Contribution ID: **55**   Type: **Talk 25'**

Towards Performance-Portable Monte-Carlo Event Generation in Julia

Wednesday 30 July 2025 11:00 (30 minutes)

The generation of scattering events is one of the most compute-intensive tasks in High-Energy Physics (HEP) experiment simulations. This challenge becomes even more significant for upcoming HEP colliders, as well as for computation-heavy applications in other domains (e.g., laser-plasma physics), where it increasingly limits the range of physics that can feasibly be included. Therefore, efficiently utilizing state-of-the-art hardware and modern software tools is crucial for the next generation of event-focused experiments. In this talk, we report on our recent progress in Monte-Carlo event generation in Julia, focusing mainly on its multi-threaded CPU and GPGPU capabilities to achieve maximum performance. In addition to the raw computing power offered by Julia for this demanding task, we also discuss our latest advancements in developing architecture-agnostic implementations of generators. These improvements enable the seamless execution of event generation across diverse computational platforms without sacrificing performance. The talk will highlight how these developments pave the way for scalable, efficient, and portable Monte-Carlo event generation solutions for simulations of future experiments.

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Session Classification: Talks