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Improving Air Shower Simulations by Tuning Pythia 8/Angantyr with Accelerator Data

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We present a combined tune of the Pythia 8 event generator using accelerator data and evaluate its impact on air shower observables.
Reliable simulations with event generators are essential for particle physics analyses, achievable only through advanced tuning to experimental data. Pythia 8 has emerged as a promising high-energy interaction model for cosmic ray air shower simulations, offering well-documented parameter settings and a user-friendly interface to enable automatic tuning efforts. Using data from collider and fixed-target experiments, we first derive tunes for each domain separately and then simultaneously tune both domains. To achieve this, we define a core set of observables and quantify their dependence on selected parameters. The tuning efforts are based on Bayesian methods, providing a full uncertainty propagation of the parameters to the observables, as well as gradient descent methods.

Results for the impact of a combined tune for the Pythia 8/Angantyr event generator on air shower observables, such as multiplicities at ground level and energy deposit profiles, are given.

Collaboration(s)

Authors: GAUDU, Chloé (Bergische Universität Wuppertal); Prof. KAMPERT, Karl-Heinz (Bergische Universität Wuppertal); Prof. KRÖNINGER, Kevin (Technische Universität Dortmund); WINDAU, Michael (Technische Universität Dortmund)

Presenter: WINDAU, Michael (Technische Universität Dortmund)

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