Keeping the Cryogenic Targets Layered Until Shot Time in a Z-Pinch IFE Power Plant*

R. Gallix and P. Mijatovic

General Atomics, P.O. Box 85608, San Diego, California 92185-5608, gallix@fusion.gat.com

In a central building of a Z-pinch based IFE power plant, the DT fuel is formed into a very smooth and uniform layer of ice at ~18 K inside a beryllium shell; placed in a cryogenic target assembly that provides support, cooling, and thermal insulation; and put into an evacuated replaceable transfer line (RTL) at room temperature (RT) [1]. The RTL is transported and inserted into one of the reactor chambers at 923 K and shot, releasing 3 GJ of nuclear fusion energy. The DT ice layer must stay below ~19.7 K to keep its geometric integrity until shot time.

Detailed transient thermal analyses of the cryogenic target assembly in the RTL were performed. They showed that, with the original design, the DT ice would reach 24.6 K by shot time. With an improved design providing better thermal insulation of the target, the ice temperature would reach only 19.1 K, meeting the requirement for successful shots.

This paper compares the thermal analysis results for both designs, which included conduction and radiation effects with temperature-dependent material properties.

*This work was performed for Sandia National Laboratories under Contract No. 453163.