BigBite Analysis

4.7GeV Positron Analysis and Čerenkov Mirror Kinematics

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Outline

Cut Adjustments

- When looking at positive polarity running and bend down particles (BB.optics.charge[]==1) in BigBite, some cuts need to be adjusted
- The E/p cut is the most affected for both positive polarity running and bend down particles
- The projected X track match to shower calorimeter X position needed adjustment for the bend down particles.

Before Adjustment: Positive Polarity

Negative Polarity:

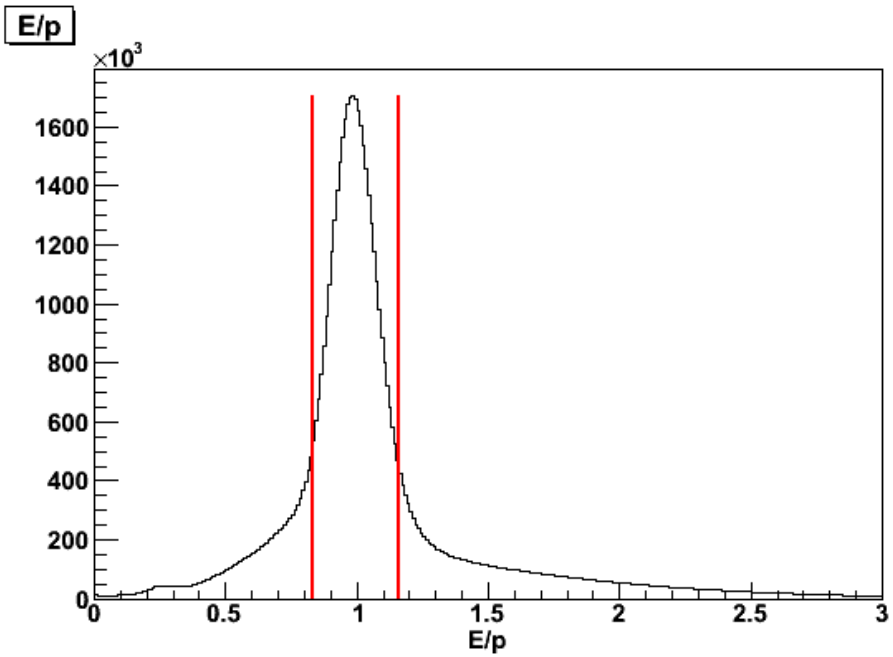

Figure: Shows the negative polarity E/p cut.

Positive Polarity:

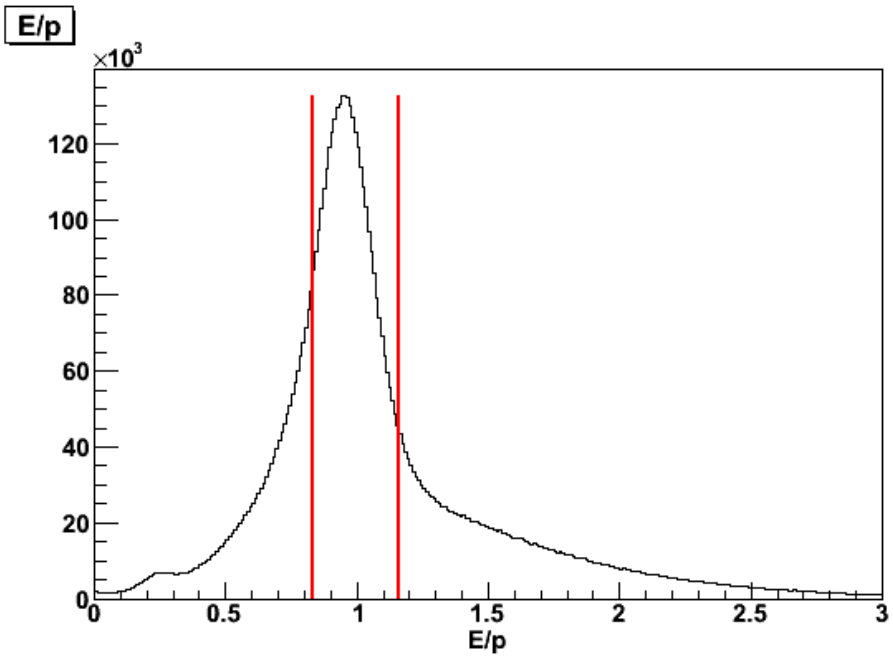

Figure: Shows the positive polarity E/p before cut adjustment.

After Adjustment: Positive Polarity

Negative Polarity:

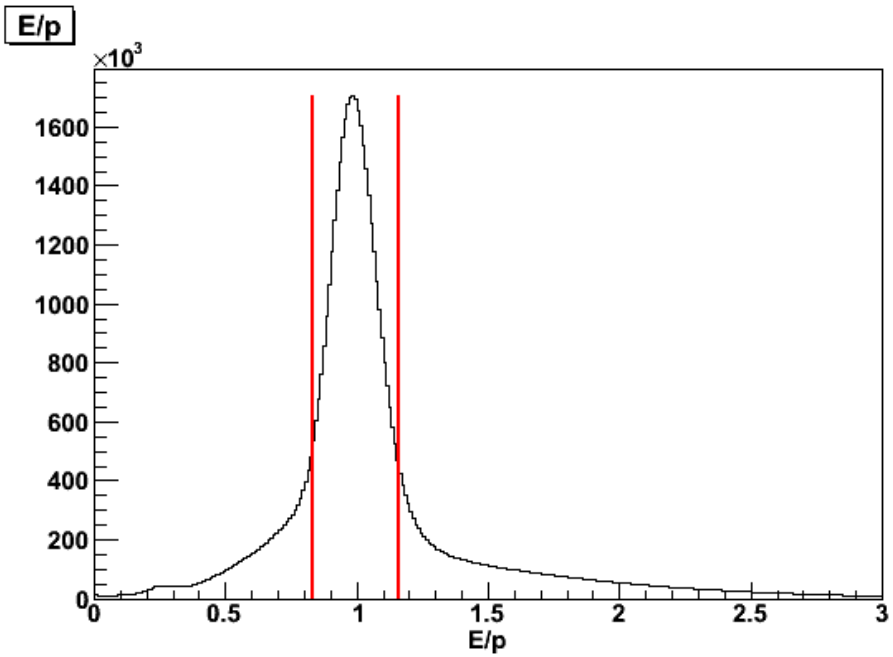

Figure: Shows the negative polarity E/p cut.

Positive Polarity:

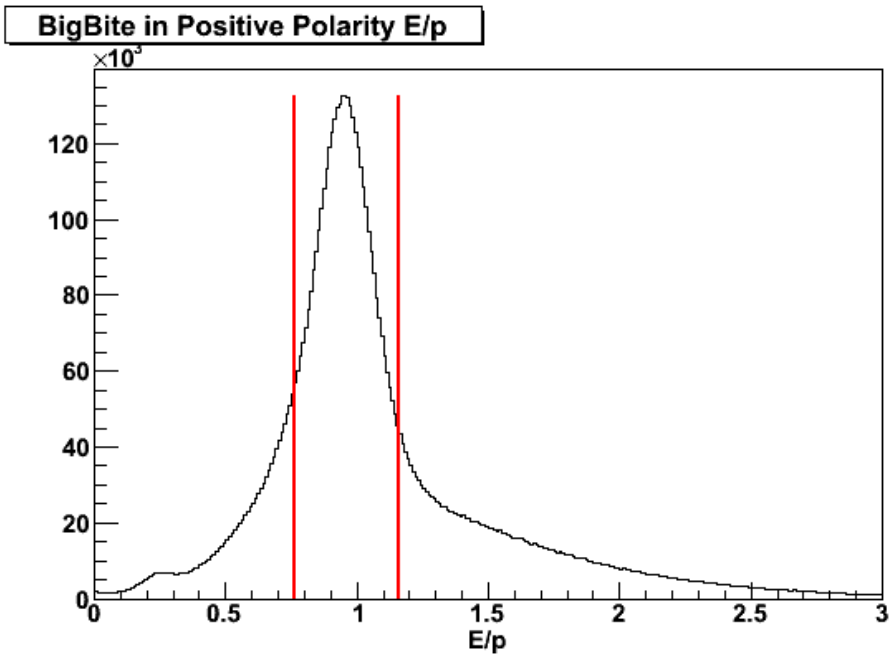

Figure: Shows the positive polarity E/p after cut adjustment.

Before Adjustment: Bend Down Particle

Electrons in Negative Polarity (charge = -1):

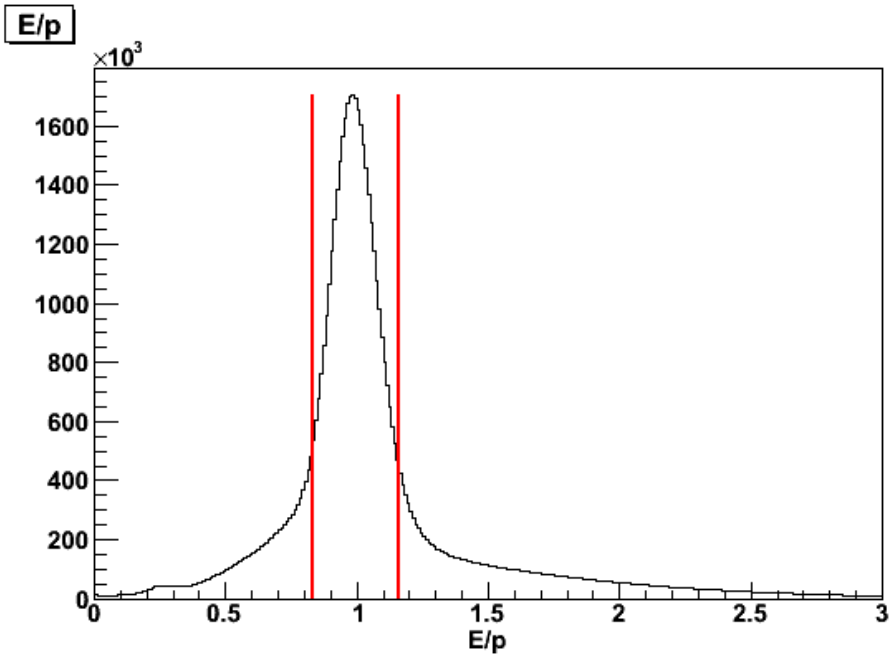

Figure: Shows the electrons in negative polarity running E/p cut.

Electrons in Positive Polarity (charge = 1):

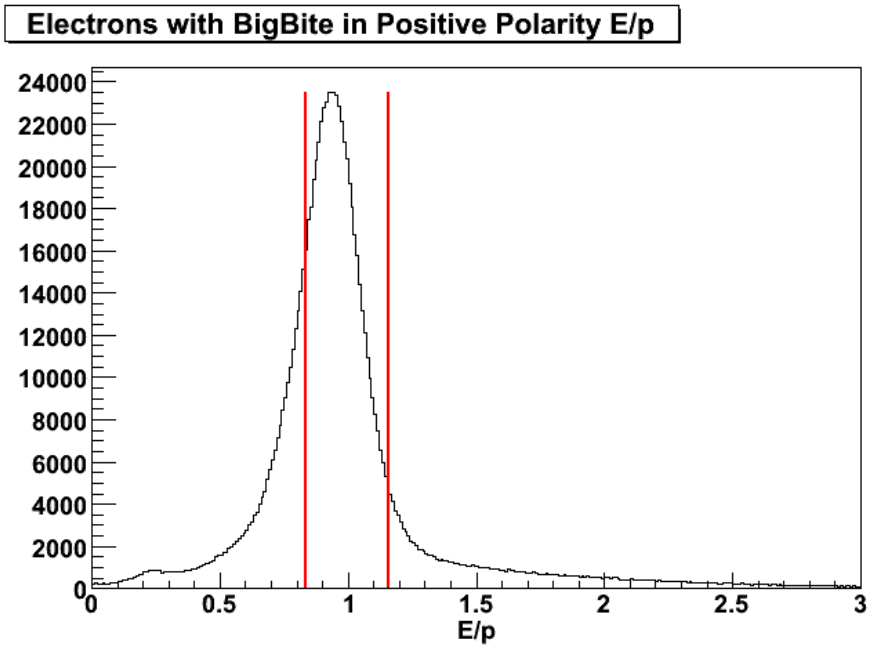

Figure: Shows the electrons in positive polarity running E/p before cut adjustment.

After Adjustment: Bend Down Particle

Electrons in Negative Polarity (charge = -1):

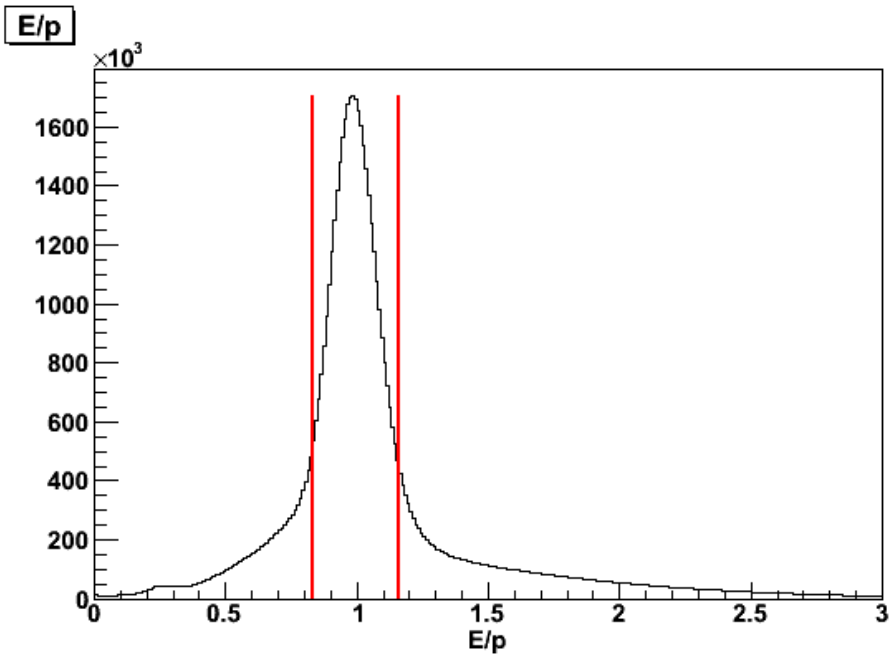

Figure: Shows the electrons in negative polarity running, E/p cut.

Electrons in Positive Polarity (charge = 1):

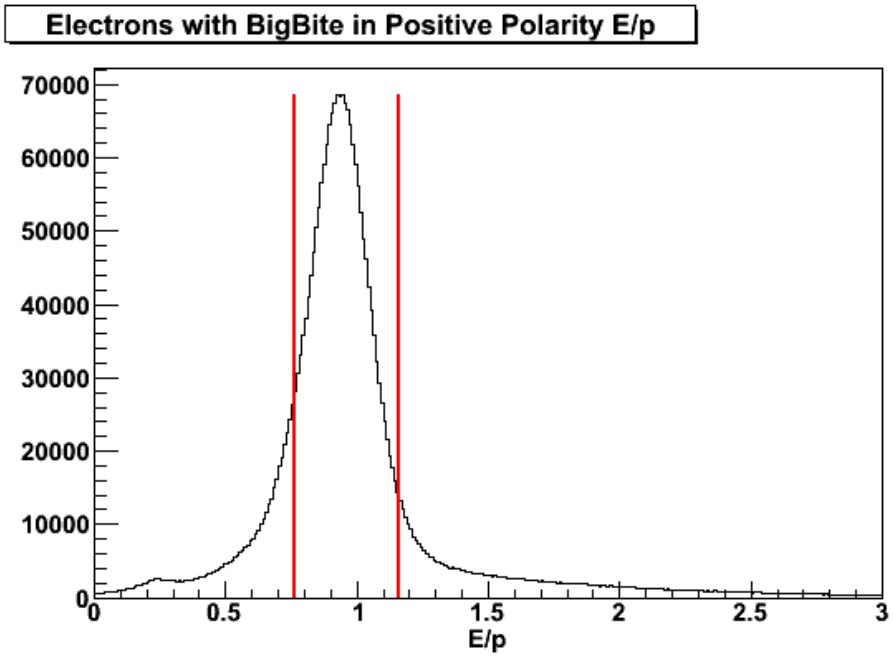

Figure: Shows the electrons in positive polarity running, E/p after cut adjustment.

Before Adjustment: Bend Down Particle

Electrons in Negative Polarity (charge = -1):

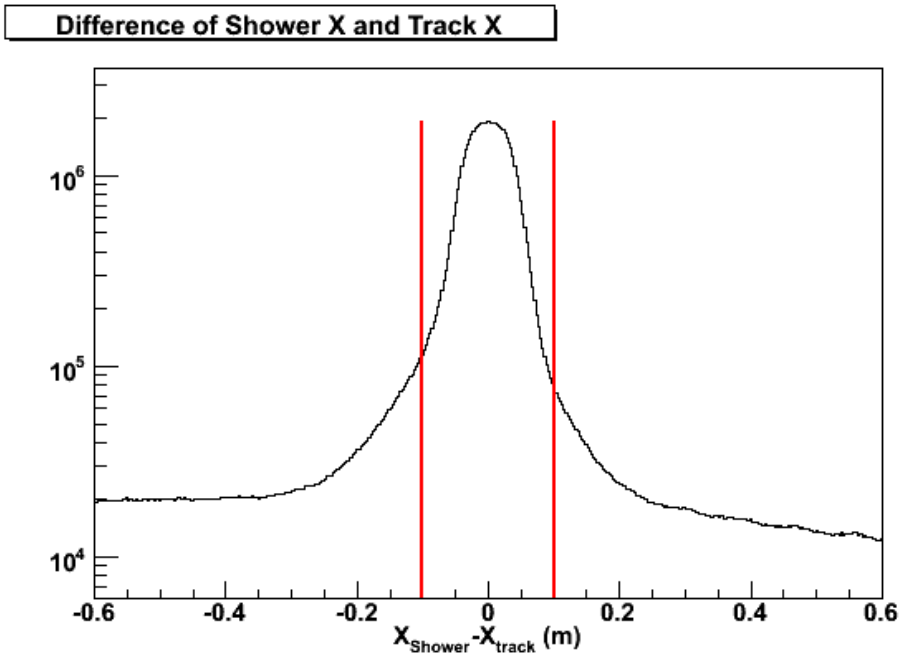

Figure: Shows the electrons in negative polarity running X track match to shower position cut.

Electrons in Positive Polarity (charge = 1):

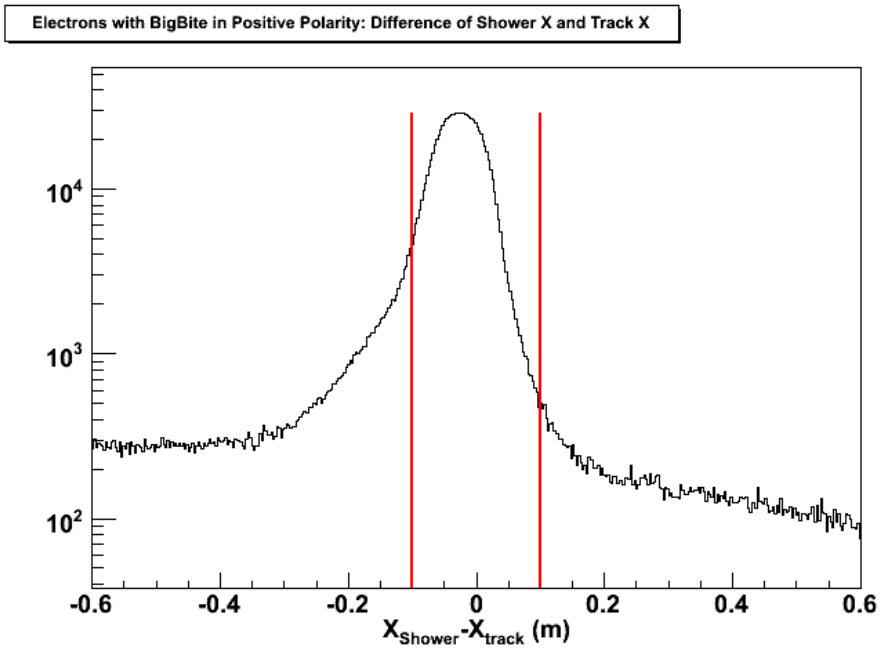

Figure: Shows the electrons in positive polarity running X track match to shower position cut before adjustment.

After Adjustment: Bend Down Particle

Electrons in Negative Polarity (charge = -1):

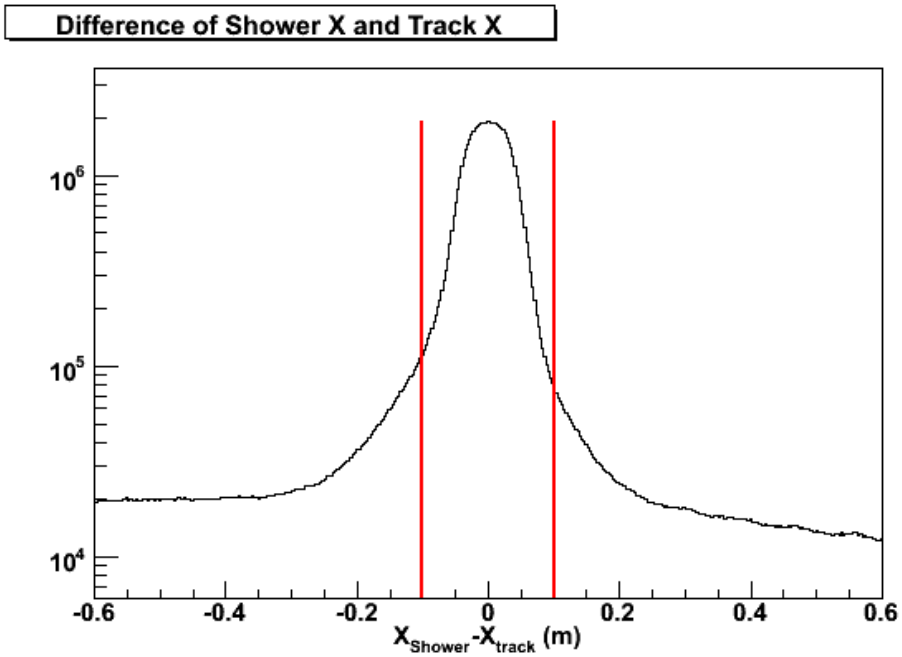

Figure: Shows the electrons in negative polarity running X track match to shower position cut.

Electrons in Positive Polarity (charge = 1):

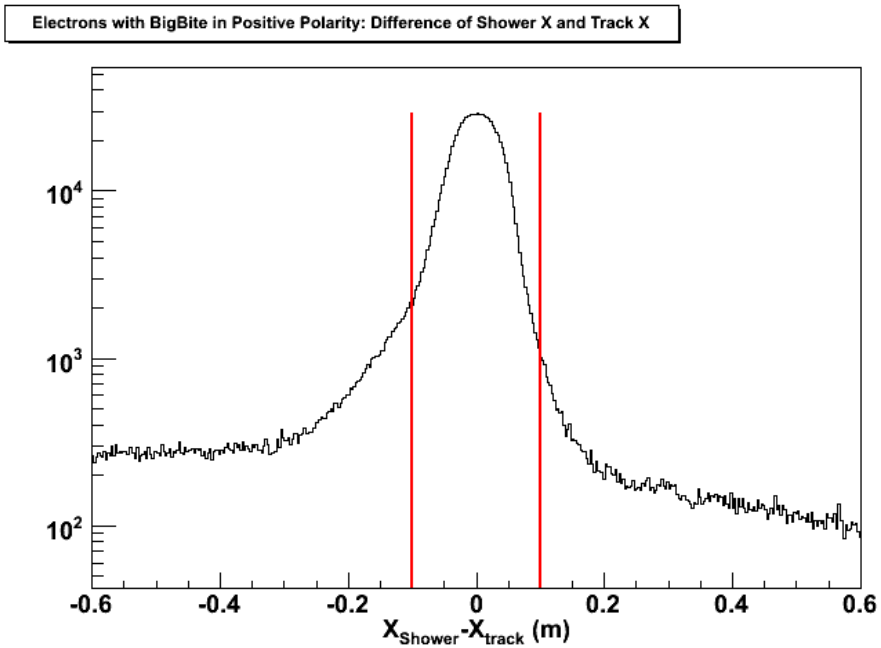

Figure: Shows the electrons in positive polarity running X track match to shower position cut after adjustment.

Cut Adjustments

- New E/p cut (bend-down particles and positive polartiy):
  - $0.763 < E/p < 1.158$
- New shower X - track X cut (bend-down particles):
  - $ABS(BB.ts.sh.x + 1.663575e-2 - BB.tr.x[] - 1.28 * BB.tr.th[]) < 0.1$

Two Positron Dilution Methods

- There are two ways to look at the positron dilution
- Positive Polarity Dilution:
  - Takeing the ratio of the positrons in positive polarity running to electrons in negative polarity running.
- In Run Dilution:
  - take ratio of positrons (BB.optics.charge[]==1) and electrons (BB.optics.charge[]==-1)

Positive Polarity Positron Dilution

- positron/electron ratio:

$$R_{e^+} = \frac{\Sigma_{e^+} Q_{e^-}}{\Sigma_{e^-} Q_{e^+}}$$

- Σ_{e^+} = total number of positrons in positive polarity running
- Σ_{e^-} = total number of electrons in negative polarity running
- Q_{e^+} = total charge on target during positive polarity running
- Q_{e^-} = total charge on target during negative polarity running
- Positron Dilution factor:

$$D_{e^+} = 1 - R_{e^+}$$

Positive Polarity Dilution: Counts

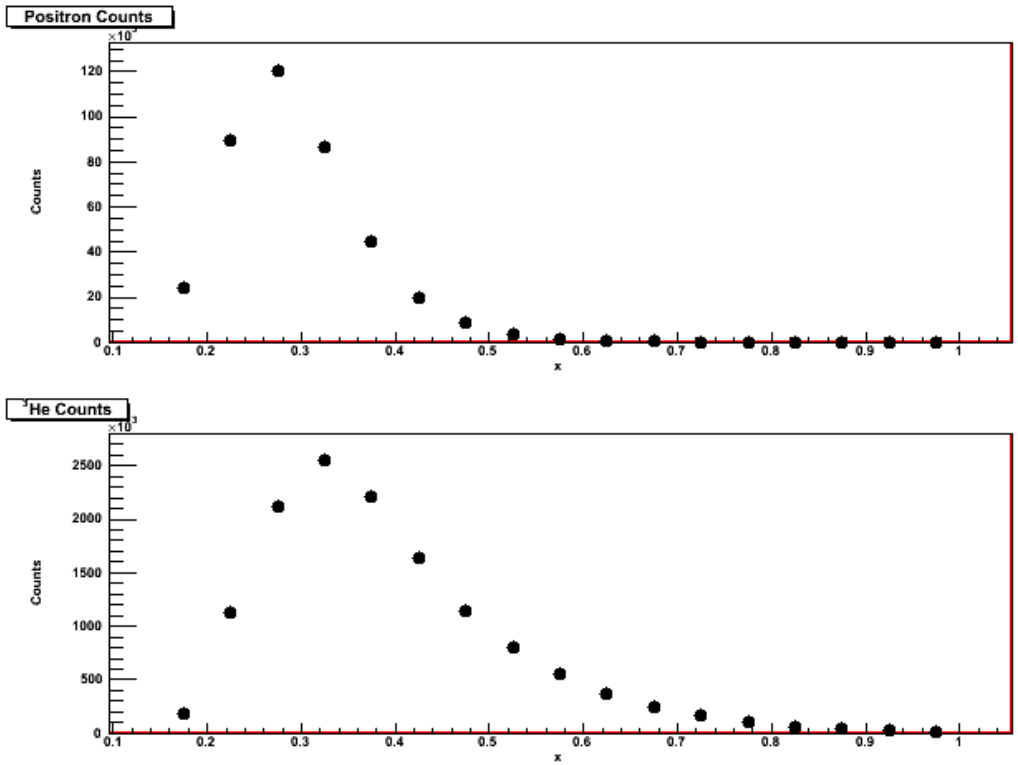

Figure: Shows charge normalized counts in positive(top) and negative(bottom) polarity running.

Positive Polarity Dilution: R_{e+}

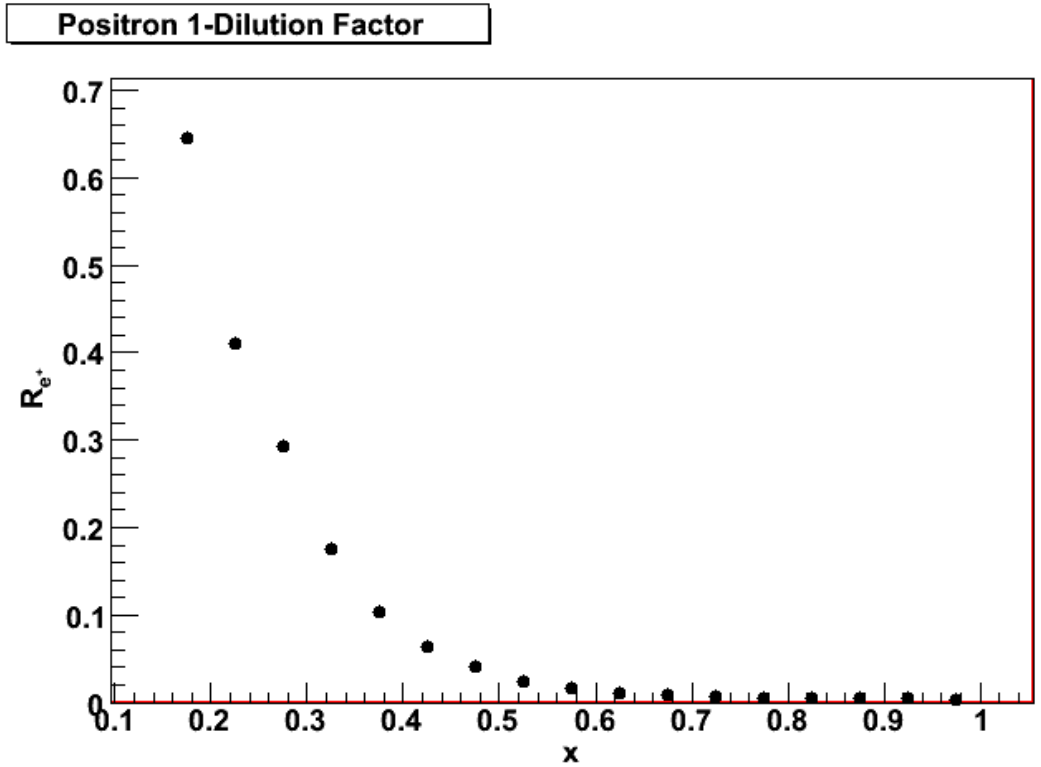

Figure: Shows ratio of positrons to electrons.

Positive Polarity Dilution: D_{e^+}

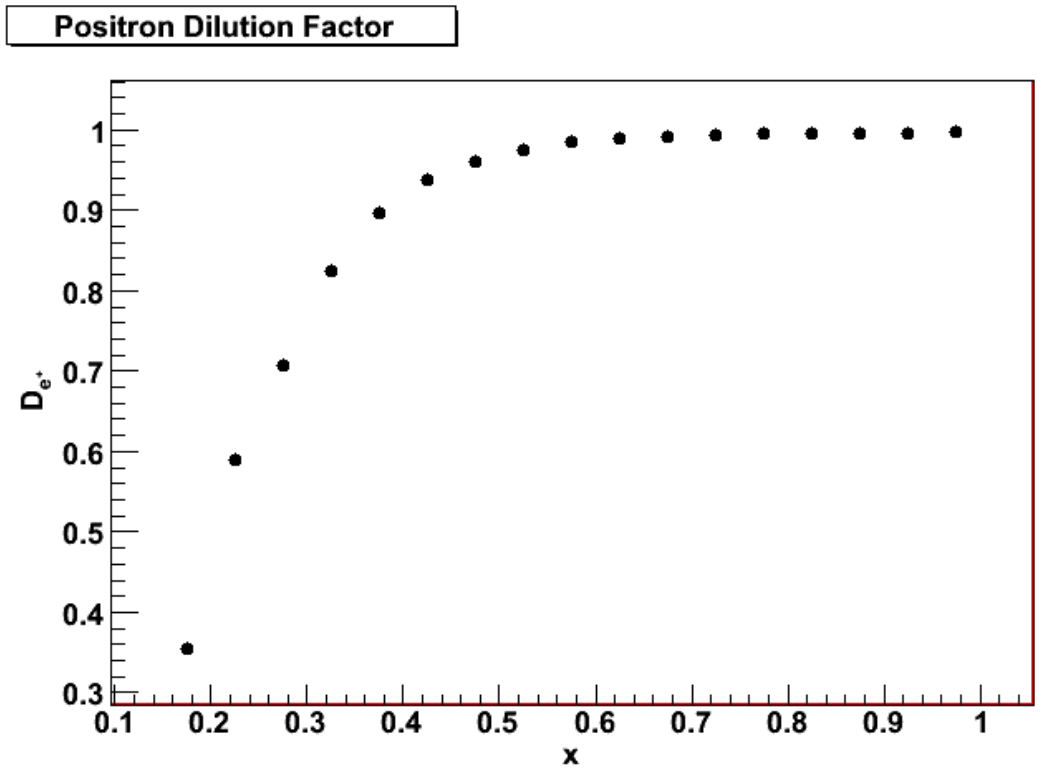

Figure: Shows positron dilution factor using the positive polarity method.

In-Run Positron Dilution

- positron/electron ratio:

$$R_{e^+} = \frac{\Sigma_{e^+}}{\Sigma_{e^-}}$$

- Σ_{e^+} = total number of positrons in negative polarity running (charge == 1 cut)
- Σ_{e^-} = total number of electrons in negative polarity running (charge == -1 cut)
- Positron Dilution factor:

$$D_{e^+} = 1 - R_{e^+}$$

In-Run Positron Dilution: R_{e+}

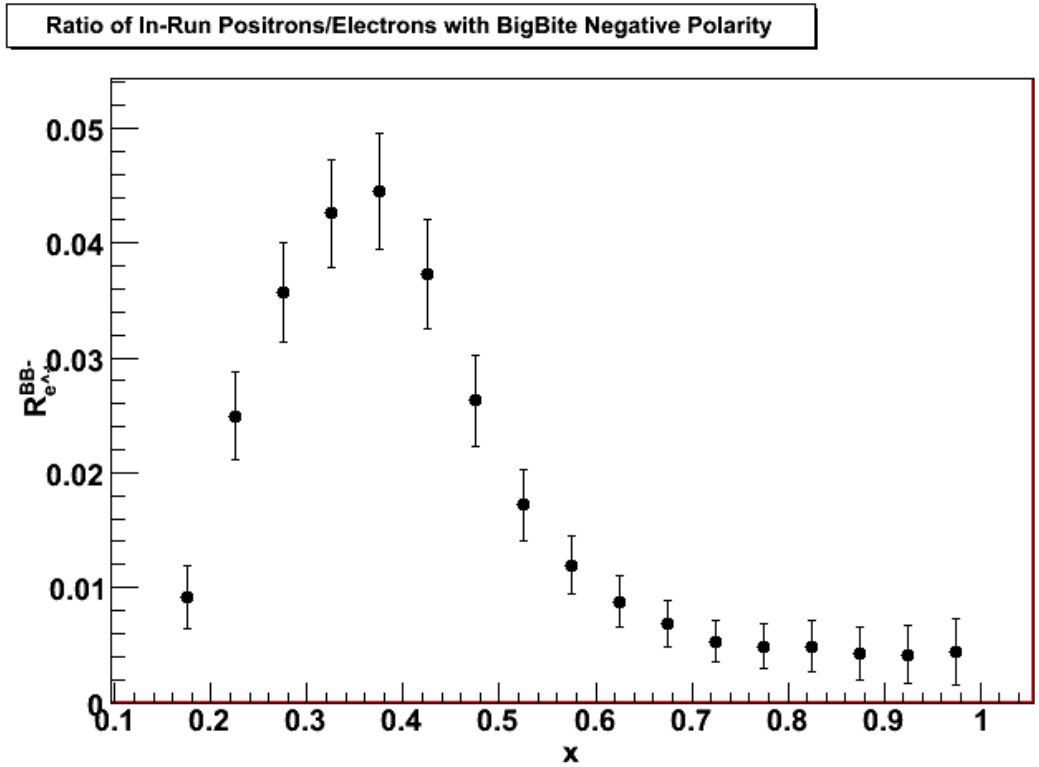

Figure: Shows ratio of positrons to electrons with in a common polarity.

In-Run Positron Dilution: D_{e^+}

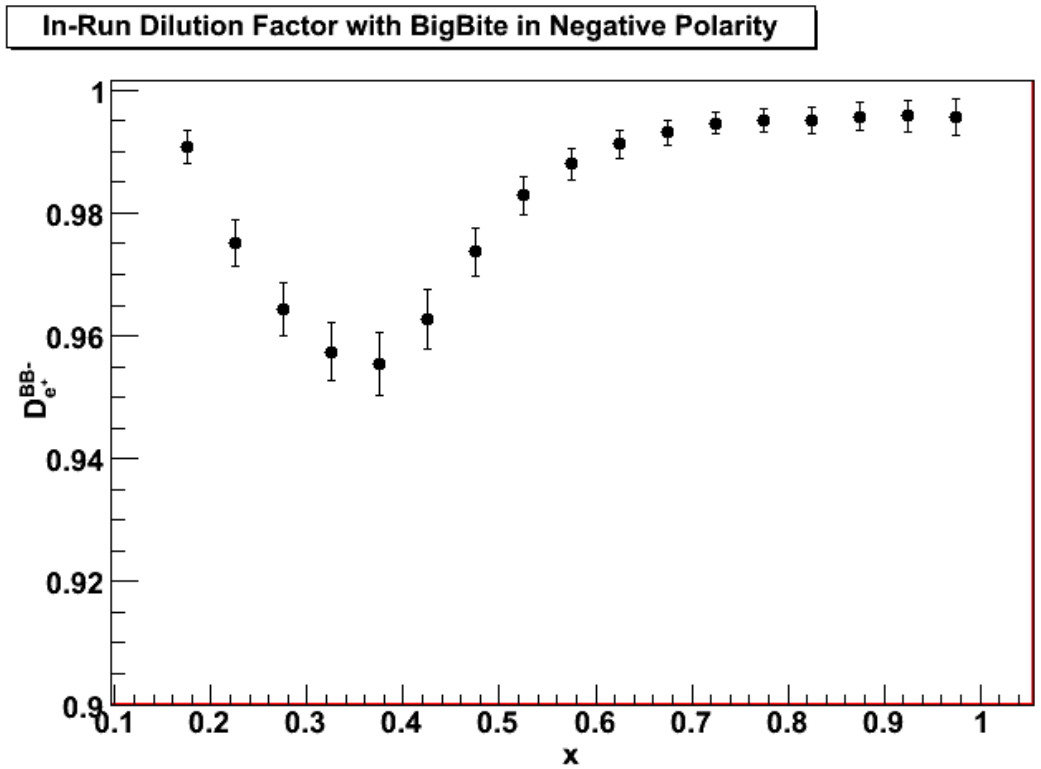

Figure: Shows positron dilution factor using the in-run method.

Summary of Two Dilution Methods

- Two dilution methods seem to agree at high x ($x > 0.5$)
- Lower x disagreement between two methods may be due to acceptance difference of bend up and bend down particles

Čerenkov x and Momentum Mirror Dependence

- Plotted x and momentum as a function of Čerenkov mirrors
- Used 10 4.7GeV runs in negative polarity
- all good 4.7GeV electron cuts were used
- Čerenkov cuts were only used on mirror being looked at (not ORed)

Kinematic in Mirror 02

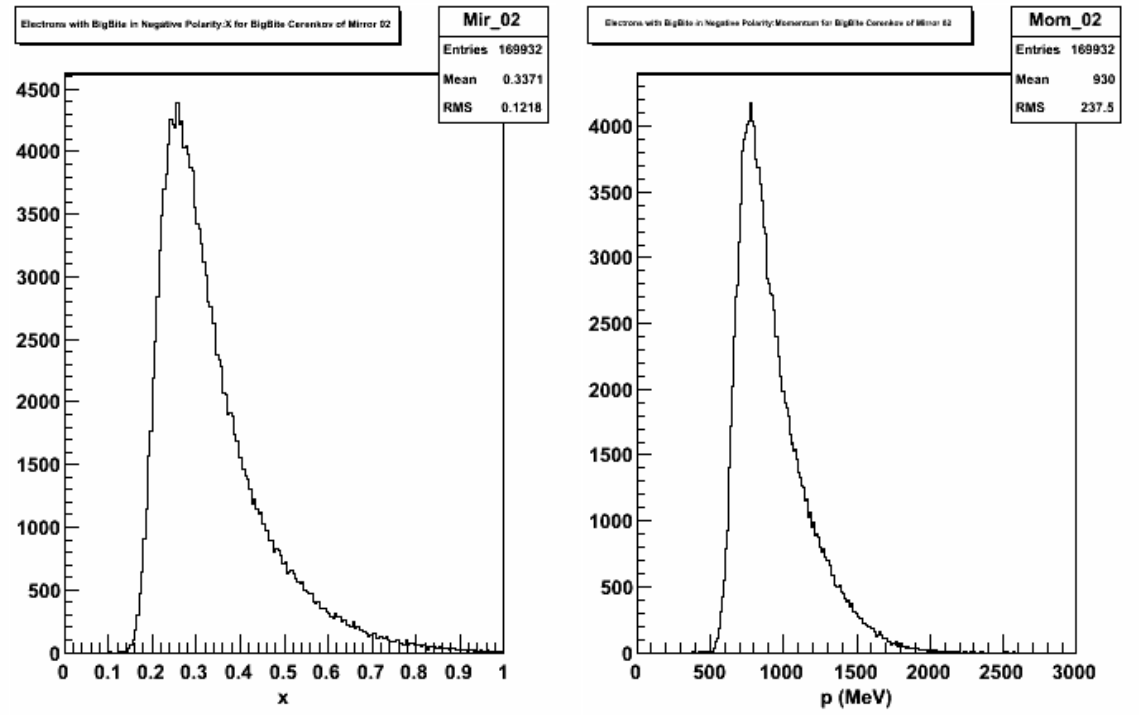

Figure: Shows typical plot of x and momentum found in mirror 02.

Mean x and Momentum vs Mirrors

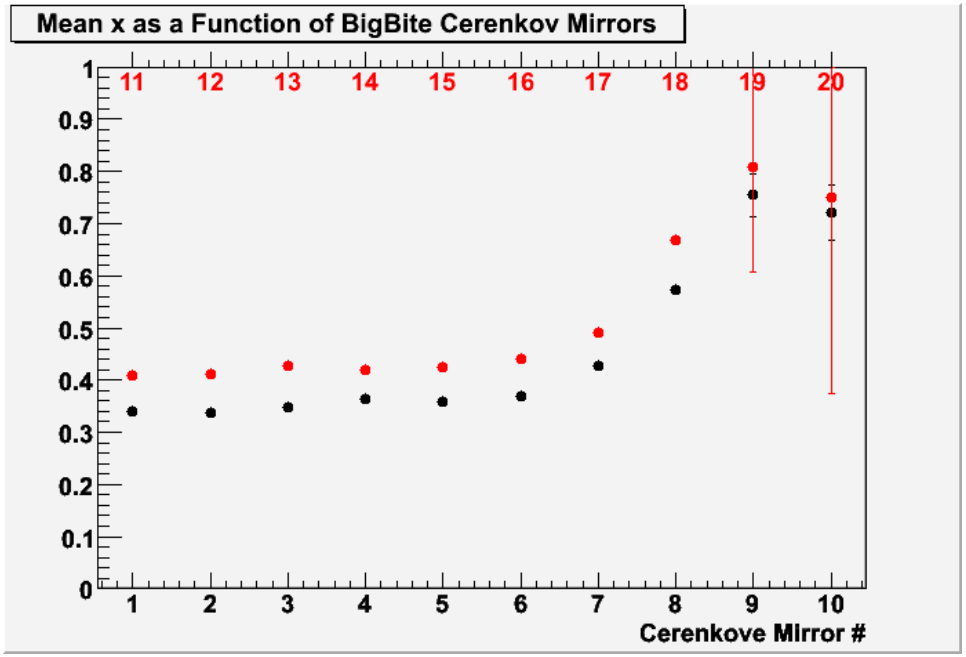

Figure: Shows mean x vs Čerenkov mirror.

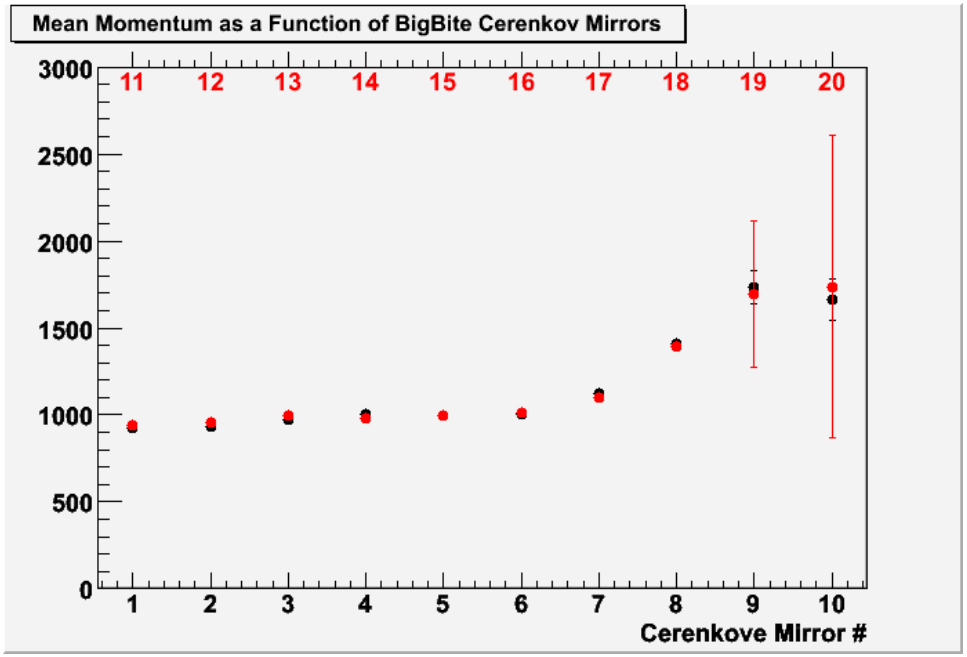

Figure: Shows mean momentum in MeV vs Čerenkov mirrors.

Summary: Čerenkov Kinematics

- Beamline-side (small angle) has a slightly lower mean x value than the RHRS-side (large angle)
- Mean x near 0.33(0.4) for most mirrors on beam(RHRS) side
- Mean momentum of adjacent mirrors agree with one another near 1GeV.

What's Next...

- Get the ball rolling on BigBite simulations
  - Andrew Puckett is going to adapt his SIMC BigBite tranversity code to d2n for us
  - Taked to Xin found his BigBite simulation code
  - Uses Geant3 and is written in fortran :(
  - Try to look at cross-sections on QFS
- Look at current poiston dilution factors affects on asymmetries