

# Construction, operation and performance of the novel MPGD-based photon detectors of COMPASS RICH-1

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The RICH-1 Detector of the COMPASS Experiment at CERN SPS has been upgraded in 2016: four new Photon Detectors, based on MPGD technology and covering an active area of 1.4 square meters replace the previously used photon detectors (MWPCs with CsI photocathodes). The new detector architecture consists in a hybrid MPGD combination: two layers of THGEMs, the first of which also acts as a reflective photocathode (its top face is coated with a CsI film) are coupled to a bulk Micromegas on a pad segmented anode; the signals are read-out via capacitive coupling by analog F-E based on the APV25 chip. All aspects of the COMPASS RICH-1 Photon Detectors upgrade are presented. The design, the engineering aspects, the mass production and the quality assessment of the MPGD components are recalled. The assembling and the validation tests of the detectors are described. The operating conditions and the on-line monitoring of the detector response are illustrated. The characterization of the novel photon detectors is presented in detail. With a typical gain approaching 20000, a signal formation time of 100 ns, a single photon angular resolution of 1.8 mrad and about 10 detected photons per ring at saturation the novel MPGD-based detectors of single photons of COMPASS RICH-1 meet the required specifications and open the way for interesting future applications.

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