

# FY08 Laser Facility Report

## OMEGA Laser Facility

During FY08 the OMEGA Laser Facility conducted 1169 target shots on OMEGA and 85 target shots on OMEGA EP for a variety of users (see Table 116.III). A total of 50 D<sub>2</sub> and 8 DT low-adiabat cryogenic target implosions were performed. Double- and triple-picket pulse-shaping developments highlighted the ongoing development of direct-drive cryogenic implosion capability. The OMEGA Availability and Experimental Effectiveness averages for FY08 were 91.3% and 96.1%, respectively. Highlights of other achievements for FY08 include the following:

Pulse-shaping capability has evolved to meet the demands of producing double- and triple-picket shaped pulses for cryogenic experiments (see Fig. 116.54). The picket-generation hardware has been upgraded to allow for the creation and independent timing/amplitude control of three picket channels. Pulse-shape measurement diagnostics and analysis software have also become more sophisticated to accurately predict picket energies and UV pulse shapes.

A new harmonic energy detector (HED) system was designed and installed to replace the legacy system that was based on aging CCD technology and controlled by dated software.

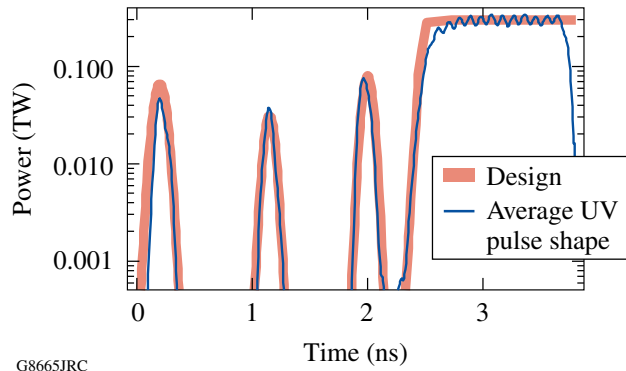


Figure 116.54  
OMEGA average pulse shape from cryogenic target implosions (shot 53066) using pulse shape SG3801T.

The Fiducial Laser System has been upgraded to solid-state, diode-pumped regenerative amplifier technology with increased capacity for fiducial signal outputs. This upgrade improves fiducial pulse stability, provides greater reliability, and requires less maintenance than the dated technology that it replaced. Additionally, the fourth-harmonic UV fiducial repetition rate increased from once every 10 min to rates as high as 0.1 Hz, resulting in more-efficient timing of experimental diagnostics.

Table 116.III: The OMEGA target shot summary for FY08.

Laboratory	Planned Number of Target Shots	Actual Number of Target Shots	IDI NIC	DDI NIC	Total NIC	Non-NIC
LLE	607	600	145	409	554	46
LLNL	221	237	117	0	117	120
NLUF	114	125	0	0	0	125
LANL	85	85	22	0	22	63
LBS	50	51	0	0	0	51
CEA	35	39	0	0	0	39
AWE	30	32	0	0	0	32
Total	1142	1169	284	409	693	476

All rod amplifier power-conditioning-unit control systems were upgraded with improved trigger boards. These upgrades mitigate the recently observed increased failure rates associated with the aging control system hardware.

A new Target Viewing System (TVS) was installed on the OMEGA target chamber in June of this year, greatly enhancing target-viewing performance and capability. The new TVS features real-time image processing, up to a 50-mm field of view, up to 2000-frames/s data collection, cryogenic target imaging improvements, remote focus capability, and target detection improvements.

New environmental controls were added to the pulse-generation room (PGR) and the driver electronics room (DER) to improve temperature and humidity stability. The thermal stability improvements resulted in better stability for both the temporal pulse shape and spatial profile.

#### **OMEGA EP Laser Facility**

The OMEGA EP Laser Facility completed the integration to target of two short-pulse beamlines and two long-pulse UV beamlines. A total of 85 target shots were taken. Beamline 1 was activated in short-pulse mode to the OMEGA EP target chamber via both the backlighter and sidelighter paths as well as to the OMEGA target chamber. Beamline 2 was activated in short-pulse mode to the OMEGA EP target chamber via the backlighter path and to the OMEGA target chamber.

Beamlines 3 and 4 were activated to the OMEGA EP target chamber in long-pulse UV mode. On 16 September 2008, an OMEGA EP beamline provided greater than 1.3 kJ of infrared light to target in a 10-ps laser pulse. This energy to target is more than a factor of 2 higher than has ever been achieved with a high-energy, short-pulse laser system.

Two additional ten-inch manipulators (TIM's) were commissioned on the OMEGA EP target chamber, bringing the total to three. A suite of initial target diagnostics have been qualified for use, including

- NRL – Dual-Crystal Spectrometer
- LLE – Yaakobi X-Ray Spectrometer
- LLE – Ultrafast X-Ray Streak Camera
- LLE – X-Ray Monitor and Neutron Time-of-Flight Detectors
- LLNL – Proton Film Pack
- CEA – Static Penumbra Imager and Fixed Activation Devices
- LLNL – High-Energy Radiography Imager for OMEGA EP

A NIF preamplifier module (PAM) was installed in the Laser Sources Bay. Preliminary engineering of a 2-D SSD module improvement as well as connection and diagnostic hardware necessary to seed Beamline 4 with the PAM has been accomplished.