

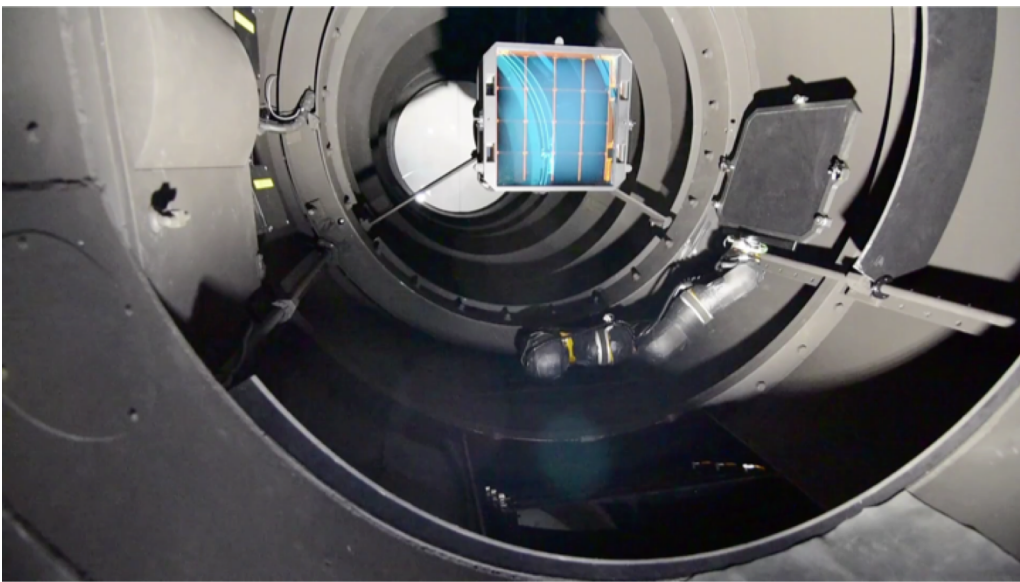
Flat-fielding



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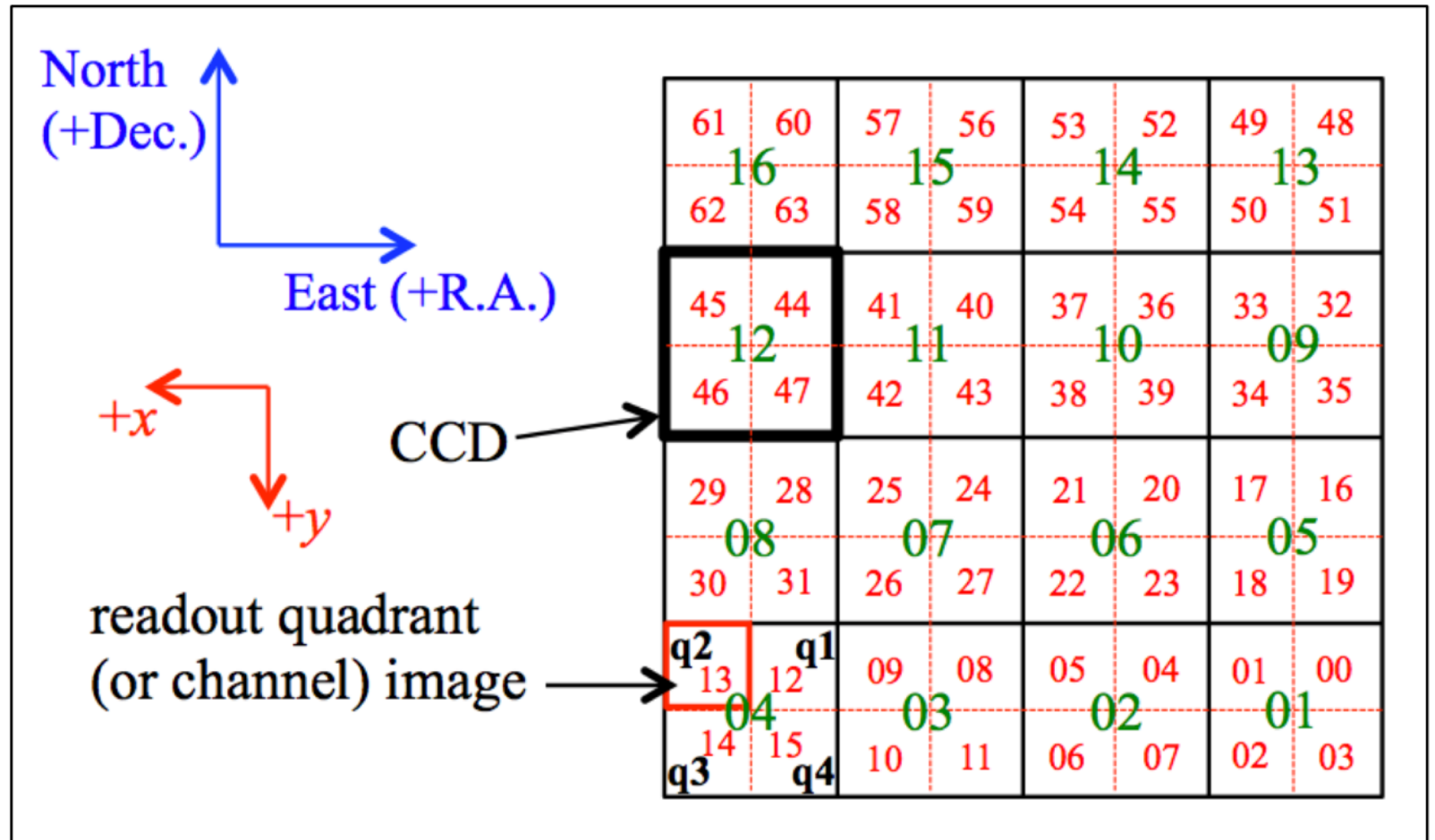


I-SITE Clermont
Clermont Auvergne Project



ZTF camera

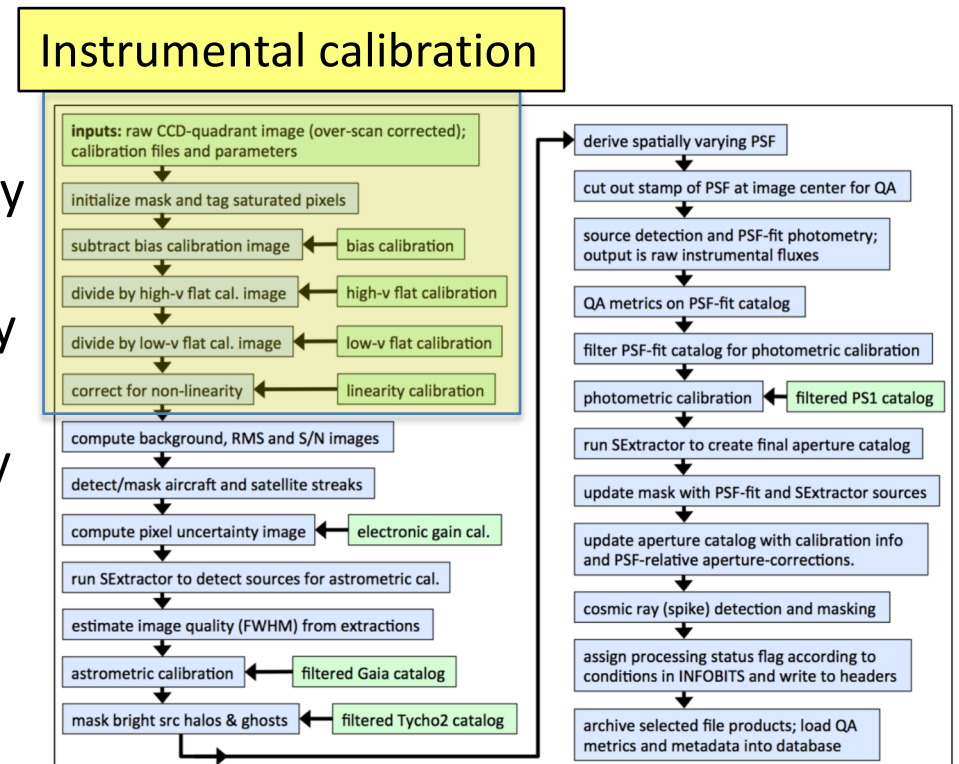
- Field-of-view = 47°
- 16 ($\sim 6k \times 6k$) e2v CCDs = 600 Mpixel
- Pixel resolution = $1''$



Goal

Current ZTF pipeline inputs:

- g-filter = stacking of 20 flat-images/day (5 per LED 02+03+04+05)
- r-filter = stacking of 20 flat-images/day (5 per LED 07+08+09+10)
- i-filter = stacking of 21 flat-images/day (7 per LED 11+12+13)



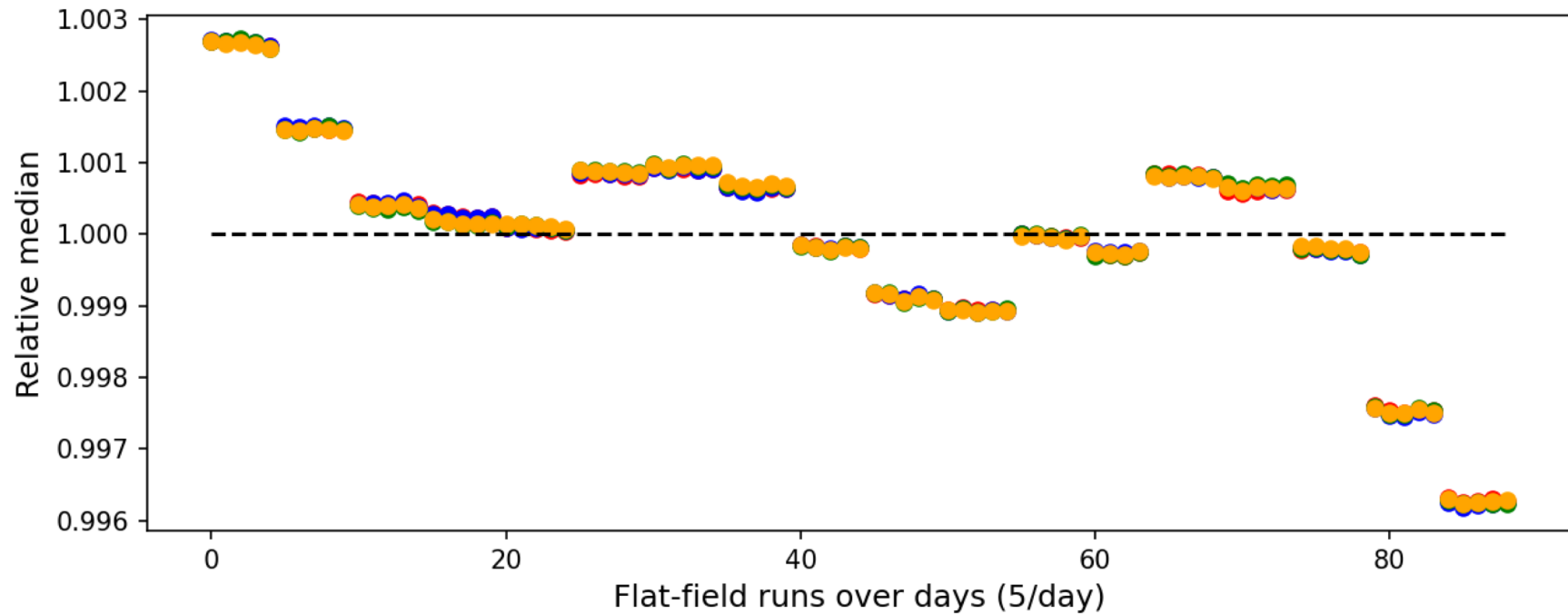
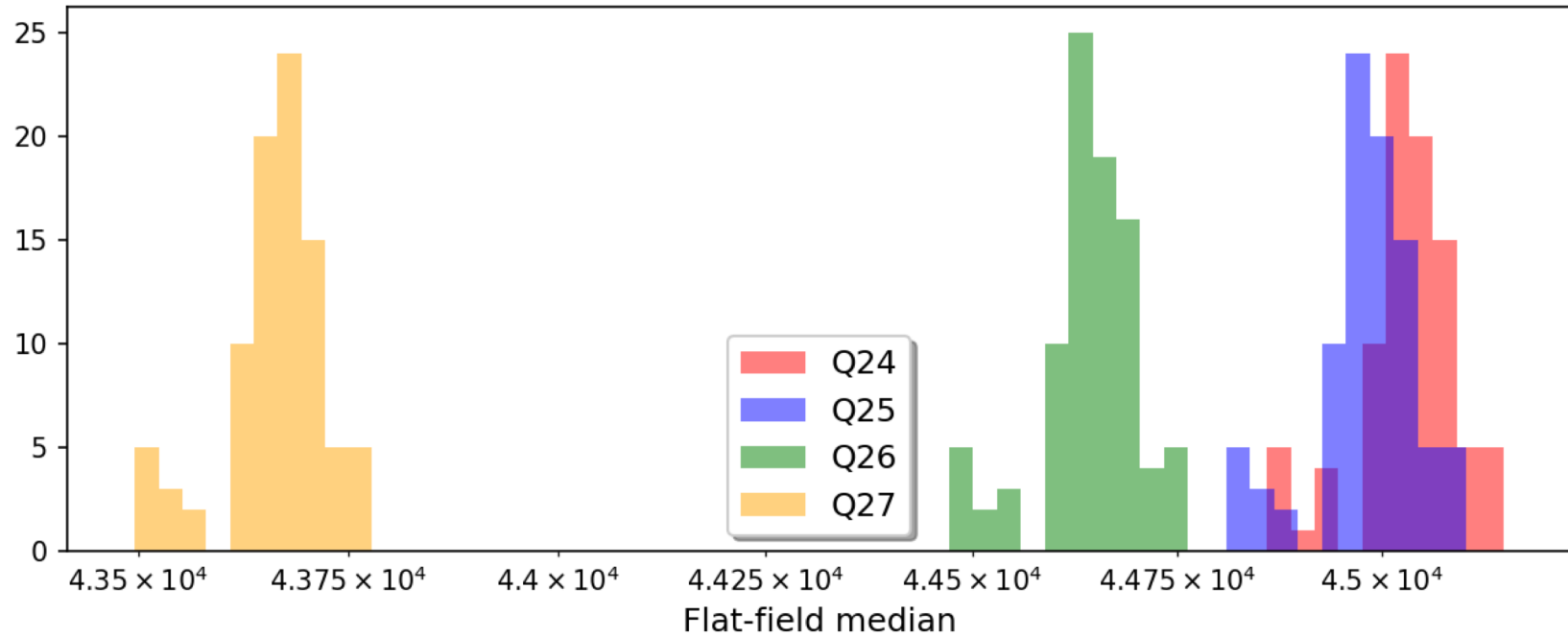
Goal for the new photometric pipeline:

- Build a master-flat for each filter } Per week, month, year or other period ?

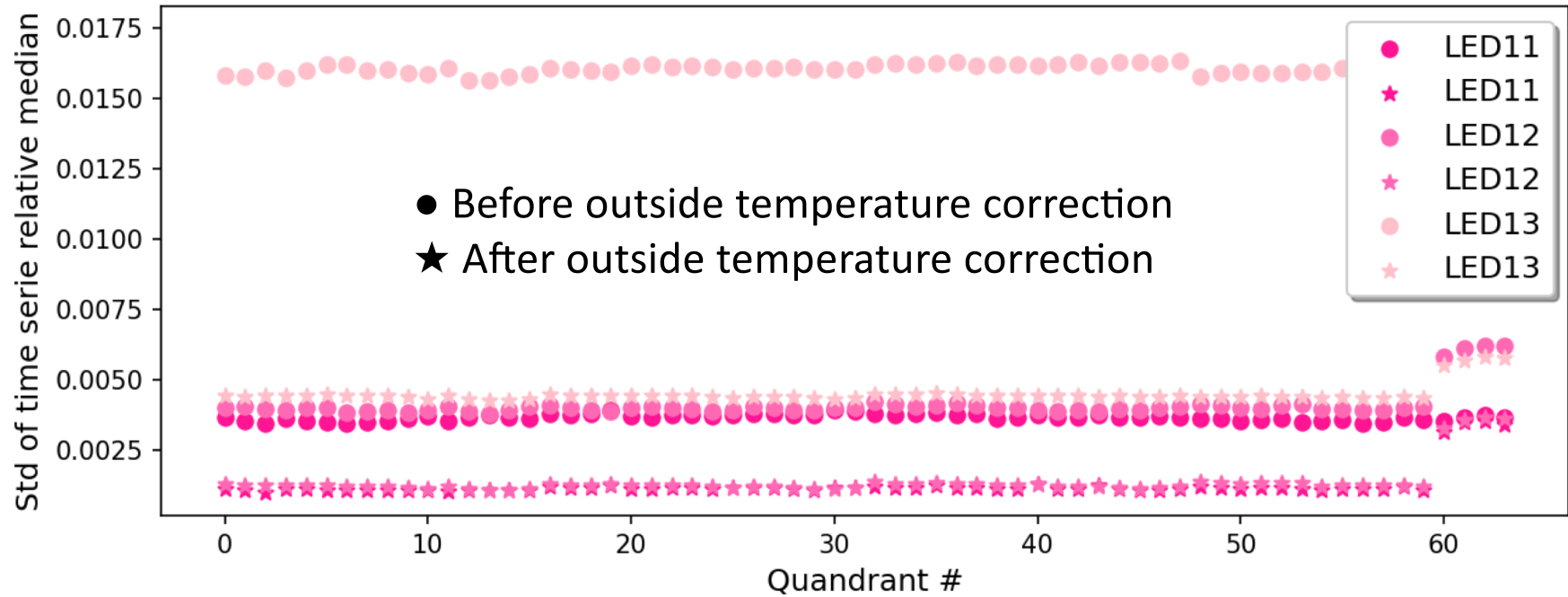
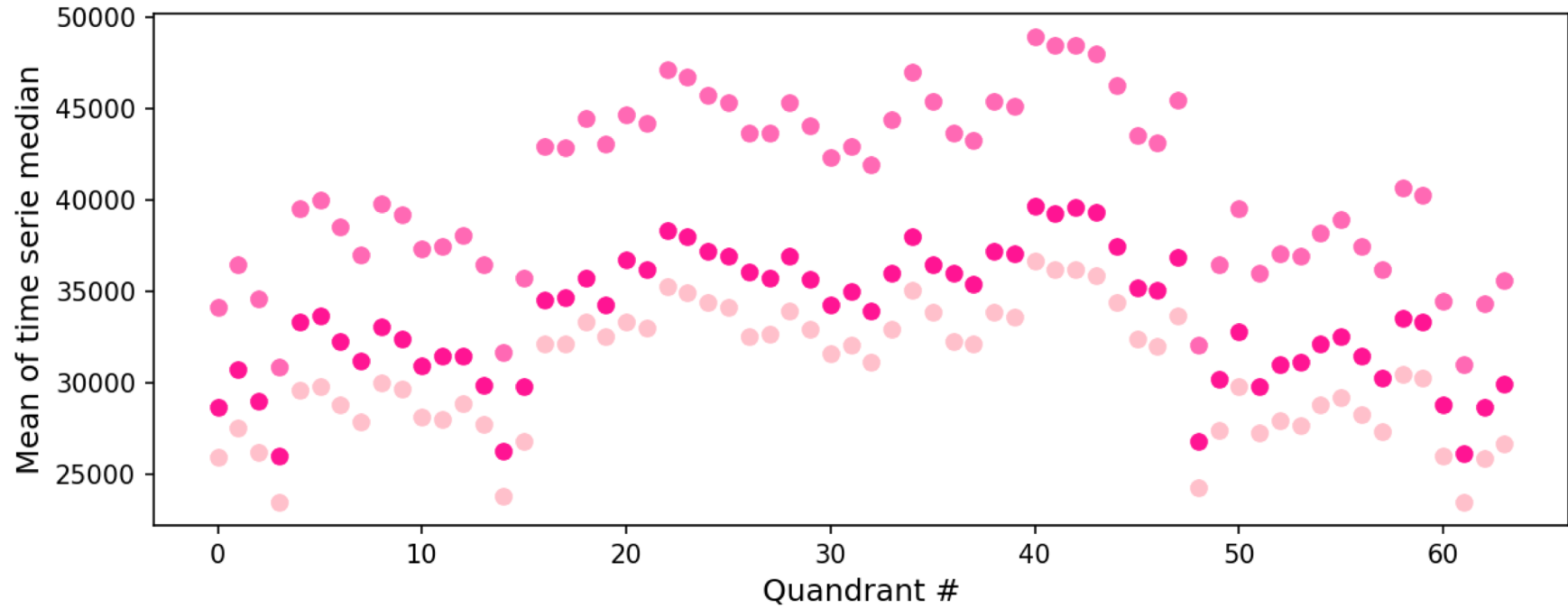
Starting point:

- Period of 2019 star-flat: 2019-03-21 to 2019-04-09
- Study stability to optimize the master-flat

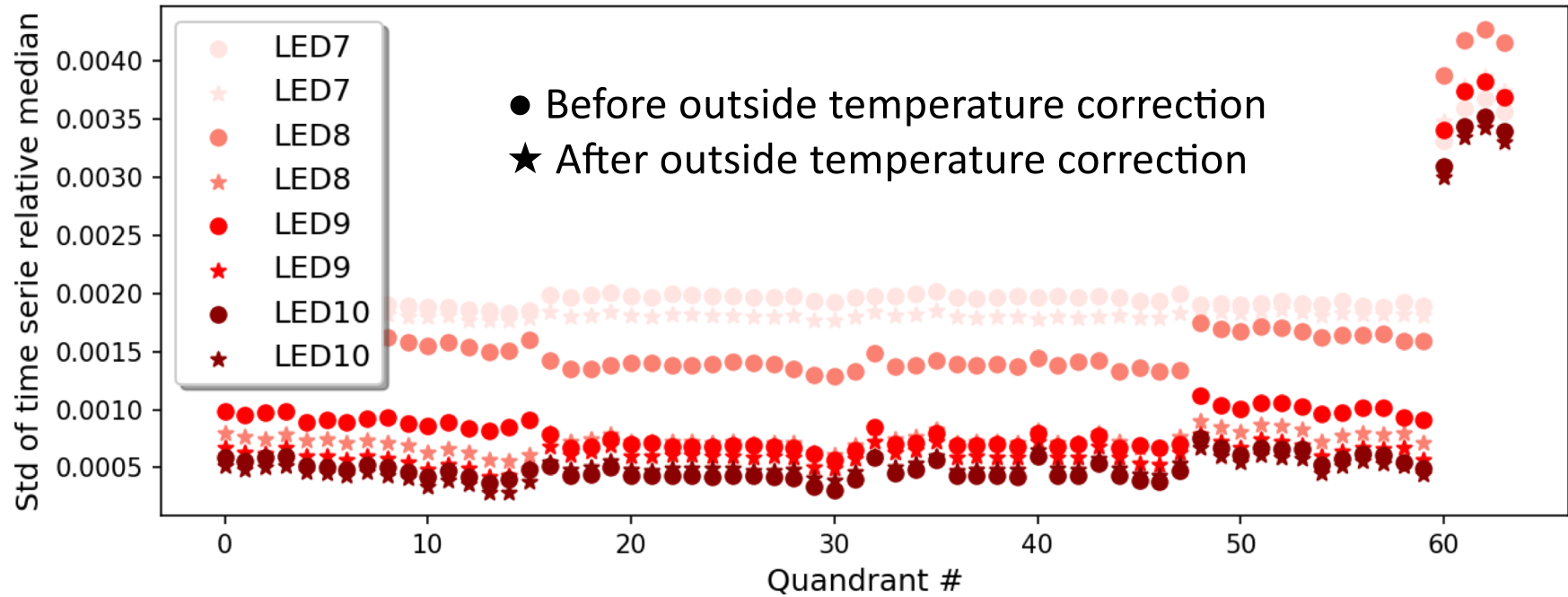
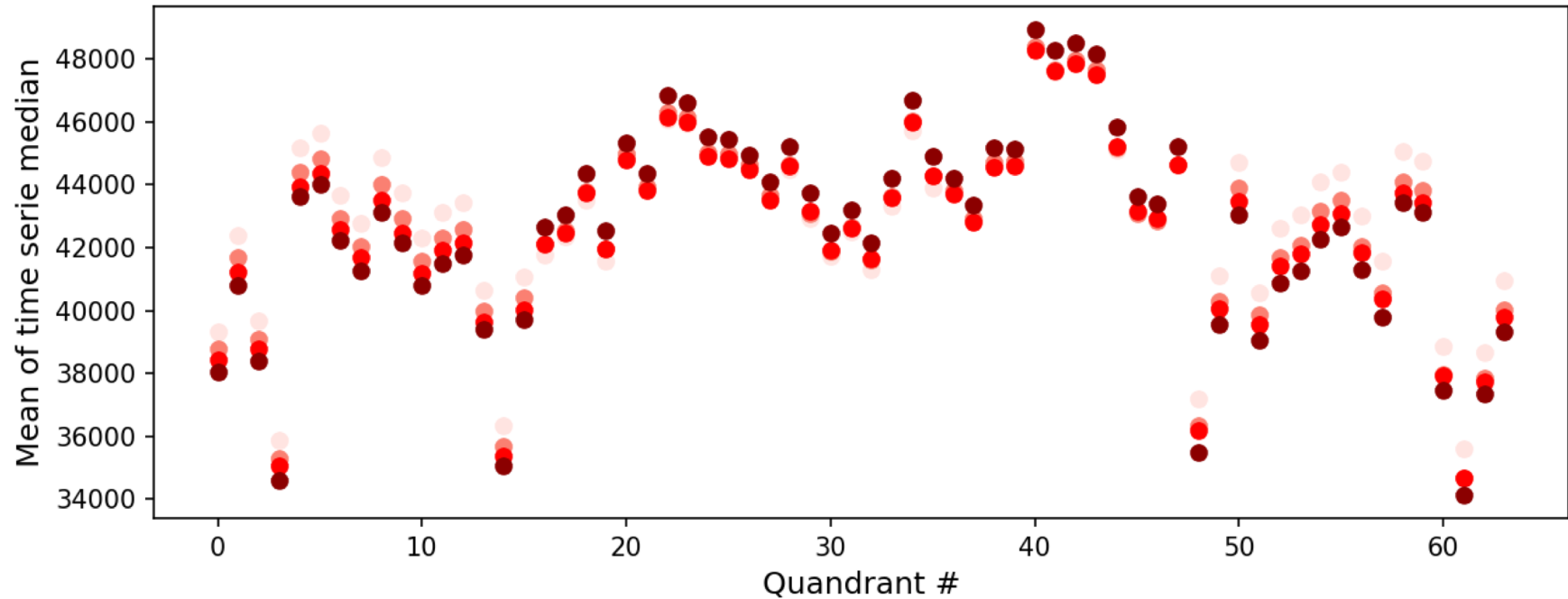
Stability of CCD07 with LED08



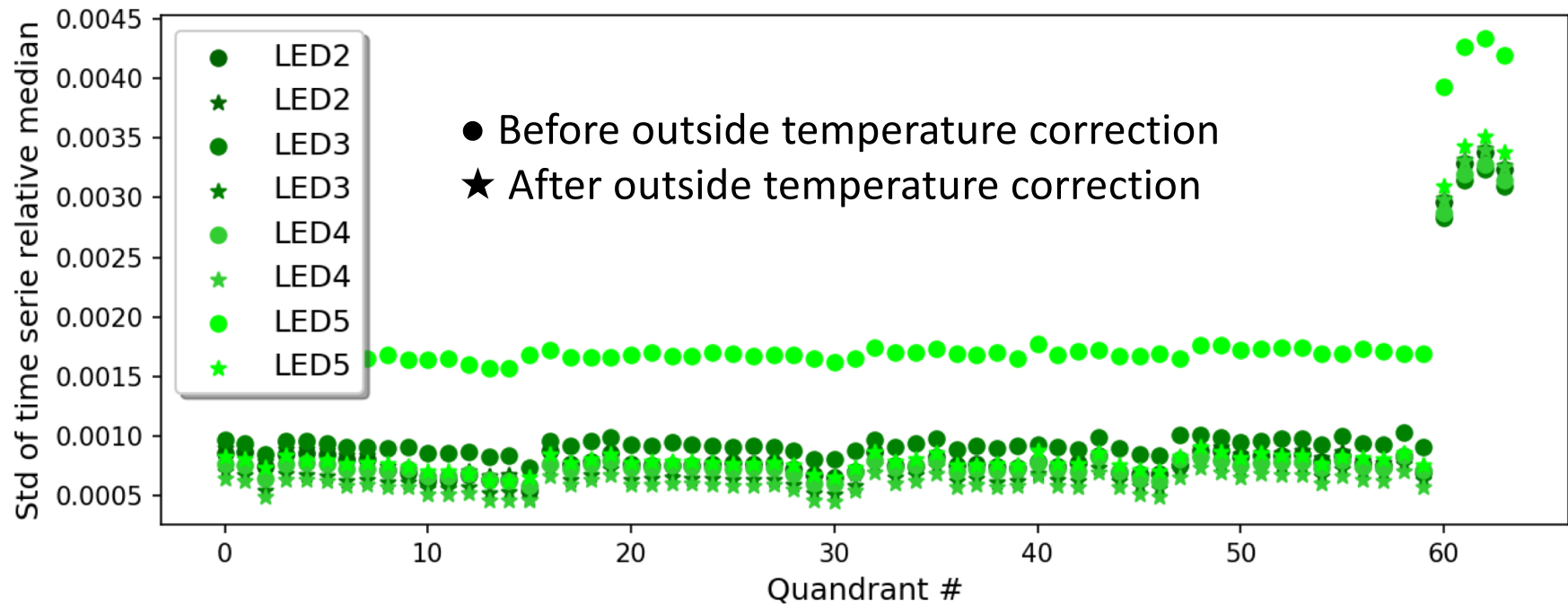
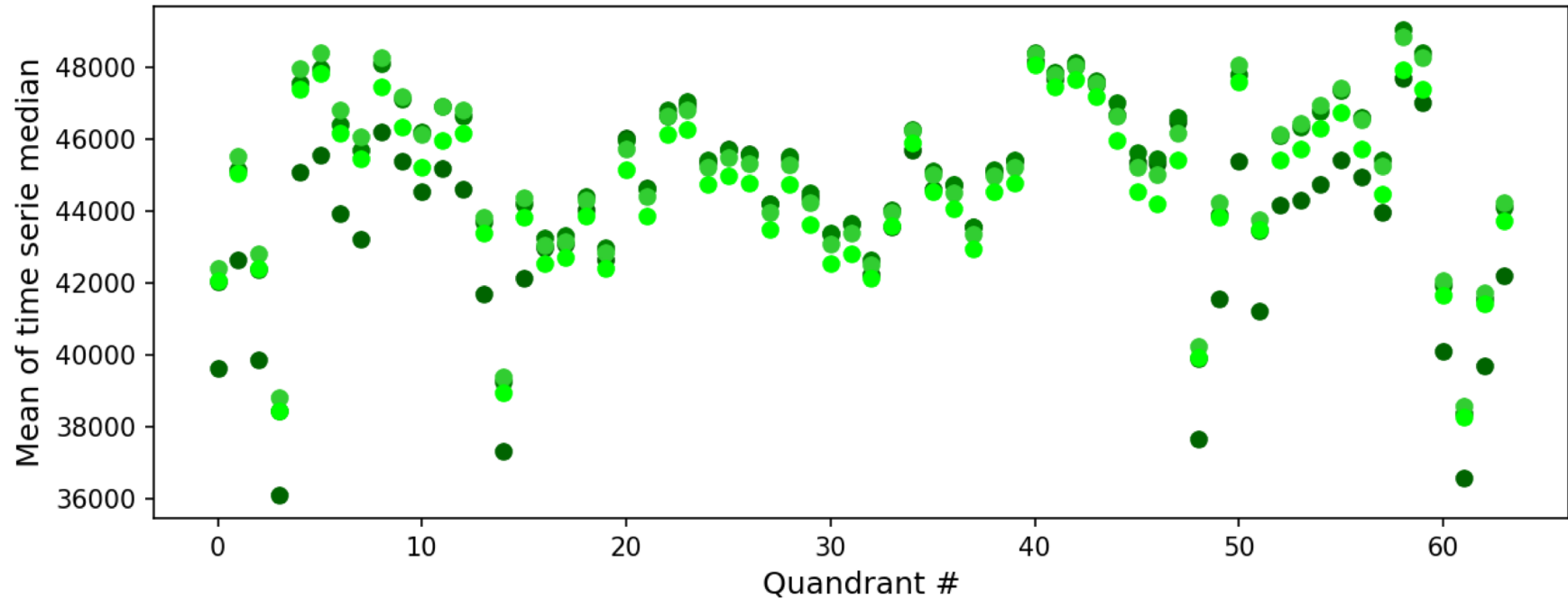
Focal plane stability for i-filter LEDs



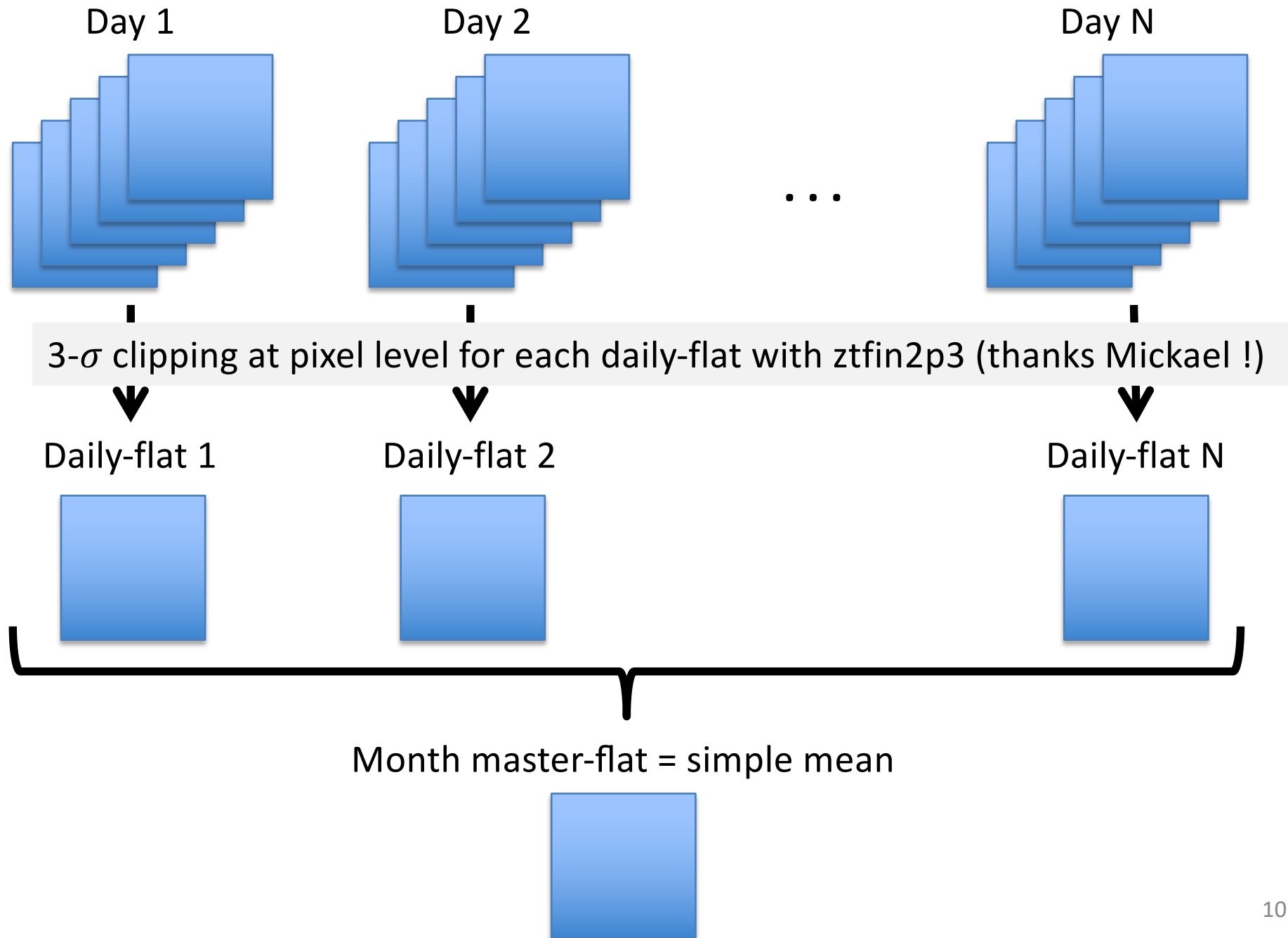
Focal plane stability for r-filter LEDs



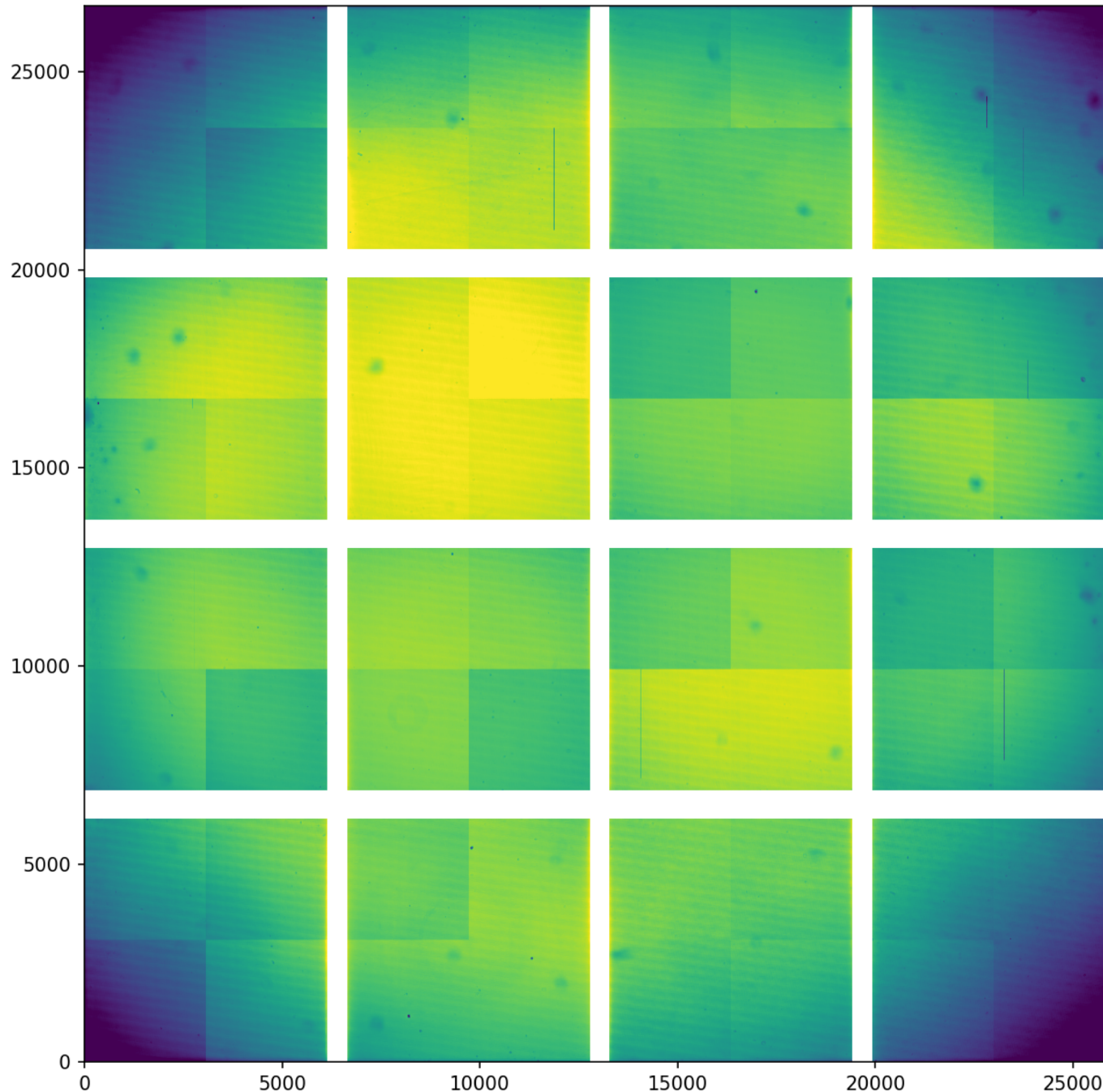
Focal plane stability for g-filter LEDs



Month master-flat construction

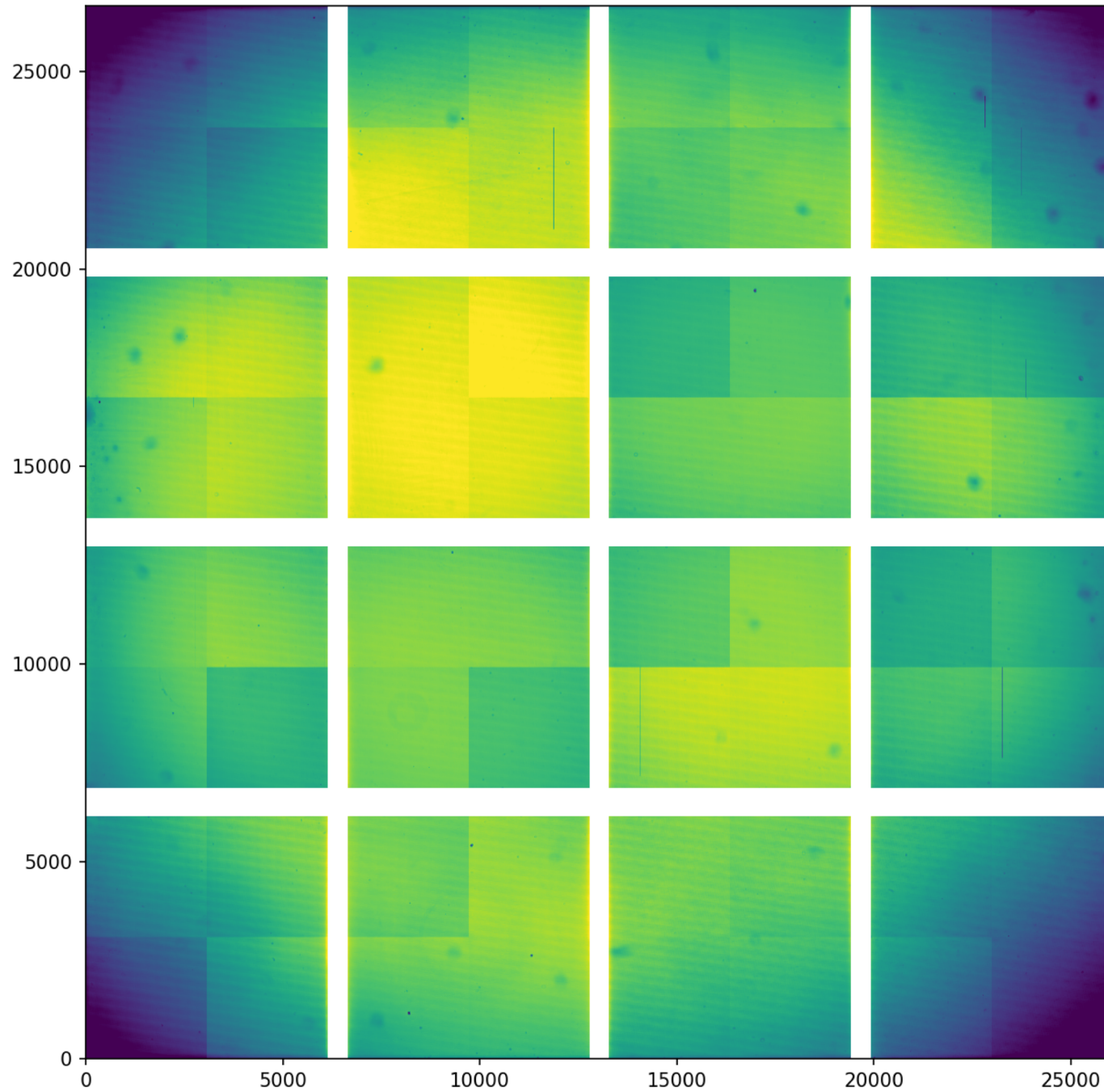


Typical flat-field : LED02

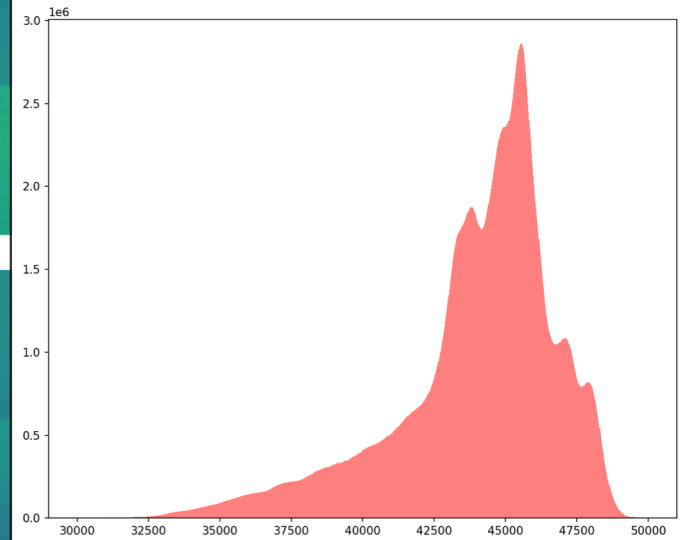


- Limit of the field-of-view
- Quadrant structure = amplifier per readout channel
- Dust spots
- Strips (horizontal) = Laser scan in CCD production process

March 2019 master flat-field : LED02

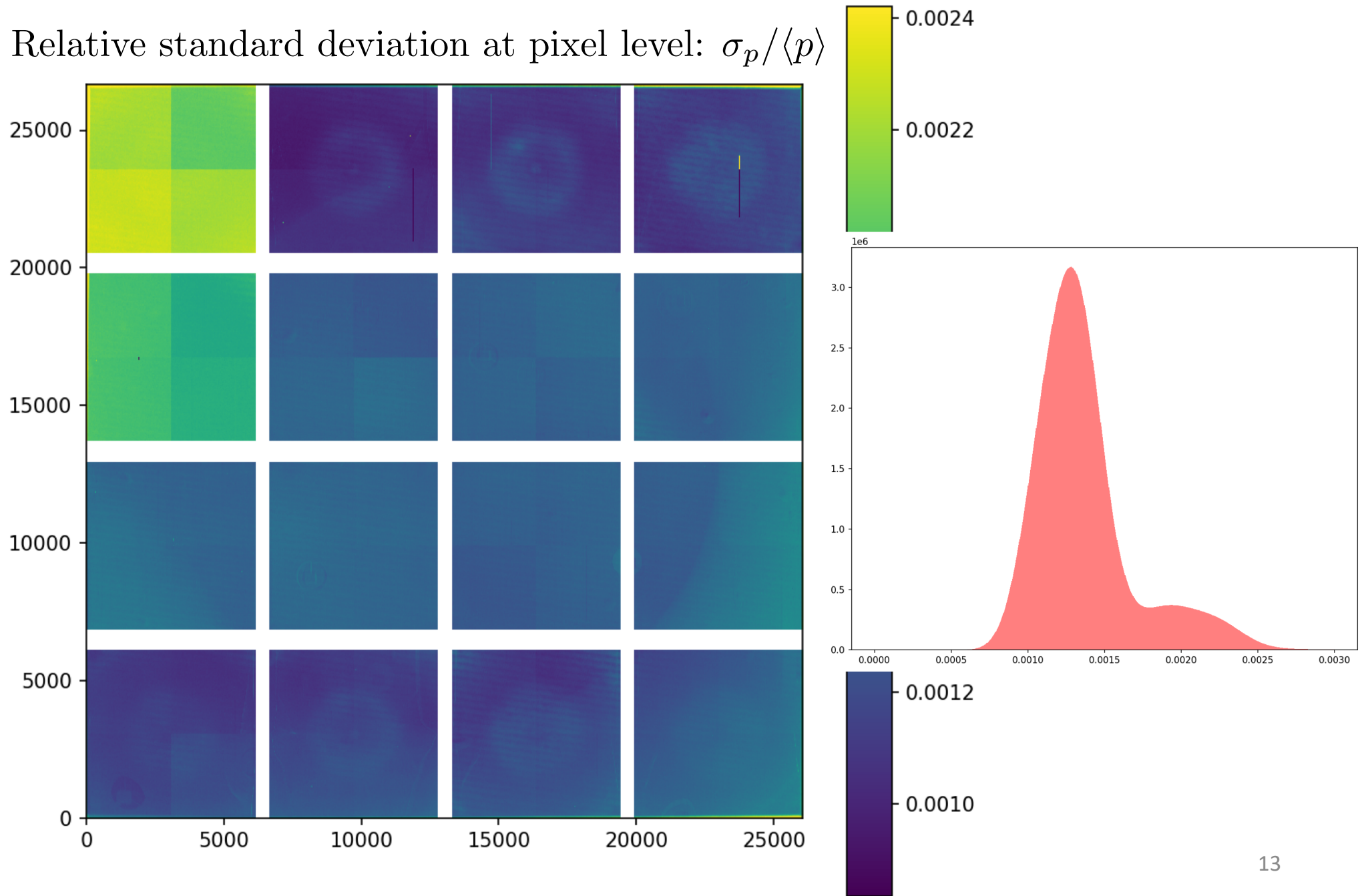


Pixel counting distribution

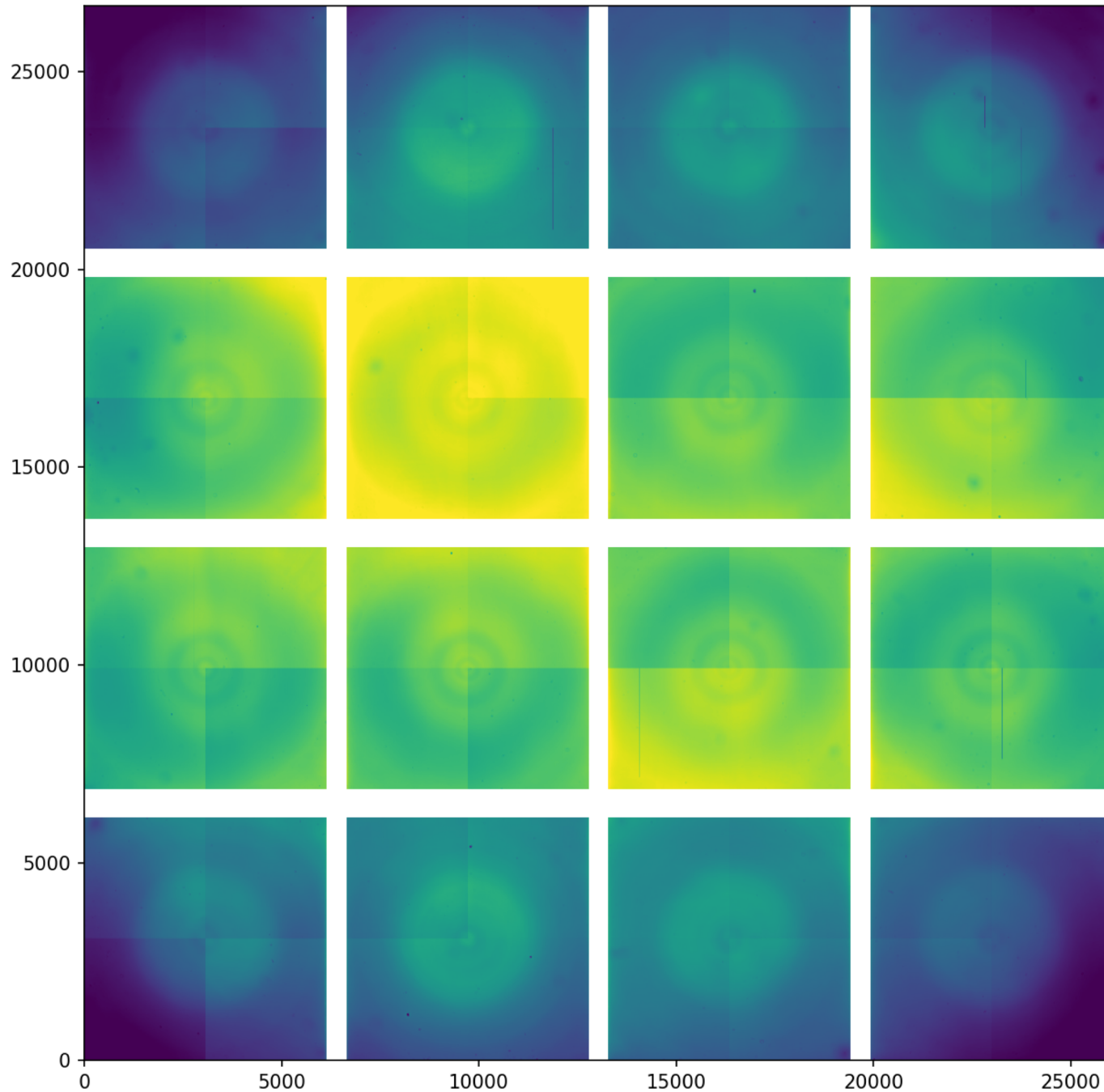


March 2019 master flat-std : LED02

Relative standard deviation at pixel level: $\sigma_p / \langle p \rangle$

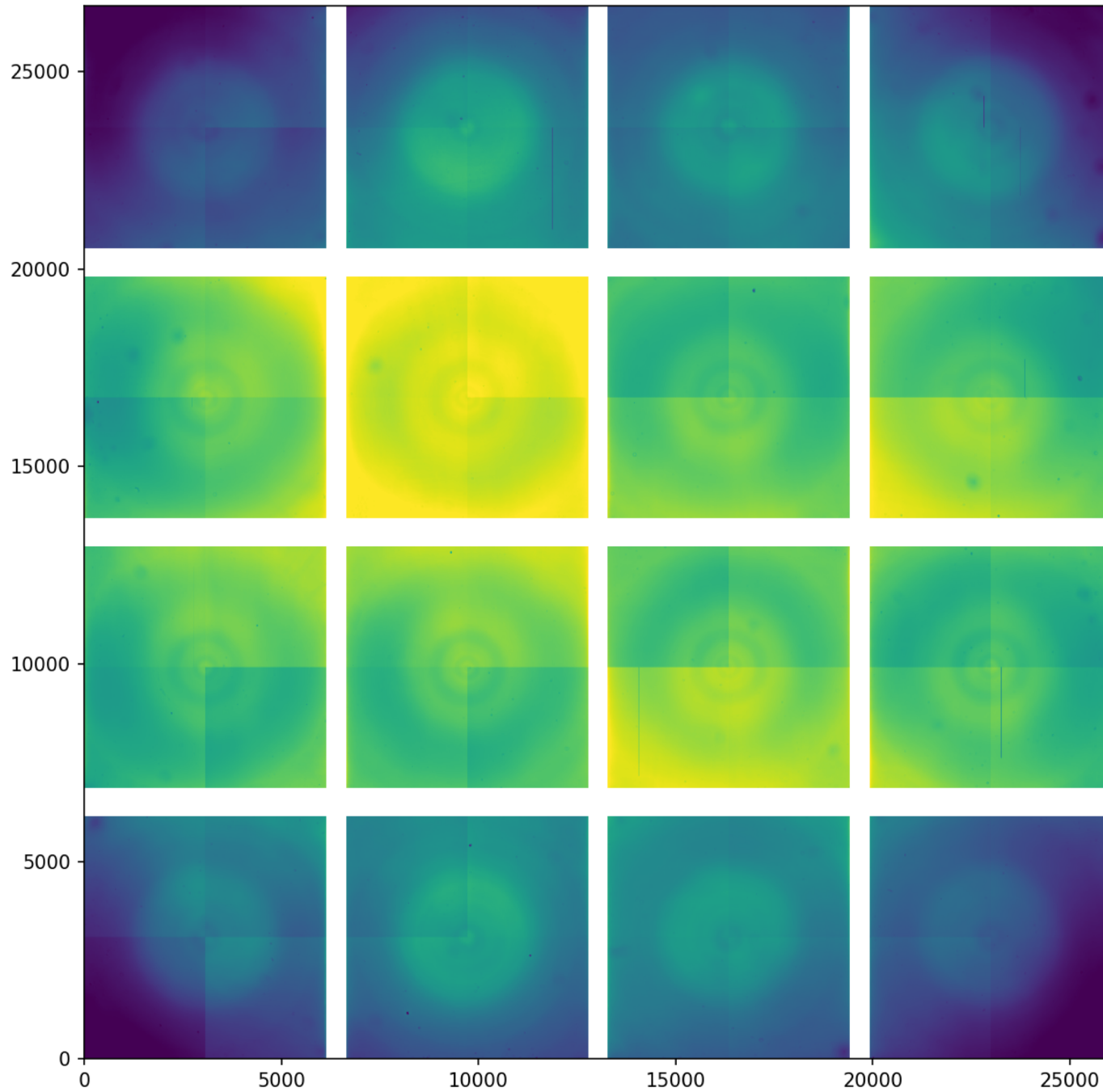


Typical flat-field : LED13

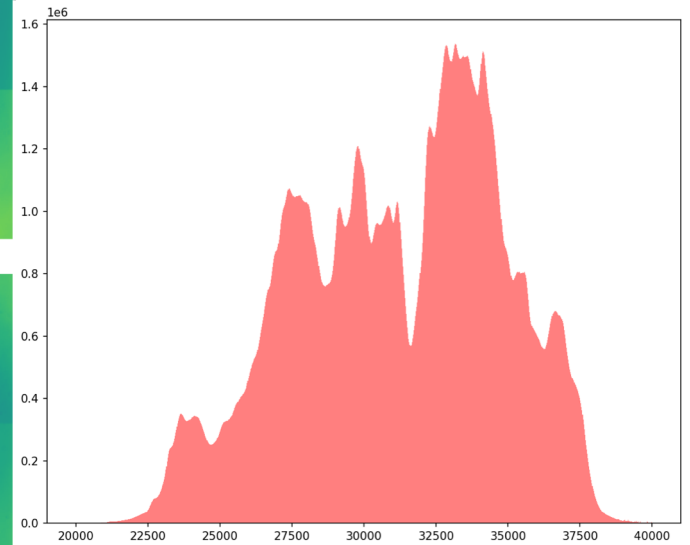


- CCD ring structure due to the CCD thickness profile (thin CCD $\sim 25 \mu\text{m}$)

March 2019 master flat-field : LED13

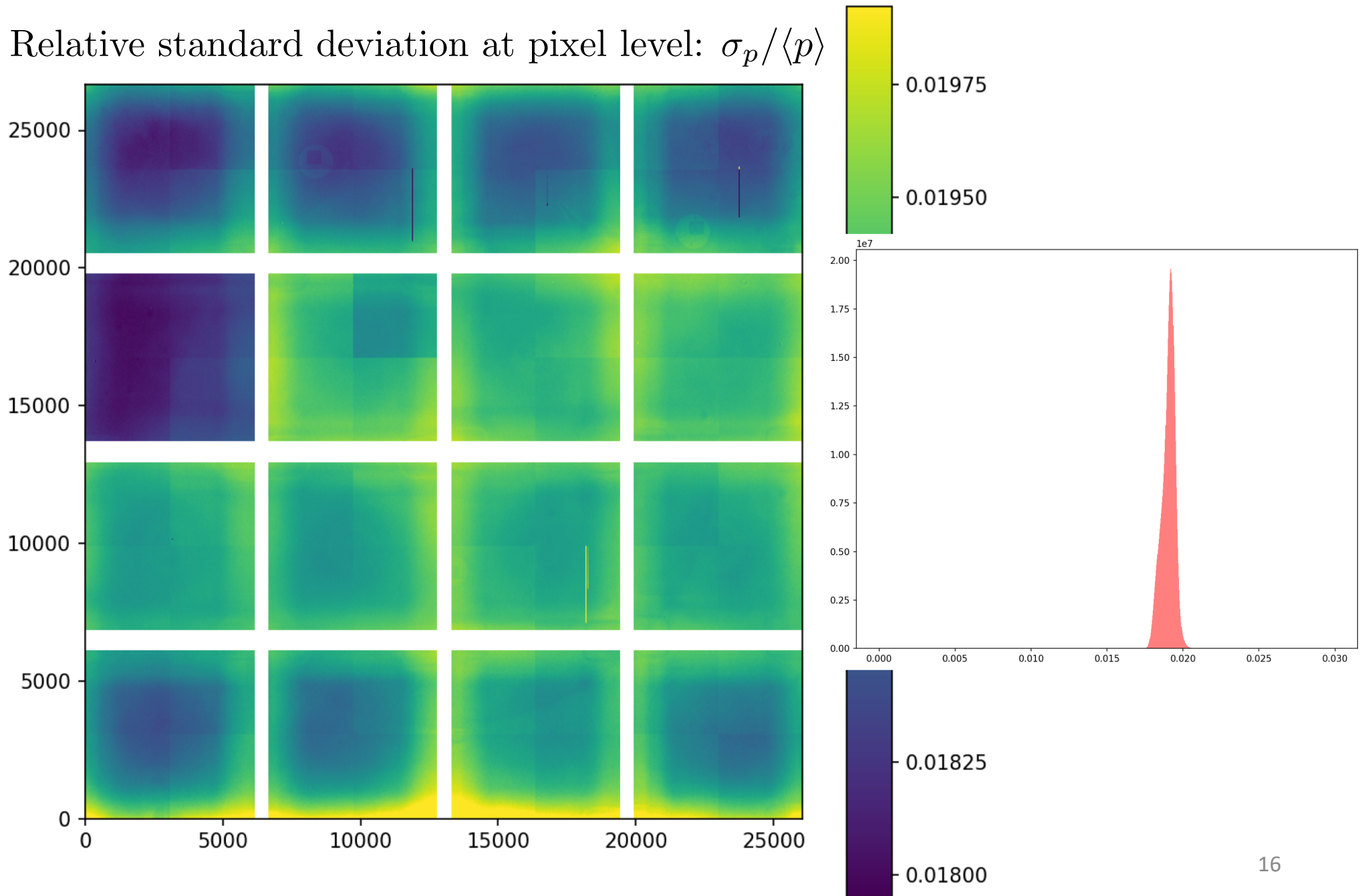


Pixel counting distribution



March 2019 master flat-std : LED13

Relative standard deviation at pixel level: $\sigma_p / \langle p \rangle$



Conclusions and perspectives

Preliminary study of stability at quadrant level

- ~ (0.4 to 1.6) % before temperature correction → Observation of outside temperature dependence of flat-field intensity, especially for LED13 (shift of peak wavelength ?)
- ~ (0.05 to 0.5) % after temperature correction

Stability at pixel level before temperature correction

- ~ 0.15 % for LED02
- ~ 2 % for LED13

Pattern observations in relative-std

- CCD-ring structure for LED02 + big-circle (telescope optical effect ?) + bad dispersion for CCD 12 & 16 (top left in focal plane)
- CCD-square structure for LED13

Next steps

- Daily-flat / monthly-flat study
- Production of master-flat per filter