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Analysis and Verification of Relation between Digitizer's Sampling Properties and Energy Resolution of HPGe Detectors

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The CDEX (China Dark matter Experiment) aims at detection of WIMPs (Weakly Interacting Massive Particles) and $0\nu\beta\beta$ (Neutrinoless double beta decay) of ^{76}Ge . It now uses ~ 10 kg HPGe (High Purity Germanium) detectors in CJPL (China Jinping Underground Laboratory). The energy resolution of detectors is calculated via height spectrum of waveforms with 6- μs shaping time. It is necessary to know how sampling properties of a digitizer effect the energy resolution. This paper will present preliminary energy resolution results of waveforms at different sampling properties. The preliminary results show that the ENOB (effective number of bits) with 8.25-bit or better can meet the energy resolution of CDEX HPGe detectors. Based on the ADC (Analog-to-Digital Converter) quantized error theory, this paper will also make a quantitative analysis on energy resolution in CDEX HPGe detectors. It will provide guidance for ADC design in full-chain cryogenic readout electronics for HPGe detectors.

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