October 1999 Progress Report on the Laboratory for Laser Energetics Inertial Confinement Fusion Program Activities

Cryogenic Target-Handling System: Integration of the OMEGA Cryogenic Target-Handling System (CTHS) into the OMEGA facility continues interleaved with the regular shot cycle. Significant progress has been made: four of the five sub-systems that comprise the CTHS have been successfully tested and the remaining sub-system is being readied for test. Three targets were filled to 1000 atm, cooled to 19.5 K, and transferred within the fill/transfer cryostat. The targets include two plasma polymer capsules with 10- and 20-μm walls and one polyimide capsule with a 4-μm wall. The cryogenic target positioner placed a warm target at the center of the target chamber, and two 4-mm gold-coated pointing targets were shot. This demonstrated the functionality of the cryostat-insertion and target-positioning mechanics. Also, the target positioner and associated electronics were demonstrated to withstand the effect of two full-power target shots. Figure 1 shows the target positioner in the target chamber during one of these shots. Figure 2 shows the placement of the laser beams on the 4-mm gold-coated pointing sphere.

Fig. 1 Cryogenic target positioner used to place a 4-mm pointing sphere at chamber center.

The controller for the linear motor portion of the shroud retractor was replaced with a more fine-tuned unit. This eliminated the sporadic control problems that afflicted the previous unit. The demonstrated maximum retraction velocity is 4.8 ms^{-1} with a constant acceleration of 3 g and deceleration of 7 g. With this performance the target is exposed to ambient radiation for ~48 ms prior to laser irradiation.

The remaining issues to be resolved before the first cryogenic target can be shot are the mechanical performance of the moving cryostat's shrouds and retraction tests with a cryogenic target. While the shrouds achieve their design temperature, 16 K at the target, the mechanical design used to achieve this performance creates a considerable frictional force where the shrouds mate. Design changes are being made to the shrouds to lower the frictional force to allow shroud replacement in the FTS, to simplify the assembly and disassembly process, and to better control the exchange gas pressure around the target. The next tests will determine how these changes affect the shroud's mechanical and target survivability.

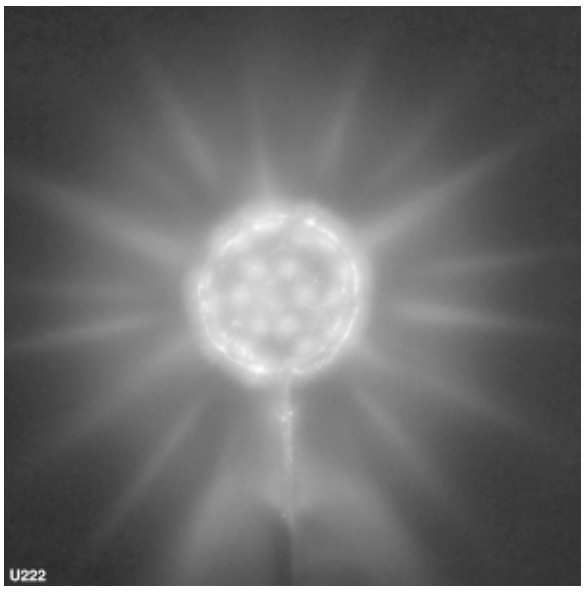

Fig. 2 Placement of laser beams around the pointing sphere.

OMEGA Operations Summary: A total of 129 target shots were taken on OMEGA during the four weeks of laser operations in the first month of FY00. One of the highlights for the month was the initial testing of CTHS hardware on OMEGA. Two shots during a diagnostic development (DD) campaign were used to demonstrate that the target insertion and positioning capabilities of the lower pylon and moving cryostat were operable. Two internal ISE campaigns shared 66 shots; DD shots included 28 for fast electron and adiabat investigations. LANL users had 33 shots dedicated to various hohlraum target configurations.

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