A more exclusive handle on strangeness enhancement

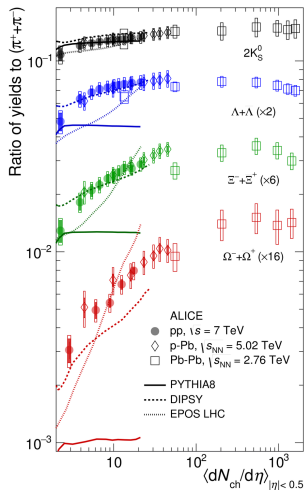**Christian Bierlich**

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October 23, 2018
CLASH idea day

Question: What is the handle that turns collectivity on?

- We already know, right? It's $dN/dy|_{y=0}$.
- Today: An idea to probing its microscopic nature.
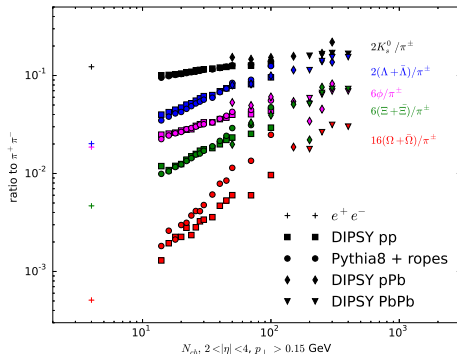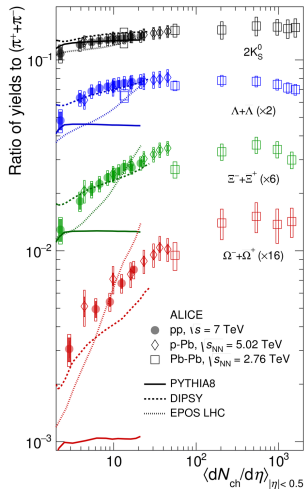
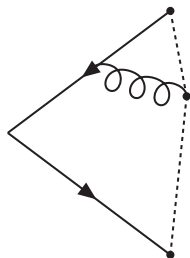# Question: What is the handle that turns collectivity on?

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- (Much is recycled from LightUP CERN 2018)

Hadronization in pp: Lund strings

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Lund symmetric fragmentation function

$$f(z) \propto z^{-1}(1-z)^a \exp\left(\frac{-bm_\perp}{z}\right).$$
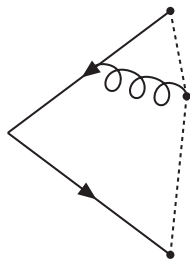
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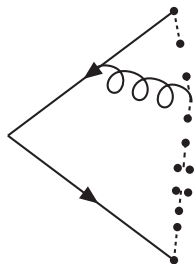> a and b related to total multiplicity.

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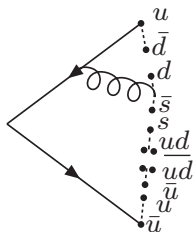

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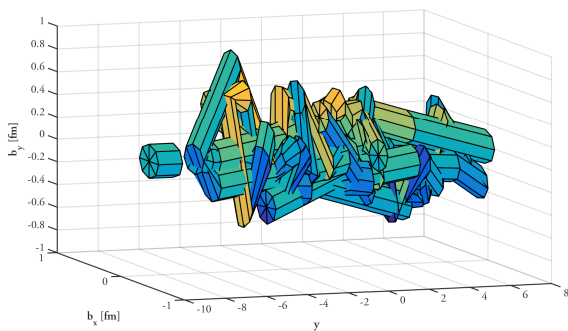
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Light flavours determined by relative probabilities

$$\rho = \frac{\mathcal{P}_{\text{strange}}}{\mathcal{P}_{\text{u or d}}}, \xi = \frac{\mathcal{P}_{\text{diquark}}}{\mathcal{P}_{\text{quark}}}$$

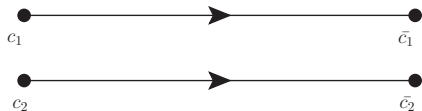Probabilities related to κ by Schwinger equation.

Ropes build on a space time picture

- If strings are colour fields with colour ends...
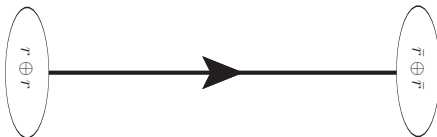- ...then they should be able to act coherently

Simple example

Case (a), $c_1 = c_2$:
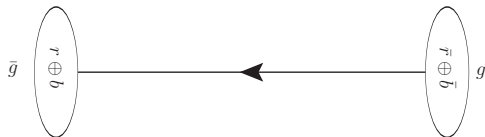
Case (b), $c_1 \neq c_2$:

DIPSY/Pythia – Rope Hadronization (JHEP 1503 (2015) 148)

- Triplet strings (p and q) overlaps in space.
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Effective string tension from the lattice

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$$\{p, q\} \otimes \vec{3} = \{p+1, q\} \oplus \{p, q+1\} \oplus \{p, q-1\}$$

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- Transform to $\tilde{\kappa} = \frac{2p+q+2}{4}\kappa_0$ and $2N = (p+1)(q+1)(p+q+2)$.
- N serves as a state's weight in the random walk.

Old idea – new in PS event generators

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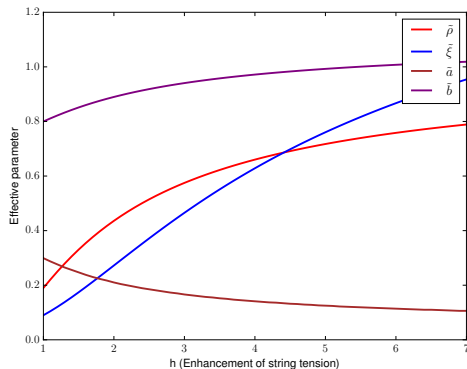- As well as the ones I forgot.

Effect on parameters

- Parameters:

  ρ strangeness.

  ξ diquarks / baryons.

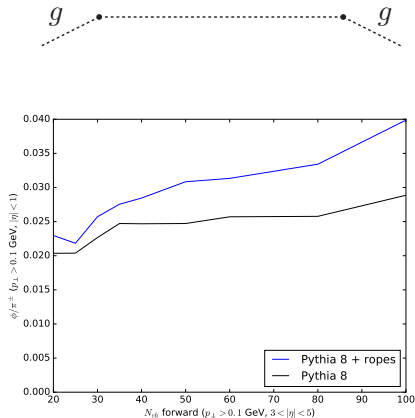 a, b multiplicity through fragmentation function.

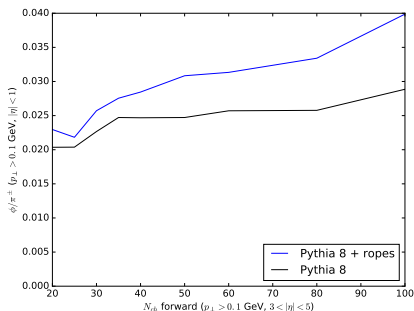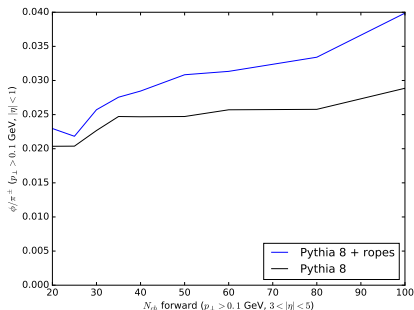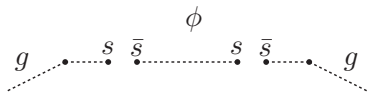# The importance of ϕ production

Very interesting new data!

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- Two s-breaks means squared suppression and added sensitivity.

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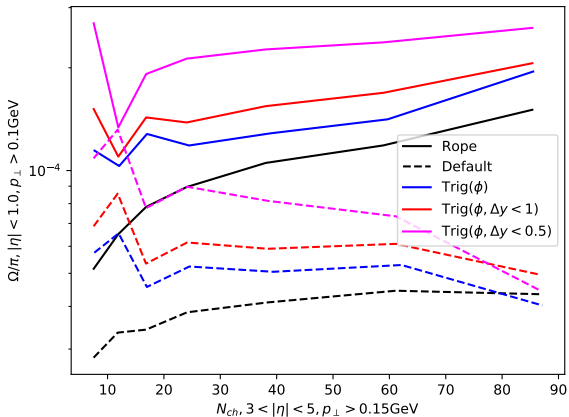
Assessing the smallest QGP droplet (CLASH project?)

- We can do better than inclusive rates.

- Accessing longitudinal (rapidity) structure: Correlation measurements.

- Consider ropes in a ϕ-triggered event.
  1. Even in e^+e^- we bias to more strange production,
  2. In pp we can assess the difference wrt. default strings.
  3. Moving closer to the ϕ production rapidity gives larger string tension.

- Statistics hungry analysis – something for HL-LHC?
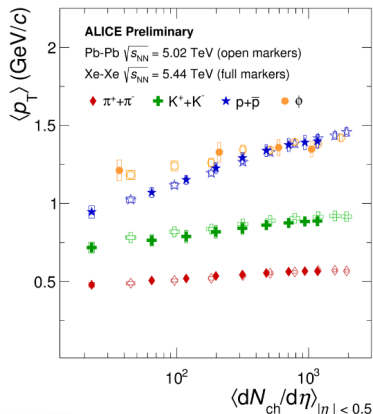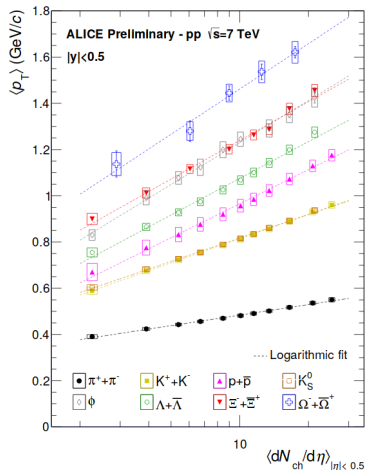
Preliminary: pp @ 13 TeV (Pythia8 + ropes)

- Input for discussion:
  1. Sensible measurement?
  2. What does thermal models say?
  3. Can we remove the neigbor bias? (require neighbor etc.)

Similar effect on $\langle p_\perp \rangle$?

- Is this also why $< p_\perp >$ for ϕ deviates from protons? (1808.05823)
- Effect even larger in pp. (1604.06736)

It's almost as if...