Ω_c^0 production in pp collisions at $\sqrt{s} = 13$ TeV with ALICE

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Heavy-flavor quarks

$m_c \simeq 1.3\ \mathrm{GeV}/c^2, m_b \simeq 4.2\ \mathrm{GeV}/c^2 \gg T_{pc}, \Lambda_{QCD}$ (T_{pc}: pseudocritical temperature)

- Heavy quarks (beauty, charm) are mainly produced via hard partonic scattering processes
- The mass of heavy quarks sets a perturbative scale, which can be computed with perturbative QCD (pQCD)

Exploited decay channels

(c. c.: charge conjugate)

$\mathbf{\Omega_c^0(ssc) \to e^+\Omega^-\nu_e \to e^+(K^-\Lambda)\nu_e \to e(Kp\pi)\nu_e + c.c.}$

$\mathbf{\Omega_c^0(ssc) \to \pi^+\Omega^- \to \pi^+(K^-\Lambda) \to \pi(Kp\pi) + c.c.}$

- Provide a value of BR($\Omega_c^0 \to e^+\Omega^-\nu_e$)/BR($\Omega_c^0 \to \pi^+\Omega^-$)

ALICE Detector

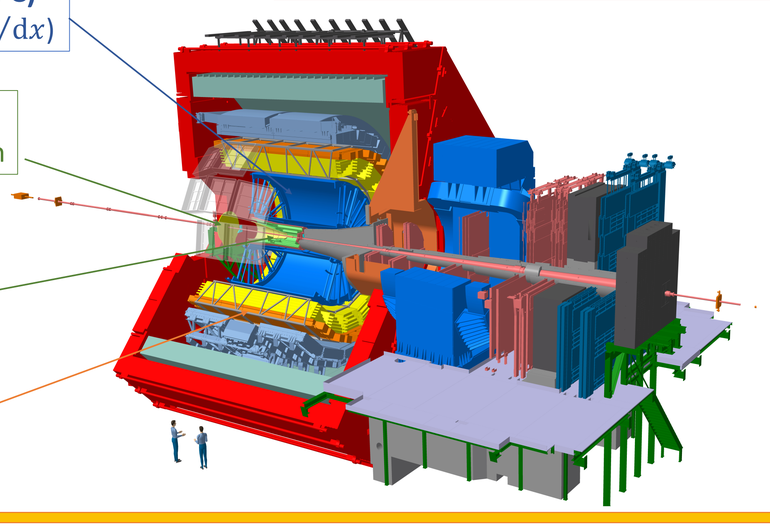
Data sample (Run 2)
pp, $\sqrt{s} = 13$ TeV, 1840 MB events
Luminosity: $L_{\mathrm{int}} = 32.8 \pm 0.51\ \mathrm{nb}^{-1}$

Time Projection Chamber (TPC)
Tracking, PID via energy loss ($\mathrm{d}E/\mathrm{d}x$)

V0 detector
Triggering, event characterisation

Inner Tracking System (ITS)
Tracking and vertexing

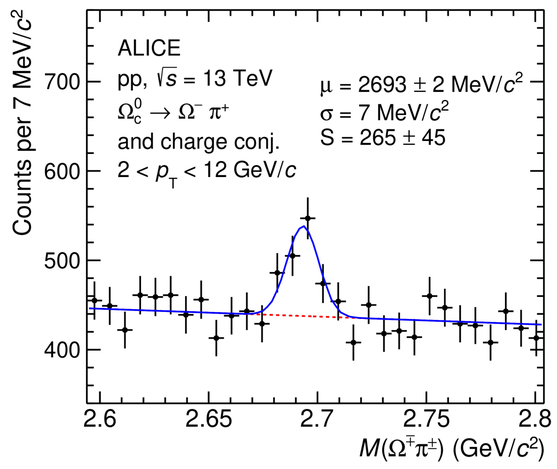
Time-of-flight (TOF) detector
PID via time of flight

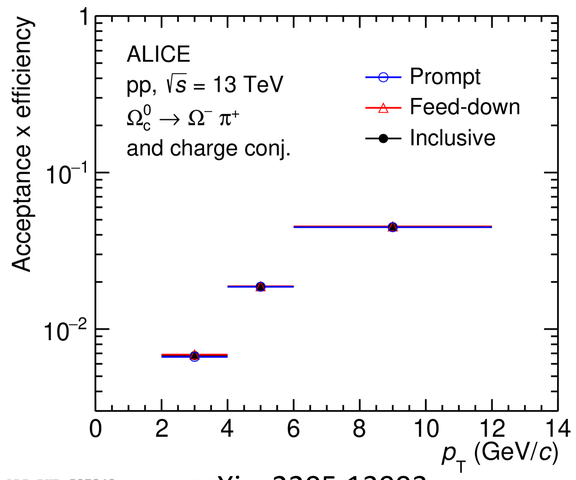


PID: Particle Identification

Decay channel: hadronic

- The Kalman filter is used to reconstruct the Ω_c^0
- A machine learning algorithm based on the Boosted Decision Tree (BDT) is adopted to reduce combinatorial background
- Signal extraction from fit to invariant-mass distribution
- Raw yield corrected for acceptance and efficiency of inclusive Ω_c^0

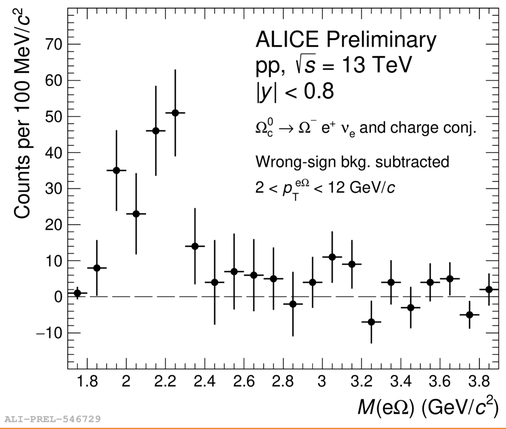




arXiv: 2205.13993

Decay channel: semileptonic

- The Ω_c^0 candidates are built from $e^+\Omega^-$ pairs
  - Electrons are identified using the $\mathrm{d}E/\mathrm{d}x$ measurement in the TPC and the time-of-flight measurement of the TOF detector
  - The Kalman filter is used to reconstruct the Ω^-
- The raw yield is extracted by subtracting the wrong sign ($e^{\pm}\Omega^{\pm}$) from the right sign ($e^{\pm}\Omega^{\mp}$) invariant-mass distribution



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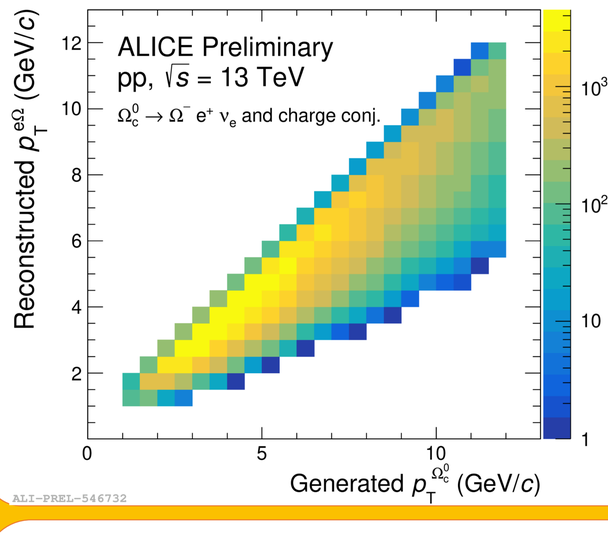
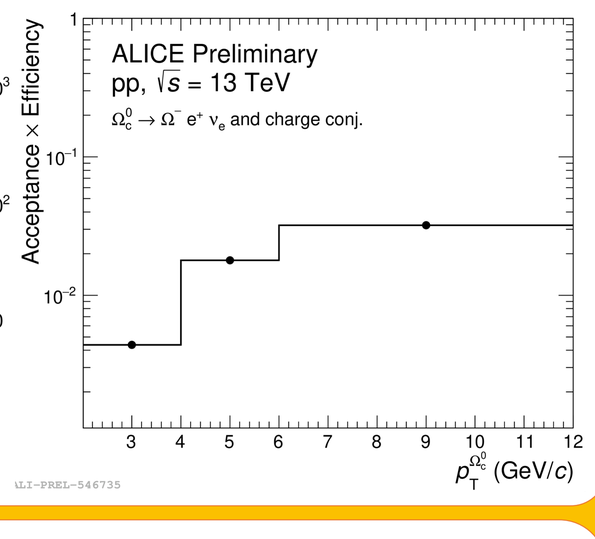
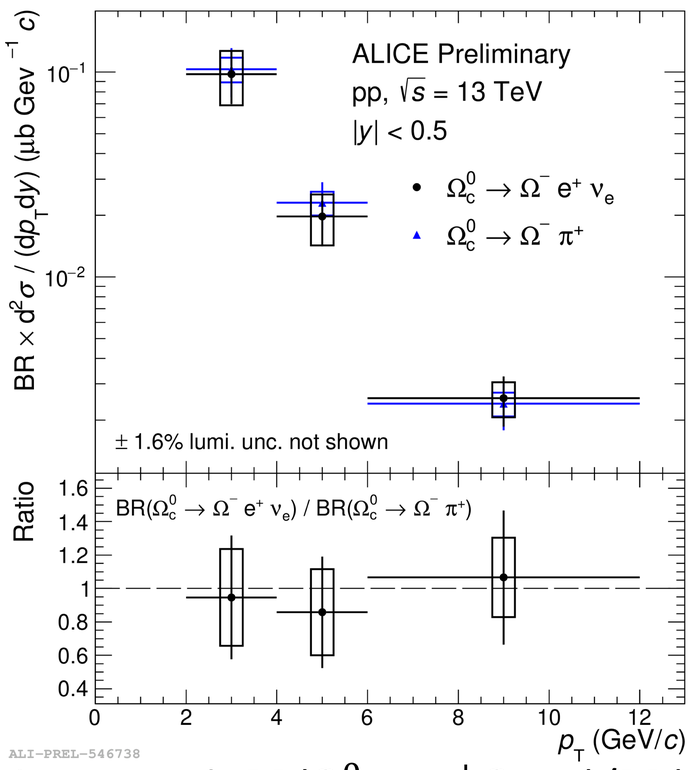
  - The Kalman filter is used to reconstruct the Ω^-
- The Bayesian unfolding technique is used to correct for the missing neutrino momentum
  - Correlation between the p_{T} of the Ω_c^0 baryon and the reconstructed $e^+\Omega^-$
- The unfolded yield is corrected for acceptance and efficiency



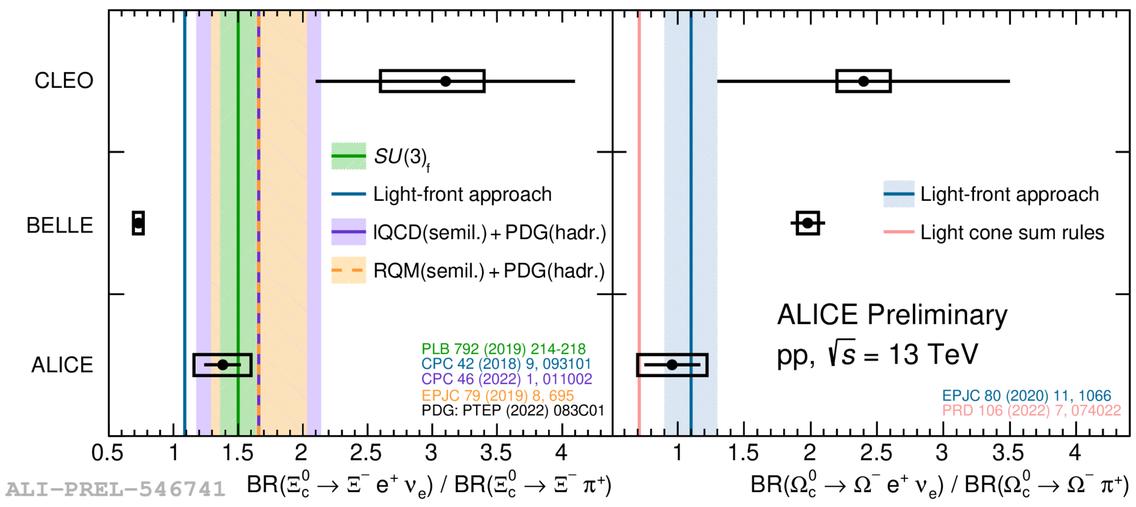


Results

- Measurement of Ω_c^0 spectrum $2 < p_{\mathrm{T}} < 12$ GeV/c
- The ratio of BR($\Omega_c^0 \to e^+\Omega^-\nu_e$)/BR($\Omega_c^0 \to \pi^+\Omega^-$) is calculated



- Preliminary result BR($\Omega_c^0 \to e^+\Omega^-\nu_e$)/BR($\Omega_c^0 \to \pi^+\Omega^-$)
  - 0.96 ± 0.21 (stat.) ± 0.28 (syst.)
  - ALICE is compatible within 2.7σ with the more precise Belle measurement PRD 105, L091191 (2022)
  - ALICE is also consistent with theory calculations
- Future Run 3 data samples will allow to reduce systematic and statistical uncertainties



Acknowledgement

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