

## **Suitability of Methods for Determining the Angle of Bullet Impact on Sheet Metal**

**Katarina Walland**, Physical Examination Section, National Forensic Laboratory, General Police Directorate, Slovenia. E-mail: [katarina.walland@policija.si](mailto:katarina.walland@policija.si)

When a crime scene involves a shooting, measurements of bullet impacts are a mandatory part of the investigation. Measurements include determining the location of the bullet impact (measurement of coordinates) and the angle of incidence of the shooting. In addition to measuring the angle of incidence with a probing rod, which is the most reliable, the lead-in and elliptical methods are also suitable for use and have the advantage that they come into consideration when we have only a single bullet impact. Such impacts are common when shooting at a vehicle due to its construction. Descriptions of these methods can be found in the literature, but they are not validated; therefore, our purpose was to check the applicability of the methods and their accuracy. In reviewing prior studies, the methods were tested with different calibres and types of bullets, and at different firing angles. Measurements were performed by forensic experts with varying levels of experience and also by students without prior knowledge of measurement. It was shown that the errors are generally less at smaller angles of incidence, up to 20°, the largest at intermediate angles, and then smaller again at angles close to right angles. The lead-in method presented an exception as it is not useful for angles close to a right angle due to too the small lead-in area. Some error patterns are observed. In the lead-in method, they also introduced correction factors based on trend curves, which significantly corrected the results and significantly reduced measurement errors. We compared methods with for matching parameters (weapon type, calibre, shooting angle) and detected minor measurement errors in the lead-in method. Then we performed a small test for both methods and came to similar conclusions as seen in the previous studies reviewed.

**Keywords:** ballistics, shooting reconstruction, angle of incidence, lead-in method, ellipse method

**UDC: 343.983**