CONSERVATION OF LINEAR MOMENTUM

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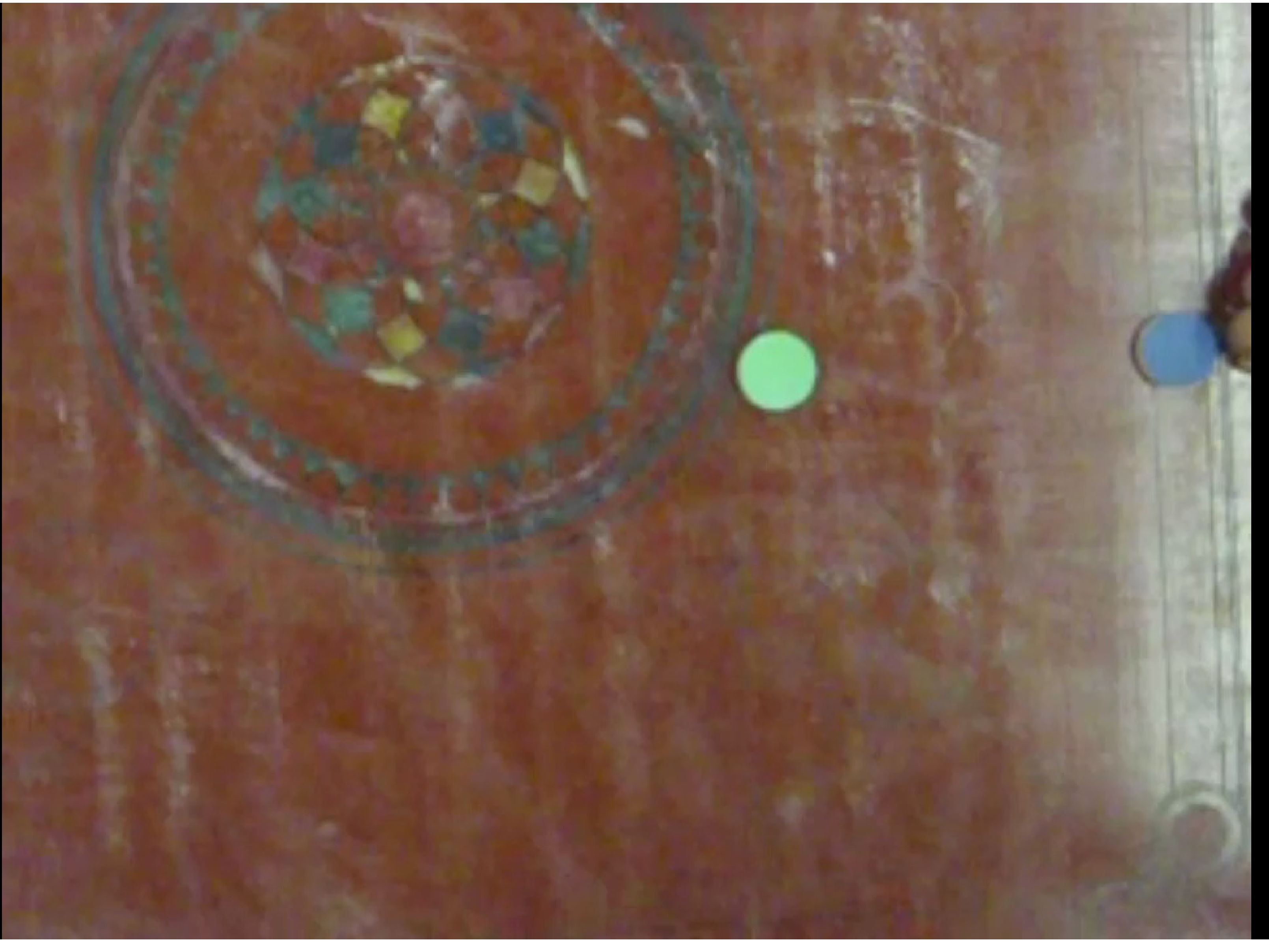
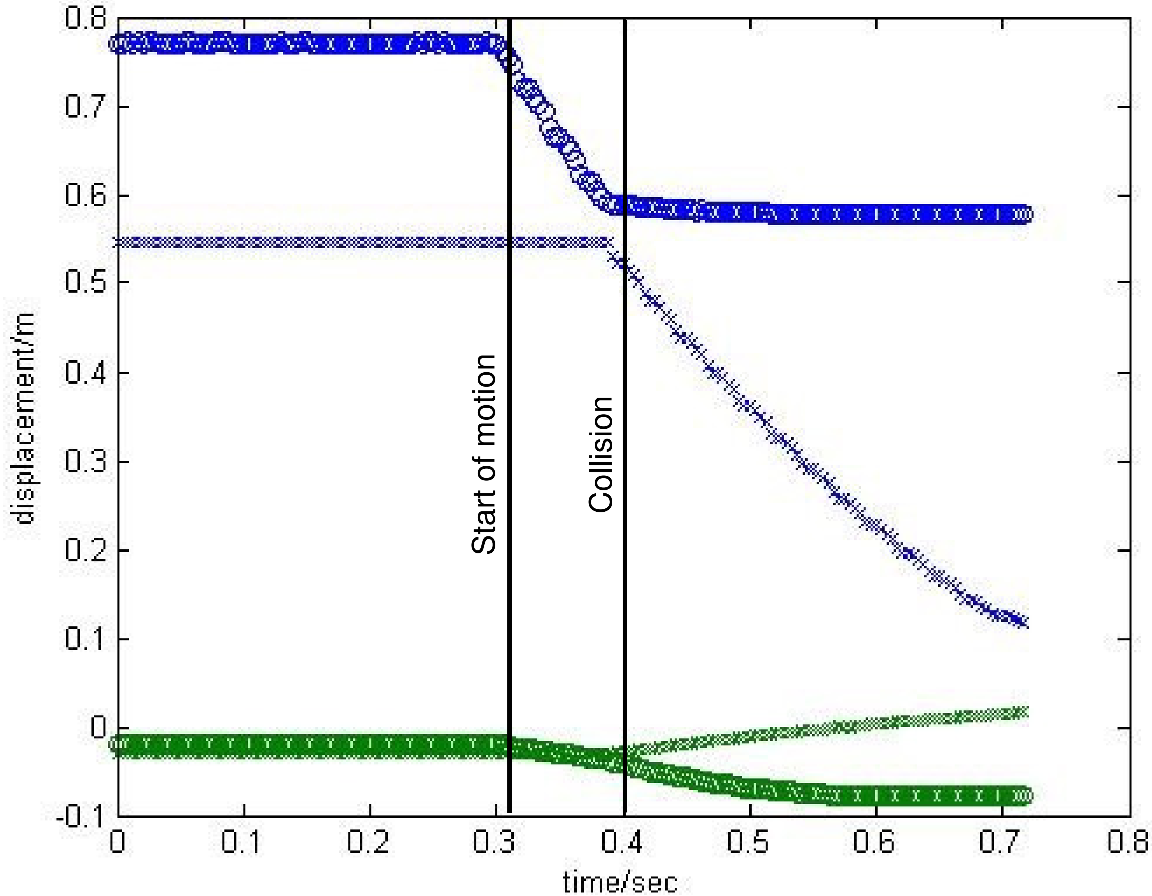
Head on Collision ($M_{target}=M_{attacker}$)

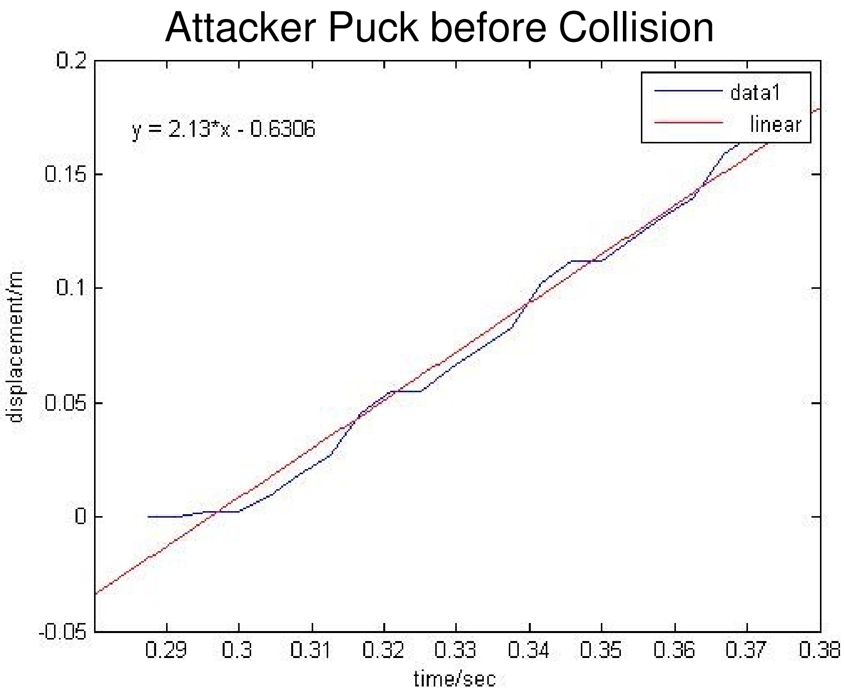




- Taking time frames of the order of $1x10^{-1}$seconds to minimise the affect of friction on the results.

- Run the x,y co-ordinates through the process data function to obtain a distance-time graph.

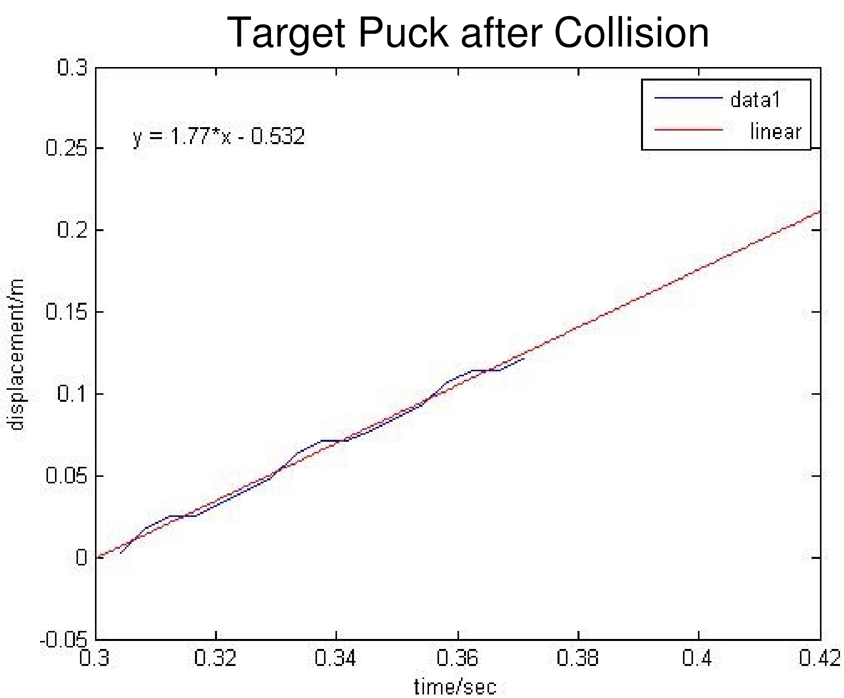
- The gradient of the graph gives us the velocity.

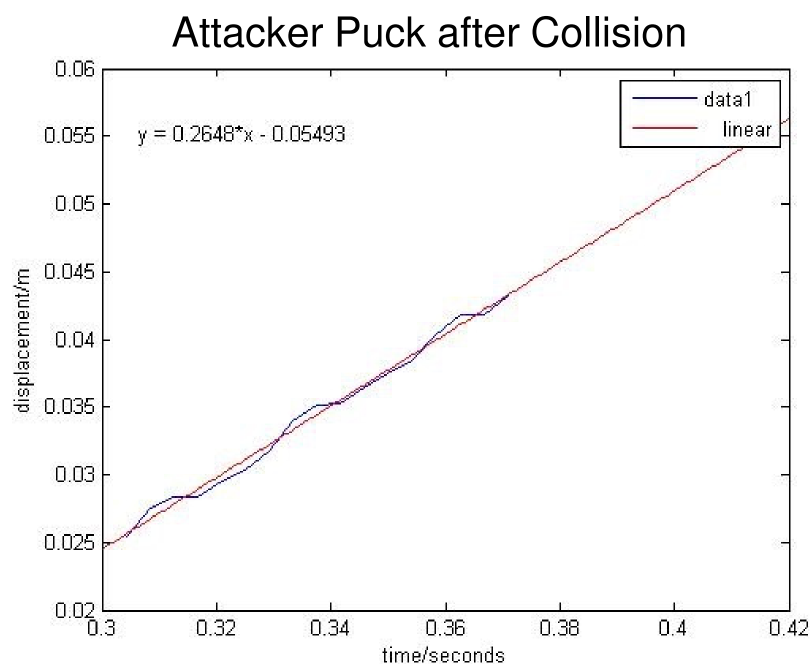


1.77m/s + 0.2648m/s = 2.0348m/s

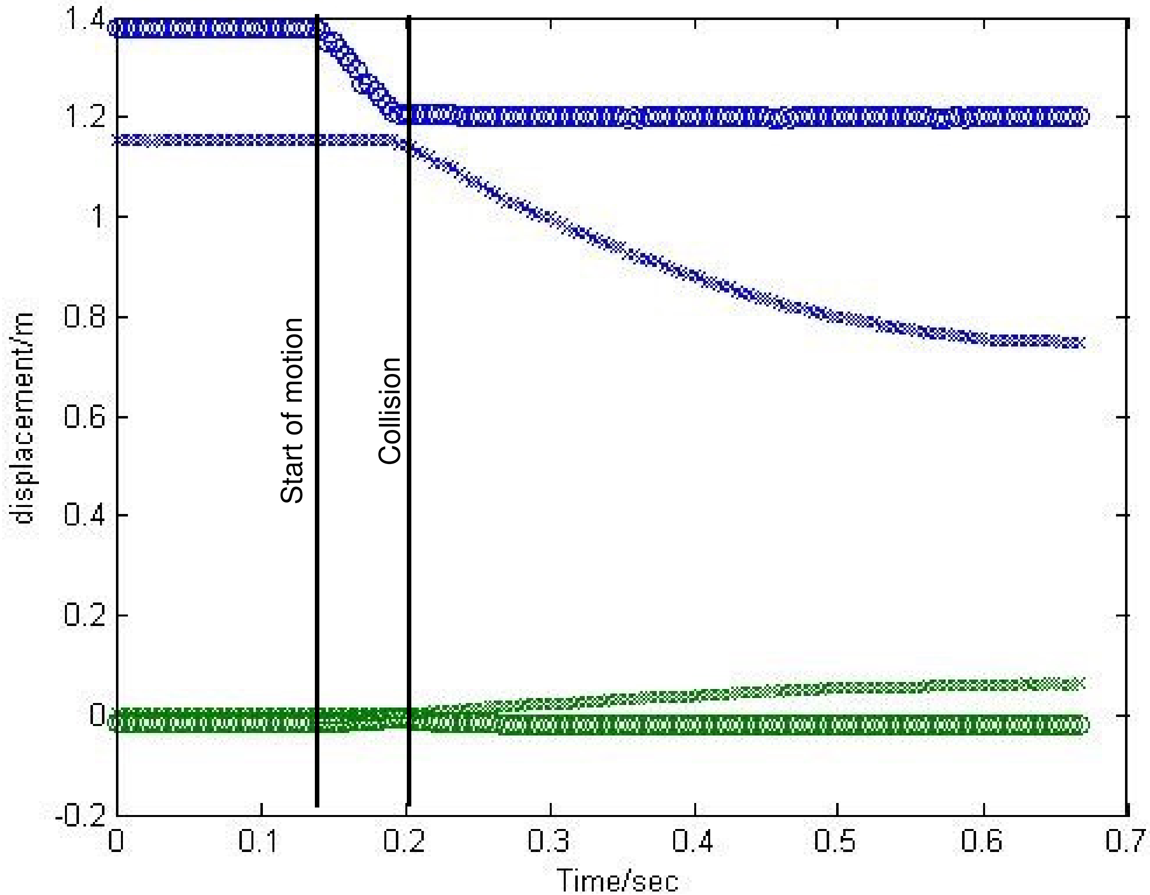
2.13m/s - 2.0348m/s = 0.095m/s

0.095/2.13 x 100 = 4.5% error



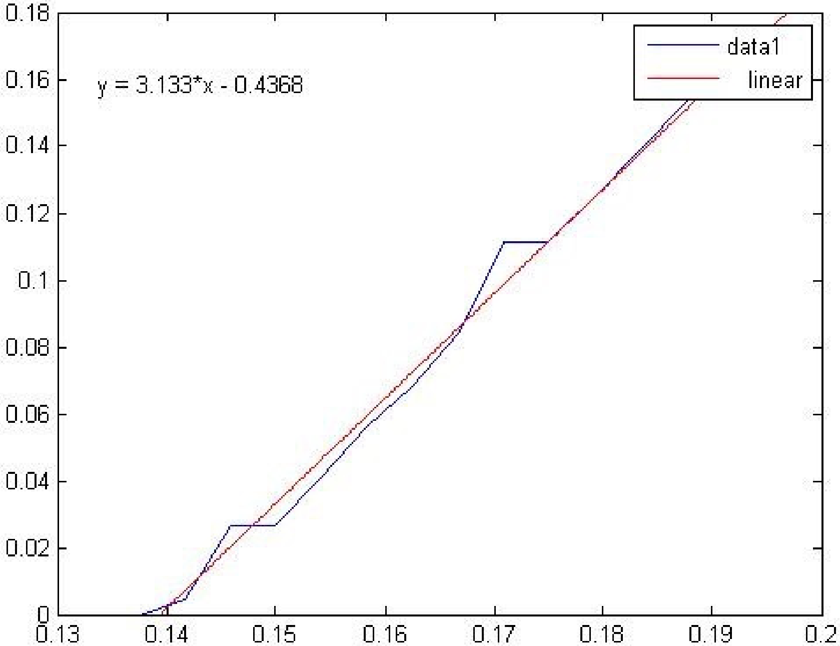


Head on Collision ($M_{target}=2M_{attacker}$)



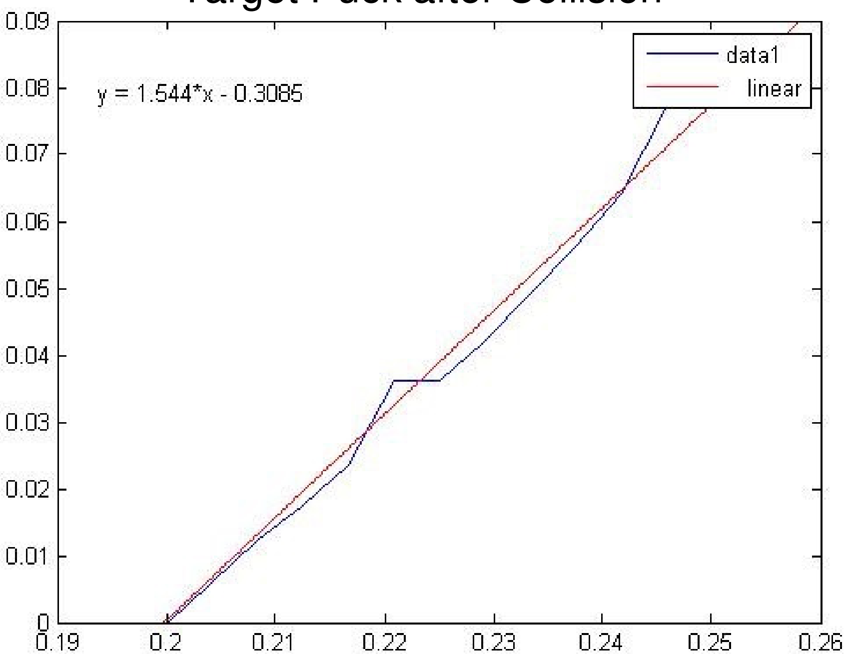
- We took a smaller time-frame because the effects of friction on the double mass body would be greater.

Attacker Puck before Collision

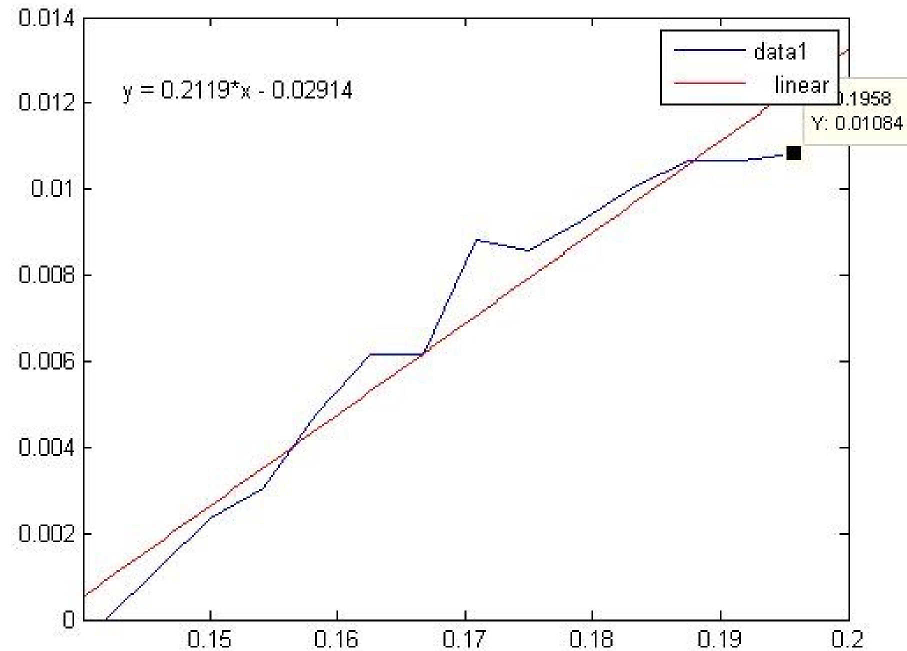


- initial momentum = final momentum
- 3.133(m) = 1.544(2m) + 0.2119(m)
- Cancelling out the masses gives us
  - RHS = 3.113 m/s
  - LHS = 3.299 m/s
- 3.299 m/s - 3.113 m/s = 0.186 m/s
- 0.186/3.113 x 100 = 5.9% error

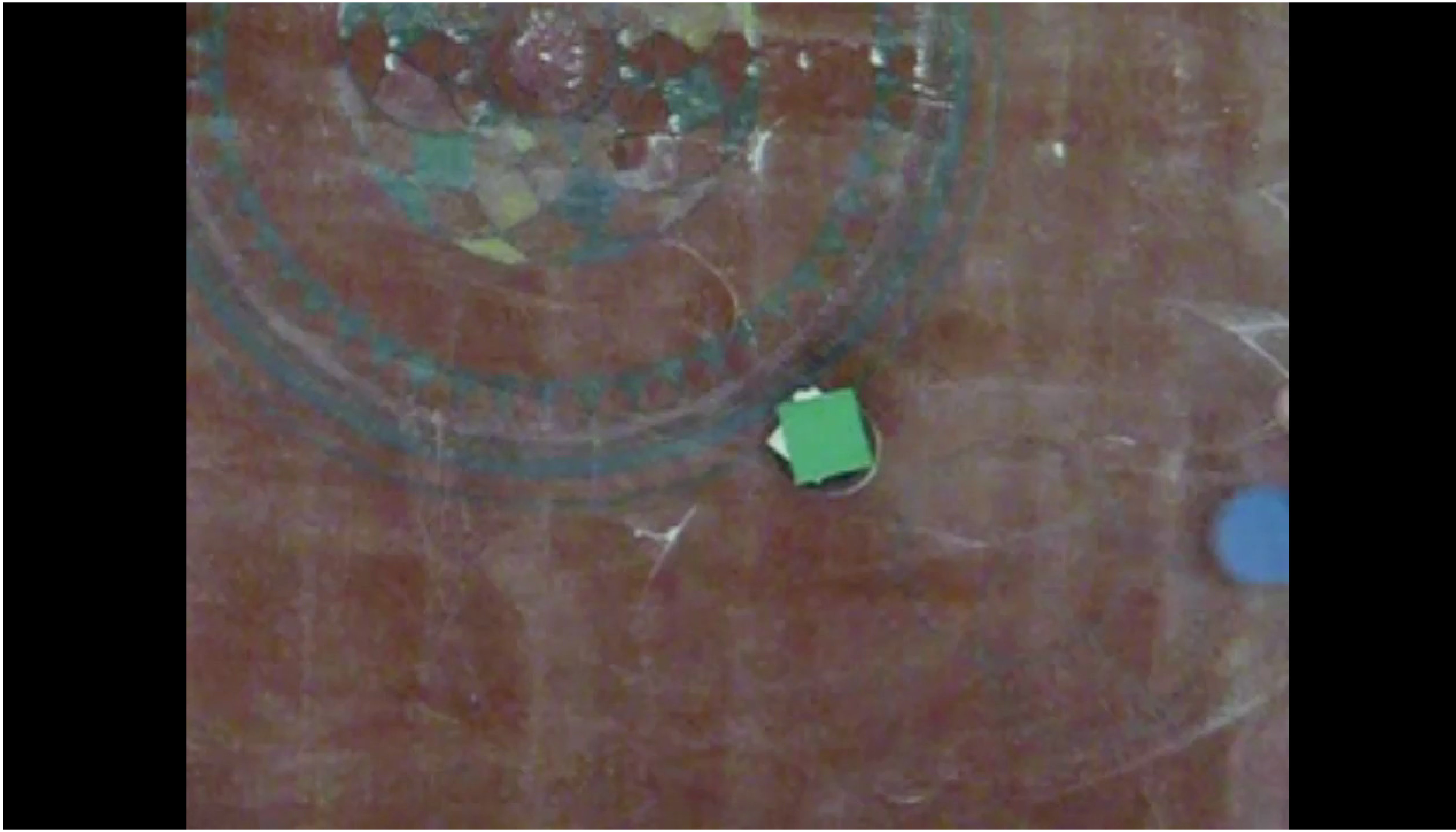
Target Puck after Collision

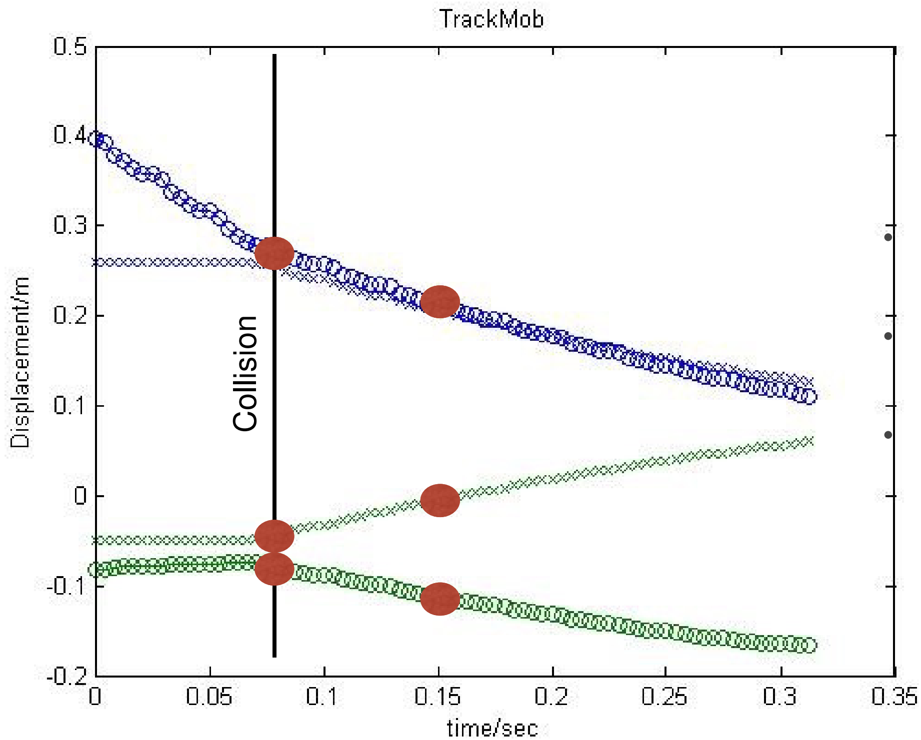


Attacker Puck after Collision



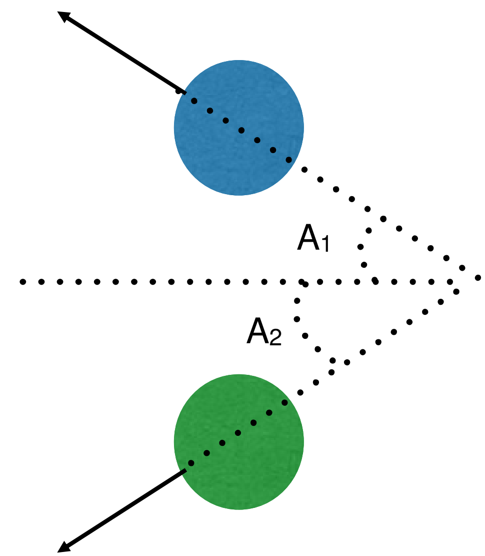
Collision at an Angle (Same mass)





Calculating the Angles

- We took the co-ordinates of the points marked in red.
- We know they lie on the line that the pucks are travelling on.
- The inverse tangents of the gradients gave us the angles relative to the initial trajectory of the attacker puck.



Gradient of path of blue puck

$= ((-0.0104)-(-0.125))/(0.3475-0.466)$

$A_1=\tan^{-1}(0.967)=44º$

Gradient of path of green puck

$= (0.06981)/(0.0837)$

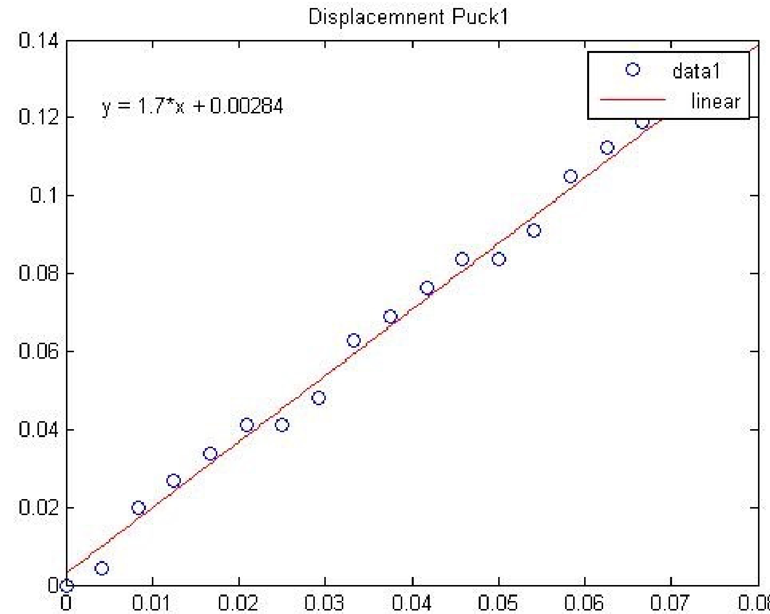
$A_1=\tan^{-1}(0.834)=39.8º$

$p_x(initial)=p_x(final)=1.7m$
$p_y(initial)=p_y(final)=0$

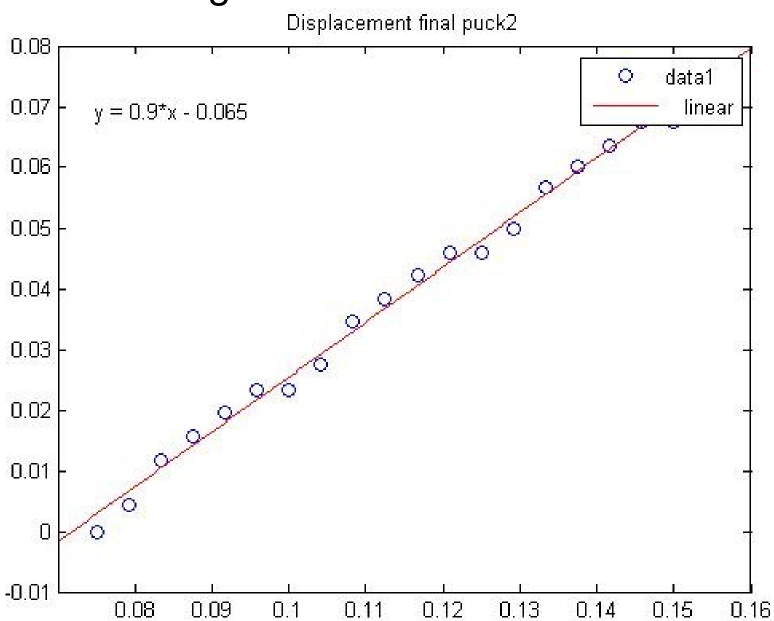
$p_x(final)=1*\cos(44)+0.9*\cos(39.8)=1.4$
$1.7-1.4=.3$
$.3/1.7 \times 100 = 17.6\%$ error

$p_y(final)=1*\sin(44)-0.9*\sin(39.8)=0.12$

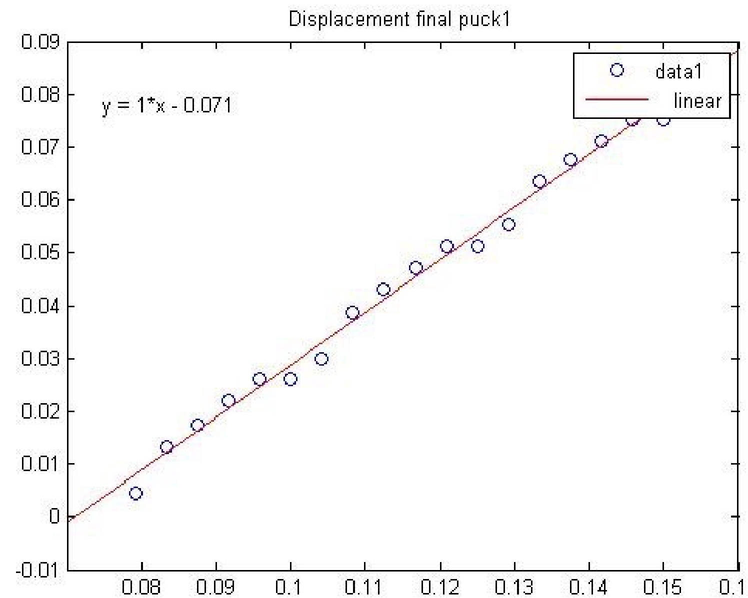
Attacker Puck before Collision



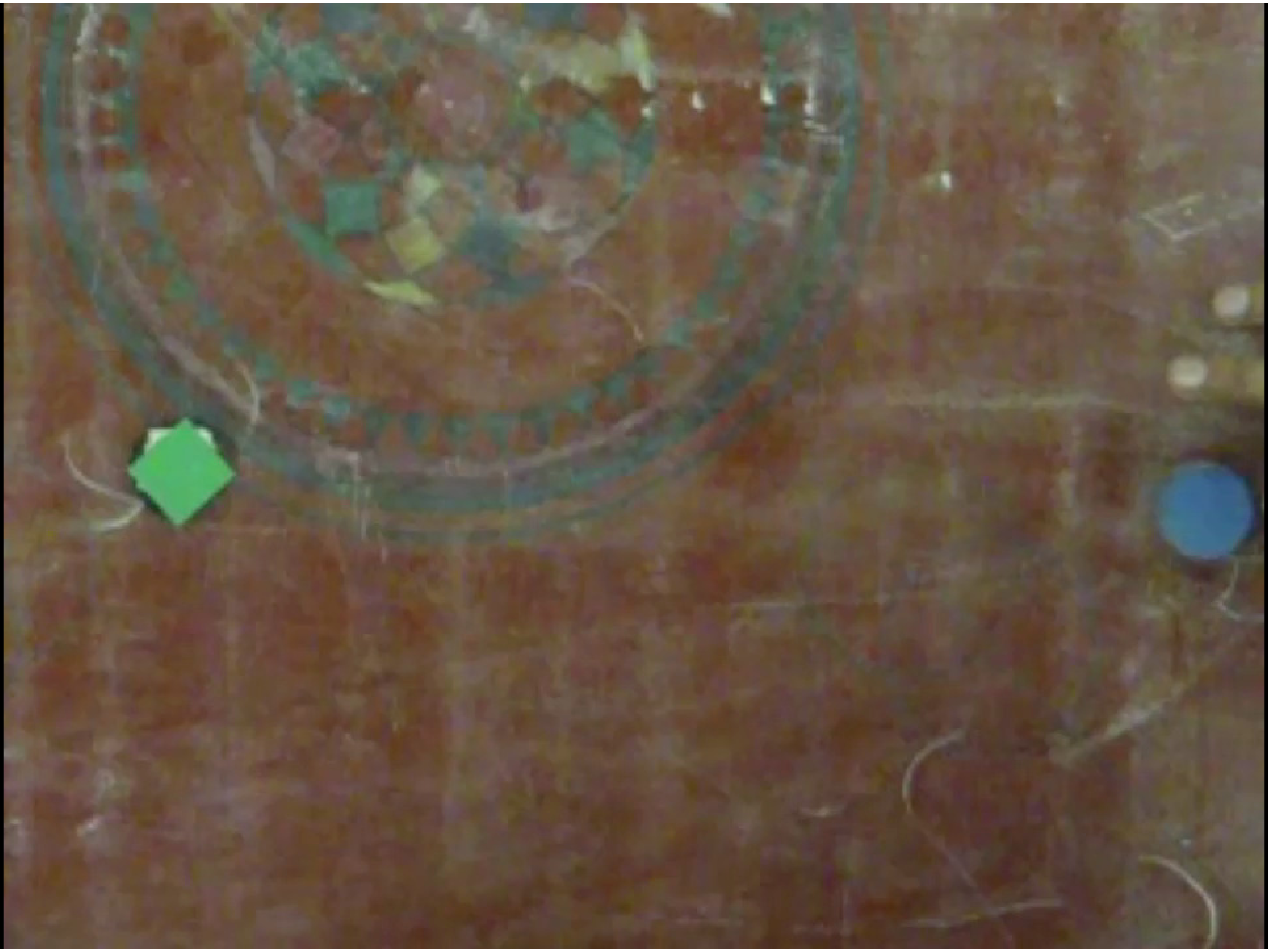
Target Puck after Collision

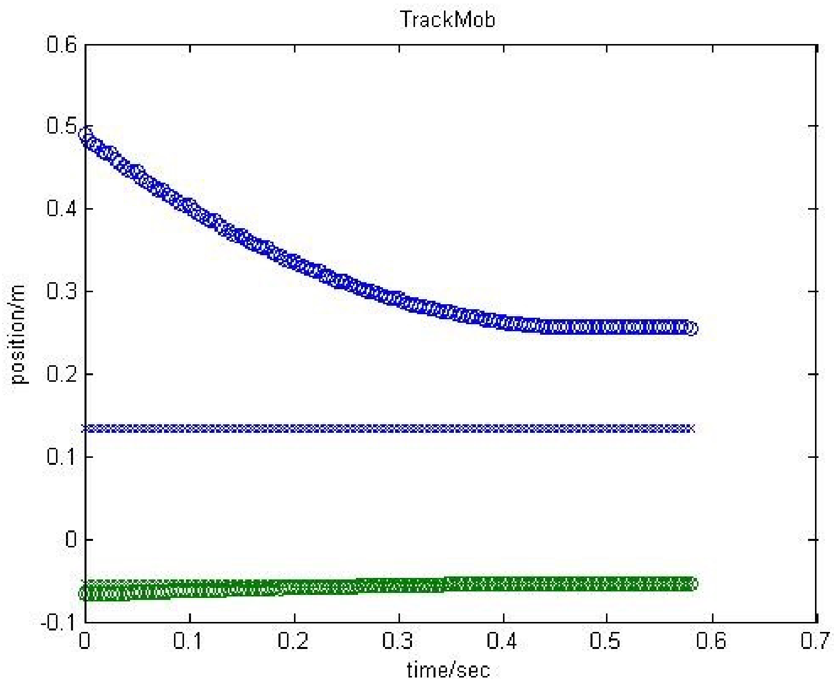


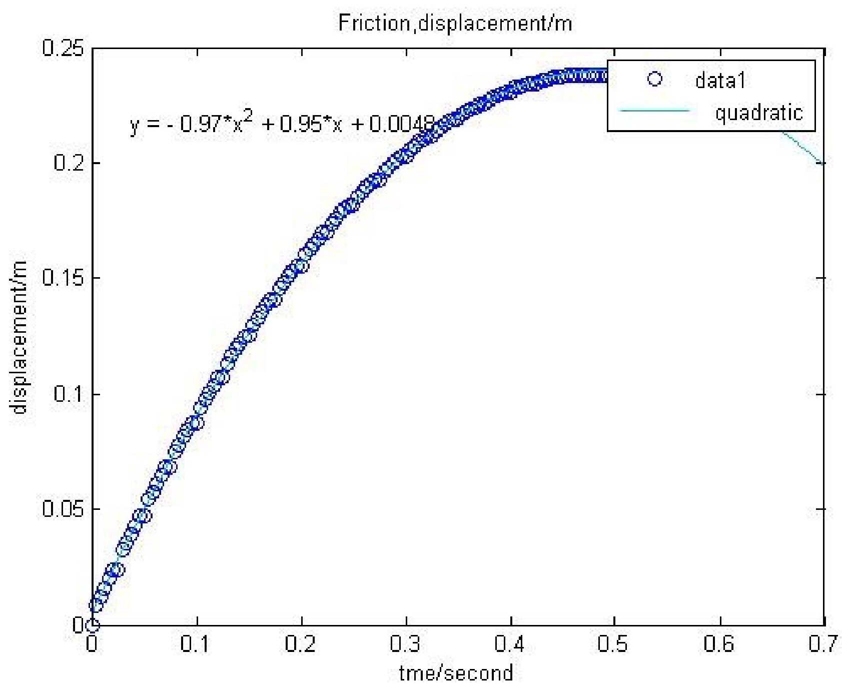
Attacker Puck after Collision



Co-efficient of Friction Analysis



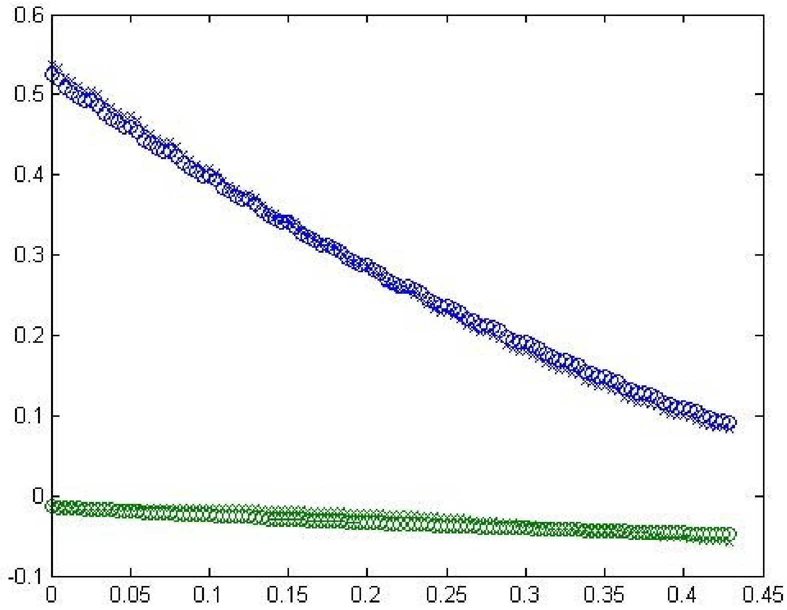




- Use the Processdata function to obtain the displacement/time curve.
- Use basic fitting to obtain a quadratic fit for the curve
- Different twice with respect to time to obtain deceleration
- Deceleration in the direction of friction is given by = 2*0.97 = 1.94
  F=ma=μR
  R=W=mg
  μmg=ma
  μg=a
  μ=a/g=9.81/1.94=5.1
- This can give us a possible explanation for any errors in the readings

Rotational Motion Analysis

Track mob Data



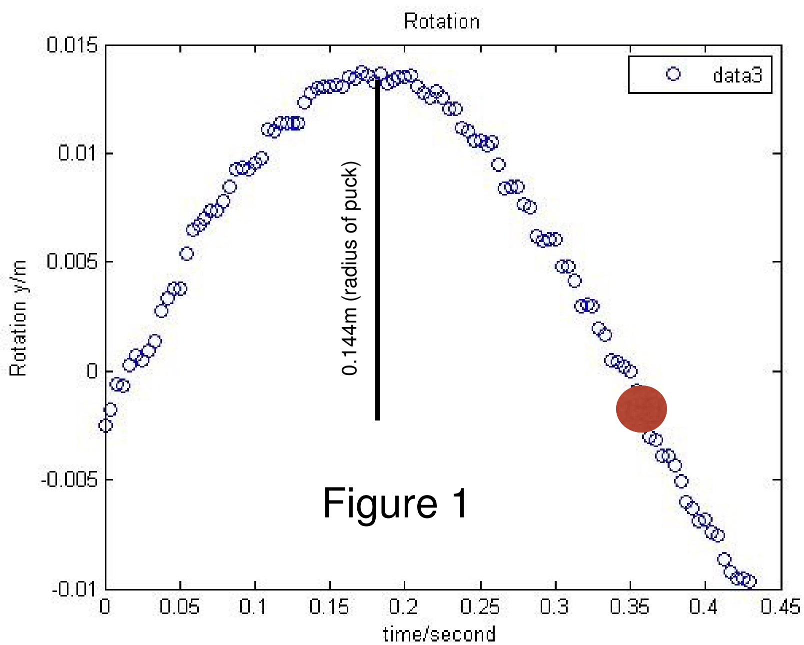


Figure 1

- Trackmob gives us the roto-translational motion of the marker on the edge of the puck.
- To analyse the rotational motion, we needed to apply a frame shift, and move to the frame of reference of the centre of mass.
- This was done by placing a marker on the centre and then subtracting the position vectors of the two markers and plotting the resultant against time (figure 1)
- Completion of one half cycle took 0.36s.
- Using $\Omega*t=\pi/2$ gives us Ω(angular speed) = 8.72 rad/s
- $Y=0.144\sin(8.72*t)$