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Tuning of new hadronisation models in PYTHIA 8.311: Rope Hadronisation and Close Packing

Hadronisation is the complex process by which hadrons form from partons. Due to its non-perturbative nature, an exact theoretical description is unavailable, making phenomenological assumptions necessary. Currently, various hadronisation models are implemented in the Monte Carlo event generator PYTHIA 8.311. In this poster, we discuss tuning these hadronisation models using Professor [1] to better reproduce data on strange hadron production relative to pions as a function of multiplicity, as measured by the ALICE experiment in proton-proton collisions [2].
The first model considered is the Rope Hadronisation model, based on the idea that in high-density string environments, increased string tension enhances strange hadron production [3]. This model has not previously been tuned with ALICE strangeness data. The second model is the more recent Close Packing model, which modifies string tension similarly but does not require space-time modelling of string breaking [4].
Results using the Rope Hadronisation model reproduce strange mesons and multi-strange baryons as a function of multiplicity with $5-10\%$ precision. This new tuning significantly improves the Λ/K^0_S and Λ/π ratios, reducing previous discrepancies with ALICE data from $15-40\%$ to more acceptable ranges. However, the p/π ratio remains inconsistent with the data despite tuning.
A first complete tuning of the Close Packing model is also presented. This model reproduces nearly all particle ratios as a function of multiplicity within one standard deviation, with improved agreement for the p/π ratio compared to the Rope Hadronisation model, though some deviations persist.
These results demonstrate the ongoing challenges of accurately modelling both strange and non-strange light-flavour hadrons, highlighting limitations in current hadronisation models.

References

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Category

Theory

Collaboration (if applicable)

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