BigBite Analysis

E/p cut definitions and Asymmetries

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Outline

1. Positive Polartiy Energy vs Momentum Distribution
2. E/p Cut Adjustments
3. Positron Dilutions with E/p Cut Adjustments
4. Positron Dilution Effects on Asymmetries
5. Azimuthal Angle Structure
6. Sign of g_1 and g_2
7. What's Next

Positive Polarity: Positron E vs p

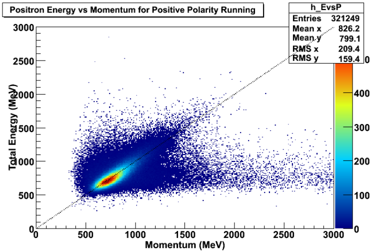


Figure: Energy vs momentum for positrons with BigBite in positive polarity. Dashed line is E=p.

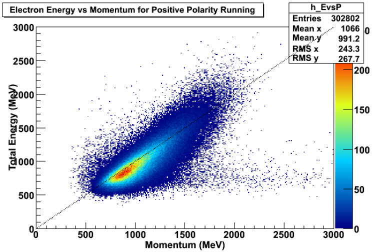


Figure: Energy vs momentum for electrons with BigBite in positive polarity. Dashed line is E=p.

E/p Cut Adjustments Definition

- Two particle types (e-,e+), two polarity settings (+,-)
- Fit Gaussian to E/p for each particle type and polarity setting
- define cut as $\mu \pm 2\sigma$
- μ = mean value from Gauss fit
- σ = sigma from Gauss fit

E/p Fit

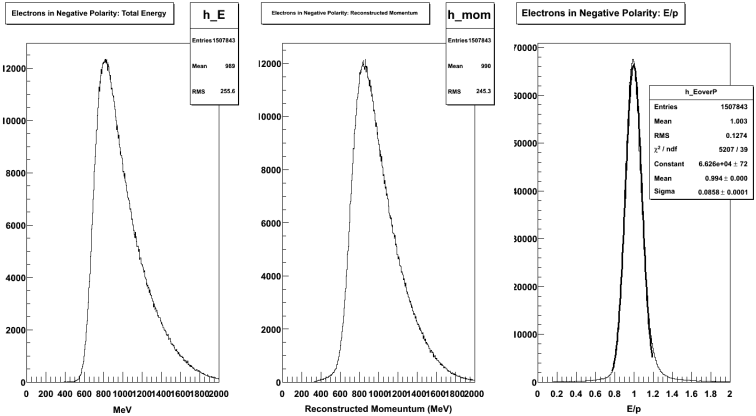


Figure: Shows the negative polarity electrons. Left plot is total energy, middle plot is momentum and right plot is E/p.

E/p Negative Polarity:Electrons E/p Cut

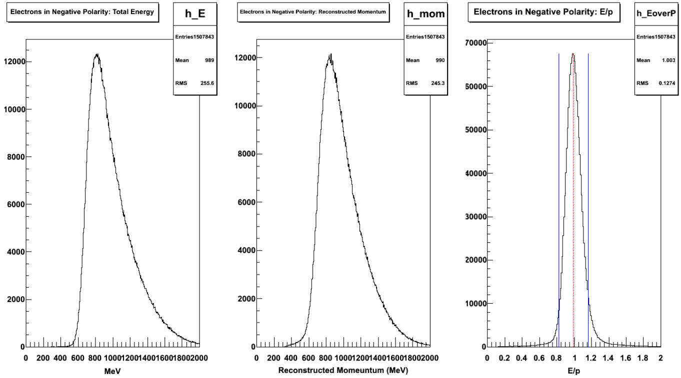
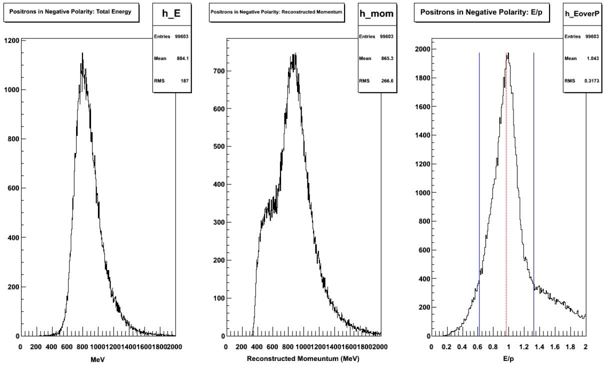


Figure: Shows the negative polarity electrons. Left plot is total energy, middle plot is momentum and right plot is E/p. Red line is mean Gauss vaue and blue lines are cut positions.

E/p Negative Polarity:Positrons E/p Cut



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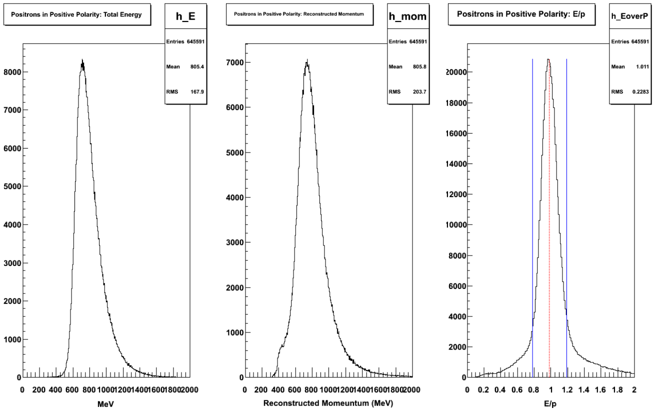
E/p Positive Polarity:Positrons E/p Cut



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E/p Positive Polarity:Electrons E/p Cut

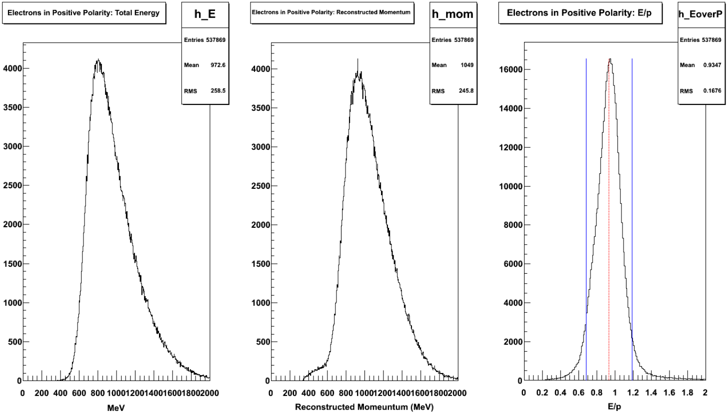


Figure: Shows the positive polarity electrons. Left plot is total energy, middle plot is momentum and right plot is E/p. Red line is mean Gauss vaue and blue lines are cut positions.

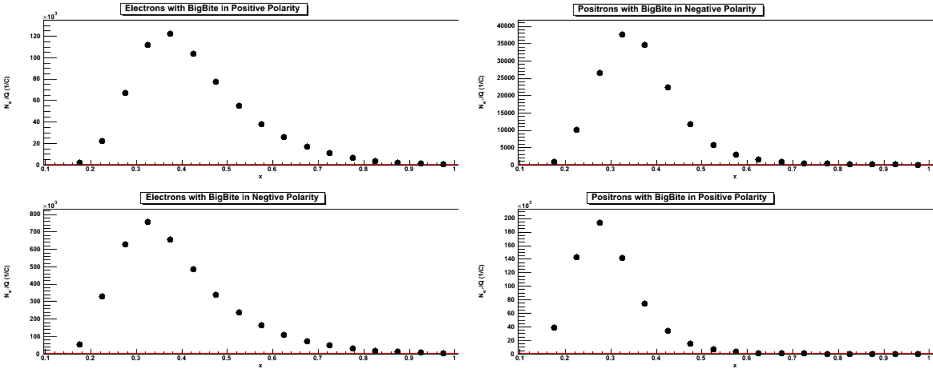
Final E/p Cuts

- neg E/p(positron) = (0.5*BB.ts.ps.e + BB.ts.sh.e)/(1000*skim.p[]) $>$ 0.619 &&(0.5*BB.ts.ps.e + BB.ts.sh.e)/(1000*skim.p[]) $<$ 1.32
- pos E/p(electron) = (0.5*BB.ts.ps.e + BB.ts.sh.e)/(1000*skim.p[]) $>$ 0.681 &&(0.5*BB.ts.ps.e + BB.ts.sh.e)/(1000*skim.p[]) $<$ 1.188
- pos E/p(positron) = (0.5*BB.ts.ps.e + BB.ts.sh.e)/(1000*skim.p[]) $>$ 0.779 &&(0.5*BB.ts.ps.e + BB.ts.sh.e)/(1000*skim.p[]) $<$ 1.187

Positron Dilutions with E/p Cut Adjustments

- After adjusting the E/p cuts for the different particle types and magnet polarity settings I took another look at the Positron dilution factors, and the ratio of electrons and positrons with BigBite in negative and positive polarity settings

Particle Type Counts



Positron Dilution Factors

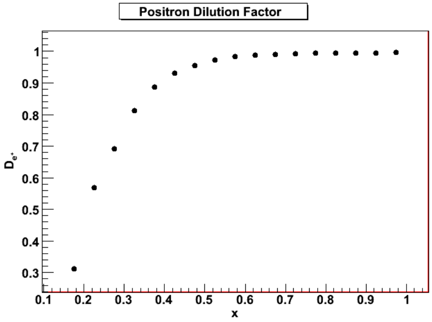


Figure: Shows positron dilution factor using an negative polarity run for electrons and positive polarity run for positrons

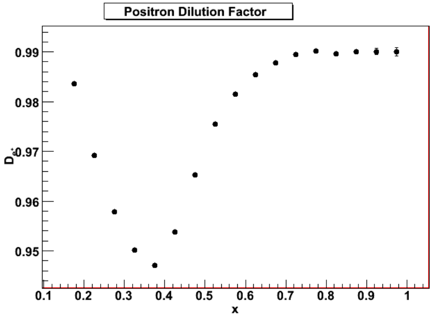


Figure: Shows positron dilution factor using negative polarity run for electrons and positrons

Particle Ratios

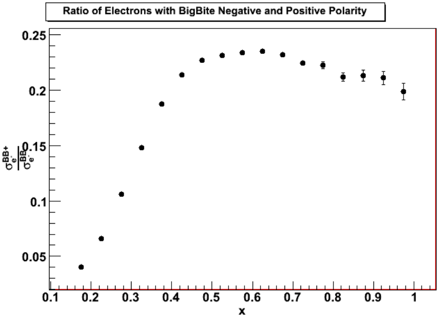


Figure: Shows ratio of electrons with BigBite in positive polarity and negative polarity

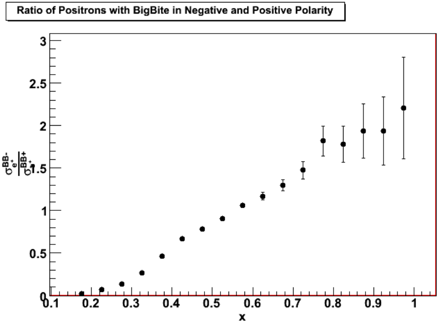


Figure: Shows ratio of positrons with BigBite in negative and positive polarity

Positron Dilutions Effects on Asymmetries

- Using the positrons dilutions factors above (positive/negative polarity ratio) I took a look at how the following asymmetries are affected:
- $A_{\|}$,$A_{\perp}$
- I then propagated the above asymmetries to A_1 and A_2

$A_{\parallel}$ and $A_{\perp}$ Definition

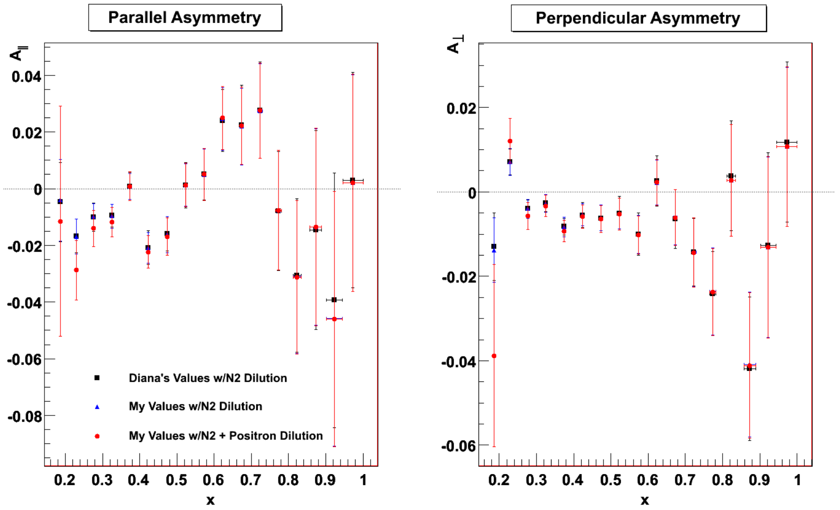
Definition ($A_{\parallel}$,$A_{\perp}$)

$$A_{\parallel} = \frac{1}{P_b P_t D_{N^2} D_{e+}} (A^0_{raw})$$

$$A_{\perp} = \frac{1}{P_b P_t D_{N^2} D_{e+} cos(\phi)} \left(\frac{\frac{A^{270}_{raw}}{(\delta A^{270}_{raw})^2} - \frac{A^{90}_{raw}}{(\delta A^{90}_{raw})^2}}{\frac{1}{(\delta A^{270}_{raw})^2} + \frac{1}{(\delta A^{90}_{raw})^2}} \right)$$

- P_b = beam polarization
- P_t = target polarization
- D_{N^2}, D_{e^+} = Nitrogen and positron dilution factors
- S = target spin
- ϕ = Azimuthal angle

4.7 GeV $A_{\|}$,$A_{\perp}$ on ^{3}He



A_1 and A_2 Definition

Definition (A_1,A_2)

$$A_1 = \left(\frac{1}{D(1+\eta\xi)}\right)A_{\parallel} - \left(\frac{\eta}{d(1+\eta\xi)}\right)A_{\perp}$$
$$A_2 = \left(\frac{\xi}{D(1+\eta\xi)}\right)A_{\parallel} + \left(\frac{1}{d(1+\eta\xi)}\right)A_{\perp}$$

- $D = \frac{E-\epsilon E'}{E(1+\epsilon R)}$
- $\eta = \frac{\epsilon\sqrt{Q^2}}{E-\epsilon E'}$
- $d = D\sqrt{(\frac{2\epsilon}{1+\epsilon})}$
- $\xi = \eta\frac{1+\epsilon}{2\epsilon}$
- $R = \frac{\sigma_L}{\sigma_T}$
- $\epsilon = \left((1+2(1+\gamma^2)tan^2(\frac{\theta}{2})\right)^{-1}$
- $\gamma^2 = \frac{Q^2}{\nu^2}$

4.7 GeV Kinematics I

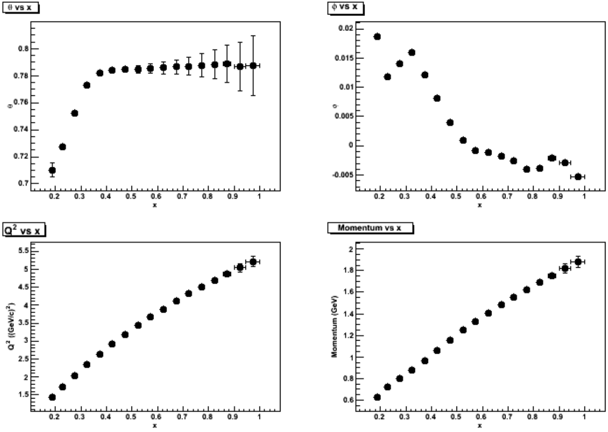


Figure: Kinematics in x-bins for 10 runs

4.7 GeV Kinematics II

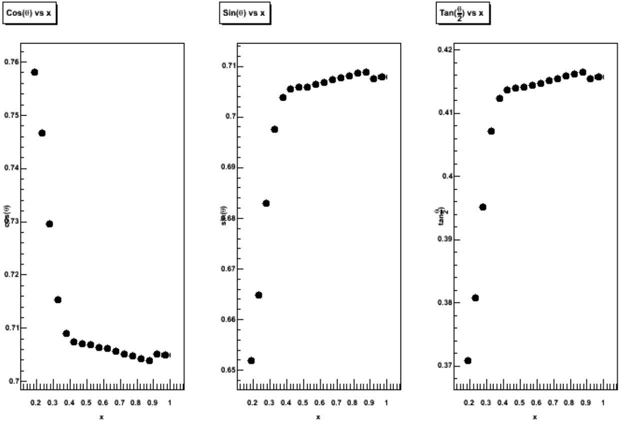


Figure: Kinematics in x-bins for 10 runs

4.7 GeV Kinematics III

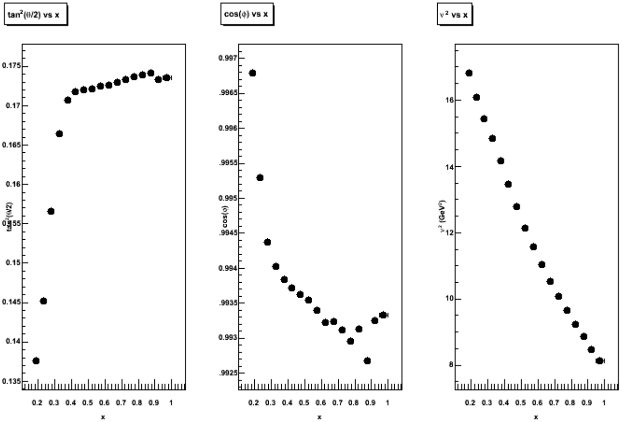
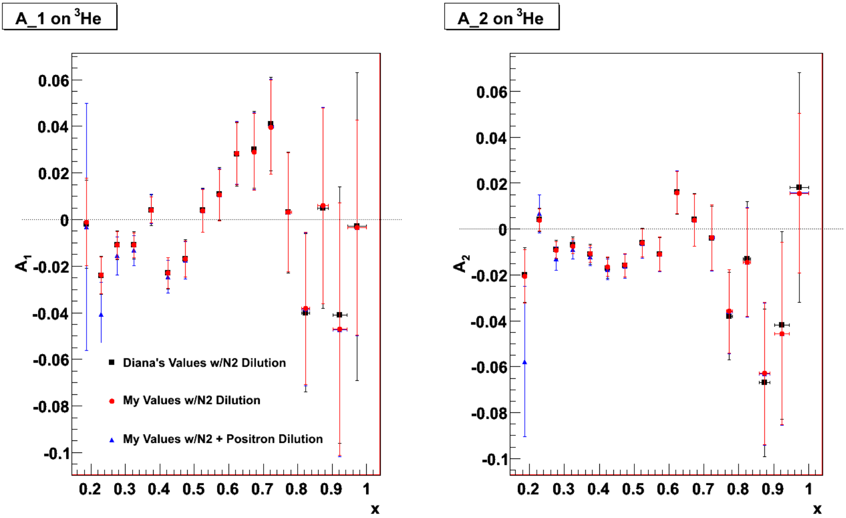


Figure: Kinematics in x-bins for 10 runs

4.7 GeV A_1 ,A_2 on ^{3}He



Azimuthal Angle Structure

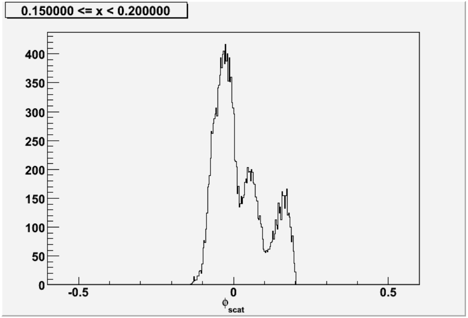


Figure: Azimuthal angle for x-bin 4

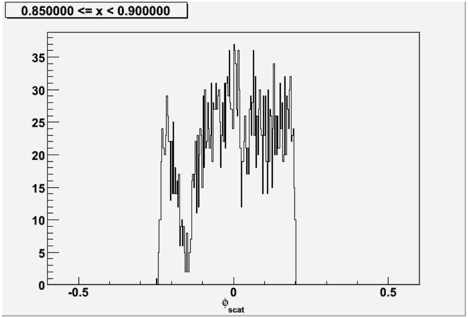


Figure: Azimuthal angle for x-bin 18

g_1 and g_2 Definitions

Definition

$$g_1 = (2\sigma_0)\left(\frac{MQ^2}{4\alpha^2}\frac{y}{(1-y)(2-y)}\right)\left[A_\parallel + tan(\frac{\theta}{2})A_\perp\right]$$

$$g_2 = (2\sigma_0)\left(\frac{MQ^2}{4\alpha^2}\frac{y^2}{2(1-y)(2-y)}\right)\left[-A_\parallel + \frac{1+(1-y)cos(\theta)}{(1-y)sin(\theta)}A_\perp\right]$$

- $\alpha = \frac{1}{137}$
- $M = 0.938 GeV$
- $y = \frac{\nu}{E}$
- need σ_0 to get g_1 and g_2, but we can look at the sign of the structure functions without the cross-section.

4.7 GeV $\frac{g_1}{2\sigma_0}$,$\frac{g_2}{2\sigma_0}$ on ^{3}He

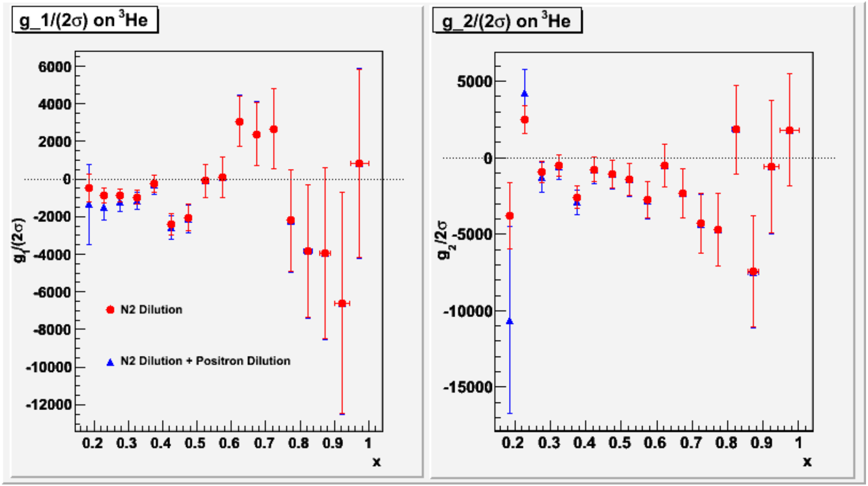


Figure: $\frac{g_1}{2\sigma_0}$ and $\frac{g_2}{2\sigma_0}$ as a function of x.

What's Next...

- Dave is going to get me a table of cross-sections and x values
- Will be able to really form g_1 and g_2