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Status of the R&D activities for the upgrade of the ALICE TPC

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After the Long Shutdown 2 (LS2) the LHC will provide lead-lead collisions at interaction rates as high as 50kHz. In order to cope with such conditions the ALICE Time Projection Chamber (TPC) needs to be upgraded.

After the upgrade the TPC will have to run in a continuous mode, but without any degradation of the momentum and dE/dx resolution compared to the performance of the present TPC. Since readout by MWPCs is no longer feasible with these requirements, new technologies have to be employed. In the new readout the electron amplification is provided by a stack of four Gas Electron Multiplier (GEM) foils. Here foils with a standard hole pitch of 140 μ m as well as large pitch foils (280 μ m) are used. Their high voltage settings and orientation have been optimised to provide an energy resolution of $\sigma(E)/E=12\%$ at the photopeak of 55Fe. At the same settings the ion backflow (IBF) into the drift volume has to be less than 1% of the effective number of ions produced during gas amplification and the primary ionisations. This is necessary to prevent the accumulation of space charge, which eventually will distort the field in the drift volume. To ensure stable operation during the high loads during LHC run 3 the chambers have to be robust against discharges, too. Therefore a setting with a discharge probability in the order of 10^{-12} per stack was aimed for.

An overview of the ALICE TPC upgrade activities will be given in this talk. We will present the optimised settings foreseen for the GEM stacks of the future readout chambers. Furthermore we will report on the outcome of two beam time campaigns at SPS and PS (at CERN) in the end of 2014. There the stability against discharges and the dE/dx performance of a prototype - with the dimensions of an inner readout chamber of the TPC - was tested.

In addition we give an outlook on the challenges of the upcoming mass production of chambers for the upgrade during LS2.

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