ZTF Photometry status

What we have, what we need
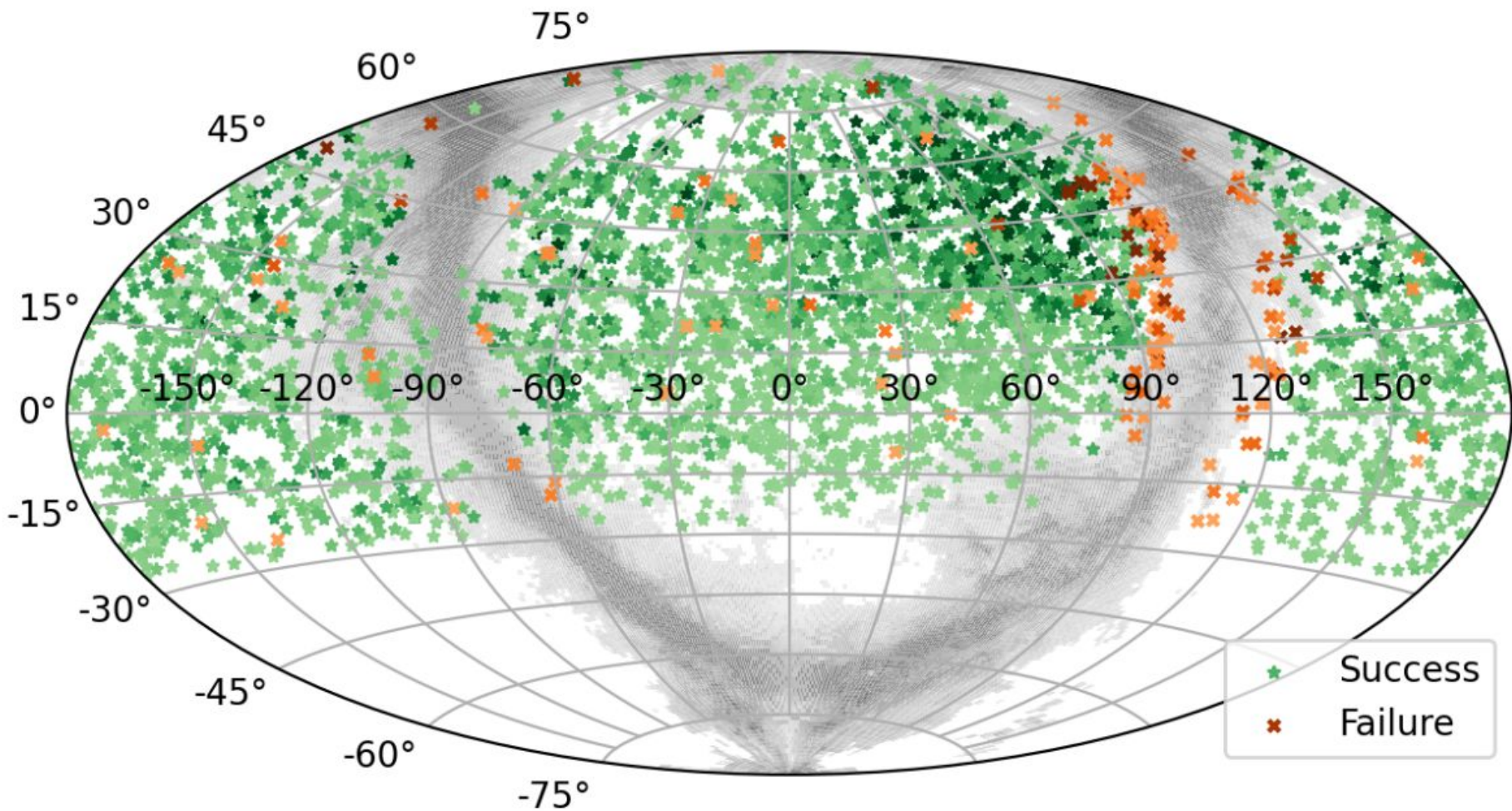
What we have…

See (Lacroix et al, in prep)
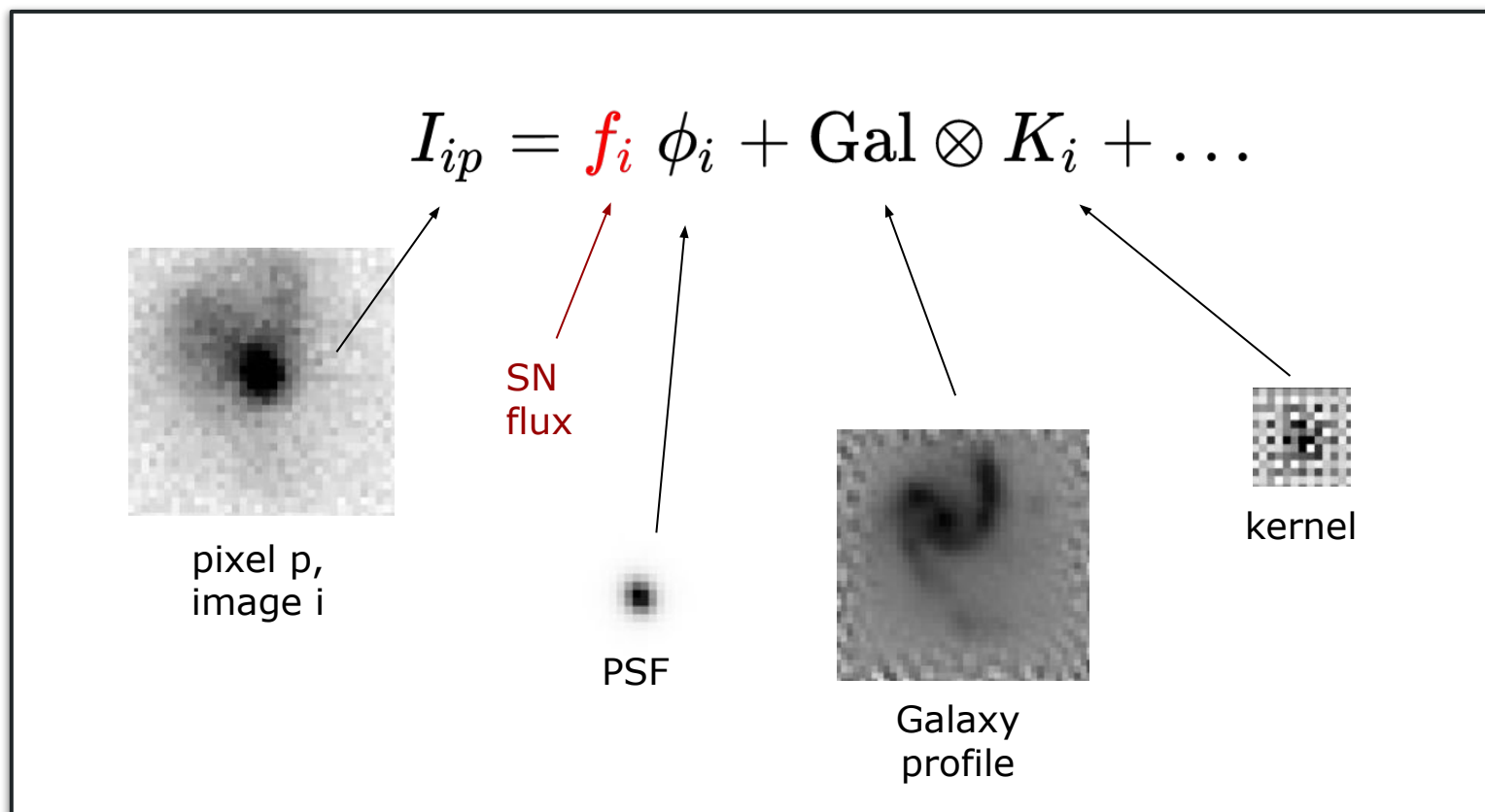
Scene modeling light curves of 3628 SNeIa

Lacroix et al, in prep

a.k.a "DR2.2"

Why scene modeling ?

$$I_{ip} = \color{red}{f_i}\color{black}\, \phi_i + \mathrm{Gal} \otimes K_i + \ldots$$

pixel p,
image i

SN
flux

PSF

Galaxy
profile

kernel

- Model: simultaneous description of the "scene" around the supernova
  - SN flux + empirical host galaxy flux profile
  - Fitted on a set of vignettes containing the SN
- Statistically optimal photometry
- **Can be applied on SNe and field stars around the supernova**
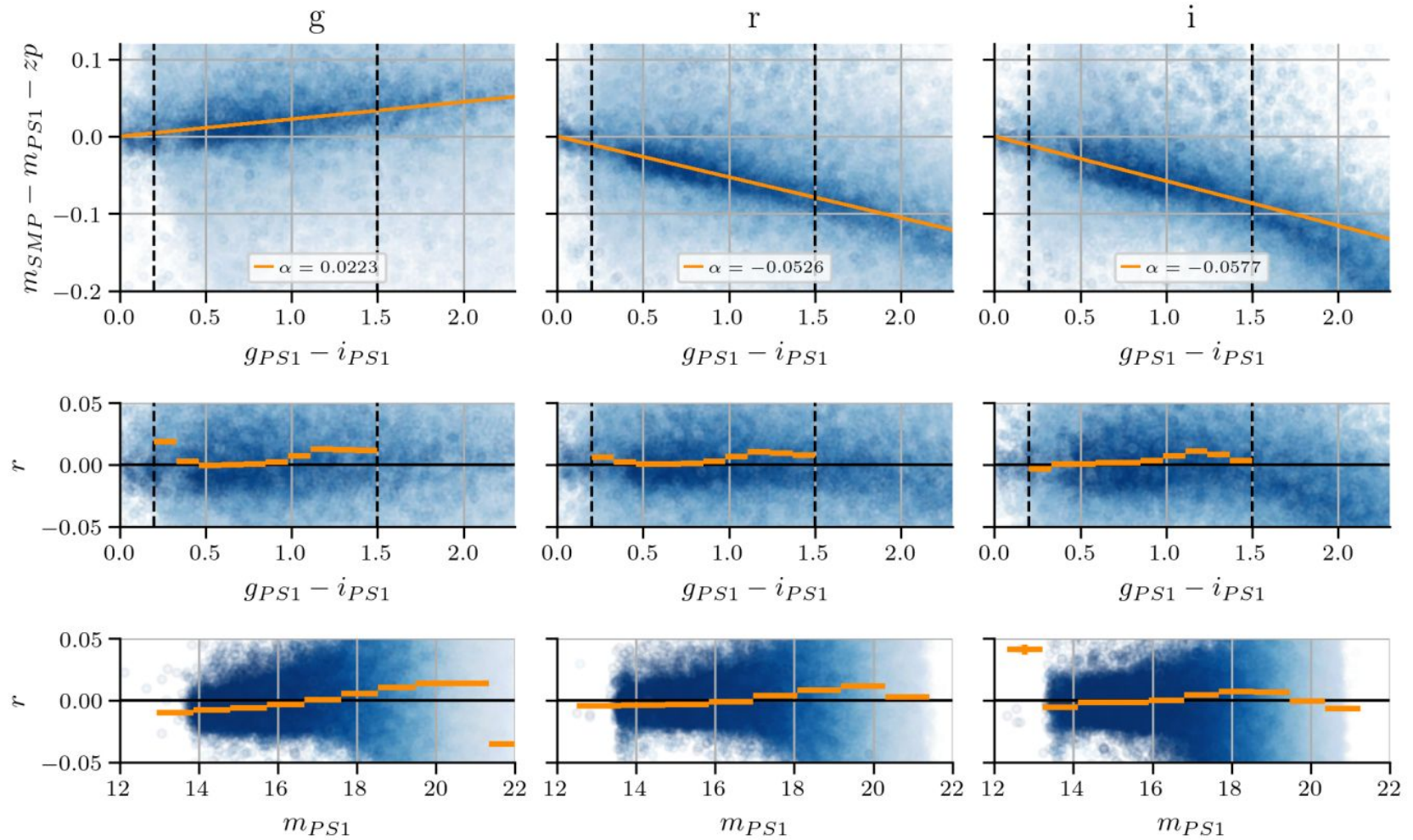
Data calibration

- DR2.2 light curves currently calibrated on PS1
  - Scene modeling LC's of field stars compressed into 1 instrumental mag $m = \frac{\sum_i w_i f_i}{\sum w_i}$ (with outlier rejection)
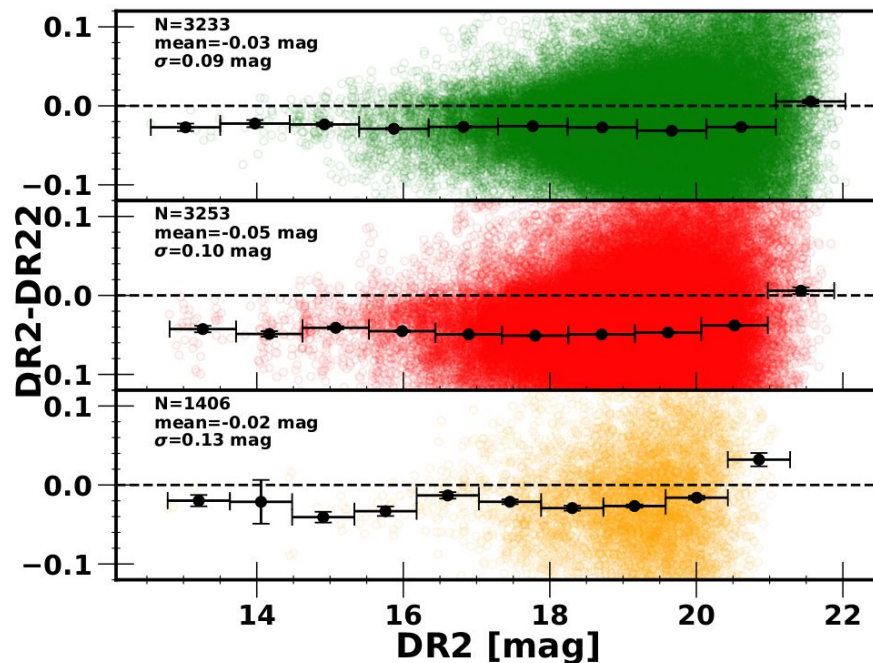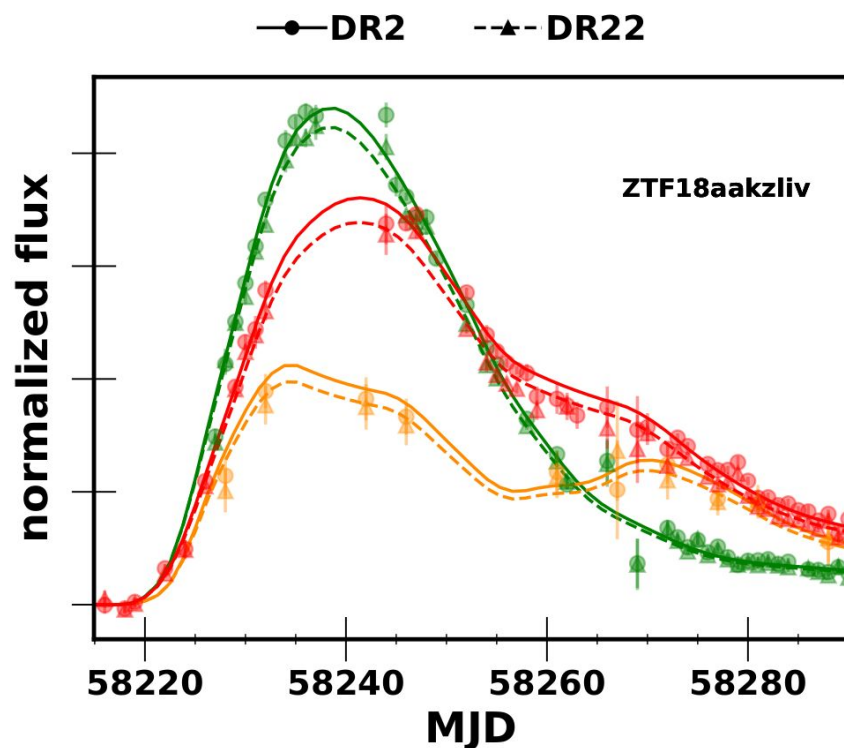 - And then :

$$m_{SMP} = m_{PS1} + \alpha \, \mathrm{col}_{PS1} + zp$$
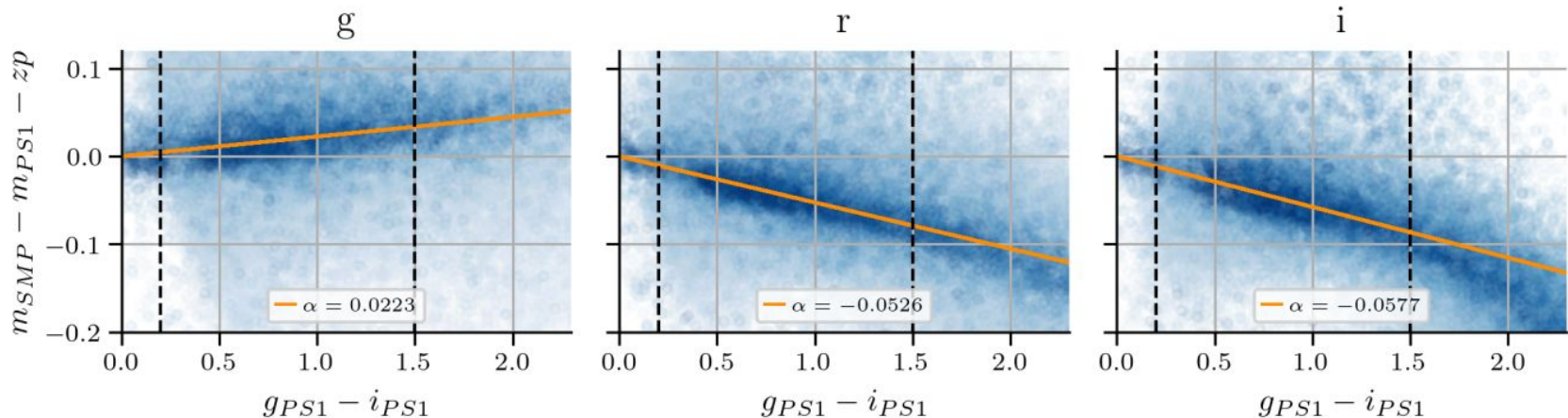
Data calibration

Comparison with DR2

- Differences at the level of 30 to 50 mmag
- -> ~ 90 mmag in distances

Caveats : linearity

- **2 identified sensor effects, affect PSF photometry**
  - *Pocket effect*, distorts PSF as a function of flux
    - (also depends on CCD/quadrant, mjd, sky level etc.)
    - Potentially strong non linearities, low background exposures
  - *Brighter fatter*, distorts PSF as a function of flux
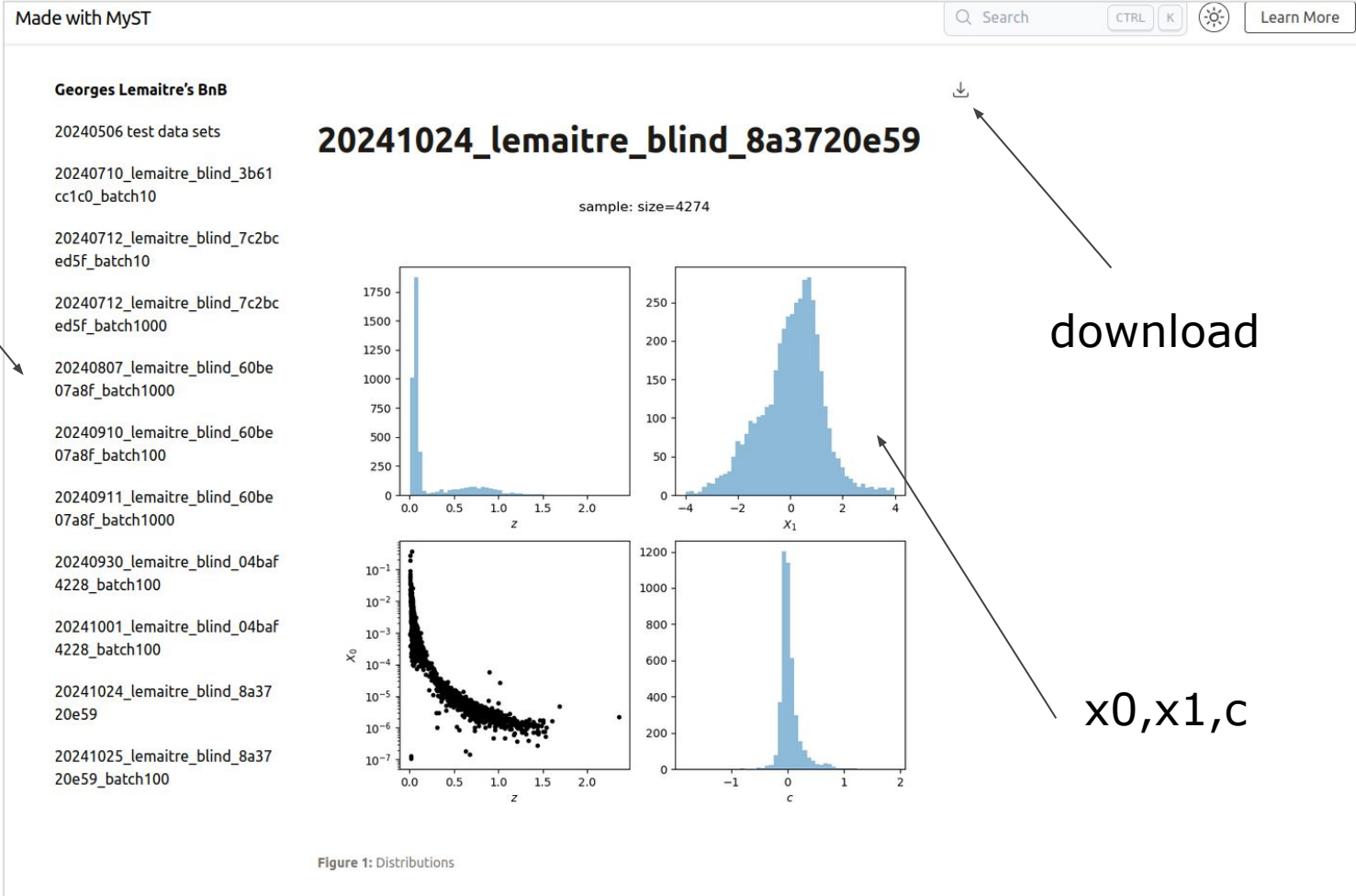   - (smaller non linearities, all exposures)
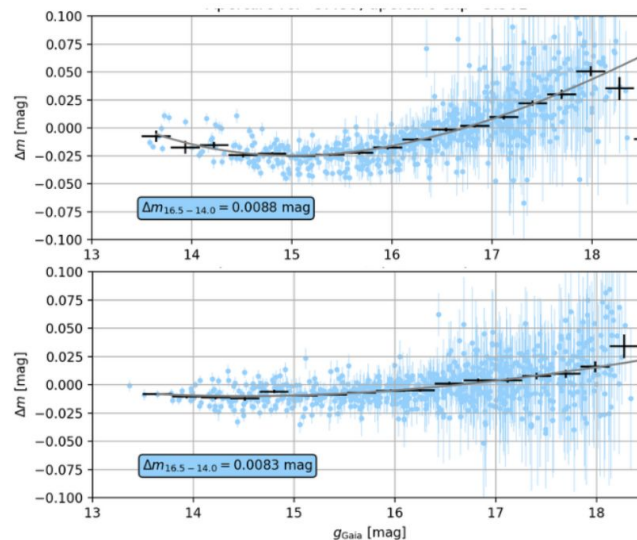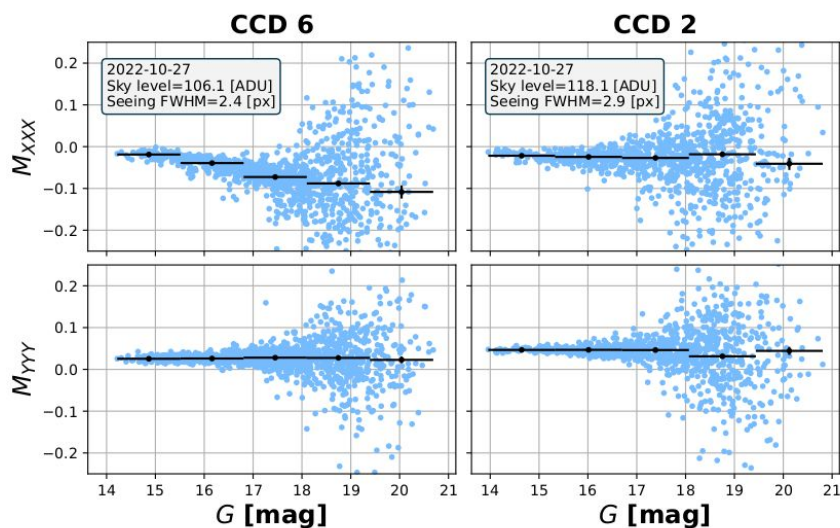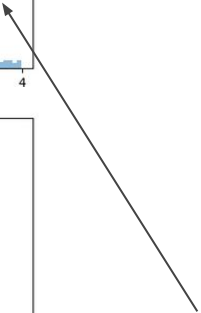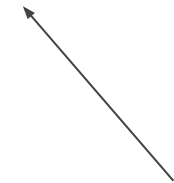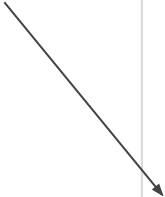
Compression and blinding

- **DR2.2 light curves are compressed**
  - 1 (robust averaged) flux per night
- **… and blinded**
  - Redshift-dependent gray scale
  - SN colors & stretch not altered

Where is the data ?

Previous releases

download

x0,x1,c

What we need …

What we need

- Scene modeling light curves of DR2/DR2.2 objects with
    - Same scene modeling code
    - Correction for sensor effects
        - Pocket effect : yes,
        - Brighter-fatter : probably not
    - New detrending chain
        - Better uniformity
    - Redundant calibration chain
        - At least 2 routes we understand from ZTF to Calspec
        - Independent checks of CALSPEC
    - Validated bandpass models
        - Adapted for PSF photometry (PSF Chromaticity)

Pocket effect correction

- (Tentative) correction
  - At pixel level
  - 1 correction / quadrant
  - Before / after 2019-11
  - Integrated in ztfimg
- Validation in progress
  - Fields #600 & 557
  - Metrics
    - PSF moments
    - PSF / aper linearity
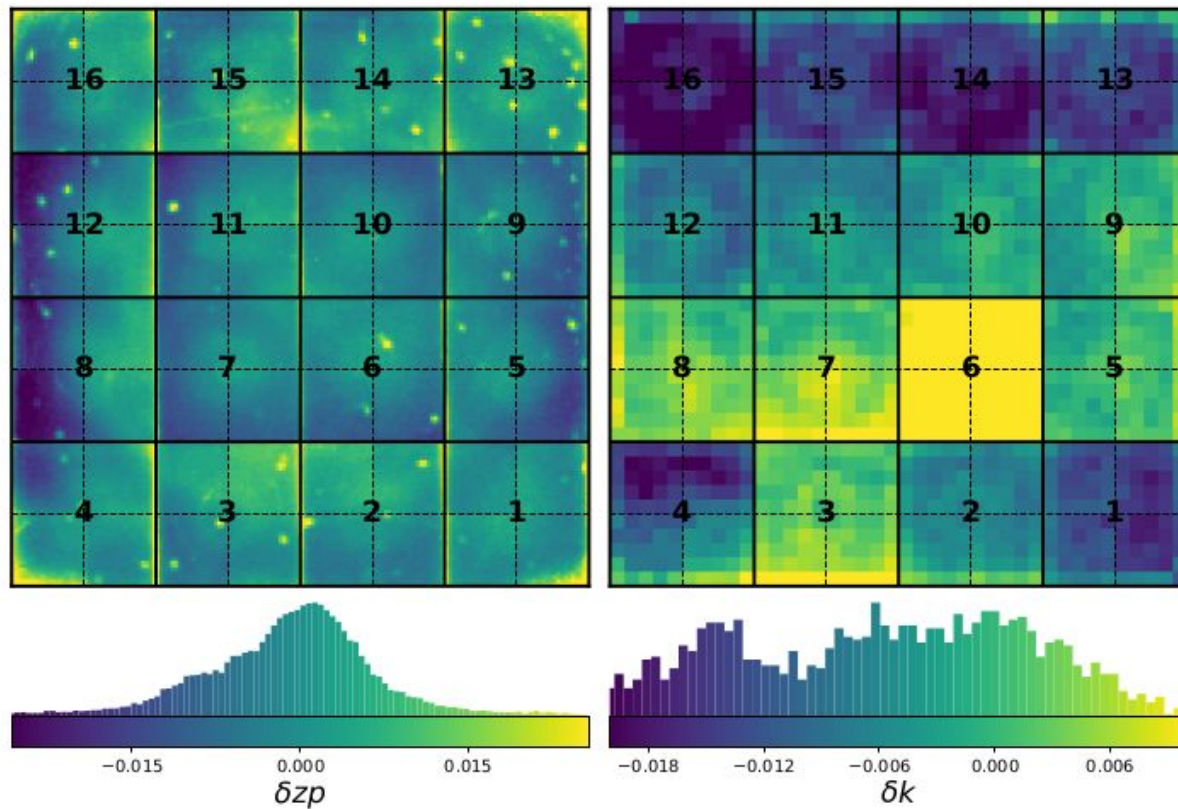   - Aper before / after
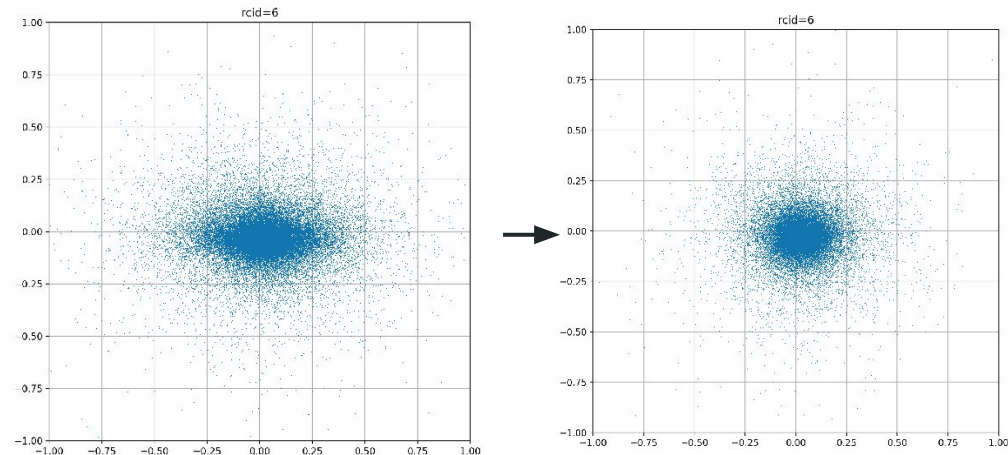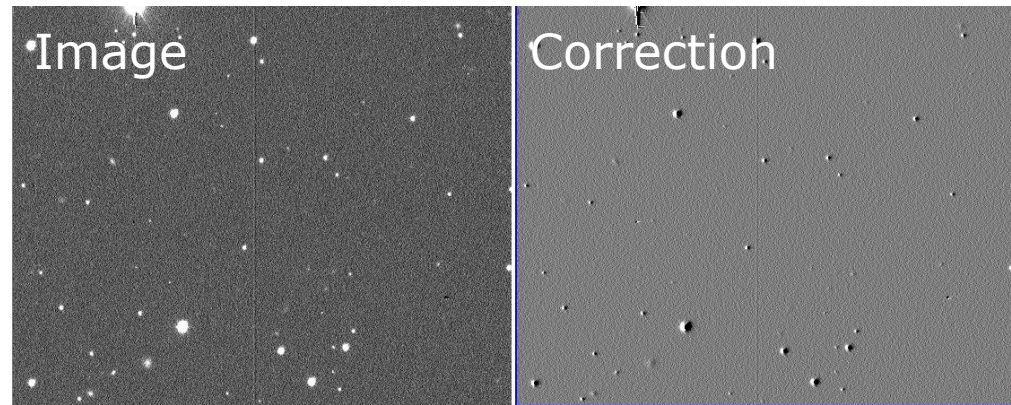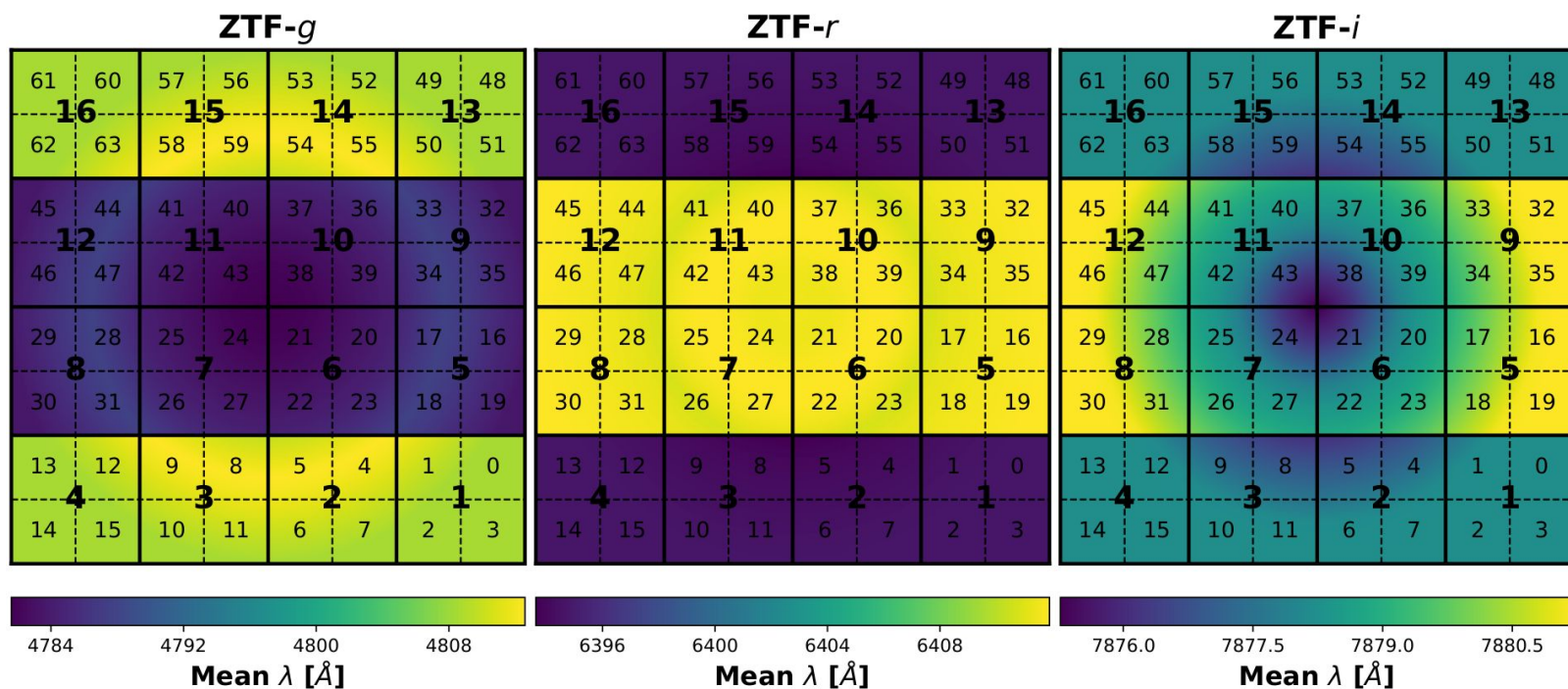
Calibration
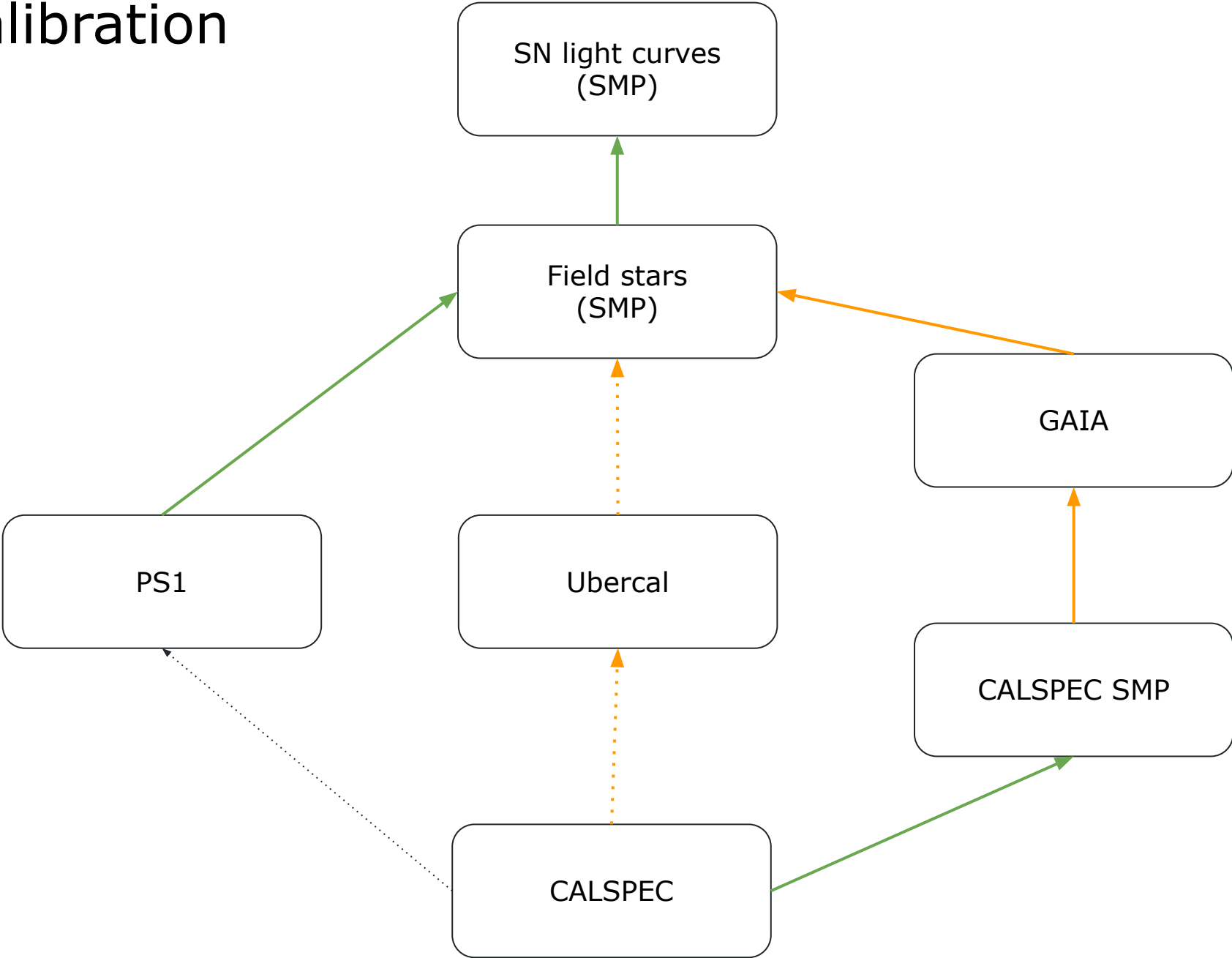
Starflats / uberflats

- For PSF photometry

Validated bandpass models

- Detailed models of ZTF bandpasses available (Philippe)
    - available in sncosmo
    - need validation on stars (in progress)

Conclusions

- 5 main new ingredients in DR2.5

  - Sensor effects (critical, validation in progress)

  - ztfimg (new detrending framework)

  - Starflats / uberflats (code exists, reprocessing in progress)

  - Bandpasses (exist, validation in progress)

  - Calibration chain (ubercal <-> SMP not connected yet)