



## Research Paper

# An empirical study on the close-range post-ricochet orientation of AK bullets (7.62 mm × 39 mm)

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## ABSTRACT

Most of the injuries and deaths from ricocheting bullets in shooting incidents are usually reported due to mis-aimed shots that had ricocheted close to the victims. Although the destabilisation of ricocheted bullets during their ricochet flights is a generally known phenomenon, no significant quantitative-based scientific studies have attempted to understand bullets' post-ricochet orientations at close distances. This empirical study explores close-range post-ricochet orientations of AK bullets (7.62 mm × 39 mm) on a range of domestic surface types typically encountered during bullet ricochet incidents. This study has revealed that ricocheting AK bullets off of various wood types and tile samples produce side-on impacts into closely located targets following a rightwards yaw action. It has also been shown that AK bullets ricocheting off concrete and cement samples at 5-degree incident angles produced nose-forward impacts on paper witness screens, similar to an orthogonal impact of a direct-fired shot. The findings present important new information on the post-ricochet yawing behaviour of AK bullets, which has the potential to aid future shooting reconstructions in which victims are hit by closely ricocheted bullets.

## 1. Introduction

The destabilisation of bullets after ricochet is a well-known phenomenon that has been empirically tested and reported in many studies. Bullets can destabilise and tumble when they start their secondary flights after ricocheting off surfaces. Destabilisation occurs due to the changing orientation of a spinning projectile's axis after impacting a surface at low incident angles [1]. This phenomenon has a great forensic significance when identifying gunshot injuries caused by ricocheting bullets [2] and identifying the distance from which severe or fatal wounds could be inflicted by ricocheting bullets [3].

An exploration into the existing forensic-related literature highlights that most of the injuries and deaths of bullet ricochet incidents are due to the bullets ricocheting close to the victims [4–8]. However, no studies have profusely attempted to understand the post-ricochet behaviour of bullets close to the ricochet impact point. It is also evident that most of the ricochet experiments have attempted to understand the initial

conditions of ricochet, and studies on post-ricochet behaviours are rare [9]. The significance of understanding the post-ricochet behaviour of bullets close to the ricochet point was highlighted during a recent experiment [10] that reported on the post-ricochet orientation of the 'main fragment' of AK bullets. The study claims that when AK bullets (lead core bullets) ricochet off of 1 mm sheet metal (between 8 and 20-degree incident angles), the bullets usually fragment and the main ricocheting fragment produces side-on impacts angled to the right on close targets. Although the finding was presented briefly concerning ricocheting bullet fragments, it promisingly highlights the need for further exploration of the reported phenomenon and understanding of any potential forensic significance of close range post ricochet orientation of bullets, when true ricochet occurs from a variety of surface types.

This empirical study aims to explore the close-range post-ricochet orientations of AK bullets (7.62 mm × 39 mm) on a range of target surfaces commonly reported in indoor and outdoor bullet ricochet incidents. 7.62 mm × 39 mm bullets used by AK rifles were selected as the

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