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Aerogel RICH counter for the Belle II forward PID

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The Belle II spectrometer, a follow up of the very successful Belle experiment, is under construction at the SuperKEKB electron-positron collider at KEK in Japan. For the PID system in the forward region of the spectrometer, a proximity focusing RICH counter with aerogel radiator is being developed. For this counter we have devised a focusing radiator consisting of two aerogel layers with increasing refractive index along the particle path, which results in a focusing of Cherenkov light at the photon detector plane. In this way, a thicker radiator can be used, and the number of photons can be increased without degrading the single photon Cherenkov angle resolution. The detector will provide a 4 σ separation of pions and kaons up to momenta of 4 GeV/c, at the kinematic limits of the experiment. The main challenge was, however, 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 in the experiment. A 144-channel Hybrid Avalanche Photo-Detector (HAPD) was developed in a collaboration with Hamamatsu Photonics K.K. The design of the detector components is currently being finalized and part of the mass production has already started. The counter will be ready for installation in 2015. We will report on the tests of the prototypes conducted with test beams at CERN and DESY, and the optimization and performance studies of the counter final design, based on the Geant4 simulation.

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