Measurement of D^+-hadron azimuthal correlations in pp collisions at $\sqrt{s} = 7$ TeV with ALICE

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Introduction

ALICE (A Large Ion Collider Experiment) is specifically optimized for the study of heavy ion collisions at the LHC [1]. In these collisions a state of matter consisting of deconfined and strongly interacting quarks and gluons (Quark Gluon Plasma) is formed. Due to their large masses, heavy quarks are predominantly produced via hard scatterings in the initial phase of the collision. While interacting with the medium, they lose energy via both collisional and radiative processes as supported by several measurements, among which is the observation of the suppression of D meson production for $p_T > 4$ GeV/c in central Pb-Pb collisions with respect to pp collisions. A larger energy loss is expected for partons with larger path length in the medium. **Azimuthal correlations** between particles from heavy−flavour hadrons (or they decay products) and charged hadrons are sensitive to the path length dependence of heavy-quark energy loss. With this objective, we report the study of D^+-hadron azimuthal correlations in pp collisions at $\sqrt{s} = 7$ TeV. Besides providing the necessary reference for future studies in Pb-Pb collisions, this measurement can give information on charm parton shower properties. D^+ **mesons** ($c\bar{d}$, mass = 1869.62 ± 0.20 MeV/c^2) reconstructed in the hadronic decay channel $D^+ \to K^-\pi^+\pi^+$ (BR = 9.13 ± 0.19%) in the transverse momentum range $2 \leq p_T \leq 16$ GeV/c were correlated to charged hadrons in the pseudorapidity range $\eta \leq |0.8|$.

Experimental setup

The main detectors exploited in this analysis are the Inner Tracking System (ITS), the Time Projection Chamber (TPC) and the Time Of Flight (TOF), embedded in a magnetic field of 0.5 T. The ITS and the TPC allow for track reconstruction in the pseudorapidity range $\eta < |0.9|$. The measurements of the specific energy loss $\mathrm{d}E/\mathrm{d}x$ in the TPC and of the time of flight in the TOF are used for particle identification, in particular for separating pions and kaons up to 1.5 GeV/c.

Analysis strategy

The analysis steps are:

1. D^+ **meson signal extraction:** D^+ meson candidates within a given p_T^{trig} range are considered. D^+ meson candidates were identified from the reconstruction of $D^+ \to K^-\pi^+\pi^+$ decays via an invariant mass analysis of displaced secondary vertices. The signal selection strategy, which exploits the relatively large D^+ life time, $c\tau \approx 312$ μm, is the same as that described in [3] and is based mainly on the request of a large decay length and good alignment between the D^+ momentum and flight line. An example of a invariant mass distribution of D^+ candidates in the transverse momentum interval $4 < p_T < 5$ GeV/c region is shown in Fig. 1.

2. **Azimuthal correlations:** Each selected D^+ is correlated with charged tracks (excluding the D^+ daughter particles) in a specified p_T^{assoc} interval.

3. **Background subtraction and corrections:** The contribution of the background under the D^+ peak is subtracted using the azimuthal correlation distribution obtained in the side-bands of the D^+ invariant mass peak. Each correlation pair is weighted by the inverse of the product of the reconstruction efficiencies of the trigger and associated

particle. Effects related to the limited detector acceptance and spatial inhomogeneities are corrected for by dividing the obtained $(\Delta\phi, \Delta\eta)$ correlations by those correlations obtained by pairing a D^+ candidate from a given event with tracks from other events (event mixing), normalized to $(\Delta\phi, \Delta\eta) = (0, 0)$.

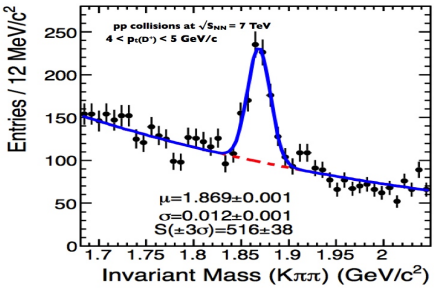

FIG. 1: Invariant mass distribution of D^+ candidates in $4 < p_T < 5$ GeV/c [3].

Data Set and Cuts

About 300 million minimum bias events from pp collisions at $\sqrt{s} = 7$ TeV collected by ALICE in 2010 were used in this analysis, corresponding to an integrated luminosity of $L_{int} = 5$ nb^{-1}.

D^+ hadron azimuthal correlations

Though statistical fluctuations are significant, correlation peaks in the near and away side can be observed, which should be produced by hadrons from the fragmentation of the parent charm quarks and, in the away side, also from the decay of charm hadrons.

Conclusion

The azimuthal correlations between D^+ mesons in the range $2 < p_T < 16$ GeV/c and hadrons ($p_T^{assoc} > 0.3$GeV/c) have been measured. The study of the properties of the correlation peaks is ongoing.

References

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