Section 4
LASER SYSTEM REPORT

4.A GDL Facility Report

During the second quarter of FY89, laser time in GDL was split between maintenance and interaction experiments in the Beta target facility. In addition, the GDL operation and engineering staff spent a portion of their time in support of OMEGA during part of the experimental program. The experiments concentrated on the effects of early-time transmission of laser light through fusion targets.

X-ray laser experiments were also conducted during this quarter. Work continued on the collisional excitation laser in germanium; for this study a polarizer and quarter-wave plate assembly was installed in the GDL beam to allow for the infrared irradiation of targets. GDL now has the capability to irradiate targets with any of three wavelengths: 1054 nm, 527 nm, or 351 nm. In addition, experiments were conducted on the photo-resonant pumping of Li-like iron with the H-like Ly_{α} of aluminum.

The various maintenance tasks performed included oscillator alignment, oscillator etalon-change/pulse-width studies, q-switch studies, and the replacement of the existing q-switch device. Work was also carried out on the oscillator mode-locker, including the installation of flow meters, fine tuning the mode-locker, and studies relating mode-locker performance to pulse width.

A summary of GDL operations this quarter follows:

Beta Shots	
Pointing	36
XRL/Focus Study	31
Shine-through	175
Laser and Crystal Tuning	93
TOTAL	335

ACKNOWLEDGMENT

This work was supported by the U.S. Department of Energy Office of Inertial Fusion under agreement No. DE-FC03-85DP40200 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.

4.B OMEGA Facility Report

During this quarter, laser operations completed the implementation of SSD on OMEGA. Integrating several new technologies and converting the main laser to broadband operation has given much-improved, on-target intensity distributions. In addition, progress continued in power balancing all of OMEGA's 24 UV beams. Using a new cw ratiometer system, characterization of transport optics can now be accomplished to a much higher accuracy than has been previously achieved. Finally, the experimental programs of high-density and high-yield implosions have been supported by target shots with power-balanced SSD beams.

The concept of bandwidth generation and dispersion for frequency conversion, combined with distributed phase for the SSD effect, was first demonstrated on OMEGA on 12 January 1989. The impact of SSD on the main portion of the laser system was minimal, requiring less than two weeks to implement. Conversion of broadband light required the addition of two holographic diffraction gratings and an electro-optic bandwidth modulator to the low-energy portion of the driver line. The main amplifier chains did not require any modifications other than a minor adjustment to the spatial filter pinhole sizes. Many shots were taken for diagnosis of temporal and spatial profile characterization followed by and mixed in with target experiments.

Further improvement in laser performance has come with the advent of a new laser-transport diagnostic. The transmission characteristics of the seven UV optics after frequency conversion can now be measured to within ±0.3%. This is accomplished by sequentially injecting a full-aperture, cw, 351-nm laser into each beamline after the frequency-conversion crystals and measuring the overall transmission at the center of the target chamber. A schematic of the OMEGA transport integrating sphere (OTIS) system appears in Fig. 38.29.

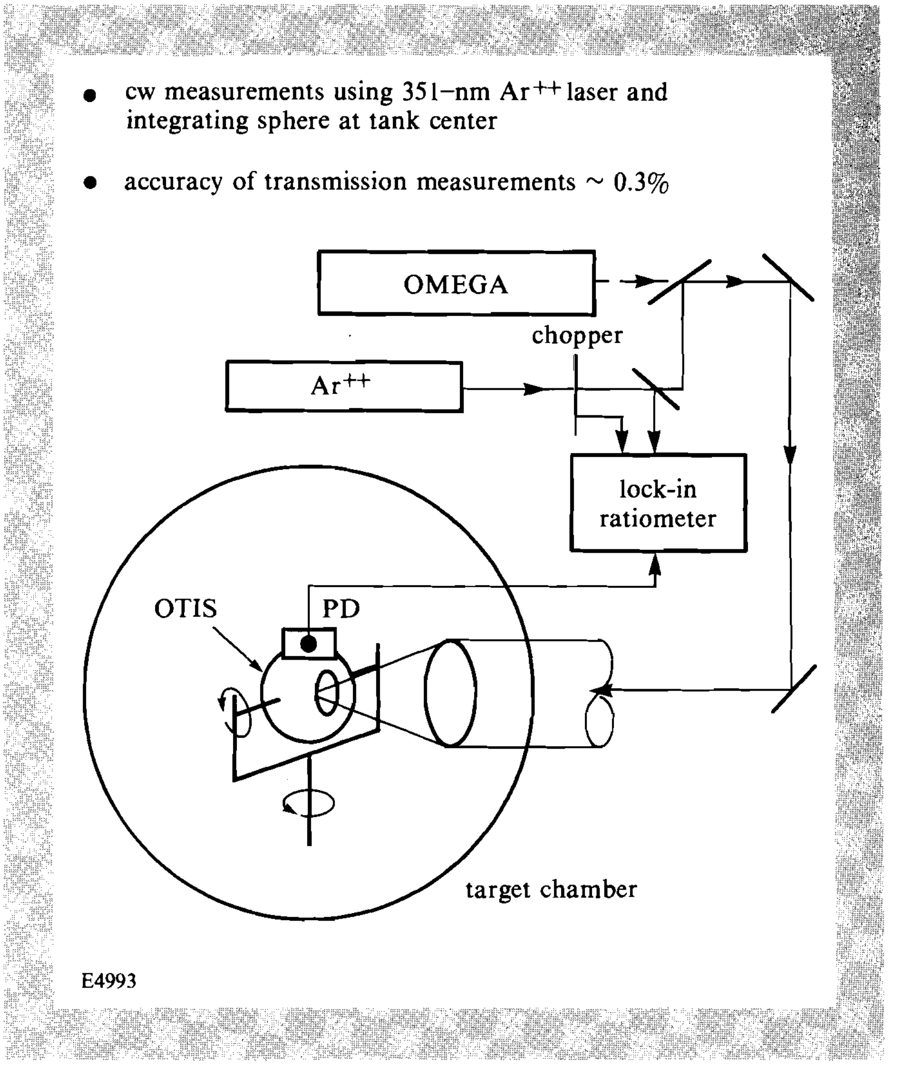

Fig. 38.29
The optical transmission at 0.35 μm of each OMEGA beamline is characterized by means of the OMEGA transport integrated sphere (OTIS)–a compact, remotely controlled integrating sphere located at the center of the OMEGA vacuum system. A 0.35-μm Ar^{++} laser, co-aligned to the OMEGA beams, provides the laser illumination for this measurement. The overall accuracy of the transmission measured with OTIS is ±0.3%.

A synopsis of laser shots for this quarter follows:

Software	59
Driver	169
Laser	272
Target	226
TOTAL	726

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