Overlapping interests between heavy ions and small systems

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Discussion item 1: Cross collaboration observables

Purpose: start from a common kinematic coverage among all the LHC Collaborations then extend to specific Collaboration peculiarities → facilitates conclusive statements on different phase space regions (e.g. low/high p_T, mid/forward rapidity)

Ideas:

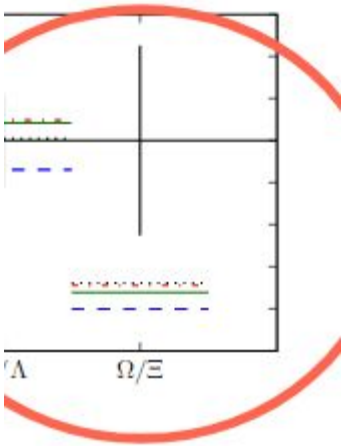
- resume work started by cross LHC MB&UE to target Run3/4?
- the smallest pseudorapidity range is the one from LHCb, can we extend starting from that? If yes, can we assess the doability across Collaborations?
- kinematic (p_T and η) cuts are the easy part, we should discuss also:
  - common trigger settings
  - common definition of primary particles
- ideally, can this effort be extended to produce common MC tunes?

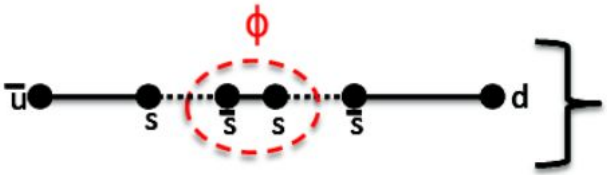
Discussion item 2: String vs. clusters vs. core-corona

Purpose: Several models can describe ratios of inclusive yields - can we distinguish?

At a glance:

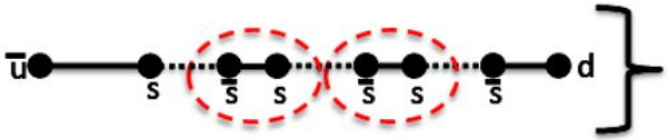
- Yield ratios can be described by *thermalized* (THERMUS, VV Tuesday), semi-thermalized (Core-Corona, YK, Tuesday) and non-thermalised (Herwig 7/PYTHIA) approaches.
- Can we device observables to distinguish?
    - Can they be measured?
- One suggestion: phi(1020) correlations being investigated
    - Are there other possibilities?
- What about the LEP constraints - do we need to go back?





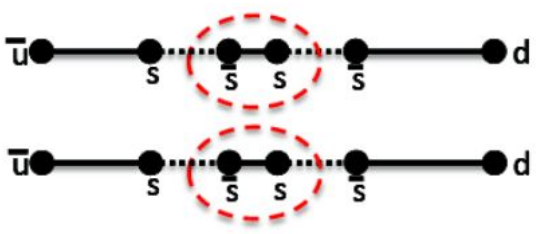
Creation of one ϕ in string or rope :

- Via 2 $s\bar{s}$ breakups: $P(1\phi) \propto P(s\bar{s})^2 \cong (1/7)^2$



Creation of 2 ϕs in string or rope :

- Via 3 $s\bar{s}$ breakups: $P(2\phi) \propto P(s\bar{s})^3$



Creation of 2 decorrelated ϕs:

- Strings: via 4 $s\bar{s}$ breakups: $P(2\phi) \propto P(s\bar{s})^4$
- Stat. hadr. / other uncorrelated: $P(2\phi) \propto P(1\phi)^2$

Generally:

- String model: **$P(2\phi) > P(1\phi)^2$**
- Uncorrelated: **$P(2\phi) = P(1\phi)^2$**

Slide: D. Chinellato (CLASH þing, Lund, 2019)

Discussion item 3: Event shapes studies

Purpose: discuss spherocity (S°), event transverse activity classifier (R_T) and possible other event shape characterising observables
(spherocity: A. Ortiz Monday, V. Vislavicius and A. Nassirpour on Tuesday.
R_T: V. Vislavicius on Tuesday, O. Rueda on Thursday)

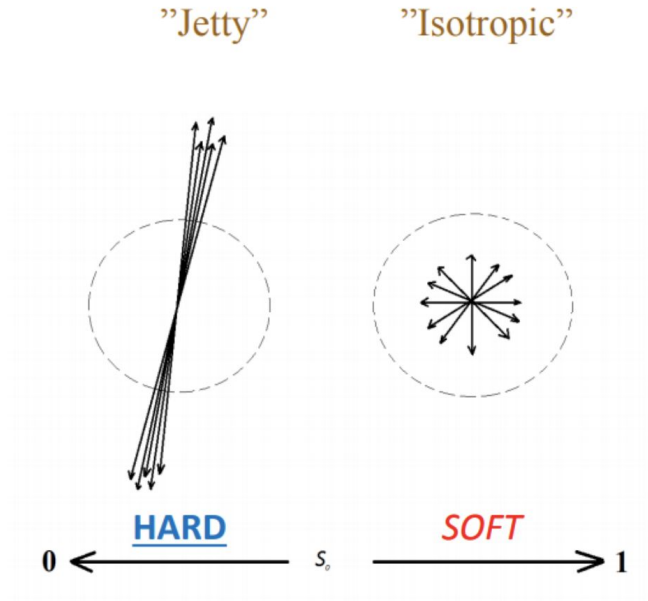
Discussion points:

- can we relate event classifiers among each other?
- can we relate them among small and large systems?
  - how can we define them in a substantially isotropic event like AA?
  - Conversely, in pp, what to expect between spherocity and Fourier decomposition (e.g. v2 harmonics)?
- can these new tools help in disentangling initial/final state effects?

Discussion item 3: Event shapes studies

Spherocity

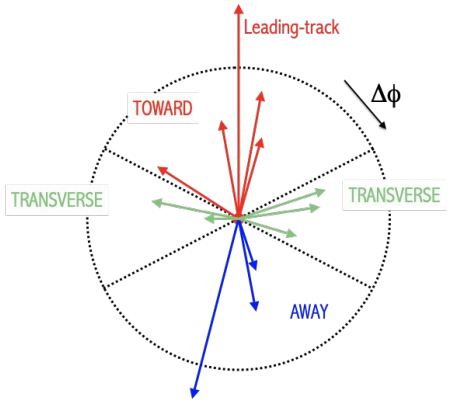
$$S_0 = \frac{\pi^2}{4} \min_{\hat{n}} \left(\frac{\Sigma_i |p_T \times \hat{n}|}{\Sigma_i p_{T_i}} \right)^2$$

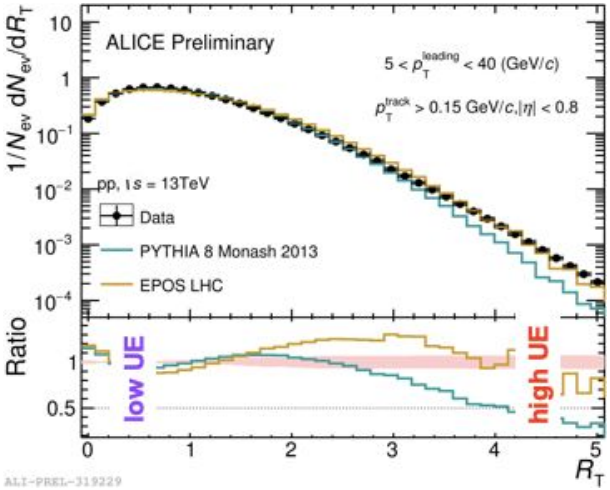


Relative transverse activity classifier

- transverse multiplicity
- plateau region $5 < p_T^{\text{leading}} < 40$ GeV/c

$$R_T = \frac{N_{inclusive}}{\langle N_{inclusive} \rangle}$$





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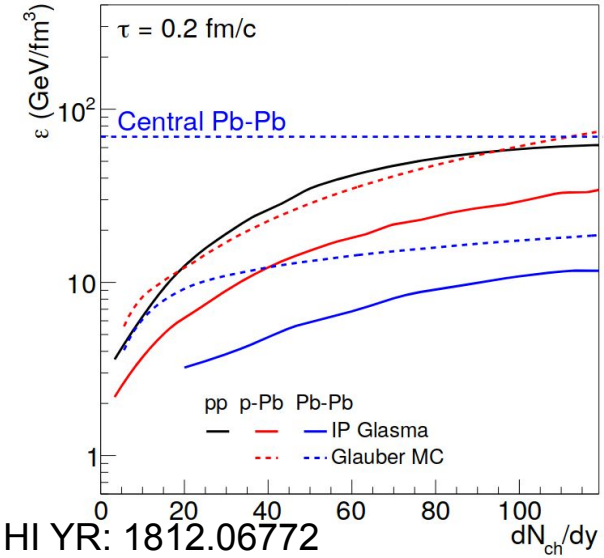
Discussion item 3: Event shapes studies

- How does Spherocity probe energy density: room for development!
- MPI based MCs can inform the discussion - example: Rope hadronization in Pythia



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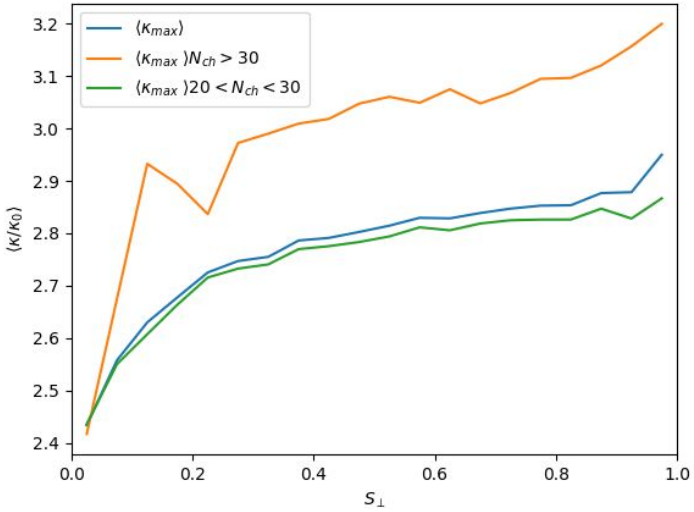
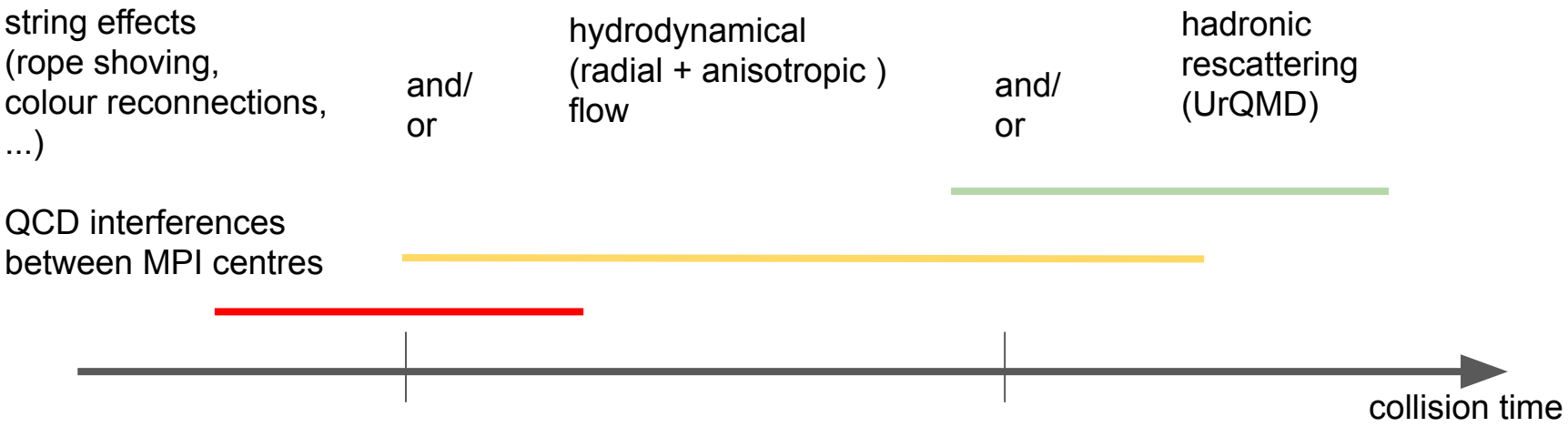


Evolving event shapes to learn what we are looking for - can this be done for “thermalised” models as well? Core-corona? String Percolation?

Discussion item 4: collective AA-like Vs pp-like push



NB : From kinetic theory, $\tau_{Hydrodynamisation} < \tau_{chemical\ equilibration} < \tau_{thermalisation}$

arXiv:1811.03068