Beam-test result of TOF counter (T565)

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We have been studying on a high-resolution time-of-flight (TOF) counter, which utilizes Cherenkov lights radiated in a crystal block. The TOF counter that we have tested consists of the quartz radiator, MCP-PMT and a tungsten plate. The motivation of this counter is to measure an arrival time of a high energy gamma with high precision, by detecting the Cherenkov photons from the shower generated at the tungsten plate. To check the shower effect, we have tested the counter with the electron beam. In this beam test, we have measured (1) the number of Cherenkov photons radiated in quartz bar with a tungsten plate, and (2) the dependence of the time resolution with the quartz thickness.

We set two test counters along the beam line and measured the time difference between two counters to evaluate the resolution. The signal output and time resolution is measured with changing the thickness of the quartz radiator and the tungsten plate. The events are triggered by two 5 × 5mm scintillation counters put at the forward and backward side of test counters. To separate the π^- and electron beam, the gas Cherenkov counter is set in front of the counters.

As the result, the number of detected photons in case of electron beam are increased obviously compared to π^- beam. The dependence on the thickness of quartz radiator is measured as expected from the result of laser test. The time resolution is about 14 ps for BINP's MCP-PMT, which is slightly worse than the result of HPK's PMT, about 10 ps. We found that it is due to the difference of light transmission distribution of the window materials between quartz and Borosilicate glass.

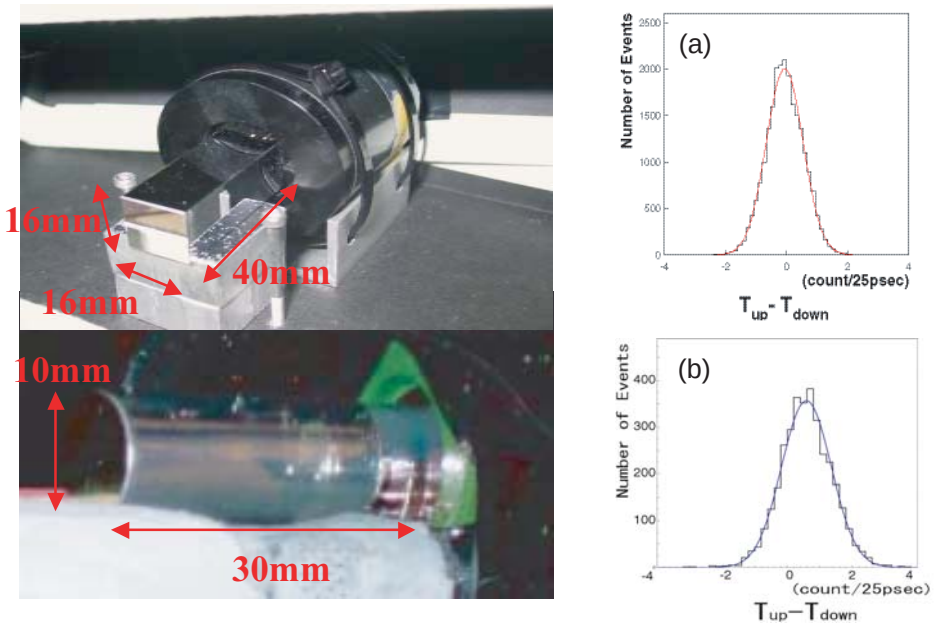

Figure 1: TOF counters (left) and the results of the time difference (right). Top one is the counter with HPK's MCP-PMT and the result (a), and bottom one with BINP's PMT and the result (b).