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# Energy calibration and signal waveform analysis of the CBM Projectile Spectator Detector

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Forward hadron lead/scintillator sampling calorimeter (Projectile Spectator Detector, PSD) consisting of 44 longitudinally segmented modules is developed and already constructed for the future Compressed Baryonic Matter (CBM) experiment at FAIR. The original approaches in the energy calibration with cosmic muons and in the signal analysis are proposed. The longitudinal segmentation of individual modules allows for the reconstruction of the cosmic muon tracks in the PSD. It makes possible to estimate the muon pass length in each longitudinal section with the subsequent correction of energy depositions in the scintillators. The developed method takes into account more accurately the muon energy deposition and improves the precision of the energy calibration.
The short (about 40 nsec) PSD analog signals from photodetectors in each longitudinal section will be digitized by 125 MS/s sampling ADCs. To improve the precision of the PSD energy calibration, the procedure of signal waveform fitting based on the Prony least squares method was developed. This method represents the waveform as a linear combination of exponential functions and allows the measurement of signal amplitude with high accuracy. The fit of the signals with a predefined function permits to discriminate the small muon signals from the electronic noises of comparable amplitudes. The speed of the applied fitting procedure is a few orders faster than the standard iteration methods. It allows the signal analysis on the fly. The developed method makes also possible the selection of pileup signals at a high counting rate.

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