Escape the HIPE!

Herschel data, non-Herschel data, and other codes

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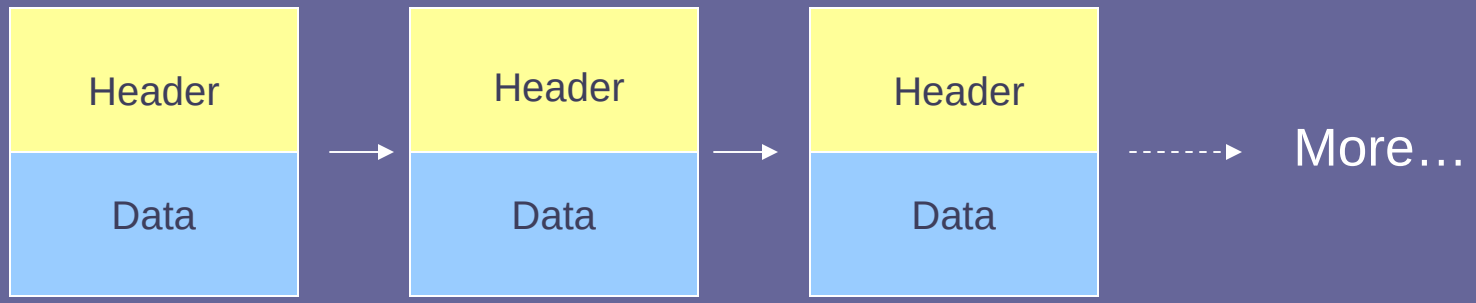
The FITS format

http://fits.gsfc.nasa.gov/fits_documentation.html

Header and Data units (HDUs)



Primary HDU

Keywords:

SIMPLE, BITPIX, NAXIS, NAXIS1,…,END

Extension 1

Keywords:

XTENSION, SIMPLE, BITPIX, NAXIS, NAXIS1, …, PCOUNT, GCOUNT, END

Extension 2

Keywords: …

Data: images, binary tables, ascii tables

IMPORTANT:

How the fits reader deals with multiple extensions is always a surprise!

Keywords

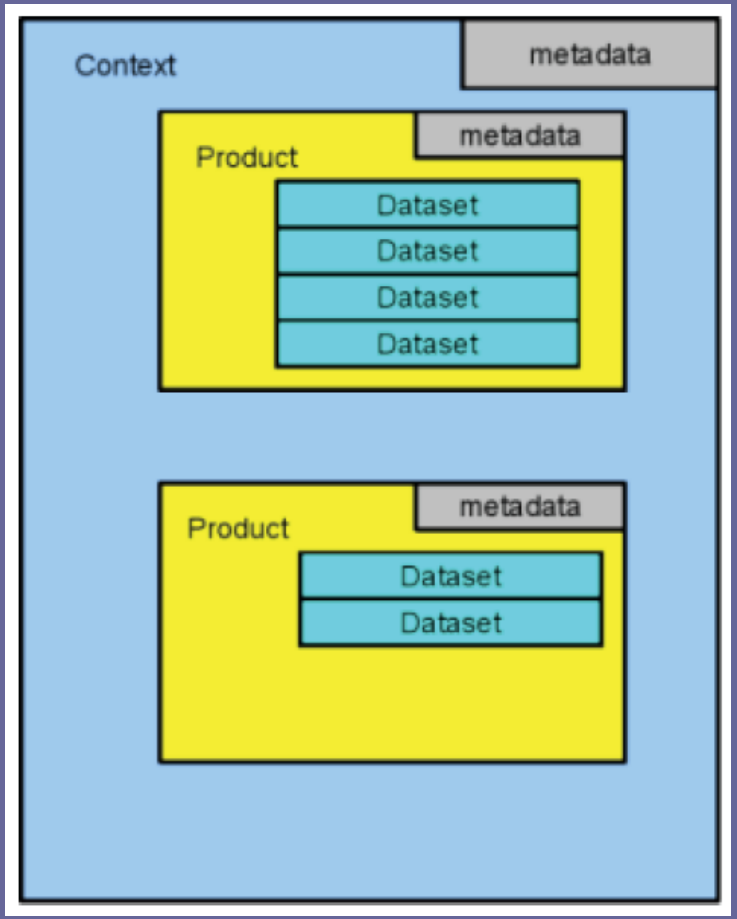
- In additional to mandatory keywords, there are optional keywords:

(blank) CROTAn EQUINOX NAXISn TBCOLn TUNITn
AUTHOR CRPIXn EXTEND OBJECT TDIMn TZEROn
BITPIX CRVALn EXTLEVEL OBSERVER TDISPn XTENSION
BLANK CTYPEn EXTNAME ORIGIN TELESCOP
BLOCKED DATAMAX EXTVER PCOUNT TFIELDS
BSCALE DATAMIN GCOUNT PSCALn TFORMn
BUNIT DATE GROUPS PTYPEn THEAP
BZERO DATE-OBS HISTORY PZEROn TNULLn
CDELTn END INSTRUME REFERENC TSCALn
COMMENT EPOCH NAXIS SIMPLE TTYPEn

There are also other, used by individual observatories

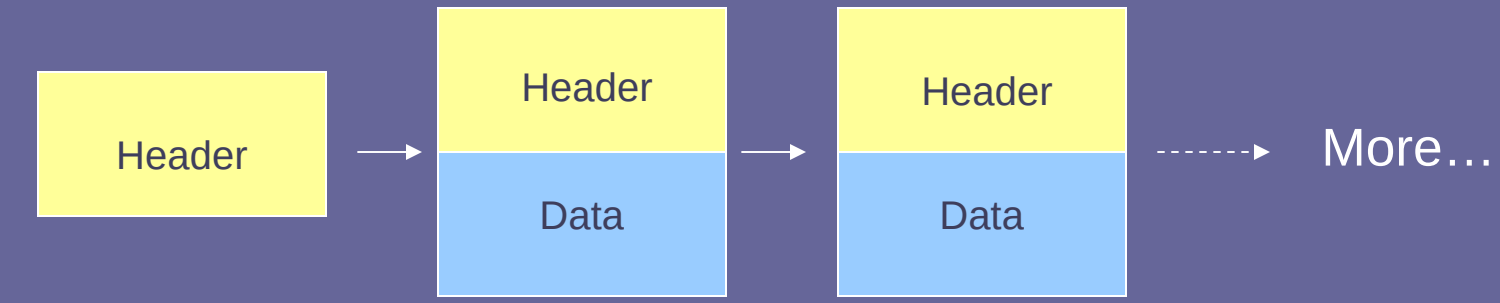
Herschel basic unit: Products

- Herschel data are stored as products. These may be images or spectra, or mixtures.
- The physical representation happens to be fits files.



Herschel Concept

The FITS format (Herschel version)



Herschel data conforms to FITS

IMPORTANT:

Some FITS readers will choke because the lack of data in the primary HDU

Inspecting FITS files

- Lowest level is IDL

Primary has no data →

```
% Compiled module: ASTROLIB.
% ASTROLIB: Astronomy Library system variables have been added
IDL> data=mrdfits('Herschel_file.fits',0,h)
MRDFITS: Null image, NAXIS=0

IDL> forprint,h
SIMPLE  =                    T / Java FITS: Mon Sep 08 17:16:13 MEST 2008
BITPIX  =                   32
NAXIS   =                    0 / Dimensionality
EXTEND  =                    T / May contain datasets
…
```

Extension does →

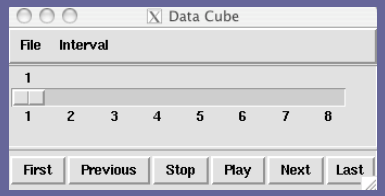
```
IDL> data=mrdfits('Herschel_file.fits',1,h)
MRDFITS: Image array (295,47)  Type=Real*8
```

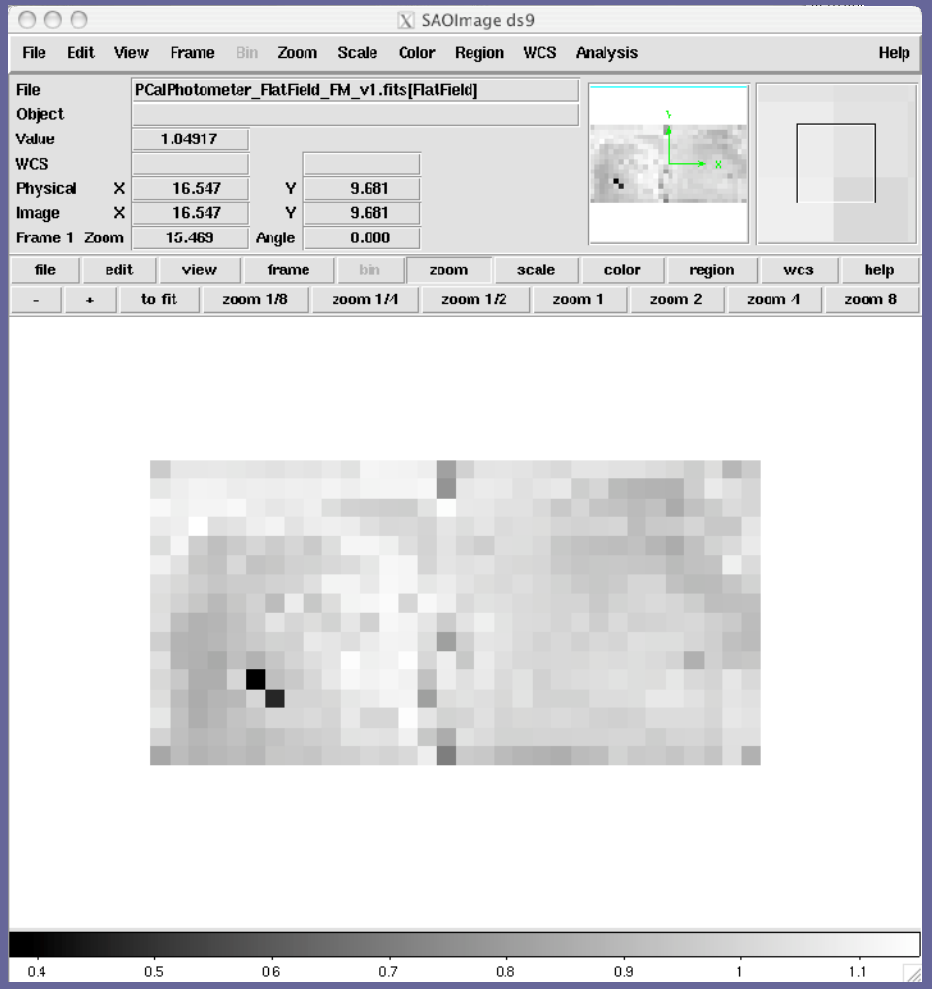
There is only one extension →

```
IDL> data=mrdfits('Herschel_file.fits',2,h)
MRDFITS: Extension past EOF
```

FITS readers and Herschel data

- ds9





Embrace the HIPE!

- HIPE can do it all. It can write images, tables, and products to fits files
- HIPE can read fits files of any type
- Downside: it takes a some learning

XTRA: Using other software within HIPE

XTRA is a Herschel software package that allows HIPE to control other pieces of software.

1. HIPE integration with TOPCAT, STILTS, SPLAT-VO, GAIA, VOSpec, and Aladin using a PLASTIC messaging server.
2. HIPE integration with XPA messaging aware software like SAOImage DS9, fv FITS viewer, etc.
3. The inclusion of applications, like SExtractor and STILTS, in Jython scripts to carry out tasks like source extraction and catalog cross-comparison.
4. XTRA import/export functions provided by the STIL Library, including the creation of FITS files and VO Tables from Herschel Products and DataSets.

XTRA Demo

FITS readers and Herschel data

- ds9: Display images, but cannot find WCS information (same as fv).
- Aladin: The lack of WCS information in the extension with the image hangs it
- Gaia: Uses WCS information from primary header
- Other: fv, FITSview, xv, etc. Try them!