Data processing and calibration

Early Data Release and Scientific Exploitation of the J-PLUS Survey

October, 2nd 2017

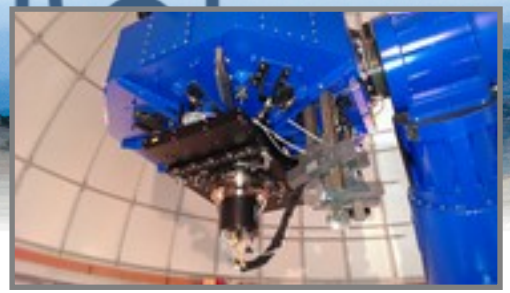
David Cristóbal-Hornillos & UPAD team
CEFCA

FONDO DE INVERSIONES DE TERUEL
GOBIERNO DE ARAGON
GOBIERNO DE ESPANA MINISTERIO DE ECONOMIA Y COMPETITIVIDAD
UNIÓN EUROPEA
Infraestructura cofinanciada por el Fondo Europeo de Desarrollo Regional

Outline

- UPAD infrastucture for data handling
- Data processing software
  - Pipelines
  - Treatment of the data
- Data publication: EDAM

Data handling

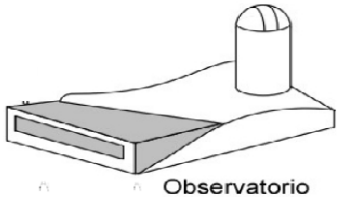


- Image acquistion
- Internal raw data publication

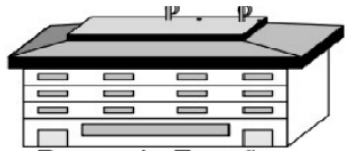
- Holds the 2 latest releases of the Science DBs
- Provides data access to the products
- Web services

EDAM

after acq



Observatorio Astronómico de Javalambre



Banco de España

Astronómico de Javalambre

DR

OAJ-CPD

- Handle data transference
- Do a quick data processing for QC.

after acq

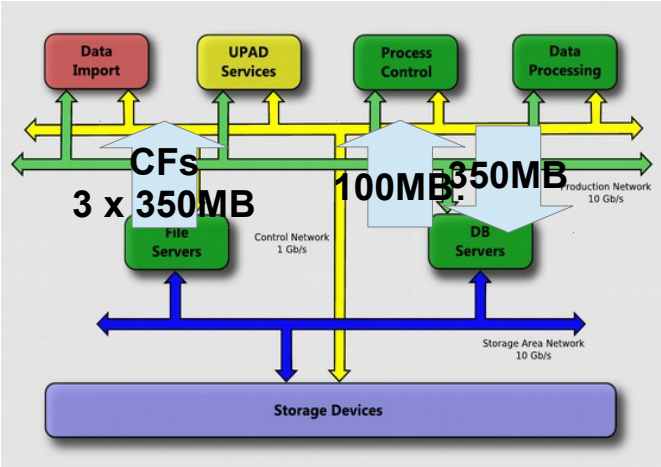
UPAD

- Archive data
- Process the data
- Store permanent copies of products, catalogs, DB

Data processing pipeline

Designed for the treatment of the images collected at the OAJ telescopes.

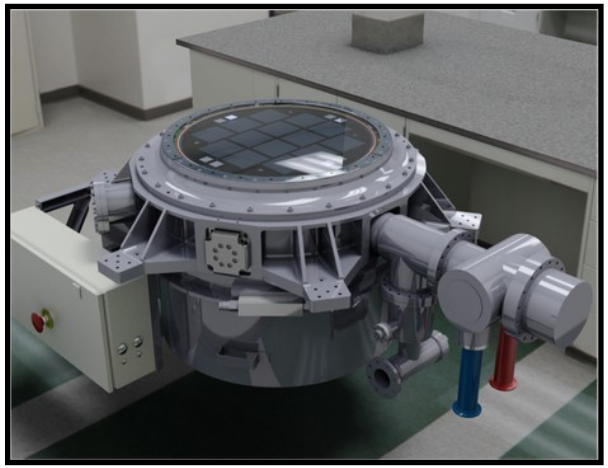
- J-PLUS & J-PAS.
- Open time projects.

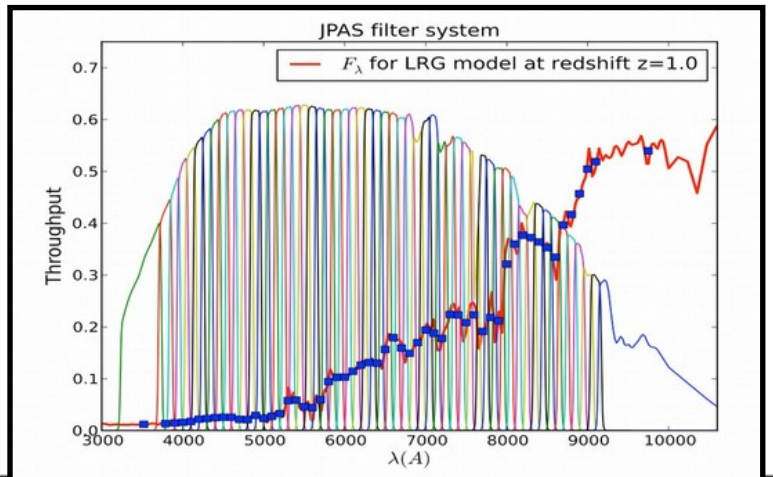


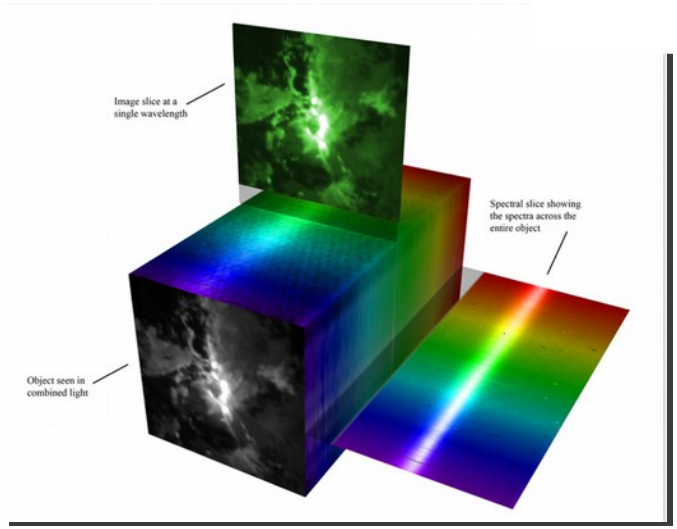
Main challenges:

- Large number of images collected by different telescopes.
- Large Field of View instruments
- Large volume of information (> 6 x 10^8 sources, >1400 properties .
- In ~ 100 different physical filters from 3500 to 9000A.
- Through varying atmospheric conditions.
- Acquired for different projects

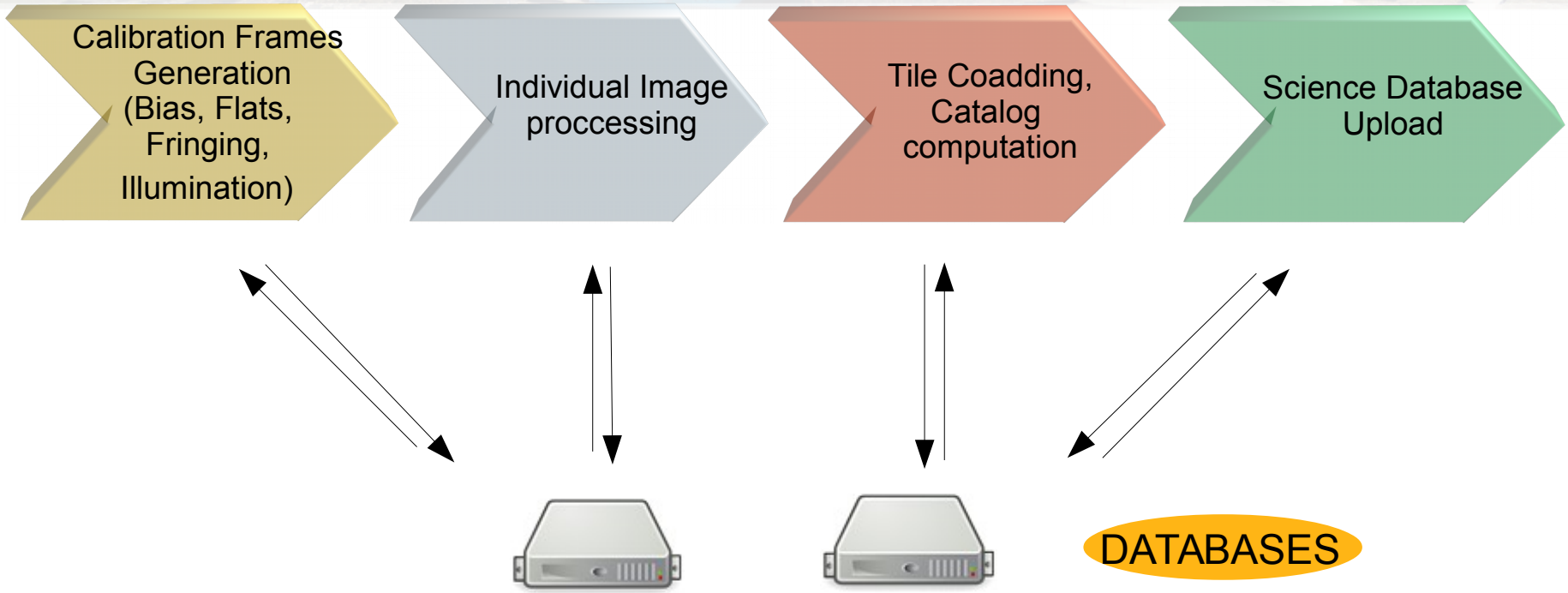
- Control the processing history of each image.
- Manage versions, data releases.







Data processing pipeline



- The process flow – job submission it is controlled by a database.
- The pipelines store in database the operations done over the images.
- The information in DB is used to trigger further steps in the process.
- The DB contains the status and processing history of each image.

Data processing pipeline
Job handling

Calibration Frames Generation

Individual Image proccessing

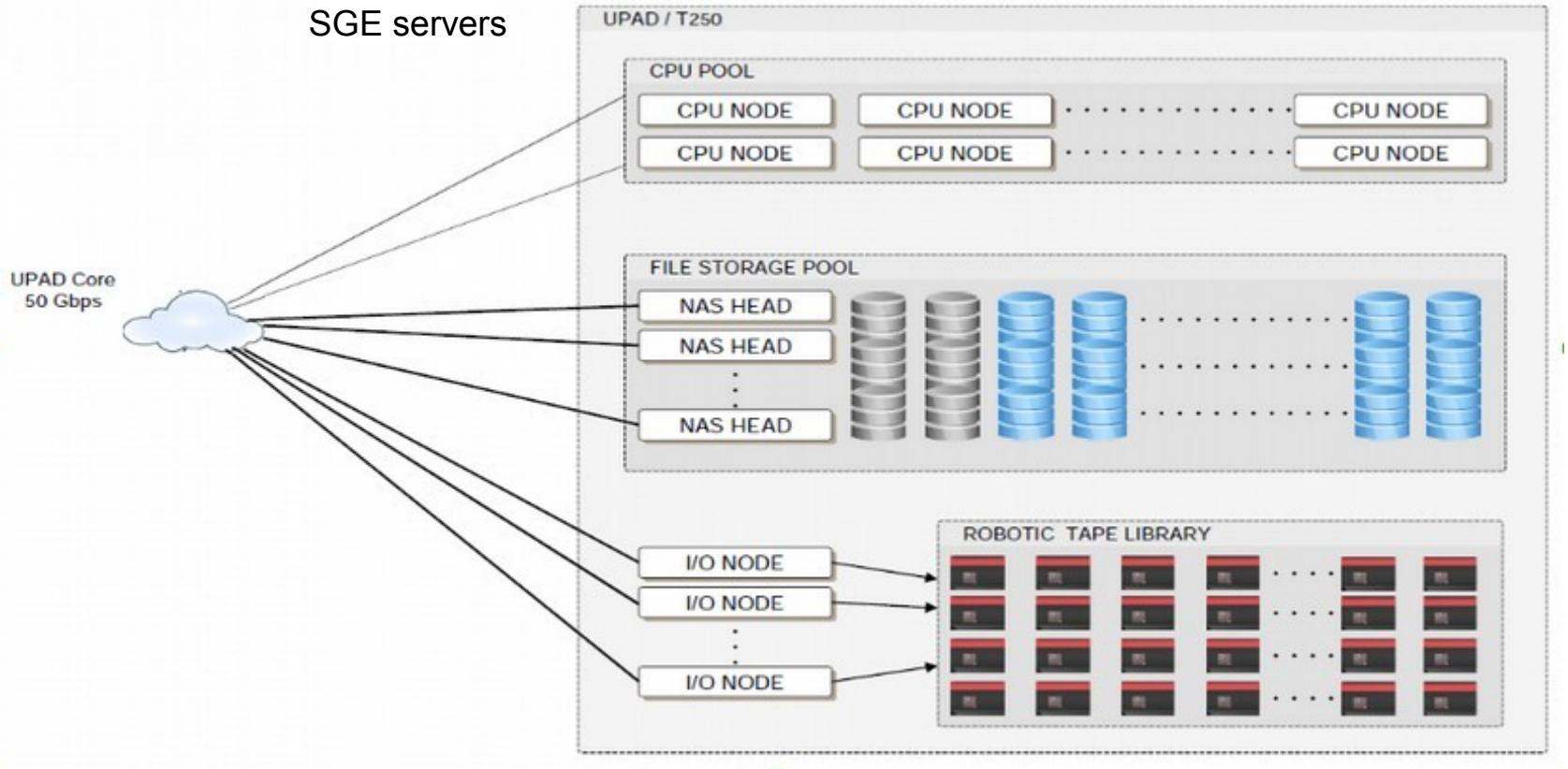
Tile Coadding, Catalog computation

Science Database Upload

SGE as batch system

Data processing jobs

SGE servers



Calibration Frames Generation (Bias, Flats, Fringing, Illumination)

Individual Image proccessing

Tile Coadding, Catalog computation

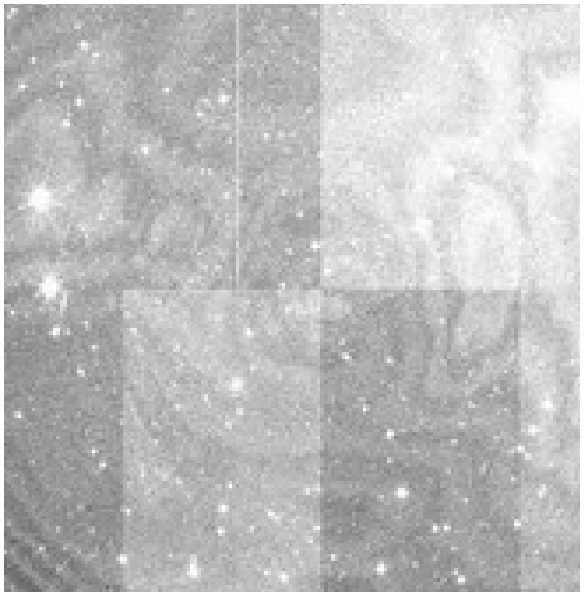
Science Database Upload

2 daily workloads

590, 7150 / day preproc

590, 7150 / day

160 K, 8 M / end of survey

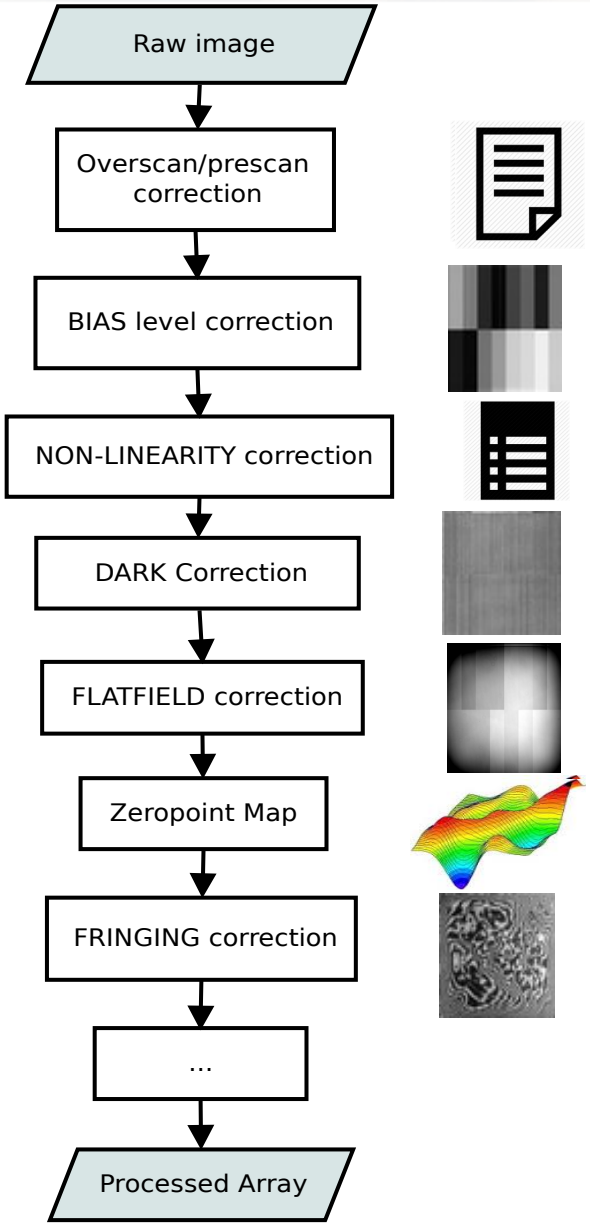


Daily pipeline:
Inidividual image processing

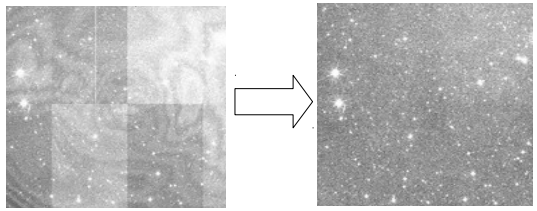
DEPEND ON:

- Observation Type:
- Instrumental configuration:
  - CCD, filter, telescope, ReadoutMode, …
- Observing time

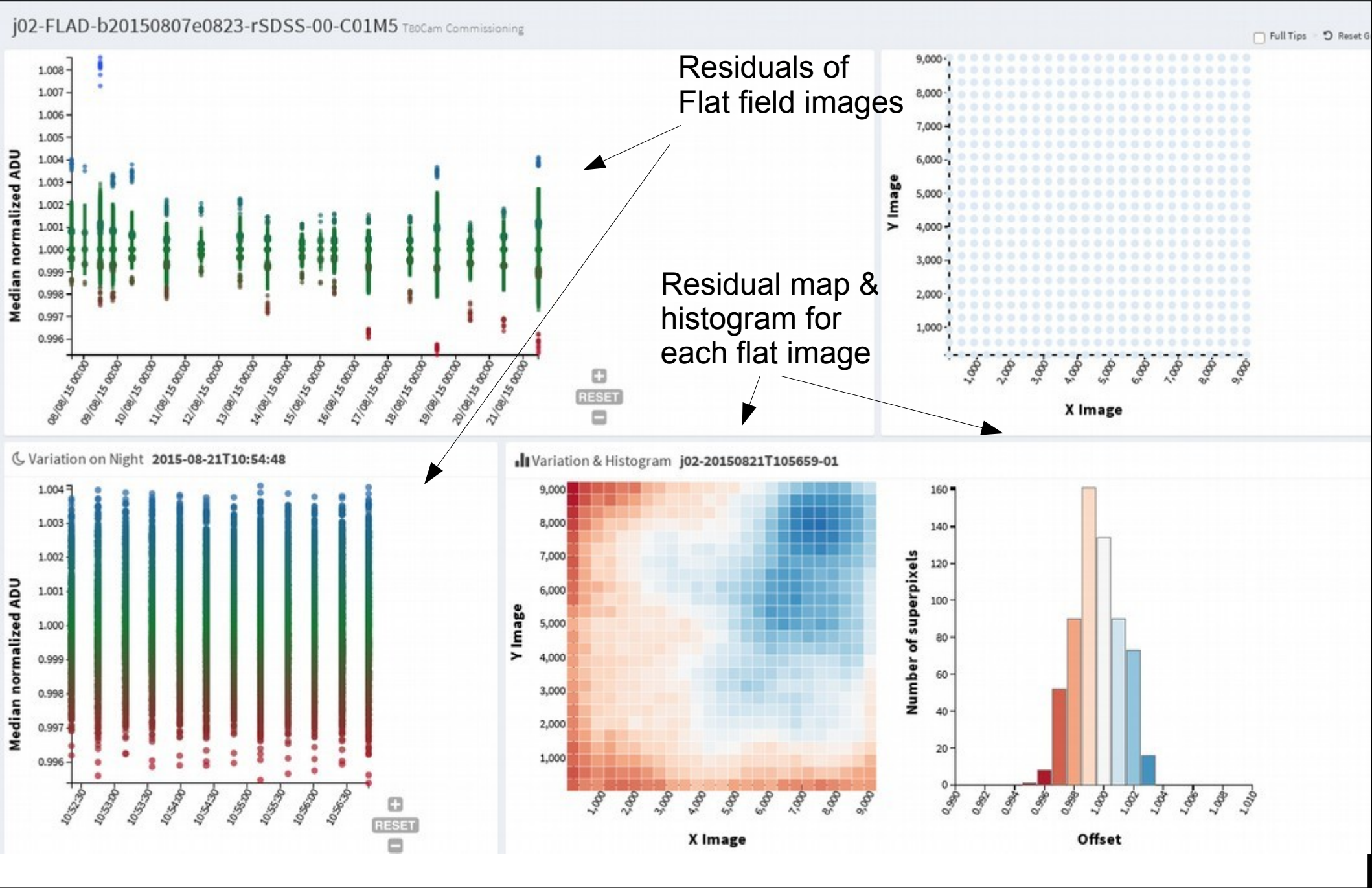
Automatically located for each image using the admin DB



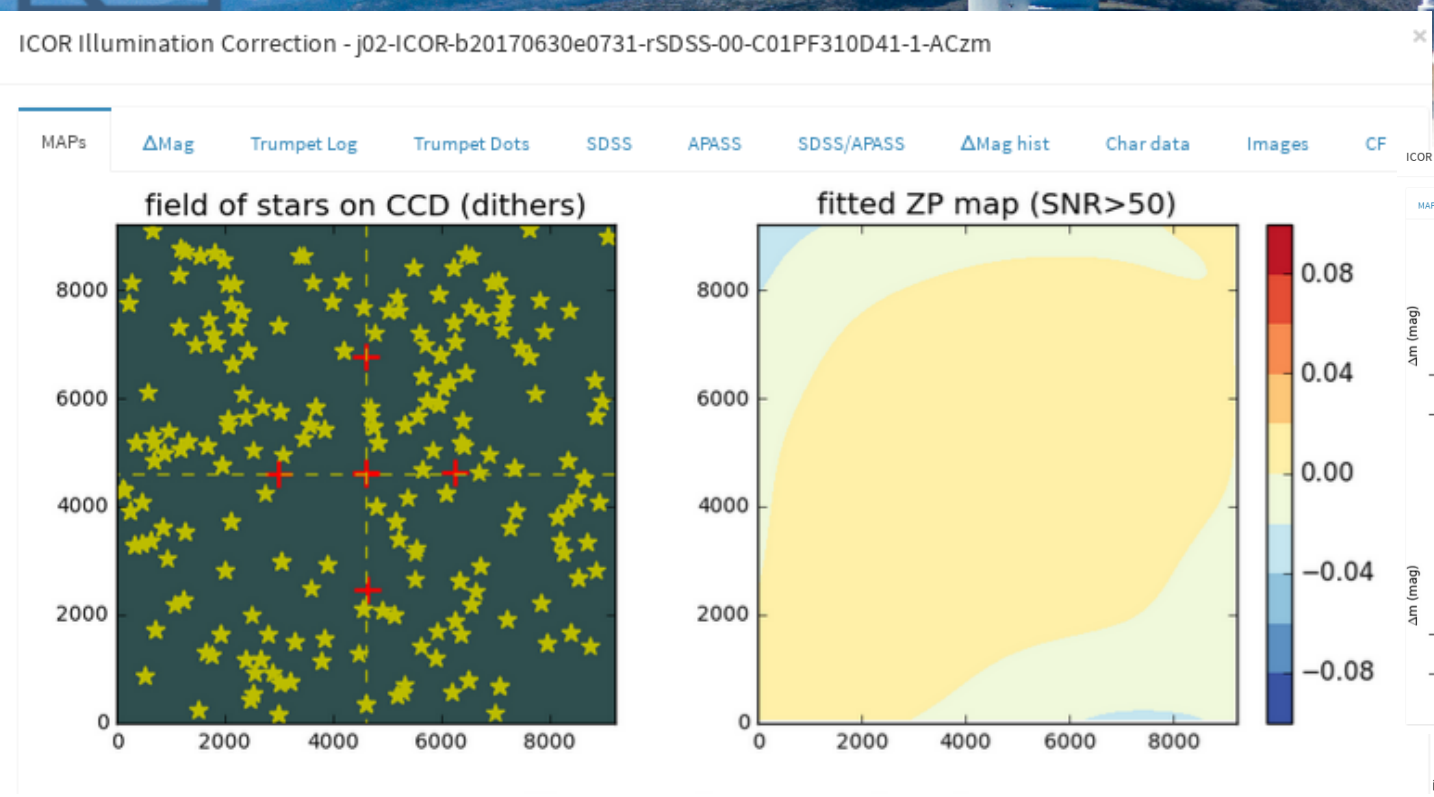
Master Calibration Frames

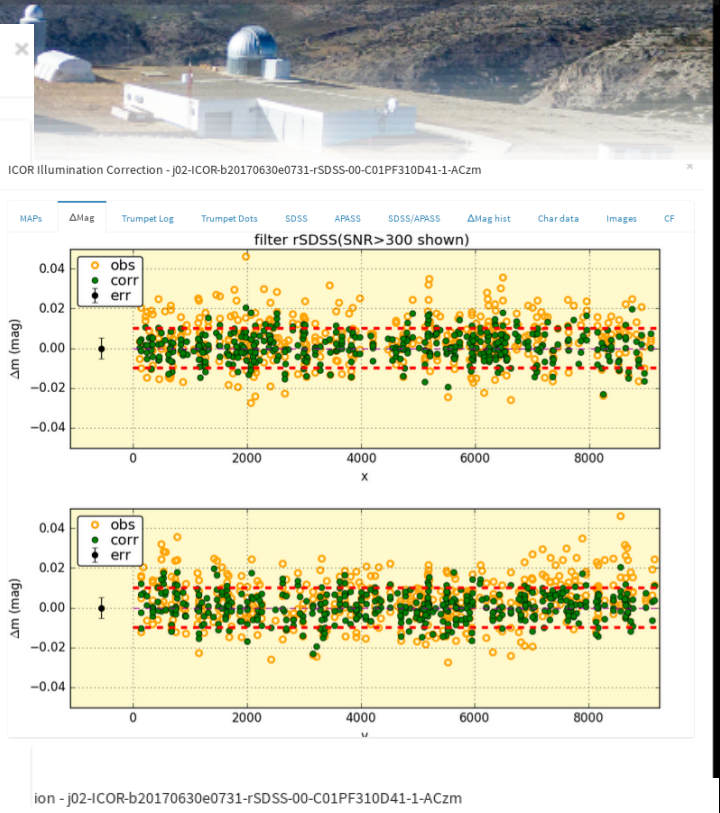


Flat-Field stability

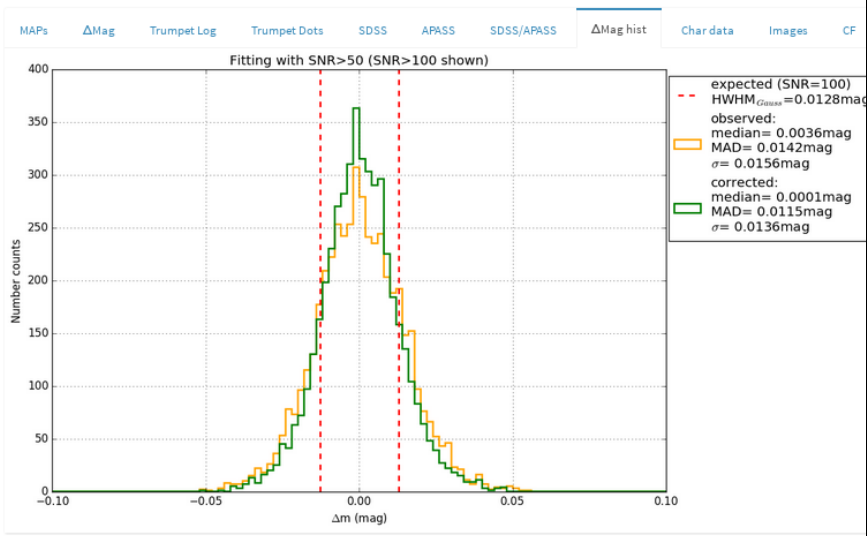


Illumination correction



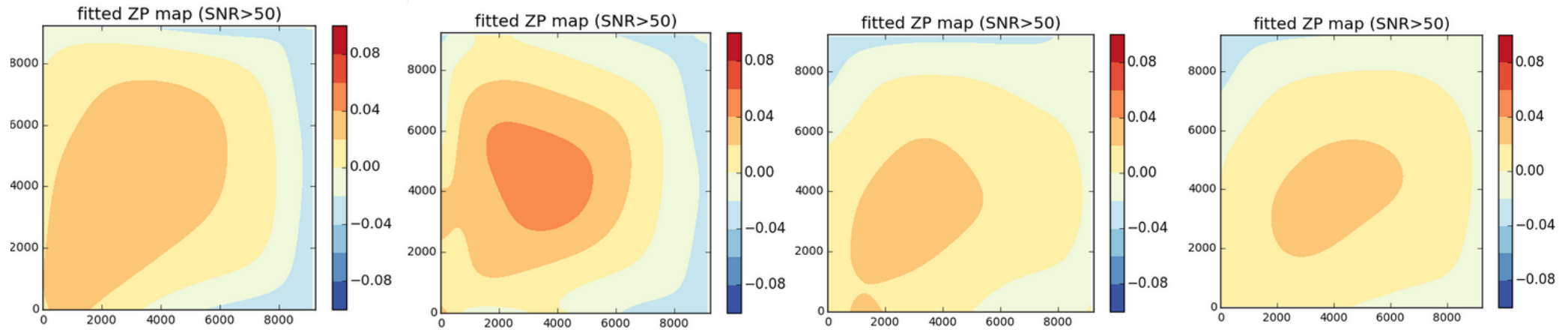


- Illumination correction is a second order correction to take into account
  - Non-homogeneus illumination of CCD during flatfields
  - “sky concentration” effect due to the reflexions in the optical system that increase the light in the center of the CDD.



Illumination correction

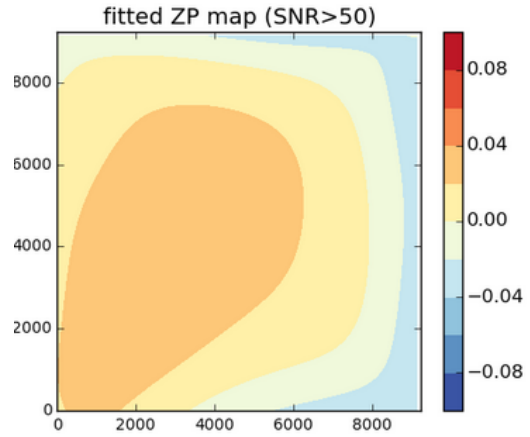
01Nov2015-07Feb2016 07Feb2016-07Apr2016 26May2016-30Jun2016 05Sep2016-11Nov2016



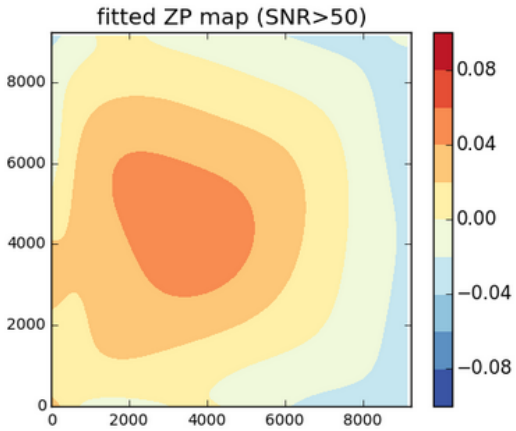
- From 2015-11 to 2016-06
  - Continuous improvements on the T80 baffling system
  - The Illumination correction that depend on the stray light was changing.
  - The proper observation to calibrate ICOR are not available for all the observing blocks

Illumination correction

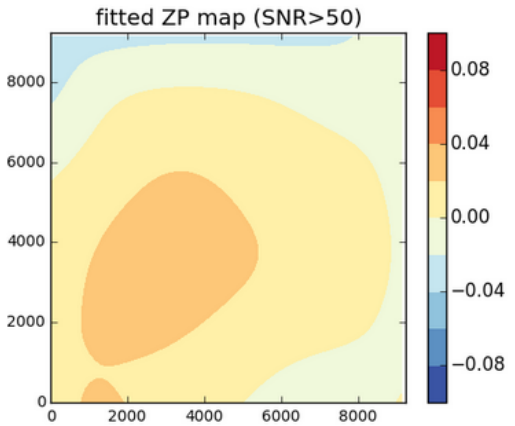
01Nov2015-07Feb2016



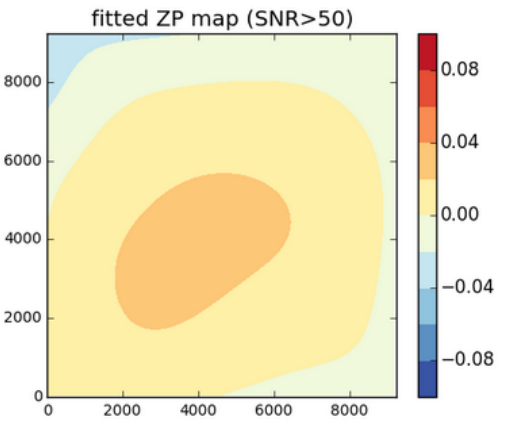
07Feb2016-07Apr2016



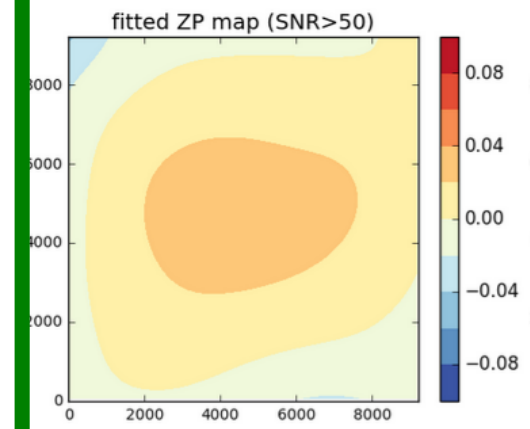
26May2016-30Jun2016



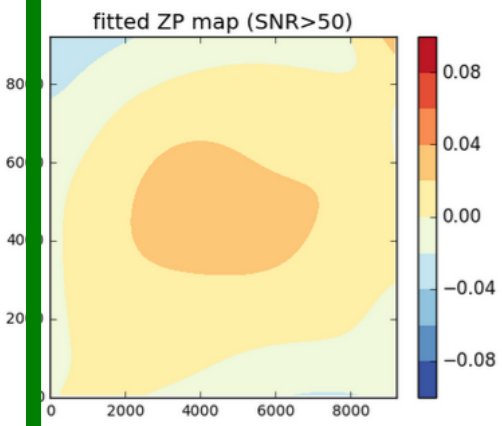
05Sep2016-11Nov2016



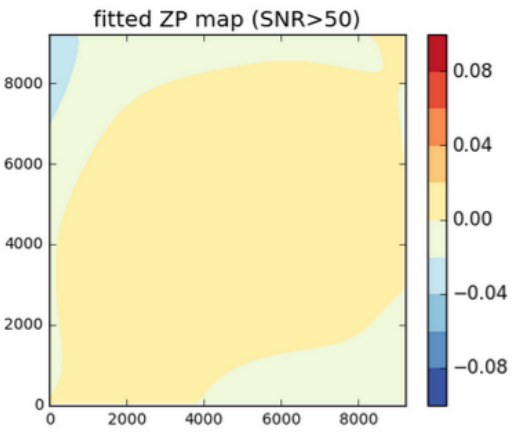
25Ene2017-09Mar2017



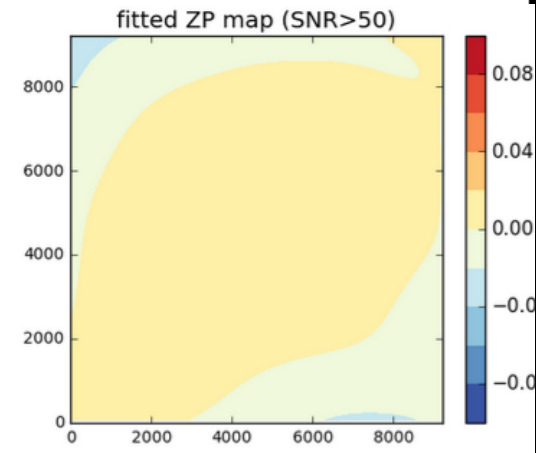
09Mar2017-31May2017

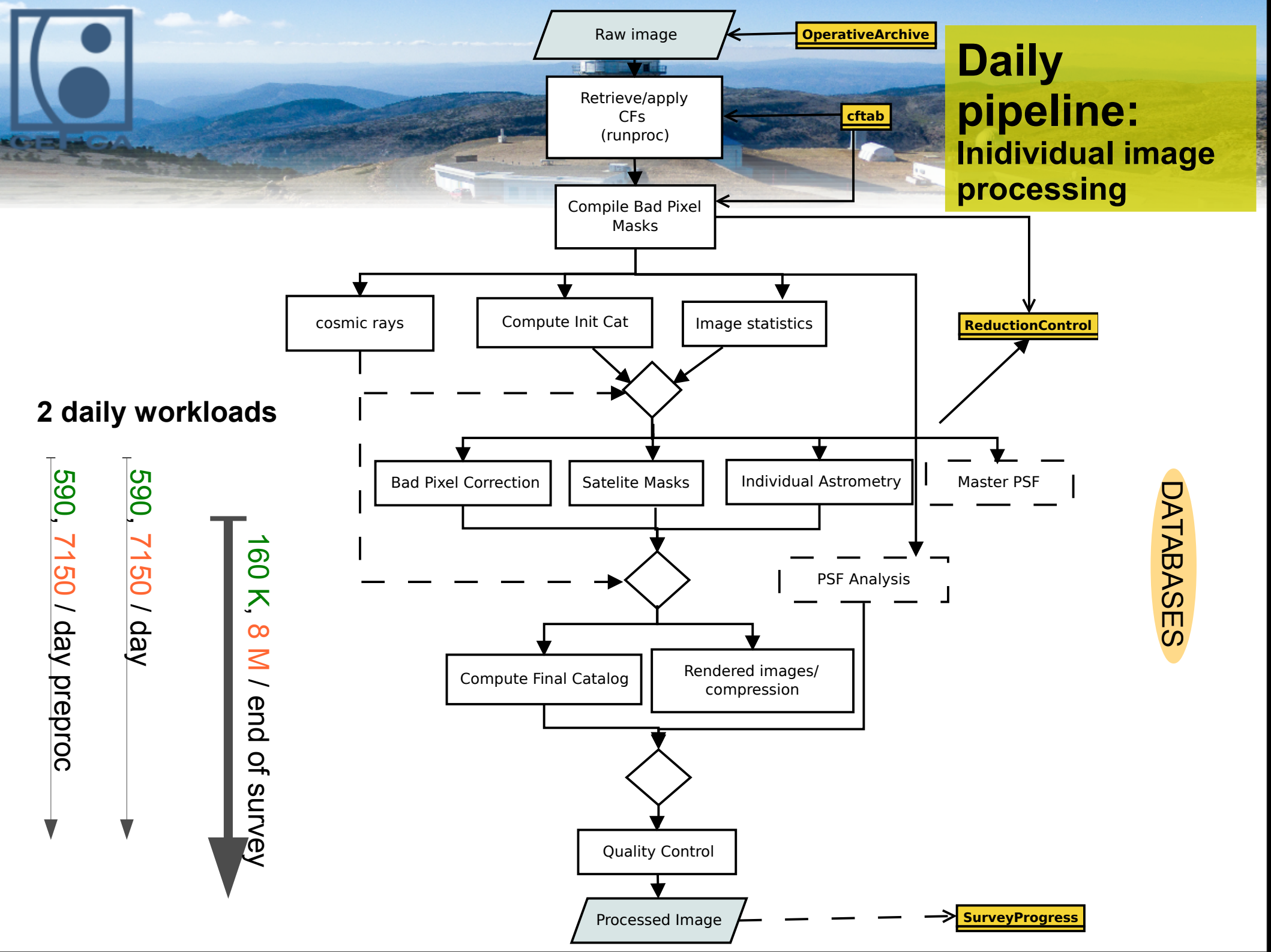


31May2017-30Jun2017



30Jun2017-31Jul2017



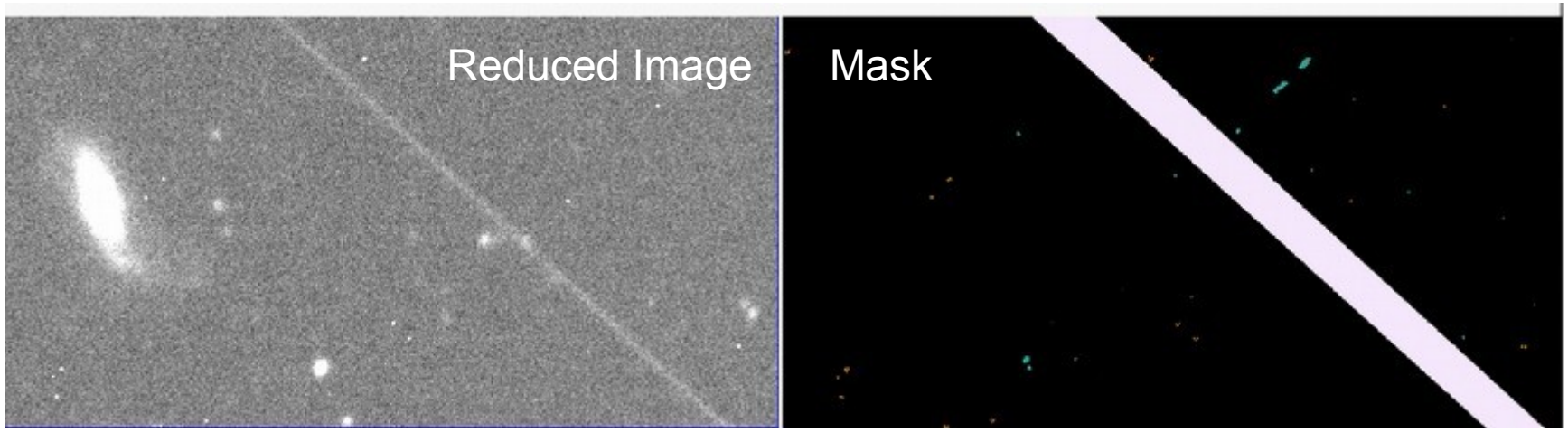


Daily pipeline:
Inidividual image processing

Image Masks

The daily pipeline produces:

- Reduced image with the compressed pixel mask stored in the 2nd HDU.



A code identifies the issue(s) affecting each pixel.

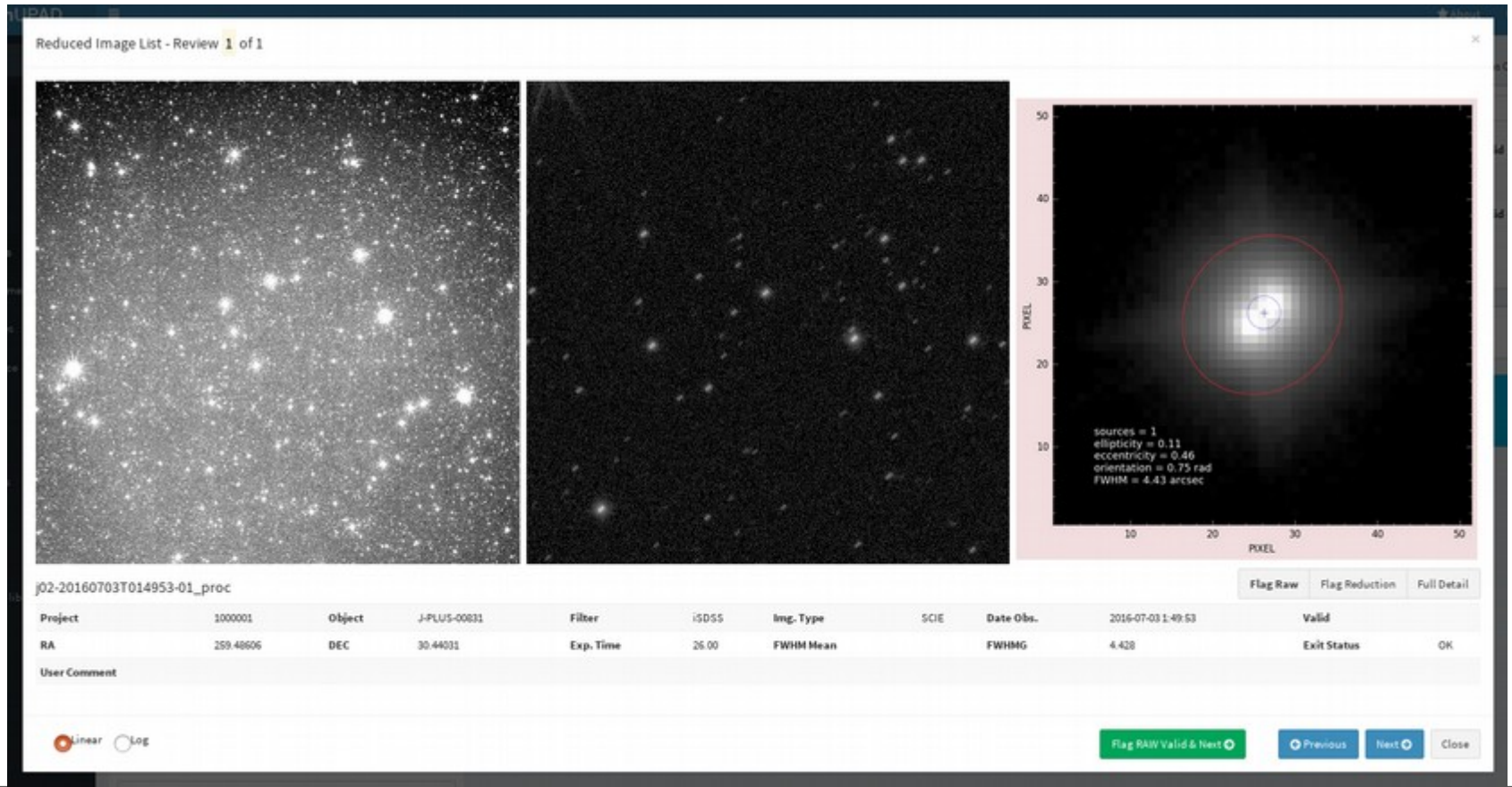
- 1 : bad pixel
- 2 : Saturated pixel
- 4 : Cosmic ray
- 8 : Pixel in a shuttle (linear) trac
- 16 : Masked pixel for interpolation (e.g. in case x-talk problems can not be solved)
- 32 : Pixel in a HOLE in any of the back subtraction frame (fringe pattern, background pattern)
- 64 : Pixel in a detected object

Data processing pipeline:

Improvements in Reduction Portal to help to revise and flags problematic images.

Developments in order to use ML to identify problematic images.

Flagging images as invalid in DB will trigger the reprocessing of any tile that have used it.



Tile Coadding

Calibration Frames Generation (Bias, Flats, Fringing, Illumination)

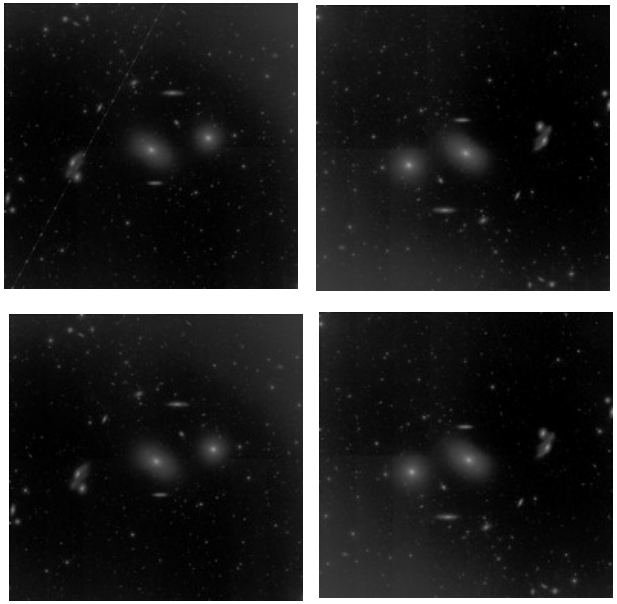
Individual Image proccessing

Tile Coadding, Catalog computation

Science Database Upload

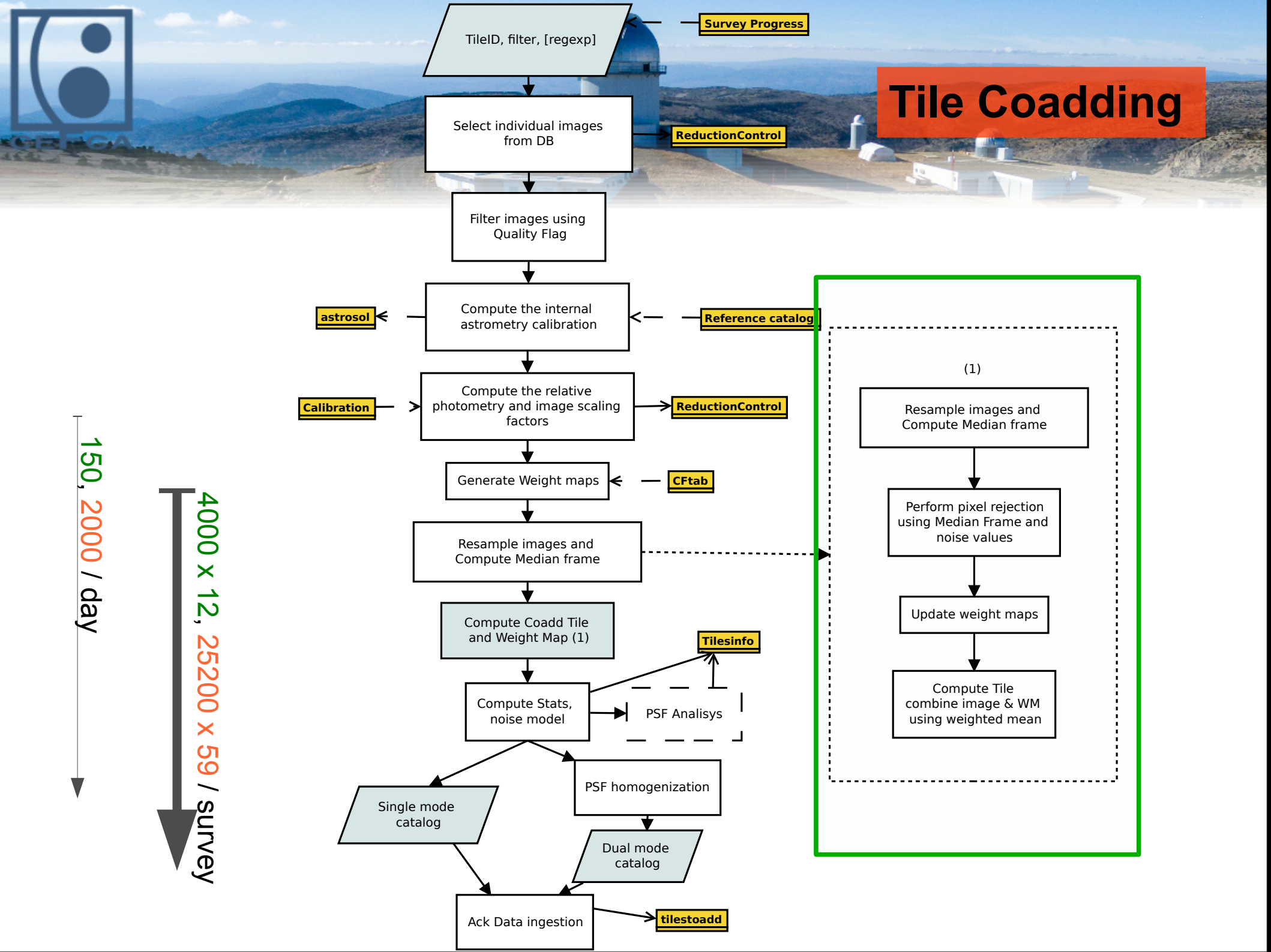
150, 2000 / day

4000 x 12, 25200 x 59 / survey



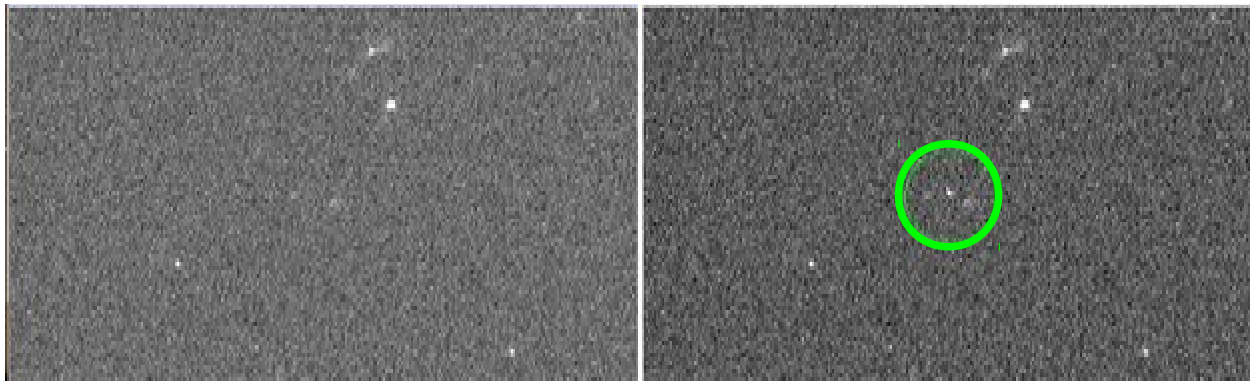
Combine into

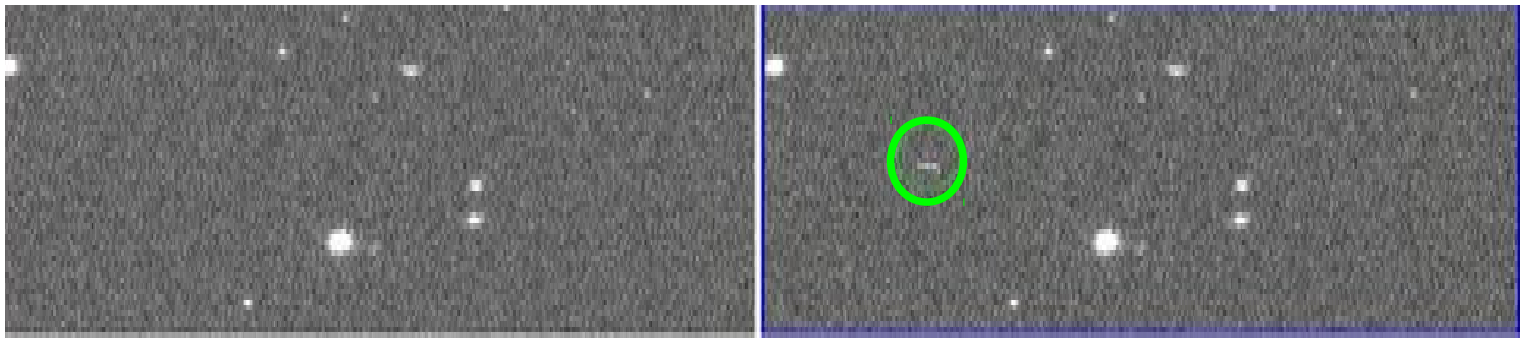
Tile Coadding



Tile Coadding

- Pixel rejection on coadding





ReductionUPAD

Not Logged

Search...

MAIN NAVIGATION

- Dashboard
- Calendar
- Raw Images
- Reduced Images
- Calibration Frames
- Coadded Images
- CCD Performance
- OAJ dashboard
- Coverage Maps
- ADQL Query

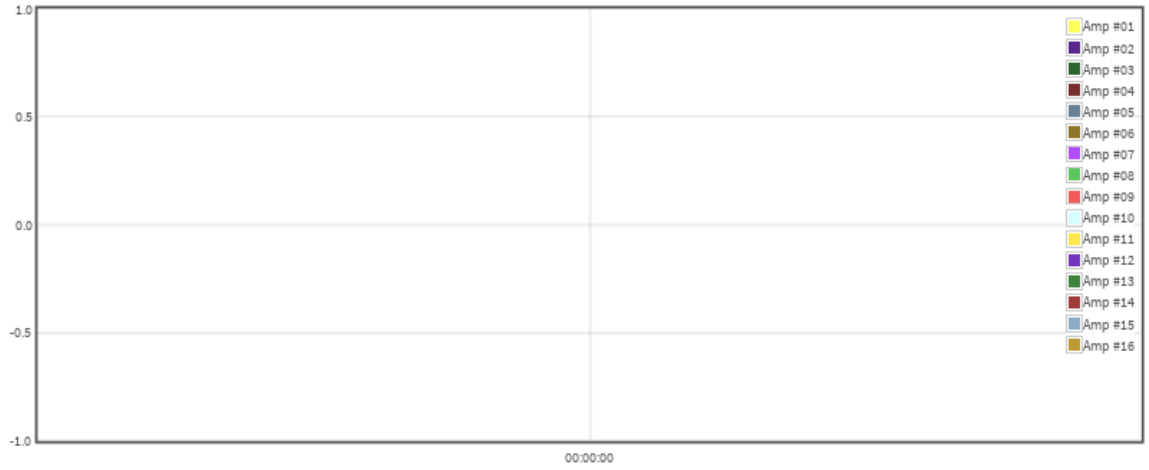
T80Cam Commissioning

Dashboard (night: 2016-03-15)

SCIENCE	BIAS	FLATS (SKY + DOME)	DARKS
67	0	0	0

CCD Level - *MODE_05* - Last month

GAIN | RON E | RON ADU



The graph admit panning and zooming! Clear Zoom

Last

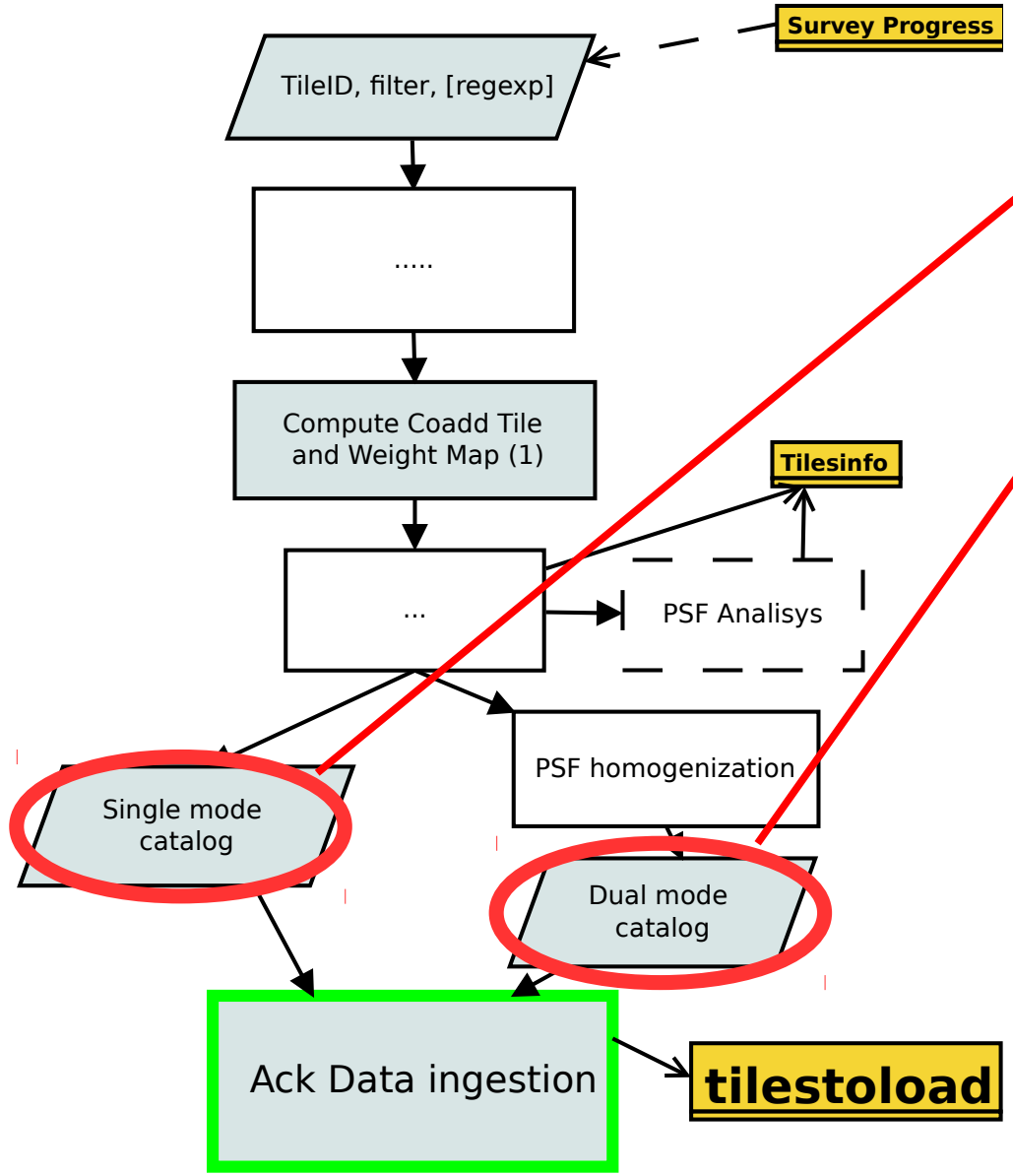
Coadded | Reduced

- j02-20160315T231107-01_prepro 0
  rSDSS - BD+381670_AFTEROPAC -2016-03-16T09:31:24
- j02-20160315T231455-01_prepro 0
  iSDSS - BD+381670 -2016-03-16T09:30:49
- j02-20160315T231707-01_prepro 0
  J0861 - BD+381670 -2016-03-16T09:30:45
- j02-20160315T231747-01_prepro 0
  J0515 - BD+381670 -2016-03-16T09:30:30
- j02-20160315T231908-01_prepro 0
  rSDSS - BD+381670 -2016-03-16T09:30:30
- j02-20160315T231821-01_prepro 0
  J0410 - BD+381670 -2016-03-16T09:30:24
- j02-20160315T231540-01_prepro 0
  uJAVA - BD+381670 -2016-03-16T09:30:12
- j02-20160315T231620-01_prepro 0
  J0430 - BD+381670 -2016-03-16T09:30:06
- j02-20160315T231952-01_prepro 0
  J0378 - BD+381670 -2016-03-16T09:30:06

Refresh Reduced

New: *Inproved access to image details in the calendar view.*
Recommended: *Thumbnail view in the result list for Raw and Reduced search pages, use the icons at the upper right.*
Press to open an image in a running Aladin program (or other SAMP enabled tool).

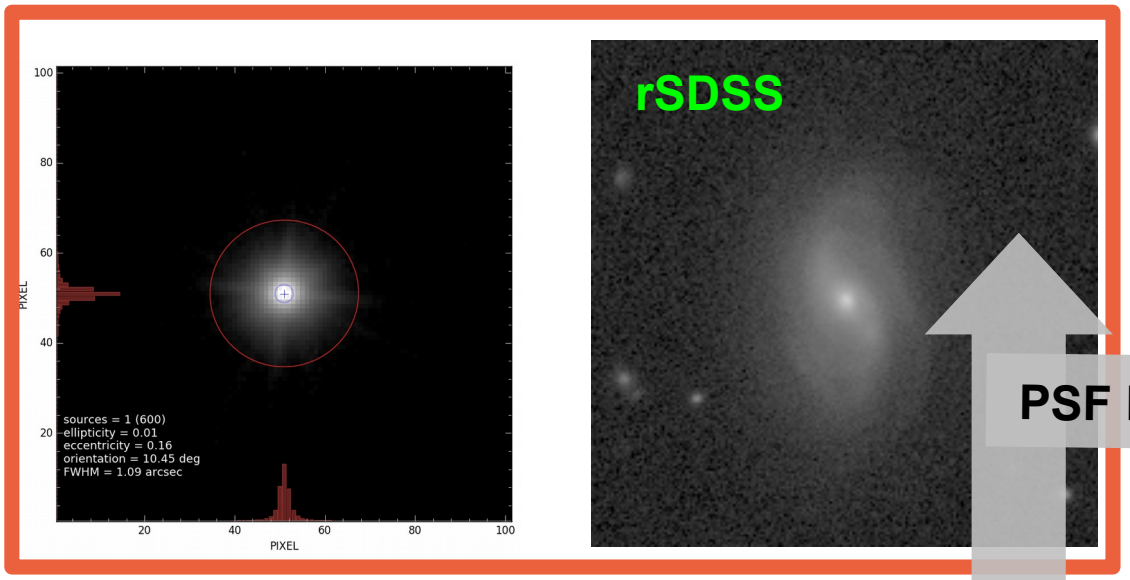
Pipelines - Catalogs

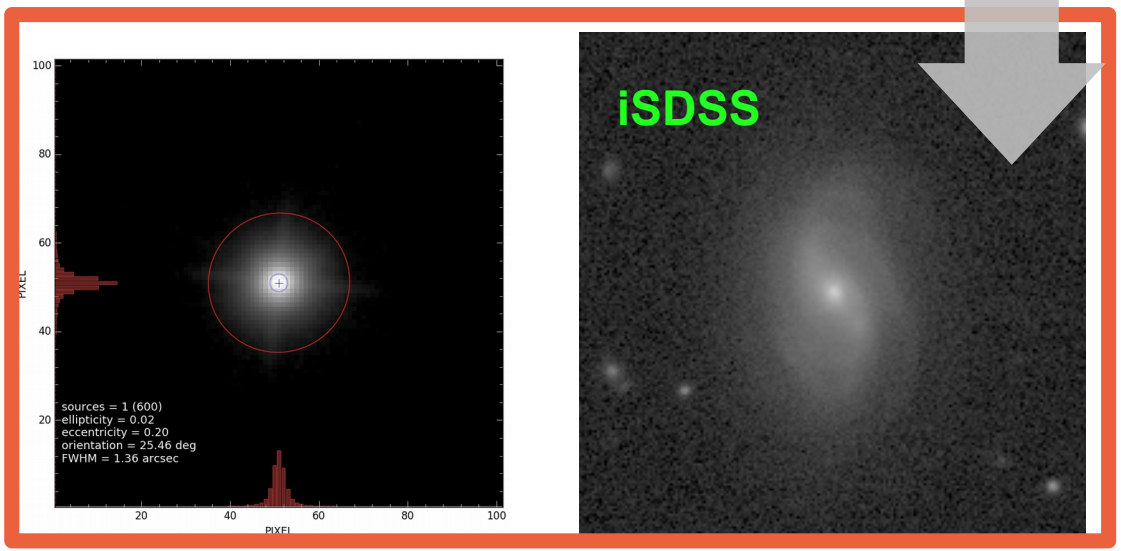


- **Single mode catalogs:**
  - Computed with SExtractor independently in each filter
- **Dual mode catalogs:**
  - A reference filter (rSDSS) is used to define the apertures
  - **PSF matched photometry** is computed following Molino et al 2014.

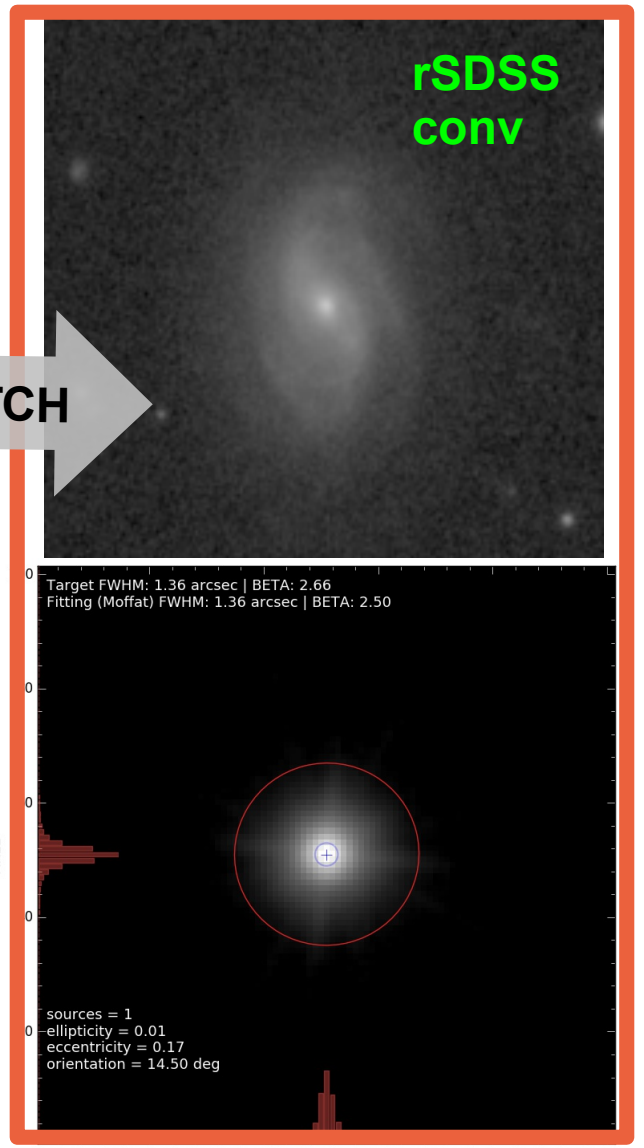
Pipelines - Catalogs

Corrections are derived in each filter by matching the PSF of the reference filter (rSDSS)

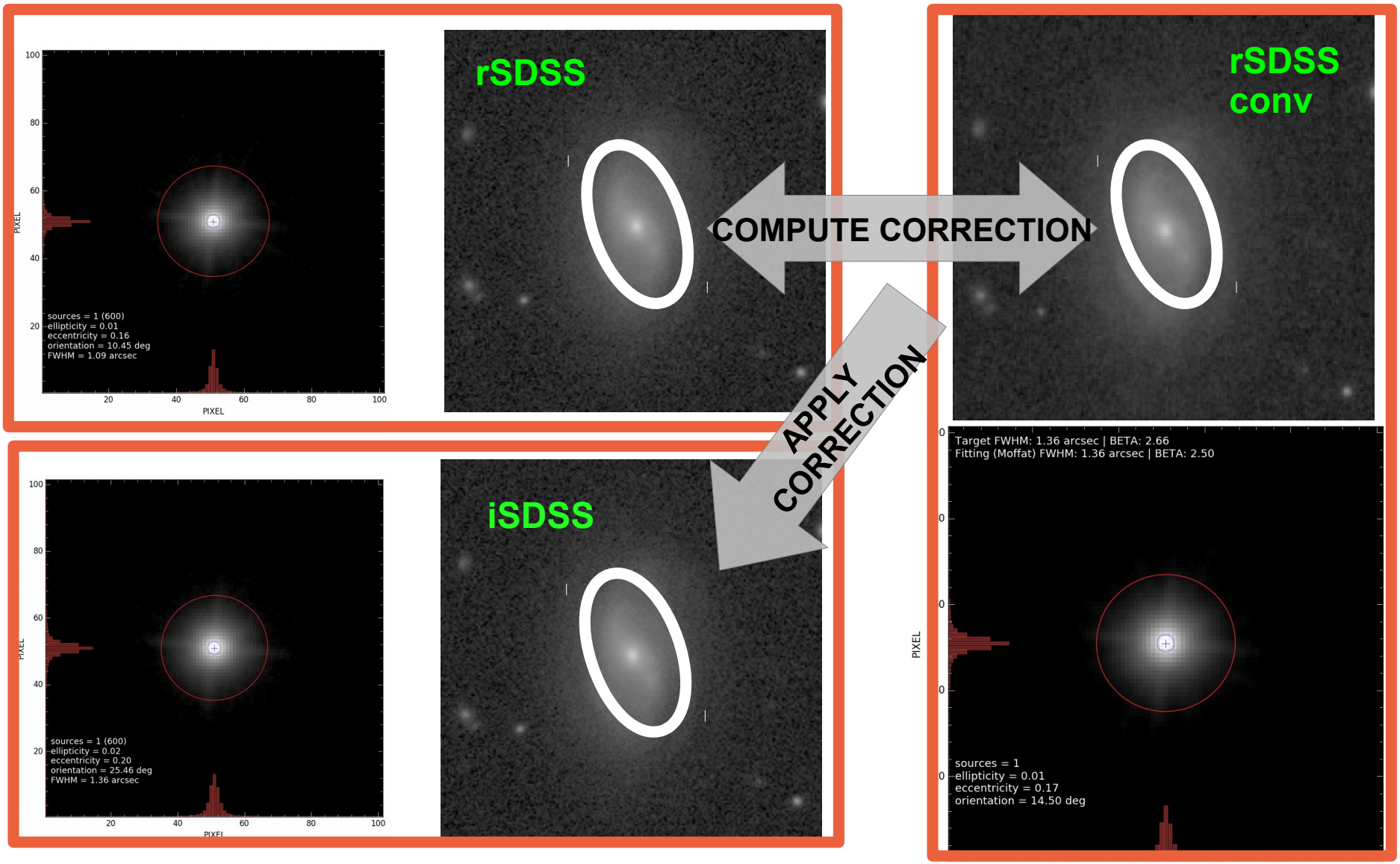




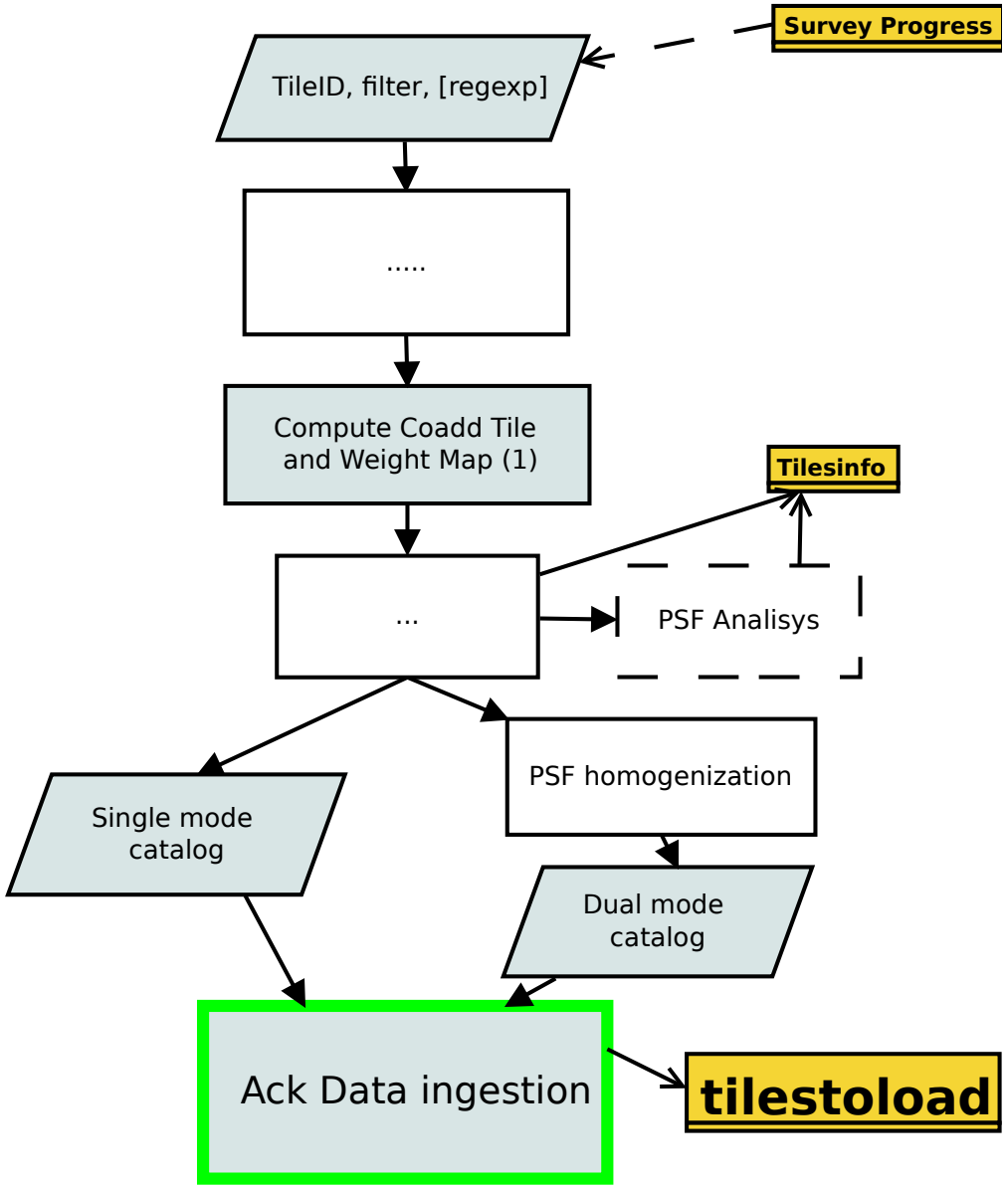
PSF MATCH

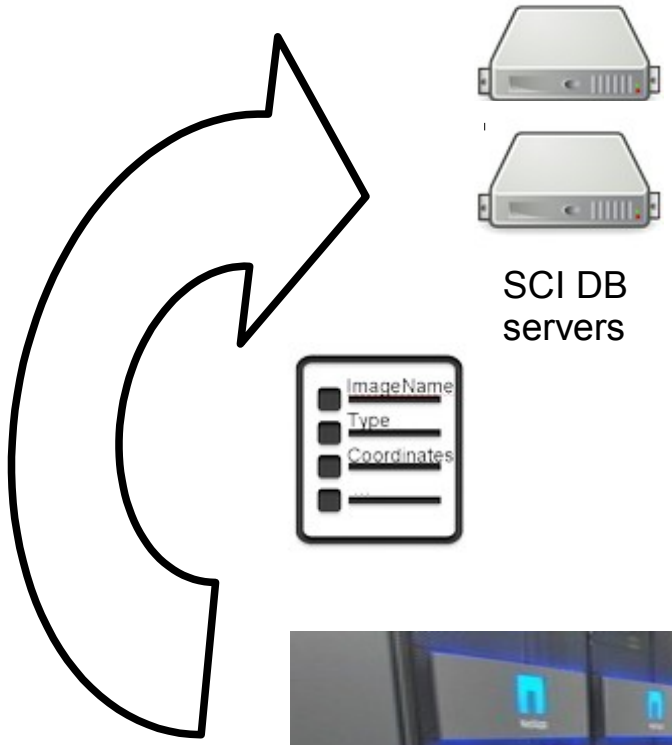


Pipelines - Catalogs



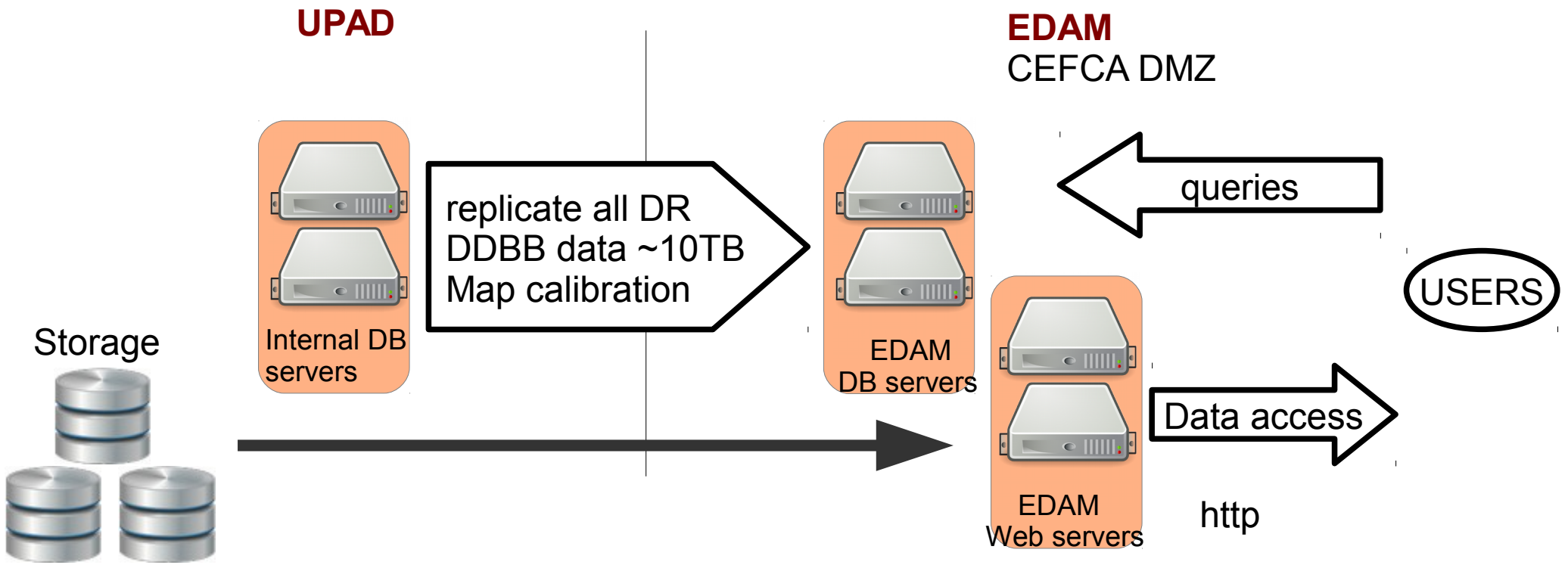
Pipelines - Catalogs





Internal DDBB -> *EDAM*

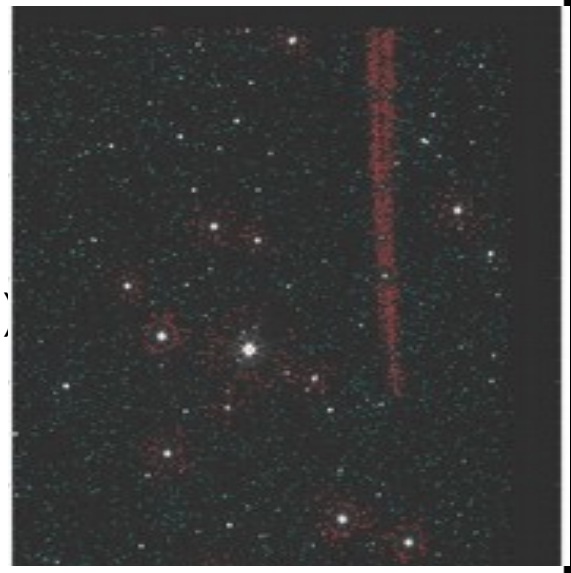
- Catalogs of coadded data are uploaded to the internal UPAD DDBB servers after computation.
- **The DB and catalogs are moved to EDAM as soon a Data Release is made public.**
- **EDAM will maintain the latest 2 DR.**

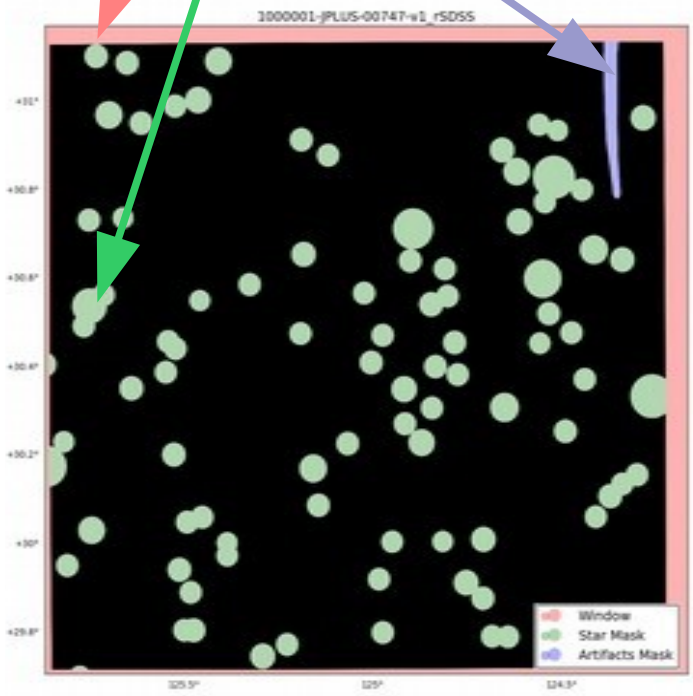


Tile Masks

In EDR we provide masks (mangle format)

- Tile area (Defined as > % texp)
- Bright stars
- Artifacts in the images (i.e. ghost produced by reflexions)





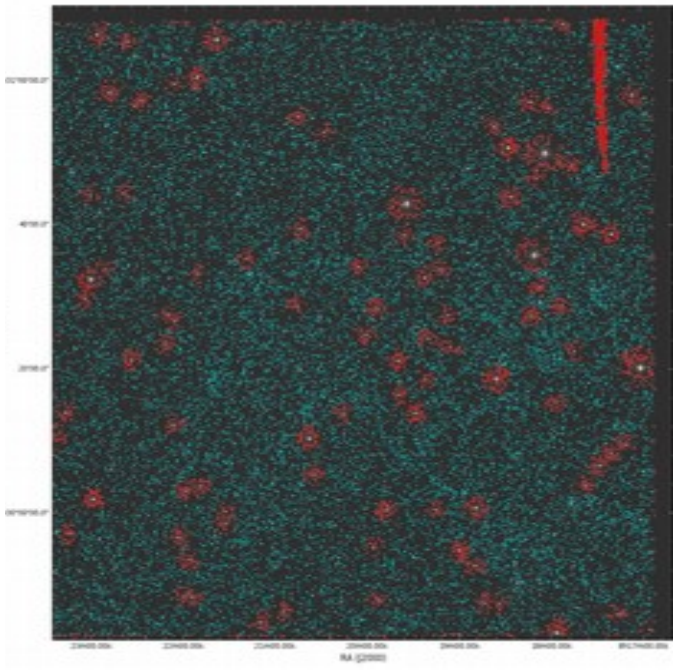
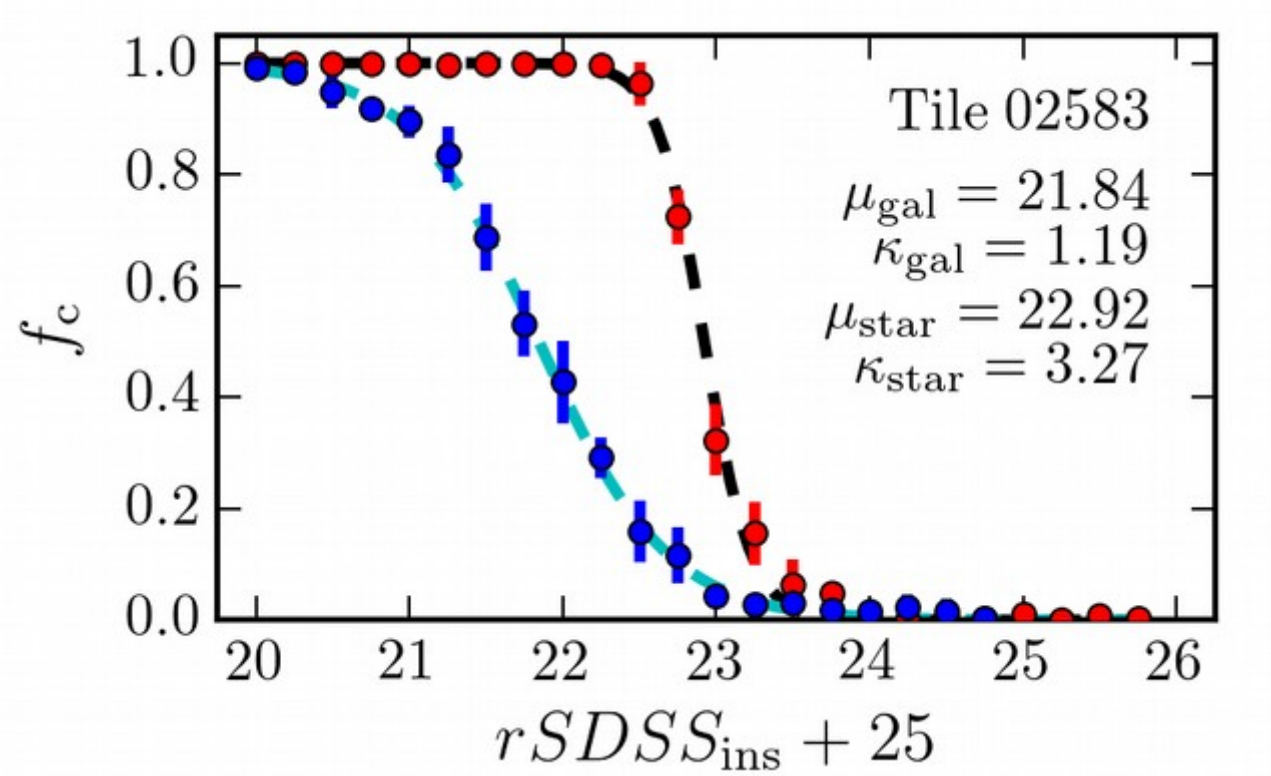


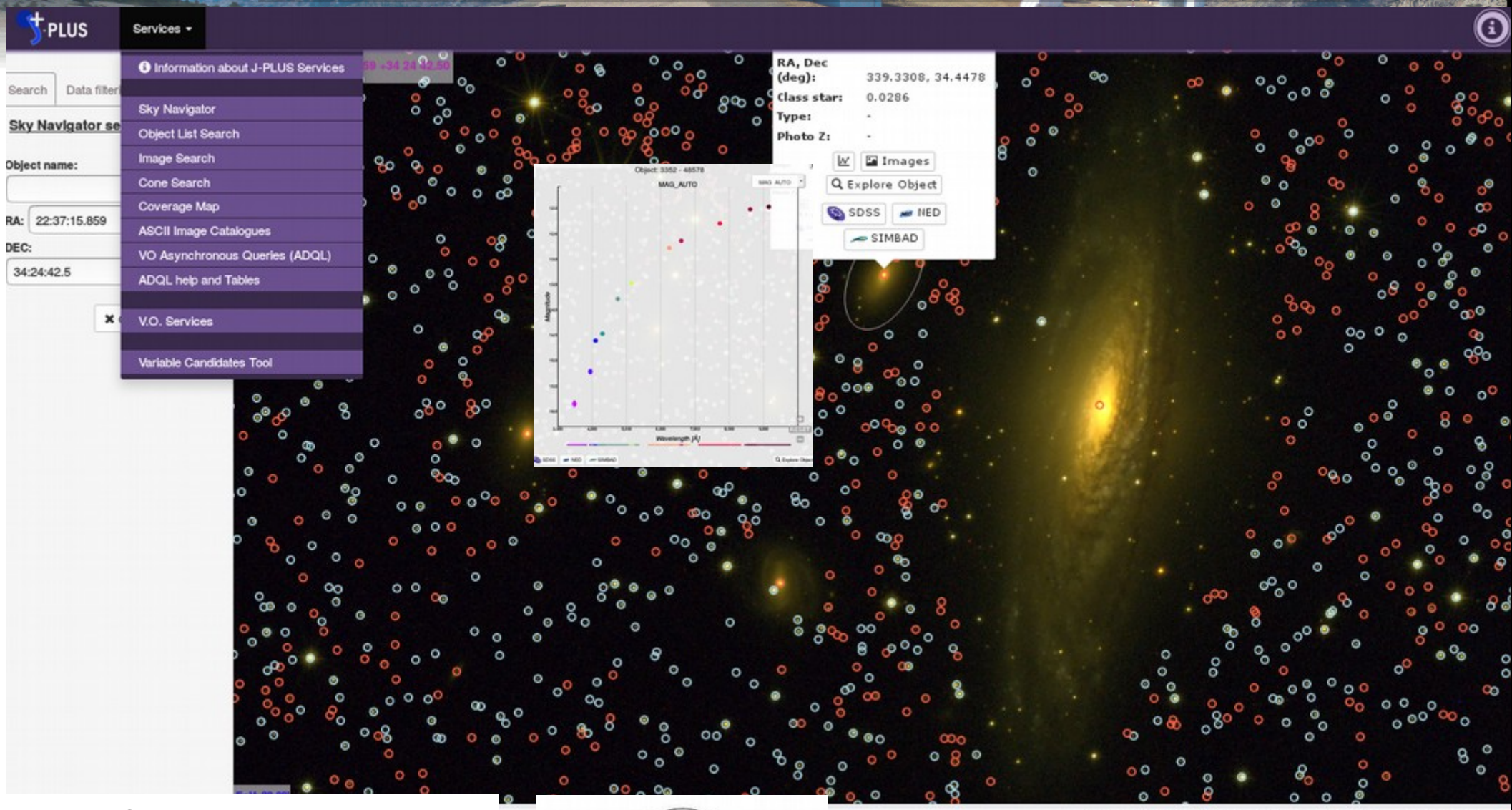
Image depth / completeness

Incorporate the analyisis of the image depth considering different object profiles.

For EDR we provide the completeness measurements in reference band (rSDSS).



EDAM Web Front End



Virtual Observatory Protocols and services: TAP, SIAP, Asyn queries

IVOA

ALADIN

Deriverables

Images & Mask:

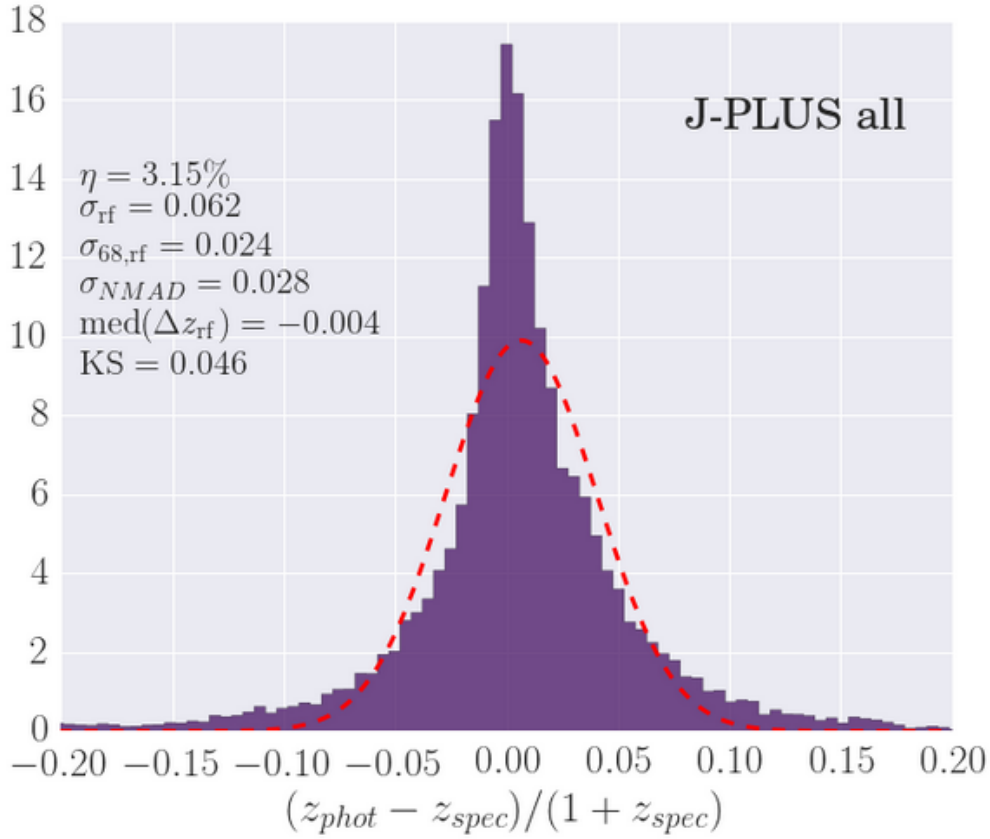
- Coadded Images & Weight Maps registered at pixel level on the different filters.
- Masks (tile area, bright stars, artifacts)
- Image characterization (FWHM, depth,...)

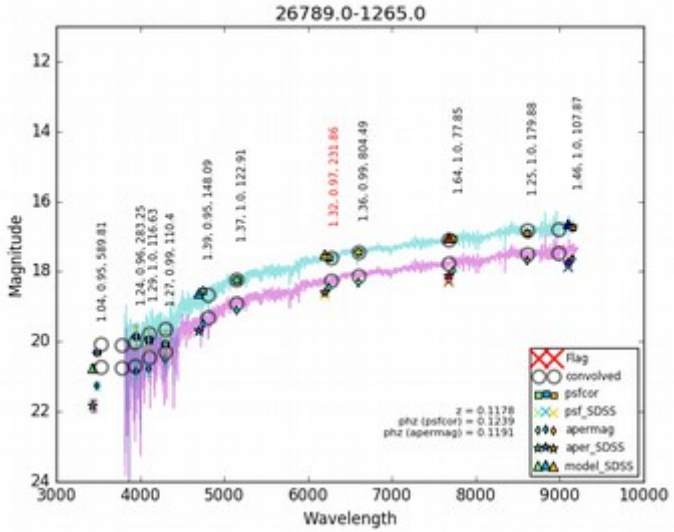
Catalogs:

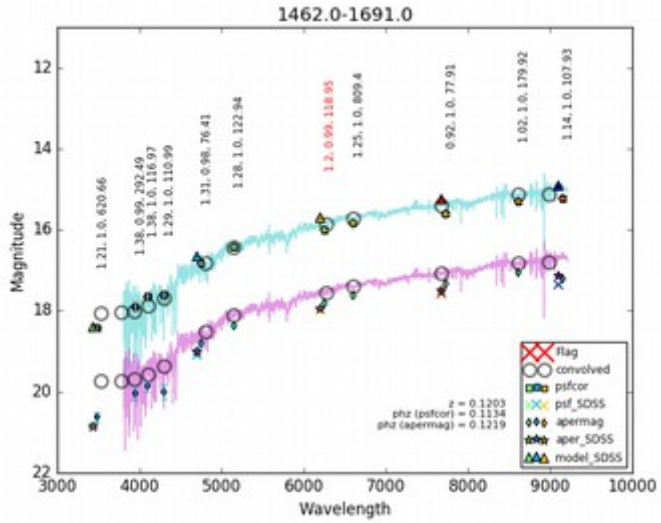
- Access through the Web Portal or VO services (ADQL, SIAP).

Data processing pipeline:
Current developments

- Working in incorporating photo-z and PDF's in the catalogs







Greisel et al (in prep)

Thanks !