
FY98 Laser Facility Report

The OMEGA facility saw substantial improvements in effectiveness at executing experimental objectives for FY98. To extend operations to meet increased demand for shots on OMEGA, UR/LLE hired additional staff to support multishift operations. Starting in May, after training was completed, we began to shoot targets for 12 h each target shot day, three shot days per week. Tailoring the facility operations crew to an uninterrupted 12-h shot shift matches staffing to the routine of OMEGA shot cycles. LLE continues to “block schedule” experiments by week to minimize the number of configuration changes and provide a sufficient run time to mitigate occasional system nonavailabilities.

Advances in individual beam and beam-to-beam uniformity have been a UR/LLE priority for the FY98 period. The technological improvements to the diagnostics—the P510 multichannel streak cameras and amplifier small-signal-gain instrumentation—are two key elements necessary for developing and characterizing power balance between beams. Both systems are currently on-line diagnostics and are being utilized to maintain OMEGA at 3%–4% rms IR beam balance. LLE has also improved the as-built reliability of the power conditioning system by upgrading the high-voltage switches and trigger systems. The decreased pre-fire fault rate has improved target irradiation repeatability substantially from the beam-to-beam uniformity standpoint. Another amplifier performance issue, the premature failure of the flash lamps, has been mitigated through the development of new lamp designs. Approximately 50% of the 6800 lamps are now a higher-reliability “hard seal” configuration.

For single-beam uniformity enhancements, long-lead procurements were initiated in FY98 to fabricate beam-smoothing optics for OMEGA. During FY98 a KDP crystal vendor has been fabricating birefringent wedges for distributed polarization rotator¹ deployment on the 60 beams. LLE anticipates permanently deploying DPR optics on OMEGA in the second quarter of FY99. Perhaps the greatest uniformity improvement to the on-target profile of individual OMEGA beams was the

installation of a full complement of 60 ion-etched DPP optics,² deployed in January 1998. These optics provide a circularly symmetric and highly repeatable individual beam profile on target which, when combined with SSD, allows OMEGA to approach the individual beam uniformity goals set for the system. Future single-beam uniformity improvements are anticipated to come through increases in SSD modulation frequency and bandwidth. During FY98 a project to frequency convert greater bandwidths with a second-harmonic mixer (KDP) was initiated.

Progress in the experimental area this year included the integration of the sixth and final 10-in. manipulator (TIM) and activation of several new diagnostics. New diagnostic capability for FY98 included activation of two charged-particle spectrometers, a time-resolved flat-field XUV spectrometer, an XUV Cassegrain telescope, an imaging XUV framing camera, a neutron bang-time diagnostic, a streaked optical pyrometer, and new streaked XR spectrometers. Many of these instruments were developed and fielded in conjunction with other organizations, including LLNL, LANL, NRL, MIT, and the University of Maryland. Other improvements in the experimental area include qualification of the facility for use in Stockpile Stewardship Program experiments and numerous enhancements to diagnostic timing command/control.

Many of the minor laser and experimental facility improvements are significantly easier to dovetail into the schedule since the extended shift operations schedule was implemented. Much of the maintenance work previously scheduled on the 0400 shift prior to shots has been moved to the Friday/Monday period, facilitating an earlier availability of the system for shots each day. Table 76.IV summarizes some of the tangible gains made from switching to the extended operations scenario. In conclusion, the shot effectiveness of two weeks of extended operations exceeds the capacity provided by three weeks of the former single-shift schedule. There were a total of 882 target shots in FY98, and it can be expected that the facility will support over 1300 target shots in FY99.

Table 76.IV: OMEGA operations shifted to extended hours in FY98.

	Prior to Extended Operations	Extended Operations
FY98 average number of shots/shot week	17	26
FY98 average number of shots/shot day	5.2	9.8
Average time of day for the first shot	11:47 AM (1/96 to 5/98)	10:20 AM
Total target shots for FY98: 882		

REFERENCES

1. Laboratory for Laser Energetics LLE Review **45**, 1, NTIS document No. DOE/DP/40200-149 (1990). Copies may be obtained from the National Technical Information Service, Springfield, VA 22161; Y. Kato, unpublished notes (1984).
2. Laboratory for Laser Energetics LLE Review **74**, 71, NTIS document No. DOE/SF/19460-241 (1998). Copies may be obtained from the National Technical Information Service, Springfield, VA 22161.