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The RICH system of the LHCb experiment: status and performance

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The LHCb experiment is an experiment that will search for new physics in CP violation from heavy flavour decays at the LHC at CERN. Particle identification (pion, kaon and proton discrimination), a crucial requirement of the physics goals of the experiment, will be provided by two Ring Imaging CHerenkov (RICH) detectors. The upstream RICH1 detector incorporates two radiators, aerogel and C4F10 gas, while the downstream RICH2 contains CF4 gas. Combined, they provide particle identification coverage over a momentum range between 1 and 100 GeV/c. RICH1 contains a system of novel low-mass carbon-fibre spherical mirrors and flat glass mirrors to focus the Cherenkov light onto arrays of 196 Hybrid Photon Detectors (HPDs). The RICH2 detector contains glass spherical and flat mirrors to focus the Cherenkov light onto arrays of 288 HPDs. Magnetic calibration systems in both RICHes measure and correct for the distortion of the ring-images in the HPDs from the residual magnetic field, up to 2.5mT, from the LHCb dipole magnet.

This paper will describe the features of the two RICH detectors that are currently installed in LHCb, as well as the novel technologies. The status of the commissioning of the detectors will be given, the calibration and alignment techniques and the results from a beam test carried out with the final detector components and readout system. Finally, the anticipated particle identification performance of the RICH detectors from comprehensive Monte Carlo simulations will be presented. A technique to calibrate the particle identification performance of the RICH system with data using D* decays will also be described.

Author: PICKFORD, Andrew (University of Glasgow)
Presenter: PICKFORD, Andrew (University of Glasgow)
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