Contribution ID: **55**   Type: **Contributed talk**

DDFastShowerML: A Library for ML-based Fast Calorimeter Shower Simulation at Future Collider Experiments and Beyond

Tuesday 20 May 2025 11:30 (20 minutes)

Given the intense computational demands of full simulation approaches based on traditional Monte Carlo methods, recent fast simulation approaches for calorimeter showers based on deep generative models have received significant attention.

However, for these models to be used in production it is essential for them to be integrated within the existing software ecosystems of experiments. This additionally allows the full reconstruction chain of an experiment to be used as a benchmark of the performance of a model. Such a development therefore provides access to a new suite of physics-based metrics, which ultimately determine a model's suitability as a fast simulation tool.

In this contribution we describe DDFastShowerML, a library now available in Key4hep. This generic library provides a means of combining inference of generative models trained to simulate calorimeter showers with the DD4hep toolkit, by making use of the fast simulation hooks that exist in Geant4. This makes it possible to simulate showers in realistically detailed detector geometries, such as those proposed for use at future colliders and for community challenges, while seamlessly combining full and fast simulation. Examples will be given of numerous models that have been integrated, as well as the various detector geometries that have been studied, highlighting the flexibility of the library. A summary of future development directions will also be given.

Would you like to be considered for an oral presentation?

Yes

Authors: KOROL, Anatolii (Deutsches Elektronen-Synchrotron (DESY)); ZABOROWSKA, Anna (CERN); GAEDE, Frank-Dieter (Deutsches Elektronen-Synchrotron (DE)); KASIECZKA, Gregor (Hamburg University (DE)); KRUGER, Katja (Deutsches Elektronen-Synchrotron (DE)); MOZZANICA, Martina (university of hamburg); MCKEOWN, Peter (CERN); RAIKWAR, Piyush (CERN); MADLENER, Thomas (Deutsches Elektronen-Synchrotron (DESY)); BUSS, Thorsten Lars Henrik (Universität Hamburg)

Presenter: MCKEOWN, Peter (CERN)

Session Classification: Contributed Talks

Track Classification: 3 ML for simulation and surrogate model: Application of ML for simulation or cases of replacing an existing complex model