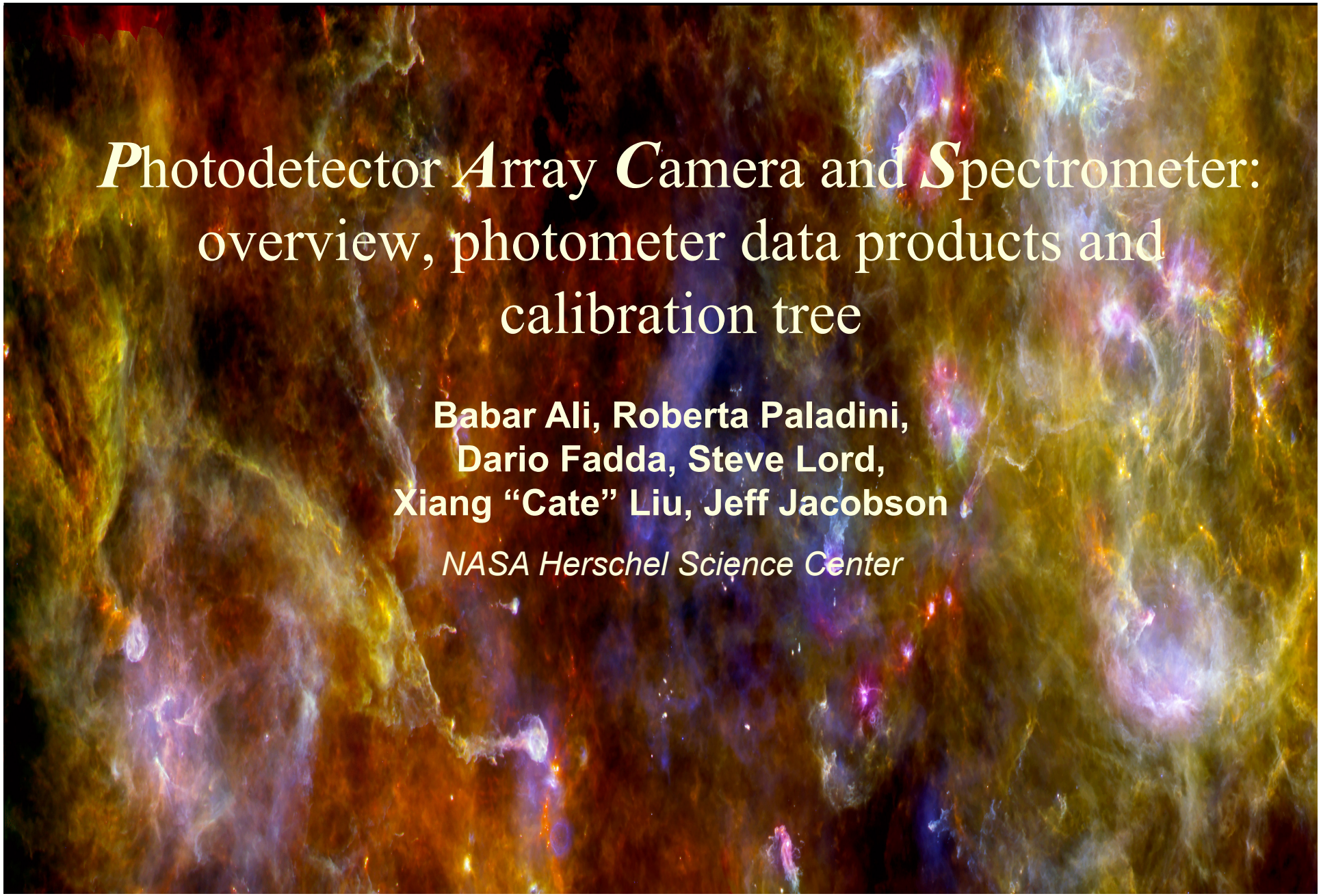

*P*hotodetector *A*rray *C*amera and *S*pectrometer: overview, photometer data products and calibration tree

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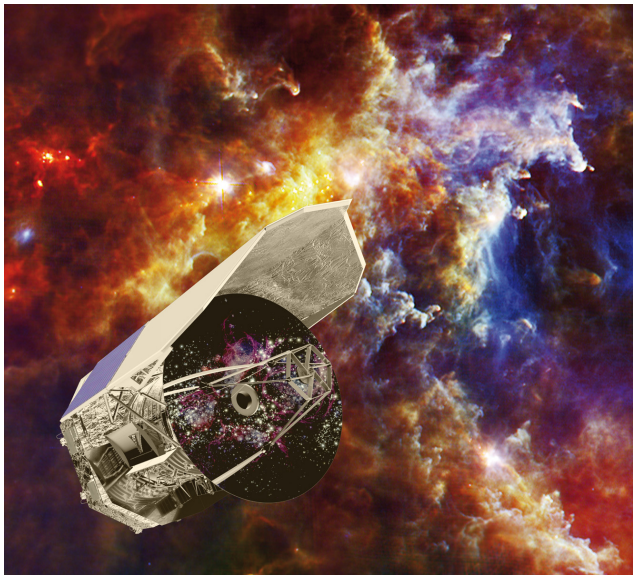
NASA Herschel Science Center

Outline

I. PACS photometer and its' observing templates

II. Photometer Products

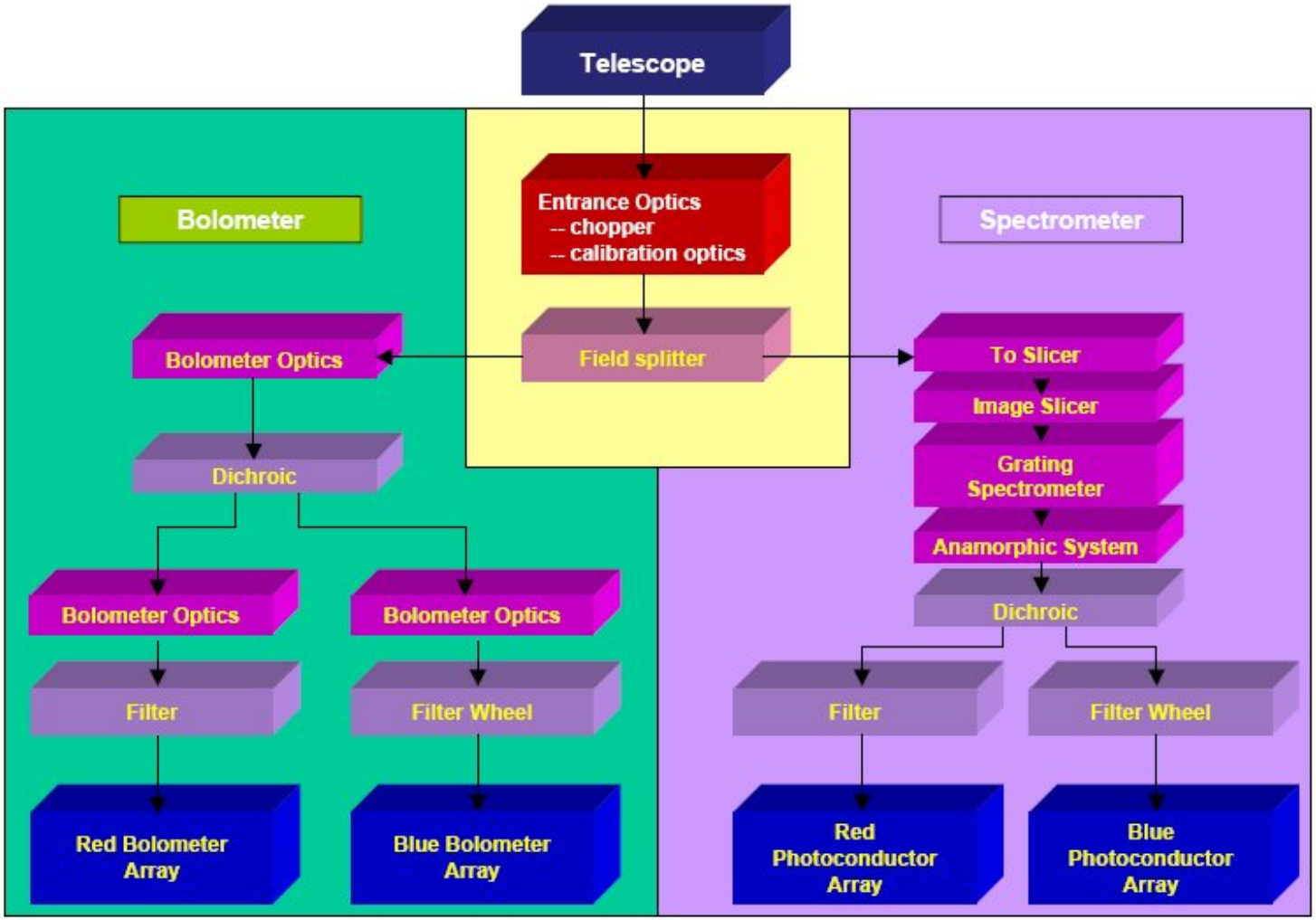
III. Calibration Products



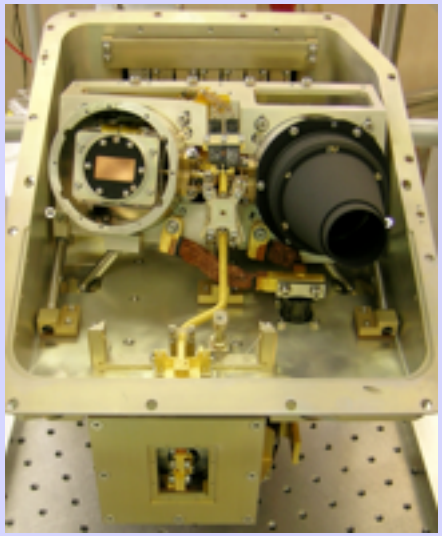
Part I

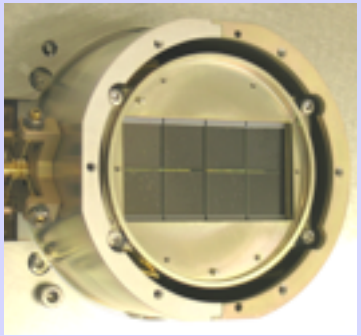
PACS photometer and AOTs

PACS is two instruments in one box



Photometer





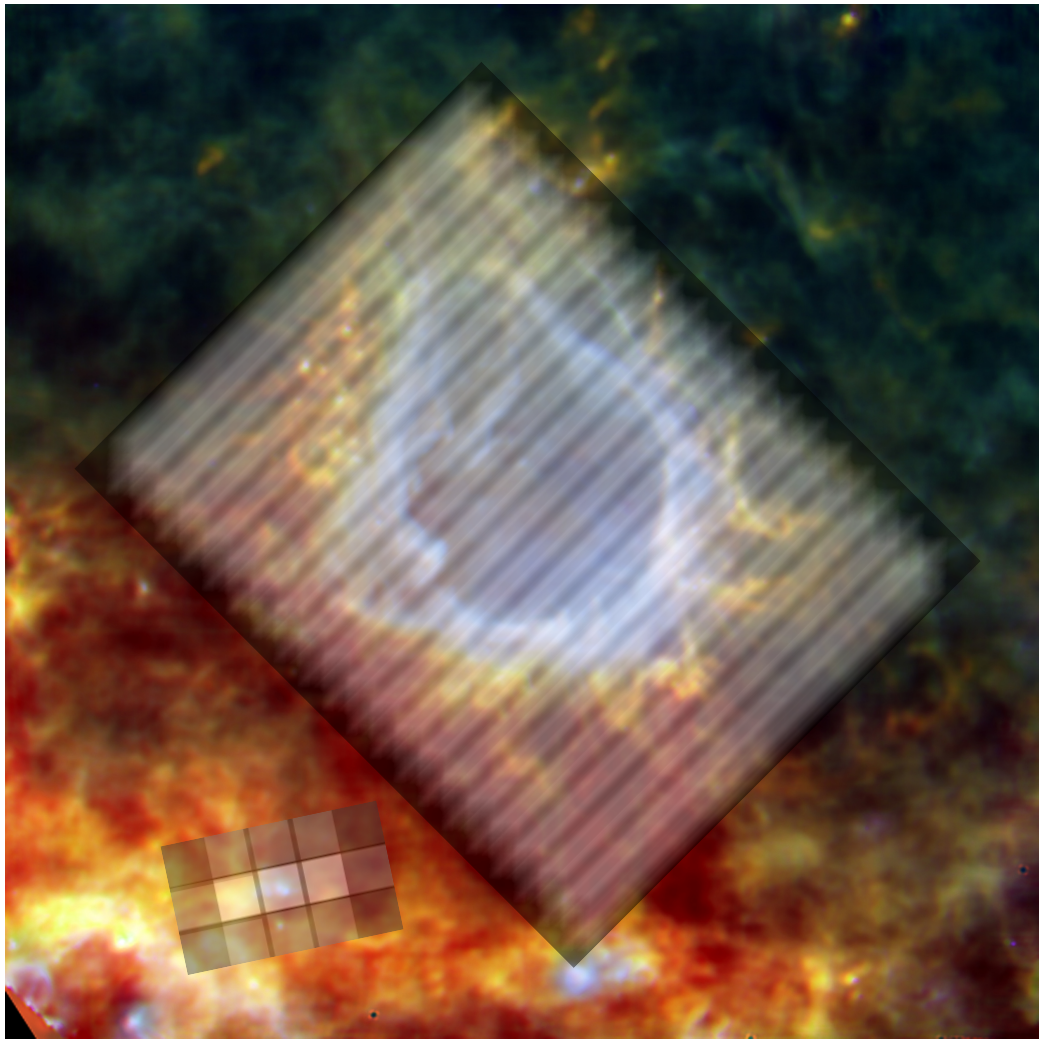
FOV 1.75 x 3.5 arcminutes^2

- **Two filled Si bolometer arrays observe blue and red channels simultaneously**
- **64x32 pixels (blue = 60-85 μm OR green = 85-130μm)**
- **32x16 pixels (red = 130-210 μm)**

Photometer AOTs

Point source photometry:

Mini scan map



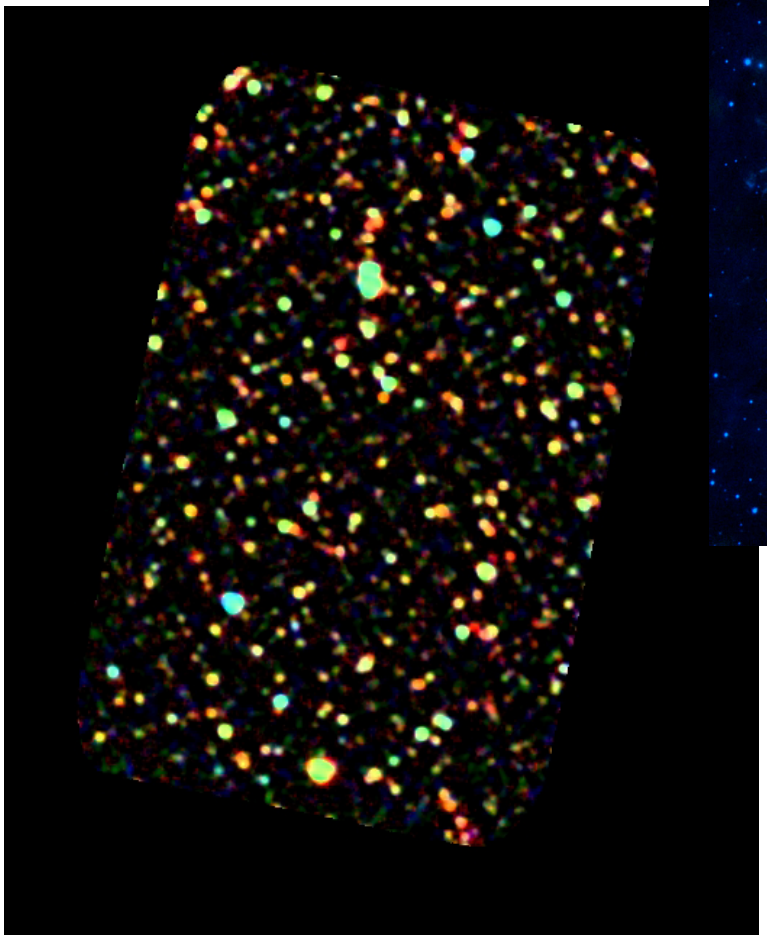
Extended source Mapping:

Scan at 20”/sec. OR 60”/sec.

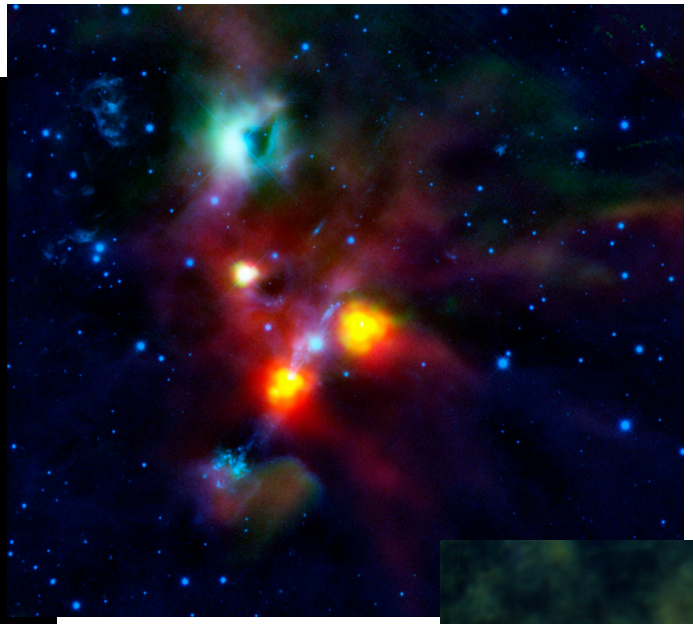
Users control map parameters.

Not confusion limits at 70 μm

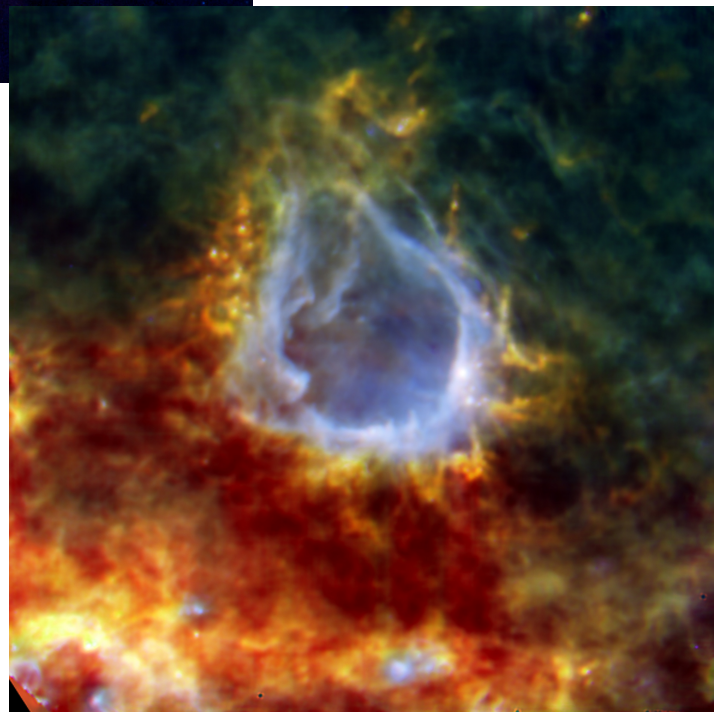
Confusion limit 0.1 and 0.7 mJy at 100 and 160 μm



PEP: Deep extra-galactic survey



HOPS Orion
HH 1-2 field



RCW 120

Part II

PACS photometer products

First there is observation context

- The observation context is a pointer to all PACS data associated with a particular observation.
- Individual observations are identified via their identifiers (OBSIDs).
- Interactive processing starts by loading the observation context first.
- Data are pulled into HIPE for processing via the observation context.
- In HIPE observation context appears as a variable.
- All PACS processed data products are linked via the observation context.

What are product levels?

- PACS pipelines save data at a few natural stopping points.
- The “level” in product level refers to the amount of processing applied to the raw signal.
- Higher levels imply more processing.
- The products at all levels are accessed in HIPE via the observation context link.

PACS product levels

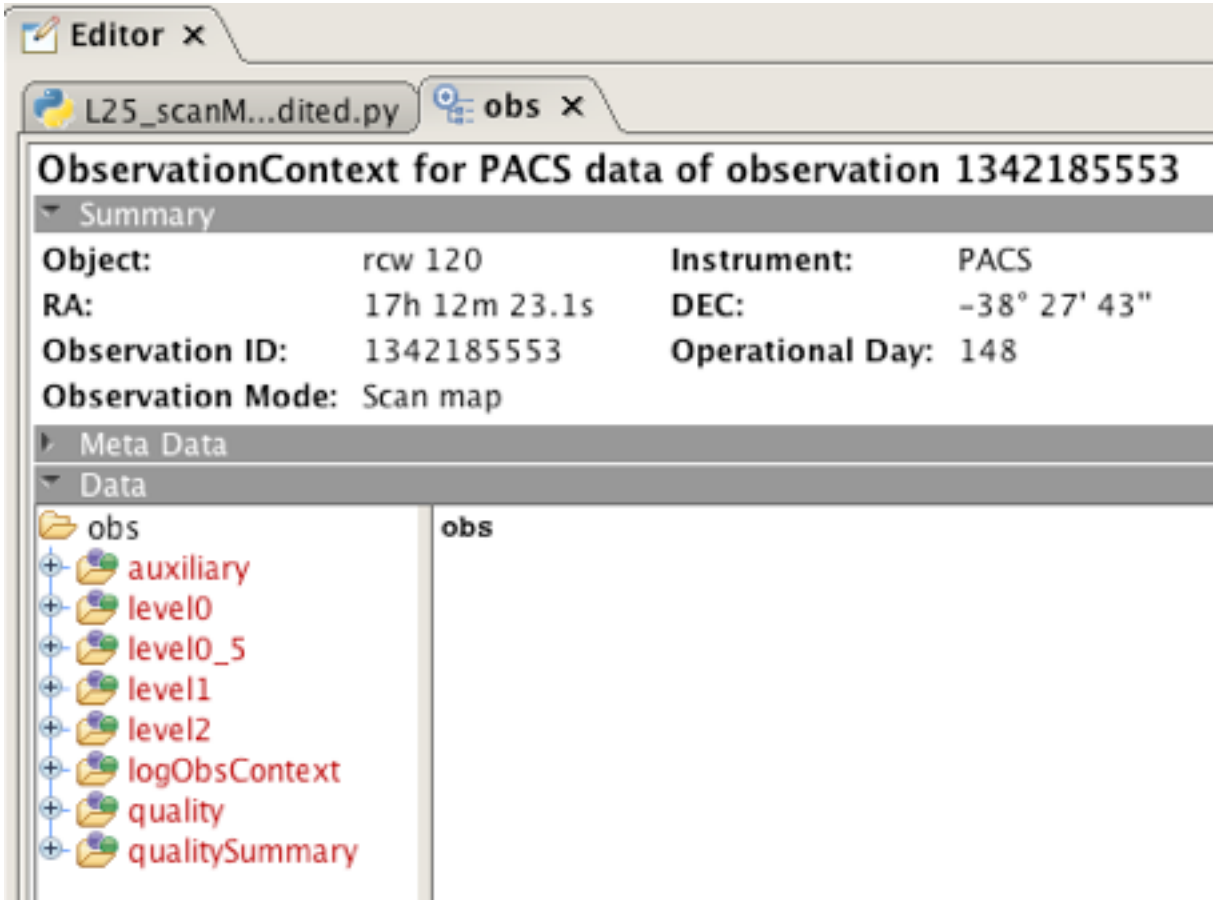
- **Level 0**: Raw signal values. Astrometry and housekeeping information is not merged.
- **Level 0.5**: Basic reorganization of data and associating housekeeping and astrometry with the signal.
- **Level 1**: Calibrated cube of PACS bolometer readouts.
- **Level 2**: Projected maps.
- **Level 2.5**: Projected maps using multiple observations. Thus far, only applicable to MADmap processing.

In addition, there are ..

- Auxilliary products, Housekeeping products and calibration products

PACS data in HIPE

- You can use the GUI aspects of HIPE to navigate though PACS data products via the observation context.



Part III

PACS photometer Calibration Files

PACS Calibration Files

- PACS processing makes frequent use of data in calibration files
  - E.g. Photometer responsivity, offset values between adjacent pixels
- The calibration tree object is used to bundle most calibration data.
  - PSFs are not included

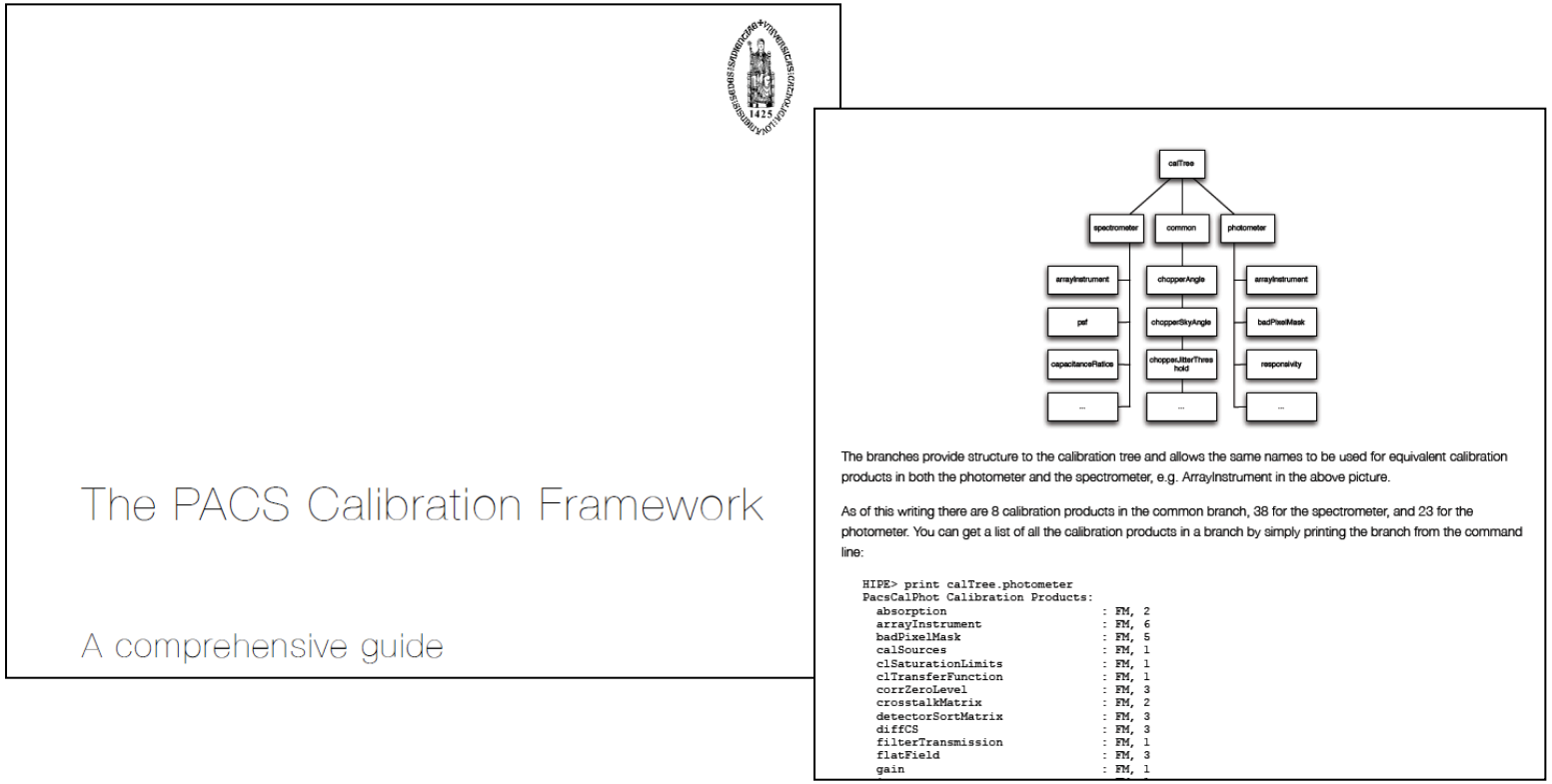
- Many names may appear cryptic ..... BUT

Console ×

```
HIPE> print caltree.photometer
PacsCalPhot Calibration Products:
  absorption                      : FM, 2
  arrayInstrument                 : FM, 6
  badPixelMask                    : FM, 5
  calSources                      : FM, 1
  clSaturationLimits              : FM, 1
  clTransferFunction              : FM, 1
  corrZeroLevel                   : FM, 3
  crosstalkMatrix                 : FM, 2
  detectorSortMatrix              : FM, 3
  diffCS                          : FM, 3
  filterTransmission              : FM, 1
  flatField                       : FM, 3
  gain                            : FM, 1
  invntt                          : FM, 1
  invnttBL                        : FM, 3
  invnttBS                        : FM, 3
  invnttRed                       : FM, 3
  masks                           : FM, 1
  noisePerPixel                   : FM, 1
  photometricStabilityThreshold   : FM, 1
  responsivity                    : FM, 5
  satLimits                       : FM, 2
  subArrayArray                   : FM, 5
  timedep                         : FM, 13
```

PACS Calibration Reference

- …. Fortunately, a detailed reference guide is available.



The PACS Calibration Framework

A comprehensive guide

The branches provide structure to the calibration tree and allows the same names to be used for equivalent calibration products in both the photometer and the spectrometer, e.g. ArrayInstrument in the above picture.

As of this writing there are 8 calibration products in the common branch, 38 for the spectrometer, and 23 for the photometer. You can get a list of all the calibration products in a branch by simply printing the branch from the command line:

```
HIPE> print calTree.photometer
PacsCalPhot Calibration Products:
  absorption                    : FM, 2
  arrayInstrument               : FM, 6
  badPixelMask                  : FM, 5
  calSources                    : FM, 1
  clSaturationLimits            : FM, 1
  clTransferFunction            : FM, 1
  corrZeroLevel                 : FM, 3
  crosstalkMatrix               : FM, 2
  detectorSortMatrix            : FM, 3
  diffCS                        : FM, 3
  filterTransmission            : FM, 1
  flatField                     : FM, 3
  gain                          : FM, 1
```

PACS Calibration Files

- The files themselves are FITS format files.
  - Access via HIPE is the only recommended way, as there is no documentation on the data organization within the FITS files
- When generated, the calibration tree object in HIPE automatically reads all calibration files in memory.
- Starting with HIPE 6.0 the status of the PACS calibration files is automatically checked and the user is prompted to update if necessary.
- Example of how to pull various PACS calibration products are provided in data reduction scripts and our FAQ page.
  - A tutorial is forth coming.