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

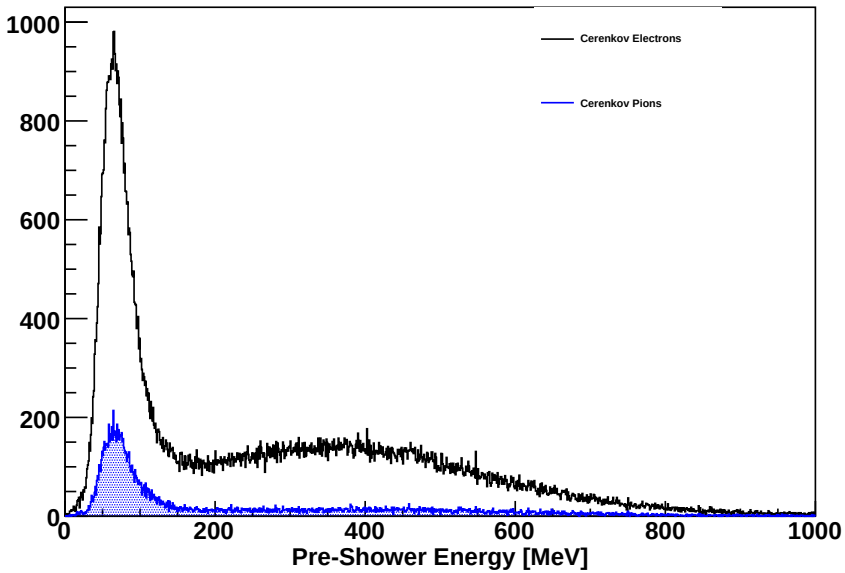

Figure: Shows pre-shower energy for pion and electron like events selected from the Čerenkov.

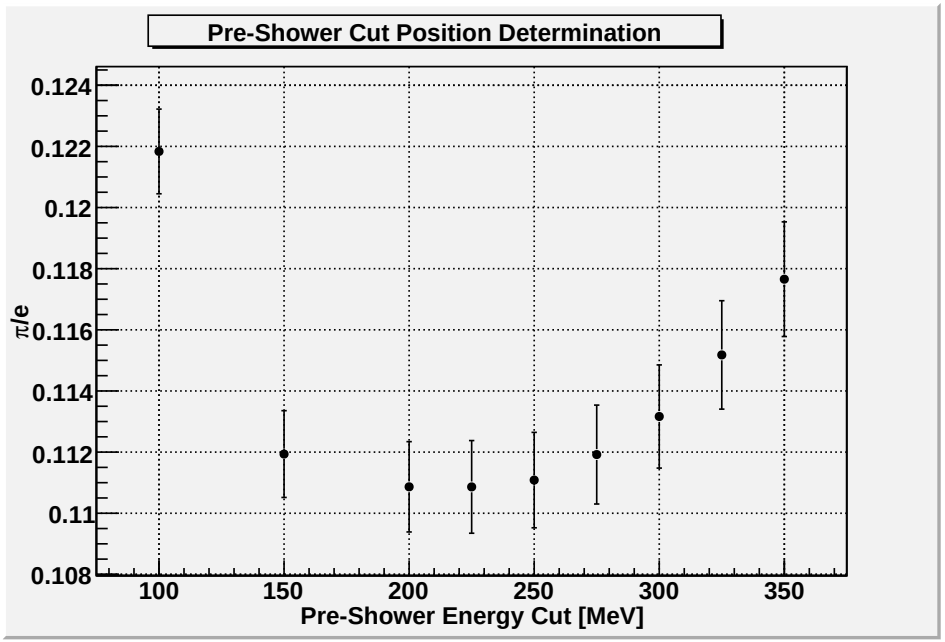

Figure: Ratio of pion like events to electron like events for various pre-shower energy cuts.

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

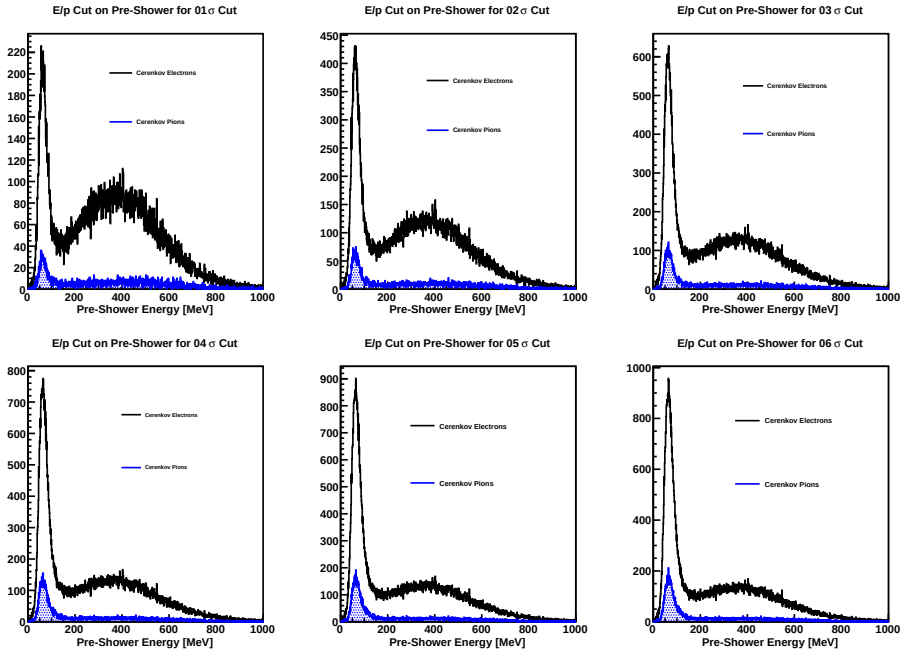

Figure: Shows pre-shower energy with various width cuts on E/p for pion and electron like events selected from the Čerenkov.

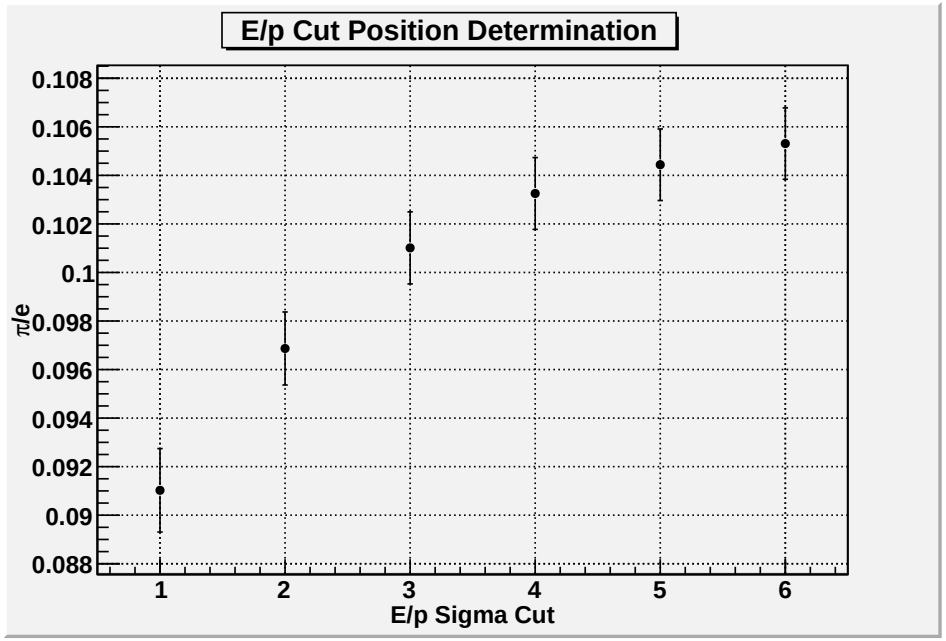

Figure: Ratio of pion like events to electron like events for various pre-shower energy cuts.

E/p Cut

Use a 3σ cut on E/p

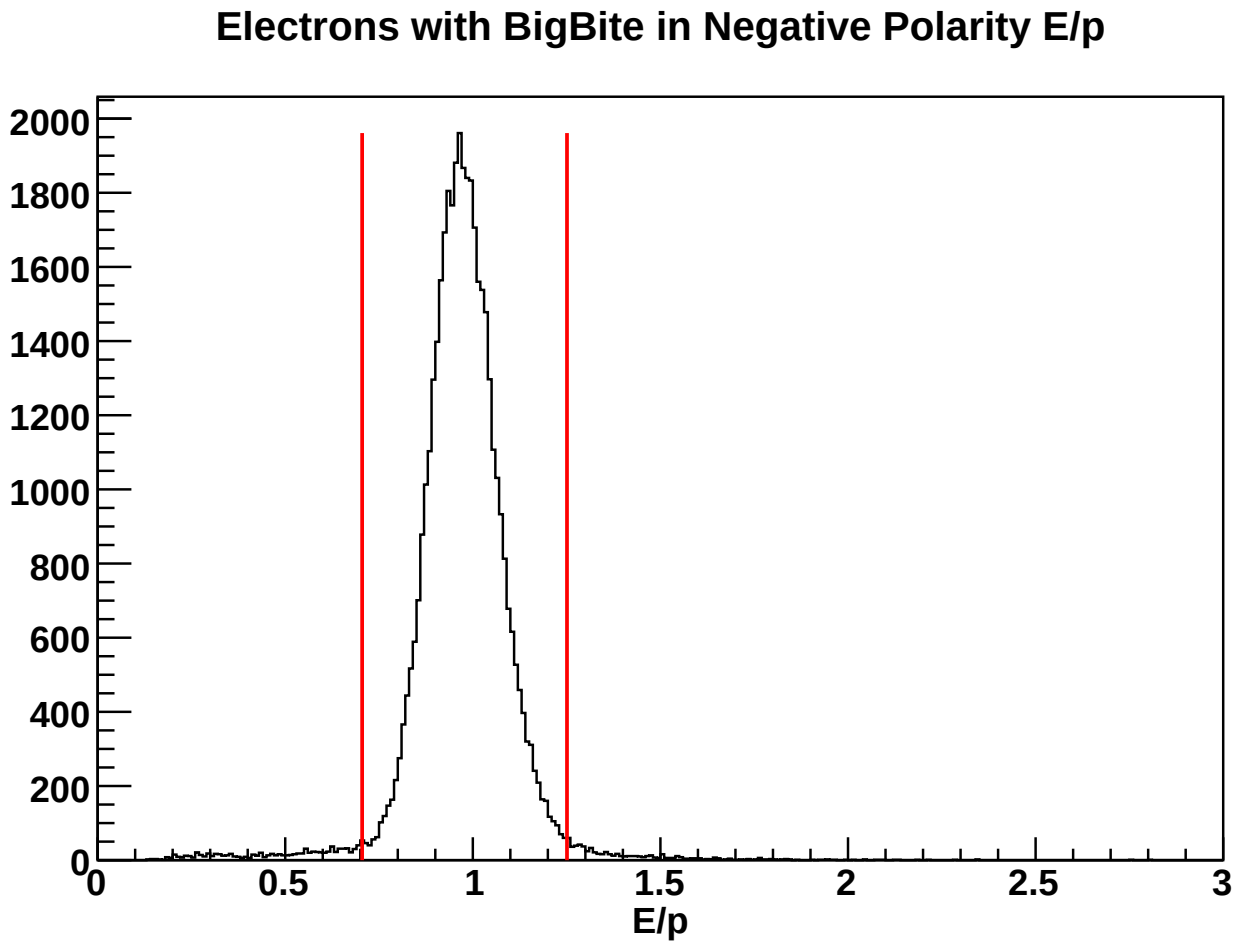

Figure: E/p, red lines show position of 3σ cut.

Track Match to Shower Cluster

Use a 3σ Cut

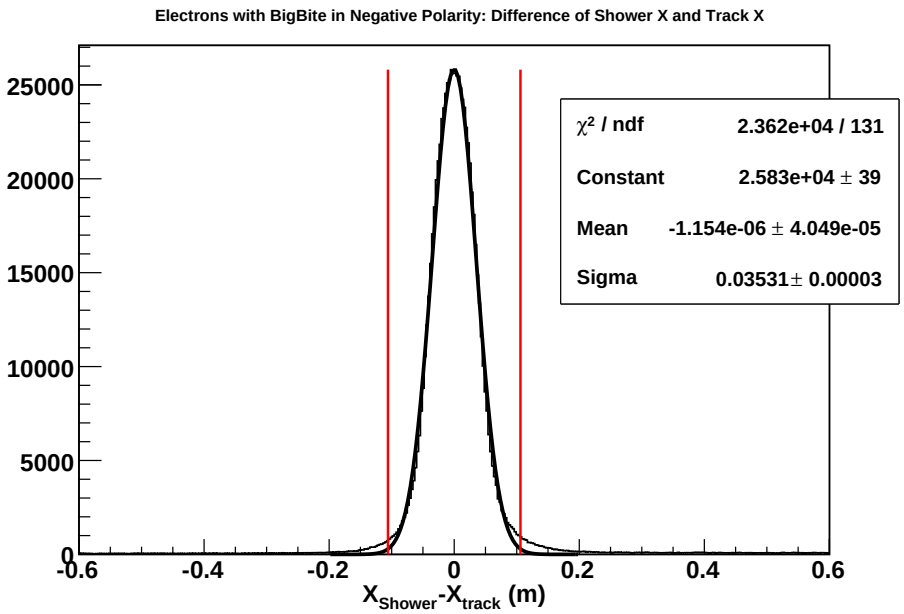

Figure: Difference between shower cluster x position and track x. Red lines show 3 sigma location.

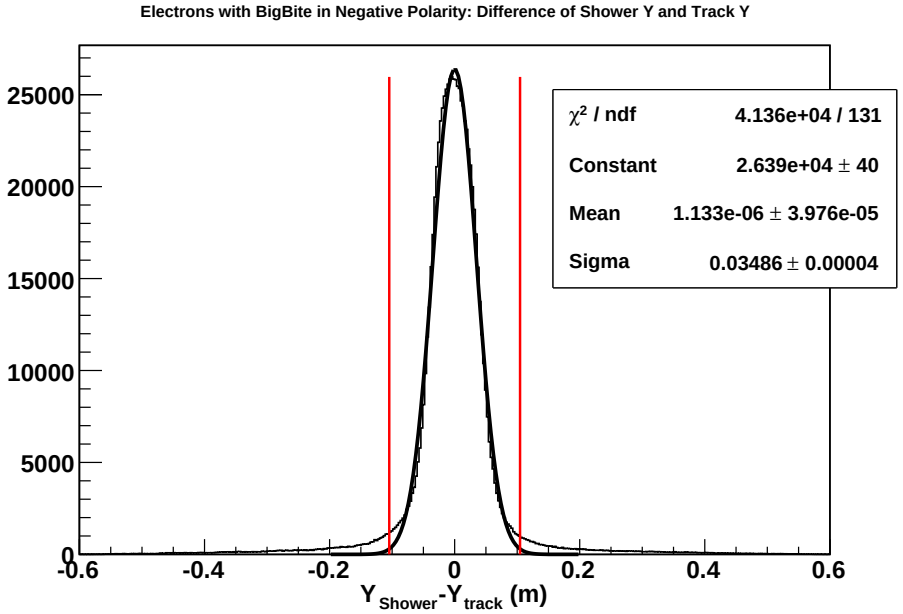

Figure: Difference between shower cluster y position and track y. Red lines show 3 sigma location.

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

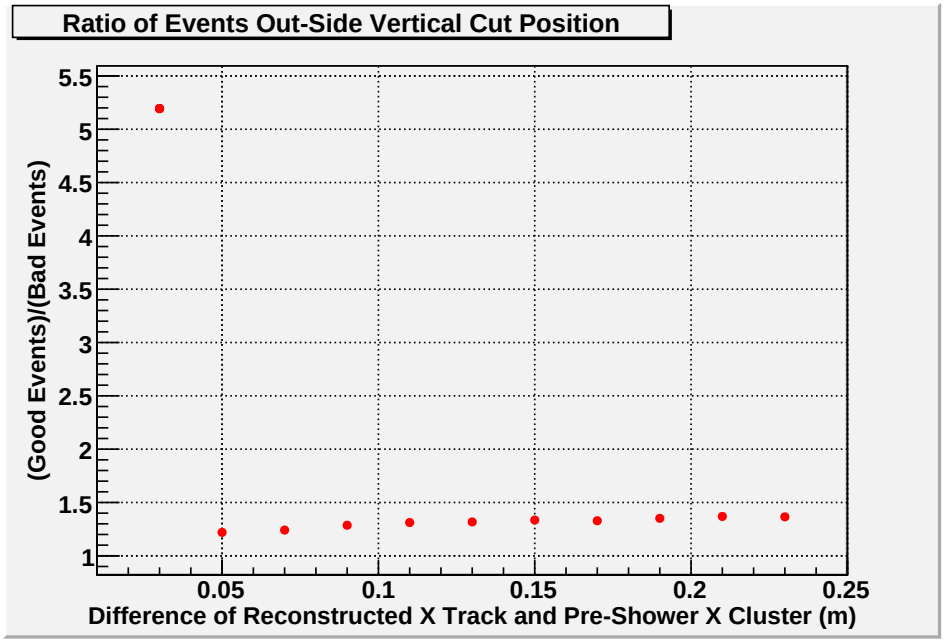

Figure: Ratio of good to bad events, using track x and pre-shower cluster x.

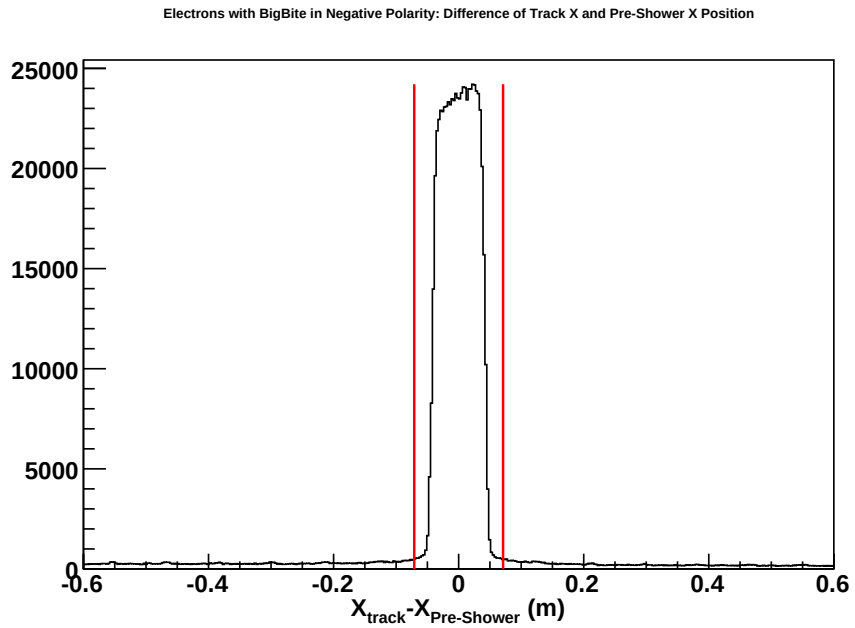

Figure: Difference between track x and pre-shower cluster x position. Red lines show $\pm$ 0.071m.

Track Y Match to Pre-Shower Cluster Y

Use a $\pm$ 0.24 m Cut

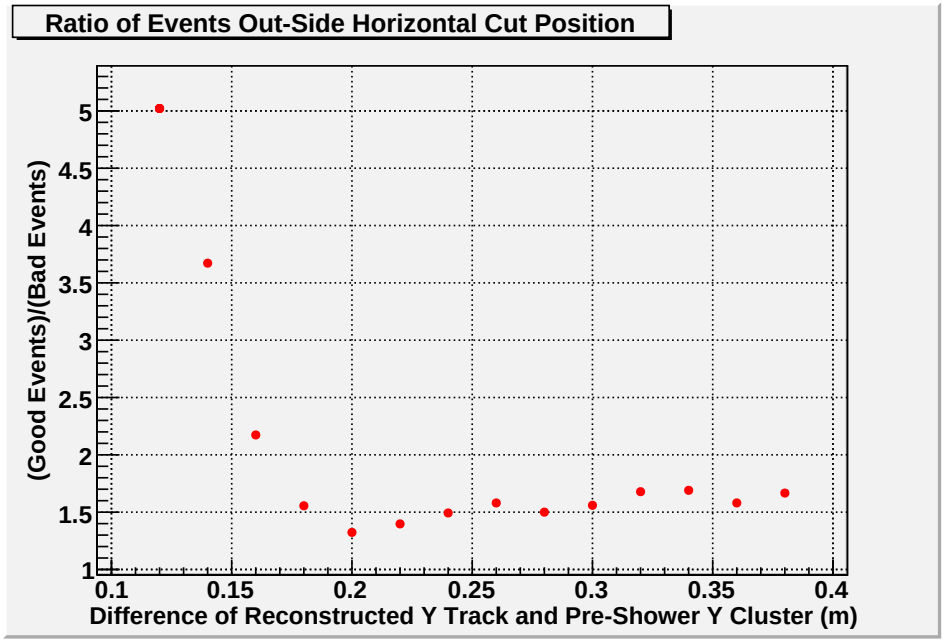

Figure: Ratio of good to bad events, using track y and pre-shower cluster y.

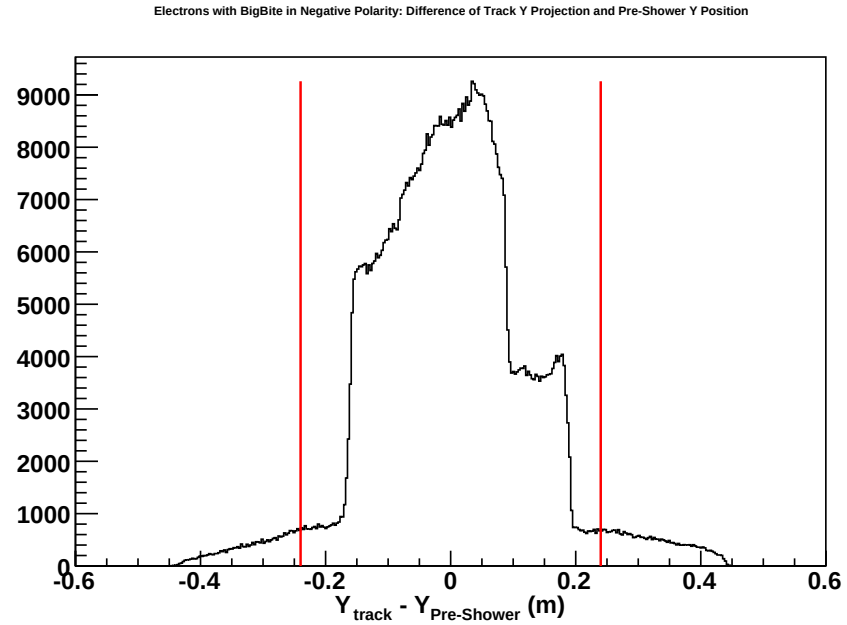

Figure: Difference between track y and pre-shower cluster y position. Red lines show $\pm$ 0.240m.

Re-Scattering Plane Cut

Same as our 4-pass Cut

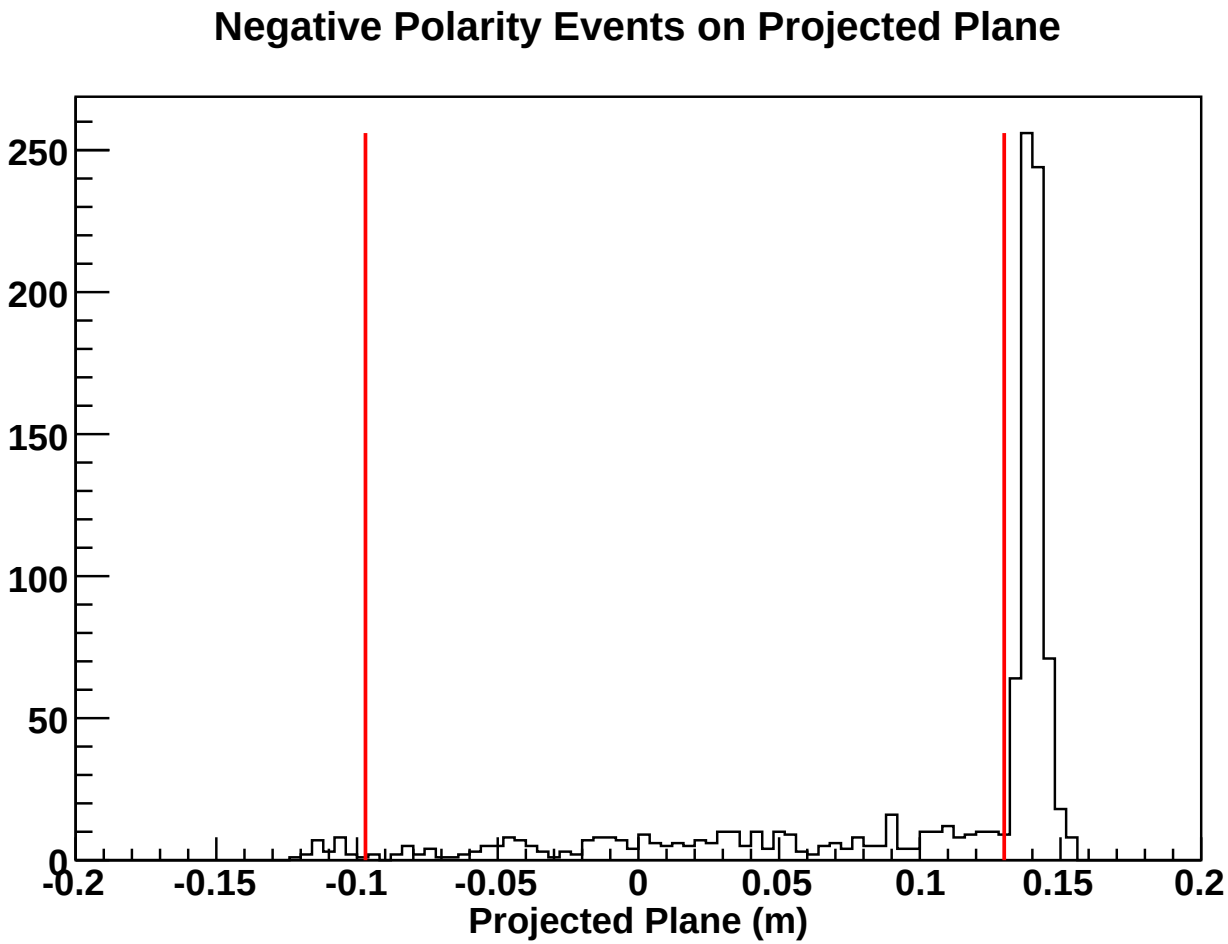

Figure: Cut on a plane to eliminate re-scattering particles.

5.89 GeV S=0 Almost Final Cut History

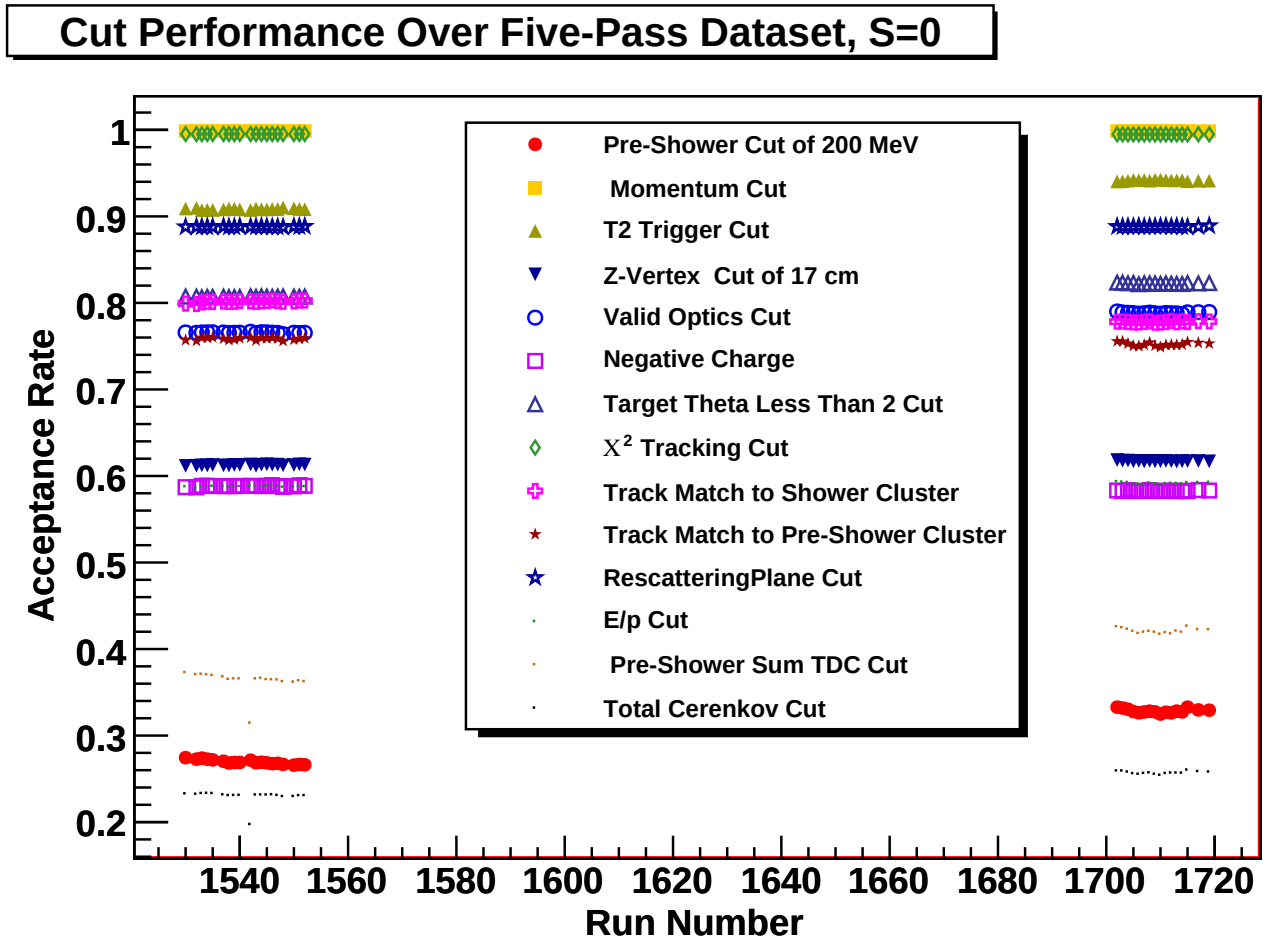

Figure: Final Cut acceptance for 5.89 target spin = 0°, with the exception of the E/p cut (not calibrated here).

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 slightly 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?

S=90 Data Quality Summary (III)

Čerenkov TDCs

- Finished correcting the Čerenkov TDC timing shifts that were correlated to threshold changes.
- It would be easier to implement the TDC timing corrections during the replays using the $BB.cer.t$ variable
- The first hit of the DBB.BBcerTxx is identical to BB.cer.t[xx]

DBB TDC Class vs BB.Cer TDC Class

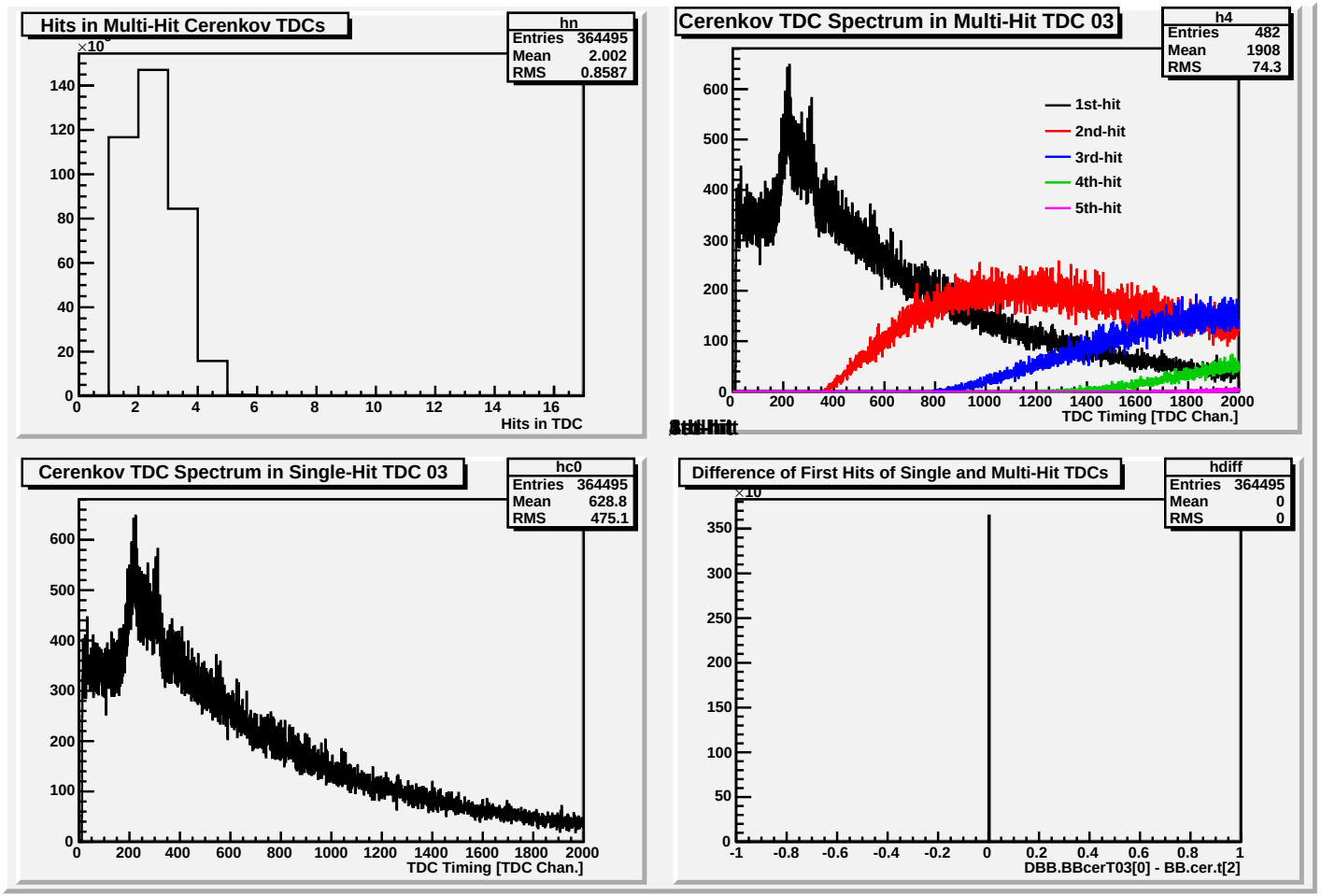

Figure: Upper left plot show the hits in the DBB TDC. The upper right plot shows the TDC timing of each hit in the DBB TDC. The bottom left plot shows the TDC timing in the BB.cer TDC. The bottom right plot shows the difference of the first hit in the DBB TDC and the BB.cer TDC

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