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Performance of the chromium GEM detector

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MPGD technology has recently been adopted for soft X-ray fluorescence detection techniques. The MPGD are relatively cheap detectors with capability of detection not only a deposited energy (inside its active volume) but also a position of an absorbed photon or a charged particle. Nevertheless, the MPGD's development is mainly driven by HEP experiments needs, recently many new application in very diverse fields have been presented. Simultaneous measurement of the position together with the information about deposited energy (and a time) makes MPGD very attractive in case of soft X-ray fluorescence detection and imaging. Moreover, flexibility in adjusting the signal amplitudes by changing the gas gain with possibility of employment variety of active gas mixtures provides additional level of freedom, which is making that type of detectors well suitable for that application.

Here, we present studies on GEM detectors with particular focus on their properties and appropriateness for soft X-ray detection. Due to the fact that variety of gas mixture were tested (some of them are quite expensive), first of all we evaluated the properties of the standard GEM detector with various active gas flow rates, especially low ones. These measurement have been done with a standard Ar/CO₂ (70/30) gas mixture. In the field of X-ray detection, one also has to take into account fluorescence radiation induced inside the detector by its inner components. Therefore, to get rid of the most of the induced fluorescence radiation, for studies with variety of gas mixtures, we have prepared copper depleted GEM detector. The detector was equipped with a drift and GEM copper (almost) free foils, only the readout structure was left untouched. The gas gain high voltage dependence, gas gain variation across the detector active area, energy resolution for Ar-, Kr- and Xe-based gas mixture were studied. Additionally, a long-term gas gain and energy resolution stability of the detector were evaluated. All these results will be presented during the Conference.

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