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Experimental Study of Plasma Cooling and Laser Beam Interaction in Gas Filled ICF Engines[1] MARK RHODES, JAVE KANE, GWENDOLEN LOOSMORE, JAMES DEMUTH, JEFFERY LATKOWSKI, Lawrence Livermore National Labs — ICF power plants, such as the LIFE scheme under development at LLNL, may employ a high-Z, target-chamber gas-fill to moderate the first-wall heat-pulse due to x-rays and energetic ions released during target detonation. This gas-fill is heated and ionized by this energy release. It must cool and recombine before the next shot (at nominally 70-ms intervals) to a temperature where the next target and laser pulse can propagate to chamber center with minimal degradation. While we expect rapid cooling to 2eV by radiation, our modeling of cooling below 2 eV has a high degree of uncertainty. We have developed a plasma source to study the cooling rates and laser propagation in high-Z gaseous plasmas. The source is a theta discharge configuration driven by a low-inductance, 5-kJ, 100-ns pulsed power system. This configuration delivers high peak power levels, has an electrode-less discharge, and has unobstructed axial access for diagnostics and beam propagation studies. Our diagnostics include Thompson scattering, time resolved spectroscopy, and plasma probes. We will report on the system design, operation, and initial results.

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