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.

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