Contribution ID: **159** Type: **Short Talk**

Graph Variational Autoencoder for Detector Reconstruction and Fast Simulation in High-Energy Physics

Tuesday, 18 May 2021 15:26 (13 minutes)

Accurate and fast simulation of particle physics processes is crucial for the high-energy physics community. Simulating particle interactions with the detector is both time consuming and computationally expensive. With its proton-proton collision energy of 13 TeV, the Large Hadron Collider is uniquely positioned to detect and measure the rare phenomena that can shape our knowledge of new interactions. The High-Luminosity Large Hadron Collider (HL-LHC) upgrade will put a significant strain on the computing infrastructure and budget due to increased event rate and levels of pile-up. Simulation of high-energy physics collisions needs to be significantly faster without sacrificing the physics accuracy. Machine learning approaches can offer faster solutions, while maintaining a high level of fidelity. We introduce a graph generative model that provides effective reconstruction of LHC events on the level of calorimeter deposits and tracks, paving the way for full detector level fast simulation.

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Session Classification: Artificial Intelligence

Track Classification: Offline Computing