Educational Raman Spectrometer and Curriculum

Background
Visible and near-infrared spectroscopy is growing at a very fast pace in many fields including forestry, medical, agriculture, defense, homeland security, and food safety. Raman spectroscopy is experiencing very strong growth, because it is noninvasive, highly sensitive, and fast. Raman spectroscopy is used in bomb detection, food safety, and medical, such as early detection of cancer. These growing applications have resulted in increased spectrometer sales, and increased demand for photonics/laser technicians with a skill set in the field of spectroscopy.

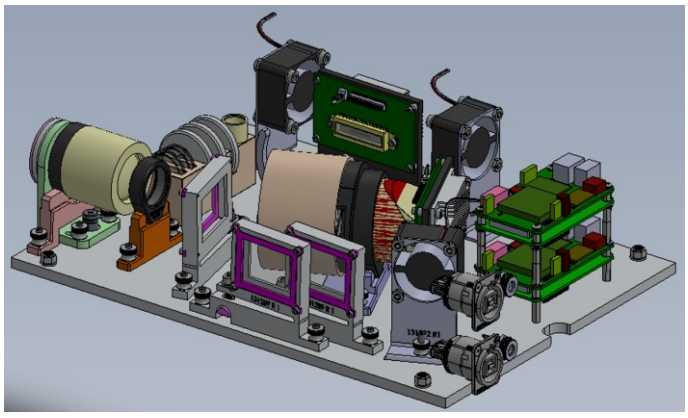
Need
Graduates from the Central Carolina Community College (CCCC) laser program have been hired by spectroscopy companies in NC, Delaware, and Florida but industry needs twice as many workers with more advanced spectroscopy skills. To answer this call CCCC developed a module on "Advanced Spectroscopy" with focus in Raman for inclusion in the "Laser Applications II" course, to complement the existing "Basic Spectroscopy" module, which uses the OP-TEC Spectroscopy Unit from the Photonics-Enabled Technologies Series.

Brief Description of Raman Spectroscopy
Raman spectroscopy works with the scattering of electromagnetic radiation by atoms or molecules. The Raman signal is observed as inelastically scattered light and is an invaluable tool for molecular fingerprinting. Using a laser source to interact with molecules, two types of scattering may occur. One being Rayleigh, and the other being Raman. The wavelength of the scattered Rayleigh energy is the exact wavelength of the laser energy source. The wavelength of the Raman scattered energy is a different wavelength than the wavelength of the laser energy source, and is in fact a unique wavelength, which is the fingerprint of the molecule under test.

Solution
One problem encountered in preparing graduates for the Raman spectroscopy industry is the lack of hands-on training students receive in building and aligning Raman spectrometers. Even if a laser program could afford one, commercial units are closed systems, with only inputs and outputs, which do not offer hands-on training in building and aligning one. They would basically just learn how to set-it up and run a sample. They would be preparing to be end user operators, versus learning how to develop, manufacture, and test one.

During the last two years CCCC collaborated with Wasatch Photonics, which employs many of its graduates, and developed a Raman spectrometer for educational lab use. Mike Sullivan, who consults for Wasatch, and is on the CCCC Advisory Committee, came-up with the idea of building an open-system Raman Spectrometer. This open system provides a teaching tool for students to gain the hands-on experience of building, aligning, and testing a Raman spectrometer. Faculty and students have access to the internal parts of the spectrometer, including alignment accessibility. Some of the parts may also be changed out with other types of parts, like the grating, filters, and source.

How to buy one with 50% Discount
According to Wasatch, the cost of the unit is $16,000, but they have recently offered a 50% discount to laser programs associated with LASER-TEC. Some examples of possible experiments using the educational unit would be comparing Raman to Fluorescence spectroscopy, resolution and throughput experiments with different slit assemblies, cooled versus uncooled detector analysis, matched 0.39NA probe versus an unmatched 0.22 probe analysis, and building and aligning a unit. As more experiments are developed, they will be made available to all OPCN members. For more information contact Gary Beasley, Co-PI of LASER-TEC at 910-814-8828.



Sandbox view of Raman Spectrometer

Encased spectrometer