

Ultra-low energy calibration of the XENON1T detector with a diluted ^{37}Ar source

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In 2018 the XENON1T experiment set the most stringent constraints on the interaction cross-section between nucleons and Weakly Interacting Massive Particles. A crucial role for the inference of such results is played by the accurate modelling of the detector response.

We report about a new calibration test with a ^{37}Ar source diluted into the liquid xenon, performed in the XENON1T detector at the end of its operation.

The isotope undergoes electron capture, emitting a cascade of Auger electrons and X-rays with a energy of 2.8 keV or 270 eV, hence providing a unique opportunity to study the detector response, including threshold effects and spatial dependencies, directly in the energy range of Dark Matter searches.

To deal with the 35 days half-life of the source, the complete removal has been ensured by cryogenic distillation, which reduced the activity by 5 orders of magnitude in ~ 25 days, opening the way for a regular use of this method in the successor experiment XENONnT.

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