

PERFORMANCE DEGRADATION STUDY OF THE ATLAS HADRONIC END-CAP CALORIMETER

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The readout electronics of the ATLAS Hadronic End-cap Calorimeter (HEC) will have to withstand a demanding radiation environment at the future high-luminosity LHC (HL-LHC). The heart of the HEC read-out electronics is the pre-amplifier and summing (PAS) system which is realized in GaAs ASIC technology. The PAS devices are installed inside the LAr cryostat directly on the detector. They have been proven to operate reliably in LHC conditions up to luminosities of 1000 fb^{-1} , within safety margins. However, at the HL-LHC a total luminosity of 3000 fb^{-1} is expected, which corresponds to radiation levels being increased by a factor 3-5.

The GaAs ASIC has therefore been tested to neutron and proton radiation with integrated fluences, several factors above the levels corresponding to ten years of HL-LHC running allowing evaluation of performance parameters, like gain, input impedance and non-linearity of the ASIC response. This allows an improved estimation of expected degradation of the HEC performance.

The measured gain and non-linearity of the ASIC response were finally applied to Monte-Carlo simulations in order to understand their effect on jet measurements in HL-LHC conditions. Results of the analysis will influence the selection of the future upgrade program for the ATLAS end-cap regions, in particular, the important decision on the cryostat opening.