



## Questioned Documents Section - 2016

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### J15 A Triad of Techniques and Instruments for the Examination of Questioned Documents

*F.L. Jim Lee, Jr., MS\*, Summit Forensic Document Examination Lab, PO Box 207, Eden, UT 84310*

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After attending this presentation, attendees will better understand the techniques and instruments available to the questioned document examiner and will be updated on their current status.

This presentation will impact the forensic science community by alerting the community to the advances made in three instruments used to aid in questioned document examination, namely, the FORAM® Raman spectrometer, the Elemental Composition Comparator (ECCO), and the Video Spectral Comparator (VSC®) 8000.

Additionally, this presentation is intended to provide attendees with an update on new instrumentation for forensic document examination, available from Foster + Freeman as an update regarding ongoing research with these instruments.

**Visual Examinations:** The VSC® 8000 combines sophisticated digital imaging and multi-wavelength Light-Emitting Diode (LED) technology with a clear and efficient software interface to provide a complete capability to the examination of questioned documents in order to reveal hidden details and irregularities such as alterations, obliterations, additions, and deletions, depicting them in Ultra High Definition (UltraHD) as sharp, bright images using super resolution imaging and displaying them on a 4K UltraHD monitor.

**Advanced Instrumental Analysis:** Beyond the visual examination of documents and their security features, it is possible to probe deeper into the chemical makeup of a document, revealing information about the origins and elemental composition of different paper and ink types and revealing the latest generation of embedded microscopic security taggants. There are two analytical instruments available which allow for this type of analysis. The first is the FORAM® Raman spectrometer 785nm; the Raman spectrometer is used for the examination of ink, toners, and other materials attached to documents. Raman spectra exhibit numerous features that are specific to molecular structure and provide valuable “signatures” for comparing and differentiating materials, making it an ideal technique for examining ink and other materials attached to documents. The FORAM® is available with a choice of three laser wavelengths: 785nm, 685nm, and 532nm. High levels of sensitivity can be achieved with the 532nm laser, while the 785nm infrared laser is better able to suppress fluorescence. A highly stable 685nm red laser provides a third option. FORAM® instruments have an integral video microscope to assist sample selection, a large XYZ translation stage and dedicated software for analysis and database comparison. The second instrument is the ECCO which employs the use of Laser-Induced Breakdown Spectroscopy (LIBS) for the elemental analysis of evidence, providing elemental analysis on materials as small as 300 microns. With a large sample chamber, ECCO is designed for the analysis of paper, glass, metals, paint, fibers, minerals, and gunshot residues. The system uses a high-intensity pulsed laser focused onto the sample to create a plasma of vaporized matter that emits an atomic spectrum of the constituent elements. A database of emission lines provides automatic identification and labeling of elements present. Features include rapid analysis and automatic identification of elements requiring only minimum sample preparation.

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#### Document Examination, Ink Examinations, Applications