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Fast Data-Driven simulation of Cherenkov Detectors Using Generative Adversarial Networks.

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The increasing luminosities of future LHC runs and next generation of collider experiments will require an unprecedented amount of simulated events to be produced. Such large scale productions are extremely demanding in terms of computing resources. Thus new approaches to event generation and simulation of detector responses are needed. In LHCb the simulation of the RICH detector using the classical method takes a sizeable fraction of CPU time. We generate high-level reconstruction observables using a generative neural network to bypass low level details. This network is trained to reproduce the particle species likelihoods based on the track kinematic parameters and detector occupancy. The fast simulation is trained using real data samples collected by LHCb during run 2 with the help of sWeight technique. We demonstrate that this approach provides high-fidelity results along with a significant speed increase and discuss possible implication of these results. We also present an implementation of this algorithm into LHCb simulation software and validation tests.

Primary author: MUELLER, Katharina (Universitaet Zuerich (CH))

Presenter: MAEVSKIY, Artem (National Research University Higher School of Economics (RU))

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