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Bias and Flat-fielding in ZTF

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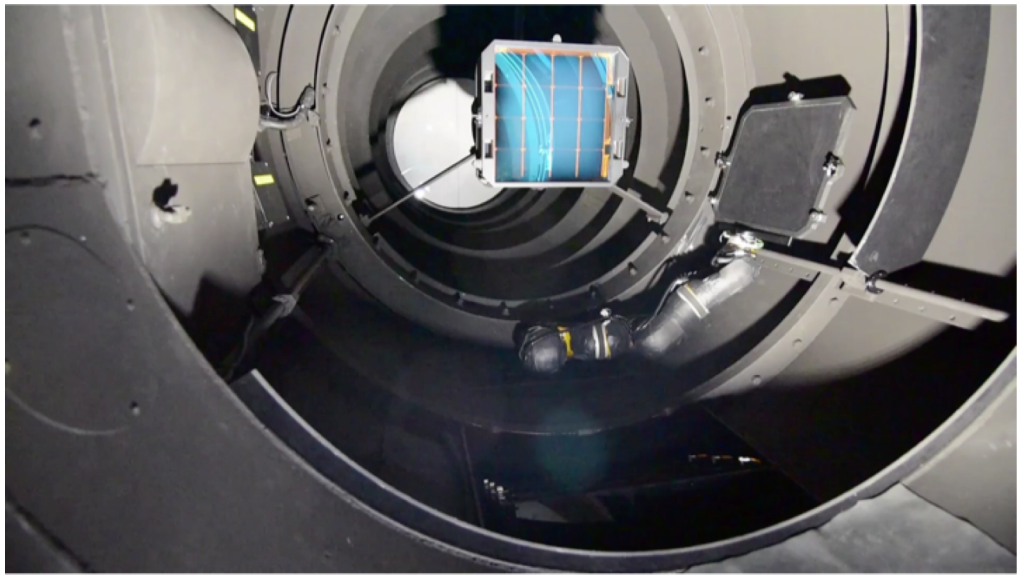
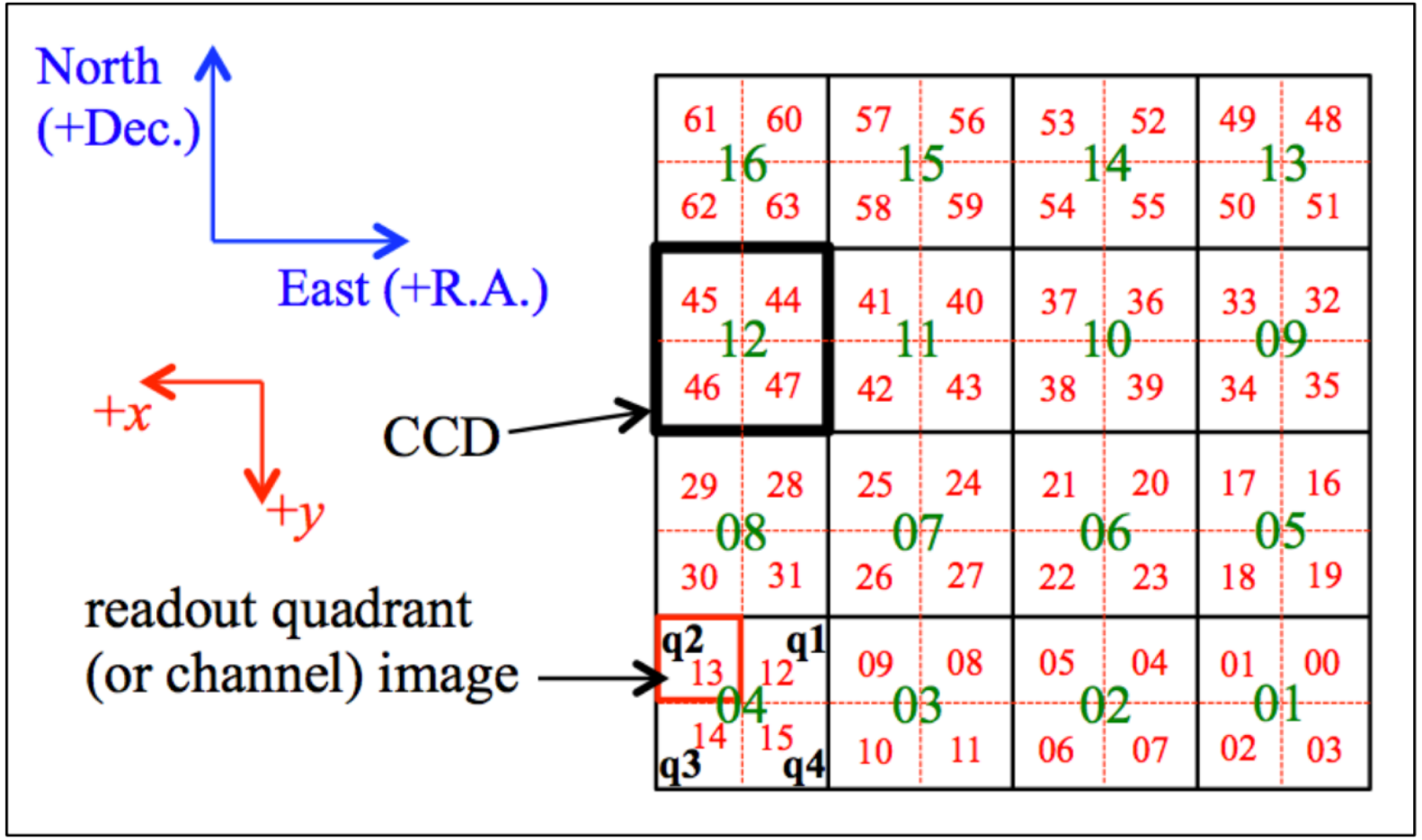
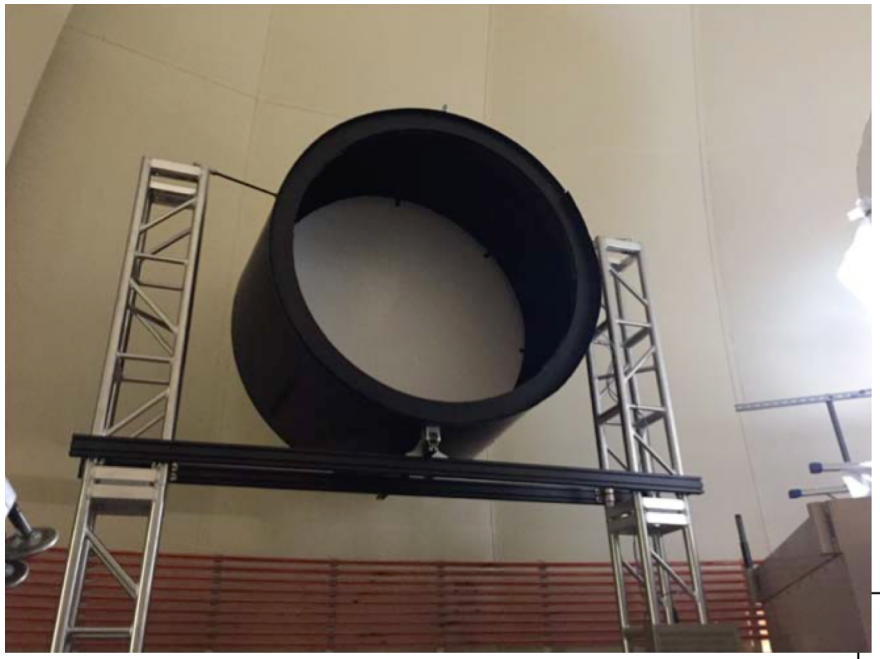


ZTF camera

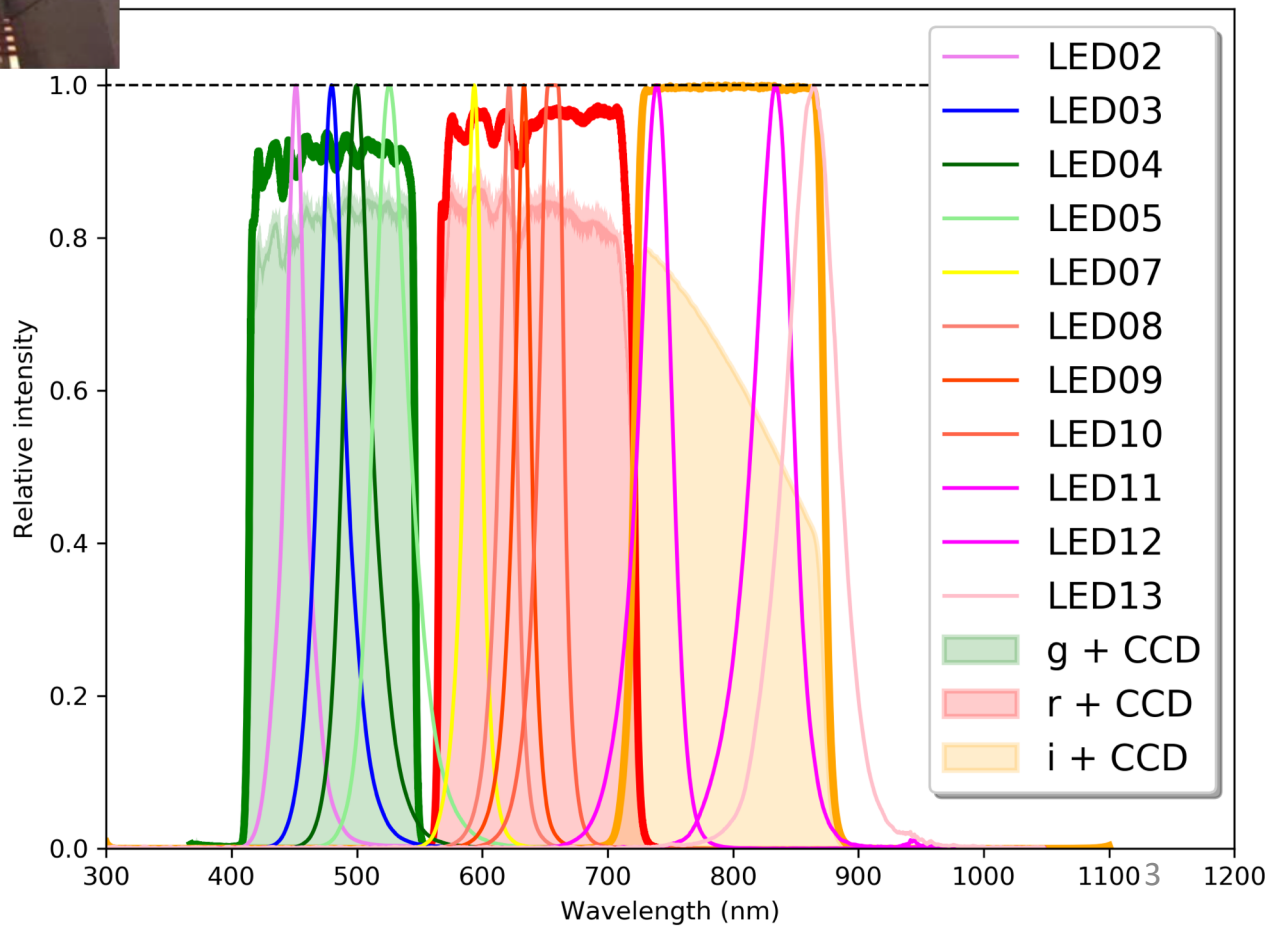
- Field-of-view = 47□
- 16 (~ 6k x 6k) e2v CCDs = 600 Mpixel
- Pixel resolution = 1”



Filter and LED spectra



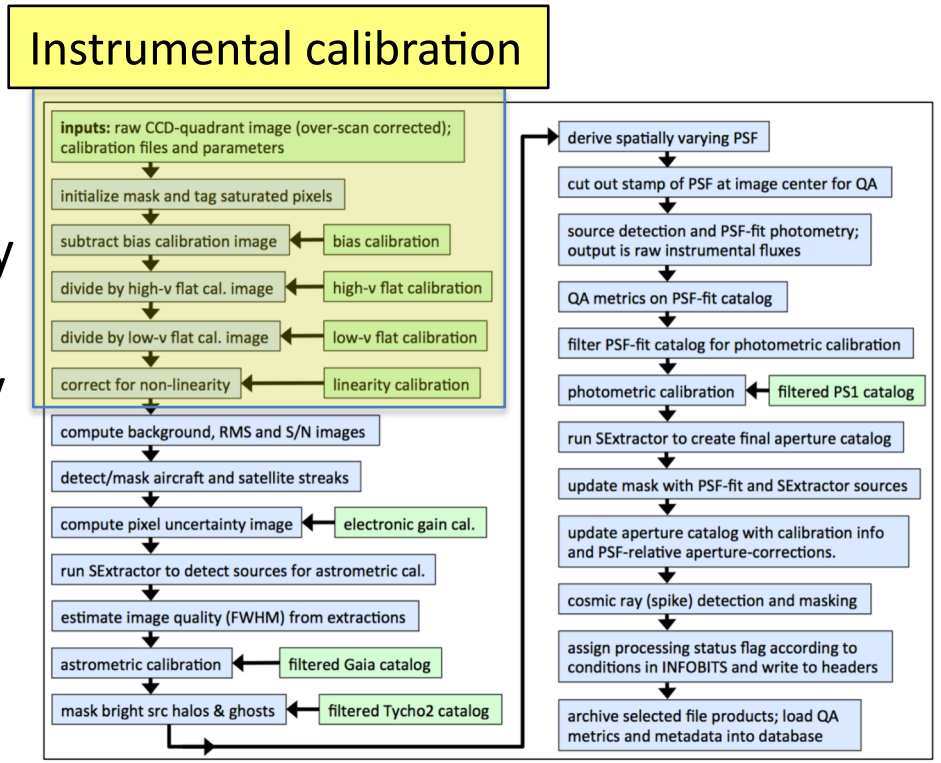
Flat-field illuminator
(32 pulsed LEDs per colour)



Goal

Current ZTF pipeline inputs:

- Bias = stacking of 20 bias-images/day
- 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-bias
- Build a master-flat for each filter

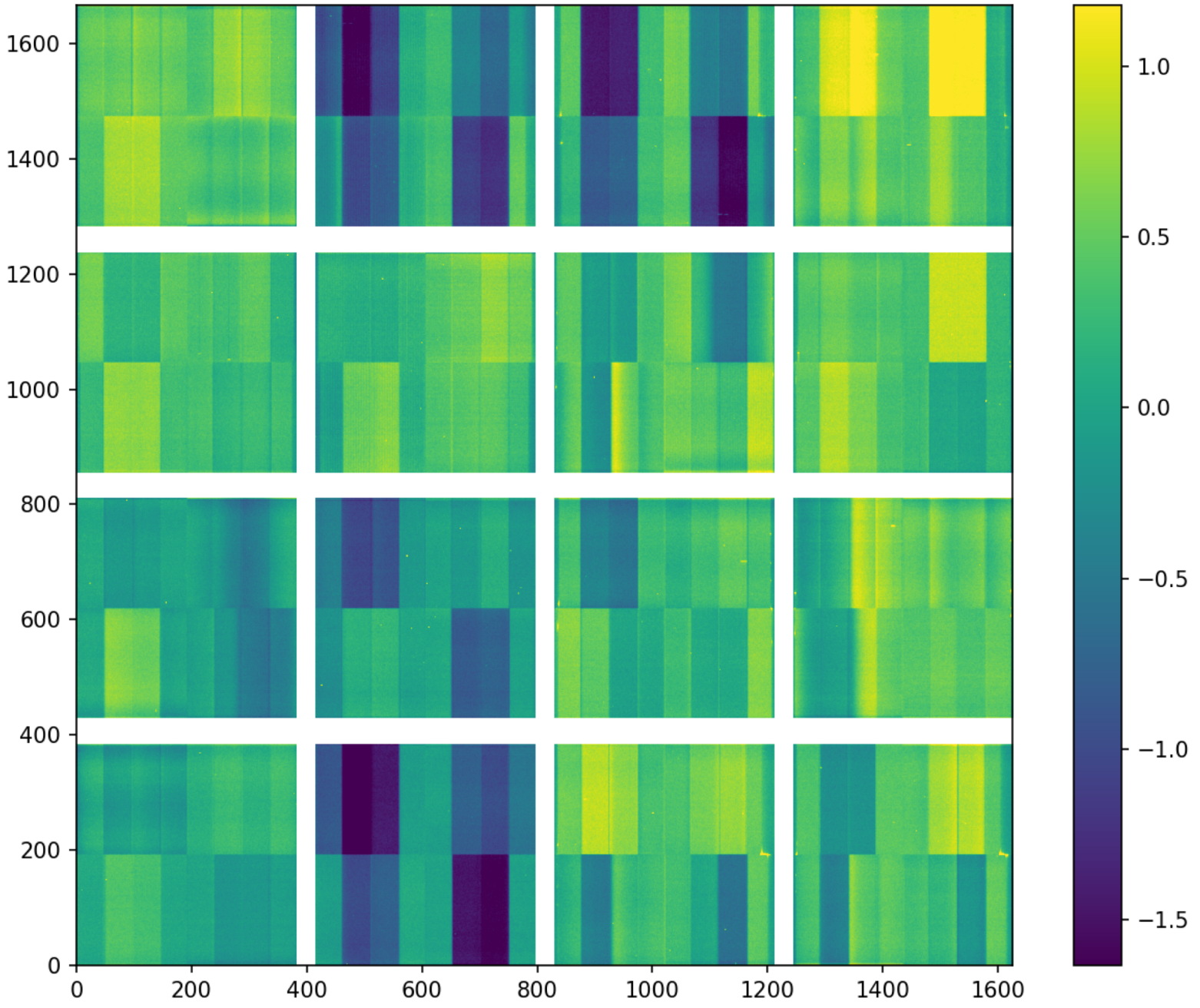
} Per week, month, year or other period ?

Starting point:

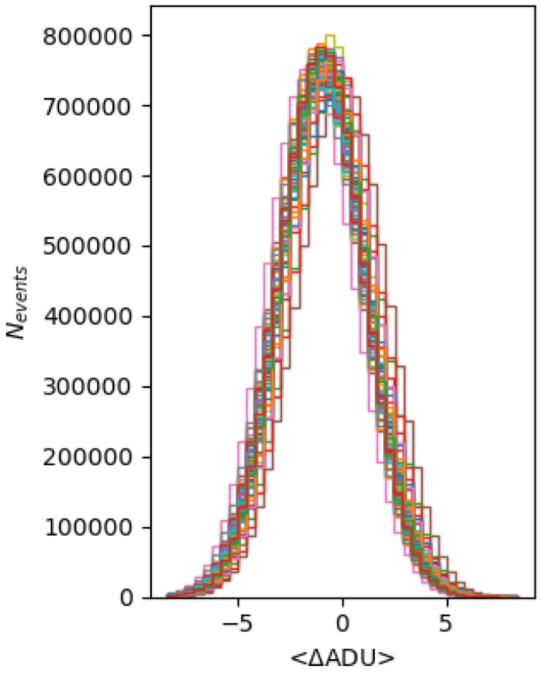
- Period of 2019 star-flat: 2019-03-21 to 2019-04-09
- Study stability to optimize the master-bias and master-flat

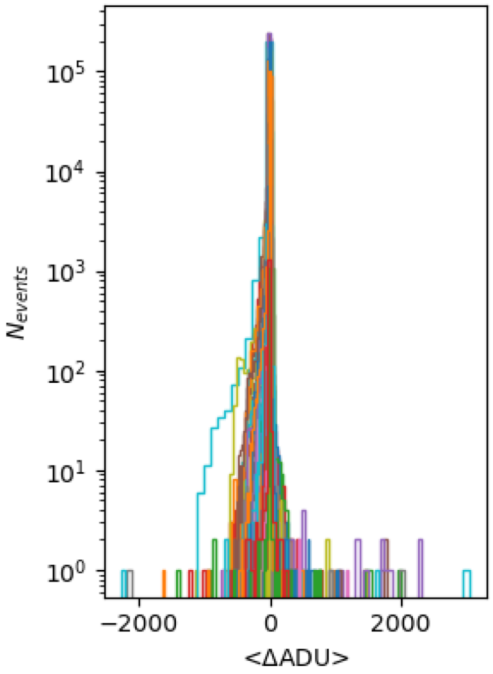
Bias images

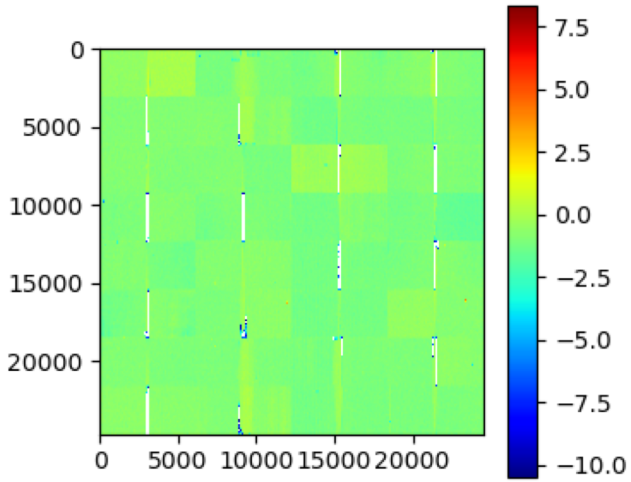
Typical bias image (overscan subtracted)

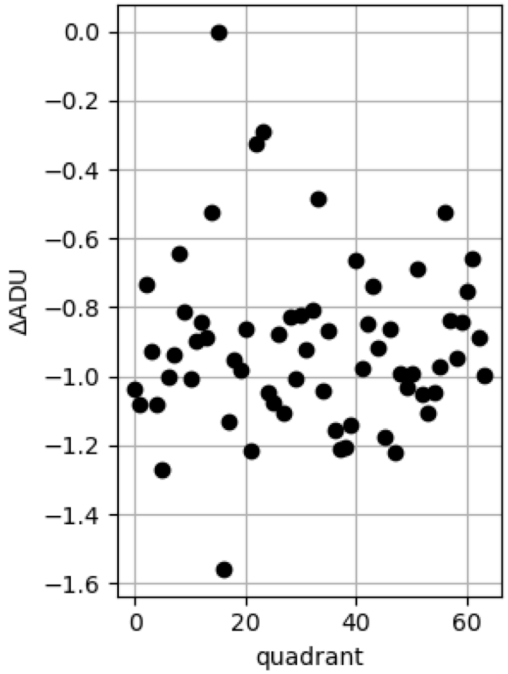


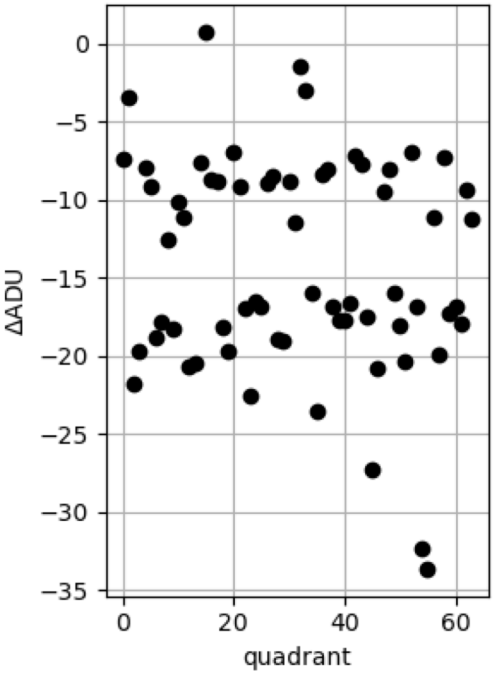
Time series of bias images

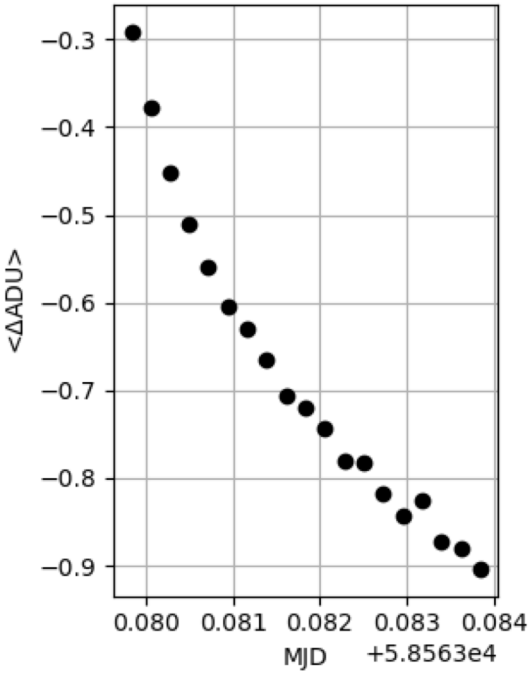






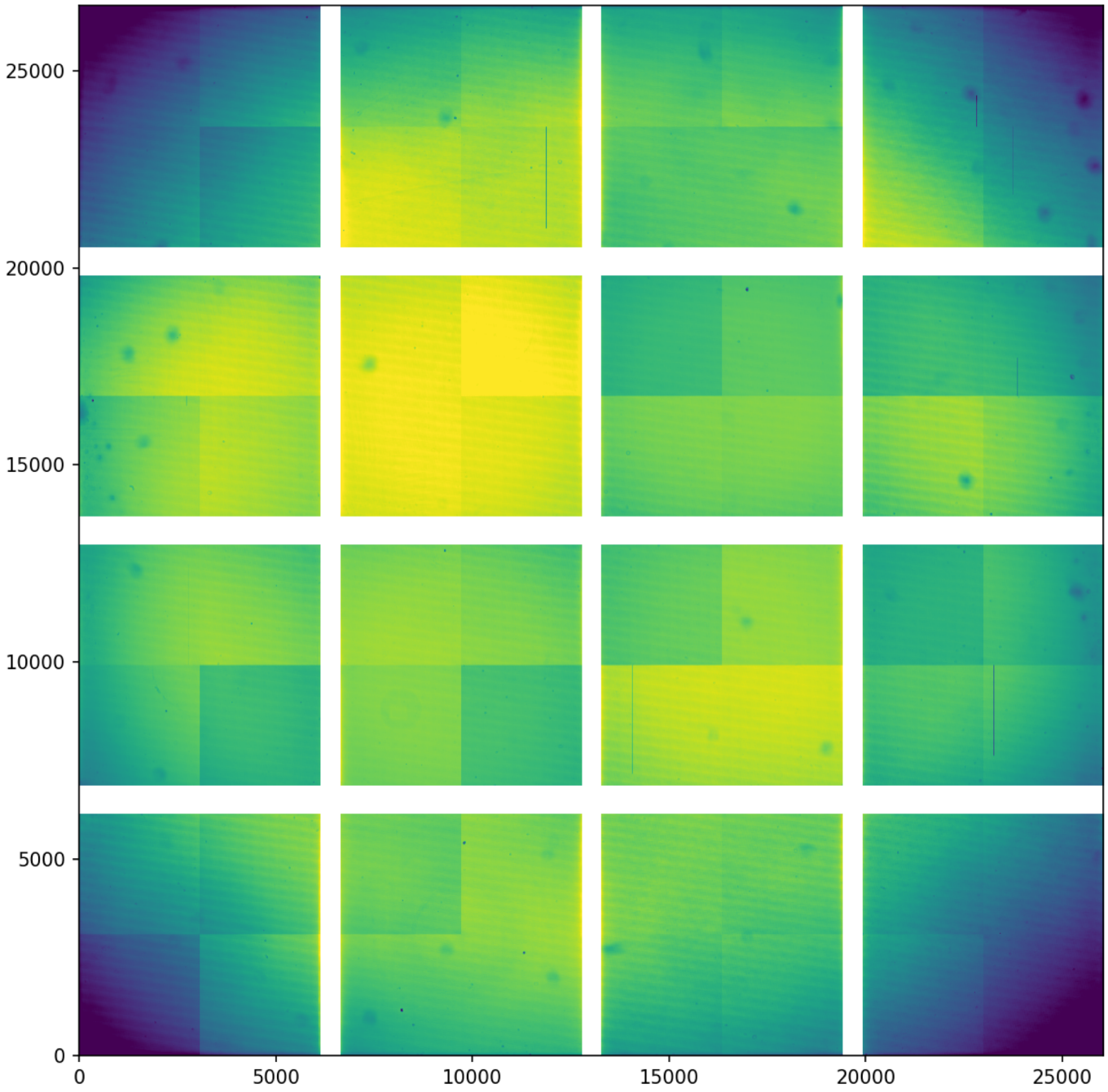






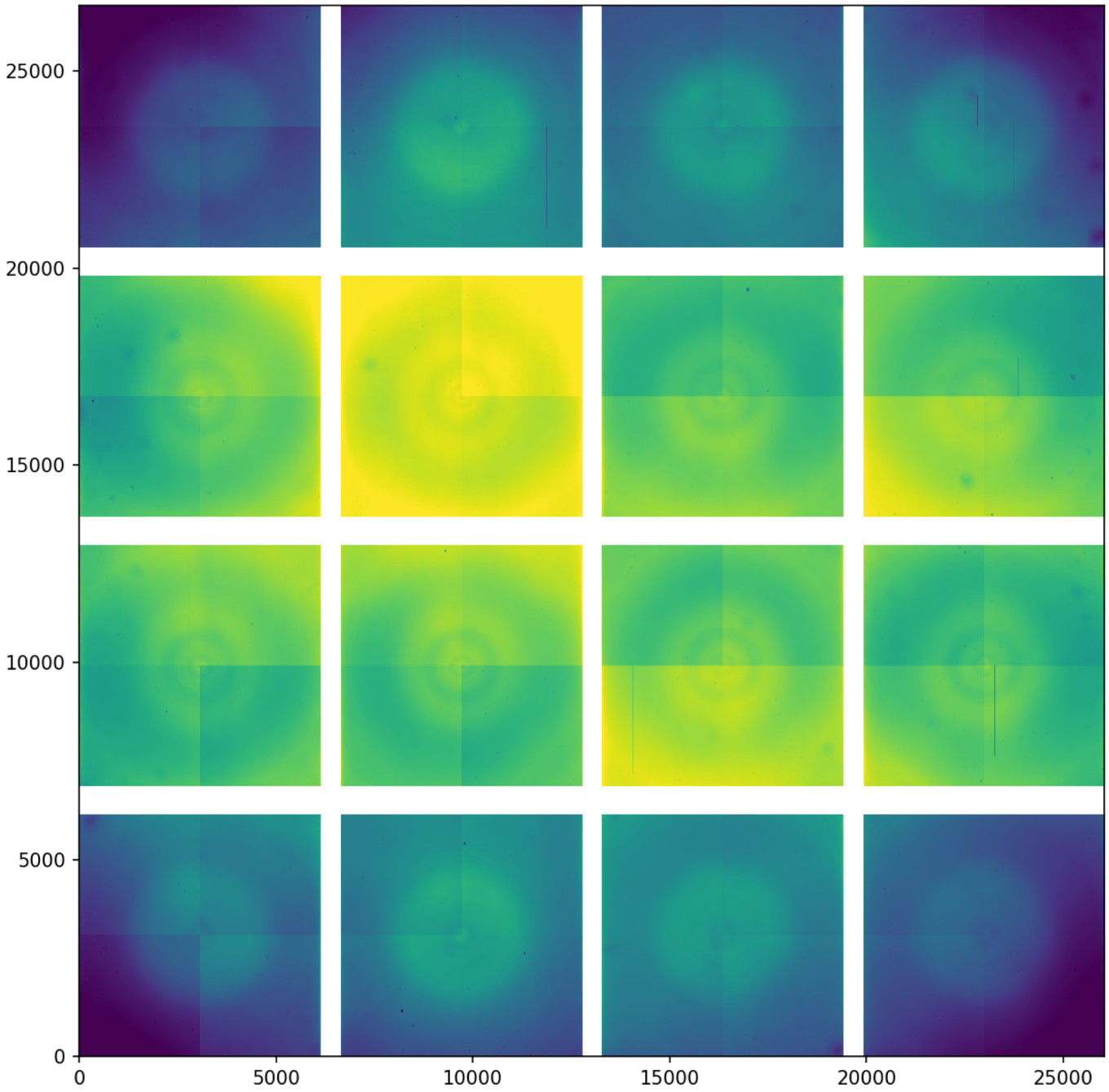
Flat-field images

Typical flat-field : LED02



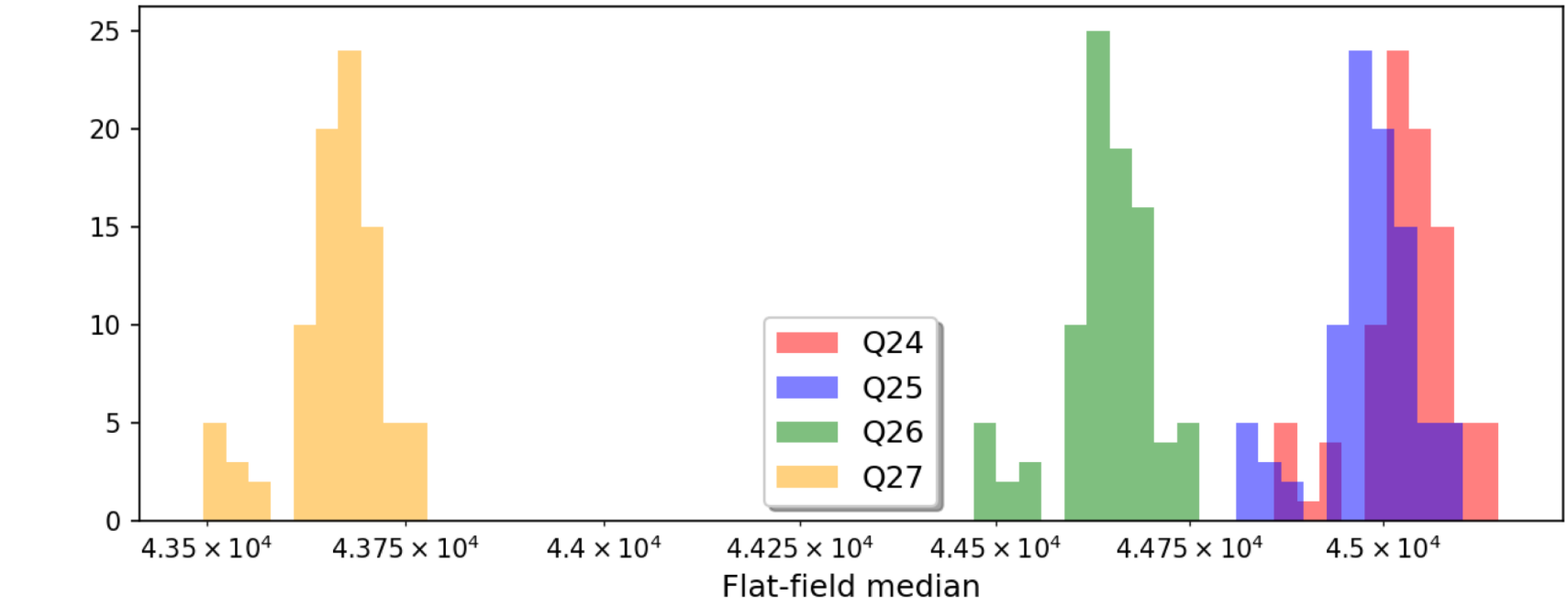
- Limit of the field-of-view
- Quadrant structure = amplifier per readout channel
- Dust spots
- Strips (horizontal) = Laser scan in CCD production process

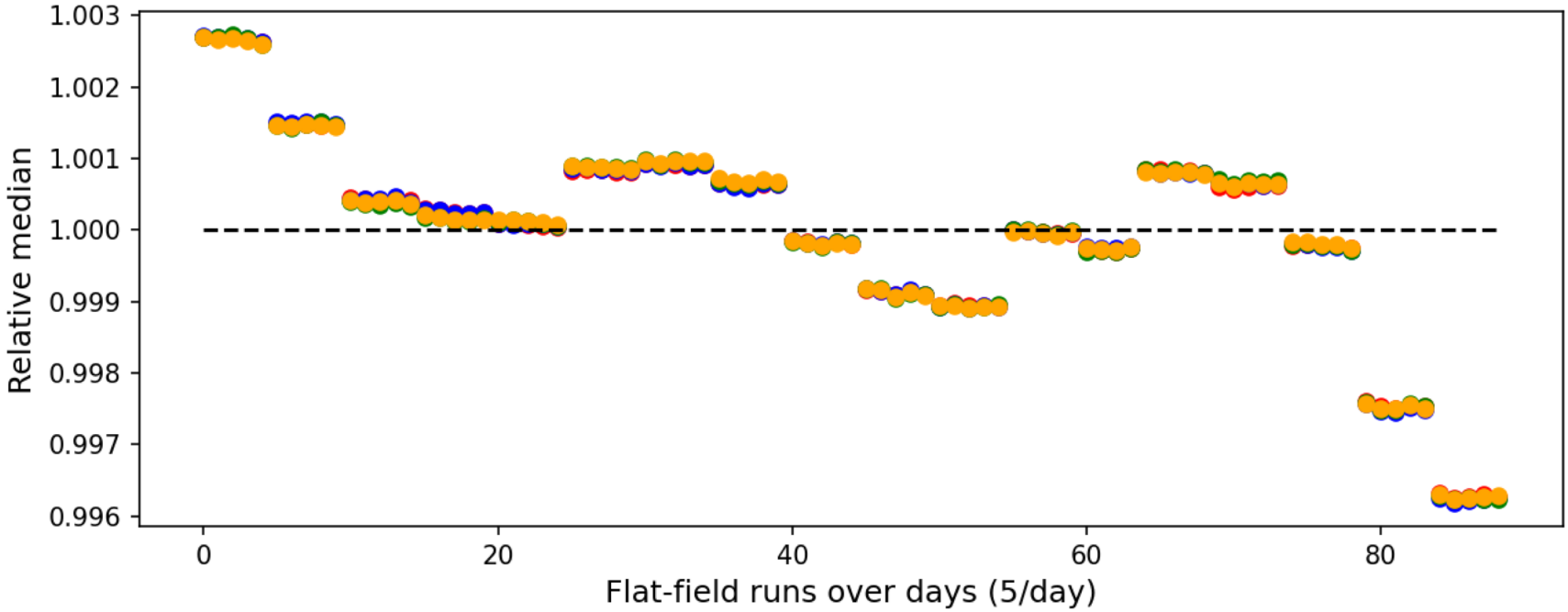
Typical flat-field : LED13



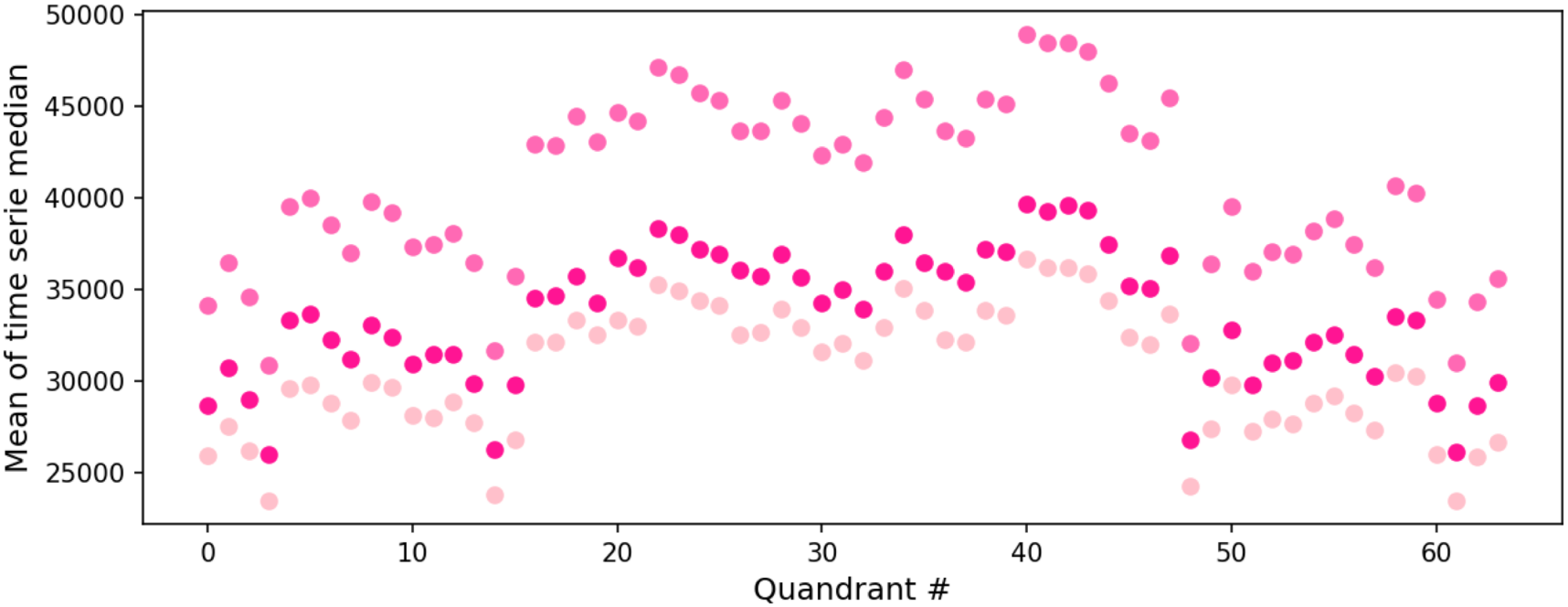
- CCD ring structure due to the CCD thickness profile (thin CCD ~ 25 µm)

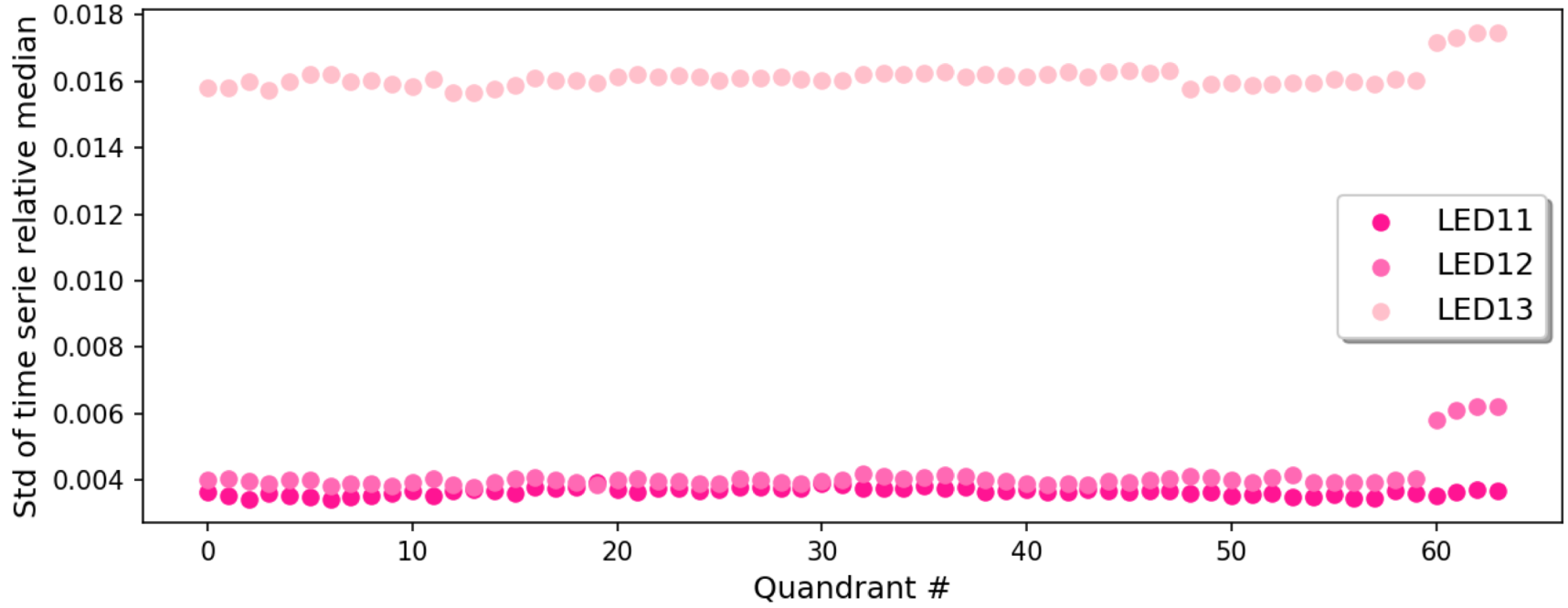
Stability of CCD07 with LED08





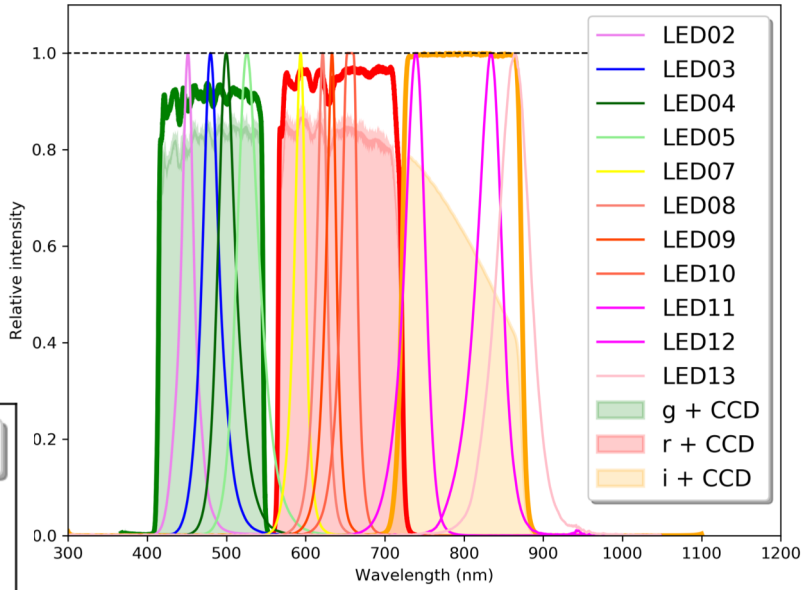
Focal plane stability for i-filter LEDs

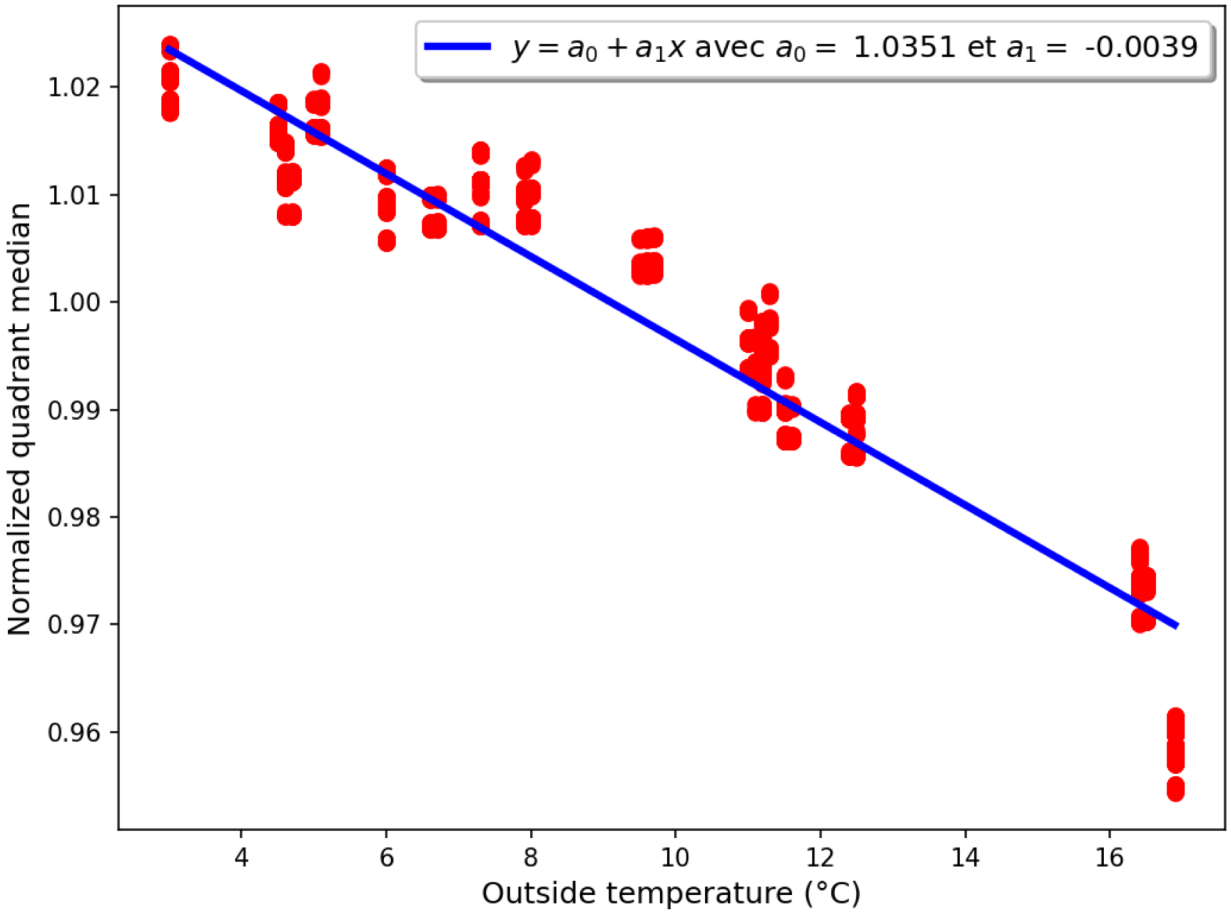




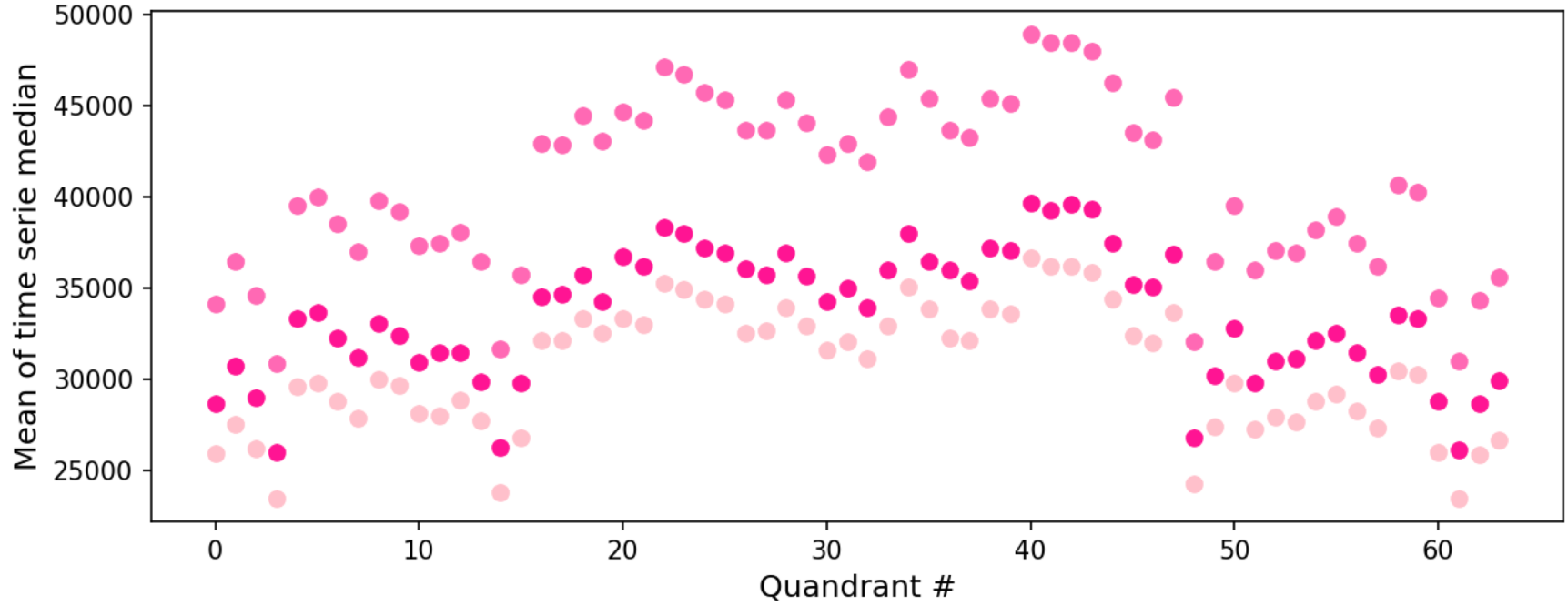
LED13 temperature evolution

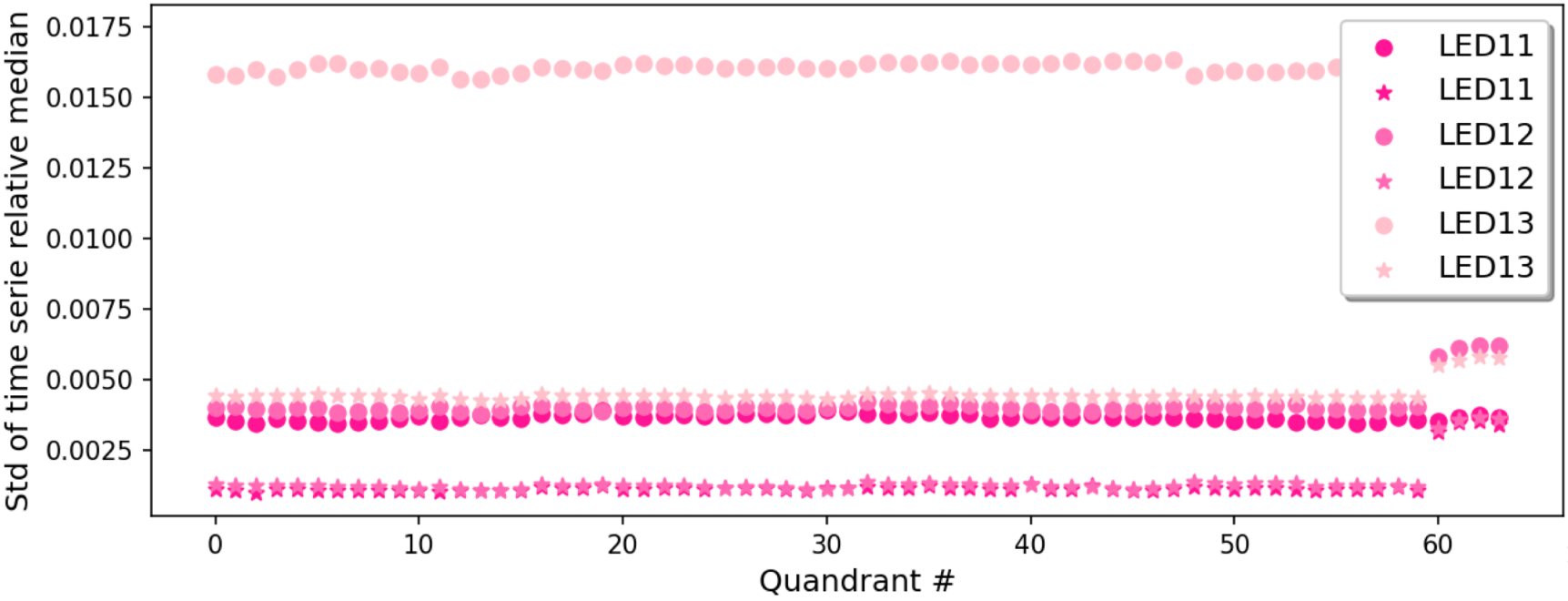
- LED13 is overlapping the i-band right edge
- Temperature dependency due to LED peak shift





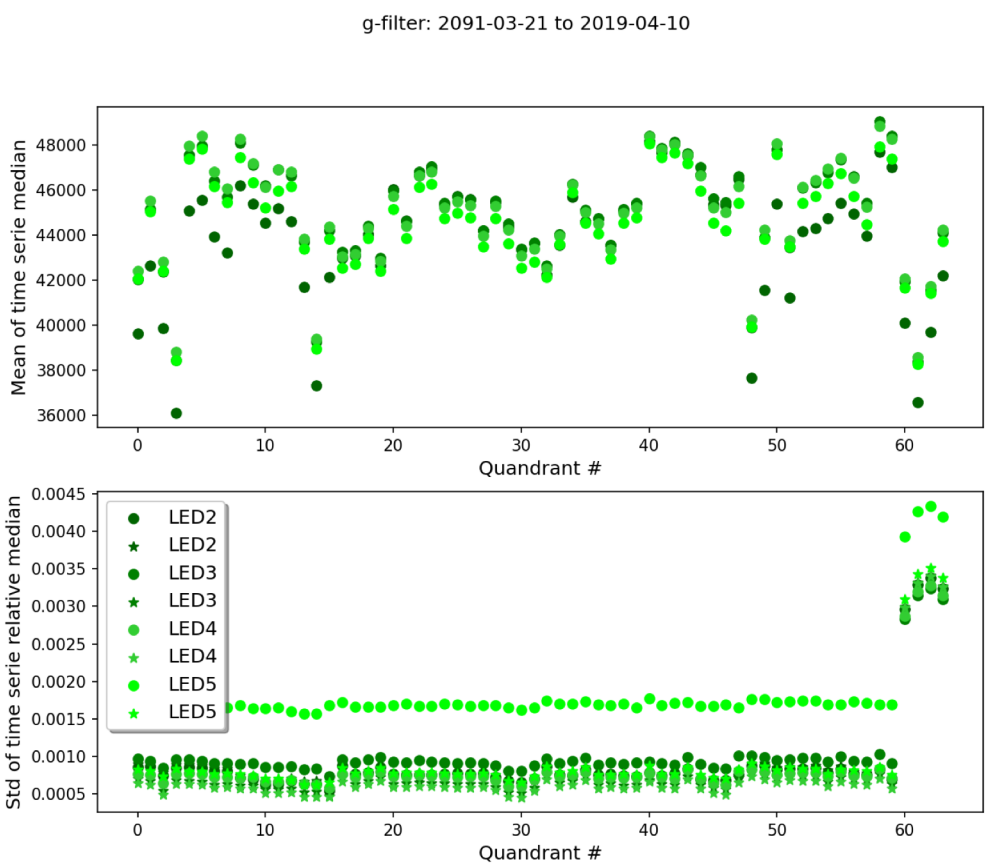
Focal plane stability with temperature correction



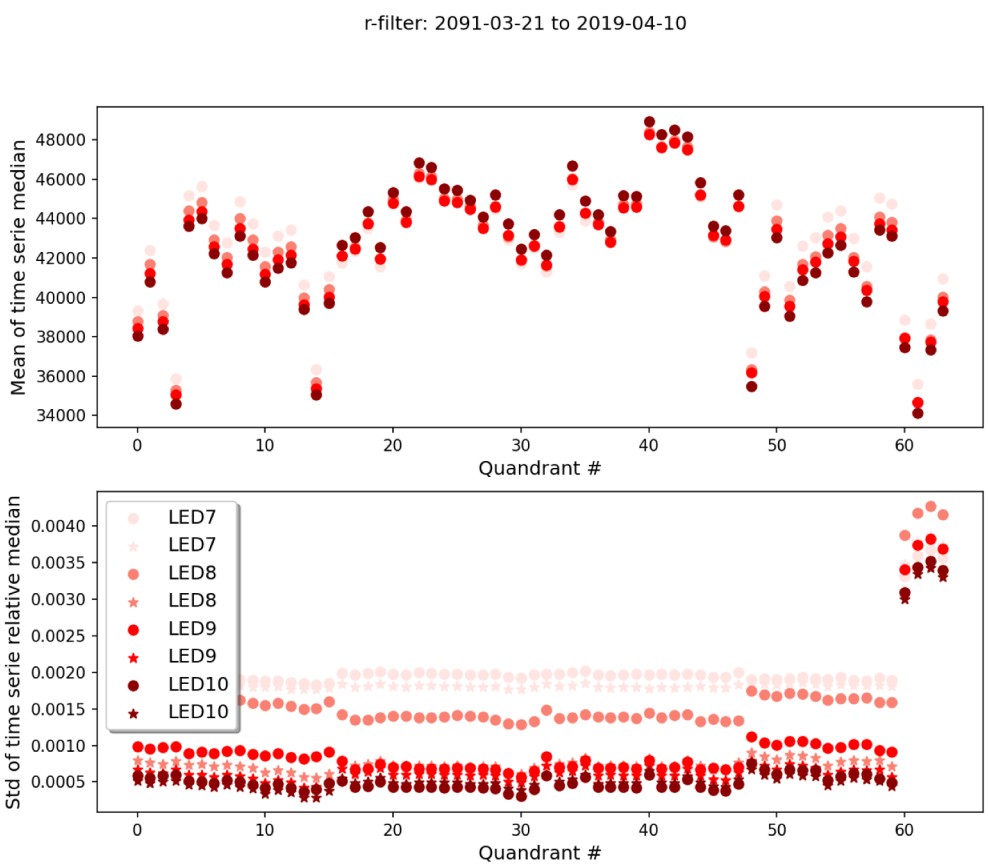


Focal plane stability for g and r-filter LEDs

g-filter



r-filter



Conclusions

Bias

- Observation of a relaxation process in the daily time series of runs
- Outliers on the edge of 1 quadrants (?) per CCD : to be investigated

Flat-field

- Observation of outside temperature dependence of flat-field intensity, especially for LED13
- preliminary study ~ (0.5 to 5) ‰ stability after temperature correction