



# Data processing and calibration

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

October, 2<sup>nd</sup> 2017

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CEFGA



**GOBIERNO  
DE ARAGON**



GOBIERNO  
DE ESPAÑA

MINISTERIO  
DE ECONOMIA  
Y COMPETITIVIDAD





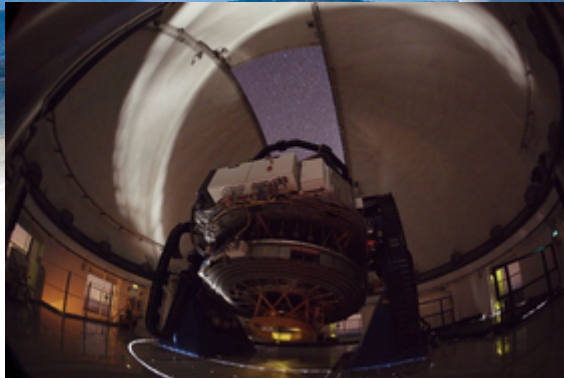
# Outline

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

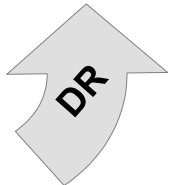
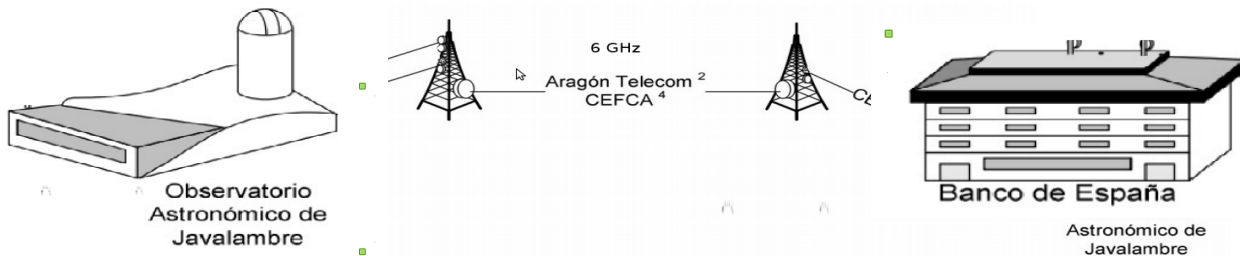
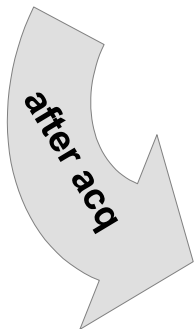
# Data handling



- Image acquisition
- Internal raw data publication



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



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



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

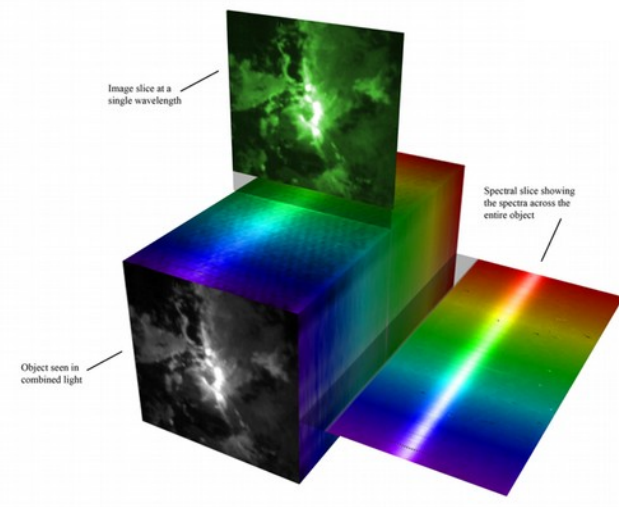
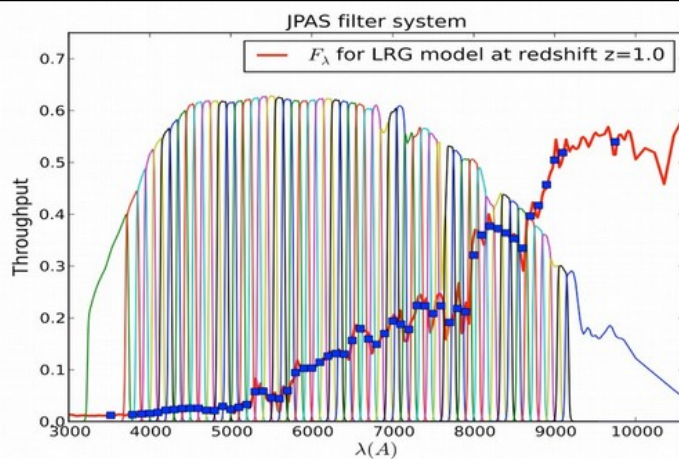
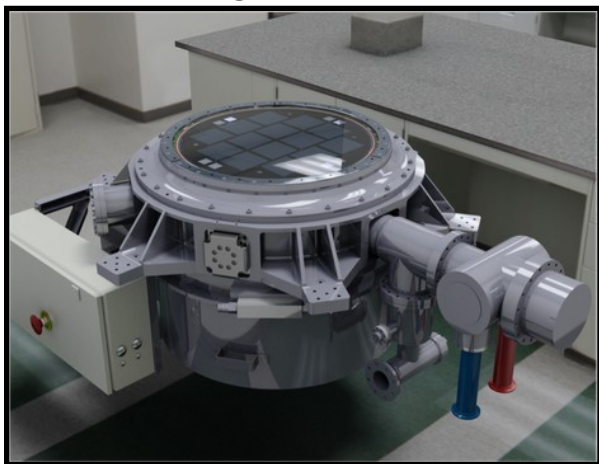
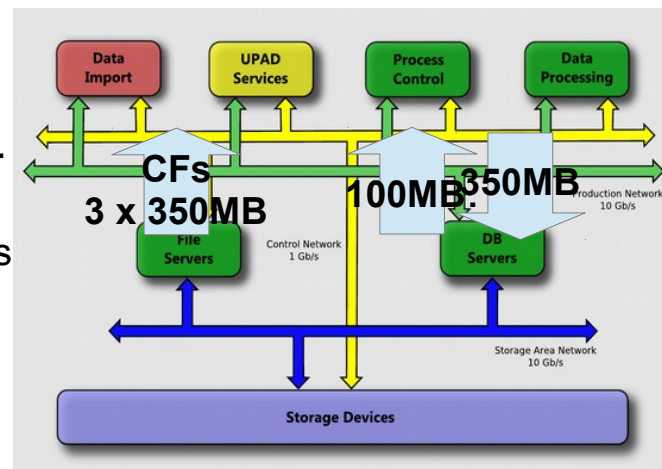
# Data processing pipeline

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

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

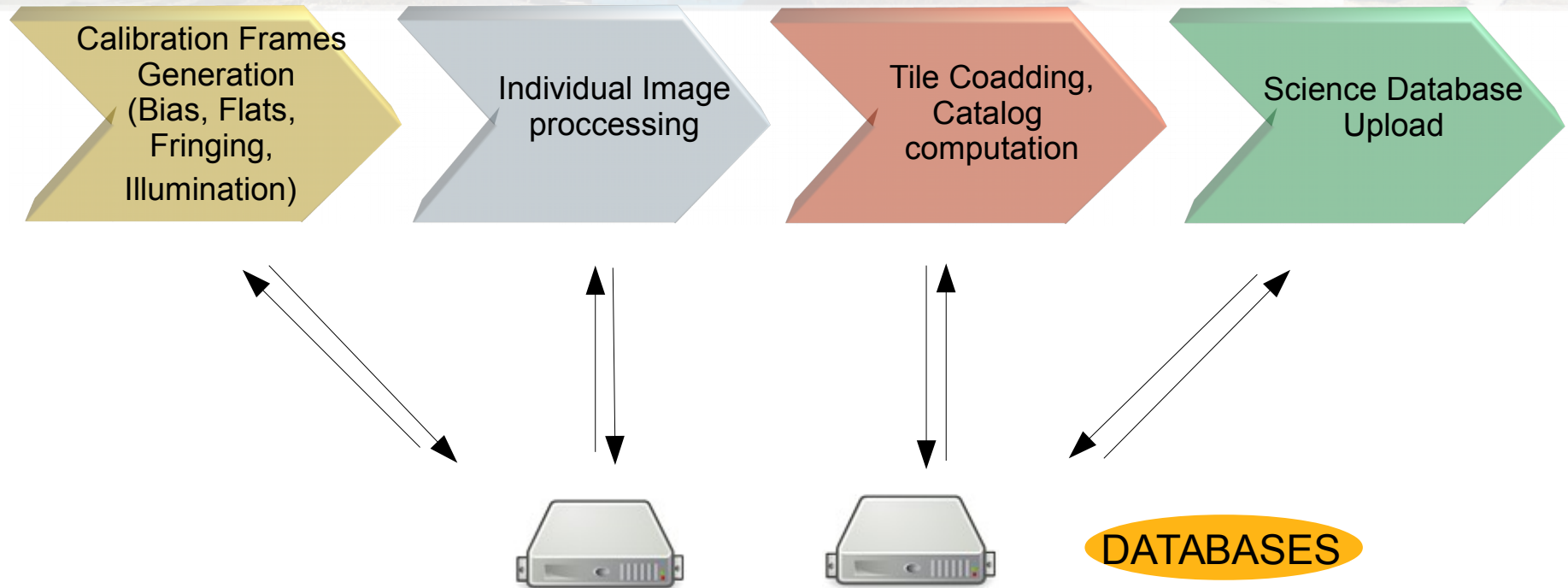
## Main challenges:

- Large number of images collected by different telescopes.
- Large Field of View instruments
- Large volume of information ( $> 6 \times 10^8$  sources,  $> 1400$  properties)
- In  $\sim 100$  different physical filters from 3500 to 9000Å.
- 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  
processing

Tile Coadding,  
Catalog  
computation

Science  
Database  
Upload

SGE as batch system

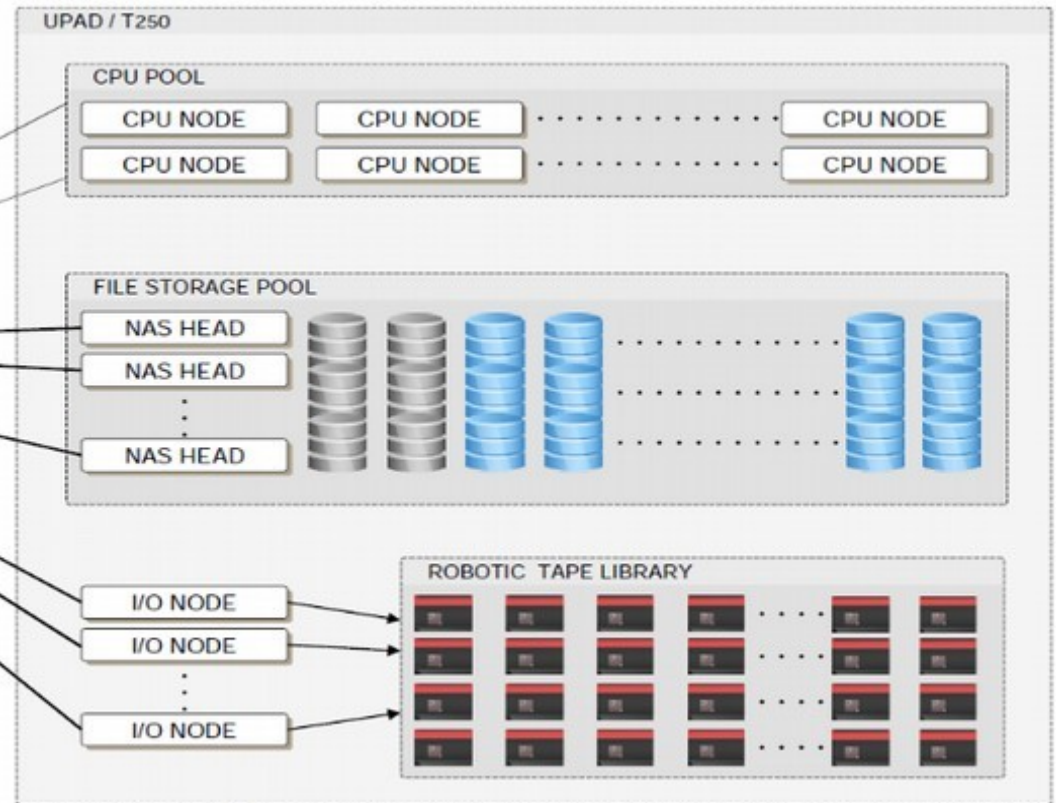
Data processing  
jobs



SGE servers

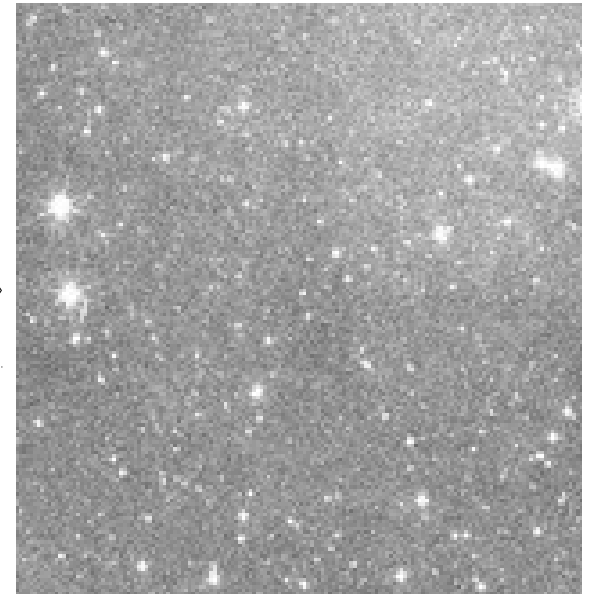
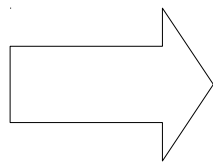
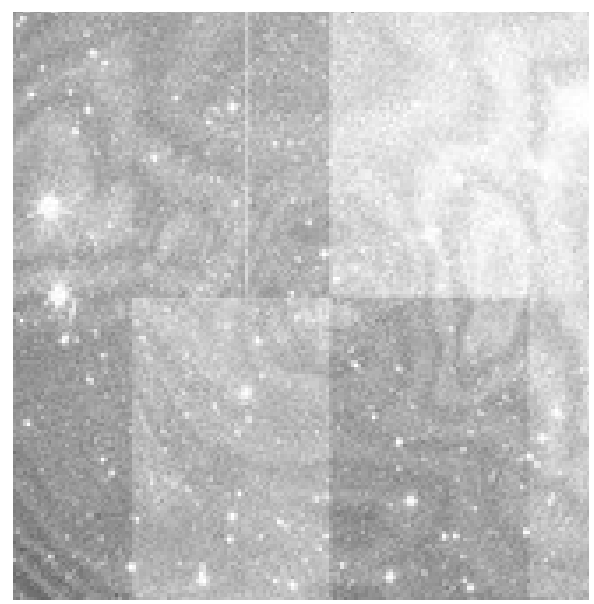


UPAD Core  
50 Gbps





## 2 daily workloads



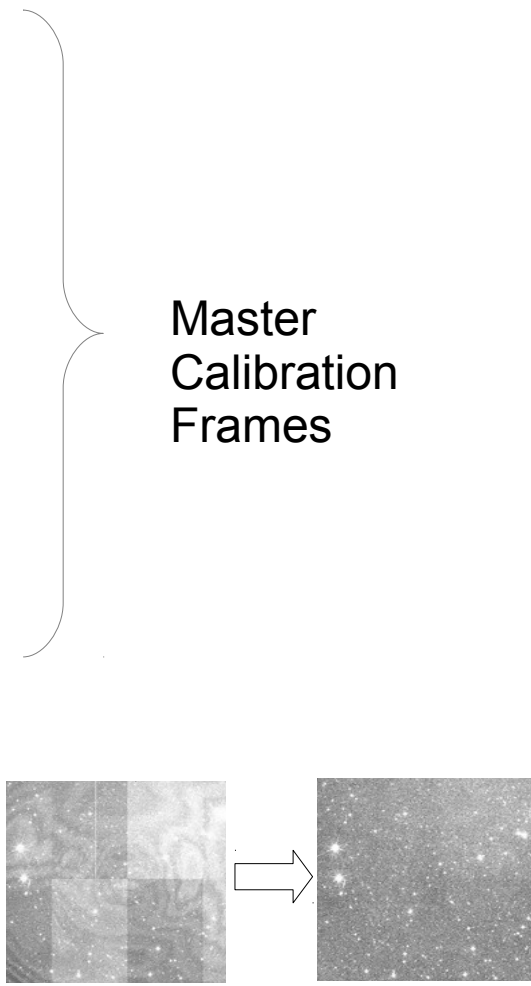
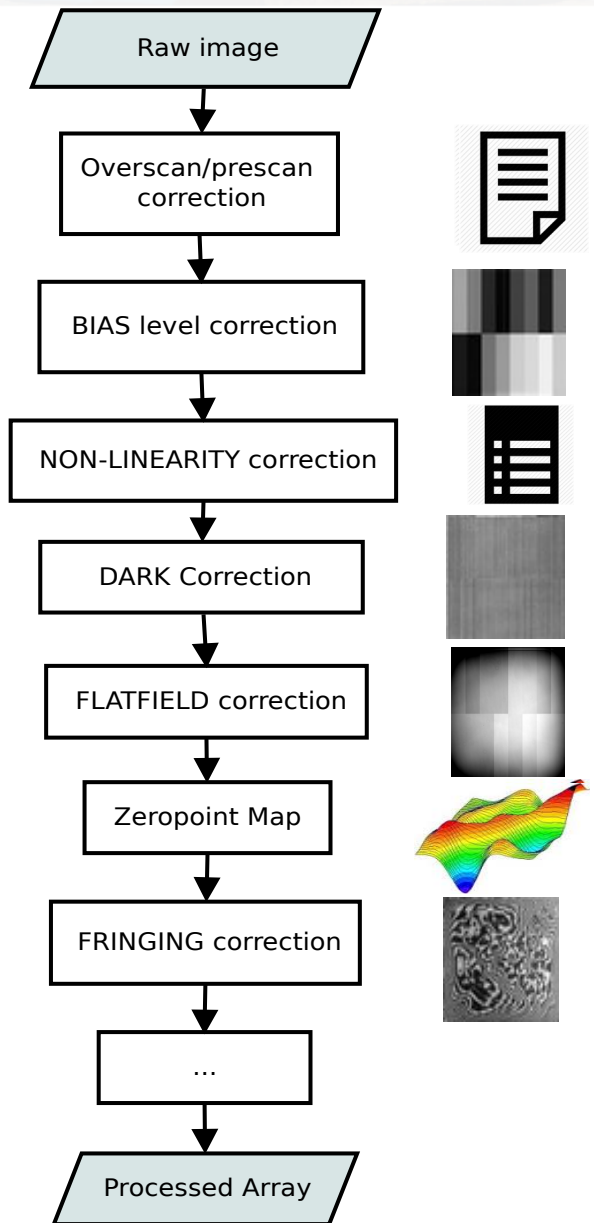


# Daily pipeline: Individual image processing

## DEPEND ON:

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

Automatically located for each image using the admin DB

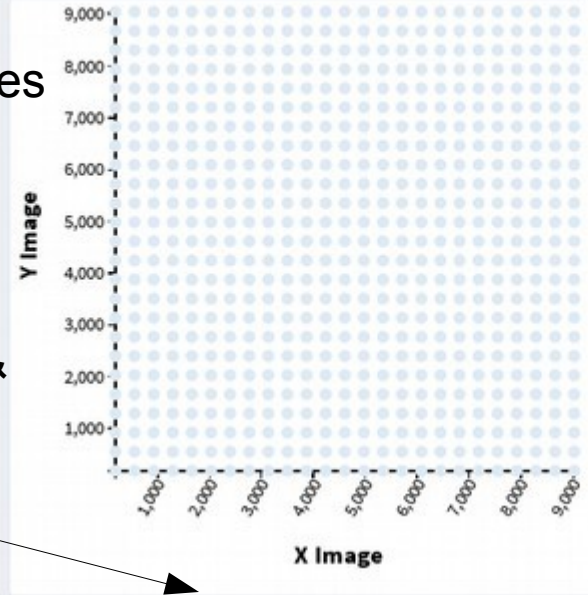
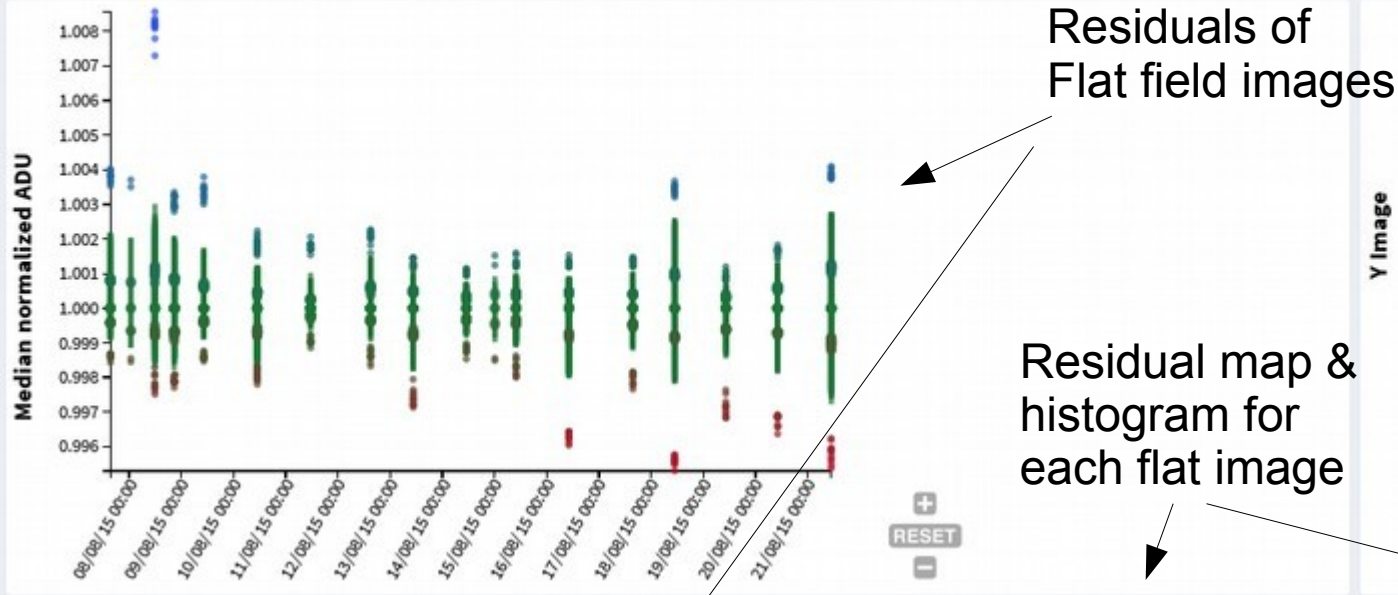




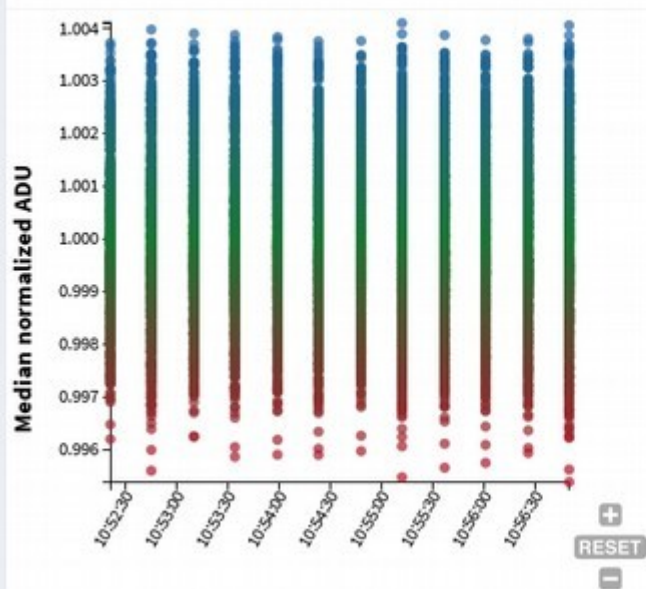
# Flat-Field stability

j02-FLAD-b20150807e0823-rSDSS-00-C01M5 T80Cam Commissioning

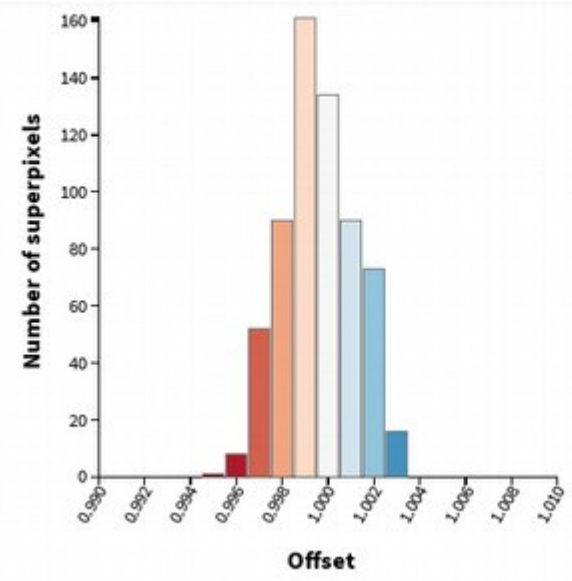
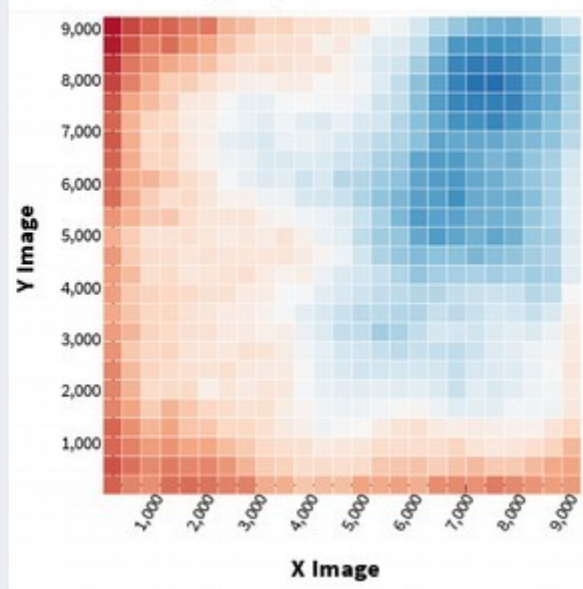
Full Tips Reset



Variation on Night 2015-08-21T10:54:48



Variation & Histogram j02-20150821T105659-01

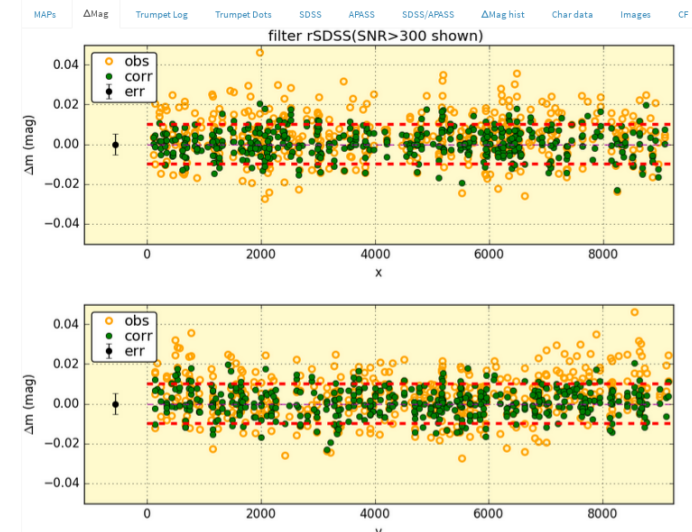


# Illumination correction

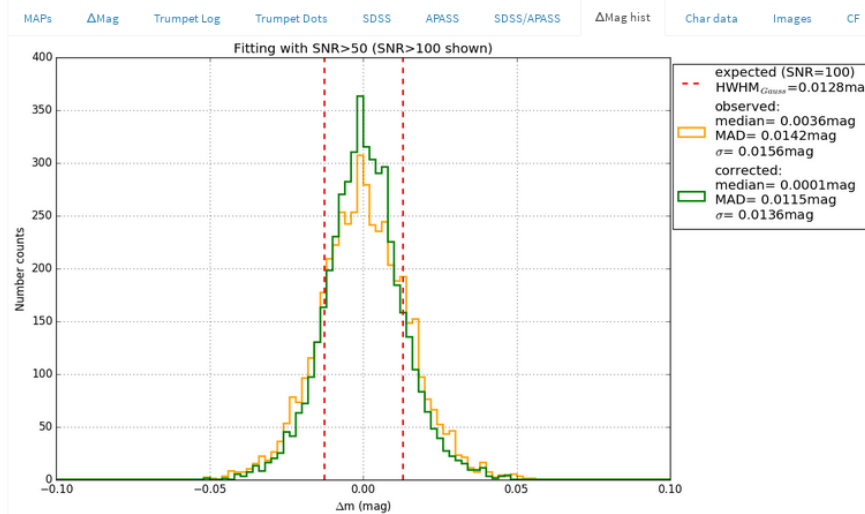
ICOR Illumination Correction - j02-ICOR-b20170630e0731-rSDSS-00-C01PF310D41-1-ACzm

MAPs [ΔMag](#) [Trumpet Log](#) [Trumpet Dots](#) [SDSS](#) [APASS](#) [SDSS/APASS](#) [ΔMag hist](#) [Char data](#) [Images](#) [CF](#)

ICOR Illumination Correction - j02-ICOR-b20170630e0731-rSDSS-00-C01PF310D41-1-ACzm



ion - j02-ICOR-b20170630e0731-rSDSS-00-C01PF310D41-1-ACzm



- Illumination correction is a second order correction to take into account
  - Non-homogeneous 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.



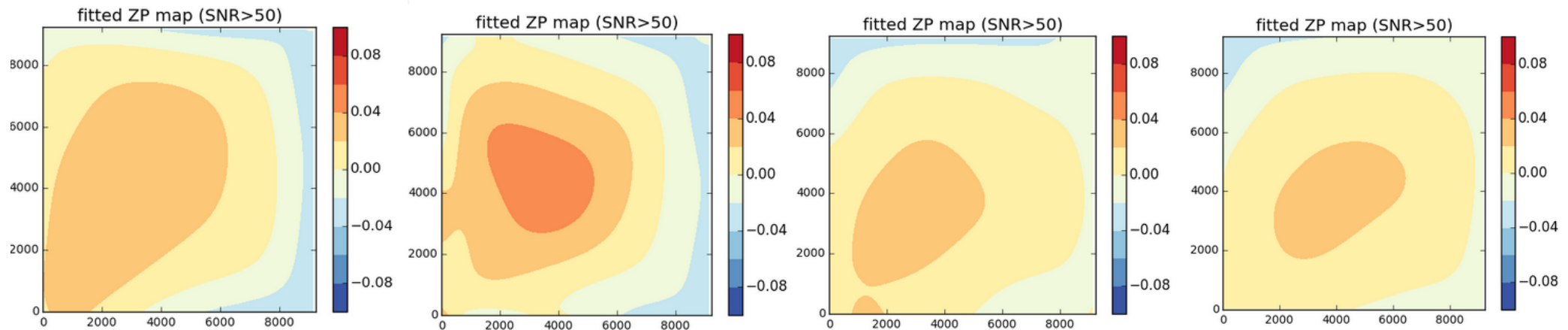
# Illumination correction

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

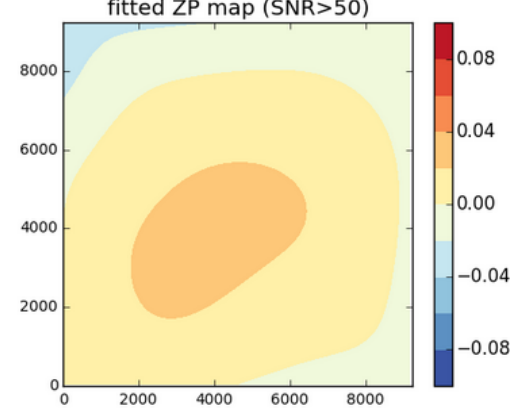
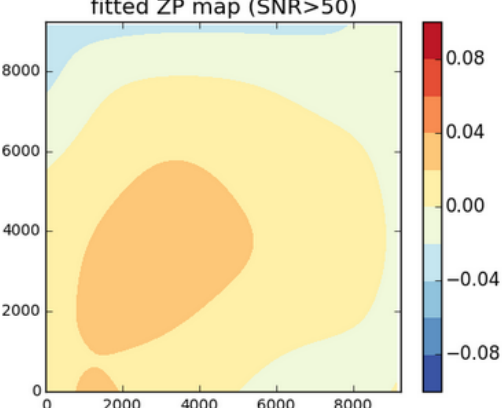
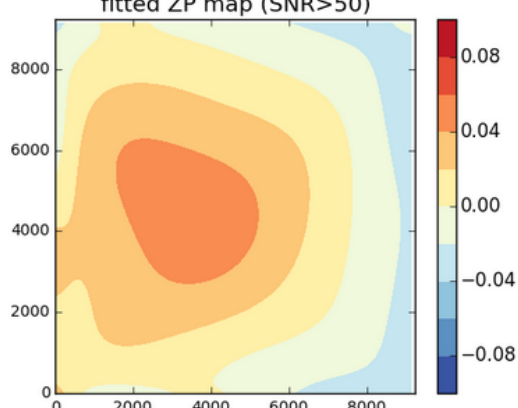
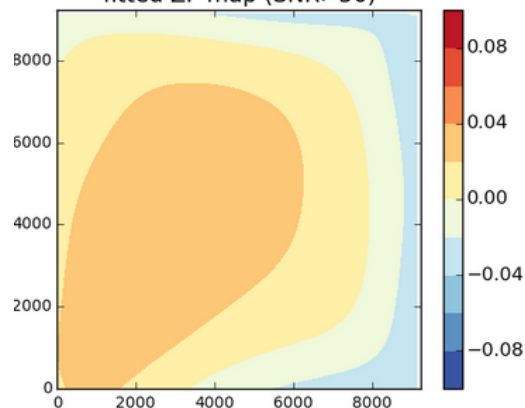
05Sep2016-11Nov2016

fitted ZP map (SNR>50)

fitted ZP map (SNR>50)

fitted ZP map (SNR>50)

fitted ZP map (SNR>50)



25Ene2017-09Mar2017

09Mar2017-31May2017

31May2017-30Jun2017

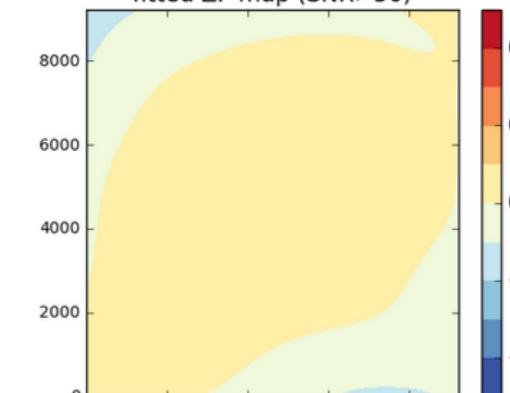
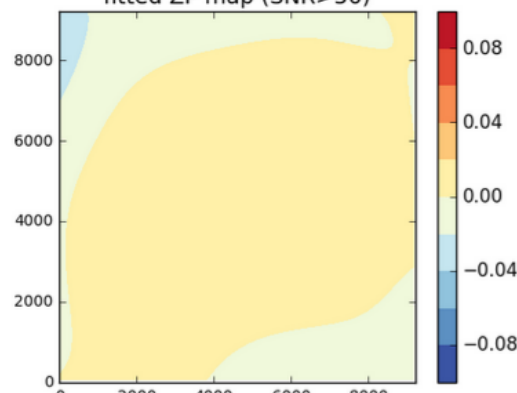
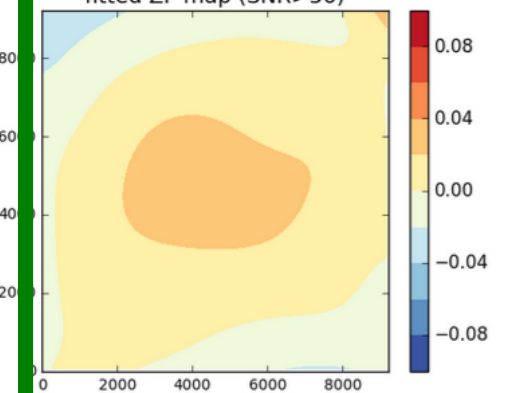
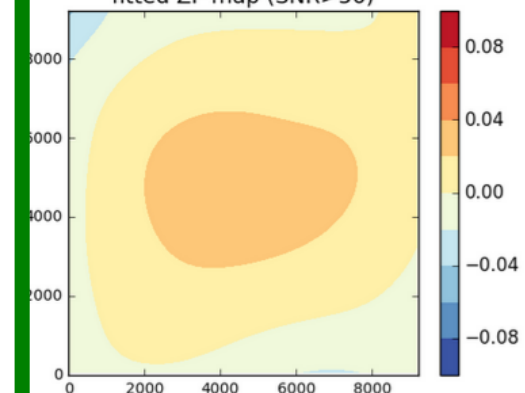
30Jun2017-31Jul2017

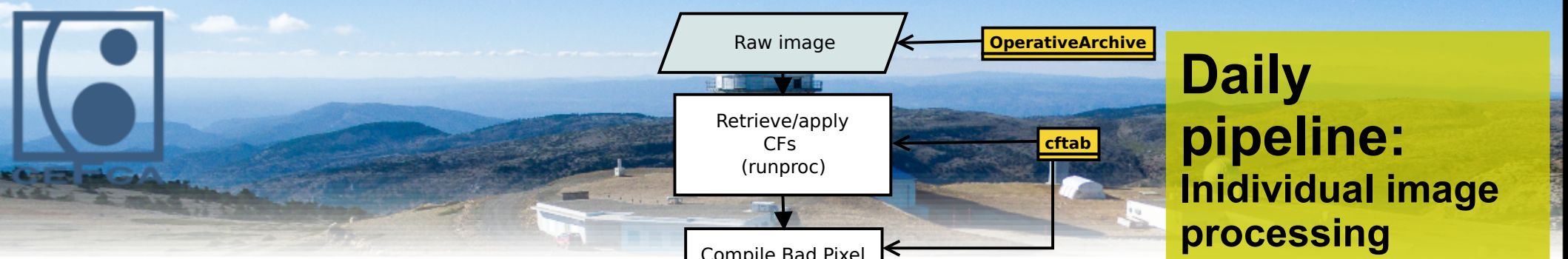
fitted ZP map (SNR>50)

fitted ZP map (SNR>50)

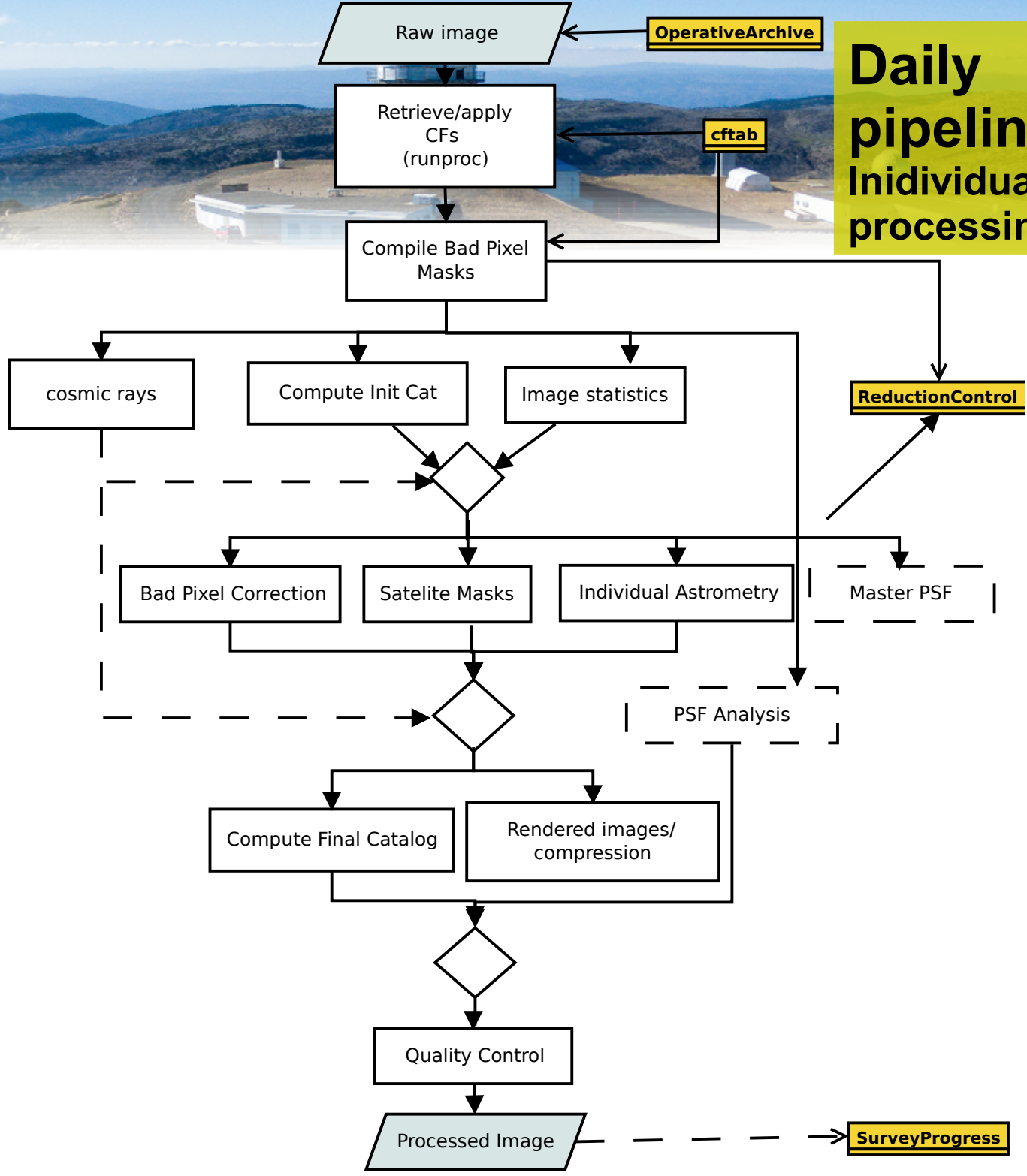
fitted ZP map (SNR>50)

fitted ZP map (SNR>50)





**Daily pipeline: Individual image processing**



**2 daily workloads**

590, 7150 / day preproc  
590, 7150 / day

160 K, 8 M / end of survey

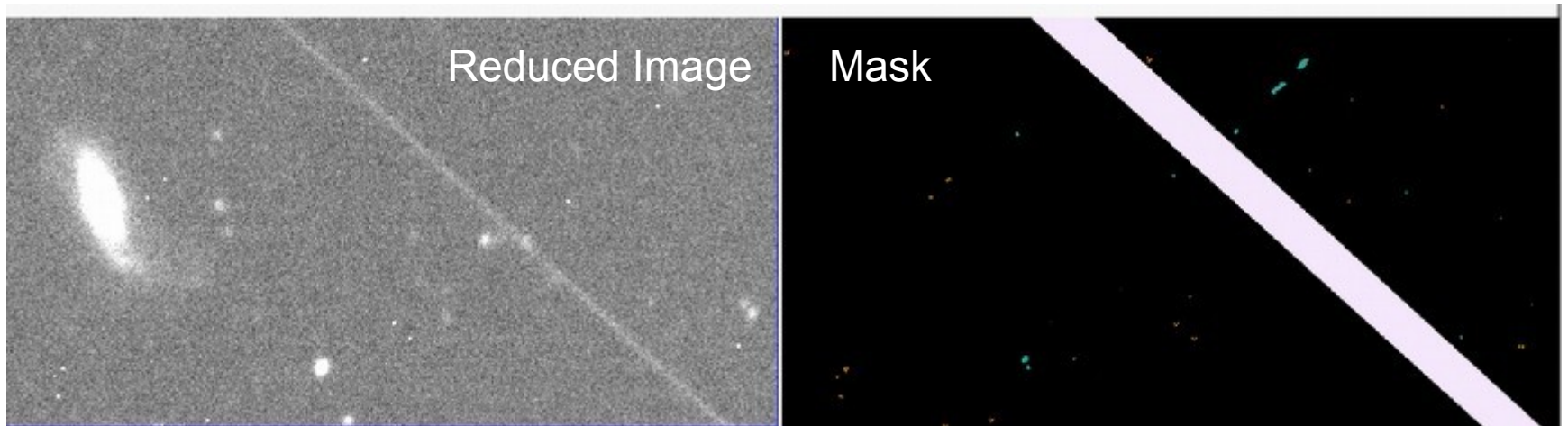
DATABASES



# Image Masks

## The daily pipeline produces:

- Reduced image with the compressed pixel mask stored in the 2<sup>nd</sup> 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.

Reduced Image List - Review 1 of 1

sources = 1  
ellipticity = 0.11  
eccentricity = 0.46  
orientation = 0.75 rad  
FWHM = 4.43 arcsec

Project	1000001	Object	J-PLUS-00831	Filter	ISD55	Img. Type	SCIE	Date Obs.	2016-07-03 1:49:53	Valid	
RA	259.48606	DEC	30.44031	Exp. Time	26.00	FWHM Mean	FWHM	4.428	Exit Status	OK	

User Comment

Linear  Log

Flag RAW Valid & Next



# Tile Coadding

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

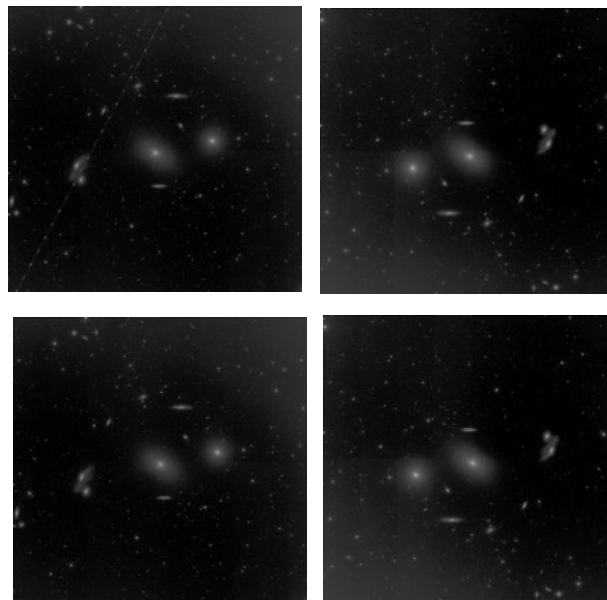
Individual Image  
processing

Tile Coadding,  
Catalog  
computation

Science Database  
Upload

150, 2000 / day

4000 x 12, 25200 x 59 / survey



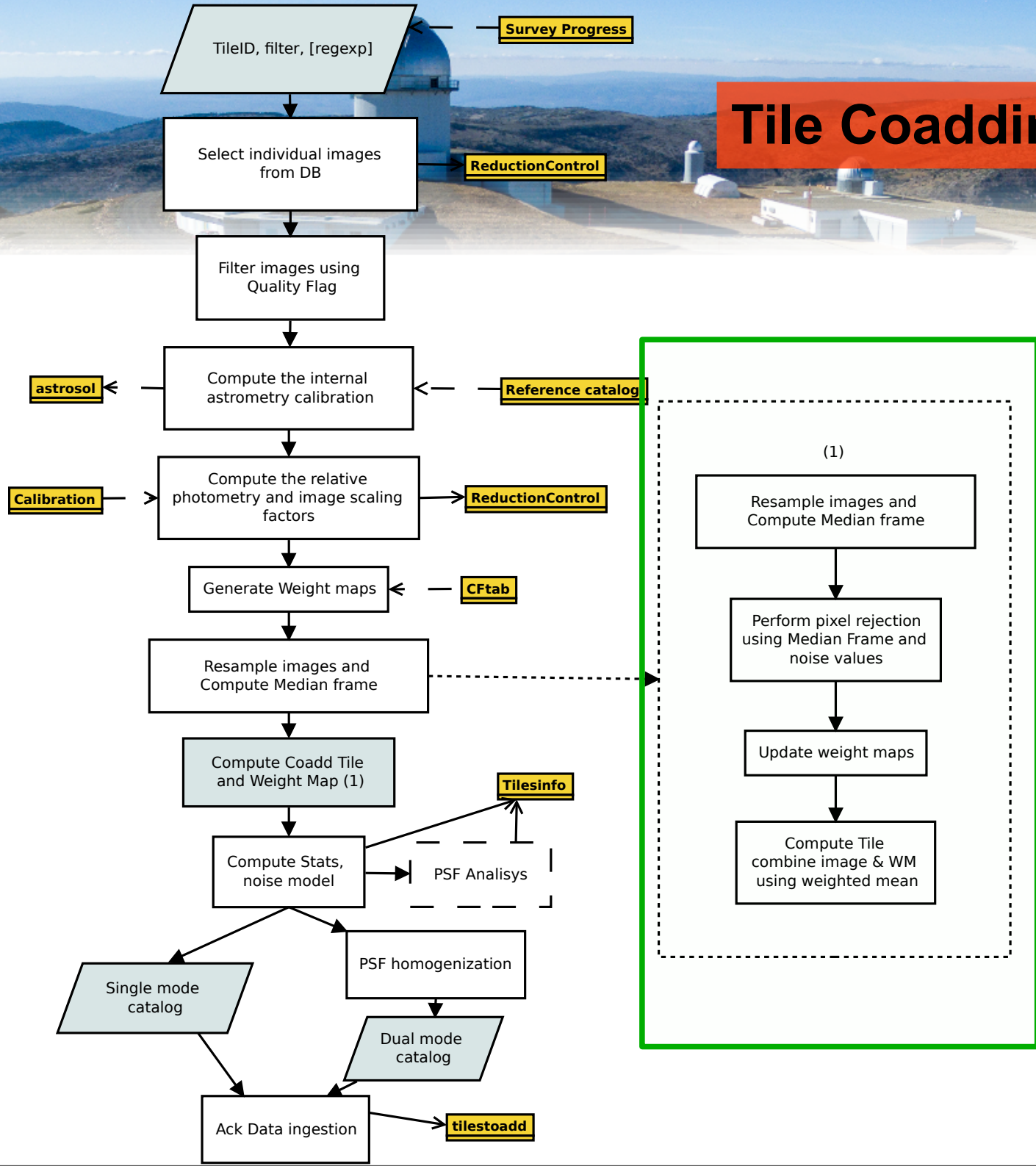
Combine  
into





# Tile Coadding

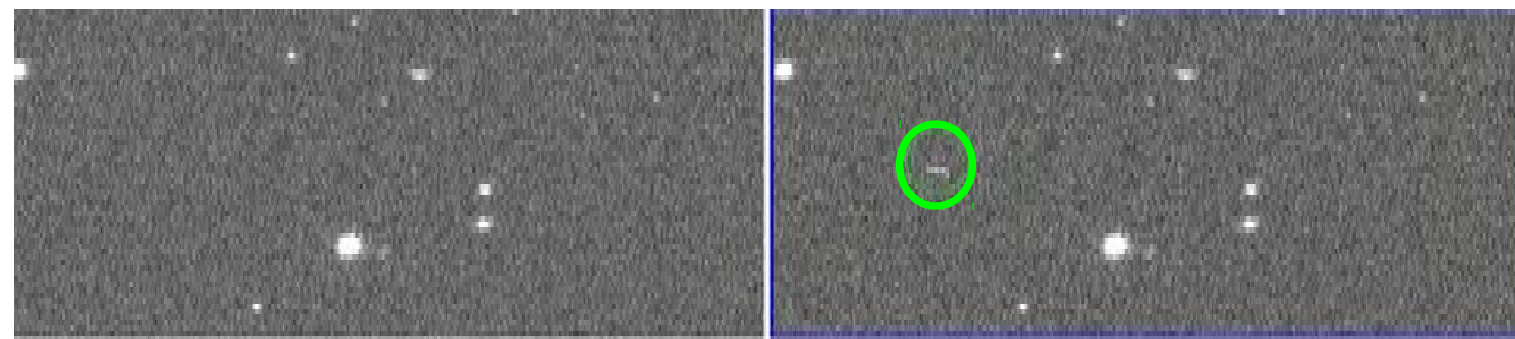
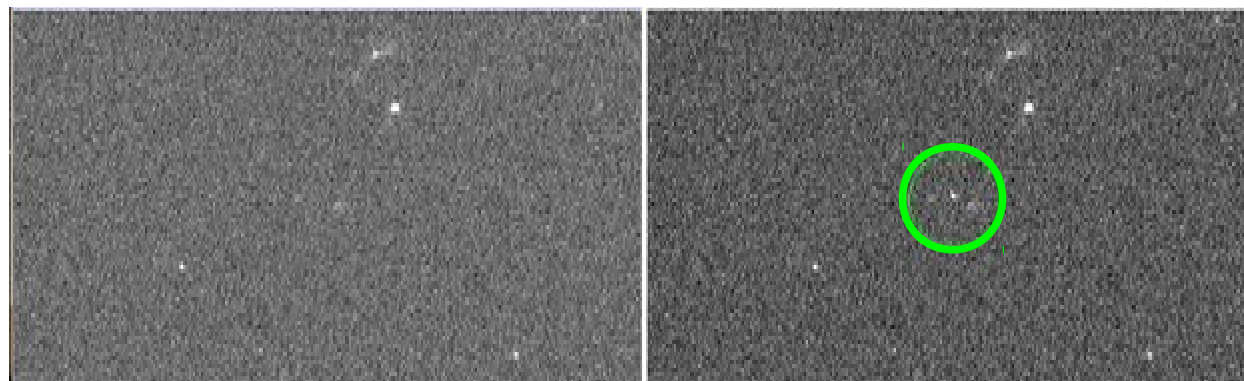
150, 2000 / day  
4000 x 12, 25200 x 59 / survey





# Tile Coadding

- Pixel rejection on coadding





# Reduction Portal

ReductionUPAD



Not Logged

Search...

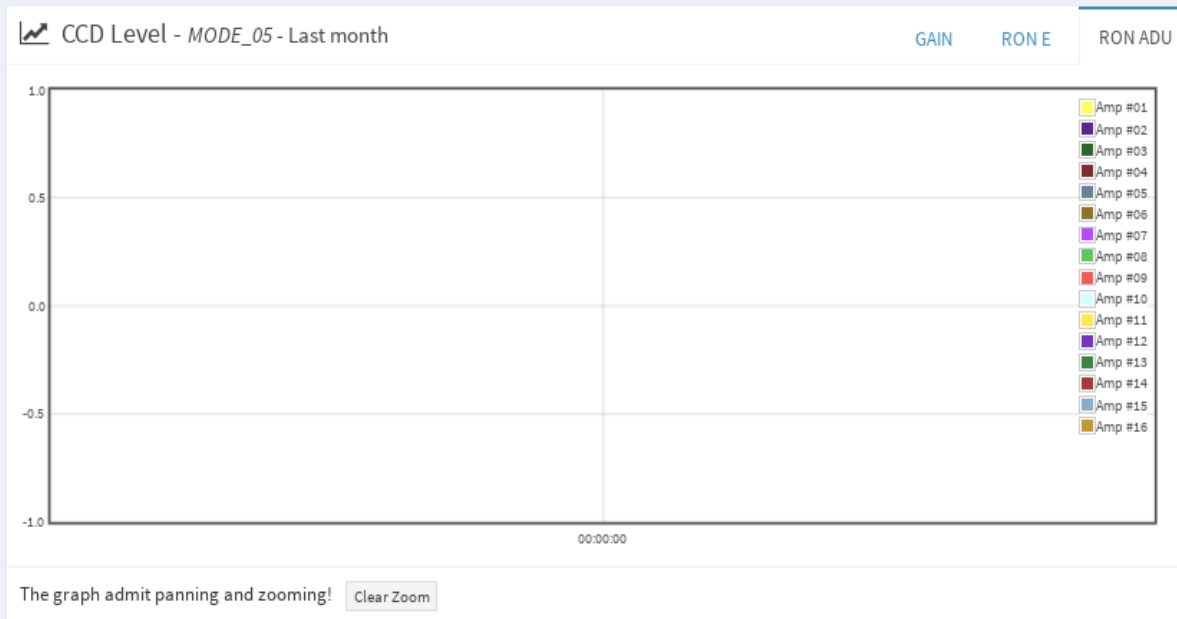
T80Cam Commissioning Dashboard (night: 2016-03-15)

**SCIENCE**  
67

**BIAS**  
0

**FLATS (SKY + DOME)**  
0

**DARKS**  
0



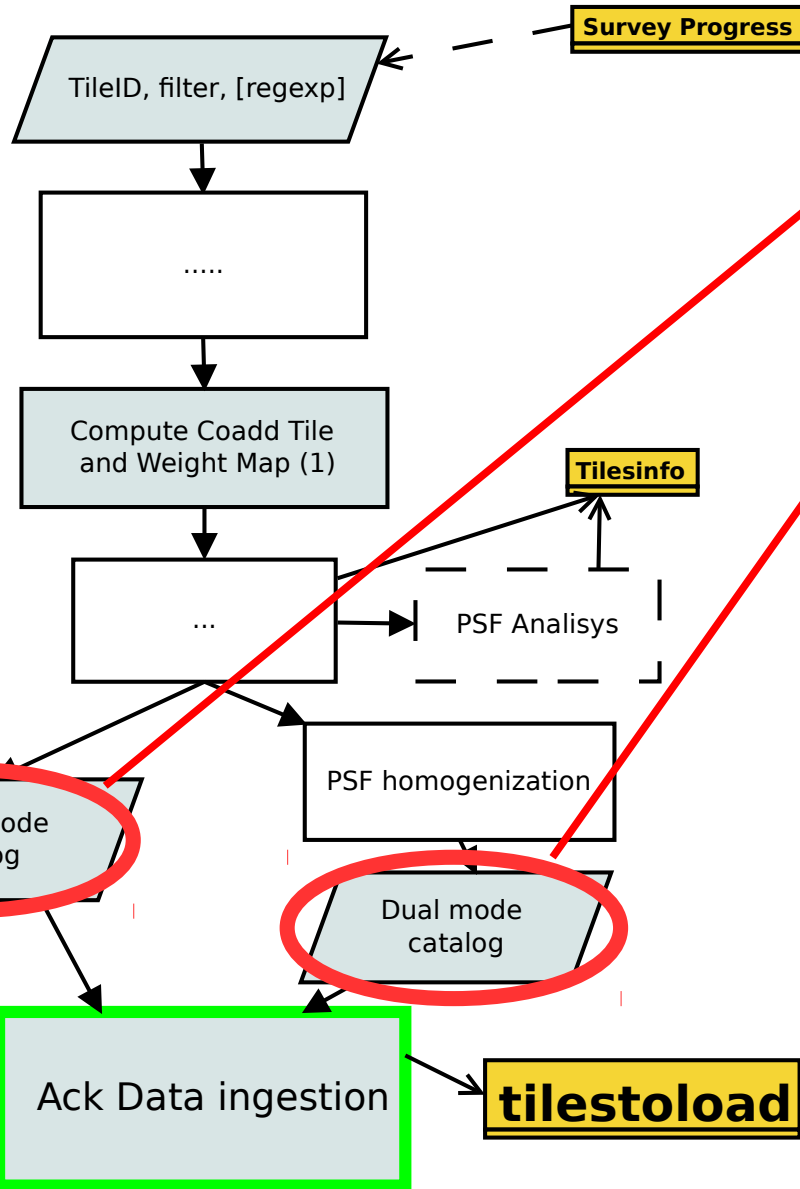
Last  Coadded  Reduced

j02-20160315T231107-01_prepro	0
rSDSS - BD+381670_AFTERO PAC -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	

New: Improved 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).

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

# Pipelines - Catalogs



## ➤ Single mode catalogs:

- Computed with SExtractor independently in each filter

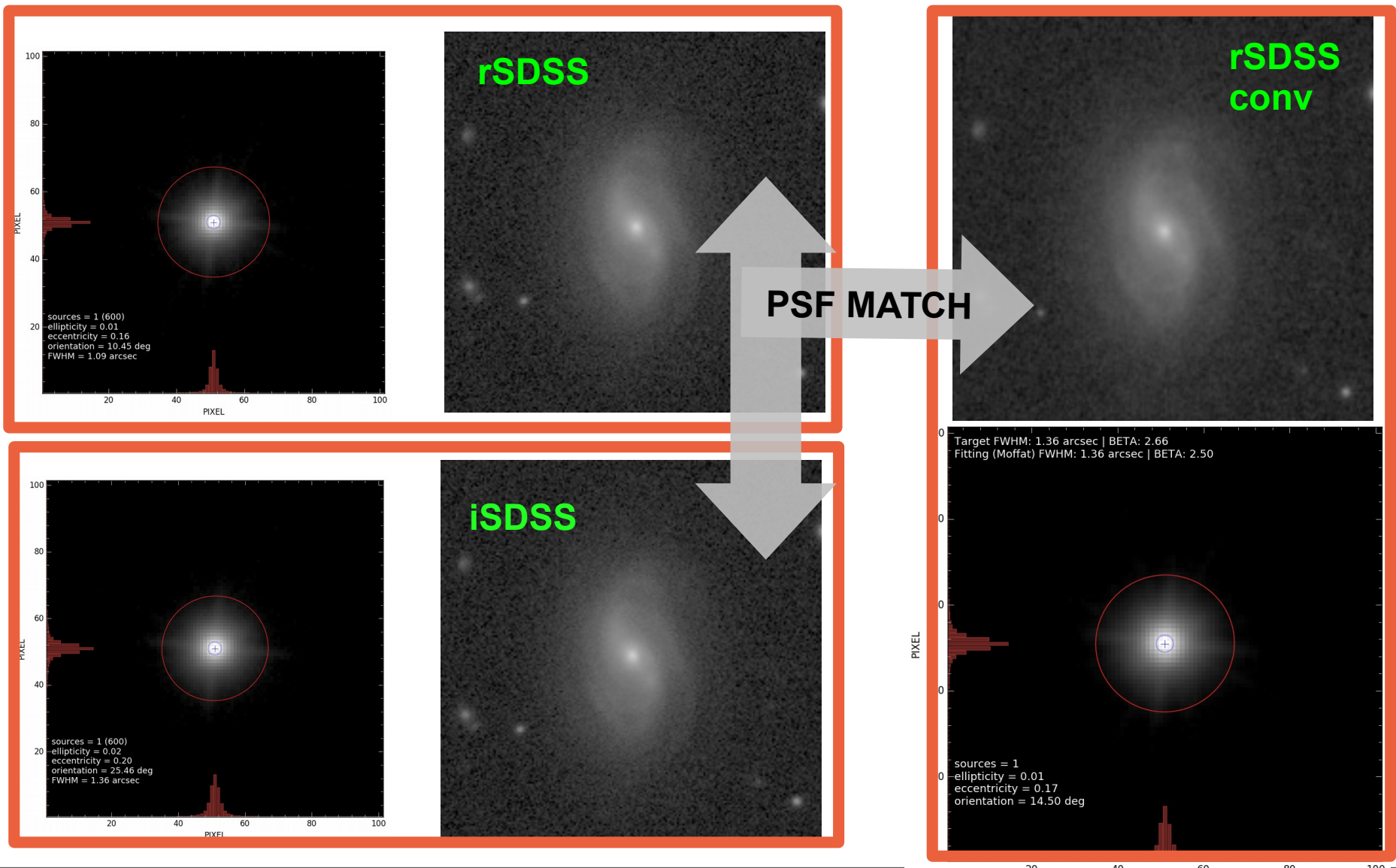
## ➤ Dual mode catalogs:

- A reference filter (rSDSS) is used to define the apertures
- **PSF matched photometry** is computed following Molino et al 2014.



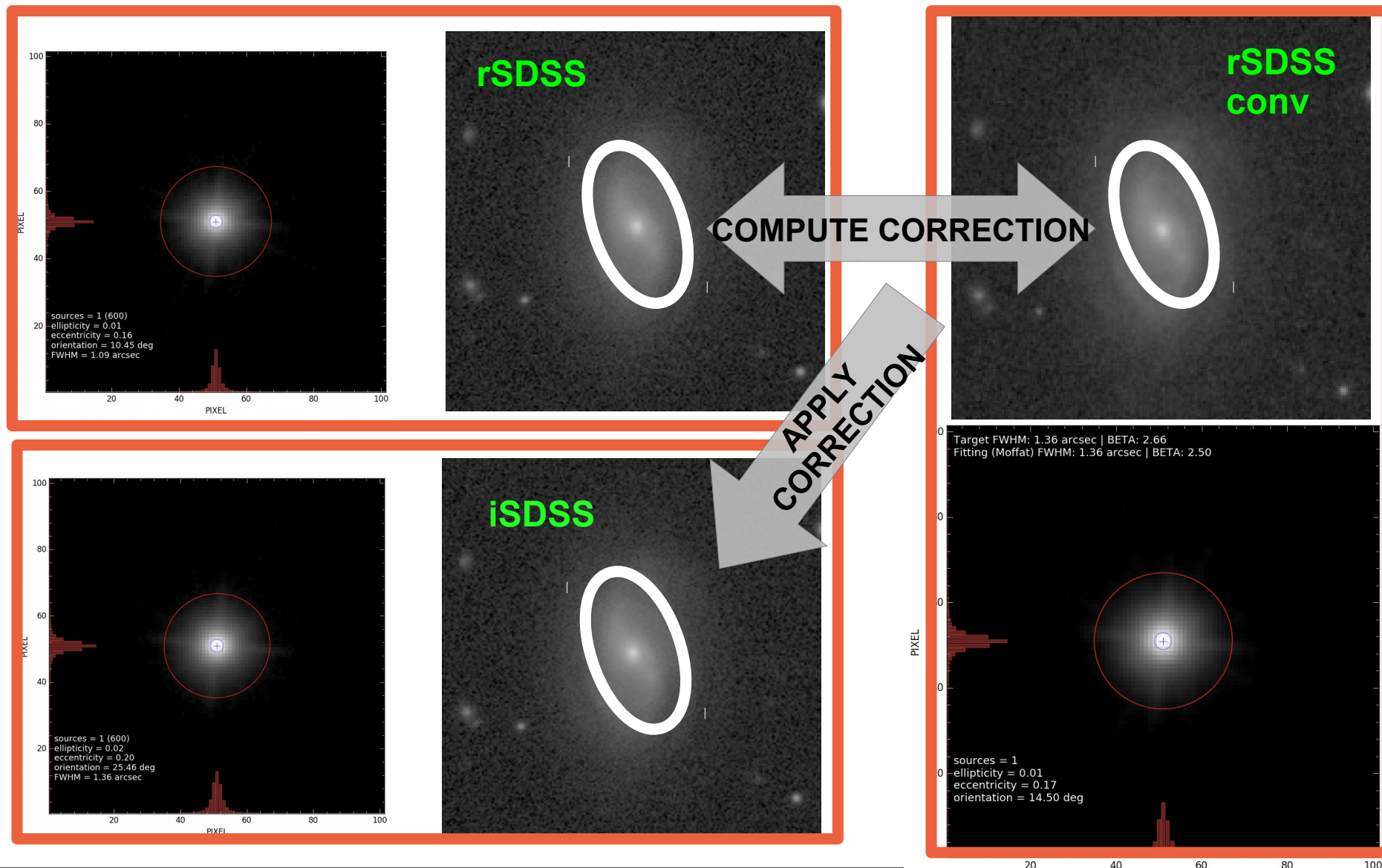
# Pipelines - Catalogs

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



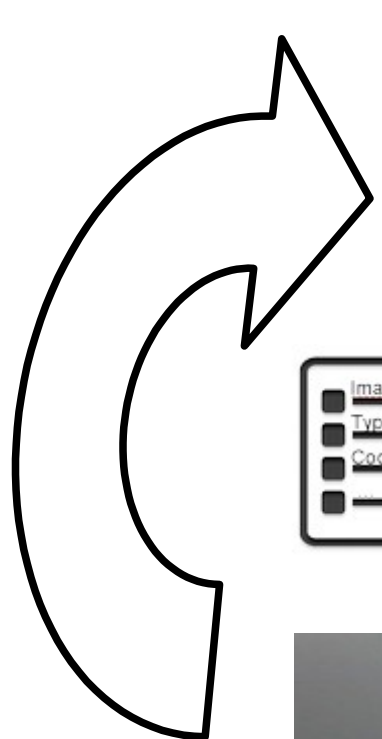
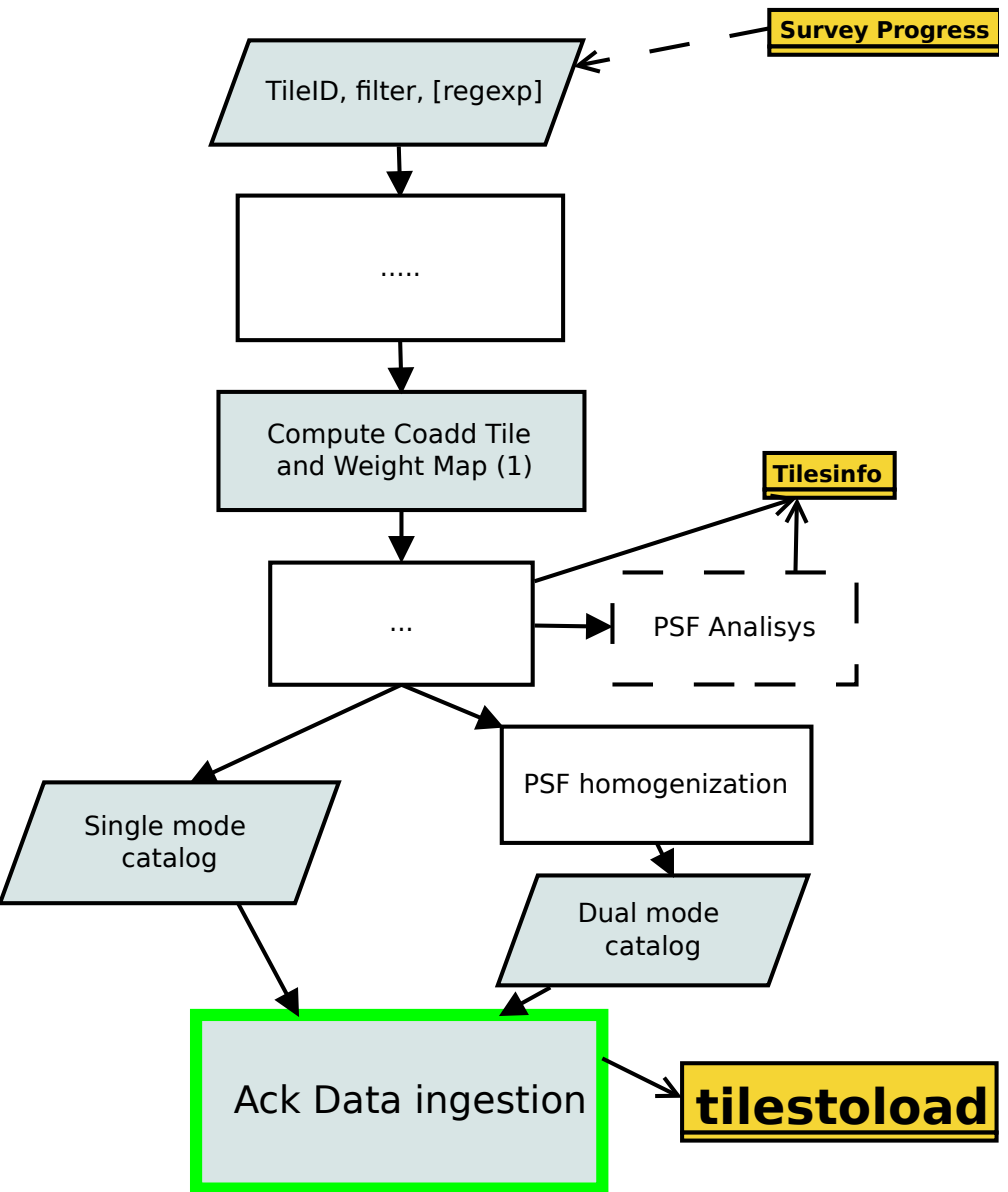


# Pipelines - Catalogs





# Pipelines - Catalogs



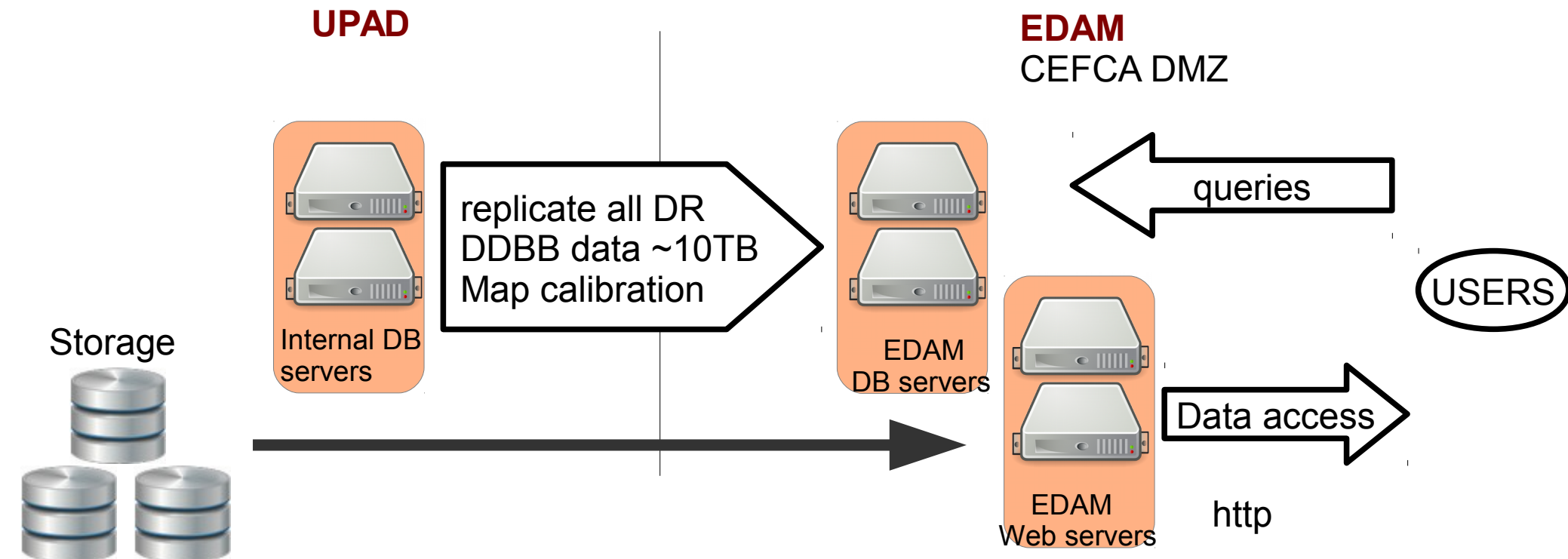
■	ImageName
■	Type
■	Coordinates
■	





# 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.**



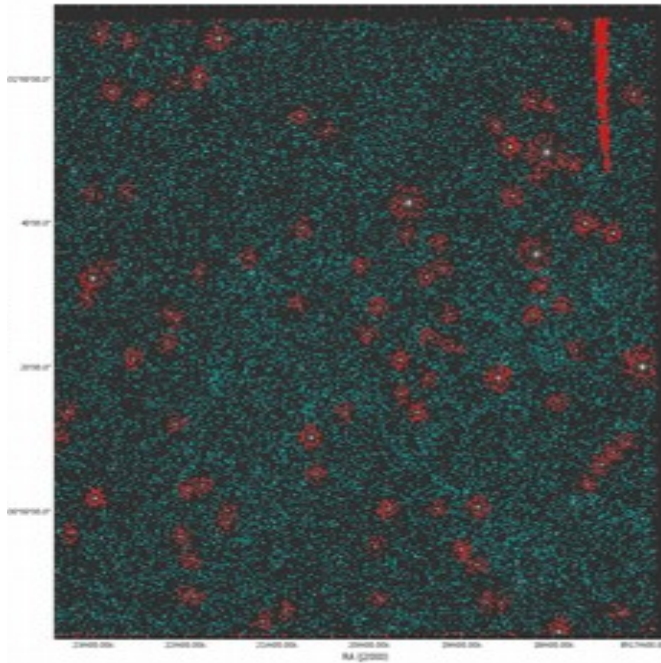
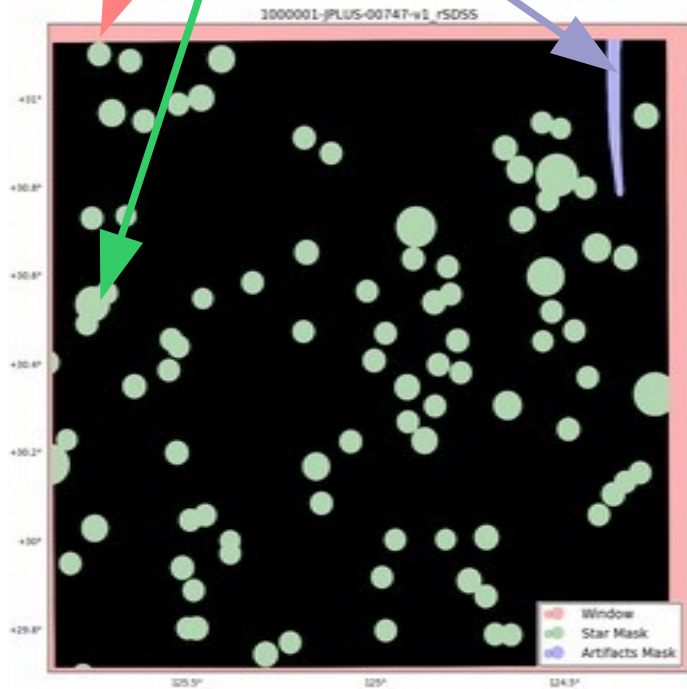
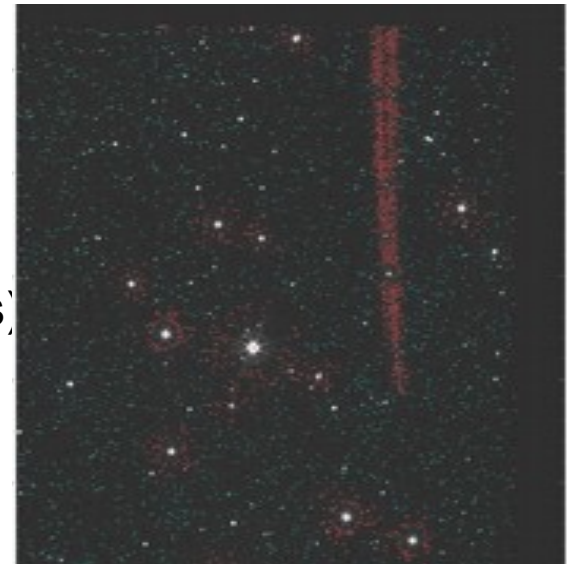




# Tile Masks

In EDR we provide masks (mangle format)

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

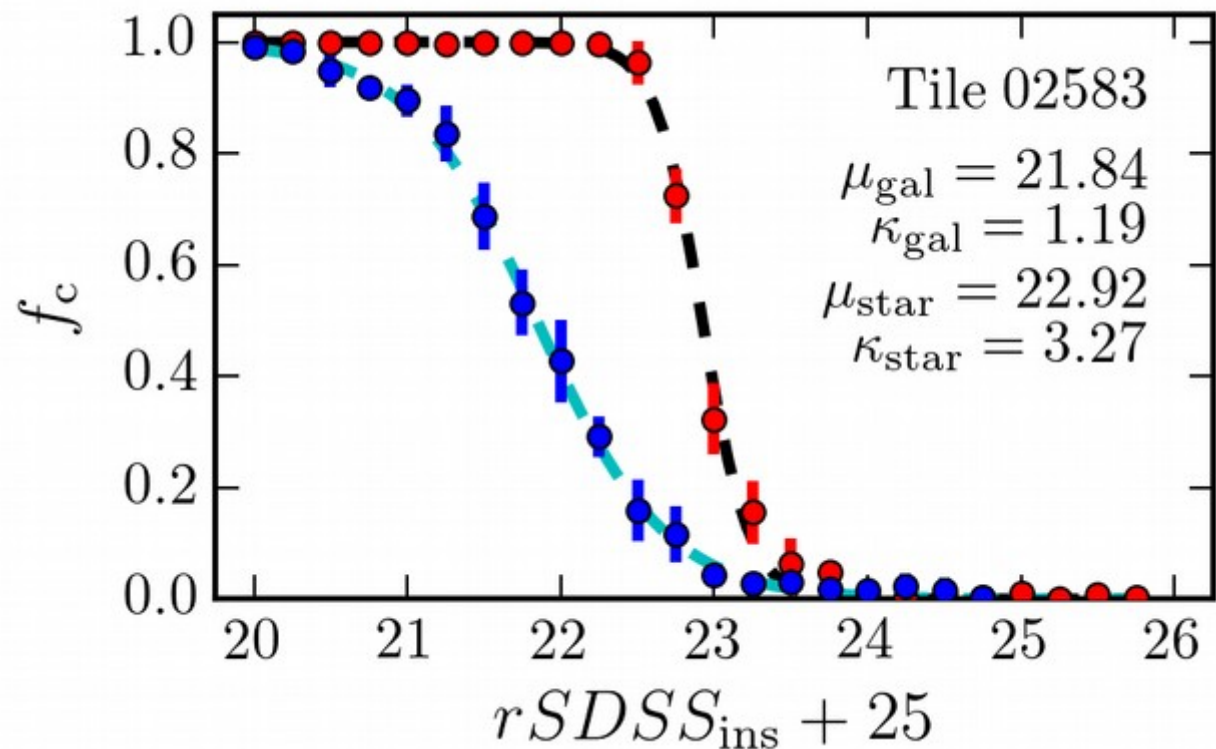




# Image depth / completeness

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

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





# EDAM Web Front End

The screenshot displays the EDAM Web Front End interface. The background is a star field with a prominent galaxy. Overlaid on the interface are several key components:

- Navigation and Search:** A top navigation bar with a 'PLUS' logo and a 'Services' dropdown menu. A search bar is located on the left side.
- Search Results:** A 'Sky Navigator search' section on the left, showing input fields for 'Object name:', 'RA: 22:37:15.859', and 'DEC: 34:24:42.5'.
- Services Menu:** A dropdown menu listing various services: Information about J-PLUS Services, Sky Navigator, Object List Search, Image Search, Cone Search, Coverage Map, ASCII Image Catalogues, VO Asynchronous Queries (ADQL), ADQL help and Tables, V.O. Services, and Variable Candidates Tool.
- Object Information Panel:** A panel on the right displaying details for a selected object: RA, Dec (deg): 339.3308, 34.4478; Class star: 0.0286; Type: -; Photo Z: -. It includes buttons for 'Images', 'Explore Object', 'SDSS', 'NED', and 'SIMBAD'.
- Color-Magnitude Diagram (CMD):** A plot titled 'Object: 5350 - 48578' showing 'MAG\_AUTO' vs 'Wavelength (Å)'. The plot displays a distribution of stars with different colors and magnitudes.

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



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# Deriverables

## Images & Mask:

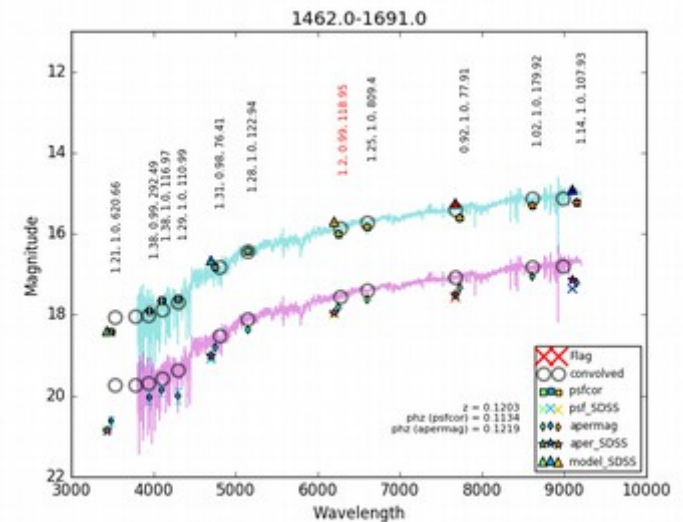
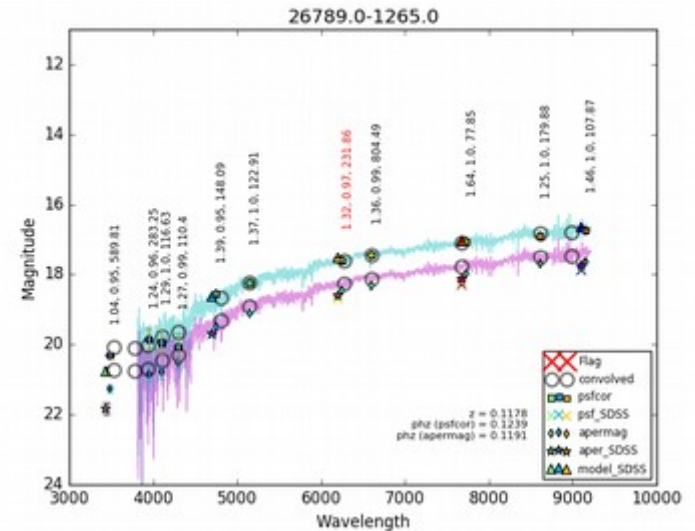
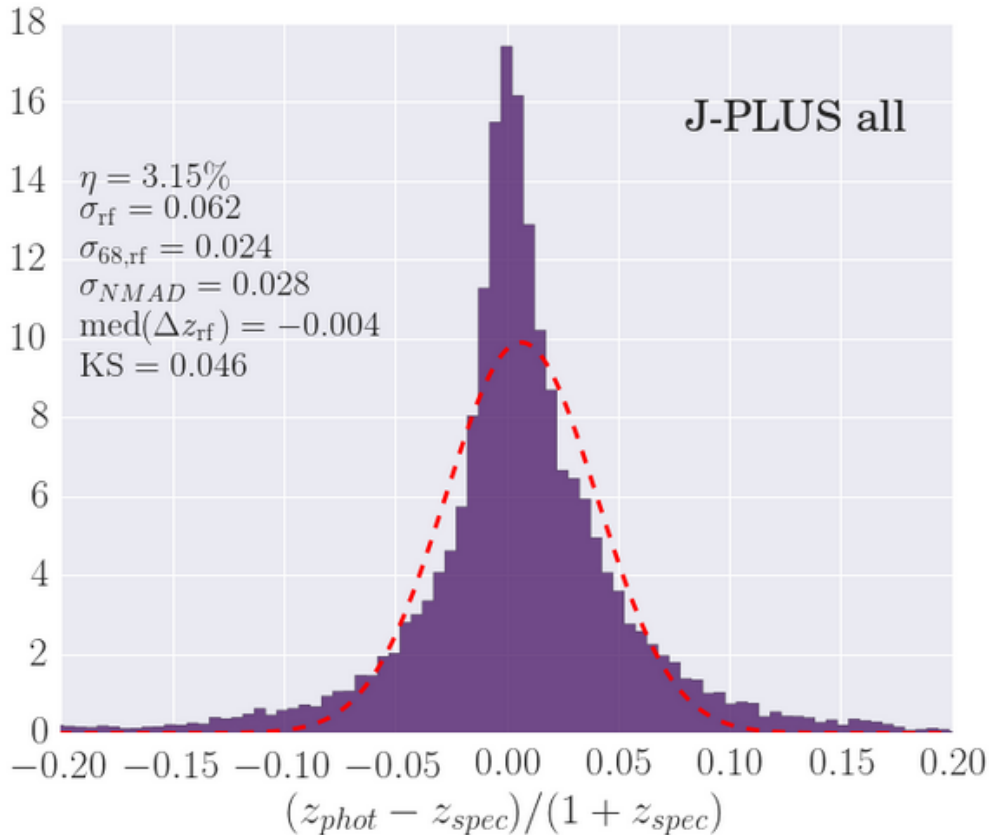
- Coadded Images & Weight Maps registered at pixel level on the different filters.
- Masks (tile area, bright stars, artifacts)
- Image characterization (FWHM, depth,...)

## 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





Thanks !