# Beam-test result of TOF counter (T576)

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We have been studying on a high-resolution time-of-flight (TOF) counter, which utilizes Cherenkov lights. The TOF counter that we have tested consists of a small quartz radiator and MCP-PMT. The aim of the beam test is to obtain and confirm the intrinsic resolution of high resolution TOF counter. We have obtained the TOF resolution of 10.6 ps in the previous beam test. The resolution is limited by the jitter of the readout electronics that is 8.8 ps. Therefore, we can expect the intrinsic resolution to be 5.9 ps. In the beam test, we have changed the readout electronics (SPC-134, Becker & Hickle GMbH's), whose jitter is 4ps RMS. Furthermore, we use faster MCP-PMTs (HPK R3809U-50-11X), which improve the transit time spread for single photo-electron from 46 ps to 30 ps.

We set two test counters along the beam line and measured the time difference between two counters to evaluate the TOF resolution. The signal output and time resolution is measured with changing the thickness of the quartz radiator. The events are triggered by two $5 \times 5$mm scintillation counters put at the forward and backward side of test counters.

As a result, we have obtained the time resolution to be 6.2 ps including the electronics jitter of 4.1 ps. The intrinsic resolution is 4.7 ps. We also have investigated the number of obtained photo-electrons and the time resolution depending on the radiator thickness (3 - 43 mm). The best resolution of 6.2 ps is obtained with the 13 mm thickness. The time resolutions detoriorate for larger thickness than 13 mm. We have observed extra photo-electrons, which seem to affect the detorioration. The results will be appeared in Nucl. Instr. Meth. A.

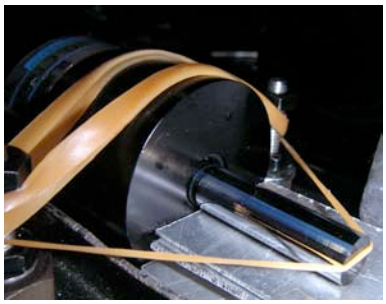

Figure 1: Photo of TOF counter.

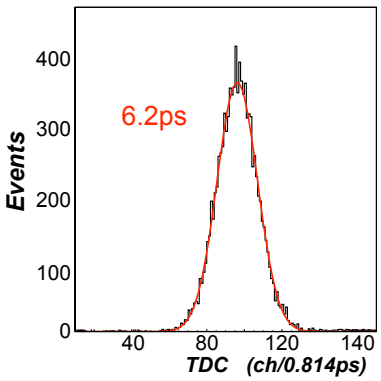


Figure 2: Time difference distribution for 13 mm thick quartz.