Transmission Studies for MagLIF

Laser-Entrance-Holes*

M. Geissel$^1$, L.E. Ruggles$^1$, I.C. Smith$^1$, A.B. Sefkow$^1$
J.E. Shores$^1$, C.S. Speas$^1$, and J.L. Porter$^1$

$^1$ Sandia National Laboratories,
Albuquerque, NM, U.S.A.

The concept of “Magnetized Liner Inertial Fusion” (MagLIF)**, which is pursued by Sandia National Laboratories (SNL), requires the deposition of laser energy into a fuel-filled metal cylinder that is exposed to an external magnetic field. The complexity of the laser-plasma-interaction as well as the influence of non-uniformities in the laser beam profile make predictions about the light propagation through a heated, foil covered laser-entrance-hole (LEH) very difficult.

Laser energy losses in the LEH have an immediate influence on the performance of MagLIF experiments. In order to further understand this critical issue, a series of studies investigating the transmission of laser light delivered by the Z-Beamlet laser has been performed at the ‘Pecos’ target area in the Z-Backlighter facility of SNL. We studied the transmitted spatial beam profile (X-ray pinhole images of witness plates), temporal profile (photo-diode) and energy (full beam calorimeter) while varying focus position, laser pulse train, window thickness, and LEH aperture size. The initial findings already proved to be essential for the forward planning and optimization of MagLIF related experiments at SNL. Now, more comprehensive experiments with surrogate fuel (gas fill) and applied pulsed external B-fields are in preparation.

One outcome of the experimental efforts in the Pecos target area is the possibility of close proximity laser beam profile enhancement measures, which can be integrated into the MagLIF target design. The advantages and disadvantages of such measures have been investigated in a dedicated experimental campaign and will also be presented.

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