High-Contrast Pulse Generation: The temporal contrast of high-intensity optical pulses is important for laser–matter interactions. For a high-intensity pulse with a degraded contrast, the prepulse intensity can be sufficient to interact with the target and modify the interaction regime of the main pulse. Several efforts are under way at the Laboratory for Laser Energetics to optimize and monitor the contrast of large-scale laser systems. An optical parametric amplifier (OPA) pumped by a short optical pulse has intrinsically a high contrast and a high gain, making it ideal as a front end for a conventional system based on chirped-pulse amplification or optical parametric chirped-pulse amplification.

The signal and pump of the OPA front end originate from a 1053-nm, 38-MHz oscillator. The pump pulse is amplified in a diode-pumped regenerative amplifier followed by a flash-lamp–pumped, two-pass amplifier. After second-harmonic generation, the 526.5-nm-short pump pulse (with a sub-10-ps duration) is combined with the unstretched 1053-nm signal, and parametric amplification takes place in a 25-mm lithium triborate (LBO) crystal. Signal energies up to 100 μJ have been obtained, demonstrating a 10^5 gain. The temporally resolved contrast, measured with a scanning third-order cross-correlator, is better than 10^{11} (measurement limited) up to 10 ps before the peak of the pulse. The measured cross-correlation, which is indicative of the pulse shape of the amplified pulse, is shown in Fig. 1. The only expected contrast limitation for such a system is the parametric fluorescence generated when the pump provides significant gain. Various temporal measurements indicate that the parametric fluorescence is restricted to a few picoseconds around the amplified signal. Further developments are underway, including the study of the potential of such a front end for OMEGA EP.

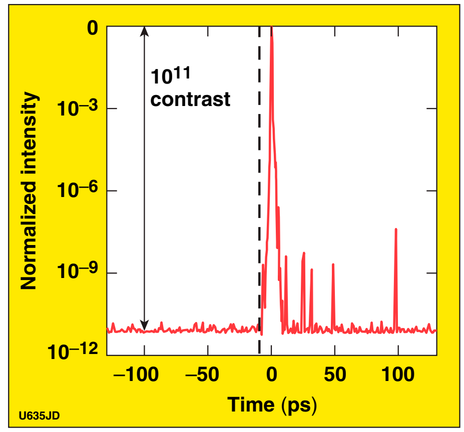

Figure 1. Cross-correlation of the OPA signal after amplification. No prepulse or pedestal has been detected in front of the pulse over a 130-ps window, at an intensity level 10^{11} times lower than the peak intensity of the pulse (limited by the diagnostic sensitivity). A vertical dashed line has been plotted 10 ps before the peak of the pulse. Post-pulses are due to reflections in the OPA or in the cross-correlator itself and are not detrimental to applications at large-scale laser facilities.

OMEGA EP Use Planning Workshop II: LLE hosted the second OMEGA EP Use Planning workshop from 30 May 2007 through 1 June 2007. It was attended by approximately 40 non-LLE scientists from the national laboratories and the university and international communities. The goal of the workshop was to begin defining the initial experimental campaigns for OMEGA EP, which will be completed in April 2008. Discussions were focused within nine different working groups—such as hard-x-ray sources and detectors, warm dense matter physics, fast ignition, and complex hydrodynamics—to define initial experimental campaigns, including laser configuration, targets, and diagnostics. Near-term actions include prioritizing diagnostic development and implementation. A summary of recommended initial experiments was prepared. A third workshop will be held near the end of 2007 or early in 2008 to continue the planning process.

Figure 2. Activation of the four-beam OMEGA EP system is currently underway. The photograph shows the power amplifier portion of the system with a view toward the target chamber area.

OMEGA Operations Summary: During May, the OMEGA Laser Facility delivered 163 target shots with an overall shot effectiveness of 95.7%. Users (shots) during this period included LLE (62), LANL (41), LLNL (10), AWE (13), and NLUF (37). Seventy-five shots were dedicated to the NIC (38 for DDI and 37 for IDI) and 38 shots were taken for HED programs. The NLUF campaigns included experiments led by four teams: one by the University of Nevada, Reno, one by MIT-PSFC, and two by the University of California, Berkeley.

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