High-School Projects at the Laboratory for Laser Energetics (2009)

Dustin Axman (Irondequoit) created a graphical user interface (GUI) that allows the user to modify the settings of and display data from a remotely located oscilloscope. The GUI communicates over Ethernet and can provide control and remote viewing of virtually any oscilloscope in the OMEGA and OMEGA EP laser systems.

Leela Chockalingam (Brighton) studied the formulation of antireflective silane sol-gel coatings used on the OMEGA and OMEGA EP lasers in an attempt to improve their resistance to mechanical damage by abrasion. She found that using glutaraldehyde or glyoxal as a hardening agent resulted in improved abrasion resistance.

Ted Conley (McQuaid) developed a computer program that calculates the correct location for the injection of a small seed laser beam into an optical-fiber amplifier. The program analyzes images of the beam emerging from the fiber and corrects for misalignment by communicating with a motorized mirror mount that controls the path of the injected beam.

Cheryl Liu (Pittsford Sutherland) designed a new neutron diagnostic that employs a plastic foil to produce protons from collisions with energetic neutrons. The protons are detected using a diode, enabling the neutron spectrum to be measured with a very high dynamic range. After testing on OMEGA, it is hoped to implement the new diagnostic on the U.S. National Ignition Facility (NIF).

Trevor Lu (Webster Thomas) used a ray-tracing code to analyze a method for the characterization of cryogenic laser fusion targets known as x-ray phase contrast imaging. He modeled the image produced when x rays from a point source pass through a target and compared his predictions with experimental measurements.

Evan Miller (Pittsford Mendon) used the Monte-Carlo computer code GEANT to model the motion of energetic electrons in the hot plasma that surrounds a laser fusion target. He wrote a FORTRAN program to model the reflection of electrons from the plasma boundary and found that the impact of the electrons on target behavior is generally insensitive to how the boundary is modeled.

Lindsay Mitchel (Spencerport) performed a large number of hydrodynamic simulations to design two classes of implosion experiments on the Laser Megajoule (LMJ) laser currently under construction in France. Her results show that these experiments, already designed for the NIF, can also be carried out on the LMJ in spite of its less favorable geometry.

Justin Owen (Irondequoit) wrote a computer program, coded in Java, Matlab and Ice, that combines data in real time from two experimental diagnostics and uses the results to provide input to drive a third experimental system. He demonstrated his program by using data from a single-shot autocorrelator and a spectrometer to predict the adjustments required by a pulse stretcher.

Ben Petroski (Livonia) studied the loss of tritiated water from the surface of a piece of copper when exposed to flowing helium gas containing water vapor. Understanding of this process is important both for tritium decontamination and for moisture removal in the semiconductor industry. Ben found that the rate of diffusion of tritium from the bulk copper to the surface is important.

Aaron VanDyne (Brighton) used a Matlab-based program to investigate a new laser-beam smoothing scheme proposed for the NIF. The scheme uses multiple phase modulators that cause the laser-beam nonuniformities seen by the fusion target to oscillate in time and thus average out. Aaron varied parameters of the smoothing scheme to arrive at an optimized design.

Marisa Vargas (Webster Thomas) worked on a new concept for laser beam shapers made from liquid crystals. Using masks to irradiate photopolymerizable polymers with linearly polarized UV light, she was able to deposit liquid crystals aligned differently in different regions of the substrate. There are many potential applications of these devices.

Kate Walden (Wayne Central) investigated the etch rate properties of NaOH/ethanol solution, proposed as an alternative to the standard NaOH solution, on the plastic CR-39 that is used to diagnose energetic particles produced in fusion reactions. Her results will support the development of improved CR-39 diagnostics.

Victor Wang (Webster Thomas) modeled the absorption spectra of optically switchable azobenzenes as a function of molecular structure using time-dependent density functional theory. He obtained results closer to observed spectra than previous research.

Paul Watrobski (Penfield) wrote a computer program that analyzed a new optical probing diagnostic planned for the OMEGA EP laser. The diagnostic uses an optical probe beam that passes through a grid and is refracted in the plasma produced by the laser. Paul identified an optimum position for the grid that results in crisp images.

Mia Young (Penfield) worked on the problem of analyzing x-ray images of imploding laser fusion targets backlit by a source of x rays. She studied the important case where x rays emitted from the imploding target complicate the interpretation of the images.

Harvest Zhang (Brighton) carried out experiments to measure and analyze the vibrational characteristics of cryogenic laser fusion targets. He measured frequency response functions and damping rates using two different methods and compared different designs intended to reduce the vibrations. He was named a semifinalist in the 2010 Intel Science Talent Search based on this project.