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Behaviour of multi-anode photomultipliers in magnetic fields for the LHCb RICH upgrade

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A key feature of the LHCb upgrade, scheduled for 2019, is to remove the first level trigger and its data reduction from 40MHz to 1MHz, which is implemented in the on-detector readout electronics. The consequence for the LHCb Ring Imaging Cherenkov (RICH) detectors is that the Hybrid Photon Detectors need to be replaced as the readout chip is inside the detector vacuum. The baseline for replacement are Multianode Photomultiplier tubes (MaPMT) and new readout electronics. The MaPMTs will be located in the fringe field of the LHCb dipole magnet with residual fields up to 25 G. Therefore, their behaviour in magnetic fields is critical.

Here we report about studies of the Hamamatsu models R11265 and H12700 in a magnetic field in an effort to qualify them for use in the LHCb RICH upgrade. Comparisons to the known model R7600 are also made. Measurements of the collection efficiency and gain were performed for all three space directions as a function of the magnetic field strength. In addition to measurements with bare tubes, measurements with different mu-metal shielding configurations were performed to optimize the configuration. This is important input for the layout of the upgraded LHCb RICH detector.

Collaboration

LHCb

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