WP5: Isotope radio-purity assessment with calorimetric methods

Task 1 - Material selection and crystal growth. See Ezio's talk

Task 2 - Bolometric tests above ground. ⟸

Task 3 - Bolometric tests deep underground. ⟸

Task 4 - Tests with scintillating crystals See Fedor's talk

Task 5 - Tests with semiconductors. (Cobra)

INFN-Budget Requests /assignments

WP1	7 K€ (travel)		130 K€
WP2	55 K€ (consumable)	15 K€ (travel)	
WP5	40 K€ (consumable)	13 K€ (travel)	

We got 54.2 k€**, i.e. 40 % of our request**. This obviously means an unavoidable slow down of some activity, mainly on WP2, since WP5 can take the opportunity to run "simultaneously" with other "funded" test runs (CUORE, LUCIFER)

Bolometric test

The calorimetric/bolometric test (in which the 0ν-DBD source is totally embedded in the detector) represent the most sensitive way since they will actually count each radioactive decay taking place in the detector therefore with an extremely high efficiency (~1) in case of α-emitters.

The actual key issue for this WP will be the set-up of a clean and <u>*reproducible*</u> way to synthesize the enriched isotopes in the form of crystals (possibly, but not necessarily, scintillators) so that the bolometric technique can be used

An extremely strong interaction is, therefore, needed with WP3

Bolometric measurements:

- Deep underground → Up to multi-kg samples → α-discrimination in scintillating and **NON** scintillating crystals
- Above ground → Up to few tenth of grams → α-discrimination in scintillating crystals

Bolometric tests – Above Ground

This task is focused on the R&D tests on small crystal samples. Only crystals of few cubic centimeters can be tested above ground, where the presence of cosmic rays induces – due to the relative slowness of thermal detectors – an unavoidable pile-up.

These measurements will be performed mainly in three infrastructures:

1. the INFN-Milano Bicocca cryogenic laboratory, Milano, Italy
2. the Insubria cryogenic laboratory, Como, Italy
3. the CNRS cryogenic laboratory located at CSNSM, Orsay, France

(1) and (3) have the possibility to host "large" samples, while (2) shows a smaller experimental volume.

Several scintillating bolometers are being tested in these facilities:
BGO and CaMoO4 at Bicocca, $ZnMoO_4$ at Insubria, $ZnMoO_4$ and ZnSe at CNRS

The use of these facilities will not only serve as screening to access to underground cryostats, since the achievable limit they can reach are <u>already</u> at a very interesting level ($10^{-10} \div 10^{-11}$ g/g)

Bolometric tests – Underground

The deep-underground bolometric measurements of large crystal samples represent the actual aim of this WP. The bolometric limits that can be achieved with large mass bolometers can reach sensitivities of the order of 10^{-14} g/g.

Presently the CUORE/Lucifer R&D cryostat@LNGS made most of the underground test for DBD crystals, testing $CaMoO_4$, $SrMoO_4$, $PbMoO_4$ $CdMoO_4$ CaF_2 ZrO_2, $MgMoO_4$, $CdWO_4$, ZnSe, $ZnMoO_4$, Li_2MoO_4....

The CUORE/LUCIFER(/ABSURD) cryostat in Hall C is presently rather "booked" since it hosts 2 (+1) R&D.
The hope is to get soon an additional cryostat. The CUORE group applied for a GRANT for R&D on next generation DBD experiment. If accepted a new cryostat will be co-funded with INFN.
There is also the hope to move underground an already existing cryostat.
The possibility to test also large sample within ISOTTA, nevertheless, is possible, provided to plan –with a good advance- the measurements. Just as for example during November 11- late march2012 the cryostat was running for a long CUORE/LUCIFER bkg measurement.

The possibility to test scintillating bolometer in the low-activity EDELWEISS set-up, during some upgrade of the detector configuration, is being tested

The Measurement Coordinating Panel will play an important role in this game…