The HEASARC CALDB

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The HEASARC

- Provides multi-mission archive

  - Gamma-ray, X-ray, EUV data

- Contains data for 20+ missions

- Stores and distributes mission data in FITS format

- Developed and distributes the FITSIO library for data access

The HEASARC CALDB

- Provides a framework to organize calibration data

- Provides a location for the documentation of calibration data

- Location for software

- Stores calibration data

- FTOOLS provides utilities to populate, index, and browse the CALDB

Calibration Data flow

? Stage 1

- Ground data

- Flight data

- Instrument models

   ? Basic Calibration Files (BCFs)

   - Instrument PSF
   - Gain Maps
   - Efficiency maps
   - Vignetting

Calibration Data flow cont.

- ? Stage 2
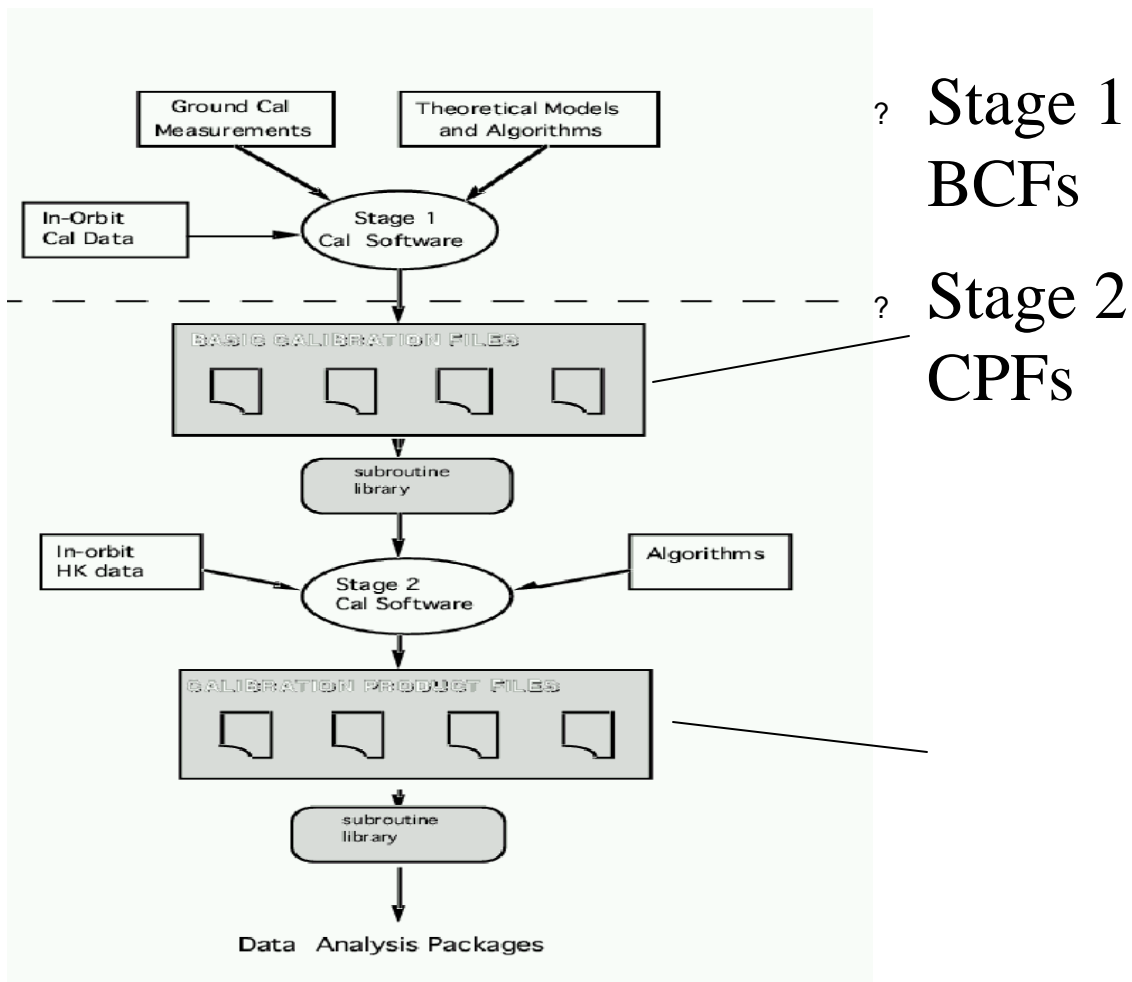 - – Stage 1 data is convolved/joined to generate Calibration Product Files (CPFs)
    - ? Along with files external to the CALDB
      - – Event data
      - – Housekeeping data
    - ? Calibration Product Files (CPFs)
      - – Instrument RMF
      - – Effective area maps
      - – Composite PSF

Calibration Data Flow cont.

? Stage 1 BCFs

? Stage 2 CPFs

BCF

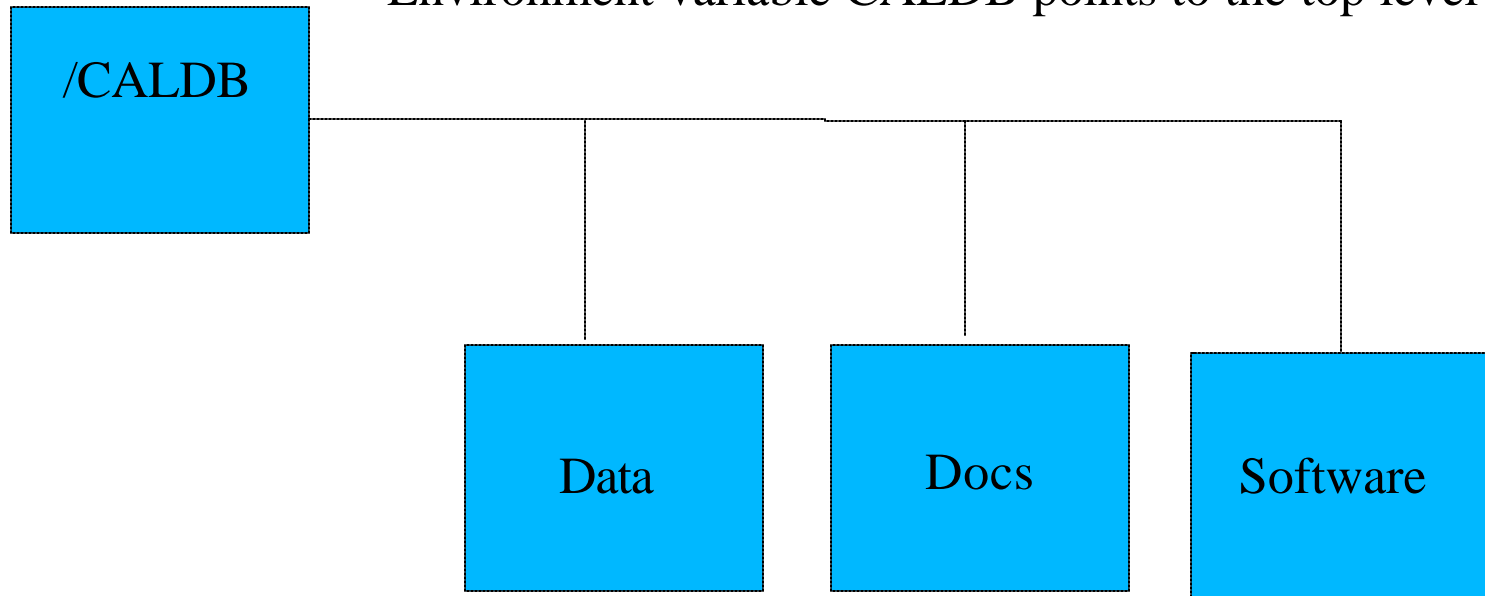- PSF as a function of energy
- dE/E
- Effective area vs energy

CPF

- *Composite PSF*
- *RMF*
- *Effective area for an observation*

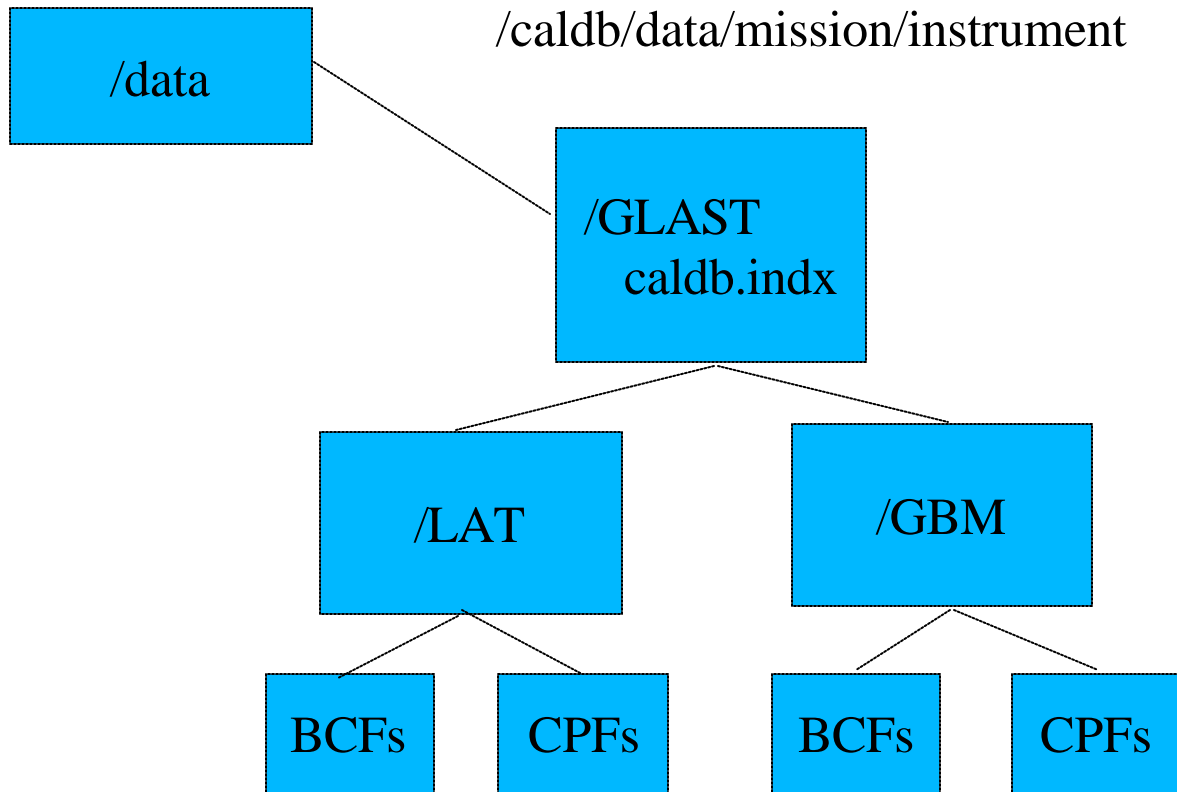# CALDB Directory Structure

Environment variable CALDB points to the top level

/CALDB

Data

Docs

Software

CALDB Directory Structure cont.

/caldb/data/mission/instrument

/data

/GLAST
caldb.indx

/LAT

/GBM

BCFs

CPFs

BCFs

CPFs

Finding files in the CALDB

? Files are found using the caldb.indx file

– Locates the file

– Contains date stamp for usage

– Contains flags for constrains

? Detector off-axis angles

? Energy range

? Temperature range

Required CALDB Keywords

Calibration File Keyword	Description	Index File Column Name
TELESCOP	The name of the satellite or mission. Allowed Values are given in OGIP/93-013	TELESCOPE
INSTRUME	Name of the instrument. Allowed values given in OGIP/93-013	INSTRUME
DETNAM	Name of the detector. Only applicable if INSTRUME value is ambiguous. Values given in OGIP/93-013	DETNAM
FILTER	Name of the filter in use, if applicable	FILTER
CCLSmmmm	HEASARC class of the calibration file (PCF, BCF, CPF, USR)	CAL_CLAS
CDTPmmmm	Distinguishes "real" (DATA) or "virtual" (TASK) calibration information	CAL_DTYP
CCNMmmmm	Contents Descriptor. See the CAL_CNAM Dictionary or Sec 4 of CAL/GEN/92-011 for defined values.	CAL_CNAM
CBDnmmmm	Parameter limits for a given calibration dataset. Syntax is defined in Section 3.2 of CAL/GEN/92-011	CAL_CBD
CVSDmmmm	Date (UTC) after which calibration dataset can be used	CAL_VSD
CVSTmmmm	Time (UTC) of day on specified CVSDmmmm after which calibration dataset can be used	CAL_VST
CDESmmmm	Descriptive summary of calibration dataset	CAL_DESC

Calibration Index File

The calibration index file, "caldb.indx", obtained has the table as shown below (this is only a part of it).

TELESCOP	INSTRUME	DETNAM	CAL_FILE	CAL_CNAM	CAL_CBD	CAL_XNO	CAL_QUAL
GLAST	LAT	FRONT	aeff_lat.fits	DETEFF	THETA(0–70.0)deg	1	0
GLAST	LAT	BACK	aeff_lat.fits	DETEFF	THETA(0–70.0)deg	2	0
GLAST	LAT	COMBINED	aeff_lat.fits	DETEFF	THETA(0–70.0)deg	3	0
GLAST	LAT	FRONT	psf_lat.fits	RPSF	THETA(0–70.0)deg	1	0
GLAST	LAT	BACK	psf_lat.fits	RPSF	THETA(0–70.0)deg	2	0
GLAST	LAT	COMBINED	psf_lat.fits	RPSF	THETA(0–70.0)deg	3	0

By using parameters found in the CIF, HEADAS and FTOOLS can locate a specific calibration data file. OGIP CALDB Access Subroutines are described in OGIP Memo (95-002) . The main FORTRAN subroutine is "gtcalf". Recently, Ziqin Pan coded it with C, and is being implemented in the HEADAS core library.

http://lheawww.gsfc.nasa.gov/~ikebe/GLAST/chart_to_xspec.html

CALDB Tools

Copy the LAT calibration files into $CALDB/data

crcif (Create an empty Calibration Index File)

udcif (Creates a new entry in a Calibration Index File)

Name of file containing dataset[psf_lat.fits] aeff_lat.fits

    Name of Calibration Index File[caldb.indx]

    Dataset: DETEFF

    Quality value for the dataset being entered[0]

    Dataset: DETEFF

    Quality value for the dataset being entered[0]

    Dataset: DETEFF

    Quality value for the dataset being entered[0]

CALDB Tools

- ? General Maintenance Utilities
    - Quzcif Returns the location of calibration files
        - ? Quzcif GLAST LAT BACK - - DETEFF 2003-07-07 00:00:00 -
        /local/data/ryu4/ikebe/PC_BACKUP/home/ikebe/GLAST/CALDB/mini_caldb/data/
        aeff_lat.fits
    - mudcif allows many datasets to be input into the CIF
    - brcaldb Browse the Caldb data holdings

```
int gtcalf(char* tele, char* instr,
        char* detnam, char* filt,
        char* codenam, char* strtdate,
        char* strtime, char* stpdate, char* stptime,
        char* expr, int* maxret, char** filenam,
        long* extno, char** online, int* nret,
        int* nfound, int* status)
```

GTCALF allows access files specified by URLs remotely, if
$CALDB == ftp://legacy.gsfc.nasa.gov/caldb

ARGUMENTS
    tele (in)   The name of the mission or telescope.
    instr (in)   The name of the instrument.
    detnam (in)   The name of the detector.
    filt (in)   The name of the filter.
    codenam (in)   The OGIP codename for the requested dataset.
    strtdate (in)   The start-date when the datasets should be valid.
    strtime (in)   The time of the day (strtdate) when the dataset should be valid.
    stpdate (in)   The end-date when the datasets should be valid.
    stptime (in)   The time of the day (in hh:mm:ss.s format) when the dataset should be valid. T
    expr (in)   A boolean expression used to select on calibration boundary parameters.
                         example: Theta.eq.10.and.energy.eq.5
    filenam (out)   A character array containing the complete system dependent path(s) to the file(s). i
    nfound (out)   The nfound argument reports the total number of datasets found during the search. w
    status (out)   The (integer) return status of the subroutine.

Remote access to the CALDB

The HEASARC CALDB can be accessed remotely eliminating the need for distributing large files

This also means that the user does not have to worry about updating their local caldb

http://heasarc.gsfc.nasa.gov/docs/heasarc/caldb/ caldb_remote_access.html

GTCALF allows remote access to files , if $CALDB == ftp://legacy.gsfc.nasa.gov/caldb

Conclusions

- CALDB allows mission data to be stored in a uniform structure

- Provides tools for accessing and updating CALDB

- Many representations are allowed as long as it can be cast into a FITS file

- Allows remote access to calibration data