Section 1
LASER SYSTEM REPORT

1.A GDL Facility Report

GDL operations continued through this quarter virtually uninterrupted by any major failure. Shots were taken to support various interaction experiments, including Stimulated Raman and Stimulated Brillouin Scattering. Various diagnostics were tested before subsequent installation on OMEGA for the coronal-physics campaign. The NLUF was supported during two different periods for a combined Yale/UCLA experiment. Several x-ray-diffraction experiments, including biological-stimulus experiments, were conducted. Damage testing continued, although at a substantially diminished rate from the previous quarter. The quarter ended with a series of shots into the BETA tank in support of a transport experiment.

A total of 526 shots was delivered by the facility during the period October 1 to December 31, 1982. The shot distribution was as follows:

3ω Target Experiments	247	(47%)
Damage Test Facility	79	(15%)
X-Ray Chamber	80	(15%)
Miscellaneous (checkout, centering, calorimetry)	120	(23%)
TOTAL	526	(100%)

1.B OMEGA Facility Report

OMEGA activities during this quarter have consisted of (1) concluding the transport and uniformity experimental campaigns, (2) continuing support of the beam-balance program, (3) testing oscillator configurations for the upcoming x-ray-laser program, and (4) diagnostic checkouts for the coronal-physics campaign. Firing of the laser in support of the experimental campaigns continued through October, and the complete system was shut down in November for maintenance and various system upgrades. The system was reactivated in December for preliminary coronal-physics tests. With the exception of some brief testing of the oscillator in November, the system remained configured for long-pulse operation (1 ns).

The distribution of OMEGA system shots during the period October 1 to December 31, 1982 was as follows:

Target Shots	105	(36%)
Driver Alignment and Testing	84	(28%)
Beamline Checkout and Calibration	72	(24%)
Software Test and Timing	34	(12%)
TOTAL	295	(100%)

During the October experimental campaign, beam balance remained in the 6 to 8% vicinity, with repeated excursions below 5% and a worst case of 13%. Energy has consistently been within 10% of the shot specification. Not a single day of shooting was lost during this campaign, a tribute to the reliability of all components of the system. Beam profiles were observed to degrade somewhat, due to optical damage in the "A" splitter area (scheduled for replacement in January) and a creeping misalignment in the driver-line optics.

In the experimental area there was little new activity in October due to limited diagnostic demand. Transport experiments and uniformity experiments required only x-ray photographic diagnostics and neutronics, and thus no new instruments were activated. Excellent results were obtained in a time-resolved transport experiment using an x-ray streak camera borrowed from NRC, and an XUV spectrometer was successfully used on an NLUF experiment in conjunction with the Naval Research Laboratory.

While the system was shut down, several improvements were made to various subsystems. An exhaustive effort to realign the driver line has resulted in an improved beam profile both out of the driver and at the far field, or equivalent target plane. Figure 1 shows a photograph of the driver-line output, digitized and presented as a topographical plot, as well as an azimuthally averaged radial plot, showing a pronounced lack of spatial irregularities and an excellent beam profile. Figure 2 is the same representation of a beam in the equivalent target plane, at approximately 100 J.

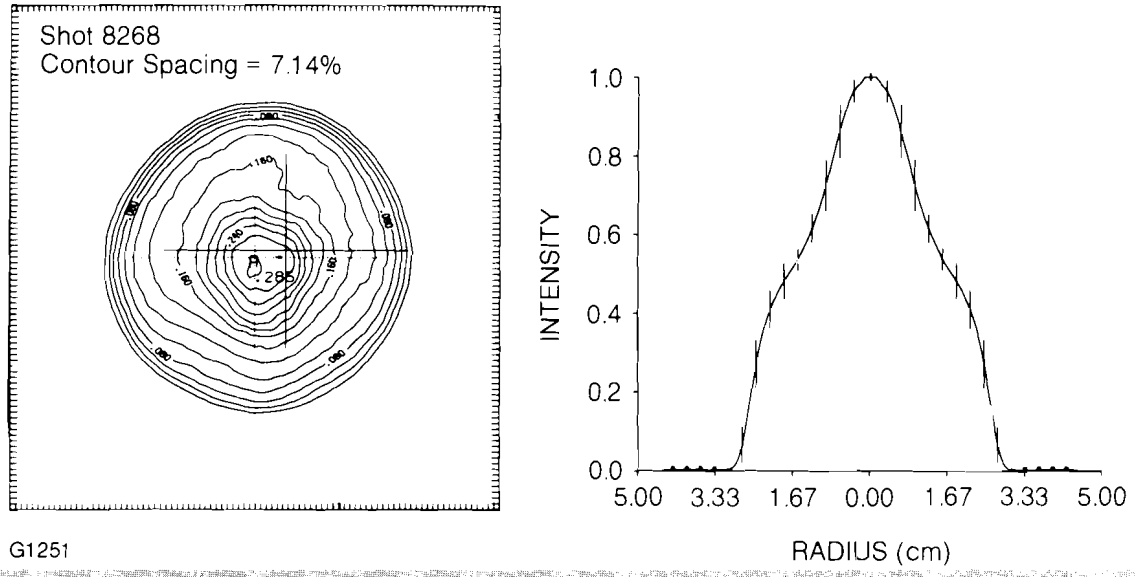

Fig. 1
Contour plot of the driver-line output (left) and an azimuthally averaged radial profile (right).

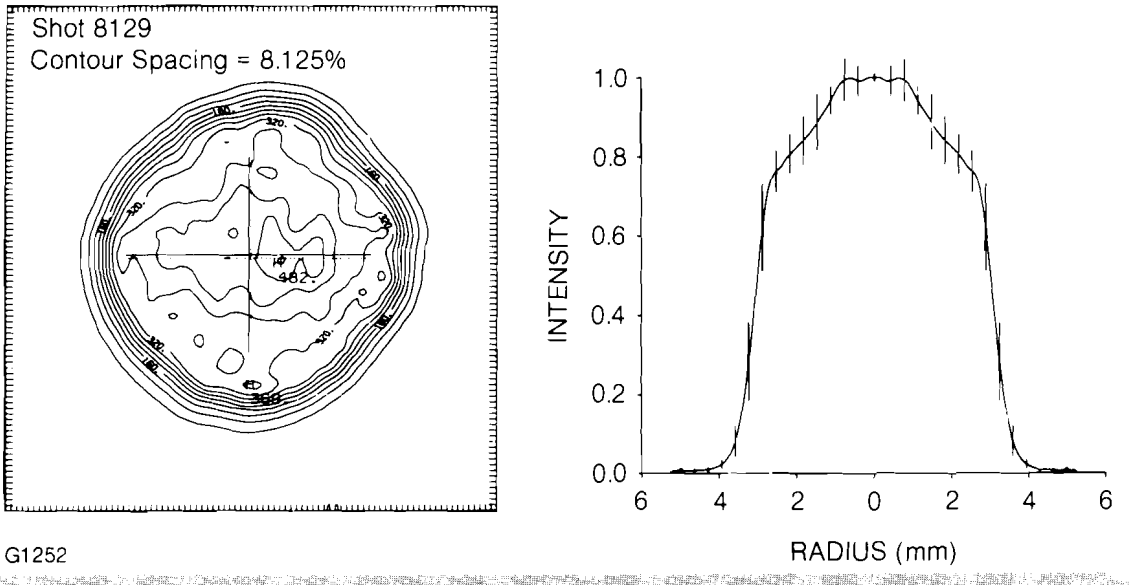

Fig. 2
Contour plot of a typical far-field beam distribution (left) and an azimuthally averaged radial profile (right).

The three-meter oscillator cavity underwent a brief configuration change, in an attempt to characterize its operation at a pulse width of approximately 50 ps in anticipation of the x-ray-laser program. The test resulted in quasi-stable operation at around 30 ps. The cavity configuration demonstrated about 75% stability. Due to a laser requirement for a beam-balance test the short-pulse tests were terminated, after lending support to the notion that stable 50-ps operation will be achieved when the proper etalon is installed.

Other improvements implemented during the shutdown period include a new (ISC) display in the power-conditioning system; this provides substantially more status information and control, and improves system reliability since backup hardware will now be available in-house. Work has progressed on the automated beam-timing system. Modifications were completed on two operations computer systems, *CER* and *MOMUS*, providing 22-bit capability and substantially more memory. The upgrade to *CER* will provide for the ongoing installation of the main diagnostic control task (*OPS*) and allow more memory for diagnostic acquisition and reduction tasks. With *OPS* installed in *CER*, the laser-diagnostic computer system (*AETHER*) will have more memory available for anticipated laser diagnostics. The *MOMUS* upgrade will provide a means for data archival, as well as a user setup for off-line software development, giving programmers the advantage of using real shot data for program evaluation.

As the laser system was reactivated, a 34-shot campaign aimed at calorimeter calibration was conducted. A single beam was split with calibrated beamsplitters into eight 8-inch calorimeters, whose positions were interchanged from shot to shot. The aim of the test was to eliminate beam-to-beam variation seen in the calorimeters in previous tests. The results of this successful campaign will be reported at a later date.

In the experimental area, the shutdown provided time to support the *CER* upgrade. In addition, film-advance controllers for x-ray diagnostics were modified to ensure more reliable operation and ease in monitoring return signals. Several diagnostics were adapted for OMEGA use, and activated as part of the coronal-physics campaign. These were: (1) an x-ray continuum spectrometer, (2) x-ray photomultiplier tubes, (3) $\omega_o/2$, $3\omega_o/2$, and $2\omega_o$ spectrometers, and (4) visible-harmonic-light diagnostics.

All systems were activated in December for a number of shots aimed at checking out and calibrating the diagnostic devices required for the coronal-physics campaign; a limited number of target shots was also provided for the Naval Research Laboratory NLUF experiment.