

First Production Modules of the ATLAS Micromegas and Performance Studies

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The ATLAS collaboration at LHC has endorsed the resistive Micromegas technology, along with the small-strip Thin Gap Chambers (sTGC), for the high luminosity upgrade of the first muon station in the high-rapidity region, the so called New Small Wheel (NSW) project. After the R&D, design and prototyping phase, the first series production Micromegas quadruplets have been constructed at all involved construction sites: in France, Germany, Italy, Russia and Greece. The achievement of the requirements for these detectors revealed to be even more challenging than expected, when scaling from the small prototypes to the large dimensions. We will describe the construction and relevant problems, to a large extent common to other micro-pattern gaseous detectors, and the adopted solutions. Final validation results on the achieved mechanical precision and on the stability during operation will be presented, along with the main results of the modules certification with cosmic rays. Additionally, one of the first series modules, equipped with a prototype of the final front-end electronics based on VMM chip, was tested in muon/pion beam at the H8 line of SPS at CERN during the summer of 2018. We present the test setup and performance results on efficiency and resolution for perpendicular and inclined tracks. These studies were focused to establish and determine the working point of the ATLAS Micromegas detectors. Comparison to initial requirements for operation in ATLAS is also discussed, namely spatial resolution of 100 μm at high background hit rate of up to 20 kHz/cm². Studies with several gas mixtures were also carried out and will be presented. In addition, we will report on results from the exposure of the Micromegas detector under X-ray irradiation environment at GIF++ facility of CERN.

Primary author: KOULOURIS, Aimilianos (National Technical Univ. of Athens (GR))

Presenter: KOULOURIS, Aimilianos (National Technical Univ. of Athens (GR))

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