Contribution ID: **50** Type: **not specified**

Generating Accurate Showers in Highly Granular Calorimeters Using Convolutional Normalizing Flows

Monday, 6 November 2023 11:00 (15 minutes)

The full simulation of particle colliders incurs a significant computational cost. Among the most resource-intensive steps are detector simulations. It is expected that future developments, such as higher collider luminosities and highly granular calorimeters, will increase the computational resource requirement for simulation beyond availability. One possible solution is generative neural networks that can accelerate simulations. Normalizing flows are a promising approach. It has been previously demonstrated, that such flows can generate showers in calorimeters with high accuracy. However, the main drawback of normalizing flows with fully connected sub-networks is that they scale poorly with input dimensions. We overcome this issue by using a U-Net based flow architecture and show how it can be applied to accurately simulate showers in highly granular calorimeters.

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Session Classification: Generative Models and Simulation