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Development of an R-value-Based Trigger Algorithm for Energy Threshold Reduction

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Cryogenic detectors are widely employed to investigate rare physical processes such as double beta decay, dark matter interactions, and coherent neutrino scattering. Lowering the energy threshold of detectors not only enhances the understanding of background but also contributes to expanding the scientific scope of experiments.

We have developed a new trigger algorithm based on the Pearson correlation coefficient, commonly referred to as the r-value. This method compares the shape of incoming data waveforms with a predefined signal template to make trigger decisions. Compared to conventional pulse-height-based triggering schemes, the r-value trigger demonstrates superior performance in reducing the energy threshold and improving trigger efficiency. By applying this technique to the AMoRE-I detector and detectors in the AMoRE R&D setups, we achieved significant improvements in lowering the detection energy thresholds. Specifically, we observed that a trigger efficiency above 90% was attained for energies below 20 keV, representing a substantial improvement over the previous threshold range of 50–100 keV.

Collaboration you are representing

AMoRE

Author: KIM, Woo Tae (IBS CUP)

Presenter: KIM, Woo Tae (IBS CUP)

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