Three-Color-Cycle SSD Installation: During the last two weeks in April the OMEGA laser was returned to a three-color-cycle (3CC) smoothing by spectral dispersion (SSD) configuration. For the last decade, OMEGA operated in the 0.8-color-cycle (or terahertz) SSD configuration. SSD smooths the target illumination in a time-averaged sense by rapidly moving the focal-spot speckle pattern on target.[1] In brief, the beam is temporally sheared, frequency-modulated (FM), and then unsheared and dispersed. In the actual implementation, this is done twice in orthogonal directions. This process is performed early in the system where the beam size and energies are small. Any temporal sample or slice of the beam will laterally cycle from the red to the blue and back to the red part of the FM bandwidth. A representation of a time slice of the two configurations is shown in Fig. 1. The shearing, unshearing, and dispersion of the beam is accomplished with dielectric transmission diffraction gratings. Frequency modulation is performed in microwave-driven bulk $LiNbO_3$ modulators. The number of color cycles is determined by the product of the temporal shear and modulator frequency. Changing OMEGA's configuration involved replacing the grating assemblies with higher-dispersion units in the SSD driver line and reducing the microwave power delivered to the $LiNbO_3$ modulators to keep the far-field deflection constant. OMEGA's driver line was designed to facilitate this process. Photos of the newly installed gratings are shown in Fig. 2. The principal motivation for this action is that the three-color-cycle 1/3-THz SSD system provides a readily available reduction in the dynamic SSD mispointing error (SSD mpe). SSD mpe became an important parameter when the drive pulse shapes for high-performance cryogenic implosions were converted from continuous foot pulses to discrete picket pulses for adiabat control. The three-color-cycle SSD system reduced the SSD mpe from $\pm 40\ \mu$m to $\pm 5\ \mu$m in the direction of the 10.4-GHz modulator. The system provides smoothing equivalent to the 1-THz, 2-D SSD system for ℓ modes < 200. The three-color-cycle SSD system has the added benefit of reduced applied bandwidth that results in more efficient frequency conversion, which improves power imbalance and provides greater available on-target energy. Following the installation of the 3CC gratings, shots were taken on the OMEGA Laser System to requalify its performance in the following areas as seen in Table I.

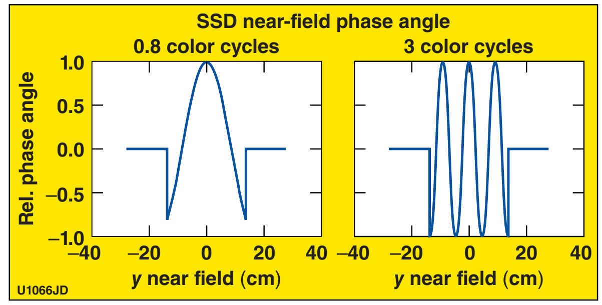

Figure 1. Conceptual time slices of both a 0.8-color-cycle (THz) SSD beam (left) and a three-color-cycle (3CC) SSD beam (right).

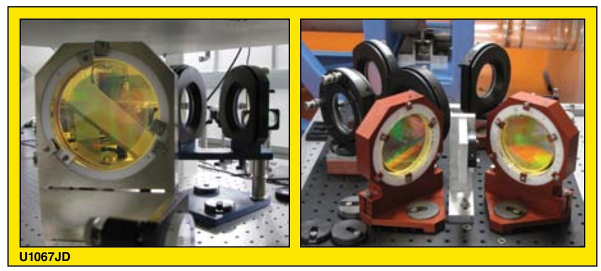

Figure 2. Newly installed three-color-cycle transmisison grating assemblies in OMEGA's SSD driver. Shear grating is depicted on the left and unshear and disperse grating assembly is depicted on the right.

Table I. Summary of OMEGA performance following change to three color cycle.

Parameter	Result
On-target energy, 1-ns square output	>27 kJ
Collimation	<0.05-wave (1.054-μm) change
On-target bandwidth	>0.33 THz
Beam quality (system fill factor)	Improved relative to THz configuration

OMEGA Operations Summary:

The Omega Laser Facility conducted a total of 157 target shots in April with an average experimental effectiveness of 92%: OMEGA produced 111 shots with an average effectiveness of 96.8% and OMEGA EP conducted 46 shots with an average effectiveness of 80.4%. The NIC program accounted for 73 of the total with experiments by teams led by LLE, LLNL, and LANL scientists. Twenty-seven shots were conducted for the LANL and LLNL HED programs. NLUF teams led by the University of Michigan, University of California–San Diego, and the University of California–Berkeley, conducted 28 shots. Nineteen target shots were taken for LBS experiments by LLE and the AWE (UK) conducted 10 target shots during this month. Maintenance activities were carried out on OMEGA during the week of 19 April 2010 and three-color-cycle SSD was implemented on OMEGA during this week.

1. S. Skupsky *et al.*, J. Appl. Phys. **66**, 3456 (1989).