# Beam Induced Background At JLab L-Shape Building

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#### **Beam Simulation Geometry**



Side View of Electron Beam Simulation



3D View of L-shape Building

## Stage Zero: Electron Beam at Beam Stop



Side View of Electron Beam Simulation

#### **Stage One: Muon at Beam Stop**

#### Muon energy & angular spectrums:

Probing leptophilic dark sectors at electron beam-dump facilities. L. Marsicano, M. Battaglieri, A. Celentano, R. De Vita, Yi-Ming Zhong. PhysRevD.98.115022.



FIG. 3. The differential muons yield per EOT for an 11 GeV  $e^-$  beam impinging on a thick aluminum and water target, as a function of the muon kinetic energy. The continuous black curve refers to all produced muons, while the dashed red curve refers only to pair-produced muons. The peak in the full distribution at E = 152 MeV is due to the kaon decay-at-rest process,  $K \rightarrow \mu\nu_{\mu}$ .

#### Stage Two: Restart Muons at Beam Stop



Side View of Muon Beam Simulation

#### **Stage Two: Restart Muons at Beam Stop**





Muon hits in dirt (side view)

Muon hits in dirt (front view)

### **Stage Three: Restart Crack Muons at Dirt**

# **Worst Case Approximation:** Assume all muons at the beam stop travels through concrete shielding only, missing the entire beam dump. Restart 7.4e8 crack muons at dirt Subtract the energy deposited in concrete from the original beam stop muons with the range calculation. Crack Muons **Sensitive** detectors Iron Dirt L-shape Building Shielding **Concrete Shielding**

Side View of Crack Muon Simulation

#### Stage One to Three: ~10e20 EOT

#### 2.1e5 EOT >> 1 muon at beam stop



Side View of Electron Beam Simulation

#### Stage One to Three: ~10e20 EOT

2.1e5 EOT >> 1 muon at beam stop

2.4e5 muons at beam stop >> 1 crack muon

7.4e8 crack muons >> 4 recoil events in DRIFT

Gas pressure of DRIFT detector is compressed by a factor of 25

9.3e20 EOT >> 4 recoil events in DRIFT

Out of 4 recoil events:

- 3 are induced by neutrons created at the scintillator through mucapture process.
- 1 is induced by neutron created at the vacuum vessel through mucapture process.