Contribution ID: **358**   Type: **Talk**

Behaviour of hybrid avalanche photo-detector for the Belle II Aerogel RICH in magnetic field

Wednesday 17 February 2016 11:55 (20 minutes)

For the Belle II spectrometer a proximity focusing RICH counter with an aerogel radiator (ARICH) will be employed as a PID system in the forward endcap region of the spectrometer. The main challenge during ARICH R&D was a reliable multichannel sensor for single photons that operates in the high magnetic field of the spectrometer (1.5 T) and withstands the radiation levels expected at the experiment. A 144-channel Hybrid Avalanche Photo-Detector (HAPD) was developed with Hamamatsu Photonics K.K. and recently the production of 450 HAPDs was completed. While our first tests of HAPD performance in the magnetic field (before mass production) showed no issues, we lately observed a presence of very large signal pulses ($\sim$5000$\times$ single photon signal), generated internally within about 20% of HAPDs, while operating in the magnetic field. The rate of these pulses varies from sample to sample. These pulses impact the HAPD performance in two ways: they introduce periods of dead time and in some cases damage to the front-end electronics was observed. In the talk we will present conditions under which such large pulses are generated, their properties and impact on HAPD performance, and discuss possible mechanism of their origin.

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Session Classification: Photon Detectors

Track Classification: Cherenkov Detectors