Uncertainties in simulations of non-perturbative QCD effects

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THIS IS A PLACEHOLDER FOR A LETTER OF INTEREST

Hadronization models are a key component of Monte-Carlo event generators. They are inspired by the lattice computation of inter-quark potentials, but in addition provide a space-time picture which cannot currently be obtained from lattice simulations. The idea of using quantum computation to improve hadronization models is tempting but seems far out of reach in the current NISQ era. This contribution to the Snowmass process aims at quantifying the opportunities and limitations in hadronization simulations, and at providing an updated list of crucial experimental measurements needed to obtain reliable tunes of the non-perturbative dynamics encoded in event generators.

At hadron colliders, a key component of the event structure is the so-called underlying event, which is conventionally modeled by multiple scattering and rescattering effects. The QCD dynamics of these effects is poorly understood. This contribution to the Snowmass process aims at assessing the current situation and providing updated recommendations for experimental analyses.

The tuning of non-perturbative parameters in Monte-Carlo event generators is paramount for the description of hadron momentum spectra at the fully differential level and for the description of the flavor composition of hadronic final states. However, most tunes are provided without related uncertainty bands. This contribution to the Snowmass process aims at identifying a procedure for providing uncertainty estimates in the spirit of the PDF4LHC recommendation.