

High precision modeling of germanium detector waveforms using MCMC machine learning

The MAJORANA DEMONSTRATOR is a neutrinoless double-beta decay experiment using high purity p-type point contact germanium detectors. The waveforms produced in these detectors exhibit subtle variations related to the detailed energy deposition and drift path information for each event. In addition, the waveforms depend sensitively on crystal impurity levels, temperature, and operating voltage. We have developed a machine learning algorithm which, given a set of calibration waveforms, can infer detector parameters. Once these parameters are known, this high precision detector model can be used to fit the drift paths of individual waveforms. This method can be used as a sensitive background rejection technique for the DEMONSTRATOR or the proposed future LEGEND experiment.

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