Charged Hadron Contamination

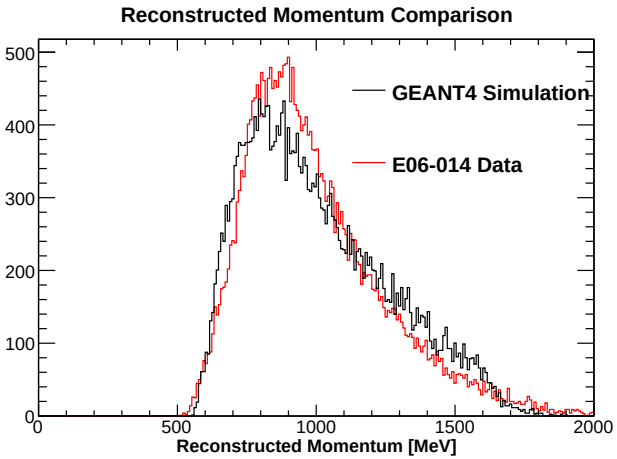
Matthew Posik

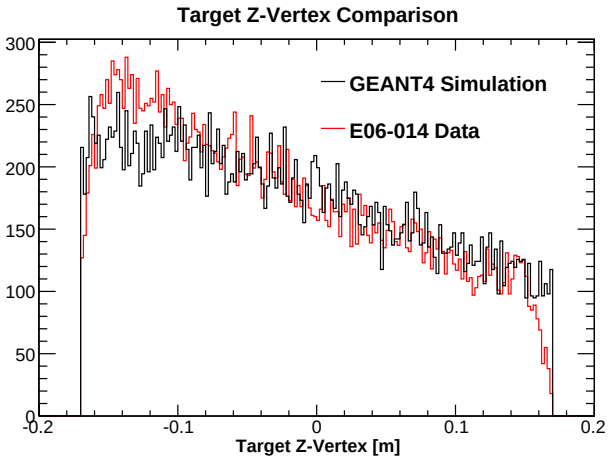
[1] Temple University
Philadelphia, PA 19122

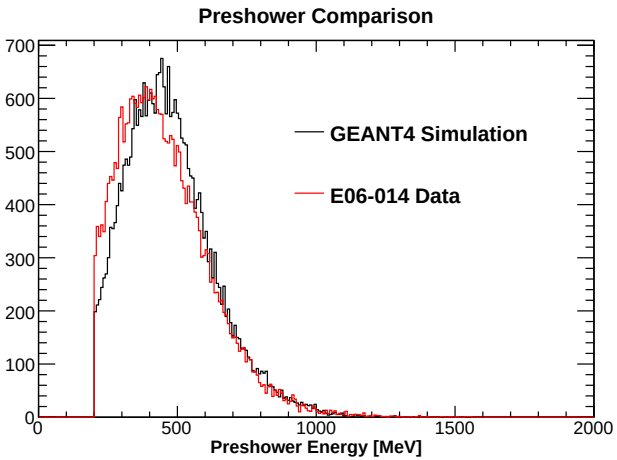
02/14/2013

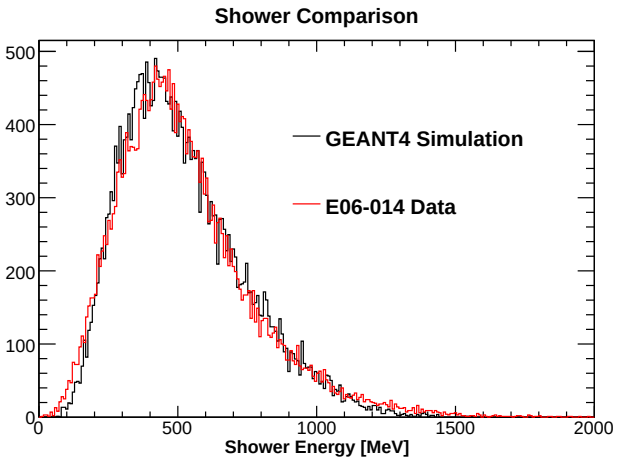
Outline

Good Agreement

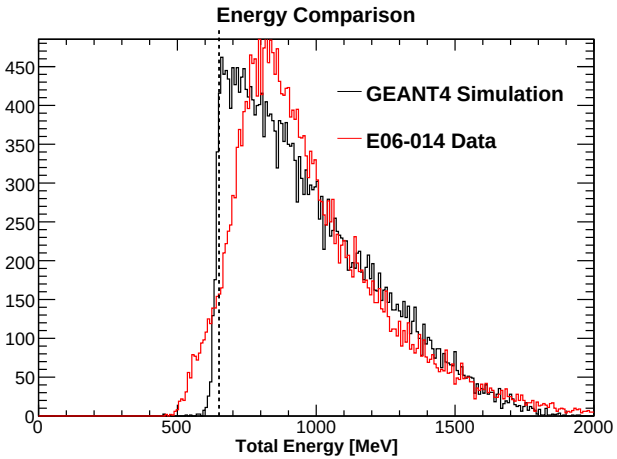


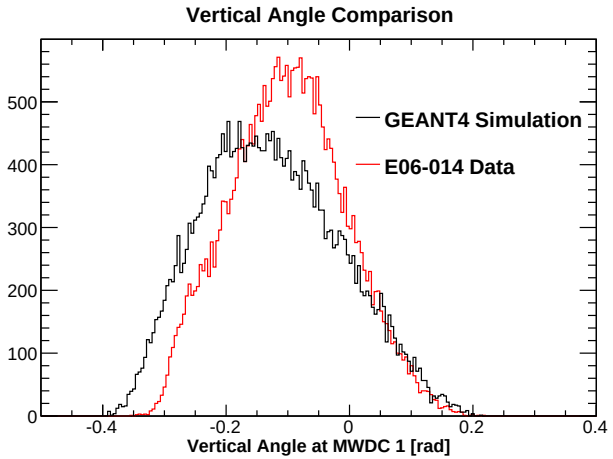


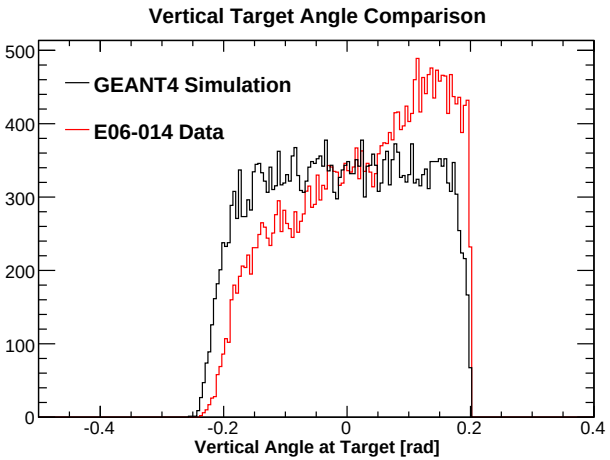


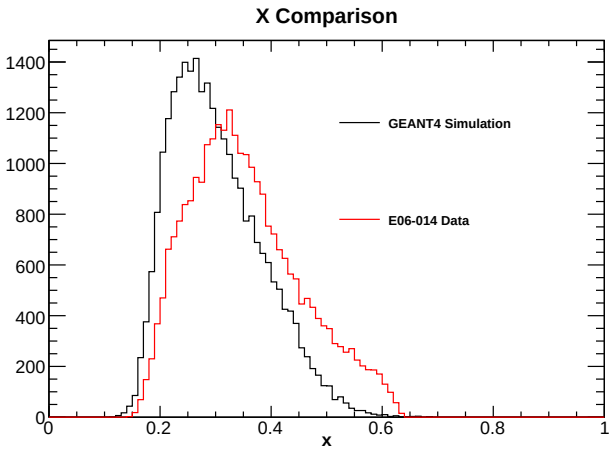


Not So Good Agreement









Summary

GEANT4 Electron Comparison

- Some disagreement between data and simulation
- Mostly with tracking variables

π^- Contamination

- I have showed that the π^- contamination is small ($< 1\%$)
- See talks from 06-14-2012 and 06-21-2012
- π^-/e^- ratio increases as momentum increases
- GEANT4 can help determine why

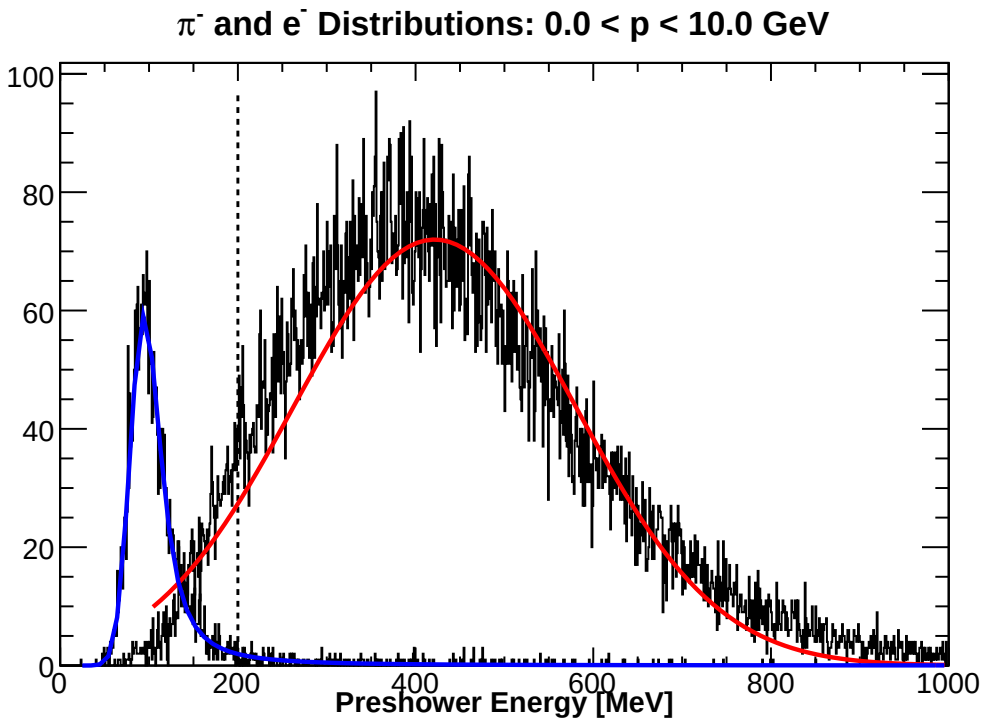


Figure: Example of π^- contamination over the entire momentum range. Pions in this plot are over counted and need to be scaled down in order to get a closer to reality contamination. (Unscaled, the pion contamination is $\sim$ 0.6 %)

Using GEANT4 for π^-

- GEANT4 weights the pion cross-section by using results computed with the wiser code
- The detected pions using the wiser code are larger than what is detected in E06-014
- Using a factor of 0.5 on the Wiser cross-section puts the π^- counts from GEANT4 in decent agreement with E06-014
- Transversity found the Wiser code to over-estimate pions by about a factor of 2

GEANT4 Comparison to DIS Data

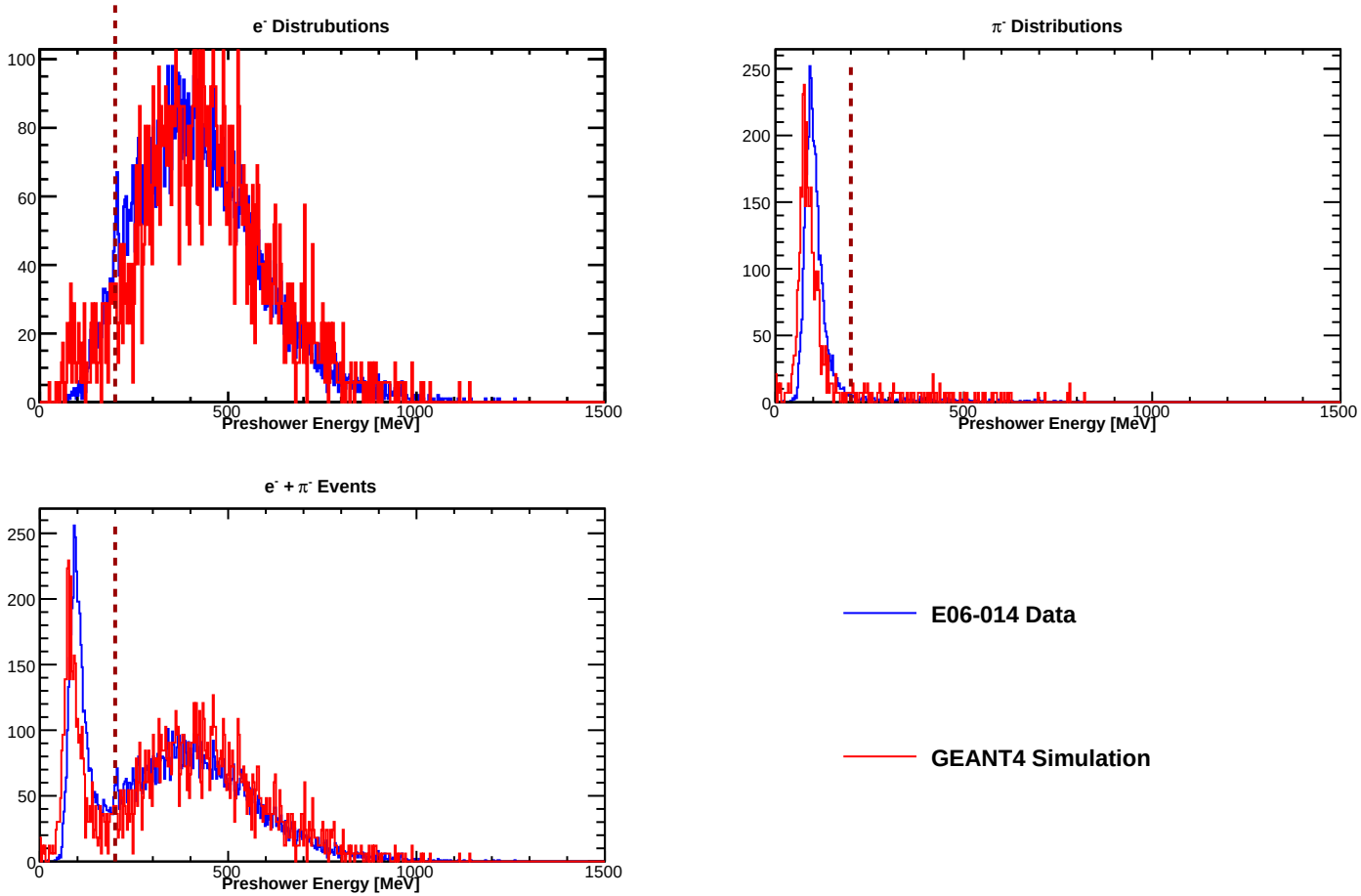


Figure: Comparison of GEANT4 E06-014 electron and negative pion data.

GEANT4 π^-/e^- Ratios

Procedure

- Divide momentum range from 0.5 - 1.7 GeV into four bins
- Compute π^-/e^- ratios in GEANT4:
  - With cuts to mimic E06-014 trigger
  - Without cuts to mimic E06-014 trigger
  - Trigger cut is 2D cut on shower and preshower energy and 1D cut on total energy
- Compare GEANT4 results to data

GEANT4 π^-/e^- Ratios

Results

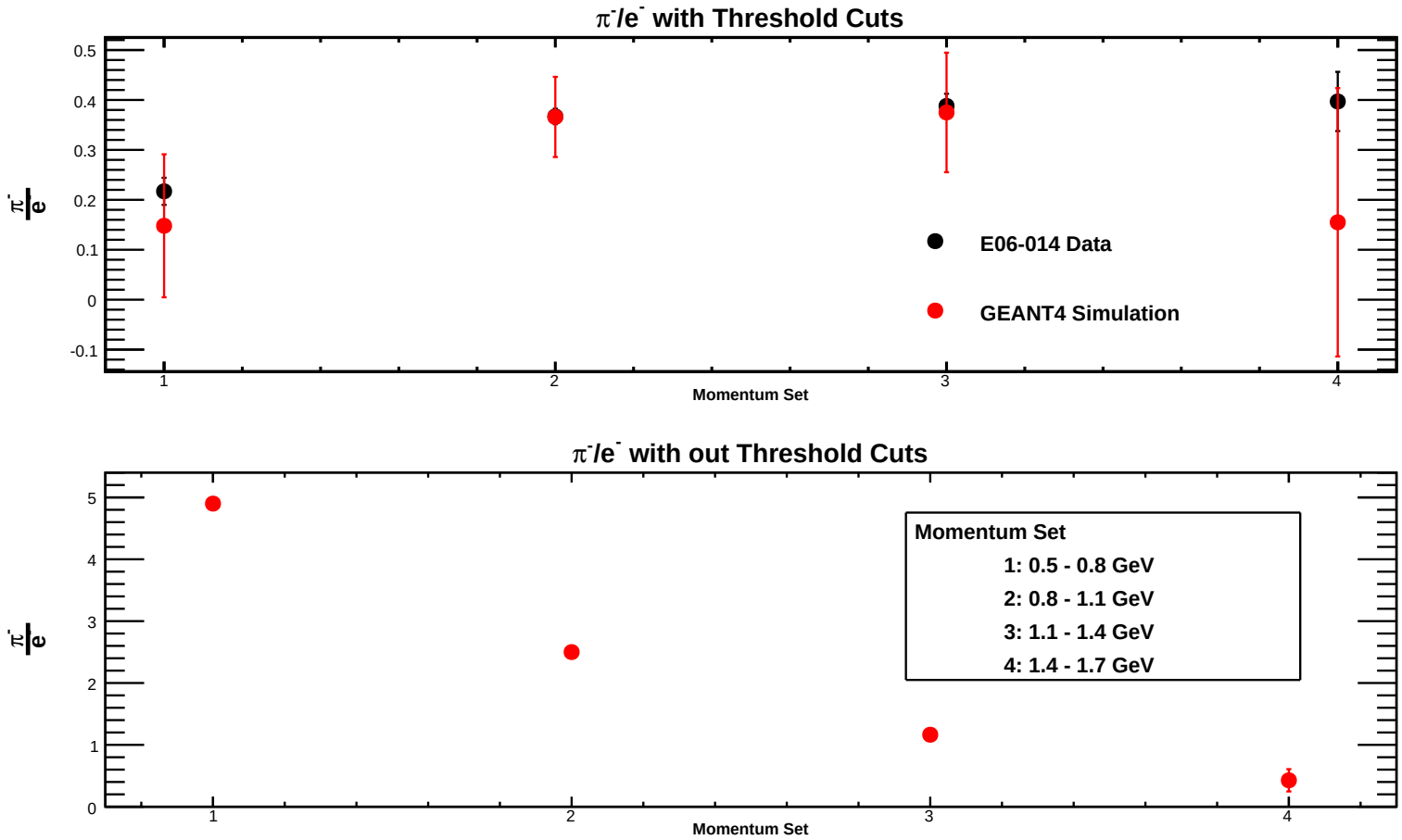


Figure: Results of GEANT4 and E06-014 π^-/e^- ratios. Note pion selection does not use Čerenkov TDCs, but electron selection does.

Summary

π^-/e^- Contamination

- π^-/e^- ratio increases with momentum due to trigger
- Low energy cuts from trigger, cut into pion cross-section

π^+ Contamination

- In order to understand positron asymmetries we need to check the positive pion contamination
- If π^+ contamination is large relative to the e^+ yields a correction will need to be done
- Use BigBite bend-down data

e^+ e^- Signal to Background

Better signal to noise with electrons

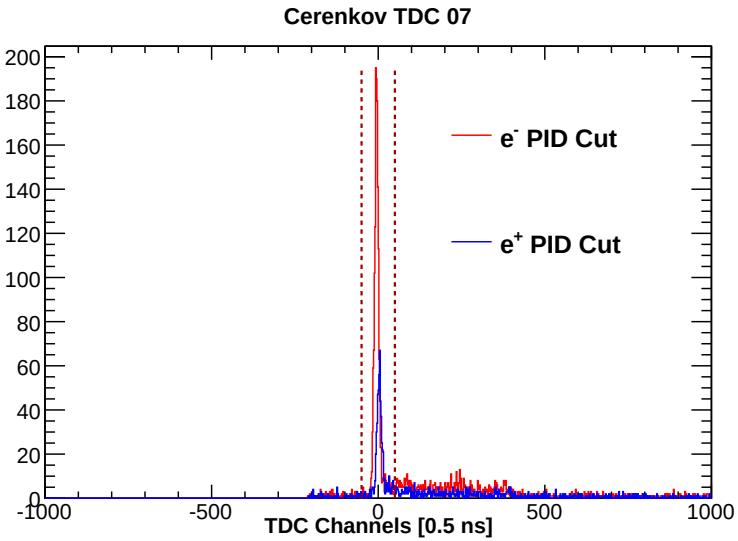


Figure: Comparison of electron and positron Čerenkov TDC signal.

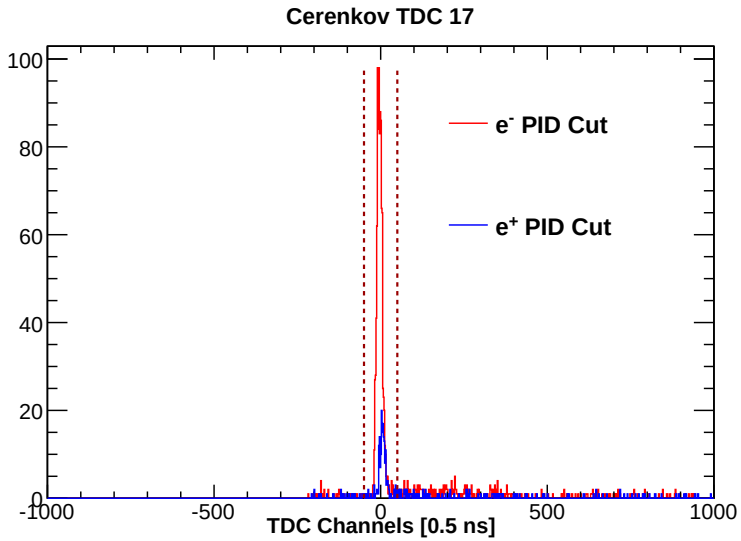


Figure: Comparison of electron and positron Čerenkov TDC signal.

π^+/e^+ Distributions

All DIS momentum

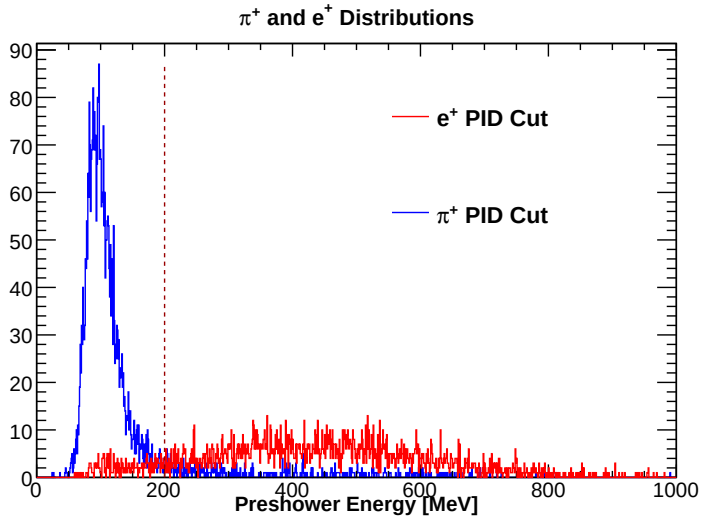


Figure: Positive Charge. All DIS Momentum.

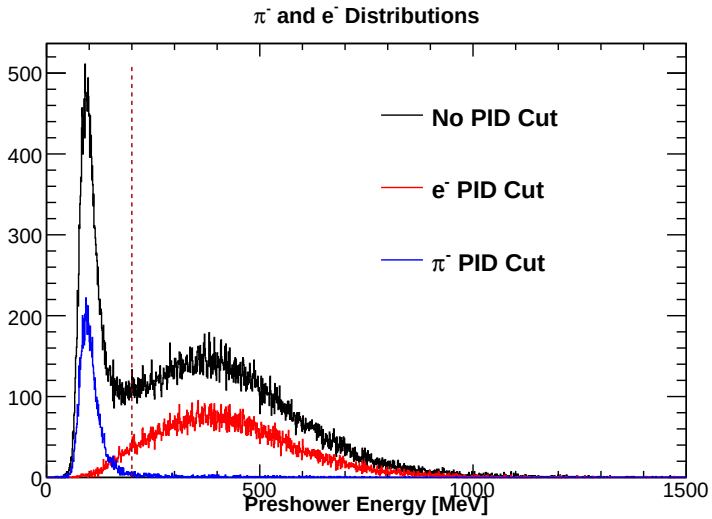


Figure: Negative Charge. All DIS momentum.

GEANT4 π^+/e^+ Ratios

Procedure

- Follow similar procedure described above
- Divide momentum range from 0.5 - 1.7 GeV into four bins
- Compute π^+/e^+ ratios by selecting pions and positrons
- Compare to π^-/e^-

π^+/e^+ Ratios

Results

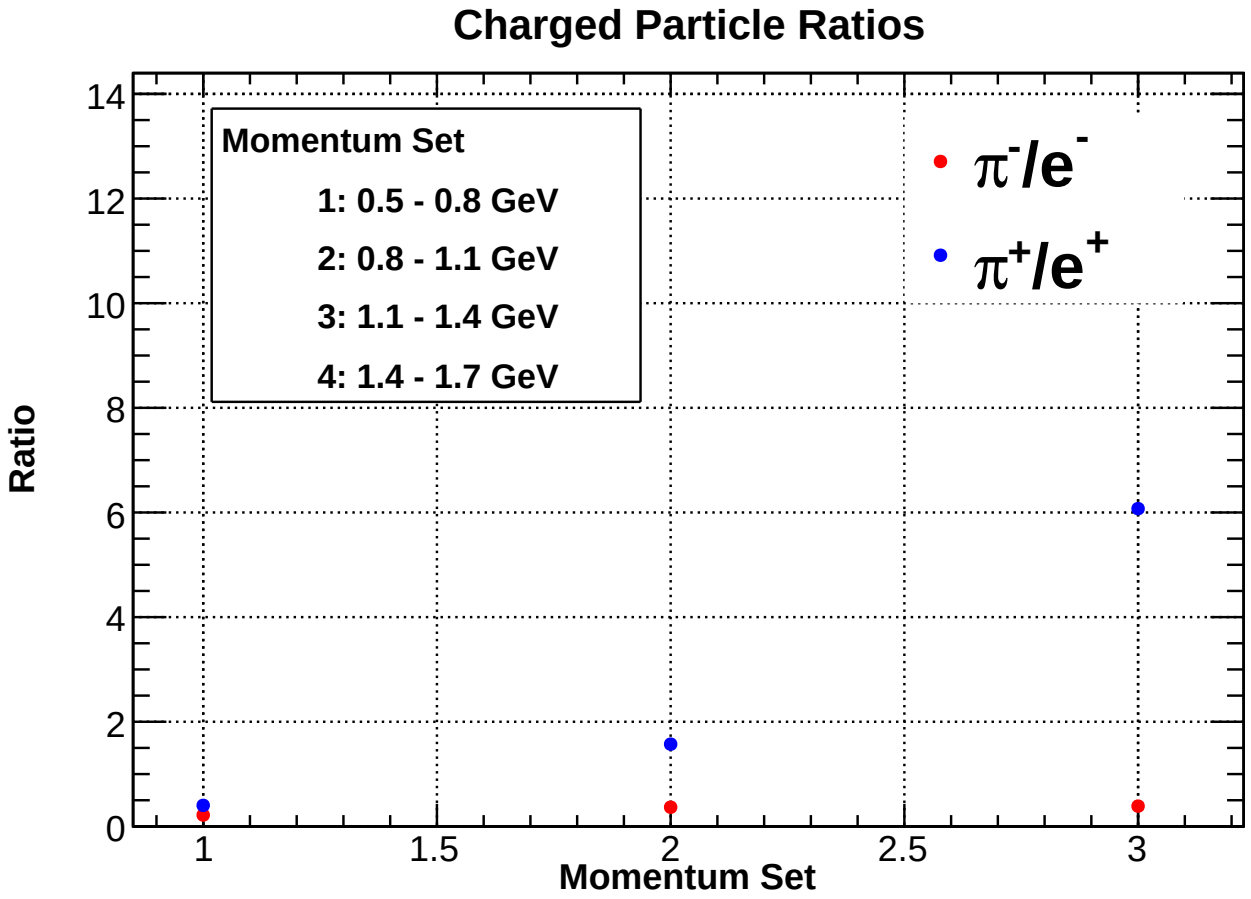


Figure: Results of π^+/e^+ compared to π^-/e^- ratios. Note pion selection does not use Čerenkov TDCs, but electron/positron selection does.

Summary

π^+/e^+ Contamination

- Positive charge signal to noise is smaller than negative charge
- Positron signal smaller than electron $\rightarrow$ leads to worse π^+/e^+ ratio
- Try to fit pion and positron distributions to get contamination (pions that populate preshower energies larger than 200 MeV)
- Look at positive pions in GEANT4

To Do

- Work on GEANT Simulation (π^+)
- π/e contamination for positive polarity
- Use world data to form d_2 at low and high x regions

π^+/e^+ Distributions (2)

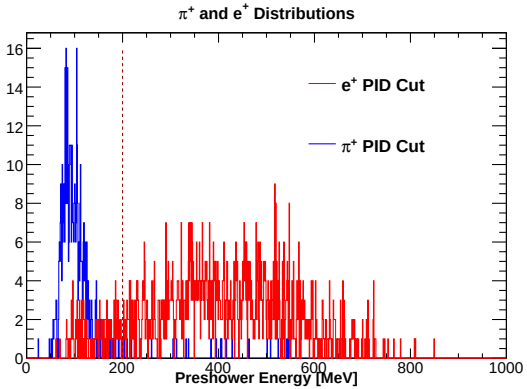


Figure: Momentum: 0.5-0.8 GeV

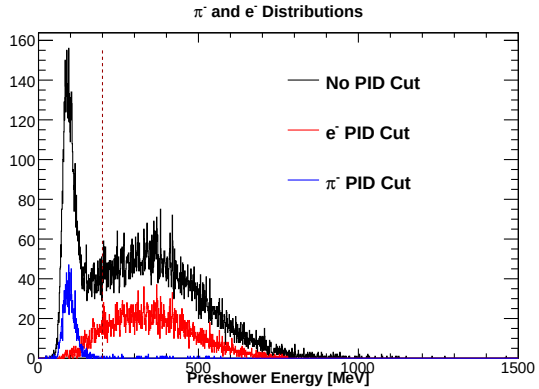


Figure: Momentum: 0.5-0.8 GeV

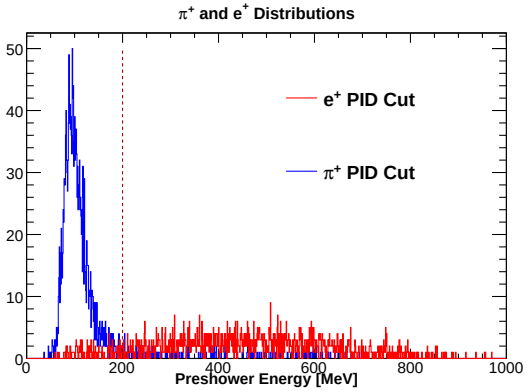


Figure: Momentum: 0.8-1.1 GeV

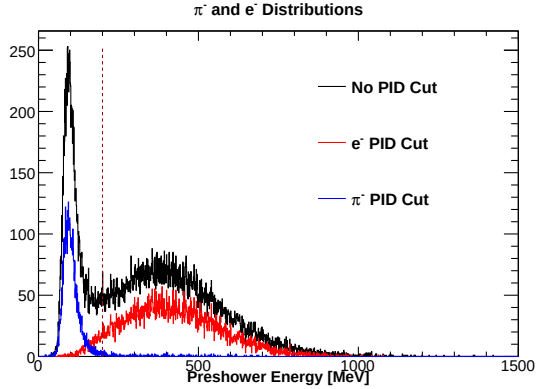


Figure: Momentum: 0.8-1.1 GeV

π^+/e^+ Distributions (3)

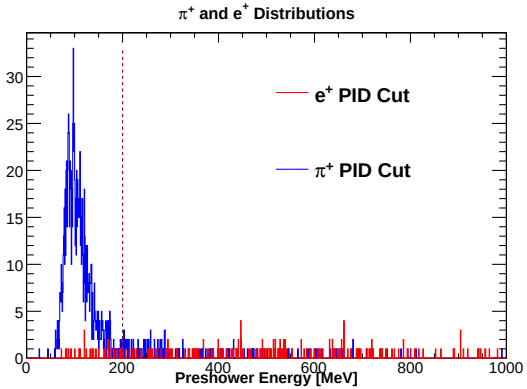


Figure: Momentum: 1.1-1.4 GeV

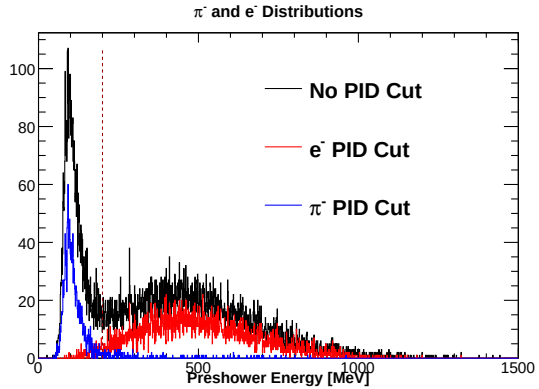


Figure: Momentum: 1.1-1.4 GeV

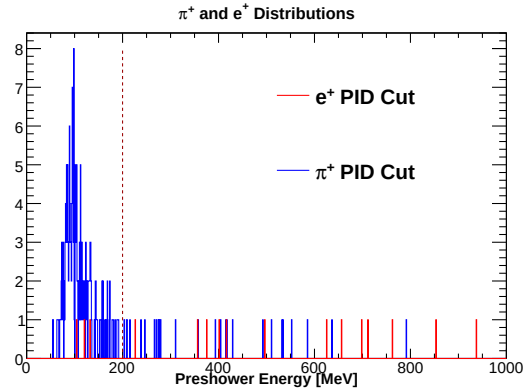


Figure: Momentum: 1.4-1.7 GeV

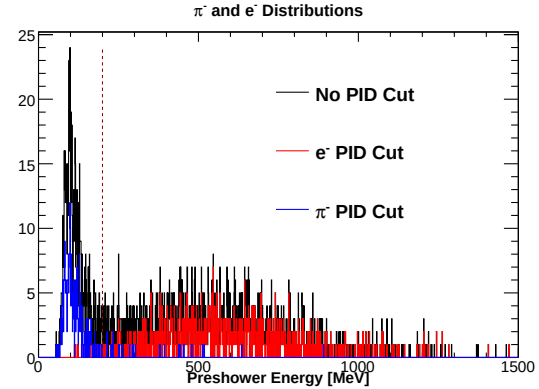


Figure: Momentum: 1.4-1.7 GeV