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FATRAS integration for ATLAS fast simulation at HL-LHC

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The computing challenges in collecting, storing, reconstructing, and analyzing the colossal volume of data produced by the ATLAS experiment and producing similar numbers of simulated Monte Carlo (MC) events put formidable requirements on the computing resources of the ATLAS collaboration. ATLAS currently expends around 40% of its CPU resources on detector simulation, in which half of the events are produced with full simulation using GEANT4. Fast Chain provides a quicker alternative to the standard ATLAS MC production chain (full simulation).

The Fast ATLAS Track Simulation (FATRAS), which simulates charged particles passing through complex magnetic and calorimetric systems, has been seamlessly integrated into the ATLAS fast simulation pipeline. This integration accelerates the simulation process and maintains high precision in reproducing particle interactions within the ATLAS inner detector using a simplified detector geometry and a parameterization of particle interactions with the detector material. Recent updates to the FATRAS have focused on improving its modeling of particle interactions, extending its applicability to a broader range of physics scenarios, and enhancing its efficiency for large-scale simulations. For High Luminosity LHC (HL-LHC), the ATLAS experiment aims to use mostly fast simulation and plans to migrate the current FATRAS to a multithread-compatible version, ACTS-FATRAS. We will discuss specific features and performance benchmarks of the updated FATRAS-integrated ATLAS fast simulation, showcasing its capabilities in accurately reproducing the physics processes of interest and the impact on reducing computational resources required for large-scale simulation campaigns.

Significance

References

Experiment context, if any

ATLAS

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