FIRST pp COLLISIONS AT THE LHC AS SEEN BY ALICE*

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Preliminary results on the pp collisions at $\sqrt{s} = 900$ GeV and 2.36 TeV are presented. Charged particles multiplicities at both energies are shown. Also the detector performance is discussed. All results shown here are preliminary.

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1. Introduction

The ALICE experiment is the only dedicated heavy-ion experiment at the CERN LHC. Although its main aim is a search for the new state of matter, the Quark–Gluon Plasma, using a broad spectrum of signatures, it has an extended programme for the proton–proton physics. Here we show first results of the 2009 pp data taking at $\sqrt{s} = 900$ GeV and 2.36 TeV.

2. ALICE detector

The ALICE detector setup can be found elsewhere [1]. Here we would like to stress that ALICE is the omnipurpose detector, designed to work in a very high particle density environment. Its physics program covers a broad spectrum of observables, which has been described in [2]. In the following subsections we will briefly describe its acceptance and the particle identification capabilities.

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2.1. Acceptance

Main ALICE components cover the so-called central region $|\eta| < 0.9$. This includes the tracking devices and main particle identification detectors. ALICE also contains a number of smaller acceptance detectors, including the forward muon spectrometer, calorimeters and small angle detectors.

2.2. Particle identification

ALICE uses all known methods for particle identification. This includes the dE/dx analysis, the time of flight measurements, the transition and the Čerenkov radiation detection for charged particles and calorimetry for the γ/e and thus the π^0 identification.

3. The day-zero physics

For the very first data taking, during the beam commissioning, only the splash-resistive detectors were used. This includes two layers of the pixel detectors of the Inner Tracking System and the VZERO detectors which allow to separate the beam–beam from the upstream beam gas interaction. In Fig. 1 signals from these detectors are shown. In Fig. 2 the pseudorapidity distribution of charged particles for two classes of events are displayed and compared with the UA5 data [3]. Details of the analysis can be found in [4]. In Fig. 3 the multiplicity of charged particles in the two mentioned event classes are shown and compared with data from other experiments.

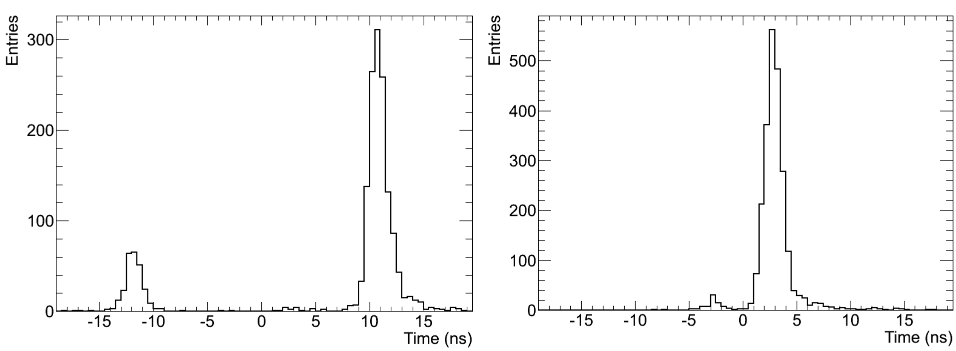

Fig. 1. Arrival time of particles in the VZERO detectors relative to the beam crossing time (time zero). A number of beam–halo or beam–gas events are visible as secondary peaks in VZERO-A (left panel) and VZERO-C (right panel). This is because particles produced in background interactions arrive at earlier times in one or the other of the two counters. The majority of the signals has the correct arrival time expected for collisions around the nominal vertex.

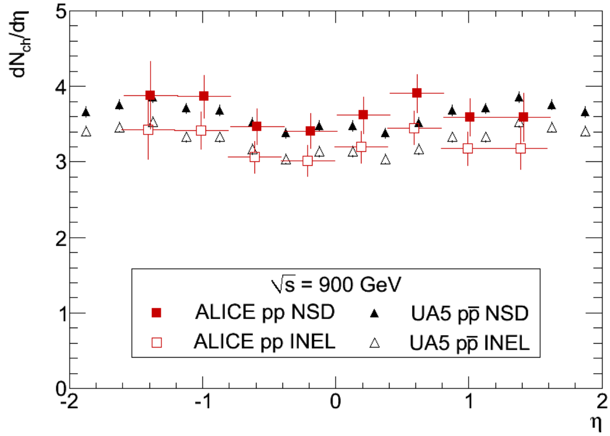

Fig. 2. Pseudorapidity dependence of $dN_{\rm ch}/d\eta$ for inelastic (INEL) and non-single diffractive (NSD) collisions. The ALICE measurements (squares) are compared to UA5 data (triangles). The errors shown are statistical only.

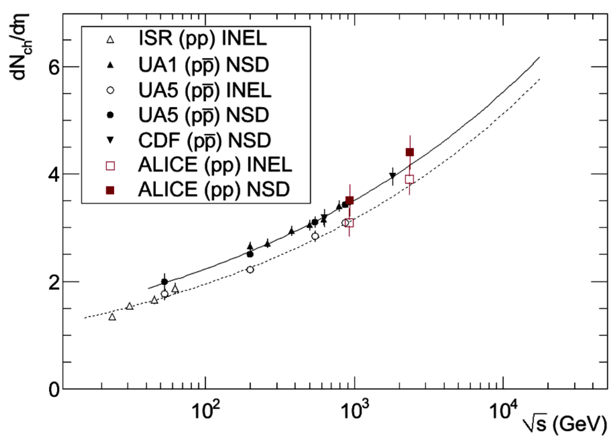

Fig. 3. Charged-particle pseudorapidity density in the central rapidity region in proton–proton and proton–antiproton interactions as a function of the centre-of-mass energy. The dashed and solid lines (for INEL and NSD interactions, respectively) indicate the fit using a power-law dependence on energy.

4. Detector performance

In this section we present a set of plots showing the detector performance during the real data taking at $\sqrt{s} = 900$ GeV. We present particle identification and reconstruction capabilities of the ALICE detector, together with some preliminary physics results, like the $p_{\rm T}$ distribution or $\overline{p}/p$ ratio.

4.1. Particle ID performance

Here we show the dE/dx distribution from the tracking detectors (Fig. 4), which shows the low energy hadron separation capabilities, as well as the Time of Flight system (middle energy range hadron separation) and the Transition Radiation Detector Performance (π–e separation), Fig. 5.

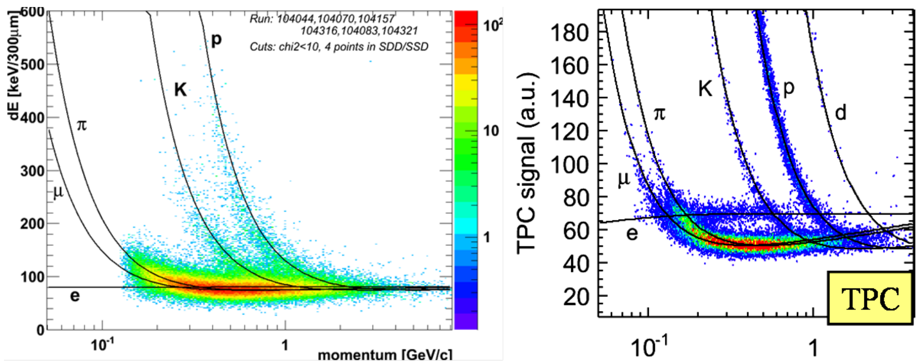

Fig. 4. dE/dx distribution for the Inner Tracking System (ITS) — left panel and for the Time Projection Chamber (TPC) — right panel.

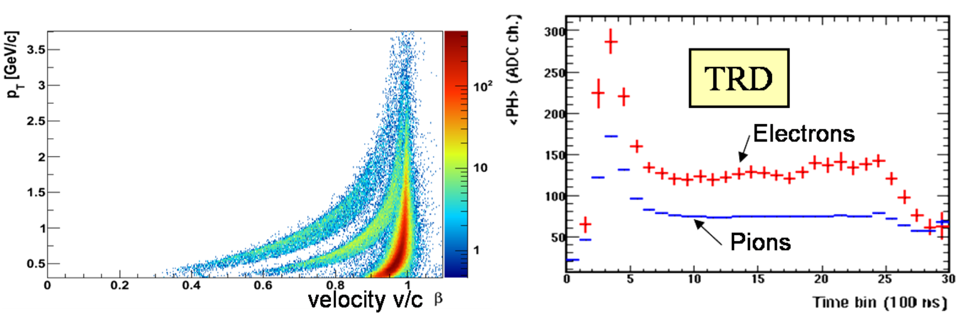

Fig. 5. Particle identification capabilities of the Time of Flight system — left, and of the Transition Radiation Detector — right.

4.2. Particle Zoo

In this section we show results of unstable particle reconstruction. Figure 6 shows the effective mass distribution for Λ, $\overline{\Lambda}$, K^0 and Φ. The mean masses of particles are very close to the PDG values, and the width of K^0 shows the excellent resolution.

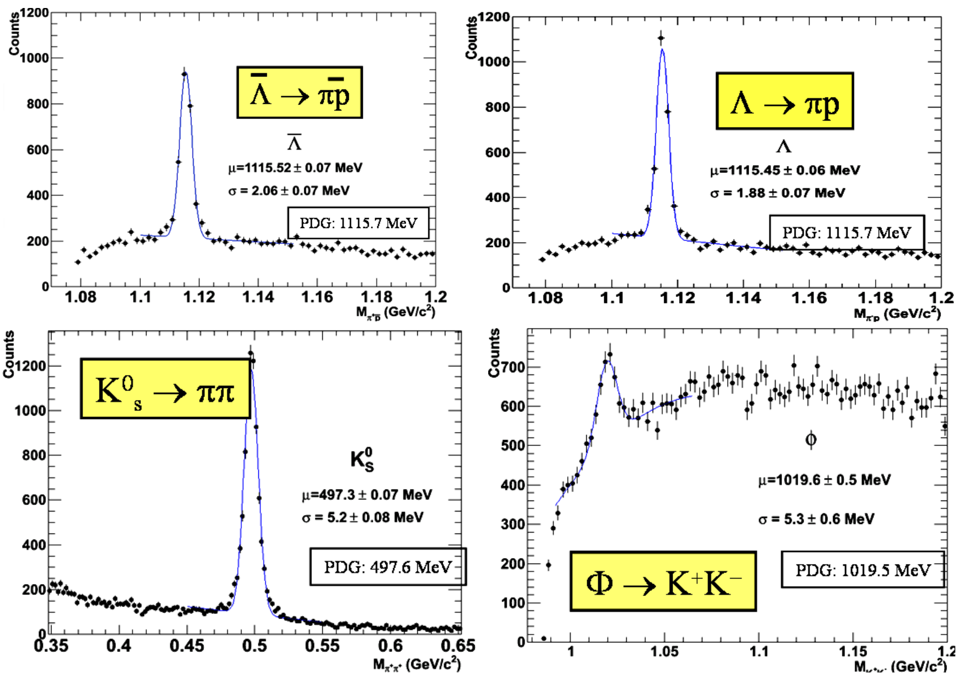

Fig. 6. Effective mass distribution for Λ, $\overline{\Lambda}$, K^0 and Φ.

As mentioned, the ALICE detector is able to reconstruct also electromagnetic probes, like π^0. In Fig. 7 the reconstructed π^0 in tracking devices and in the Photon Spectrometers are displayed. In both cases the quality of the reconstruction is encouraging.

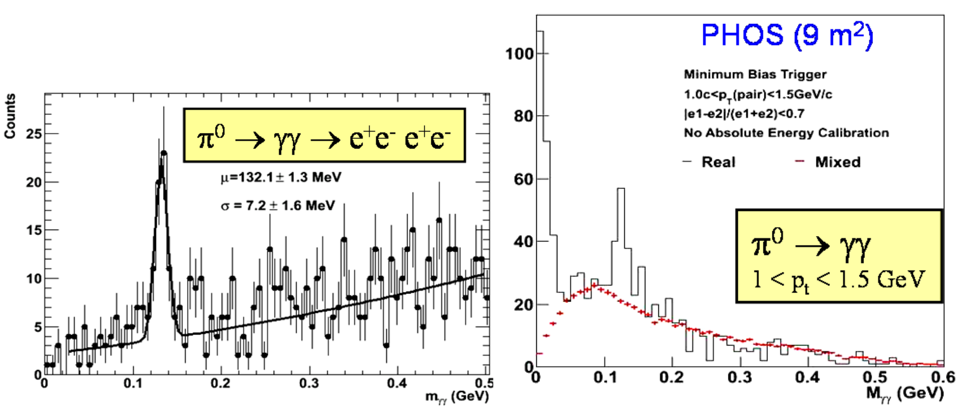

Fig. 7. Reconstructed π^0 in tracking devices (left) and from the calorimetry (right).

4.3. Preliminary results

Preliminary results on the $p_{\rm T}$ spectra and on the $\overline{p}/p$ ratio are shown (Fig. 8). One needs to keep in mind that data presented here are not fully corrected for the reconstruction efficiency and other systematic effects. They are still subject of running analysis.

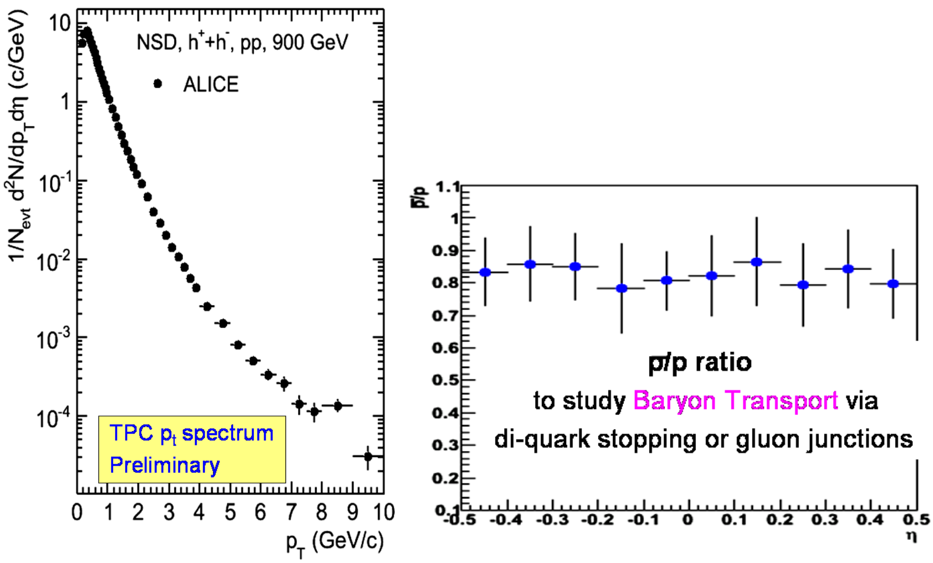

Fig. 8. The $p_{\rm T}$ spectrum of charged hadrons and $\overline{p}/p$ ratio in pp collisions at $\sqrt{s} = 900$ GeV.

5. Conclusions

Preliminary data for proton–proton collisions at $\sqrt{s} = 900$ GeV and 2.36 TeV were obtained by the ALICE experiment. Results on charged particle multiplicities, $p_{\rm T}$ spectra and $\overline{p}/p$ ratio were shown. The detector has excellent reconstruction and particle identification capabilities.

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