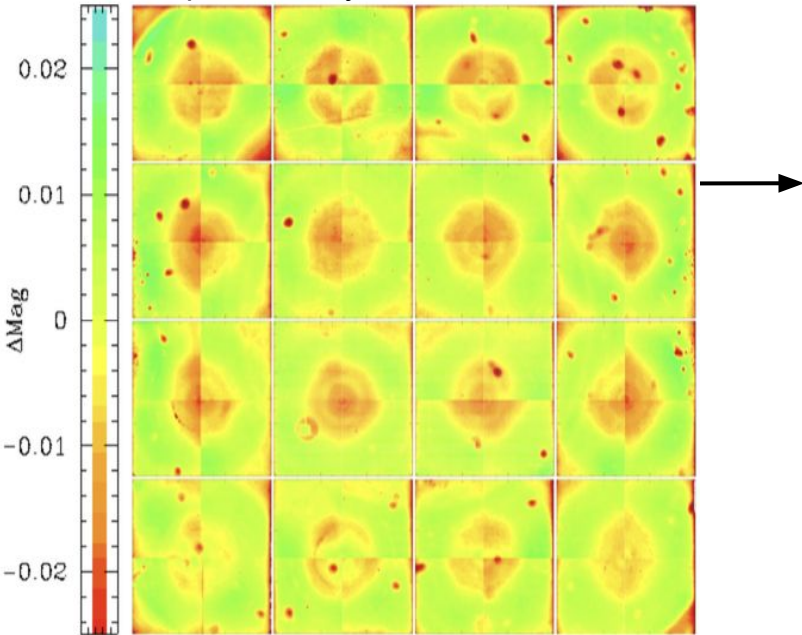


# Starflat in ZTF

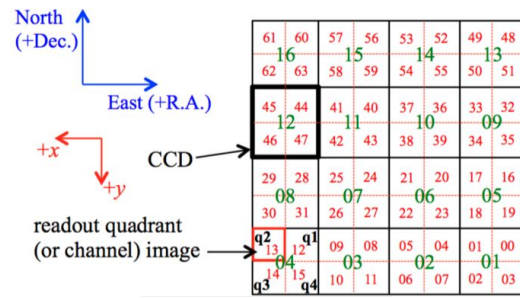
# Motivations

Flux predicted by ZTF - PS1 flux



- Difference between ZTF-calibrated and PS1 magnitudes up to 2%
- Dust spots
- Strong CCD dependency

Starflat analyses



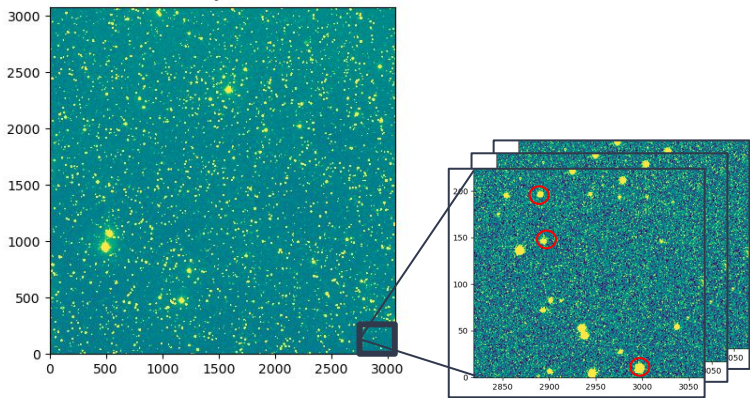
<https://www.ztf.caltech.edu/>

Relative response of focal plan : Andrew Drake's map - Caltech

Starflat : flux variation of a star depending on its position on the camera

Contexte	Catalogs	Fit	Starflat	Conclusion
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# 1 ZTF quadrant



Aperture photometry

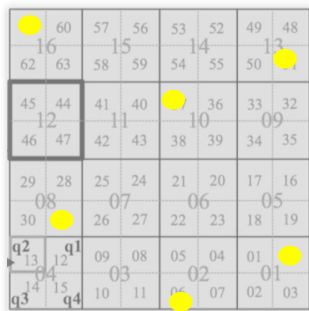
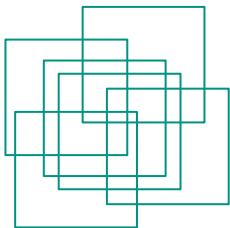
Source	ccdid	qid	x	y	...	f_10	colormag
825758177630227072	15	3	1790.861682	3044.395583	...	95.722356	2.257168

f\_0 f\_1

basename	Source							
ztf_20180221283542_700366_zg_c04_o_q1_psfcat.fits	815009596771365760	29425.714794	56384.578507					
	gmag	e_gmag	rpmag	e_rpmag	bpmag	e_bpmag	colormag	psfcat
	13.628071	0.002762	13.170574	0.003818	13.922994	0.002867	0.752420	85422.953125
	18.535330	0.003196	17.447903	0.014245	19.797472	0.052044	2.349569	305.170135
	19.012016	0.003399	17.877924	0.014084	20.312551	0.057139	2.434627	146.495590
	16.609867	0.002895	15.637225	0.004785	17.560944	0.008178	1.923719	2084.296143
ztf_20180221317141_700394_zg_c04	19.557554	0.003992	18.504904	0.027041	20.538500	0.088147	2.033596	354.749329
	...	...	...	...	...	...	...	...
	18.966047	0.003462	17.918194	0.016825	20.125122	0.054040	2.206928	260.950012
	19.160720	0.003679	18.111618	0.018353	20.308075	0.084216	2.196457	180.012039
	16.694715	0.002848	16.126848	0.005150	16.773775	0.005598	0.646927	6457.491699
	18.851212	0.003431	17.730696	0.015658	19.982006	0.059003	2.251310	NaN
	19.335558	0.003839	18.491396	0.020409	20.250107	0.066143	1.758711	NaN

301856 rows x 76 columns

## Sequence



Contexte

Catalogs

Fit

Starflat

Conclusion

61	60	57	56	53	52	49	48
16		15		14		13	
62	63	58	59	54	55	50	51
45	44	41	40	37	36	33	32
12		11		10		09	
46	47	42	43	38	39	34	35
29	28	25	24	21	20	17	16
08		07		06		05	
30	31	26	27	22	23	18	19
q2	q1	09	08	05	04	01	00
13	12	03		02		01	
q3	q4	10	11	06	07	02	03
14	15						

# Fit

Linear model:

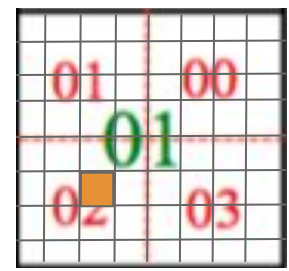
$$m_{ADU} = m + \delta ZP(x)$$

Measurements  
( $\sim 10^7$ )

Star mags  
(parameters)  
( $\sim 10^5$ )

Non uniformities  
(parameters)  
( $\sim 10^{3-4}$ )

Superpixels

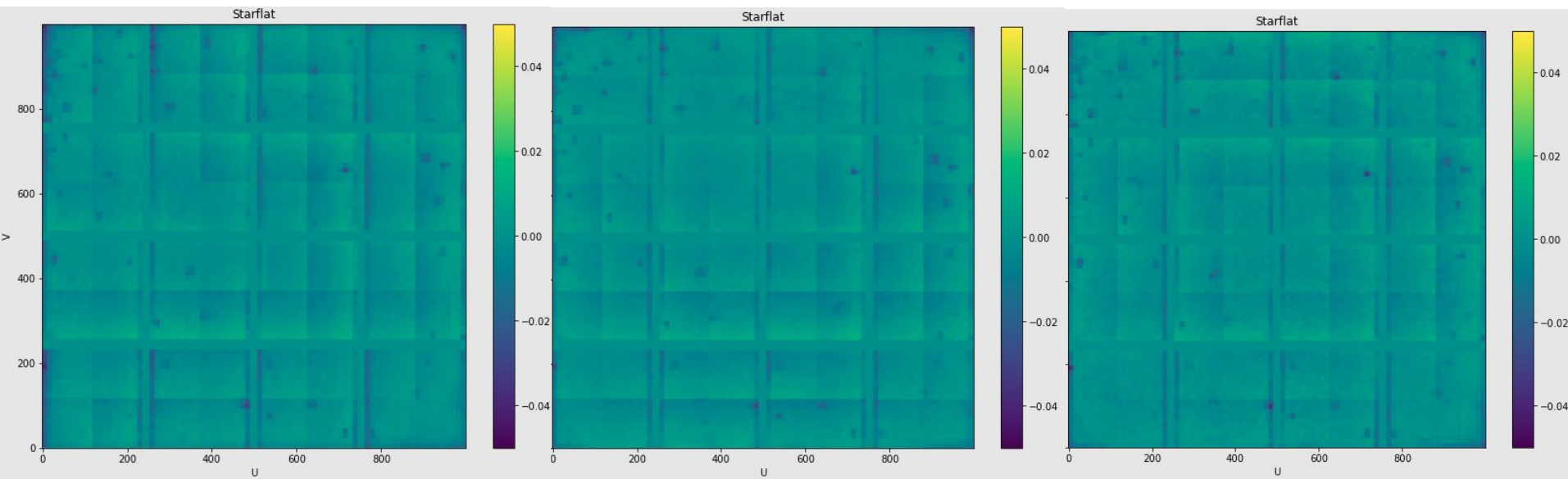


# Gain subtracted: superpix = 10\*10

g band  
aperture photometry

Gain: median of ZP in a quadrant

$$m_{ADU} = m + \delta ZP(x)$$



2018

march 2019

november 2021

Contexte

Catalogs

Fit

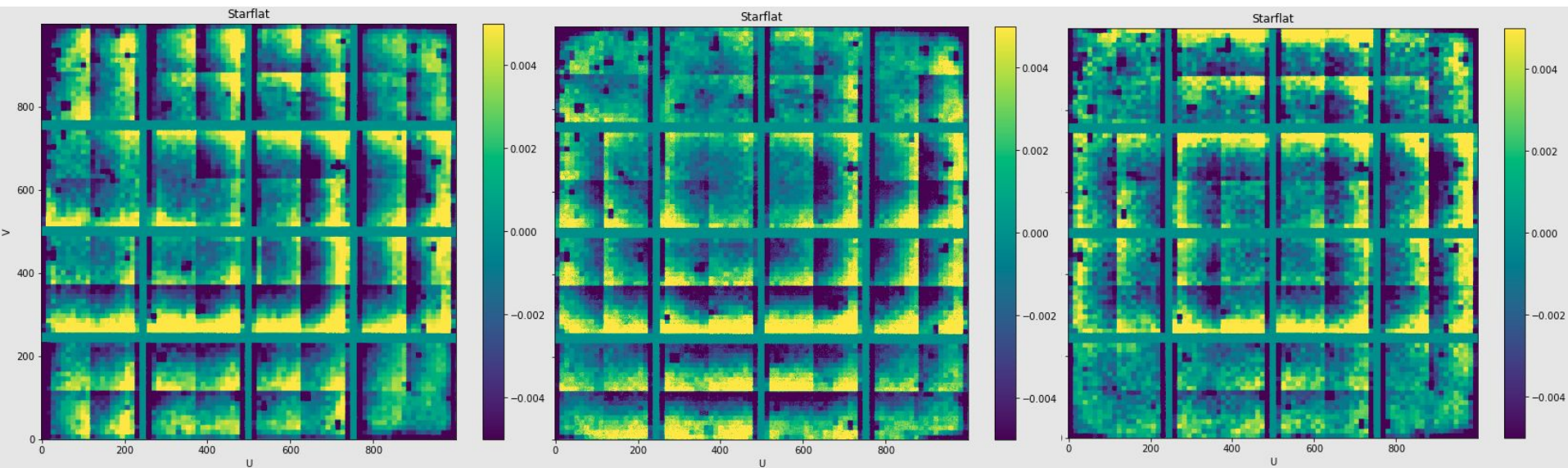
Starflat

Conclusion

Gain subtracted: superpix =  $10 \times 10$

g band  
aperture photometry

$$m_{ADU} = m + \delta ZP(x)$$



2018

march 2019

november 2021

Contexte

Catalogs

Fit

Starflat

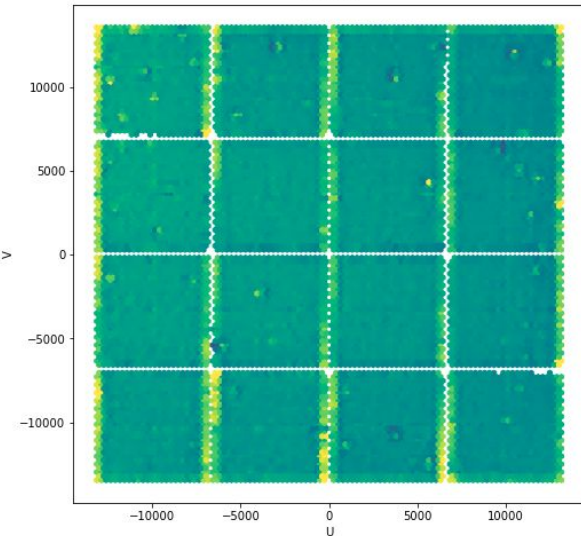
Conclusion

After iteration, gain non-subtracted: superpix = 10\*10

g band  
aperture photometry

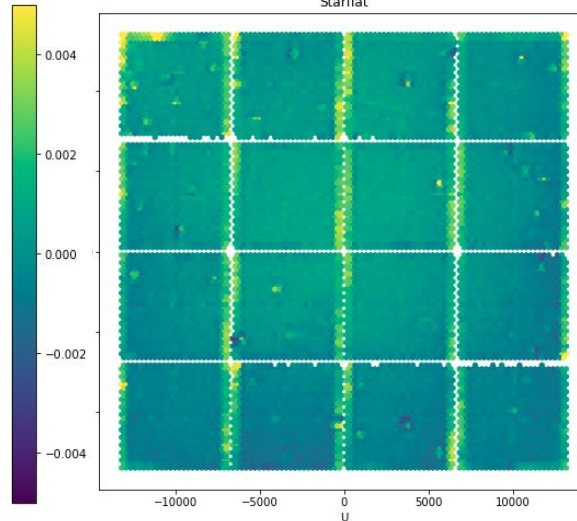
$$m_{ADU} = m + \delta ZP(x)$$

Starflat



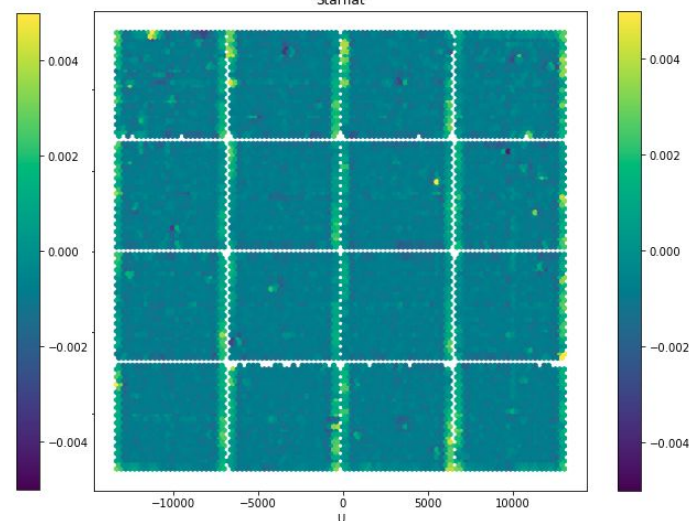
2018

Starflat



march 2019

Starflat



november 2021

Contexte

Catalogs

Fit

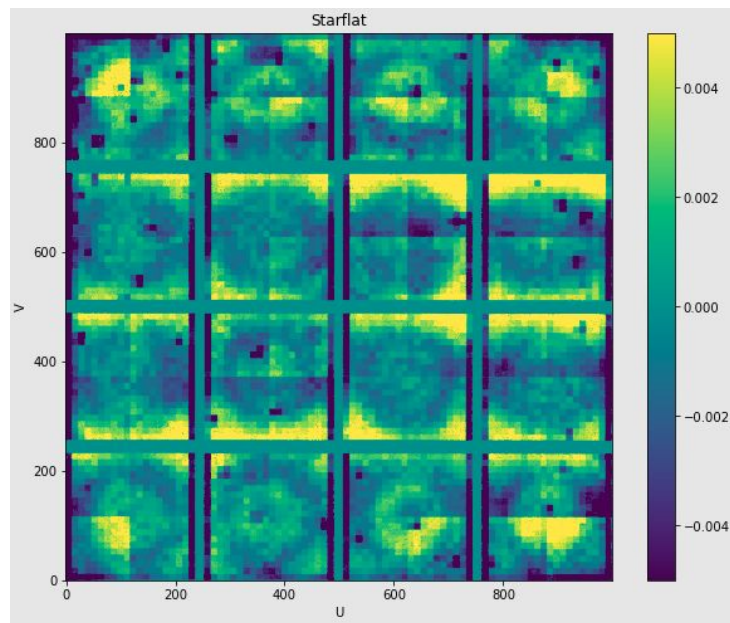
Starflat

Conclusion

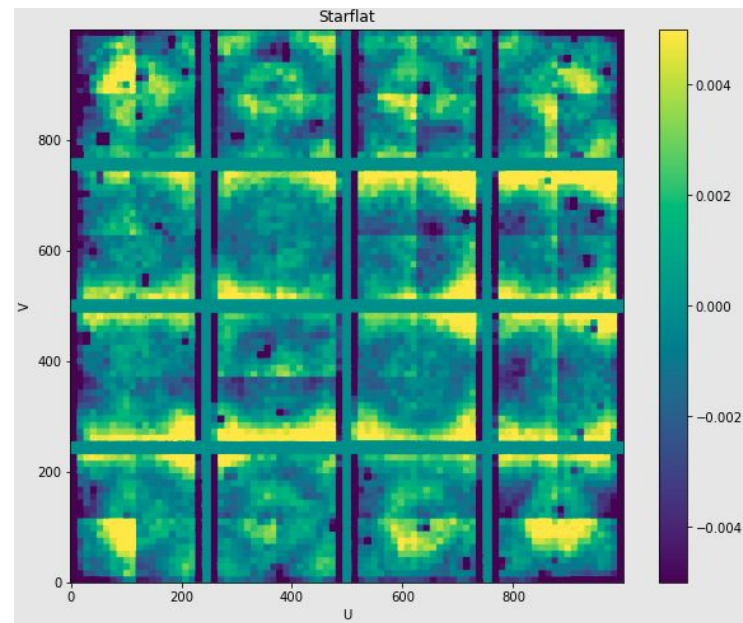
# Gain subtracted: superpix = 10\*10

r band  
aperture photometry

$$m_{ADU} = m + \delta ZP(x)$$



march 2019



november 2021

Contexte

Catalogs

Fit

Starflat

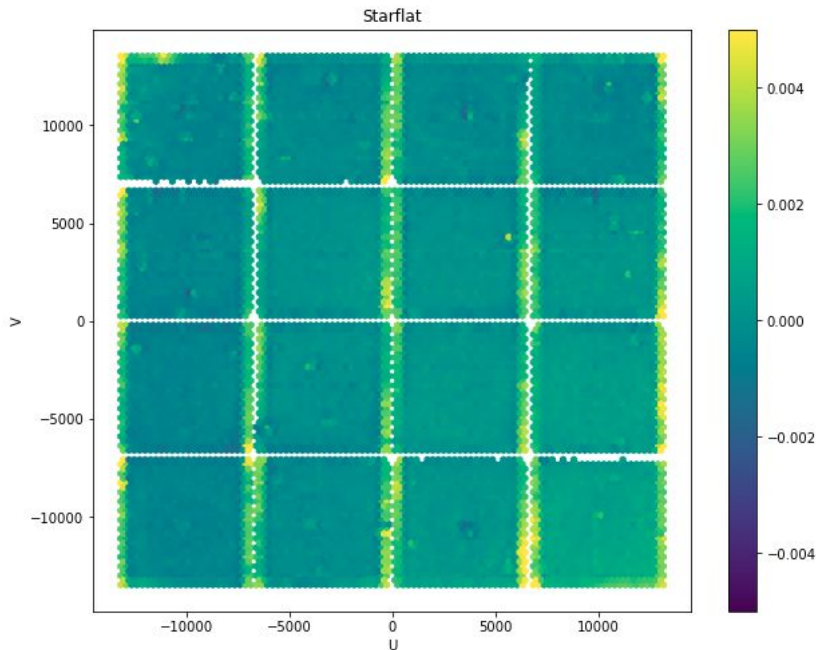
Conclusion



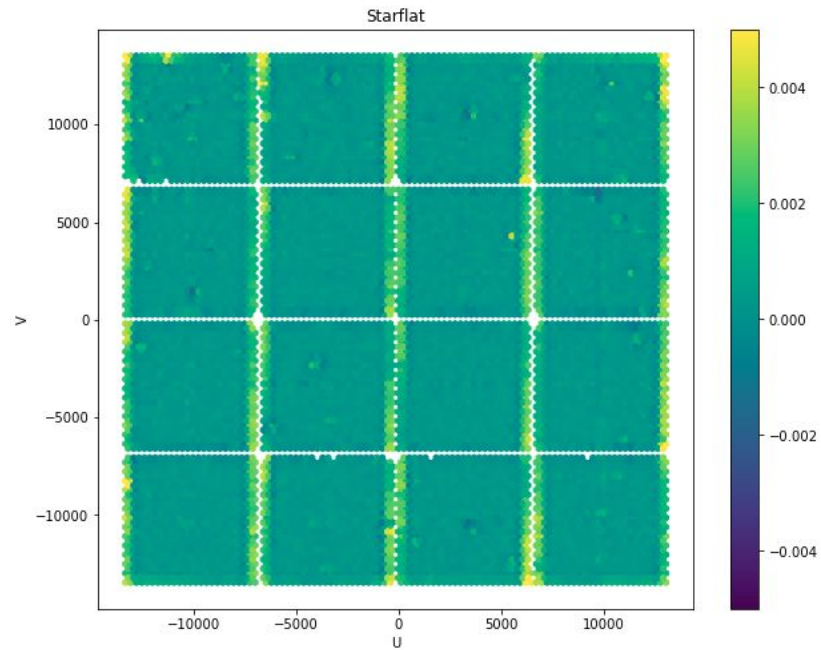
# After iteration, gain non-subtracted: superpix = 10\*10

r band  
aperture photometry

$$m_{ADU} = m + \delta ZP(x)$$



march 2019



november 2021

Contexte

Catalogs

Fit

Starflat

Conclusion

# Conclusion

To remember :

- WIP towards flat residuals

Next steps :

- Adaptive grid
- Dithering simulation
- Ubercal

Contexte

Catalogs

Fit

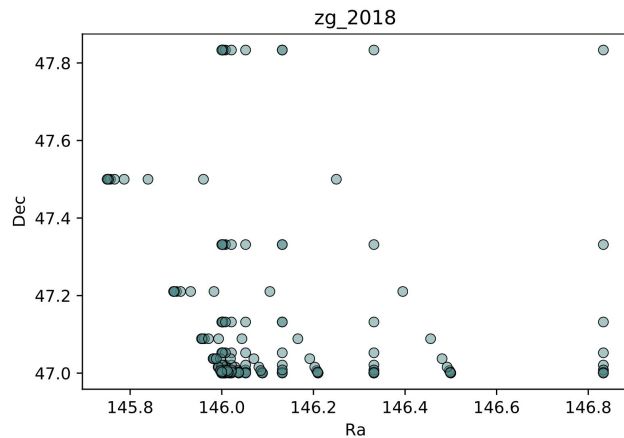
Starflat

Conclusion

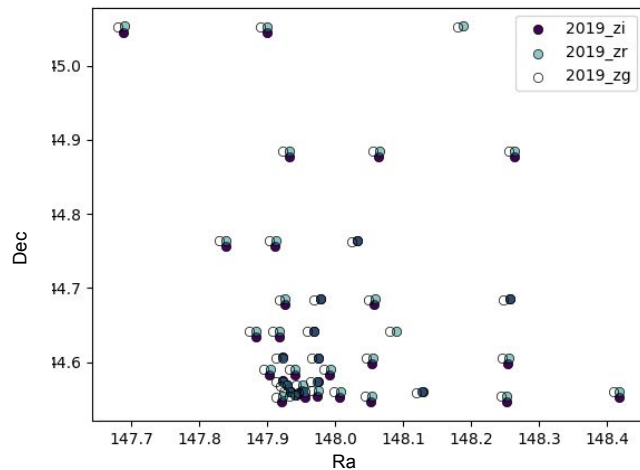
**Thanks for listening**

# BACKUP

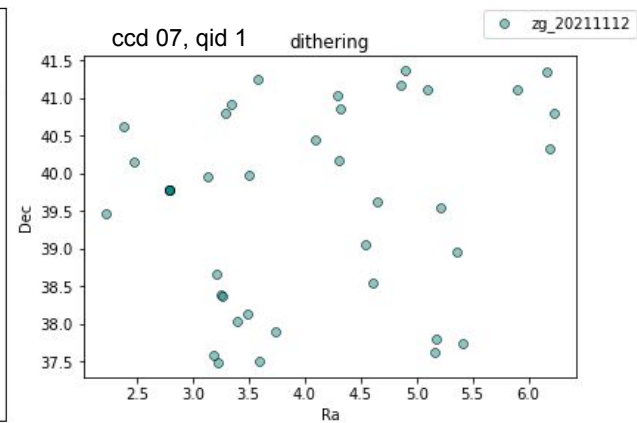
# Dithering



g band 2018

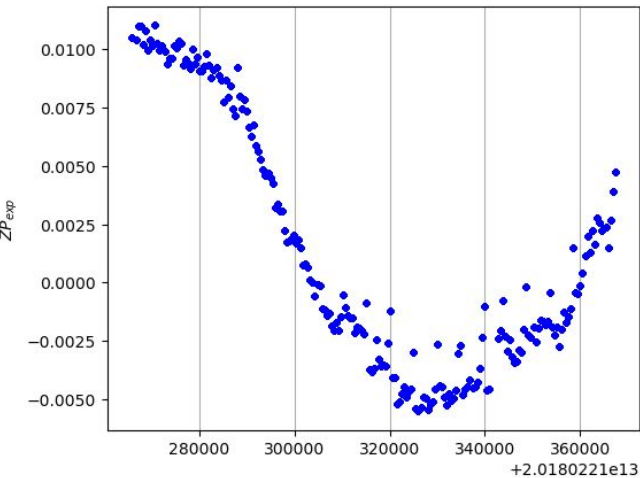


g band march 2019

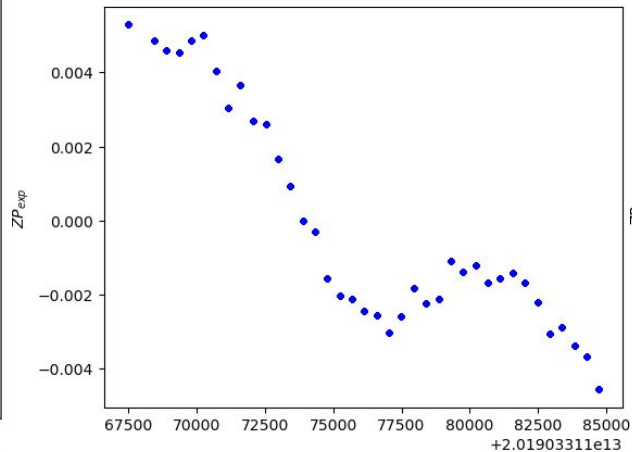


g band november 2021

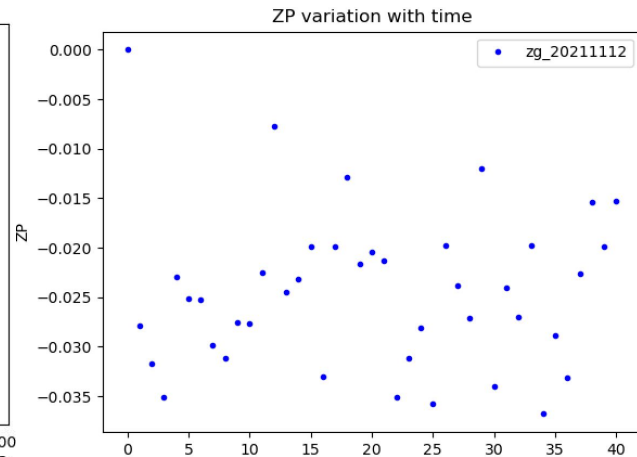
# ZP Variations



g band 2018



g band march 2019

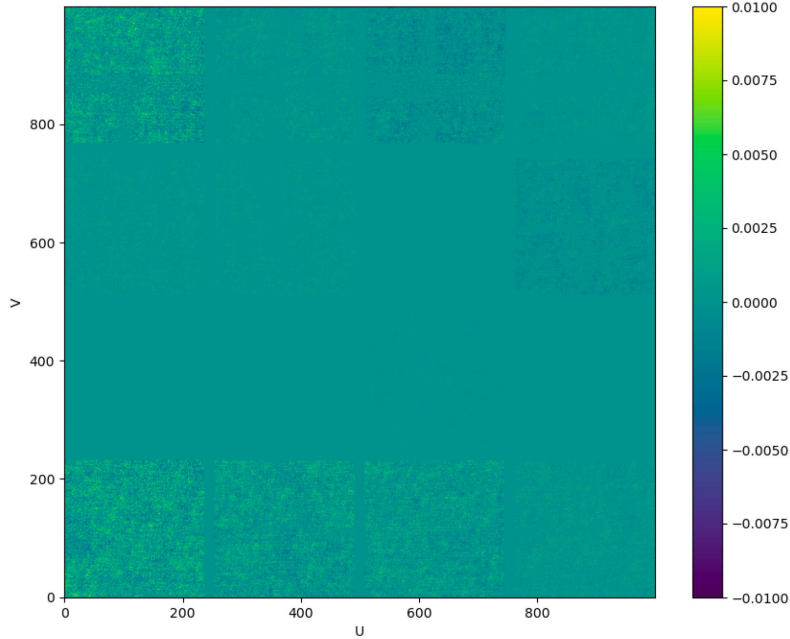


g band november 2021

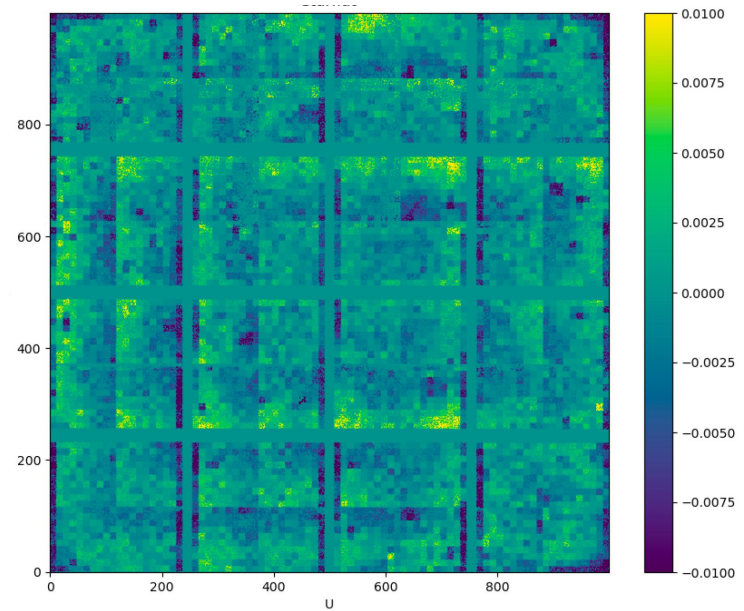
$$m_{ADU} = m + \delta ZP(x) + ZP_{exp} + \delta k(x) \text{ col}$$

aperture  
photometry

dk



dzp



$$m_{ADU} = m + \delta ZP(x) + ZP_{exp}$$

