

PHY221 LAB 02-5: Video Analysis of a Collision

Experiment 1

In this experiment, we'll measure the velocity of a system of two carts before and after the collision and we'll apply the Momentum Principle to calculate the ratio of the masses of the carts.

Procedure

1. Go to our course web site and download the video `02-5-1D-carts-collision.mov` to your computer.
2. Import the video into Logger Pro.
3. Using the technique previously taught in the class, measure the velocity of Cart 1 before and after the collision. Note that Carts 1 and 2 both have the same final velocity (i.e. after the collision). Record these measurements below.

$v_{1x,i} =$

$v_{2x,i} =$

$v_{1x,f} =$

$v_{2x,f} =$

Results

1. Apply Conservation of Momentum to this situation, and solve for the ratio of the masses of the carts m_1/m_2 (with no numbers). You should (1) sketch a picture; (2) write the Momentum Principle; (3) substitute variables, especially noting that $v_{2,i} = 0$ and $v_{1,f} = v_{2,f}$; (4) solve for the unknowns in terms of the velocities.
2. Substitute values from what you measured in the lab.
3. Calculate the ratio of the masses of the carts, m_1/m_2 .
4. Compare your result to what you obtain from the measured masses of the carts $m_1 = 1.048$ kg and $m_2 = 0.524$ kg.

Experiment 2

In this experiment, we'll analyze a 2-D collision of two pucks on an air hockey table. Note that the physics used in this situation also applies to situations like Rutherford scattering (an alpha particle colliding with a gold nucleus) and a flyby of a space probe around a planet for example.

Procedure

1. Go to our course web site and download the video 02-5-2D-pucks-collision.mov to your computer.
2. Import the video into Logger Pro.
3. Using the technique previously taught in the class, measure and record the following quantities. Note: you should first mark Puck 1 (blue puck) before and after the collision. Then, click the icon in Figure 1 to create a new series. In the resulting pop-up menu, select *Add point series*. Then, rewind to the first video and begin marking the red puck (Puck 2).



Figure 1: Icon to add a data series to the video.

$v_{1x,i} =$
$v_{2x,i} =$
$v_{1x,f} =$
$v_{2x,f} =$
$v_{1y,i} =$
$v_{2y,i} =$
$v_{1y,f} =$
$v_{2y,f} =$

Results

1. Use the masses given in the first frame of the video to calculate the following quantities.

$$p_{1x,i} =$$

$$p_{2x,i} =$$

$$p_{sys,x,i} =$$

$$p_{1x,f} =$$

$$p_{2x,f} =$$

$$p_{sys,x,f} =$$

$$p_{1y,i} =$$

$$p_{2y,i} =$$

$$p_{sys,y,i} =$$

$$p_{1y,f} =$$

$$p_{2y,f} =$$

$$p_{sys,y,f} =$$

2. Verify that $\vec{p}_i = \vec{p}_f$ for the system of the two pucks.