

LHRS Analysis for d_2^n

PID Analysis, Scintillator Calibration Study

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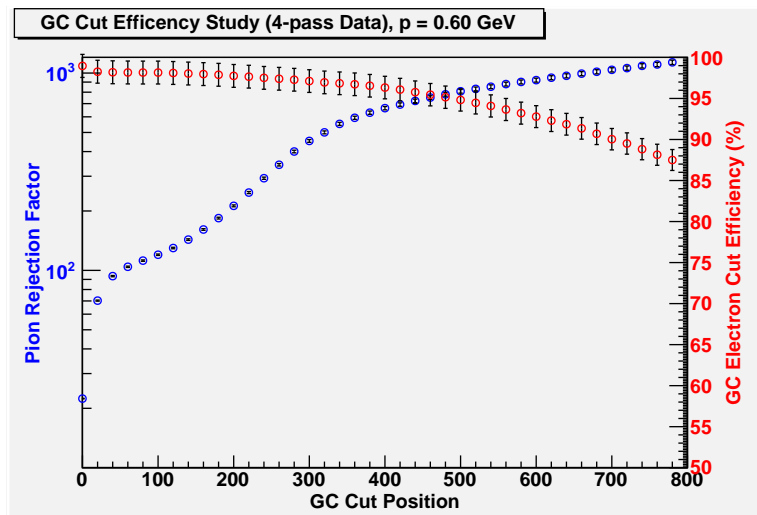
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Outline

- 1 PID: Gas Čerenkov
 - Preliminary Electron Cut
- 2 PID: Pion Rejector
 - Preliminary Electron Cut
- 3 Scintillator Calibration
 - β Distribution
 - S1 Timewalk
- 4 Summary
- 5 Appendix

Gas Čerenkov (1)

PID Results: $p = 0.60$ GeV, $E = 4.73$ GeV



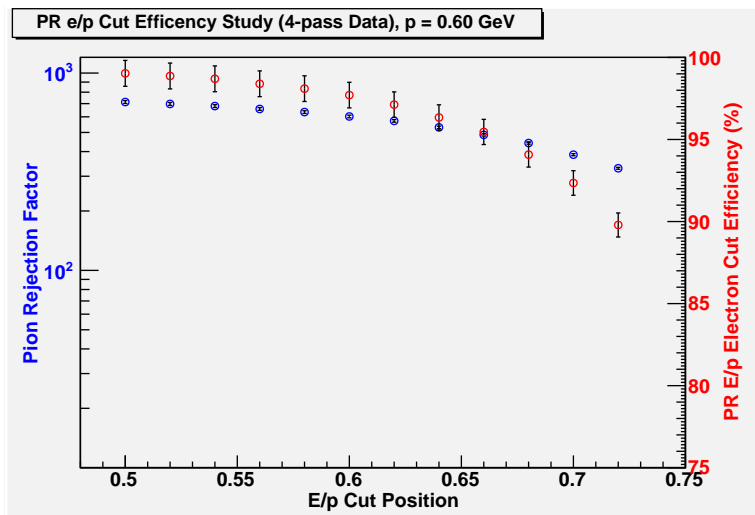
Gas Čerenkov (2)

Preliminary Cut

- We show the $p = 0.60$ GeV kinematic, as it presents the worst-case scenario for π^- production
⇒ **best estimate of pion rejection factor**
- From this plot, it's clear that our GC cut should be in the range of **~ 300 channels** (1.5 photoelectrons), considering the average number of photoelectrons is $\sim 5 - 6$ at each p
 - $\varepsilon_{\text{cer}} \sim 97 \pm 1\%$
 - $f_{\text{cer}} \sim 453 \pm 7$
 - Errors are purely statistical

Pion Rejector (1)

PID Results: $p = 0.60$ GeV, $E = 4.73$ GeV



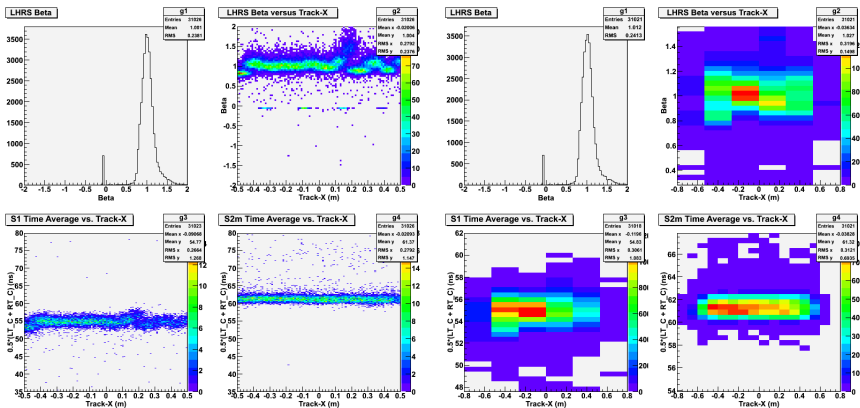
Pion Rejector (2)

Preliminary Electron Cut

- Again, we show the $p = 0.60$ GeV kinematic
- From this plot, it's clear that our E/p cut should be in the range of ~ 0.54
 - $\varepsilon_{\text{pr}} \sim 99 \pm 0.80\%$
 - $f_{\text{pr}} \sim 680 \pm 10$
 - Errors are purely statistical

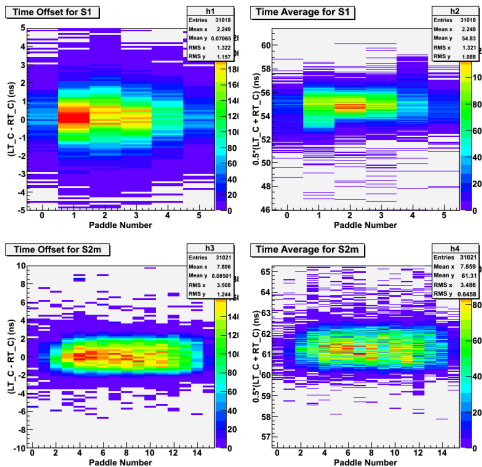
β Distribution

- Consider the binning in β
 - The binning should reflect the **paddles**



β Distribution

- S1, S2m time offsets, time averages (compare to previous slide)

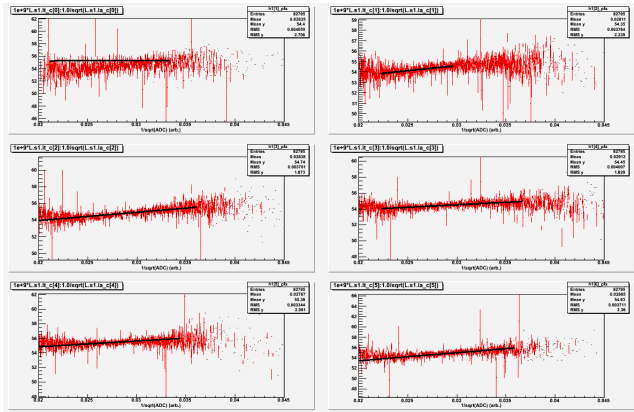


S1 Timewalk Correction (1)

- To correct for the timewalk effect:
 - Plot TDC vs. $1/\sqrt{\text{ADC}}$
 - Fit the **projection** of this plot along the x -axis to a *pol1*
 - Slope of the fit goes in the S1 DB
- However, we seem to have some issues. . .
 - The slope of the fit obtained is makes too big of a correction
 - Now, the fit isn't great, so I played with the numbers, and came up with an arbitrary value that seems to do better.
 - Implementing this number in the DB yields a **pronounced** timewalk effect. . .

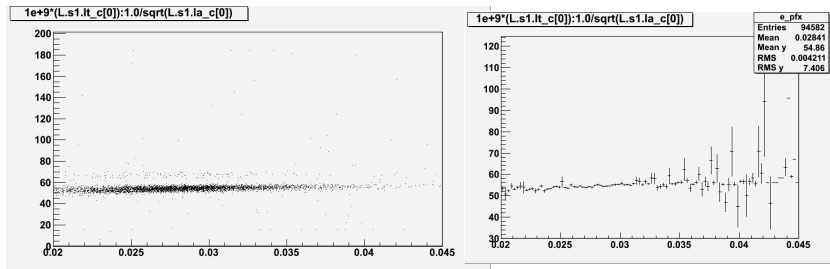
S1 Timewalk Correction (2)

The Fit



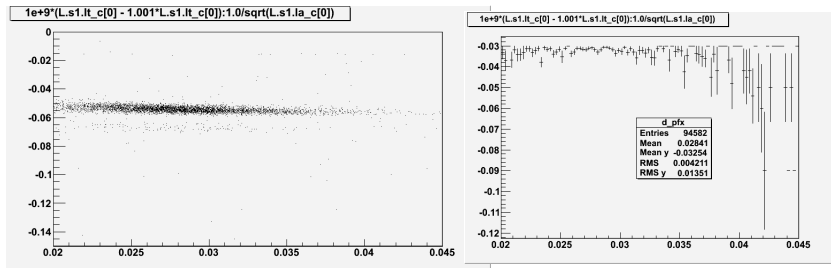
S1 Timewalk Correction (3)

Before Correction



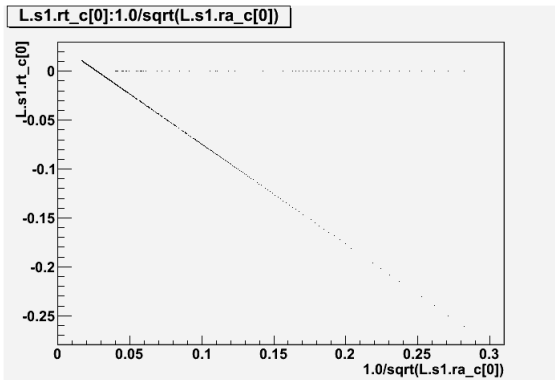
S1 Timewalk (4)

After Correction



S1 Timewalk Correction (5)

Database Implementation



Summary

● PID

- GC e^- cut efficiency $\geq 97\%$; π^- -rejection $\sim 5 \times 10^2$
 - At $GC > 300$
- PR e^- cut efficiency $\geq 99\%$; π^- -rejection $\sim 7 \times 10^2$
 - At $E/p > 0.54$
- *Combined* π^- -rejection $\geq 10^4$
 - Matches expectations stated in the proposal

● Scintillator Calibration

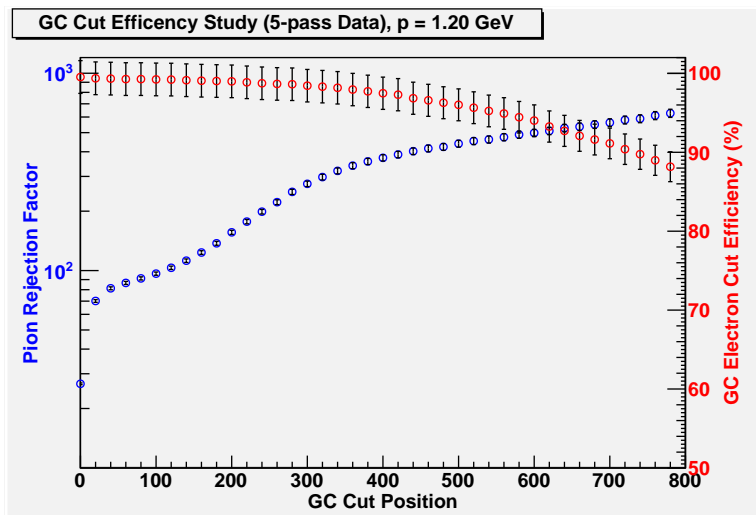
- β
 - We're limited by the spread in the S1, S2m time-offsets/time averages. . .
- Timewalk
 - There are some ideas, but nothing that absolutely works

What's Next?

- PID:
 - Continue writing technical note
 - First draft (*no data tables yet*):
www.jlab.org/~flay/thesis.html
 - Feedback is appreciated
- Scintillator Calibration
 - Finish off these timewalks...
- Optics
 - Begin checking our current optics matrix

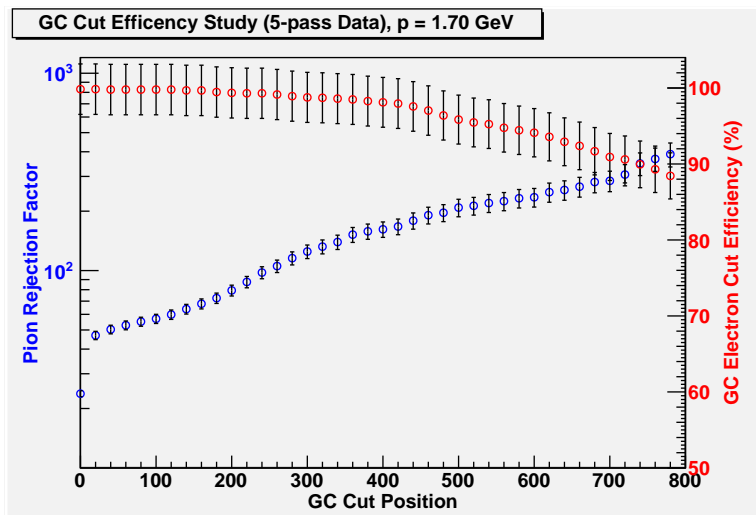
Appendix (1)

GC PID Results: $p = 1.20$ GeV, $E = 5.89$ GeV



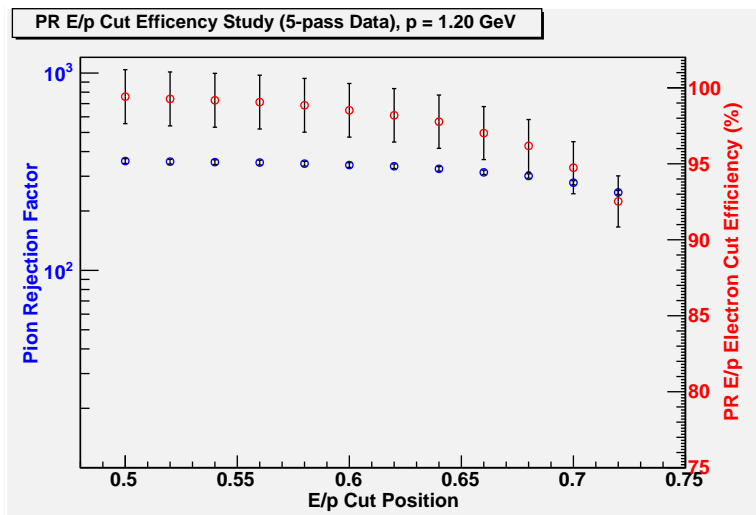
Appendix (2)

GC PID Results: $p = 1.70$ GeV, $E = 5.89$ GeV



Appendix (3)

PR PID Results: $p = 1.20$ GeV, $E = 5.89$ GeV



Appendix (4)

PR PID Results: $p = 1.70$ GeV, $E = 5.89$ GeV

