Collapsing Radiative Shocks: An NLUF collaboration, led by R. Paul Drake of the University of Michigan and including co-investigators from LLNL, LLE, CEA Saclay (France), Ecole Polytechnique (France), NRL, and the Universities of Arizona, Chicago, SUNY Stony Brook, Maryland, and Eastern Michigan, has been carrying out laboratory astrophysics experiments on OMEGA. One of the team's topics of investigation concerns collapsing radiative shocks. When the density of the shocked material becomes cool enough, the material enters a radiatively collapsing phase in which its density can increase several orders of magnitude. All supernova remnants eventually pass through this phase, and such shocks arise in a number of other contexts. The first experiment (Fig. 1) to begin this study on OMEGA used x-ray radiography for a diagnostic; additional experiments were carried out recently. Figure 2 shows the x-radiography data obtained on this experiment. The overlaid profile shows the average x-ray transmission of a 290-μm-high horizontal strip through the unobstructed portion of the image. One can clearly see the absorption feature due to the shock. Its position confirms that the shock velocity is well above 100 km/s.

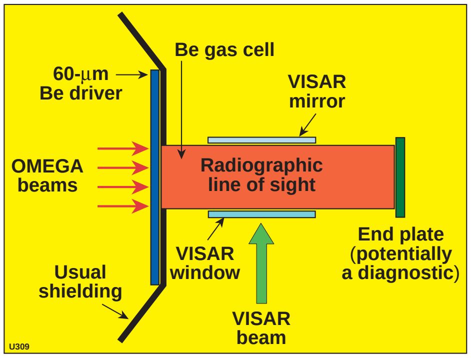

Figure 1. Schematic of radiative precursor shock experiment. A shock is launched into a tube containing Ar by depositing laser energy onto a Be foil. The shocked region is probed using x-ray radiography (normal to the plane of the paper) as well as VISAR (parallel to the plane of the paper).

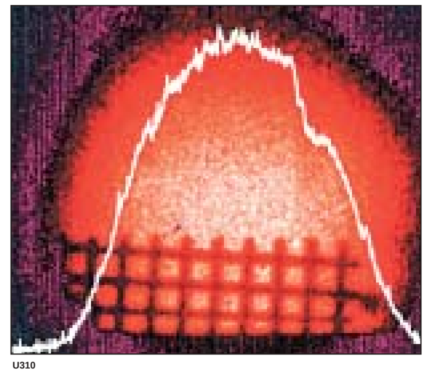

Figure 2. Image and profile from the first attempt to produce a collapsing radiative shock. The notch in the profile toward the right is produced by the shocked Ar gas. The grid spacing is 63 μm.

New OMEGA Diode-Pumped Regenerative Amplifier: A new highly stable, diode-pumped Nd:YLF regenerative amplifier (ODR) was recently installed in the OMEGA SSD driver line. This amplifier produces shaped optical pulses of up to 7-ns duration at an energy level of ~1 mJ with an output energy fluctuation of only ~0.9% rms. The ODR output is designed to drive the OMEGA power ampli-fiers and routinely demonstrates high beam roundness with an ellipticity of <1%; this is an important characteristic to ensure optimum OMEGA beamline performance. Improved temporal-pulse-shape stability, beam quality, reliability, and compactness are the principal advantages of the ODR in comparison to previous designs. Figure 3 shows the internal layout of the ODR internal view of the new regenerative amplifier.

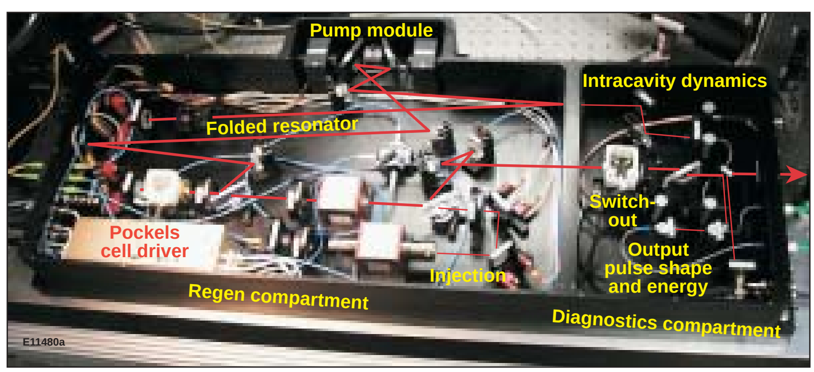

Figure 3. Overview of the major components of the ODR.

OMEGA Operations Summary: During October, the OMEGA laser provided a record 155 target shots for Lawrence Livermore National Laboratory (LLNL), Los Alamos National Laboratory (LANL), Sandia National Laboratory (SNL), and LLE campaigns. The 33 LLNL shots included the following campaigns: equation of state (EOS), EOS for NIF early light (NEL), convergent Rayleigh–Taylor (CONVRT), point-backlighting tests, indirect-drive implosions, and x-ray Thomson scattering. The 34 LANL shots included direct-drive double shell and ACE B. SNL took 6 target shots for the ablator burn-through campaign. The 82 LLE target shots included SSP experiments, integrated spherical experiments (ISE), and 2 spherical cryogenic target shots.

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