IB Physics

**Conservation of Momentum - groups of 2**

**When a moving glider strikes a glider at rest on an air track the velocity will go down, but momentum will be conserved. Here you will test this. There are three different ways to determine the velocity of the cars before and after the collision, we can use the range finder, photo gates, and video analysis.**

1. You will need **one** lab partner, (Work in groups of 2 – if you have a group of 3 then you must analyze two different collisions), an air track, two gliders, and a computer with Logger Pro on it.

2. **Mass** the two gliders and record this. Level the air track. Practice the collision (Not too fast, not too slow) – it sometimes helps to hold the stationary glider still with a finger until just before the collision. For the three ways you calculate velocity, you will need to gather the mass of both gliders, and the velocity of the gliders before and after, and the uncertainty of everything you measure.

3. Gather the velocity before and after the collision in one of three ways:

Range Finder: Run the momentum lab on the desktop. You will need to adjust the rangefinder until you get a nice graph of the collision on your velocity graph. When you get the graph you want, you can use “Analyze” > “Statistics” and it will pop up a neat balloon on your graph that has the information you need. (Including uncertainty!)

Photo gates: Run the momentum lab on the desktop. The photo gates simply time the duration that the infrared beam is blocked. The velocity of the glider is just the length of the “flag” on the top of the glider, divided by the duration of the blockage. So you will need to measure the length of the flag in m, and estimate the uncertainty of both the distance and the time. Set up the photo gates so that they time the flag just before, and just after the collision, but not during.

Video Analysis: Put a meter stick in the field of view of the video camera, and go to “Insert” > “Video Capture” and set up your camera. Make a video of the collision being careful not to block the view of the carts. Then you can open the analysis tools on the movie, set the scale (and the origin if you like) and just click on the front of the first cart every frame, and the software will calculate position and even velocity. From the velocity before and after the collision in the table you should be able to estimate the uncertainty.

Here's what you turn in:

1. A brief description (4 words) of the general method you used (Rangefinder, photo gates, or video analysis)
2. **A nice data table that has the information you used in your calculations. (units and uncertainties)**
3. Your calculations of the momentum before the collision, and after the collision and the uncertainty of those momenta.
4. An appropriate conclusion and evaluation of the experiment as per IB criteria.
   1. Use the numbers to make an argument as to whether the data you have disproves conservation of momentum. You will need to intelligently use the uncertainties, as well as the calculated momenta before and after.
   2. Discuss the sources of error present, and what effect those source might have had on the investigation
   3. Suggest ways to improve the procedure to eliminate the sources you mentioned