**D_s^+** production at central rapidity in pp collisions at 7 TeV with the ALICE experiment

Gian Michele Innocenti\(^1\)\(^\ast\) for the ALICE Collaboration

Department of Experimental Physics, University & INFN, Turin, ITALY

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**Abstract.** We present the preliminary \(p_t\) differential cross section in pp collisions of the D\(_s^+\) meson measured in the mid-rapidity region of ALICE through the D\(_s^+\) → K\(^-\)K\(^+\)π\(^+\) decay channel with an integrated luminosity of 4.8 nb\(^{-1}\). The ratios between all the D meson preliminary \(p_t\) differential cross sections measured in the ALICE experiment (D\(_s^+, D^0, D^+, D^\ast^+\)) are also presented and compared with the results of other experiments.

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**1 Introduction**

The measurement of the charm production cross section in pp collisions is a fundamental test for the perturbative QCD calculations in the new energy regime of the LHC. In particular, the measurement of the D\(_s^+\) production allows to study the fraction and the \(p_t\) distribution of the charmed-strange mesons. Results in pp collisions also provide a crucial reference for Pb-Pb studies in which heavy quarks are expected to be important probes for the properties of the medium \([1]\). In these proceedings, we report on the measurement of the production cross section of prompt D\(_s^+\) mesons in pp collisions reconstructed in the transverse momentum range 2 < \(p_t\) < 12 GeV/c at central rapidity (|\(\eta\)| < 0.5) with the ALICE detector, using data collected in 2010.

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**2 Detector layout and data sample**

The D mesons are reconstructed in the central rapidity region using the tracking detectors and particle identification systems of the ALICE central barrel which are placed in a large solenoid magnet, with a field \(B = 0.5\) T, and cover the pseudo-rapidity region -0.9 < \(\eta\) < 0.9. The central barrel detectors allow to track charged particles down to low transverse momenta (\(\approx 100\) MeV/c) and provide charged hadron and electron identification together with an accurate measurement of the positions of the primary and secondary vertices \([2]\). In this section, a short description of the detectors utilized in these analyses will be given (See \([2]\) for further details). The closest detector to the beam axis is the Inner Tracking System (ITS) \([2]\) which is composed of six cylindrical layers of silicon detectors. The two innermost layers (at radii of \(\approx 4\) and 7 cm) are made of pixel detectors (SPD), the two intermediate layers (radii \(\approx 15\) and 24 cm) are equipped with drift detectors, while strip detectors are used for the two outermost layers (radii \(\approx 39\) and 44 cm). The ITS allows the detection of secondary vertices originating from open charm decays with a resolution on the impact parameter better than 50 \(\mu\)m for tracks with \(p_t > 1.3\) GeV/c \([4]\). The Time Projection Chamber (TPC) \([5]\) is the main tracking detector that provides track reconstruction and particle identification via the measurement of the specific energy deposit dE/dx. The Time-of-Flight (TOF) detector is used for pion, kaon and proton identification on the basis of their time of flight and it provides kaon/pion separation up to a momentum of about 1.5 GeV/c. All the three detectors have full azimuthal coverage. The data sample used for this analysis consists of \(\approx 300\) million minimum-bias (MB) events collected during the 2010 LHC run with pp collisions at \(\sqrt{s} = 7\) TeV which correspond to an integrated luminosity \(L_{int} = 4.8\) nb\(^{-1}\). The minimum-bias trigger was based on the SPD and VZERO detectors. The latter is made of two scintillator hodoscopes positioned in the forward and backward regions of the experiment \([2]\). The cross section of pp collisions passing the MB condition used for the D\(_s^+\) production cross section normalization, was derived from a measurement of the cross section of collisions that give signals in both sides of the VZERO detector using a van der Meer scan \([6]\).
and selection e has been evaluated using the Monte Carlo simulations based on the PYTHIA 6.4.21 event generator [8]. The contribution of $D_s^+$ mesons coming from B meson decays (B feed-down) has been evaluated using the Monte Carlo efficiency for feed-down D mesons and the FONLL pQCD calculation which well describes bottom production at Tevatron [10] and at the LHC [11][12]. The fraction of D meson from b quark decays has been estimated as 10 - 15 % depending on the $p_t$ of the D meson. In Fig. 2 the efficiency for the $D_s^+$ meson with $|y| < 0.5$ as a function of the transverse momentum $p_t$ for prompt $D_s^+$ mesons and $D_s^+$ mesons from B feed-down decays is shown. D mesons from b quark decays present a larger efficiency since they decay further from the primary vertex because of the large B meson lifetime ($\tau \approx 500 \mu m$ [7]).

Fig. 1. Invariant mass distributions of $D_s^+$ candidates in $p_t$ bins in the transverse momentum range $2 < p_t < 12$ GeV/c obtained from the analysis of $\approx 300$ million minimum bias events.

Fig. 2. Efficiency for the $D_s^+$ meson as a function of $p_t$ for prompt D mesons (with and without PID selection) and D mesons from B feed-down.

4 Results

In Fig. 3 the preliminary $p_t$ differential cross sections for prompt $D_s^+$ mesons is shown in $p_t$ bins in the transverse momentum range $2 < p_t < 12$ GeV/c. The error bars represent the statistical uncertainties, while the systematic uncertainties are shown as boxes around the data points. A prediction for production cross section of this meson is still not available and thus a direct comparison with the theoretical calculations is not yet feasible. Figure 4 shows the preliminary results for the $p_t$ differential cross section ratios $D_s^+/D^0$ and $D_s^+/D^+$ in the $p_t$ range $2 < p_t < 12$ GeV/c with statistical and systematic uncertainties together with the $p_t$-integrated values. Due to the large uncertainties of the measurements, a final statement on the $p_t$ dependence of these ratios is not yet possible. Finally, in Fig. 5 the ratios between the preliminary D meson cross sections inte-
Fig. 3. Preliminary $D_s^+$ $p_t$ differential cross section measured with an integrated luminosity of 4.8 nb$^{-1}$ ($\approx$ 300 million minimum-bias events) in the $p_t$ range 2-12 GeV/c.

Fig. 4. Ratios between the preliminary D meson $p_t$ differential cross sections $D_s^+/D^+$ and $D_s^*/D^*$ in the $p_t$ range 2 < $p_t$ < 12 GeV/c. Both statistical and systematic uncertainties are shown. The $p_t$ integrated values are also reported in the legend.

Fig. 5. Ratios between the preliminary D meson cross sections integrated in the $p_t$ range 2 < $p_t$ < 12 GeV/c measured by ALICE compared with the results from other experiments [13,14,15]. Total uncertainties are shown.

5 Conclusions

In these proceedings, we presented the preliminary measurements by the ALICE Collaboration of the production cross sections of prompt $D_s^*$ mesons in pp collisions at $\sqrt{s} = 7$ TeV in the range 2 < $p_t$ < 12 GeV/c and in the central rapidity region. $D_s^*$ mesons were reconstructed via their hadronic decay channel $D_s^* \rightarrow K^* K^- \pi^+$. We also reported on the ratios between the preliminary $p_t$ differential cross section of D mesons compared with the results of other experiments: ALICE results are compatible with the other measurements within the uncertainties.

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