Contribution ID: **46**

Type: **YSF oral presentation**

Precision-Machine Learning for the Matrix Element Method

Monday, 30 October 2023 17:10 (10 minutes)

The matrix element method is the LHC inference method of choice for limited statistics. We present a dedicated machine learning framework, based on efficient phase-space integration, a learned acceptance and transfer function. It is based on a choice of INN and diffusion networks, and a transformer to solve jet combinatorics. We showcase this setup for the CP-phase of the top Yukawa coupling in associated Higgs and single-top production.

Brainstorming idea [title]

Combining generative models to learn better hadronization models from LHC data

Brainstorming idea [abstract]

In recent years, many ML-based approches have been proposed to replace parts of the Monte Carlo simulation chain in LHC physics with fast generative models. Two examples for this are machine-learned hadronization models and models that map directly from the particle level to reconstructed objects. Since Monte Carlo simulations of hadronization are not derived from first principles, a goal of the ML-based approach is to improve the existing models by learning from experimental data. However, this is challenging because it is not possible to propagate gradients through the detector simulation. Using a neural network surrogate for the detector simulation, these gradients become available. Therefore, the combination of these two types of generative models could have potential to enhance our understanding of hadronization effects.

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Session Classification: Young Scientist Forum