Strange-hadron correlation studies to investigate strangeness enhancement in pp collisions

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ALICE Collaboration, Nature Phys 13, 535–539 (2017)
ALICE Collaboration, Eur.Phys.J.C 80, 167 (2020)
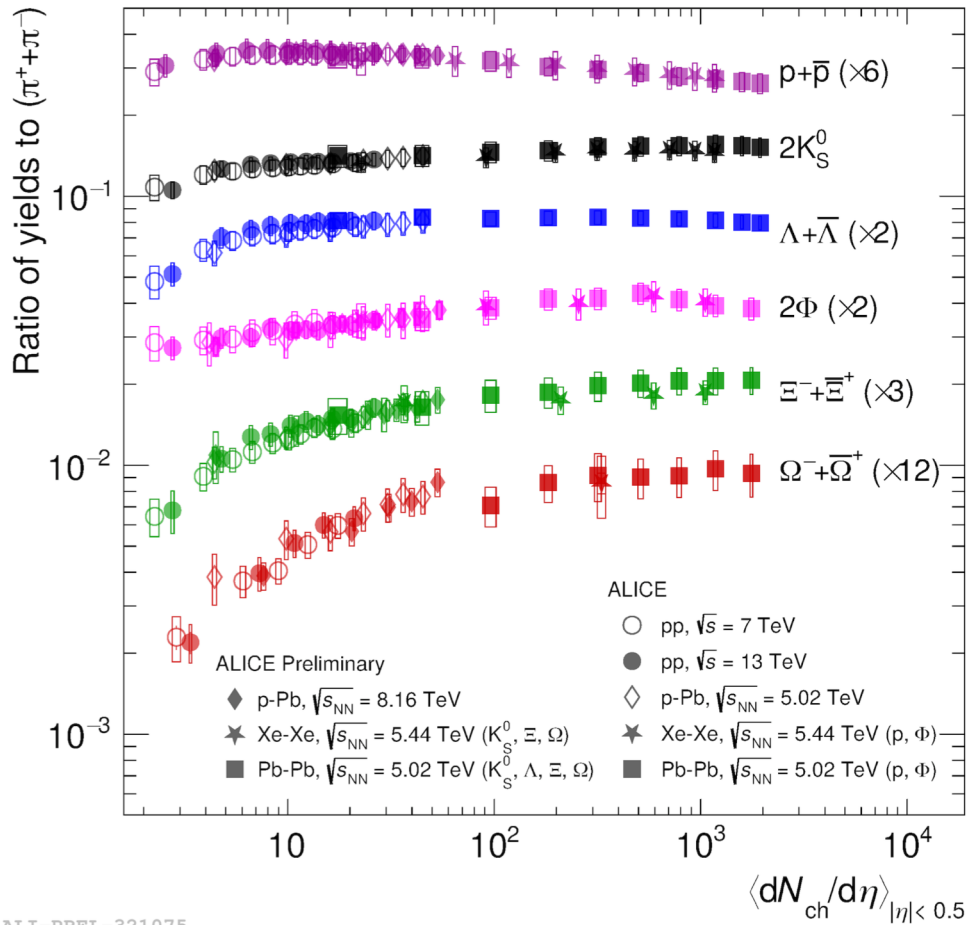
Strangeness enhancement:
The ratio between (multi-)strange hadron yields and pion yields is enhanced in heavy-ion collisions with respect to minimum bias pp collisions

- Smooth evolution with the multiplicity of charged particles across different collision systems (pp, p-Pb, Pb-Pb)

- No dependence on the collision energy at the LHC

- The enhancement is larger for particles with larger strangeness content ($\Omega > \Xi > K_S^0$)

Is strangeness enhancement related to soft particle production or to hard processes, such as jets?

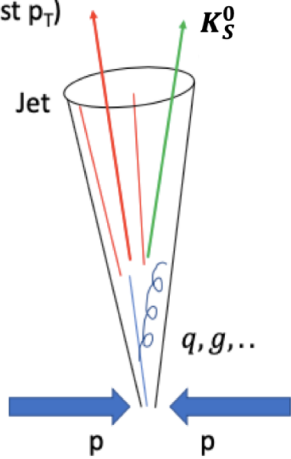# Correlations of high-p_T charged hadrons with strange particles

The angular correlation method:

1. Selection of the **trigger particle** (~jet axis): the charged primary particle with the highest p_T and $p_T > 3$ GeV/c
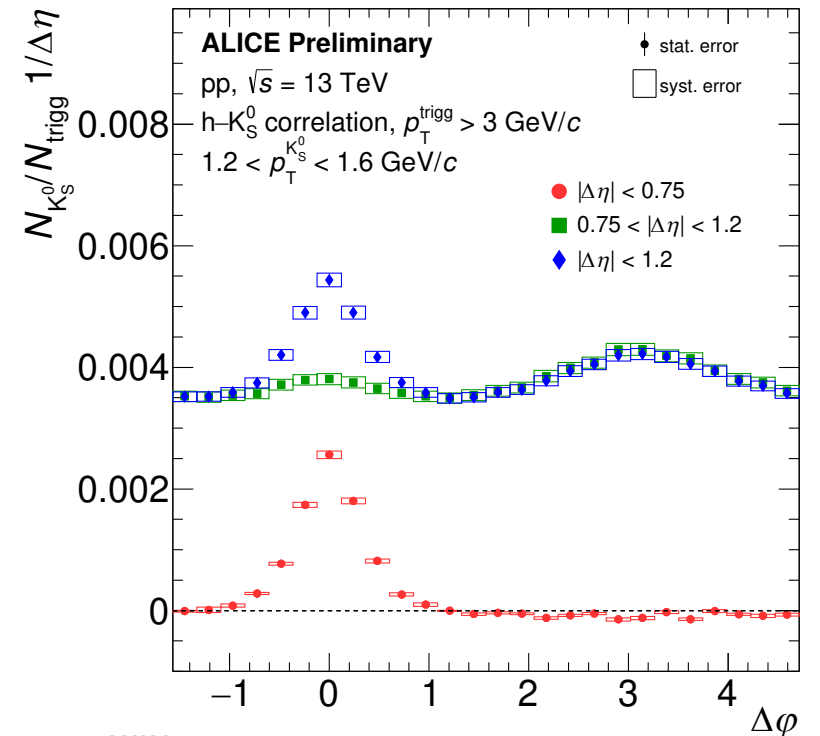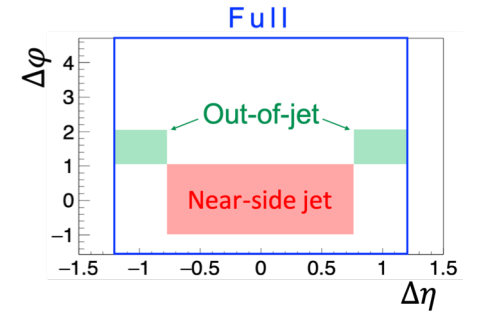
2. Identification of strange hadrons (**associated particles**)

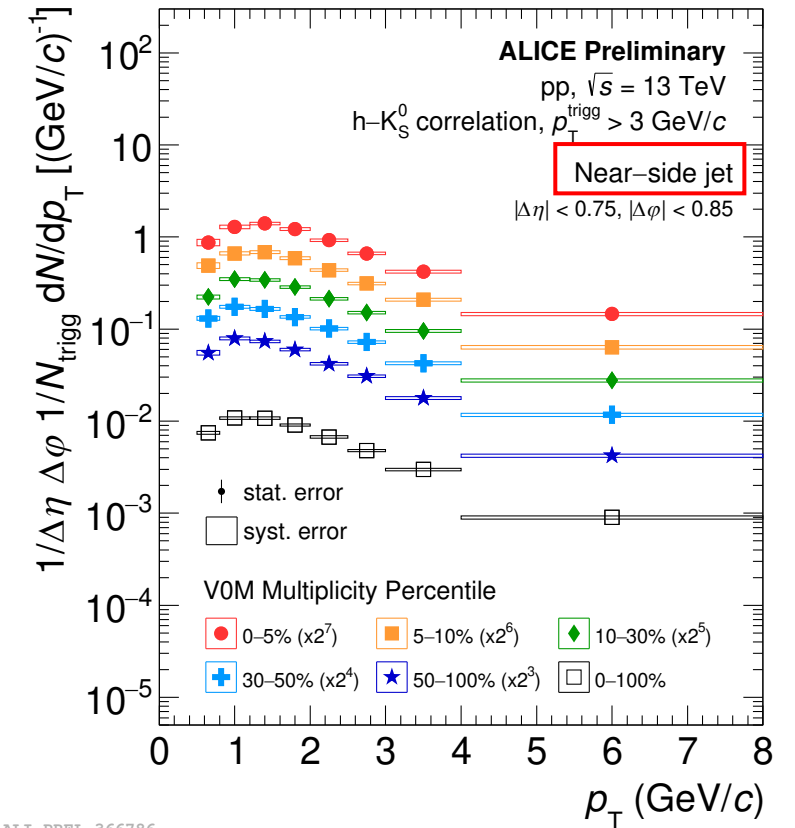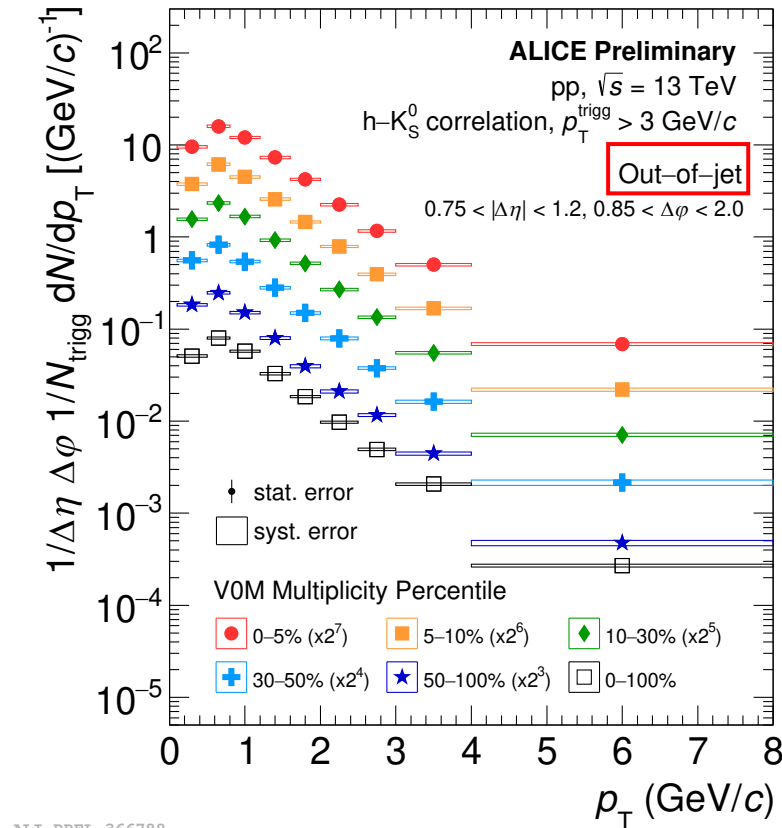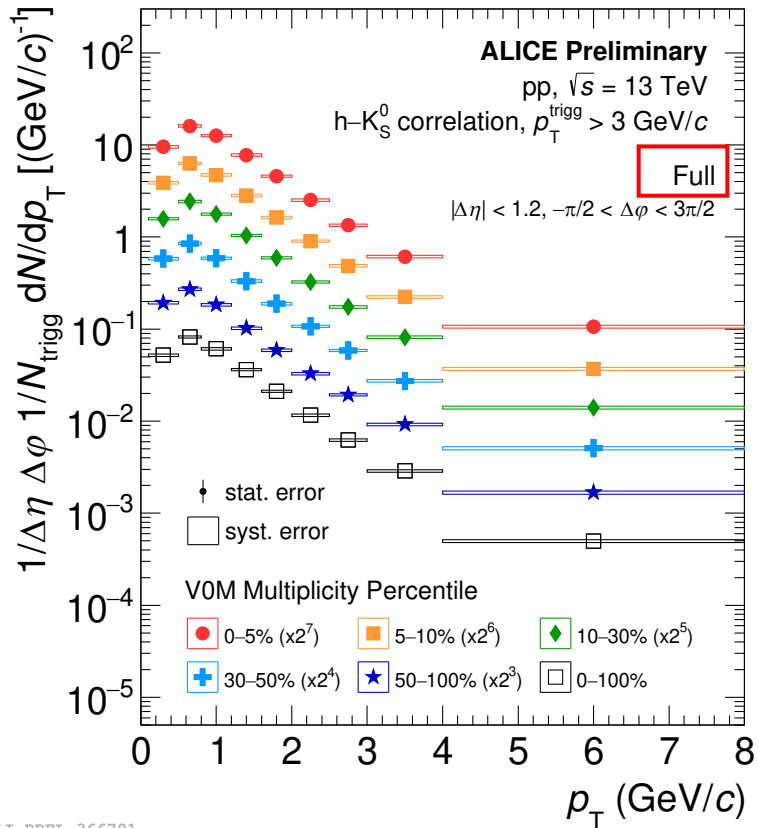3. Angular correlation between trigger and associated particles is calculated

$$\Delta\varphi = \varphi_{Trigg} - \varphi_{Assoc}$$

$$\Delta\eta = \eta_{Trigg} - \eta_{Assoc}$$

φ: azimuthal angle
$\eta = -\ln(\tan(\theta/2))$
θ: polar angle

ALICE Preliminary
pp, $\sqrt{s}$ = 13 TeV
h–K_S^0 correlation, $p_T^{trigg} > 3$ GeV/c
$1.2 < p_T^{K_S^0} < 1.6$ GeV/c

stat. error
syst. error

● $|\Delta\eta| < 0.75$
■ $0.75 < |\Delta\eta| < 1.2$
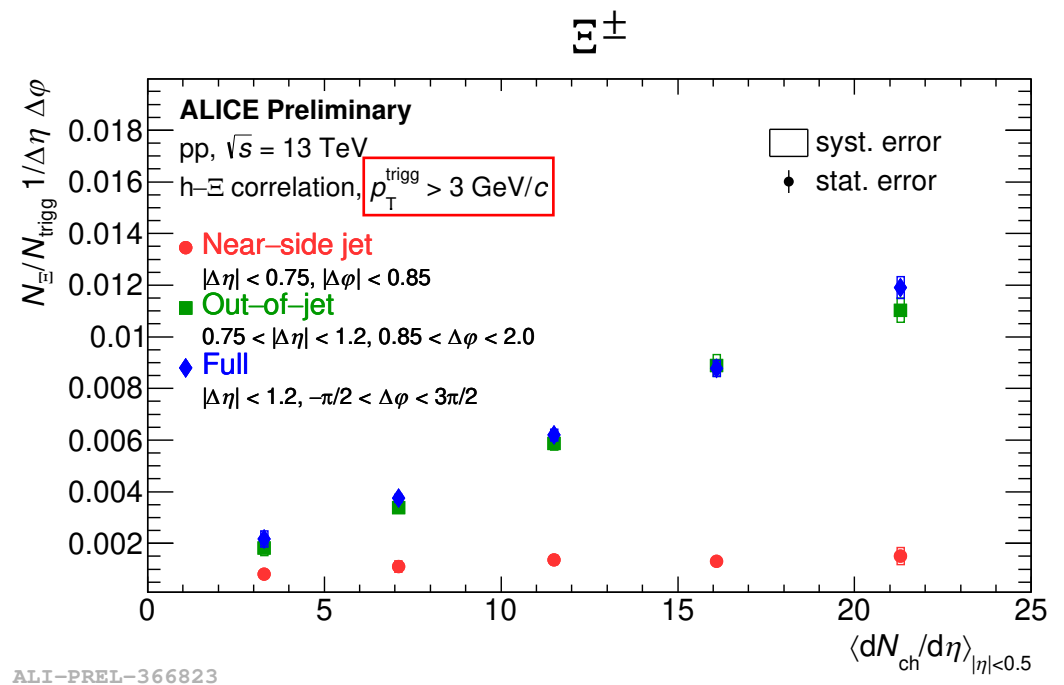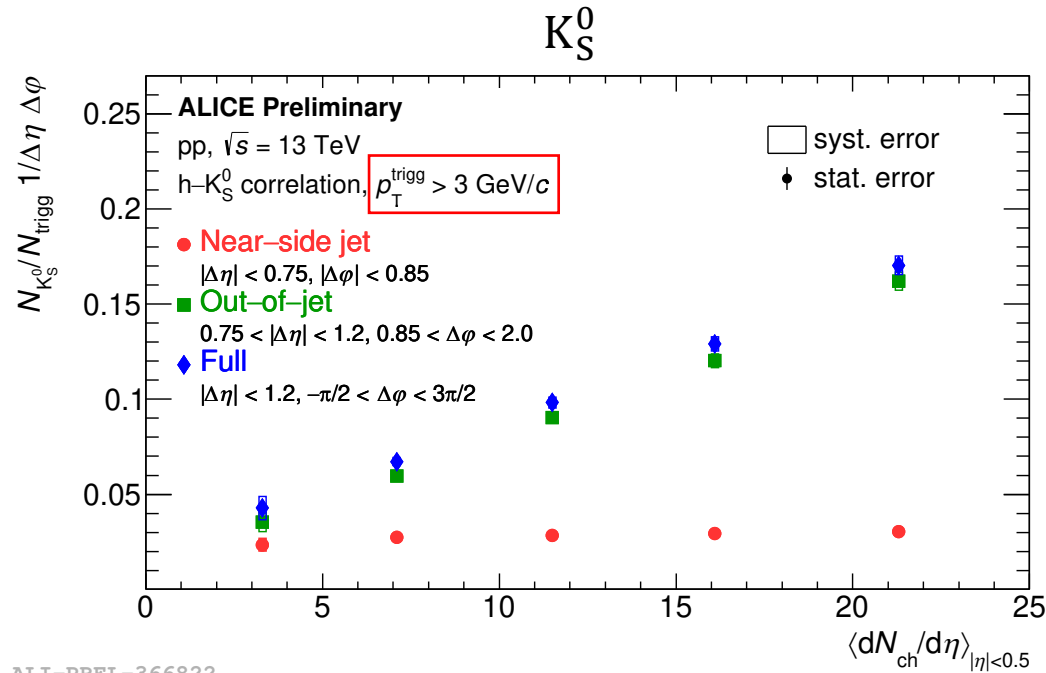◆ $|\Delta\eta| < 1.2$

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Near-side jet, out-of-jet and full p_T spectra of K_S^0

Spectra of K_S^0 produced in jets are harder than spectra of K_S^0 produced out of jets
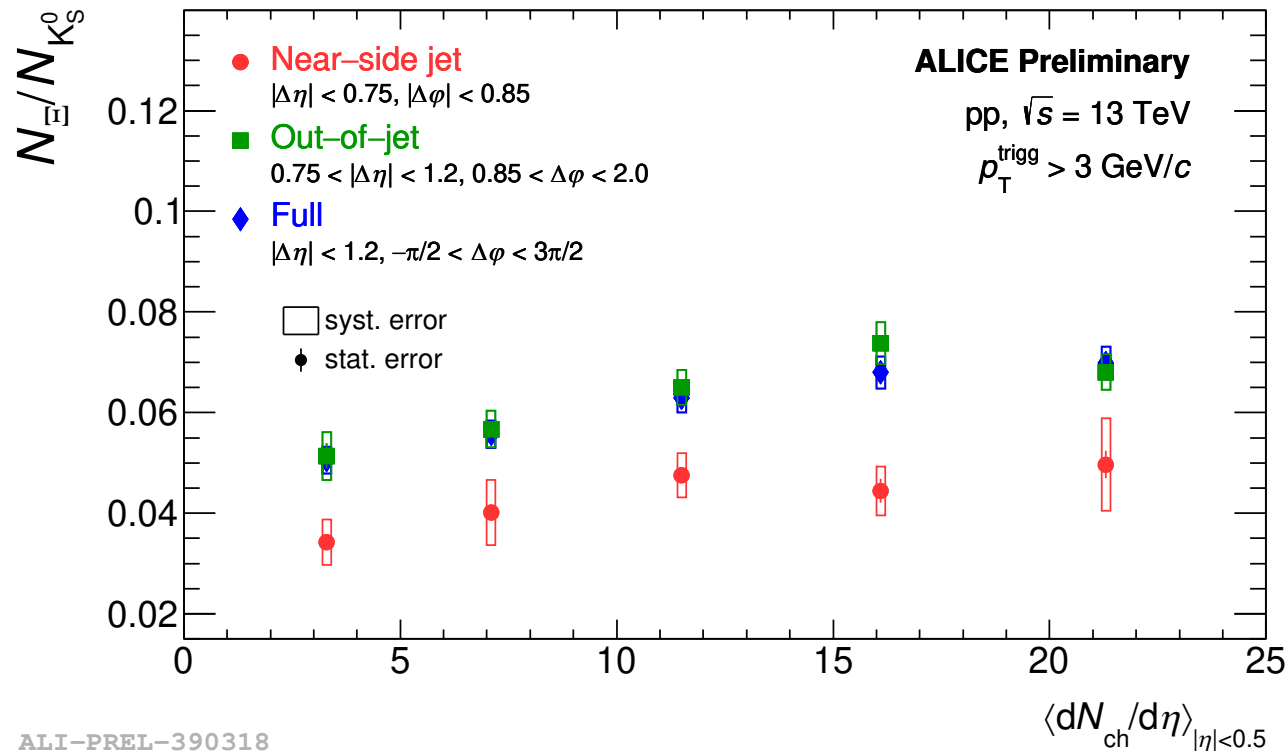
The same is observed for the $\Xi^\pm$ baryon

- Both the full yield and the out-of-jet yield increase with the multiplicity
- Very mild to no-evolution with multiplicity of the near-side jet yield

→ The contribution of out-of-jet production relative to near-side jet production increases with multiplicity

Strangeness enhancement in jets and out of jets

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- The strangeness enhancement in the ratio of full yields is attributed to the larger strangeness content of Ξ ($|S| = 2$) with respect to K_S^0 ($|S| = 1$)

- The out-of-jet Ξ/K_S^0 yield ratio increases with the multiplicity

- The near-side jet Ξ/K_S^0 yield ratio shows a hint of increase with multiplicity

Soft (out of jet) processes are the dominant contribution to the Ξ/K_S^0 full yield ratio