
FY03 Laser Facility Report

User demand was met in FY03 by continuing to operate extended shifts during select weeks. Over 95% of planned target shots were executed for a total of 1381 shots (see Table 96.VI). Shaped-pulse cryogenic implosions highlighted the ongoing development of direct drive cryogenic capability. A total of 20 spherical and 51 planar cryogenic D₂ shots were performed. Pulse-shape performance improved dramatically with the addition of diode-pumped regenerative amplifiers. Target irradiation uniformity was improved by implementing several changes, including a new set of distributed phase plates (DPP's) and improvements to beam-pointing precision. Highlights of other achievements and active projects as of the end of FY03 include the following:

- Installation of LLE-built diode-pumped regenerative amplifiers on all three laser drivers improved pulse shape and energy stability. Production-model regens were installed on both the main and backlighter drivers, replacing flashlamp-pumped units. Additionally, the prototype diode-pumped regen on the SSD driver was replaced with a production model. A concomitant increase in pulse-shape effectiveness from 93% in FY02 to 98% in FY03 resulted.
- Adiabatic shaping using picket pulses improved the performance of direct-drive ICF targets. Picket-pulse development continued with the application of new techniques for improving picket-pulse quality and stability. Improved picket-pulse prediction routines and IR streak cameras resulted in improved picket-pulse performance.
- Laser-driver timing system modifications provided the capability to more precisely delay individual drivers with increased range. All drivers are now capable of being delayed or advanced hundreds of nanoseconds with ~100-ps precision. This new capability has been utilized extensively to improve the effectiveness of experimental campaigns.
- The implementation of a new set of DPP's provided improved irradiation uniformity for direct-drive spherical capsules. The new DPP's, designated SG4, produce a flatter intensity distribution on target than the previous set (SG3). In addition to producing a larger effective beam area on target, the SG4 DPP's have a smaller beam-to-beam shape variation than their predecessors.
- Distributed polarization rotators (DPR's) continued heavy use in FY03. All DPR's were modified for remote retraction and reinstallation, improving flexibility for reconfiguring to indirect-drive setups. Nonlinear losses in the UV were observed due to DPR reconversion. This phenomena was investigated and corrective action initiated.
- The overall OMEGA irradiation uniformity on target was improved by using active repointing. Active repointing consists of evaluating the actual beam positions on target using x-ray images of the beam spots on a 4-mm, Au-coated pointing target and then repointing individual beams. Subsequent pointing shot offsets have been reduced from ~23 μm rms to 11 μm rms.
- To allow lower beam energy while preserving pulse shape, the use of frequency-conversion-crystal doubler detuning has been implemented; it was used extensively in FY03 on limited beam sets.
- Scientists and engineers from Lawrence Livermore National Laboratory along with LLE collaborators successfully implemented a 4ω (fourth harmonic, 263 nm) target irradiation capability on one of the 60 OMEGA beams. Experiments utilizing the 4ω capability were conducted in FY03, and more extensive use is planned for FY04.
- Shot operations continued in parallel with construction of the new OMEGA EP building, which commenced in July 2003. Building construction activities were carefully monitored to ensure the stability of target positioning and beam pointing at shot time. An EP beam transport opening was also created in the east target bay wall for propagating future EP beamlines into the OMEGA target chamber.

Table 96.VI: The OMEGA target shot summary for FY03.

Laboratory	Planned Number of Target Shots	Actual Number of Target Shots
LLE	744	648
LLNL*	415	390
LANL**	124	158
SNL	25	30
NLUF	121	123
CEA	30	32
Total	1459	1381
LLE ISE		222
LLE SSP		168
LLE DD		72
LLE LPI		61
LLE RTI		45
LLE Cryo		31
LLE Astro		28
LLE PB		21
LLE Total		648
*Includes 39 shots in collaboration with LANL.		
**Includes 8 shots in collaboration with LLNL.		