



IGFAE

Instituto Galego de Física de Altas Enerxías

NEXT

(A search for the nature of the neutrino)

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The NEXT Collaboration

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USA



UNIVERSITY OF TEXAS ARLINGTON

Argonne NATIONAL LABORATORY

HARVARD

Fermilab

IOWA STATE UNIVERSITY

Pacific Northwest NATIONAL LABORATORY

Spain



DIPPC

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Universitat de Girona

USC UNIVERSIDADE DE SANTIAGO DE COMPOSTELA

UNIVERSIDAD DE ZARAGOZA

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

Portugal, Israel, Russia, Columbia



UAN UNIVERSIDAD ANTONIO NARIÑO

Ben-Gurion University of the Negev

JINR DUBNA

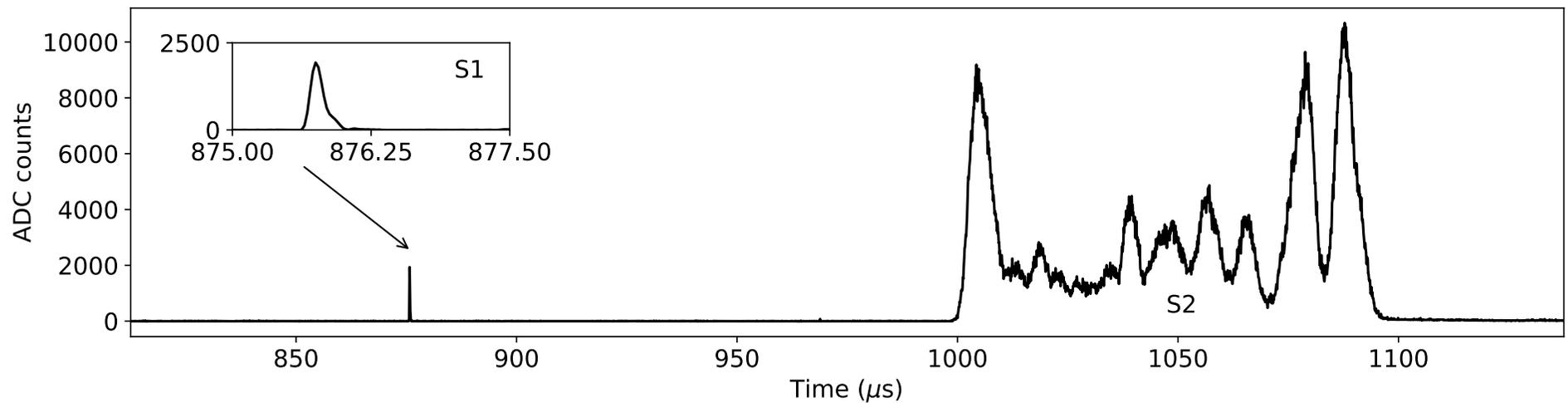
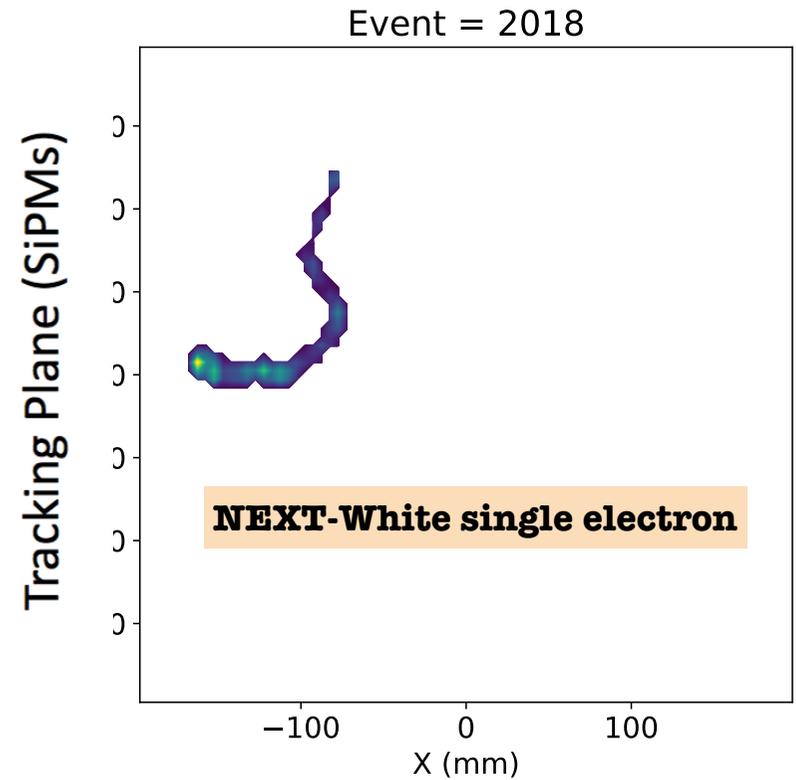
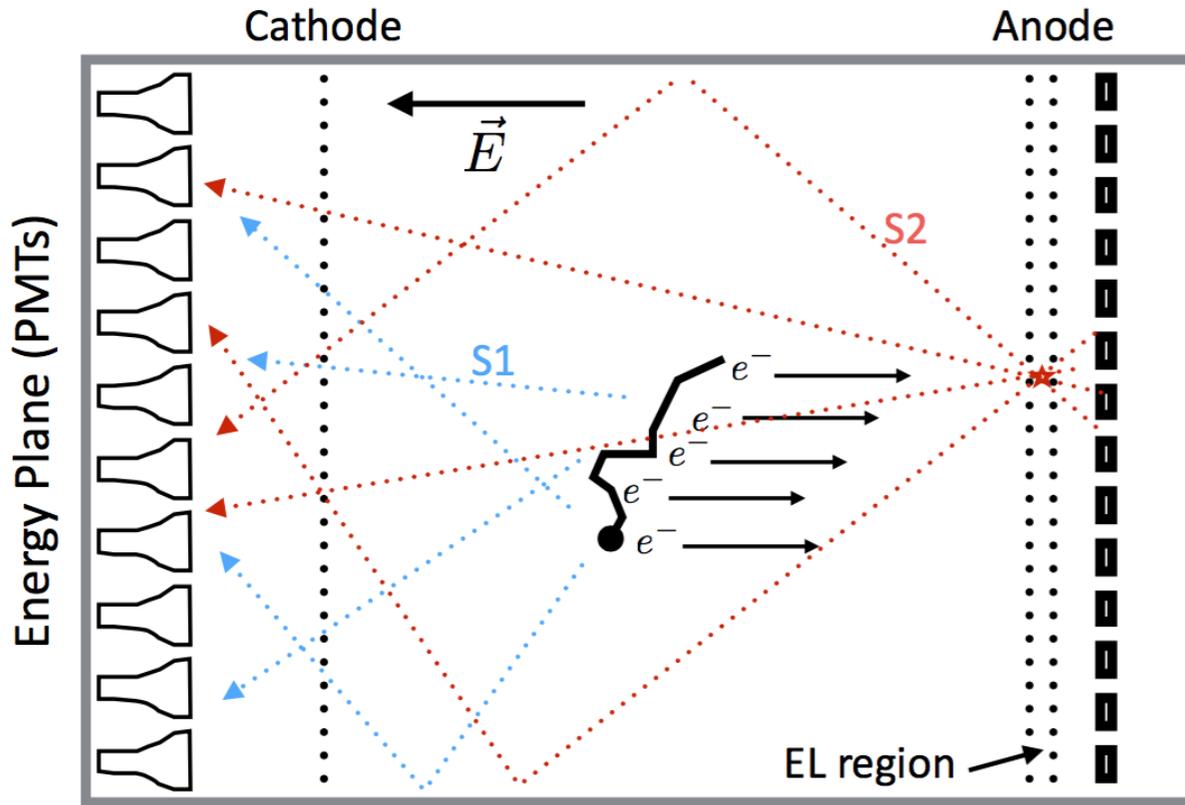
universidade de aveiro



NEXT-White (NEW):

- stability: 2019 daily operation
 - (1 M triggers /day)
- energy resolution (1% FWHM)
- background estimation
- $\bar{\nu}_\mu \rightarrow \nu_e$ lifetime

Principle of operation



Time Projection Chamber:
5 kg active region(@15bar), 50 cm drift length

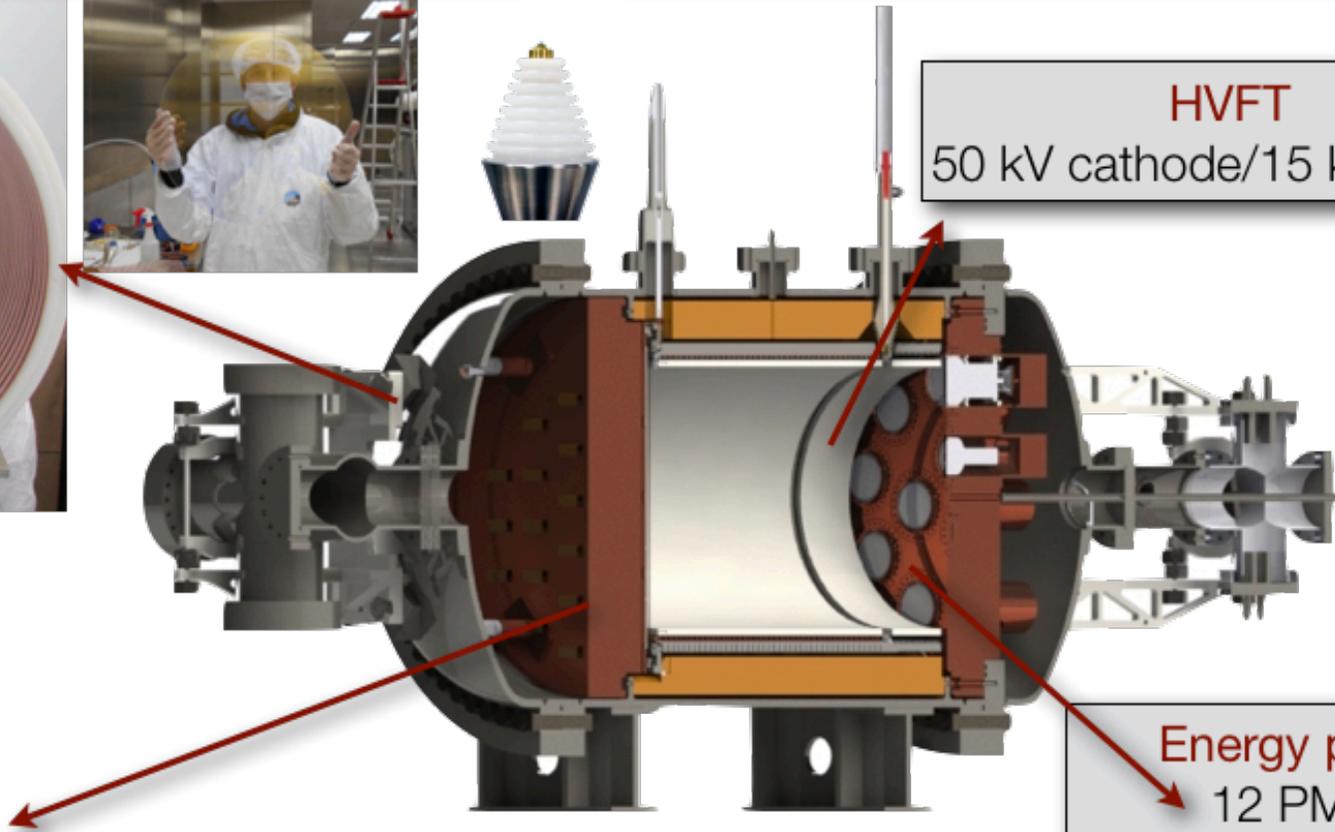


Pressure vessel:
316-Ti steel, 20 bar op pressure

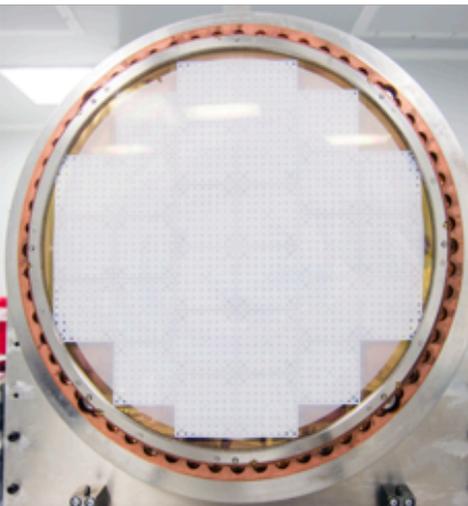


HVFT
50 kV cathode/15 kV anode

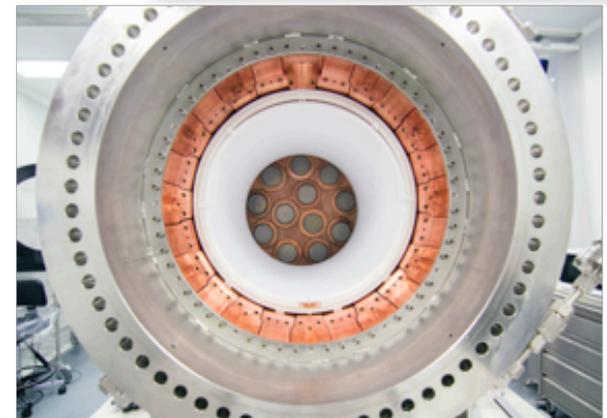
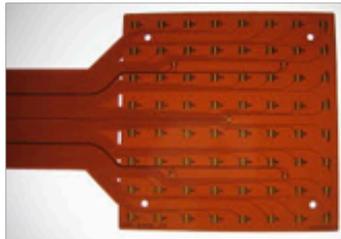
Tracking plane:
1792 SiPMs,
1 cm pitch



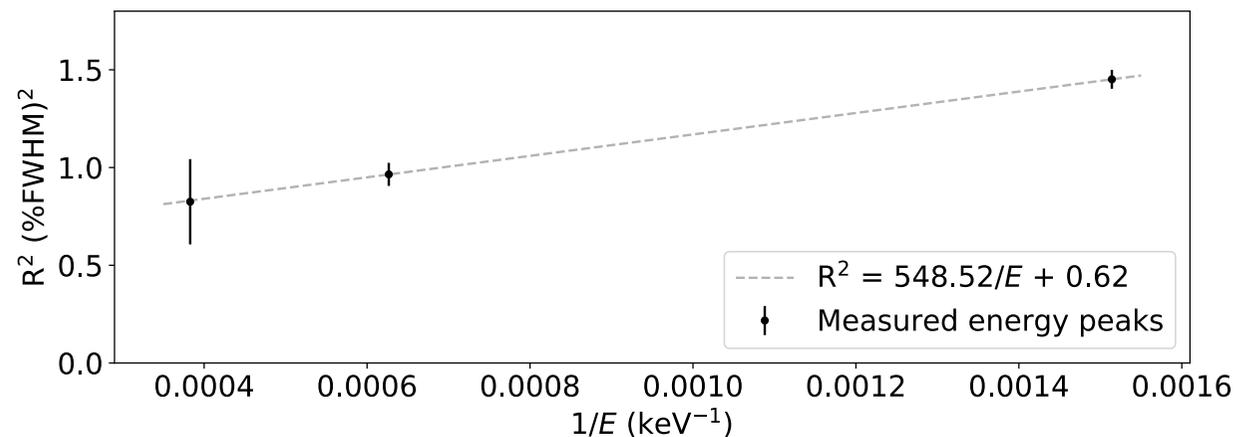
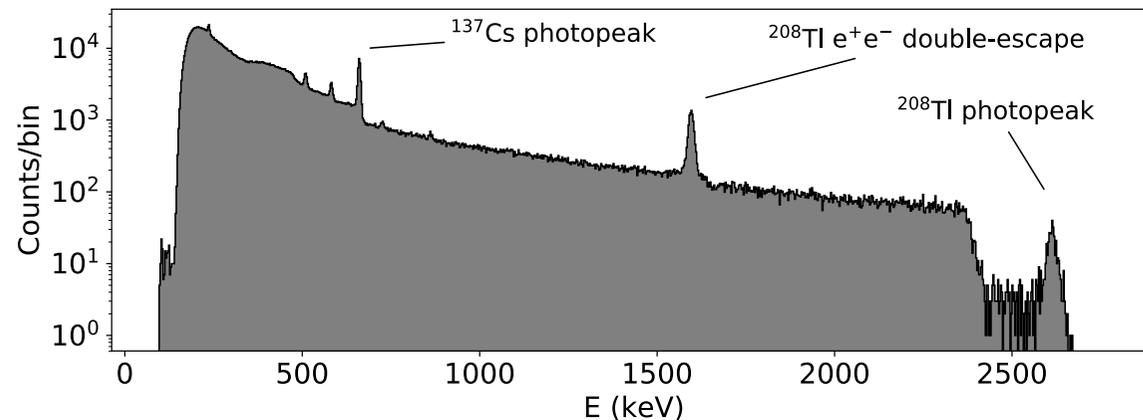
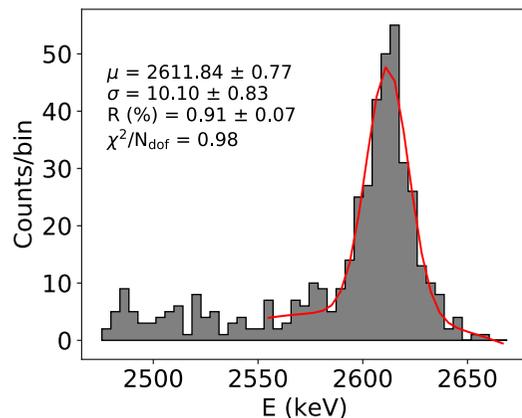
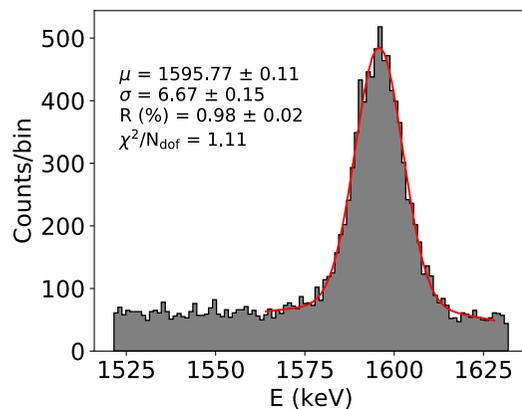
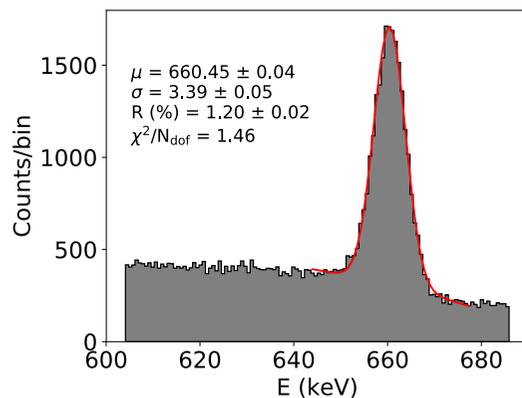
Energy plane:
12 PMTs,
30% coverage



Inner shield:
copper, 6 cm thick



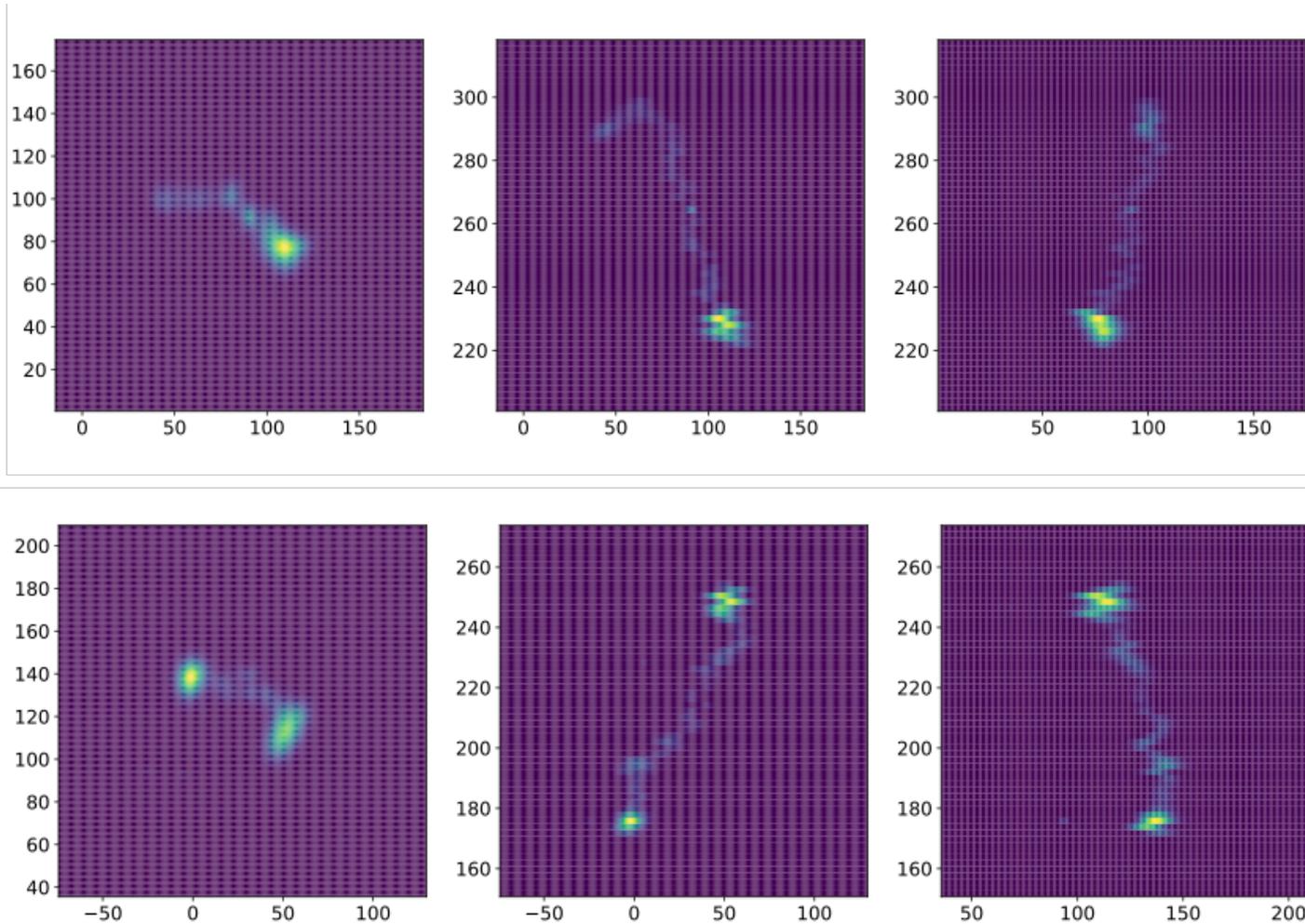
Resolution at high energy



- Energy resolution at Qbb better than 1 % FWHM (target of NEXT-100)

Double escape peak: single and double electrons

10

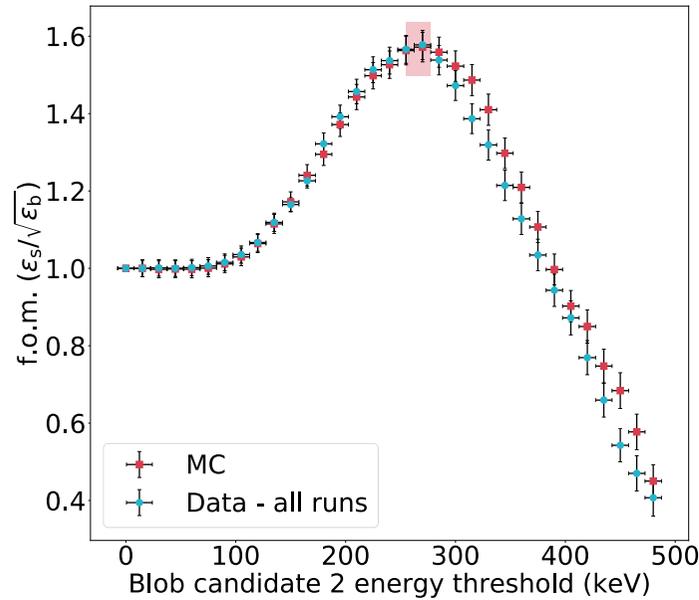
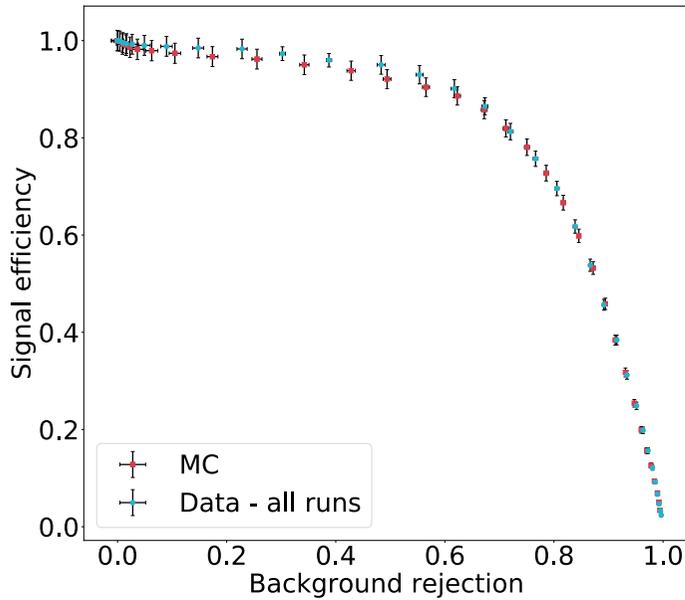


- Energy 1600 keV.
- Scale in mm.

Topological signature at Qbb using DNNs

DATA/MC comparison double escape peak

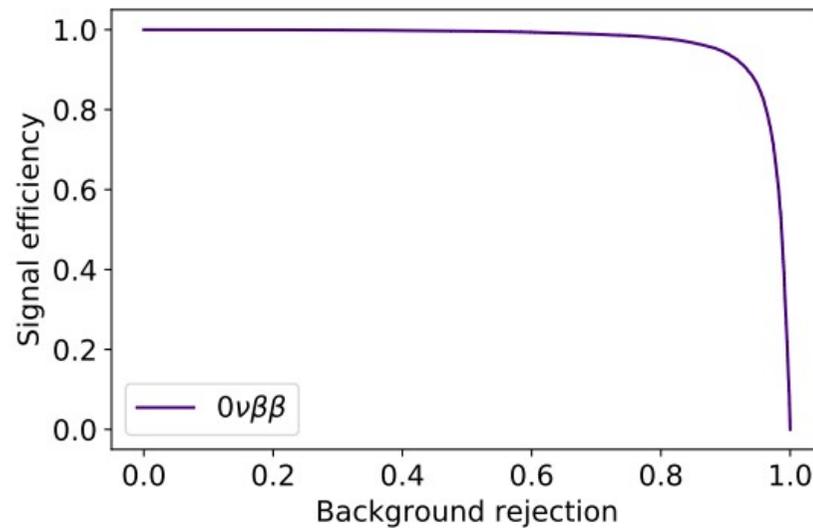
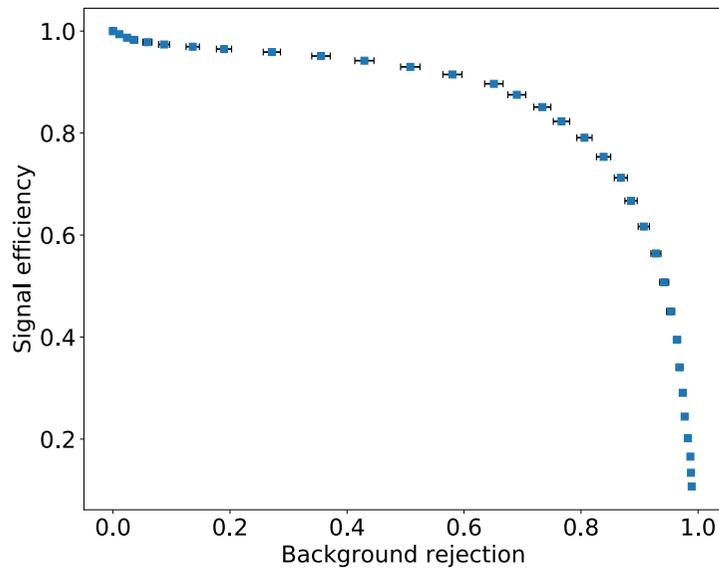
DATA/MC FOM two-blob cut.



JHEP 1910 (2019) 052
arXiv:1905.13141

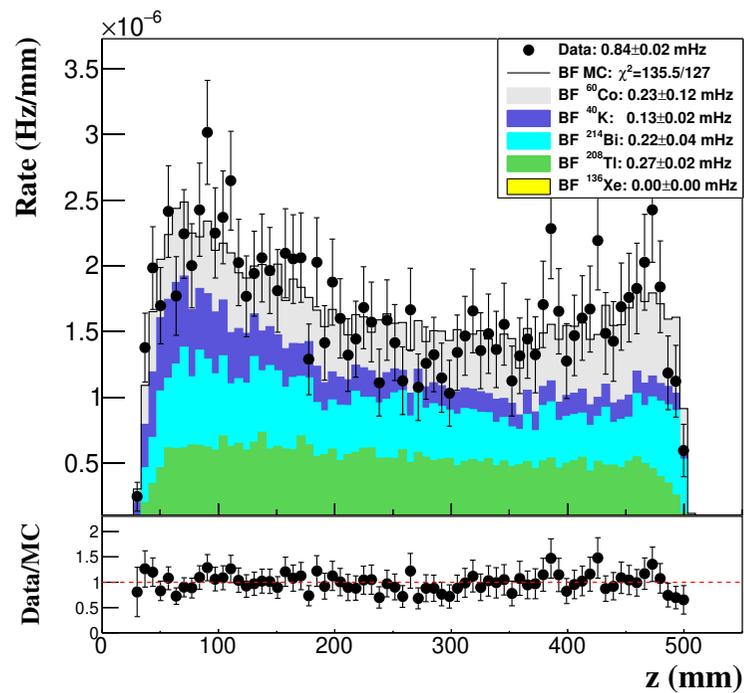
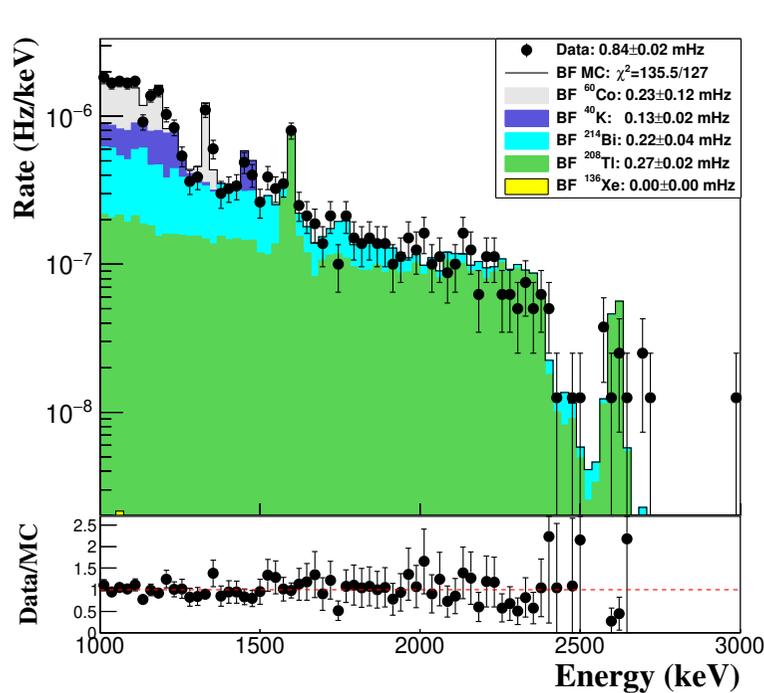
S/B at Qbb, classical analysis

S/B at Qbb, DNN analysis



Run IV background model: tuning with data

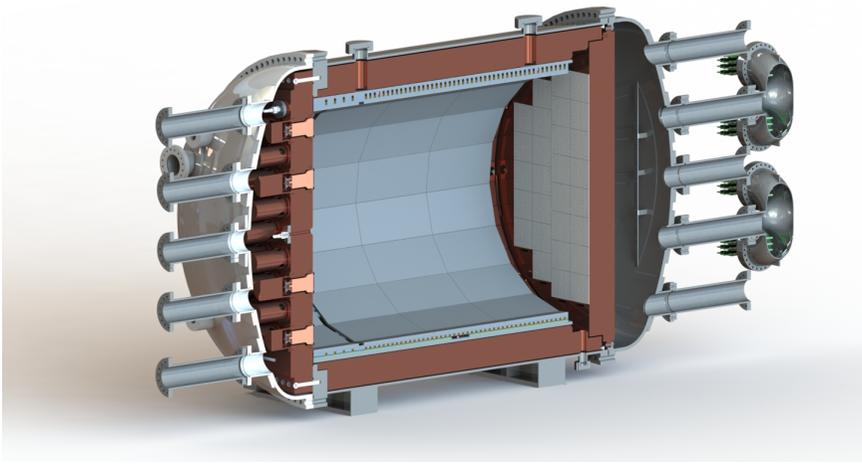
- BG contributions per isotope/volume measured with a fit to the model.
- Signal + BG fit of energy and Z distributions. 4 isotopes x 3 volumes



- Background model validated: $\chi^2/\text{ndof} = 1.07$, p-value = 29%
- Overall scale factor of 1.72 ± 0.04 to reproduce total BG rate
- In $Q_{\beta\beta} \pm 100$ keV region and after topology cuts: 1 background event observed, (0.75 ± 0.12) expected with 37.9 d exposure

What is NEXT? NEXT-100 (2020-2025)

NEXT-100



NEXT-100:

- 100 kg ^{136}Xe HPG
- energy resolution 1% FWHM
- background $4 \cdot 10^{-4}$ c/kg y keV
- 5 years. $T_{1/2}$ 10^{-26} y $\text{bb}0\nu$

- 100 kg of enriched Xenon: Fiducial: 1.2 m long, 1 m diameter.
- Operates at 15 bar pressure.
- Schedule to start operations in 2020.

USC - 2020 main goals:

- calibration, simulation, performance of NEXT-100
 - meeting at USC 21-24 January
- Revisit NEW $\text{bb}2\nu$ and topology using DNN

What is after NEXT? NEXT-HD & NEXT-BOLD (2025-2035)

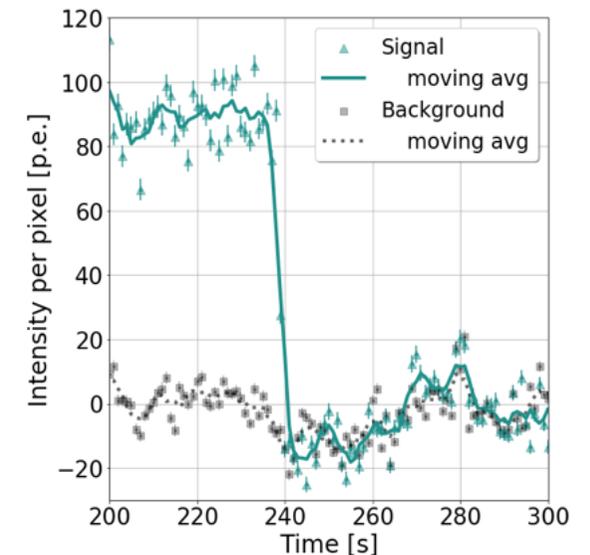
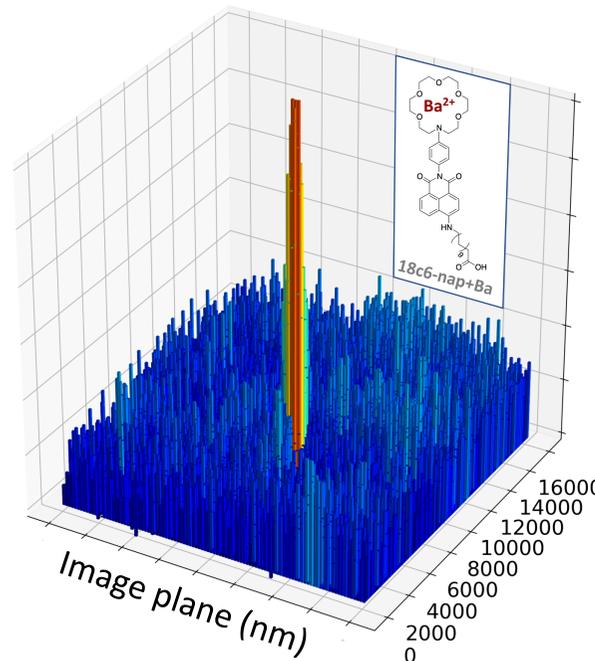
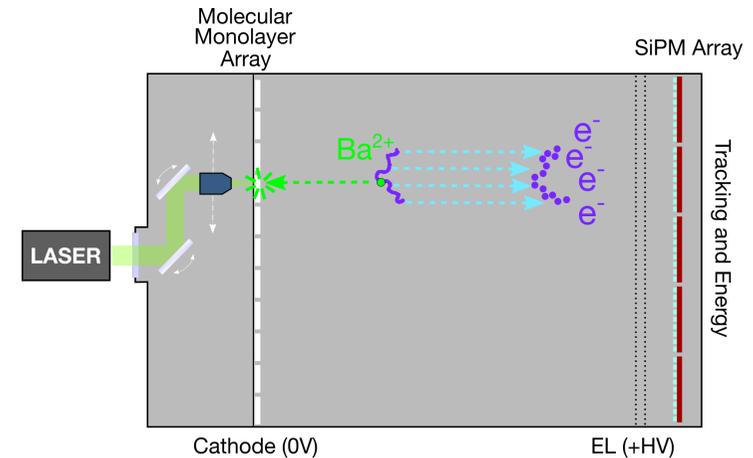
NEXT-HD:

- ton ^{136}Xe HPG
- energy resolution $<1\%$ FWHM
- background 0.36 counts ton y in RoI
- 5 years: $T_{1/2}$ 10^{27} y bb0nu
- SiPMs for tracking and energy
- Cold detector
- Fas mixtures

USC and NEXT-HD:

- EL Fat-GEM structures
- gas mixtures

NEXT-BOLD



Time line

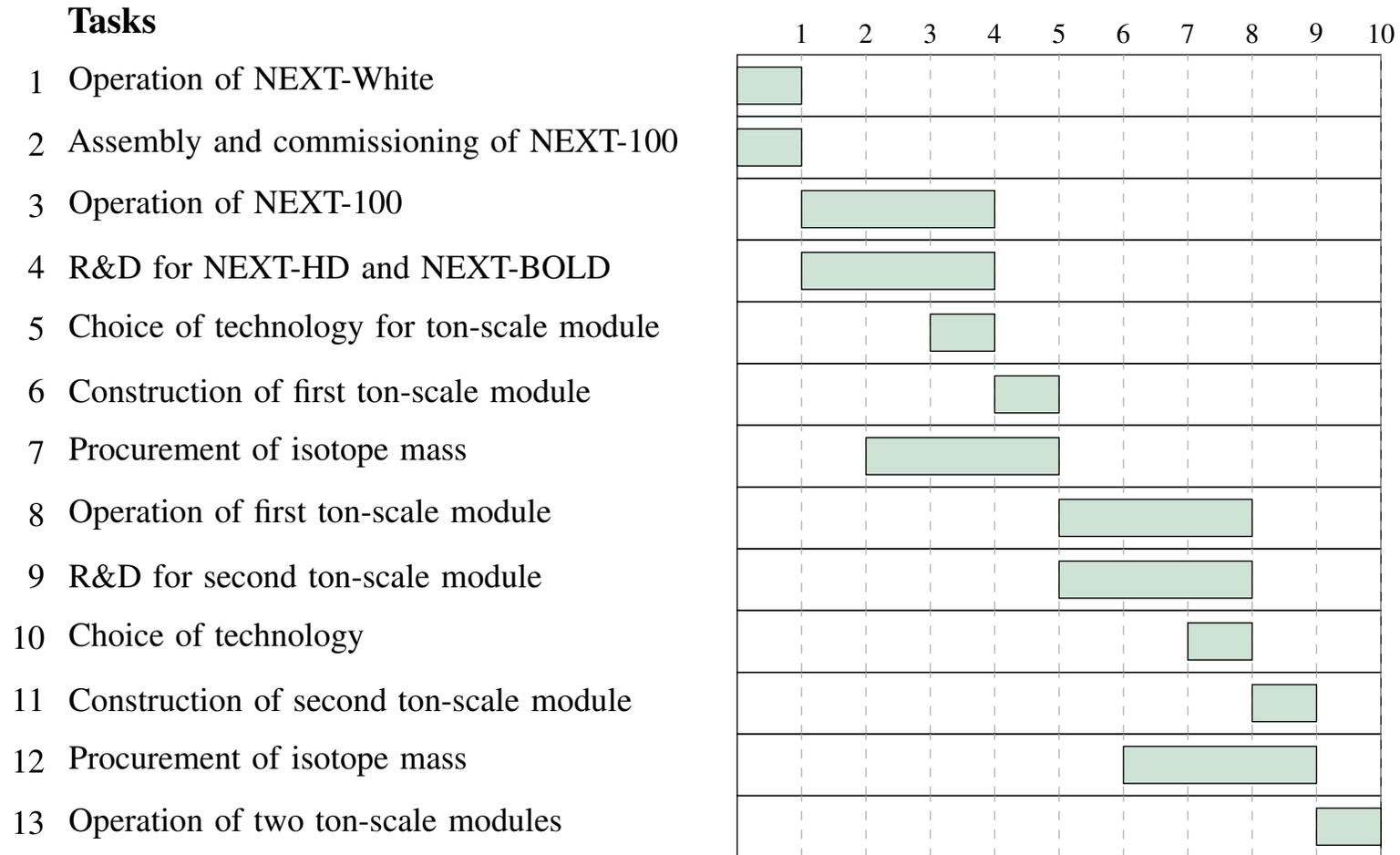
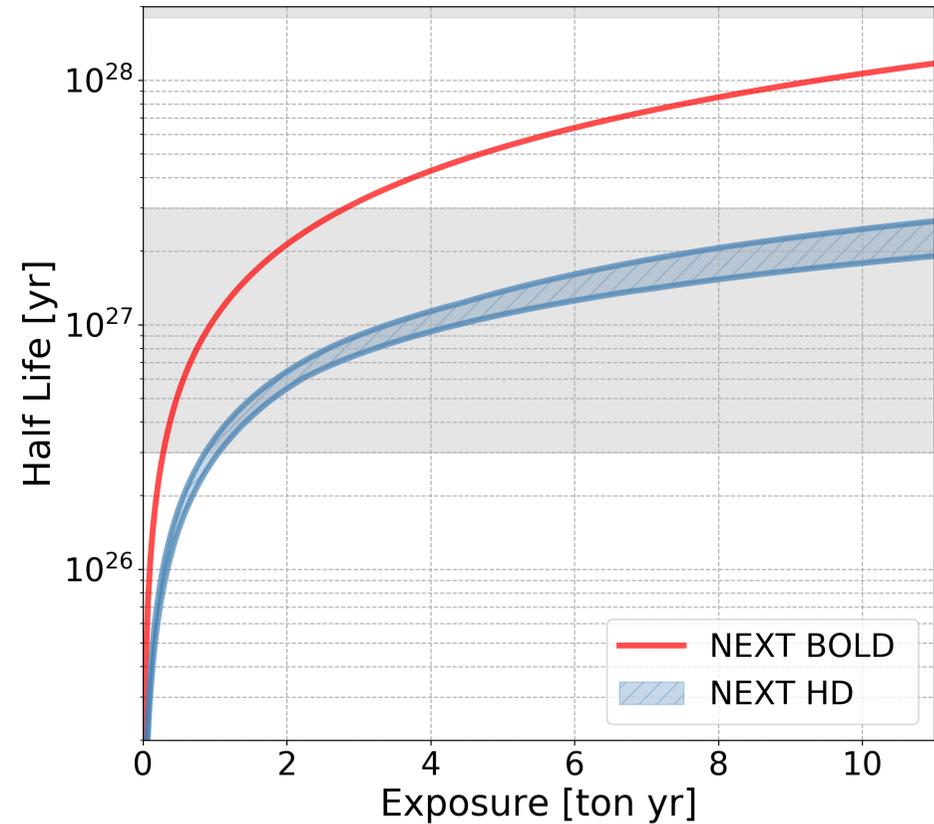
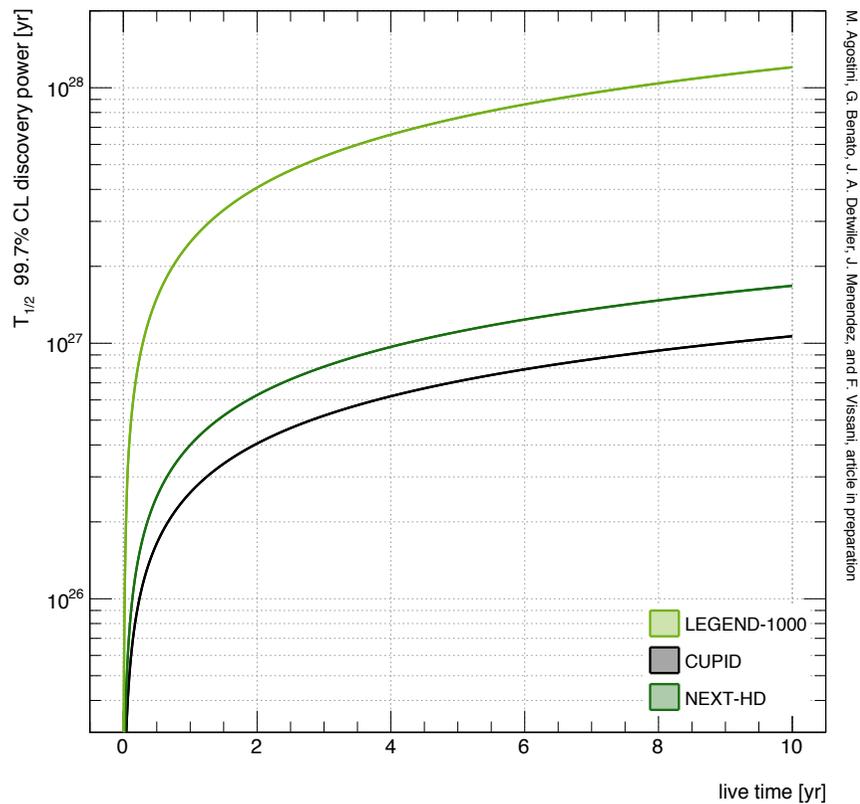


Figure 9: Time schedule of NEXT experiment including R&D program. Column numbers indicate years. Year 0 is 2019. Operation of two modules continue after year 10.

NEXT Sensitivity



Discovery potential NEXT-HD

NEXT-HD: BI. 0.39 counts/ton/year in ROI

NEXT-BOLD: “zero” counts, increased efficiency (relax topology ID)

Sensitivity NEXT (HD & BOLD)

