Measurement of azimuthal correlations of D mesons with charged particles in pp collisions at $\sqrt{s} = 13$ TeV with ALICE at the LHC

Bharati Naik (For the ALICE Collaboration)[*][†]

Indian Institute of Technology Bombay, Mumbai, India
E-mail: bharati.naik@cern.ch

The ALICE (A Large Ion Collider Experiment) detector at the LHC (Large Hadron Collider) is designed to study the properties of Quark-Gluon Plasma (QGP), a deconfined state of quarks and gluons produced in ultrarelativistic heavy ion collisions. The heavy quarks (charm and beauty) are produced in the initial stages of the collisions due to their large masses. Hence, they experience the evolution of the hot and dense medium created and act as an effective probe for its understanding.

The study of angular correlations between D mesons and charged particles in different collision systems provides information about the possible medium-induced modification of charm quark fragmentation into jets. In pp collisions, this measurement allows the study of the production mechanisms, fragmentation and hadronization of charm quarks. In addition, it acts as a reference for p–Pb and Pb–Pb systems.

In this article, the measurement of azimuthal correlations between D^0 meson and charged particles in pp collisions at $\sqrt{s} = 13$ TeV will be presented. The data will also be compared with simulations results performed with different event generators.

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[*]Speaker.

[†]A footnote may follow.

1. Introduction

The primary detectors used for the analysis are: ITS (Inner-Tracking-System) for tracking and vertexing, TPC (Time-Projection-Chamber) for particle tracking, TOF (Time-Of-Flight) for particle identification, and the V0 detector for triggering and multiplicity. The ALICE detector and its performance are described in more detail in [1, 2]. The D (D^0, D^+, D^{*+}) mesons and their charge conjugates are fully reconstructed at mid-rapidity from their hadronic decay channels and the D meson raw yields are extracted by fitting the invariant-mass distribution of the candidates. Then, each selected D meson is correlated with charged tracks produced in the collision with pseudorapidity $|\eta| < 0.8$ (excluding the daughter particles) to build the correlation distributions ($\Delta\eta$, $\Delta\varphi$). The correlation distribution is corrected by the different techniques as described in [3]. Finally, results of the three D meson species are averaged, and a fit is performed with a function composed of two Gaussian (one for the "near-side" peak at $\Delta\varphi \sim 0$ and one for the "away-side" peak at $\Delta\varphi \sim \pi$) and a constant term (baseline) to characterize the charm jet-induced correlation peaks.

2. Results

In Fig. 1 left and right side, the $\Delta\varphi$ distribution after the baseline subtraction, near-side peak associated yield, width and baseline values measured in pp collisions at $\sqrt{s} = 13$ TeV are compared with the expectations from Monte Carlo simulations with different event generators. The models reproduce the data well on the near-side for all the kinematic intervals. On the away-side POWHEG+PYTHIA6 and PYTHIA8 are closer to the data than PYTHIA6.
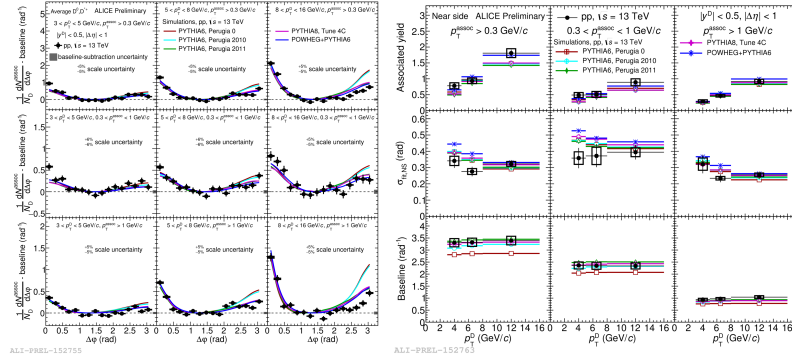
Figure 1: (Left) Comparison of $\Delta\varphi$ correlation distributions of data and Monte Carlo simulations performed with different event generators, after the baseline subtraction (Right) Comparison of near-side peak associated yield (top row), near-side peak width (middle row) and baseline (bottom row) values of data and Monte Carlo simulations with different event generators, in pp collisions at $\sqrt{s} = 13$ TeV.

References

[1] ALICE Collaboration, K. Aamodt *et al.*, JINST **3** S08002, (2008)

[2] ALICE Collaboration, B. Abelev *et al.*, Int. J. Mod. Phys. A **29**, 1430044, (2014)

[3] ALICE Collaboration, J. Adam *et al.*, Eur. Phys. J. C **77**, 245 (2017)