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Monte Carlo Simulation for Particle Detectors

Monte Carlo simulation is an essential component of experimental particle physics in all the phases of its life-cycle: the investigation of the physics reach of detector concepts, the design of facilities and detectors, the development and optimization of data reconstruction software, the data analysis for the production of physics results.

This note briefly outlines some research topics related to Monte Carlo simulation, that are relevant to future experimental perspectives in particle physics. The focus is on physics aspects: conceptual progress beyond current particle transport schemes, the incorporation of materials science knowledge relevant to novel detection technologies, functionality to model radiation damage, the capability for multi-scale simulation, quantitative validation and uncertainty quantification to determine the predictive power of simulation.

The R&D on simulation for future detectors would profit from cooperation within various components of the particle physics community, and from synergy with other experimental domains sharing similar simulation requirements.

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