

STAGNATION PERFORMANCE SCALING OF MAGNETIZED LINER INERTIAL FUSION*

M. R. Gomez, D. A. Yager-Elorriaga, C. E. Myers,
S. A. Slutz, M. R. Weis, C. A. Jennings, D. C. Lamppa,
A. J. Harvey-Thompson, M. Geissel, P. F. Knapp,
E. C. Harding, S. B. Hansen, M. Mangan, C. L. Ruiz,
G. A. Chandler, T. J. Webb, T. Moore, G. R. Laity,
D. J. Ampleford, K. J. Peterson, G. A. Rochau, D. B. Sinars,

*Sandia National Laboratories
Albuquerque, NM 87185 USA*

K. D. Hahn

*Lawrence Livermore National Laboratories
Livermore, CA 94550 USA*

Magnetized Liner Inertial Fusion (MagLIF) is a magneto-inertial fusion concept that is presently being studied on Sandia's Z machine. The concept utilizes an axial magnetic field of order 10 T to reduce thermal conduction losses as a cm-scale beryllium can implodes and compresses fusion fuel, which was preheated to of order 100 eV with a few kJ from a TW-class laser. During the implosion, the magnetic field is amplified through magnetic flux compression to several thousand Tesla, and the fuel temperature increases to several keV.

Scaling studies indicate that >100 kJ deuterium-tritium fusion yields are possible on the Z machine; however, this level of performance can only be reached by simultaneously scaling up the initial applied B-field, the energy coupled to the fuel by the laser, and the current driving the system. Using the original MagLIF platform, the input parameters were limited to 10 T, approximately 1 kJ of laser energy coupled, and 16 MA. Experiments conducted with these parameters resulted in a primary deuterium-deuterium neutron yield around 3×10^{12} and a burn-averaged ion temperature of 2.5 keV. Recent efforts focused on developing enhanced capabilities for the MagLIF platform have demonstrated peak load currents approaching 20 MA and initial applied B-fields exceeding 15 T. Combining these improvements with a change in laser preheat protocol led to a primary neutron yield exceeding 10^{13} and an ion temperature over 3 keV. Additional efforts to further increase the B-field to >20 T, the laser preheat to >2 kJ, and the current to >20 MA are underway.

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