High-School Projects at the Laboratory for Laser Energetics (2018)

Aditya Bhargava (Victor) developed a computer model to calculate how the measurement accuracy of a device that is used to determine the energy of an OMEGA EP laser beam depends on the laser beam's incident angle and the geometry of the measurement device. The model helped to provide guidance for improved device designs that may reduce measurement errors.

Steven Booth (Brighton) developed a Python-based analytical tool that retrieved and analyzed large amounts of flash-lamp data from the OMEGA EP Amplifiers operation database. This data was studied in an effort to highlight trends that might predict future failures and indicate the need for flash-lamp or power-conditioning-unit maintenance.

Carwyn Collinsworth (Brighton) worked on a proposed alternative method for forming cryogenic targets on OMEGA in which the DT enters the target through a fill tube as a liquid before being frozen into an ice layer. He developed a computer program that communicates with an x-ray camera and a temperature controller to ensure that the correct amount of fuel enters the target.

Matthew Cufari (Pittsford Sutherland) extended the Monte Carlo particle tracking code IRIS3D, which is used as a postprocessor to hydrodynamic simulations to calculate experimental observables such as neutron and charged particle spectra. His work makes it possible to calculate elastically scattered deuteron spectra, used to infer compression in OMEGA cryogenic implosion experiments.

Audrey DeVault (Penfield) used a modern interpretation of the neutron energy distribution to study the spectrum created in fusion experiments on OMEGA as measured by a neutron time-of-flight spectrometer. Applying a forward-fit analysis technique to the experimental data, she inferred the temperature of the fusing ions and quantified asymmetries in the target implosion.

Katherine Glance (Pittsford Sutherland) measured the equilibrium pressure of hydrogen and deuterium over palladium, a metal that absorbs and reacts with hydrogen isotopes to form palladium hydride at temperatures below 610 K. She obtained data for a broad range of temperatures and H:Pd and D:Pd ratios, validating and extending prior data.

Katherine Kopp (Victor) applied a new microscope technology (MUSE, microscopy with ultraviolet surface excitation), originally developed to locate defects in optical materials damaged by large lasers such as OMEGA, to biology. She explored how to integrate MUSE into a high school science classroom in order to generate a curriculum that is more engaging and inspiring for students.

Hannah Lang (Rush Henrietta) used density functional theory to design and model new re-writable photoswitchable alignment materials for an optically addressable liquid crystal laser beam shaper. Of the six polymers studied, she identified one promising material with both low-energy write states and a modest energy barrier between the switching states.

Maia Rainor (Brighton) used a copper-zinc alloy to remove elemental hydrogen from air for a range of concentration, flow, and temperature conditions. This novel approach provides the tritium community with a simplified method of reducing emissions to the environment. Maia was selected as a Scholar in the Regeneron Science Talent Search for this work.

Margaret Rudnick (Pittsford Mendon) evaluated organosilane chemistry as a means of rendering both thin-film reflective coatings and LHG-8 phosphate laser glass impervious to atmospheric moisture. She developed a process to apply an optically transparent polydimethylsiloxane coating to LHG-8 laser glass that protects it from moisture damage even at 99% relative humidity.

Aiden Sciortino (Wilson) worked on improving a container-based system for data analysis on OMEGA and OMEGA EP. He demonstrated a scalable method for providing custom scientific computing environments with easy-to-access data resources. His work involved using Docker containers with Kubernetes automation, Node resource services, and Python programming.

Anirudh Sharma (Webster Schroeder) simulated a new "double cone-in-shell" target concept for the National Ignition Facility (NIF) in support of experiments related to studying the internal structure of the Sun. He identified conditions needed to produce an optimum pulse of x rays. He was selected as a Scholar in the Regeneron Science Talent Search for this work.

Alan Tu (Pittsford Sutherland) developed a simulation model for an energy-loss mechanism known as cross-beam energy transfer that occurs in direct drive implosions on OMEGA. His numerical method is more efficient than other models, can model additional effects such as diffraction and interference, and will be implemented into an advanced 3-D code under development at LLE.