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Characterisation of the next generation fast-timing photon-detectors

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Owing to their single photon sensitivity and fast rise time micro-channel-plate photomultipliers (MCP-PMT) make a good candidate for photon detectors for the proposed Time Of Internally Reflected Cherenkov light detector (TORCH) detector. TORCH has a target time resolution per photon of approximately 70\,ps, required to achieve a 3σ separation of pions and kaons at 10 GeV/c over a 10\,m flight distance.

A major challenge for TORCH is the high detector occupancy expected during the high-luminosity phase of the LHC. A new high granularity anode for a square MCP-PMT has been developed with Photek, which has a higher special resolution and lower per pixel occupancy. This talk will cover the characterisation studies that have taken place on the high granilarity MCP-PMT; from measurements of cross-talk, transit time spread to gain and QE uniformity. Rate capability and expected lifetime were evaluated by gain vs event rate measurements and by studying ion feedback through time delay of after pluses.

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