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α, β pulse shape discrimination in silicon detectors

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The Beta-decay Paul Trap (BPT) at Argonne National Laboratory primarily studies the beta delayed-alpha decays of ^{8}Li and ^{8}B to measure the beta-neutrino angular correlation coefficient in these decays to search for a tensor contribution to the weak interaction. Additionally, the BPT is able to directly measure the ^{8}B unoscillated neutrino spectrum, an important input for current and next generation solar neutrino detectors. The BPT uses four, 1 mm thick double-sided silicon strip detectors for 25% solid angle coverage with angular resolution of $\sim 2^{\circ}$, which sample the β energy due to their thickness. One present experimental limitation is the lack of discrimination between α and β particles below $\sim$ 1 MeV, a portion of the energy spectrum which has a large impact on the reconstruction of the ^{8}B neutrino spectrum. To overcome this limitation, we investigate using pulse shape discrimination to distinguish between α and β particles in thick silicon detectors, with promising performance under both simple approaches and more complex machine learning techniques.

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