Programmable Spatial-Light Modulator: LLE successfully demonstrated a programmable spatial-light modulator (PSLIM) that simultaneously controls the spatial amplitude and wavefront of a laser beam. The goal of the PSLIM project is to develop a high-resolution beam-shaping module that can be deployed in the front end of OMEGA and OMEGA EP.

The PSLIM architecture, shown schematically in Fig. 1, uses a commercial liquid-crystal-on-silicon (LCOS) spatial-light modulator (SLM) in conjunction with a spatial filter. The LCOS-SLM is a reflective device that provides high-resolution (792×600) wavefront control. The edges of the input beam are initially shaped using a static apodizer and image-relayed to the SLM. A static phase-correction plate placed near the SLM compensates for its own residual wavefront distortion to maximize the usable dynamic range of this device. The half-wave plate and Faraday rotator switch the spatially shaped beam to the output path, where a downstream wavefront sensor (WFS) and near-field (NF) camera provide feedback for controlling the SLM.

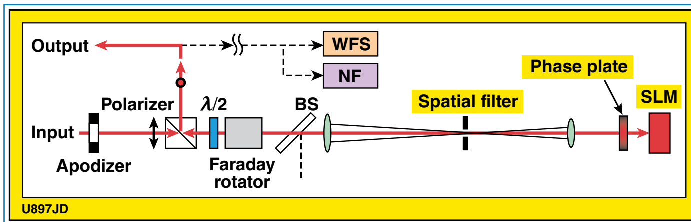

Figure 1. Schematic of the PSLIM module.

Amplitude control uses a "phase-only carrier method," as illustrated in Fig. 2. The desired wavefront is added to a carrier-modulated wavefront fluctuating between two wavefront envelopes, W_1 and W_2, which encodes the desired amplitude profile. The low-pass cutoff of the spatial filter is set below the carrier spatial frequency. The resulting wavefront and amplitude can be determined by controlling the mean and the difference of the two wavefront envelopes, respectively.

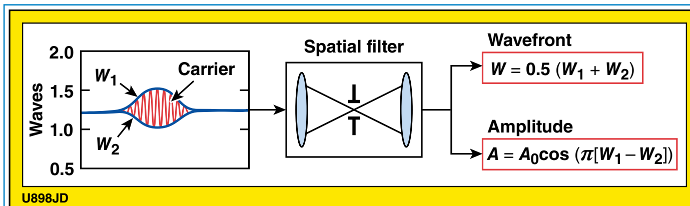

Figure 2. Illustration of "phase-only" carrier method to simultaneously control amplitude modulation and wavefront.

Figure 3 shows results from the PSLIM test bed using a continuous-wave laser at 1053 nm with an iterative feedback scheme. The measured near-field fluence for a programmed flat-top beam profile [shown in Fig. 3(a)] has a peak-to-mean variation of 3%. The measured wavefront for the same beam [shown in Fig. 3(b)] has a peak-to-valley error of 0.013 waves. We plan to demonstrate this level of performance for a pulsed beam and engineer the PSLIM hardware module and software for deployment to create a highly uniform beam profile, suppress hot spots, and provide fine adjustment of spatial-gain precompensation and high-spatial-resolution wavefront control.

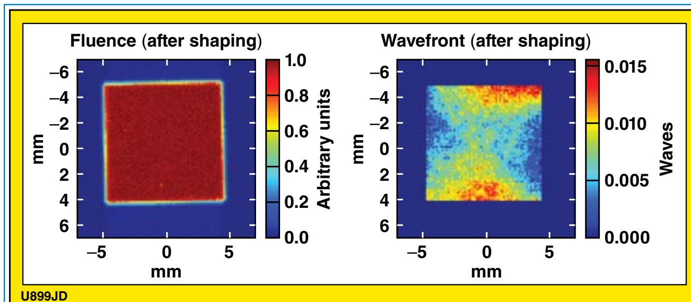

Figure 3. Measured (a) near-field fluence and (b) wavefront of programmed flat-top beam profile.

OMEGA Operations Summary: The Omega Facility conducted a total of 120 target shots in March: 84 shots were taken on the 60-beam OMEGA laser and 36 shots were taken on OMEGA EP; the experimental effectiveness was 95.8% and 93.1%, respectively. The NIC campaign accounted for 40 of OMEGA shots and 20 OMEGA EP shots. Non-NIC target shots included 22 for three NLUF experiments led by a team from the University of Michigan and two teams from the University of California–Berkeley, respectively. The HED program accounted for 21 target shots (5 on OMEGA and 16 on OMEGA EP taken by LANL and LLNL). There were also 17 OMEGA target shots taken for LBS experiments from LLNL and LLE. One week of scheduled maintenance was carried out on OMEGA in March.

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