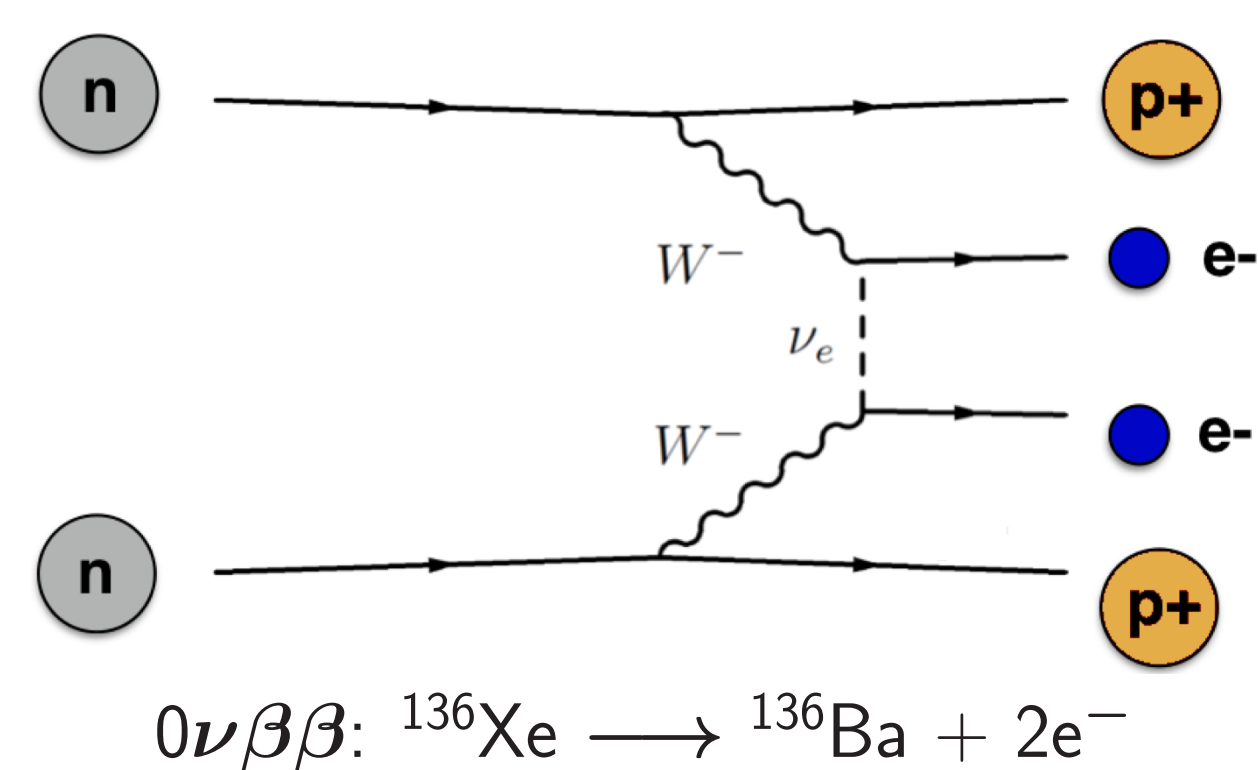# Latest results from the NEXT-White detector

Gonzalo Díaz López [1], on behalf of the NEXT Collaboration.

[1]Instituto Galego de Física de Altas Enerxías, IGFAE.

$0\nu\beta\beta$: $^{136}Xe \longrightarrow {}^{136}Ba + 2e^{-}$

The scientific goal of NEXT (Neutrino Experiment with a Xenon TPC) is to observe neutrinoless double beta decay ($0\nu\beta\beta$) in ^{136}Xe using a high pressure Xe electroluminescent gas TPC (Time Projection Chamber). Due to very long decay times ($T^{0\nu}_{1/2} > 10^{26}$ y) double beta experiments must pursue **high energy resolution, low background rate and good event identification** in the ROI ($Q_{\beta\beta}$).

Here we discuss the results from the first phase of the experiment using the NEXT-White (NEW) detector which operates in Laboratorio Subterráneo de Canfranc (LSC) in the Spanish Pyrenees.

More information on the experiment can be found in `https://next.ific.uv.es/next/`. See also related Posters 144, 150 and 193.

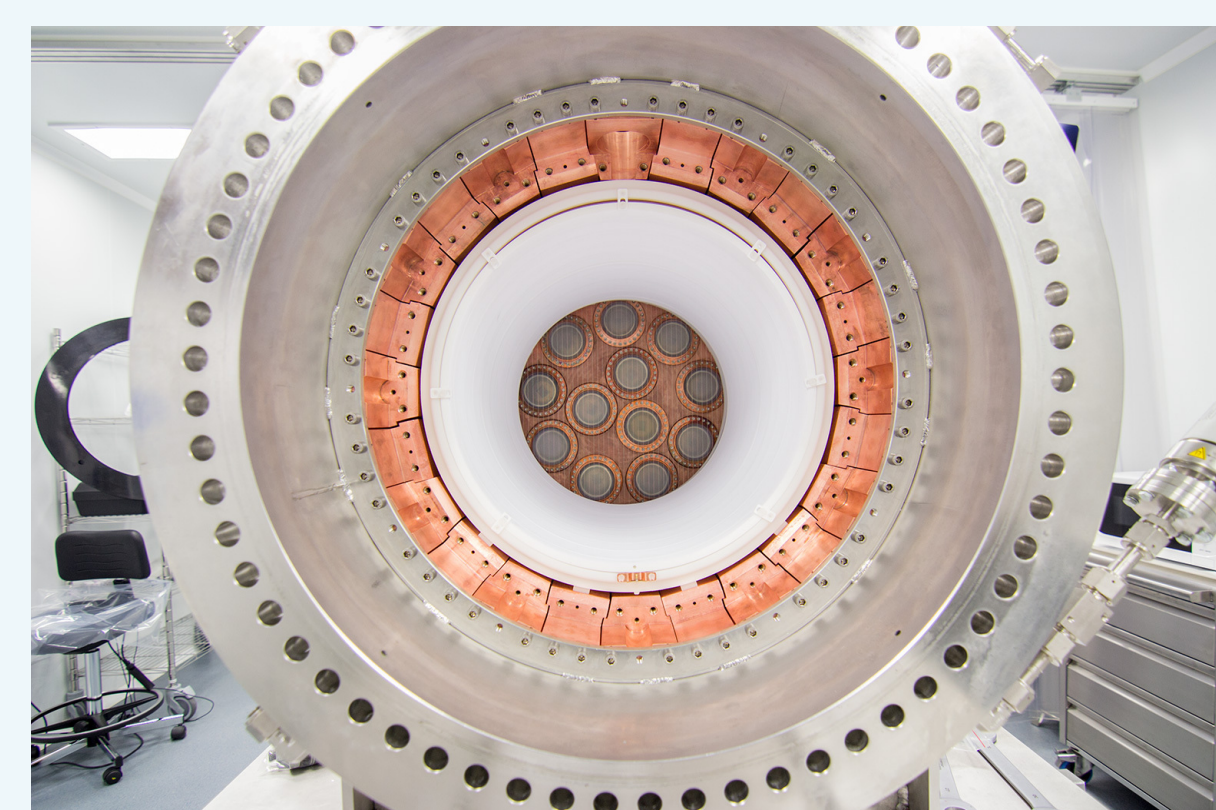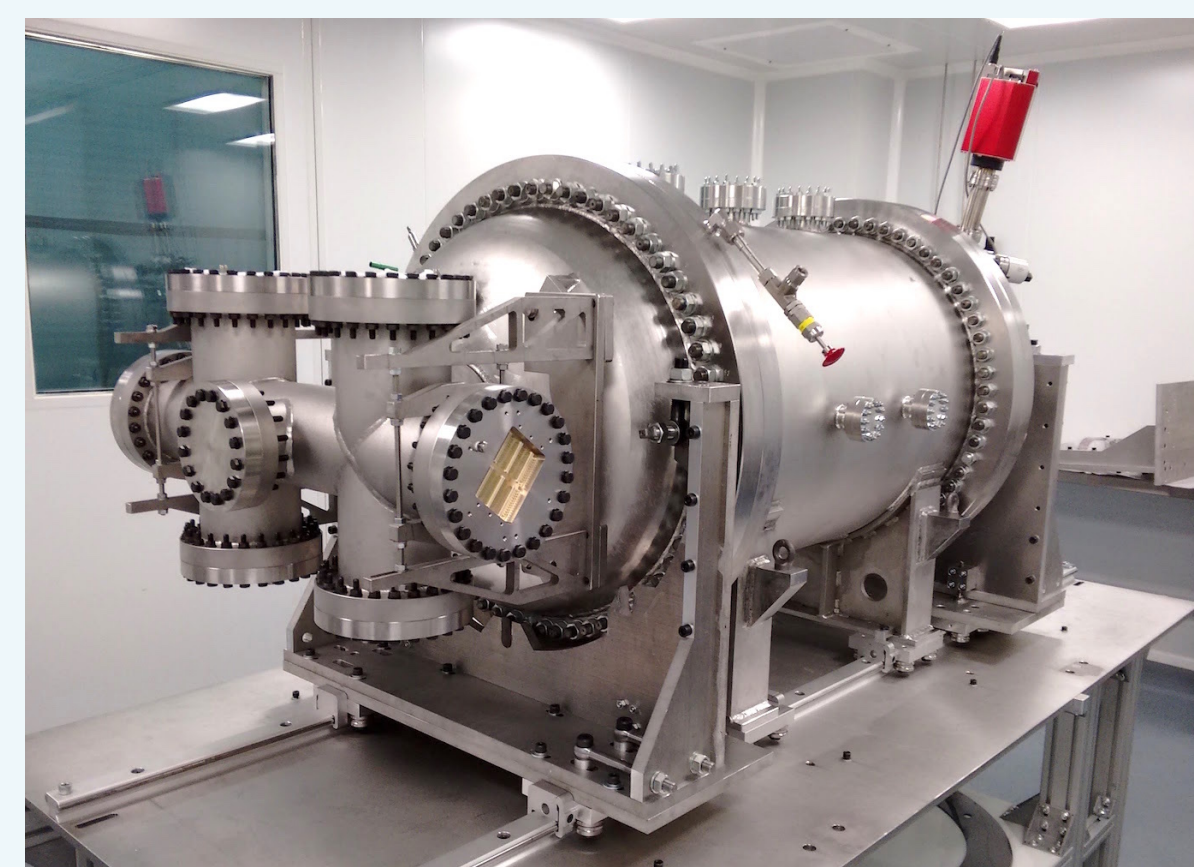## NEXT-White Detector

NEXT-White is a high pressure ^{136}Xe electroluminescent TPC that allows **energy measurement and 3D reconstruction** of the events.
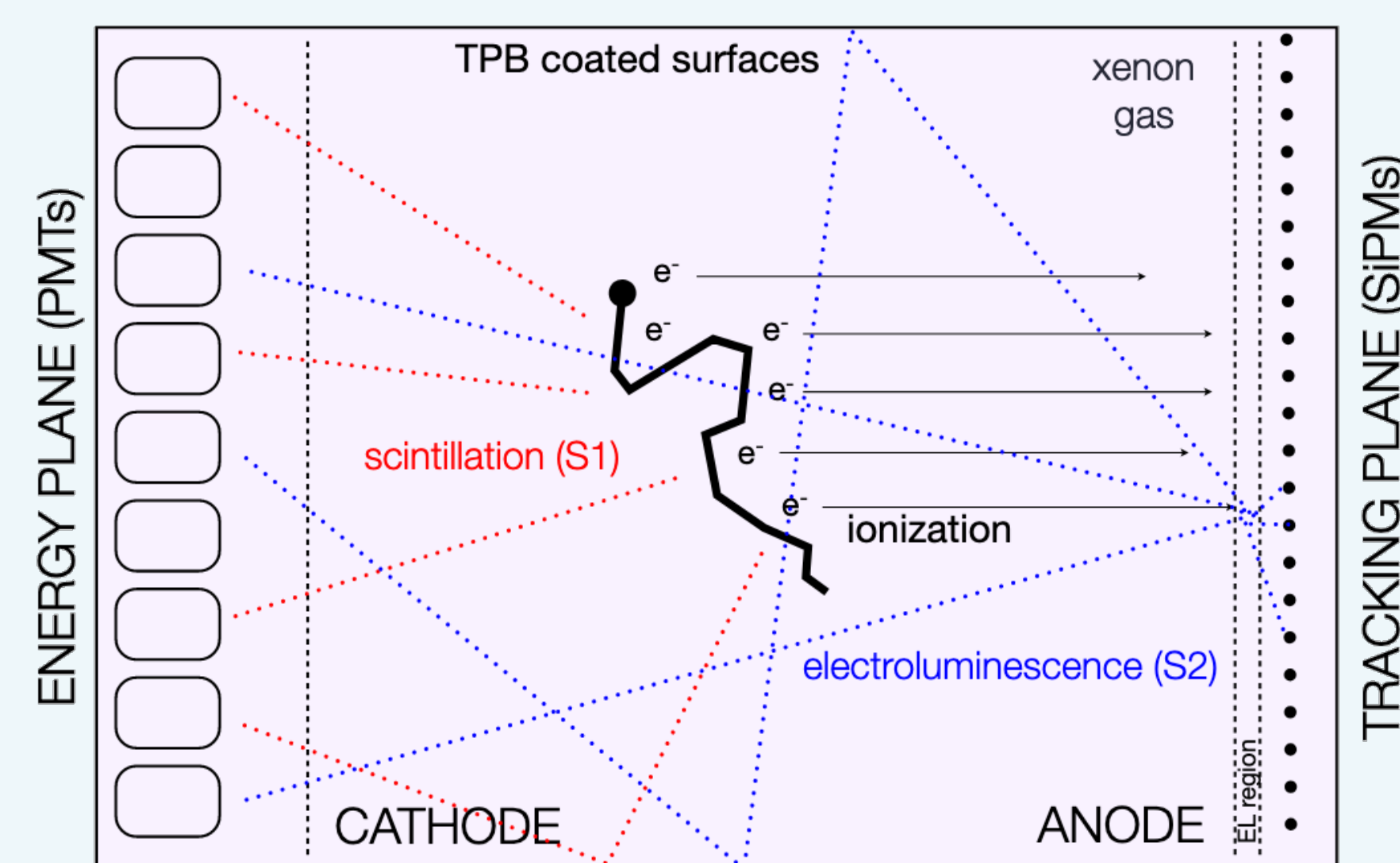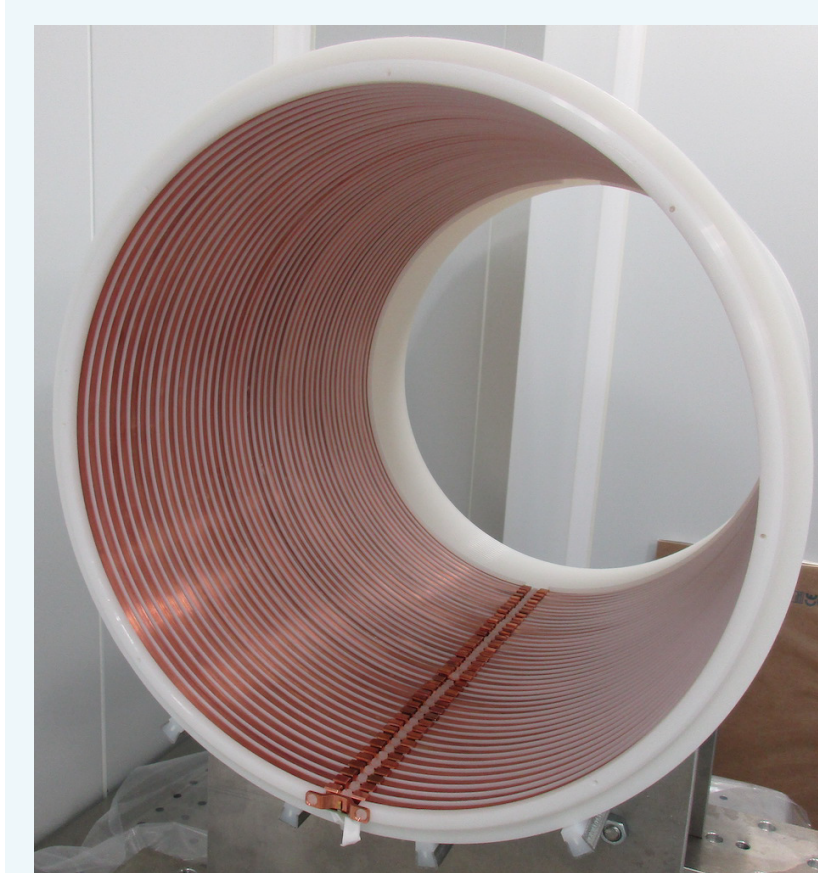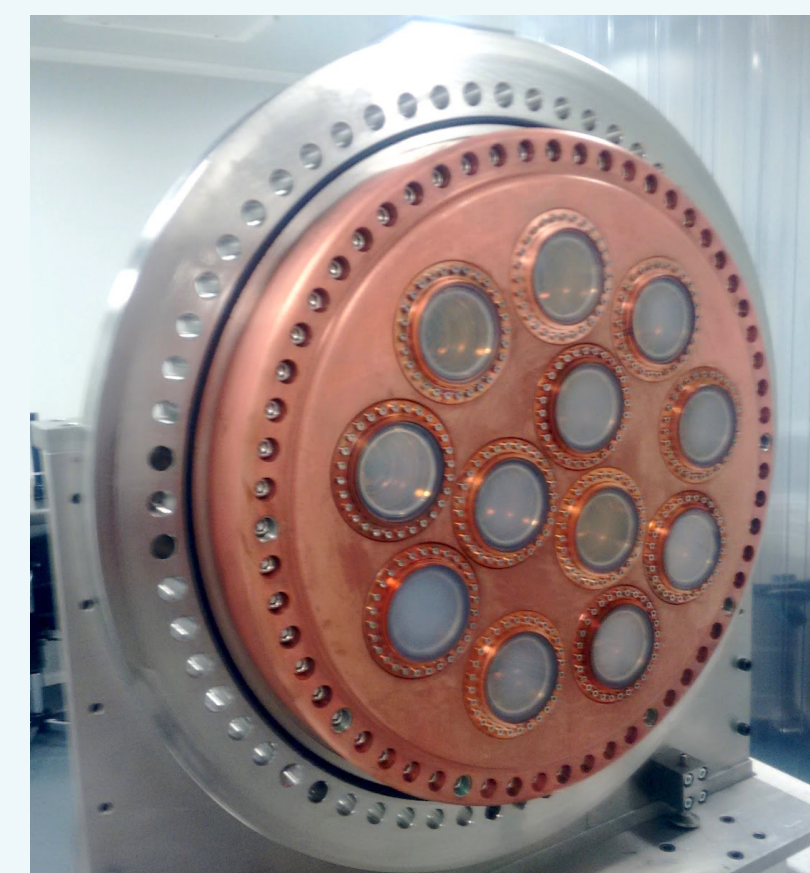

NEXT-White detection concept.
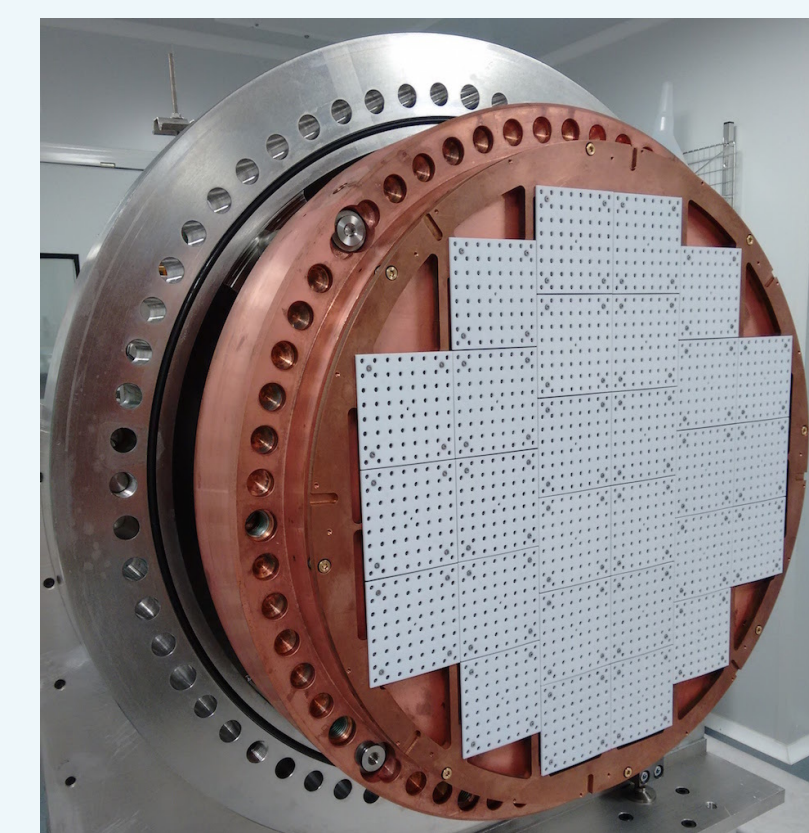

Internal view of the vessel.

External view of the vessel.

Field cage.

Energy Plane.

Tracking Plane.

References

[1] *NEXT Collaboration* (2019) [JHEP10(2019)051]. Radiogenic backgrounds in the NEXT double beta decay experiment.

[2] *NEXT Collaboration* (2019) [JHEP10(2019)230]. Energy calibration of the NEXT-White detector with 1% resolution near $Q_{\beta\beta}$ of ^{136}Xe.

[3] *NEXT Collaboration* (2019) [JHEP10(2019)052]. Demonstration of the event identification capabilities of the next-white detector.
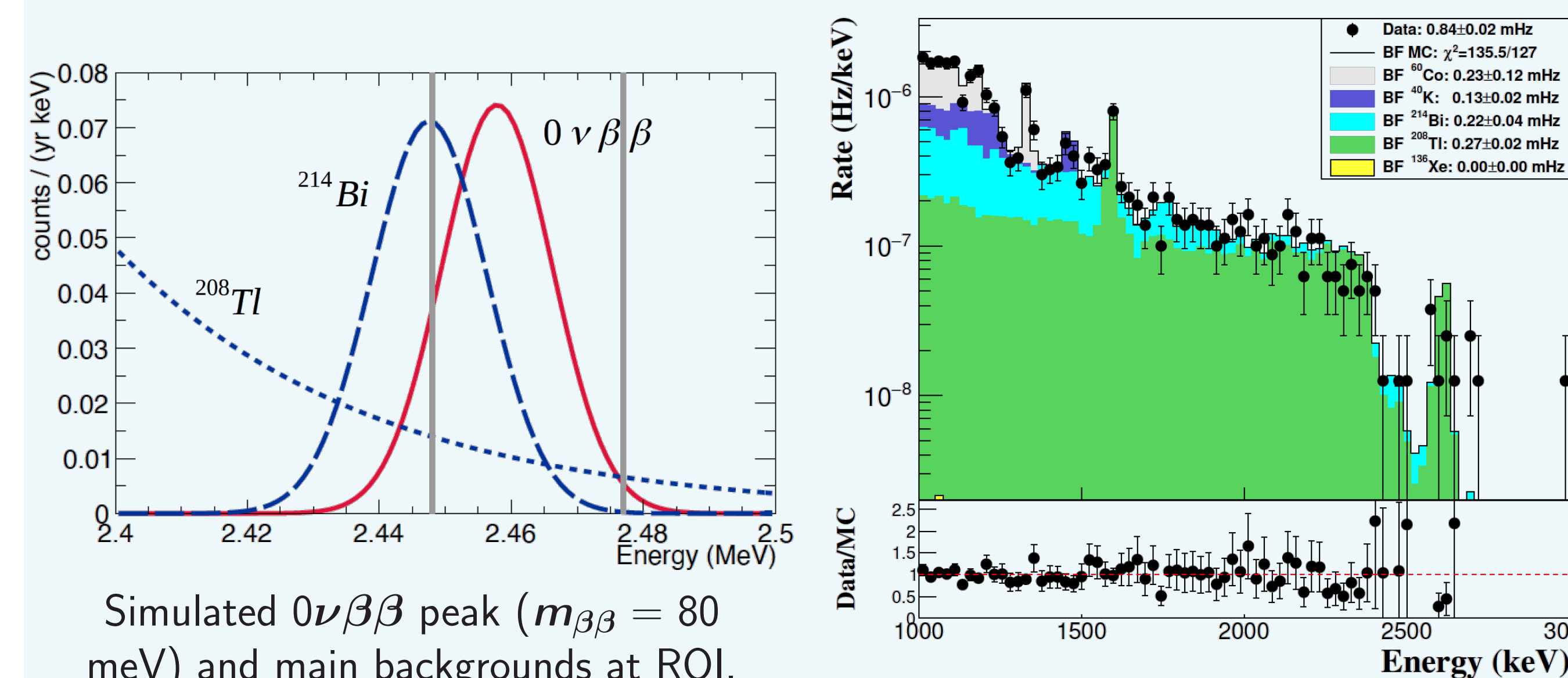
Radiogenic Backgrounds

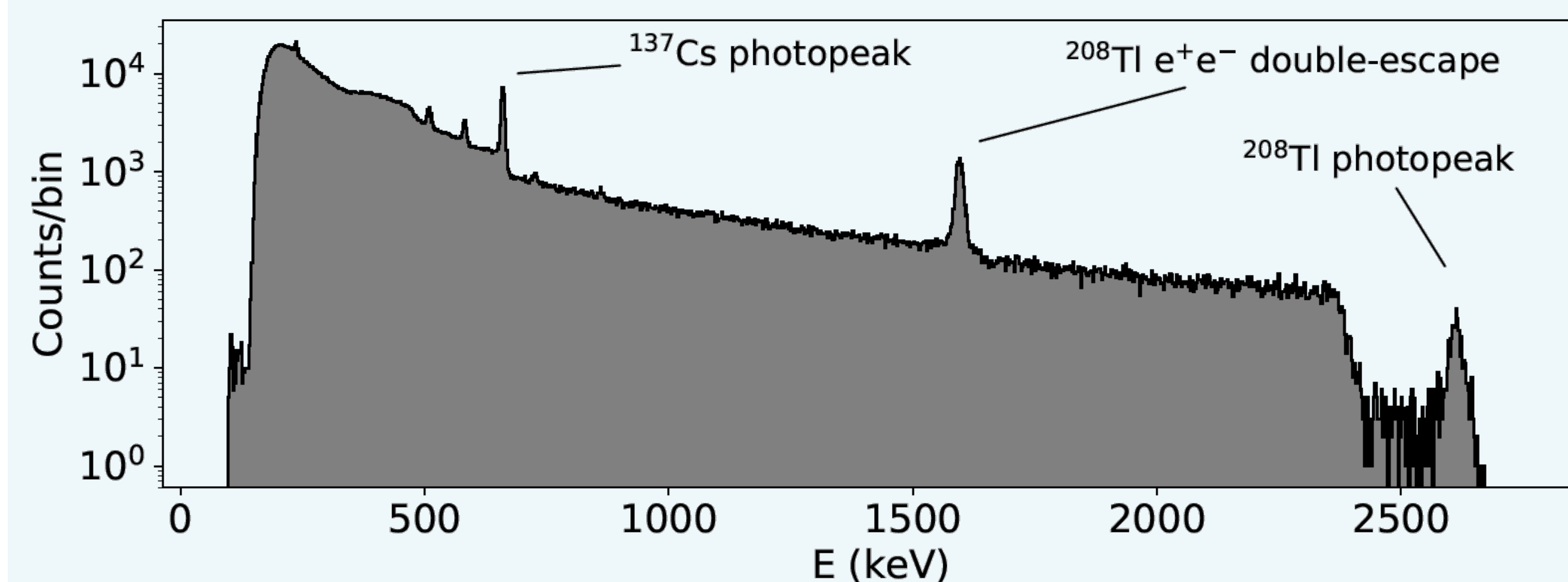NEXT **background model has been validated** with NEXT-White data [1].

Simulated $0\nu\beta\beta$ peak ($m_{\beta\beta} = 80$ meV) and main backgrounds at ROI.
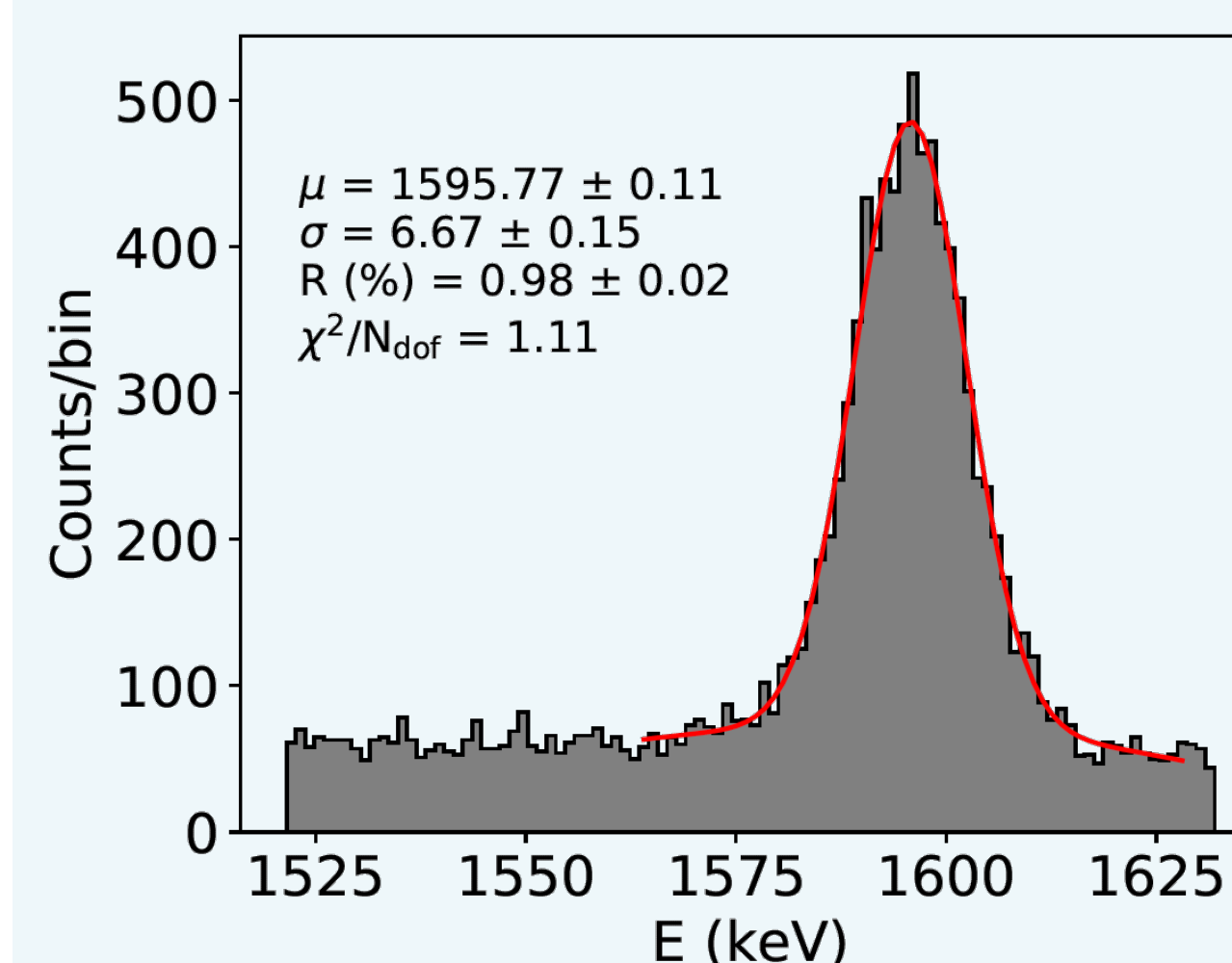

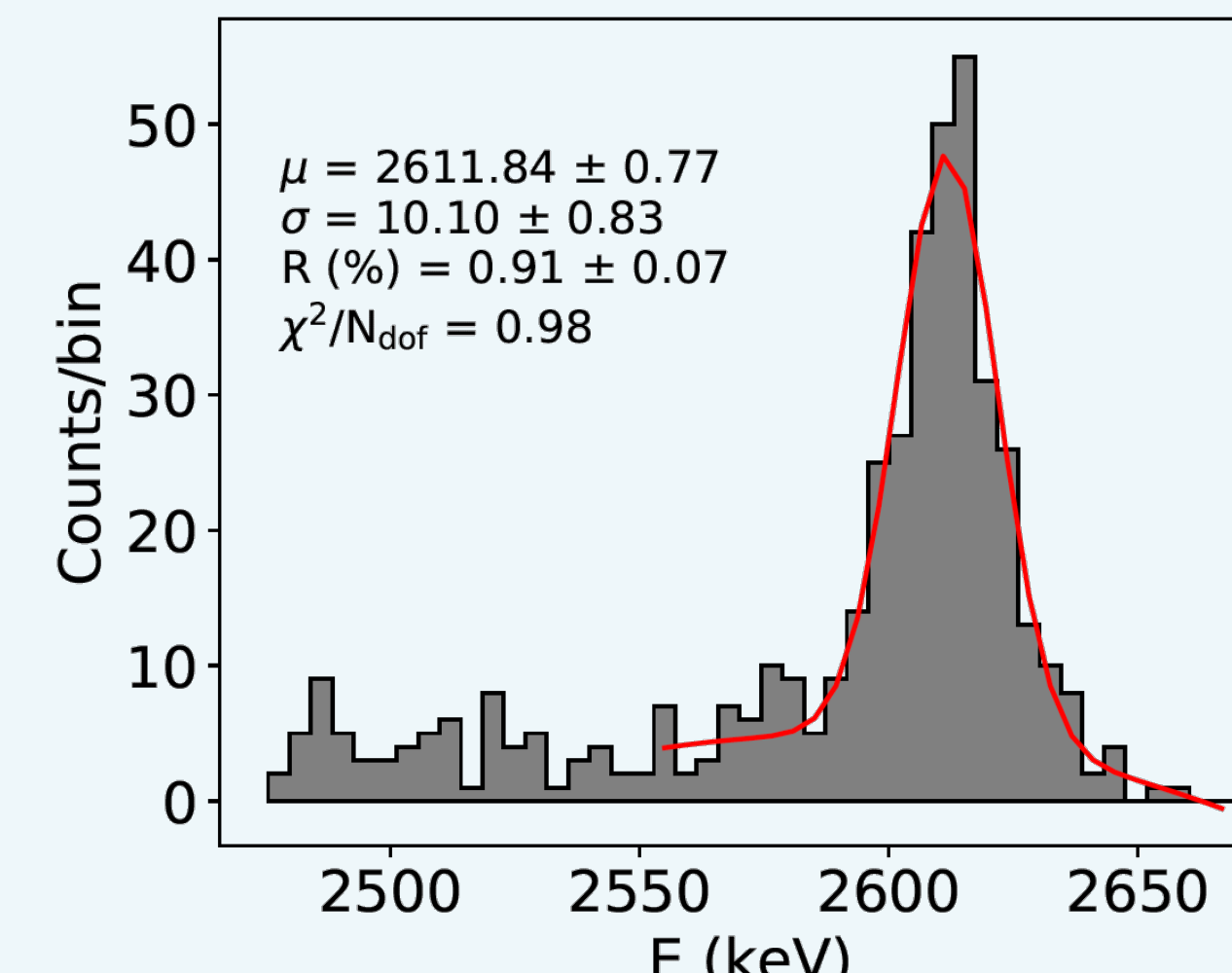NEXT background model fit to data.

Energy Resolution

We achieve a resolution at 2.6 MeV **better than 1% at FWHM**, near $Q_{\beta\beta}$=2.4 MeV of ^{136}Xe, [2].
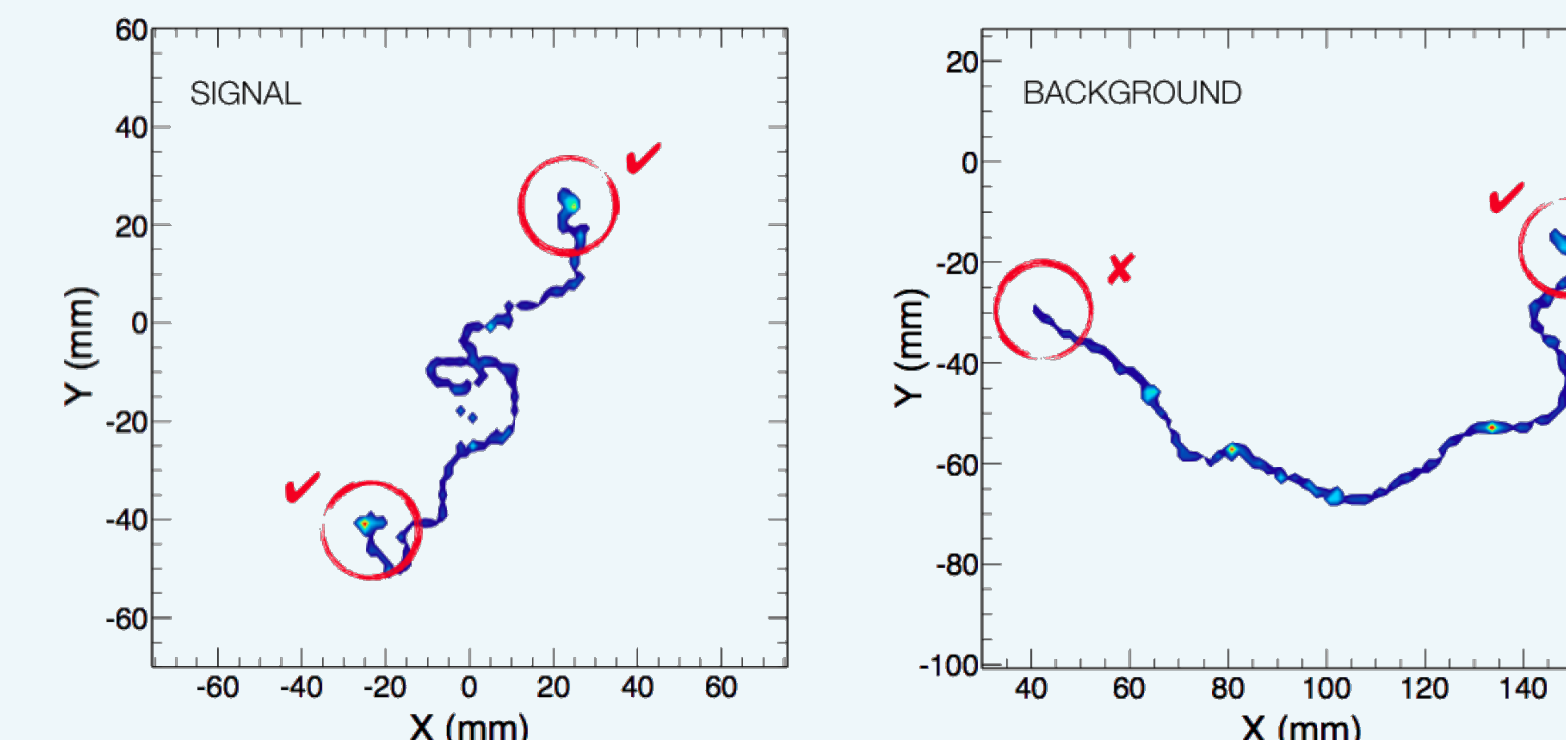

NEXT-White full energy spectrum for ^{137}Cs and ^{228}Th.

^{208}Tl double-escape peak.
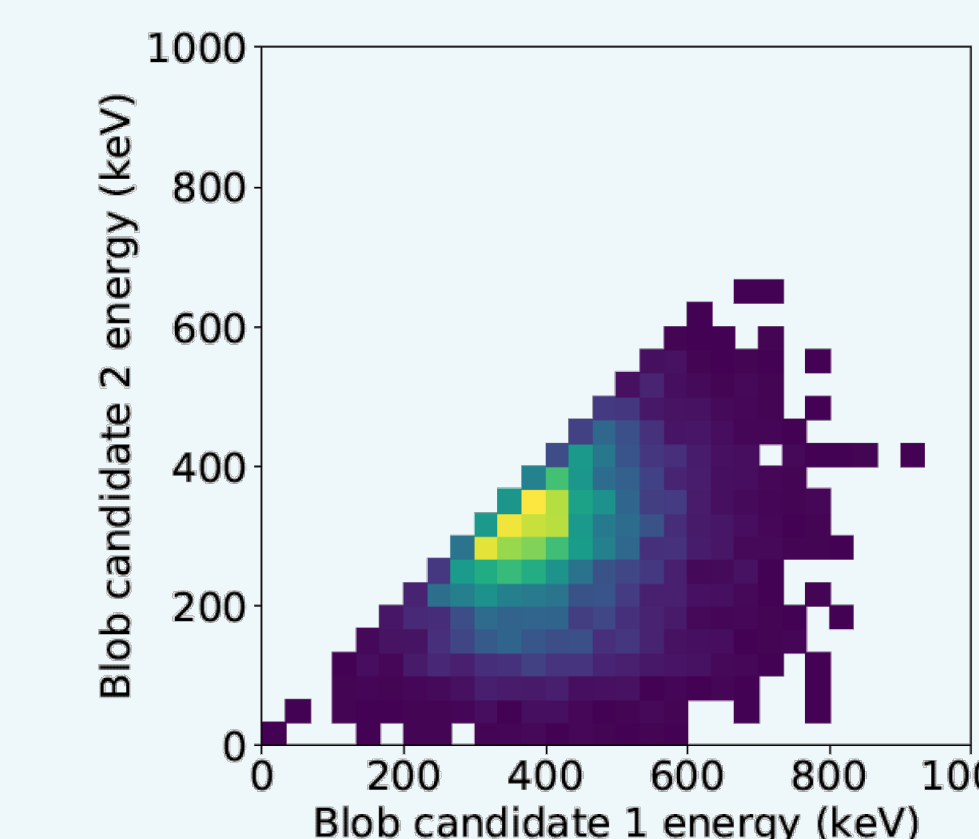

^{208}Tl photopeak.

Event Classification

The NEXT event classification is based on different **topological signatures** for signal (2e-like) and background events (1e-like)
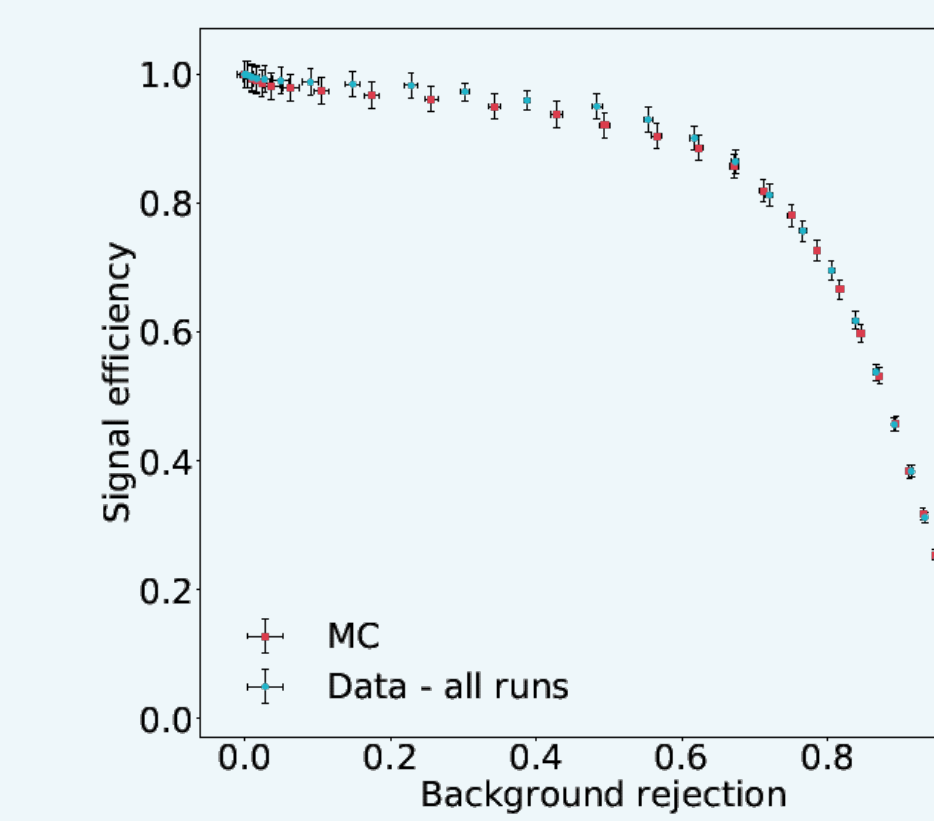

Simulated Signal and Background tracks showing 2 and 1 end blobs.

We used a data driven analysis to demonstrate the **power of the topological rejection**, [3].
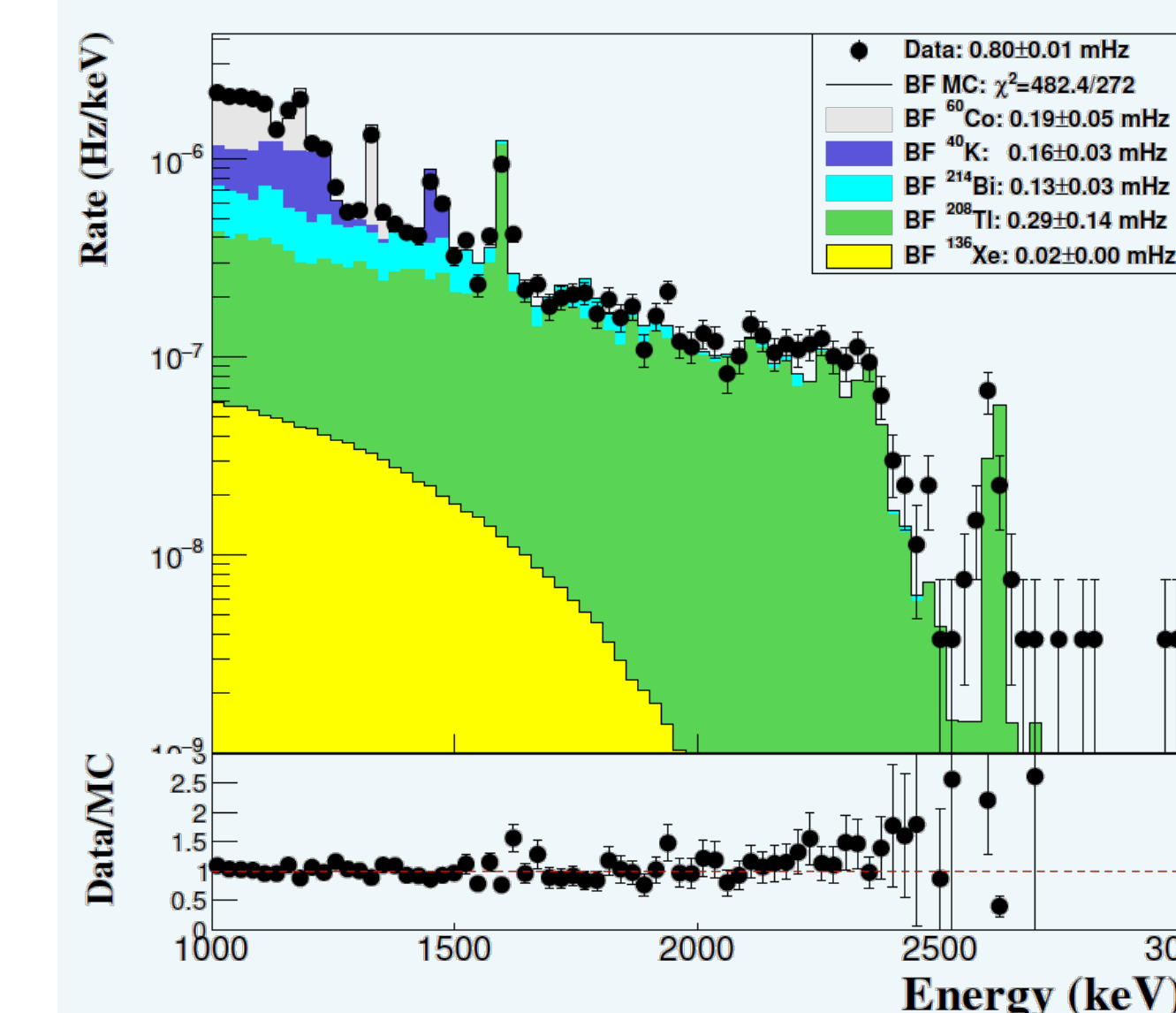

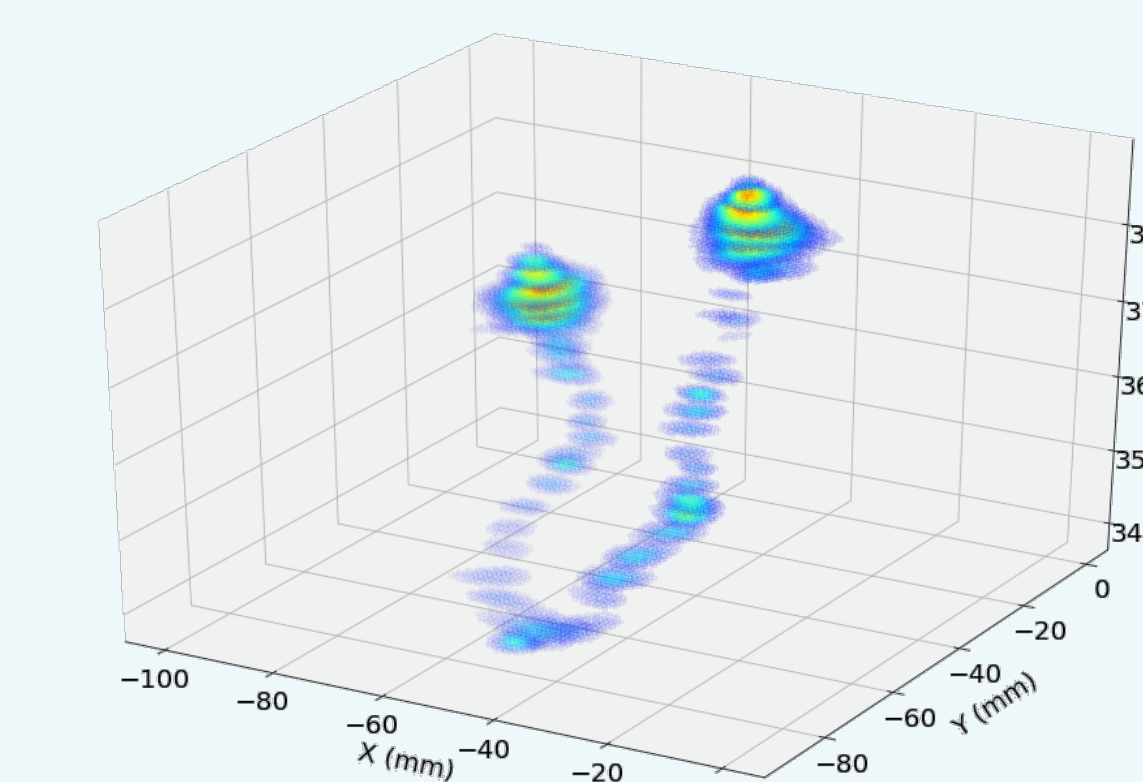Blob energies distribution for ^{208}Tl double-escape peak.

ROC curve for signal efficiency and background rejection.

Two Neutrino Mode ($2\nu\beta\beta$)

Preliminary results with enriched ^{136}Xe show a $2\nu\beta\beta$ half-life of $T^{2\nu}_{1/2} = (1.49 \pm 0.41) \times 10^{21}$ y.

Background model fit showing $2\nu\beta\beta$ contribution (yellow).

$2\nu\beta\beta$ candidate at 2 MeV, showing 2 energy blobs at the extremes.