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GEM foil gain prediction

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An optical Quality Assurance (QA) system has been developed at the Detector Laboratory of the Helsinki Institute of Physics. The diameters of the holes in a Gas Electron Multiplier (GEM) -foil, both in the copper and in the polyimide, can be measured with the system. The system is utilized for the QA of the GEM foils of the TPC Read-Out Chambers (ROC) being assembled for the upgrade of the TPC readout chambers of the ALICE experiment at CERN.
The correlation between the GEM hole size variation and the corresponding gain variation has been studied with several different gas compositions and operating voltages. A clear correlation has been shown to exist between the size of the GEM holes and the gain of the foil. Furthermore the relative gain of the foil can be estimated within 10 % based solely on the GEM hole size variation.
The current correlation results are shown, as well as the progress towards a quantitative prediction of the gain of individual GEM foils. The possibility of predicting the gain of a full GEM stack is discussed. This study has been made in collaboration between Helsinki Institute of Physics and Wigner Research Centre in Budapest as part of the QA effort of the ALICE TPC upgrade project.

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