HEP 2013
Stockholm
18-24 July 2013

Contribution ID: **175**

Type: **Talk presentation**

First results of the Focusing DIRC prototype, an innovative detector for charged particle identification

Friday 19 July 2013 09:30 (15 minutes)

The FDIRC (Focusing Detector of Internally Reflected Cherenkov light) is a charged particle identification (PID) detector which separates efficiently kaons from pions up to a few GeV/c. It is the successor of the BaBar DIRC, which was successfully operated at the PEP-II B-Factory during a decade, and benefits from the knowledge accumulated with a first focusing DIRC prototype, built and operated at SLAC in the recent years.

The FDIRC is a ring-imaging Cherenkov detector based on the same concept as the BaBar DIRC. Yet, its design has been significantly improved to be able to operate at much higher luminosity (10ˆ36 cmˆ-2sˆ-1) and with larger backgrounds. Indeed, the FDIRC was intended to cover the barrel region of the SuperB detector, a new generation flavour factory cancelled at the end of 2012 due to lack of funding.

The FDIRC photon camera has been completely redesigned, moving from a huge tank of ultra-pure water to much smaller focusing cameras with sophisticated solid fused silica optics. The BaBar camera was sensitive to background and its operation required constant attention due to the possibility of having water leaking inside the rest of the detector. The new cameras are instrumented with highly-pixelated Hamamatsu H-8500 MaPMTs, readout by new fast front-end digitizing electronics. The goal is to have a detection chain about 10 times faster than in BaBar, allowing the FDIRC to reject more background hits and to measure Cherenkov angles more accurately.

A full-scale prototype of a FDIRC sector (1/12th of the whole detector) has been successfully built at SLAC and is taking data in the Cosmic Ray Telescope facility since the beginning of 2013. The primary goals of this R&D program are to validate the innovative camera design, to test the full detection chain and to measure the FDIRC Cherenkov angle resolution.

In this contribution, we briefly review the FDIRC design and the construction of the SLAC prototype. Then, we focus on the challenges associated with the FDIRC data analysis and present the methods which are being developed to convert photon hits in the MaPMT pixels to Cherenkov angles. This work is based upon a detailed Geant4-based simulation of the test facility. Finally, we summarize the status of the ongoing data taking phase and present the first preliminary results based on data.

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Session Classification: Detector R&D and data handling

Track Classification: Detector R&D and data handling