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# Study of the dE/dx resolution of a GEM Readout Chamber prototype for the upgrade of the ALICE TPC

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The ALICE Collaboration is planning a major upgrade of its central barrel detectors to be able to cope with the increased LHC luminosity beyond 2018. In order to record an increased interaction rate of 50 kHz for Pb–Pb collisions, the TPC will be operated in an ungated mode with continuous readout. This demands for a replacement of the currently used gated MWPC (Multi-Wire Proportional Chamber) by GEM based readout chambers, while retaining the present tracking and particle identification capabilities of the TPC via measurement of the specific energy loss (dE/dx).
The present baseline solution for the TPC upgrade consists of a stack of four large size GEM foils as amplification stage, containing both Standard (S, 140 µm) and Large Pitch (LP, 280 µm) GEM foils arranged in the order S-LP-LP-S. This arrangement, under a specific voltage configuration, has been proven to fully meet the design specifications in terms of ion backflow, energy resolution and stable operation under LHC conditions.
A prototype of the ALICE IROC (Inner Readout Chamber) has been equipped with such a quadruple GEM stack, installed within a field cage and exposed to a beam of electrons and pions delivered by the CERN PS.
An evaluation of the performance of the detector in terms of dE/dx resolution has been carried out using the AliRoot software –the framework for reconstruction, analysis and simulation in the ALICE experiment [1].
The presented analysis demonstrates a dE/dx resolution that meets the requirements of the ALICE upgrade physics programme. In order to understand the performance quantitatively, a Monte Carlo simulation has been carried out with the AliRoot framework aiming at reproducing the dE/dx results obtained during the test beam campaign.
It has further been demonstrated, that the dE/dx resolution of the detector prototype is comparable to the current readout chambers.
The outcome of this work represents a milestone for the project, proving the feasibility of replacing the currently used MWPC based readout. The project now proceeds to the phase of mass production. In the following years, 72 new readout chambers will be equipped with a quadruple GEM stack, for which a total of about 200 m² of GEM foils, including spares, will be produced.
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