Experiment 9: Momentum

Physics is often concerned with what are called \conserved" quantities. Mass and energy are two examples of quantities that must remain conserved for a closed system. Conservation of a quantity is a clue to a physicist that there is some underlying principle to be discovered. Perhaps the oldest and most famous conservation principle is the conservation of momentum. This is embodied in Newton's First Law, written in 1687. It states that an object in motion will remain in motion unless acted upon by a net force. Conservation of momentum will be studied through one dimensional collisions.

One Dimensional Collisions

The concept of momentum is fundamental to an understanding of the motion and dynamics of an object. The momentum of an object is de ned to be

$$\vec{p} = m\vec{v} \tag{1}$$

For multiple objects in a system, the total momentum is a vector sum of the individual momenta. As a consequence of Newton's second law

$$\vec{F}_{ext} = \frac{d\vec{p}}{dt} \tag{2}$$

The perfectly inelastic (\sticky") collision is somewhat easier to analyze as only Equation 3 can be used. The energy equation used in the analysis depends on which case is being studied. If the collision