



**CALIFORNIA STATE SCIENCE FAIR  
2014 PROJECT SUMMARY**

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| <b>Name(s)</b><br>Justin H. Jeon   | <b>Project Number</b><br><br>34972 |
| <b>Project Title</b><br>Effect of Ball and Magnet Placement in Ejecting Velocity of Gaussian Cannon  |                                    |
| <p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b><br/>The object of this study is to determine the ideal arrangement of balls and magnets for the highest ejecting velocity. I will then analyze what effect the different arrangements have on the velocity. My hypothesis is that the more balls there are, the higher the velocity, since there is less impeding magnetic force affecting the ejecting ball</p> <p><b>Methods/Materials</b><br/>A table was set up with rails on its surface. The magnet and the desired amount of steel balls were set on top of the rail, making it so it would launch off of the table and onto the ground. The ball's distance traveled was measured and recorded. This was done ten times for each arrangement, and an equation was used to find the velocity. The initial input energy was found by using a force gauge to measure the force of the magnet. Lastly, the magnetic influence on the ejecting ball was found using a force gauge.</p> <p><b>Results</b><br/>The ejecting velocities for the different arrangements are as follows. With the 2-ball setup, there was a velocity of 1.47 m/s. With 3-balls, a velocity of 1.89 m/s was achieved. With 4-balls, there was a result of 2.06 m/s, and with 5-balls, 1.75 m/s was calculated. For the initial input energy, 0.02276 Nm was calculated. Kinetic energy of the ejecting ball was calculated for each arrangement, and the highest kinetic energy of the ejecting ball was 0.0169 Nm. The magnetic force pull on the ejecting ball was determined.</p> <p><b>Conclusions/Discussion</b><br/>The ejecting velocity highly varied with different setups, and the optimal arrangement was 4 balls, which disproved my hypothesis, which stated that the more balls in front of the magnet, the higher velocity. It is because the energy lost during multiple collisions became greater, even though the magnetic pull on the ejecting ball decreased with distance.</p> |                                    |
| <b>Summary Statement</b><br>The project is about analyzing the physics principles behind the Gaussian Cannon   |                                    |
| <b>Help Received</b><br>Dr. James Li helped me decide my project and mentored me   |                                    |