SCALING MAGNETIZED LINER INERTIAL FUSION ON Z AND FUTURE MACHINES

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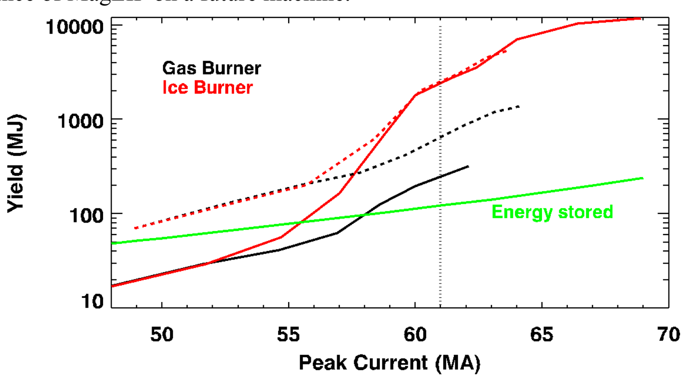
The MagLIF (Magnetized Liner Inertial Fusion) concept[1] has demonstrated[2] fusion – relevant plasma conditions on the Z machine. We present 2D numerical simulations of the scaling of MagLIF on Z as a function of drive current, preheat energy, and applied magnetic field strength. The results indicate that deuterium/tritium (DT) fusion yields greater than 100 kJ could be possible on Z when all of these parameters are at the maximum values, i.e. peak current=25, deposited preheat energy=5 kJ, and Bz=30 Tesla. Much higher yields have been predicted[3] for MagLIF driven with larger peak currents, which could be provided by future pulsed power machines[4] based on Linear Transformer Driver (LTD) technology. Two high performance LTD pulsed-power machines (Z300 and Z800) have been designed. The Z300 design would provide approximately 48 MA to a MagLIF load, while Z800 would provide about 61 MA. A parameterized Thevenin equivalent circuit was used to drive a series of 1D and 2D numerical simulations with currents between and beyond these two designs. At each value of the current the MagLIF target was optimized by varying the radius, the fuel density, the initial magnetic field and the preheat energy. Preheat energies are modest in the range of 30-40 kJ. These optimized results are plotted in the figure. MagLIF targets only filled with DT gas are referred to as “Gas burners”, while targets with a cryogenic layer of DT on the inside surface of the liner we call “Ice burners”. Yields of about 10 MJ could be possible with Z300, while yields of about 1 GJ could be possible with Z800. We will discuss how numerical scaling can be tested by experiments to reduce uncertainties in the predicted performance of MagLIF on a future machine.



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