RIPTIDE

April 2024

Gen-Z **Learner's Dictionary**

Chillare: v. *intr. Rilassarsi e prendere le cose con serenità e buon umore.*

RIPTIDE

1) Camera Test Protocols

Machine vision terminology

Exposure time: the time span for which a sensor is exposed to the light so as to record a picture.
Quantum efficiency: how many photons are traducted into electrons
System Gain: represent the number of gray levels that each photoelectron is converted to. [e-/GL]
EM-Gain: an additional mechanism to multiply the number of photoelectrons generated from incident photons.
Readout Noise: includes pixel noise, circuit noise, and ADC quantization noise.
Dark current: noise caused by thermally generated electrons
Bias: offset
Signal in grey level: output of the camera pixel per pixel (due to AD conversion)
Signal in electrons: signal should be quantified in photoelectrons as these are real world values for intensity measurement that allow for consistent signal representation across all cameras.

Machine vision terminology

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Quantum efficiency: how many photons are …
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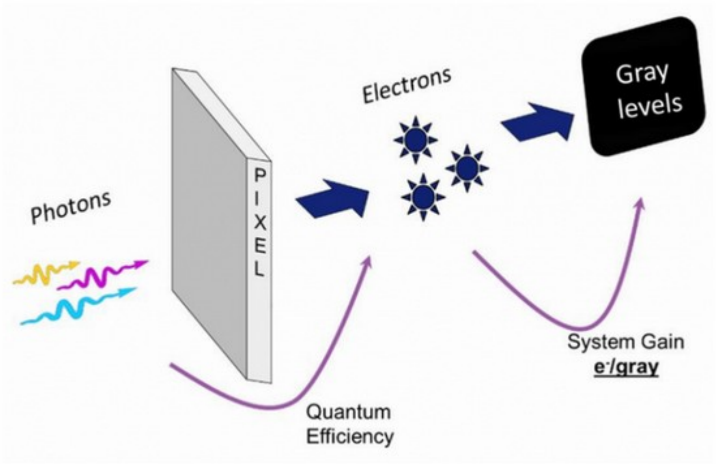


Figure 1: Diagrammatic representation of how photons are converted to gray levels on a scientific camera.

Bias and Read Noise

BIAS:

100 frames at exposure time = 0s

- Make the mean of each image and then the mean between the images

READOUT/READ NOISE:

2 frames at exposure time = 0s

- Make the difference of the two frames

- Calculate the standard deviation of the image

- Convert signal in grey level into signal in electrons

$$\text{Read Noise} = \frac{\text{Standard deviation}_{\text{Diff image}} * \text{Gain}}{\sqrt{2}}$$

System Gain

The number of gray levels that each photoelectron is converted to. [e-/GL]

-acquire 2 light images (black-chamber open)

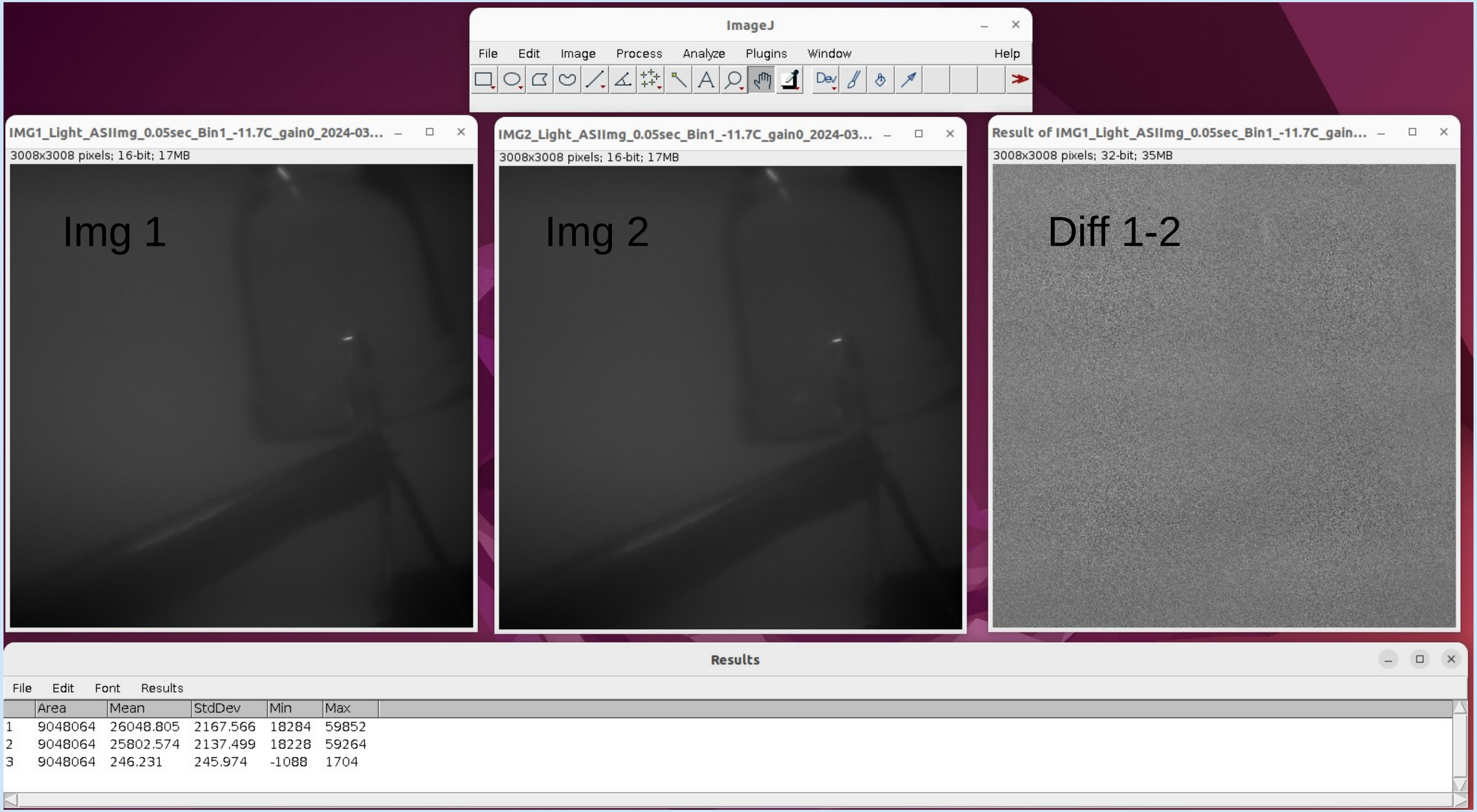
-make the mean of the two images

-make the difference of the two and measure the standard deviation of the difference image (Variance = $STD^2 / 2$)

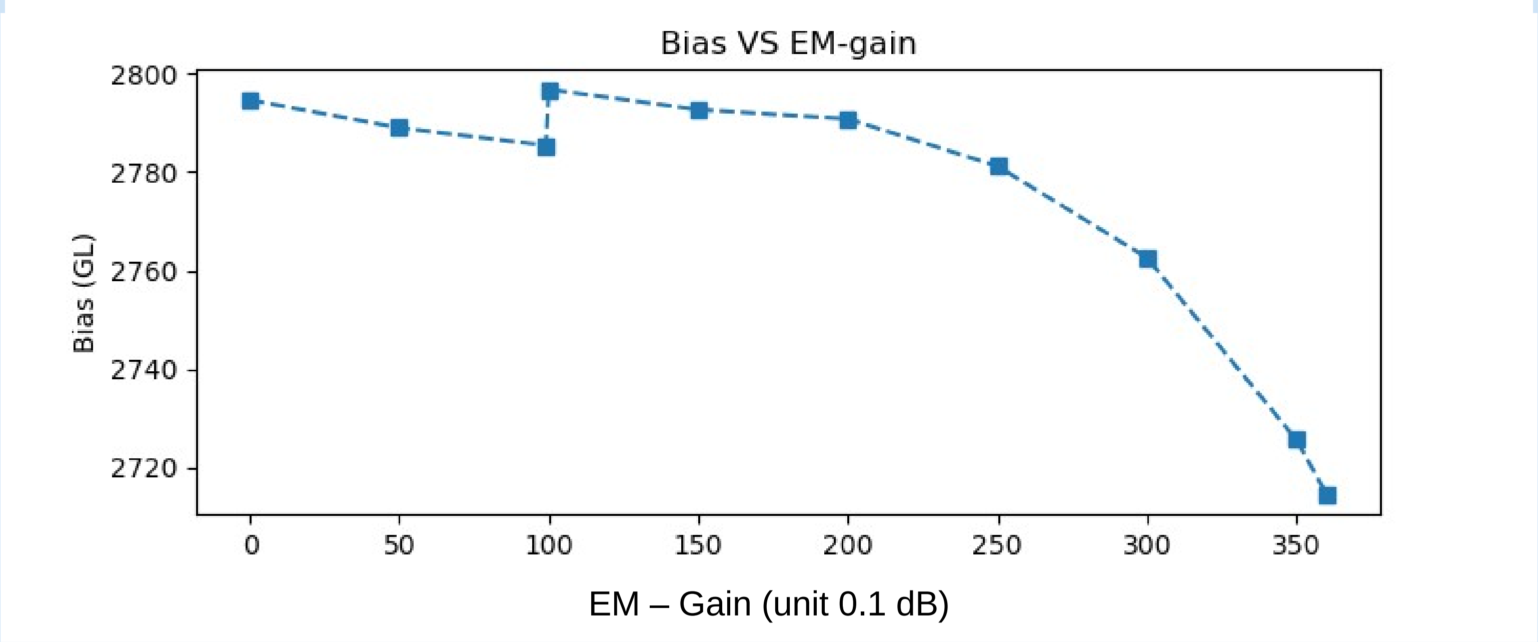
- repeat at different exposure times (10ms, 20ms, 50ms, 100ms)

$$\text{Gain} = \frac{(\text{Mean}_{\text{Image 1,Image 2}}) - \text{bias}}{\text{Variance}_{\text{Image 1,Image 2}}}$$

System Gain

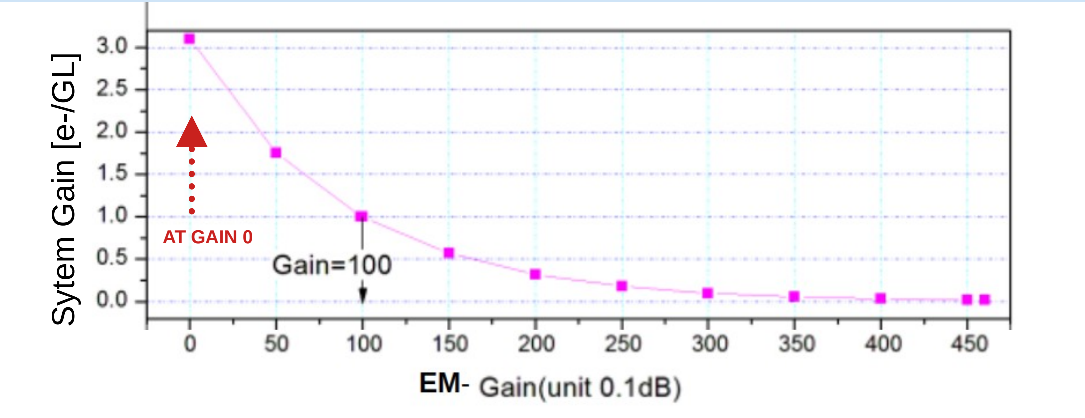

ImageJ
File Edit Image Process Analyze Plugins Window Help
IMG1_Light_ASIImg_0.05sec_Bin1_-11.7C_gain0_2024-03...
3008x3008 pixels; 16-bit; 17MB
Img 1
IMG2_Light_ASIImg_0.05sec_Bin1_-11.7C_gain0_2024-03...
3008x3008 pixels; 16-bit; 17MB
Img 2
Result of IMG1_Light_ASIImg_0.05sec_Bin1_-11.7C_gain...
3008x3008 pixels; 32-bit; 35MB
Diff 1-2
Results
File Edit Font Results
Area Mean StdDev Min Max
1 9048064 26048.805 2167.566 18284 59852
2 9048064 25802.574 2137.499 18228 59264
3 9048064 246.231 245.974 -1088 1704

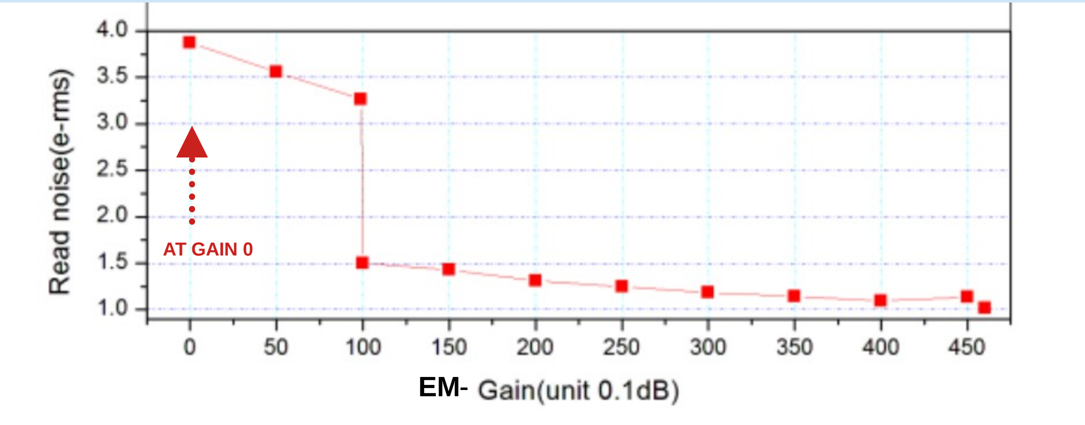
ASI533 Pro


Bias VS EM-gain
Bias (GL)
2800
2780
2760
2740
2720
0
50
100
150
200
250
300
350
EM – Gain (unit 0.1 dB)

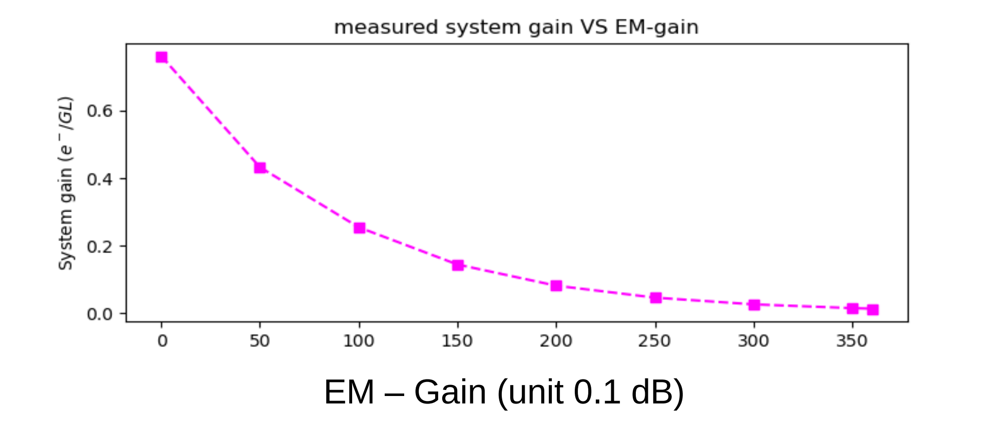
ASI533 Pro

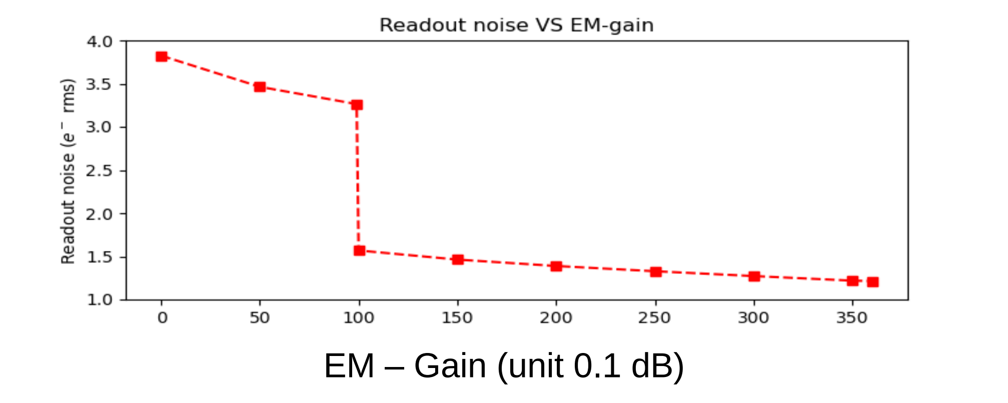
ASI533 - DATASHEET





MYDATA

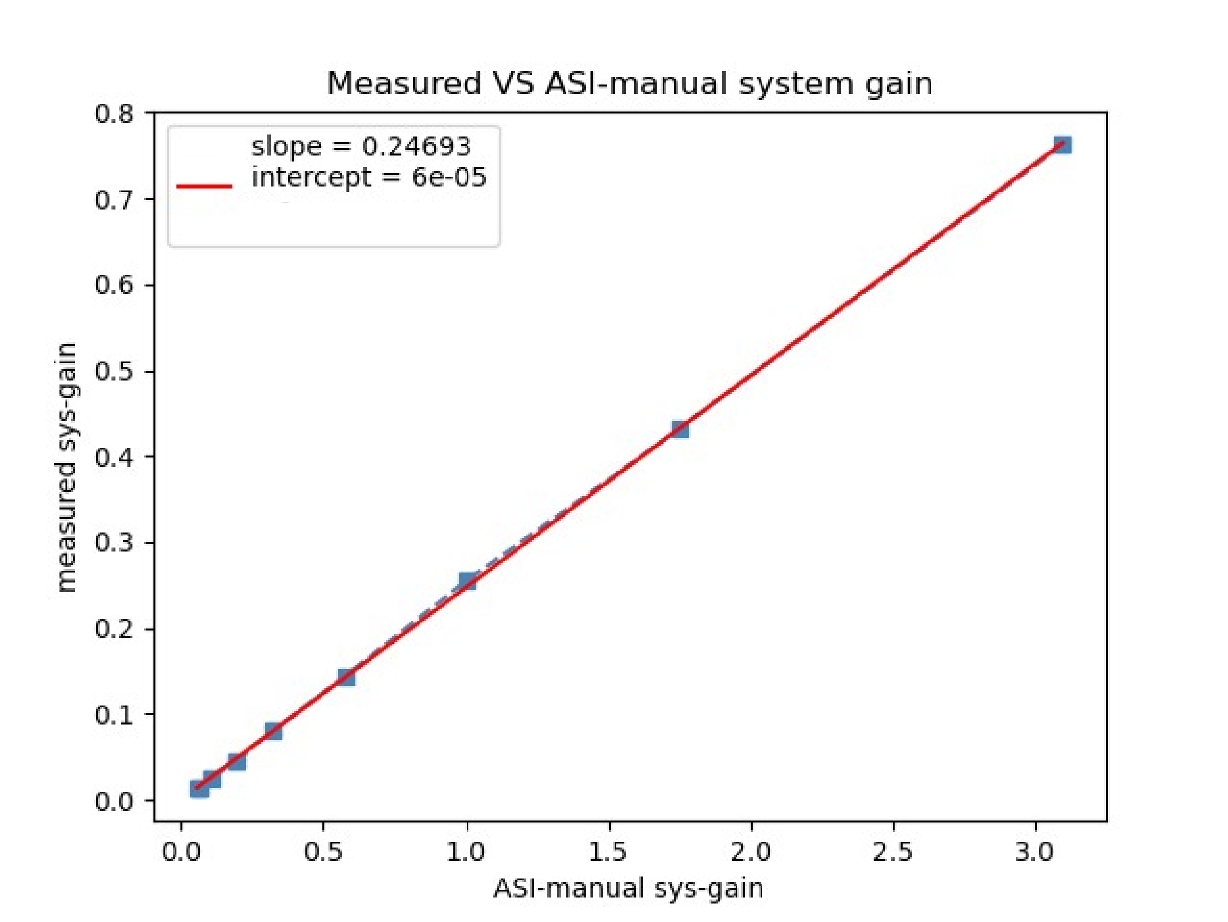




ASI533 Pro

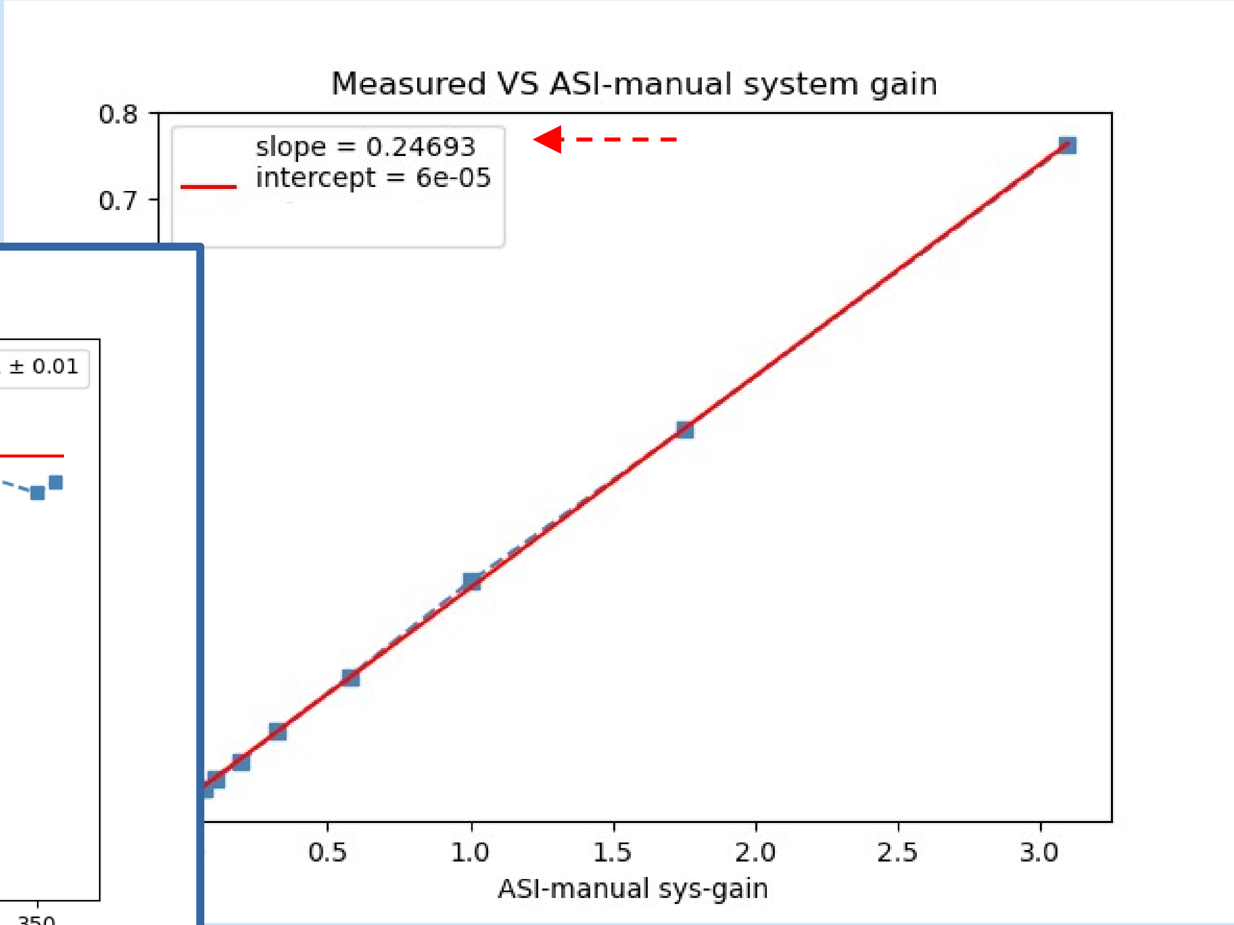
Extracted data from ASI533 datasheet

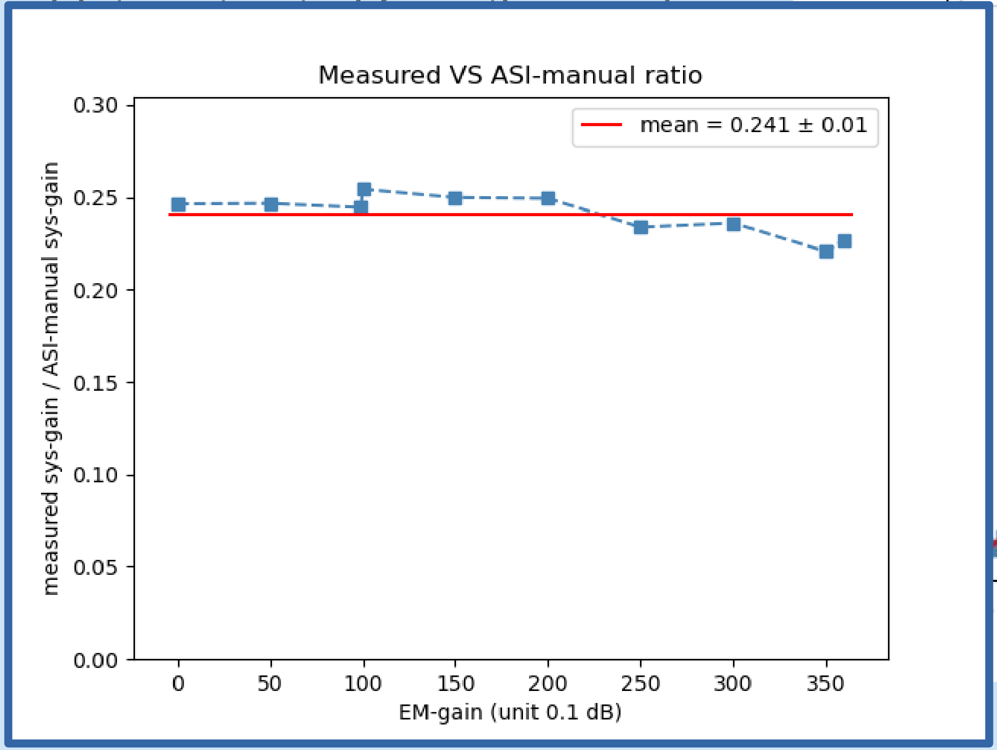
(data extracted from the graph using *WebPlotDigitizer* software)



ASI533 Pro

Extracted data from ASI533 datasheet



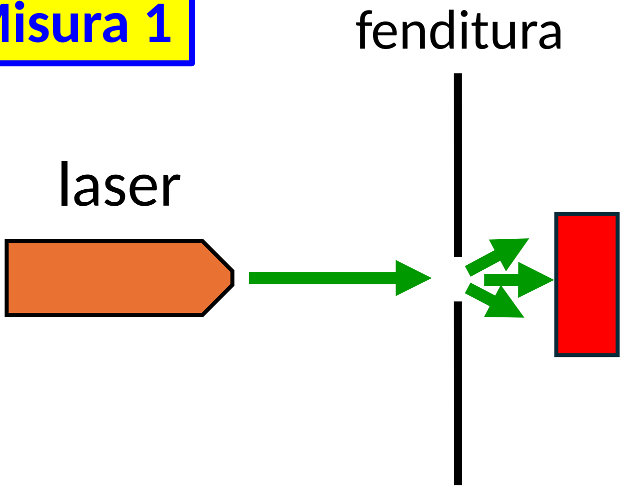


THE END

To do ???

Next future measurements

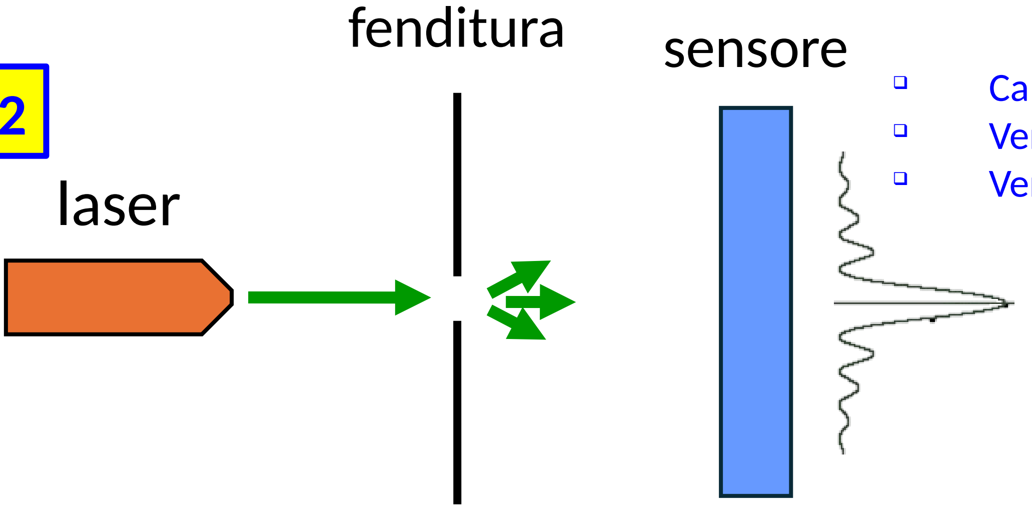
Misura 1



Fotodiodo

misura luce che passa fenditura

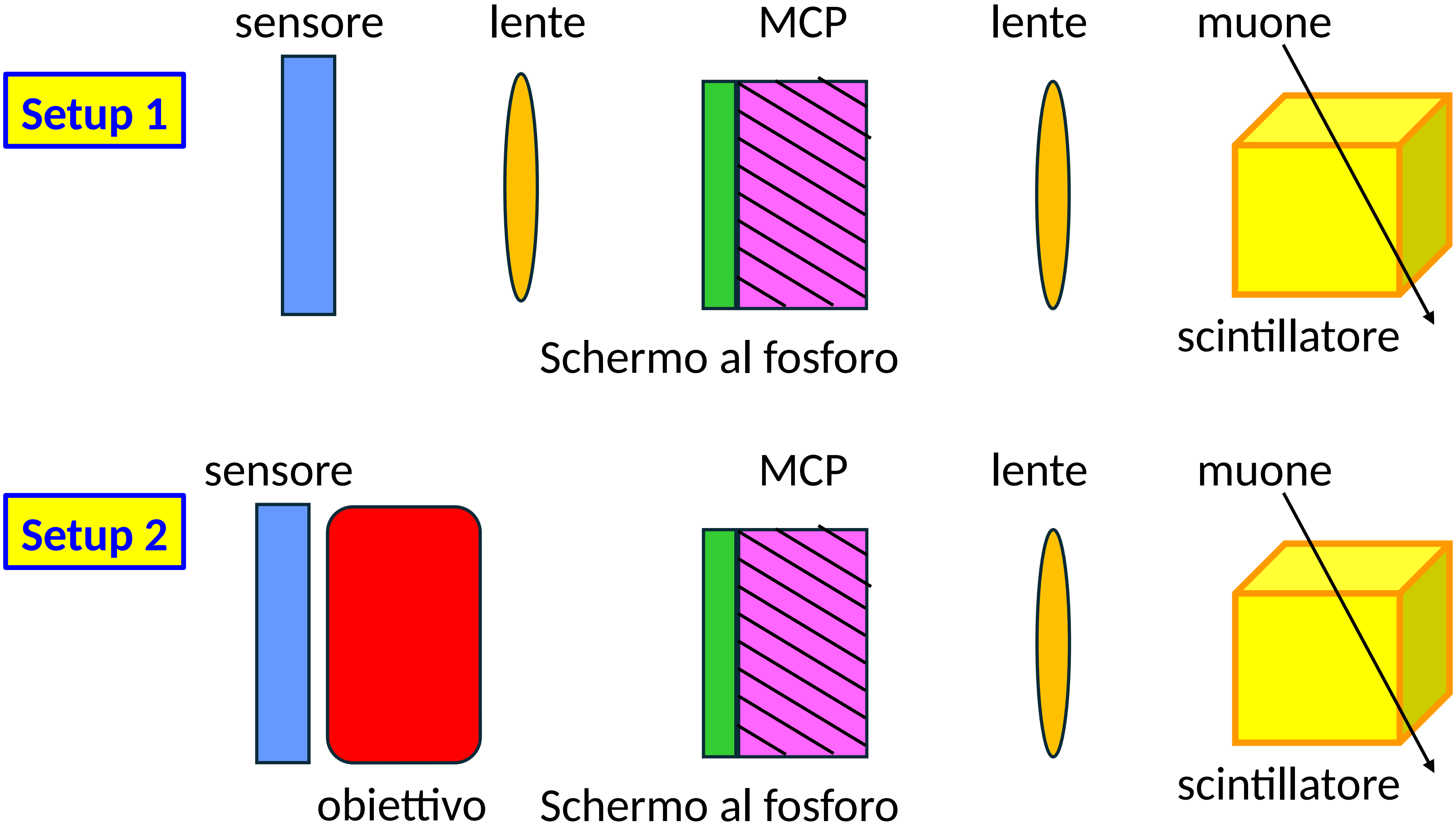
Misura 2



Sensore

- Calibrazione in numero di fotoni (con fotodiodo)
- Verifica se punti luce scalano correttamente
- Verifica sensibilità del sensore

Next measurement with MCP



THE END

(stavolta veramente)

To do ???