Contribution ID: **62** Type: **Invited talk**

Calibration considerations for neutrinoless double beta decay searches with LXe TPCs

Wednesday, 20 May 2026 11:30 (30 minutes)

The search for neutrinoless double beta decay is of paramount importance to discovering physics beyond the Standard Model. Liquid xenon time projection chambers are a powerful technology for such searches using the isotope 136Xe: the monolithic xenon target is scalable and provides strong self-shielding, enabling extremely low-background searches. Existing detectors have also demonstrated sub-percent energy resolution and mm-scale 3D event reconstruction, enabling powerful signal/background discrimination.

Reaching the sensitivity goals of next-generation experiments will require a careful calibration program spanning instrumental calibration of individual readout channels through validation of full event reconstruction for signal-like and background-like energy deposits. In this talk, I will describe these challenges in the context of current- and next-generation xenon TPCs, using the proposed nEXO experiment as a concrete example. I will summarize the main calibration systems under consideration (including ongoing R&D and prototyping) to characterize the TPC response and its spatial and time dependence. I will also briefly discuss scalability considerations for a future 60–80 tonne instrument such as the proposed XLZD detector.

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Session Classification: Technology and R&D

Track Classification: Technology