Hall C Cherenkov Calibration

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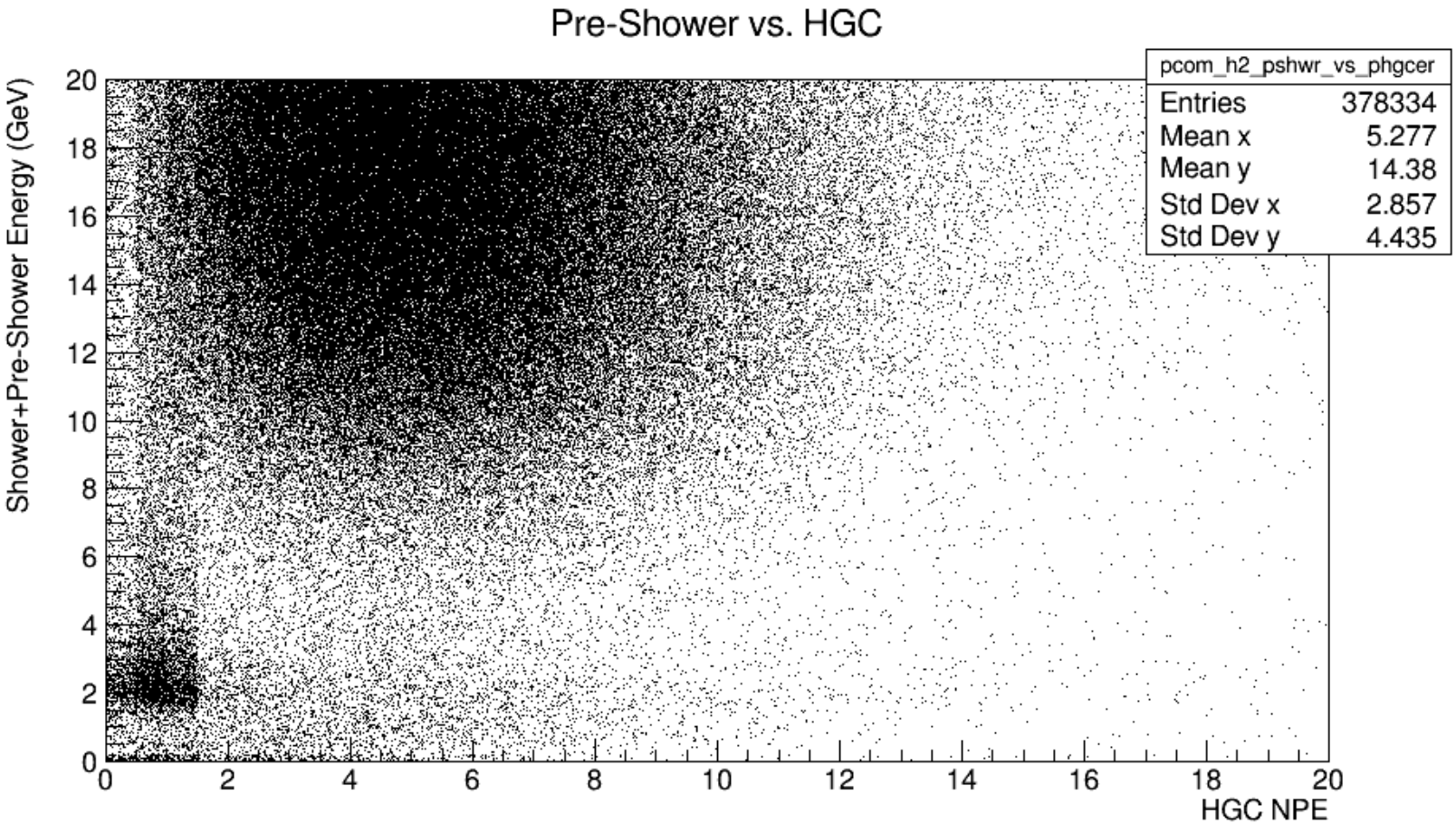
Cerenkov Detectors

Why do we use Cherenkov detectors?

- Particle Identification

How do Cerenkov detectors work?

- Threshold detector


Pre-Shower vs. HGC
pcom_h2_pshwr_vs_phgcer
Entries 378334
Mean x 5.277
Mean y 14.38
Std Dev x 2.857
Std Dev y 4.435
Shower+Pre-Shower Energy (GeV)
HGC NPE
0
2
4
6
8
10
12
14
16
18
20

Calibration Procedure

- Isolate the signal photoelectron peak (SPE)
  - Requires several cuts on the raw data
- Fit for first guess of calibration
- Refine
  - Remove Poisson-like background
  - Adjust calibration constant by a reasonable factor

Heavy Gas Cerenkov Geometry

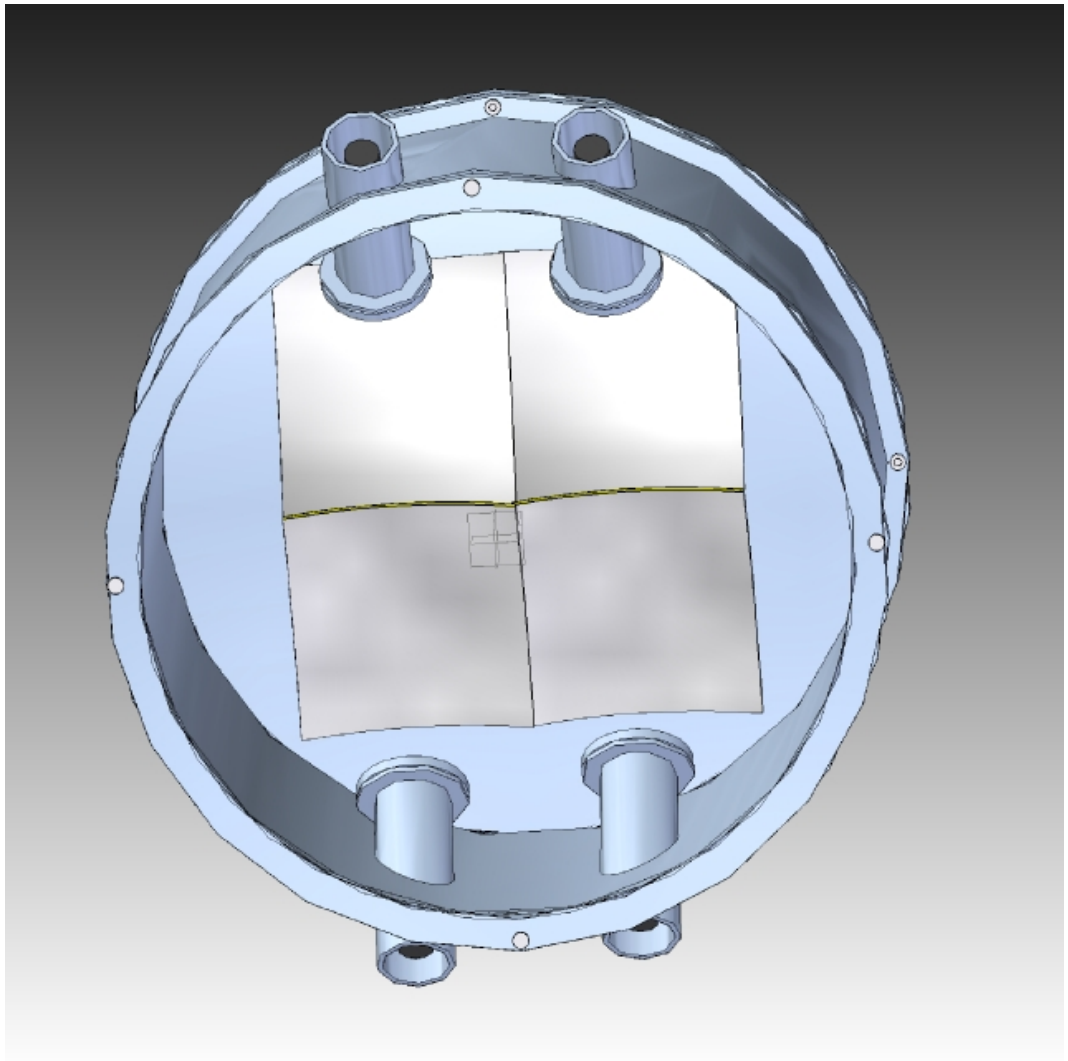


Figure 1: Orientation of the HGC, note the 4 mirror quadrants and PMTs. HGC leaves are indexed by PMT.

Cuts Performed

Some cuts are performed in replay script:

- fADC error flag
- adc timing window

More are applied in analysis:

- ntracks
- beta
- mirror location
- particle ID

Visualizing the Calibration

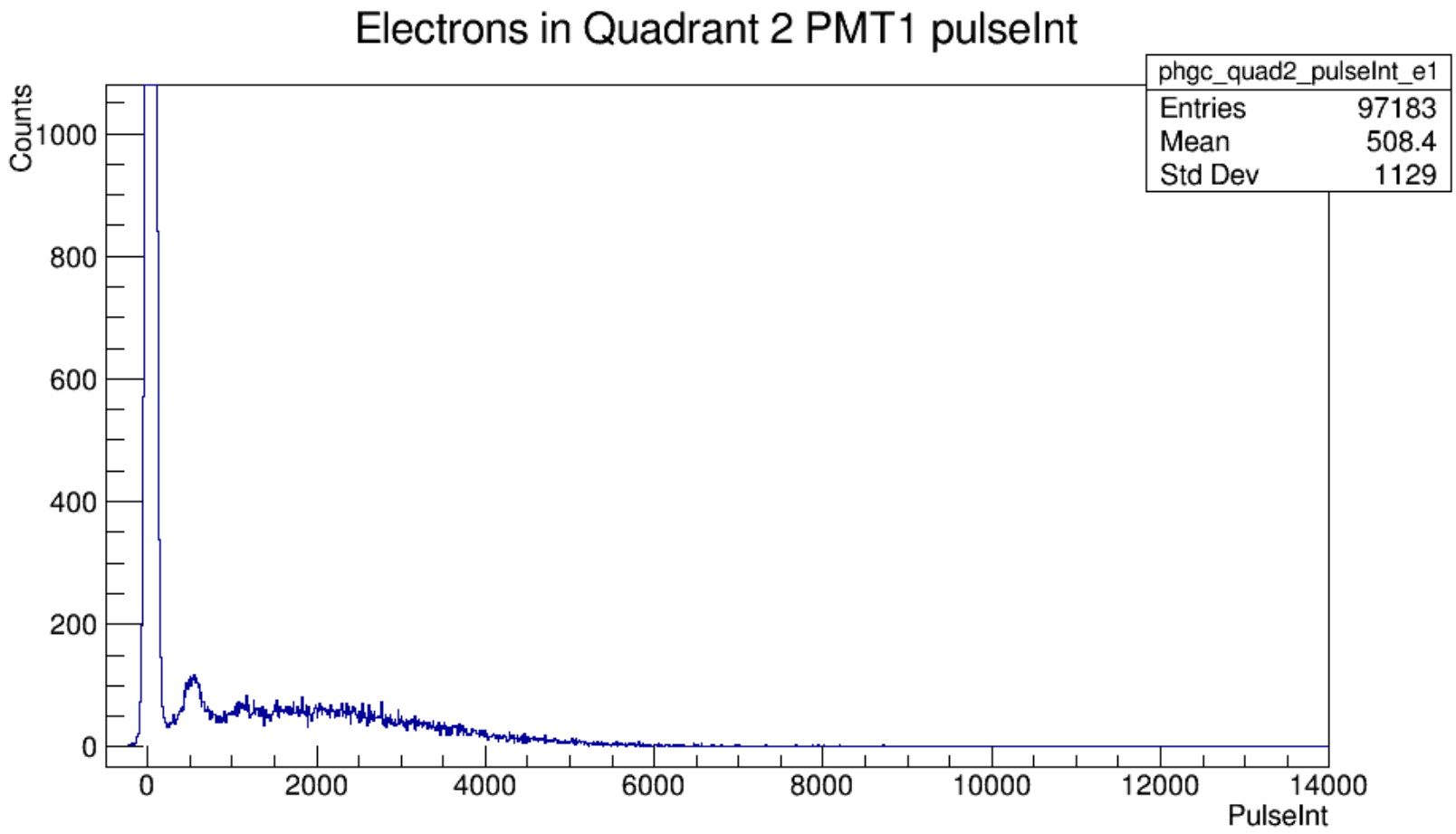


Figure 2: Isolating the single photoelectron

Visualizing the Calibration

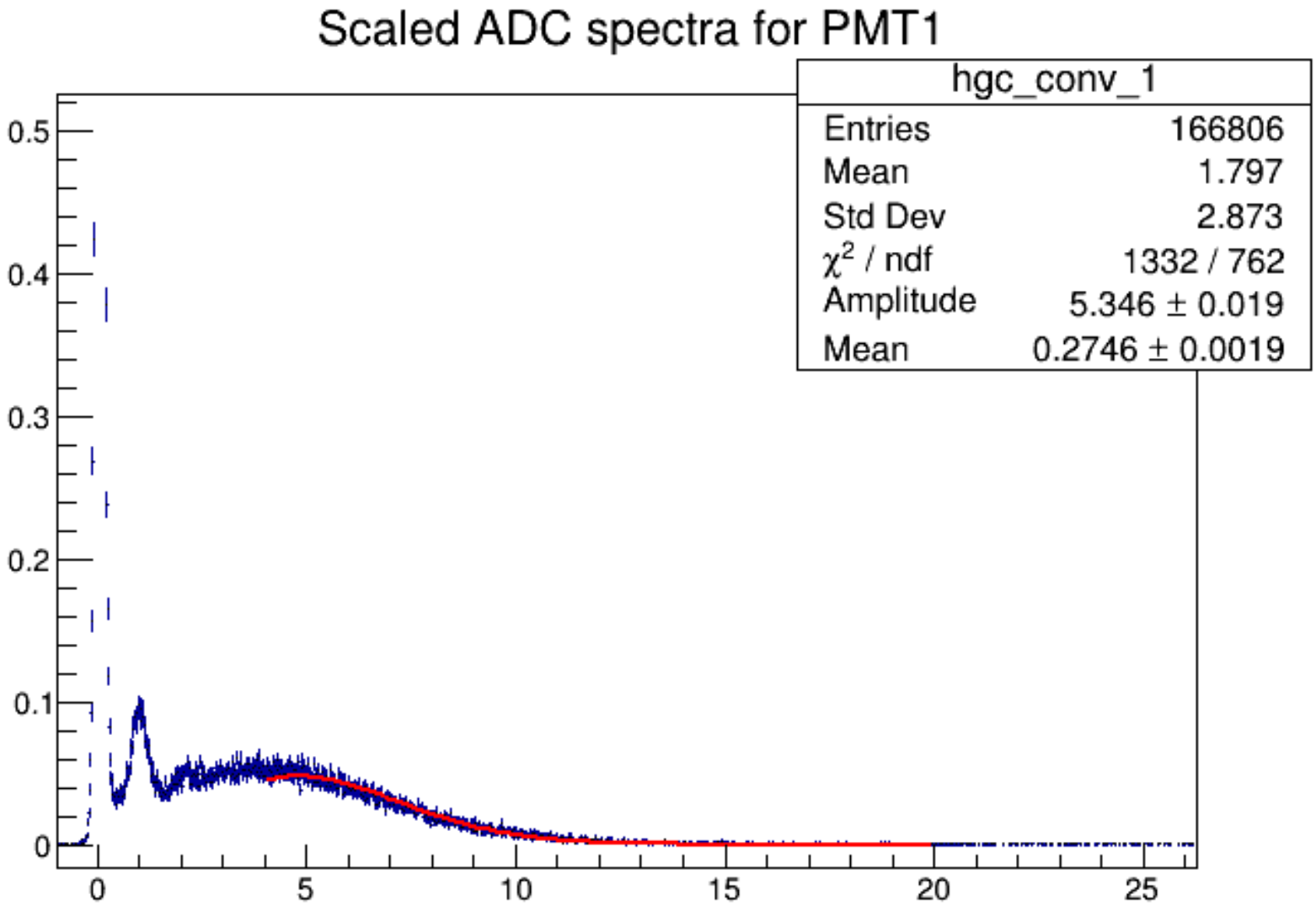


Figure 3: Removing Poisson-like background

Visualizing the Calibration

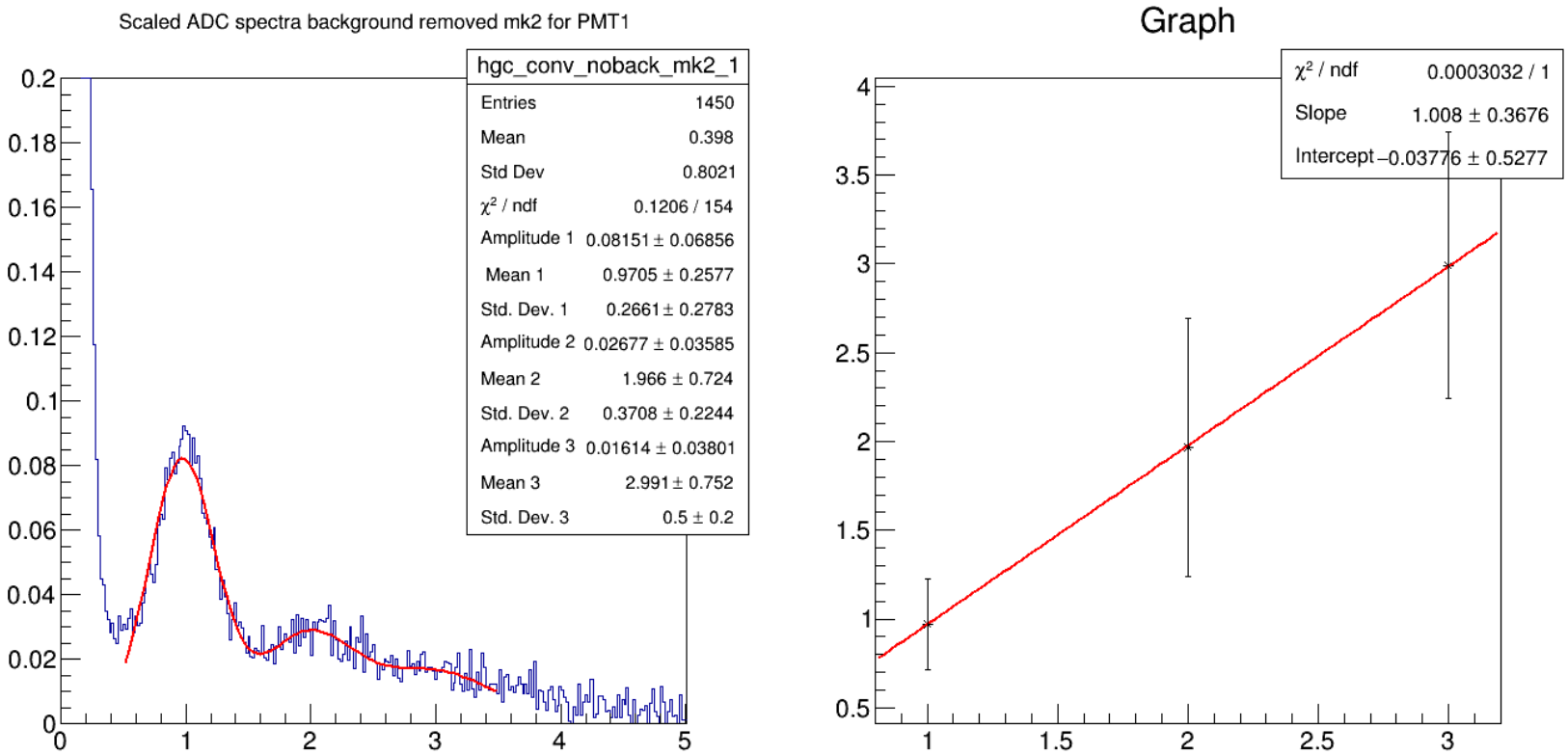


Figure 4: Verification of calibration

Another Verification

A second script exists to verify the calibration, Calibration_Visualization.C

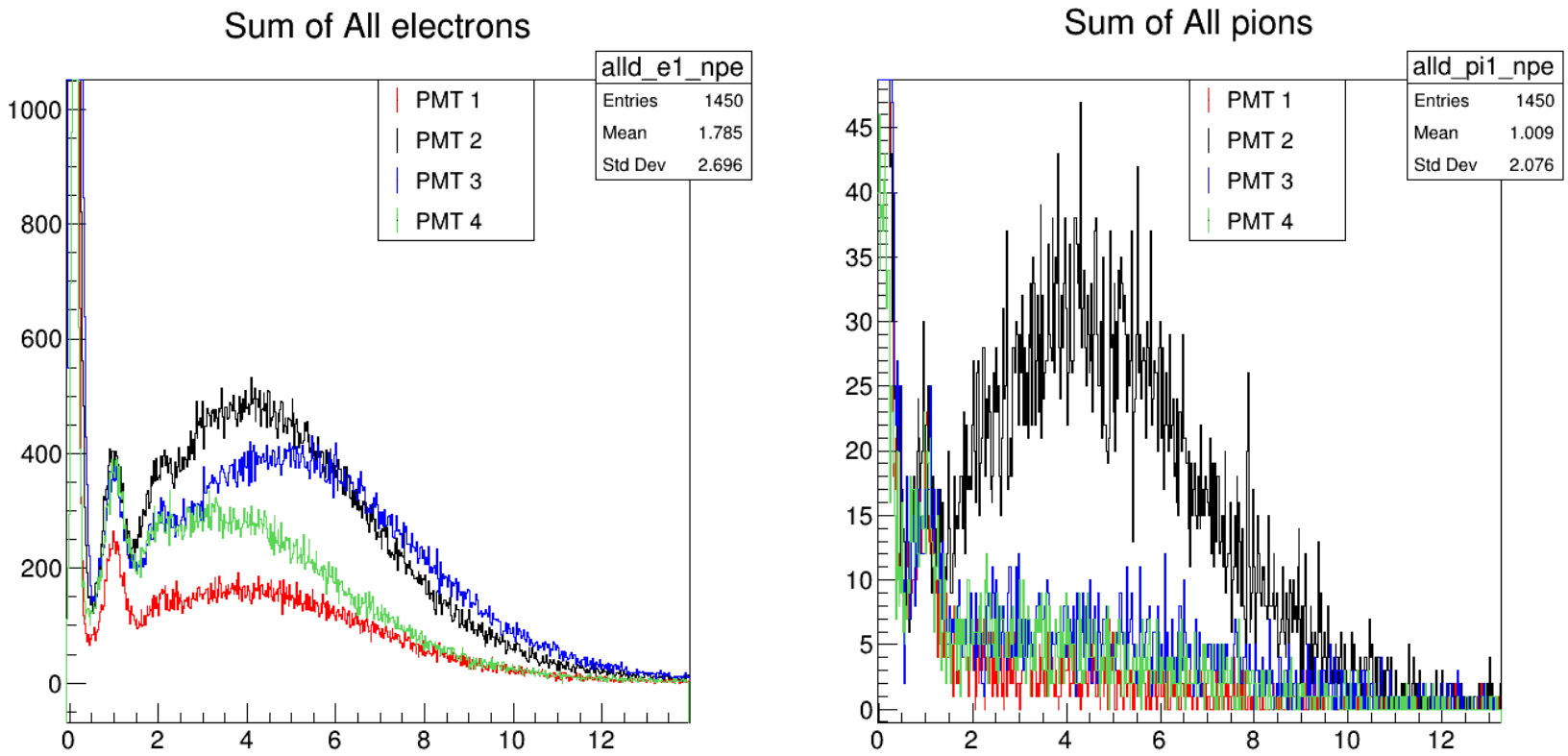


Figure 5: Observe how the NPE align

How to Obtain/Execute Calibration

- From github, download the hallc_replay directory (calibration script included)
- In CALIBRATION/shms_hgcer_calib are the scripts
- Perform root -l run_calibration.root, enter run & event number
- In root-files you can review the various cuts & histograms
- The script will output the calibration constants into a file in data-files

Common Issues

- ROOT quite often doesn't feel artistic. If the various fits and plots look incorrect, just verify the fitting parameters are logical.
- For runs with particularly low statistics, the logic setting a minimum criteria for a peak is problematic. This limit can be manually changed in the script calib_const.C, line 160.
- For unusually low voltage the gain make individual peaks hard to find. This can be modified by changing the search method, particually the parameter sigma (2nd parameter) located on line 126.