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Study of 144-channel Hybrid Avalanche Photo-Detector for Belle II RICH Counter

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For the Belle II detector, we have been conducting R&D on a proximity focusing ring imaging Cherenkov counter using a silica aerogel as a radiator. For the photodetector, which is one of the most critical components, we have developed a 144-channel Hybrid Avalanche Photo-Detector with Hamamatsu Photonics. This device has 4 chips of avalanche photo-diodes, each being pixelated into 6x6 pads.
At the test bench, by flushing a blue LED, the pulse height distributions for a single and/or multiple photons were measured and good separation of photoelectron peaks of S/N=4-20 was obtained and its total gain was measured to be over 40000. The photo cathode response was also cheeked and more than 30% of QE was found with excellent uniformity. We have also confirmed the performance in strong magnetic field up to 1.5 Tesla.
After checking basic features of the HAPD, we carried out a beam test at KEK, where 2.0 GeV/c electron beam was used. In the test, 6 HAPDs were arranged in a 2x3 configuration and an aerogel tile was used as Cherenkov radiator. For the readout electronics, ASIC chips which amplify and digitize the HAPD signal were connected at the backend of the photon detector system. With this system, we successfully observed a clear Cherenkov ring image. A detailed analysis of the beam test showed Cherenkov angle resolution of ˜13 mrad and with 9 detected photoelectrons.
This report will give detailed results from the beam tests including several basic measurements at the bench.

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

http://heal1.phys.metro-u.ac.jp/user/kuroda/VCI2010/VCI2010_shiizuka.pdf

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