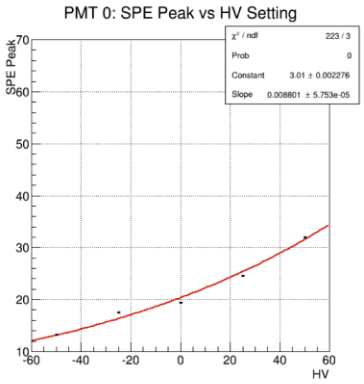
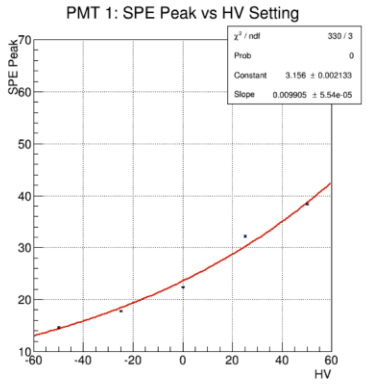
Ckov Updates

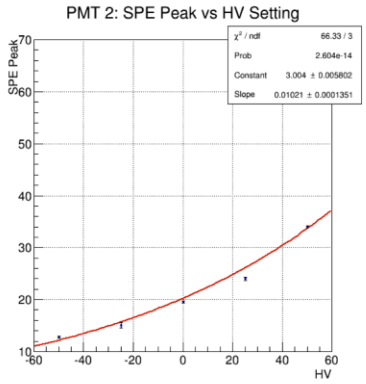
I. Introduction and Outline
II. New HV calibration
III. Refined Pedestal Finder - Michael
IV. Refined PE Integrator - Miles
V. Positron Run 3511 analysis - Miles
VI. High momentum muon run analysis ??
VIII. Summary and Outlook

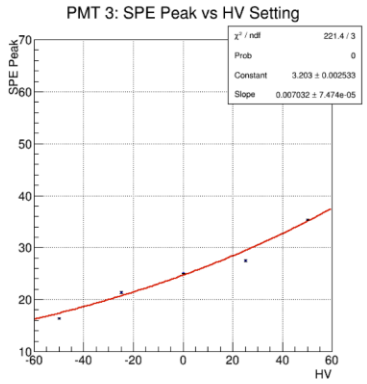
HV Calibration

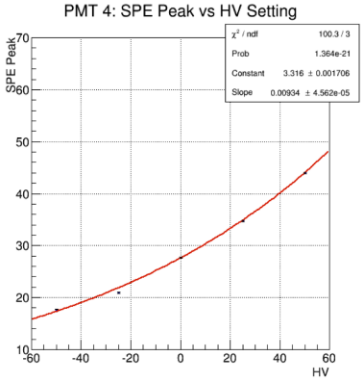
- HV-scan data from recent activation analyze.
  - –Need to get calibrations into CDB once for final reconstruction.
- CAEN HV needs to be reset to balance outputs at 25pe.

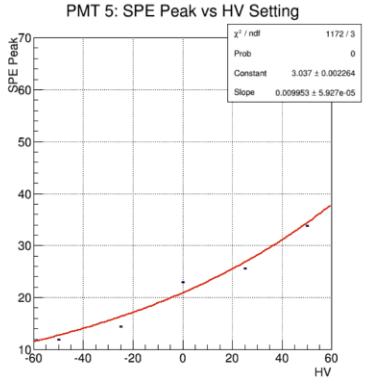


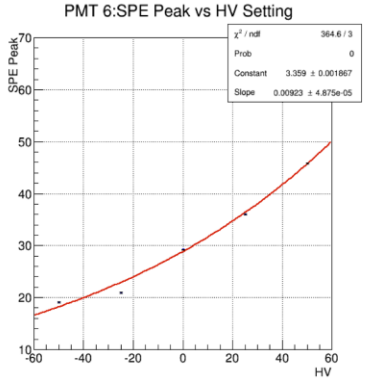


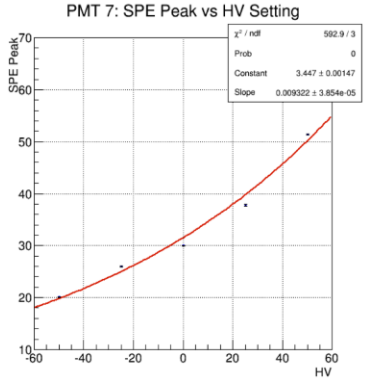






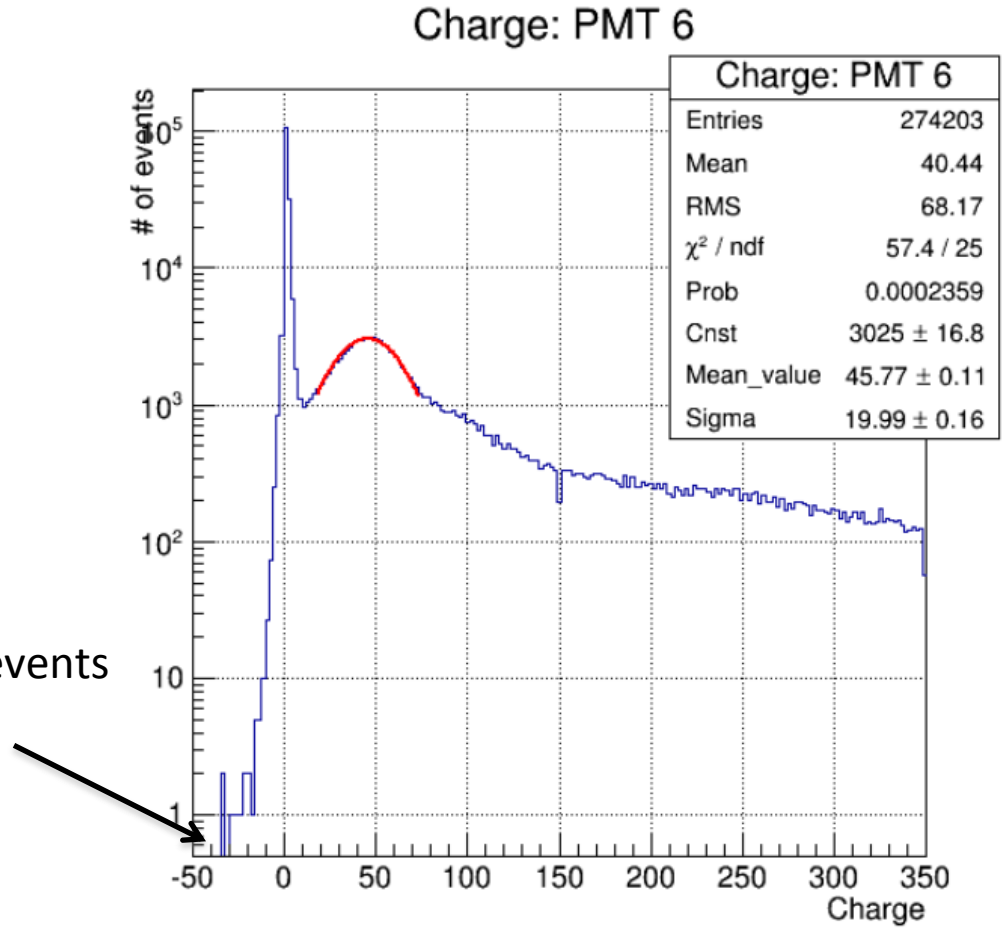






Rework of Pedestal Algorithm - Michael Drews, IIT

- Pedestals were not being set correctly - sometimes negative.
- Due to events in the integrated charge distribution with negative charge.



Negative charge events

New Pedestal Algorithm

- The fADC pedestal integration region is statically set to the last 40 bins.
- The integral of the last 40 bins is taken and then divided by 40 to obtain a potential pedestal.
- The integration region is then put through two tests to determine whether the potential pedestal should be accepted or not.
- If the integration region fails either test, the pedestal is set to a running average of the pedestal for that particular PMT.
- If both tests are passed, the region is considered acceptable and the potential pedestal value is used as the pedestal value for that PMT.

Test 1

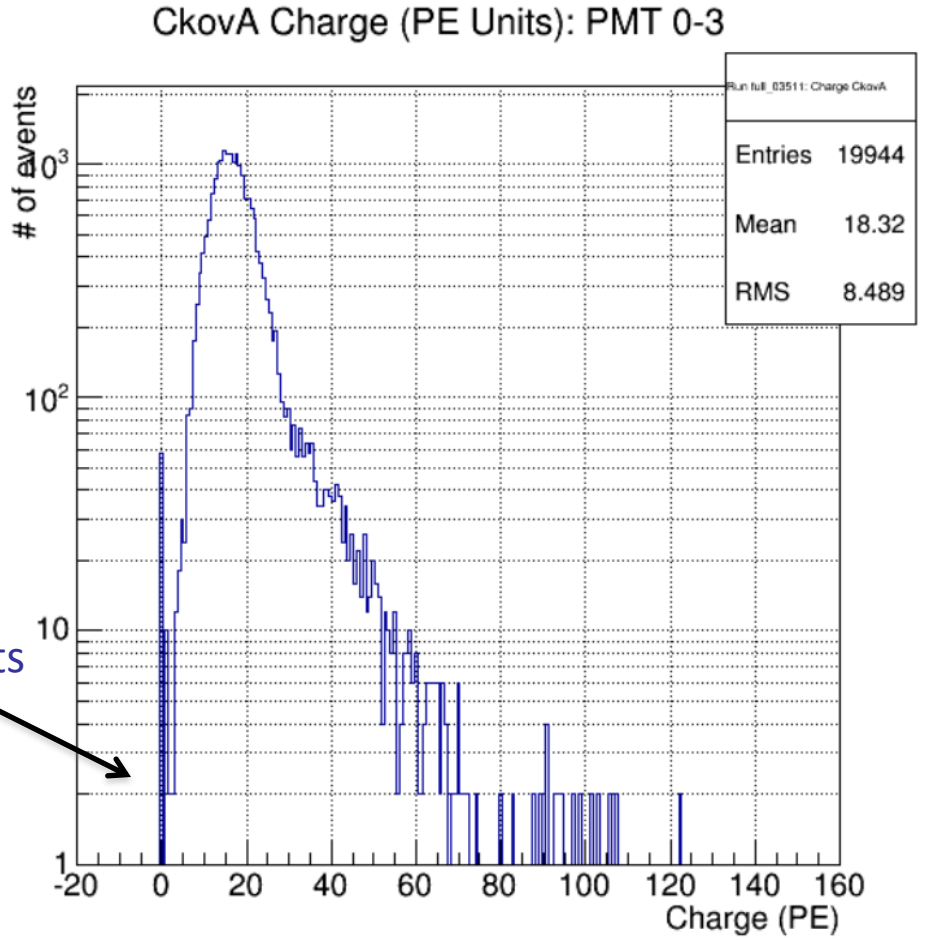
- The difference between the max and min ADC values in the integration region is calculated
- If this difference is greater than 3, i.e., there's a pulse in the region, the pedestal is set to the running average for that PMT.
- If the difference is less than 3, it moves on to test 2.

Test 2

- A finite state machine looks at each successive ADC value in the integration region.
- The difference between the current ADC value and the previous ADC value is found.
- If the difference is negative for three successive bins, this negative slope is deemed part of a pulse and the pedestal is set to the average.
- Similarly, if the difference is positive for three successive bins, this is deemed part of the tail end of a pulse and the pedestal is set to the average.

New Pedestal Results

- This new algorithm has eliminated the negative charge events.
- The following plot is the sum of the integrated electron charge for Ckov A, given in units of # of photoelectrons.



No negative charge events

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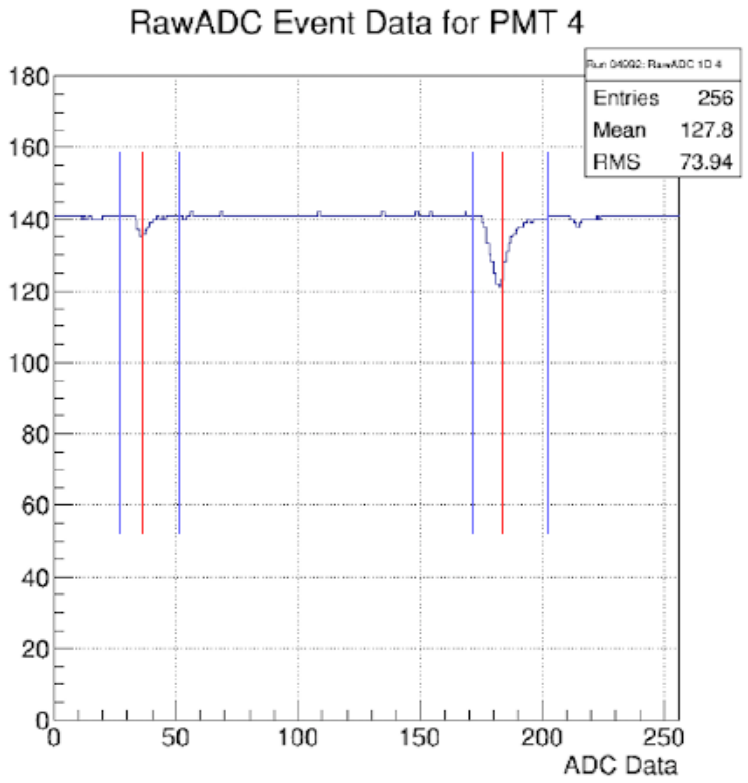
Rework of Charge Integrator - Miles Winter, IIT

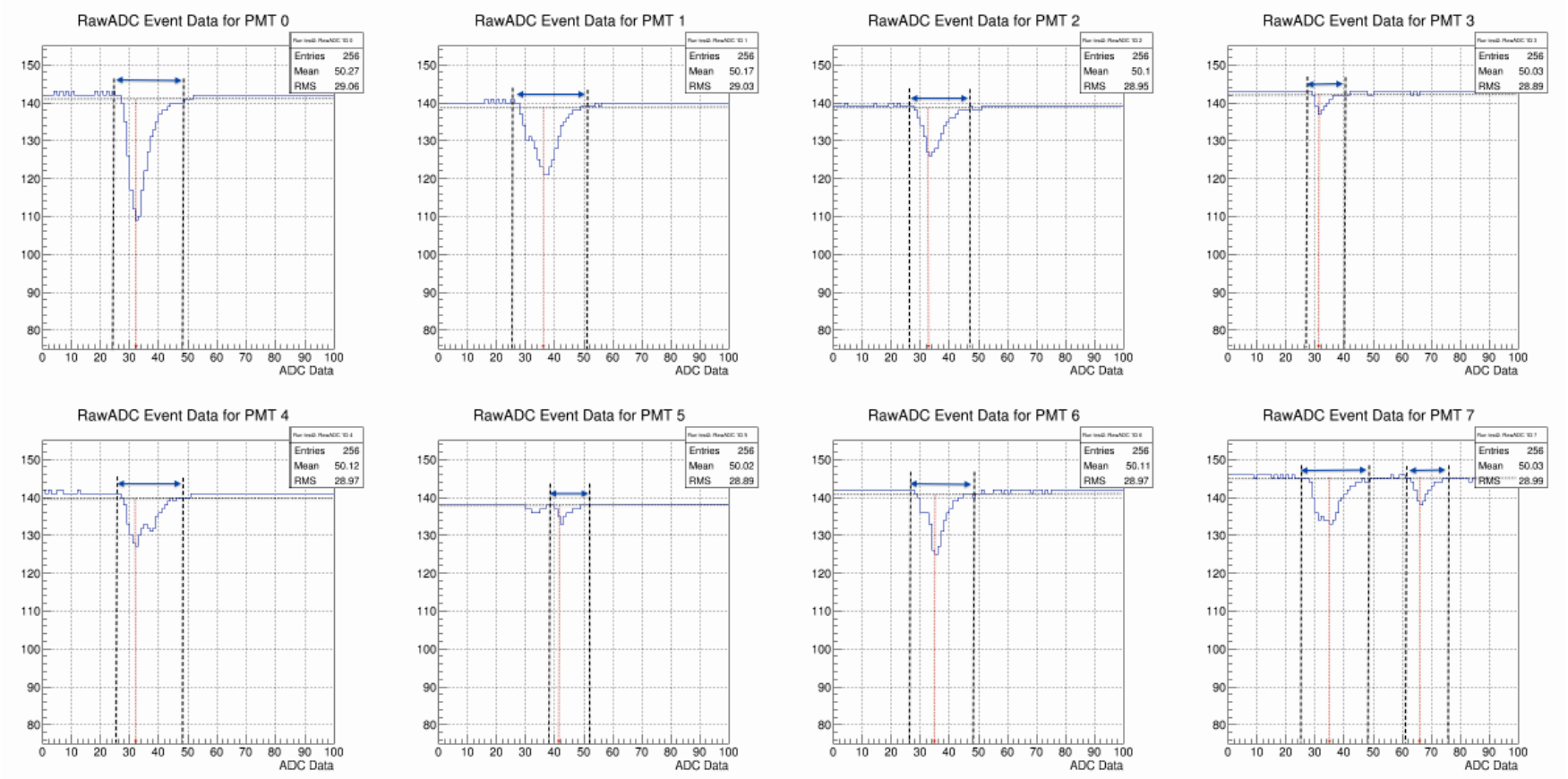
- This new algorithm (MapPyCkov) performs a multi peak exhaustive search.
- A start LO and end HI of each integration window is found by a time below threshold technique. And then the peak minima M identified.
- This step is sensitive to the pedestal finder and not explained here.
- Charge integration is then performed LO-8, HI+8.
- The charge is converted to **PEs**.
- The arrival time **toa** is set at the start of the integration window or set to 300 if zero peaks
- If zero peaks, the code exhaustively searches for smaller 1pe peaks.
- If a maximum number of peaks=7 is reached the event is flagged.

- The algorithm is being tested to establish 1PE calibrations and on e+/e- and pion data.



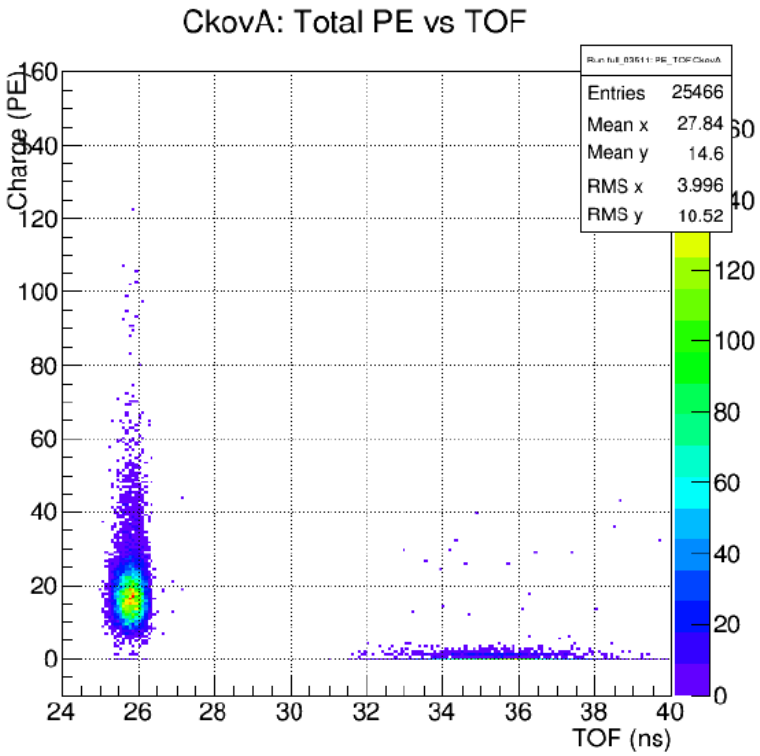
Event from Run 4991

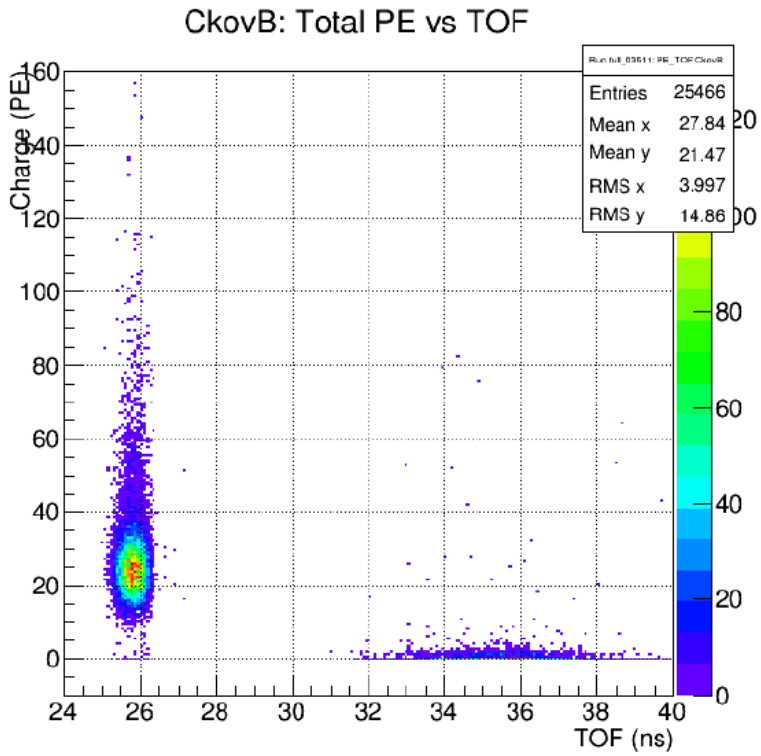
- This new algorithm working well in most cases.
- Final tuning in progress for small peaks (eg. PMT5)
- The new pedestal finder not used in these plots!



Run 3511- 148 MeV/c Positrons New w pion tail

- CKOVa,b responses are shown versus tof.
- Pions are below threshold but some excess light consistent with delta-rays (checking). These events appear to be positrons with pion tof?

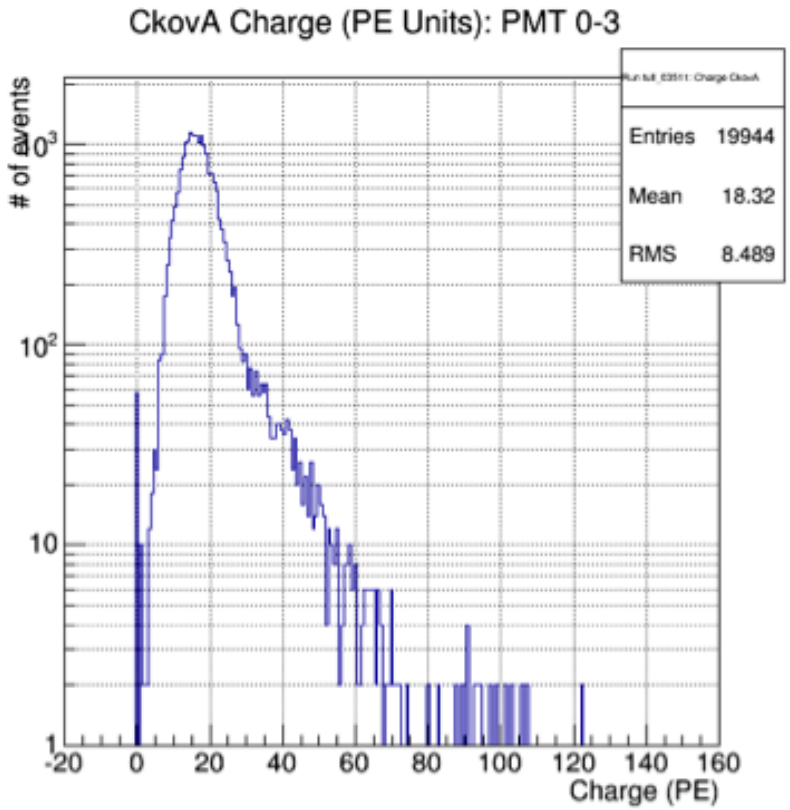


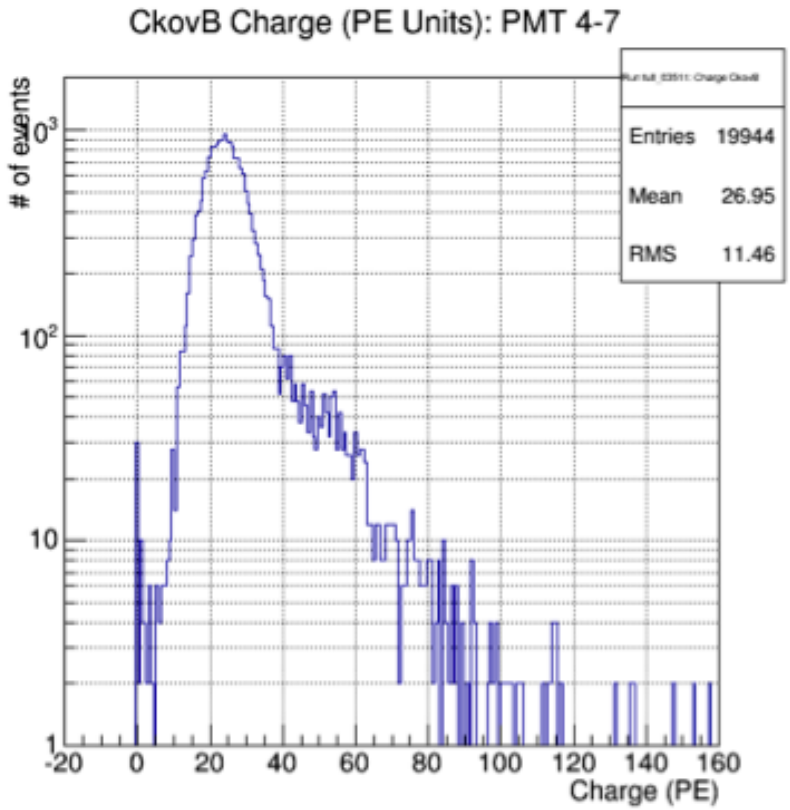


Run 3511- 148 MeV/c Positrons selected

- Efficiency for positrons at the 0.3% level.

TOF Cut: 25-27ns

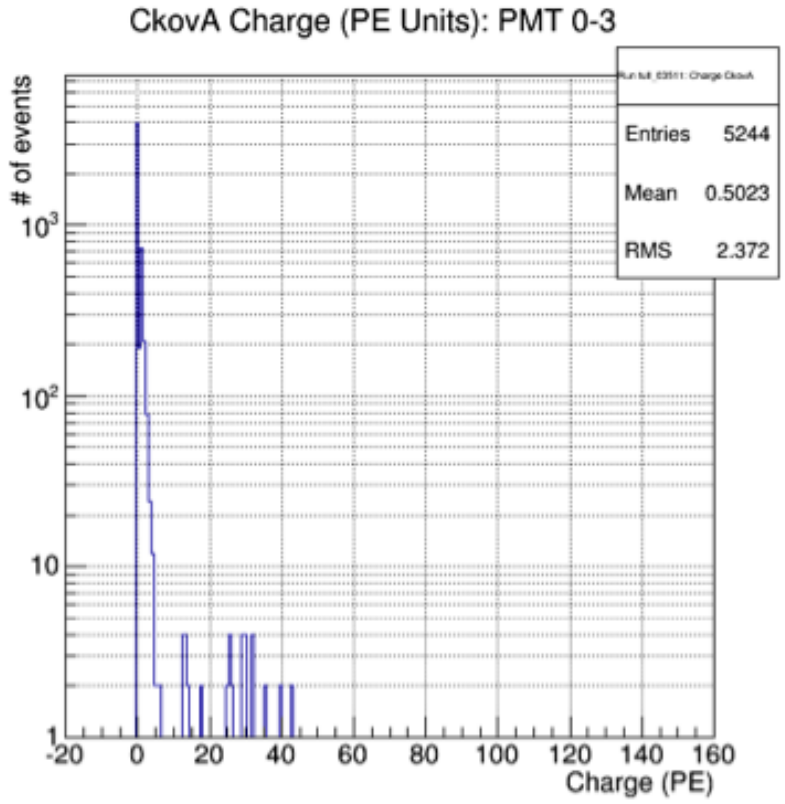


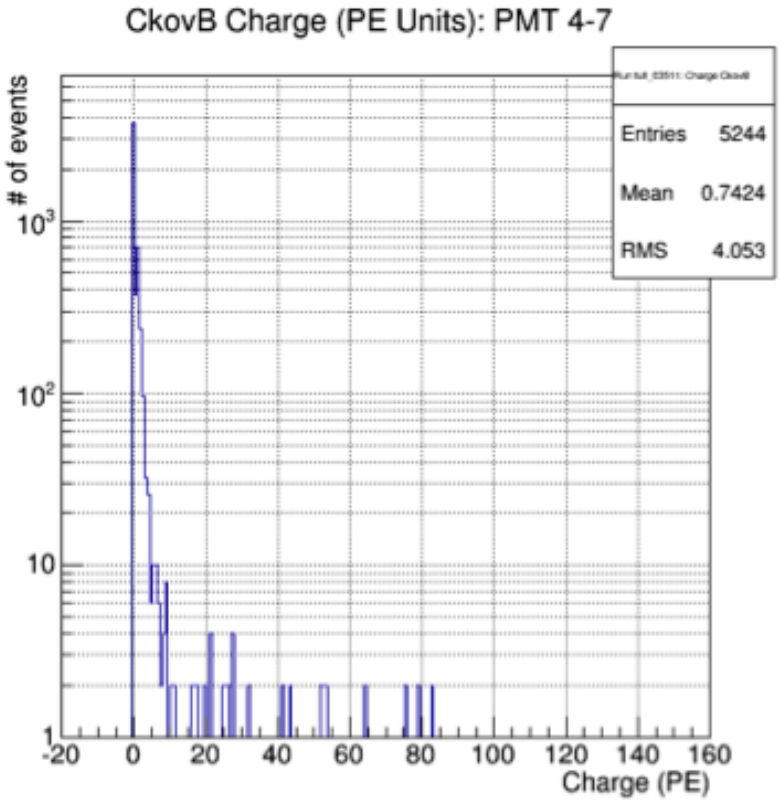


Run 3511- 148 MeV/c Pions selected

- Pions giving 0.5 and 0.8 pe background light.
- Tails are negligible and inconsistent with pions by ckov id.
- Pions giving light are not bad!

TOF Cut: 32-40ns





Delta Ray Impact on Ckov Id

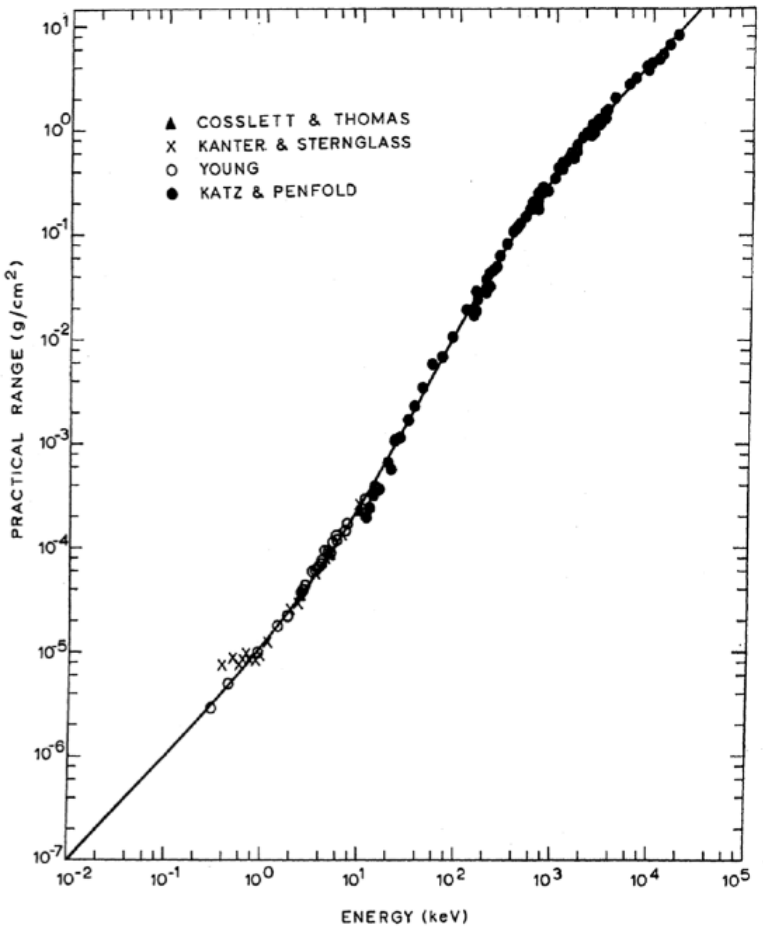


Fig. 8. Estimation of the range from Eq (5), in units of g cm^{-2}, of electrons as a function of energy [25]. The estimation, solid line, is shown to have strong agreement with experimental data over a wide range of energy.

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$\rho_{107} = 0.261$ g/cm^3 $\quad P_{th}^{\,e} = 1.01\ MeV/c$

$\rho_{112} = 0.371$ g/cm^3 $\quad P_{th}^{\,e} = 1.33\ MeV/c$

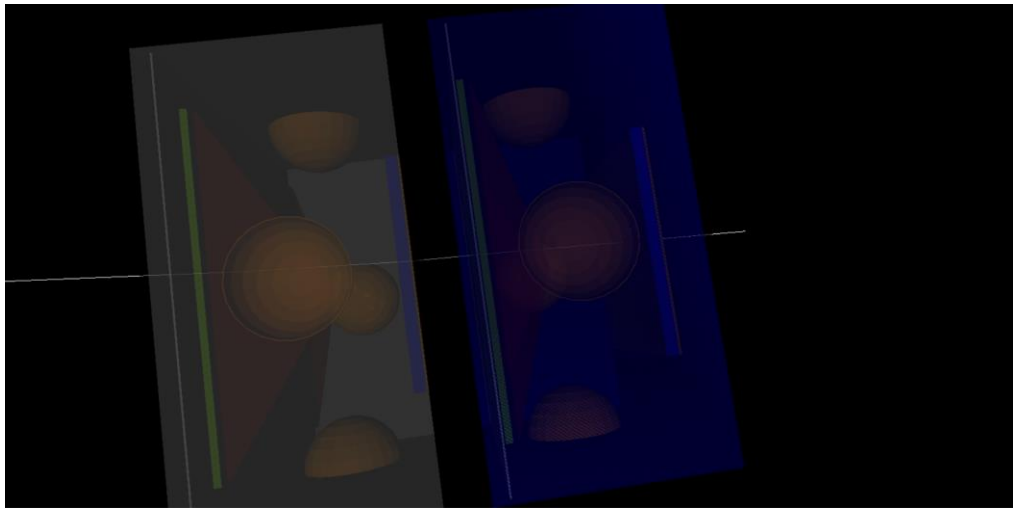
$W\max = 1.15\ MeV/c$ $\quad \max imum\ delta\ electron\ energy$

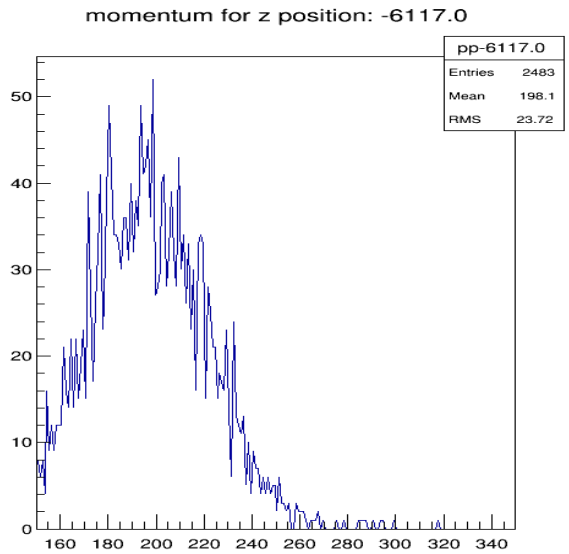
4 delta rays per 2.3 cm aerogel 107
6 delta rays per 2.3 cm aerogel 112

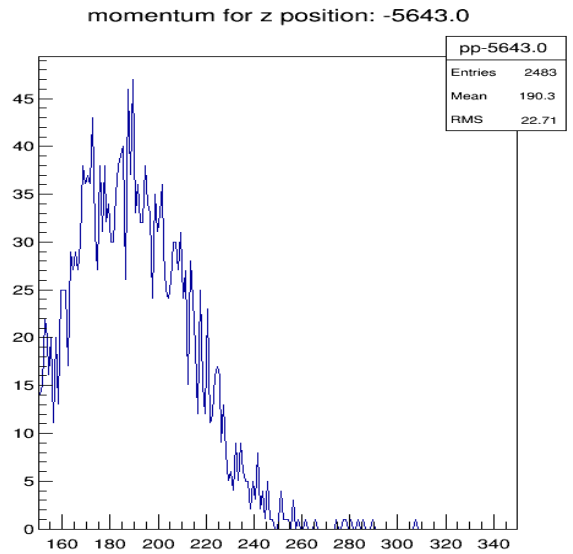
It is unlikely the light from pion tof are from delta rays.

Ckov Geometry- Neetish Pradhan (undergrad)

- Ckov Geometry and material definitions entered in to dat files.
  FILES/Models/Modules/Ckov/
- Visual checks okay.
  Tests/VirtualPlane.dat
- Next steps
  CKOVSD.cc
  CkovMirror.cc
- MC fadc Digitizer
  CkovDigit.cc
  PYTHON version running standalone. Must be converted to C++.
- These are MC charge plots for Ckova,b modeled with a Poisson generator for each PMT. Work in Progress.







Summary and Outlook

- New HV Calibration went well and runs processed to give 1PE levels vs HV.
- Need to consider if results will change with the new Ped and Integrator code.
- New Ped and Integrator code integrated in to MAUS.
- Runs are being processed to investigate pion contamination.
- CKOV MC MAUS framework lagging, and will need to be the next push.