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LZ Electron Recoil Calibrations and NEST-Based Simulations

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The LUX-ZEPLIN experiment recently announced its first, world-leading exclusion limits in the search for WIMP dark matter, with spin-independent and spin-dependent results. These results are supported by high-statistic, high-quality calibrations. For electron recoils, tritiated methane is used to produce beta decays up to 18.6 keV, Rn-220 for energies out to 100+ keV, and Kr83m and Xe131m/Xe129m for position reconstruction, 3D corrections, and detector stability monitoring. The use of these sources will be discussed in depth, along with comparisons of the SR1 (Science Run 1) tritium calibration to LZ simulations based on NEST, the Noble Element Simulation Technique. An unprecedented 1%-level agreement on means and O(10%) level on widths was observed with no tuning of free parameters, using a version of NEST predating LZ, while an unprecedented 0.1% level of agreement on means, and O(1%) on widths, was rapidly achieved through a simple tuning of mainly detector parameters, within their uncertainties.

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