P11-NTD: A new neutron temporal diagnostic (P11-NTD), to be used for high-yield DT experiments, was activated on OMEGA. The instrument design is based on the current neutron temporal diagnostic (H5-NTD), which uses a fast rise time, commercially available plastic scintillator. Neutron collisions with the scintillator convert neutron kinetic energy into 350- to 450-nm-wavelength light. The light from the scintillator inside the nose cone assembly is relayed ~16 m to a Rochester Optical Streak System (ROSS) camera located behind the main OMEGA shield wall and therefore well protected against neutrons. An ~200× reduction in neutron background was observed during the first high-yield DT cryogenic implosions compared to the H5-NTD. This significantly improves the signal-to-background ratio on high-yield shots. Figure 1 shows the experimental data obtained by P11-NTD for a DT cryogenic target compared with 1-D predictions. The measured full width at half maximum (FWHM) of the signal is 105 ps. When the effects of instrument response (40 ps), scintillator thickness (20 ps), and thermal broadening are taken into account, the actual burnwidth is estimated to be ~90±5 ps. The burnwidth is an important measurement to determine the pressure achieved in the cryogenic implosions. The pressure is a key metric in assessing the quality of these implosions.

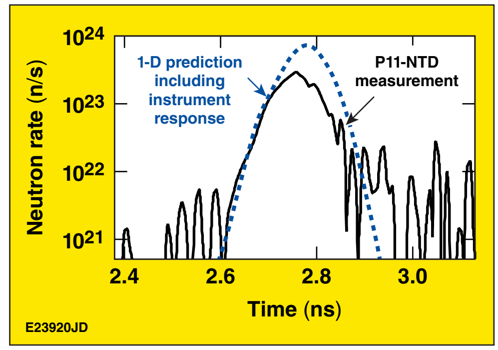

Figure 1. Measured neutron production rate (solid line) from the P11-NTD detector for a layered cryogenic DT target (shot 76607) with a yield of 3.5×10^{13} compared with 1-D predictions (dashed line).

KBFRAMED: KBFRAMED is a newly installed plasma diagnostic on the OMEGA target chamber consisting of a 16-image Kirkpatrick–Baez (KB) x-ray microscope and a four-strip, high-speed framing camera. The microscope optic has been fitted onto an existing KB microscope chassis that acts as a fixed platform, imaging x rays emitted by laser-generated plasmas. The individual KB-mirror pairs are IR-coated, superpolished, fused-silica substrates, with an ~27-m radii curvature and are used at a 0.7° grazing angle at a magnification of 12. They have a best resolution of ~5 μm over a 400-μm region, in an energy band from 2 to 8 keV. When recorded with a high-speed x-ray framing camera, the 16 images each record the x-ray emission in a 30-ps time period, with 60 ps between images, four to a strip. The individual strips can be independently triggered in increments as small as 25 ps. Figure 2 shows two framed images of implosions on OMEGA recorded with KBFRAMED. Figure 2(a) is an x-ray image at peak stagnation of a 15-atm, D_2-filled CD shell imploded by OMEGA. The x rays emitted by the plasma were filtered so that the emission was from 4 to 8 keV. The resolution is sufficient to clearly resolve the stagnating CD shell around the core's center and a feature likely caused by the target stalk at the upper right. Figure 2(b) is an image at stagnation of the x rays emitted by the implosion of a layered cryogenic DT target recorded using the same filter. Images obtained with KBFRAMED will be one of the principal means by which the evolution of the cryogenic target cores will be studied, including extracting the pressure.

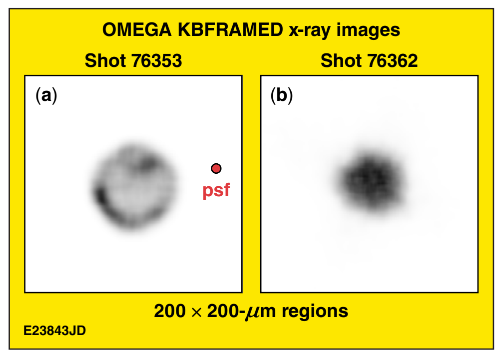

Figure 2. X-ray images obtained with the new OMEGA diagnostic KBFRAMED. (a) Image at peak stagnation of a D_2-filled CD shell. (b) Image at peak stagnation of a cryogenic DT target. The approximate point-spread function (psf) is indicated.

Omega Facility Operations Summary: During February 2015, the Omega Facility conducted 135 target shots with an average experimental effectiveness (EE) of 97% (OMEGA: 99 target shots, 97% EE and OMEGA EP: 36 target shots, 97.2% EE). The ICF program accounted for 90 target shots for experiments led by LLE and LLNL and the HED program had 14 target shots for an experiment led by LLNL. Seven target shots were taken for one NLUF experiment led by Princeton University and three LBS experiments led by LLE had 24 target shots.