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Heavy-flavour azimuthal correlations in *pp* and *p*-Pb collisions with ALICE

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Summary. — Azimuthal correlation studies of heavy-flavour particles with charged particles in *pp* collisions are powerful tools to characterize the charm fragmentation process. Comparisons of *pp* and *p*-Pb measurements of heavy quarks hadronization products allow us to investigate how cold nuclear matter effects could affect the heavy-quark hadronization process. We present ALICE measurements of azimuthal correlations of prompt D-mesons with charged hadrons in *pp* collisions at $\sqrt{s} = 7\,\mathrm{TeV}$ and *p*-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02\,\mathrm{TeV}$.

1. – Introduction

The study of heavy-flavour production in *pp* collisions at LHC energies allows us to test perturbative QCD calculations and provides a reference for studies in heavy-ion collisions. Measurements in p-Pb collisions help to characterize the effects due to the presence of a nucleus in the collision (cold nuclear matter effects). ALICE has provided measurements of p_{T}-differential cross-sections for D-meson production at central rapidity in *pp* [1-3] and *p*-Pb [4] collisions, and of the nuclear modification factor, $R_{p\mathrm{Pb}}$ (*i.e.*, the ratio of the cross-section in *p*-Pb collisions to that measured in *pp* interactions scaled by the mass number of the Pb nucleus). More differential measurements of the charm production in *pp* and *p*-Pb collisions can provide further insight on the above topics. Moreover, the analysis of angular correlations between heavy-flavour particles and charged particles is a tool to characterize the heavy-quark fragmentation process and is sensitive to their production mechanism. Differences between the measurements in *pp* and *p*-Pb collisions can give an insight into the cold nuclear matter effects on heavy-quark production and hadronization in *p*-Pb collisions.

2. – Angular correlations of D-mesons with charged particles

Azimuthal correlation distributions of D^0, D^{*+} and D^+ mesons (trigger particles reconstructed from their hadronic decay channels: $D^0 \to K^-\pi^+$, $D^+ \to K^-\pi^+\pi^+$ and

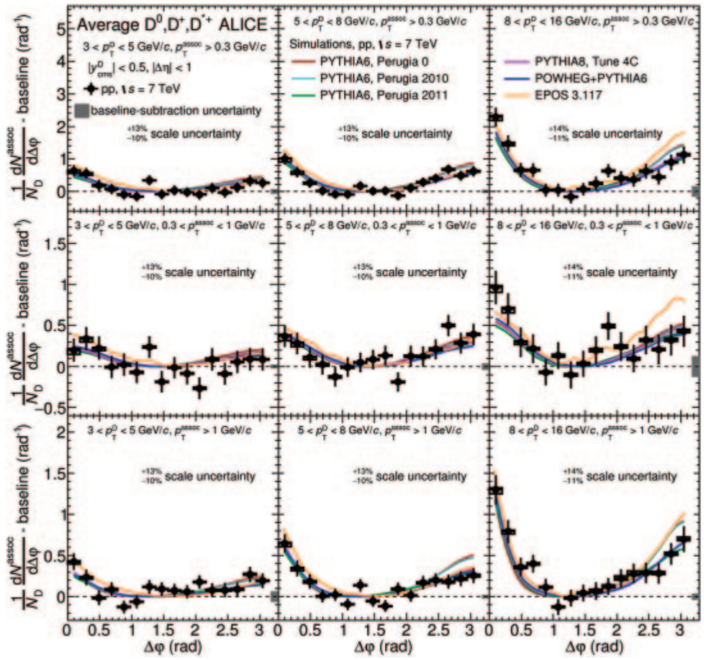

Fig. 1. – Comparison of D-meson-charged particle azimuthal correlation distributions in pp collisions at $\sqrt{s} = 7\,\mathrm{TeV}$ with predictions from Monte Carlo simulations, for different D-meson and associated particle p_{T} ranges [6].

$D^{*+} \to D^0\pi^+$) with charged particles (associated particles) in $|\eta| < 1$ are evaluated in pp collisions at $\sqrt{s} = 7\,\mathrm{TeV}$ and p-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02\,\mathrm{TeV}$, for different ranges of the D-meson p_{T} ($3 < p_{\mathrm{T}}(D) < 16\,\mathrm{GeV}/c$ in pp, $5 < p_{\mathrm{T}}(D) < 16\,\mathrm{GeV}/c$ in p-Pb) and associated particle p_{T} (starting from $p_{\mathrm{T}}(\mathrm{assoc}) > 0.3\,\mathrm{GeV}/c$). The contribution of the D-meson combinatorial background is removed by subtracting the correlation distribution evaluated from the sidebands of the D-meson invariant-mass distribution. An event-mixing correction is applied to account for detector inhomogeneities and limited acceptance. The distributions are corrected for inefficiencies in the reconstruction and selection of trigger and associated particles. The contribution of D-mesons from beauty-hadron decays is subtracted, using templates of the angular correlations of feed-down D-mesons and charged particles obtained from PYTHIA simulations [5]. The azimuthal correlation distributions of D^0, D^{*+} and D^+ mesons are compatible within uncertainties. A weighted average of the three D-meson measurements is thus performed to reduce the statistical uncertainty. The per-trigger azimuthal correlation distributions are fitted with two Gaussian functions, to account for the correlation peaks in the near-side ($\Delta\phi = 0$) and away-side ($\Delta\phi = \pi$), and a constant (baseline), allowing us to extract quantitative observables such as the near-side associated yield, near-side peak width and baseline. Figure 1 [6] compares the baseline-subtracted D-meson-charged particle azimuthal correlation distributions extracted in pp collisions at $\sqrt{s} = 7\,\mathrm{TeV}$ with predictions by PYTHIA6 [5], PYTHIA8 [7], POWHEG+PYTHIA6 [8, 9] and EPOS simulations, as a function of the D-meson p_{T}, for different associated particle p_{T} ranges. The distributions obtained with the different generators and tunes do not show significant differences.

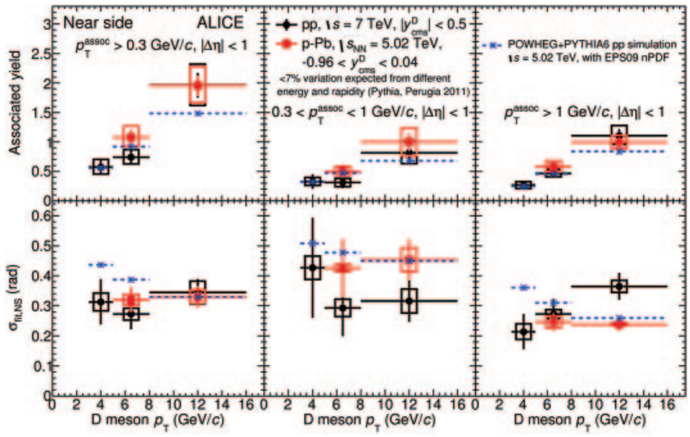

Fig. 2. – Comparison of near-side associated yields and widths extracted in pp and in p-Pb collisions and predicted by POWHEG+PYTHIA6 simulations as a function of the D-meson p_T for different associated particle p_T ranges [6].

The trends of the near-side associated yields and the near-side peak widths extracted in pp and p-Pb collisions *vs.* the D-meson p_T are compared in fig. 2 for different associated particle p_T ranges. Compatible values of the near-side observables are obtained in pp and p-Pb collisions. No modifications of the near-side peaks due to cold nuclear matter effects are observed in p-Pb collisions within the current uncertainties. Predictions by POWHEG+PYTHIA6 simulations, including nuclear shadowing effects for the nucleon PDFs, are also in agreement with the measurements.

3. – Summary

The D-meson-charged particle azimuthal correlation distributions, measured in pp and p-Pb collisions, as well as observables describing near-side peak properties extracted from their fits, are in agreement with each other within uncertainties, and are well described by PYTHIA, POWHEG+PYTHIA6 and EPOS Monte Carlo simulations.

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