NUCLEAR ASSESSMENT OF SHIELDING CONFIGURATION OPTIONS
FOR FINAL OPTICS OF HAPL LASER FUSION POWER PLANT

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**OBJECTIVE**

Assess impact of shielding configuration options on nuclear environment at final optics.

**Design Parameters Used in Analysis**

- **Input yield:** 367.1 MJ
- **Rep Rate:** 5 Hz
- **Fusion power:** 1836 MW
- **Chamber inner radius:** 10.75 m
- **Chamber outer radius:** 11.85 m
- **GIMM angle of incidence:** 85°
- **Blanket thickness of Li/FS blanket:** 0.6 m
- **Blanket thickness of SS/B4C/He shield:** 0.5 m
- **Neutron trap added at inner surface of containment building:**
  - Option I: Bio-Shield
  - Option II: GIMM enclosed in concrete shield
  - Option III: GIMM support is challenging

**Fast Neutron Flux at Final Optics with Different Shielding Configuration Options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Peak Fast Neutron Flux (n/cm²s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1.40x10⁻¹⁰</td>
</tr>
<tr>
<td>II</td>
<td>1.38x10⁻¹⁰</td>
</tr>
<tr>
<td>III</td>
<td>1.37x10⁻¹⁰</td>
</tr>
<tr>
<td>GIMM</td>
<td>1.68x10⁻¹⁰</td>
</tr>
<tr>
<td>Focusing Mirror</td>
<td>2.28x10⁻¹⁰</td>
</tr>
<tr>
<td>Turning Mirror</td>
<td>4.34x10⁻¹⁰</td>
</tr>
</tbody>
</table>

- **Preferred Final Optics Shielding Configuration**
  - **Option I**
  - Which of these is the dominant effect?
    1. "Steering" of streaming neutrons in beam duct of option I
    2. Contribution from neutrons streaming through all ports in the "open" configuration of options II and III

- **Conclusion**
  - Original shielding configuration with all optics including GIMM enclosed in concrete shield is the preferred option since it yields lowest flux at dielectric mirrors, provides better GIMM support, reduces volume under vacuum, and requires least amount of concrete.