BigBite Analysis

5-Pass S=0 Final Cuts and 5-Pass S=90 Data Quality Corrections

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Outline

Determining the Pre-Shower Energy Cut

- Look at pion like events in the BB Čerenkov
- Pion like event requires Čerenkov cut:
  - Tracking to Cer mirrors + in TDC timing peak + TDC hit + Cer ADC =0
- Electron like events require:
  - Tracking to Cer mirrors + in TDC timing peak + TDC hit + Cer ADC > 0
- Plot pre-shower energy for pion and electron like events and count ratio of pion to electron like events for various pre-shower energy cuts

5 Pass Pre-Shower Cut

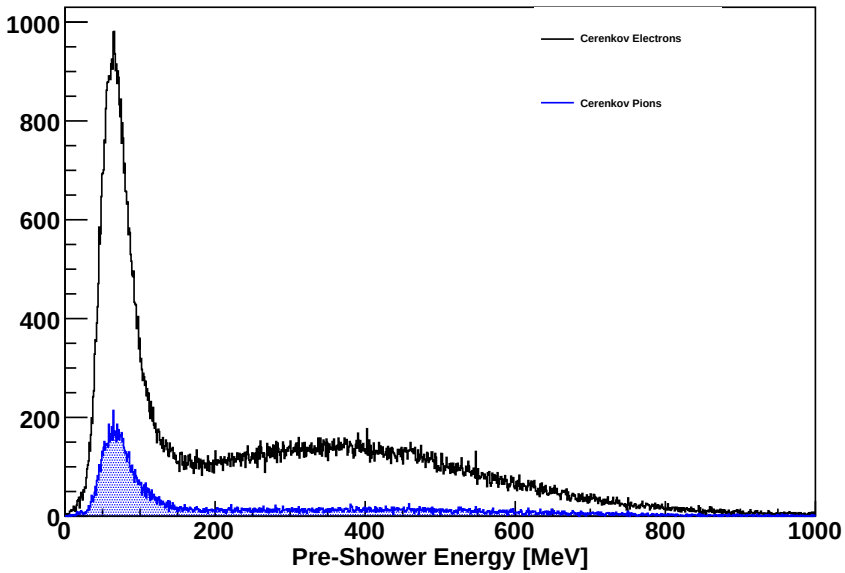

Figure: Shows pre-shower energy for pion and electron like events selected from the Čerenkov.

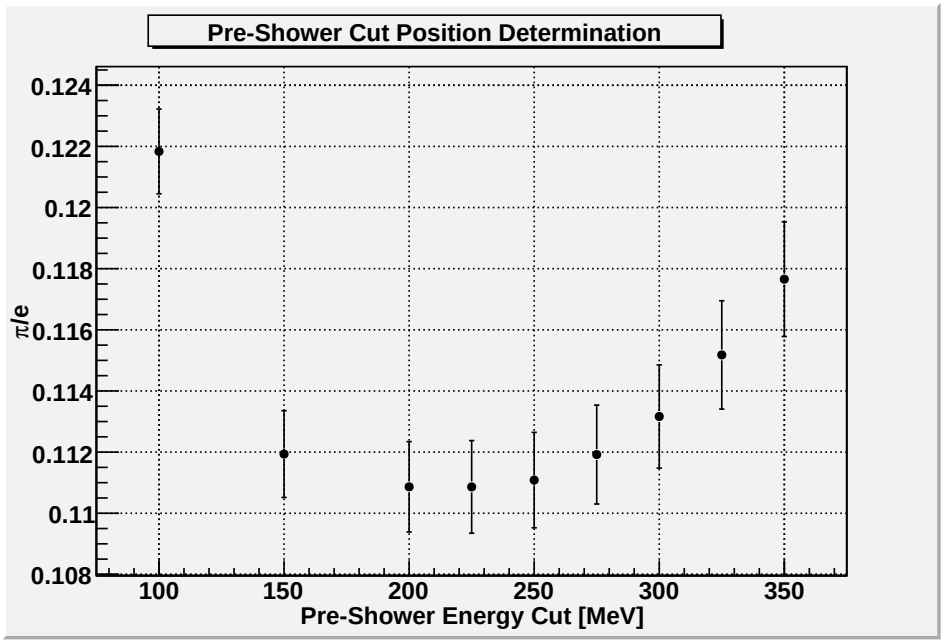

Figure: Ratio of pion like events to electron like events for various pre-shower energy cuts.

Pre-Shower energy cut of 200 MeV

E/p Calibration

- Diana pointed out that I was using the wrong momentum variable
- I was using the BB.tr.p variable when I should have been using the one from the optics class BB.optics.p_firstorder
- I am currently redoing the energy calibration using the optics momentum variable.

Determining the E/p Cut

- Fit E/p to obtain the mean value and width
- Look at electron and pion like events in the BB Čerenkov
- Plot pre-shower energy for pion and electron like events and count ratio of pion to electron like events for cut widths on E/p
- Currently:

$$\mu_{E/p} = 0.978, \sigma_{E/p} = 0.091$$

E/p Cut

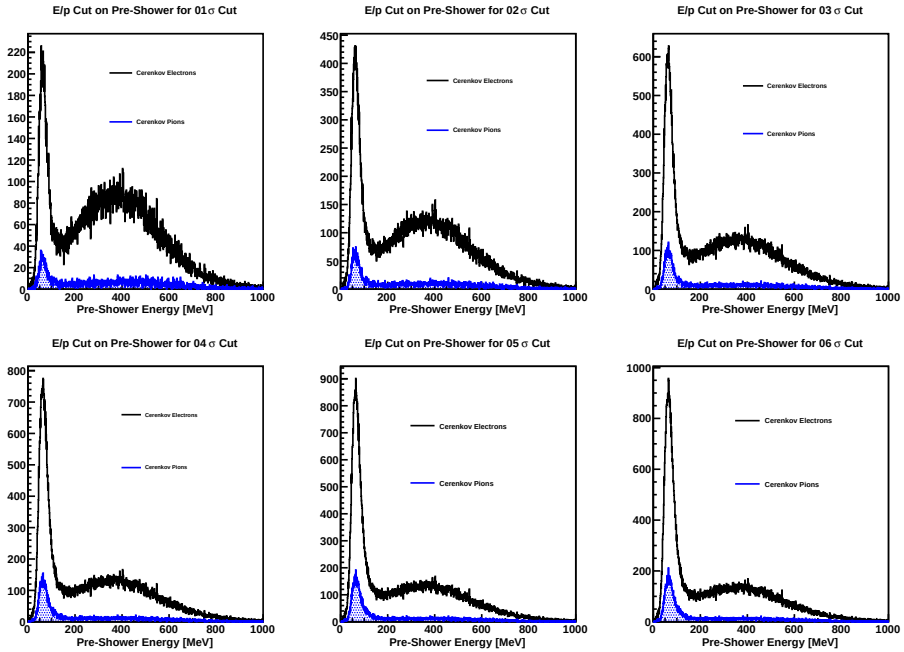

Figure: Shows pre-shower energy with various width cuts on E/p for pion and electron like events selected from the Čerenkov.

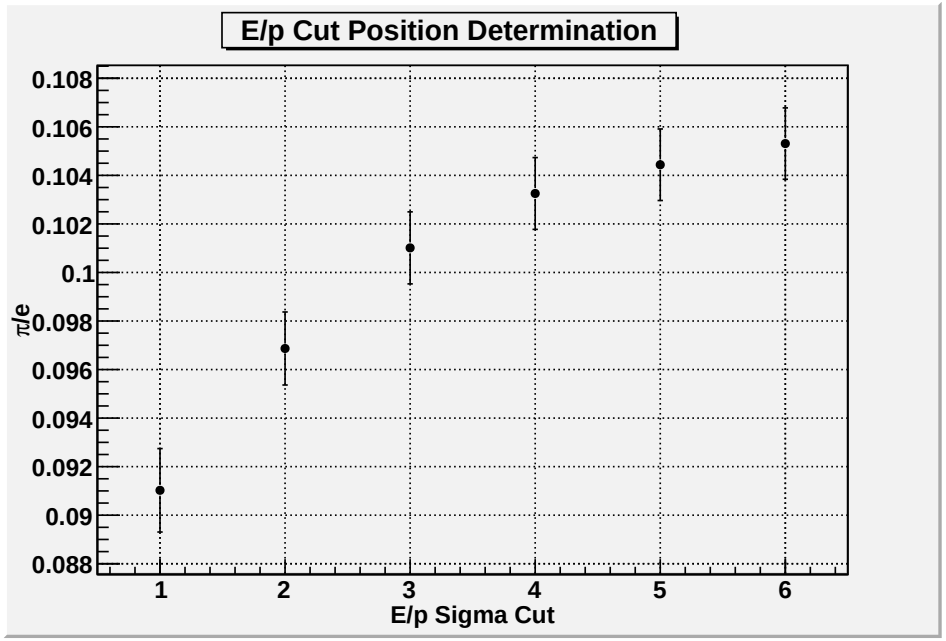

Figure: Ratio of pion like events to electron like events for various pre-shower energy cuts.

E/p Cut

Use a 3σ cut on E/p

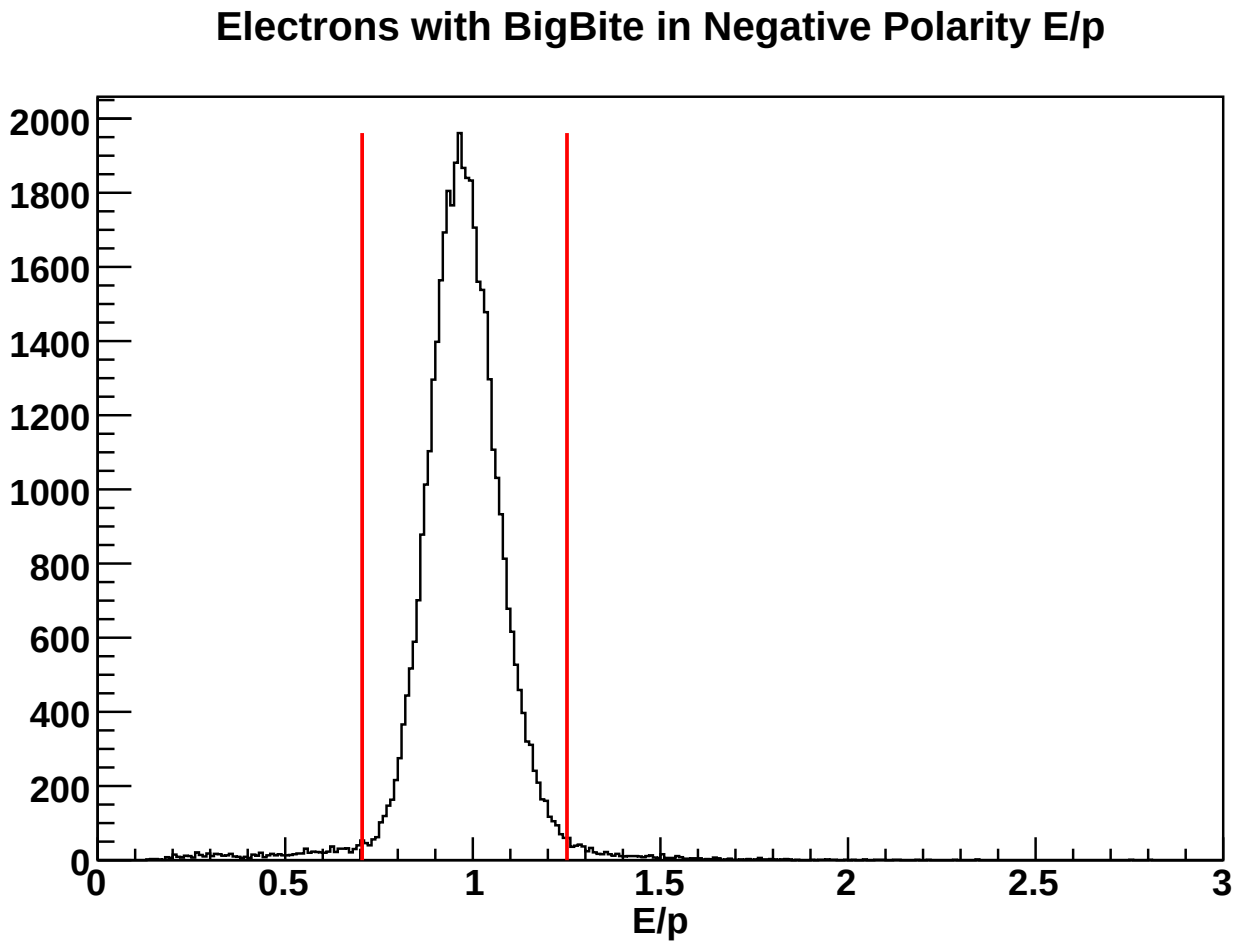

Figure: E/p, red lines show position of 3σ cut.

Track Match to Shower Cluster

Use a 3σ Cut

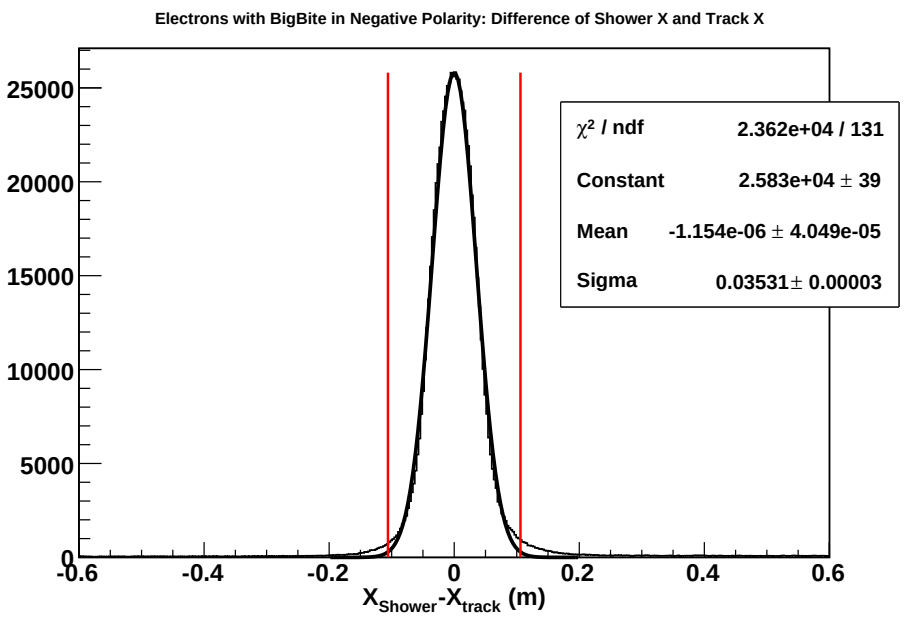

Figure: Difference between shower cluster x position and track x. Red lines show 3 sigma location.

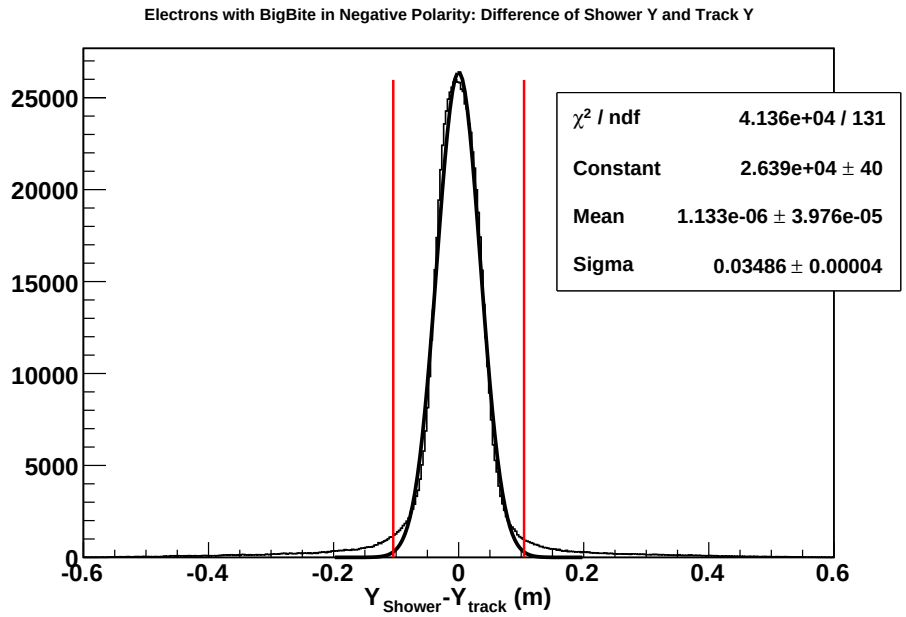

Figure: Difference between shower cluster y position and track y. Red lines show 3 sigma location.

Determining the Pre-Shower Cluster Match to Track Cut

- Choose various pre-shower cluster match to track cuts
- Count events that are outside the pre-shower cluster match to track cut position, but pass the E/p cut (good events)
- Count events that are outside the pre-shower cluster match to track cut position, but pass the E/p cut (bad events)
- Look at the ratio of the good/bad events to determine best cluster match to track cut

Track X Match to Pre-Shower Cluster X

Use a $\pm$ 0.71 m Cut

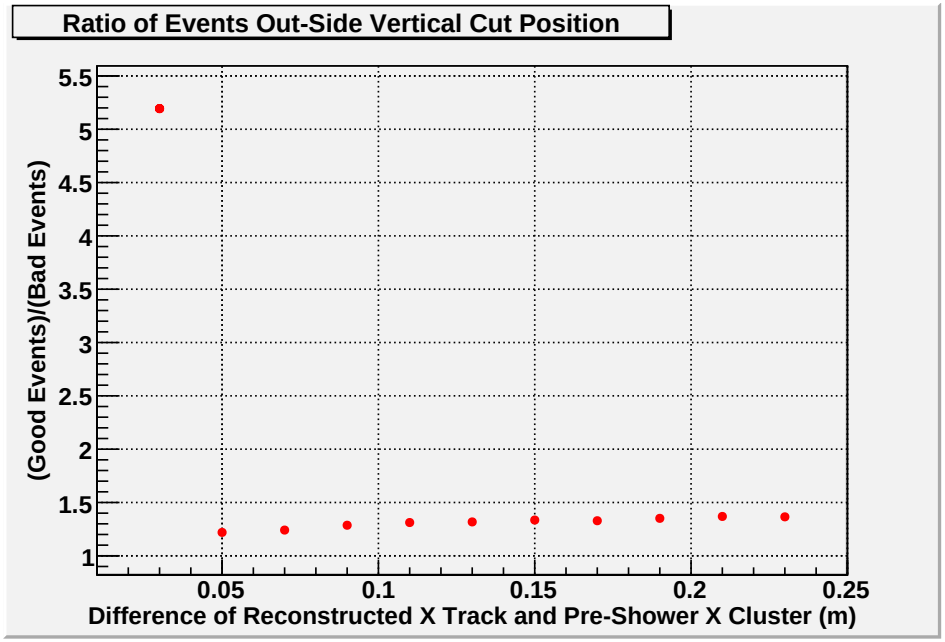

Figure: Ratio of good to bad events, using track x and pre-shower cluster x.

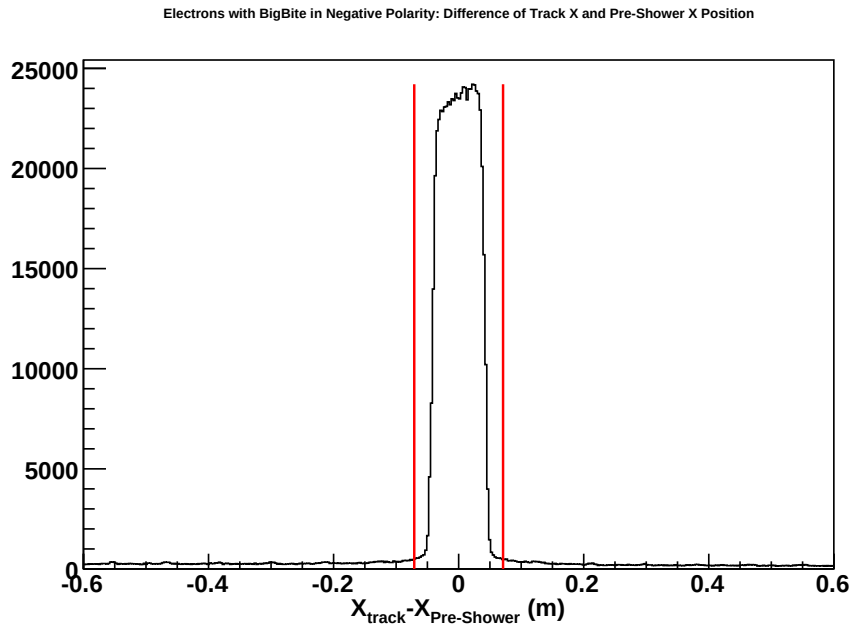

Figure: Difference between track x and pre-shower cluster x position. Red lines show $\pm$ 0.071m.

Track Y Match to Pre-Shower Cluster Y

Use a $\pm$ 0.24 m Cut

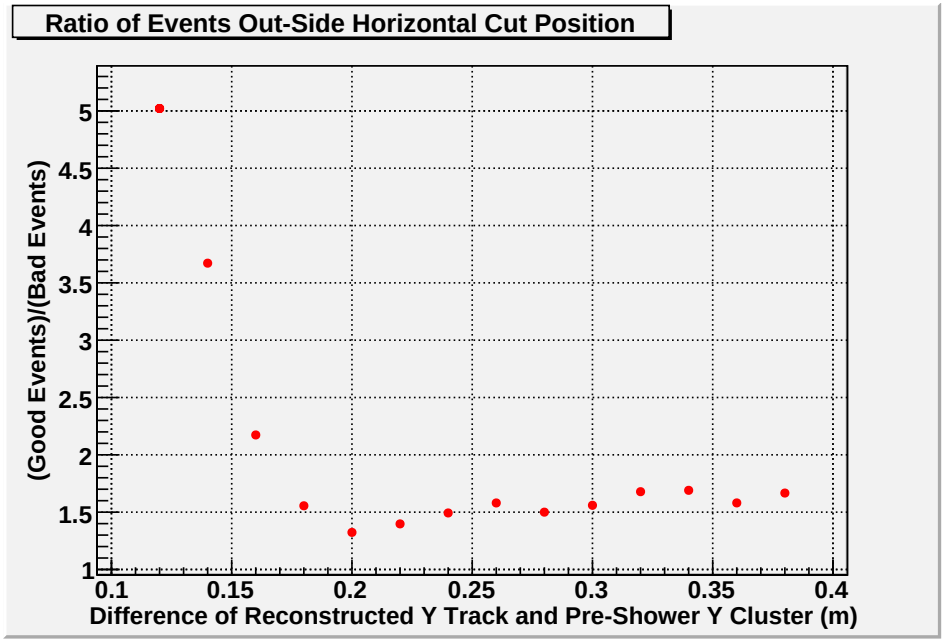

Figure: Ratio of good to bad events, using track y and pre-shower cluster y.

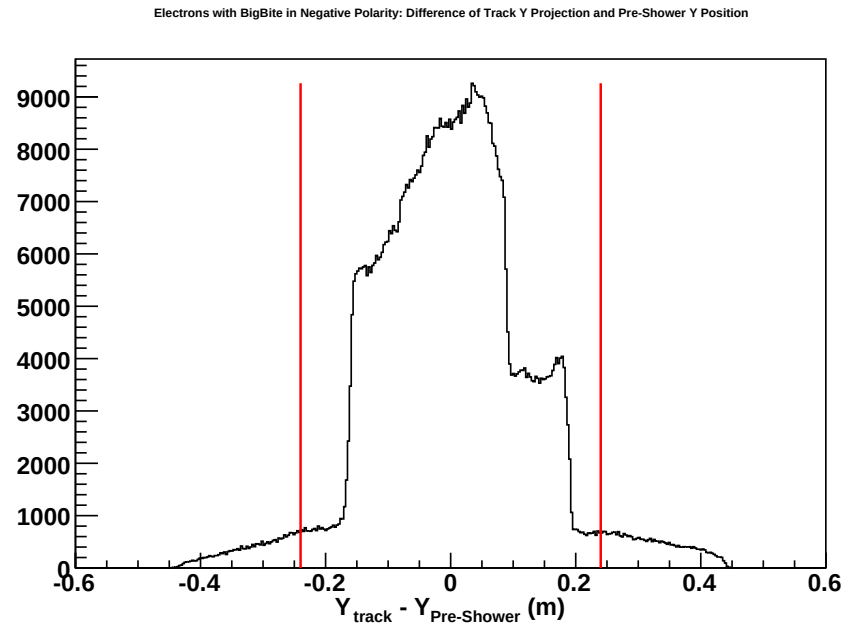

Figure: Difference between track y and pre-shower cluster y position. Red lines show $\pm$ 0.240m.

Re-Scattering Plane Cut

Same as our 4-pass Cut

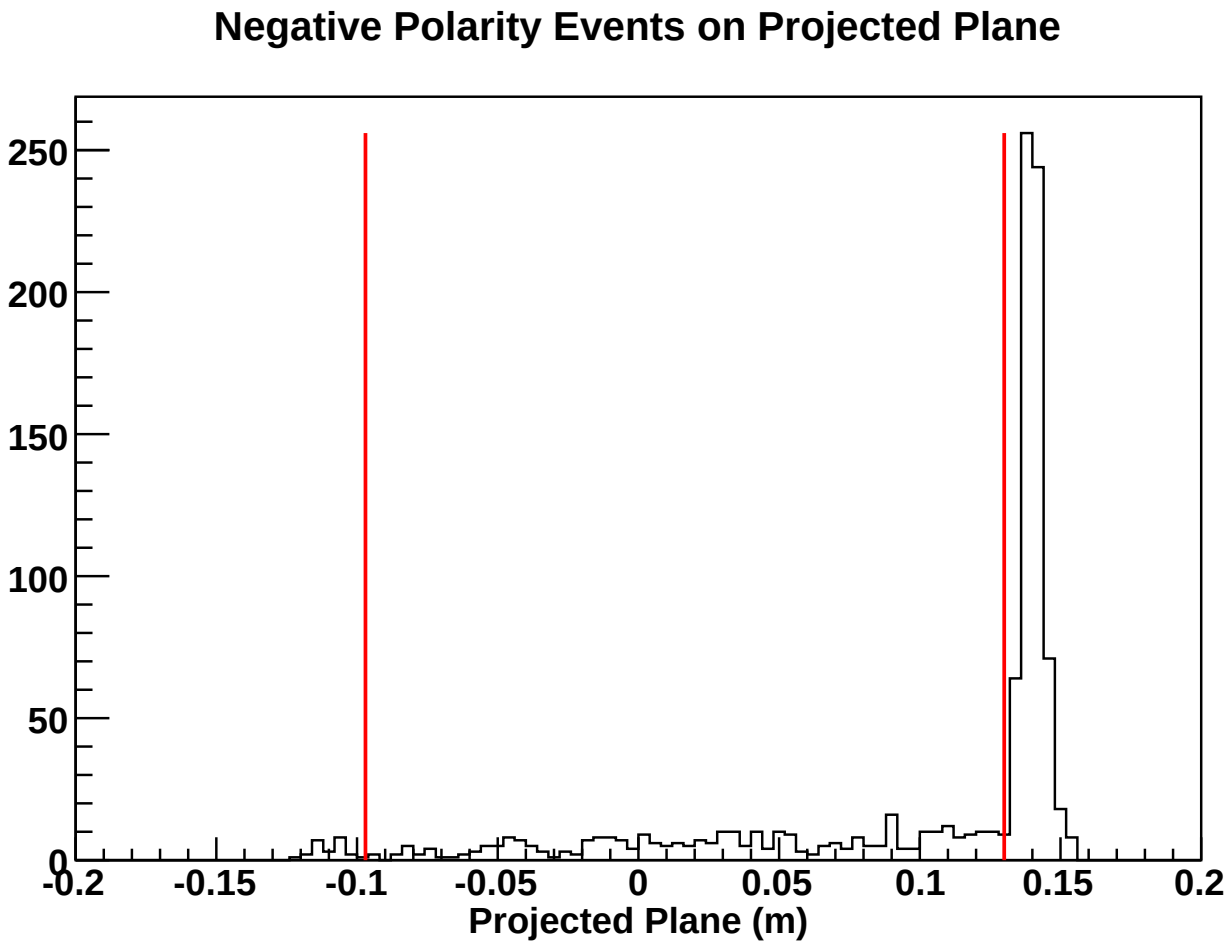

Figure: Cut on a plane to eliminate re-scattering particles.

5.89 GeV S=0 Almost Final Cut History

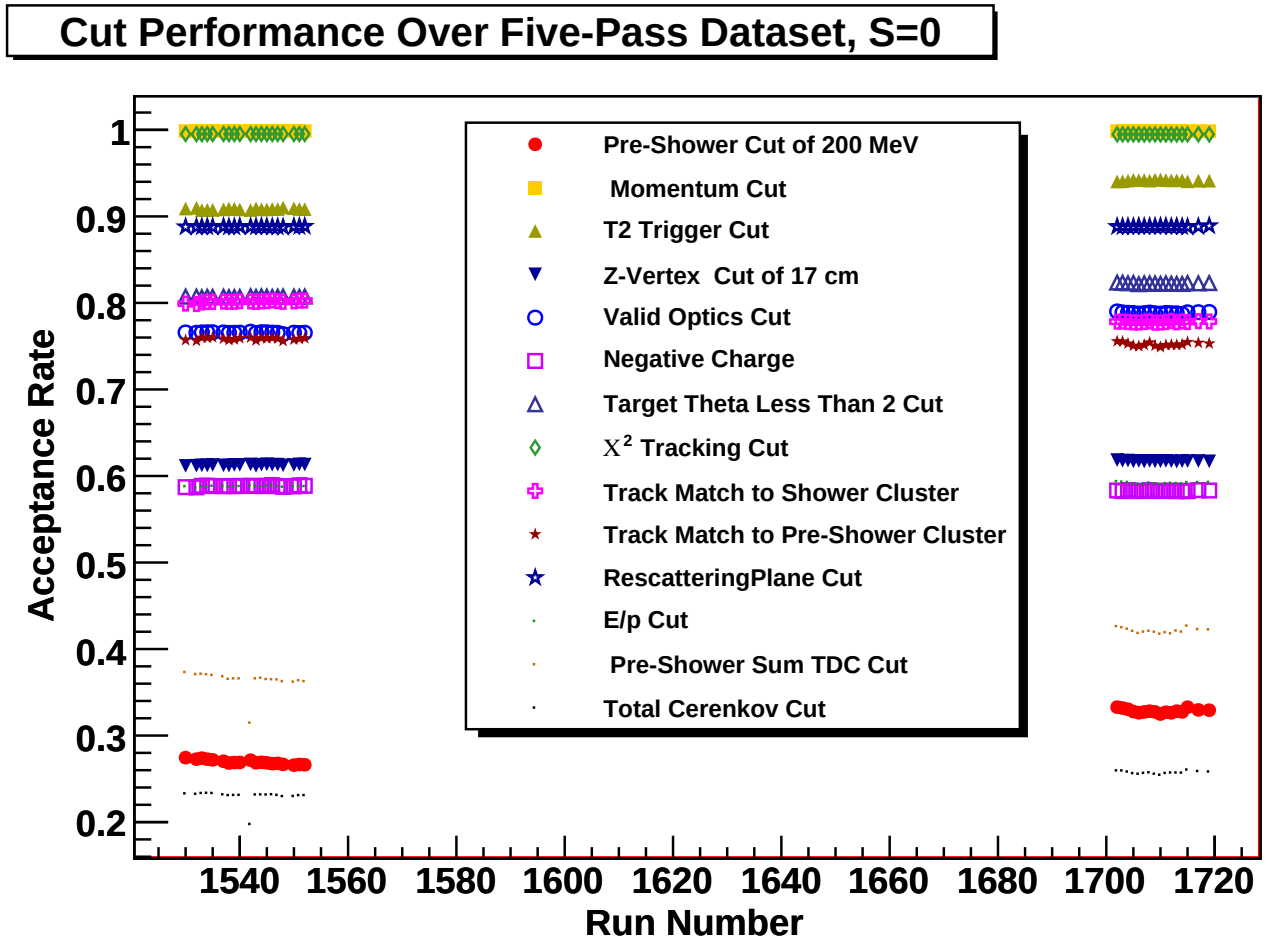

Figure: Final Cut acceptance for 5.89 target spin = 0°, with the exception of the E/p cut (not calibrated here).

S=90 Data Quality Summary (I)

MWDC

- I have finished looking at the 5-pass S=90 mwdc drift times and track residuals
- They are all stable with the exception when there is a threshold change on the shower (mean value changes slightly)
- Since we are not cutting on these variables, I think this is fine

S=90 Data Quality Summary (II)

E/p

- Looked at un-calibrated E/p
- Mean E/p jumps around (mean = 0.93 to 1.2). Correlated to the shower threshold changes
- Since we are cutting on E/p we may need to calibrate for each threshold change
- Could we just shift E/p location (add an offset to bring it to E/p=1) if there is no improvement in resolution?

Čerenkov TDCs

- Finished correcting the Čerenkov TDC timing shifts that were correlated to threshold changes
- Need to check corrections

What's Next...

- Continue with 5-pass S=90 data quality:
  - Pre-Shower Sum TDCs
  - E/p
- Start working on 5-pass S=270 data:
  - MWDC checks
  - Čerenkov TDCs
- Revisit BigBite e+/e- ratios during 4-pass with ps and LT Corrections