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Upgrade of the ALICE central barrel tracking detectors: ITS and TPC

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The ALICE Collaboration will undertake a major upgrade of the detector apparatus during the second LHC long shutdown (LS2, 2019-20) in view of the Runs 3 and 4 (2021 to 2029). The objective of the upgrade is two-fold: i) an improvement of the tracking precision and efficiency, in particular in the low-momentum range; ii) an improvement of the readout capabilities of the experiment, in order to fully exploit the luminosity for heavy ions envisaged after LS2.

The first goal will be achieved by replacing the Inner Tracking System (ITS) with a new tracker, composed of seven layers of silicon pixel detectors. The ITS will be made up of about 25000 Monolithic Active Pixel Sensors with fast readout, resulting in a material thickness reduced to 0.3% (inner layers) –1% (outer layers) of the radiation length and a granularity of $28 \times 28 \mu\text{m}^2$. The resolution of the track position will improve by about a factor of three in the direction transverse to beams and by a factor of five along the beams, reaching for example $20 \mu\text{m}$ in both directions at a transverse momentum of 1 GeV/c.

The second goal will be achieved, among other measures, by replacing the readout chambers of the 90 m^3 Time Projection Chamber (TPC) with Micro Pattern Gas Detectors. In particular, the new readout chambers will consist of stacks of 4 Gas Electron Multiplier (GEM) foils combining different hole pitches. The upgraded detector will operate continuously without the use of a triggered gating grid. It will thus be able to record all Pb-Pb collisions at the anticipated LHC interaction rate of 50 kHz. New readout electronics will send the continuous data stream to a new online farm at a rate of 3 TByte/s.

The presentation will review the results of the extensive R&D programs, which are now concluded, the final technology and design choices, and the status of the production of the two detectors. Highlights of the physics programme with the upgraded ALICE central barrel will also be presented.

Content type

Experiment

Collaboration

ALICE

Centralised submission by Collaboration

Presenter name already specified

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