Polar-Drive Experiments with Shimmed Shells: A series of OMEGA target experiments has commenced to explore the benefits of using shimmed (pole-to-equator thickness variation) targets to enhance polar-drive implosion symmetry. A recent polar-drive ignition-target design for the National Ignition Facility, described in Ref. 1, includes a shimmed DT-ice layer to enhance the calculated gain. Collins *et al.*, point out that shimming either the ice layer or the shell will allow the target equator to be more easily driven to the same speed as the target polar regions. Precision-machined targets from the General Atomics (GA) Target Facility have been used to explore this shell-shimming benefit to polar drive.

The target shim was chosen by using a series of *LILAC* simulations to determine the shell-thickness variation needed to compensate for an oblate intensity pattern with a 16% peak-to-valley variation. Figure 1 shows this shim variation calculated for a 10-atm, D_2-filled, 27-μm-thick CH shell, imploded with 24-kJ incident on the target in a 1-ns-sq pulse of UV light. The thickness variation was chosen so that the fuel–shell interface would be approximately spherical at 2.0 ns (average radius 49 μm). To accommodate the machining of the target from a single turning point, this curve was further modified to restrict the variation to angles greater than 30° from the poles. This curve and an example of a measured shell thickness profile of a GA-shimmed shell are shown in Fig. 1.

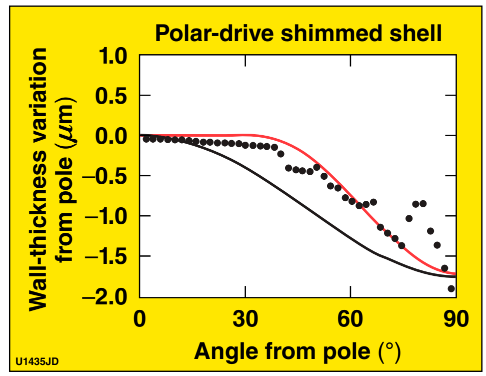

Figure 1. The wall thickness variation as a function of the angle to the target pole for a shimmed shell target. The black line is the ideal thickness variation for an oblate intensity pattern. The red line is the requested shell variation modified to avoid machining at angles less than 30° from the pole. The symbols are measured variation for an actual GA shimmed shell.

Targets for this experiment were imploded with 14 kJ of UV light from 40 OMEGA beams using a triple-picket, high-convergence pulse shape. Beam aiming was chosen by picking the most-symmetric implosion as determined from a series of *DRACO* 2-D hydrocode simulations. The pointing chosen (0-, 120-, and 140-μm offsets for Rings 1, 2, and 3) has beam offsets slightly less than the optimized case for imploding a spherical shell with polar drive on OMEGA as described in Ref. 2 (90-, 150-, and 150-μm offsets for Rings 1, 2, and 3). Figure 2 shows framed radiographs of a shimmed and a spherical shell ~60 ps before stagnation (t ~ 3.6 ns). Both images have 140-μm-diam circles superposed to highlight the differences in the shapes of the shells. The shimmed-shell target, in combination with this beam pointing, produces a more spherically shaped implosion. Further experiments on OMEGA will explore the dependence of implosion symmetry on the shape of the shimmed shell and the beam pointing.

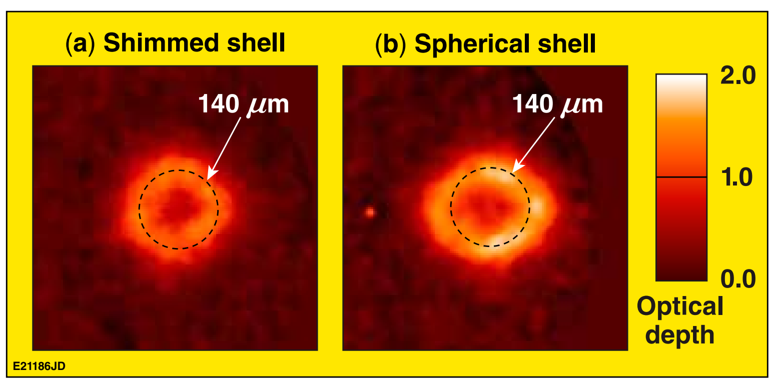

Figure 2. 500- × 500-μm region framed x-ray radiographs of (a) a shimmed and (b) a spherical shell imploded with polar drive on OMEGA. Frame times are both ~3.6 ns after the start of the pulse and are within a 30-ps time window.

Omega Facility Operations Summary: The Omega Laser Facility conducted 158 target shots during March 2012 with an average experimental effectiveness of 94.3% (114 shots on OMEGA with an experimental effectiveness of 93.9% and 44 shots on OMEGA EP with an experimental effectiveness of 95.5%). The National Ignition Campaign recorded 87 target shots and the HED programs received 32 shots. One NLUF experiment led by MIT conducted 19 shots. The Center for Radiative Shocks of the University of Michigan had 12 shots and the CEA conducted 8 shots.

1. T. J. B. Collins *et al.*, Phys Plasmas **19**, 056308 (2012).
2. F. J. Marshall *et al.*, Phys. Rev. Lett. **102**, 185004 (2009).