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Performance of the ALICE Zero Degree Calorimeters in LHC Run 3

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The Zero Degree Calorimeters (ZDC) of the ALICE experiment at LHC were designed to characterize the event and monitor the luminosity in heavy-ion measurement.

In order to fully exploit the potential offered by the LHC increased luminosity in Run 3, while preserving the time and charge resolution performance, the ZDC readout system was upgraded to allow the acquisition of all collisions in self-triggered mode without dead time.

The presence of ElectroMagnetic Dissociation (EMD) processes makes the ZDC running conditions extremely challenging, raising the readout rate for the channels of the most exposed calorimeters up to ~ 1.4 Mevents/s, compared to an hadronic rate of about 50 Kevents/s sustained by all other detectors.

The new acquisition chain is based on a commercial 12 bit digitizer with a sampling rate of ~ 1 GSps, assembled on an FPGA Mezzanine Card.

The signals produced by the ZDC channels are digitized, the samples are processed through an FPGA that, thanks to a custom trigger algorithm, flags for readout the relevant portion of the waveform and extracts information such as timing, baseline average and event rate.

The system is fully integrated with the ALICE data taking infrastructure and acquired physics data in global runs during the 2023 LHC heavy-ion data taking.

The architecture of the new readout system, the auto trigger strategy and the ZDC performance during the 2023 Pb-Pb collisions are presented.

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