X-Ray–Backlit, Polar-Drive Implosions on the National Ignition Facility (NIF): X-ray–backlit images of the converging shell have been obtained on two consecutive deuterium-filled, plastic-shell polar-drive (PD) implosions on the NIF. The primary goal of these experiments is to obtain information about shell trajectory and shape at ignition-relevant intensities. Backlit images are used to verify previous measurements of trajectories obtained from gated x-ray images of target self-emission. These two measurements infer the location of different surfaces of the imploding target; the peak of self-emission occurs outside the target, whereas the peak x-ray absorption primarily samples the region close to the fuel–shell interface. The pulse shapes for the two shots were similar to those used on previous implosions except for a deliberate coasting phase introduced to permit x-ray backlighting; on-target energy was reduced to 476 kJ compared to the 655 kJ in an otherwise identical previous shot (Fig. 1). Two different backlighters—Fe (6.7 keV) and Cu (8.3 keV)—were selected for each of the nominally identical shots. Two quads (four NIF beams)—one each from the northern and southern hemisphere—were used for backlighting. Beam displacements and energies in the neighboring quads were adjusted to improve symmetry. Excellent backlit images have been obtained (Fig. 2) in both PD implosions. Trajectories obtained from backlighting show similar trends to those from self-emission; the trajectories are delayed compared to simulations that include only collisional absorption (Fig. 3). Cross-beam energy transfer (CBET) is likely the reason for this difference. Simulations including CBET are in progress. The neutron yield improved by nearly 70% for the shorter pulse compared to a longer pulse at higher energy, suggesting that laser imprint caused by the existing NIF beam smoothing significantly influences performance.

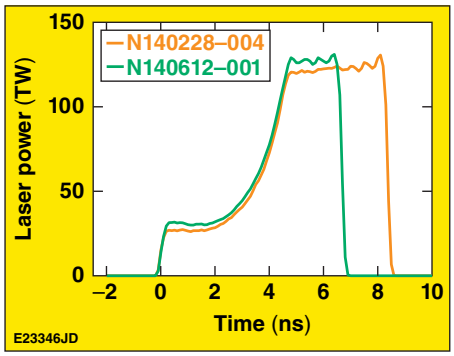


Figure 1. Pulse shapes for the backlit shots (N140612-001) compared to the previous shot (N140228-004) where only self-emission was used to infer trajectory.

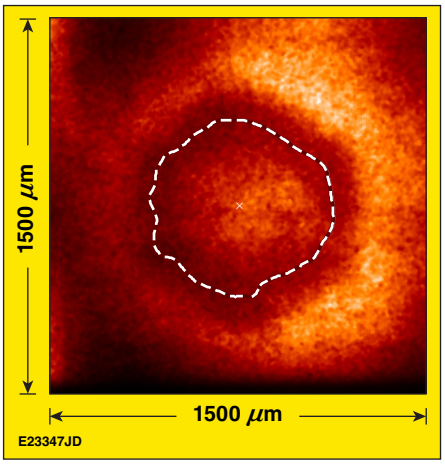


Figure 2. Images from backlit implosion N140612-001, using an Fe backlighter at a convergence ratio of ~2.8. The dashed line is the location of the surface of peak x-ray absorption.

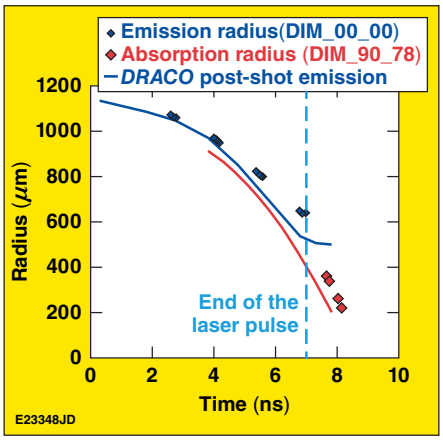
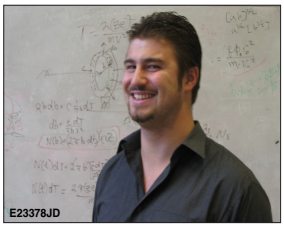


Figure 3. Trajectories inferred from self-emission images viewed from the pole compared to that inferred from backlit image viewed from the equator for NIF target shot N140612-001.

Omega Facility Operations Summary: The Omega Facility conducted 148 target shots in June with an average experimental effectiveness of 91.9% (122 on the OMEGA laser and 26 on OMEGA EP with experimental effectiveness of 91.8% and 92.3%, respectively). LLE scientists conducted 22 ICF experiments while LLNL and LLE led teams carried out 42 HED experiments. LLNL and LLE carried out 38 LBS target shots; one NLUF campaign led by MIT accounted for 8 target shots and CEA conducted 38 target shots.



2014 Marshall N. Rosenbluth Outstanding Doctoral Thesis Award: Dr. Mario Manuel was selected as the recipient of the 2014 Marshall N. Rosenbluth Outstanding Doctoral Thesis Award by the American Physical Society, Division of Plasma Physics. Manuel's thesis was based on work conducted under an National Laser Users Facility grant at the Omega Facility. The Award was established to recognize exceptional young scientists who have performed original doctoral thesis research of outstanding scientific quality and achievement in the area of plasma physics. His thesis is titled "Rayleigh–Taylor-Induced Electromagnetic Fields in Laser-Produced Plasmas."

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