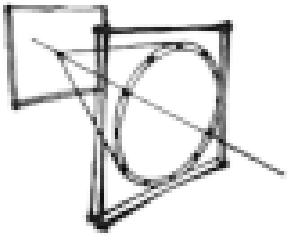

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Timing in a FLASH

Monday, 5 September 2016 17:10 (30 minutes)

Very precise timing below the 100ps-mark is gaining importance in modern detector designs. Many technology demonstrators achieving this goal were based on the Cherenkov effect exploiting its prompt light emission. One common requirement is the necessity to compensate inherent walk effects to reach the sub-100ps timing precison.
In traditional approaches either the amplitude is measured in addition to the timestamp, which requires the signal to be split, or a constant fraction discriminator is used. More recent developments include sampling the signal and extracting the relevant features which requires powerful frontend electronics and is not suited for all experimental circumstances.

With the advent of high-precision TDCs another method becomes feasible: measuring the signal amplitude via Time-over-Threshold. In this case the frontend electronics can be kept simple by only using a discriminator circuit and, optionally, a wide-band amplifier.

A prototype detector, called FLASH (Fast Light Acquiring Start Hodoscope), was built based on QUARTIC's design ideas. The fused silica radiator bars were coupled to a 10 micron-pore type PLANACON MCP-PMT with 64 channels and readout with custom electronics based on the NINO ASIC. The TRB3 system, a high-precision TDC implemented in an FPGA, was used as data acquisition system.

The performance of the system was investigated at a dedicated test experiment at the Mainz Microtron (MAMI) accelerator and a combined PANDA Barrel DIRC test experiment at CERN's PS T9 beam line.
The validity of the Time-over-Threshold approach could be established and an overall timing resolution of approx 70 ps could be achieved. The intrinsic resolution of the frontend electronics including the TDC was measured to be less than 25 ps.

Registered

Yes

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