Contribution ID: **352** Type: **Poster**

The TORCH time-of-flight detector

Monday, 23 May 2022 15:41 (1 minute)

TORCH is a large-area time-of-flight (ToF) detector, proposed for the Upgrade-II of the LHCb experiment. The detector will provide charged hadron identification over the 2-20 GeV/c range to complement LHCb's particle identification to lower momentum. To achieve this level of performance, a 15 ps timing resolution per track is required, given a 10 m flight distance from the LHC interaction point. TORCH utilizes a 1 cm thick quartz plate which, on the passage of a charged particle, acts as a source of prompt Cherenkov photons. The photons are propagated to the periphery of the plate via total internal reflection where they are focused by a cylindrical-mirrored surface onto an array of micro-channel plate photomultiplier tubes (MCPs).The MCPs record the position and arrival times of the Cherenkov photons which allows a correction for chromatic dispersion in the quartz. The MCPs are custom-developed with an industrial partner and give a 1 mrad precision on the photon trajectory; the anode of each MCP is finely segmented to give an effective granularity of 8 x 128 pixels over a 53 x 53 mm^2 square area. The MCP single-photon time resolution has been measured at around 50 ps in the laboratory, including the contribution from the TORCH customised electronics-readout system. A TORCH prototype module having a 125 x 66 x 1 cm^3 fused-silica radiator plate and housing two MCP-PMTs has been tested in a 8 GeV/c CERN test-beam. Single-photon time resolutions of between 70-100 ps have been achieved, dependent on the beam position in the radiator. The measured photon yields also agree with expectations. The performance approaches the ToF design goal for LHCb, considering that a fully-instrumented TORCH module will detect around 30 photons. Finally, the future TORCH R&D plans and the expected particle-identification performance at LHCb will be presented.

Collaboration

TORCH Collaboration

Primary author: HARNEW, Neville (University of Oxford)

Presenter: HARNEW, Neville (University of Oxford)

Session Classification: Photo Detectors and Particle ID - Poster session