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The calibration methods of hadron calorimeter modules with cosmic muons for the CBM experiment at FAIR

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A modular hadron calorimeter, the Projectile Spectator Detector (PSD) at CBM is aimed to determine a collision centrality and to reconstruct the event plane orientation in collisions of heavy nuclei. PSD is a hadron lead/scintillator sandwich calorimeter with the sampling ratio providing the compensation condition. The calorimeter includes 44 individual modules. Each module consists of 60 lead/scintillator sandwiches with the 4 mm thickness of each scintillator plate and 16 mm lead plate. Each module has ten longitudinal sections and, respectively, ten compact photodetectors, the avalanche photodiodes MPPC with active area 3x 3 mm2. The modules after assembling were tested with the cosmic muons to evaluate the light yield of each longitudinal section. At first stage, the module was installed in the vertical position and the data were collected for a few hours. Clean peaks in amplitude spectra were observed in all 10 sections. At the second stage, the module was placed back into horizontal position and the data were collected in self-triggering mode. In the last case, the cosmic muons pass different lengths in the scintillator plates depending on the angular distribution of the muons. Therefore, no clear peaks were observed in the amplitude spectra. To select the muon tracks with the similar pass-lengths in the scintillator plates the track selection algorithms were used. In the simplest way, the events with the energy depositions in 3 neighbor sections were selected. These events correspond to the almost horisontal muon tracks crossing a few longitudinal sections in the module. The different algorithms of the energy calibration and the light yields of the calorimeter modules are discussed.

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