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## Deep generative models for fast shower simulation in ATLAS

The extensive physics program of the ATLAS experiment at the Large Hadron Collider (LHC) relies on large scale and high fidelity simulation of the detector response to particle interactions. Current full simulation techniques using Geant4 provide accurate modeling of the underlying physics processes, but are inherently resource intensive. In light of the high-luminosity upgrade of the LHC and the need for ever larger simulated datasets to support physics analysis, the development of new faster simulation techniques is crucial. Building on the recent success of deep learning algorithms, Variational Auto-Encoders and Generative Adversarial Networks are investigated for modeling the response of the ATLAS electromagnetic calorimeter for photons in a central calorimeter region over a range of energies. The properties of synthesized showers using deep neural networks are compared to showers from a full detector simulation using Geant4. With this feasibility study we demonstrate the potential of using such algorithms for fast calorimeter simulation for the ATLAS experiment in the future, complementing current simulation techniques.

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