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Ballistic Launch Tube Testing & Simulation

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Predicting the complex dynamic behavior of projectiles traveling at supersonic velocity while also interacting with blast waves is of interest to a number of communities. A proposed method to develop these predictions is to couple CTH (Eulerian) to Sierra/SM (Lagrangian) using a code called Zapotec. The results of these simulations are compared to experimental observations at a ballistic launch tube facility (BLT) to validate the code.

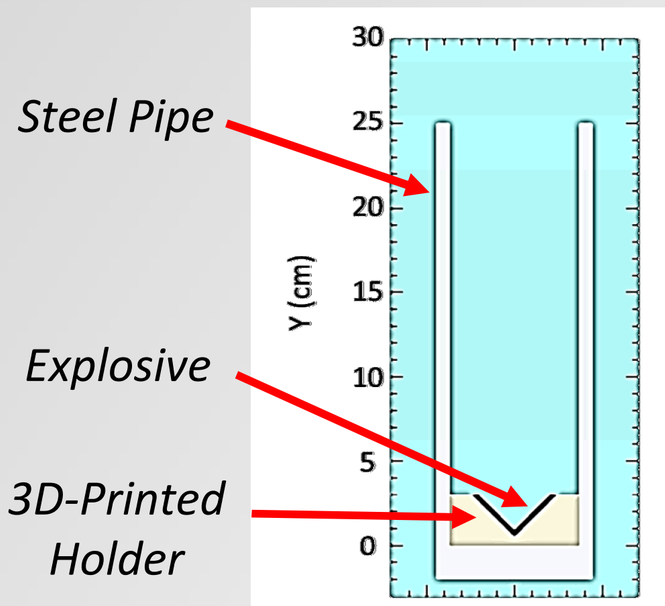
The work presented here illustrates the blast generator design process for the BLT testing and pretest predictions for projectile flight undergoing a blast interaction.

Blast Generator Design Requirements:

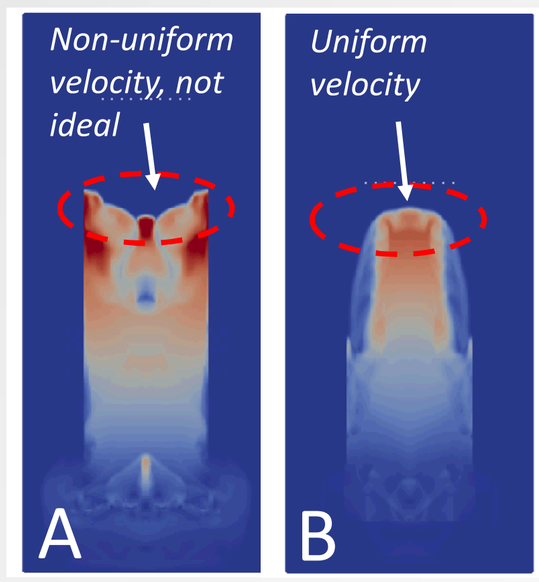
- Impact the projectile with maximum energy
- Produce a uniform blast wave

Blast Generator Design Process:

- Optimal geometries for blast wave generator was not known a priori
- An optimal geometry for meeting requirements is found using a parametric CTH model and running 100's of calculations
- The design process results in an suitably uniform blast wave that is within the facilities explosive weight limit



Blast Generator



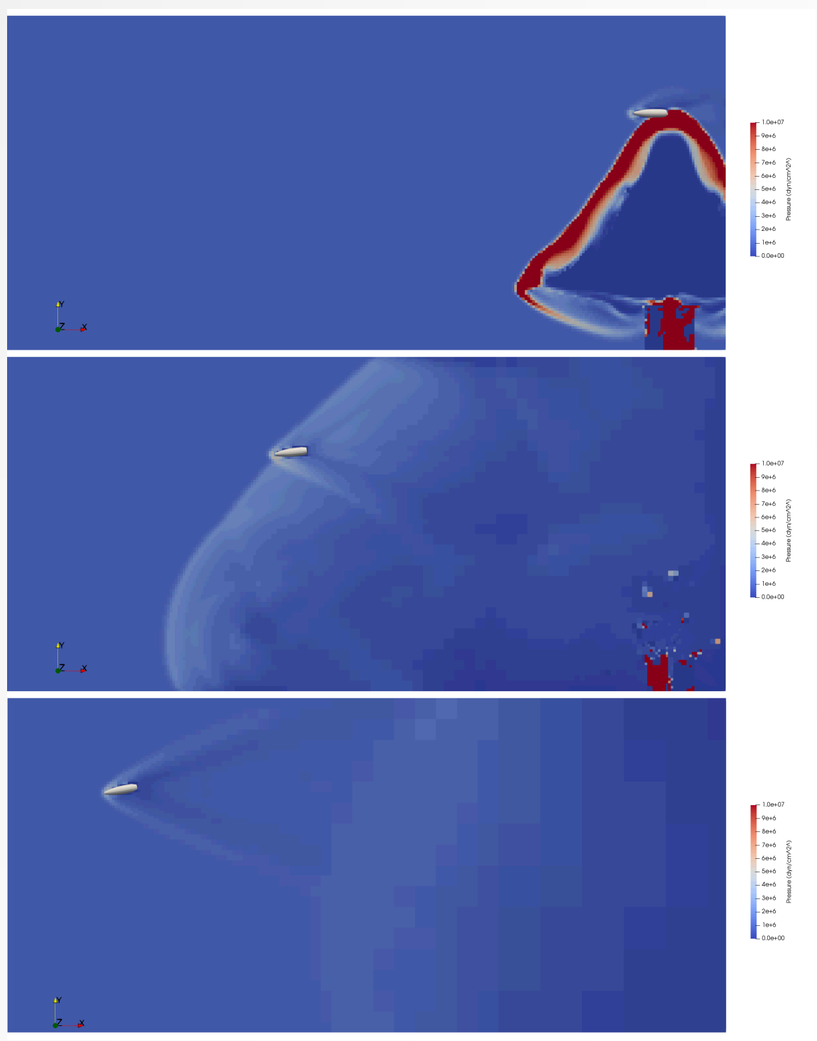
CTH 2D simulations: A. Non-uniform velocity shock wave B. Uniform velocity shock wave

Experiments:

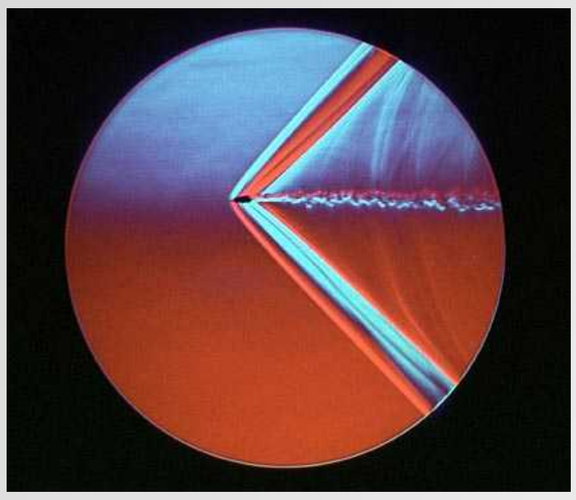
- Conduct imaging of stable and disturbed flight
- Schlieren imaging for data acquisition
- Test several projectile geometries

Projectile Blast Wave Interaction:

The optimized design is implemented in a Zapotec calculation to evaluate preliminary simulations.



Zapotec projectile deflection simulation



https://people.rit.edu/andpph/exhibit-7.html

Schlieren high speed projectile image

The ballistic launch tube

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