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Automated ballistic and tool mark identification

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Inspiring tomorrow's professionals

Introduction

Every firearm has individual characteristics that are as unique to it as fingerprints are to human beings. When a firearm is fired, it transfers these characteristics in the form of microscopic scratches and markings to the fired bullets and cartridge casings. Characterising these marks is the critical element in identifying firearms. When bullets or cartridge casings are found at a crime scene, firearms examiners can use the marks for comparison, to determine whether or not the bullets or casings were expelled from a suspect's firearm. If a firearm is recovered at the scene, a test fire of the weapon creates example bullets and cartridge casings for comparison. Bullets and cartridge casings found at one crime scene can also be compared with those found at another in order to link the crimes. Traditionally the comparison of ballistic evidence has been a tedious and time-consuming process requiring highly skilled examiners. Traditionally evidence recovered at crime scenes or from recovered firearms is manually compared, piece by piece, to the vast inventory of recovered or test-fired projectiles and casings.

Developments of Bullet-Identification Systems

The first use of the microscope as an advanced tool in firearms identification was around 1925. This was a single-eyepiece instrument similar to the microscope used today. The next advancement was the dual eyepiece ballistics microscope (comparison microscope) which is still the primary technique used in the UK today. The comparison microscope consists of two microscopes mounted side by side and connected by an optical bridge. There are two stages and images are combined in the field of view for comparison. The stages allow the bullets being examined to be rotated on their axis and moved. Most positive identifications are made on striations that occur in land impressions near the base of the bullets, Figure 1.

Figure 1: Formation mechanism of bullet marks

In the past decade, engineers have created automated ballistics identification systems that meld traditional comparison microscopes with digital cameras, computers, huge databases, and image-analysis techniques. This kind of system can help investigators to link crimes by automatically finding similarities among images of bullets or bullet cases from crime scenes or victims.

CPT is currently conducting research to apply the most advanced 3D surface topography techniques to the area of identification of bullets, cartridges, gun barrels and other tools. The research will be the fundamentals of next generation ballistic identification system.

Applications

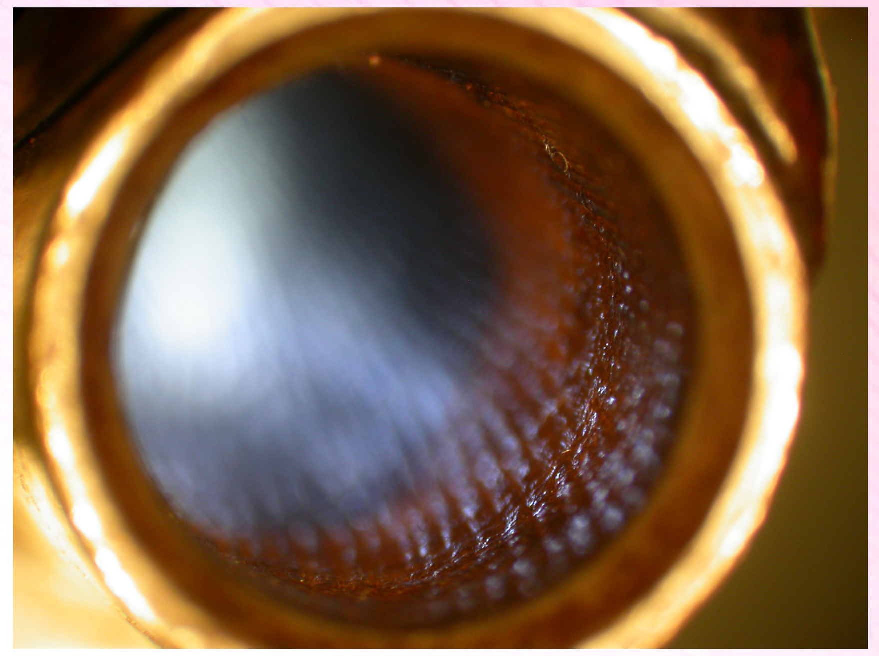

Figure 2. Photo image of the gun barrel of the world first rifled musket made for the king of France

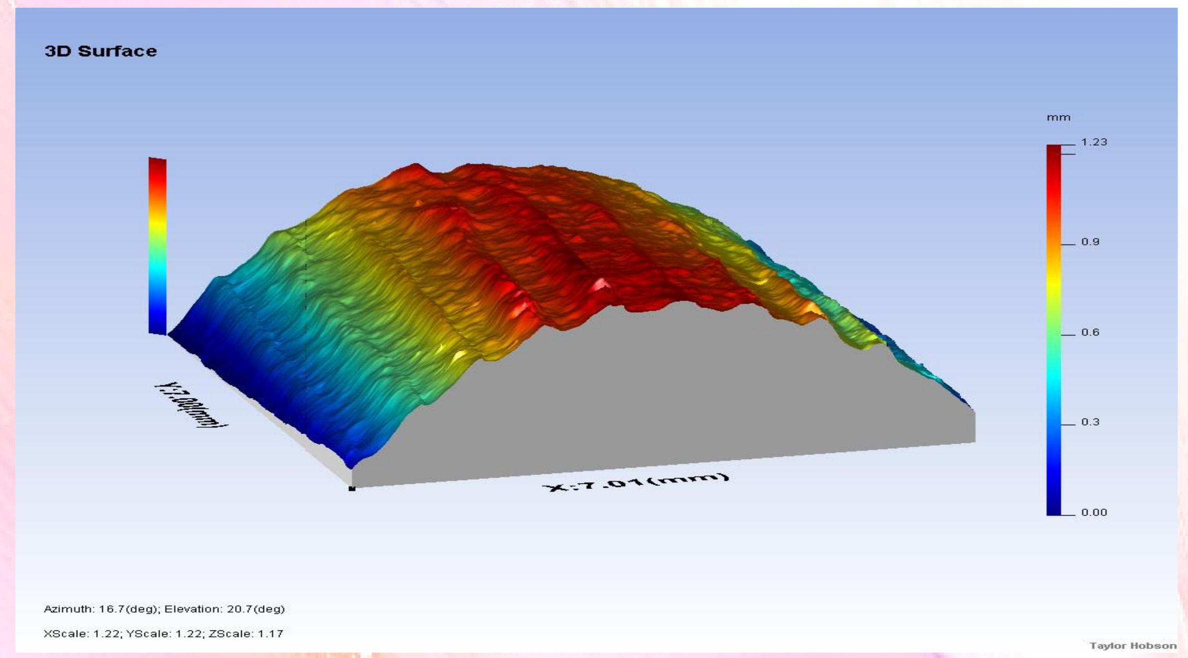

Figure 3. 3 D measurement image on the replica of the gun barrel of the world first rifled musket made for the king of France

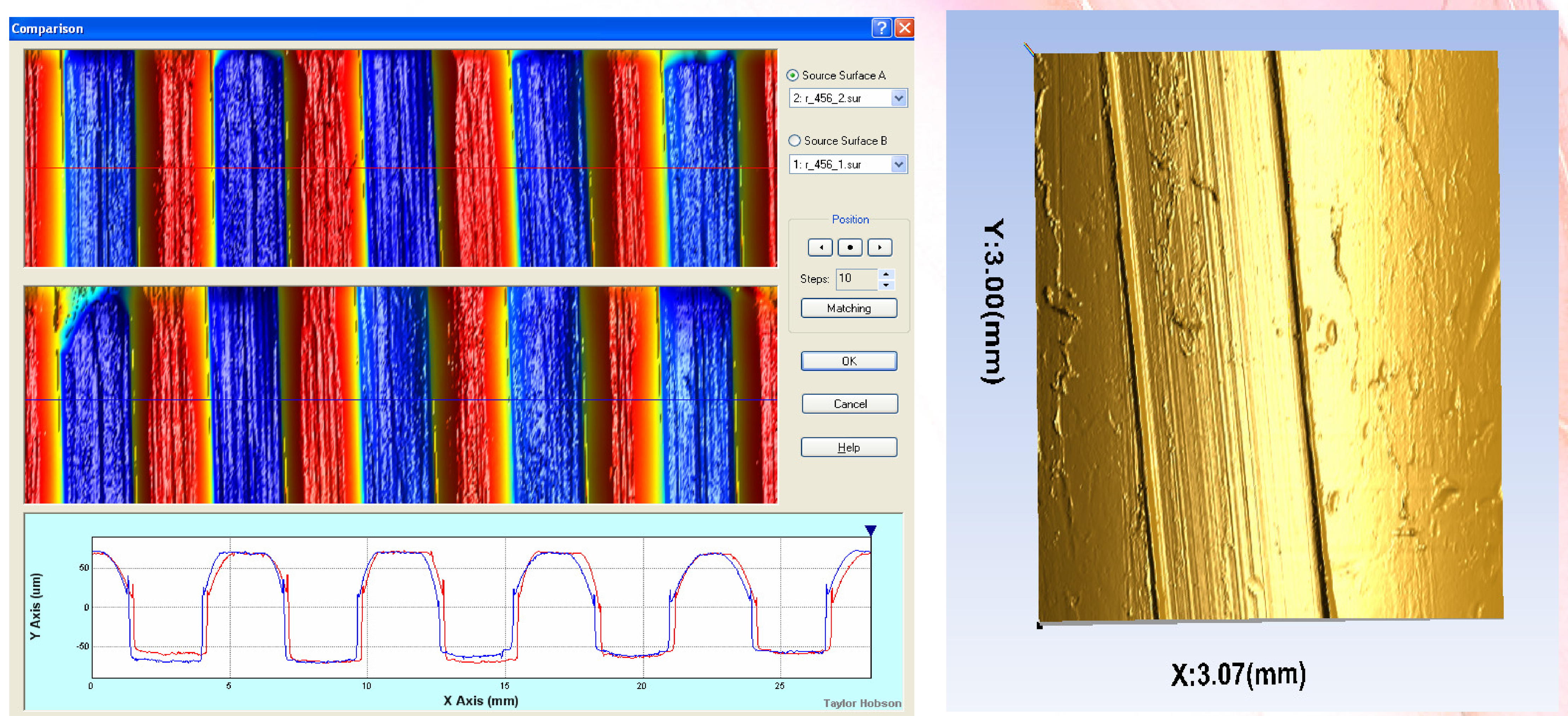

Figure 4: 2D and 3D graphics of "Benelli" bullet surface showing land and grooves

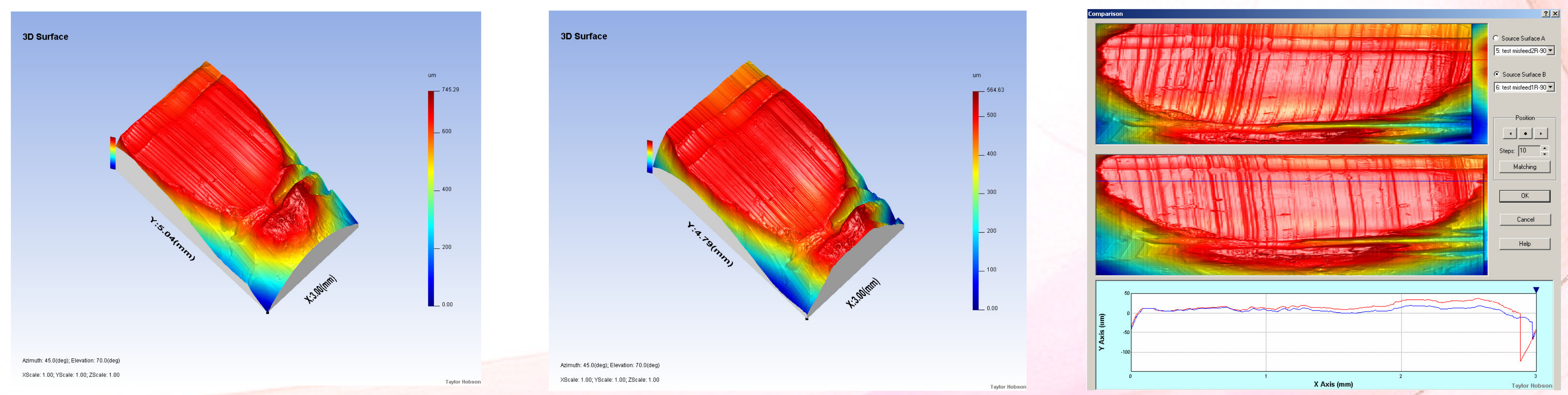

Figure 5: Measurement images of 2 fired bullets and the comparison the of the two bullets