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New results on COMPASS pixellized hybrid gaseous detectors for high muon and hadron flux

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New large size Micromegas gaseous detectors (40x40 cm² active area) were developed since 2009 in view of the COMPASS new physics programs started in 2015, which uses the CERN high intensity muon and hadron beams of a few hundred GeV scattered on thick fixed targets. The new detectors feature a huge reduction of the discharge rate compared to original COMPASS Micromegas by a factor of above 100 using the hybrid solution where a pre-amplifying GEM foil is placed 2mm above the micromesh electrode. The centers of detectors, in the beam area with intensities as high as a few hundred of kHz/mm², are also active with the same performances as the other part of the detectors thanks to a pixelized read-out adapted to the flux. The combination of the hybrid structure and the pixelized central read-out allow to detect particle flux above 10 MHz/cm² with very good detection efficiencies, above 96%, and spatial resolution around 70µm.

The delicate technology of making "bulk" detectors was transferred to the ELVIA company in the framework of this project, leading to high production rate and lower cost. The detectors are installed and in use in the different conditions of the COMPASS experiment since 2015. The 2015 COMPASS run was dedicated to Drell-Yan data taking with high flux hadron beam on a thick target, leading to a large rate of low energy hadrons in the detectors; while the 2016 and 2017 runs, dedicated to the DVCS data taking, use a muon beam at very high flux with strong demands on detector spatial resolutions at low angle.

The key characteristics of the detectors will be described, including the hybrid structure and the optimization of the printed circuit board design in order to connect a large number of pixels through a limited space. The performance during the last COMPASS runs both in high flux muon and hadron beam conditions will be presented.

Primary author: NEYRET, Damien (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))

Presenter: NEYRET, Damien (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))

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