High-School Projects at the Laboratory for Laser Energetics (2017)

Viknesh Baskar (Webster Schroeder) performed a nonlinear-least-squares fit of the neutron energy distribution resulting from deuterium−tritium fusion reactions from OMEGA implosions. Taking into account the measured instrument response function and testing various amplitude, mean, and variance parameters, he inferred the average ion temperature of the fusing plasma.

Nikhil Bose (Pittsford Sutherland) developed a simulation model and used it to design a frequency conversion crystal that reduces beam intensity modulations by up to 10% when inserted into an OMEGA EP beamline. His results suggest that it may be possible to increase OMEGA EP's current energy limits. He was selected as a Scholar in the Regeneron Science Talent Search for this work.

Benjamin Chaback (Byron-Bergen) used a CAD program to design a Cherenkov-based radiation detector to measure the width of the neutron energy distribution from deuterium−tritium fusion reactions. He made background measurements using this detector to establish the noise level. This instrument promises a more accurate measurement of the ion temperature of the fusing plasma.

Meshach Cornelius (Gates Chili) developed a non-invasive process to detect the level of flash-lamp connector deterioration. This involves analyzing changes in the resistance of the water flowing through the flash-lamp cooling system. This research will allow the state of the connectors to be monitored and will ensure that the connectors are replaced before flash-lamp failure.

Griffin Cross (Pittsford Sutherland) measured the vapor pressure of hydrogen gas over palladium for various hydrogen-to-palladium ratios and temperatures. Understanding gained from his work will support several applications that rely on storing hydrogen on or drawing hydrogen from palladium at LLE.

Matt Galan (Fairport) studied the use of DaaS (data as a service) to simplify access to data sets for the scientific analysis of Omega laser experiments. His work supported authenticated URL (universal resource locator)-based data service for internal and external users, providing real-time access from a number of data analysis programs such as MatLab and Python.

Claire Guo (Penfield) performed hydrodynamic simulations of implosion experiments performed on the OMEGA laser and post-processed these simulations to generate synthetic x-ray images that were used for the analysis of asymmetry trends. Her investigations generated new ideas for the analysis and detection of asymmetries.

Joyce Luo (Pittsford Mendon) worked on a new process that employs room-temperature purging with an inert gas to remove ammonia catalyst from sol-gel anti-reflective coating solutions. Using nitrogen purging, she removed ammonia from a production-scale batch of sol-gel solution with minimal effort and attention, and in a much shorter time than was previously possible.

Jonathan Moore (Pittsford Sutherland) developed a MATLAB computer program that predicts the final solid-fuel-layer thickness in cryogenic targets to be shot on OMEGA based on x-ray images of the liquid meniscus prior to solidification viewed from an arbitrary angle. He determined the best viewing angle from a few choices for a future cryogenic-target delivery system on OMEGA.

Arian Nadjimzadah (Brighton) modified the surface roughness and chemical composition of stainless steel by electropolishing, with the goal of reducing hydrogen ingress into the metal bulk. He found that the current density to samples was limited by both sample temperature and the rate of stirring of the electrolyte and that hydrogen evolution from the surface resulted in surface pitting.

Yujia Yang (Brighton) carried out hydrodynamic simulations of a new fusion concept for the National Ignition Facility. She developed a design using large laser spots with elliptical shapes that improved the uniformity compared with the best previous design. She was selected as a Scholar in the Regeneron Science Talent Search for this work.