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High precision physics simulation: experimental validation of Geant4 Atomic Relaxation

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A component of the Geant4 toolkit is responsible for the simulation of atomic relaxation: it is part of a modelling approach of electromagnetic interactions that takes into account the detailed atomic structure of matter, by describing particle interactions at the level of the atomic shells of the target material.

The accuracy of Geant4 Atomic Relaxation has been evaluated against the experimental measurements of the NIST Physical Reference Data, which include a systematic review of the experimental body of knowledge collected and evaluated over several decades of experimental activity.

The validation study concerns X-ray and Auger transition energies.

The comparison of the simulated and experimental data with rigorous statistical methods demonstrates the excellent accuracy of the Geant4 simulation models; precision better than 0.5 % is achieved in most cases.

The results of this validation study are relevant to various experimental fields, both for elemental analysis studies and for precise simulation of energy deposit distributions; they are also important for the design and optimization of novel tracking detectors based on nanotechnologies, which are sensitive to the effects of charged particles travelling short path lengths, like Auger electrons.

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