First NIF Polar-Drive Deuterium–Tritium (DT) Implosions: Two polar-drive target shots were taken in September at the National Ignition Facility (NIF). LLE had the lead role in the design and implementation of these experiments. The principal goal was to activate the NIF nuclear diagnostics suite in preparation for the beginning of the NIF ignition campaign. The shots marked the first deployment of a DT target on the NIF. The target experiments were performed in the polar-drive (PD) configuration[1] devised by LLE that uses NIF's indirect-drive beam configuration. The PD configuration requires repointing the NIF beams to achieve a nearly symmetrical drive on a spherical target. Figure 1 shows the NIF polar-drive beam-pointing configuration and Fig. 2 shows a target used for these experiments. The DT filling was performed at LLE's Tritium Facility. The two 192-beam polar-drive target shots were driven with a laser pulse with an overall width of 2 ns, as shown in Fig. 3, and with total on-target energies of 35 and 45 kJ. The two shots achieved the predicted DT-neutron yields of 1.5×10^{13} and 5.5×10^{13} for total laser energy of 35 and 45 kJ, respectively. These yields represent approximately 25% of the clean, ideal-perfect-target calculated yield. A framed x-ray image taken near the time of peak compression is shown in Fig. 4. The relatively symmetric core and fusion-neutron-yield performance are consistent with the polar-drive illumination pattern available on the NIF. The success of these experiments opens the path for additional PD implosions on the NIF over the next year. The next shots in this series are expected to produce neutron yields higher than the record of 1.3×10^{14} DT neutrons attained on OMEGA in 1996. Plans include additional campaigns to achieve neutron yields exceeding 1.0×10^{16} within the next year.

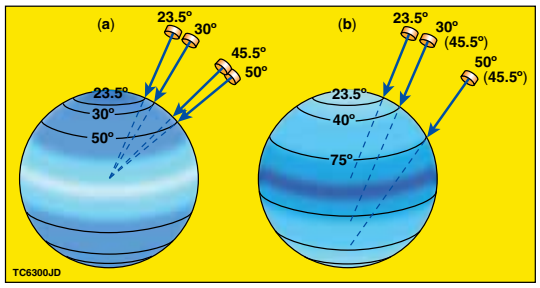

Figure 1. Polar drive was invented by scientists at LLE in 2003 to conduct direct-drive experiments on the NIF without the need to reconfigure the NIF to equatorial beams. (a) NIF conventional indirect-drive beam-pointing configuration (i.e., three rings of beams at 23.5°, 30°, and 50°) and (b) the repointing required to carry out polar-direct-drive experiments on the NIF.

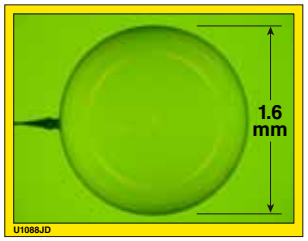

Figure 2. Photograph of one of the targets used on NIF polar-drive experiments. The targets consisted of 10-atm-DT-gas–filled, 4-μm-thick, 1600-μm-diam Hoppe[2] glass shells, held in place with 17-μm-diam boron fibers.

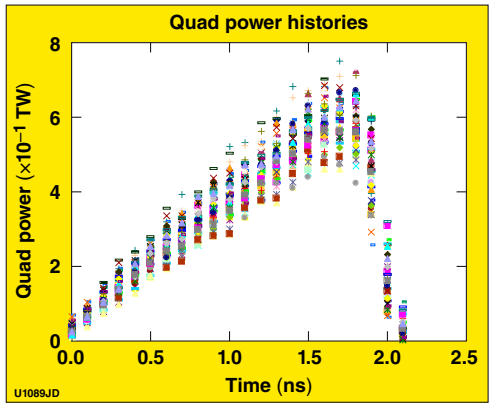

Figure 3. Laser-pulse shapes as measured on each of the NIF quads on a NIF PD target shot.

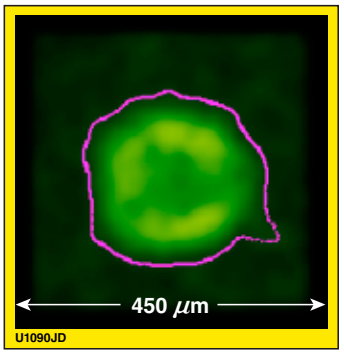

Figure 4. Gated x-ray image obtained on NIF PD target shot near the time of peak compression.

Omega Operations Summary: The Omega Laser Facility conducted 149 target shots in September—104 on OMEGA and 45 on OMEGA EP with an average experimental effectiveness of 98.1% and 100%, respectively. Twenty-five shots were conducted for the NIC program by teams led by LLE scientists; 35 target shots were carried out for the HED program by LANL and LLNL teams. The LBS program accounted for 12 shots taken by LLNL scientists and three NLUF teams led by Artep, Inc., the University of California–San Diego, and Rice University conducted 26 shots. The UR/FSC conducted 9 shots and CEA and AWE accounted for 29 and 13 shots, respectively.

1. S. Skupsky *et al.*, J. Phys. IV France **133**, 233 (2006).
2. M. L. Hoppe, presented at the 13th Target Fabrication Conference, Catalina Island, CA, 8–11 November 1999.