Measurement of Λ_c^+ production cross section as a function of multiplicity and charm fragmentation fractions in pp and p-Pb collisions with ALICE

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Charm hadron production in pp collisions

Test pQCD-based calculations with heavy flavour (HF) hadron production measurements

$$\frac{d\sigma^{hh\to H_q x}}{dp_t} = f_i(x_1,\mu_f^2) f_j(x_2,\mu_f^2) * \frac{d\sigma^{q}}{dp_t} * D_{q\to H_q}\left(z_q = p_{H_q}/p_q, \mu_f^2\right)$$

Parton Distribution Function — Partonic Cross-Section — Fragmentation Function

➔ Cross section of hadron production is typically calculated in a **factorization approach**

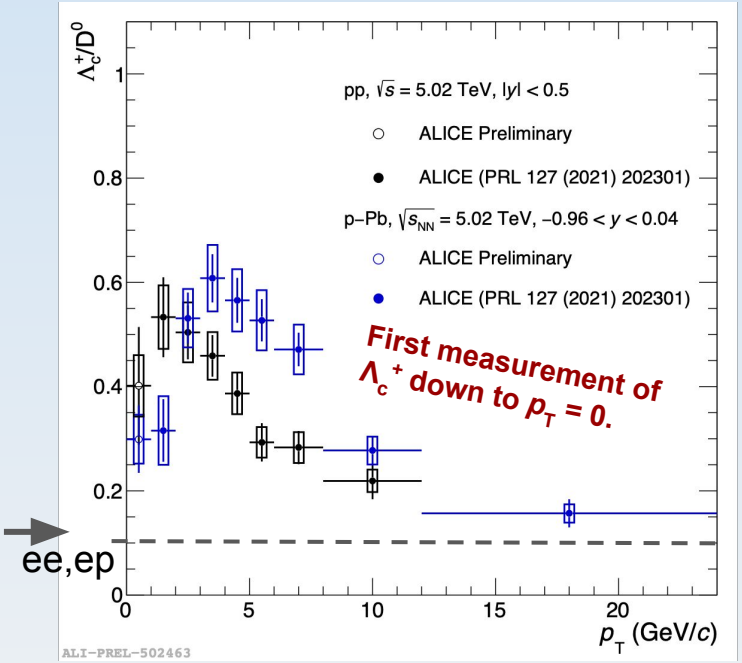
- **Fragmentation** functions are assumed to be **universal** among collision systems
- **Ratios of particle species** are sensitive to charm quark hadronization and are observed to be different in pp collisions wrt e^+e^- and ep measurements

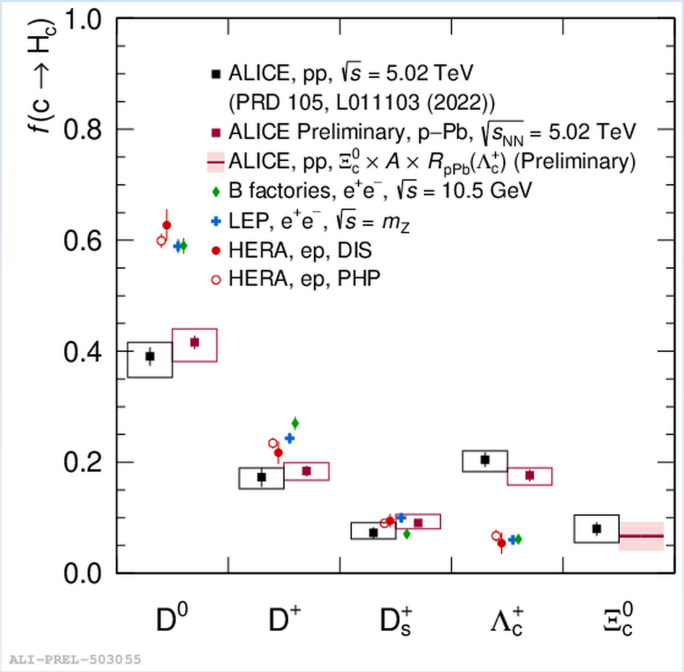
➔ **Measurements vs multiplicity in small systems:**

- low multiplicity in pp collisions: measurements closer to those observed in e^+e^- collisions?
- high multiplicity in small systems: modification of hadronization mechanisms, signatures typically ascribed to QGP in Pb-Pb collisions?

Measure baryon/meson ratio (Λ_c^+/D^0) and charm fragmentation fractions of different species and as a function of multiplicity to investigate **charm hadronization**.

Λ_c^+/D^0 yield ratio and charm relative fragmentation fractions

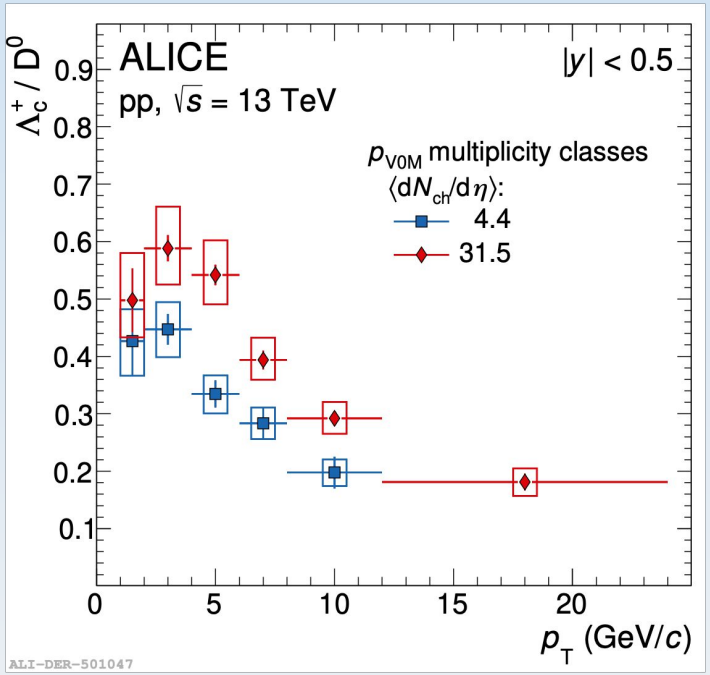


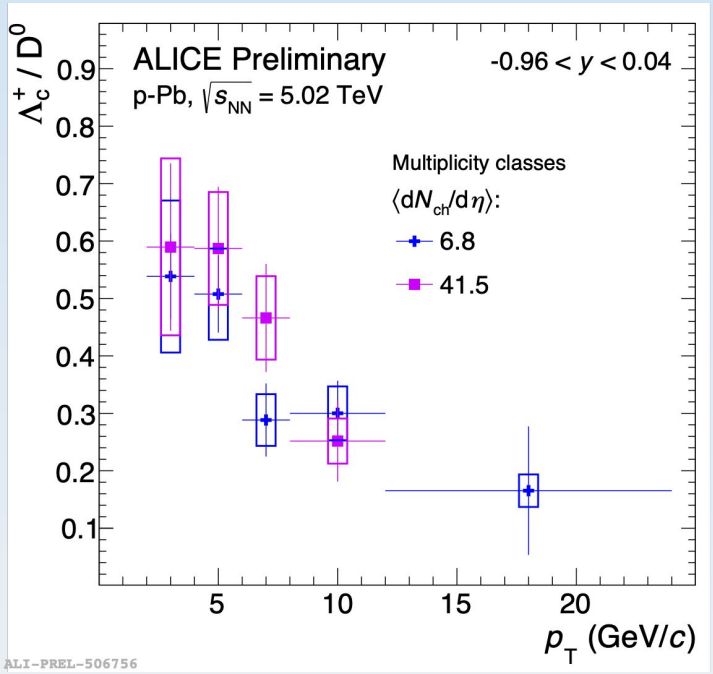


Enhanced Λ_c^+/D^0 ratio in pp and p-Pb collisions wrt. e^+e^- collisions and a **shift of p_T spectrum** in p-Pb compared to pp collision systems → Radial flow or multiplicity dependence of hadronization?

Relative fragmentations fractions are calculated for all measured species → **No significant modification between pp and p-Pb** systems but a significant deviation from e^+e^- collisions

Λ_c^+/D^0 as a function of charged particle multiplicity in pp and p-Pb collisions





Λ_c^+/D^0 ratio as function of multiplicity in pp collisions:

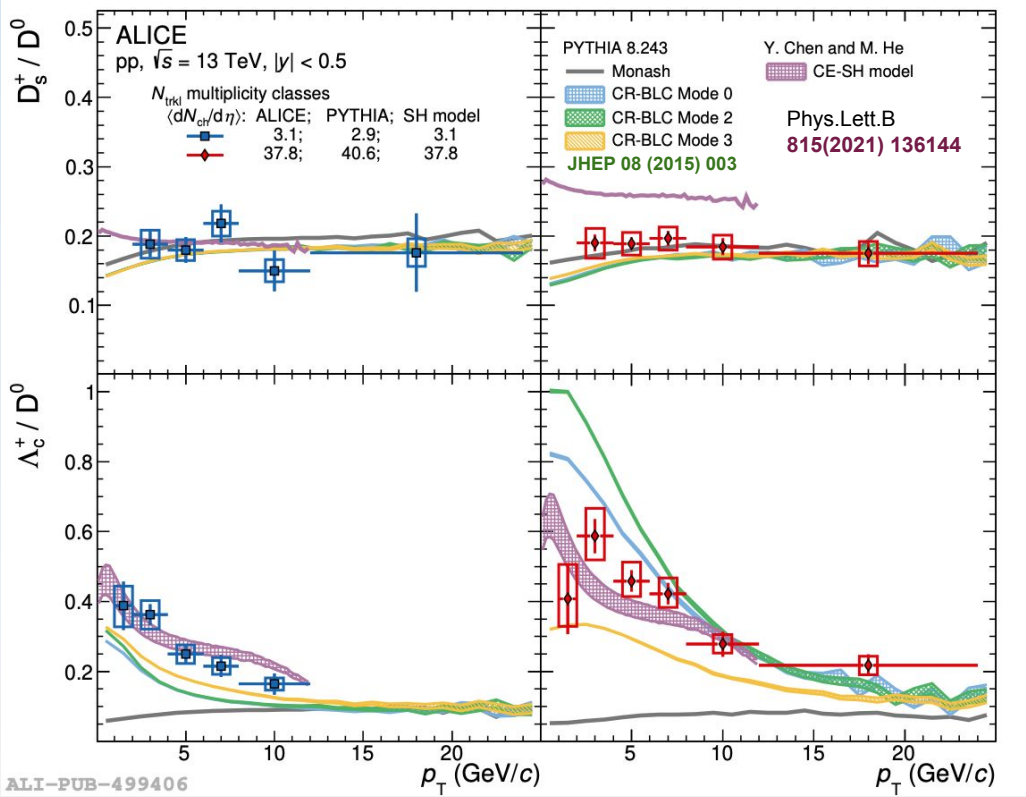
- significant enhancement in the measured p_T range between highest and the lowest multiplicity intervals.
- lowest multiplicity: still higher than measurements at e^+e^-, e^+p

Λ_c^+/D^0 ratio as function of multiplicity in p-Pb collisions:

- no significant separation between highest and lowest multiplicity intervals with the current uncertainties, but compatible with pp results, within the large uncertainties.

Comparison to Models

arXiv:2111.11948



- **Pythia Monash** fails to reproduce the shape and the multiplicity dependence of Λ_c^+/D^0.
- **Pythia with CR Beyond Leading Color (implement junctions and reconnection among strings to enhance baryon production):**
- describes qualitatively the multiplicity dependence for both Λ_c^+/D^0 and D_s^+/D^0:

- **Canonical Ensemble (CE) statistical hadronization (SH) model:** hadron abundances based on statistical hadronization model + (RQM) feed-down from augmented set of charm-baryons
  - describes Λ_c^+/D^0 but also indicates a multiplicity dependence of D_s^+/D^0 not observed in data

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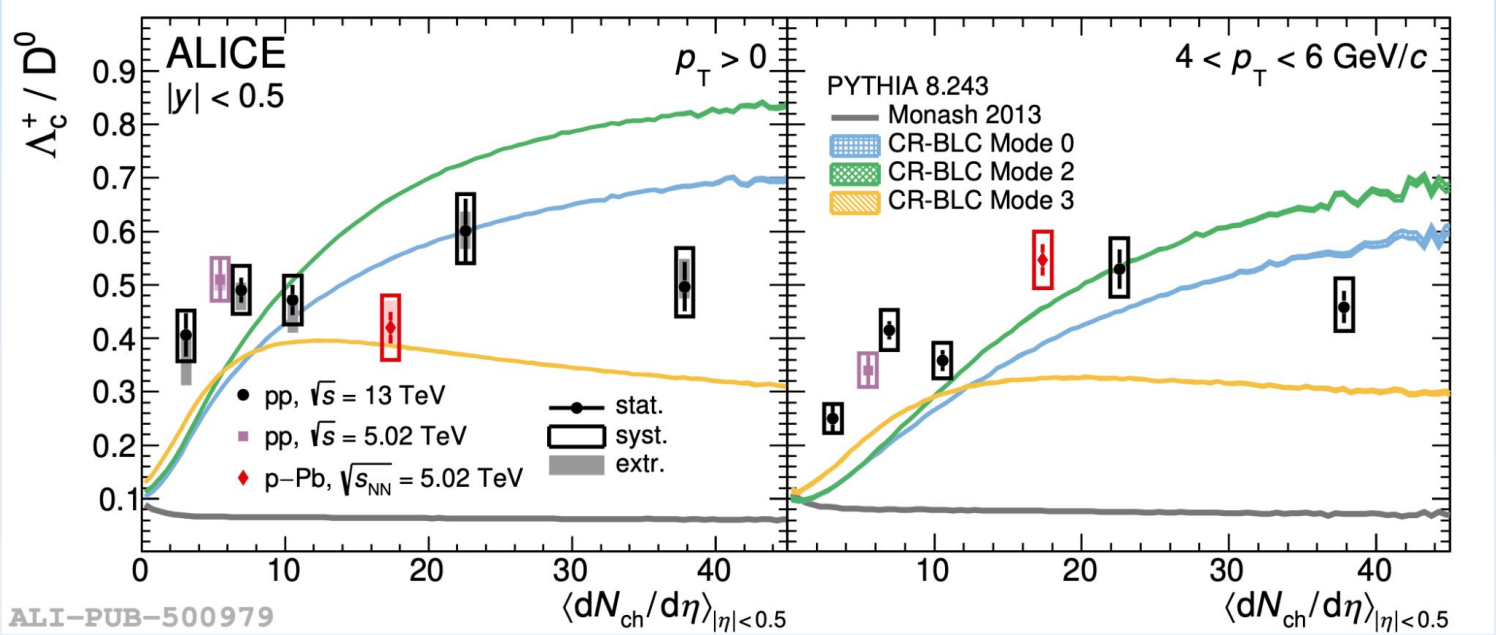
Comparison to Models



- p_T-integrated yield ratios: no significance dependence on multiplicity.
- Enhancement in the baryon-to-meson yield ratio with multiplicity in pp collisions at intermediate p_T: 4 < pt < 6 GeV/c: due to redistribution of baryons and mesons over p_T in a dense particle environment: driven by mass and parton content? radial boost in an expanding medium? coalescence?