Synthetic filters calibration with Gaia spectrum.

Chloé Barjou-Delayre,
Under the direction of Philippe Rosnet
And a help of Marie Aubert

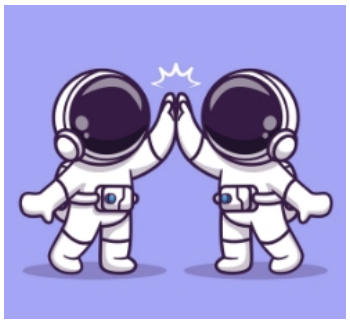
UNIVERSITÉ Clermont Auvergne

LPC Particules pLasmas Univers applicationS
Laboratoire de Physique de Clermont

LPNHE meeting
10 Mars 2025

Motivation:

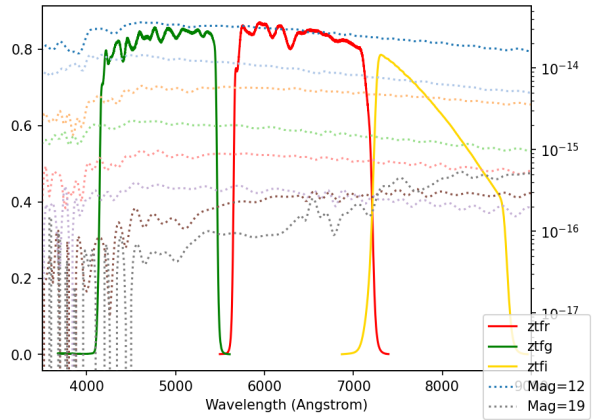
Gaia spectrum

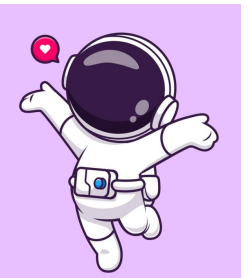


Magnitude observed by ZTF

BBF

starflat





Calibrate synthetic filters

Precision cosmology

Free

$$\chi^2 = \sum_{i=1}^{N_{stars}} \left(\frac{m^i_{measured} - ZP - m^i_{Gaia}}{\sigma_{m^i_{measured}}} \right)^2$$

Per mjd and per sensorid

Cut on outliner

Methods:

1. Cut mag<13

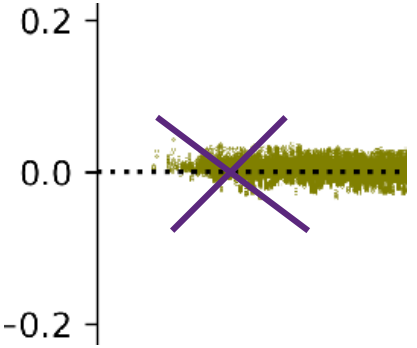
2. Fit ZP per mjd and sensorid

2. Cut outlier per bin (each 0.3 in mag) : $\chi^2 < \mu + 20 * mad$

3. Fit new ZP per mjd and sensorid

4. Compute a0,a1,a2

5. Fit ZP with new error model still per mjd and sensorid

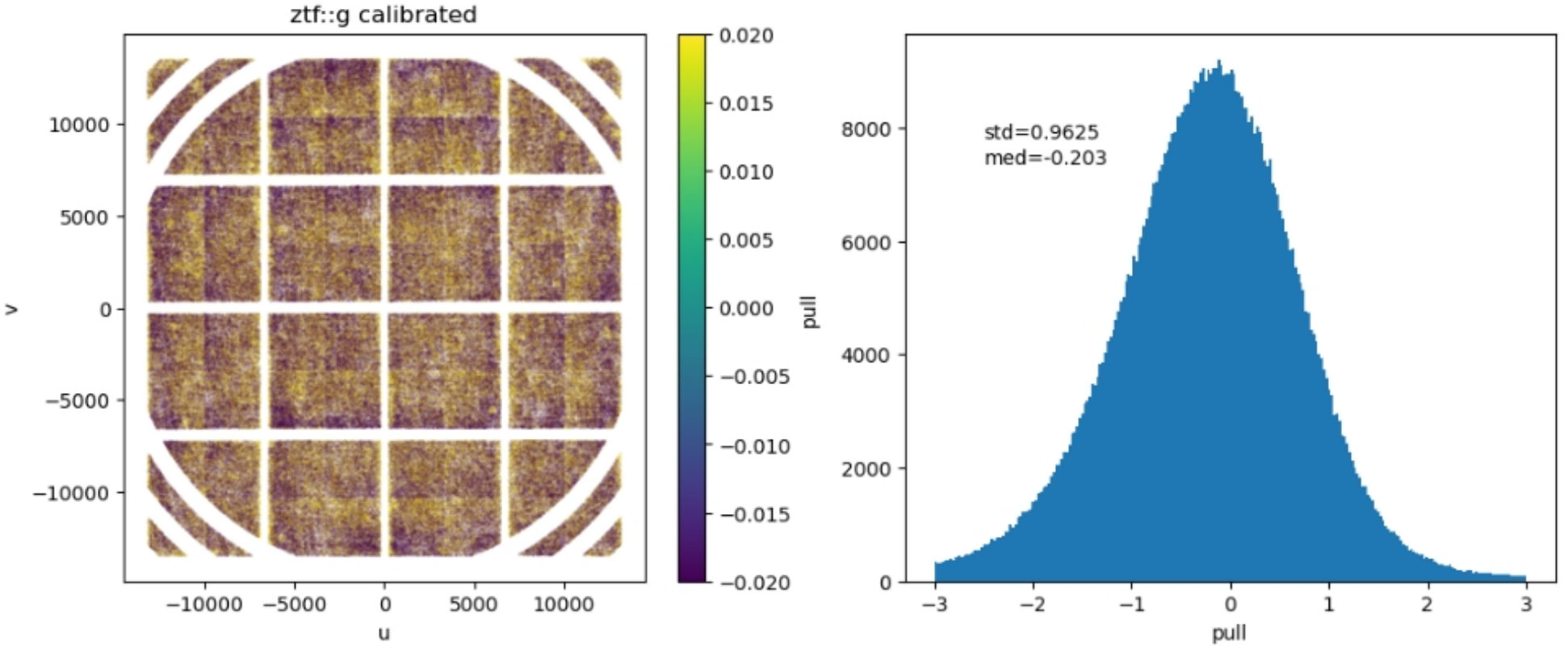


$$\chi^2 = \sum_{i=1}^{N_{stars}} \left(\frac{m^i_{measured} - ZP - m^i_{Gaia}}{\sigma_{m^i_{measured}}} \right)^2$$

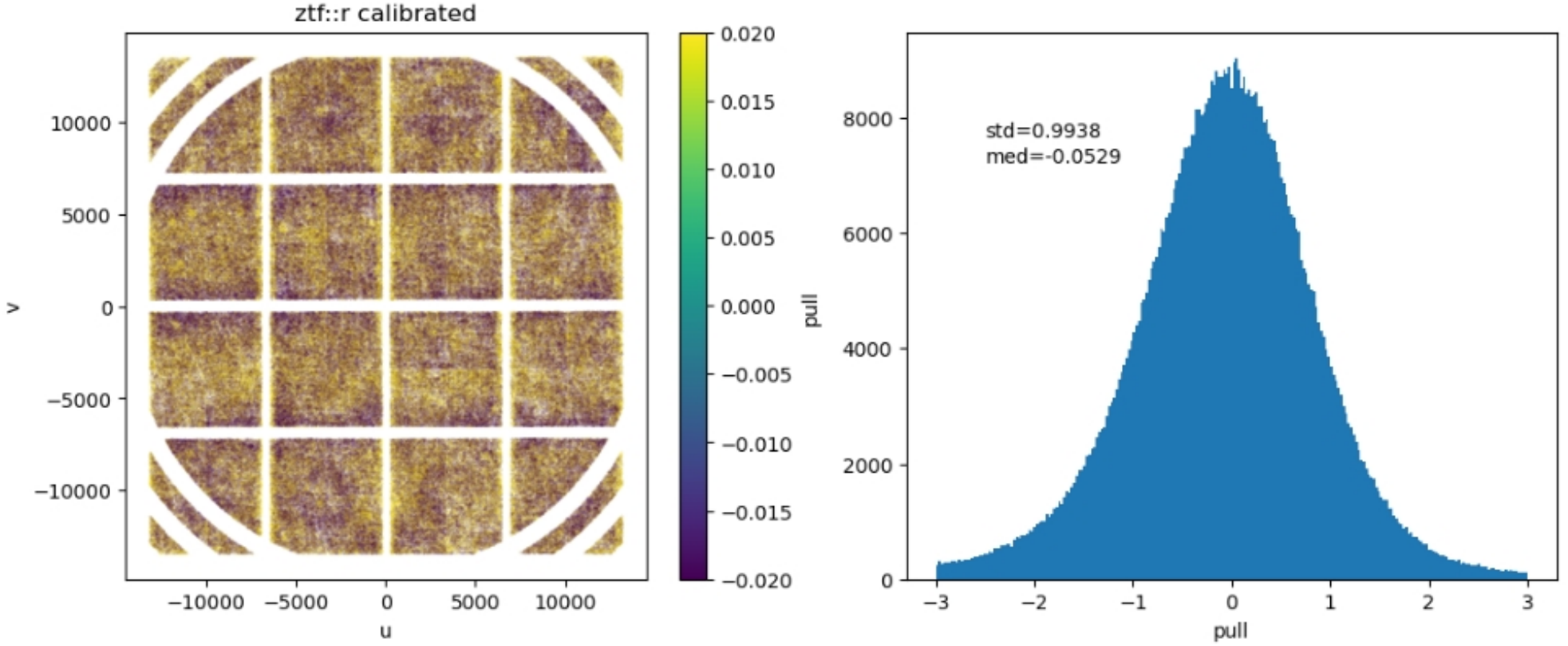
$$\sigma_m = \sqrt{(\sigma_f)^2 + (f)}$$

$$\sigma = \sqrt{(a_0 \sigma_f)^2 + (a_1 \sqrt{(f)})^2 + (a_2 f)^2}$$

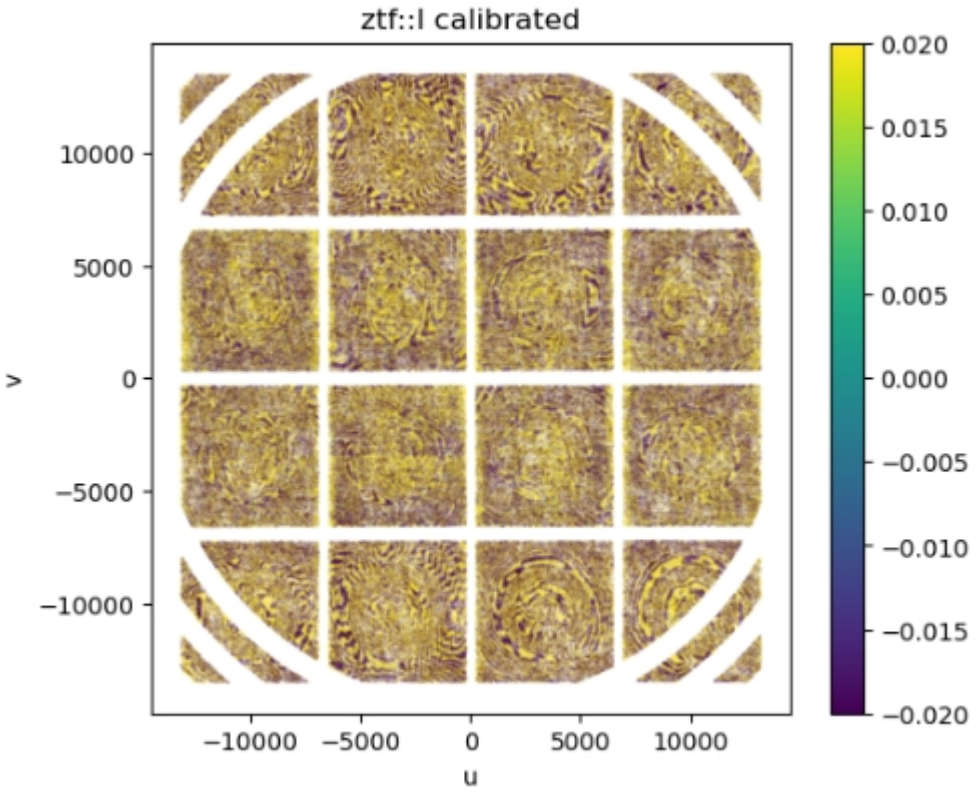
Pulls on the focal plan for the g-band:

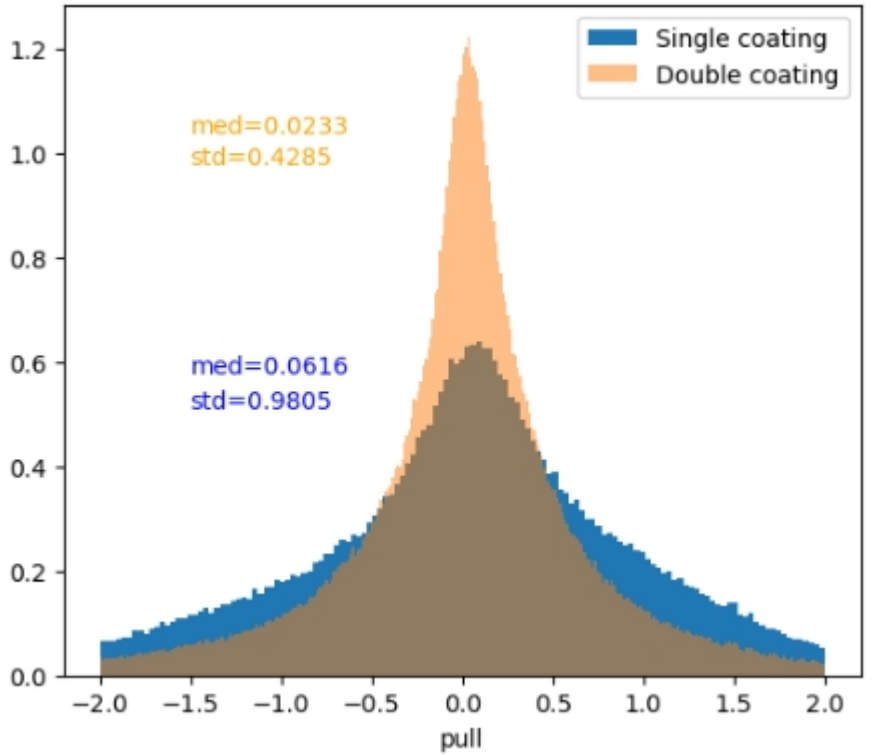


Pulls on the focal plan for the r-band:

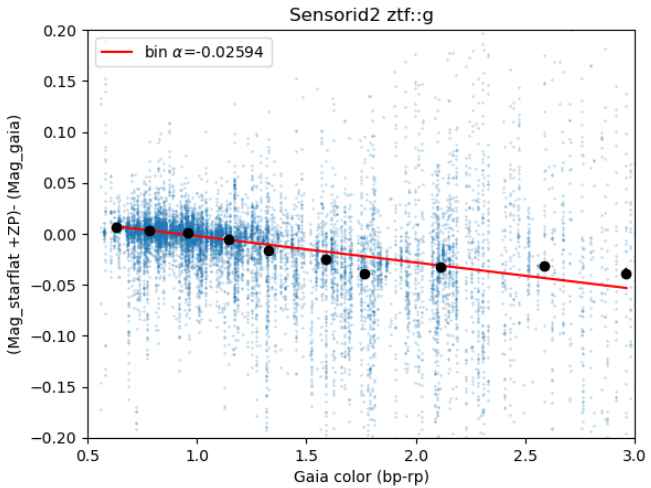


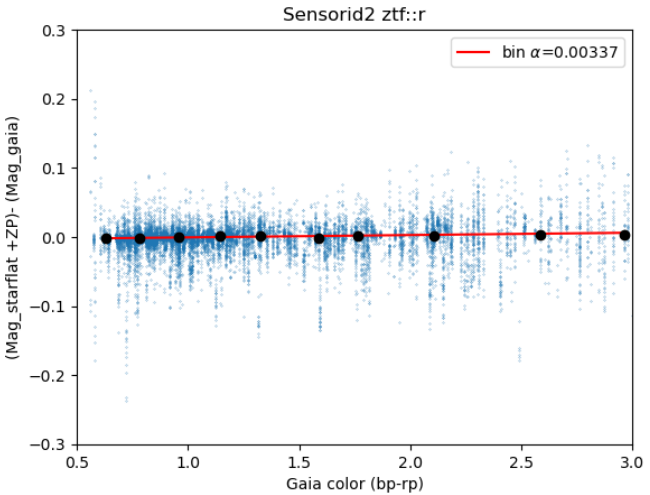
Pulls on the focal plan for the I-band:

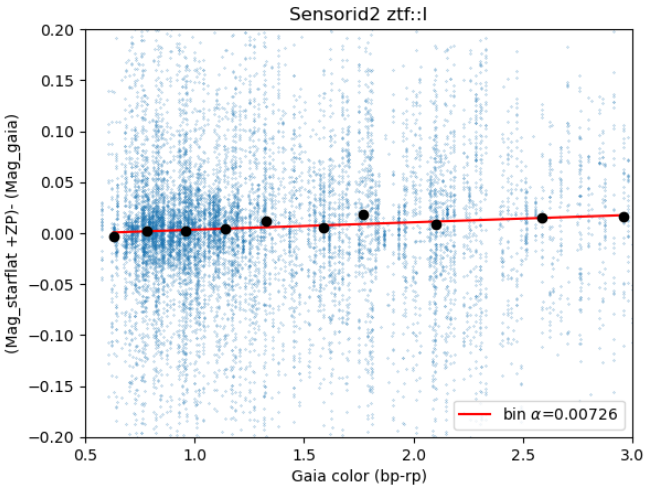




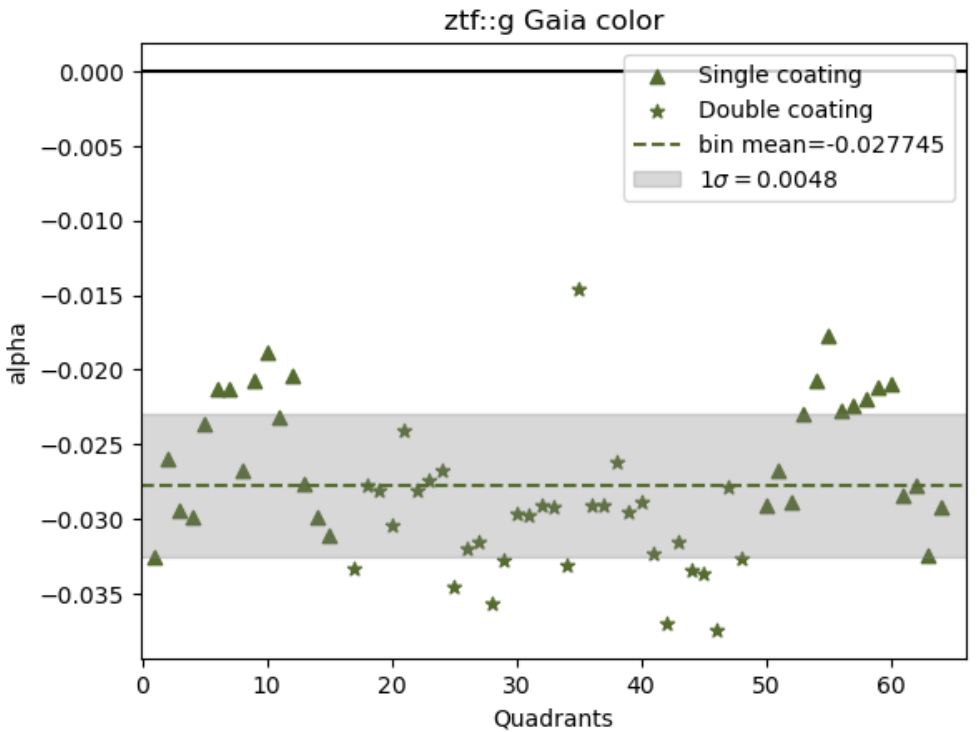
Color parameters:

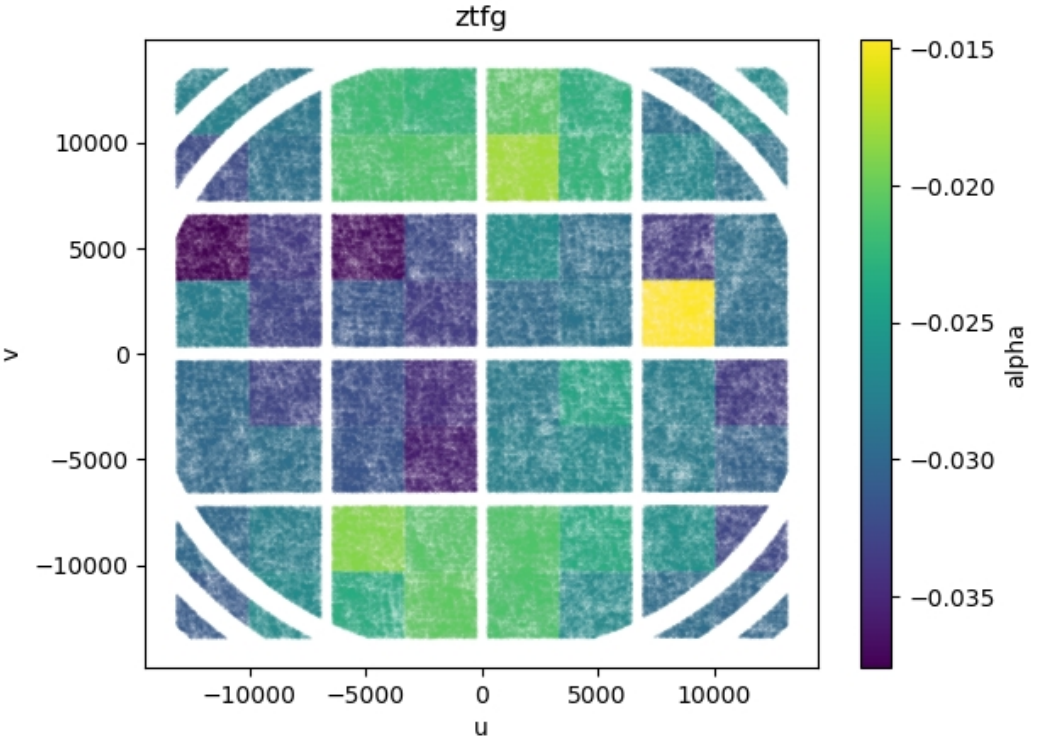




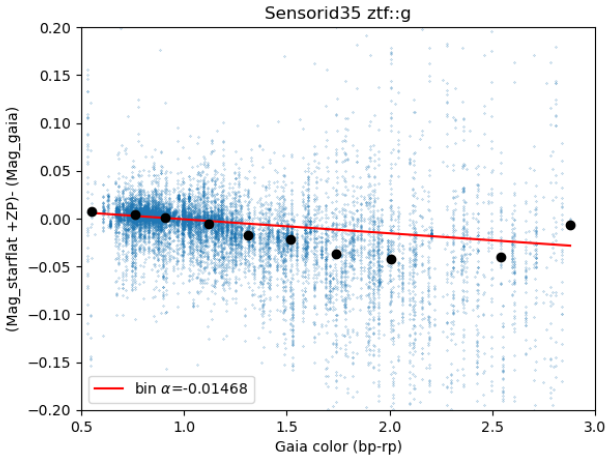


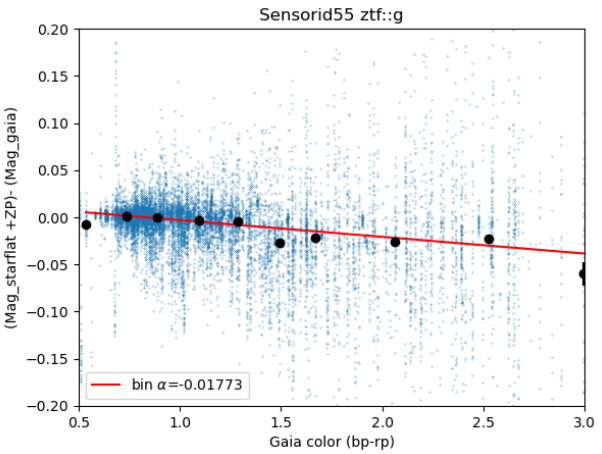
Colors parameters in focal plan for g-band:

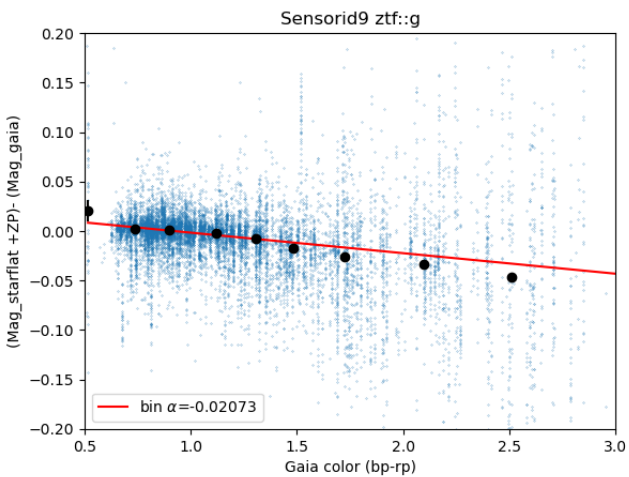


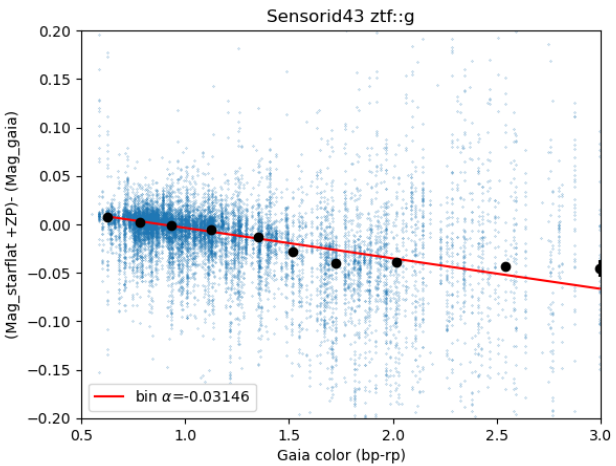


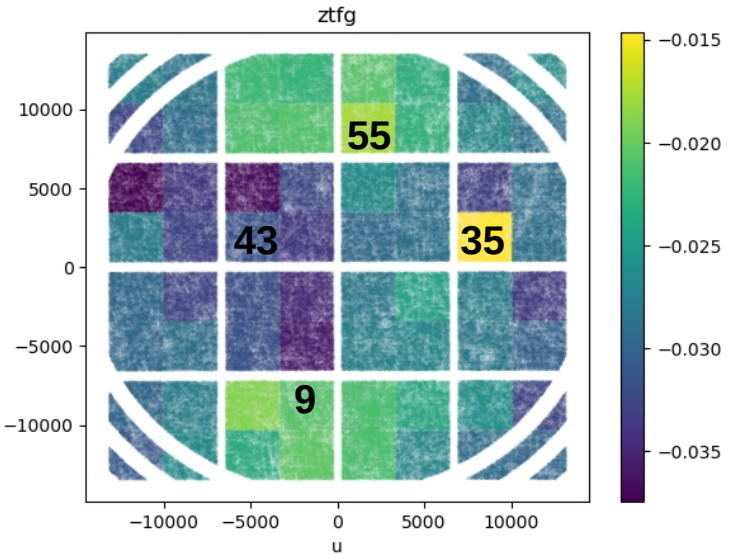
Zoom on quadrants for the colors parameters :



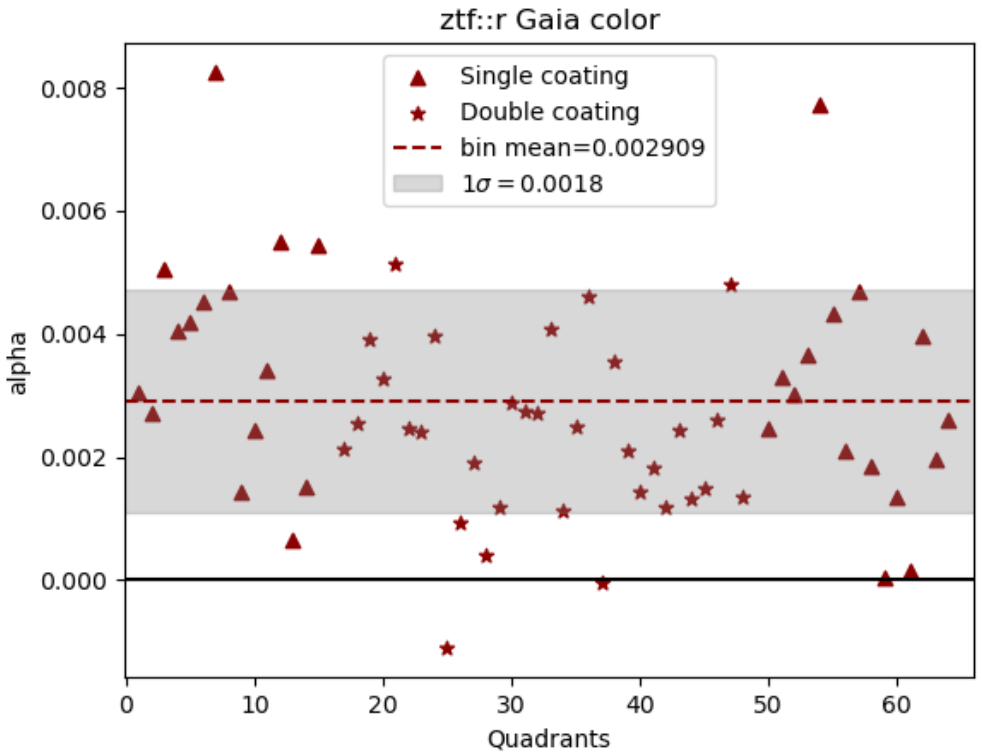


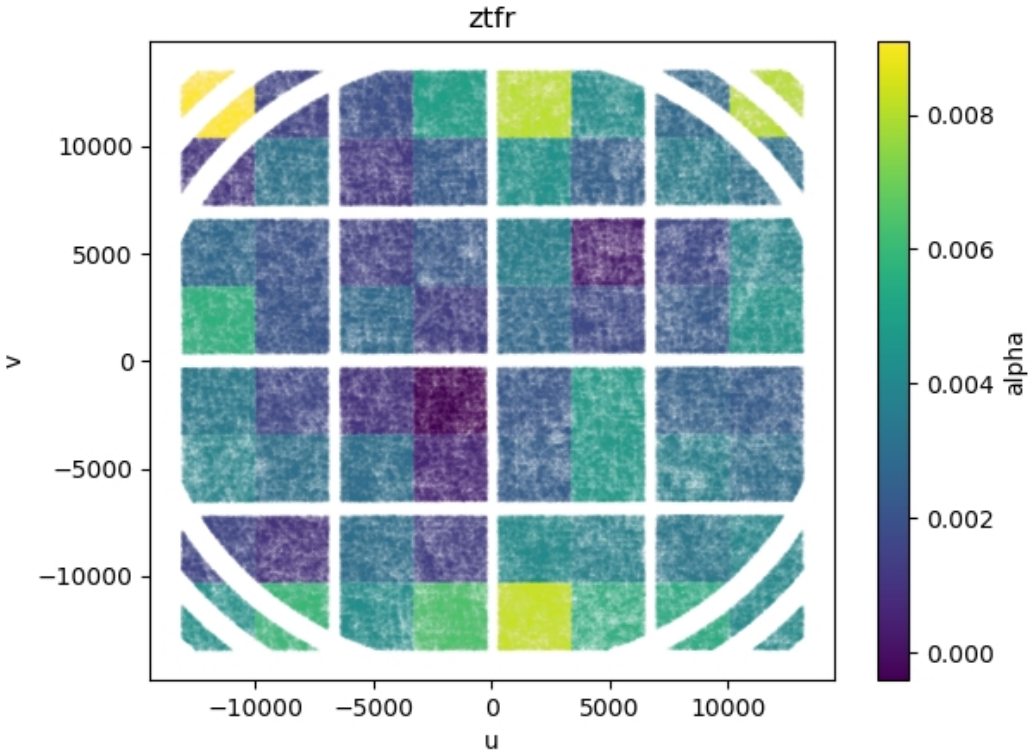




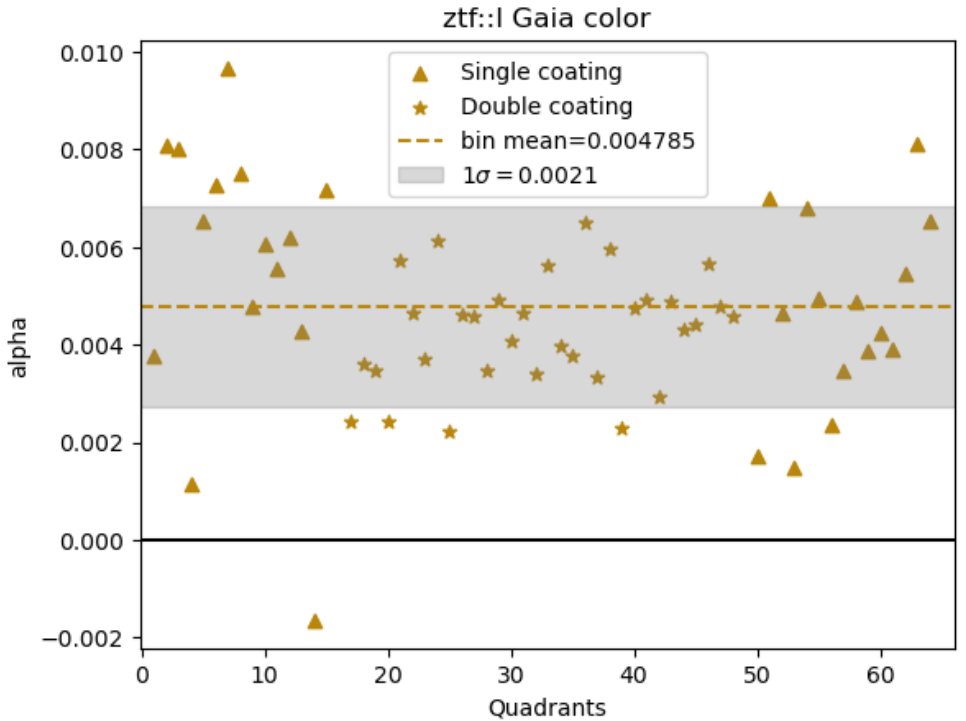


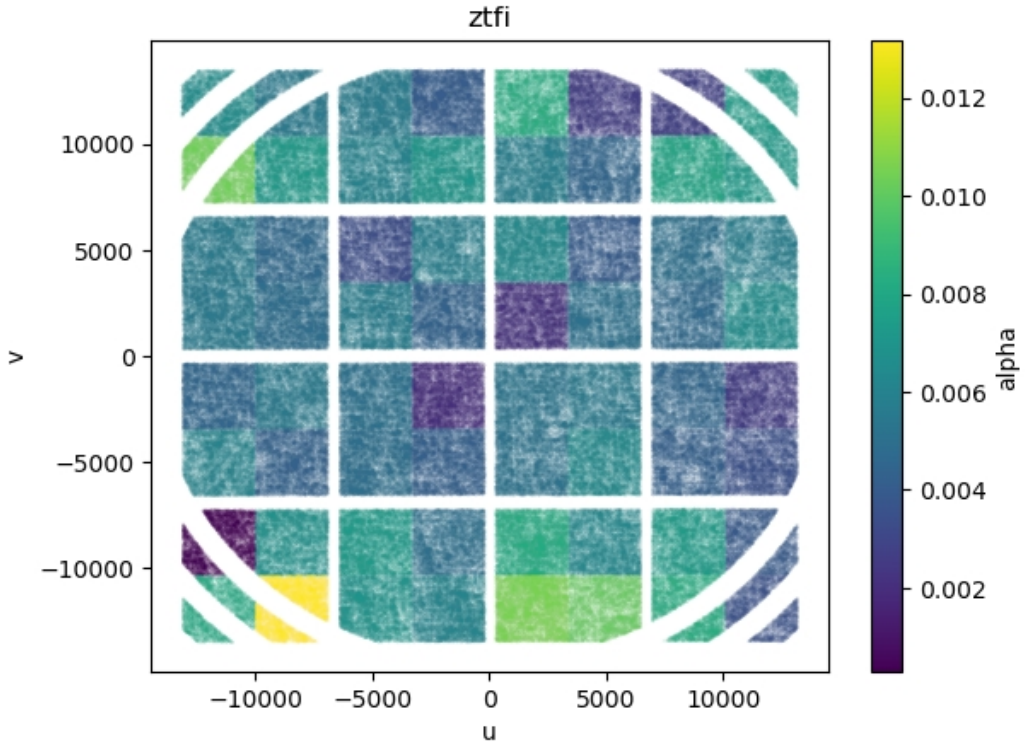
Colors parameters in focal plan for r-band:





Colors parameters in focal plan for I-band:



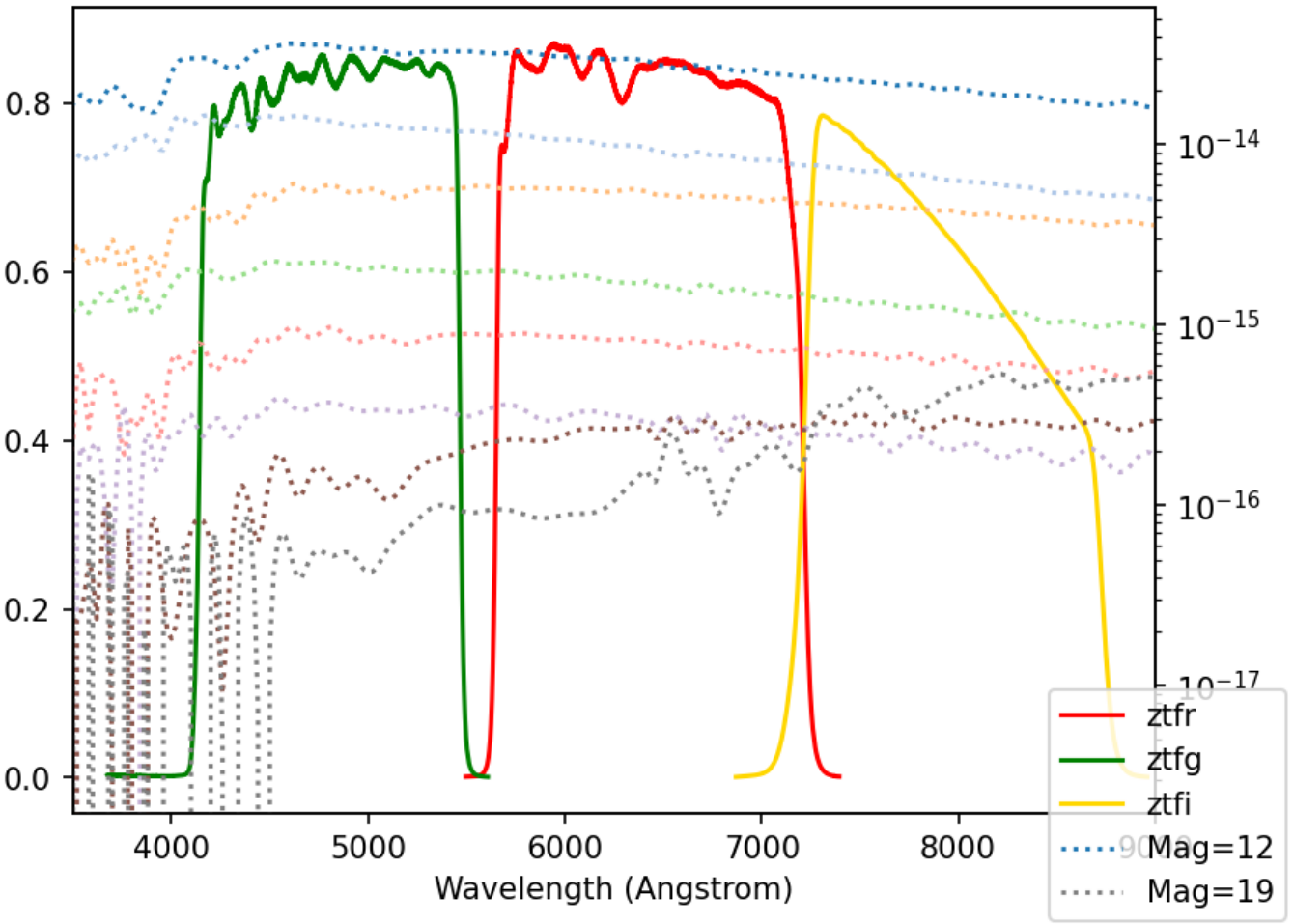


Conclusion :

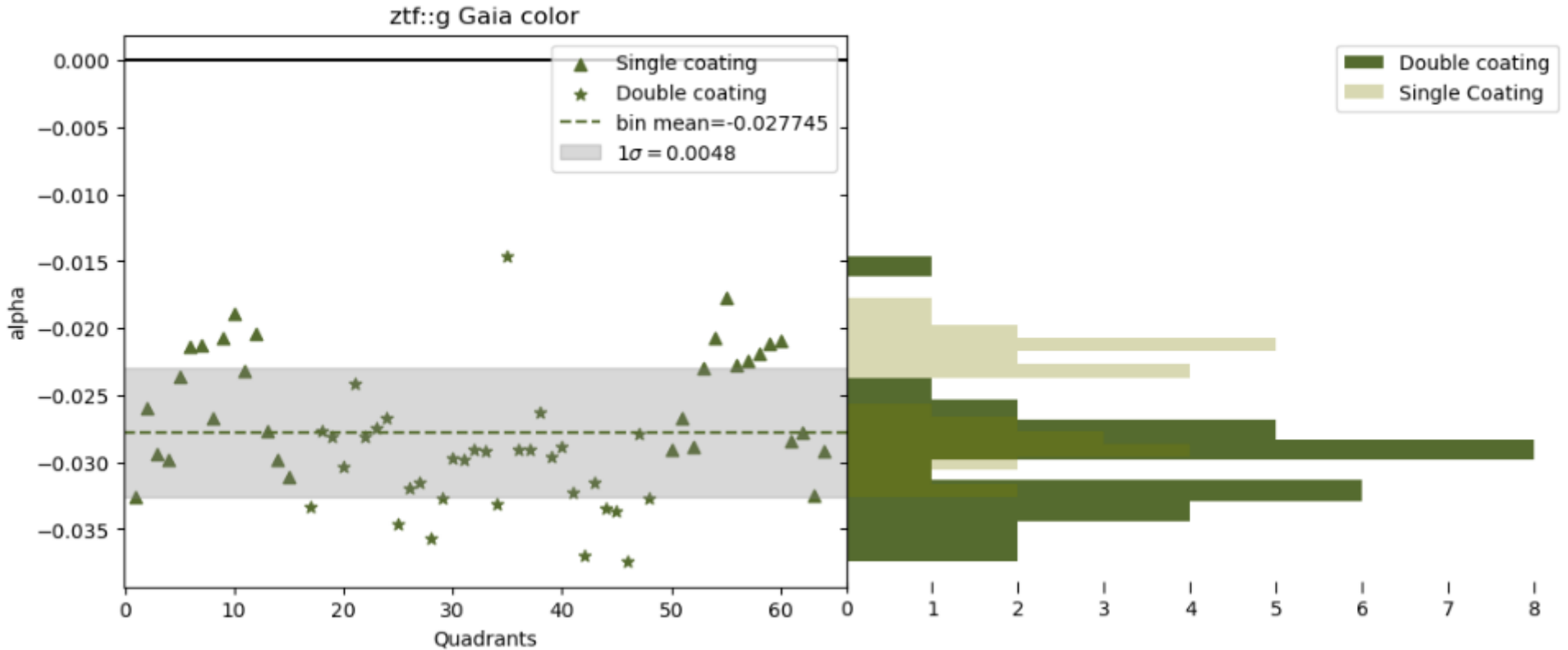
Summary :
- cut outlier by fitting a polynome on the error
- A difference betwenn single and double coating for the color parameters in g band

Futur :
- Solve the extrapolation issues
- Solve the fringing issues
- Cut selection on variable stars
- Do the same analyses on other starflats

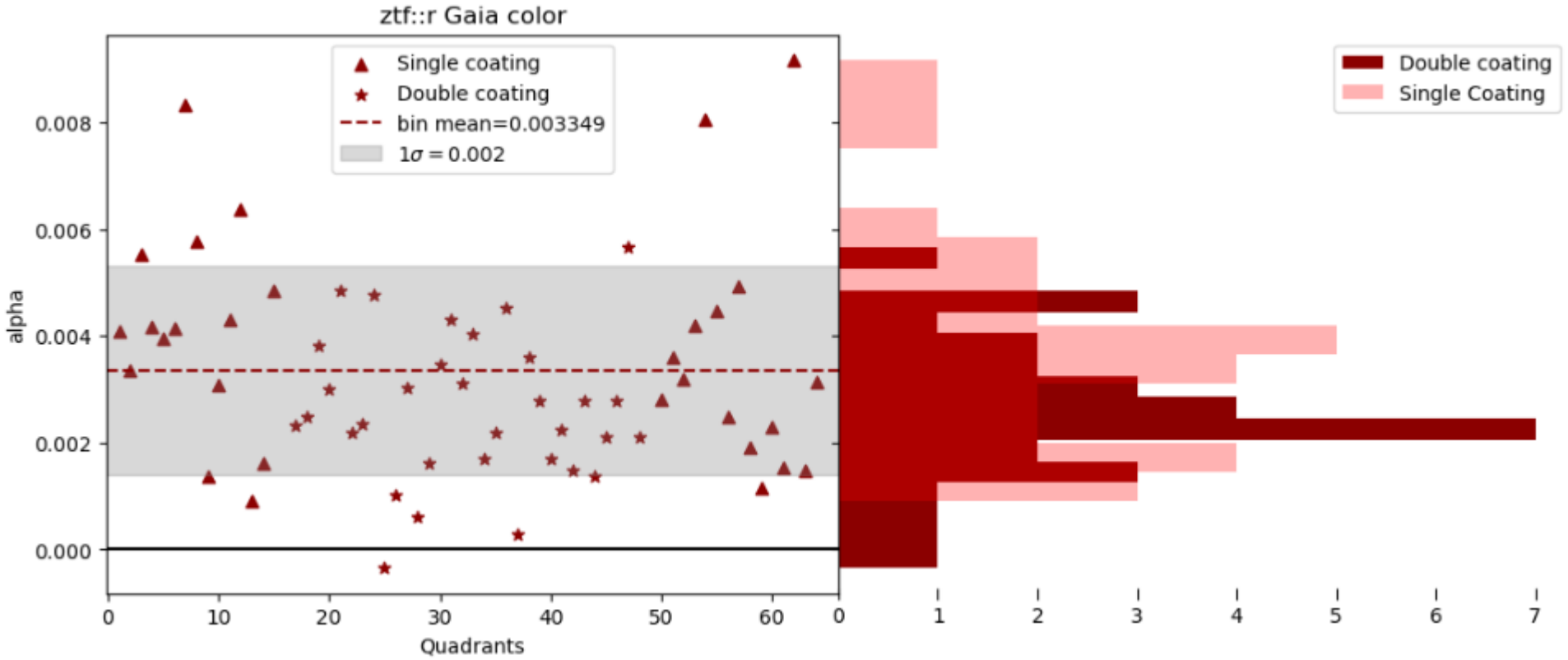
Backup - Gaia spectrum:



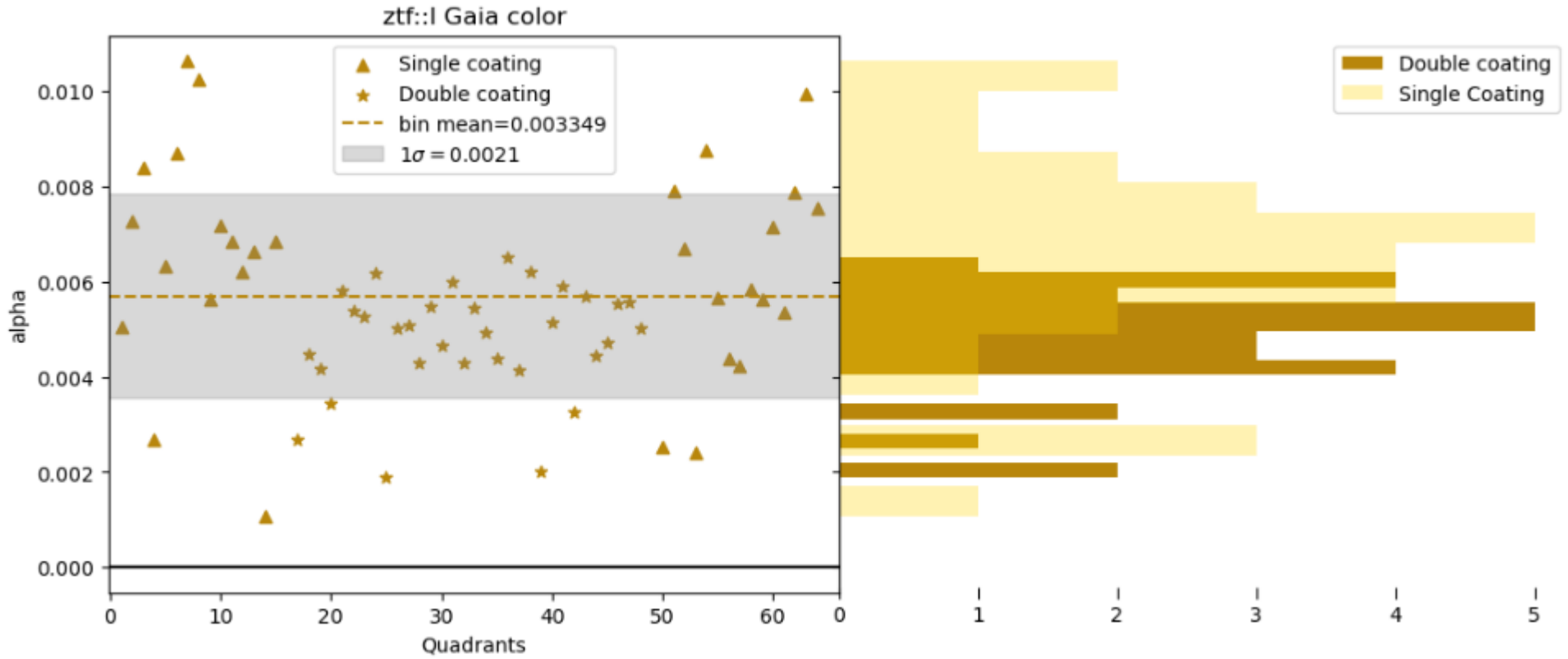
Backup - Colors parameters g-band:



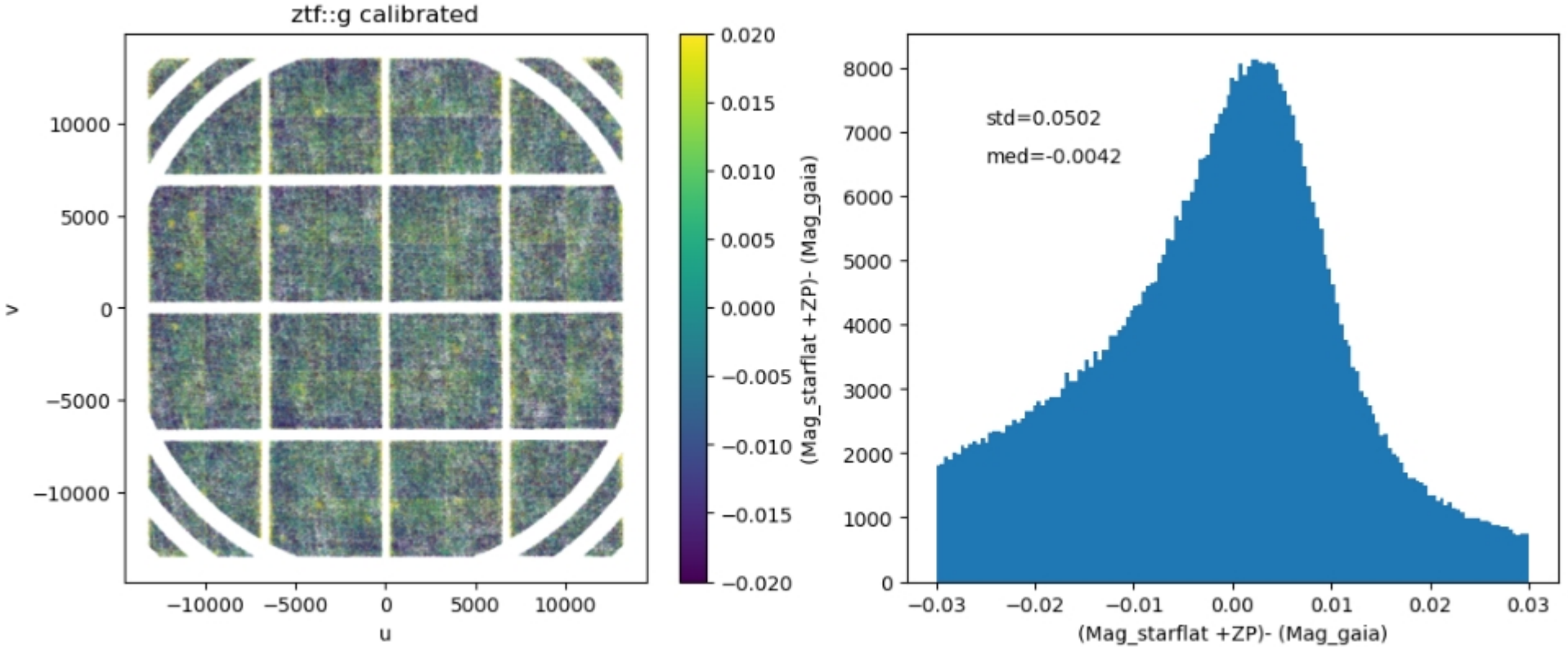
Bacup- Colors parameters r-band:



Colors parameters I-band:



Backup- Residues for g-band:



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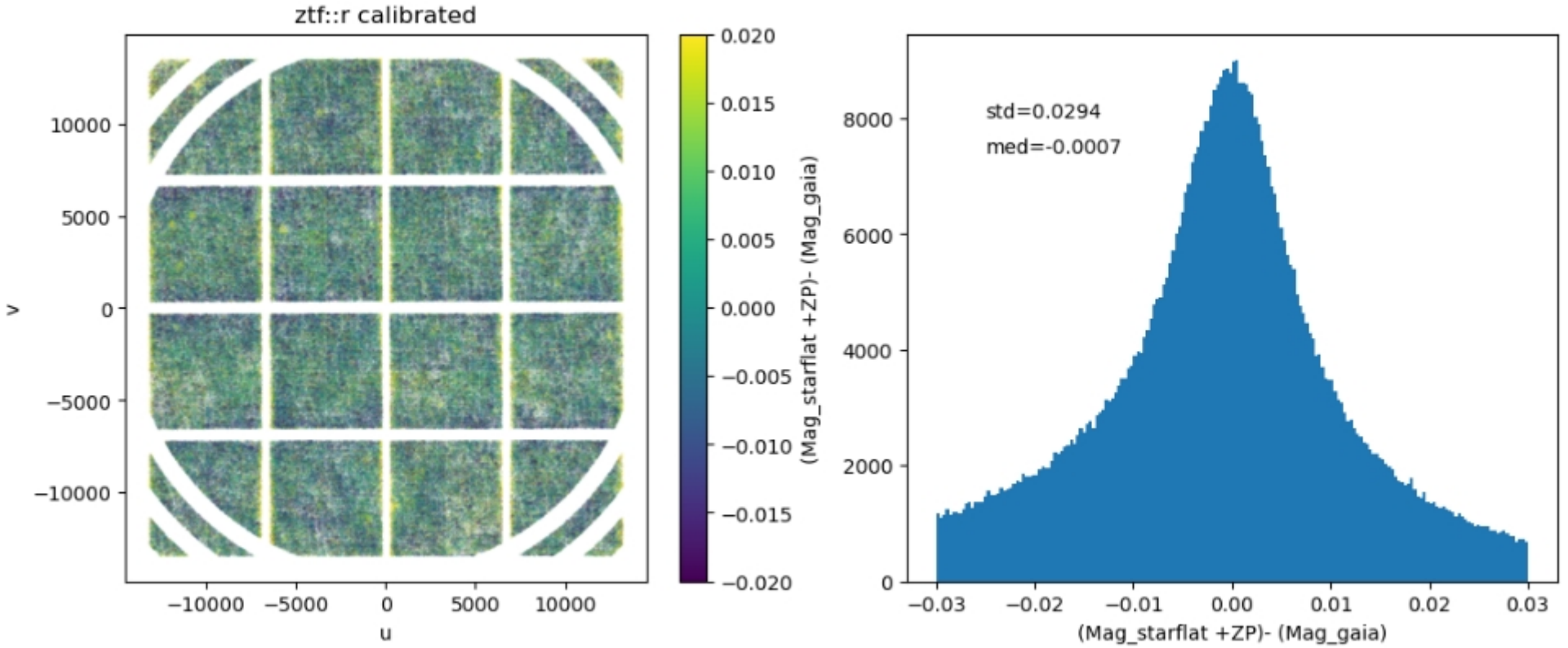
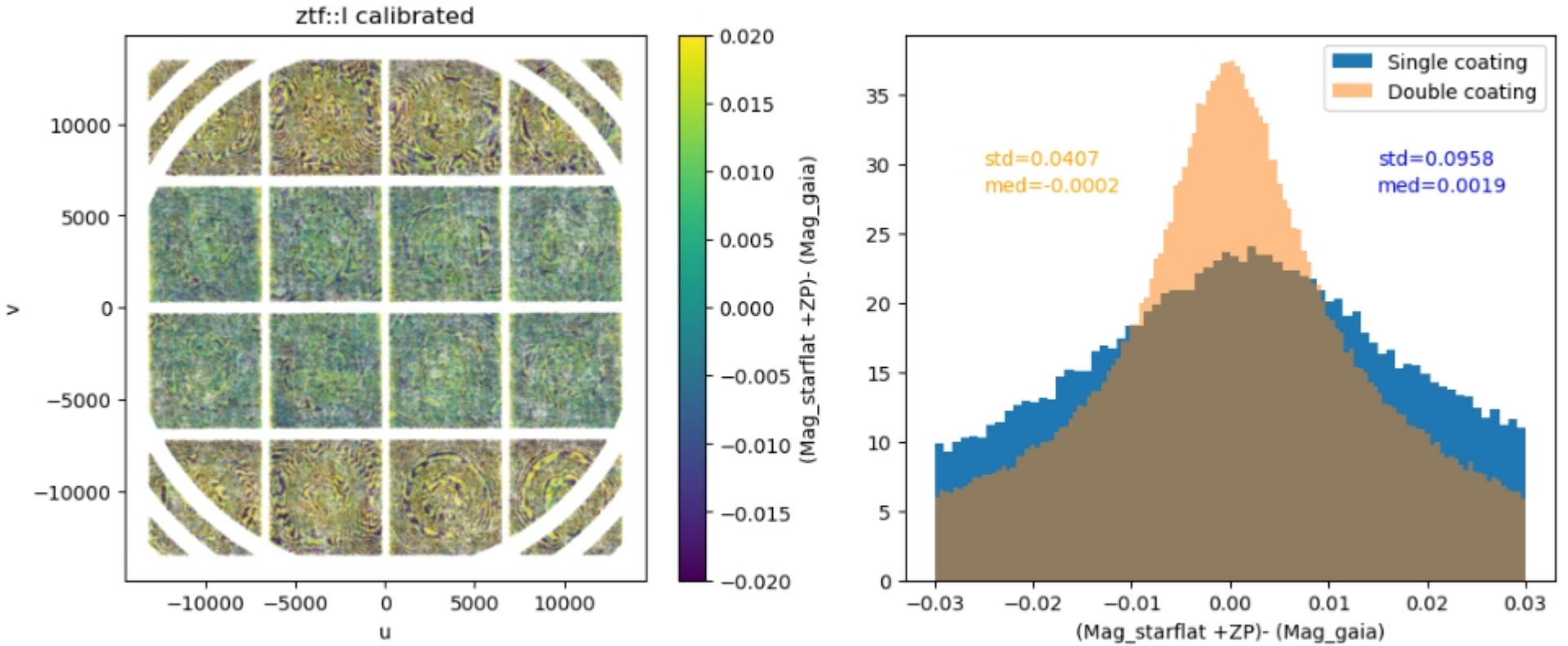
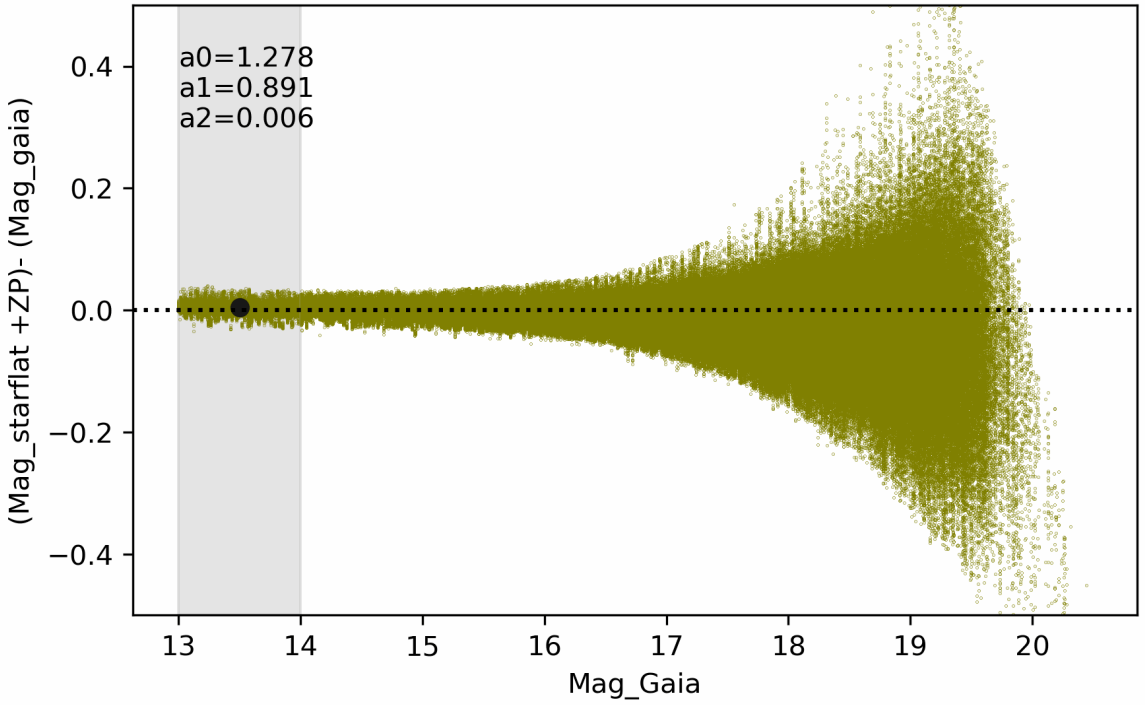
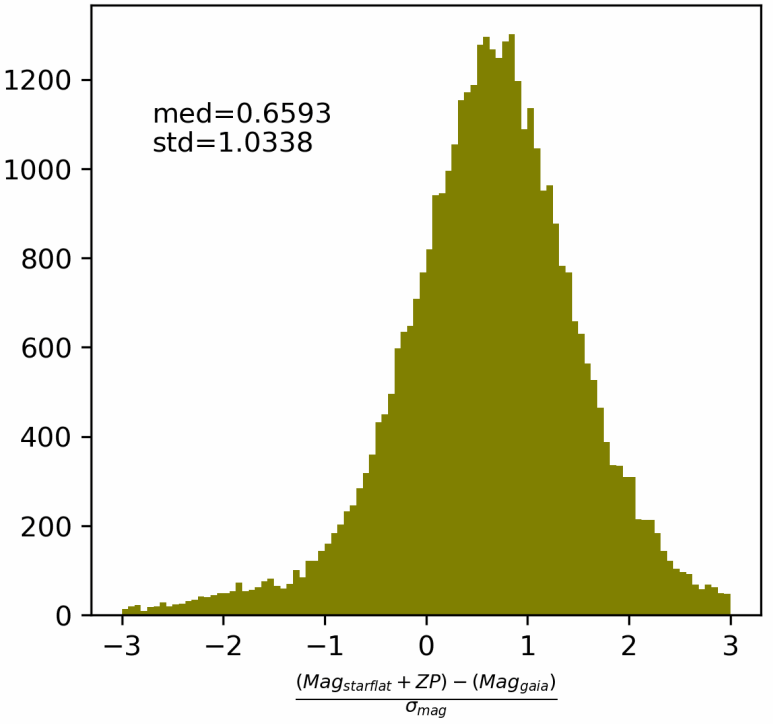


Backup -Residues for I-band:



Backup - Pull for g-band:





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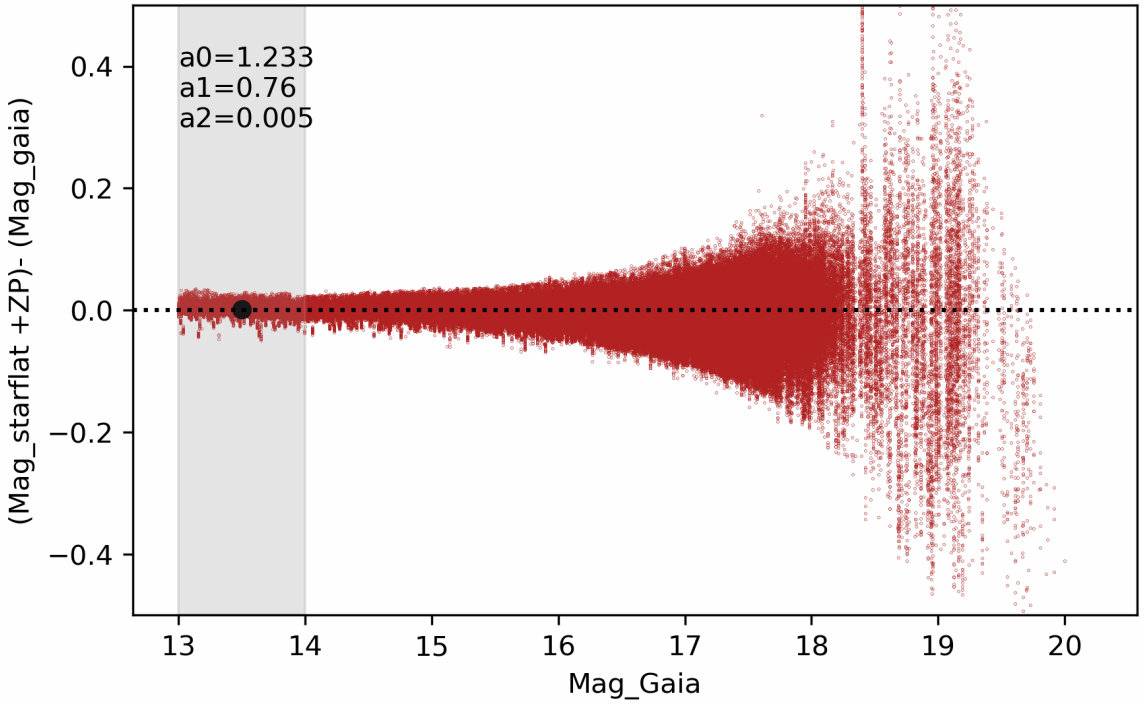

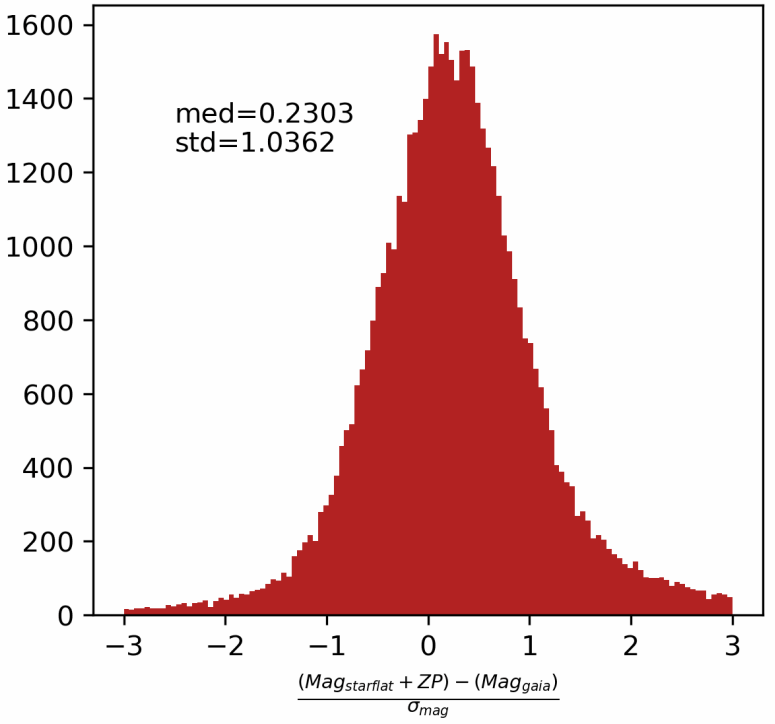

Backup - Pull for I-band: