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Aging Effects in GEM Detectors

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The COMPASS experiment located at the SPS at CERN operates triple GEM tracking detectors in an environment with very high radiation dose. Besides large GEM detectors near the beam line, also novel PixelGEM detectors characterized by a special pixel readout are used. These PixelGEM detectors are exposed to the muon- or hadron beam with energies of up to 200 GeV. Some of these detectors showed a reduced signal strength and therefore a reduced detector efficiency after four years of operation and the collection of a total charge of up to 15 mC/mm². Opening one of the affected detectors revealed colored deposits on the GEM foils and on the readout structure, matching exactly the regions of reduced gain. The investigation of GEM foils of an affected detector with an optical microscope, a scanning electron microscope (SEM) and an element analysis by energy dispersive x-ray spectroscopy (EDX) traced deposits of silicon and sulphur in the area with high beam intensity. The results of the investigation and possible origins of the depositions are presented. Additionally, an experimental setup for long term measurements is shown to reproduce such aging effects in GEM detectors. Funded by BMBF, DFG Cluster of Excellence "Origin and Structure of the Universe" (Exc 153) and Maier-Leibnitz-Labor of LMU and TUM. Authors: C. Dreisbach¹, A. Austregesilo¹, J. Durandi¹, F. Haas¹, M. Huber¹, B. Ketzer¹, I. Konorov¹, S. Paul¹, K. Rodewald², M. Tasiar¹, S. Uhl¹ —¹ TU München, Physik Department E18, Garching bei München —² TU München, Institut für Siliciumchemie, Garching bei München.

Presenter: DREISBACH, Christian

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