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Machine learning-based discrimination of bulk and surface events of germanium detectors for light dark matter detection

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Surface events that exhibit incomplete charge collection are an essential background source in the light dark matter detection experiments with p-type point-contact germanium detectors. We propose a machine learning based algorithm to identify bulk and surface events according to their pulse shape features. We construct the training and test set with part of the 𝒳-source calibration data and use the rising edge of the waveform as the model input. This method is verified with the test set and another part of the 𝒳-source calibration data. Results show that this method performs well on both datasets, and presents robustness against the bulk events' proportion and the dataset size. Compared with the previous approach, the uncertainty is reduced by 16% near the energy threshold on the physics data of CDEX-1B. In addition, the key pattern identified in the waveform is verified to be consistent with its physical nature by digging into this algorithm.

Collaboration (if any)

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