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## Generative Machine Learning for Particle Physics

To analyze events in particle colliders, a comparable amount of events has to be simulated as events are recorded. The Monte Carlo simulation of the detector needs most of the computing resources. However, the required resources will exceed the available ones soon.

To tackle this problem, we are developing several generative machine learning models in our research group at the Institute for Experimental Physics. We use them as a fast and resource-efficient alternative to Monte Carlo simulation while preserving high accuracy. We develop models for the generation of particle jets and of calorimeter showers. To this end, we employ a number of different architectures such as generative adversarial networks, diffusion-based models as well as discrete and continuous normalizing flows.

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### Keywords

particle physics  
generative ai

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