LHRS Analysis for d_2^n

The Elastic Radiative Tail and Correcting for Background Processes

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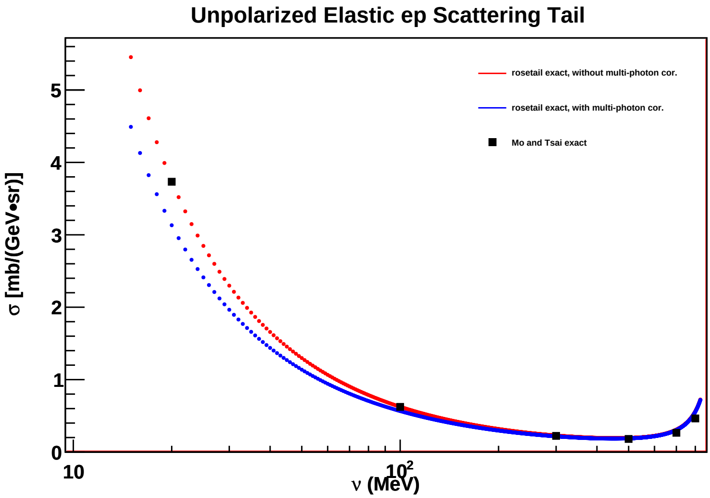
Outline

The Elastic Radiative Tail (1)

Discussion and Contributions

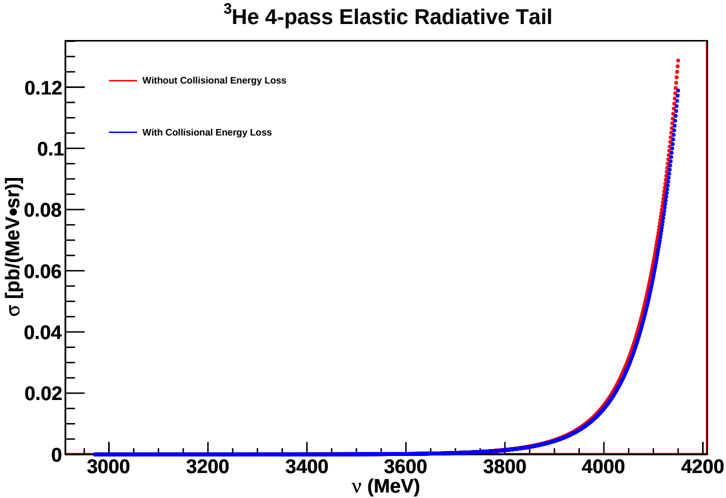
- The first step in the radiative corrections procedure is to subract off the elastic tail from both ^{3}He and N
- The elastic tail (calculated in the fortran code rosetail) contains the following corrections:
  1. Internal: photon radiation before and/or after the interaction at the vertex
  2. External: straggling in the target (ionization and bremsstrahlung) and multiple-photon radiation

The Elastic Radiative Tail (2)
Testing the Code



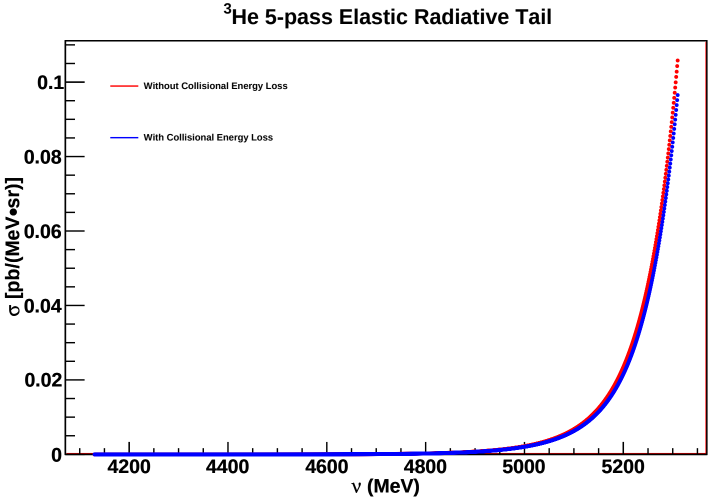
The Elastic Radiative Tail (3)

^{3}He Elastic Tail



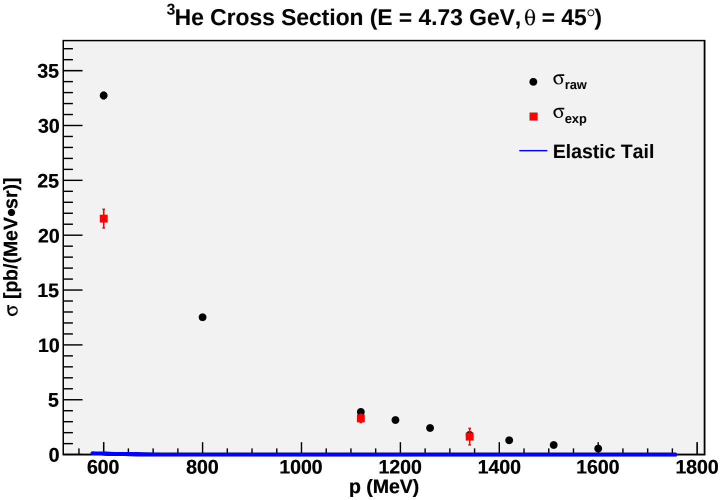
The Elastic Radiative Tail (4)

^{3}He Elastic Tail



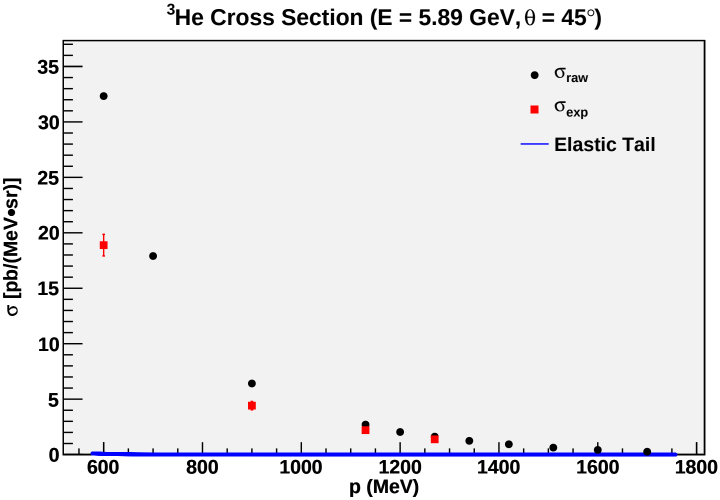
The Elastic Radiative Tail (5)

Comparison to Raw and Experimental Cross Section



The Elastic Radiative Tail (6)

Comparison to Raw and Experimental Cross Section



Correcting for Background Processes (1)
Current Method

- Currently, we correct for e^- events coming from N_2 and those corresponding to $\gamma \to e^+e^-$ by subtracting off their cross sections:

$$\sigma_{\text{exp}} = \sigma_{\text{raw}} - \sigma_{\text{dil}} - \sigma_{e^+}$$

- σ_{raw} and σ_{dil} are the cross sections obtained on the production cell and the reference cell in negative polarity, respectively
- σ_{e^+} is obtained from the production cell in positive polarity mode.
- We also have σ_{dil} is obtained from the reference cell in positive polarity mode.
  - Shouldn't we also subtract this term off too?

Correcting for Background Processes (2)

Thinking in Terms of Yields

- Consider the yield for some process:

$$Y = \frac{N}{(Q/e)LT\varepsilon}$$

- The signal we detect is: $Y_{e^-} = Y^p_{e^-} + Y^b_{e^-}$
    - $p =$ pure signal
    - $b =$ background signal
        - $Y^b_{e^-} = Y^{\mathrm{N}}_{e^-}$
    - To correct for the events scattering from N, one can subtract off $Y^{\mathrm{N}}_{e^-}$
        - This is what we do for the yield from the reference cell (to remove events scattering from nitrogen)
- For the positron data, we have a similar situation:

$$\begin{aligned} Y_{e^+} &= Y^p_{e^+} + Y^b_{e^+} \\ Y^b_{e^+} &= Y^{\mathrm{N}}_{e^+} \end{aligned}$$

Correcting for Background Processes (3)

Thinking in Terms of Yields

- To determine the yield of pair-produced e^{+} events that scatter from ^{3}He:

$$Y_{e^{+}}^{p} = Y_{e^{+}} - Y_{e^{+}}^{\mathrm{N}}$$

- Therefore, the full correction should be:

$$Y_{e^{-}}^{p} = \left(Y_{e^{-}} - Y_{e^{-}}^{\mathrm{N}}\right) - \left(Y_{e^{+}} - Y_{e^{+}}^{\mathrm{N}}\right)$$

Summary

- Cross Section:
  - ^{3}He Elastic tail has been determined for 4- and 5-pass data
    - Very small contribution ($< 1\%$) for all p_0
  - Possible refined method to correct the e^- yield and effectively the cross section

What's Next?

- Acceptance:
  - Determine momentum dependence
- Cross Section:
  - Radiative Corrections:
    - N_2 elastic tail
    - Q.E., dip, DIS and $W = 1500, 1700\ \mathrm{MeV}$ contributions