
Contribution ID: **136** Type: **Poster**

# A Simple Pico-second Timing ToF Prototype

*Tuesday, 15 May 2018 19:10 (30 minutes)*

DIRC-like Time-of-Flight detector (DTOF) is an innovative TOF utilizing internally reflected Cherenkov light for high energy charged particle identification. It achieves a high level of performance at the extreme data taking conditions under high luminosity and high backgrounds. The basic structure of DTOF is composed of a Fused Silica radiator connected to fast photomultiplier (MCP-PMT or SiPM) array, readout by a dedicated front-end electronics. The challenge comes from the fact that the limited flight length for charged particles in detectors requires its timing measurement achieves the level of tens of pico seconds, summing up all uncertainties, to meet the requirement for current and future high luminosity particle colliders. For example, the high luminosity upgrade of the Large Hadron Collider (HL-LHC) at CERN is expected to provide instantaneous luminosities of 1034cm-2s-1 and above, which requires TOF's time resolution ~30ps to suppress pileup in collisions.

To meet these requirements, we developed a pico-second timing TOF prototype based on DTOF technology, using 1.5cm x 1.5cm x 2cm square Cherenkov radiator connected by high-resolution fast MCP-PMT(Hamamastu R3809U). And we also developed high speed readout electronics (Bandwidth 2.4GHz, Gain 6dB ~ 26.6dB): Programmable Differential Amplifier(PDA) LMH6881/2 and Dual-threshold Differential Discriminator(DDD). It applied dual thresholds to process signals: low threshold to measure signals' arrival time, while high threshold to identify real signals and exclude noise. It is a much simpler and faster timing method than wave sampling. The beam test in H4 at CERN shows that: the intrinsic time resolution readout by DDD and PDA is <20ps. Since there is no tracking selection and the readout electronics (PDA and DDD) are preliminary designation, there is still potential to improve its performance. We also plan to test larger radiator and various MCP-PMTs and SiPMs in the future.

## Content type

Experiment

## Collaboration

## Centralised submission by Collaboration

Presenter name already specified

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**Session Classification:** Poster Session

**Track Classification:** Future facilities, upgrades and instrumentation