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A continuous read-out TPC for the ALICE upgrade

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The largest gaseous Time Projection Chamber (TPC) in the world, the ALICE TPC, will be upgraded based on Micro Pattern Gas Detector technology during the second long shutdown of the CERN Large Hadron Collider in 2018/19. The upgraded detector will operate continuously without the use of a triggered gating grid. It will thus be able to read all minimum bias Pb-Pb events that the LHC will deliver at the anticipated peak interaction rate of 50 kHz for the high luminosity heavy-ion era. New read-out electronics will send the continuous data stream to a new online farm at a rate of up to 1 TByte/s.

To keep distortions due to space charge from back-drifting ions at a tolerable level, an ion feedback of below 1 % is required. The new read-out chambers will consist of stacks of 4 GEM foils combining different hole pitch. In addition to a low ion backflow other key requirements such as energy resolution and operational stability have to be met. A careful optimisation of the performance in terms of all these parameters was achieved during an extensive R&D program. A working point well within the design specifications was identified with an ion backflow of 0.7 %, a local energy resolution of 12 % (σ) and a discharge probability for irradiation with alpha particles of the order of 10^{-10} .

We will give an overview on the upgrade plans and report on the R&D program and beam tests conducted with large scale Read-Out Chamber prototypes.

Collaboration

ALICE

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