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Performance study for the CEPC ScW Ecal (12' + 3')

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This article presents the status of a highly granular scintillator-based electromagnetic calorimeter (ScW Ecal) proposed to realize Particle Flow Algorithm for the CEPC. The ScW Ecal is a sandwich calorimeter consists of sampling and sensitive layers. The material of tungsten is selected as absorb material. The active layers are plastic scintillators consisting of 5×45 mm² scintillator strips. The scintillator strips in adjacent layers are perpendicular to each other to achieve a 5×5 mm² effective transverse size. Each strip is covered by a reflector film to increase collection efficiency and improve uniformity of the scintillation light. Photons from each scintillator strip are read out by very compact photon sensor, SiPM, attached at the end of the strip. Scintillator-SiPM unit is the core part of ScW Ecal. Optimization of the scintillator-SiPM unit such as shape of scintillator strip, thickness of scintillator strip, design of combination of a scintillator and a SiPM are discussed. Additionally, the performance of SiPM was tested. The gain is typically of order a few 10⁵, the dark noise rate and the inter-pixel cross-talk probability are of order 100 kHz/mm² and 0.1 respectively. The SiPM dynamic range is determined by the number of pixels.

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