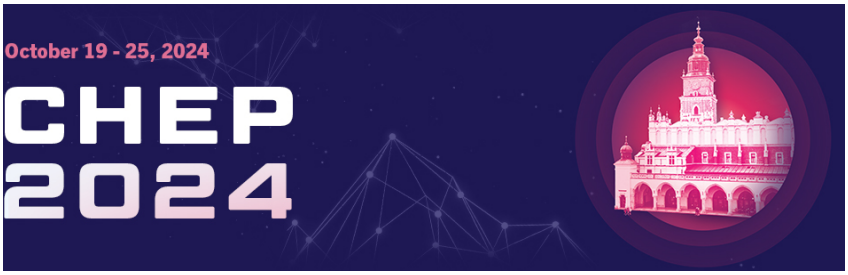

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Navigating Phase Space for Event Generation – interfacing Sherpa with BAT.jl

Wednesday 23 October 2024 15:00 (18 minutes)

The generation of Monte Carlo events is a crucial step for all particle collider experiments. Accurately simulating the hard scattering processes is the foundation for subsequent steps, such as QCD parton showering, hadronization, and detector simulations. A major challenge in event generation is the efficient sampling of the phase spaces of hard scattering processes due to the potentially large number and complexity of Feynman diagrams and their interference and divergence structures.

In this presentation, we address the challenges of efficient Monte Carlo event generation and demonstrate improvements that can be achieved through the application of advanced sampling techniques. We highlight that using the algorithms implemented in BAT.jl for sampling the phase spaces given by Sherpa offers great flexibility in the choice of sampling algorithms and has the potential to significantly enhance the efficiency of event generation.

By interfacing BAT.jl, a package designed for Bayesian analyses that offers a collection of modern sampling algorithms, with the Sherpa event generator, we aim to improve the efficiency of phase space exploration and Monte Carlo event generation. We combine the physics-informed multi-channel sampling approach of Sherpa with advanced sampling techniques such as Markov Chain Monte Carlo (MCMC) and Nested Sampling. Additionally, we investigate the potential of novel machine learning-enhanced sampling methods to optimize phase space mappings and accelerate the event generation process. The current prototype interface between Sherpa and BAT.jl features a modular design that offers full flexibility in selecting target processes and provides detailed control over the sampling algorithms. It also allows for a simple integration of innovative sampling techniques such as normalizing flow-enhanced MCMC.

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