Studies of angular correlations between Ξ and identified hadrons in $\sqrt{s} = 13$ TeV pp collisions: Is production microcanonical or grand canonical?

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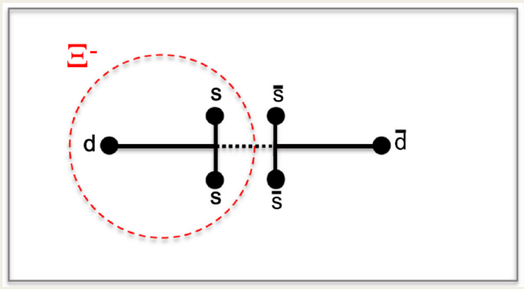
BASED ON ARXIV:2308.16706

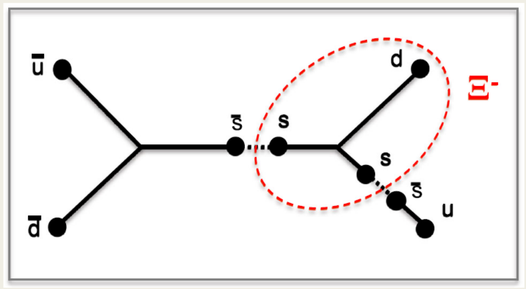
Motivation

- Is the strangeness enhancement observed by ALICE in $\sqrt{s} = 13$ TeV pp collisions caused by a change in production mechanism with multiplicity?

PYTHIA mechanism that can explain strangeness enhancement:

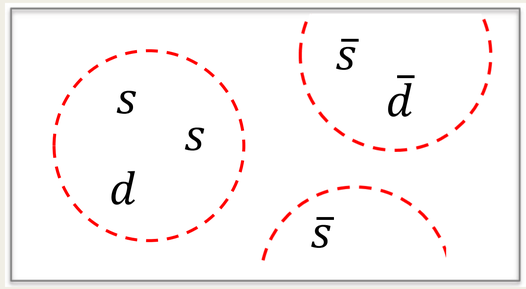


Low mult: diquark breaking → Ξ balanced by strange anti-baryon
(default mechanism = Monash)

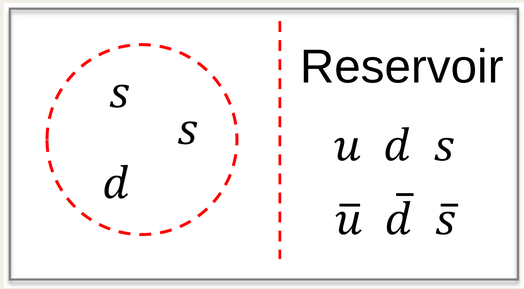


High mult: strings can reconnect to form junction topologies
(Ropes & Junctions)

"QGP" explanation: strangeness "suppressed" in small systems



Low mult: microcanonical → strangeness conserved exactly

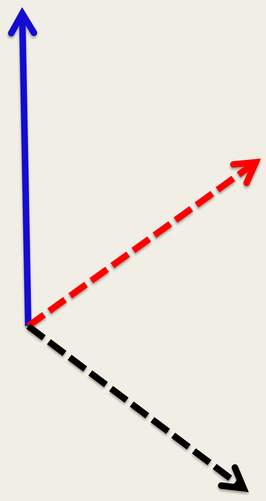


High mult: grand canonical = assuming reservoir of strangeness.
(EPOS LHC)

Method

- The idea of the method is to

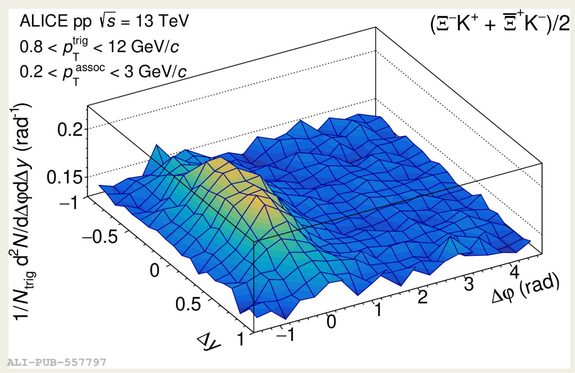
Trigger on : Ξ (ssd)



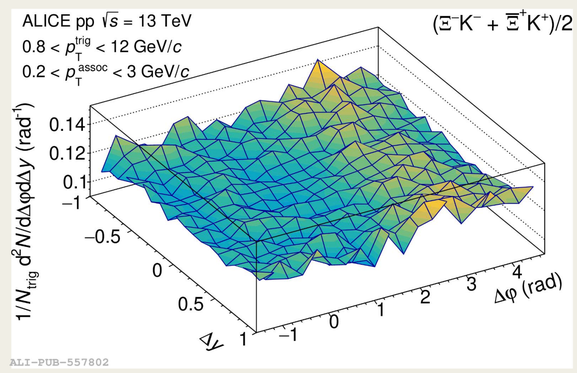
Measure where balancing Quantum Numbers (QN) ends up:
$K^+ (u\bar{s})$, $\bar{p}$ $(\bar{u}\bar{u}\bar{d})$,
$\bar{\Lambda}$ $(\bar{u}\bar{d}\bar{s})$, $\bar{\Xi}$ $(\bar{s}\bar{s}\bar{d})$

Subtract the uncorrelated production via the same QN correlations:
K^- $(s\bar{u})$, p (uud), Λ (uds), Ξ (ssd)

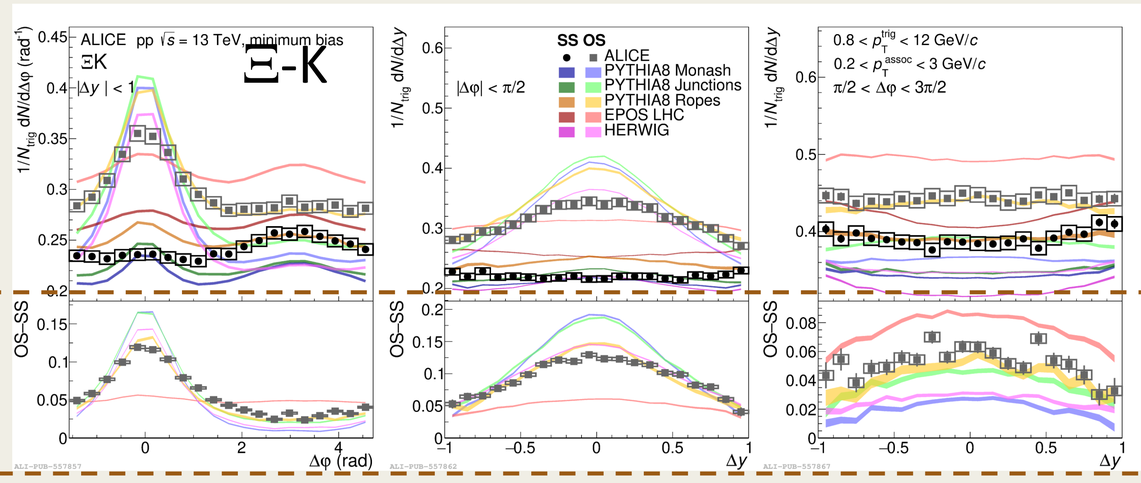
Opposite Strangeness (OS): Ξ-K$^+$
QN balancing + uncorrelated pairs



Same Strangeness (SS): Ξ-K$^-$
uncorrelated pairs

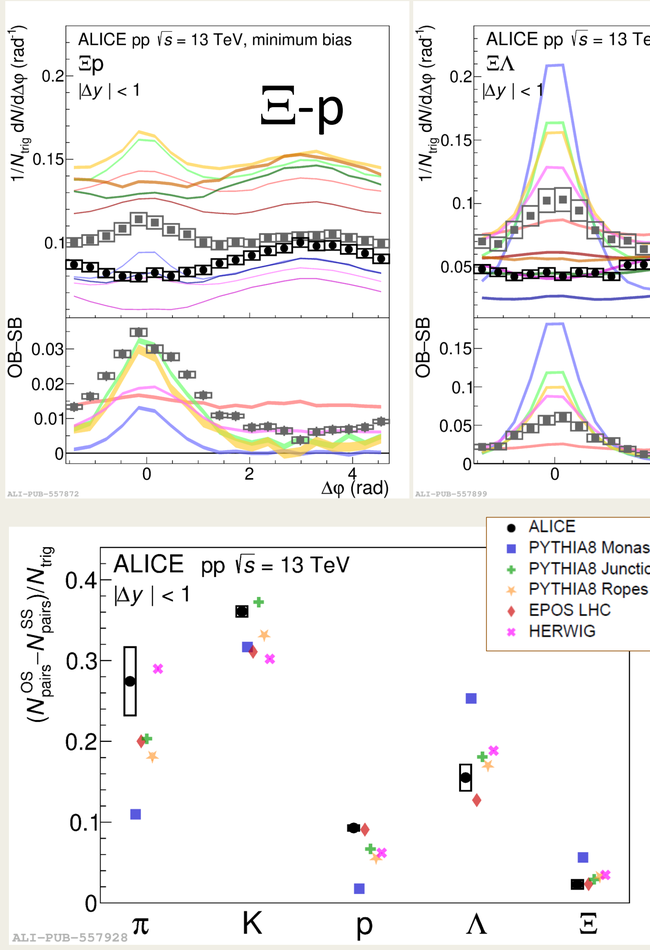


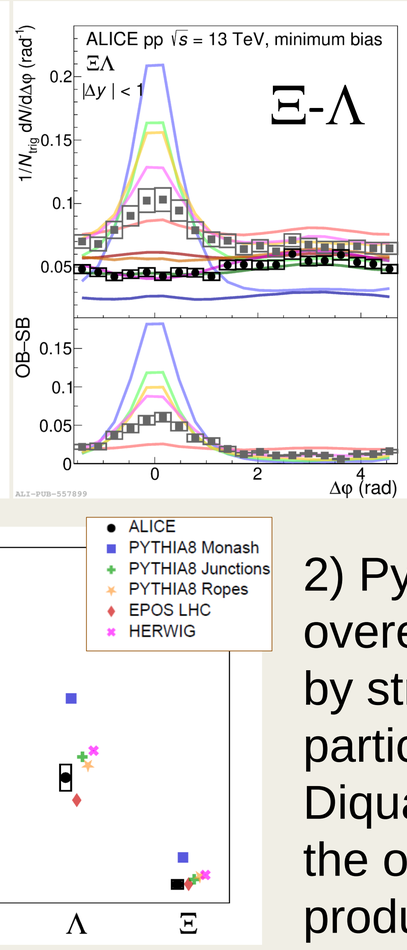
Projections: Δφ | Δy near side | Δy away side

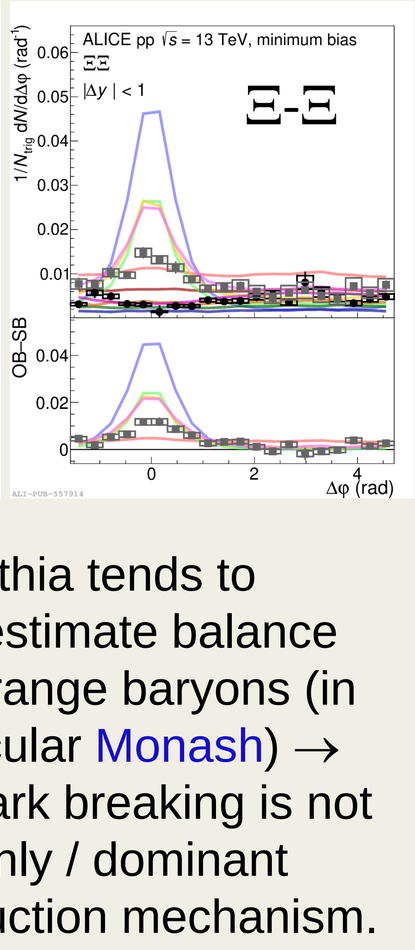


OS-SS = Balance

Minimum Bias results:

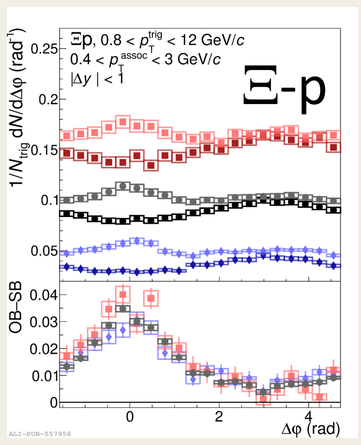


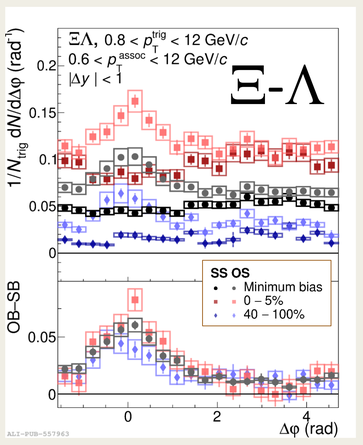


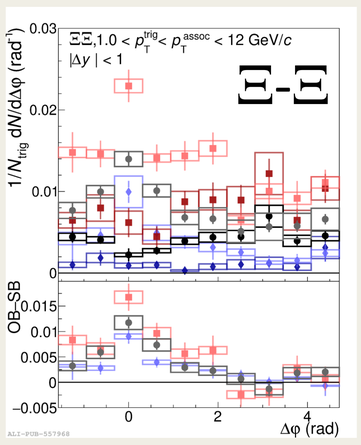


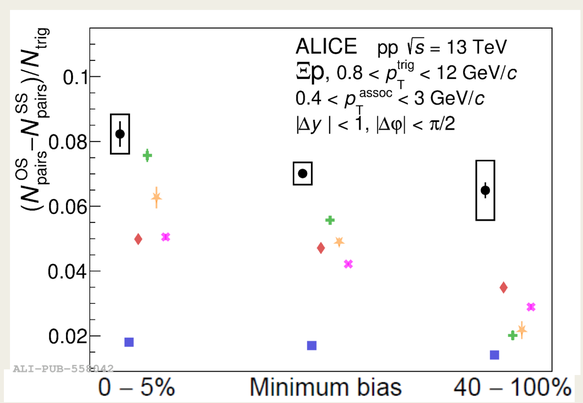
2) Pythia tends to overestimate balance by strange baryons (in particular Monash) → Diquark breaking is not the only / dominant production mechanism.

Multiplicity dependent results:









3) Very small dependence appears to challenge *all* models → Indicates same production mechanism for all multiplicities.
But how is strangeness then enhanced?