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Frozen-shower simulation of electromagnetic showers in the ATLAS forward calorimeters

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Accurate simulation of calorimeter response for high energy electromagnetic particles is essential for the LHC experiments. Detailed simulation of the electromagnetic showers using Geant4 is however very CPU intensive and various fast simulation methods were proposed instead. The frozen shower simulation substitutes the full propagation of the showers for energies below 1˜GeV by showers taken from a pre-simulated library. The method is used for production of the main ATLAS Monte Carlo samples, greatly improving the production time. The frozen showers describe shower shapes, sampling fraction, sampling and noise-related fluctuations very well, while description of the constant term, related to calorimeter non-uniformity, requires a careful choice of the shower library binning. A new method is proposed to tune the binning variables, using multivariate techniques. The method is tested and optimized for the description of the ATLAS forward calorimeter.

Secondary Keyword (Optional)

Artificial intelligence/Machine learning

Primary Keyword (Mandatory)

Simulation

Tertiary Keyword (Optional)

Primary author: GLAZOV, Alexander (Deutsches Elektronen-Synchrotron (DE))

Co-author: GASNIKOVA, Ksenia (Deutsches Elektronen-Synchrotron (DE))

Presenter: GASNIKOVA, Ksenia (Deutsches Elektronen-Synchrotron (DE))

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