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Observation of the charm baryon Λ_c with ALICE at the LHC and perspectives for future measurements with the ALICE upgrade

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ALICE is the LHC experiment dedicated to the study of the Quark-Gluon Plasma (QGP) in Pb-Pb collisions. Heavy quarks are very powerful probes to explore the QGP formation and its properties, since they are abundantly produced at LHC energies and they experience the entire evolution of the medium.

The measurement of the Λ_c yield relative to D mesons in Pb-Pb collisions would address the baryon over meson ratio in the heavy-quark sector. In pp and p-Pb collisions, the measurement of the Λ_c production cross-section provides the necessary baseline to understand the results from heavy-ion collisions and improves the precision of the measurement of the total charm cross section.

This baryon is observed with the present detector in pp and p-Pb collisions in the decay channel $\Lambda_c^+ \rightarrow pK^- \pi^+$.

Given the small displacement of the Λ_c secondary vertex from the interaction vertex (Λ_c mean proper decay length $c\tau = 60 \mu\text{m}$), the charm baryon is reconstructed using mainly kinematical selections and exploiting the ALICE particle identification capabilities.

However, the observation of Λ_c in Pb-Pb collisions is very challenging with the present detector, because of the large combinatorial background and because the mean proper decay length of the Λ_c is smaller than the present vertex resolution for the Λ_c decay, reconstructed from the three daughter tracks. An upgrade of the ALICE detector, including a new Inner Tracking System (ITS) is scheduled for the second long shutdown of the LHC. The new ALICE apparatus will provide improved resolution on the track impact parameter (by about a factor of 3) and will allow us to record data with higher rate. These new features will enable us to measure rare probes in Pb-Pb collisions, such as the Λ_c . Simulation studies, based on a detailed description of the new ITS, indicate that the measurements of the Λ_c nuclear modification factor and azimuthal anisotropy will become possible with the integrated luminosity of 10 nb^{-1} , which is the target of the ALICE programme after the upgrade.

We present the analysis strategy to observe the Λ_c signal in various p_T intervals in pp collisions at $\sqrt{s} = 7 \text{ TeV}$ and p-Pb collisions at $\sqrt{s} = 5.02 \text{ TeV}$, together with the perspectives for the measurements in Pb-Pb with the upgraded ITS.

On behalf of collaboration:

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