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Time resolved RICH testbeam simulation

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The Ring Imaging Cherenkov (RICH) detectors at LHCb play an integral role in particle identification. However, with the fivefold increase in luminosity resulting from LHCb upgrade II and the high luminosity LHC, the RICH detectors will have to introduce timing resolution on the order of 100 ps to retain performance. This time resolved upgrade is the focus of current RICH testbeam campaigns, the most recent being carried out in October 2022. The goal is to evaluate the performances of MaPMTs and SiPMs as photodetectors, and the readout electronics.

In order to characterise the detector performance and identify causes of timing jitter, an accurate GEANT4 simulation of the testbeam setup is required. This simulation covers the beam effects, the production of Cherenkov photons, their path to the photodetectors, the detection mechanisms, and the detector effects that follow. Timing information is tracked throughout the simulation, allowing for picosecond time resolution studies. This talk will cover both the simulation setup and mechanics, before making comparisons between experiment and simulation, and finally reporting the time resolution achieved.

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