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Determination of the sensitivity of an ATLAS RPC to gamma and neutrons with Geant4

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Resistive Plate Chambers (RPCs) are sensitive to the passage of charged particles and represent a fast and cost-effective solution widely adopted in experiments at high-energy colliders when instrumenting large areas detectors.

In a high-radiation environment such as the ATLAS experimental area at the Large Hadron Collider (LHC) at CERN, where gammas and neutrons are copiously produced, even a small sensitivity to neutral radiation can have an impact on the detector measurements and performance.

In RPCs, the sensitivity to neutral radiation is caused by the extraction of secondary charged particles by the neutral primary radiation from the materials composing the detector, which can subsequently enter the active part of the chamber and ionize the gas. The presence of a signal is inferred in this work from the amount of ionization energy deposition in the active part of the gas gap.

The results presented are compatible with the available measurements and, compared with previous calculations, predict a smaller sensitivity to neutrons with energies below 1 MeV, which represent a large fraction of the radiation in the LHC environment.

The results of the study are published in: Nuclear Inst. and Methods in Physics Research, A (2019) 163122, <https://doi.org/10.1016/j.nima.2019.163122>

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