

DARKLIGHT 1c

DarkLight Simulations

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DL collab meeting May 2022



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Generators: Reactions

- ▶ $e^-Ta \rightarrow e^-TaX \rightarrow e^-Tae^+e^-$ (signal)
- ▶ $e^-Ta \rightarrow e^-Tae^+e^-$ (irreducible background, γ' intermediate state or trident)
- ▶ $e^-Ta \rightarrow e^-Tae^+e^- + e^-Ta \rightarrow e^-Ta\gamma$ (random coincidences)

Generators we have

▶ Madgraph

- ▶ Hacked up to have a proton target for DL@JLAB
- ▶ Further hacked up to have a heavy target
- ▶ Very unstable at low energies
- ▶ Can do all processes

▶ MainzGen

- ▶ based on <https://arxiv.org/abs/1303.2540>
- ▶ Can do signal, irreducible background, half of random coincidence

▶ Radiative ep

- ▶ from OLYMPUS
- ▶ Can do other half of random coincidence
- ▶ Hacked to do heavier target, but needs verification

Rates

Rates for 13@31 (17@45)

Irreducible: 9.1 Hz (11.2 Hz)

Singles e^+ : 30.2 kHz (32.3kHz)

Singles e^- : 3.6 MHz (2 MHz)

This produces random coincidence rates of 168 Hz (98 Hz)

- ▶ Simulate tracks through magnetic field
 - ▶ Including multiple scattering in target, detector
- ▶ Python scripts to fit transfer matrix
 - ▶ Focal plane coordinates $f_i = \{x, y, x', y'\}$
 - ▶ Target coordinates $t_i = \{p, y_0, \theta, \phi\}$

$$t_q = \sum a_{i,j,k,l}^q f_x^i f_y^j f_{x'}^k f_{y'}^l$$

- ▶ Python scripts to reconstruct from simulated focal plane hits

Simulated kinematics

- ▶ 13@31: e^- : 34° , 11.8 MeV, e^+ : 20° , 17.5 MeV
- ▶ 17@45: e^- : 33.5° , 15 MeV, e^+ : 16° , 28 MeV

Symmetric mode:

- ▶ 17@45sym: e^- : 24° , 21 MeV, e^+ : 24° , 21 MeV
- ▶ Back of envelope for 13@31: 25° , 15 MeV