Cryogenic Target Shots: Three 60-beam cryogenic target implosions were carried out on OMEGA during the week of 9 October. CD shells with ~9- to 10-μm-thick walls were filled with 1000 atm of D_2 to provide ~100-μm-thick ice layers. The layers were formed by IR laser heating at a wavelength of 3.16 μm. For these experiments the inner-surface roughness of the ice layer was estimated to be <10-μm rms for modes $\ell < 10$. After the targets were filled and layered, they were transported to the OMEGA target chamber and inserted through the lower pylon. Each target was positioned at the center of the target chamber, and the cryogenic shroud was retracted, exposing the target to the ambient chamber radiation for ~60 ms prior to the laser firing. At the time of the shot, the shell temperature was estimated to be 18.5° K, resulting in a residual D_2 gas pressure of ~ 2.4 atm.

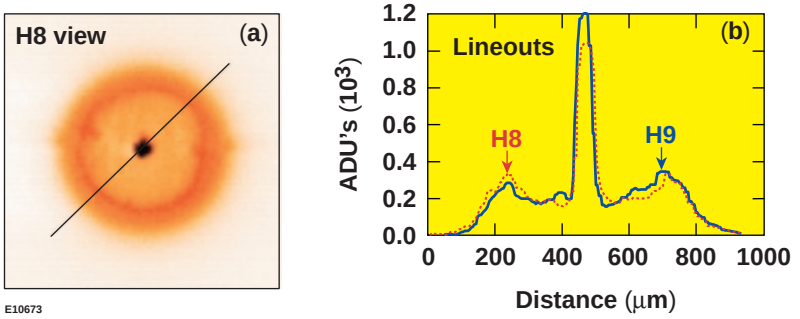

Figure 1. (a) X-ray pinhole image of cryogenic target shot taken with an electronic camera. (b) Lineouts from images from two orthogonal cameras (H8 and H9). Units are analog-to-digital values (ADUF).

The targets were imploded with PS26, a 6:1-contrast, 2.4-ns-long shaped pulse. The on-target energy was 17 kJ, and both 1-THz, 2-D SSD and polarization smoothing were employed. The first two targets had nearly spherical layers and produced ~10^9 neutrons (3%~5% of the yield predicted by 1-D simulations). The neutron-averaged ion temperature was 2.5 keV. Figure 1 shows a time-integrated x-ray pinhole camera image of one of the implosions. The non-uniformities in the imploding shell are due, in part, to the glue used to hold the target to the spider silk in the target mount. The secondary neutron yield on these two shots was ~0.5% of the primary neutron yield, and the secondary proton yield was ~0.1% of the primary neutron yield. These results suggest that the core electron temperature was >2 keV and the fuel areal density was >20 mg/cm^2. The third D_2 target was not layered and the primary neutron yield dropped by an order of magnitude.

IR1 Streak Camera: The IR1 streak camera, now fully operational in the Pulse Generation Room (PGR), is a multichannel streak camera. It measures the IR pulse shape at the input of the OMEGA amplifier chain for each driver line as well as the fiducial timing laser on each target shot. The measured pulse shapes can be used as input to the *RAINBOW* optical propagation code to generate an expected UV pulse shape at the end of the system. Figure 2 shows an average variance of less than 2% between the P510 streak cameras, which measure the UV pulse shapes in the Target Bay, and the UV output prediction based on the pulse shape measured by the IR1 streak camera. The on-shot predictions serve as a validation of the primary use of the IR1 streak camera, which is to predict the pulse shape for the next target shot. Thus it is now possible to measure the pulse shape in the PGR, feed that pulse shape to the *RAINBOW* propagation code along with the current amplifier configuration, and get an accurate prediction of what will be delivered at the output of the system. If the expected pulse shape does not meet the specification, adjustments can be made to the front end of OMEGA, and the procedure can be iterated until the desired pulse shape is obtained.

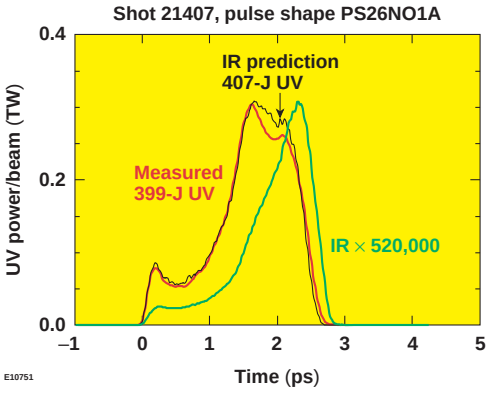

Figure 2. IR1 streak camera recording of OMEGA IR pulse at input to amplifier chain (green) and output UV (red) compared to prediction based on IR1 record (black).

OMEGA Operations Summary: The execution of three cryogenic target shots during the week of 9 October was the highlight of the OMEGA facility operations for the month. The cryogenic target shots were carried out in one week along with an additional 25 warm target shots. The operation was limited by the two-day cycle time of the single moving cryostat transfer cart (MCTC) that was available. LLE is building up it's supply of MCTC's so that by the end of FY01 it will be possible to support up to 12 deuterium-fueled cryogenic target shots per week. OMEGA operations for October totaled 102 target shots spread among five LLE campaigns (72 shots, 7 shot days) and four LLNL campaigns (30 shots, 3 shot days). In addition, one week of the month was devoted to scheduled system maintenance activities.

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