Introduction

* Hypervelocity Defined
* HVIL
  + What we do
  + Why it matters
  + 2SLGG
    - Capabilities
    - Mechanics of the gun
* Sabot Separation
  + What is a sabot
    - Sabot picture
  + Why is it used
  + Sabot Separation in hypervelocity regime
    - Aerodynamic Sabot separation
    - PAI and the sabot discard paper
* Thesis

Experimental Setup

* HVIL sabot separation
  + Blast tank setup
    - Sabot Stripper plate
      * Dimensions
      * Material

Methods

* Empirical Data
  + Data gathering
    - Experimental Setup
      * Sabot Stripper plate and the blast tank
        + Dimensions and figure
    - Painting of the stripper plate
    - Photography setup
    - Number of photographs
      * Number increases with each shot
    - Limitations to data gathering
      * Only successful shots
      * Some gathered data can’t be used due to security clearance
  + Data processing
    - Resizing pictures in photoshop to a standard size
      * 2000 x 2000 canvas size with circle diameter of
      * Normal pictures were just enlarged
      * Non-normal pictures were forced with perspective
    - Converting to black and white
      * Sabot impacts were traced
        + Impact was defined as exposed metal with no paint
    - Python
      * Edge detection software
        + Select folder that reads in all image files
        + Iterates through pictures

Uses opencv

Converts to greyscale

Turns to binary image using threshold of 127 / 255

Finds contours and identifies their edges with points

Ignores circular boundary

* + - * + Iterates through contours

Finds centroid of each contour using opencv moments

Finds distance to center

Iterates through points in each contour

Finds min and max radial distance

* + - * + Converts pixel distance to inches through conversion factor
        + Outputs average min, max, centroid distance for all 4 petals
        + Outputs each petal distance individually for statistical analysis
    - Plotting data points to find a surface
      * Using matplotlib and pyplot
      * Fit mesh grid to second order 3d surface

Sabot Discard paper

* Introduction to it
  + Assumptions
  + Limitations
* Initial calculations
  + Sound speed of ideal gas
  + Shock pressure from velocity
    - Assuming an open tube
* Introducing variables
  + Shock pressure
  + Length of sabot
  + Ratio of total length of each sabot segment to its length measured from the rear to halfway up the conical forward face
  + Sabot radius
  + Sabot material density
* Derivation – four piece sabot
  + Find out how the differential equation was found for theta wrt time
  + Integration and substitution of projectile velocity
  + Simplification of the theta equation using gamma = 1 in the shock pressure equation
  + Solving for x
  + 3d surface of theta in terms of x and velocity
  + Accuracy analysis
  + What that means for the HVI lab
  + Limitations