# BigBite Analysis

4-pass Cer cut and Delta Asym. N2 Dilution

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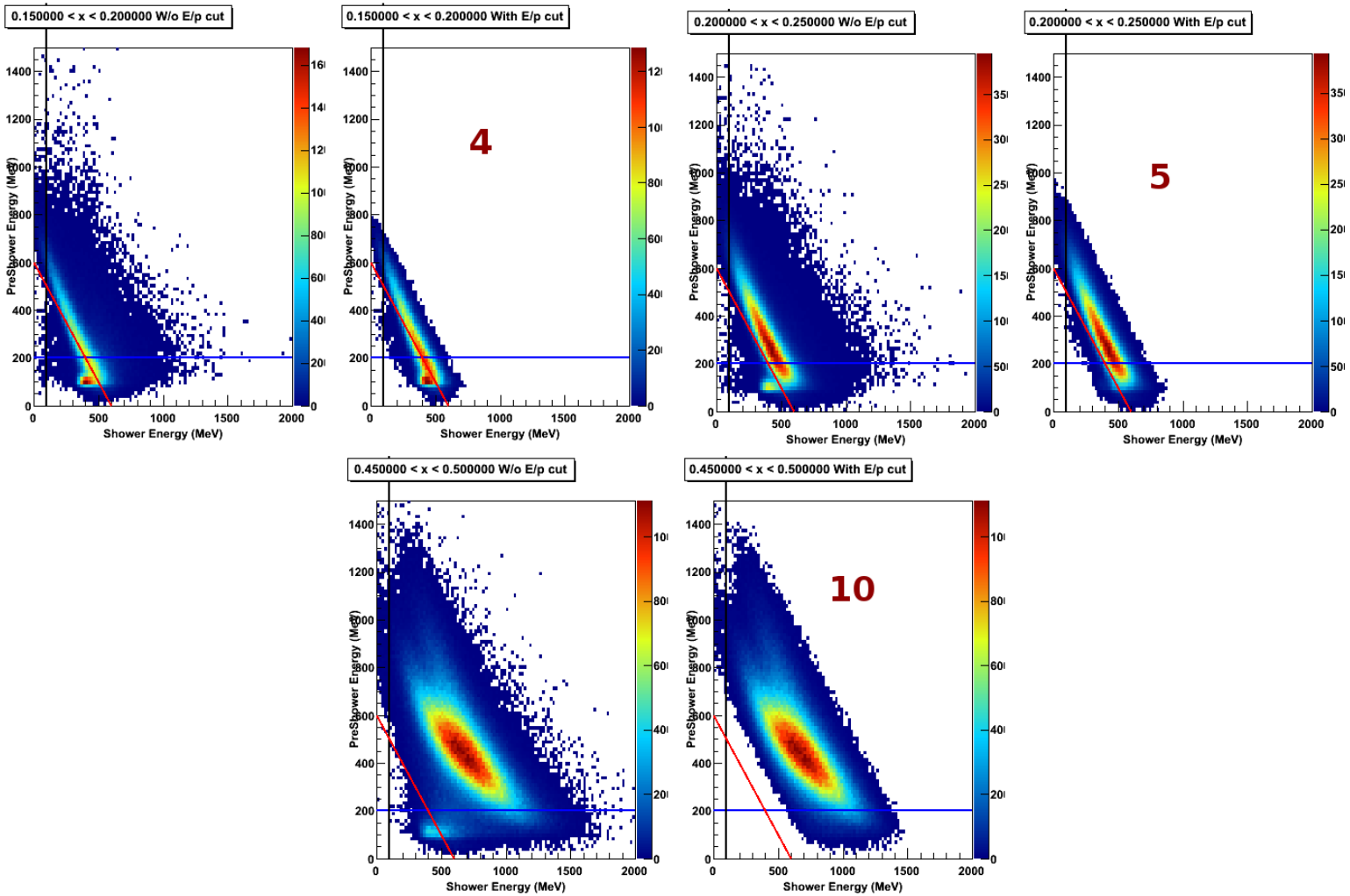
# Outline

# Shower and Minimum Energy Cuts (1)

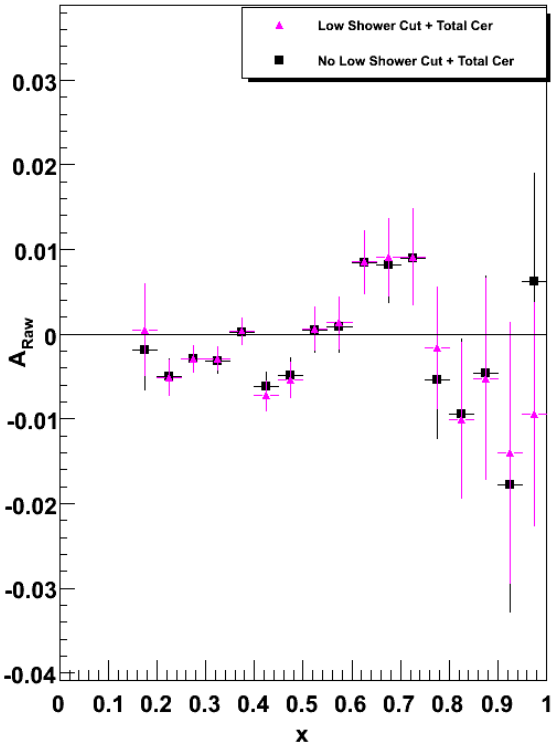
- Looking at the Pre-Shower vs Shower, we see two distinct distributions
- Even with the E/p cut, not all of the bad electron distribution is removed at lower x
- To help with this, a minimum shower energy cut of 100 Mev and
- A total energy cut of 600 MeV was added

# BigBite Shower and Minimum Energy Cuts (2)

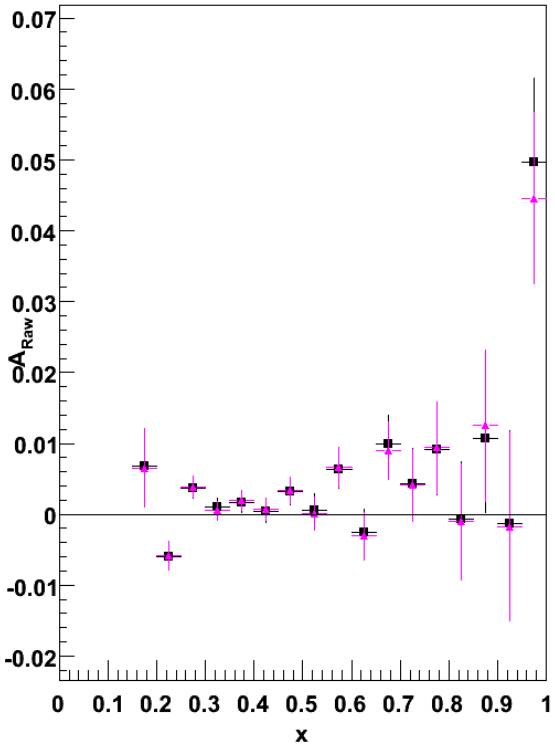


# 4-Pass Asymmetries with New Cuts

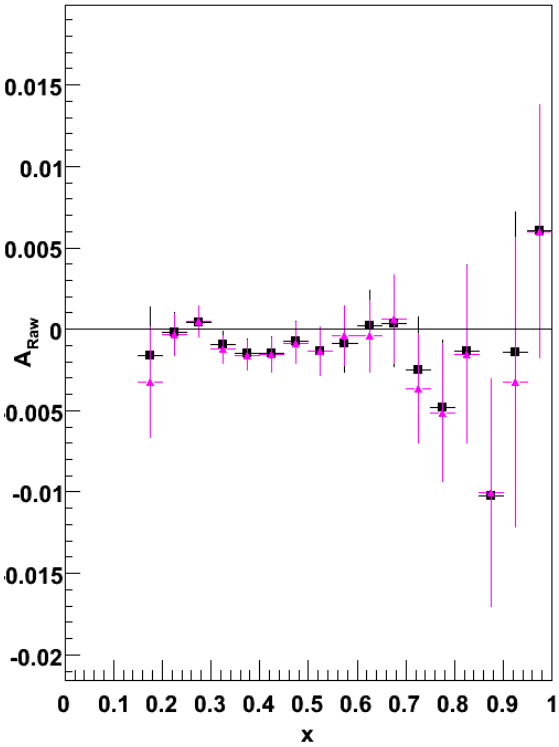
$A_{Raw}$, S = 0




$A_{Raw}$, S = 90



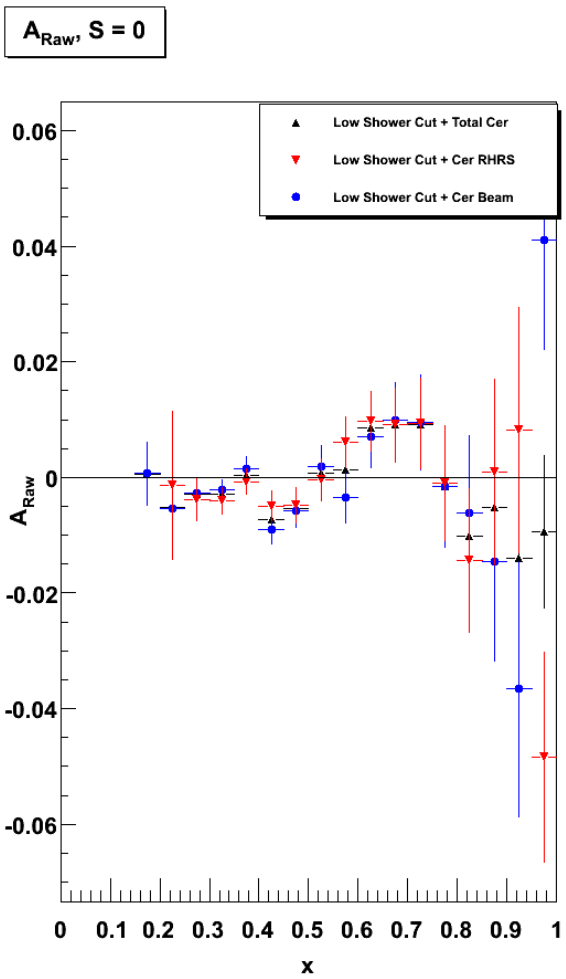

$A_{Raw}$, S = 270

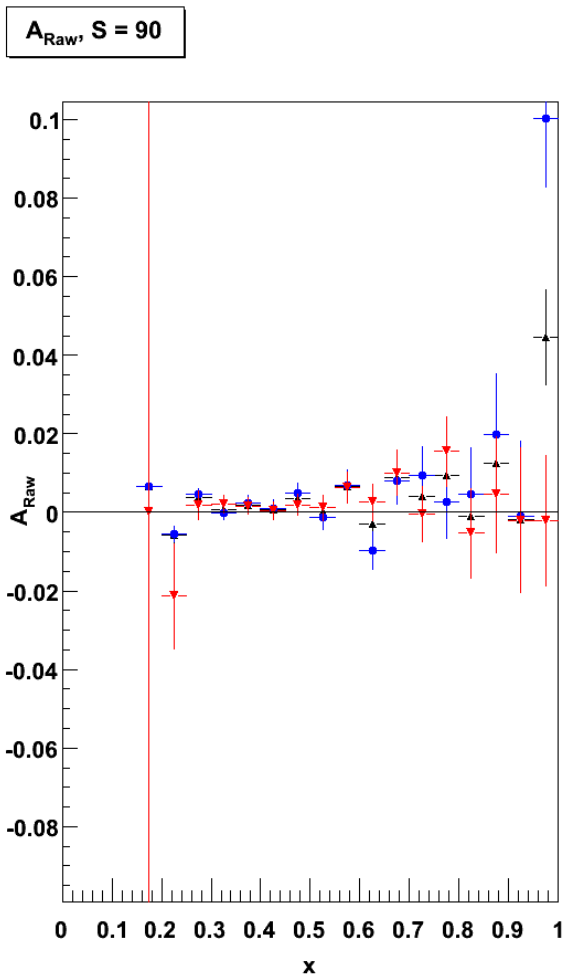


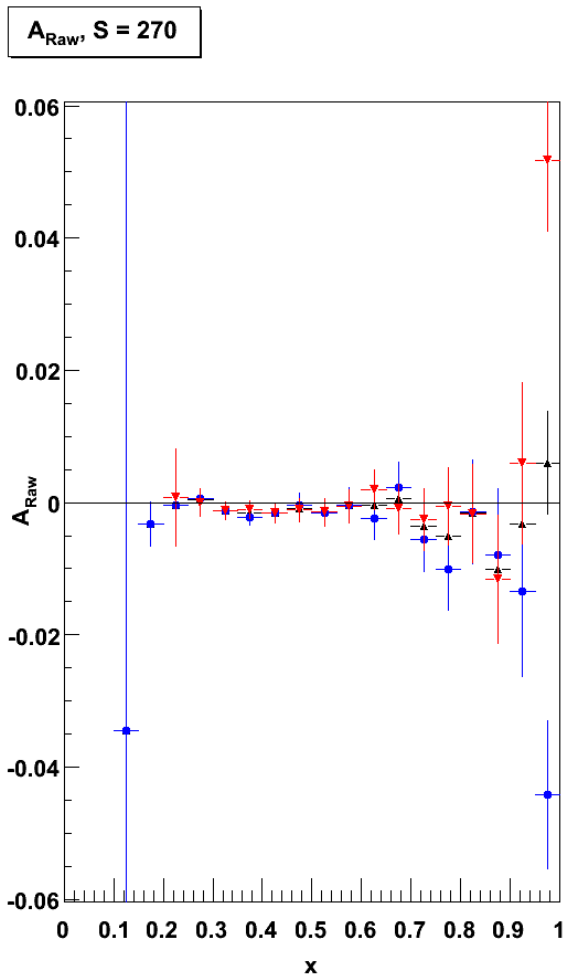
# BigBite Čerenkov Cuts

- To check if the asymmetries over lap when using the small(beamline-side) and large(RHRS-side) angle,
- Compute the asymmetries applying the small and large angle Čerenkov cuts separately
- Compare to asymmetry using the total Čerenkov cut (small || large angle)

# 4-Pass Asymmetries with Angle Dependent Čerenkov Cuts



# Target Sign Convention

- Using the asymmetry sign conventions

$$A_{\parallel} = \frac{d\sigma^{\downarrow\Uparrow} - d\sigma^{\uparrow\Downarrow}}{d\sigma^{\downarrow\Uparrow} + d\sigma^{\uparrow\Downarrow}}$$

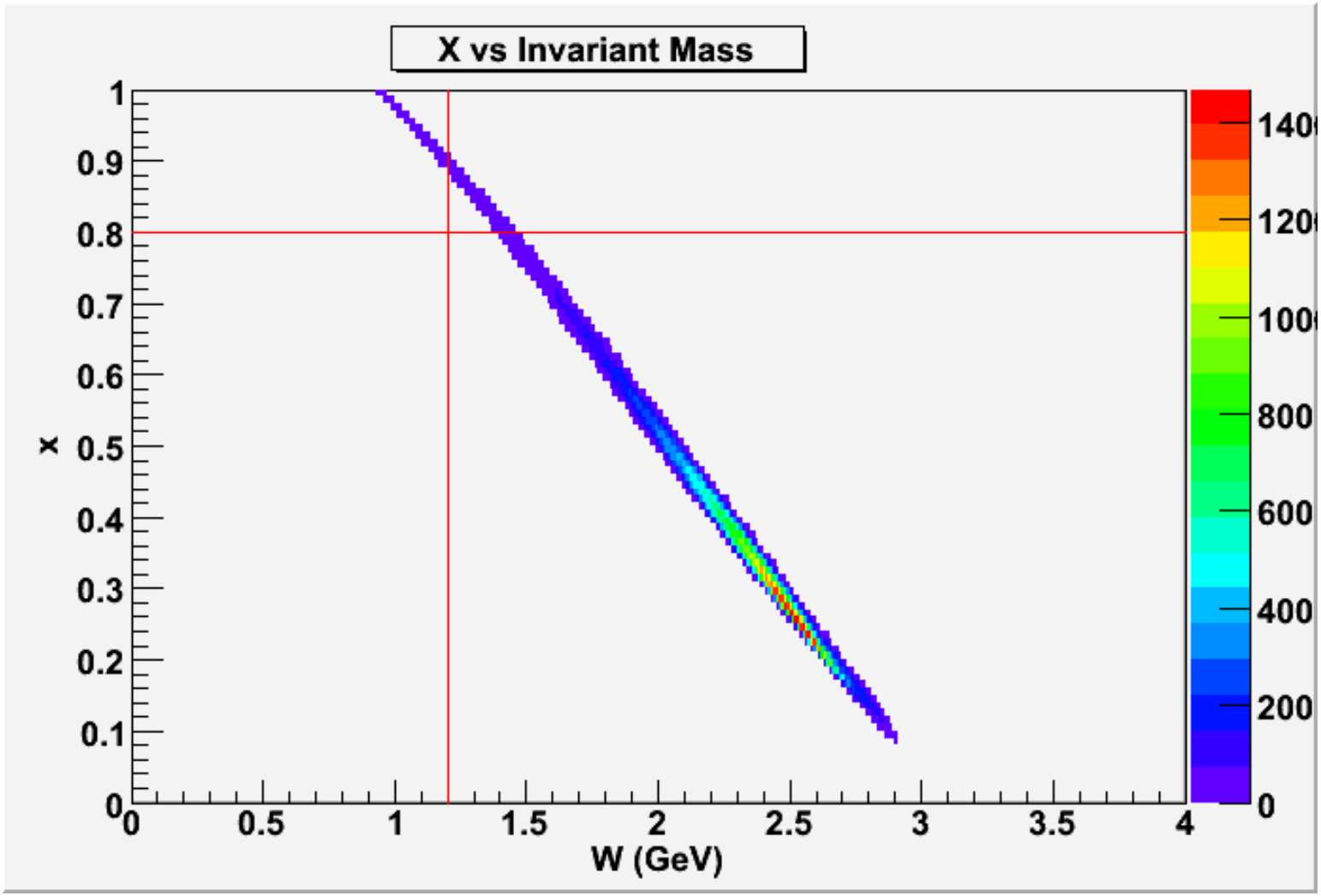
$$A_{\perp} = \frac{d\sigma^{\downarrow\Rightarrow} - d\sigma^{\uparrow\Leftarrow}}{d\sigma^{\downarrow\Rightarrow} + d\sigma^{\uparrow\Leftarrow}}$$

- $\downarrow(\uparrow)$ is electron with helicity $-1$,$(+1)$
- $\Uparrow, (\Downarrow)$ is upstream 0 deg,(downstream 180 deg)
- $\Rightarrow, (\Leftarrow)$ is BB 270 deg,(LHRS 90 deg)

# Check Target Sign Convention

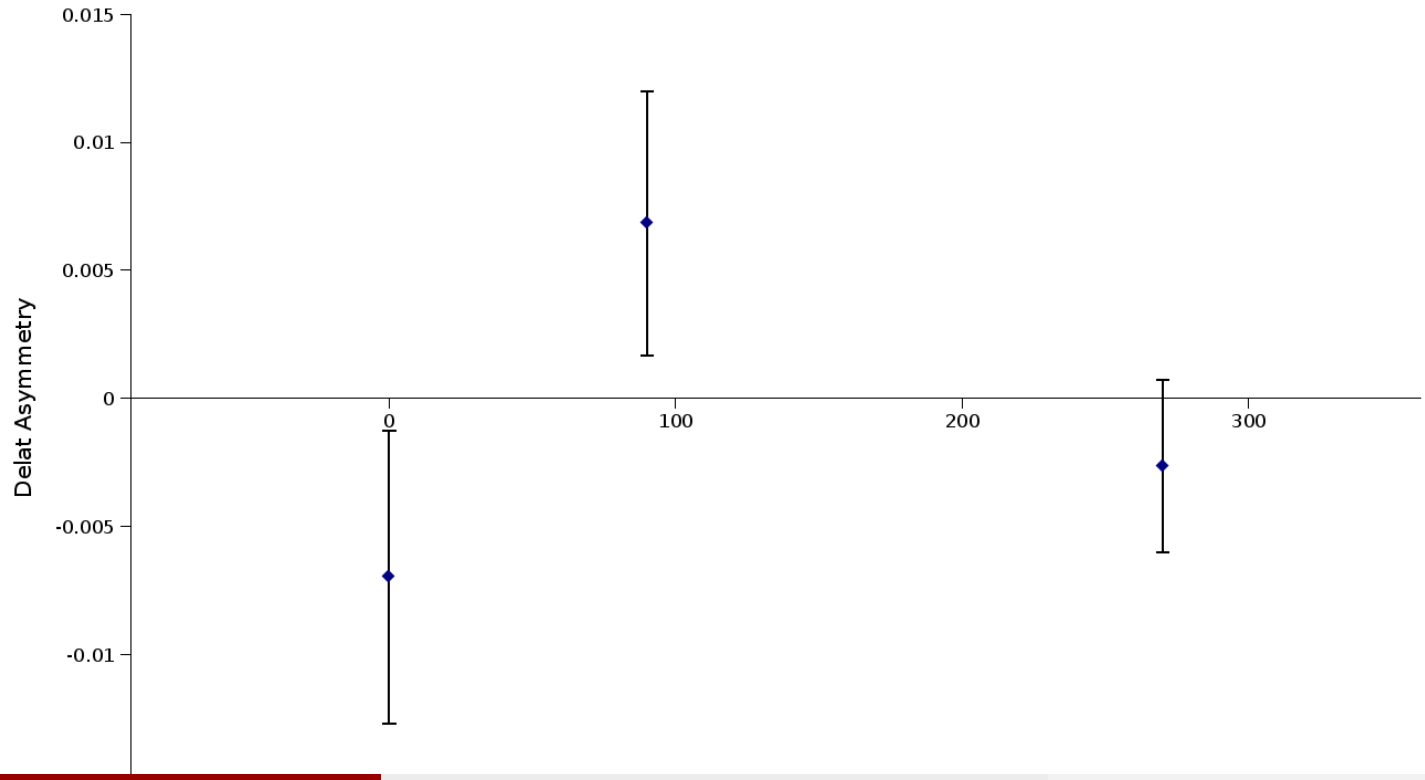
- Out of curiosity I decided to check the sign of the $\Delta_{1232}$ asymmetry
- We can add x-binned asymmetries that correspond to $W = 1.232GeV$
- Plotted x vs W and found that $x \sim 0.9$ corresponds to the $\Delta_{1232}$
- So take weighted average of x-bins $>= 0.8$ for each target orientation (0,90,270)

# x vs. W


X vs Invariant Mass
x
W (GeV)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
0.5
1
1.5
2
2.5
3
3.5
4
0
200
400
600
800
100
120
140

# $\Delta_{1232}$ Asymmetry Results

- $0^\circ = -0.00696803 \pm 0.0057209$
- $90^\circ = 0.00684876 \pm 0.00515452$
- $270^\circ = -0.00265859 \pm 0.00336483$
- Using sign convention defined earlier, we will have a negative $A_{||}$ and negative $A_{\perp}$

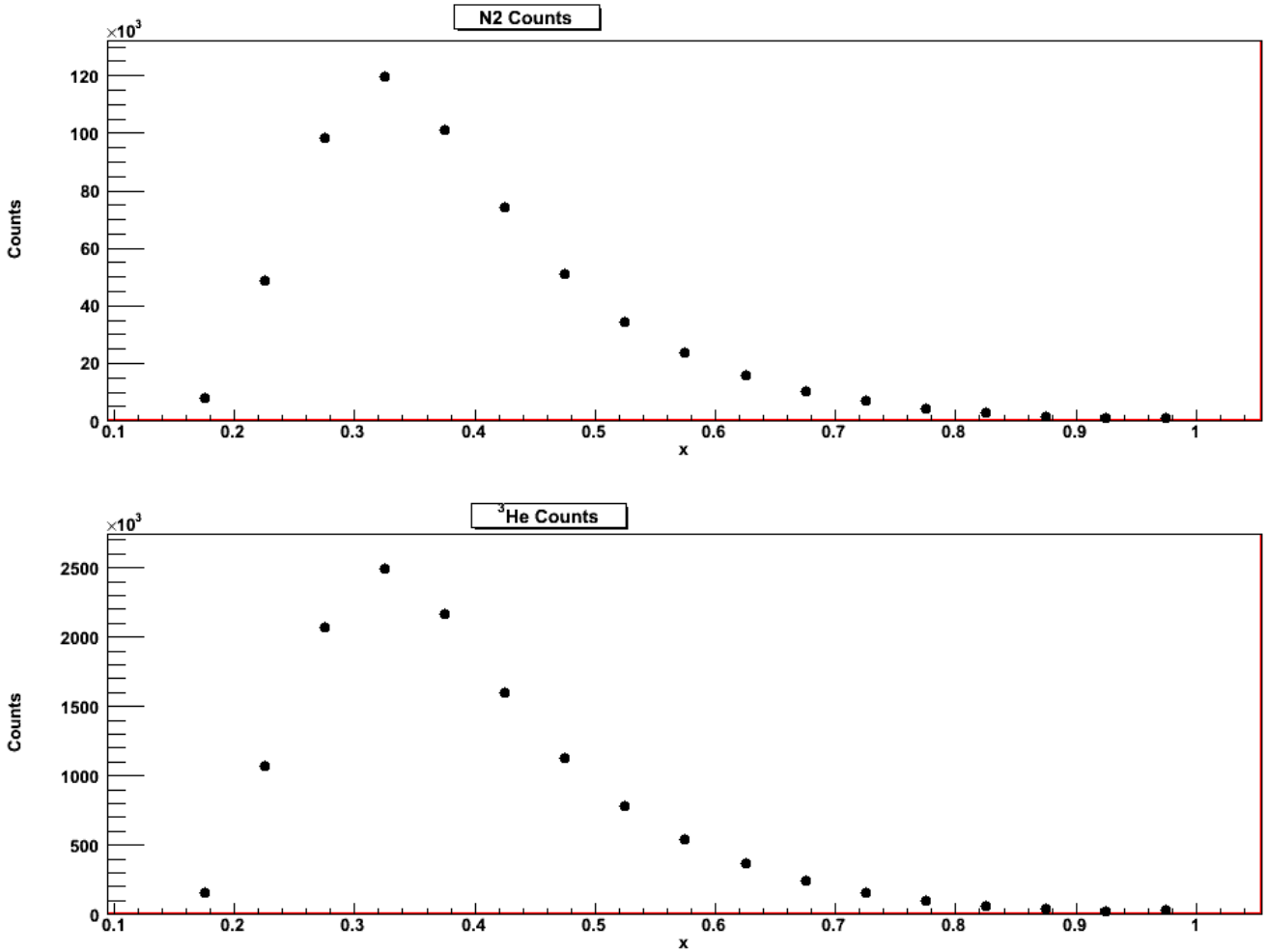


- Used 3 4-pass nitrogen target runs to compute the nitrogen dilution factor
- this is found by

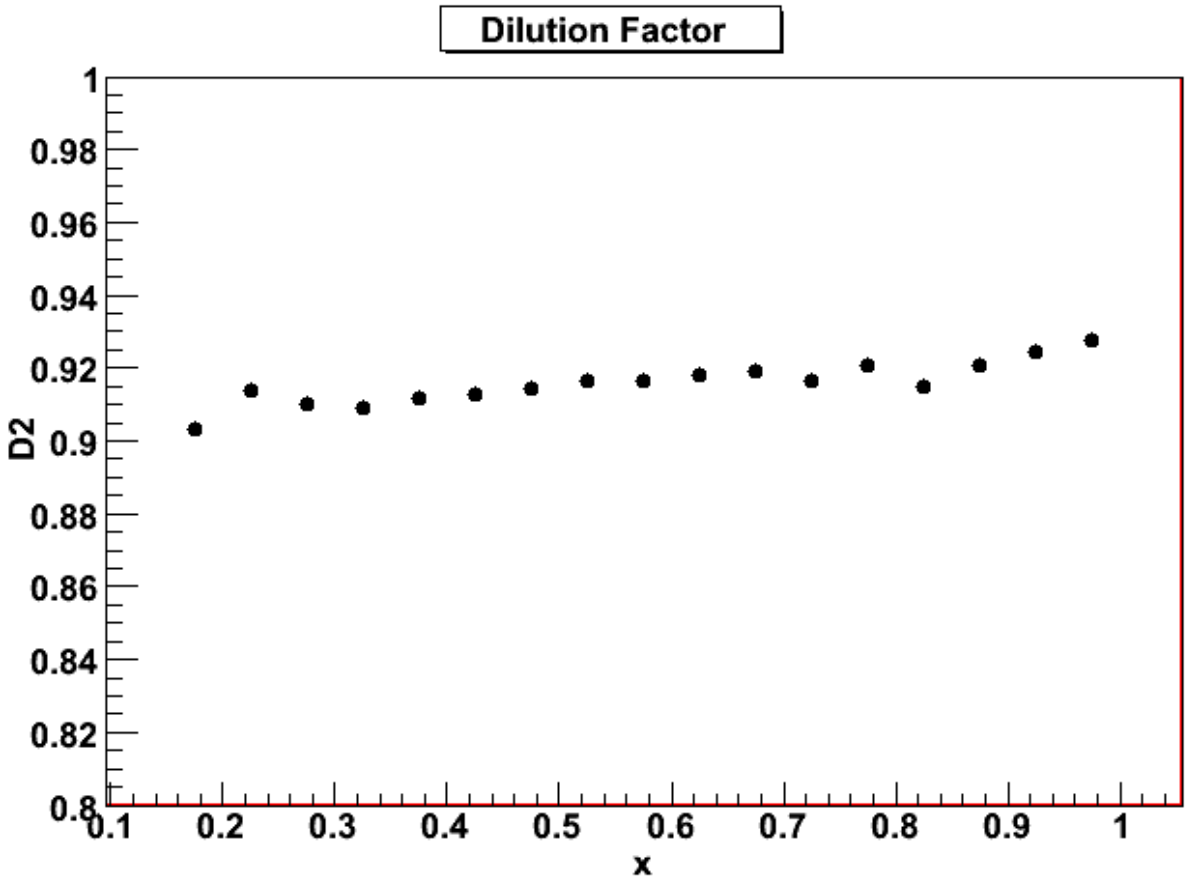
$$D_{N2} = 1 - \frac{N_{ref}}{N_{prod}} \frac{Q_{prod}\rho^{N2}_{prod}}{Q_{ref}\rho^{N2}_{ref}}$$

- $N_{ref}, (N_{prod})$ Total counts for a reference N2,(production $^3$He) run
- $Q_{ref}, (Q_{prod})$ is the total charge incident on the reference,(production) target
- $\rho^{N2}_{ref}, (\rho^{N2}_{prod})$ is the density of N2 in the reference, (production) target
- $\rho^{N2}_{prod} = 0.113 amg \pm 3\%$
- $\rho^{N2}_{ref} = 7.71 amg \pm 2.1\%$

# $D_{N2}$: Counts in 4-Pass Reference and Production Cell



# $D_{N2}$: N2 Dilution Factor



# Summary

- Having a minimum shower and total energy cut cleans up lower x bins
- The delta asymmetry seems to be backwards using our current target orientation sign convention
- N2 dilution factor agrees with what Diana found

# For Next week

- Continue working towards getting g1 and g2 on 4pass data
- Reproduce Diana's A1 and A2
- Add Error bars to N2 dilution factor
- BB Čerenkov HV1 runs calibration (in progress)
- Get 4-pass positive polarity asymmetries
  - Replay positive 4-pass runs to d2n machine (in progress)
  - Run skim code on positive data
  - Check electron cuts and get asymmetries