Cryogenic Target Performance: Over the past several weeks, 11 cryogenic D_2 target implosions were performed on the OMEGA laser. The layer quality of these capsules was generally quite good, ranging from 2.6 to 7.6 μm rms with an average of 4.3 μm rms. These rms values represent an average of either 12 or 24 independent shadowgraph characterizations (for more detail, see the September 2003 Progress Report) of the full capsule (the capsule is rotated 15° or 30° around the polar axis, and a shadowgraph is taken at each angle). The higher-quality layers were driven with the alpha401 pulse (typically 16 kJ). This pulse is designed to put the fuel on an adiabat $\alpha \sim 4$ (α is defined as the ratio of the pressure to the Fermi-degenerate pressure). The rougher layers were driven with the standard high-adiabat ($\alpha \sim 25$) SG1018 square pulse (typically 23 kJ). The capsule offset from target chamber center (TCC) at shot time on these shots was determined by comparing x-ray pinhole camera images of the shell against a reference stalk-mounted implosion. The average capsule offset was 30 μm (the range was 19 to 42 μm). These relatively small and consistent TCC offsets were the result of considerable effort to identify and eliminate (or mitigate) sources of both static misalignment and dynamic vibration. This effort resulted in changes to the upper shroud pull trajectory, improved optical alignment calibrations, and a new "flat C" mount to replace the original "C" mount (these new mounts relax the target rotational alignment tolerance with respect to the layering sphere and are somewhat stiffer that the original C mounts). The performance of the capsules driven by the SG1018 pulse is summarized in Fig. 1, which shows the measured yield normalized to the predicted 2-D yield from the hydrocode *DRACO* plotted as a function of the fully characterized ice roughness. The three performance curves in the figure represent a set of 2-D *DRACO* calculations in which a standard capsule is offset from TCC by 0 (black), 20 (red), or 40 μm (blue), and the ice roughness is varied. The data points are labeled with the measured offset, and in general the performance of these capsules tracks the offset and ice quality quite well. A point of particular interest in the figure is shot 28900 (for more details on this shot, see Ref. 1 and the September 2003 Progress Report). After a careful analysis of the fill and transfer station (FTS) data taken during the filling process for this capsule, the ice-layer thickness was corrected for a leak in the permeation cell (the layer thickness was less than originally thought). The originally reported near-1-D performance is now very close to the predicted 2-D performance for the measured layer quality and offset. Indeed, further analysis of past FTS data led to the identification and repair of an intermittent leak in the permeation cell, which corresponded directly with several anomalously high-performing targets. The performance of the low-adiabat implosions from this series was generally quite good despite the realization that the alpha401 pulse shape was not optimized for the actual capsules being imploded: the alpha401 pulse was designed for a 5-μm CH wall/100 μm of D_2 ice, while the as-shot capsules have averaged a 3.6-μm wall with 96 μm of D_2 ice. A new $\alpha \sim 4$ pulse shape has been developed for these capsules and will be tested early in 2004.

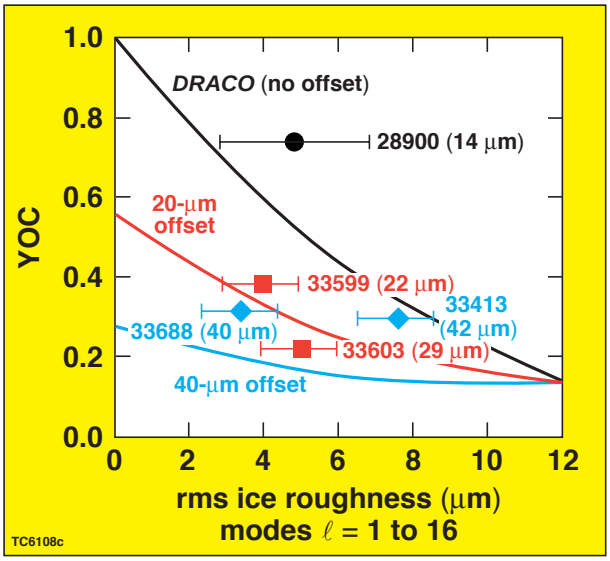

Figure 1. Analysis of experimental neutron YOC drawn as a function of target initial ice roughness. Curves are drawn for several series of *DRACO* runs analyzing the degradation of YOC with increasing ice roughness for a fixed initial target offset.

OMEGA Operations Summary: In the period of 1–18 December, OMEGA completed 102 target shots for LLE and LLNL. The 57 LLE shots included 19 for integrated spherical experiments, 2 for the cryogenic target campaign, 21 for the stockpile stewardship program, 4 for diagnostic development, and 11 Rayleigh–Taylor instability experiments. LLNL had a total of 45 shots for several campaigns. Additionally, during the period of 19–31 December, scheduled system maintenance was performed, including removal of the lower pylon from the target chamber for modifications, completion of the DPR mount tilt assembly on the first four beamlines, replacement of lenses in some spatial filters, and completion of the semiannual beam-timing test.

1. T. C. Sangster *et al.*, "Direct-Drive Cryogenic Target Implosion Performance on OMEGA," Phys. Plasmas **10**, 1937 (2003).

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