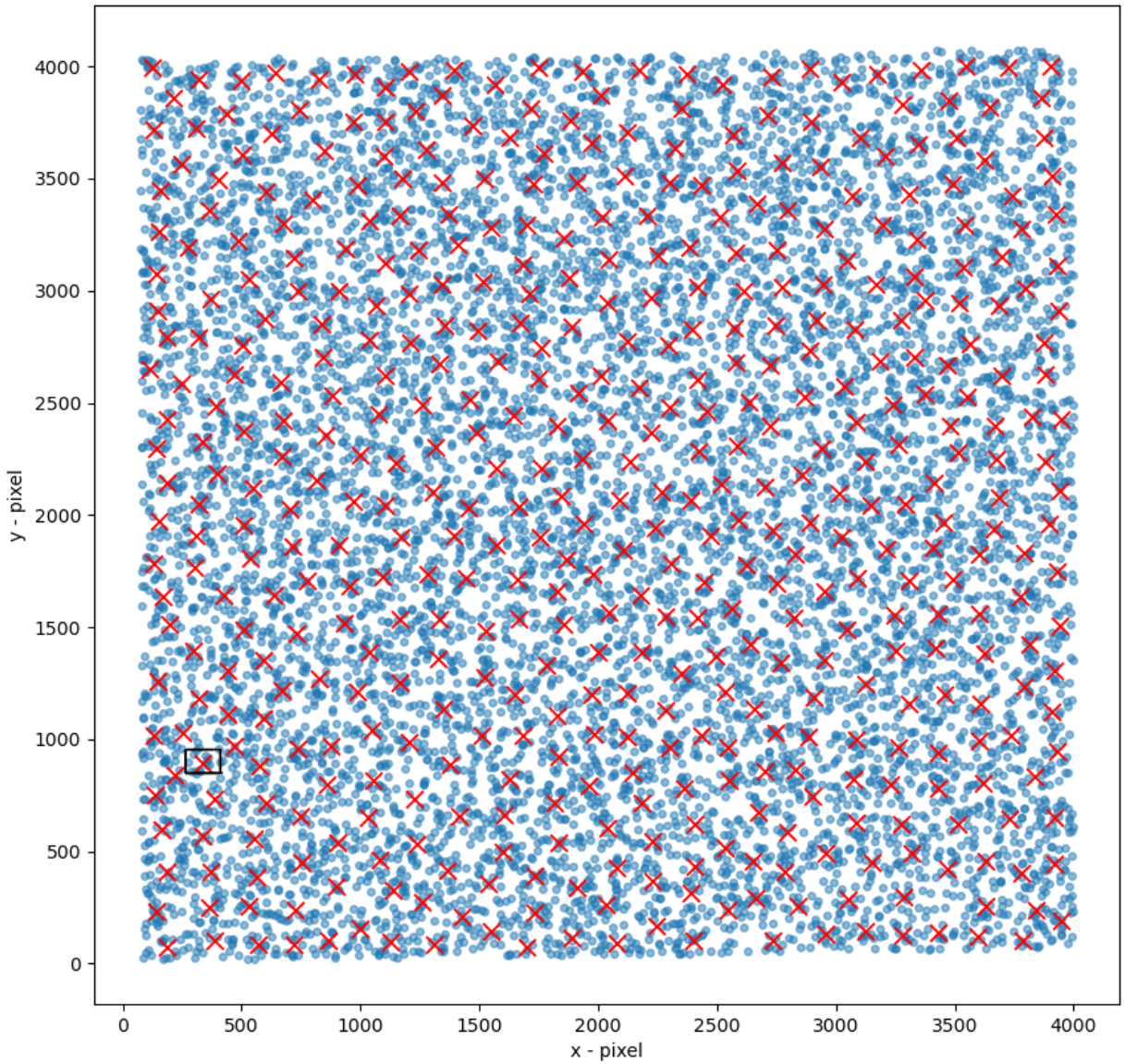
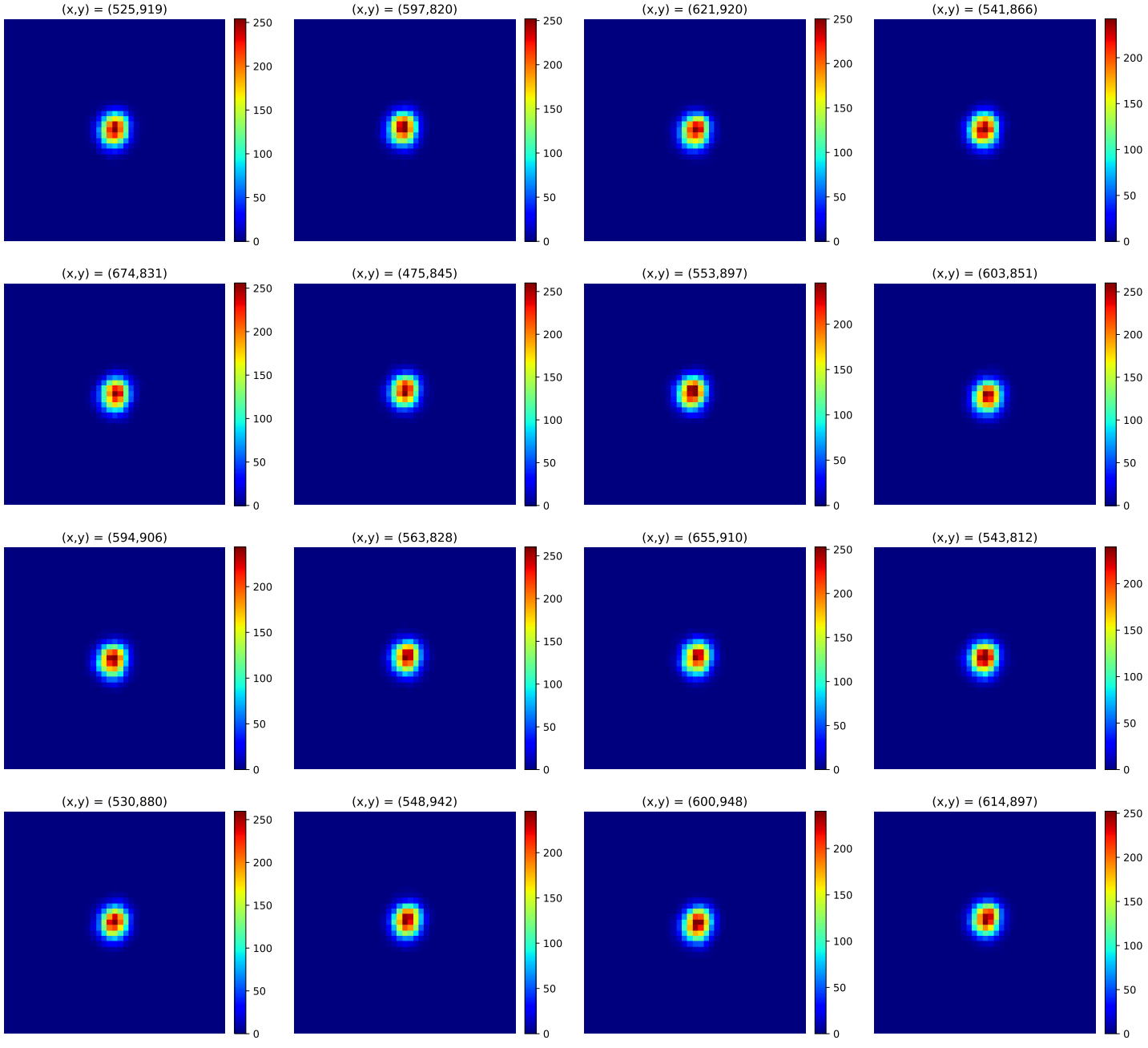
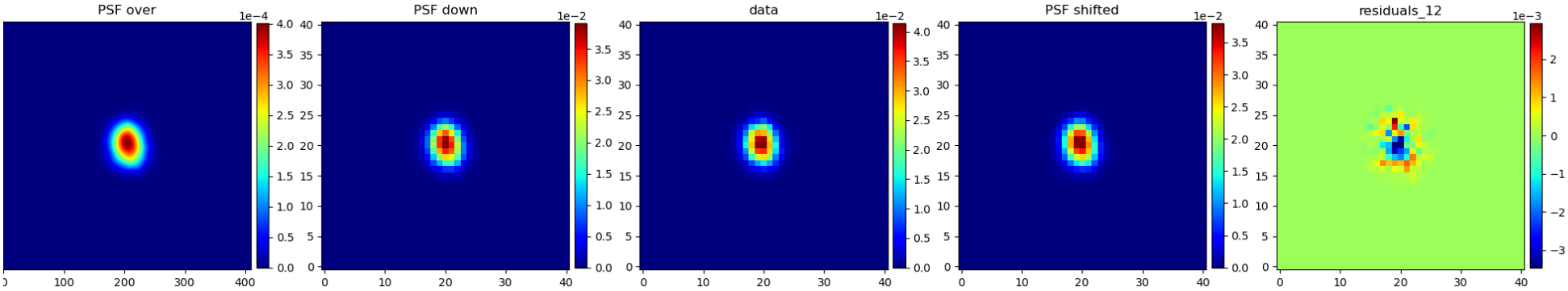
Making PSF from a Group of Dithered Stars

February 22, 2021


y - pixel
x - pixel
0
500
1000
1500
2000
2500
3000
3500
4000


(x,y) = (525,919)
(x,y) = (597,820)
(x,y) = (621,920)
(x,y) = (541,866)
(x,y) = (674,831)
(x,y) = (475,845)
(x,y) = (553,897)
(x,y) = (603,851)
(x,y) = (594,906)
(x,y) = (563,828)
(x,y) = (655,910)
(x,y) = (543,812)
(x,y) = (530,880)
(x,y) = (548,942)
(x,y) = (600,948)
(x,y) = (614,897)

1. According to our assumption PSF should be varying smoothly over the CCD.
2. We observe unexpected variations in shape of nearby stars because of random dithering.
3. Interpolate to make a oversampled image, find center and stack all stars to make PSF.
4. Use this PSF to find center in subpixel and perform photometry for an individual star.



1. We shift the oversampled PSF before downsampling(by binning) to match individual stars.
2. PSF downsampled followed by shifting is trying to imitate data but not able to do so well.

Issues:

1. We tried bicubic spline interpolation, Lanczos interpolation(an approximation of bivariate Sinc).
2. Both are conserving photons after interpolation.
3. We observe a huge bias($\approx 10\%$) in photometry for 16 magnitude stars.