Multiplicity dependent Ξ_c^0 measurement via semileptonic decay in collisions of pp at $\sqrt{s}$ = 13 TeV and p–Pb at $\sqrt{s_{NN}}$ = 5.02 TeV with ALICE

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for the ALICE Collaboration

1. Introduction

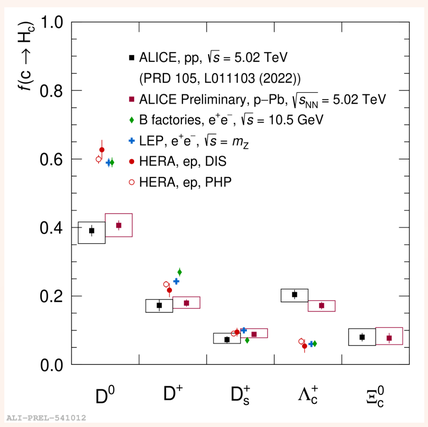
- **Describing heavy-flavor production**
  - Factorization approach:

$$\frac{d\sigma^{pp\to Hq}}{dp_T} = f_i(x_1, \mu_f^2) f_j(x_2, \mu_f^2) \times \frac{d\sigma^{ij\to q}}{dp_T}(x_1, x_2, \mu_f^2) \times D_{q\to Hq}\left(z_q = \frac{p_{Hq}}{p_q}, \mu_f^2\right)$$

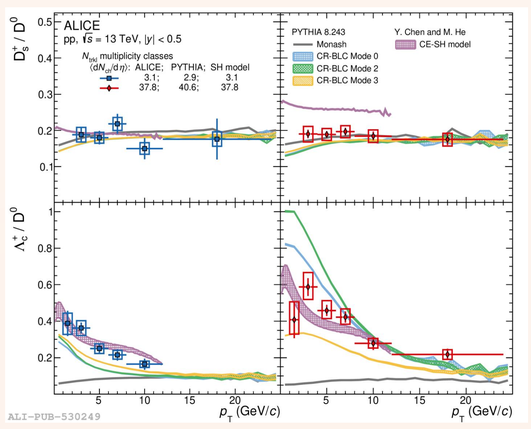
Parton distribution functions (PDFs) | Hard scattering cross section (via pQCD) | Fragmentation function (hadronization)

  - Fragmentation function (FF):
    a. Parameterized from e^+e^- and e^-p collisions
    b. Assumed to be universal and independent of collision systems
    c. Baryon-to-meson ratio provides sensitive info

- **Questioning the universality of the FF**
  - Meson-to-meson ratio: consistent with e^+e^- and e^-p
  - Baryon-to-meson ratio:
    a. Significant p_T dependence in Λ_c^+, Ξ_c^0, and Ξ_c^+
    b. Significant enhancement compared to e^+e^- and e^-p
    c. Further information accessible via multiplicity classification



PRD105, L011103 (2022)



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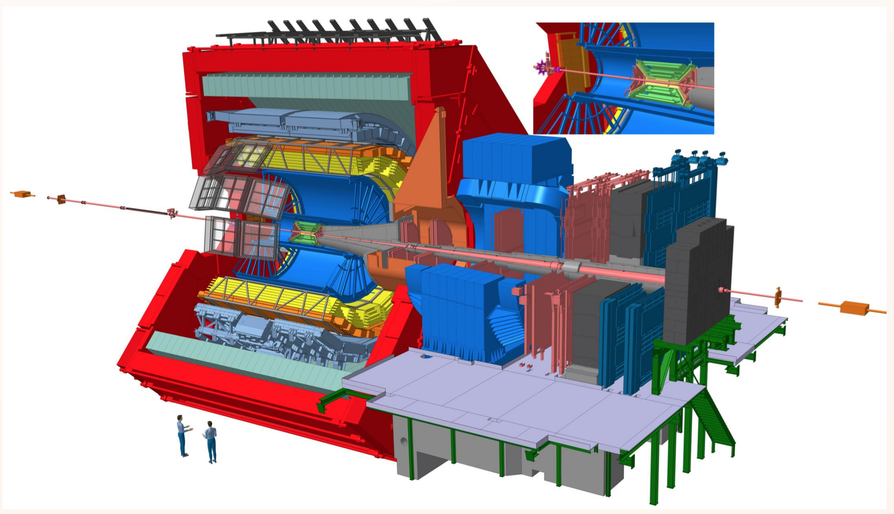
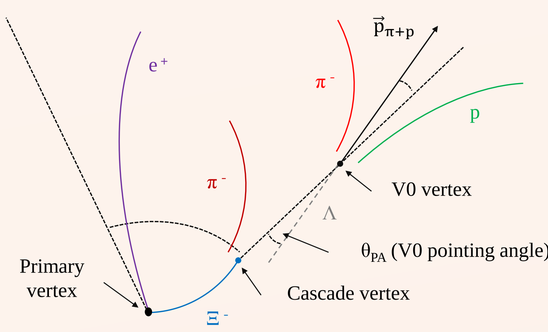
2. ALICE detector in Run 2



- **ALICE subsystems relevant to this analysis**
  - TPC (Time Projection Chamber): tracking, PID† via dE/dx
  - ITS (Inner Tracking System): tracking and vertexing
  - TOF (Time of Flight): PID via time-of-flight measurement
  - V0: triggering, centrality

†Particle identification

3. $\Xi_c^0 \to e\Xi\nu$ measurement

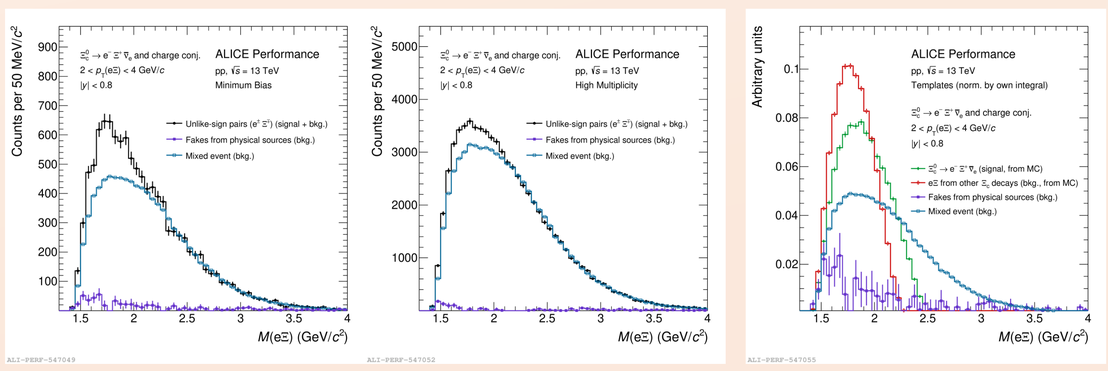


Ongoing ALICE $\Xi_c^0 \to e\Xi$ analyses			
Collision system	pp		p–Pb
$\sqrt{s}$ (TeV)	13		5.02
Trigger	HM	MB	MB
Multiplicity (%, via V0M)	0-0.1	0.1-30 / 30-100	Inclusive
L_{int}	~32 nb^{-1} (MB)		~287 μb^{-1}
Observable	Ξ_c^0/D^0		Ξ_c^0/D^0, R_{pPb}

- **Target channel and Analysis strategy**
  - Target: $\Xi_c^0 \to e^+\Xi^-\nu_e \to e^+(\pi^-\Lambda)\nu_e \to e^+(\pi^-(p\,\pi^-))\nu_e$ and its charge conjugate
  - Analysis strategy:
    1. Collect electrons and Ξ candidates
    2. Offline selection:
       a. Multiplicity classification
       b. Build eΞ pairs by using collected e and Ξ candidates
    3. Signal extraction via "template fit"
    4. Follow-up corrections:
       a. Unfolding: convert eΞ $p_T \to \Xi_c^0$ p_T, recover momentum of missing ν
       b. Acc. × eff., b-hadron contribution...
    5. Get final observables: production cross section, Ξ_c^0/D^0, and R_{pPb}

4. Status of the analysis

- **Analysis procedure**
  - Define signal and background (BG)
    a. Signal: eΞ pairs from $\Xi_c^0 \to e\Xi\nu$
    b. Total BG = Combinatorial BG + Physical BG + 4-body BG
       b-1. Combinatorial BG: general BG introduced during analysis
       b-2. Physical BG: fake eΞ pairs from other physical process (e.g., jet)
       b-3. 4-body BG: eΞ pairs from decay modes other than $\Xi_c^0 \to e\Xi\nu$
  - Obtain templates for signal extraction
    a. Signal: using MC
    b. Combinatorial BG: data-driven approach via mixed event
    c. Physical BG: data-driven approach via like-sign – mixed event
    d. 4-body BG: using MC
  - Final signal extraction:
    perform template fit to unlike-sign eΞ pair distribution



5. Outlook

- **$\Xi_c^0 \to e\Xi\nu$ analysis with ALICE**
  - For pp @ $\sqrt{s}$ = 13 TeV (vs. multiplicity) and for p–Pb @ $\sqrt{s_{NN}}$ = 5.02 TeV
  - The analysis procedure is well defined and under final tune
  - Multiplicity-dependent analysis will provide further hint to the question on the universality of FF