Chapter 44
WF/PC-1 Data Structures

In This Chapter...

This chapter contains information about WF/PC-1 data formats and file types, and necessary reference files. This chapter does not include a discussion of paper products as no such products exist for WF/PC-1,

44.1 Science Data Files

If **strfits** was used to convert the HST Archive's FITS files (as described in Chapter 3), the image data will be in GEIS format. A directory listing (type `dir` within IRAF), will show that the files all have a nine-character rootname and a three-character suffix.

By definition, a *dataset* is the collection of all files produced by the Routine Science Data Processing (RSDP) pipeline for a single HST exposure. The files in a dataset all share the same nine-character rootname or *IPPPSSOOT.* As defined in Appendix B, the rootname follows a specific naming convention that allows each executed observation to be uniquely tied to the scheduling information from which it originated.

Each file in a dataset has a three-character suffix. For each instrument, this suffix uniquely identifies the file contents. The WF/PC-1 science data file sizes and suffixes are listed in Table 44.1 below.

Files whose suffixes end with the letter "h" (e.g., `w0lo0105t.c1h`) are ASCII *header files*. The header files contain keywords that describe the parameters used to take the observation, the processing of the data, and the properties of the image. Files whose suffixes end in the letter "d" (e.g., `w0lo0105t.c1d`) are binary *data files*; these files contain the data as well as the group keywords. A single GEIS image is composed of a header and data *pair* (e.g., the files `w0lo0105t.c1h` and `w0lo0105t.c1d` together represent a single image, retrieved as `w0lo0105t_c1f.fits` from the Archive).

Table 44.1: WF/PC-1 Dataset Suffixes and File Sizes

Suffix	File Contents	File Sizes (full mode) [a]
Raw Data Files		
`.d0h/.d0d`	Raw science data	5 MB
`.q0h/.q0d`	Data quality for raw science data	5 MB
`.x0h/.x0d`	Extracted engineering data	90 KB
`.q1h/.q1d`	Data quality for extracted engineering data	90 KB
`.shh/.shd`	Standard header packet containing observation parameters	90 KB
Calibrated Data Files		
`.c0h/.c0d`	Calibrated science data	10 MB
`.c1h/.c1d`	Data quality for calibrated science data	5 MB
`.c2h/.c2d`	Histogram of science data pixel values	
`.c3h/.c3d`	Saturated pixel map	
`.trl`	Trailer file	

a. Area mode files are ~1/4 the size of Full mode.

The data quality file (`.c1h`) flags bad pixels; see Table 45.2 for a description of the data quality values and their meaning.

A single WF/PC-1 exposure is obtained as four images (less if fewer than four chips were read out). GEIS files use group format to keep all of the data from a given HST exposure together in a single image file. The data corresponding to each sub-image for the WF/PC-1 are stored sequentially in the groups of a single GEIS image. The header file for an image contains the information that applies to the observation as a whole (i.e., to all the groups in the image), viewable by paging the header. The group-specific (that is, chip-specific) keyword information is stored with the group data in the binary data file; group keywords are only accessible via specialized software such as the STSDAS tasks like **hedit** or **imhead**.

WF/PC-1 images are normally four-group images, groups 1–4 representing CCD chips WF1–WF4 or PC5–PC8, depending on the camera used; if only a subset of chips were read out, only a subset of groups will be present. The group keyword DETECTOR provides the identification number of the chip (1 through 8) stored in that group, regardless of the number of chips read out.

44.2 Reference Files

The types of WF/PC-1 reference files, along with their suffixes, are listed in Table 44.2; the `b*` suffixes refer to the associated data quality files. The rootname of the reference file is based on the time that the file was delivered to the Calibration Data Base System (CDBS); the file names and history of all WF/PC-1 reference files in CDBS (and retrievable from the HST Archive) are contained in the Reference File Memo on the WWW:

```
http://www.stsci.edu/ftp/instrument_news/WFPC/
wfpc1_memos.html
```

This memo is routinely updated with each new delivery. Any CDBS file is available for retrieval through the HST Data Archive.

Table 44.2: WF/PC-1 Calibration Reference Files

Suffix [a]	Reference File
`r0h, r0d`	Static mask
`r1h, r1d`	Analog to digital look-up table
`r2h, r2d, b2h, b2d`	Bias
`r3h, r3d, b3h, b3d`	Preflash
`r5h, r5d, b5h, b5d`	Dark frame
`r6h, r6d, b6h, b6d`	Flatfield
`r7h, r7d`	Extracted PSF images[b]
`r8h, r8d, b8h, b8d`	Delta flat images[b]
`cw0`	Photometry table

a. Suffixes `.r4h` and `.r4d` (superpurge) were not used.
b. PSFs and delta flats are additional CDBS files available from the Archive. They are intended for use separately from **calwfp**; more details on their use are provided in “Choosing and Generating Delta Flats” on page 45-18 and “PSFs” on page 46-11, as well as in the online WWW memos.

44.3 Header Keywords

Table 44.3 lists the header keywords found in a WF/PC-1 `.c0h` image header that many observers are likely to find useful; the STSDAS tasks **hedit** or **imhead** can be used to view any or all of the header and group keywords. WF/PC-1 keywords include items such as observing mode, integration time, and filters used, calibration steps performed and reference files used, and the properties of the data

itself (e.g., number of groups, coordinates, scale, flux units, image statistics, and more). In Table 44.3, the group keywords are GROUPS through PHOTBW; keywords INSTRUME through SEQNAME are the general keywords.

Table 44.3: WF/PC-1 Header Keywords

Keyword	Description
	Information about the groups
GROUPS	Multi-group image?
GCOUNT	Number of groups (number of detectors read out)
	Coordinate-related keywords
CRVAL1	RA of reference pixel (deg)
CRVAL2	Declination of reference pixel (deg)
CRPIX1	X coordinate of reference pixel
CRPIX2	Y coordinate of reference pixel
CD1_1	Partial of RA with respect to *x*
CD1_2	Partial of RA with respect to *y*
CD2_1	Partial of declination with respect to *x*
CD2_2	Partial of declination with respect to *y*
	Image Contents
ORIENTAT	Orientation of image (deg)
DETECTOR	CCD detector: WF 1-4, PC 5-8
	Bias level information (columns 3–14 of the .x0h/.x0d file)
DEZERO	Bias level from EED extended register
BIASEVEN	Bias level based on average of odd columns in x0h/x0d file
BIASODD	Average bias level based on average of even columns
	Pixel statistics
GOODMIN	Minimum value of “good” pixels (not flagged in DQF)
GOODMAX	Maximum value of “good” pixels
DATAMEAN	Mean value of “good” pixels
GPIXELS	Number of good pixels

Table 44.3: WF/PC-1 Header Keywords (Continued)

Keyword	Description
	Photometry keywords
PHOTMODE	Photometry mode
PHOTFLAM	Inverse sensitivity (units of erg/sec/cm^2/Å for 1 DN/sec)
PHOTZPT	Zero point (currently -21.10, if DOPHOTOM = yes)
PHOTPLAM	Pivot wavelength (in angstroms)
PHOTBW	rms bandwidth of filter (in angstroms)
	Image keywords
INSTRUME	Instrument used; always WFPC for either WF or PC
ROOTNAME	Rootname of the observation set
FILETYPE	SHP - standard header packet EXT - extracted engineering file EDQ - EED data quality file SDQ - science data quality file SCI - science data file
CAMERA	Camera in use: WF (wide-field), PC (planetary)
MODE	Mode: FULL (full resol.) or AREA (2x2 pixel summation)
SERIALS	Serial clocks: ON, OFF
	Data type keywords
IMAGETYP	DARK/BIAS/INTFLAT/KSPOTS /EXTERNAL/EARTH-CAL
CDBSFILE	GENERIC/BIAS/DARK/PREF/FLAT/MASK/ATOD/NO Is the image a reference file and if yes, type is specified
	Reference file selection keywords
DATE	Date file written (dd/mm/yy)
FILTNAM1	First filter name
FILTNAM2	Second filter name; blank if none
FILTER1	First filter number (0-48) (Historical, but used in SOGS)
FILTER2	Second filter number (0-48)
PFILTER1	Preflash Filter 1 number (0-48); always 1=F122M
PFILTER2	Preflash Filter 2 number (0-48); always 47=F1083N (WF) 35=F1042M (PC)
SHUTTER	Shutter in place during preflash or INTFLAT (A, B, or Unknown)

Table 44.3: WF/PC-1 Header Keywords (Continued)

Keyword	Description
	Calibration switches
MASKCORR	Do mask correction: YES, NO, DONE
ATODCORR	Do A-to-D correction: YES, NO, DONE
BLEVCORR	Do bias level correction: YES, NO, DONE
BIASCORR	Do bias correction: YES, NO, DONE
PREFCORR	Do preflash correction: YES, NO, DONE
PURGCORR	Do purge correction—always NO
DARKCORR	Do dark correction: YES, NO, DONE
FLATCORR	Do flatfield correction: YES, NO, DONE
DOSATMAP	Output Saturated Pixel Map—always NO
DOPHOTOM	Fill photometry keywords: YES, NO, DONE
DOHISTOS	Make histograms: YES, NO, DONE
	Calibration reference files used[a]
MASKFILE	Name of the input DQF of known bad pixels
ATODFILE	Name of the A-to-D conversion file
BLEVFILE	Engineering file with extended register data
BLEVDFIL	Engineering file data quality file (DQF) name
BIASFILE	Name of the bias frame reference file
BIASDFIL	Name of the bias frame reference DQF
PREFFILE	Name of the preflash reference file
PREFDFIL	Name of the preflash reference DQF
PURGFILE	Name of the purge reference file (dummy name)
PURGDFIL	Name of the purge reference DQF (dummy name)
DARKFILE	Name of the dark reference file
DARKDFIL	Name of the dark reference DQF
FLATFILE	Name of the flatfield reference file
FLATDFIL	Name of the flatfield reference DQF
PHOTTAB	Name of the photometry calibration table
SATURATE	Data value at which saturation occurs (always 4095 for WF/PC-1, which includes the bias)

Table 44.3: WF/PC-1 Header Keywords (Continued)

Keyword	Description
	Ephemeris data
PA_V3	Position angle of V3 axis of HST
RA_SUN	Right ascension of the sun (deg)
DEC_SUN	Declination of the sun (deg)
EQNX_SUN	Equinox of the sun
	Exposure Information
WEXPODUR	Commanded duration of exposure (seconds). For exposures less than 1/2 sec, WEXPODUR is set to 0.
PREFTIME	Predicted preflash time (sec); 30 for WFC and 8 for PC
DARKTIME	Estimate of darktime (in sec)
FGSLOCK	Commanded FGS lock (FINE, COARSE, GYROS, UNKNOWN)
	Timing information
DATE-OBS	UT date of start of observation (dd/mm/yy)
TIME-OBS	UT time of start of observation (hh:mm:ss)
EXPSTART	Exposure start time (Modified Julian Date)
EXPEND	Exposure end time (Modified Julian Date)
EXPTIME	Exposure duration (seconds)
EXPFLAG	How exposure time was calculated. (NORMAL, INTERRUPTED, INCOMPLETE, EXTENDED, UNCERTAIN, INDETERMINATE, or PREDICTED)
	Proposal information
TARGNAME	Proposer's target name
RA_TARG	Right ascension of the target (deg) (J2000)
DEC_TARG	Declination of the target (deg) (J2000)

a. Calibration reference file keywords are populated even when not used.