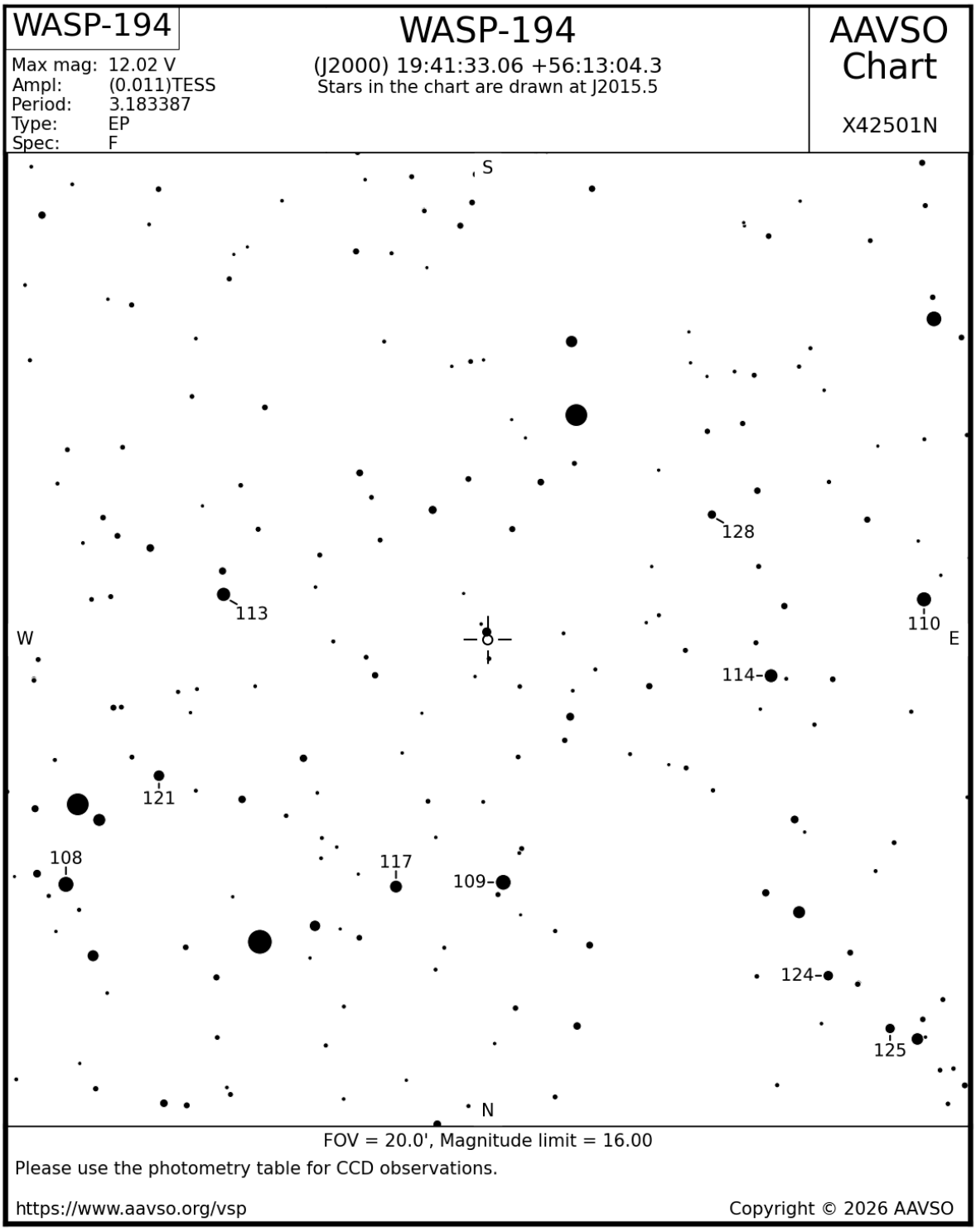
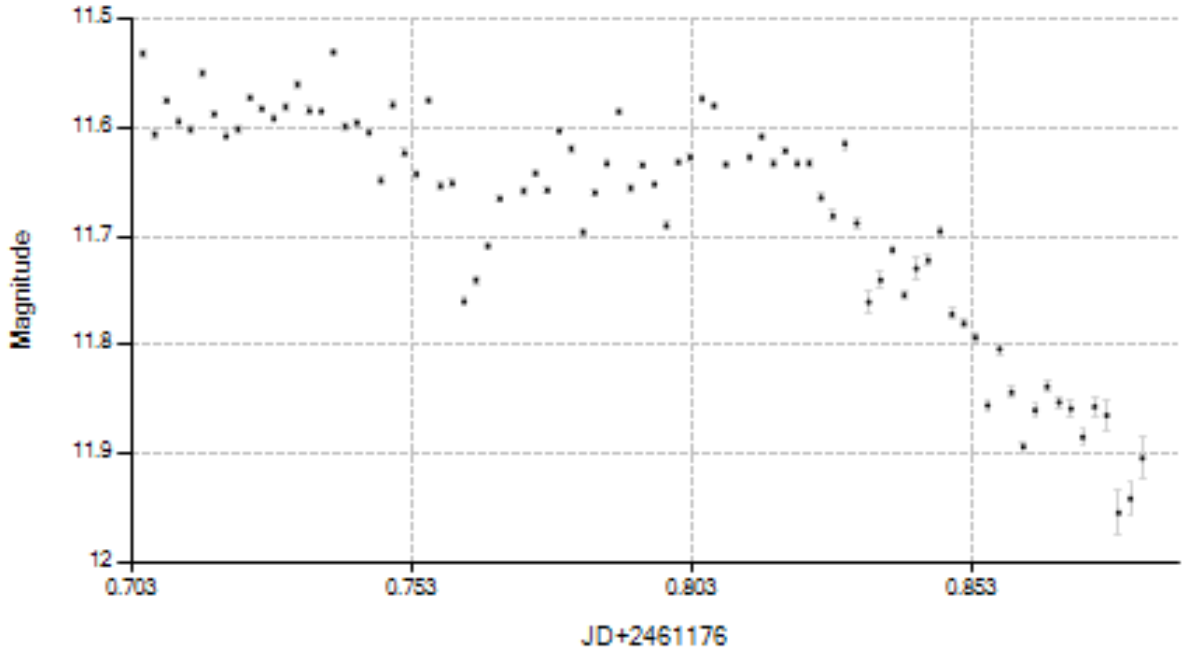
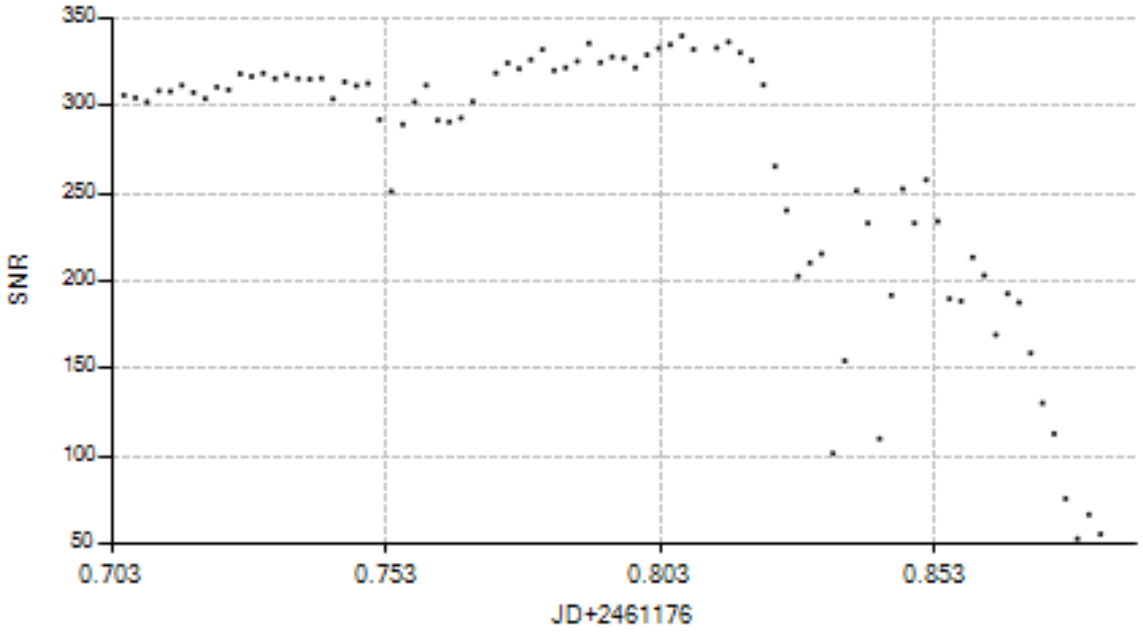
STAR CHART (has been provided yay)



Using VPhot to perform aperture photometry and keeping all comparison stars in the images FOV (for now):



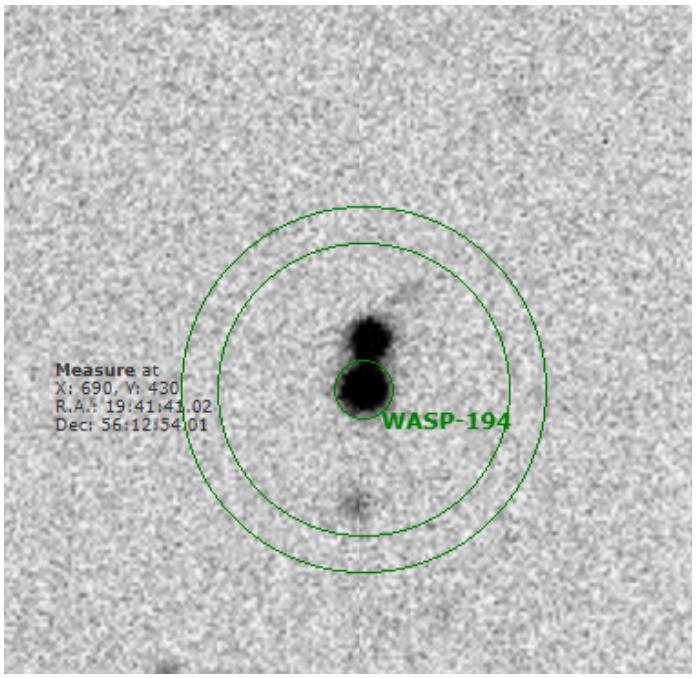
SNR: Mostly great for the majority of the night, deteriorated throughout the end, possibly due to clouds?



*** Remember to remove these images since the SNR is too low:

		Nbr	Filter	Date/Time	JD	Mag	SNR	Airmass	FWHM	Skyglow	Max ADU
	SNR too low	114	V	2026-05-16T09:17:20 +00:00	0.88704	-	-	1.20700	-	-	-
	SNR too low	113	V	2026-05-16T09:14:17+00:00	0.88492	-	-	1.21300	-	-	-

Star 119 (which I presume is the one adjacent to WASP-194) could be contaminating the image. Per star chart email notes: "`Its actual magnitude is V= 12.02 and has a bright 12.55 Vmag. companion 9.7" away.`" I'll need ot find a way to separate them.Maybe adjusting the aperture even more to avoid contamination and also lowering the SNR??



→ run photometry several times with different aperture radii…
Star profile for one of the images:

ADU Readings

General information:

WASP-194

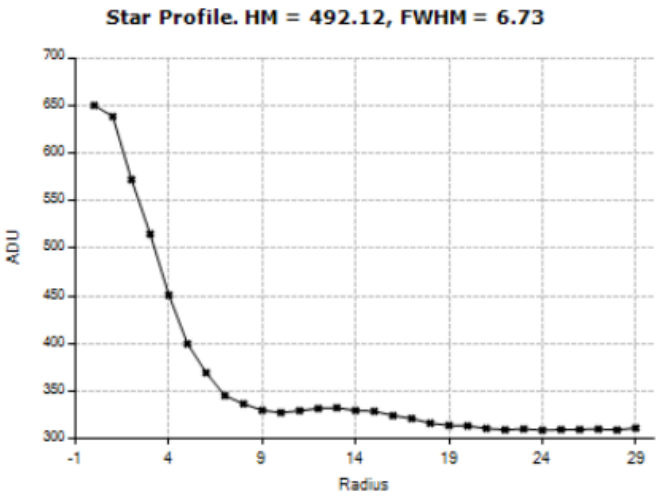
Instr.Mag,:	-5.234
SNR:	66
Error (SNR):	0.016
Airmass:	1.225
FWHM:	6.73
Centroid X:	780.92
Centroid Y:	443.65
RA Catalogue:	295.38800
Decl. Catalogue:	56.21764
RA Estimate:	19:41:33.12363
RA Estimate:	295.38802
Decl. Estimate:	56:13:03.48550
Decl. Estimate:	56.21763

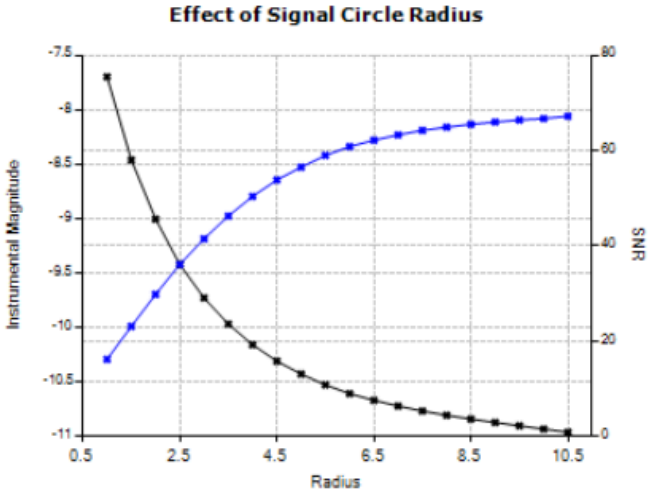
Signal Circle Statistics:

Intensity:	22324
Max:	676
Min:	301
Nbr. of Pixels:	282

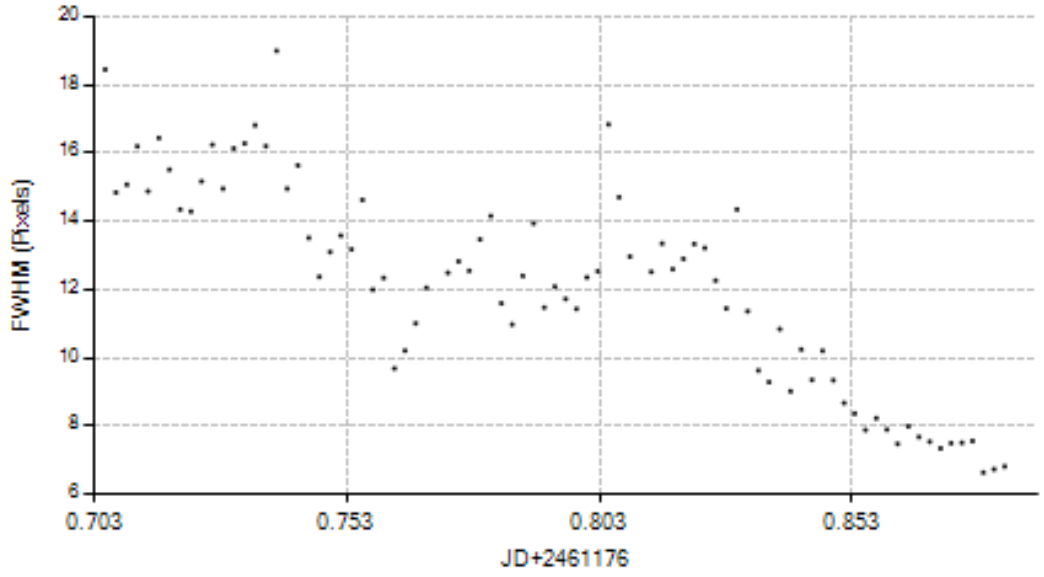
Sky Annulus Statistics:

Mode:	308.25
Mean:	309.38
Median:	309
Std.:	8.95
Max:	336
Min:	283
Nbr. of Pixels	2819



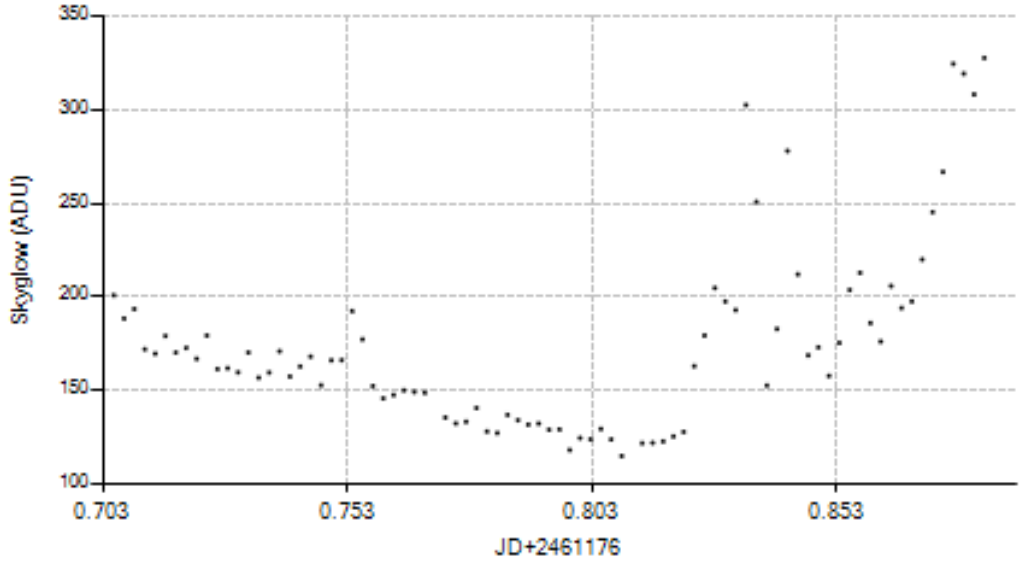


FWHM for the entire observation:



Since it varies significantly, is a variable aperture possible instead of fixed???
ALSO… if the FWHM is deecreasing woudlnt that mean that the seeing improved throughout the night?? But the SNR plot says otherwise… Maybe the telescope was able to focus better later at night…increased stability?

SKYGLOW: Maybe the background light was affecting our measurements later. Well actually, thai agrees with the SNR plot. Clouds or some other form of light pollution could have affected the last observations.

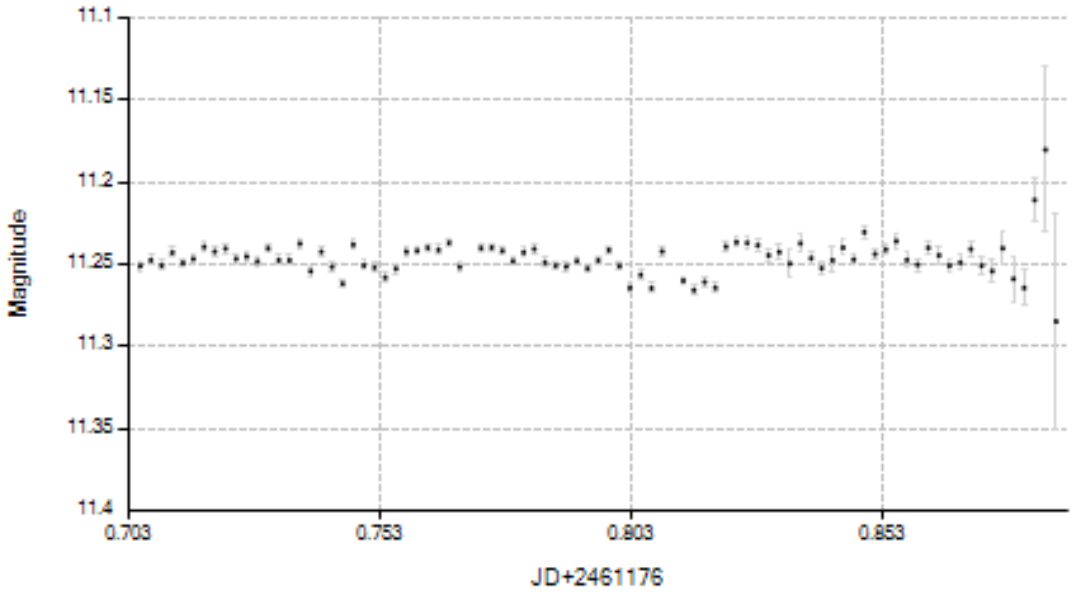


Based on the image above, I could use FWHM 6.73 px for now to obtain a fixed aperture.…

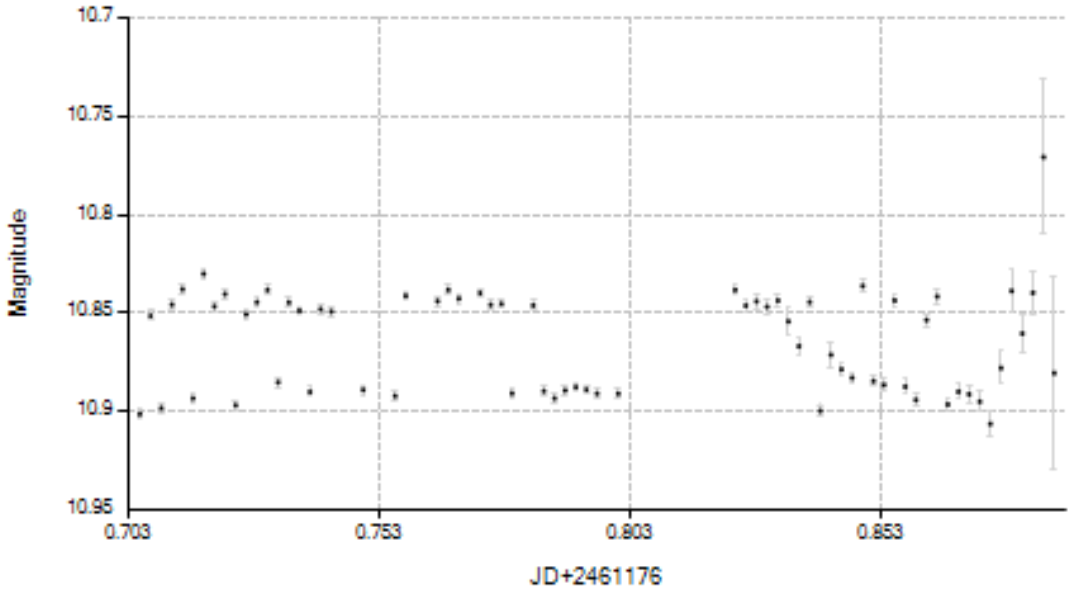
I'll try first this, then I'll work with different values if it doesn't work:
Aperture radius = 1.5-2*FWHM = 10.1-13.5 px
Gap = FWHM = 6.73 px
Sky annulus width = 3-5 FWHM = 20.2-33.7 px

ALSO: COMP STARS
Maybe I'll check mag v. time for all comp stars to make sure there aren't any sips, spiked or trends and STABLE

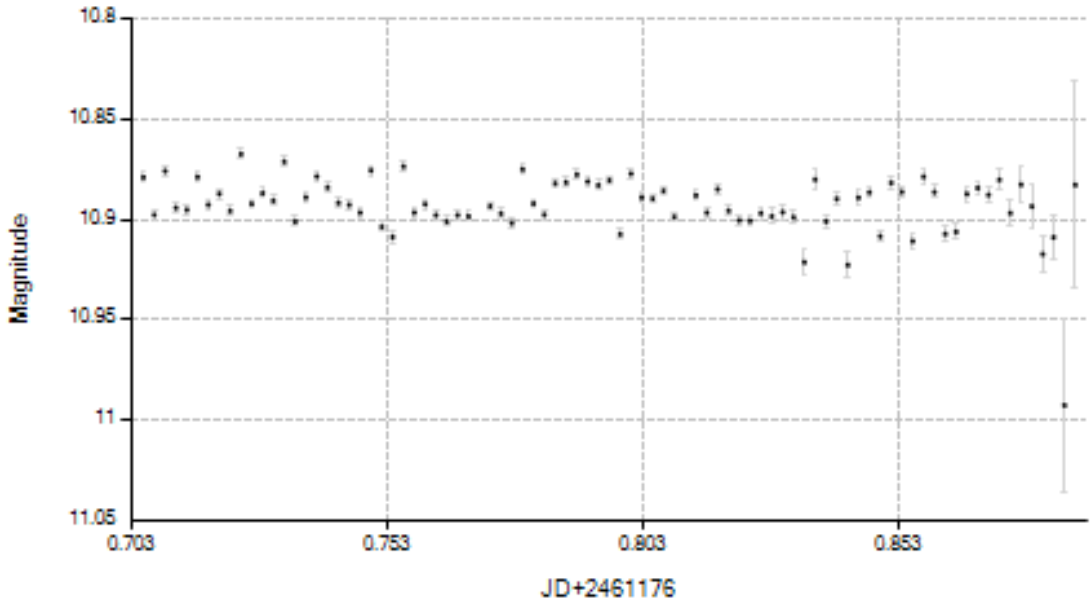
113:



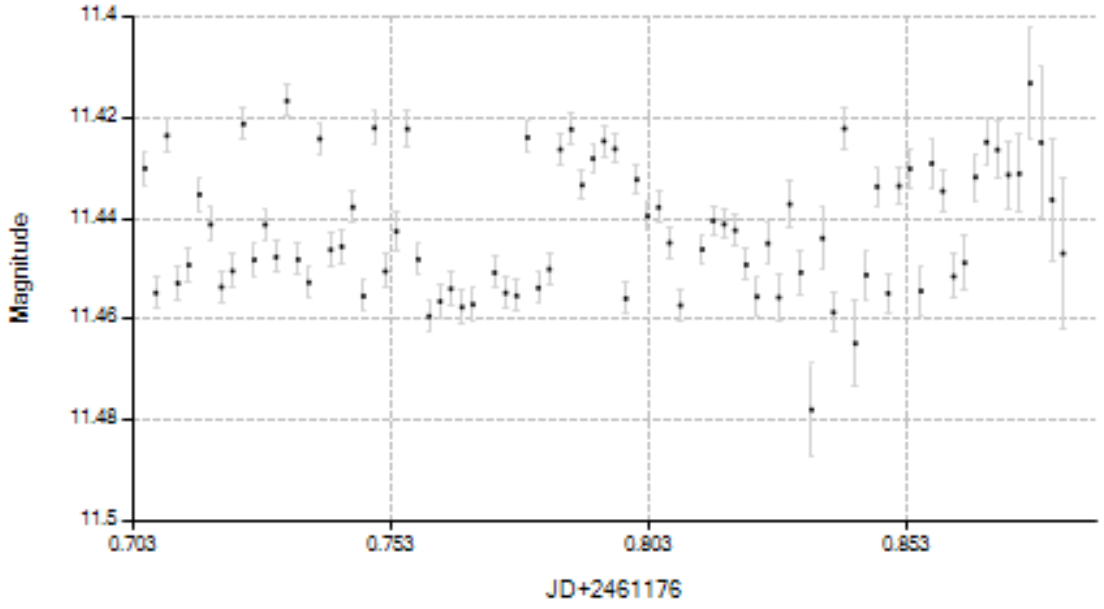
108:


10.7
10.75
10.8
10.85
10.9
10.95
Magnitude
0.703
0.753
0.803
0.853
JD+2461176

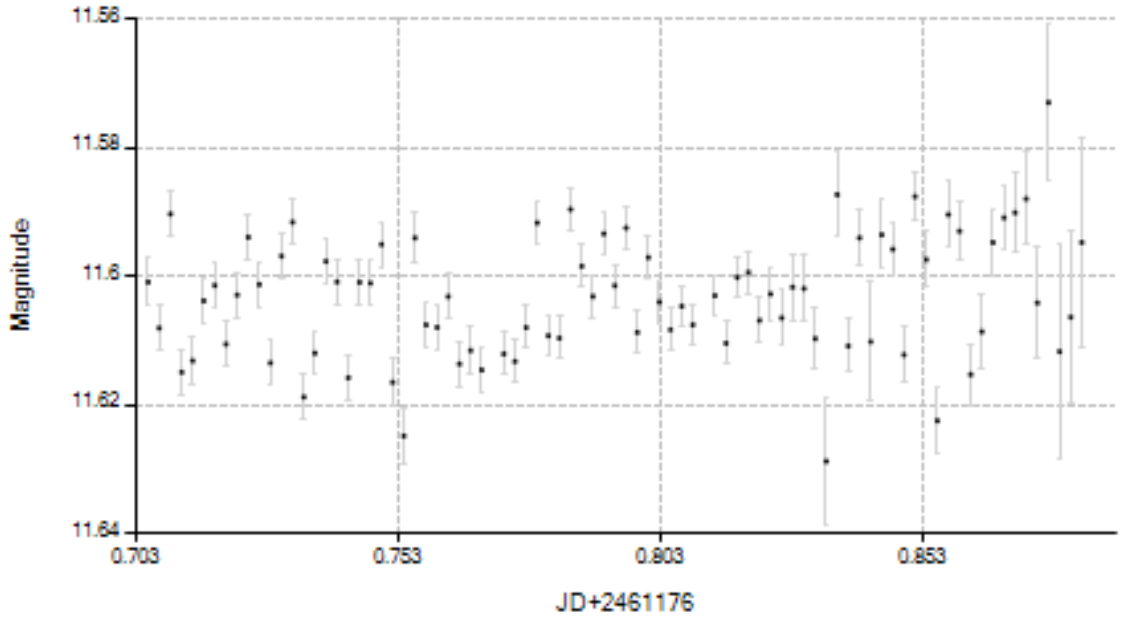
109:


10.8
10.85
10.9
10.95
11
11.05
Magnitude
0.703
0.753
0.803
0.853
JD+2461176

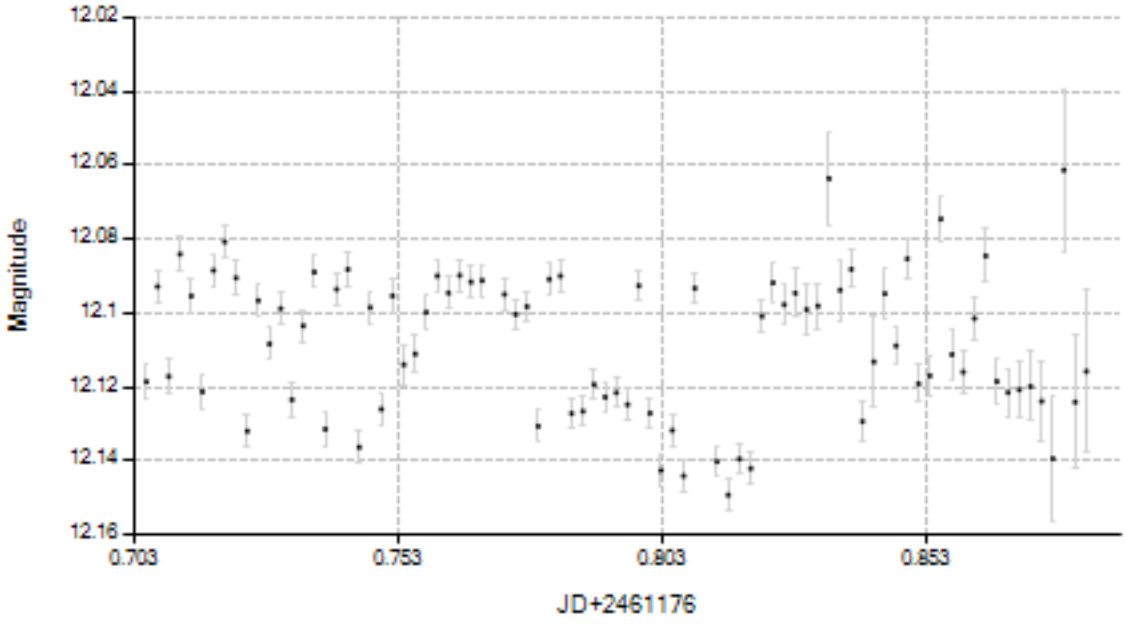
114:


11.4
11.42
11.44
11.46
11.48
11.5
Magnitude
0.703
0.753
0.803
0.853
JD+2461176

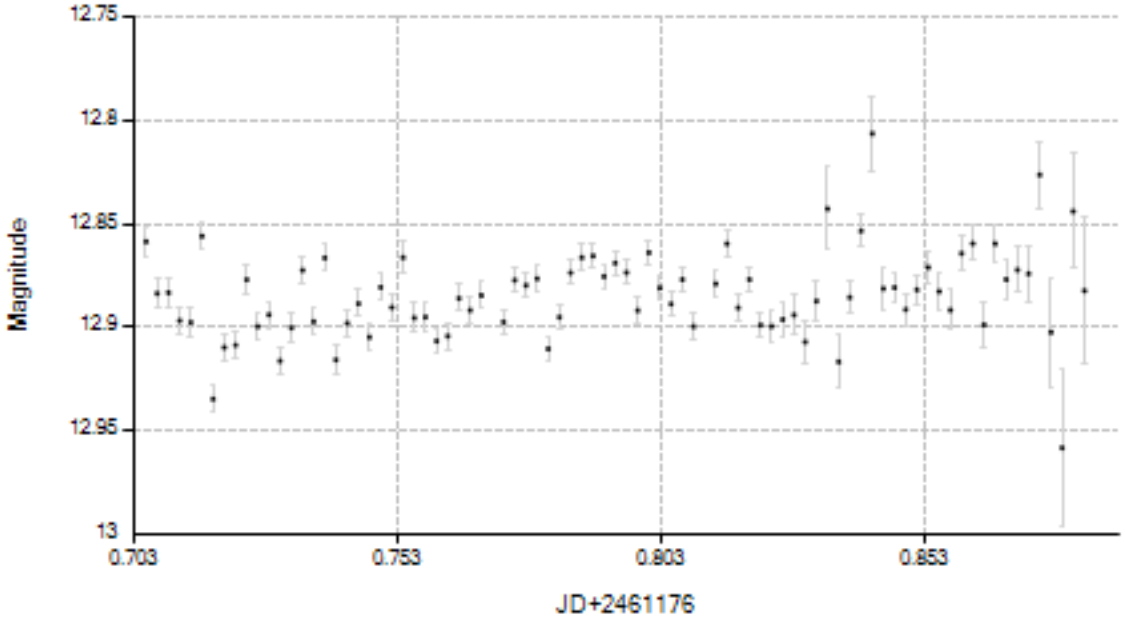
117:


11.56
11.58
11.6
11.62
11.64
Magnitude
0.703
0.753
0.803
0.853
JD+2461176

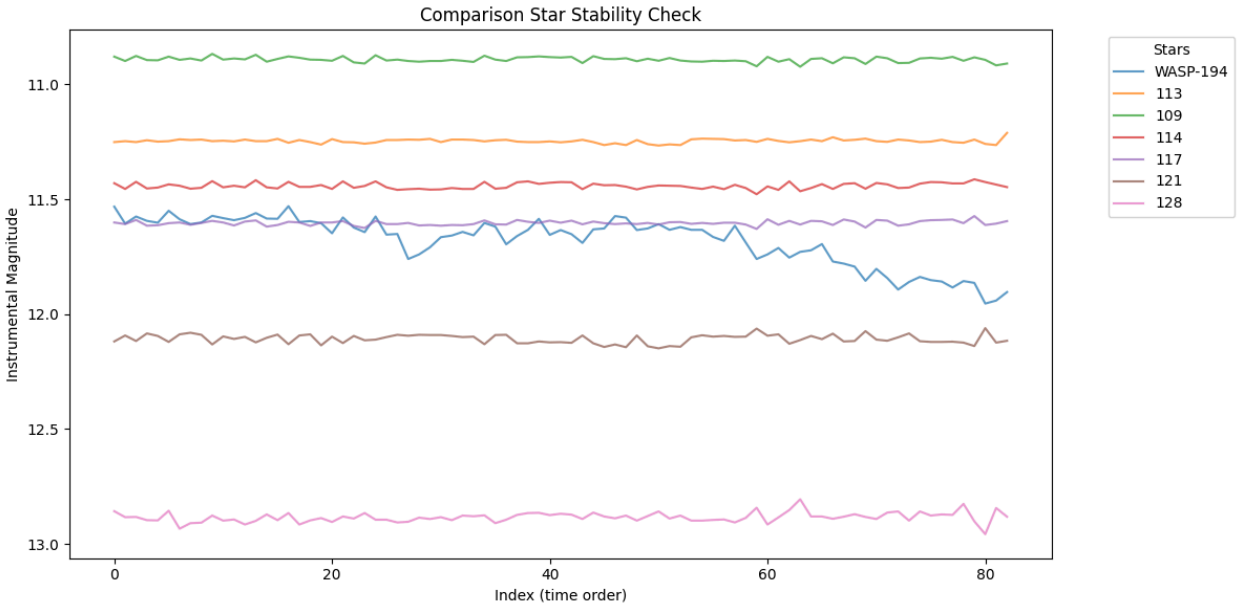
121:



128:



It’s kinds of hard to see the variations due to the difference in the y scaling for each plot. I exported the data and plotted it matplotlib to see the actual vatriations more clearly:

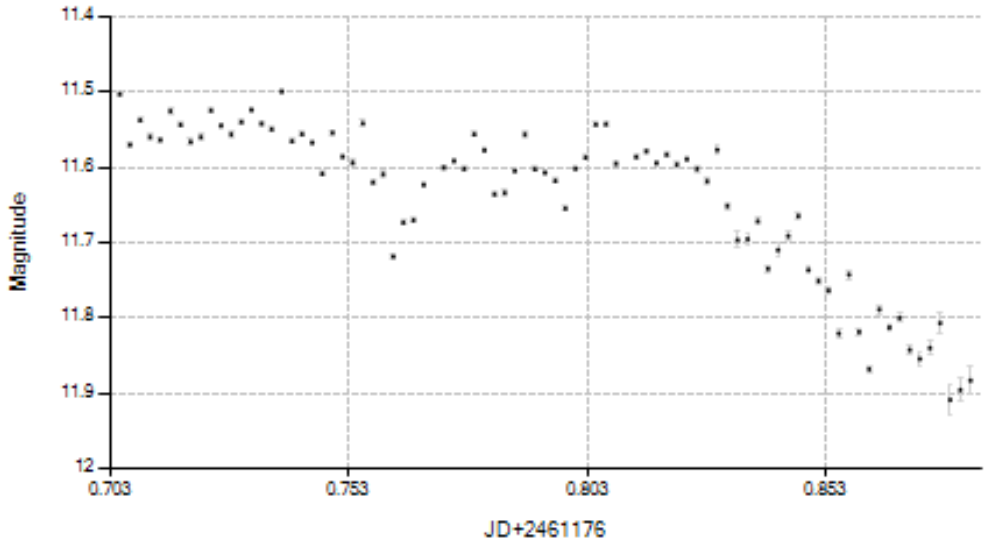


Ok, so based on that, I see that the best star to use as the check star may be 117 since it';s the closest to our WASP-193's instrumental magnitude. We could also rule out 128 since the magnitude is slightly dimmer than the rest. The same would apply to 109 if we want to continue narrowing down the comparison stars.
Ok, so keeping 117 as a check and 113, 114, and 128 as comp stars

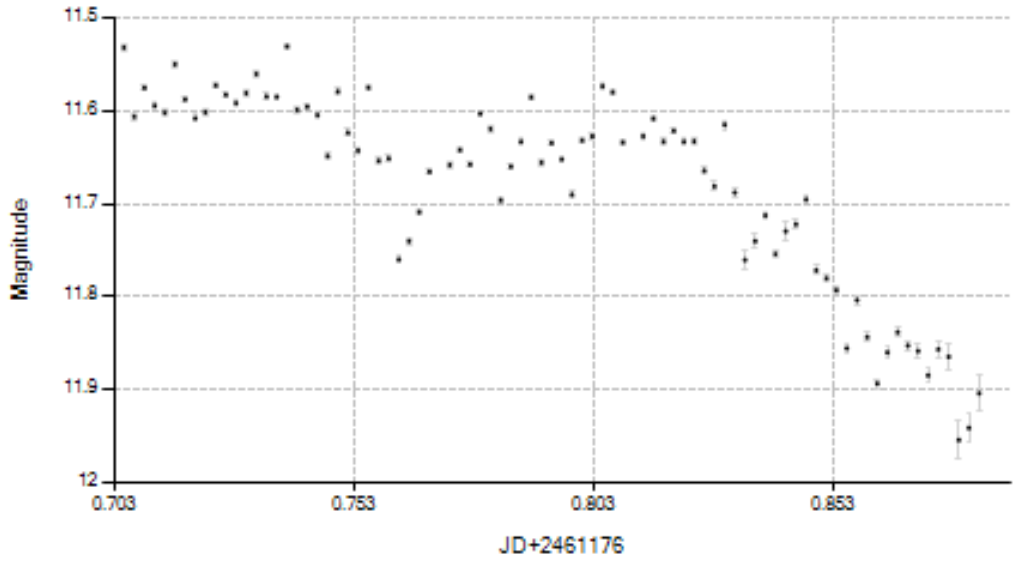
OK attempting:

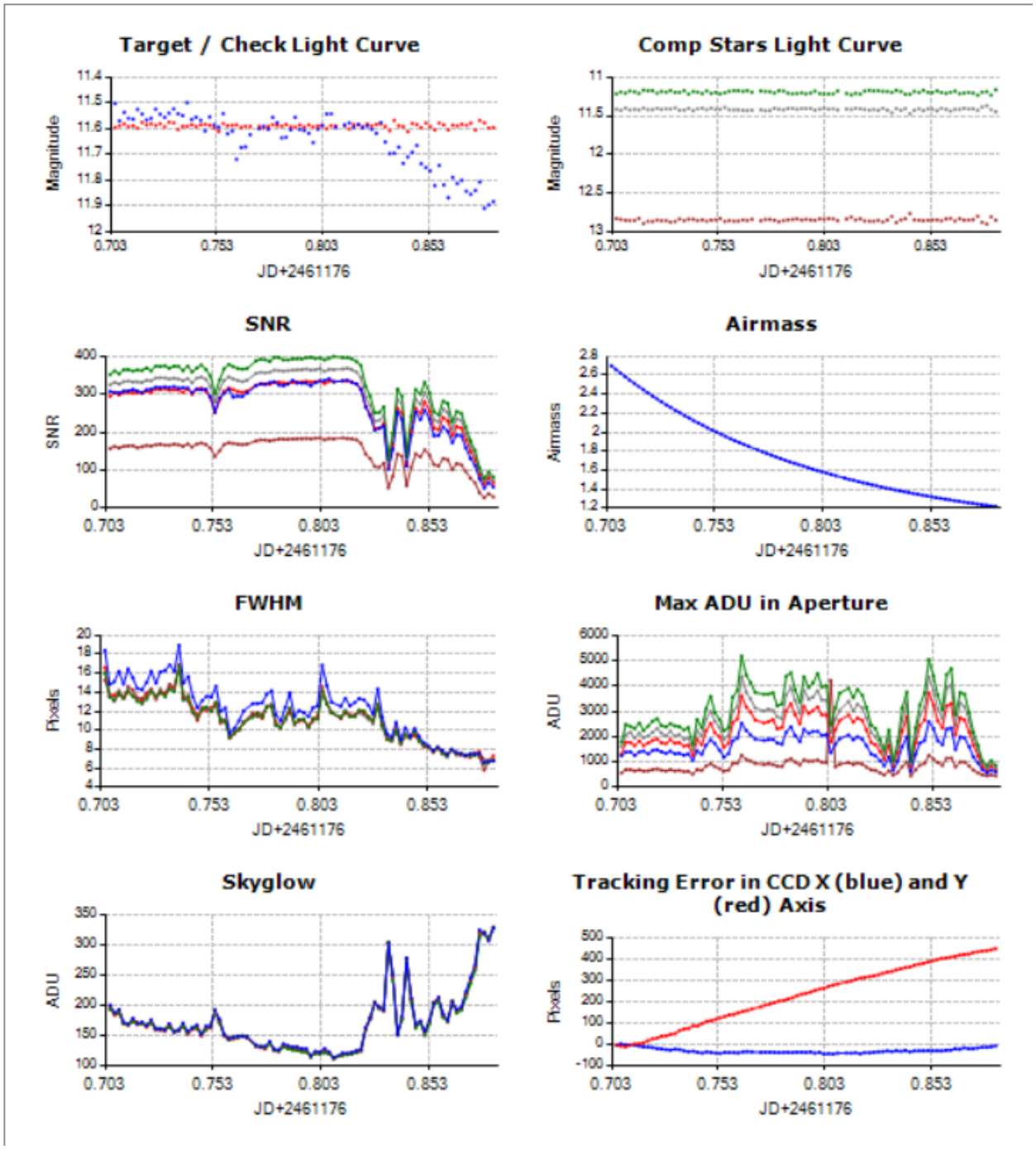
- Selecting 117 as check star (closest to magnitude and most stable)
- Selecting 113, 114, and 128 as comp stars
- Removing the two images with low SNR
- Keeping the automatically adjusted aperture that multiplies 1.5*FWHM of each data point

WASP-194 mag v time: NEW


11.4
11.5
11.6
11.7
11.8
11.9
12
Magnitude
0.703
0.753
0.803
0.853
JD+2461176

OLD


11.5
11.6
11.7
11.8
11.9
12
Magnitude
0.703
0.753
0.803
0.853
JD+2461176



OKAAAY, so much better. A lot less noise, much better idea of the baseline and easier to spot the transit.

So based on the consistency between the skyglow and SNR, the downward trend in the light curve may be due to affected seeing, clouds, (maybe the moon, I'd have to check) that could be affecting the background brightness and consequently the SNR. I manages to level oyt the

baseline a bit after carefully selecting the comparison stars, but the shape may still be affected by the other star in close proximity contaminating the images.

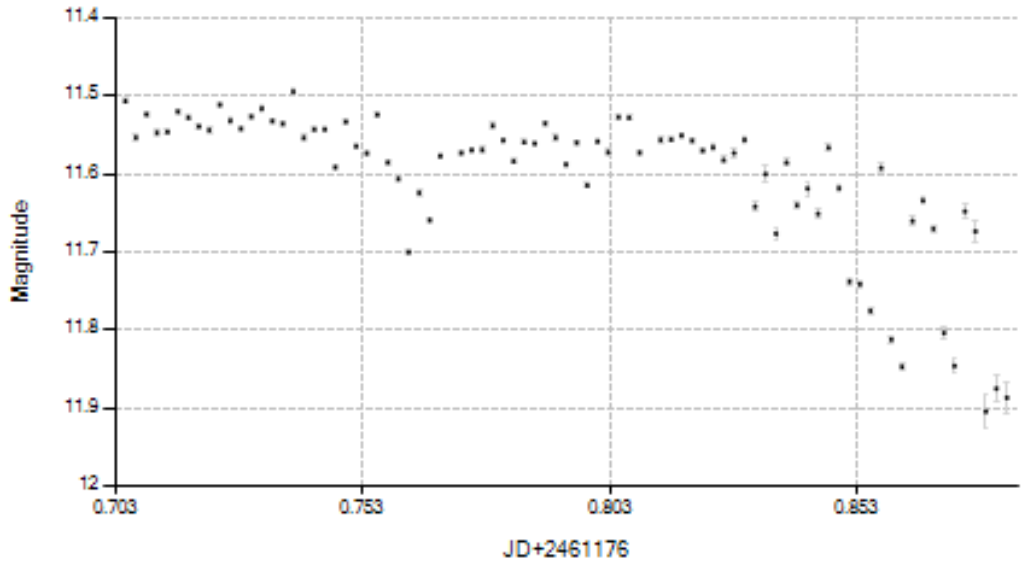
Hmmm, maybe adjusting the initial FWHM value could allow a smoother processing.

I extracted the FWHM in python to compute the mean, mode and median of the FWHM:
MEAN: 12.134915662650602
MODE: 18.461
MEDIAN: 12.409

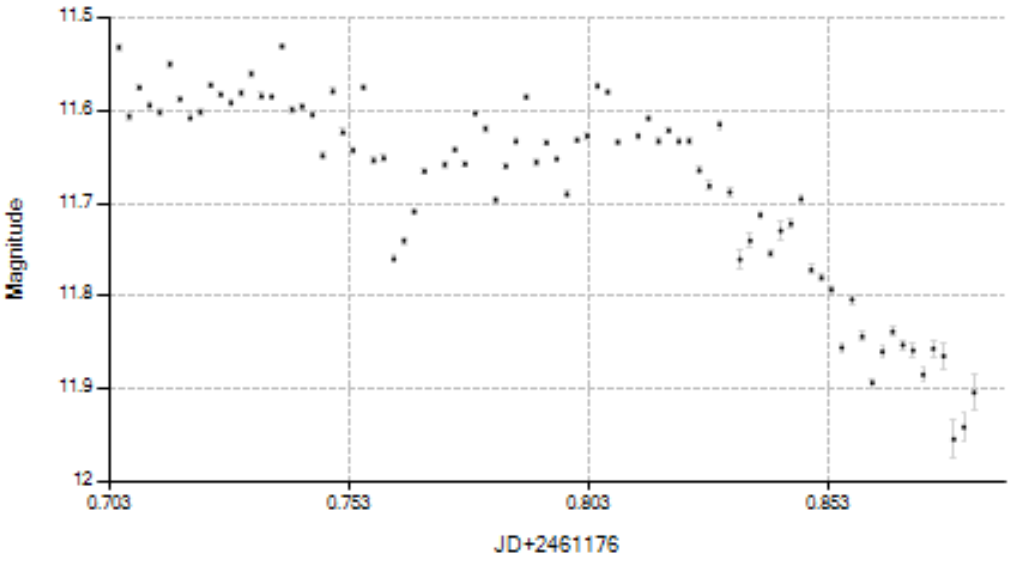
I'll set the initial FWHM to be around 12 since that is the mean FWHM of my data.

OKAAAAY… even better!! The baseline seems to be leveling out better every time:

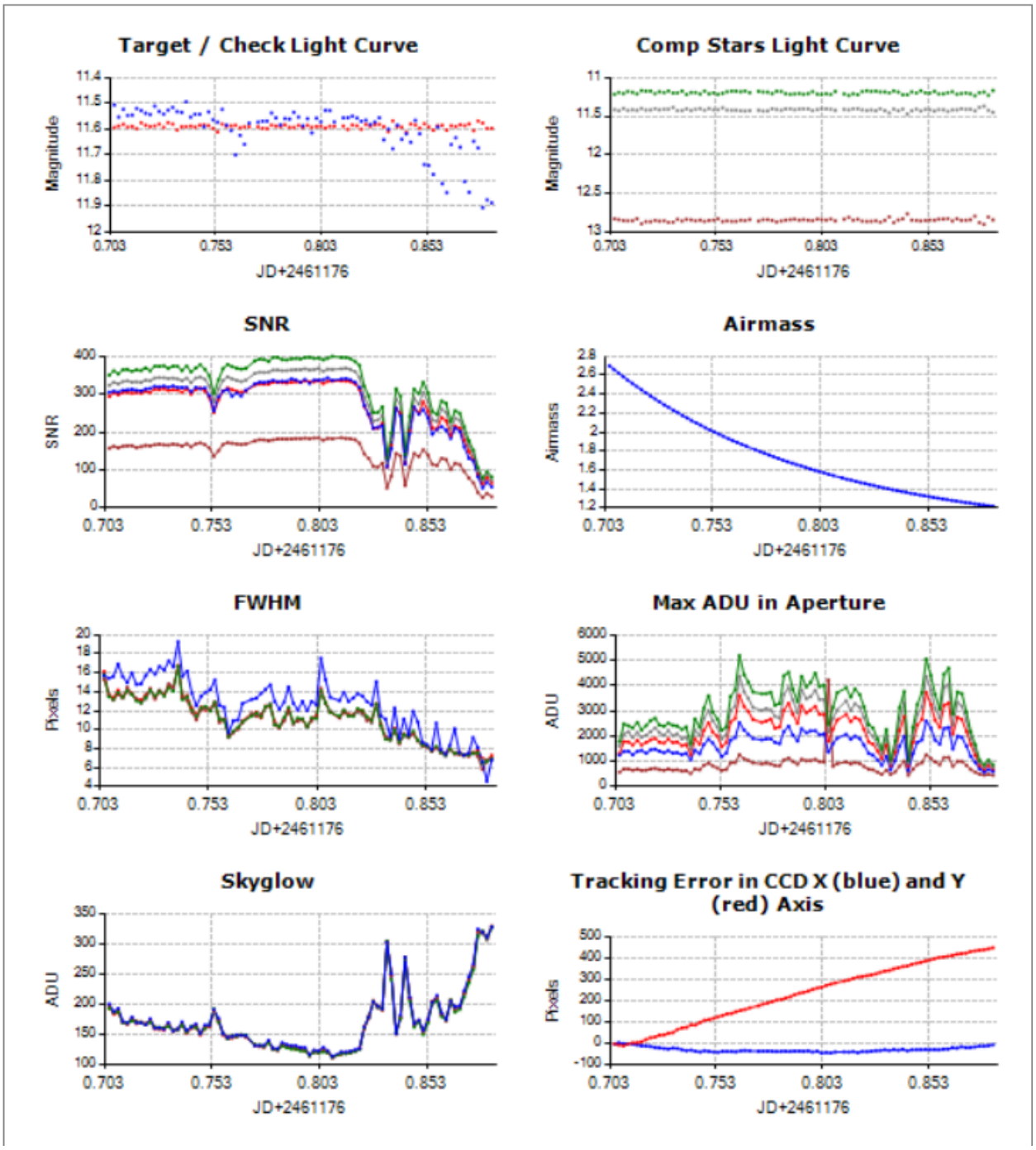
NEW:



OLD:


11.5
11.6
11.7
11.8
11.9
12
Magnitude
0.703
0.753
0.803
0.853
JD+2461176

Overall data:



Next attempt, re running the time series with varying aperture sizes to see if there's any significant change in the resulting mag v time plot

Using the FWHM plot above, I'm inclined to take the mode/mean of the values to determine which would be the best FWHM measurement to use to calculate an aperture radius…

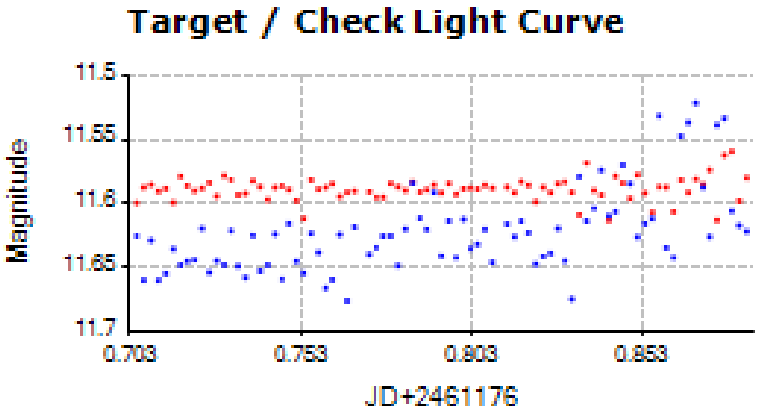
I'm not sure which would be the best option of the three though… I feel that mean would use the value that follows the overall trend, while the mode would be a good radius to use for most images, it may not be the best for the rest. I'll start with the mean for now.

Using the calculated MEAN, MODE, and MEDIAN of the FWHM and writing up a function in python I calculated the radii and widths for the aperture based on all three:

- MEAN: 12.134915662650602
    - APERTURE RADIUS RANGE: 18.202373493975905-24.269831325301205 px
    - GAP_WIDTH: 12.134915662650602 px
    - SKY ANNULUS WIDTH: 36.40474698795181-60.67457831325301 px
- MODE: 18.461
    - APERTURE RADIUS RANGE: 27.691499999999998-36.922 px
    - GAP_WIDTH: 18.461 px
    - SKY ANNULUS WIDTH: 55.382999999999996-92.30499999999999 px
- MEDIAN: 12.409
    - APERTURE RADIUS RANGE: 18.613500000000002-24.818 px
    - GAP_WIDTH: 12.409 px
    - SKY ANNULUS WIDTH: 37.227000000000004-62.045 px

Hmmm… There's no good way of putting this into VPHOT, I think I may only be able to adjust the inner aperture radius range. I should be able to do this with AstroImageJ i believe

Ok, so doesn't work…We definitely have to work with a changing aperture. The question is whether 1.5 times the FWHM is best?? I assume I would need to make it a biut smaller to avoid contamination from the other star, right??

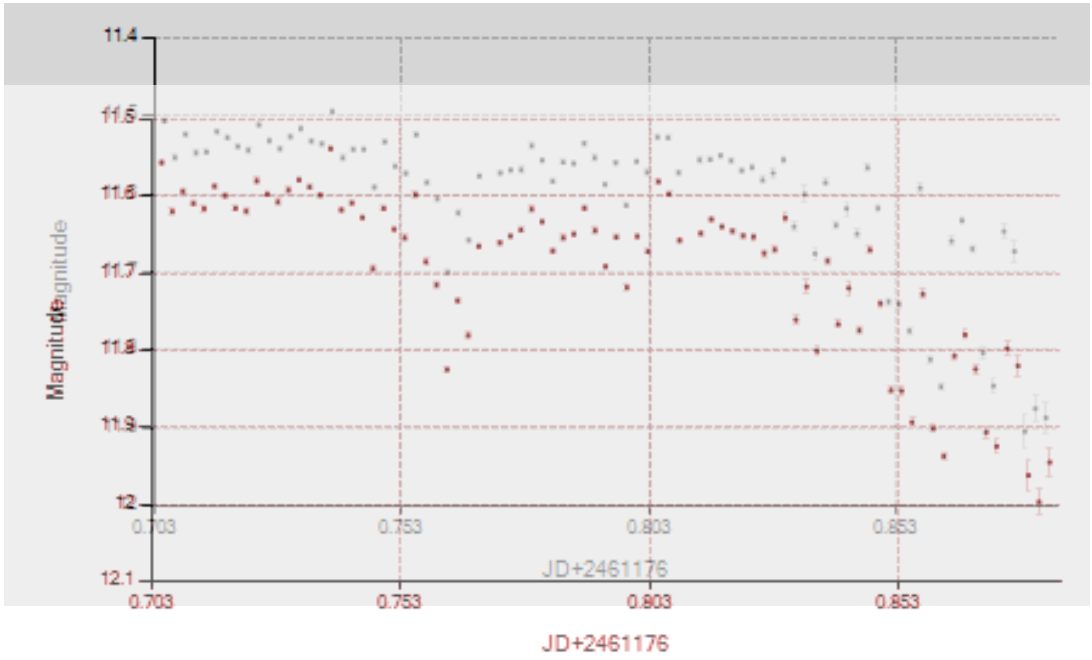


Attempting a smaller factor for calculating the automatic aperture:

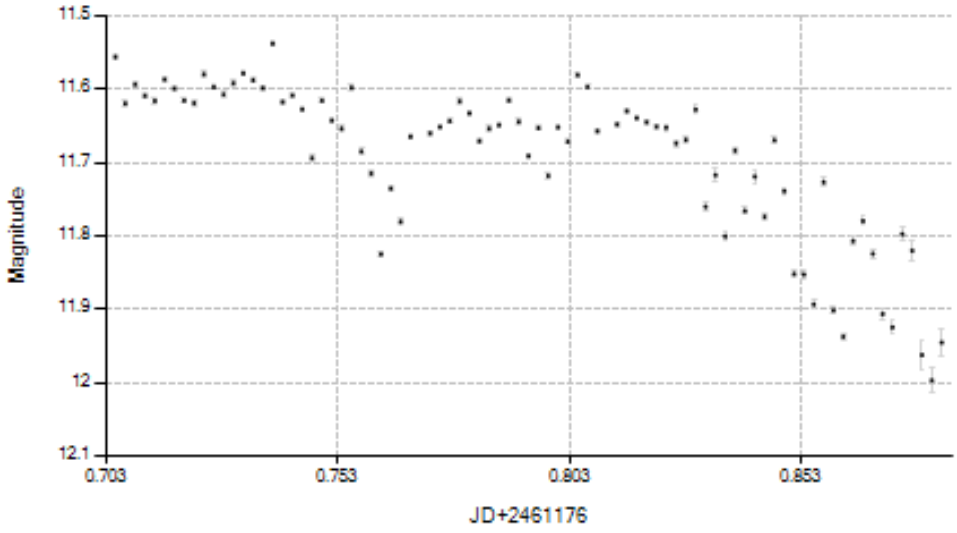
Maybe 1.2… Need to find a more objective way of determining this factor

Argh… so I can't visually tell whether it improved.

NEW (red) v OLD (black):

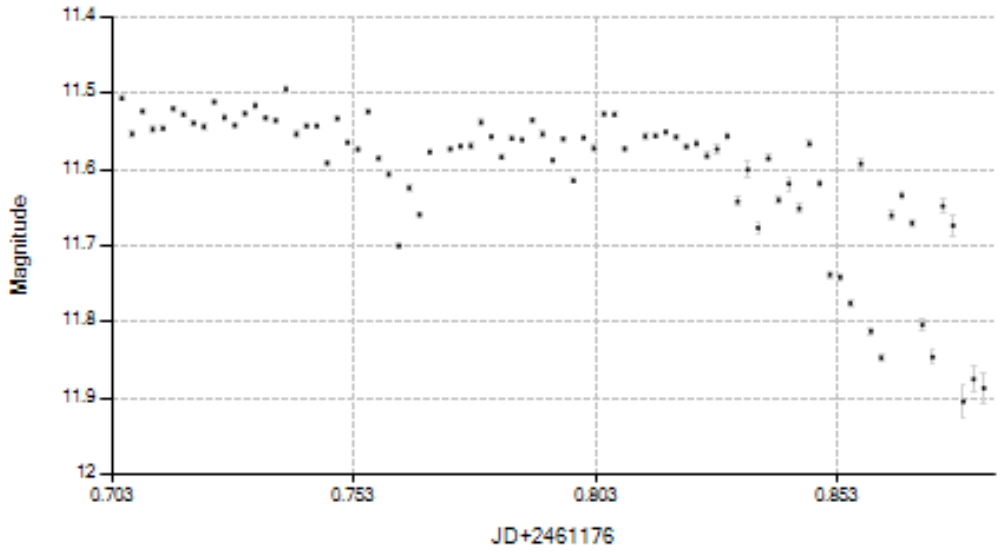


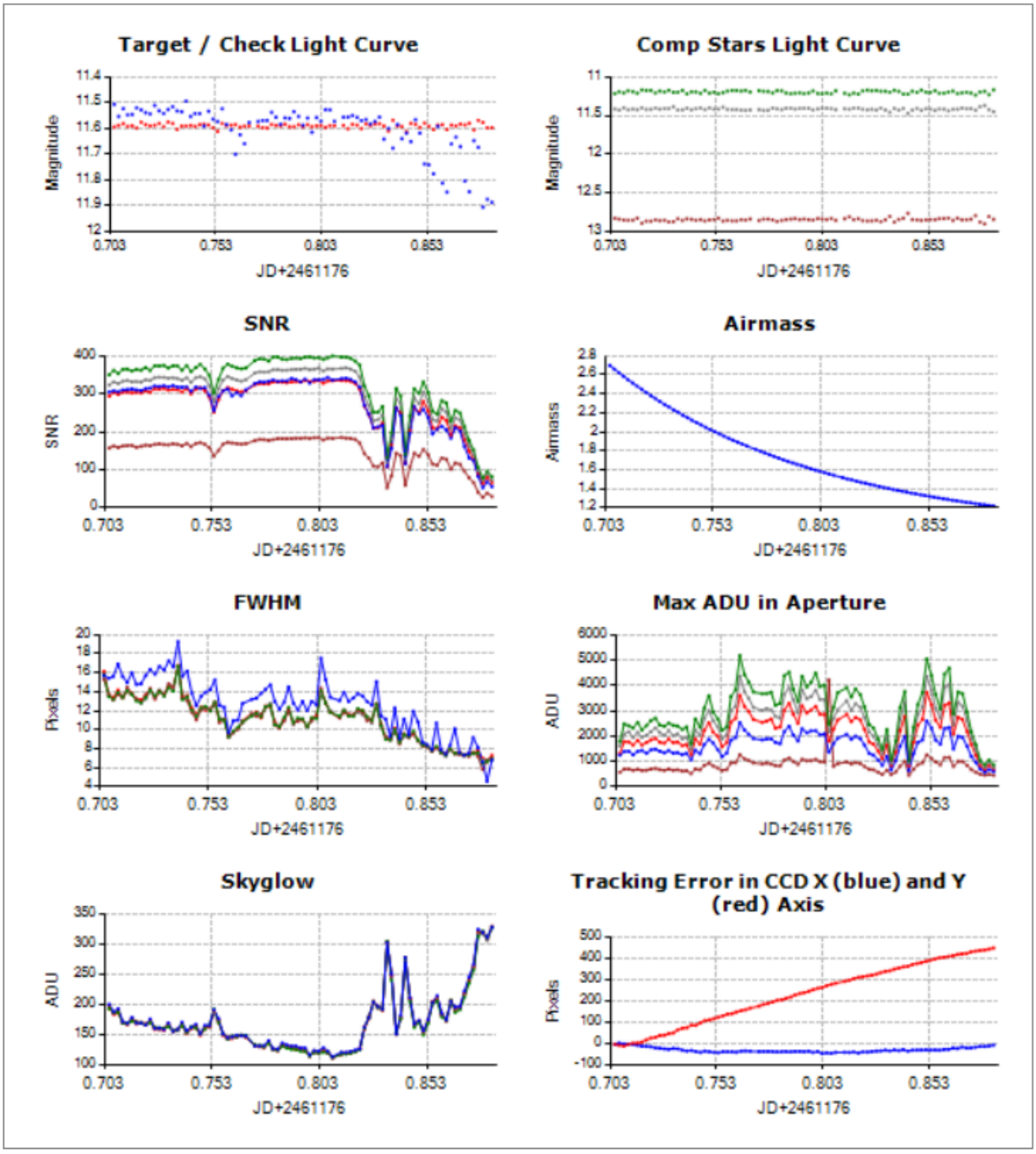
JUST NEW:



Maybe I'll keep it as the standard 1.5 for now until I can find a better way of calculating this factor.

FINAL CURVE FOR NOW:




Target / Check Light Curve
Magnitude
JD+2461176
Comp Stars Light Curve
Magnitude
JD+2461176
SNR
SNR
JD+2461176
Airmass
Airmass
JD+2461176
FWHM
Pixels
JD+2461176
Max ADU in Aperture
ADU
JD+2461176
Skyglow
ADU
JD+2461176
Tracking Error in CCD X (blue) and Y (red) Axis
Pixels
JD+2461176