OMEGA Zooming Phase Plate: One of several approaches toward mitigating cross-beam energy transfer (CBET) on the OMEGA laser involves decreasing the energy near the edge of the spherical target during the main drive of the pulse.[1,2] However, the uniformity of the picket pulses would be reduced if a smaller focal spot is maintained throughout the whole pulse. Focal-spot zooming between the picket and the main pulses would provide the necessary decrease in spot size at the optimum time. A distributed phase plate (DPP) containing two concentric phase zones, referred as a zooming phase plate (ZPP), provides two-state focusing.

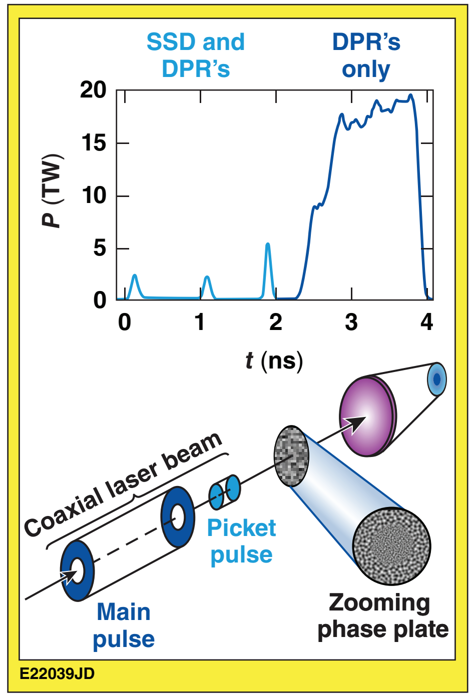

Figure 1. Focal-spot zooming with a zooming phase plate (ZPP) located at the end of the laser system requires coaxial propagation of the picket (inner) and main (outer) pulses. SSD: smoothing by spectral dispersion; DPR: distributed polarization rotator.

The OMEGA laser beam configuration that incorporates a ZPP is illustrated in Fig. 1. Dual driver lines generate the picket and main pulses that propagate coaxially toward the ZPP before being focused on target. The lower-energy picket pulses propagate down the center of the beamline, while the higher-energy main pulse propagates down the annular section. The inner and outer portions of each transmitted beam are individually focused by the same lens onto the target. Focal-spot zooming is achieved by combining the coaxial pulse-shaped beams with the coaxially registered ZPP. A zoom ratio of 0.60 mitigates the majority of CBET while maintaining adequate drive uniformity.

An expanded view of the ZPP shows it is fully continuous by design (see Fig. 2). The inner disk section has a 14-cm diameter that is one-half the outer annular section of the 28-cm-diam laser beam. This corresponds to an area ratio of 1 to 3. The average phase gradient of the inner zone is larger than that of the outer zone to produce the desired zoom ratio. The correlation length of the inner zone is smaller than the outer zone to ensure the picket-pulse focal spots are optimally homogenized with fine speckle. The feature size of the outer zone is increased to reduce overall manufacturing cost. The first ZPP prototype required twice as many passes by the polishing machine to reach completion and therefore acquired a greater amount of mid-spatial-frequency error. Additional prototype development will be carried out to enable optics vendors to meet the ZPP specifications while maintaining the production rate obtained for the OMEGA SG5 DPP's.

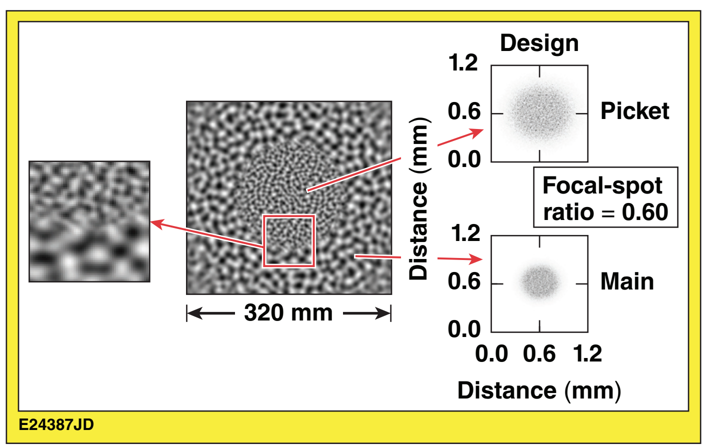

Figure 2. The ZPP contains a fully continuous surface relief with higher phase gradients in the central disk to produce a larger focal spot and lower phase gradients in the outer annulus to produce a smaller focal spot.

Omega Facility Operations Summary: The Omega Laser Facility conducted 214 target shots in September 2015 with an average experimental effectiveness (EE) of 94.0% (115 on OMEGA with EE of 95.7% and 99 on OMEGA EP with an EE of 92.4%). The ICF program accounted for 43 shots taken by LLE, LLNL, and SNL, while the HED program had 62 target shots. Ten target shots were taken for a Defense Threat Reduction Agency experiment. Six NLUF experiments led by MIT, University of California, Berkeley, General Atomics, Princeton University, and University of California, San Diego, accounted for 49 target shots and three LBS experiments led by LLNL and LLE had 42 shots. CEA-led experiments conducted eight target shots.

1. D. H. Froula *et al.*, Phys. Rev. Lett. **108**, 125003 (2012).
2. I. V. Igumenshchev *et al.*, Phys. Plasmas **17**, 122708 (2010).