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Fast Simulation in ATLAS

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The ATLAS physics program relies on very large samples of simulated events. Most of these samples are produced with GEANT4, which provides a highly detailed and accurate simulation of the ATLAS detector. However, this accuracy comes with a high price in CPU, and the sensitivity of many physics analysis is already limited by the available Monte Carlo statistics and will be even more so in the future as datasets grow. To solve this problem, sophisticated fast simulation tools are developed and they will become the default tools in ATLAS production in Run-3 and beyond.

The slowest component is the simulation of the calorimeter showers. Those are replaced by a new parametrised description of the longitudinal and lateral energy deposits, including machine learning approaches, achieving a fast but accurate description. Other fast simulation tools replace the inner detector simulation, as well as digitization and reconstruction algorithms, achieving up to two orders of magnitude improvement in speed.

In this talk we will describe the new tools for fast simulation that have been developed by ATLAS, review their technical and physics performance, and demonstrate their potential to transform physics analyses.

Consider for promotion

No

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