



B35 Implementing 3D Virtual Comparison Microscopy Into Forensic Firearm/Tool Mark Examinations

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After attending this presentation, attendees will better understand the validation method used to evaluate 3D instruments for virtual comparison microscopy, the method used to incorporate these technologies into traditional forensic firearms/tool marks examinations, and the capabilities of using 3D technology for training, examination verification, and blind verification/testing.

This presentation will impact the forensic science community by demonstrating the effectiveness of 3D technologies for integration into forensic firearms/tool marks examinations. The topics covered will include how the Federal Bureau of Investigation (FBI) Laboratory Firearms/Toolmarks Unit (FTU) has been tasked with evaluating 3D technologies for validation and incorporation into casework.

The FTU has been conducting a validation study for the incorporation of various 3D platforms into operational casework as another tool to assist in the examination of ammunition components. It is anticipated that having these technologies available will enable efficiency for cases with a high number of submitted components, provide additional training aids, and also provide larger-scale views of information captured for the examiner's examination and review. A portion of the validation study was to determine if a qualified firearms/tool mark examiner could successfully determine, using virtual comparison microscopy, the correct answers to previously distributed proficiency tests and consecutively manufactured test sets. The FBI Laboratory has a repository of Collaborative Testing Services® (CTS), Inc. firearms proficiency tests previously distributed to evaluate the FTU for quality assurance. Ten of these proficiency tests were selected, with test distributions spanning from 2003 to 2012. Some of the test participants had previously taken these proficiency tests using traditional optical comparison microscopy. All proficiency test samples, including the three knowns submitted for evaluation, were provided random identifiers for virtual microscopic comparison. Additionally, three test sets were assembled using consecutively manufactured slides from the FBI Laboratory Consecutively Manufactured Slides and Barrel Collection (CMSBC), which is used for training and research. Consecutively manufactured Ruger®, SR9 slides were selected using Winchester® ammunition to create test samples. Each consecutively manufactured test set consisted of ten cartridge cases with randomly assigned identifiers for virtual comparison. The participants contributing to this study ranged in years of experience and included qualified examiners and examiner trainees.

The Cadre® Forensic TopMatch-GelSight instrument uses the Bidirectional Reflectance Distribution Function (BRDF) to acquire 3D surface images and was acquired by the FBI Laboratory in 2014. The system's software allows for side-by-side evaluation of surface topographies and matching algorithm search capabilities for topography similarities. For this virtual comparison microscopy evaluation study, test participants did not have access to the matching algorithm to assist in reaching a conclusion. Test participants were given operating instructions on GelSight prior to conducting test examinations. Results were recorded by the individual test participant on an answer key and they were encouraged as well as the incorporation into the Firearms/Toolmarks Unit's standard operating procedures and implementation into casework as an alternative to traditional comparison microscopy.

3D Technology, Firearms, Virtual Comparison

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