Polar DIM Imager for the NIF: The polar diagnostic-instrument-manipulator (DIM) imager was delivered to the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL) in early June. Within the framework of the National Ignition Campaign, LLE scientists and engineers designed, constructed, and calibrated this snout for the gated x-ray detector (GXD or hGXI) on the NIF. The project was taken from concept to a completed instrument in six months. The origin of the polar DIM imager is rooted in the diagnostic conflicts for the polar DIM that arose on the NIF during the implosion campaign last fall [e.g., between the hot-spot x-ray spectrometer (HSXRS) used to monitor the amount of ablator mass mixed into the hot spot, and the 12× broadband x-ray imager used to monitor the symmetry of the implosion]. The hohlraum severely restricts the diagnostic access to the implosion, and the highly desirable polar DIM provides the only diagnostic view of the implosion along the symmetry axis of the hohlraum. Many primary diagnostics require lines of sight that are not obstructed by the Au hohlraum wall and do not have a view of the laser-deposition regions on the interior wall. The polar DIM imager provides the infrastructure needed to divide the view through the laser-entrance hole among five implosion diagnostics by combining the following x-ray and particle channels in a single super snout: a time-integrated, 12×, 1-D spectral imager for core Ge K-shell emission (10 to 13 keV), a 12× gated x-ray imager in the 8-keV range, an x-ray bang-time detector, a wedged range filter for D-^{3}He proton spectral measurements ($10^9 < Y_{1p} < 10^{11}$), and an indium-activation detector for primary neutron-yield measurements ($10^9 < Y_{1n} < 10^{11}$). The amount of ablator mass mixed into the hot spot via hydrodynamic instabilities will be quantified using the Ge K-shell spectroscopic measurements. A CAD model of the polar DIM imager is shown in Fig. 1(a). The particle detectors are mounted 50 cm from the implosion and are external to the snout. The x-ray detectors consisting of the GXD (or hGXI), an image plate, a charge-injection detector, and a photoconductive diamond are placed 130 cm from the implosion. The diagnostic alignment fiducial provides the required diagnostic pointing accuracy of ±0.5 mm in the target plane. A photograph of the completed instrument, which has an overall length of 120 cm, is shown in Fig. 1(b). A photograph of the Ta collimator plate for the pinhole/slit array of the x-ray channels is presented in Fig. 1(c). The central pinhole array is for the broadband, gated-implosion images detected with the GXD. The smaller array to the right is for the x-ray bang-time PCD detector. A fixed Bragg geometry configures two pentaerythritol (PET) crystals to monitor the 9.75- to 11.2-keV range and another pair to monitor the 11.4- to 13.1-keV range. The slits below the central array are 10× wider than the ones above (100 μm versus 10 μm) to increase the dynamic range of the spectral measurement. The data-collection capability of the polar DIM is maximized with this snout. It will be used for all implosion shots in the upcoming campaign ($Y_{1n} < 10^{15}$), including spherical cryogenic-layered targets of tritium, hydrogen, and deuterium (THD). First use of the polar DIM imager on the NIF is scheduled for this summer.

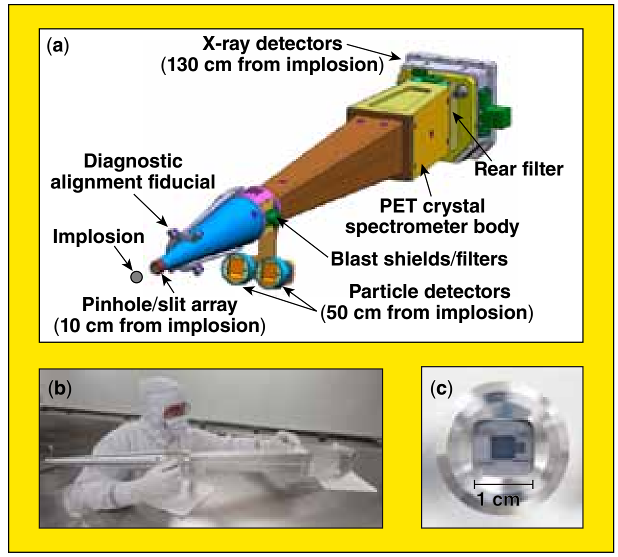

Figure 1. (a) Mechanical layout of the polar DIM imager, (b) photograph of the assembled super snout comprising five implosion diagnostics (three x-ray and two partice diagnostics), and (c) the collimator plate of the pinhole/slit array for the x-ray channels.

Omega Operations Summary: The OMEGA Laser Facility conducted 144 target shots in June (91 on OMEGA and 53 on OMEGA EP) with an average experimental effectiveness of 93.8% (94.5% for OMEGA and 92.5% for OMEGA EP). The NIC program accounted for 47 target experiments conducted by LLE and LLNL teams. There were 25 target shots taken for HED physics experiments by LLNL; 19 shots for CEA programs; 29 target shots taken for NLUF experiments conducted by teams led by MIT and the University of Nevada—Reno; and 24 experiments taken for LBS programs by LLNL and LLE scientists.

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