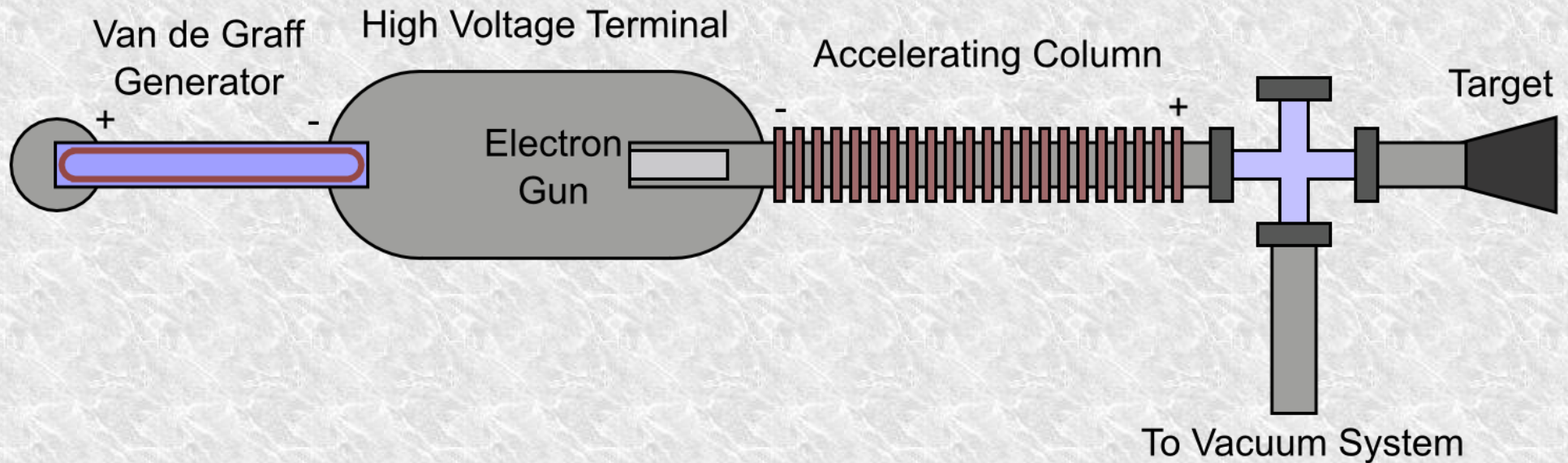


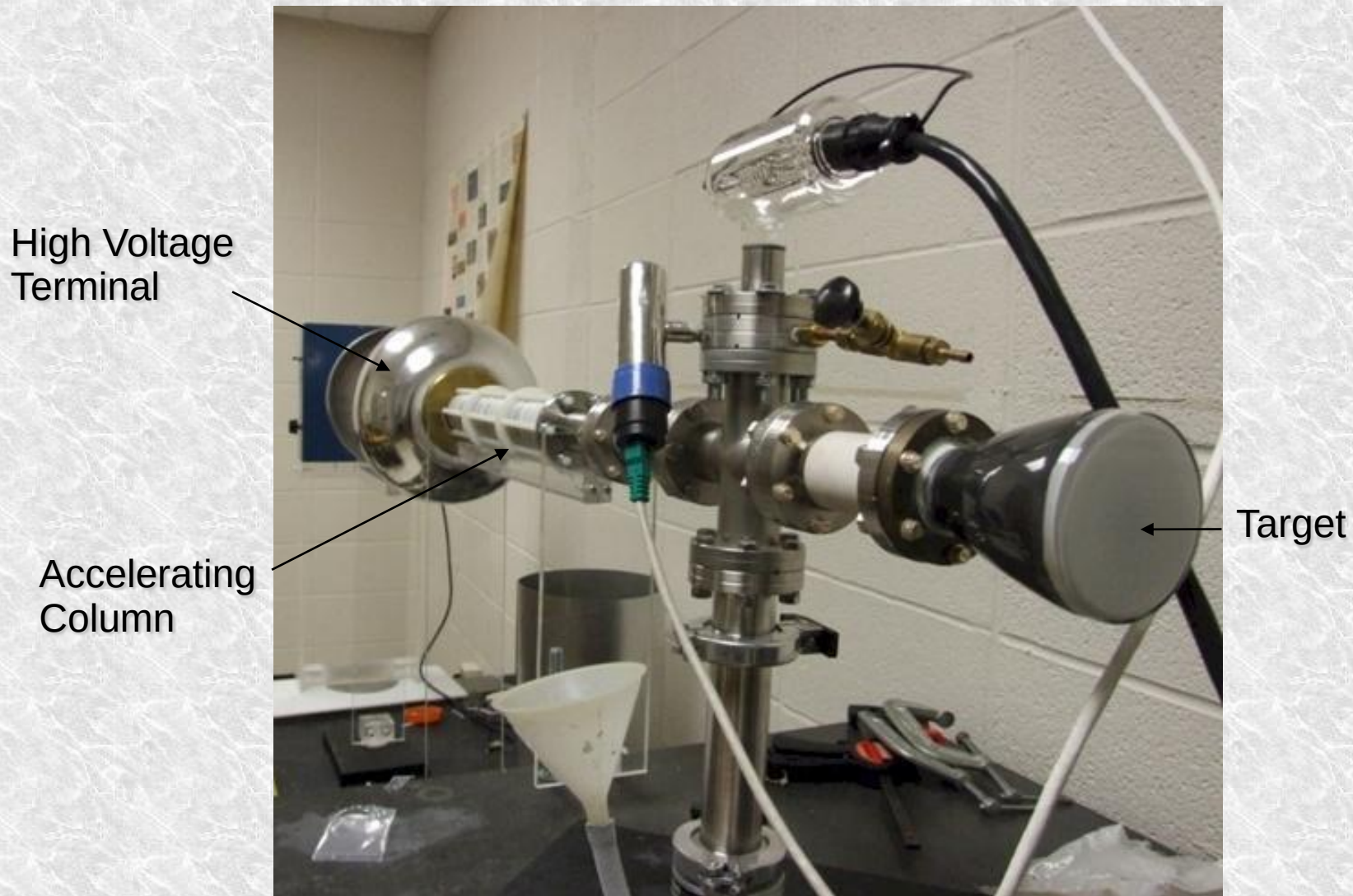
Designing an Electron Gun for an Electrostatic Accelerator

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Houghton College
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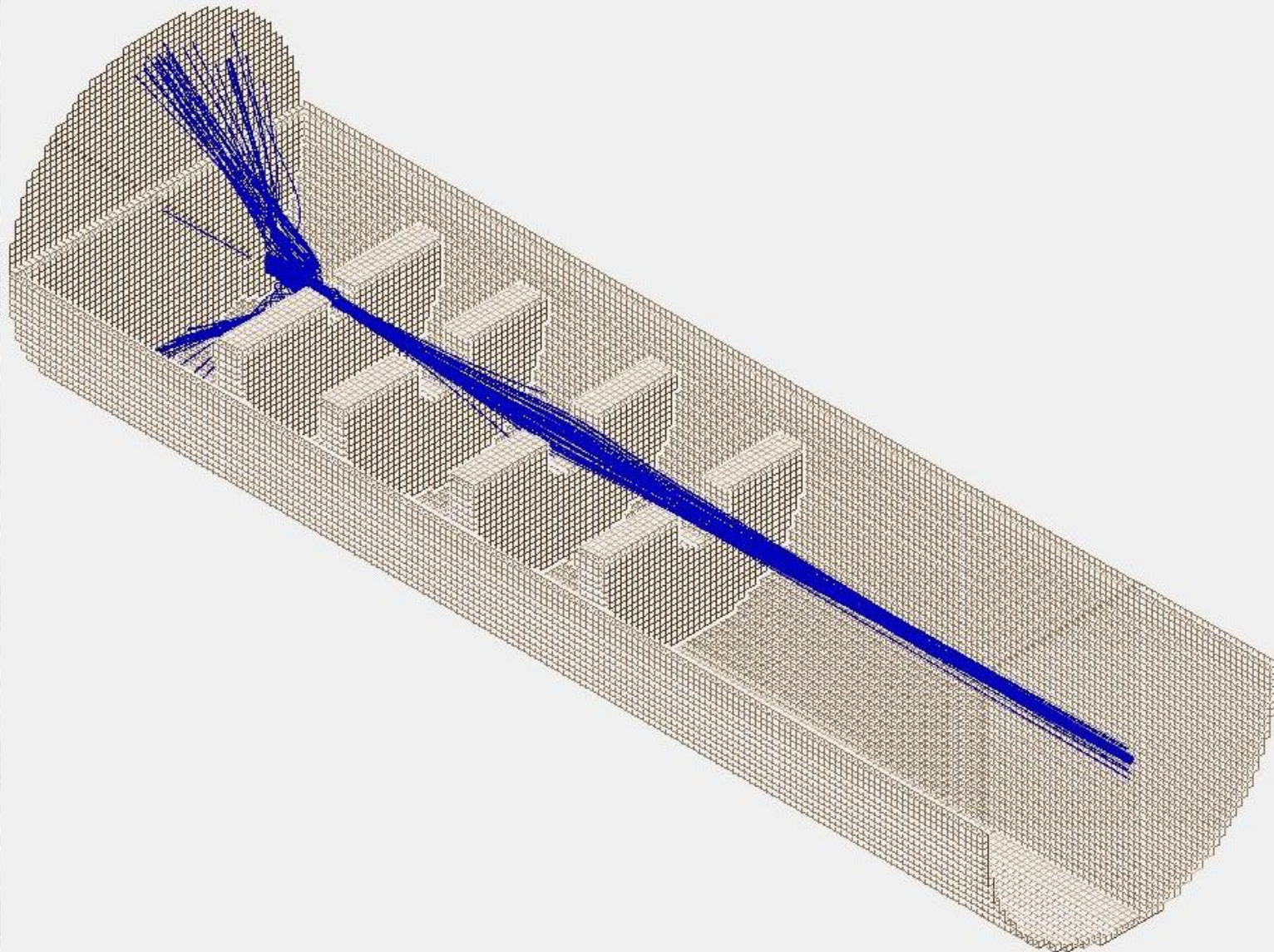
What is an Electrostatic Accelerator?



The Electrostatic Accelerator at Houghton College



Simlon Modelling Software



Laplace's Equation

Gauss's Law

$$\nabla \cdot \mathbf{E} = \rho/\epsilon_0$$

$$\nabla \cdot \mathbf{E} = -\nabla \cdot \nabla V = -\nabla^2 V$$

Electrostatic System: Laplace's Equation

$$\nabla^2 V = 0$$

$$\nabla^2 V = -\nabla \cdot \mathbf{E} = -dE_x/dx - dE_y/dy - dE_z/dz$$

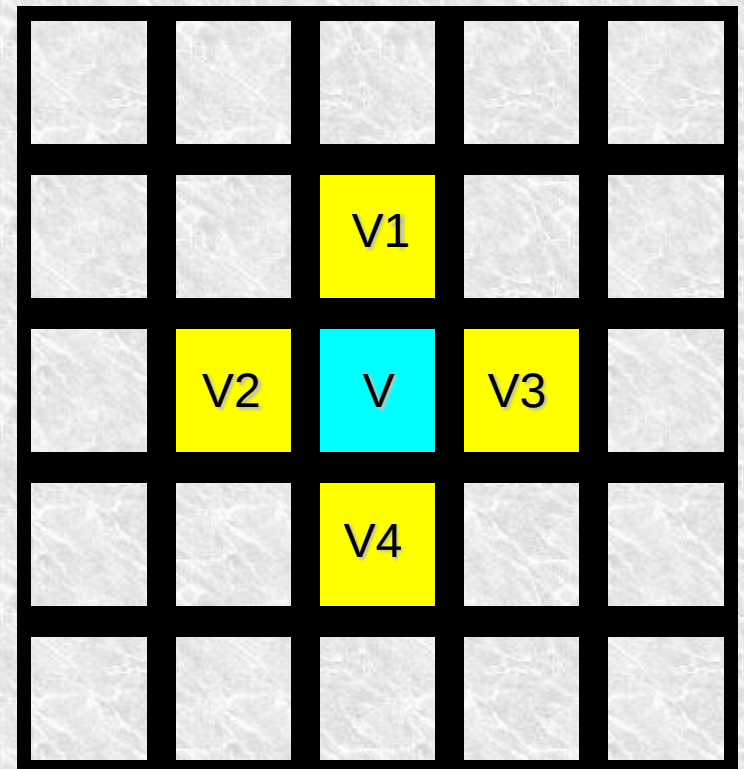
One Dimension

$$d^2V/dx^2 = 0$$

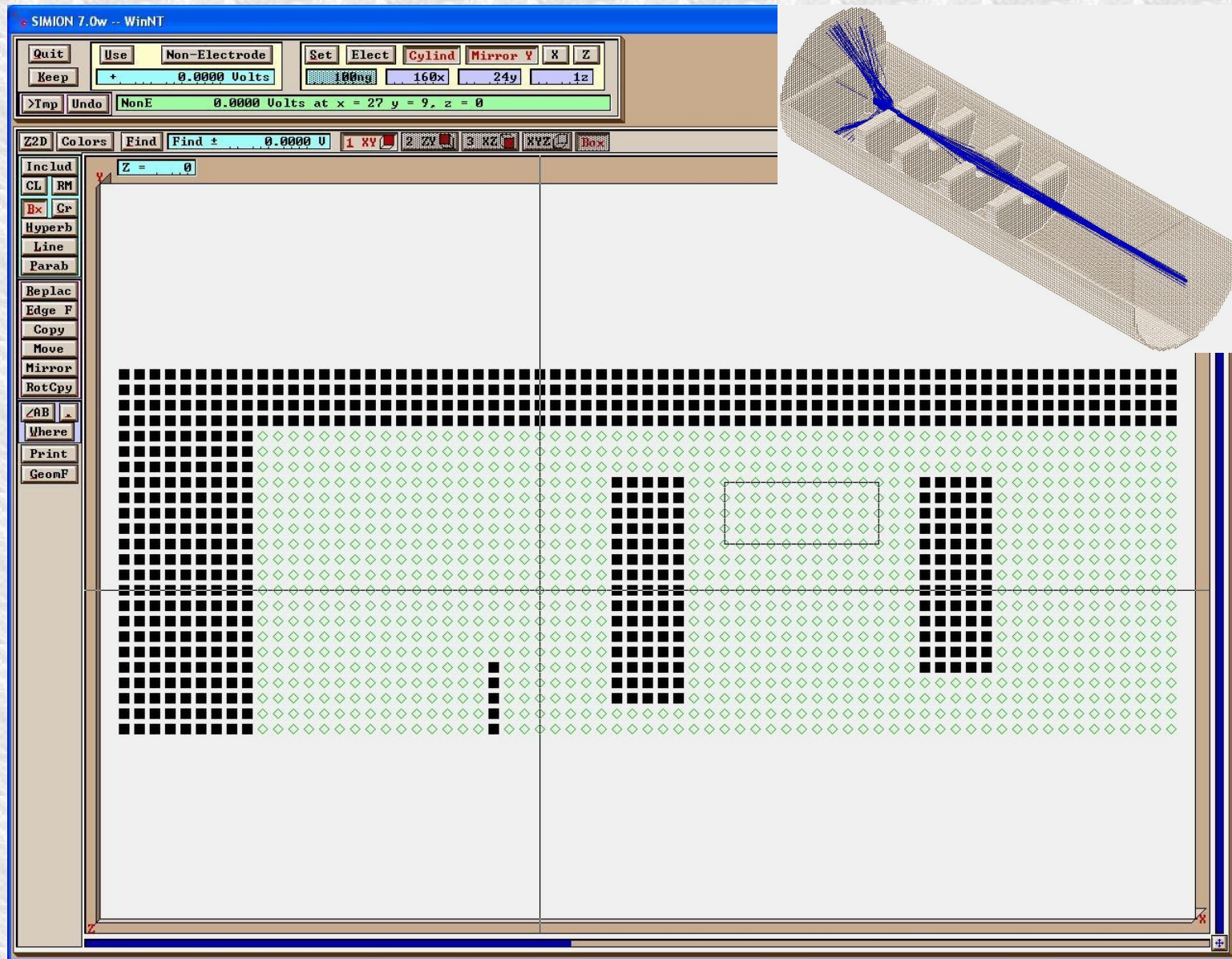
$$V = ax + b$$

Approximation

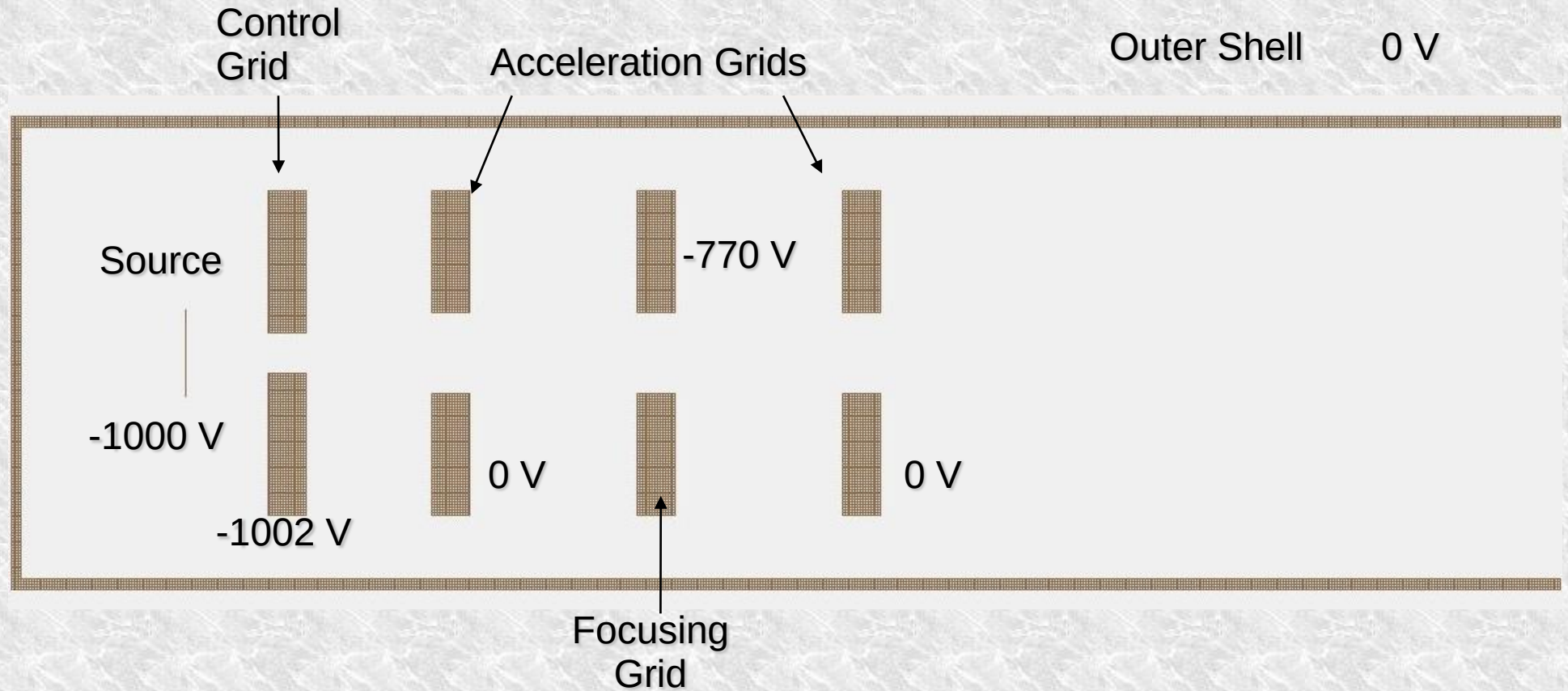
$$V = (V_1 + V_2 + V_3 + V_4)/4$$



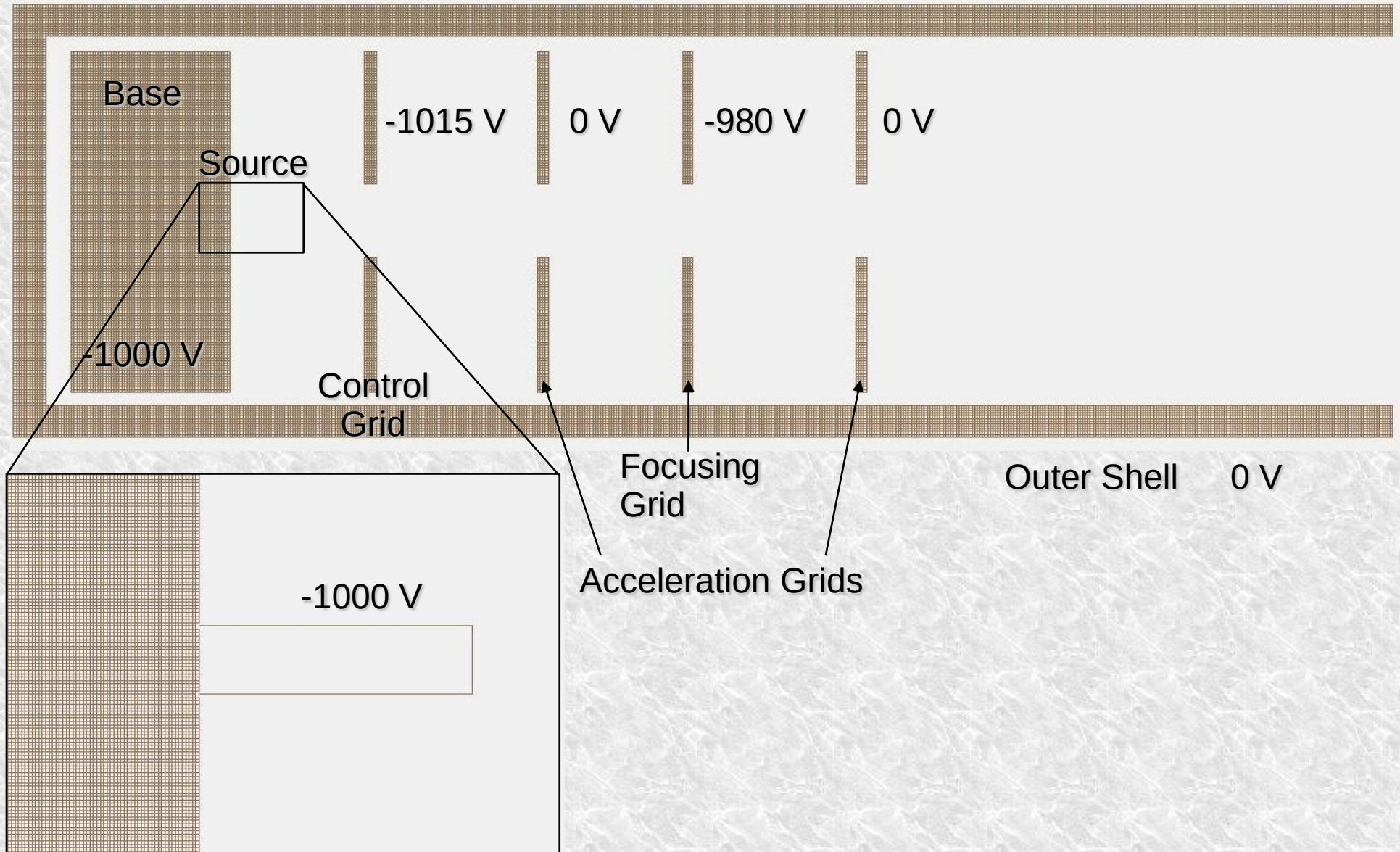
Designing an Electron Gun



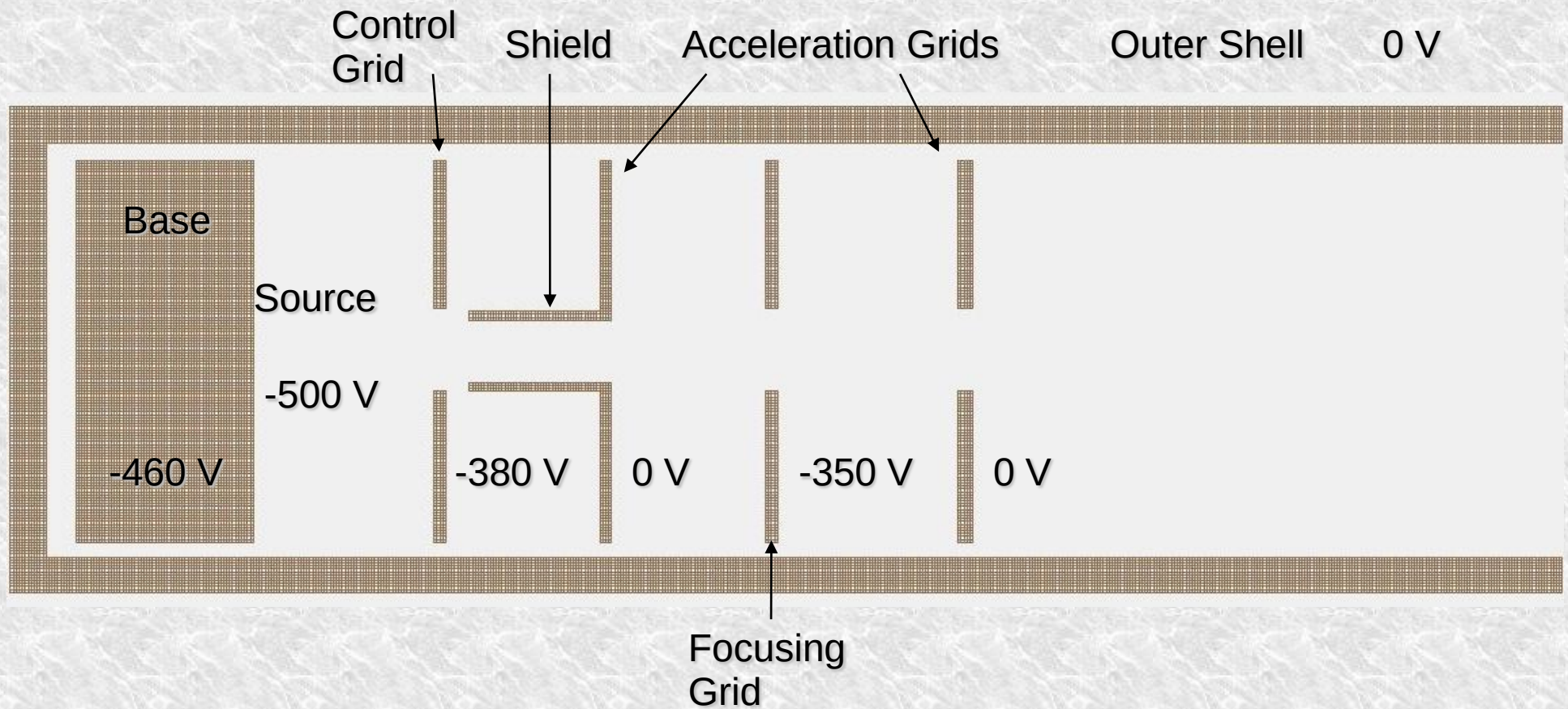
Electron Gun: Early Designs



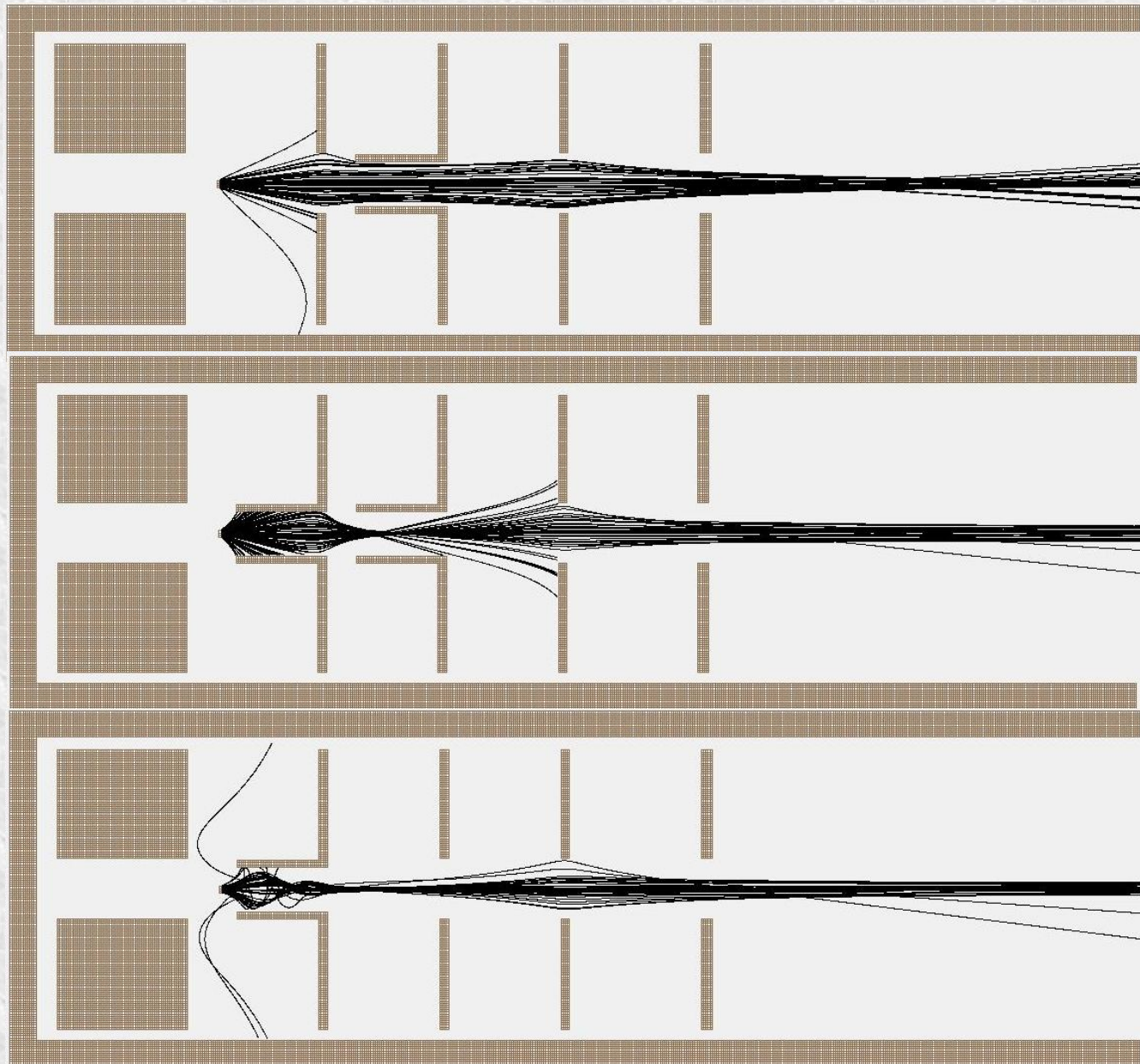
Electron Gun: Later Designs



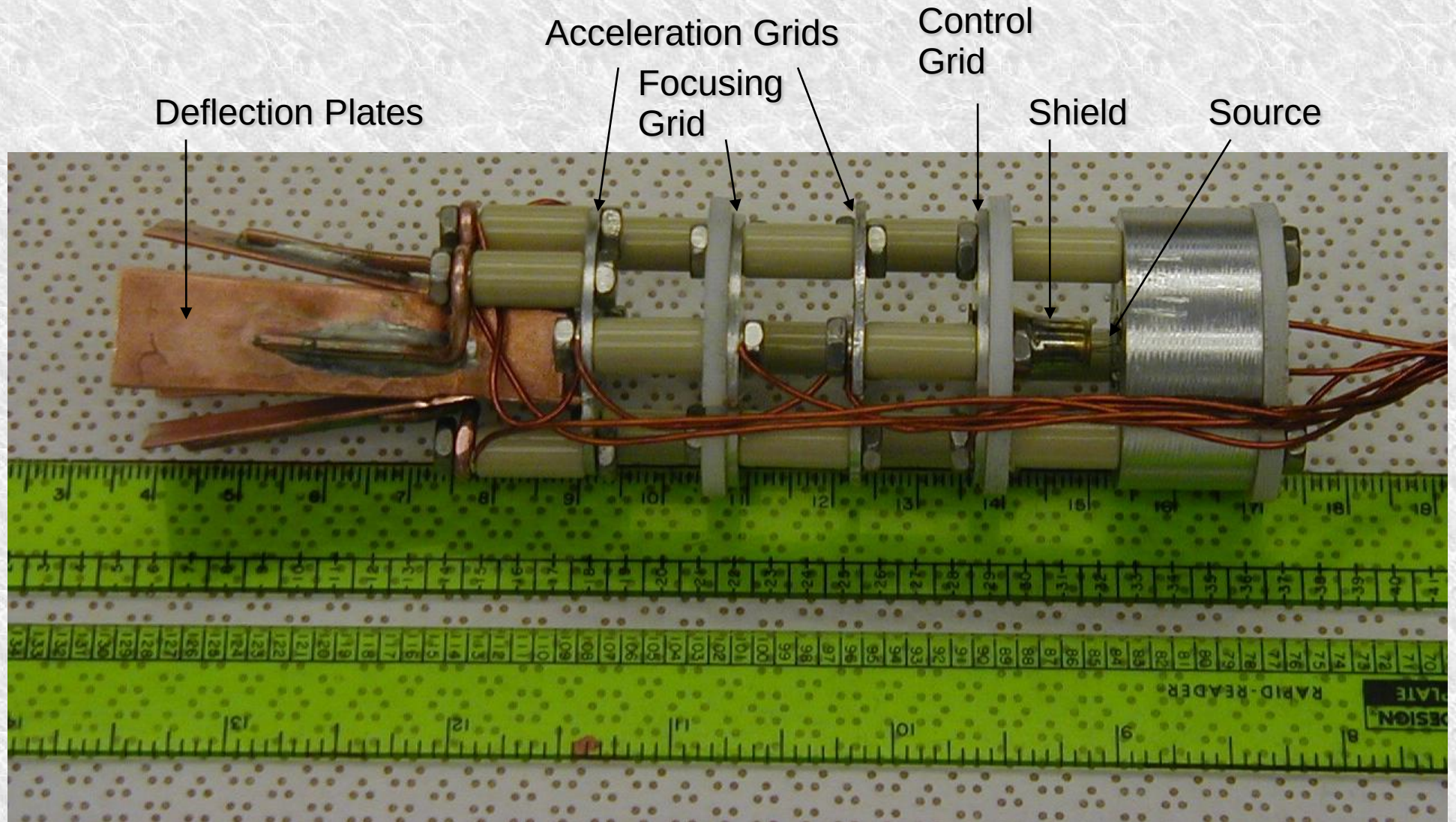
Electron Gun: Current Design



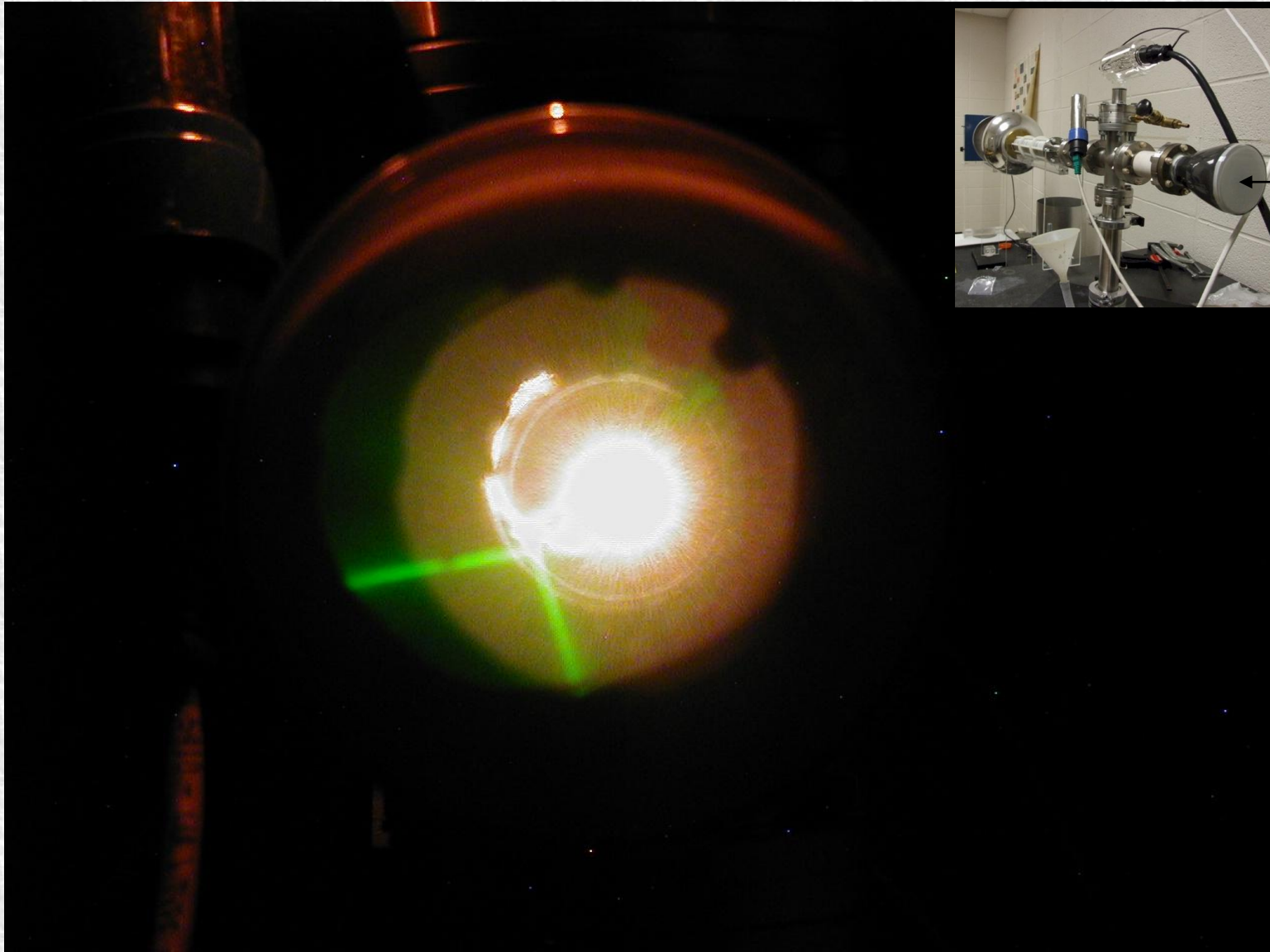
Simulations



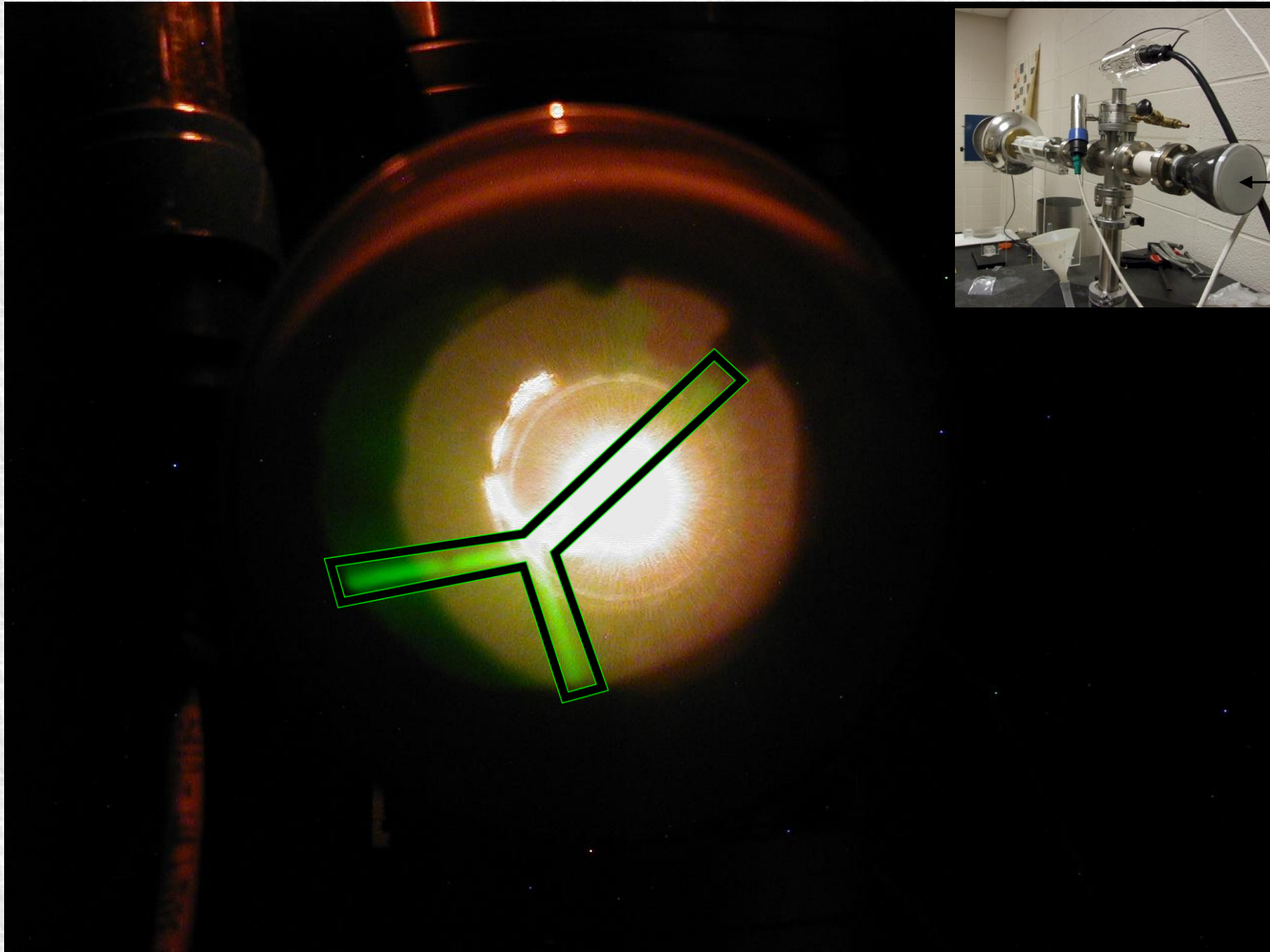
Actual Construction



Testing the Gun



Testing the Gun



Conclusion

- Overview

- We need an electron gun for our electrostatic accelerator
- By building our own, we can easily repair and modify the gun as needed
- We can model and simulate gun designs in Simlon
- Simlon has its limits, and physical testing is necessary to finalize a design