KiDS

OmegaCEN/KiDS

B. DATA PRODUCTS

Jelte de Jong
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ESO HQ, 21-03-2012

Data centre vs. Survey team?

KiDS/Astro-WISE a “special case”

OmegaCEN (data centre) is part of the KiDS collaboration (survey team), and Astro-WISE designed for the KiDS survey

Q: Which kind of data products will be delivered?

A: Baseline data products:

- Photom. and astrom. calibrated, regridded and stacked images per OB
- Single-band source catalogues
- Multi-colour source catalogues
- Calibration data (flats, bias, fringe maps...)
- For weak lensing pipeline: detrended single exposure, single CCD images

These data products are input for scientific analysis

Q: Which kind of data products will be delivered?

A: Later on, parts of scientific analysis will be included into pipeline to produce “advanced data products”, such as:

- Images with homogenised and Gaussianised PSF
- Photometric redshifts (Photo-z)
- Morphological parameters (e.g. from GALFIT and GALPHOT)
- Unsharp-masked images
- Aperture-matched colour catalogues

Q: Which kind of data products will be delivered?

A: Also, since KiDS science relies heavily on combination with VIKING, combined ugri+ZYJHK data products will be created, for example:

- 9-band catalogues (aperture matched)
- Gaussianized VIKING images

To be decided whether certain levels of reprocessing are required

Q: Do you combine deep and shallow observations?

A: Not applicable to KiDS survey data

But shallower ATLAS data will be used for photometric calibration of KiDS-S field

Q: Is reprocessing planned as data sets increase or pipeline algorithms improve?

A: Yes, this is an integral part of our strategy and the Astro-WISE philosophy!

All team members can collaborate to improve the pipeline and data products.

Complete data lineage of final products is stored allowing straightforward:

- checking whether used calibration data / software version is up-to-date
- repeating of processing steps as needed

Q: Is the content of catalogues agreed with the PI?

A: Yes, it will be

At the moment, focus is on fine-tuning the calibration of survey data, up to calibrated, regridded and stacked images

Exact content and format of catalogues will be determined with help of a team of scientists

Q: If various filters are combined, how is source detection handled?

A: To be decided

This will depend on science cases;
Astro-WISE supports several different methods

Unlikely to depend on detection in 1 band...

Re A.6: Support from operations

Several different issues/wishes

- Survey progress: lagging behind expectations, particularly r-band
- Time/data lost due to insufficient quality
  (i.e. grade C; oct/nov: 30%, dec: 20%, feb: 13%)
- Better/more information about technical work / changes on hardware would be useful
  (mailings, regular telecons?)

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KiDS survey

Requirements for Data Products and Quality Control

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Overview

- Survey overview
- Science drivers
- Data products
- Quality control
- Miscellaneous

Survey overview

- 1500 sq.deg. in u, g, r, i
- two fields: KiDS-S (-35°<δ<-25°) and KiDS-N (-5°<δ<+5°)
- overlapping with VIKING (VISTA)
- Fields chosen so that:
  - Observations possible year-round
  - Spectroscopy from SDSS and 2DFGRS already available
- repeat pass in g, providing 2-year baseline

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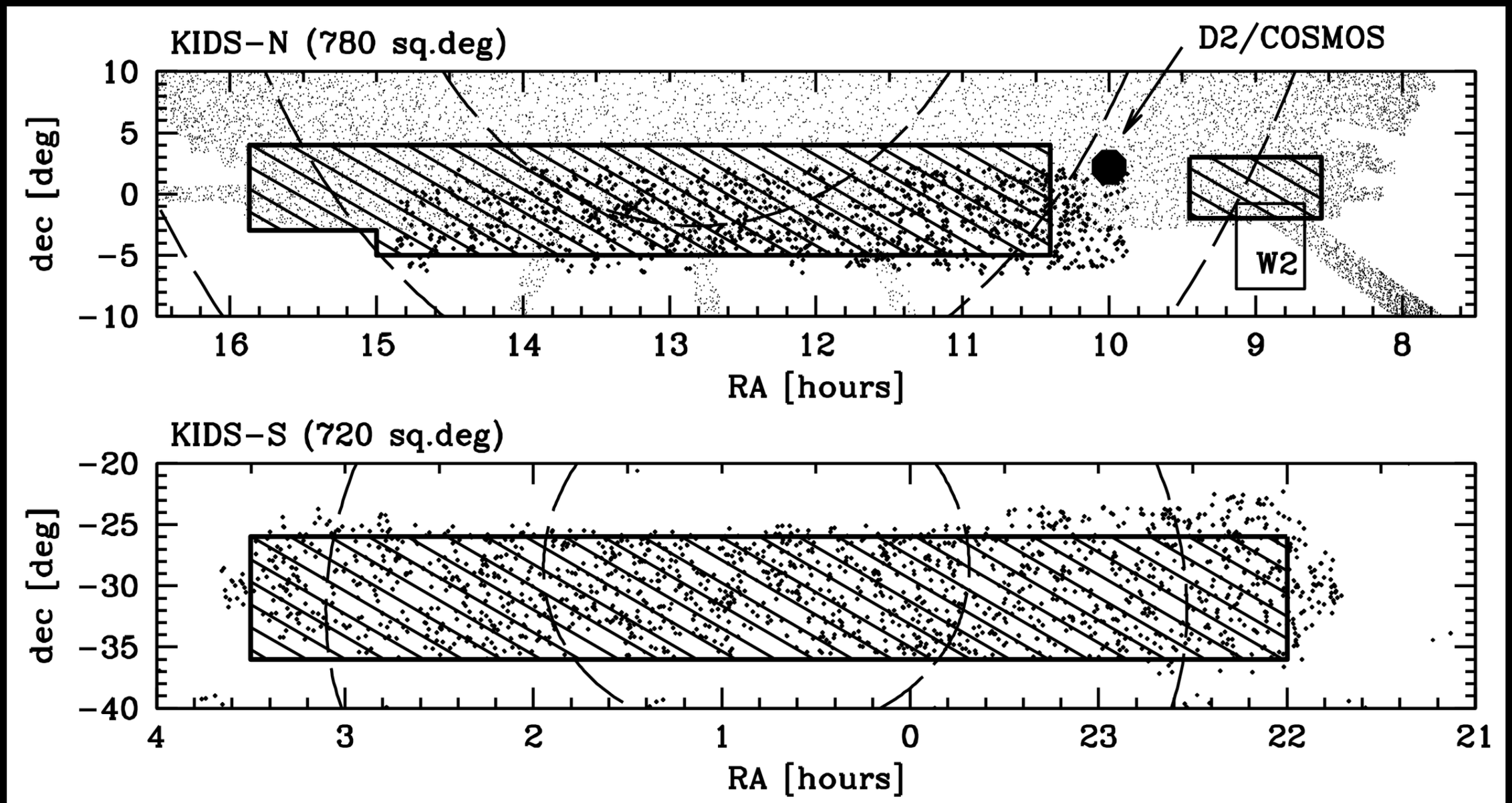
Survey overview



Survey overview

- Survey ‘tiles’ follow the Astro-WISE platesystem
- 1 OB per filter; per tile 1 group container
- OBs set-up as follows:

Filter	*Exp. time*	*IQ*	*Airmass*	*Moon FLI; dist*
u	4x250 s	<1.1’’	<1.2	<0.4; >90°
g	5x180 s	<0.9’’	<1.6	<0.4; >90°
r	5x360 s	<0.8’’	<1.3	<0.4; >60°
i	5x240 s	<1.1’’	<2.0	any ; >60°

Science drivers

Main science drivers are:

- Dark energy; expansion history of the universe (Weak Lensing, Photo-z's)
- Structure of galaxy halos (Gal-Gal Lensing)
- Evolution of galaxies and clusters (Photo-z's)
- Galactic stellar halo
- High proper motion objects (e.g. ultra-cool white dwarfs)

Science drivers

Requirements on data products and QC mainly driven by two applications:

- Weak lensing; for 'cosmic shear' systematics in ellipticity measurements must be < 1% (constraints on PSF model and astrometry)
- Photo-z's; needed accuracy in (1+z) is 3 to 5% (constraints on photometry)

Data products

Requirements on data products:

- Photometric calibration:
  - ~1% for all filters (internal, absolute) and between filters (ugri + ZYJHK)
  - PSF homogenisation and Gaussianisation will ensure combination of different filters
- Astrometric calibration:
  - At 0.6'' IQ, no ellipticity introduced when stacking -> accuracy better than ~0.05''
- PSF well understood and modeled

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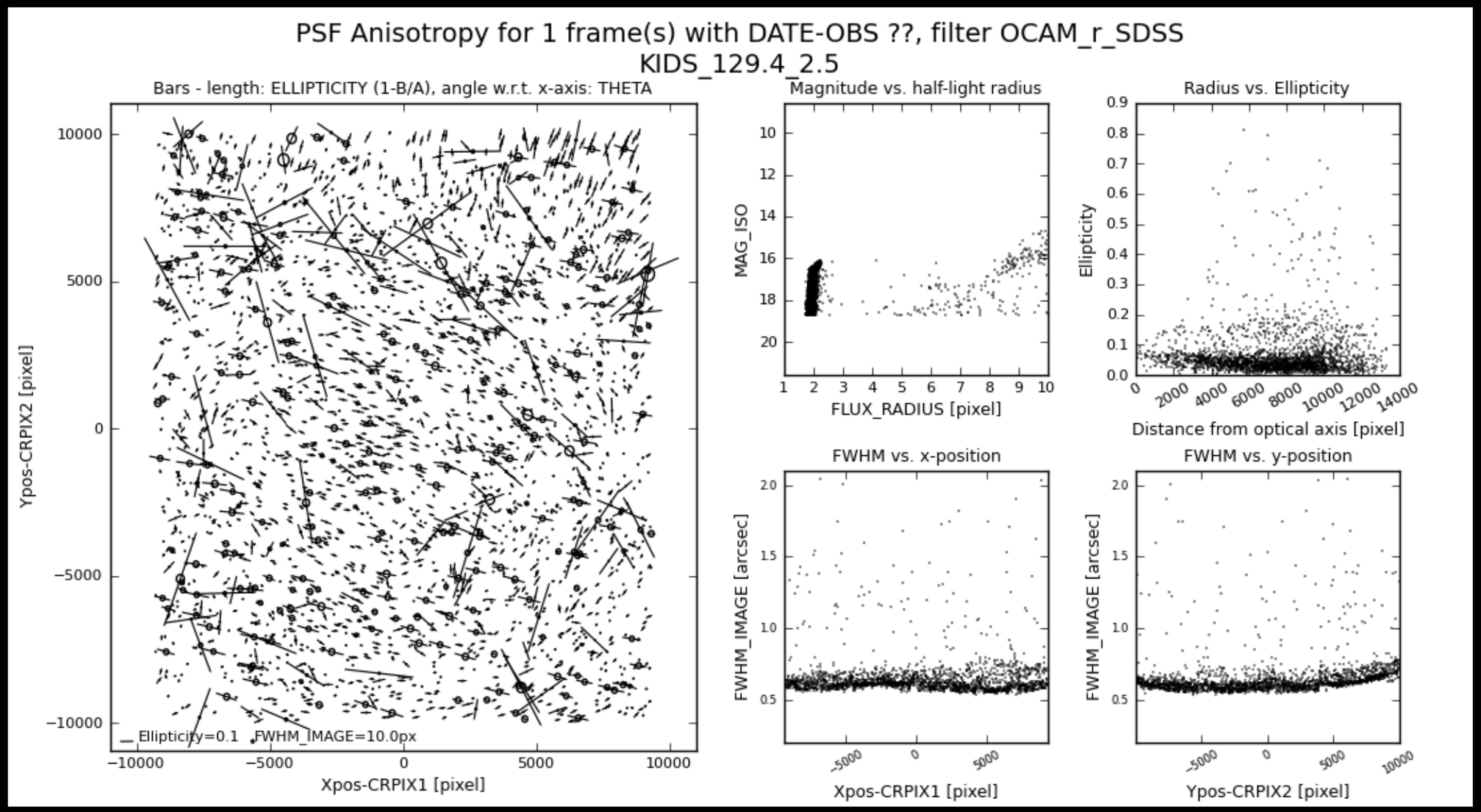
Data products

Crucial strength of VST/OmegaCAM over competitor (prime-focus) wide-field images:

high image quality over whole field!



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Data products

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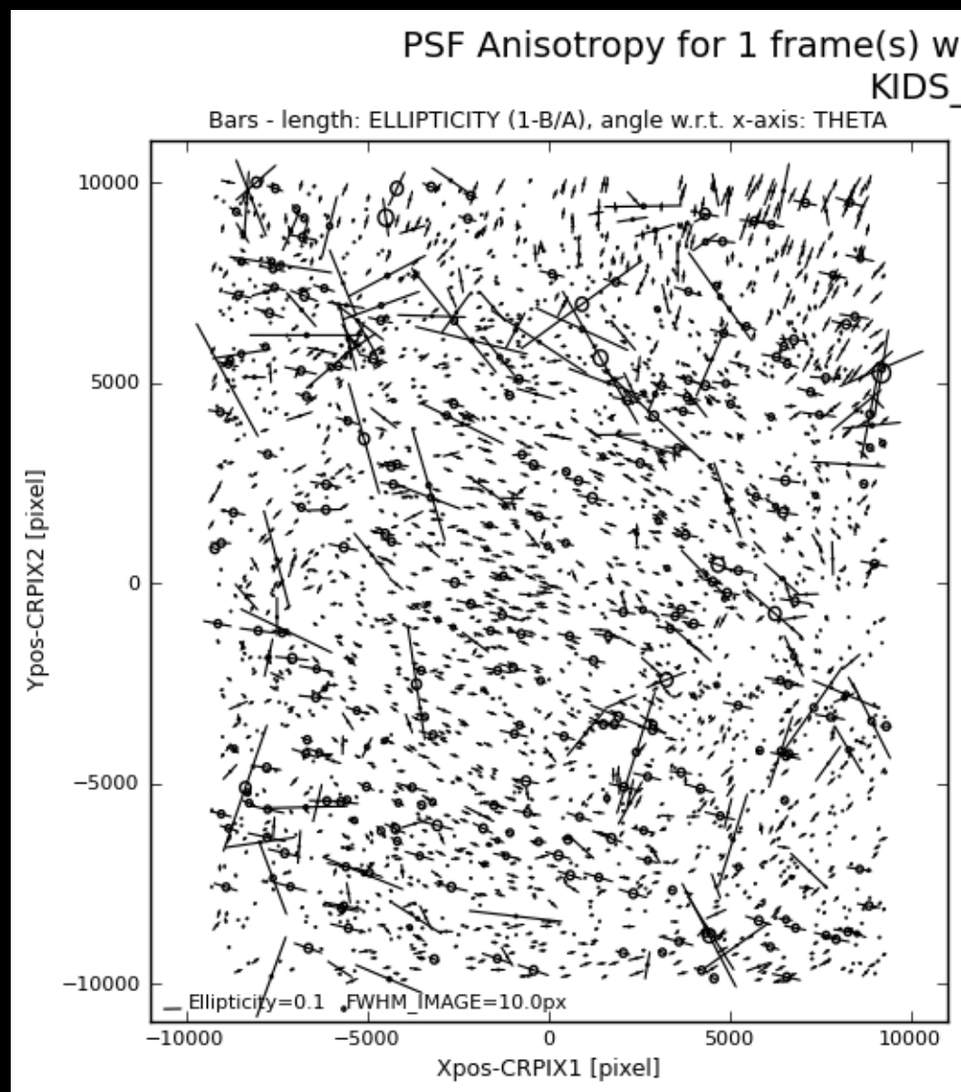
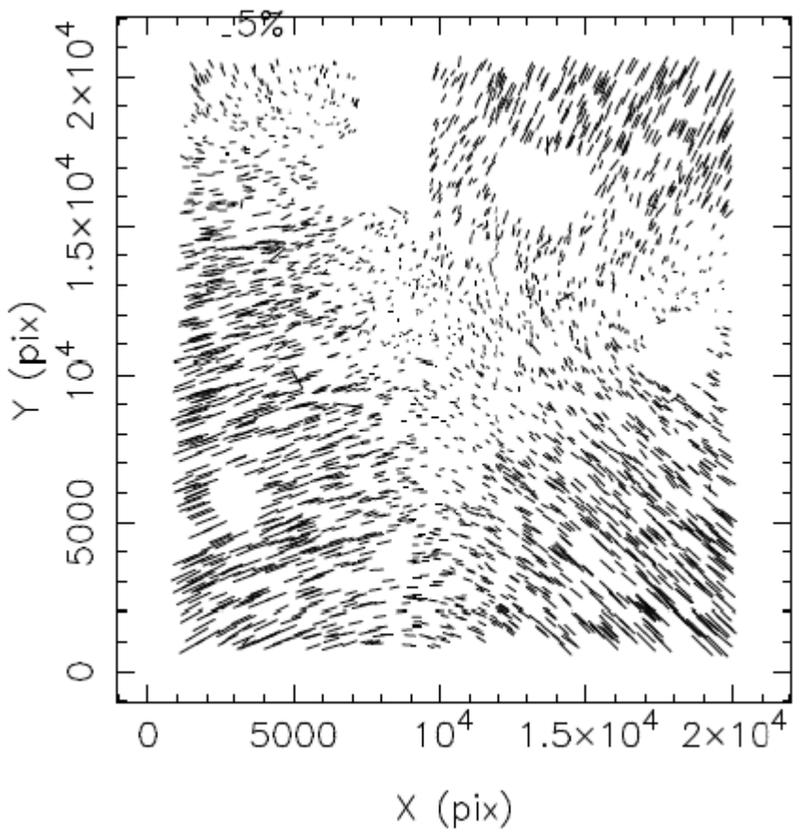


cf. “typical” CFHT PSF map



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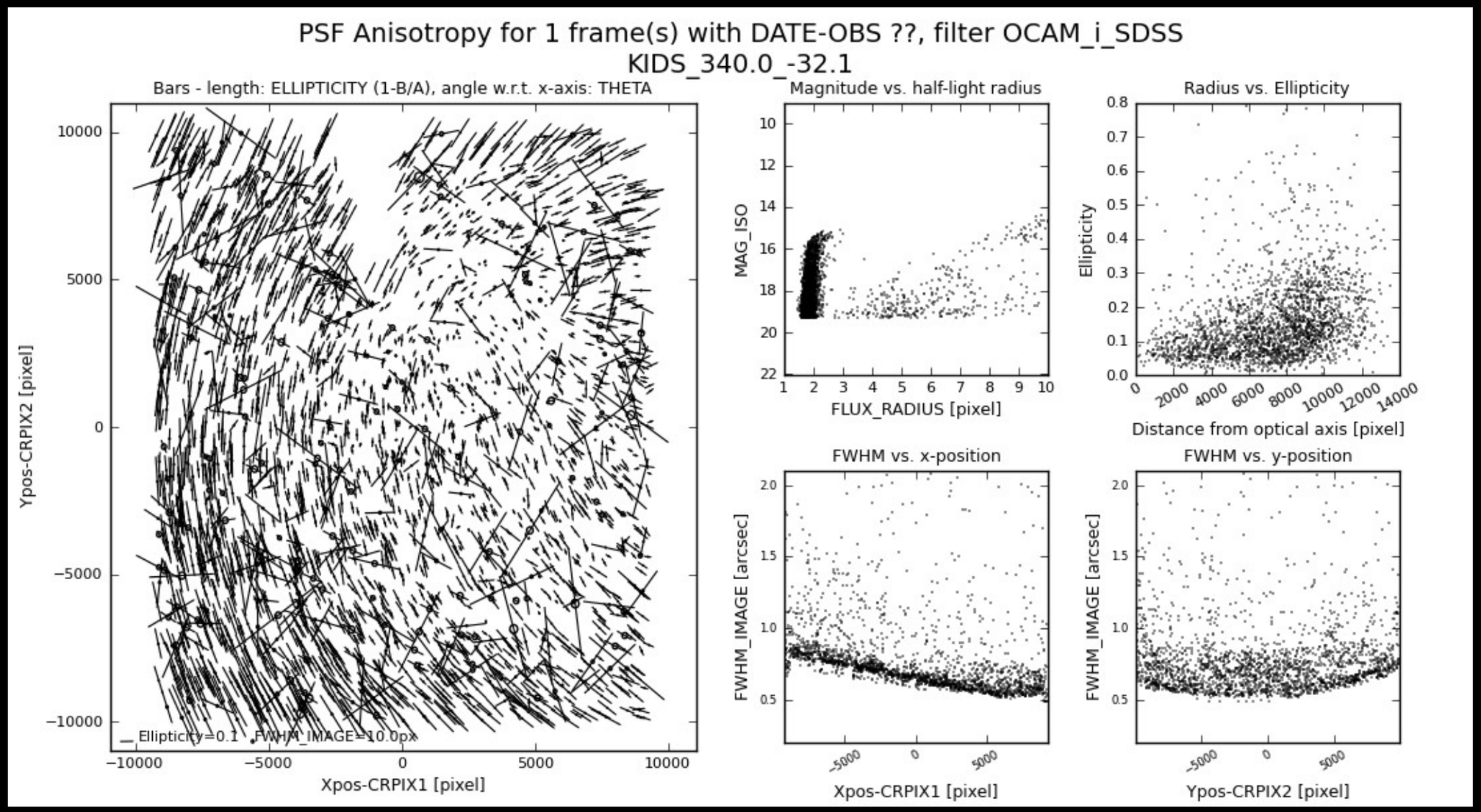
Data products

Therefore important that image quality is under control!



Quality Control

Quality control of:

- Raw Data (QC0)
- Data processing

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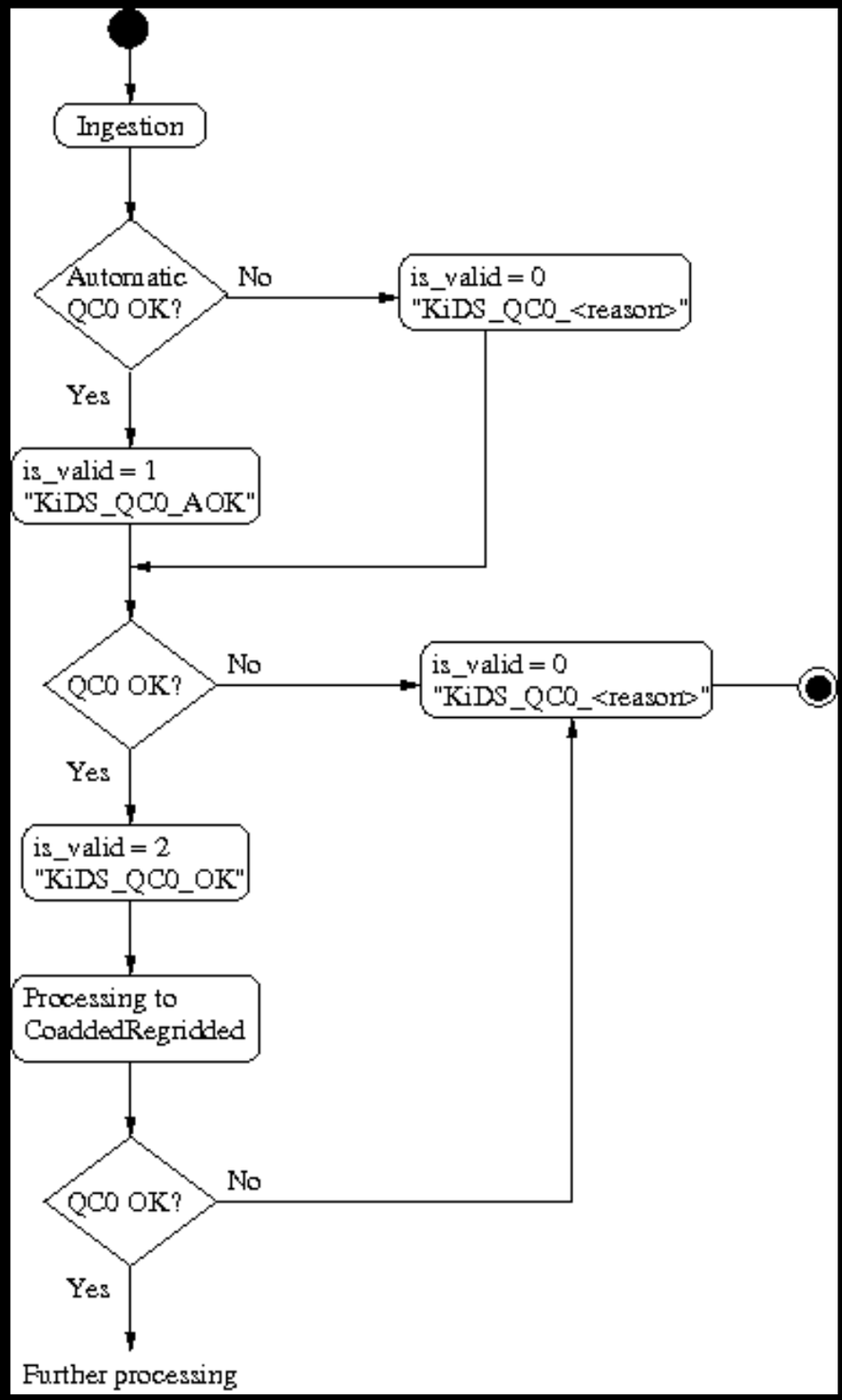
Quality Control

KiDS QC0:

Parameter	Description	When
ESO status	Executed/Completed	@Ingest
Image Quality	Within constraints	@Coadd
Airmass	Within constraints	@Ingest
Moon	Within constraints	@Ingest
Backgr. level	All CCDs working; sky background	@Ingest
# exposures	All present	@Ingest
Exp. time	correct	@Ingest
Coords	Agree with OB name	@Ingest
Dithering	correct	@Ingest
PSF anis.	Av. ellip < 0.15; Ellip < 0.2 in >24 CCDs; IQ variation < 25% (cmp 4 best vs 4 worst CCDs)	@Coadd
Tracking/guiding	And other blemishes/problems	@Coadd

KiDS QC0 ≃ ESO QC0



Quality Control

Quality control during data processing

Astro-WISE: At each step in data processing QC checks are implemented, using data product methods:

- Verify(): verifies data object fulfills certain quality criteria; sets flags accordingly
- Compare(): allows comparison of data object to other, similar data products
- Inspect(): allows visual inspection of data object and interface to update quality flags

Quality Control

Quality control during data processing

Example: PhotometricParameters

Data object with zeropoints; determined per night

QC checks currently implemented:

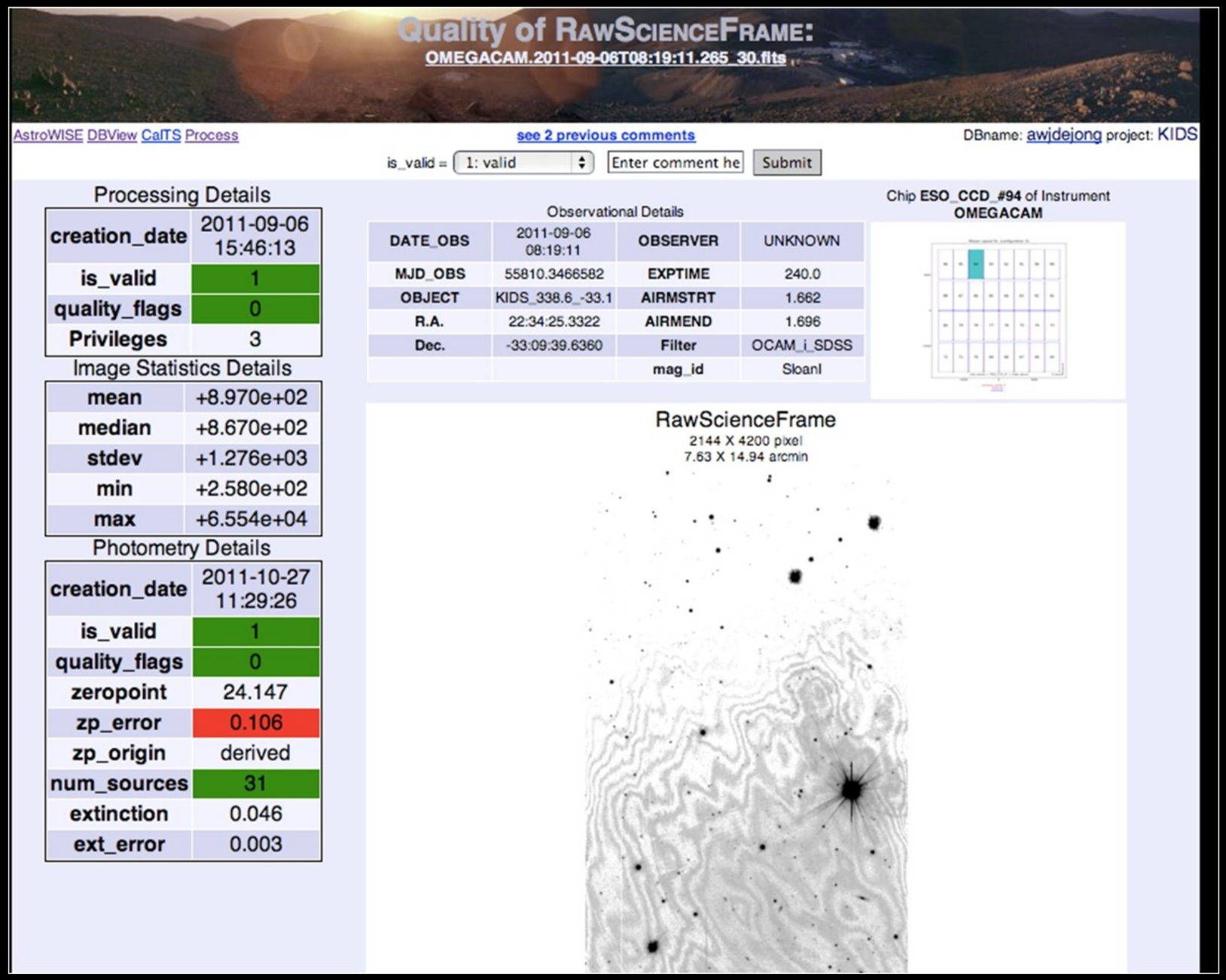
- Number of standard stars
- Derived uncertainty on ZPT
- Difference with expected ZPT: identify non-photometric nights

Quality Control

Quality control during data processing

Example:

QualityWISE page for raw science frame



Quality Control

Quality control during data processing

Example: CoaddedRegriddedFrame

Data object with astrometrically and photometrically calibrated, regridded and stacked image; 1 per OB (survey tile and filter)

QC checks currently implemented:

- QC0 (PSF size, ellipticity, anisotropy)
- Astrometry in overlaps with neighbours
- Photometry in overlaps with neighbours

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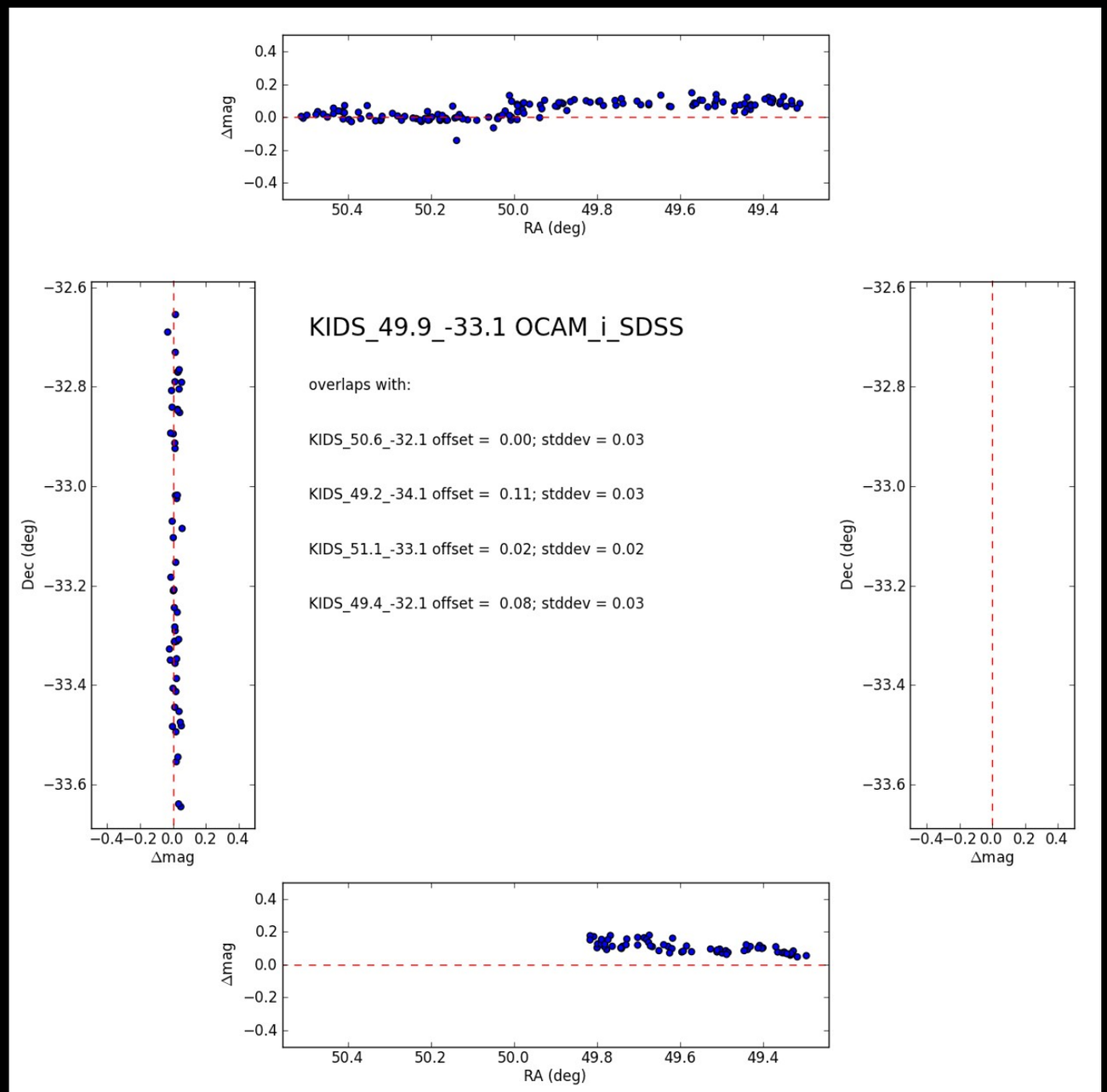
Quality Control

Quality control during data processing

Example:
Photometry in coadd-coadd overlaps



Quality Control

Quality control during data processing

Example: CoaddedRegriddedFrame

Data object with astrometrically and photometrically calibrated, regridded and stacked image; 1 per OB (survey tile and filter)

Many checks to be added, e.g.:

- Source counts
- Background flatness
- PSF(Coadd) vs. PSF(Raw data)
- Internal photometry (CCD overlaps)

Quality Control

Quality control during data processing

Certain KiDS specific checks currently checked using separate scripts: to be included in the verify() or compare() methods

Based on more data and improved insights, these QC criteria will be refined continuously, as will the data processing recipes