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

Cryogenic Target–Handling System: The target-filling and insertion portions of the Cryogenic Target–Handling System (CTHS) are assembled and the individual sub-systems are being tested. The target-filling portion of the CTHS consists of a two-stage pressure-intensification system and a cryostat (Fig. 1). The entire high-pressure ensemble is doubly encased in (a) a vacuum vessel and (b) a glovebox (Fig. 2). This design provides added protection for DT operations. The minimum pressure step during filling (0.012 psi), which occurs at 14,500 psi, is well below the 0.5-psi buckling threshold of a 1-μm-wall OMEGA capsule. The filled targets are cooled in a cryostat and individually transferred to a "moving cryostat" that transports the target to the target chamber. The filling cryostat has reached a temperature of 16 K on the top portion and 24 K (average) on the base; these temperatures will allow the use of thin-wall (1-μm) capsules. Inserting a cryogenic target into the target chamber is achieved using a "moving cryostat" to transport the target and a high-speed motor to retract the cooling shrouds immediately prior to the shot. These items are being tested at General Atomics. The moving cryostat has demonstrated sufficient cooling capability to maintain a target below 18.5 K during the layering process— a threshold that allows both D_2- and DT-filled targets to be used. The high-speed motor was operated at a constant velocity of 4.8 ms^{-1} and successfully retracted the cooling shrouds without dislodging the target. The target will be exposed to ambient radiation for less than 50 ms to minimize any disruption to the smoothness of the ice layer prior to the laser shot. Current tests of the individual portions of the CTHS are approaching completion and fully integrated tests have begun.

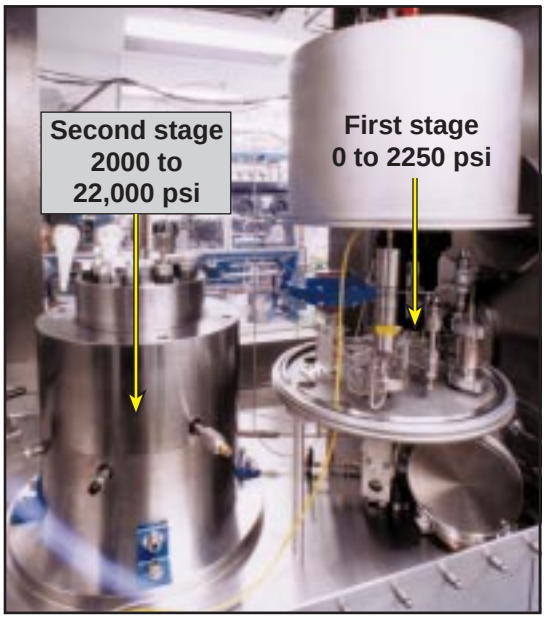

Fig. 1

Gratings for 2-D SSD: A full set of holographic gratings has been manufactured for the upcoming implementation of improved two-dimensional (2-D) SSD on the OMEGA laser system. By the end of the production series, the overall grating yield reached 75%. This was achieved with the triple requirement including 95% efficiency, one-tenth wavelength phase front, and high fidelity. Additional holographic gratings, for spectral control of a terahertz bandwidth, are now being investigated.

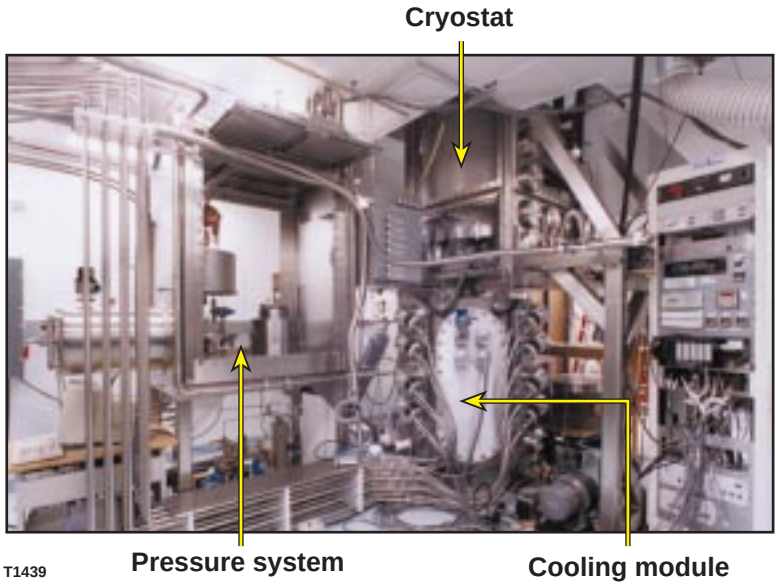

Fig. 2

OMEGA Operations Summary: During the month of April, LLE conducted a total of 122 target shots for five campaigns: 40 Rayleigh–Taylor instability (RTI), 27 integrated spherical experiments (ISE), 22 long-scale length plasma (LSP), 10 National Laser Users' Facility (NLUF), and 23 diagnostic development shots. Several days of laser test shots were supported for the power balance campaign for characterization of amplifier gain and IR beamline performance. We continue to upgrade frequency-conversion systems to the new dual-tripler design that will allow efficient conversion of up to 1 THz of laser bandwidth; ten beamlines have been modified to date.

Contact: Wolf Seka (716) 275-3815; fax: (716) 275-5960; e-mail: seka@lle.rochester.edu
John M. Soures (716) 275-3866; fax: (716) 256-2586; e-mail: jsou@lle.rochester.edu