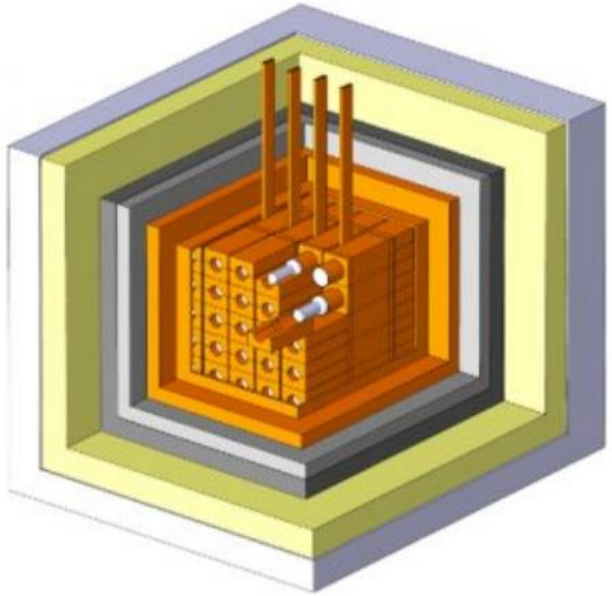
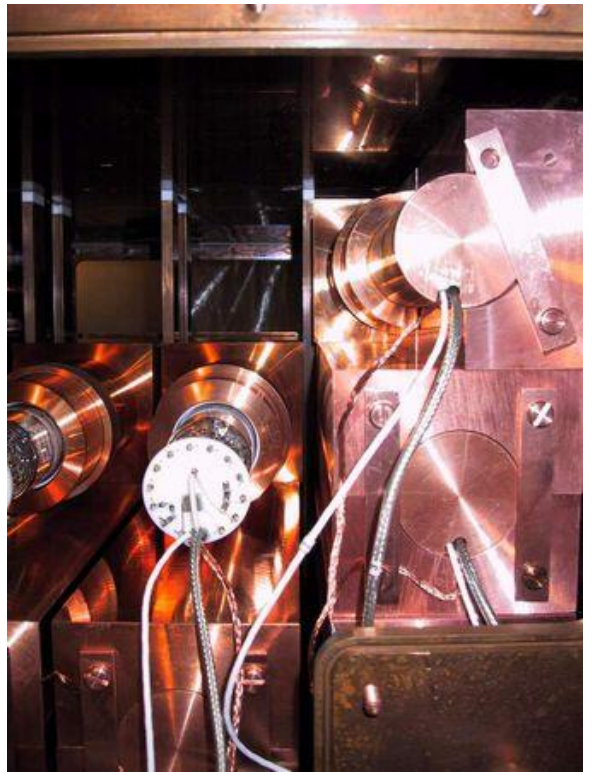
SABRE
Dark Matter experiment

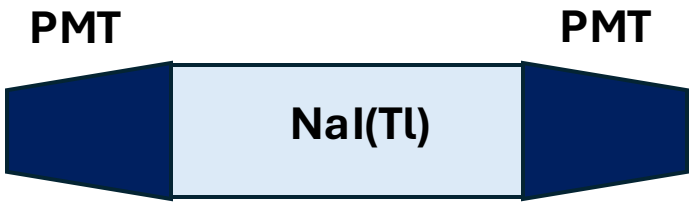
Krzysztof Szczepaniec
Laboratori Nazionali del Gran Sasso

12.02.2026, LNGS

DAMA experiment (1995-2024) at LNGS

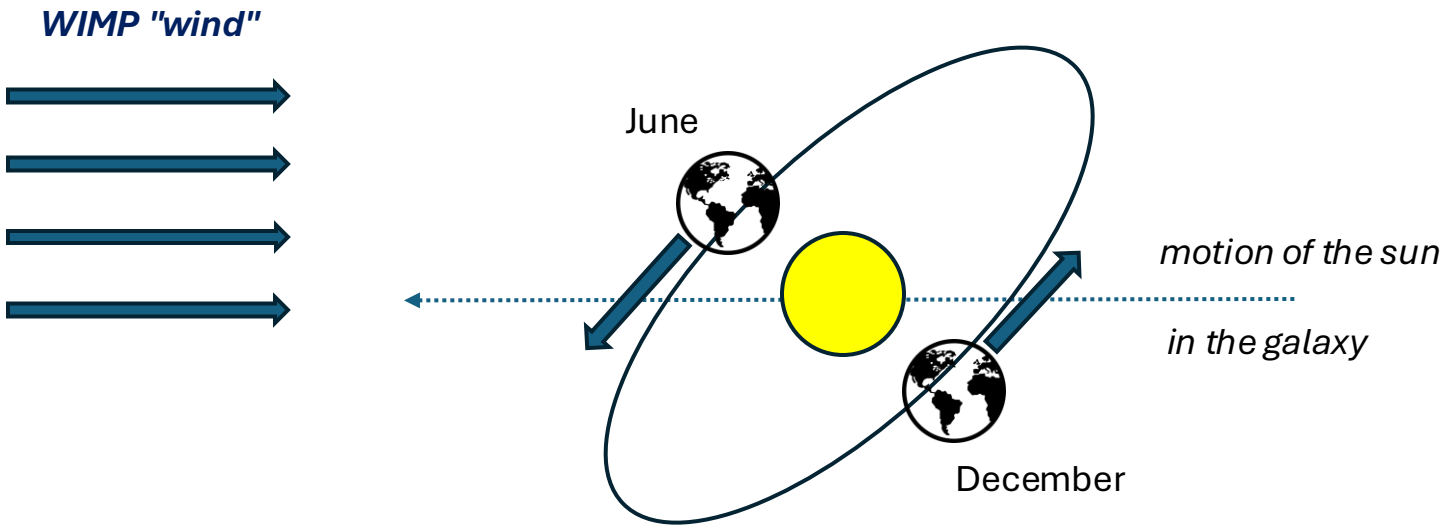






high purity
Thallium-doped Sodium Iodide crystals

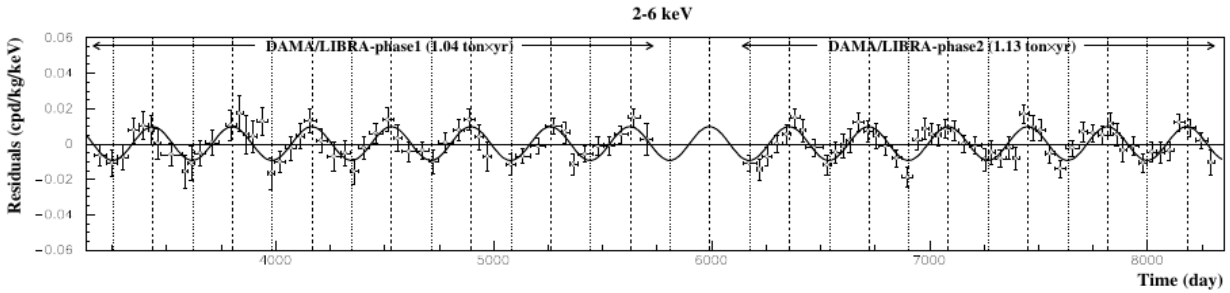
Dark Matter annual modulation



expected event rate
(if we are observing DM)

$$R(t) \approx S_0 + S_m \cos \frac{2\pi}{T}(t - t_0)$$

DAMA/NaI + DAMA/LIBRA



2-6 keV $S_m = (0.0102 \pm 0.0008)$ [cpd/kg/keV]

13.7σ

claim: model-independent direct observation of DM

"in tension" with other DM experiments (model dependent!)
> need for test with the same target

jnpae2021.04.329

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Sodium-iodide with **A**ctive **B**ackground **R**ej**E**ction

GOAL: Model independent test of DAMA claim

-> Use the same material as DAMA

-> With background level lower than DAMA

- Eliminate non-DM effect

  > **Two-site experiment**

- Use ultra-pure NaI(Tl) crystals

  > **Use of purified NaI powder to grow crystals**

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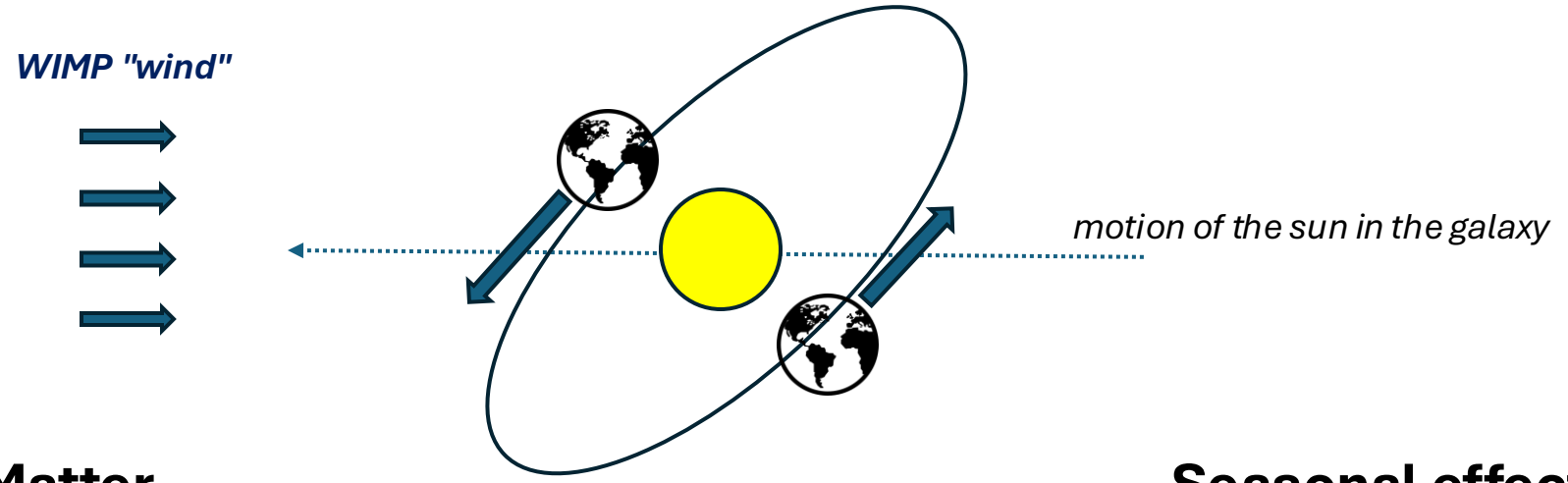
TWO-SITE EXPERIMENT

SABRE North at Laboratori Nazionali del Gran Sasso (LNGS) in Italy

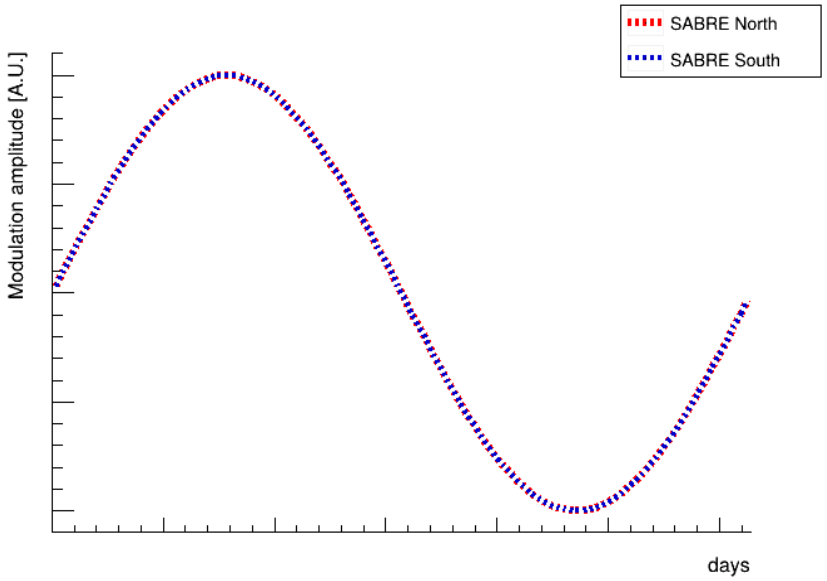
Stawell Underground Laboratory, Australia

SABRE South at Stawell Underground Physics Laboratory (SUPL) in Australia

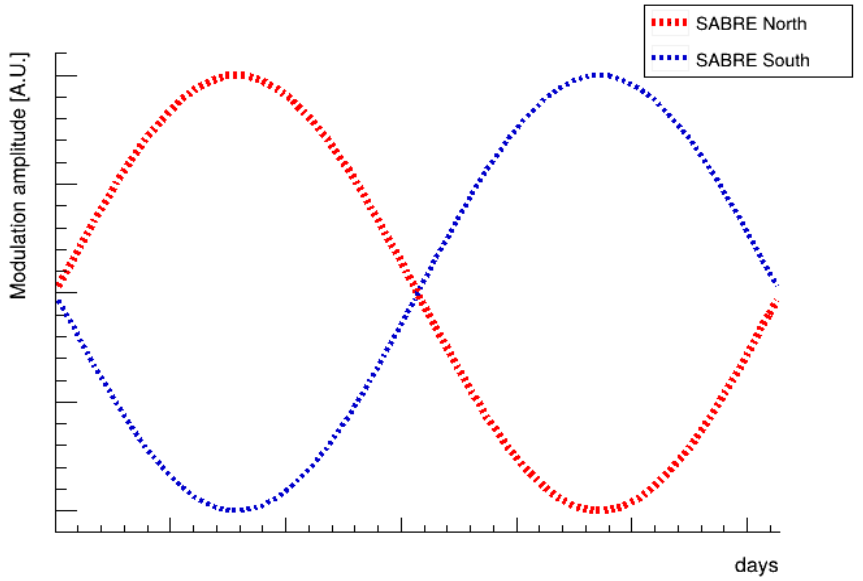
Why two locations?



Dark Matter



Seasonal effect



SABRE North location

DAMA/LIBRA

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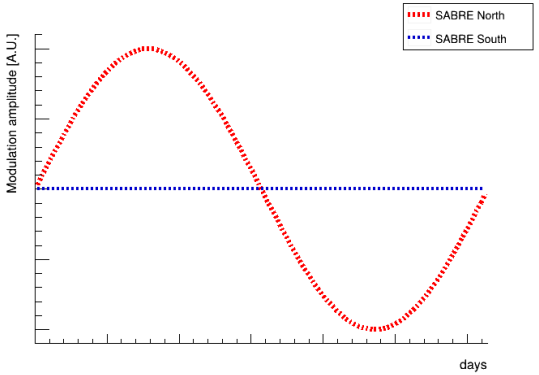
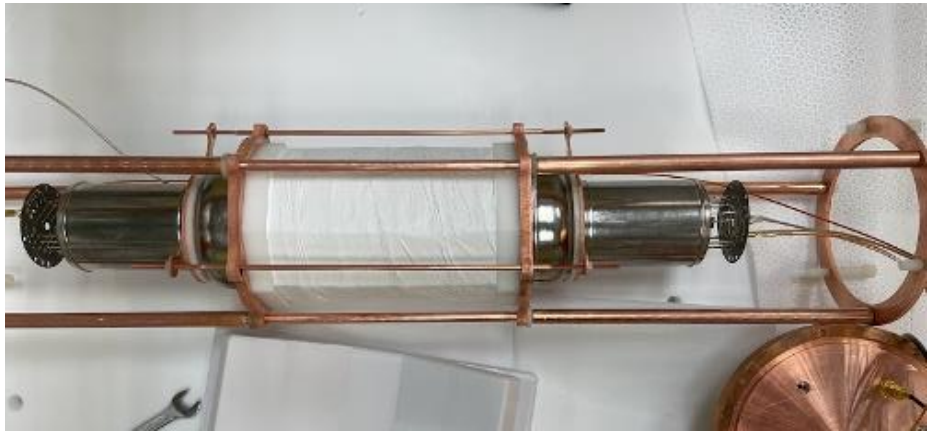
Local effect

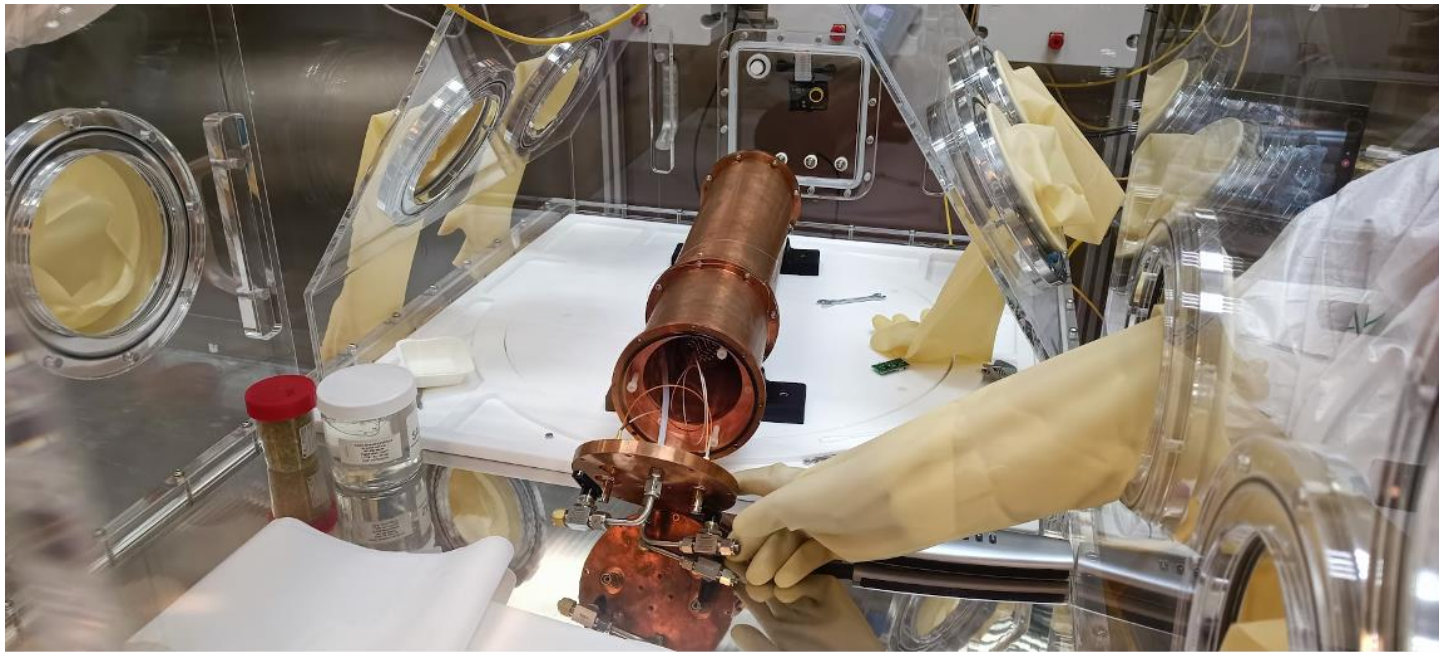


Things to do for students and postdocs?

Assembly of crystals/PMTs

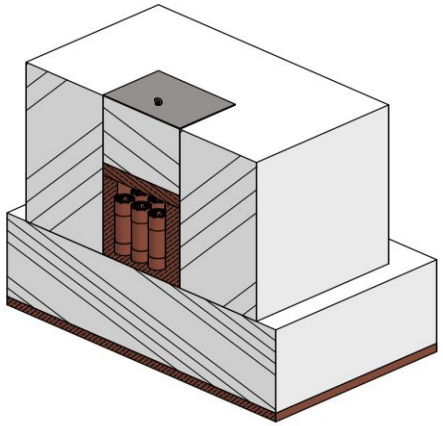
First crystal
expected in
a few months!

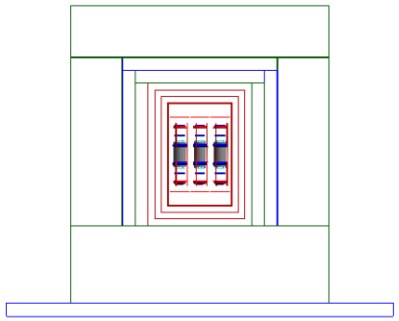


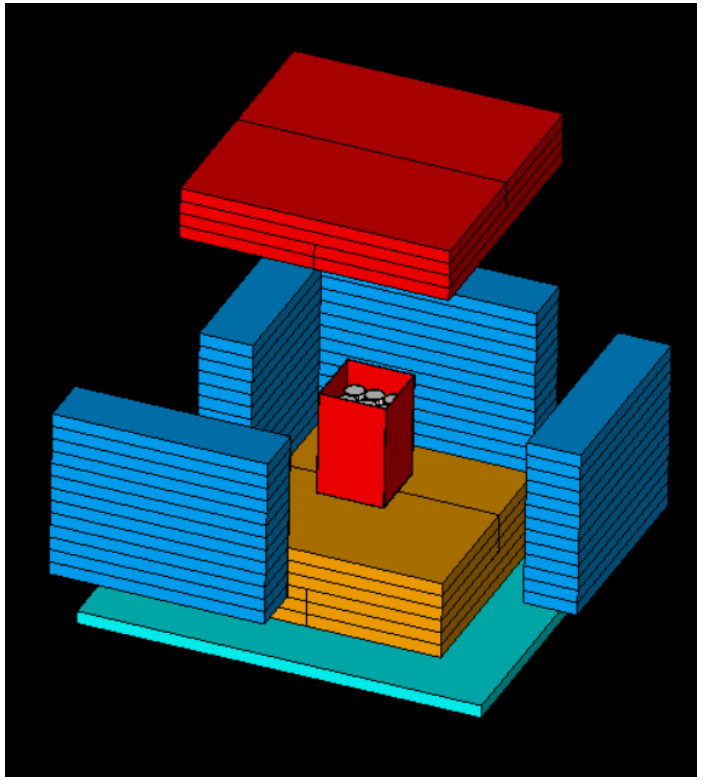


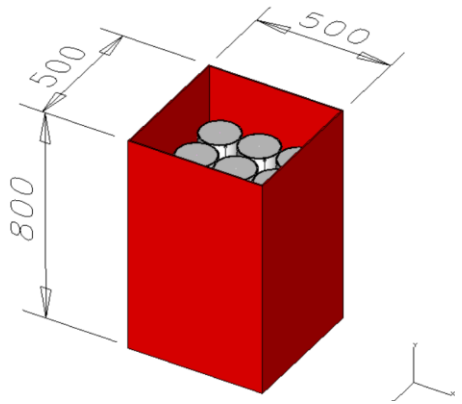
Things to do for students and postdocs?

Construction of the detector shielding



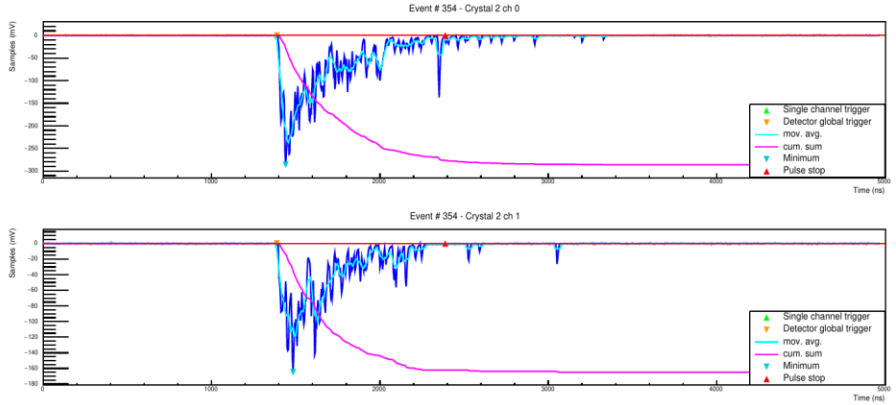






Things to do for students and postdocs?

Data analysis!

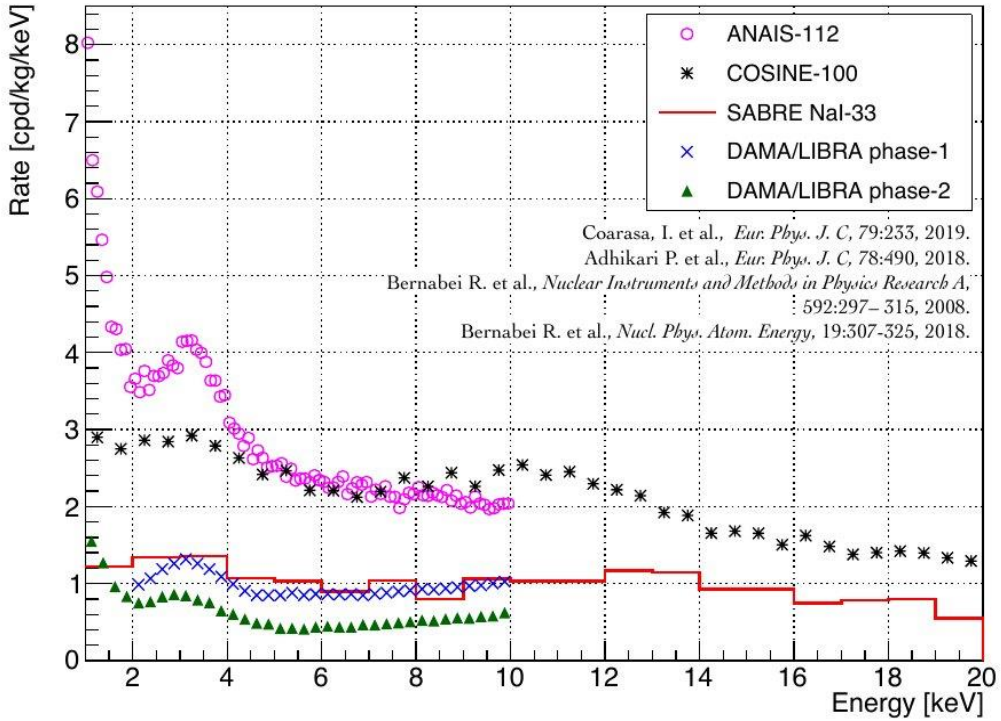


- Noise filtering and quality cuts are crucial!

more software work is always needed

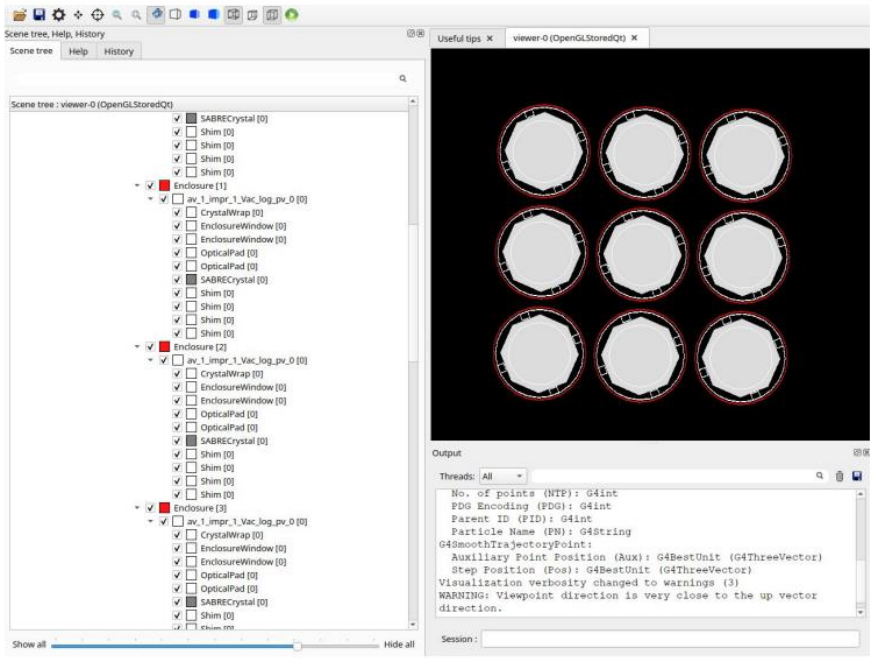
- Want to implement some custom DSP algorithms?
- Try noise filtering with MLP? BDT? magic?

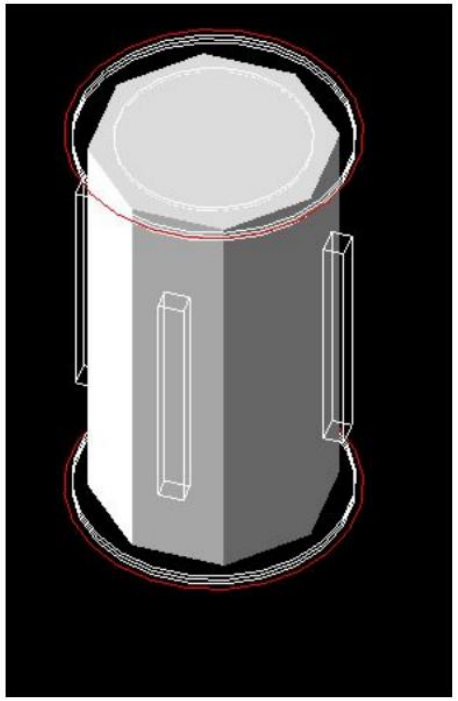
there will be data to try it on



Things to do for students and postdocs?

… and (of course) Monte Carlo!





- Modelling of the detector modules, shielding, background, etc.

- Energy deposition in the crystal, response of PMTs and electronics to final pulse.

Time perspectives:

- Assembly of detector modules 2026-2027
- Assembly of the detector shielding 2027
- Data taking starts in 2028
- Always Monte Carlo to do
- At least 3-5 years of data for analysis

…and we have the coolest logo in LNGS!

Thank you!

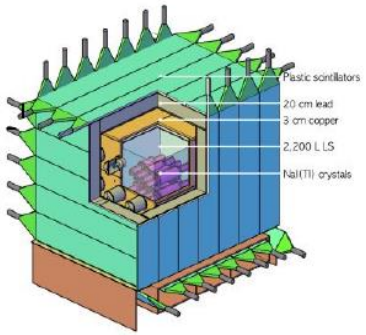
Want to join SABRE collaboration?

SABRE North Spokesperson: aldo.ianni@lngs.infn.it

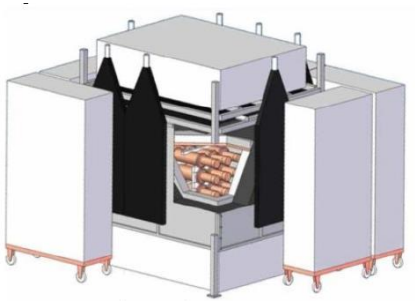
or talk to me!

backup

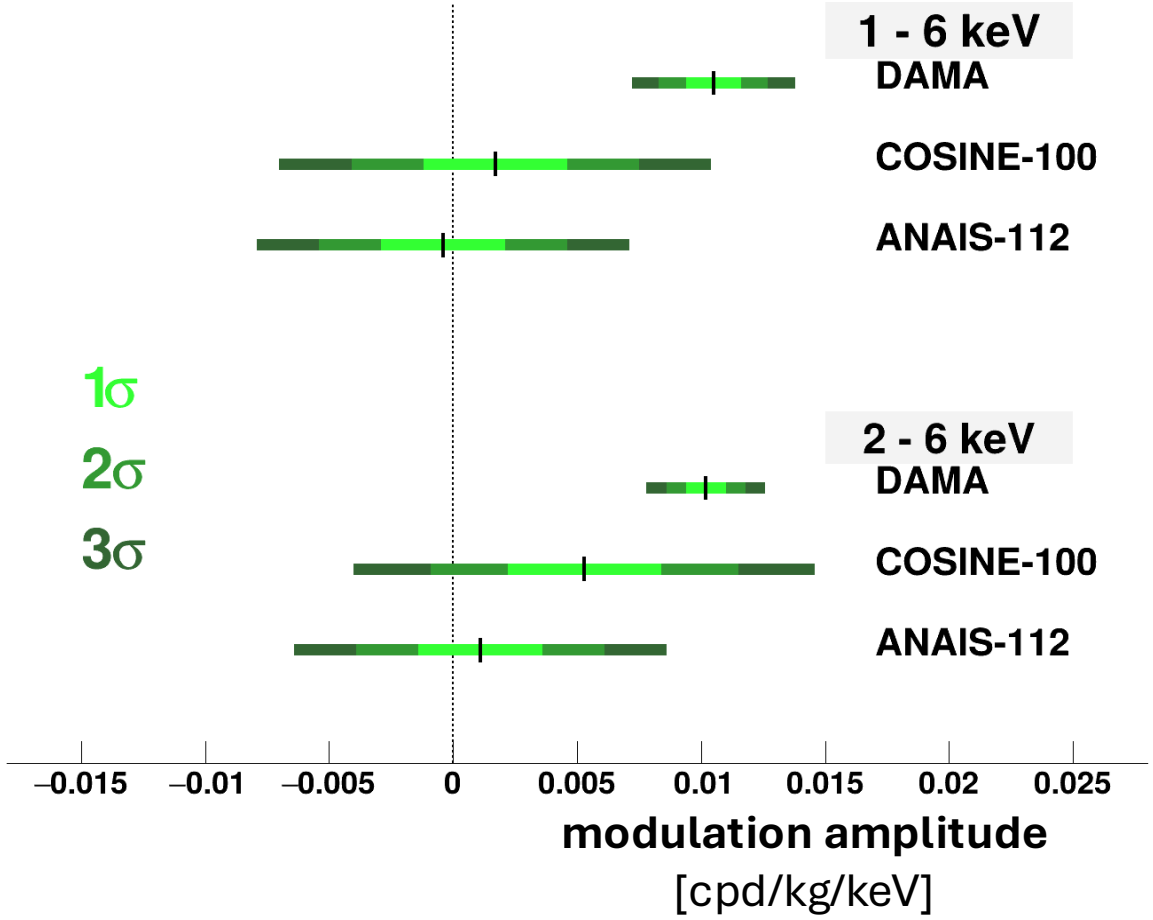
Dark Matter annual modulation



COSINE-100
Yang Yang, South Korea



ANAIS-112
Canfranc, Spain



Combined Annual Modulation Dark Matter Search with COSINE-100 and ANAIS-112 (2025)

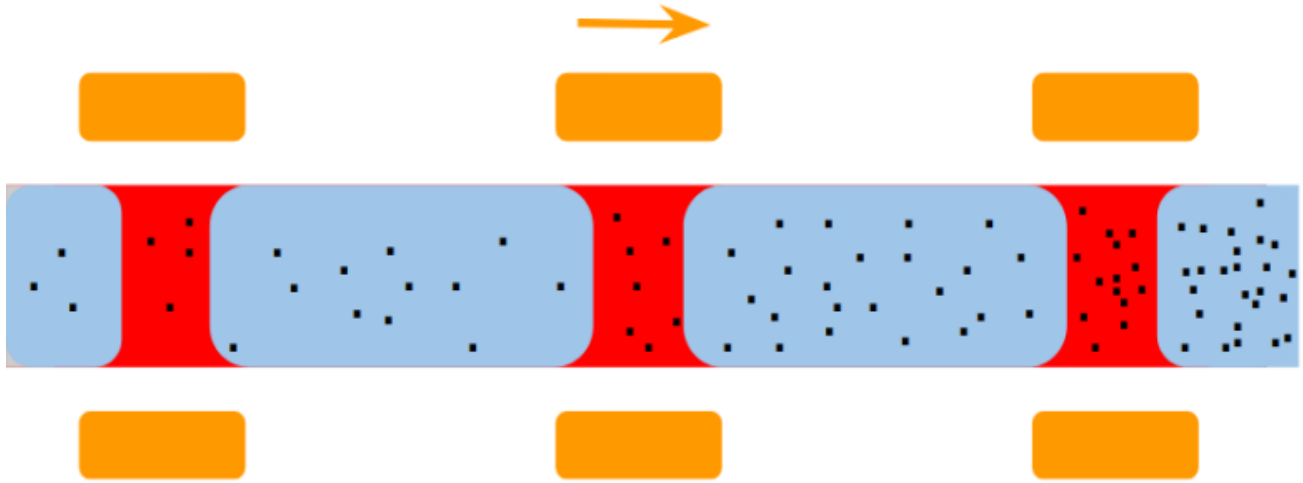
arXiv:2503.19559

COSINE-100 full dataset result arXiv:2409.13226

ANAIS-112 6 years of data result arXiv:2502.01542

10 years of SABRE crystals research

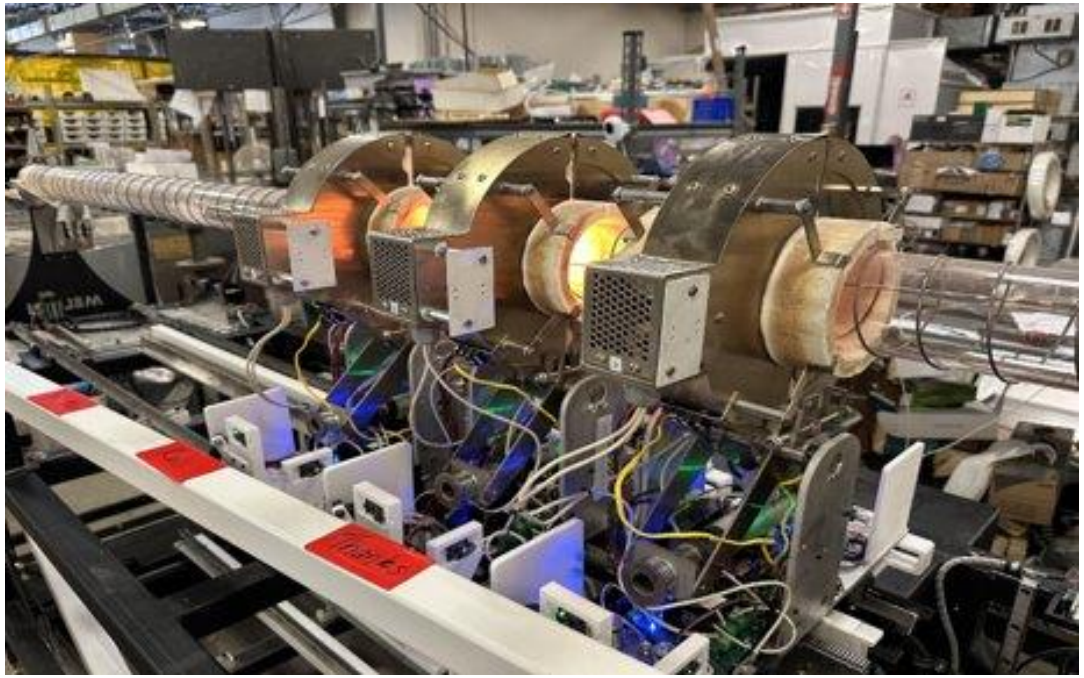
Zone refining of NaI powder

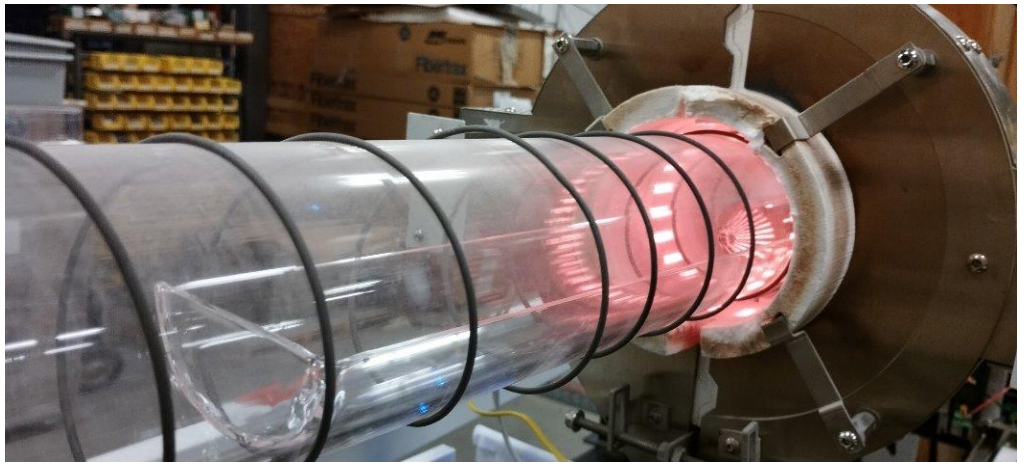


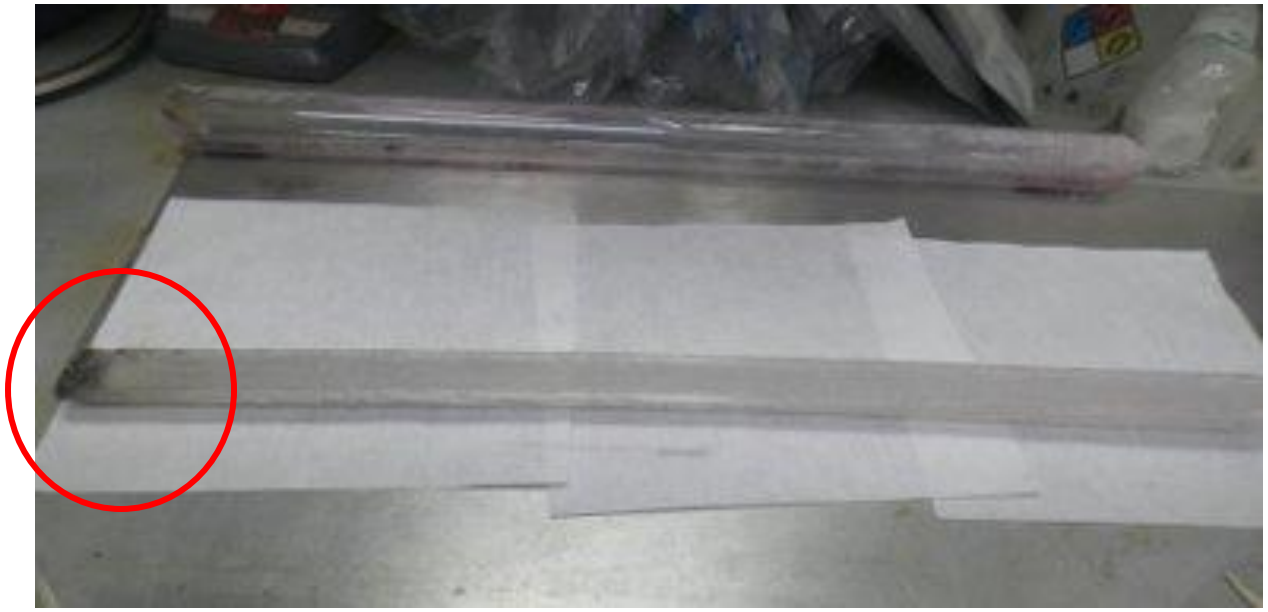
- R&D carried out by PU, INFN and ARC Centre of Excellence for DM
- Radioclean NaI powder *Astrograde* by Sigma Aldrich (now Merck)
- Crystals grown by RMD - Radiation Monitoring Devices, MA (USA)
  - Vertical Bridgeman method in fused silica vessels

10 years of SABRE crystals research

Zone refining of NaI powder







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