In-Situ ***Measurement of Direct-Drive Target Illumination Uniformity***: Experiments are underway to infer the on-target illumination uniformity of the 60-beam OMEGA laser in these experiments. Variations in the x-ray emission from the surface of a spherical target are used to infer variation of the UV illumination. The experiments are performed with Au-coated CH spheres with diameters of 865 μm, mounted on stalks identical to those used on cryogenic target experiments (17-μm-diam SiC fibers), and are diagnosed with an array of 11 digitally recorded x-ray pinhole camera images. The cameras, normally used in precision beam pointing,[1] are arrayed to sample the entire surface flux of x rays emitted by the target. Figure 1 shows one such image. The experiment was performed with 100-ps pulses of UV (351-nm) light with an average energy of 14 J/beam—a value typical in the pickets used to implode cryogenic targets. The emission is limb-brightened, as expected coming from a plasma ~50 μm in thickness. The shadows cast by the support stalk of six of the lower ten beams of OMEGA are evident at the bottom of the image and are easily associated with the shadowed beams (Fig. 2). The shadows of the remaining four lower beams are not visible from this view because they are behind the stalk. Note that pairs of beams are at the same angle, making the shadows line up, approximately doubling their depth. Additional variations in the x-ray flux, and therefore associated UV illumination, are revealed by correcting the image for limb-brightening (Fig. 3). The corrected image contains the stalk shadows seen at greater contrast and localized peaks whose centers are approximately located at the projected centers of the hexagons and pentagons, i.e., where those beams overlap. The goal of the ongoing analysis is to provide the best estimate of the UV laser nonuniformity caused by stalk shadowing, beam balance, and beam overlap and to use this information in simulations to estimate any effects on implosion performance. The laser to x-ray conversion is calibrated on separate target-physics shots.[2]

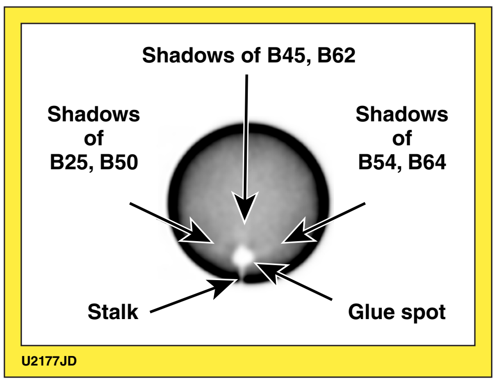

Figure 1. X-ray pinhole camera (XRPC) image of an 865-μm-diam Au-coated CH sphere illuminated with 60 OMEGA beams in a 100-ps pulse. The limb is purposely saturated in this negative image (dark means high x-ray flux). Shadows cast by the stalk of the lower beams are indicated. The glue spot covering the Au coating is larger than on an actual cryogenic target.

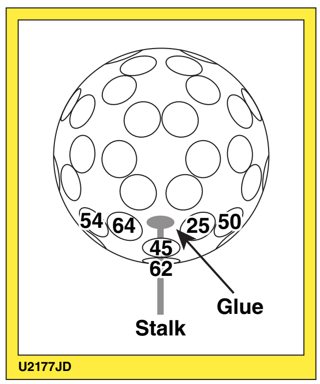

Figure 2. Orthographic projection of the target chamber sphere from the view of TIM-3. The location of the target stalk and glue spot are indicated. OMEGA beams of interest to the stalk shadowing are labeled.

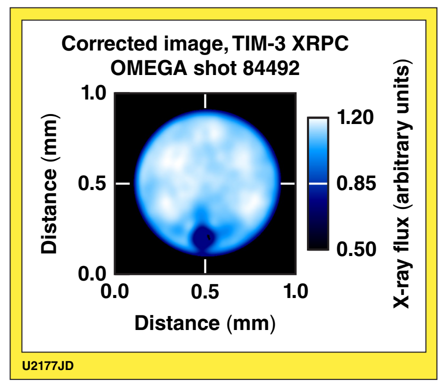

Figure 3. The TIM-3 image corrected for limb-brightening. Intensity values are linear in x-ray flux but not linearly proportional to the UV flux. The largest departures from the average are the glue spot (no x rays), the shadows of the lower OMEGA beams (less than average), and the regions approximately located at the beam overlaps at the centers of the hexagons and pentagons (above average).

Omega Facility Operations Summary: During March, 2017, the Omega Laser Facility conducted 160 target shots with an average experimental effectiveness (EE) of 97.5% (87 shots on the OMEGA laser and 73 shots on OMEGA EP with EE's of 96% and 99.3%, respectively). The ICF program accounted for 55 target shots for experiments led by LLE and NRL, and the HED program had 55 shots for experiments led by LANL, LLNL, and LLE. Two NLUF campaigns led by Princeton University investigators took 19 target shots and three LBS experiments led by LLNL and LLE accounted for 31 shots.

1. R. A. Forties and F. J. Marshall, Rev. Sci. Instrum. **76**, 073505 (2005).
2. F. J. Marshall *et al.*, Phys. Plasmas **11**, 251 (2004).