

**LA-UR-23-29490**

**Approved for public release; distribution is unlimited.**

**Title:** Modeling Ejecta from Shocked Metals

**Author(s):** Hoffart, Jordan Nicholas  
Marshall, Julia Lynn

**Intended for:** XCP Summer Workshop 2023 Final Presentations

**Issued:** 2023-08-17



Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA00001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.



# Modeling Ejecta from Shocked Metals

Students: Jordan N. Hoffart, Julia L. Marshall

Mentors: Jesse M. Canfield, Bryan E. Kaiser

XCP Computational Physics Student Summer Workshop

Quick Look

August 15, 2023

# Jordan Hoffart

## Texas A&M University

- 4th year Math PhD student at Texas A&M University
- Research interests in finite element methods for coupled multiphysics systems
- Hobbies: music, traveling, and hiking



# Julia Marshall

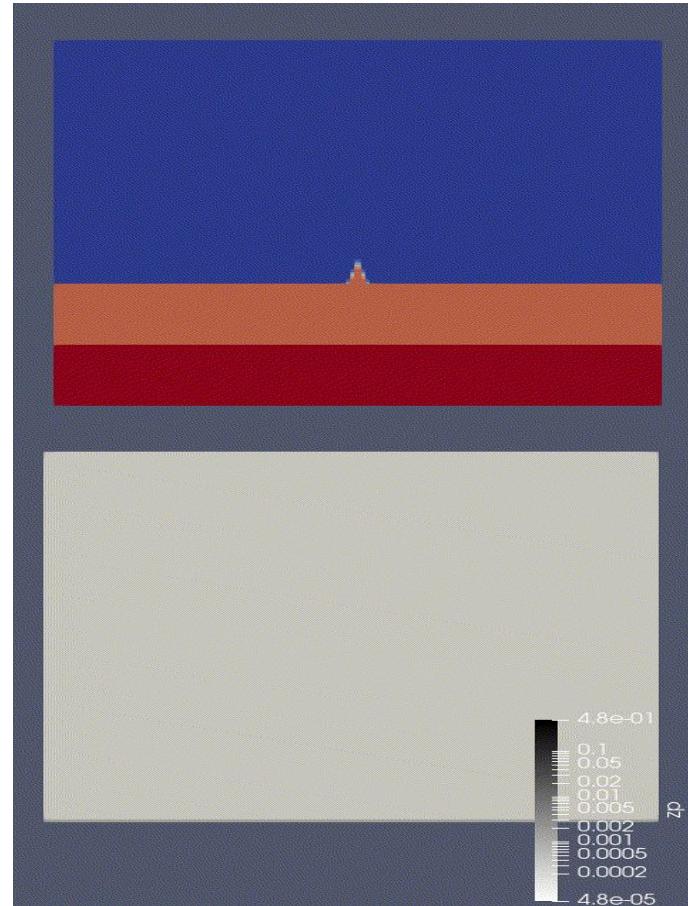
## University of Michigan

- Rising senior at the University of Michigan studying Nuclear Engineering and German
- Research interests in computational plasma physics for fusion energy applications
- Hobbies: rock climbing, hiking and quilting!

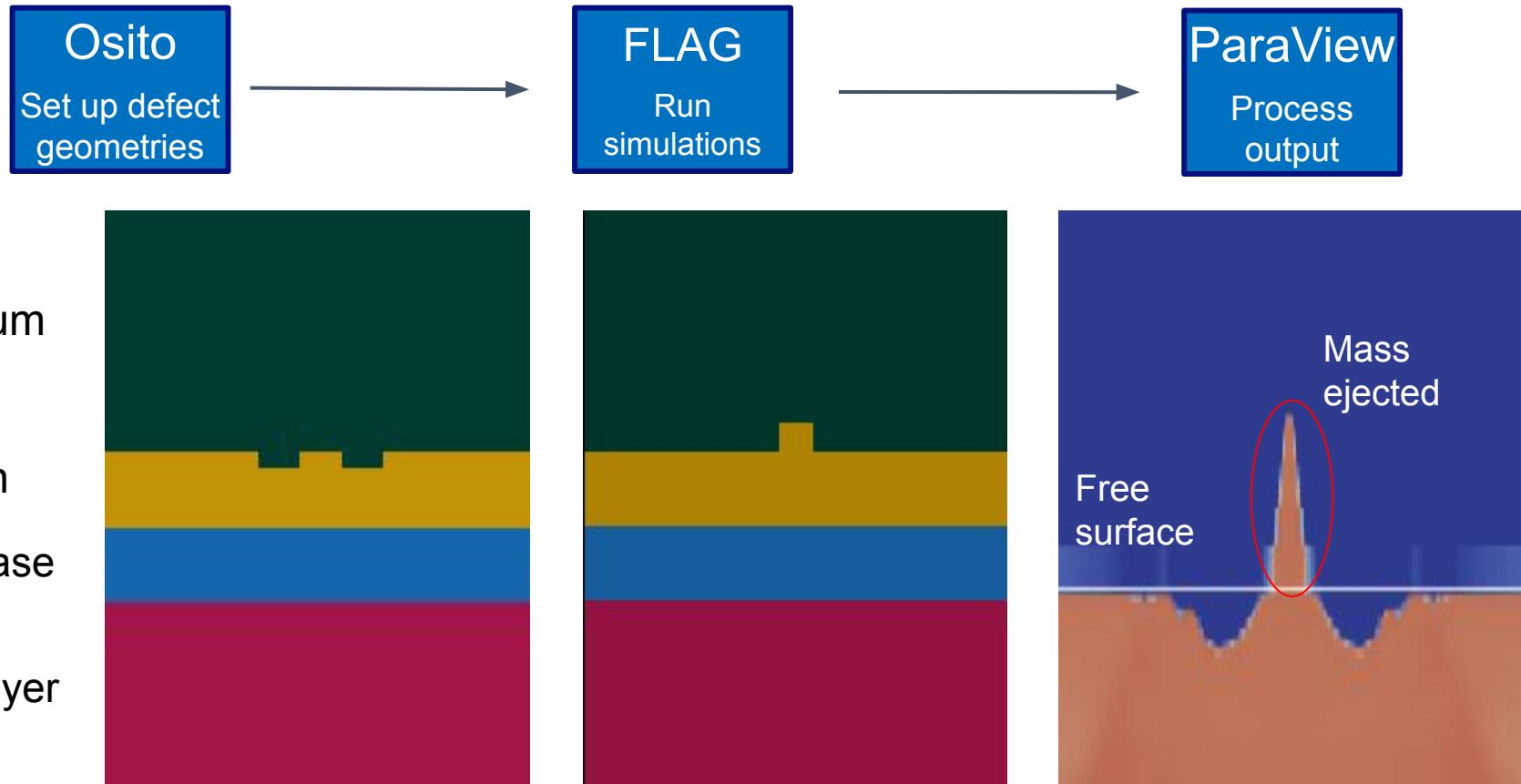


# Motivations

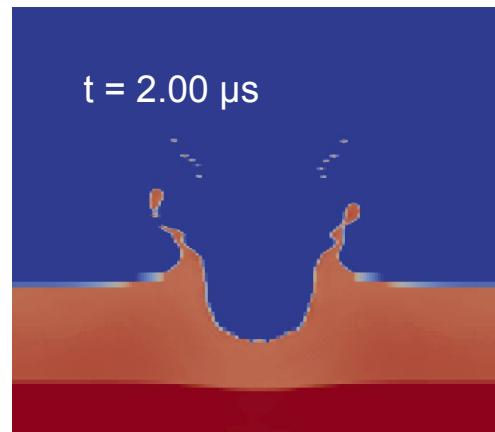
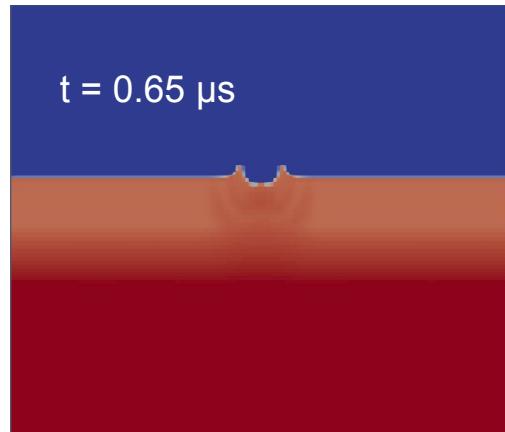
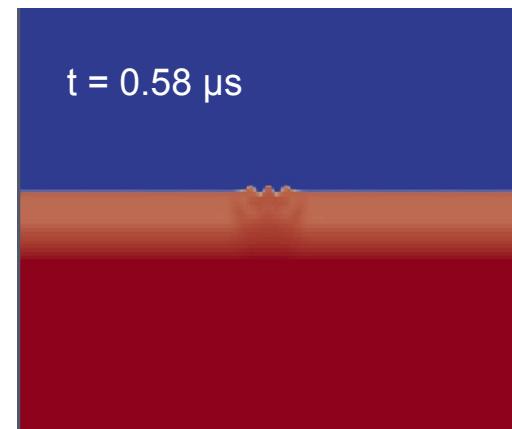
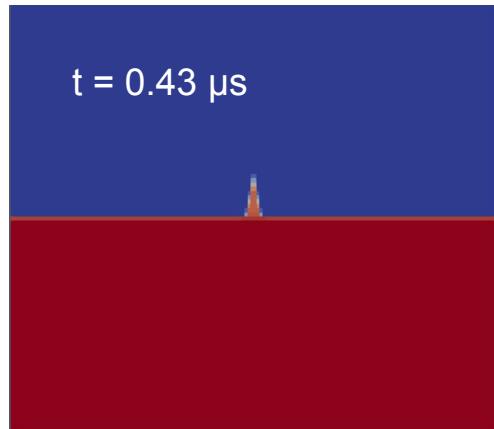
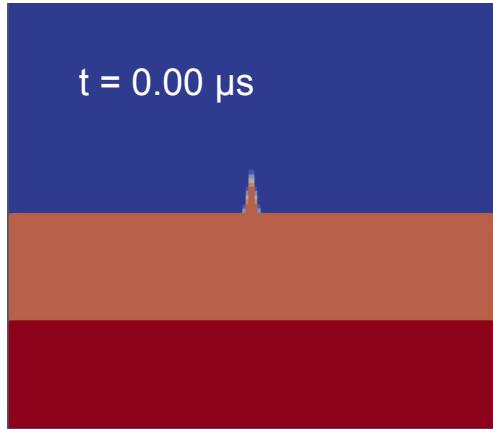
- Previous work looked at the mass ejected from single cavity defects
- Richtmyer Meshkov Instability (RMI): driving force for ejecta
- The amount of outflow highly depends on the initial configuration of the defect
- In this work, we investigate:
  - Bump-like defects
  - Multiple defects, with varying distance between them



# Methods



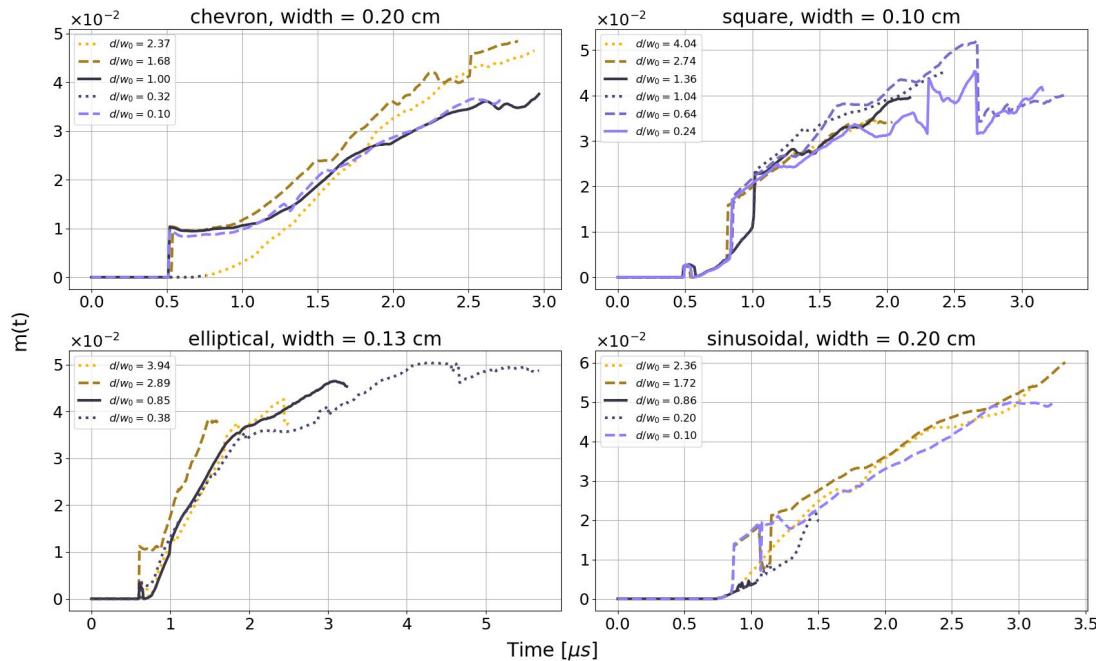
# Simulation Snapshots



# Results of the Spacing Study

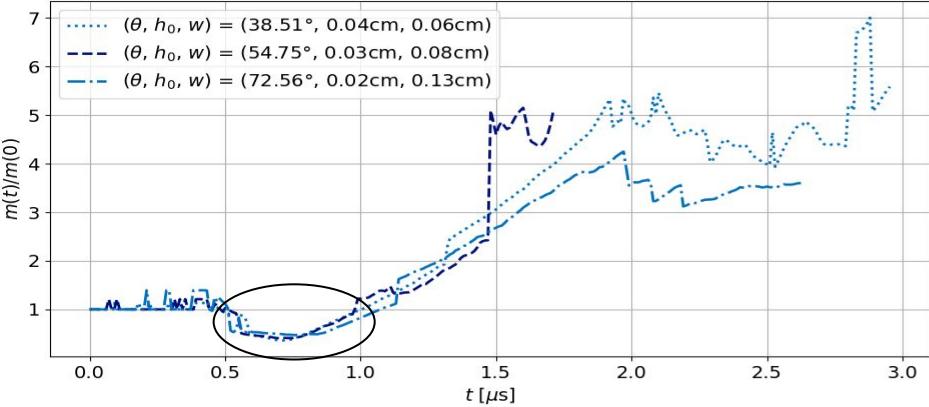
- Constant volume between defect shapes
- Varied  $d$ , the distance between two defects
- Ran at two resolutions: (240x450) and (320x600)
- Amount of ejected mass seems unaffected by separation distance, though the jetting phenomena is variable

Mass Ejected Above Free Surface

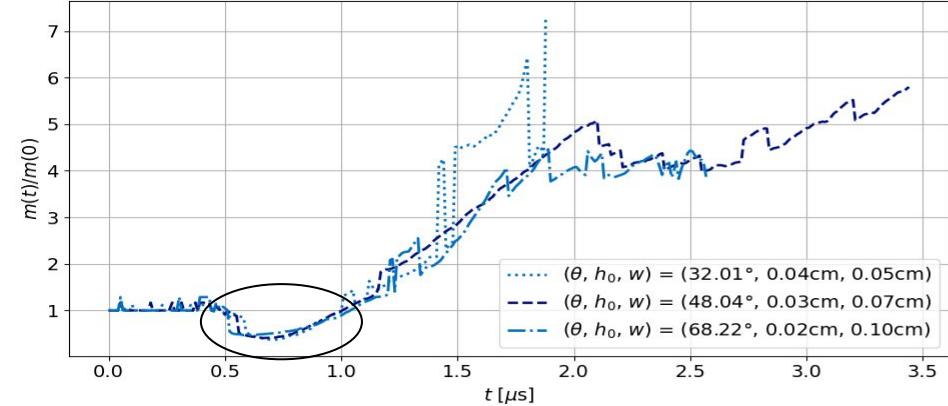


# Results of Bump Defect Study

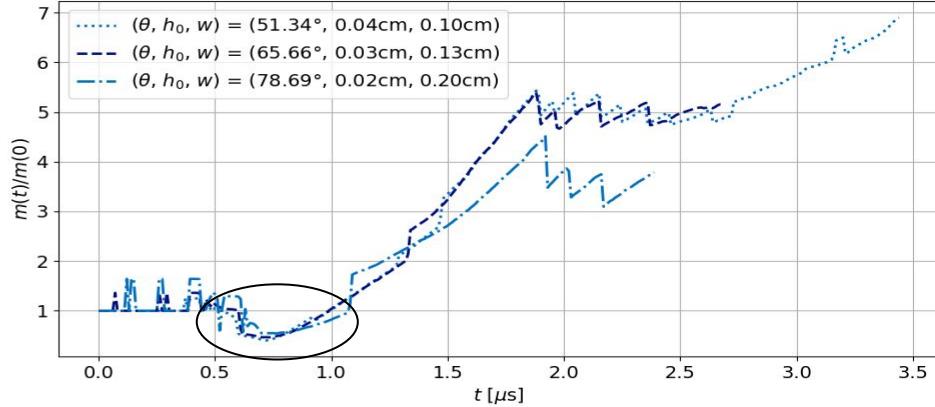
elliptic bump defects, constant  $V = 0.002\text{cm}^3$ ,  $(N_x, N_z) = (160, 600)$



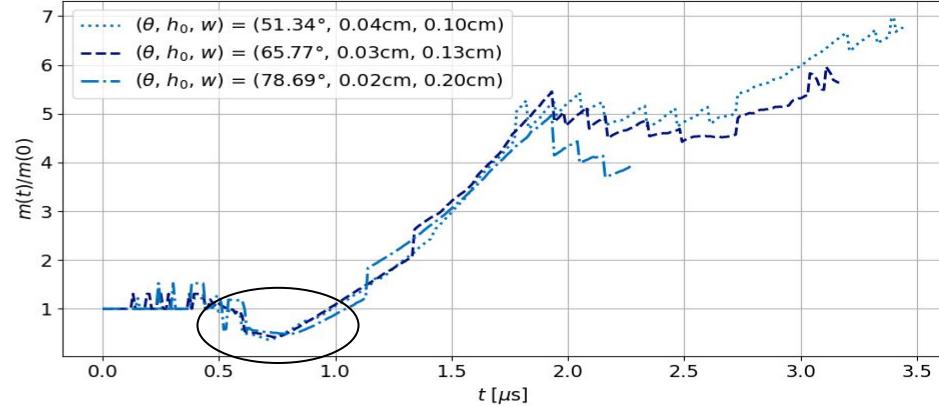
rectangular bump defects, constant  $V = 0.002\text{cm}^3$ ,  $(N_x, N_z) = (160, 600)$



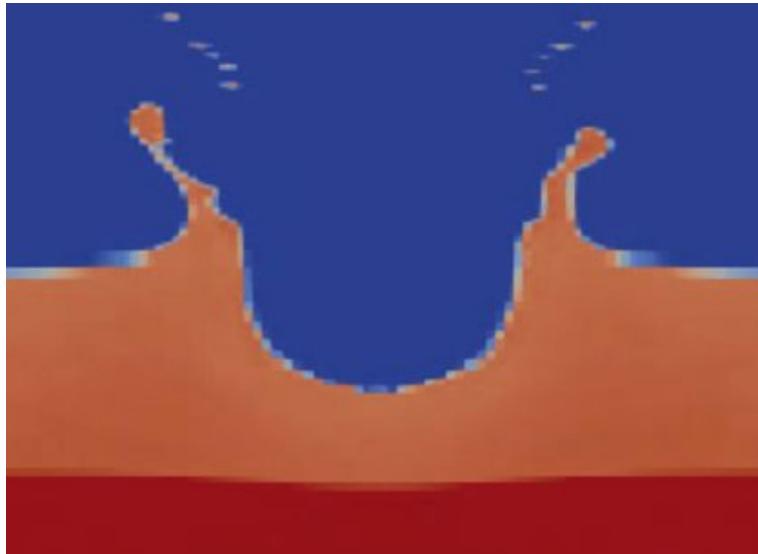
chevron bump defects, constant  $V = 0.002\text{cm}^3$ ,  $(N_x, N_z) = (160, 600)$



half-sinusoid bump defects, constant  $V = 0.002\text{cm}^3$ ,  $(N_x, N_z) = (160, 600)$



# Super-bubble formation



# Future Work

- Quantify simulation and post-processing error
- Improve free surface tracking
- Run a grid convergence study

This work will be presented at the Annual Meeting of the American Physical Society (APS) - Division of Plasma Physics (DPP), 2023-10-30/2023-11-03 (Denver, Colorado, United States)