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Optimized PMT Waveform Analysis

Photomultiplier tube (PMT) voltage waveforms are the raw data of many neutrino and dark matter experiments. Waveform analysis is usually the first critical step of data processing. Targeting precise timing and charge extraction of photoelectrons, we develop and evaluate several waveform analysis methods, among which direct demodulation, convolutional neural networks and fast Bayesian matching pursuits are the most promising. Time and energy event reconstruction can be improved upon the traditional thresholding methods, most significantly with high energy events when photoelectrons pile up in waveforms.

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