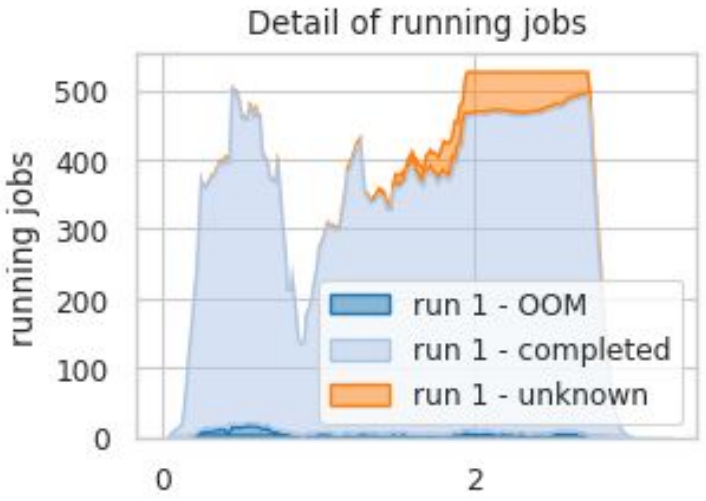
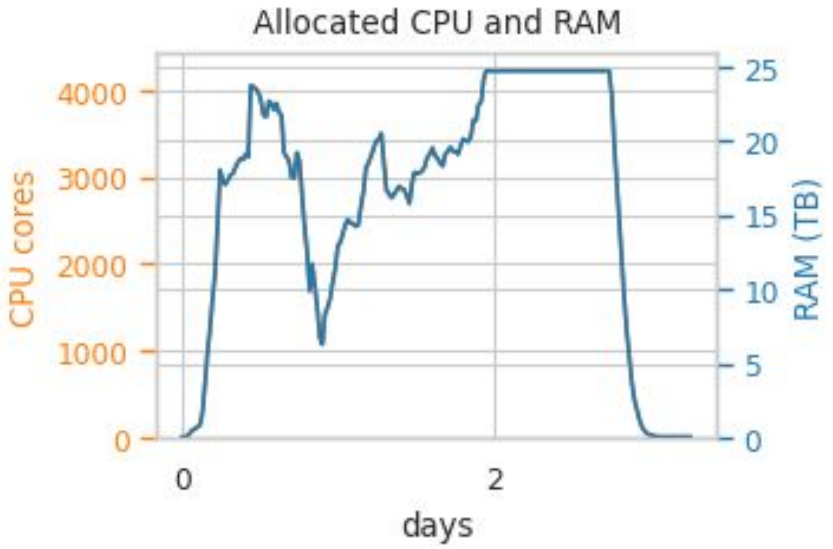
ZTF lightcurves

N. Regnault & M. Bernard

Status of the ZTF pipeline

- DR253
  - Completed in 3.5 days (!)
  - 92% success rate
  - No OOM crashes
- Previous run: DR252
  - Completed in 12 days
  - 88% success rate
  - 8% OOM
- Processing setup
  - 8 quadrants in //
  - 6 GB RAM per quadrant
  - Pocket effect corr enabled
  - CC-IN2P3 usage capped at:
    - 26TB RAM
    - 8000 cores
    - 5000 jobs





Significantly faster. Why ?

- Higher memory allocation
  - 13TB -> 26TB
- Memory usage optimization
  - Poloka (PSF processing)
  - Catalog management
- Fewer OFF quadrants
  - Capped at 500 per light curve
  - Post peak window -> +500d
  - 19% fewer quadrants
- Total volume processed
  - ~160TB of data processed

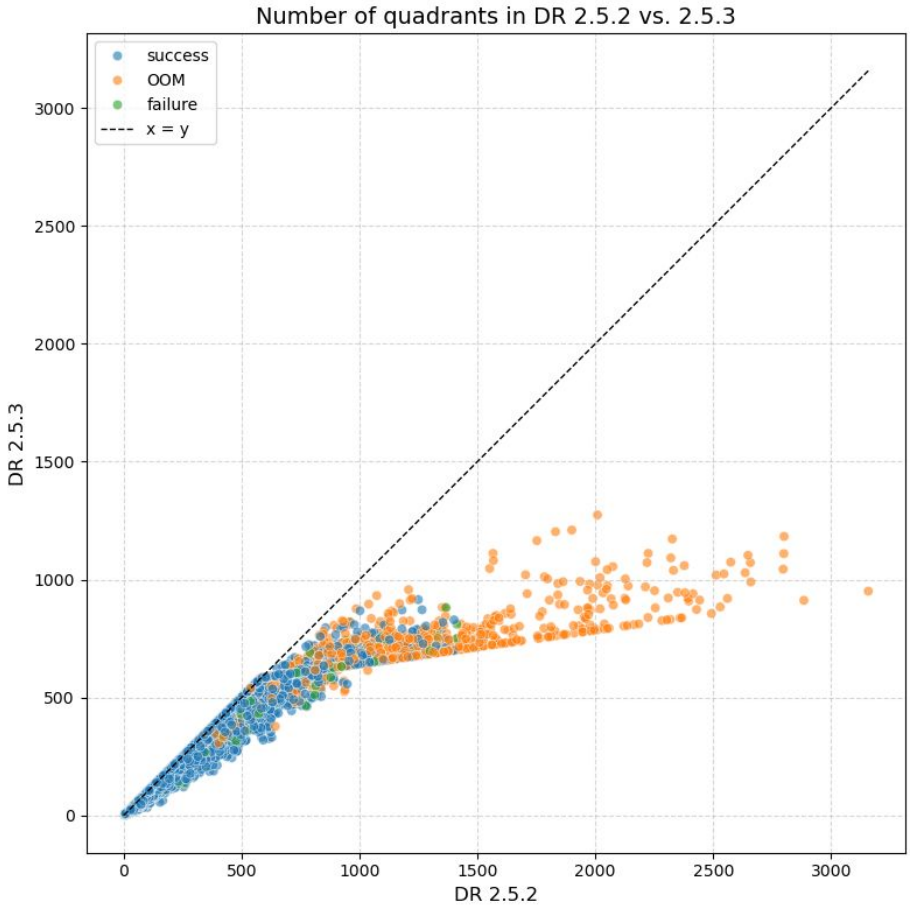


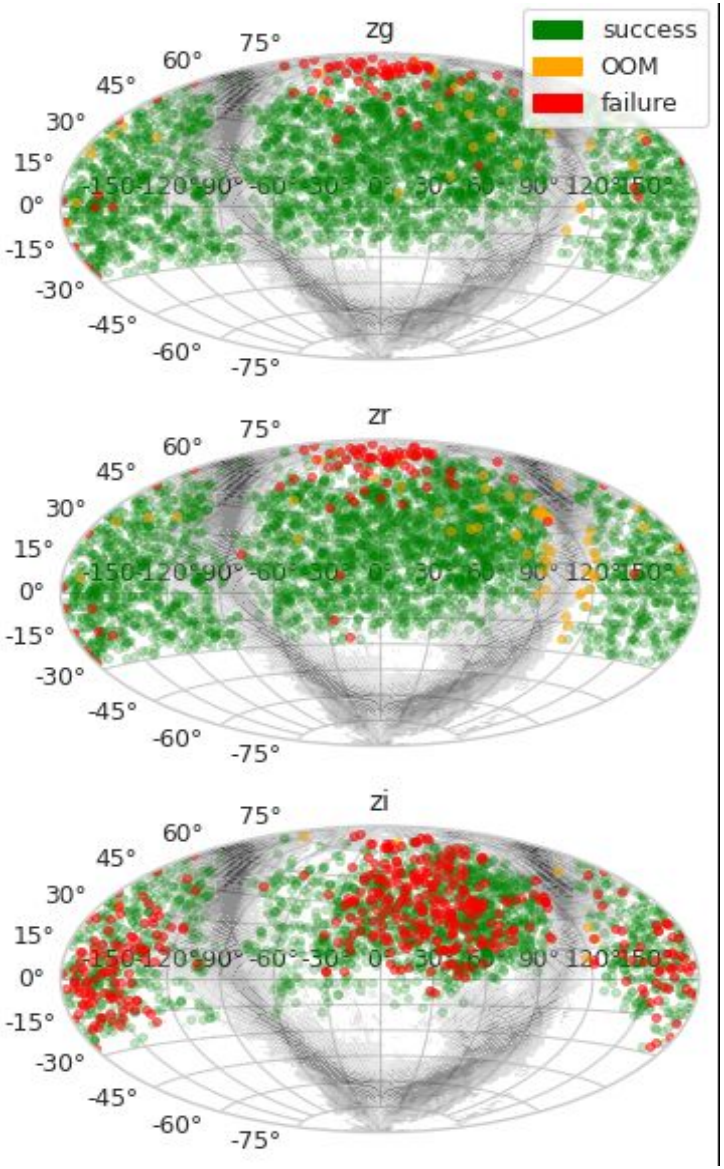
Table 1. Summary of the ZTF DR2.5 image dataset.

Band	# SNe	# ON images	# OFF images
g	3,560	242,677	843,784
r	3,561	315,539	1,024,553
i	2,415	32,236	188,872
Total	3,562	590,452	2,057,209

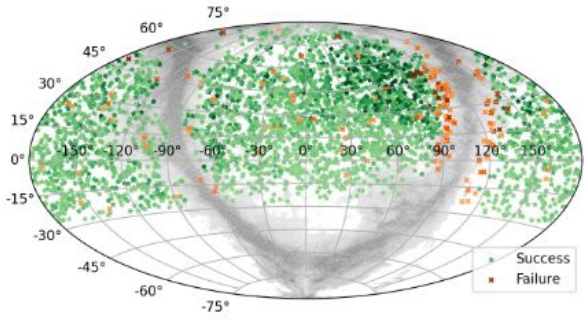
Notes. Total: 2,647,661 CCD files.

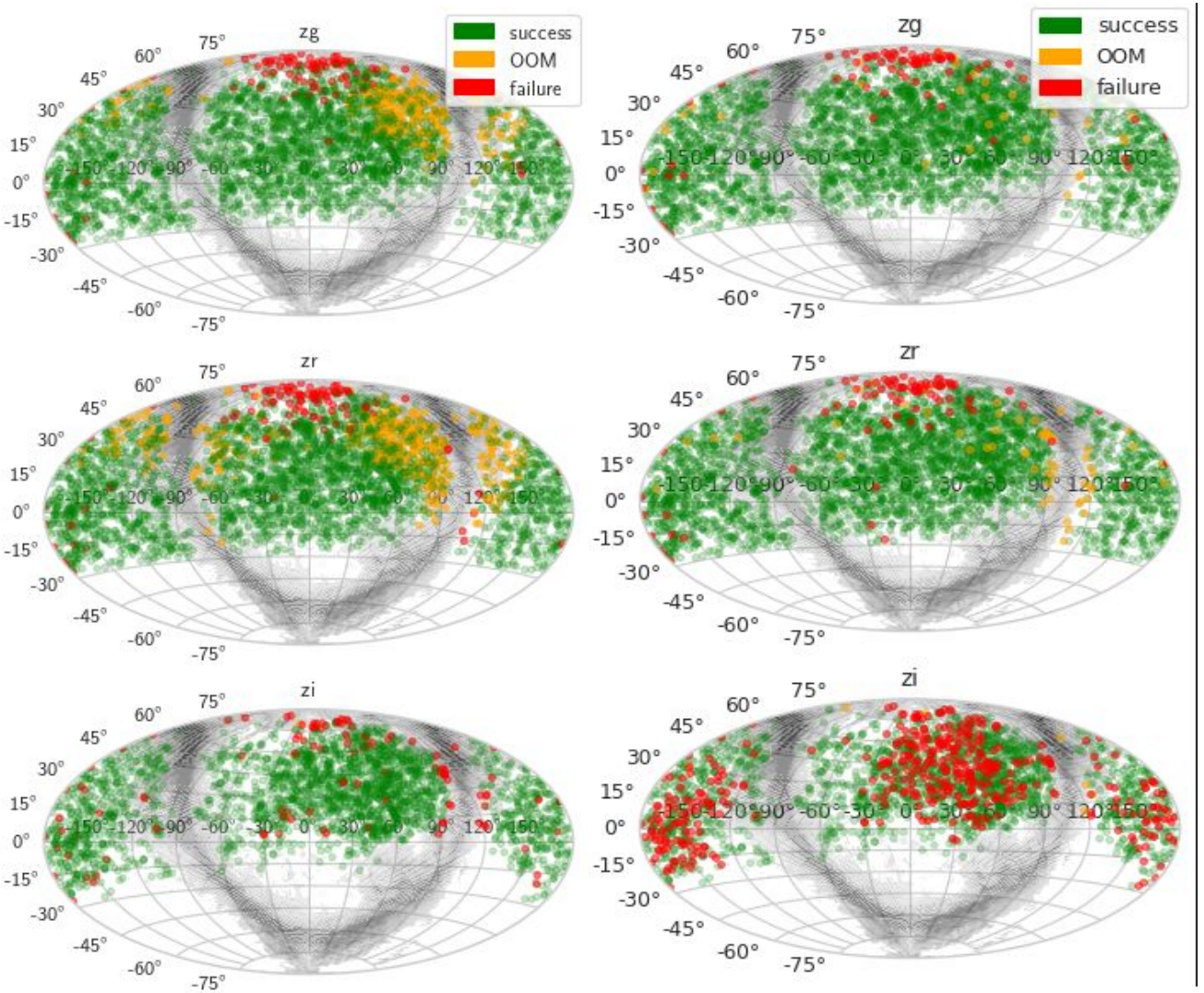
Remaining issues

- Long standing issue for high declination SNe
  - dec > 60
  - ~ 25% failures
  - In DR25X, not in DR2
- A new problem in i
  - 18% failure rate
  - Only 4.6% in DR252 – without pocket correction
  - Possibly related to pocket correction ?
- Small fraction of light curves to reprocess
  - 1% OOM failures
  - 0.5% missing / unaccounted for
- Contributions welcome

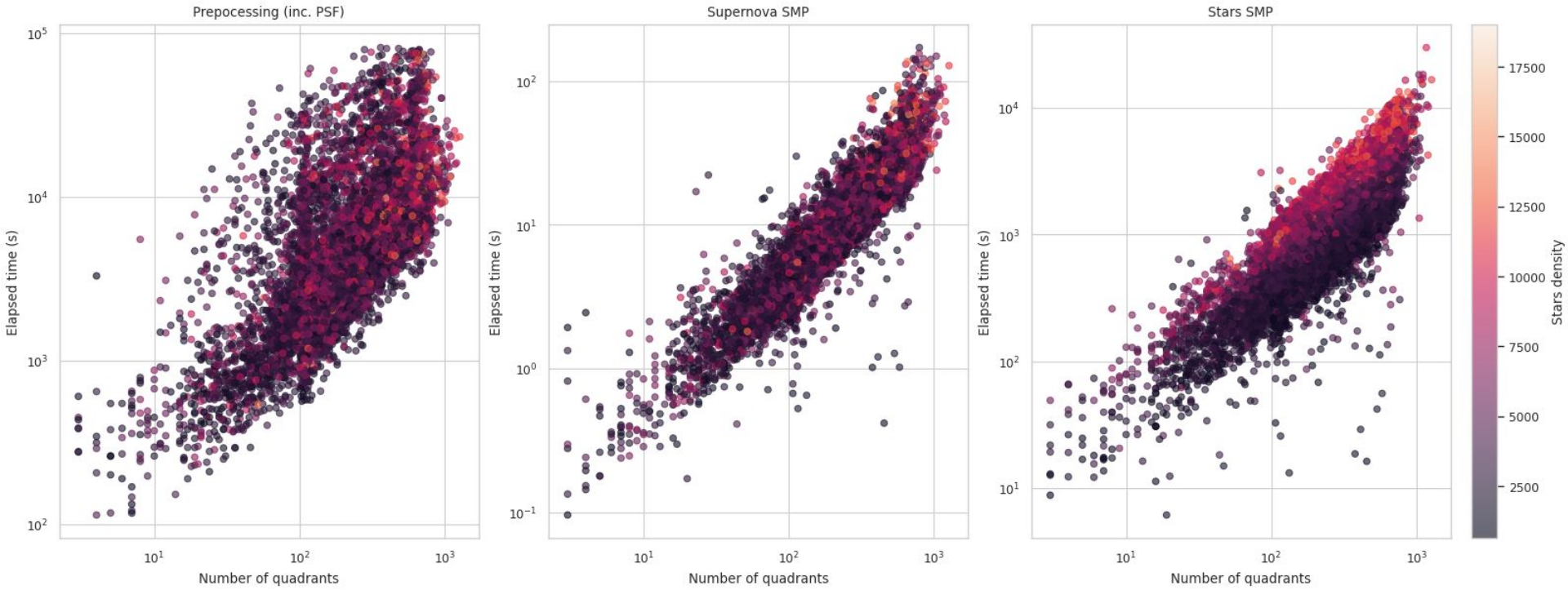


DR2 vs DR252 vs DR253

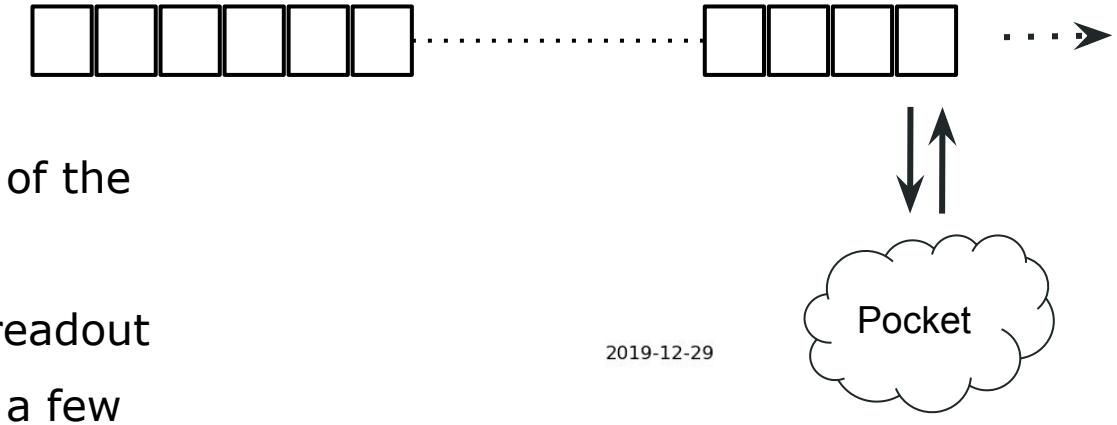




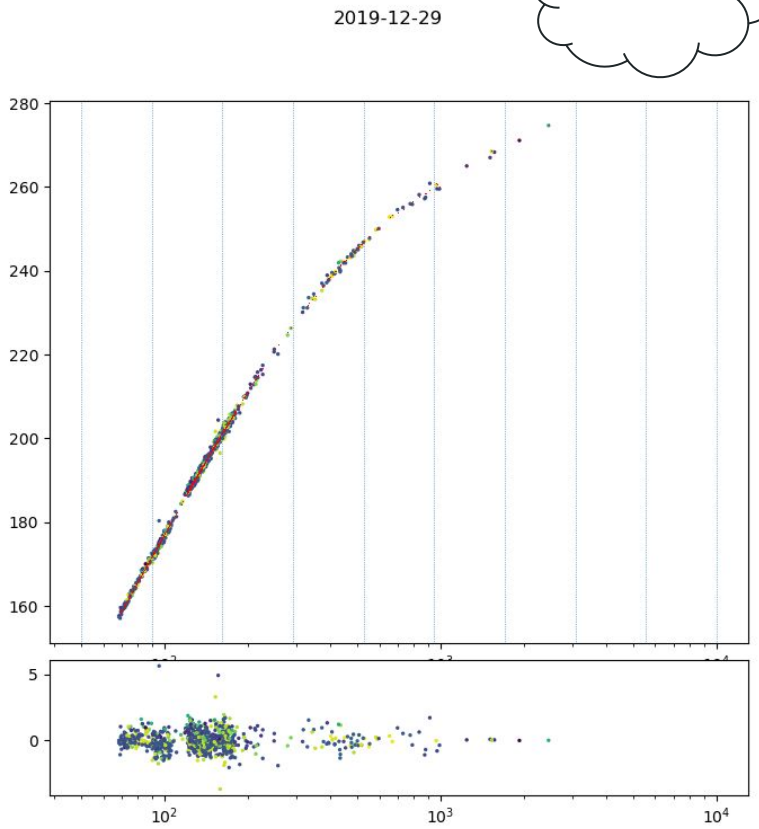
Processing Time



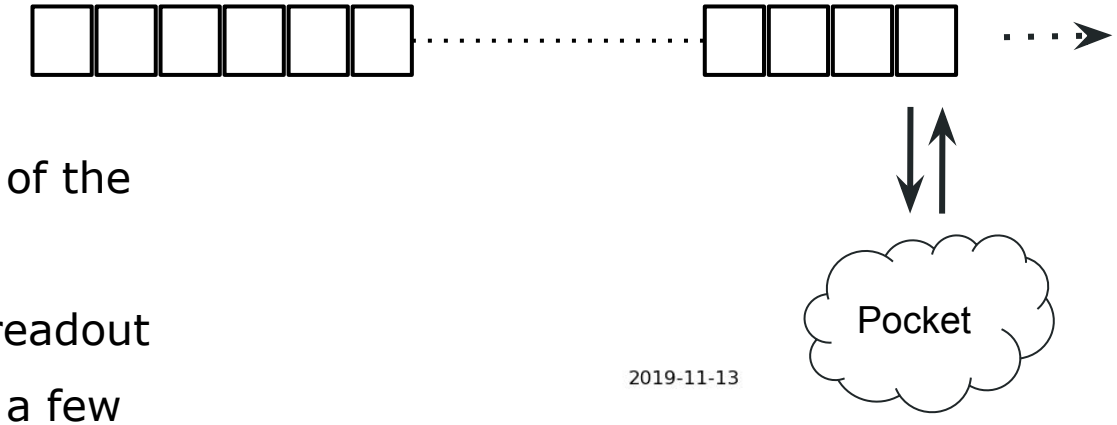
Pocket effect



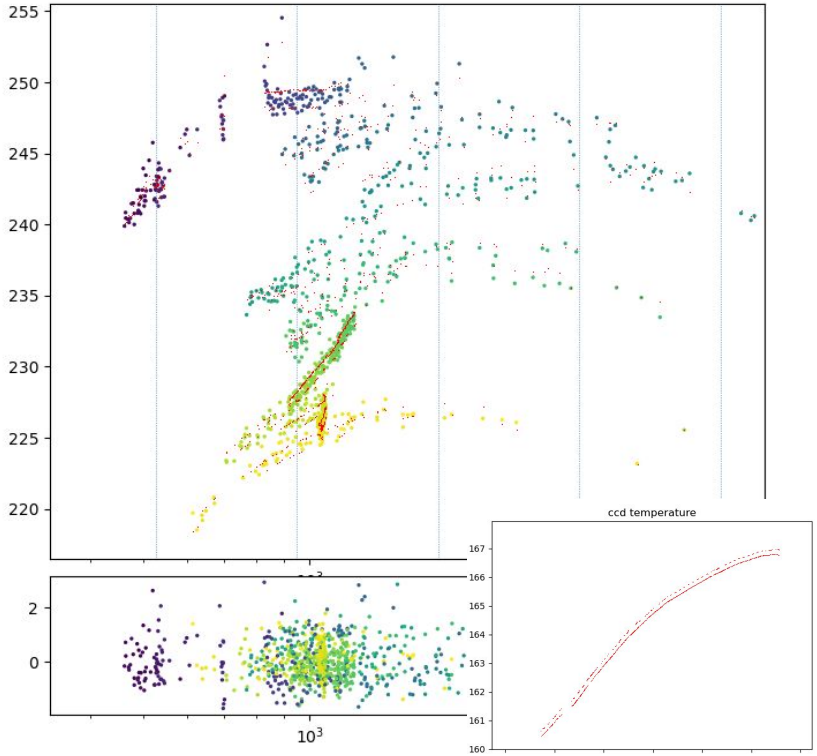
- Large charge trap near the end of the serial register
  - Captures electrons during readout
  - Trapped charge is released a few pixels later
- Dynamics encoded in the "equilibrium relation":
  - $N_{trapped}$ ($flux_{pixel}$)
  - Can be measured directly from the overscan region



Pocket effect



- Large charge trap near the end of the serial register
  - Captures electrons during readout
  - Trapped charge is released a few pixels later
- Dynamics encoded in the "equilibrium relation":
  - $N_{trapped}$ ($flux_{pixel}$)
  - Can be measured directly from the overscan region
- In practice, it is messy
  - Strongly dependent on sensor temperature variations



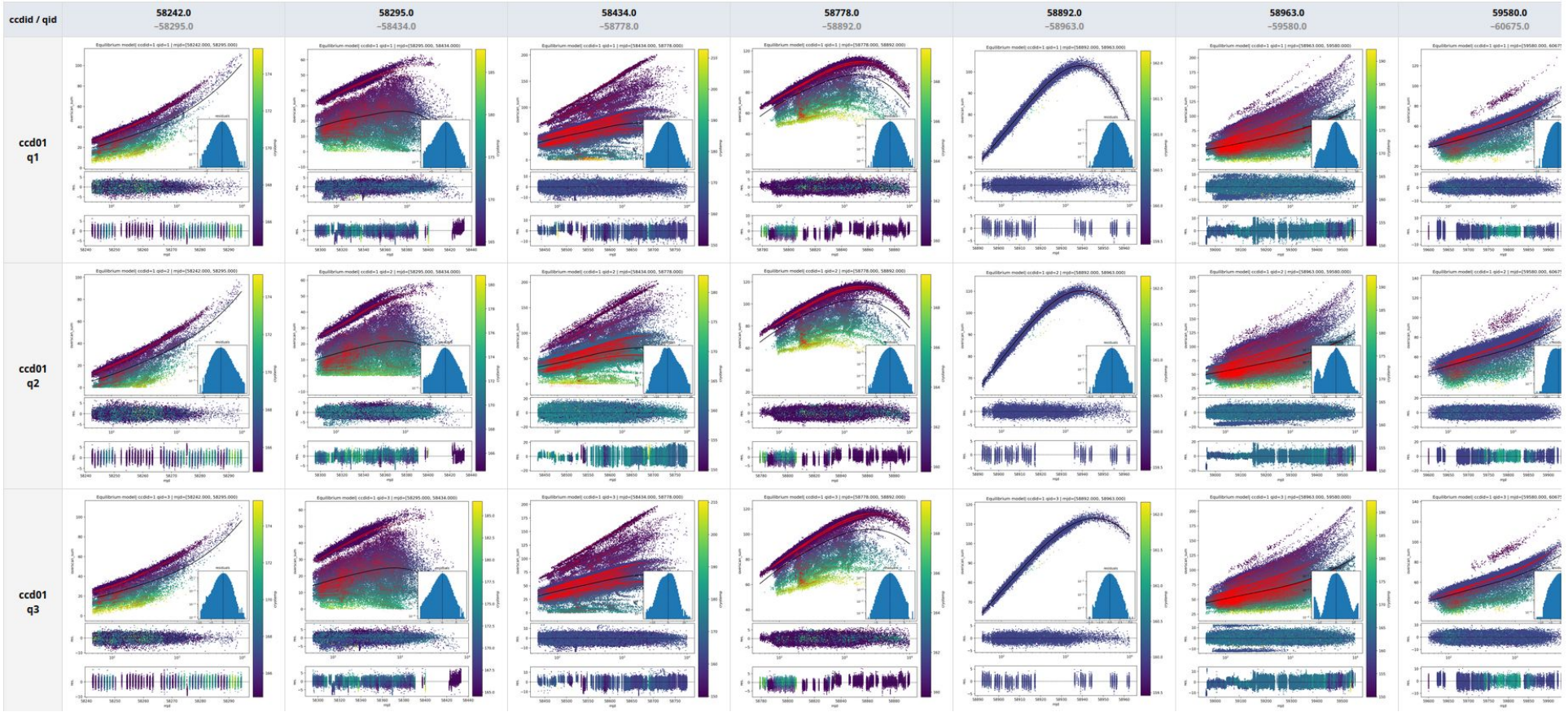
Pocket effect correction

- Learn the equilibrium relation directly from overscan data
  - Split the dataset into stable periods
  - Defined between electronics changes, maintenance interventions, or camera incidents
- Within each stable period, model the equilibrium function as

$$y(x, dt) = \sum_k \left(\sum_{p=0}^{deg} \theta_{p,k}\, dt^p \right) B_k(x)$$

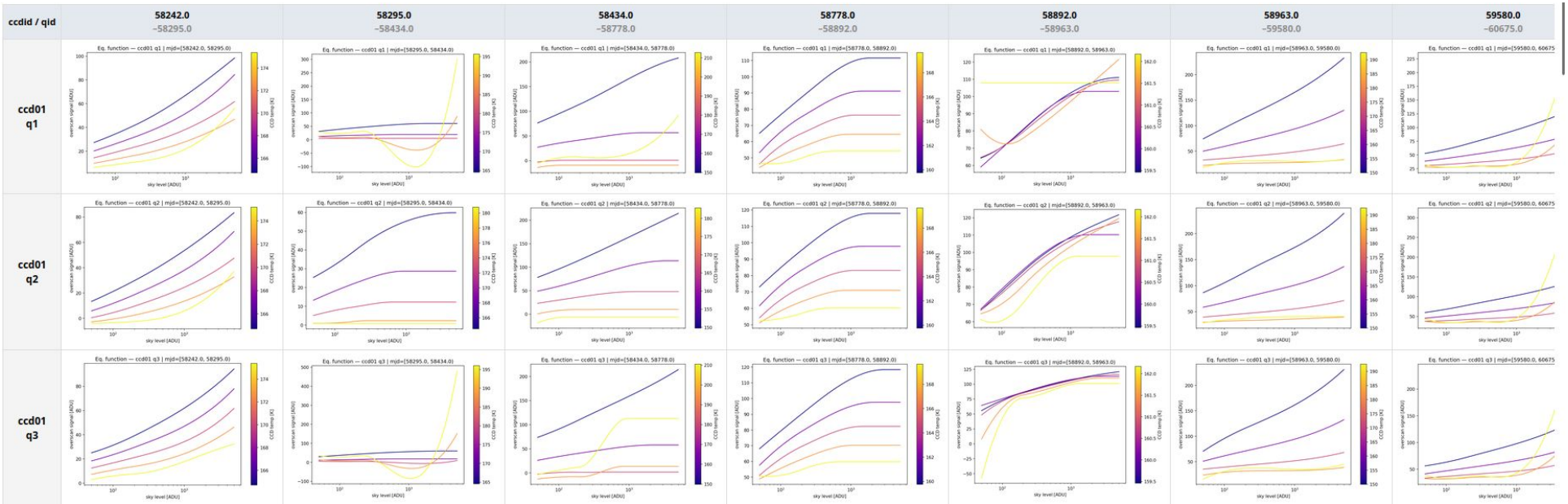
- Store the fitted coefficients in a lightweight database
- Ship the database together with the correction code

Prod gallery



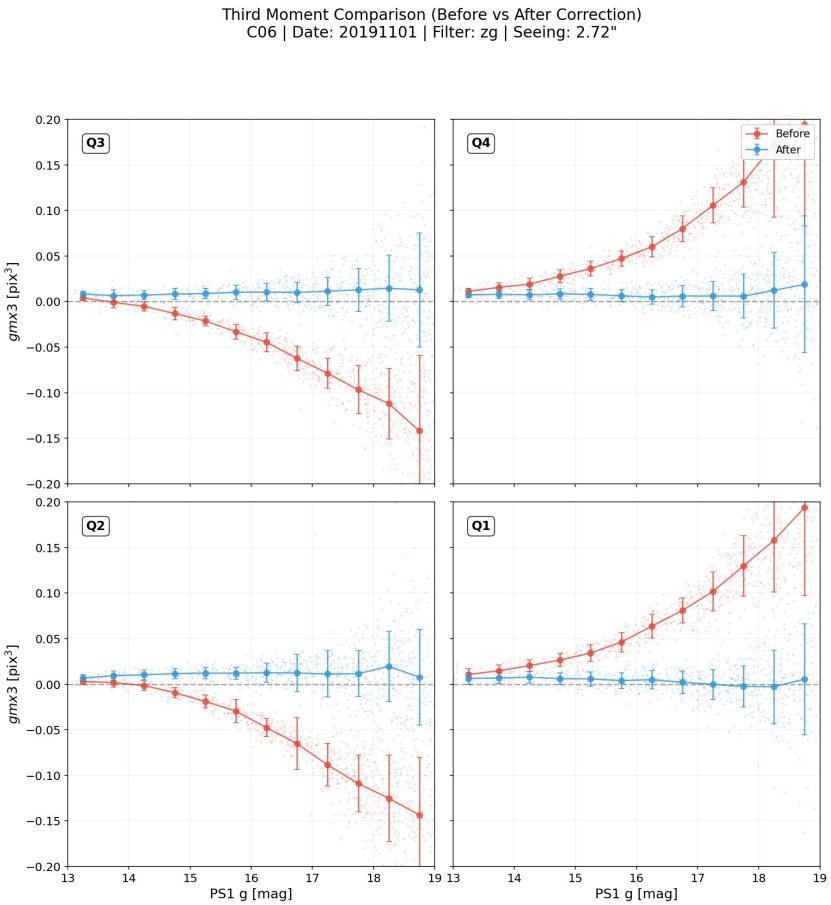
https://me.lsst.eu/regnault/lemaitre/pocket/training/prod/training_gallery/

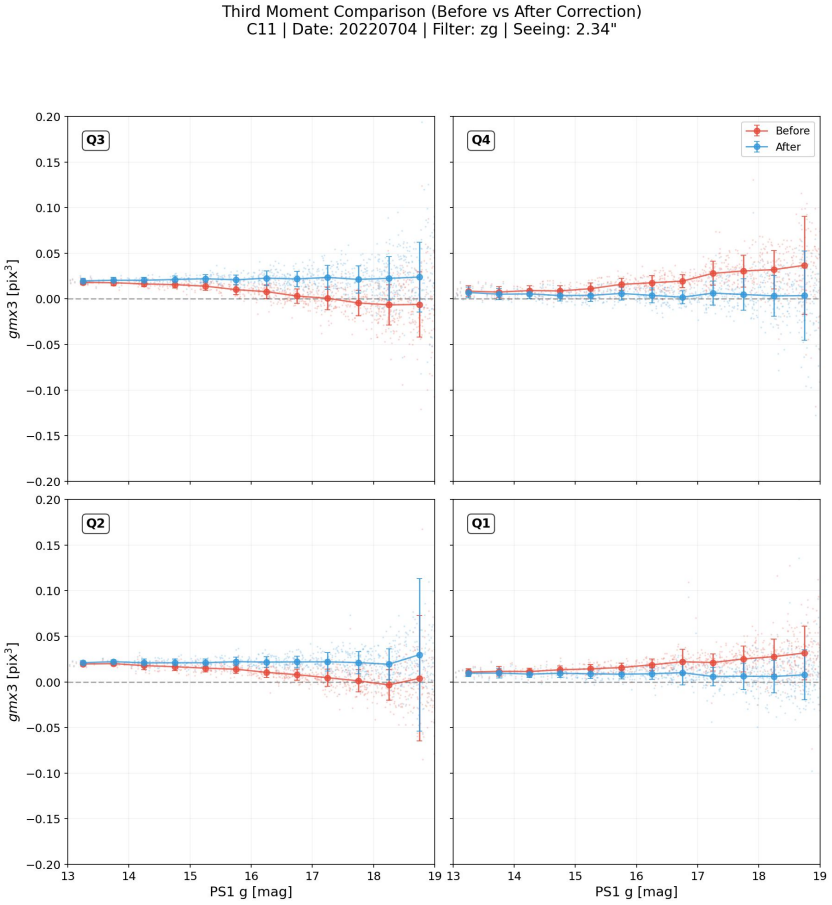
Equilibrium relation gallery



https://me.lsst.eu/regnault/lemaitre/pocket/training/prod/eq_func_gallery/

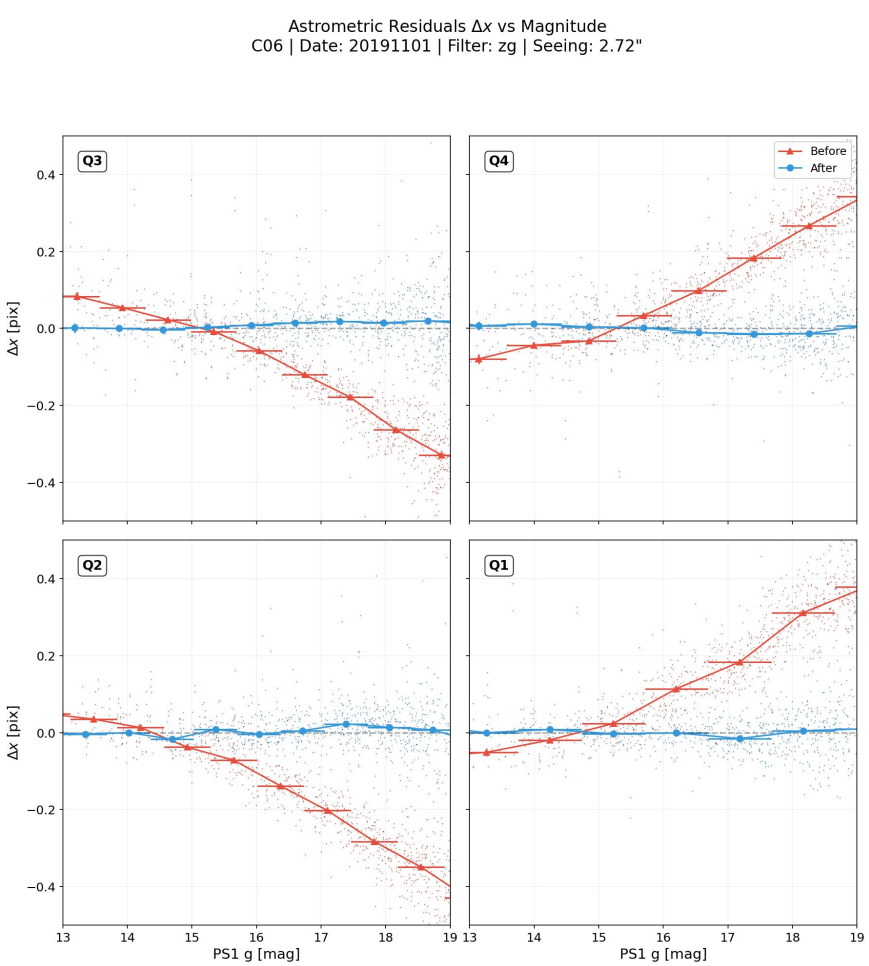
Validation : skewness

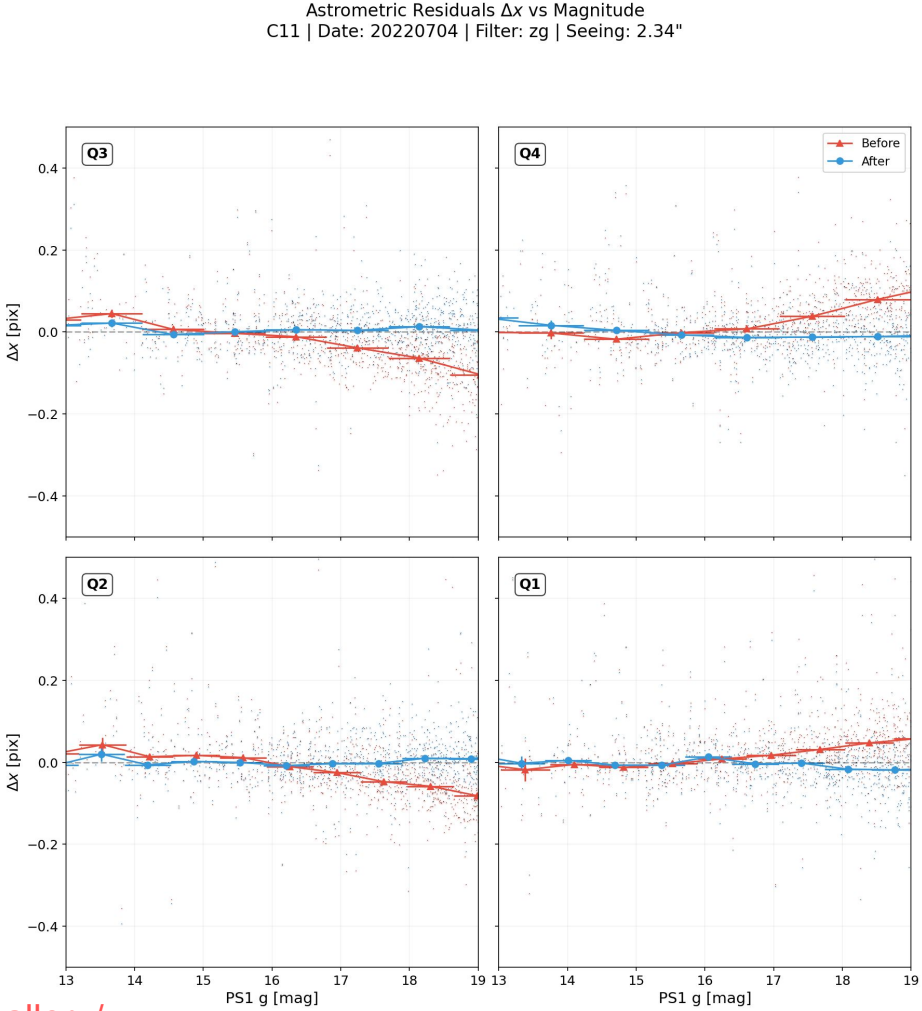




https://me.lsst.eu/regnault/lemaitre/pocket/validation/gallery/

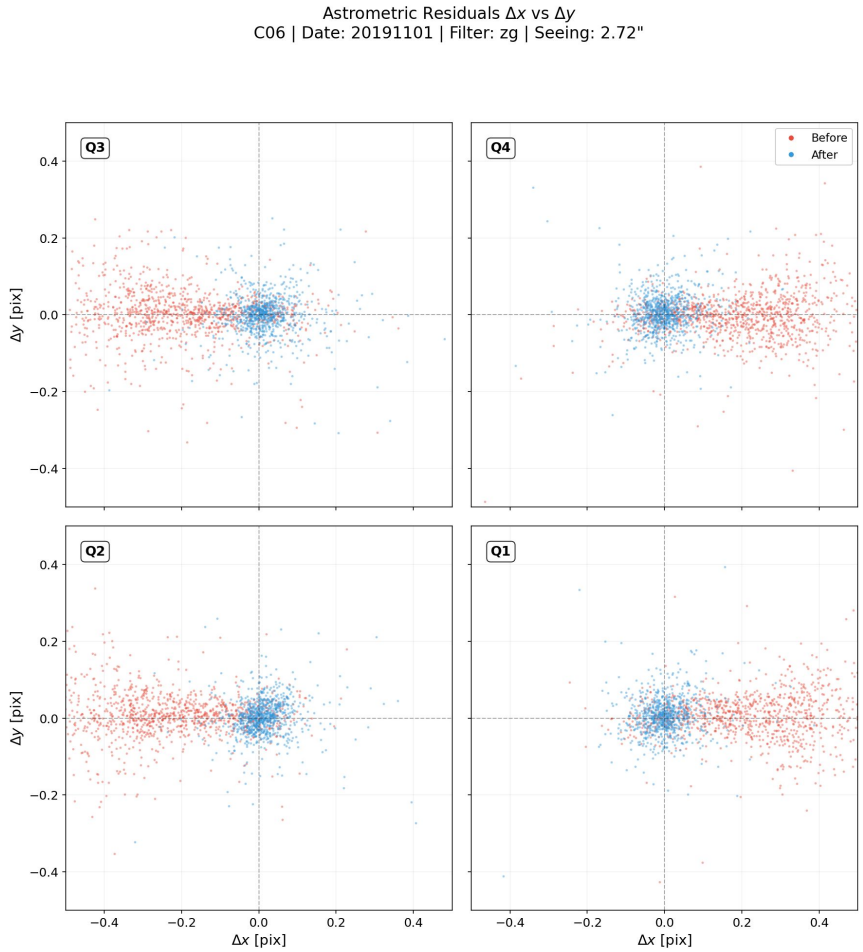
Validation : astrometry

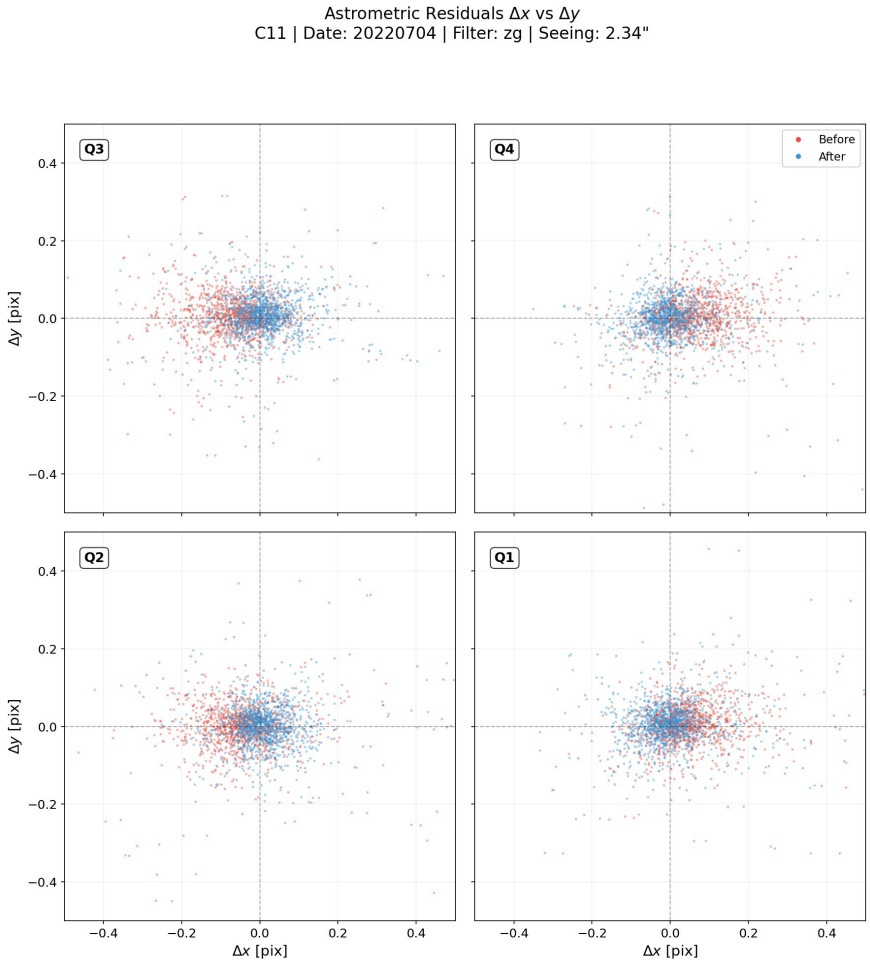




https://me.lsst.eu/regnault/lemaitre/pocket/validation/gallery/

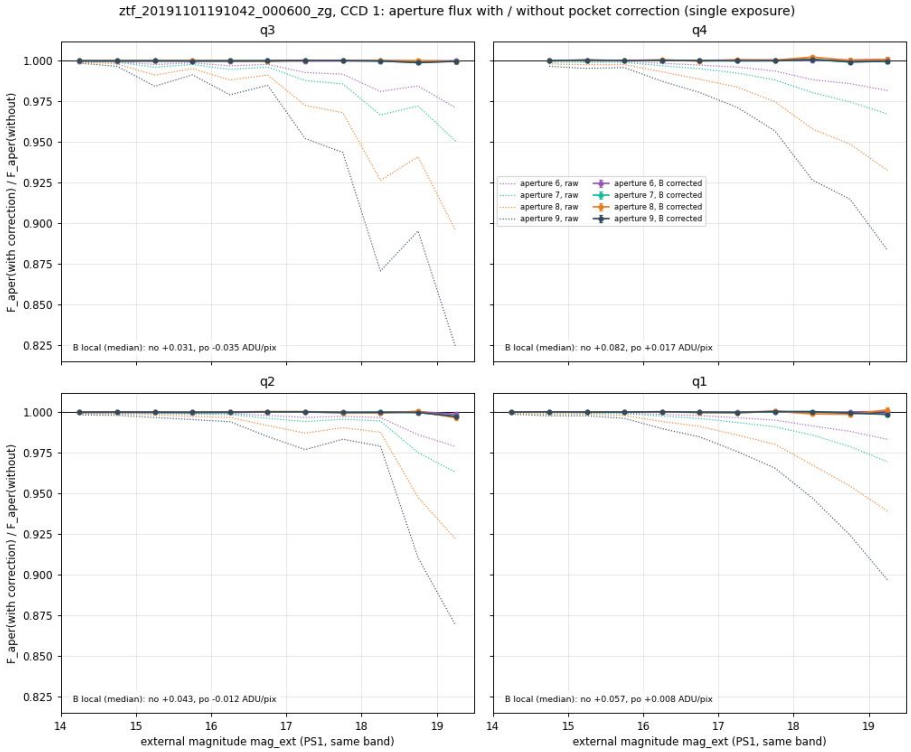
Validation : astrometry

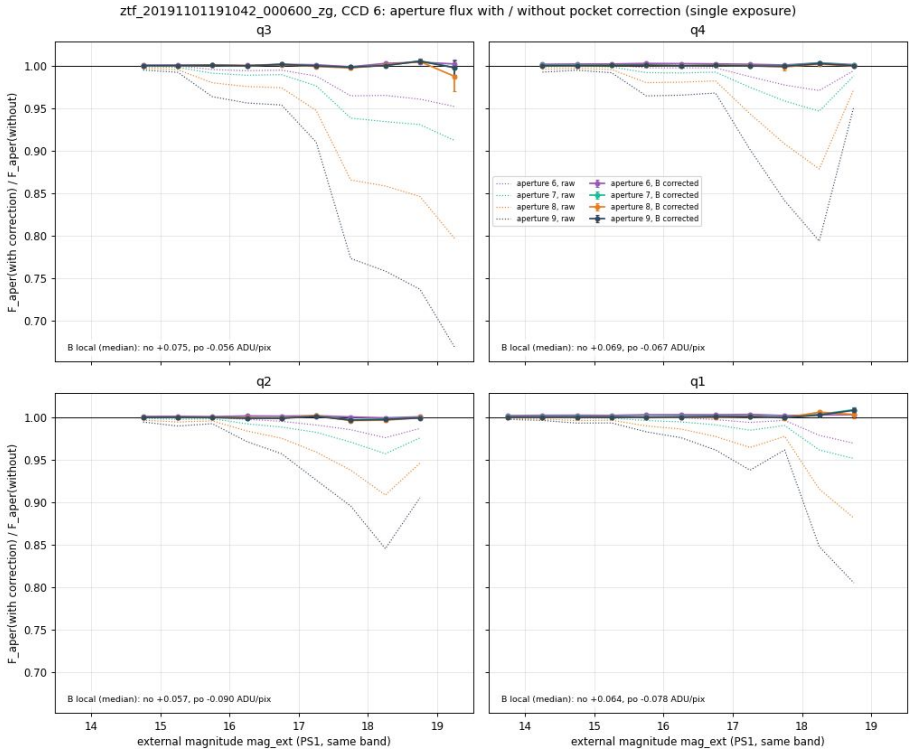




https://me.lsst.eu/regnault/lemaitre/pocket/validation/gallery/

Does the correction conserve flux ?



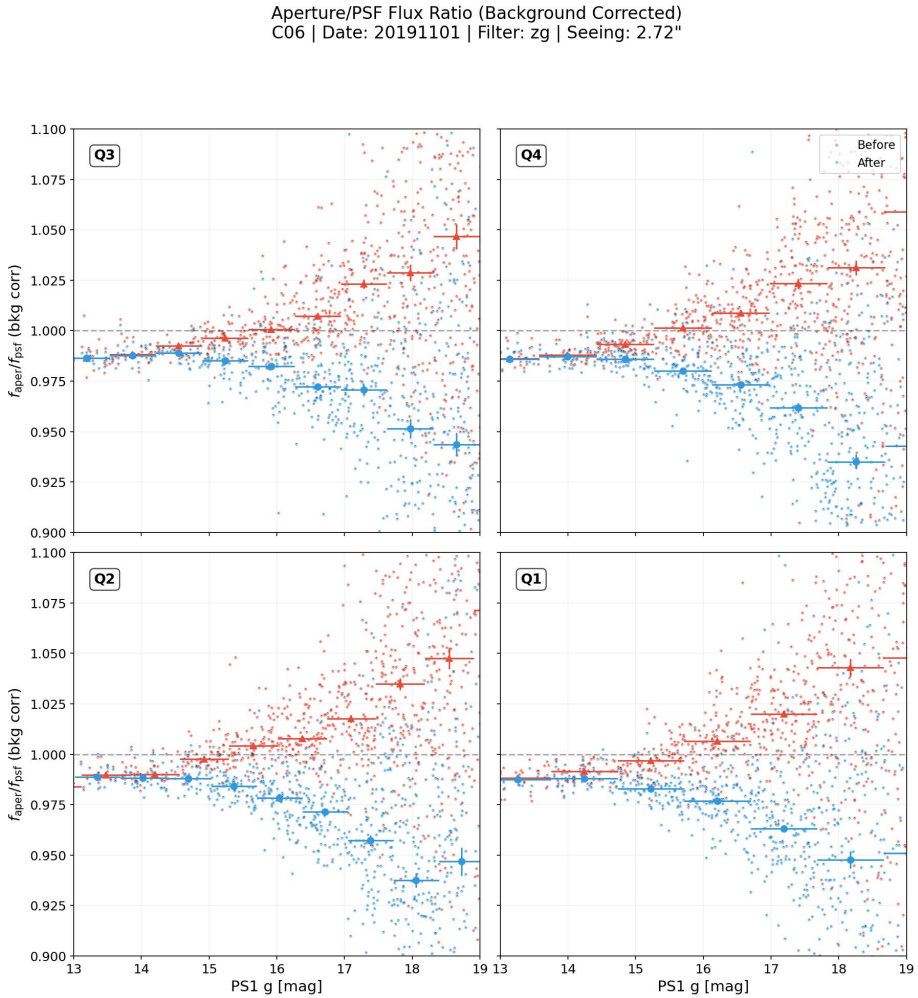


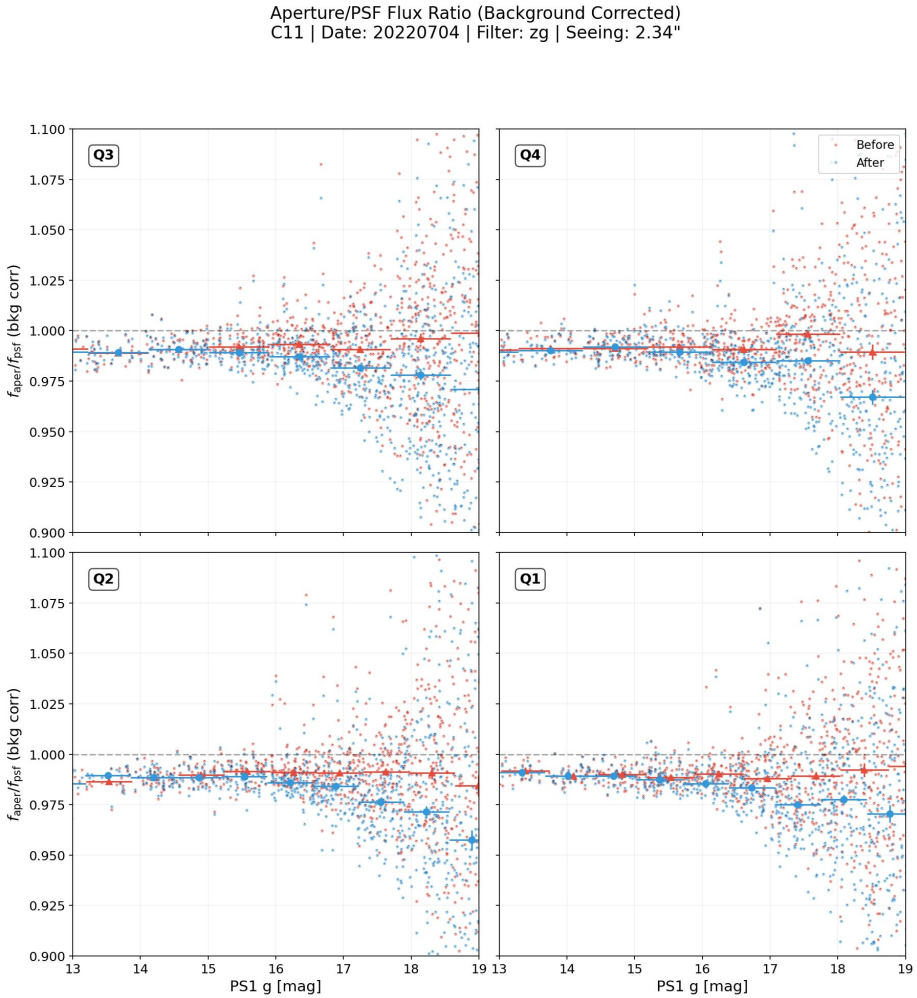
Aperture fluxes with & without pocket correction

PSF linearity ?

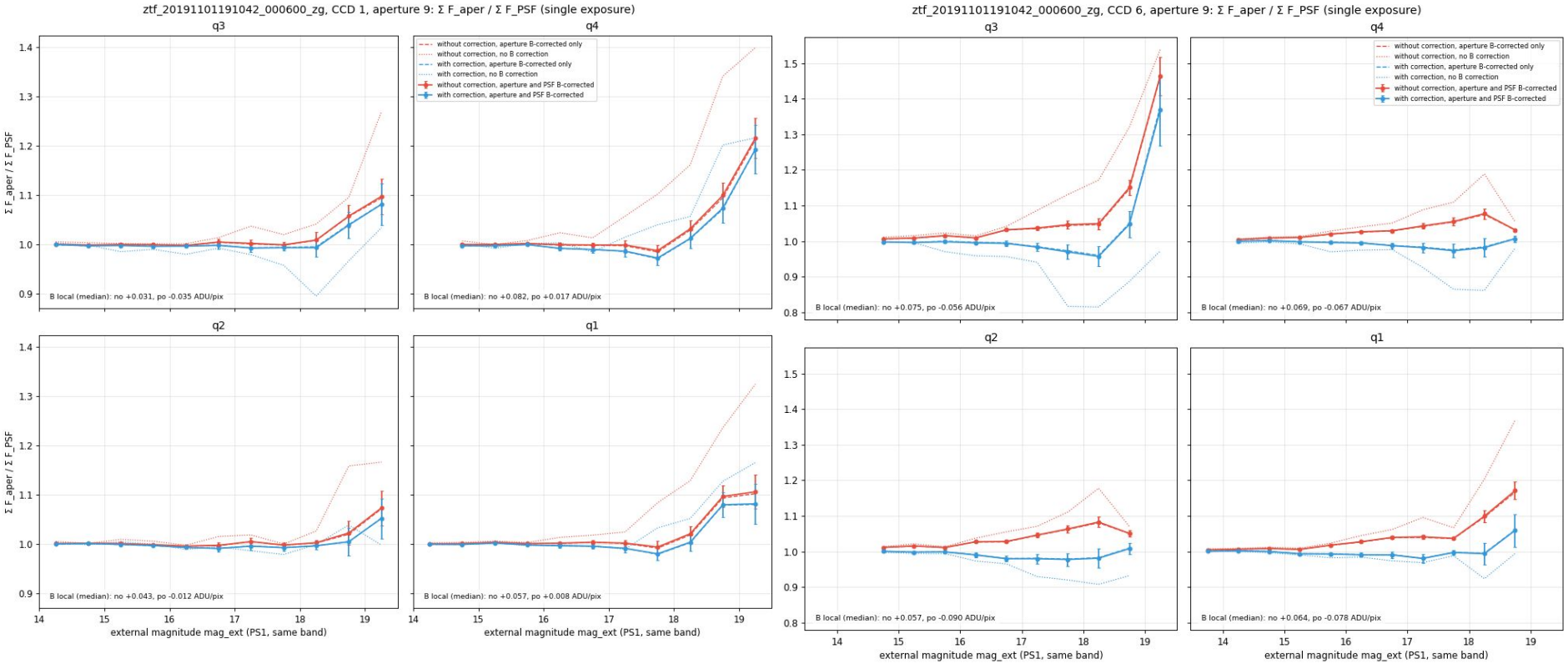
- Compare
  - PSF photometry (affected by pocket effect)
  - Large aperture photometry (insensitive to pocket effect if aperture sufficiently large)
  - Account for residual background errors
    - Can bias aperture photometry
    - Can distort PSF shape -> bias PSFflux estimates

Aperture / PSF ratio





Correcting for the residual backgrounds



Conclusion

- ZTF pipeline fully integrated
  - Runs in 3 days on DR2.5
  - Expect 10 days on DR3
- Pocket effect
  - PSF homotheticity: under control
  - Residual background effects and PSF linearity
    - not sure under control yet (<-> Benjamin)
- Residual failures
  - At high declination (dec > 60)
  - In i

Conclusion (II)

- Contributions welcome
  - Track residual errors
  - Inspect the light curves
    - compare with Leander’s processing
  -
- Papers
  - Pipeline: Mathieu (draft)
  - Release / sensors: Mathieu / Nicolas.

Subaru lightcurves