Laser Facility Report

During FY97 the OMEGA Laser Facility was in full operation, shooting targets for 41 of the 52 weeks. The remaining time was invested in adding new capabilities as well as performing preventive maintenance. New features added this fiscal year include a fourth-harmonic fiducial laser for timing reference, a limited set of distributed polarization rotators (DPR wedges for up to five beams), and a multibeam streak camera. Incremental improvements in smoothing by spectral dispersion (SSD), timing systems, power conditioning, and beam-balance equipment were accomplished this year to supplement OMEGA's versatility.

During the first quarter the fiducial laser was installed in the target bay. This independent laser source is synchronous with the OMEGA beamline pulses and is utilized by a variety of target and laser diagnostics as a timing reference. The deep UV of the fourth-harmonic pulse is used on a number of x-ray diagnostics to measure relative timing of target events. Flexibility in delivering pulses for diagnostic setup and trouble-shooting improves the overall performance of instruments in the single-shot acquisition mode common to experiments on the OMEGA facility.

Uniformity improvements for FY97 included the deployment and testing of DPR wedges on five of the 60 OMEGA beams. Time instantaneous $\sqrt{2}/2$ improvements in single-beam uniformity, as theory predicts for DPR's, was confirmed with UV and x-ray imaging techniques. The five prototype components were fabricated from KDP material and AR coated for high UV transmission. Several of the planar-foil campaigns characterized improved beam imprinting and foil acceleration when these devices were installed.[1] LLE continues to evaluate options for cost-effective production of these devices.

The first of several multibeam streak cameras was installed on one ten-beam cluster of OMEGA. While the device is collecting data on beam-to-beam power balance, the preliminary nature of the data and startup of this complex diagnostic preclude definitive power-balance conclusions. As our experience with this instrument grows, we expect to obtain high-dynamic-range, high-temporal-resolution characterization of OMEGA UV beams.

SSD system implementation continued. Amplitude modulation at the fundamental frequency of the modulators was significantly reduced through two minor modifications to the SSD configuration. Reducing the beam spot size in the far-field crystals and limiting the beam deflection angle while imaging through front-end components allowed the bandwidth to be nearly doubled (to 1.25×1.75 Å) without inducing appreciable amplitude modulation (5%). In addition, a phase-locking technique was implemented to optimize smoothing and ensure repeatability of smoothing parameters.

Progress in uniformity of laser amplifier performance resulted from adding the capability to diagnose small-signal gain. Equipment and procedures were developed that allow accurate measurement of the gain of each of OMEGA's 213 amplifiers in a next-day operation. The data from these experiments demonstrates consistency within the six gain stages and clearly identifies individual units that do not lie within the normal distribution. The few units not performing at the average level for a given stage generally are found to have electrical circuit component failures, which can be readily rectified prior to proceeding with target shots.

The shot summary for OMEGA for FY97 is as follows:

Driver	722
Beamline	419
Target	805
Total	1946

REFERENCES

1. Laboratory for Laser Energetics LLE Review **71**, 103, NTIS document No. DOE/SF/19460-186 (1997). Copies may be obtained from the National Technical Information Service, Springfield, VA 22161.