Wetted-Foam NIF Direct-Drive Target Designs: "Wetted-foam" direct-drive target designs for the NIF and OMEGA are being studied in addition to the "all-DT" designs that have been previously discussed. In the wetted-foam designs, the outer portion of the cryogenic DT shell is replaced with a region of low-density CH foam. Liquid DT is "wicked" into the voids of the foam.[1] The advantage of these wetted-foam designs over the all-DT target is the presence of higher-*Z* material (CH) in the laser deposition region, which results in increased laser absorption. For the NIF designs, the laser absorption increases by ~40% (from 60% absorption in DT to 85% in the wetted foam). For OMEGA-class targets, the laser absorption can increase by ~75%, depending on the density of the foam. With the increased absorbed laser energy available to drive the target, the capsules can contain an increased amount of fuel. The wetted-foam targets are thicker, providing increased stability, and the additional fuel provides higher target gain. The main result of the initial design work is that the wetted-foam design achieves a target gain of ~120, which is ~3 times larger than the gain for the all-DT target (see Fig. 1). An initial stability analysis indicates that the wetted-foam design is more stable than the all-DT design during the acceleration phase of the implosion. Detailed two-dimensional hydrodynamic simulations are in progress.

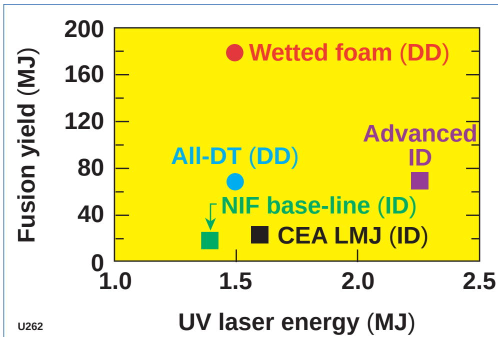

Figure 1. The calculated performance of the NIF direct-drive "wetted-foam" target (red dot) compared to several other ignition designs. The square points are for indirect-drive (ID) targets including the NIF base-line,[2] CEA LMJ design,[3] and an advanced ID design at 2.25-MJ drive.[4] The blue dot corresponds to the "all-DT," gain ~45, direct-drive target design.

Multibeam Interaction Experiments: Long-scale-length laser–plasma interaction experiments to examine multibeam interaction processes were carried out on OMEGA under NIF direct-drive plasma conditions. The experiments used two sets of plasma-forming beams while a third set of six beams was used as interaction beams. The laser and target conditions were designed to achieve plasma scale lengths of several hundred microns and electron temperatures (T_e) in the 2- to 3-keV range. Two-dimensional SSD at 1 THz and polarization smoothing were used on all beams. The peak single-beam intensity ranged up to 10^{15} W/cm^2 (averaged over the speckle pattern). The overall SBS reflectivity due to the multibeam interactions is ~10 times higher than that observed in single-beam experiments. At the highest intensities the multibeam SBS backscatter levels saturated in the 1% to 5% range. The observations indicate that the SBS backscatter is primarily seeded by the interaction beams that are specularly reflected near the critical-density region (see Fig. 2). Within the intensity range of NIF's direct-drive target designs, the multibeam backscatter levels were well below 1%.

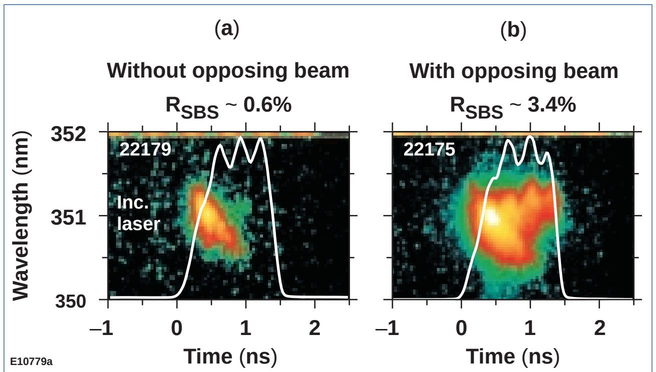

Figure 2. Streak camera recordings of the SBS backscatter (a) without and (b) with opposing beam. The interaction beam intensity was 1.6×10^{15} W/cm^2 for both shots. The integrated SBS reflectivity was 0.6% and 3.4% for shots without and with opposing beam.

OMEGA Operations Summary: OMEGA operations for May 2001 included 11 days of target shots and one quarterly maintenance week. One hundred target shots were delivered for nine experimental campaigns including one week of high-yield DT-target shots for several NLUF and LLE programs. A single DD cryogenic target was shot from the second LLE Moving Cryostat Transfer Cart. Activation of this cart is an important step toward achieving a capability for shooting up to six layered deuterium cryogenic targets per week. The target shots were distributed as follows: CEA (5), LLE/ICF (41), LLE/SSP (11), LLNL (5), and NLUF (38).

1. R. A. Sacks and D. H. Darling, Nucl. Fusion **27**, 447 (1987).
2. S. W. Haan *et al.*, in *Inertial Fusion Sciences and Applications 99*, edited by C. Labaune, W. J. Hogan, and K. A. Tanaka (Elsevier, Paris, 2000), pp. 54–59.
3. P. A. Holstein *et al.*, in *Inertial Fusion Sciences and Applications 99*, edited by C. Labaune, W. J. Hogan, and K. A. Tanaka (Elsevier, Paris, 2000), pp. 60–67.
4. L. Suter *et al.*, in *Inertial Fusion Sciences and Applications 99*, edited by C. Labaune, W. J. Hogan, and K. A. Tanaka (Elsevier, Paris, 2000), pp. 74–81.

Contact: Wolf Seka (716) 275-3815; fax: (716) 275-5960; e-mail: seka@lle.rochester.edu
John M. Soures (716) 275-3866; fax: (716) 256-2586; e-mail: jsou@lle.rochester.edu