

## 1. Overview of AMoRE-II

- AMoRE-I:  $T_{1/2}^{0\nu} > 2.9 \times 10^{24}$  years (Ref. [1]).
- AMoRE-II is under construction at Yemilab.
- 360  $\text{Li}_2^{100}\text{MoO}_4$  (LMO) and  $^{40}\text{Ca}^{100}\text{MoO}_4$  (CMO) crystals in 5 & 6 cm diameter. ( $\sim 85$  kg  $^{100}\text{Mo}$ ).

### AMoRE-II detector performance

- $\Delta E(\text{FWHM}) \sim 7$  keV @2614 keV (Ref. [2])
- Alpha discrimination power at ROI > 10

### AMoRE-II Goal

- Background <  $10^{-4}$  ckky
- $4.5 \times 10^{26}$  years sensitivity for 5 years ( $m_{\beta\beta} < 17 - 49$  meV)

### AMoRE Collaboration

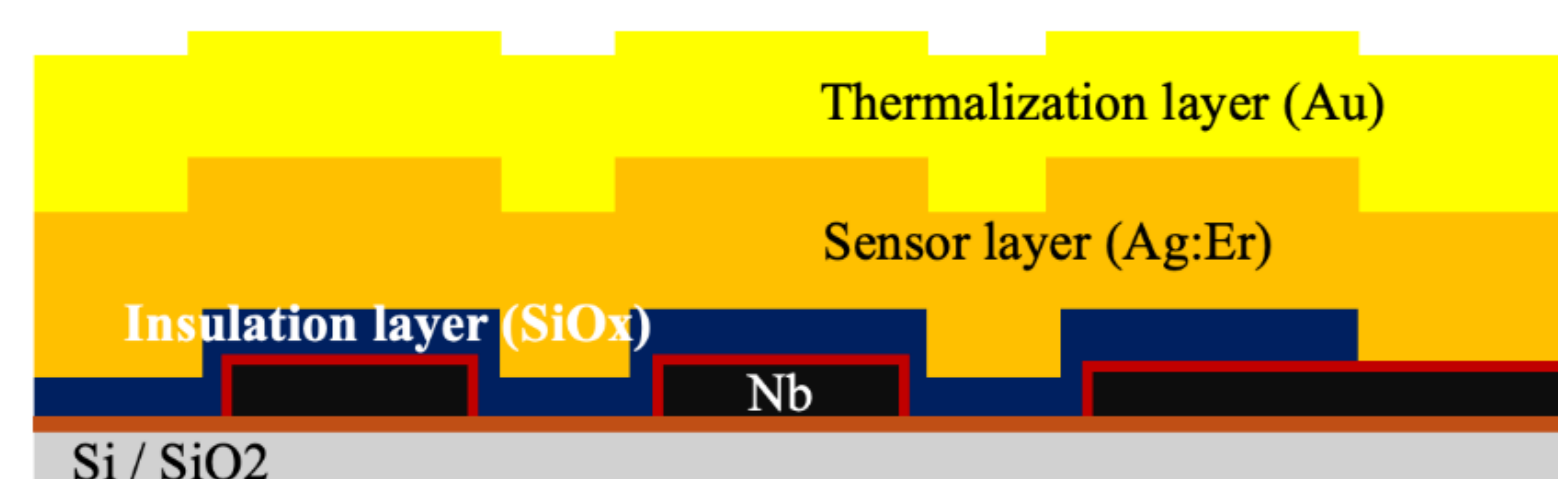
- 10 Countries, 26 Institutions.
- Korea, Germany, Ukraine, USA, Russia, China, Thailand, Indonesia, India, Pakistan



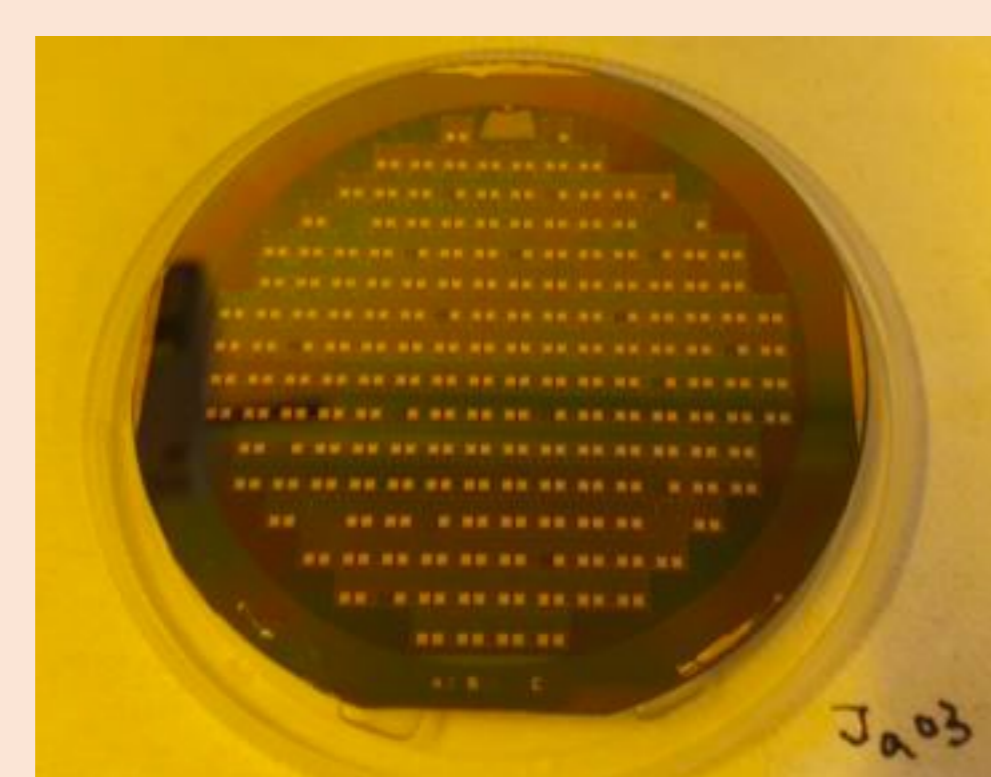
## 2. Detector Module/Sensors

- 360 Enriched Crystals (95%  $^{100}\text{Mo}$ ) grown at NIIC & CUP.
- Both phonons and photons are measured by a set of metallic magnetic calorimeter (MMC)+SQUID sensors.
- All SQUIDS produced by PTB and Heidelberg U for AMoRE-II stage 1 are tested.
- MMCs for AMoRE-II stage 1 are being tested.

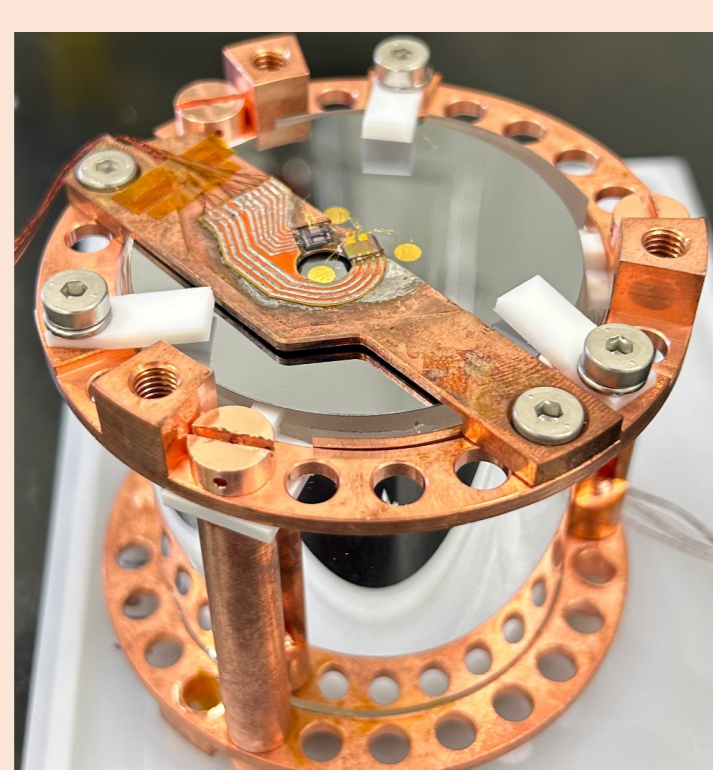
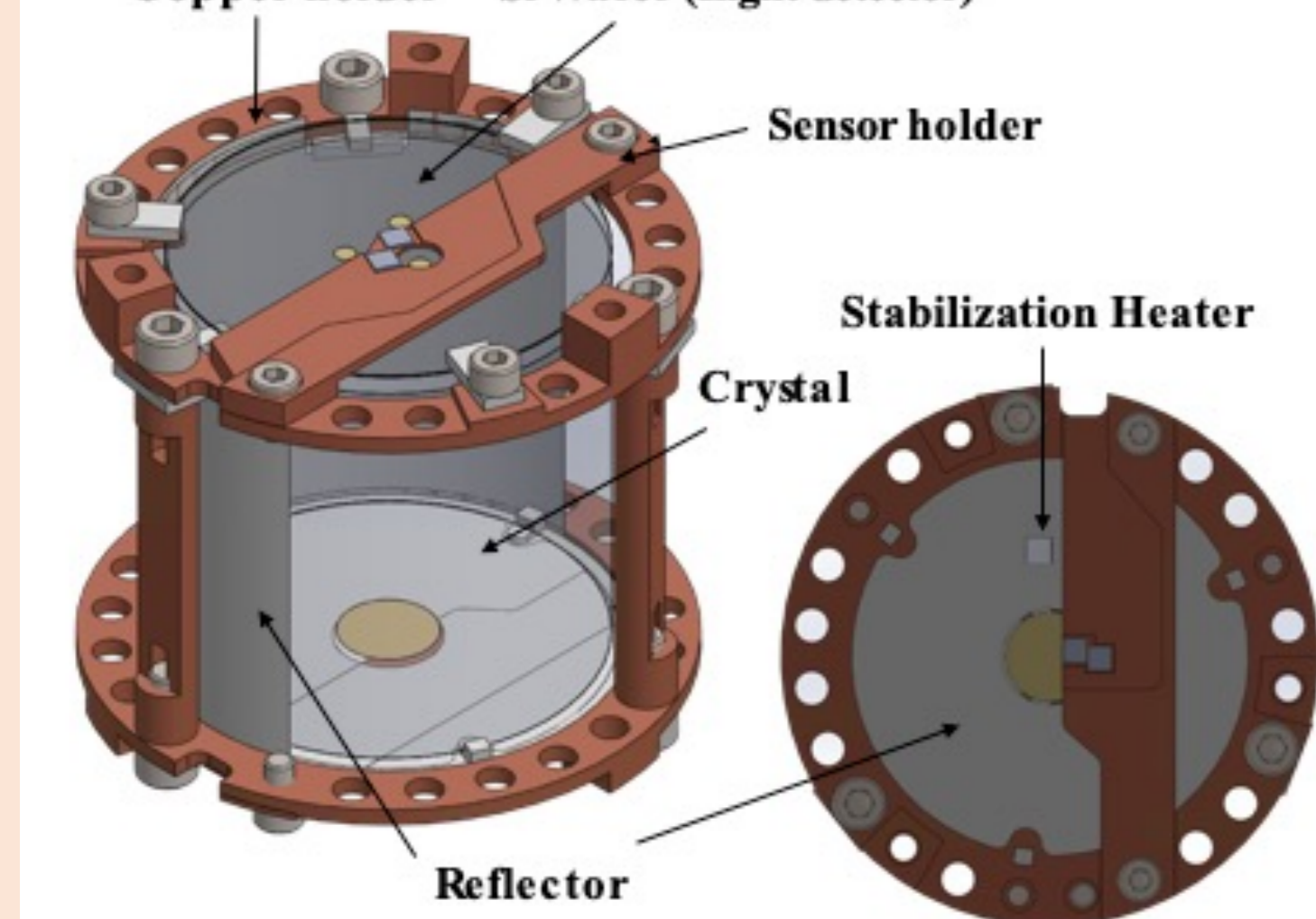
### MMC cross sectional view



### A wafer of MMC fabrication

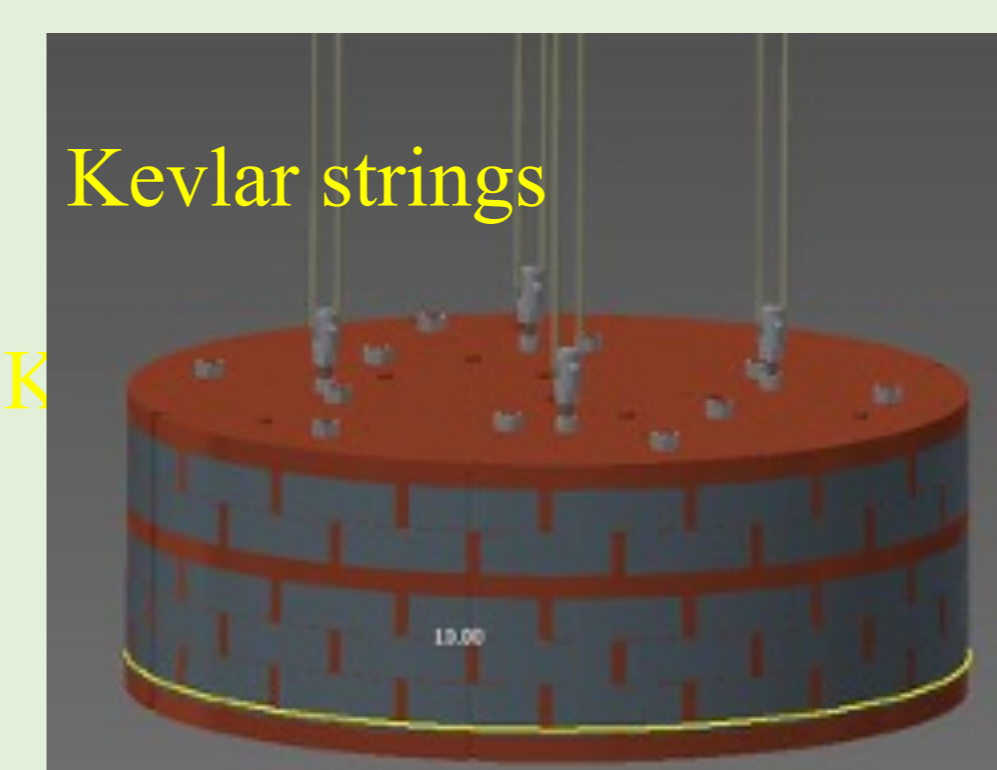
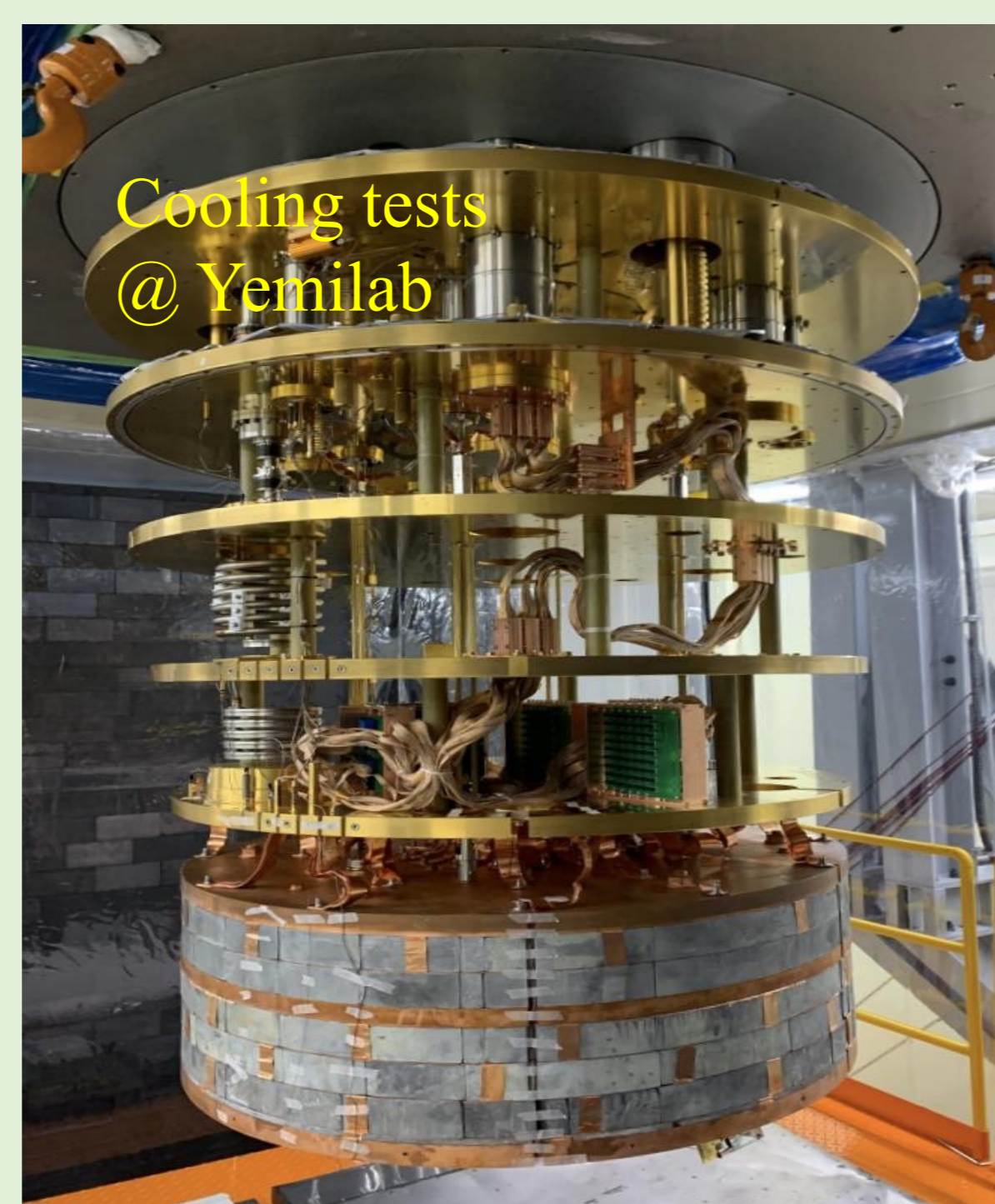
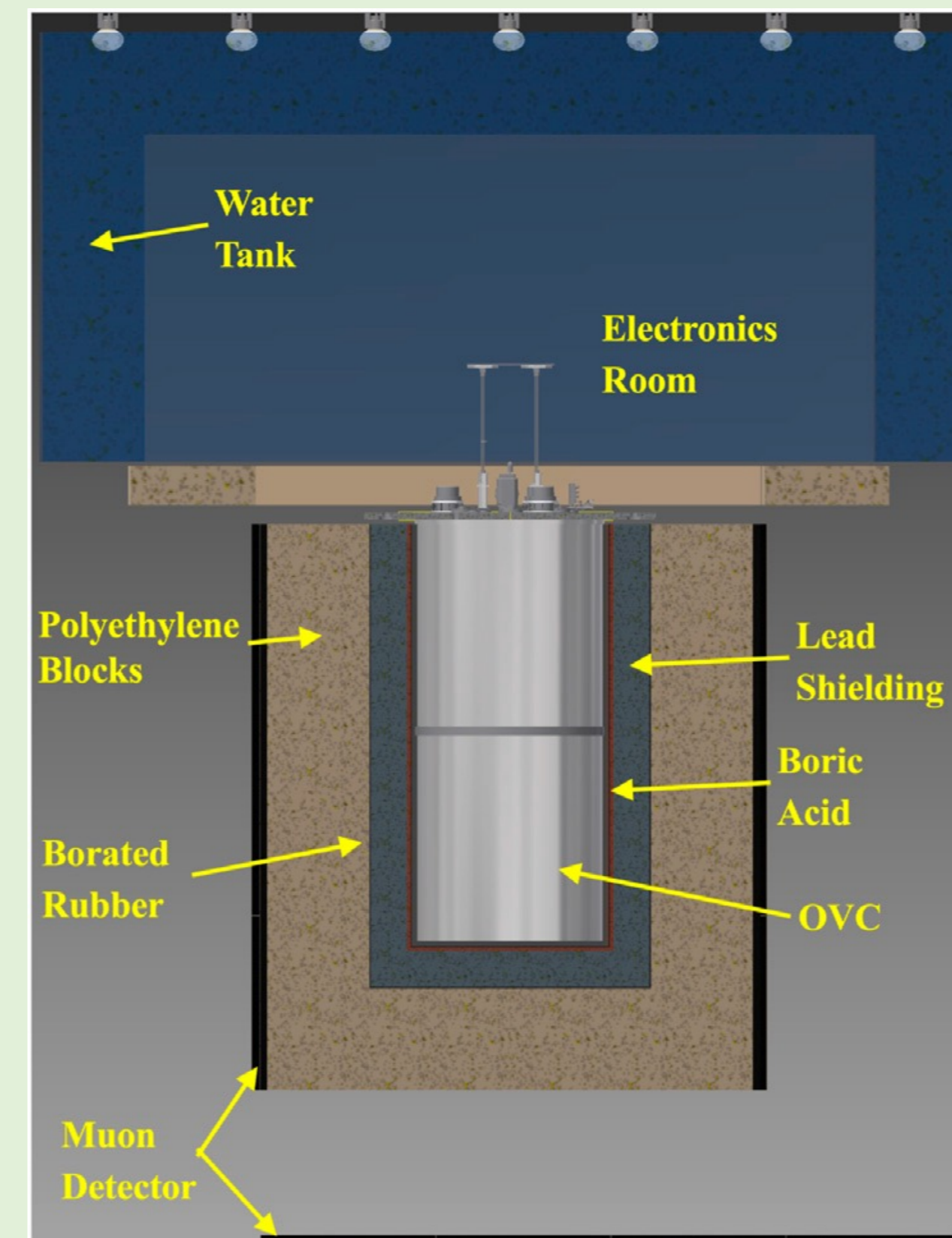


### Copper holder



## 3. Cryostat/Shielding

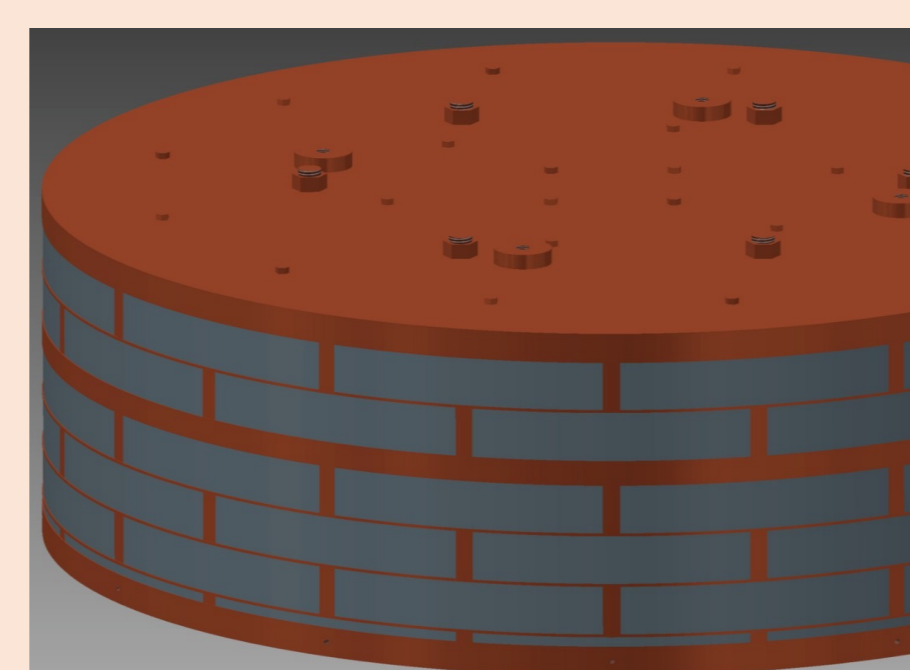
- Both water Cherenkov and plastic muon detectors are installed and tested. Total muon flux  $\sim 10^{-7}$  cm $^{-2}$ /s $^{-1}$ .
- Shields from inside to outside:  
Boric Acid (1 cm) + Cu (5 cm) + Pb (20 cm) + PE (70 cm)
- All shielding structures are installed with 3 tonnes of inner lead.
- Mixing chamber cooled down to 7.5 mK with STS rods installed
- Took 3 weeks to reach 4 K with 3 tonnes of inner lead.
- Further cooling tests down to mK temperatures are underway.



Lead shield & detector towers are suspended from the outer structure by Kevlar strings and softly connected to the Dilution Refrigerator.

## 4. Background

- Background goal: <  $10^{-4}$  counts/keV/kg/year (ckky)
- Each contribution: <  $2 \times 10^{-5}$  ckky
- Full Geant4-based simulation with radioassay inputs. (Ref. [4])



### Inner Pb shielding

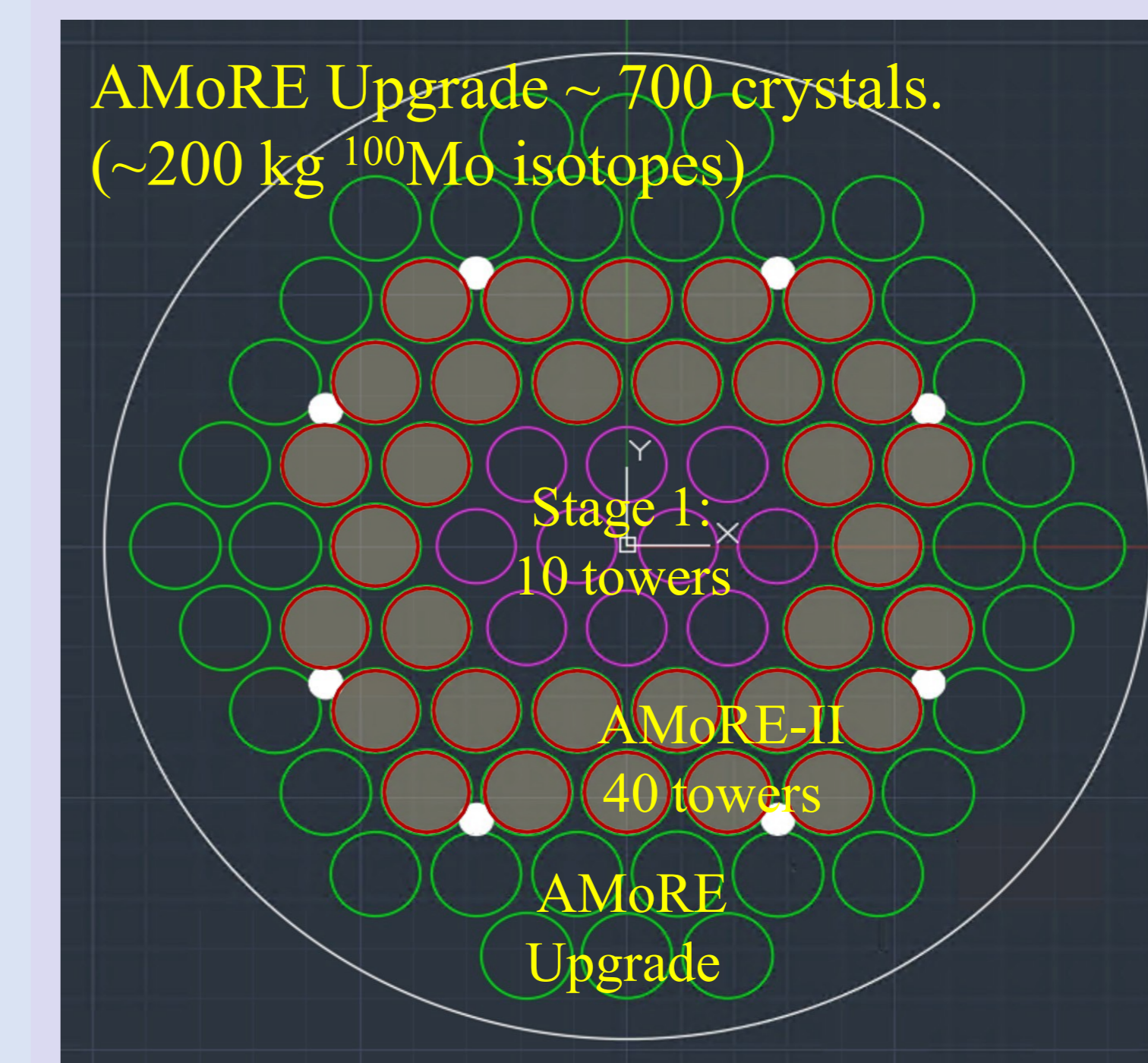
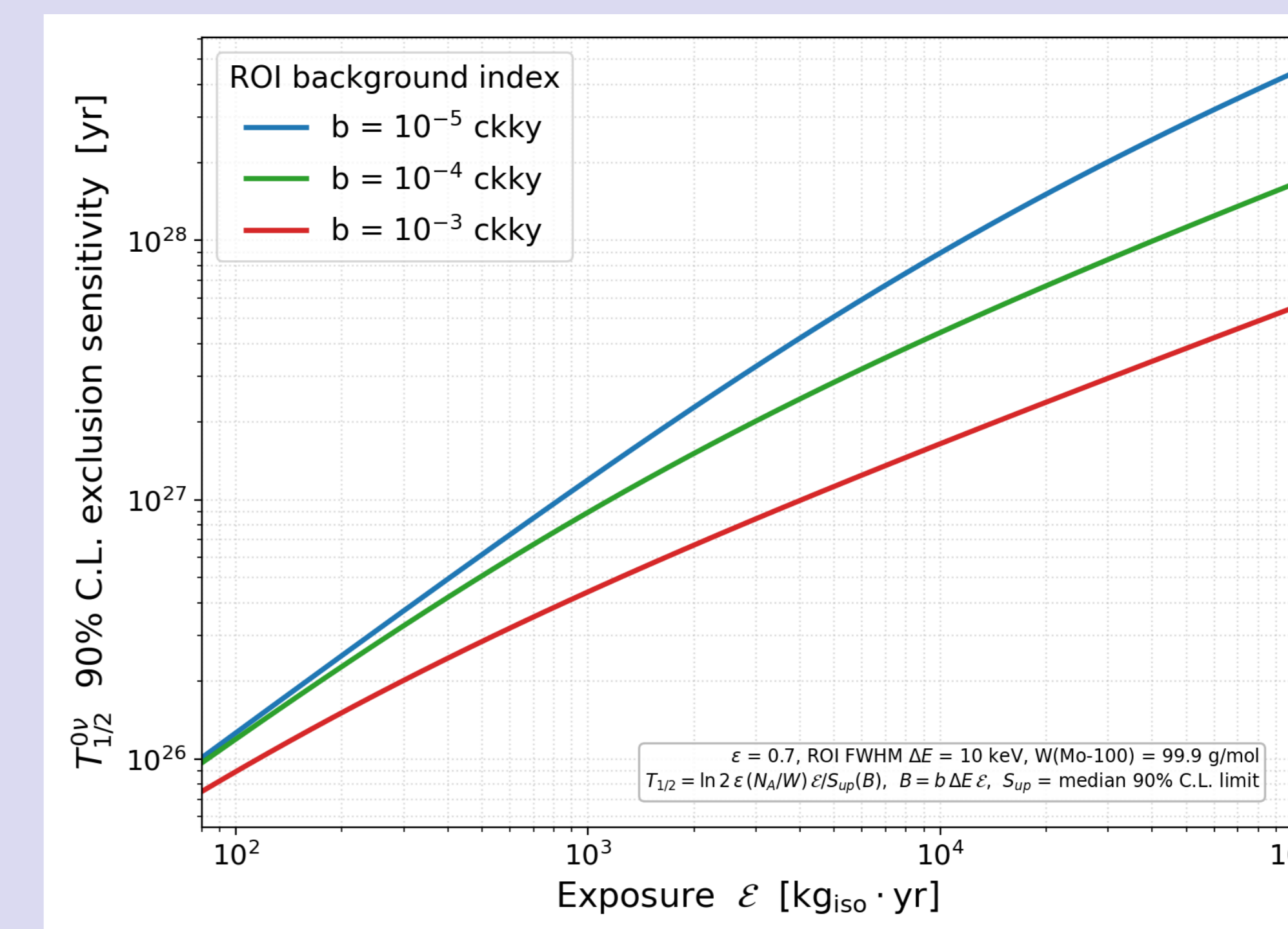
- 10 cm Goslar lead
- 15 cm Goslar lead
- 1 cm Lemer Pax lead

## Major Background

- LMO internal:  $\sim 10^{-5}$  ckky
- LMO surface
  - $\sim 6 \times 10^{-4}$  ckky from AMoRE-I alpha modeling.
  - Lower in AMoRE-II surface treatment.
- Rock gammas:  $\leq 10^{-5}$  ckky
- Pileup events:  $\sim 3 \times 10^{-5}$  ckky
  - Could reduce them using the light signal rise time analysis

## 5. Upgrade - AMoRE-III

- Propose adding 100 kg of  $^{100}\text{Mo}$  to the current Cryostat.
- Crystals and sensors will be prepared while running AMoRE-II.
- Compilation with CUPID Stage I expected.
- Further pile-up rejection with the light detector is being studied in cooperation with the CUPID group.



### Schedule

- 90 crystals, 2026-2027
- 360 crystals, 2028-2031

### References

- [1] A. Agrawal *et al.*, *Phys. Rev. Lett.* 134, 082501 (2025). AMoRE-I
- [2] A. Agrawal *et al.*, *Eur. Phys. J. C* 85, 172 (2025). Detector R&D
- [3] A. Agrawal *et al.*, *Eur. Phys. J. C* 85, 9 (2025). Background
- [4] A. Agrawal *et al.*, *Front. in Phys.* 12, 1362209 (2024). Radioassay