National Ignition Campaign Hohlraum Energetics on OMEGA: Scientists at LLE and LLNL completed a DOE milestone for the National Ignition Campaign—hohlraum energetics experiments with elliptical phase plates were successfully performed on 17 August. A set of 43 elliptical phase plates (E-IDI-300) were designed and manufactured for these experiments. The far-field intensity profile generated with one of the E-IDI-300 phase plates is nearly identical to the design specifications (see Fig. 1). Two shots were taken to confirm the laser-beam configuration and the orientation of the elliptical phase plates, then seven scale-1, thin-walled, Au hohlraums were irradiated with 40 beams smoothed with E-IDI-300 phase plates. The following gas fills were investigated: vacuum, 0.9 atm C_5H_{12}, 0.9 atm C_5H_{12} with trace amounts of Kr, and 0.9 atm C_5H_{12} with trace amounts of Ne. The high-Z dopants were introduced to reduce hard x-ray production and laser scattering levels associated with the gas fills. The hohlraum energetics were measured for a 13.5-kJ-shaped laser pulse (PS26) with the following diagnostics: DANTE, full aperture backscatter, near backscatter imaging, gated hard x-ray imaging, gated soft-x-ray imaging, and the hard-x-ray detector. Data analysis is in progress. A gated (Δt = 80 ps) hard-x-ray (>8 keV) image of a gas-filled hohlraum (0.9 atm C_5H_{12} with trace amounts of Kr) at 1.55 ns is presented in Fig. 2. The cone 1, cone 2, and cone 3 beams entering from the right side are labeled, along with the x-ray radiation escaping through the laser entrance hole (LEH). The measured radiation temperature for each shot is shown in Fig. 3. Compared to the vacuum hohlraums, the gas-filled hohlraums do not show the initial foot in the temporal history of the radiation temperature because energy is consumed to ionize the polyimide window and the gas. The peak radiation temperature dropped by only 7 eV when the gas fill was introduced, most likely due to reduced laser scattering losses with the E-IDI-300 drive.

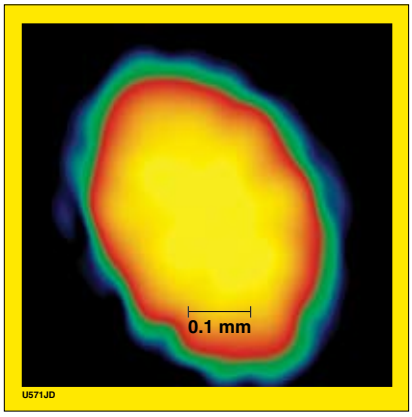

Figure 1. Far-field intensity profile generated by typical E-IDI-300 DPP. The plates were designed to have a super-Gaussian shape of the order of n = 5 and were measured to have n = 4.1.

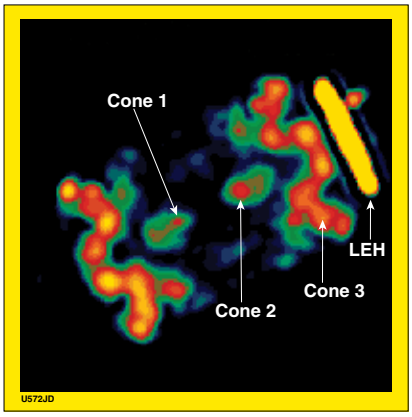

Figure 2. Gated (80 ps) hard-x-ray (>8 keV) image of the x-ray emission from a thin-walled hohlraum irradiated with 40 OMEGA beams with new elliptical phase plates.

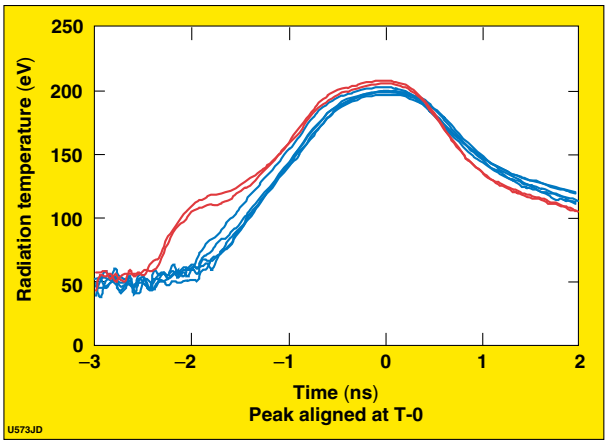

Figure 3. Data from seven OMEGA shots showing DANTE-derived radiation temperature versus time for scale-1 hohlraums driven with elliptical phase plates. Empty hohlraum shots are designated in red and gas-filled hohlraum shots are designated in blue. All shots were carried out with pulse shape PS26N02A and an average energy of 13,530±230 J.

OMEGA Operations Summary: OMEGA conducted a total of 164 target physics shots in August with an overall experimental effectiveness in excess of 96%. Of these shots, 79 were for the National Ignition Campaign. The shots were distributed as follows: LLE (31), LLNL (54), LANL (38), CEA (13), and NLUF (28). The NLUF campaigns were carried out by three teams led by the University of Michigan, Rice University, and the MIT Plasma Science and Fusion Center, respectively. A semiannual beam-timing run was conducted on 7 August.

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