OMEGA EP Prototype Amplifier: The new OMEGA EP (extended performance) laser currently in design at LLE (see February 2003 Progress Report) will use NIF-like architecture (a multipass amplifier cavity followed by a booster amplifier stage). A prototype modular, 40-cm-square-aperture, single-segment amplifier has been constructed. Several of these modules placed in series will form the cavity and booster amplifier stages of the OMEGA EP. This amplifier addresses several requirements: First, to minimize cost, it uses laser glass identical in size and shape to that of the NIF.* Second, since only a small number of beamlines will be used for OMEGA EP, the amplifier is built as a single aperture or segment (Fig. 1) to eliminate dependence on expensive robotic handling equipment and to alleviate packaging difficulties in other laser components (e.g., the output spatial filter). Finally, LLE standard 19-mm-bore water-cooled flash lamps are used in this amplifier to achieve a projected repetition rate of at least one full-bank energy shot every 2 h—a better match to the present OMEGA 45-min shot cycle than is possible with air-cooled lamps.

Figure 1. Photograph of OMEGA EP amplifier module undergoing a pulsed-ionization lamp check (PILC). The view is into the end of the single-disk module. The high-reflectance surfaces inside the module are designed to direct as much of the flash-lamp light as possible into the rectangular Nd:glass disk.

An important element of the amplifier-development effort is characterization of its performance. Figure 2 shows a plot of the module's gain distribution obtained on the gain characterization station—a system comprised of an array of eight probe beams and detectors to map out the spatial profile of the module's gain. Since the gain profile differs between a disk at the end of a string and one in the interior, these two cases can be simulated by the addition of broadband silver reflectors to one or both ends of the prototype during testing. The reflectors must be nonparallel to avoid self-oscillation of the amplifier. The results of the initial measurements confirmed the expectations of the amplifier design calculations.

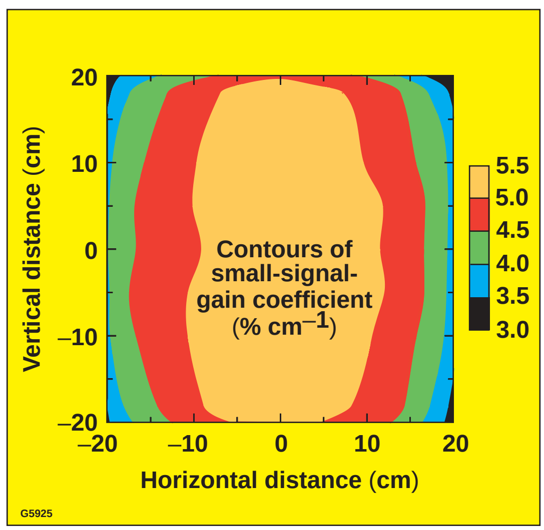

Figure 2. Gain contours in %/cm for the OMEGA EP prototype amplifier in the interior disk configuration. This map is constructed from gain measurements at 72 discrete locations in the aperture. The measurement at any individual location is an average of at least two shots. This plot is for an interior disk made of LHG-8 laser glass. The power conditioning driving the flash lamps was operated at a nominal 13.6-kV bank voltage. Note the gain uniformity in the vertical direction and the expected edge roll-off of the gain in the horizontal direction.

The OMEGA EP–prototype module has already yielded valuable information for power-conditioning design and laser-glass-mounting design. Gain and wavefront data from the prototype will be directly incorporated into models predicting the ultimate performance of the OMEGA EP.

OMEGA Operations Summary: During May, the OMEGA laser provided 115 target shots for several research groups. LLE teams carried out a total of 54 target shots for direct-drive implosions, SSP, and Rayleigh–Taylor experiments. Thirty-three target shots were taken for several campaigns led by LLNL scientists. SNL carried out a total of 12 target shots in collaboration with several other laboratories. CEA conducted six target shots. Finally, two NLUF groups (teams led by MIT and the University of Nevada, Reno, respectively) carried out 10 target experiments. A record number of target shots (46) were taken during a single week (the week of 26 May).

*We acknowledge the invaluable assistance of J. H. Campbell of LLNL in the procurement of the laser disks used in the prototype amplifier.

Contact: Wolf Seka (585) 275-3815; fax: (585) 275-5960; e-mail: seka@lle.rochester.edu
John M. Soures (585) 275-3866; fax: (585) 256-2586; e-mail: jsou@lle.rochester.edu