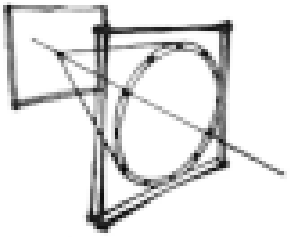

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Behaviour of HAPD for the Belle II experiment in magnetic field

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The proximity-focusing Aerogel Ring-Imaging Cherenkov detector (ARICH) has been designed to provide PID in the forward end-cap region of the Belle II spectrometer. As a photon detector a Hybrid Avalanche Photo-Detector (HAPD), which was developed in collaboration with Hamamatsu Photonics, will be used. As the ARICH will be placed in 1.5T magnetic field, the HAPD must be immune to it.
Recently the production of about 500 HAPDs was completed and their performance in the 1.5T magnetic field was tested. While from our early tests of prototype samples no adverse effects of magnetic field were expected, we observed that in about 20% of HAPDs abnormally large signals (about 5000 times a single photon signal), affecting the full APD surface, are generated when operating in the magnetic field. The main effect of these large signals on the HAPD performance is the short period of dead time following each large pulse. For the most problematic HAPDs, for which the rate of large pulses can reach up to a few per second, the induced dead time can be as high as 20%.
As a possible origin of large pulses we considered the surface flashover effect on the side-walls of the HAPD tube, which is known to depend on magnetic field. However, recently we found an unexpected dependence of the rate of pulses on the bias voltage applied to the APD, which hardly compatible with that mechanism. If we apply bias voltage to single APD pad with 10 V reduction, the frequency go down to near 0. On the other hand, when we apply 10 V reduction to all APD pads, the frequency does not decrease but sometimes increase. We also find the large pulse seems to be related to the vacuum inside HAPD.
In the poster, we report about the observation of large signals in the HAPD, our strategy to manage it, and our study to identify its mechanism behind it.

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