T562 report

1. report

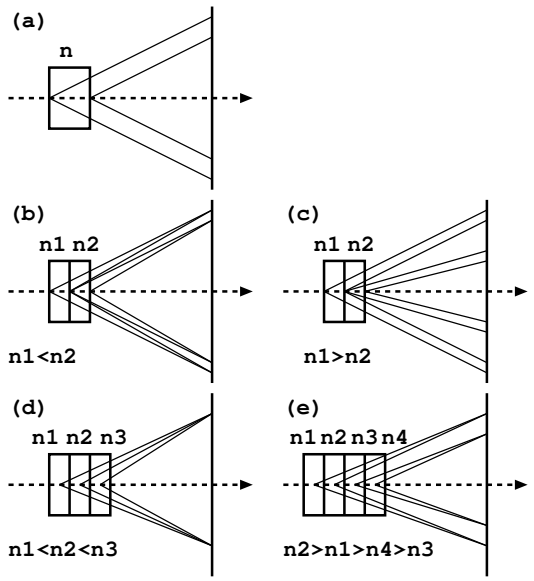

Figure 1. Principle of dual radiator and multi-radiator RICH: (a) normal single radiator RICH, (b) focusing type dual radiator RICH, (c) defocusing type dual radiator RICH, (d) focusing type multi-radiator RICH and (e) defocusing type multi-radiator RICH.

A proximity focusing ring imaging Cherenkov detector, with the radiator of two or more aerogel layers of different refractive indices, has been tested in 1-4 GeV/c pion beams at KEK PS. Essentially a multiple refractive index aerogel radiator allows for an increase in Cherenkov photon yield on account of the increase in overall radiator thickness, while avoiding the simultaneous degradation in single photon angular resolution associated with the increased uncertainty of the

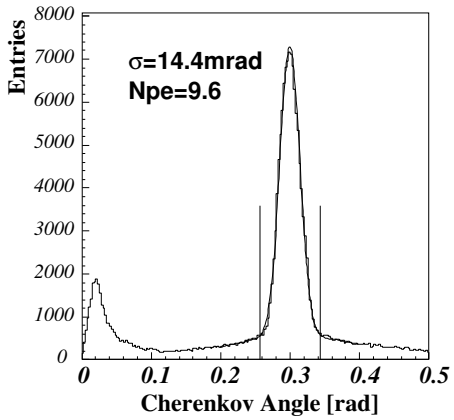

Figure 2. Distribution of the Cherenkov angle for accumulated single photons for focusing dual radiator RICH for 4 GeV/c pions.

emission point. As shown in Fig. 1, with the index of consecutive layers suitably increasing in the downstream direction, one may achieve overlapping of the Cherenkov rings from a single charged particle. In the opposite case of decreasing index, one may obtain well separated rings.

For this focusing scheme with the combination for $n = 1.047$(upper) and $n = 1.057$(lower), the obtained Cherenkov angle distribution is plotted in Fig. 2. The obtained Cherenkov angle resolution is 14.4 mrad. The number of detected photons is calculated from counting the number of hits within 3σ from the average Cherenkov angle, where background is subtracted from the fits to the Cherenkov angle distribution. We find $N_{pe} = 9.6$. The single track resolution is calculated to be 4.8 mrad, which corresponds to 4.8σ K/π separation at 4 GeV/c.

As for the defocusing dual radiator RICH, we

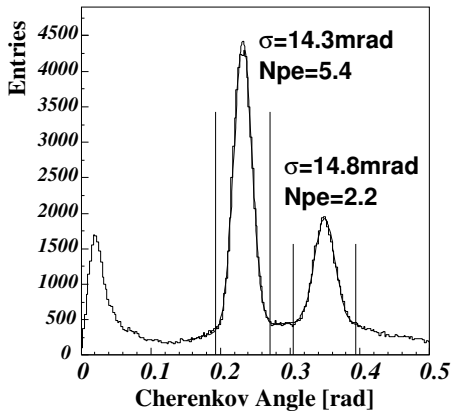

Figure 3. Distribution of the Cherenkov angle for accumulated single photons for defocusing dual radiator RICH using two-layer aerogel.

use the combination of the radiators with $n = 1.057$ and $n = 1.027$. Each radiator has a thickness of 20 mm. Figure 3 shows the Cherenkov angle distribution for the defocusing dual radiator RICH. We can clearly see two rings separated from each other. The sum of the number of photons from the two rings (Figure 3) is larger than that from a single radiator RICH with 20mm, while the resolutions are almost the same. Hence, the defocusing dual radiator RICH is also expected to have better performance than the single radiator RICH. It is important to improve the transparency of the downstream radiator to improve the light yields for the outer ring.