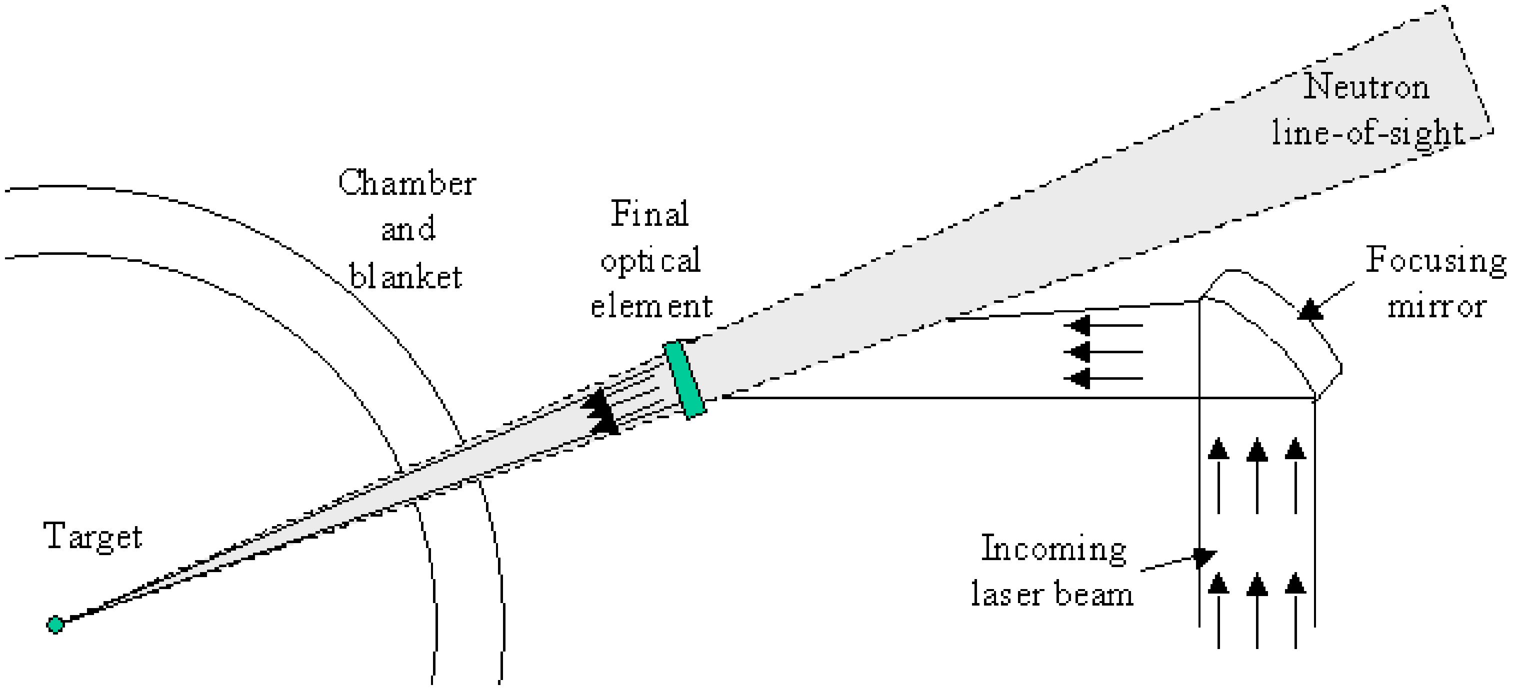
The driver-chamber interface is an active area of S&E study

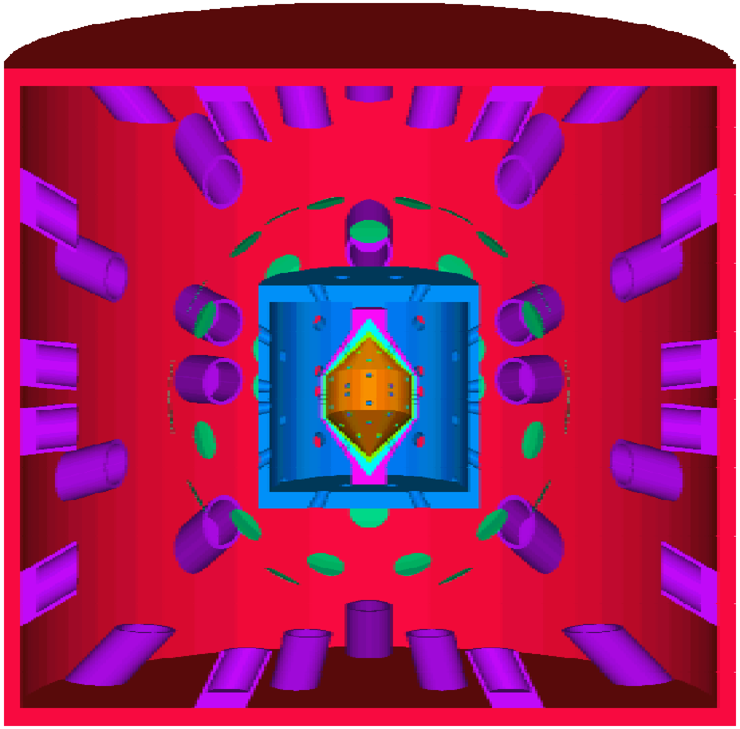
- Important issue for both laser- and heavy-ion-driven designs:
  - Laser designs need to protect final optical component (sits *in* line-of-sight) and focusing mirror (sits just *out* of line-of-sight)
  - Heavy-ion designs need to protect final focusing magnets
- Radiation damage lifetimes make the driver-chamber interface an important environmental issue:
  - Damaged components could comprise a significant waste stream
  - Not all components (e.g., NbTi or Nb_3Sn superconductors) would qualify for disposal via shallow land burial
- Down time for component replacement would negatively impact economics, plant availability, and occupational exposures

The final optical element has been included in recent driver-chamber interface neutronics studies



The final optical element (GIMM or transmissive wedge) allows the focusing mirror to sit out of the line-of-sight of high-energy neutrons.

Driver-chamber interface: lasers



- Radiation damage to the final focusing system is a key issue in a laser-driven IFE power plant.
- A detailed, 3-D model of Sombrero was developed to calculate neutron and γ-ray fluences and doses in the focusing mirrors and final optical components
- Variations of model created for open solid-angle fractions of 0.25% (from published report) and 5% (increased to maximum that might be needed for DPSSL driver)
- Grazing incidence metal mirrors (GIMMs), used as the final optical components in the original report, were replaced with transmissive fused silica wedges

Driver-chamber interface: lasers (cont'd.)

- Neutrons scattered off of the final optical component (wedge or GIMM) dominate the fast neutron flux at the focusing mirrors:
  - Relatively sensitive focusing mirrors may have fast neutron fluence limit of only 10^{18}-10^{19} n/cm^2 leading to a lifetime of only 0.25-2.5 FPY

- Final focusing mirror dose rate is dominated by neutron-induced gamma-rays:
  - 4 Gy/s at mirror location (200$\times$ higher than neutron dose rate)
  - Recent work[1] shows that γ-ray dose is important for transmissive optics–can this also be an issue for mirrors?

- Wedge/GIMM sits in line-of-sight; is subjected to much higher levels
  - Fast neutron flux at the wedge/GIMM location is 9.5×10^{12} n/cm^2-s
  - Yields wedge/GIMM lifetime of 0.33-33 FPY for 10^{20}-10^{22} n/cm^2 limits

[1] C. D. Marshall, J. A. Speth, S. A. Payne, Induced optical absorption in gamma, neutron and ultraviolet irradiated fused quartz and silica, *J. of Non-Crystalline Solids* **212** (1997) 59-73.