

Coupling of multiple coulomb scattering and energy loss and straggling in HZETRN

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Current developments in HZETRN are focused towards a full three-dimensional and computationally efficient deterministic transport code, capable of simulating radiation transport with either space or laboratory boundary conditions. One aspect of the new version of HZETRN is the inclusion of small-angle, multiple Coulomb scattering of incident ions by target nuclei. While the effects of multiple scattering are negligible in the space radiation environment, multiple scattering must be included in laboratory transport code simulations to accurately model ion beam experiments, to simulate the physical and biological-effective radiation dose, and to develop new methods and strategies for light ion radiation therapy. In this paper we present the theoretical formalism and computation procedures for incorporating multiple scattering into HZETRN, and coupling the ion-nuclear scattering interactions with energy loss and straggling. Simulations of the effects of multiple scattering on ion beam characterization will be compared with results from laboratory measurements, which include path-length corrections, angular and lateral broadening, and absorbed dose.