Controlled Symmetry Variation in Polar-Drive Experiments on the National Ignition Facility (NIF): Achieving adequate symmetry in directly driven implosions on the National Ignition Facility (NIF) requires several modifications from its existing indirect-drive (ID) configuration. The polar arrangement of the laser-beam ports provides limited irradiation of the equatorial region of the imploding target. Nearly symmetric drive with the polar beam geometry (polar drive) is achieved in simulation codes by repointing the NIF beams and using different pulse shapes for the different quads on the NIF. Experimental validation of these schemes is critical for confidence in polar-drive (PD)–ignition designs. The existing NIF configuration including the indirect-drive elliptical phase plates is used to directly drive room-temperature plastic (CH) shell implosions with a low-adiabat pulse shape (Fig. 1). Symmetry is improved by defocusing the beam spots in addition to beam repointing and different quad pulse shapes. The goal of these experiments is to understand laser–plasma interactions that can potentially influence gross hydrodynamic parameters such as symmetry and implosion velocity.

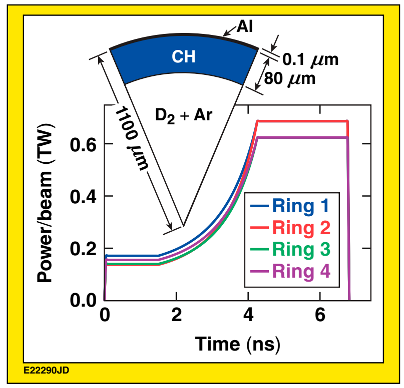

Figure 1. (a) The target used in the National Ignition Facility polar-drive (NIF PD) implosions. (b) The typical laser pulse shapes used in the designs.

Symmetry is diagnosed from gated x-ray self-emission images that measure the ablation surface position as a function of time[1] (Fig. 2). The amplitude of the various Legendre modes is obtained by decomposing the surface of the steepest gradient in emission. The first shot (N130128) showed a relatively large amplitude of the P_6 mode as indicated by the hexagonal structure in the image [Fig. 2(a)]. Improvements were made to the design using the 2-D hydrodynamic code *DRACO* that included a change in pointing, beam energies, and beam defocus. Predictions indicating a rounder image were validated with images from the next shot [Fig. 2(b)]. The amplitude of the P_6 mode is reduced by nearly a factor of 2 relative to the original design (Fig. 3). This set of experiments shows that implosion symmetry can be controlled on the NIF despite the compromised configuration with the ID phase plates.

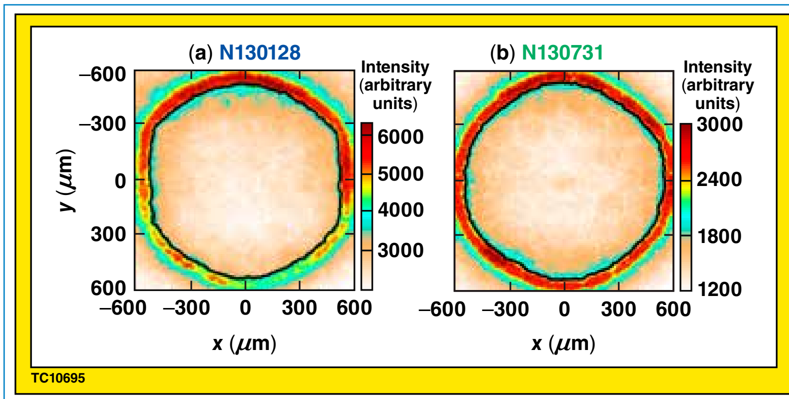

Figure 2. (a) A NIF PD implosion. (b) A NIF PD implosion showing improved sphericity compared to the earlier implosion in (a).

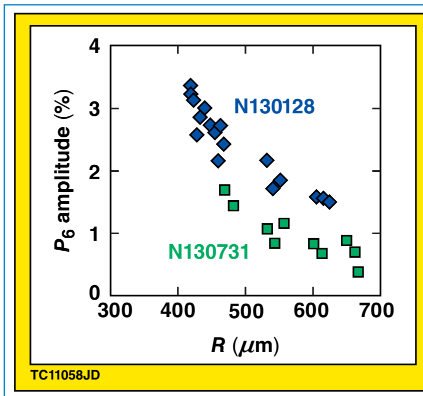

Figure 3. The amplitude of the P_6 mode for the two implosions on the NIF.

Omega Facility Operations Summary: The Omega Laser Facility conducted 118 target shots in September 2013 with an average experimental effectiveness of 90.7%. These shots included 89 OMEGA target shots and 29 OMEGA EP target shots. The average experimental effectiveness was 91% for OMEGA and 89.7% for OMEGA EP. This month's target campaigns included 15 shots for the ICF program carried out by LLE and LLNL-led teams; 32 shots for the HED program; 24 shots for the NLUF program conducted by teams led by Rice University, University of California, Berkeley, and the University of New Hampshire; 19 target shots for the LBS program for 2 experiments led by LLNL and LLE, respectively; and 28 shots for CEA (France). In addition to the target shots, the facility also conducted 14 maintenance shots on OMEGA EP during September. September marked the last month of the 2013 fiscal year. The total shot count for target experiments in FY13 was 1393 on OMEGA and 520 on OMEGA EP, i.e., 1913 target shots for the facility as a whole, including joint OMEGA and OMEGA EP target shots.

1. D. T. Michel *et al.*, Rev. Sci. Instrum. **83**, 10E530 (2012).