MIPS-24mm Calibration FITS File Header Formats

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1. Summary of MIPS-24mm Calibration Files

Latest copies of the following files are located in:
/ssc/pipe/fmasci/MIPS24_pipeline/offline_pl/DEV/mips24/calibration_data. Mirror-position/rate dependent flats and associated defaults are located in the sub-directory: **mirror_dep_flats/**

mips24_cdelt12_distort.tbl	(*Pixel scale/distortion table file for pointing transfer*)
mips24_instrument_FOV.tbl	(*instrument FOV/Euler offset file for pointing transfer*)
mips24_mirrorparameters.tbl	(*mirror parameters table for pointing transfer*)
mips24_darkest_raw1.fits	(*RAW-mode dark-current cube for DCENUM=0 DCEs*)
mips24_darkest_raw1_cmask.fits	(*C-Mask for the above*)
mips24_darkest_raw1_uncert.fits	(*Uncertainty for the above*)
mips24_darkest_raw2.fits	(*RAW-mode dark-current cube for DCENUM>0 DCEs*)
mips24_darkest_raw2_cmask.fits	(*C-Mask for the above*)
mips24_darkest_raw2_uncert.fits	(*Uncertainty for the above*)
mips24_darkest_sur1.fits	(*SUR-mode dark-current cube for DCENUM=0 DCEs*)
mips24_darkest_sur1_cmask.fits	(*C-Mask for the above*)
mips24_darkest_sur1_uncert.fits	(*Uncertainty for the above*)
mips24_darkest_sur2.fits	(*SUR-mode dark-current cube for DCENUM>0 DCEs*)
mips24_darkest_sur2_cmask.fits	(*C-Mask for the above*)
mips24_darkest_sur2_uncert.fits	(*Uncertainty for the above*)
mips24_flatfield_<csm_rate>_<csm_pred>.fits	(*Mirror-dependent flat-field calibrations, uncertainties included*)
mips24_flatfield_<csm_rate>_<csm_pred>_cmask.fits	(*C-Masks for the above*)
mips24_flatfield_default_phot.fits	(*Default flat-field for photometry mode if no mirror-dep file exists*)
mips24_flatfield_default_phot_cmask.fits	(*C-Mask for the above*)
mips24_flatfield_default_slow.fits	(*Default flat-field for slow-scan mode if no mirror-dep file exists*)
mips24_flatfield_default_slow_cmask.fits	(*C-Mask for the above*)
mips24_flatfield_default_medi.fits	(*Default flat-field for medium-scan mode if no mirror-dep file exists*)
mips24_flatfield_default_medi_cmask.fits	(*C-Mask for the above*)
mips24_flatfield_default_fast.fits	(*Default flat-field for fast-scan mode if no mirror-dep file exists*)
mips24_flatfield_default_fast_cmask.fits	(*C-Mask for the above*)
mips24_fluxconv.txt	(*DN-to-flux density conversion factors and uncertainties*)
mips24_lincal.fits	(*Non-linearity coefficient cube, uncertainties included*)
mips24_lincal_cmask.fits	(*C-Mask for the above*)
mips24_rowfluxcorr.fits	(*Row-flux or "read-2" corrections*)
mips24_rowfluxcorr_uncert.fits	(*Uncertainties in row-flux or "read-2" corrections*)
mips24_pmask.fits	(*Hardware pixel-status mask (P-Mask)*)
mips24_PRF_Map.tbl	(*Single image PRF specification table*)
mips24_PRF_Map_Image.fits	(*Single image PRF image*)
mips24_PRF_mosaic.fits	(*Output mosaic PRF image*)

2. Required FITS Header Keywords

The entries below represent the minimum information expected in each calibration product FITS header to ensure smooth running of all MIPS-24 pipelines. The "COMMENT" keywords/fields are optional and are included for informational purposes only.

2.1. mips24_pmask.fits

```
BITPIX  =                   16 / bits per data value
NAXIS   =                    2 / number of data axes
NAXIS1  =                  128
NAXIS2  =                  128
COMMENT  MIPS-24um pixel-mask (P-Mask), created 2003-07-07T17:09:38
```

2.2. mips24_darkest_raw1.fits and mips24_darkest_raw2.fits

```
BITPIX  =                  -32 / bits per data value
NAXIS   =                    3 / number of data axes
NAXIS1  =                  128
NAXIS2  =                  128
NAXIS3  =                   60
BUNIT   = 'DN     '            / Data units
COMMENT  MIPS-24um RAW-mode dark, created 2003-07-14T17:09:38
```

**__NOTE:__ NAXIS3 may be 6, 8, 20 or 60, corresponding to 3, 4, 10 or 30 MIPS-seconds respectively.

2.3. mips24_darkest_raw1_uncert.fits and mips24_darkest_raw2_uncert.fits

```
BITPIX  =                  -32 / bits per data value
NAXIS   =                    3 / number of data axes
NAXIS1  =                  128
NAXIS2  =                  128
NAXIS3  =                   60
BUNIT   = 'DN     '            / Data units
COMMENT  MIPS-24um RAW-mode dark uncertainty, created 2003-07-14T17:09:38
```

**__NOTE:__ NAXIS3 may be 6, 8, 20 or 60, corresponding to 3, 4, 10 or 30 MIPS-seconds respectively.

2.4. mips24_darkest_raw1_cmask.fits and mips24_darkest_raw2_cmask.fits

```
BITPIX  =                  -32 / bits per data value
NAXIS   =                    3 / number of data axes
NAXIS1  =                  128
NAXIS2  =                  128
NAXIS3  =                   60
COMMENT  MIPS-24um RAW-mode dark C-Mask, created 2003-07-14T17:09:38
```

**__NOTE:__ NAXIS3 may be 6, 8, 20 or 60, corresponding to 3, 4, 10 or 30 MIPS-seconds respectively.

2.5. mips24_darkest_sur1.fits and mips24_darkest_sur2.fits

```
BITPIX  =                  -32 / bits per data value
NAXIS   =                    2 / number of data axes
NAXIS1  =                  128
NAXIS2  =                  128
BUNIT   = 'DN/sec '             / Units of image data
COMMENT  MIPS-24um SUR-mode dark, created 2003-07-14T17:09:38
```

2.6. mips24_darkest_sur1_uncert.fits and mips24_darkest_sur2_uncert.fits

```
BITPIX  =                  -32 / bits per data value
NAXIS   =                    2 / number of data axes
```

NAXIS1 = 128
NAXIS2 = 128
BUNIT = 'DN/sec ' / Units of image data
COMMENT MIPS-24um SUR-mode dark uncertainty, created 2003-07-14T17:09:38

2.7. mips24_darkest_sur1_cmask.fits and mips24_darkest_sur2_cmask.fits

BITPIX = 16 / bits per data value
NAXIS = 2 / number of data axes
NAXIS1 = 128
NAXIS2 = 128
COMMENT MIPS-24um SUR-mode dark C-Mask, created 2003-07-14T17:09:38

2.8. mips24_flatfield_<csm_rate>_<csm_pred>.fits (see note 3 below)

BITPIX = -32 / bits per data value
NAXIS = 3 / number of data axes
NAXIS1 = 128
NAXIS2 = 128
NAXIS3 = 3
COMMENT MIPS-24um flatfield, created 2003-07-14T17:09:38
COMMENT Plane 1: Flatfield correction fractors.
COMMENT Plane 2: Uncertainties represented by the data-scale measure.
COMMENT Plane 3: Uncertainties represented by trimmed standard deviation.
CSM_PRED= value / Predicted mirror position (DAC)
CSM_RATE= value / Mirror scan rate (milli-arcsec/sec)

NOTES: 1. Please ensure the correct "value" is assigned to CSM_PRED and CSM_RATE.
2. Also place these values in the actual filename in the format:
mips24_flatfield_<csm_rate>_<csm_pred>.fits
3. See section 5 below for a script which automatically generates mirror-dependent flats and accompanying C-Masks.

2.9. mips24_flatfield_<csm_rate>_<csm_pred>_cmask.fits

BITPIX = 16 / bits per data value
NAXIS = 2 / number of data axes
NAXIS1 = 128
NAXIS2 = 128
COMMENT MIPS-24um flatfield C-Mask, created 2003-07-14T17:09:38

2.10. mips24_flatfield_default_<*phot or slow or medi or fast*>.fits

BITPIX = -32 / bits per data value
NAXIS = 3 / number of data axes
NAXIS1 = 128
NAXIS2 = 128
NAXIS3 = 3
COMMENT MIPS-24um flatfield, created 2003-07-14T17:09:38
COMMENT Plane 1: Flatfield correction fractors.
COMMENT Plane 2: Uncertainties represented by the data-scale measure.
COMMENT Plane 3: Uncertainties represented by trimmed standard deviation.
CSM_PRED= 999999.0 / Predicted mirror position (DAC)
CSM_RATE= value / Mirror scan rate (milli-arcsec/sec)

NOTES: 1. Please ensure the correct "value" is assigned to CSM_RATE.
2. Please ensure CSM_PRED is set exactly to 999999.0 for these defaults only.

2.11. mips24_flatfield_default_*<phot or slow or medi or fast>*_cmask.fits

BITPIX = 16 / bits per data value
NAXIS = 2 / number of data axes
NAXIS1 = 128
NAXIS2 = 128
COMMENT MIPS-24um flatfield C-Mask, created 2003-07-14T17:09:38

2.12. mips24_lincal.fits

BITPIX = -32 / bits per data value
NAXIS = 3 / number of data axes
NAXIS1 = 128
NAXIS2 = 128
NAXIS3 = 3
CALBUNIT= 'DN ' **(See note below).
COMMENT MIPS-24um non-linearity, created 2003-07-14T17:09:38
COMMENT Plane 1: Correction factors A/C**2, where DN = A*t**2 + C*t.
COMMENT Plane 2: Saturation thresholds.
COMMENT Plane 3: 1-sigma uncertainties in values (A/C**2)

****NOTE:** Ensure there are exactly six blank spaces following the DN within 'DN '

2.13. mips24_lincal_cmask.fits

BITPIX = 16 / bits per data value
NAXIS = 2 / number of data axes
NAXIS1 = 128
NAXIS2 = 128
COMMENT MIPS-24um non-linearity C-Mask, created 2003-07-14T17:09:38

2.14. mips24_rowfluxcorr.fits

BITPIX = -32 / bits per data value
NAXIS = 2 / number of data axes
NAXIS1 = 128
NAXIS2 = 128
COMMENT MIPS-24um row-flux or read-2 corrections, created 2003-07-14T17:09:38

2.15. mips24_rowfluxcorr_uncert.fits

BITPIX = -32 / bits per data value
NAXIS = 2 / number of data axes
NAXIS1 = 128
NAXIS2 = 128
COMMENT MIPS-24um row-flux or read-2 uncertainty corrections, created 2003-07-14T17:09:38

2.16. mips24_PRF_Map_Image.fits

BITPIX = -32 / bits per data value
NAXIS = 2 / number of data axes
NAXIS1 = 195
NAXIS2 = 195
COMMENT MIPS-24um Point Response Function for single input image
COMMENT Created 2003-07-14T17:09:38

2.17. mips24_PRF_mosaic.fits

```
BITPIX  =                  -32 / bits per data value
NAXIS   =                    2 / number of data axes
NAXIS1  =                  195
NAXIS2  =                  195
COMMENT  MIPS-24um Point Response Function for output mosaic
COMMENT  Created 2003-07-14T17:09:38
```

3. Optional FITS Header Keywords (SODB Fallback Table Loading)

If specific keywords are required to accompany a calibration FITS product so it can be selected accordingly during the calibration transfer stage, then these keywords must be inserted in the FITS header prior to loading the *SODB:mips1Fallback* table. The only ancillary keywords allowed for mips24 are listed below.

AD24STMI
AVDSUBV
AD24TMPA
AD24TMPB
DCE_CALC
CSM_PIDX
CSM_SLP
CSM_PRED
CSM_RATE
CSM_SKY
EXPTIME
FRAMTIME
CSM_POSC
CSM_POSF
CSM_POS
ANCSMRP1
ANCSMRP2
ACSMMTMP
ANCSMPS1
ANCSMPS2
AD24HTRI
APROFF1V
APROFF2V
APROFF3V
APROFF4V
AD24ANLI

4. Tool to flip/rotate Calibration FITS Images

If you ever need to flip/rotate FITS images, I have put together a perl script which performs flipping and/or rotation operations on an input list of images. Outputs are written to a separate user-specified directory. After setting your environment (source regular_env.csh in the mips24 tar-ball), you can type "FlipRotateImages.pl" for a command-line tutorial.

5. Tool to Make Mirror-Dependent Flats

To automatically generate mirror position/rate dependent flat-fields and C-Masks in SSC format, there is script which reads in a list of raw-MIPL or post-tranhead FITS images, sorts the data into filelists according to specified mirror-DAC intervals and optionally runs the flat-field pipeline to create flat-field products. Input FITS headers must contain the 'CSM_PRED' and 'CSM_RATE' keywords. After setting your environment (source regular_env.csh in the mips24 tar-ball), you can type “MakeMirrorDepFlats.pl” for a command-line tutorial.