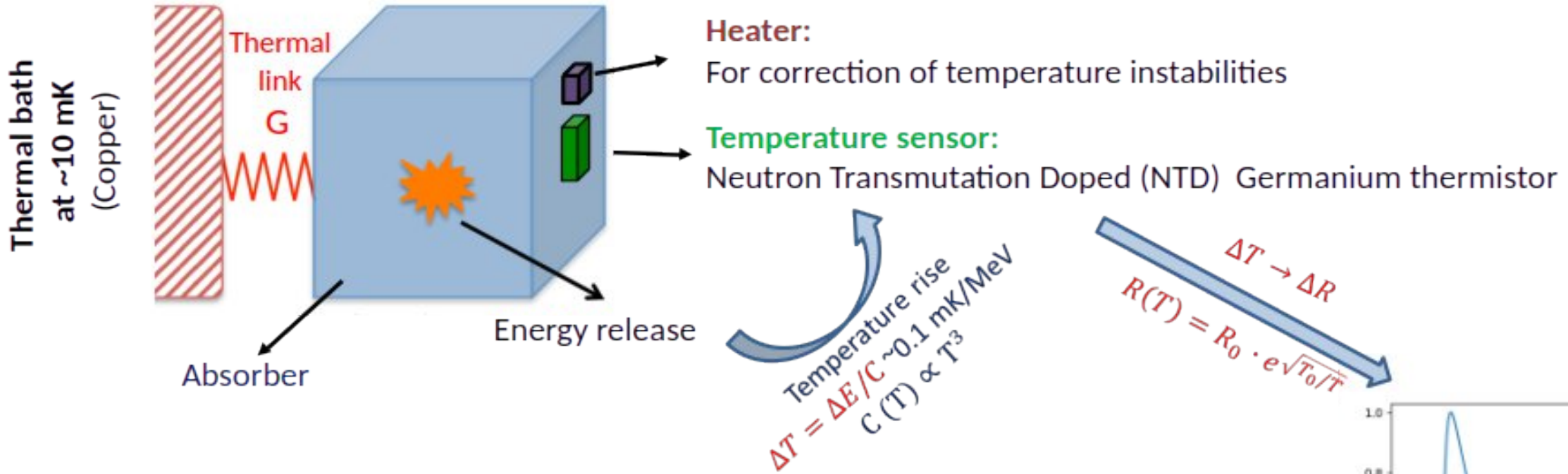


Projet CROSS

AG Pole Ingénierie

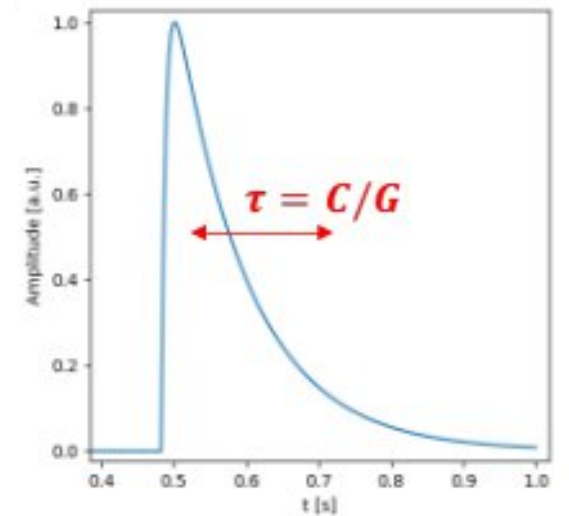
15 Avril 2026

Bolometric technique



Bolometric detector properties match well the required features for $0\nu 2\beta$ search

- Good energy resolution $\sim 5\text{-}10 \text{ keV}$ at 2.5 MeV
- Large flexibility in material choice
- Source = detector: high efficiency



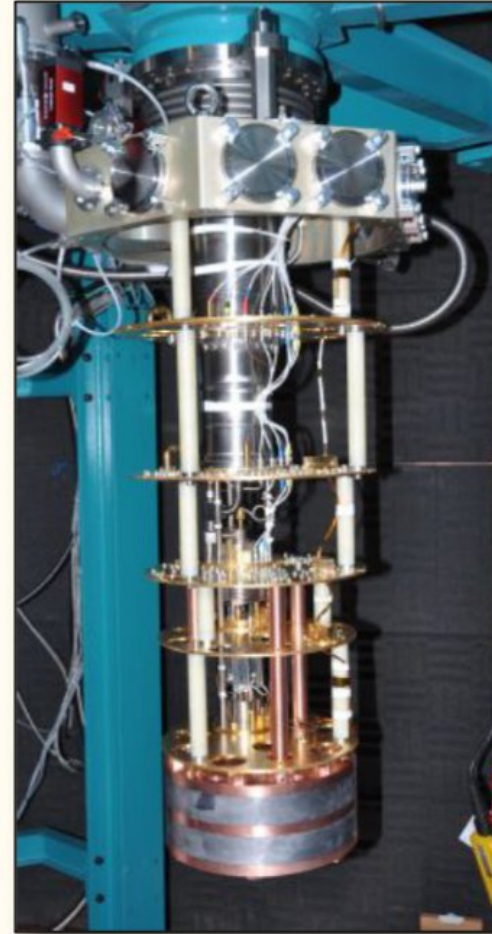
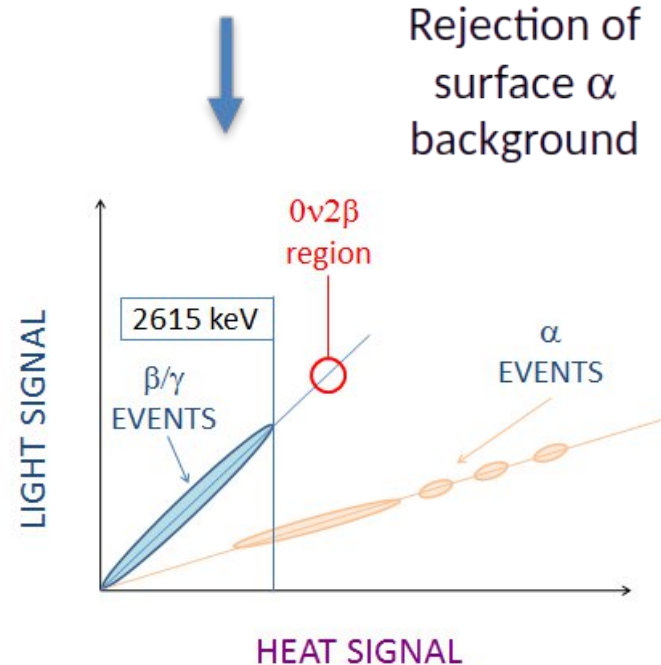
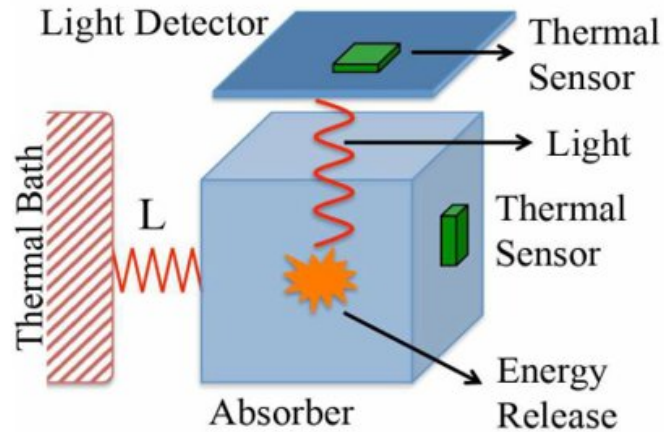
CROSS project

A standalone experiment and a test bench for CUPID

CROSS (Cryogenic Rare-event Observatory with Surface Sensitivity): $0\nu 2\beta$ bolometric search

Basic approach

- Bolometers made of enriched crystals :
 $\text{Li}_2^{100}\text{MoO}_4$ and $^{130}\text{TeO}_2$ → **The source is embedded in the detector**
- Measurement of heat and light from each event



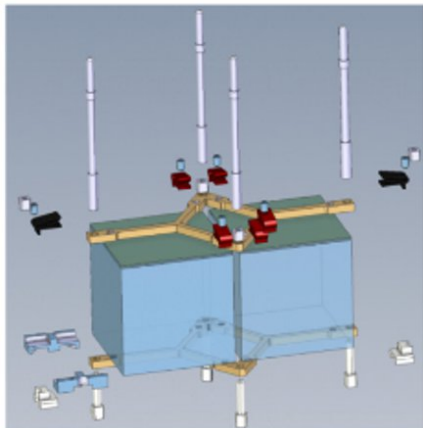
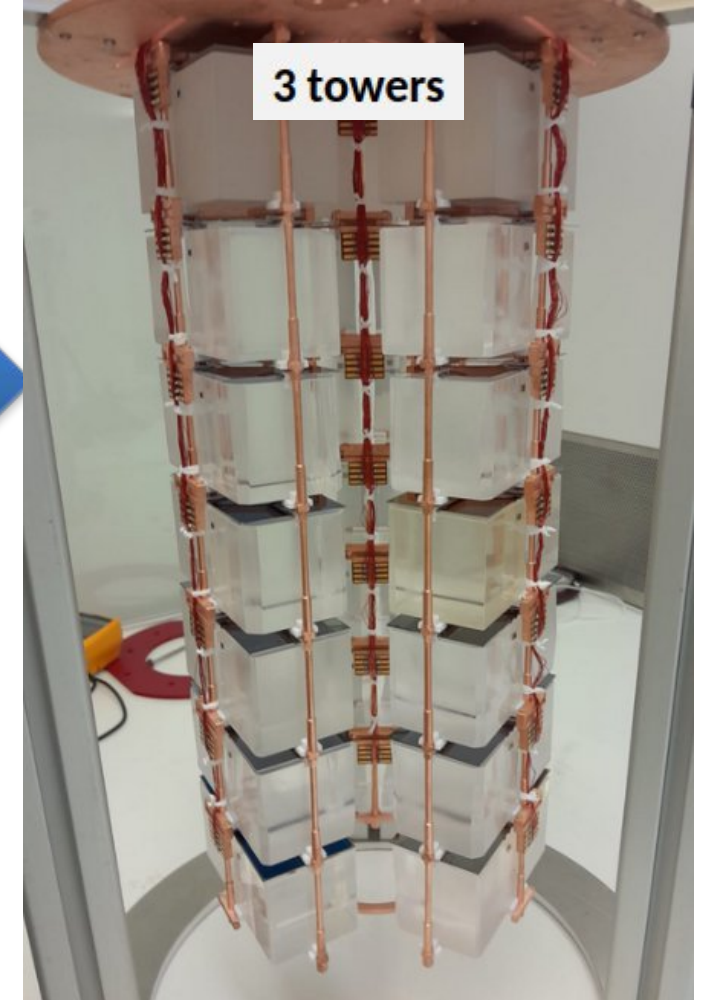
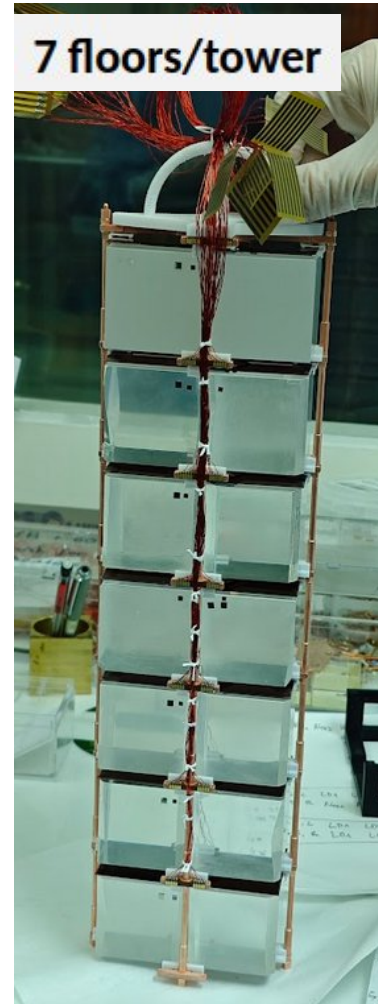
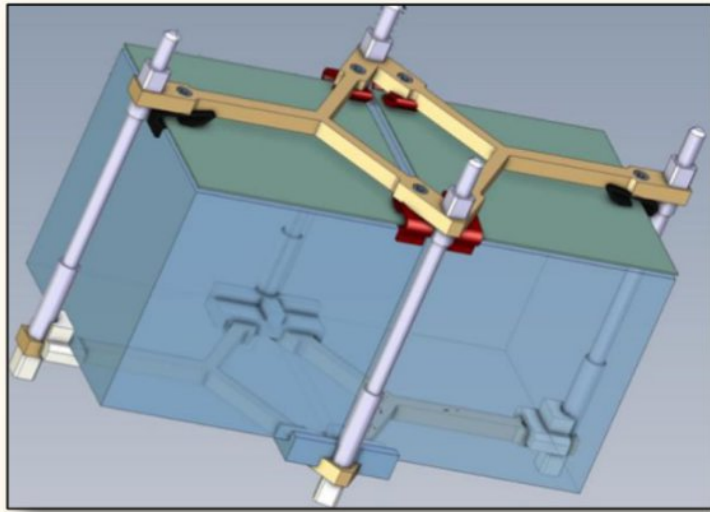
CROSS demonstrator: Structure

3 towers - 7 floors - 2 detector/floor

→ 42 crystals (45 x 45 x 45 mm) and light detectors (45 x 45 mm)

M. Buchynska, WIN 2025

Assembled CROSS demonstrator

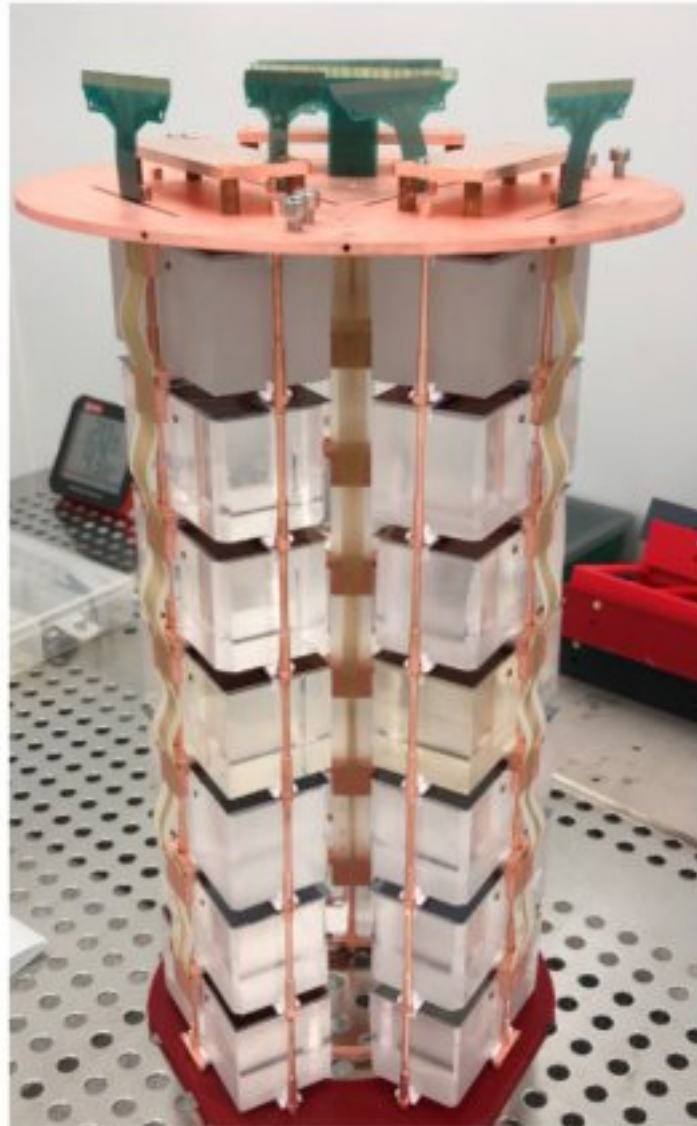


No Cu holder for
light detector wafer

Low (6%)
 $\text{Cu}/\text{Li}_2\text{MoO}_4$
mass ratio

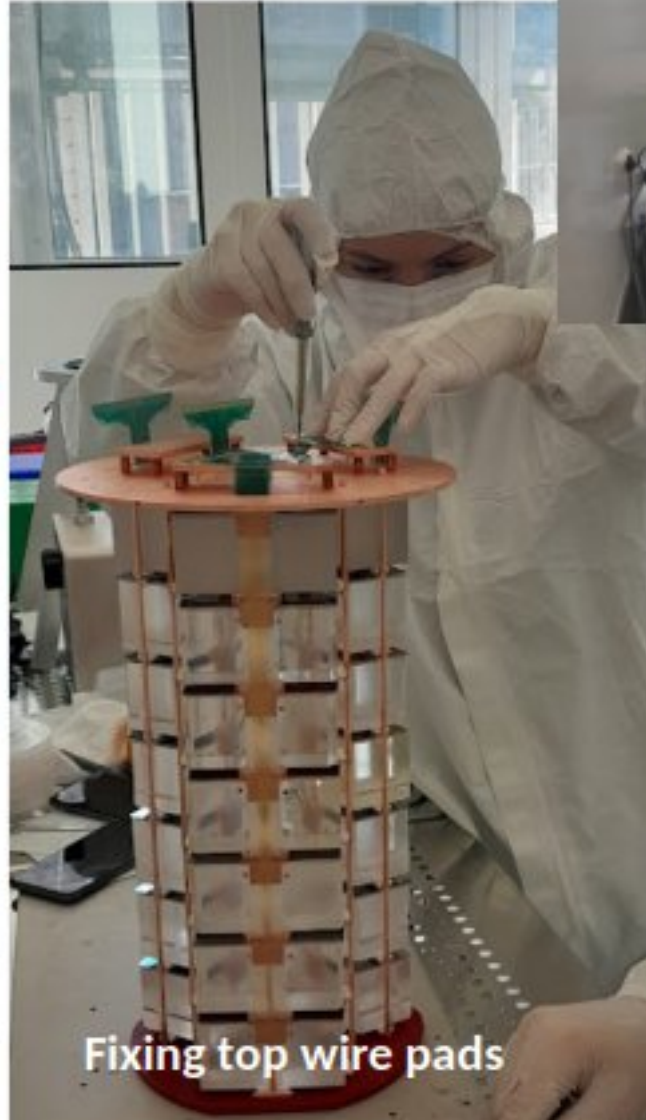
2024 JINST 19 P09013

CROSS demonstrator: assembly

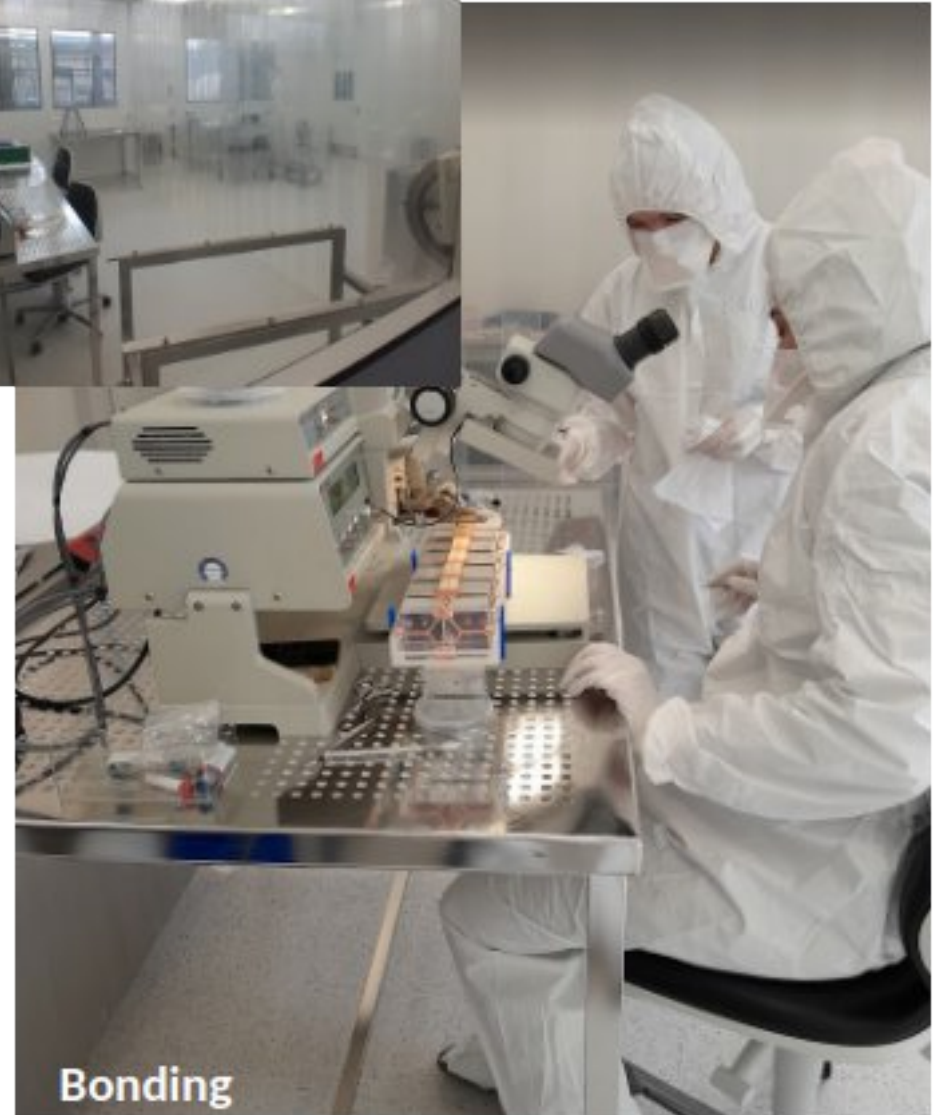


Assembled demonstrator
(baseline version of the cabling)

IJCLab-Orsay
ISO5 clean room



Fixing top wire pads



Bonding

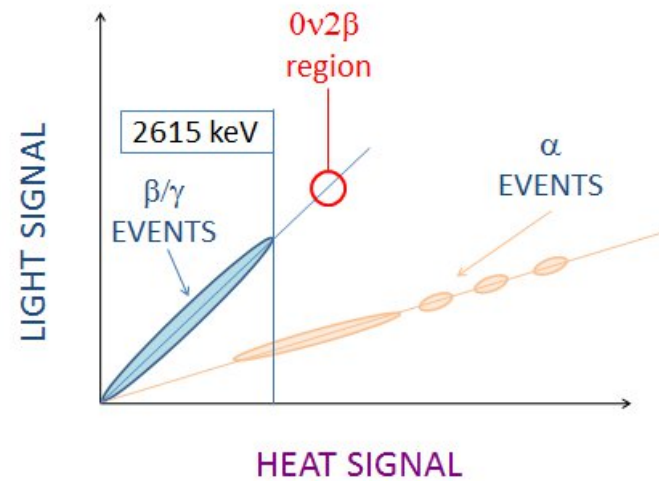
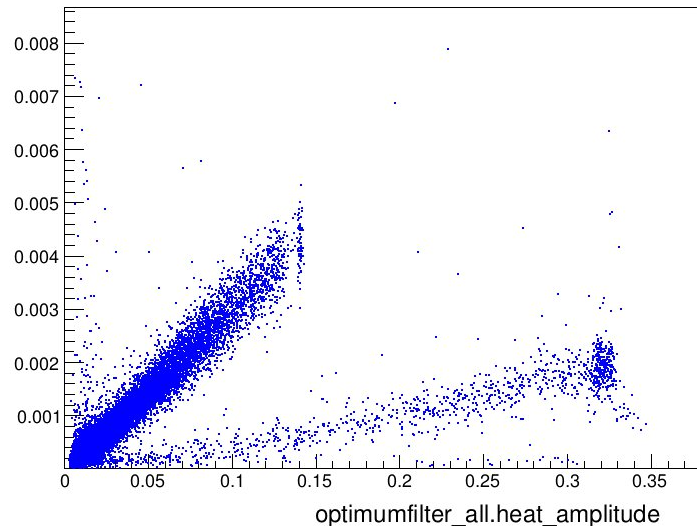
CROSS demonstrator : milestones

- **12-18/11/2025: Commissioning @20 mK (non-optimal noise)**
- **19-30/11/2025: Commissioning @25 mK (non-optimal noise)**
- **10/12/202 - now: Commissioning and data taking @25 mK (optimal noise, after UQT adjustment)**

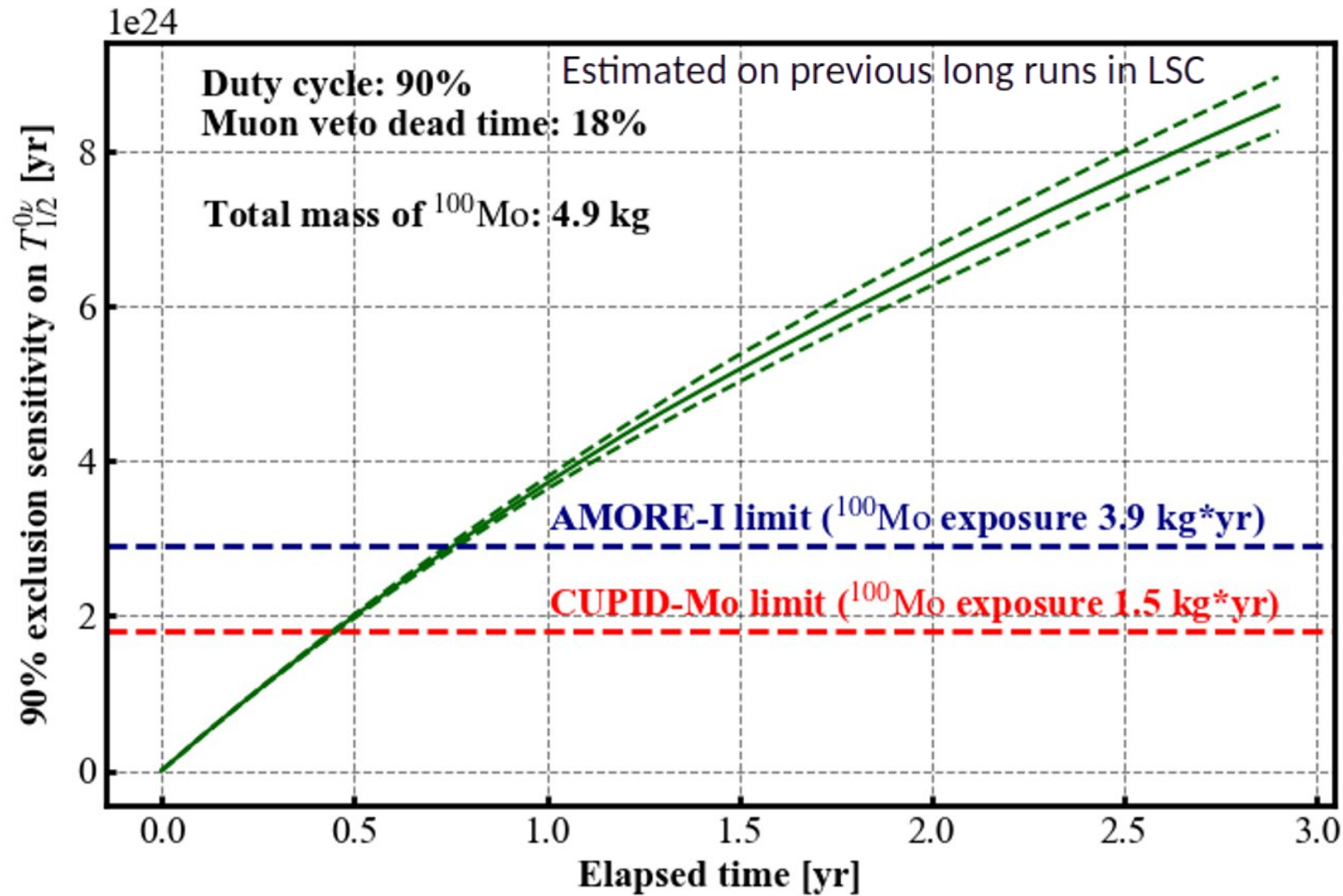
CROSS demonstrator : performances

- Energy resolution between 5 to 10 keV for most of detectors (calibration)

Particle discrimination



Sensitivity



Assumptions :

Resolution: 7 keV FWHM @ $Q\beta\beta$

ROI: 17.1 keV

(from CUPID-Mo analysis)

BI: $(3.2 \pm 0.5) \times 10^{-3}$ counts/(keV kg y)

Number of ^{100}Mo nuclei: 2.95×10^{25}

Efficiency 70.2%

- Containment efficiency: 78%
- Cut efficiency 90%

We expect to reach a sensitivity on
 ^{100}Mo $T_{1/2}^{0\nu}$ of 3.5×10^{24} y
before the end of 2026

What's new in CROSS?

Multi-year program to develop new technologies for background reduction and new radiopure enriched crystal production

1. **Surface film coating** of crystals to discriminate between bulk and surface events (both α 's and β 's)
2. **Neganov-Trofimov-Luke (NTL) Light Detectors** development and optimization
3. **Novel mechanical structure** that minimizes the amount of passive materials around the detectors
4. **Purification-crystallization** chain for enriched $^{130}\text{TeO}_2$ crystals