High-School Projects at the Laboratory for Laser Energetics (2016)

Kyle Bensink (Victor) developed Matlab programs to analyze and correlate data from multiple control and measurement systems that are used when fielding cryogenic targets on OMEGA. These programs provide a basis for defining a normal range of expected values, help identify abnormalities indicative of potential problems, and assist with troubleshooting when malfunctions occur.

Lindsay Browning (Penfield) performed hydrodynamic simulations of small imploding targets being considered to provide a source of protons for backlighting experiments on the National Ignition Facility (NIF), with each target surrounded by a plastic "Saturn ring" to block unabsorbed laser light. She found that a single-sized ring can be used for the full range of targets of interest.

James Hu (Brighton) developed an application to promote web-based collaboration among experimental scientists for post-shot data analysis. He used html5 and other web technologies to develop this application. Users on- and off-site can view and analyze data in a common web session.

Webster Kehoe (Wilson Magnet) developed an algorithm based on hydrodynamic simulations to optimize the pointings of 54 of the 60 OMEGA beams on an imploding target when the other beams are used to irradiate a secondary (x-ray backlighter) target. His design has now been successfully implemented. He was selected as a Scholar in the Regeneron Science Talent Search for this work.

Grace Lenhard (Prattsburgh) measured the efficacy of using a copper-manganese alloy to extract oxygen from inert carrier streams. She found that the quantity of oxygen collected increased with alloy temperature and remained constant for areal flow rates from 0 to 1.0 cm^3 (STP)/cm^2-s.

Joseph Mastrandrea (Webster Thomas) measured the vapor pressure of hydrogen gas over palladium for hydrogen-to-palladium ratios between 0 and 0.8 and for palladium temperatures between 233 K and 453 K. He fitted his data to the van't Hoff curve and determined the van't Hoff constants. His values compared favorably with those published in the literature.

Nathan Morse (Allendale-Columbia) developed new designs for the crystals that convert infrared light into ultraviolet light on the OMEGA laser system. His designs show an improved power balance among the 60 beams that irradiate a fusion target, potentially producing a more uniform target implosion. He was selected as a Scholar in the Regeneron Science Talent Search for this work.

Sapna Ramesh (Pittsford Mendon) used impedance spectroscopy and optical spectroscopy to study the effect of dielectric breakdown products on the electrical properties of insulating oils used in pulsed-power research. She also developed a highly efficient absorption-based process that removes these breakdown products from the oil and restores its original electrical properties.

Archana Sharma (Webster Schroeder) developed an apodized Hartmann mask for portable self-referencing wavefront measurements on the OMEGA and OMEGA EP lasers. She developed an optical test platform, experimental processes, and Matlab image-processing code to validate different apodization methods and their effects on the accuracy of wavefront retrieval.

Jonah Simpson (Brighton) performed 3-D Monte Carlo simulations using the Geant4 toolkit to study the interaction of a deuterium or tritium ion beam with energies in the range of 1 to 20 MeV incident on various target materials. He validated the energy loss model in Geant4 against the well-proven dedicated ion-stopping simulation SRIM, finding good agreement for all target materials.

Matthew Wang (Pittsford Sutherland) did experiments on the Multi-Terawatt Laser to measure the impulse response of a neutron temporal diagnostic, an instrument that uses a plastic scintillator to convert neutron energy into light, which is recorded by an optical streak camera. He found that the impulse response using an aluminum nose cone was twice as fast as that using tungsten.

Leah Xiao (Webster Schroeder) carried out hydrodynamic simulations of an alternative fusion concept wherein a cylindrical shell containing deuterium-tritium fuel and a preformed magnetic field is imploded, with a laser fired along the axis to preheat the fuel. She found that the desired preheated temperature profile can be achieved through the formation of a self-focusing density channel.

Joy Zhang (Penfield) performed a feasibility study of an *in-situ* digital microscope for use in characterizing sub-micron features on small spherical fusion targets at cryogenic temperatures. She optimized various parameters of the illumination system and demonstrated that it is possible to resolve the smallest features calculated by theory (~0.5 μm).