Transverse momentum spectra of hadrons identified with the ALICE Inner Tracking System

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1 Introduction

The Inner Tracking System (ITS) is the ALICE detector closest to the beam axis. It is composed of six layers of silicon detectors: two innermost layers of Silicon Pixel Detectors (SPD), two intermediate layers of Silicon Drift Detectors (SDD) and two outermost layers of Silicon Strip Detectors (SSD). The ITS can be used as a standalone tracker in order to recover tracks that are not reconstructed by the Time Projection Chamber (TPC) and to reconstruct low momentum particles with p_{t} down to 100 MeV/c. Particle identification in the ITS is performed by measuring the energy-loss signal in the SDD and SSD layers. The ITS allows one to extend the charged particle identification capability in the ALICE central rapidity region at low p_{t}: it is possible to separate π/K in the range 100 MeV/$c < p_{\mathrm{t}} <$ 500 MeV/c and K/p in the range 200 MeV/$c < p_{\mathrm{t}} <$ 800 MeV/c.

2 PID technique

In both the ITS standalone (track reconstruction only using the ITS) and in the ITS-TPC (reconstruction performed using both the ITS and the TPC) analyses, the $\mathrm{d}E/\mathrm{d}x$ measurement from the SDD and the SSD is used to identify particles. The standalone tracking extends the momentum range to lower p_{t} than can be measured in the TPC, while the combined tracking provides a better momentum resolution. For each track, $\mathrm{d}E/\mathrm{d}x$ is calculated using a truncated mean: the average of the lowest two points in case four points are measured, or a weighted sum of the lowest (weight 1) and the second lowest point (weight 1/2), in case only three points are measured. Figure 1 shows the truncated mean $\mathrm{d}E/\mathrm{d}x$ for the sample of ITS standalone tracks along with the PHOBOS parametrization of the most probable value [1] as function of momentum and its resolution as a function of transverse momentum both for data and Monte Carlo simulation.

The raw hadron yields extracted from the fits to the $\mathrm{d}E/\mathrm{d}x$ distributions are corrected for the reconstruction efficiency determined from Monte Carlo simulations,

applying the same analysis criteria to the simulated events as to the data. Secondary particles from interactions in the detector material and strange particle decays are subtracted from the yield of both simulated and real data. The secondary-to-primary ratio is estimated by fitting the measured track impact-parameter distributions of each hadron species with three components: prompt particles, secondaries from strange particle decays and secondaries produced in the detector material. Alternatively, the contamination from secondaries is determined using Monte Carlo samples, after rescaling the Λ yield to the measured values [2]. The difference between these two procedures is about 3% for protons and is negligible for other particles.

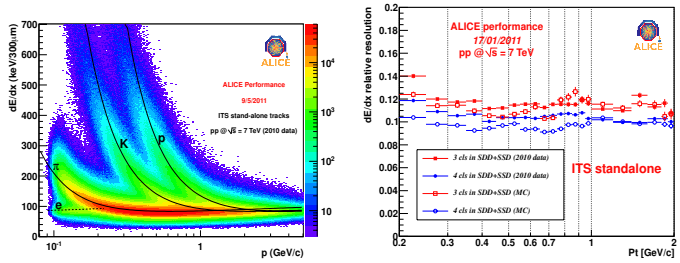

Figure 1: Specific energy-loss signal $\mathrm{d}E/\mathrm{d}x$ vs. momentum (left) and resolution vs. p_t (right) in pp collisions at $\sqrt{s} = 7$ TeV for ITS standalone tracks measured with the ITS. Solid lines in the left panel are a parametrization (from [1]).

3 Conclusions

Particle Identification in the ITS allows one to extend the the ALICE PID capability at low p_t. The first analysis of transverse momentum spectra of identified hadrons, π^+, π^-, K^+, K^-, p, $\overline{p}$, in pp collisions at $\sqrt{s} = 900$ GeV with the ALICE detector is done, result are published in [3]. The measurements of these particle spectra is a substantial part of the ALICE program in both pp and PbPb collisions.

References

[1] PHOBOS collaboration, Back, B. B. *et al.*, Phys. Rev. C **75**, (2007) 024910.

[2] ALICE Collaboration, K. Aamodt *et al.*, Eur. Phys. J. C **71(3)**, (2011) 1594.

[3] ALICE Collaboration, K. Aamodt *et al.*, Eur. Phys. J. C **71(6)**, (2011) 1655.