The AstroWise Tutorial

at MPE / USM

using the

Sikkema Dataset

Outline

- The Goals
- Tutorial Sessions (Organization & Material)
- Preliminary results
- User Resonance
- Problems / Wishes
- Future Work Planned

The Goals

- Introduce AstroWise to a larger group at MPE / USM
- Test the components of the AstroWise architecture
- Demonstrate that the integration of photoz with AstroWise works

The Dataset

Tutorial Data: October 2004: 170.A-0789(A) Krautter et al.

night	filter	STD	GOODS
02/10	BB#B	4	4x480s
07/10	BB#B	3	5x360s
02/10	V/89	5	5x240s
07/10	V/89	3	5x240s
09/10	V/89	4	5x240s
10/10	V/89	4	5x240s
04/10	Rc	5	5x240s
07/10	Rc	3	5x240s
09/10	Rc	4	5x240s
10/10	Rc	4	5x120s
02/10	BB#I	4	5x240s
03/10	BB#I	5	5x240s
04/10	BB#I	5	5x240s
07/10	BB#I	3	5x240s
02/10	z+	1	5x360s
07/10	z+	1	5x360s

total 5h54':

B = 64'
V = 80'
R = 70'
I = 80'
z = 60'

flatfields:

B : 3D+1T
V : 3D+2T
R : 4D+3T
I : 4D+3T
z : 3D+2T

The Tutorial Sessions - Organization

- ~ 25 people initially (8 groups, 3 people/group)
- 4 sessions with presentations
- 5 worksheets
- Additional tutored sessions

Tutorial Sessions: Topics Presented

- General introduction to AstroWise
- Bias & Flatfield Pipeline, including internal processing details
- Astrometry & Regridding, Web based processing
- Photometric & Image Pipeline

Session I: Introduction to AstroWise

- Concepts
  - Python Classes to represent Frames, Tasks, Modules
  - Object Persistence, Dependencies
  - Federated Database
  - Validity (timestamps)
- Functionality
  - AWE Prompt
  - Database queries
  - Local / Remote Processing
  - Web Tools (DPU status, CalTS)

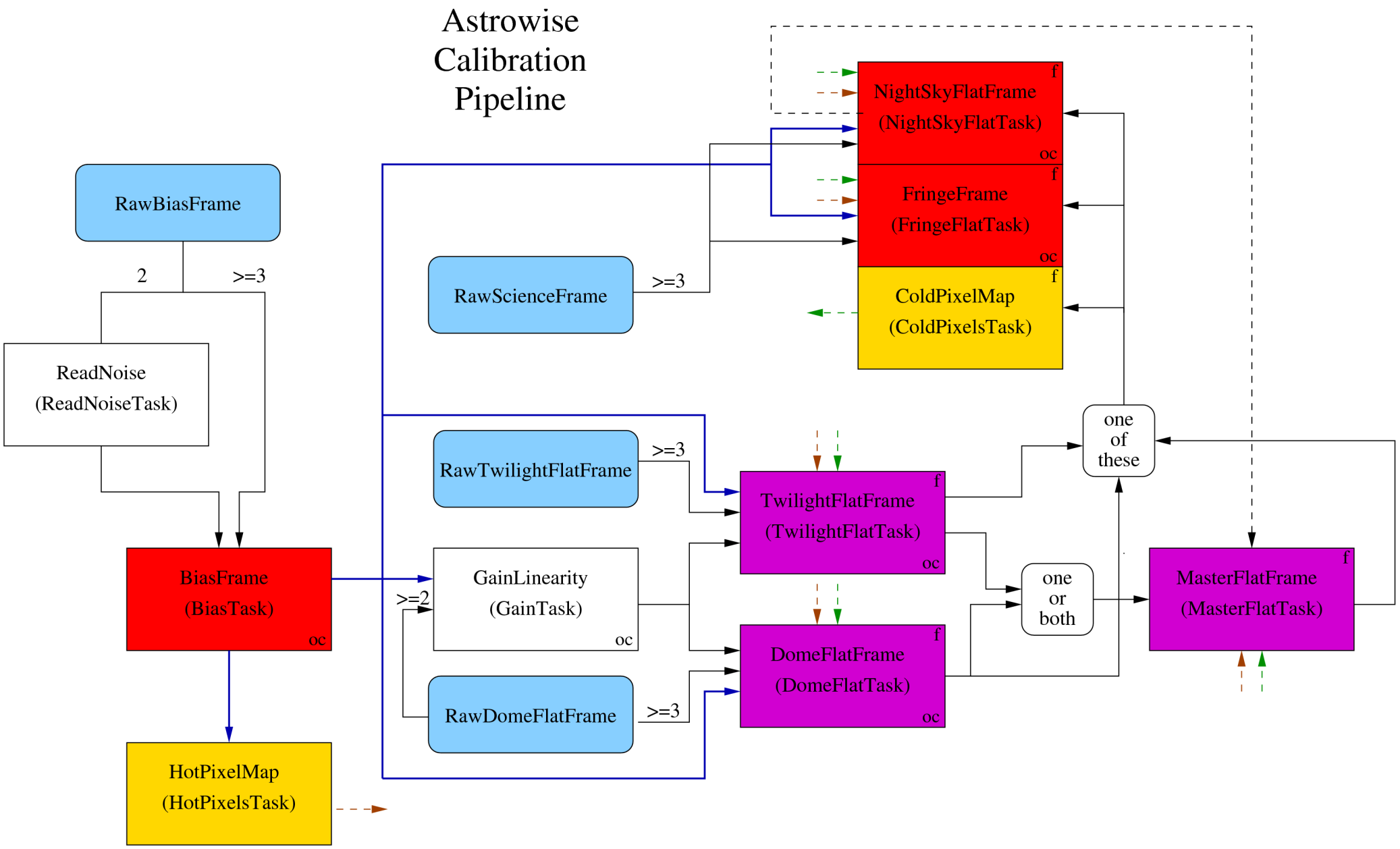
Session I: Introduction to AstroWise

- Documentation
  - AstroWise portal, HowTo's
- Worksheets
  - Bias & Flatfield Pipeline
  - Creation of Reduced Science Frame

Session II: Bias & Flatfield Pipeline

- Flowchart of Pipeline
- Internal processing steps for each object
- Statistics functions

Flowchart of Bias/Flatfield Pipeline



Internal Processing Example

ReadNoise

Requirements: RawBiasFrame (2)

make(): Take difference of images
Compute statistics iteratively (mean,median,stdev)
(MAXIMUM_ITERATIONS (5)
REJECTION_THRESHOLD (5.0))

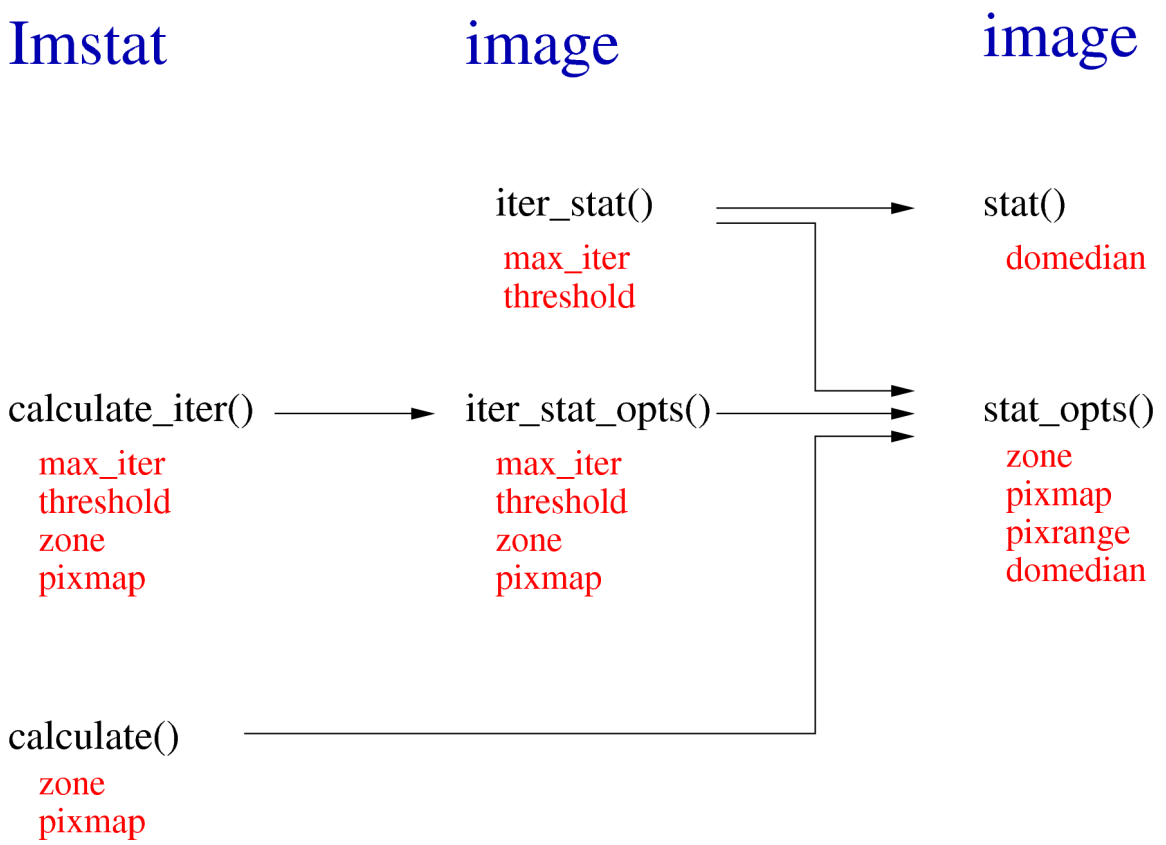
Result: readnoise = stdev / sqrt(2)
mean
median
convergence

verify(): readnoise <= MAXIMUM_READNOISE (5.0)
mean <= MAXIMUM_BIAS_DIFFERENCE (1.0)

timestamp: 1 day (derived from DATE_OBS of first raw bias frame)

Statistics

Image Statistics



Convergence for iterative statistics:
Change in stdev < 1%

Session III: Astrometry

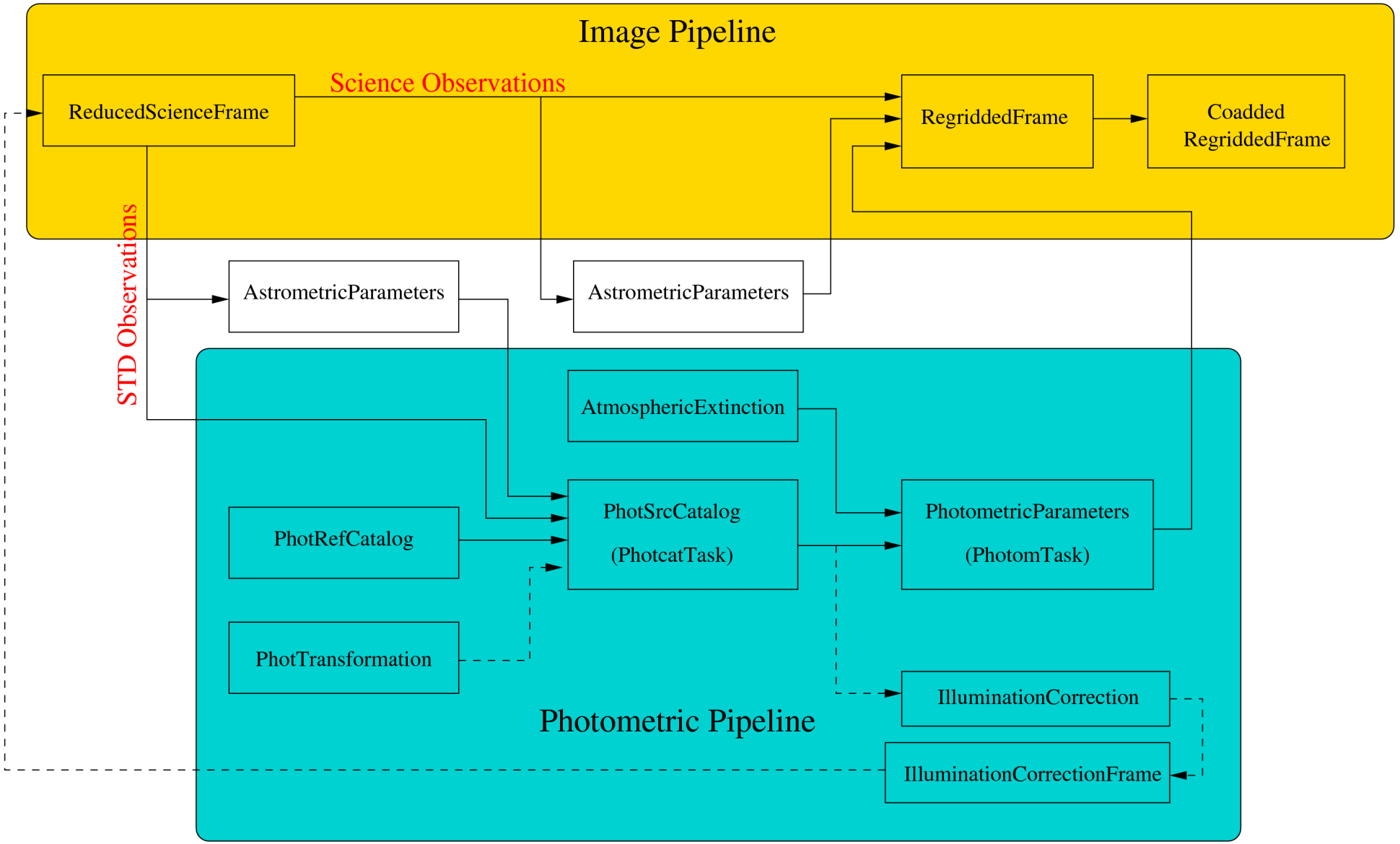
- Purpose of Astrometry
  - Determine telescope pointing uncertainty
  - Correction for non-linear effects (light path, plate mounting)
- Workhorse: LDAC tools
  - Introduced processing sequence
- Quality control: inspect(), skycat
- Problem: 0/360 deg. boundary in RA (fixed)
  - Work on equatorial STD fields only
- Worksheet: Astrometry & Regridding

Session IV: Photometry and Image Pipeline

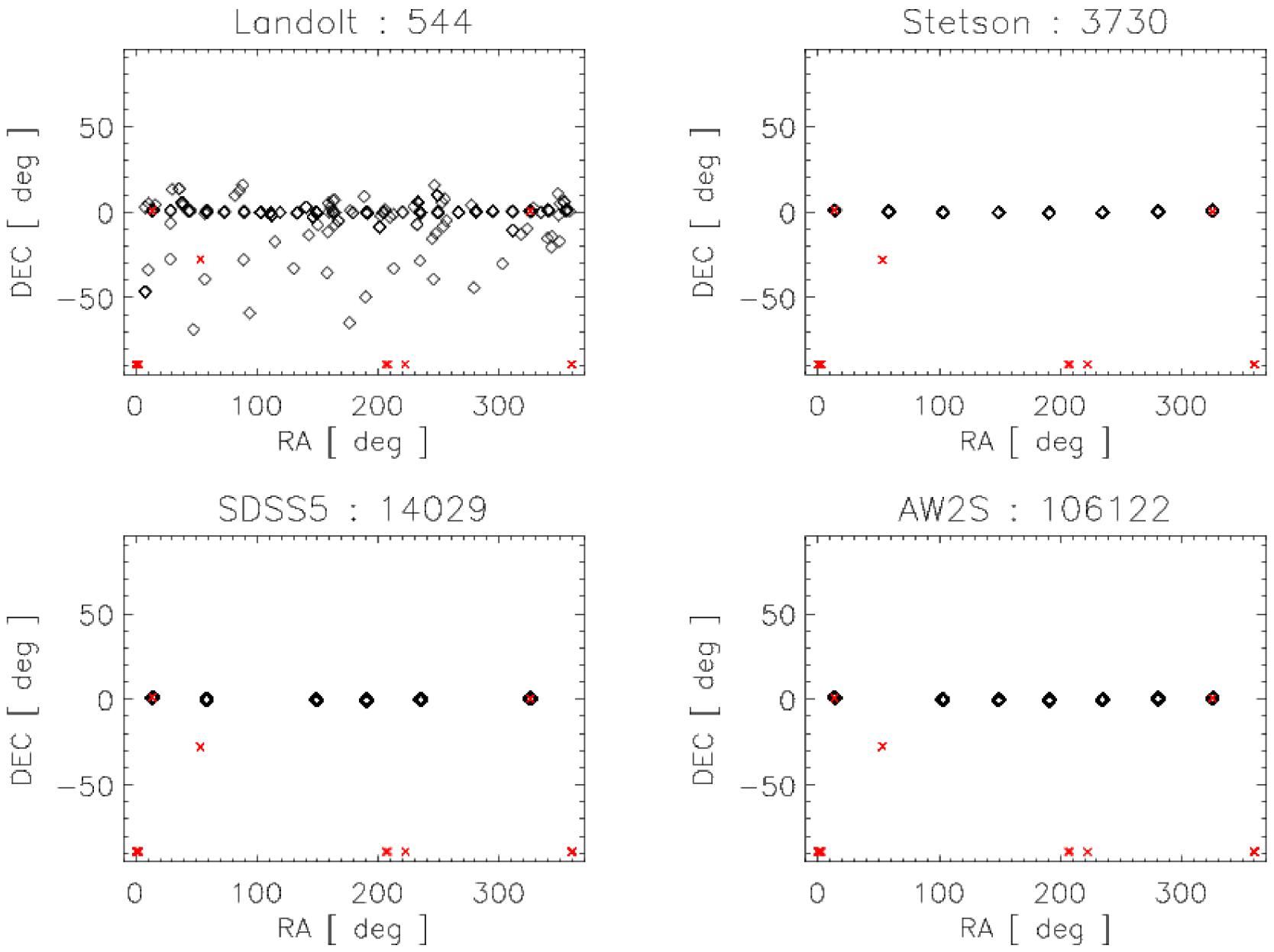
- Purpose of Photometry
  - Instrumental & apparent magnitudes
  - Raw Zeropoints (Extinction/Zeropoint)
- Flowchart of Pipelines
- Objects in Photometric Pipeline
  - PhotRefCatalog
  - PhotSrcCatalog (raw zeropoints)
  - PhotTransformation

  - Extinction Coefficients (problem!)
  - PhotometricParameters
- Worksheets:
  - photometry, regridding and coadding for the V-band
  - How to treat the Z-band

Flowchart of Pipelines



Photometric Reference Catalog (V9)



Atmospheric Extinction

AstroWise supports four ways to provide the atmospheric extinction coefficient:

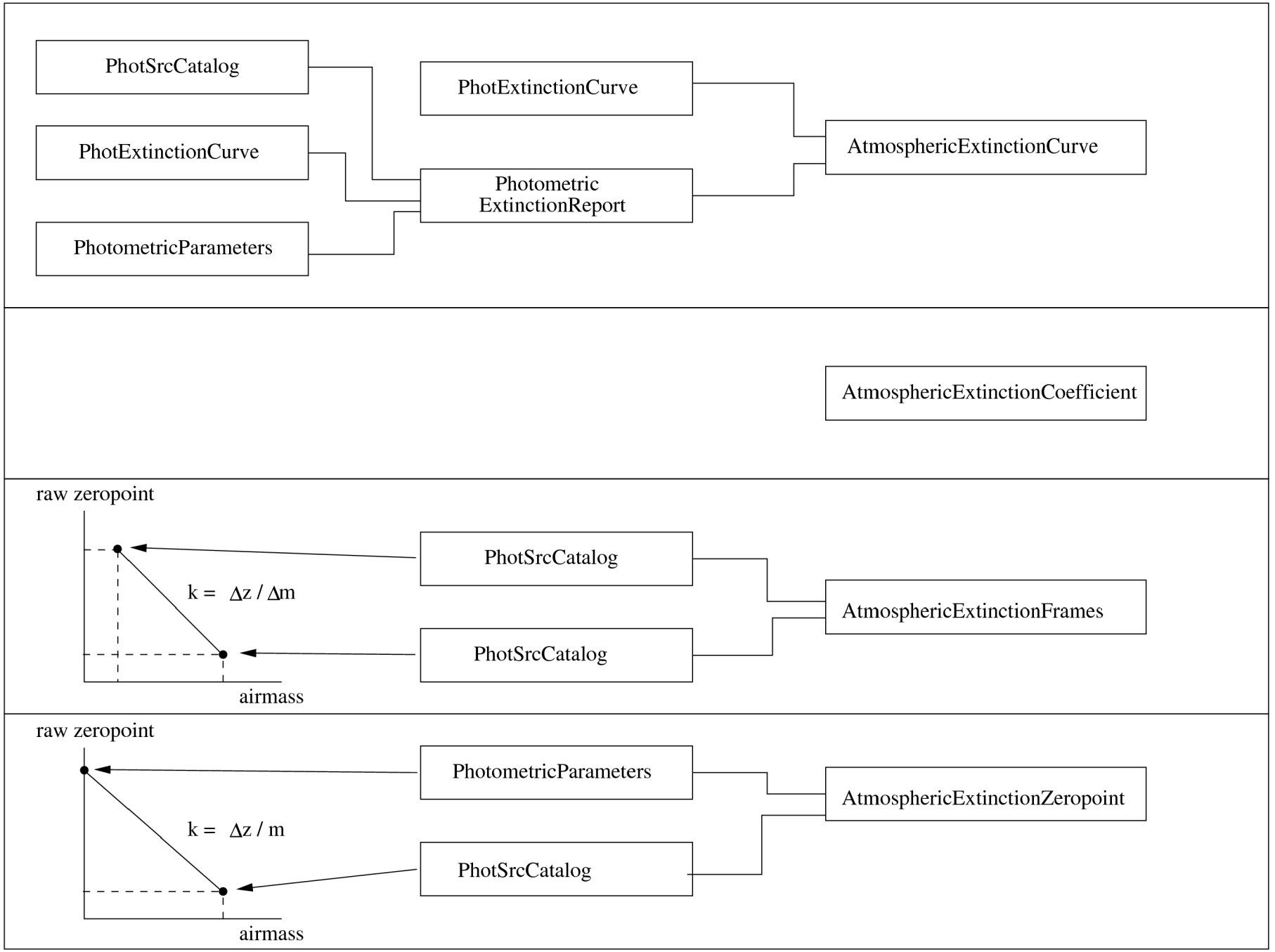
(1) Using a PhotometricExtinctionReport (OmegaCAM)

(2) Using a value stored in the database

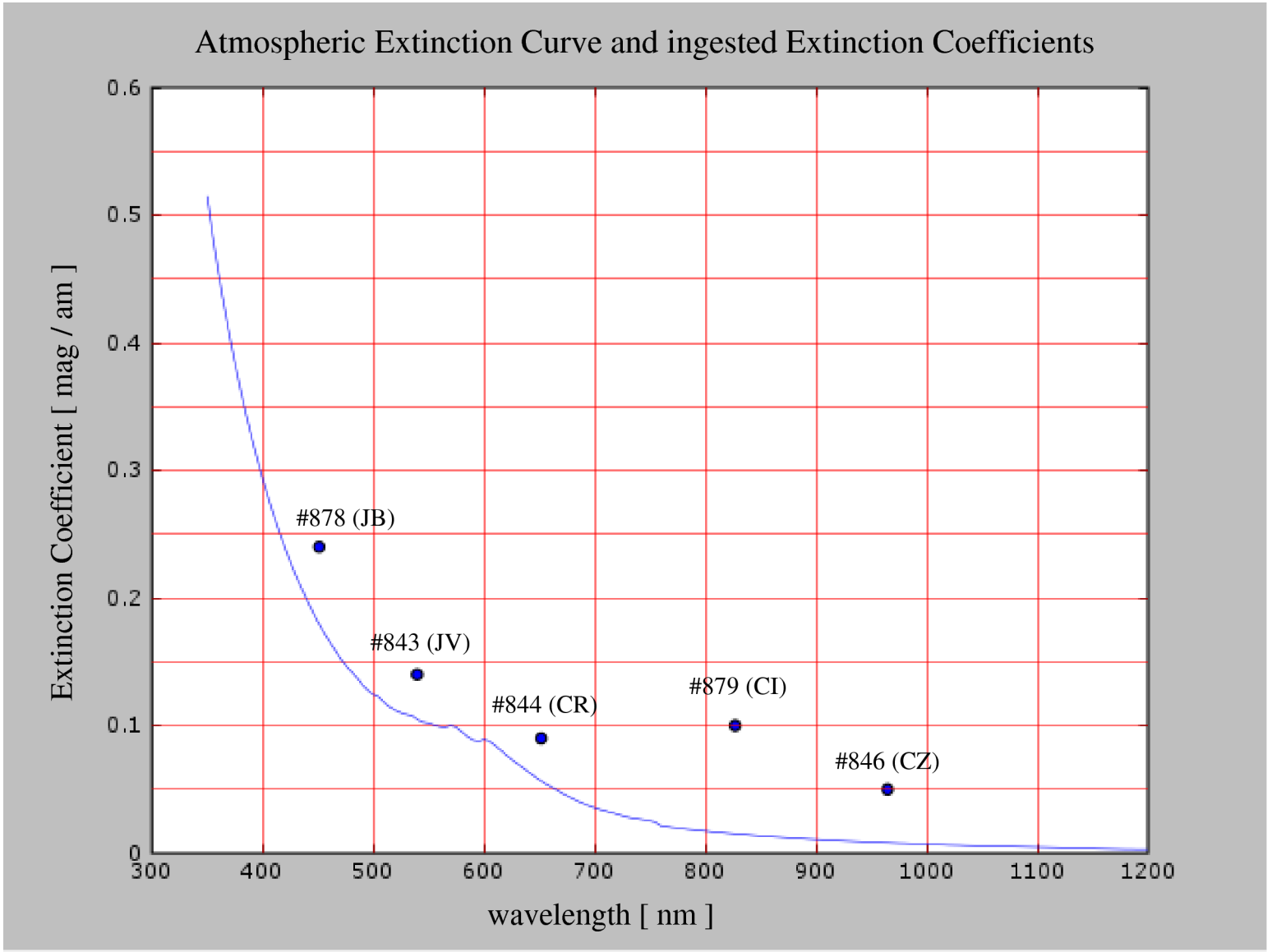
(3) Using two observations at different airmasses

(4) Using one observation and a set of known zeropoints (used primarily to derive the nightly photometric extinction report)

Atmospheric Extinction (2)



Ingested Coefficients



Photometric Parameters

Python Class: PhotometricParameters

Task:
```
task = PhotomTask( instrument = 'WFI',
                   raw_filenames = fn_list,
                   commit = 1 )
```
derives zeropoint from raw zeropoint and extinction

Data stored in PhotometricParameters:

extinct	Extinction coefficient and its error
zeropnt	Zeropoint and its error

Example of accessing the data:

```
example:  zeropoint   =   photpar.zeropnt.value
          extinct_err  =   photpar.extinct.error
```

PhotometricParameters (2)

Requires: PhotSrcCatalog;
PhotometricExtinctionReport or
AtmosphericExtinctionCoefficient

Steps performed:

- sigma-clipping of raw zeropoints:

$$\left| median(Z_{raw}) - Z_{raw} \right| < \sigma_{Zraw} * SIGCLIPLEVEL \quad (1.5)$$

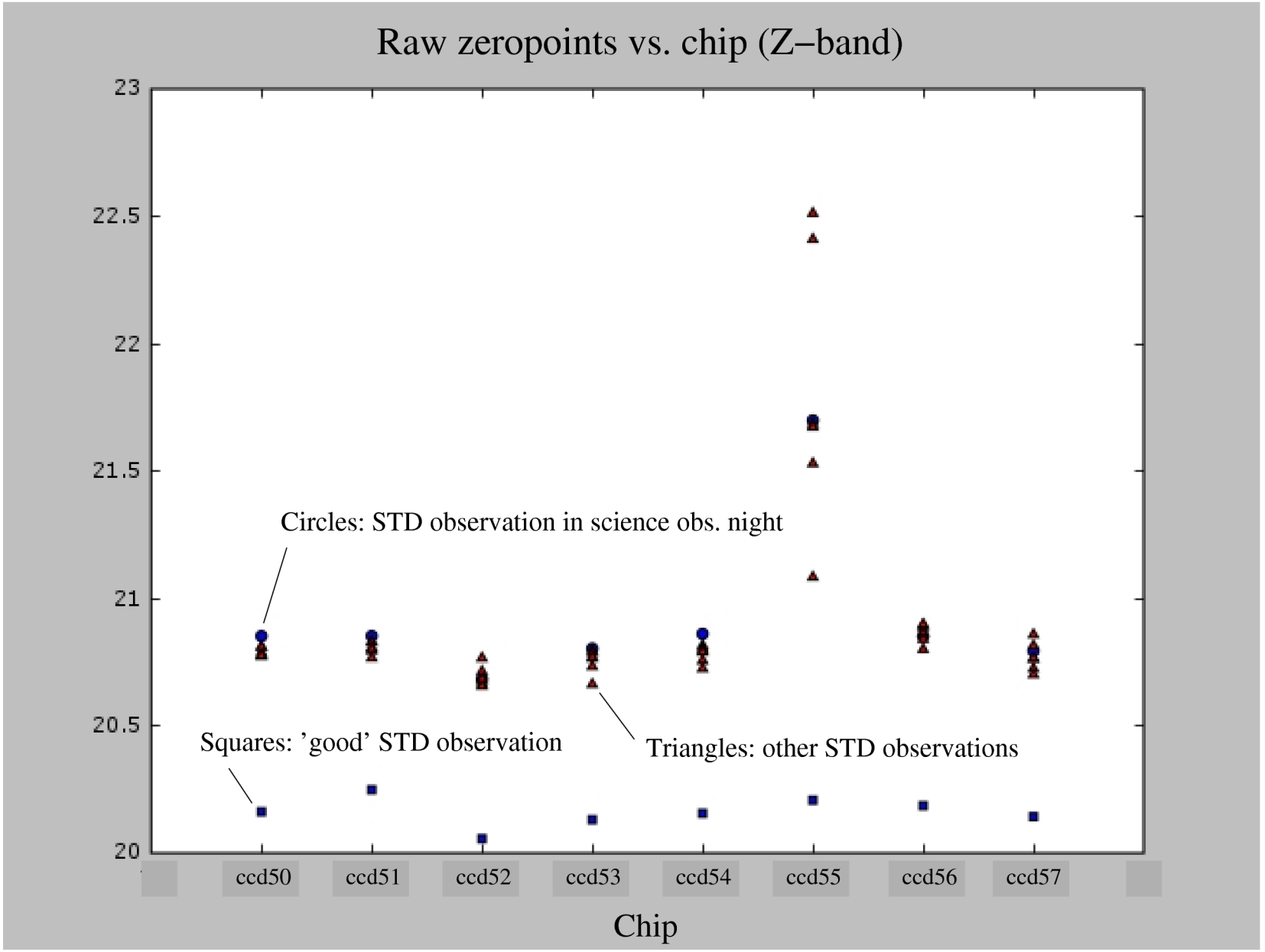
- calculate weighted mean and error

$$\overline{Z_{raw}} = \frac{\sum (Z_{raw} * weight)}{\sum (weight)} \qquad Err_{Zraw} = \sqrt{\frac{1}{\sum weight}} \qquad weight = (err_{mi}^2 + err_{ma}^2)^{-1}$$

- correct for extinction

$$Z = \overline{Z_{raw}} + \kappa * airmass \qquad Err_Z = \sqrt{Err_{Zraw}^2 + (Err_\kappa * airmass)^2}$$

Z-band: raw zeropoints



Beyond the worksheets

- Smaller group continued:
  - Created CoaddedRegridded frames for all 5 bands
  - SourceLists from (stacked) coadded frames and single regridded frames
  - photoz

Preliminary Results

- Visual inspection of coadded frames
  - Overall background very smooth, no signs of jumps (except for Z-band)
  - Astrometric Alignment very good
  - I-band (#879): strong visible fringes
  - R-band: two satellite tracks visible (**fixed**)
  - B-band: weak

Preliminary Results (2)

- SourceLists (from coadded frames)
  - Errors in flux and magnitude seem wrong
- Photoz
  - gives reasonable results with sourcelists created from regridded frames

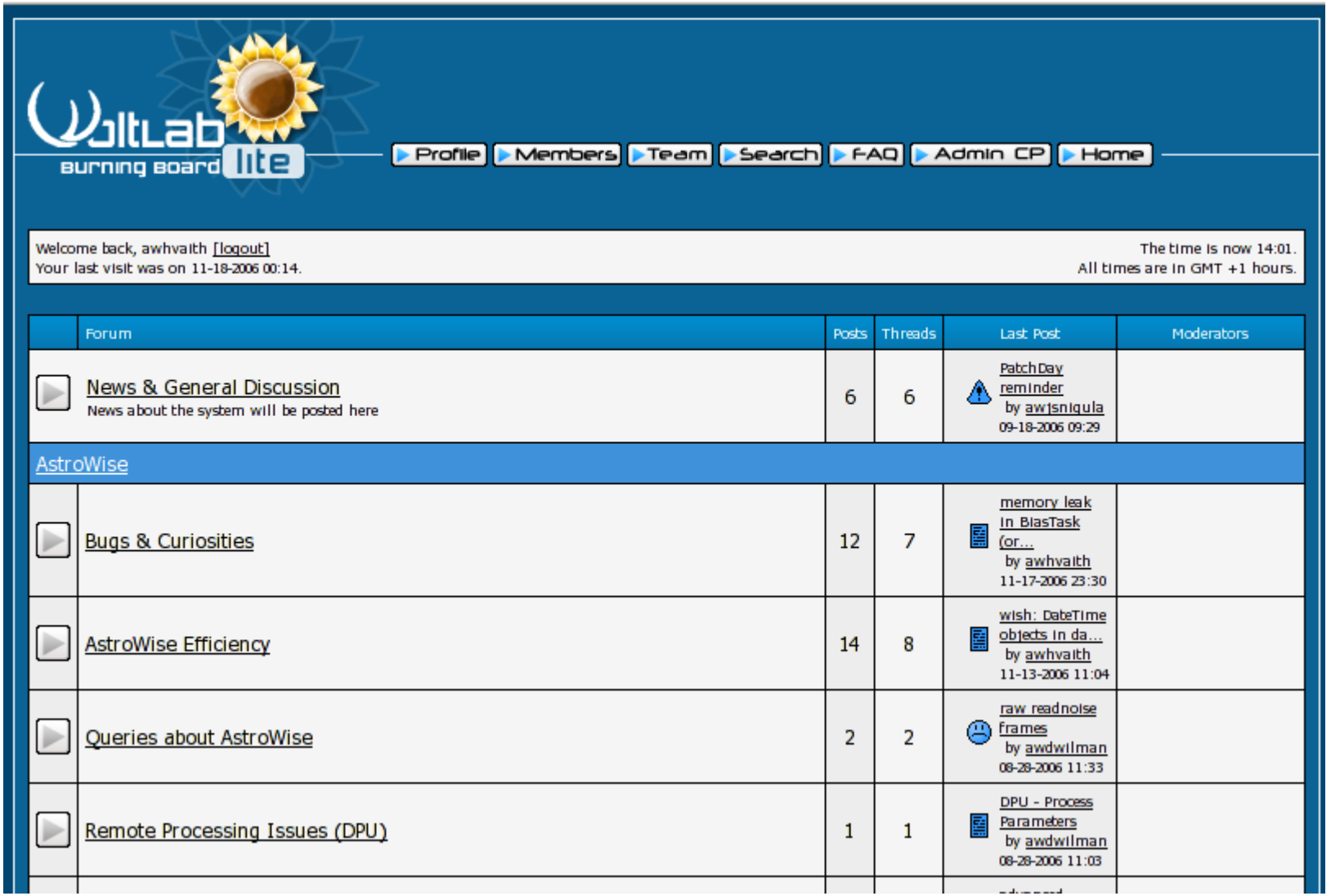
User Resonance

- AWE prompt: steep learning curve
- Wish for a graphical user interface was expressed

AstroWise Forum at MPE

- Purpose: collect bugs found, questions, wishes, ideas
- Pass on confirmed bugs to AstroWise developer team
- Collect wishes and ideas for later discussion

Screenshot of Forum Start Page



VoltLab burning board lite

Profile | Members | Team | Search | FAQ | Admin CP | Home

Welcome back, awhvaith [logout]
Your last visit was on 11-18-2006 00:14.

The time is now 14:01.
All times are in GMT +1 hours.

Forum	Posts	Threads	Last Post	Moderators
News & General Discussion News about the system will be posted here	6	6	PatchDay reminder by awjsniqula 09-18-2006 09:29	
AstroWise				
Bugs & Curiosities	12	7	memory leak in BiasTask (or... by awhvaith 11-17-2006 23:30	
AstroWise Efficiency	14	8	wish: DateTime objects in da... by awhvaith 11-13-2006 11:04	
Queries about AstroWise	2	2	raw readnoise frames by awdwilman 08-28-2006 11:33	
Remote Processing Issues (DPU)	1	1	DPU - Process Parameters by awdwilman 08-28-2006 11:03	

Problems / Issues / Wishes

- Data specific
  - Bad seeing conditions during night 7-Oct-2004
  - CCD gain is low in Z-band --> shallow exposures
- AstroWise specific
  - ReadNoiseTask takes any raw bias frame
  - ReduceTask: wants filter-dependent ColdPixelMaps
  - ReduceTask: stores some files twice (weight,saturated,satellite)
  - PhotRefCatalog: no polar stars (at the moment)
  - Various Memory leaks

Problems / Issues / Wishes (2)

- AstroWise specific (continued)
  - Some satellite tracks not detected (**fixed**)
  - Astrometry: preastrom failed at RA=0/360 (**fixed**)
  - Increase in psf radius (>25%) during regridding of some reduced science frames
  - Some unrepeatable weird behaviour (chip attribute not set in regridded frames; filter.name contains instrument name
- Minor issues
  - copy_attributes() of SatelliteMap does not copy the chip attribute

Wishes (Usability Issues)

- Running several awe sessions from same directory can result in crashes (default filenames like sex.cat, sex.conf)
- Allow strings for DateTime objects in database queries

Future Work

- Transition from tutored sessions to forming task forces
- Examine differences in results of the individual groups
- Test astrometrical and photometrical accuracy
  - Compare with existing independent GOODS catalogue
- Investigate problem with flux errors

Future Work (2)

- Work on improvements:
  - Astrometry: Global Astrometry
  - Flatfielding: NightSkyFlat
  - Fringing correction
  - Photometry: Illumination correction
  - Photometric transformations (Colour terms)