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Background simulation techniques and expected sensitivity to sub-GeV dark matter in the QUEST-DMC experiment

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QUEST-DMC (QUantum Enhanced Superfluid Technologies for Dark Matter and Cosmology) uses a superfluid helium-3 target cooled to 140 μK to search for eV-keV scale recoil energies from interactions with sub-GeV mass dark matter candidates. As the target volume of a QUEST bolometer is extremely small (<1cm^3) it is CPU intensive to produce high statistics simulations of background interactions with sources originating from outside the experiment cryostat. These simulations are sped up by creating intermediate particle generators using partially attenuated spectra, dubbed 'rethrowing'. Expected detected energies and rates are produced through the application of a data-driven response model to the final simulated spectra. This talk will outline this background simulation, the subsequent applied response model, dark matter search prospects with existing data from a prototype QUEST bolometer and ultimate sensitivity estimates in the experiment.

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