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Fast Simulation in ATLAS for LHC Run 3 and Beyond

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In view of the high luminosity campaign of the LHC (HL-LHC), the computational requirements of the ATLAS experiment are expected to increase remarkably in the coming years. In particular, simulation of Monte Carlo events is immensely demanding from the computational point of view and their limited availability is one of the major sources of uncertainty in many analyses. The main bottleneck in detector simulation is the detailed simulation of electromagnetic and hadronic showers in the ATLAS calorimeter system with the Geant4 software.

In order to increase Monte Carlo statistics and better employ available resources, the ATLAS Collaboration has put into production the AtlFast3 fast simulation system. This tool combines approaches based either on parametrisations or Machine Learning to run simulation of events in the ATLAS detector in reduced time with respect to Geant4, guaranteeing at the same time good accuracy.

This contribution presents the results obtained with the version of AtlFast3 currently in production for LHC Run 3, discussing its physics performance, improvements in computing resource usage and the benefit AtlFast3 brings to ATLAS analyses; the latest updates on the development of its future version are also presented, together with ideas and plans for the future of fast simulation in ATLAS also in view of HL-LHC.

Secondary track

T12 - Data Handling and Computing

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