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The Fast Photon Detection System of COMPASS RICH-1

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A fast photon detection system has been designed and built for the upgrade of COMPASS RICH-1, a large size gaseous RICH in use at the COMPASS Experiment at CERN SPS since 2001 and successfully operated in its upgraded version during the 2006 run. The aim of the upgrade was to make RICH-1 adequate for high rate operation: the photon detectors of the central region have been replaced by a new system based on MAPMTs coupled to individual fused silica lens telescopes and fast read-out electronics while in the peripheral regions the existing MWPCs with CsI photocathodes have been equipped with a new read-out system, based on the APV chip. The telescopes are characterized by a large image demagnification factor with minimal distortion and large angular acceptance. Accurate coupling to high sensitivity front-end electronics allowed overcoming the potential problem represented by the wide dynamical range of PMT responses to single photoelectrons, while keeping the noise rates and the channel cross-talk at a negligible level. The high rate capability and the good intrinsic PMT time resolution are fully exploited by signal digitization via a system based on the F1 TDC. We present the photon detection design and the constructive aspects, the test beam and laboratory studies, as well as the preliminary characterization of the system in the COMPASS experimental environment, where about 60 photons per ring at saturation have been routinely obtained. It will be shown that, with this upgrade, COMPASS RICH-1 is entering the era of the fast RICH counters, suitable for high rate operation.

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