

NICMOS File Formats

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1. Introduction

This is a quick overview of some key points about the NICMOS data formats to help the user understand and manage his or her data.

2. FITS extensions, IMSETs, etc.

NICMOS adopted the FITS image extension format for storing data instead of GEIS format (ippssoot.c0h, ippssoot.cod) used by previous HST instruments. The primary advantages are:

1. The files are machine-independent
2. Images of different data types may be stored in the same file

NICMOS observations are composed of multiple nondestructive reads of the detectors. In the case of ACCUM mode, processing is done onboard the spacecraft so that only one read is recorded¹ while target acquisitions record two reads and up to 26 reads are recorded for MULTIACCUM mode. Each of these reads, regardless of the OBSMODE used, require five image extensions to fully describe the data. A single group of these five associated image extensions is referred to as an IMSET. The components of an IMSET are as follows:

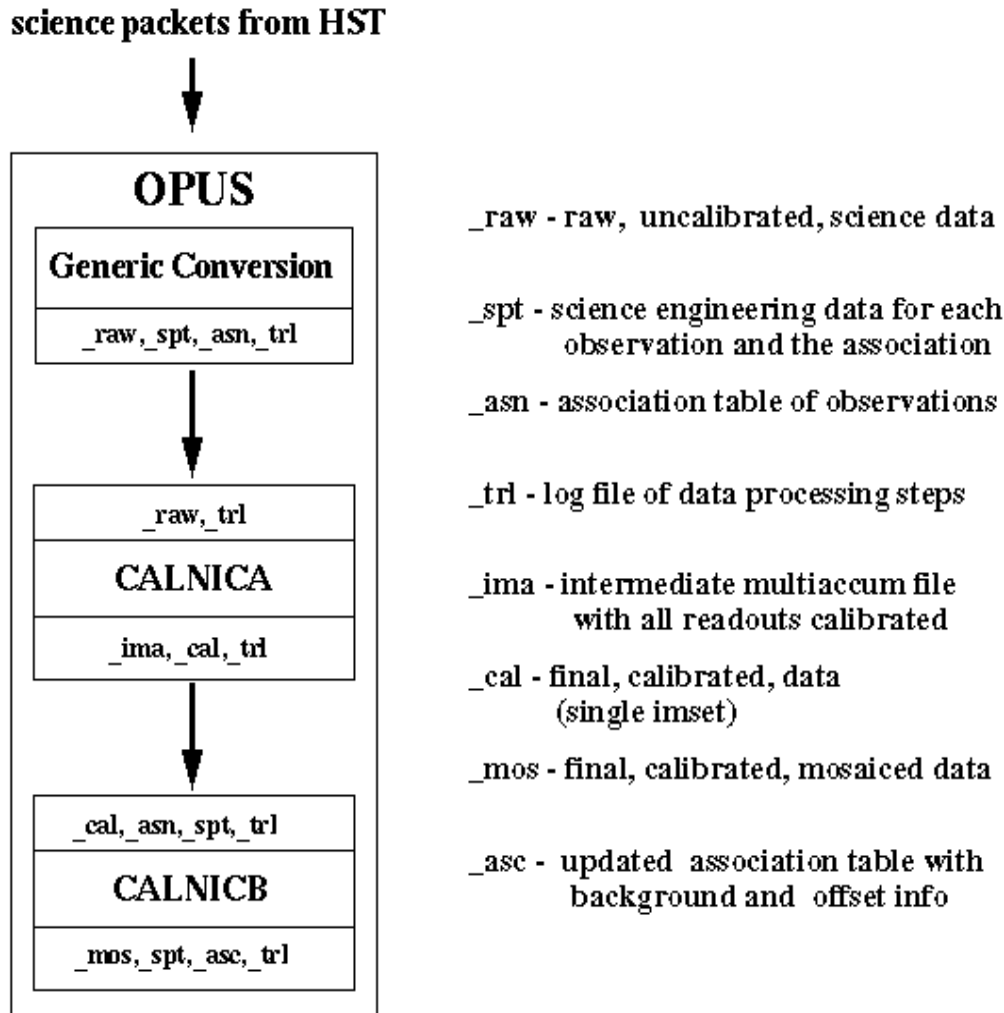
- | | | |
|----|------|---|
| 1. | SCI | science image, int*2 in raw, real*4 in calibrated |
| 2. | ERR | statistical uncertainties, null image in raw ² , real*4 in calibrated |
| 3. | DQ | data quality image, int*2, if no telemetry dropouts or reed-solomon errors in raw data then null image ² in raw file |
| 4. | SAMP | number of samples image, constant (null image ²) in raw, int*2 in calibrated |
| 5. | TIME | exposure time image, constant (null image ²) in raw, real*4 in calibrated |

¹In ACCUM mode, multiple initial and multiple final reads are averaged and differenced by the flight software to return a single image to the ground.

²In order to make files space efficient, no image is written with the image extension header if that image is a constant value. Instead, the image is described by three (3) keywords in the extension header, NPIX1, NPIX2, and PIXVALUE.

3. Calibration data flow

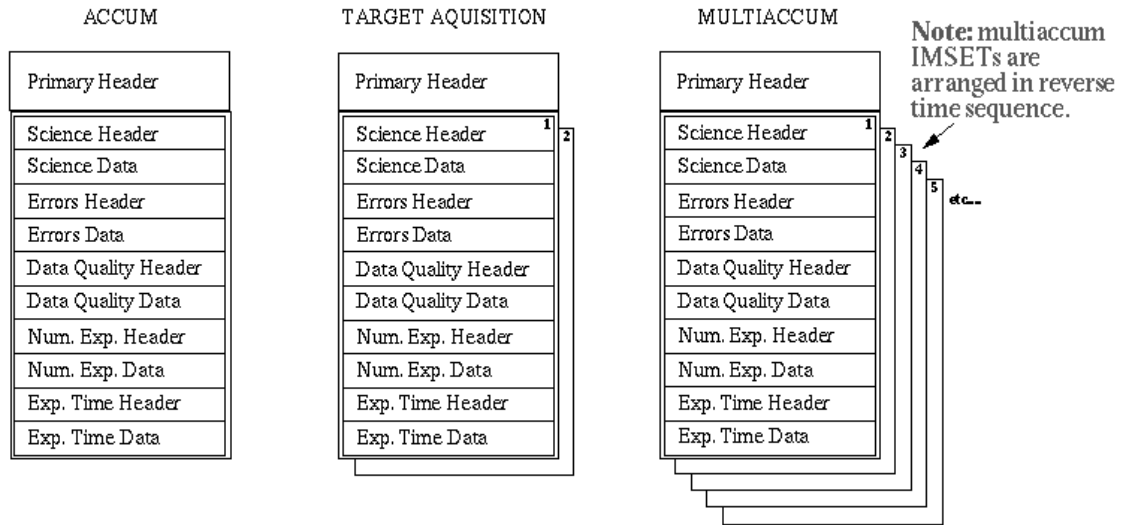
The following figure shows the flow of NICMOS data from the science packets received from HST to the final archived data products. Each FITS file name has the following format `ippssoot_ext.fits` where the “ext” part varies from file to file and describes the type of file. The different “underbar-label”s for the different file types are described in the figure.



An “association” is a grouping of several observations taken by a single command, e.g., multiple observations at a single pointing (NUMITER greater than 1) or dither patterns. These observations are bound together through the calibration process by an association table (`_asn`).

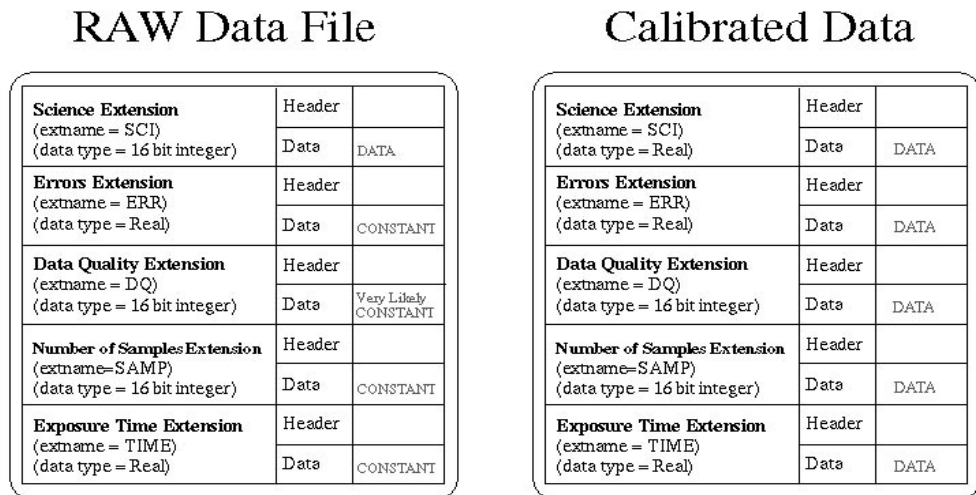
4. Raw File Formats

The raw files are the output of OPUS and are available to the PI from the STScI database. There are three raw formats, ACCUM, Target Acquisition, and MULTIACCUM. The structure of these three formats is show in the following figure:



5. Effects of Calibration

In the raw files described above, most of the extensions in each IMSET contain constant data arrays which are stored compressed. After calibration, the IMSETs will contain only uncompressed images. This difference between raw and calibrated data is illustrated in the figure below:



6. Data volume

Approximate disk file sizes of NICMOS data products.

Primary Header	0.34 Mbytes
Raw Imset	0.15 Mbytes
Calibrated Imset	0.66 Mbytes
26 read <code>_raw</code> file	4.24 Mbytes
26 read <code>_ima</code> file	17.5 Mbytes
<code>_cal</code> file	1.1 Mbytes
<code>_mos</code> file	depends on dither, could be large

7. Important Header Keywords

7.1. Primary Header

1. Target info (TARGNAME, RA_TARG, DEC_TARG)
2. Proposal info (PROPOSID, etc.)
3. Instrumental configuration info (CAMERA, APERTURE, OBSMODE, etc.)
4. CALNICA calibration reference files (DARKFILE, FLATFILE, etc.)
5. CALNICA calibration switches (DARKCORR, FLATCORR, etc.)
6. CALNICB calibration info (ILLMCORR, ILLMFILE, etc.)
7. Association keywords (ASN_ID, ASN_TAB)

7.2. Image Extension Header

1. World coordinate system (CRPIX1, CRPIX2, CRVAL1, CRVAL2, etc.)
2. Readout parameters (SAMPNUM, SAMPTIME, DELTATIM)

8. Association Tables

Below is an example of the contents of two types of association tables.

row	MEMNAME	MEMTYPE	MEMPRSNT	BKGIMAGE	MEANBKG	XOFFSET	YOFFSET
					DN	pixels	pixels
1	n3up04d2r	EXP-TARG	yes	yes	0.91	0.00	0.00
2	n3up04d3r	EXP-TARG	yes	no	INDEF	0.00	0.00
3	n3up04d5r	EXP-TARG	yes	no	INDEF	0.00	0.00
4	n3up04d7r	EXP-TARG	yes	no	INDEF	0.00	0.00
5	n3up04dar	EXP-TARG	yes	no	INDEF	0.00	0.00
6	n3up04dcr	EXP-TARG	yes	no	INDEF	0.00	0.00
7	n3up04der	EXP-TARG	yes	no	INDEF	0.00	0.00
8	n3up04020	PROD-TARG	yes	no	INDEF	INDEF	INDEF

The small rectangle encloses the columns found in an association table before CALNICB calibration, the larger rectangle encloses the columns found in an association table after CALNICB calibration