Particle IDentification with the ALICE Time-Of-Flight detector and a few physics results

F. Bellini for the ALICE Collaboration
Department of Physics, Universitá degli Studi and I.N.F.N. Bologna
40127 Bologna, ITALY
E-mail: ***bellini@bo.infn.it***

1 Introduction

The ALICE experiment[1] at the LHC is devoted to study the QCD phase transition and the hot and dense medium which is produced in ultra-relativistic heavy-ion collisions, the so-called Quark Gluon Plasma. It has been designed and optimized to study Pb-Pb collisions with a specific emphasis on particle identification (PID) capabilities. The Time-Of-Flight detector (TOF) contributes to π, K and p identification in a wide range of momenta. TOF's excellent PID performances have been exploited in particular for the study of particle transverse momentum spectra and flow. The most recent physics results obtained in ALICE from Pb-Pb collisions at $\sqrt{s_{\rm NN}} = 2.76$ TeV are presented.

2 The ALICE Time-Of-Flight System

The ALICE TOF detector is a large Multigap Resistive Plate Chamber (MRPC) array, for a total of about 153000 readout channels, located in the ALICE central barrel at a distance of 370 cm from the LHC beam pipe. It covers the full azimuthal angle ($0^\circ \leq \phi \leq 360^\circ$) and the pseudorapidity range $-0.9 \leq \eta \leq 0.9$. Thanks to the high MRPC intrinsic resolution ($\sigma_{MRPC} \leq 50$ ps), the resolution on the particle time-of-flight is $\sigma_{TOF} = 86$ ps in Pb-Pb collisions at $\sqrt{s_{\rm NN}} = 2.76$ TeV. Particle identification is based on the Gaussian unfolding of measured TOF signal for matched tracks extrapolated from the Time Projection Chamber (TPC). In particular, TOF allows a 2σ separation for π/K up to $p_t = 3.0$ GeV/c and a 2σ separation for K/p up to $p_t = 5.0$ GeV/c.

3 Results with TOF Particle Identification

The study of transverse momentum spectra of identified hadrons in Pb-Pb collisions gives information about the kinetic freeze-out properties. TOF PID information is

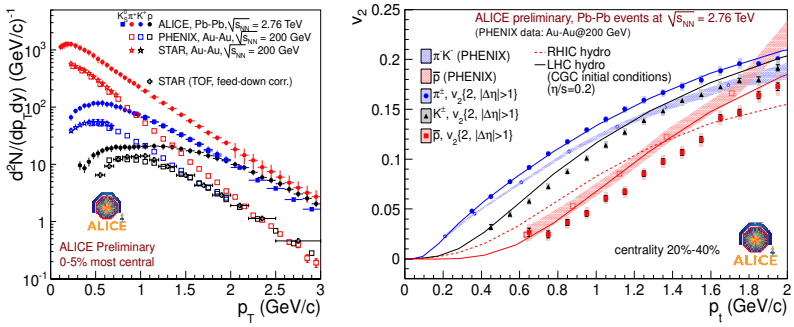

Figure 1: Transverse momentum spectra (left) and v_2 coefficient (right) for identified π, K and p measured in Pb-Pb collisions at $\sqrt{s_{\rm NN}} = 2.76$ TeV in ALICE, and compared with RHIC results and hydrodynamical models.

combined with the measurements of the specific energy loss dE/dx in the Inner Tracking System (ITS) and in the TPC to obtain the p_t spectra over a wide range shown in fig. 1 (left). Compared with RHIC, the results show that transverse momentum spectra (feed-down corrected) of positive and negative hadrons in Pb-Pb collisions in ALICE exhibit harder spectra shapes, indicating that a higher radial flow is produced at LHC. The flow of primary hadrons has been studied measuring the v_2 coefficient of the Fourier expansion of the azimuthal dependence of identified particle yield and comparing it with the results from the PHENIX experiment[2] at RHIC and with hydrodynamical models[3] (fig. 1, right). The comparison with theoretical predictions shows that proton production is not well described by existing hydrodynamical models.

References

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

[2] S. S. Adler *et al.* [PHENIX Collaboration], Phys. Rev. Lett. **91** (2003) 182301. [nucl-ex/0305013].

[3] C. Shen, U. W. Heinz, P. Huovinen, H. Song, [arXiv:1105.3226 [nucl-th]].