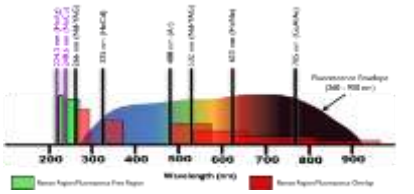
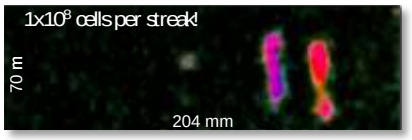
Improved CBE Detection | Deep UV Raman & Fluorescence

Deep UV excitation (<250 nm) enables non-contact and reagentless analysis of CBE threats using a combination of native fluorescence and resonance Raman spectroscopy. The deep UV based instruments can operate from a standoff distance of <1cm to >2 meters and can provide spectroscopic and spatial information for morphological/distribution assessment of threats. Unlike traditional Raman spectrometers, the natural spectral separation of Raman and fluorescence with deep UV excitation enables simultaneous collection of both the electronic and vibrational features of a material. Furthermore operating in the deep UV makes the instrument solar-blind and enables unrestricted daytime operations. One of the most compelling aspect of combining deep UV based native fluorescence and Raman spectroscopy is ability to leverage the advantages of one method with the limitations of the other – making for a more robust instrument that can address detection need for chemical, biological and explosive materials.





Top: Separation of Raman and fluorescence using deep UV excitation. Middle: Current 2M standoff sensor. Bottom: Standoff, non-contact biological detection and differentiation on natural surfaces.

In a collaborative effort between Photon Systems Inc. (PSI) and the Jet Propulsion Laboratory/NASA (JPL) a new line of compact deep UV lasers (PSI patent's: 6,693,944 & 6,287,869) have been integrated into hand-held and laboratory field instruments. These have been used to demonstrate the detection and characterization capability enabled by the combined spectroscopic methodology. The targets of interest include CBEs on a wide array of natural and man-made surfaces and water with demonstrated detection of single microbes, trace and bulk chemicals/explosive materials. More recent results also show the capability to detect latent fingerprints after environmental alterations and the ability to trace chemicals in fingerprint residues to specific people. These analyzes have been made possible by combining chemometric algorithms to the detected spectroscopic features. In addition, in the newer generation of instruments, visual and deep UV chemical mapping capabilities enable a new perspective on how a potential threat is distributed and enables mixture analysis. The next generation instrumentation leverages off the current instruments and focuses on miniaturization by utilizing recent technological advances in deep UV optics and detectors. The goal is to provide a series of non-contact and reagentless instruments for a range of CONOPS from light-weight, low power, highly sensitive and specific instrument for hand-held and robotic analysis to highly sensitive and specific mobile laboratory analyses.

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