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Simulations of the LUX-ZEPLIN (LZ) experiment using Geant4

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Liquid noble gas detectors, such as LZ, continue to demonstrate world leading sensitivity to WIMP dark matter for masses above a few GeV. Here an overview of the LZ simulation framework is provided including custom physics lists employed for low energy tracks and deposits, modifications to better model Xe and Gd processes, and external parametric models of scintillation and ionisation responses. The highly shielded design of these detectors, including the self-shielding from the dense target medium, leads to difficulty in probing the central detector volume using basic Monte Carlo techniques, with most interactions confined to the shielding or target perimeter. This problem is expected to be more pronounced in the much larger LXe detector proposed by the XLZD consortium.

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