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Detector response study of cryogenic scintillating Li_2MoO_4 detectors for next generation $0\nu\beta\beta$ search

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Next generation ^{100}Mo based neutrinoless double beta decay searches like AMoRE and CUPID require a precise understanding of the detector response of cryogenic ^{100}Mo based detectors at the Q-value (3034 keV) of the $0\nu\beta\beta$ decay. However, common long-lived calibration sources like ^{208}Tl provide the last intense calibration peaks at or below 2.6 MeV and hence require an extrapolation to the region of interest (ROI). In the CUPID-Mo demonstrator we operated 20 enriched Li_2MoO_4 detector modules at ~20 mK for an extended period of more than 1 year proving the competitiveness of this detector tenchnology for future $0\nu\beta\beta$ searches. We also performed a dedicated ~3 week calibration campaign with a specially irradiated ^{56}Co source to directly assess the detector response with high energy γ lines at and above the ^{100}Mo Q-Value. In this contribution we will present results of this calibration campaign with respect to a typical detector response extrapolation in terms of energy bias and energy resolution broadening at the Q-value of ^{100}Mo. In addition, the rich γ spectrum of the ^{56}Co source allowed for an assessment of the detector response for different event topologies in particular of well localised electron-positron pair creation events with escape of the two 511 keV γ's versus multi-site events like typical Compton + Photoabsorption events for full energy peaks in the few MeV range. We observe a small but statistically significant shift of ~0.6 keV in the energy reconstruction of these event types, which if confirmed should be considered as systematic for the $0\nu\beta\beta$ ROI.

Collaboration you are representing

CUPID-Mo

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