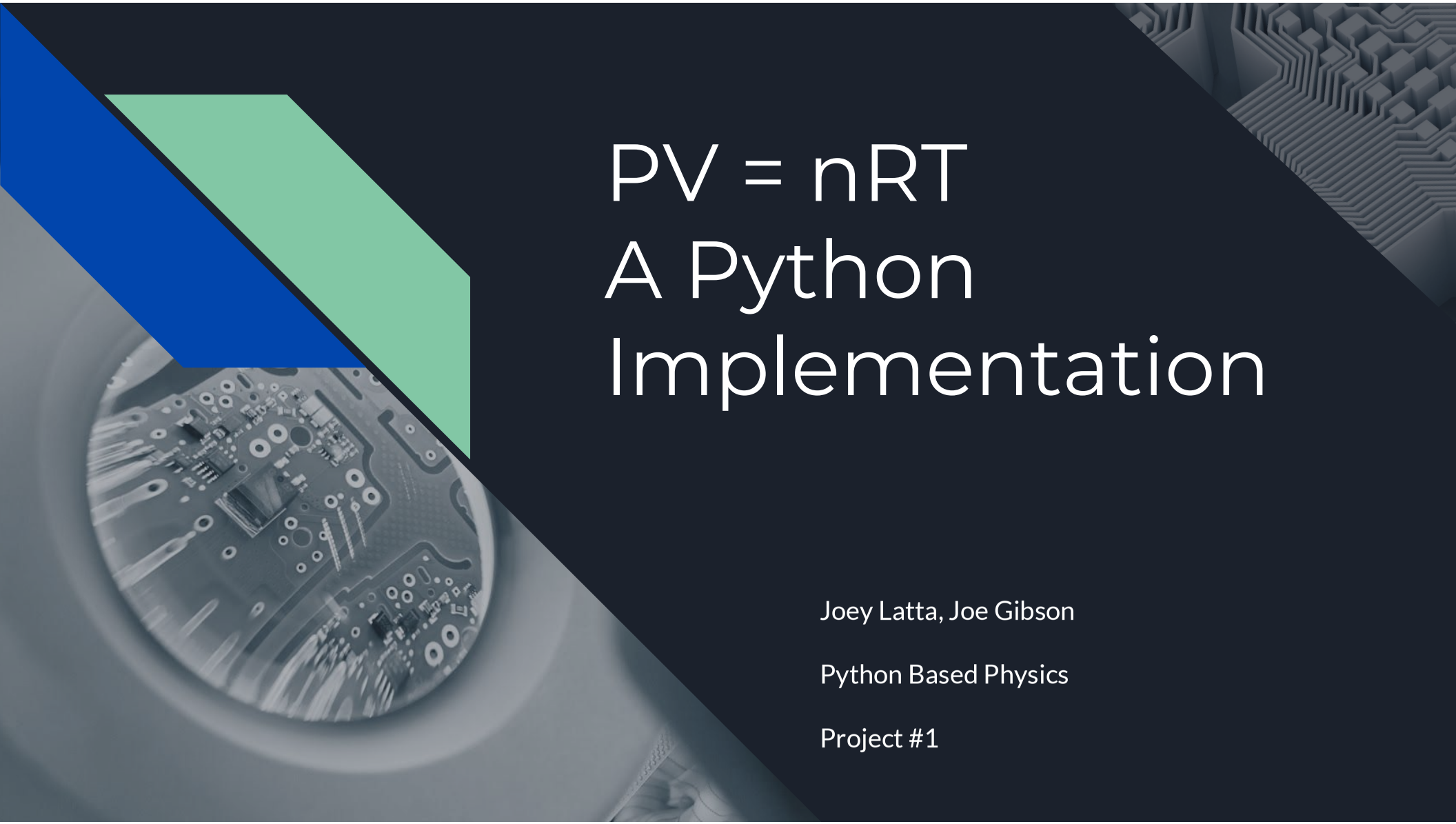


PV = nRT
A Python Implementation

Joey Latta, Joe Gibson

Python Based Physics

Project #1

Table of Contents

Ideal Gas Law

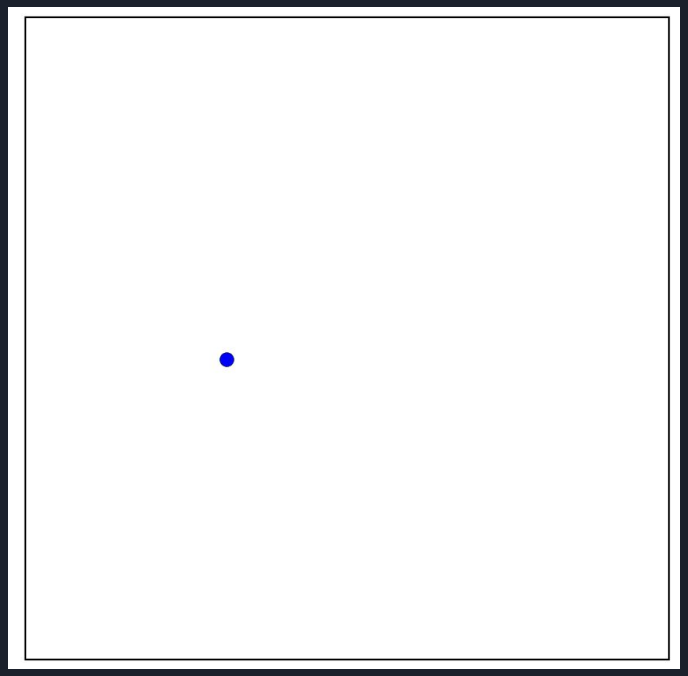
- For a volume (*V*) occupied by *n* moles of any gas with a pressure (*P*) and temperature (*T*) in Kelvin
  - *P V = n R T, where R is the Gas Constant (experimentally determined)*
- From the kinetic theory of gases,
  - Assume no intermolecular attractions between the molecules of an ideal gas.
  - -> Potential energy is zero.
  - kinetic energy is $E=3/2RT$
-

Code: Class Structure and Matrices

- Objects
  - A container for attributes and functions it can perform
    - For example a person
      - A person has the attributes hair color height etc...
      - A person has the functions walk, think eat etc…
  - Useful to make cleaner code and groups of objects
- In our case we create a container object
  - This has the attributes size, state of the balls
    - This is an nx7 array that contains each balls 3d position, 3d velocity and mass
    - This matrix allows for quick and efficient calculation of relative positions
  - Our container has the function move forward a step in time

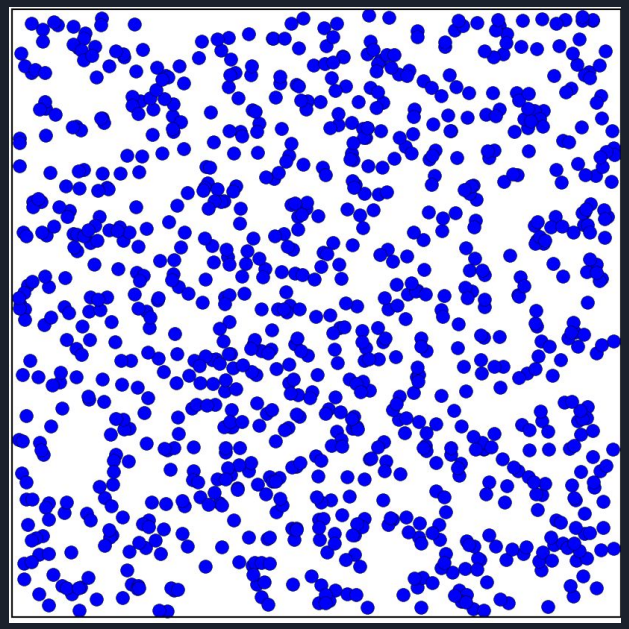
Simple System

- The simplest system we have is one body contained in a box.
  - In our System state we define its position and velocity
  - Track the particle through time and check for collisions with a wall
    - When the particle hits the wall calculate the impulse

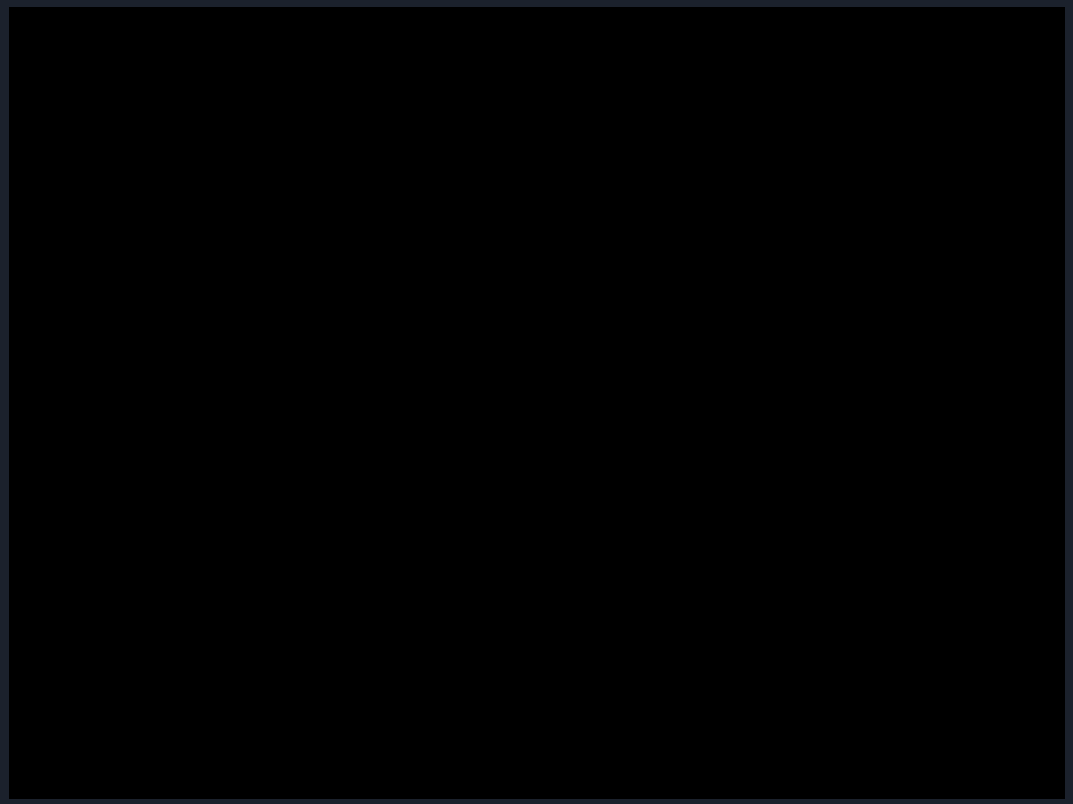


N-particle System

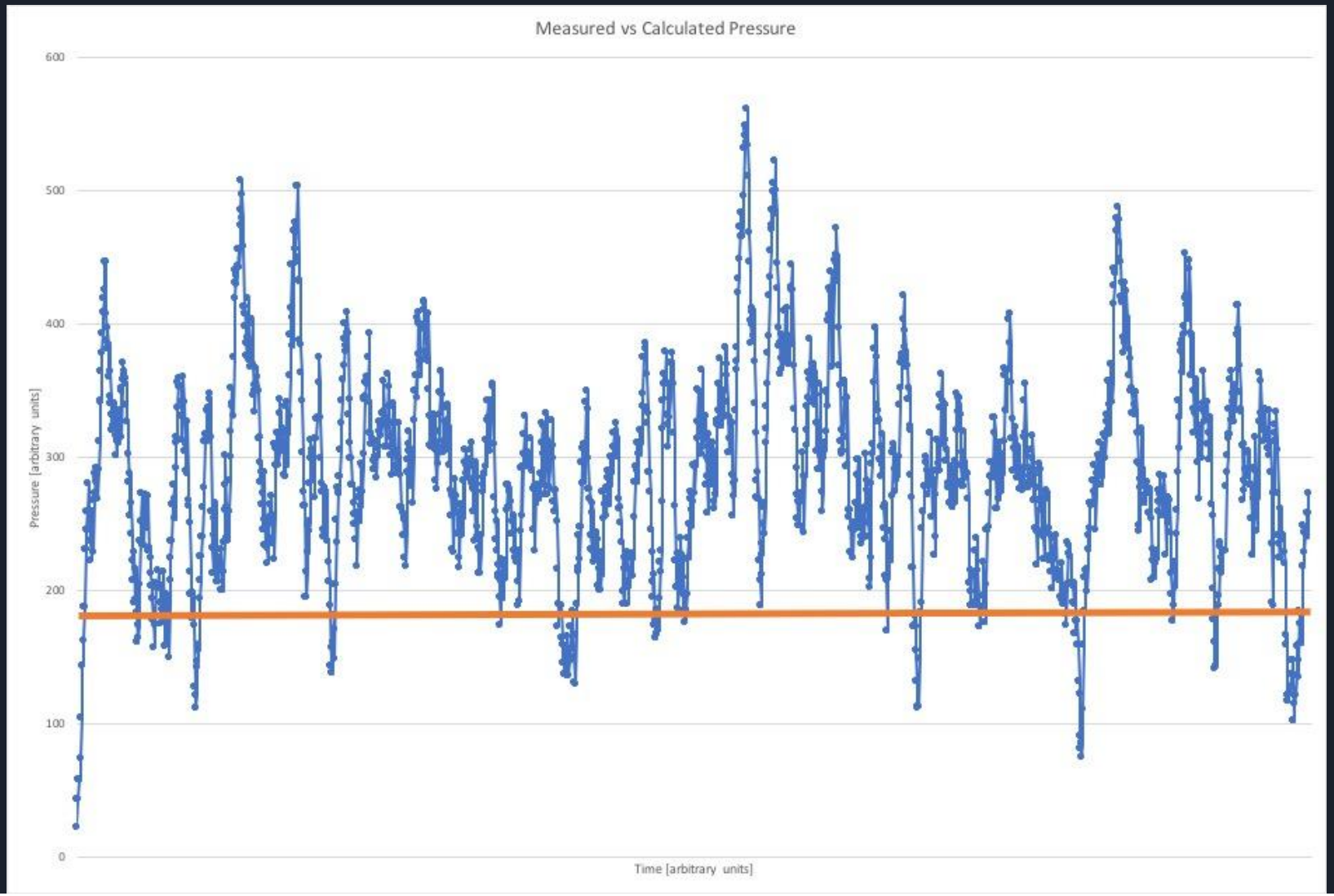
- Now we add a bunch of particles until our computer cries
  - Now we need to detect collisions between particles and calculate the distance between particles.
    - Just throw linear algebra at our state matrix until it works
  - Also check for collisions with the walls of our box.



Results



Results


Measured vs Calculated Pressure
600
500
400
300
200
100
0
Pressure [arbitrary units]
Time [arbitrary units]