Contribution ID: **10** Type: **Contributed Talk**

The Focusing DIRC - the first RICH detector to correct the chromatic error by timing, and the development of a new TOF detector concept

Friday 23 February 2007 15:55 (20 minutes)

Benefiting form from the recent introduction of new fast vacuum-based photon detectors with a transit time distribution of σ_TTS ~ 30-150ps, we are developing novel RICH detector capable of correcting the chromatic error by timing, attempted the first time ever on such a scale; we are also developing a novel TOF detector concept. We have built and successfully tested a novel particle identification detector called Focusing DIRC. The prototype's concept is based on the BaBar DIRC with several important improvements: (a) much faster pixilated photon detectors based on Burle MCP-PMT and Hamamatsu MaPMT, (b) mirror allowing to make the photon detector smaller and less sensitive to background in future applications, (c) electronics allowing to measure the single photon resolution to better than σ ~ 100-200ps, which allows a correction of the chromatic error. This is the very first time the chromatic error was corrected by this method. The detector was tested in the SLAC 10GeV electron test beam. The presented detector concept could be used for the particle identification at Super B-factory, ILC, Gluex, Panda, etc. While testing the timing resolution limits of a 64-pixel MCP-PMT with 10 μm MCP holes, we have achieved a timing resolution of σ ~ 30ps with single photoelectrons, and σ ~ 8-9ps with for a large number of photoelectrons. This is the best result ever obtained with this type of tube. The results were obtained with the PiLas laser diode and represent the point resolution response of the tube. We present a systematic timing resolution study for various timing concepts as a function of number of photoelectrons and the magnetic field. The presented TOF detector concept could be used for the particle identification at Super B-factory endcaps.

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Session Classification: Session 10