BigBite

Pair-Production Correction

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Outline

Positron Count Correction

$$N_m^+ = N_e^+ + \frac{N_p^+}{R}$$

$$N_m^- = N_e^- + \frac{N_p^-}{R}$$

$$\delta N_e^{-/+} = \sqrt{\left(\delta N_m^{-/+}\right)^2 + \left(\frac{\delta N_p^{-/+}}{R}\right)^2 + \left(\frac{N_p^{-/+}}{R^2}\delta R\right)^2}$$

where e = electron, p = positron and $-(+)$ is negative (positive) helicity

$$A_e = \frac{N_e^- - N_e^+}{N_e^- + N_e^+}$$

$$\delta A_e = \frac{2N_e^- N_e^+}{\left(N_e^- + N_e^+\right)^2}\sqrt{\left(\frac{\delta N_e^-}{N_e^-}\right)^2 + \left(\frac{\delta N_e^+}{N_e^+}\right)^2}$$

where:

- N_m = measured counts, N_p = bend-down positrons
- A_e = clean electron asymmetry
- R = $\left(e^+\right)_{\text{bend-down}}$ / $\left(e^+\right)_{\text{bend-up}}$ ratio (only stat.)

Positron Asymmetry Correction

$$N_n^{e-} = N_n^{rawe-} - N_n^{e+}$$

$$A_n^{e-} = \left(\frac{N_n^{rawe-}}{N_n^{e-}}\right) A_n^{rawe-} - \left(\frac{N_n^{e+}}{N_n^{e-}}\right) A_n^{e+}$$

$$R = \left(\frac{N_p^{e+}}{N_n^{rawe-}}\right) = \kappa \left(\frac{N_n^{e+}}{N_n^{rawe-}}\right)$$

$$\frac{N_n^{e-}}{N_n^{rawe-}} = 1 - R$$

$$A_n^{e-} = \frac{A_n^{rawe-} - R A_n^{e+}}{1 - R}$$

$$\delta A_n^{e-} = \sqrt{\left(\frac{\delta A_n^{rawe-}}{1-R}\right)^2 + \left(\frac{R \delta A_n^{e+}}{1-R}\right)^2}$$, assume $\delta R = 0$

Assume $\delta R = 0$

Where p, n mean BigBite is in positive or negative polarity. $rawe-$ is measured electron with electron cuts applied.

We assume $\frac{N_p^{e+}}{N_n^{rawe-}}$ is closer to reality based on LHRS $\frac{\sigma_{e+}}{\sigma_{e-}}$ measurements.

4.74 GeV Asymmetry Comparison

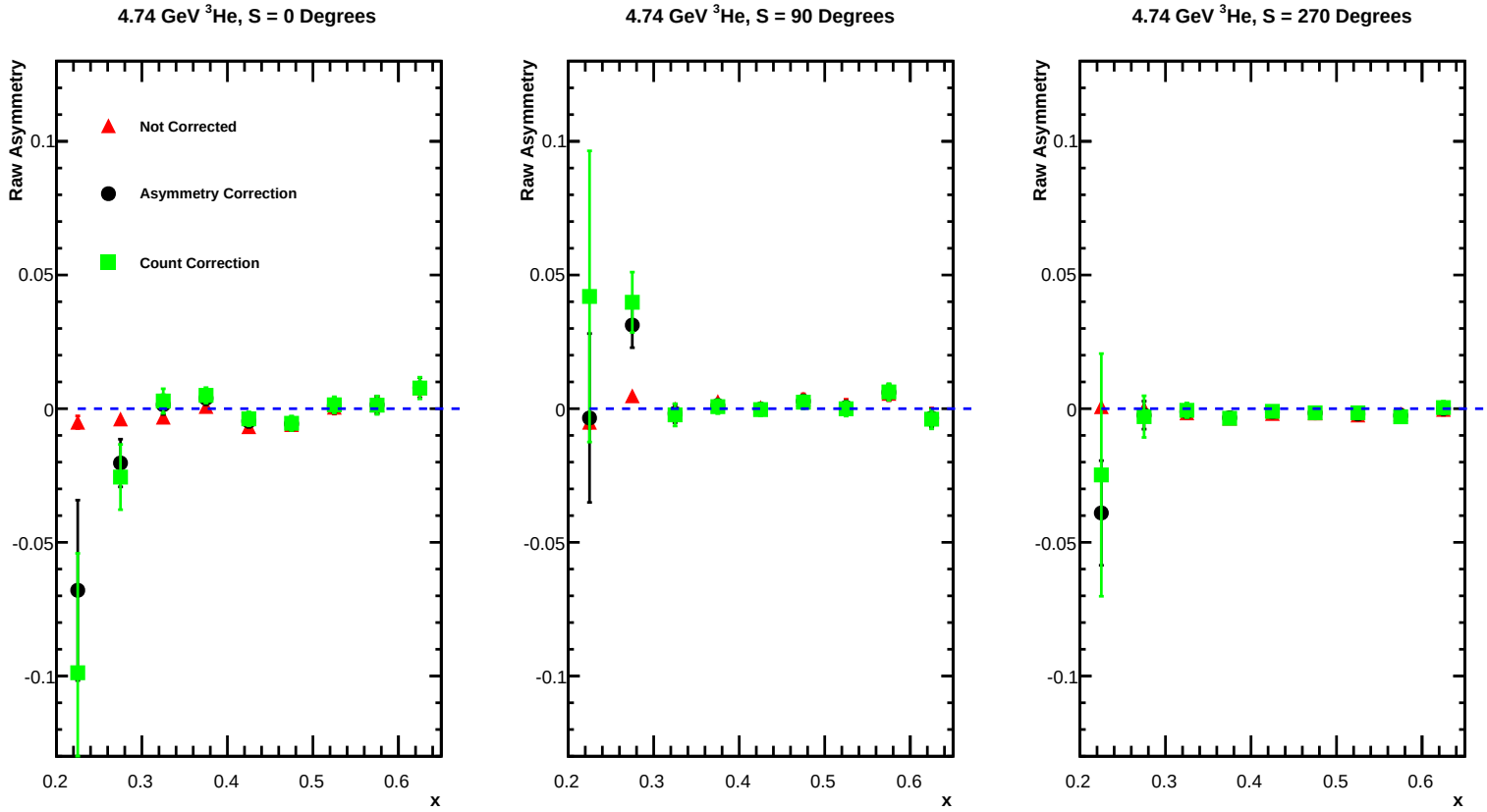
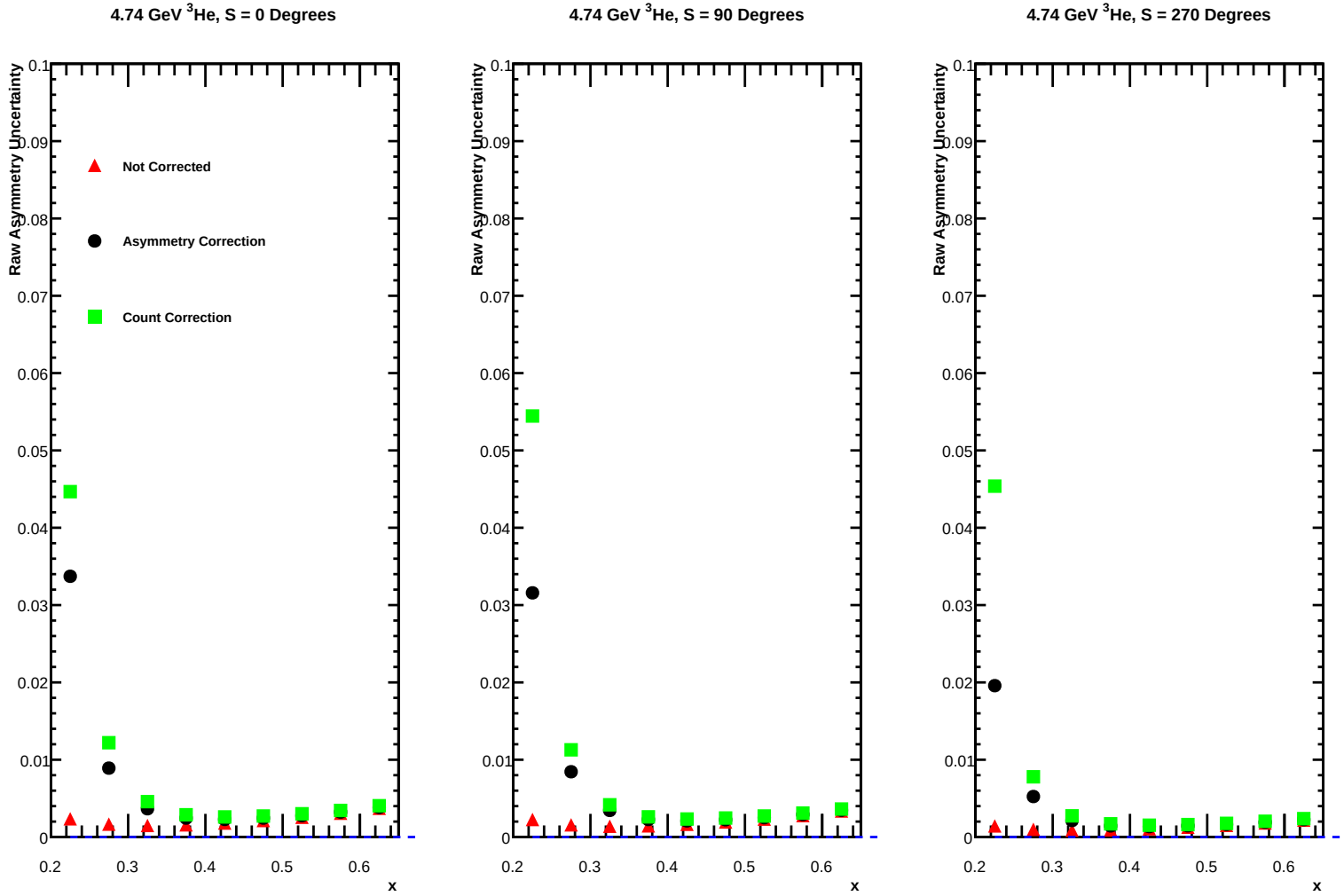


Figure: Plot shows the raw electron un-corrected asymmetry in red, the pair-produced corrected asymmetry via the counting method in green and the pair-produced corrected asymmetry via the asymmetry method in black.

4.7 GeV Asymmetry Comparison Uncertainty



TO Do

- Work on Čerenkov paper
- Apply pair production corrections to 5-pass data

4.7 GeV Ratios $\frac{N_p^{e+}}{N_n^{rawe-}}$

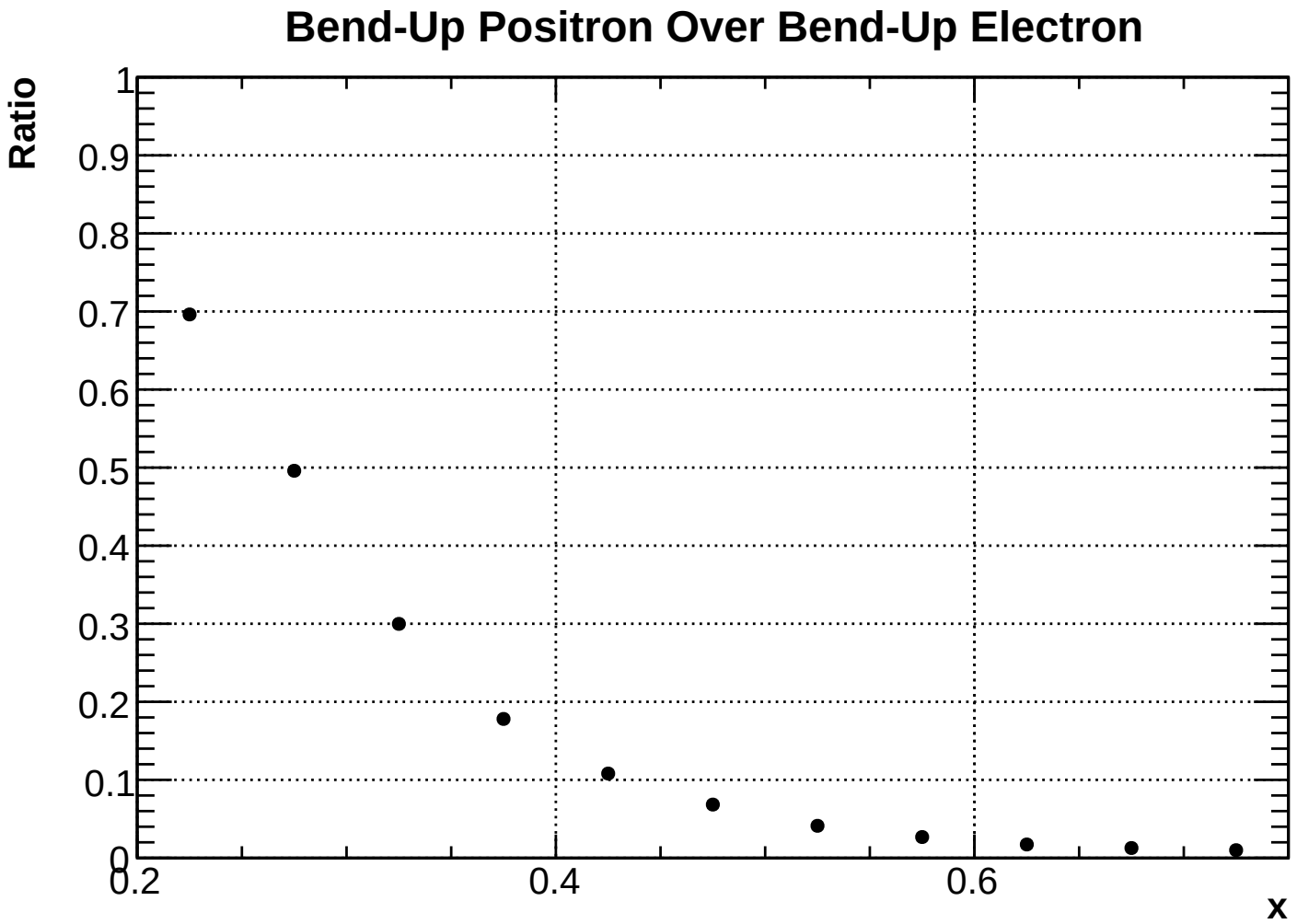


Figure: Plot shows bend-up positrons to bend-up electrons

4.7 GeV Ratios $\frac{N_n^{e+}}{N_n^{rawe-}}$

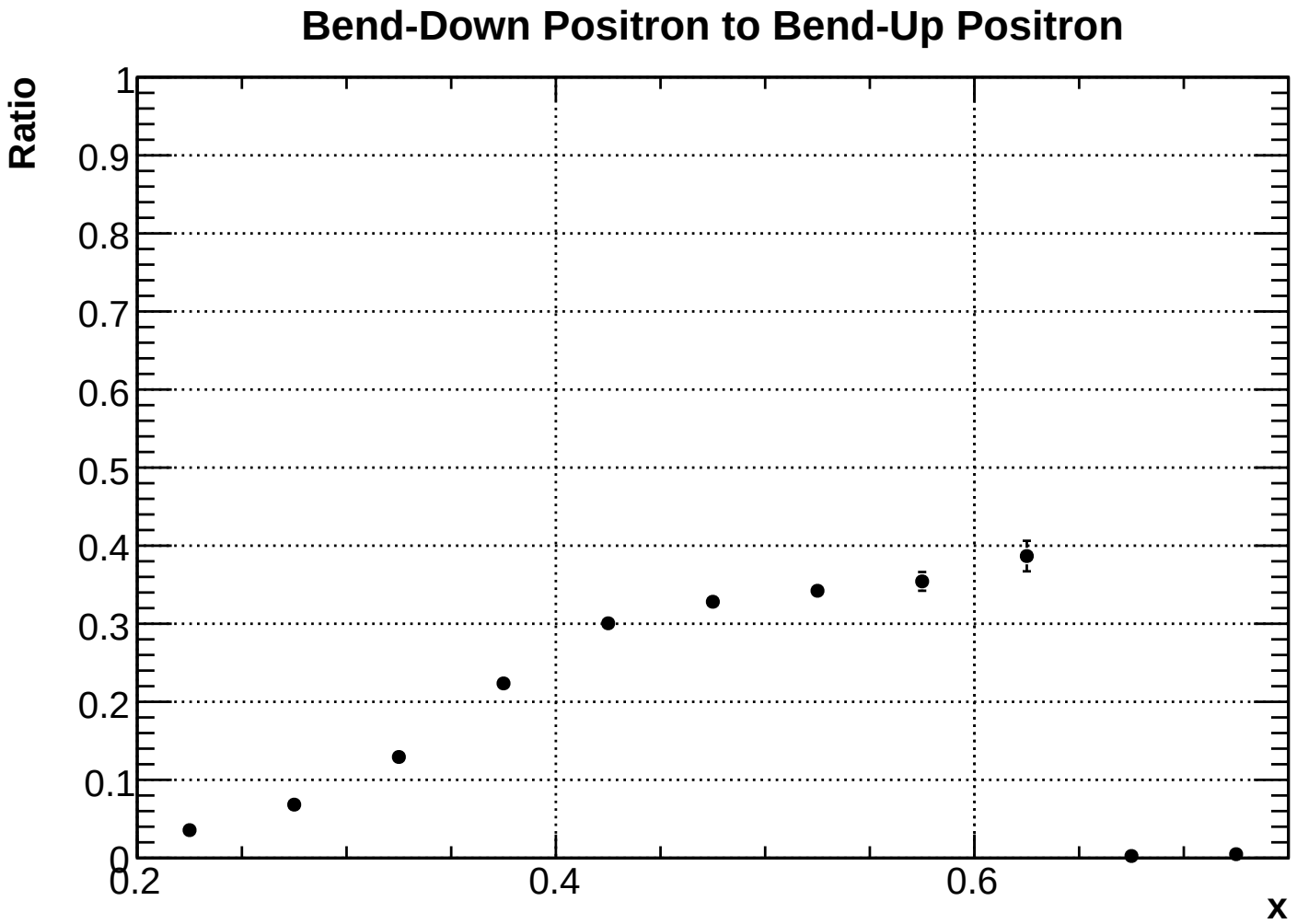
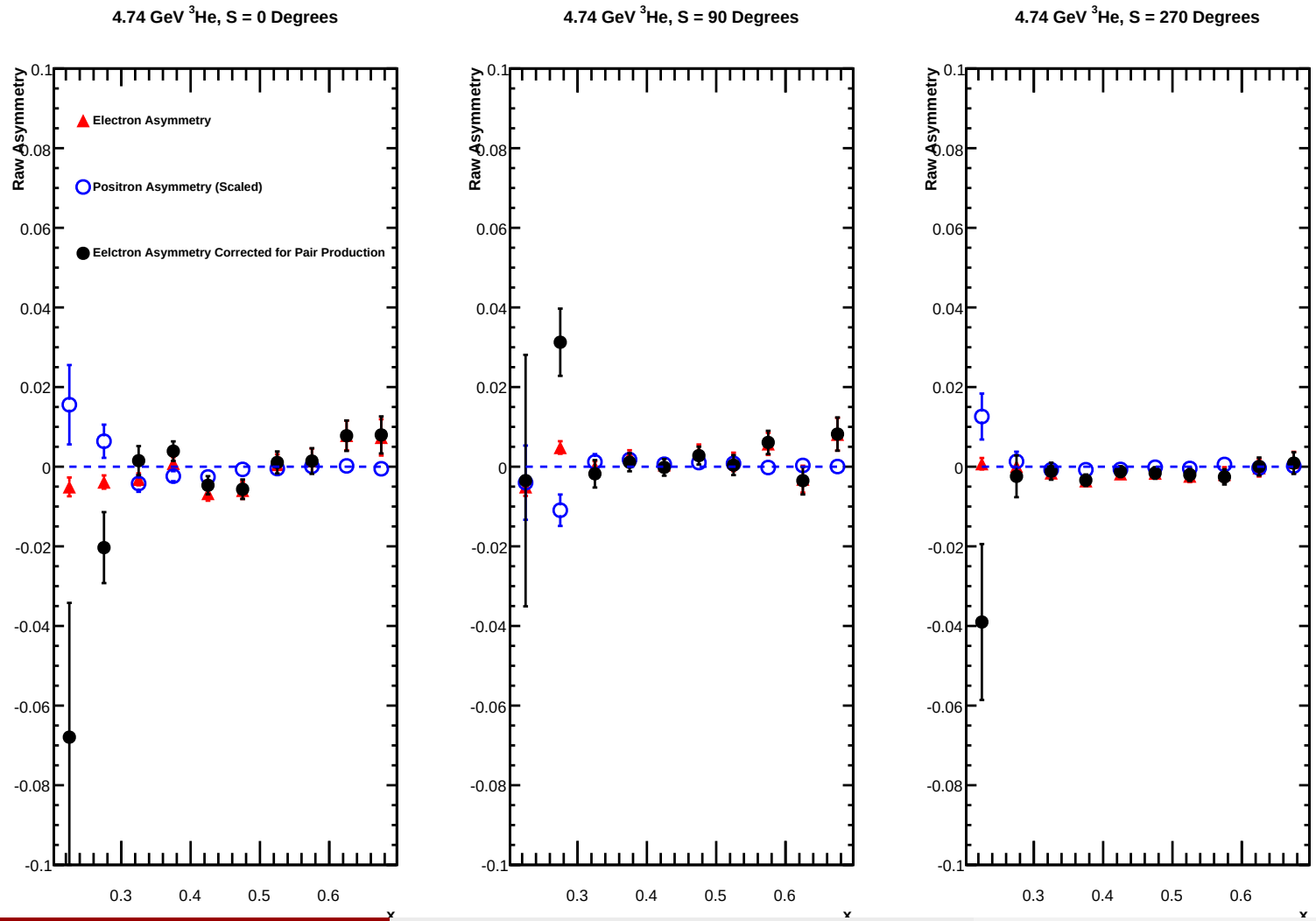


Figure: Plot shows bend-down positrons to bend-up electrons

4.74 GeV Asymmetry Comparison: Scaled Positron Asymmetry



4.74 GeV Asymmetry Comparison: Scaled Positron Asymmetry (Zoomed)