STATUS AND PROSPECTS OF THE NEXT-100 EXPERIMENT

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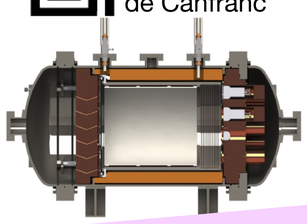
ICHEP 2024

The NEXT experiment aims at the sensitive search of the **neutrino-less double beta decay** of ^{136}Xe at the LSC. The NEXT-100 detector has been installed and is currently under commissioning.

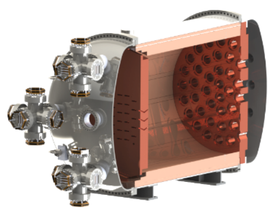
2009 — **DEMO ~1kg**
Prototype

2015 — **NEXT-WHITE (NEW) ~5kg**
Background model + 2nubb
Laboratorio Subterráneo de Canfranc



See Talk B. Palmeiro 19, July 10:45 (Room Panorama)

2023 — **NEXT-100 ~100kg**
0nubb
Laboratorio Subterráneo de Canfranc



2027 — **NEXT-HD ~1T**
0nubb in the IO

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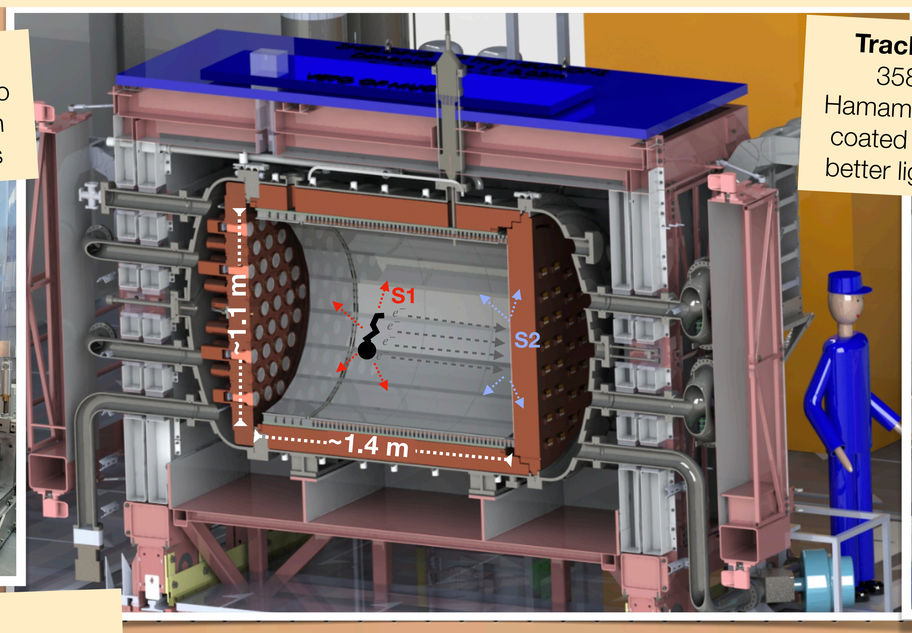
*See Posters #**909** P. Herrero #**765** N. López*

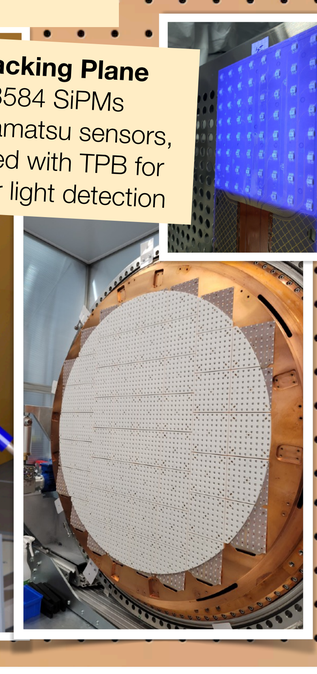
NEXT-100 DETECTOR

High Pressure Gaseous Time Projection Chamber using Electroluminiscent Amplification with 2 dedicated readout planes

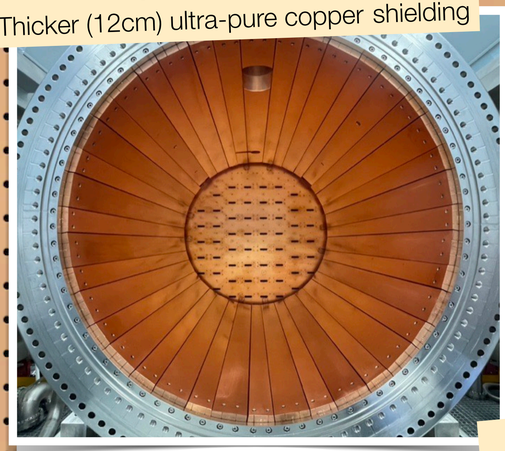
Energy Plane
60 PMTs coupled to xenon gas through sapphire windows

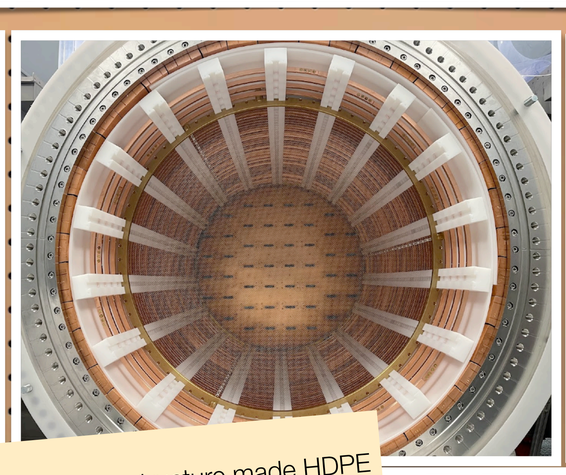


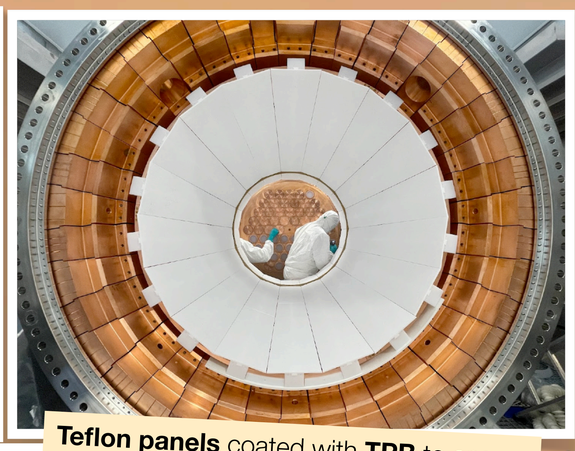
Tracking Plane
3584 SiPMs Hamamatsu sensors, coated with TPB for better light detection



Copper Shielding
Thicker (12cm) ultra-pure copper shielding



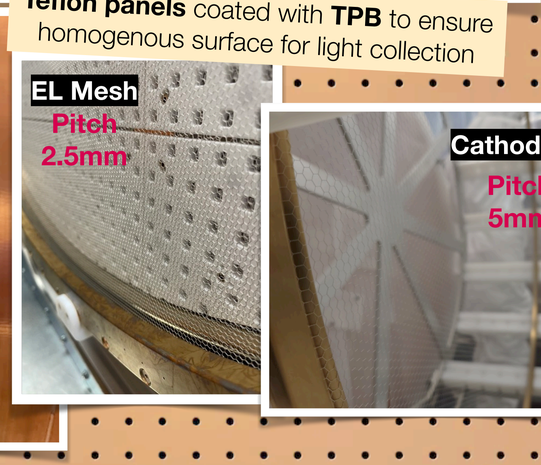




Field Cage structure made HDPE bars and with copper rings connected with 3 resistor chains

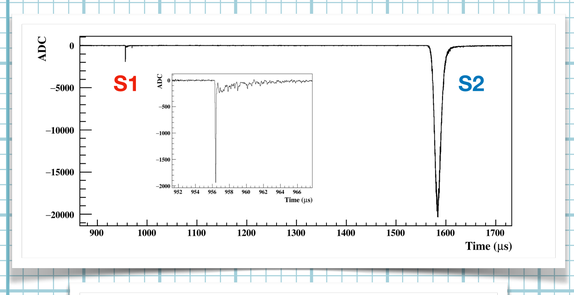
Cathode and **EL meshes** constructed from tensioned hexagonal meshes (~100 μm thickness) [1].

Teflon panels coated with **TPB** to ensure homogenous surface for light collection

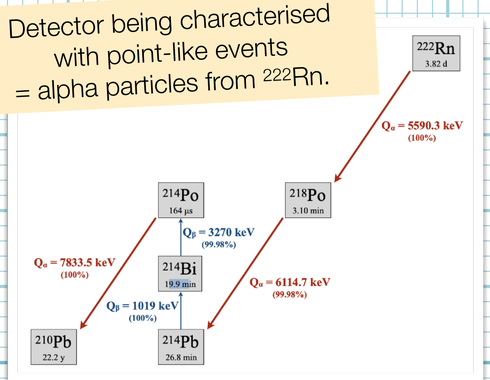


NEXT-100 COMMISSIONING

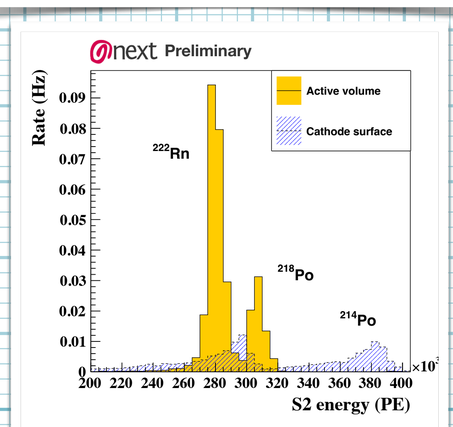
Detector ready for operation in May 2024. It is in stable operation filled with Argon at 4.3 bar, drift field of ~67 V/cm and EL field of ~6.9 kV/cm.



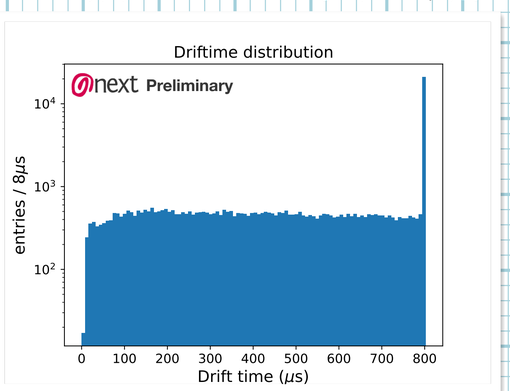
Detector being characterised with point-like events = alpha particles from ^{222}Rn.

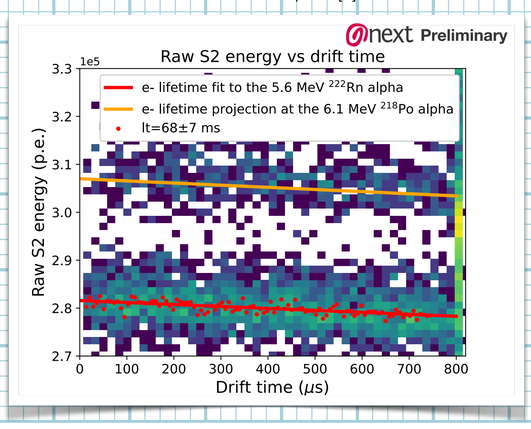


▲ Representation of ^{222}Rn decay.
▼ Distribution of events along the whole drift region. ^{214}Po alphas are mostly populated on the cathode region ($\sim 800\ \mu s$) [2].



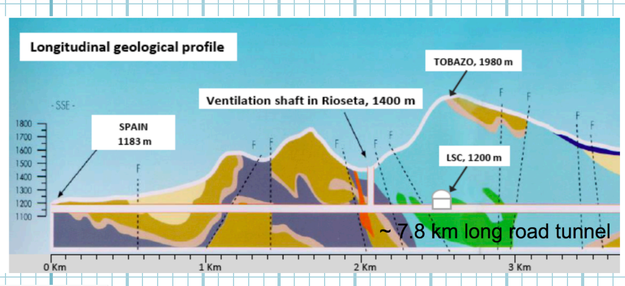
▲ S2 energy distributions for different alpha populations [2].
▼ Electron lifetime estimations along the whole drift region for ^{222}Rn and ^{218}Po alphas [2].

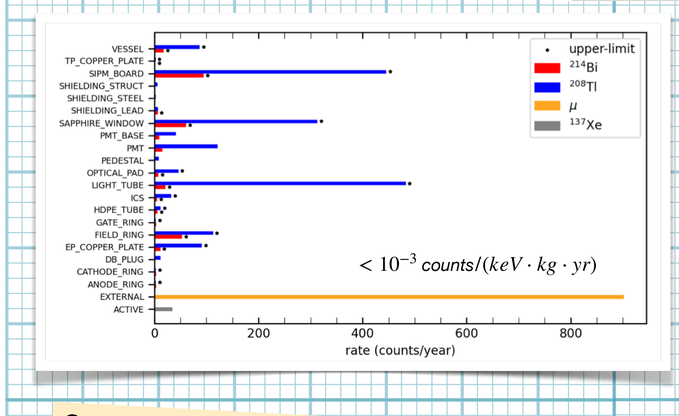




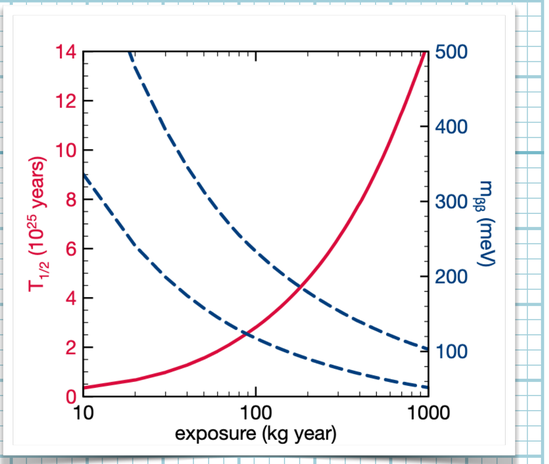
NEXT-100 SENSITIVITY

- NEXT-100 sensitivity estimated with full simulation, extensive radio purity screening, and NEXT-White results.
- The main background in NEXT is represented by natural decay series (U, Th) producing ^{214}Bi and ^{208}Tl.

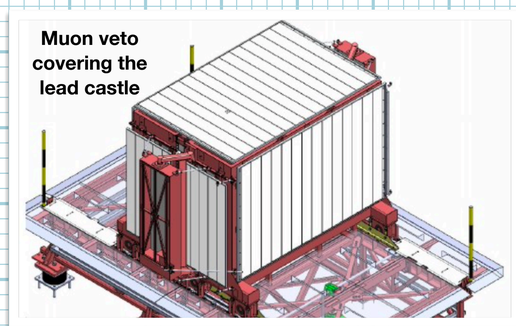




▲ Representation of the geological profile of the LSC.
◀ Expected background rate from different detector components in the energy region of interest [2.40, 2.50] MeV [3].
▼ Expected lifetime sensitivity of the detector with respect to exposure, considering $< 10^{-3}$ counts/$(keV \cdot kg \cdot yr)$ background rate [4].



Spallation neutrons produced by cosmic rays: flux reduced by rock above the detector. Main source are those originating in the detector shielding: ***muon veto is under construction.***



$T^{0\nu}_{1/2} = 6.0 \times 10^{25} years$ @ 90% CL
(3 years of data)

$m_{\beta\beta} < 80 - 160$ MeV @ 90% CL
(3 years of data)

[1] JINST 19 P02007 2024
[2] Neutrino Conference (2024), *Other present and future 0vDBD experiments*
[3] Sensitivity of NEXT-100 detector to neutrinoless double beta decay, G. Diaz PhD Thesis
[4] JHEP 1605 (2016) 159