Contribution ID: **75** Type: **20 min.**

Production of $\overline{\Sigma}^{\pm}$ baryons in p–Pb and pp collisions at the LHC with ALICE

Monday 15 September 2025 14:20 (20 minutes)

The enhancement of strangeness production has long been considered as a signature of quark–gluon plasma (QGP) formation in heavy-ion collisions. While extensive measurements have refined this idea over time, Σ hyperons remain experimentally unexplored at the LHC energies. In this study, we present the first measurements of the transverse momentum (p_{T}) spectra and integrated yields of $\overline{\Sigma}^{\pm}$ hyperons in pp and p–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV using the ALICE detector. The analysis leverages the previously unexplored decay channel $\overline{\Sigma}^{\pm} \to \overline{n}\pi^{\pm}$, employing a novel method for antineutron reconstruction with the PHOS electromagnetic spectrometer.

The $\overline{\Sigma}^{\pm}$ p_{T} spectra, measured in the range $0.5 < p_{\mathrm{T}} < 3$ GeV/c, are compared with predictions from PYTHIA 8, DPMJET, PHOJET, EPOS LHC, and EPOS4. Among these, EPOS LHC and EPOS4 provide the best agreement with the data in both collision systems, while models neglecting multiparton interactions exhibit significant discrepancies at high p_{T}. The total yields of $\overline{\Sigma}^{\pm}$ are also compared with Thermal-FIST and dynamical model predictions, all of which reproduce the measured yields within uncertainties.

Additionally, the nuclear modification factors (R_{pPb}) for $\overline{\Sigma}^{+}$ and $\overline{\Sigma}^{-}$ are evaluated and compared with those of protons, Λ, and Ξ hyperons, as well as EPOS LHC and EPOS4 predictions. No significant deviations from model expectations or other hadron measurements are observed, supporting consistency with current theoretical frameworks.

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Session Classification: Relativistic heavy ion collisions

Track Classification: Relativistic heavy ion collisions