

New models for PIXE simulation with Geant4

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The production of particle induced X-ray emission (PIXE) resulting from the de-excitation of an ionized atom is an important physical effect that is not yet accurately modelled in Geant4, nor in other general-purpose Monte Carlo systems. Its simulation concerns use cases in various physics domains – from precision evaluation of spatial energy deposit patterns to material analysis, low background particle physics experiments and astroparticle physics instrumentation in space science.

The correct simulation of PIXE is a challenge for general-purpose Monte Carlo codes: in fact, PIXE is intrinsically a discrete process, while all major Monte Carlo systems rely on condensed transport schemes to handle the infrared divergence of ionization cross sections.

We describe our ongoing effort for improving the Geant4 implementation of PIXE.

Our activities include a new design of the software model, the creation of an extended and improved data base of shell ionization cross sections, investigations into improved particle transport schemes, and techniques to deal with infrared divergence in the context of ionization and atomic relaxation.

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