XIX International Workshop on
Neutrino Telescopes

GRAN SASSO SCIENCE INSTITUTE

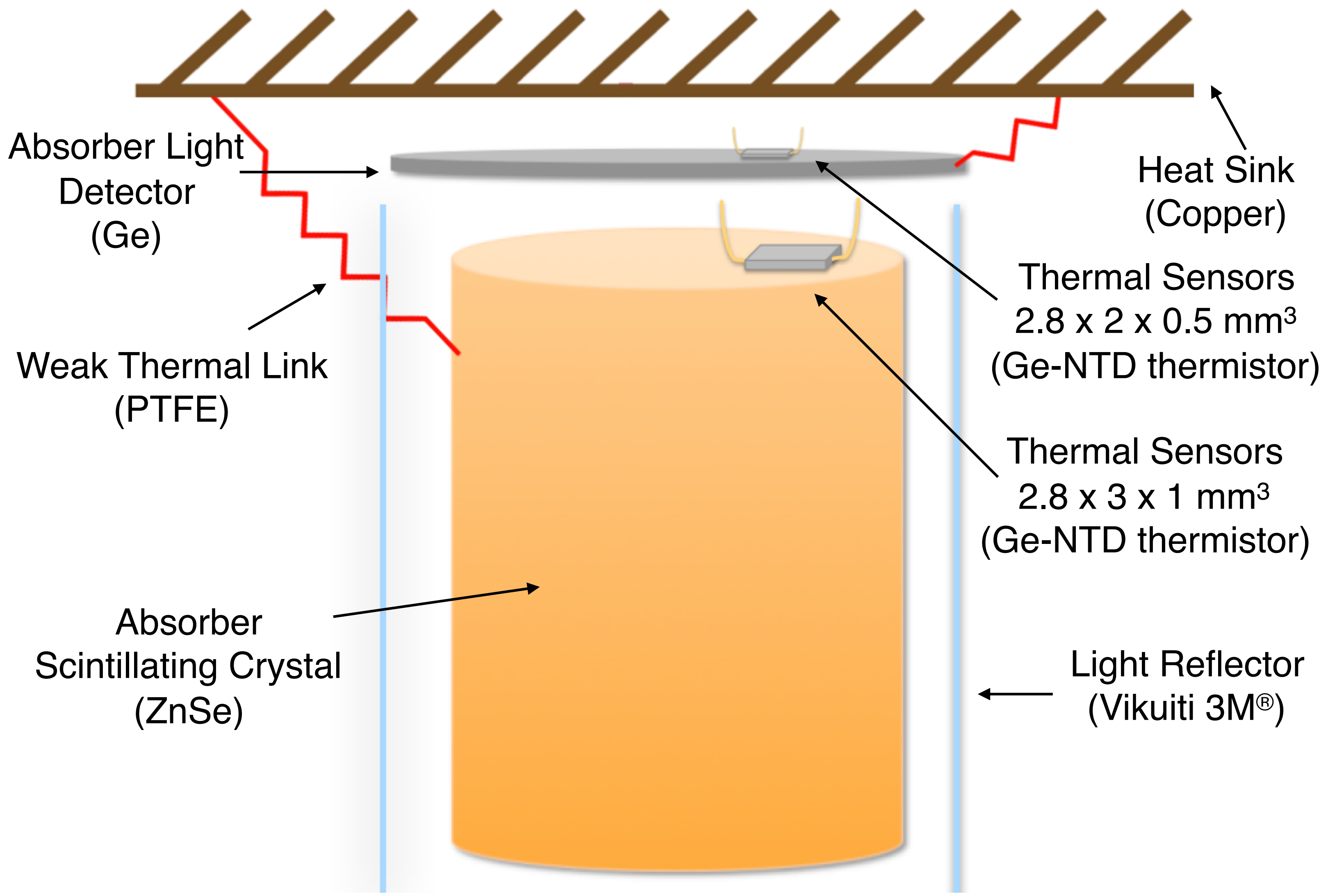
Double beta decay results from the CUPID-0 experiment

Emanuela Celi, Gran Sasso Science Institute
on behalf of CUPID-0 collaboration

Scintillating cryogenic calorimeters

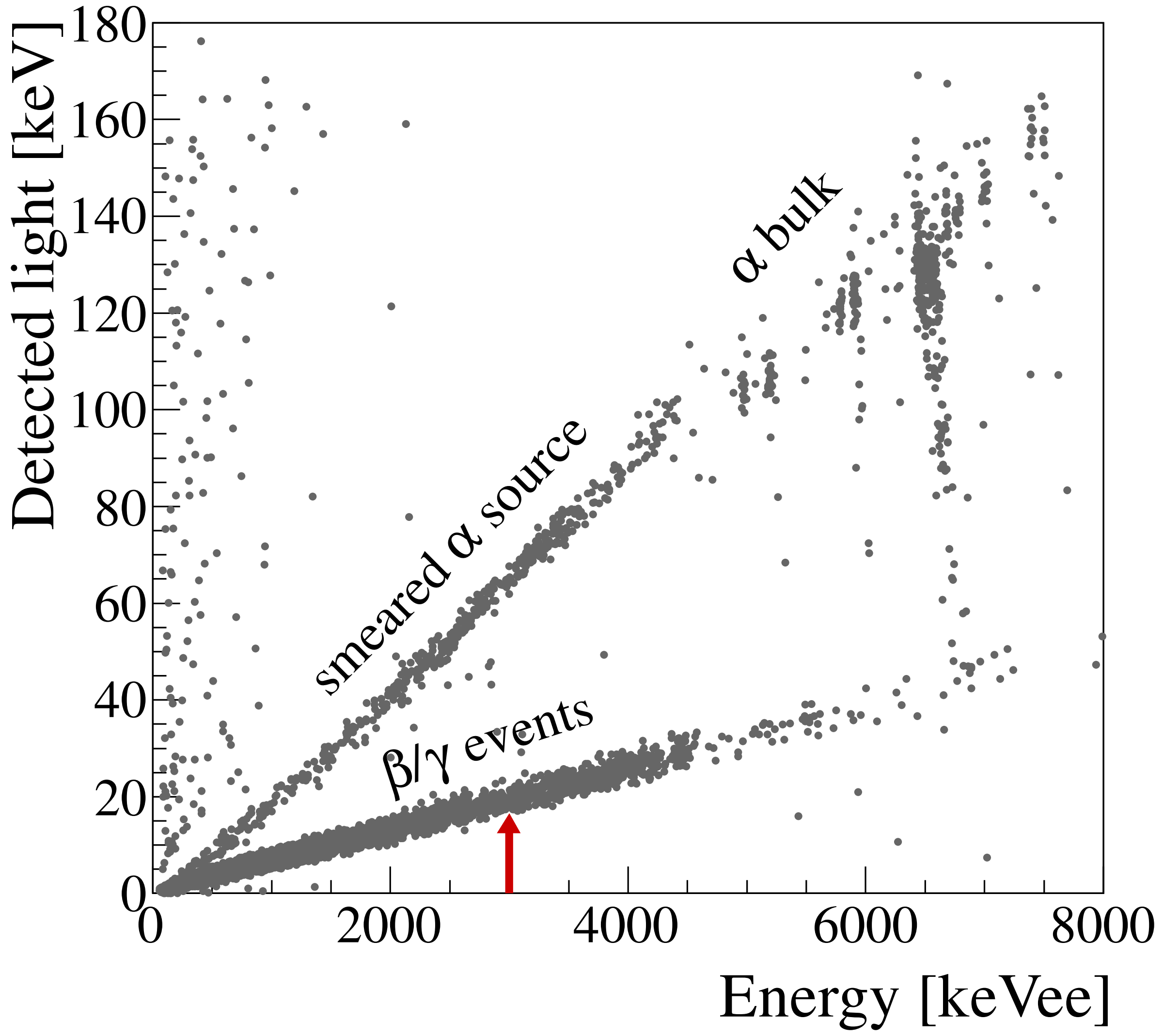
Scintillating calorimeters operating at ~10 mK
→ double read-out via heat & light.

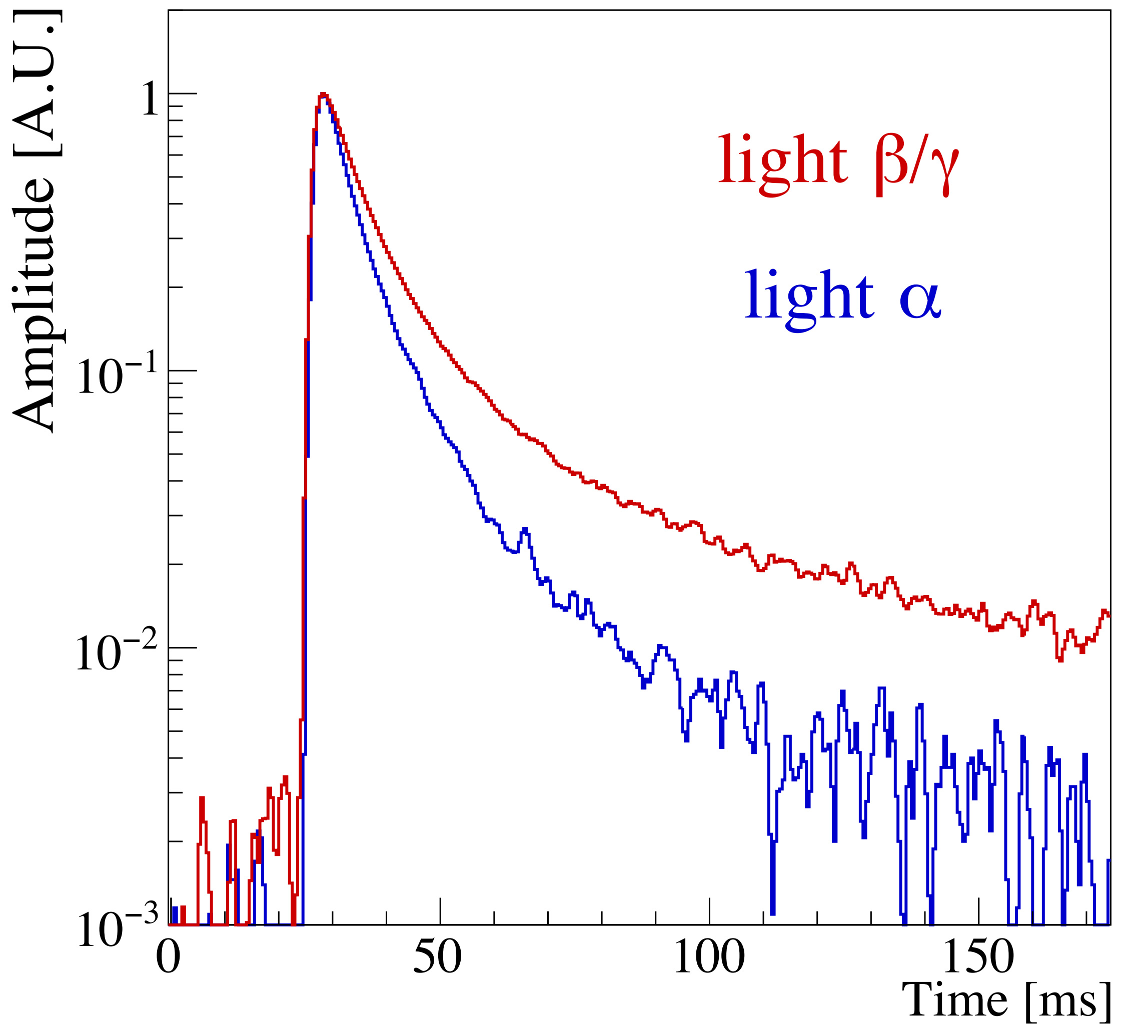
- **Source = detector** → high efficiency;
- Excellent **energy resolution** (<1%);
- Modular design → **large scalability**;
- Possibility to study **different isotopes**;
- $LY_{\alpha} \neq LY_{\beta}$ and shape parameters allow **Particle identification**;



Excellent technology to search for Neutrinoless Double Beta Decay

See F.Ferroni's talk (link)





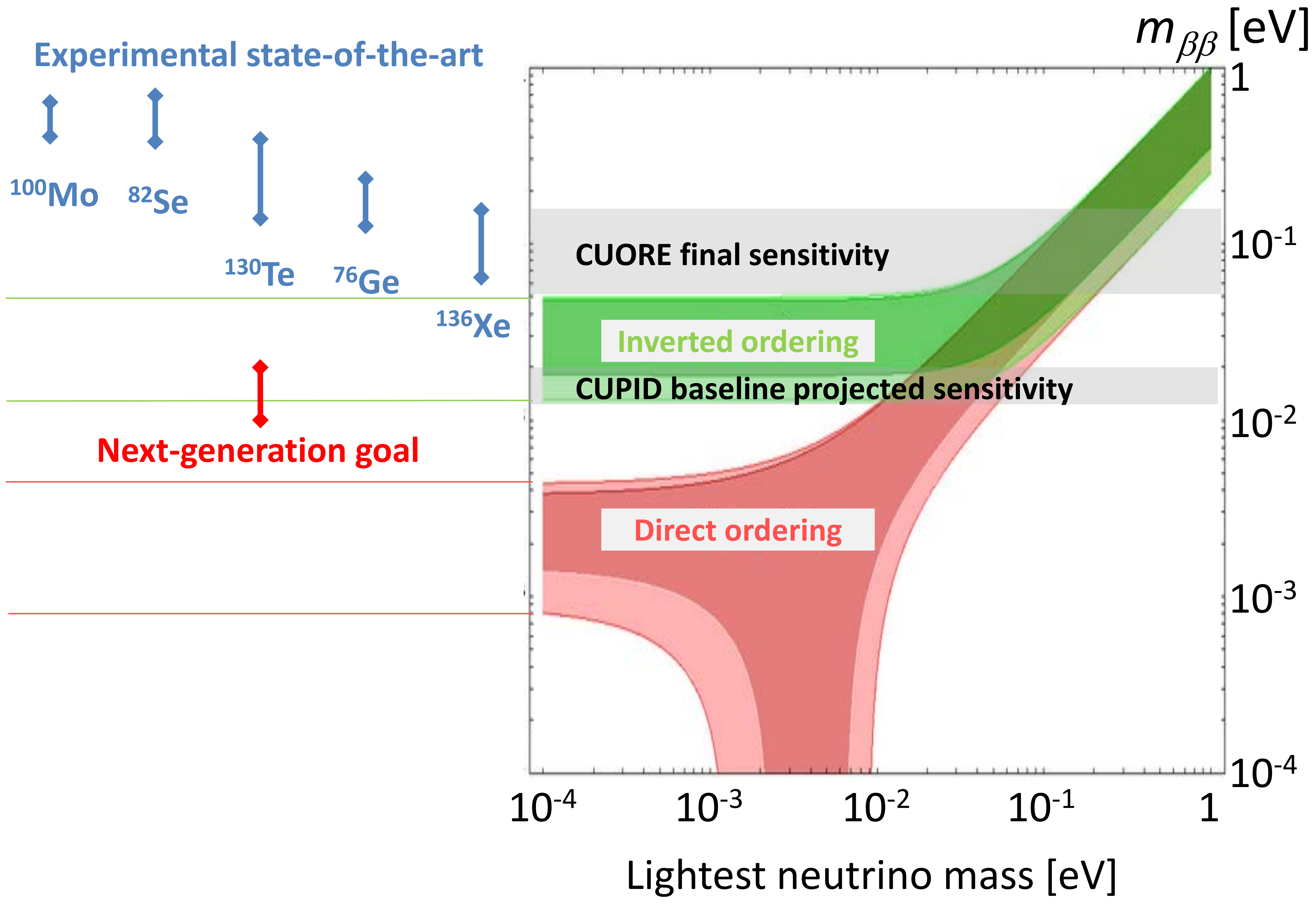
The CUPID project

- Next generation ton-scale experiment based on enriched $Li_2{}^{100}MoO_4$ scintillating crystals (arXiv:1907.09376);
- **$Q_{\beta\beta}(^{100}Mo)$ = 3034 keV**;
- Target background **~ 10^{-4} counts/keV/kg/y**;
- Expected to cover the entire inverted mass hierarchy of neutrino mass;

- Pathfinder experiments:
  - **CUPID-0** → enriched $Zn^{82}Se$ crystals;
  - **CUPID-Mo** → enriched $Li_2{}^{100}MoO_4$ crystals;
    See P.Loaiza's talk (link)

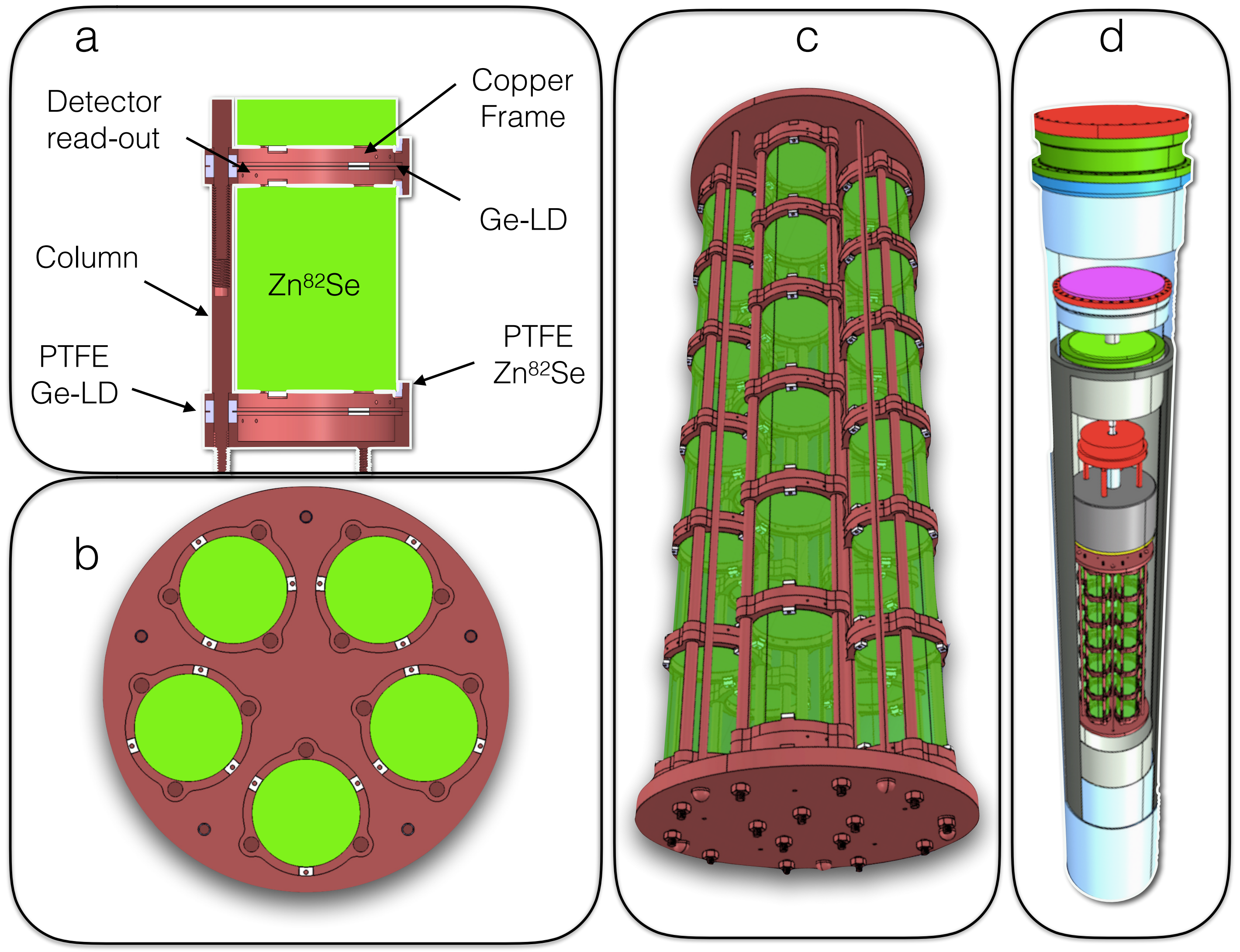
Cuore Upgrade with Particle IDentification

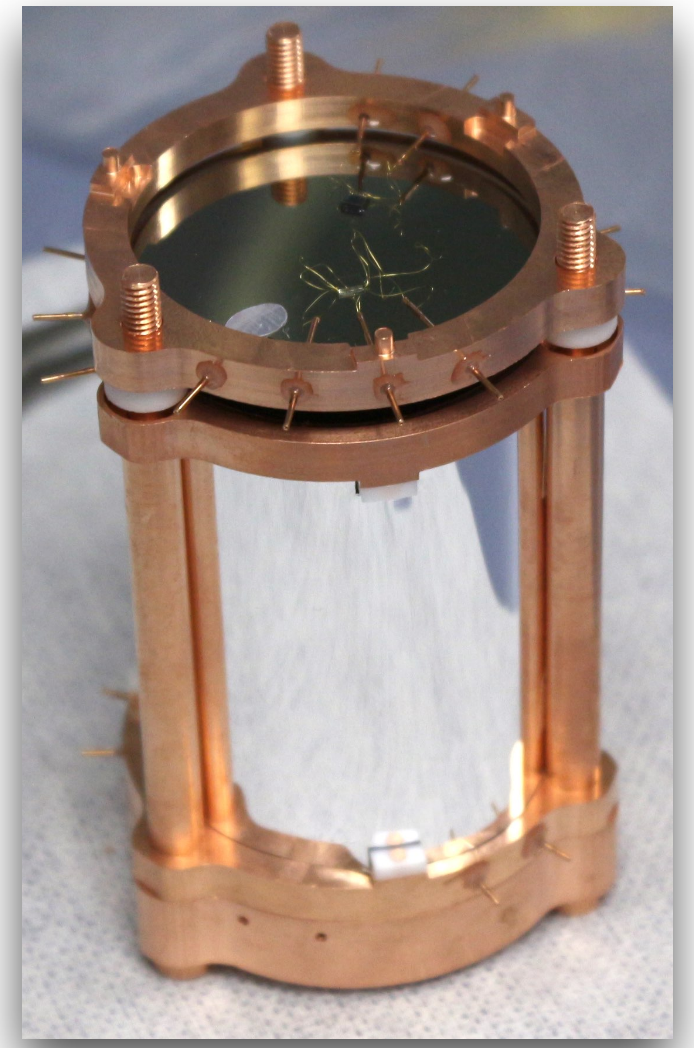
See A.Giuliani's talk (link)



The CUPID-0 experiment

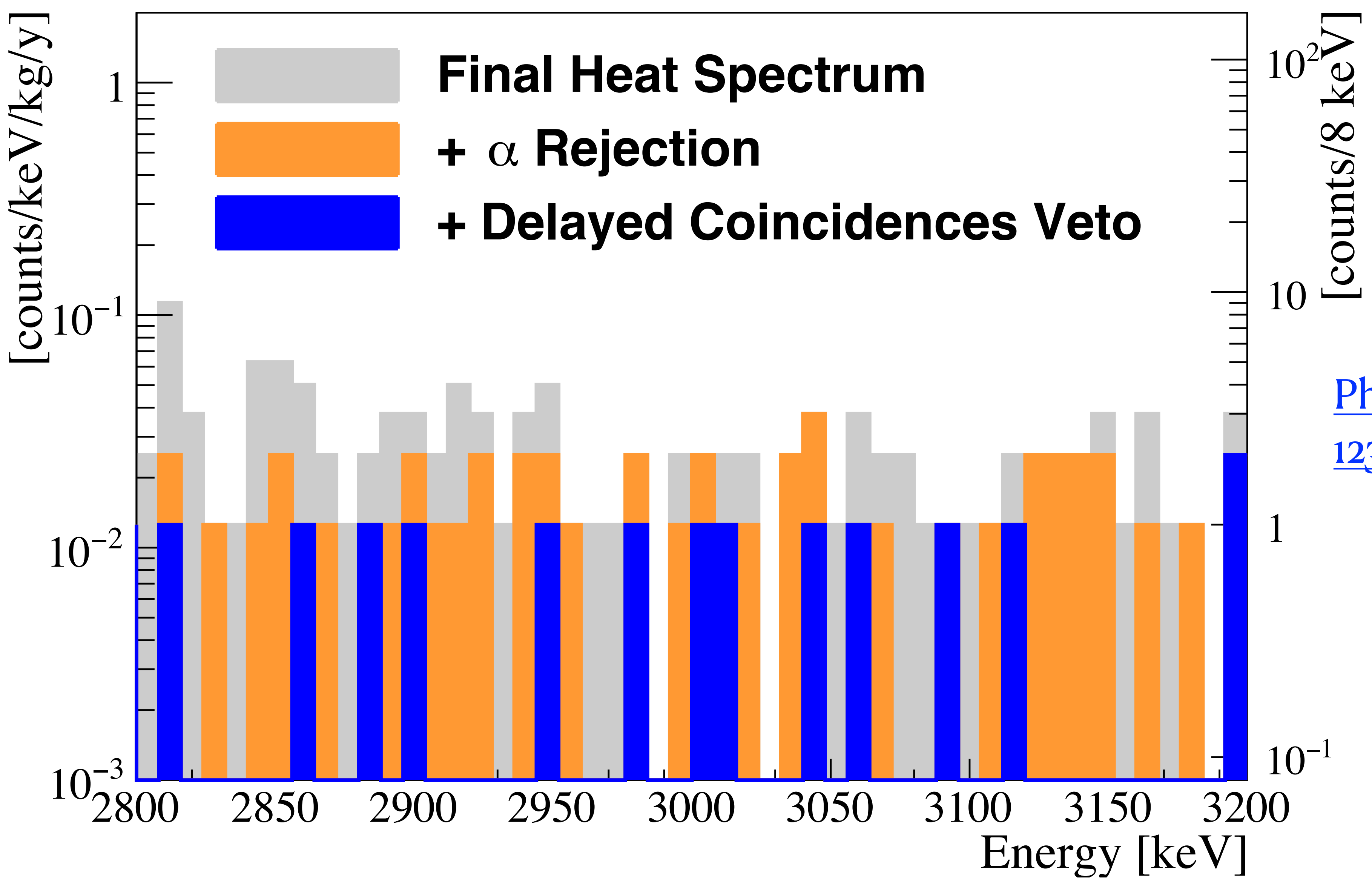
- Located at LNGS;
- 24 ZnSe crystals enriched at >95% of ^{82}Se + 2 natural ones;
- $Q_{\beta\beta}(^{82}Se) = (2997.9 \pm 0.3)$ keV → low background region;
- 31 Ge Light detectors;
- GeNTD thermistors as temperature sensors;
- Reflective foils to increase light collection;
- Total mass: **10.5 kg ZnSe**;



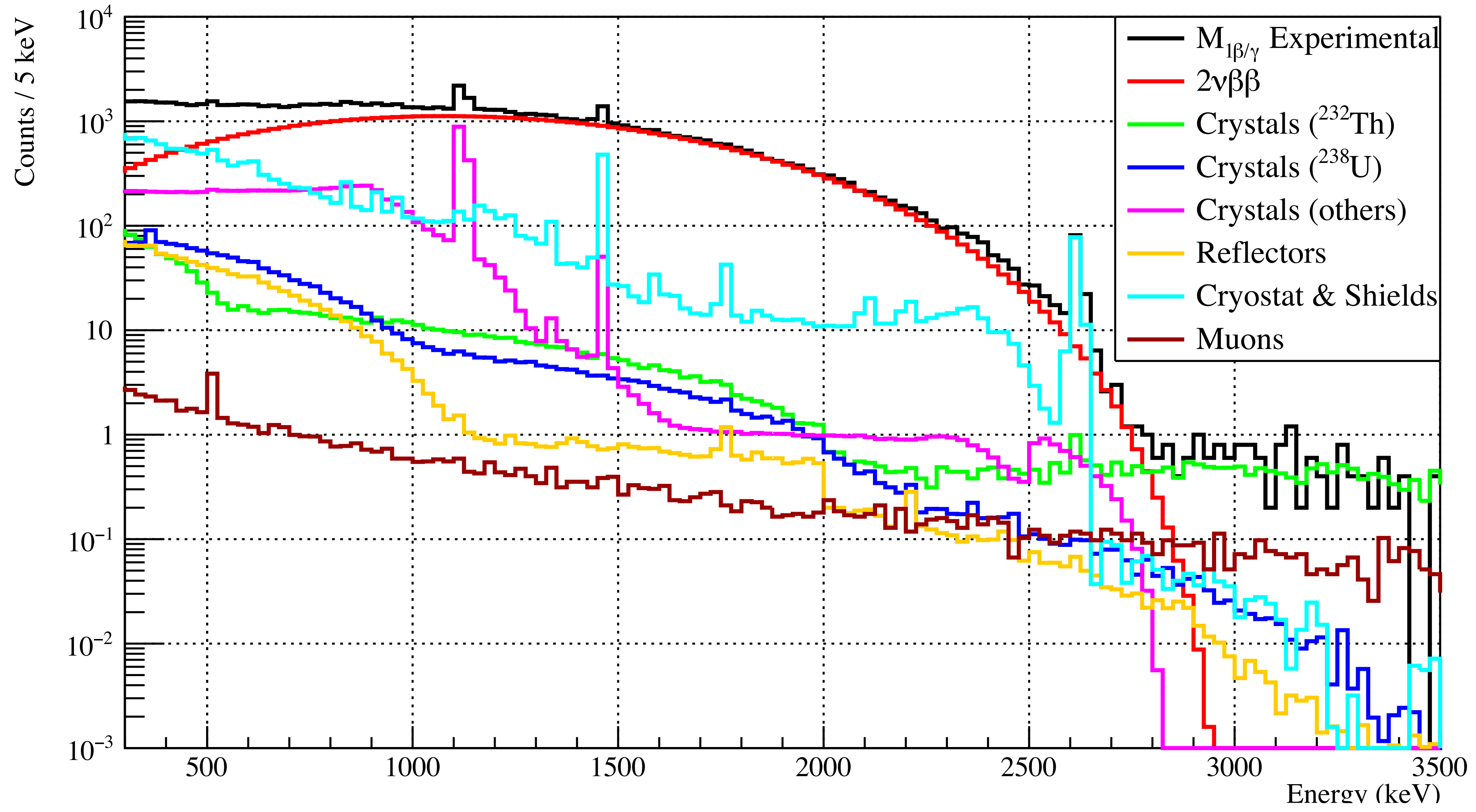


Phase I results

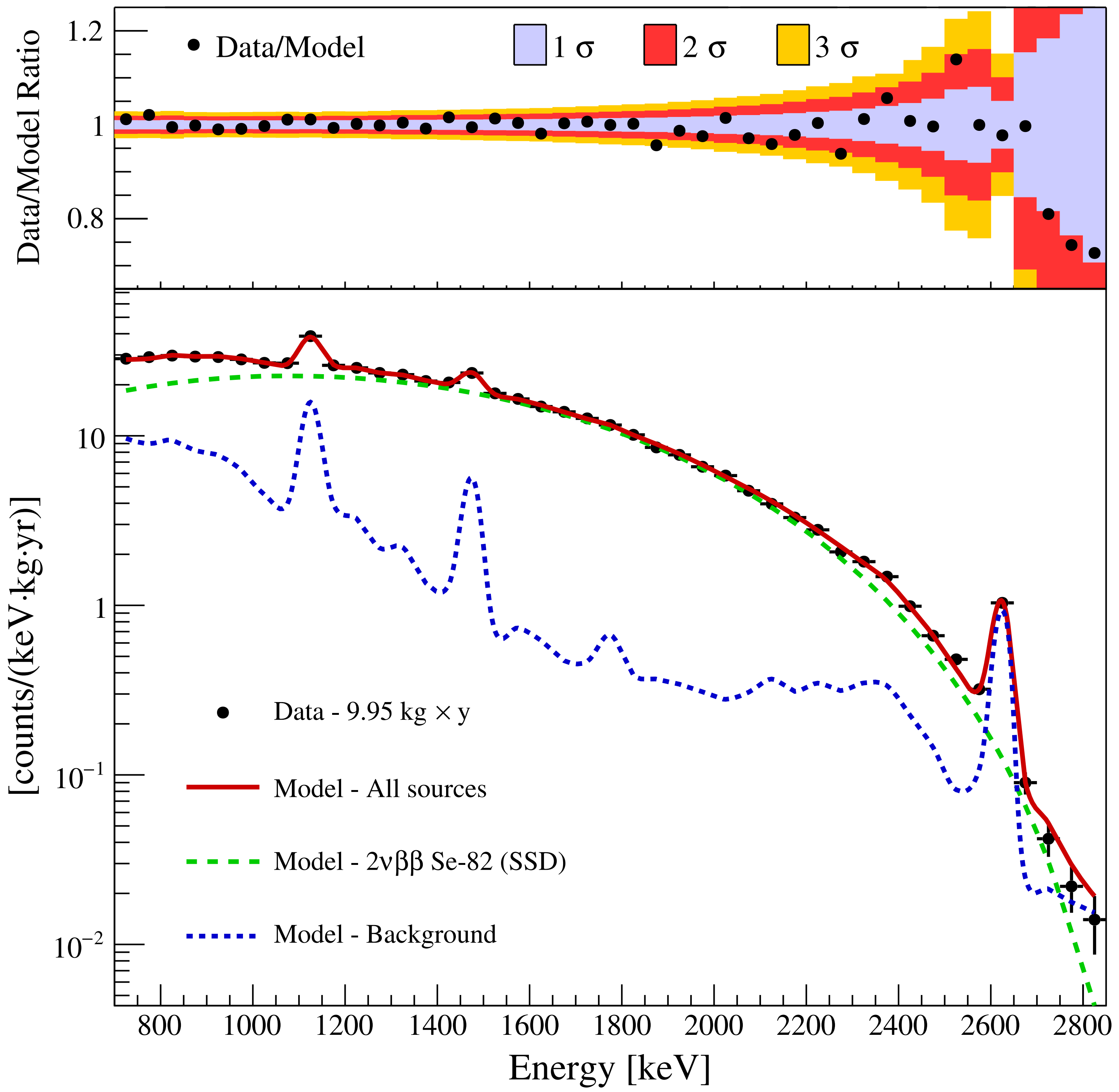
- Most stringent limit on ^{82}Se 0$\nu\beta\beta$ half-life
  $T_{1/2}^{0\nu} > 3.5 \times 10^{24}$y (90% C.I. limit);
- Comprehension of the background in experiments based on scintillating calorimeters;
- Most precise measurement of ^{82}Se 2$\nu\beta\beta$ half-life:
  $T_{1/2}^{2\nu} = \left[8.60 \pm 0.03(\text{ stat })^{+0.19}_{-0.13}(\text{syst })\right] \times 10^{19}\text{yr}$



[Phys. Rev. Lett. 123, 032501 (2019)](#)



[Eur. Phys. J. C 79, 583 (2019)](#)

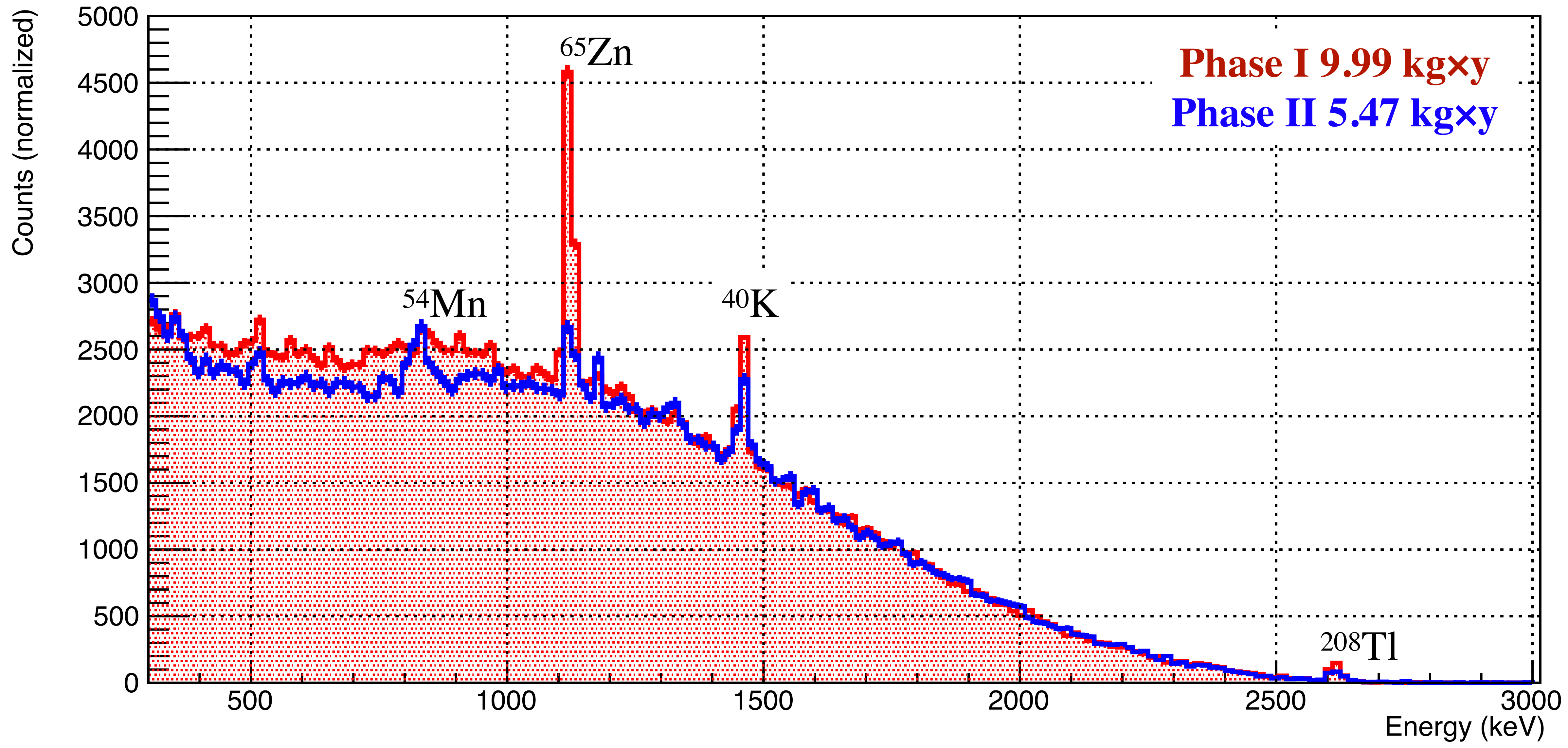


[Phys. Rev. Lett. 123, 262501 (2019)](#)

CUPID-0 phase II

Upgrade

- Removal of reflecting foils → tag surface contaminations;
- Muon veto surrounding cryostat → confirm the Background Model result;
- Internal copper shield → improve the background at low energy;



Thanks for the attention!