Laser–Plasma Interaction Experiments: LLE recently began laser–plasma interaction (LPI) experiments using multiple (six) simultaneous interaction beams. The aim was to determine the nature and magnitude of cooperative stimulated Brillouin scattering (SBS) that may occur under NIF direct-drive-ignition implosion conditions. The plasma was produced by staggering two sets of ~1-ns-long square-top shaped laser pulses separated by 1 ns. A third set of six interaction beams was turned on 1 ns after the second set of heater beams. These beams were arranged in hexagonal symmetry at ~20° to the target normal. Distributed phase plates (DPP), 1-THz smoothing by spectral dispersion (SSD) and polarization smoothing (PS) were used.

SBS was measured through the focusing lenses of two beams (25 and 30) with calorimeters (time-integrated SBS energy) and with time-resolved spectra around the incident laser wavelength (351 nm). Figure 1 shows data from a subset of these multibeam experiments obtained with the backscatter station in beamline 25. The average peak intensity in beam 25 was 4×10^{14} W/cm^2 (blue squares). Also shown are data taken previously for single-beam SBS (red dots, red line added as a guide). The insert shows the six interaction beams (beam line numbers inside the circle). Three different DPP's were used on these beams corresponding to the three different irradiation intensities as indicated outside the beam circles.

These data clearly indicate the importance of beam line 23, which is opposite to the SBS-25 measuring station. Without the opposing beam the scattering level reverts to the single-beam scattering level previously observed, whereas with the opposing beam the scattering level increases by almost an order of magnitude. Beams other than the opposing beam slightly affect the measured SBS levels, but this appears to be a second-order effect. Including information obtained from the time-resolved spectra (not shown here), we conclude that these experiments are consistent with no common ion-acoustic waves along the target normal (center of symmetry of the hexagon). The increased scattering levels thus appear to originate primarily from Brillouin-amplified reflections from near the critical density layer (turning point of beam 23).

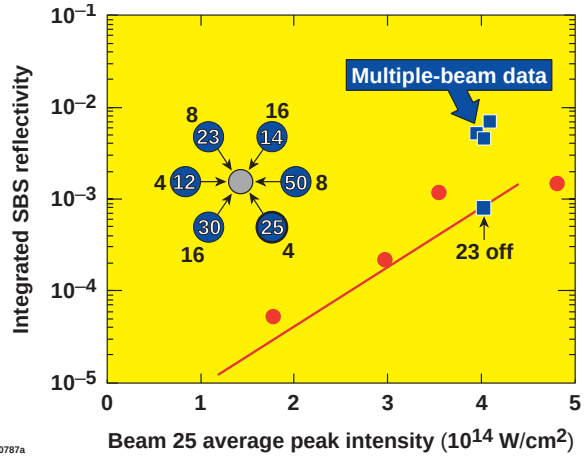

Figure 1. SBS energy reflectivity from flat, solid, planar CH targets with one (red dots) or six simultaneous interaction beams (blue squares). The interaction beams are arrayed as indicated (beam numbers inside the blue circles). The different average peak intensities as shown. These intensities (unit = 10^{14} W/cm^2) are repeated around the outside of the hexagon.

On the basis of these experiments, the expected SBS backscatter for NIF direct-drive plasma conditions (average peak intensities $<2 \times 10^{14}$ W/cm^2) is still well below 1%. If, however, the seeding from near-critical-density layer is much higher than in the present experiments, then the saturated SBS reflectivity could lie in the several percent range.

OMEGA Operations Summary: OMEGA operations for the month of February included shots for LLNL (6.5 days, 62 shots), LANL (2 days, 16 shots), NLUF (1.5 days, 20) and LLE (2 days, 22 shots). These 12 days (Fig. 2) yielded 120 shots on target for a variety of configurations. On several days the newly rebuilt active shock breakout (ASBO) system was activated and acquired data for LLNL and LLE. The rebuild by LLNL staff in February supplemented the ASBO streak camera with a time-resolving velocity interferometer system for any reflector (VISAR) streak camera.

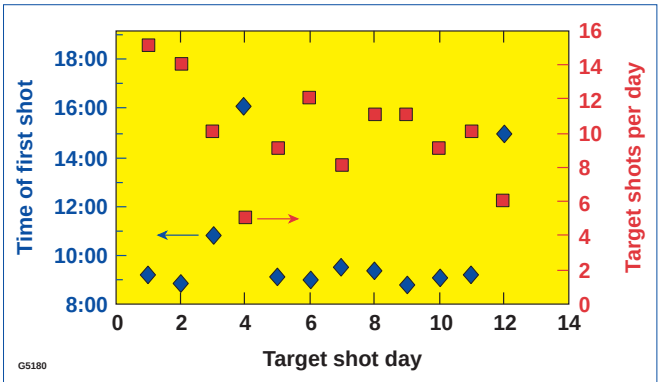

Figure 2. Time of the first shot (blue diamonds) and total target shots (red squares) for each of the twelve shot days of February 2001.

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