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High Fidelity Shower Simulation with Generative Networks

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Accurate simulation of physical processes is
crucial for the success of modern particle physics.
However, simulating the development and interaction of particle showers with calorimeter detectors is a time consuming process and drives the computing needs of large experiments at the LHC and future colliders. Recently, generative machine
learning models based on deep neural networks have shown promise in speeding up this task by several orders of magnitude. We investigate
the use of a new architecture — the Bounded Information Bottleneck Autoencoder —
for modelling electromagnetic showers in the central region of the Silicon-Tungsten calorimeter
of the proposed International Large Detector. Combined with a novel second post-processing network, this approach
%for the first time
achieves an accurate simulation of differential distributions
including for the first time the shape of the minimum-ionizing-particle peak
compared to a full GEANT4 simulation for a high-granularity calorimeter with
27k simulated channels.

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