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Validating LEGEND-200 detector model with calibration data using Monte Carlo simulations

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One of the most puzzling open questions in physics is whether neutrinos are their own antiparticles - are they Majorana particles? Demonstrating this property would impact our understanding of the neutrino mass ordering and the matter-antimatter asymmetry in the Universe. The Large Enriched Germanium Experiment for Neutrinoless $\beta\beta$ Decay (LEGEND) aims to shed light on this puzzle by searching for the neutrinoless double beta ($0\nu\beta\beta$) decay of ^{76}Ge. Since 2023, LEGEND-200 has been operating 142 kg of ^{76}Ge-enriched detectors placed in a cryostat filled with active liquid argon, which is itself housed in a large water tank for additional shielding. LEGEND-200 targets a half-life sensitivity beyond 10^{27} years after an exposure of 1 tonne-year.

Calibration of the ^{76}Ge detectors is essential to ensure accurate energy reconstruction, long-term detector stability and effective discrimination between potential $0\nu\beta\beta$ signals and background events. My contribution focuses on comparing the calibration data with Monte Carlo simulated data to validate the LEGEND-200 detector model. This work also supports the optimisation of calibration source placement to achieve uniform irradiation of all detectors in the array. Such uniformity is crucial for improving the precision of the energy calibration and enhancing the overall reliability of the physics analysis.

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