
FY05 Laser Facility Report

The OMEGA Facility continued to operate extended shifts during select weeks in FY05, accommodating user demand by conducting 1461 target shots (see Table 104.III). Highlights of other FY05 achievements include the following:

- The SSD, main, and “backlighter” OMEGA laser sources were converted to integrated front-end sources (IFES). The IFES replaces the existing OMEGA master oscillators (OMO’s) and two pulse-shaping amplitude modulators. The IFES architecture consists of a single-frequency, continuous-wave (cw) fiber laser, a dual-amplitude modulator for pulse shaping, and a cw-pumped fiber amplifier that boosts the energy injected into OMEGA’s diode-pumped regenerative amplifier. The IFES system requires significantly less maintenance, is easier to operate, requires no optical alignment, has improved pulse-shaping stability, and is much more reliable than the OMO system. The “fiducial” laser source will be converted to the IFES architecture early in FY06.
- TIM-based target positioning systems (TTPS) were utilized on a number of experimental campaigns. These instruments were developed to improve the speed and accuracy of alignment for complex targets. Previously, high-magnification x-ray imaging pinhole arrays had been mounted on the same stalk as the primary target. This configuration put the burden of alignment on target fabrication and often required several metrology iterations to establish the angle of the pinhole substrate with respect to the primary target within allowable specifications. By using separate targets, overall time spent in target fabrication, metrology, and alignment has been reduced dramatically and target positioning precision has improved.
- The planar Moving Cryostat Transfer Cart (Cart 4), was modified to accommodate cryogenic hohlraum experiments. Cart 4 is used routinely to provide cryogenic solid/liquid D₂ targets for experiments on D₂ equation of state (EOS), multiple shock timing and convergence, and Rayleigh–Taylor instability growth. These experiments directly support the National Ignition Campaign. Cryogenic gas-filled (He and H) hohlraums are part of the indirect-drive ignition point design. Cart 4 was modified to field hohlraums at temperatures appropriate for the ignition point design. The first experimental series provided valuable temperature/density data. The target design is currently being modified for experiments in FY06 to minimize the target debris associated with the thermal mass in contact with the hohlraum.
- High-yield cryogenic DT experiments are expected in early FY06 following a successful tritium readiness review in June 2005. In anticipation of these experiments, a number of new high-yield diagnostic systems have been (or are being) implemented on OMEGA. These include the 12-m nTOF (neutron time-of-flight diagnostic 12 m from target chamber center), a chemical vapor deposition (CVD) diamond detector for bang time, a light-pipe–based neutron temporal diagnostic for reaction history and γ -ray bang time, a permanent neutron imaging capability, and a magnetic recoil spectrometer for neutron spectroscopy and areal density. The full implementation of this new instrumentation suite should be completed in FY06 and will give the facility diagnostic capabilities for high-yield DT implosions comparable to those for the lower yield standard D₂ implosions.
- A continuously pumped centralized vacuum system for OMEGA’s harmonic energy detector (HED) vacuum tubes was designed and installed. This system significantly increases the flexibility to refurbish and perform maintenance on the vacuum tubes, ensuring operational readiness. Approximately one-sixth of OMEGA is outfitted with the modified tube design, with the remainder to be installed in FY06.
- The east wall of the OMEGA Target Bay was modified to support transport of the OMEGA EP beams to the OMEGA target chamber. OMEGA Facility modifications planned for FY06 include the installation of OMEGA EP beam transport into OMEGA target chamber port H9 and the installation of the off-axis parabola inserter on port H7. This installation will remove the GMXI diagnostic from port H9 and TIM-2 from port H7.

Table 104:III: The OMEGA target shot summary for FY05.

Laboratory	Planned Number of Target Shots	Actual Number of Target Shots
LLE	715	701
LLNL	375	400
LANL	140	138
SNL	30	34
NLUF	120	130
CEA	30	34
NRL	20	24
Total	1430	1461
LLE ISE		303
LLE SSP		172
LLE RTI		95
LLE ASTRO		38
LLE DD		30
LLE CRYO		23
LLE DDI		16
LLE LPI		16
LLE PB		8
LLE Total		701