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Recent progress of Geant4 electromagnetic physics for LHC and other applications

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In this work we report on recent progress of the Geant4 electromagnetic (EM) physics sub-packages. A number of new interfaces and models recently introduced are already used in LHC applications and may be useful for any type of simulation.
To improve usability, a new set of User Interface (UI) commands and corresponding C++ interfaces have been added for easier configuration of EM physics. In particular, photo-absorption ionisation model may be enabled per detector region using corresponding UI command. Also low-energy limit for charged particle tracking may be selected, because this low-energy limit is now a new EM parameter making easier user control.
Significant developments were carried out for the modeling of single and multiple scattering of charged particles. Corrections to scattering of positrons and to sampling of displacement have been recently added to the Geant4 default Urban model. The Goudsmit-Saunderson (GS) model was reviewed and re-written. The advantage of this model is that it is fully theory based. This new variant demonstrates both equivalent physics performance for simulation of thin target experiments compared to the Urban model in its best accuracy configuration together with good CPU performances. For testing purposes we provide a configuration of electron scattering based on the GS model instead of the Urban model. In addition, another fully theory-based model for single scattering of electrons with Mott correction has been introduced. This model is an important tool to study performance of tracking devices and cross validation of multiple scattering models.
In this report, we will also present developments of EM model in view of the simulation for the new FCC facility. The simulation of EM processes is important for optimization of FCC interaction region and for study of various conceptions of FCC detectors. This requires an extension of validity of EM models for energies higher than the ones used for LHC experiments. The current results and limitations will be discussed.
Important developments were also recently carried out in low-energy EM models, which may be of interest to various application domains. In particular, a possibility to simulate full Auger cascades and a new version of polarized Compton scattering were added. Regarding the very-low-energy regime, new cross sections models for an accurate tracking of electrons in liquid water were also implemented.
These developments are included in the recent Geant4 10.2 release and in the new development version 10.3beta.

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Simulation

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