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Estimation of (particle) backgrounds at sub-keV energies for the NUCLEUS CEvNS experiment

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The NUCLEUS experiment aims to detect reactor anti-neutrinos through coherent elastic neutrino-nucleus scattering (CEvNS) at the Chooz nuclear power plant in France using a 10-g cryogenic detection system made of CaWO4 and Al2O3 target crystals featuring unprecedented low energy thresholds of 20\,eV. Although being exposed to a high neutrino flux of 1.7×10^{12} $s^{-1}cm^{-2}$, the NUCLEUS experimental site exhibits challenging background conditions for CEvNS detection.
With a 3 meters water equivalent overburden, secondary cosmic-rays and gammas from natural radioactivity are expected to be the main contributors to the backgrounds in the region of interest, below 100\,eV, where most of the expected CEvNS signal in NUCLEUS lies in. To suppress these backgrounds to a sufficiently low level and achieve a signal-over-background ratio greater than 1, a combination of passive and active shieldings has to be erected around the cryogenic target detectors.
This talk will present the results of extensive Monte Carlo simulation studies of the NUCLEUS setup combined to dedicated on-site background measurements for both optimizing the design of the shielding and for achieving a first background prediction at sub-keV energies.

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