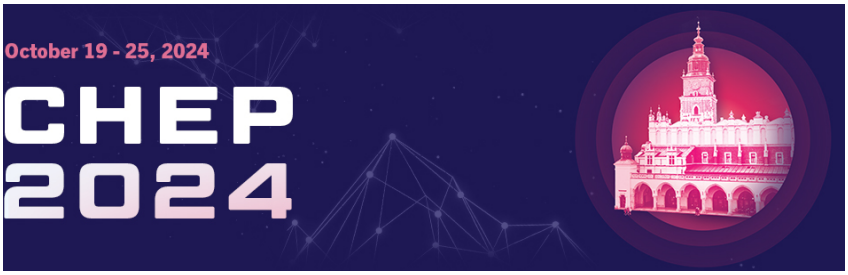

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Towards an experiment-independent toolkit for fast calorimeter simulation

Thursday 24 October 2024 13:30 (18 minutes)

For high-energy physics experiments, the generation of Monte Carlo events, and in particular the simulation of the detector response, is a very computationally intensive process. In many cases, the primary bottleneck in detector simulation is the detailed simulation of the electromagnetic and hadronic showers in the calorimeter system. For the ATLAS experiment, about 80% of the total CPU usage for detector simulation is devoted to the simulation of the secondary particles produced in the calorimeter system.

To make best use of the available resources, ATLAS is currently using its state-of-the-art fast simulation tool AtlFast3, which uses classical parametric and ML-based solutions for shower generation. AtlFast3 is deployed in a heterogeneous simulation infrastructure known as the Integrated Simulation Framework (ISF), which was originally developed over a decade ago, and is becoming increasingly difficult to maintain by the collaboration. In an effort to greatly simplify its simulation infrastructure for Run 4 and beyond, the collaboration is in the process of phasing out ISF and implementing its fast simulation library directly as a Geant4 fast simulation model.

In addition, efforts have started to develop a fully experiment-independent library for fast calorimeter simulation, providing a universal interface for the lateral and longitudinal parameterisation of calorimeter shower development, as well as for ML-based approaches to shower generation.

This talk will give an overview of the current and future (fast) simulation infrastructure in ATLAS. The new experiment-independent library for fast calorimeter simulation will be presented and its use for other experiments will be motivated and discussed.

Author: BEIRER, Joshua Falco (CERN)

Presenter: BEIRER, Joshua Falco (CERN)

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