

# NEXT: results from NEXT-White and roadmap toward the $\beta\beta 0\nu$ search

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## Abstract

The goal of the NEXT (Neutrino Experiment with a Xenon TPC) collaboration is the sensitive search of the neutrino-less double beta decay ( $\beta\beta 0\nu$ ) of  $^{136}\text{Xe}$  at the Laboratorio Subterráneo de Canfranc (LSC). The observation of such a lepton-number-violation process would prove the Majorana nature of neutrinos, providing also handles for an eventual measurement of the neutrino absolute mass. After a successful R&D phase, a first large-scale prototype of a high-pressure gas-Xenon electroluminescent TPC is being operated at the LSC since 2016. NEXT-White is a 5-kg radiopure detector meant to understand the relevant backgrounds for the  $\beta\beta 0\nu$  search and to perform a measurement of the two neutrino mode of the double beta decay ( $\beta\beta 2\nu$ ). The operation of NEXT-White is setting the grounds for the construction of the NEXT-100 detector: a TPC holding 100 kg of  $^{136}\text{Xe}$  and reaching a sensitivity to the  $\beta\beta 0\nu$  half-life of  $6 \times 10^{25}$  y after 3 years of data taking. In this talk, the latest results from the NEXT-White detector will be presented. The calibration data have allowed to evaluate the performance of the NEXT technology in terms of the topology-based background rejection capabilities and the energy resolution. In particular, a world-leading resolution for a Xe TPC has been achieved ( $<1\%$  FWHM at 2.6 MeV). The radioactivity-induced backgrounds have also been measured using the data collected operating the detector with depleted xenon. These results validate the background model of the NEXT experiment, estimating less than  $5 \times 10^{-4}$  counts/keV/kg/year in the NEXT-100 detector. As NEXT-White is currently taking data with  $^{136}\text{Xe}$ , preliminary results on the measurement of the  $\beta\beta 2\nu$  half-life will be released in this talk. Finally, the status of NEXT-100 and future upgrades, like the Ba $^{++}$  tagging R&D, will also be addressed.

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