Format for Data Files submitted with the MESSENGER Dual Imaging System (MDIS) Calibration Report

Louise Prockter

1. Introduction

This document describes the data formats of the files that were analyzed to produce the MESSENGER Mercury Dual Imaging System (MDIS) Calibration Report. Specific details of each calibration run are in the accompanying Excel spreadsheet ***MDIS ground cal 11-22-04.xls***.

2. File format

The files will be submitted in FITS format.

3. Data volume

The expected volume of ground data is ~ 190GB for pre- and post-environmental data, while instrument integration data (including I&T data) is an additional 27GB.

4. Sample image

Sample FITS image is attached.

5. Representative image label

The image label for the image shown in section 4 is shown below – comments are self-explanatory.

```
SIMPLE  =                    T /image conforms to FITS standard
BITPIX  =                   16 /bits per data value
NAXIS   =                    2 /number of axes
NAXIS1  =                 1024 /
NAXIS2  =                 1024 /
EXTEND  =                    T /file may contain extensions
BZERO   =                    0 /Data is unsigned integer
BUNITS  = 'A/D units'            / Units of brightness
DATE    = '2004-03-23'           / Creation UTC (CCCC-MM-DD) date of FITS header
O_BZERO =              32768.0 /Original Data is unsigned Integer
COMMENT FITS (Flexible Image Transport System) format is defined in 'Astronomy
COMMENT and Astrophysics', volume 376, page 359; bibcode 2001A&A...376..359H
COMM0000= '         '            /
CR_TIME = '    2004 Mar 23 14:05:29.444 Tue' /FITS file creation time (UTC)
CR_JS   =        133365929.444 /FITS file creation time (UTC)
IMG_TYPE=                    0 /Image type: 0=data, 1=dark, 2=backgrd, 3=gen
FILE    = './fits//0036050354_IM1WV_D.fit' /FITS file name.
SEQ_NUM = '1WV_D   '             /Sequence number
COMM0001= '-----------------------------------------------------------------------'
COMM0002= '    MDIS Image Header    Ref: 7390-9041, SRI-03,   John R. Hayes    '
COMM0003= '    Table 13             January 9, 2003                            '
COMM0004= '-----------------------------------------------------------------------'
COMM0005= '-----------------------------------------------------------------------'
COMM0006= '    MP Image Descriptor.doc                          Pat Murphy       '
COMM0007= '    Table 1              Revision unknown                           '
COMM0008= '-----------------------------------------------------------------------'
MET_EXP =             36050354 /Exposure time-tag (MET)
PIV_GOAL=                    0 /Pivot goal (180°/2^15)
PIV_POS =                    0 /Pivot position (180°/2^15)
PIV_READ=                    0 /Pivot reading (resolver counts)
PIV_CAL =               -26758 /Pivot calibration offset (TBD)
FW_GOAL =                11976 /Filter wheel goal (resolver counts)
FW_POS  =                12014 /Filter wheel pos. (resolver counts)
FW_READ =                    0 /Filter wheel reading (res. counts)
```

```
CCD_TEMP=                 1130 /CCD temperature
CAM_T1  =                  504 /Camera temperature #1
CAM_T2  =                  510 /Camera temperature #2
EXPOSURE=                  989 /Exposure time (1 ms units)
DPU_ID  =                    0 /DPU identifier: 0=DPU-A, 1=DPU-B
IMAGER  =                    0 /WAC or NAC imager: 0=WAC, 1=NAC
SOURCE  =                    1 /Image source: 0=CCD,1=Test patt,2=Inv
FPU_BIN =                    0 /Image binning in FPU: 0=1x1, 1=2x2
COMP12_8=                    0 /Enable/disable 12 to 8 bit image comp
COMP_ALG=                    0 /12 to 8 bit compression algorithm
COMP_FST=                    1 /Enable/disable Fast image compression
TIME_PLS=                    1 /1 Hz time pulse source:0=soft,1=MPA,2=MPB,3=Soft
LATCH_UP=                    0 /FPU latchup indicator: 0=ok, 1=Latched
EXP_MODE=                    1 /0=Manual, 1=Automatic
PIV_STAT=                    0 /Pivot control state:0=Lost,1=Search,2=Found,3=ok
PIV_MPEN=                    0 /Pivot controlled by MP: 0=Disable,1=Enable
PIV_PV  =                    0 /Pivot position validity flag
PIV_RV  =                    0 /Pivot reading validity flag
FW_PV   =                    0 /Filter wheel position validity flag
FW_RV   =                    0 /Filter wheel reading validity flag
AEX_STAT=                  896 /Mode of hist used for auto exp calc (0-4095)
AEX_STHR=                    0 /Auto exp saturation thresh (pixels 0.1%)(0-1000)
AEX_TGTB=                 3000 /Automatic exposure target brightness (0-4095)
AEX_BACB=                  240 /Automatic exposure background/noise brightness
AEX_MAXE=                  989 /Maximum automatic exposure time (1 ms) (0-989)
AEX_MINE=                    1 /Minimum automatic exposure time (1 ms) (0-989)
DLNKPRIO=                    1 /Priority that compressed file will be downlinked
WVLRATIO=                    4 /Wavelet Compression Ratio: 0..32
PIXELBIN=                    0 /MP Software Pixel Binning.
SUBFRAME=                    0 /Number of subframes
SUBF_X1 =                    0 /Subframe 1 Start col (0-1023)
SUBF_Y1 =                    0 /Subframe 1 Start row (0-1023)
SUBF_DX1=                    0 /Subframe 1 Width (0-1024)
SUBF_DY1=                    0 /Subframe 1 Height (0-1024)
SUBF_X2 =                    0 /Subframe 2 Start col (0-1023)
SUBF_Y2 =                    0 /Subframe 2 Start row (0-1023)
SUBF_DX2=                    0 /Subframe 2 Width (0-1024)
SUBF_DY2=                    0 /Subframe 2 Height (0-1024)
SUBF_X3 =                    0 /Subframe 3 Start col (0-1023)
SUBF_Y3 =                    0 /Subframe 3 Start row (0-1023)
SUBF_DX3=                    0 /Subframe 3 Width (0-1024)
SUBF_DY3=                    0 /Subframe 3 Height (0-1024)
SUBF_X4 =                    0 /Subframe 4 Start col (0-1023)
SUBF_Y4 =                    0 /Subframe 4 Start row (0-1023)
SUBF_DX4=                    0 /Subframe 4 Width (0-1024)
SUBF_DY4=                    0 /Subframe 4 Height (0-1024)
SUBF_X5 =                    0 /Subframe 5 Start col (0-1023)
SUBF_Y5 =                    0 /Subframe 5 Start row (0-1023)
SUBF_DX5=                    0 /Subframe 5 Width (0-1024)
SUBF_DY5=                    0 /Subframe 5 Height (0-1024)
CRITOPNV=                    0 /Critical Opnav: 0=false, 1=true
JAILBARS=                    0 /Vertical Jailbars:  0=disabled, 1=enabled
JB_X0   =                    0 /First Jailbar Column (0-1023)
JB_X1   =                    0 /Last Jailbar Column (0-1023)
JB_SPACE=                    0 /Jailbar intercolumn spacing
COMM0009= '_____________________________________________________________________'
COMM0010= '    Values for items set manually.  Any special notes                '
COMM0011= '    are in the comment following item.                               '
COMM0012= '_____________________________________________________________________'
MC_SRC  = '        '           /Monochromator light source
COMM0013= '                                                                     '
MC_SPWR = '        '           /Monochromator light source power
COMM0014= '                                                                     '
MC_GRNUM= '        '           /Monochromator grating number
COMM0015= '                                                                     '
MC_SI_L = '        '           /Monochromator entrance slit length (mm)
COMM0016= '                                                                     '
MC_SI_W = '        '           /Monochromator entrance slit width (microns)
COMM0017= '                                                                     '
MC_SO_L = '        '           /Monochromator exit slit length (mm)
COMM0018= '                                                                     '
MC_SO_W = '        '           /Monochromator exit slit width (microns)
COMM0019= '                                                                     '
MC_EXFIL= '        '           /Monochromator exit filter
COMM0020= '                                                                     '
MC_ENFIL= '        '           /Monochromator entrance filter
COMM0021= '                                                                     '
RMLT_OFF= '        '           /Room lights off
COMM0022= '                                                                     '
END
```

6. Further detail on ground calibration runs

The columns for the accompanying Excel file ***MDIS ground cal 10-27-04.xls*** correspond to the following:

A. Temperature
B. Test
(Columns C and D show the run number)
C. Binned pixels
D. Unbinned pixels
E. Whether instrument was in flight configuration, Y/N.
(Columns F to J refer to the Optical Calibration Facility (OCF) configuration)
F. Door to vacuum chamber
G. Collimator window on or off
H. Monochromator on or off
I. Porthole cap
J. Gate valve
(Columns K – U refer to specific details of each test)
K. Number of integration times
L. Number of bin modes used in run
M. Number of filters
N. Number of positions or cycles
O. Number of lamp settings
P. Number of frames per data set
Q. Number of background frames per data set
R. Number of frames total
S. Average number of seconds per binned frame
T. Average number of seconds per unbinned frame
U. Total time for run in hours
V. Comments about test

The runs containing data for specific calibration tests are detailed in columns C and D of the spreadsheet. These calibration tests are:

- Point Spread Function (PSF) Test
- Linearity with exposure
- Linearity with Brightness
- Flat field
- Dark current
- Stray light test
- Coarse Filter Scan
- Fine Filter Scan

- Entrance / exit mono filter factors
- Chamber Window Transmission
- Baffle3 Flat Field /Vignetting test

The majority of these tests were carried out under a variety of conditions, shown on the spreadsheet and described in detail in the MDIS calibration paper.