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Angular Distributions Across Boundaries in ITS Codes

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Sandia is a multiprogramming laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under Contract DE-AC04-94AL85000.

Outline

- ITS and Electron/Photon Transport
- Angular Distributions, How to Compute Them
- How ITS Computes the Angular Distributions
- Improvements
- Conclusion

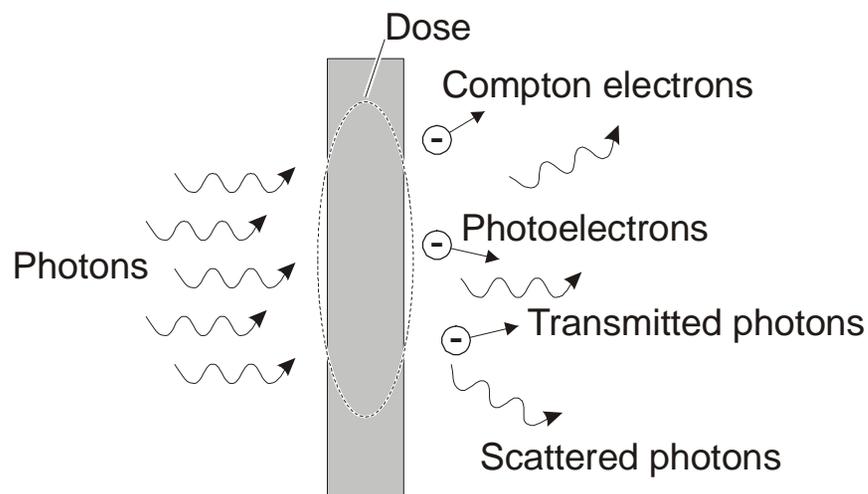
Integrated Tiger Series (ITS)

- Monte Carlo Code
- Simulates Radiation
- Applications



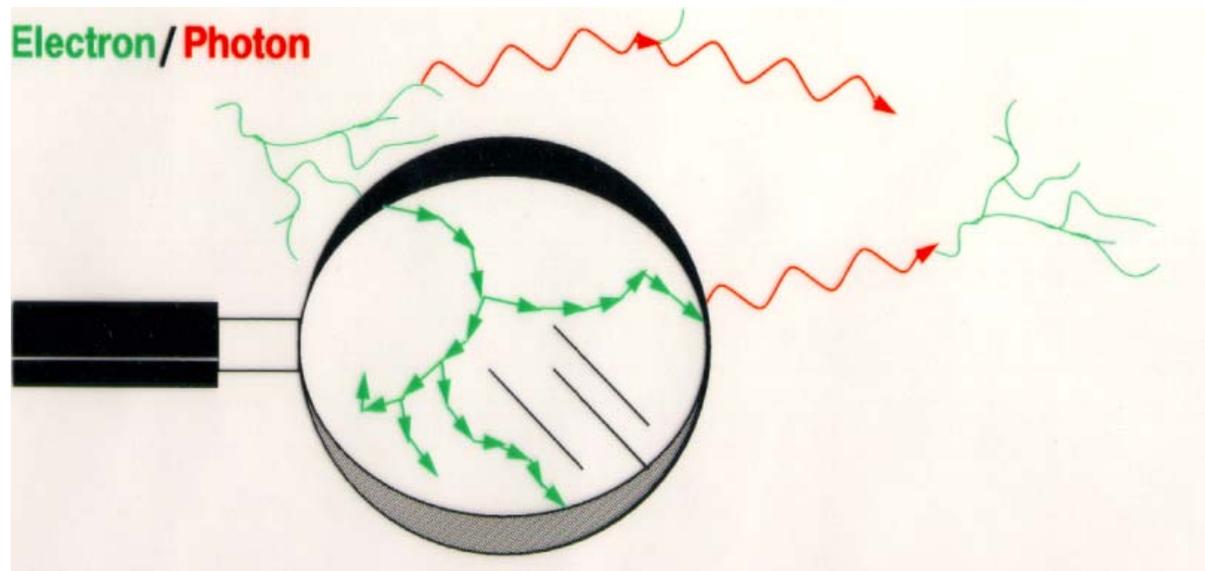
Electron/Photon Transport

- Physical Processes
- Angular Distribution



Computing the Angular Distribution

- Single Scattering - Inefficient
- Multiple Scattering



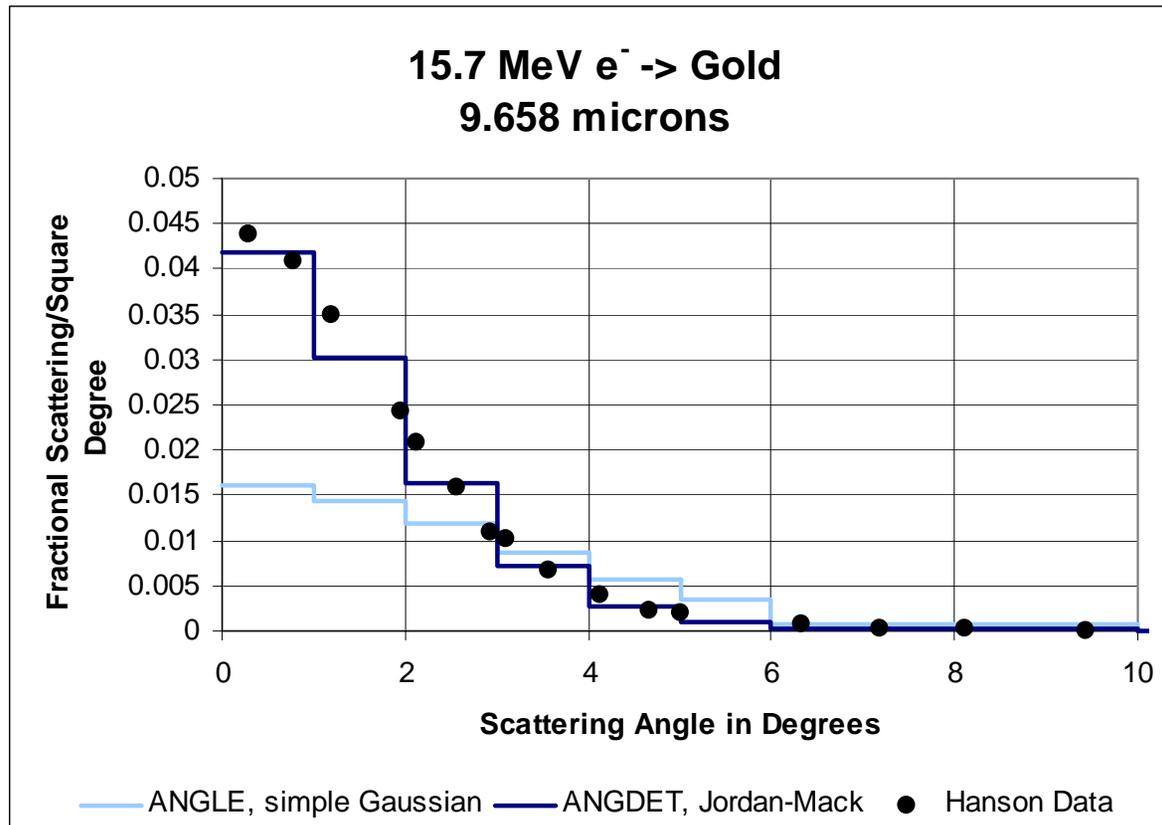
Multiple Scattering

- Sample from a Distribution of Angles
- Goudsmit-Saunderson
 - Legendre Series
 - Pre-Computed Data Based on Predefined Substep Lengths

Crossing a Boundary

- Goudsmit-Saunderson too Computationally Demanding
- Small Angle Approximations
 - Gaussian-like
- ITS Uses a Simple Gaussian
- Jordan-Mack
 - Modified Gaussian with a Single Scattering Tail

Verification and Validation



Verification and Validation

- Lower Z Materials
- Lower Energy Electrons
- Other Studies
 - Numerical Instabilities
 - Energy Dependence
 - Timing

Timing

- Jordan-Mack (J-M) takes approx. 3.1 Times Longer than the Simple Gaussian
- Interpolating the Energy Dependant Values for the J-M takes approx. 1.03 times longer than not Interpolating
- Interpolating the Goudsmit-Saunderson Distribution takes approx. 2.2 times longer than not Interpolating

Conclusion

- Jordan-Mack approx. adds accuracy without a significant increase in computation time
- Future Work
 - Linearly Scaled Goudsmit-Saunderson (LANL's MCNP)
 - Numerical Instabilities