Analyzing the SiPM Data

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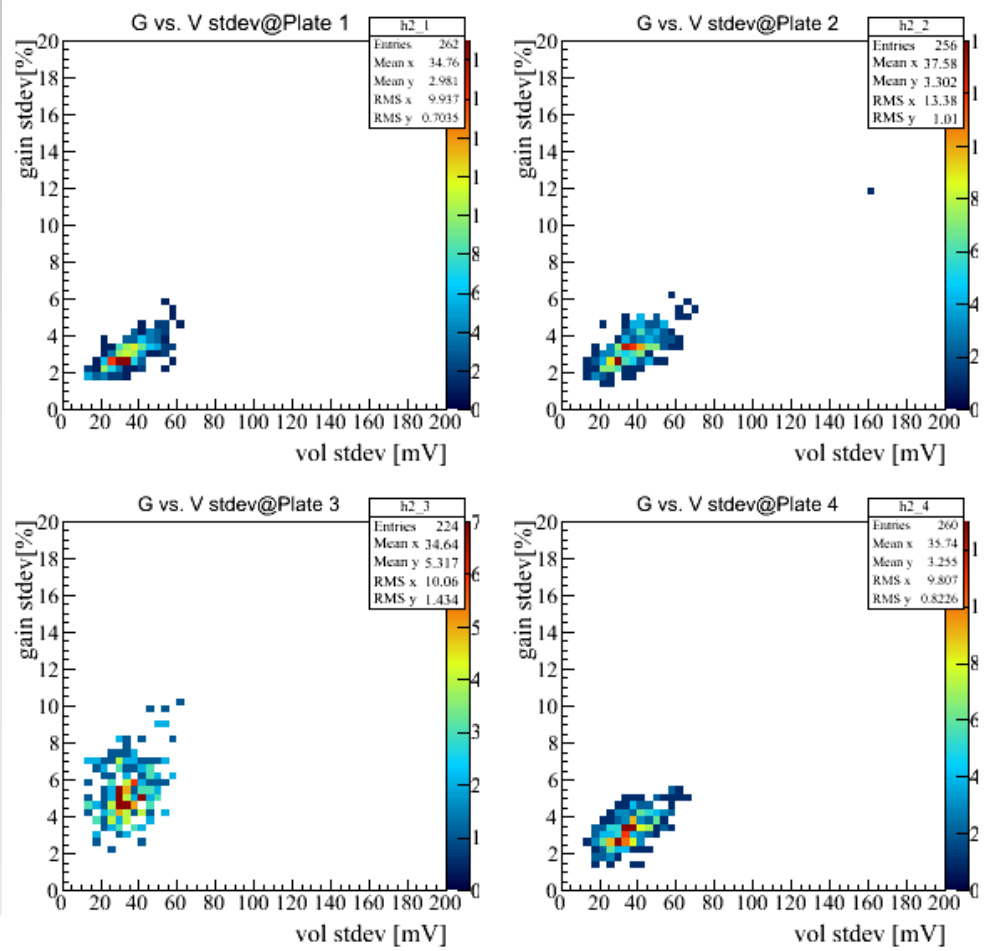
Taking the Data

- We needed to learn the characteristics of the SiPM and find the defective ones. PDE and gain variation must be less than 7.5% at 1.2V offset.
- 998 were originally tested using 0.3 and -0.3 bias voltages, a 300ns gate, and 5 light intensities.
- I tested 52 of them using the same methods.

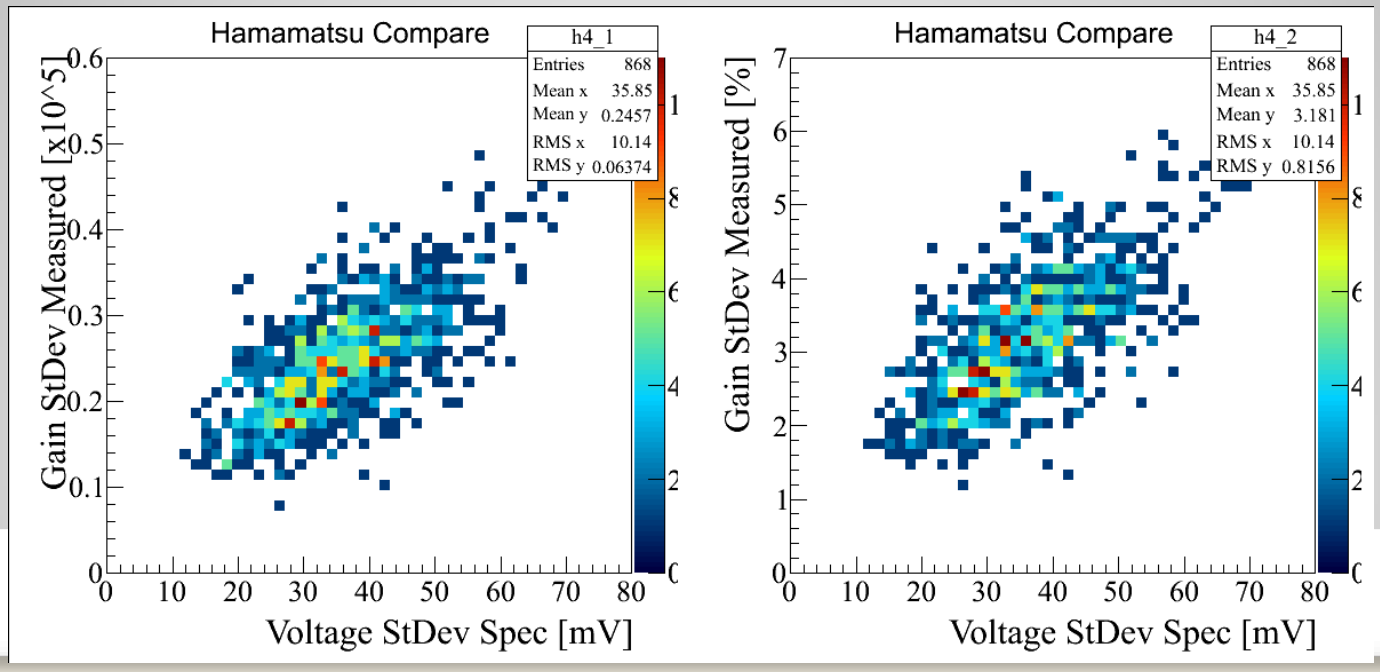
Using Graphs to Find Outliers

- The standard deviation is measured by the variation between the 16 cells in each array.
- SiPM 1442 has unusually high variation.
- Plate 3 provided lower quality data.

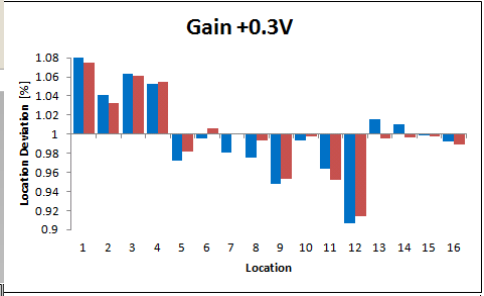


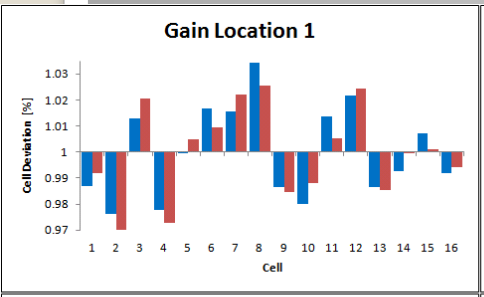
Reliability of Hamamatsu Data

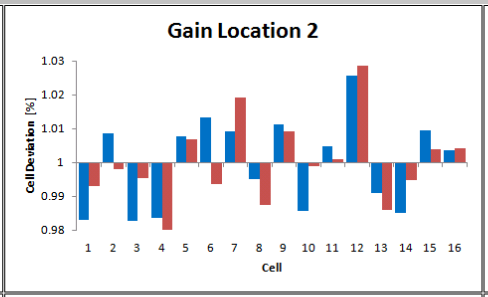
- Our data reflects the data Hamamatsu took
- We can use their data for the SiPMs that were tested on plate 3
- Gain is dependant on the bias voltage, and our gain data is correlated with the voltage data that Hamamatsu took.

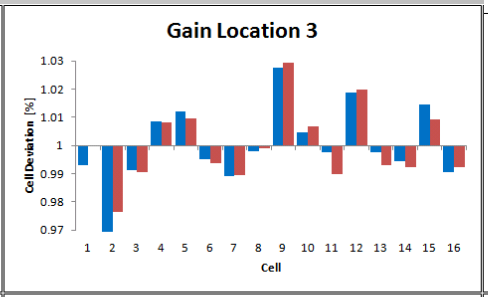


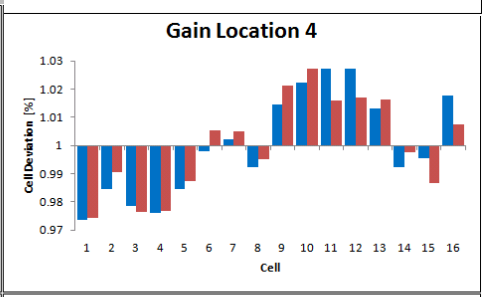
Data Consistency

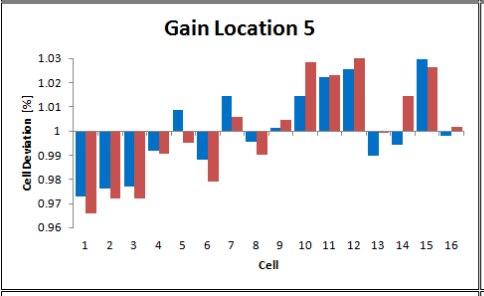


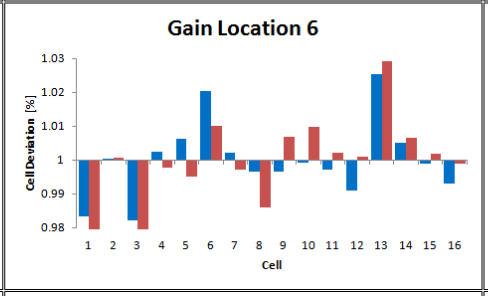


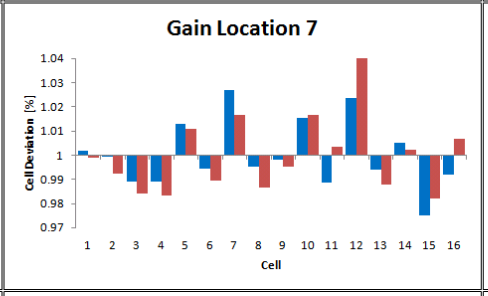


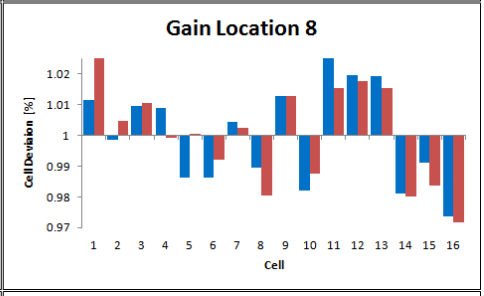


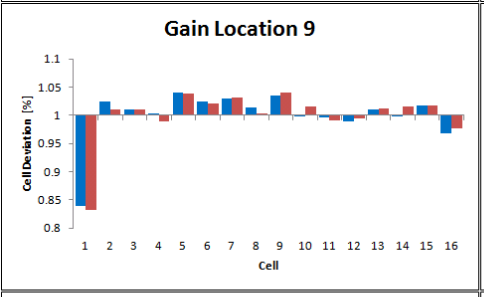


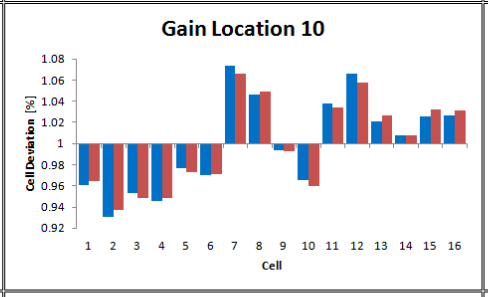


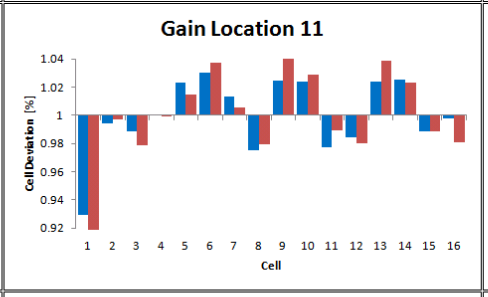


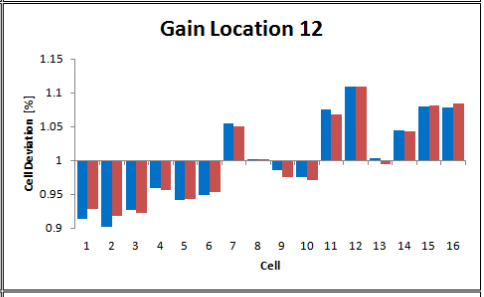


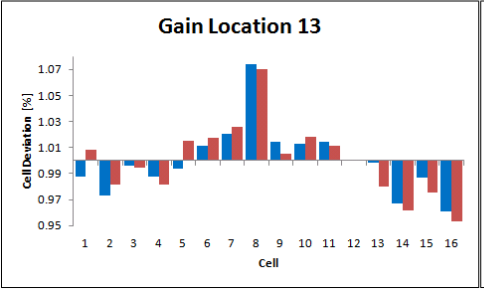


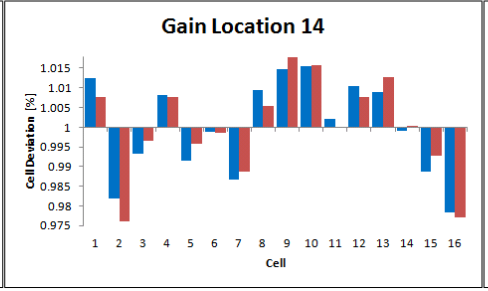


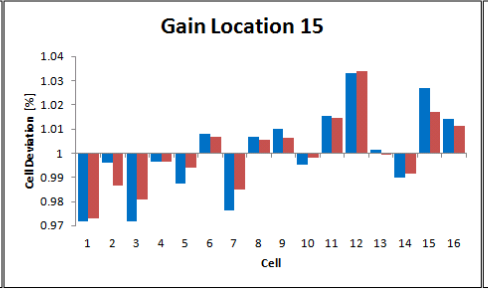


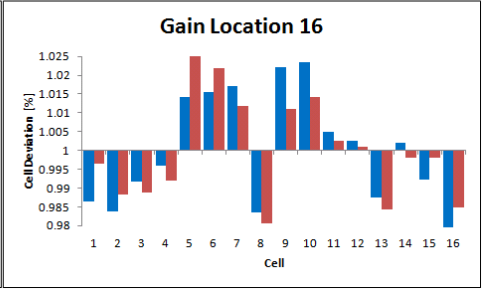




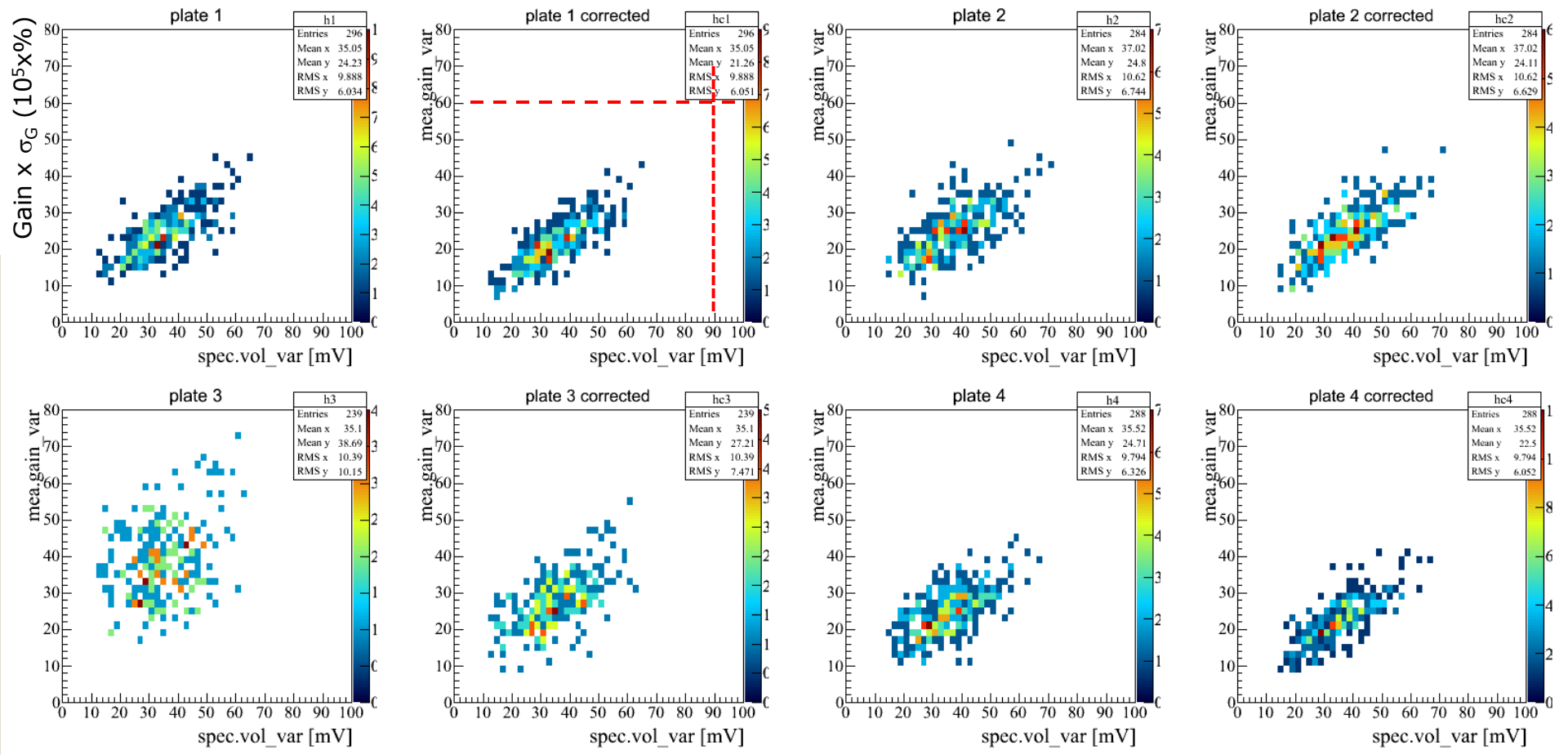






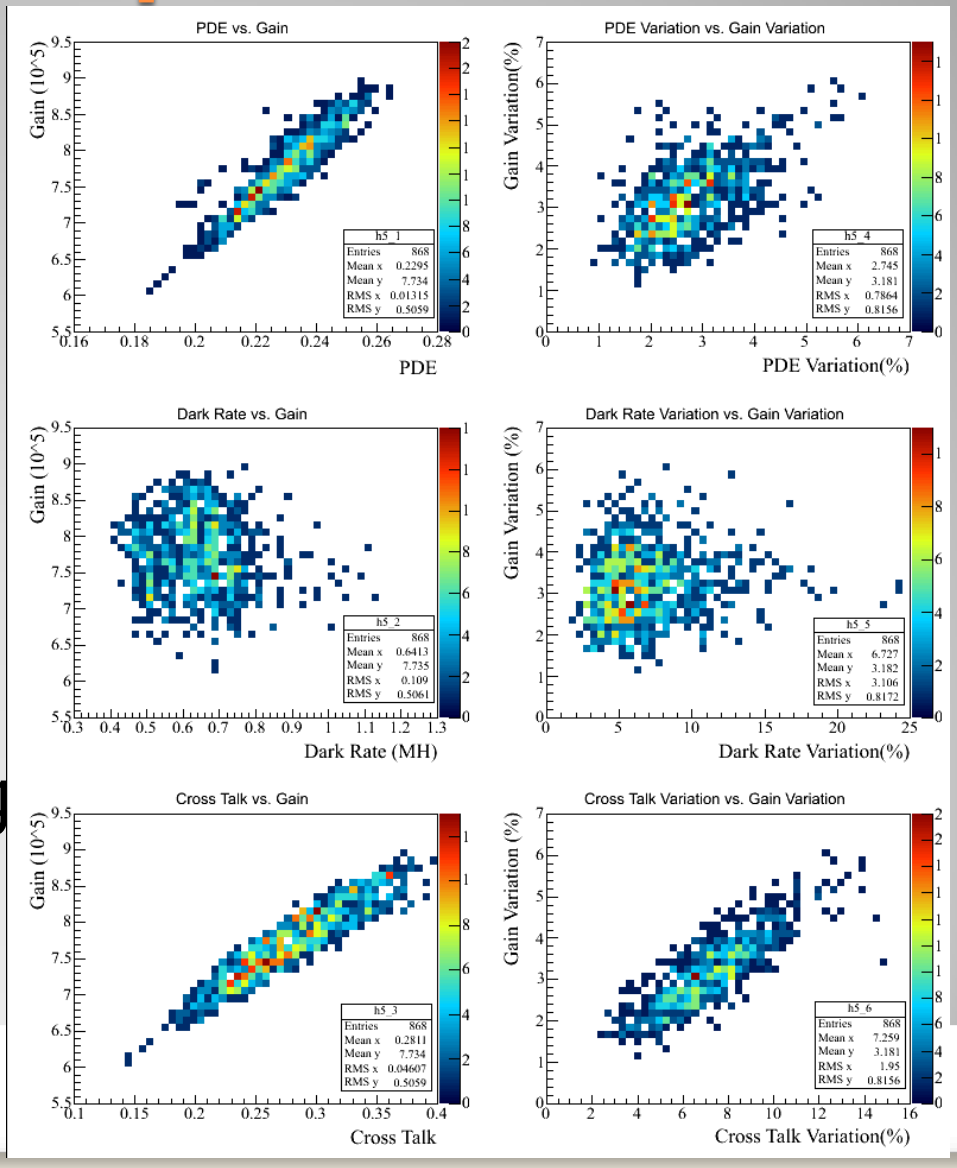


Correcting Gain

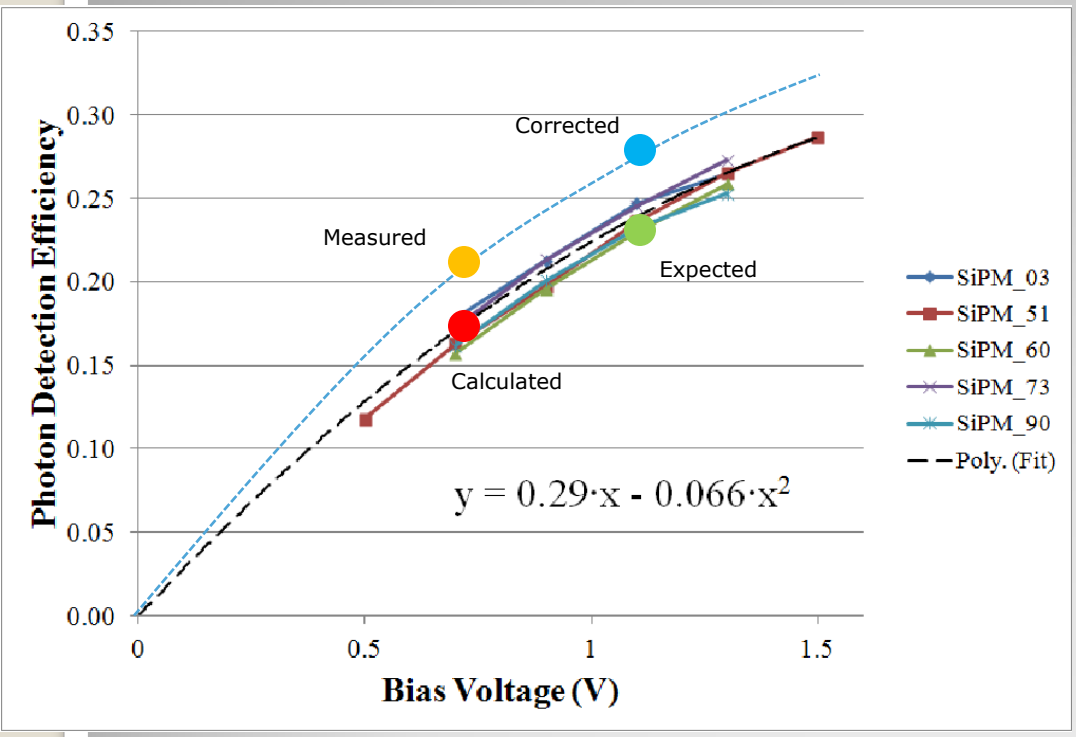


PDE and Gain Dependence on Voltage

- The gain and PDE are both dependant on voltage.
- Our result show that they are correlated along with their variations.



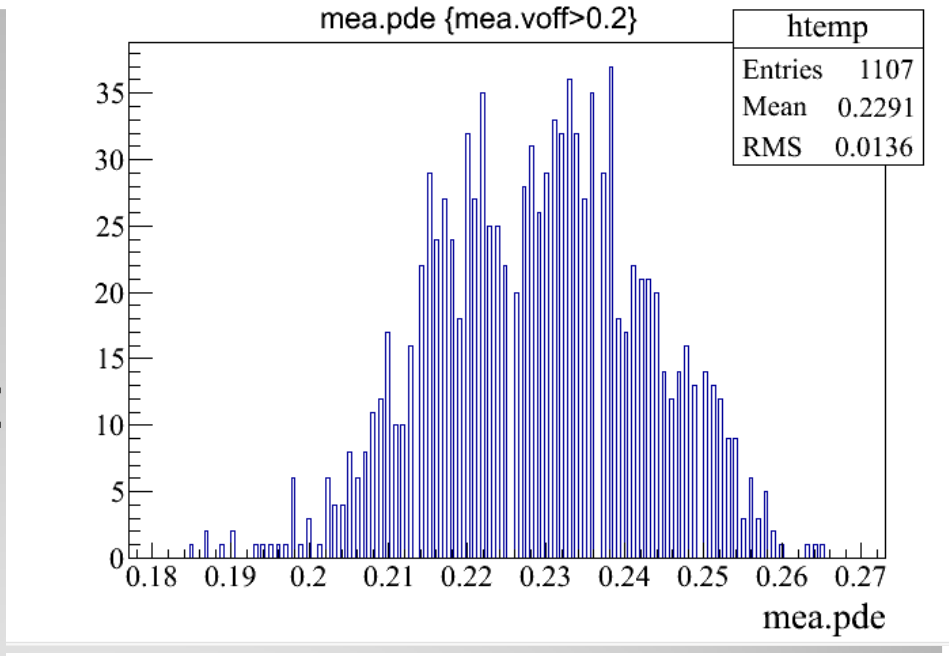
Calculating the Corrected PDE

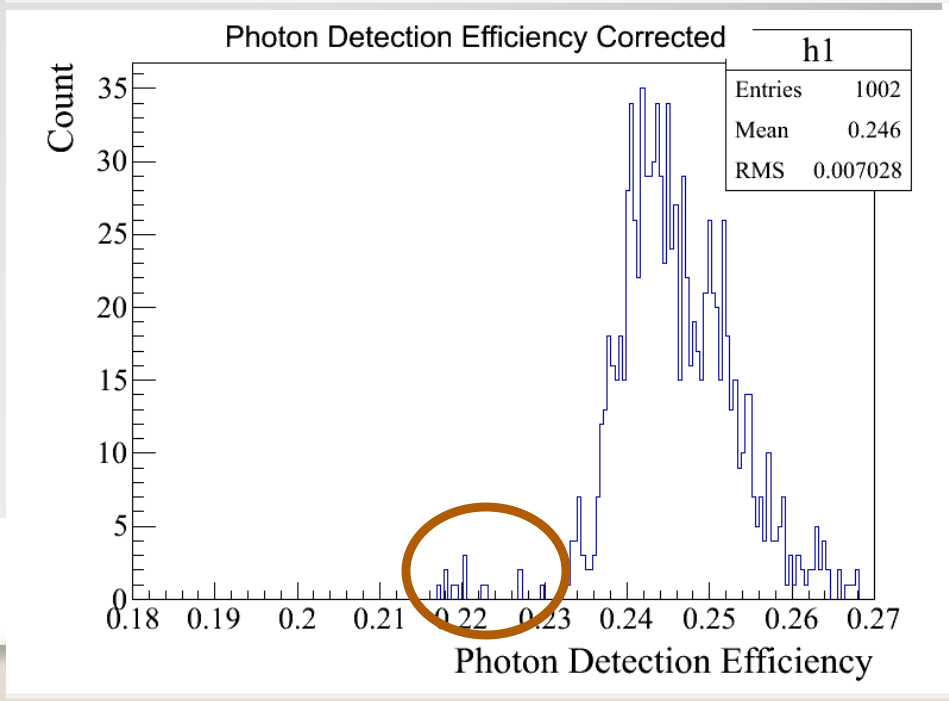


- The voltage dependence of the gain is used to calculate the actual voltage offset.
- This value is inputted into a known equation for PDE.
- The ratio between this calculated PDE and the measured PDE is divided from the expected PDE

$$Corrected = Expected \cdot \frac{Measured}{Calculated}$$

- These SiPM do not have high enough PDE
- They were all tested in one batch.





Summery

- SiPM 1442 needs to be returned
- Plate 3 did not provide accurate data, but it can be corrected
- Hamamatsu's data is a reliable substitute
- Next Steps: Cross Talk and After Pulse
  Retesting low PDE SiPM