Measurement of Ξ_c^0 via the semileptonic decay channel $\Xi_c^0 \to e^+\Xi^-\nu$ in pp and p-Pb collisions with ALICE

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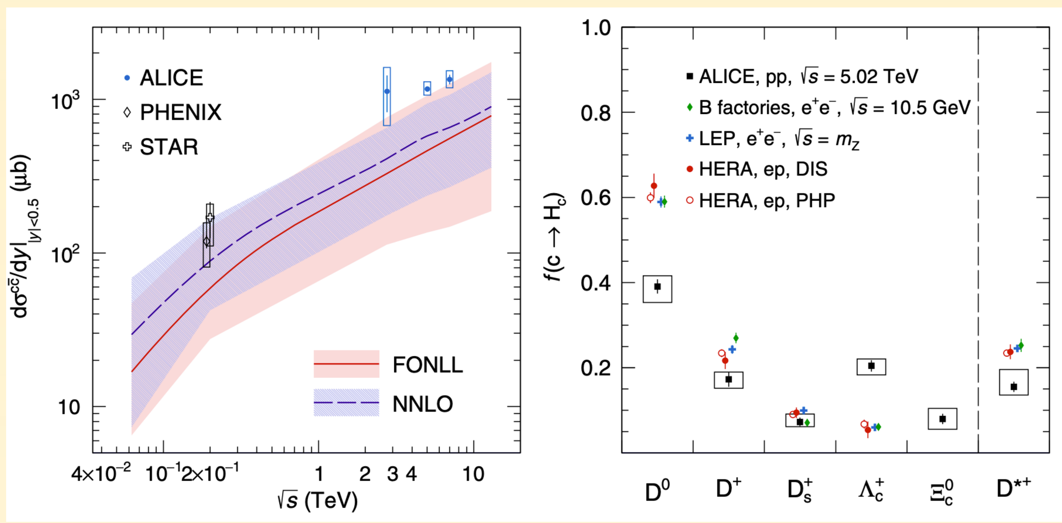
Introduction

- **Physics motivation**
  - Heavy-flavor hadron production:
    Factorization of parton distribution function
    ⊗ heavy quark production cross-section ⊗ fragmentation function
  - Meson-to-baryon ratios:
    Sensitive to fragmentation functions
  - Charm-quark fragmentation functions in pp collisions:
    a. Total charm cross-section described by pQCD calculations
    b. Higher ratio of baryon fraction than in e^+e^- or ep
    c. Clear multiplicity dependence in the Λ_c^+/D^0 ratio
    d. Question on the universality of the fragmentation function
  - Ξ_c measurements provide additional information



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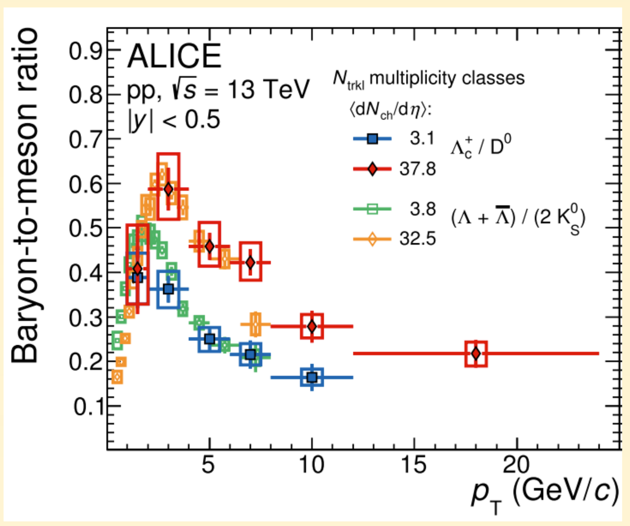

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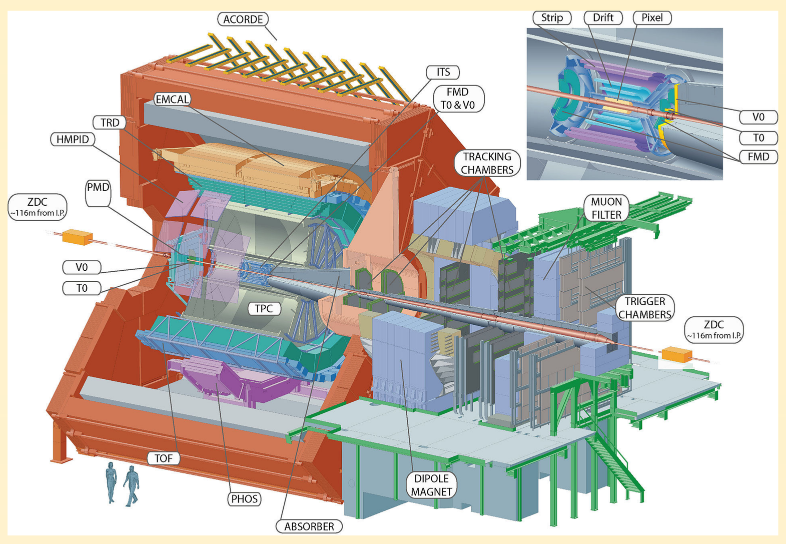
ALICE detectors and Dataset



Ongoing ALICE $\Xi_c^0 \to e\Xi\nu$ analyses			
Collision system	pp		p - Pb
√s (TeV)	13		5.02
Multiplicity	0-0.1%, 0.1%-30%, 30%-100% via V0M		MB events
Number of events	1.68 B	470 M	600 M
Observables	Ξ_c^0/D^0 (baryon-to-meson ratio)		Ξ_c^0/D^0, R_{pA}

- **ALICE detectors used in this analysis**
  - **Inner Tracking System** for tracking and vertexing
  - **Time Projection Chamber** for tracking and PID
  - **Time-Of-Flight detector** for PID
  - **V0** for trigger and multiplicity classification

- **Previous studies**
  - Ξ_c^0 measurements via both hadronic and semileptonic decay channels in minimum-bias pp collisions
  - Significantly larger Ξ_c^0/D^0 ratio than PYTHIA8 CR tunes
  - The Catania model including both coalescence and fragmentation provides a better description of data

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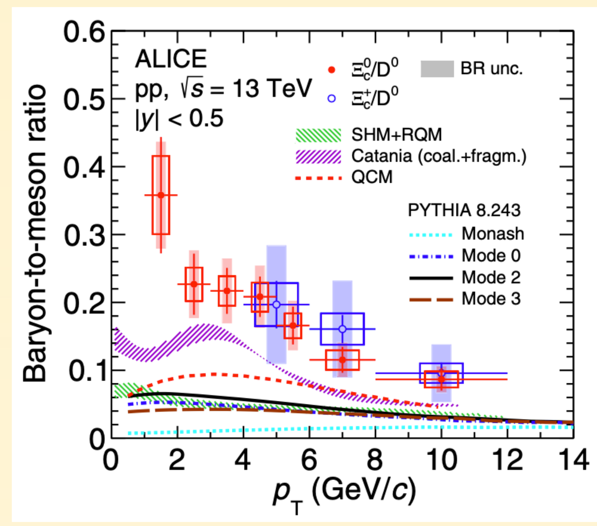
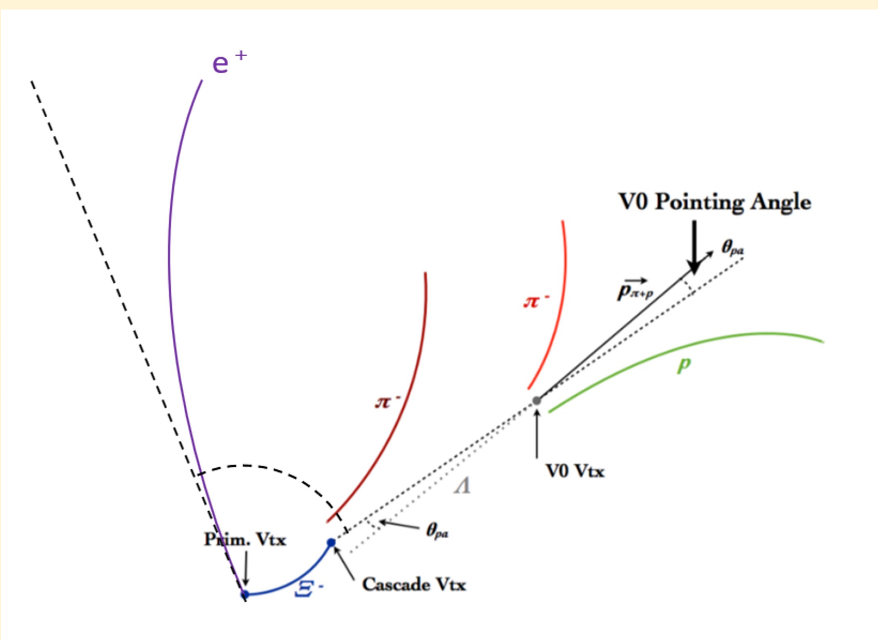


$\Xi_c^0 \to e\Xi$ measurement

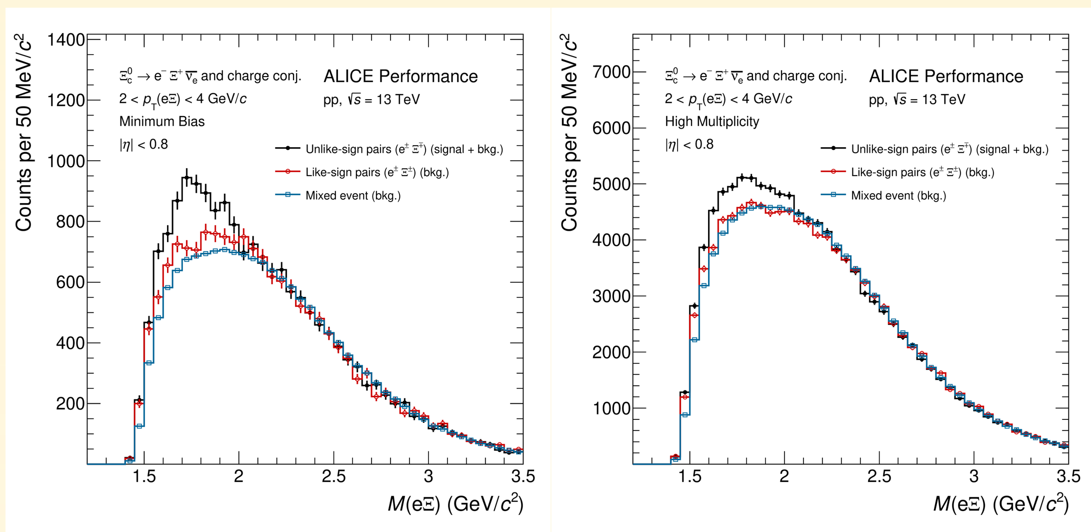


- **Target decay mode**
  - $\Xi_c^0 \to e^+\Xi^-\nu_e \to e^+(\pi^-\Lambda)\nu_e \to e^+(\pi^-(p\pi^-))\nu_e$
    and its charge conjugate

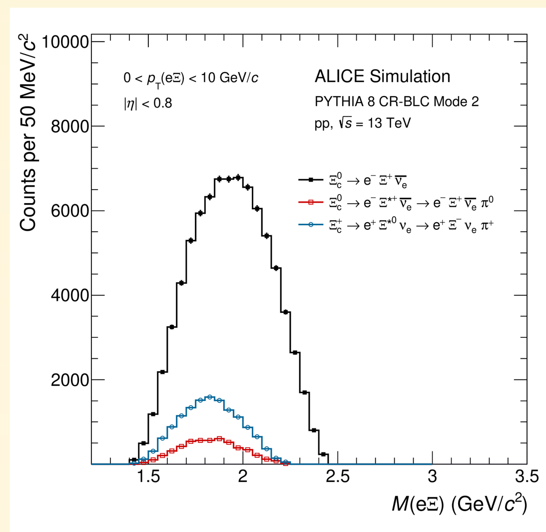
- **Analysis strategy**
  1. Reconstruct electrons and Ξ candidates
  2. Offline selection:
     a. Event classification by multiplicity
     b. Selection on the reconstructed e and Ξ by various criteria (e.g., Ξ topology)
     c. Combinatorial of e and Ξ pairs
  3. Raw Ξ_c^0 yield extraction
     a. Signal: invariant-mass distribution of unlike-sign pairs ($e^{\pm}\Xi^{\mp}$) after background subtraction
     b. Background: from like-sign ($e^{\pm}\Xi^{\pm}$) or event mixing pairs
  4. Template fit to distinguish different decay modes (details in the analysis status section)
  5. Unfolding from eΞ pair p_T to Ξ_c^0 p_T
  6. Efficiency correction exploiting PYTHIA8 + GEANT3 simulations
  7. Subtraction of b-hadron contribution
  8. Results: Ξ_c^0 production cross-section,
     Nuclear modification factor, baryon-to-meson (Ξ_c^0/D^0) ratio

Analysis Status

- **Recent development of the analysis procedure**
  - Combinatorial background estimation
    a. Like-sign pairs in the same events:
       contribution of correlated eΞ pairs from c-cbar would be different from that in unlike-sign pairs
    b. Background eΞ pairs using event mixing technique, normalized at high mass region (eΞ mass>2.5 GeV/c^2)
  - Separation of different semileptonic decay modes
    a. 3-body decay mode: $\Xi_c^0 \to e^+\Xi^-\nu_e$
    b. 4-body decay mode including Ξ* decaying to Ξ and π: smaller eΞ pair mass than the 3-body decay mode
    c. Template fit using PYTHIA8 simulations to obtain the relative contributions



eΞ mass distributions
for MB and HM collisions in pp collisions



eΞ mass distributions for
3- and 4-body decay modes
in PYTHIA8

Outlook

- **Analysis of Ξ_c^0 via the semileptonic channel $\Xi_c^0 \to e^+\Xi^-\nu$ is ongoing in pp ($\sqrt{s}$=13 TeV) and p-Pb ($\sqrt{s_{NN}}$=5.02 TeV) collisions**
  - The analysis procedure is well established and will be completed in the upcoming months
  - Multiplicity-dependent Ξ_c^0/D^0 ratio in pp collisions and nuclear modification faction in p-Pb collisions will be measured for a detailed investigation of charm hadron fragmentation