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The development of MPGD-based detectors of single photons

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A novel MPGD based architecture for single photon detection has been developed to overcome the limitations of the present generation of gaseous single photon detectors when large area coverage is needed ($\sim m^2$). It couples two different MicroPatternGasDetector structures, the THickGasElectronMultiplier and the Micromegas, resulting in a hybrid scheme able to exploit the properties and the performance of both architectures. The main goal is to provide an upgraded approach for the detection of single photons by gaseous counters, as required in particular in Cherenkov imaging counters. The constructions for a specific application, namely the upgrade of COMPASS RICH-1, is discussed at this Conference in a separate contribution.

The hybrid detector is the result of 8 years-long R&D program started with an extensive study of THGEM electron multiplier properties and followed by detailed studies of the aspects of single photon detection, ion back flow reduction as well as of the problematics related to the large area detectors instrumentation. The final large size hybrid scheme consisting of two THGEMs, the first coated with CsI, and one Micromegas is illustrated in detail. The most important aspects related to the detector optimisation and the technological choices are discussed and the detector performance are presented making use of the laboratory test results and of the detector response measured at the several test beams.

In particular, the ion backflow aspects, the photoelectron extraction from CsI deposited on a THGEM substrate, the electrical stability of a multilayer and multi-technology MPGD and the response uniformity will be reported in detail.

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