058:4114, 2065:4128]
CLOCK18	9.0,0.9999
DAC17	20.0008,14.274
CCDTMING	default_lbnl_timing_20180905.txt
DETECTOR	M1-50
PRRSECB	[2193:4249, 1:1]
TRIMSECC	[8:2064, 2130:4193]
DAC14	0.0,0.0148
BIASSECD	[2129:2192, 2130:4193]
CDSPARMS	400, 400, 8, 2000
OFFSET3	0.4000000059604645,-10.3721
PRESECA	[1:7, 2:2065]
ORSECC	[8:2064, 2098:2129]
DAC6	5.9998,6.0332
PGAGAIN	3
DAC1	-9.0002,-8.8065
DATASECB	[2193:4249, 2:2065]
CLOCK2	9.9999,0.0
CLOCK16	9.9999,3.0
PRESECD	[4250:4256, 2130:4193]
OFFSET4	2.0,6.0332
CLOCK17	9.0,0.9999
AMPSECC	[1:2057, 4128:2065]
CLOCK8	9.9992,2.9993
DETSECA	[1:2057, 1:2064]
BIASSECC	[2065:2128, 2130:4193]
BLDTIME	0.3504
OBSID	kp4m20201221t023911

Table 29

KEY	Example Value
PROCTYPE	RAW
PRODTYPE	image
GAINA	1.681
SATULEVA	28000.0
OSTEPA	0.7048677125421818
OMETHA	AVERAGE
OVERSCNA	1979.586454500641
OBSRDNA	2.618213792981265
SATUELEA	43740.31516998442
GAINB	1.625
SATULEVB	57000.0
OSTEPB	0.6850349189899134
OMETHB	AVERAGE
OVERSCNB	1997.289875350671
OBSRDNB	3.12518985733541
SATUELEB	89379.40395255515
GAINC	1.477
SATULEVC	59000.0
OSTEPC	0.6403308619337622
OMETHC	AVERAGE
OVERSCNC	1974.691977751432
OBSRDNC	2.344388520757958
SATUELEC	84226.37994886114
GAIND	1.492
SATULEVD	62000.0
OSTEPD	0.6246898852550657
OMETHD	AVERAGE
OVERSCND	1998.214476179268
OBSRDND	2.301320302261815
SATUELED	89522.66400154053
FIBERMIN	1500
CHECKSUM	9VRaITQX9TQaGTQU
DATASUM	3502588181
SP6BLUP[Page 264, 1]	7.898999999999999e-08
TCSMFDEC[Page 264, 1]	1
SLEWANGL[Page 264, 1]	15.646
TARG2[Page 264, 1]	DESIROOT/target/catalogs/gaiadr2/0.51.0/targets/sv1/resolve/supp
SEQTOT[Page 264, 1]	2
MOONSEP[Page 264, 1]	111.881
SP5REDP[Page 264, 1]	9.741999999999999e-08
SEQSTART[Page 264, 1]	2021-05-08T10:26:00.785886
CONVERGD[Page 264, 1]	F
SP9NIRP[Page 264, 1]	5.455e-08
SP3REDP[Page 264, 1]	5.899e-08
SP1BLUT[Page 264, 1]	162.97
SP0BLUT[Page 264, 1]	162.97
SP8REDT[Page 264, 1]	139.99
SP3BLUP[Page 264, 1]	7.952e-08
SP9REDT[Page 264, 1]	139.99

Table 29

KEY	Example Value
SP4NIRP[Page 264, 1]	7.251e-08
SP4REDP[Page 264, 1]	5.049e-08
PMSEEING[Page 264, 1]	0.93
SP1NIRP[Page 264, 1]	6.18e-08
SP2REDT[Page 264, 1]	139.99
SP5REDT[Page 264, 1]	140.06
SP4NIRT[Page 264, 1]	139.99
SP7BLUT[Page 264, 1]	162.99
USESPLIT[Page 264, 1]	T
SP1BLUP[Page 264, 1]	7.999e-08
SP1NIRT[Page 264, 1]	139.96
SP1REDT[Page 264, 1]	139.99
SP8REDP[Page 264, 1]	3.96e-08
SP5BLUT[Page 264, 1]	163.02
TARG3[Page 264, 1]	DESIROOT/target/catalogs/dr9/0.51.0/targets/sv1/resolve/bright
TCSGRA[Page 264, 1]	0.3
SUNDEC[Page 264, 1]	17.206123
SP7NIRP[Page 264, 1]	4.416e-08
PMTRANS[Page 264, 1]	95.5
SP0NIRT[Page 264, 1]	139.99
SP5NIRP[Page 264, 1]	6.57299999999999e-08
POSCVFRC[Page 264, 1]	0.3845
SP7BLUP[Page 264, 1]	1.04e-07
FAARGS[Page 264, 1]	–doclean n –dr dr9 –dtver 0.51.0 –faflavor sv1unwisegreen –m31cen n –pmtime 2021-03-12T00:00:00.000 -
NTSSURVY[Page 264, 1]	na
SP7REDT[Page 264, 1]	139.99
SP2REDP[Page 264, 1]	6.15e-08
SP4REDT[Page 264, 1]	140.06
SP6BLUT[Page 264, 1]	162.97
SP7REDP[Page 264, 1]	3.404e-08
SP8NIRP[Page 264, 1]	4.941e-08
SP9REDP[Page 264, 1]	5.113e-08
SP8NIRT[Page 264, 1]	139.99
TCSKRA[Page 264, 1]	0.3 0.003 0.00003
SCND[Page 264, 1]	DESIROOT/target/catalogs/dr9/0.51.0/targets/sv1/secondary/dark
TCSMFRA[Page 264, 1]	1
SP0BLUP[Page 264, 1]	7.565e-08
SP3NIRP[Page 264, 1]	4.105e-08
SP1REDP[Page 264, 1]	7.239e-08
SP4BLUP[Page 264, 1]	6.689e-08
SP3NIRT[Page 264, 1]	140.01
SP8BLUP[Page 264, 1]	8.31099999999999e-08
SP0REDT[Page 264, 1]	139.99
SEQID[Page 264, 1]	2 requests
SP2BLUP[Page 264, 1]	8.29699999999999e-08
DESIROOT[Page 264, 1]	/global/cfs/cdirs/desi
SP2BLUT[Page 264, 1]	163.02
SP2NIRP[Page 264, 1]	4.884e-08
SP9BLUP[Page 264, 1]	1.237e-07

Table 29 –

KEY	Example Value
TCSGDEC[Page 264, 1]	0.3
SP8BLUT[Page 264, 1]	162.97
SP9BLUT[Page 264, 1]	162.97
SP4BLUT[Page 264, 1]	162.97
TCSPIDEC[Page 264, 1]	1.0,0.0,0.0,0.0
SP3REDT[Page 264, 1]	139.99
SP6NIRT[Page 264, 1]	139.99
SP6REDT[Page 264, 1]	139.99
SP5NIRT[Page 264, 1]	140.08
TCSKDEC[Page 264, 1]	0.3 0.003 0.00003
SP0NIRP[Page 264, 1]	7.886e-08
SCSTD[Page 264, 1]	STD_WD,STD_FAINT
VISITIDS[Page 264, 1]	87615
SP0REDP[Page 264, 1]	4.265e-08
SUNRA[Page 264, 1]	45.595565
SP5BLUP[Page 264, 1]	1.153e-07
SKYLEVEL[Page 264, 1]	0.83
SP2NIRT[Page 264, 1]	139.99
SP6REDP[Page 264, 1]	6.491e-08
TCSPIRA[Page 264, 1]	1.0,0.0,0.0,0.0
SP7NIRT[Page 264, 1]	139.99
SP9NIRT[Page 264, 1]	139.99
SPLITEXP[Page 264, 1]	F
SP6NIRP[Page 264, 1]	2.807e-07
SP3BLUT[Page 264, 1]	162.99
PMCORR[Page 264, 1]	n
GOALTYPE[Page 264, 1]	DARK
SURVEY[Page 264, 1]	special
SCNDMTL[Page 264, 1]	DESIROOT/survey/ops/surveyops/trunk/mtl/main/secondary/dark
MINTFRAC[Page 264, 1]	0.85
FASCRIPT[Page 264, 1]	./fba_launch-20210513-special
MTLTIME[Page 264, 1]	2021-05-13T21:05:00+00:00
GOALTIME[Page 264, 1]	1000.0
FAPRGRM[Page 264, 1]	dark
EBVFAC[Page 264, 1]	1.02471876800862
TOO[Page 264, 1]	DESIROOT/survey/ops/surveyops/trunk/mtl/main/ToO/ToO.ecsv
SVNDM[Page 264, 1]	136361
MTL[Page 264, 1]	DESIROOT/survey/ops/surveyops/trunk/mtl/main/dark
SBPROF[Page 264, 1]	ELG
SVNMTL[Page 264, 1]	476
TOTTEFF[Page 264, 1]	1406.4226
REQTEFF[Page 264, 1]	1400.0
ACTTEFF[Page 264, 1]	1406.4226
BBKGMINB[Page 264, 1]	-0.5249611468569187
BBKGMAXA[Page 264, 1]	1.179777031725897
BBKGMIND[Page 264, 1]	-0.5599583904094981
BBKGMINA[Page 264, 1]	-0.9489741260224904
BBKGMAXD[Page 264, 1]	0.2726660093392476
BBKGMAXB[Page 264, 1]	0.6927871978458614

Table 29

KEY	Example Value
SEEING[Page 264, 1]	1.291
BBKGMAXC[Page 264, 1]	1.270526827094756
BBKGMINC[Page 264, 1]	-0.8627791108943093
USESPLITS[Page 264, 1]	T
SIMGFAQ[Page 264, 1]	F
SHFTFOCS[Page 264, 1]	220.0
ROLE[Page 264, 1]	GUIDERMAN
M31CEN[Page 264, 1]	n
DTVER[Page 264, 1]	0.50.0
DR[Page 264, 1]	dr9
PRIORITY[Page 264, 1]	default
ETCTHRUB[Page 264, 1]	0.575924
ACQFWHM[Page 264, 1]	1.469225
ESTTIME[Page 264, 1]	1374.714
ETCSPLIT[Page 264, 1]	1
ETCFRACE[Page 264, 1]	0.302117
ETCFRACP[Page 264, 1]	0.392042
ETCTHRUP[Page 264, 1]	0.556996
ETCPREV[Page 264, 1]	0.0
ETCTHRUE[Page 264, 1]	0.585204
ETCREAL[Page 264, 1]	1120.375
TRANSPAR[Page 264, 1]	None
PMTRANSP[Page 264, 1]	101.86
ETCPROF[Page 264, 1]	BGS
ETCVERS[Page 264, 1]	0.1.12-3-g12b54bb
ETCFRACB[Page 264, 1]	0.136941
ETCSKY[Page 264, 1]	2.674912
NTSPROG[Page 264, 1]	BRIGHT
ETCTRANS[Page 264, 1]	0.798438
ETCTEFF[Page 264, 1]	223.989487
ETCSEENG[Page 264, 1]	1.4692
MAXTIME[Page 264, 1]	5400.0
MINTIME[Page 264, 1]	120.0

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique target ID
PETAL_LOC	int16		Focal plane petal location 0-9
DEVICE_LOC	int32		Device location 0-5xx
LOCATION	int64		1000*PETAL_LOC + DEVICE_LOC
FIBER	int32		Fiber number 0-4999
FIBERSTATUS	int32		Fiber status mask; 0=good
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction

Table 30 – continued from previous page

Name	Type	Units	Description
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gai
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; "sourceid" for Gaia DR
REF_CAT	char[2]		Reference catalog source for star: "T2" for Tycho-2, "G2" for Gaia D
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
BRICKNAME	char[8]		Brick name from tractor input
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from this
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from this
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from all s
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from all s
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from all s
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blending
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE="SER"
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORPHTY
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORPHTY
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCOND
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selec
SV1_DESI_TARGET[Page 264, 1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_BGS_TARGET[Page 264, 1]	int64		BGS (bright time program) target selection bitmask for SV1
SV1_MWS_TARGET[Page 264, 1]	int64		MWS (bright time program) target selection bitmask for SV1

Table 30 – continued from previous page

Name	Type	Units	Description
SV1_SCND_TARGET[Page 264, 1]	int64		Secondary target selection bitmask for SV1
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
EXPTIME	float64	s	Length of time shutter was open
SCND_TARGET[Page 264, 1]	int64		Target selection bitmask for secondary programs
SV3_SCND_TARGET[Page 264, 1]	int64		Secondary target selection bitmask for SV3
SV3_MWS_TARGET[Page 264, 1]	int64		MWS (bright time program) target selection bitmask for SV3
SV3_DESI_TARGET[Page 264, 1]	int64		DESI (dark time program) target selection bitmask for SV3
SV3_BGS_TARGET[Page 264, 1]	int64		BGS (bright time program) target selection bitmask for SV3
SV2_MWS_TARGET[Page 264, 1]	int64		MWS (bright time program) target selection bitmask for SV2
SV2_DESI_TARGET[Page 264, 1]	int64		DESI (dark time program) target selection bitmask for SV2
SV2_SCND_TARGET[Page 264, 1]	int64		Secondary target selection bitmask for SV2
SV2_BGS_TARGET[Page 264, 1]	int64		BGS (bright time program) target selection bitmask for SV2
CMX_TARGET[Page 264, 1]	int64		Target selection bitmask for commissioning

HDU6

EXTNAME = CHI2PIX

χ^2 of PSF fit to CCD pixels per spectrum wavelength bin.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	Number of wavelengths
NAXIS2	500	int	Number of spectra
CHECKSUM	WY6VaW3VZW3VaW3V	str	HDU checksum updated 2021-07-08T15:52:40
DATASUM	2321269489	str	data unit checksum updated 2021-07-08T15:52:40

Data: FITS image [float32, 2326x500]

Notes and Examples

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

shifted-input-psf-CAMERA-EXPID.fits

Summary
PSF (point spread function) files model the mapping of fibers and wavelengths to pixels on spectrograph CCDs.

Naming Convention
`shifted-inputpsf-CAMERA-EXPID.fits`, where `CAMERA` is *e.g.*, "b0", "r5", etc. and `EXPID` is 8-digit exposure number.

Regex
`shifted-input-psf-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 998 KB

See *psfnight-CAMERA-NIGHT documentation* for a description of the PSF file content.

Four different PSF files are written per camera for each arc lamp exposure:

1. `shifted-input-psf-CAMERA-EXPID.fits`: Input PSF with spectral trace coordinates and wavelength calibration adjusted to the current CCD image, used as a starting guess for the PSF shape fit.
2. *fit-psf-before-listed-fix-CAMERA-EXPID.fits*: Result of the specex PSF fit before adjusting the PSF model of problematic fibers not included in the fit.
3. *fit-psf-fixed-listed-CAMERA-EXPID.fits*: Result of the specex PSF fit with the PSF model of problematic fibers interpolated from neighboring fibers.
4. *fit-psf-CAMERA-EXPID.fits*: Final PSF fit (which is the same as *fit-psf-fixed-listed-CAMERA-EXPID.fits* if there are problematic fibers)

The `fit-psf-*.fits` files from individual exposures are combined into the *psfnight* files for each night.

Flat and science exposures have a single PSF file per camera:

psf-CAMERA-EXPID.fits: psfnight file with spectral trace coordinates and wavelength solution adjusted to match this exposure. Flat exposures are adjusted only in x (cross dispersion = fiber direction), while science exposures are adjusted in both x and y (wavelength direction).

sky-CAMERA-EXPID.fits

Summary
This holds the sky model for a given camera and exposure.

Naming Convention
`sky-{CAMERA}-{EXPID}.fits`, where `{CAMERA}` is one of the spectrograph cameras (*e.g.* `z1`) and `{EXPID}` is the 8-digit exposure ID.

Regex
`sky-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 17 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	SKY	IMAGE	sky model in electrons per Angstrom
HDU1	IVAR	IMAGE	inverse variance of sky model
HDU2	MASK	IMAGE	sky mask (0 = good)
HDU3	WAVELENGTH	IMAGE	wavelength in Angstrom
HDU4	STATIVAR	IMAGE	statistical-only inverse variance of sky model
HDU5	THRPUTCORR	IMAGE	achromatic throughput correction per fiber

The SKY HDU is the sky model per-fiber accounting for different fiber resolutions, but it does *not* include the empirical per-fiber throughput correction in the THRPUTCORR HDU. The final sky model per fiber is `SKY * THRPUTCORR`.

FITS Header Units

HDU0

EXTNAME = SKY

2D array of sky flux model of dimension [nspec, nwave] in units of electrons per Ansgtrom (fiber flat fielded). nspec is the number of fibers per camera. nwave in the length of the wavelength array. The spectra of all fibers share the same wavelength grid (given in HDU WAVELENGTH). The sky model is different for each fiber because it is adapted to the resolution of each fiber, it contains corrections on bright sky line, and in some cases an anisotropic component.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	
NAXIS2	500	int	
EXPID	69022	int	Exposure number
EXPFRAME	0	int	Frame number
TILEID	80616	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/080/fiberassign-080616.fits	str	Fiber assign fil

continues on next page

Table 31 – continued from previous page

KEY	Example Value	Type	Comment
FLAVOR	science	str	Observation type
SEQUENCE	DESI	str	OCS Sequence name
PURPOSE	Commissioning	str	Purpose of observing night
PROGRAM	SV1 BGS+MWS tile 80616	str	Program name
PROPID	2019B-5000	str	Proposal ID
OBSERVER	DESIObserver	str	Names of observers
LEAD	RunManager	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20201220	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2020-12-21T02:36:32.099838	str	[UTC] Observation data and start time
TIME-OBS	02:39:11.845920	str	[UTC] Observation start time
MJD-OBS	59204.10870486	float	Modified Julian Date of observation
OPENSHUT	2020-12-21T02:36:32.099838	str	Time shutter opened
ST	01:10:39.210	str	Local Sidereal time at observation start (HH:MM
EXPTIME	300.007	float	[s] Actual exposure time
REQRA	356.0	float	[deg] Requested right ascension (observer input
REQDEC	29.0	float	[deg] Requested declination (observer input)
FOCUS	1426.5,-501.4,81.0,-2.6,42.3,169.2	str	Telescope focus settings
VCCD	ON	str	True (ON) if CCD voltage is on
VCCDON	2020-12-09T21:23:21.278481	str	Time when CCD voltage was turned on
VCCDSEC	969694.4	float	[s] CCD on time in seconds
TRUSTEMP	11.767	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	8.925	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Epoch of observation
MOUNTAZ	266.70224	float	[deg] Mount azimuth angle

continues on next page

Table 31 – continued from previous page

KEY	Example Value	Type	Comment
MOUNTDEC	28.999221	float	[deg] Mount declination
MOUNTEL	71.039837	float	[deg] Mount elevation angle
MOUNTHA	21.769281	float	[deg] Mount hour angle
SKYDEC	28.999221	float	[deg] Telescope declination (pointing on sky)
SKYRA	355.996551	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	28.999221	float	[deg] Target declination (to TCS)
TARGTRA	355.996551	float	[deg] Target right ascension (to TCS)
USEETC	F	bool	ETC data available if true
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	167.1	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.0	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
SPECGRPH	6	int	Spectrograph logical name (SP)
SPECID	7	int	Spectrograph serial number (SM)
FEEBOX	lbnl075	str	CCD Controller serial number
VESSEL	22	int	Cryostat serial number
FEEVER	v20160312	str	CCD Controller version
FEEPOWER	ON	str	FEE power status
FEEDMASK	2134851391	int	FEE dac mask
FEECMASK	1048575	int	FEE clk mask
CCDTEMP	850.0	float	[deg C] CCD controller CCD temperature
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
FILENAME	/exposures/desi/specs/20201220/00069022/sp1-00069022.fits.fz	str	Name
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
DELAYS	13, 13, 25, 25, 8, 3000, 7, 7, 7, 7	str	[10] Delay settings
CCDPREP	purge,clear	str	CCD prep actions
DETSECA	[1:2048, 1:2048]	str	Detector section for quadrant A

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Table 31 – continued from previous page

KEY	Example Value	Type	Comment
CDSPARMS	350, 350, 8, 1000	str	CDS parameters
CRYOTEMP[1]	162.97	float	[deg K] Cryostat CCD temperature
CLOCK15	0.0,0.0	str	[V] high rail, low rail
CLOCK11	0.0,0.0	str	[V] high rail, low rail
ORSECA	[5:2052, 2050:2081]	str	Row overscan section for quadrant A
CASETEMP	51.9392	float	[deg C] CCD controller case temperature
AMPSECC	[2048:1, 2049:4096]	str	AMP section for quadrant C
CLOCK4	3.9999,-4.0002	str	[V] high rail, low rail
CLOCK17	3.9999,-4.0002	str	[V] high rail, low rail
DAC13	0.0,-5.0544	str	[V] set value, measured value
DAC2	15.9998,15.9032	str	[V] set value, measured value
DATASECA	[5:2052, 2:2049]	str	Data section for quadrant A
DATASECB	[2181:4228, 2:2049]	str	Data section for quadrant B
PRESECB	[4229:4232, 2:2049]	str	Prescan section for quadrant B
DAC14	0.0,0.8008	str	[V] set value, measured value
ORSECD	[2181:4228, 2082:2113]	str	Row bias section for quadrant D
CCDSIZE	4162,4232	str	CCD size in pixels (rows, columns)
SETTINGS	detectors_sm_20191211.json	str	Name of DESI CCD settings file
PRESECA	[1:4, 2:2049]	str	Prescan section for quadrant A
CLOCK14	3.0,-8.0001	str	[V] high rail, low rail
DAC16	0.0,64.1256	str	[V] set value, measured value
CCDNAME	CCDSM7B	str	CCD name
AMPSECD	[4096:2049, 4096:2049]	str	AMP section for quadrant D
PRRSECC	[5:2052, 4162:4162]	str	Row prescan section for quadrant C
CCDCFG	sn22813_sta_20190405.cfg	str	CCD configuration file
DAC8	26.9998,26.0294	str	[V] set value, measured value
BIASSECD	[2117:2180, 2114:4161]	str	Bias section for quadrant D
PRESECC	[1:4, 2114:4161]	str	Prescan section for quadrant C
CCDSECD	[2049:4096, 2049:4096]	str	CCD section for quadrant D

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Table 31 – continued from previous page

KEY	Example Value	Type	Comment
CLOCK8	3.0,-8.0001	str	[V] high rail, low rail
TRIMSECA	[5:2052, 2:2049]	str	Trim section for quadrant A
DAC5	0.0,0.0	str	[V] set value, measured value
BIASSECC	[2053:2116, 2114:4161]	str	Bias section for quadrant C
OFFSET0	-1.5,15.8311	str	[V] set value, measured value
CLOCK18	3.9999,-4.0002	str	[V] high rail, low rail
CCDTMING	de-fault_sta_timing_20180905.txt	str	CCD timing file
TRIMSECD	[2181:4228, 2114:4161]	str	Trim section for quadrant D
OFFSET1	-1.5,15.8208	str	[V] set value, measured value
OFFSET4	-1.100000023841858,0.0105	str	[V] set value, measured value
DATASECD	[2181:4228, 2114:4161]	str	Data section for quadrant D
CLOCK3	6.9999,-2.0001	str	[V] high rail, low rail
PGAGAIN	5	int	Controller gain
PRRSECA	[5:2052, 1:1]	str	Row prescan section for quadrant A
CLOCK12	3.0,-8.0001	str	[V] high rail, low rail
CLOCK6	3.9999,-4.0002	str	[V] high rail, low rail
OFFSET5	-1.100000023841858,-0.0053	str	[V] set value, measured value
CLOCK2	3.9999,-4.0002	str	[V] high rail, low rail
CLOCK16	0.0,0.0	str	[V] high rail, low rail
ORSECB	[2181:4228, 2050:2081]	str	Row overscan section for quadrant B
DAC12	0.0,5.0232	str	[V] set value, measured value
DETSECC	[1:2048, 2049:4096]	str	Detector section for quadrant C
DAC15	19.9997,19.6768	str	[V] set value, measured value
CAMERA	b6	str	Camera name
DAC6	0.0,0.0053	str	[V] set value, measured value
BIASSECB	[2117:2180, 2:2049]	str	Bias section for quadrant B
DAC4	0.0,0.0105	str	[V] set value, measured value
CLOCK1	3.9999,-4.0002	str	[V] high rail, low rail
PRRSECD	[2181:4228, 4162:4162]	str	Row prescan section for quadrant D
DAC7	0.0,0.0	str	[V] set value, measured value

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KEY	Example Value	Type	Comment
DETSECD	[2049:4096, 2049:4096]	str	Detector section for quadrant D
ORSECC	[5:2052, 2082:2113]	str	Row overscan section for quadrant C
DAC17	-0.0,0.0488	str	[V] set value, measured value
CRYOPRESPage 300, 1	9.252e-08	str	[mb] Cryostat pressure (IP)
AMPSECA	[1:2048, 1:2048]	str	AMP section for quadrant A
CLOCK5	3.9999,-4.0002	str	[V] high rail, low rail
CCDSECA	[1:2048, 1:2048]	str	CCD section for quadrant A
DAC9	26.9998,26.252	str	[V] set value, measured value
CLOCK0	3.9999,-4.0002	str	[V] high rail, low rail
DETSECB	[2049:4096, 1:2048]	str	Detector section for quadrant B
DAC1	15.9998,15.8311	str	[V] set value, measured value
DAC3	15.9998,15.8517	str	[V] set value, measured value
DAC11	26.9998,26.9198	str	[V] set value, measured value
CLOCK9	3.0,-8.0001	str	[V] high rail, low rail
DIGITIME	41.6984	float	[s] Time to digitize image
OFFSET2	-1.5,15.9135	str	[V] set value, measured value
PRESECD	[4229:4232, 2114:4161]	str	Prescan section for quadrant D
CLOCK10	3.0,-8.0001	str	[V] high rail, low rail
DAC0	15.9998,15.8311	str	[V] set value, measured value
TRIMSECB	[2181:4228, 2:2049]	str	Trim section for quadrant B
OFFSET3	-1.5,15.8414	str	[V] set value, measured value
AMPSECB	[2049:4096, 2048:1]	str	AMP section for quadrant B
CPUTEMP	51.334	float	[deg C] CCD controller CPU temperature
CCDSECC	[1:2048, 2049:4096]	str	CCD section for quadrant C
OFFSET7	-1.100000023841858,0.0	str	[V] set value, measured value
BLDTIME	0.3499	float	[s] Time to build image
DATASECC	[5:2052, 2114:4161]	str	Data section for quadrant C
DETECTOR	sn22813	str	Detector (ccd) identification

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KEY	Example Value	Type	Comment
OFFSET6	-1.100000023841858,0.0053	str	[V] set value, measured value
BIASSECA	[2053:2116, 2:2049]	str	Bias section for quadrant A
TRIMSECC	[5:2052, 2114:4161]	str	Trim section for quadrant C
PRRSECB	[2181:4228, 1:1]	str	Row prescan section for quadrant B
CCDSECB	[2049:4096, 1:2048]	str	CCD section for quadrant B
DAC10	26.9998,26.9198	str	[V] set value, measured value
CLOCK13	3.0,-8.0001	str	[V] high rail, low rail
CLOCK7	6.9999,-2.0001	str	[V] high rail, low rail
REQTIME	300.0	float	[s] Requested exposure time
OBSID	kp4m20201221t023911	str	Unique observation identifier
PROCTYPE	RAW	str	Data processing level
PRODTYPE	image	str	Data product type
CHECKSUM	VAChW8AfVAAfV7Af	str	HDU checksum updated 2022-02-14T06:13:54
DATASUM	1301167967	str	data unit checksum updated 2022-02-14T06:13:54
GAINA	1.29	float	e/ADU (gain applied to image)
SATULEVA	40000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPA	1.21893160851323	float	ADUs (max-min of median overscan per row)
OMETHA	AVERAGE	str	use average overscan
OVERSCNA	1201.407080585313	float	ADUs (gain not applied)
OBSRDNA	3.932320693814749	float	electrons (gain is applied)
SATUELEA	50050.18486604495	float	saturation or non lin. level, in electrons
GAINB	1.284	float	e/ADU (gain applied to image)
SATULEVB	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPB	0.9970038118117373	float	ADUs (max-min of median overscan per row)
OMETHB	AVERAGE	str	use average overscan
OVERSCNB	1212.197611701435	float	ADUs (gain not applied)
OBSRDNB	3.323361580066672	float	electrons (gain is applied)
SATUELEB	82590.47826657536	float	saturation or non lin. level, in electrons
GAINC	1.292	float	e/ADU (gain applied to image)

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KEY	Example Value	Type	Comment
SATULEVC	40000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPC	0.7691677607072052	float	ADUs (max-min of median overscan per row)
OMETHC	AVERAGE	str	use average overscan
OVERSCNC	1178.422505897216	float	ADUs (gain not applied)
OBSRDNC	3.252427649816138	float	electrons (gain is applied)
SATUELEC	50157.4781223808	float	saturation or non lin. level, in electrons
GAIND	1.295	float	e/ADU (gain applied to image)
SATULEVD	44000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPD	0.9395222094608471	float	ADUs (max-min of median overscan per row)
OMETHD	AVERAGE	str	use average overscan
OVERSCND	1174.800960708566	float	ADUs (gain not applied)
OBSRDND	3.333804957383686	float	electrons (gain is applied)
SATUELED	55458.6327558824	float	saturation or non lin. level, in electrons
FIBERMIN	3000	int	
BBKGMINA[Page 300, 1]	-0.2077800596230136	float	
BBKGMAXA[Page 300, 1]	0.5254324469128164	float	
BBKGMINB[Page 300, 1]	-0.2033242713025349	float	
BBKGMAXB[Page 300, 1]	0.4258502359052168	float	
BBKGMINC[Page 300, 1]	-0.1314577356495719	float	
BBKGMAXC[Page 300, 1]	0.4236035445727393	float	
BBKGMIND[Page 300, 1]	-0.2582211042496522	float	
BBKGMAXD[Page 300, 1]	0.3659635169905933	float	
LONGSTRN	OGIP 1.0	str	The OGIP Long String Convention may be used.
MODULE	CI	str	Image Sources/Component
COSMSPLT	F	bool	Cosmics split exposure if true
MAXSPLIT	0	int	Number of allowed exposure splits
SPLITIDS[Page 300, 1]	69022	str	List of expids for split exposures
OBSTYPE	SCIENCE	str	Spectrograph observation type
MANIFEST	F	bool	DOS exposure manifest
OBJECT		str	Object name
SEQNUM	1	int	Number of exposure in sequence
CAMSHUT	open	str	Shutter status during observation
ACQTIME	15.0	float	[s] acqusition image exposure time

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KEY	Example Value	Type	Comment
GUIDTIME	5.0	float	[s] guider GFA exposure time
FOCSTIME[Page 300, 1]	60.0	float	[s] focus GFA exposure time
SKYTIME[Page 300, 1]	60.0	float	[s] sky camera exposure time (acquisition)
WHITESPT	F	bool	Telescope is at whitespot
ZENITH	F	bool	Telescope is at zenith
SEANNEX	F	bool	Telescope is at SE annex
BEYONDP	F	bool	Telescope is beyond pole
FIDUCIAL	off	str	Fiducials status during observation
BACKLIT	off	str	Fibers are backlit if True
AIRMASS	1.060311	float	Airmass
PMREADY	T	bool	Primary mirror ready
PMCOVER	open	str	Primary mirror cover
PMCOOL	off	str	Primary mirror cooling
DOMSHUTU	open	str	Upper dome shutter
DOMSHUTL	open	str	Lower dome shutter
DOMLIGHH	off	str	High dome lights
DOMLIGHL	off	str	Low dome lights
DOMEAZ	255.166	float	[deg] Dome azimuth angle
DOMINPOS	T	bool	Dome is in position
GUIDOFFR	-0.052283	float	[arcsec] Cummulative guider offset (RA)
GUIDOFFD	0.136634	float	[arcsec] Cummulative guider offset (dec)
MOONDEC	-8.975162	float	[deg] Moon declination at start of exposure
MOONRA	352.538429	float	[deg] Moon RA at start of exposure
INCTRL	T	bool	DESI in control
INPOS	T	bool	Mount in position
MNTOFFD	-15.76	float	[arcsec] Mount offset (dec)
MNTOFFR	29.32	float	[arcsec] Mount offset (RA)
PARALLAC	75.635085	float	[deg] Parallactic angle
TARGTAZ	267.074049	float	[deg] Target azimuth
TARGTEL	70.563787	float	[deg] Target elevation
TRGTOFFD	0.0	float	[arcsec] Telescope target offset (dec)
TRGTOFFR	0.0	float	[arcsec] Telescope target offset (RA)
ZD	19.436213	float	[deg] Telescope zenith distance
TILERA	356.0	float	RA of tile given in fiberassign file
TILEDEC	29.0	float	DEC of tile given in fiberassign file

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KEY	Example Value	Type	Comment
TCSST	01:13:18.668	str	Local Sidereal time reported by TCS (HH:MM:SS)
TCSMJD	59204.110981	float	MJD reported by TCS
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM[Page 300, 1]	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM[Page 300, 1]	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
REQADC	65.78,85.28	str	[deg] requested ADC angles
ADCCORR	T	bool	Correct pointing for ADC setting if True
ADC1PHI	65.780005	float	[deg] ADC 1 angle
ADC2PHI	85.279991	float	[deg] ADC 2 angle
ADC1HOME	F	bool	ADC 1 at home position if True
ADC2HOME	F	bool	ADC 2 at home position if True
ADC1NREV	-1.0	float	ADC 1 number of revs
ADC2NREV	0.0	float	ADC 2 number of revs
ADC1STAT	STOPPED	str	ADC 1 status
ADC2STAT	STOPPED	str	ADC 2 status
HEXPOS	1426.5,-501.3,81.0,-2.6,42.3,171.9	str	Hexapod position
RESETROT	F	bool	DOS Control: reset hex rotator
USEPOS	T	bool	Fiber positioner data available if true
PETALS	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9	str	Participating petals
POSCYCLE	1	int	Number of current iteration
POSONTGT	3626	int	Number of positioners on target
POSONFRC	0.8613	float	Fraction of positioners on target
POSDISAB	37	int	Number of disabled positioners
POSENABL	4210	int	Number of enabled positioners
POSRMS	0.0171	float	[micron] RMS of positioner accuracy
POSITER	1	int	Positioning Control: max. number of pos. cycles
POSFRACT	0.95	float	
POSTOLER	0.01	float	Positioning Control: in_position tolerance (mm)

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KEY	Example Value	Type	Comment
POSMVALL	T	bool	Positioning Control: move all positioners
GUIDMODE	catalog	str	Guider mode
USEAOS[Page 300, 1]	F	bool	DOS Control: AOS data available if true
USESPCTR	T	bool	DOS Control: use spectrographs
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating spectrograph
ILLSPECS[Page 300, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating illuminate s
CCDSPECS[Page 300, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating ccd spectrog
TDEWPNT	-16.043	float	Telescope air dew point
TAIRFLOW	0.0	float	Telescope air flow
TAIRITMP	11.8	float	[deg] Telescope air in temperature
TAIROTMP	11.7	float	[deg] Telescope air out temperature
TAIRTEMP	10.65	float	[deg] Telescope air temperature
TCASITMP	0.0	float	[deg] Telescope Cass Cage in temperature
TCASOTMP	10.8	float	[deg] Telescope Cass Cage out temperature
TCSITEMP	9.3	float	[deg] Telescope center section in temperature
TCSOTEMP	10.8	float	[deg] Telescope center section out temperature
TCIBTEMP	0.0	float	[deg] Telescope chimney IB temperature
TCIMTEMP	0.0	float	[deg] Telescope chimney IM temperature
TCITTEMP	0.0	float	[deg] Telescope chimney IT temperature
TCOSTEMP	0.0	float	[deg] Telescope chimney OS temperature
TCOWTEMP	0.0	float	[deg] Telescope chimney OW temperature
TDBTEMP	9.3	float	[deg] Telescope dec bore temperature
TFLOWIN	0.0	float	Telescope flow rate in
TFLOWOUT	0.0	float	Telescope flow rate out
TGLYCOLI	9.9	float	[deg] Telescope glycol in temperature
TGLYCOLO	9.8	float	[deg] Telescope glycol out temperature
THINGES	11.4	float	[deg] Telescope hinge S temperature
THINGEW	11.2	float	[deg] Telescope hinge W temperature
TPMAVERT	8.931	float	[deg] Telescope mirror averagetemperature

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KEY	Example Value	Type	Comment
TPMDESIT	7.0	float	[deg] Telescope mirror desired temperature
TPMEIBT	8.6	float	[deg] Telescope mirror EIB temperature
TPMEITT	8.6	float	[deg] Telescope mirror EIT temperature
TPMEOBT	8.5	float	[deg] Telescope mirror EOB temperature
TPMEOTT	9.0	float	[deg] Telescope mirror EOT temperature
TPMNIBT	8.4	float	[deg] Telescope mirror NIB temperature
TPMNITT	8.9	float	[deg] Telescope mirror NIT temperature
TPMNOBT	8.8	float	[deg] Telescope mirror NOB temperature
TPMNOTT	9.1	float	[deg] Telescope mirror NOT temperature
TPMRTDT	9.0	float	[deg] Telescope mirror RTD temperature
TPMSIBT	8.6	float	[deg] Telescope mirror SIB temperature
TPMSITT	8.8	float	[deg] Telescope mirror SIT temperature
TPMSOBT	8.2	float	[deg] Telescope mirror SOB temperature
TPMSOTT	8.9	float	[deg] Telescope mirror SOT temperature
TPMSTAT	ready	str	Telescope mirror status
TPMWIBT	8.2	float	[deg] Telescope mirror WIB temperature
TPMWITT	9.1	float	[deg] Telescope mirror WIT temperature
TPMWOBT	8.3	float	[deg] Telescope mirror WOB temperature
TPMWOTT	8.9	float	[deg] Telescope mirror WOT temperature
TPCITEMP	8.5	float	[deg] Telescope primary cell in temperature
TPCOTEMP	8.6	float	[deg] Telescope primary cell out temperature
TPR1HUM	0.0	float	Telescope probe 1 humidity
TPR1TEMP	0.0	float	[deg] Telescope probe1 temperature
TPR2HUM	0.0	float	Telescope probe 2 humidity
TPR2TEMP	0.0	float	[deg] Telescope probe2 temperature
TSERVO	40.0	float	Telescope servo setpoint

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Table 31 – continued from previous page

KEY	Example Value	Type	Comment
TTRSTEMP	11.4	float	[deg] Telescope top ring S temperature
TTRWTEMP	11.0	float	[deg] Telescope top ring W temperature
TTRUETBT	-4.2	float	[deg] Telescope truss ETB temperature
TTRUETTT	11.2	float	[deg] Telescope truss ETT temperature
TTRUNTBT	10.9	float	[deg] Telescope truss NTB temperature
TTRUNTTT	11.2	float	[deg] Telescope truss NTT temperature
TTRUSTBT	10.7	float	[deg] Telescope truss STB temperature
TTRUSTST	10.8	float	[deg] Telescope truss STS temperature
TTRUSTTT	11.1	float	[deg] Telescope truss STT temperature
TTRUTSBT	11.8	float	[deg] Telescope truss TSB temperature
TTRUTSMT	11.8	float	[deg] Telescope truss TSM temperature
TTRUTSTT	11.8	float	[deg] Telescope truss TST temperature
TTRUWTBT	10.5	float	[deg] Telescope truss WTB temperature
TTRUWTTT	10.9	float	[deg] Telescope truss WTT temperature
ALARM	F	bool	UPS major alarm or check battery
ALARM-ON	F	bool	UPS active alarm condition
BATTERY	100.0	float	[%] UPS Battery left
SECLEFT	5178.0	float	[s] UPS Seconds left
UPSSTATPage 300, 1	System Normal - On Line(7)	str	UPS Status
INAMPS	70.4	float	[A] UPS total input current
OUTWATTS	5000.0,7200.0,4800.0	str	[W] UPS Phase A, B, C output watts
COMPDEW	-12.9	float	[deg C] Computer room dewpoint
COMPHUM	7.4	float	[%] Computer room humidity
COMPAMB	19.5	float	[deg C] Computer room ambient temperature
COMPTEMP	24.5	float	[deg C] Computer room hygrometer temperature
DEWPOINT	11.5	float	[deg C] (outside) dewpoint

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KEY	Example Value	Type	Comment
HUMIDITY	10.0	float	[%] (outside) humidity
PRESSURE	795.0	float	[torr] (outside) air pressure
OUTTEMP	0.0	float	[deg C] outside temperature
WINDDIR	55.0	float	[deg] wind direction
WINDSPD	27.3	float	[m/s] wind speed
GUST	20.6	float	[m/s] Wind gusts speed
AMNIENTN	13.5	float	[deg C] ambient temperature north
CFLOOR	8.9	float	[deg C] temperature on C floor
NWALLIN	13.9	float	[deg C] temperature at north wall inside
NWALLOUT	9.6	float	[deg C] temperature at north wall outside
WWALLIN	12.9	float	[deg C] temperature at west wall inside
WWALLOUT	10.6	float	[deg C] temperature at west wall outside
AMBIENTS	14.8	float	[deg C] ambient temperature south
FLOOR	12.6	float	[deg C] temperature at floor (LCR)
EWALLCMP	10.8	float	[deg C] temperature at east wall, computer room
EWALLCOU	10.6	float	[deg C] temperature at east wall, Coude room
ROOF	10.3	float	[deg C] temperature on roof
ROOFAMB	10.6	float	[deg C] ambient temperature on roof
DOMEBLOW	10.4	float	[deg C] temperature at dome back, lower
DOMEBUP	10.7	float	[deg C] temperature at dome back, upper
DOMELLOW	10.8	float	[deg C] temperature at dome left, lower
DOMELUP	10.8	float	[deg C] temperature at dome left, upper
DOMERLOW	10.6	float	[deg C] temperature at dome right, lower
DOMERUP	10.5	float	[deg C] temperature at dome right, upper
PLATFORM	10.4	float	[deg C] temperature at platform
SHACKC	14.4	float	[deg C] temperature at shack ceiling
SHACKW	13.7	float	[deg C] temperature at shack wall

continues on next page

Table 31 – continued from previous page

KEY	Example Value	Type	Comment
STAIRSL	10.5	float	[deg C] temperature at stairs, lower
STAIRSM	10.4	float	[deg C] temperature at stairs, mid
STAIRSU	10.6	float	[deg C] temperature at stairs, upper
TELBASE	9.6	float	[deg C] temperature at telescope base
UTILWALL	11.1	float	[deg C] temperature at utility room wall
UTILROOM	10.9	float	[deg C] temperature in utilitiy room
TNFSPROC[Page 300, 1]	8.1963	float	[s] PlateMaker NFSPROC processing time
TGFAPROC[Page 300, 1]	7.9212	float	[s] PlateMaker GFAPROC processing time
SIMGFAP	F	bool	DOS Control: simulate GFAPROC
USEFVC	T	bool	DOS Control: use fvc
USEFID	T	bool	DOS Control: use fiducials
USEILLUM	T	bool	DOS Control: use illuminator
USEXSRVR	T	bool	DOS Control: use exposure server
USEOPENL	T	bool	DOS Control: use open loop move
STOPGUDR	T	bool	DOS Control: stop guider
STOPFOCS	T	bool	DOS Control: stop focus
STOPSKY	T	bool	DOS Control: stop sky monitor
KEEPGUDR	F	bool	DOS Control: keep guider running
KEEPFOCS	F	bool	DOS Control: keep focus running
KEEPSKY	F	bool	DOS Control: keep sky mon. running
REACQUIR	F	bool	DOS Control: reacquire same files
EXCLUDED		str	Components excluded from this exposure
FVCTIME[Page 300, 1]	2.0	float	[s] FVC exposure time
SIMGFACQ	F	bool	
POSCNVGD[Page 300, 1]	F	bool	Number of positioners converged
GUIEXPID	69022	int	Guider exposure id at start of spectro exp.
IGFRMNUM	12	int	Guider frame number at start of spectro exp.

continues on next page

Table 31 – continued from previous page

KEY	Example Value	Type	Comment
FOCEXPID	69022	int	Focus exposure id at start of spectro exp.
IFFRMNUM	1	int	Focus frame number at start of spectro exp.
SKYEXPID	69022	int	Sky exposure id at start of spectro exp.
ISFRMNUM	1	int	Sky frame number at start of spectro exp.
FGFRMNUM	46	int	Guider frame number at end of spectro exp.
FFFRMNUM	6	int	Focus frame number at end of spectro exp.
FSFRMNUM	5	int	Sky frame number at end of spectro exp.
HELIOCOR	0.9999115198216216	float	
NSPEC	500	int	Number of spectra
WAVEMIN	3600.0	float	First wavelength [Angstroms]
WAVEMAX	5800.0	float	Last wavelength [Angstroms]
WAVESTEP	0.8	float	Wavelength step size [Angstroms]
SPECTER	0.10.0	str	https://github.com/desihub/specter
IN_PSF	SPECPROD/exposures/20201220/00069022/psf-b6-00069022.fits	str	Input sp
IN_IMG	SPECPROD/preproc/20201220/00069022/preproc-b6-00069022.fits	str	
ORIG_PSF	SPECPROD/calibnight/20201220/psfnight-b6-20201220.fits	str	
BUNIT	electron/Angstrom	str	
IN_FRAME	SPECPROD/exposures/20201220/00069022/frame-b6-00069022.fits	str	
FIBERFLT	SPECPROD/exposures/20201220/00069022/fiberflatexp-b6-00069022.fits	str	
SP1NIRT[Page 300, 1]	139.91	float	[K] SP1 NIR temperature
SP4NIRT[Page 300, 1]	139.96	float	[K] SP4 NIR temperature
PMTRANS[Page 300, 1]	96.38	float	[%] PlateMaker GFAPROC transparency
SUNRA[Page 300, 1]	16.188197	float	[deg] Sun RA at start of exposure
SP3REDT[Page 300, 1]	139.96	float	[K] SP3 red temperature
SP2NIRP[Page 300, 1]	5.108e-08	float	[mb] SP2 NIR pressure
SP6NIRP[Page 300, 1]	2.875e-07	float	[mb] SP6 NIR pressure
SP8REDP[Page 300, 1]	6.99e-08	float	[mb] SP8 red pressure
SP4REDP[Page 300, 1]	4.945e-08	float	[mb] SP4 red pressure
SP0NIRP[Page 300, 1]	5.598e-08	float	[mb] SP0 NIR pressure
SP1REDP[Page 300, 1]	5.142e-08	float	[mb] SP1 red pressure
SP5NIRT[Page 300, 1]	139.94	float	[K] SP5 NIR temperature
SP8BLUP[Page 300, 1]	8.113e-08	float	[mb] SP8 blue pressure

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Table 31 – continued from previous page

KEY	Example Value	Type	Comment
SP1REDT[Page 300, 1]	139.89	float	[K] SP1 red temperature
SP3NIRT[Page 300, 1]	140.01	float	[K] SP3 NIR temperature
SP6BLUP[Page 300, 1]	7.209e-08	float	[mb] SP6 blue pressure
SP9BLUP[Page 300, 1]	1.181e-07	float	[mb] SP9 blue pressure
SP2REDP[Page 300, 1]	8.846e-08	float	[mb] SP2 red pressure
USESPLIT[Page 300, 1]	T	bool	Exposure splits are allowed
SP7REDT[Page 300, 1]	139.99	float	[K] SP7 red temperature
SP9NIRT[Page 300, 1]	139.89	float	[K] SP9 NIR temperature
SP0REDP[Page 300, 1]	4.896e-08	float	[mb] SP0 red pressure
SP7NIRP[Page 300, 1]	4.315e-08	float	[mb] SP7 NIR pressure
SP2REDT[Page 300, 1]	139.99	float	[K] SP2 red temperature
SP7REDP[Page 300, 1]	5.383e-08	float	[mb] SP7 red pressure
SP6NIRT[Page 300, 1]	139.89	float	[K] SP6 NIR temperature
SP6REDP[Page 300, 1]	5.397e-08	float	[mb] SP6 red pressure
SP8REDT[Page 300, 1]	139.94	float	[K] SP8 red temperature
FRAMES[Page 300, 1]	None	Unknown	Number of Frames in Archive
SP9REDT[Page 300, 1]	140.01	float	[K] SP9 red temperature
SP2NIRT[Page 300, 1]	139.91	float	[K] SP2 NIR temperature
SP4BLUP[Page 300, 1]	4.978e-08	float	[mb] SP4 blue pressure
SP8NIRP[Page 300, 1]	4.945e-08	float	[mb] SP8 NIR pressure
SPLITEXP[Page 300, 1]	F	bool	Split exposure part of a visit
SEQSTART[Page 300, 1]	2021-04-07T03:54:14.413292	str	Start time of sequence processing
SP8NIRT[Page 300, 1]	139.99	float	[K] SP8 NIR temperature
SP7BLUT[Page 300, 1]	163.02	float	[K] SP7 blue temperature
SP5REDP[Page 300, 1]	4.693e-08	float	[mb] SP5 red pressure
SP5NIRP[Page 300, 1]	7.197e-08	float	[mb] SP5 NIR pressure
SP5BLUT[Page 300, 1]	163.02	float	[K] SP5 blue temperature
SP0BLUP[Page 300, 1]	9.122e-08	float	[mb] SP0 blue pressure
SP1NIRP[Page 300, 1]	4.585e-08	float	[mb] SP1 NIR pressure
TCSKDEC[Page 300, 1]	0.3 0.003 0.00003	str	TCS Kalman (dec)
SP6REDT[Page 300, 1]	139.94	float	[K] SP6 red temperature
TCSPIDEC[Page 300, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
TCSGRA[Page 300, 1]	0.3	float	TCS simple gain (RA)
TCSGDEC[Page 300, 1]	0.3	float	TCS simple gain (dec)
SP1BLUT[Page 300, 1]	163.02	float	[K] SP1 blue temperature
SP9NIRP[Page 300, 1]	5.207e-08	float	[mb] SP9 NIR pressure
SP0NIRT[Page 300, 1]	139.89	float	[K] SP0 NIR temperature
SP4BLUT[Page 300, 1]	163.02	float	[K] SP4 blue temperature
SP9BLUT[Page 300, 1]	163.02	float	[K] SP9 blue temperature
SP9REDP[Page 300, 1]	4.884e-08	float	[mb] SP9 red pressure
PMSEEING[Page 300, 1]	1.19	float	[arcsec] PlateMaker GFAPROC seeing
SP0REDT[Page 300, 1]	139.96	float	[K] SP0 red temperature
SP2BLUT[Page 300, 1]	163.02	float	[K] SP2 blue temperature

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KEY	Example Value	Type	Comment
TCSKRA[Page 300, 1]	0.3 0.003 0.00003	str	TCS Kalman (RA)
SP3NIRP[Page 300, 1]	4.194e-08	float	[mb] SP3 NIR pressure
TCSPIRA[Page 300, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
SP8BLUT[Page 300, 1]	162.9	float	[K] SP8 blue temperature
VISITIDS[Page 300, 1]	83717	str	List of expids for a visit (same tile)
MOONSEP[Page 300, 1]	138.187	float	[deg] Moon Separation
SP5BLUP[Page 300, 1]	1.125e-07	float	[mb] SP5 blue pressure
TCSMFDEC[Page 300, 1]	1	int	TCS moving filter length (dec)
SP4NIRP[Page 300, 1]	6.595e-08	float	[mb] SP4 NIR pressure
SP7BLUP[Page 300, 1]	9.98e-08	float	[mb] SP7 blue pressure
SP2BLUP[Page 300, 1]	6.432e-08	float	[mb] SP2 blue pressure
SUNDEC[Page 300, 1]	6.890581	float	[deg] Sun declination at start of exposure
SP1BLUP[Page 300, 1]	8.039e-08	float	[mb] SP1 blue pressure
SKYLEVEL[Page 300, 1]	1.398	float	counts?] ETC sky level
TCSMFRA[Page 300, 1]	1	int	TCS moving filter length (RA)
SP3BLUP[Page 300, 1]	8.133e-08	float	[mb] SP3 blue pressure
SP5REDT[Page 300, 1]	139.99	float	[K] SP5 red temperature
SP7NIRT[Page 300, 1]	139.96	float	[K] SP7 NIR temperature
SP0BLUT[Page 300, 1]	163.02	float	[K] SP0 blue temperature
SP3REDP[Page 300, 1]	6.033e-08	float	[mb] SP3 red pressure
NTSSURVY[Page 300, 1]	sv3	str	NTS survey name
SP3BLUT[Page 300, 1]	163.04	float	[K] SP3 blue temperature
SP4REDT[Page 300, 1]	140.01	float	[K] SP4 red temperature
SP6BLUT[Page 300, 1]	163.02	float	[K] SP6 blue temperature
SEQID[Page 300, 1]	6 requests	str	Exposure sequence identifier
SEQTOT[Page 300, 1]	6	int	Total number of exposures in sequence
MINTIME[Page 300, 1]	120.0	float	[s] Minimum exposure time (from NTS, used by ET
SEEING[Page 300, 1]	None	float	[arcsec] ETC/PM seeing
ETCTEFF[Page 300, 1]	226.882385	float	[s] ETC effective exposure time
ETCPREV[Page 300, 1]	0.0	float	[s] ETC cummulative t_eff for visit
ETCSPLIT[Page 300, 1]	1	int	ETC split sequence number for this visit
TOTTEFF[Page 300, 1]	225.6017	float	[s] Total effective exposure time for visit
TRANSPAR[Page 300, 1]	None	float	ETC/PM transparency
ACQFWHM[Page 300, 1]	0.890634	float	[arcsec] FWHM of guide star PSF in acquisition
POSCVFRC[Page 300, 1]	0.4956	float	Fraction of converged positioners

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Table 31 – continued from previous page

KEY	Example Value	Type	Comment
ETCTRANS[Page 300, 1]	0.915827	float	ETC averaged TRANSP normalized to 1
SLEWANGL[1]	16.255	float	[deg] Slew Angle
SBPROF[1]	BGS	str	Profile used by ETC
ETCREAL[1]	392.495819	float	[s] ETC real open shutter time
ETCTHRUB[1]	0.964227	float	ETC averaged thruput (BGS profile)
ETCFRACE[1]	0.45002	float	ETC transparency weighted average of FFRAC (ELG
ETCPROF[1]	BGS	str	ETC source brightness profile
ACTTEFF[1]	226.882385	float	[s] Actual effective exposure time
ESTTIME[1]	366.345	float	[s] Estimated exposure time for visit (from ETC
ETCTHRUP[1]	1.034724	float	ETC averaged thruput (PSF profile)
PMTRANSP[1]	98.17	float	[%] PlateMaker GFAPROC transparency
ETCFRACP[1]	0.634939	float	ETC transparency weighted average of FFRAC (PSF
ETCVERS[1]	0.1.12-3-g12b54bb	str	ETC version
ETCFRACB[1]	0.199883	float	ETC transparency weighted average of FFRAC (BGS
MAXTIME[1]	5400.0	float	[s] Maximum exposure time for entire visit (fro
NTSPROG[1]	BRIGHT	str	NTS program name
CONVERGD[1]	F	bool	Positioning loop converged (CNFRC>0.95)
ETCTHRUE[1]	0.999856	float	ETC averaged thruput (ELG profile)
ETCSKY[1]	1.924707	float	ETC averaged, normalized sky camera flux
ETCSEENG[1]	0.8906	float	[arcsec] ETC seeing
REQTEFF[1]	220.0	float	[s] Requested effective exposure time
USESPLITS[1]	T	bool	Exposure splits are allowed
UPSSTAT[1]	17826.0	float	UPS Status

Data: FITS image [float32, 2326x500]

[1] Optional

HDU1

EXTNAME = IVAR

Inverse variance of sky model in units of (electrons per Ansgtrom)^-2.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
NAXIS2	500	int	
CHECKSUM	WMCiXJ9ZWJCfWJ9Z	str	HDU checksum updated 2021-07-08T02:23:26
DATASUM	3732109365	str	data unit checksum updated 2021-07-08T02:23:26

Data: FITS image [float32, 2326x500]

HDU2

EXTNAME = MASK

Sky mask; 0=good. See the *bitmask documentation* page for the definition of the bits. Prior to desispec/0.24.0 and software release 18.9, the MASK HDU was compressed.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
NAXIS2	500	int	
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	kIf3lGc0kGc0kGc0	str	HDU checksum updated 2021-07-08T02:23:26
DATASUM	581500	str	data unit checksum updated 2021-07-08T02:23:26

Data: FITS image [int32, 2326x500]

HDU3

EXTNAME = WAVELENGTH

1D array of wavelengths, in Angstrom. Note the wavelength is in the solar system barycenter frame, so that the sky flux array can be directly subtracted to the flat-fielded frame fluxes which are on the same wavelength grid. In order to compare the sky spectrum of different exposures, or with litterature data, one has to convert back the wavelength array to the observer frame, by dividing it by Doppler factor saved in header keyword HELIOCOR in HDU0. See also the frame *WAVELENGTH documentation* for more details.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
CHECKSUM	7BAoAA3l7A9lAA9l	str	HDU checksum updated 2021-07-08T02:23:26
DATASUM	1502044794	str	data unit checksum updated 2021-07-08T02:23:26

Data: FITS image [float32, 2326]

HDU4

EXTNAME = STATIVAR

Statistical-only inverse variance of sky model.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
NAXIS2	500	int	
CHECKSUM	SAMkT5JjSAJjS3Jj	str	HDU checksum updated 2021-07-08T02:23:27
DATASUM	3877575180	str	data unit checksum updated 2021-07-08T02:23:27

Data: FITS image [float32, 2326x500]

HDU5

EXTNAME = THRPUTCORR

Multiplicative achromatic throughput correction per fiber. This term has been measured on the bright sky lines of each fiber from the exposure (EXPID). It is used as a correction to the mean sky model.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	500	int	
BUNIT	Angstrom	str	
CHECKSUM	VPA5WO62VOA2VO52	str	HDU checksum updated 2021-07-08T02:23:27
DATASUM	63793519	str	data unit checksum updated 2021-07-08T02:23:27

Data: FITS image [float32, 500]

stdstars-SPECTROGRAPH-EXPID.fits

Summary
This file contains the normalized standard star models fitted to the frame data.

Naming Convention
`stdstars-{SPECTROGRAPH}-{EXPID}.fits` where `{SPECTROGRAPH}` is the single-digit spectrograph number 0-9, and `{EXPID}` is the zero-padded 8-digit exposure number.

Regex
`stdstars-[0-9]-[0-9]{8}\.fits`

File Type
FITS, 5 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	FLUX	IMAGE	stdstar flux[nstd, nwave] in erg/s/cm^2/Angstrom
HDU1	WAVELENGTH	IMAGE	wavelength grid used, Angstroms
HDU2	FIBERS	IMAGE	1D array of which fibers these models correspond to
HDU3	METADATA	BINTABLE	metadata from input standard star templates
HDU4	COEFF	IMAGE	Linear coefficients of stdstar model fit
HDU5	FIBERMAP	BINTABLE	Target photometry, metadata, and what fibers they are assigned to
HDU6	IN-PUT_FRAMES	BINTABLE	Table of input frames used for stdstar fitting

FITS Header Units

HDU0

EXTNAME = FLUX

2D array of best fit standard star model fluxes, in units of 10^{-17} ergs/s/cm2/A, at high resolution, including the Milky Way extinction, and the Doppler shift from the fitted radial velocity. The size of the array is [nspec, nwave]. nspec is the number of standard stars and nwave in the length of the wavelength array.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	118456	int	
NAXIS2	7	int	
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	Flux units
CHECKSUM	CjVADgT8CgTACgT7	str	HDU checksum updated 2021-07-08T20:11:43
DATASUM	2067206737	str	data unit checksum updated 2021-07-08T20:11:43

Data: FITS image [float32, 118456x7]

HDU1

EXTNAME = WAVELENGTH

Wavelength grid in Angstrom (in vacuum, not in air). It is by construction in the same reference frame as the data, which is the solar system barycenter (see the frame *WAVELENGTH documentation* for more details).

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	118456	int	
BUNIT	Angstrom	str	Wavelength units
CHECKSUM	9BfWA9fU2AfU99fU	str	HDU checksum updated 2021-07-08T20:11:43
DATASUM	1377634846	str	data unit checksum updated 2021-07-08T20:11:43

Data: FITS image [float32, 118456]

HDU2

EXTNAME = FIBERS

Fibers used for fit.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	7	int	
CHECKSUM	Rl5YSk2XRk2XRk2X	str	HDU checksum updated 2021-07-08T20:11:43
DATASUM	1945	str	data unit checksum updated 2021-07-08T20:11:43

Data: FITS image [int32, 7]

HDU3

EXTNAME = METADATA

Metadata about best fit standard star models. Normally, `DATA_G-R` and `MODEL_G-R` columns contain photometric colors, but the columns `DATA_GAIA-BP-RP` and `MODEL_GAIA-BP-RP` may be present for "off-footprint" tiles that do not have DECaLS photometry.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	80	int	length of dimension 1
NAXIS2	7	int	length of dimension 2
CHECKSUM	ja5akW3aja3ajU3a	str	HDU checksum updated 2021-07-08T20:11:43
DATASUM	1981588907	str	data unit checksum updated 2021-07-08T20:11:43

Required Data Table Columns

Name	Type	Units	Description
LOGG	float64		log10(surface gravity / solar value)
TEFF	float64	K	Effective temperature
FEH	float64		log10(iron abundance / solar value)
CHI2DOF	float64		reduced chi2
REDSHIFT	float64		redshift (can be negative)
DATA_G-R[1]	float64		g-r color of the data (from photometry)
MODEL_G-R[1]	float64		g-r color of the model
BLUE_SNR	float64		median signal to noise in blue camera
RED_SNR	float64		median signal to noise in red camera
NIR_SNR	float64		median signal to noise in NIR camera
DATA_GAIA-BP-RP[1]	float64		Gaia Bp - Rp color of the data
MODEL_GAIA-BP-RP[1]	float64		Gaia Bp - Rp color of the model

HDU4

EXTNAME = COEFF

Linear coefficients of stdstar model fit.

The model fit for stdstar *i* is `model_i = Sum_j template_j * coeff[i,j]`

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	1491	int	Number of input templates
NAXIS2	7	int	Number of standard stars
CHECKSUM	ZUOicSLgZSLgbSLg	str	HDU checksum updated 2021-07-08T20:11:43
DATASUM	3509807364	str	data unit checksum updated 2021-07-08T20:11:43

Data: FITS image [float64, 1491x7]

[1] Optional

HDU5

EXTNAME = FIBERMAP

Fibermap with targeting and photometric information for the standard stars. See also the *fibermap documentation* page.

Required Header Keywords

KEY	Example Value
NAXIS1	321
NAXIS2	22
TILEID	80616
TILERA	356.0
TILEDEC	29.0
FIELDROT	-0.00962199210064233
FA_PLAN	2022-07-01T00:00:00.000
FA_HA	0.0
FA_RUN	2020-03-06T00:00:00
FA_M_GFA[1]	0.4
FA_M_PET[Page 305, 1]	0.4
FA_M_POS[Page 305, 1]	0.05
REQRA	356.0
REQDEC	29.0
FIELDNUM	0
FA_VER	2.0.0.dev2618
FA_SURV	sv1
LONGSTRN	OGIP 1.0
GFA	/data/target/catalogs/dr9/0.47.0/gfas
SKY	/data/target/catalogs/dr9/0.47.0/skies
SKYSUPP	/data/target/catalogs/gaiadr2/0.47.0/skies-supp
TARG	/data/target/catalogs/dr9/0.47.0/targets/sv1/resolve/bright/
FAFLAVOR	sv1bgsmws
FAOUTDIR	/software/datasystems/users/raichoor/fiberassign-test/desi-sv1-20201218/
PMTIME[Page 305, 1]	2020-12-18T00:00:00.000
RUNDATE	2020-03-06T00:00:00
SCTARG[Page 305, 1]	STD_WD,BGS_ANY,MWS_ANY
OBSCON	DARK|GRAY|BRIGHT
MODULE	CI
EXPID	69016
EXPFRAME	0
COSMSPLT	F
MAXSPLIT	0
SPLITIDS[Page 305, 1]	69016
FIBASSGN	/data/tiles/SVN_tiles/080/fiberassign-080616.fits
FLAVOR	science
OBSTYPE	SCIENCE
SEQUENCE	DESI
MANIFEST	F
OBJECT	
PURPOSE	Commissioning

KEY	Example Value
PROGRAM	SV1 BGS+MWS tile 80616
PROPID	2019B-5000
OBSERVER	DESIObserver
LEAD	RunManager
INSTRUME	DESI
OBSERVAT	KPNO
OBS-LAT	31.96403
OBS-LONG	-111.59989
OBS-ELEV	2097.0
TELESCOP	KPNO 4.0-m telescope
CORRCTOR	DESI Corrector
SEQNUM	1
NIGHT	20201220
TIMESYS	UTC
DATE-OBS	2020-12-21T01:34:39.123482
MJD-OBS	59204.0657306
OPENSHUT	2020-12-21T01:34:39.123482
CAMSHUT	open
ST	00:08:36.070
ACQTIME	15.0
GUIDTIME	5.0
FOCSTIME	60.0
SKYTIME	60.0
WHITESPT	F
ZENITH	F
SEANNEX	F
BEYONDP	F
FIDUCIAL	off
BACKLIT	off
AIRMASS	1.006654
FOCUS	1140.0,-480.0,-34.8,-3.0,25.0,0.0
VCCD	ON
TRUSTEMP	11.9
PMIRTEMP	8.362
PMREADY	T
PMCOVER	open
PMCOOL	off
DOMSHUTU	open
DOMSHUTL	open
DOMLIGHH	off
DOMLIGHL	off
DOMEAZ	229.967
DOMINPOS	T
EQUINOX	2000.0
GUIDOFFR	0.111057
GUIDOFFD	0.067915
MOONDEC	-9.183969
MOONRA	352.047271
MOUNTAZ	242.892393

KEY	Example Value
MOUNTDEC	28.999551
MOUNTEL	83.835496
MOUNTHA	6.27439
INCTRL	T
INPOS	T
MNTOFFD	-18.12
MNTOFFR	22.71
PARALLAC	61.607855
SKYDEC	28.999551
SKYRA	355.999142
TARGTDEC	28.999551
TARGTRA	355.999142
TARGTAZ	245.082952
TARGTEL	83.40236
TRGTOFFD	0.0
TRGTOFFR	0.0
ZD	6.59764
TCSST	00:11:21.970
TCSMJD	59204.068077
USEETC	F
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9
SKYCAM	SKYCAM0,SKYCAM1
REQADC	55.65,62.6
ADCCORR	T
ADC1PHI	55.649996
ADC2PHI	62.6
ADC1HOME	F
ADC2HOME	F
ADC1NREV	-1.0
ADC2NREV	0.0
ADC1STAT	STOPPED
ADC2STAT	STOPPED
USESKY	T
USEFOCUS	T
HEXPOS	1140.0,-480.0,-35.4,-3.0,25.0,148.8
HEXTRIM	0.0,0.0,-150.0,0.0,0.0,0.0
USEROTAT	T
ROTOFFST	0.0
ROTENBLD	F
ROTRATE	0.0
RESETROT	F
USEPOS	T
PETALS	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9
POSCYCLE	1
POSONTGT	3387
POSONFRC	0.8037
POSDISAB	33

KEY	Example Value
POSENABL	4214
POSRMS	0.0204
POSITER	1
POSFRACT	0.95
POSTOLER	0.01
POSMVALL	T
USEGUIDR	T
GUIDMODE	catalog
USEAOS[Page 305, 1]	F
USEDONUT	T
USESPCTR	T
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
ILLSPECS[Page 305, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
CCDSPECS[Page 305, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
TDEWPNT	-17.447
TAIRFLOW	0.0
TAIRITMP	11.3
TAIROTMP	10.7
TAIRTEMP	10.677
TCASITMP	0.0
TCASOTMP	10.4
TCSITEMP	8.6
TCSOTEMP	10.5
TCIBTEMP	0.0
TCIMTEMP	0.0
TCITTEMP	0.0
TCOSTEMP	0.0
TCOWTEMP	0.0
TDBTEMP	9.0
TFLOWIN	0.0
TFLOWOUT	0.0
TGLYCOLI	7.1
TGLYCOLO	7.2
THINGES	11.6
THINGEW	11.4
TPMAVERT	8.396
TPMDESIT	7.0
TPMEIBT	7.9
TPMEITT	8.0
TPMEOBT	8.3
TPMEOTT	8.5
TPMNIBT	7.9
TPMNITT	8.3
TPMNOBT	8.4
TPMNOTT	8.7
TPMRTDT	8.45
TPMSIBT	8.3
TPMSITT	8.3
TPMSOBT	8.1

KEY	Example Value
TPMSOTT	8.6
TPMSTAT	ready
TPMWIBT	7.9
TPMWITT	8.4
TPMWOBT	8.1
TPMWOTT	8.7
TPCITEMP	8.1
TPCOTEMP	8.2
TPR1HUM	0.0
TPR1TEMP	0.0
TPR2HUM	0.0
TPR2TEMP	0.0
TSERVO	40.0
TTRSTEMP	11.5
TTRWTEMP	11.2
TTRUETBT	-4.4
TTRUETTT	11.6
TTRUNTBT	11.0
TTRUNTTT	11.6
TTRUSTBT	11.0
TTRUSTST	10.8
TTRUSTTT	11.4
TTRUTSBT	12.0
TTRUTSMT	12.2
TTRUTSTT	12.1
TTRUWTBT	10.8
TTRUWTTT	11.5
ALARM	F
ALARM-ON	F
BATTERY	100.0
SECLEFT	4704.0
UPSSTAT	System Normal - On Line(7)
INAMPS	75.6
OUTWATTS	5000.0,7900.0,5500.0
COMPDEW	-13.2
COMPHUM	7.3
COMPAMB	19.3
COMPTEMP	24.4
DEWPOINT	8.4
HUMIDITY	8.3
PRESSURE	794.7
OUTTEMP	0.0
WINDDIR	17.3
WINDSPD	20.1
GUST	15.4
AMNIENTN	13.4
CFLOOR	8.7
NWALLIN	13.8
NWALLOUT	9.6

KEY	Example Value
WWALLIN	13.3
WWALLOUT	10.3
AMBIENTS	14.8
FLOOR	12.5
EWALLCMP	10.8
EWALLCOU	10.3
ROOF	10.4
ROOFAMB	10.6
DOMEBLOW	10.4
DOMEBUP	10.6
DOMELLOW	10.7
DOMELUP	11.3
DOMERLOW	10.6
DOMERUP	10.6
PLATFORM	10.3
SHACKC	14.9
SHACKW	13.6
STAIRSL	10.6
STAIRSM	10.4
STAIRSU	10.4
TELBASE	9.1
UTILWALL	11.2
UTILROOM	11.3
RADESYS	FK5
TNFSPROC	8.7172
TGFAPROC[Page 305, 1]	8.7344
SIMGFAP	F
USEFVC	T
USEFID	T
USEILLUM	T
USEXSRVR	T
USEOPENL	T
STOPGUDR	T
STOPFOCS	T
STOPSKY	T
KEEPGUDR	F
KEEPFOCS	F
KEEPSKY	F
REACQUIR	F
FILENAME	/exposures/desi/20201220/00069016/desi-00069016.fits.fz
EXCLUDED	
DOSVER	trunk
OCSVER	1.2
CONSTVER	DESI:CURRENT
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini
REQTIME	300.0
FVCTIME[Page 305, 1]	2.0
SIMGFACQ	F
POSCNVGD[Page 305, 1]	F

KEY	Example Value
GUIEXPID	69016
IGFRMNUM	12
FOCEXPID	69016
IFFRMNUM	1
SKYEXPID	69016
ISFRMNUM	1
FGFRMNUM	49
FFFRMNUM	6
FSFRMNUM	5
FRAMES[Page 305, 1]	50
DELTARA[Page 305, 1]	None
DELTADEC[Page 305, 1]	None
GSGUIDE0[Page 305, 1]	(980.13,685.47),(879.04,731.18)
GSGUIDE2[Page 305, 1]	(371.66,939.33),(783.54,1529.89)
GSGUIDE3[Page 305, 1]	(878.35,910.00),(364.77,1424.07)
GSGUIDE5[Page 305, 1]	(849.04,79.38),(516.76,1411.65)
GSGUIDE7[Page 305, 1]	(541.54,1848.75),(505.28,831.50)
GSGUIDE8[Page 305, 1]	(868.88,1782.12),(721.07,551.89)
ARCHIVE[Page 305, 1]	/exposures/desi/20201220/00069016/guide-00069016.fits.fz
GUIDEFIL	guide-00069016.fits.fz
COORDFIL	coordinates-00069016.fits
TIME-OBS	01:37:24.969057
EXPTIME	300.088
VCCDON	2020-12-09T21:23:25.494701
VCCDSEC	965989.1
SPECGRPH	0
SPECID	4
FEEBOX	lbnl082
VESSEL	17
FEEVER	v20160312
FEEPOWER	ON
FEEDMASK	2134851391
FEECMASK	1048575
CCDTEMP	-137.6577
CLOCK2	9.9999,0.0
DAC0	-9.0002,-8.7962
DAC6	5.9998,6.0858
PRESECD	[4250:4256, 2130:4193]
PRRSECD	[2193:4249, 4194:4194]
CASETEMP	60.0603
OFFSET7	2.0,5.9964
DETSECD	[2058:4114, 2065:4128]
DETSECC	[1:2057, 2065:4128]
CLOCK5	9.9999,0.0
CLOCK13	9.9995,2.9996
AMPSECC	[1:2057, 4128:2065]
DAC3	-9.0002,-8.8683
DAC7	5.9998,5.9964
DAC4	5.9998,6.0648

KEY	Example Value
TRIMSECB	[2193:4249, 2:2065]
DAC16	39.9961,38.9928
CLOCK6	9.9999,0.0
CLOCK15	9.9995,2.9996
DATASECD	[2193:4249, 2130:4193]
CRYOPRESPage 305, 1	5.993e-08
DETSECA	[1:2057, 1:2064]
DAC9	-25.0003,-24.946
DAC13	0.0,0.1039
DATASECA	[8:2064, 2:2065]
OFFSET3	0.4000000059604645,-8.8786
DATASECB	[2193:4249, 2:2065]
AMPSECA	[1:2057, 1:2064]
BIASSECC	[2065:2128, 2130:4193]
CLOCK3	-2.0001,3.9999
CCDCFG	default_lbnl_20190717.cfg
DAC12	0.0,0.1039
PRESECC	[1:7, 2130:4193]
CLOCK11	9.9995,2.9996
DETSECB	[2058:4114, 1:2064]
CCDSECA	[1:2057, 1:2064]
OFFSET5	2.0,6.0858
DETECTOR	M1-53
ORSECD	[2193:4249, 2098:2129]
DAC11	-25.0003,-24.0408
CLOCK16	9.9999,3.0
CLOCK17	9.0,0.9999
DAC5	5.9998,6.0858
AMPSECB	[4114:2058, 1:2064]
OFFSET1	0.4000000059604645,-8.8786
CAMERA	z0
CCDSECC	[1:2057, 2065:4128]
CPUTEMP	60.1933
PRRSECA	[8:2064, 1:1]
CLOCK1	9.9999,0.0
CLOCK12	9.9995,2.9996
CLOCK7	-2.0001,3.9999
CLOCK9	9.9995,2.9996
CLOCK4	9.9999,0.0
PRRSECB	[2193:4249, 1:1]
DELAYS	20, 20, 25, 40, 7, 3000, 7, 7, 7, 7
DIGITIME	47.5379
CCDTMING	default_lbnl_timing_20180905.txt
CCDPREP	purge,clear
CCDSECD	[2058:4114, 2065:4128]
PRESECB	[4250:4256, 2:2065]
PGAGAIN	3
BLDTIME	0.3365
OFFSET2	0.4000000059604645,-8.8271

KEY	Example Value
SETTINGS	detectors_sm_20191211.json
ORSECA	[8:2064, 2066:2097]
BIASSECB	[2129:2192, 2:2065]
OFFSET4	2.0,6.0595
CCDSIZE	4194,4256
PRESECA	[1:7, 2:2065]
PRRSECC	[8:2064, 4194:4194]
DAC2	-9.0002,-8.8271
DAC15	0.0,0.089
CLOCK0	9.9999,0.0
TRIMSECC	[8:2064, 2130:4193]
ORSECB	[2193:4249, 2066:2097]
DAC17	20.0008,11.834
ORSECC	[8:2064, 2098:2129]
CLOCK18	9.0,0.9999
CCDSECB	[2058:4114, 1:2064]
CLOCK14	9.9995,2.9996
CDSPARMS	400, 400, 8, 2000
DAC8	-25.0003,-24.8273
OFFSET6	2.0,6.0858
BIASSECA	[2065:2128, 2:2065]
CLOCK10	9.9995,2.9996
CRYOTEMPPage 305, 1	139.986
DAC14	0.0,0.1039
DAC10	-25.0003,-24.7976
DAC1	-9.0002,-8.8786
TRIMSECA	[8:2064, 2:2065]
DATASECC	[8:2064, 2130:4193]
OFFSET0	0.4000000059604645,-8.7962
TRIMSECD	[2193:4249, 2130:4193]
CLOCK8	9.9995,2.9996
CCDNAME	CCDSM4Z
BIASSECD	[2129:2192, 2130:4193]
AMPSECD	[4114:2058, 4128:2065]
OBSID	kp4m20201221t013724
PROCTYPE	RAW
PRODTYPE	image
GAINA	1.614
SATULEVA	65535.0
OSTEPA	0.6242494111647829
OMETHA	AVERAGE
OVERSCNA	1963.112788319694
OBSRDNA	2.658249246622249
SATUELEA	102605.025959652
GAINB	1.519
SATULEVB	65535.0
OSTEPB	0.5685245779459365
OMETHB	AVERAGE
OVERSCNB	1995.308510208199

KEY	Example Value
OBSRDNB	2.323231415081791
SATUELEB	96516.79137299374
GAINC	1.673
SATULEVC	65535.0
OSTEPC	0.6139319066423923
OMETHC	AVERAGE
OVERSCNC	1978.346882724393
OBSRDNC	2.725520716006655
SATUELEC	106330.2806652021
GAIND	1.491
SATULEVD	65535.0
OSTEPD	0.6195056127617136
OMETHD	AVERAGE
OVERSCND	1980.214841026789
OBSRDND	2.360148832064985
SATUELED	94760.18467202906
FIBERMIN	0
CHECKSUM	SDXLVCWJSCWJSCWJ
DATASUM	2925972956
SP9NIRT[Page 305, 1]	140.03
MOONSEP[Page 305, 1]	55.183819256517
SP4NIRP[Page 305, 1]	6.268e-08
TCSKRA[Page 305, 1]	0.3 0.003 0.00003
SP6NIRT[Page 305, 1]	139.99
SP5NIRT[Page 305, 1]	139.99
SP4NIRT[Page 305, 1]	139.99
TCSMFRA[Page 305, 1]	1
SP0BLUP[Page 305, 1]	9.115e-08
SP4BLUP[Page 305, 1]	5.575e-08
SP0NIRT[Page 305, 1]	139.99
SP8BLUT[Page 305, 1]	162.97
SP8REDP[Page 305, 1]	5.066e-08
SP5BLUT[Page 305, 1]	163.02
SP1BLUP[Page 305, 1]	7.999e-08
SP2NIRT[Page 305, 1]	139.99
SP0NIRP[Page 305, 1]	9.032e-08
SP1REDP[Page 305, 1]	5.631e-08
SP1NIRT[Page 305, 1]	139.99
SP9BLUP[Page 305, 1]	1.232e-07
SP3NIRP[Page 305, 1]	4.194e-08
SP6NIRP[Page 305, 1]	2.807e-07
SP7NIRP[Page 305, 1]	8.201e-08
SP0BLUT[Page 305, 1]	162.97
SP7REDP[Page 305, 1]	4.282e-08
TCSKDEC[Page 305, 1]	0.3 0.003 0.00003
SP2BLUP[Page 305, 1]	7.552e-08
SP7BLUP[Page 305, 1]	1.018e-07
SCND[Page 305, 1]	DESIROOT/target/catalogs/dr9/0.50.0/targets/sv1/secondary/dark
SP6REDT[Page 305, 1]	139.99

KEY	Example Value
PMTRANS[Page 305, 1]	96.38
SP4REDT[Page 305, 1]	140.06
DTVER[Page 305, 1]	0.50.0
SP8NIRT[Page 305, 1]	139.99
SP2REDT[Page 305, 1]	139.99
TCSPIRA[Page 305, 1]	1.0,0.0,0.0,0.0
SP5NIRP[Page 305, 1]	7.203e-08
SP1REDT[Page 305, 1]	139.99
SP9NIRP[Page 305, 1]	5.973e-08
SP5REDT[Page 305, 1]	139.99
SP1NIRP[Page 305, 1]	4.803e-08
TCSMFDEC[Page 305, 1]	1
TARG2[Page 305, 1]	DESIROOT/target/catalogs/gaiadr2/0.50.0/targets/sv1/resolve/supp
SP4BLUT[Page 305, 1]	163.02
SP6REDP[Page 305, 1]	6.486e-08
SP3BLUP[Page 305, 1]	7.239e-08
SCSTD[Page 305, 1]	STD_WD,STD_BRIGHT
SP2NIRP[Page 305, 1]	1.205e-07
SKYLEVEL[Page 305, 1]	6.346
SP3REDT[Page 305, 1]	139.96
DR[Page 305, 1]	dr9
SP2REDP[Page 305, 1]	8.086e-08
TCSGDEC[Page 305, 1]	0.3
TCSGRA[Page 305, 1]	0.3
SP6BLUP[Page 305, 1]	6.3e-08
SP9REDT[Page 305, 1]	140.01
SP8REDT[Page 305, 1]	139.99
SP3NIRT[Page 305, 1]	139.99
PRIORITY[Page 305, 1]	default
SP5REDP[Page 305, 1]	6.578e-08
M31CEN[Page 305, 1]	n
SP9REDP[Page 305, 1]	7.546e-08
SP7NIRT[Page 305, 1]	140.01
SP8NIRP[Page 305, 1]	3.928e-08
SP5BLUP[Page 305, 1]	1.126e-07
DESIROOT[Page 305, 1]	/global/cfs/cdirs/desi
SP9BLUT[Page 305, 1]	163.02
SEQSTART[Page 305, 1]	2021-02-24T08:40:31.036828
SP7BLUT[Page 305, 1]	162.97
SP3REDP[Page 305, 1]	6.898e-08
SP6BLUT[Page 305, 1]	162.97
SP0REDP[Page 305, 1]	6.155e-08
SP0REDT[Page 305, 1]	139.99
SP8BLUP[Page 305, 1]	8.30399999999999e-08
TCSPIDEC[Page 305, 1]	1.0,0.0,0.0,0.0
SP7REDT[Page 305, 1]	139.99
SP2BLUT[Page 305, 1]	163.02
PMSEEING[Page 305, 1]	0.97
SP3BLUT[Page 305, 1]	162.99

KEY	Example Value
SP1BLUT[Page 305, 1]	162.97
SP4REDP[Page 305, 1]	5.049e-08
MINTFRAC[Page 305, 1]	0.9
MTL[Page 305, 1]	DESIROOT/survey/ops/surveyops/trunk/mtl/sv3/dark
MTLTIME[Page 305, 1]	2021-04-07T22:48:49
VISITIDS[Page 305, 1]	83870
GOALTYPE[Page 305, 1]	DARK
FAARGS[Page 305, 1]	–doclean n –dr dr9 –dtver 0.57.0 –gaiadr gaiadr2 –goaltime 1200.0 –mintfrac 0.9 –pmcorr n –pmtime 2021-0
USESPLIT[Page 305, 1]	T
PMCORR[Page 305, 1]	n
SPLITEXP[Page 305, 1]	F
SUNDEC[Page 305, 1]	7.304848
SUNRA[Page 305, 1]	17.202764
NTSSURVY[Page 305, 1]	sv3
FAPRGRM[Page 305, 1]	DARK
SBPROF[Page 305, 1]	ELG
GOALTIME[Page 305, 1]	1200.0
EBVFAC[Page 305, 1]	1.08938947147753
REQTEFF[Page 305, 1]	1400.0
SURVEY[Page 305, 1]	sv3
SCNDMTL[Page 305, 1]	DESIROOT/survey/ops/surveyops/trunk/mtl/sv3/secondary/dark
ACTTEFF[Page 305, 1]	1336.6007
SEEING[Page 305, 1]	1.0541
TOTTEFF[Page 305, 1]	1406.9563
SLEWANGL[Page 305, 1]	11.585
SEQTOT[Page 305, 1]	2
SEQID[Page 305, 1]	2 requests
POSCVFRC[Page 305, 1]	0.2147
TOO[Page 305, 1]	/data/afternoon_planning/surveyops/trunk/mtl/sv3/ToO/ToO.ecsv
CONVERGD[Page 305, 1]	F
SIMGFAQ[Page 305, 1]	F
FASCRIPT[Page 305, 1]	./fba_launch-20210513-special
SVNMTL[Page 305, 1]	476
SVNDM[Page 305, 1]	136362
USESPLITS[Page 305, 1]	T
TARG3[Page 305, 1]	DESIROOT/target/catalogs/dr9/0.51.0/targets/sv1/resolve/bright
ETCREAL[Page 305, 1]	1054.206299
ESTTIME[Page 305, 1]	2231.315
ETCFRACB[Page 305, 1]	0.123838
ETCTHRUP[Page 305, 1]	0.442956
NTSPROG[Page 305, 1]	BRIGHT
ETCFRACP[Page 305, 1]	0.346107
ETCPROF[Page 305, 1]	BGS
ACQFWHM[Page 305, 1]	1.71791
ETCTHRUE[Page 305, 1]	0.474574
MAXTIME[Page 305, 1]	5400.0
ETCSKY[Page 305, 1]	1.43154
ETCTHRUB[Page 305, 1]	0.469155
ETCPREV[Page 305, 1]	0.0

KEY	Example Value
ETCSPLIT[Page 305, 1]	1
ETCFRACE[Page 305, 1]	0.271983
TRANSPAR[Page 305, 1]	None
ETCTRANS[Page 305, 1]	0.719235
ETCSEENG[Page 305, 1]	1.7179
PMTRANSP[Page 305, 1]	104.71
MINTIME[Page 305, 1]	120.0
ETCVERS[Page 305, 1]	0.1.12-3-g12b54bb
ETCTEFF[Page 305, 1]	222.548355
ROLE[Page 305, 1]	GUIDERMAN
SHFTFOCS[Page 305, 1]	220.0

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gai
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blending
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; `sourceid` for Gaia DR

Table 33 – continued from previous page

Name	Type	Units	Description
REF_CAT	char[2]		Reference catalog source for star: 'T2' for Tycho-2, &#
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
BRICKNAME	char[8]		Brick name from tractor input
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from this
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from this
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from all s
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from all s
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from all s
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE=&#x27
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORPHTY
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORPHTY
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCOND
NUMOBS_INIT	int64		Initial number of observations for target calculated across target sele
SV1_DESI_TARGET[Page 305, 1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_BGS_TARGET[Page 305, 1]	int64		BGS (bright time program) target selection bitmask for SV1
SV1_MWS_TARGET[Page 305, 1]	int64		MWS (bright time program) target selection bitmask for SV1
SV1_SCND_TARGET[Page 305, 1]	int64		Secondary target selection bitmask for SV1
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SCND_TARGET[Page 305, 1]	int64		Target selection bitmask for secondary programs
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
SV3_BGS_TARGET[Page 305, 1]	int64		BGS (bright time program) target selection bitmask for SV3
SV3_MWS_TARGET[Page 305, 1]	int64		MWS (bright time program) target selection bitmask for SV3
SV3_SCND_TARGET[Page 305, 1]	int64		Secondary target selection bitmask for SV3
SV3_DESI_TARGET[Page 305, 1]	int64		DESI (dark time program) target selection bitmask for SV3
CMX_TARGET[Page 305, 1]	int64		Target selection bitmask for commissioning
SV2_BGS_TARGET[Page 305, 1]	int64		BGS (bright time program) target selection bitmask for SV2
SV2_SCND_TARGET[Page 305, 1]	int64		Secondary target selection bitmask for SV2
SV2_DESI_TARGET[Page 305, 1]	int64		DESI (dark time program) target selection bitmask for SV2
SV2_MWS_TARGET[Page 305, 1]	int64		MWS (bright time program) target selection bitmask for SV2

HDU6

EXTNAME = INPUT_FRAMES

Table of input frames (NIGHT, EXPID, CAMERA) used for stdstar fitting.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	18	int	length of dimension 1
NAXIS2	3	int	length of dimension 2
CHECKSUM	1o4i2o3i1o3i1o3i	str	HDU checksum updated 2021-07-08T20:11:43
DATASUM	3219797410	str	data unit checksum updated 2021-07-08T20:11:43

Required Data Table Columns

Name	Type	Units	Description
NIGHT	int64		Night of observation (YYYYMMDD) starting at local noon before observations start
EXPID	int64		DESI Exposure ID number
CAMERA	char[2]		Camera identifier. Passband and SPECGRPH ([brz][0-9]).

Notes and Examples

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

healpix

Spectra are grouped by `healpix/SURVEY/PROGRAM/PIXGROUP/PIXNUM`.

SURVEY

The `SURVEY` is the phase of the overall DESI project the spectra were observed in. The current values are `sv1`, `sv2`, `sv3`, `main`.

PROGRAM

The `PROGRAM` is related to tile design. The current allowed values are `backup`, `bright`, `dark` and `other`. `bright` and `other` currently only apply to the `sv[123]` surveys.

Caveats

1. The value of `PROGRAM` actually comes from the `FAPRGRM` in fiberassign files.
2. The value of `PROGRAM` *does not* reflect the value of `PROGRAM` as obtained from the corresponding header keyword in raw data files.
3. For `SURVEY = sv1`, the values of `FAPRGRM` had not stabilized, so for `sv1`, the `PROGRAM` is assigned *post facto*.

PIXGROUP

Pixels are grouped by subdirectories of `PIXGROUP = PIXNUM//100` to avoid having tens of thousands of directories at the same level.

PIXNUM

Default $DESI_ROOT/spectro/redux/SPECPROD/healpix/SURVEY/PROGRAM/PIXGROUP/PIXNUM

- SURVEY = sv1, sv3, main, …
- PROGRAM = dark,bright,backup,other
- PIXNUM = nside 64 nested healpix number
- PIXGROUP = int(PIXNUM/100)

Files:

spectra-SURVEY-PROGRAM-PIXNUM.fits

Summary
DESI spectra grouped by nested healpix number

Naming Convention
`spectra-SURVEY-PROGRAM-PIXNUM.fits`, where `SURVEY` is *e.g.* `main` or `sv1`, `PROGRAM` is *e.g.* `bright` or `dark` and `PIXNUM` is the HEALPixel number.

Regex
`spectra-(cmx|main|special|sv1|sv2|sv3)-(backup|bright|dark|other)-[0-9]+\.fits`

File Type
FITS, 408 MB

Spectra files contain non-coadded spectra for multiple targets observed on multiple individual exposures and cameras. The format can contain any arbitrary set of targets, though the standard DESI spectroscopic pipeline outputs are grouped either by a single petal of a given tile, or all targets on a single healpix.

Tile-based spectra can be grouped in multiple ways across exposures and nights; see the top-level *SPECPROD/tiles/* description for an overview of the per-tile GROUPTYPE and GROUPID options. Healpix-based spectra are grouped by SURVEY and PROGRAM. Science analyses may release spectra in other groups, e.g. all the spectra selected for a particular analysis.

Please see *coadd files* for a coadded version of the same spectra in a very similar format.

The FIBERMAP table contains metadata about each target, with one row per target per exposure. The corresponding SCORES table contains quantities measured from the spectra, also with one row per target per exposure.

The spectra themselves are in a set of image HDUs for the FLUX, IVAR (inverse variance), MASK, and spectral RESOLUTION, each prefixed with a spectrograph camera name, e.g. B, R, or Z for DESI, though the format in general could support other numbers and names of cameras for other instruments. A row of each image HDU correponds to the target from the same row index of the FIBERMAP and SCORES HDUs.

See the end of *tile-based spectra* for examples of reading this file format.

Note: the table below is the order in which these HDUs appear in DESI spectroscopic pipeline output, but the order is arbitrary and they should be read by name not by number.

Contents

Number	EXTNAME	Type	Contents
HDU00		IMAGE	Empty
HDU01	FIBERMAP	BINTABLE	fibermap table
HDU02	SCORES	BINTABLE	scores table
HDU03	B_WAVELENGTH	IMAGE	Wavelength array of b-channel spectra
HDU04	B_FLUX	IMAGE	Flux of b-channel spectra
HDU05	B_IVAR	IMAGE	Inverse variance of b-channel spectra
HDU06	B_MASK	BINTABLE	Mask of b-channel spectra
HDU07	B_RESOLUTION	IMAGE	Resolution matrices of b-channel spectra
HDU08	R_WAVELENGTH	IMAGE	Wavelength array of r-channel spectra
HDU09	R_FLUX	IMAGE	Flux of r-channel spectra
HDU10	R_IVAR	IMAGE	Inverse variance of r-channel spectra
HDU11	R_MASK	BINTABLE	Mask of r-channel spectra
HDU12	R_RESOLUTION	IMAGE	Resolution matrices of r-channel spectra
HDU13	Z_WAVELENGTH	IMAGE	Wavelength array of z-channel spectra
HDU14	Z_FLUX	IMAGE	Flux of z-channel spectra
HDU15	Z_IVAR	IMAGE	Inverse variance of z-channel spectra
HDU16	Z_MASK	BINTABLE	Mask of z-channel spectra
HDU17	Z_RESOLUTION	IMAGE	Resolution matrices of z-channel spectra

FITS Header Units

HDU00

HEALPixel keywords.

Required Header Keywords

KEY	Example Value	Type	Comment
SPGRP	healpix	str	Spectral grouping method
SPGRPVAL	26371	int	Grouping value = healpixel number
HPXPIXEL	26371	int	Nested nside=64 healpixel number
HPXNSIDE	64	int	Healpix nside
HPXNEST	True	str	Healpix nested? (vs. ring)
SURVEY	main	str	DESI Survey (sv1, sv3, main…)
PROGRAM	bright	str	DESI Program (dark, bright, …)
CHECKSUM	8DPU9BMR8BMR8BMR	str	HDU checksum updated 2021-07-19T17:59:29
DATASUM	0	str	data unit checksum updated 2021-07-19T17:59:29

Empty HDU.

HDU01

EXTNAME = FIBERMAP

Fibermap table with per-target metdata.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	413	int	Width of table in bytes
NAXIS2	1031	int	Number of rows in table
CHECKSUM	U9Fia89iV8Cia89i	str	HDU checksum
DATASUM	3589169610	str	data unit checksum

Required Data Table Columns

Propagated from the FIBERMAP HDU of the input *cframe files*.

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
TARGET_RA	float64	deg	Barycentric right ascension in ICRS

continues on next page

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Name	Type	Units	Description
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gaia
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky)
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)

continues on next page

Table 34 – continued from previous page

Name	Type	Units	Description
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blending
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; "sourceid" for Gaia DR2
REF_CAT	char[2]		Reference catalog source for star: "T2" for Tycho-2, "G2" for Gaia DR2, "L2" for the SGA, empty otherwise
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
BRICKNAME	char[8]		Brick name from tractor input
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from all sources at this location in 1 arcsec Gaussian seeing
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from all sources at this location in 1 arcsec Gaussian seeing

continues on next page

Table 34 – continued from previous page

Name	Type	Units	Description
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from all sources at this location in 1 arcsec Gaussian seeing
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE="SER")
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORPHTYPE
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORPHTYPE
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S' for DECaLS
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selection bitmasks and OBSCONDITIONS
SV1_DESI_TARGET[1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_BGS_TARGET[Page 327, 1]	int64		BGS (bright time program) target selection bitmask for SV1
SV1_MWS_TARGET[Page 327, 1]	int64		MWS (bright time program) target selection bitmask for SV1
SV1_SCND_TARGET[Page 327, 1]	int64		Secondary target selection bitmask for SV1
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SCND_TARGET	int64		Target selection bitmask for secondary programs

continues on next page

Table 34 – continued from previous page

Name	Type	Units	Description
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
EXPTIME	float64	s	Length of time shutter was open
PSF_TO_FIBER_SPECFLUX	float64		fraction of light from point-like source captured by 1.5 arcsec diameter fiber given atmospheric seeing
NIGHT	int32		
EXPID	int32		DESI Exposure ID number
MJD	float64		Modified Julian Date when shutter was opened for this exposure
TILEID	int32		Unique DESI tile ID

HDU02

EXTNAME = SCORES

Scores / metrics measured from the spectra for use in QA and systematics studies. These are propagated from the input *cframe SCORES HDU*.

[1] Optional

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	488	int	width of table in bytes
NAXIS2	1031	int	number of rows in table

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
SUM_RAW_COUNT_B	float64		Sum of raw counts in B camera
MEDIAN_RAW_COUNT_B	float64		Median of raw counts in B camera
MEDIAN_RAW_SNR_B	float64		Median(raw signal/noise) in B camera
SUM_FFLAT_COUNT_B	float64		Sum of fiber-flatfielded counts B camera
MEDIAN_FFLAT_COUNT_B	float64		Median of fiber-flatfielded counts in B camera
MEDIAN_FFLAT_SNR_B	float64		Median(S/N) of fiberflatfielded counts in B camera
SUM_SKYSUB_COUNT_B	float64		Sum of sky-subtracted counts in B camera
MEDIAN_SKYSUB_COUNT_B	float64		Median of sky-subtracted counts in B camera
MEDIAN_SKYSUB_SNR_B	float64		Median(S/N) of sky-subtracted counts in B camera
SUM_CALIB_COUNT_B	float64		Sum of calibrated flux in B camera
MEDIAN_CALIB_COUNT_B	float64		Median of calibrated flux in B camera
MEDIAN_CALIB_SNR_B	float64		Median(S/N) of calibrated flux in B camera
TSNR2_GPBDARK_B	float64		template (S/N)^2 for dark targets in guider pass band on B
TSNR2_ELG_B	float64		ELG B template (S/N)^2
TSNR2_GPBBRIGHT_B	float64		template (S/N)^2 for bright targets in guider pass band on B
TSNR2_LYA_B	float64		LYA B template (S/N)^2
TSNR2_BGS_B	float64		BGS B template (S/N)^2
TSNR2_GPBBACKUP_B	float64		
TSNR2_QSO_B	float64		QSO B template (S/N)^2
TSNR2_LRG_B	float64		LRG B template (S/N)^2
SUM_RAW_COUNT_R	float64		Sum of raw counts in R camera
MEDIAN_RAW_COUNT_R	float64		Median of raw counts in R camera
MEDIAN_RAW_SNR_R	float64		Median(raw signal/noise) in R camera
SUM_FFLAT_COUNT_R	float64		Sum of fiber-flatfielded counts R camera
MEDIAN_FFLAT_COUNT_R	float64		Median of fiber-flatfielded counts in R camera
MEDIAN_FFLAT_SNR_R	float64		Median(S/N) of fiberflatfielded counts in R camera
SUM_SKYSUB_COUNT_R	float64		Sum of sky-subtracted counts in R camera
MEDIAN_SKYSUB_COUNT_R	float64		Median of sky-subtracted counts in R camera
MEDIAN_SKYSUB_SNR_R	float64		Median(S/N) of sky-subtracted counts in R camera
SUM_CALIB_COUNT_R	float64		Sum of calibrated flux in R camera
MEDIAN_CALIB_COUNT_R	float64		Median of calibrated flux in R camera
MEDIAN_CALIB_SNR_R	float64		Median(S/N) of calibrated flux in R camera
TSNR2_GPBDARK_R	float64		template (S/N)^2 for dark targets in guider pass band on R
TSNR2_ELG_R	float64		ELG R template (S/N)^2
TSNR2_GPBBRIGHT_R	float64		template (S/N)^2 for bright targets in guider pass band on R
TSNR2_LYA_R	float64		LYA R template (S/N)^2
TSNR2_BGS_R	float64		BGS R template (S/N)^2
TSNR2_GPBBACKUP_R	float64		

continues on next page

Table 35 – continued from previous page

Name	Type	Units	Description
TSNR2_QSO_R	float64		QSO R template (S/N)^2
TSNR2_LRG_R	float64		LRG R template (S/N)^2
SUM_RAW_COUNT_Z	float64		Sum of raw counts in Z camera
MEDIAN_RAW_COUNT_Z	float64		Median of raw counts in Z camera
MEDIAN_RAW_SNR_Z	float64		Median(raw signal/noise) in Z camera
SUM_FFLAT_COUNT_Z	float64		Sum of fiber-flatfielded counts Z camera
MEDIAN_FFLAT_COUNT_Z	float64		Median of fiber-flatfielded counts in Z camera
MEDIAN_FFLAT_SNR_Z	float64		Median(S/N) of fiberflatfielded counts in Z camera
SUM_SKYSUB_COUNT_Z	float64		Sum of sky-subtracted counts in Z camera
MEDIAN_SKYSUB_COUNT_Z	float64		Median of sky-subtracted counts in Z camera
MEDIAN_SKYSUB_SNR_Z	float64		Median(S/N) of sky-subtracted counts in Z camera
SUM_CALIB_COUNT_Z	float64		Sum of calibrated flux in Z camera
MEDIAN_CALIB_COUNT_Z	float64		Median of calibrated flux in Z camera
MEDIAN_CALIB_SNR_Z	float64		Median(S/N) of calibrated flux in Z camera
TSNR2_GPBDARK_Z	float64		template (S/N)^2 for dark targets in guider pass band on Z
TSNR2_ELG_Z	float64		ELG Z template (S/N)^2
TSNR2_GPBBRIGHT_Z	float64		template (S/N)^2 for bright targets in guider pass band on Z
TSNR2_LYA_Z	float64		LYA Z template (S/N)^2
TSNR2_BGS_Z	float64		BGS Z template (S/N)^2
TSNR2_GPBBACKUP_Z	float64		
TSNR2_QSO_Z	float64		QSO Z template (S/N)^2
TSNR2_LRG_Z	float64		LRG Z template (S/N)^2

HDU03

EXTNAME = B_WAVELENGTH

1D array of B-camera wavelengths in Angstrom, in vacuum (not in air), in the rest frame of the solar system barycenter.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelengths
BUNIT	Angstrom	str	

Data: FITS image [float64, 2751]

HDU04

EXTNAME = B_FLUX

2D array of calibrated spectral flux of dimension `[nspec, nwave]` in units of 1e-17 erg / (s cm2 Angstrom). `nspec` is the number of fibers per camera. `nwave` in the length of the wavelength array. The spectra of all fibers share the same wavelength grid, given in HDU B_WAVELENGTH.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	`nwave` number of wavelengths
NAXIS2	1031	int	`nspec` number of spectra
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	

Data: FITS image [float32, 2751x1031]

HDU05

EXTNAME = B_IVAR

Inverse variance of flux (1/sigma^2) in units of (10^{-17} erg/s/cm2/A)^-2. Uncertainties comprise statistical uncertainties from the error propagation of the initial CCD pixel variance, the calibration uncertainties, plus an additional term on bright sky lines to account for the imperfect sky subtraction.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	`nwave` number of wavelengths
NAXIS2	1031	int	`nspec` number of spectra
BUNIT	10**+34 (s2 cm4 Angstrom2) / erg2	str	

Data: FITS image [float32, 2751x1031]

HDU06

EXTNAME = B_MASK

Mask of spectral data; 0=good. See the *bitmask documentation* page for the definition of the bits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	`nwave` number of wavelengths
NAXIS2	1031	int	`nspec` number of spectra
BZERO	2147483648	int	offset data range to that of unsigned long
BSCALE	1	int	default scaling factor

Data: FITS image [int32 (compressed), 2751x1031]

HDU07

EXTNAME = B_RESOLUTION

Resolution matrix stored as a 3D sparse matrix, modeling the per-fiber non-Gaussian effective line-spread-function resolution. See the *frame RESOLUTION HDU* documentation for details about using this HDU.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	`nwave` number of wavelengths
NAXIS2	11	int	`ndiag` number of diagonals
NAXIS3	1031	int	`nspec` number of spectra

Data: FITS image [float32, 2751x11x1031]

A sparse resolution matrix may be created for spectrum `i` with:

```
from desispec.resolution import Resolution
R = Resolution(data[i])
```

Or using lower-level scipy.sparse matrices:

```
import scipy.sparse
import numpy as np
nspec, ndiag, nwave = data.shape
offsets = ndiag//2 - np.arange(ndiag, dtype=int)
R = scipy.sparse.dia_matrix((data[i], offsets), shape=(nwave, nwave))
```

HDU08

EXTNAME = R_WAVELENGTH

1D array of R-camera wavelengths in Angstrom, in vacuum (not in air), in the rest frame of the solar system barycenter.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	number of wavelengths
BUNIT	Angstrom	str	

Data: FITS image [float64, 2326]

HDU09

EXTNAME = R_FLUX

2D array of calibrated spectral flux of dimension `[nspec, nwave]` in units of 1e-17 erg / (s cm2 Angstrom). `nspec` is the number of fibers per camera. `nwave` in the length of the wavelength array. The spectra of all fibers share the same wavelength grid, given in HDU R_WAVELENGTH.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	`nwave` number of wavelengths
NAXIS2	1031	int	`nspec` number of spectra
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	

Data: FITS image [float32, 2326x1031]

HDU10

EXTNAME = R_IVAR

Inverse variance of flux (1/sigma^2) in units of (10^{-17} erg/s/cm2/A)^-2. Uncertainties comprise statistical uncertainties from the error propagation of the initial CCD pixel variance, the calibration uncertainties, plus an additional term on bright sky lines to account for the imperfect sky subtraction.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	`nwave` number of wavelengths
NAXIS2	1031	int	`nspec` number of spectra
BUNIT	10**+34 (s2 cm4 Angstrom2) / erg2	str	

Data: FITS image [float32, 2326x1031]

HDU11

EXTNAME = R_MASK

Mask of spectral data; 0=good. See the *bitmask documentation* page for the definition of the bits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	`nwave` number of wavelengths
NAXIS2	1031	int	`nspec` number of spectra
BZERO	2147483648	int	offset data range to that of unsigned long
BSCALE	1	int	default scaling factor

Data: FITS image [int32 (compressed), 2326x1031]

HDU12

EXTNAME = R_RESOLUTION

Resolution matrix stored as a 3D sparse matrix, modeling the per-fiber non-Gaussian effective line-spread-function resolution. See the *frame RESOLUTION HDU* documentation for details about using this HDU.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	length of data axis 1
NAXIS2	11	int	length of data axis 2
NAXIS3	1031	int	length of data axis 3

Data: FITS image [float32, 2326x11x1031]

HDU13

EXTNAME = Z_WAVELENGTH

1D array of Z-camera wavelengths in Angstrom, in vacuum (not in air), in the rest frame of the solar system barycenter.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	`nwave` number of wavelengths
BUNIT	Angstrom	str	

Data: FITS image [float64, 2881]

HDU14

EXTNAME = Z_FLUX

2D array of calibrated spectral flux of dimension `[nspec, nwave]` in units of 1e-17 erg / (s cm2 Angstrom). `nspec` is the number of fibers per camera. `nwave` in the length of the wavelength array. The spectra of all fibers share the same wavelength grid, given in HDU Z_WAVELENGTH.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	`nwave` number of wavelengths
NAXIS2	1031	int	`nspec` number of spectra
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	

Data: FITS image [float32, 2881x1031]

HDU15

EXTNAME = Z_IVAR

Inverse variance of flux (1/sigma^2) in units of (10^{-17} erg/s/cm2/A)^-2. Uncertainties comprise statistical uncertainties from the error propagation of the initial CCD pixel variance, the calibration uncertainties, plus an additional term on bright sky lines to account for the imperfect sky subtraction.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	`nwave` number of wavelengths
NAXIS2	1031	int	`nspec` number of spectra
BUNIT	10**+34 (s2 cm4 Angstrom2) / erg2	str	

Data: FITS image [float32, 2881x1031]

HDU16

EXTNAME = Z_MASK

Mask of spectral data; 0=good. See the *bitmask documentation* page for the definition of the bits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	`nwave` number of wavelengths
NAXIS2	1031	int	`nspec` number of spectra
BZERO	2147483648	int	offset data range to that of unsigned long
BSCALE	1	int	default scaling factor

Data: FITS image [int32 (compressed), 2881x1031]

HDU17

EXTNAME = Z_RESOLUTION

Diagonals of z-channel resolution matrix.

Resolution matrix stored as a 3D sparse matrix, modeling the per-fiber non-Gaussian effective line-spread-function resolution. See the *frame RESOLUTION HDU* documentation for details about using this HDU.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	`nwave` number of wavelengths
NAXIS2	11	int	`ndiag` number of diagonals
NAXIS3	1031	int	`nspec` number of spectra

Data: FITS image [float32, 2881x11x1031]

Notes and Examples

The format supports arbitrary channel names as long as for each channel {X} there is a set of HDUs named {X}_WAVELENGTH, {X}_FLUX, {X}_IVAR, {X}_MASK, {X}_RESOLUTION.

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

coadd-SURVEY-PROGRAM-PIXNUM.fits

Summary
This holds the calibrated coadded spectra organized by healpix location on the sky.

Naming Convention
`coadd-SURVEY-PROGRAM-PIXNUM.fits`, where `SURVEY` is *e.g.* `main` or `sv1`, `PROGRAM` is *e.g.* `bright` or `dark` and `PIXNUM` is the HEALPixel number.

Regex
`coadd-(cmx|main|special|sv1|sv2|sv3)-(backup|bright|dark|other)-[0-9]+\.fits`

File Type
FITS, 219 MB

This file follows nearly the same format as the *spectra files*, except there is one entry per target instead of one entry per exposure per target, and the FIBERMAP replaces some exposure-specific columns with summary columns, e.g. `NIGHT` becomes `FIRST_NIGHT`, `LAST_NIGHT`, and `NUM_NIGHT`.

Contents

Number	EXTNAME	Type	Contents
HDU00		IMAGE	Keywords only
HDU01	FIBERMAP	BINTABLE	fibermap table
HDU02	EXP_FIBERMAP	BINTABLE	Per-exposure entries from input fibermaps
HDU03	B_WAVELENGTH	IMAGE	Wavelength array of b-channel spectra
HDU04	B_FLUX	IMAGE	Flux of b-channel spectra
HDU05	B_IVAR	IMAGE	Inverse variance of b-channel spectra
HDU06	B_MASK	BINTABLE	Mask of b-channel spectra
HDU07	B_RESOLUTION	IMAGE	Resolution matrices of b-channel spectra
HDU08	R_WAVELENGTH	IMAGE	Wavelength array of r-channel spectra
HDU09	R_FLUX	IMAGE	Flux of r-channel spectra
HDU10	R_IVAR	IMAGE	Inverse variance of r-channel spectra
HDU11	R_MASK	BINTABLE	Mask of r-channel spectra
HDU12	R_RESOLUTION	IMAGE	Resolution matrices of r-channel spectra
HDU13	Z_WAVELENGTH	IMAGE	Wavelength array of z-channel spectra
HDU14	Z_FLUX	IMAGE	Flux of z-channel spectra
HDU15	Z_IVAR	IMAGE	Inverse variance of z-channel spectra
HDU16	Z_MASK	BINTABLE	Mask of z-channel spectra
HDU17	Z_RESOLUTION	IMAGE	Resolution matrices of z-channel spectra
HDU18	SCORES	BINTABLE	scores table

Note: the above is the order in which these HDUs appear in DESI spectroscopic pipeline output, but the order is arbitrary and they should be read by name not by number.

FITS Header Units

HDU00

HEALPixel keywords.

Required Header Keywords

KEY	Example Value	Type	Comment
SPGRP	healpix	str	Method of grouping spectra (always healpix for this file)
SPGRPVAL	38863	int	Healpix number
HPXPIXEL	38863	int	Healpix number
HPXNSIDE	64	int	Healpix nside
HPXNEST	True	str	Healpix nested? (vs. ring)
SURVEY	sv3	str	DESI survey (sv1, sv3, main…)
PROGRAM	dark	str	DESI program (dark, bright, …)
CHECKSUM	96ZDB6YB96YBA6YB	str	HDU checksum updated 2021-07-20T01:03:03
DATASUM	0	str	data unit checksum updated 2021-07-20T01:03:03
FIBERMIN	-513	int	
INFIL000	spectra-sv1-dark-38863.fits	str	
LONGSTRN	OGIP 1.0	str	

Empty HDU.

HDU01

EXTNAME = FIBERMAP

Fibermap information combining the targeting photometry and metadata, and fiberassign requested positions. In the coadds, this HDU contains only the information that remains applicable to coadded spectra, e.g. the target flux values. Values that are only meaningful per-exposure (*e.g.* FIBER_X, FIBER_Y) are contained in the separate *EXP_FIBERMAP* HDU.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	341	int	Width of table in bytes
NAXIS2	514	int	Number of targets
ENCODING	ascii	str	
LONGSTRN	OGIP 1.0	str	
CHECKSUM	4aNU7WKR4aKR4UKR	str	HDU checksum updated 2021-07-20T01:03:03
DATASUM	4121667036	str	data unit checksum updated 2021-07-20T01:03:03

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
COADD_FIBERSTATUS	int32		bitwise-AND of input FIBERSTATUS
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gaia
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky)
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)

continues on next page

Table 36 – continued from previous page

Name	Type	Units	Description
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blending
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; "sourceid" for Gaia DR2
REF_CAT	char[2]		Reference catalog source for star: "T2" for Tycho-2, "G2" for Gaia DR2, "L2" for the SGA, empty otherwise
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
BRICKNAME	char[8]		Brick name from tractor input
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from all sources at this location in 1 arcsec Gaussian seeing
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from all sources at this location in 1 arcsec Gaussian seeing

continues on next page

Table 36 – continued from previous page

Name	Type	Units	Description
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from all sources at this location in 1 arcsec Gaussian seeing
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE=”SER”)
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORPHTYPE
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORPHTYPE
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S' for DECaLS
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selection bitmasks and OBSCONDITIONS
SV1_DESI_TARGET[1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_BGS_TARGET[Page 341, 1]	int64		BGS (bright time program) target selection bitmask for SV1
SV1_MWS_TARGET[Page 341, 1]	int64		MWS (bright time program) target selection bitmask for SV1
SV1_SCND_TARGET[Page 341, 1]	int64		Secondary target selection bitmask for SV1
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SCND_TARGET	int64		Target selection bitmask for secondary programs

continues on next page

Table 36 – continued from previous page

Name	Type	Units	Description
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
COADD_NUMEXP	int16		Number of exposures in coadd
COADD_EXPTIME	float32	s	Summed exposure time for coadd
COADD_NUMNIGHT	int16		Number of nights in coadd
COADD_NUMTILE	int16		Number of tiles in coadd
MEAN_DELTA_X	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 X location on focal plane
RMS_DELTA_X	float32	mm	RMS (over exposures) of the fiber difference between measured and requested CS5 X location on focal plane
MEAN_DELTA_Y	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 Y location on focal plane
RMS_DELTA_Y	float32	mm	RMS (over exposures) of the fiber difference between measured and requested CS5 Y location on focal plane
MEAN_FIBER_RA	float64	deg	Mean (over exposures) RA of actual fiber position
STD_FIBER_RA	float32	arcsec	Standard deviation (over exposures) of RA of actual fiber position
MEAN_FIBER_DEC	float64	deg	Mean (over exposures) DEC of actual fiber position
STD_FIBER_DEC	float32	arcsec	Standard deviation (over exposures) of DEC of actual fiber position
MEAN_PSF_TO_FIBER_SPECFLUX	float32		Mean of input exposures fraction of light from point-like source captured by 1.5 arcsec diameter fiber given atmospheric seeing

[1] Optional

HDU02

EXTNAME = EXP_FIBERMAP

Fibermap entries that only apply to individual exposures, not to a coadd. This table has one row per input target per exposure. Also see the *FIBERMAP* HDU for coadded fibermap quantities with one row per target.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	162	int	Width of table in bytes
NAXIS2	7112	int	Number of input target-exposures
ENCODING	ascii	str	
CHECKSUM	g3Nmh2Nlg2Nlg2Nl	str	HDU checksum updated 2021-07-20T01:03:03
DATASUM	3607867694	str	data unit checksum updated 2021-07-20T01:03:03

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
NIGHT	int32		
EXPID	int32		DESI Exposure ID number
MJD	float64		Modified Julian Date when shutter was opened for this exposure
TILEID	int32		Unique DESI tile ID
EXPTIME	float64	s	Length of time shutter was open
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
PSF_TO_FIBER_SPECFLUX	float64		fraction of light from point-like source captured by 1.5 arcsec diameter fiber given atmospheric seeing

HDU03

EXTNAME = B_WAVELENGTH

Wavelength[nwave] array in Angstroms of b-channel spectra

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelength bins
BUNIT	Angstrom	str	
CHECKSUM	9FJDF9H99CHCC9H9	str	HDU checksum updated 2021-07-20T01:03:03
DATASUM	979185614	str	data unit checksum updated 2021-07-20T01:03:03

Data: FITS image [float64, 2751]

HDU04

EXTNAME = B_FLUX

Flux[nspec,nwave] array in 1e-17 erg/(s cm2 Angstrom) of b-channel spectra

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelength bins
NAXIS2	514	int	Number of spectra
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	
CHECKSUM	KdcnKccnKccnKccn	str	HDU checksum updated 2021-07-20T01:03:03
DATASUM	1454063034	str	data unit checksum updated 2021-07-20T01:03:03

Data: FITS image [float32, 2751x514]

HDU05

EXTNAME = B_IVAR

Inverse variance of b-channel flux array

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelength bings
NAXIS2	514	int	Number of spectra
BUNIT	10**+34 (s2 cm4 Angstrom2) / erg2	str	
CHECK-SUM	1AE635E61AE613E6	str	HDU checksum updated 2021-07-20T01:03:03
DATASUM	2902189966	str	data unit checksum updated 2021-07-20T01:03:03

Data: FITS image [float32, 2751x514]

HDU06

EXTNAME = B_MASK

Mask[nspec,nwave] of b-channel flux array; 0=good. See the *bitmask documentation* page for the definition of the bits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelength bins
NAXIS2	514	int	Number of spectra
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	78fA97f677fA77f3	str	HDU checksum updated 2021-07-20T01:03:03
DATASUM	707110	str	data unit checksum updated 2021-07-20T01:03:03

Data: FITS image [int32, 2751x514]

HDU07

EXTNAME = B_RESOLUTION

Resolution matrix stored as diagonals of a 3D sparse matrix. See the frame file *RESOLUTION documentation* for how these are interpreted and used.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelength bins
NAXIS2	11	int	Number of diagonals
NAXIS3	514	int	Number of spectra
CHECKSUM	4q1B4o094o0A4o09	str	HDU checksum updated 2021-07-20T01:03:03
DATASUM	1510900028	str	data unit checksum updated 2021-07-20T01:03:03

Data: FITS image [float32, 2751x11x514]

A sparse resolution matrix may be created for spectrum `i` with:

```
from desispec.resolution import Resolution
R = Resolution(data[i])
```

Or using lower-level scipy.sparse matrices:

```
import scipy.sparse
import numpy as np
nspec, ndiag, nwave = data.shape
offsets = ndiag//2 - np.arange(ndiag, dtype=int)
R = scipy.sparse.dia_matrix((data[i], offsets), shape=(nwave, nwave))
```

HDU08

EXTNAME = R_WAVELENGTH

Wavelength[nwave] array in Angstroms of r-channel spectra

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	Number of wavelength bins
BUNIT	Angstrom	str	
CHECKSUM	9JTAFHQ79HQACHQ7	str	HDU checksum updated 2021-07-20T01:03:03
DATASUM	456732359	str	data unit checksum updated 2021-07-20T01:03:03

Data: FITS image [float64, 2326]

HDU09

EXTNAME = R_FLUX

Flux[nspec,nwave] array in 1e-17 erg/(s cm2 Angstrom) of r-channel spectra

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	Number of wavelength bins
NAXIS2	514	int	Number of spectra
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	
CHECKSUM	PCCbR99bPACbP99b	str	HDU checksum updated 2021-07-20T01:03:03
DATASUM	54356891	str	data unit checksum updated 2021-07-20T01:03:03

Data: FITS image [float32, 2326x514]

HDU10

EXTNAME = R_IVAR

Inverse variance of the R_FLUX HDU.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	
NAXIS2	514	int	
BUNIT	10**+34 (s2 cm4 Angstrom2) / erg2	str	
CHECKSUM	GeBDGZ9DGbADGZ7D	str	HDU checksum updated 2021-07-20T01:03:03
DATASUM	789948970	str	data unit checksum updated 2021-07-20T01:03:03

Data: FITS image [float32, 2326x514]

HDU11

EXTNAME = R_MASK

Mask[nspec,nwave] of r-channel flux array. 0==good. See the *bitmask documentation* page for the definition of the bits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	Number of wavelengths
NAXIS2	514	int	Number of spectra
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	T5gdV3dcT3dcT3dc	str	HDU checksum updated 2021-07-20T01:03:03
DATASUM	598689	str	data unit checksum updated 2021-07-20T01:03:03

Data: FITS image [int32, 2326x514]

HDU12

EXTNAME = R_RESOLUTION

Diagonals of r-channel resolution matrix.

See B_RESOLUTION HDU for description of the format.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	Number of wavelengths
NAXIS2	11	int	Number of diagonals
NAXIS3	514	int	Number of spectra
CHECKSUM	DkAIDj3GDjAGDj3G	str	HDU checksum updated 2021-07-20T01:03:04
DATASUM	1927301622	str	data unit checksum updated 2021-07-20T01:03:04

Data: FITS image [float32, 2326x11x514]

HDU13

EXTNAME = Z_WAVELENGTH

Wavelength[nwave] array in Angstroms of z-channel spectra

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	Number of wavelengths
BUNIT	Angstrom	str	
CHECKSUM	iaWMkYVMiaVMiYVM	str	HDU checksum updated 2021-07-20T01:03:04
DATASUM	3106662670	str	data unit checksum updated 2021-07-20T01:03:04

Data: FITS image [float64, 2881]

HDU14

EXTNAME = Z_FLUX

Flux[nspec,nwave] array in 1e-17 erg/(s cm2 Angstrom) of z-channel spectra

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	Number of wavelengths
NAXIS2	514	int	Number of spectra
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	
CHECKSUM	0aea1VdZ0Zda0ZdY	str	HDU checksum updated 2021-07-20T01:03:04
DATASUM	1889497861	str	data unit checksum updated 2021-07-20T01:03:04

Data: FITS image [float32, 2881x514]

HDU15

EXTNAME = Z_IVAR

Inverse variance of z-channel flux array

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	Number of wavelengths
NAXIS2	514	int	Number of spectra
BUNIT	10**+34 (s2 cm4 Angstrom2) / erg2	str	
CHECK-SUM	ni6Dpi3Cni3Cni3C	str	HDU checksum updated 2021-07-20T01:03:04
DATASUM	105099897	str	data unit checksum updated 2021-07-20T01:03:04

Data: FITS image [float32, 2881x514]

HDU16

EXTNAME = Z_MASK

Mask[nspec,nwave] of z-channel flux array. 0==good. See the *bitmask documentation* page for the definition of the bits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	Number of wavelengths
NAXIS2	514	int	Number of spectra
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	X6iYY4gYX4gYX4gY	str	HDU checksum updated 2021-07-20T01:03:04
DATASUM	740483	str	data unit checksum updated 2021-07-20T01:03:04

Data: FITS image [int32, 2881x514]

HDU17

EXTNAME = Z_RESOLUTION

Diagonals of z-channel resolution matrix.

See B_RESOLUTION HDU for description of the format.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	Number of wavelengths
NAXIS2	11	int	Number of diagonals
NAXIS3	514	int	Number of spectra
CHECKSUM	oocZpnbYonbYonbY	str	HDU checksum updated 2021-07-20T01:03:04
DATASUM	1564215354	str	data unit checksum updated 2021-07-20T01:03:04

Data: FITS image [float32, 2881x11x514]

HDU18

EXTNAME = SCORES

Scores / metrics measured from the spectra for use in QA and systematics studies. These are coadded from the input *cframe SCORES HDU* files.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	172	int	Width of table in bytes
NAXIS2	514	int	Number of spectra
ENCODING	ascii	str	
CHECKSUM	XQAAZP89XPAAXP79	str	HDU checksum updated 2021-07-20T01:03:05
DATASUM	3357773203	str	data unit checksum updated 2021-07-20T01:03:05

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
INTEG_COADD_FLUX_B	float32		integ. flux in wave. range 4000,5800A
MEDIAN_COADD_FLUX_B	float32		median flux in wave. range 4000,5800A
MEDIAN_COADD_SNR_B	float32		median SNR/sqrt(A) in wave. range 4000,5800A
INTEG_COADD_FLUX_R	float32		integ. flux in wave. range 5800,7600A
MEDIAN_COADD_FLUX_R	float32		median flux in wave. range 5800,7600A
MEDIAN_COADD_SNR_R	float32		median SNR/sqrt(A) in wave. range 5800,7600A
INTEG_COADD_FLUX_Z	float32		integ. flux in wave. range 7600,9800A
MEDIAN_COADD_FLUX_Z	float32		median flux in wave. range 7600,9800A
MEDIAN_COADD_SNR_Z	float32		median SNR/sqrt(A) in wave. range 7600,9800A
TSNR2_GPBDARK_B	float32		template (S/N)^2 for dark targets in guider pass band on B
TSNR2_ELG_B	float32		ELG B template (S/N)^2
TSNR2_GPBBRIGHT_B	float32		template (S/N)^2 for bright targets in guider pass band on B
TSNR2_LYA_B	float32		LYA B template (S/N)^2
TSNR2_BGS_B	float32		BGS B template (S/N)^2
TSNR2_GPBBACKUP_B	float32		GPBBACKUP B template (S/N)^2

continues on next page

Table 37 – continued from previous page

Name	Type	Units	Description
TSNR2_QSO_B	float32		QSO B template (S/N)^2
TSNR2_LRG_B	float32		LRG B template (S/N)^2
TSNR2_GPBDARK_R	float32		template (S/N)^2 for dark targets in guider pass band on R
TSNR2_ELG_R	float32		ELG R template (S/N)^2
TSNR2_GPBBRIGHT_R	float32		template (S/N)^2 for bright targets in guider pass band on R
TSNR2_LYA_R	float32		LYA R template (S/N)^2
TSNR2_BGS_R	float32		BGS R template (S/N)^2
TSNR2_GPBBACKUP_R	float32		GPBBACKUP R template (S/N)^2
TSNR2_QSO_R	float32		QSO R template (S/N)^2
TSNR2_LRG_R	float32		LRG R template (S/N)^2
TSNR2_GPBDARK_Z	float32		template (S/N)^2 for dark targets in guider pass band on Z
TSNR2_ELG_Z	float32		ELG Z template (S/N)^2
TSNR2_GPBBRIGHT_Z	float32		template (S/N)^2 for bright targets in guider pass band on Z
TSNR2_LYA_Z	float32		LYA Z template (S/N)^2
TSNR2_BGS_Z	float32		BGS Z template (S/N)^2
TSNR2_GPBBACKUP_Z	float32		GPBBACKUP Z template (S/N)^2
TSNR2_QSO_Z	float32		QSO Z template (S/N)^2
TSNR2_LRG_Z	float32		LRG Z template (S/N)^2
TSNR2_GPBDARK	float32		template (S/N)^2 for dark targets in guider pass band
TSNR2_ELG	float32		ELG template (S/N)^2 summed over B,R,Z
TSNR2_GPBBRIGHT	float32		template (S/N)^2 for bright targets in guider pass band
TSNR2_LYA	float32		LYA template (S/N)^2 summed over B,R,Z
TSNR2_BGS	float32		BGS template (S/N)^2 summed over B,R,Z
TSNR2_GPBBACKUP	float32		GPBBACKUP template (S/N)^2 summed over B,R,Z
TSNR2_QSO	float32		QSO template (S/N)^2 summed over B,R,Z
TSNR2_LRG	float32		LRG template (S/N)^2 summed over B,R,Z

Notes and Examples

Coadd files can be read and interpreted using the same code examples shown in the "Notes and Examples" section of the *spectra files* documentation.

The format supports arbitrary channel (camera) names as long as for each channel {X} there is a set of HDUs named {X}_WAVELENGTH, {X}_FLUX, {X}_IVAR, {X}_MASK, {X}_RESOLUTION.

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

redrock-SURVEY-PROGRAM-PIXNUM.fits

Summary
Redshifts and spectral classifications from Redrock.

Naming Convention
`redrock-SURVEY-PROGRAM-PIXNUM.fits`, where `SURVEY` is *e.g.* `main` or `sv1`, `PROGRAM` is *e.g.* `bright or ``dark` and `PIXNUM` is the HEALPixel number.

Regex
`redrock-(cmx|main|special|sv1|sv2|sv3)-(backup|bright|dark|other)-[0-9]+\.fits`

File Type
FITS, 354 KB

This file contains spectral classifications and redshifts for spectra coadded across exposures and tiles covering a given HEALpix pixel. For a similar file that only combines data across a single tile but not across tiles, see *tile-based Redrock files*.

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Keywords only
HDU1	REDSHIFTS	BINTABLE	Table with redshifts and spectral classifications
HDU2	FIBERMAP	BINTABLE	Target photometry and metadata
HDU3	EXP_FIBERMAP	BINTABLE	Per-exposure entries from input fibermaps
HDU4	TSNR2	BINTABLE	Template signal-to-noise values from input SCORES table

FITS Header Units

HDU0

Required Header Keywords

KEY	Example Value	Type	Comment
LONGSTRN	OGIP 1.0	str	
RRVER	0.15.0	str	Redrock version
TEMNAM00	GALAXY	str	Redrock template 00 name
TEMVER00	2.6	str	Redrock template 00 version
TEMNAM01	QSO	str	
TEMVER01	0.1	str	
TEMNAM02	STAR:::A	str	
TEMVER02	0.1	str	
TEMNAM03	STAR:::B	str	
TEMVER03	0.1	str	
TEMNAM04	STAR:::CV	str	
TEMVER04	0.1	str	
TEMNAM05	STAR:::F	str	
TEMVER05	0.1	str	
TEMNAM06	STAR:::G	str	
TEMVER06	0.1	str	
TEMNAM07	STAR:::K	str	
TEMVER07	0.1	str	
TEMNAM08	STAR:::M	str	
TEMVER08	0.1	str	
TEMNAM09	STAR:::WD	str	
TEMVER09	0.1	str	
SPGRP	healpix	str	Grouping method
SPGRPVAL	32637	int	Grouping value (same as HPXPIXEL)
HPXPIXEL	36637	int	Healpix pixel
HPXNSIDE	64	int	Healpix nside
HPXNEST	True	str	Healpix nested (not ring)
SURVEY	sv1	str	DESI survey (sv1, sv3, main, …)
PROGRAM	dark	str	DESI program (dark, bright, …)

Empty HDU.

HDU1

EXTNAME = REDSHIFTS

Spectral classifications and redshifts from Redrock.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	170	int	Width of table in bytes
NAXIS2	415	int	Number of targets in table

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Target ID for this row
CHI2	float64		Best fit χ^2
COEFF	float64[10]		Redrock template coefficients
Z	float64		Best fit redshift
ZERR	float64		Uncertainty on best fit redshift
ZWARN	int64		Warning flags; 0 is good
NPIXELS	int64		Number of unmasked pixels contributing to the Redrock fit
SPECTYPE	char[6]		Spectral type
SUBTYPE	char[20]		Spectral subtype (maybe blank)
NCOEFF	int64		Number of Redrock template coefficients
DELTACHI2	float64		$\Delta\chi^2$ to next best fit

HDU2

EXTNAME = FIBERMAP

Fibermap with target metadata such as photometry and target selection bits. This table is row-matched to the REDSHIFTS table.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	317	int	Width of table in bytes
NAXIS2	415	int	Number of targets in table.

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
COADD_FIBERSTATUS	int32		bitwise-AND of input FIBERSTATUS
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec)
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 fo

Table 38 – continued from previous page

Name	Type	Units	Description
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TY
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, sup
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or ble
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; “sourceid” for Ga
REF_CAT	char[2]		Reference catalog source for star: “T2” for Tycho-2, “G2” for G
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
BRICKNAME	char[8]		Brick name from tractor input
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE=”
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORF
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORF
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, &#x
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSC
NUMOBS_INIT	int64		Initial number of observations for target calculated across targe
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SCND_TARGET	int64		Target selection bitmask for secondary programs
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
COADD_NUMEXP	int16		Number of exposures in coadd
COADD_EXPTIME	float32	s	Summed exposure time for coadd

Table 38 – continued from previous page

Name	Type	Units	Description
COADD_NUMNIGHT	int16		Number of nights in coadd
COADD_NUMTILE	int16		Number of tiles in coadd
MEAN_DELTA_X	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 X
RMS_DELTA_X	float32	mm	RMS (over exposures) of the fiber difference between measured
MEAN_DELTA_Y	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 Y
RMS_DELTA_Y	float32	mm	RMS (over exposures) of the fiber difference between measured
MEAN_FIBER_RA	float64	deg	Mean (over exposures) RA of actual fiber position
STD_FIBER_RA	float32	arcsec	Standard deviation (over exposures) of RA of actual fiber positi
MEAN_FIBER_DEC	float64	deg	Mean (over exposures) DEC of actual fiber position
STD_FIBER_DEC	float32	arcsec	Standard deviation (over exposures) of DEC of actual fiber posi
MEAN_PSF_TO_FIBER_SPECFLUX	float32		Mean of input exposures fraction of light from point-like sourc

HDU3

EXTNAME = EXP_FIBERMAP

Fibermap entries that vary from exposure to exposure, e.g. what exposures were include in the coadd and what focalplane (x,y) each target was located at for each exposure.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	162	int	Width of table in bytes
NAXIS2	415	int	Number of input target-exposures = rows in table

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
NIGHT	int32		
EXPID	int32		DESI Exposure ID number
MJD	float64		Modified Julian Date when shutter was opened for this exposure
TILEID	int32		Unique DESI tile ID
EXPTIME	float64	s	Length of time shutter was open
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
PSF_TO_FIBER_SPECFLUX	float64		fraction of light from point-like source captured by 1.5 arcsec diameter fiber given atmospheric seeing

HDU4

EXTNAME = TSNR2

Template signal-to-noise squared. These quantities weight the observed (S/N)^2 by which wavelengths matter most for different target types, e.g. QSOs weight blue wavelengths more while ELGs weight redder wavelengths more due to the wavelengths of the observed emission lines. For more details, see section 4.14 of Guy et al 2023.

This table is row-matched to the REDSHIFTS table.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	136	int	Width of table in bytes.
NAXIS2	415	int	Number of targets = number of table rows.

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
TSNR2_GPBDARK_B	float32		
TSNR2_ELG_B	float32		ELG B template (S/N)^2
TSNR2_GPBBRIGHT_B	float32		
TSNR2_LYA_B	float32		LYA B template (S/N)^2
TSNR2_BGS_B	float32		BGS B template (S/N)^2
TSNR2_GPBBACKUP_B	float32		
TSNR2_QSO_B	float32		QSO B template (S/N)^2
TSNR2_LRG_B	float32		LRG B template (S/N)^2
TSNR2_GPBDARK_R	float32		
TSNR2_ELG_R	float32		ELG R template (S/N)^2
TSNR2_GPBBRIGHT_R	float32		
TSNR2_LYA_R	float32		LYA R template (S/N)^2
TSNR2_BGS_R	float32		BGS R template (S/N)^2
TSNR2_GPBBACKUP_R	float32		
TSNR2_QSO_R	float32		QSO R template (S/N)^2
TSNR2_LRG_R	float32		LRG R template (S/N)^2
TSNR2_GPBDARK_Z	float32		
TSNR2_ELG_Z	float32		ELG Z template (S/N)^2
TSNR2_GPBBRIGHT_Z	float32		
TSNR2_LYA_Z	float32		LYA Z template (S/N)^2
TSNR2_BGS_Z	float32		BGS Z template (S/N)^2
TSNR2_GPBBACKUP_Z	float32		
TSNR2_QSO_Z	float32		QSO Z template (S/N)^2
TSNR2_LRG_Z	float32		LRG Z template (S/N)^2
TSNR2_GPBDARK	float32		
TSNR2_ELG	float32		ELG template (S/N)^2 summed over B,R,Z
TSNR2_GPBBRIGHT	float32		
TSNR2_LYA	float32		LYA template (S/N)^2 summed over B,R,Z
TSNR2_BGS	float32		BGS template (S/N)^2 summed over B,R,Z
TSNR2_GPBBACKUP	float32		
TSNR2_QSO	float32		QSO template (S/N)^2 summed over B,R,Z
TSNR2_LRG	float32		LRG template (S/N)^2 summed over B,R,Z

Notes and Examples

The REDSHIFTS, FIBERMAP, and TSNR2 tables are row-matched with one row per target. They also include a TARGETID column for confirmation and database-like joins with other tables. The EXP_FIBERMAP HDU has one row per target-exposure, and thus will have multiple entries per target when a target was observed on multiple input exposures.

This file is for redshifts from an individual healpixel. For a contatenation of all such files within a given survey and program, see the *zpix file*.

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

emline-SURVEY-PROGRAM-PIXNUM.fits

Summary
This file records simple (Gaussian) emission line fits on the spectra for few major lines.

Naming Convention
`coadd-SURVEY-PROGRAM-PIXNUM.fits`, where `SURVEY` is *e.g.* `main` or `sv1`, `PROGRAM` is *e.g.* `bright or ``dark` and `PIXNUM` is the HEALPixel number.

Regex
`emline-(cmx|main|special|sv1|sv2|sv3)-(backup|bright|dark|other)-[0-9]+\.fits`

File Type
FITS, 123 KB

Contents

See *emline-SPECTROGRAPH-TILEID-GROUPID* for details.

hpixexp-SURVEY-PROGRAM-PIXNUM

Summary
Auxilliary file listing exposures that contribute to spectra in a HEALPixel.

Naming Convention
`hpixexp-SURVEY-PROGRAM-PIXNUM.csv`, where `SURVEY` is *e.g.* `main` or `sv1`, `PROGRAM` is *e.g.* `bright` or `dark` and `PIXNUM` is the HEALPixel number.

Regex
`hpixexp-(cmx|main|special|sv1|sv2|sv3)-(backup|bright|dark|other)-[0-9]+\.csv`

File Type
CSV, 1 KB

Contents

The file should have these columns:

Name	Type	Description
NIGHT	int	Night of observation (YYYYMMDD) starting at local noon before observations start
EXPID	int	DESI Exposure ID number
TILEID	int	Unique DESI tile ID
SURVEY	char[*]	Survey name
PROGRAM	char[*]	DESI program type - BRIGHT, DARK, BACKUP, OTHER
SPECTRO	int	Spectrograph number [0-9]
HEALPIX	int	HEALPixel containing this location at NSIDE=64 in the NESTED scheme

qso_mgii-SURVEY-PROGRAM-PIXNUM.fits

Summary
This file contains the output of the MgII fitter which is a classifier algorithm to collect spectra with MgII broad emission line.

Naming Convention
`qso_mgii-SURVEY-PROGRAM-PIXNUM.fits`, where `SURVEY` is *e.g.* `main` or `sv1`, `PROGRAM` is *e.g.* `bright or ``dark` and `PIXNUM` is the HEALPixel number.

Regex
`qso_mgii-(cmx|main|special|sv1|sv2|sv3)-(backup|bright|dark|other)-[0-9]+\.fits`

File Type
FITS, 22 KB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty.
HDU1	MGII	BINTABLE	Output of MgII fitter.

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = MGII

Output of MgII fitter.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	83	int	width of table in bytes
NAXIS2	154	int	number of rows in table

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique target ID
RA	float64		Target Right Ascension [degrees]
DEC	float64		Target declination [degrees]
Z_RR	float64		Redshift collected from redrock file
ZERR	float32		Redshift error from redrock file
IS_QSO_MGII	logical		Is the object pass the MgII selection ?
SV1_DESI_TARGET[1]	int64		Dark survey + calibration targeting bits for SV1
DESI_TARGET	int64		Dark survey + calibration targeting bits
SPECTYPE	char[10]		Spectype from redrock file
DELTA_CHI2	float32		Difference of chi2 between redrock fit and MgII fitter over the lambda interval considered during the fit[2]
A	float32		fitted parameter by MgII fitter[2][3]
SIGMA	float32		fitted parameter by MgII fitter[2][3]
B	float32		fitted parameter by MgII fitter[3]
VAR_A	float32		error on A[2]
VAR_SIGMA	float32		error on SIGMA
VAR_B	float32		error on B

Notes and Examples

These files are generated with https://github.com/desihub/desispec/blob/master/bin/desi_qso_mgii_afterburner

As mentioned on the top of the previous file, the MgII fitter is available here: https://github.com/desihub/desispec/blob/master/py/desispec/mgii_afterburner.py

qso_qn-SURVEY-PROGRAM-PIXNUM.fits

Summary

This file contains the output of QuasarNet (QSO classification algorithm and redshift fitter). When there is a disagreement between the redshift from QN and Redrock, a new redshift is fitted using only QSO templates and redshift from QN as prior.

Naming Convention

`qso_qn-SURVEY-PROGRAM-PIXNUM.fits`, where `SURVEY` is *e.g.* `main` or `sv1`, `PROGRAM` is *e.g.* `bright or ``dark` and `PIXNUM` is the HEALPixel number.

Regex

`qso_qn-(cmx|main|special|sv1|sv2|sv3)-(backup|bright|dark|other)-[0-9]+\.fits`

File Type

FITS, 19 KB

[1] Optional

[2] MgII selection is performed with these parameters. See: https://github.com/desihub/desispec/blob/720153babcf85dd93530252b0c1f631d48edfc0d/py/desispec/mgii_afterburner.py#L5

[3] MgII fitter use the following form: `fit_function = lambda x, A, sigma, B : A * np.exp(-1.0 * (x)**2 / (2 * sigma**2)) + B` See: https://github.com/desihub/desispec/blob/720153babcf85dd93530252b0c1f631d48edfc0d/py/desispec/mgii_afterburner.py#L283

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty.
HDU1	QN_RR	BINTABLE	Output of QuasarNet afterburner.

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = QN_RR

Contains the result of QuasarNet afterburner and the new redshift fit from run of Redrock with QSO templates and redshift prior from QuasarNet.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	151	int	width of table in bytes
NAXIS2	75	int	number of rows in table

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique target ID
RA	float64		Target Right Ascension [degrees]
DEC	float64		Target declination [degrees]
Z_NEW	float64		New redshift computed with redrock with QN prior and only qso templates
ZERR_NEW	float32		Redshift error from the new run of redrock
SV1_DESI_TARGET[1]	int64		Dark survey + calibration targeting bits for SV1
DESI_TARGET[Page 362, 1]	int64		Dark survey + calibration targeting bits
COEFFS	float32[10]		Coefficient of the fit for the new run of redrock
SPECTYPE	char[10]		Spectype from the redrock file
Z_RR	float32		Redshift collected from redrock file
Z_QN	float32		Redshift computed with quasarnp[2]
IS_QSO_QN_NEW_RR	logical		Is the object detected QSO with quasarnp and a new redshift fit with prior is performed?
C_LYA	float32		Confidence line for LYA (*i.e.*) ~ probability to be a QSO[3]
C_CIV	float32		Confidence line for CIV[3]
C_CIII	float32		Confidence line for CIII[3]
C_MgII	float32		Confidence line for MgII[3]
C_Hbeta	float32		Confidence line for Hbeta[3]
C_Halpha	float32		Confidence line for Halpha[3]
Z_LYA	float32		Redshift estimated by quasarnp with LYA line[2]
Z_CIV	float32		Redshift estimated by quasarnp with CIV line[2]
Z_CIII	float32		Redshift estimated by quasarnp with CIII line[2]
Z_MgII	float32		Redshift estimated by quasarnp with MgII line[2]
Z_Hbeta	float32		Redshift estimated by quasarnp with Hbeta line[2]
Z_Halpha	float32		Redshift estimated by quasarnp with Halpha line[2]

Notes and Examples

These files are generated with https://github.com/desihub/desispec/blob/master/bin/desi_qso_qn_afterburner

tilepix.fits

Summary
This file maps which DESI tiles overlap which HEALpix pixels (nested nside=64).

Naming Convention
`tilepix.fits`

Regex
`tilepix\.fits`

[1] Optional
[2] Z_QN is the redshift estimated on the line of the highest confidence
[3] The QN selection is performed with these parameters. As it stands, in QN afterburner everything with np.max(confindence) > 0.5 is considered as a quasar. However, specific cut will be used depends on each target class; QSO_target will use np.max(confidence) > 0.95. See: https://github.com/echaussidon/desispec/blob/720153babcf85dd93530252b0c1f631d48edfc0d/bin/desi_qso_qn_afterburner#L236

File Type
FITS, 630 KB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Blank
HDU1	TILEPIX	BINTABLE	table with healpix:tile mapping

FITS Header Units

HDU0

Empty HDU.

HDU1

EXTNAME = TILEPIX

Table mapping tile petals to HEALPix pixels (nested nside=64).

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	9	int	length of dimension 1
NAXIS2	70894	int	length of dimension 2
HPXNSIDE	64	int	
HPXNEST	T	bool	

Required Data Table Columns

Name	Type	Units	Description
TILEID	int32		DESI Tile ID
SURVEY	char[7]		DESI survey (sv1, sv3, main…)
PROGRAM	char[6]		DESI program (dark, bright, …)
PETAL_LOC	int16		Petal location 0-9 = spectrograph number
HEALPIX	int32		Nested nside=64 healpix number

Notes and Examples

Each DESI tile has 10 petals/spectrographs, each of which overlaps multiple healpixels. Similarly, each healpixel could be covered by multiple tile petals. Since many DESI files are split by petal (spectrograph), this map gives the individual petal coverage as well, not just that the tile overlaps the healpixel.

Example:

```
import numpy as np
from astropy.table import Table
tilepix = Table.read('tilepix.fits')

#- All healpix that cover tile 100 (20 healpix)
np.unique(tilepix['HEALPIX'][tilepix['TILEID']==100])

#- All tiles that cover healpix 11250 (28 tiles)
np.unique(tilepix['TILEID'][tilepix['HEALPIX'] == 11250])
```

There is also a json version of this file with a dictionary structured as:

```
tilepix[tileid][petal] -> list of healpix covered by that tile+petal
```

Due to limitations of the json format, the `tileid` and `petal` keys of the dictionary are strings, not integers.

preproc

NIGHT

EXPID

fibermap-EXPID.fits

Summary
fibermap augmenting the input fiber assignment file with information about where the fibers actually ended up from the coordinates file.

Naming Convention
`fibermap-{expid}.fits`, where `{expid}` is the zero-padded 8-digit exposure ID.

Regex
`fibermap-[0-9]{8}\.fits`

File Type
FITS, 1.8 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Keywords only
HDU1	FIBERMAP	BINTABLE	Target metadata including photometry and fiber assignments

FITS Header Units

HDU0

Required Header Keywords

KEY	Example Value	Type	Comment
CHECKSUM	C6gEC3Z9C3dCC3Z9	str	HDU checksum updated 2022-02-14T05:35:59
DATASUM	0	str	data unit checksum updated 2022-02-14T05:35:59

Empty HDU.

HDU1

EXTNAME = FIBERMAP

Target metadata including photometry, fiber assignments, and as-observed positions.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	385	int	length of dimension 1
NAXIS2	5000	int	length of dimension 2
TILEID	80616	int	
TILERA	356.0	float	
TILEDEC	29.0	float	
FIELDROT	-0.00962199210064233	float	
FA_PLAN	2022-07-01T00:00:00.000	str	
FA_HA	0.0	float	
FA_RUN	2020-03-06T00:00:00	str	
FA_M_GFA[1]	0.4	float	
FA_M_PET[Page 380, 1]	0.4	float	
FA_M_POS[Page 380, 1]	0.05	float	
REQRA	356.0	float	
REQDEC	29.0	float	
FIELDNUM	0	int	
FA_VER	2.0.0.dev2618	str	
FA_SURV	sv1	str	

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KEY	Example Value	Type	Comment
LONGSTRN	OGIP 1.0	str	The OGIP Long String Convention may be used.
GFA	/data/target/catalogs/dr9/0.47.0/gfas	str	
SKY	/data/target/catalogs/dr9/0.47.0/skies	str	
SKYSUPP	/data/target/catalogs/gaiadr2/0.47.0/skies-supp	str	
TARG	/data/target/catalogs/dr9/0.47.0/targets/sv1/resolve/bright/	str	
FAFLAVOR	sv1bgsmws	str	
FAOUTDIR	/software/datasystems/users/raichoor/fiberassign-test/desi-sv1-20201218/	str	
PMTIME[Page 380, 1]	2020-12-18T00:00:00.000	str	
RUNDATE	2020-03-06T00:00:00	str	
SCTARG[Page 380, 1]	STD_WD,BGS_ANY,MWS_ANY	str	
OBSCON	DARK|GRAY|BRIGHT	str	
MODULE	CI	str	Image Sources/Component
EXPID	69022	int	Exposure number
EXPFRAME	0	int	Frame number
COSMSPLT	F	bool	Cosmics split exposure if true
MAXSPLIT	0	int	Number of allowed exposure splits
SPLITIDS[Page 380, 1]	69022	str	List of expids for split exposures
FIBASSGN	/data/tiles/SVN_tiles/080/fiberassign-080616.fits	str	Fiber assign fil
FLAVOR	science	str	Observation type
OBSTYPE	SCIENCE	str	Spectrograph observation type
SEQUENCE	DESI	str	OCS Sequence name
MANIFEST	F	bool	DOS exposure manifest
OBJECT		str	Object name
PURPOSE	Commissioning	str	Purpose of observing night
PROGRAM	SV1 BGS+MWS tile 80616	str	Program name
PROPID	2019B-5000	str	Proposal ID
OBSERVER	DESIObserver	str	Names of observers
LEAD	RunManager	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
SEQNUM	1	int	Number of exposure in sequence

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KEY	Example Value	Type	Comment
NIGHT	20201220	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2020-12-21T02:36:32.099838	str	[UTC] Observation data and start time
MJD-OBS	59204.10870486	float	Modified Julian Date of observation
OPENSHUT	2020-12-21T02:36:32.099838	str	Time shutter opened
CAMSHUT	open	str	Shutter status during observation
ST	01:10:39.210	str	Local Sidereal time at observation start (HH:MM
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
FOCSTIME	60.0	float	[s] focus GFA exposure time
SKYTIME	60.0	float	[s] sky camera exposure time (acquisition)
WHITESPT	F	bool	Telescope is at whitespot
ZENITH	F	bool	Telescope is at zenith
SEANNEX	F	bool	Telescope is at SE annex
BEYONDP	F	bool	Telescope is beyond pole
FIDUCIAL	off	str	Fiducials status during observation
BACKLIT	off	str	Fibers are backlit if True
AIRMASS	1.060311	float	Airmass
FOCUS	1426.5,-501.4,81.0,-2.6,42.3,169.2	str	Telescope focus settings
VCCD	ON	str	True (ON) if CCD voltage is on
TRUSTEMP	11.767	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	8.925	float	[deg] Average primary mirror temperature (nit,e
PMREADY	T	bool	Primary mirror ready
PMCOVER	open	str	Primary mirror cover
PMCOOL	off	str	Primary mirror cooling
DOMSHUTU	open	str	Upper dome shutter
DOMSHUTL	open	str	Lower dome shutter
DOMLIGHH	off	str	High dome lights
DOMLIGHL	off	str	Low dome lights
DOMEAZ	255.166	float	[deg] Dome azimuth angle
DOMINPOS	T	bool	Dome is in position
EQUINOX	2000.0	float	Epoch of observation
GUIDOFFR	-0.052283	float	[arcsec] Cummulative guider offset (RA)

continues on next page

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KEY	Example Value	Type	Comment
GUIDOFFD	0.136634	float	[arcsec] Cummulative guider offset (dec)
MOONDEC	-8.975162	float	[deg] Moon declination at start of exposure
MOONRA	352.538429	float	[deg] Moon RA at start of exposure
MOUNTAZ	266.70224	float	[deg] Mount azimuth angle
MOUNTDEC	28.999221	float	[deg] Mount declination
MOUNTEL	71.039837	float	[deg] Mount elevation angle
MOUNTHA	21.769281	float	[deg] Mount hour angle
INCTRL	T	bool	DESI in control
INPOS	T	bool	Mount in position
MNTOFFD	-15.76	float	[arcsec] Mount offset (dec)
MNTOFFR	29.32	float	[arcsec] Mount offset (RA)
PARALLAC	75.635085	float	[deg] Parallactic angle
SKYDEC	28.999221	float	[deg] Telescope declination (pointing on sky)
SKYRA	355.996551	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	28.999221	float	[deg] Target declination (to TCS)
TARGTRA	355.996551	float	[deg] Target right ascension (to TCS)
TARGTAZ	267.074049	float	[deg] Target azimuth
TARGTEL	70.563787	float	[deg] Target elevation
TRGTOFFD	0.0	float	[arcsec] Telescope target offset (dec)
TRGTOFFR	0.0	float	[arcsec] Telescope target offset (RA)
ZD	19.436213	float	[deg] Telescope zenith distance
TCSST	01:13:18.668	str	Local Sidereal time reported by TCS (HH:MM:SS)
TCSMJD	59204.110981	float	MJD reported by TCS
USEETC	F	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
REQADC	65.78,85.28	str	[deg] requested ADC angles
ADCCORR	T	bool	Correct pointing for ADC setting if True

continues on next page

Table 40 – continued from previous page

KEY	Example Value	Type	Comment
ADC1PHI	65.780005	float	[deg] ADC 1 angle
ADC2PHI	85.279991	float	[deg] ADC 2 angle
ADC1HOME	F	bool	ADC 1 at home position if True
ADC2HOME	F	bool	ADC 2 at home position if True
ADC1NREV	-1.0	float	ADC 1 number of revs
ADC2NREV	0.0	float	ADC 2 number of revs
ADC1STAT	STOPPED	str	ADC 1 status
ADC2STAT	STOPPED	str	ADC 2 status
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	1426.5,-501.3,81.0,-2.6,42.3,171.9	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	167.1	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.0	float	[arcsec/min] Rotator rate
RESETROT	F	bool	DOS Control: reset hex rotator
USEPOS	T	bool	Fiber positioner data available if true
PETALS	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9	str	Participating petals
POSCYCLE	1	int	Number of current iteration
POSONTGT	3626	int	Number of positioners on target
POSONFRC	0.8613	float	Fraction of positioners on target
POSDISAB	37	int	Number of disabled positioners
POSENABL	4210	int	Number of enabled positioners
POSRMS	0.0171	float	[micron] RMS of positioner accuracy
POSITER	1	int	Positioning Control: max. number of pos. cycles
POSFRACT	0.95	float	
POSTOLER	0.01	float	Positioning Control: in_position tolerance (mm)
POSMVALL	T	bool	Positioning Control: move all positioners
USEGUIDR	T	bool	DOS Control: use guider
GUIDMODE	catalog	str	Guider mode
USEAOS	F	bool	DOS Control: AOS data available if true
USEDONUT	T	bool	DOS Control: use donuts

continues on next page

Table 40 – continued from previous page

KEY	Example Value	Type	Comment
USESPCTR	T	bool	DOS Control: use spectrographs
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating spectrograph
ILLSPECS[Page 380, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating illuminate s
CCDSPECS[Page 380, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating ccd spectrog
TDEWPNT	-16.043	float	Telescope air dew point
TAIRFLOW	0.0	float	Telescope air flow
TAIRITMP	11.8	float	[deg] Telescope air in temperature
TAIROTMP	11.7	float	[deg] Telescope air out temperature
TAIRTEMP	10.65	float	[deg] Telescope air temperature
TCASITMP	0.0	float	[deg] Telescope Cass Cage in temperature
TCASOTMP	10.8	float	[deg] Telescope Cass Cage out temperature
TCSITEMP	9.3	float	[deg] Telescope center section in temperature
TCSOTEMP	10.8	float	[deg] Telescope center section out temperature
TCIBTEMP	0.0	float	[deg] Telescope chimney IB temperature
TCIMTEMP	0.0	float	[deg] Telescope chimney IM temperature
TCITTEMP	0.0	float	[deg] Telescope chimney IT temperature
TCOSTEMP	0.0	float	[deg] Telescope chimney OS temperature
TCOWTEMP	0.0	float	[deg] Telescope chimney OW temperature
TDBTEMP	9.3	float	[deg] Telescope dec bore temperature
TFLOWIN	0.0	float	Telescope flow rate in
TFLOWOUT	0.0	float	Telescope flow rate out
TGLYCOLI	9.9	float	[deg] Telescope glycol in temperature
TGLYCOLO	9.8	float	[deg] Telescope glycol out temperature
THINGES	11.4	float	[deg] Telescope hinge S temperature
THINGEW	11.2	float	[deg] Telescope hinge W temperature
TPMAVERT	8.931	float	[deg] Telescope mirror averagetemperature
TPMDESIT	7.0	float	[deg] Telescope mirror desired temperature
TPMEIBT	8.6	float	[deg] Telescope mirror EIB temperature

continues on next page

Table 40 – continued from previous page

KEY	Example Value	Type	Comment
TPMEITT	8.6	float	[deg] Telescope mirror EIT temperature
TPMEOBT	8.5	float	[deg] Telescope mirror EOB temperature
TPMEOTT	9.0	float	[deg] Telescope mirror EOT temperature
TPMNIBT	8.4	float	[deg] Telescope mirror NIB temperature
TPMNITT	8.9	float	[deg] Telescope mirror NIT temperature
TPMNOBT	8.8	float	[deg] Telescope mirror NOB temperature
TPMNOTT	9.1	float	[deg] Telescope mirror NOT temperature
TPMRTDT	9.0	float	[deg] Telescope mirror RTD temperature
TPMSIBT	8.6	float	[deg] Telescope mirror SIB temperature
TPMSITT	8.8	float	[deg] Telescope mirror SIT temperature
TPMSOBT	8.2	float	[deg] Telescope mirror SOB temperature
TPMSOTT	8.9	float	[deg] Telescope mirror SOT temperature
TPMSTAT	ready	str	Telescope mirror status
TPMWIBT	8.2	float	[deg] Telescope mirror WIB temperature
TPMWITT	9.1	float	[deg] Telescope mirror WIT temperature
TPMWOBT	8.3	float	[deg] Telescope mirror WOB temperature
TPMWOTT	8.9	float	[deg] Telescope mirror WOT temperature
TPCITEMP	8.5	float	[deg] Telescope primary cell in temperature
TPCOTEMP	8.6	float	[deg] Telescope primary cell out temperature
TPR1HUM	0.0	float	Telescope probe 1 humidity
TPR1TEMP	0.0	float	[deg] Telescope probe1 temperature
TPR2HUM	0.0	float	Telescope probe 2 humidity
TPR2TEMP	0.0	float	[deg] Telescope probe2 temperature
TSERVO	40.0	float	Telescope servo setpoint
TTRSTEMP	11.4	float	[deg] Telescope top ring S temperature
TTRWTEMP	11.0	float	[deg] Telescope top ring W temperature

continues on next page

Table 40 – continued from previous page

KEY	Example Value	Type	Comment
TTRUETBT	-4.2	float	[deg] Telescope truss ETB temperature
TTRUETTT	11.2	float	[deg] Telescope truss ETT temperature
TTRUNTBT	10.9	float	[deg] Telescope truss NTB temperature
TTRUNTTT	11.2	float	[deg] Telescope truss NTT temperature
TTRUSTBT	10.7	float	[deg] Telescope truss STB temperature
TTRUSTST	10.8	float	[deg] Telescope truss STS temperature
TTRUSTTT	11.1	float	[deg] Telescope truss STT temperature
TTRUTSBT	11.8	float	[deg] Telescope truss TSB temperature
TTRUTSMT	11.8	float	[deg] Telescope truss TSM temperature
TTRUTSTT	11.8	float	[deg] Telescope truss TST temperature
TTRUWTBT	10.5	float	[deg] Telescope truss WTB temperature
TTRUWTTT	10.9	float	[deg] Telescope truss WTT temperature
ALARM	F	bool	UPS major alarm or check battery
ALARM-ON	F	bool	UPS active alarm condition
BATTERY	100.0	float	[%] UPS Battery left
SECLEFT	5178.0	float	[s] UPS Seconds left
UPSSTAT[Page 380, 1]	System Normal - On Line(7)	str	UPS Status
INAMPS	70.4	float	[A] UPS total input current
OUTWATTS	5000.0,7200.0,4800.0	str	[W] UPS Phase A, B, C output watts
COMPDEW	-12.9	float	[deg C] Computer room dewpoint
COMPHUM	7.4	float	[%] Computer room humidity
COMPAMB	19.5	float	[deg C] Computer room ambient temperature
COMPTEMP	24.5	float	[deg C] Computer room hygrometer temperature
DEWPOINT	11.5	float	[deg C] (outside) dewpoint
HUMIDITY	10.0	float	[%] (outside) humidity
PRESSURE	795.0	float	[torr] (outside) air pressure

continues on next page

Table 40 – continued from previous page

KEY	Example Value	Type	Comment
OUTTEMP	0.0	float	[deg C] outside temperature
WINDDIR	55.0	float	[deg] wind direction
WINDSPD	27.3	float	[m/s] wind speed
GUST	20.6	float	[m/s] Wind gusts speed
AMNIENTN	13.5	float	[deg C] ambient temperature north
CFLOOR	8.9	float	[deg C] temperature on C floor
NWALLIN	13.9	float	[deg C] temperature at north wall inside
NWALLOUT	9.6	float	[deg C] temperature at north wall outside
WWALLIN	12.9	float	[deg C] temperature at west wall inside
WWALLOUT	10.6	float	[deg C] temperature at west wall outside
AMBIENTS	14.8	float	[deg C] ambient temperature south
FLOOR	12.6	float	[deg C] temperature at floor (LCR)
EWALLCMP	10.8	float	[deg C] temperature at east wall, computer room
EWALLCOU	10.6	float	[deg C] temperature at east wall, Coude room
ROOF	10.3	float	[deg C] temperature on roof
ROOFAMB	10.6	float	[deg C] ambient temperature on roof
DOMEBLOW	10.4	float	[deg C] temperature at dome back, lower
DOMEBUP	10.7	float	[deg C] temperature at dome back, upper
DOMELLOW	10.8	float	[deg C] temperature at dome left, lower
DOMELUP	10.8	float	[deg C] temperature at dome left, upper
DOMERLOW	10.6	float	[deg C] temperature at dome right, lower
DOMERUP	10.5	float	[deg C] temperature at dome right, upper
PLATFORM	10.4	float	[deg C] temperature at platform
SHACKC	14.4	float	[deg C] temperature at shack ceiling
SHACKW	13.7	float	[deg C] temperature at shack wall
STAIRSL	10.5	float	[deg C] temperature at stairs, lower

continues on next page

Table 40 – continued from previous page

KEY	Example Value	Type	Comment
STAIRSM	10.4	float	[deg C] temperature at stairs, mid
STAIRSU	10.6	float	[deg C] temperature at stairs, upper
TELBASE	9.6	float	[deg C] temperature at telescope base
UTILWALL	11.1	float	[deg C] temperature at utility room wall
UTILROOM	10.9	float	[deg C] temperature in utilitiy room
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
TNFSPROC	8.1963	float	[s] PlateMaker NFSPROC processing time
TGFAPROC[Page 380, 1]	7.9212	float	[s] PlateMaker GFAPROC processing time
SIMGFAP	F	bool	DOS Control: simulate GFAPROC
USEFVC	T	bool	DOS Control: use fvc
USEFID	T	bool	DOS Control: use fiducials
USEILLUM	T	bool	DOS Control: use illuminator
USEXSRVR	T	bool	DOS Control: use exposure server
USEOPENL	T	bool	DOS Control: use open loop move
STOPGUDR	T	bool	DOS Control: stop guider
STOPFOCS	T	bool	DOS Control: stop focus
STOPSKY	T	bool	DOS Control: stop sky monitor
KEEPGUDR	F	bool	DOS Control: keep guider running
KEEPFOCS	F	bool	DOS Control: keep focus running
KEEPSKY	F	bool	DOS Control: keep sky mon. running
REACQUIR	F	bool	DOS Control: reacquire same files
FILENAME	/exposures/desi/20201220/00069022/desi-00069022.fits.fz	str	Name of (F
EXCLUDED		str	Components excluded from this exposure
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
REQTIME	300.0	float	[s] Requested exposure time

continues on next page

Table 40 – continued from previous page

KEY	Example Value	Type	Comment
FVCTIME[Page 380, 1]	2.0	float	[s] FVC exposure time
SIMGFACQ	F	bool	
POSCNVGD[Page 380, 1]	F	bool	Number of positioners converged
GUIEXPID	69022	int	Guider exposure id at start of spectro exp.
IGFRMNUM	12	int	Guider frame number at start of spectro exp.
FOCEXPID	69022	int	Focus exposure id at start of spectro exp.
IFFRMNUM	1	int	Focus frame number at start of spectro exp.
SKYEXPID	69022	int	Sky exposure id at start of spectro exp.
ISFRMNUM	1	int	Sky frame number at start of spectro exp.
FGFRMNUM	46	int	Guider frame number at end of spectro exp.
FFFRMNUM	6	int	Focus frame number at end of spectro exp.
FSFRMNUM	5	int	Sky frame number at end of spectro exp.
CHECKSUM	IHcZL9cYIGcYI9cY	str	HDU checksum updated 2022-02-14T05:35:59
DATASUM	1766599107	str	data unit checksum updated 2022-02-14T05:35:59
FRAMES[Page 380, 1]	47	int	Number of Frames in Archive
DELTARA[Page 380, 1]	None	Unknown	[arcsec] Offset], right ascension, observer inp
DELTADEC[Page 380, 1]	None	Unknown	[arcsec] Offset], declination, observer input
GSGUIDE0[Page 380, 1]	(980.05,685.98),(878.97,731.68)	str	
GSGUIDE2[Page 380, 1]	(372.65,939.43),(784.50,1529.96)	str	
GSGUIDE3[Page 380, 1]	(365.22,1423.83),(249.12,411.52)	str	
GSGUIDE5[Page 380, 1]	(848.52,78.26),(516.16,1410.54)	str	
GSGUIDE7[Page 380, 1]	(540.95,1848.95),(504.68,831.62)	str	
GSGUIDE8[Page 380, 1]	(720.29,552.69),(499.80,465.13)	str	
ARCHIVE[Page 380, 1]	/exposures/desi/20201220/00069022/guide-00069022.fits.fz	str	
GUIDEFIL	guide-00069022.fits.fz	str	
COORDFIL	coordinates-00069022.fits	str	
TRANSPAR[Page 380, 1]	None	Unknown	ETC/PM transparency
ETCPREV[Page 380, 1]	0.0	float	[s] ETC cummulative t_eff for visit
SUNRA[Page 380, 1]	75.582834	float	[deg] Sun RA at start of exposure
SP7BLUP[Page 380, 1]	1.063e-07	float	[mb] SP7 blue pressure
SP8REDP[Page 380, 1]	1.717e-07	float	[mb] SP8 red pressure

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Table 40 – continued from previous page

KEY	Example Value	Type	Comment
SVNMTL[Page 380, 1]	unknown	str	
ETCSEENG[Page 380, 1]	0.9441	float	[arcsec] ETC seeing
PMCORR[Page 380, 1]	n	str	
SP7NIRP[Page 380, 1]	7.647e-08	float	[mb] SP7 NIR pressure
MINTIME[Page 380, 1]	300.0	float	[s] Minimum exposure time (from NTS, used by ET
SP1REDP[Page 380, 1]	5.904e-08	float	[mb] SP1 red pressure
SLEWANGL[Page 380, 1]	3.345	float	[deg] Slew Angle
NTSPROG[Page 380, 1]	DARK	str	NTS program name
SP9REDT[Page 380, 1]	140.13	float	[K] SP9 red temperature
REQTEFF[Page 380, 1]	1000.0	float	[s] Requested effective exposure time
SP5REDP[Page 380, 1]	4.487e-08	float	[mb] SP5 red pressure
ETCTHRUB[Page 380, 1]	0.934663	float	ETC avg. thruput (BGS profile)
SP8REDT[Page 380, 1]	140.01	float	[K] SP8 red temperature
TCSKDEC[Page 380, 1]	1.5 0 0	str	TCS Kalman (dec)
ETCFRACE[Page 380, 1]	0.435801	float	ETC transp. weighted avg. FFRAC (ELG)
SPLITEXP[Page 380, 1]	F	bool	Split exposure part of a visit
SP1BLUT[Page 380, 1]	162.97	float	[K] SP1 blue temperature
SP4NIRT[Page 380, 1]	139.99	float	[K] SP4 NIR temperature
FAARGS[Page 380, 1]	–doclean n –dr dr9 –dtver 1.1.1 –gaiadr gaiadr2 –goaltime 1000.0 –ha 13.02 –hdr_faprgrm dark –hdr_survey main –log_stdout False –margin_gfa 0.4 –margin_petal 0.4 –margin_pos 0.05 –mintfrac 0.85 –mtltime 2021-05-30T15:33:07+00:00 –pmcorr n –pmtime_utc_str 2021-05-30T15:33:07+00:00 –program DARK –rundate 2021-05-30T15:33:07+00:00 –sbprof ELG –sky_per_petal 40 –sky_per_slitblock 1 –standards_per_petal 10 –steps tiles,sky,gfa,targ,scnd,too,fa,zip,move,qa –survey main –tiledec 25.487 –tileid 1200 –tilera 227.758	str	

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KEY	Example Value	Type	Comment
ETCVERS[Page 380, 1]	0.1.12-5-g205dbce	str	ETC version
SP4REDT[Page 380, 1]	140.06	float	[K] SP4 red temperature
SEEING[Page 380, 1]	None	float	[arcsec] ETC/PM seeing
SP0BLUP[Page 380, 1]	9.345e-08	float	[mb] SP0 blue pressure
PMTRANSP[Page 380, 1]	97.27	float	[%] PlateMaker GFAPROC transparency
SP8BLUP[Page 380, 1]	8.514e-08	float	[mb] SP8 blue pressure
SP2BLUT[Page 380, 1]	162.99	float	[K] SP2 blue temperature
SP4NIRP[Page 380, 1]	8.331e-08	float	[mb] SP4 NIR pressure
ETCFRACP[Page 380, 1]	0.609684	float	ETC transp. weighted avg. FFRAC (PSF)
SP2REDP[Page 380, 1]	8.283e-08	float	[mb] SP2 red pressure
SP8NIRT[Page 380, 1]	139.99	float	[K] SP8 NIR temperature
MAXTIME[Page 380, 1]	5400.0	float	[s] Maximum exposure time for entire visit (fro
DESIROOT[Page 380, 1]	/global/cfs/cdirs/desi	str	
TCSPIDEC[Page 380, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
SP5BLUT[Page 380, 1]	163.02	float	[K] SP5 blue temperature
SP6NIRP[Page 380, 1]	2.811e-07	float	[mb] SP6 NIR pressure
TCSMFDEC[Page 380, 1]	1	int	TCS moving filter length (dec)
SCND[Page 380, 1]	DESIROOT/target/catalogs/dr9/1.1.1/targets/main/secondary/dark/targets-dark-secondary.fits	str	
SVNDM[Page 380, 1]	136470	str	
SP5REDT[Page 380, 1]	140.03	float	[K] SP5 red temperature
ETCREAL[Page 380, 1]	879.548462	float	[s] ETC real open shutter time
ETCSKY[Page 380, 1]	0.823054	float	ETC averaged, normalized sky camera flux
POSCVFRC[Page 380, 1]	0.4681	float	Fraction of converged positioners
FASCRIPT[Page 380, 1]	/global/common/software/desi/cori/desiconda/20200801-1.4.0-spec/code/fiberassign/5.0.0/bin/fba_launch	str	
TOO[Page 380, 1]	DESIROOT/target/catalogs/mtl/1.1.1/mtl/main/ToO/ToO.ecsv	str	
SP3REDP[Page 380, 1]	5.645e-08	float	[mb] SP3 red pressure
SP2REDT[Page 380, 1]	139.99	float	[K] SP2 red temperature
ETCTEFF[Page 380, 1]	1015.311096	float	[s] ETC effective exposure time
SP9NIRT[Page 380, 1]	139.99	float	[K] SP9 NIR temperature
SP1REDT[Page 380, 1]	139.99	float	[K] SP1 red temperature
SP0BLUT[Page 380, 1]	162.97	float	[K] SP0 blue temperature
TCSGDEC[Page 380, 1]	0.3	float	TCS simple gain (dec)
SP6NIRT[Page 380, 1]	139.99	float	[K] SP6 NIR temperature
SP6REDP[Page 380, 1]	6.342e-08	float	[mb] SP6 red pressure
SEQSTART[Page 380, 1]	2021-06-07T06:09:31.221083	str	Start time of sequence processing
SP9BLUT[Page 380, 1]	162.97	float	[K] SP9 blue temperature

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KEY	Example Value	Type	Comment
TOTTEFF[Page 380, 1]	1013.4202	float	[s] Total effective exposure time for visit
SP8NIRP[Page 380, 1]	5.428e-08	float	[mb] SP8 NIR pressure
ACQFWHM[Page 380, 1]	0.944125	float	[arcsec] FWHM of guide star PSF in acq. image
SP3BLUT[Page 380, 1]	162.99	float	[K] SP3 blue temperature
SP5NIRP[Page 380, 1]	5.87e-08	float	[mb] SP5 NIR pressure
MOONSEP[Page 380, 1]	141.486	float	[deg] Moon Separation
TCSGRA[Page 380, 1]	0.3	float	TCS simple gain (RA)
ETCSPLIT[Page 380, 1]	1	int	ETC split sequence number for this visit
SP9REDP[Page 380, 1]	4.884e-08	float	[mb] SP9 red pressure
SCNDMTL[Page 380, 1]	DESIROOT/target/catalogs/mtl/1.1.1/mtl/main/secondary/dark	str	
SP3BLUP[Page 380, 1]	9.36e-08	float	[mb] SP3 blue pressure
SP2NIRT[Page 380, 1]	139.99	float	[K] SP2 NIR temperature
ETCTHRUP[Page 380, 1]	0.992089	float	ETC avg. thruput (PSF profile)
SBPROF[Page 380, 1]	ELG	str	Profile used by ETC
SP4BLUT[Page 380, 1]	162.99	float	[K] SP4 blue temperature
SUNDEC[Page 380, 1]	22.773665	float	[deg] Sun declination at start of exposure
SP4BLUP[Page 380, 1]	6.222e-08	float	[mb] SP4 blue pressure
ETCTRANS[Page 380, 1]	0.914464	float	ETC avg. TRANSP normalized to 1
SP6BLUT[Page 380, 1]	162.97	float	[K] SP6 blue temperature
SP1NIRT[Page 380, 1]	140.01	float	[K] SP1 NIR temperature
SP0NIRP[Page 380, 1]	5.607e-08	float	[mb] SP0 NIR pressure
SP4REDP[Page 380, 1]	5.286e-08	float	[mb] SP4 red pressure
SP2NIRP[Page 380, 1]	4.995e-08	float	[mb] SP2 NIR pressure
MTLTIME[Page 380, 1]	2021-05-30T15:33:07+00:00	str	
USESPLIT[Page 380, 1]	T	bool	Exposure splits are allowed
TIME-OBS[Page 380, 1]	2021-06-06T06:13:10.829196288	str	[UTC] Observation start time
ACTTEFF[Page 380, 1]	1015.311096	float	[s] Actual effective exposure time
SP8BLUT[Page 380, 1]	162.97	float	[K] SP8 blue temperature
SP0REDP[Page 380, 1]	4.369e-08	float	[mb] SP0 red pressure
MINTFRAC[Page 380, 1]	0.85	float	
SP9NIRP[Page 380, 1]	4.756e-08	float	[mb] SP9 NIR pressure
SP7REDP[Page 380, 1]	4.187e-08	float	[mb] SP7 red pressure
SP1BLUP[Page 380, 1]	8.387e-08	float	[mb] SP1 blue pressure
ETCPROF[Page 380, 1]	ELG	str	ETC source brightness profile
SP7REDT[Page 380, 1]	140.01	float	[K] SP7 red temperature
EBVFAC[Page 380, 1]	1.09985066283748	float	
SP3NIRT[Page 380, 1]	140.01	float	[K] SP3 NIR temperature

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KEY	Example Value	Type	Comment
TCSPIRA[Page 380, 1]	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
SP3REDT[Page 380, 1]	140.01	float	[K] SP3 red temperature
MTL[Page 380, 1]	DESI-ROOT/target/catalogs/mtl/1.1.1/mtl/main/dark	str	
SP5BLUP[Page 380, 1]	1.177e-07	float	[mb] SP5 blue pressure
SP1NIRP[Page 380, 1]	1.116e-07	float	[mb] SP1 NIR pressure
SP9BLUP[Page 380, 1]	1.21e-07	float	[mb] SP9 blue pressure
SP0REDT[Page 380, 1]	139.99	float	[K] SP0 red temperature
TCSMFRA[Page 380, 1]	1	int	TCS moving filter length (RA)
GOALTIME[Page 380, 1]	1000.0	float	
PMSEEING[Page 380, 1]	0.95	float	[arcsec] PlateMaker GFAPROC seeing
SP2BLUP[Page 380, 1]	7.919e-08	float	[mb] SP2 blue pressure
SP6BLUP[Page 380, 1]	8.092e-08	float	[mb] SP6 blue pressure
TCSKRA[Page 380, 1]	1.5 0 0	str	TCS Kalman (RA)
ESTTIME[Page 380, 1]	1064.348	float	[s] Estimated exposure time for visit (from ETC
CONVERGD[Page 380, 1]	F	bool	Positioning loop converged (CNFRC>0.95)
NTSSURVY[Page 380, 1]	main	str	NTS survey name
SP7NIRT[Page 380, 1]	140.01	float	[K] SP7 NIR temperature
SP3NIRP[Page 380, 1]	3.659e-08	float	[mb] SP3 NIR pressure
ETCTHRUE[Page 380, 1]	0.966824	float	ETC avg. thruput (ELG profile)
ETCFRACB[Page 380, 1]	0.194043	float	ETC transp. weighted avg. FFRAC (BGS)
SP5NIRT[Page 380, 1]	140.06	float	[K] SP5 NIR temperature
SP6REDT[Page 380, 1]	139.99	float	[K] SP6 red temperature
SURVEY[Page 380, 1]	main	str	
FAPRGRM[Page 380, 1]	dark	str	
SP0NIRT[Page 380, 1]	139.99	float	[K] SP0 NIR temperature
VISITIDS[Page 380, 1]	91383	str	List of expids for a visit (same tile)
SP7BLUT[Page 380, 1]	162.97	float	[K] SP7 blue temperature
SKYLEVEL[Page 380, 1]	0.829	float	counts?] ETC sky level
GOALTYPE[Page 380, 1]	DARK	str	
PMTRANS[Page 380, 1]	96.38	float	[%] PlateMaker GFAPROC transparency
ROLE[Page 380, 1]	GUIDERMAN	str	
SEQTOT[Page 380, 1]	6	int	Total number of exposures in sequence
SEQID[Page 380, 1]	6 requests	str	Exposure sequence identifier
TARG2[Page 380, 1]	DESI-ROOT/target/catalogs/gaiadr2/0.51.0/targets/sv1/resolve/supp	str	
SCSTD[Page 380, 1]	STD_WD,STD_FAINT	str	
UPS-STAT.undefined[Page 380, 1]	17814.0	float	UPS Status

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KEY	Example Value	Type	Comment
SIMGFAQ[Page 380, 1]	F	bool	DOS Control: simulate GFA acquisition
USESPLITS[1]	T	bool	Exposure splits are allowed
DR[1]	dr9	str	
PRIORITY[1]	default	str	
DTVER[1]	0.50.0	str	
M31CEN[1]	n	str	
TARG3[1]	DESI-ROOT/target/catalogs/dr9/0.51.0/targets/sv1/resolve/bright	str	
SHFTFOCS[1]	220.0	float	[micron] focus shift for out of focus tests

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gai
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKNAME	char[8]		Brick name from tractor input
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)

[1] Optional

Table 41 – continued from previous page

Name	Type	Units	Description
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from this
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from this
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from all s
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from all s
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from all s
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blending
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE="SER"
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORPHTY
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORPHTY
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; "sourceid" for Gaia DR
REF_CAT	char[2]		Reference catalog source for star: "T2" for Tycho-2, "G2" for Gaia D
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCOND
NUMOBS_INIT	int64		Initial number of observations for target calculated across target sele
SV1_DESI_TARGET[1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_BGS_TARGET[Page 380, 1]	int64		BGS (bright time program) target selection bitmask for SV1
SV1_MWS_TARGET[Page 380, 1]	int64		MWS (bright time program) target selection bitmask for SV1
SV1_SCND_TARGET[Page 380, 1]	int64		Secondary target selection bitmask for SV1
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SCND_TARGET[Page 380, 1]	int64		Target selection bitmask for secondary programs
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
EXPTIME	float64	s	Length of time shutter was open
SV3_DESI_TARGET[Page 380, 1]	int64		DESI (dark time program) target selection bitmask for SV3
SV3_BGS_TARGET[Page 380, 1]	int64		BGS (bright time program) target selection bitmask for SV3
SV3_SCND_TARGET[Page 380, 1]	int64		Secondary target selection bitmask for SV3
SV3_MWS_TARGET[Page 380, 1]	int64		MWS (bright time program) target selection bitmask for SV3
SV2_DESI_TARGET[Page 380, 1]	int64		DESI (dark time program) target selection bitmask for SV2

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Name	Type	Units	Description
SV2_MWS_TARGET[Page 380, 1]	int64		MWS (bright time program) target selection bitmask for SV2
SV2_SCND_TARGET[Page 380, 1]	int64		Secondary target selection bitmask for SV2
SV2_BGS_TARGET[Page 380, 1]	int64		BGS (bright time program) target selection bitmask for SV2
CMX_TARGET[Page 380, 1]	int64		Target selection bitmask for commissioning

Notes and Examples

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

preproc-CAMERA-EXPID.fits

Summary
Pre-processed spectrograph CCD raw data.

Naming Convention
`preproc-{camera}-{expid}.fits`, where `{camera}` is the spectrograph camera (e.g. "b0", "r1", "z9"), and `{expid}` is the zero-padded 8-digit exposure ID.

Regex
`preproc-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 194 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	IMAGE	IMAGE	Flat-fielded pixel values in electrons [FLOAT]
HDU1	IVAR	IMAGE	Inverse variance (1/sigma^2) of pixel values [FLOAT]
HDU2	MASK	IMAGE	Bitmask to flag bad pixels or cosmics [INT]
HDU3	READNOISE	IMAGE	Flat-fielded readout noise in electrons [FLOAT]
HDU4	FIBERMAP	BINTABLE	Table with information about the targets

FITS Header Units

HDU0

EXTNAME = IMAGE

2D image with flat-fielded pixel values in electrons. Bias level and dark current have been subtracted. Electronic gains, converting ADC count to electrons have been applied. Pixel values have been divided by a pixel flat field. Additional corrections for some CCDs are electronic amplifier cross-talk correction, and negative trails corrections. The pre-scan and over-scan regions have been removed.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	4114	int	
NAXIS2	4128	int	
EXPID	68979	int	Exposure number
EXPFRAME	0	int	Frame number
FLAVOR	science	str	Observation type
SEQUENCE	Spectrographs	str	OCS Sequence name
PURPOSE	Commissioning	str	Purpose of observing night
PROGRAM	CALIB DESI-CALIB-00 LEDs only	str	Program name
PROPID	2019B-5000	str	Proposal ID
OBSERVER	DESIObserver	str	Names of observers
LEAD	RunManager	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20201220	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2020-12-20T22:24:15.672815	str	[UTC] Observation data and start time
TIME-OBS	22:24:15.672815	str	[UTC] Observation start time
MJD-OBS	59203.93351473	float	Modified Julian Date of observation
ST	20:57:41.340	str	Local Sidereal time at observation start (HH:MM
EXPTIME	120.037	float	[s] Actual exposure time
DELTARA[1]	0.0	float	[arcsec] Offset], right ascension, observer inp

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KEY	Example Value	Type	Comment
DELTADECPage 400, 1	0.0	float	[arcsec] Offset], declination, observer input
VCCD	ON	str	True (ON) if CCD voltage is on
VCCDON	2020-12-14T04:22:19.522101	str	Time when CCD voltage was turned on
VCCDSEC	583485.8	float	[s] CCD on time in seconds
EQUINOX	2000.0	float	Epoch of observation
SPECGRPH	5	int	Spectrograph logical name (SP)
SPECID	9	int	Spectrograph serial number (SM)
FEEBOX	lbnl057	str	CCD Controller serial number
VESSEL	26	int	Cryostat serial number
FEEVER	v20160312	str	CCD Controller version
FEEPOWER	ON	str	FEE power status
FEEDMASK	2134851391	int	FEE dac mask
FEECMASK	1048575	int	FEE clk mask
CCDTEMP	-135.8073	float	[deg C] CCD controller CCD temperature
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
FILENAME	/exposures/desi/specs/20201220/00068979/sp9-00068979.fits.fz	str	Name
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
DAC3	-9.0002,-8.9919	str	[V] set value, measured value
CLOCK5	9.9999,0.0	str	[V] high rail, low rail
BLDTIME	0.3522	float	[s] Time to build image
CLOCK2	9.9999,0.0	str	[V] high rail, low rail
BIASSECD	[2129:2192, 2130:4193]	str	Bias section for quadrant D
PGAGAIN	3	int	Controller gain
OFFSET5	2.0,5.9964	str	[V] set value, measured value
BIASSECB	[2129:2192, 2:2065]	str	Bias section for quadrant B
CLOCK4	9.9999,0.0	str	[V] high rail, low rail
ORSECD	[2193:4249, 2098:2129]	str	Row bias section for quadrant D
DAC2	-9.0002,-8.9404	str	[V] set value, measured value
DAC6	5.9998,6.0437	str	[V] set value, measured value

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KEY	Example Value	Type	Comment
CCDPREP	purge,clear	str	CCD prep actions
CASETEMP	59.322	float	[deg C] CCD controller case temperature
DAC15	0.0,-0.0148	str	[V] set value, measured value
DAC16	39.9961,39.8706	str	[V] set value, measured value
DAC9	-25.0003,-24.6344	str	[V] set value, measured value
AMPSECB	[4114:2058, 1:2064]	str	AMP section for quadrant B
DAC11	-25.0003,-24.5157	str	[V] set value, measured value
DELAYS	20, 20, 25, 40, 7, 3000, 7, 7, 7, 7	str	[10] Delay settings
CLOCK13	9.9992,2.9993	str	[V] high rail, low rail
PRESECD	[4250:4256, 2130:4193]	str	Prescan section for quadrant D
CDSPARMS	400, 400, 8, 2000	str	CDS parameters
DATASECD	[2193:4249, 2130:4193]	str	Data section for quadrant D
CLOCK15	9.9992,2.9993	str	[V] high rail, low rail
CLOCK18	9.0,0.9999	str	[V] high rail, low rail
CLOCK8	9.9992,2.9993	str	[V] high rail, low rail
OFFSET7	2.0,6.0122	str	[V] set value, measured value
DAC8	-25.0003,-24.946	str	[V] set value, measured value
CCDSECC	[1:2057, 2065:4128]	str	CCD section for quadrant C
CLOCK14	9.9992,2.9993	str	[V] high rail, low rail
CLOCK3	-2.0001,3.9999	str	[V] high rail, low rail
DIGITIME	47.5948	float	[s] Time to digitize image
CLOCK1	9.9999,0.0	str	[V] high rail, low rail
PRRSECD	[2193:4249, 4194:4194]	str	Row prescan section for quadrant D
CLOCK9	9.9992,2.9993	str	[V] high rail, low rail
CCDNAME	CCDSM9R	str	CCD name
DETSECB	[2058:4114, 1:2064]	str	Detector section for quadrant B
CCDSECA	[1:2057, 1:2064]	str	CCD section for quadrant A
DETSECD	[2058:4114, 2065:4128]	str	Detector section for quadrant D
DATASECB	[2193:4249, 2:2065]	str	Data section for quadrant B
CRYOPRES[Page 400, 1]	1.166e-07	str	[mb] Cryostat pressure (IP)
CAMERA	r5	str	Camera name

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KEY	Example Value	Type	Comment
PRRSECA	[8:2064, 1:1]	str	Row prescan section for quadrant A
DAC1	-9.0002,-8.9507	str	[V] set value, measured value
PRESECC	[1:7, 2130:4193]	str	Prescan section for quadrant C
TRIMSECA	[8:2064, 2:2065]	str	Trim section for quadrant A
TRIMSECD	[2193:4249, 2130:4193]	str	Trim section for quadrant D
CCDCFG	default_lbnl_20190717.cfg	str	CCD configuration file
PRRSECB	[2193:4249, 1:1]	str	Row prescan section for quadrant B
CLOCK12	9.9992,2.9993	str	[V] high rail, low rail
CCDSECB	[2058:4114, 1:2064]	str	CCD section for quadrant B
TRIMSECB	[2193:4249, 2:2065]	str	Trim section for quadrant B
DATASECA	[8:2064, 2:2065]	str	Data section for quadrant A
DAC17	20.0008,12.3342	str	[V] set value, measured value
CLOCK17	9.0,0.9999	str	[V] high rail, low rail
PRESECB	[4250:4256, 2:2065]	str	Prescan section for quadrant B
CLOCK0	9.9999,0.0	str	[V] high rail, low rail
PRESECA	[1:7, 2:2065]	str	Prescan section for quadrant A
ORSECA	[8:2064, 2066:2097]	str	Row overscan section for quadrant A
BIASSECC	[2065:2128, 2130:4193]	str	Bias section for quadrant C
DETSECC	[1:2057, 2065:4128]	str	Detector section for quadrant C
DAC14	0.0,-0.0148	str	[V] set value, measured value
DAC4	5.9998,6.0595	str	[V] set value, measured value
CLOCK16	9.9999,3.0	str	[V] high rail, low rail
AMPSECA	[1:2057, 1:2064]	str	AMP section for quadrant A
OFFSET4	2.0,6.0595	str	[V] set value, measured value
CCDSIZE	4194,4256	str	CCD size in pixels (rows, columns)
OFFSET2	0.4000000059604645,-8.9301	str	[V] set value, measured value
DAC13	0.0,-0.0148	str	[V] set value, measured value

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KEY	Example Value	Type	Comment
CRYOTEMP[Page 400, 1]	163.02	float	[deg K] Cryostat CCD temperature
OFFSET6	2.0,6.0437	str	[V] set value, measured value
CLOCK6	9.9999,0.0	str	[V] high rail, low rail
DETSECA	[1:2057, 1:2064]	str	Detector section for quadrant A
CCDTMING	default_lbnl_timing_20180905.txt	str	CCD timing file
DETECTOR	M1-52	str	Detector (ccd) identification
OFFSET3	0.4000000059604645,-8.9816	str	[V] set value, measured value
AMPSECC	[1:2057, 4128:2065]	str	AMP section for quadrant C
CLOCK10	9.9992,2.9993	str	[V] high rail, low rail
ORSECC	[8:2064, 2098:2129]	str	Row overscan section for quadrant C
SETTINGS	detectors_sm_20191211.json	str	Name of DESI CCD settings file
CPUTEMP	58.9629	float	[deg C] CCD controller CPU temperature
OFFSET0	0.4000000059604645,-8.755	str	[V] set value, measured value
DAC12	0.0,0.0	str	[V] set value, measured value
DATASECC	[8:2064, 2130:4193]	str	Data section for quadrant C
AMPSECD	[4114:2058, 4128:2065]	str	AMP section for quadrant D
DAC10	-25.0003,-25.0054	str	[V] set value, measured value
CLOCK7	-2.0001,3.9999	str	[V] high rail, low rail
DAC0	-9.0002,-8.7653	str	[V] set value, measured value
CLOCK11	9.9992,2.9993	str	[V] high rail, low rail
DAC7	5.9998,6.0122	str	[V] set value, measured value
OFFSET1	0.4000000059604645,-8.9507	str	[V] set value, measured value
DAC5	5.9998,5.9964	str	[V] set value, measured value
ORSECB	[2193:4249, 2066:2097]	str	Row overscan section for quadrant B
CCDSECD	[2058:4114, 2065:4128]	str	CCD section for quadrant D
PRRSECC	[8:2064, 4194:4194]	str	Row prescan section for quadrant C
TRIMSECC	[8:2064, 2130:4193]	str	Trim section for quadrant C

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KEY	Example Value	Type	Comment
BIASSECA	[2065:2128, 2:2065]	str	Bias section for quadrant A
REQTIME	120.0	float	[s] Requested exposure time
OBSID	kp4m20201220t222415	str	Unique observation identifier
PROCTYPE	RAW	str	Data processing level
PRODTYPE	image	str	Data product type
CHECKSUM	JfhdMZgdJfgdJZgd	str	HDU checksum updated 2022-01-29T00:45:28
DATASUM	38776208	str	data unit checksum updated 2022-01-29T00:45:28
GAINA	1.684	float	e/ADU (gain applied to image)
SATULEVA	33000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPA	0.6500495005602716	float	ADUs (max-min of median overscan per row)
OMETHA	AVERAGE	str	use average overscan
OVERSCNA	1972.92976646288	float	ADUs (gain not applied)
OBSRDNA	3.218229918807175	float	electrons (gain is applied)
SATUELEA	52249.58627327651	float	saturation or non lin. level, in electrons
GAINB	1.655	float	e/ADU (gain applied to image)
SATULEVB	47000.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPB	0.6179795354764792	float	ADUs (max-min of median overscan per row)
OMETHB	AVERAGE	str	use average overscan
OVERSCNB	1975.23548556518	float	ADUs (gain not applied)
OBSRDNB	3.153470147761547	float	electrons (gain is applied)
SATUELEB	74515.98527138963	float	saturation or non lin. level, in electrons
GAINC	1.467	float	e/ADU (gain applied to image)
SATULEVC	65535.0	float	saturation or non lin. level, in ADU, inc. bias
OSTEPC	0.5848174212296726	float	ADUs (max-min of median overscan per row)
OMETHC	AVERAGE	str	use average overscan
OVERSCNC	1959.467167892971	float	ADUs (gain not applied)
OBSRDNC	2.894849081776217	float	electrons (gain is applied)
SATUELEC	93265.30666470101	float	saturation or non lin. level, in electrons
GAIND	1.509	float	e/ADU (gain applied to image)
SATULEVD	65535.0	float	saturation or non lin. level, in ADU, inc. bias

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KEY	Example Value	Type	Comment
OSTEPD	0.4709297982626595	float	ADUs (max-min of median overscan per row)
OMETHD	AVERAGE	str	use average overscan
OVERSCND	1992.393350767962	float	ADUs (gain not applied)
OBSRDND	2.694583892275785	float	electrons (gain is applied)
SATUELED	95885.79343369114	float	saturation or non lin. level, in electrons
FIBERMIN[Page 400, 1]	2500	int	
LONGSTRN	OGIP 1.0	str	The OGIP Long String Convention may be used.
MODULE	CI	str	Image Sources/Component
FRAMES[Page 400, 1]	None	Unknown	Number of Frames in Archive
COSMSPLT	F	bool	Cosmics split exposure if true
MAXSPLIT	0	int	Number of allowed exposure splits
SPLITIDS[Page 400, 1]	68979	str	List of expids for split exposures
OBSTYPE	FLAT	str	Spectrograph observation type
MANIFEST	F	bool	DOS exposure manifest
OBJECT		str	Object name
SEQID[Page 400, 1]	3 requests	str	Exposure sequence identifier
SEQNUM	2	int	Number of exposure in sequence
SEQTOT[Page 400, 1]	3	int	Total number of exposures in sequence
OPENSHUT	None	Unknown	Time shutter opened
CAMSHUT	open	str	Shutter status during observation
WHITESPT[Page 400, 1]	T	bool	Telescope is at whitespot
ZENITH[Page 400, 1]	F	bool	Telescope is at zenith
SEANNEX[Page 400, 1]	F	bool	Telescope is at SE annex
BEYONDP[Page 400, 1]	F	bool	Telescope is beyond pole
FIDUCIAL[Page 400, 1]	off	str	Fiducials status during observation
AIRMASS[Page 400, 1]	1.521306	float	Airmass
FOCUS[Page 400, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0	str	Telescope focus settings
TRUSTEMP[Page 400, 1]	13.267	float	[deg] Average Telescope truss temperature (only
PMIRTEMP[Page 400, 1]	7.35	float	[deg] Average primary mirror temperature (nit,e
PMREADY[Page 400, 1]	F	bool	Primary mirror ready
PMCOVER[Page 400, 1]	open	str	Primary mirror cover
PMCOOL[Page 400, 1]	on	str	Primary mirror cooling

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KEY	Example Value	Type	Comment
DOMSHUTU[Page 400, 1]	not open	str	Upper dome shutter
DOMSHUTL[Page 400, 1]	not open	str	Lower dome shutter
DOMLIGHH[Page 400, 1]	off	str	High dome lights
DOMLIGHL[Page 400, 1]	off	str	Low dome lights
DOMEAZ[Page 400, 1]	253.289	float	[deg] Dome azimuth angle
DOMINPOS[Page 400, 1]	F	bool	Dome is in position
GUIDOFFR[Page 400, 1]	0.0	float	[arcsec] Cummulative guider offset (RA)
GUIDOFFD[Page 400, 1]	-0.0	float	[arcsec] Cummulative guider offset (dec)
MOONDEC[Page 400, 1]	-9.830944	float	[deg] Moon declination at start of exposure
MOONRA[Page 400, 1]	350.511461	float	[deg] Moon RA at start of exposure
MOUNTAZ[Page 400, 1]	73.49407	float	[deg] Mount azimuth angle
MOUNTDEC[Page 400, 1]	31.962703	float	[deg] Mount declination
MOUNTEL[Page 400, 1]	41.035778	float	[deg] Mount elevation angle
MOUNTHA[Page 400, 1]	-58.479517	float	[deg] Mount hour angle
INCTRL[Page 400, 1]	F	bool	DESI in control
INPOS[Page 400, 1]	T	bool	Mount in position
MNTOFFD[Page 400, 1]	-0.0	float	[arcsec] Mount offset (dec)
MNTOFFR[Page 400, 1]	-0.0	float	[arcsec] Mount offset (RA)
PARALLAC[Page 400, 1]	-73.492813	float	[deg] Parallactic angle
SKYDEC[Page 400, 1]	31.962703	float	[deg] Telescope declination (pointing on sky)
SKYRA[Page 400, 1]	12.901561	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC[Page 400, 1]	31.963299	float	[deg] Target declination (to TCS)
TARGTRA[Page 400, 1]	6.305086	float	[deg] Target right ascension (to TCS)
TARGTAZ[Page 400, 1]	75.558672	float	[deg] Target azimuth
TARGTEL[Page 400, 1]	46.429343	float	[deg] Target elevation
TRGTOFFD[Page 400, 1]	0.0	float	[arcsec] Telescope target offset (dec)
TRGTOFFR[Page 400, 1]	0.0	float	[arcsec] Telescope target offset (RA)
ZD[Page 400, 1]	48.964222	float	[deg] Telescope zenith distance
TCSST[Page 400, 1]	20:57:41.291	str	Local Sidereal time reported by TCS (HH:MM:SS)
TCSMJD[Page 400, 1]	59203.933945	float	MJD reported by TCS
ADCCORR	F	bool	Correct pointing for ADC setting if True
ADC1PHI[Page 400, 1]	114.980003	float	[deg] ADC 1 angle

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KEY	Example Value	Type	Comment
ADC2PHI[Page 400, 1]	162.869907	float	[deg] ADC 2 angle
ADC1HOME[Page 400, 1]	F	bool	ADC 1 at home position if True
ADC2HOME[Page 400, 1]	F	bool	ADC 2 at home position if True
ADC1NREV[Page 400, 1]	0.0	float	ADC 1 number of revs
ADC2NREV[Page 400, 1]	-1.0	float	ADC 2 number of revs
ADC1STAT[Page 400, 1]	STOPPED	str	ADC 1 status
ADC2STAT[Page 400, 1]	STOPPED	str	ADC 2 status
HEXPOS[Page 400, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0	str	Hexapod position
HEXTRIM[Page 400, 1]	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
ROTOFFST[Page 400, 1]	0.0	float	[arcsec] Rotator offset
ROTENBLD[Page 400, 1]	T	bool	Rotator enabled
ROTRATE[Page 400, 1]	0.0	float	[arcsec/min] Rotator rate
RESETROT	F	bool	DOS Control: reset hex rotator
GUIDMODE	catalog	str	Guider mode
USEAOS[Page 400, 1]	F	bool	DOS Control: AOS data available if true
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating spectrograph
ILLSPECS[Page 400, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating illuminate s
CCDSPECS[Page 400, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating ccd spectrog
TDEWPNT[Page 400, 1]	-18.2	float	Telescope air dew point
TAIRFLOW[Page 400, 1]	1.121	float	Telescope air flow
TAIRITMP[Page 400, 1]	10.5	float	[deg] Telescope air in temperature
TAIROTMP[Page 400, 1]	5.5	float	[deg] Telescope air out temperature
TAIRTEMP[Page 400, 1]	11.86	float	[deg] Telescope air temperature
TCASITMP[Page 400, 1]	0.0	float	[deg] Telescope Cass Cage in temperature
TCASOTMP[Page 400, 1]	9.6	float	[deg] Telescope Cass Cage out temperature
TCSITEMP[Page 400, 1]	7.4	float	[deg] Telescope center section in temperature
TCSOTEMP[Page 400, 1]	10.2	float	[deg] Telescope center section out temperature
TCIBTEMP[Page 400, 1]	0.0	float	[deg] Telescope chimney IB temperature
TCIMTEMP[Page 400, 1]	0.0	float	[deg] Telescope chimney IM temperature
TCITTEMP[Page 400, 1]	0.0	float	[deg] Telescope chimney IT temperature
TCOSTEMP[Page 400, 1]	0.0	float	[deg] Telescope chimney OS temperature
TCOWTEMP[Page 400, 1]	0.0	float	[deg] Telescope chimney OW temperature

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KEY	Example Value	Type	Comment
TDBTEMP[Page 400, 1]	7.4	float	[deg] Telescope dec bore temperature
TFLOWIN[Page 400, 1]	7.7	float	Telescope flow rate in
TFLOWOUT[Page 400, 1]	8.3	float	Telescope flow rate out
TGLYCOLI[Page 400, 1]	-1.8	float	[deg] Telescope glycol in temperature
TGLYCOLO[Page 400, 1]	0.0	float	[deg] Telescope glycol out temperature
THINGES[Page 400, 1]	12.9	float	[deg] Telescope hinge S temperature
THINGEW[Page 400, 1]	11.7	float	[deg] Telescope hinge W temperature
TPMAVERT[Page 400, 1]	7.304	float	[deg] Telescope mirror av-eragetemperature
TPMDESIT[Page 400, 1]	7.0	float	[deg] Telescope mirror de-sired temperature
TPMEIBT[Page 400, 1]	7.3	float	[deg] Telescope mirror EIB temperature
TPMEITT[Page 400, 1]	7.3	float	[deg] Telescope mirror EIT temperature
TPMEOBT[Page 400, 1]	7.4	float	[deg] Telescope mirror EOB temperature
TPMEOTT[Page 400, 1]	7.2	float	[deg] Telescope mirror EOT temperature
TPMNIBT[Page 400, 1]	7.4	float	[deg] Telescope mirror NIB temperature
TPMNITT[Page 400, 1]	7.3	float	[deg] Telescope mirror NIT temperature
TPMNOBT[Page 400, 1]	7.7	float	[deg] Telescope mirror NOB temperature
TPMNOTT[Page 400, 1]	7.6	float	[deg] Telescope mirror NOT temperature
TPMRTDT[Page 400, 1]	6.96	float	[deg] Telescope mirror RTD temperature
TPMSIBT[Page 400, 1]	7.4	float	[deg] Telescope mirror SIB temperature
TPMSITT[Page 400, 1]	7.0	float	[deg] Telescope mirror SIT temperature
TPMSOBT[Page 400, 1]	7.4	float	[deg] Telescope mirror SOB temperature
TPMSOTT[Page 400, 1]	7.2	float	[deg] Telescope mirror SOT temperature
TPMSTAT[Page 400, 1]	soft air	str	Telescope mirror status
TPMWIBT[Page 400, 1]	7.2	float	[deg] Telescope mirror WIB temperature
TPMWITT[Page 400, 1]	7.1	float	[deg] Telescope mirror WIT temperature
TPMWOBT[Page 400, 1]	7.6	float	[deg] Telescope mirror WOB temperature

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KEY	Example Value	Type	Comment
TPMWOTT[Page 400, 1]	8.1	float	[deg] Telescope mirror WOT temperature
TPCITEMP[Page 400, 1]	7.7	float	[deg] Telescope primary cell in temperature
TPCOTEMP[Page 400, 1]	7.7	float	[deg] Telescope primary cell out temperature
TPR1HUM[Page 400, 1]	0.0	float	Telescope probe 1 humidity
TPR1TEMP[Page 400, 1]	0.0	float	[deg] Telescope probe1 temperature
TPR2HUM[Page 400, 1]	0.0	float	Telescope probe 2 humidity
TPR2TEMP[Page 400, 1]	0.0	float	[deg] Telescope probe2 temperature
TSERVO[Page 400, 1]	7.0	float	Telescope servo setpoint
TTRSTEMP[Page 400, 1]	13.2	float	[deg] Telescope top ring S temperature
TTRWTEMP[Page 400, 1]	13.4	float	[deg] Telescope top ring W temperature
TTRUETBT[Page 400, 1]	-4.8	float	[deg] Telescope truss ETB temperature
TTRUETTT[Page 400, 1]	11.5	float	[deg] Telescope truss ETT temperature
TTRUNTBT[Page 400, 1]	10.9	float	[deg] Telescope truss NTB temperature
TTRUNTTT[Page 400, 1]	11.8	float	[deg] Telescope truss NTT temperature
TTRUSTBT[Page 400, 1]	11.1	float	[deg] Telescope truss STB temperature
TTRUSTST[Page 400, 1]	10.8	float	[deg] Telescope truss STS temperature
TTRUSTTT[Page 400, 1]	12.4	float	[deg] Telescope truss STT temperature
TTRUTSBT[Page 400, 1]	13.6	float	[deg] Telescope truss TSB temperature
TTRUTSMT[Page 400, 1]	13.7	float	[deg] Telescope truss TSM temperature
TTRUTSTT[Page 400, 1]	12.5	float	[deg] Telescope truss TST temperature
TTRUWTBT[Page 400, 1]	10.9	float	[deg] Telescope truss WTB temperature
TTRUWTTT[Page 400, 1]	11.6	float	[deg] Telescope truss WTT temperature
ALARM[Page 400, 1]	F	bool	UPS major alarm or check battery
ALARM-ON[Page 400, 1]	F	bool	UPS active alarm condition
BATTERY[Page 400, 1]	100.0	float	[%] UPS Battery left
SECLEFT[Page 400, 1]	5772.0	float	[s] UPS Seconds left

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KEY	Example Value	Type	Comment
UPSSTAT[Page 400, 1]	System Normal - On Line(7)	str	UPS Status
INAMPS[Page 400, 1]	64.3	float	[A] UPS total input current
OUTWATTS[Page 400, 1]	4500.0,6800.0,4100.0	str	[W] UPS Phase A, B, C output watts
COMPDEW[Page 400, 1]	-12.0	float	[deg C] Computer room dewpoint
COMPHUM[Page 400, 1]	7.8	float	[%] Computer room humidity
COMPAMB[Page 400, 1]	19.4	float	[deg C] Computer room ambient temperature
COMPTEMP[Page 400, 1]	24.9	float	[deg C] Computer room hygrometer temperature
DEWPOINT[Page 400, 1]	5.7	float	[deg C] (outside) dewpoint
HUMIDITY[Page 400, 1]	7.0	float	[%] (outside) humidity
PRESSURE[Page 400, 1]	794.7	float	[torr] (outside) air pressure
OUTTEMP[Page 400, 1]	0.0	float	[deg C] outside temperature
WINDDIR[Page 400, 1]	82.0	float	[deg] wind direction
WINDSPD[Page 400, 1]	23.3	float	[m/s] wind speed
GUST[Page 400, 1]	18.1	float	[m/s] Wind gusts speed
AMNIENTN[Page 400, 1]	13.3	float	[deg C] ambient temperature north
CFLOOR[Page 400, 1]	8.1	float	[deg C] temperature on C floor
NWALLIN[Page 400, 1]	13.6	float	[deg C] temperature at north wall inside
NWALLOUT[Page 400, 1]	8.8	float	[deg C] temperature at north wall outside
WWALLIN[Page 400, 1]	12.8	float	[deg C] temperature at west wall inside
WWALLOUT[Page 400, 1]	9.4	float	[deg C] temperature at west wall outside
AMBIENTS[Page 400, 1]	14.6	float	[deg C] ambient temperature south
FLOOR[Page 400, 1]	12.3	float	[deg C] temperature at floor (LCR)
EWALLCMP[Page 400, 1]	10.2	float	[deg C] temperature at east wall, computer room
EWALLCOU[Page 400, 1]	9.5	float	[deg C] temperature at east wall, Coude room
ROOF[Page 400, 1]	10.0	float	[deg C] temperature on roof
ROOFAMB[Page 400, 1]	9.9	float	[deg C] ambient temperature on roof
DOMEBLOW[Page 400, 1]	12.1	float	[deg C] temperature at dome back, lower

continues on next page

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KEY	Example Value	Type	Comment
DOMEBUP[Page 400, 1]	12.5	float	[deg C] temperature at dome back, upper
DOMELLOW[Page 400, 1]	14.4	float	[deg C] temperature at dome left, lower
DOMELUP[Page 400, 1]	19.3	float	[deg C] temperature at dome left, upper
DOMERLOW[Page 400, 1]	12.3	float	[deg C] temperature at dome right, lower
DOMERUP[Page 400, 1]	12.8	float	[deg C] temperature at dome right, upper
PLATFORM[Page 400, 1]	15.3	float	[deg C] temperature at platform
SHACKC[Page 400, 1]	15.2	float	[deg C] temperature at shack ceiling
SHACKW[Page 400, 1]	13.2	float	[deg C] temperature at shack wall
STAIRSL[Page 400, 1]	12.6	float	[deg C] temperature at stairs, lower
STAIRSM[Page 400, 1]	13.3	float	[deg C] temperature at stairs, mid
STAIRSU[Page 400, 1]	13.6	float	[deg C] temperature at stairs, upper
TELBASE[Page 400, 1]	8.5	float	[deg C] temperature at telescope base
UTILWALL[Page 400, 1]	11.6	float	[deg C] temperature at utility room wall
UTILROOM[Page 400, 1]	12.4	float	[deg C] temperature in utilitiy room
EXCLUDED		str	Components excluded from this exposure
MOONSEP[Page 400, 1]	53.303	float	[deg] Moon Separation
TCSMFDEC[Page 400, 1]	2	int	TCS moving filter length (dec)
TRANSPAR[Page 400, 1]	None	Unknown	ETC/PM transparency
TCSGRA[Page 400, 1]	0.15	float	TCS simple gain (RA)
SEEING[Page 400, 1]	None	float	[arcsec] ETC/PM seeing
TCSKDEC[Page 400, 1]	0.01 0.04 0.01	str	TCS Kalman (dec)
TCSPIDEC[Page 400, 1]	0.9,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
TCSPIRA[Page 400, 1]	0.9,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
SEQSTART[Page 400, 1]	2021-07-07T00:53:59.919044	str	Start time of sequence processing
TCSMFRA[Page 400, 1]	2	int	TCS moving filter length (RA)
NTSSURVY[Page 400, 1]	na	str	NTS survey name
SUNRA[Page 400, 1]	106.440846	float	[deg] Sun RA at start of exposure
SUNDEC[Page 400, 1]	22.575648	float	[deg] Sun declination at start of exposure

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Table 42 – continued from previous page

KEY	Example Value	Type	Comment
TCSGDEC[Page 400, 1]	0.15	float	TCS simple gain (dec)
TCSKRA[Page 400, 1]	0.01 0.04 0.01	str	TCS Kalman (RA)
SP6REDT[Page 400, 1]	139.99	float	[K] SP6 red temperature
ETCTEFF[Page 400, 1]	188.90274	float	[s] ETC effective exposure time
USEDONUT[Page 400, 1]	T	bool	DOS Control: use donuts
SP3REDP[Page 400, 1]	7.09e-08	float	[mb] SP3 red pressure
SP2NIRP[Page 400, 1]	7.628e-08	float	[mb] SP2 NIR pressure
TGFAPROC[Page 400, 1]	4.7487	float	[s] PlateMaker GFAPROC processing time
SP6NIRT[Page 400, 1]	139.99	float	[K] SP6 NIR temperature
GUIEXPID[Page 400, 1]	91269	int	Guider exposure id at start of spectro exp.
SP9NIRP[Page 400, 1]	4.982e-08	float	[mb] SP9 NIR pressure
SP1REDP[Page 400, 1]	7.756e-08	float	[mb] SP1 red pressure
GUIDECAM[Page 400, 1]	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
REQADC[Page 400, 1]	348.89,10.34	str	[deg] requested ADC angles
SP8REDP[Page 400, 1]	5.299e-08	float	[mb] SP8 red pressure
SP6BLUP[Page 400, 1]	7.73e-08	float	[mb] SP6 blue pressure
USEPOS[Page 400, 1]	T	bool	Fiber positioner data available if true
FSFRMNUM[Page 400, 1]	4	int	Sky frame number at end of spectro exp.
SKYTIME[Page 400, 1]	60.0	float	[s] sky camera exposure time (acquisition)
ETCREAL[Page 400, 1]	359.955383	float	[s] ETC real open shutter time
FGFRMNUM[Page 400, 1]	53	int	Guider frame number at end of spectro exp.
SP2BLUT[Page 400, 1]	162.99	float	[K] SP2 blue temperature
SP8NIRT[Page 400, 1]	139.99	float	[K] SP8 NIR temperature
POSMVALL[Page 400, 1]	T	bool	Positioning Control: move all positioners
SP0BLUP[Page 400, 1]	8.506e-08	float	[mb] SP0 blue pressure
SP6REDP[Page 400, 1]	6.497e-08	float	[mb] SP6 red pressure
USEFOCUS[Page 400, 1]	T	bool	DOS Control: use focus
SP9REDT[Page 400, 1]	140.13	float	[K] SP9 red temperature
SP4NIRP[Page 400, 1]	6.464e-08	float	[mb] SP4 NIR pressure
POSCVFRC[Page 400, 1]	0.6457	float	Fraction of converged positioners
SP8BLUP[Page 400, 1]	8.514e-08	float	[mb] SP8 blue pressure
POSONFRC[Page 400, 1]	1.0	float	Fraction of positioners on target
SP7REDP[Page 400, 1]	4.929e-08	float	[mb] SP7 red pressure
USEILLUM[Page 400, 1]	T	bool	DOS Control: use illuminator
STOPFOCS[Page 400, 1]	T	bool	DOS Control: stop focus
IFFRMNUM[Page 400, 1]	1	int	Focus frame number at start of spectro exp.

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KEY	Example Value	Type	Comment
SP9NIRT[Page 400, 1]	139.99	float	[K] SP9 NIR temperature
STOPGUDR[Page 400, 1]	T	bool	DOS Control: stop guider
POSENABL[Page 400, 1]	4183	int	Number of enabled positioners
SP5NIRP[Page 400, 1]	9.685e-08	float	[mb] SP5 NIR pressure
ETCFRACP[Page 400, 1]	0.598449	float	ETC transp. weighted avg. FFRAC (PSF)
REACQUIR[Page 400, 1]	F	bool	DOS Control: reacquire same files
ESTTIME[Page 400, 1]	685.169	float	[s] Estimated exposure time for visit (from ETC
SPLITEXP[Page 400, 1]	F	bool	Split exposure part of a visit
SP1BLUT[Page 400, 1]	162.97	float	[K] SP1 blue temperature
POSTOLER[Page 400, 1]	0.005	float	Positioning Control: in_position tolerance (mm)
SBPROF[Page 400, 1]	BGS	str	Profile used by ETC
SP1BLUP[Page 400, 1]	8.436e-08	float	[mb] SP1 blue pressure
TILEID[Page 400, 1]	21088	int	DESI Tile ID
FIBASSGN[Page 400, 1]	/data/tiles/SVN_tiles/021/fiberassign-021088.fits.gz	str	Fiber assign
CONVERGD[Page 400, 1]	F	bool	Positioning loop converged (CNFRC>0.95)
ETCTRANS[Page 400, 1]	0.873803	float	ETC avg. TRANSP normalized to 1
POSRMS[Page 400, 1]	0.0046	float	[micron] RMS of positioner accuracy
SP5BLUT[Page 400, 1]	163.02	float	[K] SP5 blue temperature
SP7NIRP[Page 400, 1]	4.958e-08	float	[mb] SP7 NIR pressure
POSFRACT[Page 400, 1]	0.95	float	
ETCTHRUP[Page 400, 1]	0.930508	float	ETC avg. thruput (PSF profile)
POSCNVGD[Page 400, 1]	2701	bool	Number of positioners converged
SP0NIRP[Page 400, 1]	6.295e-08	float	[mb] SP0 NIR pressure
SP6NIRP[Page 400, 1]	2.749e-07	float	[mb] SP6 NIR pressure
USEXSRVR[Page 400, 1]	T	bool	DOS Control: use exposure server
POSDISAB[Page 400, 1]	798	int	Number of disabled positioners
FOCUSCAM[Page 400, 1]	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
NTSPROG[Page 400, 1]	BRIGHT	str	NTS program name
SP1REDT[Page 400, 1]	139.99	float	[K] SP1 red temperature
FOCSTIME[Page 400, 1]	60.0	float	[s] focus GFA exposure time
ACTTEFF[Page 400, 1]	188.90274	float	[s] Actual effective exposure time
PETALS[Page 400, 1]	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9	str	Participating petals

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KEY	Example Value	Type	Comment
SP0REDT[Page 400, 1]	139.99	float	[K] SP0 red temperature
MAXTIME[Page 400, 1]	5400.0	float	[s] Maximum exposure time for entire visit (fro
SP0NIRT[Page 400, 1]	139.99	float	[K] SP0 NIR temperature
USEFID[Page 400, 1]	T	bool	DOS Control: use fiducials
ISFRMNUM[Page 400, 1]	5	int	Sky frame number at start of spectro exp.
USEETC[Page 400, 1]	T	bool	ETC data available if true
SP3NIRP[Page 400, 1]	4.205e-08	float	[mb] SP3 NIR pressure
SKYCAM[Page 400, 1]	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
SP0REDP[Page 400, 1]	5.012e-08	float	[mb] SP0 red pressure
REQDEC[Page 400, 1]	11.479	float	[deg] Requested declination (observer input)
ETCFRACB[Page 400, 1]	0.190657	float	ETC transp. weighted avg. FFRAC (BGS)
SP7REDT[Page 400, 1]	139.99	float	[K] SP7 red temperature
SP7NIRT[Page 400, 1]	139.99	float	[K] SP7 NIR temperature
SLEWANGL[Page 400, 1]	5.812	float	[deg] Slew Angle
ETCSKY[Page 400, 1]	1.373246	float	ETC averaged, normalized sky camera flux
ETCFRACE[Page 400, 1]	0.427971	float	ETC transp. weighted avg. FFRAC (ELG)
SP5NIRT[Page 400, 1]	140.03	float	[K] SP5 NIR temperature
USESPCTR[Page 400, 1]	T	bool	DOS Control: use spectrographs
SP2REDT[Page 400, 1]	139.99	float	[K] SP2 red temperature
ETCPREV[Page 400, 1]	0.0	float	[s] ETC cummulative t_eff for visit
SKYEXPID[Page 400, 1]	91268	int	Sky exposure id at start of spectro exp.
USEFVC[Page 400, 1]	T	bool	DOS Control: use fvc
PMTRANSP[Page 400, 1]	101.86	float	[%] PlateMaker GFAPROC transparency
STOPSKY[Page 400, 1]	T	bool	DOS Control: stop sky monitor
KEEPFOCS[Page 400, 1]	F	bool	DOS Control: keep focus running
SP1NIRT[Page 400, 1]	139.99	float	[K] SP1 NIR temperature
USEOPENL[Page 400, 1]	T	bool	DOS Control: use open loop move
SP4BLUT[Page 400, 1]	162.99	float	[K] SP4 blue temperature
SKYLEVEL[Page 400, 1]	1.359	float	counts?] ETC sky level
USEGUIDR[Page 400, 1]	T	bool	DOS Control: use guider
VISITIDS[Page 400, 1]	91269	str	List of expids for a visit (same tile)
SP4BLUP[Page 400, 1]	6.4e-08	float	[mb] SP4 blue pressure
SP1NIRP[Page 400, 1]	6.617e-08	float	[mb] SP1 NIR pressure
SP4REDP[Page 400, 1]	5.177e-08	float	[mb] SP4 red pressure

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KEY	Example Value	Type	Comment
ETCTHRUB[Page 400, 1]	0.877517	float	ETC avg. thruput (BGS profile)
USESPLIT[Page 400, 1]	T	bool	Exposure splits are allowed
SP8BLUT[Page 400, 1]	162.97	float	[K] SP8 blue temperature
SIMGFAP[Page 400, 1]	F	bool	DOS Control: simulate GFAPROC
SP4NIRT[Page 400, 1]	139.99	float	[K] SP4 NIR temperature
REQTEFF[Page 400, 1]	180.0	float	[s] Requested effective exposure time
SP5REDP[Page 400, 1]	6.023e-08	float	[mb] SP5 red pressure
SP7BLUT[Page 400, 1]	162.97	float	[K] SP7 blue temperature
ETCTHRUE[Page 400, 1]	0.907236	float	ETC avg. thruput (ELG profile)
SP3BLUP[Page 400, 1]	9.573e-08	float	[mb] SP3 blue pressure
POSITER[Page 400, 1]	1	int	Positioning Control: max. number of pos. cycles
SP3BLUT[Page 400, 1]	162.99	float	[K] SP3 blue temperature
REQRA[Page 400, 1]	202.544	float	[deg] Requested right ascension (observer input
SP8NIRP[Page 400, 1]	5.185e-08	float	[mb] SP8 NIR pressure
ACQFWHM[Page 400, 1]	1.091989	float	[arcsec] FWHM of guide star PSF in acq. image
FFFRMNUM[Page 400, 1]	6	int	Focus frame number at end of spectro exp.
ETCSPLIT[Page 400, 1]	1	int	ETC split sequence number for this visit
IGFRMNUM[Page 400, 1]	10	int	Guider frame number at start of spectro exp.
USEROTAT[Page 400, 1]	T	bool	DOS Control: use rotator
SP9BLUP[Page 400, 1]	1.21e-07	float	[mb] SP9 blue pressure
SP0BLUT[Page 400, 1]	162.97	float	[K] SP0 blue temperature
SP2NIRT[Page 400, 1]	139.99	float	[K] SP2 NIR temperature
KEEPGUDR[Page 400, 1]	F	bool	DOS Control: keep guider running
SP5REDT[Page 400, 1]	140.03	float	[K] SP5 red temperature
ACQCAM[Page 400, 1]	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
SP7BLUP[Page 400, 1]	1.04e-07	float	[mb] SP7 blue pressure
TILERA[Page 400, 1]	202.544	float	RA of tile given in fiberassign file
PMSEEING[Page 400, 1]	1.12	float	[arcsec] PlateMaker GFAPROC seeing
TOTTEFF[Page 400, 1]	187.1934	float	[s] Total effective exposure time for visit
TNFSPROC[Page 400, 1]	11.8836	float	[s] PlateMaker NFSPROC processing time
ETCPROF[Page 400, 1]	BGS	str	ETC source brightness profile
SIMGFACQ[Page 400, 1]	F	bool	
BACKLIT[Page 400, 1]	off	str	Fibers are backlit if True

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KEY	Example Value	Type	Comment
SP3NIRT[Page 400, 1]	139.99	float	[K] SP3 NIR temperature
USESKY[1]	T	bool	DOS Control: use Sky Monitor
POSCYCLE[1]	1	int	Number of current iteration
FOCEXPID[1]	91269	int	Focus exposure id at start of spectro exp.
SP4REDT[1]	140.06	float	[K] SP4 red temperature
SP6BLUT[1]	162.97	float	[K] SP6 blue temperature
ETCVERS[1]	0.1.12-5-g205dbce	str	ETC version
MINTIME[1]	180.0	float	[s] Minimum exposure time (from NTS, used by ET
ETCSEENG[1]	1.092	float	[arcsec] ETC seeing
TILEDEC[1]	11.479	float	DEC of tile given in fiberassign file
ACQTIME[1]	15.0	int	[s] acqusition image exposure time
SP2REDP[1]	5.879e-08	float	[mb] SP2 red pressure
SP8REDT[1]	139.99	float	[K] SP8 red temperature
POSONTGT[1]	4183	int	Number of positioners on target
SP9REDP[1]	1.039e-07	float	[mb] SP9 red pressure
SP5BLUP[1]	1.176e-07	float	[mb] SP5 blue pressure
SP3REDT[1]	140.01	float	[K] SP3 red temperature
SP2BLUP[1]	7.227e-08	float	[mb] SP2 blue pressure
KEEPSKY[1]	F	bool	DOS Control: keep sky mon. running
SP9BLUT[1]	162.99	float	[K] SP9 blue temperature
GUIDTIME[1]	5.0	float	[s] guider GFA exposure time
PMTRANS[1]	99.08	float	[%] PlateMaker GFAPROC transparency
BBKGMAXB[1]	0.4087930861702396	float	
BBKGMAXA[1]	0.6506116222504337	float	
BBKGMINC[1]	-0.5119155349796523	float	
BBKGMAXC[1]	0.443700474442688	float	
BBKGMAXD[1]	0.1595466623310998	float	
BBKGMIND[1]	-0.4877611679234296	float	
BBKGMINA[1]	-0.4375617018822571	float	
BBKGMINB[1]	-0.5070931422048309	float	
FVCTIME[1]	2.0	float	[s] FVC exposure time
USESPLITS[1]	T	bool	Exposure splits are allowed

Data: FITS image [float32, 4114x4128]

[1] Optional

HDU1

EXTNAME = IVAR

2D image with the inverse variance (1/sigma^2) of the flat-fielded pixel values. The units are 1/electrons^2. The variance comprises read noise and Poisson noise from the signal (including Poisson noise from the dark current). The Poisson noise is based on a model of the illumination of the CCD to minimize the correlation between the noise realization in the pixel value and the estimated variance. The variance also comprise the noise of the calibration data (master bias and master dark).

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	4114	int	
NAXIS2	4128	int	
CHECKSUM	MOb9PMb6MMb6MMb6	str	HDU checksum updated 2022-01-29T00:45:32
DATASUM	3688631381	str	data unit checksum updated 2022-01-29T00:45:32

Data: FITS image [float32, 4114x4128]

HDU2

EXTNAME = MASK

2D image with CCD pixels bitmask values. Good pixels have a mask=0. See the *bitmask documentation* page for the definition of the bits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	4128	int	number of rows in table
CHECKSUM	GfAAId07Gd7AGd77	str	HDU checksum updated 2022-01-29T00:45:35
DATASUM	856031529	str	data unit checksum updated 2022-01-29T00:45:35

Data: FITS image [int16 (compressed), 4114x4128]

HDU3

EXTNAME = READNOISE

Flat-fielded read noise in electrons. Read noise abusively includes the Poisson noise from clock induced charges for some CCDs along with the Poisson noise from the dark current and the calibration frame uncertainties.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	4114	int	
NAXIS2	4128	int	
CHECKSUM	cRUgeQRecQRecQRe	str	HDU checksum updated 2022-01-29T00:45:38
DATASUM	2700029362	str	data unit checksum updated 2022-01-29T00:45:38

Data: FITS image [float32, 4114x4128]

HDU4

EXTNAME = FIBERMAP

Exposure *fibermap* trimmed to the fibers of this camera.

Required Header Keywords

KEY	Example Value
NAXIS1	369
NAXIS2	500
EXPID	68979
EXPFRAME	0
FLAVOR	science
SEQUENCE	Spectrographs
PURPOSE	Commissioning
PROGRAM	CALIB DESI-CALIB-00 LEDs only
PROPID	2019B-5000
OBSERVER	DESIObserver
LEAD	RunManager
INSTRUME	DESI
OBSERVAT	KPNO
OBS-LAT	31.96403
OBS-LONG	-111.59989
OBS-ELEV	2097.0
TELESCOP	KPNO 4.0-m telescope
CORRCTOR	DESI Corrector
NIGHT	20201220
TIMESYS	UTC
DATE-OBS	2020-12-20T22:24:15.672815
TIME-OBS	22:24:15.672815
MJD-OBS	59203.93351473
ST	20:57:41.340
EXPTIME	120.037
DELTARA[1]	0.0
DELTADEC[Page 400, 1]	0.0
VCCD	ON
VCCDON	2020-12-14T04:22:19.522101

KEY	Example Value
VCCDSEC	583485.8
EQUINOX	2000.0
SPECGRPH	5
SPECID	9
FEEBOX	lbnl057
VESSEL	26
FEEVER	v20160312
FEEPOWER	ON
FEEDMASK	2134851391
FEECMASK	1048575
CCDTEMP	-135.8073
RADESYS	FK5
FILENAME	/exposures/desi/specs/20201220/00068979/sp9-00068979.fits.fz
DOSVER	trunk
OCSVER	1.2
CONSTVER	DESI:CURRENT
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini
DAC3	-9.0002,-8.9919
CLOCK5	9.9999,0.0
BLDTIME	0.3522
CLOCK2	9.9999,0.0
BIASSECD	[2129:2192, 2130:4193]
PGAGAIN	3
OFFSET5	2.0,5.9964
BIASSECB	[2129:2192, 2:2065]
CLOCK4	9.9999,0.0
ORSECD	[2193:4249, 2098:2129]
DAC2	-9.0002,-8.9404
DAC6	5.9998,6.0437
CCDPREP	purge,clear
CASETEMP	59.322
DAC15	0.0,-0.0148
DAC16	39.9961,39.8706
DAC9	-25.0003,-24.6344
AMPSECB	[4114:2058, 1:2064]
DAC11	-25.0003,-24.5157
DELAYS	20, 20, 25, 40, 7, 3000, 7, 7, 7, 7
CLOCK13	9.9992,2.9993
PRESECD	[4250:4256, 2130:4193]
CDSPARMS	400, 400, 8, 2000
DATASECD	[2193:4249, 2130:4193]
CLOCK15	9.9992,2.9993
CLOCK18	9.0,0.9999
CLOCK8	9.9992,2.9993
OFFSET7	2.0,6.0122
DAC8	-25.0003,-24.946
CCDSECC	[1:2057, 2065:4128]
CLOCK14	9.9992,2.9993
CLOCK3	-2.0001,3.9999

KEY	Example Value
DIGITIME	47.5948
CLOCK1	9.9999,0.0
PRRSECD	[2193:4249, 4194:4194]
CLOCK9	9.9992,2.9993
CCDNAME	CCDSM9R
DETSECB	[2058:4114, 1:2064]
CCDSECA	[1:2057, 1:2064]
DETSECD	[2058:4114, 2065:4128]
DATASECB	[2193:4249, 2:2065]
CRYOPRES[Page 400, 1]	1.166e-07
CAMERA	r5
PRRSECA	[8:2064, 1:1]
DAC1	-9.0002,-8.9507
PRESECC	[1:7, 2130:4193]
TRIMSECA	[8:2064, 2:2065]
TRIMSECD	[2193:4249, 2130:4193]
CCDCFG	default_lbnl_20190717.cfg
PRRSECB	[2193:4249, 1:1]
CLOCK12	9.9992,2.9993
CCDSECB	[2058:4114, 1:2064]
TRIMSECB	[2193:4249, 2:2065]
DATASECA	[8:2064, 2:2065]
DAC17	20.0008,12.3342
CLOCK17	9.0,0.9999
PRESECB	[4250:4256, 2:2065]
CLOCK0	9.9999,0.0
PRESECA	[1:7, 2:2065]
ORSECA	[8:2064, 2066:2097]
BIASSECC	[2065:2128, 2130:4193]
DETSECC	[1:2057, 2065:4128]
DAC14	0.0,-0.0148
DAC4	5.9998,6.0595
CLOCK16	9.9999,3.0
AMPSECA	[1:2057, 1:2064]
OFFSET4	2.0,6.0595
CCDSIZE	4194,4256
OFFSET2	0.4000000059604645,-8.9301
DAC13	0.0,-0.0148
CRYOTEMP[Page 400, 1]	163.02
OFFSET6	2.0,6.0437
CLOCK6	9.9999,0.0
DETSECA	[1:2057, 1:2064]
CCDTMING	default_lbnl_timing_20180905.txt
DETECTOR	M1-52
OFFSET3	0.4000000059604645,-8.9816
AMPSECC	[1:2057, 4128:2065]
CLOCK10	9.9992,2.9993
ORSECC	[8:2064, 2098:2129]
SETTINGS	detectors_sm_20191211.json

KEY	Example Value
CPUTEMP	58.9629
OFFSET0	0.4000000059604645,-8.755
DAC12	0.0,0.0
DATASECC	[8:2064, 2130:4193]
AMPSECD	[4114:2058, 4128:2065]
DAC10	-25.0003,-25.0054
CLOCK7	-2.0001,3.9999
DAC0	-9.0002,-8.7653
CLOCK11	9.9992,2.9993
DAC7	5.9998,6.0122
OFFSET1	0.4000000059604645,-8.9507
DAC5	5.9998,5.9964
ORSECB	[2193:4249, 2066:2097]
CCDSECD	[2058:4114, 2065:4128]
PRRSECC	[8:2064, 4194:4194]
TRIMSECC	[8:2064, 2130:4193]
BIASSECA	[2065:2128, 2:2065]
REQTIME	120.0
OBSID	kp4m20201220t222415
PROCTYPE	RAW
PRODTYPE	image
GAINA	1.684
SATULEVA	33000.0
OSTEPA	0.6500495005602716
OMETHA	AVERAGE
OVERSCNA	1972.92976646288
OBSRDNA	3.218229918807175
SATUELEA	52249.58627327651
GAINB	1.655
SATULEVB	47000.0
OSTEPB	0.6179795354764792
OMETHB	AVERAGE
OVERSCNB	1975.23548556518
OBSRDNB	3.153470147761547
SATUELEB	74515.98527138963
GAINC	1.467
SATULEVC	65535.0
OSTEPC	0.5848174212296726
OMETHC	AVERAGE
OVERSCNC	1959.467167892971
OBSRDNC	2.894849081776217
SATUELEC	93265.30666470101
GAIND	1.509
SATULEVD	65535.0
OSTEPD	0.4709297982626595
OMETHD	AVERAGE
OVERSCND	1992.393350767962
OBSRDND	2.694583892275785
SATUELED	95885.79343369114

KEY	Example Value
FIBERMIN[Page 400, 1]	2500
LONGSTRN	OGIP 1.0
MODULE	CI
FRAMES[Page 400, 1]	None
COSMSPLT	F
MAXSPLIT	0
SPLITIDS[Page 400, 1]	65741
OBSTYPE	FLAT
MANIFEST	F
OBJECT	
SEQID[Page 400, 1]	3 requests
SEQNUM	2
SEQTOT[Page 400, 1]	3
OPENSHUT	None
CAMSHUT	open
WHITESPT[Page 400, 1]	T
ZENITH[Page 400, 1]	F
SEANNEX[Page 400, 1]	F
BEYONDP[Page 400, 1]	F
FIDUCIAL[Page 400, 1]	off
AIRMASS[Page 400, 1]	1.521306
FOCUS[Page 400, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0
TRUSTEMP[Page 400, 1]	13.267
PMIRTEMP[Page 400, 1]	7.35
PMREADY[Page 400, 1]	F
PMCOVER[Page 400, 1]	open
PMCOOL[Page 400, 1]	on
DOMSHUTU[Page 400, 1]	not open
DOMSHUTL[Page 400, 1]	not open
DOMLIGHH[Page 400, 1]	off
DOMLIGHL[Page 400, 1]	off
DOMEAZ[Page 400, 1]	253.289
DOMINPOS[Page 400, 1]	F
GUIDOFFR[Page 400, 1]	0.0
GUIDOFFD[Page 400, 1]	-0.0
MOONDEC[Page 400, 1]	-9.830944
MOONRA[Page 400, 1]	350.511461
MOUNTAZ[Page 400, 1]	73.49407
MOUNTDEC[Page 400, 1]	31.962703
MOUNTEL[Page 400, 1]	41.035778
MOUNTHA[Page 400, 1]	-58.479517
INCTRL[Page 400, 1]	F
INPOS[Page 400, 1]	T
MNTOFFD[Page 400, 1]	-0.0
MNTOFFR[Page 400, 1]	-0.0
PARALLAC[Page 400, 1]	-73.492813
SKYDEC[Page 400, 1]	31.962703
SKYRA[Page 400, 1]	12.901561
TARGTDEC[Page 400, 1]	31.963299

KEY	Example Value
TARGTRA[Page 400, 1]	6.305086
TARGTAZ[Page 400, 1]	75.558672
TARGTEL[Page 400, 1]	46.429343
TRGTOFFD[Page 400, 1]	0.0
TRGTOFFR[Page 400, 1]	0.0
ZD[Page 400, 1]	48.964222
TCSST[Page 400, 1]	20:57:41.291
TCSMJD[Page 400, 1]	59203.933945
ADCCORR	F
ADC1PHI[Page 400, 1]	114.980003
ADC2PHI[Page 400, 1]	162.869907
ADC1HOME[Page 400, 1]	F
ADC2HOME[Page 400, 1]	F
ADC1NREV[Page 400, 1]	0.0
ADC2NREV[Page 400, 1]	-1.0
ADC1STAT[Page 400, 1]	STOPPED
ADC2STAT[Page 400, 1]	STOPPED
HEXPOS[Page 400, 1]	1163.9,-689.8,370.4,13.8,24.2,-0.0
HEXTRIM[Page 400, 1]	0.0,0.0,0.0,0.0,0.0,0.0
ROTOFFST[Page 400, 1]	0.0
ROTENBLD[Page 400, 1]	T
ROTRATE[Page 400, 1]	0.0
RESETROT	F
GUIDMODE	catalog
USEAOS[Page 400, 1]	F
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
ILLSPECS[Page 400, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
CCDSPECS[Page 400, 1]	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9
TDEWPNT[Page 400, 1]	-18.2
TAIRFLOW[Page 400, 1]	1.121
TAIRITMP[Page 400, 1]	10.5
TAIROTMP[Page 400, 1]	5.5
TAIRTEMP[Page 400, 1]	11.86
TCASITMP[Page 400, 1]	0.0
TCASOTMP[Page 400, 1]	9.6
TCSITEMP[Page 400, 1]	7.4
TCSOTEMP[Page 400, 1]	10.2
TCIBTEMP[Page 400, 1]	0.0
TCIMTEMP[Page 400, 1]	0.0
TCITTEMP[Page 400, 1]	0.0
TCOSTEMP[Page 400, 1]	0.0
TCOWTEMP[Page 400, 1]	0.0
TDBTEMP[Page 400, 1]	7.4
TFLOWIN[Page 400, 1]	7.7
TFLOWOUT[Page 400, 1]	8.3
TGLYCOLI[Page 400, 1]	-1.8
TGLYCOLO[Page 400, 1]	0.0
THINGES[Page 400, 1]	12.9
THINGEW[Page 400, 1]	11.7

KEY	Example Value
TPMAVERT[Page 400, 1]	7.304
TPMDESIT[Page 400, 1]	7.0
TPMEIBT[Page 400, 1]	7.3
TPMEITT[Page 400, 1]	7.3
TPMEOBT[Page 400, 1]	7.4
TPMEOTT[Page 400, 1]	7.2
TPMNIBT[Page 400, 1]	7.4
TPMNITT[Page 400, 1]	7.3
TPMNOBT[Page 400, 1]	7.7
TPMNOTT[Page 400, 1]	7.6
TPMRTDT[Page 400, 1]	6.96
TPMSIBT[Page 400, 1]	7.4
TPMSITT[Page 400, 1]	7.0
TPMSOBT[Page 400, 1]	7.4
TPMSOTT[Page 400, 1]	7.2
TPMSTAT[Page 400, 1]	soft air
TPMWIBT[Page 400, 1]	7.2
TPMWITT[Page 400, 1]	7.1
TPMWOBT[Page 400, 1]	7.6
TPMWOTT[Page 400, 1]	8.1
TPCITEMP[Page 400, 1]	7.7
TPCOTEMP[Page 400, 1]	7.7
TPR1HUM[Page 400, 1]	0.0
TPR1TEMP[Page 400, 1]	0.0
TPR2HUM[Page 400, 1]	0.0
TPR2TEMP[Page 400, 1]	0.0
TSERVO[Page 400, 1]	7.0
TTRSTEMP[Page 400, 1]	13.2
TTRWTEMP[Page 400, 1]	13.4
TTRUETBT[Page 400, 1]	-4.8
TTRUETTT[Page 400, 1]	11.5
TTRUNTBT[Page 400, 1]	10.9
TTRUNTTT[Page 400, 1]	11.8
TTRUSTBT[Page 400, 1]	11.1
TTRUSTST[Page 400, 1]	10.8
TTRUSTTT[Page 400, 1]	12.4
TTRUTSBT[Page 400, 1]	13.6
TTRUTSMT[Page 400, 1]	13.7
TTRUTSTT[Page 400, 1]	12.5
TTRUWTBT[Page 400, 1]	10.9
TTRUWTTT[Page 400, 1]	11.6
ALARM[Page 400, 1]	F
ALARM-ON[Page 400, 1]	F
BATTERY[Page 400, 1]	100.0
SECLEFT[Page 400, 1]	5772.0
UPSSTAT[Page 400, 1]	System Normal - On Line(7)
INAMPS[Page 400, 1]	64.3
OUTWATTS[Page 400, 1]	4500.0,6800.0,4100.0
COMPDEW[Page 400, 1]	-12.0

KEY	Example Value
COMPHUM[Page 400, 1]	7.8
COMPAMB[Page 400, 1]	19.4
COMPTEMP[Page 400, 1]	24.9
DEWPOINT[Page 400, 1]	5.7
HUMIDITY[Page 400, 1]	7.0
PRESSURE[Page 400, 1]	794.7
OUTTEMP[Page 400, 1]	0.0
WINDDIR[Page 400, 1]	82.0
WINDSPD[Page 400, 1]	23.3
GUST[Page 400, 1]	18.1
AMNIENTN[Page 400, 1]	13.3
CFLOOR[Page 400, 1]	8.1
NWALLIN[Page 400, 1]	13.6
NWALLOUT[Page 400, 1]	8.8
WWALLIN[Page 400, 1]	12.8
WWALLOUT[Page 400, 1]	9.4
AMBIENTS[Page 400, 1]	14.6
FLOOR[Page 400, 1]	12.3
EWALLCMP[Page 400, 1]	10.2
EWALLCOU[Page 400, 1]	9.5
ROOF[Page 400, 1]	10.0
ROOFAMB[Page 400, 1]	9.9
DOMEBLOW[Page 400, 1]	12.1
DOMEBUP[Page 400, 1]	12.5
DOMELLOW[Page 400, 1]	14.4
DOMELUP[Page 400, 1]	19.3
DOMERLOW[Page 400, 1]	12.3
DOMERUP[Page 400, 1]	12.8
PLATFORM[Page 400, 1]	15.3
SHACKC[Page 400, 1]	15.2
SHACKW[Page 400, 1]	13.2
STAIRSL[Page 400, 1]	12.6
STAIRSM[Page 400, 1]	13.3
STAIRSU[Page 400, 1]	13.6
TELBASE[Page 400, 1]	8.5
UTILWALL[Page 400, 1]	11.6
UTILROOM[Page 400, 1]	12.4
EXCLUDED	
CHECKSUM	oLYrpJYooJYooJYo
DATASUM	1239496881
MOONSEP[Page 400, 1]	53.303
TCSMFDEC[Page 400, 1]	2
TRANSPAR[Page 400, 1]	None
TCSGRA[Page 400, 1]	0.15
SEEING[Page 400, 1]	None
TCSKDEC[Page 400, 1]	0.01 0.04 0.01
TCSPIDEC[Page 400, 1]	0.9,0.0,0.0,0.0
TCSPIRA[Page 400, 1]	0.9,0.0,0.0,0.0
SEQSTART[Page 400, 1]	2021-07-07T00:53:59.919044

KEY	Example Value
TCSMFRA[Page 400, 1]	2
NTSSURVY[Page 400, 1]	na
SUNRA[Page 400, 1]	106.440846
SUNDEC[Page 400, 1]	22.575648
TCSGDEC[Page 400, 1]	0.15
TCSKRA[Page 400, 1]	0.01 0.04 0.01
SP6REDT[Page 400, 1]	139.99
ETCTEFF[Page 400, 1]	188.90274
USEDONUT[Page 400, 1]	T
SP3REDP[Page 400, 1]	7.09e-08
SP2NIRP[Page 400, 1]	7.628e-08
TGFAPROC[Page 400, 1]	4.7487
SP6NIRT[Page 400, 1]	139.99
GUIEXPID[Page 400, 1]	91269
SP9NIRP[Page 400, 1]	4.982e-08
SP1REDP[Page 400, 1]	7.756e-08
GOALTIME[Page 400, 1]	180.0
GUIDECAM[Page 400, 1]	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8
REQADC[Page 400, 1]	348.89,10.34
SP8REDP[Page 400, 1]	5.299e-08
FIELDROT[Page 400, 1]	-0.0491761627957582
SP6BLUP[Page 400, 1]	7.73e-08
USEPOS[Page 400, 1]	T
FSFRMNUM[Page 400, 1]	4
SKYTIME[Page 400, 1]	60.0
FGFRMNUM[Page 400, 1]	53
ETCREAL[Page 400, 1]	359.955383
GSGUIDE5[Page 400, 1]	(603.93,717.73),(852.56,266.71)
SP2BLUT[Page 400, 1]	162.99
SCNDMTL[Page 400, 1]	DESIROOT/target/catalogs/mtl/1.1.1/mtl/main/secondary/bright
SP8NIRT[Page 400, 1]	139.99
POSMVALL[Page 400, 1]	T
SP0BLUP[Page 400, 1]	8.506e-08
SP6REDP[Page 400, 1]	6.497e-08
USEFOCUS[Page 400, 1]	T
SP9REDT[Page 400, 1]	140.13
SP4NIRP[Page 400, 1]	6.464e-08
FA_PLAN[Page 400, 1]	2022-07-01T00:00:00.000
POSCVFRC[Page 400, 1]	0.6457
SP8BLUP[Page 400, 1]	8.513999999999999e-08
POSONFRC[Page 400, 1]	1.0
GOALTYPE[Page 400, 1]	BRIGHT
SP7REDP[Page 400, 1]	4.929e-08
USEILLUM[Page 400, 1]	T
SCND[Page 400, 1]	DESIROOT/target/catalogs/dr9/1.1.1/targets/main/secondary/bright/targets-bright-secondary.fits
STOPFOCS[Page 400, 1]	T
IFFRMNUM[Page 400, 1]	1
SP9NIRT[Page 400, 1]	139.99
STOPGUDR[Page 400, 1]	T

KEY	Example Value
POSENABL[Page 400, 1]	4183
SP5NIRP[Page 400, 1]	9.685e-08
COORDFIL[Page 400, 1]	coordinates-00091269.fits
ETCFRACP[Page 400, 1]	0.598449
GSGUIDE7[Page 400, 1]	(802.42,621.97),(808.88,951.00)
REACQUIR[Page 400, 1]	F
ESTTIME[Page 400, 1]	685.169
SPLITEXP[Page 400, 1]	F
MINTFRAC[Page 400, 1]	0.85
SP1BLUT[Page 400, 1]	162.97
POSTOLER[Page 400, 1]	0.005
SBPROF[Page 400, 1]	BGS
SP1BLUP[Page 400, 1]	8.436e-08
TILEID[Page 400, 1]	21088
FIBASSGN[Page 400, 1]	/data/tiles/SVN_tiles/021/fiberassign-021088.fits.gz
TARG[Page 400, 1]	DESIROOT/target/catalogs/dr9/1.1.1/targets/main/resolve/bright
FAARGS[Page 400, 1]	–doclean n –dr dr9 –dtver 1.1.1 –gaiadr gaiadr2 –goaltime 180.0 –ha -2.8 –hdr_faprgrm bright –hdr_survey
CONVERGD[Page 400, 1]	F
ETCTRANS[Page 400, 1]	0.873803
OBSCON[Page 400, 1]	DARK|GRAY|BRIGHT|BACKUP
POSRMS[Page 400, 1]	0.0046
SP5BLUT[Page 400, 1]	163.02
SP7NIRP[Page 400, 1]	4.958e-08
POSFRACT[Page 400, 1]	0.95
ETCTHRUP[Page 400, 1]	0.930508
POSCNVGD[Page 400, 1]	2701
SP0NIRP[Page 400, 1]	6.295e-08
SP6NIRP[Page 400, 1]	2.749e-07
MTLTIME[Page 400, 1]	2021-05-30T15:42:44+00:00
POSDISAB[Page 400, 1]	798
EBVFAC[Page 400, 1]	1.06121245388856
USEXSRVR[Page 400, 1]	T
FAPRGRM[Page 400, 1]	bright
FOCUSCAM[Page 400, 1]	FOCUS1,FOCUS4,FOCUS6,FOCUS9
NTSPROG[Page 400, 1]	BRIGHT
SP1REDT[Page 400, 1]	139.99
FOCSTIME[Page 400, 1]	60.0
GSGUIDE8[Page 400, 1]	(923.64,1926.73),(806.21,1893.13)
FAOUTDIR[Page 400, 1]	/global/cscratch1/sd/raichoor/holding_pen/main-pass0-20210530-nobackup-5.0.0/021/
ACTTEFF[Page 400, 1]	188.90274
PMTIME[Page 400, 1]	2021-05-30T15:42:44+00:00
PETALS[Page 400, 1]	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9
RUNDATE[Page 400, 1]	2021-05-30T15:42:44+00:00
SP0REDT[Page 400, 1]	139.99
MAXTIME[Page 400, 1]	5400.0
FA_RUN[Page 400, 1]	2021-05-30T15:42:44+00:00
SP0NIRT[Page 400, 1]	139.99
USEFID[Page 400, 1]	T
ISFRMNUM[Page 400, 1]	5

KEY	Example Value
GSGUIDE3[Page 400, 1]	(586.04,1814.56),(175.31,1315.13)
SP3NIRP[Page 400, 1]	4.205e-08
USEETC[Page 400, 1]	T
MTL[Page 400, 1]	DESIROOT/target/catalogs/mtl/1.1.1/mtl/main/bright
SKYCAM[Page 400, 1]	SKYCAM0,SKYCAM1
SP0REDP[Page 400, 1]	5.012e-08
REQDEC[Page 400, 1]	11.479
ETCFRACB[Page 400, 1]	0.190657
SVNMTL[Page 400, 1]	unknown
SP7REDT[Page 400, 1]	139.99
SP7NIRT[Page 400, 1]	139.99
SLEWANGL[Page 400, 1]	5.812
ETCSKY[Page 400, 1]	1.373246
FASCRIPT[Page 400, 1]	/global/common/software/desi/cori/desiconda/20200801-1.4.0-spec/code/fiberassign/5.0.0/bin/fba_launch
SP5NIRT[Page 400, 1]	140.03
ETCFRACE[Page 400, 1]	0.427971
USESPCTR[Page 400, 1]	T
SP2REDT[Page 400, 1]	139.99
ETCPREV[Page 400, 1]	0.0
FA_VER[Page 400, 1]	5.0.0
SKYEXPID[Page 400, 1]	91268
USEFVC[Page 400, 1]	T
PMTRANSP[Page 400, 1]	101.86
STOPSKY[Page 400, 1]	T
DESIROOT[Page 400, 1]	/global/cfs/cdirs/desi
KEEPFOCS[Page 400, 1]	F
SP1NIRT[Page 400, 1]	139.99
USEOPENL[Page 400, 1]	T
SP4BLUT[Page 400, 1]	162.99
SKYLEVEL[Page 400, 1]	1.359
USEGUIDR[Page 400, 1]	T
FAFLAVOR[Page 400, 1]	mainbright
VISITIDS[Page 400, 1]	91269
TOO[Page 400, 1]	DESIROOT/target/catalogs/mtl/1.1.1/mtl/main/ToO/ToO.ecsv
SKYSUPP[Page 400, 1]	DESIROOT/target/catalogs/gaiadr2/1.1.1/skies-supp
SP4BLUP[Page 400, 1]	6.4e-08
SP1NIRP[Page 400, 1]	6.617e-08
SP4REDP[Page 400, 1]	5.177e-08
FA_HA[Page 400, 1]	-2.8
ETCTHRUB[Page 400, 1]	0.877517
USESPLIT[Page 400, 1]	T
SP8BLUT[Page 400, 1]	162.97
SIMGFAP[Page 400, 1]	F
SP4NIRT[Page 400, 1]	139.99
REQTEFF[Page 400, 1]	180.0
SP5REDP[Page 400, 1]	6.023e-08
SP7BLUT[Page 400, 1]	162.97
ETCTHRUE[Page 400, 1]	0.907236
SP3BLUP[Page 400, 1]	9.573e-08

KEY	Example Value
PMCORR[Page 400, 1]	n
POSITER[Page 400, 1]	1
REQRA[Page 400, 1]	202.544
SP3BLUT[Page 400, 1]	162.99
SP8NIRP[Page 400, 1]	5.185e-08
ACQFWHM[Page 400, 1]	1.091989
FFFRMNUM[Page 400, 1]	6
ETCSPLIT[Page 400, 1]	1
IGFRMNUM[Page 400, 1]	10
USEROTAT[Page 400, 1]	T
SURVEY[Page 400, 1]	main
SP9BLUP[Page 400, 1]	1.21e-07
FIELDNUM[Page 400, 1]	0
SP0BLUT[Page 400, 1]	162.97
SP2NIRT[Page 400, 1]	139.99
KEEPGUDR[Page 400, 1]	F
SP5REDT[Page 400, 1]	140.03
ACQCAM[Page 400, 1]	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8
SP7BLUP[Page 400, 1]	1.04e-07
TILERA[Page 400, 1]	202.544
PMSEEING[Page 400, 1]	1.12
SKY[Page 400, 1]	DESIROOT/target/catalogs/dr9/1.1.1/skies
GFA[Page 400, 1]	DESIROOT/target/catalogs/dr9/1.1.1/gfas
TOTTEFF[Page 400, 1]	187.1934
TNFSPROC[Page 400, 1]	11.8836
ETCPROF[Page 400, 1]	BGS
SIMGFACQ[Page 400, 1]	F
BACKLIT[Page 400, 1]	off
FA_SURV[Page 400, 1]	main
SP3NIRT[Page 400, 1]	139.99
ARCHIVE[Page 400, 1]	/exposures/desi/20210605/00091269/guide-00091269.fits.fz
USESKY[Page 400, 1]	T
POSCYCLE[Page 400, 1]	1
FOCEXPID[Page 400, 1]	91269
SP4REDT[Page 400, 1]	140.06
SP6BLUT[Page 400, 1]	162.97
ETCVERS[Page 400, 1]	0.1.12-5-g205dbce
GUIDEFIL[Page 400, 1]	guide-00091269.fits.fz
ETCSEENG[Page 400, 1]	1.092
TILEDEC[Page 400, 1]	11.479
MINTIME[Page 400, 1]	180.0
GSGUIDE2[Page 400, 1]	(183.31,1907.84),(667.21,1409.44)
ACQTIME[Page 400, 1]	15.0
SP2REDP[Page 400, 1]	5.879e-08
SP8REDT[Page 400, 1]	139.99
POSONTGT[Page 400, 1]	4183
SVNDM[Page 400, 1]	136470
SP9REDP[Page 400, 1]	1.039e-07
SP5BLUP[Page 400, 1]	1.176e-07

KEY	Example Value
SP3REDT[Page 400, 1]	140.01
SP2BLUP[Page 400, 1]	7.227e-08
KEEPSKY[Page 400, 1]	F
SP9BLUT[Page 400, 1]	162.99
GUIDTIME[Page 400, 1]	5.0
GSGUIDE0[Page 400, 1]	(620.31,759.74),(928.19,1625.64)
PMTRANS[Page 400, 1]	99.08
BBKGMAXB[Page 400, 1]	0.4087930861702396
BBKGMAXA[Page 400, 1]	0.6506116222504337
BBKGMINC[Page 400, 1]	-0.5119155349796523
BBKGMAXC[Page 400, 1]	0.443700474442688
BBKGMAXD[Page 400, 1]	0.1595466623310998
BBKGMIND[Page 400, 1]	-0.4877611679234296
BBKGMINA[Page 400, 1]	-0.4375617018822571
BBKGMINB[Page 400, 1]	-0.5070931422048309
FVCTIME[Page 400, 1]	2.0
SCTARG[Page 400, 1]	MWS_WD,MWS_NEARBY,MWS_BHB,MWS_MAIN_BROAD,MWS_MAIN_FAINT,BACKUP_FAINT,
SCSTD[Page 400, 1]	STD_WD,STD_BRIGHT
TARG2[Page 400, 1]	DESIROOT/target/catalogs/gaiadr2/0.50.0/targets/sv1/resolve/supp
USESPLITS[Page 400, 1]	T
SIMGFAQ[Page 400, 1]	F
DR[Page 400, 1]	dr9
DTVER[Page 400, 1]	0.50.0
M31CEN[Page 400, 1]	n
PRIORITY[Page 400, 1]	default
SHFTFOCS[Page 400, 1]	500.0
ROLE[Page 400, 1]	GUIDERMAN
TARG3[Page 400, 1]	DESIROOT/target/catalogs/dr9/0.51.0/targets/sv1/resolve/bright
FA_M_GFA[Page 400, 1]	0.4
FA_M_PET[Page 400, 1]	0.4
FA_M_POS[Page 400, 1]	0.05

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LO
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	10**-3 arcsec yr-1	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	10**-3 arcsec yr-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fib

Table 44 – continued from previous page

Name	Type	Units	Description
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYP
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, supp
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKNAME	char[8]		Brick name from tractor input
BRICKID	int64		Brick ID from tractor input
BRICK_OBJID	int64		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_G	float32	nanomaggies	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggies	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggies	Flux in the Legacy Survey z-band (AB)
FLUX_W1	float32	nanomaggies	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggies	WISE flux in W2 (AB)
FLUX_IVAR_G	float32	1/nanomaggies**2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	1/nanomaggies**2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	1/nanomaggies**2	Inverse variance of FLUX_Z (AB)
FLUX_IVAR_W1	float32	1/nanomaggies**2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	1/nanomaggies**2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggies	Predicted g-band flux within a fiber of diameter 1.5 arcsec from t
FIBERFLUX_R	float32	nanomaggies	Predicted r-band flux within a fiber of diameter 1.5 arcsec from th
FIBERFLUX_Z	float32	nanomaggies	Predicted z-band flux within a fiber of diameter 1.5 arcsec from t
FIBERTOTFLUX_G	float32	nanomaggies	Predicted g-band flux within a fiber of diameter 1.5 arcsec from a
FIBERTOTFLUX_R	float32	nanomaggies	Predicted r-band flux within a fiber of diameter 1.5 arcsec from a
FIBERTOTFLUX_Z	float32	nanomaggies	Predicted z-band flux within a fiber of diameter 1.5 arcsec from a
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blen
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE=&#
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORPH
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORPH
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; `sourceid` for Gaia
REF_CAT	char[2]		Reference catalog source for star: 'T2' for Tycho-2,
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	10**-3 arcsec	Reference catalog parallax
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, &#x2
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCO
NUMOBS_INIT	int64		Initial number of observations for target calculated across target s
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SCND_TARGET[Page 400, 1]	int64		Target selection bitmask for secondary programs
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker

Table 44 – continued from previous page

Name	Type	Units	Description
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
EXPTIME	float64	s	Length of time shutter was open
SV1_MWS_TARGET[Page 400, 1]	int64		MWS (bright time program) target selection bitmask for SV1
SV1_BGS_TARGET[Page 400, 1]	int64		BGS (bright time program) target selection bitmask for SV1
SV1_SCND_TARGET[Page 400, 1]	int64		Secondary target selection bitmask for SV1
SV1_DESI_TARGET[Page 400, 1]	int64		DESI (dark time program) target selection bitmask for SV1
SV3_MWS_TARGET[Page 400, 1]	int64		MWS (bright time program) target selection bitmask for SV3
SV3_SCND_TARGET[Page 400, 1]	int64		Secondary target selection bitmask for SV3
SV3_DESI_TARGET[Page 400, 1]	int64		DESI (dark time program) target selection bitmask for SV3
SV3_BGS_TARGET[Page 400, 1]	int64		BGS (bright time program) target selection bitmask for SV3
CMX_TARGET[Page 400, 1]	int64		Target selection bitmask for commissioning
SV2_SCND_TARGET[Page 400, 1]	int64		Secondary target selection bitmask for SV2
SV2_BGS_TARGET[Page 400, 1]	int64		BGS (bright time program) target selection bitmask for SV2
SV2_DESI_TARGET[Page 400, 1]	int64		DESI (dark time program) target selection bitmask for SV2
SV2_MWS_TARGET[Page 400, 1]	int64		MWS (bright time program) target selection bitmask for SV2

Notes and Examples

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

tilepix-TILEID.json

Summary
This file maps the TILEID for an exposure to HEALpix pixels (nested nside=64).

Naming Convention
`tilepix-TILEID.json`, where `TILEID` is the tile id number.

Regex
`tilepix-[0-9]+\.json`

File Type
JSON, 1 KB

Since each exposure observes one tile, the mapping consists of a keyword which is the TILEID to petal number, 0 - 9, which in turn is mapped to the HEALPix pixels that overlap the petal.

Example:

```
{"51": {"0": [25596, 25598, 25599, 26965],
        "1": [25595, 25598, 25599, 26961, 26964, 26965],
        "2": [26961, 26964, 26965, 26966],
        "3": [26964, 26965, 26966, 26967],
        "4": [26965, 26967, 26973, 27650, 27656],
        "5": [26965, 27648, 27650, 27651],
        "6": [26965, 27648, 27649, 27650, 27651],
        "7": [25599, 26282, 26283, 26965, 27648, 27649],
        "8": [25597, 25599, 26280, 26282, 26965],
        "9": [25596, 25597, 25598, 25599, 26965]}}
```


tiles

Spectra, coadds, and redshifts organized **per tile** are under `tiles/GROUPTYPE/TILEID/GROUPID`. These come in various groups (GROUPTYPE), e.g. whether they are data from a single exposure, a single night, all data for a given tile across all nights, or a custom combination.

Related: all data for a given patch of sky, including data grouped across overlapping tiles and coadds of targets observed on multiple tiles, are organized under the *healpix* directories.

`GROUPTYPE` can be one of:

`cumulative`
: Coadds of all spectra on a given tile across all nights.

`pernight`
: Coadds of all spectra on a given tile in a given night.

`perexp`
: Spectra grouped by tile and then exposure.

`1x_depth`
: Selected custom subsets of exposures of deep ($N >> 1$ exposures) tiles to achieve a combined depth for each subset matching the main survey depth. That is, they are subsets of the total exposures taken for that tile, selected to achieve a specific depth, for systematics comparisons with the full depth coadds+redshifts in the cumulative group that has all exposures for each tile.

`4x_depth`
: Similar to `1x_depth`, but selected to achieve a combined depth of 4x the main survey depth.

`lowspeed`
: Coadds of deep tiles using only exposures taken under poor observing conditions, for systematics checks vs. coadds using data taken under normal/good conditions. "lowspeed" refers to the rate at which S/N is accumulated.

Other custom `GROUPTYPE` may appear in future produtions, and not every production will include every `GROUPTYPE`.

The `GROUPID` depends on the `GROUPTYPE`:

GROUPTYPE	GROUPID
cumulative	YEARMMDD NIGHT - all data through that night
pernight	YEARMMDD NIGHT - only data from that night
perexp	EXPID - only data from that single exposure
1x_depth	subset number
4x_depth	subset number
lowspeed	subset number

e.g. spectra, coadds, and redshifts for all exposures of tile 80605 observed on 20210109 are under `tiles/pernight/80605/20210109`, while all data for tile 80605 for all nights through 20210205 (including previous nights like 20210109) are under `tiles/cumulative/80605/20210205`.

Subdirectories of `tiles/` :

GROUPTYPE

Per-tile spectra, coadds, and redshifts are grouped in `tiles/GROUPTYPE/TILEID/GROUPID`; See the *top-level tiles/ description* for an overview of the GROUPTYPE and GROUPID options.

Subdirectories of tiles/GROUPTYPE:

TILEID

Per-tile spectra, coadds, and redshifts are grouped in `tiles/GROUPTYPE/TILEID/GROUPID`; See the *top-level tiles/ description* for an overview of the GROUPTYPE and GROUPID options.

Subdirectories of tiles/GROUPTYPE/TILEID:

GROUPID

Per-tile spectra, coadds, and redshifts are grouped in `tiles/GROUPTYPE/TILEID/GROUPID`; See the *top-level tiles/ description* for an overview of the GROUPTYPE and GROUPID options.

Files in tiles/GROUPTYPE/TILEID/GROUPID:

coadd-SPECTROGRAPH-TILEID-GROUPID.fits

Summary
Coadded spectra.

Naming Convention
`coadd-SPECTROGRAPH-TILEID-GROUPID.fits`, where `SPECTROGRAPH` is the spectrograph ID, `TILEID` is the tile number and `GROUPID` depends on the `GROUPTYPE` of the tile coadd.

Regex
`coadd-[0-9]-[0-9]+-([14]xsubset[1-6]|lowspeedsubset[1-6]|exp[0-9]{8}|thru[0-9]{8}|[0-9]{8})\.fits`

File Type
FITS, 213 MB

Coadd files contain spectra for multiple targets coadded across exposures but not across spectrograph cameras. This file follows nearly the same format as the *spectra files*, except there is one entry per target instead of one entry per exposure per target, and the FIBERMAP is split into two HDUs:

- FIBERMAP: values such as fluxes and targeting bits that remain applicable for each target even after a coadd.
- EXP_FIBERMAP: values like fiber offsets and atmospheric seeing that apply to the individual exposures contributing to the coadd.

The coadded FIBERMAP also gets some new summary columns, *e.g.* `COADD_NUMEXP` and `COADD_NUMTILE` recording the number of exposures and unique TILEIDs contributing to the coadd.

Contents

Number	EXTNAME	Type	Contents
HDU00		IMAGE	Keywords only
HDU01	FIBERMAP	BINTABLE	Coadded fibermap table
HDU02	EXP_FIBERMAP	BINTABLE	Per-exposure entries from input fibermaps
HDU03	B_WAVELENGTH	IMAGE	Wavelength array of b-channel spectra
HDU04	B_FLUX	IMAGE	Flux of b-channel spectra
HDU05	B_IVAR	IMAGE	Inverse variance of b-channel spectra
HDU06	B_MASK	IMAGE	Mask of b-channel spectra
HDU07	B_RESOLUTION	IMAGE	Resolution matrices of b-channel spectra
HDU08	R_WAVELENGTH	IMAGE	Wavelength array of r-channel spectra
HDU09	R_FLUX	IMAGE	Flux of r-channel spectra
HDU10	R_IVAR	IMAGE	Inverse variance of r-channel spectra
HDU11	R_MASK	IMAGE	Mask of r-channel spectra
HDU12	R_RESOLUTION	IMAGE	Resolution matrices of r-channel spectra
HDU13	Z_WAVELENGTH	IMAGE	Wavelength array of z-channel spectra
HDU14	Z_FLUX	IMAGE	Flux of z-channel spectra
HDU15	Z_IVAR	IMAGE	Inverse variance of z-channel spectra
HDU16	Z_MASK	IMAGE	Mask of z-channel spectra
HDU17	Z_RESOLUTION	IMAGE	Resolution matrices of z-channel spectra
HDU18	SCORES	BINTABLE	QA scores table

Note: the above is the order in which these HDUs appear in DESI spectroscopic pipeline output, but the order is arbitrary and they should be read by name not by number.

FITS Header Units

HDU00

Keywords only.

Required Header Keywords

KEY	Example Value	Type	Comment
SPGRP	cumulative	str	Method of grouping spectra for coadd, e.g. PERNIGHT or CUMULATIVE
SPGRPVAL	20210205	int	Group value for this coadd, e.g.
NIGHT[1]	20210708	int	YEARMMDD night identifier for "pernight" and "cumulative" groups
TILEID	80605	int	DESI Tile ID
SPECTRO	2	int	Spectrograph number
PETAL	2	int	Focal plane petal number
CHECKSUM	AfAMBZ1KAf8KAZ8K	str	HDU checksum updated 2021-07-16T14:01:46
DATASUM	0	str	data unit checksum updated 2021-07-16T14:01:46
FIBERMIN	1000	int	First fiber number included in this coadd
INFIL000	spectra-2-545-thru20210510.fits	str	Input file(s) contributing to this coadd
LONGSTRN	OGIP 1.0	str	

Empty HDU.

HDU01

EXTNAME = FIBERMAP

Fibermap information combining the targeting photometry and metadata, and fiberassign requested positions. In the coadds, this HDU contains only the information that remains applicable to coadded spectra, e.g. the target flux values. Values that are only meaningful per-exposure (*e.g.* FIBER_X, FIBER_Y) are contained in the separate *EXP_FIBERMAP* HDU.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	387	int	
NAXIS2	500	int	Number of targets
ENCODING	ascii	str	
LONGSTRN	OGIP 1.0	str	
CHECKSUM	H5Z5H5Z3H5Z3H5Z3	str	HDU checksum updated 2021-07-16T14:01:46
DATASUM	4214162542	str	data unit checksum updated 2021-07-16T14:01:46

[1] Optional

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LO
FIBER	int32		Fiber ID on the CCDs [0-4999]
COADD_FIBERSTATUS	int32		bitwise-AND of input FIBERSTATUS
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec)
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 fo
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fi
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TY
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, sup
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or ble
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; “sourceid” for Ga
REF_CAT	char[2]		Reference catalog source for star: “T2” for Tycho-2, “G2” for G
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
BRICKNAME	char[8]		Brick name from tractor input
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from

Table 45 – continued from previous page

Name	Type	Units	Description
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE='
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORI
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORI
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, &#x
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSC
NUMOBS_INIT	int64		Initial number of observations for target calculated across targe
SV1_DESI_TARGET[Page 420, 1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_BGS_TARGET[Page 420, 1]	int64		BGS (bright time program) target selection bitmask for SV1
SV1_MWS_TARGET[Page 420, 1]	int64		MWS (bright time program) target selection bitmask for SV1
SV1_SCND_TARGET[Page 420, 1]	int64		Secondary target selection bitmask for SV1
SV3_DESI_TARGET[Page 420, 1]	int64		DESI (dark time program) target selection bitmask for SV3
SV3_BGS_TARGET[Page 420, 1]	int64		BGS (bright time program) target selection bitmask for SV3
SV3_MWS_TARGET[Page 420, 1]	int64		MWS (bright time program) target selection bitmask for SV3
SV3_SCND_TARGET[Page 420, 1]	int64		Secondary target selection bitmask for SV3
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SCND_TARGET[Page 420, 1]	int64		Target selection bitmask for secondary programs
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
TILEID	int32		Unique DESI tile ID
COADD_NUMEXP	int16		Number of exposures in coadd
COADD_EXPTIME	float32	s	Summed exposure time for coadd
COADD_NUMNIGHT	int16		Number of nights in coadd
COADD_NUMTILE	int16		Number of tiles in coadd
MEAN_DELTA_X	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 X
RMS_DELTA_X	float32	mm	RMS (over exposures) of the fiber difference between measured
MEAN_DELTA_Y	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 Y
RMS_DELTA_Y	float32	mm	RMS (over exposures) of the fiber difference between measured
MEAN_FIBER_RA	float64	deg	Mean (over exposures) RA of actual fiber position
STD_FIBER_RA	float32	arcsec	Standard deviation (over exposures) of RA of actual fiber positi
MEAN_FIBER_DEC	float64	deg	Mean (over exposures) DEC of actual fiber position
STD_FIBER_DEC	float32	arcsec	Standard deviation (over exposures) of DEC of actual fiber posi
MEAN_PSF_TO_FIBER_SPECFLUX	float32		Mean of input exposures fraction of light from point-like source
MEAN_FIBER_X	float32	mm	Mean (over exposures) fiber CS5 X location on focal plane
MEAN_FIBER_Y	float32	mm	Mean (over exposures) fiber CS5 Y location on focal plane

HDU02

EXTNAME = EXP_FIBERMAP

Fibermap entries that only apply to individual exposures, not to a coadd. This table has one row per input target per exposure. Also see the *FIBERMAP* HDU for coadded fibermap quantities with one row per target.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	162	int	
NAXIS2	1000	int	Number of input target exposures
ENCODING	ascii	str	
CHECKSUM	3f5X4e3U3e3U3e3U	str	HDU checksum updated 2021-07-16T14:01:46
DATASUM	360255485	str	data unit checksum updated 2021-07-16T14:01:46

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
NIGHT	int32		
EXPID	int32		DESI Exposure ID number
MJD	float64		Modified Julian Date when shutter was opened for this exposure
TILEID	int32		Unique DESI tile ID
EXPTIME	float64	s	Length of time shutter was open
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
PSF_TO_FIBER_SPECFLUX	float64		fraction of light from point-like source captured by 1.5 arcsec diameter fiber given atmospheric seeing

HDU03

EXTNAME = B_WAVELENGTH

Wavelength grid of spectra from the B camera.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelength bins
BUNIT	Angstrom	str	
CHECKSUM	7CGAA9F99AFAA9F9	str	HDU checksum updated 2021-07-16T14:01:46
DATASUM	979185614	str	data unit checksum updated 2021-07-16T14:01:46

Data: FITS image [float64, 2751]

HDU04

EXTNAME = B_FLUX

Extracted spectral flux from the B camera.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelength bins
NAXIS2	500	int	Number of spectra
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	
CHECKSUM	lgKZngKZlgKZlgKZ	str	HDU checksum updated 2021-07-16T14:01:46
DATASUM	1157856797	str	data unit checksum updated 2021-07-16T14:01:46

Data: FITS image [float32, 2751x500]

HDU05

EXTNAME = B_IVAR

Inverse variance of the B_FLUX HDU.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelength bins
NAXIS2	500	int	Number of spectra
BUNIT	10**+34 (s2 cm4 Angstrom2) / erg2	str	
CHECKSUM	JATXJASUJASUJASU	str	HDU checksum updated 2021-07-16T14:01:47
DATASUM	2428790047	str	data unit checksum updated 2021-07-16T14:01:47

Data: FITS image [float32, 2751x500]

HDU06

EXTNAME = B_MASK

Mask for B-camera flux values. 0=good. See the *bitmask documentation* for definitions of individual bits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelength bins
NAXIS2	500	int	Number of spectra
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	W4fLW4dLW4dLW4dL	str	HDU checksum updated 2021-07-16T14:01:47
DATASUM	688030	str	data unit checksum updated 2021-07-16T14:01:47

Data: FITS image [int32, 2751x500]

HDU07

EXTNAME = B_RESOLUTION

Resolution matrix stored as diagonals of a 3D sparse matrix. See the frame file *RESOLUTION documentation* for how these are interpreted and used.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	Number of wavelength bins
NAXIS2	11	int	Number of diagonals
NAXIS3	500	int	Number of spectra
CHECKSUM	1l9M1i6K1i6K1i6K	str	HDU checksum updated 2021-07-16T14:01:50
DATASUM	1827421509	str	data unit checksum updated 2021-07-16T14:01:50

Data: FITS image [float32, 2751x11x500]

A sparse resolution matrix may be created for spectrum `i` with:

```
from desispec.resolution import Resolution
R = Resolution(data[i])
```

Or using lower-level scipy.sparse matrices:

```
import scipy.sparse
import numpy as np
nspec, ndiag, nwave = data.shape
offsets = ndiag//2 - np.arange(ndiag, dtype=int)
R = scipy.sparse.dia_matrix((data[i], offsets), shape=(nwave, nwave))
```

HDU08

EXTNAME = R_WAVELENGTH

Wavelength grid of spectra from the R camera.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	Number of wavelength bins
BUNIT	Angstrom	str	
CHECKSUM	7JPAAHO78HOAAHO7	str	HDU checksum updated 2021-07-16T14:01:51
DATASUM	456732359	str	data unit checksum updated 2021-07-16T14:01:51

Data: FITS image [float64, 2326]

HDU09

EXTNAME = R_FLUX

Extracted spectral flux from the R camera.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	Number of wavelength bins
NAXIS2	500	int	Number of spectra
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	
CHECKSUM	M3ENO3BMM3BMM3BM	str	HDU checksum updated 2021-07-16T14:01:51
DATASUM	640139918	str	data unit checksum updated 2021-07-16T14:01:51

Data: FITS image [float32, 2326x500]

HDU10

EXTNAME = R_IVAR

Inverse variance of the R_FLUX HDU.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	Number of wavelength bins
NAXIS2	500	int	Number of spectra
BUNIT	10**+34 (s2 cm4 Angstrom2) / erg2	str	
CHECKSUM	VDCjYABhVABhVABh	str	HDU checksum updated 2021-07-16T14:01:51
DATASUM	2650218726	str	data unit checksum updated 2021-07-16T14:01:51

Data: FITS image [float32, 2326x500]

HDU11

EXTNAME = R_MASK

Mask for R-camera flux values. 0=good. See the *bitmask documentation* for definitions of individual bits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	Number of wavelength bins
NAXIS2	500	int	Number of spectra
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	m7e4n4e1m4e1m4e1	str	HDU checksum updated 2021-07-16T14:01:51
DATASUM	582966	str	data unit checksum updated 2021-07-16T14:01:51

Data: FITS image [int32, 2326x500]

HDU12

EXTNAME = R_RESOLUTION

Resolution matrix stored as diagonals of a 3D sparse matrix. See the frame file *RESOLUTION documentation* for how thease are interpreted and used.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	Number of wavelength bins
NAXIS2	11	int	Number of diagonals
NAXIS3	500	int	Number of spectra
CHECKSUM	e3FYh09Xe0CXe09X	str	HDU checksum updated 2021-07-16T14:01:54
DATASUM	1488519775	str	data unit checksum updated 2021-07-16T14:01:54

Data: FITS image [float32, 2326x11x500]

HDU13

EXTNAME = Z_WAVELENGTH

Wavelength grid of spectra from the Z camera.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	Number of wavelength bins
BUNIT	Angstrom	str	
CHECKSUM	gaVNgYSLgaSLgWSL	str	HDU checksum updated 2021-07-16T14:01:54
DATASUM	3106662670	str	data unit checksum updated 2021-07-16T14:01:54

Data: FITS image [float64, 2881]

HDU14

EXTNAME = Z_FLUX

Extracted spectral flux from the Z camera.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	Number of wavelength bins
NAXIS2	500	int	Number of spectra
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	
CHECKSUM	9GPWGFMU9FMUGFMU	str	HDU checksum updated 2021-07-16T14:01:55
DATASUM	3338246075	str	data unit checksum updated 2021-07-16T14:01:55

Data: FITS image [float32, 2881x500]

HDU15

EXTNAME = Z_IVAR

Inverse variance of the Z_FLUX HDU.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	Number of wavelength bins
NAXIS2	500	int	Number of spectra
BUNIT	10**+34 (s2 cm4 Angstrom2) / erg2	str	
CHECK-SUM	4Ala47iR4AiX47iX	str	HDU checksum updated 2021-07-16T14:01:55
DATASUM	2758170465	str	data unit checksum updated 2021-07-16T14:01:55

Data: FITS image [float32, 2881x500]

HDU16

EXTNAME = Z_MASK

Mask for Z-camera flux values. 0=good. See the *bitmask documentation* for definitions of individual bits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	Number of wavelength bins
NAXIS2	500	int	Number of spectra
BSCALE	1	int	
BZERO	2147483648	int	
CHECKSUM	95fkD3fk93fkC3fk	str	HDU checksum updated 2021-07-16T14:01:56
DATASUM	720616	str	data unit checksum updated 2021-07-16T14:01:56

Data: FITS image [int32, 2881x500]

HDU17

EXTNAME = Z_RESOLUTION

Resolution matrix stored as diagonals of a 3D sparse matrix. See the frame file *RESOLUTION documentation* for how thease are interpreted and used.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	Number of wavelength bins
NAXIS2	11	int	Number of diagonals
NAXIS3	500	int	Number of spectra
CHECKSUM	DFFSG99QDECQD99Q	str	HDU checksum updated 2021-07-16T14:01:59
DATASUM	500309470	str	data unit checksum updated 2021-07-16T14:01:59

Data: FITS image [float32, 2881x11x500]

HDU18

EXTNAME = SCORES

Scores / metrics measured from the spectra for use in QA and systematics studies. These are coadded from the input *cframe SCORES HDU* files.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	172	int	Width of table in bytes
NAXIS2	500	int	Number of spectra
ENCODING	ascii	str	
CHECKSUM	EpXcGmWcEmWcEmWc	str	HDU checksum updated 2021-07-16T14:01:59
DATASUM	1286335698	str	data unit checksum updated 2021-07-16T14:01:59

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
INTEG_COADD_FLUX_B	float32		integ. flux in wave. range 4000,5800A
MEDIAN_COADD_FLUX_B	float32		median flux in wave. range 4000,5800A
MEDIAN_COADD_SNR_B	float32		median SNR/sqrt(A) in wave. range 4000,5800A
INTEG_COADD_FLUX_R	float32		integ. flux in wave. range 5800,7600A
MEDIAN_COADD_FLUX_R	float32		median flux in wave. range 5800,7600A
MEDIAN_COADD_SNR_R	float32		median SNR/sqrt(A) in wave. range 5800,7600A
INTEG_COADD_FLUX_Z	float32		integ. flux in wave. range 7600,9800A
MEDIAN_COADD_FLUX_Z	float32		median flux in wave. range 7600,9800A
MEDIAN_COADD_SNR_Z	float32		median SNR/sqrt(A) in wave. range 7600,9800A
TSNR2_GPBDARK_B	float32		template (S/N)^2 for dark targets in guider pass band on B
TSNR2_ELG_B	float32		ELG B template (S/N)^2
TSNR2_GPBBRIGHT_B	float32		template (S/N)^2 for bright targets in guider pass band on B
TSNR2_LYA_B	float32		LYA B template (S/N)^2
TSNR2_BGS_B	float32		BGS B template (S/N)^2
TSNR2_GPBBACKUP_B	float32		GPBBACKUP B template (S/N)^2

continues on next page

Table 46 – continued from previous page

Name	Type	Units	Description
TSNR2_QSO_B	float32		QSO B template (S/N)^2
TSNR2_LRG_B	float32		LRG B template (S/N)^2
TSNR2_GPBDARK_R	float32		template (S/N)^2 for dark targets in guider pass band on R
TSNR2_ELG_R	float32		ELG R template (S/N)^2
TSNR2_GPBBRIGHT_R	float32		template (S/N)^2 for bright targets in guider pass band on R
TSNR2_LYA_R	float32		LYA R template (S/N)^2
TSNR2_BGS_R	float32		BGS R template (S/N)^2
TSNR2_GPBBACKUP_R	float32		GPBBACKUP R template (S/N)^2
TSNR2_QSO_R	float32		QSO R template (S/N)^2
TSNR2_LRG_R	float32		LRG R template (S/N)^2
TSNR2_GPBDARK_Z	float32		template (S/N)^2 for dark targets in guider pass band on Z
TSNR2_ELG_Z	float32		ELG Z template (S/N)^2
TSNR2_GPBBRIGHT_Z	float32		template (S/N)^2 for bright targets in guider pass band on Z
TSNR2_LYA_Z	float32		LYA Z template (S/N)^2
TSNR2_BGS_Z	float32		BGS Z template (S/N)^2
TSNR2_GPBBACKUP_Z	float32		GPBBACKUP Z template (S/N)^2
TSNR2_QSO_Z	float32		QSO Z template (S/N)^2
TSNR2_LRG_Z	float32		LRG Z template (S/N)^2
TSNR2_GPBDARK	float32		template (S/N)^2 for dark targets in guider pass band
TSNR2_ELG	float32		ELG template (S/N)^2 summed over B,R,Z
TSNR2_GPBBRIGHT	float32		template (S/N)^2 for bright targets in guider pass band
TSNR2_LYA	float32		LYA template (S/N)^2 summed over B,R,Z
TSNR2_BGS	float32		BGS template (S/N)^2 summed over B,R,Z
TSNR2_GPBBACKUP	float32		GPBBACKUP template (S/N)^2 summed over B,R,Z
TSNR2_QSO	float32		QSO template (S/N)^2 summed over B,R,Z
TSNR2_LRG	float32		LRG template (S/N)^2 summed over B,R,Z

Notes and Examples

Coadd files can be read and interpreted using the same code examples shown in the "Notes and Examples" section of the *spectra files* documentation.

The format supports arbitrary channel (camera) names as long as for each channel {X} there is a set of HDUs named {X}_WAVELENGTH, {X}_FLUX, {X}_IVAR, {X}_MASK, {X}_RESOLUTION.

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

emline-SPECTROGRAPH-TILEID-GROUPID.fits

Summary
This file records simple (Gaussian) emission line fits on the spectra for few major lines.

Naming Convention
`emline-SPECTROGRAPH-TILEID-GROUPID.fits`, where `SPECTROGRAPH` is the spectrograph ID, `TILEID` is the tile number and `GROUPID` depends on the `GROUPTYPE` of the tile coadd.

Regex
`emline-[0-9]-[0-9]+-([14]xsubset[1-6]|lowspeedsubset[1-6]|exp[0-9]{8}|thru[0-9]{8}|[0-9]{8})\.fits`

File Type
FITS, 188 KB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	EMLINEFIT	BINTABLE	Emission line fits table

FITS Header Units

HDU0

Empty HDU.

HDU1

EXTNAME = EMLINEFIT

Table with the emission line fit results for few major lines.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	345	int	width of table in bytes
NAXIS2	500	int	number of rows in table
RRFN	/global/cfs/cdirs/desi/spectro/redux/fuji/tiles/1x_depth/80608/5/redrock-1-80608-1xsubset5.fits	str	full path to the redrock file which contains the redshifts
COADDFN	/global/cfs/cdirs/desi/spectro/redux/fuji/tiles/1x_depth/80608/5/coadd-1-80608-1xsubset5.fits	str	full path to the coadd file which contains the spectra
RFHW	40	int	[Angstrom] rest-frame wavelength width used for fitting on each side of the line
MIN-RFHW	20	int	[Angstrom] minimum requested *rest-frame* width on each side of the line to consider the fitting
RF-CONTW	200	int	[Angstrom] rest-frame wavelength extent to fit the continuum
RV	3.1	float	value of R_V to convert EBV to magnitudes
EM-NAMES	OII,HDELTA,HGAMMA,HBETA,OIII,HALPHA	str	comma-separated list of emission lines to fit
RFWAVE00	3727.092,3729.874	str	[Angstrom] rest-frame, vacuum, wavelength for the first emission line to fit
RFWAVE01	4102.892	str	[Angstrom] rest-frame, vacuum, wavelength for the second emission line to fit
RFWAVE02	4341.684	str	[Angstrom] rest-frame, vacuum, wavelength for the third emission line to fit
RFWAVE03	4862.683	str	[Angstrom] rest-frame, vacuum, wavelength for the forth emission line to fit
RFWAVE04	4960.295,5008.239	str	[Angstrom] rest-frame, vacuum, wavelength for the fifth emission line to fit
RFWAVE05	6564.613	str	[Angstrom] rest-frame, vacuum, wavelength for the sixth emission line to fit

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask from Redrock
SPECTYPE	char[6]		Spectral type of Redrock best fit template (e.g. GAL
DELTACHI2	float64		chi2 difference between first- and second-best redroc
TARGET_RA	float64	deg	Target right ascension
TARGET_DEC	float64	deg	Target declination
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
OII_FLUX	float32	10**-17 erg/(s cm2)	Fitted flux for the [OII] doublet
OII_FLUX_IVAR	float32	10**+34 (s2 cm4) / erg2	Inverse variance of the fitted flux for the [OII] double
OII_SIGMA	float32	Angstrom	Fitted line width (in the observed frame) for the [OII
OII_SIGMA_IVAR	float32	Angstrom^-2	Inverse variance of the fitted line width (in the observ
OII_CONT	float32	10**-17 erg/(s cm2 Angstrom)	Continuum used for the fitting (fixed value) for the [O
OII_CONT_IVAR	float32	10**+34 (s2 cm4 Angstrom2) / erg2	Inverse variance of the continuum for the [OII] doubl

Table 47 – continued from previous page

Name	Type	Units	Description
OII_SHARE	float32		Fitted F1/(F0+F1) for the [OII] doublet, where F0 an
OII_SHARE_IVAR	float32		Inverse variance of the fitted F1/(F0+F1) for the [OII
OII_EW	float32	Angstrom	Fitted rest-frame equivalent width for the [OII] doubl
OII_EW_IVAR	float32	Angstrom^-2	Inverse variance of the fitted rest-frame equivalent w
OII_CHI2	float32		Reduced chi2 of the fit for the [OII] doublet
OII_NDOF	int32		Number of degrees of freedom of the fit for the [OII]
HDELTA_FLUX	float32	10**-17 erg/(s cm2)	Fitted flux for the HDELTA line
HDELTA_FLUX_IVAR	float32	10**+34 (s2 cm4) / erg2	Inverse variance of the fitted flux for the HDELTA lin
HDELTA_SIGMA	float32	Angstrom	Fitted line width (in the observed frame) for the HDE
HDELTA_SIGMA_IVAR	float32	Angstrom^-2	Inverse variance of the fitted line width (in the observ
HDELTA_CONT	float32	10**-17 erg/(s cm2 Angstrom)	Continuum used for the fitting (fixed value) for the H
HDELTA_CONT_IVAR	float32	10**+34 (s2 cm4 Angstrom2) / erg2	Inverse variance of the continuum for the HDELTA l
HDELTA_SHARE	float32		NaN (SHARE not relevant for HDELTA line)
HDELTA_SHARE_IVAR	float32		NaN (SHARE not relevant for HDELTA line)
HDELTA_EW	float32	Angstrom	Fitted rest-frame equivalent width for the HDELTA l
HDELTA_EW_IVAR	float32	Angstrom^-2	Inverse variance of the fitted rest-frame equivalent w
HDELTA_CHI2	float32		Reduced chi2 of the fit for the HDELTA line
HDELTA_NDOF	int32		Number of degrees of freedom of the fit for the HDE
HGAMMA_FLUX	float32	10**-17 erg/(s cm2)	Fitted flux for the HGAMMA line
HGAMMA_FLUX_IVAR	float32	10**+34 (s2 cm4) / erg2	Inverse variance of the fitted flux for the HGAMMA
HGAMMA_SIGMA	float32	Angstrom	Fitted line width (in the observed frame) for the HGA
HGAMMA_SIGMA_IVAR	float32	Angstrom^-2	Inverse variance of the fitted line width (in the observ
HGAMMA_CONT	float32	10**-17 erg/(s cm2 Angstrom)	Continuum used for the fitting (fixed value) for the H
HGAMMA_CONT_IVAR	float32	10**+34 (s2 cm4 Angstrom2) / erg2	Inverse variance of the continuum for the HGAMMA
HGAMMA_SHARE	float32		NaN (SHARE not relevant for HGAMMA line)
HGAMMA_SHARE_IVAR	float32		NaN (SHARE not relevant for HGAMMA line)
HGAMMA_EW	float32	Angstrom	Fitted rest-frame equivalent width for the HGAMMA
HGAMMA_EW_IVAR	float32	Angstrom^-2	Inverse variance of the fitted rest-frame equivalent w
HGAMMA_CHI2	float32		Reduced chi2 of the fit for the HGAMMA line
HGAMMA_NDOF	int32		Number of degrees of freedom of the fit for the HGA
HBETA_FLUX	float32	10**-17 erg/(s cm2)	Fitted flux for the HBETA line
HBETA_FLUX_IVAR	float32	10**+34 (s2 cm4) / erg2	Inverse variance of the fitted flux for the HBETA line
HBETA_SIGMA	float32	Angstrom	Fitted line width (in the observed frame) for the HBE
HBETA_SIGMA_IVAR	float32	Angstrom^-2	Inverse variance of the fitted line width (in the observ
HBETA_CONT	float32	10**-17 erg/(s cm2 Angstrom)	Continuum used for the fitting (fixed value) for the H
HBETA_CONT_IVAR	float32	10**+34 (s2 cm4 Angstrom2) / erg2	Inverse variance of the continuum for the HBETA lin
HBETA_SHARE	float32		NaN (SHARE not relevant for HBETA line)
HBETA_SHARE_IVAR	float32		NaN (SHARE not relevant for HBETA line)
HBETA_EW	float32	Angstrom	Fitted rest-frame equivalent width for the HBETA lin
HBETA_EW_IVAR	float32	Angstrom^-2	Inverse variance of the fitted rest-frame equivalent w
HBETA_CHI2	float32		Reduced chi2 of the fit for the HBETA line
HBETA_NDOF	int32		Number of degrees of freedom of the fit for the HBE
OIII_FLUX	float32	10**-17 erg/(s cm2)	Fitted flux for the [OIII] doublet
OIII_FLUX_IVAR	float32	10**+34 (s2 cm4) / erg2	Inverse variance of the fitted flux for the [OIII] doubl
OIII_SIGMA	float32	Angstrom	Fitted line width (in the observed frame) for the [OII
OIII_SIGMA_IVAR	float32	Angstrom^-2	Inverse variance of the fitted line width (in the observ
OIII_CONT	float32	10**-17 erg/(s cm2 Angstrom)	Continuum used for the fitting (fixed value) for the [C
OIII_CONT_IVAR	float32	10**+34 (s2 cm4 Angstrom2) / erg2	Inverse variance of the continuum for the [OIII] doub
OIII_SHARE	float32		F1/(F0+F1) for the [OIII] doublet, where F0 and F1 a

Table 47 – continued from previous page

Name	Type	Units	Description
OIII_SHARE_IVAR	float32		Infinite value, as SHARE is fixed during the fit
OIII_EW	float32	Angstrom	Fitted rest-frame equivalent width for the [OIII] doub
OIII_EW_IVAR	float32	Angstrom^-2	Inverse variance of the fitted rest-frame equivalent w
OIII_CHI2	float32		Reduced chi2 of the fit for the [OIII] doublet
OIII_NDOF	int32		Number of degrees of freedom of the fit for the [OIII
HALPHA_FLUX	float32	10**-17 erg/(s cm2)	Fitted flux for the HALPHA line
HALPHA_FLUX_IVAR	float32	10**+34 (s2 cm4) / erg2	Inverse variance of the fitted flux for the HALPHA li
HALPHA_SIGMA	float32	Angstrom	Fitted line width (in the observed frame) for the HAL
HALPHA_SIGMA_IVAR	float32	Angstrom^-2	Inverse variance of the fitted line width (in the obser
HALPHA_CONT	float32	10**-17 erg/(s cm2 Angstrom)	Continuum used for the fitting (fixed value) for the H
HALPHA_CONT_IVAR	float32	10**+34 (s2 cm4 Angstrom2) / erg2	Inverse variance of the continuum for the HALPHA l
HALPHA_SHARE	float32		NaN (SHARE not relevant for HALPHA line)
HALPHA_SHARE_IVAR	float32		NaN (SHARE not relevant for HALPHA line)
HALPHA_EW	float32	Angstrom	Fitted rest-frame equivalent width for the HALPHA l
HALPHA_EW_IVAR	float32	Angstrom^-2	Inverse variance of the fitted rest-frame equivalent w
HALPHA_CHI2	float32		Reduced chi2 of the fit for the HALPHA line
HALPHA_NDOF	int32		Number of degrees of freedom of the fit for the HAL

Notes and Examples

- The fit is done with the desispec.scripts.emline script.
- [OII] is fit as a doublet (3927 and 3929), with the line ratio left free during the fit.
- [OIII] is fit as a doublet (4960 and 5007), with the line ratio fixed during the fit.
- The SHARE is fitted only for the [OII] doublet; for the [OIII] doublet, its value is fixed (hence the infinite OIII_SHARE_IVAR); for the other lines, the SHARE is not used, and NaN are reported.
- If there are not enough pixels to fit or if the fit fails, NaN values are reported.
- The default settings are designed for the ELGs (e.g. max_sigma); values to be interpreted with caution for the other targets.
- The fitted flux is not forced to be positive, so negative values can happen.
- The Z,ZWARN,SPECTYPE,DELTACHI2 (TARGET_RA,TARGET_DEC,OBJTYPE, respectively) columns come from the REDSHIFTS (FIBERMAP, respectively) extension of the input redrock file (see *redrock-SPECTROGRAPH-TILEID-GROUPID*).
- For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

qso_mgii-SPECTROGRAPH-TILEID-GROUPID.fits

Summary
This file contains the output of the MgII fitter which is a classifier algorithm to collect spectra with MgII broad emission line.

Naming Convention
`qso_mgii-SPECTROGRAPH-TILEID-GROUPID.fits`, where `SPECTROGRAPH` is the spectrograph ID, `TILEID` is the tile number and `GROUPID` depends on the `GROUPTYPE` of the tile coadd.

Regex
`qso_mgii-[0-9]-[0-9]+-([14]xsubset[1-6]|lowspeedsubset[1-6]|exp[0-9]{8}|thru[0-9]{8}|[0-9]{8})\.fits`

File Type
FITS, 19 KB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty.
HDU1	MGII	BINTABLE	Output of MgII fitter.

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = MGII

Output of MgII fitter.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	83	int	width of table in bytes
NAXIS2	131	int	number of rows in table

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
RA	float64	deg	Target Right Ascension
DEC	float64	deg	Target declination
Z_RR	float64		Redshift collected from redrock file
ZERR	float32		Redshift error from redrock
IS_QSO_MGII	logical		Boolean: True if the object passes the MgII selection
SV1_DESI_TARGET[1]	int64		DESI (dark time program) target selection bitmask for SV1
DESI_TARGET[1]	int64		DESI (dark time program) target selection bitmask
SPECTYPE	char[10]		Spectral type of Redrock best fit template (e.g. GALAXY, QSO, STAR)
DELTA_CHI2	float32		Difference of chi2 between redrock fit and MgII fitter over the lambda interval considered during the fit[2]
A	float32		fitted parameter by MgII fitter[2][3]
SIGMA	float32		fitted parameter by MgII fitter[2][3]
B	float32		fitted parameter by MgII fitter[3]
VAR_A	float32		error on A[2]
VAR_SIGMA	float32		error on SIGMA
VAR_B	float32		error on B

Notes and Examples

These files are generated with https://github.com/desihub/desispec/blob/master/bin/desi_qso_mgii_afterburner

As mentionned on the top of the previous file, the MgII fitter is available here: https://github.com/desihub/desispec/blob/master/py/desispec/mgii_afterburner.py

qso_qn-SPECTROGRAPH-TILEID-GROUPID.fits

Summary
This file contains the output of QuasarNet (QSO classification algorithm and redshift fitter). When there is a disagreement between the redshift from QN and Redrock, a new redshift is fitted using only QSO templates and redshift from QN as prior.

Naming Convention
`qso_qn-SPECTROGRAPH-TILEID-GROUPID.fits`, where `SPECTROGRAPH` is the spectrograph ID, `TILEID` is the tile number and `GROUPID` depends on the `GROUPTYPE` of the tile coadd.

Regex
`qso_qn-[0-9]-[0-9]+-([14]xsubset[1-6]|lowspeedsubset[1-6]|exp[0-9]{8}|thru[0-9]{8}|[0-9]{8})\.fits`

File Type
FITS, 33 KB

[1] Optional

[2] MgII selection is performed with these parameters. See: https://github.com/desihub/desispec/blob/720153babcf85dd93530252b0c1f631d48edfc0d/py/desispec/mgii_afterburner.py#L5

[3] MgII fitter use the following form: `fit_function = lambda x, A, sigma, B : A * np.exp(-1.0 * (x)**2 / (2 * sigma**2)) + B` See: https://github.com/desihub/desispec/blob/720153babcf85dd93530252b0c1f631d48edfc0d/py/desispec/mgii_afterburner.py#L283

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty.
HDU1	QN_RR	BINTABLE	Output of QuasarNet afterburner.

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = QN_RR

Contains the result of QuasarNet afterburner and the new redshift fit from run of Redrock with QSO templates and redshift prior from QuasarNet.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	151	int	width of table in bytes
NAXIS2	155	int	number of rows in table

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
RA	float64	deg	Target Right Ascension
DEC	float64	deg	Target declination
Z_NEW	float64		New redshift computed with redrock with QN prior and only qso templates
ZERR_NEW	float32		Redshift error from the new run of redrock
SV1_DESI_TARGET[1]	int64		DESI (dark time program) target selection bitmask for SV1
DESI_TARGET[Page 439, 1]	int64		DESI (dark time program) target selection bitmask
COEFFS	float32[10]		Coefficient of the fit for the new run of redrock
SPECTYPE	char[10]		Spectral type of Redrock best fit template (e.g. GALAXY, QSO, STAR)
Z_RR	float32		Redshift collected from redrock file
Z_QN	float32		Redshift measured by QuasarNET using line with highest confidence
IS_QSO_QN_NEW_RR	logical		QN identified as QSO at different redshift or classification than Redrock
C_LYA	float32		Confidence for LyA line, i.e. ~probability to be a QSO
C_CIV	float32		Confidence for CIV line
C_CIII	float32		Confidence for CIII line
C_MgII	float32		Confidence for MgII line
C_Hbeta	float32		Confidence for Hbeta line
C_Halpha	float32		Confidence for Halpha line
Z_LYA	float32		Redshift estimated by QuasarNET with LyA line
Z_CIV	float32		Redshift estimated by QuasarNET with CIV line
Z_CIII	float32		Redshift estimated by QuasarNET with CIII line
Z_MgII	float32		Redshift estimated by QuasarNET with MgII line
Z_Hbeta	float32		Redshift estimated by QuasarNET with Hbeta line
Z_Halpha	float32		Redshift estimated by QuasarNET with Halpha line

Notes:

`IS_QSO_QN_NEW_RR` is set if QuasarNET selects this as a QSO *and* the answer is different from Redrock, either because Redrock didn't identify it as a QSO or because the Redrock redshift differed by more than 0.05. If both QuasarNET and Redrock agree that it is a QSO and agree on the redshift, then `IS_QSO_QN_NEW_RR=False`.

The QuasarNET QSO selection is performed with the C_XXX confidence parameters. `IS_QSO_QN_NEW_RR` uses a relatively loose cut of `max(C_XXX) >= 0.5`; downstream code may choose to use a tighter cut.

Notes and Examples

These files are generated with https://github.com/desihub/desispec/blob/main/bin/desi_qso_qn_afterburner

[1] Optional

redrock-SPECTROGRAPH-TILEID-GROUPID.fits

Summary
Redshifts and spectral classifications from Redrock.

Naming Convention
`redrock-SPECTROGRAPH-TILEID-GROUPID.fits`, where `SPECTROGRAPH` is the spectrograph ID, `TILEID` is the tile number and `GROUPID` depends on the `GROUPTYPE` of the tile coadd.

Regex
`redrock-[0-9]-[0-9]+-([14]xsubset[1-6]|lowspeedsubset[1-6]|exp[0-9]{8}|thru[0-9]{8}|[0-9]{8})\.fits`

File Type
FITS, 450 KB

This file contains spectral classifications and redshifts for spectra coadded across exposures of an individual tile. For a similar file that also combined data across multiple tiles, see *healpix-based Redrock files*.

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Keywords only
HDU1	REDSHIFTS	BINTABLE	Table with redshifts and spectral classifications
HDU2	FIBERMAP	BINTABLE	Target photometry, metadata, and what fibers they are assigned to
HDU3	EXP_FIBERMAP	BINTABLE	Per-exposure entries from input fibermaps
HDU4	TSNR2	BINTABLE	Template signal-to-noise values from input coadd SCORES table

FITS Header Units

HDU0

Required Header Keywords

KEY	Example Value	Type	Comment
LONGSTRN	OGIP 1.0	str	
RRVER	0.15.0	str	Redrock version
TEMNAM00	GALAXY	str	Redrock template 00 name
TEMVER00	2.6	str	Redrock template 00 version
TEMNAM01	QSO	str	
TEMVER01	0.1	str	
TEMNAM02	STAR:::A	str	
TEMVER02	0.1	str	
TEMNAM03	STAR:::B	str	
TEMVER03	0.1	str	
TEMNAM04	STAR:::CV	str	
TEMVER04	0.1	str	
TEMNAM05	STAR:::F	str	
TEMVER05	0.1	str	
TEMNAM06	STAR:::G	str	
TEMVER06	0.1	str	
TEMNAM07	STAR:::K	str	
TEMVER07	0.1	str	
TEMNAM08	STAR:::M	str	
TEMVER08	0.1	str	
TEMNAM09	STAR:::WD	str	
TEMVER09	0.1	str	
SPGRP	cumulative	str	Exposure grouping (pernight, cumulative, …)
SPGRPVAL	20210205	int	Value of grouping (night, expid, …)
TILEID	80605	int	DESI Tile ID
SPECTRO	6	int	Spectrograph number
PETAL	6	int	Focal plane petal number (same as SPECTRO)
NIGHT[1]	20210205	int	(Last) night of data included, if applicable to grouping

Empty HDU.

HDU1

EXTNAME = REDSHIFTS

Spectral classifications and redshifts from Redrock.

[1] Optional

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	170	int	Width of table in bytes
NAXIS2	500	int	Number of targets in table

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
CHI2	float64		Best fit chi squared
COEFF	float64[10]		Redrock template coefficients
Z	float64		Redshift measured by Redrock
ZERR	float64		Redshift error from redrock
ZWARN	int64		Redshift warning bitmask from Redrock
NPIXELS	int64		Number of unmasked pixels contributing to the Redrock fit
SPECTYPE	char[6]		Spectral type of Redrock best fit template (e.g. GALAXY, QSO, STAR)
SUBTYPE	char[20]		Spectral subtype
NCOEFF	int64		Number of Redrock template coefficients
DELTACHI2	float64		chi2 difference between first- and second-best redrock template fits

HDU2

EXTNAME = FIBERMAP

Fibermap with target metadata such as photometry, target selection bits, and what fibers each target was assigned to. This table is row-matched to the REDSHIFTS table.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	371	int	Width of table in bytes
NAXIS2	500	int	Number of targets in table.

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LO
FIBER	int32		Fiber ID on the CCDs [0-4999]
COADD_FIBERSTATUS	int32		bitwise-AND of input FIBERSTATUS
TARGET_RA	float64	deg	Barycentric right ascension in ICRS

Table 48 – continued from previous page

Name	Type	Units	Description
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec)
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 fo
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fi
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TY
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, sup
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKNAME	char[8]		Brick name from tractor input
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or ble
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE='
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORP
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORP
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; “sourceid” for Ga
REF_CAT	char[2]		Reference catalog source for star: “T2” for Tycho-2, “G2” for G
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, &#x
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSC
NUMOBS_INIT	int64		Initial number of observations for target calculated across targe

Table 48 – continued from previous page

Name	Type	Units	Description
SV1_DESI_TARGET[Page 441, 1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_BGS_TARGET[Page 441, 1]	int64		BGS (bright time program) target selection bitmask for SV1
SV1_MWS_TARGET[Page 441, 1]	int64		MWS (bright time program) target selection bitmask for SV1
SV1_SCND_TARGET[Page 441, 1]	int64		Secondary target selection bitmask for SV1
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SCND_TARGET[Page 441, 1]	int64		Target selection bitmask for secondary programs
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
TILEID	int32		Unique DESI tile ID
COADD_NUMEXP	int16		Number of exposures in coadd
COADD_EXPTIME	float32	s	Summed exposure time for coadd
COADD_NUMNIGHT	int16		Number of nights in coadd
COADD_NUMTILE	int16		Number of tiles in coadd
MEAN_DELTA_X	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 X
RMS_DELTA_X	float32	mm	RMS (over exposures) of the fiber difference between measured
MEAN_DELTA_Y	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 Y
RMS_DELTA_Y	float32	mm	RMS (over exposures) of the fiber difference between measured
MEAN_FIBER_RA	float64	deg	Mean (over exposures) RA of actual fiber position
STD_FIBER_RA	float32	arcsec	Standard deviation (over exposures) of RA of actual fiber positi
MEAN_FIBER_DEC	float64	deg	Mean (over exposures) DEC of actual fiber position
STD_FIBER_DEC	float32	arcsec	Standard deviation (over exposures) of DEC of actual fiber posi
MEAN_PSF_TO_FIBER_SPECFLUX	float32		Mean of input exposures fraction of light from point-like source
MEAN_FIBER_X	float32	mm	Mean (over exposures) fiber CS5 X location on focal plane
MEAN_FIBER_Y	float32	mm	Mean (over exposures) fiber CS5 Y location on focal plane

HDU3

EXTNAME = EXP_FIBERMAP

Fibermap entries that vary from exposure to exposure, e.g. what exposures were include in the coadd and what focalplane (x,y) each target was located at for each exposure.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	162	int	Width of table in bytes
NAXIS2	500	int	Number of input target-exposures = rows in table

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
NIGHT	int32		
EXPID	int32		DESI Exposure ID number
MJD	float64		Modified Julian Date when shutter was opened for this exposure
TILEID	int32		Unique DESI tile ID
EXPTIME	float64	s	Length of time shutter was open
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
PSF_TO_FIBER_SPECFLUX	float64		fraction of light from point-like source captured by 1.5 arcsec diameter fiber given atmospheric seeing

HDU4

EXTNAME = TSNR2

Template signal-to-noise squared. These quantities weight the observed (S/N)^2 by which wavelengths matter most for different target types, e.g. QSOs weight blue wavelengths more while ELGs weight redder wavelengths more due to the wavelengths of the observed emission lines. For more details, see section 4.14 of Guy et al 2023.

This table is row-matched to the REDSHIFTS table.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	136	int	Width of table in bytes.
NAXIS2	500	int	Number of targets = number of table rows.

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
TSNR2_GPBDARK_B	float32		
TSNR2_ELG_B	float32		ELG B template (S/N)^2
TSNR2_GPBBRIGHT_B	float32		
TSNR2_LYA_B	float32		LYA B template (S/N)^2
TSNR2_BGS_B	float32		BGS B template (S/N)^2
TSNR2_GPBBACKUP_B	float32		
TSNR2_QSO_B	float32		QSO B template (S/N)^2
TSNR2_LRG_B	float32		LRG B template (S/N)^2
TSNR2_GPBDARK_R	float32		
TSNR2_ELG_R	float32		ELG R template (S/N)^2
TSNR2_GPBBRIGHT_R	float32		
TSNR2_LYA_R	float32		LYA R template (S/N)^2
TSNR2_BGS_R	float32		BGS R template (S/N)^2
TSNR2_GPBBACKUP_R	float32		
TSNR2_QSO_R	float32		QSO R template (S/N)^2
TSNR2_LRG_R	float32		LRG R template (S/N)^2
TSNR2_GPBDARK_Z	float32		
TSNR2_ELG_Z	float32		ELG Z template (S/N)^2
TSNR2_GPBBRIGHT_Z	float32		
TSNR2_LYA_Z	float32		LYA Z template (S/N)^2
TSNR2_BGS_Z	float32		BGS Z template (S/N)^2
TSNR2_GPBBACKUP_Z	float32		
TSNR2_QSO_Z	float32		QSO Z template (S/N)^2
TSNR2_LRG_Z	float32		LRG Z template (S/N)^2
TSNR2_GPBDARK	float32		
TSNR2_ELG	float32		ELG template (S/N)^2 summed over B,R,Z
TSNR2_GPBBRIGHT	float32		
TSNR2_LYA	float32		LYA template (S/N)^2 summed over B,R,Z
TSNR2_BGS	float32		BGS template (S/N)^2 summed over B,R,Z
TSNR2_GPBBACKUP	float32		
TSNR2_QSO	float32		QSO template (S/N)^2 summed over B,R,Z
TSNR2_LRG	float32		LRG template (S/N)^2 summed over B,R,Z

Notes and Examples

The REDSHIFTS, FIBERMAP, and TSNR2 tables are row-matched with one row per target. They also include a TARGETID column for confirmation and database-like joins with other tables. The EXP_FIBERMAP HDU has one row per target-exposure, and thus will have multiple entries per target when a target was observed on multiple input exposures.

This file is for redshifts from an individual spectrograph/petal of an individual tile. For a contatenation of all such files within a given survey and program, see the *ztile file*.

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

spectra-SPECTROGRAPH-TILEID-GROUPID.fits

Summary
Collection of non-coadded spectra across exposures and cameras for a given TILEID on a given SPECTROGRAPH [0-9].

Naming Convention
`spectra-SPECTROGRAPH-TILEID-GROUPID.fits`, where `SPECTROGRAPH` is the spectrograph ID (0-9), `TILEID` is the tile number and `GROUPID` depends on the `GROUPTYPE` of the tile coadd.

Regex
`spectra-[0-9]-[0-9]+-([14]xsubset[1-6]|lowspeedsubset[1-6]|exp[0-9]{8}|thru[0-9]{8}|[0-9]{8})\.fits`

File Type
FITS, 198 MB

Spectra files contain non-coadded spectra for multiple targets observed on multiple individual exposures and cameras. The format can contain any arbitrary set of targets, though the standard DESI spectroscopic pipeline outputs are grouped either by a single petal of a given tile, or all targets on a single healpix.

Tile-based spectra can be grouped in multiple ways across exposures and nights; see the top-level *SPECPROD/tiles/* description for an overview of the per-tile GROUPTYPE and GROUPID options. Healpix-based spectra are grouped by SURVEY and PROGRAM. Science analyses may release spectra in other groups, e.g. all the spectra selected for a particular analysis.

Please see *coadd files* for a coadded version of the same spectra in a very similar format.

The FIBERMAP table contains metadata about each target, with one row per target per exposure. The corresponding SCORES table contains quantities measured from the spectra, also with one row per target per exposure.

The spectra themselves are in a set of image HDUs for the FLUX, IVAR (inverse variance), MASK, and spectral RESOLUTION, each prefixed with a spectrograph camera name, e.g. B, R, or Z for DESI, though the format in general could support other numbers and names of cameras for other instruments. A row of each image HDU correponds to the target from the same row index of the FIBERMAP and SCORES HDUs.

Details are given below, with examples for reading and interpreting the spectra files at the end.

Note: the table below is the order in which these HDUs appear in DESI spectroscopic pipeline output, but the order is arbitrary and they should be read by name not by number.

Contents

Number	EXTNAME	Type	Contents
HDU00		IMAGE	Keywords only
HDU01	FIBERMAP	BINTABLE	Target photometry, metadata, and what fibers they are assigned to
HDU02	SCORES	BINTABLE	QA metrics calculated from the data
HDU03	B_WAVELENGTH	IMAGE	Wavelength grid from the B-cameras
HDU04	B_FLUX	IMAGE	Spectral Flux, 10^{-17} erg/s/cm2/Angstrom
HDU05	B_IVAR	IMAGE	Inverse variance of B_FLUX
HDU06	B_MASK	BINTABLE	Mask, 0=good
HDU07	B_RESOLUTION	IMAGE	Resolution Matrix diagonals
HDU08	R_WAVELENGTH	IMAGE	Wavelength grid from the R-cameras
HDU09	R_FLUX	IMAGE	Spectral Flux, 10^{-17} erg/s/cm2/Angstrom
HDU10	R_IVAR	IMAGE	Inverse variance of R_FLUX
HDU11	R_MASK	BINTABLE	Mask, 0=good
HDU12	R_RESOLUTION	IMAGE	Resolution Matrix diagonals
HDU13	Z_WAVELENGTH	IMAGE	Wavelength grid from the Z-cameras
HDU14	Z_FLUX	IMAGE	Spectral Flux, 10^{-17} erg/s/cm2/Angstrom
HDU15	Z_IVAR	IMAGE	Inverse variance of Z_FLUX
HDU16	Z_MASK	BINTABLE	Mask, 0=good
HDU17	Z_RESOLUTION	IMAGE	Resolution Matrix diagonals

FITS Header Units

HDU00

Keywords only

Required Header Keywords

KEY	Example Value	Type	Comment
SPGRP	pernight	str	*GROUPTYPE* how these spectra are grouped
SPGRPVAL	20201215	int	*GROUPID* value
TILEID	80605	int	Integer tile ID
SPECTRO	6	int	Spectrograph number (same as PETAL)
PETAL	6	int	Focal plane petal number (same as SPECTRO)
CHECKSUM	cXXRdWUQcWUQcWUQ	str	HDU checksum updated 2021-07-15T00:33:13
DATASUM	0	str	data unit checksum updated 2021-07-15T00:33:13

Depending upon the SPGRP=GROUPTYPE, there may be additional keywords with more human-friendly names for the SPGRPVAL, e.g.

SPGRP=GROUPTYPE	Extra keywords
cumulative	NIGHT: all data through this YEARMMDD
pernight	NIGHT: only data on this YEARMMDD
perexp	NIGHT, EXPID: only data from this YEARMMDD and exposure ID

Empty HDU.

HDU01

EXTNAME = FIBERMAP

Fibermap information combining the targeting photometry and metadata, fiberassign requested positions, and actual as-observed fiber locations.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	413	int	Width of table in bytes
NAXIS2	500	int	Number of unique targets (table rows)
CHECKSUM	TcPqUbPoTbPoTbPo	str	HDU checksum
DATASUM	1051947488	str	data unit checksum

Required Data Table Columns

Propagated from the FIBERMAP HDU of the input *cframe files*.

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gaia
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers

continues on next page

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Name	Type	Units	Description
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky)
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
RELEASE	int16		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blending
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; "sourceid" for Gaia DR2
REF_CAT	char[2]		Reference catalog source for star: "T2" for Tycho-2, "G2" for Gaia DR2, "L2" for the SGA, empty otherwise
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude

continues on next page

Table 50 – continued from previous page

Name	Type	Units	Description
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
BRICKNAME	char[8]		Brick name from tractor input
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from all sources at this location in 1 arcsec Gaussian seeing
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from all sources at this location in 1 arcsec Gaussian seeing
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from all sources at this location in 1 arcsec Gaussian seeing
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE=”SER”)
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORPHTYPE

continues on next page

Table 50 – continued from previous page

Name	Type	Units	Description
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORPHTYPE
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S' for DECaLS
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selection bitmasks and OBSCONDITIONS
SV1_DESI_TARGET[1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_BGS_TARGET[Page 453, 1]	int64		BGS (bright time program) target selection bitmask for SV1
SV1_MWS_TARGET[Page 453, 1]	int64		MWS (bright time program) target selection bitmask for SV1
SV1_SCND_TARGET[Page 453, 1]	int64		Secondary target selection bitmask for SV1
SV3_DESI_TARGET[Page 453, 1]	int64		DESI (dark time program) target selection bitmask for SV3
SV3_BGS_TARGET[Page 453, 1]	int64		BGS (bright time program) target selection bitmask for SV3
SV3_MWS_TARGET[Page 453, 1]	int64		MWS (bright time program) target selection bitmask for SV3
SV3_SCND_TARGET[Page 453, 1]	int64		Secondary target selection bitmask for SV3
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SCND_TARGET[Page 453, 1]	int64		Target selection bitmask for secondary programs
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker

continues on next page

Table 50 – continued from previous page

Name	Type	Units	Description
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
EXPTIME	float64	s	Length of time shutter was open
PSF_TO_FIBER_SPECFLUX	float64		fraction of light from point-like source captured by 1.5 arcsec diameter fiber given atmospheric seeing
NIGHT	int32		
EXPID	int32		DESI Exposure ID number
MJD	float64		Modified Julian Date when shutter was opened for this exposure
TILEID	int32		Unique DESI tile ID

HDU02

EXTNAME = SCORES

Scores / metrics measured from the spectra for use in QA and systematics studies. These are propagated from the input *cframe SCORES HDU*.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	488	int	width of table in bytes
NAXIS2	500	int	`nspec` number of rows in table

[1] Optional

Required Data Table Columns

See the *cframe SCORES HDU* documentation for details about the columns.

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
SUM_RAW_COUNT_B	float64		Sum of raw counts in B camera
MEDIAN_RAW_COUNT_B	float64		Median of raw counts in B camera
MEDIAN_RAW_SNR_B	float64		Median(raw signal/noise) in B camera
SUM_FFLAT_COUNT_B	float64		Sum of fiber-flatfielded counts B camera
MEDIAN_FFLAT_COUNT_B	float64		Median of fiber-flatfielded counts in B camera
MEDIAN_FFLAT_SNR_B	float64		Median(S/N) of fiberflatfielded counts in B camera
SUM_SKYSUB_COUNT_B	float64		Sum of sky-subtracted counts in B camera
MEDIAN_SKYSUB_COUNT_B	float64		Median of sky-subtracted counts in B camera
MEDIAN_SKYSUB_SNR_B	float64		Median(S/N) of sky-subtracted counts in B camera
SUM_CALIB_COUNT_B	float64		Sum of calibrated flux in B camera
MEDIAN_CALIB_COUNT_B	float64		Median of calibrated flux in B camera
MEDIAN_CALIB_SNR_B	float64		Median(S/N) of calibrated flux in B camera
TSNR2_GPBDARK_B	float64		template (S/N)^2 for dark targets in guider pass band on B
TSNR2_ELG_B	float64		ELG B template (S/N)^2
TSNR2_GPBBRIGHT_B	float64		template (S/N)^2 for bright targets in guider pass band on B
TSNR2_LYA_B	float64		LYA B template (S/N)^2
TSNR2_BGS_B	float64		BGS B template (S/N)^2
TSNR2_GPBBACKUP_B	float64		
TSNR2_QSO_B	float64		QSO B template (S/N)^2
TSNR2_LRG_B	float64		LRG B template (S/N)^2
SUM_RAW_COUNT_R	float64		Sum of raw counts in R camera
MEDIAN_RAW_COUNT_R	float64		Median of raw counts in R camera
MEDIAN_RAW_SNR_R	float64		Median(raw signal/noise) in R camera
SUM_FFLAT_COUNT_R	float64		Sum of fiber-flatfielded counts R camera
MEDIAN_FFLAT_COUNT_R	float64		Median of fiber-flatfielded counts in R camera
MEDIAN_FFLAT_SNR_R	float64		Median(S/N) of fiberflatfielded counts in R camera
SUM_SKYSUB_COUNT_R	float64		Sum of sky-subtracted counts in R camera
MEDIAN_SKYSUB_COUNT_R	float64		Median of sky-subtracted counts in R camera
MEDIAN_SKYSUB_SNR_R	float64		Median(S/N) of sky-subtracted counts in R camera
SUM_CALIB_COUNT_R	float64		Sum of calibrated flux in R camera
MEDIAN_CALIB_COUNT_R	float64		Median of calibrated flux in R camera
MEDIAN_CALIB_SNR_R	float64		Median(S/N) of calibrated flux in R camera
TSNR2_GPBDARK_R	float64		template (S/N)^2 for dark targets in guider pass band on R
TSNR2_ELG_R	float64		ELG R template (S/N)^2
TSNR2_GPBBRIGHT_R	float64		template (S/N)^2 for bright targets in guider pass band on R
TSNR2_LYA_R	float64		LYA R template (S/N)^2
TSNR2_BGS_R	float64		BGS R template (S/N)^2
TSNR2_GPBBACKUP_R	float64		
TSNR2_QSO_R	float64		QSO R template (S/N)^2
TSNR2_LRG_R	float64		LRG R template (S/N)^2
SUM_RAW_COUNT_Z	float64		Sum of raw counts in Z camera
MEDIAN_RAW_COUNT_Z	float64		Median of raw counts in Z camera
MEDIAN_RAW_SNR_Z	float64		Median(raw signal/noise) in Z camera
SUM_FFLAT_COUNT_Z	float64		Sum of fiber-flatfielded counts Z camera
MEDIAN_FFLAT_COUNT_Z	float64		Median of fiber-flatfielded counts in Z camera

continues on next page

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Name	Type	Units	Description
MEDIAN_FFLAT_SNR_Z	float64		Median(S/N) of fiberflatfielded counts in Z camera
SUM_SKYSUB_COUNT_Z	float64		Sum of sky-subtracted counts in Z camera
MEDIAN_SKYSUB_COUNT_Z	float64		Median of sky-subtracted counts in Z camera
MEDIAN_SKYSUB_SNR_Z	float64		Median(S/N) of sky-subtracted counts in Z camera
SUM_CALIB_COUNT_Z	float64		Sum of calibrated flux in Z camera
MEDIAN_CALIB_COUNT_Z	float64		Median of calibrated flux in Z camera
MEDIAN_CALIB_SNR_Z	float64		Median(S/N) of calibrated flux in Z camera
TSNR2_GPBDARK_Z	float64		template (S/N)^2 for dark targets in guider pass band on Z
TSNR2_ELG_Z	float64		ELG Z template (S/N)^2
TSNR2_GPBBRIGHT_Z	float64		template (S/N)^2 for bright targets in guider pass band on Z
TSNR2_LYA_Z	float64		LYA Z template (S/N)^2
TSNR2_BGS_Z	float64		BGS Z template (S/N)^2
TSNR2_GPBBACKUP_Z	float64		
TSNR2_QSO_Z	float64		QSO Z template (S/N)^2
TSNR2_LRG_Z	float64		LRG Z template (S/N)^2

HDU03

EXTNAME = B_WAVELENGTH

1D array of B-camera wavelengths in Angstrom, in vacuum (not in air), in the rest frame of the solar system barycenter.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	number of wavelengths
BUNIT	Angstrom	str	

Data: FITS image [float64, 2751]

HDU04

EXTNAME = B_FLUX

2D array of calibrated spectral flux of dimension `[nspec, nwave]` in units of 1e-17 erg / (s cm2 Angstrom). `nspec` is the number of fibers per camera. `nwave` in the length of the wavelength array. The spectra of all fibers share the same wavelength grid, given in HDU B_WAVELENGTH.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	`nwave` number of wavelengths
NAXIS2	500	int	`nspec` number of spectra
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	

Data: FITS image [float32, 2751x500]

HDU05

EXTNAME = B_IVAR

Inverse variance of flux (1/sigma^2) in units of (10^{-17} erg/s/cm2/A)^-2. Uncertainties comprise statistical uncertainties from the error propagation of the initial CCD pixel variance, the calibration uncertainties, plus an additional term on bright sky lines to account for the imperfect sky subtraction.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	`nwave` number of wavelengths
NAXIS2	500	int	`nspec` number of spectra
BUNIT	10**+34 (s2 cm4 Angstrom2) / erg2	str	

Data: FITS image [float32, 2751x500]

HDU06

EXTNAME = B_MASK

Mask of spectral data; 0=good. See the *bitmask documentation* page for the definition of the bits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	`nwave` number of wavelengths
NAXIS2	500	int	`nspec` number of spectra
BZERO	2147483648	int	offset data range to that of unsigned long
BSCALE	1	int	default scaling factor

Data: FITS image [int32 (compressed), 2751x500]

HDU07

EXTNAME = B_RESOLUTION

Resolution matrix stored as a 3D sparse matrix, modeling the per-fiber non-Gaussian effective line-spread-function resolution. See the *frame RESOLUTION HDU* documentation for details about using this HDU.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2751	int	`nwave` number of wavelengths
NAXIS2	11	int	`ndiag` number of diagonals
NAXIS3	500	int	`nspec` number of spectra

Data: FITS image [float32, 2751x11x500]

A sparse resolution matrix may be created for spectrum `i` with:

```
from desispec.resolution import Resolution
R = Resolution(data[i])
```

Or using lower-level scipy.sparse matrices:

```
import scipy.sparse
import numpy as np
nspec, ndiag, nwave = data.shape
offsets = ndiag//2 - np.arange(ndiag, dtype=int)
R = scipy.sparse.dia_matrix((data[i], offsets), shape=(nwave, nwave))
```

HDU08

EXTNAME = R_WAVELENGTH

1D array of R-camera wavelengths in Angstrom, in vacuum (not in air), in the rest frame of the solar system barycenter.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	number of wavelengths
BUNIT	Angstrom	str	

Data: FITS image [float64, 2326]

HDU09

EXTNAME = R_FLUX

2D array of calibrated spectral flux of dimension `[nspec, nwave]` in units of 1e-17 erg / (s cm2 Angstrom). `nspec` is the number of fibers per camera. `nwave` in the length of the wavelength array. The spectra of all fibers share the same wavelength grid, given in HDU R_WAVELENGTH.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	`nwave` number of wavelengths
NAXIS2	500	int	`nspec` number of spectra
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	

Data: FITS image [float32, 2326x500]

HDU10

EXTNAME = R_IVAR

Inverse variance of flux (1/sigma^2) in units of (10^{-17} erg/s/cm2/A)^-2. Uncertainties comprise statistical uncertainties from the error propagation of the initial CCD pixel variance, the calibration uncertainties, plus an additional term on bright sky lines to account for the imperfect sky subtraction.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	`nwave` number of wavelengths
NAXIS2	500	int	`nspec` number of spectra
BUNIT	10**+34 (s2 cm4 Angstrom2) / erg2	str	

Data: FITS image [float32, 2326x500]

HDU11

EXTNAME = R_MASK

Mask of spectral data; 0=good. See the *bitmask documentation* page for the definition of the bits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	`nwave` number of wavelengths
NAXIS2	500	int	`nspec` number of spectra
BZERO	2147483648	int	offset data range to that of unsigned long
BSCALE	1	int	default scaling factor

Data: FITS image [int32 (compressed), 2326x500]

HDU12

EXTNAME = R_RESOLUTION

Resolution matrix stored as a 3D sparse matrix, modeling the per-fiber non-Gaussian effective line-spread-function resolution. See the *frame RESOLUTION HDU* documentation for details about using this HDU.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2326	int	`nwave` number of wavelengths
NAXIS2	11	int	`ndiag` number of diagonals
NAXIS3	500	int	`nspec` number of spectra

Data: FITS image [float32, 2326x11x500]

HDU13

EXTNAME = Z_WAVELENGTH

1D array of Z-camera wavelengths in Angstrom, in vacuum (not in air), in the rest frame of the solar system barycenter.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	`nwave` number of wavelengths
BUNIT	Angstrom	str	

Data: FITS image [float64, 2881]

HDU14

EXTNAME = Z_FLUX

2D array of calibrated spectral flux of dimension `[nspec, nwave]` in units of 1e-17 erg / (s cm2 Angstrom). `nspec` is the number of fibers per camera. `nwave` in the length of the wavelength array. The spectra of all fibers share the same wavelength grid, given in HDU Z_WAVELENGTH.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	`nwave` number of wavelengths
NAXIS2	500	int	`nspec` number of spectra
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	

Data: FITS image [float32, 2881x500]

HDU15

EXTNAME = Z_IVAR

Inverse variance of flux (1/sigma^2) in units of (10^{-17} erg/s/cm2/A)^-2. Uncertainties comprise statistical uncertainties from the error propagation of the initial CCD pixel variance, the calibration uncertainties, plus an additional term on bright sky lines to account for the imperfect sky subtraction.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	`nwave` number of wavelengths
NAXIS2	500	int	`nspec` number of spectra
BUNIT	10**+34 (s2 cm4 Angstrom2) / erg2	str	

Data: FITS image [float32, 2881x500]

HDU16

EXTNAME = Z_MASK

Mask of spectral data; 0=good. See the *bitmask documentation* page for the definition of the bits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	`nwave` number of wavelengths
NAXIS2	500	int	`nspec` number of spectra
BZERO	2147483648	int	offset data range to that of unsigned long
BSCALE	1	int	default scaling factor

Data: FITS image [int32 (compressed), 2881x500]

HDU17

EXTNAME = Z_RESOLUTION

Resolution matrix stored as a 3D sparse matrix, modeling the per-fiber non-Gaussian effective line-spread-function resolution. See the *frame RESOLUTION HDU* documentation for details about using this HDU.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2881	int	`nwave` number of wavelengths
NAXIS2	11	int	`ndiag` number of diagonals
NAXIS3	500	int	`nspec` number of spectra

Data: FITS image [float32, 2881x11x500]

Notes and Examples

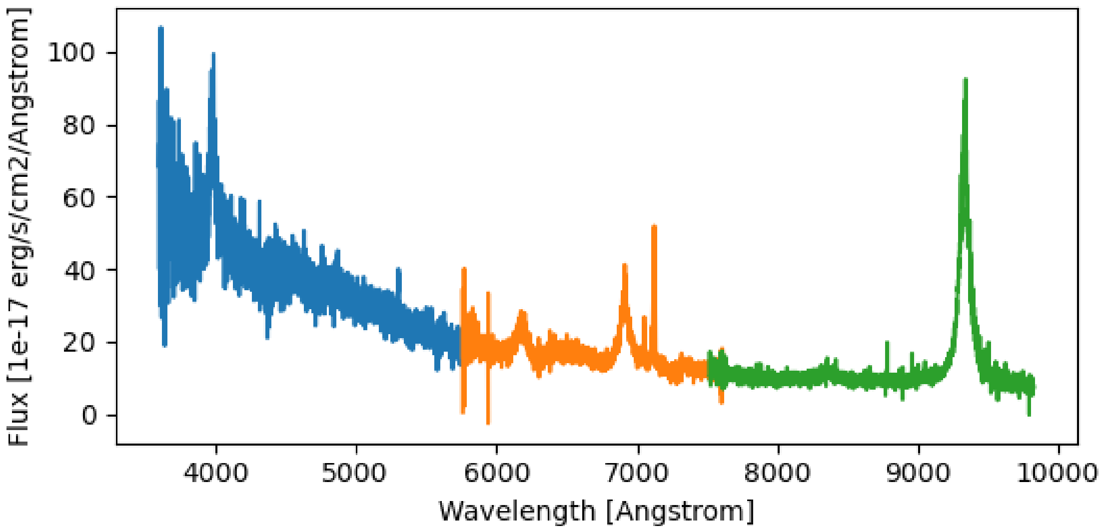
Spectra can be read and plotted with Python code like:

```
from astropy.io import fits

wave = dict()
flux = dict()
with fits.open('spectra-0-100-thru20210505.fits.gz') as hdus:
    for camera in ['B', 'R', 'Z']:
        wave[camera] = hdus[f'{camera}_WAVELENGTH'].data
        flux[camera] = hdus[f'{camera}_FLUX'].data

import matplotlib.pyplot as plt
plt.figure(figsize=(6,3))
ispec = 217
for camera in wave.keys():
    plt.plot(wave[camera], flux[camera][ispec])

plt.xlabel('Wavelength [Angstrom]')
plt.ylabel('Flux [1e-17 erg/s/cm2/Angstrom]')
plt.tight_layout()
plt.show()
```



The desispec package provides utility functions and classes for reading, slicing, combining, and writing spectra. e.g. the same plot can be made with:

```
from desispec.io import read_spectra
sp = read_spectra('spectra-0-100-thru20210505.fits.gz')

import matplotlib.pyplot as plt
plt.figure(figsize=(6,3))
ispec = 217
for camera in sp.bands:
    plt.plot(sp.wave[camera], sp.flux[camera][ispec])

plt.xlabel('Wavelength [Angstrom]')
plt.ylabel('Flux [1e-17 erg/s/cm2/Angstrom]')
plt.tight_layout()
plt.show()
```

or multiple spectra files can be read, sub-selected, combined, and re-written with:

```
from desispec.io import read_spectra, write_spectra
from desispec.spectra import stack
spectra = list()
for petal in range (10):
    sp = read_spectra(f'spectra-{petal}-100-thru20210505.fits')
    keep = sp.fibermap['FLUX_R'] > 10**((22.5-17)/2.5)   # mag_r > 17
    spectra.append(sp[keep])

combined_spectra = stack(spectra)
write_spectra('bright_spectra.fits', combined_spectra)
```

The format supports arbitrary channel (camera) names as long as for each channel {X} there is a set of HDUs named {X}_WAVELENGTH, {X}_FLUX, {X}_IVAR, {X}_MASK, {X}_RESOLUTION.

The contents of the spectra files are a reformatting of the data in multiple input *cframe files* files. Spectra files do not contain any additional information or calculations beyond what is already in the cframe files, but they provide an analysis convenience to get all the data for a given tile petal or healpix in a single file without having to find and read multiple cframe files across multiple nights, exposures, and cameras.

The FIBERMAP and SCORES tables are concatenated from the input cframe files, with one row per target per exposure. The WAVELENGTH, FLUX, IVAR, MASK, and RESOLUTION HDUs of the input cframes are combined and stored here with a [BRZ]_ prefix, e.g. B_FLUX for the stack of all FLUX HDUs from the input B-camera cframes.

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

tile-qa-TILEID-GROUPID.fits

Summary
These files are mostly associated with `cumulative` tile coadds. They contain information which helps to decide during operations if the observation is valid or not.

Naming Convention
`tile-qa-TILEID-GROUPID.fits`, where `TILEID` is the tile number and `GROUPID` depends on the `GROUPTYPE` of the tile coadd.

Regex
`tile-qa-[0-9]+-(thru[0-9]{8}|[0-9]{8})\.fits`

File Type
FITS, 627 KB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Keywords only
HDU1	FIBERQA	BINTABLE	Per-fiber information table
HDU2	PETALQA	BINTABLE	Per-petal information table

FITS Header Units

HDU0

No data, checksum/datasum header keywords only.

Required Header Keywords

KEY	Example Value	Type	Comment
CHECKSUM	D5aEE4a9D4aED4a9	str	HDU checksum updated 2021-07-16T19:03:01
DATASUM	0	str	data unit checksum updated 2021-07-16T19:03:01

Empty HDU.

HDU1

EXTNAME = FIBERQA

This table contains the per-fiber information which helps to decide if the observation is valid or not. For each fiber, the QA information is computed from the QA information for that fiber in all exposures used for that tile coadd reduction (see *exposure-qa-EXPID*). That information is also used to define some column content of the PETALQA extension.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	124	int	length of dimension 1
NAXIS2	5000	int	length of dimension 2
TILEID	20096	int	Tile ID
LASTNITE	20210608	int	Last night of data included in this coadd reduction
NGOODFIB	3992	int	Number of fibers with EFFTIME_SPEC above the threshold
NGOODPET	9	int	Number of petals with good fibers (only used for plotting routines)
EFFTIME	214.8598327636719	float	[s] Median of EFFTIME_SPEC of fibers that are good in all exposures
VALID	T	bool	A tile is valid if EFFTIME > MINTFRAC*GOALTIME AND NGOODFIB > threshold
RMSDIST	0.014169211499392986	float	[mm] RMS distance of good fibers
TILERA	229.546	float	[deg] Tile Right Ascension
TILEDEC	-0.056	float	[deg] Tile Declination
GOALTIME	180.0	float	[s] Aimed EFFTIME_SPEC
GOALTYPE	BRIGHT	str	Sky conditions used for some noise estimation
FAPRGRM	bright	str	Program to which this tile belongs
SURVEY	main	str	Survey of origin of the targets
EBVFAC	1.12631027332157	float	10.0 ** (2.165 * median(EBV) / 2.5))
MINTFRAC	0.85	float	Fraction of GOALTIME to be reached by EFFTIME_SPEC to consider the tile has completed
CHECKSUM	73CQ71BN71BN71BN	str	HDU checksum updated 2021-07-16T19:03:01
DATASUM	105714500	str	data unit checksum updated 2021-07-16T19:03:01

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
TARGET_RA	float64	deg	Target right ascension
TARGET_DEC	float64	deg	Target declination
MEAN_FIBER_X	float32	mm	Mean (over exposures) fiber CS5 X location on focal plane
MEAN_FIBER_Y	float32	mm	Mean (over exposures) fiber CS5 Y location on focal plane
MEAN_DELTA_X	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 X location on focal plane
MEAN_DELTA_Y	float32	mm	Mean (over exposures) fiber difference requested - actual CS5 Y location on focal plane
RMS_DELTA_X	float32	mm	RMS (over exposures) of the fiber difference between measured and requested CS5 X location on focal plane
RMS_DELTA_Y	float32	mm	RMS (over exposures) of the fiber difference between measured and requested CS5 Y location on focal plane
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
TSNR2_LRG	float64		LRG template (S/N)^2 summed over B,R,Z
Z	float64		Redshift measured by Redrock
SPECTYPE	char[6]		Spectral type of Redrock best fit template (e.g. GALAXY, QSO, STAR)
DELTACHI2	float64		chi2 difference between first- and second-best redrock template fits
QAFIBERSTATUS	int32		Fiber status bitmask, inflated with further QA diagnoses
EFFTIME_SPEC	float32	s	Effective exposure time for nominal conditions derived from the TSNR2 fits to the spectroscopy

HDU2

EXTNAME = PETALQA

This table contains the per-petal information which helps to decide if the observation is valid or not, and if a petal should be considered as "bad" (i.e. as if it would not have been observed), because of a too-low quality. It is the mean (over exposures) of the PETALQA extension of the *exposure-qa-EXPID* values, to which we refer for the column definition.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	66	int	length of dimension 1
NAXIS2	10	int	length of dimension 2
CHECKSUM	5m3P8l1M5l1M5l1M	str	HDU checksum updated 2021-07-16T19:03:01
DATASUM	807618843	str	data unit checksum updated 2021-07-16T19:03:01

Required Data Table Columns

Name	Type	Units	Description
PETAL_LOC	int16		Petal location [0-9]
WORSTREAD-NOISE	float32		Mean of the per-exposure WORSREADNOISE
NGOODPOS	float32		Mean of the per-exposure NGOODPOS
NSTDSTAR	float32		Mean of the per-exposure NSTDSTAR
STARRMS	float32		Mean of the per-exposure STARRMS
TSNR2FRA[1]	float32		Deprecated column
NCFRAME	float32		Mean of the per-exposure NCFRAME
BSKYTHRURMS	float32		Mean of the per-exposure BSKYTHRURMS
BSKYCHI2PDF	float32		Mean of the per-exposure BSKYCHI2PDF
RSKYTHRURMS	float32		Mean of the per-exposure RSKYTHRURMS
RSKYCHI2PDF	float32		Mean of the per-exposure RSKYCHI2PDF
ZSKYTHRURMS	float32		Mean of the per-exposure ZSKYTHRURMS
ZSKYCHI2PDF	float32		Mean of the per-exposure ZSKYCHI2PDF
BTHRUFRAC	float32		Mean of the per-exposure BTHRUFRAC
RTHRUFRAC	float32		Mean of the per-exposure RTHRUFRAC
ZTHRUFRAC	float32		Mean of the per-exposure ZTHRUFRAC
EFF-TIME_SPEC	float32	s	Median effective exposure time for nominal conditions derived from the TSNR2 fits to the spectroscopy

Notes and Examples

- For some data releases, this `tile-qa-TILEID-GROUPID.fits` also exists for the tile per-night coadd reductions.
- The QAFIBERSTATUS bitmasks are defined here *bitmasks*.
- Some FIBERQA extension header keywords are originally coming from the *fiberassign-TILEID* file (TILEID, TILERA, TILEDEC, GOALTIME, GOALTYPE, FAPRGRM, SURVEY, EBVFAC, MINTFRAC).
- The FIBERQA EFFTIME_SPEC is proportional to the TSNR2 values in the TSNR2 extension of the *redrock-SPECTROGRAPH-TILEID-GROUPID* file; for the BACKUP and BRIGHT programs, the TSNR2_BGS is used; for the DARK program, the TSNR2_ELG or TSNR2_LRG is used.
- For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

[1] Optional

zmtl-SPECTROGRAPH-TILEID-thruGROUPID.fits

Summary
The `zmtl` files contain information about redshifts used by the *MTL ("Merged Target List") process* to update the observational state of targets in the MTL ledgers. In particular, the redshift information is crucial for deciding whether a target is a Lyman-alpha quasar that requires additional DESI observations.

Naming Convention
`zmtl-SPECTROGRAPH-TILEID-thruGROUPID.fits`, where `SPECTROGRAPH` is the spectrograph ID, `TILEID` is the tile number and `GROUPID` depends on the `GROUPTYPE` of the tile coadd.

Regex
`zmtl-[0-9]-[0-9]+-(thru|)[0-9]{8}\.fits`

File Type
FITS, 67 KB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	ZMTL	BINTABLE	Redshifts to inform MTL updates

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = ZMTL

Redshifts to inform MTL updates

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	112	int	width of table in bytes
NAXIS2	500	int	number of rows in table
QN_ADDED	T	bool	True if QuasarNET information included
SQ_ADDED	F	bool	True if SQUEzE information included
AB_ADDED	F	bool	True if absorption line information included
ZC_ADDED	F	bool	True if combined redshift information included
QN-MODFIL	/global/cfs/cdirs/desi/target/catalogs/lya/qn_models/qn_train_coadd_indtrain_0_0_boss10.h5	str	Filename of QuasarNET model
BADPTLQA	F	bool	True if all fibers on a petal were masked

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Target Right Ascension
DEC	float64	deg	Target declination
TARGETID	int64		Unique DESI target ID
SV1_DESI_TARGET[1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_BGS_TARGET[Page 469, 1]	int64		BGS (bright time program) target selection bitmask for SV1
SV1_MWS_TARGET[Page 469, 1]	int64		MWS (bright time program) target selection bitmask for SV1
SV1_SCND_TARGET[Page 469, 1]	int64		Secondary target selection bitmask for SV1
SV3_DESI_TARGET[Page 469, 1]	int64		DESI (dark time program) target selection bitmask for SV3
SV3_BGS_TARGET[Page 469, 1]	int64		BGS (bright time program) target selection bitmask for SV3
SV3_MWS_TARGET[Page 469, 1]	int64		MWS (bright time program) target selection bitmask for SV3
SV3_SCND_TARGET[Page 469, 1]	int64		Secondary target selection bitmask for SV3
DESI_TARGET[Page 469, 1]	int64		DESI (dark time program) target selection bitmask
BGS_TARGET[Page 469, 1]	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET[Page 469, 1]	int64		Milky Way Survey targeting bits
SCND_TARGET[Page 469, 1]	int64		Target selection bitmask for secondary programs
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask from Redrock, plus DESI-specific bits set
SPECTYPE	char[6]		Spectral type of Redrock best fit template (e.g. GALAXY, QSO, STAR)
DELTACHI2	float64		chi2 difference between first- and second-best redrock template fits
NUMOBS	int32		Number of spectroscopic observations (on this specific, single tile)
ZTILEID	int32		ID of tile that most recently updated target's state
Z_QN	float64		Redshift measured by QuasarNET
Z_QN_CONF	float64		Redshift confidence from QuasarNET
IS_QSO_QN	int16		Spectroscopic classification from QuasarNET (1 for a quasar)

Notes and Examples

See the DESI Survey Operations paper (Schlafly et al., in preparation) for details of how the quantities in the `zmtl` files are used to update the observational state of a target in the MTL ledgers.

For more information, see QuasarNET for QuasarNET and SQUEzE for SQUEzE.

zcatalog

Redshift catalogs.

zall-pix-SPECPROD.fits

Summary
Concatenation of all `zpix-*.fits` files.

Naming Convention
`zall-pix-{SPECPROD}.fits`, where `{SPECPROD}` is the official name of the full reduction, *e.g.* `fuji`.

Regex
`zall-pix-[a-z0-9_-]+\.fits`

File Type
FITS, 2 GB

This file contains a concatenation of all input *zpix-*.fits* files, combining redshift catalog entries across SURVEYs and PROGRAMs. It additionally adds a column `SV_PRIMARY` to indicate the best recommended redshift if the same `TARGETID` appears multiple times, and `SV_NSPEC` for how many times each target appears.

e.g. if the same Survey Validation `TARGETID` was observed during both Target Selection Validation (sv1) and the One-Percent Survey (sv3), it will appear as separate redshifts in separate zpix files, and will appear twice in this file with one of the entries having `SV_PRIMARY==True`. Any target that appears only once will also have `SV_PRIMARY==True`.

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	ZCATALOG	BINTABLE	Redshift catalog joined with target catalog

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

[1] Only *either* the four `SV1`, `SV3` *or* Main Survey columns will be present. `TARGET` bitmask columns are preceded by the survey `PHASE` except in the case of Main Survey files (i.e. `DESI_TARGET` is called `SV1_DESI_TARGET` when the survey `PHASE` is `sv1`).

HDU1

See ZCATALOG HDU1 of zpix-SURVEY-PROGRAM.fits.

zall-tilecumulative-SPECPROD.fits

Summary
Concatenation of all `ztile-*-cumulative.fits` files.

Naming Convention
`zall-tilecumulative-{SPECPROD}.fits`, where `{SPECPROD}` is the official name of the full reduction, *e.g.* `fuji`.

Regex
`zall-tilecumulative-[a-z0-9_-]+\.fits`

File Type
FITS, 2 GB

This file contains a concatenation of all input *ztile-*-cumulative.fits* files, combining redshift catalog entries across TILEs, SURVEYs and PROGRAMs. It additionally adds a column `SV_PRIMARY` to indicate the best recommended redshift if the same `TARGETID` appears multiple times, and `SV_NSPEC` for how many times each target appears.

e.g. if the same Survey Validation `TARGETID` was observed on two different tiles, it will appear as separate redshifts in separate ztile files, and will appear twice in this file with one of the entries having `SV_PRIMARY==True`. Any target that appears only once will also have `SV_PRIMARY==True`.

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	ZCATALOG	BINTABLE	Redshift catalog joined with target catalog

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

See HDU1 of ztile-SURVEY-PROGRAM-GROUPTYPE.fits.

zpix-SURVEY-PROGRAM.fits

Summary
This file contatenates the individual *healpix-based Redrock redshift catalogs* into a single file per SURVEY and PROGRAM.

Naming Convention
`ztile-SURVEY-PROGRAM.fits`, where `SURVEY` is *e.g.* `main` or `sv1` and `PROGRAM` is *e.g.* `bright or ``dark`.

Regex
`zpix-(cmx|main|sv1|sv2|sv3|special)-(backup|bright|dark|other)\.fits`

File Type
FITS, 296 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	ZCATALOG	BINTABLE	Redshift catalog joined with target catalog
HDU2	EXP_FIBERMAP	BINTABLE	Per-exposure entries from input fibermaps

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = ZCATALOG

Redshift catalog joined with the targeting metadata from the REDSHIFTS and FIBERMAP HDUs of the *input redrock files*

`TEMNAMnn` and `TEMVERnn` record the redrock template names and versions used for the redshift fits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	631	int	width of table in bytes
NAXIS2	139728	int	number of rows in table
LONGSTRN	OGIP 1.0	str	
RRVER	0.15.0	str	Redrock version
TEMNAM00	GALAXY	str	Redrock template 00 name
TEMVER00	2.6	str	Redrock template 00 version
TEMNAM01	QSO	str	
TEMVER01	0.1	str	
TEMNAM02	STAR:::A	str	
TEMVER02	0.1	str	
TEMNAM03	STAR:::B	str	
TEMVER03	0.1	str	
TEMNAM04	STAR:::CV	str	
TEMVER04	0.1	str	
TEMNAM05	STAR:::F	str	
TEMVER05	0.1	str	
TEMNAM06	STAR:::G	str	
TEMVER06	0.1	str	
TEMNAM07	STAR:::K	str	
TEMVER07	0.1	str	
TEMNAM08	STAR:::M	str	
TEMVER08	0.1	str	
TEMNAM09	STAR:::WD	str	
TEMVER09	0.1	str	
SPGRP	healpix	str	Spectral grouping method
HPXNSIDE	64	int	Healpix nside
HPXNEST	True	str	Nested healpix (not ring)
SURVEY[1]	sv2	str	DESI sub-survey (e.g. sv1, sv3, main)
PROGRAM[Page 472, 1]	dark	str	DESI program (e.g. dark, bright)

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		ID (unique to file? and the whole survey?)
SURVEY[1]	char[7]		Survey name
PROGRAM[1]	char[6]		DESI program type - BRIGHT, DARK, BACKUP, OTHER
HEALPIX	int32		HEALPixel containing this location at NSIDE=64 in the NI
SPGRPVAL	int32		Value by which spectra are grouped for a coadd (e.g. a YEA
Z	float64		Redshift measured by Redrock
ZERR	float64		Redshift error from redrock
ZWARN	int64		Redshift warning bitmask from Redrock
CHI2	float64		Best fit chi squared
COEFF	float64[10]		Redrock template coefficients
NPIXELS	int64		Number of unmasked pixels contributing to the Redrock fit

[1] Optional

Table 52 – continued from previous page

Name	Type	Units	Description
SPECTYPE	char[6]		Spectral type of Redrock best fit template (e.g. GALAXY, Q
SUBTYPE	char[20]		Spectral subtype
NCOEFF	int64		Number of Redrock template coefficients
DELTACHI2	float64		chi2 difference between first- and second-best redrock temp
COADD_FIBERSTATUS	int32		bitwise-AND of input FIBERSTATUS
TARGET_RA	float64	deg	Barycentric Right Ascension in ICRS
TARGET_DEC	float64	deg	Barycentric Declination in ICRS
PMRA	float32	mas yr^-1	Reference catalog proper motion in the RA direction
PMDEC	float32	mas yr^-1	Reference catalog proper motion in the Dec direction
REF_EPOCH	float32	yr	Reference catalog reference epoch (*e.g.*, 2015.5 for Gaia DI
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Flag the target to be observed in graytime.
RELEASE	int16		Legacy Surveys (LS) Release
BRICKNAME	char[8]		Brick name from tractor input
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		OBJID (unique to brick, but not to file)
MORPHTYPE	char[4]		Morphological Model type
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_G	float32	nanomaggy	LS flux from tractor input (g)
FLUX_R	float32	nanomaggy	LS flux from tractor input (r)
FLUX_Z	float32	nanomaggy	LS flux from tractor input (z)
FLUX_W1	float32	nanomaggy	WISE flux in W1
FLUX_W2	float32	nanomaggy	WISE flux in W2
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse Variance of FLUX_G
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse Variance of FLUX_R
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse Variance of FLUX_Z
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse Variance of FLUX_W1
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse Variance of FLUX_W2
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec f
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec f
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec f
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec f
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec f
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec f
MASKBITS	int16		Bitwise mask indicating that an object touches a pixel in the
SERSIC	float32		Power-law index for the Sersic profile model (`type="SER"`
SHAPE_R	float32	arcsec	Half-light radius of galaxy model for galaxy type `type` (>0
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type `ty`
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type `ty`
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; “sourceid” fo
REF_CAT	char[2]		Reference catalog source for this star: “T2” for Tycho-2, “G
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
PHOTSYS	char[1]		‘N’ for the MzLS/BASS photometric system, ‘S’ for DECaL

Table 52 – continued from previous page

Name	Type	Units	Description
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OB
NUMOBS_INIT	int64		Initial number of observations for target calculated across ta
CMX_TARGET[1]	int64		Target selection bitmask for commissioning
SV1_DESI_TARGET[Page 472, 1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_BGS_TARGET[Page 472, 1]	int64		BGS (bright time program) target selection bitmask for SV
SV1_MWS_TARGET[Page 472, 1]	int64		MWS (bright time program) target selection bitmask for SV
SV1_SCND_TARGET[Page 472, 1]	int64		Secondary target selection bitmask for SV1
SV2_DESI_TARGET[Page 472, 1]	int64		DESI (dark time program) target selection bitmask for SV2
SV2_BGS_TARGET[Page 472, 1]	int64		BGS (bright time program) target selection bitmask for SV
SV2_MWS_TARGET[Page 472, 1]	int64		MWS (bright time program) target selection bitmask for SV
SV2_SCND_TARGET[Page 472, 1]	int64		Secondary target selection bitmask for SV2
SV3_DESI_TARGET[Page 472, 1]	int64		DESI (dark time program) target selection bitmask for SV3
SV3_BGS_TARGET[Page 472, 1]	int64		BGS (bright time program) target selection bitmask for SV
SV3_MWS_TARGET[Page 472, 1]	int64		MWS (bright time program) target selection bitmask for SV
SV3_SCND_TARGET[Page 472, 1]	int64		Secondary target selection bitmask for SV3
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SCND_TARGET[Page 472, 1]	int64		Secondary target selection bitmask
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateM
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
COADD_NUMEXP	int16		Number of exposures in coadd
COADD_EXPTIME	float32	s	Summed exposure time for coadd
COADD_NUMNIGHT	int16		Number of nights in coadd
COADD_NUMTILE	int16		Number of tiles in coadd
MEAN_DELTA_X	float32	mm	Mean (over exposures) fiber difference requested - actual C
RMS_DELTA_X	float32	mm	RMS (over exposures) of the fiber difference between meas
MEAN_DELTA_Y	float32	mm	Mean (over exposures) fiber difference requested - actual C
RMS_DELTA_Y	float32	mm	RMS (over exposures) of the fiber difference between meas
MEAN_FIBER_RA	float64	deg	Mean (over exposures) RA of actual fiber position
STD_FIBER_RA	float32	arcsec	Standard deviation (over exposures) of RA of actual fiber p
MEAN_FIBER_DEC	float64	deg	Mean (over exposures) DEC of actual fiber position
STD_FIBER_DEC	float32	arcsec	Standard deviation (over exposures) of DEC of actual fiber
MEAN_PSF_TO_FIBER_SPECFLUX	float32		Mean of input exposures fraction of light from point-like so
TSNR2_GPBDARK_B	float32		template (S/N)^2 for dark targets in guider pass band on B
TSNR2_ELG_B	float32		ELG B template (S/N)^2
TSNR2_GPBBRIGHT_B	float32		template (S/N)^2 for bright targets in guider pass band on B
TSNR2_LYA_B	float32		LYA B template (S/N)^2
TSNR2_BGS_B	float32		BGS B template (S/N)^2
TSNR2_GPBBACKUP_B	float32		template (S/N)^2 for backup targets in guider pass band on
TSNR2_QSO_B	float32		QSO B template (S/N)^2
TSNR2_LRG_B	float32		LRG B template (S/N)^2
TSNR2_GPBDARK_R	float32		template (S/N)^2 for dark targets in guider pass band on R
TSNR2_ELG_R	float32		ELG R template (S/N)^2
TSNR2_GPBBRIGHT_R	float32		template (S/N)^2 for bright targets in guider pass band on R
TSNR2_LYA_R	float32		LYA R template (S/N)^2
TSNR2_BGS_R	float32		BGS R template (S/N)^2
TSNR2_GPBBACKUP_R	float32		template (S/N)^2 for backup targets in guider pass band on
TSNR2_QSO_R	float32		QSO R template (S/N)^2

Table 52 – continued from previous page

Name	Type	Units	Description
TSNR2_LRG_R	float32		LRG R template (S/N)^2
TSNR2_GPBDARK_Z	float32		template (S/N)^2 for dark targets in guider pass band on Z
TSNR2_ELG_Z	float32		ELG Z template (S/N)^2
TSNR2_GPBBRIGHT_Z	float32		template (S/N)^2 for bright targets in guider pass band on Z
TSNR2_LYA_Z	float32		LYA Z template (S/N)^2
TSNR2_BGS_Z	float32		BGS Z template (S/N)^2
TSNR2_GPBBACKUP_Z	float32		template (S/N)^2 for backup targets in guider pass band on
TSNR2_QSO_Z	float32		QSO Z template (S/N)^2
TSNR2_LRG_Z	float32		LRG Z template (S/N)^2
TSNR2_GPBDARK	float32		template (S/N)^2 for dark targets in guider pass band
TSNR2_ELG	float32		ELG template (S/N)^2 summed over B,R,Z
TSNR2_GPBBRIGHT	float32		template (S/N)^2 for bright targets in guider pass band
TSNR2_LYA	float32		LYA template (S/N)^2 summed over B,R,Z
TSNR2_BGS	float32		BGS template (S/N)^2 summed over B,R,Z
TSNR2_GPBBACKUP	float32		template (S/N)^2 for backup targets in guider pass band
TSNR2_QSO	float32		QSO template (S/N)^2 summed over B,R,Z
TSNR2_LRG	float32		LRG template (S/N)^2 summed over B,R,Z
SV_NSPEC[Page 472, 1]	int32		Number of coadded spectra for this TARGETID in SV (SV
SV_PRIMARY[Page 472, 1]	logical		Boolean flag (True/False) for the primary coadded spectrum
MAIN_NSPEC[Page 472, 1]	int32		Number of coadded spectra for this TARGETID in Main su
MAIN_PRIMARY[Page 472, 1]	logical		Boolean flag (True/False) for the primary coadded spectrum
ZCAT_NSPEC	int16		Number of coadded spectra for this TARGETID in this zcat
ZCAT_PRIMARY	logical		Boolean flag (True/False) for the primary coadded spectrum

Note: zpix files do not have `SV_NSPEC` or `SV_PRIMARY` columns; these are added when the zpix files are combined into *zall-pix* files. `MAIN_NSPEC` and `MAIN_PRIMARY` are reserved for future data releases for the DESI Main Survey.

HDU2

EXTNAME = EXP_FIBERMAP

Input fibermap entries for columns that apply per-exposure and can't be coadded, e.g. the individual TILEIDs and FIBERs on which each target was observed.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	162	int	width of table in bytes
NAXIS2	1374500	int	number of rows in table

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
NIGHT	int32		Night of observation (YYYYMMDD) starting at local noon before observations start
EXPID	int32		DESI Exposure ID number
MJD	float64		Modified Julian Date when shutter was opened for this exposure
TILEID	int32		Unique DESI tile ID
EXPTIME	float64	s	Length of time shutter was open
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
PSF_TO_FIBER_SPECFLUX	float64		fraction of light from point-like source captured by 1.5 arcsec diameter fiber given atmospheric seeing

Notes and Examples

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

ztile-SURVEY-PROGRAM-GROUPTYPE.fits

Summary
This file contatenates the individual *tile-based Redrock redshift catalogs* into a single file per SURVEY, PROGRAM, and spectral GROUPTYPE.

Naming Convention
`ztile-SURVEY-PROGRAM-GROUPTYPE.fits`, where `SURVEY` is *e.g.* `main` or `sv1`, `PROGRAM` is *e.g.* `bright or ``dark`, and `GROUPTYPE` is `cumulative` or `pernight`.

Regex
`ztile-(cmx|main|sv1|sv2|sv3|special)-(backup|bright|dark|other)-(cumulative|perexp|pernight|1x_`
`.fits`

File Type
FITS, 4 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	ZCATALOG	BINTABLE	Redshift catalog joined with target catalog
HDU2	EXP_FIBERMAP	BINTABLE	Per-exposure entries from input fibermaps

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = ZCATALOG

Redshift catalog joined with the targeting metadata from the REDSHIFTS and FIBERMAP HDUs of the *input redrock files*.

`TEMNAMnn` and `TEMVERnn` record the redrock template names and versions used for the redshift fits.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	677	int	width of table in bytes
NAXIS2	5000	int	number of rows in table
LONGSTRN	OGIP 1.0	str	
RRVER	0.15.0	str	Redrock version
TEMNAM00	GALAXY	str	Redrock template 00 name
TEMVER00	2.6	str	Redrock template 00 version
TEMNAM01	QSO	str	
TEMVER01	0.1	str	
TEMNAM02	STAR:::A	str	
TEMVER02	0.1	str	
TEMNAM03	STAR:::B	str	
TEMVER03	0.1	str	
TEMNAM04	STAR:::CV	str	
TEMVER04	0.1	str	
TEMNAM05	STAR:::F	str	
TEMVER05	0.1	str	
TEMNAM06	STAR:::G	str	
TEMVER06	0.1	str	
TEMNAM07	STAR:::K	str	
TEMVER07	0.1	str	
TEMNAM08	STAR:::M	str	
TEMVER08	0.1	str	
TEMNAM09	STAR:::WD	str	
TEMVER09	0.1	str	
SPGRP	cumulative	str	Spectral grouping method
SURVEY[1]	sv3	str	DESI sub-survey (e.g. sv1, sv3, main)
PROGRAM[Page 478, 1]	dark	str	DESI program (e.g. dark, bright)

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		ID (unique to file? and the whole survey?)
SURVEY[1]	char[7]		Survey name
PROGRAM[1]	char[6]		DESI program type - BRIGHT, DARK, BACKUP, OTHER
LASTNIGHT	int32		Final night of observation included in a series of coadds
SPGRPVAL	int32		Value by which spectra are grouped for a coadd (e.g. a YEA
Z	float64		Redshift measured by Redrock
ZERR	float64		Redshift error from redrock
ZWARN	int64		Redshift warning bitmask from Redrock
CHI2	float64		Best fit chi squared
COEFF	float64[10]		Redrock template coefficients
NPIXELS	int64		Number of unmasked pixels contributing to the Redrock fit
SPECTYPE	char[6]		Spectral type of Redrock best fit template (e.g. GALAXY, Q
SUBTYPE	char[20]		Spectral subtype

[1] Optional

Table 53 – continued from previous page

Name	Type	Units	Description
NCOEFF	int64		Number of Redrock template coefficients
DELTACHI2	float64		chi2 difference between first- and second-best redrock temp
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE
FIBER	int32		Fiber ID on the CCDs [0-4999]
COADD_FIBERSTATUS	int32		bitwise-AND of input FIBERSTATUS
TARGET_RA	float64	deg	Barycentric Right Ascension in ICRS
TARGET_DEC	float64	deg	Barycentric Declination in ICRS
PMRA	float32	mas yr^-1	Reference catalog proper motion in the RA direction
PMDEC	float32	mas yr^-1	Reference catalog proper motion in the Dec direction
REF_EPOCH	float32	yr	Reference catalog reference epoch (*e.g.*, 2015.5 for Gaia DI
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered c
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Flag the target to be observed in graytime.
RELEASE	int16		Legacy Surveys (LS) Release
BRICKNAME	char[8]		Brick name from tractor input
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		OBJID (unique to brick, but not to file)
MORPHTYPE	char[4]		Morphological Model type
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_G	float32	nanomaggy	LS flux from tractor input (g)
FLUX_R	float32	nanomaggy	LS flux from tractor input (r)
FLUX_Z	float32	nanomaggy	LS flux from tractor input (z)
FLUX_W1	float32	nanomaggy	WISE flux in W1
FLUX_W2	float32	nanomaggy	WISE flux in W2
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse Variance of FLUX_G
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse Variance of FLUX_R
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse Variance of FLUX_Z
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse Variance of FLUX_W1
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse Variance of FLUX_W2
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec f
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec f
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec f
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec f
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec f
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec f
MASKBITS	int16		Bitwise mask indicating that an object touches a pixel in the
SERSIC	float32		Power-law index for the Sersic profile model (`type="SER"`
SHAPE_R	float32	arcsec	Half-light radius of galaxy model for galaxy type `type` (>0
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type `ty`
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type `ty`
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; "sourceid" fo

Table 53 – continued from previous page

Name	Type	Units	Description
REF_CAT	char[2]		Reference catalog source for this star: "T2" for Tycho-2, "G
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PARALLAX	float32	mas	Reference catalog parallax
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S' for DECal
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OB
NUMOBS_INIT	int64		Initial number of observations for target calculated across ta
CMX_TARGET[1]	int64		Target selection bitmask for commissioning
SV1_DESI_TARGET[Page 478, 1]	int64		DESI (dark time program) target selection bitmask for SV1
SV1_BGS_TARGET[Page 478, 1]	int64		BGS (bright time program) target selection bitmask for SV
SV1_MWS_TARGET[Page 478, 1]	int64		MWS (bright time program) target selection bitmask for SV
SV1_SCND_TARGET[Page 478, 1]	int64		Secondary target selection bitmask for SV1
SV2_DESI_TARGET[Page 478, 1]	int64		DESI (dark time program) target selection bitmask for SV2
SV2_BGS_TARGET[Page 478, 1]	int64		BGS (bright time program) target selection bitmask for SV2
SV2_MWS_TARGET[Page 478, 1]	int64		MWS (bright time program) target selection bitmask for SV
SV2_SCND_TARGET[Page 478, 1]	int64		Secondary target selection bitmask for SV2
SV3_DESI_TARGET[Page 478, 1]	int64		DESI (dark time program) target selection bitmask for SV3
SV3_BGS_TARGET[Page 478, 1]	int64		BGS (bright time program) target selection bitmask for SV3
SV3_MWS_TARGET[Page 478, 1]	int64		MWS (bright time program) target selection bitmask for SV
SV3_SCND_TARGET[Page 478, 1]	int64		Secondary target selection bitmask for SV3
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SCND_TARGET	int64		Secondary target selection bitmask
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateM
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
TILEID	int32		Unique DESI tile ID
COADD_NUMEXP	int16		Number of exposures in coadd
COADD_EXPTIME	float32	s	Summed exposure time for coadd
COADD_NUMNIGHT	int16		Number of nights in coadd
COADD_NUMTILE	int16		Number of tiles in coadd
MEAN_DELTA_X	float32	mm	Mean (over exposures) fiber difference requested - actual C
RMS_DELTA_X	float32	mm	RMS (over exposures) of the fiber difference between meas
MEAN_DELTA_Y	float32	mm	Mean (over exposures) fiber difference requested - actual C
RMS_DELTA_Y	float32	mm	RMS (over exposures) of the fiber difference between meas
MEAN_FIBER_RA	float64	deg	Mean (over exposures) RA of actual fiber position
STD_FIBER_RA	float32	arcsec	Standard deviation (over exposures) of RA of actual fiber p
MEAN_FIBER_DEC	float64	deg	Mean (over exposures) DEC of actual fiber position
STD_FIBER_DEC	float32	arcsec	Standard deviation (over exposures) of DEC of actual fiber
MEAN_PSF_TO_FIBER_SPECFLUX	float32		Mean of input exposures fraction of light from point-like so
MEAN_FIBER_X	float32	mm	Mean (over exposures) fiber CS5 X location on focal plane
MEAN_FIBER_Y	float32	mm	Mean (over exposures) fiber CS5 X location on focal plane
TSNR2_GPBDARK_B	float32		template (S/N)^2 for dark targets in guider pass band on B
TSNR2_ELG_B	float32		ELG B template (S/N)^2
TSNR2_GPBBRIGHT_B	float32		template (S/N)^2 for bright targets in guider pass band on B
TSNR2_LYA_B	float32		LYA B template (S/N)^2
TSNR2_BGS_B	float32		BGS B template (S/N)^2
TSNR2_GPBBACKUP_B	float32		template (S/N)^2 for backup targets in guider pass band on

Table 53 – continued from previous page

Name	Type	Units	Description
TSNR2_QSO_B	float32		QSO B template (S/N)^2
TSNR2_LRG_B	float32		LRG B template (S/N)^2
TSNR2_GPBDARK_R	float32		template (S/N)^2 for dark targets in guider pass band on R
TSNR2_ELG_R	float32		ELG R template (S/N)^2
TSNR2_GPBBRIGHT_R	float32		template (S/N)^2 for bright targets in guider pass band on R
TSNR2_LYA_R	float32		LYA R template (S/N)^2
TSNR2_BGS_R	float32		BGS R template (S/N)^2
TSNR2_GPBBACKUP_R	float32		template (S/N)^2 for backup targets in guider pass band on
TSNR2_QSO_R	float32		QSO R template (S/N)^2
TSNR2_LRG_R	float32		LRG R template (S/N)^2
TSNR2_GPBDARK_Z	float32		template (S/N)^2 for dark targets in guider pass band on Z
TSNR2_ELG_Z	float32		ELG Z template (S/N)^2
TSNR2_GPBBRIGHT_Z	float32		template (S/N)^2 for bright targets in guider pass band on Z
TSNR2_LYA_Z	float32		LYA Z template (S/N)^2
TSNR2_BGS_Z	float32		BGS Z template (S/N)^2
TSNR2_GPBBACKUP_Z	float32		template (S/N)^2 for backup targets in guider pass band on
TSNR2_QSO_Z	float32		QSO Z template (S/N)^2
TSNR2_LRG_Z	float32		LRG Z template (S/N)^2
TSNR2_GPBDARK	float32		template (S/N)^2 for dark targets in guider pass band
TSNR2_ELG	float32		ELG template (S/N)^2 summed over B,R,Z
TSNR2_GPBBRIGHT	float32		template (S/N)^2 for bright targets in guider pass band
TSNR2_LYA	float32		LYA template (S/N)^2 summed over B,R,Z
TSNR2_BGS	float32		BGS template (S/N)^2 summed over B,R,Z
TSNR2_GPBBACKUP	float32		template (S/N)^2 for backup targets in guider pass band
TSNR2_QSO	float32		QSO template (S/N)^2 summed over B,R,Z
TSNR2_LRG	float32		LRG template (S/N)^2 summed over B,R,Z
SV_NSPEC[Page 478, 1]	int32		Number of coadded spectra for this TARGETID in SV (SV
SV_PRIMARY[Page 478, 1]	logical		Boolean flag (True/False) for the primary coadded spectrum
MAIN_NSPEC[Page 478, 1]	int32		Number of coadded spectra for this TARGETID in Main su
MAIN_PRIMARY[Page 478, 1]	logical		Boolean flag (True/False) for the primary coadded spectrum
ZCAT_NSPEC	int16		Number of coadded spectra for this TARGETID in this zcat
ZCAT_PRIMARY	logical		Boolean flag (True/False) for the primary coadded spectrum

Note: ztile files do not have `SV_NSPEC` or `SV_PRIMARY` columns; these are added when the ztile files are combined into *zall-tilecumulative* files. `MAIN_NSPEC` and `MAIN_PRIMARY` are reserved for future data releases for the DESI Main Survey.

HDU2

EXTNAME = EXP_FIBERMAP

Input fibermap entries for columns that apply per-exposure and can't be coadded, e.g. the individual TILEIDs and FIBERs on which each target was observed.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	162	int	width of table in bytes
NAXIS2	5000	int	number of rows in table

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
NIGHT	int32		Night of observation (YYYYMMDD) starting at local noon before observations start
EXPID	int32		DESI Exposure ID number
MJD	float64		Modified Julian Date when shutter was opened for this exposure
TILEID	int32		Unique DESI tile ID
EXPTIME	float64	s	Length of time shutter was open
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int64		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
NUM_ITER	int64		Number of positioner iterations
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
PSF_TO_FIBER_SPECFLUX	float64		fraction of light from point-like source captured by 1.5 arcsec diameter fiber given atmospheric seeing

Notes and Examples

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

exposures-SPECPROD.fits

Summary
File containing metadata about individual DESI exposures. There are two tables. The first is per-exposure and the second is per-camera per-exposure. The per-exposure table includes observational information as well as derived quantities estimating the observational depth for each target class, quoted in seconds of effective, idealized observing time. The second provides similar information on a per-camera basis.

Naming Convention
`exposures-{SPECPROD}.fits`, where `{SPECPROD}` is the official name of the full reduction, *e.g.* `everest`.

Regex
`exposures-[a-z0-9_-]+\.fits`

File Type
FITS, 19 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	EXPOSURES	BINTABLE	Per-exposure metadata
HDU2	FRAMES	BINTABLE	Per-camera per-exposure metadata

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = EXPOSURES

Binary table containing metadata about individual DESI exposures. This includes observational information as well as derived quantities estimating the observational depth for each target class, quoted in seconds of effective, idealized observing time.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	337	int	Number of columns
NAXIS2	3912	int	Number of exposure rows

Required Data Table Columns

Name	Type	Units	Description
NIGHT	int32		Observing night
EXPID	int32		DESI Exposure number
TILEID	int32		DESI Tile ID
TILERA	float64	deg	RA of tile given in fiberassign file
TILEDEC	float64	deg	DEC of tile given in fiberassign fileDEC of tile given in fiberassign file
MJD	float64		Modified Julian Date when shutter was opened for this exposure.
SURVEY	char[7]		Survey name
PROGRAM	char[6]		Program name
FAPRGRM	char[*]		Fiberassign program name
FAFLAVOR	char[*]		Fiberassign flavor name
EXPTIME	float64	s	Length of time shutter was open.
EFFTIME_SPEC	float64	s	Effective exposure time for nominal conditions derived from the TSNR2 fits to
GOALTIME	float64	s	Goal for total effective exposure time for the tile
GOALTYPE	char[6]		The intended observing conditions for the tile
MINTFRAC	float64		Minimum fraction of GOALTIME acceptable for considering a tile complete
AIRMASS	float32		Average airmass during this exposure.
EBV	float64		Galactic extinction E(B-V) reddening from SFD98
SEEING_ETC	float64	arcsec	Average FWHM atmospheric seeing during this exposure as measured by ETC
EFFTIME_ETC	float32	s	Effective exposure time for nominal conditions inferred from ETC data
TSNR2_ELG	float32		ELG template (S/N)^2 summed over B,R,Z
TSNR2_QSO	float32		QSO template (S/N)^2 summed over B,R,Z
TSNR2_LRG	float32		LRG template (S/N)^2 summed over B,R,Z
TSNR2_LYA	float64		LYA template (S/N)^2 summed over B,R,Z
TSNR2_BGS	float32		BGS template (S/N)^2 summed over B,R,Z
TSNR2_GPBDARK	float32		GPBDARK template (S/N)^2 summed over B,R,Z
TSNR2_GPBBRIGHT	float32		GPBBRIGHT template (S/N)^2 summed over B,R,Z
TSNR2_GPBBACKUP	float32		GPBBACKUP template (S/N)^2 summed over B,R,Z
LRG_EFFTIME_DARK	float32	s	Effective exposure time for nominal dark conditions inferred for LRG targets
ELG_EFFTIME_DARK	float32	s	Effective exposure time for nominal dark conditions inferred for ELG targets
BGS_EFFTIME_BRIGHT	float32	s	Effective exposure time for nominal bright conditions inferred for BGS targets
LYA_EFFTIME_DARK	float64	s	Effective exposure time for nominal dark conditions inferred for LYA targets

Name	Type	Units	Description
GPB_EFFTIME_DARK	float32	s	Effective exposure time for nominal dark conditions inferred for GPB targets
GPB_EFFTIME_BRIGHT	float32	s	Effective exposure time for nominal bright conditions inferred for GPB targets
GPB_EFFTIME_BACKUP	float32	s	Effective exposure time for nominal backup conditions inferred for GPB targe
TRANSPARENCY_GFA	float64		Average airmass during this exposure as measured by GFA.
SEEING_GFA	float64	arcsec	Average FWHM atmospheric seeing during this exposure as measured by GF
FIBER_FRACFLUX_GFA	float64		Fraction of the flux entering the fiber relative to nominal 1.1” seeing using the
FIBER_FRACFLUX_ELG_GFA	float64		Fraction of the flux entering the fiber relative to nominal 1.1” seeing using the
FIBER_FRACFLUX_BGS_GFA	float64		Fraction of the flux entering the fiber relative to nominal 1.1” seeing using the
FIBERFAC_GFA	float64		Fraction of light entering a fiber relative to expectations for 1.1” seeing, transp
FIBERFAC_ELG_GFA	float64		Same as FIBERFAC_GFA except for an ELG profile
FIBERFAC_BGS_GFA	float64		Same as FIBERFAC_GFA except for a BGS profile
AIRMASS_GFA	float64		Average airmass during this exposure as measured by GFA.
SKY_MAG_AB_GFA	float64		Sky background in the GFA passband, measured from the GFA backgrounds.
SKY_MAG_G_SPEC	float64		Sky background measured in the spectroscopy integrated over the DECam g p
SKY_MAG_R_SPEC	float64		Sky background measured in the spectroscopy integrated over the DECam r pa
SKY_MAG_Z_SPEC	float64		Sky background measured in the spectroscopy integrated over the DECam z p
EFFTIME_GFA	float64	s	Effective exposure time for nominal conditions inferred from GFA data
EFFTIME_DARK_GFA	float64	s	Effective exposure time for nominal dark conditions inferred from GFA data
EFFTIME_BRIGHT_GFA	float64	s	Effective exposure time for nominal bright conditions inferred from GFA data
EFFTIME_BACKUP_GFA	float64	s	Effective exposure time for nominal backup conditions inferred from GFA dat

HDU2

EXTNAME = FRAMES

Binary table containing metadata about individual DESI exposures per camera. This includes observational information as well as derived quantities estimating the observational depth for each target class, quoted as TSNR2_*. TSNR2_* can be converted to EFFTIME using the desispec function *desispec.tsnr.tsnr2_to_efftime(tsnr2,target_type)*.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	167	int	Number of columns
NAXIS2	111720	int	Number of per-camera per-exposure rows

Required Data Table Columns

Name	Type	Units	Description
NIGHT	int32		Observing night
EXPID	int32		DESI Exposure number
TILEID	int32		DESI Tile ID
TILERA	float64	deg	RA of tile given in fiberassign file
TILEDEC	float64	deg	DEC of tile given in fiberassign file
MJD	float64		Modified Julian Date when shutter was opened for this exposure.
EXPTIME	float32	s	Length of time shutter was open.
AIRMASS	float32		Average airmass during this exposure.
EBV	float64		Galactic extinction E(B-V) reddening from SFD98
SEEING_ETC	float64	arcsec	Average FWHM atmospheric seeing during this exposure as measured by ETC.
EFFTIME_ETC	float32	s	Effective exposure time for nominal conditions derived from exposure ETC data
CAMERA	char[2]		Camera identifier. Passband and SPECGRPH ([brz][0-9]).
TSNR2_GPBDARK	float32		GPBDARK template (S/N)^2 summed over B,R,Z
TSNR2_ELG	float32		ELG template (S/N)^2 summed over B,R,Z
TSNR2_GPBBRIGHT	float32		GPBBRIGHT template (S/N)^2 summed over B,R,Z
TSNR2_LYA	float64		LYA template (S/N)^2 summed over B,R,Z
TSNR2_BGS	float32		BGS template (S/N)^2 summed over B,R,Z
TSNR2_GPBBACKUP	float32		GPBBACKUP template (S/N)^2 summed over B,R,Z
TSNR2_QSO	float32		QSO template (S/N)^2 summed over B,R,Z
TSNR2_LRG	float32		LRG template (S/N)^2 summed over B,R,Z
SURVEY	char[7]		Survey name
GOALTYPE	char[6]		The intended observing conditions for the tile
FAPRGRM	char[*]		PROGRAM in fiberassign file
FAFLAVOR	char[*]		FLAVOR in fiberassign file
MINTFRAC	float64		Minimum fraction of GOALTIME acceptable for considering a tile complete
GOALTIME	float64	s	Goal for total effective exposure time for the tile

Notes and Examples

This file is based on the `guadalupe` production. There are minor type differences for these columns in both HDU1 and HDU2: `FAPRGRM`, `FAFLAVOR`, `EBV`, `EFFTIME_ETC`. Type warnings about these columns should be ignored.

tiles-SPECPROD.fits

Summary
: Table containing cumulative observational metadata as well as derived quantities estimating the observational "depth" for each target class, quoted in seconds of effective, idealized observing time.

Naming Convention
: `tiles-{SPECPROD}.fits`, where `{SPECPROD}` is the official name of the full reduction, *e.g.* `everest`.

Regex
: `tiles-[a-z0-9_-]+.fits`

File Type
FITS, 165 KB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	TILE_COMPLETENESS	BINTABLE	Per-tile metadata

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TILE_COMPLETENESS

Binary table containing metadata about individual DESI tiles. This includes cumulative observational information as well as derived quantities estimating the observational "depth" for each target class, quoted in seconds of effective, idealized observing time.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	218	int	length of dimension 1
NAXIS2	732	int	length of dimension 2

Required Data Table Columns

Name	Type	Units	Description
TILEID	int32		Unique DESI tile ID
SURVEY	char[20]		Survey name
PROGRAM	char[6]		Program name
FAPRGRM	char[20]		PROGRAM in fiberassign file
FAFLAVOR	char[20]		FLAVOR in fiberassign file
NEXP	int64		Number of exposures used in EFFTIME estimates
EXPTIME	float64	s	Actual exposure time
TILERA	float64	deg	RA of tile given in fiberassign file
TILEDEC	float64	deg	DEC of tile given in fiberassign file
EFFTIME_ETC	float64	s	Effective exposure time for nominal conditions derived from exposure ETC data
EFFTIME_SPEC	float64	s	Effective exposure time for nominal conditions derived from the TSNR2 fits to the spectroscopy
EFFTIME_GFA	float64	s	Effective exposure time for nominal conditions derived from exposure GFA data
GOALTIME	float64	s	Goal for total effective exposure time for the tile
OBSSTATUS	char[20]		Observing conditions bitmask
LRG_EFFTIME_DARK	float64	s	Effective exposure time for nominal dark conditions inferred for LRG targets
ELG_EFFTIME_DARK	float64	s	Effective exposure time for nominal dark conditions inferred for ELG targets
BGS_EFFTIME_BRIGHT	float64	s	Effective exposure time for nominal bright conditions inferred for BGS targets
LYA_EFFTIME_DARK	float64	s	Effective exposure time for nominal dark conditions inferred for LYA targets
GOALTYPE	char[20]		The intended observing conditions for the tile
MINTFRAC	float64		Minimum fraction of GOALTIME acceptable for considering a tile complete
LASTNIGHT	int32		Most recent night with a good exposure

Notes and Examples

For the definition of OBSCONDITIONS please see the *bitmask documentation* page for the definition of the bits.

survey

`${DESI_ROOT}/survey` contains data related to daily operations, fiberassignment, etc.

Subdirectories:

fiberassign

Intermediate fiberassign files related to the canonical *fiberassign data*.

Subdirectories:

SURVEY

The `SURVEY` is the phase of the overall DESI project the spectra were observed in. For example, `sv1`, `sv2`, `sv3`, `main`.

TILEXX

`TILEXX` is the first three characters of the zero-padded 6-digit TILEID.

TILEID-gfa.fits

Summary
This file contains the stars for the ETC / GUIDE / FOCUS covered by the tile disk-footprint.

Naming Convention
`{TILEID}-gfa.fits`, where `{TILEID}` is the zero-padded, 6-digit TILED.

Regex
`[0-9]{6}-gfa\.fits`

File Type
FITS, 6 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty HDU
HDU1	TARGETS	BINTABLE	Stars for the ETC / GUIDE / FOCUS covered by the tile disk-footprint.

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TARGETS

Stars for the ETC / GUIDE / FOCUS covered by the tile disk-footprint: those are read from the desitarget catalogs and provided as input to fiberassign.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	164	int	width of table in bytes
NAXIS2	43904	int	number of rows in table
SURVEY	main	str	
RESOLVE	T	bool	
MASKBITS	T	bool	
BACKUP	F	bool	
NOSEC	F	bool	
DR	9	int	

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int32		Imaging surveys release ID
TARGETID	int64		Unique DESI target ID
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
RA	float64	deg	Barycentric Right Ascension in ICRS
DEC	float64	deg	Barycentric declination in ICRS
RA_IVAR	float32	deg^-2	Inverse variance of RA (no cosine term!), excludin
DEC_IVAR	float32	deg^-2	Inverse variance of DEC, excluding astrometric cal
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
MASKBITS	int16		Bitwise mask from the imaging indicating potentia
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; sour
REF_CAT	char[2]		Reference catalog source for star: 'T2&#x27
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typica
PARALLAX	float32	mas	Reference catalog parallax
PARALLAX_IVAR	float32	mas^-2	Inverse variance of PARALLAX
PMRA	float32	mas / yr	proper motion in the +RA direction (already incluc
PMDEC	float32	mas / yr	Proper motion in the +Dec direction
PMRA_IVAR	float32	yr^2 / mas^2	Inverse variance of PMRA
PMDEC_IVAR	float32	yr^2 / mas^2	Inverse variance of PMDEC
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude

Table 55 – continued from previous p

Name	Type	Units	Description
GAIA_PHOT_G_MEAN_FLUX_OVER_ERROR	float32		Gaia G band signal-to-noise
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_BP_MEAN_FLUX_OVER_ERROR	float32		Gaia BP band signal-to-noise
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
GAIA_PHOT_RP_MEAN_FLUX_OVER_ERROR	float32		Gaia RP band signal-to-noise
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise
URAT_ID	int64		ID in the URAT catalog for sources where URAT s
URAT_SEP	float32	arcsec	Separation between URAT and Gaia sources where
GAIA_PHOT_G_N_OBS	int32		Gaia G band number of observations
HPXPIXEL	int64		HEALPixel containing this location at NSIDE=64

Notes and Examples

Some units in this file do not conform to the FITS standard:

- deg^-2 is incorrectly recorded as 1/deg^2
- nanomaggy^-2 is incorrectly recorded as 1/nanomaggy^2
- mas^-2 is incorrectly recorded as 1/mas^2

Such issues can typically be fixed by parsing the unit through astropy after reading in a Table, e.g.:

```
import astropy.units as u
from astropy.table import Table
objs = Table.read(filename, 1)
u.Unit(str(objs["RA_IVAR"].unit))
```

TILEID-scnd.fits

Summary
This file contains the secondary targets covered by the tile disk-footprint.

Naming Convention
`{TILEID}-scnd.fits`, where `{TILEID}` is the zero-padded, 6-digit TILED.

Regex
`[0-9]{6}-scnd\.fits`

File Type
FITS, 1 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty HDU
HDU1	TARGETS	BINTABLE	Secondary targets covered by the tile disk-footprint.

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TARGETS

Secondary targets covered by the tile disk-footprint: those are read from the MTL ledgers and desitarget catalogs and provided as input to fiberassign.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	275	int	width of table in bytes
NAXIS2	4751	int	number of rows in table
SURVEY	main	str	
RESOLVE	T	bool	
MASKBITS	T	bool	
BACKUP	F	bool	
NOSEC	F	bool	
DR	None	Unknown	

Required Data Table Columns

Name	Type	Units	Description
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
TARGETID	int64		Unique DESI target ID
RA	float64	deg	Barycentric Right Ascension in ICRS
DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas / yr	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	mas / yr	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gaia
PARALLAX	float32	mas	Reference catalog parallax
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SCND_TARGET	int64		Target selection bitmask for secondary programs
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCONDIT

Table 56 – continued from previous page

Name	Type	Units	Description
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selecti
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
NUMOBS_MORE	int64		Number of additional observations needed
NUMOBS	int64		Number of spectroscopic observations (on this specific, single tile)
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask from Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
Z_QN	float64		Redshift measured by QuasarNET using line with highest confidence
IS_QSO_QN	int16		Spectroscopic classification from QuasarNET (1 for a quasar)
DELTACHI2	float64		chi2 difference between first- and second-best redrock template fits
TARGET_STATE	char[30]		Combination of target class and its current observational state
TIMESTAMP	char[25]	s	UTC/ISO time at which the target state was updated
VERSION	char[14]		Tag of desitarget used to create the target catalog
PRIORITY	int64		Target current priority
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
PLATE_REF_EPOCH	float32	yr	Copy of REF_EPOCH to be used by PlateMaker

Notes and Examples

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

TILEID-sky.fits

Summary
This file contains the sky targets covered by the tile disk-footprint.

Naming Convention
`{TILEID}-sky.fits`, where `{TILEID}` is the zero-padded, 6-digit TILED.

Regex
`[0-9]{6}-sky\.fits`

File Type
FITS, 23 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty HDU
HDU1	SKY_TARGETS	BINTABLE	Sky targets covered by the tile disk-footprint.

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = SKY_TARGETS

Sky targets covered by the tile disk-footprint: those are read from the desitarget catalogs and provided as input to fiberassign.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	152	int	width of table in bytes
NAXIS2	163775	int	number of rows in table
SUPP	F	bool	
DR	9	int	

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int32		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
RA	float64	deg	Barycentric Right Ascension in ICRS
DEC	float64	deg	Barycentric declination in ICRS
BLOBDIST	float32	pix	Maximum distance from a detected Legacy Surveys source
FIBER-FLUX_G	float32	nanomaggy	g-band flux measured in aperture of radius 0.75 arcsec, extracted from the Legacy Surveys coadd stacks
FIBER-FLUX_R	float32	nanomaggy	r-band flux measured in aperture of radius 0.75 arcsec, extracted from the Legacy Surveys coadd stacks
FIBER-FLUX_Z	float32	nanomaggy	z-band flux measured in aperture of radius 0.75 arcsec, extracted from the Legacy Surveys coadd stacks
FIBER-FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of `FIBERFLUX_G`
FIBER-FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of `FIBERFLUX_R`
FIBER-FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of `FIBERFLUX_Z`
TARGETID	int64		Unique DESI target ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SUBPRIOR-ITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDI-TIONS	int64		Bitmask of allowed observing conditions
PRIOR-ITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCONDI-TIONS
NU-MOBS_INIT	int64		Initial number of observations for target calculated across target selection bitmasks and OBSCONDITIONS
HPXPIXEL	int64		HEALPixel containing this location at NSIDE=64 in the NESTED scheme
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker

Notes and Examples

The `FIBERFLUX` quantities use a different definition `FIBERFLUX` as measured in other files. See also the *skies files* files produced by desitarget.

Some units in this file do not conform to the FITS standard:

- nanomaggy^-2 is incorrectly recorded as 1/nanomaggy^2

Such issues can typically be fixed by parsing the unit through astropy after reading in a Table, e.g.:

```
import astropy.units as u
from astropy.table import Table
```

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```
objs = Table.read(filename, 1)
u.Unit(str(objs["FIBERFLUX_IVAR_G"].unit))
```

TILEID-targ.fits

Summary
This file contains the primary science targets covered by the tile disk-footprint.

Naming Convention
`{TILEID}-targ.fits`, where `{TILEID}` is the zero-padded, 6-digit TILED.

Regex
`[0-9]{6}-targ\.fits`

File Type
FITS, 11 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty HDU
HDU1	TARGETS	BINTABLE	Primary science targets covered by the tile disk-footprint.

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TARGETS

Primary science targets covered by the tile disk-footprint: those are read from the MTL ledgers and desitarget catalogs and provided as input to fiberassign.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	382	int	width of table in bytes
NAXIS2	30866	int	number of rows in table
SURVEY	main	str	
RESOLVE	T	bool	
MASKBITS	T	bool	
BACKUP	F	bool	
NOSEC	F	bool	
DR	None	Unknown	

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int16		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from thi
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from thi
FIBERTOTFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from all
FIBERTOTFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from all s
FIBERTOTFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from all
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blendin
SHAPE_R	float32	arcsec	Half-light radius of galaxy model (>0)
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORPHTY
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORPHTY
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE=&#x2
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; `sourceid` for Gaia D
REF_CAT	char[2]		Reference catalog source for star: 'T2' for Tycho-2, &
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S

Table 57 – continued from previous page

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
RA	float64	deg	Barycentric Right Ascension in ICRS
DEC	float64	deg	Barycentric declination in ICRS
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for G
PARALLAX	float32	mas	Reference catalog parallax
PMRA	float32	mas / yr	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	mas / yr	Proper motion in the +Dec direction
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCONI
NUMOBS_INIT	int64		Initial number of observations for target calculated across target sel
SCND_TARGET	int64		Target selection bitmask for secondary programs
NUMOBS_MORE	int64		Number of additional observations needed
NUMOBS	int64		Number of spectroscopic observations (on this specific, single tile)
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask from Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
Z_QN	float64		Redshift measured by QuasarNET using line with highest confidenc
IS_QSO_QN	int16		Spectroscopic classification from QuasarNET (1 for a quasar)
DELTACHI2	float64		chi2 difference between first- and second-best redrock template fits
TARGET_STATE	char[30]		Combination of target class and its current observational state
TIMESTAMP	char[25]	s	UTC/ISO time at which the target state was updated
VERSION	char[14]		Tag of desitarget used to create the target catalog
PRIORITY	int64		Target current priority
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMaker
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
PLATE_REF_EPOCH	float32	yr	Copy of REF_EPOCH to be used by PlateMaker

Notes and Examples

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

Some units in this file do not conform to the FITS standard:

- nanomaggy^-2 is incorrectly recorded as 1/nanomaggy^2

Such issues can typically be fixed by parsing the unit through astropy after reading in a Table, e.g.:

```
import astropy.units as u
from astropy.table import Table
objs = Table.read(filename, 1)
u.Unit(str(objs["FLUX_IVAR_Z"].unit))
```

TILEID-tiles.fits

Summary
This file contains the designed properties of the observed tile.

Naming Convention
`{TILEID}-tiles.fits`, where `{TILEID}` is the zero-padded, 6-digit TILED.

Regex
`[0-9]{6}-tiles\.fits`

File Type
FITS, 8 KB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty HDU
HDU1	TILES	BINTABLE	Tile designed properties.

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TILES

Tile designed properties.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	32	int	width of table in bytes
NAXIS2	1	int	number of rows in table

Required Data Table Columns

Name	Type	Units	Description
TILEID	int32		Unique DESI tile ID
RA	float64	deg	Barycentric Right Ascension in ICRS
DEC	float64	deg	Barycentric declination in ICRS
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
IN_DESI	int16		Used by fiberassign to make a tile in the DESI footprint; always set to 1
PROGRAM	char[6]		DESI program type - BRIGHT, DARK, BACKUP, OTHER

TILEID-too.fits

Summary
This file contains the Target-of-Opportunity targets covered by the tile disk-footprint.

Naming Convention
`{TILEID}-too.fits`, where `{TILEID}` is the zero-padded, 6-digit TILED.

Regex
`[0-9]{6}-too\.fits`

File Type
FITS, 19 KB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty HDU
HDU1	TARGETS	BINTABLE	Target-of-Opportunity targets covered by the tile disk-footprint.

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TARGETS

Target-of-Opportunity targets covered by the tile disk-footprint: those are read from the MTL ledgers and desitarget catalogs and provided as input to fiberassign.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	223	int	width of table in bytes
NAXIS2	1	int	number of rows in table
SURVEY	main	str	
RESOLVE	T	bool	
MASKBITS	T	bool	
BACKUP	F	bool	
NOSEC	F	bool	
DR	None	Unknown	

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Barycentric Right Ascension in ICRS
DEC	float64	deg	Barycentric declination in ICRS
PMRA	float64	mas / yr	proper motion in the +RA direction (already including cos(d
PMDEC	float64	mas / yr	Proper motion in the +Dec direction
REF_EPOCH	float64	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
PARALLAX	float32	mas	Reference catalog parallax
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise
TARGETID	int64		Unique DESI target ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SCND_TARGET	int64		Target selection bitmask for secondary programs
SCND_ORDER	int32		Number of row for target entry in secondary file (placeholder
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBS
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
NUMOBS_INIT	int64		Initial number of observations for target calculated across tar
OBSCONDITIONS	int64		Bitmask of allowed observing conditions
CHECKER	char[5]		Initials of researcher who vetted the target
TOO_TYPE	char[5]		Either "TILE" for a special tile or "FIBER" for a fiber-overri
TOO_PRIO	char[2]		Either "HI" for a very-high-priority target or "LO" for a very
OCLAYER	char[6]		Either "DARK" for dark-time or "BRIGHT" to observe in eit
MJD_BEGIN	float64	d	Start of the allowed observing window for this target (Modifi
MJD_END	float64	d	End of the allowed observing window for this target (Modifie
TOOID	int64		ID for this target assigned by the `CHECKER`
TIMESTAMP	char[25]	s	UTC/ISO time at which the target state was updated
PLATE_RA	float64	deg	Barycentric Right Ascension in ICRS to be used by PlateMa
PLATE_DEC	float64	deg	Barycentric Declination in ICRS to be used by PlateMaker
PLATE_REF_EPOCH	float64	yr	Copy of REF_EPOCH to be used by PlateMaker

Notes and Examples

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: TARGET_RA, TARGET_DEC, REF_EPOCH, PLATE_RA, PLATE_DEC, and PLATE_REF_EPOCH.

Some units in this file do not conform to the FITS standard:

- d is incorrectly recorded as day

Such issues can typically be fixed by parsing the unit through astropy after reading in a Table, e.g.:

```
import astropy.units as u
from astropy.table import Table
objs = Table.read(filename, 1)
u.Unit(str(objs["MJD_END"].unit))
```

DESI_TARGET

Default $DESI_ROOT/target

DESI_TARGET contains target selection data (including information about secondary targets), and fiberassign data. See also Myers *et al.* (2023).

fiberassign

fiberassign folder contains the fiber assignment main products.

tiles

tiles contains the SVN folder with the per-tile fiberassign main products.

TILES_VERSION

TILES_VERSION tracks the SVN version number.

TILEXX

TILEXX is the first three characters of the zero-padded 6-digit TILEID.

fiberassign-TILEID.fits.gz

Summary
The fiberassign file contains the fiber positioner configuration information for each exposure: what fiber is placed where, what target that is, etc.

Naming Convention
`fiberassign-TILEID.fits.gz`, where TILEID is the zero-padded 6-digit tile ID. Some early versions were not compressed.

Regex
`fiberassign-[0-9]{6}\.fits\.gz`

File Type
FITS, 5 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Keywords only
HDU1	FIBERASSIGN	BINTABLE	Target assignments for each fiber
HDU2	SKY_MONITOR	BINTABLE	Sky location for the 20 sky monitor fibers used by the ETC
HDU3	GFA_TARGETS	BINTABLE	Selected star for the ETC / GUIDE / FOCUS
HDU4	TARGETS	BINTABLE	List of targets that are reachable by a positioner
HDU5	POTENTIAL_ASSIGNMENTS	BINTABLE	All possible (TARGETID, FIBER, LOCATION) assignments

FITS Header Units

HDU0

EXTNAME = PRIMARY

No data, but some useful header keywords.

Required Header Keywords

KEY	Example Value	Type	Comment
TILEID	4403	int	Tile ID
TILERA	170.239	float	[deg] Tile Right Ascension
TILEDEC	-7.093	float	[deg] Tile Declination
FIELDROT	0.0210480650645507	float	[deg] Field rotation
FA_PLAN	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
FA_HA	-6.72	float	[deg] Design Hour Angle

continues on next page

Table 59 – continued from previous page

KEY	Example Value	Type	Comment
FA_RUN	2022-01-03T17:00:31+00:00	str	[UTC] Date of the loaded Focal Plane state
FA_M_GFA	0.4	float	[mm] Margin around GFA keep-out polygons
FA_M_PET	0.4	float	[mm] Margin around petal-boundary keep-out polygons
FA_M_POS	0.05	float	[mm] Margin around positioner keep-out polygons
REQRA	170.239	float	[deg] Tile Right Ascension
REQDEC	-7.093	float	[deg] Tile Declination
FIELDNUM	0	int	Not used, always zero
FA_VER	5.4.0	str	Fiberassign code version
FA_SURV	main	str	Survey of origin of the targets
FAFLAVOR	maindark	str	String composed of the SURVEY and the PROGRAM
DESIROOT	/data/datasystems	str	DESI_ROOT environment variable path
GFA	DESIROOT/target/catalogs/dr9/1.1.1/gfas	str	Path to the input GFA targets
MTL	DESIROOT/survey/ops/surveyops/trunk/mtl/main/dark	str	Path to the primary targets ledgers
SCND	DESIROOT/target/catalogs/dr9/1.1.1/targets/main/secondary/dark/targets-dark-secondary.fits	str	Path to the secondary targets static catalogs
SCND2	DESIROOT/target/catalogs/dr9/1.1.1/targets/main2/secondary/dark/main2targets-dark-secondary.fits	str	Path to the secondary targets static catalogs
SCNDMTL	DESIROOT/survey/ops/surveyops/trunk/mtl/main/secondary/dark	str	Path to the secondary targets ledgers
SKY	DESIROOT/target/catalogs/dr9/1.1.1/skies	str	Path to the sky targets
SKYSUPP	DESIROOT/target/catalogs/gaiadr2/1.1.1/skies-supp	str	Path to the supp-sky targets
TARG	DESIROOT/target/catalogs/dr9/1.1.1/targets/main/resolve/dark	str	Path to the primary targets static catalogs
TOO	DESIROOT/survey/ops/surveyops/trunk/mtl/main/ToO/ToO.ecsv	str	Path to the Target-of-Opportunity catalog

continues on next page

Table 59 – continued from previous page

KEY	Example Value	Type	Comment
FAARGS	–doclean n –dr dr9 –dtver 1.1.1 –gaiadr gaiadr2 –goaltime 1000.0 –ha -6.72 –hdr_faprgrm dark –hdr_survey main –log_stdout False –lookup_sky_source ls –margin_gfa 0.4 –margin_petal 0.4 –margin_pos 0.05 –mintfrac 0.85 –mtltime 2022-01-13T18:13:09+00:00 –nosteps qa –pmcorr n –pmtime_utc_str 2022-01-14T10:13:28+00:00 –program DARK –rundate 2022-01-03T17:00:31+00:00 –sbprof ELG –sky_per_petal 40 –sky_per_slitblock 1 –standards_per_petal 10 –steps tiles,sky,gfa,targ,scnd,too,fa,zip,move,qa –survey main –svntiledir /data/tiles/SVN_tiles –tiledec -7.093 –tileid 4403 –tilera 170.239 –worldreadable True	str	fba_launch command arguments
OUTDIR	/data/datasystems/target/fiberassign/holding_pen/	str	Folder where the fba_launch outputs are written
SURVEY	main	str	Survey of origin of the targets
NOWTIME	2022-01-14T10:13:28+00:00	str	[UTC] Date of the fba_launch call
RUNDATE	2022-01-03T17:00:31+00:00	str	[UTC] Date of the loaded Focal Plane state
PMCORR	n	str	Is proper-motion correction applied for stars?
PMTIME	2022-01-14T10:13:28+00:00	str	[UTC] Used current time, if proper-motion correction is applied
FAPRGRM	dark	str	Program to which this tile belongs
MTLTIME	2022-01-13T18:13:09+00:00	str	[UTC] Date used to read the ledgers
OBSCON	DARK|GRAY|BRIGHT|BACKUP	str	Allowed observing conditions for this tile
GOALTIME	1000.0	float	[s] Aimed EFFTIME_SPEC

continues on next page

Table 59 – continued from previous page

KEY	Example Value	Type	Comment
GOALTYPE	DARK	str	Sky conditions used for some noise estimation
EBVFAC	1.08401875659818	float	10.0 ** (2.165 * median(EBV) / 2.5))
SBPROF	ELG	str	Source profile used for some noise estimation
MINTFRAC	0.85	float	Fraction of GOALTIME to be reached by EFFTIME_SPEC to consider the tile has completed
FASCRIPT	/software/datasystems/desiconda/20200924/code/fiberassign/5.4.0/bin/fba_launch	str	Path to the fba_launch used script
SVNDM	138481	str	DESIMODEL/data svn revision number
SVNMTL	1083	str	DESI_SURVEYOPS/mtl svn revision number
LKSKYSRC[1]	ls	str	Photometric survey used for the sky look-up table for the stuck fibers

Empty HDU.

HDU1

EXTNAME = FIBERASSIGN

The target assignments for each fiber of this tile.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	293	int	width of table in bytes
NAXIS2	5000	int	number of rows in table
TILEID	4403	int	Tile ID
TILERA	170.239	float	[deg] Tile Right Ascension
TILEDEC	-7.093	float	[deg] Tile Declination
FIELDROT	0.0210480650645507	float	[deg] Field rotation
FA_PLAN	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
FA_HA	-6.72	float	[deg] Design Hour Angle
FA_RUN	2022-01-03T17:00:31+00:00	str	[UTC] Date of the loaded Focal Plane state
FA_M_GFA	0.4	float	[mm] Margin around GFA keep-out polygons
FA_M_PET	0.4	float	[mm] Margin around petal-boundary keep-out polygons
FA_M_POS	0.05	float	[mm] Margin around positioner keep-out polygons
REQRA	170.239	float	[deg] Tile Right Ascension
REQDEC	-7.093	float	[deg] Tile Declination
FIELDNUM	0	int	Not used, always zero
FA_VER	5.4.0	str	Fiberassign code version
FA_SURV	main	str	Survey of origin of the targets

[1] Optional

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask; 0=good
TARGET_RA	float64	deg	Target Right Ascension
TARGET_DEC	float64	deg	Target Declination
PMRA	float32	mas/yr	Proper motion in the RA direction (already including cosDEC term)
PMDEC	float32	mas/yr	Proper motion in the DEC direction
REF_EPOCH	float32	yr	Reference catalog reference epoch (eg, 2015.5 for Gaia DR2)
LAMBDA_REF	float32	Angstrom	Wavelength at which targets should be centered on fibers
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Target type (science, standard, sky, safe, suppsky)
OBJTYPE	char[3]		TGT, SKY, BAD, empty
FIBERASSIGN_X	float32	mm	Expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Expected CS5 Y location on focal plane
PRIORITY	int32		Assignment priority; larger = higher priority
SUBPRIORITY	float64		Assignment subpriority [0-1]
OBSCONDITIONS	int32		Bit-coded of allowed observing conditions
RELEASE	int16		Imaging release number
BRICKNAME	char[8]		Imaging Surveys brick name
BRICKID	int32		Imaging Surveys brick ID
BRICK_OBJID	int32		Imaging surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging surveys morphological type
EBV	float32	mag	Galactic extinction E(B-V) reddening
FLUX_G	float32	nanomaggy	Flux in g-band
FLUX_R	float32	nanomaggy	Flux in r-band
FLUX_Z	float32	nanomaggy	Flux in z-band
FLUX_W1	float32	nanomaggy	Flux in WISE W1-band
FLUX_W2	float32	nanomaggy	Flux in WISE W2-band
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse variance of FLUX_W1
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse variance of FLUX_W2
FIBERFLUX_G	float32	nanomaggy	g-band object model flux for 1 arcsec seeing and 1.5 arcsec diameter
FIBERFLUX_R	float32	nanomaggy	r-band object model flux for 1 arcsec seeing and 1.5 arcsec diameter
FIBERFLUX_Z	float32	nanomaggy	z-band object model flux for 1 arcsec seeing and 1.5 arcsec diameter
FIBERTOTFLUX_G	float32	nanomaggy	like FIBERFLUX_G but including all objects overlapping this locati
FIBERTOTFLUX_R	float32	nanomaggy	like FIBERFLUX_R but including all objects overlapping this locati
FIBERTOTFLUX_Z	float32	nanomaggy	like FIBERFLUX_Z but including all objects overlapping this locati
MASKBITS	int16		Bitwise mask from the imaging indicating potential issue or blending
SERSIC	float32		Power-law index for the Sersic profile model
SHAPE_R	float32	arcsec	Half-light radius of galaxy model for galaxy type
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type

Table 60 – continued from previous page

Name	Type	Units	Description
REF_ID	int64		Astrometric catalog reference ID (SOURCE_ID from Gaia and SGA
REF_CAT	char[2]		Reference catalog source for this star
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band mag
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP mag
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP mag
PARALLAX	float32	mas	Reference catalog parallax
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S' for DECaLS, 'G' fo
PRIORITY_INIT	int64		Initial priority for target calculated across target selection bitmasks a
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selec
DESI_TARGET	int64		Dark survey + calibration bitmask
BGS_TARGET	int64		Bright Galaxy Survey bitmask
MWS_TARGET	int64		Milky Way Survey bitmask
SCND_TARGET	int64		Secondary programs bitmask
PLATE_RA	float64	deg	Right Ascension to be used by PlateMaker
PLATE_DEC	float64	deg	Declination to be used by PlateMaker

HDU2

EXTNAME = SKY_MONITOR

Blank sky assignments for sky monitor positioners.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	99	int	width of table in bytes
NAXIS2	20	int	number of rows in table
TILEID	4403	int	Tile ID
TILERA	170.239	float	[deg] Tile Right Ascension
TILEDEC	-7.093	float	[deg] Tile Declination
FIELDROT	0.0210480650645507	float	[deg] Field rotation
FA_PLAN	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
FA_HA	-6.72	float	[deg] Design Hour Angle
FA_RUN	2022-01-03T17:00:31+00:00	str	[UTC] Date of the loaded Focal Plane state
FA_M_GFA	0.4	float	[mm] Margin around GFA keep-out polygons
FA_M_PET	0.4	float	[mm] Margin around petal-boundary keep-out polygons
FA_M_POS	0.05	float	[mm] Margin around positioner keep-out polygons
REQRA	170.239	float	[deg] Tile Right Ascension
REQDEC	-7.093	float	[deg] Tile Declination
FIELDNUM	0	int	Not used, always zero
FA_VER	5.4.0	str	Fiberassign code version
FA_SURV	main	str	Survey of origin of the targets

Required Data Table Columns

Name	Type	Units	Description
FIBER	int32		Fiber ID on the CCDs [0-4999]
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
TARGETID	int64		Unique target ID
BRICKID	int32		Imaging Surveys brick ID
BRICK_OBJID	int32		Imaging surveys OBJID on that brick
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Target type (science, standard, sky, safe, suppsky)
TARGET_RA	float64	deg	Target Right Ascension
TARGET_DEC	float64	deg	Target Declination
FIBERASSIGN_X	float32	mm	Expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Expected CS5 Y location on focal plane
BRICKNAME	char[8]		Imaging Surveys brick name
FIBERSTATUS	int32		Fiber status mask; 0=good
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
PRIORITY	int32		Assignment priority; larger = higher priority
SUBPRIORITY	float64		Assignment subpriority [0-1]
FIBERFLUX_G	float32	nanomaggy	Flux in g-band
FIBERFLUX_R	float32	nanomaggy	Flux in r-band
FIBERFLUX_Z	float32	nanomaggy	Flux in z-band

HDU3

EXTNAME = GFA_TARGETS

GFA stars to be used by the ETC / GUIDE / FOCUS

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	172	int	width of table in bytes
NAXIS2	988	int	number of rows in table
TILEID	4403	int	Tile ID
TILERA	170.239	float	[deg] Tile Right Ascension
TILEDEC	-7.093	float	[deg] Tile Declination
FIELDROT	0.0210480650645507	float	[deg] Field rotation
FA_PLAN	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
FA_HA	-6.72	float	[deg] Design Hour Angle
FA_RUN	2022-01-03T17:00:31+00:00	str	[UTC] Date of the loaded Focal Plane state
FA_M_GFA	0.4	float	[mm] Margin around GFA keep-out polygons
FA_M_PET	0.4	float	[mm] Margin around petal-boundary keep-out polygons
FA_M_POS	0.05	float	[mm] Margin around positioner keep-out polygons
REQRA	170.239	float	[deg] Tile Right Ascension
REQDEC	-7.093	float	[deg] Tile Declination
FIELDNUM	0	int	Not used, always zero
FA_VER	5.4.0	str	Fiberassign code version
FA_SURV	main	str	Survey of origin of the targets

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int32		Imaging release number
TARGETID	int64		Unique target ID
BRICKID	int32		Imaging Surveys brick ID
BRICK_OBJID	int32		Imaging surveys OBJID on that brick
TARGET_RA	float64	deg	Target Right Ascension
TARGET_DEC	float64	deg	Target Declination
TARGET_RA_IVAR	float32	deg^-2	Inverse variance of TARGET_RA
TARGET_DEC_IVAR	float32	deg^-2	Inverse variance of TARGET_DEC
MORPHTYPE	char[4]		Imaging surveys morphological type
MASKBITS	int16		Bitwise mask from the imaging indicating potentia
FLUX_G	float32	nanomaggy	Flux in g-band
FLUX_R	float32	nanomaggy	Flux in r-band
FLUX_Z	float32	nanomaggy	Flux in z-band
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z
REF_ID	int64		Astrometric catalog reference ID (SOURCE_ID fr
REF_CAT	char[2]		Reference catalog source for this star
REF_EPOCH	float32	yr	Reference catalog reference epoch
PARALLAX	float32	mas	Reference catalog parallax
PARALLAX_IVAR	float32	mas^-2	Inverse variance of PARALLAX
PMRA	float32	mas/yr	Proper motion in the RA direction (already includi
PMDEC	float32	mas/yr	Proper motion in the DEC direction
PMRA_IVAR	float32	yr^2/mas^2	Inverse variance of PMRA

Table 61 – continued from previous page

Name	Type	Units	Description
PMDEC_IVAR	float32	yr^2/mas^2	Inverse variance of PMDEC
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band mag
GAIA_PHOT_G_MEAN_FLUX_OVER_ERROR	float32		Gaia G band signal-to-noise
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band mag
GAIA_PHOT_BP_MEAN_FLUX_OVER_ERROR	float32		Gaia BP signal-to-noise
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band mag
GAIA_PHOT_RP_MEAN_FLUX_OVER_ERROR	float32		Gaia RP signal-to-noise
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise
URAT_ID	int64		URAT ID
URAT_SEP	float32	arcsec	Distance separation to the URAT coordinates
GAIA_PHOT_G_N_OBS	int32		Gaia G band number of observations
HPXPIXEL	int64		HEALPixel containing GFA target
GFA_LOC	int16		Covered GFA identifier
GUIDE_FLAG	int16		GUIDING bitmask
FOCUS_FLAG	int16		FOCUS bitmask
ETC_FLAG	int16		ETC bitmask

HDU4

EXTNAME = TARGETS

Unique list of targets reachable by a positioner.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	81	int	width of table in bytes
NAXIS2	152687	int	number of rows in table
TILEID	4403	int	Tile ID
TILERA	170.239	float	[deg] Tile Right Ascension
TILEDEC	-7.093	float	[deg] Tile Declination
FIELDROT	0.0210480650645507	float	[deg] Field rotation
FA_PLAN	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
FA_HA	-6.72	float	[deg] Design Hour Angle
FA_RUN	2022-01-03T17:00:31+00:00	str	[UTC] Date of the loaded Focal Plane state
FA_M_GFA	0.4	float	[mm] Margin around GFA keep-out polygons
FA_M_PET	0.4	float	[mm] Margin around petal-boundary keep-out polygons
FA_M_POS	0.05	float	[mm] Margin around positioner keep-out polygons
REQRA	170.239	float	[deg] Tile Right Ascension
REQDEC	-7.093	float	[deg] Tile Declination
FIELDNUM	0	int	Not used, always zero
FA_VER	5.4.0	str	Fiberassign code version
FA_SURV	main	str	Survey of origin of the targets

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique target ID
RA	float64	deg	Target Right Ascension
DEC	float64	deg	Target Declination
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Target type (science, standard, sky, safe, suppsky)
PRIORITY	int32		Assignment priority; larger = higher priority
SUBPRIORITY	float64		Assignment subpriority [0-1]
OBSCONDITIONS	int32		Bit-coded of allowed observing conditions
DESI_TARGET	int64		Dark survey + calibration bitmask
BGS_TARGET	int64		Bright Galaxy Survey bitmask
MWS_TARGET	int64		Milky Way Survey bitmask
SCND_TARGET	int64		Secondary programs bitmask

HDU5

EXTNAME = POTENTIAL_ASSIGNMENTS

A list of targets that could have been assigned to each fiber.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	16	int	width of table in bytes
NAXIS2	169775	int	number of rows in table
TILEID	4403	int	Tile ID
TILERA	170.239	float	[deg] Tile Right Ascension
TILEDEC	-7.093	float	[deg] Tile Declination
FIELDROT	0.0210480650645507	float	[deg] Field rotation
FA_PLAN	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
FA_HA	-6.72	float	[deg] Design Hour Angle
FA_RUN	2022-01-03T17:00:31+00:00	str	[UTC] Date of the loaded Focal Plane state
FA_M_GFA	0.4	float	[mm] Margin around GFA keep-out polygons
FA_M_PET	0.4	float	[mm] Margin around petal-boundary keep-out polygons
FA_M_POS	0.05	float	[mm] Margin around positioner keep-out polygons
REQRA	170.239	float	[deg] Tile Right Ascension
REQDEC	-7.093	float	[deg] Tile Declination
FIELDNUM	0	int	Not used, always zero
FA_VER	5.4.0	str	Fiberassign code version
FA_SURV	main	str	Survey of origin of the targets

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique target ID
FIBER	int32		Fiber ID on the CCDs [0-4999]
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC

Notes and Examples

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

- HDU0: early tiles may have some missing keywords from the listed ones.
- HDU1: this table defines the *requested* fiber assignments; see *fibermap-EXPID* for the actual observed assignments.
- HDU1: `LAMBDA_REF` : 5400 so far, not used for fiber positioning.
- HDU1, HDU4, HDU5: files built from CMX, SV1, SV2, or SV3 targets will have a slightly different column content for the targetings bit columns (e.g., `CMX_TARGET`, `SV1_DESI_TARGET`).
- HDU2: `BRICKID`, `BRICK_OBJID`, `FA_TARGET`, `BRICKNAME`, `PRIORITY`, `SUBPRIORITY`, `FIBERFLUX_G`, `FIBERFLUX_R`, `FIBERFLUX_Z` mostly are a zero value (and an empty string for `BRICKNAME`).
- HDU3: for objects that do not have a match in URAT, the `URAT_ID` and `URAT_SEP` columns are -1.
- HDU5: the same target can appear more than once if it is reachable by more than one fiber.

fiberassign-TILEID.fits

Summary
The fiberassign file contains the fiber positioner configuration information for each exposure: what fiber is placed where, what target that is, etc. The uncompressed version may contain extra HDUs relative to the compressed version.

Naming Convention
`fiberassign-TILEID.fits`, where TILEID is the zero-padded 6-digit tile ID.

Regex
`fiberassign-[0-9]{6}\.fits`

File Type
FITS, 42 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Keywords only
HDU1	FIBERASSIGN	BINTABLE	Target assignments for each fiber
HDU2	SKY_MONITOR	BINTABLE	Sky location for the 20 sky monitor fibers used by the ETC
HDU3	GFA_TARGETS	BINTABLE	Selected star for the ETC / GUIDE / FOCUS
HDU4	TARGETS	BINTABLE	List of targets that are reachable by a positioner
HDU5	POTENTIAL_ASSIGNMENTS	BINTABLE	All possible (TARGETID, FIBER, LOCATION) assignments
HDU6	FASSIGN	BINTABLE	Short version of FIBERASSIGN
HDU7	FTARGETS	BINTABLE	Short version of TARGETS
HDU8	FAVAIL	BINTABLE	Equivalent to POTENTIAL_ASSIGNMENTS

FITS Header Units

HDU0

EXTNAME = PRIMARY

No data, but some useful header keywords.

Required Header Keywords

KEY	Example Value	Type	Comment
FA_VER	1.2.1.dev2478	str	Fiberassign code version
FIELDNUM	0	int	Not used, always zero
TILEDEC	28.12	float	[deg] Tile Declination
FA_SURV	main	str	Survey of origin of the targets
TILEID	59096	int	Tile ID
FA_HA	0.0	float	[deg] Design Hour Angle
FIELDROT	0.0	float	[deg] Field rotation
REQRA	348.12	float	[deg] Tile Right Ascension
REQDEC	28.12	float	[deg] Tile Declination
FA_DATE	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
TILERA	348.12	float	[deg] Tile Right Ascension

Empty HDU.

HDU1

EXTNAME = FIBERASSIGN

The target assignments for each fiber of this tile.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	204	int	width of table in bytes
NAXIS2	5000	int	number of rows in table
FA_VER	1.2.1.dev2478	str	Fiberassign code version
FIELDNUM	0	int	Not used, always zero
TILEDEC	28.12	float	[deg] Tile Declination
FA_SURV	main	str	Survey of origin of the targets
TILEID	59096	int	Tile ID
FA_HA	0.0	float	[deg] Design Hour Angle
FIELDROT	0.0	float	[deg] Field rotation
REQRA	348.12	float	[deg] Tile Right Ascension
REQDEC	28.12	float	[deg] Tile Declination
FA_DATE	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
TILERA	348.12	float	[deg] Tile Right Ascension

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
PMRA_IVAR	float32	yr^2 mas^-2	Inverse variance of PMRA
PMDEC_IVAR	float32	yr^2 mas^-2	Inverse variance of PMDEC
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gaia
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky)
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
NUMTARGET	int16		Total number of targets that this positioner covered
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties

Table 62 – continued from previous page

Name	Type	Units	Description
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
NUMOBS_MORE	int32		Number of additional observations needed
RELEASE	int32		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
BLOBDIST	float32	pix	Maximum distance from a detected Legacy Surveys source
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from this object in 1
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this object in 1
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from this object in 1
FIBERFLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of `FIBERFLUX_G`
FIBERFLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of `FIBERFLUX_R`
FIBERFLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of `FIBERFLUX_Z`
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selection bitma
HPXPIXEL	int64		HEALPixel containing this location at NSIDE=64 in the NESTED scheme

HDU2

EXTNAME = SKY_MONITOR

Blank sky assignments for sky monitor positioners.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	113	int	width of table in bytes
NAXIS2	20	int	number of rows in table
FA_VER	1.2.1.dev2478	str	Fiberassign code version
FIELDNUM	0	int	Not used, always zero
TILEDEC	28.12	float	[deg] Tile Declination
FA_SURV	main	str	Survey of origin of the targets
TILEID	59096	int	Tile ID
FA_HA	0.0	float	[deg] Design Hour Angle
FIELDROT	0.0	float	[deg] Field rotation
REQRA	348.12	float	[deg] Tile Right Ascension
REQDEC	28.12	float	[deg] Tile Declination
FA_DATE	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
TILERA	348.12	float	[deg] Tile Right Ascension

Required Data Table Columns

Name	Type	Units	Description
FIBER	int32		Fiber ID on the CCDs [0-4999]
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
NUMTARGET	int16		Total number of targets that this positioner covered
TARGETID	int64		Unique DESI target ID
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky)
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
BRICKNAME	char[8]		Brick name from tractor input
FIBERSTATUS	int32		Fiber status mask. 0=good
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
FIBERFLUX_G	float32	nanomaggy	Predicted g-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERFLUX_R	float32	nanomaggy	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERFLUX_Z	float32	nanomaggy	Predicted z-band flux within a fiber of diameter 1.5 arcsec from this object in 1 arcsec Gaussian seeing
FIBERFLUX_IVAR_G	float32	nanomaggy 2	^-Inverse variance of `FIBERFLUX_G`
FIBERFLUX_IVAR_R	float32	nanomaggy 2	^-Inverse variance of `FIBERFLUX_R`
FIBERFLUX_IVAR_Z	float32	nanomaggy 2	^-Inverse variance of `FIBERFLUX_Z`

HDU3

EXTNAME = GFA_TARGETS

GFA stars to be used by the ETC / GUIDE / FOCUS

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	166	int	width of table in bytes
NAXIS2	1873	int	number of rows in table
FA_VER	1.2.1.dev2478	str	Fiberassign code version
FIELDNUM	0	int	Not used, always zero
TILEDEC	28.12	float	[deg] Tile Declination
FA_SURV	main	str	Survey of origin of the targets
TILEID	59096	int	Tile ID
FA_HA	0.0	float	[deg] Design Hour Angle
FIELDROT	0.0	float	[deg] Field rotation
REQRA	348.12	float	[deg] Tile Right Ascension
REQDEC	28.12	float	[deg] Tile Declination
FA_DATE	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
TILERA	348.12	float	[deg] Tile Right Ascension

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int32		Imaging surveys release ID
TARGETID	int64		Unique DESI target ID
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
TARGET_RA_IVAR	float32		label for field 7
TARGET_DEC_IVAR	float32		label for field 8
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of FLUX_Z (AB)
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; `sour`
REF_CAT	char[2]		Reference catalog source for star: 'T2&#x2
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typica
PARALLAX	float32	mas	Reference catalog parallax
PARALLAX_IVAR	float32	mas^-2	Inverse variance of PARALLAX
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already incluc
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
PMRA_IVAR	float32	yr^2 mas^-2	Inverse variance of PMRA
PMDEC_IVAR	float32	yr^2 mas^-2	Inverse variance of PMDEC
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_G_MEAN_FLUX_OVER_ERROR	float32		Gaia G band signal-to-noise
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_BP_MEAN_FLUX_OVER_ERROR	float32		Gaia BP band signal-to-noise

Table 63 – continued from previous p

Name	Type	Units	Description
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
GAIA_PHOT_RP_MEAN_FLUX_OVER_ERROR	float32		Gaia RP band signal-to-noise
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise
URAT_ID	int64		ID in the URAT catalog for sources where URAT s
URAT_SEP	float32	arcsec	Separation between URAT and Gaia sources where
HPXPIXEL	int64		HEALPixel containing this location at NSIDE=64
GFA_LOC	int16		label for field 35
ETC_FLAG	int16		label for field 36
GUIDE_FLAG	int16		label for field 37
FOCUS_FLAG	int16		label for field 38

HDU4

EXTNAME = TARGETS

Unique list of targets reachable by a positioner.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	204	int	width of table in bytes
NAXIS2	145163	int	number of rows in table
FA_VER	1.2.1.dev2478	str	Fiberassign code version
FIELDNUM	0	int	Not used, always zero
TILEDEC	28.12	float	[deg] Tile Declination
FA_SURV	main	str	Survey of origin of the targets
TILEID	59096	int	Tile ID
FA_HA	0.0	float	[deg] Design Hour Angle
FIELDROT	0.0	float	[deg] Field rotation
REQRA	348.12	float	[deg] Tile Right Ascension
REQDEC	28.12	float	[deg] Tile Declination
FA_DATE	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
TILERA	348.12	float	[deg] Tile Right Ascension

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
FIBERSTATUS	int32		Fiber status mask. 0=good
RA	float64	deg	Barycentric Right Ascension in ICRS
DEC	float64	deg	Barycentric declination in ICRS

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Table 64 – continued from previous page

Name	Type	Units	Description
PMRA	float32	mas yr^-1	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	mas yr^-1	Proper motion in the +Dec direction
PMRA_IVAR	float32	yr^2 mas^-2	Inverse variance of PMRA
PMDEC_IVAR	float32	yr^2 mas^-2	Inverse variance of PMDEC
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gaia
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky)
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
NUMTARGET	int16		Total number of targets that this positioner covered
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
NUMOBS_MORE	int32		Number of additional observations needed
RELEASE	int32		Imaging surveys release ID
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		Imaging Surveys OBJID on that brick
BLOBDIST	float32	pix	Maximum distance from a detected Legacy Surveys source
APFLUX_G	float32	nanomaggy	Total flux in nanomaggies extracted in a 0.75 arcsec radius in the g band at this loc
APFLUX_R	float32	nanomaggy	Total flux in nanomaggies extracted in a 0.75 arcsec radius in the r band at this loca
APFLUX_Z	float32	nanomaggy	Total flux in nanomaggies extracted in a 0.75 arcsec radius in the z band at this loc
APFLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of APFLUX_G
APFLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of APFLUX_R
APFLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of APFLUX_Z
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selection bitmasks
HPXPIXEL	int64		HEALPixel containing this location at NSIDE=64 in the NESTED scheme

HDU5

EXTNAME = POTENTIAL_ASSIGNMENTS

A list of targets that could have been assigned to each fiber.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	16	int	width of table in bytes
NAXIS2	163503	int	number of rows in table
FA_VER	1.2.1.dev2478	str	Fiberassign code version
FIELDNUM	0	int	Not used, always zero
TILEDEC	28.12	float	[deg] Tile Declination
FA_SURV	main	str	Survey of origin of the targets
TILEID	59096	int	Tile ID
FA_HA	0.0	float	[deg] Design Hour Angle
FIELDROT	0.0	float	[deg] Field rotation
REQRA	348.12	float	[deg] Tile Right Ascension
REQDEC	28.12	float	[deg] Tile Declination
FA_DATE	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
TILERA	348.12	float	[deg] Tile Right Ascension

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
FIBER	int32		Fiber ID on the CCDs [0-4999]
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC

HDU6

EXTNAME = FASSIGN

Short version of FIBERASSIGN.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	66	int	width of table in bytes
NAXIS2	5020	int	number of rows in table
FA_VER	1.2.1.dev2478	str	Fiberassign code version
FIELDNUM	0	int	Not used, always zero
TILEDEC	28.12	float	[deg] Tile Declination
FA_SURV	main	str	Survey of origin of the targets
TILEID	59096	int	Tile ID
FA_HA	0.0	float	[deg] Design Hour Angle
FIELDROT	0.0	float	[deg] Field rotation
REQRA	348.12	float	[deg] Tile Right Ascension
REQDEC	28.12	float	[deg] Tile Declination
FA_DATE	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
TILERA	348.12	float	[deg] Tile Right Ascension

Required Data Table Columns

Name	Type	Units	Description
FIBER	int32		Fiber ID on the CCDs [0-4999]
TARGETID	int64		Unique DESI target ID
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBERSTATUS	int32		Fiber status mask. 0=good
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
DEVICE_TYPE	char[3]		Device type
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky)
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane

HDU7

EXTNAME = FTARGETS

Short version of TARGETS.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	53	int	width of table in bytes
NAXIS2	145163	int	number of rows in table
FA_VER	1.2.1.dev2478	str	Fiberassign code version
FIELDNUM	0	int	Not used, always zero
TILEDEC	28.12	float	[deg] Tile Declination
FA_SURV	main	str	Survey of origin of the targets
TILEID	59096	int	Tile ID
FA_HA	0.0	float	[deg] Design Hour Angle
FIELDROT	0.0	float	[deg] Field rotation
REQRA	348.12	float	[deg] Tile Right Ascension
REQDEC	28.12	float	[deg] Tile Declination
FA_DATE	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
TILERA	348.12	float	[deg] Tile Right Ascension

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	binary		Fiberassign internal target type (science, standard, sky, safe, suppsky)
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
NUMOBS_MORE	int32		Number of additional observations needed

HDU8

EXTNAME = FAVAIL

Equivalent to POTENTIAL_ASSIGNMENTS.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	16	int	width of table in bytes
NAXIS2	163503	int	number of rows in table
FA_VER	1.2.1.dev2478	str	Fiberassign code version
FIELDNUM	0	int	Not used, always zero
TILEDEC	28.12	float	[deg] Tile Declination
FA_SURV	main	str	Survey of origin of the targets
TILEID	59096	int	Tile ID
FA_HA	0.0	float	[deg] Design Hour Angle
FIELDROT	0.0	float	[deg] Field rotation
REQRA	348.12	float	[deg] Tile Right Ascension
REQDEC	28.12	float	[deg] Tile Declination
FA_DATE	2022-07-01T00:00:00.000	str	[UTC] Plan field rotations for this date
TILERA	348.12	float	[deg] Tile Right Ascension

Required Data Table Columns

Name	Type	Units	Description
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBER	int32		Fiber ID on the CCDs [0-4999]
TARGETID	int64		Unique DESI target ID

TARG_DIR

TARG_DIR is the root directory for catalogs of targets, gfas, skies, randoms, pixweight files (files of quantities from the random catalogs averaged across HEALPixels) and QA (quality assurance) webpages. The canonical location is $DESI_ROOT/TS/target/catalogs but the environment variable TARG_DIR can be set to point anywhere. Here, TS is, e.g., public/ets for DESI early target selection.

Under TARG_DIR:

- Target catalogs derived from DESI Legacy Surveys imaging are grouped by the imaging Data Release (DR) as a drX.Y string. The X refers to the primary Data Release integer and the Y is only rarely used for critical reprocessing of a Data Release (*e.g.* dr7.1).
- Target catalogs derived solely from Gaia are in the gaiadr2 directory.
- Fixed subpriorities assigned for the DESI Main Survey (see Section 5.2 of the Myers et al. DESI Target Selection Pipeline paper) are stored in the subpriority directory.

Subdirectories:

DR

DR is the Data Release of imaging from the Legacy Surveys as a drX.Y string. The X refers to the primary Data Release integer and the Y is only rarely used for critical reprocessing of a Data Release (*e.g.* dr7.1) Under each Data Release, data are grouped according to the release number (tag) of the desitarget code version on GitHub.

Subdirectories:

VERSION

VERSION is the release number (tag) of the desitarget code version on GitHub in the format X.Y.Z. Under each code version, data are grouped according to the type of target.

Types of target include "targets", "skies" "gfas", "randoms", "pixweight" files (files of quantities from the random catalogs averaged across HEALPixels) and QA (quality assurance) files. Not every target type is included in a given VERSION directory.

Subdirectories:

gfas

The gfas directory contains targets used to guide, focus and align the DESI instrument. GFA targets are stored in files that are grouped by (nested) HEALPixel number in filenames that resemble gfas-hp-{HP}.fits, where HP is the HEALPixel number.

gfas

Summary
DESI guide/focus/alignment (GFA) files contain a single binary table covering the entire footprint. They contain objects derived from matches between Gaia and the Legacy Surveys and the associated quantities used by fiber assignment to select sources for guiding and focus.

Naming Convention
`gfas-hp-HP.fits`, where `HP` is the HEALPixel covered at the (nested) HEALPixel nside included in the file header as `FILENSID` (*e.g.* 11).

Regex
`gfas-hp-?[0-9]+\.fits`

File Type
FITS, 20 MB - 8.5 GB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	GFA_TARGETS	BINTABLE	Target table

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = GFA_TARGETS

Target selection table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	164	int	width of table in bytes
NAXIS2	142824	int	number of rows in table
DR	9	int	Legacy Surveys Data Release used to find targets
MAGLIM	21.0	float	magnitude limit on GFA targets in Gaia G-band
MINDEC	-90.0	float	minimum declination for GFAs that are not selected from the Legacy Surveys
MIN-GALB	0.0	float	closest latitude to Galactic Plane for GFAs that are not selected from the Legacy Surveys
NOURAT	F	bool	`True` if the URAT catalog was not used to supplement missing proper motions
GAIADR	"edr3"	str	Gaia Data Release used to select GFAs
HPXN-SIDE	64	int	HEALPix nside for column *HPXPIXEL*
HPXNEST	T	bool	HEALPix nested (not ring) ordering
FILEN-SID	2	int	HEALPix nside covered by file
FILEN-EST	T	bool	HEALPix nested (not ring) ordering
FILEHPX	11	int	HEALPix pixel(s) covered by file

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int32		Legacy Surveys (LS) Release
TARGETID	int64		Unique targeting ID
BRICKID	int32		Brick ID from tractor input
BRICK_OBJID	int32		OBJID (unique to brick, but not to file)
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
RA_IVAR	float32	deg**-2	Right ascension inverse variance
DEC_IVAR	float32	deg**-2	Declination inverse variance
MORPHTYPE	char[4]		Morphological Model type
MASKBITS	int16		Bitmask for `coadd/*/*/*maskbits*` maps, as d
FLUX_G	float32	nanomaggy	LS flux from tractor input (g)
FLUX_R	float32	nanomaggy	LS flux from tractor input (r)
FLUX_Z	float32	nanomaggy	LS flux from tractor input (z)
FLUX_IVAR_G	float32	nanomaggy**-2	Inverse Variance of FLUX_G
FLUX_IVAR_R	float32	nanomaggy**-2	Inverse Variance of FLUX_R
FLUX_IVAR_Z	float32	nanomaggy**-2	Inverse Variance of FLUX_Z
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; "so
REF_CAT	char[2]		Reference catalog source for star: "T2" for Tycho
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typi
PARALLAX	float32	mas	Reference catalog parallax
PARALLAX_IVAR	float32	mas**-2	Inverse variance of parallax
PMRA	float32	mas / yr	Reference catalog proper motion in the RA direct
PMDEC	float32	mas / yr	Reference catalog proper motion in the Dec direc

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Name	Type	Units	Description
PMRA_IVAR	float32	yr^2 / mas^2	Inverse variance of PMRA
PMDEC_IVAR	float32	yr^2 / mas^2	Inverse variance of PMDEC
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_G_MEAN_FLUX_OVER_ERROR	float32		Gaia G band signal-to-noise
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_BP_MEAN_FLUX_OVER_ERROR	float32		Gaia BP band signal-to-noise
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
GAIA_PHOT_RP_MEAN_FLUX_OVER_ERROR	float32		Gaia RP band signal-to-noise
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise
URAT_ID	int64		ID in the URAT catalog for sources where URAT
URAT_SEP	float32	arcsec	Separation between URAT and Gaia sources whe
GAIA_PHOT_G_N_OBS	int32		Number of observations in Gaia G band
HPXPIXEL	int64		HEALPixel containing target at HPXNSIDE

Notes

Some units in this file do not conform to the FITS standard:

- deg^-2 is incorrectly recorded as 1/deg^2
- nanomaggy^-2 is incorrectly recorded as 1/nanomaggy^2
- mas^-2 is incorrectly recorded as 1/mas^2

Such issues can typically be fixed by parsing the unit through astropy after reading in a Table, e.g.:

```
import astropy.units as u
from astropy.table import Table
objs = Table.read(filename, 1)
u.Unit(str(objs["RA_IVAR"].unit))
```

See https://www.legacysurvey.org for more details about columns in the data model.

pixweight

The pixweight directory contains catalogs that combine useful quantities from the imaging surveys used to select DESI targets with information about the targets themselves. Quantities in the pixweight files are grouped by HEALPixel to facilitate the production of sky maps and to help calculate metrics related to imaging systematics.

The pixweight catalogs are grouped according to the specific DESI observational phase. Observational phases include “mainX” for iterations of the DESI Main Science Survey, “svX” for iterations of Survey Validation and “cmx” for commissioning, where “X” is an integer.

This directory may also contain a README file indicating which target files and random catalogs were used to assemble the pixweight files.

Subdirectories:

PHASE

PHASE is a specific DESI observational phase, which can include "mainX" for iterations of the DESI Main Science Survey, "svX" for iterations of Survey Validation and "cmx" for commissioning, where X is an integer. Under each phase, data are grouped according to whether a catalog has been resolved to account for duplicates in overlapping Legacy Surveys imaging. The northern and southern imaging footprints overlap and are *resolved* to only retain targets in the northern imaging that are both at Dec. > 32.375 degrees and north of the Galactic Plane.

Subdirectories:

RESOLVE

RESOLVE refers to whether targets have been resolved to account for duplicates in overlapping Legacy Surveys imaging. The northern and southern imaging footprints overlap and are *resolved* to only retain targets in the northern imaging that are both at Dec. > 32.375 degrees and north of the Galactic Plane.

The pixweight catalogs are typically always resolved, and will therefore be in a directory named "resolve". Under "resolve", data are grouped according to the observational conditions (or "layer") in which corresponding targets will be observed.

Subdirectories:

OBSCON

OBSCON designates the observational conditions (or "layer") in which targets will be observed. Possible values include "dark" and "bright" for dark-time and bright-time targets, respectively.

Under each observing condition, pixweight files are stored in files that are grouped by the seed used to make the random catalog incorporated into the pixweight file. They have filenames that resemble {PHASE}pixweight-{SEED}-{OBSCON}.fits . Here, SEED is the seed of the corresponding random catalog.

pixweight

Summary
DESI HEALPixel weight files contain a single binary table covering the entire Legacy Surveys footprint. They contain meta information (the number of observations, the depth, etc.) derived from pixels in Legacy Surveys CCDs, together with target densities, conveniently stored as HEALPixel maps. They are derived from corresponding DESI random catalogs and target files, which are listed in the README file in the parent *pixweight* directory.

Naming Convention
`PHASEpixweight-SEED-OBSCON.fits`, where PHASE is a specific DESI observational phase (*e.g.* svX with X=1,2,3 for iterations of Survey Validation) OBSCON is the observing condition (or "layer") for the targets (*e.g.* dark), and SEED is the random seed used to generate the associated random catalog. PHASE is omitted for Main Survey catalogs.

Regex
`(cmx|sv1|sv2|sv3|main2|)pixweight(-[0-9]+)?-(bright|dark)\.fits`

File Type
FITS, 100 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	PIXWEIGHTS	BINTABLE	pixweight catalog table

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = PIXWEIGHTS

pixweight catalog table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	132	int	Width of table in bytes
NAXIS2	786432	int	Number of rows in table
FILEN-SID	2	int	HEALPix nside covered by file
FILEN-EST	T	bool	HEALPix nested (not ring) ordering
FILEHPX	"11,5,4"	str	HEALPix pixel(s) covered by file
DR	9	int	Legacy Surveys (LS) Data Release used to generate randoms
DEN-SITY	45000	int	Number of random points generated per sq. deg.
APRAD	0.75	float	Aperture radius used to calculate flux-related quantities (arcsec)
SEED	1	int	Seed used to generate random catalog
AD-DMTL	F	bool	`True` if MTL-related columns were added to the parent catalog used to build this catalog
HPXN-SIDE	64	int	HEALPix nside
HPXNEST	T	bool	HEALPix nested (not ring) ordering
SUPP	F	bool	`True` if randoms were generated without using LS pixels
RE-SOLVE	T	bool	`True` if from unique imaging
RESEED	626	int	Seed used to re-shuffle combined random catalogs to ensure randomness
MTL-SPLIT	T	bool	`True` if MTL-related columns were added to this random catalog
GA-IALOC	"/global/"	str	Location of file used to generate stellar density
SURVEY	"main"	str	svX for SV, main for Main Survey

Required Data Table Columns

Name	Type	Units	Description
HPXPIXEL	int32		HEALPixel in pixweight map at HPXNSIDE
FRACAREA	float32		Fraction of HEALPixel with at least one observation in any band of the Legacy Surveys
STARDENS	float32	deg^-2	The stellar density in the HEALPixel from Gaia
EBV	float32		E(B-V) in HEALPixel from the SFD98 dust map, from the median `EBV` in the associated
PSFDEPTH_G	float32		PSF depth in LS g in the HEALPixel, from the median `PSFDEPTH_G` in the associated ran
PSFDEPTH_R	float32		PSF depth in LS r in the HEALPixel, from the median `PSFDEPTH_R` in the associated ran
PSFDEPTH_Z	float32		PSF depth in LS z in the HEALPixel, from the median `PSFDEPTH_Z` in the associated ran
GALDEPTH_G	float32		Galaxy depth in LS g in the HEALPixel, from the median `GALDEPTH_G` in the associated
GALDEPTH_R	float32		Galaxy depth in LS r in the HEALPixel, from the median `GALDEPTH_R` in the associated
GALDEPTH_Z	float32		Galaxy depth in LS z in the HEALPixel, from the median `GALDEPTH_Z` in the associated
PSFDEPTH_W1	float32		(AB) PSF depth in WISE W1 in the HEALPixel, from the median `PSFDEPTH_W1` in the a
PSFDEPTH_W2	float32		(AB) PSF depth in WISE W2 in the HEALPixel, from the median `PSFDEPTH_W2` in the a
PSFSIZE_G	float32	arcsec	Weighted average PSF FWHM in LS g in the HEALPixel, from the median `PSFSIZE_G` i
PSFSIZE_R	float32	arcsec	Weighted average PSF FWHM in LS r in the HEALPixel, from the median `PSFSIZE_R` i
PSFSIZE_Z	float32	arcsec	Weighted average PSF FWHM in LS z in the HEALPixel, from the median `PSFSIZE_Z` i

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Name	Type	Units	Description
FRACAREA_12290	float32		Fraction of HEALPixel with at least one observation in any band with LS MASKBITS =
FRACAREA_8194	float32		Fraction of HEALPixel with at least one observation in any band with LS MASKBITS =
ELG	float32	deg^-2	Density of ELG targets in HEALPixel
LRG	float32	deg^-2	Density of LRG targets in HEALPixel
QSO	float32	deg^-2	Density of QSO targets in HEALPixel
BGS_ANY	float32	deg^-2	Density of BGS_ANY targets in HEALPixel
MWS_ANY	float32	deg^-2	Density of MWS_ANY targets in HEALPixel
ALL	float32	deg^-2	Density of *all* targets in HEALPixel
STD_FAINT	float32	deg^-2	Density of STD_FAINT targets in HEALPixel
STD_BRIGHT	float32	deg^-2	Density of STD_BRIGHT targets in HEALPixel
BGS_FAINT	float32	deg^-2	Density of BGS_FAINT targets in HEALPixel
BGS_BRIGHT	float32	deg^-2	Density of BGS_BRIGHT targets in HEALPixel
BGS_WISE	float32	deg^-2	Density of BGS_WISE targets in HEALPixel
MWS_BROAD	float32	deg^-2	Density of MWS_BROAD targets in HEALPixel
MWS_MAIN_RED	float32	deg^-2	Density of MWS_MAIN_RED targets in HEALPixel
MWS_MAIN_BLUE	float32	deg^-2	Density of MWS_MAIN_BLUE targets in HEALPixel
MWS_WD	float32	deg^-2	Density of MWS_WD targets in HEALPixel
MWS_NEARBY	float32	deg^-2	Density of MWS_NEARBY targets in HEALPixel

Notes and Examples

See http://legacysurvey.org for more details about the corresponding columns for sources extracted by the Tractor in the Legacy Surveys, e.g. the units of the depth quantities.

QA

The QA directory contains Quality Assurance webpages used to display information about (and diagnose any issues with) DESI targets.

The QA webpages are built from the corresponding pixweight catalogs.

Subdirectories:

PHASE

`PHASE` is a specific DESI observational phase, which can include "mainX" for iterations of the DESI Main Science Survey, "svX" for iterations of Survey Validation and "cmx" for commissioning, where X is an integer.

Under each phase, QA webpages are stored in directories that resemble `{PHASE}`desitargetQA-`{DR}`-`{OBSCON}`-`{VERSION}`. Here, `PHASE` is a specific DESI observational phase (*e.g.* svX with X=1,2,3 for iterations of Survey Validation), `DR` is the Legacy Surveys Data Release associated with the targets and randoms used to build the pixweight files on which the QA is based, `OBSCON` is the observing condition (or "layer") for the targets (*e.g.* dark), and `VERSION` is the version of the desitarget code used to generate the QA. For targets that are part of the DESI Main Science Survey `PHASE` is omitted from the filename.

Clicking on these QA directories (or the associated `{PHASE}`desitargetQA-`{DR}`-`{OBSCON}`-`{VERSION}`/index.html page) will display the QA webpages.

randoms

Random catalogs are grouped according to whether the randoms have been resolved to account for duplicates in overlapping Legacy Surveys imaging. The northern and southern imaging footprints overlap and are *resolved* to only retain targets in the northern imaging that are both at Dec. > 32.375 degrees and north of the Galactic Plane.

In addition, a `randomsall` directory may exist. The `randomsall` directory contains larger random catalogs that have been assembled by concatenating smaller catalogs, as described in `randomsall/README`.

Subdirectories:

RESOLVE

`RESOLVE` refers to whether targets have been resolved to account for duplicates in overlapping Legacy Surveys (LS) imaging. The northern and southern imaging footprints overlap and are *resolved* to only retain targets in the northern imaging that are both at Dec. > 32.375 degrees and north of the Galactic Plane. Randoms catalogs that have been resolved are in directories named "resolve" and randoms that have not been resolved are in directories named "noresolve". Under each "resolve", random catalogs can take several different forms.

REGION

These randoms have not been resolved by the desitarget code. Resolving in this sense means only retaining northern points in northern bricks in the northern portion of the Legacy Surveys footprint and only retaining southern points in the southern bricks in the southern portion. southern bricks in the southern portion of the Legacy Surveys footprint.

`REGION` can have the value `north` or `south`.

See also:

- Section 4.1.3. of the desitarget paper.
- The documentation on the Legacy Surveys website.

randoms-noresolve

Summary
These files are identical to the standard randoms, but they have not been "resolved" with respect to imaging region.

Naming Convention
`randoms-noresolve-seed-iteration.fits`, where `seed` represents the random seed used to generate the catalog and `iteration` lists the iteration number of the catalog (several iterations are typically conducted during a given run to generate random catalogs).

Regex
`randoms-noresolve-[0-9]+-[0-9]+\.fits`

File Type
FITS, 14 GB

These files have an additional header keyword in HDU1, *e.g.*

```
REGION  = 'north   '
```

where `REGION` can be 'north' or 'south'.

See *the standard randoms file description*.

randoms-SEED-ITERATION

These randoms are identical to the standard "randoms-seed-iteration files" but have been split up by HEALPixel.

randoms-seed-pixnum

Summary
DESI inside-the-footprint random catalogs contain a single binary table covering the entire Legacy Surveys footprint. They contain meta information (the number of observations, the depth, etc.) derived from pixels in Legacy Surveys CCDs at random RA/Dec coordinates.

Naming Convention
`randoms-seed-iteration-hp-pixnum.fits`, where `seed` represents the random seed used to generate the catalog, `iteration` lists the iteration number of the catalog (several iterations are typically conducted during a given run to generate random catalogs), and `pixnum` is the HEALPixel number.

Regex
`randoms-[0-9]+-hp-[0-9]+\.fits`

File Type
FITS, 14 GB

These files contain the same data as a standard "randoms" file, but split by HEALPixel, using the `NSIDE=8`, `NESTED` scheme. For example, given a standard randoms file, `randoms-1-15.fits`, `randoms-1-15/randoms-1-hp-123.fits` would contain the portion of the data that is in pixel number 123.

These files have an additional header keyword in HDU1, *e.g.*

```
INFILE  = '/global/cfs/cdirs/desi/target/catalogs/dr9/0.49.0/randoms/resolve/randoms-1-
↪17.fits'
```

which is the original randoms file prior to splitting by HEALPixel.

See *the standard randoms file description*.

randoms

Summary
DESI inside-the-footprint random catalogs contain a single binary table covering the entire Legacy Surveys footprint. They contain meta information (the number of observations, the depth, etc.) derived from pixels in Legacy Surveys CCDs at random RA/Dec coordinates.

Naming Convention
`randoms-seed-iteration.fits`, where `seed` represents the random seed used to generate the catalog and `iteration` lists the iteration number of the catalog (several iterations are typically conducted during a given run to generate random catalogs).

Regex
`randoms(-[0-9]+)?-[0-9]+\.fits`

File Type
FITS, 14 GB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	RANDOMS	BINTABLE	Random catalog table

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = RANDOMS

Random catalog table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	281	int	Width of table in bytes
NAXIS2	1124357626	int	Number of rows in table
FILENSID	2	int	HEALPix nside covered by file
FILENEST	T	bool	HEALPix nested (not ring) ordering
FILEHPX	11,5,4	str	HEALPix pixel(s) covered by file
DR	9	int	Legacy Surveys (LS) Data Release used to generate randoms
DENSITY	45000	int	Number of random points generated per sq. deg.
APRAD	0.75	float	Aperture radius used to calculate flux-related quantities (arcsec)
SEED	1	int	Seed used to generate random catalog
ADDMTL	F	bool	`True` if MTL-related columns were added to the parent catalog used to build this catalog
HPXNSIDE	64	int	HEALPix nside
HPXNEST	T	bool	HEALPix nested (not ring) ordering
SUPP	F	bool	`True` if randoms were generated without using LS pixels
RESOLVE	T	bool	`True` if from unique imaging
RESEED	626	int	Seed used to re-shuffle combined random catalogs to ensure randomness
MTLSPLIT	T	bool	`True` if MTL-related columns were added to this random catalog
REGION[1]	north	str	"noresolve" randoms may have this keyword set. Values are 'north' or 'south'.
INFILE[1]	randoms-1-15.fits	str	HEALPixel-split randoms may have this keyword set. Value is the original source randoms file.

[1] Optional

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int16		Integer denoting the camera and filter set used
BRICKID	int32		A unique Brick ID
BRICKNAME	char[8]		Name of the brick
BRICK_OBJID	int32		Random catalog object number enumerated by increasing RA within each brick; a
RA	float64	deg	Right ascension at pixel location
DEC	float64	deg	Declination at pixel location
NOBS_G	int16		Number of images at pixel location in LS g
NOBS_R	int16		Number of images at pixel location in LS r
NOBS_Z	int16		Number of images at pixel location in LS z
PSFDEPTH_G	float32		PSF-based depth at pixel location in LS g
PSFDEPTH_R	float32		PSF-based depth at pixel location in LS r
PSFDEPTH_Z	float32		PSF-based depth at pixel location in LS z
GALDEPTH_G	float32		Galaxy model-based depth at pixel location in LS g
GALDEPTH_R	float32		Galaxy model-based depth at pixel location in LS r
GALDEPTH_Z	float32		Galaxy model-based depth at pixel location in LS z
PSFDEPTH_W1	float32		PSF-based depth in WISE W1 (AB mag system)
PSFDEPTH_W2	float32		PSF-based depth in WISE W2 (AB mag system)
PSFSIZE_G	float32	arcsec	Weighted average PSF FWHM in LS g
PSFSIZE_R	float32	arcsec	Weighted average PSF FWHM in LS r
PSFSIZE_Z	float32	arcsec	Weighted average PSF FWHM in LS z
APFLUX_G	float32	nanomaggy	Total flux extracted in a 0.75 arcsec radius in g
APFLUX_R	float32	nanomaggy	Total flux extracted in a 0.75 arcsec radius in r
APFLUX_Z	float32	nanomaggy	Total flux extracted in a 0.75 arcsec radius in z
APFLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of APFLUX_G
APFLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of APFLUX_R
APFLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of APFLUX_Z
MASKBITS	int16		Bit mask of possible problems with pixel (see the LS DR9 bitmasks page)
WISEMASK_W1	binary		Bitwise mask for WISE W1 data (see the LS DR9 bitmasks page)
WISEMASK_W2	binary		Bitwise mask for WISE W2 data (see the LS DR9 bitmasks page)
EBV	float32		Galactic extinction E(B-V) reddening at pixel from SFD98
PHOTSYS	char[1]		'N' for an MzLS/BASS location, 'S' for a DECaLS location
HPXPIXEL	int64		HEALPixel containing this location at NSIDE=64 in the NESTED scheme
TARGETID	int64		See the desitarget data model (added to facilitate running randoms through the DI
DESI_TARGET	int64		See the desitarget data model; set to 4, appropriate to a QSO, the highest-priority
BGS_TARGET	int64		See the desitarget data model; set to 0 (added to facilitate running randoms throug
MWS_TARGET	int64		See the desitarget data model; set to 0 (added to facilitate running randoms throug
SUBPRIORITY	float64		See the desitarget data model (added to facilitate running randoms through the DI
OBSCONDITIONS	int32		See the desitarget data model; set to 511, which corresponds to all possible obser
PRIORITY_INIT	int64		See the desitarget data model; set to 3400, appropriate to a QSO, the highest-prio
NUMOBS_INIT	int64		See the desitarget data model; set to 4, appropriate to a QSO, the highest-priority
SCND_TARGET	int64		See the desitarget data model; set to 0 (added to facilitate running randoms throug
NUMOBS_MORE	int64		See the desitarget data model; set to 4, appropriate to a QSO, the highest-priority
NUMOBS	int64		See the desitarget data model; set to 0 (added to facilitate running randoms throug
Z	float64		See the desitarget data model; set to -1.0 (added to facilitate running randoms thro
ZWARN	int64		See the desitarget data model; set to -1 (added to facilitate running randoms throu
TARGET_STATE	char[15]		See the desitarget data model; set to "QSO|UNOBS", denoting an unobserved QS
TIMESTAMP	char[19]		See the desitarget data model; time at which this random was processed (added to

Table 67 – continued from previous

Name	Type	Units	Description
VERSION	char[14]		See the desitarget data model; version of the desitarget code used to process this r
PRIORITY	int64		See the desitarget data model; set to 3400, appropriate to a QSO, the highest-prio

Notes and Examples

See http://legacysurvey.org for more details about the corresponding columns for sources extracted by the Tractor in the Legacy Surveys, e.g. the units of the depth quantities.

randoms-outside

Summary
DESI outside-the-footprint random catalogs contain a single binary table covering areas beyond the Legacy Surveys footprint. The columns in this file are simplified compared to the other random catalogs as entries in additional columns would be zeros.

Naming Convention
`randoms-outside-seed-iteration.fits`, where `seed` represents the random seed used to generate the catalog and `iteration` lists the iteration number of the catalog (several iterations are typically conducted during a given run to generate random catalogs).

Regex
`randoms-outside(-[0-9]+)?-[0-9]+\.fits`

File Type
FITS, 2 GB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	RANDOMS	BINTABLE	Random catalog table

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = RANDOMS

Random catalog table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	281	int	Width of table in bytes
NAXIS2	1124357626	int	Number of rows in table
DR	9	int	Legacy Surveys (LS) Data Release used to generate randoms
DENSITY	45000	int	Number of random points generated per sq. deg.
SEED	1	int	Seed used to generate supplemental random catalog
ORIGSEED	3	int	Original seed used to generate associated LS random catalog
SUPP	T	bool	`True` if randoms were generated without using LS pixels
RESOLVE	T	bool	`True` if from unique imaging

Required Data Table Columns

Name	Type	Units	Description
BRICKID	int32		A unique Brick ID
BRICKNAME	char[8]		Name of the brick
RA	float64	deg	Right ascension at pixel location
DEC	float64	deg	Declination at pixel location
NOBS_G	int16		Number of images at pixel location in LS g (should be zero)
NOBS_R	int16		Number of images at pixel location in LS r (should be zero)
NOBS_Z	int16		Number of images at pixel location in LS z (should be zero)
EBV	float32		Galactic extinction E(B-V) reddening at pixel from SFD98

randoms-allsky

Summary
DESI allsky random catalogs contain a single binary table covering the entire sky. Inside the Legacy Surveys (LS) footprint they contain meta information (the number of observations, the depth, etc.) derived from pixels in Legacy Surveys CCDs at random RA/Dec coordinates. Outside the LS footprint they contain highly simplified columns. These files are a combination of the standard inside-the-footprint random catalogs and the simplified outside-the-footprint random catalogs.

Naming Convention
`randoms-allsky-seed-iteration.fits`, where `seed` represents the random seed used to generate the catalog and `iteration` lists the iteration number of the catalog (several iterations are typically conducted during a given run to generate random catalogs).

Regex
`randoms-allsky(-[0-9]+)?-[0-9]+\.fits`

File Type
FITS, 12 GB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	RANDOMS	BINTABLE	Random catalog table

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = RANDOMS

Random catalog table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	281	int	Width of table in bytes
NAXIS2	1124357626	int	Number of rows in table
FILENSID	2	int	HEALPix nside covered by file
FILENEST	T	bool	HEALPix nested (not ring) ordering
FILEHPX	11,5,4	str	HEALPix pixel(s) covered by file
DR	9	int	Legacy Surveys (LS) Data Release used to generate randoms
DENSITY	45000	int	Number of random points generated per sq. deg.
APRAD	0.75	float	Aperture radius used to calculate flux-related quantities (arcsec)
SEED	1	int	Seed used to generate random catalog
ADDMTL	F	bool	`True` if MTL-related columns were added to the parent catalog used to build this catalog
HPXNSIDE	64	int	HEALPix nside
HPXNEST	T	bool	HEALPix nested (not ring) ordering
SUPP	F	bool	`True` if randoms were generated without using LS pixels
RESOLVE	T	bool	`True` if from unique imaging
RESEED	626	int	Seed used to re-shuffle combined random catalogs to ensure randomness
MTLSPLIT	T	bool	`True` if MTL-related columns were added to this random catalog

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension at pixel location
DEC	float64	deg	Declination at pixel location
BRICKNAME	char[8]		Name of the brick
BRICKID	int32		A unique Brick ID
NOBS_G	int16		Number of images at pixel location in LS g
NOBS_R	int16		Number of images at pixel location in LS r
NOBS_Z	int16		Number of images at pixel location in LS z
PSFDEPTH_G	float32		PSF-based depth at pixel location in LS g
PSFDEPTH_R	float32		PSF-based depth at pixel location in LS r
PSFDEPTH_Z	float32		PSF-based depth at pixel location in LS z
GALDEPTH_G	float32		Galaxy model-based depth at pixel location in LS g
GALDEPTH_R	float32		Galaxy model-based depth at pixel location in LS r
GALDEPTH_Z	float32		Galaxy model-based depth at pixel location in LS z
PSFDEPTH_W1	float32		PSF-based depth in WISE W1 (AB mag system)
PSFDEPTH_W2	float32		PSF-based depth in WISE W2 (AB mag system)
PSFSIZE_G	float32	arcsec	Weighted average PSF FWHM in LS g
PSFSIZE_R	float32	arcsec	Weighted average PSF FWHM in LS r
PSFSIZE_Z	float32	arcsec	Weighted average PSF FWHM in LS z
APFLUX_G	float32	nanomaggy	Total flux extracted in a 0.75 arcsec radius in g
APFLUX_R	float32	nanomaggy	Total flux extracted in a 0.75 arcsec radius in r
APFLUX_Z	float32	nanomaggy	Total flux extracted in a 0.75 arcsec radius in z
APFLUX_IVAR_G	float32	nanomaggy^-2	Inverse variance of APFLUX_G
APFLUX_IVAR_R	float32	nanomaggy^-2	Inverse variance of APFLUX_R
APFLUX_IVAR_Z	float32	nanomaggy^-2	Inverse variance of APFLUX_Z
MASKBITS	int16		Bit mask of possible problems with pixel (see the LS DR9 bitmasks page)
WISEMASK_W1	binary		Bitwise mask for WISE W1 data (see the LS DR9 bitmasks page)
WISEMASK_W2	binary		Bitwise mask for WISE W2 data (see the LS DR9 bitmasks page)
EBV	float32		Galactic extinction E(B-V) reddening at pixel from SFD98
PHOTSYS	char[1]		'N' for an MzLS/BASS location, 'S' for a DECaLS location
HPXPIXEL	int64		HEALPixel containing this location at NSIDE=64 in the NESTED scheme

Notes and Examples

See http://legacysurvey.org for more details about the corresponding columns for sources extracted by the Tractor in the Legacy Surveys, e.g. the units of the depth quantities.

randomsall

The `randomsall` directory contains larger random catalogs that have been assembled by concatenating smaller catalogs, as described in `randomsall/README`.

randoms-seed-interations

Summary
The larger DESI random catalogs (`randomsall`) contain a single binary table covering the entire Legacy Surveys footprint. They contain meta information (the number of observations, the depth, etc.) derived from pixels in Legacy Surveys CCDs at random RA/Dec coordinates. The content of these files resembles the standard, smaller DESI random catalogs.

Naming Convention
`randomsall-seed-iterations.fits`, where `seed` represents the random seed used to generate the catalog and `iterations` lists the iteration numbers of the smaller random catalogs that have been concatenated to make the larger random catalog.

Regex
`randoms(-[0-9.]+)?-[0-9]+-[0-9]+\.fits`

File Type
FITS, 63 GB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	RANDOMS	BINTABLE	Random catalog table

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = RANDOMS

Random catalog table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	68	int	Width of table in bytes
NAXIS2	1124357626	int	Number of rows in table
FILEN-SID	2	int	HEALPix nside covered by file
FILEN-EST	T	bool	HEALPix nested (not ring) ordering
FILEHPX	11,5,4	str	HEALPix pixel(s) covered by file
DR	9	int	Legacy Surveys (LS) Data Release used to generate randoms
DENSITY	45000	int	Number of random points generated per sq. deg.
APRAD	0.75	float	Aperture radius used to calculate flux-related quantities (arcsec)
SEED	1	int	Seed used to generate random catalog
ADDMTL	F	bool	`True` if MTL-related columns were added to this larger random catalog
HPXN-SIDE	64	int	HEALPix nside
HPXNEST	T	bool	HEALPix nested (not ring) ordering
SUPP	F	bool	`True` if randoms were generated by avoiding Gaia sources rather than using LS pixels
RE-SOLVE	T	bool	`True` if from unique imaging
RESEED	626	int	Seed used to re-shuffle combined random catalogs to ensure randomness
MTL-SPLIT	T	bool	`True` if MTL-related columns were added to individual, smaller random catalogs

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension at pixel location
DEC	float64	deg	Declination at pixel location
NOBS_G	int16		Number of images at pixel location in LS g
NOBS_R	int16		Number of images at pixel location in LS r
NOBS_Z	int16		Number of images at pixel location in LS z
PSFDEPTH_G	float32		PSF-based depth at pixel location in LS g
PSFDEPTH_R	float32		PSF-based depth at pixel location in LS r
PSFDEPTH_Z	float32		PSF-based depth at pixel location in LS z
GALDEPTH_G	float32		Galaxy model-based depth at pixel location in LS g
GALDEPTH_R	float32		Galaxy model-based depth at pixel location in LS r
GALDEPTH_Z	float32		Galaxy model-based depth at pixel location in LS z
PSFDEPTH_W1	float32		PSF-based depth in WISE W1 (AB mag system)
PSFDEPTH_W2	float32		PSF-based depth in WISE W2 (AB mag system)
PSFSIZE_G	float32	arcsec	Weighted average PSF FWHM in LS g
PSFSIZE_R	float32	arcsec	Weighted average PSF FWHM in LS r
PSFSIZE_Z	float32	arcsec	Weighted average PSF FWHM in LS z
MASKBITS	int16		Bit mask of possible problems with pixel
EBV	float32		Galactic extinction E(B-V) reddening at pixel from SFD98

Notes and Examples

See http://legacysurvey.org for more details about the corresponding columns for sources extracted by the Tractor in the Legacy Surveys, e.g. the units of the depth quantities.

skies

The `skies` directory contains blank sky locations derived at the pixel-level from the Legacy Surveys images. Sky locations are stored in files that are grouped by (nested) HEALPixel number in filenames that resemble skies-hp-`{HP}`.fits, where `HP` is the HEALPixel number.

The `skies` directory may also contain an unpartitioned sub-directory. This exists because the sky locations are originally generated in Legacy Surveys *bricks* before being re-partitioned into HEALPixels. The unpartitioned sub-directory contains files assembled according to which *bricks* occupy each HEALPixel rather than by which *sky locations* occupy each HEALPixel.

Subdirectories and files:

unpartitioned

The `unpartitioned` directory will *not* be a useful data product for most users. It exists because the sky locations are originally generated in Legacy Surveys *bricks* before being re-partitioned into HEALPixels. The unpartitioned sub-directory contains files assembled according to which *bricks* occupy each HEALPixel rather than by which *sky locations* occupy each HEALPixel. It is included for completeness.

unpartitioned skies

Summary
Unpartitioned DESI sky locations contain a single binary table covering the entire Legacy Surveys footprint. They will *not* be a useful data product for most users. They exist because DESI sky locations are originally generated in Legacy Surveys *bricks* before being re-partitioned into HEALPixels. The unpartitioned sky files are assembled according to which *bricks* occupy each HEALPixel rather than by which *sky locations* occupy each HEALPixel. They are purely included for completeness, and are merely a rearrangement of the DESI skies files.

Naming Convention
`skies-hp-HP.fits-unpartitioned`, where `HP` is the HEALPixel covered at the (nested) HEALPixel nside included in the file header as `FILENSID` (*e.g.* 11).

Regex
`skies-hp-?[0-9]+\.fits-unpartitioned`

File Type
FITS, 2 MB - 140 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Empty
HDU1	SKY_TARGETS	BINTABLE	Table of sky locations

FITS Header Units

HDU0

EXTNAME = PRIMARY

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = SKY_TARGETS

Table of sky locations

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	136	int	width of table in bytes
NAXIS2	1055419	int	number of rows in table
AP0	0.75	float	aperture radius used to calculate flux-related quantities (arcsec)
SUPP	F	bool	`True` if sky location are *not* derived from the Legacy Surveys
DR	9	int	Legacy Surveys Data Release used to find targets
NPERSDEG	18000.0	float	density of sky locations generated per sq. deg.
HPXNSIDE	64	int	HEALPix nside for column *HPXPIXEL*
HPXNEST	T	bool	HEALPix nested (not ring) ordering
SUBPSEED	805	int	random seed used to generate *SUBPRIORITY* values
MASKED	T	bool	`True` if targets were masked to avoid bright sources
MASKDIR	“masks/”	str	location of directory of masks used to avoid bright sources
CMDLINE	“/global/”	str	command-line call used to generate target file
FILENSID	2	int	HEALPix nside covered by file
FILENEST	T	bool	HEALPix nested (not ring) ordering
FILEHPX	11	int	HEALPix pixel(s) covered by file

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int32		Legacy Surveys (LS) Release
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		OBJID (unique to brick, but not to file)
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
BLOBDIST	float32	pix	Maximum distance from a detected Legacy Surveys source
FIBERFLUX_G	float32		g-band object model flux calculated in aperture of radius `AP0`
FIBERFLUX_R	float32		r-band object model flux calculated in aperture of radius `AP0`
FIBERFLUX_Z	float32		z-band object model flux calculated in aperture of radius `AP0`
FIBERFLUX_IVAR_G	float32		Inverse Variance of `FIBERFLUX_G`
FIBERFLUX_IVAR_R	float32		Inverse Variance of `FIBERFLUX_R`
FIBERFLUX_IVAR_Z	float32		Inverse Variance of `FIBERFLUX_Z`
TARGETID	int64		Unique targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int64		Flag target to be observed in combinations of dark/bright observing layer
PRIORITY_INIT	int64		Initial priority for target calculated across target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selection bitmasks and OBSCONDITIONS
HPXPIXEL	int64		HEALPixel containing sky location

skies

Summary

DESI sky locations contain a single binary table covering the entire Legacy Surveys footprint. The imaging "blob maps" are bisected to achieve a requisite number of sky locations per sq. deg. Sky locations are placed within the bisected grid as far from blobs that contain sources as is possible. Flux is measured in an aperture at each sky location.

Naming Convention

`skies-hp-HP.fits`, where `HP` is the HEALPixel covered at the (nested) HEALPixel nside included in the file header as `FILENSID` (*e.g.* 11).

Regex

`skies-hp-?[0-9]+\.fits`

File Type

FITS, 137 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty HDU
HDU1	SKY_TARGETS	BINTABLE	Table of sky locations

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = SKY_TARGETS

Table of sky locations

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	136	int	width of table in bytes
NAXIS2	1055419	int	number of rows in table
AP0	0.75	float	aperture radius used to calculate flux-related quantities (arcsec)
SUPP	F	bool	`True` if sky locations are supplemental (i.e. are *not* derived from the Legacy Surveys)
DR	9	int	Legacy Surveys Data Release used to find targets
NPERSDEG	18000.0	float	density of sky locations generated per sq. deg.
HPXNSIDE	64	int	HEALPix nside for column *HPXPIXEL*
HPXNEST	T	bool	HEALPix nested (not ring) ordering
SUBPSEED	805	int	random seed used to generate *SUBPRIORITY* values
MASKED	T	bool	`True` if targets were masked to avoid bright sources
MASKDIR	“masks/”	str	location of directory of masks used to avoid bright sources
CMDLINE	“/global/”	str	command-line call used to generate target file
FILENSID	2	int	HEALPix nside covered by file
FILENEST	T	bool	HEALPix nested (not ring) ordering
FILEHPX	11	int	HEALPix pixel(s) covered by file

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int32		Legacy Surveys (LS) Release
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		OBJID (unique to brick, but not to file)
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
BLOBDIST	float32	pix	Maximum distance from a detected Legacy Surveys source
FIBERFLUX_G	float32		g-band object model flux calculated in aperture of radius `AP0`
FIBERFLUX_R	float32		r-band object model flux calculated in aperture of radius `AP0`
FIBERFLUX_Z	float32		z-band object model flux calculated in aperture of radius `AP0`
FIBERFLUX_IVAR_G	float32		Inverse Variance of `FIBERFLUX_G`
FIBERFLUX_IVAR_R	float32		Inverse Variance of `FIBERFLUX_R`
FIBERFLUX_IVAR_Z	float32		Inverse Variance of `FIBERFLUX_Z`
TARGETID	int64		Unique targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int64		Flag target to be observed in combinations of dark/bright observing layer
PRIORITY_INIT	int64		Initial priority for target calculated across target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selection bitmasks and OBSCONDITIONS
HPXPIXEL	int64		HEALPixel containing sky location

targets

Target catalogs are grouped according to the specific DESI observational phase. Observational phases include "mainX" for iterations of the DESI Main Science Survey, "svX" for iterations of Survey Validation and "cmx" for commissioning, where "X" is an integer.

Subdirectories:

PHASE

`PHASE` is a specific DESI observational phase, which can include "mainX" for iterations of the DESI Main Science Survey, "svX" for iterations of Survey Validation and "cmx" for commissioning, where X is an integer. Under each target phase, data are grouped according to whether the targets have been resolved to account for duplicates in overlapping Legacy Surveys imaging. The northern and southern imaging footprints overlap and are *resolved* to only retain targets in the northern imaging that are both at Dec. > 32.375 degrees and north of the Galactic Plane.

Subdirectories:

RESOLVE

`RESOLVE` refers to whether targets have been resolved to account for duplicates in overlapping Legacy Surveys imaging. The northern and southern imaging footprints overlap and are *resolved* to only retain targets in the northern imaging that are both at Dec. > 32.375 degrees and north of the Galactic Plane.

Targets that have been resolved are in a directory named "resolve" and targets that have not been resolved are in a directory named "noresolve". In addition, secondary targets, which may not have been selected from the Legacy Surveys at all are in a directory called "secondary" (as there is no easy way to know in advance how, or whether, each secondary target class was "resolved").

Under each "resolve", data are grouped according to the observational conditions (or "layer") in which they will be observed.

Subdirectories:

OBSCON

`OBSCON` designates the observational conditions (or "layer") in which targets will be observed. Possible values include "dark" and "bright" for dark-time and bright-time targets, respectively. Under each observing condition, targets are stored in files that are grouped by (nested) HEALPixel number in filenames that resemble {`PHASE`}targets-{`OBSCON`}-{`RESOLVE`}-hp-{`HP`}.fits . For targets that are *not* resolved `RESOLVE` is omitted from the filename. For targets that are part of the DESI Main Science Survey `PHASE` is omitted from the filename.

There is a special case of secondary targets that were not merged with primary targets — these secondary targets have no concept of a "resolve". Such "standalone" secondary targets are written to monolithic files with names resembling targets-{`OBSCON`}-secondary.fits .

targets

Summary
: DESI target selection files include a binary table containing the targets in a (nested) HEALPixel. They store the variables used by target selection (*e.g.* fluxes), variables needed by fiber assignment (*e.g.* RA, DEC), and variables needed for traceability (*e.g.* DESITARGET, TARGETID).

Naming Convention
: `PHASEtargets-OBSCON-hp-HP.fits`, where `PHASE` is a specific DESI observational phase (*e.g.* svX with X=1,2,3 for iterations of Survey Validation) `OBSCON` is the observing condition (or "layer") for the targets (*e.g.* dark), and `HP` is the HEALPixel covered at the (nested) HEALPixel nside included in the file header as `FILENSID` (*e.g.* 11). For targets that are part of the DESI Main Science Survey `PHASE` is omitted from the filename.

Regex
: `(cmx|sv1|sv2|sv3|main2|)targets-(bright|dark|no-obscon)-hp-[0-9]+\.fits`

File Type
: FITS, 2 GB

Note: this documents the target catalog format starting with DR9 / desitarget 0.47.0 . The previous format is documented in *targets-dr8*.

Examples

DESI target selection files, based on DR9 of the Legacy Surveys, are available at:

https://data.desi.lbl.gov/public/ets/target/catalogs/dr9 .

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	TARGETS	BINTABLE	Target table
HDU2	INFILES	BINTABLE	Files used to produce target table

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TARGETS

Target selection table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	374	int	width of table in bytes
NAXIS2	72660205	int	number of rows in table
OBSCON	"DARK"	str	observing layer for file
HPXNSIDE	64	int	HEALPix nside for column *HPXPIXEL*
HPXNEST	T	bool	HEALPix nested (not ring) ordering
SUBPSEED	1154	int	random seed used to generate *SUBPRIORITY* values
SURVEY	"main"	str	svX for SV, main for Main Survey
RESOLVE	T	bool	`True` if from unique imaging
MASKBITS	T	bool	`True` if masking cuts applied
BACKUP	F	bool	`True` for backup/supplemental targets
DR	9	int	Legacy Surveys Data Release used to find targets
TCNAMES	"QSO,LRG"	str	run for this target-class subset
GAIASUB	T	bool	`True` if Gaia EDR3 astrometric values were substituted for Gaia DR2 quantities.
CMDLINE	"/global/"	str	command-line call used to generate target file
SCNDOUT	"/global/"	str	directory from which secondary targets were read
FILENSID	2	int	HEALPix nside covered by file
FILENEST	T	bool	HEALPix nested (not ring) ordering
FILEHPX	11	int	HEALPix pixel(s) covered by file

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int16		Legacy Surveys (LS) Release
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		OBJID (unique to brick, but not to file)
MORPHTYPE	char[4]		Morphological Model type
RA	float64	deg	Right ascension
RA_IVAR	float32	deg^-2	Right ascension inverse variance
DEC	float64	deg	Declination
DEC_IVAR	float32	deg^-2	Declination inverse variance
DCHISQ	float32[5]		Difference in chi-squared between model fits

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Name	Type	Units	Description
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
FLUX_G	float32	nanomaggy	LS flux from tractor input (g)
FLUX_R	float32	nanomaggy	LS flux from tractor input (r)
FLUX_Z	float32	nanomaggy	LS flux from tractor input (z)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse Variance of FLUX_G
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse Variance of FLUX_R
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse Variance of FLUX_Z
MW_TRANSMISSION_G	float32		Milky Way dust transmission in LS g
MW_TRANSMISSION_R	float32		Milky Way dust transmission in LS r
MW_TRANSMISSION_Z	float32		Milky Way dust transmission in LS z
FRACFLUX_G	float32		Fraction of flux from other sources compared to this source in LS g
FRACFLUX_R	float32		Fraction of flux from other sources compared to this source in LS r
FRACFLUX_Z	float32		Fraction of flux from other sources compared to this source in LS z
FRACMASKED_G	float32		Fraction of pixels masked for this source in LS g
FRACMASKED_R	float32		Fraction of pixels masked for this source in LS r
FRACMASKED_Z	float32		Fraction of pixels masked for this source in LS z
FRACIN_G	float32		Fraction of a source's flux within a LS blob in g
FRACIN_R	float32		Fraction of a source's flux within a LS blob in r
FRACIN_Z	float32		Fraction of a source's flux within a LS blob in z
NOBS_G	int16		Number of images for central pixel in LS g
NOBS_R	int16		Number of images for central pixel in LS r
NOBS_Z	int16		Number of images for central pixel in LS z
PSFDEPTH_G	float32	nanomaggy^-2	PSF-based depth in LS g
PSFDEPTH_R	float32	nanomaggy^-2	PSF-based depth in LS r
PSFDEPTH_Z	float32	nanomaggy^-2	PSF-based depth in LS z

continues on next page

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Name	Type	Units	Description
GALDEPTH_G	float32	nanomaggy^-2	Galaxy model-based depth in LS g
GALDEPTH_R	float32	nanomaggy^-2	Galaxy model-based depth in LS r
GALDEPTH_Z	float32	nanomaggy^-2	Galaxy model-based depth in LS z
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB system)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_W3	float32	nanomaggy	WISE flux in W3 (AB)
FLUX_W4	float32	nanomaggy	WISE flux in W4 (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse Variance of FLUX_W1 (AB system)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse Variance of FLUX_W2 (AB)
FLUX_IVAR_W3	float32	nanomaggy^-2	Inverse Variance of FLUX_W3 (AB)
FLUX_IVAR_W4	float32	nanomaggy^-2	Inverse Variance of FLUX_W4 (AB)
MW_TRANSMISSION_W1	float32		Milky Way dust transmission in WISE W1
MW_TRANSMISSION_W2	float32		Milky Way dust transmission in WISE W2
MW_TRANSMISSION_W3	float32		Milky Way dust transmission in WISE W3
MW_TRANSMISSION_W4	float32		Milky Way dust transmission in WISE W4
ALLMASK_G	int16		Bitwise mask for central pixel in LS g
ALLMASK_R	int16		Bitwise mask for central pixel in LS r
ALLMASK_Z	int16		Bitwise mask for central pixel in LS z
FIBERFLUX_G	float32	nanomaggy	g-band object model flux for 1 arcsec seeing and 1.5 arcsec diameter fiber
FIBERFLUX_R	float32	nanomaggy	r-band object model flux for 1 arcsec seeing and 1.5 arcsec diameter fiber
FIBERFLUX_Z	float32	nanomaggy	z-band object model flux for 1 arcsec seeing and 1.5 arcsec diameter fiber
FIBERTOTFLUX_G	float32	nanomaggy	like FIBERFLUX_G but including all objects overlapping this location
FIBERTOTFLUX_R	float32	nanomaggy	like FIBERFLUX_R but including all objects overlapping this location

continues on next page

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Name	Type	Units	Description
FIBERTOTFLUX_Z	float32	nanomaggy	like FIBERFLUX_Z but including all objects overlapping this location
REF_EPOCH	float32	yr	reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gaia.
WISEMASK_W1	binary		W1 bitmask as cataloged on the LS DR9 bitmasks page
WISEMASK_W2	binary		W2 bitmask as cataloged on the LS DR9 bitmasks page
MASKBITS	int16		bitmask for `coadd/*/*/*maskbits*` maps, as on the LS DR9 bitmasks page
LC_FLUX_W1	float32[15]	nanomaggy	FLUX_W1 in each of up to fifteen unWISE coadd epochs (AB system; defaults to zero for unused entries)
LC_FLUX_W2	float32[15]	nanomaggy	FLUX_W2 in each of up to fifteen unWISE coadd epochs (AB system; defaults to zero for unused entries)
LC_FLUX_IVAR_W1	float32[15]	nanomaggy^-2	Inverse variance of LC_FLUX_W1 (AB system; defaults to zero for unused entries)
LC_FLUX_IVAR_W2	float32[15]	nanomaggy^-2	Inverse variance of LC_FLUX_W2 (AB system; defaults to zero for unused entries)
LC_NOBS_W1	int16[15]		NOBS_W1 in each of up to fifteen unWISE coadd epochs
LC_NOBS_W2	int16[15]		NOBS_W2 in each of up to fifteen unWISE coadd epochs
LC_MJD_W1	float64[15]		MJD_W1 in each of up to fifteen unWISE coadd epochs (defaults to zero for unused entries)
LC_MJD_W2	float64[15]		MJD_W2 in each of up to fifteen unWISE coadd epochs (defaults to zero for unused entries)
SHAPE_R	float32	arcsec	Half-light radius of galaxy model for galaxy type MORPHTYPE (>0)

continues on next page

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Name	Type	Units	Description
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for galaxy type MORPHTYPE
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for galaxy type MORPHTYPE
SHAPE_R_IVAR	float32	arcsec^-2	Inverse variance of SHAPE_R
SHAPE_E1_IVAR	float32		Inverse variance of SHAPE_E1
SHAPE_E2_IVAR	float32		Inverse variance of SHAPE_E2
SERSIC	float32		Power-law index for the Sersic profile model (MORPHTYPE="SER")
SERSIC_IVAR	float32		Inverse variance of SERSIC
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; "sourceid" for Gaia DR2
REF_CAT	char[2]		Reference catalog source for star: "T2" for Tycho-2, "G2" for Gaia DR2, "L2" for the SGA, empty otherwise
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_G_MEAN_FLUX_OVER_ERROR	float32		Gaia G band signal-to-noise
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_BP_MEAN_FLUX_OVER_ERROR	float32		Gaia BP band signal-to-noise
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
GAIA_PHOT_RP_MEAN_FLUX_OVER_ERROR	float32		Gaia RP band signal-to-noise
GAIA_PHOT_BP_RP_EXCESS_FACTOR	float32		Gaia BP/RP excess factor
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise
GAIA_DUPLICATED_SOURCE	logical		Gaia duplicated source flag
GAIA_ASTROMETRIC_SIGMA5D_MAX	float32	mas	Gaia longest semi-major axis of the 5-d error ellipsoid
GAIA_ASTROMETRIC_PARAMS_SOLVED	binary		which astrometric parameters were estimated for a Gaia source
PARALLAX	float32	mas	Reference catalog parallax
PARALLAX_IVAR	float32	mas^-2	Inverse variance of parallax
PMRA	float32	mas / yr	Reference catalog proper motion in the RA direction

continues on next page

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Name	Type	Units	Description
PMRA_IVAR	float32	yr^2 / mas^2	Inverse variance of PMRA
PMDEC	float32	mas / yr	Reference catalog proper motion in the Dec direction
PMDEC_IVAR	float32	yr^2 / mas^2	Inverse variance of PMDEC
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S' for DECaLS
TARGETID	int64		Unique targeting ID
DESI_TARGET[1]	int64		DESI (dark time program) target selection bitmask
BGS_TARGET[Page 554, 1]	int64		BGS (bright time program) target selection bitmask
MWS_TARGET[1]	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int64		Flag target to be observed in combinations of dark/bright observing layer
PRIORITY_INIT	int64		Initial priority for target calculated across target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selection bitmasks and OBSCONDITIONS
SCND_TARGET[1]	int64		SCND (secondary program) target selection bitmask
HPXPIXEL	int64		HEALPixel containing target at HPXNSIDE

[1] `TARGET` columns are preceded by the survey `PHASE` except in the case of Main Survey files (i.e. `DESI_TARGET` is called `SV1_DESI_TARGET` when the survey `PHASE` is `sv1`).

HDU2

EXTNAME = INFILES

Files used to produce target table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	152	int	width of table in bytes
NAXIS2	6	int	number of rows in table

Required Data Table Columns

Name	Type	Units	Description
FILENAME	char[88]		LS sweep files associated with this HEALPixel
SHA256	char[64]		Checksum for each LS sweep file

Notes

Some units in this file do not conform to the FITS standard:

- deg^-2 is incorrectly recorded as 1/deg^2
- nanomaggy^-2 is incorrectly recorded as 1/nanomaggy^2
- arcsec^-2 is incorrectly recorded as 1/arcsec^2
- mas^-2 is incorrectly recorded as 1/mas^2

Such issues can typically be fixed by parsing the unit through astropy after reading in a Table, e.g.:

```
import astropy.units as u
from astropy.table import Table
objs = Table.read(filename, 1)
u.Unit(str(objs["RA_IVAR"].unit))
```

In general, the above format contains:

- Columns that were used by target selection (e.g. FLUX_G/R/Z).
- Columns needed by fiber assignment (e.g. RA, DEC).
- Columns needed for traceability (e.g. BRICKNAME, TARGETID, DESI_TARGET, BGS_TARGET, MWS_TARGET).

FRACFLUX and FRACMASKED are profile-weighted quantities.

SUBPRIORITY, OBSCONDITIONS, PRIORITY_INIT, NUMOBS_INIT, PHOTSYS, TARGETID, DESI_TARGET, BGS_TARGET, MWS_TARGET, SCND_TARGET and HPXPIXEL are created by target selection; the rest are passed through from the original LS tractor or sweep files.

See https://www.legacysurvey.org for more details about columns in the data model.

"standalone" secondary targets

Summary
DESI "standalone" secondary targets are stored in single, monolithic binary tables. Here, "standalone" refers to the fact that either the proposer of the particular secondary target class requested that their targets should *not* be merged with matching primary targets, or that no match was found to a primary target.

Naming Convention
`PHASEtargets-OBSCON-secondary.fits`, where `PHASE` is a specific DESI observational phase (*e.g.* svX with X=1,2,3 for iterations of Survey Validation), and `OBSCON` is the observing condition or "layer") for the targets (*e.g.* dark).

Regex
`(cmx|sv1|sv2|sv3|main2|)targets-(bright|dark)-secondary(-dr9photometry)?\.fits`

File Type
FITS, 200-900 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	SCND_TARGETS	BINTABLE	Table of secondary targets

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = SCND_TARGETS

Table of secondary targets

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	121	int	width of table in bytes
NAXIS2	7125595	int	number of rows in table
SURVEY	"main"	str	svX for SV, main for Main Survey
PRIMDIR	"/global/"	str	location of directory of information about corresponding primary targets
SEP	1.0	float	matching radius that was used to find primary targets (arcsec)
MASKED	T	bool	`True` if targets were masked to avoid bright sources
MASKDIR	"masks/"	str	location of directory of masks used to avoid bright sources
SCNDDIR	"/global/"	str	directory from which secondary targets were read
OBSCON	"DARK"	str	observing layer for file
SUBPSEED	717	int	random seed used to generate *SUBPRIORITY* values

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float32	mas / yr	Reference catalog proper motion in the RA direction
PMDEC	float32	mas / yr	Reference catalog proper motion in the Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gaia.
OVERRIDE	logical		`True` if the secondary target class was not matched to primary targets
FLUX_G	float32	nanomaggy	LS flux from tractor input (g)
FLUX_R	float32	nanomaggy	LS flux from tractor input (r)
FLUX_Z	float32	nanomaggy	LS flux from tractor input (z)
PARALLAX	float32	mas	Reference catalog parallax
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise
TARGETID	int64		Unique targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SCND_TARGET	int64		SCND (secondary program) target selection bitmask
SCND_ORDER	int32		Row in which this target appeared in the input secondary target file
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int64		Flag target to be observed in combinations of dark/bright observing layer
PRIORITY_INIT	int64		Initial priority for target calculated across target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selection bitmasks and OBSCONDITIONS

targets-dr3

Summary
DESI target selection files contain a single binary table covering the entire footprint. They contain the variables used by target selection (*e.g.* fluxes), variables needed by fiber assignment (*e.g.* RA, DEC), and variables needed for traceability (*e.g.* TARGETFLAG, TARGETID).

Naming Convention
TBD, let's try `targets-{source}-{version}.fits` where `source` is where the input data came from (*e.g.* 'dr1', 'dr2') and `version` is the code version that wrote this, preferably a git tag of desitargets.

Regex
`targets-dr[0-9]+-v?[0-9]+\.[0-9]+(\.[0-9]+|)\.fits`

File Type
FITS

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Blank
HDU1	TARGETS	BINTABLE	Target selection table

FITS Header Units

HDU0

EXTNAME = PRIMARY

Empty HDU.

HDU1

EXTNAME = TARGETS

Required Header Keywords

KEY	Example Value	Type	Comment
EXTNAME	TARGETS	str	name of this binary table extension
DEPNAM00	desitarget	str	
DEPVER00	0.1.0	str	desitarget.__version__
DEPNAM01	desitarget-git	str	
DEPVAL01	0.1.0	str	git revision
DEPNAM02	tractor-files	str	
DEPVER02	/project/projectdirs/cosmo/data/legacysurvey/dr1/tractor	str	input directory

Required Data Table Columns

Name	Type	Units	Description
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		OBJID (unique to brick, but not to file)
BRICK_PRIMARY	logical		should always be True
TYPE	char[4]		tractor object type
RA	float64		Right ascension [degrees]
RA_IVAR	float32		Inverse variance of RA
DEC	float64		Declination [degrees]
DEC_IVAR	float32		Inverse variance of DEC
DECAM_FLUX	float32[6]		DECam flux from tractor input (ugrizY)
DECAM_MW_TRANSMISSION	float32[6]		Milky Way dust transmission ([0-1] ugrizY)
WISE_FLUX	float32[4]		WISE flux (W1, W2, W3, W4)
WISE_MW_TRANSMISSION	float32[4]		Milky Way transmission
SHAPEEXP_R	float32		Half-light radius of exponential model (>0)
SHAPEDEV_R	float32		Half-light radius of deVaucouleurs model (>0)
TARGETID	int64		Unique targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask

Notes and Examples

In general, the above format contains:

- Columns that were used by target selection (e.g. DECAM_FLUX)
- Columns needed by fiber assignment (e.g. RA, DEC)
- Columns needed for traceability (e.g. BRICKNAME, TARGETID, DESI_TARGET, BGS_TARGET, MWS_TARGET)

TARGETID, DESI_TARGET, BGS_TARGET and MWS_TARGET are created by target selection; the rest are passed through from the original input tractor files

See http://legacysurvey.org for more details about the columns from input tractor files

targets-dr6

Summary
DESI target selection files contain a single binary table covering the entire footprint. They contain the variables used by target selection (*e.g.* fluxes), variables needed by fiber assignment (*e.g.* RA, DEC), and variables needed for traceability (*e.g.* TARGETFLAG, TARGETID).

Naming Convention
`targets-DRX-VERSION.fits`, where `DRX` is the imaging surveys data release name (e.g. dr4) and `VERSION` is the desitarget code version defining the cuts.

Regex
`targets-dr[0-9]+-v?[0-9]+\.[0-9]+(\.[0-9]+|)\.fits`

File Type
FITS, 3 GB

Note: this documents the target catalog format starting with DR4 / desitarget 0.14.0 . The previous format is documented in *targets-dr3*.

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Empty
HDU1	TARGETS	BINTABLE	Target table

FITS Header Units

HDU0

EXTNAME = PRIMARY

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TARGETS

Target selection table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	176	int	width of table in bytes
NAXIS2	15050911	int	number of rows in table
ENCODING	ascii	str	
SEED	1028862084	int	initial random seed
HPXNSIDE	64	int	HEALPix nside
HPXNEST	T	bool	HEALPix nested (not ring) ordering

Required Data Table Columns

Name	Type	Units	Description
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		OBJID (unique to brick, but not to file)
RA	float64		Right ascension [degrees]
DEC	float64		Declination [degrees]

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Name	Type	Units	Description
FLUX_G	float32		DECaLS flux from tractor input (g)
FLUX_R	float32		DECaLS flux from tractor input (r)
FLUX_Z	float32		DECaLS flux from tractor input (z)
FLUX_W1	float32		WISE flux in W1
FLUX_W2	float32		WISE flux in W2
MW_TRANSMISSION_G	float32		Milky Way dust transmission in DECaLS g
MW_TRANSMISSION_R	float32		Milky Way dust transmission in DECaLS r
MW_TRANSMISSION_Z	float32		Milky Way dust transmission in DECaLS z
MW_TRANSMISSION_W1	float32		Milky Way transmission in WISE W1
MW_TRANSMISSION_W2	float32		Milky Way transmission in WISE W2
PSFDEPTH_G	float32		PSF-based depth in DECaLS g
PSFDEPTH_R	float32		PSF-based depth in DECaLS r
PSFDEPTH_Z	float32		PSF-based depth in DECaLS z
GALDEPTH_G	float32		Model-based depth in DECaLS g
GALDEPTH_R	float32		Model-based depth in DECaLS r
GALDEPTH_Z	float32		Model-based depth in DECaLS z
PSFDEPTH_W1	float32		PSF-based depth in WISE W1
PSFDEPTH_W2	float32		PSF-based depth in WISE W2
SHAPEDEV_R	float32		Half-light radius of deVaucouleurs model (>0)
SHAPEDEV_E1	float32		Ellipticity parameter e1 of deVaucouleurs model
SHAPEDEV_E2	float32		Ellipticity parameter e2 of deVaucouleurs model
SHAPEEXP_R	float32		Half-light radius of exponential model (>0)
SHAPEEXP_E1	float32		Ellipticity parameter e1 of exponential model
SHAPEEXP_E2	float32		Ellipticity parameter e1 of exponential model
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
TARGETID	int64		Unique targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
HPXPIXEL	int64		HEALPixel containing target.

Notes and Examples

In general, the above format contains:

- Columns that were used by target selection (e.g. FLUX_G/R/Z)
- Columns needed by fiber assignment (e.g. RA, DEC)
- Columns needed for traceability (e.g. BRICKNAME, TARGETID, DESI_TARGET, BGS_TARGET, MWS_TARGET)

TARGETID, HPXPIXEL, PHOTSYS, DESI_TARGET, BGS_TARGET and MWS_TARGET are created by target selection; the rest are passed through from the original input tractor files

See http://legacysurvey.org for more details about the columns from input tractor files

targets-dr7

Summary
DESI target selection files contain a single binary table covering the entire footprint. They contain the variables used by target selection (*e.g.* fluxes), variables needed by fiber assignment (*e.g.* RA, DEC), and variables needed for traceability (*e.g.* TARGETFLAG, TARGETID).

Naming Convention
`DRX/VERSION/targets-DRX-VERSION.fits`, where `DRX` is the imaging surveys data release name (e.g. dr7.1) and `VERSION` is the desitarget code version defining the cuts (e.g. 0.22.0).

Regex
`targets-dr[0.9]+\.[0-9]+-v?[0-9]+\.[0-9]+(\.[0-9]+|)\.fits`

File Type
FITS, 30 GB

Note: this documents the target catalog format starting with DR7 / desitarget 0.22.0 . The previous format is documented in *targets-dr6*.

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Empty
HDU1	TARGETS	BINTABLE	Target table

FITS Header Units

HDU0

EXTNAME = PRIMARY

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TARGETS

Target selection table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	374	int	width of table in bytes
NAXIS2	72660205	int	number of rows in table
OBSCON	DARK|GRAY	str	
HPXNSIDE	64	int	HEALPix nside
HPXNEST	T	bool	HEALPix nested (not ring) ordering
SURVEY	main	str	
RESOLVE	T	bool	
MASKBITS	T	bool	
FILENSID	64	int	
FILENEST	T	bool	
FILEHPX	5261	int	

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int16		Legacy Surveys (LS) Release
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		OBJID (unique to brick, but not to file)
MORPHTYPE	char[4]		Morphological Model type
RA	float64	deg	Right ascension [degrees]
DEC	float64	deg	Declination [degrees]
RA_IVAR	float32	deg**-2	Right ascension inverse variance [1/degrees**2]
DEC_IVAR	float32	deg**-2	Declination inverse variance [1/degrees**2]
DCHISQ	float32[5]		Difference in chi-squared between model fits
FLUX_G	float32		LS flux from tractor input (g)
FLUX_R	float32		LS flux from tractor input (r)
FLUX_Z	float32		LS flux from tractor input (z)
FLUX_W1	float32		WISE flux in W1
FLUX_W2	float32		WISE flux in W2
FLUX_W3	float32		WISE flux in W3
FLUX_W4	float32		WISE flux in W4
FLUX_IVAR_G	float32		Inverse Variance of FLUX_G
FLUX_IVAR_R	float32		Inverse Variance of FLUX_R
FLUX_IVAR_Z	float32		Inverse Variance of FLUX_Z
FLUX_IVAR_W1	float32		Inverse Variance of FLUX_W1
FLUX_IVAR_W2	float32		Inverse Variance of FLUX_W2
FLUX_IVAR_W3	float32		Inverse Variance of FLUX_W3
FLUX_IVAR_W4	float32		Inverse Variance of FLUX_W4
MW_TRANSMISSION_G	float32		Milky Way dust transmission in LS g
MW_TRANSMISSION_R	float32		Milky Way dust transmission in LS r
MW_TRANSMISSION_Z	float32		Milky Way dust transmission in LS z
MW_TRANSMISSION_W1	float32		Milky Way dust transmission in WISE W1
MW_TRANSMISSION_W2	float32		Milky Way dust transmission in WISE W2
MW_TRANSMISSION_W3	float32		Milky Way dust transmission in WISE W3

contin

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Name	Type	Units	Description
MW_TRANSMISSION_W4	float32		Milky Way dust transmission in WISE W4
NOBS_G	int16		Number of images for central pixel in LS g
NOBS_R	int16		Number of images for central pixel in LS r
NOBS_Z	int16		Number of images for central pixel in LS z
FRACFLUX_G	float32		Fraction of flux from other sources compared to this so
FRACFLUX_R	float32		Fraction of flux from other sources compared to this so
FRACFLUX_Z	float32		Fraction of flux from other sources compared to this so
FRACMASKED_G	float32		Fraction of pixels masked for this source in LS g
FRACMASKED_R	float32		Fraction of pixels masked for this source in LS r
FRACMASKED_Z	float32		Fraction of pixels masked for this source in LS z
FRACIN_G	float32		*Description needed*
FRACIN_R	float32		*Description needed*
FRACIN_Z	float32		*Description needed*
ALLMASK_G	int16		Bitwise mask for central pixel in LS g
ALLMASK_R	int16		Bitwise mask for central pixel in LS r
ALLMASK_Z	int16		Bitwise mask for central pixel in LS z
WISEMASK_W1	byte		*Description needed*
WISEMASK_W2	byte		*Description needed*
PSFDEPTH_G	float32		PSF-based depth in LS g
PSFDEPTH_R	float32		PSF-based depth in LS r
PSFDEPTH_Z	float32		PSF-based depth in LS z
GALDEPTH_G	float32		Galaxy model-based depth in LS g
GALDEPTH_R	float32		Galaxy model-based depth in LS r
GALDEPTH_Z	float32		Galaxy model-based depth in LS z
FRACDEV	float32		Fraction of model in deVaucouleurs profile
FRACDEV_IVAR	float32		Inverse variance of FRACDEV
SHAPEDEV_R	float32		Half-light radius of deVaucouleurs model
SHAPEDEV_R_IVAR	float32		Inverse variance of SHAPEDEV_R
SHAPEDEV_E1	float32		Ellipticity component 1 of deVaucouleurs model
SHAPEDEV_E1_IVAR	float32		Inverse variance of SHAPEDEV_E1
SHAPEDEV_E2	float32		Ellipticity component 2 of deVaucouleurs model
SHAPEDEV_E2_IVAR	float32		Inverse variance of SHAPEDEV_E2
SHAPEEXP_R	float32		Half-light radius of exponential model
SHAPEEXP_R_IVAR	float32		Inverse variance of SHAPEEXP_R
SHAPEEXP_E1	float32		Ellipticity component 1 of exponential model
SHAPEEXP_E1_IVAR	float32		Inverse variance of SHAPEEXP_E1
SHAPEEXP_E2	float32		Ellipticity component 2 of exponential model
SHAPEEXP_E2_IVAR	float32		Inverse variance of SHAPEEXP_E2
FIBERFLUX_G	float32		g-band object model flux for 1 arcsec seeing and 1.5 ar
FIBERFLUX_R	float32		r-band object model flux for 1 arcsec seeing and 1.5 ar
FIBERFLUX_Z	float32		z-band object model flux for 1 arcsec seeing and 1.5 ar
FIBERTOTFLUX_G	float32		like FIBERFLUX_G but including all objects overlapp
FIBERTOTFLUX_R	float32		like FIBERFLUX_R but including all objects overlapp
FIBERTOTFLUX_Z	float32		like FIBERFLUX_Z but including all objects overlapp
REF_CAT	char[2]		*Description needed*
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; "sourceid
GAIA_PHOT_G_MEAN_MAG	float32		Gaia G band magnitude
GAIA_PHOT_G_MEAN_FLUX_OVER_ERROR	float32		Gaia G band signal-to-noise
GAIA_PHOT_BP_MEAN_MAG	float32		Gaia BP band magnitude

contin

Table 71 – continued from previous page

Name	Type	Units	Description
GAIA_PHOT_BP_MEAN_FLUX_OVER_ERROR	float32		Gaia BP band signal-to-noise
GAIA_PHOT_RP_MEAN_MAG	float32		Gaia RP band magnitude
GAIA_PHOT_RP_MEAN_FLUX_OVER_ERROR	float32		Gaia RP band signal-to-noise
GAIA_PHOT_BP_RP_EXCESS_FACTOR	float32		*Description needed*
GAIA_ASTROMETRIC_SIGMA5D_MAX	float32		*Description needed*
GAIA_ASTROMETRIC_PARAMS_SOLVED	int64		*Description needed*
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise
GAIA_DUPLICATED_SOURCE	bool		Gaia duplicated source flag
PARALLAX	float32		Reference catalog parallax
PARALLAX_IVAR	float32		Inverse variance of parallax
PMRA	float32		Reference catalog proper motion in the RA direction
PMRA_IVAR	float32		Inverse variance of PMRA
PMDEC	float32		Reference catalog proper motion in the Dec direction
PMDEC_IVAR	float32		Inverse variance of PMDEC
MASKBITS	int16		*Description needed*
EBV	float32		Median (average?) Milky Way dust E(B-V) extinction
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S' for D
TARGETID	int64		Unique targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int64		Flag the target to be observed in graytime.
PRIORITY_INIT	int64		*Description needed*
NUMOBS_INIT	int64		*Description needed*
HPXPIXEL	int64		HEALPixel containing target

Notes and Examples

In general, the above format contains:

- Columns that were used by target selection (e.g. FLUX_G/R/Z)
- Columns needed by fiber assignment (e.g. RA, DEC)
- Columns needed for traceability (e.g. BRICKNAME, TARGETID, DESI_TARGET, BGS_TARGET, MWS_TARGET)

FRACFLUX and FRACMASKED are profile-weighted quantities

SUBPRIORITY, PHOTSYS, TARGETID, DESI_TARGET, BGS_TARGET, MWS_TARGET and HPXPIXEL are created by target selection; the rest are passed through from the original input tractor or sweep files

See http://legacysurvey.org for more details about the columns from input tractor files

targets-dr8

Summary
DESI target selection files include a single binary table containing the targets in a (nested) HEALPixel. They contain the variables used by target selection (*e.g.* fluxes), variables needed by fiber assignment (*e.g.* RA, DEC), and variables needed for traceability (*e.g.* DESITARGET, TARGETID).

Naming Convention
`PHASEtargets-OBSCON-RESOLVE-hp-HP.fits`, where `PHASE` is a specific DESI observational phase (*e.g.* svX with X=1,2 for iterations of Survey Validation), `OBSCON` is the observing condition (or "layer") for the targets (*e.g.* dark), `RESOLVE` is "noresolve" for targets that are not resolved, and `HP` is the HEALPixel covered by the file at the (nested) HEALPixel nside included in the file header as `FILENSID` (*e.g.* 11). For targets that are *not* resolved `RESOLVE` is omitted from the filename. For targets that are part of the DESI Main Science Survey `PHASE` is omitted from the filename.

Regex
`.*?target-.*?-hp-?[0-9]+\.fits`

File Type
FITS, 2 GB

Note: this documents the target catalog format starting with DR8 / desitarget 0.31.0 . The previous format is documented in *targets-dr7*.

Examples

For research notes detailing early target selections for DESI, target files are available at:

https://data.desi.lbl.gov/public/ets/target/catalogs/dr8 .

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Empty
HDU1	TARGETS	BINTABLE	Target table

FITS Header Units

HDU0

EXTNAME = PRIMARY

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TARGETS

Target selection table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	374	int	width of table in bytes
NAXIS2	72660205	int	number of rows in table
OBSCON	DARK|GRAY	str	observing layer for file
HPXNSIDE	64	int	HEALPix nside for column *HPXPIXEL*
HPXNEST	T	bool	HEALPix nested (not ring) ordering
SURVEY	main	str	sv1 for SV, main for Main Survey
RESOLVE	T	bool	`True` if from unique imaging
MASKBITS	T	bool	`True` if masking cuts applied
SUPP	F	bool	`True` for supplemental targets
TCNAMES	"QSO,LRG"	str	run for this target-class subset
FILENSID	2	int	HEALPix nside covered by file
FILENEST	T	bool	HEALPix nested (not ring) ordering
FILEHPX	11	int	HEALPix pixel(s) covered by file

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int16		Legacy Surveys (LS) Release
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		OBJID (unique to brick, but not to file)
MORPHTYPE	char[4]		Morphological Model type
RA	float64	deg	Right ascension [degrees]
RA_IVAR	float32	deg**-2	Right ascension inverse variance [1/degrees**
DEC	float64	deg	Declination [degrees]
DEC_IVAR	float32	deg**-2	Declination inverse variance [1/degrees**2]
DCHISQ	float32[5]		Difference in chi-squared between model fits
EBV	float32	mag	Galactic extinction E(B-V) reddening from SF
FLUX_G	float32	nanomaggy	LS flux from tractor input (g)
FLUX_R	float32	nanomaggy	LS flux from tractor input (r)
FLUX_Z	float32	nanomaggy	LS flux from tractor input (z)
FLUX_IVAR_G	float32	nanomaggy**-2	Inverse Variance of FLUX_G
FLUX_IVAR_R	float32	nanomaggy**-2	Inverse Variance of FLUX_R
FLUX_IVAR_Z	float32	nanomaggy**-2	Inverse Variance of FLUX_Z
MW_TRANSMISSION_G	float32		Milky Way dust transmission in LS g
MW_TRANSMISSION_R	float32		Milky Way dust transmission in LS r
MW_TRANSMISSION_Z	float32		Milky Way dust transmission in LS z
FRACFLUX_G	float32		Fraction of flux from other sources compared t
FRACFLUX_R	float32		Fraction of flux from other sources compared t

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Name	Type	Units	Description
FRACFLUX_Z	float32		Fraction of flux from other sources compared t
FRACMASKED_G	float32		Fraction of pixels masked for this source in LS
FRACMASKED_R	float32		Fraction of pixels masked for this source in LS
FRACMASKED_Z	float32		Fraction of pixels masked for this source in LS
FRACIN_G	float32		Fraction of a source's flux within a LS blob in
FRACIN_R	float32		Fraction of a source's flux within a LS blob in
FRACIN_Z	float32		Fraction of a source's flux within a LS blob in
NOBS_G	int16		Number of images for central pixel in LS g
NOBS_R	int16		Number of images for central pixel in LS r
NOBS_Z	int16		Number of images for central pixel in LS z
PSFDEPTH_G	float32	nanomaggy**-2	PSF-based depth in LS g
PSFDEPTH_R	float32	nanomaggy**-2	PSF-based depth in LS r
PSFDEPTH_Z	float32	nanomaggy**-2	PSF-based depth in LS z
GALDEPTH_G	float32	nanomaggy**-2	Galaxy model-based depth in LS g
GALDEPTH_R	float32	nanomaggy**-2	Galaxy model-based depth in LS r
GALDEPTH_Z	float32	nanomaggy**-2	Galaxy model-based depth in LS z
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB system)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_W3	float32	nanomaggy	WISE flux in W3 (AB)
FLUX_W4	float32	nanomaggy	WISE flux in W4 (AB)
FLUX_IVAR_W1	float32	nanomaggy**-2	Inverse Variance of FLUX_W1 (AB system)
FLUX_IVAR_W2	float32	nanomaggy**-2	Inverse Variance of FLUX_W2 (AB)
FLUX_IVAR_W3	float32	nanomaggy**-2	Inverse Variance of FLUX_W3 (AB)
FLUX_IVAR_W4	float32	nanomaggy**-2	Inverse Variance of FLUX_W4 (AB)
MW_TRANSMISSION_W1	float32		Milky Way dust transmission in WISE W1
MW_TRANSMISSION_W2	float32		Milky Way dust transmission in WISE W2
MW_TRANSMISSION_W3	float32		Milky Way dust transmission in WISE W3
MW_TRANSMISSION_W4	float32		Milky Way dust transmission in WISE W4
ALLMASK_G	int16		Bitwise mask for central pixel in LS g
ALLMASK_R	int16		Bitwise mask for central pixel in LS r
ALLMASK_Z	int16		Bitwise mask for central pixel in LS z
FIBERFLUX_G	float32	nanomaggy	g-band object model flux for 1 arcsec seeing ar
FIBERFLUX_R	float32	nanomaggy	r-band object model flux for 1 arcsec seeing an
FIBERFLUX_Z	float32	nanomaggy	z-band object model flux for 1 arcsec seeing ar
FIBERTOTFLUX_G	float32	nanomaggy	like FIBERFLUX_G but including all objects c
FIBERTOTFLUX_R	float32	nanomaggy	like FIBERFLUX_R but including all objects c
FIBERTOTFLUX_Z	float32	nanomaggy	like FIBERFLUX_Z but including all objects c
REF_EPOCH	float32	yr	reference epoch for Gaia/Tycho astrometry. Ty
WISEMASK_W1	byte		W1 bitmask as cataloged on the LS DR8 bitma
WISEMASK_W2	byte		W2 bitmask as cataloged on the LS DR8 bitma
MASKBITS	int16		bitmask for `coadd/*/*/*maskbits*` maps, a
FRACDEV	float32		Fraction of model in deVaucouleurs profile
FRACDEV_IVAR	float32		Inverse variance of FRACDEV
SHAPEDEV_R	float32	arcsec	Half-light radius of deVaucouleurs model
SHAPEDEV_E1	float32		Ellipticity component 1 of deVaucouleurs mod
SHAPEDEV_E2	float32		Ellipticity component 2 of deVaucouleurs mod
SHAPEDEV_R_IVAR	float32	arcsec**-2	Inverse variance of SHAPEDEV_R
SHAPEDEV_E1_IVAR	float32		Inverse variance of SHAPEDEV_E1
SHAPEDEV_E2_IVAR	float32		Inverse variance of SHAPEDEV_E2

Table 72 – continued from previous page

Name	Type	Units	Description
SHAPEEXP_R	float32	arcsec	Half-light radius of exponential model
SHAPEEXP_E1	float32		Ellipticity component 1 of exponential model
SHAPEEXP_E2	float32		Ellipticity component 2 of exponential model
SHAPEEXP_R_IVAR	float32	arcsec**-2	Inverse variance of SHAPEEXP_R
SHAPEEXP_E1_IVAR	float32		Inverse variance of SHAPEEXP_E1
SHAPEEXP_E2_IVAR	float32		Inverse variance of SHAPEEXP_E2
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; “
REF_CAT	char[2]		Reference catalog source for star: “T2” for Tyc
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_G_MEAN_FLUX_OVER_ERROR	float32		Gaia G band signal-to-noise
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_BP_MEAN_FLUX_OVER_ERROR	float32		Gaia BP band signal-to-noise
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
GAIA_PHOT_RP_MEAN_FLUX_OVER_ERROR	float32		Gaia RP band signal-to-noise
GAIA_PHOT_BP_RP_EXCESS_FACTOR	float32		Gaia BP/RP excess factor
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise
GAIA_DUPLICATED_SOURCE	bool		Gaia duplicated source flag
GAIA_ASTROMETRIC_SIGMA5D_MAX	float32	mas	Gaia longest semi-major axis of the 5-d error e
GAIA_ASTROMETRIC_PARAMS_SOLVED	int64		which astrometric parameters were estimated f
PARALLAX	float32	mas	Reference catalog parallax
PARALLAX_IVAR	float32	mas**-2	Inverse variance of parallax
PMRA	float32	mas/yr	Reference catalog proper motion in the RA dir
PMRA_IVAR	float32	mas/yr**-2	Inverse variance of PMRA
PMDEC	float32	mas/yr	Reference catalog proper motion in the Dec dir
PMDEC_IVAR	float32	mas/yr**-2	Inverse variance of PMDEC
PHOTSYS	char[1]		‘N’ for the MzLS/BASS photometric system, ‘
TARGETID	int64		Unique targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitn
BGS_TARGET	int64		BGS (bright time program) target selection bit
MWS_TARGET	int64		MWS (bright time program) target selection bi
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment
OBSCONDITIONS	int64		Flag target to be observed in combinations of c
PRIORITY_INIT	int64		Initial priority for target calculated across targe
NUMOBS_INIT	int64		Initial number of observations for target calcul
HPXPIXEL	int64		HEALPixel containing target at HPXNSIDE

Notes

In general, the above format contains:

- Columns that were used by target selection (e.g. FLUX_G/R/Z).
- Columns needed by fiber assignment (e.g. RA, DEC).
- Columns needed for traceability (e.g. BRICKNAME, TARGETID, DESI_TARGET, BGS_TARGET, MWS_TARGET).

FRACFLUX and FRACMASKED are profile-weighted quantities.

SUBPRIORITY, OBSCONDITIONS, PRIORITY_INIT, NUMOBS_INIT, PHOTSYS, TARGETID, DESI_TARGET, BGS_TARGET, MWS_TARGET and HPXPIXEL are created by target selection; the rest are passed through from the original LS tractor or sweep files.

See https://www.legacysurvey.org for more details about columns in the data model.

gaiadr2

The `gaiadr2` directory hosts target catalogs derived solely from Gaia.

Under the `gaiadr2` directory, data are grouped according to the release number (tag) of the desitarget code version on GitHub.

Subdirectories:

VERSION

`VERSION` is the release number (tag) of the desitarget code version on GitHub in the format X.Y.Z. Under each code version, data are grouped according to the type of target. Types include "targets" and "skies-supp" (supplementary sky locations).

Subdirectories:

targets

The `targets` directory holds catalogs of DESI targets derived from Gaia. Under the `targets` directory data are grouped according to the specific DESI observational phase. Observational phases include "mainX" for iterations of the DESI Main Science Survey, "svX" for iterations of Survey Validation and "cmx" for commissioning, where "X" is an integer.

Subdirectories:

PHASE

`PHASE` is a specific DESI observational phase, which can include "mainX" for iterations of the DESI Main Science Survey, "svX" for iterations of Survey Validation and "cmx" for commissioning, where X is an integer. Under each target phase, data are grouped according to whether the targets have been resolved to account for duplicates in overlapping Legacy Surveys imaging. The northern and southern imaging footprints overlap and are *resolved* to only retain targets in the northern imaging that are both at Dec. > 32.375 degrees and north of the Galactic Plane.

Subdirectories:

RESOLVE

`RESOLVE` refers to whether targets have been resolved to account for duplicates in overlapping Legacy Surveys imaging. The northern and southern imaging footprints overlap and are *resolved* to only retain targets in the northern imaging that are both at Dec. > 32.375 degrees and north of the Galactic Plane. Targets that have been resolved are in directories named "resolve" and targets that have not been resolved are in directories named "noresolve".

Under each "resolve", data are stored in a `BACKUP` directory named `supp` prior to version `0.50.0` of the `desitarget` code and `backup` for `0.50.0`, or later, of the `desitarget` code. The choice of `backup` versus `supp` is semantic, and files in the `BACKUP` directory are similarly constructed.

Subdirectories:

BACKUP

BACKUP refers to either a directory called supp prior to version 0.50.0 of the desitarget code or backup for 0.50.0, or later, of the desitarget code. The choice of backup versus supp is semantic, and files in the BACKUP directory are similarly constructed.

backup targets

Summary
DESI backup target selection files include a binary table containing the backup targets in a (nested) HEALPixel. They store the variables used by target selection (*e.g.* fluxes), variables needed by fiber assignment (*e.g.* RA, DEC), and variables needed for traceability (*e.g.* DESITARGET, TARGETID). They are compiled from Gaia to provide a source of targets that does not rely on Legacy Surveys imaging.

Naming Convention
PHASEtargets-BACKUP-hp-HP.fits, where PHASE is a specific DESI observational phase (*e.g.* svX with X=1,2,3 for iterations of Survey Validation) BACKUP is supp prior to version 0.50.0 of the desitarget code or backup for later versions, and HP is the HEALPixel covered by the targets at the (nested) HEALPixel nside included in the file header as FILENSID (*e.g.* 11). For targets that are part of the DESI Main Science Survey PHASE is omitted from the filename.

Regex
`(cmx|sv1|sv2|sv3|main2|)targets-(backup|supp)-hp-[0-9]+\.fits`

File Type
FITS, 26 MB - 1.2 GB

Examples

DESI target selection files based on Gaia are available at:

https://data.desi.lbl.gov/public/ets/target/catalogs/gaiadr2 .

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	TARGETS	BINTABLE	Target table
HDU2	INFILES	BINTABLE	Files used to produce target table

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TARGETS

Target selection table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	983	int	width of table in bytes
NAXIS2	205901	int	number of rows in table
OBSCON	“BACKUP”	str	observing layer for file
HPXNSIDE	64	int	HEALPix nside for column *HPXPIXEL*
HPXNEST	T	bool	HEALPix nested (not ring) ordering
SUBPSEED	1015	int	random seed used to generate *SUBPRIORITY* values
SURVEY	“main”	str	svX for SV, main for Main Survey
RESOLVE	T	bool	`True` if from unique imaging
MASKBITS	T	bool	`True` if masking cuts applied
BACKUP	F	bool	`True` for backup/supplemental targets from Gaia
GAIADR	2	int	Gaia Data Release used to produce targets
TCNAMES	“QSO,LRG”	str	run for this target-class subset
GAIASUB	T	bool	`True` if Gaia EDR3 astrometric values were substituted for Gaia DR2 quantities.
CMDLINE	“/global/”	str	command-line call used to generate target file
SCNDOUT	“/global/”	str	directory from which secondary targets were read
FILENSID	2	int	HEALPix nside covered by file
FILENEST	T	bool	HEALPix nested (not ring) ordering
FILEHPX	11	int	HEALPix pixel(s) covered by file

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int16		Legacy Surveys (LS) Release
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		OBJID (unique to brick, but not to file)
MORPHTYPE	char[4]		Morphological Model type
RA	float64	deg	Right ascension [degrees]
RA_IVAR	float32	deg^-2	Right ascension inverse variance
DEC	float64	deg	Declination [degrees]
DEC_IVAR	float32	deg^-2	Declination inverse variance
DCHISQ	float32[5]		Difference in chi-squared between model fits
EBV	float32	mag	Galactic extinction E(B-V) reddening from SF

Table 73 – continued from previous page

Name	Type	Units	Description
FLUX_G	float32	nanomaggy	LS flux from tractor input (g)
FLUX_R	float32	nanomaggy	LS flux from tractor input (r)
FLUX_Z	float32	nanomaggy	LS flux from tractor input (z)
FLUX_IVAR_G	float32	nanomaggy^-2	Inverse Variance of FLUX_G
FLUX_IVAR_R	float32	nanomaggy^-2	Inverse Variance of FLUX_R
FLUX_IVAR_Z	float32	nanomaggy^-2	Inverse Variance of FLUX_Z
MW_TRANSMISSION_G	float32		Milky Way dust transmission in LS g
MW_TRANSMISSION_R	float32		Milky Way dust transmission in LS r
MW_TRANSMISSION_Z	float32		Milky Way dust transmission in LS z
FRACFLUX_G	float32		Fraction of flux from other sources compared t
FRACFLUX_R	float32		Fraction of flux from other sources compared t
FRACFLUX_Z	float32		Fraction of flux from other sources compared t
FRACMASKED_G	float32		Fraction of pixels masked for this source in LS
FRACMASKED_R	float32		Fraction of pixels masked for this source in LS
FRACMASKED_Z	float32		Fraction of pixels masked for this source in LS
FRACIN_G	float32		Fraction of a source's flux within a LS blob in
FRACIN_R	float32		Fraction of a source's flux within a LS blob in
FRACIN_Z	float32		Fraction of a source's flux within a LS blob in
NOBS_G	int16		Number of images for central pixel in LS g
NOBS_R	int16		Number of images for central pixel in LS r
NOBS_Z	int16		Number of images for central pixel in LS z
PSFDEPTH_G	float32	nanomaggy^-2	PSF-based depth in LS g
PSFDEPTH_R	float32	nanomaggy^-2	PSF-based depth in LS r
PSFDEPTH_Z	float32	nanomaggy^-2	PSF-based depth in LS z
GALDEPTH_G	float32	nanomaggy^-2	Galaxy model-based depth in LS g
GALDEPTH_R	float32	nanomaggy^-2	Galaxy model-based depth in LS r
GALDEPTH_Z	float32	nanomaggy^-2	Galaxy model-based depth in LS z
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB system)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_W3	float32	nanomaggy	WISE flux in W3 (AB)
FLUX_W4	float32	nanomaggy	WISE flux in W4 (AB)
FLUX_IVAR_W1	float32	nanomaggy^-2	Inverse Variance of FLUX_W1 (AB system)
FLUX_IVAR_W2	float32	nanomaggy^-2	Inverse Variance of FLUX_W2 (AB)
FLUX_IVAR_W3	float32	nanomaggy^-2	Inverse Variance of FLUX_W3 (AB)
FLUX_IVAR_W4	float32	nanomaggy^-2	Inverse Variance of FLUX_W4 (AB)
MW_TRANSMISSION_W1	float32		Milky Way dust transmission in WISE W1
MW_TRANSMISSION_W2	float32		Milky Way dust transmission in WISE W2
MW_TRANSMISSION_W3	float32		Milky Way dust transmission in WISE W3
MW_TRANSMISSION_W4	float32		Milky Way dust transmission in WISE W4
ALLMASK_G	int16		Bitwise mask for central pixel in LS g
ALLMASK_R	int16		Bitwise mask for central pixel in LS r
ALLMASK_Z	int16		Bitwise mask for central pixel in LS z
FIBERFLUX_G	float32	nanomaggy	g-band object model flux for 1 arcsec seeing ar
FIBERFLUX_R	float32	nanomaggy	r-band object model flux for 1 arcsec seeing an
FIBERFLUX_Z	float32	nanomaggy	z-band object model flux for 1 arcsec seeing ar
FIBERTOTFLUX_G	float32	nanomaggy	like FIBERFLUX_G but including all objects c
FIBERTOTFLUX_R	float32	nanomaggy	like FIBERFLUX_R but including all objects c
FIBERTOTFLUX_Z	float32	nanomaggy	like FIBERFLUX_Z but including all objects c
REF_EPOCH	float32	yr	reference epoch for Gaia/Tycho astrometry. Ty

Table 73 – continued from previous page

Name	Type	Units	Description
WISEMASK_W1	binary		W1 bitmask as cataloged on the LS DR9 bitma
WISEMASK_W2	binary		W2 bitmask as cataloged on the LS DR9 bitma
MASKBITS	int16		bitmask for `coadd/*/*/*maskbits*` maps, a
LC_FLUX_W1	float32[15]	nanomaggy	FLUX_W1 in each of up to fifteen unWISE co
LC_FLUX_W2	float32[15]	nanomaggy	FLUX_W2 in each of up to fifteen unWISE co
LC_FLUX_IVAR_W1	float32[15]	nanomaggy^-2	Inverse variance of LC_FLUX_W1 (AB syster
LC_FLUX_IVAR_W2	float32[15]	nanomaggy^-2	Inverse variance of LC_FLUX_W2 (AB syster
LC_NOBS_W1	int16[15]		NOBS_W1 in each of up to fifteen unWISE co
LC_NOBS_W2	int16[15]		NOBS_W2 in each of up to fifteen unWISE co
LC_MJD_W1	float64[15]		MJD_W1 in each of up to fifteen unWISE coad
LC_MJD_W2	float64[15]		MJD_W2 in each of up to fifteen unWISE coad
SHAPE_R	float32	arcsec	Half-light radius of galaxy model for galaxy ty
SHAPE_E1	float32		Ellipticity component 1 of galaxy model for ga
SHAPE_E2	float32		Ellipticity component 2 of galaxy model for ga
SHAPE_R_IVAR	float32	arcsec^-2	Inverse variance of SHAPE_R
SHAPE_E1_IVAR	float32		Inverse variance of SHAPE_E1
SHAPE_E2_IVAR	float32		Inverse variance of SHAPE_E2
SERSIC	float32		Power-law index for the Sersic profile model (N
SERSIC_IVAR	float32		Inverse variance of SERSIC
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; "
REF_CAT	char[2]		Reference catalog source for star: "T2" for Tyc
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_G_MEAN_FLUX_OVER_ERROR	float32		Gaia G band signal-to-noise
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_BP_MEAN_FLUX_OVER_ERROR	float32		Gaia BP band signal-to-noise
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
GAIA_PHOT_RP_MEAN_FLUX_OVER_ERROR	float32		Gaia RP band signal-to-noise
GAIA_PHOT_BP_RP_EXCESS_FACTOR	float32		Gaia BP/RP excess factor
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise
GAIA_DUPLICATED_SOURCE	logical		Gaia duplicated source flag
GAIA_ASTROMETRIC_SIGMA5D_MAX	float32	mas	Gaia longest semi-major axis of the 5-d error e
GAIA_ASTROMETRIC_PARAMS_SOLVED	binary		which astrometric parameters were estimated f
PARALLAX	float32	mas	Reference catalog parallax
PARALLAX_IVAR	float32	mas^-2	Inverse variance of parallax
PMRA	float32	mas / yr	Reference catalog proper motion in the RA dir
PMRA_IVAR	float32	yr^2 / mas^2	Inverse variance of PMRA
PMDEC	float32	mas / yr	Reference catalog proper motion in the Dec dir
PMDEC_IVAR	float32	yr^2 / mas^2	Inverse variance of PMDEC
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, '
TARGETID	int64		Unique targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitm
BGS_TARGET	int64		BGS (bright time program) target selection bitr
MWS_TARGET	int64		MWS (bright time program) target selection bi
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment
OBSCONDITIONS	int64		Flag target to be observed in combinations of c
PRIORITY_INIT	int64		Initial priority for target calculated across targe
NUMOBS_INIT	int64		Initial number of observations for target calcula
SCND_TARGET	int64		SCND (secondary program) target selection bi
HPXPIXEL	int64		HEALPixel containing target at HPXNSIDE

HDU2

EXTNAME = INFILES

Files used to produce target table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	152	int	width of table in bytes
NAXIS2	6	int	number of rows in table

Required Data Table Columns

Name	Type	Units	Description
FILENAME	char[88]		LS sweep files associated with this HEALPixel
SHA256	char[64]		Checksum for each LS sweep file

Notes

Some units in this file do not conform to the FITS standard:

- deg^-2 is incorrectly recorded as 1/deg^2
- nanomaggy^-2 is incorrectly recorded as 1/nanomaggy^2
- arcsec^-2 is incorrectly recorded as 1/arcsec^2
- mas^-2 is incorrectly recorded as 1/mas^2

Such issues can typically be fixed by parsing the unit through astropy after reading in a Table, e.g.:

```
import astropy.units as u
from astropy.table import Table
objs = Table.read(filename, 1)
u.Unit(str(objs["RA_IVAR"].unit))
```

In general, the above format contains:

- Columns that were used by target selection (e.g. FLUX_G/R/Z).
- Columns needed by fiber assignment (e.g. RA, DEC).
- Columns needed for traceability (e.g. BRICKNAME, TARGETID, DESI_TARGET, BGS_TARGET, MWS_TARGET).

FRACFLUX and FRACMASKED are profile-weighted quantities.

SUBPRIORITY, OBSCONDITIONS, PRIORITY_INIT, NUMOBS_INIT, PHOTSYS, TARGETID, DESI_TARGET, BGS_TARGET, MWS_TARGET, SCND_TARGET and HPXPIXEL are created by target selection; the rest are passed through from the original Gaia files.

As the BACKUP files are derived solely using Gaia, quantities from the Legacy Surveys that aren't also in Gaia are populated with meaningless values.

skies-supp

The skies-supp directory hosts supplemental sky locations derived by avoiding bright sources in Gaia. Supplemental sky locations are stored in files that are grouped by (nested) HEALPixel number in filenames that resemble skies-supp-hp-{HP}.fits, where HP is the HEALPixel number.

supplemental skies

Summary
DESI supplemental sky locations contain a single binary table covering the entire Gaia footprint. They are generated to help find sky locations in regions that are not covered by Legacy Surveys imaging. Supplemental sky locations are produced at random positions across the sky and are subsequently removed if they either lie close to a Gaia source or share an nside = 4096 HEALPixel with an existing pixel-based sky location from the Legacy Surveys.

Naming Convention
skies-supp-hp-HP.fits, where HP is the HEALPixel covered at the (nested) HEALPixel nside included in the file header as FILENSID (*e.g.* 11).

Regex
skies-supp-hp-?[0-9]+\.fits

File Type
FITS, 186 KB - 9.4 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	SKY_TARGETS	BINTABLE	Table of sky locations

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = SKY_TARGETS

Table of sky locations

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	136	int	width of table in bytes
NAXIS2	2342	int	number of rows in table
SUPP	T	bool	`True` if sky locations are supplemental (i.e. are *not* derived from the Legacy Surveys)
GAIADR	2	int	Gaia Data Release used to select supplemental skies
NPERSDEG	18000.0	float	density of sky locations generated per sq. deg.
HPXNSIDE	64	int	HEALPix nside for column *HPXPIXEL*
HPXNEST	T	bool	HEALPix nested (not ring) ordering
SUBPSEED	12583926	int	random seed used to generate *SUBPRIORITY* values
RADIUS	2.0	float	separation (arcsec) at which to avoid Gaia sources
MINDEC	-90.0	float	minimum declination for GFAs that are not selected from the Legacy Surveys
MINGALB	0.0	float	closest latitude to Galactic Plane for GFAs that are not selected from the Legacy Surveys
MASKED	T	bool	`True` if targets were masked to avoid bright sources
MASKDIR	"masks/"	str	location of directory of masks used to avoid bright sources
CMDLINE	"/global/"	str	command-line call used to generate target file
FILENSID	2	int	HEALPix nside covered by file
FILENEST	T	bool	HEALPix nested (not ring) ordering
FILEHPX	"11"	str	HEALPix pixel(s) covered by file

Required Data Table Columns

Name	Type	Units	Description
RELEASE	int32		Legacy Surveys (LS) Release
BRICKID	int32		Brick ID from tractor input
BRICKNAME	char[8]		Brick name from tractor input
BRICK_OBJID	int32		OBJID (unique to brick, but not to file)
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
BLOBDIST	float32	pix	Maximum distance from a detected Legacy Surveys source
FIBERFLUX_G	float32		g-band object model flux
FIBERFLUX_R	float32		r-band object model flux
FIBERFLUX_Z	float32		z-band object model flux
FIBERFLUX_IVAR_G	float32		Inverse Variance of `FIBERFLUX_G`
FIBERFLUX_IVAR_R	float32		Inverse Variance of `FIBERFLUX_R`
FIBERFLUX_IVAR_Z	float32		Inverse Variance of `FIBERFLUX_Z`
TARGETID	int64		Unique targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int64		Flag target to be observed in combinations of dark/bright observing layer
PRIORITY_INIT	int64		Initial priority for target calculated across target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selection bitmasks and OBSCONDITIONS
HPXPIXEL	int64		HEALPixel containing sky location

Notes

As quantities in the supplemental skies files are derived from Gaia, quantities from the Legacy Surveys that aren't also in Gaia (*i.e.* fluxes) are populated with meaningless values.

subpriority

The subpriority directory includes files recording the `desitarget/1.0.0` `SUBPRIORITY` values used by `fiberassign/4.0.0` for some initial DESI Main Survey tiles. As of these versions of the DESI code, `fiberassign` was overwriting the `SUBPRIORITY` column, meaning that that column recorded different values to those originally populated by `desitarget`. Files in this directory were used to enforce consistent values of `SUBPRIORITY` for targets in the `desitarget/1.1.1` targeting run used for the bulk of the DESI Main Survey.

The `subpriority` directory contains a sub-directory named `fba-version-4.0.0`, indicative of the `fiberassign` version.

Subdirectories:

fba-version-4.0.0

The subpriority/fba-version-4.0.0 directory holds files recording the `desitarget/1.0.0` `SUBPRIORITY` values used by `fiberassign/4.0.0` for some initial DESI Main Survey tiles. As of these versions of the DESI code, `fiberassign` was overwriting the `SUBPRIORITY` column, meaning that that column recorded different values to those originally populated by `desitarget`. Files in this directory were used to enforce consistent values of `SUBPRIORITY` for targets in the `desitarget/1.1.1` targeting run used for the bulk of the DESI Main Survey.

The circumstances that led to the need to enforce `SUBPRIORITY` values is included in a `README` file in this directory.

The subpriority files themselves have names that resemble subpriorities-`<TTYPE>`.fits, where `TTYPE` is one of `bright`, `dark` or `sky` for bright-time and dark-time targets and sky locations, respectively.

supplemental skies

Summary
The subpriority files are single binary tables that include the fixed values of subpriority enforced for Main Survey targets. There is one file for each of dark-time and bright-time targets, and one for blank sky locations.

Naming Convention
`subpriorities-TTYPE.fits`, where `TTYPE` is one of `dark`, `bright` or `sky`.

Regex
`subpriorities-[a-zA-Z]+\.fits`

File Type
FITS, 41 - 360 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	SUBPRIORITY	BINTABLE	Per-target SUBPRIORITY values

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = SUBPRIORITY

Per-target SUBPRIORITY values

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	width of table in bytes
NAXIS2	2026104	int	number of rows in table
FAPRGRM	"bright"	str	one of "dark", "bright" or "sky"
INFIL000	"$DESI_ROOT/"	str	zeroth fiberassign file/tile for which fixed SUBPRIORITY values need to be enforced
INFIL001	"$DESI_ROOT/"	str	first fiberassign file/tile for which fixed SUBPRIORITY values need to be enforced
INFILxxx	"$DESI_ROOT/"	str	etc.

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique targeting ID
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
DESI_TARGET	int64		DESI (dark time program) target selection bitmask

SCND_DIR

`SCND_DIR` is the root directory for secondary targets. The canonical location is `$DESI_ROOT/TS/target/secondary` but the environment variable `SCND_DIR` can be set to point anywhere. Here, `TS` is, e.g., `public/ets` for DESI early target selection.

Under `SCND_DIR`, secondary targets are grouped according to DESI observational phase. Observational phases include "mainX" for iterations of the DESI Main Science Survey, "svX" for iterations of Survey Validation and "cmx" for commissioning, where "X" is an integer.

`SCND_DIR` may also contain a directory `bespoke` which includes secondary programs that needed special handling to be incorporated into DESI observations. The `bespoke` directory contains simple text files with an accompanying README file that describes each special program.

Finally, `SCND_DIR` may include a README file outlining the general nature of secondary targets.

Subdirectories:

PHASE

PHASE is a specific DESI observational phase, which can include "mainX" for iterations of the DESI Main Science Survey, "svX" for iterations of Survey Validation and "cmx" for commissioning, where X is an integer.

Under each survey phase, secondary targeting information is distributed across 3 directories:

- `indata` contains a .txt or .fits file that includes the targets submitted by each researcher who proposed secondary targets for DESI observations.
- `docs` contains a .ipynb (Jupyter Notebook) or .txt file provided by the proposer describing how each secondary target class was constructed.
- `outdata` contains files from the `indata` directory with the added targeting information (*i.e.* IDs and bits) needed by the DESI pipeline.

The filename for a given secondary program is consistent across each of the `indata`, `docs` and `outdata` directories, and corresponds to the name of the secondary targeting bit used by the desitarget pipeline for a given survey phase (see the desitarget GitHub repository for, *e.g.* sv1 or main). The file *extension* can differ, though (*i.e.* some files in `docs` would have the extension .ipynb whereas the corresponding file in `outdata` would have the extension .fits).

A special filename case is the `veto` file (i.e. `veto.txt` or `veto.fits`). The veto file was designed as a mechanism to flag targets that should *never* be observed rather than new secondary targets to *additionally* observe. The form and contents of the `veto` files *are consistent with the rest of the data model*, described in the previous two paragraphs, except:

- The veto mechanism was never used by DESI — but the `desitarget` code expected the `veto` file to exist. Therefore all `veto` files contain a single "dummy" object at a location well outside of the DESI footprint.
- To reflect the singular, peculiar nature of the `veto` file, the filename is lower-case.

The PHASE directory may also contain a `notes` file, which includes working notes compiled by the run manager for secondary targets (Adam D. Myers, University of Wyoming) while sifting through the various files submitted as part of the DESI secondary proposal process.

Subdirectories:

indata

The `indata` directory contains one .txt or .fits file for each target class submitted by each researcher who proposed secondary targets for DESI observations.

Files in the `indata` directory resemble {BITNAME}.fits or {BITNAME}.txt, where BITNAME is the name of the secondary targeting bit used by the desitarget pipeline for a given survey phase (see the desitarget GitHub repository for, *e.g.* the sv1 or main secondary target bitmasks).

input secondary targets

Summary
DESI secondary target input files contain the targets provided with a given secondary proposal. They can consist of either a binary fits table or a text file.

Naming Convention
`BITNAME.fits` or `BITNAME.txt`, where BITNAME matches the name of the secondary targeting bit used by the desitarget pipeline for a given survey phase (see the desitarget GitHub repository for, *e.g.* the sv1 or main secondary target bitmasks).

Regex
`[A-Z_0-9]+\.(fits|txt)`

File Type
FITS or text, 10 KB - 900 MB

Contents (FITS version; see notes, below, for text version)

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	NONE	BINTABLE	Input secondary targets

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = NONE

Input secondary targets

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	29	int	width of table in bytes
NAXIS2	2772483	int	number of rows in table

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float32	mas / yr	Proper motion in the RA direction
PMDEC	float32	mas / yr	Proper motion in the Dec direction
REF_EPOCH	float32	yr	Astrometric reference epoch. Defaults to 2015.5.
OVERRIDE	logical		If `True` do not match to and accept an existing primary target. Instead, always generate a new `TARGETID`.

Notes

For .fits files, a subset of the columns must correspond to the *Required Data Table Columns* listed above. Any other columns can exist and can be populated with any values.

For .txt files the first 6 columns must correspond to the *Required Data Table Columns* listed above. Subsequent columns can contain any additional information. The # may be included as a comment card. For objects with low proper motion, zero can be passed for the proper motion columns. If zero is passed for `REF_EPOCH`, it will be interpreted to be 2015.5.

docs

The `docs` directory contains one .ipynb (Jupyter Notebook) or .txt file that documents each target class submitted by each researcher who proposed secondary targets for DESI observations.

Files in the `docs` directory resemble `{BITNAME}`.ipynb or `{BITNAME}`.txt, where `BITNAME` is the name of the secondary targeting bit used by the desitarget pipeline for a given survey phase (see the desitarget GitHub repository for, *e.g.* the sv1 or main secondary target bitmasks).

outdata

The `outdata` directory contains files from the `indata` directory with the added targeting information (*i.e.* IDs and bits) needed by the DESI pipeline.

Under each Data Release, data are grouped according to the release number (tag) of the desitarget code version on GitHub that was used to process the secondary targets.

Subdirectories:

VERSION

`VERSION` is the release number (tag) of the desitarget code version on GitHub in the format X.Y.Z.

Under each `VERSION`, data are grouped according to the observational conditions (or "layer") in which they will be observed, typically "dark" or bright".

The `VERSION` directory also includes a subdirectory named priminfo-`{DR}`-`{VERSION}` that stores matches between secondary targets and DESI primary targets. Here, `DR` is the Legacy Surveys data release used to select the primary targets.

Subdirectories:

OBSCON

`OBSCON` designates the observational conditions (or "layer") in which targets will be observed. Possible values include "dark" and "bright" for dark-time and bright-time targets, respectively.

Under each observing condition, secondary targets are stored in files that resemble `{BITNAME}`.fits, where `BITNAME` is the name of the secondary targeting bit used by the desitarget pipeline for a given survey phase (see the desitarget GitHub repository for, *e.g.* the sv1 or main secondary target bitmasks).

output secondary targets

Summary
DESI secondary target output files include a binary fits table. This table contains the targets provided with a given secondary proposal, with the added targeting information (*i.e.* IDs and bits) needed by the DESI pipeline.

Naming Convention
`BITNAME.fits`, where `BITNAME` matches the name of the secondary targeting bit used by the desitarget pipeline for a given survey phase (see the desitarget GitHub repository for, *e.g.* the sv1 or main secondary target bitmasks).

Regex
`[A-Z_0-9]+\.fits`

File Type
FITS, 20 KB - 284 MB

Contents (FITS version; see notes, below, for text version)

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	TARGETS	BINTABLE	Output secondary targets

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TARGETS

Output secondary targets

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	89	int	width of table in bytes
NAXIS2	4838	int	number of rows in table
SURVEY	"main"	str	svX for SV, main for Main Survey
PRIMDIR	"/global/"	str	location of directory of information about corresponding primary targets
SEP	1.0	float	matching radius that was used to find primary targets (arcsec)
MASKED	T	bool	`True` if targets were masked to avoid bright sources
MASKDIR	"masks/"	str	location of directory of masks used to avoid bright sources
SCNDDIR	"/global/"	str	directory from which secondary targets were read
OBSCON	"DARK"	str	observing layer for file
SUBPSEED	717	int	random seed used to generate *SUBPRIORITY* values

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float32	mas / yr	Proper motion in the RA direction
PMDEC	float32	mas / yr	Proper motion in the Dec direction
REF_EPOCH	float32	yr	Astrometric reference epoch. Defaults to 2015.5.
OVERRIDE	logical		If `True` do not match to and accept an existing primary target. Instead, always generate a new `TARGETID`.
FLUX_G	float32	nanomaggy	LS flux from tractor input (g)
FLUX_R	float32	nanomaggy	LS flux from tractor input (r)
FLUX_Z	float32	nanomaggy	LS flux from tractor input (z)
PARALLAX	float32	mas	Reference catalog parallax
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise
TARGETID	int64		Unique targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SCND_TARGET	int64		SCND (secondary program) target selection bitmask
SCND_ORDER	int32		Row in which this target appeared in the input secondary target file

priminfo-DR-VERSION

The priminfo-{DR}-{VERSION} directory stores matches between secondary targets and DESI primary targets. Here, DR is the Legacy Surveys data release used to select the primary targets, and VERSION is the release number (tag) of the desitarget code version on GitHub in the format X.Y.Z.

Matches to primary targets are grouped by (nested) HEALPixel number in filenames that resemble targets-no-obscon-hp-{HP}.fits.

priminfo

Summary
priminfo files include a binary table containing matches between secondary targets and DESI primary targets in a (nested) HEALPixel.

Naming Convention
`PHASEtargets-no-obscon-hp-HP.fits`, where `PHASE` is `sv1` or `sv3` for the corresponding survey, but empty for `main` and `HP` is the HEALPixel covered at the (nested) HEALPixel nside included in the file header as `FILENSID` (*e.g.* 11).

Regex
`(sv1|sv3|)targets-no-obscon-hp-?[0-9]+\.fits`

File Type
FITS, 12 KB - 9.8 MB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Empty
HDU1	TARGETS	SCND_TARG	Matches between primary and secondary targets

FITS Header Units

HDU0

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = SCND_TARG

Matches between primary and secondary targets

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	130	int	width of table in bytes
NAXIS2	30444	int	number of rows in table
SURVEY	"main"	str	svX for SV, main for Main Survey

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float32	mas / yr	Proper motion in the RA direction
PMDEC	float32	mas / yr	Proper motion in the Dec direction
REF_EPOCH	float32	yr	Astrometric reference epoch. Typically 2015.5.
OVERRIDE	logical		If `True` do not match to and accept an existing primary target. Instead, always generate a new `TARGETID`
FLUX_G	float32	nanomaggy	LS flux from tractor input (g)
FLUX_R	float32	nanomaggy	LS flux from tractor input (r)
FLUX_Z	float32	nanomaggy	LS flux from tractor input (z)
PARALLAX	float32	mas	Reference catalog parallax
GAIA_PHOT_G_MEAN_MAG	float32	mag	Gaia G band magnitude
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Gaia BP band magnitude
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Gaia RP band magnitude
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise
TARGETID	int64		Unique targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SCND_TARGET	int64		SCND (secondary program) target selection bitmask
SCND_ORDER	int32		Row in which this target appeared in the input secondary target file
PRIORITY_INIT	int64		Initial priority for target calculated across target selection bitmasks and OBSCONDITIONS
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selection bitmasks and OBSCONDITIONS
OBSCONDITIONS	int64		Flag target to be observed in combinations of dark/bright observing layer
SCND_TARGET_INIT	int64		Duplication of `SCND_TARGET` column (used for internal bookkeeping)
PRIM_MATCH	logical		`True` if a secondary target matches a primary target

Notes

The general user will likely not find the `priminfo` files useful. They are generated for internal bookkeeping to track whether a secondary target is a "standalone" secondary target or is instead allowed to be merged with a DESI primary target.

bespoke

The `bespoke` directory includes secondary programs that needed special handling to be incorporated into DESI observations. The `bespoke` directory contains simple text files with an accompanying README file that describes each special program.

Individual "bespoke" files are not documented further in the data model — consult the README file for each program for additional details.

1.1.3 DESI_SPECTRO_DATA

Default $DESI_ROOT/spectro/data

`DESI_SPECTRO_DATA` contains raw data as produced by the telescope. The canonical location is `$DESI_ROOT/spectro/data`, but one can set the environment variable `DESI_SPECTRO_DATA` to point anywhere. The exposures are grouped by night as a YEARMMDD string. The "night" roles over at noon local time, so all data taken between sunset and sunrise belong to the same night (i.e. the date of the sunset). Under each night, data are grouped in subdirectories by exposure ID (zero-padded 8-digit).

Subdirectories:

NIGHT

$DESI_SPECTRO_DATA/NIGHT
Default $DESI_ROOT/spectro/data/NIGHT

`NIGHT` is the night of observation in YYYYMMDD format. The "night" roles over at noon local time, so all data taken between sunset and sunrise belong to the same night (i.e. the date of the sunset). Under each night, data are grouped in subdirectories by exposure ID (zero-padded 8-digit).

EXPID

$DESI_SPECTRO_DATA/NIGHT/EXPID
Default $DESI_ROOT/spectro/data/NIGHT/EXPID

Raw data for each exposure of the DESI instrument.

`NIGHT` is the night of observation in YYYYMMDD format. The "night" roles over at noon local time, so all data taken between sunset and sunrise belong to the same night (i.e. the date of the sunset). `EXPID` is the 8-digit zero-padded exposure ID.

Each exposure id (expid) generates multiple files:

centroids-EXPID

Summary
JSON file containing centroid data associated with the guide cameras.

Naming Convention
`centroids-EXPID.json`, where EXPID is the zero-padded 8-digit exposure ID.

Regex
`centroids-[0-9]{8}\.json`

File Type
JSON, 100 kB

Contents

Each file contains a dictionary with the following top-level keys:

Key	Description
`expid`	Exposure number
`frames`	*Description needed*

coordinates-EXPID

Summary
Coordinates data used and produced by fiber positioning, FVC and positioner calibration.

Naming Convention
`coordinates-EXPID.fits`, where EXPID is the zero-padded 8-digit exposure ID.

Regex
`coordinates-[0-9]{8}\.fits`

File Type
FITS, 1 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	COORDS	IMAGE	Empty HDU
HDU1	DATA	BINTABLE	Coordinates data
HDU2	STATIONARY	BINTABLE	Reference stationary positions

FITS Header Units

HDU0

EXTNAME = COORDS

This HDU contains header keywords with summary information for the exposure.

Required Header Keywords

KEY	Example Value	Type	Comment
TILEID	4403	int	
TILERA	170.239	float	
TILEDEC	-7.093	float	
FIELDROT	0.0210480650645507	float	
FA_PLAN	2022-07-01T00:00:00.000	str	
FA_HA	-6.72	float	
FA_RUN	2022-01-03T17:00:31+00:00	str	
FA_M_GFA	0.4	float	
FA_M_PET	0.4	float	
FA_M_POS	0.05	float	
REQRA	170.239	float	
REQDEC	-7.093	float	
FIELDNUM	0	int	
FA_VER	5.4.0	str	
FA_SURV	main	str	
EXPID	103659	int	
FLAVOR	science	str	
SEQUENCE	DESI	str	
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	
GUIDTIME	5.0	float	
ACQTIME	15.0	float	
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	
FOCSTIME	60.0	float	
SKYCAM	SKYCAM0,SKYCAM1	str	
SKYTIME	60.0	float	
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	
CCDSPECS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	
ILLSPECS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	
OBSTYPE	SCIENCE	str	
EXPTIME	None	Unknown	
ESTTIME	3705.79	float	
MAXTIME	5400.0	float	
MINTIME	300.0	float	
REQTIME	1860.0	float	
MIDTIME	915.0	float	

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KEY	Example Value	Type	Comment
NIGHT	20211010	int	
SEQSTART	2022-01-14T11:03:08.447408	str	
POSRMS	0.0091	float	
TURBRMS	None	Unknown	
POSENABL	4268	int	
POSDISAB	711	int	
POSONTGT	4268	int	
POSONFRC	1.	float	
POSCVFRC	0.1743	float	
POSCYCLE	1	int	
POSCNVGD	744	int	
CONVERGD	F	bool	

Empty HDU.

HDU1

EXTNAME = DATA

Data used and produced by the fiber positioning loop.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	240	int	width of table in bytes
NAXIS2	5133	int	number of rows in table

Required Data Table Columns

Name	Type	Units	Description
PETAL_LOC	int64		Petal index number
DEVICE_LOC	int64		Index of fiber on petal
POS_Q	float64		TODO: description needed
POS_S	float64		TODO: description needed
POS_FLAGS	float64		TODO: description needed
POS_X	float64		TODO: description needed
POS_Y	float64		TODO: description needed
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
FA_X	float32		TODO: description needed
FA_Y	float32		TODO: description needed
FA_FIBER	float64		TODO: description needed
FOR_DX_1	float64		TODO: description needed

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Name	Type	Units	Description
FOR_DY_1	float64		TODO: description needed
FOR_X_1	float64		TODO: description needed
FOR_Y_1	float64		TODO: description needed
FLAGS_FOR_1	int64		TODO: description needed
FOR_OFFSET_1	float64		TODO: description needed
EXP_Q_1	float64		Expected focal plane Q position after correction move 1
EXP_S_1	float64		Expected focal plane S position after correction move 1
FLAGS_EXP_1	int64		Expected focal plane flags after correction move 1
EXP_X_1	float64		Expected focal plane X position after correction move 1
EXP_Y_1	float64		Expected focal plane Y position after correction move 1
FVC_X_1	float64		FVC position in pixels predicted by PlateMaker after correction move 1
FVC_Y_1	float64		FVC position in pixels predicted by PlateMaker after correction move 1
FLAGS_FVC_1	int64		FVC flags after correction move 1
CNT_X_1	float64		Matched position in FVC pixels after correction move 1
CNT_Y_1	float64		Matched position in FVC pixels after correction move 1
FLAGS_CNT_1	int64		FVC flags on matched position after correction move 1
CNT_MAG_1	float64	mag	FVC estimated magnitude after correction move 1
CNT_ERR_1	float64	mag	FVC estimated magnitude after correction move 1

HDU2

EXTNAME = STATIONARY

Refererence stationary fiber positions used when correcting for turbulence.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	358	int	width of table in bytes
NAXIS2	796	int	number of rows in table

Required Data Table Columns

Name	Type	Units	Description
PETAL_LOC	int64		Petal index number
DEVICE_LOC	int64		Index of fiber on petal
ZENITH_X	float64		TODO: description needed
ZENITH_Y	float64		TODO: description needed
MODEL_X	char[163]		TODO: description needed
MODEL_Y	char[163]		TODO: description needed
STATCOR_X_0	float64		TODO: description needed
STATCOR_Y_0	float64		TODO: description needed
STAT_X_0	float64		TODO: description needed
STAT_Y_0	float64		TODO: description needed
STATCOR_X_1	float64		TODO: description needed
STATCOR_Y_1	float64		TODO: description needed
STAT_X_1	float64		TODO: description needed
STAT_Y_1	float64		TODO: description needed

Notes and Examples

For the SURVEY=cmx m33 tile (TILEID=80615) tile and all the SURVEY=sv1 tiles (except TILEID=80971-80976, the dc3r2 ones), proper-motion correction was applied at the *fiberassign* design step; thus the following columns can have different values than in the *desitarget products*: `TARGET_RA`, `TARGET_DEC`, `REF_EPOCH`, `PLATE_RA`, `PLATE_DEC`, and `PLATE_REF_EPOCH`.

desi-EXPID

Summary
Raw data from the DESI spectrographs, with one fpack-compressed HDU per spectrograph camera, plus additional telemetry data.

Naming Convention
`desi-EXPID.fits.fz`, where EXPID is the zero-padded 8-digit exposure ID.

Regex
`desi-[0-9]{8}\.fits\.fz`

File Type
FITS, 500 MB

Contents

There is one HDU per spectrograph camera with EXTNAMEs like B0, B1, … R0, R1, … Z8, Z9. The structure of each of these is the same; only one is explicitly documented below. These could appear in any order and individual cameras could be missing from a data file depending upon the state of the hardware and the ICS configuration.

Number	EXTNAME	Type	Contents
HDU00		IMAGE	Empty HDU
HDU01	SPEC	Compressed IMAGE	Global header keywords
HDU02	Z0	Compressed IMAGE	Raw data from the Z0 spectrograph
HDU03 – HDU31	various	Compressed IMAGE	Raw data similar to Z0 spectrograph.
HDU32	SPECTCONS	BINTABLE	Telemetry data

FITS Header Units

HDU00

This HDU has no non-standard required keywords.

Empty HDU.

Early commissioning data and simulated data may have had `EXTNAME = SPS` as well as header keywords that now appear in *HDU01*.

HDU01

EXTNAME = SPEC

This HDU should be treated as the primary HDU. In particular, this HDU contains header keywords that should be treated as belonging to the entire file.

The data contents are a dummy payload that should not be used. The dummy value is typically `[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]` in compressed format.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	1	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
MODULE	CI	str	Image Sources/Component
EXPID	118526	int	Exposure number
EXPFRAME	0	int	Frame number
FRAMES	None	Unknown	Number of Frames in Archive
COSMSPLT	T	bool	Cosmics split exposure if true
MAXSPLIT	0	int	Number of allowed exposure splits
VISITIDS[1]	118524,118525,118526	str	List of expids for a visit (same tile)
TILEID[Page 607, 1]	4403	int	DESI Tile ID

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KEY	Example Value	Type	Comment
FIBASSGN[Page 607, 1]	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type
OBSTYPE	SCIENCE	str	Spectrograph observation type
SEQUENCE	_Split	str	OCS Sequence name
MANIFEST	F	bool	DOS exposure manifest
OBJECT		str	Object name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
NTSSURVY	main	str	NTS survey name
NTSPROG[Page 607, 1]	DARK	str	NTS program name
SBPROF[Page 607, 1]	ELG	str	Profile used by ETC
MAXTIME[Page 607, 1]	5400.0	float	[s] Maximum exposure time for entire visit (fro
ESTTIME[Page 607, 1]	3705.79	float	[s] Estimated exposure time for visit (from ETC
MINTIME[Page 607, 1]	300.0	float	[s] Minimum exposure time (from NTS, used by ET
MIDTIME[Page 607, 1]	915.0	float	[s] Exposure midpoint time used by PlateMaker
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
SEQID	5 requests	str	Exposure sequence identifier
SEQNUM	1	int	Number of exposure in sequence
SEQTOT	5	int	Total number of exposures in sequence
NIGHT	20220113	int	Observing night
SEQSTART	2022-01-14T11:03:08.447408	str	Start time of sequence processing
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:04:17.830044160	str	[UTC] Observation data and start tim
TIME-OBS	2022-01-14T11:04:17.830044160	str	[UTC] Observation start time

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KEY	Example Value	Type	Comment
MJD-OBS	59593.461317476	float	Modified Julian Date of observation
STARTADJ[Page 607, 1]	2022-01-14T11:03:22.140652	str	Time sequence starts adjusting the inst
OPENSHUT	2022-01-14T11:04:18.577390	str	Time shutter opened
CAMSHUT	open	str	Shutter status during observation
ST	11:13:28.582000	str	Local Sidereal time at observation start (HH:MM
EXPTIME	579.1588	float	[s] Actual exposure time
DELTARA	0.	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.	float	[arcsec] Offset], declination, observer input
ACQTIME[Page 607, 1]	15.0	float	[s] acqusition image exposure time
GUIDTIME[Page 607, 1]	5.0	float	[s] guider GFA exposure time
FOCSTIME[Page 607, 1]	60.0	float	[s] focus GFA exposure time
SKYTIME[Page 607, 1]	60.0	float	[s] sky camera exposure time (acquisition)
REQRA[Page 607, 1]	170.239	float	[deg] Requested right ascension (observer input
REQDEC[Page 607, 1]	-7.093	float	[deg] Requested declination (observer input)
WHITESPT	F	bool	Telescope is at whitespot
ZENITH	F	bool	Telescope is at zenith
SEANNEX	F	bool	Telescope is at SE annex
BEYONDP	F	bool	Telescope is beyond pole
FIDUCIAL	off	str	Fiducials status during observation
BACKLIT[Page 607, 1]	off	str	Fibers are backlit if True
AIRMASS	1.287912	float	Airmass
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
VCCD[Page 607, 1]	ON	str	True (ON) if CCD voltage is on
TRUSTEMP[Page 607, 1]	12.267	float	[deg] Average Telescope truss temperature (only
PMIRTEMP[Page 607, 1]	11.675	float	[deg] Average primary mirror temperature (nit,e
PMREADY	T	bool	Primary mirror ready
PMCOVER[Page 607, 1]	open	str	Primary mirror cover
PMCOOL[Page 607, 1]	off	str	Primary mirror cooling
DOMSHUTU[Page 607, 1]	open	str	Upper dome shutter
DOMSHUTL[Page 607, 1]	open	str	Lower dome shutter

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KEY	Example Value	Type	Comment
DOMLIGHH[Page 607, 1]	off	str	High dome lights
DOMLIGHL[Page 607, 1]	off	str	Low dome lights
DOMEAZ	180.062	float	[deg] Dome azimuth angle
DOMINPOS	T	bool	Dome is in position
EPOCH	2000.0	float	Epoch of observation
GUIDOFFR	-0.659376	float	[arcsec] Cummulative guider offset (RA)
GUIDOFFD	0.003783	float	[arcsec] Cummulative guider offset (dec)
SUNRA	296.151203	float	[deg] Sun RA at start of exposure
SUNDEC	-21.264137	float	[deg] Sun declination at start of exposure
MOONDEC	23.960888	float	[deg] Moon declination at start of exposure
MOONRA	73.944051	float	[deg] Moon RA at start of exposure
MOONSEP	99.032	float	[deg] Moon Separation
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
INCTRL	T	bool	DESI in control
INPOS	T	bool	Mount in position
MNTOFFD	75.86	float	[arcsec] Mount offset (dec)
MNTOFFR	-31.1	float	[arcsec] Mount offset (RA)
PARALLAC	-2.510103	float	[deg] Parallactic angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky)
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
TARGTAZ	177.063681	float	[deg] Target azimuth
TARGTEL	50.893802	float	[deg] Target elevation
TRGTOFFD	0.0	float	[arcsec] Telescope target offset (dec)
TRGTOFFR	0.0	float	[arcsec] Telescope target offset (RA)
ZD	39.106198	float	[deg] Telescope zenith distance
TILERA[Page 607, 1]	170.239	float	RA of tile given in fiberassign file

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KEY	Example Value	Type	Comment
TILEDEC[Page 607, 1]	-7.093	float	DEC of tile given in fiberassign file
TCSST	11:13:30.164	str	Local Sidereal time reported by TCS (HH:MM:SS)
TCSMJD	59593.461771	float	MJD reported by TCS
USETURB[Page 607, 1]	T	bool	Turbulence corrections are applied if true
USEETC[Page 607, 1]	T	bool	ETC data available if true
REQTEFF[Page 607, 1]	1000.0	float	[s] Requested effective exposure time
ACTTEFF[Page 607, 1]	1.113899	float	[s] Actual effective exposure time
TOTTEFF[Page 607, 1]	936.3194	float	[s] Total effective exposure time for visit
SEEING	None	Unknown	[arcsec] ETC/PM seeing
TRANSPAR	None	Unknown	ETC/PM transparency
SKYLEVEL[Page 607, 1]	7.516	float	[unit?] PM/ETC sky level
PMSEEING	None	Unknown	[arcsec] PlateMaker GFAPROC seeing
PMTRANSP	None	Unknown	[%] PlateMaker GFAPROC transparency
ETCSEENG[Page 607, 1]	1.1695	float	[arcsec] ETC seeing
ETCTEFF[Page 607, 1]	1.113899	float	[s] ETC effective exposure time
ETCREAL[Page 607, 1]	580.104492	float	[s] ETC real open shutter time
ETCPREV[Page 607, 1]	454.940948	float	[s] ETC cummulative t_eff for visit
ETCSPLIT[Page 607, 1]	3	int	ETC split sequence number for this visit
ETCPROF[Page 607, 1]	ELG	str	ETC source brightness profile
ETCTRANS[Page 607, 1]	0.10543	float	ETC avg. TRANSP normalized to 1
ETCTHRUP[Page 607, 1]	0.10793	float	ETC avg. thruput (PSF profile)
ETCTHRUE[Page 607, 1]	0.10457	float	ETC avg. thruput (ELG profile)
ETCTHRUB[Page 607, 1]	0.101061	float	ETC avg. thruput (BGS profile)
ETCFRACP[Page 607, 1]	0.575305	float	ETC transp. weighted avg. FFRAC (PSF)
ETCFRACE[Page 607, 1]	0.408837	float	ETC transp. weighted avg. FFRAC (ELG)
ETCFRACB[Page 607, 1]	0.181983	float	ETC transp. weighted avg. FFRAC (BGS)
ETCSKY[Page 607, 1]	6.882767	float	ETC averaged, normalized sky camera flux

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KEY	Example Value	Type	Comment
ACQFWHM[Page 607, 1]	1.169528	float	[arcsec] FWHM of guide star PSF in acq. image
ACQCAM[Page 607, 1]	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM[Page 607, 1]	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM[Page 607, 1]	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM[Page 607, 1]	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
REQADC[Page 607, 1]	334.05,26.06	str	[deg] requested ADC angles
ADCCORR	T	bool	Correct pointing for ADC setting if True
ADC1PHI	334.049995	float	[deg] ADC 1 angle
ADC2PHI	26.058728	float	[deg] ADC 2 angle
ADC1HOME	F	bool	ADC 1 at home position if True
ADC2HOME	F	bool	ADC 2 at home position if True
ADC1NREV	-1.0	float	ADC 1 number of revs
ADC2NREV	1.0	float	ADC 2 number of revs
ADC1STAT	STOPPED	str	ADC 1 status
ADC2STAT	STOPPED	str	ADC 2 status
USESKY[Page 607, 1]	T	bool	DOS Control: use Sky Monitor
USEFOCUS[Page 607, 1]	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT[Page 607, 1]	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
RESETROT	F	bool	DOS Control: reset hex rotator
SPLITEXP[Page 607, 1]	T	bool	Split exposure part of a visit
USESPLIT[Page 607, 1]	T	bool	Exposure splits are allowed
USEPOS[Page 607, 1]	T	bool	Fiber positioner data available if true
PETALS[Page 607, 1]	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9	str	Participating petals
POSCYCLE[Page 607, 1]	None	Unknown	Number of current iteration
POSONTGT[Page 607, 1]	None	Unknown	Number of positioners on target
POSONFRC[Page 607, 1]	None	Unknown	Fraction of positioners on target
POSDISAB[Page 607, 1]	None	Unknown	Number of disabled positioners

continues on next page

Table 76 – continued from previous page

KEY	Example Value	Type	Comment
POSENABL[Page 607, 1]	None	Unknown	Number of enabled positioners
POSRMS[Page 607, 1]	None	Unknown	[mm] RMS of positioner accuracy
POSITER[Page 607, 1]	1	int	Positioning Control: max. number of pos. cycles
POSFRACT[Page 607, 1]	0.95	float	
POSTOLER[Page 607, 1]	0.005	float	Positioning Control: in_position tolerance (mm)
POSMVALL[Page 607, 1]	T	bool	Positioning Control: move all positioners
USEGUIDR[Page 607, 1]	T	bool	DOS Control: use guider
GUIDMODE	catalog	str	Guider mode
USEAOS[Page 607, 1]	T	bool	DOS Control: AOS data available if true
USEDONUT[Page 607, 1]	T	bool	DOS Control: use donuts
USESPCTR[Page 607, 1]	T	bool	DOS Control: use spectrographs
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating spectrograph
ILLSPECS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating illuminate s
CCDSPECS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Participating ccd spectrog
TDEWPNT[Page 607, 1]	-32.86	float	Telescope air dew point
TAIRFLOW[Page 607, 1]	0.0	float	Telescope air flow
TAIRITMP[Page 607, 1]	12.5	float	[deg] Telescope air in temperature
TAIROTMP[Page 607, 1]	12.7	float	[deg] Telescope air out temperature
TAIRTEMP[Page 607, 1]	11.05	float	[deg] Telescope air temperature
TCASITMP[Page 607, 1]	6.6	float	[deg] Telescope Cass Cage in temperature
TCASOTMP[Page 607, 1]	12.2	float	[deg] Telescope Cass Cage out temperature
TCSITEMP[Page 607, 1]	12.1	float	[deg] Telescope center section in temperature
TCSOTEMP[Page 607, 1]	12.3	float	[deg] Telescope center section out temperature
TCIBTEMP[Page 607, 1]	0.0	float	[deg] Telescope chimney IB temperature
TCIMTEMP[Page 607, 1]	0.0	float	[deg] Telescope chimney IM temperature
TCITTEMP[Page 607, 1]	0.0	float	[deg] Telescope chimney IT temperature
TCOSTEMP[Page 607, 1]	0.0	float	[deg] Telescope chimney OS temperature
TCOWTEMP[Page 607, 1]	0.0	float	[deg] Telescope chimney OW temperature
TDBTEMP[Page 607, 1]	12.4	float	[deg] Telescope dec bore temperature

continues on next page

Table 76 – continued from previous page

KEY	Example Value	Type	Comment
TFLOWIN[Page 607, 1]	0.0	float	Telescope flow rate in
TFLOWOUT[Page 607, 1]	0.0	float	Telescope flow rate out
TGLYCOLI[Page 607, 1]	12.8	float	[deg] Telescope glycol in temperature
TGLYCOLO[Page 607, 1]	12.6	float	[deg] Telescope glycol out temperature
THINGES[Page 607, 1]	12.1	float	[deg] Telescope hinge S temperature
THINGEW[Page 607, 1]	22.3	float	[deg] Telescope hinge W temperature
TPMAVERT[Page 607, 1]	11.658	float	[deg] Telescope mirror av-eragetemperature
TPMDESIT[Page 607, 1]	6.0	float	[deg] Telescope mirror de-sired temperature
TPMEIBT[Page 607, 1]	12.1	float	[deg] Telescope mirror EIB temperature
TPMEITT[Page 607, 1]	11.5	float	[deg] Telescope mirror EIT temperature
TPMEOBT[Page 607, 1]	12.3	float	[deg] Telescope mirror EOB temperature
TPMEOTT[Page 607, 1]	12.0	float	[deg] Telescope mirror EOT temperature
TPMNIBT[Page 607, 1]	11.9	float	[deg] Telescope mirror NIB temperature
TPMNITT[Page 607, 1]	11.4	float	[deg] Telescope mirror NIT temperature
TPMNOBT[Page 607, 1]	12.3	float	[deg] Telescope mirror NOB temperature
TPMNOTT[Page 607, 1]	12.0	float	[deg] Telescope mirror NOT temperature
TPMRTDT[Page 607, 1]	11.67	float	[deg] Telescope mirror RTD temperature
TPMSIBT[Page 607, 1]	12.1	float	[deg] Telescope mirror SIB temperature
TPMSITT[Page 607, 1]	11.5	float	[deg] Telescope mirror SIT temperature
TPMSOBT[Page 607, 1]	12.0	float	[deg] Telescope mirror SOB temperature
TPMSOTT[Page 607, 1]	11.7	float	[deg] Telescope mirror SOT temperature
TPMSTAT[Page 607, 1]	ready	str	Telescope mirror status
TPMWIBT[Page 607, 1]	11.9	float	[deg] Telescope mirror WIB temperature
TPMWITT[Page 607, 1]	11.3	float	[deg] Telescope mirror WIT temperature
TPMWOBT[Page 607, 1]	11.9	float	[deg] Telescope mirror WOB temperature
TPMWOTT[Page 607, 1]	11.8	float	[deg] Telescope mirror WOT temperature

continues on next page

Table 76 – continued from previous page

KEY	Example Value	Type	Comment
TPCITEMP[Page 607, 1]	12.1	float	[deg] Telescope primary cell in temperature
TPCOTEMP[Page 607, 1]	12.0	float	[deg] Telescope primary cell out temperature
TPR1HUM[Page 607, 1]	0.0	float	Telescope probe 1 humidity
TPR1TEMP[Page 607, 1]	0.0	float	[deg] Telescope probe1 temperature
TPR2HUM[Page 607, 1]	0.0	float	Telescope probe 2 humidity
TPR2TEMP[Page 607, 1]	0.0	float	[deg] Telescope probe2 temperature
TSERVO[Page 607, 1]	40.0	float	Telescope servo setpoint
TTRSTEMP[Page 607, 1]	11.9	float	[deg] Telescope top ring S temperature
TTRWTEMP[Page 607, 1]	11.7	float	[deg] Telescope top ring W temperature
TTRUETBT[Page 607, 1]	-1.5	float	[deg] Telescope truss ETB temperature
TTRUETTT[Page 607, 1]	11.6	float	[deg] Telescope truss ETT temperature
TTRUNTBT[Page 607, 1]	11.7	float	[deg] Telescope truss NTB temperature
TTRUNTTT[Page 607, 1]	11.6	float	[deg] Telescope truss NTT temperature
TTRUSTBT[Page 607, 1]	11.7	float	[deg] Telescope truss STB temperature
TTRUSTST[Page 607, 1]	10.8	float	[deg] Telescope truss STS temperature
TTRUSTTT[Page 607, 1]	11.7	float	[deg] Telescope truss STT temperature
TTRUTSBT[Page 607, 1]	12.2	float	[deg] Telescope truss TSB temperature
TTRUTSMT[Page 607, 1]	12.2	float	[deg] Telescope truss TSM temperature
TTRUTSTT[Page 607, 1]	12.2	float	[deg] Telescope truss TST temperature
TTRUWTBT[Page 607, 1]	11.6	float	[deg] Telescope truss WTB temperature
TTRUWTTT[Page 607, 1]	11.6	float	[deg] Telescope truss WTT temperature
ALARM[Page 607, 1]	F	bool	UPS major alarm or check battery
ALARM-ON[Page 607, 1]	F	bool	UPS active alarm condition
BATTERY[Page 607, 1]	100.0	float	[%] UPS Battery left
SECLEFT[Page 607, 1]	6312.0	float	[s] UPS Seconds left
UPSSTAT	System Normal - On Line(7)	str	UPS Status

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Table 76 – continued from previous page

KEY	Example Value	Type	Comment
INAMPS[Page 607, 1]	68.3	float	[A] UPS total input current
OUTWATTS[Page 607, 1]	4800.0,7200.0,4500.0	str	[W] UPS Phase A, B, C output watts
COMPDEW[Page 607, 1]	-10.3	float	[deg C] Computer room dewpoint
COMPHUM[Page 607, 1]	13.9	float	[%] Computer room humidity
COMPAMB[Page 607, 1]	25.2	float	[deg C] Computer room ambient temperature
COMPTEMP[Page 607, 1]	17.6	float	[deg C] Computer room hygrometer temperature
DEWPOINT[Page 607, 1]	-36.9	float	[deg C] (outside) dewpoint
HUMIDITY[Page 607, 1]	2.0	float	[%] (outside) humidity
PRESSURE[Page 607, 1]	793.2	float	[torr] (outside) air pressure
OUTTEMP[Page 607, 1]	11.0	float	[deg C] outside temperature
WINDDIR[Page 607, 1]	264.5	float	[deg] wind direction
WINDSPD[Page 607, 1]	11.7	float	[m/s] wind speed
GUST[Page 607, 1]	10.8	float	[m/s] Wind gusts speed
AMNIENTN[Page 607, 1]	16.8	float	[deg C] ambient temperature north
CFLOOR[Page 607, 1]	11.6	float	[deg C] temperature on C floor
NWALLIN[Page 607, 1]	17.3	float	[deg C] temperature at north wall inside
NWALLOUT[Page 607, 1]	11.1	float	[deg C] temperature at north wall outside
WWALLIN[Page 607, 1]	16.5	float	[deg C] temperature at west wall inside
WWALLOUT[Page 607, 1]	11.5	float	[deg C] temperature at west wall outside
AMBIENTS[Page 607, 1]	17.6	float	[deg C] ambient temperature south
FLOOR[Page 607, 1]	15.7	float	[deg C] temperature at floor (LCR)
EWALLCMP[Page 607, 1]	11.9	float	[deg C] temperature at east wall, computer room
EWALLCOU[Page 607, 1]	11.6	float	[deg C] temperature at east wall, Coude room
ROOF[Page 607, 1]	10.9	float	[deg C] temperature on roof
ROOFAMB[Page 607, 1]	11.1	float	[deg C] ambient temperature on roof
DOMEBLOW[Page 607, 1]	11.2	float	[deg C] temperature at dome back, lower
DOMEBUP[Page 607, 1]	11.3	float	[deg C] temperature at dome back, upper

continues on next page

Table 76 – continued from previous page

KEY	Example Value	Type	Comment
DOMELLOW[Page 607, 1]	11.1	float	[deg C] temperature at dome left, lower
DOMELUP[Page 607, 1]	10.9	float	[deg C] temperature at dome left, upper
DOMERLOW[Page 607, 1]	11.1	float	[deg C] temperature at dome right, lower
DOMERUP[Page 607, 1]	10.7	float	[deg C] temperature at dome right, upper
PLATFORM[Page 607, 1]	10.6	float	[deg C] temperature at platform
SHACKC[Page 607, 1]	16.7	float	[deg C] temperature at shack ceiling
SHACKW[Page 607, 1]	16.6	float	[deg C] temperature at shack wall
STAIRSL[Page 607, 1]	10.9	float	[deg C] temperature at stairs, lower
STAIRSM[Page 607, 1]	10.7	float	[deg C] temperature at stairs, mid
STAIRSU[Page 607, 1]	10.9	float	[deg C] temperature at stairs, upper
TELBASE[Page 607, 1]	11.6	float	[deg C] temperature at telescope base
UTILWALL[Page 607, 1]	11.4	float	[deg C] temperature at utility room wall
UTILROOM[Page 607, 1]	10.1	float	[deg C] temperature in utilitiy room
SP0NIRT[Page 607, 1]	139.96	float	[K] SP0 NIR temperature
SP0REDT[Page 607, 1]	139.99	float	[K] SP0 red temperature
SP0BLUT[Page 607, 1]	163.02	float	[K] SP0 blue temperature
SP0NIRP[Page 607, 1]	7.36e-08	float	[mb] SP0 NIR pressure
SP0REDP[Page 607, 1]	5.492e-08	float	[mb] SP0 red pressure
SP0BLUP[Page 607, 1]	1.001e-07	float	[mb] SP0 blue pressure
SP1NIRT[Page 607, 1]	139.96	float	[K] SP1 NIR temperature
SP1REDT[Page 607, 1]	139.96	float	[K] SP1 red temperature
SP1BLUT[Page 607, 1]	163.02	float	[K] SP1 blue temperature
SP1NIRP[Page 607, 1]	6.622e-08	float	[mb] SP1 NIR pressure
SP1REDP[Page 607, 1]	6.033e-08	float	[mb] SP1 red pressure
SP1BLUP[Page 607, 1]	8.599e-08	float	[mb] SP1 blue pressure
SP2NIRT[Page 607, 1]	139.96	float	[K] SP2 NIR temperature
SP2REDT[Page 607, 1]	139.96	float	[K] SP2 red temperature
SP2BLUT[Page 607, 1]	163.02	float	[K] SP2 blue temperature
SP2NIRP[Page 607, 1]	5.556e-08	float	[mb] SP2 NIR pressure
SP2REDP[Page 607, 1]	6.013e-08	float	[mb] SP2 red pressure
SP2BLUP[Page 607, 1]	8.897e-08	float	[mb] SP2 blue pressure
SP3NIRT[Page 607, 1]	140.03	float	[K] SP3 NIR temperature
SP3REDT[Page 607, 1]	139.96	float	[K] SP3 red temperature
SP3BLUT[Page 607, 1]	163.04	float	[K] SP3 blue temperature
SP3NIRP[Page 607, 1]	4.3e-08	float	[mb] SP3 NIR pressure
SP3REDP[Page 607, 1]	7.066e-08	float	[mb] SP3 red pressure
SP3BLUP[Page 607, 1]	8.324e-08	float	[mb] SP3 blue pressure

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KEY	Example Value	Type	Comment
SP4NIRT[Page 607, 1]	139.96	float	[K] SP4 NIR temperature
SP4REDT[Page 607, 1]	139.99	float	[K] SP4 red temperature
SP4BLUT[Page 607, 1]	163.04	float	[K] SP4 blue temperature
SP4NIRP[Page 607, 1]	6.921e-08	float	[mb] SP4 NIR pressure
SP4REDP[Page 607, 1]	4.505e-08	float	[mb] SP4 red pressure
SP4BLUP[Page 607, 1]	6.846e-08	float	[mb] SP4 blue pressure
SP5NIRT[Page 607, 1]	139.99	float	[K] SP5 NIR temperature
SP5REDT[Page 607, 1]	139.99	float	[K] SP5 red temperature
SP5BLUT[Page 607, 1]	163.02	float	[K] SP5 blue temperature
SP5NIRP[Page 607, 1]	7.886e-08	float	[mb] SP5 NIR pressure
SP5REDP[Page 607, 1]	4.383e-08	float	[mb] SP5 red pressure
SP5BLUP[Page 607, 1]	1.003e-07	float	[mb] SP5 blue pressure
SP6NIRT[Page 607, 1]	139.96	float	[K] SP6 NIR temperature
SP6REDT[Page 607, 1]	139.96	float	[K] SP6 red temperature
SP6BLUT[Page 607, 1]	163.04	float	[K] SP6 blue temperature
SP6NIRP[Page 607, 1]	2.688e-07	float	[mb] SP6 NIR pressure
SP6REDP[Page 607, 1]	6.65e-08	float	[mb] SP6 red pressure
SP6BLUP[Page 607, 1]	9.062e-08	float	[mb] SP6 blue pressure
SP7NIRT[Page 607, 1]	139.96	float	[K] SP7 NIR temperature
SP7REDT[Page 607, 1]	140.03	float	[K] SP7 red temperature
SP7BLUT[Page 607, 1]	162.97	float	[K] SP7 blue temperature
SP7NIRP[Page 607, 1]	6.073e-08	float	[mb] SP7 NIR pressure
SP7REDP[Page 607, 1]	4.807e-08	float	[mb] SP7 red pressure
SP7BLUP[Page 607, 1]	1.066e-07	float	[mb] SP7 blue pressure
SP8NIRT[Page 607, 1]	139.96	float	[K] SP8 NIR temperature
SP8REDT[Page 607, 1]	139.96	float	[K] SP8 red temperature
SP8BLUT[Page 607, 1]	163.04	float	[K] SP8 blue temperature
SP8NIRP[Page 607, 1]	1.257e-07	float	[mb] SP8 NIR pressure
SP8REDP[Page 607, 1]	4.635e-08	float	[mb] SP8 red pressure
SP8BLUP[Page 607, 1]	8.912e-08	float	[mb] SP8 blue pressure
SP9NIRT[Page 607, 1]	139.96	float	[K] SP9 NIR temperature
SP9REDT[Page 607, 1]	139.96	float	[K] SP9 red temperature
SP9BLUT[Page 607, 1]	163.02	float	[K] SP9 blue temperature
SP9NIRP[Page 607, 1]	5.325e-08	float	[mb] SP9 NIR pressure
SP9REDP[Page 607, 1]	6.124e-08	float	[mb] SP9 red pressure
SP9BLUP[Page 607, 1]	1.236e-07	float	[mb] SP9 blue pressure
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
SIMGFAP[Page 607, 1]	F	bool	DOS Control: simulate GFAPROC
USEFVC[Page 607, 1]	T	bool	DOS Control: use fvc
USEFID[Page 607, 1]	T	bool	DOS Control: use fiducials
USEILLUM[Page 607, 1]	T	bool	DOS Control: use illuminator
USEXSRVR[Page 607, 1]	T	bool	DOS Control: use exposure server

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KEY	Example Value	Type	Comment
USEOPENL[Page 607, 1]	T	bool	DOS Control: use open loop move
USEMIDPT[Page 607, 1]	T	bool	Use exposure midpoint if true
STOPGUDR[Page 607, 1]	T	bool	DOS Control: stop guider
STOPFOCS[Page 607, 1]	T	bool	DOS Control: stop focus
STOPSKY[Page 607, 1]	T	bool	DOS Control: stop sky monitor
KEEPGUDR[Page 607, 1]	F	bool	DOS Control: keep guider running
KEEPFOCS[Page 607, 1]	F	bool	DOS Control: keep focus running
KEEPSKY[Page 607, 1]	F	bool	DOS Control: keep sky mon. running
REACQUIR[Page 607, 1]	F	bool	DOS Control: reacquire same files
FILENAME	/exposures/desi/20220113/00118526/desi-00118526.fits.fz	str	Name of (F
EXCLUDED		str	Components excluded from this exposure
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
PMVER[Page 607, 1]	desi-138368	str	PlateMaker/Dervish version
ETCVERS[Page 607, 1]	0.1.14	str	ETC version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
REQTIME	1860.0	float	[s] Requested exposure time
SIMGFACQ[Page 607, 1]	F	bool	
TCSKRA	0.01 0.04 0.01	str	TCS Kalman (RA)
TCSKDEC	0.01 0.04 0.01	str	TCS Kalman (dec)
TCSGRA	0.15	float	TCS simple gain (RA)
TCSGDEC	0.15	float	TCS simple gain (dec)
TCSMFRA	2	int	TCS moving filter length (RA)
TCSMFDEC	2	int	TCS moving filter length (dec)
TCSPIRA	0.9,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
TCSPIDEC	0.9,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, satu
GUIEXPID[Page 607, 1]	118526	int	Guider exposure id at start of spectro exp.
IGFRMNUM[Page 607, 1]	2	int	Guider frame number at start of spectro exp.
FOCEXPID[Page 607, 1]	118526	int	Focus exposure id at start of spectro exp.
IFFRMNUM[Page 607, 1]	0	int	Focus frame number at start of spectro exp.

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KEY	Example Value	Type	Comment
SKYEXPID[Page 607, 1]	118526	int	Sky exposure id at start of spectro exp.
ISFRMNUM[1]	0	int	Sky frame number at start of spectro exp.
FGFRMNUM[1]	72	int	Guider frame number at end of spectro exp.
FFFRMNUM[1]	9	int	Focus frame number at end of spectro exp.
FSFRMNUM[1]	7	int	Sky frame number at end of spectro exp.
ETCSKYLV[1]	7.8081	float	[unit?] ETC skylevel
CHECKSUM	OIYZPIXZOIXZOIXZ	str	HDU checksum updated 2022-01-14T11:15:03
DATASUM	306780459	str	data unit checksum updated 2022-01-14T11:15:03

Data: FITS image [int16 (compressed), 10]

HDU02

EXTNAME = Z0

Unprocessed spectrograph raw data, including overscans, from camera Z0.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	4194	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
EXPID	118526	int	Exposure number
EXPFRAME	0	int	Frame number
FRAMES[1]	None	Unknown	Number of Frames in Archive
TILEID[1]	4403	int	DESI Tile ID
FIBASSGN[1]	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID

continues on next page

[1] Optional

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KEY	Example Value	Type	Comment
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:04:17.790636032	str	[UTC] Observation data and start tim
TIME-OBS	2022-01-14T11:04:17.790636032	str	[UTC] Observation start time
MJD-OBS	59593.46131702	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:04:18.577390	str	Time shutter opened
ST	11:13:28.540000	str	Local Sidereal time at observation start (HH:MM
EXPTIME	579.193	float	[s] Actual exposure time
DELTARA	0.	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.	float	[arcsec] Offset], declination, observer input
REQRA[1]	170.239	float	[deg] Requested right ascension (observer input
REQDEC[Page 607, 1]	-7.093	float	[deg] Requested declination (observer input)
FOCUS[Page 607, 1]	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
VCCD	ON	str	True (ON) if CCD voltage is on
VCCDON	2022-01-10T20:55:43.758808	str	Time when CCD voltage was turned on
VCCDSEC	310751.8	float	[s] CCD on time in seconds
TRUSTEMP[Page 607, 1]	12.267	float	[deg] Average Telescope truss temperature (only
PMIRTEMP[Page 607, 1]	11.675	float	[deg] Average primary mirror temperature (nit,e
EPOCH	2000.0	float	Epoch of observation
MOUNTAZ[Page 607, 1]	176.725567	float	[deg] Mount azimuth angle

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KEY	Example Value	Type	Comment
MOUNTDEC[Page 607, 1]	-7.102329	float	[deg] Mount declination
MOUNTEL[Page 607, 1]	50.883914	float	[deg] Mount elevation angle
MOUNTHA[Page 607, 1]	-2.081118	float	[deg] Mount hour angle
SKYDEC[Page 607, 1]	-7.102329	float	[deg] Telescope declination (pointing on sky)
SKYRA[Page 607, 1]	170.24163	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC[Page 607, 1]	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA[Page 607, 1]	170.24163	float	[deg] Target right ascension (to TCS)
USEETC[Page 607, 1]	T	bool	ETC data available if true
USESKY[Page 607, 1]	T	bool	DOS Control: use Sky Monitor
USEFOCUS[Page 607, 1]	T	bool	DOS Control: use focus
HEXTRIM[Page 607, 1]	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT[Page 607, 1]	T	bool	DOS Control: use rotator
ROTOFFST[Page 607, 1]	138.8	float	[arcsec] Rotator offset
ROTENBLD[Page 607, 1]	T	bool	Rotator enabled
ROTRATE[Page 607, 1]	0.513	float	[arcsec/min] Rotator rate
USEGUIDR[Page 607, 1]	T	bool	DOS Control: use guider
USEDONUT[Page 607, 1]	T	bool	DOS Control: use donuts
SPECGRPH	0	int	Spectrograph logical name (SP)
SPECID	4	int	Spectrograph serial number (SM)
FEEBOX	lbnl082	str	CCD Controller serial number
VESSEL	17	int	Cryostat serial number
FEEVER	v20160312	str	CCD Controller version
DETFLVER	FAILED: invalid argument for get command	str	CCD Controller detector f
FEEPOWER	ON	str	FEE power status
FEEDMASK	2134851391	int	FEE dac mask
FEECMASK	1048575	int	FEE clk mask
CCDTEMP	-137.5647	float	[deg C] CCD controller CCD temperature
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
CAMERA	z0	str	Camera name
DAC2	-9.0002,-8.8271	str	[V] set value, measured value
DATASECA	[8:2064, 2:2065]	str	Data section for quadrant A

continues on next page

Table 77 – continued from previous page

KEY	Example Value	Type	Comment
CLOCK6	9.9999,0.0	str	[V] high rail, low rail
DIGITIME	56.4524	float	[s] Time to digitize image
DAC17	20.0008,11.834	str	[V] set value, measured value
CLOCK15	9.9992,2.9993	str	[V] high rail, low rail
DETSECB	[2058:4114, 1:2064]	str	Detector section for quadrant B
CLOCK0	9.9999,0.0	str	[V] high rail, low rail
CRYOPRES	7.360e-08	str	[mb] Cryostat pressure (IP)
AMPSECC	[1:2057, 4128:2065]	str	AMP section for quadrant C
CCDTMING	flatdark_lbnl_timing.txt	str	CCD timing file
CLOCK8	9.9992,2.9993	str	[V] high rail, low rail
CLOCK4	9.9999,0.0	str	[V] high rail, low rail
PRESECB	[4250:4256, 2:2065]	str	Prescan section for quadrant B
DAC1	-9.0002,-8.8683	str	[V] set value, measured value
PRRSECC	[8:2064, 4194:4194]	str	Row prescan section for quadrant C
DAC10	-25.0003,-24.7976	str	[V] set value, measured value
OFFSET2	0.4000000059604645,-8.8271	str	[V] set value, measured value
CLOCK14	9.9992,2.9993	str	[V] high rail, low rail
DAC16	39.9961,39.039	str	[V] set value, measured value
ORSECB	[2193:4249, 2066:2097]	str	Row overscan section for quadrant B
AMPSECA	[1:2057, 1:2064]	str	AMP section for quadrant A
DAC14	0.0,0.1039	str	[V] set value, measured value
DAC11	-25.0003,-24.0556	str	[V] set value, measured value
CLOCK7	-2.0001,3.9999	str	[V] high rail, low rail
PGAGAIN	3	int	Controller gain
ORSECA	[8:2064, 2066:2097]	str	Row overscan section for quadrant A
DAC15	0.0,0.089	str	[V] set value, measured value
DETSECD	[2058:4114, 2065:4128]	str	Detector section for quadrant D
ORSECD	[2193:4249, 2098:2129]	str	Row bias section for quadrant D
OFFSET0	0.4000000059604645,-8.7962	str	[V] set value, measured value
OFFSET6	2.0,6.0911	str	[V] set value, measured value

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Table 77 – continued from previous page

KEY	Example Value	Type	Comment
PRRSECD	[2193:4249, 4194:4194]	str	Row prescan section for quadrant D
DAC13	0.0,0.1187	str	[V] set value, measured value
OFFSET3	0.4000000059604645,-8.8786	str	[V] set value, measured value
AMPSECD	[4114:2058, 4128:2065]	str	AMP section for quadrant D
DAC9	-25.0003,-24.946	str	[V] set value, measured value
DELAYS	20, 20, 25, 40, 7, 3000, 7, 7, 400, 7	str	[10] Delay settings
SETTINGS	detectors_sm_20210128.json	str	Name of DESI CCD settings file
DETSECA	[1:2057, 1:2064]	str	Detector section for quadrant A
CLOCK5	9.9999,0.0	str	[V] high rail, low rail
PRRSECB	[2193:4249, 1:1]	str	Row prescan section for quadrant B
DETECTOR	M1-53	str	Detector (ccd) identification
CLOCK12	9.9992,2.9993	str	[V] high rail, low rail
DAC12	0.0,0.1039	str	[V] set value, measured value
TRIMSECA	[8:2064, 2:2065]	str	Trim section for quadrant A
DATASECB	[2193:4249, 2:2065]	str	Data section for quadrant B
CDSPARMS	400, 400, 8, 2000	str	CDS parameters
TRIMSECC	[8:2064, 2130:4193]	str	Trim section for quadrant C
DAC3	-9.0002,-8.8683	str	[V] set value, measured value
BIASSECA	[2065:2128, 2:2065]	str	Bias section for quadrant A
TRIMSECB	[2193:4249, 2:2065]	str	Trim section for quadrant B
CASETEMP	60.1833	float	[deg C] CCD controller case temperature
CPUTEMP	59.5781	float	[deg C] CCD controller CPU temperature
OFFSET5	2.0,6.0806	str	[V] set value, measured value
CCDSECD	[2058:4114, 2065:4128]	str	CCD section for quadrant D
CCDNAME	CCDSM4Z	str	CCD name
DAC4	5.9998,6.0648	str	[V] set value, measured value
BLDTIME	0.3529	float	[s] Time to build image
CLOCK13	9.9992,2.9993	str	[V] high rail, low rail

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Table 77 – continued from previous page

KEY	Example Value	Type	Comment
CLOCK1	9.9999,0.0	str	[V] high rail, low rail
PRESECA	[1:7, 2:2065]	str	Prescan section for quadrant A
CCDSIZE	4194,4256	str	CCD size in pixels (rows, columns)
DATASECC	[8:2064, 2130:4193]	str	Data section for quadrant C
CLOCK18	9.0,0.9999	str	[V] high rail, low rail
CLOCK10	9.9992,2.9993	str	[V] high rail, low rail
CRYOTEMP	139.962	float	[deg K] Cryostat CCD temperature
CLOCK3	-2.0001,3.9999	str	[V] high rail, low rail
DAC0	-9.0002,-8.7962	str	[V] set value, measured value
CCDSECA	[1:2057, 1:2064]	str	CCD section for quadrant A
CLOCK11	9.9992,2.9993	str	[V] high rail, low rail
CLOCK2	9.9999,0.0	str	[V] high rail, low rail
CLOCK9	9.9992,2.9993	str	[V] high rail, low rail
CLOCK17	9.0,0.9999	str	[V] high rail, low rail
ORSECC	[8:2064, 2098:2129]	str	Row overscan section for quadrant C
CCDSECC	[1:2057, 2065:4128]	str	CCD section for quadrant C
PRESECD	[4250:4256, 2130:4193]	str	Prescan section for quadrant D
BIASSECD	[2129:2192, 2130:4193]	str	Bias section for quadrant D
AMPSECB	[4114:2058, 1:2064]	str	AMP section for quadrant B
CCDCFG	default_lbnl_20210128.cfg	str	CCD configuration file
BIASSECB	[2129:2192, 2:2065]	str	Bias section for quadrant B
BIASSECC	[2065:2128, 2130:4193]	str	Bias section for quadrant C
CLOCK16	9.9999,3.0	str	[V] high rail, low rail
CCDPREP	purge,clear	str	CCD prep actions
DAC8	-25.0003,-24.8273	str	[V] set value, measured value
PRRSECA	[8:2064, 1:1]	str	Row prescan section for quadrant A
DATASECD	[2193:4249, 2130:4193]	str	Data section for quadrant D
DAC5	5.9998,6.0806	str	[V] set value, measured value
PRESECC	[1:7, 2130:4193]	str	Prescan section for quadrant C
OFFSET1	0.4000000059604645,-8.8786	str	[V] set value, measured value

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Table 77 – continued from previous page

KEY	Example Value	Type	Comment
OFFSET4	2.0,6.0595	str	[V] set value, measured value
DAC7	5.9998,5.9964	str	[V] set value, measured value
DAC6	5.9998,6.0963	str	[V] set value, measured value
OFFSET7	2.0,5.9911	str	[V] set value, measured value
DETSECC	[1:2057, 2065:4128]	str	Detector section for quadrant C
TRIMSECD	[2193:4249, 2130:4193]	str	Trim section for quadrant D
CCDSECB	[2058:4114, 1:2064]	str	CCD section for quadrant B
REQTIME	1860.0	float	[s] Requested exposure time
OBSID	kp4m20220114t110417	str	Unique observation identifier
PROCTYPE	RAW	str	Data processing level
PRODTYPE	image	str	Data product type
CHECKSUM	mqJSonIQmnIQmnIQ	str	HDU checksum updated 2022-01-14T11:15:05
DATASUM	3453799606	str	data unit checksum updated 2022-01-14T11:15:05

Data: FITS image [int16 (compressed), 4256x4194]

HDU03 – HDU31

EXTNAME = B0, R0, B1, R1, Z1, B2, R2, Z2, B3, R3, Z3, B4, R4, Z4, B5, R5, Z5, B6, R6, Z6, B7, R7, Z7, B8, R8, Z8, B9, R9, Z9

Data: See Z0.

Note: any combination of B0..Z9 could exist in any order.

HDU32

EXTNAME = SPECTCONS

This is a telemetry table. This table contains variable-length arrays, whose length depends on the exact number of HDUs included in this file.

Note: this is the last HDU, but its exact number will depend upon the number of cameras in included in the file.

The `smid` column is not present for exposures before expid 172920.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	352	int	width of table in bytes
NAXIS2	10	int	number of rows in table
EXPID	118526	int	Exposure number
EXPFRAME	0	int	Frame number
FRAMES[Page 607, 1]	None	Unknown	Number of Frames in Archive
TILEID[Page 607, 1]	4403	int	DESI Tile ID
FIBASSGN[Page 607, 1]	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DELTARA	0.	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.	float	[arcsec] Offset], declination, observer input
REQRA[Page 607, 1]	170.239	float	[deg] Requested right ascension (observer input
REQDEC[Page 607, 1]	-7.093	float	[deg] Requested declination (observer input)
FOCUS[Page 607, 1]	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP[Page 607, 1]	12.267	float	[deg] Average Telescope truss temperature (only
PMIRTEMP[Page 607, 1]	11.675	float	[deg] Average primary mirror temperature (nit,e
EPOCH	2000.0	float	Epoch of observation
MOUNTAZ[Page 607, 1]	176.725567	float	[deg] Mount azimuth angle

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KEY	Example Value	Type	Comment
MOUNTDEC[Page 607, 1]	-7.102329	float	[deg] Mount declination
MOUNTEL[Page 607, 1]	50.883914	float	[deg] Mount elevation angle
MOUNTHA[Page 607, 1]	-2.081118	float	[deg] Mount hour angle
SKYDEC[Page 607, 1]	-7.102329	float	[deg] Telescope declination (pointing on sky)
SKYRA[Page 607, 1]	170.24163	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC[Page 607, 1]	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA[Page 607, 1]	170.24163	float	[deg] Target right ascension (to TCS)
USEETC[Page 607, 1]	T	bool	ETC data available if true
USESKY[Page 607, 1]	T	bool	DOS Control: use Sky Monitor
USEFOCUS[Page 607, 1]	T	bool	DOS Control: use focus
HEXTRIM[Page 607, 1]	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT[Page 607, 1]	T	bool	DOS Control: use rotator
ROTOFFST[Page 607, 1]	138.8	float	[arcsec] Rotator offset
ROTENBLD[Page 607, 1]	T	bool	Rotator enabled
ROTRATE[Page 607, 1]	0.513	float	[arcsec/min] Rotator rate
USEGUIDR[Page 607, 1]	T	bool	DOS Control: use guider
USEDONUT[Page 607, 1]	T	bool	DOS Control: use donuts
SPCGRPHS	SP4, SP9, SP8, SP2, SP0, SP5, SP7, SP6, SP1, SP3	str	Participating spe
DEVICES	SPECTCON4, SPECTCON9, SPECTCON8, SPECTCON2, SPECTCON0, SPECTCON5, SPECTCON7, SPECTCON6, SPECTCON1, SPECTCON3	str	Participating devices (spectro controller)
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
REQTIME	1860.0	float	[s] Requested exposure time
OBSID	kp4m20220114t110417	str	Unique observation identifier
PROCTYPE	RAW	str	Data processing level
PRODTYPE	image	str	Data product type
CHECKSUM	0YhA1VZ30VfA0VZ3	str	HDU checksum updated 2022-01-14T11:15:09
DATASUM	2915472531	str	data unit checksum updated 2022-01-14T11:15:09

Required Data Table Columns

Name	Type	Units	Description
unit	int64		spectrograph ID (SP notation)
specid	int64		spectrograph ID (SP notation)
smid[Page 607, 1]	int64		spectrograph hardware ID (SM notation)
EXPTIME[Page 607, 1]	float64	s	exposure time for this spectrograph
DATE-OBS	char stream		timestamp (date and time of observation for this spectrograph)
TIME-OBS	char stream		timestamp (time of observation for this spectrograph)
MJD-OBS	float64	d	MJD time of observation for this spectrograph
ST	char stream		timestamp (local sidereal time for this spectrograph)
OPENSHUT[Page 607, 1]	char stream		timestamp (shutter open time for this spectrograph)
CLOSSHUT[Page 607, 1]	float64	s	time to close shutter for this spectrograph
OBSID	char stream		unique identifier for this exposure
STATUS	char stream		Overall spectro-controller status
HARTL	char stream		Status of left Hartmann door (open, closed, error)
HARTLP	char stream		Left Hartmann door power (on, off, error)
HARTR	char stream		Status of right Hartmann door (open, closed, error)
HARTRP	char stream		Right Hartmann door power (on, off, error)
WAGO	char stream		Status of WAGO PLC (ready, error)
NIRSHUT	char stream		Status of NIR shutter (open, closed, error)
NIRSEAL	char stream		NIR shutter seal (inflated, deflated, error)
NIRPOW	char stream		NIR shutter power (ON, OFF)
EXPSHUT	char stream		Status of EXP shutter (open, closed, error)
EXPSEAL	char stream		EXP shutter seal (inflated, deflated, error)
EXPPOW	char stream		EXP shutter power (ON, OFF)
ILLUM	char stream		Fiber illuminator (on, off, notready, ready, error, flashing)
ZTEMP	float64		[degrees] NIR camera temperature
ZHUMID	float64		[%] NIR camera humidity
BTEMP	float64		[degrees] blue camera temperature
BHUMID	float64		[%] blue camera humidity
RTEMP	float64		[degrees] red camera temperature
RHUMID	float64		[%] red camera humidity
IEBTEMP	float64		[degrees] electronics board temperature
COLLTEMP	float64		[degrees] enclosure temperature near collimator
CRYOTEMP	float64		[degrees] enclosure temperature near cryostat
BZTEMP	float64		[degrees] enclosure temperature near NIR shutter
MIRROR	char stream		Serial number for this hardware component
MOUNT	char stream		Serial number for this hardware component
EXPMEC	char stream		Serial number for this hardware component
ZDICHR	char stream		Serial number for this hardware component
NIRMEC	char stream		Serial number for this hardware component
RDICHR	char stream		Serial number for this hardware component
BVPHG	char stream		Serial number for this hardware component
ZVPHG	char stream		Serial number for this hardware component
RVPHG	char stream		Serial number for this hardware component
BCAM	char stream		Serial number for this hardware component
ZCAM	char stream		Serial number for this hardware component
RCAM	char stream		Serial number for this hardware component

Notes and Examples

Known Issues

- The compressed SPEC HDU contains the ZSIMPLE keyword. This would be appropriate in a compressed *primary* HDU but not in a compressed extension.
- Some header keywords contain empty values. These will produce warnings when files of this type are examined with fitsverify.

Provenance

- 2019-02-21: Revised based on headers from spectrograph functional verification files.
- 2019-04-03: Revised based on raw data files created from spectrograph functional verification files.
- 2023-03-21: Revised in preparation for first public data release.

etc-EXPID

Summary
JSON file containing details of the ETC analysis for one DESI spectrograph exposure.

Naming Convention
etc-EXPID.json, where EXPID is the zero-padded 8-digit exposure ID.

Regex
etc-[0-9]{8}\.json

File Type
JSON, 100 kB

Contents

Each file contains a dictionary with the following top-level keys:

Key	Description
desietc	Version number of the desietc package used.
expinfo	Information about this spectrograph exposure including a summary of the results of analyzing the initial GFA acquisition images.
fassign	Information about the fiber assignment for the tile to observe used by the ETC.
acquisition	Details from the analysis of the initial in-focus GFA acquisition images.
-guide_stars	Details of the guide stars used from each in-focus GFA.
header	List of the ETC summary keywords that also appear in the main spectrograph FITS file.
shutter	Tracking of successive cosmic-split exposures.
thru	Details of the per-GFA exposure analysis of fiber acceptance fraction and atmospheric transmission contributing to the signal throughput.
sky	Details of the per-SKYCAM exposure analysis of relative sky background levels.
accum	Details of the ETC model of accumulated of signal to noise after each GFA and SKYCAM exposure.

fiberassign-TILEID

Summary
The fiberassign file contains the fiber positioner configuration information for each exposure: what fiber is placed where, what target that is, etc.

Naming Convention
`fiberassign-TILEID.fits.gz`, where TILEID is the zero-padded 6-digit tile ID. Sometimes the file is not compressed, so the `.gz` is missing.

Regex
`fiberassign-[0-9]{6}\.fits(\.gz)?`

File Type
FITS, 5 MB

Contents

See description in *fiberassign-TILEID*

fibermap-EXPID

Summary
The fibermap contains the fiber positioner configuration information for each exposure: what fiber is placed where, what target that is, etc. This file type only appears in raw data from 2018 and should be considered obsolete.

Naming Convention
`fibermap-{EXPID}.fits`, where {EXPID} is the 8-digit exposure ID.

Regex
`fibermap-[0-9]{8}\.fits`

File Type
FITS, 2 MB

This table is also propagated forward to the *frame*, *cframe*, and *spectra* files.

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Blank
HDU1	FIBERMAP	BINTABLE	Fiber map table of what targets are on what fibers
HDU2	TARGETS	BINTABLE	Row matched target catalog for those assignments

FITS Header Units

HDU0

EXTNAME = PRIMARY

Empty HDU.

This HDU has no non-standard required keywords.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	0	int	
TILEID	1165	int	
REQRA	150.69	float	
REQDEC	33.86	float	
TILERA	150.69	float	
TILEDEC	33.86	float	
REFEPOCH	2015.5	str	
NIGHT	20201010	int	
EXPID	123456	int	
FLAVOR	science	str	
FIELDNUM	0	int	Field configuration number for this tile
TELRA	150.6899871709776	float	
TELDEC	150.6899913445232	float	

Data: FITS image [float64, 0]

HDU1

EXTNAME = FIBERMAP

The fiber map table of which targets where placed on which fibers at which locations. This is a superset of the requested fiberassignments, augmented with columns describing where the fibers actually ended up.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	378	int	length of dimension 1
NAXIS2	5000	int	length of dimension 2
NIGHT	20170327	str	YEARMMDD of sunset for this night
EXPID	2	int	unique DESI exposure ID
TILEID	4	int	DESI tile ID
PROGRAM	DARK	str	program [dark, bright, gray, calib, . . .]
FLAVOR	science	str	Flavor [arc, flat, science, zero, . . .]
REQRA	335.03	float	Requested telescope RA [degrees]
REQDEC	19.88	float	Requested telescope dec [degrees]
REQRA	335.03	float	Requested telescope RA [degrees]
REQDEC	19.88	float	Requested telescope dec [degrees]
TELRA	335.03	float	Actual telescope pointing RA [degrees]
TELDEC	19.88	float	Actual telescope pointing dec [degrees]
AIRMASS	1.17754	float	Airmass at middle of exposure
EXPTIME	629.827	float	Exposure time [sec]
SEEING	0.7769	float	Seeing FWHM [arcsec]
MOONFRAC	0.4083	float	Moon illumination fraction 0-1; 1=full
MOONALT	-72.8225	float	Moon altitude [degrees]
MOONSEP	131.1832	float	Moon:tile separation angle [degrees]
DATE-OBS	2020-03-17T03:35:05.835	str	Start of exposure

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique target ID
FIBER	int32		Fiber ID on the CCDs [0-4999]
PETAL_LOC	int16		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBERSTATUS	int32		Fiber status mask; 0=good
OBJTYPE	char[3]		SKY, OBJ, NON
DESI_TARGET	int64		Dark survey + calibration targeting bits
BGS_TARGET	int64		Bright Galaxy Survey targeting bits
MWS_TARGET	int64		Milky Way Survey targeting bits
SECONDARY_TARGET	int64		Secondary targets targeting bits
COMM_TARGET	int64		Commissioning targeting bits
SV1_DESI_TARGET	int64		Survey Validation targeting bits
SV1_BGS_TARGET	int64		Survey Validation targeting bits
SV1_MWS_TARGET	int64		Survey Validation targeting bits
TARGET_RA	float64	deg	Target Right Ascension [degrees]
TARGET_DEC	float64	deg	Target declination [degrees]
TARGET_RA_IVAR	float32	deg^-2	Inverse variance of TARGET_RA
TARGET_DEC_IVAR	float32	deg^-2	Inverse variance of TARGET_DEC
LAMBDA_REF	float32	Angstrom	Wavelength at which targets should be centered on fibers
DESIGN_X	float32	mm	Expected CS5 X location on focal plane

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Name	Type	Units	Description
DESIGN_Y	float32	mm	Expected CS5 Y location on focal plane
DESIGN_Q	float32	deg	CS5 Q azimuthal coordinate
DESIGN_S	float32	mm	CS5 S radial distance along curved focal surface
BRICKID	int64		Imaging Surveys brick ID
BRICK_OBJID	int64		Imaging surveys OBJID on that brick
TYPE	char[4]		Imaging surveys morphological type
PRIORITY	int32		Assignment priority; larger = higher priority
SUBPRIORITY	float64		Assignment subpriority [0-1]
NUMTARGET	int16		Total number of targets that this positioner covered
REF_ID	int64		Astrometric catalog reference ID (SOURCE_ID from GAIA)
PMRA	float32	mas/yr	Proper motion in the RA direction (already including cosDec term)
PMDEC	float32	mas/yr	Proper motion in the dec direction
PMRA_IVAR	float32		Inverse variance of PMRA
PMDEC_IVAR	float32		Inverse variance of PMDEC
FLUX_G	float32	nanomaggies	Flux in g-band
FLUX_R	float32	nanomaggies	Flux in r-band
FLUX_Z	float32	nanomaggies	Flux in z-band
FLUX_W1	float32	nanomaggies	Flux in WISE W1-band
FLUX_W2	float32	nanomaggies	Flux in WISE W2-band
FLUX_IVAR_G	float32		Inverse variance of FLUX_G
FLUX_IVAR_R	float32		Inverse variance of FLUX_R
FLUX_IVAR_Z	float32		Inverse variance of FLUX_Z
FLUX_IVAR_W1	float32		Inverse variance of FLUX_W1
FLUX_IVAR_W2	float32		Inverse variance of FLUX_W2
FIBERFLUX_G	float32	nanomaggies	g-band object model flux for 1 arcsec seeing and 1.5 arcsec diameter fiber
FIBERFLUX_R	float32	nanomaggies	r-band object model flux for 1 arcsec seeing and 1.5 arcsec diameter fiber
FIBERFLUX_Z	float32	nanomaggies	z-band object model flux for 1 arcsec seeing and 1.5 arcsec diameter fiber
FIBERTOTFLUX_G	float32	nanomaggies	like FIBERFLUX_G but including all objects overlapping this location
FIBERTOTFLUX_R	float32	nanomaggies	like FIBERFLUX_R but including all objects overlapping this location
FIBERTOTFLUX_Z	float32	nanomaggies	like FIBERFLUX_Z but including all objects overlapping this location
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
FIBER_RA_IVAR	float32	deg^-2	Inverse variance of FIBER_RA [not meaningful yet]
FIBER_DEC_IVAR	float32	deg^-2	Inverse variance of FIBER_DEC [not meaningful yet]
DELTA_X	float32	mm	CS5 x difference between requested and actual position
DELTA_Y	float32	mm	CS5 y difference between requested and actual position
DELTA_X_IVAR	float32	mm^-2	Inverse variance of DELTA_X [not meaningful yet]
DELTA_Y_IVAR	float32	mm^-2	Inverse variance of DELTA_Y [not meaningful yet]
NUM_ITER	int16		Number of positioner iterations
SPECTROID	int16		Hardware ID of spectrograph (not used)

HDU2

EXTNAME = TARGETS

Target catalog row-matched to the FIBERASSIGN table entries. Unassigned fibers will have TARGETID=-1 here.

Note: Software release 18.11 (desispec/0.26.0 desisim/0.31.0) does not include this HDU. In the future it will either be included or deprecated and removed.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	184	int	length of dimension 1
NAXIS2	5000	int	length of dimension 2
TNULL1	999999	int	
TNULL3	999999	int	
TNULL31	999999	int	
TNULL32	999999	int	
TNULL33	999999	int	
TNULL34	999999	int	
TNULL35	999999	int	
TNULL36	999999	int	
ENCODING	ascii	str	
SEED	1028862084	int	
HPXNSIDE	64	int	
HPXNEST	T	bool	

Required Data Table Columns

Name	Type	Units	Description
BRICKID	int32		
BRICKNAME	char[8]		
BRICK_OBJID	int32		
RA	float64		
DEC	float64		
FLUX_G	float32		
FLUX_R	float32		
FLUX_Z	float32		
FLUX_W1	float32		
FLUX_W2	float32		
MW_TRANSMISSION_G	float32		
MW_TRANSMISSION_R	float32		
MW_TRANSMISSION_Z	float32		
MW_TRANSMISSION_W1	float32		
MW_TRANSMISSION_W2	float32		
PSFDEPTH_G	float32		
PSFDEPTH_R	float32		
PSFDEPTH_Z	float32		
GALDEPTH_G	float32		

continues on next page

Table 81 – continued from previous page

Name	Type	Units	Description
GALDEPTH_R	float32		
GALDEPTH_Z	float32		
PSFDEPTH_W1	float32		
PSFDEPTH_W2	float32		
SHAPEDEV_R	float32		
SHAPEDEV_E1	float32		
SHAPEDEV_E2	float32		
SHAPEEXP_R	float32		
SHAPEEXP_E1	float32		
SHAPEEXP_E2	float32		
SUBPRIORITY	float64		
TARGETID	int64		
DESI_TARGET	int64		
BGS_TARGET	int64		
MWS_TARGET	int64		
HPXPIXEL	int64		
OBSCONDITIONS	int64		

Notes and Examples

- Future versions will include IVAR columns

focus-EXPID

Summary
Raw images from focus cameras.

Naming Convention
`focus-EXPID.fits.fz`, where EXPID is the zero-padded 8-digit exposure ID.

Regex
`focus-[0-9]{8}\.fits\.fz`

File Type
FITS, 91 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	FOCUS	Empty HDU	Header keywords only
HDU1	FOCUS4	Compressed IMAGE	Focus image 4
HDU2	FOCUS4T	BINTABLE	Focus image 4 metadata
HDU3	FOCUS1	Compressed IMAGE	Focus image 1
HDU4	FOCUS1T	BINTABLE	Focus image 1 metadata
HDU5	FOCUS9	Compressed IMAGE	Focus image 9
HDU6	FOCUS9T	BINTABLE	Focus image 9 metadata
HDU7	FOCUS6	Compressed IMAGE	Focus image 6
HDU8	FOCUS6T	BINTABLE	Focus image 6 metadata

Raw images from focus cameras. The data are deliberately out of focus with one half positive out of focus and the other half negative. There is a region in between that vignetted by the filter holder.

The FOCUSn data will be 3D[nframes, ny, nx] such that `data[i]` is the 2D GFA frame number `i`. Row `i` of the FOCUSnT table will contain the metadata about that frame, e.g. the DATE-OBS and EXPTIME.

Note that other than the blank data primary HDU, the order of the other HDUs is arbitrary and some FOCUSn(T) HDUs may even be missing. The nominal set (1,4,6,9) is the plan for full DESI, but particularly during commissioning other combinations will appear in the data. Always access by `EXTNAME` not HDU number.

Other than the name and number of the HDUs, the structure of this format is identical to the guide GFA raw data.

FITS Header Units

HDU0

EXTNAME = FOCUS

Header keywords only.

Required Header Keywords

KEY	Example Value	Type	Comment
MODULE	FOCUS	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	9	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FLAVOR	science	str	Observation type
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
NIGHT	20220113	int	Observing night
ACQTIME	None	Unknown	[s] acqusition image exposure time
GUIDTIME	None	Unknown	[s] guider GFA exposure time
FOCSTIME	60.0	float	[s] focus GFA exposure time
SKYTIME	None	Unknown	[s] sky camera exposure time (acquisition
REQRA	170.239	float	[deg] Requested right ascension (observe
REQDEC	-7.093	float	[deg] Requested declination (observer inp
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer
DELTADEC	0.0	float	[arcsec] Offset], declination, observer inp
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperatur
PMIRTEMP	11.675	float	[deg] Average primary mirror temperatur
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle

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Table 82 – continued from previous page

KEY	Example Value	Type	Comment
ADC2PHI	None	Unknown	[deg] ADC 2 angle
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
DOSVER	trunk	str	DOS software version
CONSTVER	DESI:CURRENT	str	Constants version
ARCHIVE	/exposures/desi/20220113/00118526/focus-00118526.fits.fz	str	
CHECKSUM	FAA2H992FAA2F772	str	HDU checksum updated 2022-01-14T11:
DATASUM	0	str	data unit checksum updated 2022-01-14T

Empty HDU.

HDU1

EXTNAME = FOCUS4

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	9288	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	FOCUS4	str	Device/controller name
UNIT	4	int	Unit number/letter
UNITTYPE	FOCUS	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	9	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs

continues on nex

Table 83 – continued from previous page

KEY	Example Value	Type	Comment
DATE-OBS	2022-01-14T11:03:58.542861	str	[UTC] Observation data and start time
MJD-OBS	59593.46109425	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.542861	str	Time shutter opened
ST	11:14:12.2376	str	Local Sidereal time at observation start (HH
FOCSTIME	60.0	float	[s] focus GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing on
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	5.6335e-05	float	
CD1_2	1.6773e-05	float	
CD2_1	1.8252e-05	float	
CD2_2	-5.1774e-05	float	
SHAPE	1032,2248	str	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version

continues on nex

Table 83 – continued from previous page

KEY	Example Value	Type	Comment
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	None	Unknown	
ROIWIDTH	None	Unknown	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev07	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	4hDA7hAA4hAA4hAA	str	HDU checksum updated 2022-01-14T11:13
DATASUM	1294762993	str	data unit checksum updated 2022-01-14T11

Data: FITS image [int16 (compressed), 2248x1032x9]

HDU2

EXTNAME = FOCUS4T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	9	int	number of rows in table
CHECKSUM	RNb1SLa0RLa0RLa0	str	HDU checksum updated 2022-01-14T11:13:59
DATASUM	1194419227	str	data unit checksum updated 2022-01-14T11:13:59

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
REQTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[*]		TODO: description needed
TIME-OBS	char[*]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[*]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU3

EXTNAME = FOCUS1

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	9288	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	FOCUS1	str	Device/controller name
UNIT	1	int	Unit number/letter
UNITTYPE	FOCUS	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	9	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type

continues on nex

Table 84 – continued from previous page

KEY	Example Value	Type	Comment
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.542861	str	[UTC] Observation data and start time
MJD-OBS	59593.46109425	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.542861	str	Time shutter opened
ST	11:14:12.2376	str	Local Sidereal time at observation start (HH
FOCSTIME	60.0	float	[s] focus GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing on
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset

continues on nex

Table 84 – continued from previous page

KEY	Example Value	Type	Comment
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	-3.4711e-05	float	
CD1_2	4.4105e-05	float	
CD2_1	4.8013e-05	float	
CD2_2	3.1893e-05	float	
SHAPE	1032,2248	str	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	None	Unknown	
ROIWIDTH	None	Unknown	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev05	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	4NNh7NNg4NNg4NNg	str	HDU checksum updated 2022-01-14T11:13
DATASUM	3152869116	str	data unit checksum updated 2022-01-14T11

Data: FITS image [int16 (compressed), 2248x1032x9]

HDU4

EXTNAME = FOCUS1T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	9	int	number of rows in table
CHECKSUM	jaafmSWfjYafjYUf	str	HDU checksum updated 2022-01-14T11:13:59
DATASUM	626101938	str	data unit checksum updated 2022-01-14T11:13:59

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
REQTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[*]		TODO: description needed
TIME-OBS	char[*]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[*]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU5

EXTNAME = FOCUS9

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	9288	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	FOCUS9	str	Device/controller name
UNIT	9	int	Unit number/letter
UNITTYPE	FOCUS	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	9	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type

continues on nex

Table 85 – continued from previous page

KEY	Example Value	Type	Comment
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.542861	str	[UTC] Observation data and start time
MJD-OBS	59593.46109425	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.542861	str	Time shutter opened
ST	11:14:12.2376	str	Local Sidereal time at observation start (HH
FOCSTIME	60.0	float	[s] focus GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing on
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset

continues on nex

Table 85 – continued from previous page

KEY	Example Value	Type	Comment
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	-5.6317e-05	float	
CD1_2	-1.6905e-05	float	
CD2_1	-1.8398e-05	float	
CD2_2	5.1751e-05	float	
SHAPE	1032,2248	str	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	None	Unknown	
ROIWIDTH	None	Unknown	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev03	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	gjaCgjZBgjaBgjWB	str	HDU checksum updated 2022-01-14T11:13
DATASUM	1001490193	str	data unit checksum updated 2022-01-14T11

Data: FITS image [int16 (compressed), 2248x1032x9]

HDU6

EXTNAME = FOCUS9T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	9	int	number of rows in table
CHECKSUM	79AXA97X79AXA97X	str	HDU checksum updated 2022-01-14T11:14:00
DATASUM	2395983219	str	data unit checksum updated 2022-01-14T11:14:00

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
REQTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[*]		TODO: description needed
TIME-OBS	char[*]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[*]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU7

EXTNAME = FOCUS6

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	9288	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	FOCUS6	str	Device/controller name
UNIT	6	int	Unit number/letter
UNITTYPE	FOCUS	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	9	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type

continues on nex

Table 86 – continued from previous page

KEY	Example Value	Type	Comment
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.542861	str	[UTC] Observation data and start time
MJD-OBS	59593.46109425	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.542861	str	Time shutter opened
ST	11:14:12.2376	str	Local Sidereal time at observation start (HH
FOCSTIME	60.0	float	[s] focus GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing on
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset

continues on nex

Table 86 – continued from previous page

KEY	Example Value	Type	Comment
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	3.496e-05	float	
CD1_2	-4.3929e-05	float	
CD2_1	-4.782e-05	float	
CD2_2	-3.2123e-05	float	
SHAPE	1032,2248	str	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	None	Unknown	
ROIWIDTH	None	Unknown	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev13	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	Uf34ac13Vc13ac13	str	HDU checksum updated 2022-01-14T11:14
DATASUM	1884870740	str	data unit checksum updated 2022-01-14T11

Data: FITS image [int16 (compressed), 2248x1032x9]

HDU8

EXTNAME = FOCUS6T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	9	int	number of rows in table
CHECKSUM	K2DmK0BjK0BjK0Bj	str	HDU checksum updated 2022-01-14T11:14:00
DATASUM	2998174015	str	data unit checksum updated 2022-01-14T11:14:00

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
REQTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[*]		TODO: description needed
TIME-OBS	char[*]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[*]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

fvc-EXPID

Summary
Fiber View Camera data

Naming Convention
`fvc-EXPID.fits.fz`, where EXPID is the zero-padded 8-digit exposure ID.

Regex
`fvc-[0-9]{8}\.fits(\.fz)?`

File Type
FITS, 30 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	FVC	IMAGE	TODO: description needed
HDU1	F0000	BINTABLE	TODO: description needed
HDU2	C0000	BINTABLE	TODO: description needed

FITS Header Units

HDU0

EXTNAME = FVC

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comm
NAXIS1	1	int	length
MODULE	FVC	str	Image
EXPID	118526	int	Expos
FRAMES	None	Unknown	Numb
COSMSPLT	T	bool	Cosm
MAXSPLIT	0	int	Numb
VISITIDS	118524,118525,118526	str	List o
TILEID	4403	int	DESI
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber
FLAVOR	science	str	Obser
OBSTYPE	SCIENCE	str	Spectr
SEQUENCE	_Split	str	OCS S
MANIFEST	F	bool	DOS (
OBJECT		str	Objec
PURPOSE	Main Survey	str	Purpo
PROGRAM	DARK	str	Progra
NTSSURVY	main	str	NTS s
NTSPROG	DARK	str	NTS p
SBPROF	ELG	str	Profile
MAXTIME	5400.0	float	[s] Ma
ESTTIME	3705.79	float	[s] Es
MINTIME	300.0	float	[s] Mi
MIDTIME	915.0	float	[s] Ex
PROPID	2020B-5000	str	Propo
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Name
LEAD	Martin Landriau	str	Lead (
INSTRUME	DESI	str	Instru
OBSERVAT	KPNO	str	Obser
OBS-LAT	31.96403	str	[deg]
OBS-LONG	-111.59989	str	[deg]
OBS-ELEV	2097.0	float	[m] O
TELESCOP	KPNO 4.0-m telescope	str	Telesc
CORRCTOR	DESI Corrector	str	Corre
SEQNUM	1	int	Numb
NIGHT	20220113	int	Obser
SEQSTART	2022-01-14T11:03:08.447408	str	Start t
TIMESYS	UTC	str	Time
DATE-OBS	None	Unknown	[UTC
MJD-OBS	None	Unknown	Modif

Table 87 – continued from previous page

KEY	Example Value	Type	Comm
STARTADJ	2022-01-14T11:03:22.140652	str	Time
OPENSHUT	2022-01-14T11:04:18.577390	str	Time
CAMSHUT	open	str	Shutte
ST	None	Unknown	Local
EXPTIME	None	Unknown	[s] Ac
ACQTIME	15.0	float	[s] acq
GUIDTIME	5.0	float	[s] gu
FOCSTIME	60.0	float	[s] foc
SKYTIME	60.0	float	[s] sky
REQRA	170.239	float	[deg]
REQDEC	-7.093	float	[deg]
WHITESPT	F	bool	Telesc
ZENITH	F	bool	Telesc
SEANNEX	F	bool	Telesc
BEYONDP	F	bool	Telesc
FIDUCIAL	off	str	Fiduc
BACKLIT	off	str	Fibers
AIRMASS	1.287912	float	Airma
FOCUS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Telesc
VCCD	ON	str	True (
TRUSTEMP	12.2	float	[deg]
PMIRTEMP	11.65	float	[deg]
PMREADY	T	bool	Prima
PMCOVER	open	str	Prima
PMCOOL	off	str	Prima
DOMSHUTU	open	str	Upper
DOMSHUTL	open	str	Lower
DOMLIGHH	off	str	High
DOMLIGHL	off	str	Low
DOMEAZ	180.062	float	[deg]
DOMINPOS	T	bool	Dome
EPOCH	2000.0	float	Epoch
GUIDOFFR	-0.659376	float	[arcse
GUIDOFFD	0.003783	float	[arcse
SUNRA	296.151203	float	[deg]
SUNDEC	-21.264137	float	[deg]
MOONDEC	23.960888	float	[deg]
MOONRA	73.944051	float	[deg]
MOONSEP	99.032	float	[deg]
MOUNTAZ	177.063681	float	[deg]
MOUNTDEC	-7.10233	float	[deg]
MOUNTEL	50.893802	float	[deg]
MOUNTHA	-1.865946	float	[deg]
INCTRL	T	bool	DESI
INPOS	T	bool	Moun
MNTOFFD	75.86	float	[arcse
MNTOFFR	-31.1	float	[arcse
PARALLAC	-2.510103	float	[deg]
SKYDEC	-7.10233	float	[deg]

Table 87 – continued from previous page

KEY	Example Value	Type	Comm
SKYRA	170.241629	float	[deg]
TARGTDEC	-7.10233	float	[deg]
TARGTRA	170.241629	float	[deg]
TARGTAZ	177.063681	float	[deg]
TARGTEL	50.893802	float	[deg]
TRGTOFFD	0.0	float	[arcse
TRGTOFFR	0.0	float	[arcse
ZD	39.106198	float	[deg]
TILERA	170.239	float	RA of
TILEDEC	-7.093	float	DEC
TCSST	11:13:30.164	str	Local
TCSMJD	59593.461771	float	MJD
USETURB	T	bool	Turbu
USEETC	T	bool	ETC
SEEING	None	Unknown	[arcse
TRANSPAR	None	Unknown	ETC/
SKYLEVEL	4.415	float	[unit?
PMSEEING	None	Unknown	[arcse
PMTRANSP	None	Unknown	[%] P
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acqui
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus
SKYCAM	SKYCAM0,SKYCAM1	str	Sky c
REQADC	334.05,26.06	str	[deg]
ADCCORR	T	bool	Corre
ADC1PHI	334.049995	float	[deg]
ADC2PHI	26.058728	float	[deg]
ADC1HOME	F	bool	ADC
ADC2HOME	F	bool	ADC
ADC1NREV	-1.0	float	ADC
ADC2NREV	1.0	float	ADC
ADC1STAT	STOPPED	str	ADC
ADC2STAT	STOPPED	str	ADC
USESKY	T	bool	DOS
USEFOCUS	T	bool	DOS
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexap
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexap
USEROTAT	T	bool	DOS
ROTOFFST	138.8	float	[arcse
ROTENBLD	T	bool	Rotato
ROTRATE	0.513	float	[arcse
RESETROT	F	bool	DOS
SPLITEXP	T	bool	Split e
USESPLIT	T	bool	Expos
USEPOS	T	bool	Fiber
PETALS	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9	str	Partic
POSCYCLE	None	Unknown	Numb
POSONTGT	None	Unknown	Numb
POSONFRC	None	Unknown	Fracti

Table 87 – continued from previous page

KEY	Example Value	Type	Comm
POSDISAB	None	Unknown	Numb
POSENABL	None	Unknown	Numb
POSRMS	None	Unknown	[mm]
POSITER	1	int	Positi
POSFRACT	0.95	float	
POSTOLER	0.005	float	Positi
POSMVALL	T	bool	Positi
USEGUIDR	T	bool	DOS
GUIDMODE	catalog	str	Guide
USEAOS	T	bool	DOS
USEDONUT	T	bool	DOS
USESPCTR	T	bool	DOS
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Partic
ILLSPECS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Partic
CCDSPECS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Partic
TDEWPNT	-32.86	float	Telesc
TAIRFLOW	0.0	float	Telesc
TAIRITMP	12.5	float	[deg]
TAIROTMP	12.7	float	[deg]
TAIRTEMP	11.05	float	[deg]
TCASITMP	6.6	float	[deg]
TCASOTMP	12.2	float	[deg]
TCSITEMP	12.1	float	[deg]
TCSOTEMP	12.3	float	[deg]
TCIBTEMP	0.0	float	[deg]
TCIMTEMP	0.0	float	[deg]
TCITTEMP	0.0	float	[deg]
TCOSTEMP	0.0	float	[deg]
TCOWTEMP	0.0	float	[deg]
TDBTEMP	12.4	float	[deg]
TFLOWIN	0.0	float	Telesc
TFLOWOUT	0.0	float	Telesc
TGLYCOLI	12.8	float	[deg]
TGLYCOLO	12.6	float	[deg]
THINGES	12.1	float	[deg]
THINGEW	22.3	float	[deg]
TPMAVERT	11.658	float	[deg]
TPMDESIT	6.0	float	[deg]
TPMEIBT	12.1	float	[deg]
TPMEITT	11.5	float	[deg]
TPMEOBT	12.3	float	[deg]
TPMEOTT	12.0	float	[deg]
TPMNIBT	11.9	float	[deg]
TPMNITT	11.4	float	[deg]
TPMNOBT	12.3	float	[deg]
TPMNOTT	12.0	float	[deg]
TPMRTDT	11.67	float	[deg]
TPMSIBT	12.1	float	[deg]
TPMSITT	11.5	float	[deg]

Table 87 – continued from previous page

KEY	Example Value	Type	Comm
TPMSOBT	12.0	float	[deg]
TPMSOTT	11.7	float	[deg]
TPMSTAT	ready	str	Telesc
TPMWIBT	11.9	float	[deg]
TPMWITT	11.3	float	[deg]
TPMWOBT	11.9	float	[deg]
TPMWOTT	11.8	float	[deg]
TPCITEMP	12.1	float	[deg]
TPCOTEMP	12.0	float	[deg]
TPR1HUM	0.0	float	Telesc
TPR1TEMP	0.0	float	[deg]
TPR2HUM	0.0	float	Telesc
TPR2TEMP	0.0	float	[deg]
TSERVO	40.0	float	Telesc
TTRSTEMP	11.9	float	[deg]
TTRWTEMP	11.7	float	[deg]
TTRUETBT	-1.5	float	[deg]
TTRUETTT	11.6	float	[deg]
TTRUNTBT	11.7	float	[deg]
TTRUNTTT	11.6	float	[deg]
TTRUSTBT	11.7	float	[deg]
TTRUSTST	10.8	float	[deg]
TTRUSTTT	11.7	float	[deg]
TTRUTSBT	12.2	float	[deg]
TTRUTSMT	12.2	float	[deg]
TTRUTSTT	12.2	float	[deg]
TTRUWTBT	11.6	float	[deg]
TTRUWTTT	11.6	float	[deg]
ALARM	F	bool	UPS r
ALARM-ON	F	bool	UPS a
BATTERY	100.0	float	[%] U
SECLEFT	6312.0	float	[s] UP
UPSSTAT	System Normal - On Line(7)	str	UPS S
INAMPS	68.3	float	[A] U
OUTWATTS	4800.0,7200.0,4500.0	str	[W] U
COMPDEW	-10.3	float	[deg C
COMPHUM	13.9	float	[%] C
COMPAMB	25.2	float	[deg C
COMPTEMP	17.6	float	[deg C
DEWPOINT	-36.9	float	[deg C
HUMIDITY	2.0	float	[%] (c
PRESSURE	793.2	float	[torr]
OUTTEMP	11.0	float	[deg C
WINDDIR	264.5	float	[deg]
WINDSPD	11.7	float	[m/s]
GUST	10.8	float	[m/s]
AMNIENTN	16.8	float	[deg C
CFLOOR	11.6	float	[deg C
NWALLIN	17.3	float	[deg C

Table 87 – continued from previous page

KEY	Example Value	Type	Comm
NWALLOUT	11.1	float	[deg C
WWALLIN	16.5	float	[deg C
WWALLOUT	11.5	float	[deg C
AMBIENTS	17.6	float	[deg C
FLOOR	15.7	float	[deg C
EWALLCMP	11.9	float	[deg C
EWALLCOU	11.6	float	[deg C
ROOF	10.9	float	[deg C
ROOFAMB	11.1	float	[deg C
DOMEBLOW	11.2	float	[deg C
DOMEBUP	11.3	float	[deg C
DOMELLOW	11.1	float	[deg C
DOMELUP	10.9	float	[deg C
DOMERLOW	11.1	float	[deg C
DOMERUP	10.7	float	[deg C
PLATFORM	10.6	float	[deg C
SHACKC	16.7	float	[deg C
SHACKW	16.6	float	[deg C
STAIRSL	10.9	float	[deg C
STAIRSM	10.7	float	[deg C
STAIRSU	10.9	float	[deg C
TELBASE	11.6	float	[deg C
UTILWALL	11.4	float	[deg C
UTILROOM	10.1	float	[deg C
SP0NIRT	139.96	float	[K] SI
SP0REDT	139.99	float	[K] SI
SP0BLUT	163.02	float	[K] SI
SP0NIRP	7.36e-08	float	[mb] S
SP0REDP	5.492e-08	float	[mb] S
SP0BLUP	1.001e-07	float	[mb] S
SP1NIRT	139.96	float	[K] SI
SP1REDT	139.96	float	[K] SI
SP1BLUT	163.02	float	[K] SI
SP1NIRP	6.622e-08	float	[mb] S
SP1REDP	6.033e-08	float	[mb] S
SP1BLUP	8.599e-08	float	[mb] S
SP2NIRT	139.96	float	[K] SI
SP2REDT	139.96	float	[K] SI
SP2BLUT	163.02	float	[K] SI
SP2NIRP	5.556e-08	float	[mb] S
SP2REDP	6.013e-08	float	[mb] S
SP2BLUP	8.897e-08	float	[mb] S
SP3NIRT	140.03	float	[K] SI
SP3REDT	139.96	float	[K] SI
SP3BLUT	163.04	float	[K] SI
SP3NIRP	4.3e-08	float	[mb] S
SP3REDP	7.066e-08	float	[mb] S
SP3BLUP	8.324e-08	float	[mb] S
SP4NIRT	139.96	float	[K] SI

Table 87 – continued from previous page

KEY	Example Value	Type	Comm
SP4REDT	139.99	float	[K] S
SP4BLUT	163.04	float	[K] S
SP4NIRP	6.921e-08	float	[mb]
SP4REDP	4.505e-08	float	[mb]
SP4BLUP	6.846e-08	float	[mb]
SP5NIRT	139.99	float	[K] S
SP5REDT	139.99	float	[K] S
SP5BLUT	163.02	float	[K] S
SP5NIRP	7.886e-08	float	[mb]
SP5REDP	4.383e-08	float	[mb]
SP5BLUP	1.003e-07	float	[mb]
SP6NIRT	139.96	float	[K] S
SP6REDT	139.96	float	[K] S
SP6BLUT	163.04	float	[K] S
SP6NIRP	2.688e-07	float	[mb]
SP6REDP	6.65e-08	float	[mb]
SP6BLUP	9.062e-08	float	[mb]
SP7NIRT	139.96	float	[K] S
SP7REDT	140.03	float	[K] S
SP7BLUT	162.97	float	[K] S
SP7NIRP	6.073e-08	float	[mb]
SP7REDP	4.807e-08	float	[mb]
SP7BLUP	1.066e-07	float	[mb]
SP8NIRT	139.96	float	[K] S
SP8REDT	139.96	float	[K] S
SP8BLUT	163.04	float	[K] S
SP8NIRP	1.257e-07	float	[mb]
SP8REDP	4.635e-08	float	[mb]
SP8BLUP	8.912e-08	float	[mb]
SP9NIRT	139.96	float	[K] S
SP9REDT	139.96	float	[K] S
SP9BLUT	163.02	float	[K] S
SP9NIRP	5.325e-08	float	[mb]
SP9REDP	6.124e-08	float	[mb]
SP9BLUP	1.236e-07	float	[mb]
RADESYS	FK5	str	Coord
SIMGFAP	F	bool	DOS
USEFVC	T	bool	DOS
USEFID	T	bool	DOS
USEILLUM	T	bool	DOS
USEXSRVR	T	bool	DOS
USEOPENL	T	bool	DOS
USEMIDPT	T	bool	Use e
STOPGUDR	T	bool	DOS
STOPFOCS	T	bool	DOS
STOPSKY	T	bool	DOS
KEEPGUDR	F	bool	DOS
KEEPFOCS	F	bool	DOS
KEEPSKY	F	bool	DOS

Table 87 – continued from previous page

KEY	Example Value	Type	Comm
REACQUIR	F	bool	DOS
EXCLUDED		str	Comp
DOSVER	trunk	str	DOS
OCSVER	1.2	float	OCS
PMVER	desi-138368	str	PlateM
CONSTVER	DESI:CURRENT	str	Const
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS
REQTIME	1860.0	float	[s] Re
SIMGFACQ	F	bool	
TCSKRA	0.01 0.04 0.01	str	TCS
TCSKDEC	0.01 0.04 0.01	str	TCS
TCSGRA	0.15	float	TCS
TCSGDEC	0.15	float	TCS
TCSMFRA	2	int	TCS
TCSMFDEC	2	int	TCS
TCSPIRA	0.9,0.0,0.0,0.0	str	TCS
TCSPIDEC	0.9,0.0,0.0,0.0	str	TCS
GUIEXPID	118526	int	Guide
IGFRMNUM	2	int	Guide
FOCEXPID	118526	int	Focus
IFFRMNUM	0	int	Focus
SKYEXPID	118526	int	Sky e
ISFRMNUM	0	int	Sky f
CHECKSUM	KdJcMZJbKdJbKZJb	str	HDU
DATASUM	1072693248	str	data u

Data: FITS image [float64, 1]

HDU1

EXTNAME = F0000

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	6000	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
EXPID	118526.0	float	
EXPTIME	2.0	float	
RDTIME	4.26886796951294	float	
DRKEXP	0	int	
DRKFLAG	0	int	
IDLEFLAG	0	int	

continues on next page

Table 88 – continued from previous page

KEY	Example Value	Type	Comment
SIMFLAG	0	int	
SIMFIB	0	int	
CCDTEMP	-10.0	float	
BASETMP	18.0	float	
TEMPSET	-10.0	float	
COOLPOW	48.0	float	
PIXSZX	6.00000021222513e-06	float	
PIXSZY	6.00000021222513e-06	float	
CCDX1	0	int	
CCDX2	8304	int	
CCDY1	0	int	
CCDY2	6220	int	
VISX1	64	int	
VISX2	8240	int	
VISY1	45	int	
VISY2	6177	int	
SUBX1	1152	int	
SUBX2	7151	int	
SUBY1	111	int	
SUBY2	6110	int	
HBIN	0	int	
VBIN	0	int	
OBSNUM	118526	int	
OBSFRM	0	int	
HDREV	256	int	
FWREV	516	int	
DATE	2022-01-14T11:04:12	str	
CHECKSUM	97c4H4b494b4E4b4	str	HDU checksum updated 2022-01-14T11:04:36
DATASUM	2941763729	str	data unit checksum updated 2022-01-14T11:04:36

Data: FITS image [int16 (compressed), 6000x6000]

HDU2

EXTNAME = C0000

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	48	int	width of table in bytes
NAXIS2	5439	int	number of rows in table
EXPID	118526	int	
MODULE	CENTROIDS	str	
CHECKSUM	93Ad908Z90Ad907Z	str	HDU checksum updated 2022-01-14T11:04:37
DATASUM	1135191656	str	data unit checksum updated 2022-01-14T11:04:37

Required Data Table Columns

Name	Type	Units	Description
x	float64		TODO: description needed
y	float64		TODO: description needed
mag	float64		TODO: description needed
fwhm	float64		TODO: description needed
flags	int64		TODO: description needed
device_id	int64		TODO: description needed

fvc-primary-EXPID

Summary
This file type is found in early commissioning data, but should be considered obsolete.

Naming Convention
`fvc-primary-EXPID.fits`, where EXPID is the zero-padded 8-digit exposure ID.

Regex
`fvc-primary-[0-9]{8}\.fits`

File Type
FITS, 19 KB

Contents

Number	EXTNAME	Type	Contents
HDU0	fvc	IMAGE	TODO: description needed

FITS Header Units

HDU0

EXTNAME = fvc

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
FVCTIME	2.0	float	
EXPTIME	None	Unknown	
REQTIME	2.0	float	
IMAGECAM	FVC	str	
EXPID	51406	int	
OBSERVER	DESIObserver	str	
PROPID	2019B-5000	str	

continues on next page

Table 89 – continued from previous page

KEY	Example Value	Type	Comment
PROGRAM	FVC alt-az dome closed	str	
LEAD	RunManager	str	
RADESYS	FK5	str	
TIMESYS	UTC	str	
EPOCH	2000.0	float	
DOSVER	trunk	str	
OCSVER	1.2	float	
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	
INSTRUME	DESI	str	
CONSTVER	DESI:CURRENT	str	
CORRCTOR	DESI Corrector	str	
TELESCOP	KPNO 4.0-m telescope	str	
OBSERVAT	KPNO	str	
OBS-ELEV	2097.0	float	
OBS-LAT	31.96403	str	
OBS-LONG	-111.59989	str	
NIGHT	20200220	int	
DATE-OBS	2020-02-21T11:04:11.878701	str	
MJD-OBS	58900.4612486	float	
OPENSHUT	2020-02-21T11:04:11.878701	str	
ST	13:41:09.750	str	
SEQUENCE	FVC	str	
FLAVOR	science	str	
DELTARA	0.0	float	
DELTADEC	0.0	float	
EXCLUDED		str	
GUIDMODE	catalog	str	
MANIFEST	F	bool	
OBJECT		str	
SEQID	20 requests	str	
SEQTOT	20	int	
SEQNUM	5	int	
CAMSHUT	open	str	
INPOS	T	bool	
INCTRL	T	bool	
DOMINPOS	T	bool	
WHITESPT	F	bool	
ZENITH	F	bool	
SEANNEX	F	bool	
BEYONDP	F	bool	
SKYRA	205.295743	float	
SKYDEC	-28.030359	float	
TARGTRA	204.369079	float	
TARGTDEC	-28.0367	float	
TARGTAZ	180.937824	float	
TARGTEL	29.993611	float	
TRGTOFFR	0.0	float	
TRGTOFFD	0.0	float	
GUIDOFFR	0.0	float	

continues on next page

Table 89 – continued from previous page

KEY	Example Value	Type	Comment
GUIDOFFD	-0.0	float	
MNTOFFR	-0.0	float	
MNTOFFD	-0.0	float	
AIRMASS	1.994121	float	
MOUNTHA	-0.006443	float	
MOUNTAZ	179.993433	float	
MOUNTEL	30.006341	float	
MOUNTDEC	-28.030359	float	
PARALLAC	-0.006312	float	
ZD	59.993659	float	
TCSST	13:41:09.432	str	
TCSMJD	58900.461678	float	
DOMEAZ	184.424	float	
PMREADY	T	bool	
MOONRA	310.75149	float	
MOONDEC	-20.881956	float	
TCSKRA	0.15 0.003 0.00003	str	
TCSKDEC	0.15 0.003 0.00003	str	
TCSGRA	0.3	float	
TCSGDEC	0.3	float	
TCSMFRA	1	int	
TCSMFDEC	1	int	
TCSPIRA	1.0,0.0,0.0,0.0	str	
TCSPIDEC	1.0,1.0,0.0,0.0	str	
ADC1PHI	359.999931	float	
ADC2PHI	0.000101	float	
ADC1HOME	F	bool	
ADC2HOME	F	bool	
ADC1NREV	0.0	float	
ADC2NREV	0.0	float	
ADC1STAT	STOPPED	str	
ADC2STAT	STOPPED	str	
HEXPOS	1139.5,-480.5,61.0,-3.1,25.0,-0.0	str	
HEXTRIM	0.0,0.0,-46.0,0.0,0.0,0.0	str	
ROTENBLD	T	bool	
ROTOFFST	153.1	float	
ROTRATE	0.496	float	
UPSSTAT	System Normal - On Line(7)	str	
FIDUCIAL	off	str	
FOCUS	1139.5,-480.5,61.0,-3.1,25.0,-0.0	str	
COMPAMB	19.6	float	
COMPTEMP	20.4	float	
COMPDEW	-2.0	float	
COMPHUM	22.1	float	
ALARM	F	bool	
ALARM-ON	F	bool	
SECLEFT	5922.0	float	
BATTERY	100.0	float	
INAMPS	65.6	float	

continues on next page

Table 89 – continued from previous page

KEY	Example Value	Type	Comment
OUTWATTS	4500.0,6600.0,4400.0	str	
TPMAVERT	10.927	float	
TPMDESIT	8.0	float	
TSERVO	40.0	float	
TAIRTEMP	11.068	float	
TDEWPNT	-3.42	float	
TAIRFLOW	0.0	float	
TPR1HUM	-100.0	float	
TPR1TEMP	-100.0	float	
TPR2HUM	-99.99	float	
TPR2TEMP	-99.99	float	
TFLOWIN	0.0	float	
TFLOWOUT	0.0	float	
TPMRTDT	-99.9	float	
TPMNIBT	10.6	float	
TPMEIBT	10.7	float	
TPMSIBT	10.7	float	
TPMWIBT	10.5	float	
TPMNOBT	11.0	float	
TPMEOBT	10.6	float	
TPMSOBT	10.7	float	
TPMWOBT	10.6	float	
TPMNITT	10.7	float	
TPMEITT	10.7	float	
TPMSITT	10.8	float	
TPMWITT	10.7	float	
TPMNOTT	11.2	float	
TPMEOTT	11.1	float	
TPMSOTT	11.0	float	
TPMWOTT	11.0	float	
TGLYCOLI	12.3	float	
TGLYCOLO	12.1	float	
TAIRITMP	12.2	float	
TAIROTMP	12.2	float	
TTRUNTTT	11.7	float	
TTRUETTT	11.7	float	
TTRUSTTT	11.7	float	
TTRUWTTT	11.7	float	
TTRUNTBT	11.6	float	
TTRUETBT	11.5	float	
TTRUSTBT	11.7	float	
TTRUWTBT	11.4	float	
TTRUSTST	12.3	float	
TTRUTSBT	12.4	float	
TTRUTSMT	12.5	float	
TTRUTSTT	12.3	float	
TTRSTEMP	12.1	float	
TTRWTEMP	11.9	float	
THINGES	12.3	float	

continues on next page

Table 89 – continued from previous page

KEY	Example Value	Type	Comment
THINGEW	11.8	float	
TCOSTEMP	21.7	float	
TCOWTEMP	21.6	float	
TCIBTEMP	21.6	float	
TCIMTEMP	21.6	float	
TCITTEMP	21.7	float	
TCSITEMP	11.5	float	
TCSOTEMP	11.9	float	
TPCITEMP	11.0	float	
TPCOTEMP	11.0	float	
TCASITMP	10.6	float	
TCASOTMP	11.9	float	
TDBTEMP	11.3	float	
TPMSTAT	ready	str	
TRUSTEMP	12.4	float	
PMIRTEMP	10.9	float	
PLATFORM	11.0	float	
STAIRSU	11.1	float	
STAIRSM	11.0	float	
STAIRSL	11.1	float	
DOMELUP	10.9	float	
DOMELLOW	11.3	float	
DOMEBUP	11.0	float	
DOMEBLOW	11.1	float	
DOMERUP	10.8	float	
DOMERLOW	11.2	float	
NWALLIN	15.1	float	
WWALLIN	14.1	float	
FLOOR	13.7	float	
SHACKC	16.0	float	
SHACKW	14.3	float	
AMNIENTN	14.3	float	
AMBIENTS	15.7	float	
NWALLOUT	10.2	float	
WWALLOUT	11.1	float	
CFLOOR	10.2	float	
TELBASE	10.9	float	
UTILROOM	11.3	float	
UTILWALL	11.4	float	
EWALLCOU	11.1	float	
EWALLCMP	11.7	float	
ROOF	11.1	float	
ROOFAMB	10.9	float	
DOMSHUTU	not open	str	
DOMSHUTL	not open	str	
DOMLIGHH	off	str	
DOMLIGHL	off	str	
PMCOVER	open	str	
WINDSPD	11.2	float	

continues on next page

Table 89 – continued from previous page

KEY	Example Value	Type	Comment
WINDDIR	209.6	float	
HUMIDITY	31.0	float	
PRESSURE	793.5	float	
OUTTEMP	11.7	float	
DEWPOINT	-4.9	float	
GUST	117.6	float	
AOS	F	bool	

Empty HDU.

FVC-measure-EXPID

Summary
This file type is found in early commissioning data, but should be considered obsolete.

Naming Convention
`FVC-measure-EXPID.fits`, where EXPID is the zero-padded 8-digit exposure ID.

Regex
`FVC-measure-[0-9]{8}\.fits`

File Type
FITS, 531 KB

Contents

Number	EXTNAME	Type	Contents
HDU0	PM	IMAGE	TODO: description needed
HDU1	FVCCNTRD	BINTABLE	TODO: description needed
HDU2	FVCCNTER	BINTABLE	TODO: description needed

FITS Header Units

HDU0

EXTNAME = PM

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	1	int	length of data axis 1
EXPID	51435	int	
MODULE	FVCMEASURE	str	
SEQUENCE	FVC	str	
MJD-OBS	58900.47012345	float	
NIGHT	20200220	int	
DATE-OBS	2020-02-21T11:16:58.665928	str	
ST	13:53:58.630	str	
CHECKSUM	8B6A99338A3A8733	str	HDU checksum updated 2020-02-21T11:16:58
DATASUM	1072693248	str	data unit checksum updated 2020-02-21T11:16:58

Data: FITS image [float64, 1]

HDU1

EXTNAME = FVCCNTRD

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	48	int	width of table in bytes
NAXIS2	5406	int	number of rows in table
EXPID	51435	int	
MODULE	FVCCENTROIDS	str	
CHECKSUM	EiMfHgMZEgMdEgMZ	str	HDU checksum updated 2020-02-21T11:16:58
DATASUM	3879177035	str	data unit checksum updated 2020-02-21T11:16:58

Required Data Table Columns

Name	Type	Units	Description
mag	float64		TODO: description needed
serial	int64		TODO: description needed
x	float64		TODO: description needed
fwhm	float64		TODO: description needed
flags	int64		TODO: description needed
y	float64		TODO: description needed

HDU2

EXTNAME = FVCCNTER

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	53	int	width of table in bytes
NAXIS2	5088	int	number of rows in table
EXPID	51435	int	
MODULE	FVCCENTERS	str	
CHECKSUM	380QA80Q480QA80Q	str	HDU checksum updated 2020-02-21T11:16:58
DATASUM	812294905	str	data unit checksum updated 2020-02-21T11:16:58

Required Data Table Columns

Name	Type	Units	Description
mag	float64		TODO: description needed
serial	int64		TODO: description needed
comment	char[5]		TODO: description needed
x	float64		TODO: description needed
fwhm	float64		TODO: description needed
flags	int64		TODO: description needed
y	float64		TODO: description needed

gfa-EXPID

Summary
TODO: description needed

Naming Convention
`gfa-EXPID.fits.fz`, where EXPID is the zero-padded 8-digit exposure ID.

Regex
`gfa-[0-9]{8}\.fits\.fz`

File Type
FITS, 26 MB

Contents

Number	EXTNAME	Type	Contents
HDU00		IMAGE	TODO: description needed
HDU01	GFA	BINTABLE	TODO: description needed
HDU02	GUIDE0	BINTABLE	TODO: description needed
HDU03	FOCUS9	BINTABLE	TODO: description needed
HDU04	FOCUS1	BINTABLE	TODO: description needed
HDU05	FOCUS4	BINTABLE	TODO: description needed
HDU06	GUIDE3	BINTABLE	TODO: description needed
HDU07	GUIDE7	BINTABLE	TODO: description needed
HDU08	GUIDE5	BINTABLE	TODO: description needed
HDU09	GUIDE2	BINTABLE	TODO: description needed
HDU10	FOCUS6	BINTABLE	TODO: description needed
HDU11	GUIDE8	BINTABLE	TODO: description needed

FITS Header Units

HDU00

This HDU has no non-standard required keywords.

Empty HDU.

HDU01

EXTNAME = GFA

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	1	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
MODULE	GFA	str	Image Sources/Component
EXPID	168807	int	Exposure number
EXPFRAME	0	int	Frame number
FRAMES	1	int	Number of Frames in Archive
COSMSPLT	F	bool	Cosmics split exposure if true
MAXSPLIT	0	int	Number of allowed exposure splits
FLAVOR	science	str	Observation type
SEQUENCE	GFA	str	OCS Sequence name
MANIFEST	F	bool	DOS exposure manifest
OBJECT		str	Object name
PURPOSE	Main Survey	str	Purpose of observing night

continues on

Table 90 – continued from previous page

KEY	Example Value	Type	Comment
PROGRAM	Kickstart Focus Procedure	str	Program name
NTSSURVY	na	str	NTS survey name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jesse Han, Christopher Manser	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
SEQNUM	1	int	Number of exposure in sequence
NIGHT	20230224	int	Observing night
SEQSTART	2023-02-25T01:58:04.748405	str	Start time of sequence processing
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2023-02-25T01:58:27.541024	str	[UTC] Observation data and start time
MJD-OBS	60000.08226321	float	Modified Julian Date of observation
OPENSHUT	2023-02-25T01:58:27.541024	str	[s] Time shutter opened
CLOSSHUT	None	Unknown	[s] Time it takes exposure shutter to close
CAMSHUT	open	str	Shutter status during observation
ST	4:51:50.015	str	Local Sidereal time at observation start (H
EXPTIME	60.0	float	[s] Actual exposure time
GFATIME	60.0	float	[s] GFA camera exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer i
DELTADEC	0.0	float	[arcsec] Offset], declination, observer inpu
WHITESPT	F	bool	Telescope is at whitespot
ZENITH	F	bool	Telescope is at zenith
SEANNEX	F	bool	Telescope is at SE annex
BEYONDP	F	bool	Telescope is beyond pole
FIDUCIAL	off	str	Fiducials status during observation
BACKLIT	off	str	Fibers are backlit if True
AIRMASS	1.000057	float	Airmass
FOCUS	1140.0,-480.0,690.3,-3.0,25.0,0.0	str	Telescope focus settings
TRUSTEMP	6.967	float	[deg] Average Telescope truss temperature
PMIRTEMP	5.0	float	[deg] Average primary mirror temperature
PMREADY	T	bool	Primary mirror ready
PMCOVER	open	str	Primary mirror cover
PMCOOL	off	str	Primary mirror cooling
DOMSHUTU	open	str	Upper dome shutter
DOMSHUTL	open	str	Lower dome shutter
DOMLIGHH	off	str	High dome lights
DOMLIGHL	off	str	Low dome lights
DOMEAZ	106.495	float	[deg] Dome azimuth angle
DOMINPOS	T	bool	Dome is in position
EPOCH	2000.0	float	Epoch of observation
GUIDOFFR	0.0	float	[arcsec] RA guider offset (cummulative, fr
GUIDOFFD	-0.0	float	[arcsec] DEC guider offset (cummulative, f
SUNRA	337.957105	float	[deg] Sun RA at start of exposure

continues on

Table 90 – continued from previous page

KEY	Example Value	Type	Comment
SUNDEC	-9.241851	float	[deg] Sun declination at start of exposure
MOONDEC	14.950187	float	[deg] Moon declination at start of exposure
MOONRA	36.900458	float	[deg] Moon RA at start of exposure
MOONSEP	36.415	float	[deg] Moon Separation
SLEWTIME	0.543	float	[s] Slew Time
MOUNTAZ	269.404239	float	[deg] Mount azimuth angle
MOUNTDEC	31.954914	float	[deg] Mount declination
MOUNTEL	89.388961	float	[deg] Mount elevation angle
MOUNTHA	0.720137	float	[deg] Mount hour angle
INCTRL	T	bool	DESI in control
INPOS	T	bool	Mount in position
MNTOFFD	-0.0	float	[arcsec] DEC mMount offset (GFAPROC p
MNTOFFR	-0.0	float	[arcsec] RA mount offset (GFAPROC poin
PARALLAC	89.023058	float	[deg] Parallactic angle
SKYDEC	31.954914	float	[deg] Telescope declination (pointing on sk
SKYRA	71.974937	float	[deg] Telescope right ascension (pointing o
TARGTDEC	31.954914	float	[deg] Target declination (to TCS)
TARGTRA	71.974937	float	[deg] Target right ascension (to TCS)
TARGTAZ	269.404239	float	[deg] Target azimuth
TARGTEL	89.388961	float	[deg] Target elevation
TRGTOFFD	0.0	float	[arcsec] Telescope target offset (dec)
TRGTOFFR	0.0	float	[arcsec] Telescope target offset (RA)
ZD	0.611039	float	[deg] Telescope zenith distance
TCSST	04:50:46.818	str	Local Sidereal time reported by TCS (HH:
TCSMJD	60000.082691	float	MJD reported by TCS
SEEING	None	Unknown	[arcsec] ETC/PM seeing
TRANSPAR	None	Unknown	ETC/PM transparency
PMSEEING	None	Unknown	[arcsec] PlateMaker GFAPROC seeing
PMTRANSP	None	Unknown	[%] PlateMaker GFAPROC transparency
IMAGECAM	G0,G2,G3,G5,G7,G8,F1,F4,F6,F9	str	Image cameras used for this exposure
REQADC	96.74,99.01	str	[deg] requested ADC angles
ADCCORR	T	bool	Correct pointing for ADC setting if True
ADC1PHI	96.739876	float	[deg] ADC 1 angle
ADC2PHI	99.009244	float	[deg] ADC 2 angle
ADC1HOME	F	bool	ADC 1 at home position if True
ADC2HOME	F	bool	ADC 2 at home position if True
ADC1NREV	-1.0	float	ADC 1 number of revs
ADC2NREV	0.0	float	ADC 2 number of revs
ADC1STAT	STOPPED	str	ADC 1 status
ADC2STAT	STOPPED	str	ADC 2 status
HEXPOS	1140.0,-480.0,690.3,-3.0,25.0,0.0	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
ROTOFFST	0.0	float	[arcsec] Rotator offset
ROTENBLD	F	bool	Rotator enabled
ROTRATE	0.0	float	[arcsec/min] Rotator rate
RESETROT	T	bool	DOS Control: reset hex rotator
GUIDMODE	catalog	str	Guider mode
TDEWPNT	-8.03	float	Telescope air dew point
TAIRFLOW	0.0	float	Telescope air flow

continues on

Table 90 – continued from previous page

KEY	Example Value	Type	Comment
TAIRITMP	6.6	float	[deg] Telescope air in temperature
TAIROTMP	5.7	float	[deg] Telescope air out temperature
TAIRTEMP	5.695	float	[deg] Telescope air temperature
TCASITMP	6.6	float	[deg] Telescope Cass Cage in temperature
TCASOTMP	5.7	float	[deg] Telescope Cass Cage out temperature
TCSITEMP	4.6	float	[deg] Telescope center section in temperatu
TCSOTEMP	6.1	float	[deg] Telescope center section out tempera
TCIBTEMP	0.0	float	[deg] Telescope chimney IB temperature
TCIMTEMP	0.0	float	[deg] Telescope chimney IM temperature
TCITTEMP	0.0	float	[deg] Telescope chimney IT temperature
TCOSTEMP	0.0	float	[deg] Telescope chimney OS temperature
TCOWTEMP	0.0	float	[deg] Telescope chimney OW temperature
TDBTEMP	4.9	float	[deg] Telescope dec bore temperature
TFLOWIN	0.0	float	Telescope flow rate in
TFLOWOUT	0.0	float	Telescope flow rate out
TGLYCOLI	0.5	float	[deg] Telescope glycol in temperature
TGLYCOLO	0.9	float	[deg] Telescope glycol out temperature
THINGES	6.7	float	[deg] Telescope hinge S temperature
THINGEW	22.3	float	[deg] Telescope hinge W temperature
TPMAVERT	4.995	float	[deg] Telescope mirror averagetemperature
TPMDESIT	1.0	float	[deg] Telescope mirror desired temperature
TPMEIBT	5.0	float	[deg] Telescope mirror EIB temperature
TPMEITT	5.1	float	[deg] Telescope mirror EIT temperature
TPMEOBT	4.7	float	[deg] Telescope mirror EOB temperature
TPMEOTT	5.2	float	[deg] Telescope mirror EOT temperature
TPMNIBT	4.7	float	[deg] Telescope mirror NIB temperature
TPMNITT	5.0	float	[deg] Telescope mirror NIT temperature
TPMNOBT	4.6	float	[deg] Telescope mirror NOB temperature
TPMNOTT	5.0	float	[deg] Telescope mirror NOT temperature
TPMRTDT	5.01	float	[deg] Telescope mirror RTD temperature
TPMSIBT	5.0	float	[deg] Telescope mirror SIB temperature
TPMSITT	5.0	float	[deg] Telescope mirror SIT temperature
TPMSOBT	4.5	float	[deg] Telescope mirror SOB temperature
TPMSOTT	5.0	float	[deg] Telescope mirror SOT temperature
TPMSTAT	ready	str	Telescope mirror status
TPMWIBT	4.7	float	[deg] Telescope mirror WIB temperature
TPMWITT	4.9	float	[deg] Telescope mirror WIT temperature
TPMWOBT	4.2	float	[deg] Telescope mirror WOB temperature
TPMWOTT	4.8	float	[deg] Telescope mirror WOT temperature
TPCITEMP	4.0	float	[deg] Telescope primary cell in temperatur
TPCOTEMP	4.1	float	[deg] Telescope primary cell out temperatu
TPR1HUM	0.0	float	Telescope probe 1 humidity
TPR1TEMP	0.0	float	[deg] Telescope probe1 temperature
TPR2HUM	0.0	float	Telescope probe 2 humidity
TPR2TEMP	0.0	float	[deg] Telescope probe2 temperature
TSERVO	40.0	float	Telescope servo setpoint
TTRSTEMP	6.4	float	[deg] Telescope top ring S temperature
TTRWTEMP	6.4	float	[deg] Telescope top ring W temperature
TTRUETBT	-9.6	float	[deg] Telescope truss ETB temperature

continues on

Table 90 – continued from previous page

KEY	Example Value	Type	Comment
TTRUETTT	6.4	float	[deg] Telescope truss ETT temperature
TTRUNTBT	6.0	float	[deg] Telescope truss NTB temperature
TTRUNTTT	6.6	float	[deg] Telescope truss NTT temperature
TTRUSTBT	6.1	float	[deg] Telescope truss STB temperature
TTRUSTST	10.8	float	[deg] Telescope truss STS temperature
TTRUSTTT	6.2	float	[deg] Telescope truss STT temperature
TTRUTSBT	7.0	float	[deg] Telescope truss TSB temperature
TTRUTSMT	6.9	float	[deg] Telescope truss TSM temperature
TTRUTSTT	7.0	float	[deg] Telescope truss TST temperature
TTRUWTBT	5.8	float	[deg] Telescope truss WTB temperature
TTRUWTTT	6.6	float	[deg] Telescope truss WTT temperature
ALARM	F	bool	UPS major alarm or check battery
ALARM-ON	F	bool	UPS active alarm condition
BATTERY	100.0	float	[%] UPS Battery left
SECLEFT	6138.0	float	[s] UPS Seconds left
UPSSTAT	System Normal - On Line(7)	str	UPS Status
INAMPS	67.8	float	[A] UPS total input current
OUTWATTS	5000.0,7000.0,4500.0	str	[W] UPS Phase A, B, C output watts
COMPDEW	-0.5	float	[deg C] Computer room dewpoint
COMPHUM	18.5	float	[%] Computer room humidity
COMPAMB	18.4	float	[deg C] Computer room ambient temperatu
COMPTEMP	25.1	float	[deg C] Computer room hygrometer tempe
DEWPOINT	-9.7	float	[deg C] (outside) dewpoint
HUMIDITY	32.0	float	[%] (outside) humidity
PRESSURE	795.0	float	[torr] (outside) air pressure
OUTTEMP	5.8	float	[deg C] outside temperature
WINDDIR	133.4	float	[deg] wind direction
WINDSPD	21.3	float	[m/s] wind speed
GUST	19.0	float	[m/s] Wind gusts speed
AMNIENTN	13.6	float	[deg C] ambient temperature north
CFLOOR	4.9	float	[deg C] temperature on C floor
NWALLIN	13.8	float	[deg C] temperature at north wall inside
NWALLOUT	5.1	float	[deg C] temperature at north wall outside
WWALLIN	13.4	float	[deg C] temperature at west wall inside
WWALLOUT	5.7	float	[deg C] temperature at west wall outside
AMBIENTS	14.5	float	[deg C] ambient temperature south
FLOOR	11.9	float	[deg C] temperature at floor (LCR)
EWALLCMP	6.1	float	[deg C] temperature at east wall, computer
EWALLCOU	5.7	float	[deg C] temperature at east wall, Coude ro
ROOF	5.5	float	[deg C] temperature on roof
ROOFAMB	5.9	float	[deg C] ambient temperature on roof
DOMEBLOW	6.3	float	[deg C] temperature at dome back, lower
DOMEBUP	6.9	float	[deg C] temperature at dome back, upper
DOMELLOW	5.8	float	[deg C] temperature at dome left, lower
DOMELUP	5.8	float	[deg C] temperature at dome left, upper
DOMERLOW	6.2	float	[deg C] temperature at dome right, lower
DOMERUP	5.9	float	[deg C] temperature at dome right, upper
PLATFORM	5.7	float	[deg C] temperature at platform
SHACKC	15.2	float	[deg C] temperature at shack ceiling

continues on

Table 90 – continued from previous page

KEY	Example Value	Type	Comment
SHACKW	14.2	float	[deg C] temperature at shack wall
STAIRSL	5.8	float	[deg C] temperature at stairs, lower
STAIRSM	5.6	float	[deg C] temperature at stairs, mid
STAIRSU	5.8	float	[deg C] temperature at stairs, upper
TELBASE	4.5	float	[deg C] temperature at telescope base
UTILWALL	6.4	float	[deg C] temperature at utility room wall
UTILROOM	6.3	float	[deg C] temperature in utilitiy room
RADESYS	FK5	str	Coordinate reference frame of major/minor
FILENAME	/exposures/desi/20230224/00168807/gfa-00168807.fits.fz	str	Name of (FI
EXCLUDED		str	Components excluded from this exposure
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
TCSKRA	0 0 0	str	TCS Kalman (RA)
TCSKDEC	0 0 0	str	TCS Kalman (dec)
TCSGRA	0.15	float	TCS simple gain (RA)
TCSGDEC	0.15	float	TCS simple gain (dec)
TCSMFRA	2	int	TCS moving filter length (RA)
TCSMFDEC	2	int	TCS moving filter length (dec)
TCSPIRA	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, s
TCSPIDEC	1.0,0.0,0.0,0.0	str	TCS PI settings (P, I (gain, error window, s
ROLE	GFAMAN	str	
CHECKSUM	TAHAV895TAEAT593	str	HDU checksum updated 2023-02-25T01:5
DATASUM	306780459	str	data unit checksum updated 2023-02-25T0

Data: FITS image [int16 (compressed), 10]

HDU02

EXTNAME = GUIDE0

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	1032	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	GUIDE0	str	Device/controller name
UNIT	0	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	168807	int	Exposure number
EXPFRAME	0	int	Frame number
FRAMES	1	int	Number of Frames in Archive

continues on next page

Table 91 – continued from previous page

KEY	Example Value	Type	Comment
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	GFA	str	OCS Sequence name
OBJECT		str	Object name
PROGRAM	Kickstart Focus Procedure	str	Program name
NIGHT	20230224	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2023-02-25T01:58:27.541024	str	[UTC] Observation data and start time
TIME-OBS	01:58:27.541024	str	[UTC] Observation start time
MJD-OBS	60000.08226321	float	Modified Julian Date of observation
OPENSHUT	2023-02-25T01:58:27.541024	str	[s] Time shutter opened
ST	4:51:50.015	str	Local Sidereal time at observation start (HH:MM
EXPTIME	60.0	float	[s] Actual exposure time
GFATIME	60.0	float	[s] GFA camera exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.0	float	[arcsec] Offset], declination, observer input
TRUSTEMP	6.967	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	5.0	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Equinox of selected coordinate reference frame
MOUNTAZ	269.404239	float	[deg] Mount azimuth angle
MOUNTDEC	31.954914	float	[deg] Mount declination
MOUNTEL	89.388961	float	[deg] Mount elevation angle
MOUNTHA	0.720137	float	[deg] Mount hour angle
SKYDEC	31.954914	float	[deg] Telescope declination (pointing on sky)
SKYRA	71.974937	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	31.954914	float	[deg] Target declination (to TCS)
TARGTRA	71.974937	float	[deg] Target right ascension (to TCS)
HEXPOS	1140.0,-480.0,690.3,-3.0,25.0,0.0	str	Hexapod position
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	-5.6435e-05	float	
CD1_2	1.65e-05	float	
CD2_1	1.7957e-05	float	
CD2_2	5.1854e-05	float	
CRPIX1	1024.1	float	
CRPIX2	513.5	float	
CRVAL1	71.5016	float	
CRVAL2	30.4332	float	
SHAPE	1032,2248	str	
DTYPE	uint16	str	
DOSVER	trunk	str	DOS software version
OVERSCAN	50	int	
DEVICEID	dev10	str	GFA device id (serial number)
GAMBNTT	11.71	float	[deg C] GFA ambient temperature
GFPGAT	33.241	float	[deg C] GFA fpga temperature
GFILTERT	11.675	float	[deg C] GFA filter temperature
GCOLDTEC	11.838	float	[deg C] GFA cold Peltier temperature
GHOTTEC	11.635	float	[deg C] GFA hot Peltier temperature

continues on next page

Table 91 – continued from previous page

KEY	Example Value	Type	Comment
GCCDTEMP	11.838	float	[deg C] GFA CCD temperature
GCAMTEMP	11.675	float	[deg C] GFA camera temperature
GCAMHUM	0.467	float	[%/100] GFA camera humidity
GHUMID2	0.467	float	[%/100] GFA humidity sensor 2
GHUMID3	0.0	float	[%/100]GFA humidity sensor 3
GEXPMODE	normal	str	GFA readout mode (loop/normal)
READOUT	OK	str	
CHECKSUM	gXJAiUJ8gUJAgUJ5	str	HDU checksum updated 2023-02-25T01:59:31
DATASUM	3489471984	str	data unit checksum updated 2023-02-25T01:59:31

Data: FITS image [int16 (compressed), 2248x1032]

HDU03

EXTNAME = FOCUS9

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	1032	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	FOCUS9	str	Device/controller name
UNIT	9	int	Unit number/letter
UNITTYPE	FOCUS	str	Image Sources/Component
EXPID	168807	int	Exposure number
EXPFRAME	0	int	Frame number
FRAMES	1	int	Number of Frames in Archive
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	GFA	str	OCS Sequence name
OBJECT		str	Object name
PROGRAM	Kickstart Focus Procedure	str	Program name
NIGHT	20230224	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2023-02-25T01:58:27.546749	str	[UTC] Observation data and start time
TIME-OBS	01:58:27.546749	str	[UTC] Observation start time
MJD-OBS	60000.08226327	float	Modified Julian Date of observation
OPENSHUT	2023-02-25T01:58:27.546749	str	[s] Time shutter opened
ST	4:51:50.0253	str	Local Sidereal time at observation start (HH:MM
EXPTIME	60.0	float	[s] Actual exposure time
GFATIME	60.0	float	[s] GFA camera exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.0	float	[arcsec] Offset], declination, observer input
TRUSTEMP	6.967	float	[deg] Average Telescope truss temperature (only

continues on next page

Table 92 – continued from previous page

KEY	Example Value	Type	Comment
PMIRTEMP	5.0	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Equinox of selected coordinate reference frame
MOUNTAZ	269.404239	float	[deg] Mount azimuth angle
MOUNTDEC	31.954914	float	[deg] Mount declination
MOUNTEL	89.388961	float	[deg] Mount elevation angle
MOUNTHA	0.720137	float	[deg] Mount hour angle
SKYDEC	31.954914	float	[deg] Telescope declination (pointing on sky)
SKYRA	71.974937	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	31.954914	float	[deg] Target declination (to TCS)
TARGTRA	71.974937	float	[deg] Target right ascension (to TCS)
HEXPOS	1140.0,-480.0,690.3,-3.0,25.0,0.0	str	Hexapod position
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	-5.6403e-05	float	
CD1_2	-1.6591e-05	float	
CD2_1	-1.8057e-05	float	
CD2_2	5.1824e-05	float	
CRPIX1	1024.5	float	
CRPIX2	516.5	float	
CRVAL1	72.6287	float	
CRVAL2	30.4828	float	
SHAPE	1032,2248	str	
DTYPE	uint16	str	
DOSVER	trunk	str	DOS software version
OVERSCAN	50	int	
DEVICEID	dev03	str	GFA device id (serial number)
GAMBNTT	11.6	float	[deg C] GFA ambient temperature
GFPGAT	35.332	float	[deg C] GFA fpga temperature
GFILTERT	11.67	float	[deg C] GFA filter temperature
GCOLDTEC	11.849	float	[deg C] GFA cold Peltier temperature
GHOTTEC	11.678	float	[deg C] GFA hot Peltier temperature
GCCDTEMP	11.849	float	[deg C] GFA CCD temperature
GCAMTEMP	11.67	float	[deg C] GFA camera temperature
GCAMHUM	0.0	float	[%/100] GFA camera humidity
GHUMID2	0.0	float	[%/100] GFA humidity sensor 2
GHUMID3	0.0	float	[%/100]GFA humidity sensor 3
GEXPMODE	normal	str	GFA readout mode (loop/normal)
READOUT	OK	str	
CHECKSUM	dR8EfQ6DdQ6DdQ6D	str	HDU checksum updated 2023-02-25T01:59:31
DATASUM	56345574	str	data unit checksum updated 2023-02-25T01:59:31

Data: FITS image [int16 (compressed), 2248x1032]

HDU04

EXTNAME = FOCUS1

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	1032	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	FOCUS1	str	Device/controller name
UNIT	1	int	Unit number/letter
UNITTYPE	FOCUS	str	Image Sources/Component
EXPID	168807	int	Exposure number
EXPFRAME	0	int	Frame number
FRAMES	1	int	Number of Frames in Archive
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	GFA	str	OCS Sequence name
OBJECT		str	Object name
PROGRAM	Kickstart Focus Procedure	str	Program name
NIGHT	20230224	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2023-02-25T01:58:27.543959	str	[UTC] Observation data and start time
TIME-OBS	01:58:27.543959	str	[UTC] Observation start time
MJD-OBS	60000.08226324	float	Modified Julian Date of observation
OPENSHUT	2023-02-25T01:58:27.543959	str	[s] Time shutter opened
ST	4:51:50.8273	str	Local Sidereal time at observation start (HH:MM
EXPTIME	60.0	float	[s] Actual exposure time
GFATIME	60.0	float	[s] GFA camera exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.0	float	[arcsec] Offset], declination, observer input
TRUSTEMP	6.967	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	5.0	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Equinox of selected coordinate reference frame
MOUNTAZ	269.404239	float	[deg] Mount azimuth angle
MOUNTDEC	31.954914	float	[deg] Mount declination
MOUNTEL	89.388961	float	[deg] Mount elevation angle
MOUNTHA	0.720137	float	[deg] Mount hour angle
SKYDEC	31.954914	float	[deg] Telescope declination (pointing on sky)
SKYRA	71.974937	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	31.954914	float	[deg] Target declination (to TCS)
TARGTRA	71.974937	float	[deg] Target right ascension (to TCS)
HEXPOS	1140.0,-480.0,690.3,-3.0,25.0,0.0	str	Hexapod position
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	

continues on next page

Table 93 – continued from previous page

KEY	Example Value	Type	Comment
CD1_1	-3.5521e-05	float	
CD1_2	4.3542e-05	float	
CD2_1	4.7389e-05	float	
CD2_2	3.2637e-05	float	
CRPIX1	1024.5	float	
CRPIX2	516.5	float	
CRVAL1	70.5475	float	
CRVAL2	30.9564	float	
SHAPE	1032,2248	str	
DTYPE	uint16	str	
DOSVER	trunk	str	DOS software version
OVERSCAN	50	int	
DEVICEID	dev05	str	GFA device id (serial number)
GAMBNTT	11.707	float	[deg C] GFA ambient temperature
GFPGAT	32.625	float	[deg C] GFA fpga temperature
GFILTERT	11.712	float	[deg C] GFA filter temperature
GCOLDTEC	12.07	float	[deg C] GFA cold Peltier temperature
GHOTTEC	11.787	float	[deg C] GFA hot Peltier temperature
GCCDTEMP	12.07	float	[deg C] GFA CCD temperature
GCAMTEMP	11.712	float	[deg C] GFA camera temperature
GCAMHUM	0.0	float	[%/100] GFA camera humidity
GHUMID2	0.0	float	[%/100] GFA humidity sensor 2
GHUMID3	0.0	float	[%/100]GFA humidity sensor 3
GEXPMODE	normal	str	GFA readout mode (loop/normal)
READOUT	OK	str	
CHECKSUM	JJAaLH1XJH8aJH8U	str	HDU checksum updated 2023-02-25T01:59:32
DATASUM	745303104	str	data unit checksum updated 2023-02-25T01:59:32

Data: FITS image [int16 (compressed), 2248x1032]

HDU05

EXTNAME = FOCUS4

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	1032	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	FOCUS4	str	Device/controller name
UNIT	4	int	Unit number/letter
UNITTYPE	FOCUS	str	Image Sources/Component
EXPID	168807	int	Exposure number

continues on next page

Table 94 – continued from previous page

KEY	Example Value	Type	Comment
EXPFRAME	0	int	Frame number
FRAMES	1	int	Number of Frames in Archive
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	GFA	str	OCS Sequence name
OBJECT		str	Object name
PROGRAM	Kickstart Focus Procedure	str	Program name
NIGHT	20230224	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2023-02-25T01:58:27.546248	str	[UTC] Observation data and start time
TIME-OBS	01:58:27.546248	str	[UTC] Observation start time
MJD-OBS	60000.08226327	float	Modified Julian Date of observation
OPENSHUT	2023-02-25T01:58:27.546248	str	[s] Time shutter opened
ST	4:51:50.1021	str	Local Sidereal time at observation start (HH:MM
EXPTIME	60.0	float	[s] Actual exposure time
GFATIME	60.0	float	[s] GFA camera exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.0	float	[arcsec] Offset], declination, observer input
TRUSTEMP	6.967	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	5.0	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Equinox of selected coordinate reference frame
MOUNTAZ	269.404239	float	[deg] Mount azimuth angle
MOUNTDEC	31.954914	float	[deg] Mount declination
MOUNTEL	89.388961	float	[deg] Mount elevation angle
MOUNTHA	0.720137	float	[deg] Mount hour angle
SKYDEC	31.954914	float	[deg] Telescope declination (pointing on sky)
SKYRA	71.974937	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	31.954914	float	[deg] Target declination (to TCS)
TARGTRA	71.974937	float	[deg] Target right ascension (to TCS)
HEXPOS	1140.0,-480.0,690.3,-3.0,25.0,0.0	str	Hexapod position
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	5.6177e-05	float	
CD1_2	1.7223e-05	float	
CD2_1	1.8745e-05	float	
CD2_2	-5.1616e-05	float	
CRPIX1	1024.5	float	
CRPIX2	516.5	float	
CRVAL1	71.2999	float	
CRVAL2	33.4235	float	
SHAPE	1032,2248	str	
DTYPE	uint16	str	
DOSVER	trunk	str	DOS software version
OVERSCAN	50	int	
DEVICEID	dev07	str	GFA device id (serial number)
GAMBNTT	11.798	float	[deg C] GFA ambient temperature
GFPGAT	33.364	float	[deg C] GFA fpga temperature
GFILTERT	11.763	float	[deg C] GFA filter temperature

continues on next page

Table 94 – continued from previous page

KEY	Example Value	Type	Comment
GCOLDTEC	12.097	float	[deg C] GFA cold Peltier temperature
GHOTTEC	11.827	float	[deg C] GFA hot Peltier temperature
GCCDTEMP	12.097	float	[deg C] GFA CCD temperature
GCAMTEMP	11.763	float	[deg C] GFA camera temperature
GCAMHUM	0.0	float	[%/100] GFA camera humidity
GHUMID2	0.0	float	[%/100] GFA humidity sensor 2
GHUMID3	0.0	float	[%/100]GFA humidity sensor 3
GEXPMODE	normal	str	GFA readout mode (loop/normal)
READOUT	OK	str	
CHECKSUM	78F898E578E578E5	str	HDU checksum updated 2023-02-25T01:59:32
DATASUM	874713498	str	data unit checksum updated 2023-02-25T01:59:32

Data: FITS image [int16 (compressed), 2248x1032]

HDU06

EXTNAME = GUIDE3

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	1032	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	GUIDE3	str	Device/controller name
UNIT	3	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	168807	int	Exposure number
EXPFRAME	0	int	Frame number
FRAMES	1	int	Number of Frames in Archive
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	GFA	str	OCS Sequence name
OBJECT		str	Object name
PROGRAM	Kickstart Focus Procedure	str	Program name
NIGHT	20230224	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2023-02-25T01:58:27.542072	str	[UTC] Observation data and start time
TIME-OBS	01:58:27.542072	str	[UTC] Observation start time
MJD-OBS	60000.08226322	float	Modified Julian Date of observation
OPENSHUT	2023-02-25T01:58:27.542072	str	[s] Time shutter opened
ST	4:51:50.3575	str	Local Sidereal time at observation start (HH:MM
EXPTIME	60.0	float	[s] Actual exposure time
GFATIME	60.0	float	[s] GFA camera exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer inp

continues on next page

Table 95 – continued from previous page

KEY	Example Value	Type	Comment
DELTADEC	0.0	float	[arcsec] Offset], declination, observer input
TRUSTEMP	6.967	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	5.0	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Equinox of selected coordinate reference frame
MOUNTAZ	269.404239	float	[deg] Mount azimuth angle
MOUNTDEC	31.954914	float	[deg] Mount declination
MOUNTEL	89.388961	float	[deg] Mount elevation angle
MOUNTHA	0.720137	float	[deg] Mount hour angle
SKYDEC	31.954914	float	[deg] Telescope declination (pointing on sky)
SKYRA	71.974937	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	31.954914	float	[deg] Target declination (to TCS)
TARGTRA	71.974937	float	[deg] Target right ascension (to TCS)
HEXPOS	1140.0,-480.0,690.3,-3.0,25.0,0.0	str	Hexapod position
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	3.403e-05	float	
CD1_2	4.4534e-05	float	
CD2_1	4.8469e-05	float	
CD2_2	-3.1267e-05	float	
CRPIX1	1004.23	float	
CRPIX2	503.43	float	
CRVAL1	70.4043	float	
CRVAL2	32.8036	float	
SHAPE	1032,2248	str	
DTYPE	uint16	str	
DOSVER	trunk	str	DOS software version
OVERSCAN	50	int	
DEVICEID	dev02	str	GFA device id (serial number)
GAMBNTT	11.838	float	[deg C] GFA ambient temperature
GFPGAT	34.84	float	[deg C] GFA fpga temperature
GFILTERT	11.793	float	[deg C] GFA filter temperature
GCOLDTEC	11.99	float	[deg C] GFA cold Peltier temperature
GHOTTEC	11.907	float	[deg C] GFA hot Peltier temperature
GCCDTEMP	11.99	float	[deg C] GFA CCD temperature
GCAMTEMP	11.793	float	[deg C] GFA camera temperature
GCAMHUM	0.0	float	[%/100] GFA camera humidity
GHUMID2	0.0	float	[%/100] GFA humidity sensor 2
GHUMID3	0.0	float	[%/100]GFA humidity sensor 3
GEXPMODE	normal	str	GFA readout mode (loop/normal)
READOUT	OK	str	
CHECKSUM	3NGeAMEc5MEcAMEc	str	HDU checksum updated 2023-02-25T01:59:32
DATASUM	4112356301	str	data unit checksum updated 2023-02-25T01:59:32

Data: FITS image [int16 (compressed), 2248x1032]

HDU07

EXTNAME = GUIDE7

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	1032	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	GUIDE7	str	Device/controller name
UNIT	7	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	168807	int	Exposure number
EXPFRAME	0	int	Frame number
FRAMES	1	int	Number of Frames in Archive
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	GFA	str	OCS Sequence name
OBJECT		str	Object name
PROGRAM	Kickstart Focus Procedure	str	Program name
NIGHT	20230224	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2023-02-25T01:58:27.546379	str	[UTC] Observation data and start time
TIME-OBS	01:58:27.546379	str	[UTC] Observation start time
MJD-OBS	60000.08226327	float	Modified Julian Date of observation
OPENSHUT	2023-02-25T01:58:27.546379	str	[s] Time shutter opened
ST	4:51:50.0216	str	Local Sidereal time at observation start (HH:MM
EXPTIME	60.0	float	[s] Actual exposure time
GFATIME	60.0	float	[s] GFA camera exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.0	float	[arcsec] Offset], declination, observer input
TRUSTEMP	6.967	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	5.0	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Equinox of selected coordinate reference frame
MOUNTAZ	269.404239	float	[deg] Mount azimuth angle
MOUNTDEC	31.954914	float	[deg] Mount declination
MOUNTEL	89.388961	float	[deg] Mount elevation angle
MOUNTHA	0.720137	float	[deg] Mount hour angle
SKYDEC	31.954914	float	[deg] Telescope declination (pointing on sky)
SKYRA	71.974937	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	31.954914	float	[deg] Target declination (to TCS)
TARGTRA	71.974937	float	[deg] Target right ascension (to TCS)
HEXPOS	1140.0,-480.0,690.3,-3.0,25.0,0.0	str	Hexapod position
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	

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Table 96 – continued from previous page

KEY	Example Value	Type	Comment
CD1_1	-9.1428e-07	float	
CD1_2	-5.4407e-05	float	
CD2_1	-5.9215e-05	float	
CD2_2	8.4006e-07	float	
CRPIX1	1031.43	float	
CRPIX2	503.9	float	
CRVAL1	73.8298	float	
CRVAL2	32.0231	float	
SHAPE	1032,2248	str	
DTYPE	uint16	str	
DOSVER	trunk	str	DOS software version
OVERSCAN	50	int	
DEVICEID	dev01	str	GFA device id (serial number)
GAMBNTT	11.493	float	[deg C] GFA ambient temperature
GFPGAT	32.133	float	[deg C] GFA fpga temperature
GFILTERT	-45.0	float	[deg C] GFA filter temperature
GCOLDTEC	11.803	float	[deg C] GFA cold Peltier temperature
GHOTTEC	11.638	float	[deg C] GFA hot Peltier temperature
GCCDTEMP	11.803	float	[deg C] GFA CCD temperature
GCAMTEMP	-45.0	float	[deg C] GFA camera temperature
GCAMHUM	0.0	float	[%/100] GFA camera humidity
GHUMID2	0.0	float	[%/100] GFA humidity sensor 2
GHUMID3	0.0	float	[%/100]GFA humidity sensor 3
GEXPMODE	normal	str	GFA readout mode (loop/normal)
READOUT	OK	str	
CHECKSUM	NhPkNhNjNhNjNhNj	str	HDU checksum updated 2023-02-25T01:59:32
DATASUM	1863549263	str	data unit checksum updated 2023-02-25T01:59:32

Data: FITS image [int16 (compressed), 2248x1032]

HDU08

EXTNAME = GUIDE5

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	1032	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	GUIDE5	str	Device/controller name
UNIT	5	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	168807	int	Exposure number

continues on next page

Table 97 – continued from previous page

KEY	Example Value	Type	Comment
EXPFRAME	0	int	Frame number
FRAMES	1	int	Number of Frames in Archive
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	GFA	str	OCS Sequence name
OBJECT		str	Object name
PROGRAM	Kickstart Focus Procedure	str	Program name
NIGHT	20230224	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2023-02-25T01:58:27.542201	str	[UTC] Observation data and start time
TIME-OBS	01:58:27.542201	str	[UTC] Observation start time
MJD-OBS	60000.08226322	float	Modified Julian Date of observation
OPENSHUT	2023-02-25T01:58:27.542201	str	[s] Time shutter opened
ST	4:51:50.0184	str	Local Sidereal time at observation start (HH:MM
EXPTIME	60.0	float	[s] Actual exposure time
GFATIME	60.0	float	[s] GFA camera exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.0	float	[arcsec] Offset], declination, observer input
TRUSTEMP	6.967	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	5.0	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Equinox of selected coordinate reference frame
MOUNTAZ	269.404239	float	[deg] Mount azimuth angle
MOUNTDEC	31.954914	float	[deg] Mount declination
MOUNTEL	89.388961	float	[deg] Mount elevation angle
MOUNTHA	0.720137	float	[deg] Mount hour angle
SKYDEC	31.954914	float	[deg] Telescope declination (pointing on sky)
SKYRA	71.974937	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	31.954914	float	[deg] Target declination (to TCS)
TARGTRA	71.974937	float	[deg] Target right ascension (to TCS)
HEXPOS	1140.0,-480.0,690.3,-3.0,25.0,0.0	str	Hexapod position
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	5.6271e-05	float	
CD1_2	-1.6963e-05	float	
CD2_1	-1.8461e-05	float	
CD2_2	-5.1702e-05	float	
CRPIX1	1019.63	float	
CRPIX2	507.57	float	
CRVAL1	72.4643	float	
CRVAL2	33.4748	float	
SHAPE	1032,2248	str	
DTYPE	uint16	str	
DOSVER	trunk	str	DOS software version
OVERSCAN	50	int	
DEVICEID	dev08	str	GFA device id (serial number)
GAMBNTT	11.771	float	[deg C] GFA ambient temperature
GFPGAT	33.61	float	[deg C] GFA fpga temperature
GFILTERT	11.763	float	[deg C] GFA filter temperature

continues on next page

Table 97 – continued from previous page

KEY	Example Value	Type	Comment
GCOLDTEC	12.02	float	[deg C] GFA cold Peltier temperature
GHOTTEC	11.803	float	[deg C] GFA hot Peltier temperature
GCCDTEMP	12.02	float	[deg C] GFA CCD temperature
GCAMTEMP	11.763	float	[deg C] GFA camera temperature
GCAMHUM	0.0	float	[%/100] GFA camera humidity
GHUMID2	0.0	float	[%/100] GFA humidity sensor 2
GHUMID3	0.0	float	[%/100]GFA humidity sensor 3
GEXPMODE	normal	str	GFA readout mode (loop/normal)
READOUT	OK	str	
CHECKSUM	oeaCqdYCodaCodWC	str	HDU checksum updated 2023-02-25T01:59:32
DATASUM	2464151765	str	data unit checksum updated 2023-02-25T01:59:32

Data: FITS image [int16 (compressed), 2248x1032]

HDU09

EXTNAME = GUIDE2

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	1032	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	GUIDE2	str	Device/controller name
UNIT	2	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	168807	int	Exposure number
EXPFRAME	0	int	Frame number
FRAMES	1	int	Number of Frames in Archive
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	GFA	str	OCS Sequence name
OBJECT		str	Object name
PROGRAM	Kickstart Focus Procedure	str	Program name
NIGHT	20230224	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2023-02-25T01:58:27.543003	str	[UTC] Observation data and start time
TIME-OBS	01:58:27.543003	str	[UTC] Observation start time
MJD-OBS	60000.08226323	float	Modified Julian Date of observation
OPENSHUT	2023-02-25T01:58:27.543003	str	[s] Time shutter opened
ST	4:51:50.1039	str	Local Sidereal time at observation start (HH:MM
EXPTIME	60.0	float	[s] Actual exposure time
GFATIME	60.0	float	[s] GFA camera exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer inp

continues on next page

Table 98 – continued from previous page

KEY	Example Value	Type	Comment
DELTADEC	0.0	float	[arcsec] Offset], declination, observer input
TRUSTEMP	6.967	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	5.0	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Equinox of selected coordinate reference frame
MOUNTAZ	269.404239	float	[deg] Mount azimuth angle
MOUNTDEC	31.954914	float	[deg] Mount declination
MOUNTEL	89.388961	float	[deg] Mount elevation angle
MOUNTHA	0.720137	float	[deg] Mount hour angle
SKYDEC	31.954914	float	[deg] Telescope declination (pointing on sky)
SKYRA	71.974937	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	31.954914	float	[deg] Target declination (to TCS)
TARGTRA	71.974937	float	[deg] Target right ascension (to TCS)
HEXPOS	1140.0,-480.0,690.3,-3.0,25.0,0.0	str	Hexapod position
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	-1.1129e-06	float	
CD1_2	5.4405e-05	float	
CD2_1	5.9213e-05	float	
CD2_2	1.0225e-06	float	
CRPIX1	1020.17	float	
CRPIX2	504.83	float	
CRVAL1	70.1233	float	
CRVAL2	31.8598	float	
SHAPE	1032,2248	str	
DTYPE	uint16	str	
DOSVER	trunk	str	DOS software version
OVERSCAN	50	int	
DEVICEID	dev06	str	GFA device id (serial number)
GAMBNTT	11.771	float	[deg C] GFA ambient temperature
GFPGAT	33.979	float	[deg C] GFA fpga temperature
GFILTERT	11.83	float	[deg C] GFA filter temperature
GCOLDTEC	11.979	float	[deg C] GFA cold Peltier temperature
GHOTTEC	11.915	float	[deg C] GFA hot Peltier temperature
GCCDTEMP	11.979	float	[deg C] GFA CCD temperature
GCAMTEMP	11.83	float	[deg C] GFA camera temperature
GCAMHUM	0.0	float	[%/100] GFA camera humidity
GHUMID2	0.0	float	[%/100] GFA humidity sensor 2
GHUMID3	0.0	float	[%/100]GFA humidity sensor 3
GEXPMODE	normal	str	GFA readout mode (loop/normal)
READOUT	OK	str	
CHECKSUM	7O3i7M0Z7M0f7M0Z	str	HDU checksum updated 2023-02-25T01:59:32
DATASUM	3563886804	str	data unit checksum updated 2023-02-25T01:59:32

Data: FITS image [int16 (compressed), 2248x1032]

HDU10

EXTNAME = FOCUS6

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	1032	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	FOCUS6	str	Device/controller name
UNIT	6	int	Unit number/letter
UNITTYPE	FOCUS	str	Image Sources/Component
EXPID	168807	int	Exposure number
EXPFRAME	0	int	Frame number
FRAMES	1	int	Number of Frames in Archive
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	GFA	str	OCS Sequence name
OBJECT		str	Object name
PROGRAM	Kickstart Focus Procedure	str	Program name
NIGHT	20230224	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2023-02-25T01:58:27.544487	str	[UTC] Observation data and start time
TIME-OBS	01:58:27.544487	str	[UTC] Observation start time
MJD-OBS	60000.08226325	float	Modified Julian Date of observation
OPENSHUT	2023-02-25T01:58:27.544487	str	[s] Time shutter opened
ST	4:51:50.1179	str	Local Sidereal time at observation start (HH:MM
EXPTIME	60.0	float	[s] Actual exposure time
GFATIME	60.0	float	[s] GFA camera exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.0	float	[arcsec] Offset], declination, observer input
TRUSTEMP	6.967	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	5.0	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Equinox of selected coordinate reference frame
MOUNTAZ	269.404239	float	[deg] Mount azimuth angle
MOUNTDEC	31.954914	float	[deg] Mount declination
MOUNTEL	89.388961	float	[deg] Mount elevation angle
MOUNTHA	0.720137	float	[deg] Mount hour angle
SKYDEC	31.954914	float	[deg] Telescope declination (pointing on sky)
SKYRA	71.974937	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	31.954914	float	[deg] Target declination (to TCS)
TARGTRA	71.974937	float	[deg] Target right ascension (to TCS)
HEXPOS	1140.0,-480.0,690.3,-3.0,25.0,0.0	str	Hexapod position
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	

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Table 99 – continued from previous page

KEY	Example Value	Type	Comment
CD1_1	3.4242e-05	float	
CD1_2	-4.4396e-05	float	
CD2_1	-4.8319e-05	float	
CD2_2	-3.1462e-05	float	
CRPIX1	1024.5	float	
CRPIX2	516.5	float	
CRVAL1	73.4335	float	
CRVAL2	32.937	float	
SHAPE	1032,2248	str	
DTYPE	uint16	str	
DOSVER	trunk	str	DOS software version
OVERSCAN	50	int	
DEVICEID	dev13	str	GFA device id (serial number)
GAMBNTT	11.707	float	[deg C] GFA ambient temperature
GFPGAT	33.733	float	[deg C] GFA fpga temperature
GFILTERT	11.664	float	[deg C] GFA filter temperature
GCOLDTEC	11.942	float	[deg C] GFA cold Peltier temperature
GHOTTEC	11.744	float	[deg C] GFA hot Peltier temperature
GCCDTEMP	11.942	float	[deg C] GFA CCD temperature
GCAMTEMP	11.664	float	[deg C] GFA camera temperature
GCAMHUM	2.87	float	[%/100] GFA camera humidity
GHUMID2	2.87	float	[%/100] GFA humidity sensor 2
GHUMID3	0.0	float	[%/100]GFA humidity sensor 3
GEXPMODE	normal	str	GFA readout mode (loop/normal)
READOUT	OK	str	
CHECKSUM	9oYA9mY59mYA9mY5	str	HDU checksum updated 2023-02-25T01:59:32
DATASUM	1254217566	str	data unit checksum updated 2023-02-25T01:59:32

Data: FITS image [int16 (compressed), 2248x1032]

HDU11

EXTNAME = GUIDE8

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	1032	int	number of rows in table
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	GUIDE8	str	Device/controller name
UNIT	8	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	168807	int	Exposure number

continues on next page

Table 100 – continued from previous page

KEY	Example Value	Type	Comment
EXPFRAME	0	int	Frame number
FRAMES	1	int	Number of Frames in Archive
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	GFA	str	OCS Sequence name
OBJECT		str	Object name
PROGRAM	Kickstart Focus Procedure	str	Program name
NIGHT	20230224	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2023-02-25T01:58:27.544653	str	[UTC] Observation data and start time
TIME-OBS	01:58:27.544653	str	[UTC] Observation start time
MJD-OBS	60000.08226325	float	Modified Julian Date of observation
OPENSHUT	2023-02-25T01:58:27.544653	str	[s] Time shutter opened
ST	4:51:50.1118	str	Local Sidereal time at observation start (HH:MM
EXPTIME	60.0	float	[s] Actual exposure time
GFATIME	60.0	float	[s] GFA camera exposure time
DELTARA	0.0	float	[arcsec] Offset], right ascension, observer inp
DELTADEC	0.0	float	[arcsec] Offset], declination, observer input
TRUSTEMP	6.967	float	[deg] Average Telescope truss temperature (only
PMIRTEMP	5.0	float	[deg] Average primary mirror temperature (nit,e
EQUINOX	2000.0	float	Equinox of selected coordinate reference frame
MOUNTAZ	269.404239	float	[deg] Mount azimuth angle
MOUNTDEC	31.954914	float	[deg] Mount declination
MOUNTEL	89.388961	float	[deg] Mount elevation angle
MOUNTHA	0.720137	float	[deg] Mount hour angle
SKYDEC	31.954914	float	[deg] Telescope declination (pointing on sky)
SKYRA	71.974937	float	[deg] Telescope right ascension (pointing on sk
TARGTDEC	31.954914	float	[deg] Target declination (to TCS)
TARGTRA	71.974937	float	[deg] Target right ascension (to TCS)
HEXPOS	1140.0,-480.0,690.3,-3.0,25.0,0.0	str	Hexapod position
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor axes
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	-3.5408e-05	float	
CD1_2	-4.3618e-05	float	
CD2_1	-4.7472e-05	float	
CD2_2	3.2533e-05	float	
CRPIX1	1036.7	float	
CRPIX2	522.17	float	
CRVAL1	73.5165	float	
CRVAL2	31.0872	float	
SHAPE	1032,2248	str	
DTYPE	uint16	str	
DOSVER	trunk	str	DOS software version
OVERSCAN	50	int	
DEVICEID	dev04	str	GFA device id (serial number)
GAMBNTT	11.531	float	[deg C] GFA ambient temperature
GFPGAT	33.856	float	[deg C] GFA fpga temperature
GFILTERT	11.464	float	[deg C] GFA filter temperature

continues on next page

Table 100 – continued from previous page

KEY	Example Value	Type	Comment
GCOLDTEC	11.79	float	[deg C] GFA cold Peltier temperature
GHOTTEC	11.52	float	[deg C] GFA hot Peltier temperature
GCCDTEMP	11.79	float	[deg C] GFA CCD temperature
GCAMTEMP	11.464	float	[deg C] GFA camera temperature
GCAMHUM	2.313	float	[%/100] GFA camera humidity
GHUMID2	2.313	float	[%/100] GFA humidity sensor 2
GHUMID3	0.0	float	[%/100]GFA humidity sensor 3
GEXPMODE	normal	str	GFA readout mode (loop/normal)
READOUT	OK	str	
CHECKSUM	fgachdUbfdabfdUb	str	HDU checksum updated 2023-02-25T01:59:32
DATASUM	2242340315	str	data unit checksum updated 2023-02-25T01:59:32

Data: FITS image [int16 (compressed), 2248x1032]

guide-EXPID

Summary
Raw data from the 6 in-focus GFA cameras captured during a DESI spectrograph exposure.

Naming Convention
`guide-EXPID.fits.fz`, where `EXPID` is the zero-padded 8-digit exposure ID. Sometimes `EXPID` takes the form `EXPID-0000`. Sometimes the `.fz` is missing.

Regex
`guide-[0-9]{8}(-[0-9]{4})?\.fits(\.fz)?`

File Type
FITS, 732 MB

Contents

Number	EXTNAME	Type	Contents
HDU00	GUIDER	Empty HDU	Header keywords only
HDU01	PMGSTARS	BINTABLE	PlateMaker star table
HDU02	GUIDE5	Compressed IMAGE	GUIDE5 image cube
HDU03	GUIDE5T	BINTABLE	GUIDE5 image cube metadata
HDU04	GUIDE3	Compressed IMAGE	GUIDE3 image cube
HDU05	GUIDE3T	BINTABLE	GUIDE3 image cube metadata
HDU06	GUIDE2	Compressed IMAGE	GUIDE2 image cube
HDU07	GUIDE2T	BINTABLE	GUIDE2 image cube metadata
HDU08	GUIDE7	Compressed IMAGE	GUIDE7 image cube
HDU09	GUIDE7T	BINTABLE	GUIDE7 image cube metadata
HDU10	GUIDE8	Compressed IMAGE	GUIDE8 image cube
HDU11	GUIDE8T	BINTABLE	GUIDE8 image cube metadata
HDU12	GUIDE0	Compressed IMAGE	GUIDE0 image cube
HDU13	GUIDE0T	BINTABLE	GUIDE0 image cube metadata

GFA raw data is used to acuquire a new field, guide the telescope, determine the mapping from sky coordinates to focal-plane coordinates, and estimate the accumulated signal to noise in the spectrographs.

One option for reducing GFA raw data is to use the `desietc.gfa` module.

The GUIDEn data will be 3D[nframes, ny, nx] such that `data[i]` is the 2D GFA frame number `i`. Row `i` of the GUIDEnT table will contain the metadata about that frame, for example the `DATE-OBS` and `EXPTIME`. The image cubes include the overscan and prescan; `nx` is 2248 and *ny* is 1032. The active image area is 2048 by 1032 pixels once overscan and prescan have been removed.

Note that other than the blank data primary HDU, the order of the other HDUs is arbitrary and some GUIDEn(T) HDUs may even be missing. The nominal set (0,2,3,5,7,8) is the plan for full DESI, but particularly during commissioning other subsets will appear in the data. Also note that the acquisition image is frame `i = 0` when there is an acquisition image (a `sequence=DESI` exposure has an acquisition image but a `sequence=_Split` exposure does not, for example).

Other than the name and number of the HDUs, the structure of this format is identical to the focus GFA raw data.

FITS Header Units

HDU00

EXTNAME = GUIDER

Blank data HDU with a header that contains a lot of exposure-level metadata.

Required Header Keywords

KEY	Example Value	Type	Comm
MODULE	GUIDE	str	Image
EXPID	118526	int	Expos
FRAMES	72	int	Numb
COSMSPLT	F	bool	Cosm
MAXSPLIT	0	int	Numb
VISITIDS	118524	str	List o
TILEID	4403	int	DESI
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber
FLAVOR	science	str	Obser
OBSTYPE	SCIENCE	str	Spectr
SEQUENCE	DESI	str	OCS S
MANIFEST	F	bool	DOS
OBJECT		str	Objec
PURPOSE	Main Survey	str	Purpo
PROGRAM	DARK	str	Progra
NTSSURVY	main	str	NTS s
NTSPROG	DARK	str	NTS p
SBPROF	ELG	str	Profil
MAXTIME	5400.0	float	[s] Ma
ESTTIME	3705.79	float	[s] Es
MINTIME	300.0	float	[s] Mi
MIDTIME	915.0	float	[s] Ex
PROPID	2020B-5000	str	Propo
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Name
LEAD	Martin Landriau	str	Lead
INSTRUME	DESI	str	Instru

Table 101 – continued from previous page

KEY	Example Value	Type	Comm
OBSERVAT	KPNO	str	Obser
OBS-LAT	31.96403	str	[deg]
OBS-LONG	-111.59989	str	[deg]
OBS-ELEV	2097.0	float	[m] O
TELESCOP	KPNO 4.0-m telescope	str	Telesc
CORRCTOR	DESI Corrector	str	Corre
SEQNUM	1	int	Numb
NIGHT	20220113	int	Obser
SEQSTART	2022-01-14T10:13:58.576904	str	Start t
TIMESYS	UTC	str	Time
DATE-OBS	2022-01-14T11:03:58.319124	str	[UTC
MJD-OBS	59593.46109166	float	Modif
STARTADJ	2022-01-14T10:14:26.234369	str	Time
OPENSHUT	2022-01-14T11:03:58.319124	str	Time
CAMSHUT	open	str	Shutte
ST	11:13:16.9528	str	Local
EXPTIME	5.0	float	[s] Ac
ACQTIME	15.0	float	[s] acc
GUIDTIME	5.0	float	[s] gu
FOCSTIME	60.0	float	[s] foc
SKYTIME	60.0	float	[s] sky
REQRA	170.239	float	[deg]
REQDEC	-7.093	float	[deg]
DELTARA	None	Unknown	[arcse
DELTADEC	None	Unknown	[arcse
WHITESPT	F	bool	Telesc
ZENITH	F	bool	Telesc
SEANNEX	F	bool	Telesc
BEYONDP	F	bool	Telesc
AIRMASS	1.331363	float	Airma
FOCUS	948.5,-231.1,-91.3,-18.3,10.0,126.3	str	Telesc
VCCD	ON	str	True (
TRUSTEMP	12.4	float	[deg]
PMIRTEMP	11.662	float	[deg]
PMREADY	T	bool	Prima
PMCOVER	open	str	Prima
PMCOOL	off	str	Prima
DOMSHUTU	open	str	Upper
DOMSHUTL	open	str	Lower
DOMLIGHH	off	str	High (
DOMLIGHL	off	str	Low d
DOMEAZ	165.277	float	[deg]
DOMINPOS	T	bool	Dome
EPOCH	2000.0	float	Epoch
GUIDOFFR	0.0	float	[arcse
GUIDOFFD	-0.0	float	[arcse
SUNRA	296.113998	float	[deg]
SUNDEC	-21.270133	float	[deg]
MOONDEC	23.881736	float	[deg]

Table 101 – continued from previous page

KEY	Example Value	Type	Comm
MOONRA	73.512629	float	[deg]
MOONSEP	99.425	float	[deg]
SLEWANGL	5.795	float	[deg]
SLEWTIME	31.341	float	[s] Sle
MOUNTAZ	158.328478	float	[deg]
MOUNTDEC	-7.10233	float	[deg]
MOUNTEL	48.640103	float	[deg]
MOUNTHA	-14.235346	float	[deg]
INCTRL	T	bool	DESI
INPOS	T	bool	Moun
MNTOFFD	-0.0	float	[arcse
MNTOFFR	-0.0	float	[arcse
PARALLAC	-18.404235	float	[deg]
SKYDEC	-7.10233	float	[deg]
SKYRA	170.241629	float	[deg]
TARGTDEC	-7.10233	float	[deg]
TARGTRA	170.241629	float	[deg]
TARGTAZ	158.328478	float	[deg]
TARGTEL	48.640103	float	[deg]
TRGTOFFD	0.0	float	[arcse
TRGTOFFR	0.0	float	[arcse
ZD	41.359897	float	[deg]
TILERA	170.239	float	RA of
TILEDEC	-7.093	float	DEC
TCSST	10:24:01.508	str	Local
TCSMJD	59593.427501	float	MJD
USETURB	T	bool	Turbu
USEETC	T	bool	ETC
SEEING	None	Unknown	[arcse
TRANSPAR	None	Unknown	ETC/
SKYLEVEL	4.036	float	[unit?
PMSEEING	None	Unknown	[arcse
PMTRANSP	None	Unknown	[%] P
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acqui
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus
SKYCAM	SKYCAM0,SKYCAM1	str	Sky ca
REQADC	316.38,12.3	str	[deg]
ADCCORR	T	bool	Corre
ADC1PHI	316.380005	float	[deg]
ADC2PHI	12.300831	float	[deg]
ADC1HOME	F	bool	ADC
ADC2HOME	F	bool	ADC
ADC1NREV	-1.0	float	ADC
ADC2NREV	1.0	float	ADC
ADC1STAT	STOPPED	str	ADC
ADC2STAT	STOPPED	str	ADC
USESKY	T	bool	DOS
USEFOCUS	T	bool	DOS

Table 101 – continued from previous page

KEY	Example Value	Type	Comm
HEXPOS	948.5,-231.1,-91.3,-18.3,10.0,126.3	str	Hexap
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexap
USEROTAT	T	bool	DOS
ROTOFFST	121.0	float	[arcse
ROTENBLD	T	bool	Rotato
ROTRATE	0.0	float	[arcse
RESETROT	F	bool	DOS
SPLITEXP	F	bool	Split
USESPLIT	T	bool	Expos
USEPOS	T	bool	Fiber
PETALS	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9	str	Partic
USEGUIDR	T	bool	DOS
GUIDMODE	catalog	str	Guide
USEDONUT	T	bool	DOS
USESPCTR	T	bool	DOS
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Partic
ILLSPECS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Partic
CCDSPECS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Partic
TDEWPNT	-33.473	float	Telesc
TAIRFLOW	0.0	float	Telesc
TAIRITMP	12.7	float	[deg]
TAIROTMP	12.8	float	[deg]
TAIRTEMP	11.3	float	[deg]
TCASITMP	6.6	float	[deg]
TCASOTMP	12.3	float	[deg]
TCSITEMP	12.1	float	[deg]
TCSOTEMP	12.2	float	[deg]
TCIBTEMP	0.0	float	[deg]
TCIMTEMP	0.0	float	[deg]
TCITTEMP	0.0	float	[deg]
TCOSTEMP	0.0	float	[deg]
TCOWTEMP	0.0	float	[deg]
TDBTEMP	12.3	float	[deg]
TFLOWIN	0.0	float	Telesc
TFLOWOUT	0.0	float	Telesc
TGLYCOLI	12.9	float	[deg]
TGLYCOLO	12.6	float	[deg]
THINGES	12.3	float	[deg]
THINGEW	22.3	float	[deg]
TPMAVERT	11.695	float	[deg]
TPMDESIT	6.0	float	[deg]
TPMEIBT	12.2	float	[deg]
TPMEITT	11.5	float	[deg]
TPMEOBT	12.3	float	[deg]
TPMEOTT	12.0	float	[deg]
TPMNIBT	12.0	float	[deg]
TPMNITT	11.4	float	[deg]
TPMNOBT	12.3	float	[deg]
TPMNOTT	12.0	float	[deg]

Table 101 – continued from previous page

KEY	Example Value	Type	Comm
TPMRTDT	11.68	float	[deg]
TPMSIBT	12.1	float	[deg]
TPMSITT	11.5	float	[deg]
TPMSOBT	12.1	float	[deg]
TPMSOTT	11.8	float	[deg]
TPMSTAT	ready	str	Telesc
TPMWIBT	11.9	float	[deg]
TPMWITT	11.3	float	[deg]
TPMWOBT	11.9	float	[deg]
TPMWOTT	11.8	float	[deg]
TPCITEMP	12.1	float	[deg]
TPCOTEMP	12.1	float	[deg]
TPR1HUM	0.0	float	Telesc
TPR1TEMP	0.0	float	[deg]
TPR2HUM	0.0	float	Telesc
TPR2TEMP	0.0	float	[deg]
TSERVO	40.0	float	Telesc
TTRSTEMP	12.1	float	[deg]
TTRWTEMP	12.0	float	[deg]
TTRUETBT	-1.5	float	[deg]
TTRUETTT	11.7	float	[deg]
TTRUNTBT	11.7	float	[deg]
TTRUNTTT	11.7	float	[deg]
TTRUSTBT	11.7	float	[deg]
TTRUSTST	10.8	float	[deg]
TTRUSTTT	11.9	float	[deg]
TTRUTSBT	12.4	float	[deg]
TTRUTSMT	12.5	float	[deg]
TTRUTSTT	12.3	float	[deg]
TTRUWTBT	11.6	float	[deg]
TTRUWTTT	11.7	float	[deg]
ALARM	F	bool	UPS r
ALARM-ON	F	bool	UPS a
BATTERY	100.0	float	[%] U
SECLEFT	5904.0	float	[s] UP
UPSSTAT	System Normal - On Line(7)	str	UPS S
INAMPS	72.1	float	[A] U
OUTWATTS	4900.0,7600.0,4600.0	str	[W] U
COMPDEW	-10.4	float	[deg C
COMPHUM	14.1	float	[%] C
COMPAMB	25.2	float	[deg C
COMPTEMP	17.3	float	[deg C
DEWPOINT	-36.9	float	[deg C
HUMIDITY	1.6	float	[%] (c
PRESSURE	793.6	float	[torr]
OUTTEMP	11.0	float	[deg C
WINDDIR	252.9	float	[deg]
WINDSPD	10.7	float	[m/s]
GUST	13.0	float	[m/s]

Table 101 – continued from previous page

KEY	Example Value	Type	Comm
AMNIENTN	16.8	float	[deg C
CFLOOR	11.6	float	[deg C
NWALLIN	17.3	float	[deg C
NWALLOUT	11.1	float	[deg C
WWALLIN	16.6	float	[deg C
WWALLOUT	11.5	float	[deg C
AMBIENTS	17.6	float	[deg C
FLOOR	15.8	float	[deg C
EWALLCMP	11.9	float	[deg C
EWALLCOU	11.6	float	[deg C
ROOF	11.0	float	[deg C
ROOFAMB	11.3	float	[deg C
DOMEBLOW	11.2	float	[deg C
DOMEBUP	11.3	float	[deg C
DOMELLOW	11.2	float	[deg C
DOMELUP	11.1	float	[deg C
DOMERLOW	11.1	float	[deg C
DOMERUP	10.8	float	[deg C
PLATFORM	10.8	float	[deg C
SHACKC	16.6	float	[deg C
SHACKW	16.7	float	[deg C
STAIRSL	11.2	float	[deg C
STAIRSM	11.0	float	[deg C
STAIRSU	11.1	float	[deg C
TELBASE	11.7	float	[deg C
UTILWALL	11.4	float	[deg C
UTILROOM	10.3	float	[deg C
RADESYS	FK5	str	Coord
TNFSPROC	7.9838	float	[s] Pla
SIMGFAP	F	bool	DOS
USEFVC	T	bool	DOS
USEFID	T	bool	DOS
USEILLUM	T	bool	DOS
USEXSRVR	T	bool	DOS
USEOPENL	T	bool	DOS
USEMIDPT	T	bool	Use e
STOPGUDR	T	bool	DOS
STOPFOCS	T	bool	DOS
STOPSKY	T	bool	DOS
KEEPGUDR	F	bool	DOS
KEEPFOCS	F	bool	DOS
KEEPSKY	F	bool	DOS
REACQUIR	F	bool	DOS
EXCLUDED		str	Comp
DOSVER	trunk	str	DOS
OCSVER	1.2	float	OCS
PMVER	desi-138368	str	PlateM
CONSTVER	DESI:CURRENT	str	Const
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS

Table 101 – continued from previous page

KEY	Example Value	Type	Comm
REQTIME	1860.0	float	[s] Re
SIMGFACQ	F	bool	
TCSKRA	0.01 0.04 0.01	str	TCS I
TCSKDEC	0.01 0.04 0.01	str	TCS I
TCSGRA	0.15	float	TCS s
TCSGDEC	0.15	float	TCS s
TCSMFRA	2	int	TCS r
TCSMFDEC	2	int	TCS r
TCSPIRA	0.9,0.0,0.0,0.0	str	TCS F
TCSPIDEC	0.9,0.0,0.0,0.0	str	TCS F
GSGUIDE2	(664.34,38.87)	str	
GSGUIDE5	(593.78,1504.27),(437.14,545.33)	str	
GSGUIDE3	(537.68,1656.18),(360.10,1393.84)	str	
GSGUIDE7	(223.31,1205.23),(687.61,1805.82)	str	
GSGUIDE8	(479.93,780.28),(548.26,388.92)	str	
GSGUIDE0	(167.25,277.52),(622.59,595.97)	str	
ARCHIVE	/exposures/desi/20220113/00118526/guide-00118526.fits.fz	str	
CHECKSUM	lFAHlC7GlCAGlC5G	str	HDU
DATASUM	0	str	data u

Empty HDU.

HDU01

EXTNAME = PMGSTARS

Binary table of candidate guide/ETC stars detected by PlateMaker.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	86	int	width of table in bytes
NAXIS2	18	int	number of rows in table
CHECKSUM	YeEnYZBmYbBmYZBm	str	HDU checksum updated 2022-01-14T11:13:59
DATASUM	315340011	str	data unit checksum updated 2022-01-14T11:13:59

Required Data Table Columns

Name	Type	Units	Description
GFA_LOC	char[6]		PETAL_LOC number
RA	float64		Star RA in degrees
DEC	float64		Star Dec in degrees
ROW	float64		Star y pixel coord
COL	float64		Star x pixel coord
RA_IVAR	float64		RA inverse variance
DEC_IVAR	float64		Dec inverse variance
MAG	float64		Star magnitude
MORPHTYPE	int64		Morphological type
GUIDE_FLAG	int64		Guiding bitmask
ETC_FLAG[1]	int64		ETC bitmask

`COL` is the x pixel coordinate of each star in a convention where the left edge of the image has x = 0.

`ROW` is the y pixel coordinate of each star in a convention where the bottom edge of the image has y = 0.

So in this convention the center of the lower left pixel is (x, y) = (0.5, 0.5) rather than (0, 0).

The star MAG is a synthetic version of DECam r created from Gaia photometry, inherited from the fiberassign GFA_TARGETS extension.

MORPHTYPE is the GFA_TARGETS morphological type; this may, by definition, always be equal to 0, since the GFA_TARGETS target list should not include resolved galaxies.

GUIDE_FLAG is a flag indicating whether each star is suitable for use as a guide star. This may always be equal to 1 by definition, as the PMGSTARS table would simply discard any star not suitable for use as a guide star.

ETC_FLAG is a bitmask indicating whether each PlateMaker-selected guide star is suitable for use by the ETC. The main problem case that ETC_FLAG is supposed to address is variable stars, which can be fine for guiding but would mess up ETC transparency estimates. ETC_FLAG = 0 means that a star is usable for the ETC, whereas nonzero ETC_FLAG means that a star should not be used by the ETC.

HDU02

EXTNAME = GUIDE5

GUIDE5 image cube

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	74304	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	GUIDE5	str	Device/controller name

continues on nex

[1] Optional

Table 102 – continued from previous page

KEY	Example Value	Type	Comment
UNIT	5	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.319124	str	[UTC] Observation data and start time
MJD-OBS	59593.46109166	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.319124	str	Time shutter opened
ST	11:13:16.9528	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing on
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure

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Table 102 – continued from previous page

KEY	Example Value	Type	Comment
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	5.6345e-05	float	
CD1_2	-1.6764e-05	float	
CD2_1	-1.8252e-05	float	
CD2_2	-5.1779e-05	float	
SHAPE	1032,2248	str	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	None	Unknown	
ROIWIDTH	None	Unknown	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev08	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	drbFfoZDdobDdoZD	str	HDU checksum updated 2022-01-14T11:13
DATASUM	1908774157	str	data unit checksum updated 2022-01-14T11

Data: FITS image [int16 (compressed), 2248x1032x72]

HDU03

EXTNAME = GUIDE5T

GUIDE5 image cube metadata

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	CZCLCWCKCWCKCWCK	str	HDU checksum updated 2022-01-14T11:13:59
DATASUM	79233899	str	data unit checksum updated 2022-01-14T11:13:59

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		Exposure time (sec)
NIGHT	int64		Observing night
DATE-OBS	char[26]		YYYY-MM-DDTHH:MM:SS.SSSSSS (UT)
TIME-OBS	char[15]		HH:MM:SS.SSSSSS (UT)
MJD-OBS	float64		MJD (start of frame)
OPENSHUT	char[*]		YYYY-MM-DDTHH:MM:SS.SSSSSS (UT)
ST	char[*]		HH:MM:SS.SS (Local Sidereal Time at frame start)
HEXPOS	char[34]		Hexapod position
GAMBNTT	float64		GFA ambient temp (C)
GFPGAT	float64		GFA FPGA temp (C)
GFILTERT	float64		GFA filter temp (C)
GCOLDTEC	float64		GFA cold peltier temp (C)
GHOTTEC	float64		GFA hot peltier temp (C)
GCCDTEMP	float64		GFA CCD temp (C)
GCAMTEMP	float64		GFA camera temp (C)
GHUMID2	float64		GFA humidity 2
GHUMID3	float64		GFA humidity 3
CRPIX1	float64		Reference pixel in axis1
CRPIX2	float64		Reference pixel in axis2
CRVAL1	float64		Physical value of the reference pixel
CRVAL2	float64		Physical value of the reference pixel

`HEXPOS` is a string containing the six hexapod parameters separated by commas, ordered as X, Y, Z, tip, tilt, rotation (positions in microns, angles in arcseconds).

HDU04

EXTNAME = GUIDE3

GUIDE3 image cube

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	74304	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	GUIDE3	str	Device/controller name
UNIT	3	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.319124	str	[UTC] Observation data and start time
MJD-OBS	59593.46109166	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.319124	str	Time shutter opened
ST	11:13:16.9528	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle

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Table 103 – continued from previous page

KEY	Example Value	Type	Comment
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sk
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing o
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	3.4943e-05	float	
CD1_2	4.3939e-05	float	
CD2_1	4.7823e-05	float	
CD2_2	-3.2116e-05	float	
SHAPE	1032,2248	str	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	None	Unknown	
ROIWIDTH	None	Unknown	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev02	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	loGEloDBloDBloDB	str	HDU checksum updated 2022-01-14T11:14
DATASUM	2587335691	str	data unit checksum updated 2022-01-14T11

Data: FITS image [int16 (compressed), 2248x1032x72]

HDU05

EXTNAME = GUIDE3T

GUIDE3 image cube metadata

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	ZA2Ve40TZ90Tb90T	str	HDU checksum updated 2022-01-14T11:14:00
DATASUM	1996482551	str	data unit checksum updated 2022-01-14T11:14:00

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		Exposure time (sec)
NIGHT	int64		Observing night
DATE-OBS	char[26]		YYYY-MM-DDTHH:MM:SS.SSSSSS (UT)
TIME-OBS	char[15]		HH:MM:SS.SSSSSS (UT)
MJD-OBS	float64		MJD (start of frame)
OPENSHUT	char[*]		YYYY-MM-DDTHH:MM:SS.SSSSSS (UT)
ST	char[*]		HH:MM:SS.SS (Local Sidereal Time at frame start)
HEXPOS	char[34]		Hexapod position
GAMBNTT	float64		GFA ambient temp (C)
GFPGAT	float64		GFA FPGA temp (C)
GFILTERT	float64		GFA filter temp (C)
GCOLDTEC	float64		GFA cold peltier temp (C)
GHOTTEC	float64		GFA hot peltier temp (C)
GCCDTEMP	float64		GFA CCD temp (C)
GCAMTEMP	float64		GFA camera temp (C)
GHUMID2	float64		GFA humidity 2
GHUMID3	float64		GFA humidity 3
CRPIX1	float64		Reference pixel in axis1
CRPIX2	float64		Reference pixel in axis2
CRVAL1	float64		Physical value of the reference pixel
CRVAL2	float64		Physical value of the reference pixel

HDU06

EXTNAME = GUIDE2

GUIDE2 image cube

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	74304	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	GUIDE2	str	Device/controller name
UNIT	2	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.319124	str	[UTC] Observation data and start time
MJD-OBS	59593.46109166	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.319124	str	Time shutter opened
ST	11:13:16.9528	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

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Table 104 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sk
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing o
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	1.9486e-07	float	
CD1_2	5.4424e-05	float	
CD2_1	5.9241e-05	float	
CD2_2	-1.8383e-07	float	
SHAPE	1032,2248	str	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	None	Unknown	
ROIWIDTH	None	Unknown	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev06	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	9iG4AfE49fE4AfE4	str	HDU checksum updated 2022-01-14T11:14
DATASUM	2955333335	str	data unit checksum updated 2022-01-14T11

Data: FITS image [int16 (compressed), 2248x1032x72]

HDU07

EXTNAME = GUIDE2T

GUIDE2 image cube metadata

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	7qDGAoD90oDE7oD9	str	HDU checksum updated 2022-01-14T11:14:01
DATASUM	2746564241	str	data unit checksum updated 2022-01-14T11:14:01

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		Exposure time (sec)
NIGHT	int64		Observing night
DATE-OBS	char[26]		YYYY-MM-DDTHH:MM:SS.SSSSSS (UT)
TIME-OBS	char[15]		HH:MM:SS.SSSSSS (UT)
MJD-OBS	float64		MJD (start of frame)
OPENSHUT	char[*]		YYYY-MM-DDTHH:MM:SS.SSSSSS (UT)
ST	char[*]		HH:MM:SS.SS (Local Sidereal Time at frame start)
HEXPOS	char[34]		Hexapod position
GAMBNTT	float64		GFA ambient temp (C)
GFPGAT	float64		GFA FPGA temp (C)
GFILTERT	float64		GFA filter temp (C)
GCOLDTEC	float64		GFA cold peltier temp (C)
GHOTTEC	float64		GFA hot peltier temp (C)
GCCDTEMP	float64		GFA CCD temp (C)
GCAMTEMP	float64		GFA camera temp (C)
GHUMID2	float64		GFA humidity 2
GHUMID3	float64		GFA humidity 3
CRPIX1	float64		Reference pixel in axis1
CRPIX2	float64		Reference pixel in axis2
CRVAL1	float64		Physical value of the reference pixel
CRVAL2	float64		Physical value of the reference pixel

HDU08

EXTNAME = GUIDE7

GUIDE7 image cube

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	74304	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	GUIDE7	str	Device/controller name
UNIT	7	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.319124	str	[UTC] Observation data and start time
MJD-OBS	59593.46109166	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.319124	str	Time shutter opened
ST	11:13:16.9528	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

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Table 105 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sk
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing o
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	2.0968e-07	float	
CD1_2	-5.443e-05	float	
CD2_1	-5.9249e-05	float	
CD2_2	-1.8791e-07	float	
SHAPE	1032,2248	str	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	None	Unknown	
ROIWIDTH	None	Unknown	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev01	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	HB4WH93VHA3VH73V	str	HDU checksum updated 2022-01-14T11:14
DATASUM	1347049373	str	data unit checksum updated 2022-01-14T11

Data: FITS image [int16 (compressed), 2248x1032x72]

HDU09

EXTNAME = GUIDE7T

GUIDE7 image cube metadata

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	IbGoJaDnIaDnIaDn	str	HDU checksum updated 2022-01-14T11:14:02
DATASUM	3635643212	str	data unit checksum updated 2022-01-14T11:14:02

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		Exposure time (sec)
NIGHT	int64		Observing night
DATE-OBS	char[26]		YYYY-MM-DDTHH:MM:SS.SSSSSS (UT)
TIME-OBS	char[15]		HH:MM:SS.SSSSSS (UT)
MJD-OBS	float64		MJD (start of frame)
OPENSHUT	char[*]		YYYY-MM-DDTHH:MM:SS.SSSSSS (UT)
ST	char[*]		HH:MM:SS.SS (Local Sidereal Time at frame start)
HEXPOS	char[34]		Hexapod position
GAMBNTT	float64		GFA ambient temp (C)
GFPGAT	float64		GFA FPGA temp (C)
GFILTERT	float64		GFA filter temp (C)
GCOLDTEC	float64		GFA cold peltier temp (C)
GHOTTEC	float64		GFA hot peltier temp (C)
GCCDTEMP	float64		GFA CCD temp (C)
GCAMTEMP	float64		GFA camera temp (C)
GHUMID2	float64		GFA humidity 2
GHUMID3	float64		GFA humidity 3
CRPIX1	float64		Reference pixel in axis1
CRPIX2	float64		Reference pixel in axis2
CRVAL1	float64		Physical value of the reference pixel
CRVAL2	float64		Physical value of the reference pixel

HDU10

EXTNAME = GUIDE8

GUIDE8 image cube

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	74304	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	GUIDE8	str	Device/controller name
UNIT	8	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.319124	str	[UTC] Observation data and start time
MJD-OBS	59593.46109166	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.319124	str	Time shutter opened
ST	11:13:16.9528	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

continues on nex

Table 106 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sk
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing o
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	-3.4681e-05	float	
CD1_2	-4.4134e-05	float	
CD2_1	-4.804e-05	float	
CD2_2	3.1872e-05	float	
SHAPE	1032,2248	str	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	None	Unknown	
ROIWIDTH	None	Unknown	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev04	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	9KhoAJhn4Jhn9Jhn	str	HDU checksum updated 2022-01-14T11:14
DATASUM	663748813	str	data unit checksum updated 2022-01-14T11

Data: FITS image [int16 (compressed), 2248x1032x72]

HDU11

EXTNAME = GUIDE8T

GUIDE8 image cube metadata

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	241	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	EAADG439E99CE999	str	HDU checksum updated 2022-01-14T11:14:03
DATASUM	2061256282	str	data unit checksum updated 2022-01-14T11:14:03

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		Exposure time (sec)
NIGHT	int64		Observing night
DATE-OBS	char[26]		YYYY-MM-DDTHH:MM:SS.SSSSSS (UT)
TIME-OBS	char[15]		HH:MM:SS.SSSSSS (UT)
MJD-OBS	float64		MJD (start of frame)
OPENSHUT	char[*]		YYYY-MM-DDTHH:MM:SS.SSSSSS (UT)
ST	char[*]		HH:MM:SS.SS (Local Sidereal Time at frame start)
HEXPOS	char[34]		Hexapod position
GAMBNTT	float64		GFA ambient temp (C)
GFPGAT	float64		GFA FPGA temp (C)
GFILTERT	float64		GFA filter temp (C)
GCOLDTEC	float64		GFA cold peltier temp (C)
GHOTTEC	float64		GFA hot peltier temp (C)
GCCDTEMP	float64		GFA CCD temp (C)
GCAMTEMP	float64		GFA camera temp (C)
GHUMID2	float64		GFA humidity 2
GHUMID3	float64		GFA humidity 3
CRPIX1	float64		Reference pixel in axis1
CRPIX2	float64		Reference pixel in axis2
CRVAL1	float64		Physical value of the reference pixel
CRVAL2	float64		Physical value of the reference pixel

HDU12

EXTNAME = GUIDE0

GUIDE0 image cube

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	74304	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
DEVICE	GUIDE0	str	Device/controller name
UNIT	0	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.319124	str	[UTC] Observation data and start time
MJD-OBS	59593.46109166	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.319124	str	Time shutter opened
ST	11:13:16.9528	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

continues on nex

Table 107 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing or
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	-5.6334e-05	float	
CD1_2	1.6861e-05	float	
CD2_1	1.836e-05	float	
CD2_2	5.1764e-05	float	
SHAPE	1032,2248	str	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	None	Unknown	
ROIWIDTH	None	Unknown	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev10	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	X2EZY2DZX2DZX2DZ	str	HDU checksum updated 2022-01-14T11:14
DATASUM	2619950170	str	data unit checksum updated 2022-01-14T11

Data: FITS image [int16 (compressed), 2248x1032x72]

HDU13

EXTNAME = GUIDE0T

GUIDE0 image cube metadata

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	Jo9AJm64Jm6AJm63	str	HDU checksum updated 2022-01-14T11:14:04
DATASUM	2766359628	str	data unit checksum updated 2022-01-14T11:14:04

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		Exposure time (sec)
NIGHT	int64		Observing night
DATE-OBS	char[26]		YYYY-MM-DDTHH:MM:SS.SSSSSS (UT)
TIME-OBS	char[15]		HH:MM:SS.SSSSSS (UT)
MJD-OBS	float64		MJD (start of frame)
OPENSHUT	char[*]		YYYY-MM-DDTHH:MM:SS.SSSSSS (UT)
ST	char[*]		HH:MM:SS.SS (Local Sidereal Time at frame start)
HEXPOS	char[34]		Hexapod position
GAMBNTT	float64		GFA ambient temp (C)
GFPGAT	float64		GFA FPGA temp (C)
GFILTERT	float64		GFA filter temp (C)
GCOLDTEC	float64		GFA cold peltier temp (C)
GHOTTEC	float64		GFA hot peltier temp (C)
GCCDTEMP	float64		GFA CCD temp (C)
GCAMTEMP	float64		GFA camera temp (C)
GHUMID2	float64		GFA humidity 2
GHUMID3	float64		GFA humidity 3
CRPIX1	float64		Reference pixel in axis1
CRPIX2	float64		Reference pixel in axis2
CRVAL1	float64		Physical value of the reference pixel
CRVAL2	float64		Physical value of the reference pixel

guide-rois-EXPID

Summary
TODO: description needed

Naming Convention
`guide-rois-EXPID.fits.fz`, where EXPID is the zero-padded 8-digit exposure ID.

Regex
`guide-rois-[0-9]{8}\.fits\.fz`

File Type
FITS, 2 MB

Contents

Number	EXTNAME	Type	Contents
HDU00	GUIDER	IMAGE	Header keywords only
HDU01	PMGSTARS	BINTABLE	Guide stars from PlateMaker
HDU02	GUIDE5_0	BINTABLE	TODO: description needed
HDU03	GUIDE5_0T	BINTABLE	TODO: description needed
HDU04	GUIDE5_1	BINTABLE	TODO: description needed
HDU05	GUIDE5_1T	BINTABLE	TODO: description needed
HDU06	GUIDE3_0	BINTABLE	TODO: description needed
HDU07	GUIDE3_0T	BINTABLE	TODO: description needed
HDU08	GUIDE3_1	BINTABLE	TODO: description needed
HDU09	GUIDE3_1T	BINTABLE	TODO: description needed
HDU10	GUIDE2_0	BINTABLE	TODO: description needed
HDU11	GUIDE2_0T	BINTABLE	TODO: description needed
HDU12	GUIDE2_1	BINTABLE	TODO: description needed
HDU13	GUIDE2_1T	BINTABLE	TODO: description needed
HDU14	GUIDE7_0	BINTABLE	TODO: description needed
HDU15	GUIDE7_0T	BINTABLE	TODO: description needed
HDU16	GUIDE7_1	BINTABLE	TODO: description needed
HDU17	GUIDE7_1T	BINTABLE	TODO: description needed
HDU18	GUIDE8_0	BINTABLE	TODO: description needed
HDU19	GUIDE8_0T	BINTABLE	TODO: description needed
HDU20	GUIDE8_1	BINTABLE	TODO: description needed
HDU21	GUIDE8_1T	BINTABLE	TODO: description needed
HDU22	GUIDE0_0	BINTABLE	TODO: description needed
HDU23	GUIDE0_0T	BINTABLE	TODO: description needed
HDU24	GUIDE0_1	BINTABLE	TODO: description needed
HDU25	GUIDE0_1T	BINTABLE	TODO: description needed

FITS Header Units

HDU00

EXTNAME = GUIDER

Header keywords only.

Required Header Keywords

KEY	Example Value	Type	Comm
MODULE	GUIDE	str	Image
EXPID	118526	int	Expos
FRAMES	72	int	Numb
COSMSPLT	F	bool	Cosm
MAXSPLIT	0	int	Numb
VISITIDS	118524	str	List o
TILEID	4403	int	DESI
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber
FLAVOR	science	str	Obser
OBSTYPE	SCIENCE	str	Spectr
SEQUENCE	DESI	str	OCS S
MANIFEST	F	bool	DOS (
OBJECT		str	Objec
PURPOSE	Main Survey	str	Purpo
PROGRAM	DARK	str	Progra
NTSSURVY	main	str	NTS s
NTSPROG	DARK	str	NTS p
SBPROF	ELG	str	Profile
MAXTIME	5400.0	float	[s] Ma
ESTTIME	3705.79	float	[s] Es
MINTIME	300.0	float	[s] Mi
MIDTIME	915.0	float	[s] Ex
PROPID	2020B-5000	str	Propo
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Name
LEAD	Martin Landriau	str	Lead (
INSTRUME	DESI	str	Instru
OBSERVAT	KPNO	str	Obser
OBS-LAT	31.96403	str	[deg]
OBS-LONG	-111.59989	str	[deg]
OBS-ELEV	2097.0	float	[m] O
TELESCOP	KPNO 4.0-m telescope	str	Telesc
CORRCTOR	DESI Corrector	str	Corre
SEQNUM	1	int	Numb
NIGHT	20220113	int	Obser
SEQSTART	2022-01-14T10:13:58.576904	str	Start t
TIMESYS	UTC	str	Time
DATE-OBS	2022-01-14T11:03:58.319124	str	[UTC
MJD-OBS	59593.46109166	float	Modif
STARTADJ	2022-01-14T10:14:26.234369	str	Time

Table 108 – continued from previous page

KEY	Example Value	Type	Comm
OPENSHUT	2022-01-14T11:03:58.319124	str	Time
CAMSHUT	open	str	Shutte
ST	11:13:16.9528	str	Local
EXPTIME	5.0	float	[s] Ac
ACQTIME	15.0	float	[s] acc
GUIDTIME	5.0	float	[s] gu
FOCSTIME	60.0	float	[s] foc
SKYTIME	60.0	float	[s] sky
REQRA	170.239	float	[deg]
REQDEC	-7.093	float	[deg]
DELTARA	None	Unknown	[arcse
DELTADEC	None	Unknown	[arcse
WHITESPT	F	bool	Telesc
ZENITH	F	bool	Telesc
SEANNEX	F	bool	Telesc
BEYONDP	F	bool	Telesc
AIRMASS	1.331363	float	Airma
FOCUS	948.5,-231.1,-91.3,-18.3,10.0,126.3	str	Telesc
VCCD	ON	str	True (
TRUSTEMP	12.4	float	[deg]
PMIRTEMP	11.662	float	[deg]
PMREADY	T	bool	Prima
PMCOVER	open	str	Prima
PMCOOL	off	str	Prima
DOMSHUTU	open	str	Upper
DOMSHUTL	open	str	Lower
DOMLIGHH	off	str	High (
DOMLIGHL	off	str	Low c
DOMEAZ	165.277	float	[deg]
DOMINPOS	T	bool	Dome
EPOCH	2000.0	float	Epoch
GUIDOFFR	0.0	float	[arcse
GUIDOFFD	-0.0	float	[arcse
SUNRA	296.113998	float	[deg]
SUNDEC	-21.270133	float	[deg]
MOONDEC	23.881736	float	[deg]
MOONRA	73.512629	float	[deg]
MOONSEP	99.425	float	[deg]
SLEWANGL	5.795	float	[deg]
SLEWTIME	31.341	float	[s] Sle
MOUNTAZ	158.328478	float	[deg]
MOUNTDEC	-7.10233	float	[deg]
MOUNTEL	48.640103	float	[deg]
MOUNTHA	-14.235346	float	[deg]
INCTRL	T	bool	DESI
INPOS	T	bool	Moun
MNTOFFD	-0.0	float	[arcse
MNTOFFR	-0.0	float	[arcse
PARALLAC	-18.404235	float	[deg]

Table 108 – continued from previous page

KEY	Example Value	Type	Comm
SKYDEC	-7.10233	float	[deg]
SKYRA	170.241629	float	[deg]
TARGTDEC	-7.10233	float	[deg]
TARGTRA	170.241629	float	[deg]
TARGTAZ	158.328478	float	[deg]
TARGTEL	48.640103	float	[deg]
TRGTOFFD	0.0	float	[arcse
TRGTOFFR	0.0	float	[arcse
ZD	41.359897	float	[deg]
TILERA	170.239	float	RA of
TILEDEC	-7.093	float	DEC
TCSST	10:24:01.508	str	Local
TCSMJD	59593.427501	float	MJD
USETURB	T	bool	Turbu
USEETC	T	bool	ETC
SEEING	None	Unknown	[arcse
TRANSPAR	None	Unknown	ETC/
SKYLEVEL	4.036	float	[unit?
PMSEEING	None	Unknown	[arcse
PMTRANSP	None	Unknown	[%] P
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acqui
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus
SKYCAM	SKYCAM0,SKYCAM1	str	Sky c
REQADC	316.38,12.3	str	[deg]
ADCCORR	T	bool	Corre
ADC1PHI	316.380005	float	[deg]
ADC2PHI	12.300831	float	[deg]
ADC1HOME	F	bool	ADC
ADC2HOME	F	bool	ADC
ADC1NREV	-1.0	float	ADC
ADC2NREV	1.0	float	ADC
ADC1STAT	STOPPED	str	ADC
ADC2STAT	STOPPED	str	ADC
USESKY	T	bool	DOS
USEFOCUS	T	bool	DOS
HEXPOS	948.5,-231.1,-91.3,-18.3,10.0,126.3	str	Hexa
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexa
USEROTAT	T	bool	DOS
ROTOFFST	121.0	float	[arcse
ROTENBLD	T	bool	Rotat
ROTRATE	0.0	float	[arcse
RESETROT	F	bool	DOS
SPLITEXP	F	bool	Split
USESPLIT	T	bool	Expos
USEPOS	T	bool	Fiber
PETALS	PETAL0,PETAL1,PETAL2,PETAL3,PETAL4,PETAL5,PETAL6,PETAL7,PETAL8,PETAL9	str	Partic
USEGUIDR	T	bool	DOS
GUIDMODE	catalog	str	Guide

Table 108 – continued from previous page

KEY	Example Value	Type	Comm
USEDONUT	T	bool	DOS
USESPCTR	T	bool	DOS
SPCGRPHS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Partic
ILLSPECS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Partic
CCDSPECS	SP0,SP1,SP2,SP3,SP4,SP5,SP6,SP7,SP8,SP9	str	Partic
TDEWPNT	-33.473	float	Telesc
TAIRFLOW	0.0	float	Telesc
TAIRITMP	12.7	float	[deg]
TAIROTMP	12.8	float	[deg]
TAIRTEMP	11.3	float	[deg]
TCASITMP	6.6	float	[deg]
TCASOTMP	12.3	float	[deg]
TCSITEMP	12.1	float	[deg]
TCSOTEMP	12.2	float	[deg]
TCIBTEMP	0.0	float	[deg]
TCIMTEMP	0.0	float	[deg]
TCITTEMP	0.0	float	[deg]
TCOSTEMP	0.0	float	[deg]
TCOWTEMP	0.0	float	[deg]
TDBTEMP	12.3	float	[deg]
TFLOWIN	0.0	float	Telesc
TFLOWOUT	0.0	float	Telesc
TGLYCOLI	12.9	float	[deg]
TGLYCOLO	12.6	float	[deg]
THINGES	12.3	float	[deg]
THINGEW	22.3	float	[deg]
TPMAVERT	11.695	float	[deg]
TPMDESIT	6.0	float	[deg]
TPMEIBT	12.2	float	[deg]
TPMEITT	11.5	float	[deg]
TPMEOBT	12.3	float	[deg]
TPMEOTT	12.0	float	[deg]
TPMNIBT	12.0	float	[deg]
TPMNITT	11.4	float	[deg]
TPMNOBT	12.3	float	[deg]
TPMNOTT	12.0	float	[deg]
TPMRTDT	11.68	float	[deg]
TPMSIBT	12.1	float	[deg]
TPMSITT	11.5	float	[deg]
TPMSOBT	12.1	float	[deg]
TPMSOTT	11.8	float	[deg]
TPMSTAT	ready	str	Telesc
TPMWIBT	11.9	float	[deg]
TPMWITT	11.3	float	[deg]
TPMWOBT	11.9	float	[deg]
TPMWOTT	11.8	float	[deg]
TPCITEMP	12.1	float	[deg]
TPCOTEMP	12.1	float	[deg]
TPR1HUM	0.0	float	Telesc

Table 108 – continued from previous page

KEY	Example Value	Type	Comm
TPR1TEMP	0.0	float	[deg]
TPR2HUM	0.0	float	Telesc
TPR2TEMP	0.0	float	[deg]
TSERVO	40.0	float	Telesc
TTRSTEMP	12.1	float	[deg]
TTRWTEMP	12.0	float	[deg]
TTRUETBT	-1.5	float	[deg]
TTRUETTT	11.7	float	[deg]
TTRUNTBT	11.7	float	[deg]
TTRUNTTT	11.7	float	[deg]
TTRUSTBT	11.7	float	[deg]
TTRUSTST	10.8	float	[deg]
TTRUSTTT	11.9	float	[deg]
TTRUTSBT	12.4	float	[deg]
TTRUTSMT	12.5	float	[deg]
TTRUTSTT	12.3	float	[deg]
TTRUWTBT	11.6	float	[deg]
TTRUWTTT	11.7	float	[deg]
ALARM	F	bool	UPS r
ALARM-ON	F	bool	UPS a
BATTERY	100.0	float	[%] U
SECLEFT	5904.0	float	[s] UP
UPSSTAT	System Normal - On Line(7)	str	UPS S
INAMPS	72.1	float	[A] U
OUTWATTS	4900.0,7600.0,4600.0	str	[W] U
COMPDEW	-10.4	float	[deg C
COMPHUM	14.1	float	[%] C
COMPAMB	25.2	float	[deg C
COMPTEMP	17.3	float	[deg C
DEWPOINT	-36.9	float	[deg C
HUMIDITY	1.6	float	[%] (c
PRESSURE	793.6	float	[torr]
OUTTEMP	11.0	float	[deg C
WINDDIR	252.9	float	[deg]
WINDSPD	10.7	float	[m/s]
GUST	13.0	float	[m/s]
AMNIENTN	16.8	float	[deg C
CFLOOR	11.6	float	[deg C
NWALLIN	17.3	float	[deg C
NWALLOUT	11.1	float	[deg C
WWALLIN	16.6	float	[deg C
WWALLOUT	11.5	float	[deg C
AMBIENTS	17.6	float	[deg C
FLOOR	15.8	float	[deg C
EWALLCMP	11.9	float	[deg C
EWALLCOU	11.6	float	[deg C
ROOF	11.0	float	[deg C
ROOFAMB	11.3	float	[deg C
DOMEBLOW	11.2	float	[deg C

Table 108 – continued from previous page

KEY	Example Value	Type	Comm
DOMEBUP	11.3	float	[deg C
DOMELLOW	11.2	float	[deg C
DOMELUP	11.1	float	[deg C
DOMERLOW	11.1	float	[deg C
DOMERUP	10.8	float	[deg C
PLATFORM	10.8	float	[deg C
SHACKC	16.6	float	[deg C
SHACKW	16.7	float	[deg C
STAIRSL	11.2	float	[deg C
STAIRSM	11.0	float	[deg C
STAIRSU	11.1	float	[deg C
TELBASE	11.7	float	[deg C
UTILWALL	11.4	float	[deg C
UTILROOM	10.3	float	[deg C
RADESYS	FK5	str	Coord
TNFSPROC	7.9838	float	[s] Pla
SIMGFAP	F	bool	DOS C
USEFVC	T	bool	DOS C
USEFID	T	bool	DOS C
USEILLUM	T	bool	DOS C
USEXSRVR	T	bool	DOS C
USEOPENL	T	bool	DOS C
USEMIDPT	T	bool	Use ex
STOPGUDR	T	bool	DOS C
STOPFOCS	T	bool	DOS C
STOPSKY	T	bool	DOS C
KEEPGUDR	F	bool	DOS C
KEEPFOCS	F	bool	DOS C
KEEPSKY	F	bool	DOS C
REACQUIR	F	bool	DOS C
EXCLUDED		str	Comp
DOSVER	trunk	str	DOS s
OCSVER	1.2	float	OCS s
PMVER	desi-138368	str	PlateM
CONSTVER	DESI:CURRENT	str	Const
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS C
REQTIME	1860.0	float	[s] Re
SIMGFACQ	F	bool	
TCSKRA	0.01 0.04 0.01	str	TCS P
TCSKDEC	0.01 0.04 0.01	str	TCS P
TCSGRA	0.15	float	TCS s
TCSGDEC	0.15	float	TCS s
TCSMFRA	2	int	TCS n
TCSMFDEC	2	int	TCS n
TCSPIRA	0.9,0.0,0.0,0.0	str	TCS P
TCSPIDEC	0.9,0.0,0.0,0.0	str	TCS P
GSGUIDE2	(664.34,38.87)	str	
GSGUIDE5	(593.78,1504.27),(437.14,545.33)	str	
GSGUIDE3	(537.68,1656.18),(360.10,1393.84)	str	

Table 108 – continued from previous page

KEY	Example Value	Type	Comm
GSGUIDE7	(223.31,1205.23),(687.61,1805.82)	str	
GSGUIDE8	(479.93,780.28),(548.26,388.92)	str	
GSGUIDE0	(167.25,277.52),(622.59,595.97)	str	
ARCHIVE	/exposures/desi/20220113/00118526/guide-rois-00118526.fits.fz	str	
CHECKSUM	Bl9AEj77Bj7ABj75	str	HDU
DATASUM	0	str	data u

Empty HDU.

HDU01

EXTNAME = PMGSTARS

Table of guide stars to be used for guiding.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	86	int	width of table in bytes
NAXIS2	18	int	number of rows in table
CHECKSUM	YdEoYZBmYdBmYZBm	str	HDU checksum updated 2022-01-14T11:13:58
DATASUM	315340011	str	data unit checksum updated 2022-01-14T11:13:58

Required Data Table Columns

Name	Type	Units	Description
GFA_LOC	char[6]		Location on focal plane of GFA (same numbering convention as petal location)
RA	float64	deg	Barycentric Right Ascension in ICRS
DEC	float64	deg	Barycentric declination in ICRS
ROW	float64		GFA pixel row coordinate
COL	float64		GFA pixel col coordinate
RA_IVAR	float64	deg^-2	Inverse variance of RA (no cosine term!), excluding astrometric calibration errors
DEC_IVAR	float64	deg^-2	Inverse variance of DEC, excluding astrometric calibration errors
MAG	float64		Gaia “G” magnitude
MORPHTYPE	int64		Imaging Surveys morphological type from Tractor
GUIDE_FLAG	int64		Should be 1
ETC_FLAG[1]	int64		Should be 0

[1] Optional

HDU02

EXTNAME = GUIDE5_0

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	width of table in bytes
NAXIS2	3600	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
ZQUANTIZ	SUBTRACTIVE_DITHER_1	str	Pixel Quantization Algorithm
ZDITHER0	662	int	dithering offset when quantizing floats
DEVICE	GUIDE5	str	Device/controller name
UNIT	5	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.319124	str	[UTC] Observation data and start time
MJD-OBS	59593.46109166	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.319124	str	Time shutter opened
ST	11:13:16.9528	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

continues on nex

Table 109 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sk
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing o
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	5.6345e-05	float	
CD1_2	-1.6764e-05	float	
CD2_1	-1.8252e-05	float	
CD2_2	-5.1779e-05	float	
SHAPE	None	Unknown	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	593,1504	str	
ROIWIDTH	25,25	str	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev08	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	jg8Ekd7Ejd7Ejd7E	str	HDU checksum updated 2022-01-14T11:1
DATASUM	3978037814	str	data unit checksum updated 2022-01-14T1

Data: FITS image [float64 (compressed), 50x50x72]

HDU03

EXTNAME = GUIDE5_0T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	7WHIAV9G0VGG7V9G	str	HDU checksum updated 2022-01-14T11:13:58
DATASUM	79233899	str	data unit checksum updated 2022-01-14T11:13:58

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[34]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU04

EXTNAME = GUIDE5_1

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	width of table in bytes
NAXIS2	3600	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
ZQUANTIZ	SUBTRACTIVE_DITHER_1	str	Pixel Quantization Algorithm
ZDITHER0	665	int	dithering offset when quantizing floats
DEVICE	GUIDE5	str	Device/controller name
UNIT	5	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.319124	str	[UTC] Observation data and start time
MJD-OBS	59593.46109166	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.319124	str	Time shutter opened
ST	11:13:16.9528	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

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Table 110 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing on
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	5.6345e-05	float	
CD1_2	-1.6764e-05	float	
CD2_1	-1.8252e-05	float	
CD2_2	-5.1779e-05	float	
SHAPE	None	Unknown	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	437,545	str	
ROIWIDTH	25,25	str	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev08	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	7D6A8D687D6A7D67	str	HDU checksum updated 2022-01-14T11:13
DATASUM	1963935739	str	data unit checksum updated 2022-01-14T11

Data: FITS image [float64 (compressed), 50x50x72]

HDU05

EXTNAME = GUIDE5_1T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	7WHHAV9G0VGG7V9G	str	HDU checksum updated 2022-01-14T11:13:58
DATASUM	79233899	str	data unit checksum updated 2022-01-14T11:13:58

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[34]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU06

EXTNAME = GUIDE3_0

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	32	int	width of table in bytes
NAXIS2	3600	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
ZQUANTIZ	SUBTRACTIVE_DITHER_1	str	Pixel Quantization Algorithm
ZDITHER0	668	int	dithering offset when quantizing floats
DEVICE	GUIDE3	str	Device/controller name
UNIT	3	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.319190	str	[UTC] Observation data and start time
MJD-OBS	59593.46109166	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.319190	str	Time shutter opened
ST	11:13:16.9531	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

continues on nex

Table 111 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing on
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	3.4943e-05	float	
CD1_2	4.3939e-05	float	
CD2_1	4.7823e-05	float	
CD2_2	-3.2116e-05	float	
SHAPE	None	Unknown	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	537,1656	str	
ROIWIDTH	25,25	str	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev02	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	Uda4WZW2Uda2UZU2	str	HDU checksum updated 2022-01-14T11:13
DATASUM	3032621297	str	data unit checksum updated 2022-01-14T11

Data: FITS image [float64 (compressed), 50x50x72]

HDU07

EXTNAME = GUIDE3_0T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	R8oPT5lNR5lNR5lN	str	HDU checksum updated 2022-01-14T11:13:58
DATASUM	1996482551	str	data unit checksum updated 2022-01-14T11:13:58

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[34]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU08

EXTNAME = GUIDE3_1

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	width of table in bytes
NAXIS2	3600	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
ZQUANTIZ	SUBTRACTIVE_DITHER_1	str	Pixel Quantization Algorithm
ZDITHER0	671	int	dithering offset when quantizing floats
DEVICE	GUIDE3	str	Device/controller name
UNIT	3	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.319190	str	[UTC] Observation data and start time
MJD-OBS	59593.46109166	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.319190	str	Time shutter opened
ST	11:13:16.9531	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

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Table 112 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing or
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	3.4943e-05	float	
CD1_2	4.3939e-05	float	
CD2_1	4.7823e-05	float	
CD2_2	-3.2116e-05	float	
SHAPE	None	Unknown	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	360,1393	str	
ROIWIDTH	25,25	str	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev02	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	AA9BA789AA8AA787	str	HDU checksum updated 2022-01-14T11:13
DATASUM	2752856041	str	data unit checksum updated 2022-01-14T11

Data: FITS image [float64 (compressed), 50x50x72]

HDU09

EXTNAME = GUIDE3_1T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	R8oOT5lNR5lNR5lN	str	HDU checksum updated 2022-01-14T11:13:58
DATASUM	1996482551	str	data unit checksum updated 2022-01-14T11:13:58

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[34]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU10

EXTNAME = GUIDE2_0

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	width of table in bytes
NAXIS2	3600	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
ZQUANTIZ	SUBTRACTIVE_DITHER_1	str	Pixel Quantization Algorithm
ZDITHER0	674	int	dithering offset when quantizing floats
DEVICE	GUIDE2	str	Device/controller name
UNIT	2	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.317551	str	[UTC] Observation data and start time
MJD-OBS	59593.46109164	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.317551	str	Time shutter opened
ST	11:13:16.9462	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

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Table 113 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing on
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	1.9486e-07	float	
CD1_2	5.4424e-05	float	
CD2_1	5.9241e-05	float	
CD2_2	-1.8383e-07	float	
SHAPE	None	Unknown	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	664,38	str	
ROIWIDTH	25,25	str	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev06	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	oaOfoUMcoZMcoZMc	str	HDU checksum updated 2022-01-14T11:13
DATASUM	836997168	str	data unit checksum updated 2022-01-14T11

Data: FITS image [float64 (compressed), 50x50x72]

HDU11

EXTNAME = GUIDE2_0T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	klHAml93klG9kl99	str	HDU checksum updated 2022-01-14T11:13:58
DATASUM	2746564241	str	data unit checksum updated 2022-01-14T11:13:58

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[34]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU12

EXTNAME = GUIDE2_1

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	width of table in bytes
NAXIS2	3600	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
ZQUANTIZ	SUBTRACTIVE_DITHER_1	str	Pixel Quantization Algorithm
ZDITHER0	674	int	dithering offset when quantizing floats
DEVICE	GUIDE2	str	Device/controller name
UNIT	2	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.317551	str	[UTC] Observation data and start time
MJD-OBS	59593.46109164	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.317551	str	Time shutter opened
ST	11:13:16.9462	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

continues on nex

Table 114 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing on
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	1.9486e-07	float	
CD1_2	5.4424e-05	float	
CD2_1	5.9241e-05	float	
CD2_2	-1.8383e-07	float	
SHAPE	None	Unknown	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	664,38	str	
ROIWIDTH	25,25	str	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev06	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	oaOfoUMcoZMcoZMc	str	HDU checksum updated 2022-01-14T11:13
DATASUM	836997168	str	data unit checksum updated 2022-01-14T11

Data: FITS image [float64 (compressed), 50x50x72]

HDU13

EXTNAME = GUIDE2_1T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	klHAml93klG9kl99	str	HDU checksum updated 2022-01-14T11:13:58
DATASUM	2746564241	str	data unit checksum updated 2022-01-14T11:13:58

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[34]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU14

EXTNAME = GUIDE7_0

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	width of table in bytes
NAXIS2	3600	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
ZQUANTIZ	SUBTRACTIVE_DITHER_1	str	Pixel Quantization Algorithm
ZDITHER0	677	int	dithering offset when quantizing floats
DEVICE	GUIDE7	str	Device/controller name
UNIT	7	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.319984	str	[UTC] Observation data and start time
MJD-OBS	59593.46109167	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.319984	str	Time shutter opened
ST	11:13:16.9527	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

continues on nex

Table 115 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sk
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing o
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	2.0968e-07	float	
CD1_2	-5.443e-05	float	
CD2_1	-5.9249e-05	float	
CD2_2	-1.8791e-07	float	
SHAPE	None	Unknown	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	223,1205	str	
ROIWIDTH	25,25	str	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev01	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	eka2ehX2eha2ehU2	str	HDU checksum updated 2022-01-14T11:13
DATASUM	91966036	str	data unit checksum updated 2022-01-14T11

Data: FITS image [float64 (compressed), 50x50x72]

HDU15

EXTNAME = GUIDE7_0T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	9bAkAZAh9bAhAZAh	str	HDU checksum updated 2022-01-14T11:13:58
DATASUM	3635643212	str	data unit checksum updated 2022-01-14T11:13:58

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[34]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU16

EXTNAME = GUIDE7_1

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	width of table in bytes
NAXIS2	3600	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
ZQUANTIZ	SUBTRACTIVE_DITHER_1	str	Pixel Quantization Algorithm
ZDITHER0	680	int	dithering offset when quantizing floats
DEVICE	GUIDE7	str	Device/controller name
UNIT	7	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.319984	str	[UTC] Observation data and start time
MJD-OBS	59593.46109167	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.319984	str	Time shutter opened
ST	11:13:16.9527	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

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Table 116 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing on
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	2.0968e-07	float	
CD1_2	-5.443e-05	float	
CD2_1	-5.9249e-05	float	
CD2_2	-1.8791e-07	float	
SHAPE	None	Unknown	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	687,1805	str	
ROIWIDTH	25,25	str	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev01	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	EhMcEhKZEhKbEhKZ	str	HDU checksum updated 2022-01-14T11:13
DATASUM	3736249036	str	data unit checksum updated 2022-01-14T11

Data: FITS image [float64 (compressed), 50x50x72]

HDU17

EXTNAME = GUIDE7_1T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	9bAjAZAh9bAhAZAh	str	HDU checksum updated 2022-01-14T11:13:58
DATASUM	3635643212	str	data unit checksum updated 2022-01-14T11:13:58

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[34]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU18

EXTNAME = GUIDE8_0

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	width of table in bytes
NAXIS2	3600	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
ZQUANTIZ	SUBTRACTIVE_DITHER_1	str	Pixel Quantization Algorithm
ZDITHER0	684	int	dithering offset when quantizing floats
DEVICE	GUIDE8	str	Device/controller name
UNIT	8	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.320940	str	[UTC] Observation data and start time
MJD-OBS	59593.46109168	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.320940	str	Time shutter opened
ST	11:13:16.947	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

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Table 117 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sk
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing or
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	-3.4681e-05	float	
CD1_2	-4.4134e-05	float	
CD2_1	-4.804e-05	float	
CD2_2	3.1872e-05	float	
SHAPE	None	Unknown	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	479,780	str	
ROIWIDTH	25,25	str	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev04	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	cPoafOmacOmacOma	str	HDU checksum updated 2022-01-14T11:13
DATASUM	1481156710	str	data unit checksum updated 2022-01-14T11

Data: FITS image [float64 (compressed), 50x50x72]

HDU19

EXTNAME = GUIDE8_0T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	241	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	9989A65926599659	str	HDU checksum updated 2022-01-14T11:13:58
DATASUM	2061256282	str	data unit checksum updated 2022-01-14T11:13:58

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[34]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU20

EXTNAME = GUIDE8_1

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	width of table in bytes
NAXIS2	3600	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
ZQUANTIZ	SUBTRACTIVE_DITHER_1	str	Pixel Quantization Algorithm
ZDITHER0	687	int	dithering offset when quantizing floats
DEVICE	GUIDE8	str	Device/controller name
UNIT	8	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.320940	str	[UTC] Observation data and start time
MJD-OBS	59593.46109168	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.320940	str	Time shutter opened
ST	11:13:16.947	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

continues on nex

Table 118 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sk
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing o
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	-3.4681e-05	float	
CD1_2	-4.4134e-05	float	
CD2_1	-4.804e-05	float	
CD2_2	3.1872e-05	float	
SHAPE	None	Unknown	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	548,388	str	
ROIWIDTH	25,25	str	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev04	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	CASJE1SGC8SGC8SG	str	HDU checksum updated 2022-01-14T11:13
DATASUM	3014792423	str	data unit checksum updated 2022-01-14T11

Data: FITS image [float64 (compressed), 50x50x72]

HDU21

EXTNAME = GUIDE8_1T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	241	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	998AA65226589658	str	HDU checksum updated 2022-01-14T11:13:58
DATASUM	2061256282	str	data unit checksum updated 2022-01-14T11:13:58

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[34]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU22

EXTNAME = GUIDE0_0

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	width of table in bytes
NAXIS2	3600	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
ZQUANTIZ	SUBTRACTIVE_DITHER_1	str	Pixel Quantization Algorithm
ZDITHER0	690	int	dithering offset when quantizing floats
DEVICE	GUIDE0	str	Device/controller name
UNIT	0	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.318944	str	[UTC] Observation data and start time
MJD-OBS	59593.46109165	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.318944	str	Time shutter opened
ST	11:13:16.9602	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

continues on nex

Table 119 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing on
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	-5.6334e-05	float	
CD1_2	1.6861e-05	float	
CD2_1	1.836e-05	float	
CD2_2	5.1764e-05	float	
SHAPE	None	Unknown	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	167,277	str	
ROIWIDTH	25,25	str	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev10	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	3AqAA7o53AoAA5o3	str	HDU checksum updated 2022-01-14T11:13
DATASUM	2939767313	str	data unit checksum updated 2022-01-14T11

Data: FITS image [float64 (compressed), 50x50x72]

HDU23

EXTNAME = GUIDE0_0T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	9m36Dj359j35Aj35	str	HDU checksum updated 2022-01-14T11:13:58
DATASUM	2766359628	str	data unit checksum updated 2022-01-14T11:13:58

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[34]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

HDU24

EXTNAME = GUIDE0_1

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	width of table in bytes
NAXIS2	3600	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
ZQUANTIZ	SUBTRACTIVE_DITHER_1	str	Pixel Quantization Algorithm
ZDITHER0	693	int	dithering offset when quantizing floats
DEVICE	GUIDE0	str	Device/controller name
UNIT	0	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	72	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:03:58.318944	str	[UTC] Observation data and start time
MJD-OBS	59593.46109165	float	Modified Julian Date of observation
OPENSHUT	2022-01-14T11:03:58.318944	str	Time shutter opened
ST	11:13:16.9602	str	Local Sidereal time at observation start (HH
ACQTIME	15.0	float	[s] acqusition image exposure time
GUIDTIME	5.0	float	[s] guider GFA exposure time
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (

continues on nex

Table 120 – continued from previous page

KEY	Example Value	Type	Comment
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sk
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing or
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	946.7,-231.6,-83.4,-18.3,9.9,138.8	str	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/minor
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	-5.6334e-05	float	
CD1_2	1.6861e-05	float	
CD2_1	1.836e-05	float	
CD2_2	5.1764e-05	float	
SHAPE	None	Unknown	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	622,595	str	
ROIWIDTH	25,25	str	
GEXPMODE	normal	str	GFA readout mode (loop/normal)
DEVICEID	dev10	str	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	hccAhZb4hbb9hZb9	str	HDU checksum updated 2022-01-14T11:13
DATASUM	881151304	str	data unit checksum updated 2022-01-14T11

Data: FITS image [float64 (compressed), 50x50x72]

HDU25

EXTNAME = GUIDE0_1T

TODO: description needed

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	242	int	width of table in bytes
NAXIS2	72	int	number of rows in table
CHECKSUM	9m35Dj359j35Aj35	str	HDU checksum updated 2022-01-14T11:13:58
DATASUM	2766359628	str	data unit checksum updated 2022-01-14T11:13:58

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[34]		TODO: description needed
GAMBNTT	float64		TODO: description needed
GFPGAT	float64		TODO: description needed
GFILTERT	float64		TODO: description needed
GCOLDTEC	float64		TODO: description needed
GHOTTEC	float64		TODO: description needed
GCCDTEMP	float64		TODO: description needed
GCAMTEMP	float64		TODO: description needed
GHUMID2	float64		TODO: description needed
GHUMID3	float64		TODO: description needed
CRPIX1	float64		TODO: description needed
CRPIX2	float64		TODO: description needed
CRVAL1	float64		TODO: description needed
CRVAL2	float64		TODO: description needed

manifest_EXPID

Summary
JSON file containing descriptive data about an exposure. These files were used in early commissioning, but are now obsolete.

Naming Convention
`manifest_EXPID.json`, where EXPID is the zero-padded 8-digit exposure ID.

Regex
`manifest_[0-9]{8}\.json`

File Type
JSON, 250 B

Contents

Each file contains a dictionary with the following top-level keys:

Key	Description
`MANIFEST`	*Description needed*
`PURPOSE`	*Description needed*
`PROGRAM`	*Description needed*
`EXPID`	Exposure ID.
`NIGHT`	Observation night.
`DATE-OBS`	Timestamp of observation.
`MJD-OBS`	MJD of observation.
`LAST`	*Description needed*

pm-EXPID

Summary
PlateMaker data.

Naming Convention
`pm-EXPID.fits`, where EXPID is the zero-padded 8-digit exposure ID.

Regex
`pm-[0-9]{8}\.fits`

File Type
FITS, 1 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	PM	IMAGE	Header Keywords
HDU1	PMGSTARS	BINTABLE	Guide stars
HDU2	PMGWCS	BINTABLE	Guider WCS
HDU3	PMFIDPOS	BINTABLE	Predicted fiducial postitons
HDU4	PMPOSPOS	BINTABLE	Predicted fiber positions
HDU5	PMCNTPOS	BINTABLE	Predicted center-of-travel positions
HDU6	PMFIBMAP	BINTABLE	Positions after calibration

FITS Header Units

HDU0

EXTNAME = PM

The data contents are a dummy payload that should not be used. The most important header keywords are:

- `CENTER`: Apparent telescope coordinates needed to place field center at center of the focal plane.
- `GCENTER`: Pointing corrections after computing astrometric solution.
- `GHEXROT`: Absolute hexapod rotation and rate after computing astrometric solution. Rate is not used.
- `PMNFSADC`: Absolute ADC angles.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	1	int	length of data axis 1
DEVICE	GUIDE8	str	Device/controller name
UNIT	8	int	Unit number/letter
UNITTYPE	GUIDE	str	Image Sources/Component
MODULE	GUIDE	str	Image Sources/Component
EXPID	182039	int	Exposure number
EXPFRAME	0	int	Frame number
FRAMES	1	int	Number of Frames in Archive
TILEID	4361	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004361.fits.gz	str	Fiber assign
FLAVOR	SCIENCE	str	Observation type
SEQUENCE	DESI	str	OCS Sequence name
OBJECT	start_loop	str	Object name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Rodrigo Calderon, Khaled Said	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name

continues on

Table 121 – continued from previous page

KEY	Example Value	Type	Comment
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20230524	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2023-05-25T08:34:19.830256	str	[UTC] Observation data and start time
TIME-OBS	08:34:19.830256	str	[UTC] Observation start time
MJD-OBS	60089.35717396	float	Modified Julian Date of observation
OPENSHUT	2023-05-25T08:34:19.830256	str	[s] Time shutter opened
ST	17:18:55.6097	str	Local Sidereal time at observation start
EXPTIME	15.0	float	[s] Actual exposure time
ACQTIME	15.0	float	[s] acqusition image exposure time
REQRA	244.33	float	[deg] Requested right ascension (obser
REQDEC	15.297	float	[deg] Requested declination (observer i
FOCUS	1331.8,-319.4,-468.0,-11.5,32.4,174.9	str	Telescope focus settings
TRUSTEMP	15.633	float	[deg] Average Telescope truss temperat
PMIRTEMP	15.188	float	[deg] Average primary mirror temperat
EPOCH	2000.0	float	Epoch of observation
EQUINOX	2000.0	float	Equinox of selected coordinate referenc
MOUNTAZ	223.47215	float	[deg] Mount azimuth angle
MOUNTDEC	15.29368	float	[deg] Mount declination
MOUNTEL	68.266626	float	[deg] Mount elevation angle
MOUNTHA	15.314189	float	[deg] Mount hour angle
SKYDEC	15.29368	float	[deg] Telescope declination (pointing o
SKYRA	244.327071	float	[deg] Telescope right ascension (pointi
TARGTDEC	15.29368	float	[deg] Target declination (to TCS)
TARGTRA	244.327071	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	1331.8,-319.4,-468.0,-11.5,32.4,174.9	str	Hexapod position
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
WCSAXES	2	int	
RADESYS	FK5	str	Coordinate reference frame of major/m
CTYPE1	RA—TAN	str	
CTYPE2	DEC–TAN	str	
CD1_1	-3.521e-05	float	
CD1_2	-4.3757e-05	float	
CD2_1	-4.7625e-05	float	
CD2_2	3.235e-05	float	
CRPIX1	1036.7	float	
CRPIX2	522.17	float	

continues on

Table 121 – continued from previous page

KEY	Example Value	Type	Comment
CRVAL1	245.6899	float	
CRVAL2	14.4297	float	
TNFSPROC	8.9117	float	[s] PlateMaker NFSPROC processing ti
TGFAPROC	5.0955	float	[s] PlateMaker GFAPROC processing t
FILENAME	/exposures/desi/20230524/00182039/guide-00182039-0000.fits.fz	str	Name
SHAPE	1032,2248	str	
DTYPE	uint16	str	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
CENTER	244.32707,15.29368	str	Platemaker nfsproc center (ra, dec)
GCENTER	8.27,53.17	str	Platemaker gfaproc center (ra, dec)
GHEXROT	165.2,0.38	str	Platemaker gfaproc hexapod rotation (i
PMNFSADC	28.06,52.49	str	Platemaker nfsproc adc angles
REQTIME	1860.0	float	[s] Requested exposure time
ROLE	GUIDERMAN	str	
OVERSCAN	50	int	
DEVICEID	dev04	str	GFA device id (serial number)
GAMBNTT	10.313	float	[deg C] GFA ambient temperature
GFPGAT	32.748	float	[deg C] GFA fpga temperature
GFILTERT	10.281	float	[deg C] GFA filter temperature
GCOLDTEC	10.479	float	[deg C] GFA cold Peltier temperature
GHOTTEC	10.236	float	[deg C] GFA hot Peltier temperature
GCCDTEMP	10.479	float	[deg C] GFA CCD temperature
GCAMTEMP	10.281	float	[deg C] GFA camera temperature
GCAMHUM	3.346	float	[%/100] GFA camera humidity
GHUMID2	3.346	float	[%/100] GFA humidity sensor 2
GHUMID3	0.0	float	[%/100]GFA humidity sensor 3
GEXPMODE	normal	str	GFA readout mode (loop/normal)
READOUT	OK	str	
ROIS	469.4,1724.9776.3,505.3	str	
CHECKSUM	ZjADfi99ZiACfi79	str	HDU checksum updated 2023-05-25T0
DATASUM	1072693248	str	data unit checksum updated 2023-05-25

Data: FITS image [float64, 1]

HDU1

EXTNAME = PMGSTARS

Table of guide stars to be used for guiding.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	86	int	width of table in bytes
NAXIS2	29	int	number of rows in table
EXPID	182039	int	
MODULE	GUIDESTARS	str	
CHECKSUM	8qKfAnKe1nKe8nKe	str	HDU checksum updated 2023-05-25T08:35:47
DATASUM	612635513	str	data unit checksum updated 2023-05-25T08:35:47

Required Data Table Columns

Name	Type	Units	Description
GFA_LOC	char[6]		Location on focal plane of GFA (same numbering convention as petal location)
RA	float64	deg	Barycentric Right Ascension in ICRS
DEC	float64	deg	Barycentric declination in ICRS
ROW	float64		GFA pixel row coordinate
COL	float64		GFA pixel col coordinate
RA_IVAR	float64	deg^-2	Inverse variance of RA (no cosine term!), excluding astrometric calibration errors
DEC_IVAR	float64	deg^-2	Inverse variance of DEC, excluding astrometric calibration errors
MAG	float64		Gaia “G” magnitude
MORPHTYPE	int64		Imaging Surveys morphological type from Tractor
GUIDE_FLAG	int64		Should be 1
ETC_FLAG	int64		Should be 0

HDU2

EXTNAME = PMGWCS

Table of WCS coefficients for each GFA.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	72	int	width of table in bytes
NAXIS2	7	int	number of rows in table
EXPID	182039	int	
MODULE	GUIDERWCS	str	
CHECKSUM	CaGaCW9WCaEaCU9W	str	HDU checksum updated 2023-05-25T08:35:47
DATASUM	2237461692	str	data unit checksum updated 2023-05-25T08:35:47

Required Data Table Columns

Name	Type	Units	Description
GFA_LOC	int64		Location on focal plane of GFA (same numbering convention as petal location)
CRVAL1	float64		WCS keyword and value
CRVAL2	float64		WCS keyword and value
CRPIX1	float64		WCS keyword and value
CRPIX2	float64		WCS keyword and value
CD1_1	float64		WCS keyword and value
CD1_2	float64		WCS keyword and value
CD2_1	float64		WCS keyword and value
CD2_2	float64		WCS keyword and value

HDU3

EXTNAME = PMFIDPOS

Table of predicted FVC CCD pixel coordinates for illuminated fiducials in an FVC image of the focal plane. These are the average of 4 pinhole positions.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	40	int	width of table in bytes
NAXIS2	113	int	number of rows in table
EXPID	182039	int	
MODULE	FIDUCIALPOS	str	
CHECKSUM	gPHJiPEGgPEGgPEG	str	HDU checksum updated 2023-05-25T08:35:47
DATASUM	2559088998	str	data unit checksum updated 2023-05-25T08:35:47

Required Data Table Columns

Name	Type	Units	Description
PETAL_LOC	int64		Petal location [0-9]
DEVICE_LOC	int64		Device location on focal plane [0-523]
XPIX	float64		CCD X (column) coordinate
YPIX	float64		CCD Y (row) coordinate
FLAGS	int64		Flags as defined somewhere

HDU4

EXTNAME = PMPOSPOS

Table of predicted FVC CCD pixel coordinates for back-illuminated positioner fibers in an FVC image of the focal plane.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	75	int	width of table in bytes
NAXIS2	5020	int	number of rows in table
EXPID	182039	int	
MODULE	POSITIONERPOS	str	
CHECKSUM	QioaRglUQglaQglU	str	HDU checksum updated 2023-05-25T08:35:47
DATASUM	2541629356	str	data unit checksum updated 2023-05-25T08:35:47

Required Data Table Columns

Name	Type	Units	Description
PETAL_LOC	int64		Petal location [0-9]
DEVICE_LOC	int64		Device location on focal plane [0-523]
DEVICE_TYPE	char[3]		Device type
XFPA	float64	mm	Focal plane CS5 X coordinate
YFPA	float64	mm	Focal plane CS5 Y coordinate
Q	float64	rad	Focal plane CS5 Q coordinate (position angle)
S	float64	mm	Focal plane CS5 S coordinates (radius)
XPIX	float64		CCD X (column) coordinate
YPIX	float64		CCD Y (row) coordinate
FLAGS	int64		Flags as defined somewhere

HDU5

EXTNAME = PMCNTPOS

Table of predicted FVC pixel coordinates for the location of the center-of-travel for positioners in an FVC image of the focal plane.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	40	int	width of table in bytes
NAXIS2	5133	int	number of rows in table
EXPID	182039	int	
MODULE	CENTERPOS	str	
CHECKSUM	ooVAolUAolUAolUA	str	HDU checksum updated 2023-05-25T08:35:47
DATASUM	1382328634	str	data unit checksum updated 2023-05-25T08:35:47

Required Data Table Columns

Name	Type	Units	Description
PETAL_LOC	int64		Petal location [0-9]
DEVICE_LOC	int64		Device location on focal plane [0-523]
XPIX	float64		CCD X (column) coordinate
YPIX	float64		CCD Y (column) coordinate
FLAGS	int64		Flags as defined somewhere

HDU6

EXTNAME = PMFIBMAP

Table of all target and sky monitor positions after calibration with the FVC.

NOTE: For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	94	int	width of table in bytes
NAXIS2	5020	int	number of rows in table
EXPID	182039	int	
MODULE	FIBERMAP	str	
CHECKSUM	OQIDPOI9OOIAOOI9	str	HDU checksum updated 2023-05-25T08:35:47
DATASUM	2870350002	str	data unit checksum updated 2023-05-25T08:35:47

Required Data Table Columns

Name	Type	Units	Description
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
FIBER_XI	float64	deg	Actual ICRS tangent plane xi coordinates pointed to by a fiber
FIBER_ETA	float64	deg	Actual ICRS tangent plane eta coordinates pointed to by a fiber
FIBER_RA_IVAR	float32	arcsec^-2	Inverse variance (not meaningful)
FIBER_DEC_IVAR	float32	arcsec^-2	Inverse variance (not meaningful)
FIBER_X	float64	mm	CS5 X location requested by PlateMaker
FIBER_Y	float64	mm	CS5 Y location requested by PlateMaker
DELTA_XFPA	float32	mm	Focal plane X correction (target minus actual)
DELTA_YFPA	float32	mm	Focal plane Y correction (target minus actual)
DELTA_XFPA_IVAR	float32	mm^-2	Inverse variance (not meaningful)
DELTA_YFPA_IVAR	float32	mm^-2	Inverse variance (not meaningful)
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBERSTATUS	int32		Fiber status mask. 0=good
DEVICE_LOC	int32		Device location on focal plane [0-523]
NUM_ITER	int32		Number of positioner iterations
SPECTROID	int32		Hardware ID of spectrograph (not used)
PETAL_LOC	int16		Petal location [0-9]

Notes and Examples

There is an inaccuracy in the way proper motions are applied in fields at high dec: the proper motions are applied after target positions have been converted to tangent plane coordinates centered on the field center, but are not corrected to account for the fact that lines of constant RA and DEC are not Cartesian coordinates in the tangent plane.

For targets with a non-zero proper motion, `FIBER_RA` and `FIBER_DEC` refer to the position at the reference epoch (but note that the proper-motion correction has been applied at the time of the observation, it is just not recorded in `FIBER_RA` and `FIBER_DEC`).

request-EXPID

Summary
JSON file containing commands to be executed during the current exposure.

Naming Convention
`request-EXPID.json`, where EXPID is the zero-padded 8-digit exposure ID.

Regex
`request-[0-9]{8}\.json`

File Type
JSON, 100 bB

Contents

Each file contains a dictionary with the following top-level keys:

Key	Description
SEQUENCE	Overall exposure type.

sky-EXPID

Summary
Raw data from the two DESI Sky Cameras, with one fpack-compressed HDU for each camera.

Naming Convention
`sky-EXPID.fits.fz`, where EXPID is the zero-padded 8-digit exposure ID.

Regex
`sky-[0-9]{8}\.fits\.fz`

File Type
FITS, 70 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	SKY	Empty HDU	Header keywords only
HDU1	SKYCAM1	Compressed IMAGE	Sky camera frames
HDU2	SKYCAM1T	BINTABLE	Metadata about each frame
HDU3	SKYCAM0	Compressed IMAGE	Sky camera frames
HDU4	SKYCAM0T	BINTABLE	Metadata about each frame

The SKYCAMERA data will be 3D[nframes, ny, nx] such that `data[i]` is the 2D sky camera frame number `i`. Row `i` of the SKYCAM[01]T table will contain the metadata about that frame, *e.g.* the DATE-OBS and EXPTIME.

FITS Header Units

HDU0

EXTNAME = SKY

This HDU contains header keywords only.

Required Header Keywords

KEY	Example Value	Type	Comment
MODULE	SKY	str	Image Sources/Component
EXPID	118526	int	Exposure number
FRAMES	7	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FLAVOR	science	str	Observation type
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
NIGHT	20220113	int	Observing night
ACQTIME	None	Unknown	[s] acqusition image exposure time
GUIDTIME	None	Unknown	[s] guider GFA exposure time
FOCSTIME	None	Unknown	[s] focus GFA exposure time
SKYTIME	60.0	float	[s] sky camera exposure time (acquisition)
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer inpu
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer i
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sk
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing o
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
ADC2PHI	None	Unknown	[deg] ADC 2 angle
HEXPOS	None	Unknown	Hexapod position
DOSVER	trunk	str	DOS software version
CONSTVER	DESI:CURRENT	str	Constants version
ARCHIVE	/exposures/desi/20220113/00118526/sky-00118526.fits.fz	str	
CHECKSUM	1m7R3m7P1m7P1m7P	str	HDU checksum updated 2022-01-14T11:14
DATASUM	0	str	data unit checksum updated 2022-01-14T1

Empty HDU.

HDU1

EXTNAME = SKYCAM1

Contains the raw data from multiple exposures of SkyCam1, normally taken concurrently with a DESI spectrograph exposure. Each raw image contains spots from the ETC fibers whose total flux is a measure of relative sky brightness in the r band. Use the `desietc.sky` module to reduce these images and measure sky fiber fluxes.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	14329	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
EXPID	118526	int	Exposure number
FRAMES	7	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:04:17.933414	str	[UTC] Observation data and start time
MJD-OBS	59593.46131867	float	Modified Julian Date of observation
ST	11:14:42.9462	str	Local Sidereal time at observation start (HH
SKYTIME	60.0	float	[s] sky camera exposure time (acquisition)
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (
EPOCH	2000.0	float	Epoch of observation
EQUINOX	None	Unknown	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle

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Table 123 – continued from previous page

KEY	Example Value	Type	Comment
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sk
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing o
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	None	Unknown	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
RADESYS	FK5	str	Coordinate reference frame of major/minor
SHAPE	2047,3072	str	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	None	Unknown	
ROIWIDTH	None	Unknown	
GEXPMODE	None	Unknown	GFA readout mode (loop/normal)
DEVICEID	None	Unknown	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	CPA0EN50CNA0CN30	str	HDU checksum updated 2022-01-14T11:1
DATASUM	4223421838	str	data unit checksum updated 2022-01-14T1

Data: FITS image [int16 (compressed), 3072x2047x7]

HDU2

EXTNAME = SKYCAM1T

A table of timestamps and instrument parameters for each SkyCam0 exposure stored in HDU SKYCAM1.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	144	int	width of table in bytes
NAXIS2	7	int	number of rows in table
CHECKSUM	S14XT04US04US04U	str	HDU checksum updated 2022-01-14T11:14:08
DATASUM	136958306	str	data unit checksum updated 2022-01-14T11:14:08

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
REQTIME[1]	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[4]		TODO: description needed
GAMBNTT	char[4]		TODO: description needed
GFPGAT	char[4]		TODO: description needed
GFILTERT	char[4]		TODO: description needed
GCOLDTEC	char[4]		TODO: description needed
GHOTTEC	char[4]		TODO: description needed
GCCDTEMP	char[4]		TODO: description needed
GCAMTEMP	char[4]		TODO: description needed
GHUMID2	char[4]		TODO: description needed
GHUMID3	char[4]		TODO: description needed

HDU3

EXTNAME = SKYCAM0

Contains the raw data from multiple exposures of SkyCam0, normally taken concurrently with a DESI spectrograph exposure. Each raw image contains spots from the ETC fibers whose total flux is a measure of relative sky brightness in the r band. Use the `desietc.sky` module to reduce these images and measure sky fiber fluxes.

[1] Optional

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	width of table in bytes
NAXIS2	14329	int	number of rows in table
ZTILE3	1	int	size of tiles to be compressed
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
EXPID	118526	int	Exposure number
FRAMES	7	int	Number of Frames in Archive
TILEID	4403	int	DESI Tile ID
FIBASSGN	/data/tiles/SVN_tiles/004/fiberassign-004403.fits.gz	str	Fiber assign
FLAVOR	science	str	Observation type
SEQUENCE	_Split	str	OCS Sequence name
PURPOSE	Main Survey	str	Purpose of observing night
PROGRAM	DARK	str	Program name
PROPID	2020B-5000	str	Proposal ID
OBSERVER	Jessica Chellino, Corentin Ravoux	str	Names of observers
LEAD	Martin Landriau	str	Lead observer
INSTRUME	DESI	str	Instrument name
OBSERVAT	KPNO	str	Observatory name
OBS-LAT	31.96403	str	[deg] Observatory latitude
OBS-LONG	-111.59989	str	[deg] Observatory east longitude
OBS-ELEV	2097.0	float	[m] Observatory elevation
TELESCOP	KPNO 4.0-m telescope	str	Telescope name
CORRCTOR	DESI Corrector	str	Corrector Identification
NIGHT	20220113	int	Observing night
TIMESYS	UTC	str	Time system used for date-obs
DATE-OBS	2022-01-14T11:04:17.933414	str	[UTC] Observation data and start time
MJD-OBS	59593.46131867	float	Modified Julian Date of observation
ST	11:14:42.9462	str	Local Sidereal time at observation start (HH
SKYTIME	60.0	float	[s] sky camera exposure time (acquisition)
REQRA	170.239	float	[deg] Requested right ascension (observer i
REQDEC	-7.093	float	[deg] Requested declination (observer input
DELTARA	None	Unknown	[arcsec] Offset], right ascension, observer in
DELTADEC	None	Unknown	[arcsec] Offset], declination, observer input
FOCUS	946.6,-231.6,-83.4,-18.3,9.8,139.4	str	Telescope focus settings
TRUSTEMP	12.267	float	[deg] Average Telescope truss temperature (
PMIRTEMP	11.675	float	[deg] Average primary mirror temperature (
EPOCH	2000.0	float	Epoch of observation
EQUINOX	None	Unknown	Equinox of selected coordinate reference fra
MOUNTAZ	176.725567	float	[deg] Mount azimuth angle
MOUNTDEC	-7.102329	float	[deg] Mount declination
MOUNTEL	50.883914	float	[deg] Mount elevation angle
MOUNTHA	-2.081118	float	[deg] Mount hour angle
SKYDEC	-7.102329	float	[deg] Telescope declination (pointing on sky
SKYRA	170.24163	float	[deg] Telescope right ascension (pointing on
TARGTDEC	-7.102329	float	[deg] Target declination (to TCS)
TARGTRA	170.24163	float	[deg] Target right ascension (to TCS)
USEETC	T	bool	ETC data available if true

continues on nex

Table 124 – continued from previous page

KEY	Example Value	Type	Comment
ACQCAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Acquisition cameras used
GUIDECAM	GUIDE0,GUIDE2,GUIDE3,GUIDE5,GUIDE7,GUIDE8	str	Guide cameras used for t
FOCUSCAM	FOCUS1,FOCUS4,FOCUS6,FOCUS9	str	Focus cameras used for this exposure
SKYCAM	SKYCAM0,SKYCAM1	str	Sky cameras used for this exposure
ADC1PHI	None	Unknown	[deg] ADC 1 angle
USESKY	T	bool	DOS Control: use Sky Monitor
USEFOCUS	T	bool	DOS Control: use focus
HEXPOS	None	Unknown	Hexapod position
HEXTRIM	0.0,0.0,0.0,0.0,0.0,0.0	str	Hexapod trim values
USEROTAT	T	bool	DOS Control: use rotator
ROTOFFST	138.8	float	[arcsec] Rotator offset
ROTENBLD	T	bool	Rotator enabled
ROTRATE	0.513	float	[arcsec/min] Rotator rate
USEGUIDR	T	bool	DOS Control: use guider
USEDONUT	T	bool	DOS Control: use donuts
RADESYS	FK5	str	Coordinate reference frame of major/minor
SHAPE	2047,3072	str	
DOSVER	trunk	str	DOS software version
OCSVER	1.2	float	OCS software version
CONSTVER	DESI:CURRENT	str	Constants version
INIFILE	/data/msdos/dos_home/architectures/kpno/desi.ini	str	DOS Configuration
ADCPHI2	None	Unknown	
ROI	None	Unknown	
ROIWIDTH	None	Unknown	
GEXPMODE	None	Unknown	GFA readout mode (loop/normal)
DEVICEID	None	Unknown	GFA device id (serial number)
REQTIME	1860.0	float	[s] Requested exposure time
CHECKSUM	SLfNTKfKSKfKSKfK	str	HDU checksum updated 2022-01-14T11:14
DATASUM	4278834758	str	data unit checksum updated 2022-01-14T11

Data: FITS image [int16 (compressed), 3072x2047x7]

HDU4

EXTNAME = SKYCAM0T

A table of timestamps and instrument parameters for each SkyCam0 exposure stored in HDU SKYCAM0.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	144	int	width of table in bytes
NAXIS2	7	int	number of rows in table
CHECKSUM	dFIceCHbdCHbdCHb	str	HDU checksum updated 2022-01-14T11:14:09
DATASUM	3066928412	str	data unit checksum updated 2022-01-14T11:14:09

Required Data Table Columns

Name	Type	Units	Description
EXPTIME	float64		TODO: description needed
REQTIME[Page 761, 1]	float64		TODO: description needed
NIGHT	int64		TODO: description needed
DATE-OBS	char[26]		TODO: description needed
TIME-OBS	char[15]		TODO: description needed
MJD-OBS	float64		TODO: description needed
OPENSHUT	char[*]		TODO: description needed
ST	char[*]		TODO: description needed
HEXPOS	char[4]		TODO: description needed
GAMBNTT	char[4]		TODO: description needed
GFPGAT	char[4]		TODO: description needed
GFILTERT	char[4]		TODO: description needed
GCOLDTEC	char[4]		TODO: description needed
GHOTTEC	char[4]		TODO: description needed
GCCDTEMP	char[4]		TODO: description needed
GCAMTEMP	char[4]		TODO: description needed
GHUMID2	char[4]		TODO: description needed
GHUMID3	char[4]		TODO: description needed

1.1.4 DESI_SPECTRO_SIM

`DESI_SPECTRO_SIM` contains simulated raw data, with the canonical location of `$DESI_ROOT/spectro/sim`. Simulated files are additionally grouped under a $PIXPROD subdirectory to isolate different simulation runs.

The intention is that $DESI_SPECTRO_SIM/$PIXPROD will contain a superset of the files in $DESI_SPECTRO_DATA, such that one could set DESI_SPECTRO_DATA=$DESI_SPECTRO_SIM/$PIXPROD and run the pipeline. The simulator does not yet output truly raw data (only preprocessed data) so this is not yet possible.

PIXPROD

Simulation runs are grouped into $PIXPROD subdirectories, which are further subdivided by NIGHT = YYYYMMDD and 8-digit zero-padded EXPID.

NIGHT

$DESI_SPECTRO_SIM contains simulated raw data, with the canonical location of $DESI_ROOT/spectro/sim. Simulated files are additionally grouped under a $PIXPROD subdirectory to isolate different simulation runs.

The intention is that $DESI_SPECTRO_SIM/$PIXPROD will contain a superset of the files in $DESI_SPECTRO_DATA, such that one could set DESI_SPECTRO_DATA=$DESI_SPECTRO_SIM/$PIXPROD and run the pipeline.

Within each NIGHT (YEARMMDD), individual exposures are grouped in subdirectories by EXPID.

EXPID

$DESI_SPECTRO_SIM contains simulated raw data, with the canonical location of $DESI_ROOT/spectro/sim. Simulated files are additionally grouped under a $PIXPROD subdirectory to isolate different simulation runs.

The intention is that $DESI_SPECTRO_SIM/$PIXPROD will contain a superset of the files in $DESI_SPECTRO_DATA, such that one could set DESI_SPECTRO_DATA=$DESI_SPECTRO_SIM/$PIXPROD and run the pipeline. The simulator does not yet output truly raw data (only preprocessed data) so this is not yet possible.

Within each NIGHT (YEARMMDD), individual exposures are grouped in subdirectories by EXPID.

fibermap-EXPID.fits

See *DESI_SPECTRO_DATA/NIGHT/EXPID/fibermap-EXPID*.

pix-CAMERA-EXPID.fits

Summary
Pre-processed CCD pixel data.

Naming Convention
`pix-{CAMERA}-{EXPID}.fits`, where {CAMERA} is the camera name (*e.g.* `b0`, `r1`, or `z9`), and `{EXPID}` is the 8-digit exposure ID.

Regex
`pix-[brz]{1}[0-9]{1}-[0-9]{8}\.fits`

File Type
FITS, 320 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	ELECTRONS	IMAGE	Pre-processed electrons
HDU1	IVAR	IMAGE	Inverse variance [1/electrons^2]
HDU2	MASK	IMAGE	Mask 0=good, non-0 is bad

FITS Header Units

HDU0 - ELECTRONS

EXTNAME = ELECTRONS

Bias subtracted, pixel flat fielded, gain corrected CCD image in electrons.

Required Header Keywords

KEY	Example Value	Type	Comment
CAMERA	b0	str	Spectograph Camera
VSPECTER	0.0.0	str	TODO: Specter version
EXPTIME	1000.0	float	Exposure time [sec]
RDNOISE	3.0	float	Read noise [electrons]
FLAVOR	arc	str	Exposure type (arc, flat, science)

Data: FITS image

HDU1 - IVAR

EXTNAME = IVAR

Inverse variance image of the electron image in HDU 0

Required Header Keywords

KEY	Value	Type	Comment
EXTNAME	IVAR	str	extension name
RDNOISE	3.0	float	Read noise [electrons]

Data: FITS image

HDU2

EXTNAME = MASK

Mask image, where 0=good, non-0=bad.

Required Header Keywords

KEY	Value	Type	Comment
EXTNAME	MASK	str	extension name

Data: FITS image

simpix

Summary
simpix files contain the noiseless CCD pixel image. The corresponding pix-*.fits files contain the noisy realization of this image like the real data would see. It optionally contains the x and y trace locations vs. wavelength.

Naming Convention
`simpix-{CAMERA}-{EXPID}.fits`, where `{CAMERA}` is the spectrograph camera, *e.g.* b0, r1, z9; and `{EXPID}` is the 8-digit exposure ID.

Regex
`simpix-[brz][0-9]-[0-9]{8}\.fits`

File Type
FITS, 128 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	ELECTRONS	IMAGE	Noiseless simulated image
HDU1	XCOEFF	IMAGE	Optional: Legendre coefficients for x vs. wavelength
HDU2	YCOEFF	IMAGE	Optional: Legendre coefficients for y vs. wavelength

FITS Header Units

HDU0

EXTNAME = ELECTRONS

Noiseless simulated image in electrons

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	4096	int	Number of pixels in y (wavelength direction)
NAXIS2	4096	int	Number of pixels in x (fiber direction)
VSPECTER	0.0.0	str	Specter version used to simulate this image

Data: FITS image [float64]

HDU1

EXTNAME = XCOEFF

Legendre coefficients to describe the spectral trace x vs. wavelength.

To evaluate, convert the wavelength in Angstroms to the domain [-1,1] using WAVEMIN and WAVEMAX, and then evaluate the Legendre polynomial:

```
w = 2*(wavelength - WAVEMIN) / (WAVEMAX - WAVEMIN) - 1.0
x = numpy.polynomial.legval(w, xcoeff[i])
```

Required Header Keywords

Most keywords are inherited from the input PSF, which inherited them from the input Zemax spot files.

KEY	Example Value	Type	Comment
NAXIS1	8	int	Number of Legendre coefficients
NAXIS2	500	int	Number of spectra
EXTNAME	XCOEFF	str	
DATAMIN	1.17549435082e-38	float	minimum allowed data value
DATAMAX	3.40282346638e+38	float	maximum allowed data value
DATATYPE	Normalized Image	str	Type of image
SPECTRO	DESI-0224-v1.ZMX(95% are better)	str	
ARM	Blue	str	Spectrograph Arm
ARMINT	1	int	Spectrograph Arm
WAVECENT	476.5	float	Center Wavelength (nm)
XCENT	5.379251126	float	Detector X Centroid (mm)
YCENT	-29.956071488	float	Detector Y Centroid (mm)
XDIRCOS	-0.0353851399911	float	x direction cosine
YDIRCOS	-0.976475545755	float	y direction cosine
ZDIRCOS	4.77449053078e-312	float	z direction cosine
PIXSIZE	0.001	float	size of pixel (mm)
DIFFRACT	T	bool	diffraction added?
DETEFF	T	bool	detector effects added?
PUPIL	126.5	float	Camera Pupil (mm)
FOCALLEN	215.0	float	Camera focal length (mm)
E2VFLAG	T	bool	e2v detector
TEMP	175.0	float	Detector T (K)
DETSIG	5.0	float	sigma for detector (um)
DETTHICK	0.0	float	thickness of detector (um)
DATE	2013-09-12	str	Date
CTYPE1	X	str	X coordinate (mm)
CTYPE2	Y	str	Y coordinate (mm)
CRPIX1	113.0	float	Reference X pixel
CRPIX2	113.0	float	Reference Y pixel
CRVAL1	5.380413942	float	Reference X value
CRVAL2	-29.95920258	float	Reference Y value
CDELT1	0.001	float	X pixel size (mm)
CDELT2	0.001	float	Y pixel size (mm)
PSFTYPE	SPOTGRID	str	Grid of simulated PSF spots

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KEY	Example Value	Type	Comment
NPIX_X	4096	int	Number of CCD pixels in X direction
NPIX_Y	4096	int	Number of CCD pixels in Y direction
NSPEC	500	int	Number of spectra
NWAVE	11	int	Number of wavelength samples
CCDPIXSZ	0.015	float	CCD pixel size [mm]
DFIBER	0.23	float	Center-to-center pitch of fibers on slit [mm]
DGROUP	0.556	float	Spacing between fiber groups on slit [mm]
NGROUPS	20	int	Number of fiber groups per slit
NFIBGRP	25	int	Number of fibers per group
WAVEMIN	3533	int	Min wavelength for Legendre domain [-1,1]
WAVEMAX	5998	int	Max wavelength for Legendre domain [-1,1]
WMIN_ALL	3569	int	Min wavelength seen by all spectra [Ang]
WMAX_ALL	5949	int	Max wavelength seen by all spectra [Ang]

Data: FITS image [float64]

HDU2

EXTNAME = YCOEFF

Legendre coefficients to describe the spectral trace y vs. wavelength. See the description in HDU1 for how to evaluate these.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	
NAXIS2	500	int	
EXTNAME	YCOEFF	str	
WAVEMIN	3533	int	Min wavelength on the CCD [Ang]
WAVEMAX	5998	int	Max wavelength on the CCD [Ang]
WMIN_ALL	3569	int	Min wavelength seen by all spectra [Ang]
WMAX_ALL	5949	int	Max wavelength seen by all spectra [Ang]

Data: FITS image [float64]

simspec-EXPID.fits

Summary
Input spectra to simulate with pixsim.

Naming Convention
`simspec-{EXPID}.fits`, where {EXPID} is the 8-digit exposure ID.

Regex
`simspec-[0-9]{8}\.fits`

File Type
FITS, 2 GB

Contents

Number	EXTNAME	Type	Contents
HDU0	WAVE	IMAGE	Input wavelength vector
HDU1	FLUX	IMAGE	Input object spectra
HDU2	SKYFLUX	IMAGE	Input sky flux
HDU3	WAVE_B	IMAGE	Input wavelengths b-channel
HDU4	PHOT_B	IMAGE	Input object photons b-channel
HDU5	SKYPHOT_B	IMAGE	Input sky photons b-channel
HDU6	WAVE_R	IMAGE	Input wavelengths r-channel
HDU7	PHOT_R	IMAGE	Input object photons r-channel
HDU8	SKYPHOT_R	IMAGE	Input sky photons r-channel
HDU9	WAVE_Z	IMAGE	Input wavelengths z-channel
HDU10	PHOT_Z	IMAGE	Input object photons z-channel
HDU11	SKYPHOT_Z	IMAGE	Input sky photons z-channel
HDU12	TRUTH	BINTABLE	Truth metadata about the targets
HDU13	FIBERMAP	BINTABLE	Fibermap
HDU14	OBSCONDITIONS	BINTABLE	Observing conditions metadata
HDU15	TRUTH_BGS	BINTABLE	BGS-specific truth metadata
HDU16	TRUTH_ELG	BINTABLE	ELG-specific truth metadata
HDU17	TRUTH_STAR	BINTABLE	STAR-specific truth metadata
HDU18	TRUTH_WD	BINTABLE	WD-specific truth metadata

FITS Header Units

HDU0

EXTNAME = WAVE

Input wavelength vector. Simulation inputs are stored in header cards.

Required Header Keywords

KEY	Value	Type	Comment
NAXIS1	32001	int	Number of wavelength pixels
NIGHT	YYYYMMDD	str	Night of observation
EXPID	0	int	DESI exposure ID
TILEID	1	int	DESI tile ID
PROGRAM	dark	str	Program name
FLAVOR	science	str	Flavor of observation (arc, flat, science)
TELRA	0.0	float	Telescope pointing RA [degrees]
TELDEC	0.0	float	Telescope pointing Dec [degrees]
AIRMASS	1.0	float	Airmass at middle of exposure
EXPTIME	1000.0	float	Exposure time [sec]
SEEING	1.080542206764221	float	Seeing FWHM [arcsec]
MOONFRAC	0.4083473802955095	float	Moon illumination fraction 0-1; 1=full
MOONALT	-4.92578905244666	float	Moon altitude [degrees]
MOONSEP	135.3911422523808	float	Moon:tile separation angle [degrees]
DATE-OBS	2017-06-15T22:00:00	str	Start of exposure
MJD	58925.38986146489	float	
SNR2FRAC	0.501188337802887	float	
TRANSP	0.9904059171676636	float	
SKY	1.0	float	
RA	150.73	float	
DEC	30.52	float	
PASS	4	int	
DOSVER	SIM	str	
FEEVER	SIM	str	
BUNIT	Angstrom	str	Wavelength unit
AIRORVAC	vac	str	Vacuum wavelengths

Data: FITS image [float64, 32001]

HDU1

EXTNAME = FLUX

Input object spectra.

Required Header Keywords

KEY	Value	Type	Comment
NAXIS1	32001	int	
NAXIS2	5000	int	
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	Flux unit

Data: FITS image [float32, 32001x5000]

HDU2

EXTNAME = SKYFLUX

Input sky flux.

Required Header Keywords

KEY	Value	Type	Comment
NAXIS1	32001	int	
NAXIS2	5000	int	
BUNIT	10**-17 erg/(s cm2 Angstrom)	str	Flux unit

Data: FITS image [float32, 32001x5000]

HDU3

EXTNAME = WAVE_B

Input wavelengths b-channel [Angstrom].

Required Header Keywords

KEY	Value	Type	Comment
NAXIS1	11901	int	

Data: FITS image [float64, 11901]

HDU4

EXTNAME = PHOT_B

Input object photons b-channel.

Required Header Keywords

KEY	Value	Type	Comment
NAXIS1	11901	int	
NAXIS2	5000	int	
BUNIT	photon	str	

Data: FITS image [float32, 11901x5000]

HDU5

EXTNAME = SKYPHOT_B

Input object photons b-channel.

Required Header Keywords

KEY	Value	Type	Comment
NAXIS1	11901	int	
NAXIS2	5000	int	
BUNIT	photon	str	

Data: FITS image [float32, 11901x5000]

HDU6

EXTNAME = WAVE_R

Input wavelengths r-channel [Angstrom].

Required Header Keywords

KEY	Value	Type	Comment
NAXIS1	10581	int	

Data: FITS image [float64, 10581]

HDU7

EXTNAME = PHOT_R

Input object photons r-channel.

Required Header Keywords

KEY	Value	Type	Comment
NAXIS1	10581	int	
NAXIS2	5000	int	
BUNIT	photon	str	

Data: FITS image [float32, 10581x5000]

HDU8

EXTNAME = SKYPHOT_R

Input object photons r-channel.

Required Header Keywords

KEY	Value	Type	Comment
NAXIS1	10581	int	
NAXIS2	5000	int	
BUNIT	photon	str	

Data: FITS image [float32, 10581x5000]

HDU9

EXTNAME = WAVE_Z

Input wavelengths z-channel [Angstrom].

Required Header Keywords

KEY	Value	Type	Comment
NAXIS1	11996	int	

Data: FITS image [float64, 11996]

HDU10

EXTNAME = PHOT_Z

Input object photons z-channel.

Required Header Keywords

KEY	Value	Type	Comment
NAXIS1	11996	int	
NAXIS2	5000	int	
BUNIT	photon	str	

Data: FITS image [float32, 11996x5000]

HDU11

EXTNAME = SKYPHOT_Z

Input object photons z-channel.

Required Header Keywords

KEY	Value	Type	Comment
NAXIS1	11996	int	
NAXIS2	5000	int	
BUNIT	photon	str	

Data: FITS image [float32, 11996x5000]

HDU12

EXTNAME = TRUTH

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	109	int	length of dimension 1
NAXIS2	5000	int	length of dimension 2

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
MOCKID	int64		TODO: description needed
TRUEZ	float32		TODO: description needed
TRUESPECTYPE	char[10]		TODO: description needed
TEMPLATETYPE	char[10]		TODO: description needed
TEMPLATESUBTYPE	char[10]		TODO: description needed
TEMPLATEID	int32		TODO: description needed
SEED	int64		TODO: description needed
MAG	float32		TODO: description needed
MAGFILTER	char[15]		TODO: description needed
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_W3	float32		TODO: description needed
FLUX_W4	float32		TODO: description needed

HDU13

EXTNAME = FIBERMAP

Map of which fibers are on which targets. See See *DESI_SPECTRO_DATA/NIGHT/EXPID/fibermap-EXPID*.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	334	int	length of dimension 1
NAXIS2	5000	int	length of dimension 2
NIGHT	20200316	str	Night of observation YEARMMDD
EXPID	10	int	DESI exposure ID
TILEID	28408	int	DESI tile ID
PROGRAM	GRAY	str	program [dark, bright, . . .]
FLAVOR	science	str	Flavor [arc, flat, science, zero, . . .]
TELRA	150.73	float	Telescope pointing RA [degrees]
TELDEC	30.52	float	Telescope pointing dec [degrees]
AIRMASS	1.34693655042678	float	Airmass at middle of exposure
EXPTIME	757.8536680645208	float	Exposure time [sec]
SEEING	1.080542206764221	float	Seeing FWHM [arcsec]
MOONFRAC	0.4083473802955095	float	Moon illumination fraction 0-1; 1=full
MOONALT	-4.92578905244666	float	Moon altitude [degrees]
MOONSEP	135.3911422523808	float	Moon:tile separation angle [degrees]
DATE-OBS	2020-03-17T09:21:24.031	str	Start of exposure

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (Bright Galaxy Survey) target selection bitmask
MWS_TARGET	int64		Milky Way Survey targeting bits
SECONDARY_TARGET	int64		TODO: description needed
TARGET_RA	float64	deg	Barycentric right ascension in ICRS
TARGET_DEC	float64	deg	Barycentric declination in ICRS
TARGET_RA_IVAR	float64	deg-2	TODO: description needed
TARGET_DEC_IVAR	float64	deg-2	TODO: description needed
BRICKID	int64		Brick ID from tractor input
BRICK_OBJID	int64		Imaging Surveys OBJID on that brick
MORPHTYPE	char[4]		Imaging Surveys morphological type from Tractor
PRIORITY	int32		Target current priority
SUBPRIORITY	float64		Random subpriority [0-1) to break assignment ties
REF_ID	int64		Tyc1*1,000,000+Tyc2*10+Tyc3 for Tycho-2; `sourceid` for Gaia DR
PMRA	float32	10**-3 arcsec yr-1	proper motion in the +RA direction (already including cos(dec))
PMDEC	float32	10**-3 arcsec yr-1	Proper motion in the +Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry. Typically 2015.5 for Gai
PMRA_IVAR	float32	10**+6 arcsec-2 yr2	Inverse variance of PMRA

Table 126 – continued from previous page

Name	Type	Units	Description
PMDEC_IVAR	float32	10**+6 arcsec-2 yr2	Inverse variance of PMDEC
RELEASE	int16		Imaging surveys release ID
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (AB)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (AB)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (AB)
FLUX_W1	float32	nanomaggy	WISE flux in W1 (AB)
FLUX_W2	float32	nanomaggy	WISE flux in W2 (AB)
FLUX_IVAR_G	float32	1/nanomaggies**2	Inverse variance of FLUX_G (AB)
FLUX_IVAR_R	float32	1/nanomaggies**2	Inverse variance of FLUX_R (AB)
FLUX_IVAR_Z	float32	1/nanomaggies**2	Inverse variance of FLUX_Z (AB)
FLUX_IVAR_W1	float32	1/nanomaggies**2	Inverse variance of FLUX_W1 (AB)
FLUX_IVAR_W2	float32	1/nanomaggies**2	Inverse variance of FLUX_W2 (AB)
FIBERFLUX_G	float32	nanomaggies	Predicted g-band flux within a fiber of diameter 1.5 arcsec from this o
FIBERFLUX_R	float32	nanomaggies	Predicted r-band flux within a fiber of diameter 1.5 arcsec from this ol
FIBERFLUX_Z	float32	nanomaggies	Predicted z-band flux within a fiber of diameter 1.5 arcsec from this o
FIBERFLUX_W1	float32	nanomaggies	TODO: description needed
FIBERFLUX_W2	float32	nanomaggies	TODO: description needed
FIBERTOTFLUX_G	float32	nanomaggies	Predicted g-band flux within a fiber of diameter 1.5 arcsec from all so
FIBERTOTFLUX_R	float32	nanomaggies	Predicted r-band flux within a fiber of diameter 1.5 arcsec from all sou
FIBERTOTFLUX_Z	float32	nanomaggies	Predicted z-band flux within a fiber of diameter 1.5 arcsec from all so
FIBERTOTFLUX_W1	float32	nanomaggies	TODO: description needed
FIBERTOTFLUX_W2	float32	nanomaggies	TODO: description needed
MW_TRANSMISSION_G	float32		Milky Way dust transmission in LS g-band
MW_TRANSMISSION_R	float32		Milky Way dust transmission in LS r-band
MW_TRANSMISSION_Z	float32		Milky Way dust transmission in LS z-band
EBV	float32	mag	Galactic extinction E(B-V) reddening from SFD98
PHOTSYS	char[1]		'N' for the MzLS/BASS photometric system, 'S&
OBSCONDITIONS	int32		Bitmask of allowed observing conditions
NUMOBS_INIT	int64		Initial number of observations for target calculated across target selec
PRIORITY_INIT	int64		Target initial priority from target selection bitmasks and OBSCONDI
NUMOBS_MORE	int32		Number of additional observations needed
HPXPIXEL	int64		HEALPixel containing this location at NSIDE=64 in the NESTED sc
FIBER	int32		Fiber ID on the CCDs [0-4999]
PETAL_LOC	int32		Petal location [0-9]
DEVICE_LOC	int32		Device location on focal plane [0-523]
LOCATION	int32		Location on the focal plane PETAL_LOC*1000 + DEVICE_LOC
FIBERSTATUS	int32		Fiber status mask. 0=good
OBJTYPE	char[3]		Object type: TGT, SKY, NON, BAD
LAMBDA_REF	float32	Angstrom	Requested wavelength at which targets should be centered on fibers
FIBERASSIGN_X	float32	mm	Fiberassign expected CS5 X location on focal plane
FIBERASSIGN_Y	float32	mm	Fiberassign expected CS5 Y location on focal plane
FA_TARGET	int64		Targeting bit internally used by fiberassign (linked with FA_TYPE)
FA_TYPE	byte		Fiberassign internal target type (science, standard, sky, safe, suppsky)
NUMTARGET	int16		Total number of targets that this positioner covered
FIBER_RA	float64	deg	RA of actual fiber position
FIBER_DEC	float64	deg	DEC of actual fiber position
FIBER_RA_IVAR	float32	deg-2	TODO: description needed
FIBER_DEC_IVAR	float32	deg-2	TODO: description needed
PLATEMAKER_X	float32	mm	TODO: description needed

Table 126 – continued from previous page

Name	Type	Units	Description
PLATEMAKER_Y	float32	mm	TODO: description needed
PLATEMAKER_RA	float32	deg	TODO: description needed
PLATEMAKER_DEC	float32	deg	TODO: description needed
NUM_ITER	int32		Number of positioner iterations
SPECTROID	int32		Hardware ID of spectrograph (not used)
BRICKNAME	char[8]		Brick name from tractor input
LAMBDAREF	float64		TODO: description needed
DELTA_X	float64	mm	CS5 X requested minus actual position
DELTA_Y	float64	mm	CS5 Y requested minus actual position

HDU14

EXTNAME = OBSCONDITIONS

Table with a single row defining the observing conditions for this exposure, e.g. SEEING, AIRMASS, lunar conditions.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	115	int	length of dimension 1
NAXIS2	1	int	length of dimension 2

Required Data Table Columns

Name	Type	Units	Description
EXPID	int32		Exposure ID
MJD	float64	d	Modified Julian Date
EXPTIME	float32	s	Exposure time
TILEID	int32		Tile ID
SNR2FRAC	float32		TODO: description needed
AIRMASS	float32		Airmass
SEEING	float32	arcsec	Atmospheric seeing FWHM
TRANSP	float32		Transparency [0-1]; 0=no photons
SKY	float32		TODO: description needed
PROGRAM	char[6]		DESI program name (e.g. DARK/GRAY/BRIGHT)
NIGHT	char[8]		Night 'YEARMMDD'
FLAVOR	char[7]		Exposure flavor (e.g. science or calib)
MOONFRAC	float64		Moon illumination fraction [0-1]; 1=full moon
MOONALT	float64	deg	Moon altitude
MOONSEP	float64	deg	Separation angle between moon and center of tile
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PASS	int16		tiling pass number

TODO: define if AIRMASS etc. are at middle of exposure, averaged, etc.

HDU15

EXTNAME = TRUTH_BGS

Truth metadata that are specific to BGS targets.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	56	int	length of dimension 1
NAXIS2	262	int	length of dimension 2

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
OIIFLUX	float32		TODO: description needed
HBETAFLUX	float32		TODO: description needed
EWOII	float32		TODO: description needed
EWHBETA	float32		TODO: description needed
D4000	float32		TODO: description needed
VDISP	float32		TODO: description needed
OIIDOUBLET	float32		TODO: description needed
OIIIHBETA	float32		TODO: description needed
OIIHBETA	float32		TODO: description needed
NIIHBETA	float32		TODO: description needed
SIIHBETA	float32		TODO: description needed
TRUEZ_NORSD	float32		TODO: description needed

HDU16

EXTNAME = TRUTH_ELG

Truth metadata that are specific to ELG targets.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	56	int	length of dimension 1
NAXIS2	4225	int	length of dimension 2

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
OIIFLUX	float32		TODO: description needed
HBETAFLUX	float32		TODO: description needed
EWOII	float32		TODO: description needed
EWHBETA	float32		TODO: description needed
D4000	float32		TODO: description needed
VDISP	float32		TODO: description needed
OIIDOUBLET	float32		TODO: description needed
OIIIHBETA	float32		TODO: description needed
OIIHBETA	float32		TODO: description needed
NIIHBETA	float32		TODO: description needed
SIIHBETA	float32		TODO: description needed
TRUEZ_NORSD	float32		TODO: description needed

HDU17

EXTNAME = TRUTH_STAR

Truth metadata that are specific to STAR targets.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	20	int	length of dimension 1
NAXIS2	106	int	length of dimension 2

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
TEFF	float32		TODO: description needed
LOGG	float32		TODO: description needed
FEH	float32		TODO: description needed

HDU18

EXTNAME = TRUTH_WD

Truth metadata that are specific to White Dwarf targets.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	16	int	length of dimension 1
NAXIS2	1	int	length of dimension 2

Required Data Table Columns

Name	Type	Units	Description
TARGETID	int64		Unique DESI target ID
TEFF	float32		TODO: description needed
LOGG	float32		TODO: description needed

1.1.5 DESI_SPECTRO_CALIB

`DESI_SPECTRO_CALIB` contains spectrographs calibration data. This directory tree is only partially documented here.

Files / subdirectories:

fluxcalib-CAMERA.fits

Summary
Flux calibration file contains an average calibration model for a given camera including airmass and seeing dependencies.

Naming Convention
`fluxcalib-{CAMERA}.fits`, where where `{CAMERA}` is one of the spectrograph cameras (*e.g.* `z1`).

Regex
`fluxcalib-{brz][0-9].fits`

File Type
FITS, 84 KB

The model is parameterized as

calibration_model(lambda) = average_cal(lambda) * 10^(-0.4*((seeing-pivot_seeing)*seeing_term(lambda) + (airmass-pivot_airmass)*atm_ext(lambda)))

calib_flux [1e-17 erg/s/cm2/Angstrom] = uncalib_flux [counts/Angstrom] / (calibration_model * exptime [s])

Contents

Number	EXTNAME	Type	Contents
HDU0	FLUXCALIB	IMAGE	Average flux calibration
HDU1	ATERM	IMAGE	Airmass dependent term
HDU2	STERM	IMAGE	Seeing dependent term
HDU3	WAVELENGTH	IMAGE	Wavelength grid
HDU4	ATERM_ERR	IMAGE	Uncertainty on airmass dependent term
HDU5	STERM_ERR	IMAGE	Uncertainty on seeing dependent term

FITS Header Units

HDU0

EXTNAME = FLUXCALIB

Average flux calibration model such that calibrated flux = uncalibrated photons / model.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2380	int	
BUNIT	10**+17 cm2 count s / erg	str	i.e. (elec/A) / (1e-17 erg/s/cm2/A)
CHECKSUM	2pfC2ofA2ofA2ofA	str	HDU checksum updated 2018-11-27T11:46:41
DATASUM	3135063907	str	data unit checksum updated 2018-11-27T11:46:41

Data: FITS image [float32, 2380]

HDU1

EXTNAME = ATERM

Atmospheric extinction term

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2380	int	
PAIRMASS	1.132032318244172	float	pivot airmass (airmass of average calib.)
CHECKSUM	Xd3dYd0bXd0bXd0b	str	HDU checksum updated 2018-11-27T11:46:41
DATASUM	1519080666	str	data unit checksum updated 2018-11-27T11:46:41

Data: FITS image [float32, 2380]

HDU2

EXTNAME = STERM

Seeing term

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2380	int	
PSEEING	1.075342118740081	float	pivot seeing (seeing of average calib.), FWHM arcsec
CHECKSUM	IOTaKNRTINRZINRZ	str	HDU checksum updated 2018-11-27T11:46:41
DATASUM	1211437529	str	data unit checksum updated 2018-11-27T11:46:41

Data: FITS image [float32, 2380]

HDU3

EXTNAME = WAVELENGTH

Wavelengths at which the flux calibration model is evaluated.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2380	int	
BUNIT	Angstrom	str	
CHECKSUM	CbCQFZ9OCaAOCY9O	str	HDU checksum updated 2018-11-27T11:46:41
DATASUM	3517056679	str	data unit checksum updated 2018-11-27T11:46:41

Data: FITS image [float32, 2380]

HDU4

EXTNAME = ATERM_ERR

Uncertainty on atmospheric extinction term

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2380	int	
CHECKSUM	fCmKhBkHfBkHfBkH	str	HDU checksum updated 2018-11-27T11:46:41
DATASUM	984665518	str	data unit checksum updated 2018-11-27T11:46:41

Data: FITS image [float32, 2380]

HDU5

EXTNAME = STERM_ERR

Uncertainty on seeing dependent term

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2380	int	
CHECKSUM	LaNJNZNJLaNJLYNJ	str	HDU checksum updated 2018-11-27T11:46:41
DATASUM	803867299	str	data unit checksum updated 2018-11-27T11:46:41

Data: FITS image [float32, 2380]

Notes and Examples

File produced by the desispec script desi_average_flux_calibration. Used by QuickLook and the off-line calibration.

1.1.6 DESI_SURVEYOPS

`DESI_SURVEYOPS` contains data files used for day-to-day survey operations, with the canonical location of `$DESI_ROOT/survey/ops/surveyops/trunk/`, though data releases will use a tagged version. The main directory is an SVN trunk that is updated as the DESI survey proceeds.

Subdirectories:

mtl

`mtl` is the root directory for the Merged Target List ledgers. The MTL ledgers record the state of each DESI target as redshift information is acquired. There is a set of ledgers for each of phase 2 of Survey Validation (`sv2`) the One-Percent Survey (`sv3`) and the Main Survey (`main`).

The `mtl-done-tiles.ecsv` and `scnd-mtl-done-tiles.ecsv` files in the `mtl` directory track which tiles have had target states updated over the course of all DESI survey phases (i.e. all of `sv2`, `sv3` and `main`).

Files and subdirectories:

mtl-done-tiles

Summary
Record of tiles with MTL updates for primary targets.

Naming Convention
`mtl-done-tiles.ecsv`

Regex
`mtl-done-tiles\.ecsv`

File Type
ecsv, 200 KB

Contents

EXTNAME	Type	Contents
MTLTILE	TABLE	Tile information

Required Data Table Columns

Name	Type	Units	Description
TILEID	int32		Unique tile ID on which MTL updates occurred
TIMESTAMP	str	s	UTC/ISO time when MTL updates on tile completed
VERSION	str		Version of desitarget code used to update ledgers
PROGRAM	str		DESI program type - BRIGHT, DARK or BACKUP
ZDATE	int64		Final night (YYYYMMDD) when redshifts were acquired
ARCHIVEDATE	int64		Date (YYYYMMDD) on which redshifts were archived

scnd-mtl-done-tiles

Summary
Record of tiles with MTL updates for secondary targets.

Naming Convention
`scnd-mtl-done-tiles.ecsv`

Regex
`scnd-mtl-done-tiles\.ecsv`

File Type
ecsv, 200 KB

Contents

EXTNAME	Type	Contents
MTLTILE	TABLE	Tile information

Required Data Table Columns

Name	Type	Units	Description
TILEID	int32		Unique tile ID on which MTL updates occurred
TIMESTAMP	str	s	UTC/ISO time when MTL updates on tile completed
VERSION	str		Version of desitarget code used to update ledgers
PROGRAM	str		DESI program type - BRIGHT or DARK
ZDATE	int64		Final night (YYYYMMDD) when redshifts were acquired
ARCHIVEDATE	int64		Date (YYYYMMDD) on which redshifts were archived

main

main is the root directory for the Merged Target List ledgers for the DESI Main Survey. The MTL ledgers record the state of each DESI target as redshift information is acquired. There is a set of ledgers for each of the DESI Main Survey primary programs (dark, bright and backup) as well as for the DESI secondary programs (secondary) and for Targets of Opportunity (ToO).

Subdirectories:

dark

The dark directory hosts MTL ledgers for the DESI dark-time program. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles mtl-dark-hp-HPX.ecsv, where HPX is the healpixel number.

mtl-dark-hp-HPX

Summary
MTL ledgers for the DESI dark-time program.

Naming Convention
mtl-dark-hp-HPX.ecsv, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
mtl-dark-hp-[0-12287]\.ecsv

File Type
ecsv, 0-10 MB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
DR	9	int	Legacy Surveys Data Release used to produce the targets (should always be 9)
FILEHPX	4447	int	HEALPixel integer for the file
FILEN-EST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILEN-SID	32	int	HEALPixel nside used for the file (should always be 32)
INDIR	dr9/1.1.1/targets/main/resolve/dark	str	Location of the directory of targets used to produce the file
OB-SCON	DARK	str	DESI program (DARK, BRIGHT or BACKUP)
SCND	False	bool	Whether the file is a ledger of primary or secondary targets
SURVEY	main	str	DESI survey phase (main, sv2 or sv3)
TS-FORCED	2021-05-13T08:15:37+00:00	str	UTC/ISO TIMESTAMP that was specified to produce initial ledgers

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
TARGETID	int64		Unique DESI targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
SCND_TARGET	int64		Target selection bitmask for secondary programs
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
Z_QN	float64		Redshift measured by QuasarNET
IS_QSO_QN	int16		Classification determined by QuasarNET (1=QSO)
DELTACHI2	float64		Delta-chi-squared for template fit from Redrock
TARGET_STATE	char[18]		Combination of target's class and its current observational state
TIMESTAMP	char[25]	s	UTC/ISO time at which the target's state was updated
VERSION	char[5]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

bright

The `bright` directory hosts MTL ledgers for the DESI bright-time program. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles mtl-bright-hp-HPX.ecsv, where HPX is the healpixel number.

mtl-bright-hp-HPX

Summary
MTL ledgers for the DESI bright-time program.

Naming Convention
`mtl-bright-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`mtl-bright-hp-[0-12287]\.ecsv`

File Type
ecsv, 0-10 MB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
DR	9	int	Legacy Surveys Data Release used to produce the targets (should always be 9)
FILEHPX	4447	int	HEALPixel integer for the file
FILEN-EST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILEN-SID	32	int	HEALPixel nside used for the file (should always be 32)
INDIR	dr9/1.1.1/targets/main/resolve/bright	str	Location of the directory of targets used to produce the file
OB-SCON	BRIGHT	str	DESI program (DARK, BRIGHT or BACKUP)
SCND	False	bool	Whether the file is a ledger of primary or secondary targets
SURVEY	main	str	DESI survey phase (main, sv2 or sv3)
TS-FORCED	2021-05-13T08:15:37+00:00	str	UTC/ISO TIMESTAMP that was specified to produce initial ledgers

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
TARGETID	int64		Unique DESI targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
SCND_TARGET	int64		Target selection bitmask for secondary programs
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
Z_QN	float64		Redshift measured by QuasarNET
IS_QSO_QN	int16		Classification determined by QuasarNET (1=QSO)
DELTACHI2	float64		Delta-chi-squared for template fit from Redrock
TARGET_STATE	char[18]		Combination of target's class and its current observational state
TIMESTAMP	char[25]	s	UTC/ISO time at which the target's state was updated
VERSION	char[5]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

backup

The `backup` directory hosts MTL ledgers for the DESI backup program. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles mtl-backup-hp-HPX.ecsv, where HPX is the healpixel number.

mtl-backup-hp-HPX

Summary
MTL ledgers for the DESI backup program.

Naming Convention
`mtl-backup-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`mtl-backup-hp-[0-12287]\.ecsv`

File Type
ecsv, 0-20 MB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
FILEHPX	4447	int	HEALPixel integer for the file
FILENEST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILENSID	32	int	HEALPixel nside used for the file (should always be 32)
GAIADR	2	int	Gaia Data Release used to produce (photometric quantities for) the targets
INDIR	gaiadr2/2.2.0/targets/main/resolve/backup/	str	Location of the directory of targets used to produce the file
OBSCON	BACKUP	str	DESI program (DARK, BRIGHT or BACKUP)
OVERRIDE	False	bool	Whether this ledger is a regular, standard ledger or used for overrides
SCND	False	bool	Whether the file is a ledger of primary or secondary targets
SURVEY	main	str	DESI survey phase (main, sv2 or sv3)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
TARGETID	int64		Unique DESI targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
SCND_TARGET	int64		Target selection bitmask for secondary programs
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
Z_QN	float64		Redshift measured by QuasarNET
IS_QSO_QN	int16		Classification determined by QuasarNET (1=QSO)
DELTACHI2	float64		Delta-chi-squared for template fit from Redrock
TARGET_STATE	char[18]		Combination of target's class and its current observational state
TIMESTAMP	char[25]	s	UTC/ISO time at which the target's state was updated
VERSION	char[5]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

secondary

The `secondary` directory hosts MTL ledgers for the DESI secondary targets. DESI secondary targets are observed alongside primary targets in both the bright-time and dark-time programs.

Subdirectories:

dark

The `dark` directory hosts MTL ledgers for the DESI dark-time program. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles mtl-dark-hp-HPX.ecsv, where HPX is the healpixel number.

Files and subdirectories:

mtl-dark-hp-HPX

Summary
MTL ledgers for the DESI dark-time program (secondary targets).

Naming Convention
`mtl-dark-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`mtl-dark-hp-[0-12287]\.ecsv`

File Type
ecsv, 0-1 MB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
DR	0	int	Legacy Surveys Data Release (meaningless for secondary targets)
FILEHPX	4447	int	HEALPixel integer for the file
FILENEST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILENSID	32	int	HEALPixel nside used for the file (should always be 32)
INDIR	dr9/1.1.1/targets/main/secondary/dark	str	Location of the directory of targets used to produce the file
OBSCON	DARK	str	DESI program (DARK, BRIGHT or BACKUP)
SCND	True	bool	Whether the file is a ledger of primary or secondary targets
SURVEY	main	str	DESI survey phase (main, sv2 or sv3)
TSFORCED	2021-05-13T08:15:37+00:00	str	UTC/ISO TIMESTAMP that was specified to produce initial ledgers

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
TARGETID	int64		Unique DESI targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SCND_TARGET	int64		Target selection bitmask for secondary programs
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
Z_QN	float64		Redshift measured by QuasarNET
IS_QSO_QN	int16		Classification determined by QuasarNET (1=QSO)
DELTACHI2	float64		Delta-chi-squared for template fit from Redrock
TARGET_STATE	char[18]		Combination of target's class and its current observational state
TIMESTAMP	char[25]	s	UTC/ISO time at which the target's state was updated
VERSION	char[5]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

override

The `override` directory hosts ledgers used to override MTL information for secondary targets in the DESI dark-time program. Each entry is copied over the entry for the corresponding TARGETID in the standard ledgers, each time the MTL code is run. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles mtl-override-dark-hp-HPX.ecsv, where HPX is the healpixel number.

mtl-dark-hp-HPX

Summary
MTL ledgers used to override information for DESI dark-time secondary targets.

Naming Convention
`mtl-override-dark-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`mtl-override-dark-hp-[0-12287]\.ecsv`

File Type
ecsv, 0-10 KB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
DR	0	int	Legacy Surveys Data Release (meaningless for secondary targets)
FILEHPX	4447	int	HEALPixel integer for the file
FILENEST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILENSID	32	int	HEALPixel nside used for the file (should always be 32)
INDIR	dr9/1.1.1/targets/main/secondary/dark	str	Location of the directory of targets used to produce the file
OBSCON	DARK	str	DESI program (DARK, BRIGHT or BACKUP)
OVERRIDE	True	bool	Whether this ledger is a regular, standard ledger or used for overrides
SCND	True	bool	Whether the file is a ledger of primary or secondary targets
SURVEY	main	str	DESI survey phase (main, sv2 or sv3)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
TARGETID	int64		Unique DESI targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SCND_TARGET	int64		Target selection bitmask for secondary programs
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
Z_QN	float64		Redshift measured by QuasarNET
IS_QSO_QN	int16		Classification determined by QuasarNET (1=QSO)
DELTACHI2	float64		Delta-chi-squared for template fit from Redrock
TARGET_STATE	char[18]		Combination of target's class and its current observational state
TIMESTAMP	char[25]	s	UTC/ISO time at which the target's state was updated
VERSION	char[5]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority
NUMOVERRIDE	int64		Number of times to override a target's state (typically a large number)

bright

The `bright` directory hosts MTL ledgers for the DESI bright-time program. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles mtl-bright-hp-HPX.ecsv, where HPX is the healpixel number.

mtl-bright-hp-HPX

Summary
MTL ledgers for the DESI bright-time program (secondary targets).

Naming Convention
`mtl-bright-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`mtl-bright-hp-[0-12287]\.ecsv`

File Type
ecsv, 0-1 MB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
DR	0	int	Legacy Surveys Data Release (meaningless for secondary targets)
FILEHPX	4447	int	HEALPixel integer for the file
FILENEST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILENSID	32	int	HEALPixel nside used for the file (should always be 32)
INDIR	dr9/1.1.1/targets/main/secondary/bright	str	Location of the directory of targets used to produce the file
OBSCON	BRIGHT	str	DESI program (DARK, BRIGHT or BACKUP)
SCND	True	bool	Whether the file is a ledger of primary or secondary targets
SURVEY	main	str	DESI survey phase (main, sv2 or sv3)
TSFORCED	2021-05-13T08:15:37+00:00	str	UTC/ISO TIMESTAMP that was specified to produce initial ledgers

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
TARGETID	int64		Unique DESI targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SCND_TARGET	int64		Target selection bitmask for secondary programs
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
BGS_TARGET	int64		BGS (bright time program) target selection bitmask
MWS_TARGET	int64		MWS (bright time program) target selection bitmask
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
Z_QN	float64		Redshift measured by QuasarNET
IS_QSO_QN	int16		Classification determined by QuasarNET (1=QSO)
DELTACHI2	float64		Delta-chi-squared for template fit from Redrock
TARGET_STATE	char[18]		Combination of target's class and its current observational state
TIMESTAMP	char[25]	s	UTC/ISO time at which the target's state was updated
VERSION	char[5]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

ToO

The `ToO` directory hosts a monolithic ledger of Targets of Opportunity. This is used by the DESI fiberassign pipeline to assign special, time-critical, observations.

Note that for the DESI main survey, the Targets of Opportunity ledger that is read by fiberassign is split into two. The `ToO.ecsv` file hosts Targets of Opportunity assigned on their own special tiles. The `ToO-fiber.ecsv` file hosts Targets of Opportunity assigned to fibers during the course of normal survey operations.

ToO-input

Summary
Targets of Opportunity input ledger

Naming Convention
`ToO-input.ecsv`

Regex
`ToO-input\.ecsv`

File Type
ecsv, about 100 MB

Contents

EXTNAME	Type	Contents
TOO	TABLE	ToO Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
RE-LEASE	9999	int	Ersatz Legacy Surveys RELEASE used for Targets of Opportunity (always 9999)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
CHECKER	char[2]		Initials of researcher who vetted the target
TOO_TYPE	char[4]		Either “TILE” for a special tile or “FIBER” for a fiber-override ToO
TOO_PRIO	char[2]		Either “HI” for a very-high-priority target or “LO” for a very-low-priority target
OCLAYER	char[6]		Either “DARK” for dark-time or “BRIGHT” to observe in either bright- or dark-time
MJD_BEGIN	float64	d	Start of the allowed observing window for this target (Modified Julian Date)
MJD_END	float64	d	End of the allowed observing window for this target (Modified Julian Date)
TOOID	int32		ID for this target assigned by the CHECKER

ToO

Summary
Targets of Opportunity ledger (used to assign ToOs on special tiles).

Naming Convention
`ToO.ecsv`

Regex
`ToO\.ecsv`

File Type
ecsv, about 100 MB

Contents

EXTNAME	Type	Contents
TOO	TABLE	ToO Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
RELEASE	9999	int	Ersatz Legacy Surveys RELEASE used for Targets of Opportunity (always 9999)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float64	mas/yr	Proper motion in the RA direction
PMDEC	float64	mas/yr	Proper motion in the Dec direction
REF_EPOCH	float64	yr	Reference epoch for Gaia/Tycho astrometry
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (placeholder; needed by fiberassign)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (placeholder; needed by fiberassign)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (placeholder; needed by fiberassign)
PARALLAX	float32	mas	Parallax (placeholder; needed by fiberassign)
GAIA_PHOT_G_MEAN_MAG	float32	mag	Magnitude in the Gaia G-band (placeholder; needed by fiberassign)
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Magnitude in the Gaia BP-band (placeholder; needed by fiberassign)
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Magnitude in the Gaia RP-band (placeholder; needed by fiberassign)
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise (placeholder; needed by fiberassign)
TARGETID	int64		Unique DESI targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SCND_TARGET	int64		Target selection bitmask for DESI secondary programs
SCND_ORDER	int32		Number of row for target entry in secondary file (placeholder; needed by fiberassign)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
NUMOBS_INIT	int64		Target's initial desired number of observations
OBSCONDITIONS	int64		Observing conditions/program bitmask (bright/dark/backup/etc.)
CHECKER	char[2]		Initials of researcher who vetted the target
TOO_TYPE	char[4]		Either "TILE" for a special tile or "FIBER" for a fiber-override ToO
TOO_PRIO	char[2]		Either "HI" for a very-high-priority target or "LO" for a very-low-priority target
OCLAYER	char[6]		Either "DARK" for dark-time or "BRIGHT" to observe in either bright- or dark-time
MJD_BEGIN	float64	d	Start of the allowed observing window for this target (Modified Julian Date)
MJD_END	float64	d	End of the allowed observing window for this target (Modified Julian Date)
TOOID	int64		ID for this target assigned by the CHECKER
TIMESTAMP	char[25]	s	UTC/ISO time at which the target was added to the ToO ledger

Notes

The unit `nanomaggy` in this file is actually recorded as `nmgy`. This unit will be read correctly into an astropy table from a .ecsv file.

ToO-fiber

Summary
Targets of Opportunity ledger (used to override fibers on regular, main survey tiles).

Naming Convention
`ToO-fiber.ecsv`

Regex
`ToO-fiber\.ecsv`

File Type
ecsv, about 100 KB

Contents

EXTNAME	Type	Contents
TOO	TABLE	ToO Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
RELEASE	9999	int	Ersatz Legacy Surveys RELEASE used for Targets of Opportunity (always 9999)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float64	mas/yr	Proper motion in the RA direction
PMDEC	float64	mas/yr	Proper motion in the Dec direction
REF_EPOCH	float64	yr	Reference epoch for Gaia/Tycho astrometry
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (placeholder; needed by fiberassign)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (placeholder; needed by fiberassign)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (placeholder; needed by fiberassign)
PARALLAX	float32	mas	Parallax (placeholder; needed by fiberassign)
GAIA_PHOT_G_MEAN_MAG	float32	mag	Magnitude in the Gaia G-band (placeholder; needed by fiberassign)
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Magnitude in the Gaia BP-band (placeholder; needed by fiberassign)
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Magnitude in the Gaia RP-band (placeholder; needed by fiberassign)
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise (placeholder; needed by fiberassign)
TARGETID	int64		Unique DESI targeting ID
DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SCND_TARGET	int64		Target selection bitmask for DESI secondary programs
SCND_ORDER	int32		Number of row for target entry in secondary file (placeholder; needed by fiberassign)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
NUMOBS_INIT	int64		Target's initial desired number of observations
OBSCONDITIONS	int64		Observing conditions/program bitmask (bright/dark/backup/etc.)
CHECKER	char[2]		Initials of researcher who vetted the target
TOO_TYPE	char[4]		Either "TILE" for a special tile or "FIBER" for a fiber-override ToO
TOO_PRIO	char[2]		Either "HI" for a very-high-priority target or "LO" for a very-low-priority target
OCLAYER	char[6]		Either "DARK" for dark-time or "BRIGHT" to observe in either bright- or dark-time
MJD_BEGIN	float64	d	Start of the allowed observing window for this target (Modified Julian Date)
MJD_END	float64	d	End of the allowed observing window for this target (Modified Julian Date)
TOOID	int64		ID for this target assigned by the CHECKER
TIMESTAMP	char[25]	s	UTC/ISO time at which the target was added to the ToO ledger

Notes

The unit `nanomaggy` in this file is actually recorded as `nmgy`. This unit will be read correctly into an astropy table from a .ecsv file.

sv2

`sv2` is the root directory for the Merged Target List ledgers for the second phase of Survey Validation. The MTL ledgers record the state of each DESI target as redshift information is acquired. There is a set of ledgers for each of the DESI SV2 primary programs (`dark`, `bright` and `backup`).

Subdirectories:

dark

The `dark` directory hosts MTL ledgers for the DESI dark-time program. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles sv2mtl-dark-hp-HPX.ecsv, where HPX is the healpixel number.

sv2mtl-dark-hp-HPX

Summary
MTL ledgers for the DESI dark-time program.

Naming Convention
`sv2mtl-dark-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`sv2mtl-dark-hp-[0-12287]\.ecsv`

File Type
ecsv, 2-3 MB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
DR	9	int	Legacy Surveys Data Release used to produce the targets (should always be 9)
FILEHPX	2802	int	HEALPixel integer for the file
FILENEST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILENSID	32	int	HEALPixel nside used for the file (should always be 32)
INDIR	dr9/0.53.0/targets/sv2/resolve/dark/	str	Location of the directory of targets used to produce the file
OBSCON	DARK	str	DESI program (DARK, BRIGHT or BACKUP)
SURVEY	sv2	str	DESI survey phase (main, sv2 or sv3)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
TARGETID	int64		Unique DESI targeting ID
SV2_DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SV2_BGS_TARGET	int64		BGS (bright time program) target selection bitmask
SV2_MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
SV2_SCND_TARGET	int64		Target selection bitmask for secondary programs
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
TARGET_STATE	char[16]		Combination of target's class and its current observational state
TIMESTAMP	char[19]	s	UTC time at which the target's state was updated
VERSION	char[6]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

bright

The `bright` directory hosts MTL ledgers for the DESI bright-time program. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles sv2mtl-bright-hp-HPX.ecsv, where HPX is the healpixel number.

sv2mtl-bright-hp-HPX

Summary
MTL ledgers for the DESI bright-time program.

Naming Convention
`sv2mtl-bright-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`sv2mtl-bright-hp-[0-12287]\.ecsv`

File Type
ecsv, 1-2 MB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
DR	9	int	Legacy Surveys Data Release used to produce the targets (should always be 9)
FILEHPX	2802	int	HEALPixel integer for the file
FILEN-EST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILEN-SID	32	int	HEALPixel nside used for the file (should always be 32)
INDIR	dr9/0.53.0/targets/sv2/resolve/bright/	str	Location of the directory of targets used to produce the file
OB-SCON	BRIGHT	str	DESI program (DARK, BRIGHT or BACKUP)
SUR-VEY	sv2	str	DESI survey phase (main, sv2 or sv3)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
TARGETID	int64		Unique DESI targeting ID
SV2_DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SV2_BGS_TARGET	int64		BGS (bright time program) target selection bitmask
SV2_MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
SV2_SCND_TARGET	int64		Target selection bitmask for secondary programs
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
TARGET_STATE	char[16]		Combination of target's class and its current observational state
TIMESTAMP	char[19]	s	UTC time at which the target's state was updated
VERSION	char[6]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

backup

The `backup` directory hosts MTL ledgers for the DESI backup program. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles sv2mtl-backup-hp-HPX.ecsv, where HPX is the healpixel number.

sv2mtl-backup-hp-HPX

Summary
MTL ledgers for the DESI backup program.

Naming Convention
`sv2mtl-backup-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`sv2mtl-backup-hp-[0-12287]\.ecsv`

File Type
ecsv, 500-1000 KB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
FILEHPX	2802	int	HEALPixel integer for the file
FILENEST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILENSID	32	int	HEALPixel nside used for the file (should always be 32)
GAIADR	2	int	Gaia Data Release used to produce (photometric quantities for) the targets
INDIR	gaiadr2/0.53.0/targets/sv2/resolve/backup/	str	Location of the directory of targets used to produce the file
OBSCON	BACKUP	str	DESI program (DARK, BRIGHT or BACKUP)
SURVEY	sv2	str	DESI survey phase (main, sv2 or sv3)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
TARGETID	int64		Unique DESI targeting ID
SV2_DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SV2_BGS_TARGET	int64		BGS (bright time program) target selection bitmask
SV2_MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
SV2_SCND_TARGET	int64		Target selection bitmask for secondary programs
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
TARGET_STATE	char[16]		Combination of target's class and its current observational state
TIMESTAMP	char[19]	s	UTC time at which the target's state was updated
VERSION	char[6]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

sv3

`sv3` is the root directory for the Merged Target List ledgers for the DESI One-Percent Survey. The MTL ledgers record the state of each DESI target as redshift information is acquired. There is a set of ledgers for each of the DESI Main Survey primary programs (`dark`, `bright` and `backup`) as well as for the DESI secondary programs (`secondary`) and for Targets of Opportunity (`ToO`).

Subdirectories:

dark

The `dark` directory hosts MTL ledgers for the DESI dark-time program. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles sv3mtl-dark-hp-HPX.ecsv, where HPX is the healpixel number.

sv3mtl-dark-hp-HPX

Summary
MTL ledgers for the DESI dark-time program.

Naming Convention
`sv3mtl-dark-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`sv3mtl-dark-hp-[0-12287]\.ecsv`

File Type
ecsv, 2-6 MB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
DR	9	int	Legacy Surveys Data Release used to produce the targets (should always be 9)
FILEHPX	7031	int	HEALPixel integer for the file
FILENEST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILENSID	32	int	HEALPixel nside used for the file (should always be 32)
INDIR	dr9/0.57.0/targets/sv3/resolve/dark	str	Location of the directory of targets used to produce the file
OBSCON	DARK	str	DESI program (DARK, BRIGHT or BACKUP)
SCND	False	bool	Whether the file is a ledger of primary or secondary targets
SURVEY	sv3	str	DESI survey phase (main, sv2 or sv3)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
TARGETID	int64		Unique DESI targeting ID
SV3_DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SV3_BGS_TARGET	int64		BGS (bright time program) target selection bitmask
SV3_MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
SV3_SCND_TARGET	int64		Target selection bitmask for secondary programs
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
TARGET_STATE	char[16]		Combination of target's class and its current observational state
TIMESTAMP	char[19]	s	UTC/ISO time at which the target's state was updated
VERSION	char[6]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

bright

The `bright` directory hosts MTL ledgers for the DESI bright-time program. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles sv3mtl-bright-hp-HPX.ecsv, where HPX is the healpixel number.

sv3mtl-bright-hp-HPX

Summary
: MTL ledgers for the DESI bright-time program.

Naming Convention
: `sv3mtl-bright-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
: `sv3mtl-bright-hp-[0-12287]\.ecsv`

File Type
: ecsv, 1-6 MB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
DR	9	int	Legacy Surveys Data Release used to produce the targets (should always be 9)
FILEHPX	7031	int	HEALPixel integer for the file
FILENEST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILENSID	32	int	HEALPixel nside used for the file (should always be 32)
INDIR	dr9/0.57.0/targets/sv3/resolve/bright	str	Location of the directory of targets used to produce the file
OBSCON	BRIGHT	str	DESI program (DARK, BRIGHT or BACKUP)
SCND	False	bool	Whether the file is a ledger of primary or secondary targets
SURVEY	sv3	str	DESI survey phase (main, sv2 or sv3)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
TARGETID	int64		Unique DESI targeting ID
SV3_DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SV3_BGS_TARGET	int64		BGS (bright time program) target selection bitmask
SV3_MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
SV3_SCND_TARGET	int64		Target selection bitmask for secondary programs
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
TARGET_STATE	char[24]		Combination of target's class and its current observational state
TIMESTAMP	char[19]	s	UTC/ISO time at which the target's state was updated
VERSION	char[6]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

backup

The `backup` directory hosts MTL ledgers for the DESI backup program. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles sv3mtl-backup-hp-HPX.ecsv, where HPX is the healpixel number.

sv3mtl-backup-hp-HPX

Summary
MTL ledgers for the DESI backup program.

Naming Convention
`sv3mtl-backup-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`sv3mtl-backup-hp-[0-12287]\.ecsv`

File Type
ecsv, 750 KB-3 MB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
FILEHPX	7031	int	HEALPixel integer for the file
FILENEST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILENSID	32	int	HEALPixel nside used for the file (should always be 32)
GAIADR	2	int	Gaia Data Release used to produce (photometric quantities for) the targets
INDIR	gaiadr2/0.57.0/targets/sv3/resolve/backup/	str	Location of the directory of targets used to produce the file
OBSCON	BACKUP	str	DESI program (DARK, BRIGHT or BACKUP)
SCND	False	bool	Whether the file is a ledger of primary or secondary targets
SURVEY	sv3	str	DESI survey phase (main, sv2 or sv3)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
TARGETID	int64		Unique DESI targeting ID
SV3_DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SV3_BGS_TARGET	int64		BGS (bright time program) target selection bitmask
SV3_MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
SV3_SCND_TARGET	int64		Target selection bitmask for secondary programs
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
TARGET_STATE	char[28]		Combination of target's class and its current observational state
TIMESTAMP	char[19]	s	UTC time at which the target's state was updated
VERSION	char[6]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

secondary

The `secondary` directory hosts MTL ledgers for the DESI secondary targets. DESI secondary targets are observed alongside primary targets in both the bright-time and dark-time programs.

Subdirectories:

dark

The dark directory hosts MTL ledgers for the DESI dark-time program. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles sv3mtl-dark-hp-HPX.ecsv, where HPX is the healpixel number.

sv3mtl-dark-hp-HPX

Summary
MTL ledgers for the DESI dark-time program (secondary targets).

Naming Convention
`sv3mtl-dark-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`sv3mtl-dark-hp-[0-12287]\.ecsv`

File Type
ecsv, 100-600 KB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
DR	9	int	Legacy Surveys Data Release (meaningless for secondary targets)
FILEHPX	7031	int	HEALPixel integer for the file
FILENEST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILENSID	32	int	HEALPixel nside used for the file (should always be 32)
INDIR	dr9/0.57.0/targets/sv3/secondary/dark	str	Location of the directory of targets used to produce the file
OBSCON	DARK	str	DESI program (DARK, BRIGHT or BACKUP)
SCND	True	bool	Whether the file is a ledger of primary or secondary targets
SURVEY	sv3	str	DESI survey phase (main, sv2 or sv3)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
TARGETID	int64		Unique DESI targeting ID
SV3_DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SV3_SCND_TARGET	int64		Target selection bitmask for secondary programs
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
SV3_BGS_TARGET	int64		BGS (bright time program) target selection bitmask
SV3_MWS_TARGET	int64		MWS (bright time program) target selection bitmask
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
TARGET_STATE	char[15]		Combination of target's class and its current observational state
TIMESTAMP	char[19]	s	UTC time at which the target's state was updated
VERSION	char[6]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

bright

The `bright` directory hosts MTL ledgers for the DESI bright-time program. Targets are stored in ledgers that are split by HEALPixel (in the NESTED scheme) at a resolution of nside=32.

The filename for each ledger resembles sv3mtl-bright-hp-HPX.ecsv, where HPX is the healpixel number.

sv3mtl-bright-hp-HPX

Summary
MTL ledgers for the DESI bright-time program (secondary targets).

Naming Convention
`sv3mtl-bright-hp-HPX.ecsv`, where HPX is the nside=32 (NESTED) HEALPixel integer.

Regex
`sv3mtl-bright-hp-[0-12287]\.ecsv`

File Type
ecsv, 20-200 KB

Contents

EXTNAME	Type	Contents
MTL	TABLE	MTL Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
DR	9	int	Legacy Surveys Data Release (meaningless for secondary targets)
FILEHPX	7031	int	HEALPixel integer for the file
FILENEST	True	bool	If the HEALPixel NESTED scheme was used for the file (should always be True)
FILENSID	32	int	HEALPixel nside used for the file (should always be 32)
INDIR	dr9/0.57.0/targets/sv3/secondary/bright	str	Location of the directory of targets used to produce the file
OBSCON	BRIGHT	str	DESI program (DARK, BRIGHT or BACKUP)
SCND	True	bool	Whether the file is a ledger of primary or secondary targets
SURVEY	sv3	str	DESI survey phase (main, sv2 or sv3)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
PARALLAX	float32	mas	Parallax
TARGETID	int64		Unique DESI targeting ID
SV3_DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SV3_SCND_TARGET	int64		Target selection bitmask for secondary programs
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
OBSCONDITIONS	int32		Observing conditions/program bitmask (bright/dark/backup/etc.)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
NUMOBS_INIT	int64		Target's initial desired number of observations
SV3_MWS_TARGET	int64		MWS (bright time program) target selection bitmask
SV3_BGS_TARGET	int64		BGS (bright time program) target selection bitmask
NUMOBS_MORE	int64		Desired number of observations given target's current state
NUMOBS	int64		Number of (good) observations of target acquired so far
Z	float64		Redshift measured by Redrock
ZWARN	int64		Redshift warning bitmask measured by Redrock
ZTILEID	int32		ID of tile that most recently updated target's state
TARGET_STATE	char[25]		Combination of target's class and its current observational state
TIMESTAMP	char[19]	s	ISO time at which the target's state was updated
VERSION	char[6]		Version of desitarget code used to update target's state
PRIORITY	int64		Target's current priority

ToO

The `ToO` directory hosts a monolithic ledger of Targets of Opportunity. This is used by the DESI fiberassign pipeline to assign special, time-critical, observations.

ToO-input

Summary
: Targets of Opportunity input ledger

Naming Convention
: `ToO-input.ecsv`

Regex
: `ToO-input\.ecsv`

File Type
: ecsv, 58 KB

Contents

EXTNAME	Type	Contents
TOO	TABLE	ToO Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
RE-LEASE	9999	int	Ersatz Legacy Surveys RELEASE used for Targets of Opportunity (always 9999)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float32	mas/yr	Proper motion in the RA direction
PMDEC	float32	mas/yr	Proper motion in the Dec direction
REF_EPOCH	float32	yr	Reference epoch for Gaia/Tycho astrometry
CHECKER	char[5]		Initials of researcher who vetted the target
TOO_TYPE	char[5]		Either “TILE” for a special tile or “FIBER” for a fiber-override ToO
TOO_PRIO	char[2]		Either “HI” for a very-high-priority target or “LO” for a very-low-priority target
OCLAYER	char[6]		Either “DARK” for dark-time or “BRIGHT” to observe in either bright- or dark-time
MJD_BEGIN	float64	d	Start of the allowed observing window for this target (Modified Julian Date)
MJD_END	float64	d	End of the allowed observing window for this target (Modified Julian Date)
TOOID	int32		ID for this target assigned by the CHECKER

ToO

Summary
Targets of Opportunity ledger

Naming Convention
`ToO.ecsv`

Regex
`ToO\.ecsv`

File Type
ecsv, 112 KB

Contents

EXTNAME	Type	Contents
TOO	TABLE	ToO Ledger

Required Header Keywords

KEY	Example Value	Type	Comment
RE-LEASE	9999	int	Ersatz Legacy Surveys RELEASE used for Targets of Opportunity (always 9999)

Required Data Table Columns

Name	Type	Units	Description
RA	float64	deg	Right ascension
DEC	float64	deg	Declination
PMRA	float64	mas/yr	Proper motion in the RA direction
PMDEC	float64	mas/yr	Proper motion in the Dec direction
REF_EPOCH	float64	yr	Reference epoch for Gaia/Tycho astrometry
FLUX_G	float32	nanomaggy	Flux in the Legacy Survey g-band (placeholder; needed by fiberassign)
FLUX_R	float32	nanomaggy	Flux in the Legacy Survey r-band (placeholder; needed by fiberassign)
FLUX_Z	float32	nanomaggy	Flux in the Legacy Survey z-band (placeholder; needed by fiberassign)
PARALLAX	float32	mas	Parallax (placeholder; needed by fiberassign)
GAIA_PHOT_G_MEAN_MAG	float32	mag	Magnitude in the Gaia G-band (placeholder; needed by fiberassign)
GAIA_PHOT_BP_MEAN_MAG	float32	mag	Magnitude in the Gaia BP-band (placeholder; needed by fiberassign)
GAIA_PHOT_RP_MEAN_MAG	float32	mag	Magnitude in the Gaia RP-band (placeholder; needed by fiberassign)
GAIA_ASTROMETRIC_EXCESS_NOISE	float32		Gaia astrometric excess noise (placeholder; needed by fiberassign)
TARGETID	int64		Unique DESI targeting ID
SV3_DESI_TARGET	int64		DESI (dark time program) target selection bitmask
SV3_SCND_TARGET	int64		Target selection bitmask for DESI secondary programs
SCND_ORDER	int32		Number of row for target entry in secondary file (placeholder; needed by fiberassign)
PRIORITY_INIT	int64		Target's initial priority from target selection bitmasks and OBSCONDITIONS
SUBPRIORITY	float64		Random subpriority [0-1] to break assignment ties
NUMOBS_INIT	int64		Target's initial desired number of observations
OBSCONDITIONS	int64		Observing conditions/program bitmask (bright/dark/backup/etc.)
CHECKER	char[5]		Initials of researcher who vetted the target
TOO_TYPE	char[5]		Either "TILE" for a special tile or "FIBER" for a fiber-override ToO
TOO_PRIO	char[2]		Either "HI" for a very-high-priority target or "LO" for a very-low-priority target
OCLAYER	char[6]		Either "DARK" for dark-time or "BRIGHT" to observe in either bright- or dark-time
MJD_BEGIN	float64	d	Start of the allowed observing window for this target (Modified Julian Date)
MJD_END	float64	d	End of the allowed observing window for this target (Modified Julian Date)
TOOID	int64		ID for this target assigned by the CHECKER

Notes

The unit `nanomaggy` in this file is actually recorded as `nmgy`. This unit will be read correctly into an astropy table from a .ecsv file.

ops

The ops directory should be described here.

Subdirectories:

1.1.7 DESIMODEL

`DESIMODEL` points to the location of desimodel files used to model the DESI instrument for data simulations.

data

This is the root directory of the desimodel data tree.

focalplane

Contains focal plane plate scale and fiber position parameters.

fiberpos

Summary
A random mapping of positioner number to fiber number. ECSV and plain text versions of this file might also be present.

Naming Convention
`fiberpos.fits`

Regex
`fiberpos\.fits`

File Type
FITS, 440 KB

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Empty
HDU1	FIBERPOS	BINTABLE	Map of positioner to fiber.

FITS Header Units

HDU0

EXTNAME = PRIMARY

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = FIBERPOS

Map of positioner to fiber.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	87	int	width of table in bytes
NAXIS2	5000	int	number of rows in table
EXTNAME	FIBERPOS	str	name of this binary table extension

Required Data Table Columns

Name	Type	Units	Description
PETAL	int32		TODO: description needed
DEVICE	int32		TODO: description needed
DEVICE_TYPE	char[3]		TODO: description needed
LOCATION	int64		TODO: description needed
FIBER	int32		fiber number [0-4999]
X	float64	mm	positioner x center [mm]
Y	float64	mm	positioner y center [mm]
Z	float64	mm	positioner z location [mm]
Q	float64	deg	TODO: description needed
S	float64	mm	TODO: description needed
SPECTRO	int32		spectrograph number [0-9]
SLIT	int32		TODO: description needed
SLITBLOCK	int64		TODO: description needed
BLOCKFIBER	int64		TODO: description needed

fiberpos-all

Summary
A mapping of positioner number to fiber number, including positions from DESI-0530. An ECSV version of this file might also be present.

Naming Convention
`fiberpos-all.fits`

Regex
`fiberpos-all\.fits`

File Type
FITS, 472 KB

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Empty
HDU1	FIBERPOS	BINTABLE	Fiber positions on focal plane

FITS Header Units

HDU0

EXTNAME = PRIMARY

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = FIBERPOS

Fiber positions on focal plane

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	87	int	length of dimension 1
NAXIS2	5430	int	length of dimension 2

Required Data Table Columns

Name	Type	Units	Description
PETAL	int32		TODO: description needed
DEVICE	int32		TODO: description needed
DEVICE_TYPE	char[3]		TODO: description needed
LOCATION	int64		TODO: description needed
FIBER	int32		fiber number [0-4999]
X	float64	mm	positioner x center [mm]
Y	float64	mm	positioner y center [mm]
Z	float64	mm	positioner z location [mm]
Q	float64	deg	TODO: description needed
S	float64	mm	TODO: description needed
SPECTRO	int32		spectrograph number [0-9]
SLIT	int32		TODO: description needed
SLITBLOCK	int64		TODO: description needed
BLOCKFIBER	int64		TODO: description needed

platescale

Summary
A file describing the plate scale.

Naming Convention
`platescale.txt`

Regex
`platescale\.txt`

File Type
ASCII, 35 KB

Contents

This ASCII file contains the following columns:

Name	Units	Description
Radius	mm	radius from center of focal plane
Angle	deg	radial angle that has a centroid at this radius
MF/#		Meridional F/#
SF/#		Sagittal F/#
MFL	m	Meridional focal length
SFL	m	Sagittal focal length
MPS	um/arcsec	Meridional plate scale
SPS	um/arcsec	Sagittal plate scale

footprint

Files describing the DESI footprint.

desi-tiles

Summary
The DESI footprint, described in terms of tiles. ECSV versions of this file might also be present, lacking vector-valued columns (BRIGHT*).

Naming Convention
`desi-tiles.fits`

Regex
`desi-tiles\.fits`

File Type
FITS, 2 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Empty Header
HDU1	TILES	BINTABLE	Tile data

FITS Header Units

HDU0

EXTNAME = PRIMARY

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = TILES

Pre-defined DESI tile locations on the sky (i.e. telescope pointings)

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	114	int	length of dimension 1
NAXIS2	57620	int	length of dimension 2

Required Data Table Columns

Name	Type	Units	Description
tileid	int32		Unique tile ID
ra	float64	deg	Right ascension
dec	float64	deg	Declination
pass	int16		DESI layer
in_desi	int16		1=within DESI footprint; 0=outside'
ebv_med	float32	mag	Median Galactic E(B-V) extinction in tile
airmass	float32		Airmass if observed at hour angle 15 deg
star_density	float32	deg^-2	Median number density of Gaia stars brighter than 19.5 mag in tile
exposefac	float32		Multiplicative exposure time factor from airmass and E(B-V)
program	char[6]		DARK, GRAY, BRIGHT, or EXTRA
obsconditions	int32		1 for DARK, 2 for GRAY, 4 for BRIGHT, 0 for EXTRA
brightra	float64[3]	deg	RAs of 3 brightest Tycho-2 stars in tile
brightdec	float64[3]	deg	Decs of 3 brightest Tycho-2 stars in tile
brightvtmag	float32[3]	mag	V_T magnitudes of 3 brightest Tycho-2 stars in tile
centerid	int32		Unique tile ID of pass 0 tile corresponding to this tile

inputs

Data used to construct other files in the data model.

throughput

Data used for throughput estimates.

raytracing

Summary
: Ray tracing.

Naming Convention
: `raytracing.txt`

Regex
: `raytracing\.txt`

File Type
: ASCII, 45 KB

Contents

This ASCII file contains ray-tracing data in a non-standard format. There are sections, labeled 'Whole band', '360-375nm', '360-400 band', etc. Each section contains a list of keyword-value pairs:

```
                                   X                Y
Field coordinate  :  0.00000000E+000  0.00000000E+000
Image coordinate  : -1.31443308E-014  1.90926685E-015
RMS Spot Radius   :  1.56900183E+001 um
RMS Spot X Size   :  1.10945183E+001 um
RMS Spot Y Size   :  1.10945183E+001 um
Max Spot Radius   :  4.77164316E+001 um
```

There are no obvious units on the coordinate values.

ZenithExtinction

Summary
Atmospheric extinction data.

Naming Convention
`ZenithExtinction-{observatory}.fits`, where `{observatory}` is the name of the name of the observatory where the extinction was measured, *e.g.* 'KPNO'.

Regex
`ZenithExtinction-[A-Z]+\.fits`

File Type
FITS, 1 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Empty
HDU1	EXTINCTION	BINTABLE	Atmospheric Extinction

FITS Header Units

HDU0

EXTNAME = PRIMARY

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = EXTINCTION

Atmospheric extinction in magnitudes per airmass.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	16	int	Number of bytes per row
NAXIS2	74000	int	Number of rows
EXTNAME	EXTINCTION	str	KPNO extinction in magnitudes per airmass

Required Data Table Columns

Name	Type	Units	Description
WAVELENGTH	float64		Wavelength in Angstroms
EXTINCTION	float64		Extinction in magnitudes per airmass

sky

Data describing sky backgrounds, Lunar flux, etc.

kpnoextinct

Summary
Lunar data

Naming Convention
`kpnoextinct_lunarmodel.dat`

Regex
`kpnoextinct_lunarmodel\.dat`

File Type
ASCII, 195 KB

Contents

This ASCII file contains two columns, wavelength [Å] and flux [?].

solarspec

Summary
Solar data

Naming Convention
`solarspec.txt`

Regex
`solarspec\.txt`

File Type
ASCII, 10 KB

Contents

This ASCII file contains three columns, wavelength [nm], wavelength [Å] and flux [?].

The first two columns are completely redundant since:

```
first_column*10 == second_column
```

exactly.

Vfilt

Summary
V-band filter response function.

Naming Convention
`Vfilt.txt`

Regex
`Vfilt\.txt`

File Type
ASCII, 4.5 KB

Contents

This ASCII file contains two columns, wavelength [Å] and filter response [fraction transmitted].

specpsf

PSF simulations and related data.

psf

Summary
PSF data.

Naming Convention
`psf-{ARM}.fits`, where `{ARM}` is one of 'b', 'r', 'z'.

Regex
`psf-[brz]\.fits`

File Type
FITS, 23 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	XCOEFF	IMAGE	Legendre coeff for CCD x vs. wavelength
HDU1	YCOEFF	IMAGE	Legendre coeff for CCD y vs. wavelength
HDU2	SPOTS	IMAGE	Zemax PSF spots
HDU3	SPOTX	IMAGE	CCD x locations of spots
HDU4	SPOTY	IMAGE	CCD y locations of spots
HDU5	FIBERPOS	IMAGE	Location of each fiber along slit
HDU6	SPOTPOS	IMAGE	Locations along slit where spots were generated
HDU7	SPOTWAVE	IMAGE	Wavelength of generated spots

SPOTS[i,j] is 2D image[y,x] of Zemax spot on the CCD at SPOTX[j], SPOTY[i] and along the slit at SPOTPOS[i] which is wavelength SPOTWAVE[i].

FITS Header Units

HDU0

EXTNAME = XCOEFF

Legendre coeff for CCD x vs. wavelength.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	length of data axis 1
NAXIS2	500	int	length of data axis 2
EXTNAME	XCOEFF	str	
DATAMIN	1.175494350822e-38	float	minimum allowed data value
DATAMAX	3.402823466385e+38	float	maximum allowed data value
DATATYPE	Normalized Image	str	Type of image
SPECTRO	DESI-0224-v1.ZMX (95% better)	str	
ARM	Red	str	Spectrograph Arm
ARMINT	3	int	Spectrograph Arm

continues on next page

Table 127 – continued from previous page

KEY	Example Value	Type	Comment
WAVECENT	669.0	float	Center Wavelength (nm)
XCENT	6.159039977	float	Detector X Centroid (mm)
YCENT	-29.960402484	float	Detector Y Centroid (mm)
XDIRCOS	0.01699287200071	float	x direction cosine
YDIRCOS	-0.9885050150412	float	y direction cosine
ZDIRCOS	4.774490530784e-312	float	z direction cosine
PIXSIZE	0.001	float	size of pixel (mm)
DIFFRACT	T	bool	diffraction added?
DETEFF	T	bool	detector effects added?
PUPIL	126.5	float	Camera Pupil (mm)
FOCALLEN	215.0	float	Camera focal length (mm)
E2VFLAG	F	bool	e2v detector
TEMP	175.0	float	Detector T (K)
DETSIG	5.0	float	sigma for detector (um)
DETTHICK	250.0	float	thickness of detector (um)
DATE	2013-09-12	str	Date
CTYPE1	X	str	X coordinate (mm)
CTYPE2	Y	str	Y coordinate (mm)
CRPIX1	113.0	float	Reference X pixel
CRPIX2	113.0	float	Reference Y pixel
CRVAL1	6.158579827	float	Reference X value
CRVAL2	-29.961502809	float	Reference Y value
CDELT1	0.001	float	X pixel size (mm)
CDELT2	0.001	float	Y pixel size (mm)
PSFTYPE	SPOTGRID	str	Grid of simulated PSF spots
NPIX_X	4114	int	Number of CCD pixels in X direction
NPIX_Y	4128	int	Number of CCD pixels in Y direction
NSPEC	500	int	Number of spectra
NWAVE	11	int	Number of wavelength samples
CCDPIXSZ	0.015	float	CCD pixel size [mm]
DFIBER	0.23	float	Center-to-center pitch of fibers on slit [mm]
DGROUP	0.556	float	Spacing between fiber groups on slit [mm]
NGROUPS	20	int	Number of fiber groups per slit
NFIBGRP	25	int	Number of fibers per group
WAVEMIN	5564	int	Min wavelength for Legendre domain [-1,1]
WAVEMAX	7805	int	Max wavelength for Legendre domain [-1,1]
WMIN_ALL	5625	int	Min wavelength seen by all spectra [Ang]
WMAX_ALL	7741	int	Max wavelength seen by all spectra [Ang]

Data: FITS image [float64, 8x500]

HDU1

EXTNAME = YCOEFF

Legendre coeff for CCD y vs. wavelength.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	8	int	length of data axis 1
NAXIS2	500	int	length of data axis 2
EXTNAME	YCOEFF	str	
WAVEMIN	5564	int	Min wavelength on the CCD [Ang]
WAVEMAX	7805	int	Max wavelength on the CCD [Ang]
WMIN_ALL	5625	int	Min wavelength seen by all spectra [Ang]
WMAX_ALL	7741	int	Max wavelength seen by all spectra [Ang]

Data: FITS image [float64, 8x500]

HDU2

EXTNAME = SPOTS

Zemax simulated spots.

SPOTS[i,j] is 2D image[y,x] of Zemax spot on the CCD at SPOTX[j], SPOTY[i] and along the slit at SPOTPOS[i] which is wavelength SPOTWAVE[i].

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	225	int	length of data axis 1
NAXIS2	225	int	length of data axis 2
NAXIS3	11	int	length of data axis 3
NAXIS4	11	int	length of data axis 4
EXTNAME	SPOTS	str	

Data: FITS image [float32, 225x225x11x11]

HDU3

EXTNAME = SPOTX

X locations of spots.

SPOTS[i,j] is 2D image[y,x] of Zemax spot on the CCD at SPOTX[j], SPOTY[i] and along the slit at SPOTPOS[i] which is wavelength SPOTWAVE[i].

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	11	int	length of data axis 1
NAXIS2	11	int	length of data axis 2
EXTNAME	SPOTX	str	

Data: FITS image [float32, 11x11]

HDU4

EXTNAME = SPOTY

Y locations of spots.

SPOTS[i,j] is 2D image[y,x] of Zemax spot on the CCD at SPOTX[j], SPOTY[i] and along the slit at SPOTPOS[i] which is wavelength SPOTWAVE[i].

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	11	int	length of data axis 1
NAXIS2	11	int	length of data axis 2
EXTNAME	SPOTY	str	

Data: FITS image [float32, 11x11]

HDU5

EXTNAME = FIBERPOS

Location along the slit of each fiber.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	500	int	length of data axis 1
EXTNAME	FIBERPOS	str	

Data: FITS image [float64, 500]

HDU6

EXTNAME = SPOTPOS

Location along the slit of each spot.

SPOTS[i,j] is 2D image[y,x] of Zemax spot on the CCD at SPOTX[j], SPOTY[i] and along the slit at SPOTPOS[i] which is wavelength SPOTWAVE[i].

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	11	int	length of data axis 1
EXTNAME	SPOTPOS	str	

Data: FITS image [float64, 11]

HDU7

EXTNAME = SPOTWAVE

Wavelengths at which each spot was measured.

SPOTS[i,j] is 2D image[y,x] of Zemax spot on the CCD at SPOTX[j], SPOTY[i] and along the slit at SPOTPOS[i] which is wavelength SPOTWAVE[i].

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	11	int	length of data axis 1
EXTNAME	SPOTWAVE	str	

Data: FITS image [float64, 11]

psf

Summary
PSF data for quicksim.

Naming Convention
`psf-quicksim.fits`

Regex
`psf-quicksim\.fits`

File Type
FITS, 554 KB

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Empty
HDU1	QUICKSIM-B	BINTABLE	b-camera PSF parameters
HDU2	QUICKSIM-R	BINTABLE	r-camera PSF parameters
HDU3	QUICKSIM-Z	BINTABLE	z-camera PSF parameters

FITS Header Units

HDU0

EXTNAME = PRIMARY

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = QUICKSIM-B

b-camera PSF parameters.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	40	int	width of table in bytes
NAXIS2	4761	int	number of rows in table
EXTNAME	QUICKSIM-B	str	name of this binary table extension
PSFFILE	psf-b.fits	str	Input PSF file
PSFSHA1	a88fbc9ab3567518a5c89bb6a15055e68bc4b94e	str	SHA1 checksum input PSF
WMIN_ALL	3569	int	Starting wavelength [Angstroms]
WMAX_ALL	5949	int	Last wavelength [Angstroms]
WAVEUNIT	Angstrom	str	Wavelengths in Angstroms

Required Data Table Columns

Name	Type	Units	Description
wavelength	float64	Angstrom	wavelength
fwhm_wave	float64	Angstrom	FWHM in wavelength (y) direction
fwhm_spatial	float64	pixel	FWHM in cross-dispersion (x) direction
neff_spatial	float64	pixel	Number of effective pixels covered
angstroms_per_row	float64	Angstrom/bin	Angstroms per CCD pixels at this wavelength

HDU2

EXTNAME = QUICKSIM-R

r-camera PSF parameters.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	40	int	width of table in bytes
NAXIS2	4233	int	number of rows in table
EXTNAME	QUICKSIM-R	str	name of this binary table extension
PSFFILE	psf-r.fits	str	Input PSF file
PSFSHA1	0709be9b7275c7f6ef3a1bd9003426ae9a68b2aa	str	SHA1 checksum input PSF
WMIN_ALL	5625	int	Starting wavelength [Angstroms]
WMAX_ALL	7741	int	Last wavelength [Angstroms]
WAVEUNIT	Angstrom	str	Wavelengths in Angstroms

Required Data Table Columns

Name	Type	Units	Description
wavelength	float64	Angstrom	wavelength
fwhm_wave	float64	Angstrom	FWHM in wavelength (y) direction
fwhm_spatial	float64	pixel	FWHM in cross-dispersion (x) direction
neff_spatial	float64	pixel	Number of effective pixels covered
angstroms_per_row	float64	Angstrom/bin	Angstroms per CCD pixels at this wavelength

HDU3

EXTNAME = QUICKSIM-Z

z-camera PSF parameters.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	40	int	width of table in bytes
NAXIS2	4799	int	number of rows in table
EXTNAME	QUICKSIM-Z	str	name of this binary table extension
PSFFILE	psf-z.fits	str	Input PSF file
PSFSHA1	d19b2f2054a89182cc9f7bd03508b105982943ae	str	SHA1 checksum input PSF
WMIN_ALL	7435	int	Starting wavelength [Angstroms]
WMAX_ALL	9834	int	Last wavelength [Angstroms]
WAVEUNIT	Angstrom	str	Wavelengths in Angstroms

Required Data Table Columns

Name	Type	Units	Description
wavelength	float64	Angstrom	wavelength
fwhm_wave	float64	Angstrom	FWHM in wavelength (y) direction
fwhm_spatial	float64	pixel	FWHM in cross-dispersion (x) direction
neff_spatial	float64	pixel	Number of effective pixels covered
angstroms_per_row	float64	Angstrom/bin	Angstroms per CCD pixels at this wavelength

spectra

Contains spectra (flux *versus* wavelength) for use in various modeling tasks.

spec

Summary
Contains "raw" spectra in some sense.

Naming Convention
`spec-{target}-{type}.dat`, where `{target}` is, *e.g.*, `qso`, `elg`, `lrg`, etc.

Regex
`spec-(elg|lrg|lya|qso|sky)-.+\.dat`

File Type
ASCII, 1 MB

Contents

These ASCII files typically contain two columns, Wavelength [Å], and flux in unknown units.

sn-spec

Summary
Contains processed versions of the `spec` files in the same directory.

Naming Convention
`sn-spec-{target}-{type}.dat`, where `{target}` is, *e.g.*, `qso`, `elg`, `lrg`, etc.

Regex
`spec-(elg|lrg|lya|qso|sky)-.+\.dat`

File Type
ASCII, 1 MB

Contents

These ASCII files typically contain several columns, Wavelength [Å], flux [erg / cm2 sec Å], inverse variance, and signal-to-noise. Additional columns, such as electron counts, may also be present.

targets

Information on target densities.

nz

Summary
Contains target densities as a function of redshift and possibly other parameters.

Naming Convention
`nz_{target}.dat`, where `{target}` is, *e.g.*, `qso`, `elg`, `lrg`, etc.

Regex
`(nzr?|dNdzdg)_[A-Za-z_]+\.dat`

File Type
ASCII

Contents

These ASCII files contain data in 2 to 3 columns. The first column is the redshift bin, the second column, if present, is a magnitude bin (*g* or *r*), the third column is the target density in the bin defined by the other column(s).

targets.yaml

Summary
Contains fundamental parameters related to DESI target densities.

Naming Convention
`targets.yaml`

Regex
`targets\.yaml`

File Type
YAML

throughput

Contains data for modeling the throughput of the DESI instrument.

DESI-0347

Summary
Focal plane distortion maps. ECSV files may also be present.

Naming Convention
`DESI-0347_random_offset_{N}.fits`, where `{N}` is the (arbitrary) number of the random realization.

Regex
`DESI-0347_random_offset_[0-9]+\.fits`

File Type
FITS, 525 KB

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Empty
HDU1	XOFFSET	IMAGE	2D image of x-offsets on the focal plane
HDU2	YOFFSET	IMAGE	2D image of y-offsets on the focal plane

TODO: expand description with links to documentation about how this is used.

FITS Header Units

HDU0

EXTNAME = PRIMARY

Required Header Keywords

KEY	Example Value	Type	Comment
SEED	1	int	

Empty HDU.

HDU1

EXTNAME = XOFFSET

2D image of x-offsets on the focal plane.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	256	int	
NAXIS2	256	int	
WCSAXES	2	int	Number of coordinate axes
CRPIX1	128.5	float	Pixel coordinate of reference point
CRPIX2	128.5	float	Pixel coordinate of reference point
CDELT1	0.0125	float	Coordinate increment at reference point
CDELT2	0.0125	float	Coordinate increment at reference point
CTYPE1	x	str	Coordinate type code
CTYPE2	y	str	Coordinate type code
CRVAL1	0.0	float	Coordinate value at reference point
CRVAL2	0.0	float	Coordinate value at reference point
LATPOLE	90.0	float	[deg] Native latitude of celestial pole
BUNIT	um	str	
EXTNAME	XOFFSET	str	extension name

Data: FITS image [float32, 256x256]

HDU2

EXTNAME = YOFFSET

2D image of x-offsets on the focal plane.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	256	int	
NAXIS2	256	int	
WCSAXES	2	int	Number of coordinate axes
CRPIX1	128.5	float	Pixel coordinate of reference point
CRPIX2	128.5	float	Pixel coordinate of reference point
CDELT1	0.0125	float	Coordinate increment at reference point
CDELT2	0.0125	float	Coordinate increment at reference point
CTYPE1	x	str	Coordinate type code
CTYPE2	y	str	Coordinate type code
CRVAL1	0.0	float	Coordinate value at reference point
CRVAL2	0.0	float	Coordinate value at reference point
LATPOLE	90.0	float	[deg] Native latitude of celestial pole
BUNIT	um	str	
EXTNAME	YOFFSET	str	extension name

Data: FITS image [float32, 256x256]

Notes and Examples

The ECSV files express blur and offset calculated from ray-tracing (?) the DESI optical path.

fiberloss

Summary
Data on losses due to transmission through fibers.

Naming Convention
`fiberloss-{type}.dat`, where `{type}` is a particular target class such as `lrg`, or `perfect`.

Regex
`fiberloss-(elg|lrg|perfect|qso|sky|star)\.dat`

File Type
ASCII, 1 KB

Contents

This ASCII file contains two columns, wavelength [Å] and the fiber acceptance.

sdss

Summary
Filter transmission curves for SDSS filters.

Naming Convention
`sdss_{date}_{filter}_atm.dat`, where `{date}` is when the curves were measured, and `{filter}` is *u*, *g*, *r*, *i*, *z*.

Regex
`sdss_jun2001_[ugriz]_atm\.dat`

File Type
ASCII, 1 KB

Contents

Derived from the comments in the files:

The first column is the wavelength in Ångstroms. The second column (respt) is the quantum efficiency on the sky looking through 1.3 airmasses at APO for a point source. The third column (resbig) is the QE under these conditions for very large sources (size greater than about 80 pixels) for which the infrared scattering is negligible. The only filters for which the infrared scattering has any effect are r and i; the scattering in the bluer chips is negligible, and the z chips are not thinned and the phenomenon does not exist. The fourth column (resnoa) is the response of the third column with *no* atmosphere, and the fifth column is the assumed atmospheric transparency at *one* airmass at APO.

thru

Summary
Throughput data file.

Naming Convention
`thru-{ARM}.fits`, where `{ARM}` is 'b', 'r', 'z'.

Regex
`thru-[brz]\.fits`

File Type
FITS, 1 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Empty
HDU1	THROUGHPUT	BINTABLE	Throughput model
HDU2	FIBERINPUT	BINTABLE	Geometric loss at fiber input

FITS Header Units

HDU0

EXTNAME = PRIMARY

This HDU has no non-standard required keywords.

Empty HDU.

HDU1

EXTNAME = THROUGHPUT

Throughput model.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	32	int	length of dimension 1
NAXIS2	24651	int	length of dimension 2
EXPTIME	1000.0	float	default exposure time [sec]
GEOMAREA	86787.09421000001	float	geometric area of mirror - obscurations
FIBERDIA	1.52	float	average fiber diameter [arcsec]
WAVEMIN	3533	int	Minimum wavelength [Angstroms]
WAVEMAX	5998	int	Maximum wavelength [Angstroms]
EXTNAME	THROUGHPUT	str	extension name

Required Data Table Columns

Name	Type	Units	Description
wavelength	float64	Angstrom	Wavelengths
throughput	float64		Throughput losses not due to atmosphere or fiber inputs
extinction	float64		Atmospheric extinction
fiberinput	float64		DEPRECATED; fiber input losses (point-source?)

HDU2

EXTNAME = FIBERINPUT

Typical fiber input geometric throughput for various object types. 0 = no transmission; 1 = all light makes it into the fibers.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	40	int	length of dimension 1
NAXIS2	24651	int	length of dimension 2
EXTNAME	FIBERINPUT	str	extension name

Required Data Table Columns

Name	Type	Units	Description
wavelength	float64	Angstrom	Wavelengths at which loss is modeled
elg	float64		throughput for typical ELG
lrg	float64		throughput for typical LRG
star	float64		throughput for typical point source
sky	float64		throughput for uniform source

desi.yaml

Summary
Contains fundamental DESI parameters.

Naming Convention
`desi.yaml`

Regex
`desi\.yaml`

File Type
YAML

1.1.8 DESISURVEY_OUTPUT

`DESISURVEY_OUTPUT` contains the outputs of desisurvey and surveysim, and is expected to be manually by users of these packages. There is no one, official location for these files in the DESI directory tree.

We expect this directory structure will be updated as part of integrating desisurvey (afternoon planning and next tile selector) into online operations.

> **Warning:** These files are not expected to be released, and `DESISURVEY_OUTPUT` is not normally defined automatically in the DESI environment.

ephem

Summary
Cached ephemeris calculations for desisurvey.

Naming Convention
`ephem_YEAR-MM-DD_YEAR-MM-DD.fits`, where `YEAR-MM-DD` are the first and last dates covered by this ephemeris cache.

Regex
`ephem_[0-9]{4}-[0-9]{2}-[0-9]{2}_[0-9]{4}-[0-9]{2}-[0-9]{2}\.fits`

File Type
FITS, 100 KB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Blank
HDU1	EPHEM	BINTABLE	Ephemeris table

FITS Header Units

HDU0

EXTNAME = (None)

Empty HDU.

HDU1

EXTNAME = EPHEM

Ephemeris table

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2920	int	length of dimension 1
NAXIS2	31	int	length of dimension 2
NAME	Survey Ephemerides	str	
START	2020-03-15	str	Calculated ephemerides start on the evening of this date.
STOP	2020-04-15	str	Calculated ephemerides stop on the morning of this date.

Required Data Table Columns

Name	Type	Units	Description
noon	float64		MJD of local noon before night
dusk	float64		MJD of dark/gray sunset
dawn	float64		MJD of dark/gray sunrise
brightdusk	float64		MJD of bright sunset
brightdawn	float64		MJD of bright sunrise
brightdusk_LST	float64	deg	Apparent LST at brightdawn
brightdawn_LST	float64	deg	Apparent LST at brightdusk
moonrise	float64		MJD of moonrise before/during night
moonset	float64		MJD of moonset after/during night
moon_illum_frac	float64		Illuminated fraction of moon surface
nearest_full_moon	float64		Nearest full moon - local midnight in days
programs	int16[4]		Program sequence between dusk and dawn (see notes)
changes	float64[3]		MJD of program changes between dusk and dawn
moon_ra	float64[25]	deg	RA of moon tabulated during the night (see notes)
moon_dec	float64[25]	deg	DEC of moon tabulated during the night (see notes)
venus_ra	float64[25]	deg	RA of venus
venus_dec	float64[25]	deg	DEC of venus
mars_ra	float64[25]	deg	RA of mars
mars_dec	float64[25]	deg	DEC of mars
jupiter_ra	float64[25]	deg	RA of jupiter
jupiter_dec	float64[25]	deg	DEC of jupiter
saturn_ra	float64[25]	deg	RA of saturn
saturn_dec	float64[25]	deg	DEC of saturn
neptune_ra	float64[25]	deg	RA of neptune
neptune_dec	float64[25]	deg	DEC of neptune
uranus_ra	float64[25]	deg	RA of uranus
uranus_dec	float64[25]	deg	DEC of uranus

Notes and Examples

The default date range is chosen large enough to cover commissioning, survey validation and the 5-year main survey, so should not normally need to be changed.

The desisurvey package includes a convenience wrapper that should normally be used to access this file:

```
import desisurvey.ephem
ephem = desisurvey.ephem.get_ephem()
```

This wrapper implements memory and disk caching, for efficiency, and returns an Ephemerides with useful methods for working with the table data. If you need direct access to the table use, for example:

```
print(ephem.table[:10])
```

The integer codes used for the nightly program sequence are DARK=0, GRAY=1, BRIGHT=2. Use program names where possible, instead of integer codes: the mapping between them is defined in the desisurvey.tiles module:

```
import desisurvey.tiles
assert deisurvey.tiles.Tiles.PROGRAM_INDEX['GRAY'] == 1
```

RA, DEC coordinates for the moon and planets are tabulated on an hourly grid spanning local noon - noon (inclusive, so 25 grid points) spanning each night. You will normally want to interpolate these values using the get_object_interpolator convenience method:

```
night_ephem = ephem.get_night('2022-12-25')
moon_altaz = desisurvey.ephem.get_object_interpolator(night_ephem, 'moon', altaz=True)
alt, az = moon_altaz(mjd)
```

Note that you can either interpolate in (RA,DEC) or (Alt,Az).

surveyinit

Summary
Design hour angles calculated during survey initialization.

Naming Convention
surveyinit.fits

Regex
surveyinit.fits

File Type
FITS, 36 KB

Contents

Number	EXTNAME	Type	Contents
HDU0	WEATHER	IMAGE	Nightly dome-open fractions assumed to calculate available LST.
HDU1	DARK	BINTABLE	Summary of hour angle optimization for the DARK program.
HDU2	GRAY	BINTABLE	Summary of hour angle optimization for the GRAY program.
HDU3	BRIGHT	BINTABLE	Summary of hour angle optimization for the BRIGHT program.
HDU4	DESIGN	BINTABLE	Design hours angles for all programs.

FITS Header Units

HDU0

EXTNAME = WEATHER

Nightly dome-open fractions due to weather that are are assumed when calculating the available LST per program, as an input to the design hour-angle optimization.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	2556	int	Length of dimension 1.
FIRST	2019-01-01	str	Date of the first tabulated night.
YEARS	2007,2008,2009,2010,2011,2012,2013,2014,2015,2016,2017	str	List of years averaged to calculate predicted dome-open fractions.
START	2019-12-01	str	Nominal survey start date used for hour-angle optimization.
STOP	2024-11-30	str	Nominal survey stop date used for hour-angle optimization.
TWILIGHT	F	bool	Was twilight included in the BRIGHT program schedule for optimzation?

Data: FITS image [float64, 2556]

The HDU data consists of a 1D array of dome-open fractions estimated by averaging historical weather data. The value at index `K` corresponds to the night of `FIRST` plus `K` days. Note that dome-open fractions are tabulated for an extended date range that covers the nominal survey dates but also commissioning and survey validation.

Use load_weather to read the dome-open fractions as a 1D array, optionally sliced to a specified range of dates.

HDU1

EXTNAME = DARK

Summary of hour angle optimization for the DARK program.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	length of dimension 1
NAXIS2	192	int	length of dimension 2
ORIGIN	-60.0	float	Low edge of first LST histogram bin in degrees.

Required Data Table Columns

Name	Type	Units	Description
AVAIL	float64		Histogram of available LST in the DARK program.
INIT	float64		Histogram of initial LST usage, before optimization.
PLAN	float64		Histogram of planned LST usage, after optimization.

Histograms are normalized to the (dimensionless) units of sidereal hours per LST bin integrated over the survey.

HDU2

EXTNAME = GRAY

Summary of hour angle optimization for the GRAY program.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	length of dimension 1
NAXIS2	192	int	length of dimension 2
ORIGIN	-60.0	float	Low edge of first LST histogram bin in degrees.

Required Data Table Columns

Name	Type	Units	Description
AVAIL	float64		Histogram of available LST in the GRAY program.
INIT	float64		Histogram of initial LST usage, before optimization.
PLAN	float64		Histogram of planned LST usage, after optimization.

Histograms are normalized to the (dimensionless) units of sidereal hours per LST bin integrated over the survey.

HDU3

EXTNAME = BRIGHT

Summary of hour angle optimization for the BRIGHT program.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	24	int	length of dimension 1
NAXIS2	192	int	length of dimension 2
ORIGIN	-60.0	float	Low edge of first LST histogram bin in degrees.

Required Data Table Columns

Name	Type	Units	Description
AVAIL	float64		Histogram of available LST in the BRIGHT program.
INIT	float64		Histogram of initial LST usage, before optimization.
PLAN	float64		Histogram of planned LST usage, after optimization.

Histograms are normalized to the (dimensionless) units of sidereal hours per LST bin integrated over the survey.

HDU4

EXTNAME = DESIGN

Optimized design hour angles for each tile in all programs.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	16071	int	length of dimension 1
NAXIS2	10	int	length of dimension 2

Required Data Table Columns

Name	Type	Units	Description
INIT	float64	deg	Initial hour angles before optimization.
HA	float64	deg	Final hour angles after optimization.
TEXP	float64	s	Irreducible exposure time due to dust extinction and airmass at the design hour angle.

Each row of the table corresponds to one tile with indexing that matches `desisurvey.tiles.Tiles`.

Use load_design_hourangle to read the `HA` column as a 1D array.

Notes and Examples

The histograms of available LST in each program are calculated by get_available_lst.

Hour angle optimization is performed by desisurvey.optimize.Optimizer and documented in DESI-3060.

planner

Summary
Cached state of the survey afternoon planner.

Naming Convention
`planner_YEAR-MM-DD.fits`, where `YEAR-MM-DD` is the date of the afternoon when the planner was run.

Regex
`planner_[0-9]{4}-[0-9]{2}-[0-9]{2}\.fits`

File Type
FITS, 400 KB

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Blank.
HDU1	PLAN	BINTABLE	Survey planner state.

FITS Header Units

HDU0

EXTNAME = (None)

Empty HDU.

HDU1

EXTNAME = PLAN

Snapshot of the internal state of a desisurvey.plan.Planner object.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	29	int	length of dimension 1.
NAXIS2	16071	int	length of dimension 2.
CADENCE	monthly	str	Fiber assignment cadence (monthly / daily).
FIRST	2019-12-01	str	First night that was planned.
LAST	2024-11-29	str	Last night that has been planned so far.

Required Data Table Columns

Name	Type	Units	Description
TILEID	int64		Tile ID from the tiles file.
COVERED	int64		Day number that tile was first covered relative to FIRST or -1.
COUNTDOWN	int64		Countdown of remaining fiber assignment cycles until this tile will be assigned.
AVAILABLE	logical		Does this tile have fibers already assigned?
PRIORITY	float64		Relative priority for scheduling this tile. Must be >= 0.

The meaning of "covered" is specified by the `fiber_assignment_order` configuration parameter, which also specifies the starting `COUNTDOWN` value for each pass.

Each row of the table corresponds to one tile with indexing that matches desisurvey.tiles.Tiles.

Notes and Examples

A Planner object manages updates during afternoon planning:

```
import desisurvey.rules
import desisurvey.plan
rules = desisurvey.rules.Rules()
planner = desisurvey.plan.Planner(rules)
```

Its internal state after each afternoon can be saved using, for example:

```
planner.save('planner_snapshot.fits')
```

This state can then be later restored using:

```
planner = desisurvey.plan.Planner(rules, restore='planner_snapshot.fits')
```

scheduler

Summary
Cached state of the next tile selector.

Naming Convention
`scheduler_YEAR-MM-DD.fits`, where `YEAR-MM-DD` is the date of the sunset (*i.e.* night) when the scheduler was run.

Regex
`scheduler_[0-9]{4}-[0-9]{2}-[0-9]{2}\.fits`

File Type
FITS, 130 KB

Contents

Number	EXTNAME	Type	Contents
HDU0	SCHED	IMAGE	1D Array of Scheduler state

FITS Header Units

HDU0

EXTNAME = SCHED

Snapshot of the internal state of a Scheduler object.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	16071	int	Length of dimension 1.
NIGHT	2020-03-15	str	Last night the scheduler was initialized for.
NDONE	3	int	Total number of completed tiles.

Data: FITS image [float64, 16071]

The data is a 1D array of the integrated squared signal-to-noise ratio (SNR) accumulated on each tile so far, relative to the target value. Tile indexing matches desisurvey.tiles.Tiles.

Notes and Examples

A Scheduler object schedules observations during each night:

```
import desisurvey.scheduler
scheduler = desisurvey.scheduler.Scheduler()
```

Its internal state after each afternoon can be saved using, for example:

```
scheduler.save('scheduler_snapshot.fits')
```

This state can then be later restored using:

```
scheduler = desisurvey.scheduler.Scheduler(restore='scheduler_snapshot.fits')
```

stats

Summary
Nightly summary statistics, recorded by pass, from a surveysim run.

Naming Convention
`stats_surveysim.fits`

Regex
`stats_surveysim\.fits`

File Type
FITS, 810 KB

Note: currently this is an output of surveysim, but in the future may become an output of real operations survey QA.

Contents

Number	EXTNAME	Type	Contents
HDU0		IMAGE	Blank.
HDU1	STATS	BINTABLE	Nighly summary statistics by pass.

FITS Header Units

HDU0

EXTNAME = PRIMARY

Empty HDU.

HDU1

EXTNAME = STATS

Survey summary statistics by pass.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	1826	int	length of dimension 1
NAXIS2	13	int	length of dimension 2
TILES	desi-tiles.fits	str	Name of the tiles file specified in desisurvey config.
START	2020-03-15	str	YEAR-MM-YY of the first night of the survey.
STOP	2020-04-15	str	YEAR-MM-YY of the most recent night with statistics recorded.

Required Data Table Columns

Name	Type	Units	Description
MJD	float64		MJD of local noon before this night.
tsched	float64	d	Total scheduled time for all programs during this night.
topen	float64[3]	d	Actual time dome was open during this night, per program.
tdead	float64[3]	d	Deadtime during this night (dome open, but idling), per program.
tscience	float64[8]	d	Time spent with the shutter open for science exposures, per pass.
tsetup	float64[8]	d	Time spent setting up to observe a new field, per pass.
tsplit	float64[8]	d	Time spent setting up to reobserve the previous field, per pass.
completed	int32[8]	d	Number of tiles completed this night, per pass.
nexp	int32[8]	d	Number of exposures recorded this night, per pass.
nsetup	int32[8]	d	Number of setups to observe a new field, per pass.
nsplit	int32[8]	d	Number of setups to re-observe a previous field, per pass.
nsetup_abort	int32[8]	d	Number of times a new field setup was aborted, per pass.
nsplit_abort	int32[8]	d	Number of times a repeat field setup was aborted, per pass.

The table contains one row per night, with row `N` corresponding to `N` nights after the header `START` date.

All timing statistics are in units of days.

The `topen` and `tdead` arrays are indexed by the number of programs, which are defined in the tiles module. There will always be space for all three programs (DARK, GRAY, BRIGHT), even when using a custom tiles file with fewer programs actually used.

The remaining arrays are indexed by the number of passes, which depends on the actual tiles file being used. In general, a tiles file uses arbitrary pass numbering, which might not be dense or consecutive for each program. The Tiles object defines data structures to map the indices used here to the pass numbers and programs used in the tiles file.

Notes and Examples

A SurveyStatistics object tracks survey statistics during simulation:

```
import surveysim.stats
stats = surveysim.stats.SurveyStatistics()
```

Its internal state after a simulation (or each night) can be saved using, for example:

```
stats.save('stats.fits', comment='Baseline (seed=1)')
```

This state can then later be restored using:

```
stats = surveysim.stats.SurveyStatistics(restore='stats.fits')
```

exposures

Summary
Record of simulated exposures.

Naming Convention
`exposures_surveysim.fits`

Regex
`exposures_surveysim\.fits`

File Type
FITS, 2 MB (scales with the number of exposures)

Note: currently this is only an output from surveysim, but it may become an output of survey operations, caching in a file the information that is also contained in the operations database.

Contents

Number	EXTNAME	Type	Contents
HDU0	META	IMAGE	Blank
HDU1	EXPOSURES	BINTABLE	Per-exposure metadata
HDU2	TILEDATA	BINTABLE	Per-tile metadata

FITS Header Units

HDU0

EXTNAME = META

Required Header Keywords

KEY	Example Value	Type	Comment
TILES	desi–tiles.fits	str	Name of the tiles file specified in desisurvey config.
NEXP	41875	int	Number of exposures recorded so far.
INITIAL	2019-12-01	str	YEAR-MM-DD of initial night used for integer offsets (or blank before any observing).

Empty HDU.

HDU1

EXTNAME = EXPOSURES

Per-exposure metadata.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	41875	int	length of dimension 1
NAXIS2	8	int	length of dimension 2

Required Data Table Columns

Name	Type	Units	Description
MJD	float64		MJD when shutter was opened for this exposure.
EXPTIME	float32	s	Length of time shutter was open.
TILEID	int32		ID of the observed tile.
SNR2FRAC	float32		Fractional SNR2 accumulated on this tile during this exposure.
AIRMASS	float32		Average airmass during this exposure.
SEEING	float32	arcsec	Average FWHM atmospheric seeing during this exposure.
TRANSP	float32		Average atmospheric transparency during this exposure.
SKY	float32		Average sky background level during this exposure.

HDU2

EXTNAME = TILEDATA

Per-tile metadata.

Required Header Keywords

KEY	Example Value	Type	Comment
NAXIS1	20	int	length of dimension 1
NAXIS2	10	int	length of dimension 2

Required Data Table Columns

Name	Type	Units	Description
AVAIL	int32		Night when this tile was first available (or -1 if not yet available).
PLANNED	int32		Night when this tile was first planned (or -1 if not yet planned).
EXPTIME	float32	s	Total exposure time of this tile.
SNR2FRAC	float32		Total fractional SNR2 accumulated on this tile.
NEXP	int32		Total number of exposures of this tile.

There is one table row per tile, indexed to match desisurvey.tiles.Tiles.

The integer AVAIL and PLANNED values are nights since the date specified by the NIGHT keyword in HDU0.

A tile is considered "available" once it has fibers assigned. A tile is considered "planned" once its priority has been set non-zero. In general, these changes of state occur independently: availability is determined by the fiber assignment policy and when covering tiles have been completed, while the priorities are set by survey strategy rules. **A tile will not be scheduled until it is both available and planned.**

Notes and Examples

An ExposuresList object records exposures during simulation:

```
import surveysim.exposures
explist = surveysim.exposures.ExposureList()
```

Its internal state after a simulation (or each night) can be saved using, for example:

```
explist.save('exposures.fits', comment='Baseline (seed=1)')
```

This state can then later be restored using:

```
explist = surveysim.exposures.ExposureList(restore='exposures.fits')
```

1.1.9 PROTODESI

ProtoDESI was a DESI precursor program to test the DESI corrector and fiber positioning technology, albeit without spectra.

PROTODESI points to the location of ProtoDESI files.

images

Contains images produced by the ProtoDESI campaign.

fits

Placeholder.

fpc

Contains Fiber Photometry Camera (FPC) data.

PROTODESI_FPC

Summary
Data model for protoDESI Fiber Photometry Camera images for ProtoDESI.

Naming Convention
`PROTODESI_FPC_{EXPID}.fits`, where `{EXPID}` is the 8-digit exposure ID.

Regex
`PROTODESI_FPC_[0-9]{8}.fits` *Give a regular expression for this filename. For example, a six-digit number would correspond to ``[0-9]{6}``.*

File Type
FITS, 16 MB *This section gives the type of the file and its approximate size.*

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	NPIX1xNPIX2 float image	Raw image

FITS Header Units

HDU0

EXTNAME = PRIMARY

Raw image

Header Keywords (dump)

KEY	Example Value	Type	Comment
NAXIS1	3352	int	length of data axis 1
NAXIS2	2532	int	length of data axis 2
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor or unsigned short
DEVICE	FPC	str	imaging device
DATE-OBS	2016-08-17T17:49:22.235092	str	datetime at observation start (UTC)
TIME-OBS	17:49:22.235092	str	time at observation start (UTC)
MJD-OBS	57617.74261846	float	MJD at observation start
OPEN-SHUT	2016-08-17T17:49:22.235092	str	time at shutter open (UTC)
LST	08:09:06.860	str	LST at observation start (HH:mm:ss.ss)
EXPREQ	1.0	float	[s] Requested Exposure duration, also defined as REQTIME
FILE-NAME	/data/images/PROTODESI_FPC_00000050.fits	str	absolute path of file on desirpi1
CCDTEMP	-1.907	float	CCD temperature **before or after exposure?**
CCDSET	-9.788	float	setpoint of CCD TEC
CCD-POWER	100.0	float	cooling power of TEC
TECFROZE	F	bool	whether TEC is frozen or not
IN-STRUME	PROTODESI	str	instrument
EXPNUM	50	int	exposure ID
CCD-COOL	T	bool	whether TEC is enabled or not
CHECK-SUM	R2QLS1OIR1OIR1OI	str	HDU checksum updated 2016-08-17T17:49:25
DATA-SUM	2903024359	str	data unit checksum updated 2016-08-17T17:49:25

Other Header Keywords (not currently present)

KEY	Example Value	Type	Comment
XTENSION	BINTABLE, IMAGE	str	binary table written by MWRFITS v1.8
BITPIX	16	int	required value
NAXIS	2	int	required value
PCOUNT	0	int	normally 0 (no varying arrays)
GCOUNT	1	int	required value
TFIELDS		int	number of columns in table
TIMESYS	UTC	str	time system
EXPTIME	1500.1	float	measured exposure time
CCDBIN1	1	int	pixel binning, axis 1
CCDBIN2	1	int	pixel binning, axis 2
TELEQUIN	2000.0	float	equinox of telescope coordinates
TELRA	19:17:34.440	str	[HH:MM:SS] telescope RA
RA	19:17:34.440	str	[HH:MM:SS] RA
TELDEC	20:39:59.760	str	[DD:MM:SS] telescope DEC
DEC	00:00:48.240	str	[DD:MM:SS] DEC
HA	20:39:59.760	str	[HH:MM:SS] telescope hour angle
ZD	30.7000	float	[deg] telescope zenith distance
AIRMASS	1.1620	float	Airmass
TELFOCUS	1.22, 145.3, 2.9, 4300.1, 0.2,0.0	str	DESI hexapod settings
TELSTAT	Track	str	telescope tracking status
FIELDID	2321	int	DESI field identifier
OBSTYPE	object	str	observation type: zero, dark, dome flat, sky flat, object, test, calibration, guider
SEQID	4x4 dither	str	sequence name
SEQNUM	2	int	number of image in sequence
SEQTOT	16	int	total number of images in sequence

KEY	Example Value	Type	Comment
F0-RA		float	fiber 0 RA
F0-DEC		float	fiber 0 DEC
F1-RA		float	fiber 1 RA
F1-DEC		float	fiber 1 DEC
F2-RA		float	fiber 2 RA
F2-DEC		float	fiber 2 DEC
FIPOS	T	bool	fiber positioner data available if true
CYCLES	3	int	number of positioner iterations
ONTARGET	3	int	number of fibers on target
FAILED	5	int	number of failed fiber assignments
MAXRES	12.5	float	[micron] maximum target-fiber position residual

KEY	Example Value	Type	Comment
GS-FILE		str	guide Star filename
GS-RA		float	guide ref pixel RA
GS-DEC		float	guide ref pixel DEC
GS-X		float	guide ref pixel X
GS-Y		float	guide ref pixel Y

KEY	Example Value	Type	Comment
GUIDER	1	int	guider (0-absent,1-ok,2-lost star,3-lost all stars)
G-MODE	auto	str	guider operation mode
G-CCDNUM	4	int	number of active guide CCDs
G-FEEDBK	0.75	float	guider feedback percentage
G-MEANX	0.1	float	Guider x-axis mean offsets
G-MEANY	0.2	float	Guider y-axis mean offsets
G-MEANX2	12.1	float	Guider x-axis second moment mean offsets
G-MEANY2	12.1	float	Guider y-axis second moment mean offsets
G-MEANXY	12.1	float	Guider cross-axis second moment mean offsets
G-MAXX	0.9	float	Guider x-axis maximum offset
G-MAXY	0.9	float	Guider y-axis maximum offset
G-FLXVAR	12.4	float	Guide stars flux variance
G-TRANSP	0.8	float	Guider average sky transparency
G-SEEING	0.5	float	[arcsec] Guider average seeing
G-LATENC	0.15	float	[s] Guider average latency between exposures
G-EXPTIM	0.5	float	[s] Guider average exposure time

Data: FITS image [int16, 3352x2532]

Notes and Examples

The missing keywords listed above in the Other Keywords section, grouped roughly by categories, are either found in an older version of data model, or defined in DESI-1229 and deemed relevant for protoDESI run.

While this data model is up to date, FPC and GFA images may not be in their final shape and are subject to change.

fpc_analysis

Placeholder.

fpc_engineering_data

Placeholder.

fvc

Contains Fiber View Camera (FVC) images.

fvc

Summary
Fiber View Camera images for ProtoDESI.

Naming Convention
`fvc\.[0-9]{8}(_[0-9]{4}|[0-9]{6})\.fits`

Regex
`fvc\.[0-9]{8}(_[0-9]{4}|[0-9]{6})\.fits`

File Type
FITS, 72 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Raw image

FITS Header Units

HDU0

EXTNAME = PRIMARY

Raw image data.

Required Header Keywords

Header	Value	Type	Comment
BITPIX	16	int	number of bits per data pixel
NAXIS	2	int	number of data axes
NAXIS1	6000	int	length of data axis 1
NAXIS2	6000	int	length of data axis 2
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
EXPID	200728.000032	float	Exposure ID
EXPTIME	1.	float	Exposure time in seconds
RDTIME	9.25288391113281	float	readout time in seconds

continues on next page

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Header	Value	Type	Comment
DRKEXP	0	int	0/1 for open-shutter/dark exposure
DRKFLAG	0	int	0/1 for unsubtracted/dark-corrected
SIMFLAG	0	int	0/1 for real/fake image
SIMFIB	0	int	0/1 for real/fake fiber spots
CCDTEMP	-10.	float	CCD temperature (C)
BASETMP	-10.	float	Camera base temperature (C)
TEMPSET	-10.	float	CCD temperature set point (C)
COOLPOW	50.	float	CCD cooler power (%)
PIXSZX	6.00000021222513E-06	float	Camera Pixel Size in x (m)
PIXSZY	6.00000021222513E-06	float	Camera Pixel Size in y (m)
CCDX1	0	int	Physical array start x
CCDX2	8304	int	Physical array end x
CCDY1	0	int	Physical array start y
CCDY2	6220	int	Physical array end y
VISX1	64	int	Visible array start x
VISX2	8240	int	Visible array end x
VISY1	45	int	Visible array start y
VISY2	6177	int	Visible array end y
SUBX1	1152	int	Sub-array start x
SUBX2	7151	int	Sub-array end x
SUBY1	111	int	Sub-array start y
SUBY2	6110	int	Sub-array end y
HBIN	0	int	Horizontal binning
VBIN	0	int	Vertical binning
OBSNUM	200728	int	Observation Number
OBSFRM	32	int	Observation Frame
HDREV	256	int	Camera hardware revision
FWREV	513	int	Camera firmware revision
DATE	‘2016-09-28T11:11:12’	str	file creation date (YYYY-MM-DDThh:mm:ss UT)

Data: int16 FITS image [6000, 6000]

gfa

Contains Guide camera data.

PROTODESI_GFA

Summary
GFA images for ProtoDESI, including guider "postage stamps". Should we also save full frame images?

Naming Convention
`PROTODESI_GFA[01]G_roi_[0-9]{8}_[0-9]{4}\.fits`.

Regex
`PROTODESI_GFA[01]G_roi_[0-9]{8}_[0-9]{4}\.fits`

File Type
FITS

Contents

Number	EXTNAME	Type	Contents
HDU0	PRIMARY	IMAGE	Raw image
HDU1	GFA	IMAGE	Raw image

FITS Header Units

HDU0

EXTNAME = PRIMARY

Empty HDU.

Required Header Keywords

Header	Value	Type	Comment
DEVICE	'GFA1G '	str	
OBSNUM	1622	int	
OBSFRAME	7	int	
OBSTYPE	'ROI '	str	
DATE-OBS	'2016-08-31T03:10:47.945228'	str	
TIME-OBS	'03:10:47.945228'	str	
MJD-OBS	57631.13249937	float	
OPENSHUT	'2016-08-31T03:10:47.945228'	str	
LST	'18:23:19.990'	str	
EXPREQ	1.	float	
EXPTIME	1.	float	
FILENAME	'/data/images/gfa/PROTODESI_GFA1G_roi_00001622_0007.fits'	str	
ROI_LIST	'(190.51099891749917, 124.5090160850238)'	str	
CHECKSUM	'Y72la70kS70kY70k'	str	HDU checksum updated 2016-08-31T03:10:47
DATASUM	' 0'	str	data unit checksum updated 2016-08-31T03:10:47

HDU1

EXTNAME = GFA

This is the actual GFA image, which got stored in an extension instead of the primary.

Header	Value	Type	Comment
BITPIX	16	int	number of bits per data pixel
NAXIS	2	int	number of data axes
NAXIS1	64	int	length of data axis 1
NAXIS2	64	int	length of data axis 2
PCOUNT	0	int	required keyword; must = 0
GCOUNT	1	int	required keyword; must = 1
BZERO	32768	int	offset data range to that of unsigned short
BSCALE	1	int	default scaling factor
ROI_X	190.510998917499	float	
ROI_Y	124.509016085024	float	
SHAPE	'64,64 '	str	
DTYPE	'uint16 '	str	
CHECKSUM	'EeRhFZQZEbQfEZQZ'	str	HDU checksum updated 2016-08-31T03:10:47
DATASUM	'1260997802'	str	data unit checksum updated 2016-08-31T03:10:47

Data: int16 FITS image [64, 64]

sti

Placeholder.

logs

Contains logs from the ProtoDESI campaign.

LOGNAME

Placeholder.

on_sky_movedata

Summary
Contains a record of positioner move commands and results.

Naming Convention
`{posname}_{seqid}_on_sky_movedata.csv`

Regex
`(UM[0-9]{5})(_)([0-9]{4})(-)([0-9]{2})(-)([0-9]{2})(_)(T)([0-9]{6})(_on_sky_movedata.csv)`

File Type
csv

Warning

This description does not correspond to any file in the *actual* ProtoDESI logs.

on_sky_movedata

Summary
Contains a summary of a fiber positioner test

Naming Convention
`{posname}_{seqid}_on_sky_summary.csv`

Regex
`(UM[0-9]{5})(_)([0-9]{4})(-)([0-9]{2})(-)([0-9]{2})(_)(T)([0-9]{6})(_on_sky_summary.csv)`

File Type
csv

Warning

This description does not correspond to any file in the *actual* ProtoDESI logs.

1.2 Other information

Bitmask definitions and environment variables used by the DESI data pipelines:

1.2.1 Bit Masks in DESI

This page describes the bitmasks found in DESI files. For details on working with these values, please see the tutorial on that topic.

Redshift Fitting (Redrock) Masks

ZWARN

The **ZWARN** bitmask in redshift catalogs indicates known problems with a particular redshift fit or associated QA. ZWARN==0 is good; any non-zero value indicates a potential problem. This mask will be described in more detail in the Redrock paper (Bailey et al. 2023 in prep), as well as Section 5.3.1 of the Survey Operations Paper (Schlafly et al. 2023).

The canonical code location defining these bits is desitarget targetmask.yaml. Bits 0-15 are set by Redrock itself (the redshift fitter), while bits 16-19 are set by DESI-specific post-processing.

ZWARN Mask Locations

File	Table HDU	Column
redrock	REDSHIFTS	ZWARN
emline	EMLINEFIT	ZWARN
zmtl	ZMTL	ZWARN
mtl	MTL	ZWARN
zpix	ZCATALOG	ZWARN
ztile	ZCATALOG	ZWARN
zall	ZCATALOG	ZWARN
lss	LSS	ZWARN

ZWARN Bit Definitions

Bit Name	Bit Number	Description
SKY	0	sky fiber
LITTLE_COVERAGE	1	too little wavelength coverage
SMALL_DELTA_CHI2	2	chi-squared of best fit is too close to that of second best
NEGATIVE_MODEL	3	synthetic spectrum is negative
MANY_OUTLIERS	4	fraction of points more than 5 sigma away from best model is too large (>0.05)
Z_FITLIMIT	5	chi-squared minimum at edge of the redshift fitting range
NEGATIVE_EMISSION	6	a QSO line exhibits negative emission, triggered only in QSO spectra, if C_IV, C_III, Mg_II, H_beta, or H_alpha has LINEAREA + 3 * LINEAREA_ERR < 0
UNPLUGGED	7	the fiber was unplugged/broken, so no spectrum obtained
BAD_TARGET	8	catastrophically bad targeting data
NODATA	9	No data for this fiber, e.g. because spectrograph was broken during this exposure (ivar=0 for all pixels)
BAD_MINFIT	10	Bad parabola fit to the chi2 minimum
POORDATA	11	Poor input data quality but try fitting anyway
LOW_DEL_CHI2	16	DELTACHI2 is lower than 25 for a DESI SV3 target
LOW_DEL_CHI2_BGS	17	DELTACHI2 is lower than 40 for a DESI SV3 BGS target in bright time
BAD_SPECQA	18	QA rejected due to spectrum-level problems
BAD_PETALQA	19	QA rejected due to petal-level problems

Spectroscopic Reduction Masks

The **FIBERSTATUS** bit mask records the state of individual fibers for issues that impact the entire spectrum, e.g. a broken fiber. The **SPECMASK** bit mask tracks wavelength dependent isses per spectrum, e.g. masks for cosmic rays.

FIBERSTATUS

The **FIBERSTATUS** mask is kept as a column in FIBERMAP and related HDUs. Bits 0-7 are set by fiber assignment from focal plane information known before observations; bits 8-24 are set by the spectroscopic pipeline; bits 25-30 are set by the final QA step to set bits for all fibers in a petal (e.g. because sky model noise makes all spectra questionable).

The canonical code location defining FIBERSTATUS bits is desispec.maskbits L55.

FIBERSTATUS Mask Locations

File	Table HDU	Column
frame	FIBERMAP	FIBERSTATUS
sframe	FIBERMAP	FIBERSTATUS
cframe	FIBERMAP	FIBERSTATUS
spectra	FIBERMAP	FIBERSTATUS
coadd	EXP_FIBERMAP	FIBERSTATUS
coadd	FIBERMAP	COADD_FIBERSTATUS
exposure-qa	FIBERQA	QAFIBERSTATUS
tile-qa	FIBERQA	QAFIBERSTATUS

FIBERSTATUS Bit Definitions

Bit 3 (RESTRICTED) is informative and doesn't necessarily mean that the spectrum is bad, i.e. a FIBERSTATUS value of 0 or 8=2**3 is good.

Bit Name	Bit Number	Description
UNASSIGNED	0	Fiber is not assigned to a known target or sky location
STUCKPOSITIONER	1	INFO: Stuck positioner (but could still be on a good sky location)
BROKENFIBER	2	Broken fiber
RESTRICTED	3	INFO: Positioner has restricted reach (but might still be on valid target)
MISSINGPOSITION	8	Fiber location information is missing
BADPOSITION	9	Fiber >100 microns from target location
POORPOSITION	10	Fiber >30 microns from target location
LOWTRANSMISSION	12	Low fiber transmission. Cannot use for sky.
LOWEFFTIME	15	Effective time for this fiber is too low
BADFIBER	16	Unusable fiber
BADTRACE	17	Bad trace solution
BADFLAT	18	Bad fiber flat
BADARC	19	Bad arc solution
MANYBADCOL	20	>10% of pixels are bad columns
MANYREJECTED	21	>10% of pixels rejected in extraction
BADAMPB	22	Issues in the amplifier readouts of camera B make this unusable
BADAMPR	23	Issues in the amplifier readouts of camera R make this unusable
BADAMPZ	24	Issues in the amplifier readouts of camera Z make this unusable
BADPETALPOS	25	Too many fibers with bad positioning in petal
BADPETALSKY	26	Bad sky model across petal
BADPETALSTDSTAR	27	To few standard stars or rms between stars too large in the petal
BADPETALFLUXCAL	28	Unphysical flux calibration for the petal (calib vector too high or too low)
BADPETALSNR	29	TSNR is too low for this petal compared to the others
BADREADNOISE	30	Bad read noise in one of the 3 cameras
RESERVED31	31	Reserved sign bit; do not use

SPECMASK

The **SPECMASK** is stored as an image HDU in files with spectra, matched to the FLUX HDU, i.e. specmask[i,j] is the mask for fiber i wavelength j with flux value flux[i,j]. All bits in SPECMASK are bad, i.e. non-zero values mean that the corresponding flux should not be used.

The canonical code location defining SPECMASK bits is desispec.maskbits L84.

SPECMASK Mask Locations

Note: the FITS file HDU EXTNAME=MASK or MASK_B/R/Z, not "SPECMASK".

File	Image HDU
frame	MASK
sframe	MASK
cframe	MASK
spectra	MASK_B/R/Z
coadd	MASK_B/R/Z

SPECMASK Bit Definitions

Bit Name	Bit Number	Description
SOMEBADPIX	0	Some input pixels were masked or ivar=0
ALLBADPIX	1	All input pixels were masked or ivar=0
COSMIC	2	Input pixels included a masked cosmic
LOWFLAT	3	Fiber flat < 0.5
BADFIBERFLAT	4	Bad fiber flat solution
BRIGHTSKY	5	Bright sky level (details TBD)
BADSKY	6	Bad sky model
BAD2DFIT	7	Bad fit of extraction 2D model to pixel data
NODATA	8	No data exists
BADFIBER	9	fibermask has a non-zero bit
BADCOLUMN	10	Bad CCD column biases the flux

CCDMASK

The **CCDMASK** is used for masking spectrograph CCD images during preprocessing, prior to extracting the spectra. It is stored in the MASK HDU of *preproc* files.

The canonical code location defining CCDMASK bits is desispec.maskbits L42.

CCDMASK Bit Definitions

Bit Name	Bit Number	Description
BAD	0	Pre-determined bad pixel (any reason)
HOT	1	Hot pixel
DEAD	2	Dead pixel
SATURATED	3	Saturated pixel from object
COSMIC	4	Cosmic ray
PIXFLATZERO	5	pixflat is 0
PIXFLATLOW	6	pixflat < 0.1
HIGHVAR	7	High variability in pixel value
BADREADNOISE	8	Very high CCD amplifier read noise

Target masks

Target masks record the reasons why each target was selected for DESI observations. These are stored in the `*_TARGET` columns of the TARGETS, FIBERASSIGN, and FIBERMAP tables in data files.

These masks are described in more detail in Section 2 of Myers et al. (2023) and Appendices A and B of the the DESI EDR Overview paper (DESI Collaboration et al. 2023).

The following table lists a subset of the most commonly used bits that maintained the same definition throughout different phases of DESI observations. For the full definition of all bits, see the EDR Overview paper appendices and the code links in the second table below.

Bit Name	Bit Number	Description
LRG	0	Luminous Red Galaxies
ELG	1	Emission Line Galaxies
QSO	2	Quasars
SKY	32	Blank sky locations
(various STD_*)	33-35	Standard stars
BGS_ANY	60	Bright Galaxy Survey galaxies
MWS_ANY	61	Milky Way Survey stars
SCND_ANY	62	Secondary targets

Canonical code locations where targeting bits are defined:

BIT_MASK	URL
CMX_TARGET	CMX
SV1_DESI_TARGET	SV1
SV1_BGS_TARGET	SV1
SV1_MWS_TARGET	SV1
SV2_DESI_TARGET	SV2
SV2_BGS_TARGET	SV2
SV2_MWS_TARGET	SV2
SV2_SCND_TARGET	SV2
SV3_DESI_TARGET	SV3
SV3_BGS_TARGET	SV3
SV3_MWS_TARGET	SV3
SV3_SCND_TARGET	SV3
DESI_TARGET	TARGET
BGS_TARGET	TARGET
MWS_TARGET	TARGET
SCND_TARGET	TARGET
OBSCONDITIONS	TARGET_L188

Imaging masks

These masks were defined or used by the DESI Legacy Imaging Surveys. Please see their information on these masks at the links below.

BIT_MASK	URL
WISEMASK_W1	BITMASKS_LEGACY
WISEMASK_W2	BITMASKS_LEGACY
MASKBITS	BITMASKS_LEGACY

1.2.2 Environment Variables

DESI data are grouped broadly by category, using environment variables to define the base directory under which files of that category are kept. These variables have a standard location relative to `DESI_ROOT`, but code uses these variables so that one can swap out different input/output locations for testing.

Imaging data and their catalogs are documented separately by the Legacy Survey.

The desidatamodel package on GitHub includes the data model input files and some Python utility code for generating and checking data model files. These links will be useful for developers:

1.2.3 Contributing to desidatamodel

Introduction

This page is about contributing to the DESI data model documentation; it is not about the data model itself.

Examples and Other Documents

examples

This directory contains examples for use in constructing real data model files.

sdR

Summary
Raw data.

Naming Convention
`sdR-{EXPID}.fits`, where `EXPID` is an 8-digit number.

Regex
`sdR-[0-9]{8}\.fits`

File Type
FITS, 10 MB

Contents

Number	EXTNAME	Type	Contents
HDU0	FLUX	IMAGE	Flux in ADU

HDU0

EXTNAME = FLUX

Data: FITS image [float64]

spPlate

Summary
Combined spectra for one plate. The spPlate files contain the combined spectra for all exposures of a given plate. There are typically four 900s exposures which may have been taken in a single night, or over multiple nights. This page is an updated summary of the SDSS2 spPlate data model .

Naming Convention
`spPlate-PLATE4-MJD5.fits`, where `PLATE4` is the zero-padded, four-digit plate number and `MJD5` is the five-digit MJD.

Regex
`spPlate-[0-9]{4}-[0-9]{5}\.fits`

Contents

Number	EXTNAME	Type	Contents
HDU0	FLUX	IMAGE	Flux in units of 10^{-17} erg/s/cm^2/Å.
HDU1	IVAR	IMAGE	Inverse variance $(1/\sigma^2)$ for HDU 0
HDU2	ANDMASK	IMAGE	AND mask
HDU3	ORMASK	IMAGE	OR mask
HDU4	WAVEDISP	IMAGE	Wavelength dispersion in pixels
HDU5	PLUGMAP	BINTABLE	Plug-map structure from plPlugMapM file
HDU6	SKY	IMAGE	Average sky flux in units of 10^{-17} erg/s/cm^2/Å.

FITS Header Units

HDU0

EXTNAME = FLUX

Data: FITS image [float64]

HDU1

EXTNAME = IVAR

Data: FITS image [float64]

HDU2

EXTNAME = ANDMASK

Data: FITS image [int32]

HDU3

EXTNAME = ORMASK

Data: FITS image [int32]

HDU4

EXTNAME = WAVEDISP

Data: FITS image [float64]

HDU5

EXTNAME = PLUGMAP

Required Header Keywords

Header	Value	Type	Comment
XTENSION	BINTABLE	str	Binary table written by MWRFITS v1.8
BITPIX	8	int	Required value
NAXIS	2	int	Required value
NAXIS1	250	int	Number of bytes per row
NAXIS2	NFIBER	int	Number of rows
PCOUNT	0	int	Normally 0 (no varying arrays)
GCOUNT	1	int	Required value
TFIELDS	34	int	Number of columns in table

Required Data Table Columns

Column	Type	Comment
OBJID	int32[5]	
HOLETYPE	char[6]	
RA	double	
DEC	double	
MAG	float[5]	
STARL	float	
EXPL	float	
DEVAUCL	float	
OBJTYPE	char[16]	
XFOCAL	double	
YFOCAL	double	
SPECTROGRAPHID	int32	
FIBERID	int32	
THROUGHPUT	int32	
PRIMTARGET	int32	
SECTARGET	int32	
OFFSETID	int32	
SCI_EXPTIME	float	
SOURCETYPE	char[7]	
LAMBDA_EFF	float	
ZOFFSET	float	
BLUEFIBER	int32	
BOSS_TARGET1	int64	
BOSS_TARGET2	int64	
ANCILLARY_TARGET1	int64	
ANCILLARY_TARGET2	int64	
RUN	int32	
RERUN	char[5]	
CAMCOL	int32	

continues on next page

Table 129 – continued from previous page

Column	Type	Comment
FIELD	int32	
ID	int32	
CALIBFLUX	float[5]	
CALIBFLUX_IVAR	float[5]	
SFD_EBV	float	

HDU6

EXTNAME = SKY

FITS Image: Average sky flux

Required Header Keywords

Header	Value	Type	Comment
XTENSION	IMAGE	str	Image Extension created by MWRFITS v1.4a
BITPIX	-32	int	Data is 32-bit float
NAXIS	2	int	Number of data axes
NAXIS1	NPIX	int	Width
NAXIS2	NFIBER	int	Height

Data: FITS image [float64]

Notes and Examples

Additional HDUs may be present for engineering purposes, but are not supported and are subject to change. Users should refrain from using HDUs not listed here.

There are two masks, an "AND" mask and an "OR" mask. The spectra are constructed from 3 or more 15-minute observations, and the "AND" mask bits are set if that bit is set for each and every input observation. The "OR" mask bits are set if that bit is set for any of the observations. Usually, only "AND" mask is of interest.

The mask bits are set as follows. The authoritative definition of mask bits is in idlutils/data/sdss/sdssMaskbits.par, with an alternate parsing at the data release documentation. They are included here for convenience:

Bit	Name	Description
0	NOPLUG	Fiber not listed in plugmap file
1	BADTRACE	Bad trace from routine TRACE320CRUDE
2	BADFLAT	Low counts in fiberflat
3	BADARC	Bad arc solution
4	MANYBAD-COLUMNS	>10% pixels are bad columns
5	MANYREJECTED	>10% pixels are rejected in extraction
6	LARGESHIFT	Large spatial shift between flat and object pos'n
7	BADSKYFIBER	Sky Fiber shows extreme residuals
8	NEARWHOPPER	Within 2 fibers of a whopping fiber (deprecated)
10	SMEARIMAGE	Smear available for red and blue cameras (deprecated)
11	SMEARHIGHSN	S/N sufficient for full smear fit (deprecated)
12	SMEARMEDSN	S/N only sufficient for scaled median fit (deprecated)
16	NEARBADPIXEL	Bad pixel within 3 pixels of trace
17	LOWFLAT	Flat field less than 0.5
18	FULLREJECT	Pixel fully rejected in extraction (INVVAR=0)
19	PARTIALREJECT	Some pixels rejected in extraction
20	SCATTEREDLIGHT	Scattered light significant
21	CROSSTALK	Cross-talk significant
22	NOSKY	Sky level unknown at this wavelength (INVVAR=0)
23	BRIGHTSKY	Sky level > flux + 10*(flux error) AND sky > 2.0 * median(sky,99 pixels)
24	NODATA	No data available in combine B-spline (deprecated; INVVAR=0)
25	COMBINEREJ	Rejected in combine B-spline
26	BADFLUXFACTOR	Low flux-calibration or flux-correction factor
27	BADSKYCHI	Relative χ^2 > 3 in sky residuals at this wavelength
28	REDMONSTER	Contiguous region of bad χ^2 in sky residuals (with threshhold of relative χ^2 > 3)

When low numbered bits (<16) are set, those will be set for half of the spectra: either the blue or red spectrograph. The higher-numbered bits (>=16) are set for individual pixels.

Which mask bits are important? The conditions that are considered very bad are already used to set the errors to infinity for the effected pixels (specifically, the inverse variance is set to zero). The most useful mask bit to look at is BRIGHTSKY, which indicates when the sky is so bright relative to the object that perhaps one shouldn't trust any of the object flux there. Our reported errors are meant to include sky-subtraction errors, but there are instances (particularly around 5577) where these errors may be untrustworthy.

Dispersion and sky: The dispersion per pixel and the sky flux are computed at each pixel by re-weighting the individual spectra at each pixel according to their formal errors. This re-weighting is only approximate.

Sky wavelengths: Note that the sky lines are slightly shifted in the reductions because we transform the velocities to the barycenter of the solar system. Each exposure that contributes to the co-added spectra will have slightly different barycenter correction, so the "average sky" contains a superposition of these slightly-offset sky lines. These shifts keep the object spectra as-measured at the barycenter, regardless of the time of year or the Earth's rotation relative to the spectroscopic targets.

Doodles

See sdR

Superscript^{superscript}

Subscript$_{subscript}$

Generate html with:

```
rst2html.py -gdts datamodel_test.rst datamodel_test.html
```

With docutils installed by MacPorts, I have to do:

```
rst2html-2.7.py -gdts datamodel_test.rst datamodel_test.html
```

badModel

Summary
This file is deliberately designed *not* to follow DESI data model standards for test purposes.

Naming Convention
This file has a bad naming convention. Note that even though there is a regular expression below, the line does not start with `regex:` so automation will not be able to identify it.

`badModel-[0-9]{8}\.fits`

Directory Tree

Please follow these rules when creating or updating directories within the data model.

1. All directories must have an index.rst file.
2. The title of every index.rst file contains *only* the name of the directory it is in.
3. Each index.rst contains the following items in its toctree:
   a. Links to index.rst files in any subdirectories.
   b. Links to files in that directory.
4. Every file must have a title. For example:

```
===================
fibermap-EXPID.fits
===================
```

Code setup

To build the data model locally, you first need to install the following:

```
pip install sphinx-toolbox sphinx-rtd-theme
```

Building the Documents

To build all the documents, in your git clone directory:

```
cd doc
make html
```

Once the build is complete, you can open the file `_build/html/index.html` in a browser, *e.g.*: `file:///home/user/desidatamodel/doc/_build/html/index.html`. If you have installed the sphinx-rtd-theme Python package, the docs will be formatted using the ReadTheDocs theme as they will appear at https://desidatamodel.readthedocs.io In macOS, there is a shortcut for this:

```
open _build/html/index.html
```

Sphinx will often print warnings and claim that the "build succeeded" when in fact there were syntax errors that break the output. You must pay attention to the warnings and fix them!

Also note that Sphinx builds documents incrementally. That is, if you run **make html**, change one file, and then run **make html** again, it will only rebuild the changed file. Normally this is fine, but if the change causes the directory tree to change, for example, adding a file to a table of contents, then the entire document tree should be rebuilt. This can be done by simply cleaning up first:

```
make clean
make html
```

Code Tests

desidatamodel also includes unit tests; you can run these locally before opening a PR using:

```
pytest py/desidatamodel/test
```

Units

We encourage the documentation of units as well as types. Although not *every* FITS file specifies units, we want units to be documented anyway. FITS images that have units should have a `BUNIT` header keyword. FITS table columns that have units should have a `TUNITxx` keyword. For the purposes of documentation though, we want the units to be specified, even if they don't actually appear in the file being documented.

Units should follow the FITS Standard, in particular following Section 4.3, and Tables 3, 4, and 5 in that document.

You can test units for validity by using Astropy Units. This package already supports the FITS Standard. The `desidatamodel` package itself already uses this internally. In fact, we have added some units that DESI considers acceptable, even if they do not strictly follow the FITS Standard.

Here are some examples of units that are used in this data model, as well as a few common gotchas.

Unit	FITS Standard?	Comment
`um`	Yes	Micrometers, μm.
`Angstrom`	Yes	Ångström.
`photon`	Yes	Number of photons.
`count`	Yes	Number of counts, usually electrons.
`adu`	Yes	Closely related to `counts`.
`deg`	Yes	Degrees.
`arcsec`	Yes	Seconds of arc. Not time!
`mag`	Yes	Standard astronomical magnitude. *Not* the same as a `maggie`.
`pc`	Yes	Parsec.
`Jy`	Yes	Jansky.
`10**-17 erg/(s cm2 Angstrom)`	Yes	Common unit of spectrophotometric flux.
`10**+34 (s2 cm4 Angstrom2) / erg2`	Yes	Inverse variance of flux.
`A`	Yes, but…	`A` is the unit for amperes not Ångström.
`maggie`	No, but OK	Standard prefix is also OK: `nanomaggie`. `nanomaggy` is also OK.
`mgy`	No, but OK	Abbreviation for `maggie`.
`electron/Angstrom`	No, but OK	Used in some calibration files.
`ergs`	**No**	`erg`, not `ergs`.
`sec`	**No**	`s` for seconds, not `sec`. Even though `arcsec` is OK.
`1/deg^2`	**No**	1 is not a unit. Use `deg^-2` instead. `deg**-2` is also OK.

Tips and Tests

You can browse some *examples*.

Cross-Referencing

To a file

Here is how you make a *direct link to a file*:

```
Here is how you make a :doc:`direct link to a file <examples/spPlate>`
```

Note that the link must take into account the directory structure. So for example, if you're in the directory `DESI_SPECTRO_SIM/PIXPROD/NIGHT` and want to refer to a file in `DESI_SPECTRO_DATA/NIGHT`, the link has to have the form:

```
:doc:`link to real data <../../../DESI_SPECTRO_DATA/NIGHT/real_data_file>`
```

or:

```
:doc:`link to real data </DESI_SPECTRO_DATA/NIGHT/real_data_file>`
```

That is, you can use a relative or absolute path.

Within a file

You can also cross-reference sections within files, however the notation is somewhat different. There are two methods. The first involves creating an explicit reference point in the target document. For example, in the spPlate file we referenced above, we can label HDU5:

```
.. _spplate-hdu5-plugmap:

HDU5
----

EXTNAME = PLUGMAP
```

Then we use `:ref:` to cross-reference that label. Here's a link to that *section of the spPlate file*:

```
:ref:`section of the spPlate file <spplate-hdu5-plugmap>`
```

Note however, that this label must be globally unique!

Alternatively, one can use "raw" ReStructuredText constructions. Here's a link to another section of the spPlate file we already linked to above:

```
link to another `section of the spPlate file`_

.. _`section of the spPlate file`: examples/spPlate.html#hdu6
```

Note this time that the section name may be upper case (`HDU6`), but the HTML anchor is lower case `#hdu6`.

To a HDU

The latter form can be used to create cross references to individual HDUs in other files. This would have the (strict!) form:

```
HDU5
----

See `HDU1 in some-other-file <../../some-other-file.html#hdu2`_.
```

In other words, with this notation, the data model for HDU2 in `some-other-file` will be used as the data model for HDU5 in the file with the cross-reference.

Environment variables

Here is how to highlight an `ENVIRONMENT_VARIABLE`:

```
Here is how to highlight an :envvar:`ENVIRONMENT_VARIABLE`
```

Optional Keywords and Columns

Sometimes HDU in a file might not have all of the header keywords or a table might not have all the columns described in the data model. Sometimes this is expected, and these items should be marked as optional, so we can focus on *required* items that might be missing. The optional notation leverages reStructuredText's footnote notation. Here is an example using table columns:

```
Required Data Table Columns
~~~~~~~~~~~~~~~~~~~~~~~~~~~

========= ======== ===== ===========
Name      Type     Units Description
========= ======== ===== ===========
target    char[20]
OPT1 [1]_ int16
V_mag     float32  mag
vdisp     float64  km/s
OPT2 [1]_ float32
========= ======== ===== ===========

.. [1] Optional
```

Note how `.. [1] Optional` is added to the bottom. This keeps Sphinx from complaining about undefined footnotes, but also makes it easy for humans to see what this notation means. `.. [1] Optional` only needs to be added once per file, not once per table.

Optional HDUs

This is a work in progress.

Strings

Depending on how data sets are collated, it sometimes happens that sets of strings may be written out to FITS files with different lengths.

For example, data files A and B are supposedly identical (same columns, same types, etc.). However data file A has a string-valued column `NAME` that has values from the set `{'one', 'two', 'three'}`, while in data file B the same column has values from the set `{'one', 'two', 'six'}`. When written out, file A has the `NAME` column represented as `char[5]` (`5A` in FITS notation), while file B has the same column represented as `char[3]` (`3A`).

To account for differences like this, one can use:

```
Required Data Table Columns
~~~~~~~~~~~~~~~~~~~~~~~~~~~

========= ======== ===== ===========
Name      Type     Units Description
========= ======== ===== ===========
...
NAME      char[*]
...
========= ======== ===== ===========
```

to represent the fact that the actual length of the string doesn't matter.

1.2.4 desidatamodel API

desidatamodel

This package provides support for the DESI Data Model.

exception `desidatamodel.`**`DataModelError`**

Errors related to missing or malformed data model files, etc.

exception `desidatamodel.`**`DataModelWarning`**

Warnings related to missing or malformed data model files, etc.

desidatamodel.check

Check actual files against the data model for validity.

class `desidatamodel.check.`**`DataModel`**(*filename*, *section*)

Simple object to store data model data and metadata.

Parameters

- **filename** (`str`) – The full path of the data model file.
- **section** (`str`) – The full path to the section of the data model containing the file.

`_cross_reference`(*line*)

Obtain the path to a file referred to in another file.

Parameters
line (`str`) – Line from original file that *is* the cross-reference.

Returns
The path to the referenced file.

Return type
`str`

`_extract_columns`(*row*, *columns*)

Given column sizes, extract the data in each column.

Assumes a reStructuredText-compatible table.

Parameters

- **row** (`str`) – A table row.
- **columns** (`list`) – The sizes of the columns.

Returns
A tuple containing the extracted data.

Return type
`tuple()`

_type_size(*line*)

Obtain file type and size from a matching *line*.

Parameters
`line` (str) – Line from file that contains the type and size.

Returns
A tuple containing the type and size.

Return type
tuple

extract_metadata(*error=False*)

Extract metadata from a data model file.

Parameters
`error` (bool, optional) – If `True`, failure to extract certain required metadata raises an exception.

Returns
Metadata in a form similar to *Stub* metadata. The keys are the `EXTNAME` header values.

Return type
dict

Raises
DataModelError – If *error* is set and the HDU has no `EXTNAME` keyword.

get_regexp(*root*, *error=False*)

Obtain the regular expression used to match files on disk.

Also internally updates the file type, if detected.

Parameters

- `root` (str) – Path to real files on disk.
- `error` (bool, optional) – If `True`, failure to find a regular expression raises an exception instead of just a warning.

Returns
The regular expression found, or `None` if not found. The regular expression is also stored internally.

Return type
regular expression

Raises
`DataModelError` – If *error* is set and problems with the data model file are detected.

validate_prototype(*error=False*, *skip_keywords=False*)

Compares a model's prototype data file to the data models.

Parameters

- `error` (bool, optional) – If `True`, failure to extract certain required metadata raises an exception.
- `skip_keywords` (bool, optional) – If `True`, don't check FITS header keywords

Notes

- Use set theory to compare the data headers to model headers. This should automatically find missing headers, extraneous headers, etc.

`desidatamodel.check._options()`

Parse command-line options.

Returns
The parsed options.

Return type
`Namespace`

`desidatamodel.check.collect_files(`*root*, *files*, *n_prototypes=5*`)`

Scan a directory tree for files that correspond to data model files.

Parameters

- **root** (`str`) – Path to real files on disk.
- **files** (`list`) – A list of data model files.
- **n_prototypes** (`int`, optional) – Save up to *n_prototypes* possible prototype files, in case the first one is bad. Defaults to 5.

Notes

Files are analyzed using this algorithm:

- The first *n_prototypes* files that matches a regexp become the 'prototype candidates' for that data model file. The first candidate that can be opened cleanly is the 'prototype'.
- If no files match a data model file, then files of that type are 'missing'.
- If a file does not match any regular expression, it is 'extraneous'.
- If a file matches a regular expression that already has a prototype, it is 'ignored'.

`desidatamodel.check.files_to_regexp(`*root*, *files*, *error=False*`)`

Convert a list of data model files into a list of regular expressions.

Parameters

- **root** (`str`) – Path to real files on disk.
- **files** (`list`) – List of files obtained from the data model.
- **error** (`bool`, optional) – If `True`, failure to find a regular expression raises an exception instead of just a warning.

Raises
`DataModelError` – If *error* is set and data model files with malformed regular expressions are detected.

`desidatamodel.check.main()`

Entry point for the check_model script.

Returns
An integer suitable for passing to `sys.exit()`.

Return type
`int`

`desidatamodel.check.scan_model(section)`

Find all data model files in a top-level directory.

Parameters
section (`str`) – Full path to a section of the data model.

Returns
The data model files found.

Return type
`list`

`desidatamodel.check.validate_prototypes(files, error=False, skip_keywords=False)`

Compares a set of prototype data files to their data models.

Parameters

- **files** (`list`) – A list of data model files.
- **error** (`bool`, optional) – If `True`, failure to extract certain required metadata raises an exception.
- **skip_keywords** (`bool`, optional) – If `True`, don't check FITS header keywords

Notes

- Use set theory to compare the data headers to model headers. This should automatically find missing headers, extraneous headers, etc.

desidatamodel.scan

Deep scan available files to obtain a comprehensive set of metadata.

`class desidatamodel.scan.UnionStub(model, count, error=False)`

Container for unified metadata for both existing models and data files.

Initialize the metadata with a *DataModel* object, then add additional *Stub* metadata.

Parameters

- **model** (*DataModel*) – A data model file object.
- **count** (`int`) – Number of files that will be examined. This is used to determine whether a keyword or column is mandatory, optional or unused.
- **error** (`bool`, optional) – If `True`, failure to extract certain required metadata raises an exception.

`mark_optional()`

Mark the keywords and columns that do not appear in every file as optional.

`update(hdu, data, columns=False)`

Search for missing keywords or columns in *hdu* and add them if necessary.

Parameters

- **hdu** (`int`) – The HDU number.

- **data** (list) – List of keywords or columns to compare to the internal set.
- **columns** (bool, optional) – If True, *data* represents BINTABLE columns, rather than keywords.

desidatamodel.scan.**_options**()

Parse command-line options.

Returns
The parsed options.

Return type
Namespace

desidatamodel.scan.**collect_files**(*root*, *model*)

Scan a directory tree for all files that correspond to a data model files.

Parameters

- **root** (str) – Path to real files on disk.
- **model** (*DataModel*) – A data model file object.

Returns
All files in *root* that match *model*.

Return type
list

desidatamodel.scan.**main**()

Entry point for the deep_scan_metadata script.

Returns
An integer suitable for passing to sys.exit().

Return type
int

desidatamodel.scan.**union_metadata**(*model*, *stubs*, *error=False*)

Combine all HDU metadata from *model* and *stubs*.

Parameters

- **model** (*DataModel*) – The initial data model.
- **stubs** (list) – A list of *Stub* objects.
- **error** (bool, optional) – If True, failure to extract certain required metadata raises an exception.

Returns
A new *Stub* object containing the unified metadata of all the inputs.

Return type
Stub

desidatamodel.stub

Generate data model files from FITS files.

class desidatamodel.stub.**Stub**(*filename*, *description_file=None*, *error=False*)

This object contains metadata about a file and methods to print that metadata.

Parameters

- **filename** (file path, file-like object or `HDUList`) – Data file to convert to a data model file.
- **error** (`bool`, optional) – If `True`, failure to extract certain required metadata raises an exception.

columns_header

The header of a table summarizing the columns of a BINTABLE HDU.

Type
`tuple()`

contents_header

The header of a table summarizing the HDUs.

Type
`tuple()`

filename

Name of the file.

Type
`str`

headers

The HDUs read from the file.

Type
`list`

keywords_header

The header of a table listing interesting FITS keywords.

Type
`tuple()`

nhdr

Number of HDUs.

Type
`int`

property basef

Base name of the file.

colformat(*sizes*)

Return a string ready to be formatted.

Parameters
sizes (`list`) – The width of each column.

Returns
A string with format characters.

Return type
`str`

`colsizes`(*table*)

Compute the size (number of characters) of each column in a table.

Parameters
table (`list`) – A list representing a table.

Returns
The size of each column in the table.

Return type
`list`

`columns`(*hdu*, *error=False*)

Describe the columns of a BINTABLE HDU.

Parameters

- **hdu** (`int`) – The HDU number (zero-indexed).
- **error** (`bool`, optional) – If `True`, failure to extract certain required metadata raises an exception.

Returns
The rows of the table.

Return type
`list`

Raises

- *DataModelError* – If the BINTABLE is actually a compressed image.
- `ValueError` – If *error* and a `TUNIT` value does not have FITS-standard units.

property contents

A table summarizing the HDUs.

property filesize

Size of the file in human-readable format.

property filetype

Type of file. Assumes FITS (for now) unless overridden in a subclass.

`format_table`(*table*, *indent=False*)

Convert tabular data into reStructuredText-compatible string.

This function assumes that *table* already has a header as the first row.

Parameters

- **table** (`list`) – A data table.
- **indent** (`bool`) – If `True`, indent the table for compatibility with collapsible tables.

Returns
A list of strings that can be joined.

Return type
`list`

property hdumeta

Metadata associated with each HDU.

property hduname

Format of HDU names.

highlight(*sizes*)

Return reStructuredText-compatible table highlights.

Parameters
sizes (list) – The width of each column.

Returns
A highlight string.

Return type
str

image_format(*hdr*)

Obtain format of an image HDU.

Parameters
hdr (Header) – The header to parse.

Returns
A string describing the image format.

Return type
str

Raises
DataModelError – If `self.error` is set a *BUNIT* header with units that do not follow the FITS standard is detected.

keywords(*hdu*)

A table summarizing the interesting keywords in a particular HDU.

Parameters
hdu (int) – The HDU number (zero-indexed).

Returns
The rows of the table.

Return type
list

property modelname

Name to use for the data model file.

section(*hdu*)

A string describing an HDU.

Parameters
hdu (int) – The HDU number (zero-indexed).

Returns
A list of strings that can be joined.

Return type
list

desidatamodel.stub.**extract_keywords**(*hdr*)

Extract interesting keywords from a FITS header.

Parameters
hdr (Header) – The header to parse.

Returns
A list of tuples containing the metadata of interesting keywords.

Return type
list

desidatamodel.stub.**extrakey**(*key*)

Return True if key is not a boring standard FITS keyword.

To make the data model more human readable, we don't overwhelm the output with required keywords which are required by the FITS standard anyway, or cases where the number of headers might change over time.

This list isn't exhaustive.

Parameters
key (str) – A FITS keyword.

Returns
True if the keyword is not boring.

Return type
bool

Examples

```
>>> extrakey('SIMPLE')
False
>>> extrakey('DEPNAM01')
False
>>> extrakey('BZERO')
True
```

desidatamodel.stub.**file_size**(*filename*)

Determine file size and return string with human readable size format.

Adapted from stackoverflow answers for human readable size formatting.

Parameters
filename (str) – A string containing a filename.

Returns
A human-readable file size.

Return type
str

Examples

```
>>> file_size('one-gb-file.dat')
'1 GB'
```

desidatamodel.stub.**fits_column_format**(*format*)

Convert a FITS column format to a human-readable form.

Parameters
format (str) – A FITS-style format string.

Returns
A human-readable version of the format string.

Return type
str

Examples

```
>>> fits_column_format('A')
'char[1]'
>>> fits_column_format('J')
'int32'
>>> fits_column_format('12E')
'float32[12]'
```

desidatamodel.stub.**main**()

Entry point for the generate_model script.

Returns
An integer suitable for passing to `sys.exit()`.

Return type
int

desidatamodel.stub.**read_column_descriptions**(*filename*)

Read column descriptions csv file and return dictionary

Parameters
filename (*str*) – csv filename with columns NAME,TYPE,UNITS,DESCRIPTION

Returns
coldesc_dict[NAME] = dict with keys TYPE, UNITS, DESCRIPTION

desidatamodel.unit

Shared code for dealing with units in files and data models.

class desidatamodel.unit.**DataModelUnit**

Allow unit-handling code to be shared with several classes.

check_unit(*unit*, *error=False*)

Check units for consistency with FITS standard, while allowing some special exceptions.

Parameters

- **unit** (str) – The unit to parse.

- **error** (bool, optional) – If True, failure to interpret the unit raises an exception.

Returns
If a special exception is detected, the name of the unit is returned. Otherwise, None.

Return type
str

Raises
ValueError – If *error* is set and the unit can't be parsed.

desidatamodel.update

Tools to update column units and descriptions in a pre-existing datamodel file.

desidatamodel.update.**format_rst_table**(*table*)

Format an astropy Table in left-aligned RST format

Parameters
table (*astropy.table.Table*) –

Returns
list of strings to print/write for the RST-format table

Note: this doesn't use astropy.io.ascii.rst because that generates right-aligned columns.

desidatamodel.update.**main**()

Updates a datamodel file with standard units and descriptions

Returns
An integer suitable for passing to sys.exit().

Return type
int

desidatamodel.update.**read_table_rows**(*lines*, *i*)

Read an RST-format table from a set of lines

Parameters

- **lines** (*list of str*) – lines from data model file
- **i** (*int*) – start at line number i

Return: None or list of dict(Name, Type, Units, Description)

Looks for data table description of the form:

```
==== ==== ===== ===========
Name Type Units Description
==== ==== ===== ===========
blat int  s     biz bat bar
foo  int        bing bang boom
==== ==== ===== ===========
```

while allowing the columns to have arbitrary widths or possibly be blank.

Returns None if table starting at line *i* doesn't match that form.

`desidatamodel.update.`**`update`**`(`*lines*, *force=False*`)`

Update units and descriptions for data tables in datamodel lines

Parameters
`lines` (*`list of str`*) – lines read from an input datamodel file

Options:
force (bool): if True, update non-blank input entries too

Returns: list of str lines with updates units and descriptions

This function is separated from *main* primarily to facilitate testing of updating input lines into output lines without having to actually read and write files every time.

1.2.5 desidatamodel Change Log

23.1 (2023-06-12)

- Warnings about `TARGET_RA`, etc. (PR #177).
- Automate generation of `bitmasks.rst` (PR #176).
- Reorganize front pages for DESI non-experts (PR #172).
- Clean up `DESI_SPECTRO_REDUX` and `DESI_TARGET` after verification of EDR (PR #171).
- Add Lyman-alpha VAC data model (PR #169).
- Final clean up for DESI EDR (PR #167).
- Add LSS catalog to data model (PR #166).
- Updates to redshift catalog files and other spectroscopic reduction files (PRs #164, #162, #161).
- Clarify definition of RA, Dec (PR #160).
- Add `$DESI_ROOT/vac` directory (PR #157).
- Updates to raw data files; validation now selects multiple candidate files for testing (PR #151).
- Update description of guide files in raw data (PR #154).
- Update description of sky files in raw data (PR #153).
- Update column descriptions for galaxy clustering files meeting EDR datamodel (PR #152).
- Update column descriptions for tile-based spectra/redshift/afterburner files (PR #145).
- Update column descriptions from a master list of columns (PR #144).
- Update spectra and coadd text with additional examples (PR #143).
- Rename `SURVEYOPS` (PR #142).
- Add links to maskbit definitions (PR #139).
- Update *the contributing page* (PR #138).
- Update documentation for QSO afterburner files (PR #134).
- Resolve maggy/maggies discrepancies in `DESI_TARGET` / `DESI_SURVEY` (PR #133).
- Update documentation of QA files (PR #132).
- Document top level exposure and tile summary files (PR #131).

- Populate the data model for the zmtl files (PR #130).
- Improve documenetation of `emline` files (PR #128).
- Add documentation of various calibration files (PR #127).
- Further cleanup of `fuji` and `guadalupe` header keywords and columns (PR #126).
- Update data model for target files to reflect ets/dr9 release (PR #105).
- Update data model for fiberassign files in the tiles product (PR #103).

22.2 (2022-05-31)

- **Updates for `fuji` and `guadalupe` reductions (PR #102). Includes support for:**
  - Variable-length string-valued columns.
  - Cross references to HDUs in other data models.
  - Notation for optional header keywords and columns.
  - Improved visual styling for header keyword and column description tables.
- Add data model for MTL ledgers (PR #101).
- Migrated to GitHub Actions for testing.
- Update *DESI_SPECTRO_DATA* model based on Main Survey data (PR #94).
- Update *DESI_SPECTRO_REDUX* model based on `everest` production (PRs #93, #90).
- **Update desitarget data model to reflect the ets release (PR #85):**
  - Alter filenames to add `PHASE/OBSCON/RESOLVE` and remove `DR`.
  - Add full directory structure for `DESI_TARGET/TARG_DIR`.
- **Use the DR8 data model for targets and deprecate DR7 (PR #84):**
  - Updates columns to match the DR8 target files.
  - Adds a targets-dr8.rst file to deprecate once DR9 is released.
  - Updates the header information to match the DR8 target files.
  - Adds units for some columns.
  - Directory structure now reflects the (HEALPix-split) target files.
  - Adds urls for the DR8 target files for upcoming research notes.
- Update Travis test configuration (PR #81).
- Update data model to reflect 19.9 software release (PR #78).

19.2 (2019-10-01)

This is primarily a reference tag to capture changes prior to the planned 19.9 release. The release date *does not* reflect the state of pipeline outputs as of October 2019.

- Update raw data model based on spectrograph tests (PR #73).
- Allow documentation of similar ranges of HDUs (PR #75).
- Update data model for desisurvey and surveysim (PR #70, #71).

18.11 (2018-12-11)

- Lots of format cleanup updates (PR #68).
- `MASK` HDUs will no longer be compressed (PR #60).
- Deprecate `DESI_TARGET` files (`sky`, `stdstar`) that aren't in use (PR #59).
- Describe apertures in the skies file as "radius" not "size" (PR #59).
- Add randoms/gfas/skies/pixweight files to the `DESI_TARGET` model (PR #57).
- Update the targets file in the `DESI_TARGET` model (PR #57).
- Ensure that `BUNIT` and `TUNIT*` values obey the FITS standard (PR #54).

18.6 (2018-07-20)

Tag for 18.6 software release (with a slight delay).

- Updates for quicklook pipeline (PR #48, #50).
- Raw data now stored in `NIGHT/EXPID` directories (PR #52)

18.3 (2018-05-09)

Tag for 18.3 software release (albeit 1.5 months later).

- Switching to YY.[M]M versioning to match software releases.
- Fill in missing file summaries and HDU descriptions (PR #47).
- Update data model to reflect reference run 18.3 (PR #46).
- Drop support for Python 2.

1.2.0 (2018-03-23)

- Vet data model against reference run 18.2a. Numerous changes to data model Python code to support, *e.g.* compressed HDUs (PR #42).
- Many accumulated changes since 2015.

1.1.1 (2015-11-06)

- Some fixes for Python 3 tests (PR #5).

1.1.0 (2015-11-06)

- Use `astropy.io.fits` consistently (PR #4).

1.0.0 (2015-10-29)

- Support for `desiInstall`, etc. (PR #1).

0.2.0 (2015-05-22)

- See git log files.

0.1.0 (2015-01-16)

- See git log files.

0.0.4 (2015-01-12)

- See git log files.

0.0.3 (2014-07-21)

- See git log files.

0.0.2 (2014-06-10)

- See git log files.

0.0.1 (2014-05-29)

- See git log files.

CHAPTER

TWO

REFERENCES

- Target Selection: Myers, A. D., et al. 2023, AJ 165, 50
- Spectroscopic Pipeline: Guy, J., et al. 2023, AJ 165, 4, 144
- Early Data Release: DESI Collaboration et al. 2023

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PYTHON MODULE INDEX

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