Monte Carlo Simulations of Electron Scattering Experiments

Alan Russian
Illinois Wesleyan University

Bruno deHarak, Faculty Advisor
Illinois Wesleyan University

Mark Liffiton, Faculty Advisor
Illinois Wesleyan University

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Monte Carlo Simulations of Electron Scattering Experiments
Alan Russian, Dr. deHarak, and Dr. Liffiton
Computer Science and Physics, Illinois Wesleyan University

Research Question
• Is it necessary to account for the following details when modeling electron scattering experiments?
  • True Interaction Volume When Using a Moveable Gas Mount
  • Gaussian Laser Distribution
  • Cosine-Squared Gas Distribution
• Experiments typically have a 10% error. Are these approximation errors greater than 10%?

Methodology
• Used a Monte Carlo Simulation: Performed operations on random points that represented electrons
• Written in Python
  • Used SciPy for Graphing
  • Used PyQt for GUI
• Over 600 Lines of Code

Results and Data Analysis
• Percent error of two cylinder interaction volumes when using line/cylinder approximation is displayed in Figure 2.
• Adding a Gaussian distribution to the laser alone does not make a difference of over 10%.
• Adding a cosine-squared distribution to the gas jet as well as the Gaussian distribution laser makes over a 10% difference when looking at 2 photons and above.

Conclusion
• A line/cylinder approximation for intersection volume cannot be used when the ratio of cylinders is approximately 1:1.
• One needs to take into account the cosine-squared gas distribution and the Gaussian distribution laser when looking at the absorption of two or more photons.