The Electromagnetic Cannon

Respond to Reviewer's comments:

Reviewer 1

Ferromagnetic materials can be simulated as current rings when placed in magnetic fields. Thus, we have considered the ferromagnetic part of the plunger to be made up of a finite number of disks (or current rings) with the same radius as the plunger and a current, which depends on the thickness of the disk, magnetic field of the solenoid and the plunger's magnetic properties.

$$\mu_0 \vec{M} = (k_m - 1)\vec{B} \text{ (4)}$$

Where:

$$\vec{M} = \frac{\vec{\mu}}{V}$$

$$\mu = iA$$

M is the magnetic dipole moment, V is the volume of the element and A is its area.

(In equation 4) Substituting for M and μ, and also replacing B with the magnetic field of a solenoid, results in eq.5:

$$i = \frac{dv}{\pi R_p^2}(1 - k_m)\frac{N}{l_s}I$$

We have added some explanations on order to clarify the theory and the formulas.

Equation 6, is the final equation which calculates the net force exerted on the plunger and is therefore crucial in finding the velocity of the ball.

We have also added explanations in order to make the resulted graphs clearer and describe the physical processes that take place within the system.

Reviewer 2

As explained above, certain changes have been made in the explanation of our theoretical model. We hope that these changes (considering the limitation in the number of pages of the article) have clarified vague points within the theory.

Reviewer 3

The comments on the graphs have been modified in order to add more clear interpretations of the results.

Graphs 7-11 contain both theoretical curves (resulted from the numerical simulations) and experimental data's.

The errors accounted for our experimental data are as listed below:

Speedometer: 0.0001 (m/s)
Voltmeter: 0.001 (v)
Calculating the discharge time: 0.001 (s)
Measuring lengths: 0.02 (mm)
All of which are too small to be demonstrated as error bars in our graphs.

The references have also modified and properly formatted.

Editorial Request

All the requests have been taken into account during revision (format of the references, the title and data plotting).
Images: The images are all of own work. The setup has been designed in ***solidworks, 2009.*** *(See the attached pdf)*

We would like to thank all the reviewers for pointing out the advantages as well as the drawbacks of the article. We hope that this revision has satisfied all the editorial requests of the reviewers and editors and leveled up the paper for publishing.