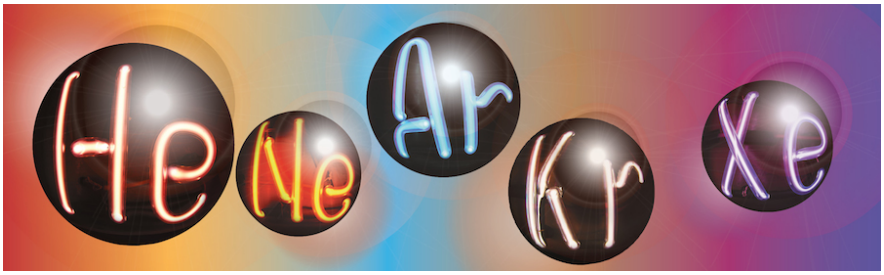


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# The NEXT-100 detector: performance and first low-background results for the 0nubetabeta search

The NEXT Collaboration searches for neutrinoless double beta decay ($0\nu\beta\beta$) in $^{136}$Xe using high-pressure xenon gas electroluminescent time projection chambers. This technology offers excellent energy resolution and powerful background rejection via three-dimensional event topology reconstruction.

The NEXT-100 detector, which can accommodate approximately $100\,\mathrm{kg}$ of xenon at a pressure of $15\,\mathrm{bar}$, began operation at the Laboratorio Subterr\'aneo de Canfranc in 2024. Its main objectives are to demonstrate the scalability of the NEXT technology and to deliver the first competitive $0\nu\beta\beta$ results of the collaboration. Following a successful commissioning campaign, the detector was calibrated with the low-energy $^{83\mathrm{m}}$Kr and high-energy $^{228}$Th sources. These measurements yielded an energy resolution below $1\%$ FWHM at the $Q_{\beta\beta}$ value of $2.46\,\mathrm{MeV}$, meeting the experimental design goal. A first low-background run with xenon depleted in $^{136}$Xe was subsequently carried out to measure and characterize the different sources of background. The contribution from internally produced radon was found to be negligible, with a background index of approximately $0.4 \times 10^{-4}\,\mathrm{counts\,keV^{-1}\,kg^{-1}\,yr^{-1}}$.
In addition, the radon abatement system at the LSC allows NEXT-100 to operate in an effectively radon-free environment. I will also describe the next phase of the NEXT-100 programme, in which high-pressure data for the $0\nu\beta\beta$ search will be collected with both depleted and enriched xenon.
%I will also describe the next phase of the NEXT-100 programme, focused on high-pressure operation under conditions approaching those foreseen for the $0\nu\beta\beta$ search.
With an expected total background index below $10^{-3}\,\mathrm{counts\,keV^{-1}\,kg^{-1}\,yr^{-1}}$, NEXT-100 is projected to reach a $0\nu\beta\beta$ half-life sensitivity of $6 \times 10^{25}\,\mathrm{yr}$ at $90\%$ C.L. after three years of data taking with xenon enriched in $^{136}$Xe.

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