***Low-Mode Nonuniformity Measurement and Correction in Direct-Drive Implosions***: Using the self-emission shadowgraphy technique previously developed on OMEGA,[1,2] low-mode nonuniformities of directly driven imploded CH capsules were measured and corrected on the OMEGA laser between shots by adjusting the laser beam power balance. These adjustments were based on the technique developed using the 3-D hydrodynamic code *ASTER*.[3] In this technique, the measured modes (from 1 to 3) are reduced by applying corrections to corresponding modes of the angular distribution of the power of OMEGA beams. Simulations found a linear dependency between amplitudes of the measured and correction modes with mode-dependent linear factors. These factors were predicted in simulations.

The spherical harmonic modes 2 and 3 were obtained by doing tomography in four different directions of the ablation-front surface of a capsule imploded on OMEGA. In each direction, a framing camera was used to produce 16 time-resolved (40-ps integration time), soft x-ray (~1-keV) self-emission images of the target throughout its implosion. In each image, the steep intensity gradient inside the coronal emission was used to measure the projection of the ablation-front surface on the diagnostic.[1,2] Each projection was decomposed over the Fourier basis to determine the evolution of modes 2 and 3 over the successive images. From each view, the best mode 2 and 3 at an averaged radius of 150 $\mu$m was obtained using a linear fit and the best contour was reconstructed by adding those two modes. The four contours were oriented in 3-D perpendicular to the viewing axis of the diagnostic [red lines in Figs. 1(a) and 1(b)] and the spherical harmonics 2 and 3 that best fit those contours were determined [Figs. 1(a) and 1(b)]. On the first shot [Fig. 1(a)], one can observe an axis where the target is underdriven (northeast–southwest, $\Delta R \approx$ 8 $\mu$m) and an axis where it is overdriven (northwest–southeast, $\Delta R \approx$ 5 $\mu$m on the figure). On the second shot where the laser beam energy balance was modified to correct those nonuniformities, a significant reduction of those nonuniformities was observed, resulting in a reduction of the root mean square of the variation of the radius relative to the average radius from 1.7±0.2 $\mu$m to 1.1±0.2 $\mu$m.

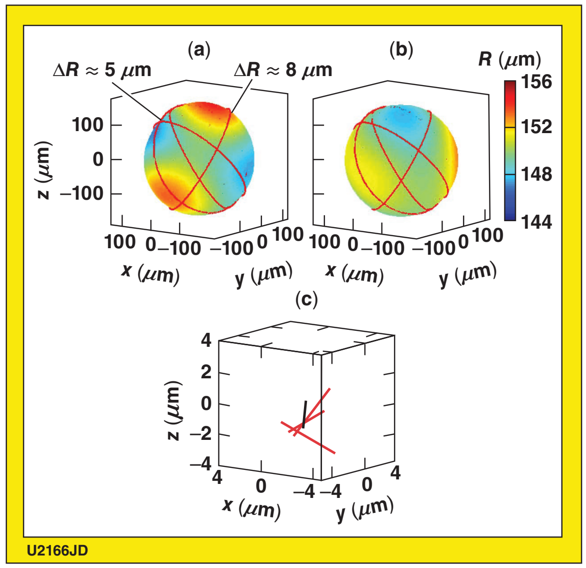


Figure 1. Spherical mode 2 and 3 that best fit the projections of the ablation-front surface measured on the four diagnostics (red lines) (a) before and (b) after correction of the laser beam imbalance. (c) Shift of the imploding target (black line) located at the intersection of the straight lines defined by the diagnostic axis translated by the measured projected mode 1 (red lines).

The spherical harmonic mode 1 (displacement of the ablation-front surface) was determined by measuring its projection on the four framing cameras. On the first shot (reference shot), the projection of the ablation-front surface of a nonimploding solid CH ball located at target chamber center was obtained on each image of each camera. Its center corresponded to the projection of the target chamber center on the diagnostic (reference center). On the second shot (imploding capsule), the projection of the ablation-front surface was measured and the difference between its center and the reference center corresponded to the projection of the mode 1 on the diagnostic. The 3-D mode 1 is located at the intersection of the straight lines defined by the diagnostic axis translated by the projected mode 1 [Fig. 1(c)]. The measured mode 1 was about 3 $\mu$m and in the same direction on all shots. The objective of the next round of experiments is to determine the correcting factor to mitigate the three 3-D modes and demonstrate improvement in the implosion performance.

***Omega Facility Operations Summary***: During November, the Omega Laser Facility conducted 105 target shots with an average experimental effectiveness (EE) of 98.1% (84 shots on the OMEGA laser with an EE = 98.2% and 21 on OMEGA EP with EE = 97.6%). The ICF program accounted for 33 target shots for experiments performed by LLE while the HED program had 43 shots for experiments led by LANL, LLNL, and LLE. One NLUF experiment led by Princeton University carried out 18 target shots including 6 joint shots using both OMEGA and OMEGA EP. The CEA carried out 11 target shots.

1. D. T. Michel *et al.*, Rev. Sci. Instrum. **83**, 10E530 (2012); 2. D. T. Michel *et al.*, High Power Laser Science and Engineering **3**, e19 (2015); 3. I. V. Igumenshchev *et al.*, Phys. Plasmas **23**, 052702 (2016).