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High Energy Preheat Configurations for MagLIF[1] MATTHEW WEIS, ADAM HARVEY-THOMPSON, DANIEL RUIZ, Sandia National Laboratories — Three-dimensional HYDRA calculations were carried out to identify achievable laser preheat energies for the Magnetized Liner Inertial Fusion (MagLIF) platform under the assumption of various upgrades to the Z-Beamlet laser, up to a 6.3 kJ laser pulse. The simulations assumed a $\sim$ 500 nm laser entrance foil enabled by cryogenic cooling and a 1.5 mm laser spot produced by a distributed phase plate. Smaller laser spot sizes showed significant self-focusing that limited energy deposition to the imploding deuterium fuel region. With larger spot sizes, simulations suggest that laser pulses ranging from 2.6 to 6.3 kJ can robustly couple $\sim$ 75 % of the incident energy to the fuel, with the remainder lost to the laser entrance window. When compared to 2D simulations, 3D simulations predict similar coupled energies to the fuel but also consistently show more radial filamentation and spray of the beam as the magnetic field is increased. This may cause additional mix from the liner walls and introduce vorticity into the fuel. In the absence of these effects, the calculated achievable preheat energies applied to implosion calculations suggest that a 6.3 kJ Z-Beamlet laser is sufficient to optimize MagLIF performance at 20 MA for a variety of fuel densities and applied field strengths.

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