# ROPES, SHOVING AND JETS IN HEAVY-ION COLLISIONS

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## MOTIVATION

- Hydrodynamical approaches in generating heavy-ion collisions have provided a baseline where it can be quite difficult to handle jets in the system.
- Angantyr model for heavy-ion collision has jets, parton showers and soft partons (see poster by Leif Lönnblad), but the effects can be improved by string shoving mechanism.
- We have three mechanisms in this model: **string shoving**, **colour reconnection** and **rope hadronization** all of which together might be able to explain long-range angular correlation in p-p collisions, jet quenching and strangeness enhancement in heavy-ion collision, respectively.

## STRING SHOVING MECHANISM

- Two individual Lund strings interact over their length and **shove** each other. This force later pushes the hadrons that are formed during hadronization.

- String shoving mechanism, working with **parallel strings**, has been able to explain the ridge effects in p-p collision.

- Hence this model aims to build the string shoving mechanism with parallel frame and rope hadronization for **jets**.

- The partons constituting a jet also interact with each other and with partons in the medium to form colour dipoles which are not necessarily parallel to the beam axis, but can be handled in the parallel frame.

- Thus, these interaction forces will add up to alter the initial energy of the jets which can be observed in jet quenching.

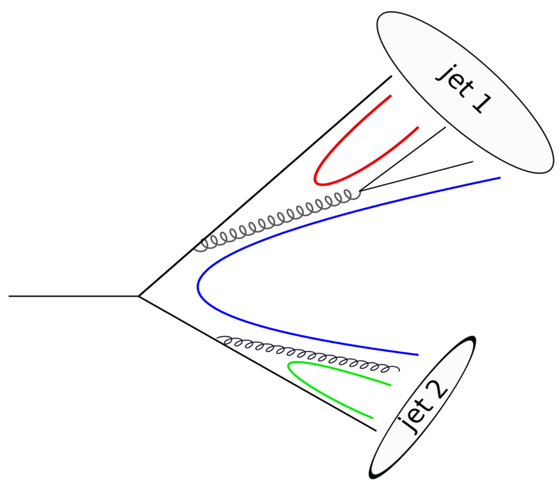
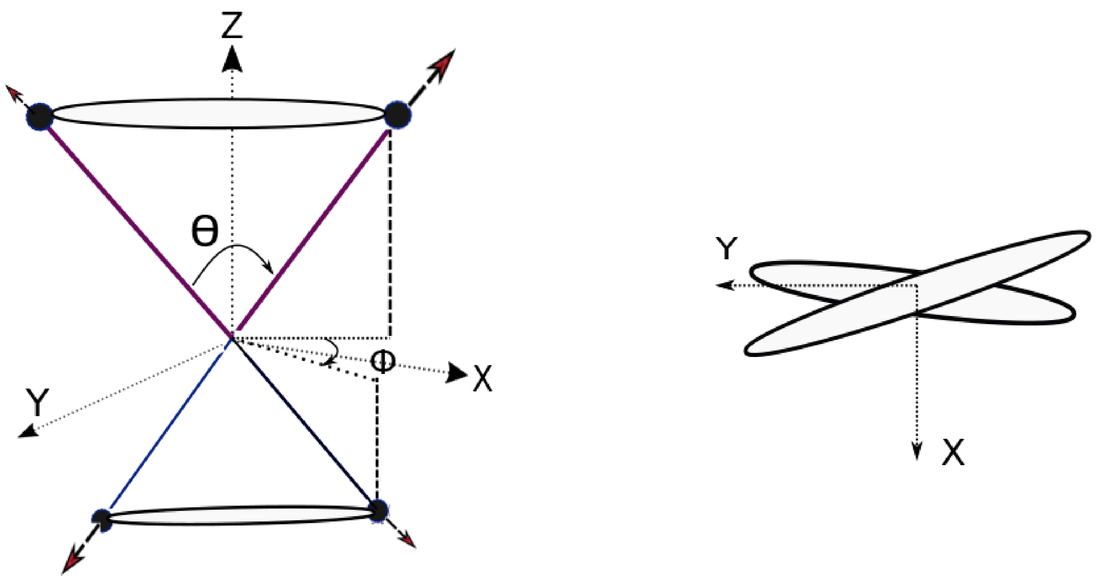



Figure 1: Colour dipoles in jets

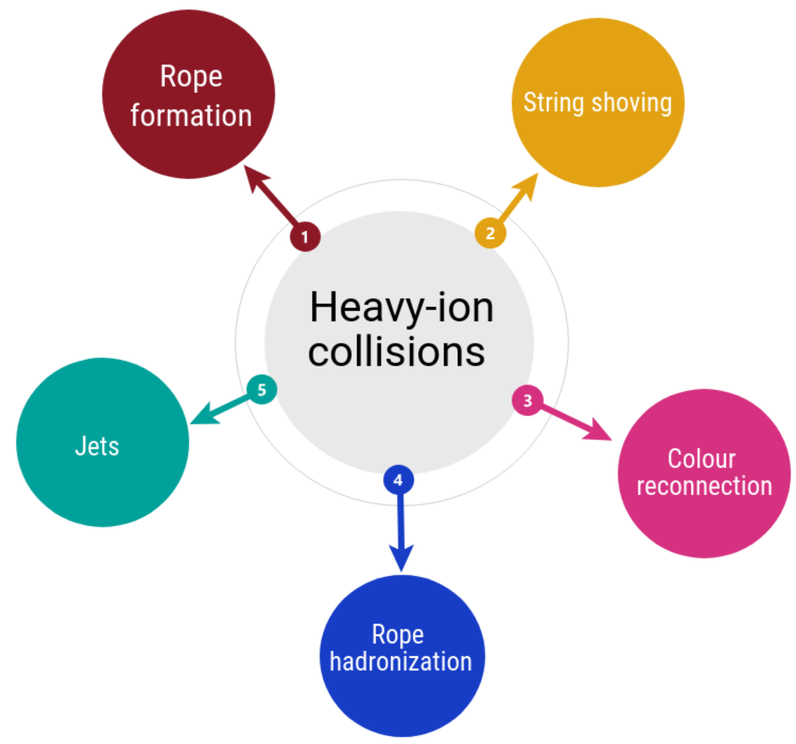
## PARALLEL FRAME

In the parallel frame, the strings are boosted to have a *symmetric geometry*, where a pair of strings have symmetric angles between them and the interaction is calculated at each time step based on how much they overlap in spatial dimensions.




## SIMULATION SUMMARY

These processes together will lead to the generation of heavy ion collisions in PYTHIA 8.




## JET QUENCHING?

- The jets cut through the dense parton and hadron population and the partons constituting a jet, interact with each other by forming *colour-connected strings* between dipole pairs (Fig 1).

- The earlier processes, rope interaction, shoving and colour reconnection follow in succession, leaving *a change in initial energy of jets*. These physical changes will be apparent in jet quenching observables.

## REFERENCE

[1] C. Bierlich, G. Gustafson, L. Lönnblad, Collectivity without plasma in hadronic collisions, Phys. Lett. B779 (2018) 5863. arXiv:1710.09725, doi:10.1016/j.physletb.2018.01.069.