E34 Gunshot Residue Documentation Using 3D Laser Scanning Methodology

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After attending this presentation, attendees will: (1) understand the use of 3D laser technology for the documentation of Gunshot Residue (GSR) evidence at crime scenes; and, (2) determine the limitations of 3D laser technology for the documentation of GSR.

This presentation will impact the forensic science community by illustrating how the use of 3D scanning technology for the documentation of crime scenes and physical evidence, while accepted in court, has little research background for its use as a documentation format. This study looked specifically at the use of 3D laser images for the documentation of GSR and its limitations.

This study focused on the limitations of the 3D laser scanner in relation to GSR and how minute traces, if any, can or cannot be detected by the laser scanner. If the scanner is able to detect minute traces, investigators can then use it at crime scenes to help reconstruct the events that transpired. The ability to determine if a suspect was standing relatively close to the victim who is shot in the back compared to shooting the victim from a distance can corroborate or disprove a story of self-defense.

Six distances of muzzle-to-target fabrics shot with a .40-caliber Smith & Wesson® were provided. Distances included contact, 3 inches, 6 inches, 12 inches, 18 inches, and 24 inches. First, the GSR targets were photographed using typical documentation techniques. Subsequently, they were documented using the 3D laser scanner. The Leica® C10 3D laser scanner was placed 17 feet away for two scans, and then 2 feet away for two scans. Medium resolution scans of the test room with the targets and highest resolution scans of the premade gunshot residue patterns were used to attempt to determine the muzzle to target distance of the shot. These long-distance and short-distance scans at different angles allowed for the software to have multiple angles and distances to stich together. The scans were then downloaded to a flash drive and to a computer to upload into the Cyclone software. After the scans were applied and registered, a TruView™ model was created in which the photographs taken of the GSR patterns were imbedded into the software.

A visual comparison of the GSR 3D laser scans to the traditional photographic images was performed to determine the resolution of the scans for their use and ability for range-of-fire determination. The 3D laser scans of the GSR patterns had a significant difference in the resolution compared to the photographs of the GSR patterns. The scans did allow for the user to see the burn pattern up to and including 12 inches. As the GSR pattern diminished with the further distances, the lesser quantity of powder became more difficult to see in the scans as compared to the traditional photographic images.

When working with the scanner, the closer the scanner is placed to the target, the denser the information points will be when one uploads the data onto the software. In this study, even when the scanner was placed two feet from the GSR patterns and at approximately the same height, with this optimal condition, the scans' quality was subpar to that of the traditional photographs. While the scanner does have the ability to resolve the shorter firing distance GSR burn patterns, there was difficulty determining the location of the bullet hole in the fabric in some of the patterns. As the scans were zoomed in, the resolution became increasingly poor. The scanner can be used for overall and larger pieces of evidence, but the smaller pattern evidence, such as GSR patterns or bloodstain patterns, should still be documented with photographs, then presented separately. Also, using the photos imbedded in the TruView™ scans could be an option.

3D Laser Scanning, GSR, Range of Fire