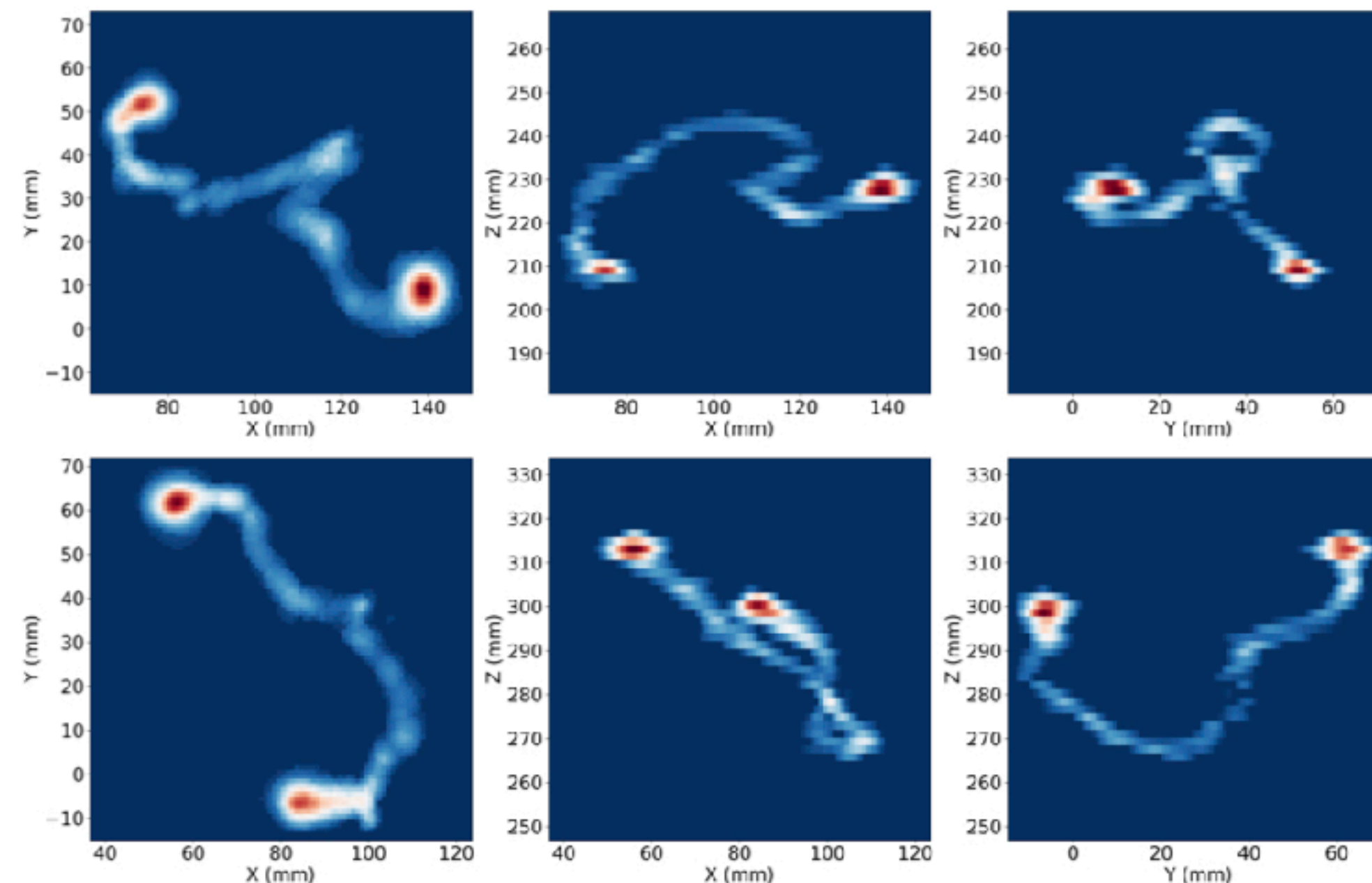




# NEXT: A high pressure gas xenon detector (with Ba tagging)

**Collaboration:** ~20 institutions (6 countries), >~100 people

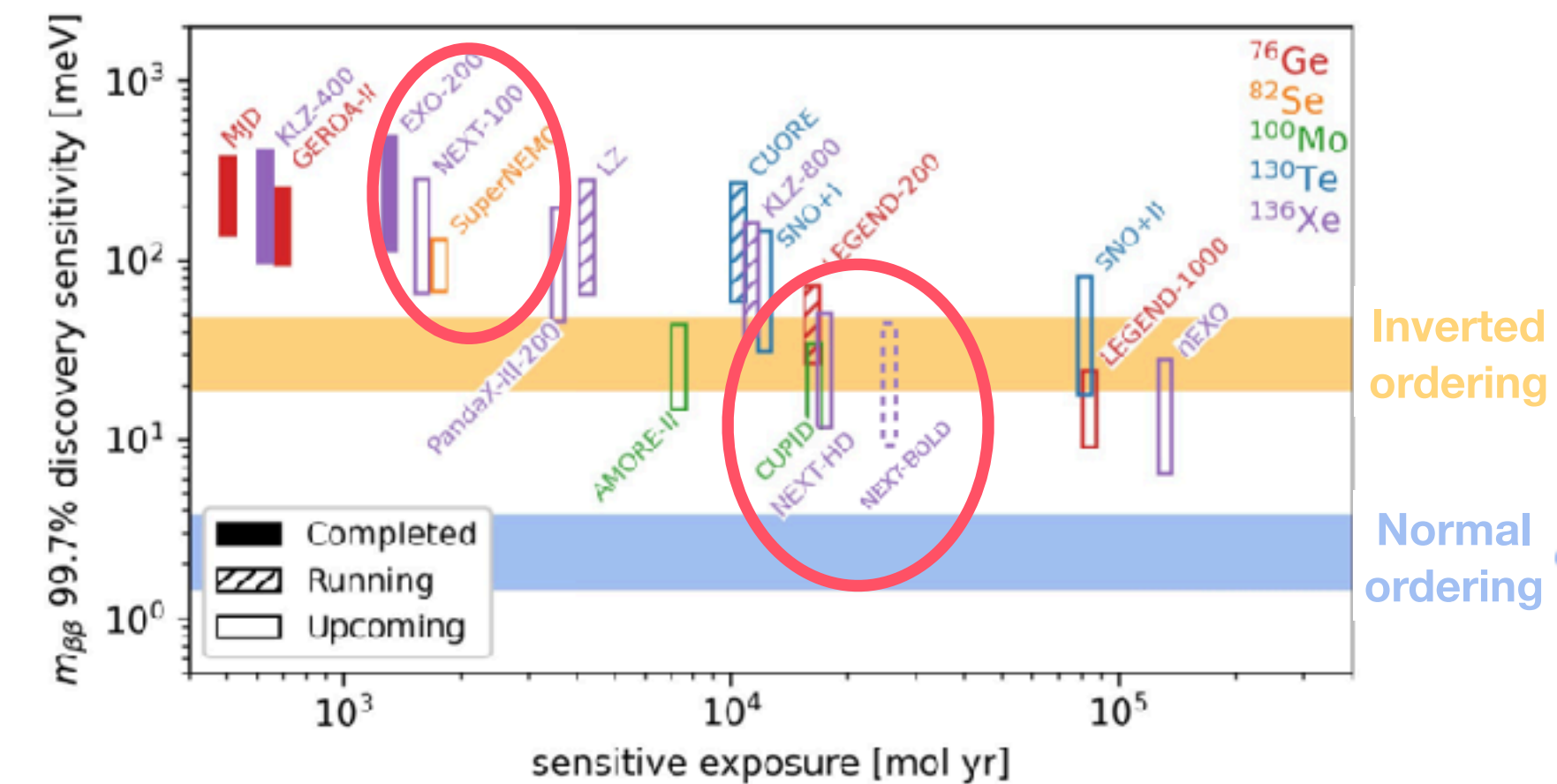
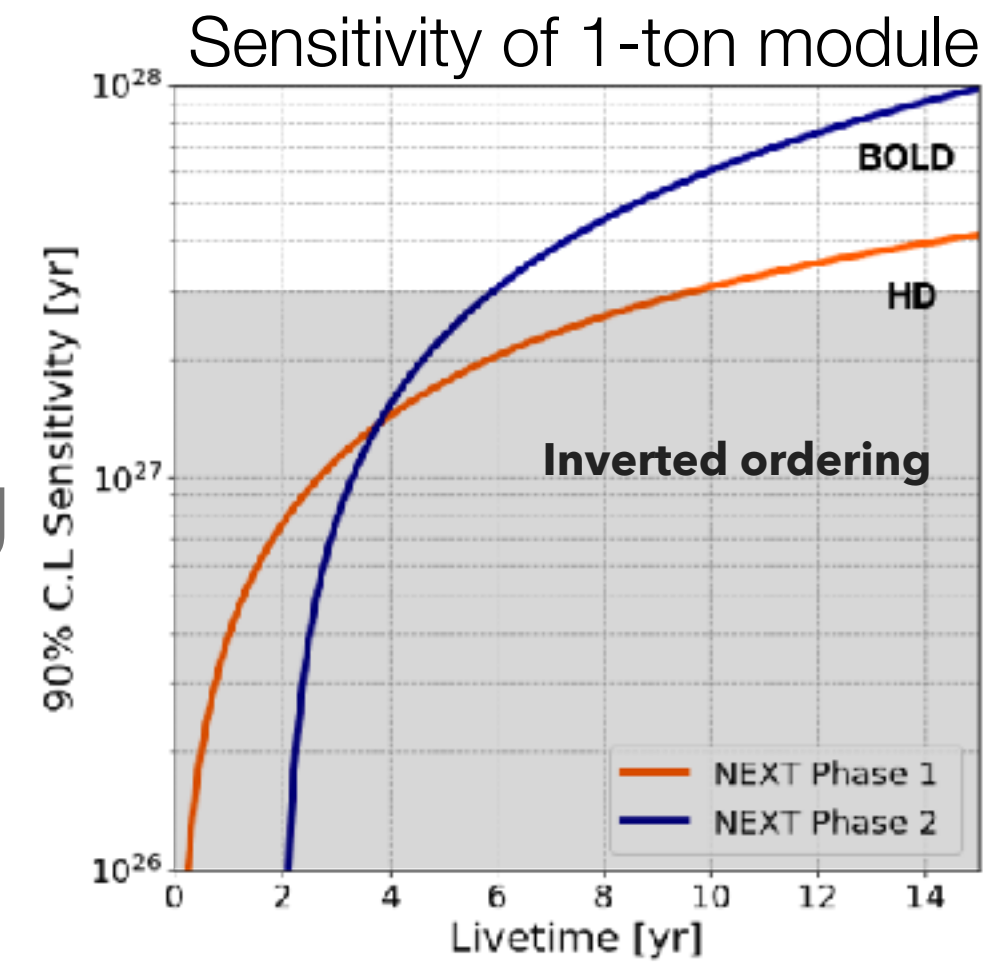


UK ESPPU Input to Nov. 4 Drafting Session

# Towards a background-free experiment

## Key Physics goals:

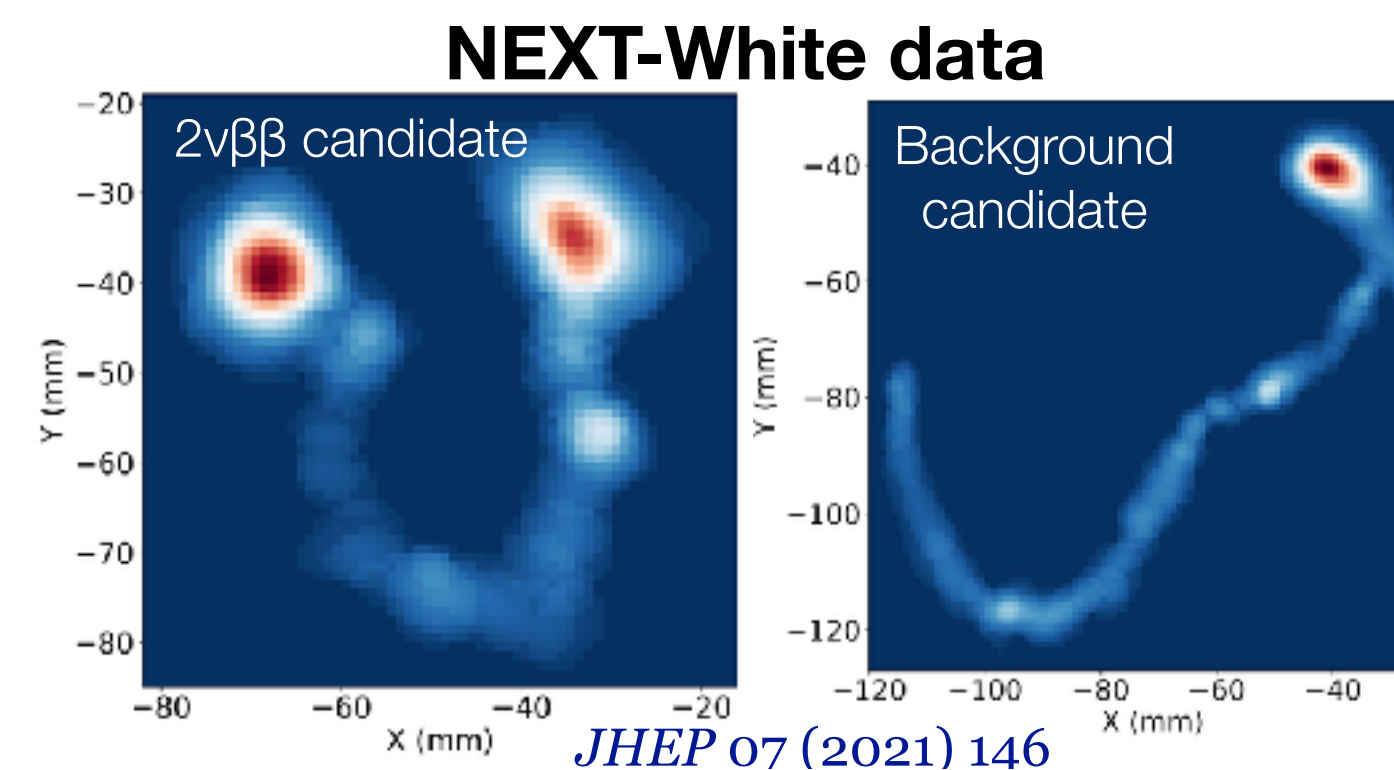
- Search for  $0\nu\beta\beta$ : At (one) ton-scale sensitivity to cover the inverted ordering
- Unique sensitivity to different lepton violating operators via topology
- One of the few promising technologies to push towards normal ordering (with larger mass)



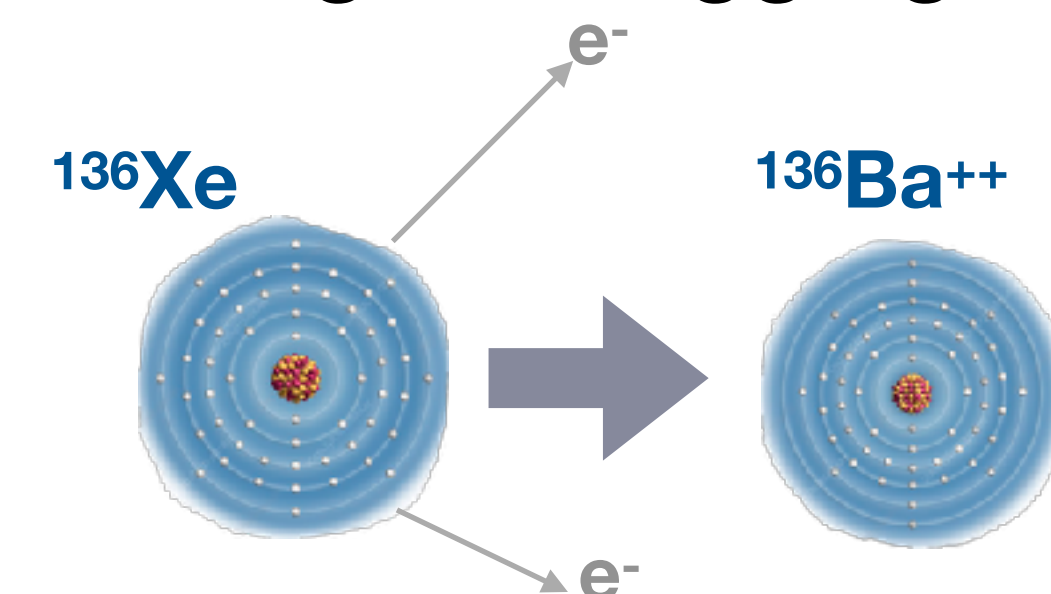
Adapted from arxiv:2304.03451 (Whitepaper for the 2023 NSAC Long Range Plan)

## Key technological advantages:

- Sub-percent (FWHM) energy resolution
- Topological signature will allow to study the decays in details (bkg rejection and  $0\nu\beta\beta$  models)
- Modular technology
- Potential to add daughter tagging, making it background free experiment

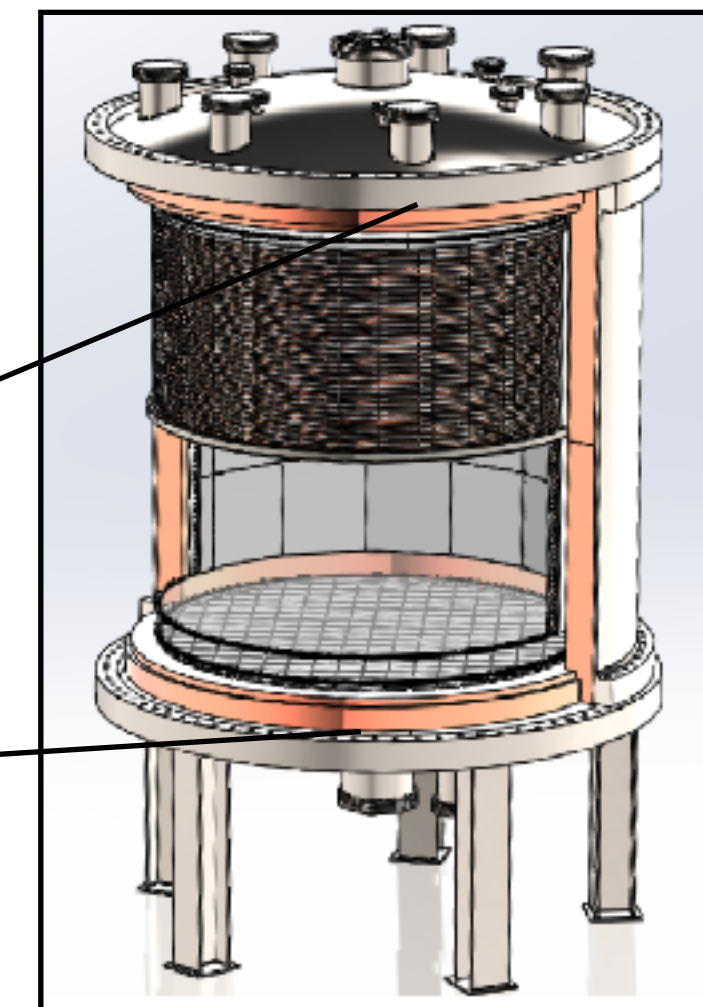
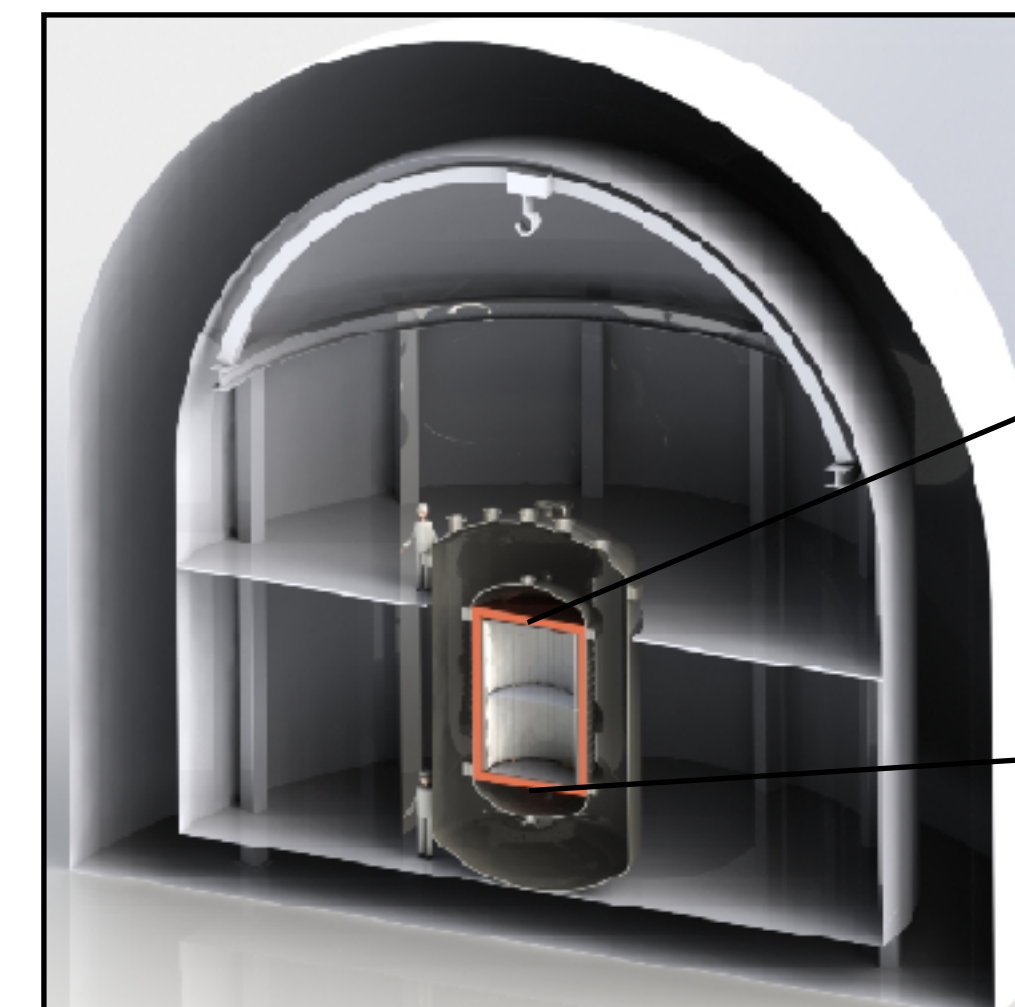
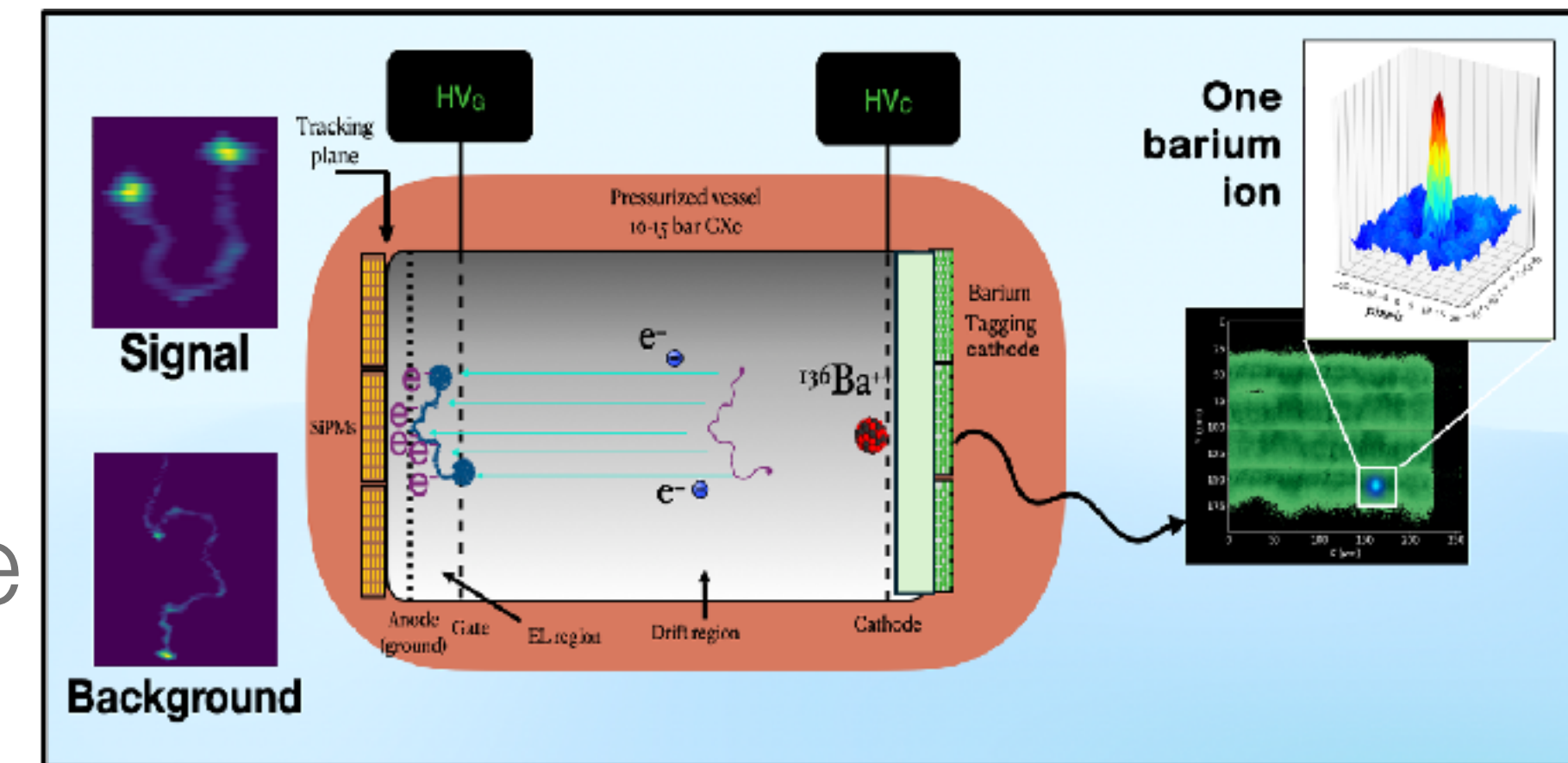


## Daughter tagging:



# Towards a background-free experiment

- Recent progress on Ba tagging is making it's addition a realistic possibility within 10 years
- Modular approach attractive to build a **1-ton** module in Canfranc and add modules (anywhere) (future modules with Ba tagging)
- NEXT-100 (technology demonstrator at scale) is under commissioning and will take data (2025-2028) ensuring **physics outputs** for early-career scientists



NEXT Collaboration, *JHEP* 164 (2021) 08

**Letter of Intent to be submitted in 2025 to LSC**

## NEXT: Location / Timeline / Prioritisation

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- **Location:** The first ton-scale module will be located in Canfranc, Spain (additional modules could be built once Ba tagging is ready to go towards the normal ordering)
- **Timeline:** Proposed construction of first ton-scale module to start at the end of 2020s (~2028) with data taking in early 2030s (~2031)
- **Prioritisation:** NEXT recognized as one of the four European ton-scale projects and recognized as a next generation experiment in the US. Strong support for pursuing the R&D towards Ba tagging.

# NEXT-UK Involvement

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- Contributions:
  - NEXT-100 TPC construction and assembly
  - Many leadership roles: IB chair, Run Coordinator, 2 Working Group conveners
  - Responsible for sensor calibration, topology studies and energy resolution with SiPMs
  - Lead of the readout plane for NEXT ton-scale proposal
- Currently one institutions (Manchester): efforts on operation/analysis and R&D
  - Senior members: 3.3 FTEs/y (1 academic , 3 PDRAS)
  - Students: 3.4 FTEs/y (4 PhD students + 2 Master students)
  - Engineers: 0.6 FTE/y (electronics engineers)
- Estimated costs for support to operation/analysis and R&D: 250k£/year
- Estimated costs for the NEXT ton-scale: 50M£
- Environmental cost estimates: Should be small given the infrastructures (under study)