Compton Analysis Progress

for the d_2^n analysis meeting

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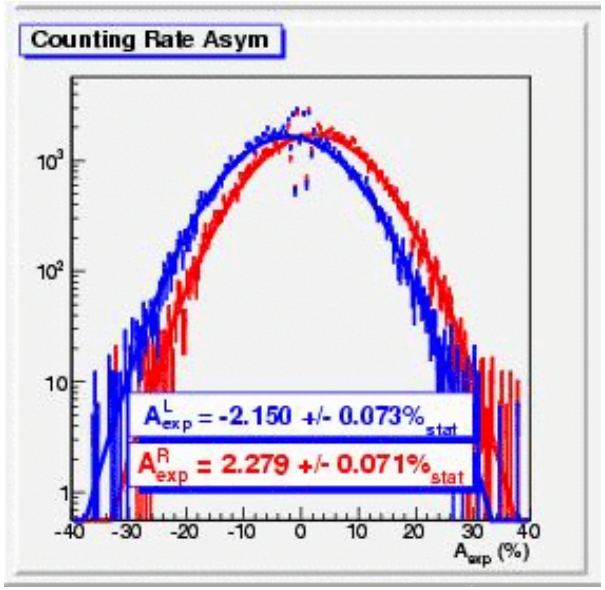
1. Extracting Compton Asymmetries from Saclay DAQ

2. Understanding the Compton Spectrum

Saclay DAQ Asymmetries

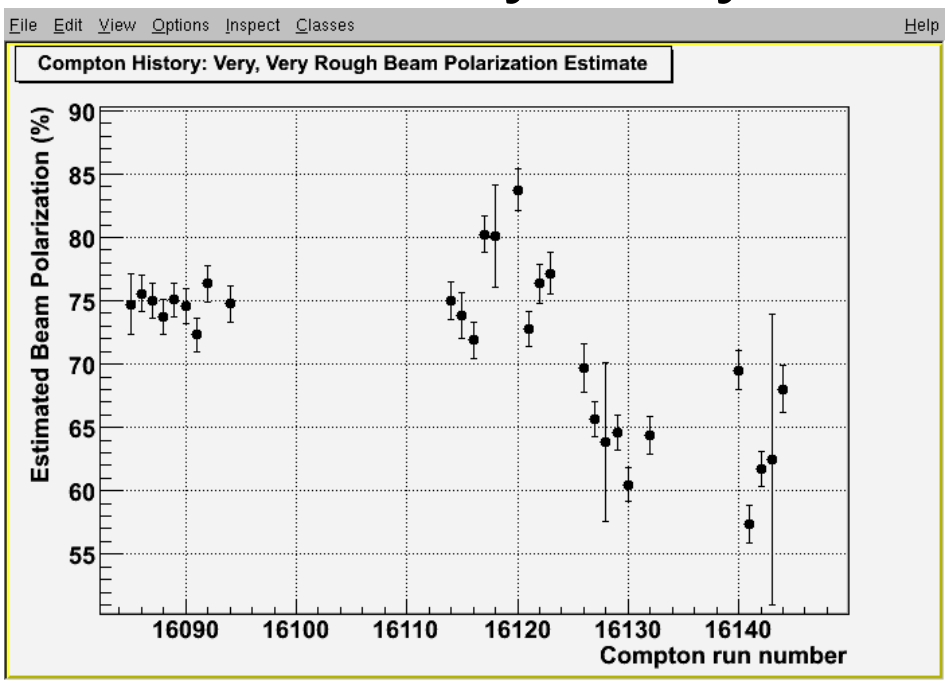
- In our last meeting, we discussed a better asymmetry to take from the Saclay Compton analyzer
- Unfortunately, in its finite wisdom, the analyzer fails to write this asymmetry to a .ROOT file
- Fortunately, we have Jin Huang on our side. We can now extract this number from the .EPS file.



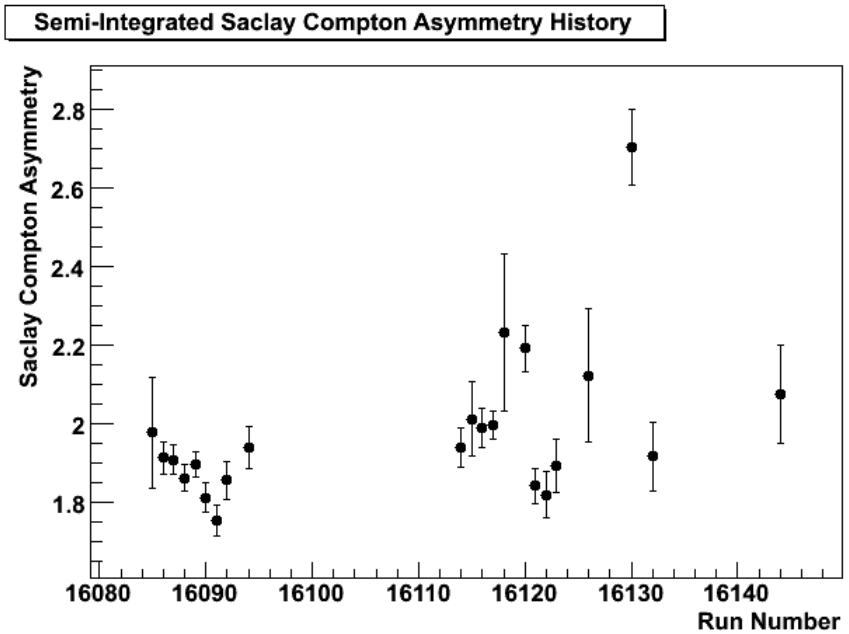
Is This Method Really More Stable?

- Feb. 28: we observe a big drop in the binwise asymmetry
- This drop was not supported by CMU-DAQ data or by Hall B ...

Binwise Asymmetry



Semi-Integrated Asymmetry

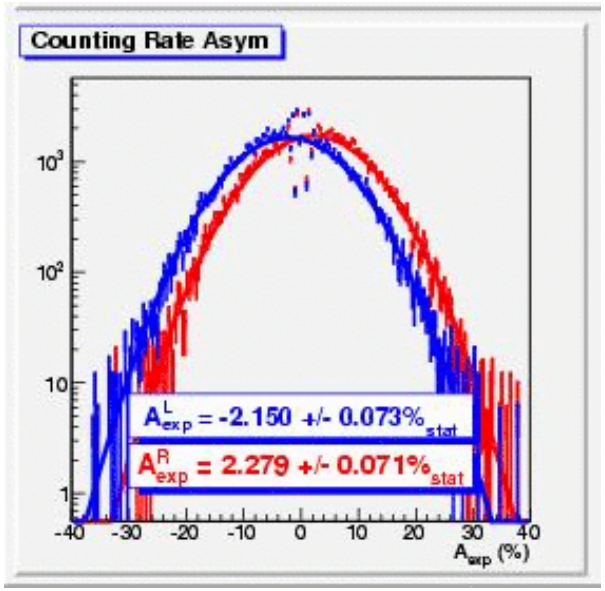


- Sure enough, the semi-integrated asymmetry doesn't show a drop!
  - Scatter does increase, though ...

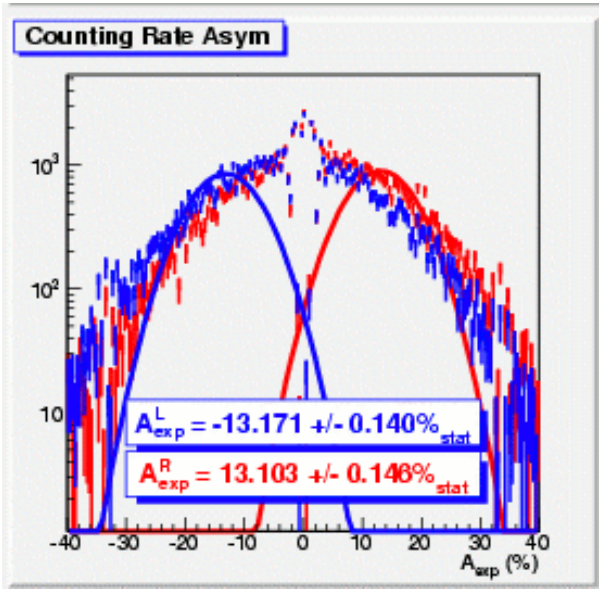
When the Saclay Analysis Fails

- This method depends on the Saclay analyzer finding a good fit
- When the fitter fails for unknown reasons, we must discard the run
- Without understanding the failure modes, the Saclay data's usefulness is limited

Successful Fit

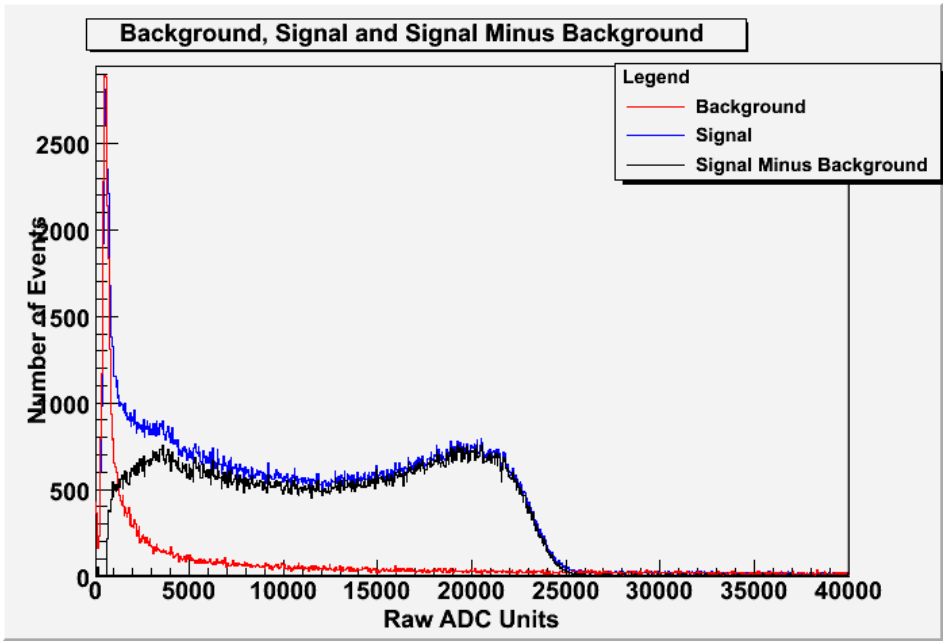


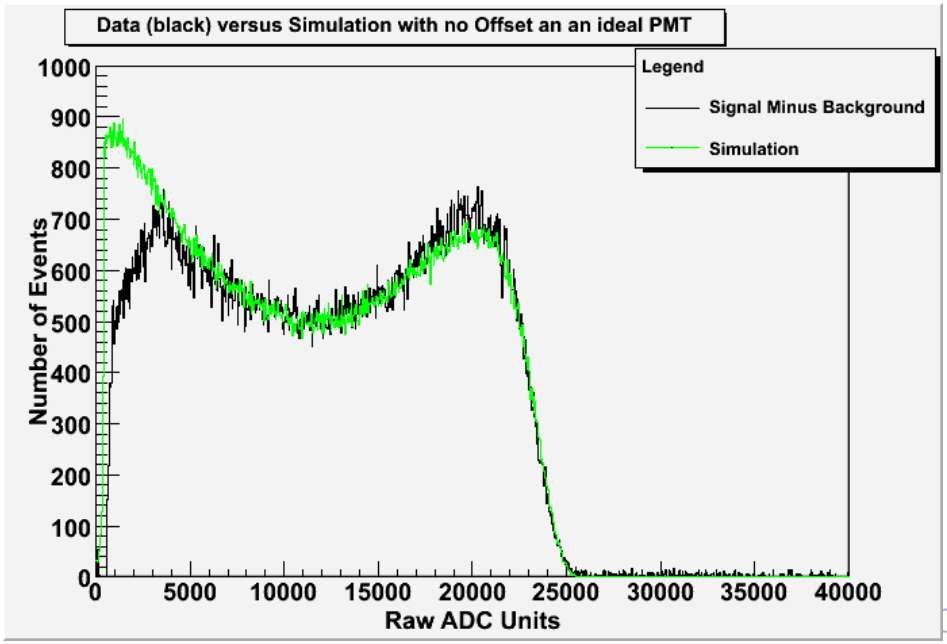
Failed Fit



Low-Energy Mystery

- To compute the Compton analyzing power, we need to understand the detector
- But d_2^n's 4.7 GeV Compton spectra posed some mysteries:
  - Even before background subtraction, something is "turning on" at low energies
  - Low-energy events are "missing" compared to simulation
  - Excess of high-energy events compared to simulation





Low-Energy Mystery: Solved

- Summer student Matt Oborski added an offset to the simulation
  - Compton-scattered photons of a given energy trace a conical surface
  - A misaligned cone means the 1-cm collimator preferentially rejects low-E photons
- Student Megan Friend measured non-linearity of our photon detector system
  - More non-linear in high-E region

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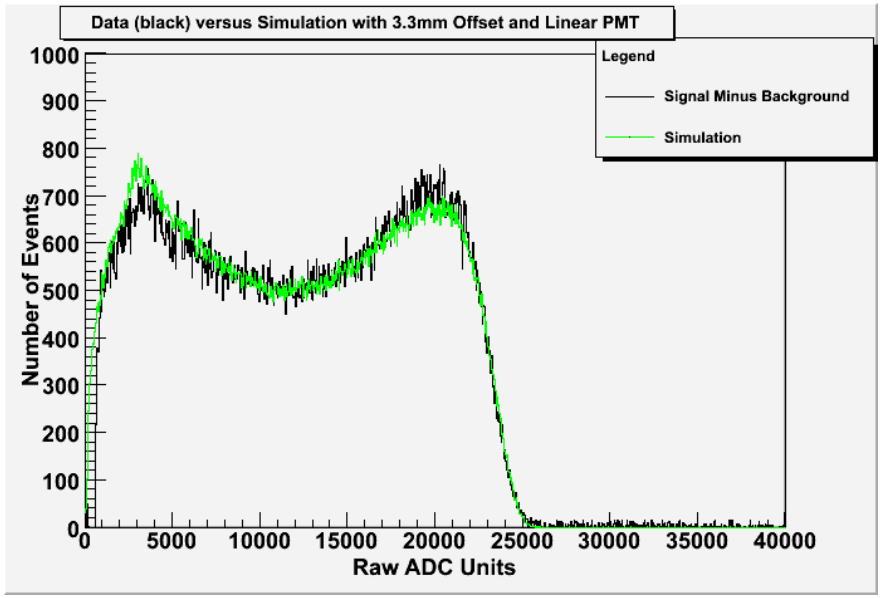
3.3 mm Misalignment



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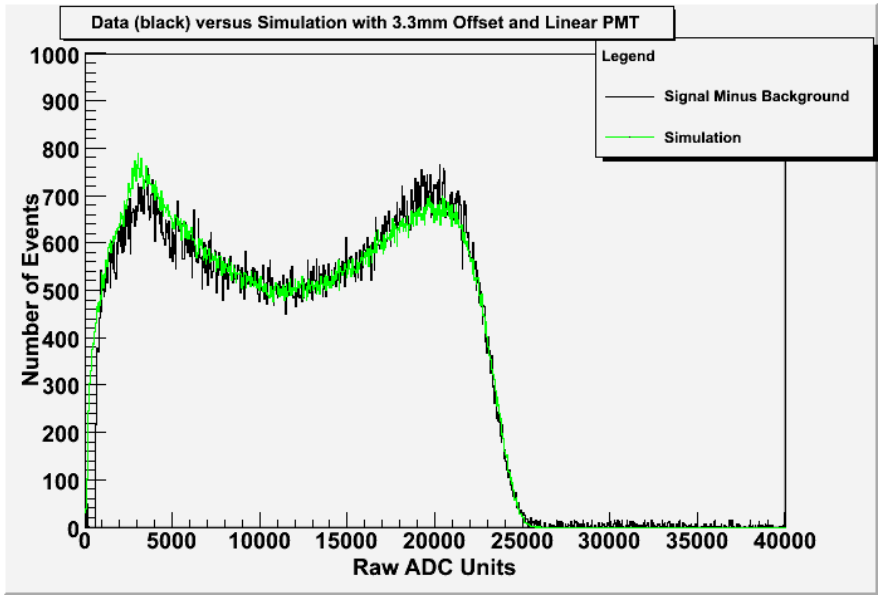
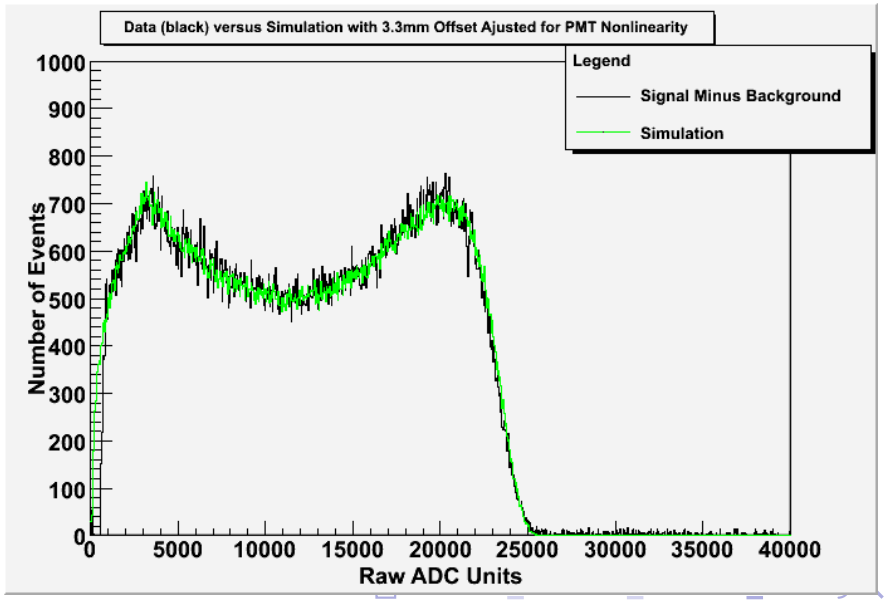


Misalignment + Non-Linearity



Cross-Check: 5.9 GeV Spectrum

- The 3.3 mm offset – computed for the 4.7 GeV Compton spectra – reproduces the observed 5.9 GeV spectrum as well
- The PMT nonlinearity changes the x-axis (MeV→ADC units) conversion factor slightly
- Still finalizing the horizontal conversion factor