



Laboratori Nazionali del Gran Sasso

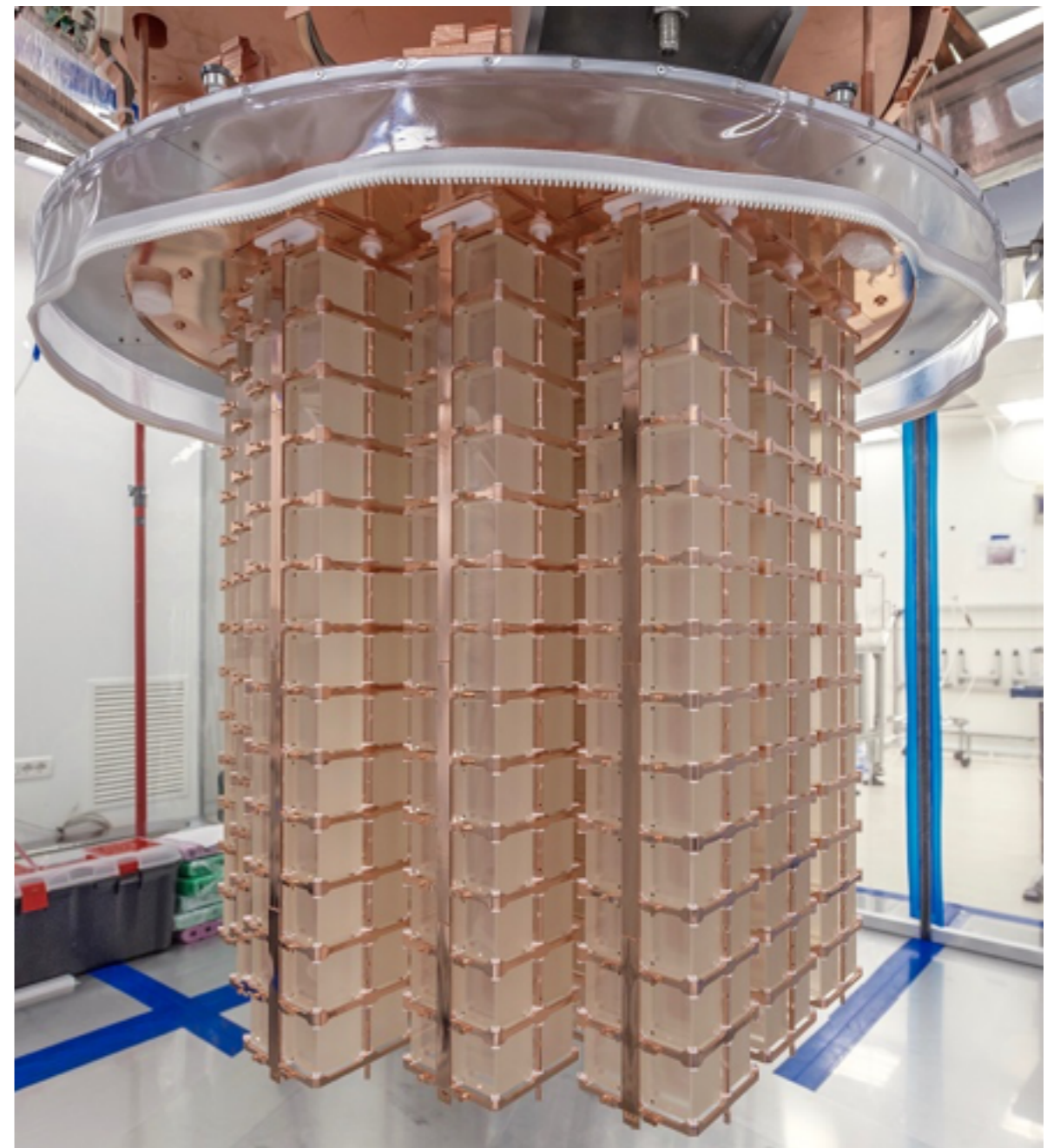
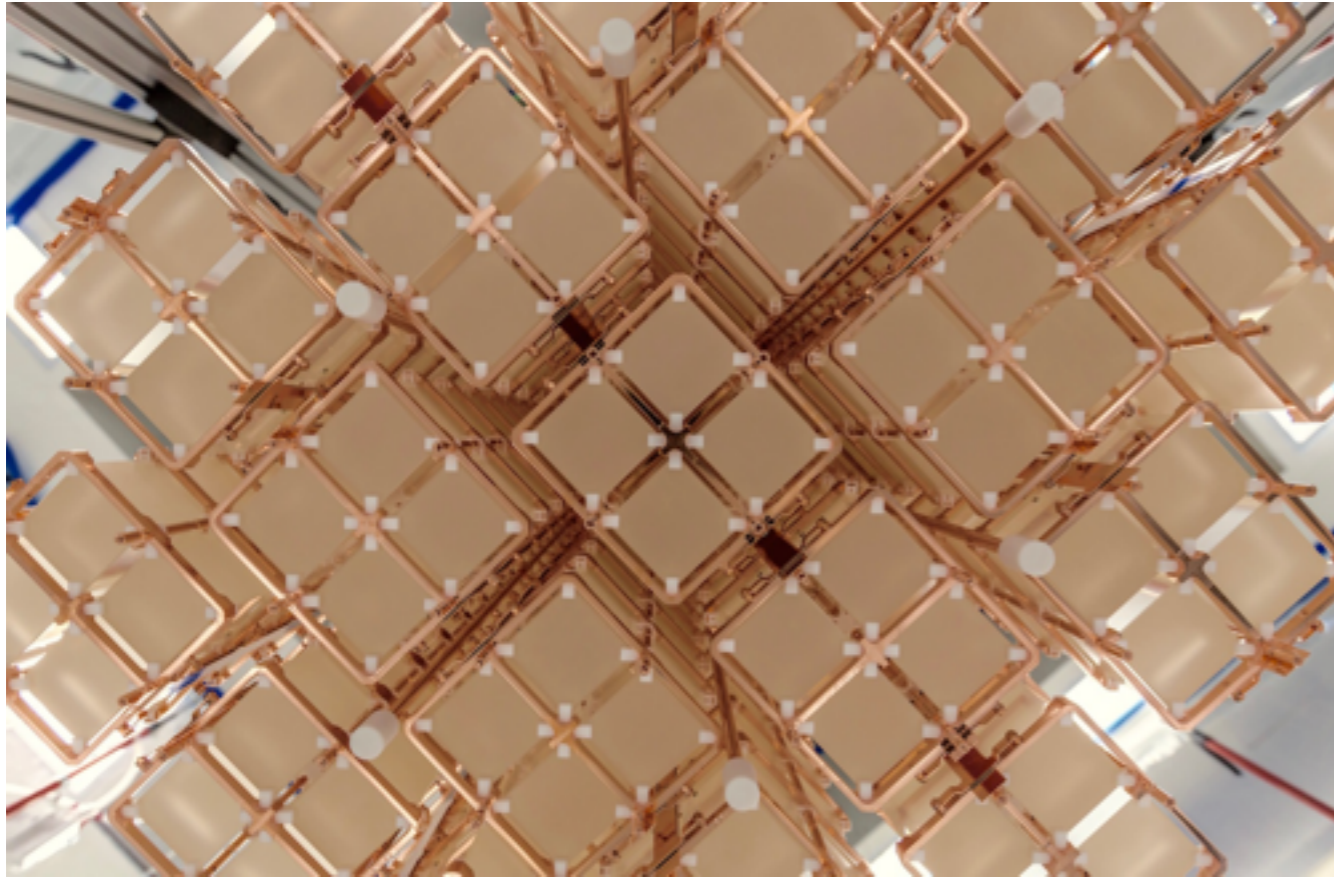
# Background-free search of Neutrinoless Double Beta Decay with the CUPID-0 experiment

Lorenzo Pagnanini

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# The CUORE experiment



The CUORE experiment **has started** and will take data for 5 years.

-----> **What's next?** <-----

# CUORE Upgrade with Particle Identification

Different options for the future of the Neutrinoless Double Beta Decay bolometric search

$^{130}\text{TeO}_2$   
with Cherenkov Light  
readout

**Scintillating Crystals:**  
 $\text{Li}^{100}\text{MoO}_4$ ,  $\text{Zn}^{82}\text{Se}$ ,  
 $^{116}\text{CdWO}_4$

R&D on light detector  
 $Q_{\text{value}} < 2615 \text{ keV}$

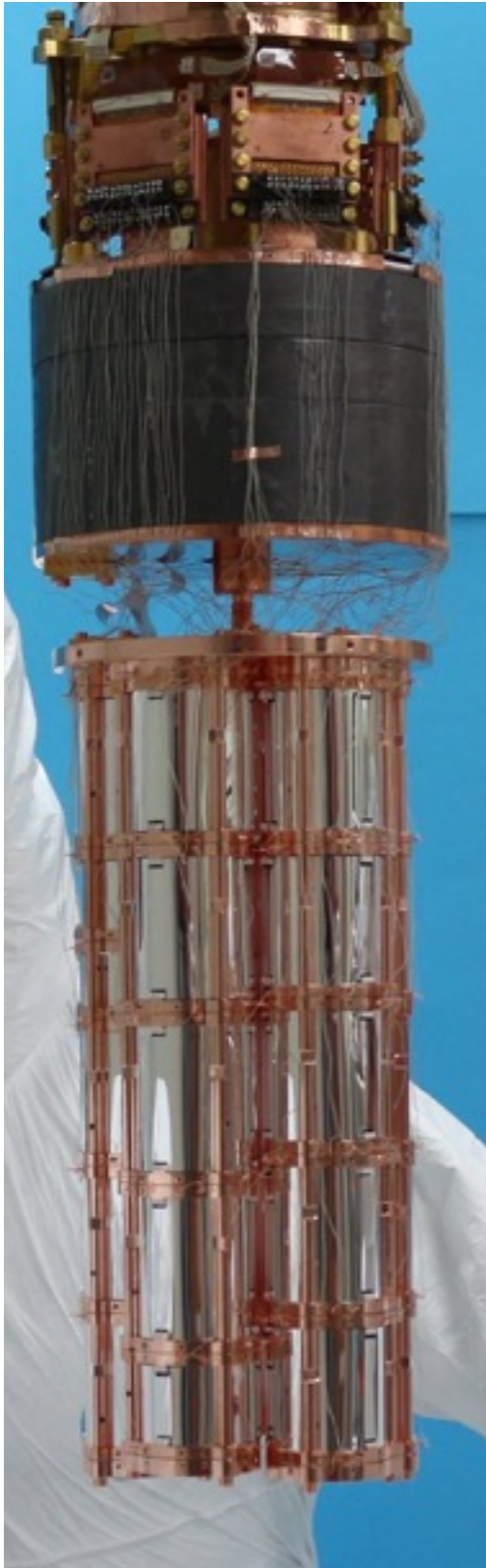
Lower Energy Resolution (Se)  
 $2\nu\beta\beta$  pileup (Mo)  
High price (Cd)

Easier and cheaper  
crystals growth

Good amount of light  
 $Q_{\text{value}} > 2615 \text{ keV}$   
Light PSA



# Status of CUPID-0 ZnSe



## *Timeline*

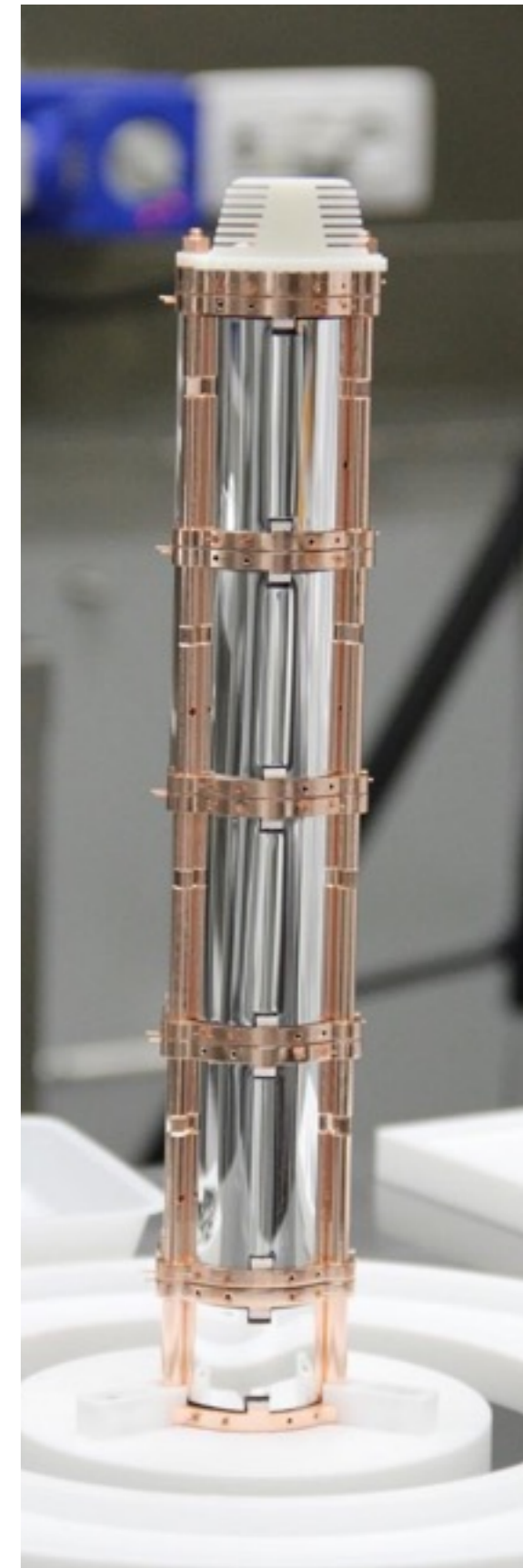
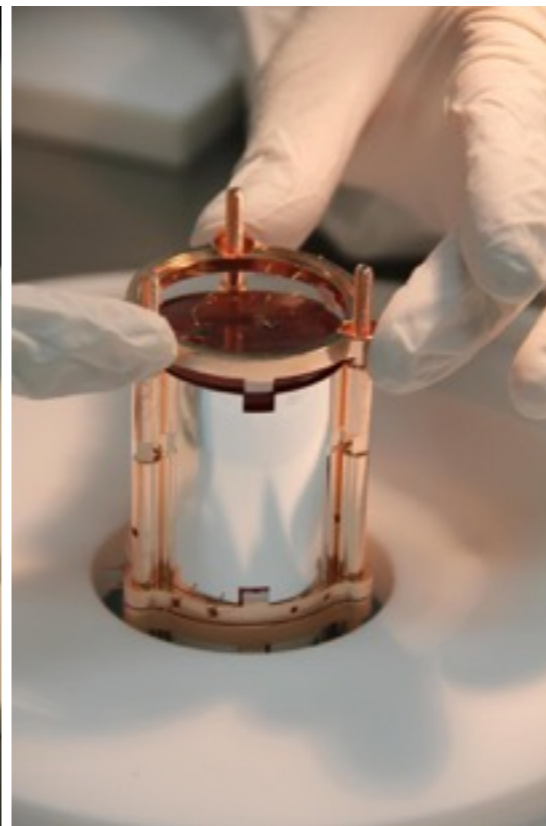
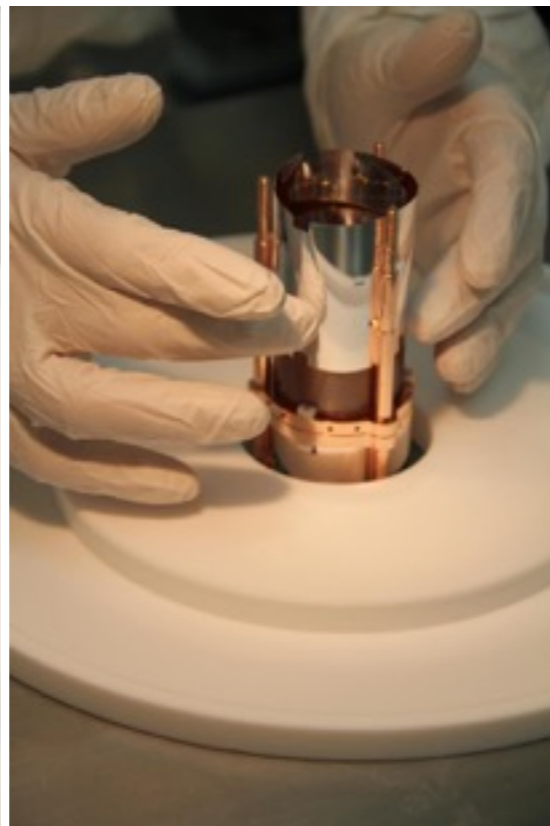
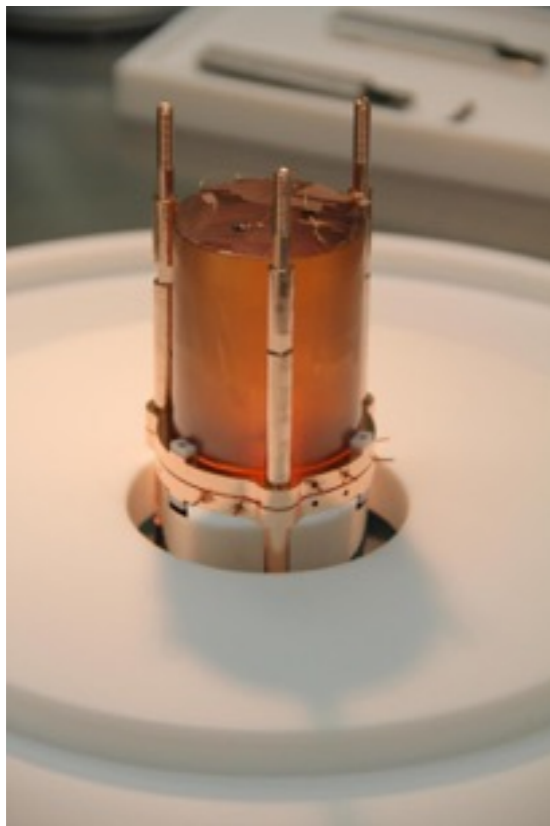
- \* *October 2016, End of the **assembly***
- \* *Nov./Dec. 2016, Cryostat Commissioning*
- \* *January 2017, Cooling down*
- \* *February 2017, Detector Commissioning*
- \* *March 2017, Start of the **data taking***



# The CUPID-0 ZnSe detector

## Our numbers...

- \* 24 96%-enriched Zn  $^{82}\text{Se}$  crystals + 2 natural ones
- \* 31 Ge-Light detectors
- \* 10.5 kg ZnSe (5.17 kg of  $^{82}\text{Se}$ )
- \* Q-value  $^{82}\text{Se} = 2998 \text{ keV}$
- \* Expected background  $\sim 10^{-3} \text{ cnts/kg/keV/y}$
- \*  $\sim 3.8 \times 10^{25}$   $\beta\beta$ -emitters

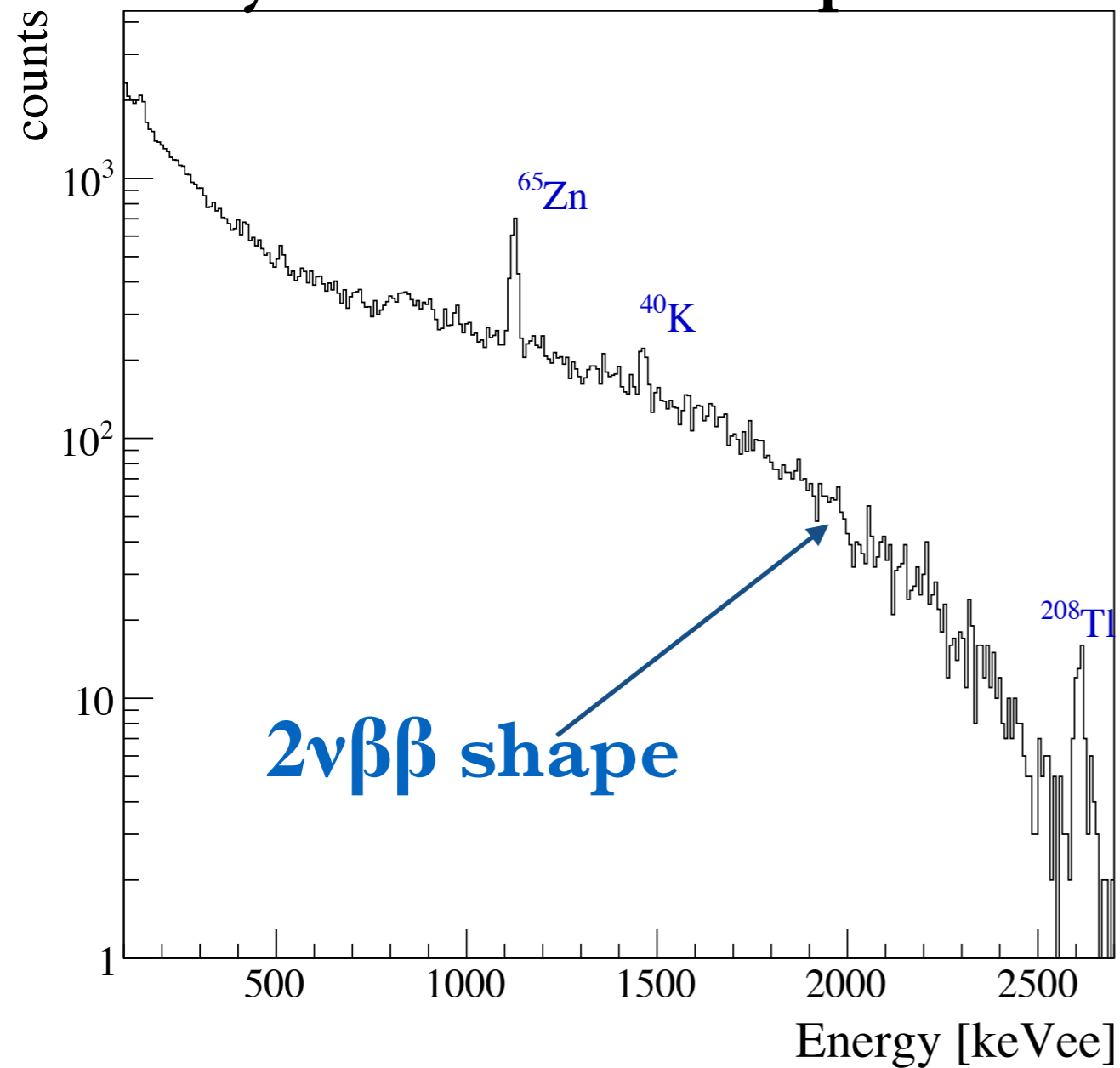


# First Data

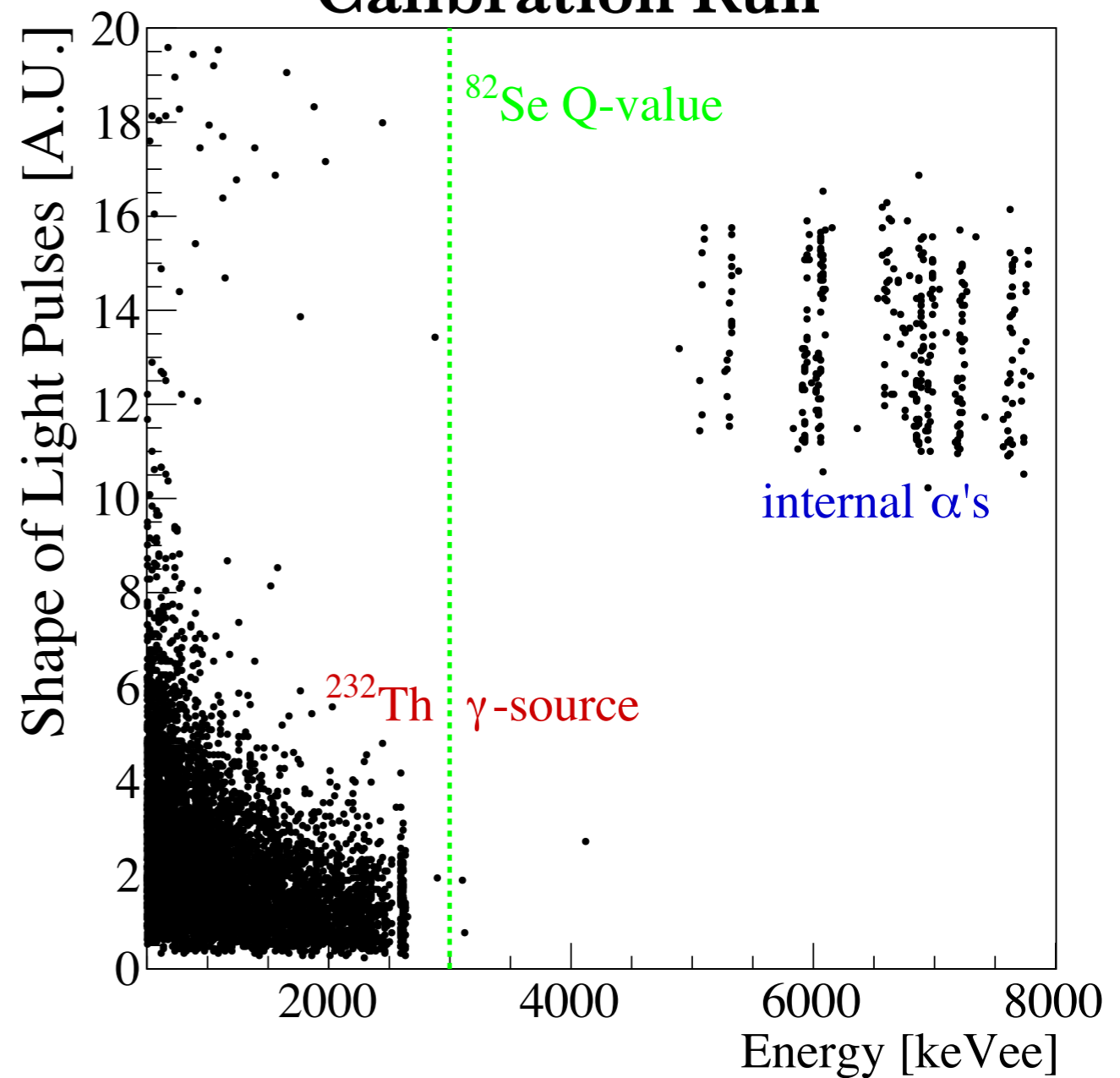
preliminary

The first dataset ended in May with a collected exposure of  
**0.47 kg x y** of  **$^{82}\text{Se}$**

## Physics Run - Total Spectrum



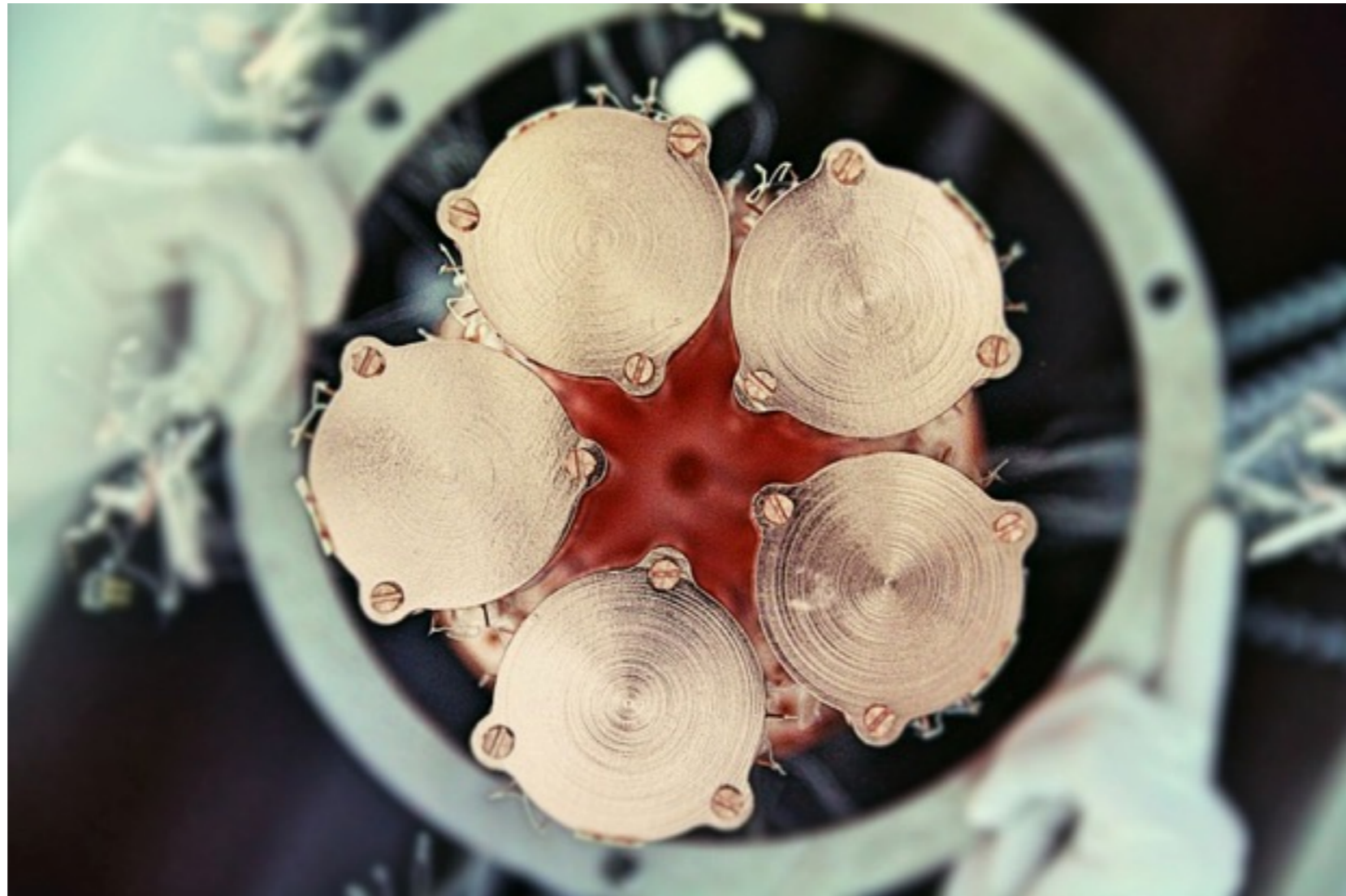
## Calibration Run





# Very soon...

- \* Physics run ongoing to increase the **statistics**
- \* Compute and improve the **energy resolution**
- \* Prove that we can reach **zero background in the ROI**
- \* First **data release** foreseen for the summer



# Best Limit

$T_{0\nu} > 3.2 \times 10^{23}$  @90% C.L. (NEMO 3)

## CUPID-0 sensitivity

$S_{0\nu} = 9.3 \times 10^{24}$  @90% C.L. (1 year)

$$S^{bkg} \propto \varepsilon \frac{i.a.}{A} \sqrt{\frac{MT}{B\Delta E}} [y] \quad \longrightarrow \quad S^{0bkg} \propto \varepsilon \frac{i.a.}{A} MT [y]$$

