



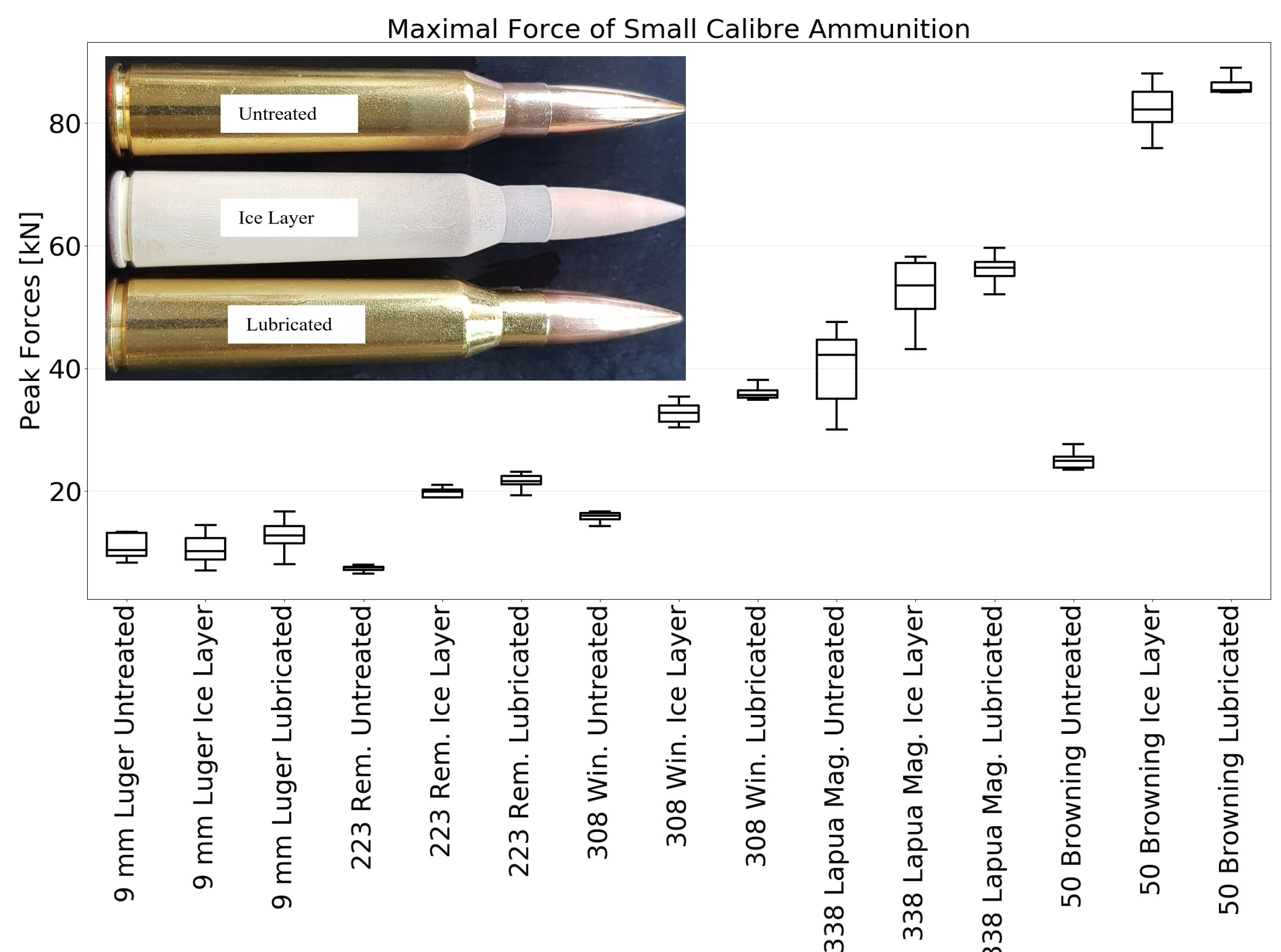
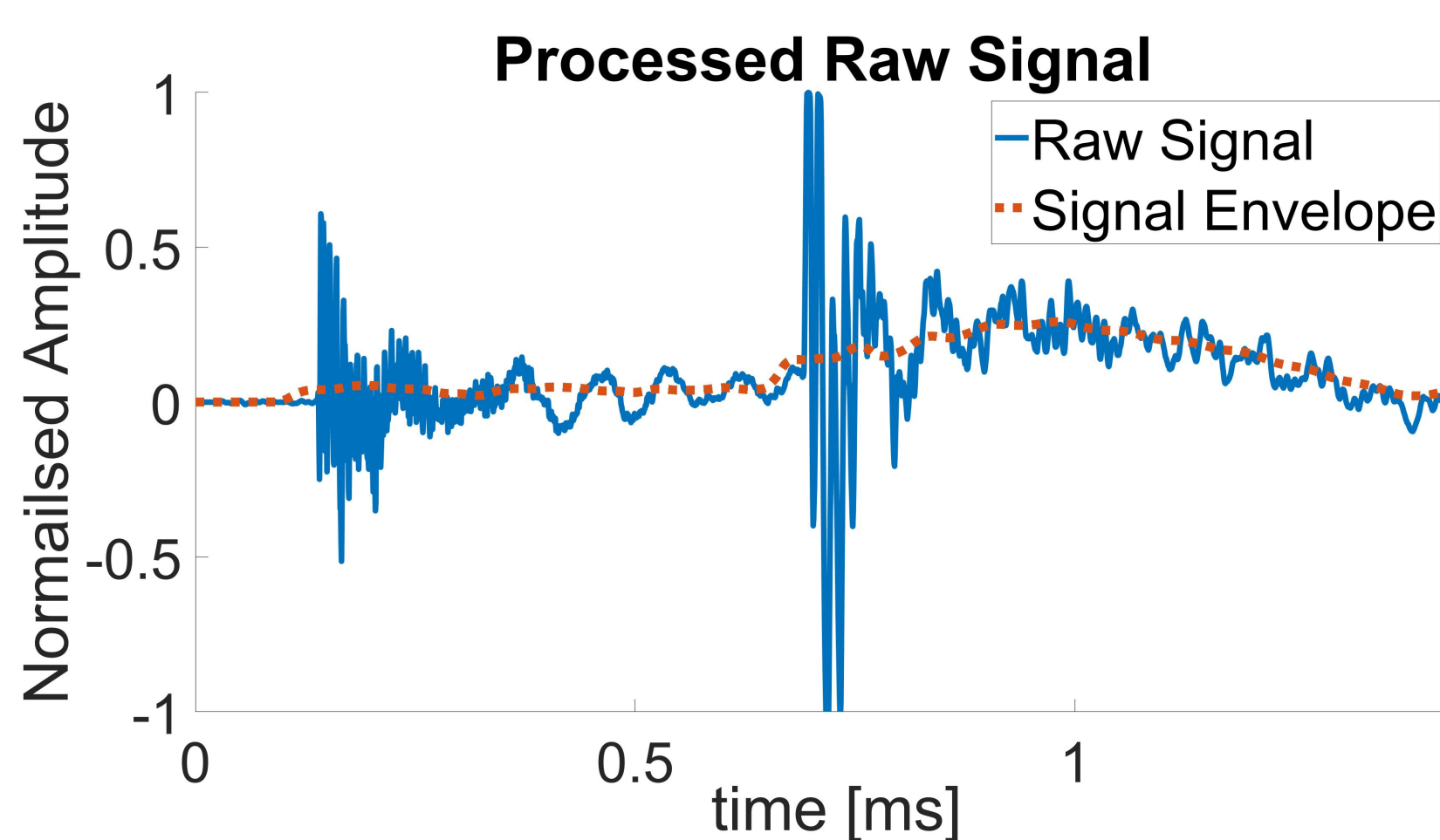
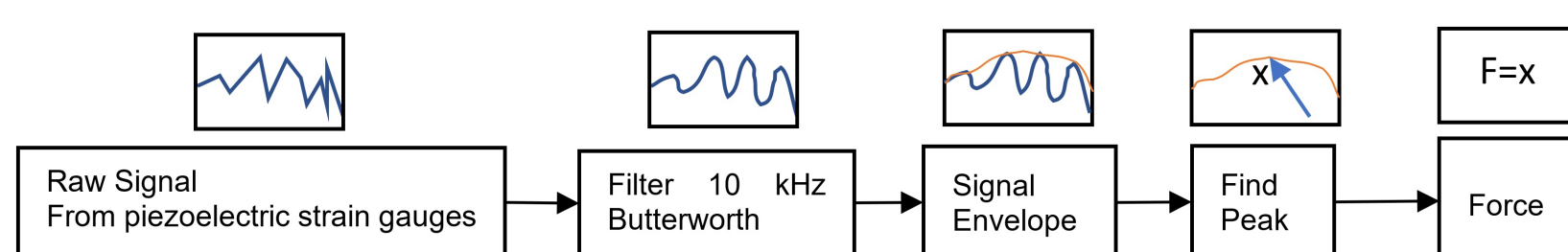
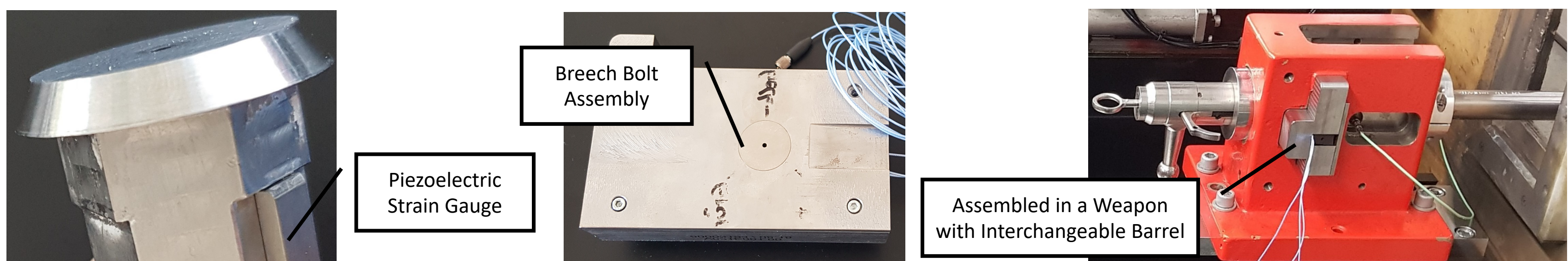
Push out Measurements of Ammunition under Dynamic Conditions

Introduction

A small caliber weapon system consists of the weapon and the ammunition. In the case of bolt action rifles during the process of firing, the breech is a rigid bearing which prevents the casing from being pushed out. However, not the whole pushout force acts on the bolt. Because of the obturation of the casing, friction forces act at the boundaries. The chamber of the weapon can absorb a significant part of the pushout force.

Findings

The duration of the pushout force is in the order of milliseconds. Piezoelectric strain gauges are capable of recording such short time events qualitatively. The raw signal from the piezoelectric force sensors is noisy, it is filtered using a bandpass filter enhanced by a RMS signal envelope. The results from the strain gauges are successful verified by a calibrated force washer. The analysis indicated that water or lubrication treated casings lead to bolt forces which are more than three times higher when compared untreated casings. This might have a significant influence on the weapon safety.



Discussion

The results are consistent with the published models that used finite element analysis [1]. The measurements are conducted with two different approaches and are highly comparable which strengthens the outcome of key results. A change in treatment type leads to a significant difference in the pushout force. It was proven that the initial times of excitation remain the same while the main signal is strongly smoothened using signal envelop approach. This leads to a reliable overall result.

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Applications

This work demonstrates how to measure highly dynamic events. The acquired results can be directly applied to small caliber bolt action rifles. These measurements may also have a significant influence on the functionality of self-loading rifles, since the process of reloading is also dependent on the pushout force. The user recommendation is that the chamber and the ammunition should be free from residuals which reduce the friction between the boundaries. Otherwise, huge forces apply at the breech bolt.

Reference

[1] D. Gubernat and C. Fischer, "Explicit finite element model for determining influence of cartridge case material properties on small caliber weapon function," Proc. 26th Int. Symp. Ballist., pp. 806–817, 2011.

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