

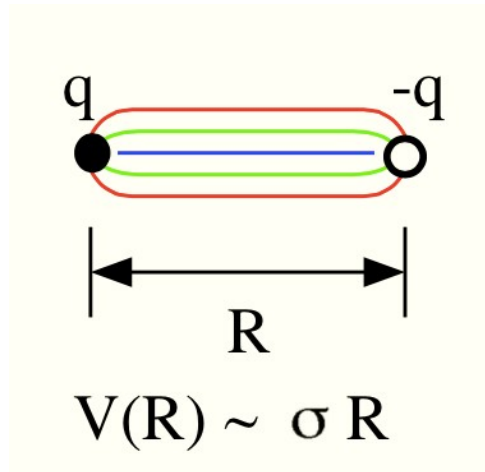
Correlations between strange hadrons in ALICE

Rik Spijkers

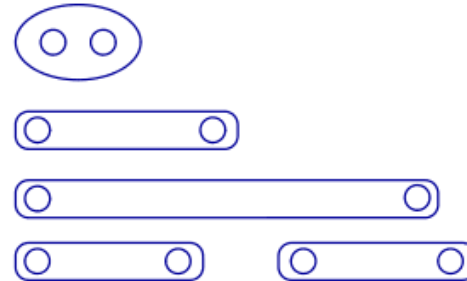
NNV subatomic physics meeting
4 November 2022

Lund string model

- QCD dipole
- Field lines form a “tube”
- Potential energy scales with r , analogy with string
- When energy (distance) large enough, breaks

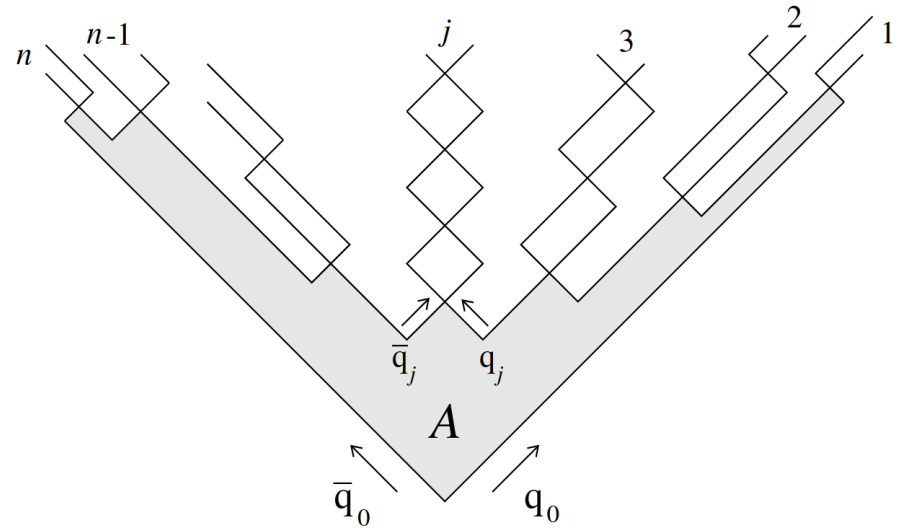


Thought experiment:
separating charges



String fragmentation

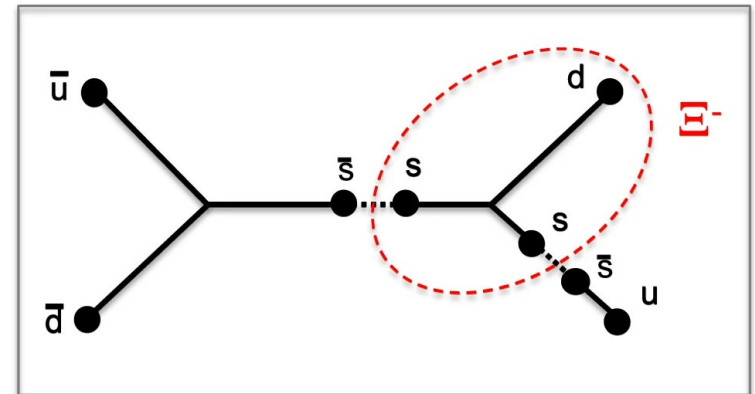
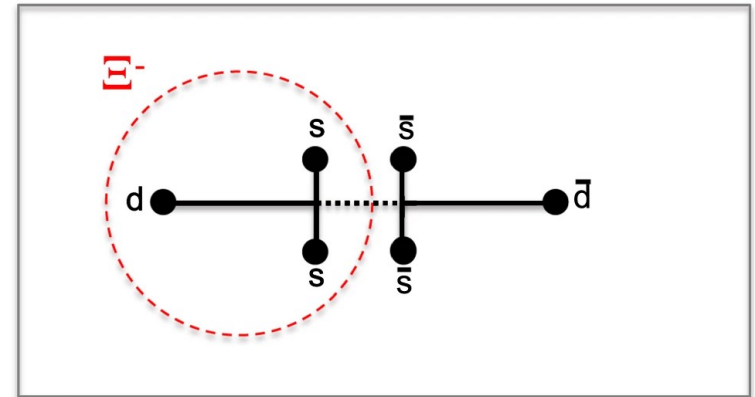
- Parton shower
- Start with two energetic quarks
- Multiple string breaking
- Hadron formation when energy low enough
- Implemented in PYTHIA



Bo Andersson et al JHEP09(1998)014

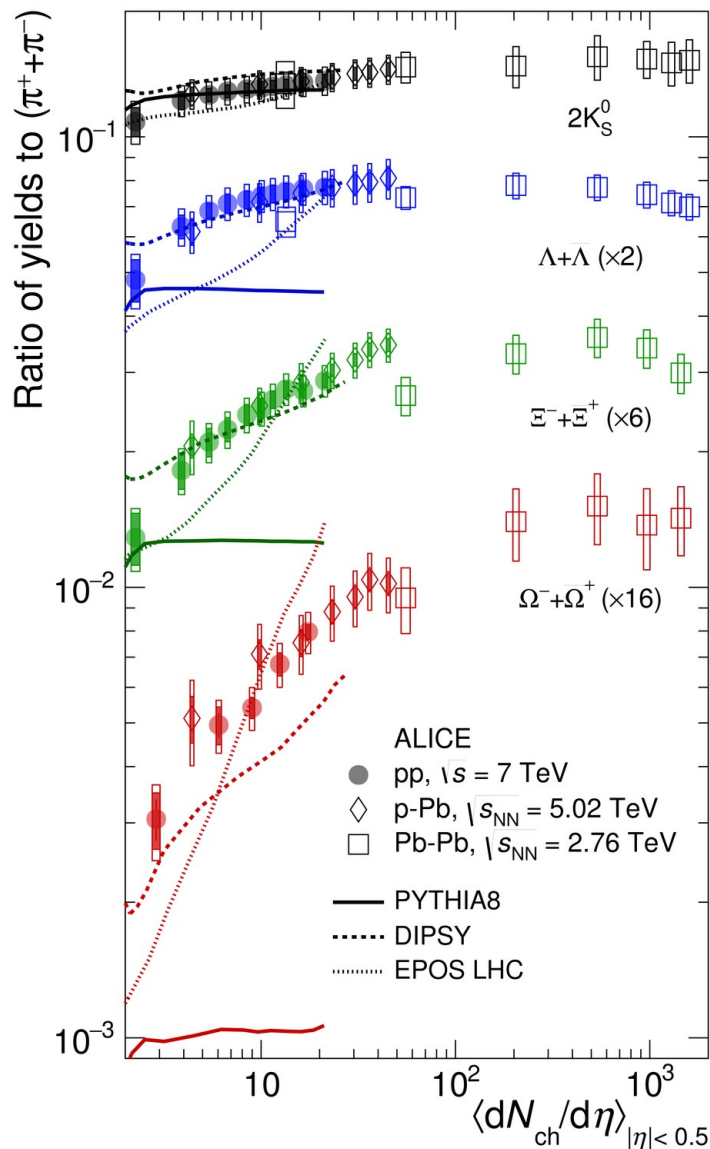
Baryon formation

- q-q pairs \rightarrow mesons
- Di-quarks needed for baryons
 - Standard PYTHIA (Monash)
- Junctions (reconnecting strings)
 - Skands mode 2
- Overlapping strings
 - Ropes
- Correlations probe string breaking mechanism



Strange baryons

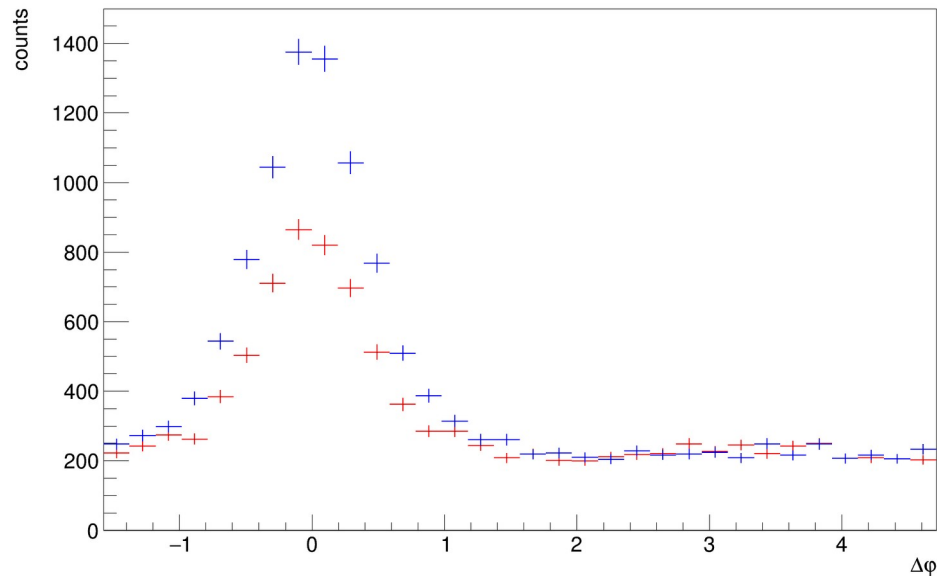
- Discrepancy between data and models
- Increases with strangeness
- Strange baryon production not understood



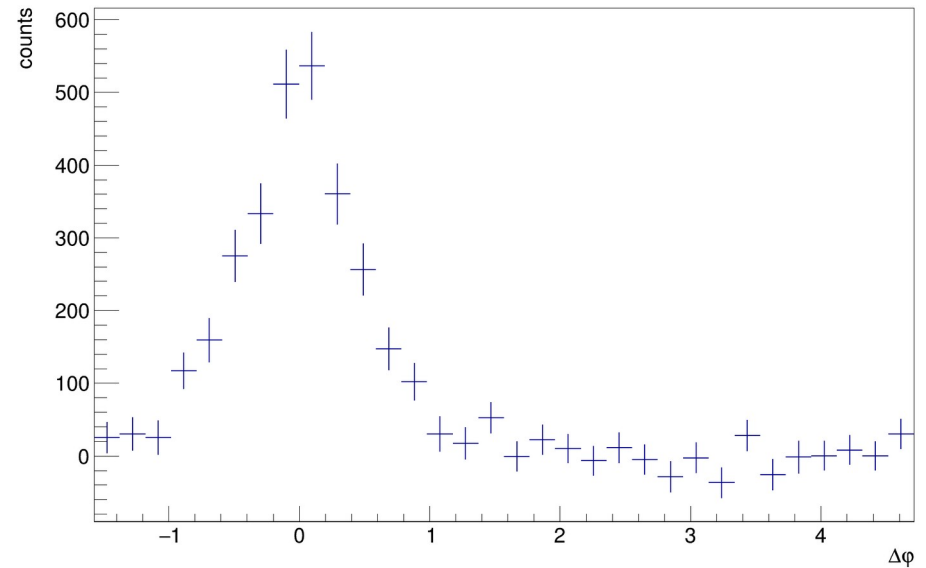
Analysis method

- Correlate strange hadrons within the same event
- Opposite strangeness (OS) – same strangeness (SS)

- OS (blue) and SS (red) Ξ^- pairs



- OS – SS Ξ^- pairs



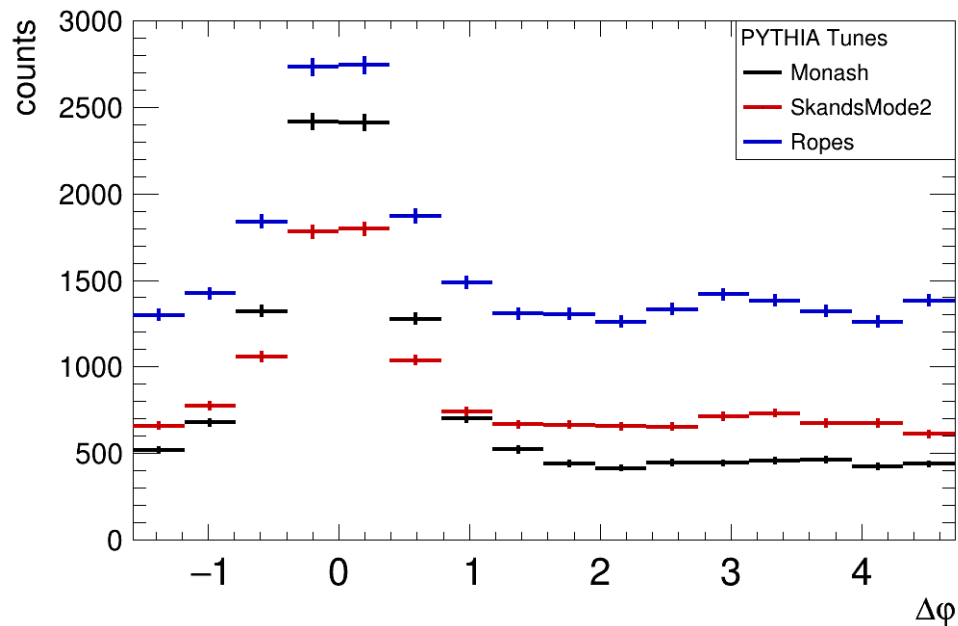
Analysis configuration

- 3 different PYTHIA tunes
 - Monash
 - Skands mode 2
 - Ropes
- $p_T > 1.2 \text{ GeV}$
- $|y| < 1.0$
- 10 million pp events
- Errors are estimated as \sqrt{N}

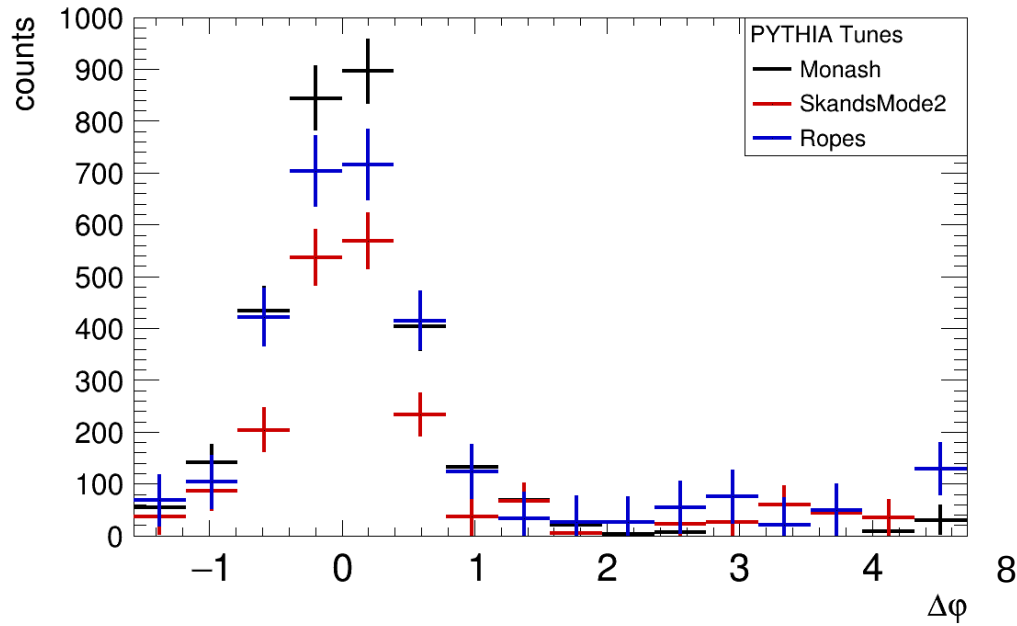
$\Xi^- \Xi^+$ correlations

- Three different PYTHIA tunes, not normalized
- Di-quark: more $\Xi^- \Xi^-$ pairs

OS correlations



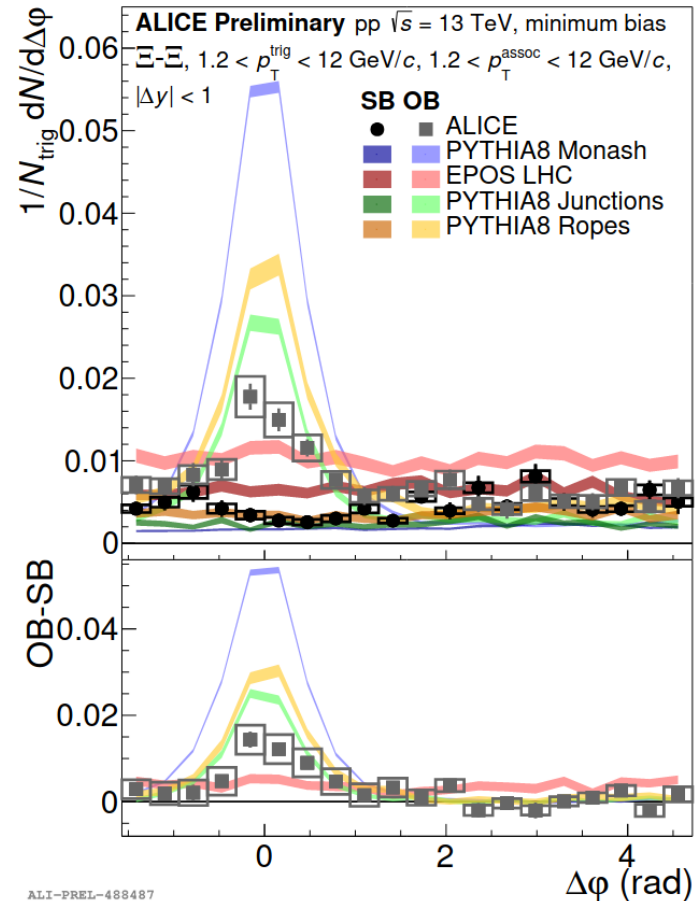
OS - SS



Comparison to existing studies

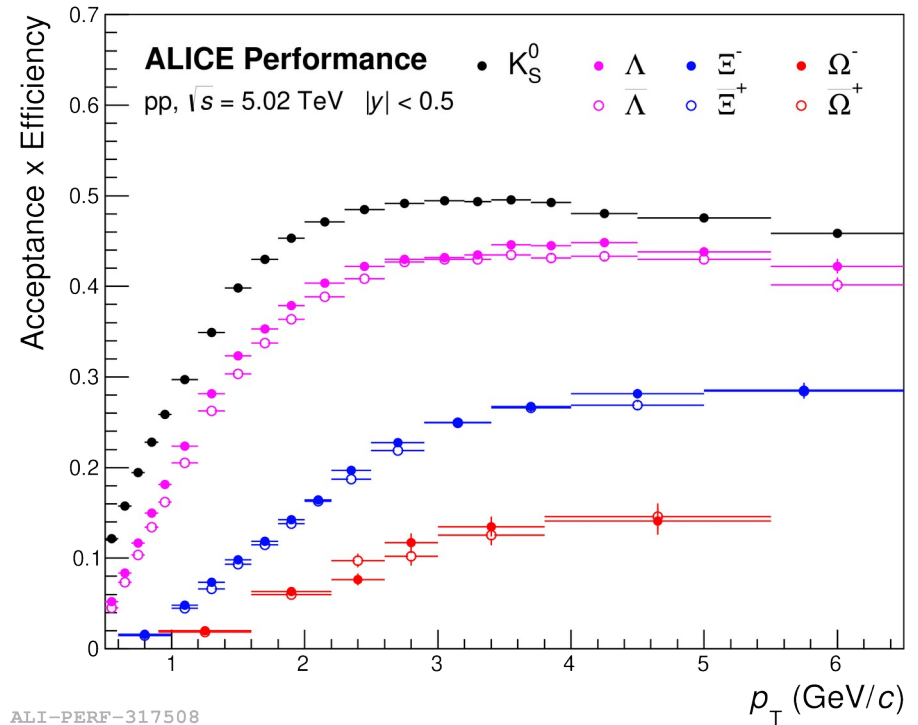
- Jonatan Adolfsson
- 800 million MB events
- $\Lambda \rightarrow p + \pi^-$
- $\Xi^- \rightarrow \Lambda + \pi^-$

Jonatan Adolfsson SQM 2021



Experimental feasibility

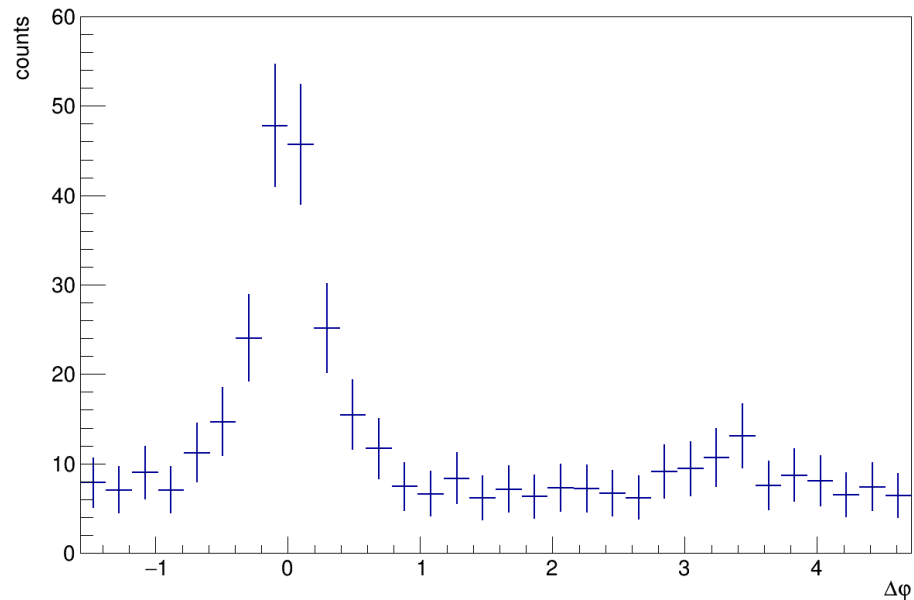
- Detector has limited acceptance
- It is also not perfect (reco efficiency)
- Branching ratios
- Kinematic cuts



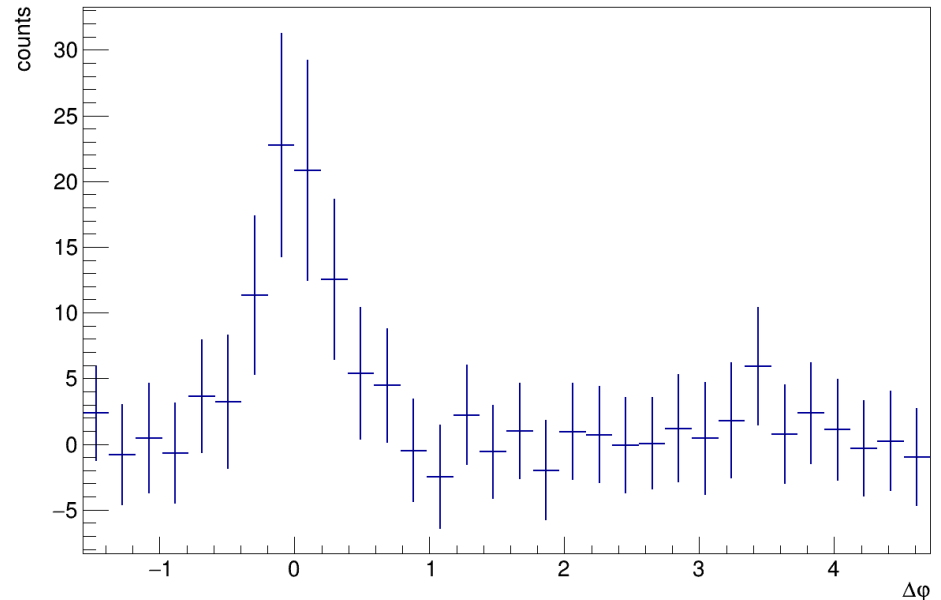
$\Xi^- \Xi^+$ efficiency projection

- Scaled up to 10E9 events
- Skands mode 2

OS correlations

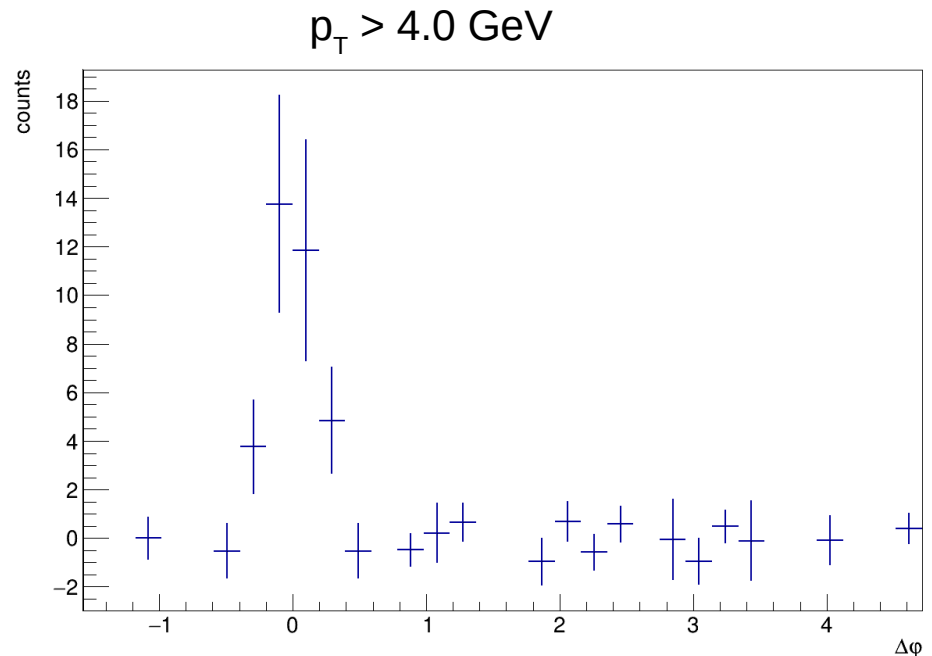
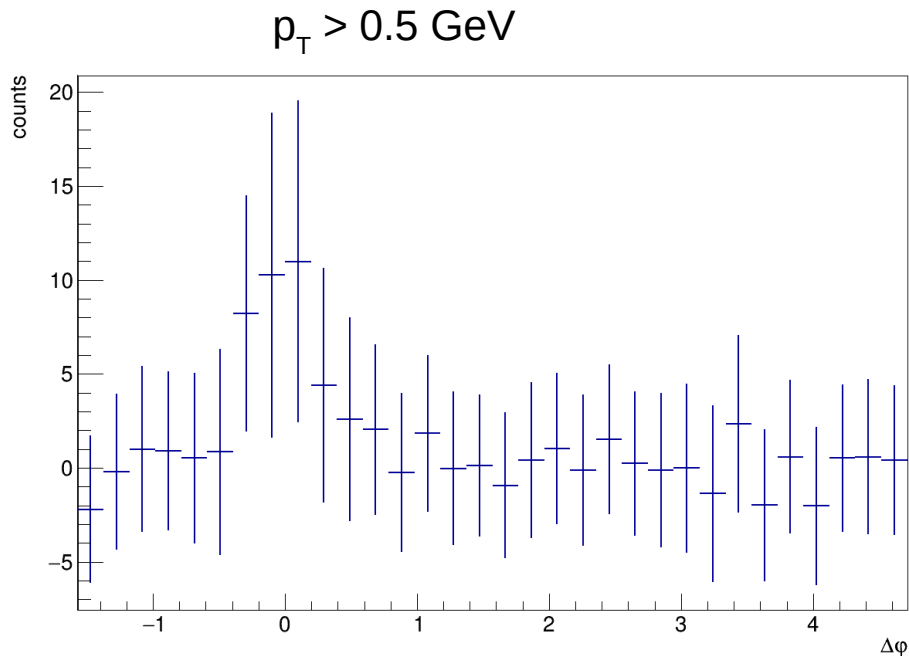


OS – SS



Min p_T dependence

- 1.2 GeV “default”
- High min. $p_T \rightarrow$ less statistics, low min. $p_T \rightarrow$ more background



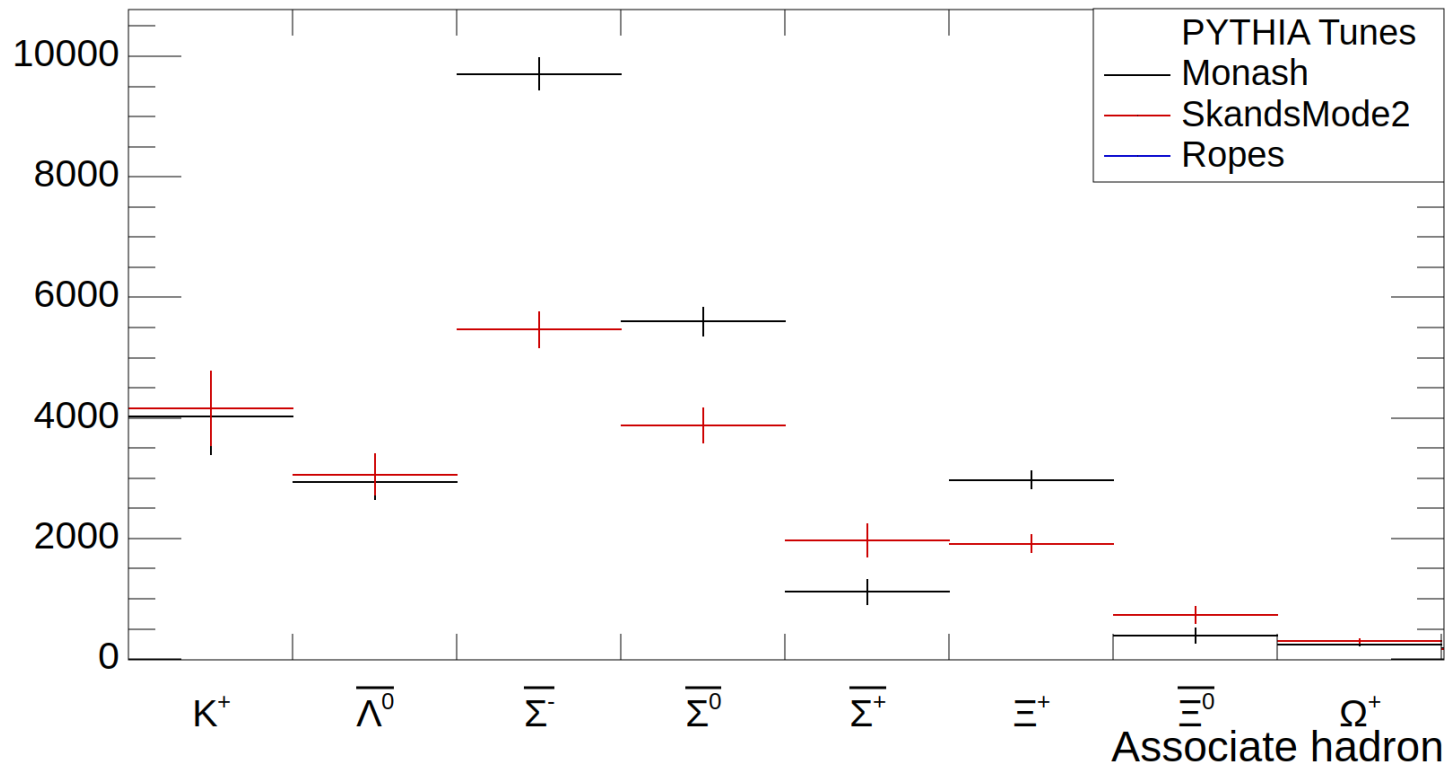
Summary & outlook

- Strange hadron correlations probes string breaking mechanism
- Double strange hadrons (Ξ) are especially interesting
- Perform analysis on (new) data
- Investigate multiplicity dependence
- Possibly extend analysis from Ξ to Ω
- Run 3+4: total luminosity $\sim 200 \text{ pb}^{-1}$ expected

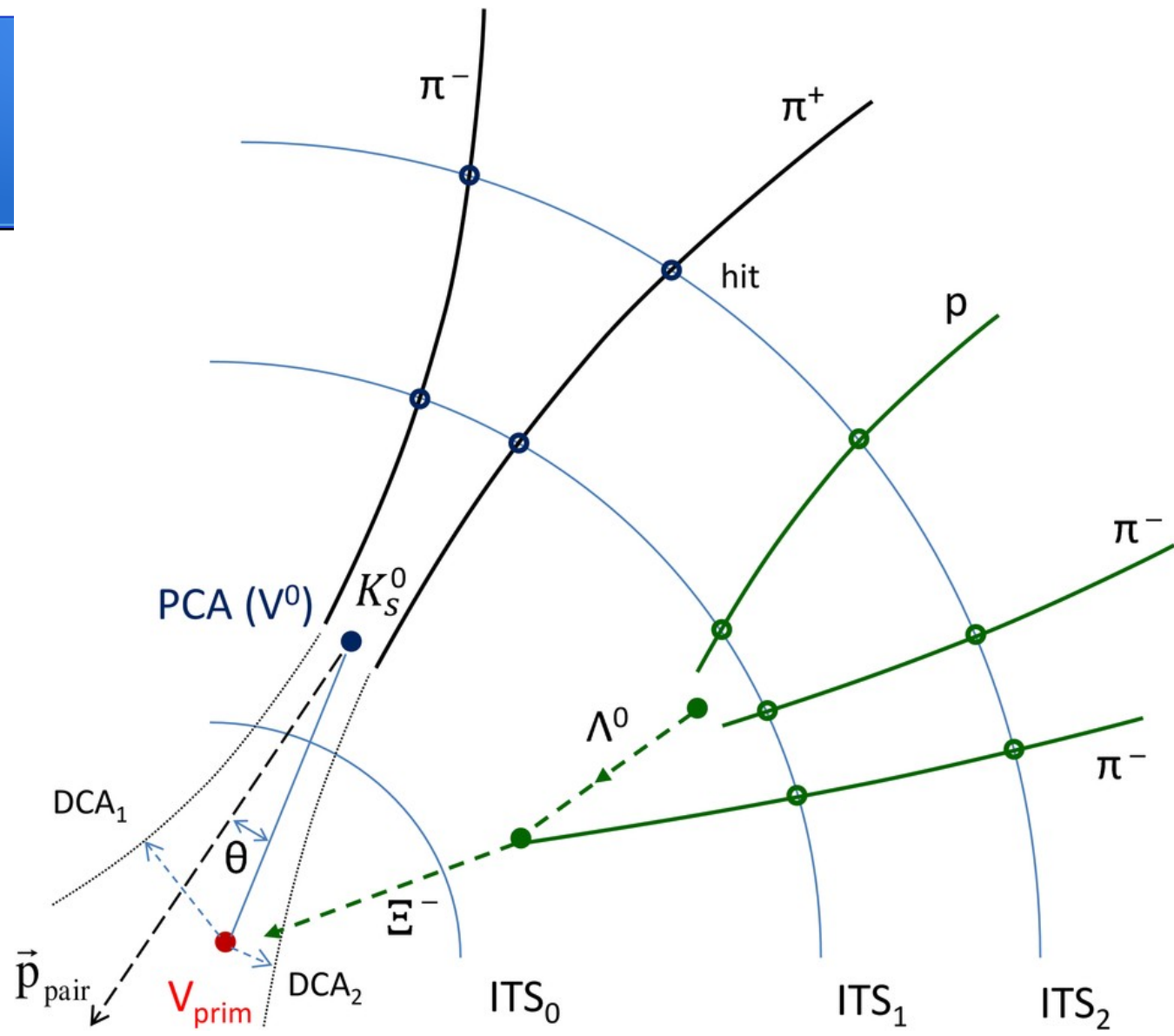
Backup

Ξ^- - hadron correlation yields

- Given a Ξ^- , where does the associated strangeness end up?

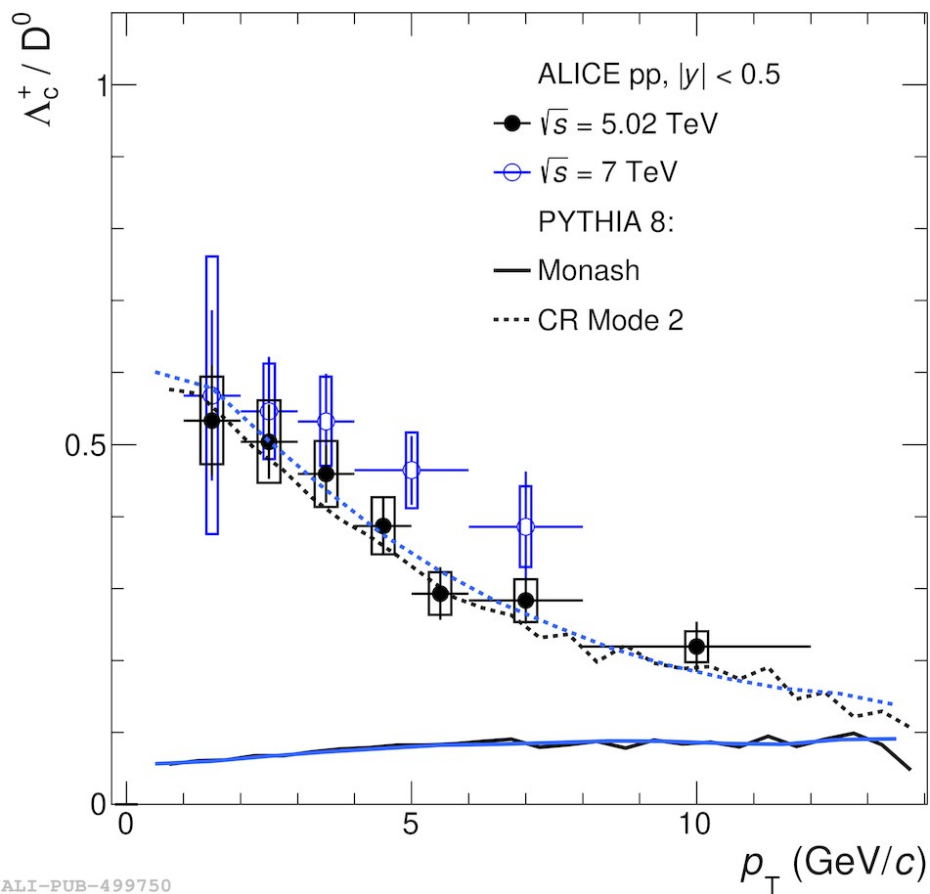


Decay Topology



arXiv:1911.04845

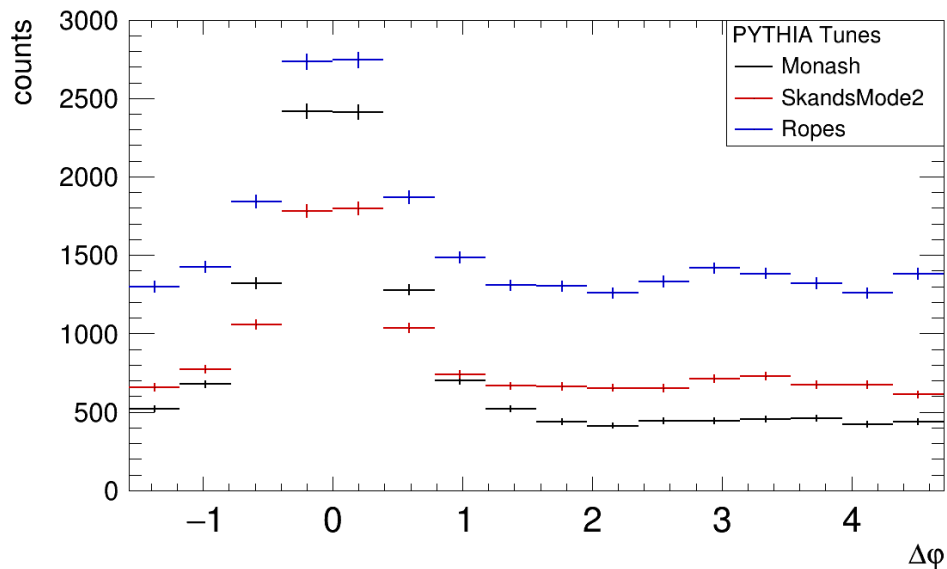
Mode 2 vs Monash, charm



$\Xi^- \Xi^+$ correlations

- Three different PYTHIA tunes, not normalized
- Di-quark: more $\Xi^- \Xi^-$ pairs

OS correlations



OS - SS

