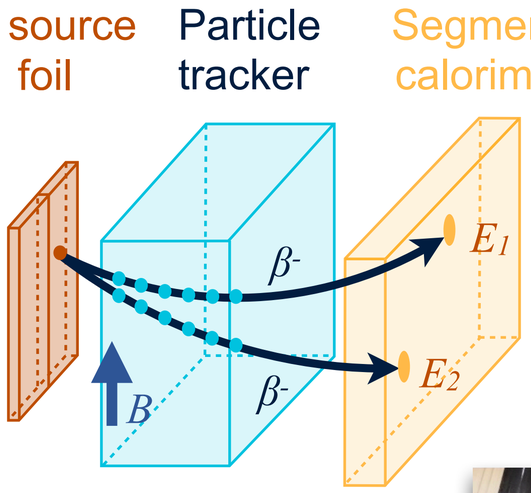
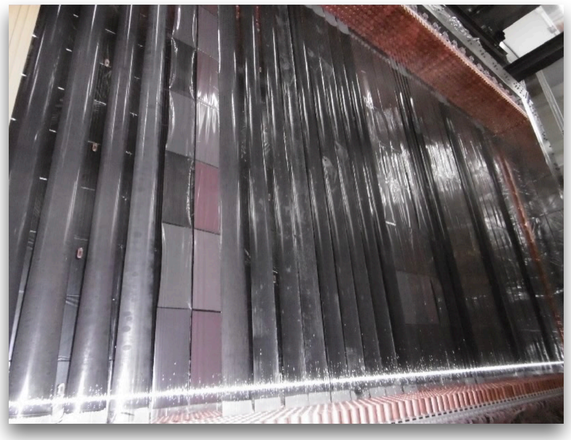
SuperNEMO: a fully topological tracking detector for $0\nu\beta\beta$

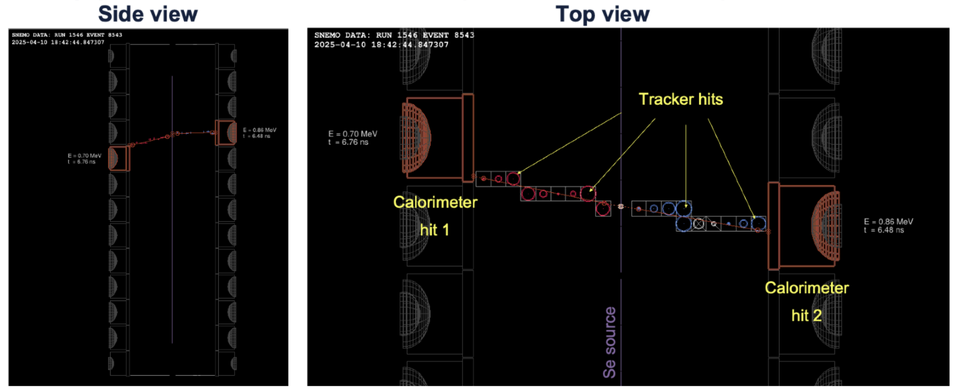


- Unique individual particle identification
- (Almost) isotope agnostic

- Excellent background rejection
- Background measurement (dedicated channels)
- Golden-event signature
- Individual energy
- Angular correlation



Our first $\beta\beta$-candidate event (10 April 2025)



98.4% of tracker,
97.4% of calorimeter
operational!

SuperNEMO Demonstrator has rich physics potential with ^{82}Se

- $0\nu\beta\beta$ V-A
- $0\nu\beta\beta$ V+A (λ and η)
- $0\nu\beta\beta$ with Majoron
- $2\nu\beta\beta$ and $0\nu\beta\beta$ to excited states
- Nuclear structure effects via $2\nu\beta\beta$ spectrum
- BSM decay searches: sterile neutrinos, Lorentz violation, bosonic neutrinos…

Currently taking physics data at LSM, France

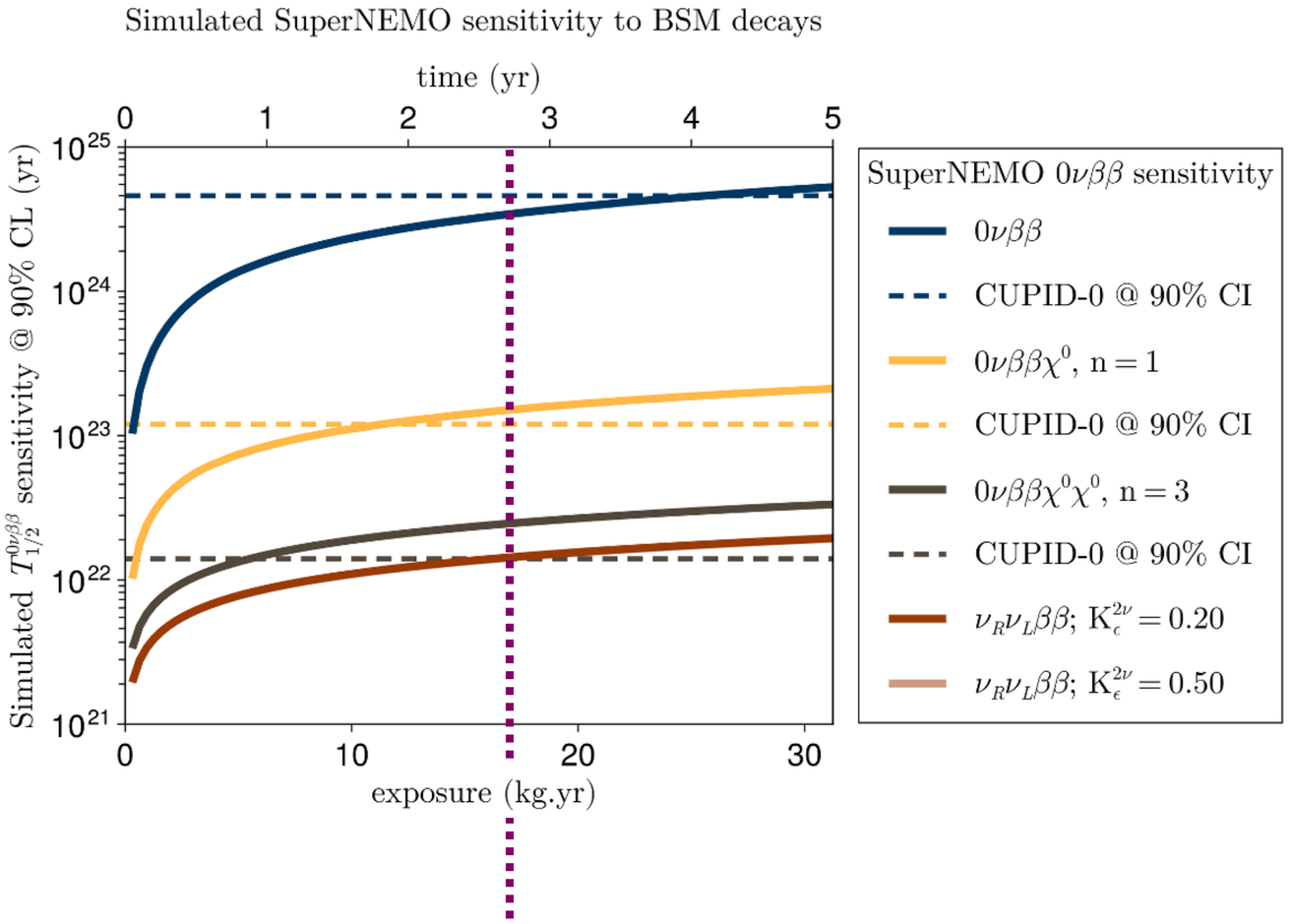
Key to probing and understanding $0\nu\beta\beta$ mechanism if it's discovered

SuperNEMO challenges - runtime and radon-free air

- **SuperNEMO running steadily since April 2025**
  - Total acquisition time 354 days (by mid-May 2026)
  - 97.9% duty cycle (90.8 accounting for calibration)
- **Threat: reduced runtime**
  - Competition with other experiments for LSM space
  - Nominal runtime needed to achieve physics potential
- **Threat - nominal background conditions not met**
  - Goal: background free in $0\nu\beta\beta$ ROI
  - Requires Rn-free (1mBq m^{-3}) surrounding air (supplied by LSM)
    - Anti-Rn facility activated Oct 2025 (6 months into run)
    - Facility malfunctioning: **still no Rn-free air**

SuperNEMO radon activity target: 0.15 mBq m^{-3}

Mean radon activity since first ββ run: 39 mBq m^{-3}



Nominal exposure (17.5 kg.yr)

Rn-free air and nominal runtime critical to physics results!