**Motivation and Introduction**

- Highly enriched uranium (HEU) is arguably the most challenging material for nuclear security.
- Gamma rays emitted by HEU are low energy and easily shielded, and it passively emits very few neutrons.
- Active interrogation with photons or neutrons is likely necessary to detect shielded HEU.
- We are developing organic scintillator based systems to detect photon induced prompt fission neutron detection.
- This will enable the application of commercially available linacs to reduce the cost and complexity of active interrogation systems.

**Varian M9 Linear Accelerator**

- The linear accelerator is a commercial available Varian model, originally for medical applications.
- The electron energy is fixed at 9 MeV, while pulse rate can be adjusted to either 25 or 250 Hz.

<table>
<thead>
<tr>
<th>Varian M9 Linac Parameters</th>
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<tbody>
<tr>
<td>Beam Endpoint Energy</td>
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<tr>
<td>Pulse Rate</td>
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<tr>
<td>Average Current</td>
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<tr>
<td>Converter: Copper backed tungsten, no spectral filtering</td>
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### Shielding Design

- The accelerator laboratory is in the basement of the University of Michigan Nuclear Engineering Laboratory, so is shielded well in most directions.
- However, the beamline is directed towards a storage room in an adjacent building.
- A beamstop is simulated as 8” thick lead with a 1” BPE coating.

**Experiment Planning**

- A shielding enclosure was provided by Rapiscan Systems, developed for cargo screening testing.
- The accelerator head rolls into the enclosure on an aluminum rack.
- A tungsten and lead collimator is centered around the converter.
- Borated polyethylene shields neutrons produced in the high-Z collimator.

### Accelerator Laboratory Space

- Target and detectors can be placed ~15 m from the accelerator, with the beam 3 ft off the floor.
- The beam has a 22 cm radius at 15 m.

**Conclusions**

- Interrogation of targets with a 9 MV linac will allow for investigation into scintillator based active detection methods.
- These methods will enable the use of commercially available accelerators and detectors in nuclear security applications.
- The construction of this facility is progressing well, and will be open for collaboration on experiments when complete.

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