Comparisons of High-Resolution Neutron and X-Ray Imaging: The penumbral-based neutron imaging system (NIS) implemented on OMEGA by a team from Commissariat à l'Énergie Atomique (CEA) was upgraded in FY01 to a resolution of 17 μm.* Recently, neutron and x-ray images obtained on OMEGA implosions with NIS and x-ray microscopes, respectively, were analyzed and compared. Figures 1 and 2 show some of the results taken on the implosions of CH and glass-shell capsules filled with DT. The time-integrated x-ray images were taken with x-ray microscopes GMXI in port H9 and KB1 in port H8. Both microscopes have Ir-coated optics with 5-μm resolution and accounting for filtration are sensitive to x rays in the 4- to 7-keV energy band. The NIS images are taken through port P7 (TIM6) of the OMEGA chamber. The relative positions of the three instruments are shown in the Aitoff projection of the target chamber (Fig. 3). The NIS and KB1 are located on the same meridian; therefore, the NIS image contours of Figs. 1 and 2 are overlayed on the KB1 image with no tilt. The direction perpendicular to both the NIS and the GMXI is tilted 34° from the vertical as seen from the GMXI; therefore, the NIS contours are overlayed on the GMXI image with tilt of 34°. The elongation of the neutron emission appears to coincide with elongated shell emission as seen from the GMXI. To improve the characterization of the compressed core structure, additional images of the core neutron or fusion-charged-particle emission along an axis orthogonal to the exisiting NIS system would be required.

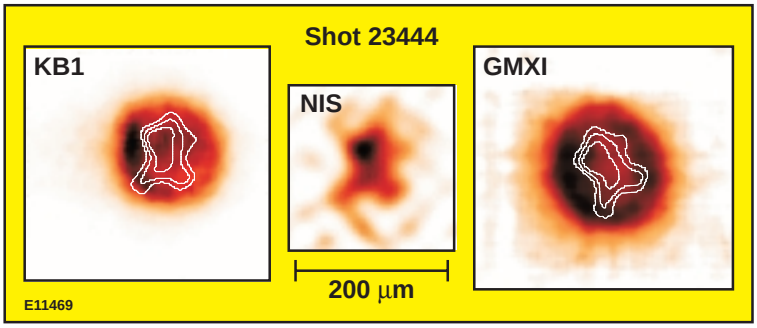

Figure 1. KB1 (left) and GMXI (right) x-ray images and a NIS neutron image (center) for shot 23444—a 933-μm-diam, 4-μm-thick glass shell filled with 20 atm of DT, and irradiated with 28.7 kJ of UV (no SSD was used for this shot). The neutron yield for this shot was ~ 6×10^{13}. The NIS image was processed at the CEA in France and the contour lines (white) corresponding to the 0.88, 0.75, and 0.5 of peak intensity contours are superimposed on the x-ray images. The x-ray emission is primarily from the compressed shell.

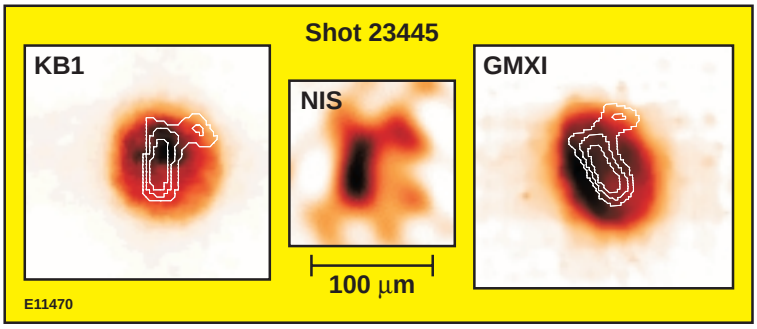

Figure 2. KB1, GMXI, and NIS images for shot 23445—a 932-μm-diam, 18.9-μm-thick CH shell filled with 15 atm of DT and irradiated with 23.3 kJ of UV laser light with full 2-D SSD beam smoothing. Neutron yield for this shot was ~2×10^{13}. Note that the CH capsule achieved a higher convergence (~2×) than the glass-shell capsule (shot 23444) and that both implosion cores appear prolate in the vertical direction.

OMEGA Operations Summary: A total of 98 OMEGA target shots were taken during December for LLE and LANL programs. The LLE shots included 59 for the ISE campaign and 3 cryogenic implosions. Thirty-six LANL shots were taken for a variety of experiments including hydrodynamics of imploding cylinders. A total of 392 target shots were taken on OMEGA in the first quarter of FY02. During December progress was made on several ongoing OMEGA projects including the backlighter driver alignment sensor package, characterization of the 60-beam path length adjuster system in order to automate this system, and testing of a new OMEGA transport instrumentation system to measure the beam-energy losses to target.

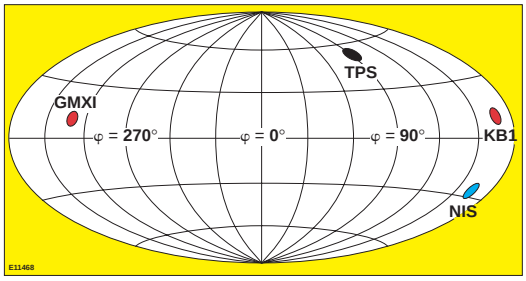

Figure 3. Aitoff projection of the OMEGA target chamber showing the relative positions of the GMXI, KBI, NIS, and target positioner system (TPS). GMXI is approximately 70° in azimuth (φ) from the position of the NIS.

*L. Disdier, A. Rouyer, A. Fedotoff, V. Yu. Glebov, C. Stoeckl, and F. J. Marshall, "Neutron Prenumbral Imaging at OMEGA," submitted to Nuclear Instruments & Methods in Physics Research, Section A.

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