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Introducing a semi-Gaussian mixture model for simulating multiple coulomb scattering in RF-Track

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The deflection of charged particles in matter can be characterized by multiple-Coulomb scattering. Simulating the interaction of each particle with the Coulomb forces of the material is prohibitively time-consuming from a computational perspective. To address this, scientists have developed a scattering probability models, such as the Moliere model, which have seen refinements and contributions from various researchers over the past decades. In the context of a design study of a LINAC for ionization cooling, RF-Track has recently incorporated particle interactions with matter. This inclusion enables simulations for applications like ionization cooling channels for muon colliders and the design of machines for medical purposes. Within RF-Track, a novel Semi-Gaussian mixture model has been introduced to describe the deflection of charged particles. This innovative model comprises a Gaussian core and a non-Gaussian tail function to account for the effects of hard scattering. To validate the accuracy of our results, we conducted a benchmarking against other particle tracking codes, with the outcomes demonstrating a high level of agreement.

Footnotes

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