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Wraparound PDV for Measuring the Impactor Velocity History in High-Hazard Plate Impact Experiments STL-029-20, Year 1

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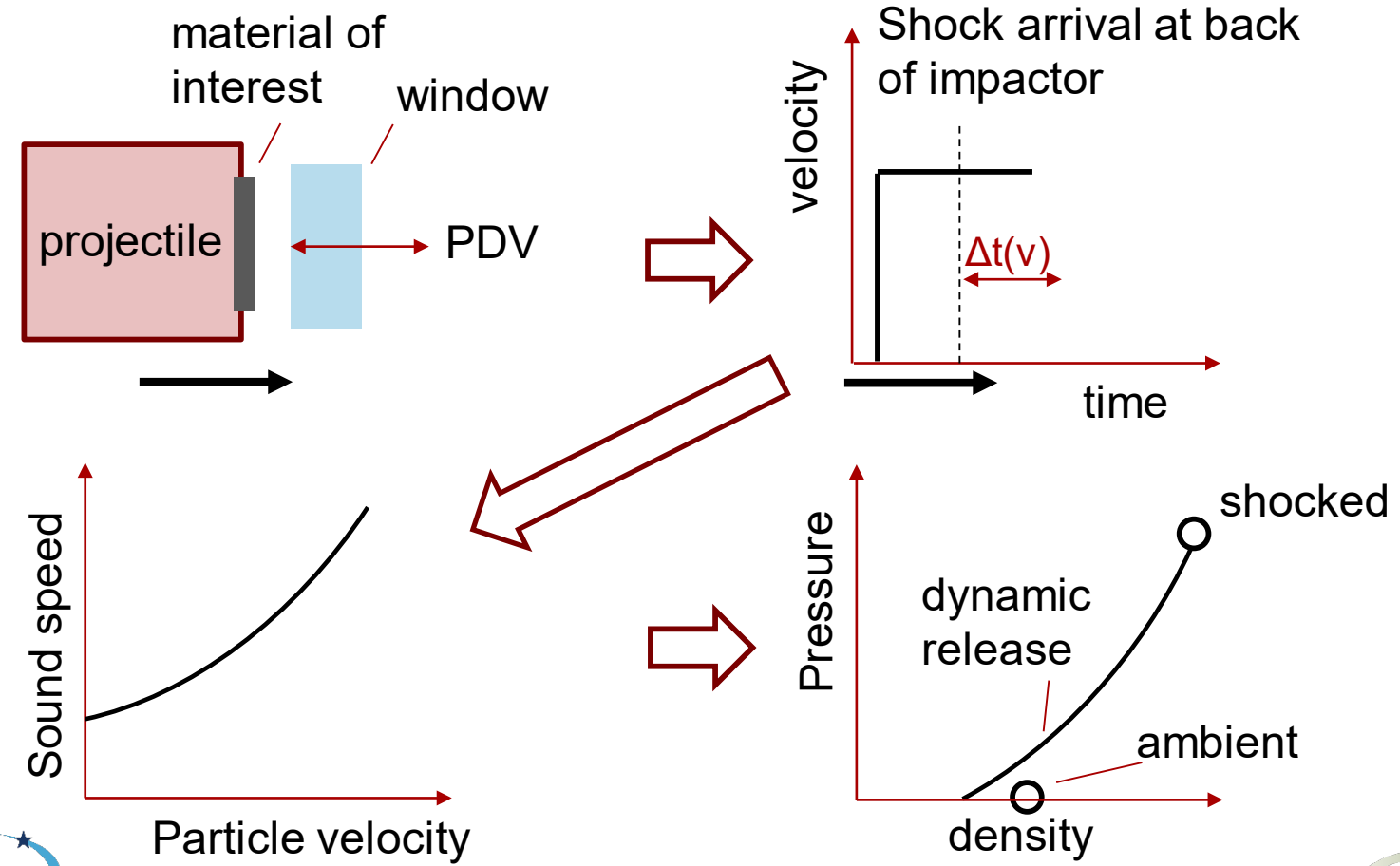
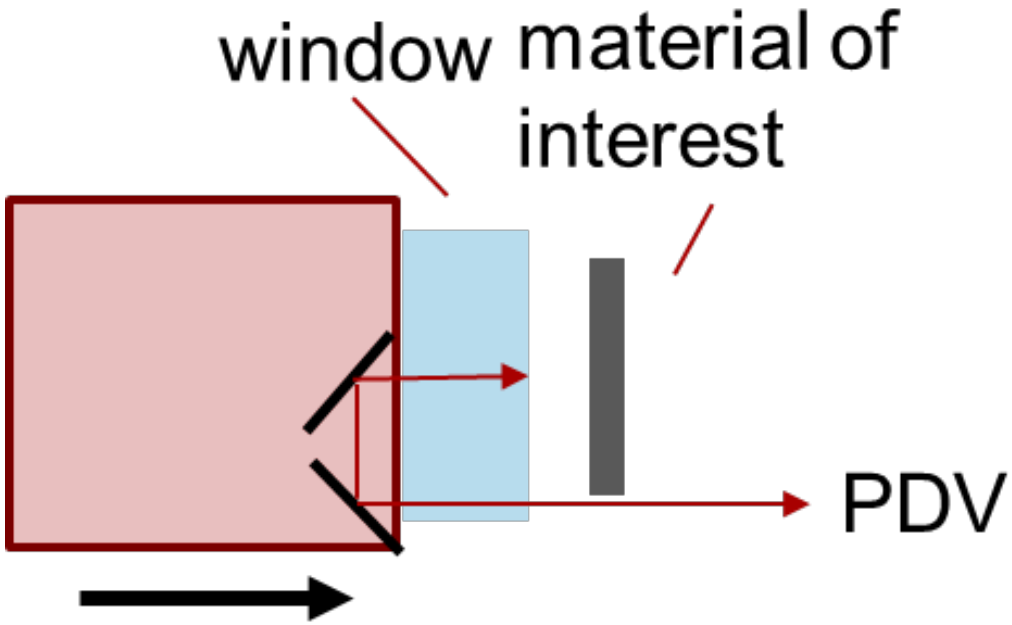
Challenge

Reverse impact is a straightforward way to achieve P-ρ data along release isentrope, but not all materials can be thrown down a gun barrel.



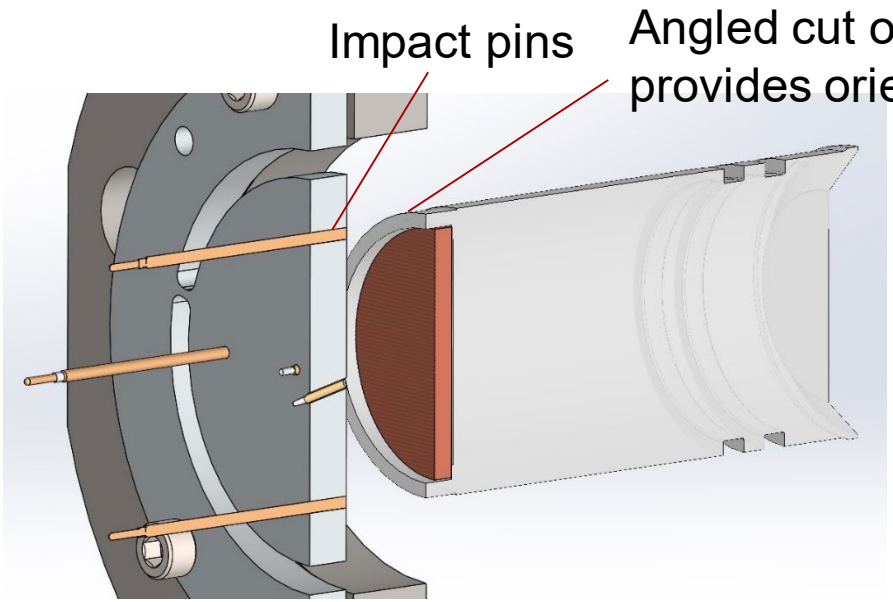
Innovation

Put window on projectile! But now we have to measure velocity from the back side of the impactor, hence the need for wraparound PDV.



Technical Approach

Projectile rotation in barrel influences prism design; we performed test shots to measure it on our powder gun.



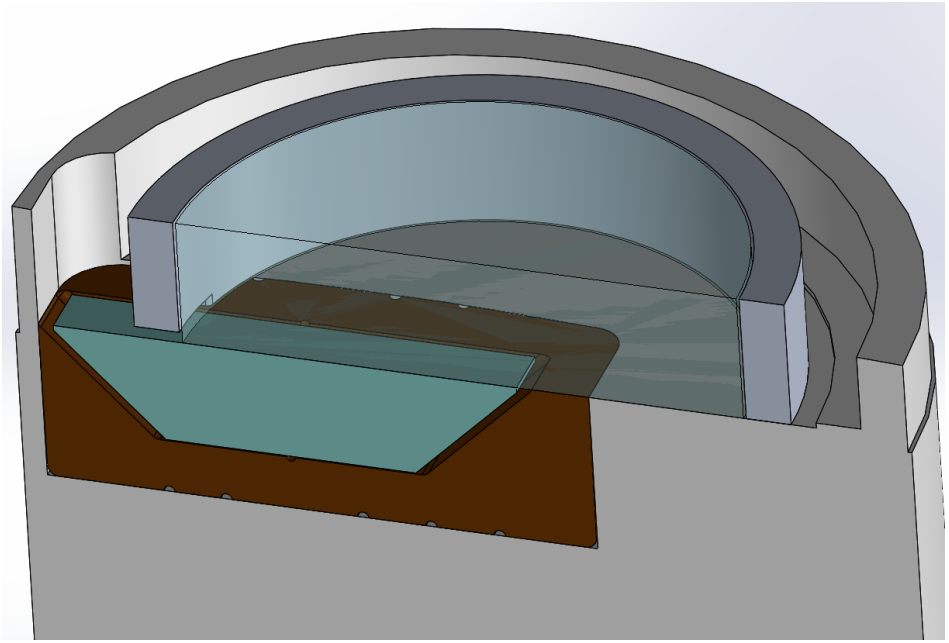
Shot No.	Velocity (m/s)	Rotation (degrees)
191205	2008	10.4
191210	1949	8.8
191211	2585	8.0

Projectile rotation measured on powder gun to be 10 degrees or less

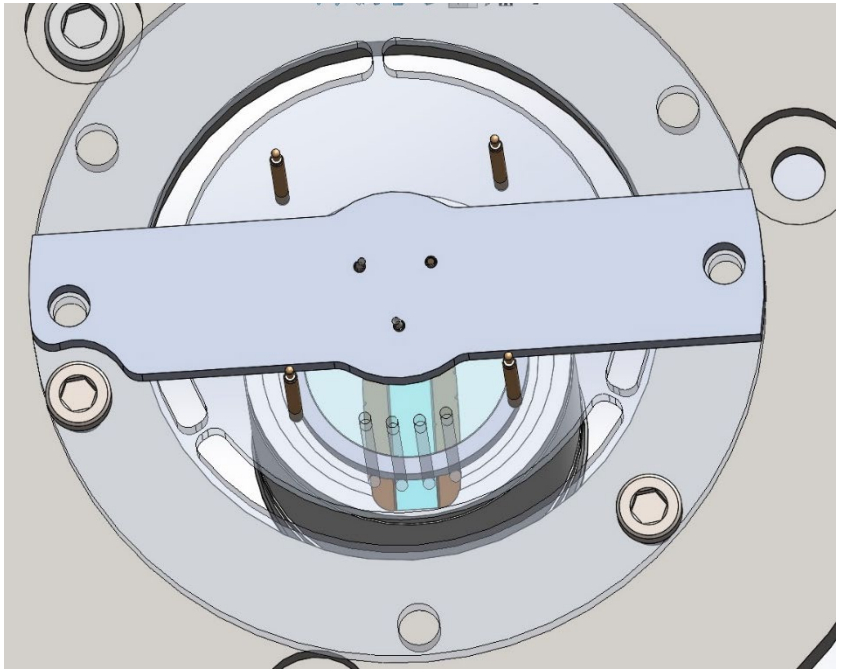
Technical Approach

Present design accommodates ±24 degrees of projectile rotation.
Three experiments performed in May

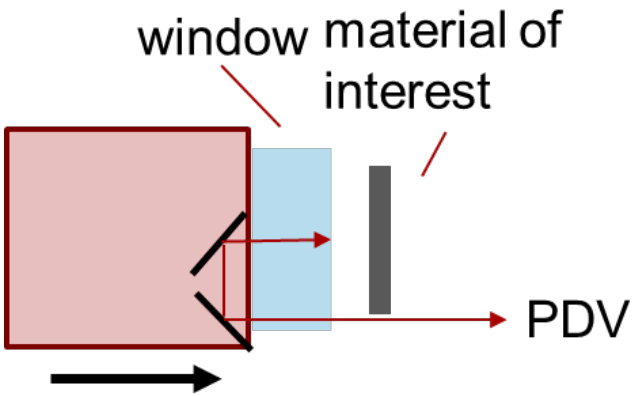
Impactor assembly includes dove prism

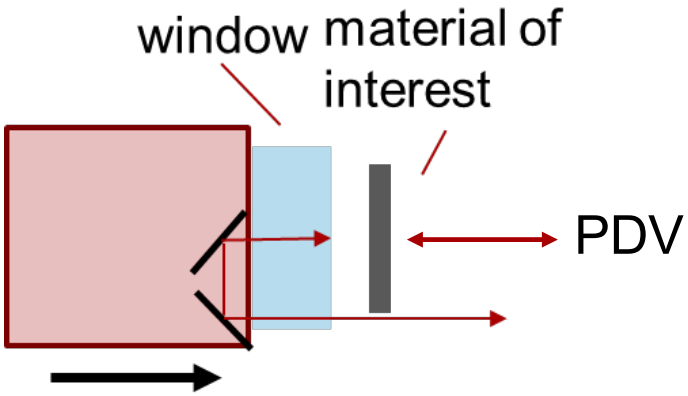


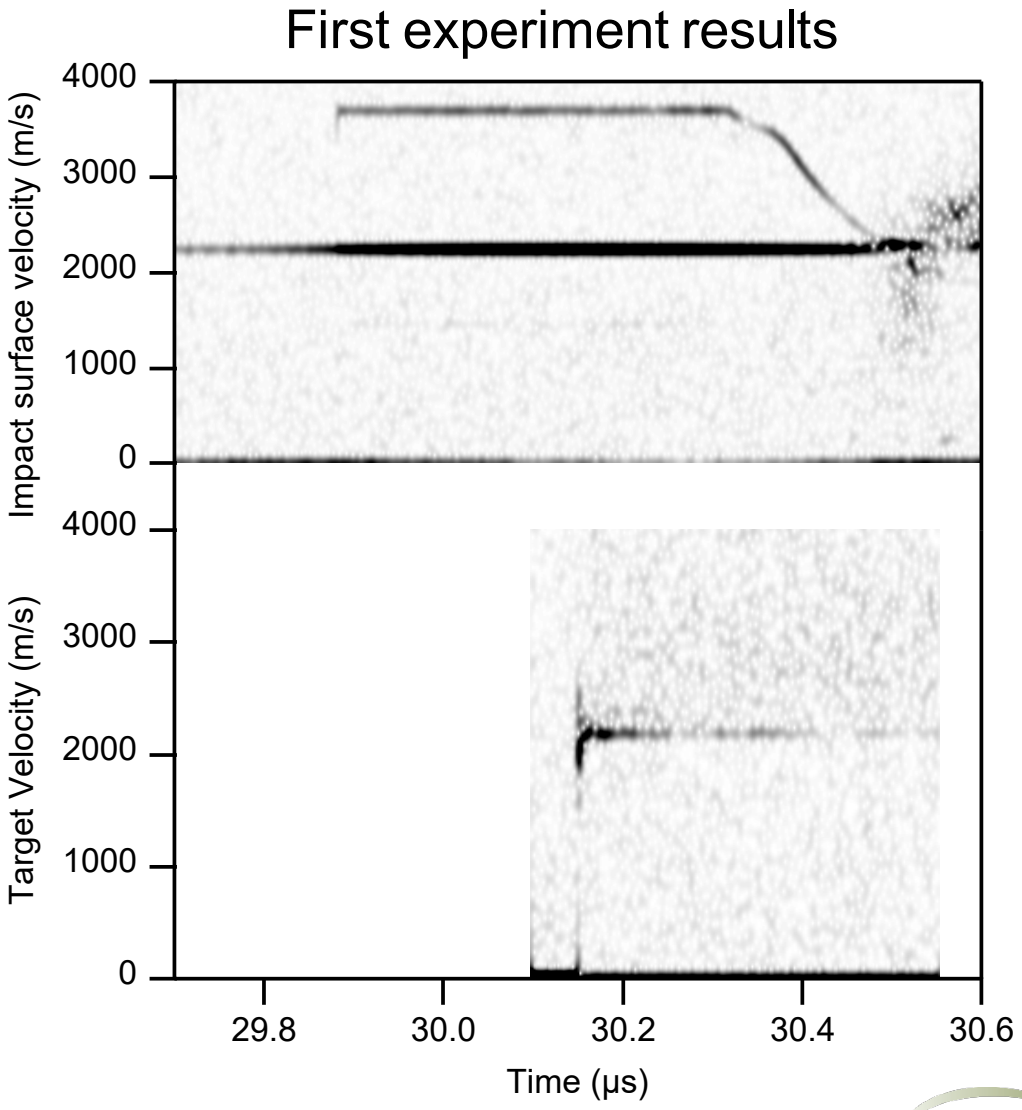
Target assembly (20 mm x 1.8 mm 1100 aluminum target opposite probe holder)



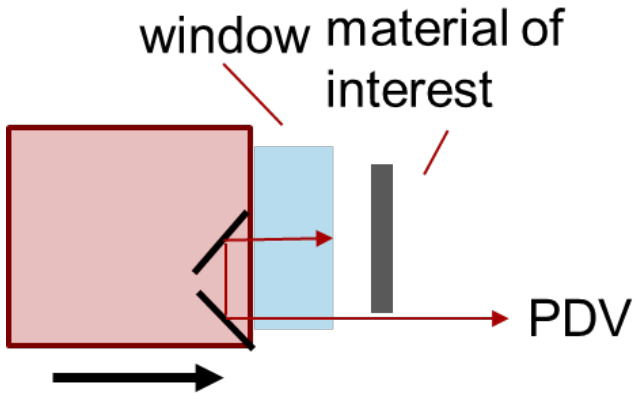
Results: First experiment worked well

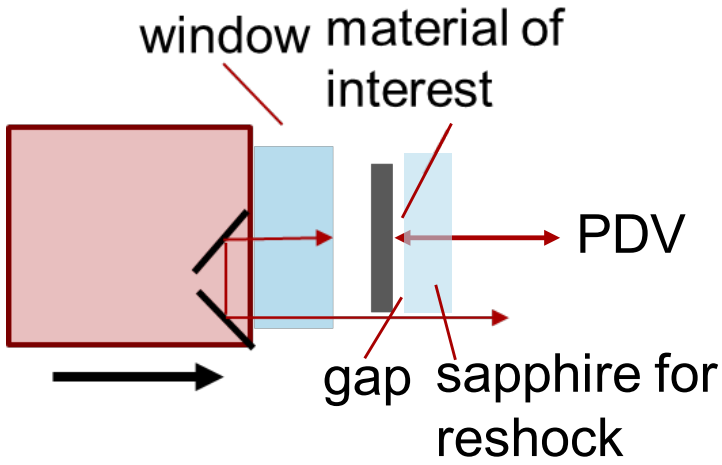




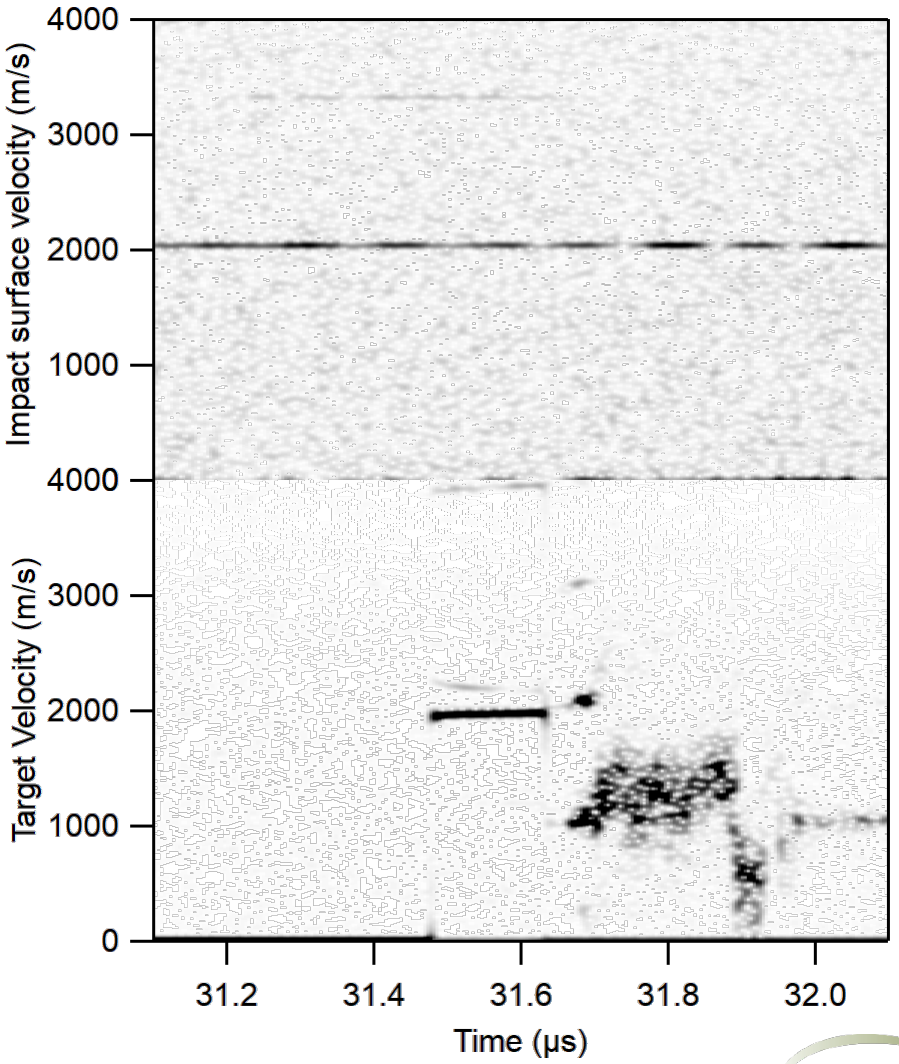


Results: Second and third experiments did not work well





Second experiment results



Summary of Results, Path Forward

Projectile rotation in barrel is minimal and not an issue on our gun (less than 10 degrees of rotation measured on 6 shots).

We think the window might be failing on launch.

Ongoing experiments with tougher window (PMMA). If that works, figure out how to make LiF survive launch better.