Moment Preserving Monte Carlo Electron Transport

Luke J. Kersting
NEEP
University of Wisconsin - Madison
FRENSIE Meeting

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Outline

- Monte Carlo Electron Transport
- Analog Transport Method
- Condensed History Method
- Moment Preserving Method
- Evaluated Electron Data Library
- Implementation
- Future Work

Monte Carlo Electron Transport

Challenges

- Electron charge increases scattering cross section
- Neutral Particles may scatter a couple dozen times over a distance
- Electrons may scatter 10,000 or more times over the same distance
- Purely analog transport is impractical at higher energies
- Approximations must be made to reduce computation costs
- Monte Carlo development lags behind

Motivation

- Electrons transport needed for precision dose and energy deposition calculations
- Photon transport through high Z material
- Solid state physics
- Medical physics

Condensed History Method

- "Condensed" random walk method to speed up electron transport
- Electrons move a set step length that is many mean free paths
- Multiple scattering theory sampled to get the outgoing direction
- The Continuous Slowing Down Approximation (CSDA) used to calculate energy loss
- Production of secondary particles are averaged
- Approximations don't hold below 1 keV
- Assumes infinite medium

Condensed History Step

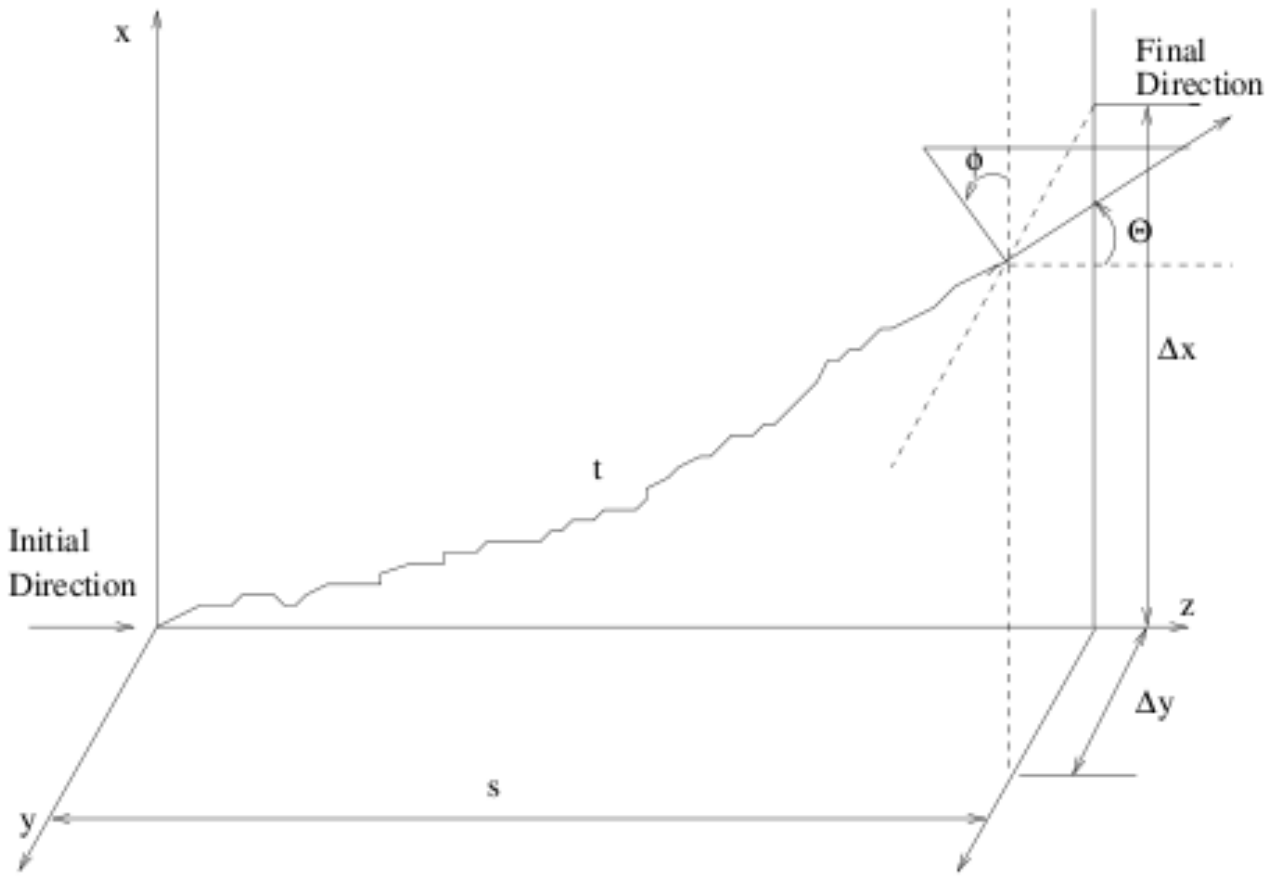

Figure : Schematic of electron transport mechanics model in EGS. Where s is the step length, t the total distance traveled, Δx and Δy are the lateral displacements, Θ and ϕ are the final polar and azimuthal angles.