1. Physics motivation

- Charm and beauty quarks are valuable probes to study the properties of the Quark-Gluon Plasma created in ultra-relativistic Pb-Pb collisions.
- Measurements in Pb-Pb collisions are crucial to investigate Cold Nuclear Matter (CNM) effects and distinguish them from hot nuclear matter effects present in Pb-Pb collisions. Relevant CNM effects include: shadowing, gluon saturation, kT-broadening, initial- and final-state energy loss as well as possible hot-medium like effects.
- The nuclear modification factor \( R_{\text{pPb}} \) is used to quantify CNM effects: \( R_{\text{pPb}} = \frac{d^2\sigma_{\text{pPb}}/d\eta dy}{d^2\sigma/\text{pPb}/d\eta dy} \), where \( A = 208 \) is the Pb mass number.

2. \( D^{*+} \) Reconstruction in ALICE

- \( D^{*+} \) reconstruction at central rapidity via the hadronic decay channel: \( D^{*+} \to D^0 \pi^+ \to K^{-}\pi^+\pi^+ \).
- B.R. of 67.7 ± 0.5 % (\( D^{*+} \to D^0 \pi^+ \)) and 3.93 ± 0.04% (\( D^\ast^+ \to K^{-}\pi^+\pi^+ \)) [1].

Analysis based on:

- Tracking information via ① Inner Tracking System and ③ Time Projection Chamber
- Selection of \( D^{*+} \) decay vertices displaced from the interaction vertex.
- Combination with pion tracks (down to very low \( p_T \)).
- Particle identification via the TPC and ⑤ Time-Of-Flight to reduce combinatorial background.

3. Analysis Method:

- \( D^{*+} \) meson raw yield extracted via fit to the invariant mass difference \( M(M^-\pi^+\pi^+) - M(K^-\pi^+\pi^+) \) distributions [2].
- Acceptance and selection efficiency correction from Monte Carlo simulations [2] and feed-down (D meson from beauty-hadron decays) correction based on FONLL calculations.

4. Production cross sections in pp collisions at various energies and ratios between different energies

- Data Samples
  - \( p \bar{p} \): \( \sqrt{s} = 5 \) TeV, \( \sqrt{s} = 7 \) TeV, \( \sqrt{s} = 13 \) TeV, \( \sqrt{s} = 5, 8, 7 \) and 13 TeV
  - \( pPb \): \( \sqrt{s_{NN}} = 5 \) and 8 TeV are measured in \( \sqrt{s_{NN}} = 5, 8, 7 \) and 13 TeV

- The larger data p-Pb sample collected during the LHC run 2 allows:
  1. Extension of the cross section measurement up to \( p_T = 36 \) GeV/c
  2. Reduction of the uncertainties on the measurement by a factor \( \sim 2 \) w.r.t. Run 1 results.
  3. Improved precision on the \( R_{\text{pPb}} \) using the measured cross section in pp collisions at 5.02 TeV.

- The \( R_{\text{pPb}} \) is consistent with unity within uncertainties.
  - The current precision of the model calculations and of the measurement does not allow us to conclusively distinguish scenarios with only CNM effects and those including also hot-medium effects in p-Pb collisions.
  - The data disfavor a suppression larger than 15% at high \( p_T \).

5. p-Pb results

- The larger data p-Pb sample collected during the LHC run 2 allows:
  1. Extension of the cross section measurement up to \( p_T = 36 \) GeV/c
  2. Reduction of the uncertainties on the measurement by a factor \( \sim 2 \) w.r.t. Run 1 results.
  3. Improved precision on the \( R_{\text{pPb}} \) using the measured cross section in pp collisions at 5.02 TeV.

- The \( R_{\text{pPb}} \) is consistent with unity within uncertainties.

References