Measurements of Λ_c^+ production via $\Lambda_c^+ \to pK^-\pi^+$ channel in pp and p–Pb collisions at 5.02 TeV with ALICE

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Why study Heavy Flavour?

- Charm and Beauty quarks are produced in hard partonic scattering processes in the early stages of the collisions and experience the entire evolution of the medium.
- *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 study Λ_c^+ production?

- Baryon/meson ratio (Λ_c^+/D^0) is sensitive to the hadronisation processes.
- RUN 1 measurements have shown enhanced production of the Λ_c^+ baryon [udc] [1] with respect to e^+e^- and ep collisions. [2]

Why study smaller systems?

- Reference to Pb–Pb collisions and tests universality of fragmentation functions in different systems.
- Disentangles cold nuclear matter effects such as k_T broadening or nuclear modification of the Parton Distribution Functions.

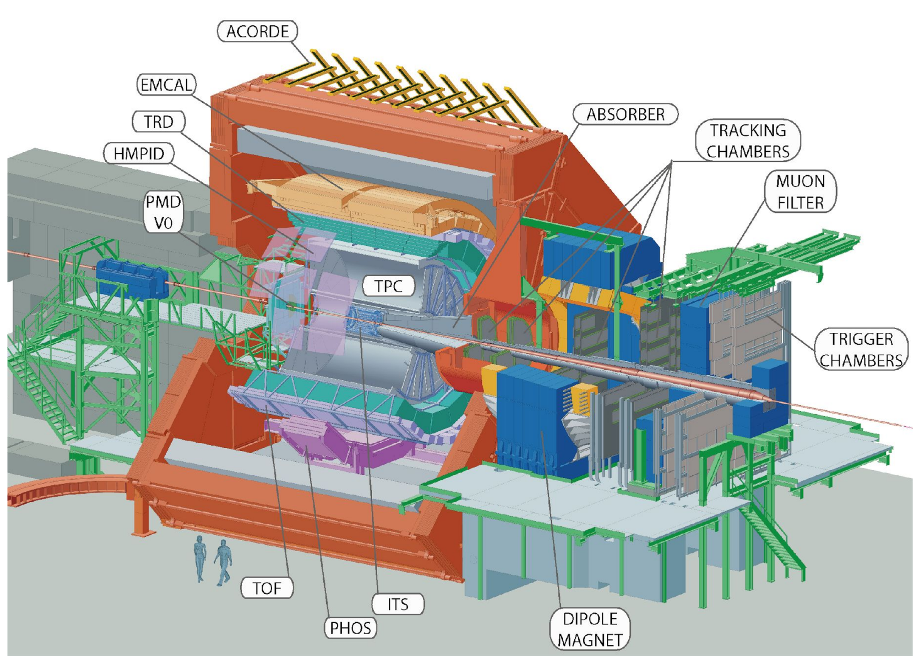
The ALICE detector

Inner Tracking System (ITS)

- Track reconstruction
- Vertex reconstruction

Time Projection Chamber (TPC)

- Track reconstruction
- Particle Identification (PID) with d*E*/d*x* measurements.



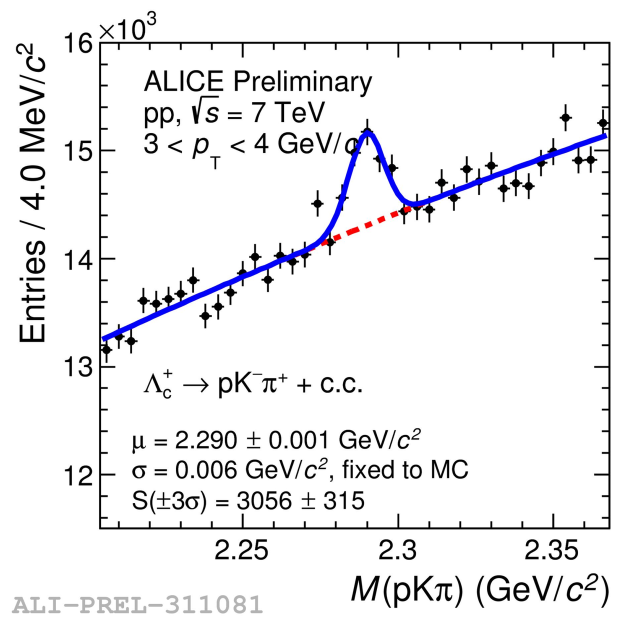
Time Of Flight (TOF)

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

Particle Identification

- A Bayesian approach is used to identify the tracks as protons, kaons or pions. [3] The species with the highest probability is assigned to the track.

Reconstructing the $\Lambda_c^+ \to pK^-\pi^+$



Candidate Reconstruction

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

Selection of the reconstructed candidates is based on the quality of the secondary 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.

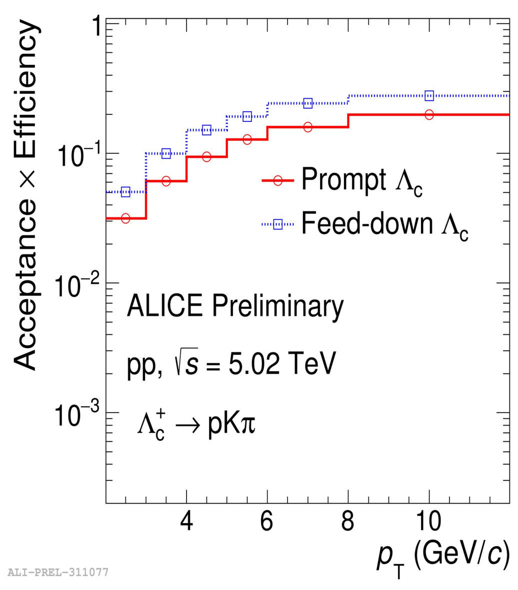
Corrections

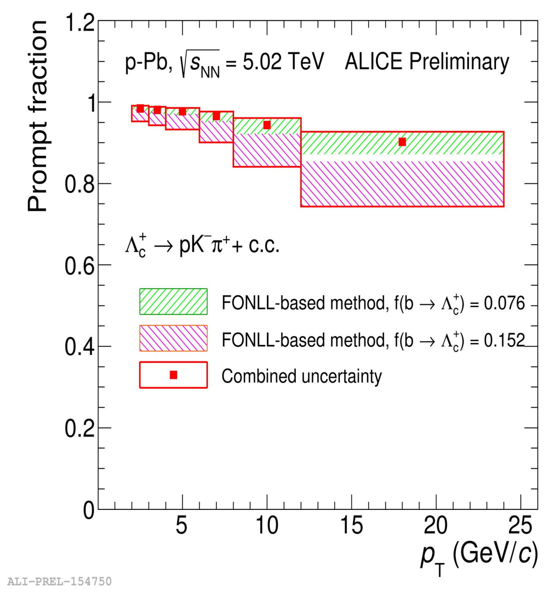
Efficiency x Acceptance

Efficiency x Acceptance corrections are based on MC simulations.

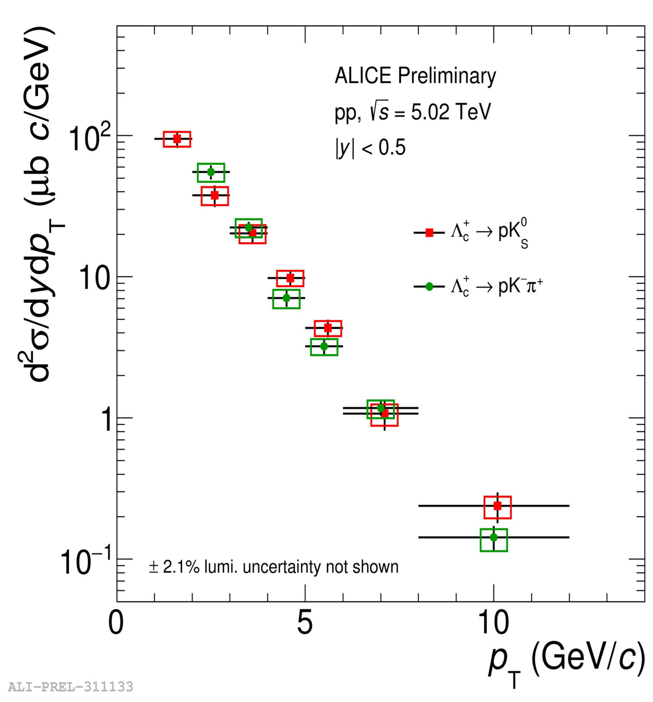
Prompt fraction

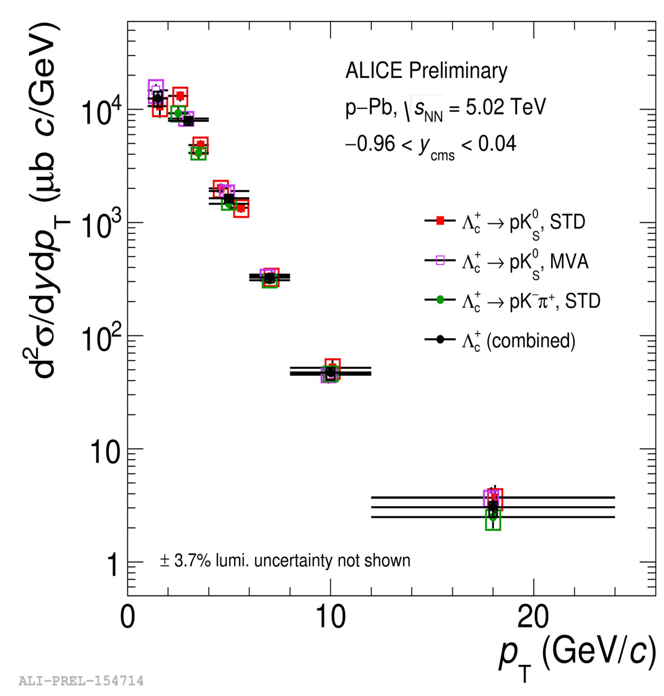
The contribution from feed-down is evaluated using the FONLL [4] beauty production cross section, the branching fraction $b \to \Lambda_b$ from [5], and the EvtGen package [6] to simulate the $\Lambda_b \to \Lambda_c X$ decay kinematics.





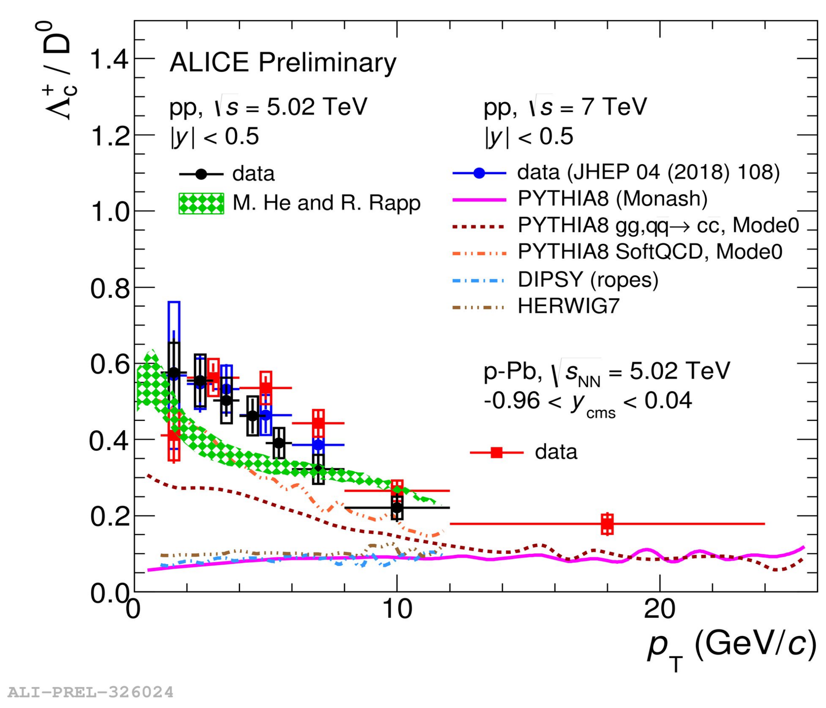
Cross Section





The p_T-differential cross section of prompt Λ_c^+ measured from the $pK^-\pi^+$ decay channel is consistent with those obtained from the $\Lambda_c^+ \to pK^0_S$ channel, which was studied with standard rectangular cuts as well as with a multivariate technique exploiting Boosted Decision Trees [7].

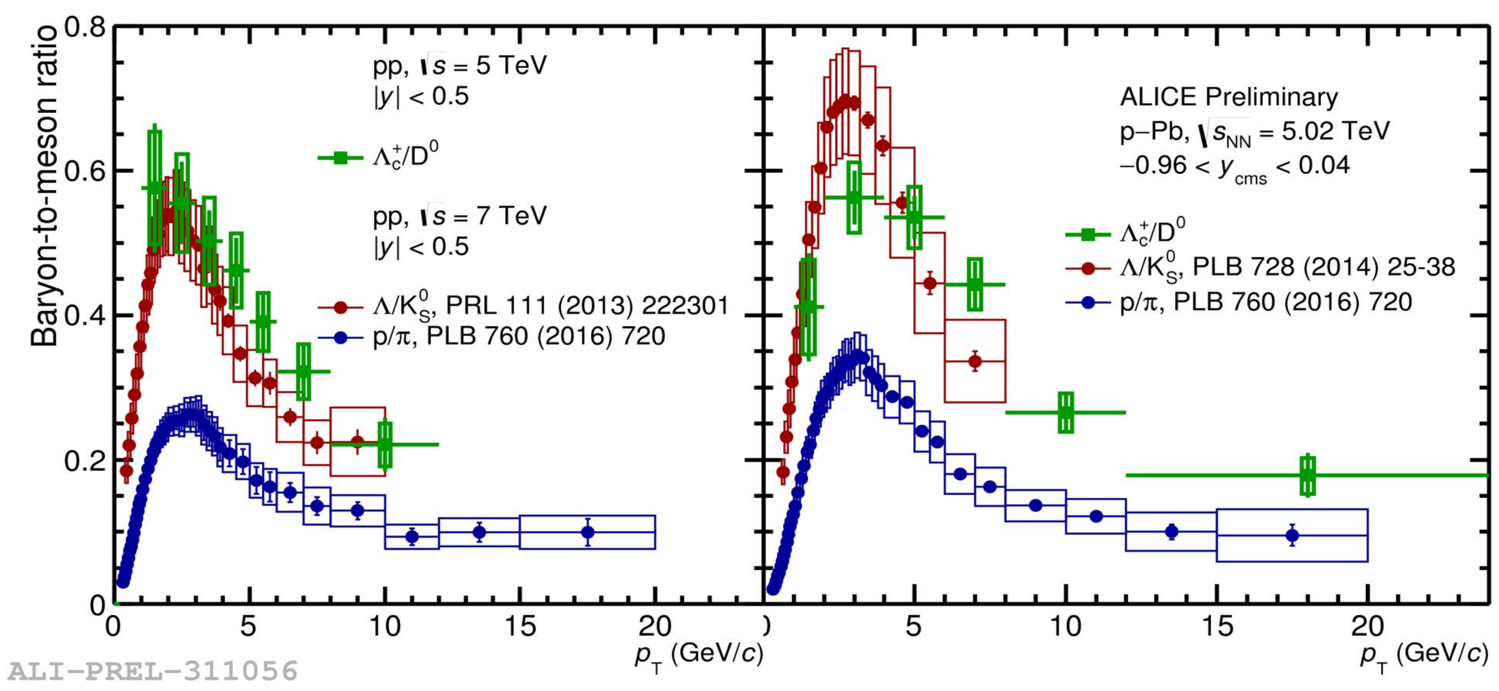
Baryon-to-meson ratio



Measurements in pp and p–Pb are better described by models that either include an augmented list of charm states(green) [8] or colour reconnection (orange) [9].

Models based on results from e^+e^- experiments fail to describe the enhancement.

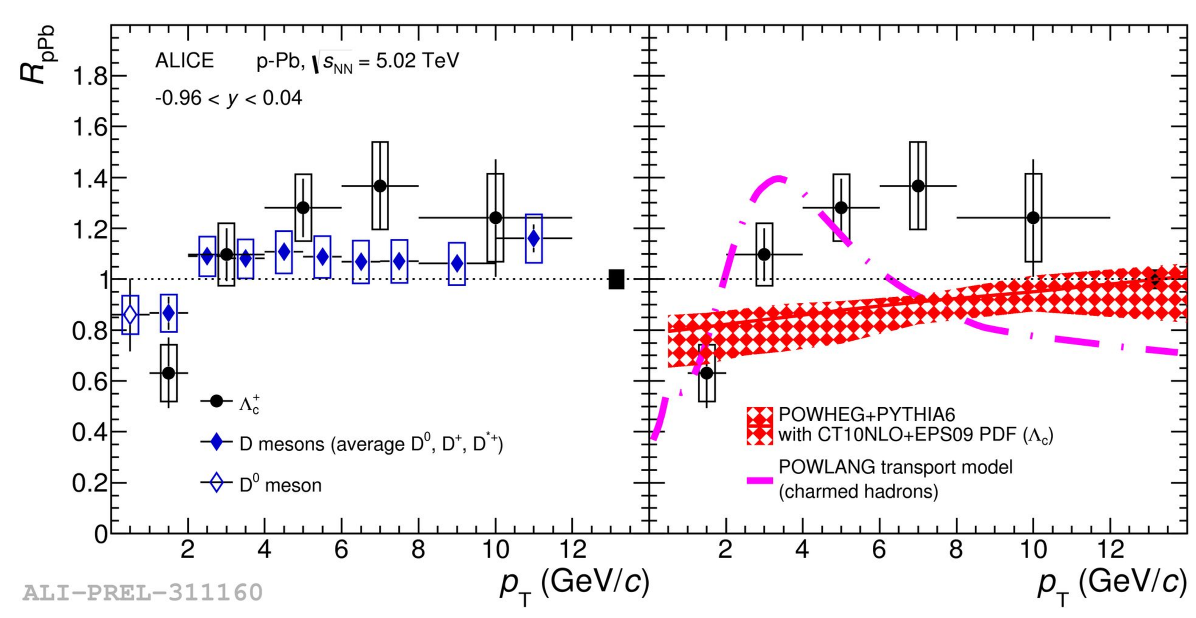
Similarities in charm and strange baryon-to-meson ratios hint at a common hadronisation mechanism.



Nuclear Modification Factor

The nuclear modification factor compares the differential cross section in p–Pb collisions with the differential cross section in pp collisions scaled by the lead mass number.

$$R_{\mathrm{pPb}} = \frac{1}{A}\frac{\mathrm{d}\sigma_{\mathrm{pPb}}/\mathrm{d}p_{\mathrm{T}}}{\mathrm{d}\sigma_{\mathrm{pp}}/\mathrm{d}p_{\mathrm{T}}}$$



The R_{pPb} of the Λ_c^+ is consistent with the D mesons within uncertainties. Current uncertainties allow both models to qualitatively describe the data. No significant cold nuclear matter effects are observed.

References

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