

T589 report

We tested a new type of ring imaging Cherenkov detector 'RICH with TOF', which has not only position information but also time information in pion beams at KEK PS.

We has researched and developed a proximity focusing ring imaging Cherenkov detector for an upgrade of the Belle detector at the KEK B-factory. At this time we suggest a new Aerogel RICH 'RICH with TOF'. The aim is to improve the performance of Aerogel RICH further by adding high precision timing measurement provided by the multi-channel plate photomultiplier (MCP-PMT).

Fig. 1 shows the concept of 'RICH with TOF' in the BELLE detector upgrade. We can obtain time information from two points of 'glass hit point G' and 'ring image point R'. At point G, one can observe Cherenkov photons generated in the window material of PMT. The differences of TOF of K/π between the interaction point and PMT are 47 psec at point G and 37 psec at point R for 4 GeV/c. We examined the possibility of 'RICH with TOF' with the beam test.

The setup at the beam test is shown in Fig 2. At this beam test, we adopted 64 anode BURLE MCP-PMT 85011-501. Fig. 3(a) and 3(b) shows the TDC count distribution for point G and point R, respectively. The obtained time resolution for point G is 34 psec. As for point R, the obtained time resolution is 51 psec. The resolution for point R is for a single detected photon. Because we expect the number of photons in the ring for each track to be 6, the TOF resolution for a track for point R is expected to be 21 psec. The total K/π separation of TOF combining point G and point R is 2.2σ . Therefore, we confirmed the worth of development of 'RICH with TOF'. It is important to improve the time resolution. We have a plan to measure another BURLE MCP-PMT with narrower diameter of MCP pore that is expected to give better timing resolution.

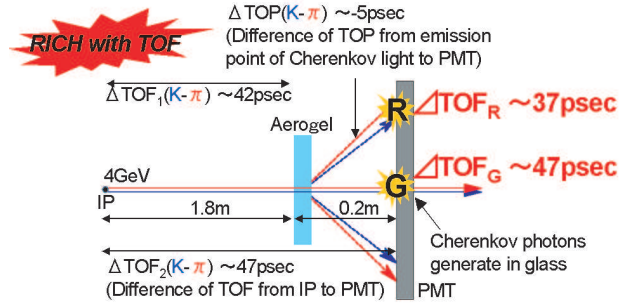


Figure 1: Concept of 'RICH with TOF' in the Belle detector upgrade.

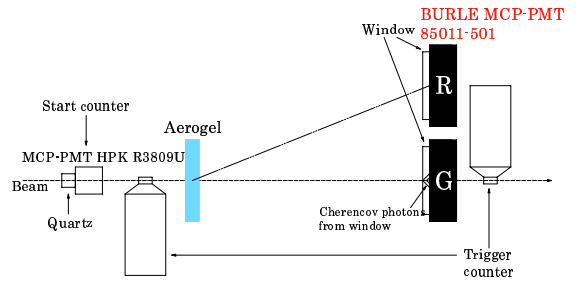


Figure 2: Setup for the beam test. HPK MCP-PMT R3809U with extra quartz bar attached on was adopted for start counter.

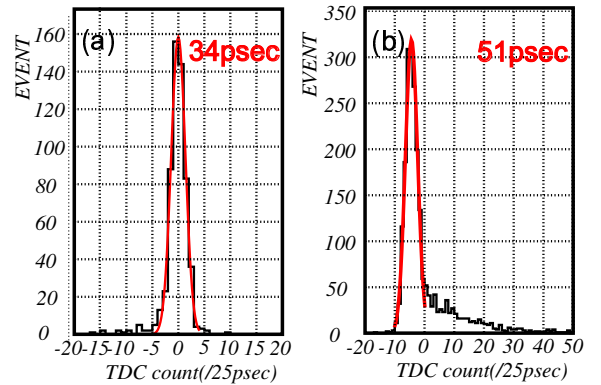


Figure 3: Distribution of TDC for (a)glass hit point and (b)ring image point for 3 GeV/c pions.