2000

First Cryogenic Implosions of D_2-filled Targets

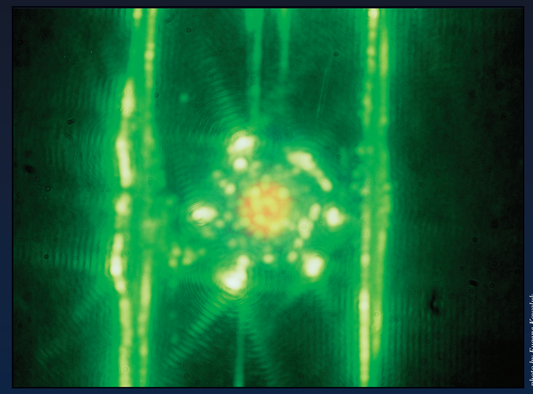
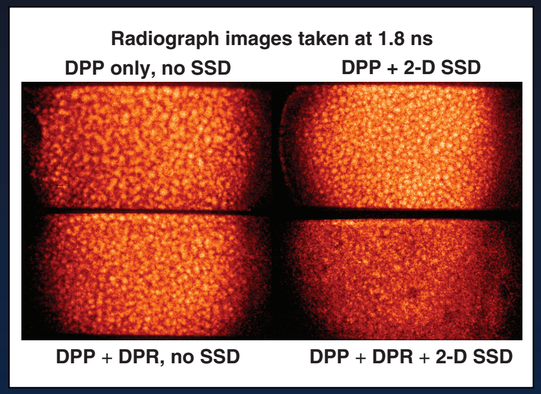


photo by Eugene Kowaluk

First cryogenic implosions on the 60-beam OMEGA laser showing remnants of the spider webs on either side of the imploding target

The first cryogenic implosions of D_2-filled targets using the new Cryogenic Target Handling System (CTHS) was carried out on 14 July 2000. This was a major milestone in the program that would eventually lead to direct-drive, high-gain implosions on the National Ignition Facility. The primary capabilities for the CTHS included filling thin-walled plastic shells with a room-temperature-equivalent pressure of 1500 atm of DT; producing four targets per fill cycle, up to 12 targets per week; cryogenically manipulating and transporting targets to the center of the target chamber; using infrared heating to smooth the D_2 or DT-ice surface into an ice shell; characterizing the ice smoothness; and safely operating with tritium. This system was the first of its kind to become operational.

Polarization Smoothing Implemented



Higher irradiation uniformity produces less imprint, particularly with DPR's and 2-D SSD

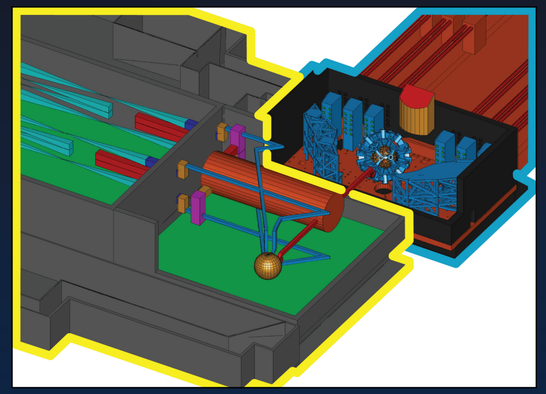
Polarization smoothing using distributed polarization rotators (DPR's) was implemented on OMEGA along with high-bandwidth (1-THz) 2-D SSD in 2000. The improved level of beam smoothing led to increased performance by direct-drive capsules.

"Experimental Investigation of Smoothing by Spectral Dispersion" by S. P. Regan *et al*. was published in the September Journal of the Optical Society of America B, reporting on measurements of smoothing rates for smoothing by spectral dispersion (SSD) of high-power, solid-state laser beams used for inertial confinement fusion (ICF) research.

S. P. Regan, J. A. Marozas, J. H. Kelly, T. R. Boehly, W. R. Donaldson, P. A. Jaanimagi, R. L. Keck, T. L. Kessler, D. D. Meyerhofer, W. Seka, S. Skupsky, and V. A. Smalyuk, "Experimental Investigation of Smoothing by Spectral Dispersion," J. Opt. Soc. Am. B ***17*** *(9), 1483–1489 (2000).*

2001

OMEGA Extended Performance Laser Proposed



Preliminary OMEGA EP design

In October 2001, LLE proposed a major enhancement to the OMEGA Laser System to include four new high-energy beamlines, a versatile high-intensity capability, and a new auxiliary target chamber. The high-intensity beams would be generated using the chirped-pulse–amplification (CPA) technique originally developed and demonstrated at LLE in 1985.

Cryogenic Target Implosions Continued

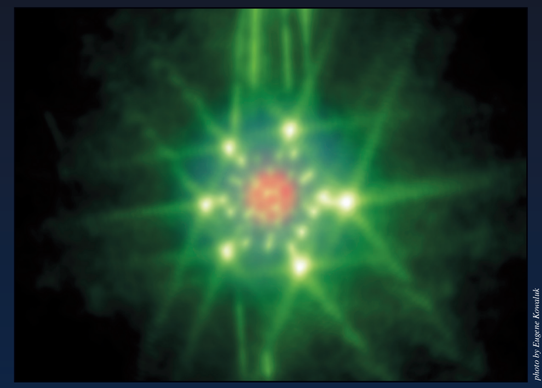


photo by Eugene Kowaluk

Time-integrated photograph of an imploding OMEGA cryogenic target

With the completion of the improvements to the OMEGA Cryogenic Target Handling System in August 2001, cryogenic target implosions were restarted. Five target shots were successfully performed using layered and characterized thin-wall targets.

Simulations based on ray-tracing calculations show that the 60 OMEGA beams are both reflected from the front of the target and refracted from behind the target into the camera lens. In this way all 60 laser spots are visible in the photograph.