BigBite Analysis
Round 2 MWDC,E/p and Pion Rejection

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Outline

Chamber 1

Drift-Time $\Delta t_{max} \approx 8$ ns

Track Residual $\Delta d_{max} \approx 70\ \mu m$
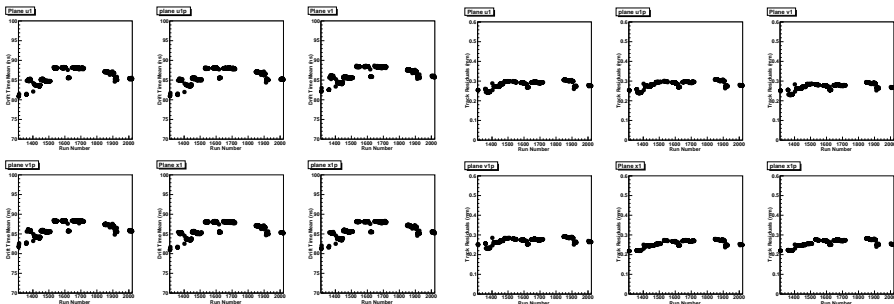

Figure: Drift times for chamber 1 of 5.89 GeV data set.

Figure: Track residuals for chamber 1 of 5.89 GeV data set.
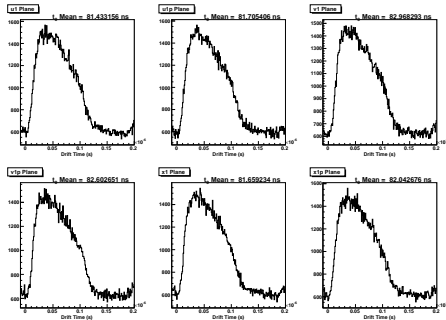
Chamber 1: Drift Time

Run 1314   Run 1663
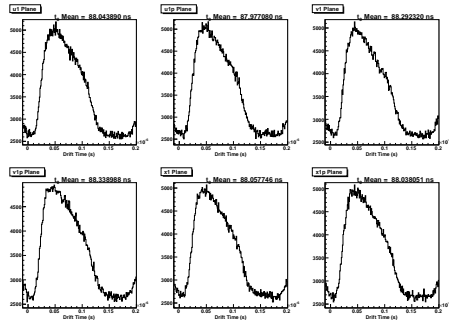

Figure: Drift times for run 1314 of chamber 1.

Figure: Drift times for run 1663 of chamber 1.

Chamber 1: Track Residuals

Run 1314

Run 1663
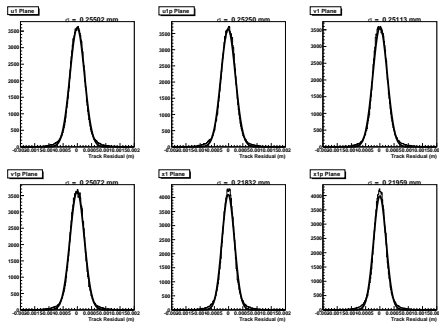

Figure: Track residuals for run 1314 of chamber 1.
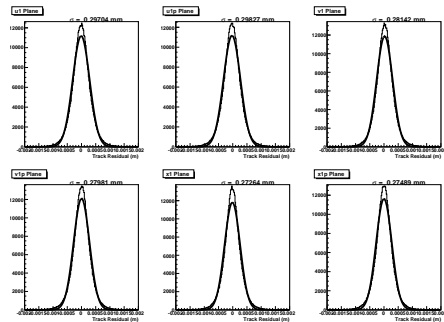
Figure: Track residuals for run 1663 of chamber 1.
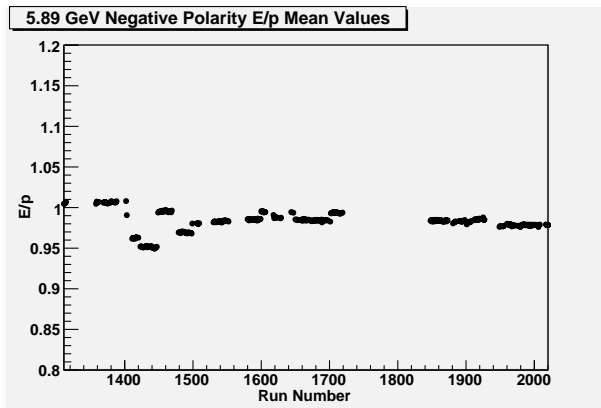
E/p Stability

Figure: E/p as a function of run number for 5.89 GeV data set.

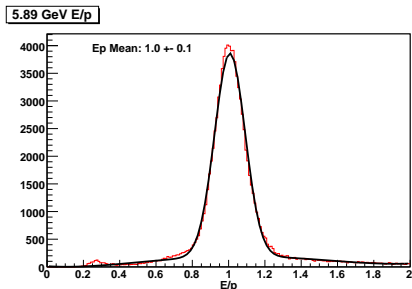# E/p Fits

Run 1314

Figure: E/p fit for run 1314 of chamber 1.

Run 1447
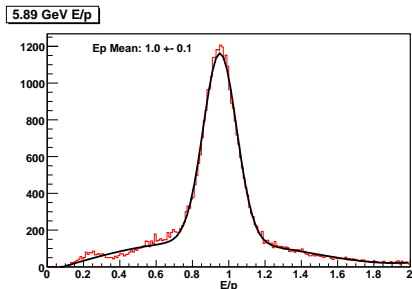

Figure: E/p fit for run 1447 of chamber 1.

Background issue with fit?

Pion Rejection: Define Base Cuts

- Used runs 1881-1900
- Basic Cuts included in all plots:
    - Valid optics cut
    - Track quality cut
    - Target vertical angle cut
    - Track match to shower and Pre-shower energy clusters
    - Rescatter cut
    - Negative charge
    - T6 trigger (high shower threshold)

Čerenkov Pion Rejection: Define Čerenkov Electron Cut (1)

- Each Čerenkov PMT had several cuts applied:
    - TDC Cut $->$ Requires the event to fall within TDC cut window
    - ADC Cut $->$ Requires the event to produce a certain amount of Čerenkov light
    - Mirror Cut $->$ Requires the reconstructed track to pass through the Čerenkov PMT location
- A Čerenkov PMT Cut is then defined as:

$$Cer_{PMT} = TDC_{PMT} \&\& ADC_{PMT} \&\& MIR_{PMT}$$

- There are 20 Čerenkov PMT cuts in total

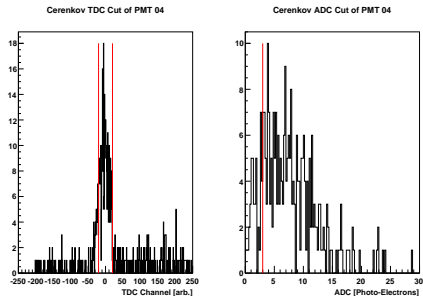# Čerenkov Pion Rejection: Define Čerenkov Electron Cut (2)

Figure: TDC and ADC cuts for PMT 4. Red lines of the TDC (left) plot defines the TDC timing window. The red line in the ADC (right) plot marks the 3 photo-electrons position.

Čerenkov Pion Rejection: Define Čerenkov Electron Cut (3)

- Each Čerenkov PMT cut can be combined to form the following cuts
  - Beam Side Cut $->$ Any of the Cer_{PMT} cuts of PMTs 1-10 are true (small angle side of the detector)
  - RHRS Side Cut $->$ Any of the Cer_{PMT} cuts of PMTs 11-20 are true (large angle side of detector)
  - Total Cer Cut $->$ Any of the Cer_{PMT} cuts of PMTs 1-20 are true
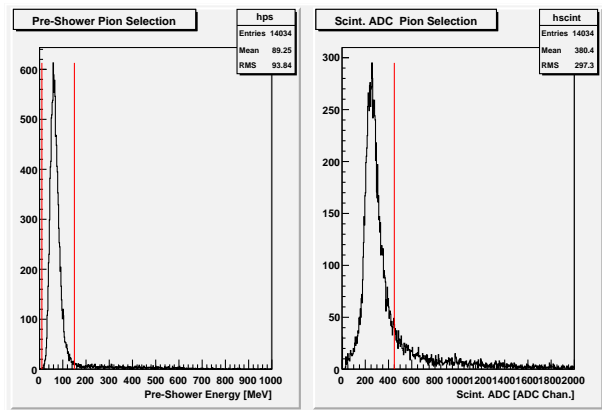
Čerenkov Pion Rejection: Define Pions

Figure: Pre-Shower and scint. selection of pions.

Čerenkov Pion Rejection: Define Rejection Factor

- Count events in pion selection, N_π
- Apply Čerenkov electron cuts to pion selection, $N_{\pi,e}$
- Pion rejection factor is then $N_\pi/N_{\pi,e}$
- Rejection factor was Computed for the Čerenkov single PMTs, beam, rhrs and total cuts using the T6 trigger

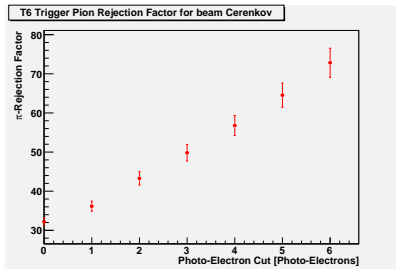# Čerenkov Beam and RHRS Pion Rejection Factors

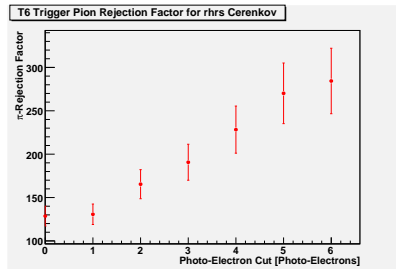Figure: Small angle (beam) side Čerenkov pion rejection factors as a function of photo-electron cuts.

Figure: Large angle (RHRS) side Čerenkov pion rejection factors as a function of photo-electron cuts.

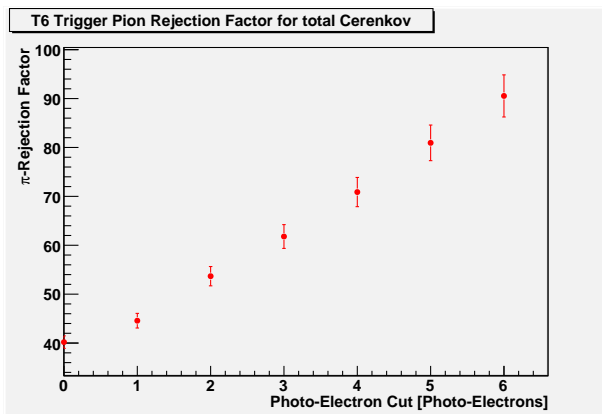# Čerenkov Pion Rejection: Čerenkov Total Pion Rejection

Figure: Total Čerenkov pion rejection factors as a function of photo-electron cuts.

Scintillator/Pre-Shower Pion Rejection: Define Rejection Factor

- Count events in pion selection defined by pre-shower/scintillator ADC, N_π
- Apply Scintillator/pre-shower electron ADC cuts to pion selection, $N_{\pi,e}$
- Pion rejection factor is then $N_\pi / N_{\pi,e}$
- Rejection factor was Computed for several scintillator/pre-shower ADC values

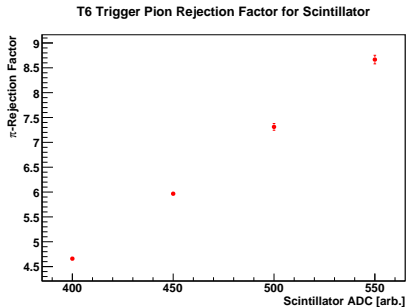# Scintillator/Pre-Shower Pion Rejection: Rejection Factors

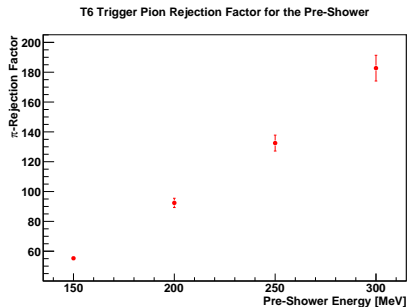Figure: Scintillator pion rejection factors as a function of scintillator ADC cuts.

Figure: Pre-Shower pion rejection factors as a function of Pre-Shower ADC cuts.

Total T6 Pion Rejection

- Čerenkov at 3p.e: 62
- Scintillator at ADC cut of 500 ADC chan.: 7
- Pre-Shower at energy cut of 200 MeV: 93
- Total Pion Rejection: 40362
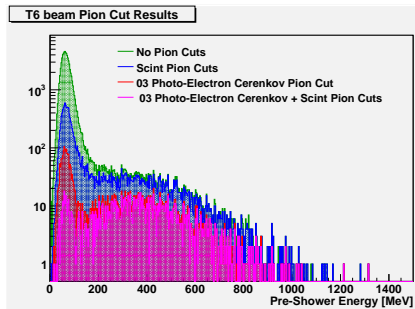
Total T6 Pion Rejection Results (1)

Figure: Pre-Shower Energy with various pion rejection cuts applied. Here, only the small angle Čerenkov cut is applied.
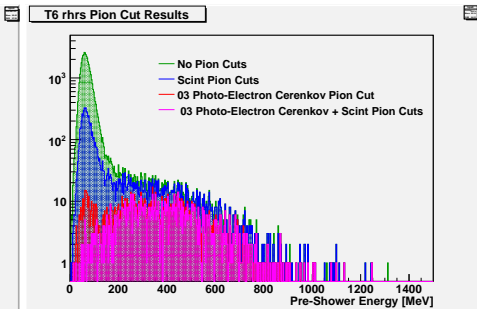

Figure: Pre-Shower Energy with various pion rejection cuts applied. Here, only the large angle Čerenkov cut is applied.
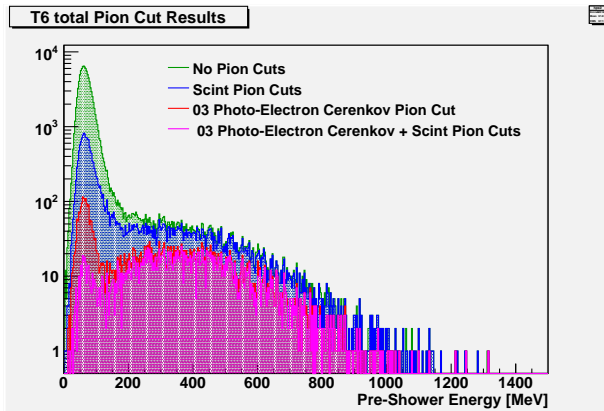
Total T6 Pion Rejection Results (2)

Figure: Pre-Shower Energy with various pion rejection cuts applied. Here, only the total Čerenkov cut is applied.

Summary

- Some Fluctuations in MWDC and E/p values over 5.89 GeV runsets
    - Most extreme drift-time difference between runs is about 8 ns
    - Most extreme track residual difference between runs is about 70 μm
- Čerenkov π-rejection is dominated by the small angle side (larger rate)
- Total π rejection of $\approx 10^4$

What's Next

- Look at pion rejection using full TDC cut ($\pm$ 50 TDC Chan.)
- Get π/e ratio and π contamination for small and large angle side
- Look into shift seen in the in-plane angle