BigBite Analysis

Positron Asymmetry Corrections

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Outline

Positron Correction

$$A_m = \frac{N_-^{e-} - N_+^{e-} + N_-^{e+} - N_+^{e+}}{N_{tot}^{e-} + N_{tot}^{e+}} = \frac{A_{e-} + R_0 A_{e+}}{1 + R_0} \tag{1}$$

- A_m is measured raw asymmetry
- $N_{-(+)}^{e-(e+)}$ are electron (positron) counts with incident electron having negative (positive) helicity
- $N_{tot} = N_- + N_+$
- A_{e-} is clean electron asymmetry
- A_{e+} is positron asymmetry
- R_0 is positron to electron (bend down to bend up) ratio

Positron asymmetry correction :

$$A_{e-} = A_m (1 + R_0) - R_0 A_{e+} \tag{2}$$

Correcting e^+/e^-

- BigBite has large enough acceptance to detect particles that are bent up and down when passing through the dipole magnet
- For each run with BB in negative polarity mode positron to electron ratio can be formed by using the bend down to bend up events (R_0).
- Do to acceptance differences between bend down and bend up events are corrected using σ_{e+} to σ_{e-} ratios in the LHRS.

$$CR_0 = \frac{\sigma_{e+}}{\sigma_{e-}} = R$$

Positron asymmetry correction is then:

$$A_{e-} = A_m (1 + R) - RA_{e+} \tag{3}$$

Preliminary 4-Pass Positron to Electron Correction: LHRS Fit

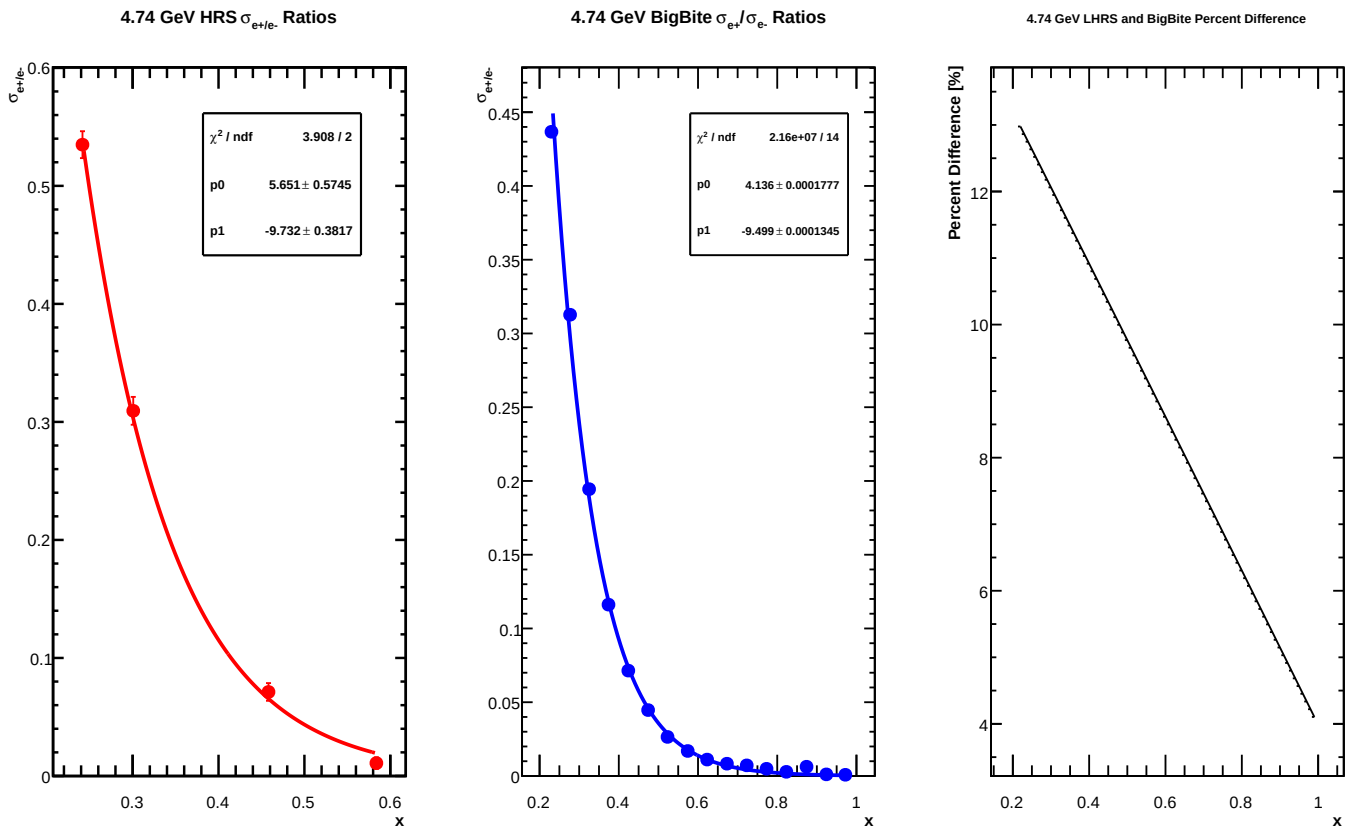


Figure: 4.74 GeV fit to LHRS positron to electron ratio using an exponential fit.

Preliminary 4-Pass Positron to Electron Correction: Correction Factors

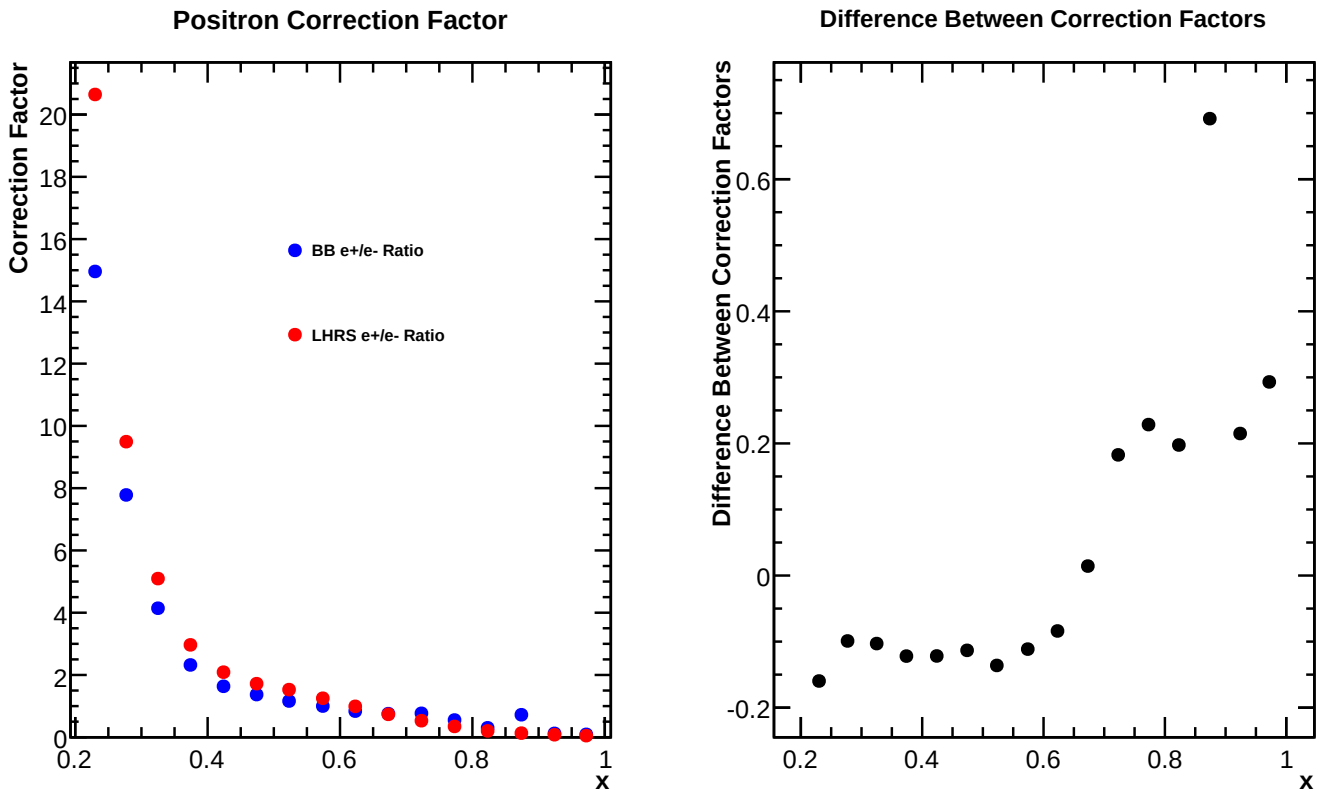


Figure: 4.74 GeV Correction Factors using LHRS fit.

Preliminary 4-Pass Positron to Electron Correction: Applied Correction Factors

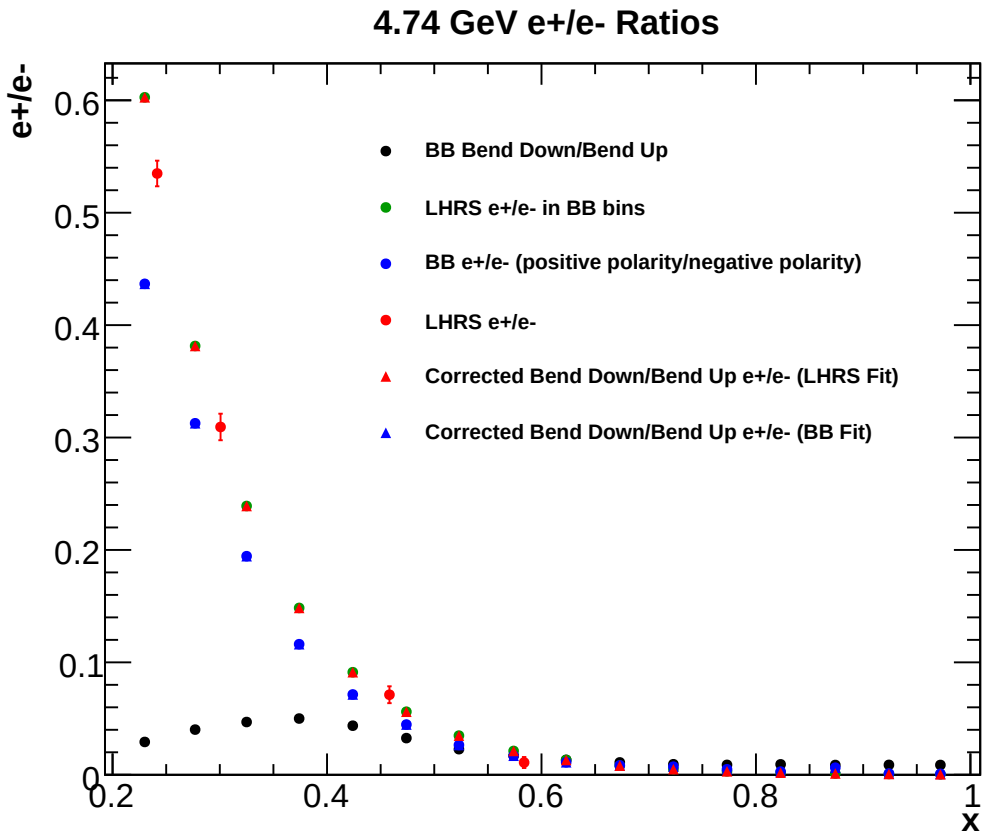


Figure: 4.74 GeV Correction factors applied.

Preliminary 5-Pass Positron to Electron Correction: LHRS Fit

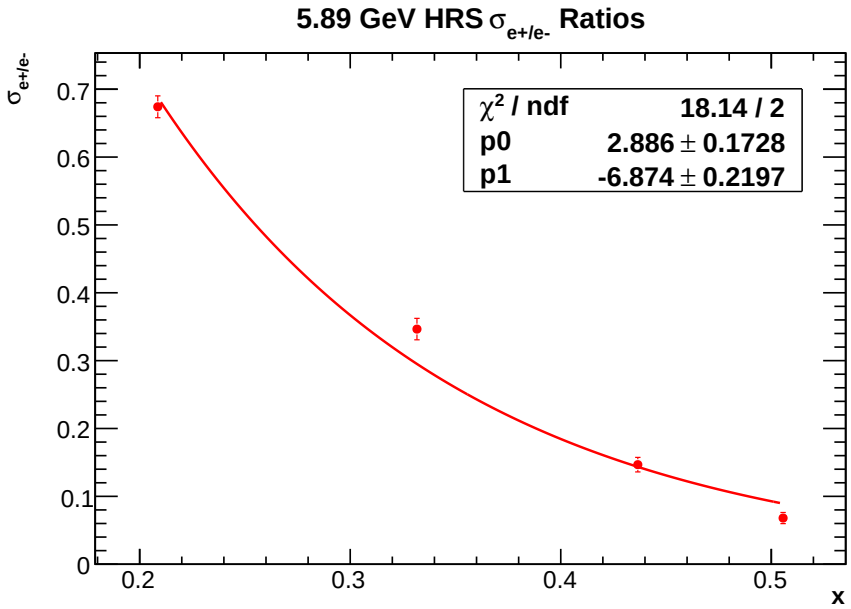
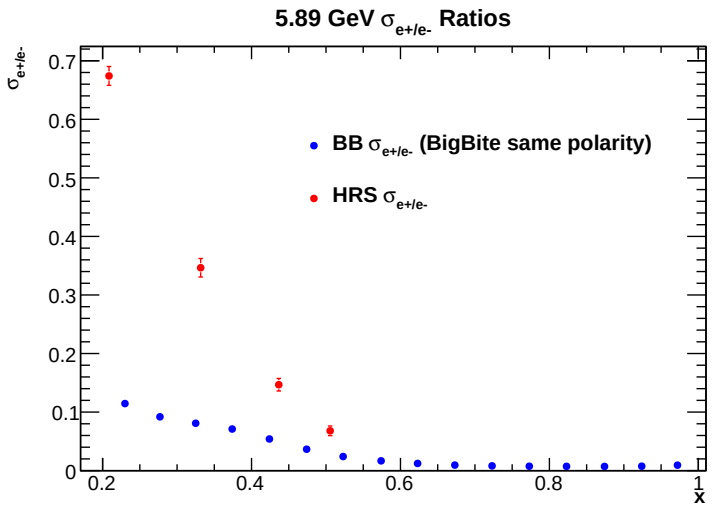
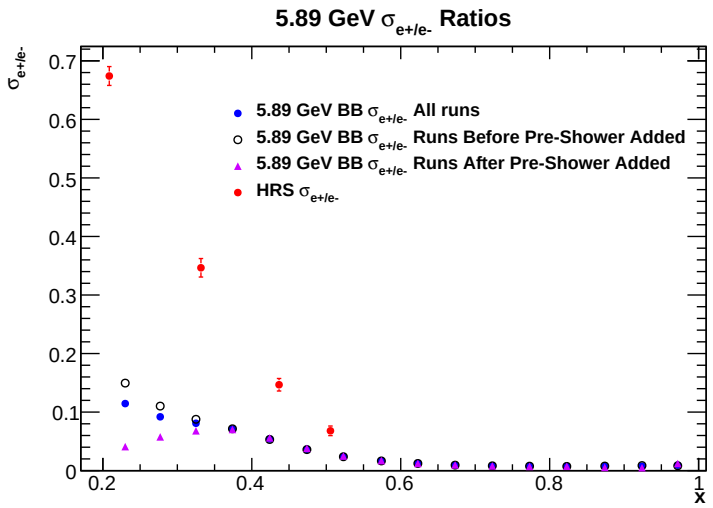
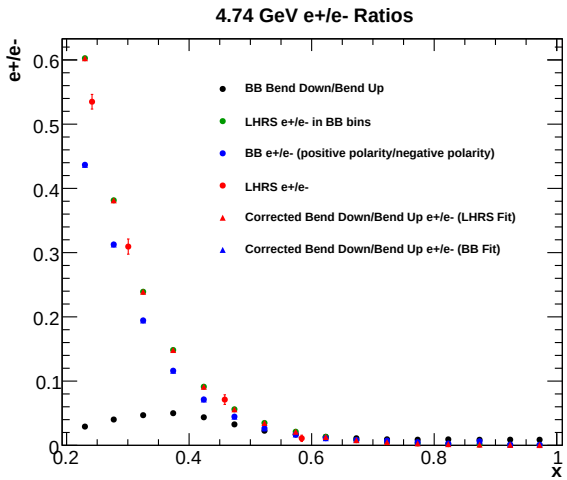


Figure: 5.89 GeV fit to LHRS positron to electron ratio using an exponential fit.

Preliminary 5-Pass Positron to Electron Correction: e+/e- Ratios







Preliminary 5-Pass Positron to Electron Correction: Correction Factors

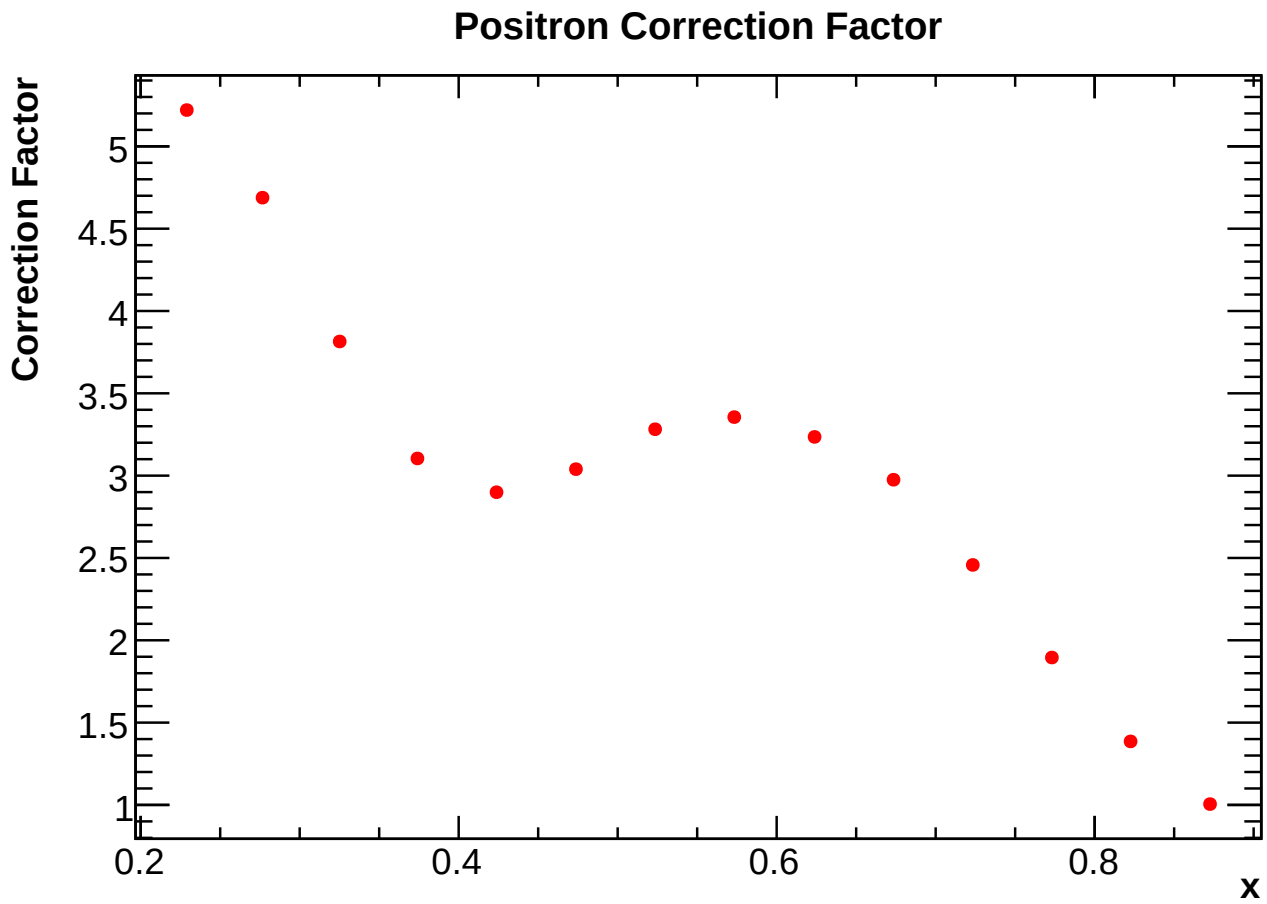


Figure: 5.89 GeV Correction Factors using LHRS fit.

Preliminary 5-Pass Positron to Electron Correction: Applied Correction Factors

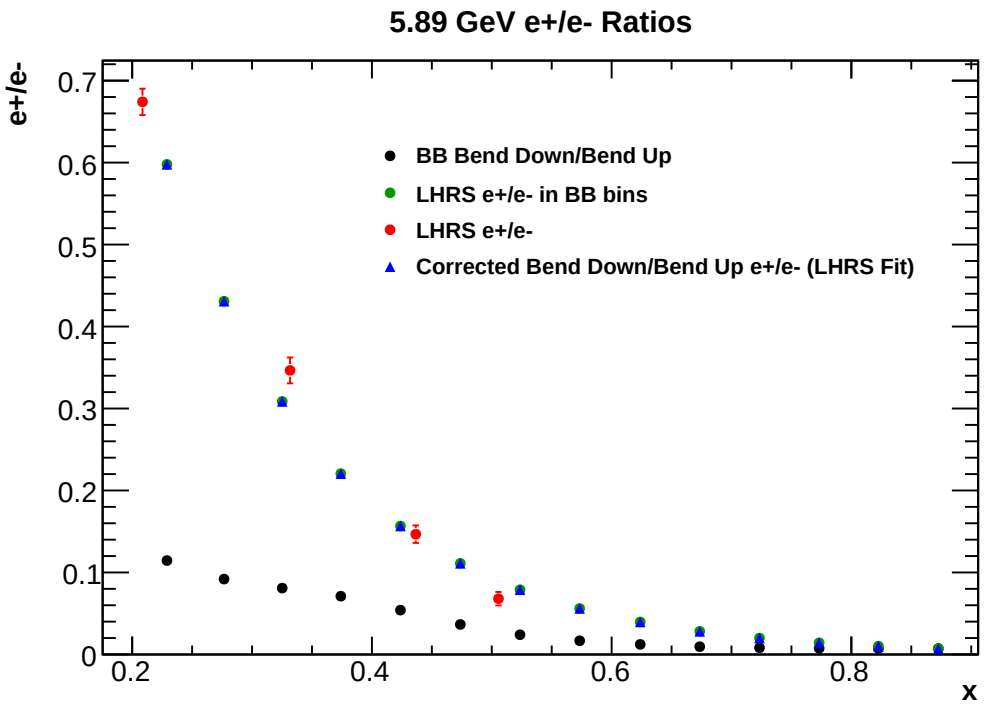


Figure: 5.89 GeV Correction factors applied.

Preliminary 4-Pass Raw Electron and Positron Asymmetry

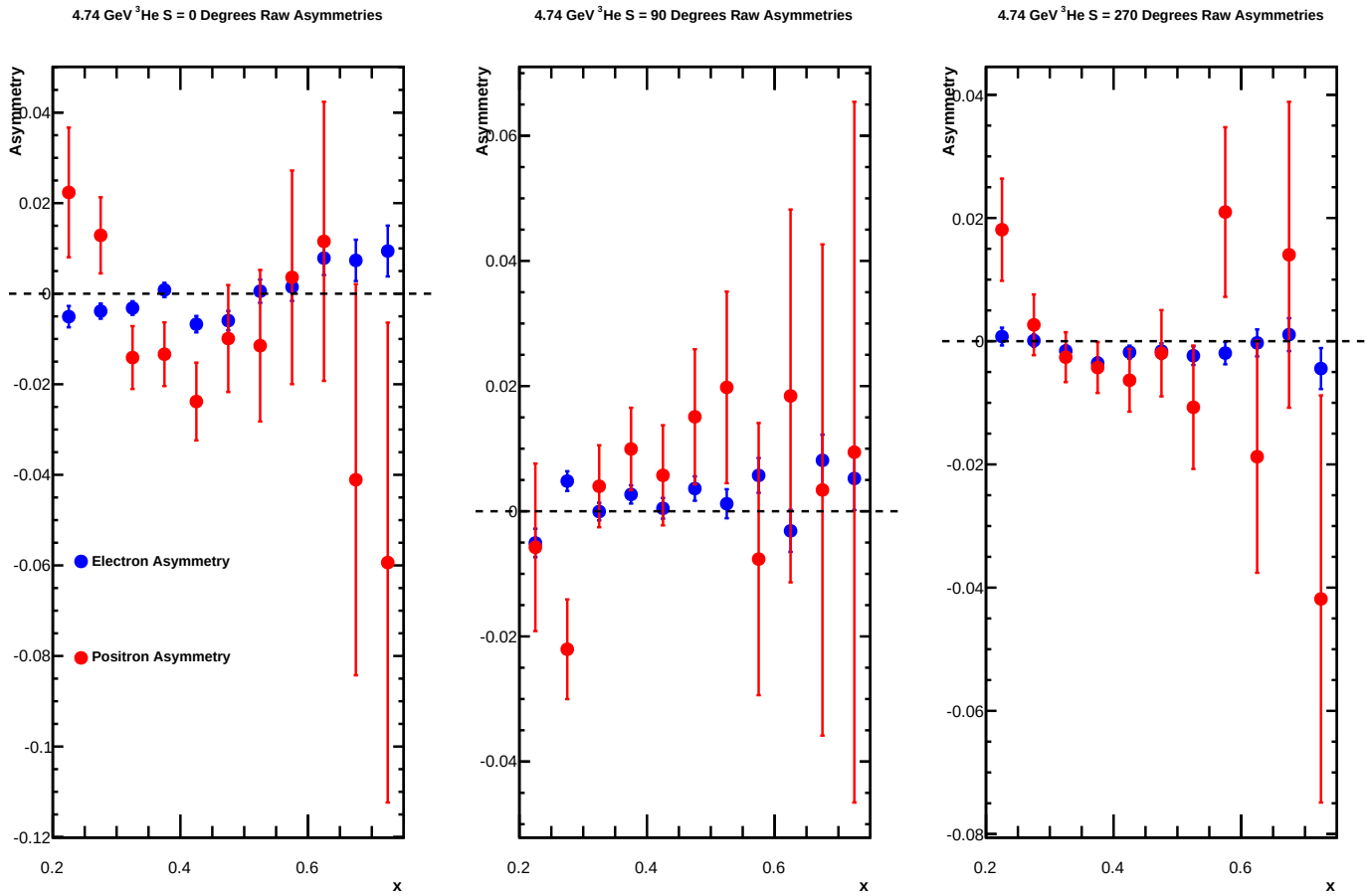


Figure: 4.74 GeV raw electron asymmetries compared to raw positron asymmetries, which are separated into target directions

Preliminary 5-Pass Raw Electron and Positron Asymmetry

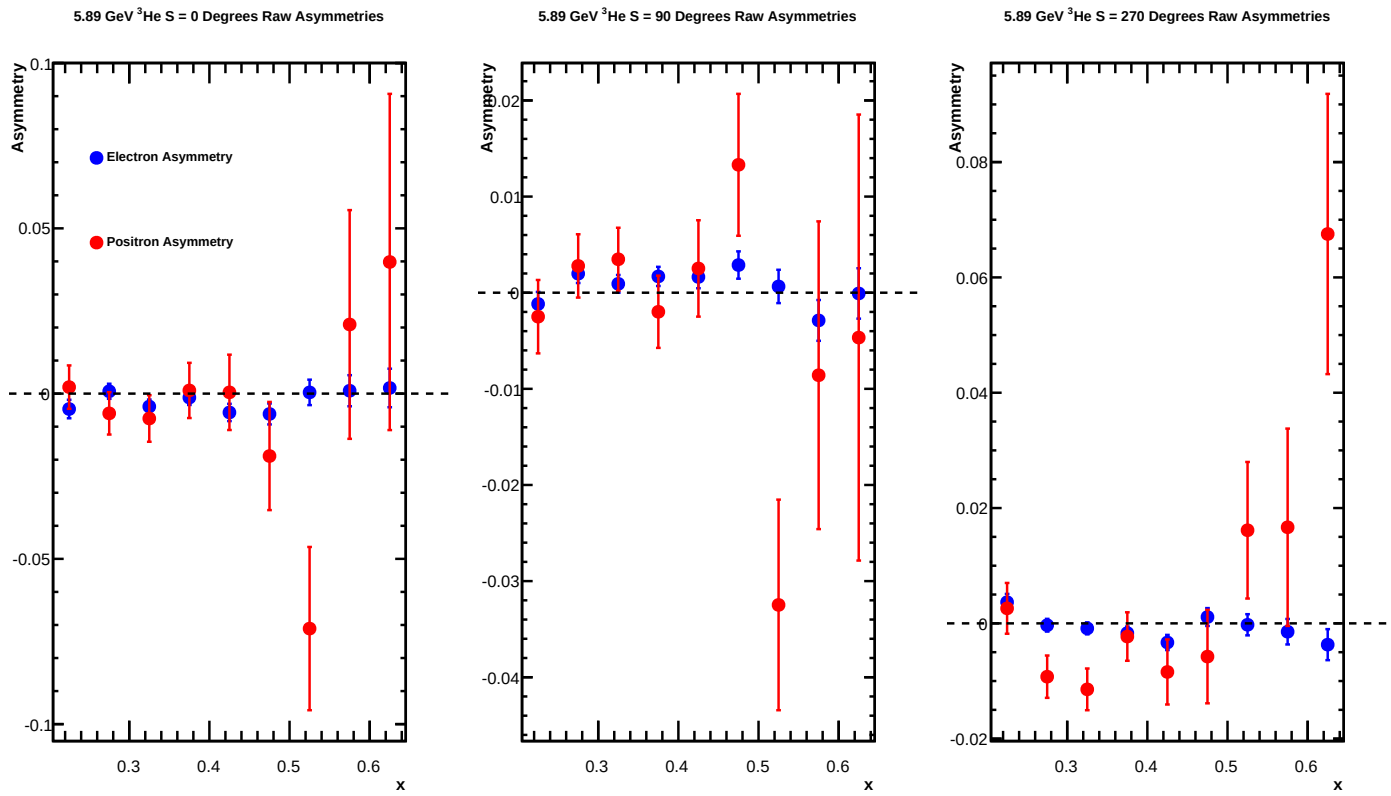
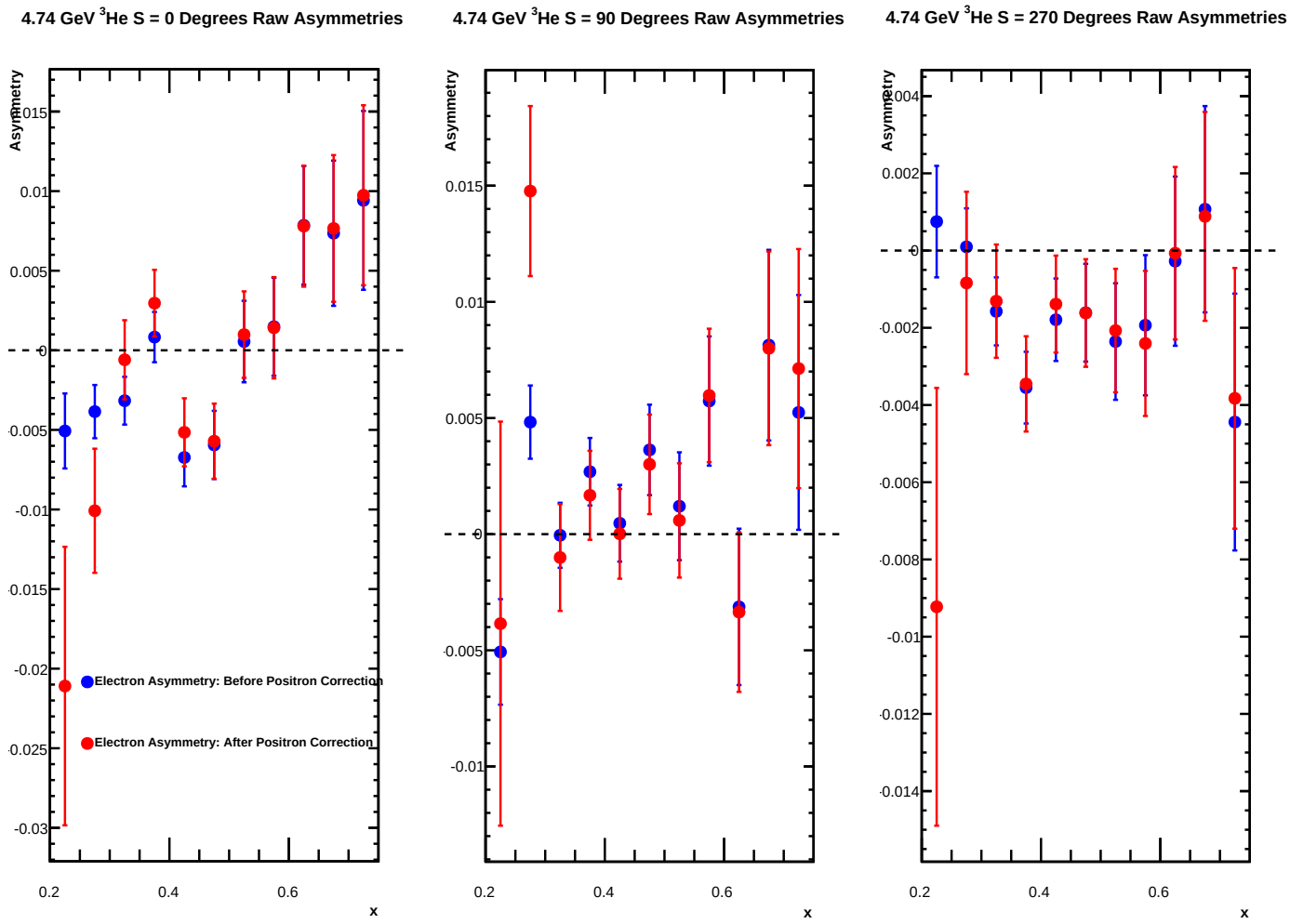


Figure: 5.89 GeV raw electron asymmetries compared to raw positron asymmetries, which are separated into target directions.

Preliminary 4-Pass Raw Positron Asymmetry Correction



Preliminary 5-Pass Raw Positron Asymmetry Correction

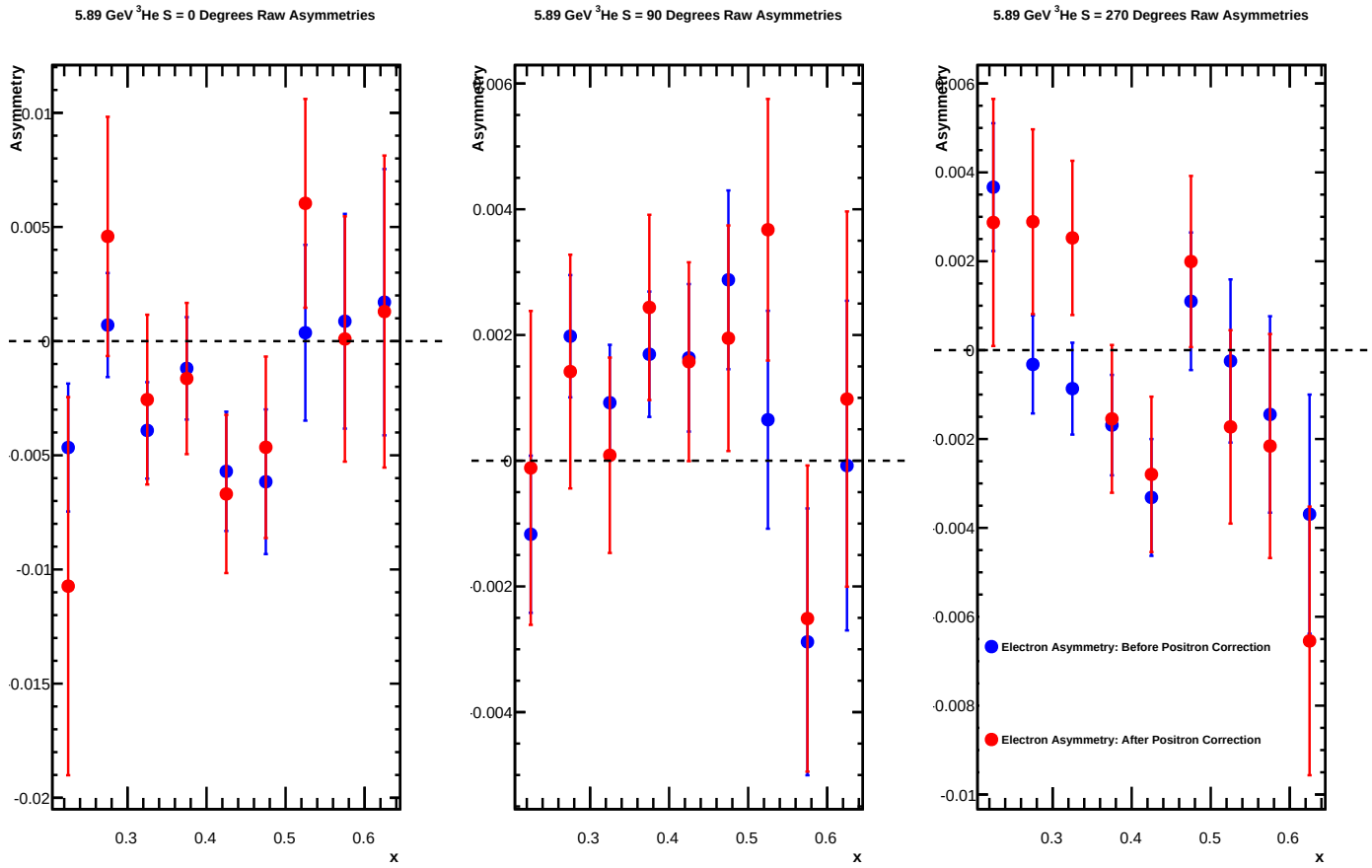


Figure: 5.89 GeV raw positron corrections separated into target directions.

Preliminary 4-Pass Longitudinal and Transverse Positron Asymmetry Correction

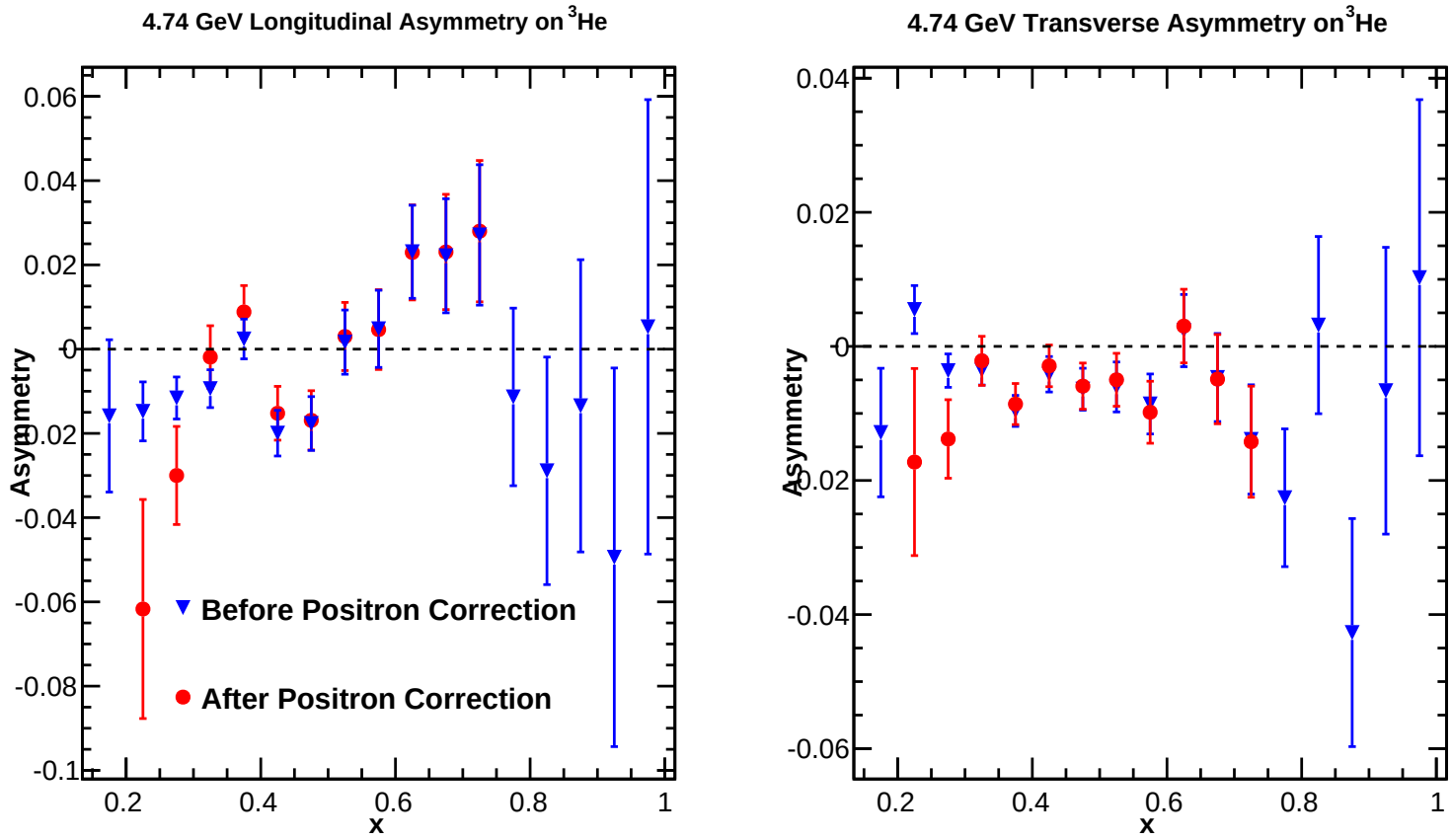
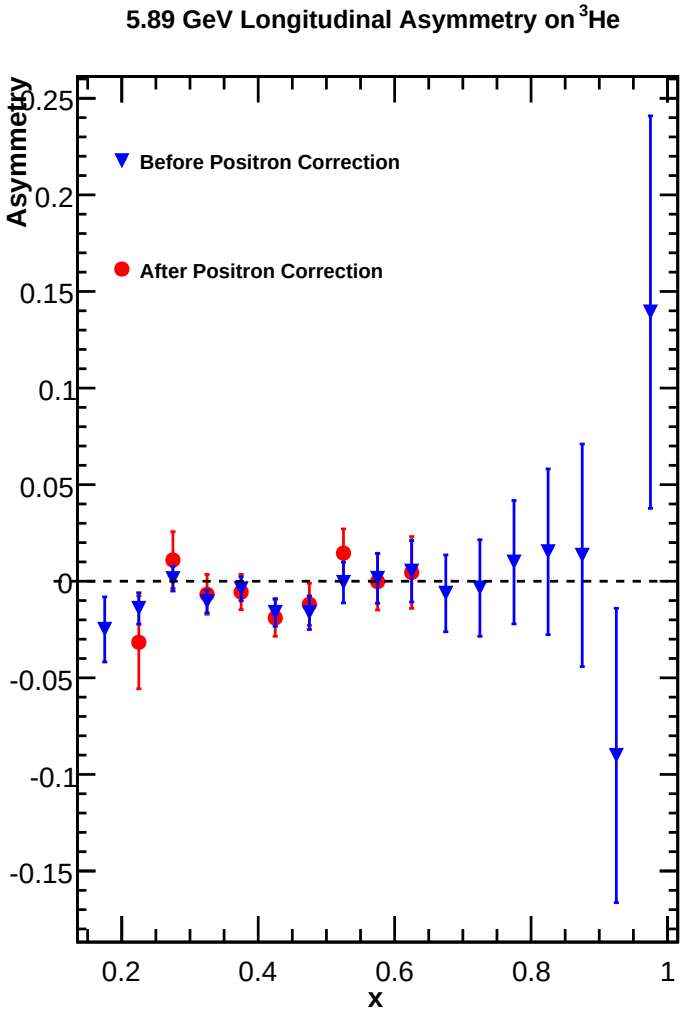
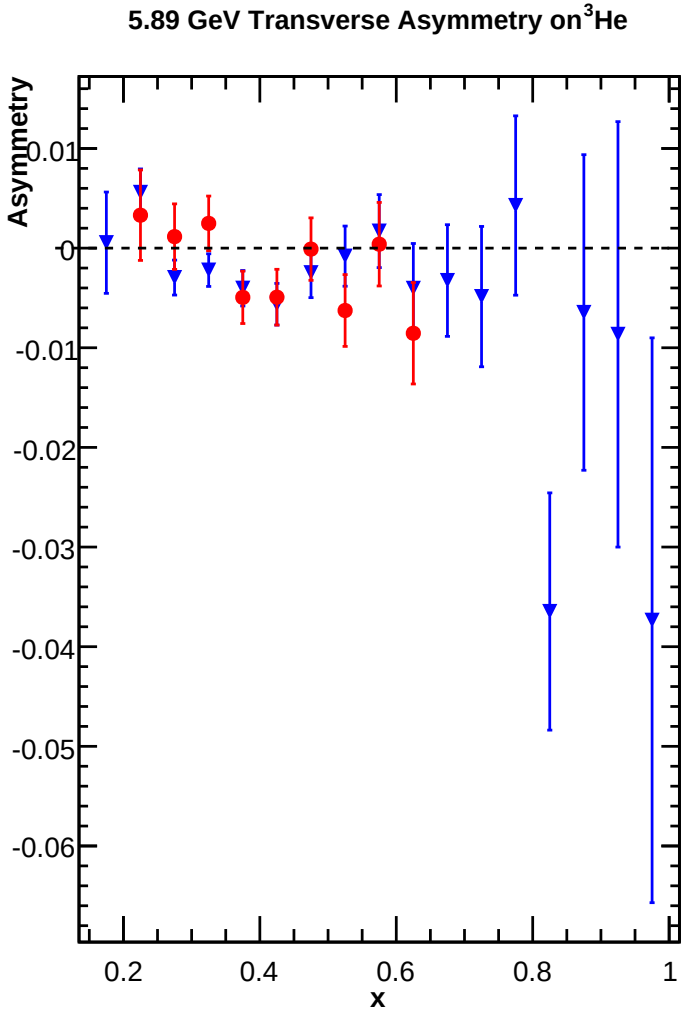


Figure: 4.74 GeV longitudinal and transverse asymmetries.

Preliminary 5-Pass Longitudinal and Transverse Positron Asymmetry Correction





To Do

- Re-check 5-pass bend down cuts
- Determine optimal fit to LHRS data
- Determine error from fitting LHRS data to apply to e+/e- ratios
- Use a statistical subtraction when doing positron correction?
- Look at bend up electron and bend down electron ratios (see if bend up positrons can be predicted)

5.89 GeV Bend Down Cuts (Run 1532)

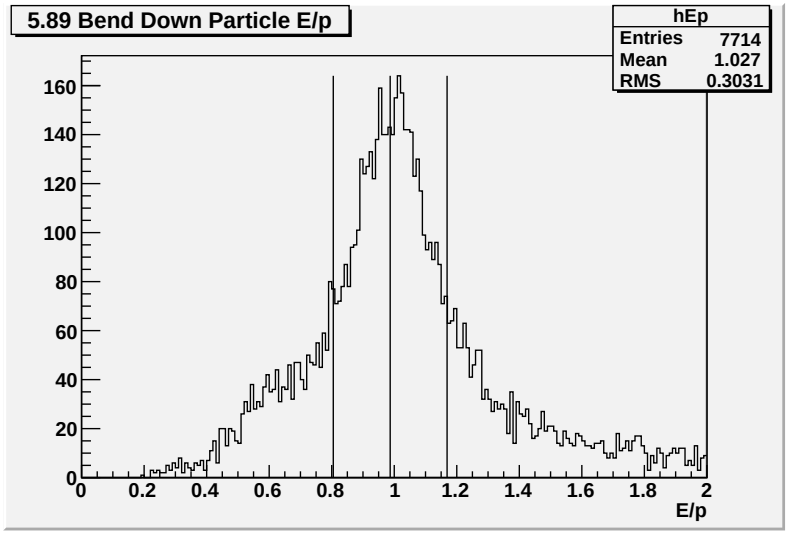


Figure: E/p cut on 5.89 GeV bend down events for run 1532.

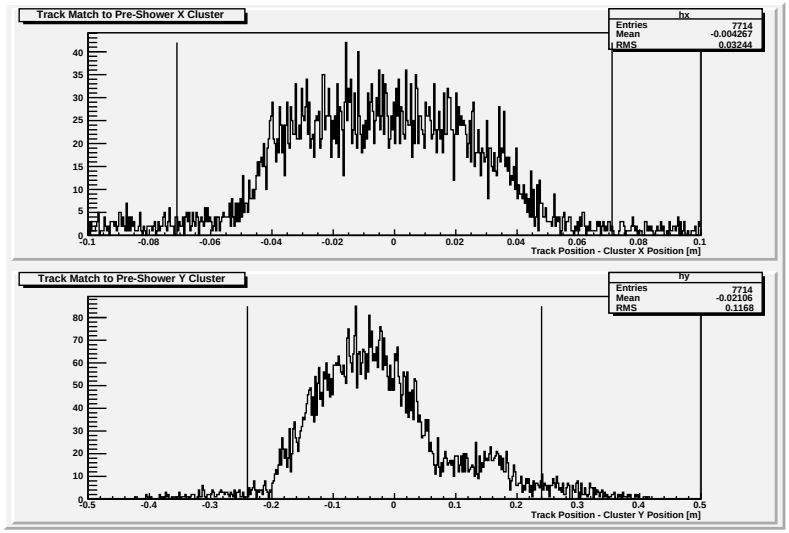


Figure: Pre-shower x (top) and y (bottom) cuts on 5.89 GeV bend down events for run 1532.

4-Pass Bend Down/Bend Up Ratios for Target Orientations

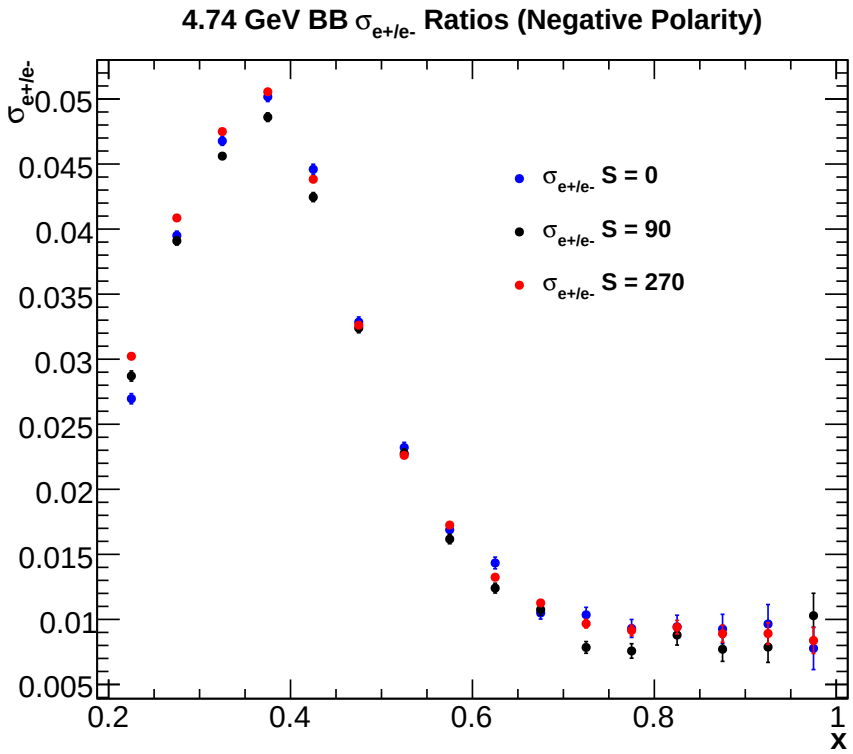


Figure: 4.74 GeV bend down over bend up ratios for each target setting.

5-Pass Bend Down/Bend Up Ratios for Target Orientations

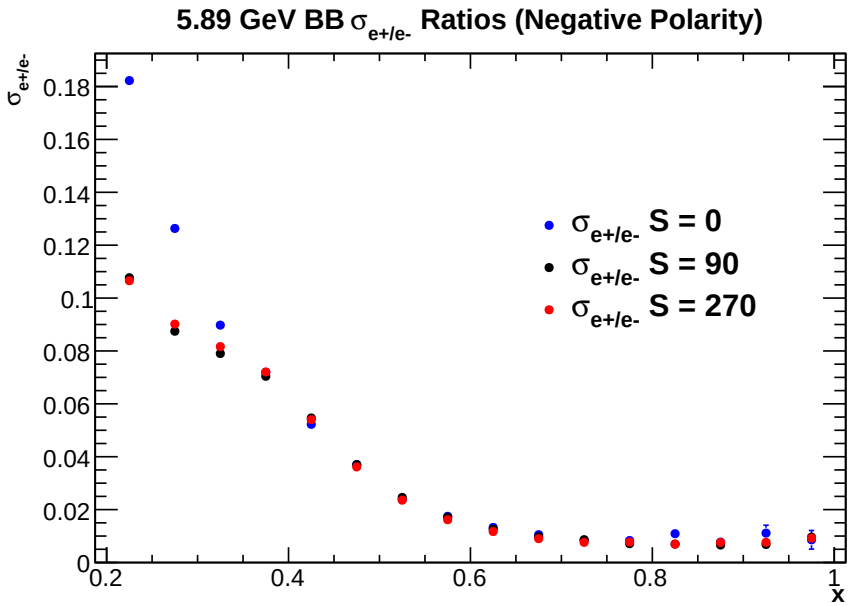


Figure: 5.89 GeV bend down over bend up ratios for each target setting.