Hadronization: How does the hadronization process depend on the properties of the hadronizing system?







Hadronization



In the string model: **\$\$** comes with extra kaons (depending on original q**\$\overline{q}\$** pair)

- 0.6 charged kaon per phi (+ 0.6 neutral kaon) ~ 1.2 kaons per phi
- Clear prediction
- Rapidity correlations give additional information
- More: K**\u03c6**K ordered in rapidity (along string)

Creation of one $\pmb{\varphi}$ in string or rope :

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







Creation of one ϕ in string or rope : • Via 2 $s\bar{s}$ breakups: $P(|\phi) \propto P(s\bar{s})^2 \cong (1/7)^2$

Creation of 2 \$\overline\$s in string or rope :
Via 3 \$\overline{s\$\overline{s}\$ breakups: P(2\$\overline{\phi}\$) \$\infty\$ P(\$\overline{s}\$)³

Creation of 2 decorrelated ϕ s:

- 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: $P(2\phi) > P(I\phi)^2$
- Uncorrelated: $P(2\phi) = P(I\phi)^2$







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Strangeness production: strings, junctions, ropes, ...





Creation in junction-antijunction:

- Via 2 ss breakups
- Not that suppressed
- Accompanied by strange meson(s)
- Balancing baryon potentially further away in rapidity
- Flavour-baryon number decorrelated



Strangeness production: strings, junctions, ropes, ...





- In the string / rope case in PYTHIA: the antibaryon is at least single-strange
- With junctions: not so much
- Relevant observables:
 - **Ξ**-K correlation
 - Ξ - \bar{p} correlation
 - $\Xi \overline{\Xi}$ correlation





Shower in vacuum ...



...and medium



The space-time picture

Jets and high momentum probes: sample medium between production vertex and the vacuum

Correct space-time picture important to connect to bulk physics

Theoretical work: introduce realistic formation time into perturbative showers: "clock"

How important is the hadronic phase for hard probes?

• can one distinguish between interactions with partons and hadrons?



The space-time picture





Space-time towards smaller systems



PYTHIA Angantyr + UrQMD:

Jet quenching decreases with centrality

Small flow buildup does not decrease so significantly?

- Length vs density gradient?
- Needs further investigation

Backup









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