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The performance of the ALICE TOF detector

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Summary. — The performances of the ALICE *Time Of Flight* detector are presented, based on the 2010 data taking. Hardware status, time resolution and PID capability are shown and compared with the design values. First results in Pb-Pb at $\sqrt{s_{NN}} = 2.76\,\text{TeV}$ are reported.

PACS 29.40.Cs – Gas-filled counters: ionization chambers, proportional, and avalanche counters.

1. – Introduction

ALICE is an experiment at CERN LHC designed and optimized to study Pb-Pb collisions with $\sqrt{s_{NN}} = 5.5\,\text{TeV}$. The investigation of colored deconfined matter, the so called *Quark Gluon Plasma*, is its main goal. To achieve this it has been designed with an excellent tracking system and very high particle identification (PID) performance. Time Of Flight system is one of the main ALICE detectors for particle identification [1]. This detector covers a cylindrical surface of about $150\,\text{m}^2$, with an inner radius of 3.7 m. It has full azimuthal acceptance (with a segmentation in 18 sectors) and a polar acceptance of $|\eta| \leq 0.9$. In each sector 91 *Multigap Resistive Plate Chamber* (MRPC) have been installed. The MRPCs have an active area of $7.4 \times 120\,\text{cm}^2$, with ten $250\,\mu$m width gas gaps delimited by $400\,\mu$m tick soda-lime glasses which are grouped into two stacks, placed on both side around a central anode. External electrodes are obtained from $550\,\mu$m tick glasses with a specially developed acrylic paint loaded with metal oxydes, giving an average surface resistivity between 2 and $25\,\text{M}\,\Omega/\square$. The strips work in avalanche mode regime, with $E \sim 100\,\text{kV/cm}$. Measurements at test beam for a sample of mass-production MRPCs have shown an efficiency $\epsilon_{MRPC} > 99\%$ and a time resolution $\sigma_{MRPC} < 50\,\text{ps}$, at a working voltage of 13 kV [2]. Without beam operations, on average, the MRPC strips draw a current less than 1 nA. Finally, each strip is divided into 96 readout channels of about $10\,\text{cm}^2$ of active area. During 2010 data taking the system used on average 96% of its 157248 readout channels.

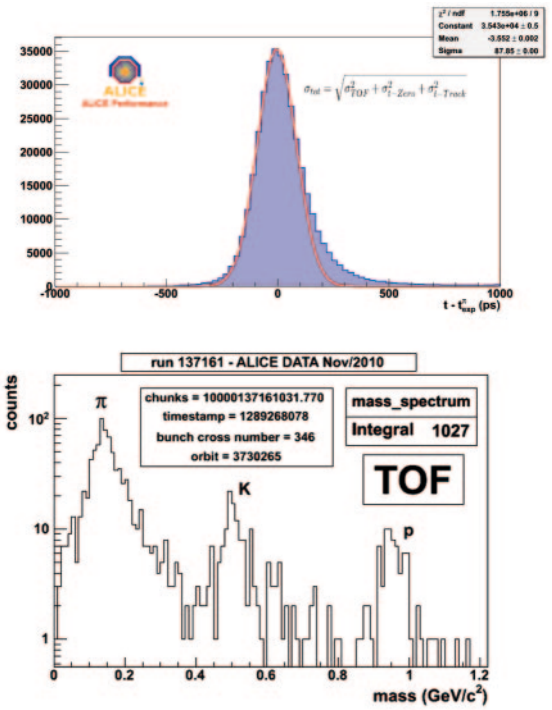

Fig. 1. – Top: measured resolution during Pb-Pb data taking. Bottom: mass distribution of particle which reached TOF from a single Pb-Pb collision.

2. – Results from 2010 data taking

First results on identified particle spectra in p-p collisions at 900 GeV have been published in [3]. Here selected results from last year heavy ions runs are shown. The measure of global time resolution (σ_{tot}) is reported in fig. 1. For each track, the quantity $t_{measured} - t_{expected}$ is related to the TOF time resolution (σ_{TOF}), the time zero of a single Pb-Pb collision ($\sigma_{t\text{-}Zero}$) and the time resolution due to tracking ($\sigma_{t\text{-}Track}$). In Pb-Pb, with $\sigma_{t\text{-}Zero}$ and $\sigma_{t\text{-}Track}$ typical values of 10 and 20 ps respectively, σ_{TOF} is about 80 ps, as from design value. These distributions will be improved by single channel time-slewing corrections and time-walk inside a pad. Considering an expected time resolution of 90 ps, TOF allows π/K (and K/p) separation better than 2σ up to about 3.0 GeV/c (4.4 GeV/c). Mass distribution for the particles with a measured time of flight from TOF detector in just a single Pb-Pb event is also shown. Particle identification at an event by event level becomes in this way a straight and amazing reality for the TOF detector.

REFERENCES

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