Cross Section Systematic Errors and Radiative Corrections to Asymmetries

Analysis for d_2^n

D. Flay

10/11/12

Outline

Background Subtraction Errors (1)

Description

- We measure the background signals for:
  - Positrons from ^{3}He (σ_{e^+})
  - Nitrogen ($\sigma_N^{e^-}$, $\sigma_N^{e^+}$)

  These data are subtracted from the raw signal.
- When we do not have data, we use a fit:

$$f(x) = \frac{1}{x^2} e^{(p_0 + p_1 x)}$$

- How to estimate the error from using the fit? Utilize the errors on the parameters obtained from ROOT

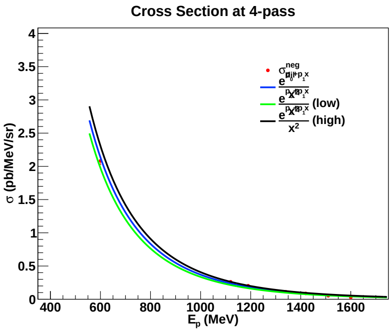
Background Subtraction Errors (2)

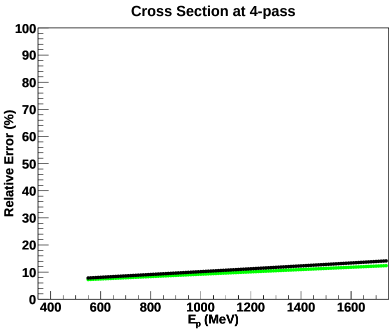
Procedure

- Plot the fit for each spectrum using $p_i = p_i^0 \pm \delta p_i$
  - p_i^0 is the central value of the i^{th} parameter
- Re-calculate the experimental cross section for a given set of parameters for each spectrum and compare to the result obtained from the central parameter values

Background Subtraction Errors (3)

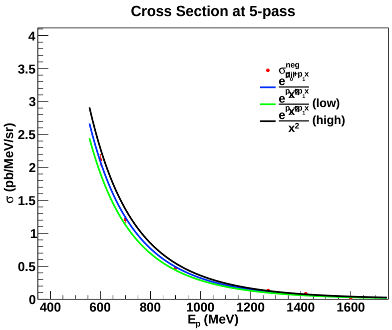
Nitrogen Dilution (Negative Polarity, 4-pass)

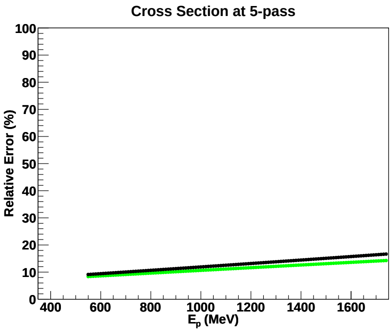




Background Subtraction Errors (4)

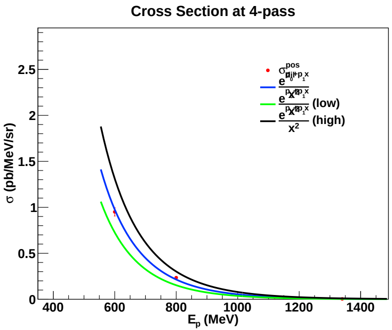
Nitrogen Dilution (Negative Polarity, 5-pass)

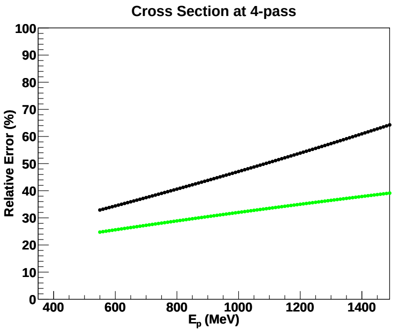




Background Subtraction Errors (5)

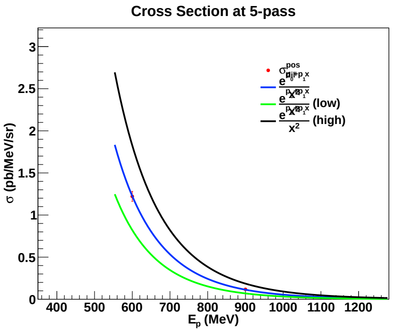
Nitrogen Dilution (Positive Polarity, 4-pass)

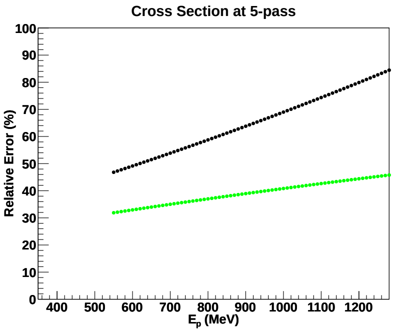




Background Subtraction Errors (6)

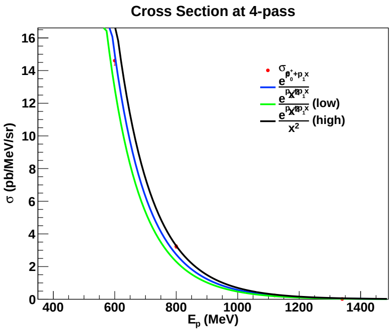
Nitrogen Dilution (Positive Polarity, 5-pass)

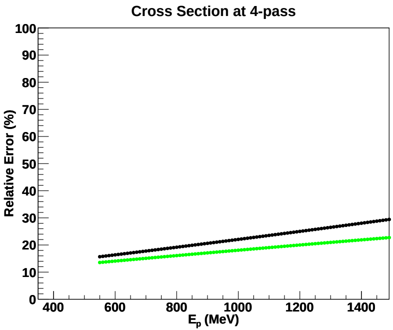




Background Subtraction Errors (7)

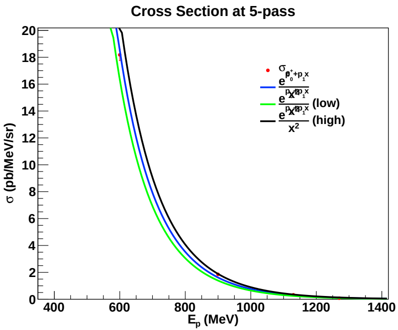
Positrons (4-pass)

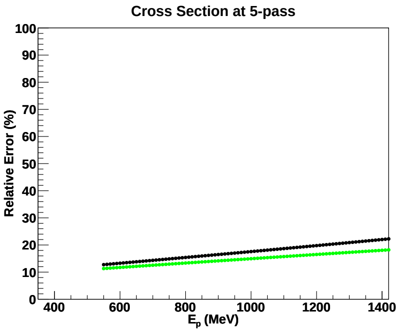




Background Subtraction Errors (8)

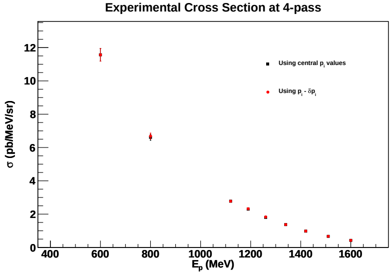
Positrons (5-pass)

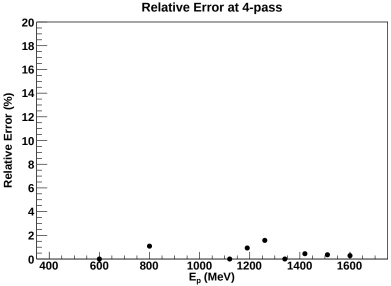




Background Subtraction Errors (9)

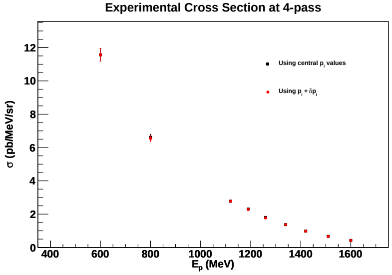
Experimental Cross Sections (Low band, 4-pass)

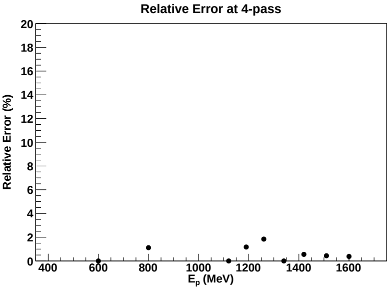




Background Subtraction Errors (10)

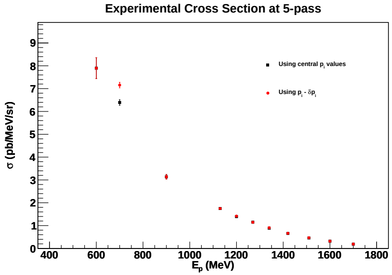
Experimental Cross Sections (High band, 4-pass)

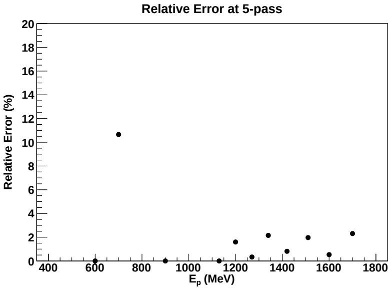




Background Subtraction Errors (11)

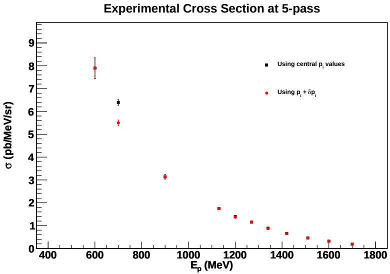
Experimental Cross Sections (Low band, 5-pass)

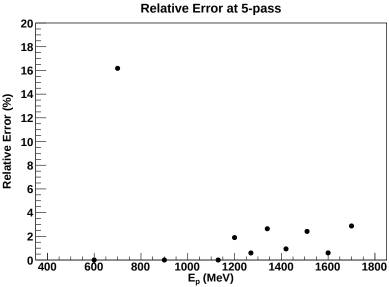




Background Subtraction Errors (12)

Experimental Cross Sections (High band, 5-pass)





Polarized σ Differences (1)

Description

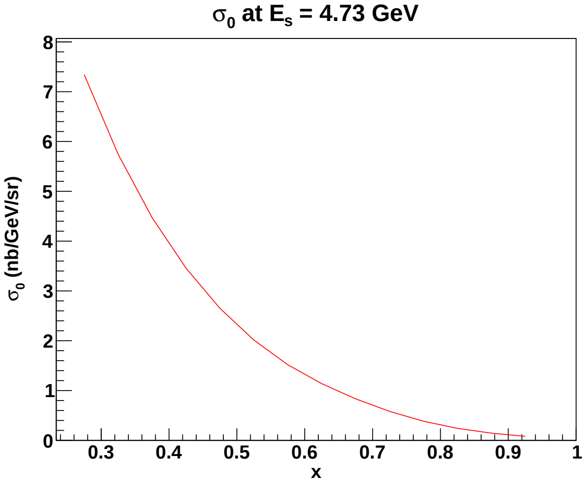
- We calculate the polarized cross section difference by:

$$\begin{aligned} \Delta\sigma &= 2\sigma_0 A \\ \sigma_0 &= \text{Unpolarized } \sigma \text{ from F1F209 (radiated)} \\ A &= \text{Asymmetry from data} \end{aligned}$$

- In the plots that follow, A and $\Delta\sigma$ have been corrected for positrons but no subtraction of polarized elastic tail

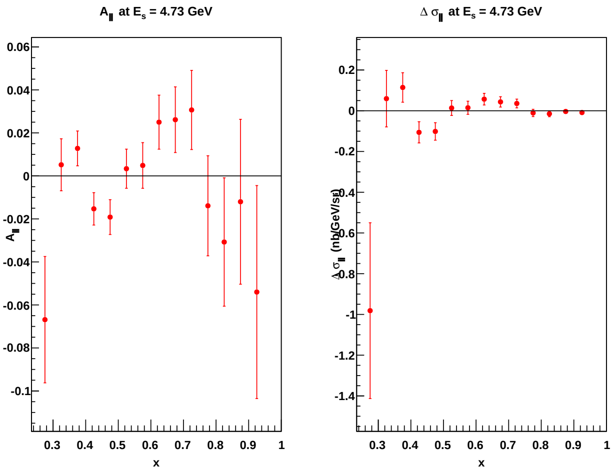
Polarized σ Differences (2)

F1F209 Unpolarized Cross Section at 4-pass



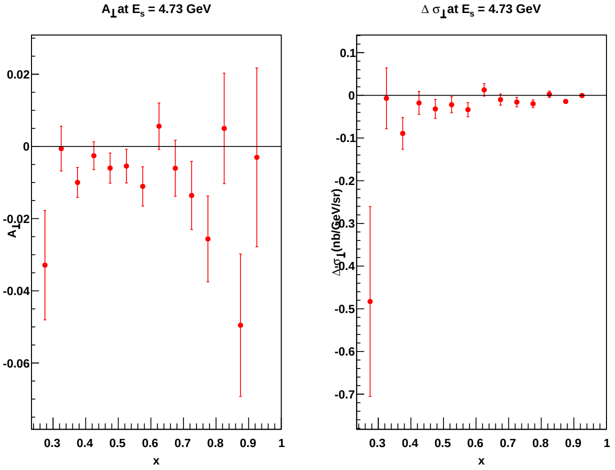
Polarized σ Differences (3)

4-pass, Longitudinal



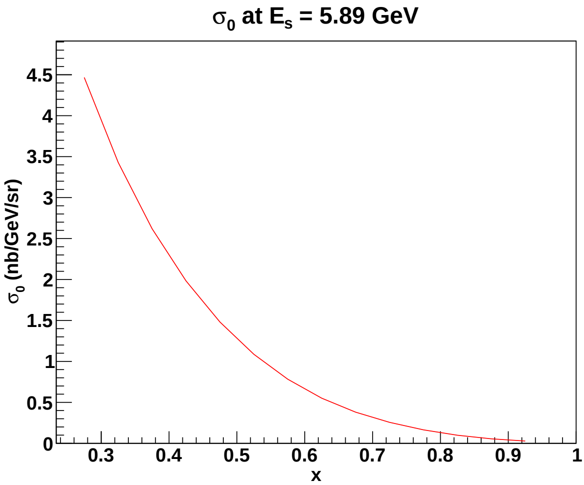
Polarized σ Differences (4)

4-pass, Transverse



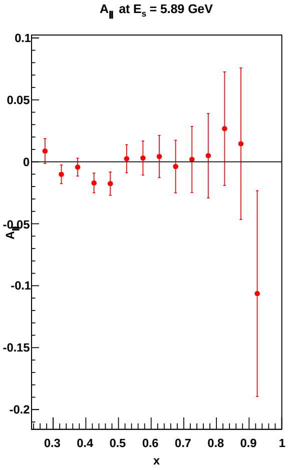
Polarized σ Differences (5)

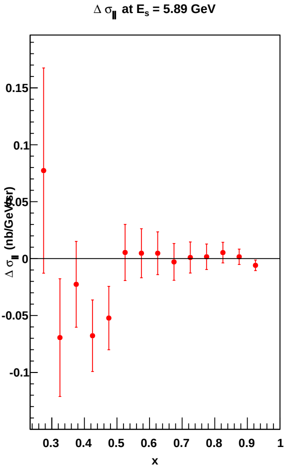
F1F209 Unpolarized Cross Section at 5-pass



Polarized σ Differences (6)

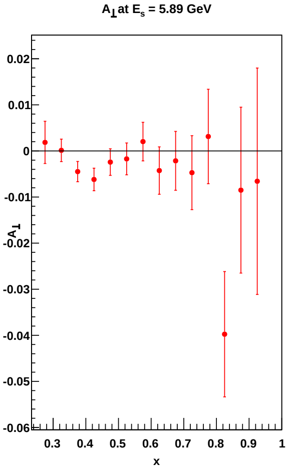
5-pass, Longitudinal

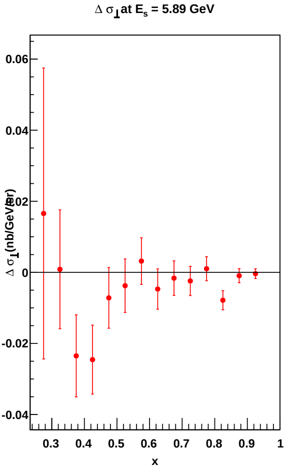




Polarized σ Differences (7)

5-pass, Transverse





Summary

- Cross Sections
  - Background subtraction errors from fits seem reasonably well behaved at $\lesssim$ 2–4%
    - E_s = 5.89 GeV, E_p = 0.70 GeV data point has a large fluctuation $\Rightarrow$ high sensitivity to positron fit
- Radiative Corrections of Asymmetries
  - Used F1F209 to determine $\Delta\sigma_{\parallel,\perp}$ from asymmetry data

What's Next?

- Cross Sections
  - What to do about the E_s = 5.89 GeV, E_p = 0.70 GeV data point?
- Radiative Corrections of Asymmetries
  - Use F1F209 and DSSV to construct $g_{1,2}$, leading to $\Delta\sigma_{\parallel,\perp}$ to fill in phase space