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ANGULAR DISTRIBUTIONS ACROSS BOUNDARIES IN ITS CODES

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The ITS (Integrated Tiger Series) code is a Monte Carlo code that simulates the transport of electrons and photons. This code is used in a wide range of applications to calculate a number of radiation characteristics such as energy deposition (dose), energy spectra and angular distribution to name a few. This study will focus on the angular distribution of the electrons which describes how they spread in angle after traversing through a medium. Calculating each electronic collision that results in an angular deflection would be very computationally inefficient because the distance an electron travels between interactions (mean free path) is extremely short. For example, 1.0 MeV electrons incident on lead have a mean free path of 3.0×10^{-6} cm. ITS employs a multiple scattering technique where an angular distribution for a predefined length (sub-step) is pre-computed in a program called XGEN. After the electron has traveled a sub-step, its resultant angle is sampled from this distribution. When a boundary is crossed, the sub-step is truncated and the angular deflection can no longer be found by sampling from the pre-computed data. Presently, this angular distribution is calculated inside ITS using a subroutine called ANGLE that uses a simple Gaussian approximation. Since the last truncated sub-step is generally small compared to the thickness of the entire medium, its contribution to the angular scattering is often not significant. However, the current implementation in ANGLE is not accurate and poses a problem for very thin materials and any situation with frequent boundary crossings. Thin material approximations such as a more narrow Gaussian with an explicit single scattering tail (Jordan-Mack approximation) can be used to better calculate the distribution for this truncated sub-step. The implications of applying this approximation and others to ITS are being investigated.

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