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).

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 NLF 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, D₂-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.

OMEGA Operations Summary: A total of 121 target shots were provided by OMEGA for LLE, LLNL, and NLF programs in August. LLNL’s 44 shots included 2π 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 NLF 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.