Conserved Quantities

In this experiment you will examine what happens when two cars collide with each other.

Setting up the Equipment

Hardware:
Each table of 4 students will work as one team. Each table has two laser gates, each gate is connected to a computer. Each team of 4 students will be given two cars, some bar weights, and tabs that can be used to block the laser gate. Note: **The cars are expensive. Do not let the cars fall off the table and hit the ground!!!**

Software:
You can use the program "energy". Click once on the icon to start the program. The menu should be self-explanatory. The interface measures the time that the laser gate is blocked. Then the tab thickness is divided by this time, and the resulting speed displayed on the screen.
a) To check if the laser gate is working, type "t". The program samples the detector once every second and displays if the gate is blocked or unblocked.
b) To set the number of data points that will be collected, type "n".
c) To change the tab thickness, press "z".
d) To take data, press "d".

Designing the Experimental Setup

The collisions will take place in one dimension, and you will need to measure the speed of one car before the collision and both cars after the collision. To do this, you will need to setup the laser gates so that a car traveling straight will block each of the gates with its tabs.

Check that the equipment is working properly, and that the two laser gates are consistent in their calibration. You might want to let one car travel through the two gates and see if the speed decreases as expected.

Before you start with the collision experiments, measure the mass of each car.

Some Experiments to try

Try various collisions using different masses for the cars. To change the mass, add "mass bars" to the cars. Some collisions can be:

1. A collision where one car is initially at rest, and after the collision the two cars stick together.
2. A collision where one car is initially at rest, and the cars bounce off each other.
3. A collision where the spring is initially compressed, and after the collision the spring extends adding energy to the system.

Ideas for the Analysis

1. Measure the product mass times velocity (momentum) of the cars before the collision and after the collision.
2. Measure the kinetic energy of the cars before and after the collision.
3. Arrange the data in a table in an appropriate manner, and discuss your results.
4. Compare your data with that of the other groups in the class, and have a classroom discussion of your results.