D31 Quantitative Characterization of Tool Marks for Comparative Identification

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The goal of this research project is to measure surface roughness as a means of identifying features such as toolmarks.

This presentation will impact the forensic community and/or humanity by demonstrating If successful, this process should yield a forensic technique that is rapid, easy to perform, applicable to any shaped surface, and has the potential to be automated for automatic matching. By providing quantitative data the method answers the challenges created by the Daubert decision. The instrumentation needed for the method, while somewhat expensive, should still be affordable to many state and regional laboratories.

This paper will present initial results of an effort to provide the forensic community with quantitative, scientific, statistical data that supports the current comparative identification of bullet striations and toolmarks. This study is designed not to replace the current method, challenged in courts as being "unscientific" (see 1993 *Daubert v. Merrell Dow*), but to supplement the method with scientific data. The overall goal is to provide local, state, and federal law enforcement officials with statistically valid data that supports examiner testimony and is suitable for courtroom presentation.

Current examination relies upon qualitative examination of a surface and optical matching of a pattern across a region that essentially is two-dimensional in nature. This project extends the characterization of tool marks from a two-dimensional qualitative examination to a threedimensional quantitative one.

In the proposed method the surface is examined optically and regions of interest identified using conventional comparative examination techniques.Replicas are then made of the 'evidence' and 'standard' surfaces, the regions of interest identified and the resulting replicas are characterized using a three-dimensional profilometer. This instrument uses a finely balanced stylus to measure the topography of the surface over a user-defined area. The resulting data from the 'evidence' scan is then matched to the 'standard' scan and statistically evaluated to determine a probability of fit using a computer program.

In order to be useful it must first be shown that replicas produced using commercial materials and resins do accurately replicate the intended surface, and that these replicas can be accurately and consistently measured using a profilometer. Initial experiments have shown that, to within the specifications of the instrument, replicas are an accurate reflection of the surface and that multiple scans produce only slight changes in the surface. Current efforts are now aimed at developing the computer match routine that will take the quantitative data, automatically align the 'evidence' and 'standard' scans, then compare them statistically to determine an order of fit.

Tool Markings, Quantitative Characterization, Automatic Identification