g4rc update
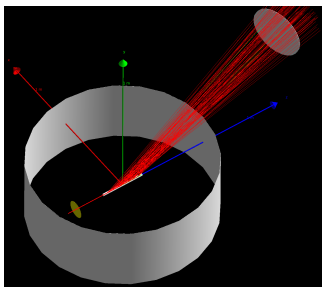
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January 31, 2019

Overview

- Brief review and progress on `g4rc`

- Model cross section results
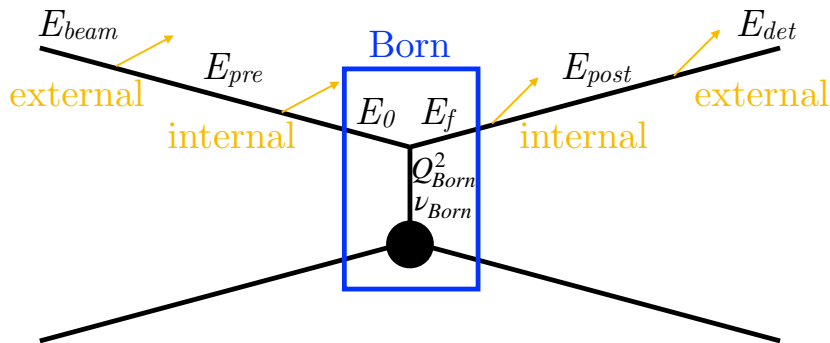
- Bin smearing results

Simulation geometry

- Geometry contains material through Q1 window
- Electrons begin with $E_{beam} = 10.589$ GeV
- Scattering events generated:
    - Uniformly in target (-10 cm < z < 10 cm)
    - Uniformly in $\cos\theta$ and allowed Q^2
- Detected just past Q1 window

Specified target includes cell thickness, gas density from target reports:
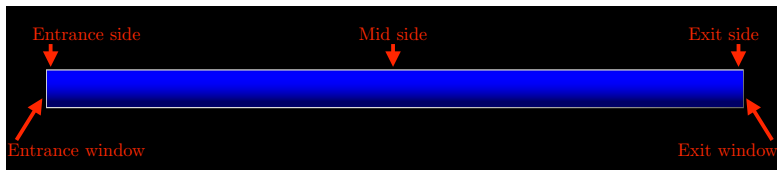
Radiative kinematics

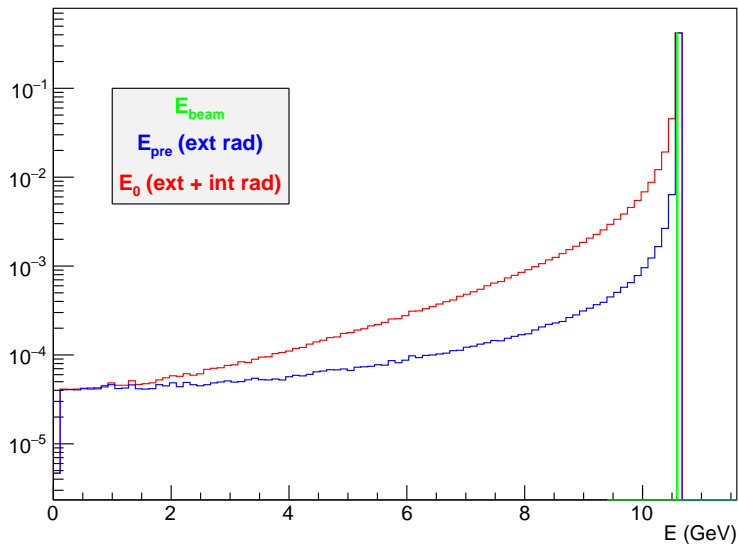Observed kinematics calculated from beam and detected energy:

$$Q^2_{obs} = 2E_b E_d (1 - \cos\theta_{obs}) \qquad \nu_{obs} = E_b - E_d \qquad x_{obs} = \frac{Q^2_{obs}}{2M\nu_{obs}}$$

Born-level kinematics calculated from initial and final energy of Born diagram:

$$Q^2_{Born} = 2E_0 E_f (1 - \cos\theta_{Born}) \qquad \nu_{Born} = E_0 - E_f \qquad x_{Born} = \frac{Q^2_{Born}}{2M\nu_{Born}}$$
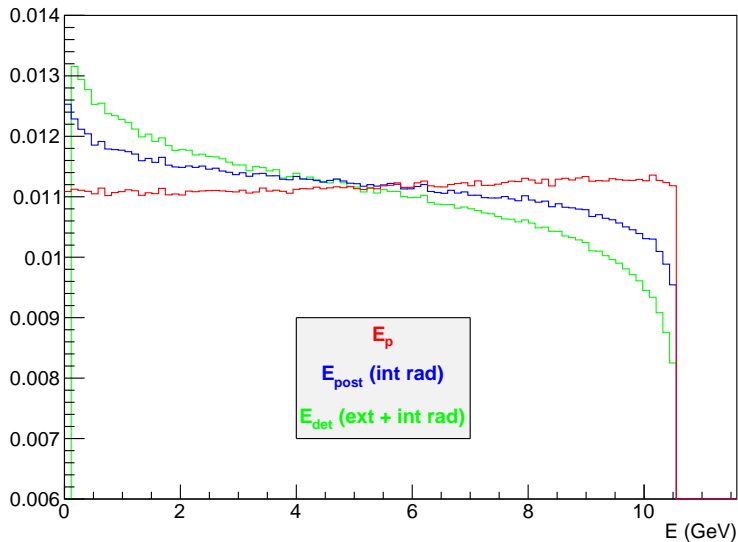
Pre-scattering energy distributions

Energy before scattering (H3)

Post-scattering energy distributions

Energy after scattering (H3)
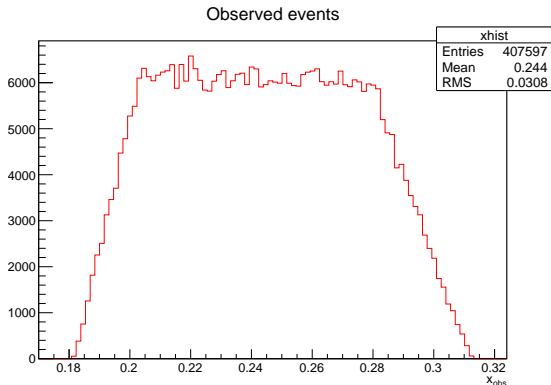
Model cross section

- Call subroutine `sigmodel_calc_simple.f` from `g4rc` to calculate cross sections from Bodek/INEFT model

- Calculate two cross sections:

$$\sigma_{Born} = \sigma_{model}(E_0, E_f, \theta_{Born})$$
$$\sigma_{obs} = \sigma_{model}(E_{beam}, E_{det}, \theta_{obs})$$

- Every detected event has a σ_{Born} and σ_{det} value associated with it (output to ROOT file)
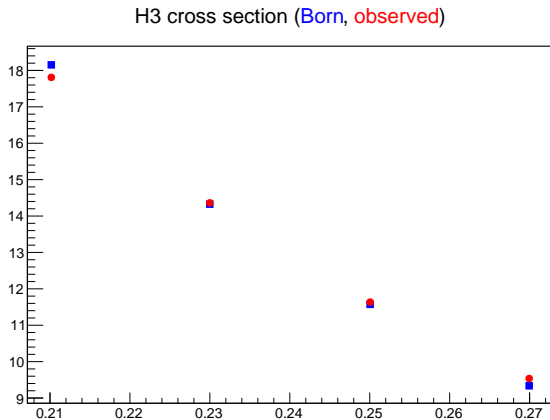
Binned cross section calculation

- Data binned in x_{obs} with a bin width of $\Delta x_{obs} = 0.02$
- Average event cross sections determined for each bin
    - Each bin has average value for σ_{Born} and σ_{det}
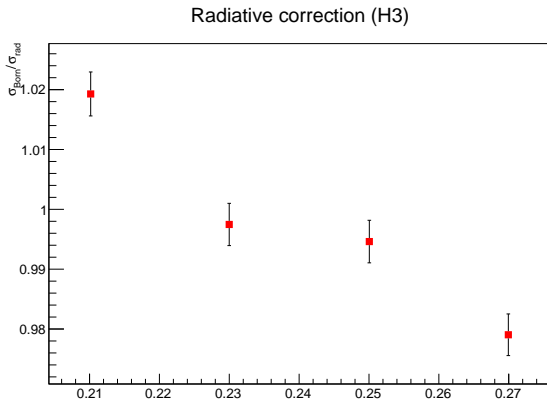- Radiative correction factor obtained by $\sigma_{Born}/\sigma_{det}$

Binned cross section results

H3 cross section (Born, observed)

- Cross section looks completely reasonable on their own...
- ...but relative positions indicate strange behavior for RC factor

Radiative correction factor

Radiative correction (H3)

- Need to compare to `externals` results and troubleshoot

Bin smearing

Next week!