Istituto Nazionale di Fisica Nucleare

Studies on charm-strange baryon Ξ_c^+ in 8.16 TeV pPb collisions with LHCb.

Roman Litvinov

on behalf of the LHCb collaboration.

QUARK MATTER KRAKÓW 2022

29TH INTERNATIONAL CONFERENCE ON ULTRARELATIVISTIC NUCLEUS - NUCLEUS COLLISIONS

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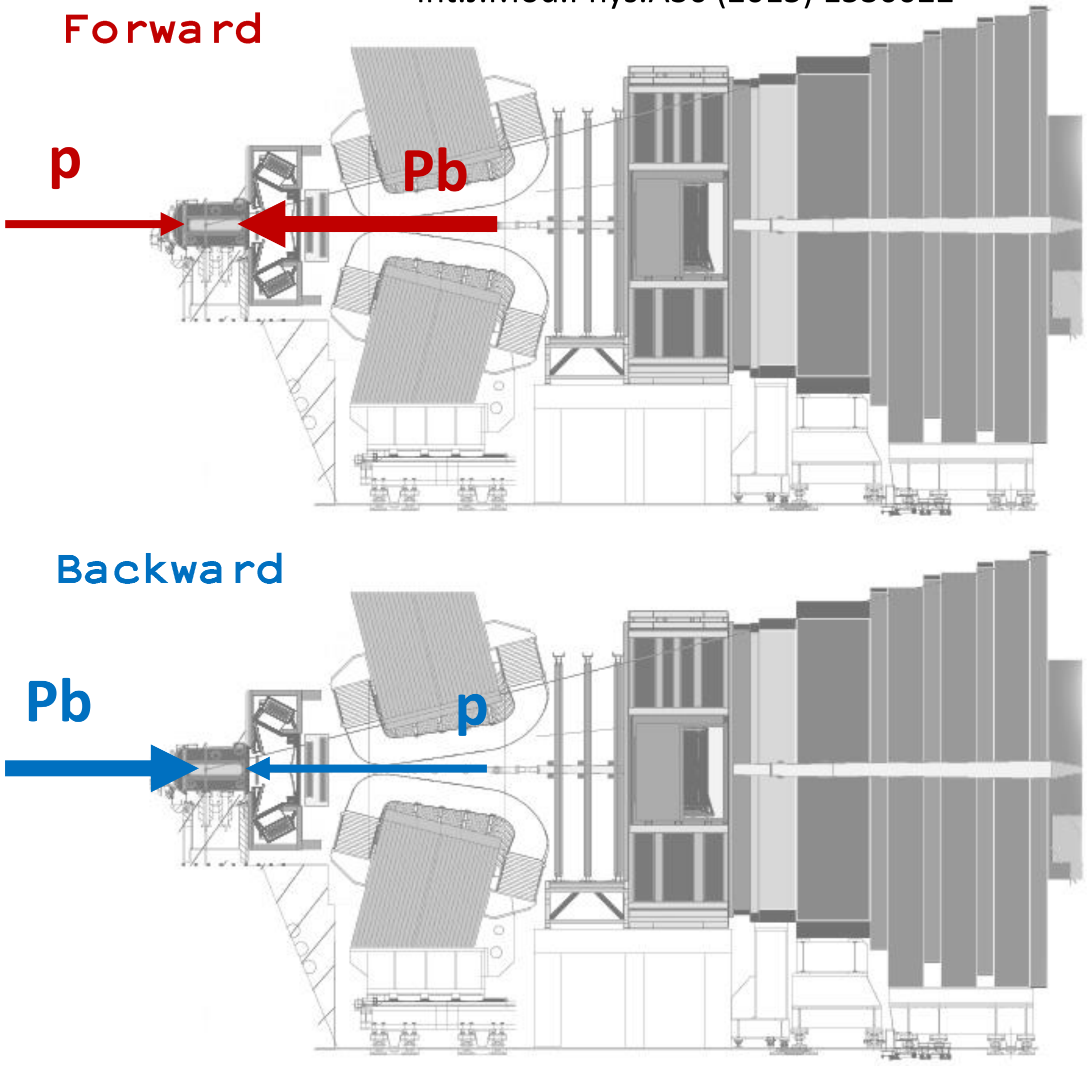
KRAKÓW, POLAND

The LHCb detector at CERN

- Precise detector in the forward region $2 < \eta < 5$;
- Able to explore *pp*/Pb*p*/PbPb collisions and fixed target mode!
- Excellent performances:
  - Interaction point resolution $< 80\ \mu m$;
  - Momentum resolution 0.5-1.0% (5-200 GeV/c);
  - High precision **e, μ, π, K, p, γ** identification.

JINST 3, (2008) S08005
Int.J.Mod.Phys.A30 (2015) 1530022



Rapidity Coverage

- $y*$: rapidity in nucleon-nucleon cms;
- $y_{cms} = \pm\ 0.465$;
- Forward: $1.5 < y* < 4.0$;
- Backward: $-5.0 < y* < -2.5$;

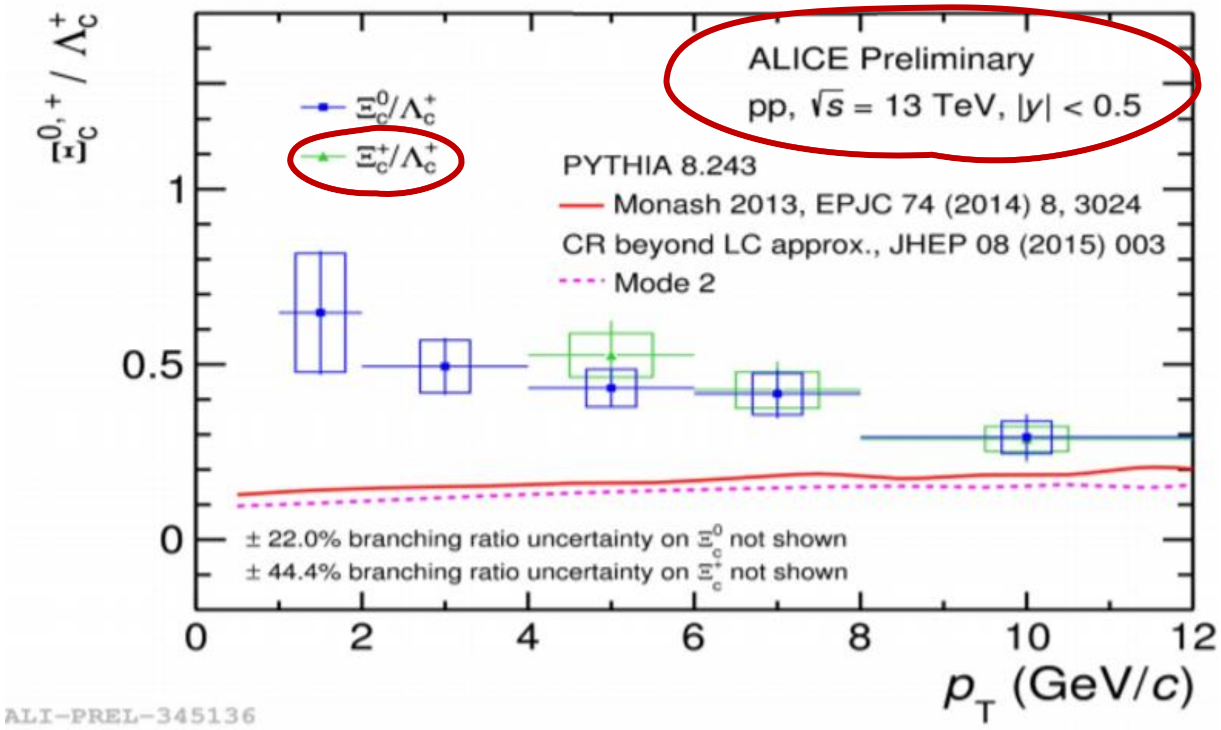
Motivation

Ξ_c^+(2467 MeV/c2) = *usc*
Λ_c^+(2286 MeV/c2) = *udc*
both decay into $\rightarrow p\,K^-\pi^+$

$$\frac{\sigma(\Xi_c^+)}{\sigma(\Lambda_c^+)} = \frac{N_{\Xi_c^+}}{N_{\Lambda_c^+}} \times \frac{\varepsilon^{\Lambda_c^+}}{\varepsilon^{\Xi_c^+}} \times \frac{\mathfrak{B}(\Lambda_c^+ \rightarrow pK^-\pi^+)}{\mathfrak{B}\,(\Xi_c^+ \rightarrow pK^-\pi^+)}$$

$$\text{Production}(\Xi_c^+) \sim \begin{pmatrix} parton \\ distribution \\ functions \end{pmatrix} \otimes \begin{pmatrix} hard \\ scattering \\ cross-section \end{pmatrix} \otimes \begin{pmatrix} (modified?) \\ fragmentation \\ function \end{pmatrix} \ldots$$

- Ratio of Ξ_c^+/Λ_c^+ in *pPb*:
  - charm hadronization is not well understood;
  - charmed baryon formation might depend on collision system;
  - enhancement can be indication of other effects (ref.);



- R_{FB}
  - probes cold nuclear matter effects.

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$\mathfrak{B}(\Xi_c^+ \to pK^-\pi^+) =$ (0.45 ± 0.21 ± 0.07)% (Belle)
arXiv:1904.12093v3 [hep-ex] 12 Aug 2019
$\mathfrak{B}(\Xi_c^+ \to pK^-\pi^+) =$ (1.135 ± 0.002 ± 0.387)% (LHCb)
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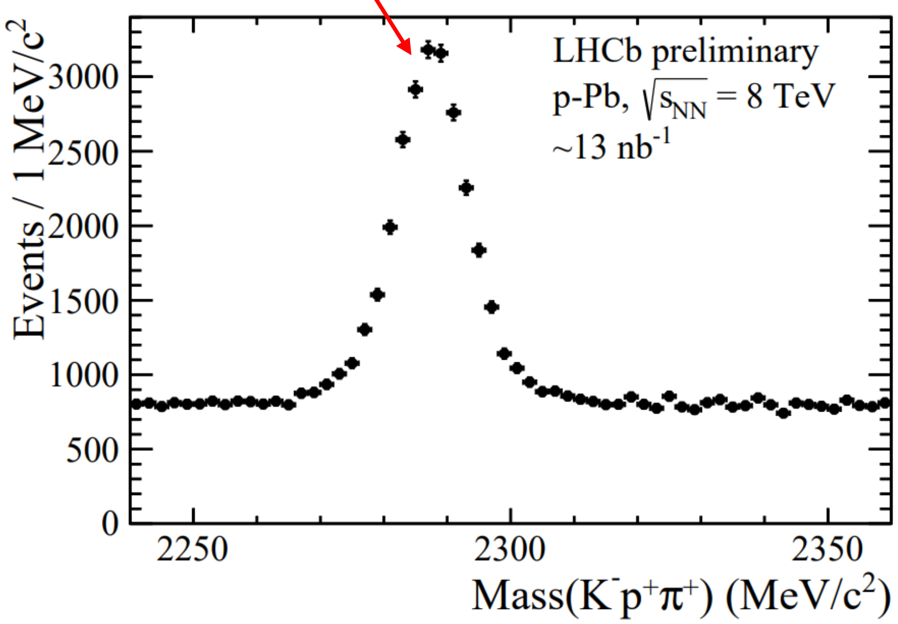
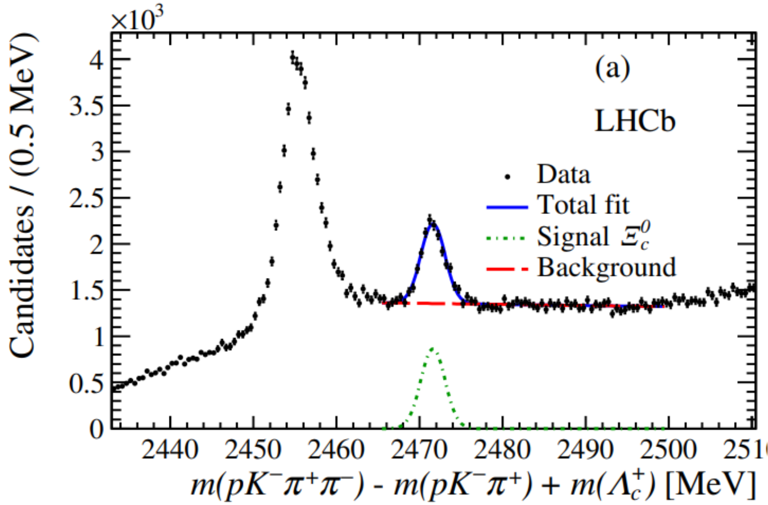
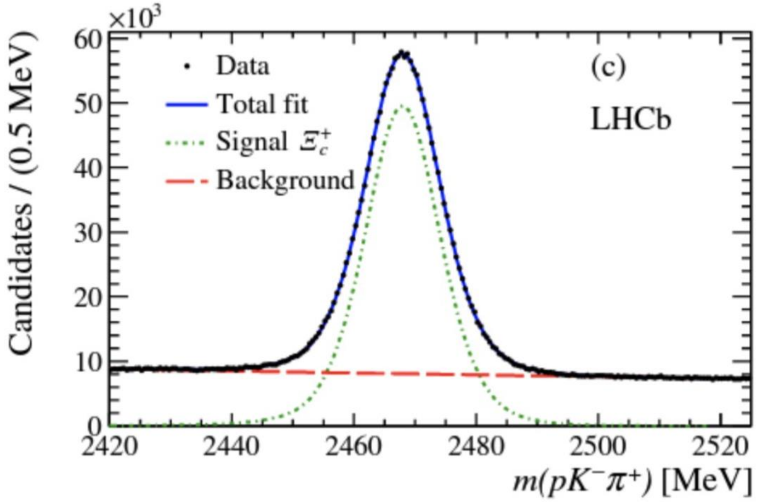




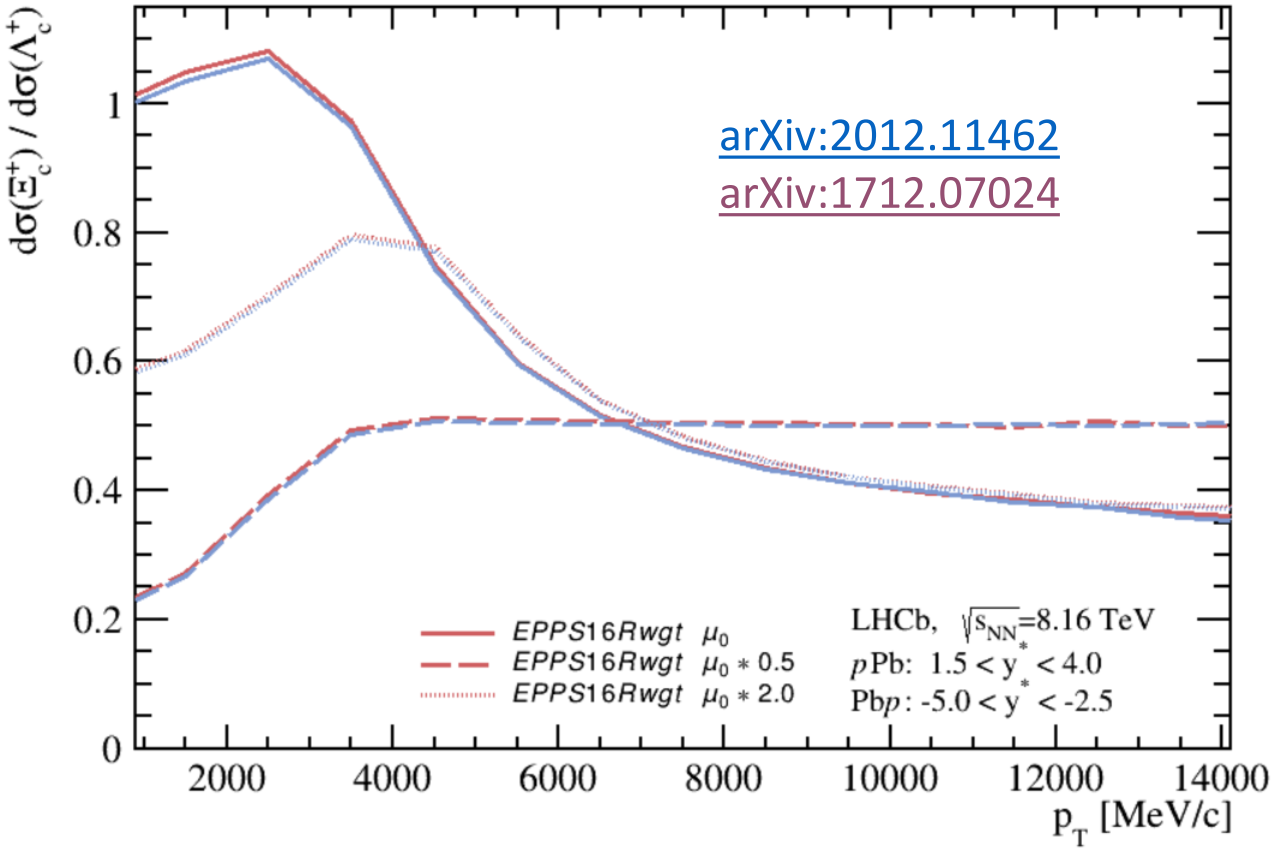


Data:

- pPb and Pbp $\sqrt{s_{NN}}$ = 8.16 TeV

Conclusion

- There are no other measurements of this quantity in *pPb* at the moment (only in *pp* in a different kinematic range).
- Theory predictions with the EPPS16 nuclear PDFs computed in three different factorisation scales μ_F.
- The predictions have large difference in the region of low p_T where LHCb is most sensitive.
- Having a measurement in this region could be crucial in disentangling the different model and give clear indication of the mechanism of charm hadronisation in pPb collisions.



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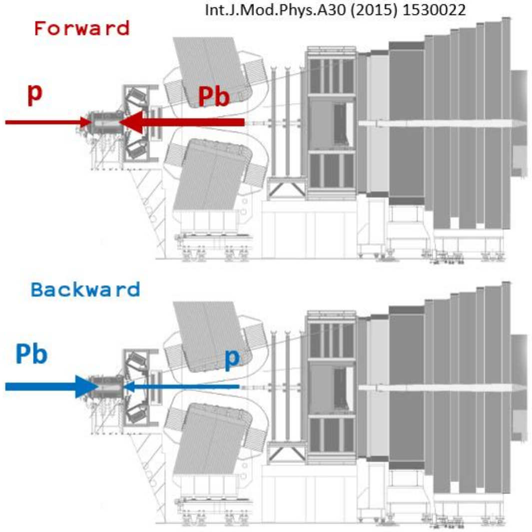

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Production(Ξ_c^+) ~ (parton distribution functions) ⊗ (hard scattering cross − section) ⊗ ((modified?) fragmentation function)....

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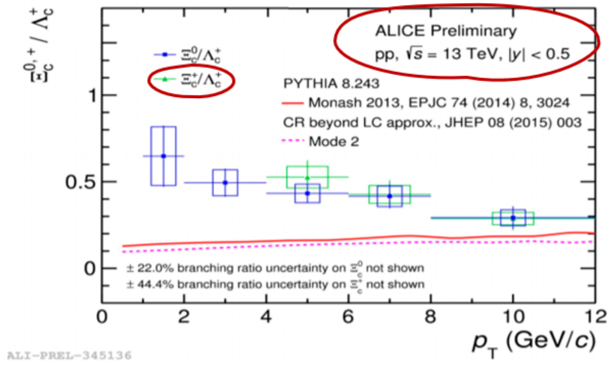

Strategy

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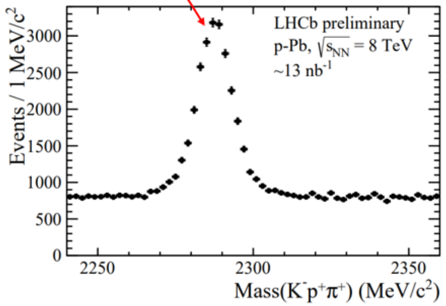

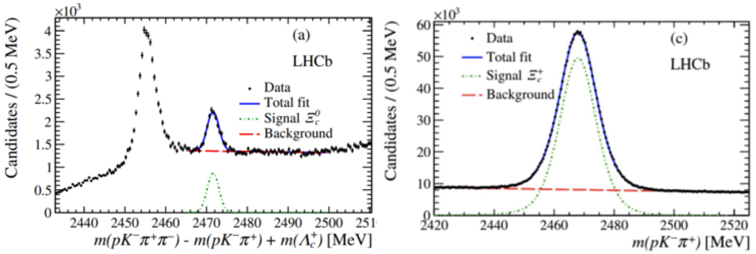

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arXiv:2012.11462
arXiv:1712.07024