MIT's NLUF Experiments: A collaborative team led by scientists from the MIT Plasma Science and Fusion Center (PSFC) is investigating the use of penumbral proton imaging to study the spatial distribution of DD and D^3He reactions in imploded D^3He-filled capsules on OMEGA. The imaging is performed with multiple cameras. The images are recorded in stacked sheets of CR-39 nuclear track detector separated by ranging filters that results in the efficient detection of 14.7-MeV D^3He protons on one sheet and 3-MeV DD protons on another. One of the approaches used to process this data is to reconstruct two-dimensional images of the proton surface brightness of the capsule.Three cameras can be mounted to image capsules from three orthogonal directions for symmetry studies. Data from each are then used to reconstruct a two-dimensional map of surface brightness, and the three separate images provide information about three-dimensional burn asymmetries. To study the relationship between illumination asymmetry and burn asymmetry, an experiment was recently performed with laser drive containing an intentional P2 asymmetry. Laser intensity was reduced at the two poles of a symmetry axis (TIM4 and TIM6), with the result that the capsule imploded with a prolate ("sausage"-shaped) asymmetry. Figure 1 shows the resultant burn asymmetry; one camera viewed the end of the sausage (TIM4) while the other two viewed the sides (TIM5 and TIM3). A substantial elongation of the emission region is seen. The direction of the elongation is coincident with the axis of the illumination asymmetry. In addition, the data suggest that the emission is peaked at the two ends of the region, resulting in a "dumbbell"-like shape.

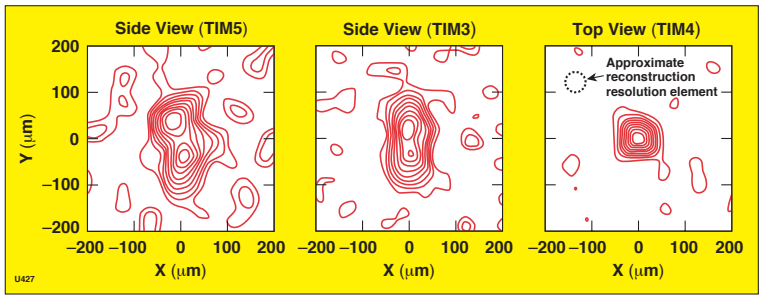

Figure 1. The first images of D^3He nuclear burn in an asymmetric implosion. These three contour plots show nearly orthogonal views of the fusion burn region in OMEGA implosions 35172 and 35173, recorded by three proton-emission cameras operating simultaneously (data from the two implosions are summed).

High School Summer Research Program: During the summer of 2004, 16 students from Rochester-area high schools participated in the Laboratory for Laser Energetics' Summer High School Research Program. The goal of this program is to excite high school students about careers in the areas of science and technology by exposing them to research in a state-of-the-art environment. One hundred and seventy-six high school students have participated in the program since it began in 1989. This year's students were selected from approximately 50 applicants. The students spent most of their time working on their individual research projects with members of LLE's technical staff. The program culminated on 25 August with the "High School Student Summer Research Symposium," where the students presented the results of their research to an audience including parents, teachers, and LLE staff. The students' written reports will be bound into a permanent record of their work that can be cited in scientific publications. These reports are available by contacting LLE.

OMEGA Shot Record: A total of 1558 target shots were taken on OMEGA in FY2004. This is a record high number of target shots for OMEGA and the highest number of target shots ever taken in a single year by a comparable-sized ICF facility. Over 50% of these shots were conducted for external users of OMEGA including the National Laboratories (LLNL, LANL, SNL, and NRL). Figure 2 shows that the 60-beam OMEGA facility produced over 10,000 target shots during its first decade of operation.

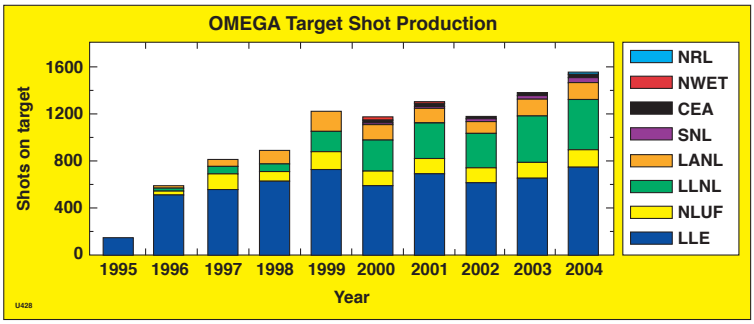

Figure 2. OMEGA target-shot production and allocation for the fiscal years 1995 to 2004.

OMEGA Operations Summary: During the month of September, 105 target shots were taken on OMEGA for LLE, LLNL, LANL, and NLUF campaigns. LLE's total of 41 shots included experiments for the ISE, RTI, DDI, and SSP campaigns. LLNL and LANL had 23 and 22 targets shots, respectively, and an NLUF team led by Polymath Research, Inc. conducted 19 target shots.

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