



CALIFORNIA STATE SCIENCE FAIR 2005 PROJECT SUMMARY

Name(s) James (Jiajun) Luo	Project Number S0710
Project Title Comparison of the Efficiency of Gauss and Rail Guns	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals One of the most interesting and useful applications of magnetism is to accelerate objects at tremendous velocities using magnetic accelerators. The two most are the Gauss Gun and Rail Gun. However, there has been no actual comparison of the efficiency of these two guns, only blind amplification by various institutions. Thus, the goal of my project is to determine which accelerator is actually more efficient, and in what scenarios and environments, to put an end to blind amplification.</p> <p>Methods/Materials I constructed the Gauss Gun by using a plastic 12.75-inch long tube, copper coils, and electric receivers. I constructed the Rail Gun using wood and copper tape as the rails, and used a solid-state magnet as a boost for the magnetic field. I used a power source that provided 10 amperes at 40 volts, and I also constructed a graphite switch to efficiently connect the circuit. To fire the accelerators, I quickly completed the circuit using the switch and then disconnected it. I conducted five trials each for the two guns using projectiles of the same dimensions (a copper and a metallic one). Then, I calculated the velocity in meters per second by using mathematic equations for the two guns.</p> <p>Results Through experimentation, I discovered that the Gauss Gun allows projectiles to launch projectiles at higher speeds and farther distances when the guns are smaller. The average distance for the Gauss Gun was 245 cm. The Rail Gun's average distance was 52 cm. The theoretical velocities for the accelerators also confirmed my experimental results. However, through analysis of the equations and various difficulties during experimentation with the Gauss Gun, I found that when the launchers are increased in size, the Rail Gun becomes more pragmatically efficient than the Gauss Gun because of physical properties.</p> <p>Conclusions/Discussion I concluded that the Gauss Gun is better for small-scale purposes while the Rail Gun is better for larger scale purposes. This is due to the effect of length on the velocity and distance, heat generation, and extreme inconsistency with the Gauss Gun. Although these accelerators are already more promising than most other launching mechanisms, the reason why they are not used currently is because of the aforementioned temporary difficulties with the Gauss Gun, the rail erosion of the Rail Gun, and not knowing which is more efficient.</p>	
Summary Statement The focus of my project is to compare efficiencies of the accelerators to put an end to blind amplification and allow for the advancement of these promising launching mechanisms.	
Help Received Seung Jung helped measure distance; Used lab equipment at California State University Los Angeles under the supervision of Professor/Doctor Oscar Bernal.	