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Gas-filled hohlraum experiments at the National Ignition Facility[1]

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A joint team from the National Laboratories at Los Alamos (LANL) and Lawrence Livermore (LLNL) has fielded the first gas-filled hohlraum experiments at the National Ignition Facility (NIF) laser, with the available four beams arranged as a single *f/8* beam. The gas-fill in this LANL design provides plasma pressure to tamp the hohlraum gold wall to avoid filling, the same technique used in ignition designs. A shaped laser pulse 8 ns in duration was used, with a low-power foot and a late peak of 7 TW, a contrast ratio exceeding 100 (the highest on NIF so far), and a total energy of 14 kJ. Deployed measurements include laser energy and power; back-scattered light spectrum, power and energy directly into the focusing lenses; back-scattered laser light energy outside the lenses; soft x-ray drive spectrum and power, and; gated framing-camera images of the hohlraum self-emission with x-ray energy > 10 keV. Our main results and conclusions are: (1) This is the first experimental demonstration that a low-Z fill can keep the interior of a laser-driven hohlraum open long enough to ensure efficient coupling of ignition-relevant laser pulses. (2) When backscattering losses are accounted ($\approx 25\%$ reflectivity due to stimulated Brillouin scattering [SBS]), we have the radiation-hydrodynamics predictive capability necessary to understand the energy balance in such hohlraums quantitatively, as well as other details of the hohlraum-plasma evolution. (3) Laser-plasma instabilities (LPI) can lead to considerable laser reflectivity levels, with a significant and measurable deleterious impact on hohlraum energetics. Thus, continued development of LPI predictive capability and understanding is needed. (4) These experiments provide evidence that Stimulated Raman back-scattering losses (SRS) may be minimized with a proper choice of plasma conditions.

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