Measurements of Λ_c^+ baryon production via $\Lambda_c^+ \rightarrow pK^-\pi^+$ channel in p-Pb collisions at 5.02 TeV with ALICE

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Introduction

Why study Heavy Flavour?

- Heavy quarks (c,b) are produced in hard parton scattering processes in the early stages of Pb-Pb collisions and experience the entire evolution of the system.
- $M >> T$, thermal production in the plasma is negligible.
- The study of charm and beauty production provides information on the in-medium partonic energy loss and on the medium transport properties.

Why measure Λ_c^+ baryon production?

- Charm hadronisation in Pb-Pb collisions can occur through either fragmentation or coalescence with the surrounding medium.
- The baryon-over-meson (Λ_c^+/D) ratio is sensitive to hadronisation processes in the medium.

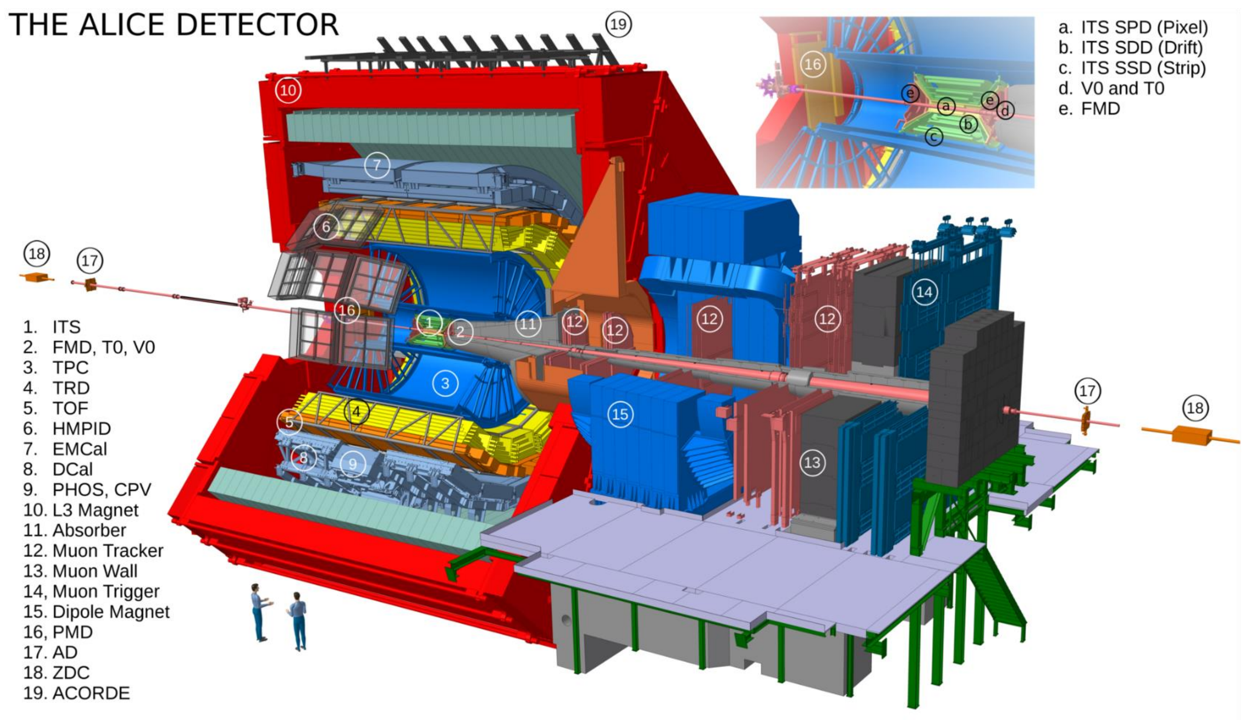
Why study p-Pb collisions?

- Act as a reference to Pb-Pb collisions for nuclear modification factor measurements.
- Constrain cold nuclear matter effects that are not due to the QGP medium such as k_T broadening or nuclear modification of the Parton Distribution Functions.
- Search for possible final-state effects in p-Pb collisions

Reconstructing the $\Lambda_c^+ \rightarrow pK^-\pi^+$ decay

Inner Tracking System (ITS)

- Track reconstruction
- Vertex reconstruction



Time Projection Chamber (TPC)

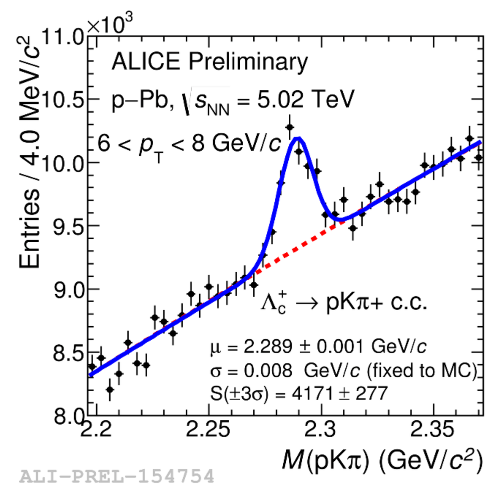
- Track reconstruction
- Particle Identification (PID) with dE/dx measurements.

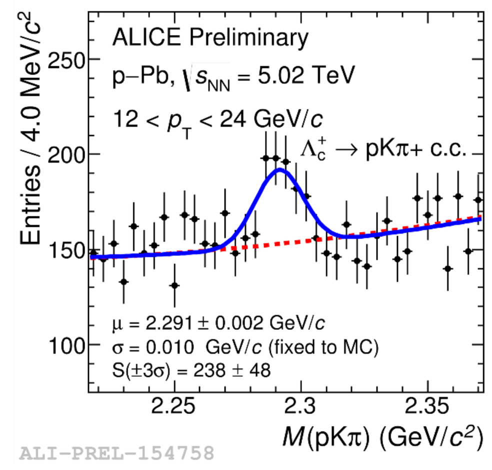
Time Of Flight (TOF)

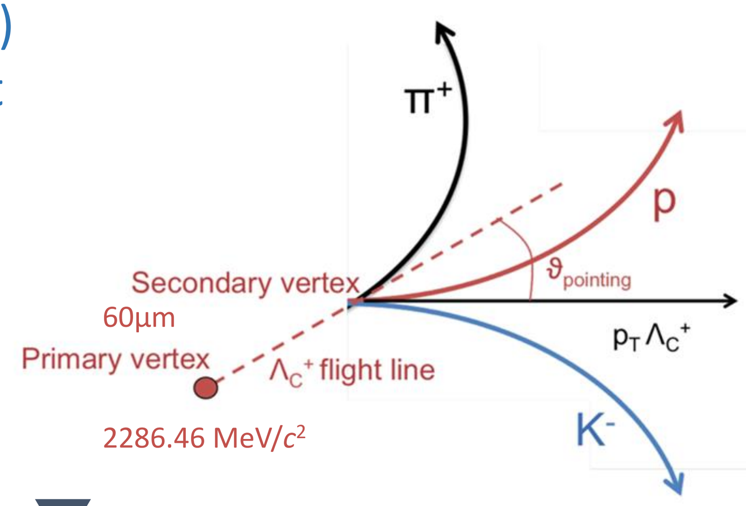
- Particle Identification (PID) with time-of-flight measurements.

Particle Identification

- A Bayesian approach is used to identify the tracks as protons, kaons or pions [1].
- The track is accepted as the species with the highest probability.







Candidate Building

Triplets of identified particles with proper sign combinations are formed. High-quality single track cuts and cuts on daughter p_T are applied.

Selection of the reconstructed candidates is based on the quality of the reconstructed vertex, decay length, and the cosine of the pointing angle.

Signal is extracted via an invariant mass fit. A Gaussian function is used to model the signal, a second-order polynomial to model the background.

This decay channel includes not only the direct (non-resonant) decay channel but also three resonant decay channels [2]:

Non-resonant:	B.R. = (3.5±0.4%)
Resonant:	
p K*(892)^0	B.R. = (1.98±0.28%)
Δ(1232)$^{++}$ K$^-$	B.R. = (1.09±0.25%)
Λ(1520) π$^+$	B.R. = (2.2±0.5%)

Tot. B.R. =(6.35±0.33%)

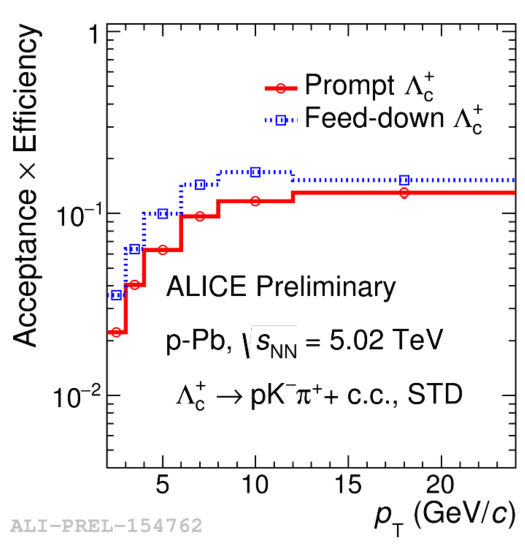
From raw yield to cross section

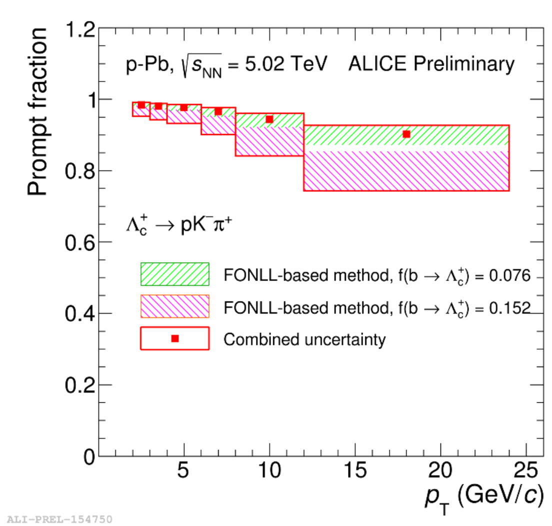
Efficiency x Acceptance

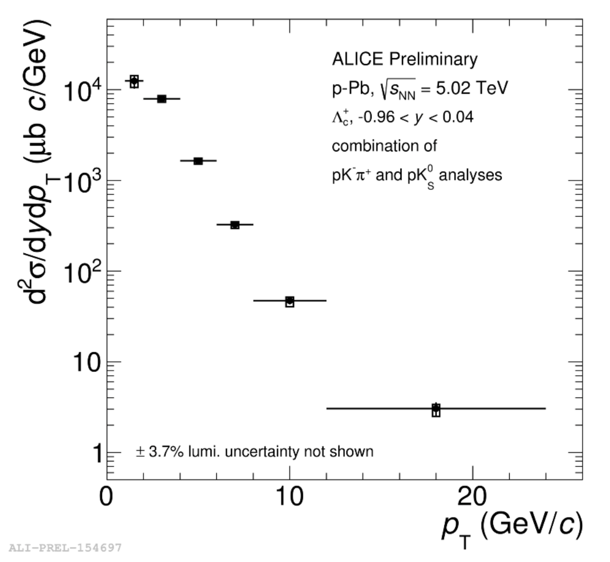
- Efficiency x Acceptance corrections are from Monte-Carlo simulations performed by adding a HIJING [3] p-Pb event on top of a PYTHIA pp event in which a heavy-quark pair is required in the event .

Prompt fraction

- The measured cross section is for prompt Λ_c^+ only, and the contribution from feed-down is evaluated using the FONLL [4] beauty production cross section, the branching fraction $b \rightarrow \Lambda_b$ from [5], and the EvtGen package [6] to simulate the $\Lambda_b \rightarrow \Lambda_c X$ decay kinematics.







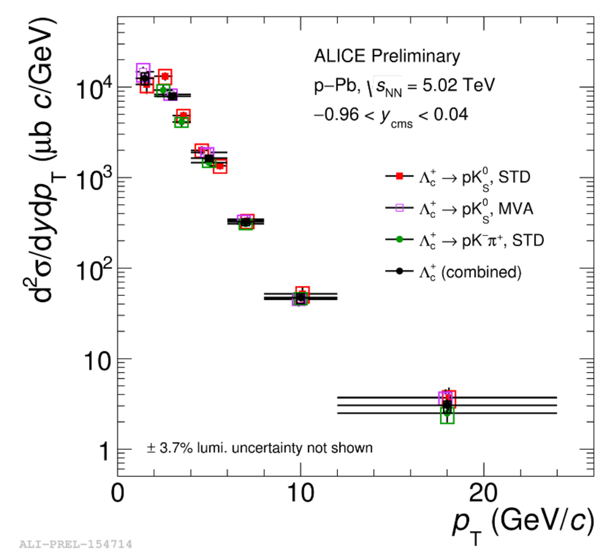
Systematic uncertainties

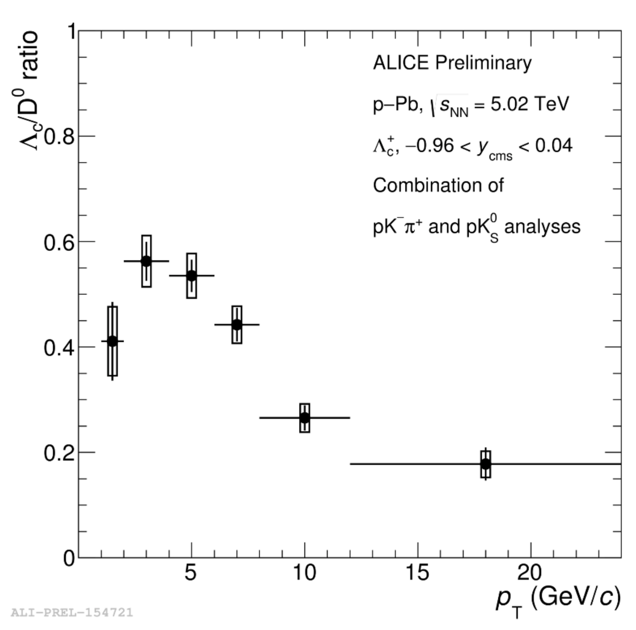
Sources of systematic uncertainty *(and variations to estimate them)*:

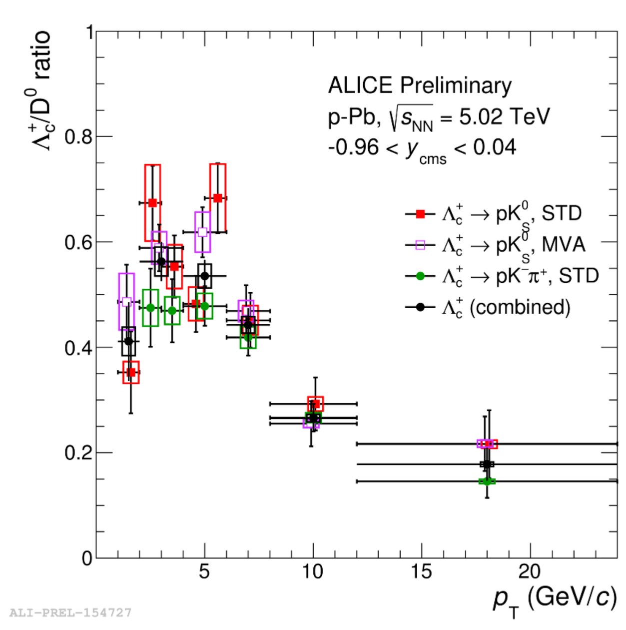
- Raw yield (*invariant mass fit configuration*)
- Cut efficiency (*topological cuts*)
- Tracking efficiency (*track quality cuts*)
- PID efficiency (*track probability thresholds*)
- p_T shape (*p_T shape of generated Λ_c^+ in simulations (FONLL, flat)*)
- Beauty feed-down (*x2 increase of feed-down Λ_c^+ cross section, suggested by measurement [7]*)

Cross section

The p_T-differential cross section of prompt Λ_c^+ measured from the pK⁻π⁺ decay channel is consistent with those obtained from the $\Lambda_c^+ \rightarrow pK^0_S$ channel, which was studied with standard rectangular cuts (see poster by E. Meninno) as well as with a multivariate technique exploiting Boosted Decision Trees [8] (see poster by J. Wilkinson).

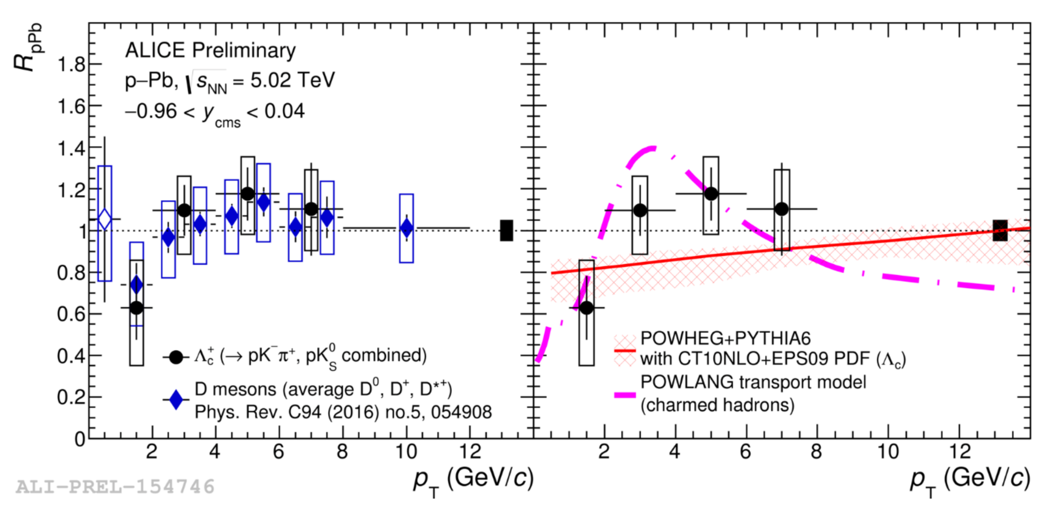






Λ_c^+/D^0

- Run-2 results compatible with Run-1 measurements: improved precision and extended p_T interval down to p_T = 1 GeV/c and up to 24 GeV/c.
- Improved precision allows to appreciate decreasing trend from 4 to 24 GeV/c.



Nuclear modification factor (R_{pPb})

- Λ_c^+ result is consistent with R_{pPb} of D mesons in the full p_T range.
- Consistent with both POWLANG and POWHEG/PYTHIA model calculations.

$$R_{pPb} = \frac{1}{A} \frac{d\sigma^{5TeV}_{pPb}/dp_T}{f^{\sqrt{s},y}_{FONLL}(p_T) \cdot d\sigma^{7TeV}_{pp}/dp_T}$$

References

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