LHRS Analysis for d_2^n: PID Analysis

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Outline

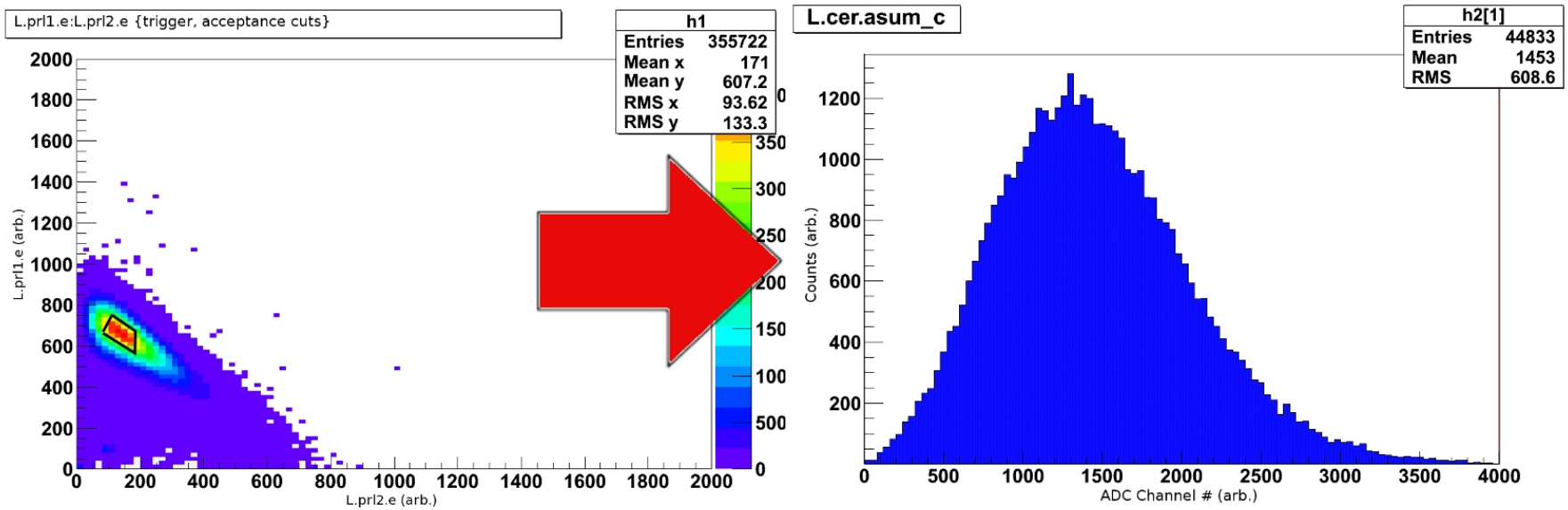
Definition of Cuts

- Cuts used (*to be used on all histos displayed in talk*):
  one track:
  L.tr.n==1
  trigger cuts:
  (DL.edtpl==0)&&((DL.evtypebits&(1<<3))==(1<<3))
  cuts on target y:
  (abs(L.tr.tg_y)<0.04)
  VDC cuts:
  (L.vdc.u1.nclust==1)&&(L.vdc.v1.nclust==1)
  (L.vdc.u2.nclust==1)&&(L.vdc.v2.nclust==1)
  cuts on acceptance:
  (abs(L.tr.tg_dp)<0.035)
  (abs(L.tr.tg_th)<0.05)&&(abs(L.tr.tg_ph)<0.03)

Gas Čerenkov: Electron Detection (1)

Method

- Use $^3\mathrm{He}$ elastic runs 1229, 1230
- Quick review of the method:



Gas Čerenkov: Electron Detection (2)

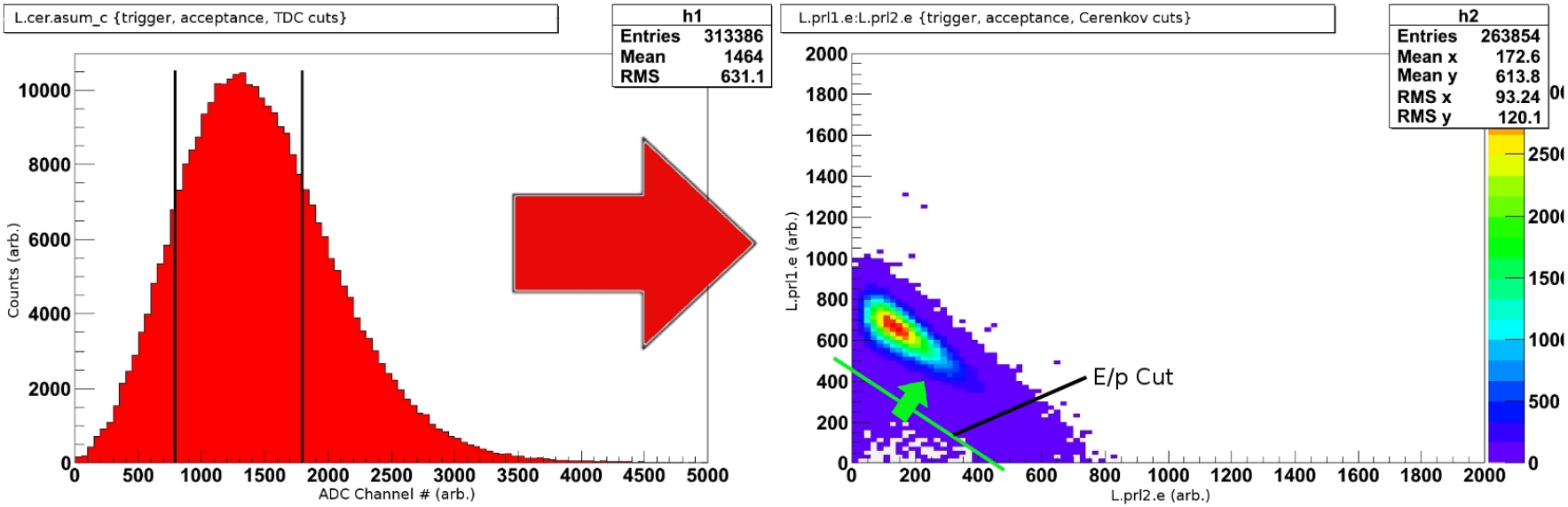
Čerenkov Cut Efficiency

- Added a few more cut positions from last time:

Pion Rejector: Electron Detection (1)

Method

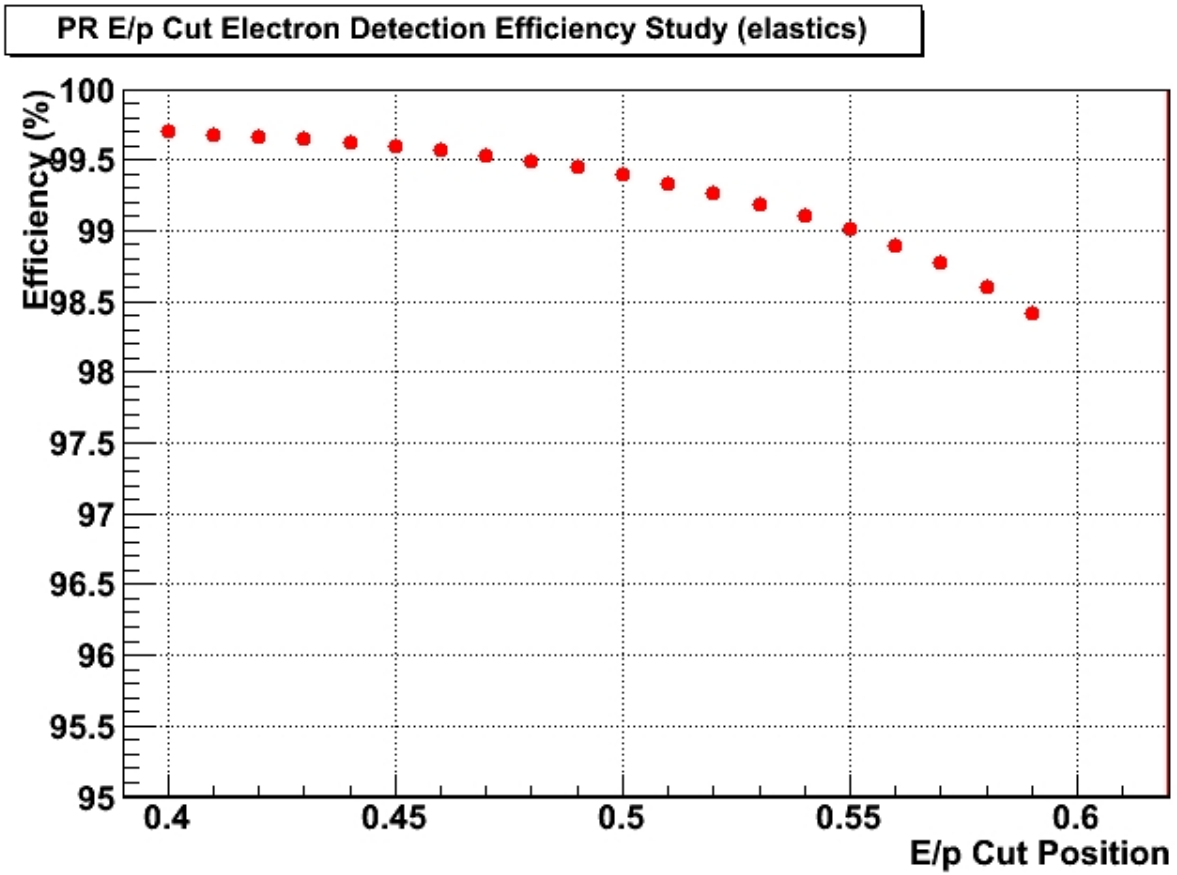
- Use $^3\mathrm{He}$ elastic runs 1229, 1230
- Use E/p cut to count electrons in 2D shower plot
  - Maybe we should add PRL1 cut?
- Quick review of the method:



Pion Rejector: Electron Detection (2)

E/p Cut Efficiency

- Changing E/p cut position:



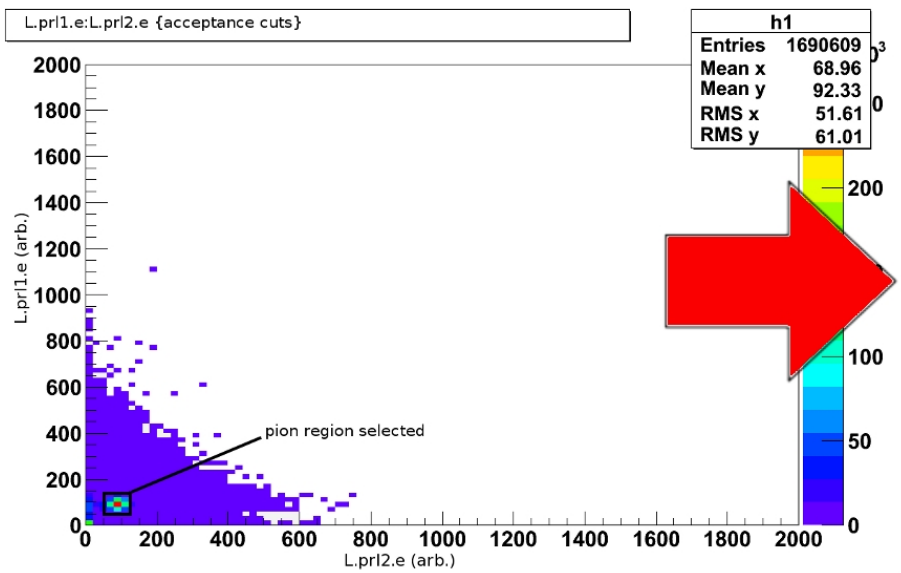
Gas Čerenkov: Pion Rejection (1)

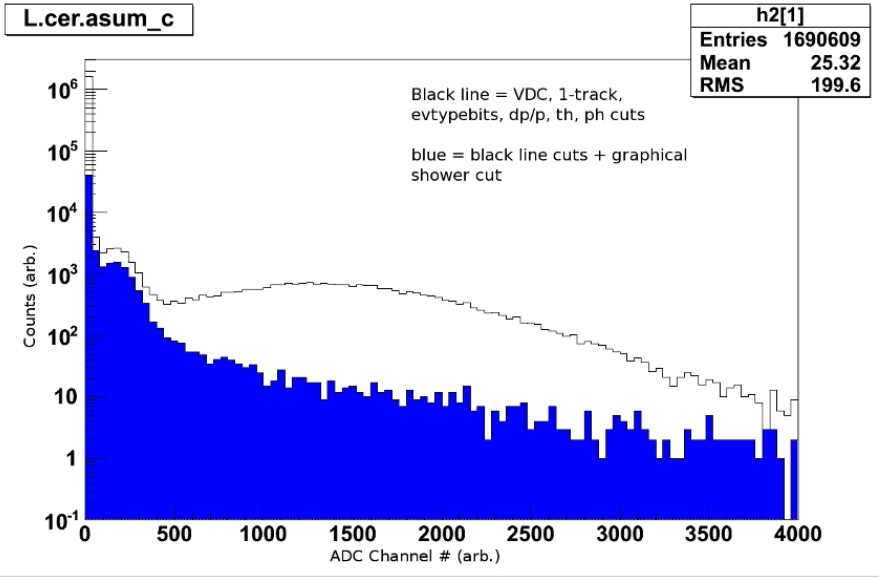
Method

- We select the pion region in the 2D shower plot (N_{sh}), and see how many show up in the Čerenkov (N_{cer})
- The ratio of $r = N_{\text{cer}}/N_{\text{sh}}$ is the percentage of pions that trigger the Čerenkov
  - So, $1/r$ is our pion rejection factor
- We may also calculate the pion rejection efficiency as: $\epsilon_{\pi-\text{rej.}} = 1 - r$

Gas Čerenkov: Pion Rejection (2)

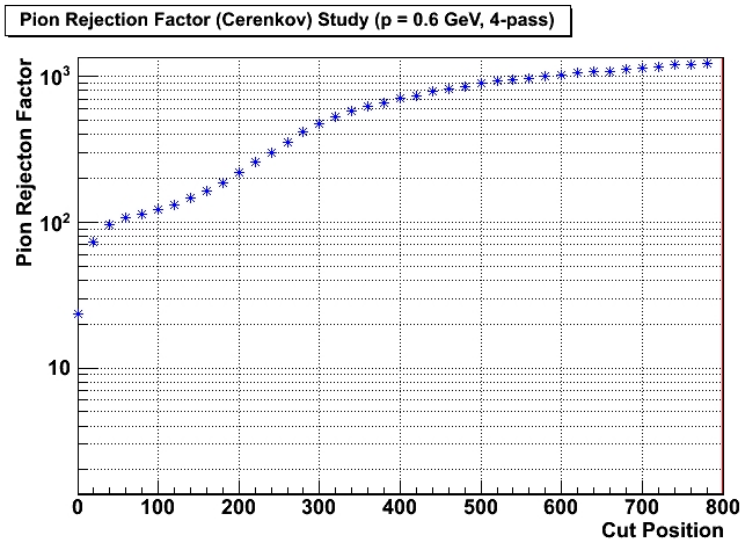
Method: Selection of Pions and Resulting Čerenkov

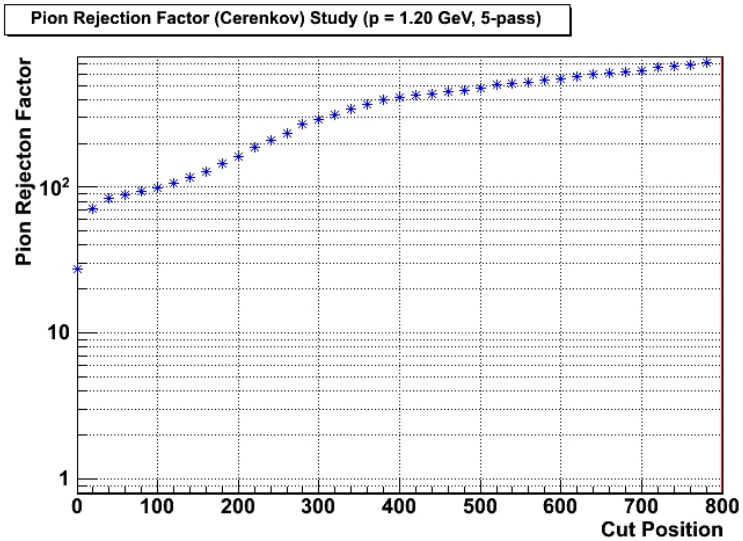


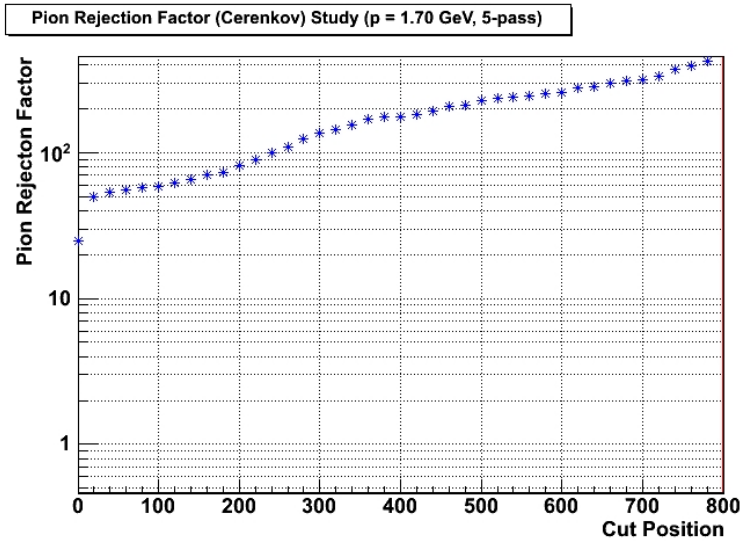


Gas Čerenkov: Pion Rejection (3)

Rejection Factor due to Čerenkov Cut: Results



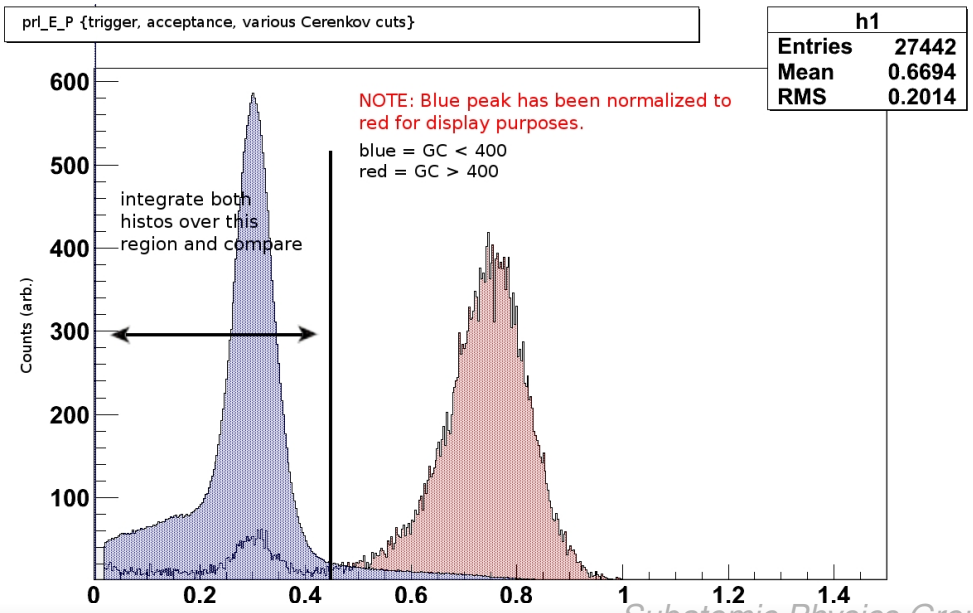




Pion Rejector: Pion Rejection (1)

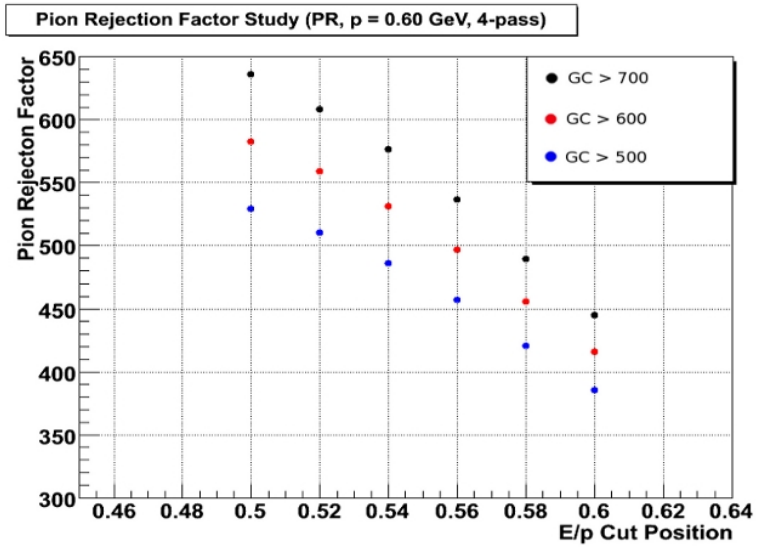
Method: Rejection Factor for E/p + Čerenkov Cut

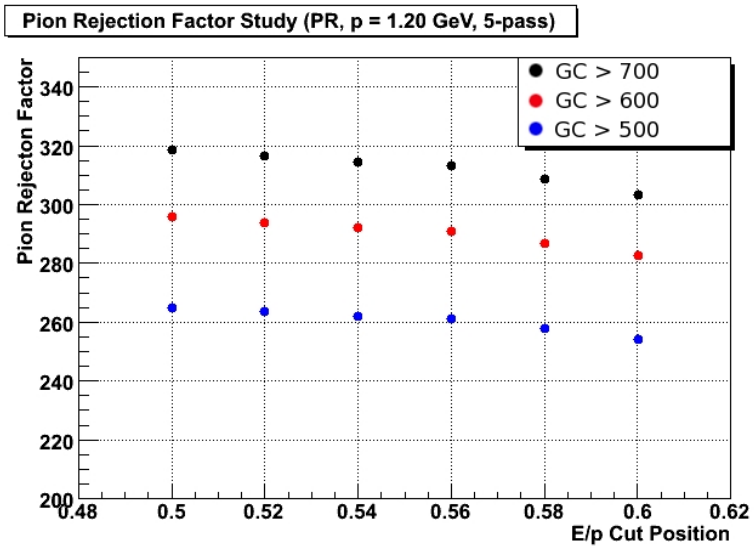
- We choose a cut position in the Čerenkov, and see how many events pass the cut in the E/p histo
- Compare this to the number of events in E/p with 'inverse' Čerenkov cut (GC $<$ X)
- Count events over a specified region in E/p – $(0, 0.5)$ for instance:

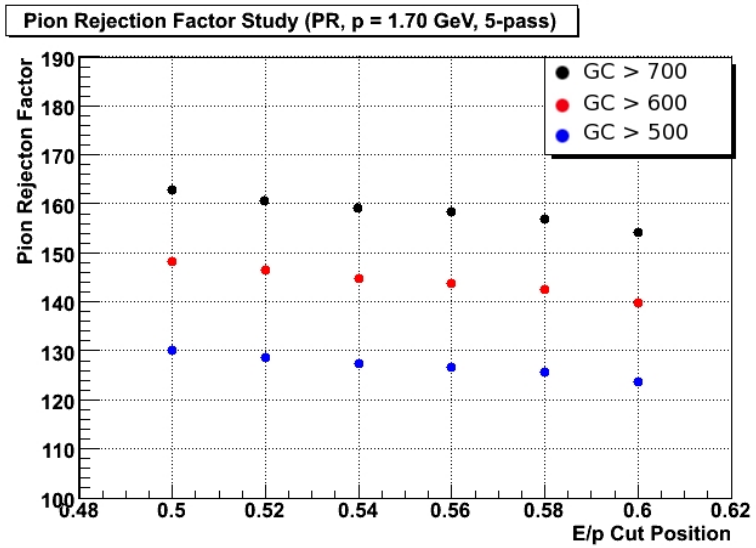


Pion Rejector: Pion Rejection (2)

Rejection Factor for E/p + Čerenkov Cut: Results







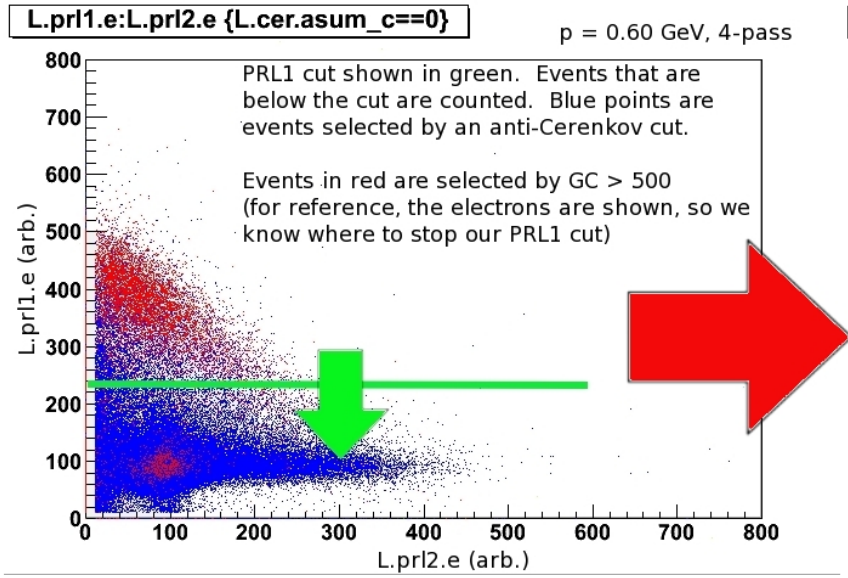
Pion Rejector: Pion Rejection (3)

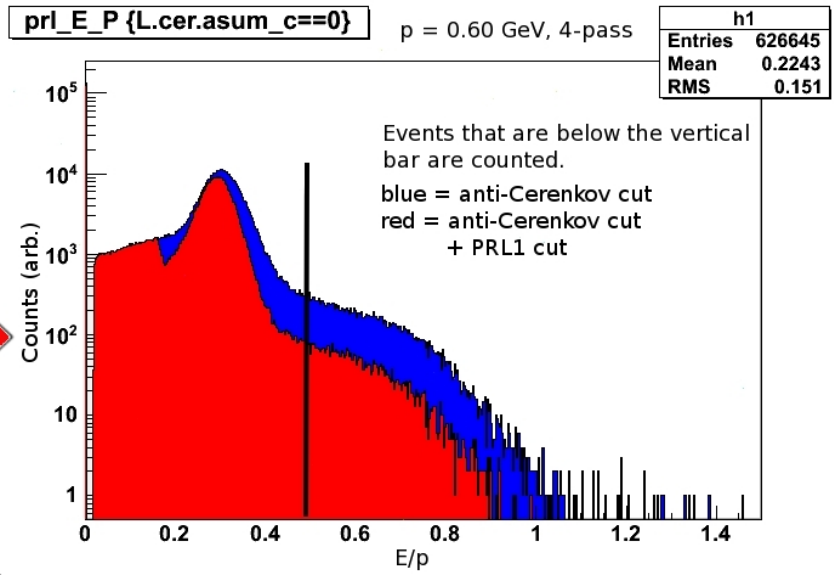
Method: Rejection Factor for E/p + PRL1 Cut

- Similar to process for utilizing the Čerenkov cut with the E/p cut
- Plot E/p subject to an anti-Čerenkov cut (L.cer.asum_c==0) to tag pions (N_i)
- Compare this with E/p subject to anti-Čerenkov and PRL1 cut (L.prl1.e$< X$) (N_f)
- Integrate over region below some E/p value (as before). Then, we have: $r = N_f/N_i \Rightarrow$ perentage of pions detected by E/p + PRL1 cut
  - Effectively shows the amount of pions rejected when considering L.prl1.e$> X_i$, prl_E_P$> X_j$

Pion Rejector: Pion Rejection (4)

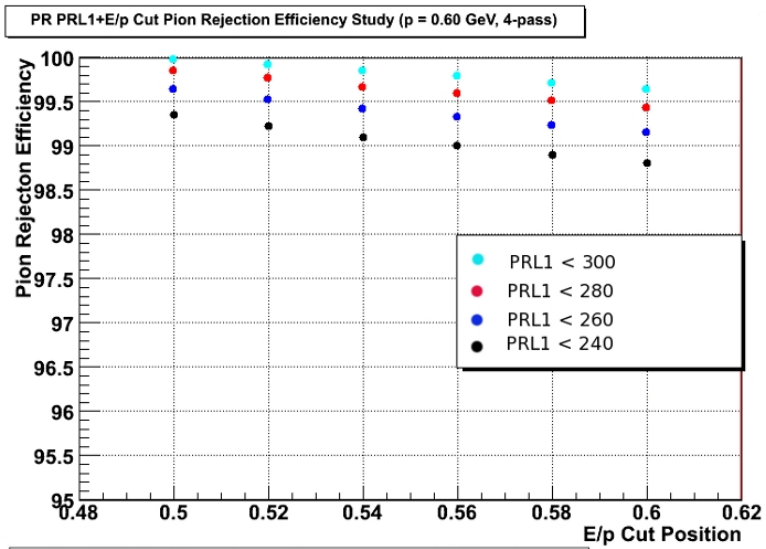
Method: Rejection Factor for E/p + PRL1 Cut

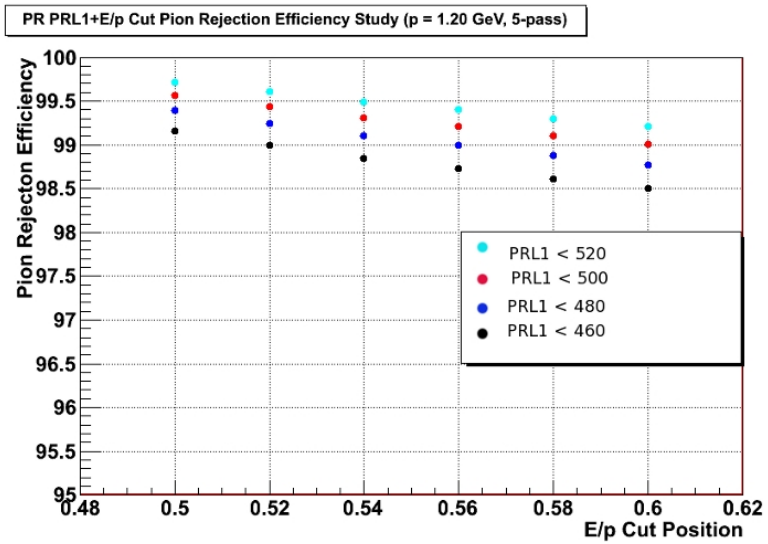


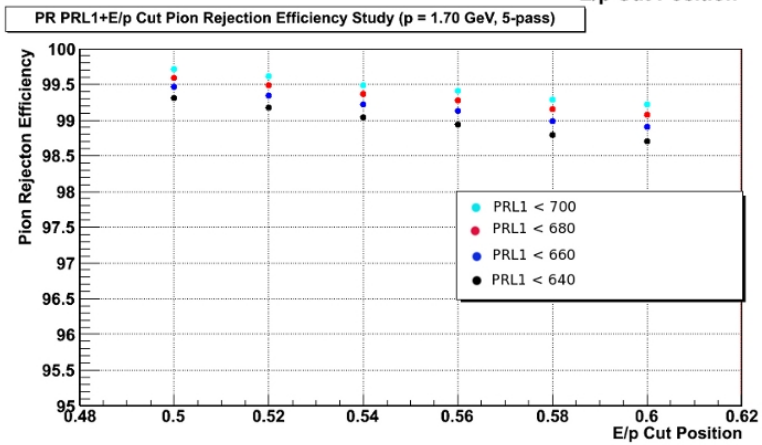


Pion Rejector: Pion Rejection (4)

Rejection Factor for E/p + PRL1 Cut: Results

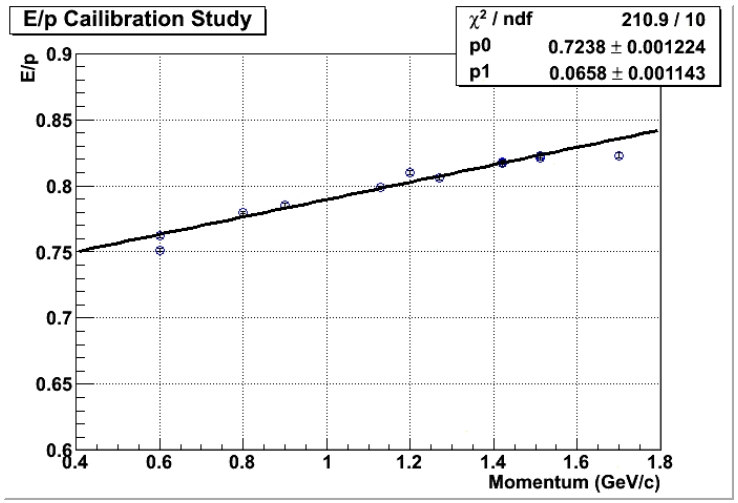






Momentum Dependence of E/p vs.p Plot

- There is a significant momentum dependence to the E/p vs. p plot
  - Pion peak positions are all calibrated to 100 channels in PRL1&2 ADC – consistent for all kinematics
  - Talked to Huan – maybe an issue with the calculation of p_0/optics problem?
    Useful paper on how the spectrometer momentum is calculated:
    http://hallaweb.jlab.org/publications/Technotes/files/2001/01-049.pdf



Summary

- Elastic (e^- detection) efficiencies look good ($> 99\%$)
- Gas Čerenkov:
  - Pion rejection factors on the order of 10^2, 10^3 ($\sim 99\%$ rejection efficiency)
- Pion Rejector:
  - Most (if not all) pion rejection efficiencies across all kinematics for various E/p+Cer, E/p+PRL1 cut combinations $> 99\%$
  - E/p momentum dependence is strange – not terribly sure where to go on this besides the paper I mentioned

What's Next?

- PID:
  - Continue calculating pion rejection factors for all other kinematics
  - Figure out what to do about electron efficiencies
- Calibrations:
  - Investigate E/p momentum dependence further
- d_2^n Status Report:
  - I'm roughly halfway done – now need to do sections on LHRS, BB, Compton analysis
    - Send me plot(s) and brief description(s) as soon as you can!
  - I would like to have a first (finished) draft out to you for comments by early December