High t Rates

Axel Schmidt

SRC/CT Daily Analysis Meeting

November 18, 2021

Reproducing the proposal's back-of-the-envelope numbers

All numbers will be in terms of "Events per calendar day (50% live)."

$$N = \sigma \cdot \frac{A}{2} \cdot A^{-\frac{1}{3}} \cdot F \cdot \rho \cdot \epsilon \cdot t$$

- $F = 2{\times}10^{7}$ photons / s
- $\epsilon = 0.64$
- $t = 43{,}200\ s$
- $\rho_d = 1.5\ {\times}10^{24}$ deuterium nuclei / cm^2
- $\rho_{He} = 5.7\ {\times}10^{23}$ helium nuclei / cm^2

$$N_d = \sigma \cdot\ 6.6{\times}10^{35}\ \mathrm{cm}^{-2} = \sigma \cdot 6.6{\times}10^{-2}\ nb^{-1}$$
$$N_{He} = \sigma \cdot 4.0{\times}10^{35}\ \mathrm{cm}^{-2} = \sigma \cdot 4.0{\times}10^{-2}\ nb^{-1}$$

Cross section model for $n(\gamma, \pi^-)p$

For a stationary neutron:

$$\frac{d\sigma}{d\cos\theta_{cm}} = 2.5\times10^7 nb\ GeV^{12} \cdot k_{cm}k'_{cm}s^7(1-\cos\theta_{cm})^{-5}(1+cos\theta_{cm})^{-4}$$

We have different ways to handle nucleon motion:

- **Ignore it**, treat all nucleons as stationary
- **Maria's model** (E* unconstrained)
- **Our generator's model** (E* constrained)

Proposal Figure for Deuterium

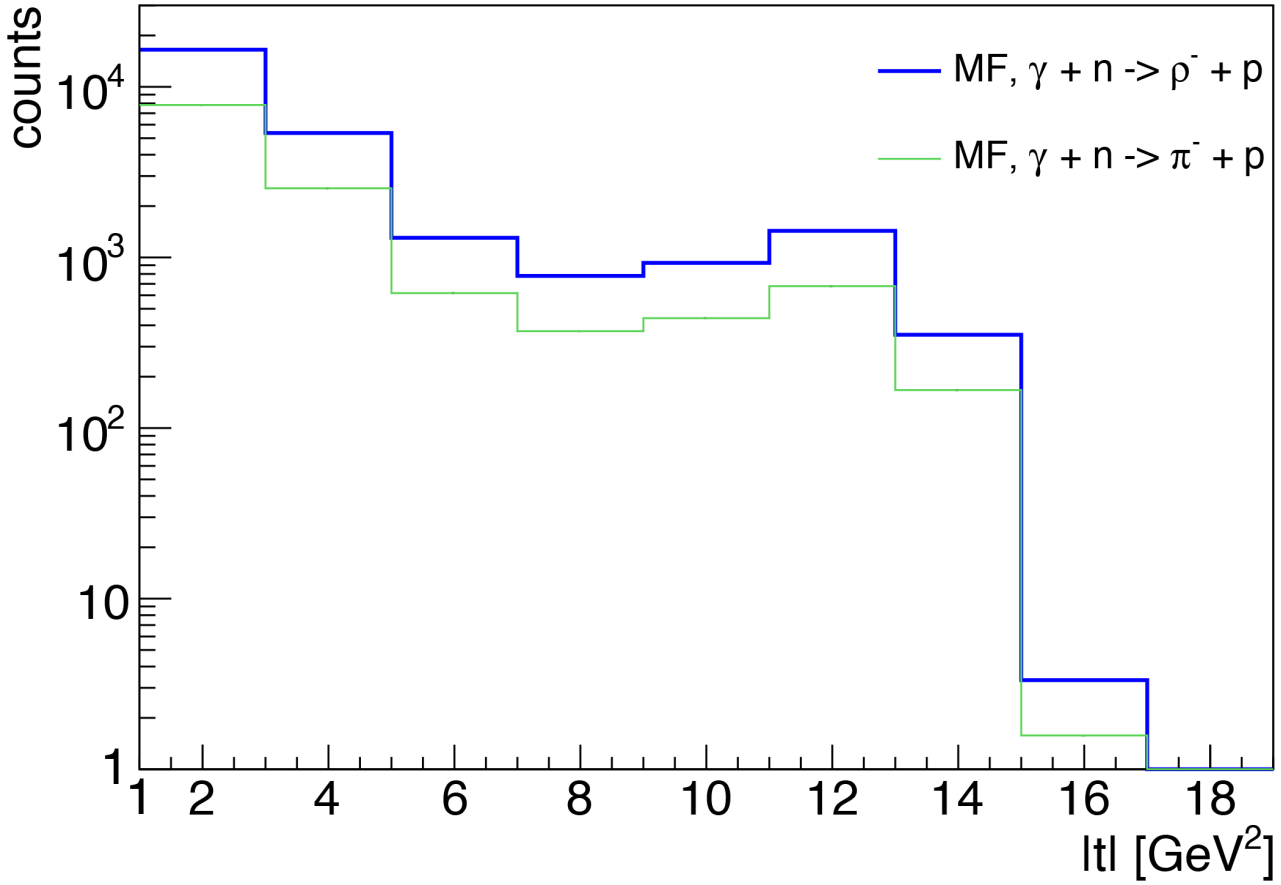
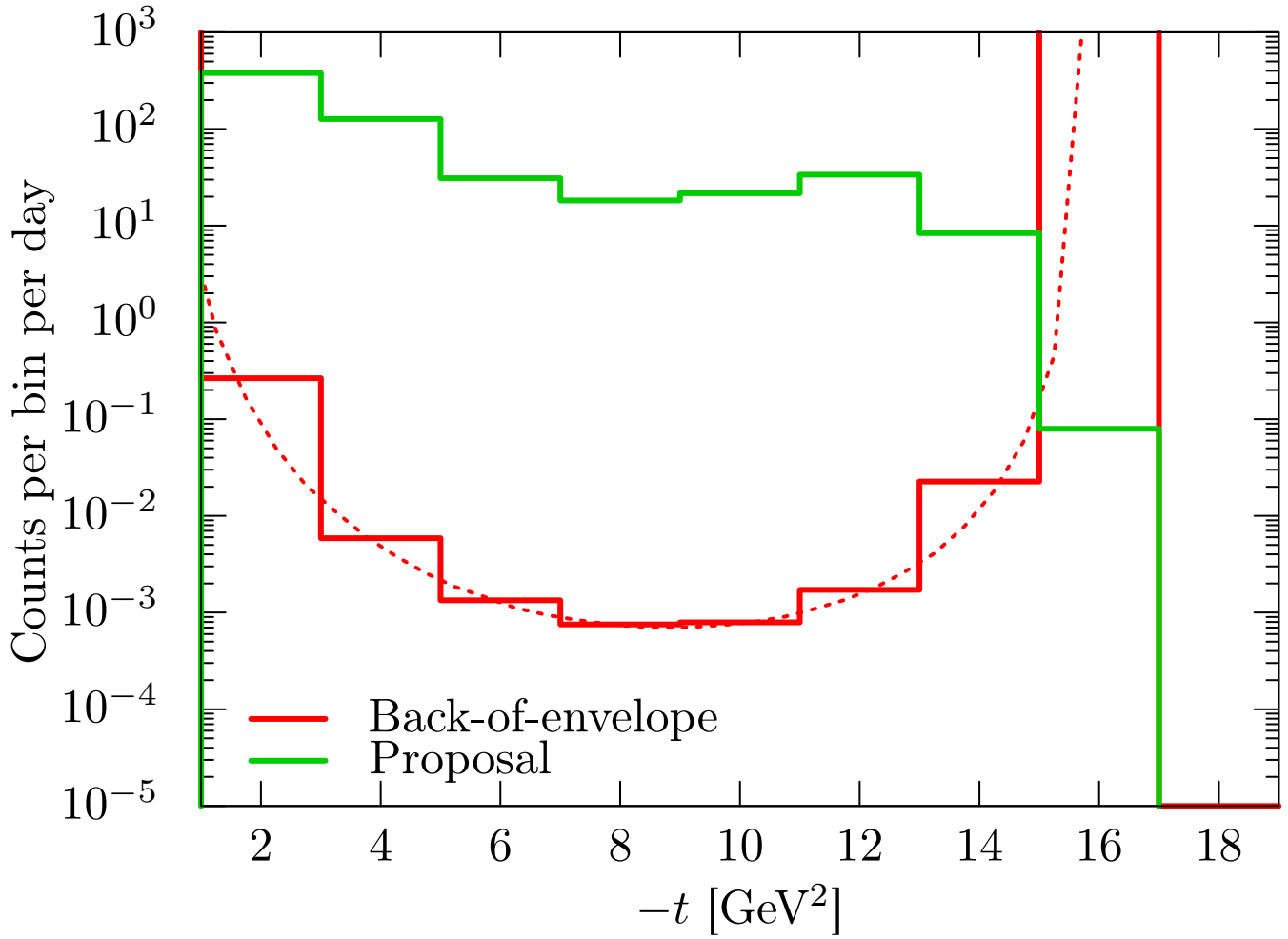


Figure 24: The expected count rate for 10 days running as a function of |t| for Deuterium

Expected rates for deuterium



Back-of-the-envelope calculation shows deeper dips in t.

Back-of-the-envelope calculation is missing:

- Energy spread of beam (I took 9 GeV)
- Cuts on $cos\theta_{CM}$
- Model for nucleon motion
- GlueX acceptance