Chapter 40
HSP Data Structures

In This Chapter...

This chapter contains information about HSP data formats and file types, and necessary reference tables. This chapter does not include a discussion of paper products since no such products exist for the HSP.

40.1 Data Products and File Structures

There are five standard data formats for HSP data. They are listed in Table 40.1.

Table 40.1: HSP Data Formats

Format	Description
BYTE	One-byte digital
WORD	Two-byte digital
LONGWORD (LWRD)	Three-byte digital
ANALOG (ALOG)	12-bit analog (in two bytes)
ALL	Three-byte digital plus two-byte analog

The Post-Observation Data Processing System (PODPS) pipeline calibration process produces datasets in Generic Edited Information Set (GEIS) format. The datasets contain a *standard header packet*, a *unique data log*, and one to four

science data files (and corresponding data quality files). Each file contains an ASCII header file and a binary data file. Each of the files has the same rootname, and the type of file is designated by its suffix. The following table lists the description of the suffixes as determined by the data format and the mode.

Table 40.2: HSP Data Files

Extension	File Contents
Raw Data Files	
`.shh/.shd`	Standard header packet
`.ulh/.uld`	Unique data log
`.d0h/.d0d`	Science data, digital star
`.d1h/.d1d`	Science data, digital sky
`.d2h/.d2d`	Science data, analog star
`.d3h/.d3d`	Science data, analog sky
`.q0h/.q0d`	Data quality, digital star
`.q1h/.q1d`	Data quality, digital sky
`.q2h/.q2d`	Data quality, analog star
`.q3h/.q3d`	Data quality, analog sky
Calibrated Data Files	
`.c0h/.c0d`	Calibrated digital star data
`.c1h/.c1d`	Calibrated digital sky data
`.c2h/.c2d`	Calibrated analog star data
`.c3h/.c3d`	Calibrated analog sky data

40.1.1 Standard Header Packet

The Standard Header Packet (SHP) contains the instrument engineering telemetry values, and other data from spacecraft operations. The telemetry values found in the SHP are observed values and may include quantities that are not controllable.

40.1.2 Unique Data Log

The Unique Data Log contains commanded values for various instrument settings. The UDL also contains data from the flight software.

40.1.3 Science Data Files

Science data are stored as single-precision floating point values. The results of the pipeline calibration are files containing the HSP count rates as a function of time. The number of files in the dataset depends on the mode and the data type. A single observation could generate up to eight separate data files. Science data files are identified by their suffixes as shown in Table 40.2.

40.1.4 Quality Mask Files

Each of the science data files has a corresponding quality file that contains single-precision floating point values. Good data values are identified in the file with a value of zero. An error at any pixel during the data capture process results in a non-zero value. HSP data quality flag values are listed in Table 40.3.

Table 40.3: HSP Data Quality Flag Values

Flag Value	Description
0	Good data
1	Reed-Solomon decoding error
8	A/D converter saturation
16	Missing data

40.1.5 Calibrated Data Files

The HSP calibration program, **calhsp**, generates the calibrated file for each corresponding raw science data file. The calibrated and the raw data header files contain the same keywords, except the raw data are corrected for instrument signatures.

Note that the photometric sensitivity is poorly determined and the calibration correspondingly uncertain.

40.1.6 HSP Data Products

Generally, most HSP data are delivered from the Archive in FITS format. For large volume data samples, FITS format files may not be produced. In this case the delivered data remain in GEIS format.

40.1.7 HSP Keywords

Table 40.4 describes important HSP keywords. This table does not include all keywords that are found in all of the data headers.

Table 40.4: HSP Keywords

Keyword	Description
ROOTNAME	Root file name of the observation dataset
RA_TARG	Right ascension of target, in degrees (J2000)
DEC_TARG	Declination of target, in degrees (J2000)
MODE	Instrument mode (SCP, SSP, or ARS)
DETECTOB	Detector in use (0–5); object data
DETECTSK	Detector in use (0–5); sky data
APERTOBJ	Aperture in use—object data
APERTSKY	Aperture in use—sky data
DEADTIME	Deadtime correction
TRUE_CNT	Compute the true count rates
TRUE_PHC	Compute the true photocurrents
DATA_TYP	Data type (digital or analog)
DATA_SRC	Data source (star, sky, or area scan)
DATA_FMT	Data format (byte, word, lwrd, alog, or all)
TIMEBIAS	Instrument time bias (in seconds)
SAMPTIME	Time of integration (in seconds)
PT_EFFIC	Scaled point source cathode efficiency
EX_EFFIC	Scaled extended source cathode efficiency
DARKRATE	Scaled cathode dark rate
PRE_AMP	Scaled tube pre-amp contribution
HIGHVOLT	Scaled high voltage factor
TUBEGAIN	Scaled tube gain factor
DEADTM	Deadtime
CVCOFSET	Scaled CVC offset
EXPSTART	Exposure start time (modified Julian date)
EXPEND	Exposure end time (modified Julian date)
FILETYPE	shp, udl, or dst (digital sky); dsk (digital sky); ast (analog star); ask (analog sky); asd (area scan digital); or asa (area scan analog)
PTSRCFLG	Point source flag (P for point, or E for extended)

40.2 HSP Reference Tables

Table 40.5 provides a listing of all of the reference tables that are needed for calibration or re-calibration of HSP data. See Chapter 1 for information concerning how to determine the best reference tables and how to retrieve them from the HST Archive.

Table 40.5: HSP Reference Tables in CDBS

Header Keyword for Table	Description
CCP0	Aperture size
CCP1	High voltage factor
CCP2	Gain factor
CCP3	Pre-amplifier noise
CCP4	Relative efficiency
CCP5	Dark signal
CCP7	CVC offset
CCP8	Dead time
CCP9	Dark aperture name

40.3 Displaying HSP Data

To get started using IRAF and STSDAS refer to the tutorial information in Appendix A of Volume I of this manual, or in the *STSDAS Users Guide*. An example of displaying HSP data is provided below.

40.3.1 Displaying the SHP and UDL

The header consists of engineering telemetry values, plus other information. The SHP and the UDL each contain two groups. This should be checked by looking at the keyword GCOUNT. The value for GCOUNT should be 2. The keyword PTSRCFLG (point source flag) should list either P for a point source or E for an extended source. The IRAF task **listpixels** under the **images** package can be used to look at the values of the SHP and UDL pixels. The following chart

shows the correct value for SHP pixel #937 according to MODE and if the source is EXTENDED or POINT.

Table 40.6: Correct Value for SHP Pixel Value 937

Mode	Source	SHP 937 Pixel Value
SCP	P	1
SSP	P	2
SCP	E	257
SSP	E	258
ARS	–	3

40.3.2 Displaying HSP Area Scans

HSP area scans can be displayed by using the IRAF **surface** or **contour** tasks under the **plot** package.

You can display area scans (which make little images) using the IRAF **display** task and SAOimage, described on page 3-4. The time series data can be displayed using either **splot** (page 3-25) or **implot** (page 3-10), which will make one-dimensional plots of counts versus time.

Figure 40.1: HSP Area Mode Display

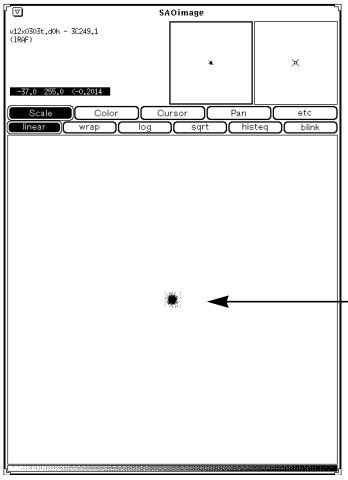

Figure 40.2: HSP Time Series Data Plot