Field integration and tracking improvements in ATLAS simulation

Content:
We will present a number of substantial improvements to the magnetic field integration and tracking simulation within the ATLAS simulation. One particular improvement is the development of a Stepper Dispatcher, which can intelligently set the required precision required by the integration in a variety of ways, based upon particle type, kinetic energy, step length, and particular step (detector region). It can also change which integration (stepper) algorithm is used. This is important since often for very low energy electrons and positrons within showers a high tracking precision is not always required, whereas for long flight length muons the high level of tracking precision must be retained. We also present a new optimised stepper algorithm, developed within ATLAS, and now introduced into the latest GEANT4 releases. Lastly, to reduce the number of field map calls we cache the field within a (small) radius. In most HEP simulation applications the field map calls and integrations are a substantial fraction of CPU time and we expect these improvements to be relevant to the wider community. We will also present the physics validation of these new developments.

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