First Results from Laser-Driven MagLIF Experiments on OMEGA: Time Evolution of Laser Gas Heating Using Soft X-Ray Diagnostics

D.H. Barnak, R. Betti, P.-Y. Chang, J.R. Davies, Fusion Science Center and Laboratory for Laser Energetics, U. of Rochester — Magnetized liner inertial fusion (MagLIF) is a promising inertial confinement fusion scheme comprised of three stages: axial magnetization, laser heating of the deuterium-tritium gas fill, and compression of the gas by the liner. To study the physics of MagLIF, a scaled-down version has been designed and implemented on the OMEGA-60 laser. This talk will focus primarily on the heating process of a MagLIF target using a 351-nm laser. A neon-doped deuterium gas capsule was heated using a 2.5-ns square pulse delivering 200 J of laser energy. Spectral analysis of the x-ray emission from the side and the laser entrance hole of the capsule is used to infer the time evolution of the gas temperature. The x-ray spectra for a grid of possible gas temperatures and densities are simulated using Spect3D atomic modeling software. The simulation results are then used to deconvolve the raw signals and obtain density and temperature estimations. A gas temperature lower bound of 100 eV at 1.3 ns after the start of the laser pulse can be inferred from these estimations. The estimations are then compared to 2-D hydrocode modeling. This material is based upon work supported by the Department of Energy National Nuclear Security Administration under Award Number DE-NA0001944 and by DE-FG02-04ER54786 and DE-FC02-04ER54789 (Fusion Science Center).