Offset Target Implosions: OMEGA design calculations predict that the position of the target with respect to the common pointing of all 60 beams must be accurate to ~25 μm to achieve optimum target irradiation uniformity. Experiments were carried out recently to measure the effect of target offset on implosion performance. Deuterium-filled (15 atm) CH shells (~20 μm thick, ~900-μm diam) were used for these shots. The laser conditions were ~23-kJ UV energy on target and 1-ns square laser pulses; SSD beam smoothing and polarization smoothing were used. Centering of the targets was adjusted to achieve measured offsets ranging from 0 to 100 μm. Figure 1 shows the effect of target offset on the absolute neutron yield measured for these experiments. For the largest offset measured (~100 μm), the yield drops by approximately a factor of 3 compared to offsets that are below ~40 μm. X-ray imaging of the cores of these implosions shows a significantly distorted core for target displacements of 100 μm. Simulations using the 2-D code *DRACO* produced core images similar to those measured (Fig. 2).

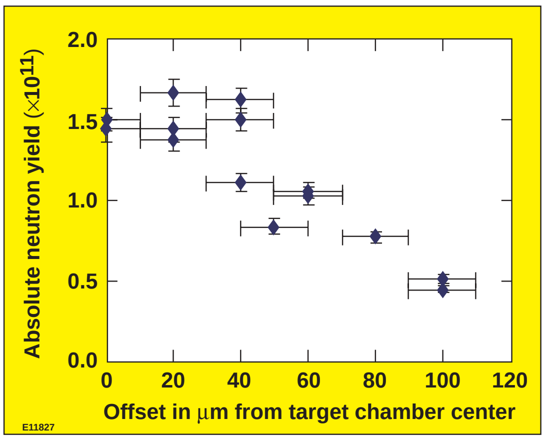

Figure 1. Neutron yield plotted as a function of target offset.

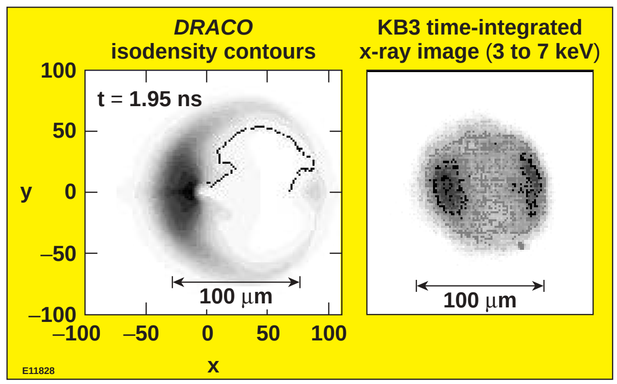

Figure 2. *DRACO* simulation (left) of an x-ray image of shot 26646 compared to the time-integrated x-ray image obtained on shot 26646. The target was offset by 50 μm in this experiment.

Determination of Imploded Core Temperature and Density Gradients: A team led by Roberto Mancini of the University of Nevada, Reno and Jeffrey Koch of LLNL is conducting NLUF experiments to spectroscopically determine 1-D temperature and density gradients in the cores of indirect-drive capsules imploded on OMEGA. The method is based on a novel self-consistent analysis for data from simultaneous x-ray line spectra and x-ray monochromatic images. This targets are Ar-doped, D_2-filled plastic shells placed inside Au-lined hohlraums. Progress has been made on two aspects of this work: (a) the self-consistent analysis of Ar x-ray line spectra and monochromatic images, and (b) the development and implementation of a multiple monochromatic imaging diagnostic (MMI-2) on OMEGA. This instrument uses a pinhole array and a flat, multilayer x-ray reflector to record numerous narrow-bandwidth x-ray images spanning the 3- to 5-keV photon energy range. Figure 3 displays typical data recorded by MMI-2. Each image spans ~75 eV along the spectral axis. Groups of images can be combined to produce line-based images as shown in the figure. This diagnostic is being developed to characterize future NIF implosions.

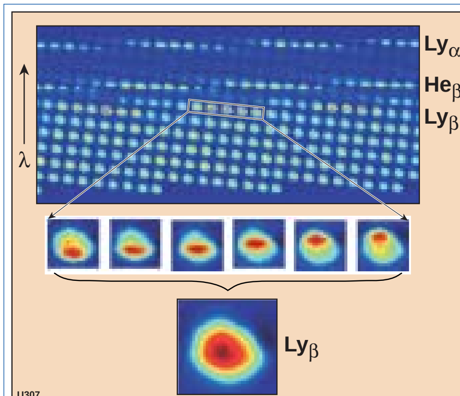

Figure 3. An array of implosion core images recorded with MMI-2 in OMEGA shot 26787. Three Ar line transitions are indicated along the spectral dispersion axis: Lyα (3.734 Å), Heβ (3.369 Å), and Lyβ (3.151 Å). The subgroup of six images shows different portions of each image covered by the Lyβ emission. This subgroup of images is used to produce a Lyβ-based image of the core in the bottom of the figure.

OMEGA Operations Summary: A total of 121 target shots were provided by OMEGA for LLE, LLNL, and NLUF programs in August. LLNL's 44 shots included 2ω beam activation, laser–plasma interaction, hot-hohlraum physics, NWET, features, diagnostics development, dynamic hohlraum, and non-LTE campaigns. LLE's 56 shots included ISE, cryogenic target, long-scale-length plasma physics, Rayleigh–Taylor, and power-balance campaigns. The 21 NLUF shots included laser–plasma interaction experiments for Polymath Sciences and collaborators, laboratory astrophysics experiments for the University of Michigan collaboration, and high-density plasma x-ray spectroscopy for the University of Wisconsin and colleagues.

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