SOFIA Keywords Dictionary

[**Version:**REV L] [**Date**: 1-25-2023]

FITS Keywords Table

All FITS files submitted to the DCS for archiving must adhere to the FITS standard (v3.0, 2008 July 10)

WCS Keywords (see Array Detector Keywords section) should adhere to standard conventions (see http://fits.gsfc.nasa.gov/fits_wcs.html and http://tdc-www.harvard.edu/wcstools/wcstools.fits.html for discussion and references).

Parameter: Keyword parameter, may not be the same as the shorter FITS keyword name
Comment: Short description of keyword - suitable for FITS comment fields. Long descriptions can be found in the detailed descriptions. Comment text should include units as well.
HDU: header data unit - where the keyword can be used in the FITS file.
Representation: How the value of the keyword should be represented. In simple cases this may just be "string" or "float", but more complicated formats can be specified here (e.g. date and time)
Type: Specific FITS type - integer, float, string, or logical (boolean).
Units: Required units for keyword, if applicable.
Range: Possible keyword values, including enumerated types.
Example: Value example.
Is Required: Condition for which the keyword is required
-- If "Yes (Absolutely)", then the keywords are required for archive ingestion: If any of these is missing, the host file must be corrected and then re-ingested.
-- If it is "Yes", then the keywords are needed for data processing or archive search: If any of these is missing, the files can still be ingested into the archive, but it will impact pipeline and searching.
-- Conditionally required keywords are those that are only required if the stated condition applies, (e.g. DETCHAN is required if the instrument is FORCAST or FIFI-LS)
Source: Provider and location, if blank then data provided by SI. Known pre-defined aliases for some of the MCCS HK and TA HK data items are included. We recommend the SI developers assign custom aliases to the others as well for ease of reference.
-- MCCS HK source: SOF-DA-ICD-SE03-052M Interface Control Document MCCS to Science Instrument April 2019 Software Interface (Functional) MCCS_SI_04.
-- TA source: SOF-DF-ICD-SE03-047.11 Interface Control Document TA_MCCS_F 2017-04-12.
-- SI: Science Instrument
-- FITS: Other FITS
-- DCS: Observing Plan - approved proposals
-- DCS: AOR - AORs defined in Observing Plan
-- DCS: DCS assigend value
-- SSC: SOFIA science center assigned value
Missing Data Sources: If the HK datanode is not available, or returns NotFound (or any other error), then the following values should be used to populate the corresponding FITS keyword based on the FITS keyword datatype (float, int, str, bool): FLOAT = -9999.0; INT = -9999; STRING = UNKNOWN; BOOL = defined on keyword by keyword basis. For missing RA and Dec values, use the string representation with "UNKNOWN".

Observation Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source

Datasource	DATASRC	Data Source	primary	[string]	[str]		enum [ASTRO, CALIBRATION, LAB, TEST, OTHER, FIRSTPOINT]	['ASTRO']	**Yes (Absolutely)***	:
ObservationType	OBSTYPE	Observation type, added STANDARD_WAVECAL in revG for FIFI-LS	any	[string]	[str]		enum [OBJECT, STANDARD_FLUX, STANDARD_TELLURIC, LAMP, FLAT, DARK, BIAS, SKY, BB, GASCELL, LASER, FOCUS_LOOP, STANDARD_WAVECAL]	['OBJECT']	Yes	:
SourceType	SRCTYPE	Source type, added COMPACT_SOURCE in revG	any	[string]	[str]		enum [POINT_SOURCE, EXTENDED_SOURCE, COMPACT_SOURCE, OTHER, UNKNOWN]	['POINT_SOURCE']	Yes	:
ObservationStatus	OBSSTAT	Observation status	primary	[string]	[str]		enum [OK, ERROR]	['OK']	If entered by SI	:
KeywordDictionaryVersion	KWDICT	SOFIA Keyword dictionary version, DCS ICD rev.	primary	[string]	[str]		[]	['DCS_SI_01_A']	Yes	:
ObservationID	OBS_ID	SOFIA Observation Identification	any	[MMMMMM_[C]nnn]	[str]		[]	['2011-06-08_FO_F064B0187']	**Yes (Absolutely)***	:
ImageID	IMAGEID	Image identification index	extension	[integer]	[int]		[]	[1]	Multiple images in a single file for an observation, e.g. dithering, mapping, etc...	:
ObjectName	OBJECT	Object Name	any	[string]	[str]		[]	['Orion Nebula (M42)']	Yes	:
NAIF_ID	NAIF_ID	Object Name	any	[integer]	[int]		[]	[599]	Non-sidereal target	DCS : Observing Plan
AOTUniqueID	AOT_ID	Astronomical Observation Template Identifier, most SI already use the correct format, clarified in revF	any	[string]	[str]		[]	['FLITECAM_Imaging AOT SCI-US-ICD-SE03-2044, revB, AOT_FORCAST_GRISM SCI-US-ICD-SE03-2001 Rev. D']	If AOT in use.	:
AORUniqueID	AOR_ID	Astronomical Observation Request Identifier. Clarified format in revF to be [PLANID]_n, n is an integer from 1 to 9999	any	[PLANID_n]	[str]		[]	['02_0103_128']	If observation associated with DCS AOR	DCS : Observing Plan
FileGroupID	FILEGPID	File group identifier.	primary	[string]	[str]		[]	['ORIONMAP_20040101']	SI	SI :
FileGroupB	FILEGP_B	File group identifier for the BLUE/SW filter for FIFI-LS and FORCAST	primary	[string]	[str]		[]	['ORIONMAP_20040101']	SI	SI :

FileGroupR	FILEGP_R	File group identifier for the RED/LW filter for FIFI-LS and FORCAST.	primary	[string]	[str]		[]	['ORIONMAP_20040101']	SI	SI :

Data Processing Related Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
ASSC_MSN	ASSC_MSN	List of Mission IDs used in generating a combined output file, added in revG	any	[MID_n,MID_n]	[str]		[]	['2011-06-08_FO_F06, 2011-06-08_FO_F07']	LEVEL 2/3/4 data, if product is associated with multiple missions	FITS : FITS
ASSC_FRQ	ASSC_FRQ	List of all frequencies used in generating a combined output file, added in revG	any	[float]	[flt]	GHz	[]	['1900.54, 1496.92']	LEVEL 2/3/4 data, if product is associated with multiple frequencies	FITS : FITS
ProcessingStatus	PROCSTAT	Processing status, required for all SI starting revF	primary	[string]	[str]		enum [LEVEL_0, LEVEL_1, LEVEL_2, LEVEL_3, LEVEL_4]	['LEVEL_1']	Required for all SI, FLITECAM already has	SI | Pipeline :
HeaderStatus	HEADSTAT	Header status, added MODIFIED in revF	primary	[string]	[str]		enum [ORIGINAL, UNKNOWN, CORRECTED, ERROR, MODIFIED]	['ORIGINAL']	Yes	SI | DCS :
DataQuality	DATAQUAL	Result of data processing, replaced the old DataQualityAssessment	primary	[string]	[str]		enum [NOMINAL, USABLE, TEST, PROBLEM, FAIL]	['NOMINAL']	LEVEL 2/3/4 Product.	Pipeline :
NumberOfSpectral	N_SPEC	Number of spectra included in file. (GREAT only)	primary	[integer]	[int]		[]	[]	Yes	Pipeline :
AssociatedAORIDs	ASSC_AOR	List of Astronomical Observation Request Identifiers.	any	[PLANID_n,PLANID_n]	[str]		[]	['02_0103_1, 03_0098_127']	LEVEL 2/3/4 data, if product is associated with multiple DCS AORs	DCS : Observing Plan
PipelineName	PIPELINE	Pipeline/Processing Software	primary	[string]	[str]		[]	['FDRP v1.0.0']	LEVEL 2/3/4 Product.	Pipeline :
PipelineVersion	PIPEVERS	Pipeline Version, full tag.	primary	[string]	[str]		[]	['FDRP_1_0_0_UT2013_4_1']	LEVEL 2/3/4 Product.	Pipeline :
ProductType	PRODTYPE	Product type.	primary	[string]	[str]		[]	['DRIP-COADDED']	LEVEL 2/3/4 Product.	Pipeline :
DCSFileRevision	FILEREV	File revision identifier.	primary	[string]	[str]		[]	['r2']	If file changed in post-processing.	DCS only :

Mission Management Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
ObservingPlanUniqueID	PLANID	Observing plan identification	primary	[string]	[str]		[]	['81_0131']	If observation associated with an observing plan.	DCS : Observing Plan
AircraftDeployment	DEPLOY	Site deployment	primary	[string]	[str]		[]	['DAOF']	Yes	SSC : Mission Plan
MissionID	MISSN-ID	Mission ID	primary	[string]	[str]		[]	[2011-06-08_FO_F06]	**Yes (Absolutely)***	MCCS : session.user_environment.mission_id
FlightLeg	FLIGHTLG	Flight leg, updated to fltexes_data from leg_data	primary	[integer]	[int]		[]	[4]	Yes	MCCS : fltexec.fltexec_data.leg_seq

Origination Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
Origin	ORIGIN	Origin of FITS file.	primary	[string]	[str]		[]	['FORCAST -- Cornell Univ.']	Yes	:
Observers	OBSERVER	Observer(s)	primary	[string]	[str]		[]	['Jane Astro']	Yes	:
FileCreator	CREATOR	File creation task (with version info).	primary	[string]	[str]		[]	['Mauna Kea IR']	Yes	:
TelescopeOperator	OPERATOR	Telescope operator	primary	[string]	[str]		[]	['Joe Astro']	Yes	SSC : Mission Plan
Filename	FILENAME	Name of host file	primary	[string]	[str]		[]	['040101_077_05FL001.fits']	Yes	:

Date and Time Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
CreationDate	DATE	Date of file creation	any	[yyyy-mm-ddThh:mm:ss[.sss]]	[str]		[]	['2004-01-01T13:45:45.2']	Yes	:
ObservationDate	DATE-OBS	UTC Date of exposure start	any	[yyyy-mm-ddThh:mm:ss[.sss]]	[str]		[]	['2004-01-01T12:11:10.5']	**Yes (Absolutely)***	:
ObservationStartUTC	UTCSTART	UTC of exposure start	any	[hh:mm:ss.s]	[str]		[]	['09:30:01.00']	Yes	:
ObservationEndUTC	UTCEND	UTC of exposure end	any	[hh:mm:ss.s]	[str]		[]	['09:30:01.00']	Yes	:

Environmental Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
WaterVaporZenith_Start	WVZ_STA	Water vapor, integrated to zenith, observation start.	any	[general]	[flt]	microns	gt [0.0]	[1.503]	Yes	MCCS : wvm_if.wvmdata.water_vapor
WaterVaporZenith_End	WVZ_END	Water vapor, integrated to zenith, observation end.	any	[general]	[flt]	microns	gt [0.0]	[1.634]	Yes	MCCS : wvm_if.wvmdata.water_vapor

static_air_temp	TEMP_OUT	Static air temperature outside aircraft. (For Early Science: Value=NotSet)	any	[general]	[flt]	C	[]	[-10.5]	Yes	MCCS : das.ic1080_2hz.static_air_temp | $static_air_temp
PrimaryMirrorTemperature_1	TEMPPRI1	Temperature of primary mirror, source changed from MCCS to TA in revG.1	any	[general]	[flt]	C	gt [-273.0]	[-10.5]	Yes	TA : ta_mcp.mcp_hk_pms.pms_temp_1
PrimaryMirrorTemperature_2	TEMPPRI2	Temperature of primary mirror, source changed from MCCS to TA in revG.1	any	[general]	[flt]	C	gt [-273.0]	[-10.5]	Yes	TA : ta_mcp.mcp_hk_pms.pms_temp_2
PrimaryMirrorTemperature_3	TEMPPRI3	Temperature of primary mirror	any	[general]	[flt]	C	gt [-273.0]	[-10.5]	Yes	TA : ta_mcp.mcp_hk_pms.pms_temp_3
SecondaryMirrorTemperature_1	TEMPSEC1	Temperature of secondary, source changed from MCCS to TA in revG.1	any	[general]	[flt]	C	[]	[-15.2]	Yes	TA : ta_mcp.mcp_hk_pms.sma_temp_1

Aircraft Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
Altitude_Start	ALTI_STA	Aircraft pressure altitude, start of observation.	any	[general]	[flt]	Feet	[]	[35229]	Yes	MCCS : das.ic1080_15hz.press_alt
Altitude_End	ALTI_END	Aircraft pressure altitude, end of observation.	any	[general]	[flt]	Feet	[]	[35128]	Yes	MCCS : das.ic1080_15hz.press_alt
Airspeed	AIRSPEED	True aircraft airspeed.	any	[general]	[flt]	Knots	[]	[375.0]	Yes	MCCS : das.ic1080_10hz.true_airspeed | $true_airspeed
GroundSpeed	GRDSPEED	Aircraft ground speed.	any	[general]	[flt]	Knots	[]	[350.0]	Yes	MCCS : das.ic1080_2hz.ground_speed | $ground_speed
Latitude_Start	LAT_STA	Aircraft latitude, start of observation.	any	[general]	[flt]	Degrees	[]	[35.2567]	Yes	MCCS : das.ic1080_2hz.lat_fms_1 | $latitude
Longitude_Start	LON_STA	Aircraft longitude, start of observation.	any	[general]	[flt]	Degrees	[]	[35.2567]	Yes	MCCS : das.ic1080_2hz.lon_fms_1 | $longitude
Latitude_End	LAT_END	Aircraft latitude, end of observation.	any	[general]	[flt]	Degrees	[]	[35.2567]	Yes	MCCS : das.ic1080_2hz.lat_fms_1 | $latitude
Longitude_End	LON_END	Aircraft longitude, end of observation.	any	[general]	[flt]	Degrees	[]	[35.2567]	Yes	MCCS : das.ic1080_2hz.lon_fms_1 | $longitude
Heading	HEADING	Aircraft true heading.	any	[general]	[flt]	Degrees	[]	[10.7892]	Yes	MCCS : das.ic1080_2hz.true_heading | $heading
TrackAngle	TRACKANG	Aircraft track angle.	any	[general]	[flt]	Degrees	[]	[10.7892]	Yes	MCCS : das.ic1080_2hz.true_track_angle | $track_angle

Telescope Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
Telescope	TELESCOP	Telescope name	primary	[string]	[str]		[]	['SOFIA 2.5m']	Yes	:
TelescopeConfig	TELCONF	Telescope configuration	primary	[string]	[str]		[]	[]	Yes	SSC : Mission Plan
TelescopeRA	TELRA	Updated in revH:SI Boresight astrometric RA (not including aberration or refraction effects, but including parallax, proper	any	[general] [hh:mm:ss.s]	[flt]	Hours	interval [0,24]	[9.023456] [5:35:17.3]	Yes	MCCS : coord.pos.sibs.ra

		motion, and precession to J2000) – as returned by MCCS in the coord.pos.sibs.ra HK; see 'Observing Effects' in MCCS_SI_04"								
TelescopeDec	TELDEC	Updated in revH:SI Boresight astrometric RA (not including aberration or refraction effects, but including parallax, proper motion, and precession to J2000) – as returned by MCCS in the coord.pos.sibs.ra HK; see 'Observing Effects' in MCCS_SI_04"	any	[general] [dd:mm:ss]	[flt]	decimal degrees	interval [-90,90]	[47.345789] [-5:23:28]	Yes	MCCS : coord.pos.sibs.dec
TelescopeVPA	TELVPA	SI Boresight VPA (ICRS J2000) - as returned by MCCS, Clarified in revG: ROF (given in the flight plans) is the Zenith PA (from North through East). For EXES it means that slit PA=ROF+270.	any	[general]	[flt]	decimal degrees	interval [0,360]	[255.05]	Yes	MCCS : coord.pos.sibs.vpa
TelescopeEquinox	TELEQUI	Equinox of ERF coords (RA/Dec/VPA).	any	[general]	[str]		[]	[J2000]	Yes	MCCS : coord.pos.sibs.equinox
LastRewindUTC	LASTREW	Time of last rewind (UTC).	any	[yyyy-mm-ddThh:mm:ss.sssZ]	[str]		[]	['2012-09-13T21:30:28.317Z']	Yes	MCCS : ta_pos.time_of_last_rewind
TelescopeFocus_Start	FOCUS_ST	Telescope focus - SMA FCM t position (microns), observation start. Source changed from MCCS to TA in revG.1	any	[general]	[flt]	microns	interval [-5000,5000]	[1245]	Yes	TA : ta_scs.fcm_status.fcm_act_t
TelescopeFocus_End	FOCUS_EN	Telescope focus - SMA FCM t position (microns), observation end. Source changed from MCCS to TA in revG.1	any	[general]	[flt]	microns	interval [-5000,5000]	[1322]	Yes	TA : ta_scs.fcm_status.fcm_act_t
TelescopeElevation	TELEL	Telescope elevation above the horizon at observation start - as returned by MCCS. Changed source from coord.pos.sibs.el to coord.pos.sibs.alt in revF.	any	[general]	[flt]	decimal degrees	interval [0,90]	[47.345789]	Yes	MCCS : coord.pos.sibs.alt
TelescopeCrossElevation	TELXEL	Telescope cross elevation at observation start - as returned by MCCS	any	[general]	[flt]	decimal degrees	interval [-90,90]	[0.543]	Yes	MCCS : coord.pos.sibs.xel
TelescopeLineOfSight	TELLOS	Telescope LOS at observation start - as returned by MCCS	any	[general]	[flt]	decimal degrees	interval [-180,180]	[0.543]	Yes	MCCS : coord.pos.sibs.los
TascuStatus	TSC-STAT	TASCU Status at observation end.	any	[string (TBC)]	[str]		[]	[STAB_INERTIAL_ONGOING]	Yes	MCCS : ta_state.tsc_status

TascuFBCStatus	FBC-STAT	FBC Status at observation end, source changed from MCCS to TA in revG.1	any	[string]	[str]		enum [FBC_OFF (1), FBC_QS (2), FBC_DY (3), FBC_ON (4)]	[FBC_ON]	Yes	TA : ta_tsc.tsc_mcs_hk.fbc_status
ObservationRequestRA	OBSRA	RA - requested	any	[general] [hh:mm:ss.s]	[flt] [str]	Hours	interval [0,24]	[9.0230] [5:35:17.3]	Yes	DCS : AOR
ObservationRequestDec	OBSDEC	Dec - requested	any	[general] [dd:mm:ss]	[flt] [str]	Degrees	interval [-90,90]	[47.3465] [-5:23:28]	Yes	DCS : AOR
ObservationRequestEquinox	EQUINOX	Coordinate equinox for OBSRA and OBSDEC	any	[general]	[flt]	yr	[]	[2000.0]	Yes	DCS : AOR
ZenithAngle_Start	ZA_START	Telescope zenith angle, start of observation.	any	[general]	[flt]	decimal degrees	interval [0,90]	[42.359]	Yes	MCCS : (90 - coord.pos.sibs.alt)
ZenithAngle_End	ZA_END	Telescope zenith angle, end of observation.	any	[general]	[flt]	decimal degrees	interval [0,90]	[39.285]	Yes	MCCS : (90 - coord.pos.sibs.alt)
TrackingMode	TRACMODE	SOFIA tracking mode, reduced from 9 to 5 modes based on MCCS-SI_04 revL	any	[string]	[str]		enum [OFF, ROF, LIMB, OFFSET, ROF+OFFSET]	['OFFSET']	Tracking	MCCS : ta_pos.track.state
TrackingError	TRACERR	Tracking error flag.	any	[boolean]	[log]		[]	[F]	Tracking	MCCS : ta_trc.trc_status_table.main_op_mode_id

Data Collection Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
isChopping	CHOPPING	Chopping flag	primary	[boolean]	[log]		[]	[T]	If mode in use.	:
isNodding	NODDING	Nodding flag	primary	[boolean]	[log]		[]	[T]	If mode in use.	:
isDithering	DITHER	Dithering flag	primary	[boolean]	[log]		[]	[T]	If mode in use.	:
isMapping	MAPPING	Mapping flag.	primary	[boolean]	[log]		[]	[T]	If mode in use.	:
isScanning	SCANNING	Scanning flag.	primary	[boolean]	[log]		[]	[T]	If mode in use.	:

Annotation Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
Comment	COMMENT	Comments may be placed anywhere throughout the header.	any	[string]	[str]		[]	['These data on ORION are GRRRRREAAAT!']	If entered by SI or pipeline	:
History	HISTORY	Processing history information.	any	[string]	[str]		[]	['FDRP - Redux0 (2004-01-01, 00:00:00) OUTPUT = FILENAME']	If entered by SI or pipeline	:

Error	ERROR	Error information. FITS: Suffix index can be used to order entries (1-999).	primary	[string]	[str]		[]	['Guide star lost - reacquired']	If entered by SI	:

Instrument Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
Instrument	INSTRUME	Instrument	primary	[string]	[str]		[]	['FLITECAM']	**Yes (Absolutely)***	:
Datatype	DATATYPE	Data type	primary	[string]	[str]		enum [IMAGE, SPECTRAL, OTHER]	['IMAGE']	Yes	:
InstrumentConfiguration	INSTCFG	Instrument configuration	primary	[string]	[str]		[]	['IMAGING']	Yes	:
InstrumentMode	INSTMODE	Instrument observing mode, added allow TOTAL_POWER in revG, requested by pipeline	primary	[string]	[str]		[]	['C2N','MAPPING','TOTAL_POWER']	Yes	:
MCCSMode	MCCSMODE	MCCS SI Mode (MCCS_SI_04).	primary	[string]	[str]		[]	['flitecam_imaging']	Yes	MCCS : (instrument).si_config.current_mode
ExposureTime	EXPTIME	On-source exposure time	any	[general]	[flt]	s	[]	[600]	Yes	:
SpectralElement1	SPECTEL1	First spectral element in use -- Clarified in revF, set to "NONE" If not in use.	any	[string]	[str]		[]	['FLT_J']	**Yes (Absolutely)***	:
SpectralElement2	SPECTEL2	Second spectral element in use -- Set to "NONE" if not in use.	any	[string]	[str]		[]	['FOR_XG063']	**Yes (Absolutely)***	:
InstrumentSlit	SLIT	Instrument slit in use.	any	[string]	[str]		[]	['FOR_SS24']	Spectroscopy configs: if slit in use.	:
WavelengthCentral	WAVECENT	Central wavelength of observation.	primary	[general]	[flt]	Microns	[]	[2.2]	Imaging modes only.	:
Resolution	RESOLUN	Spectral resolution of observation.	primary	[general]	[flt]		[]	[2500]	Spectroscopy modes only.	:
DetectorChannel	DETCHAN	The values are FORCAST: SW | LW , FIFI-LS: BLUE | RED	primary	[string]	[str]		enum [SW, LW, BLUE, RED]	[LW]	FORCAST and FIFI-LS should populate these.	:
TotalIntegrationTime	TOTINT	Total integration time (s), for FORCAST, If SKYMODE is C2NC2 or NXCAC, then TOTINT =	any	[float]	[flt]	s	[]	[600]	FORCAST	:

		DETITIME * 0.5, otherwise TOTINT = DETITIME*2.0								

Array Detector Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
Detector	DETECTOR	Detector name	primary	[string]	[str]		[]	['SBRC InSb']	Array instruments only.	:
DetectorSize	DETSIZE	Detector size	primary	[vector]	[str]		[]	['(1024,1024)']	Array instruments only.	:
PixelScale	PIXSCAL	Pixel scale	primary	[general]	[flt]	arcsec	[]	[0.32]	Array instruments only.	:
Subarrays	SUBARRNO	Number of subarrays used	primary	[integer]	[int]		[]	[2]	If subarrays in use.	:
SubarraySize	SUBARR%2d	Sub array size	primary	[section]	[str]		[]	['[0:255,0:255]']	If subarrays in use.	:
ScienceInstrumentBoresightX	SIBS_X	SI Boresight (x) - as returned by MCCS, typo in name fixed	any	[float]	[flt]		[]	[255]	Array instruments only.	MCCS : coord.pos.sibs.xsi
ScienceInstrumentBoresightY	SIBS_Y	SI Boresight (y) - as returned by MCCS, typo in name fixed	any	[float]	[flt]		[]	[255]	Array instruments only.	MCCS : coord.pos.sibs.ysi
WCS_CTYPE	CTYPEn	Axis type (8 characters)	any	[string]	[str]		[]	['RA--TAN']	Imaging only.	:
WCS_CRPIX	CRPIXn	Array location of the reference point in pixels for the n-th axis. Changed from int to float in revF	any	[float]	[flt]		[]	[511]	Array instruments only.	:
WCS_CRVAL	CRVALn	Coordinate value at reference point for the n-th axis.	any	[flt]	[flt]		[]	[82.345690]	Imaging only.	:
WCS_CDELT	CDELTn	Plate scale for the n-th axis at reference point (deg/pixel).	any	[flt]	[flt]		[]	[1.3852E-4]	Imaging only.	:
WCS_CROTA2	CROTA2	Rotation of axes in degrees.	any	[flt]	[flt]		[]	[113.45]	Imaging only.	:
WCS_RotMatrix	CDi_j	WCS Rotation Matrix elements.	any	[flt]	[flt]		[]	[1.3852E-4]	Imaging only.	:

Heterodyne Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
FrontendDevice	FRONTEND	Name of frontend device.	primary	[string]	[str]		[]	['GREAT LOW 1']	Heterodyne instruments only.	:
BackendDevice	BACKEND	Name of backend device.	primary	[string]	[str]		[]	['AOS']	Heterodyne instruments only.	:
BackendBandwidth	BANDWID	Total bandwidth of heterodyne backend	primary	[general]	[flt]	MHz	[]	[300.547]	Heterodyne instruments only.	:
SystemTemperature	TSYS	System temperature.	primary	[general]	[flt]	K	[]	[10.5]	Heterodyne instruments only.	:
FrequencyResolution	FREQRES	Nominal frequency resolution -- may differ from channel spacing.	primary	[general]	[flt]	MHz	[]	[100.0]	Heterodyne instruments only.	:
ReferenceFrequency	OBSFREQ	Reference frequency.	primary	[general]	[flt]	MHz	[]	[]	Heterodyne instruments only.	:

SidebandFrequency	IMAGFREQ	Image sideband frequency.	primary	[general]	[flt]	MHz	[]	[]	Heterodyne instruments only.	:
RestFrequency	RESTFREQ	Rest frequency.	primary	[general]	[flt]	MHz	[]	[]	Heterodyne instruments only.	:
VelocityDefinition	VELDEF	Velocity Definition	primary	[string]	[str]		[]	['RADI-LSR']	Heterodyne instruments only.	:
VelocityFrame	VFRAME	Radial velocity of reference frame.	primary	[general]	[flt]	km/s	[]	[250.3]	Heterodyne instruments only.	:
RadialVelocity	RVSYS	Radial velocity.	primary	[general]	[flt]	km/s	[]	[22.3]	Heterodyne instruments only.	:

Data Structure Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source

Chopping Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
ChopFrequency	CHPFREQ	Chop frequency	any	[general]	[flt]	MHz	interval [0.0, 20.0]	[15.0]	Chopping	MCCS : sma.chop.frequency
ChopProfile	CHPPROF	Chopping profile: 2 or 3 point	any	[string]	[str]		enum [2-POINT, 3-POINT]	['2-POINT']	Chopping	MCCS : sma.chop.profile
ChopSymmetry	CHPSYM	Chopping symmetry: symmetric or asymmetric. MCCS revL: An indicator of chopper symmetry [ENUM: (0: no_chop) (2: asymmetric) (4: non_zero_tilt) (5: 2_point_symmetric) (9: 3_point_symmetric) (6: asymmetric_plus) (10: asymmetric_minus) (7: extreme_asymmetric_plus) (11: extreme_asymmetric_minus) (15: contrived)]	any	[string]	[str]		[]	['on-axis']	Chopping	MCCS : sma.chop_symmetry
ChopAmplitude_1	CHPAMP1	Chop amplitude 1	any	[general]	[flt]	arcsec	interval [-1125.0, 1125.0]	[300.0]	Chopping	MCCS : sma.sky_amplitude
ChopAmplitude_2	CHPAMP2	Chop amplitude 2	any	[general]	[flt]	arcsec	interval [-1125.0, 1125.0]	[300.0]	Chopping	MCCS : sma.sky_amp2
ChopCoordSys	CHPCRSYS	MCCS Coordinate system for sky tip, tilt, and angle. Added SIRF in revF	any	[string]	[str]		enum [TARF, ERF, SIRF]	[ERF]	Chopping	MCCS : sma.sky_coord_sys
ChopAngle	CHPANGLE	Calculated angle in the sky_coord_sys reference frame. Range increased in revF from -/+180 to -/+360	any	[general]	[flt]	decimal degrees	interval [-360,360]	[45.0]	Chopping	MCCS : sma.sky_angle
ChopTip	CHPTIP	Calculated tip in the sky_coord_sys reference frame.	any	[general]	[flt]	arcsec	interval [-1125,1125]	[15]	Chopping	MCCS : sma.sky_tip
ChopTilt	CHPTILT	Calculated tilt in the sky_coord_sys reference frame.	any	[general]	[flt]	arcsec	interval [-1125,1125]	[10]	Chopping	MCCS : sma.sky_tilt
ChopPhase	CHPPHASE	Chop phase, changed to float from int in revG	any	[float]	[flt]	millisec	interval [0,1000]	[200]	Chopping	MCCS : sma.chop.phase

Nodding Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
NodDwellTime	NODTIME	Nod time	any	[general]	[flt]	s	[]	[300.0]	Nodding	:
NodCycles	NODN	Nod cycles.	any	[integer]	[int]		[]	[30]	Nodding	:
NodSettleTime	NODSETL	Nod settle time	any	[general]	[flt]	s	[]	[0.0556]	Nodding	:
NodAmplitude	NODAMP	Nod amplitude on sky.	any	[general]	[flt]	arcsec	[]	[30.0]	Nodding	MCCS : nod.amplitude
NodBeam	NODBEAM	Current nod beam position	any	[string]	[str]		[]	['A']	Nodding	MCCS : nod.current
NodPattern	NODPATT	Nodding pattern, one cycle. Added BA in revF, changed to allowing any String in revG requested by pipeline	any	[string]	[str]		[]	['ABBA','AB','BA','CUSTOM']	Nodding	:
NodStyle	NODSTYLE	Chop/nod Style.	any	[string]	[str]		enum [NMC, NPC, C2NC2, CUSTOM]	['NPC']	Nodding/Chopping	:
NodCoordSys	NODCRSYS	Coordinate system for Nod angle	any	[string]	[str]		enum [ERF, ECRF, GALRF, TARF, FPIRF, FFIRF, WFIRF, SIRF, USER]	['ERF']	Nodding	MCCS : nod.coord_sys
NodAngle	NODANGLE	Nod angle, range increased in revF from -/+180 to -/+360	any	[general]	[flt]	decimal degrees	interval [-360,360]	[45.0]	Nodding	MCCS : nod.pos_angle

Dithering Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
DitherCoordiante	DTHCRSYS	Dither coordinate, needed by DPS for FORCAST, FLITECAM	any	[str]	[str]		enum [SIRF,TARF,ERF]	['SIRF']	Dithering	SI | DCS, not from MCCS :
DitherXOffset	DTHXOFF	Dither offset in X axis (arcseconds).	any	[float]	[flt]	arcsec	[]	[2.5]	Dithering	:
DitherYOffset	DTHYOFF	Dither offset in Y axis (arcseconds).	any	[float]	[flt]	arcsec	[]	[2.5]	Dithering	:
DitherPattern	DTHPATT	Dither pattern, added NONE in revF	any	[string]	[str]		enum [NONE, 3-POINT, 5-POINT, 9-POINT, CUSTOM]	['9-POINT']	Dithering	:
DitherPositions	DTHNPOS	Number of dither positions.	any	[integer]	[int]		[]	[9]	Dithering	:
DitherPositionIndex	DTHINDEX	Dither position index.	any	[integer]	[int]		[]	[5]	Dithering	:

Mapping Keywords

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
MapCoordSys	MAPCRSYS	Coordinate system for mapping/scanning.	any	[string]	[str]		enum [EQUATORIAL, GALACTIC, ECLIPTIC, USER]	['GALACTIC']	Mapping	:
MapPositionsX	MAPNXPOS	Number of map positions in X	any	[integer]	[int]		[]	[4]	Mapping	:
MapPositionsY	MAPNYPOS	Number of map positions in Y	any	[integer]	[int]		[]	[4]	Mapping	:
MapIntervalX	MAPINTX	Mapping step interval in X	primary	[general]	[flt]	arcmin	[]	[8.5]	Mapping	:
MapIntervalY	MAPINTY	Mapping step interval in Y	any	[general]	[flt]	arcmin	[]	[8.5]	Mapping	:

Scanning Keywords (Constant Velocity)

Parameter	FITS Keyword	Comment	HDU	Representation	Type	Units	Range	Example	Is Required	Source
ScanRate	SCNRATE	Scan rate	any	[general]	[flt]	arcsec/s	[]	[10.0]	Scanning	:
ScanType	SCANTYPE	Scan type, added SWEEP, HONEYCOMB in revGH, requested by pipeine	any	[string]	[str]		enum ['BOX','LISSAJOUS', 'SWEEP', 'HONEYCOMB']	['BOX']	Scanning	:

Keyword Descriptions revL Jan 2023

Observation Keywords

Datasource
FITS Name:DATASRC
FITS Type:str
Description: Overall source/type of data: ASTRO = Astronomical observation; CALIBRATION = calibration data; LAB = Laboratory data; TEST = Test data; FIRSTPOINT = SOFIA first pointing observation; OTHER = Any other source not listed here. If datasource is set to "CALIBRATION", the host file will be made public immediately upon ingestion.
Requirement:Absolutely Required for Archive Ingestion*

ObservationType
FITS Name:OBSTYPE
FITS Type:str
Description: The type of observation such as an astronomical exposure or a particular type of calibration exposure: OBJECT = astronomical object; STANDARD = Astronomical flux standard for calibration; LAMP = Calibration lamp; FLAT = Flat-field exposure for calibration; DARK = Dark current exposure for calibration, STANDARD_WAVECAL for FIFI-LS
Requirement: Required

SourceType
FITS Name:SRCTYPE
FITS Type:str
Description: Source type. Maps to AOR SourceType. Needed for reduction of slit spectra, but useful for other data types as well.
Requirement: Required

ObservationStatus
FITS Name:OBSSTAT
FITS Type:str
Description: Status of the observation: OK = observation performed successfully; ERROR = Observation completed but with an error.
Requirement: If entered by SI

KeywordDictionaryVersion
FITS Name:KWDICT
FITS Type:str
Description: SOFIA keyword dictionary version. Since the keywrod dictionary is now a part of the DCS ICD (DCS_SI_01, this keyword should reference which version of the ICD is being used. The document rev (A, B, C, etc...) should be appended to the string 'DCS_SI_01' with an underscore (see example).
Requirement: Required

ObservationID
FITS Name:OBS_ID
FITS Type:str
Description: The unique identifier for any given data file, meant to provide ready timing and sequencing information at a glance to the user. It is created at the same time that the data file is first written, in a format common to all instruments (and thus mandated by the observatory). The OBS_ID is assigned to saved datasets only. Some test data may be taken during a flight for immediate diagnostic purposes, but not saved (e.g., a snapshot to verify pointing), in which case there would be no point in assigning an OBS_ID, but we note that the default should almost always be to save the data and thus assign this keyword. The OBS_ID number is distinct from the AOR_ID. The AOR_ID is the unique identifier for an AOR which can, in principle, generate multiple files to be saved. Each of these files would have a unique OBS_ID. The mapping from AOR_ID to OBS_ID is one-to-many, i.e., one AOR can produce multiple data files. Note that the converse is not true -- one data file cannot be the product of multiple AORs. We suggest the following as a format for the OBS_ID keyword: MMMMMM_[C]nnn. Where: MMM = Mission ID (see MissionID) -- Data not taken as part of a SOFIA mission should set MMM to current date or some other suitable value; C = Channel identifier (optional) -- preferably a letter (B for Blue, S for short, etc...); nnn = Observation sequence number -- The sequence should be reset at mission start and advanced all the way through mission close-out (as defined my the MCCS), which should allow for capture of pre- and post-flight data -- This field will have a minimum of three digits (typical expected length), but more digits will be allowed as necessary.

Requirement:Absolutely Required for Archive Ingestion*

ImageID
FITS Name:IMAGEID
FITS Type:int
Description: The image identification when there are multiple images for an observation within the SAME file (e.g. images stored as FITS extensions).
Requirement: Multiple images in a single file for an observation, e.g. dithering, mapping, etc...

ObjectName
FITS Name:OBJECT
FITS Type:str
Description: The object name as given by the observer, or as specified by the flight plan.
Requirement: Required

NAIF_ID
FITS Name:NAIF_ID
FITS Type:int
Description: NAIF ID of a non sidereal object.
Requirement: Non-sidereal target

AOTUniqueID
FITS Name:AOT_ID
FITS Type:str
Description: Unique Astronomical Observation Template (AOT) identifier as defined in SI-DCS ICD. AORs generated from SOFIA USpot are based on the [SI]-DCS ICD which defines AOTs, the combination of the AOT name, ICD document number, and the ICD version number can uniquely identify an AOT version. Note that the ICD version number is important, AOTs in different versions of ICD can sometimes have conflicting values.
Requirement: If AOT in use.

AORUniqueID
FITS Name:AOR_ID
FITS Type:str
Description: Unique Astronomical Observation Request (AOR) identifier. The AOR_ID is assigned during the creation of the final version of an AOR to be used in flight planning. The value of this keyword should be equivalent to the AOR/ID tag in the AOR document. During Early Science, the AOR ID will be equivalent to the proposed observation ID and will be documented in the observing plan. The AOR_ID should not be reused once data is taken for this AOR to define a different observation. For example, if 90_0004_1 has been observed for SA 114-656, it should not be reused to observe SA 114-670 even if all other parameters are exactly the same.
Requirement: If observation associated with DCS AOR

FileGroupID
FITS Name:FILEGPID
FITS Type:str
Description: Identifier for a group of images stored as separate data files. This is the mechanism for associating multiple data files that should be considered together. Can be defined by the user -- not necessarily unique in the SOFIA mission. For example, suppose a map of Orion is made such that each individual map point is stored in a separate file. The user could then set this keyword to something like "OrionMap_20040101" for each of the files so that they can be associated later.
Requirement:SI

FileGroupB
FITS Name:FILEGP_B
FITS Type:str
Description: Identifier for a group of images stored as separate data files. This is the mechanism for associating multiple data files that should be considered together. Can be defined by the user -- not necessarily unique in the SOFIA mission. For example, suppose a map of Orion is made such that each individual map point is stored in a separate file. The user could then set this keyword to something like "OrionMap_20040101" for each of the files so that they can be associated later.
Requirement:SI

FileGroupR
FITS Name:FILEGP_R
FITS Type:str
Description: Identifier for a group of images stored as separate data files. This is the mechanism for associating multiple data files that should be considered together. Can be defined by the user -- not necessarily unique in the SOFIA mission. For example, suppose a map of Orion is made such that each individual map point is stored in a separate file. The user could then set this keyword to something like "OrionMap_20040101" for each of the files so that they can be associated later.
Requirement:SI

Data Processing Related Keywords

ASSC_MSN
FITS Name:ASSC_MSN
FITS Type:str
Description: List of all mission IDs used in generating a combined output file.
Requirement:LEVEL 2/3/4 data, if product is associated with multiple missions

ASSC_FRQ
FITS Name:ASSC_FRQ
FITS Type:flt
Description: List of all frequencies used in generating a combined output file.
Requirement:LEVEL 2/3/4 data, if product is associated with multiple frequencies

ProcessingStatus
FITS Name:PROCSTAT
FITS Type:str
Description: Status of any processing applied to the data, as defined in the SOFIA Project Data Management Plan SOF-AR-PLA-PM03-2059: LEVEL_0 = Raw engineering data for diagnostic purposes, generally not intended for archiving; LEVEL_1 = Raw, uncalibrated science data in FITS or SDFITS format with complete header adhering to the SOFIA Keyword Dictionary; LEVEL_2 = Processed science data corrected for instrument artifacts; LEVEL_3 = Flux-calibrated science data (e.g. BUNIT keyword takes image to MJy/sr); LEVEL_4 = Higher order products.
Requirement: Required for all SI, FLITECAM already has

HeaderStatus
FITS Name:HEADSTAT
FITS Type:str
Description: Status of FITS header data (updated during post-processing). ORIGINAL: Header values are from original raw data file and have not been modified. UNKNOWN: header values have not been reviewed/verified. CORRECTED: header values have been corrected as part of post-processing, see HISTORY records for details. ERROR: There is a problem with the header values that has not been fixed, see COMMENT records for details. SI would set HEADSTAT = 'ORIGINAL' for raw data acquired on the aircraft. MODIFIED: Headers have been changed but are not yet fully CORRECTED.
Requirement: Required

DataQuality
FITS Name:DATAQUAL
FITS Type:str
Description: Indicates overall data quality; indicator of scientific reliability for the dataset. Values are: NOMINAL: no outstanding issues with processing/calibration/observing conditions. USABLE: minor issue(s) with processing/calibration/conditions but should still be scientifically valid (perhaps with larger than usual uncertainties); see HISTORY records for details. PROBLEM: significant issue(s) encountered with processing, calibration, or observing conditions; may not be scientifically useful (depending on application); see HISTORY records for details. In general, these cases are addressed through manual re-processing before archiving and distribution. FAIL: data could not be processed successfully for some reason. These cases are rare and generally not archived or distributed to the GI.
Requirement:LEVEL 2/3/4 Product.

NumberOfSpectral
FITS Name:N_SPEC

FITS Type:int
Description: Number of spectral, optional for spectroscopic modes.
Requirement: Required

AssociatedAORIDs
FITS Name:ASSC_AOR
FITS Type:str
Description: List of all unique input AOR_IDs used in generating a combined output file.
Requirement:LEVEL 2/3/4 data, if product is associated with multiple DCS AORs

PipelineName
FITS Name:PIPELINE
FITS Type:str
Description: Name of pipeline/processing software used to generate file (e.g. “FDRP v1.0.0”). LEVEL 2/3/4 data only.
Requirement:LEVEL 2/3/4 Product.

PipelineVersion
FITS Name:PIPEVERS
FITS Type:str
Description: Full release tag for pipeline that produced the file (e.g. “FDRP_1_0_0_UT2013_4_1”). LEVEL 2/3/4 data only.
Requirement:LEVEL 2/3/4 Product.

ProductType
FITS Name:PRODTYPE
FITS Type:str
Description: Type of product produced by the processing software or pipeline, as defined in SI-DCS ICD. Should be simple identifier that the GI can use to look up in the processing handbook or ICD. ID should include an identifier for the software that was used to produce the file (e.g. "DRIP_XXX"). For example, the FORCAST product types are: DRIP-UNDISTORTED, DRIP-MERGED, DRIP-COADDED, DRIP-REDALL. Generally, the SI will not need to set this keyword for raw data.
Requirement:LEVEL 2/3/4 Product.

DCSFileRevision
FITS Name:FILEREV
FITS Type:str
Description: File revision identifier, to be inserted by archive ingestion tasks if file was modified as part of post-processing. Change details to be documented using HISTORY records at the end of the header. String value, typically a lower case 'r' (ASCII 114) immediately followed by a integer greater than zero in decimal format with no padding or leading zeros. E.g., "r1" not "r01". The SI will not need to set this keyword for raw data; included here for completeness.
Requirement: If file changed in post-processing.

Mission Management Keywords

ObservingPlanUniqueID
FITS Name:PLANID
FITS Type:str
Description: The observing plan which contains all the AORs. The value of this keyword should be equivalent to <AOR/Reference/ObservingPlan> in the AOR document.
Requirement: If observation associated with an observing plan.

AircraftDeployment
FITS Name:DEPLOY
FITS Type:str
Description: Aircraft base of operations for current instrument run.
Requirement: Required

MissionID
FITS Name:MISSN-ID

FITS Type:str
Description: Unique mission identifier, as specified in the Mission Plan and returned by the MCCS. Current spec for mission ID includes a date stamp, instrument ID, and mission type indicators.
Requirement:Absolutely Required for Archive Ingestion*

FlightLeg
FITS Name:FLIGHTLG
FITS Type:int
Description: Flight leg identifier for given mission ID.
Requirement: Required

Origination Keywords

Origin
FITS Name:ORIGIN
FITS Type:str
Description: Organization or institution responsible for creation of FITS file.
Requirement: Required

Observers
FITS Name:OBSERVER
FITS Type:str
Description: Observer name(s).
Requirement: Required

FileCreator
FITS Name:CREATOR
FITS Type:str
Description: Software task which wrote the FITS file (including version information).
Requirement: Required

TelescopeOperator
FITS Name:OPERATOR
FITS Type:str
Description: The telescope operator for the mission.
Requirement: Required

Filename
FITS Name:FILENAME
FITS Type:str
Description: Name of host file. The FILENAME keyword allows for different stages in the treatment of a dataset: raw, calibrated, custom reduced, pipelined, or reduced at an intermediate stage. Files resulting from actions taken upon a given raw dataset will all have the same OBS_ID, but could have different values of the FILENAME keyword. For the FILENAME format, we recommend using OBSID as a prefix, and attach qualifiers denoting the stage of treatment and format.
Requirement: Required

Date and Time Keywords

CreationDate
FITS Name:DATE
FITS Type:str
Description: UTC date of file creation in date/time format (yyyy-mm-ddThh:mm:ss.ssss); see FITS standard for additional detail.
Requirement: Required

ObservationDate
FITS Name:DATE-OBS

FITS Type:str
Description: UTC date of observation at the start of the exposure in date/time format (yyyy-mm-ddThh:mm:ss.ssss); see FITS standard for additional detail.
Requirement:Absolutely Required for Archive Ingestion*

ObservationStartUTC
FITS Name:UTCSTART
FITS Type:str
Description: UTC time at the start of the exposure.
Requirement: Required

ObservationEndUTC
FITS Name:UTCEND
FITS Type:str
Description: UTC time at the end of the exposure.
Requirement: Required

Environmental Keywords

WaterVaporZenith_Start
FITS Name:WVZ_STA
FITS Type:flt
Description: Integrated precipitable water vapor to the zenith, running average of previous 60 seconds. Start of observation.
Requirement: Required

WaterVaporZenith_End
FITS Name:WVZ_END
FITS Type:flt
Description: Integrated precipitable water vapor to the zenith, running average of previous 60 seconds. End of observation.
Requirement: Required

static_air_temp
FITS Name:TEMP_OUT
FITS Type:flt
Description: Static air temperature, as returned by the MCCS at start of observation.
Requirement: Required

PrimaryMirrorTemperature_1
FITS Name:TEMPPRI1
FITS Type:flt
Description: Primary mirror temp #1, at start of observation.
Requirement: Required

PrimaryMirrorTemperature_2
FITS Name:TEMPPRI2
FITS Type:flt
Description: Primary mirror temp #2, at start of observation.
Requirement: Required

PrimaryMirrorTemperature_3
FITS Name:TEMPPRI3
FITS Type:flt
Description: Primary mirror temp #3, at start of observation.
Requirement: Required

SecondaryMirrorTemperature_1
FITS Name:TEMPSEC1

FITS Type:flt
Description: Temperature of secondary mirror, at start of observation.
Requirement: Required

Aircraft Keywords

Altitude_Start
FITS Name:ALTI_STA
FITS Type:flt
Description: Aircraft altitude from mean sea level according to MCCS (baro corrected), at start of observation.
Requirement: Required

Altitude_End
FITS Name:ALTI_END
FITS Type:flt
Description: Aircraft altitude from mean sea level according to MCCS (baro corrected), at end of observation.
Requirement: Required

Airspeed
FITS Name:AIRSPEED
FITS Type:flt
Description: True aircraft airspeed, as returned by the MCCS at start of observation.
Requirement: Required

GroundSpeed
FITS Name:GRDSPEED
FITS Type:flt
Description: Current ground speed of aircraft, as returned by the MCCS at start of observation.
Requirement: Required

Latitude_Start
FITS Name:LAT_STA
FITS Type:flt
Description: Current aircraft latitude, as returned by the MCCS at start of observation.
Requirement: Required

Longitude_Start
FITS Name:LON_STA
FITS Type:flt
Description: Current aircraft longitude, as returned by the MCCS at start of observation. W is negative, E is positive, from prime meridian.
Requirement: Required

Latitude_End
FITS Name:LAT_END
FITS Type:flt
Description: Current aircraft latitude, as returned by the MCCS at end of observation.
Requirement: Required

Longitude_End
FITS Name:LON_END
FITS Type:flt
Description: Current aircraft longitude, as returned by the MCCS at end of observation. W is negative, E is positive, from prime meridian.
Requirement: Required

Heading

FITS Name:HEADING
FITS Type:flt
Description: True aircraft heading, as returned by the MCCS at start of observation.
Requirement: Required

TrackAngle
FITS Name:TRACKANG
FITS Type:flt
Description: Aircraft track angle, as returned by the MCCS at start of observation.
Requirement: Required

Telescope Keywords

Telescope
FITS Name:TELESCOP
FITS Type:str
Description: Telescope used for the observation. Usually SOFIA but can also be telescope an another observatory.
Requirement: Required

TelescopeConfig
FITS Name:TELCONF
FITS Type:str
Description: Telescope configuration. The configuration defines the mirrors, correctors, light paths, etc... On SOFIA, this should be controlled by the MCCS.
Requirement: Required

TelescopeRA
FITS Name:TELRA
FITS Type:flt
Description: Right ascension of SI boresight (SIBS), as returned by the telescope control system (J2000). Representation may be either decimal hours or HH:MM:SS.s.
Requirement: Required

TelescopeDec
FITS Name:TELDEC
FITS Type:flt
Description: Declination of SI boresight, as returned by the telescope control system (J2000). Representation may be either decimal degrees or DD:MM:SS.
Requirement: Required

TelescopeVPA
FITS Name:TELVPA
FITS Type:flt
Description: Vertical Position Angle (VPA) of SI boresight, as returned by the telescope control system in ICRS (J2000) -- (given in the flight plans) is the Zenith PA (from North through East). For EXES it means that slit PA=ROF+270.
Requirement: Required

TelescopeEquinox
FITS Name:TELEQUI
FITS Type:str
Description: Equinox of returned RA/Dec/VPA.
Requirement: Required

LastRewindUTC
FITS Name:LASTREW
FITS Type:str
Description: UTC time of last telescope rewind.

Requirement: Required

TelescopeFocus_Start
FITS Name:FOCUS_ST
FITS Type:flt
Description: Telescope focus: Measured position of the FCM focus mechanism in the T direction -- as returned by the TA (microns) at observation start.
Requirement: Required

TelescopeFocus_End
FITS Name:FOCUS_EN
FITS Type:flt
Description: Telescope focus: Measured position of the FCM focus mechanism in the T direction -- as returned by the TA (microns) at observation end.
Requirement: Required

TelescopeElevation
FITS Name:TELEL
FITS Type:flt
Description: Telescope elevation above the horizon. At start of observation.
Requirement: Required

TelescopeCrossElevation
FITS Name:TELXEL
FITS Type:flt
Description: Telescope cross elevation in the cavity reference frame. At start of observation.
Requirement: Required

TelescopeLineOfSight
FITS Name:TELLOS
FITS Type:flt
Description: Telescope line of sight angle in the cavity reference frame. At start of observation.
Requirement: Required

TascuStatus
FITS Name:TSC-STAT
FITS Type:str
Description: State of the TASCU system at the end of the current observation as returned by the MCCS. See specification in MCCS_SI_04.
Requirement: Required

TascuFBCStatus
FITS Name:FBC-STAT
FITS Type:str
Description: State of the flexible body compensation system at the end of the current observation as returned by the TA. See specification in TA-MCCS-F .
Requirement: Required

ObservationRequestRA
FITS Name:OBSRA
FITS Type:flt
Description: Requested right ascension for the observation before any manual "tweaking", either from the instrument control software, an AOR, or the flight executor. This may be different from the actual object coordinates and/or telescope coordinates. Representation may be either decimal hours or HH:MM:SS.s. Reference frame can be specified in the comment field (ICRS recommended) and equinox specified using the Equinox keyword.
Requirement: Required

ObservationRequestDec

FITS Name:OBSDEC
FITS Type:flt
Description: Requested declination for the observation before any manual "tweaking", either from the instrument control software, an AOR, or the flight executor. This may be different from the actual object coordinates and/or telescope coordinates. Representation may be either decimal degrees or DD:MM:SS. Reference frame can be specified in comment field (ICRS recommended) and equinox specified using the Equinox keyword.
Requirement: Required

ObservationRequestEquinox
FITS Name:EQUINOX
FITS Type:flt
Description: Equinox for ObservationRA and ObservationDec. Does not apply to TelescopeRA/Dec which are fixed to ICRS (J2000). See FITS standard for additional detail. If not specified, equinox is assumed to be year 2000.
Requirement: Required

ZenithAngle_Start
FITS Name:ZA_START
FITS Type:flt
Description: Zenith angle of telescope pointing at start of acquisition. Use telescope elevation to calculate ZA.
Requirement: Required

ZenithAngle_End
FITS Name:ZA_END
FITS Type:flt
Description: Zenith angle of telescope pointing at end of acquisition. Use telescope elevation to calculate ZA.
Requirement: Required

TrackingMode
FITS Name:TRACMODE
FITS Type:str
Description: SOFIA Tracking mode (last commanded). See MCCS_SI_04 for description of states and modes.
Requirement: Tracking

TrackingError
FITS Name:TRACERR
FITS Type:log
Description: Flag to indicate if there was a tracking error during the observation. Ideally the SI software would monitor the tracking mode (ta_trc.trc_status_table.main_op_mode_id) for any error/abnormalities. If an error does occur, the TRACERR would then be set to T.
Requirement: Tracking

Data Collection Keywords

isChopping
FITS Name:CHOPPING
FITS Type:log
Description: Chopping flag
Requirement: If mode in use.

isNodding
FITS Name:NODDING
FITS Type:log
Description: Nodding flag -- this should be set if the SI is executing a repeated nod pattern, for example (ABBA)(ABBA), etc...
Requirement: If mode in use.

isDithering
FITS Name:DITHER

FITS Type:log
Description: Dithering flag
Requirement: If mode in use.

isMapping
FITS Name:MAPPING
FITS Type:log
Description: Mapping flag.
Requirement: If mode in use.

isScanning
FITS Name:SCANNING
FITS Type:log
Description: Scanning flag.
Requirement: If mode in use.

Annotation Keywords

Comment
FITS Name:COMMENT
FITS Type:str
Description: Comment keyword. This keyword does not normally have an equal sign. Any number of COMMENT records may be present from any legitimate source. This is a good place for <AOR/SpecialInstructions>.
Requirement: If entered by SI or pipeline

History
FITS Name:HISTORY
FITS Type:str
Description: History keyword. This keyword does not normally have an equal sign. This keyword should be reserved for any processing of the data, especially pre-processing (i.e. instrument level). Any number of HISTORY records may be present.
Requirement: If entered by SI or pipeline

Error
FITS Name:ERROR
FITS Type:str
Description: Error information *useful to a guest investigator*; this is not meant to be a catalog of system errors. Any number of Error messages may be present. In the FITS implementation, sequence numbers are used to order the information. Generally this keyword should only be used if OBSSTAT=ERROR.
Requirement: If entered by SI

Instrument Keywords

Instrument
FITS Name:INSTRUME
FITS Type:str
Description: Instrument name, as specified in the SI-DCS ICD.
Requirement:Absolutely Required for Archive Ingestion*

Datatype
FITS Name:DATATYPE
FITS Type:str
Description: Type of observation data: Image, Spectral, or Other.
Requirement: Required

InstrumentConfiguration
FITS Name:INSTCFG

FITS Type:str
Description: Instrument configuration - simple description, as specified in the SI-DCS ICD. e.g. IMAGING, GRISM, SPECTROSCOPY, etc...
Requirement: Required

InstrumentMode
FITS Name:INSTMODE
FITS Type:str
Description: Instrument observing mode - simple description, as specified in the SI-DCS ICD. e.g. C2N, MAPPING, TOTAL_POWER, etc...
Requirement: Required

MCCSMode
FITS Name:MCCSMODE
FITS Type:str
Description:SI mode as defined in the MCCS_SI_04.
Requirement: Required

ExposureTime
FITS Name:EXPTIME
FITS Type:flt
Description: Total effective on-source exposure time of the observation. This is the total time during which photons from the object of interest are collected by the detector. It includes any shutter corrections (which may not apply for most (all?) SOFIA instruments), and nodding/chopping corrections, and should match the algorithm(s) supplied for any time estimation tools (e.g. SITE). For FITS, EXPTIME should be used instead of the FITS specification EXPOSURE. ExposureTime should be specified for all images in a data file.
Requirement: Required

SpectralElement1
FITS Name:SPECTEL1
FITS Type:str
Description: First spectral element (filter, grism, etc...) as specified in SI-DCS ICD. Need only contain the unique identifier from the SI-DCS ICD; more detailed filter/grism/mixer can be stored in instrument-specific keywords.
Requirement:Absolutely Required for Archive Ingestion*

SpectralElement2
FITS Name:SPECTEL2
FITS Type:str
Description: Second spectral element (filter, grism, etc...) as specified in SI-DCS ICD. Need only contain the unique identifier from the SI-DCS ICD; more detailed filter/grism/mixer can be stored in instrument-specific keywords. Set to "NONE" if no second element in use.
Requirement:Absolutely Required for Archive Ingestion*

InstrumentSlit
FITS Name:SLIT
FITS Type:str
Description: Slit identifier, as specified in the SI-DCS ICD. Need only contain the unique identifier; more detailed info can be stored in instrument-specific keywords.
Requirement: Spectroscopy configs: if slit in use.

WavelengthCentral
FITS Name:WAVECENT
FITS Type:flt
Description: Central wavelength of observation for imaging modes. This is a rough figure only, intended to be used for archive searches across all SOFIA instruments.
Requirement: Imaging modes only.

Resolution

FITS Name:RESOLUN
FITS Type:flt
Description: Approximate spectral resolution of observation for spectroscopy modes, expressed as R = c/DeltaV = Lambda/DeltaLambda. This is a rough figure only, intended to be used for archive searches across all SOFIA instruments.
Requirement: Spectroscopy modes only.

DetectorChannel
FITS Name:DETCHAN
FITS Type:str
Description: Detector Channel as specified in the SI-DCS ICD.
Requirement:FORCAST and FIFI-LS should populate these.

TotalIntegrationTime
FITS Name:TOTINT
FITS Type:flt
Description: Total integration time (s)
Requirement:FORCAST

Array Detector Keywords

Detector
FITS Name:DETECTOR
FITS Type:str
Description: Detector name.
Requirement: Array instruments only.

DetectorSize
FITS Name:DETSIZE
FITS Type:str
Description: Unbinned detector size in pixels.
Requirement: Array instruments only.

PixelScale
FITS Name:PIXSCAL
FITS Type:flt
Description: Projected pixel scale on the sky.
Requirement: Array instruments only.

Subarrays
FITS Name:SUBARRNO
FITS Type:int
Description: Number of sub arrays used in data acquisition. Full array assumed if absent.
Requirement: If subarrays in use.

SubarraySize
FITS Name:SUBARR%2d
FITS Type:str
Description: The log unbinned size of the n-th subarray in section notation.
Requirement: If subarrays in use.

ScienceInstrumentBoresightX
FITS Name:SIBS_X
FITS Type:flt
Description: Location of SI boresight in pixel space -- x_si.
Requirement: Array instruments only.

ScienceInstrumentBoresightY

FITS Name:SIBS_Y
FITS Type:flt
Description: Location of SI boresight in pixel space -- y_si.
Requirement: Array instruments only.

WCS_CTYPE
FITS Name:CTYPEn
FITS Type:str
Description:WCS: Coordinate type and projection for n-th axis. See list of supported projections at http://tdc-www.harvard.edu/wcstools/wcstools.fits.html.
Requirement: Imaging only.

WCS_CRPIX
FITS Name:CRPIXn
FITS Type:flt
Description:WCS: pixel coordinates of the reference point of the n-th axis to which the projection and the rotation refer.
Requirement: Array instruments only.

WCS_CRVAL
FITS Name:CRVALn
FITS Type:flt
Description:WCS: reference pixel coordinate for n-th axis as right ascension and declination or longitude and latitude in decimal degrees. FITS Comment field should include estimate of uncertainty in absolute pointing (See TBD Document).
Requirement: Imaging only.

WCS_CDELT
FITS Name:CDELTn
FITS Type:flt
Description:WCS: Plate scale in degrees per pixel for the n-th axis at the reference pixel. Either the CDi_j *or* the CDELT/CROTA keywords should be used, but not both. FITS comment field should include estimate of uncertainty based on known distortion or other optical effects.
Requirement: Imaging only.

WCS_CROTA2
FITS Name:CROTA2
FITS Type:flt
Description:WCS: Rotation of axes in degrees. WCS FITS convention is to use CROTA2. Either the CDi_j *or* the CDELT/CROTA keywords should be used, but not both. FITS comment field should include estimate of uncertainty in TA rotation of field (see TBD Document).
Requirement: Imaging only.

WCS_RotMatrix
FITS Name:CDi_j
FITS Type:flt
Description:WCS: Rotation matrix for WCS -- CD1_1, CD1_2, CD2_1, and CD2_2. Either the CDi_j *or* the CDELT/CROTA keywords should be used, but not both. FITS comment field should include estimate of uncertainty for each matrix element.
Requirement: Imaging only.

Heterodyne Keywords

FrontendDevice
FITS Name:FRONTEND
FITS Type:str
Description: Name of frontend device.
Requirement: Heterodyne instruments only.

BackendDevice

FITS Name:BACKEND
FITS Type:str
Description: Name of backend device.
Requirement: Heterodyne instruments only.

BackendBandwidth
FITS Name:BANDWID
FITS Type:flt
Description: Total bandwidth of heterodyne backend (Hz).
Requirement: Heterodyne instruments only.

SystemTemperature
FITS Name:TSYS
FITS Type:flt
Description: Heterodyne system temperature.
Requirement: Heterodyne instruments only.

FrequencyResolution
FITS Name:FREQRES
FITS Type:flt
Description: Nominal frequency resolution -- may differ from channel spacing.
Requirement: Heterodyne instruments only.

ReferenceFrequency
FITS Name:OBSFREQ
FITS Type:flt
Description: The observed frequency (Hz) at the reference pixel of the frequency-like axis.
Requirement: Heterodyne instruments only.

SidebandFrequency
FITS Name:IMAGFREQ
FITS Type:flt
Description: The image sideband freq (Hz) corresponding to ReferenceFrequency.
Requirement: Heterodyne instruments only.

RestFrequency
FITS Name:RESTFREQ
FITS Type:flt
Description: Rest frequency.
Requirement: Heterodyne instruments only.

VelocityDefinition
FITS Name:VELDEF
FITS Type:str
Description: The velocity definition and frame (8 characters). The first 4 characters describe the velocity definition. Possible definitions include: RADI (radio); OPTI (optical); RELA (relativistic). The second 4 characters describe the reference frame (e.g. -LSR, -HEL, -OBS). If the frequency-like axis gives a frame, then the frame in VELDEF only applies to any velocities given as columns or keywords (virtual columns).
Requirement: Heterodyne instruments only.

VelocityFrame
FITS Name:VFRAME
FITS Type:flt
Description: The radial velocity of the reference frame wrt the observer. V_frame - V_telescope.
Requirement: Heterodyne instruments only.

RadialVelocity
FITS Name:RVSYS

FITS Type:flt
Description: The radial velocity, V_source - V_telescope.
Requirement: Heterodyne instruments only.

Data Structure Keywords

Chopping Keywords

ChopFrequency
FITS Name:CHPFREQ
FITS Type:flt
Description: Measured TCM chop frequency
Requirement: Chopping

ChopProfile
FITS Name:CHPPROF
FITS Type:str
Description: Indicates whether 2 or 3 point chopping profile is being used. For 3-point chopping, the center position usually contains the object of interest. MCCS returns '2-POINT ' for 2 point and '3-POINT' for 3-point.
Requirement: Chopping

ChopSymmetry
FITS Name:CHPSYM
FITS Type:str
Description: Indicates whether symmetric or asymmetric chopping is being used.
Requirement: Chopping

ChopAmplitude_1
FITS Name:CHPAMP1
FITS Type:flt
Description: Calculated amplitude on the sky. MCCS calculates the amplitude on the sky based on actual SMA data.
Requirement: Chopping

ChopAmplitude_2
FITS Name:CHPAMP2
FITS Type:flt
Description: Calculated second amplitude on the sky. MCCS calculates the amplitude on the sky based on actual SMA data.
Requirement: Chopping

ChopCoordSys
FITS Name:CHPCRSYS
FITS Type:str
Description: Reference frame for which MCCS computes SMA parameters. MCCS calculates sky_tip, sky_tilt, and sky_angle differently depending on which reference frame was last used in the sma.chop command. This value defaults to TARF if sma.chop has not been sent previously.
Requirement: Chopping

ChopAngle
FITS Name:CHPANGLE
FITS Type:flt
Description: Calculated angle in the sky_coord_sys reference frame. MCCS calculates the angle in the sky_coord_sys reference frame based on actual SMA data. The angle is the orientation of the chop throw with up equals zero.
Requirement: Chopping

ChopTip
FITS Name:CHPTIP
FITS Type:flt

Description: Calculated tip in the sky_coord_sys reference frame. MCCS calculates the tip in the sky_coord_sys reference frame based on actual SMA data.
Requirement: Chopping

ChopTilt
FITS Name:CHPTILT
FITS Type:flt
Description: Calculated tilt in the sky_coord_sys reference frame. MCCS calculates the tilt in the sky_coord_sys reference frame based on actual SMA data.
Requirement: Chopping

ChopPhase
FITS Name:CHPPHASE
FITS Type:flt
Description: Chopper phase as defined by MCCS. Time delay between the sync signal and the start of the setpoint which has the positive tilt increment with respect to the commanded offset.
Requirement: Chopping

Nodding Keywords

NodDwellTime
FITS Name:NODTIME
FITS Type:flt
Description: Total time per nod position (dwell time) -- not including nod slew time and nod settle time (see NodSettleTime).
Requirement: Nodding

NodCycles
FITS Name:NODN
FITS Type:int
Description: Number of nod cycles.
Requirement: Nodding

NodSettleTime
FITS Name:NODSETL
FITS Type:flt
Description: Time required for telescope to settle after nod slew is complete. Amount of time to wait between when telescope arrives at nod destination and when to begin integrating.
Requirement: Nodding

NodAmplitude
FITS Name:NODAMP
FITS Type:flt
Description: Nod amplitude on sky.
Requirement: Nodding

NodBeam
FITS Name:NODBEAM
FITS Type:str
Description: Current nod beam position.
Requirement: Nodding

NodPattern
FITS Name:NODPATT
FITS Type:str
Description: Pointing sequence pattern for one nod cycle (there could be many nod cycles in an observation). Beam A is usually assumed to contain the object of interest.
Requirement: Nodding

NodStyle
FITS Name:NODSTYLE
FITS Type:str
Description: Nodding style for coordinated chopping/nodding. e.g. nod-matched-chop, nod-perpendicular-chop, etc...
Requirement: Nodding/Chopping

NodCoordSys
FITS Name:NODCRSYS
FITS Type:str
Description: Coordinate system in which nod positions (NODPOSX,Y) and rotations are defined.
Requirement: Nodding

NodAngle
FITS Name:NODANGLE
FITS Type:flt
Description: Nod angle, clockwise from y axis defined by NODCRSYS.
Requirement: Nodding

Dithering Keywords

DitherCoordiante
FITS Name:DTHCRSYS
FITS Type:str
Description: Coordinate system for dither offsets.
Requirement: Dithering

DitherXOffset
FITS Name:DTHXOFF
FITS Type:flt
Description: Specified dither offset X for each subsequent frame, in arcseconds.
Requirement: Dithering

DitherYOffset
FITS Name:DTHYOFF
FITS Type:flt
Description: Specified dither offset Y for each subsequent frame, in arcseconds.
Requirement: Dithering

DitherPattern
FITS Name:DTHPATT
FITS Type:str
Description: Approximate shape of dither pattern.
Requirement: Dithering

DitherPositions
FITS Name:DTHNPOS
FITS Type:int
Description: Number of dither positions.
Requirement: Dithering

DitherPositionIndex
FITS Name:DTHINDEX
FITS Type:int
Description: Dither position index.
Requirement: Dithering

Mapping Keywords

MapCoordSys
FITS Name:MAPCRSYS
FITS Type:str
Description: Coordinate system in which extended source map positions are defined. OBSRA/DEC are assumed to describe position of Map Center.
Requirement: Mapping

MapPositionsX
FITS Name:MAPNXPOS
FITS Type:int
Description: Number of map positions in X coordinate as defined by MAPCRSYS.
Requirement: Mapping

MapPositionsY
FITS Name:MAPNYPOS
FITS Type:int
Description: Number of map positions in Y coordinate as defined by MAPCRSYS.
Requirement: Mapping

MapIntervalX
FITS Name:MAPINTX
FITS Type:flt
Description: Mapping step interval in X coordinate as defined by MAPCRSYS. OBSRA/DEC are assumed to describe position of Map Center.
Requirement: Mapping

MapIntervalY
FITS Name:MAPINTY
FITS Type:flt
Description: Mapping step interval in Y coordinate as defined by MAPCRSYS. OBSRA/DEC are assumed to describe position of Map Center.
Requirement: Mapping

Scanning Keywords (Constant Velocity)

ScanRate
FITS Name:SCNRATE
FITS Type:flt
Description: Commanded slew rate in arcsec/sec along path.
Requirement: Scanning

ScanType
FITS Name:SCANTYPE
FITS Type:str
Description: Scan type HAWC (BOX | LISSAJOUS | SWEEP | HONEYCOMB)
Requirement: Scanning

ACRONYMS

AOR	Astronomical Observation Request
API	Application Programming Interface
ARC	Ames Research Center
CCB	Configuration Control Board
CM	Configuration Management
CORBA	Common Object Request Broker Architecture
CS	Cycle Scheduler
CSCI	Computer Software Configuration Item
CVS	Concurrent Versioning System
DCS	Data Cycle System
FMI	Flight Management Infrastructure
FPE	Flight Plan Editor
GI	Guest Investigator (early nomenclature for someone who submits a proposal)
GO	Guest Observer (replaced GI)
GUI	Graphical User Interface
HEL	Heliocentric
HTTPS	Hypertext Transfer Protocol Secure
JSP	Java Server Page
LSR	Local Standard of Rest
MCCS	Mission Control and Communication System
NAIF_ID	Navigation and Ancillary Information Facility (NAIF) assigned ID for an object
ObsPlan	Observing Plan
ObsBlock	Observation Block
SI	Science Instrument
SITE	Science Instrument Time Estimator
SMA	Secondary Mission Assembly
SMO	SOFIA Missions Operations
SSC	SOFIA Science Center
SSMO	SOFIA Science Missions Operations
SSMOC	SOFIA Science Missions Operations Center
STS	Short Term Scheduler
TA	Telescope Assembly
TAC	Time Allocation Committee
USRA	University Space Research Association
XML	Extensible Markup Language