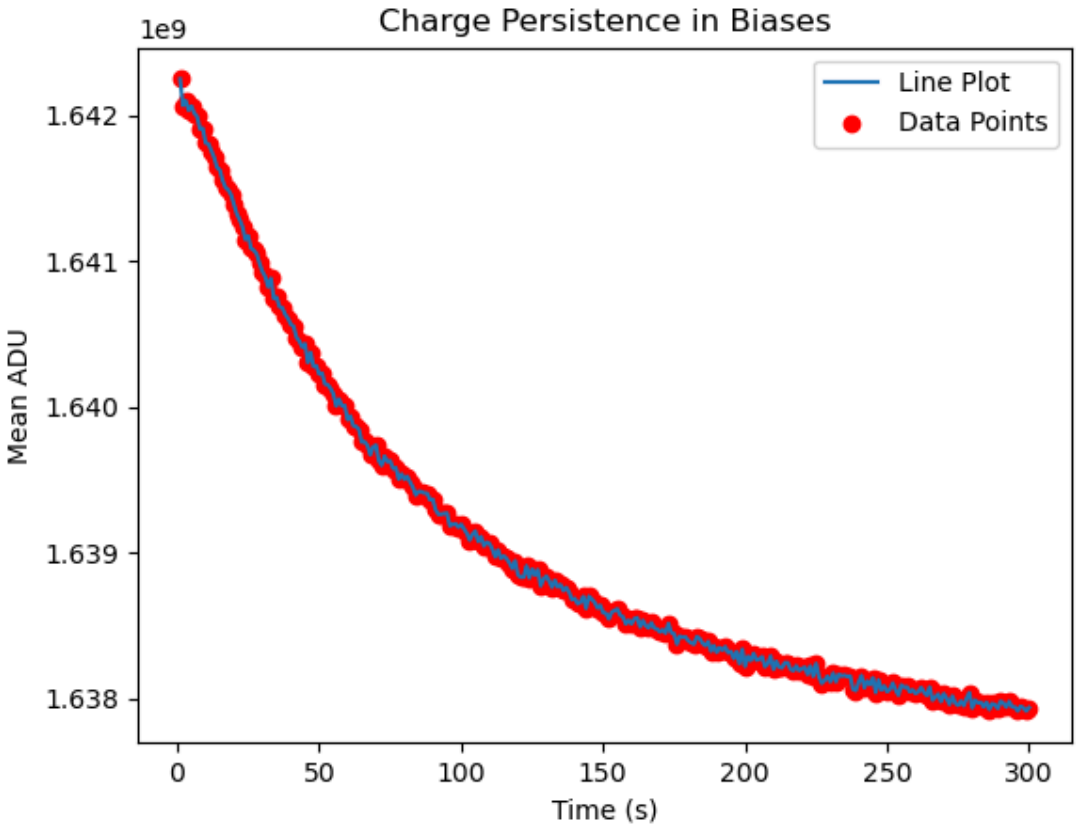
Charge Persistence

Procedure:

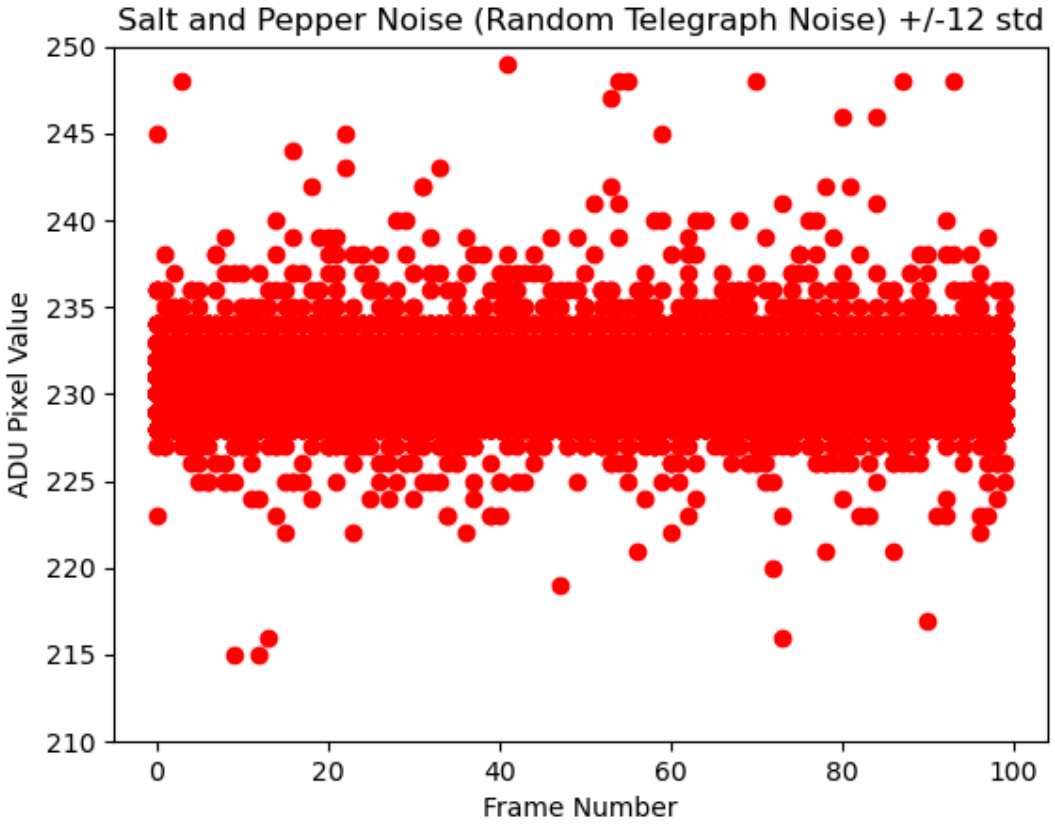
1. Open the shutter for the camera for 10 seconds and let all the pixels saturate.
2. Then immediately close the shutter and take 1 second images consecutively.
3. Graph Average signal (ADU) vs time for the images taken.



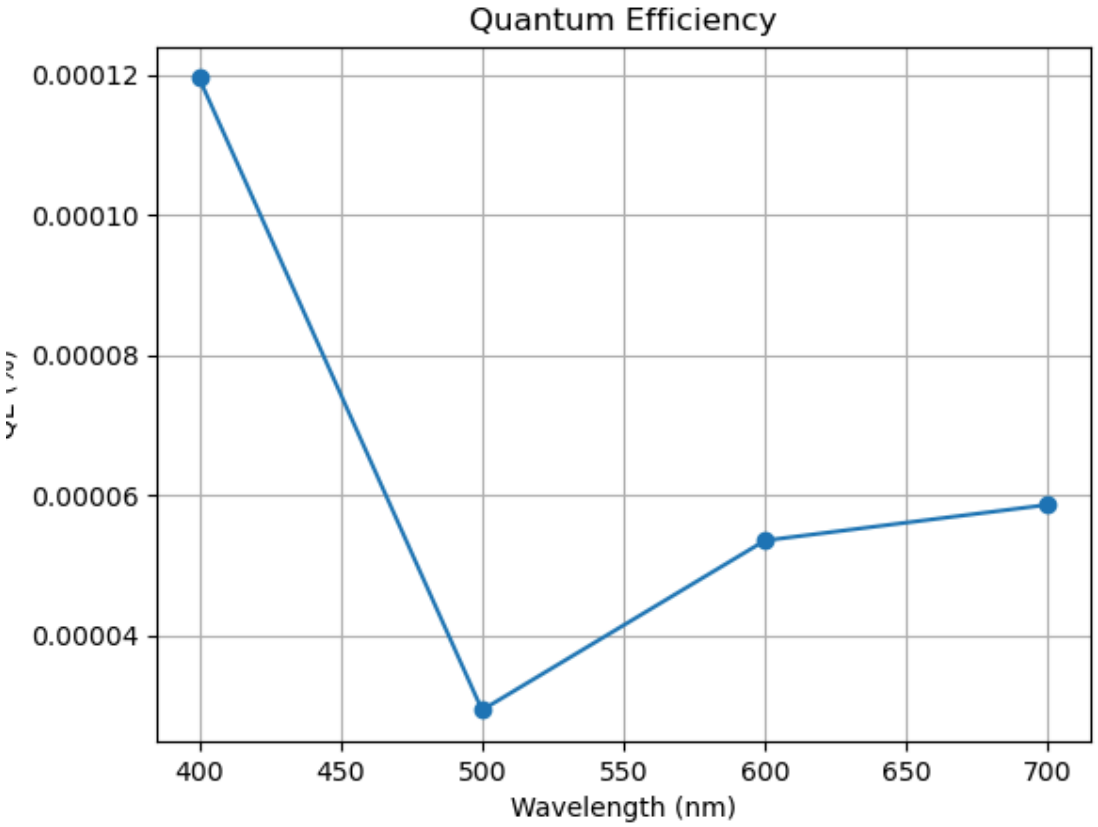
Salt and Pepper Noise

Procedure:

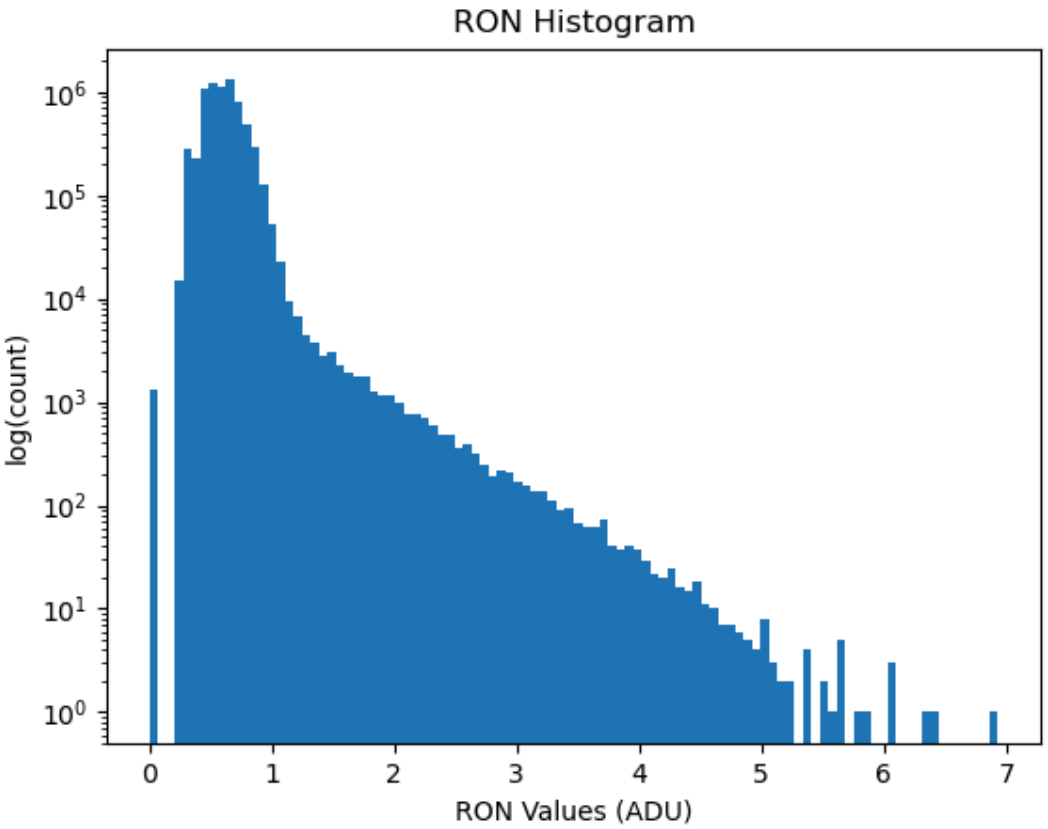
1. Take 100 bias frames.
2. Take a smaller region of interest (ROI (30x30 pixels)). This region will contain pixels with a much higher standard deviation.
3. Graph the value of the pixels in ADU for each of the 100 frames.



Quantum Efficiency



Read Out Noise

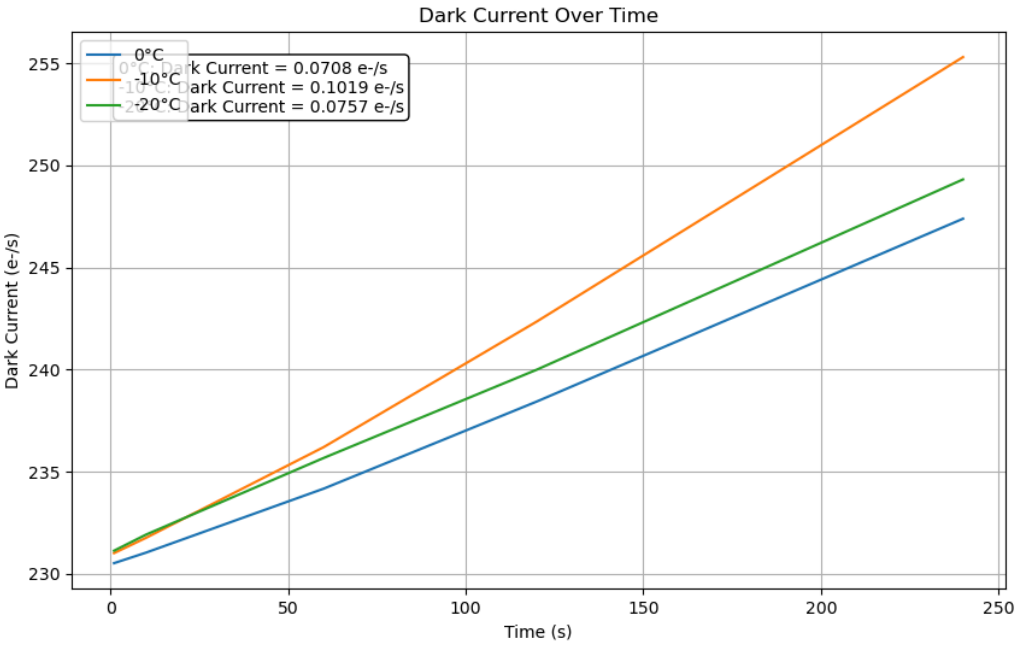


Dark Current

Procedure:

1. Take 10 dark frames (shutter closed) at the a temperature and varying exposure times- 1 seconds, 10 seconds, 60 seconds, 120 seconds and 240 seconds.
2. Repeat the first step for five different sensor temperatures- 0°C,-5°C,-10°C,-15°C, -20°C.
3. Take Bias images and create master bias for all the temperatures using median 3 sigma clipping on individual biases then average each pixel together.
4. Subtract master bias from each individual frames.
5. Dark current is calculated as follows-

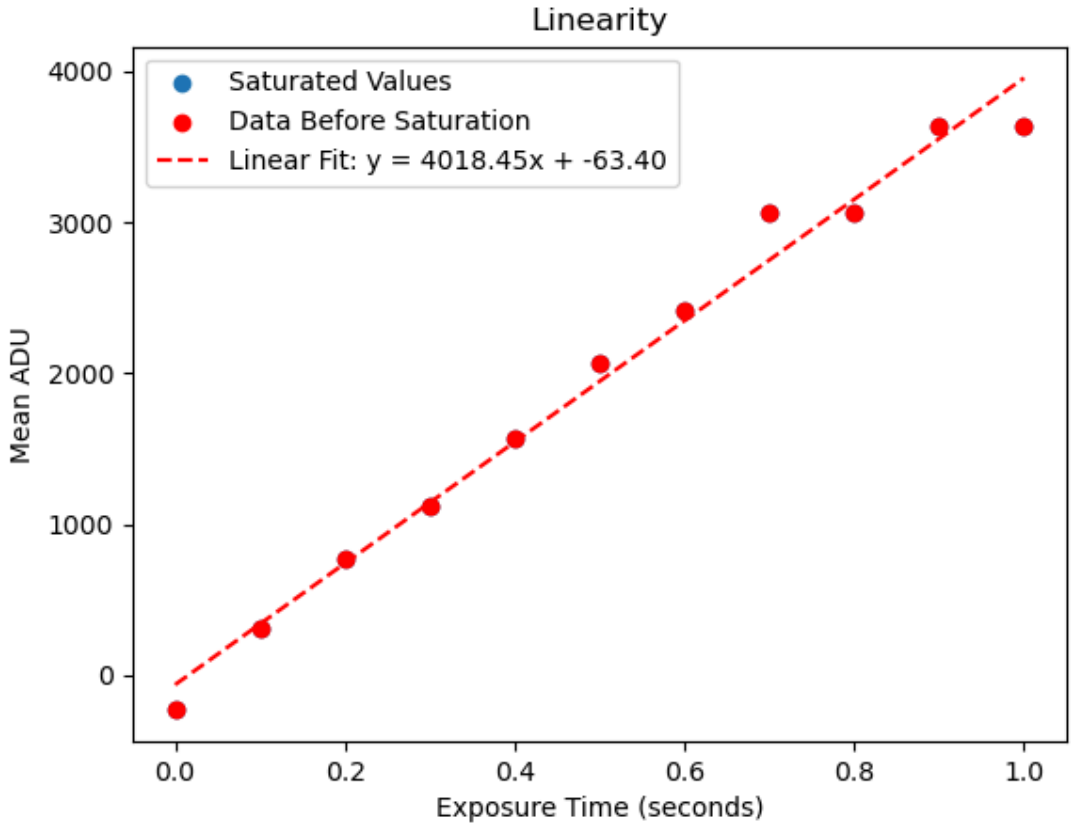
$$D_c = \frac{\sigma_{1-10} - MasterBias_{e-}}{t}$$

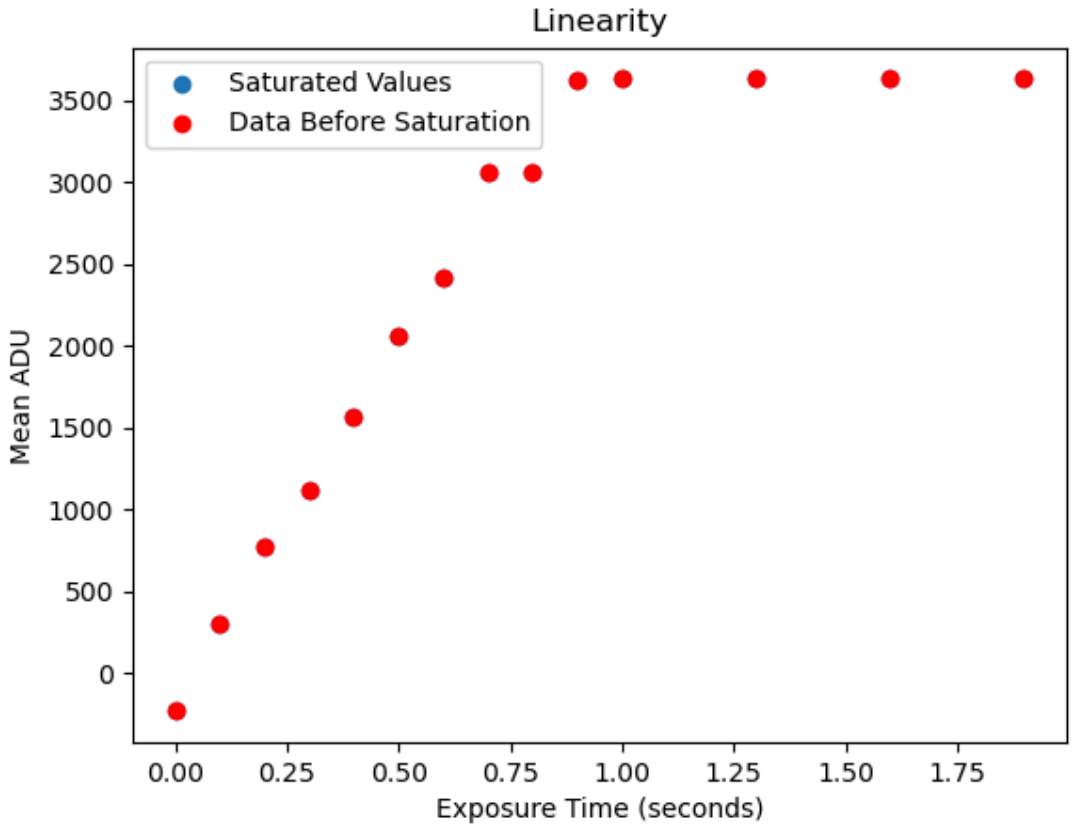


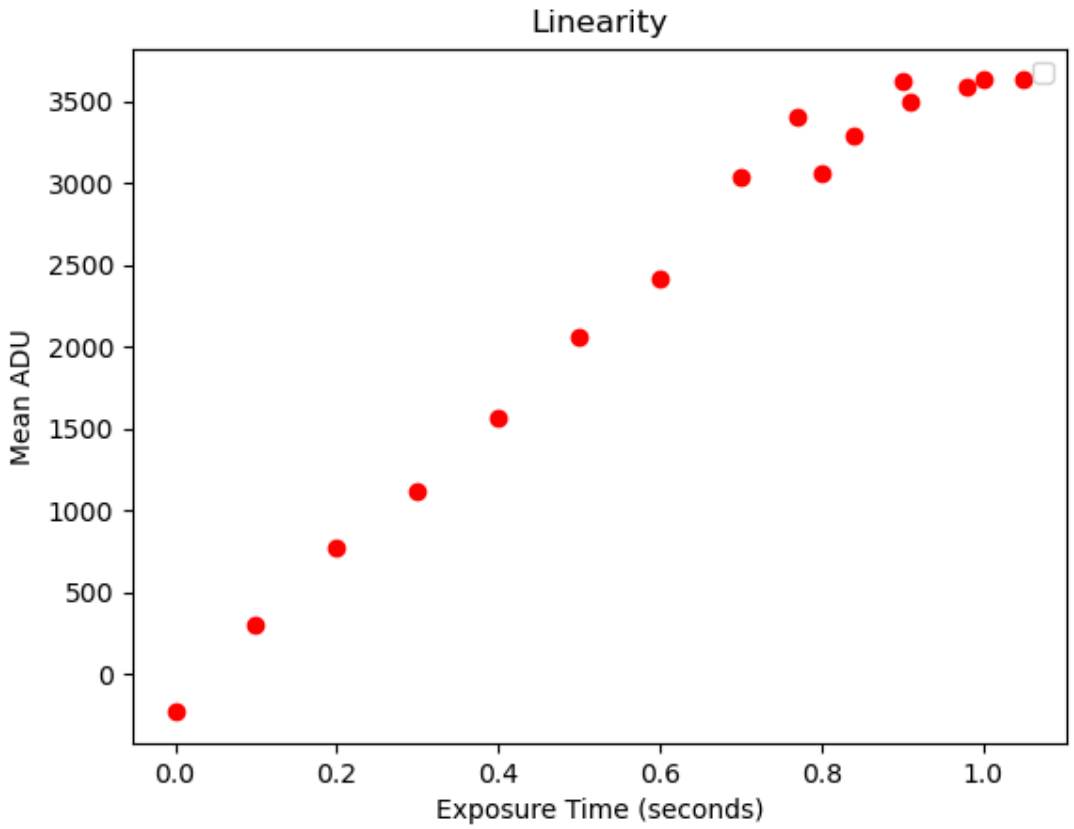
Linearity

Procedure:

1. Take 3 illuminated images while increasing the exposure time until the saturation point is reached.
2. Take 3 bias images before and after each series of illuminated images and stack them by median 3 sigma clipping and subtract it from all the illuminated images.
3. Use a central Region of Interest (ROI (4096x4096)) unbiased pixels.
4. The signal(ADU) is the mean of the three images stacked and plotted against exposure time.


Linearity
Saturated Values
Data Before Saturation
Linear Fit: y = 4018.45x + -63.40
Mean ADU
Exposure Time (seconds)
4000
3000
2000
1000
0
0.0
0.2
0.4
0.6
0.8
1.0

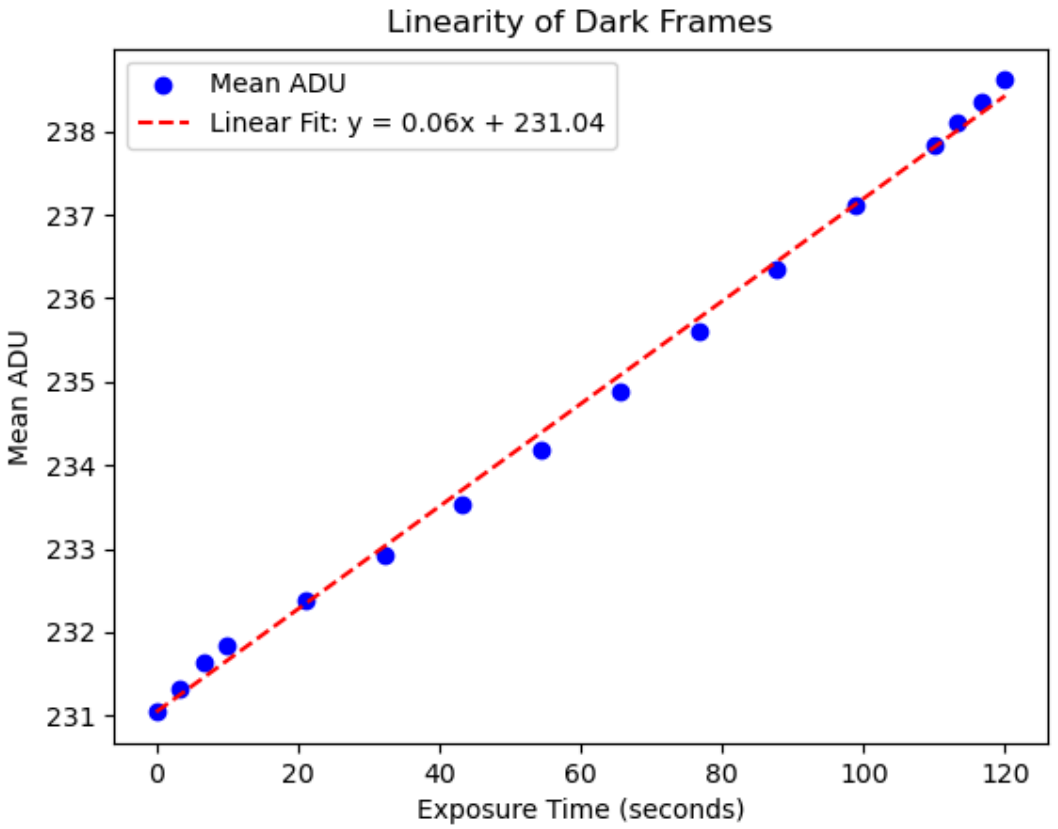

Linearity
Saturated Values
Data Before Saturation
Mean ADU
Exposure Time (seconds)
3500
3000
2500
2000
1500
1000
500
0
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75



Linearity can also be calculated using this alternative procedure by taking dark frames-

Procedure:

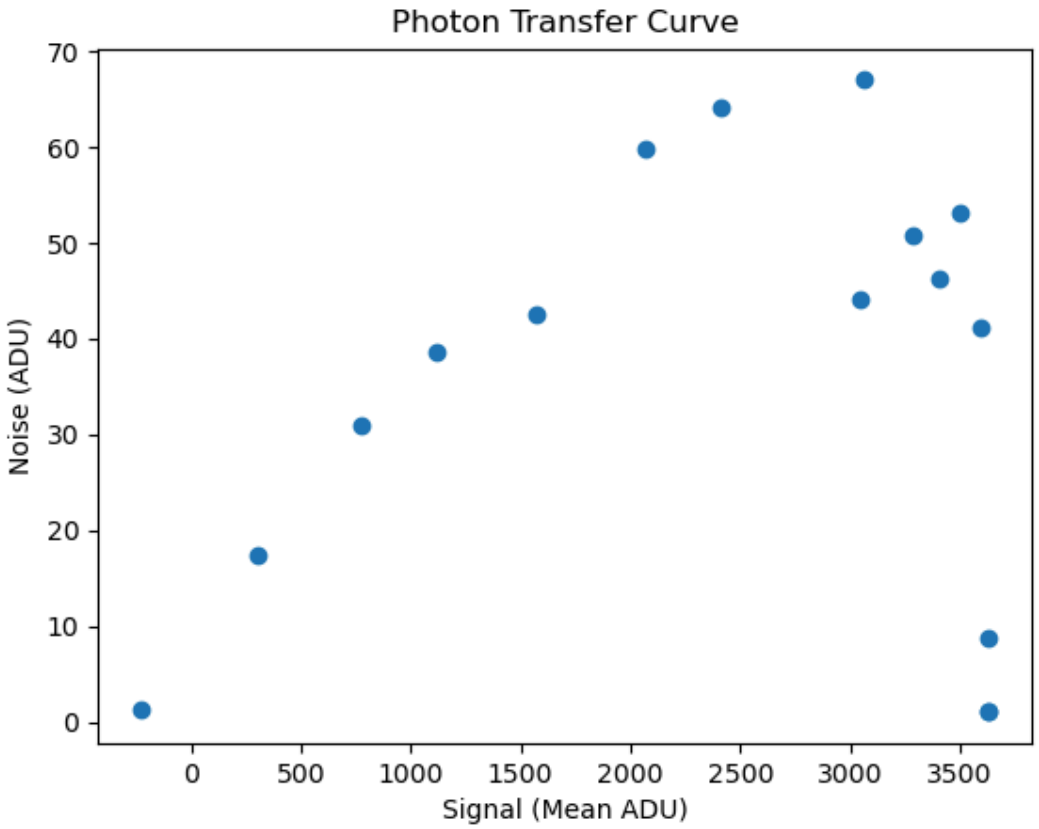
1. Take 30 dark frames with an exposure time varying between 0s and 120s.
2. For each dark frame, obtain the mean pixel value in ADU.
3. Graph mean ADU vs exposure time for all the dark frames taken.



Photon Transfer Curve

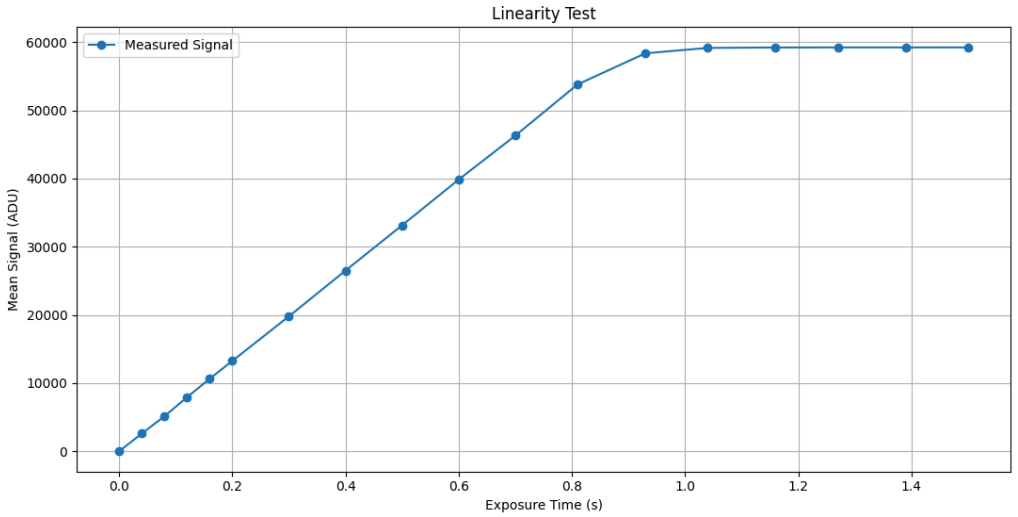
Procedure:

1. Take 3 illuminated images while increasing the exposure time until the saturation point is reached.
2. Take 3 bias images before and after each series of illuminated images and stack them by median 3 sigma clipping and subtract it from all the illuminated images.
3. Use a central Region of Interest (ROI (4096x4096)) unbiased pixels.
4. The signal(ADU) is the mean of the three images stacked and plotted against noise (ADU) which is the mean of the standard deviation across the 3 frames.

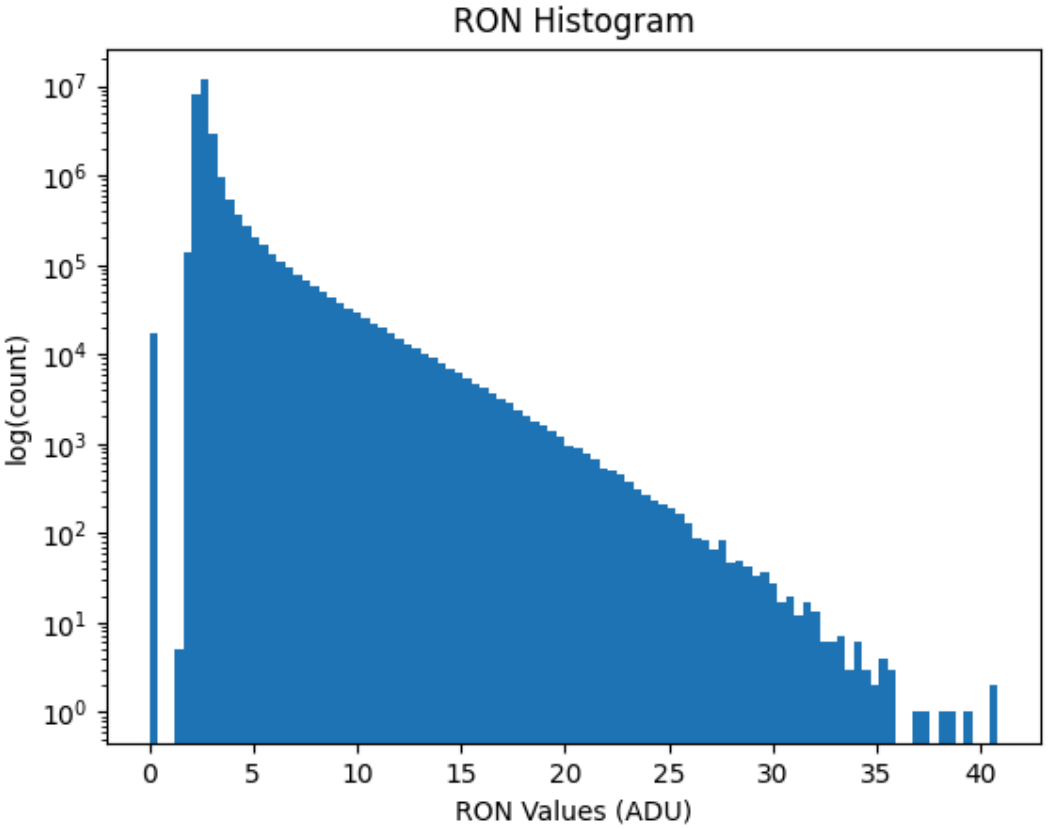


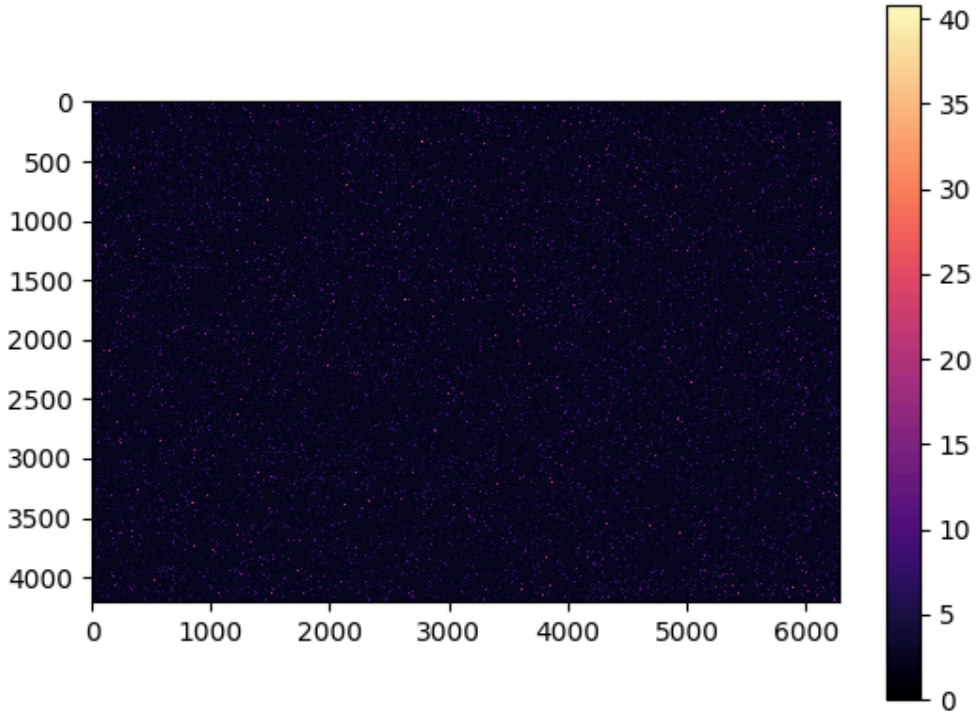
New Camera Plots:-

Linearity

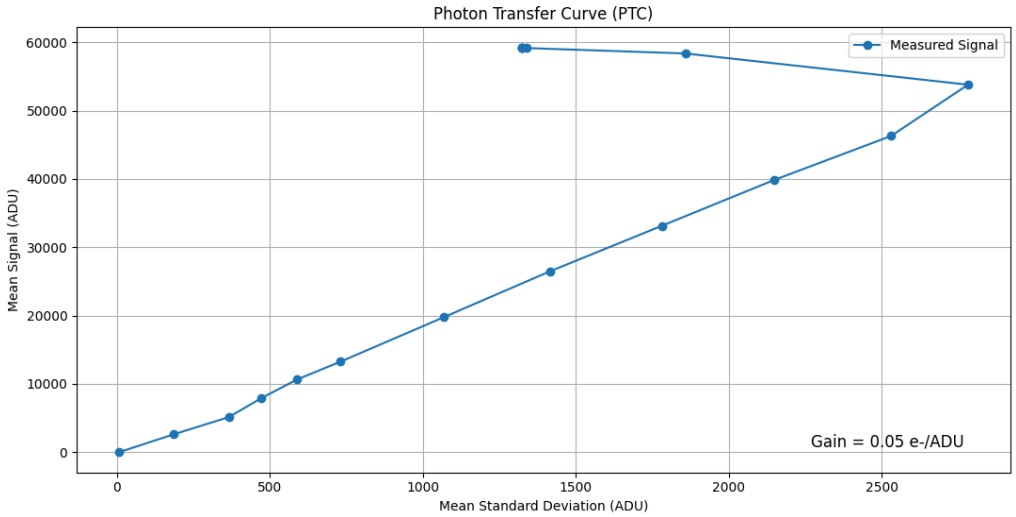


Read Out Noise:-

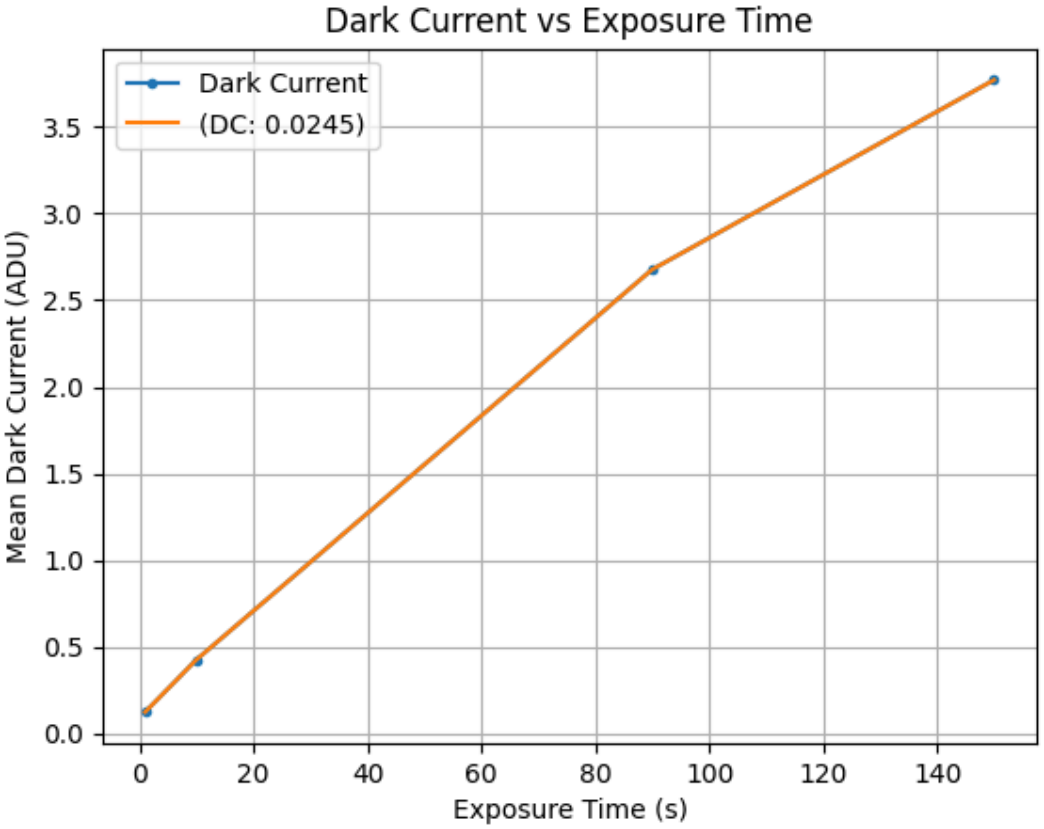

RON Histogram
log(count)
RON Values (ADU)



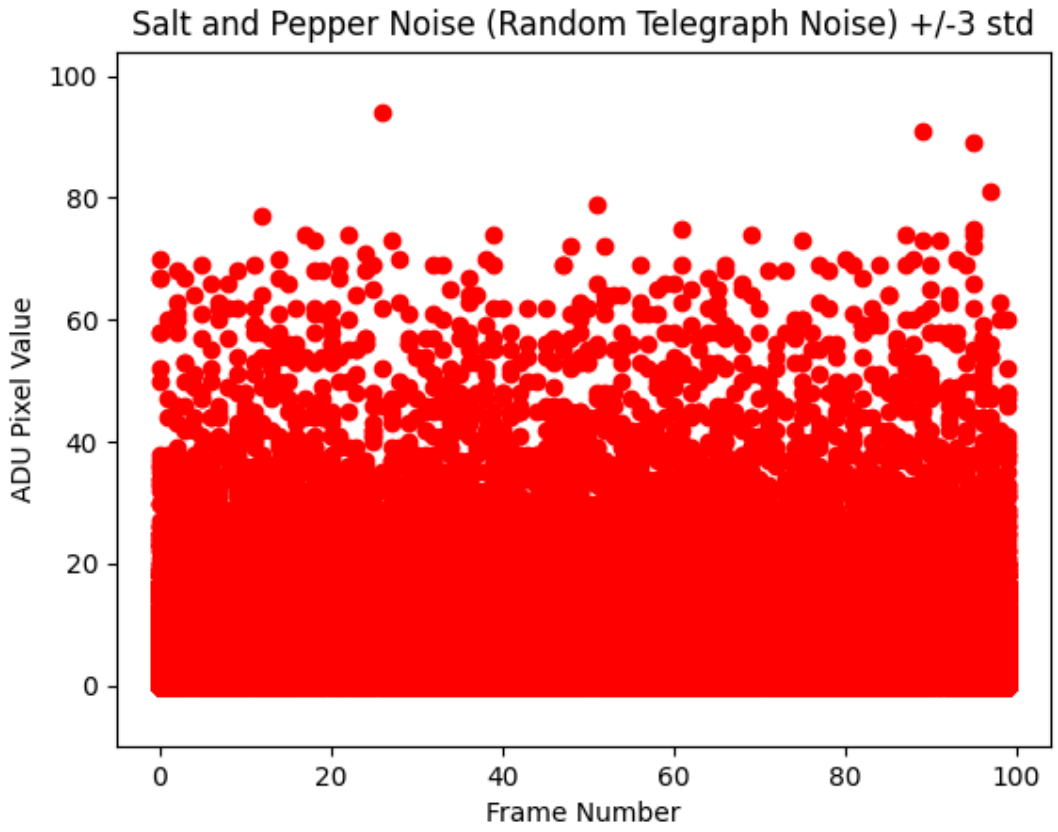
Photon Transfer Curve (Gain) :-



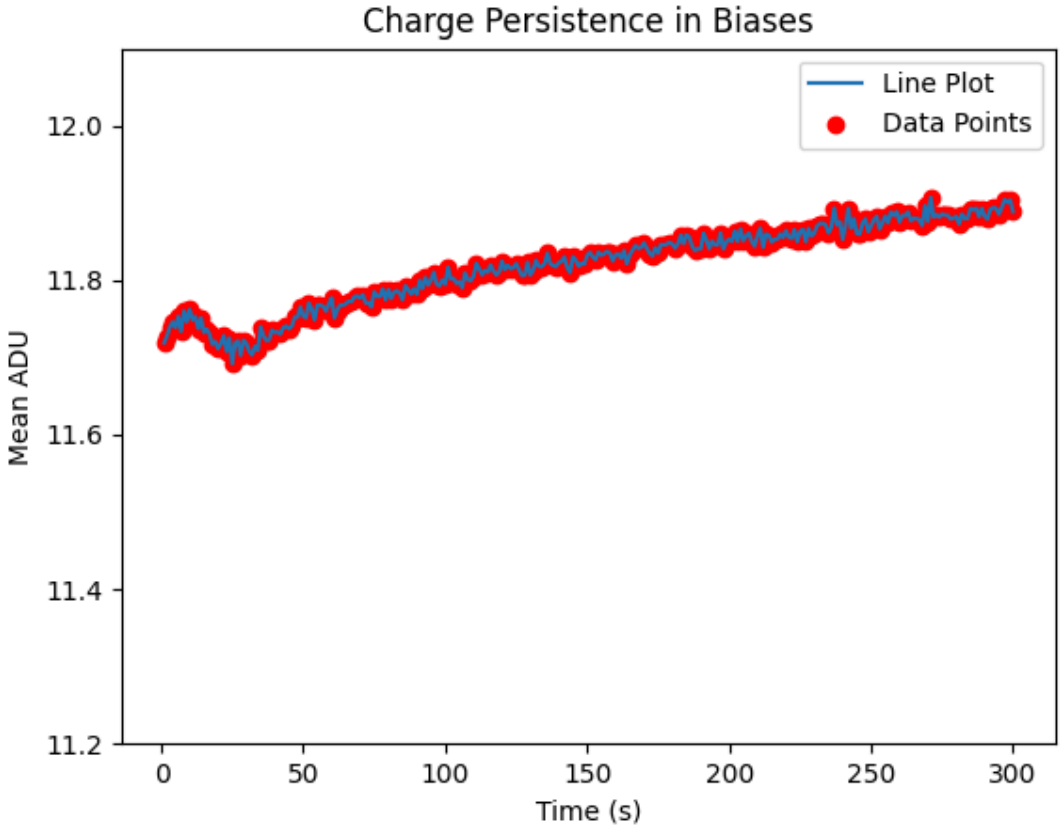
Dark Current:-



Salt and Pepper Noise:-



Charge Persistence:-


Charge Persistence in Biases
Line Plot
Data Points
12.0
11.8
11.6
11.4
11.2
Mean ADU
0
50
100
150
200
250
300
Time (s)