FY01 Laser Facility Report

Improving operational reliability for precision spherical implosions including direct-drive cryogenic targets was the primary priority for FY01 on OMEGA. Laser diagnostics and techniques to characterize and improve power balance performance were extended beyond prior achievements to allow experimentalists to probe fine details of spherical target performance. In particular, plastic-shell implosions with THz SSD (smoothing by spectral dispersion) and polarization smoothing show good reproducibility and performance. All users, including experimentalists fielding indirect-drive (ID) experiments, have benefited from the improved repeatability and reliability that has come from the power balance program. (See Table 88.X for a summary of this year's targets shots.) System improvements were also geared toward specifically improving flexibility for ID experiments. Highlights of these changes and other achievements of FY01 include the following:

- The P510 UV streak camera system was completed to provide streak camera–based pulse shape, pulse timing, and power balance for all beams on every shot. The cameras combine 1000:1 signal to noise at the peak and a bandwidth of 11 GHz. Each cluster of ten beams is captured on a single camera, thus the full complement consists of six ten-beam instruments.

- Power balance of <5% was routinely achieved for 1-ns square pulses by increased execution of periodic laser-tuning shots combined with continuous monitoring and optimization of frequency-conversion-crystal (FCC) tuning.

- Power balance on target was investigated and optimized through careful characterization of x-ray yield from the focal spot of each of the 60 beams. For some implosion shots, the results were used to adjust the power settings of the beams to investigate elimination of residual power balance errors. This technique demonstrated that peak x-ray intensity measurements of 6% rms can be improved to 2% rms.

- Cryogenic target capability was extended through deployment of additional Moving Cryostat Transfer Carts (MCTC's), increased diagnostics, and refined control. Three fully functional MCTC's have been deployed as of the end of FY01, providing flexibility between the filling station, characterization and layering station, and target delivery to OMEGA. While the maximum capacity to shoot up to eight direct-drive cryogenic targets in a week was not realized in FY01, five good cryogenic implosions were accomplished during a two-week ISE (integrated spherical experiments campaign.

- The Wide-Field Target Viewing System (WFTVS) was modified in FY01 to handle images from a mega-pixel-class camera. A 2-k × 2-k array was deployed to provide a four-fold improvement positioning capability over the entire field of view of the viewing system. Indirect-drive targets with point-imaging backlighter targets can now be more precisely positioned in the chamber.

- New elliptical-focal-spot distributed phase plates (DPP's) have been deployed. These optics can be used to create uniform, circular, drive spots on EOS targets and other planar foils when the targets are not normal to the beam. Several designs are available to compensate for the incidence angles of beams from three cones.

- A completely reengineered Path Length Adjustment System (PLAS) was developed and integrated into the system largely to accommodate the flexibility demanded by users from LLNL and LANL. The new hardware and software allow for rapid reconfiguration of beam timing on target. Staggering beam arrival times for backlighting and long drive pulses is frequently requested by the user community.

Table 88.X: The OMEGA target shot summary for FY01.

LLE-ISE	376
LLE-RTI	106
LLE LPI	50
LLE (other)	44
LLE-SSP	113
LLNL	312
LANL	124
NLUF	125
CEA	29
SNL	10
Total	1289