

Luca Gironi on behalf of the LUCIFER collaboration

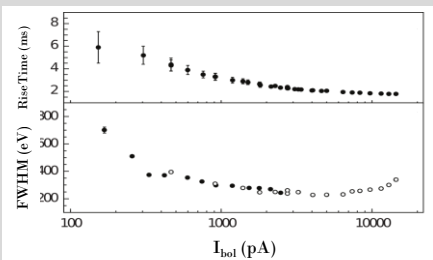
## The Low-background Underground Cryogenics Installation For Elusive Rates (LUCIFER)

The LUCIFER setup will consist of an array of 30 individual module detectors, arranged in a tower-like structure installed underground in the Laboratori Nazionali del Gran Sasso. Each module will be composed by a  $\sim 0.5$  kg enriched (95%) ZnSe scintillating crystal equipped with a Ge-crystal light detector operated as bolometers at  $\sim 10$  mK. The goal of Lucifer is to reach sensitivity of few  $10^{25}$  y for the search of the neutrinoless double beta decay and to be a demonstrator for a background free experiment.

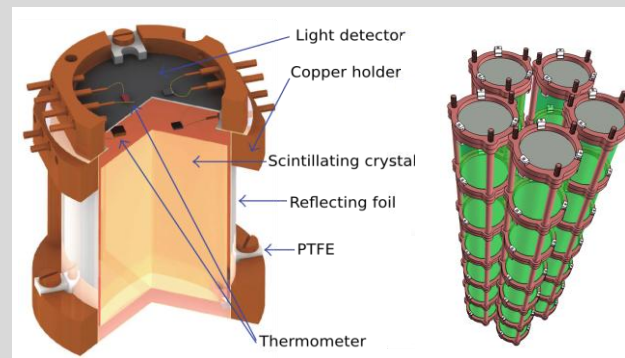
### Light Detectors



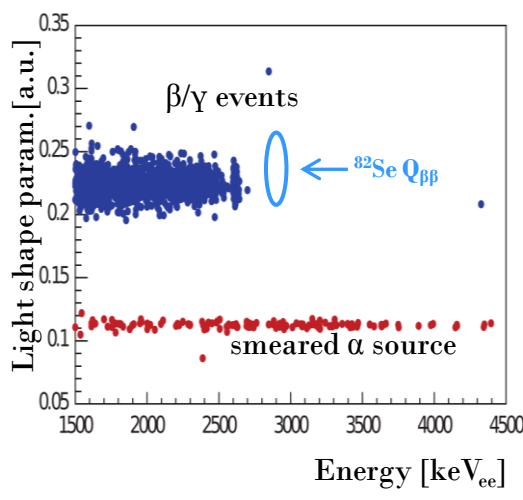
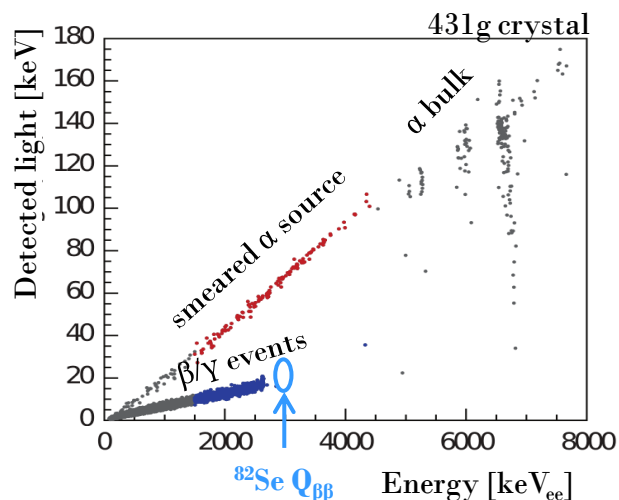
$\text{Ø}=44.5$  mm,  $h=0.175$  mm



Performances as a function of the sensor polarization current.



### ZnSe crystal



Isotope	Q-value	i.a.
$^{82}\text{Se}$	2996 keV	8.7 %

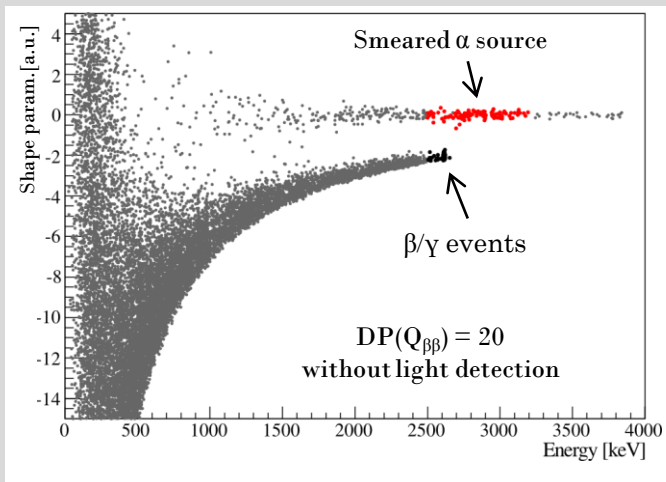
The light emitted and the shape of the same light pulses are reported as a function of the energy released in the ZnSe bolometer. A  $\gamma$ -source was used to produce events (blue) up to 2615 keV ( $^{208}\text{Tl}$ ) while a smearred  $\alpha$  source was placed under the crystal to provide a continuum of  $\alpha$ 's extending to lower energies (red).

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## ZnMoO4

Successful R&D pursued within LUCIFER with Mo-based compound before choosing ZnSe.

Isotope	Q-value	i.a.
$^{100}\text{Mo}$	3034 keV	9.6 %



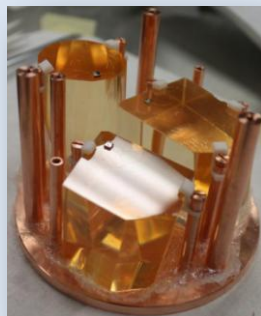
They demonstrate the very appealing possibility to discriminate particle through pulse shape analysis on the heat channel.



Background reduction without a double readout.

## 2vDBD of $^{100}\text{Mo}$

The large statistics collected during the operation of a  $\text{ZnMoO}_4$  array, for a total exposure of 1.3 kg day of  $^{100}\text{Mo}$ , allowed the first bolometric observation of the 2vDBD of  $^{100}\text{Mo}$ . The analysis of coincidences between the crystals allowed the assignment of constraints to the intensity of the different background sources, resulting in a reconstruction of the measured spectrum down to an energy of  $\sim 300$  keV.



$$T_{1/2}^{2\nu} (^{100}\text{Mo}) = [7.15 \pm 0.37 (\text{stat}) \pm 0.66 (\text{syst})] \times 10^{18} \text{ y}$$

Crystal mass (g)	Anticoincidence	Coincidence
247	$509 \pm 26$	$4.4 \pm 0.2$
235	$472 \pm 24$	$5.4 \pm 0.3$
329	$661 \pm 34$	$6.2 \pm 0.3$

Number of events from the 2vDBD of  $^{100}\text{Mo}$  in the anticoincidence spectrum and in the coincidence spectrum for each crystal.

