## B37 Performance Evaluation and Calibration Artifacts for 3D Ballistic Imaging

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After attending this presentation, attendees will understand the fundamental metrological requirements for a smooth transition of 3D ballistic imaging from research to application in crime laboratories.

This presentation will impact the forensic science community by providing a roadmap to practitioners for obtaining accurate and traceable surface topography measurement results of ballistic samples in crime laboratories. A new effort at the National Institute of Standards and Technology (NIST) is working toward providing instrument performance evaluation specifications, performance evaluation procedures, and custom reference artifacts tailored to objective tool mark identification.

A promising approach to improving objective tool mark identification is the direct optical measurement of 3D sample surface topography; however, forensic laboratories seeking to implement this new approach are faced with several challenges. There is no guidance on instrument performance specifications that address the challenges and requirements of tool mark identification. Consequently, when a crime laboratory compares instrument specifications, it is difficult to determine which system is most appropriate for its measurement needs. Furthermore, there is no guidance on the type and frequency of tests that the laboratory needs to conduct to ensure that the instrument performs to specification and to establish traceability of measurement results. Finally, many physical reference artifacts for testing surface topography measurement devices are not compatible with the instruments and sample mounts designed for forensic applications and are time consuming to apply.

NIST is addressing these challenges by first developing a detailed performance-specification document, explicitly defining instrument performance parameters relevant to forensic tool mark metrology. This document will enable a laboratory to make informed decisions when specifying and comparing 3D optical instruments for ballistic imaging purposes. The specification will address relevant performance parameters, such as the instrument transfer function, lateral and vertical measurement accuracy, stitching performance, maximum measurable slope, and environmental conditions.

The main part of the project is focused on the design of a set of ballistics-oriented test procedures and physical reference standards that enable a forensic laboratory to validate the specified instrument performance. The standards are complementary to the NIST Standard Reference Manuals (SRMs) 2460 (standard bullet) and 2461 (standard cartridge case) and are envisioned as having the shape and dimension of a cartridge case to facilitate their application. The process control and calibration artifacts will be made available in one set, calibrated at NIST and International System of Units (SI) traceable. The set will likely include roughness standards, step height standards, 2D grids, and a reference flat. The specifications, test procedures, and reference artifacts addressed by this project are critical in establishing traceability of tool mark measurement results in forensic laboratories.

This presentation will outline the primary components of the performance evaluation specification detailed above and will present initial designs of the new ballistics-oriented physical reference standards.

**Tool Mark, Topography, Standards**