

Section 4

LASER SYSTEM REPORT

4.A GDL Facility Report

The GDL system was in service during the entire quarter as a target interaction facility. Campaigns undertaken with the GDL system included an extensive investigation of laser propagation through aerosol media in conjunction with the U.S. Army CRDEC; electro-optic focussing experiments; time-resolved uniformity measurements of the GDL beam; and continued x-ray laser studies. For the laser-propagation study, a new target chamber, vacuum system, and diagnostic package were installed in the Beta target room.

A summary of GDL operations this quarter follows:

Beamline Test, Calibration, Tuning, and Laser Alignment Shots	156
Target Shots	
LLE-CRDEC	186
Electro-Optic Focussing	142
Uniformity Measurement	77
X-Ray Laser	102
Other	<u>37</u>
TOTAL	700

4.B OMEGA Facility Report

The OMEGA laser and target system has been out of operation as a target illuminator for this reporting period. Shutdown has provided the time necessary to complete major maintenance activities on OMEGA. In addition to maintenance, upgrades to our alignment system and laser diagnostics have been implemented, improving our capabilities in IR and UV alignment and transport optics measurement.

Since OMEGA has 30 m of path and eight optical components between the frequency-conversion crystals and the target chamber center, a cw UV alignment system has been introduced that provides means to accurately assess the losses of each component in the transport path. Ultraviolet alignment and diagnosis can now be accomplished using a cw, 351-nm beam coaligned with any beamline at the output of the crystal structure. In addition to providing the capability of observing the UV light retroreflected from the target in each beam, the UV alignment table (UVAT) incorporates a precision ratiometer to allow accurate (to 1%) measurement of transport optics losses to the center of the chamber. Improvements have been implemented into the existing IR alignment table. Liquid-crystal polarizers have been installed, thereby improving the polarization of the YLF beam and allowing more energy to be properly coupled into individual beamlines. A CID camera has been installed on the table, allowing improved viewing of the retroreflected beam from the target chamber for ease of targeting.

During this quarter fused silica plates with a novel thin-film coating have been fabricated and will be used to reject remaining IR energy in the beams after frequency conversion. The plates, dubbed "red dumps," are mounted on kinematic bases for easy installation and removal. As we return to operation, we will observe the effect of shielding the beamlines from potentially damaging IR energy backscattered from targets. Another possible benefit of the red dumps is the reduction of IR energy incident on experimental chamber surfaces.

Plasma calorimetry has been refurbished during the shutdown. An entirely new electronics package provides direct measurement of energy incident on both the ring and disc of the differential calorimeter. By processing the data from each calorimeter element independently, problems that have troubled plasma calorimetry during the last campaigns may be eliminated. Hardware that accompanies the electronics, consisting of a new calorimeter mount, aperture, shutter, and an in-situ calibration system, has been designed and prototyped.

An all new computer-controlled vacuum system has been implemented on the OMEGA target chamber. The new vacuum controller gives the experimental and operational personnel a global picture of vacuum status in the experimental chamber and on individual diagnostics.

In the area of OMEGA uniformity, substantial progress has been made since last quarter. Off-line testing of electro-optic beam-deflection schemes has been accomplished. Project goals are speckle smoothing of the phase-converted OMEGA beams on target, yielding improved irradiation uniformity. The beam analysis table (BAT), a laser diagnostic system used for phase measurement of the pulsed UV beams, is nearing activation in OMEGA. The BAT is installed on a track system allowing rapid installation into any beamline. During the reactivation and characterization period of the shutdown, several alternative uniformity improvements were pursued. Along with complete calibration of the laser-energy-measurement systems, a new technique for temporal analysis of the laser pulse was developed. A system was implemented that has the capability of monitoring the pulse width of several beams simultaneously using fibers to transport the beams to a single streak-camera photocathode. A system for analyzing all 24 beams on a streak camera is undergoing design and procurement for deployment in September.

As the quarter was dedicated to improving laser performance and beam quality, there have been a number of driverline and laser test shots. Target shots have been limited to laser characterization, plasma calorimeter testing, vacuum system testing, and target systems reactivation.

A summary of OMEGA operations for this quarter follows:

Target Shots	10
Driver Line Shot and Tests	28
Laser Test and Alignment Shots	<u>109</u>
TOTAL	147

ACKNOWLEDGMENT

This work was supported by the U. S. Department of Energy Office of Inertial Fusion under agreement No. DE-FC08-85DP40200 and by the Laser Fusion Feasibility Project at the Laboratory for Laser Energetics, which has the following sponsors: Empire State Electric Energy Research Corporation, New York State Energy Research and Development Authority, Ontario Hydro, and the University of Rochester. Such support does not imply endorsement of the content by any of the above parties.