

Shielding For DarkLight

Ethan Cline

Center for Frontiers in Nuclear Science
Stony Brook University
Stony Brook, NY

Laboratory for Nuclear Science
Massachusetts Institute of Technology
Cambridge, MA

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Stony Brook University



Shielding Simulations

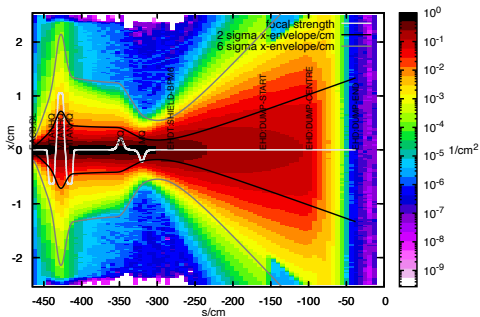
Recall there are two types of shielding we need to address:

1. Shielding for personnel
2. Shielding for electronics

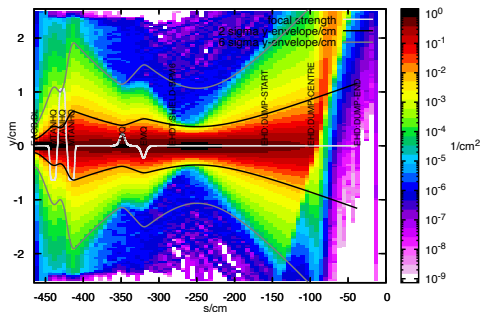
Both have been discussed during the weekly meetings, and simulated in FLUKA. I'll provide an overview today.

Beam and Beam-Induced Background

In order to determine necessary shielding, we need to ensure we properly describe the beam. After lots of discussion, we have a good beam in transoptr, which has good agreement with FLUKA.



Top-down beam view.



Side beam view.

Figures from Aveen.

Shielding for Personnel

Shielding for personnel involves more bureaucracy and safety reporting for TRIUMF.

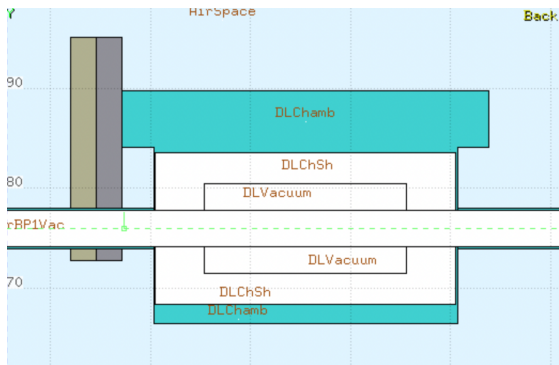
After discussion with Rock, Ricardo, and Max we have support from the TRIUMF side that the simulations are reasonable and appropriately detailed for the experiment to operate. ✓

~~After further discussion with Max, we have support from the TRIUMF side that the simulations indicate we can operate the experiment safely! ✓~~

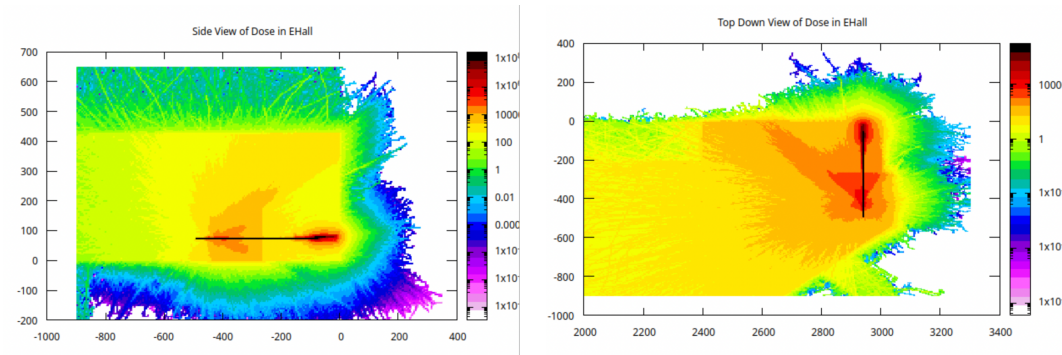
Kate has started to write a safety report with plots I will provide. I am concerned about this timeline!

Shielding for Personnel

From previous discussion, the only area of concern is the area above the beamline. We are within safety limits with 1 inch of Pb and 1 inch of BPe around the downstream edge of the chamber, beginning at the height of the beamline.



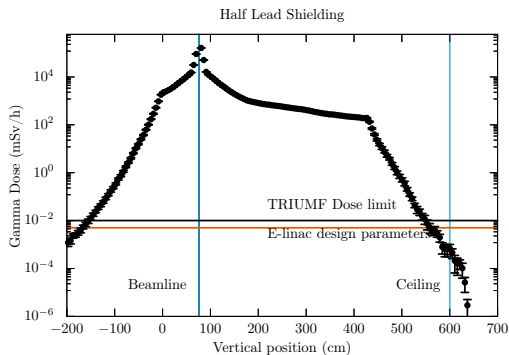
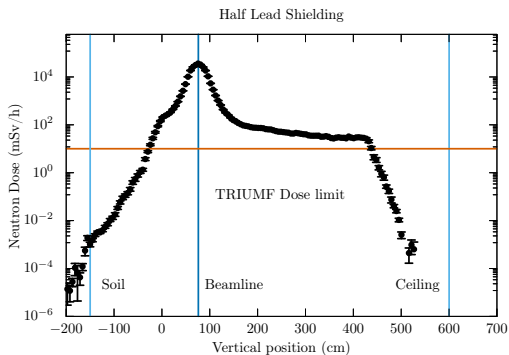
Dose in the Hall



Dose in the e-hall in mSv/h. Don't stand in the hall, but outside the hall is safe. Only point of concern is the ceiling above the hall.

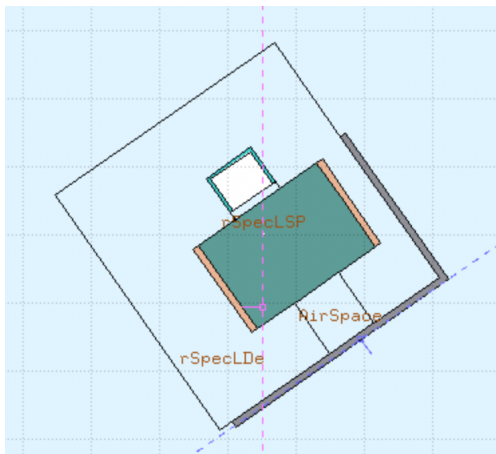
Shielding for Personnel

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Shielding for Detectors

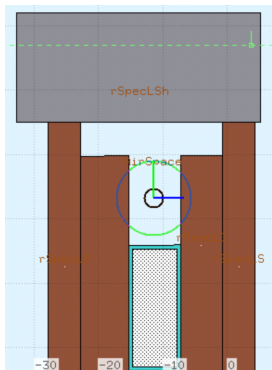
Detector shielding has more stringent requirements than personnel shielding. We require the chamber shielding plus additional shielding around the focal plane detectors.



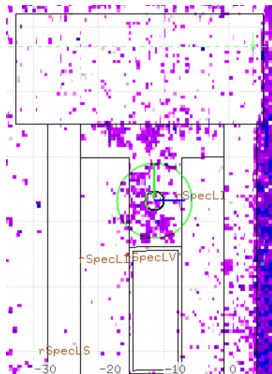
Left spectrometer shielding, top down view. SiPMs and scintillators are visible

Shielding for Detectors

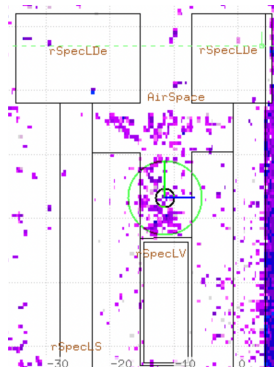
- The Silicon 1 MeV n -equivalent fluence is $\approx 6 \times 10^{10}/\text{cm}^2$ (1000 h lifetime) ✓
- The dose is ≈ 0.5 kGy/h (10,000 h lifetime) ✓
- Very likely we will need to replace the trigger SiPMs/scintillators after 1000 h
- Primarily line of sight from the target



Reference view of the Left Spectrometer at the shielding face.



View of the spectrometer with dose overlaid at the shielding face.



View of the spectrometer with dose overlaid inside the shielding.

Summary

- Human safety shielding design is finalized. Waiting to meet with TRIUMF personnel to confirm.
- Safety report needs to be written, will take time to be approved.
- Lead shielding around the detectors should be sufficient. Few additional lead sheets above the spectrometer vacuum chamber for good measure.
- Detector shielding will be discussed more tomorrow.

Back Up