



DAREDEVIL

DARk-mattEr-DEVices-for-Low-energy-detection

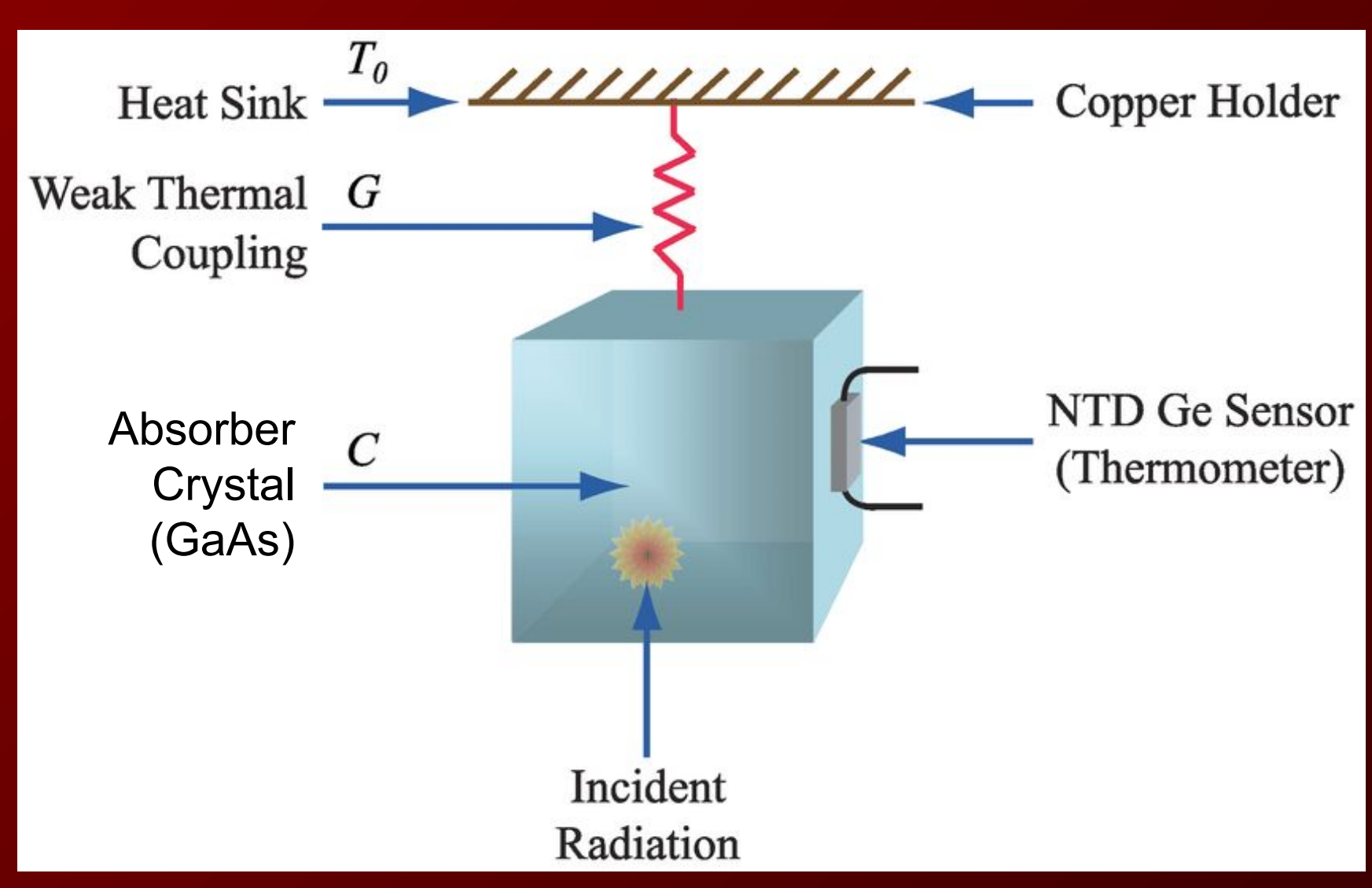
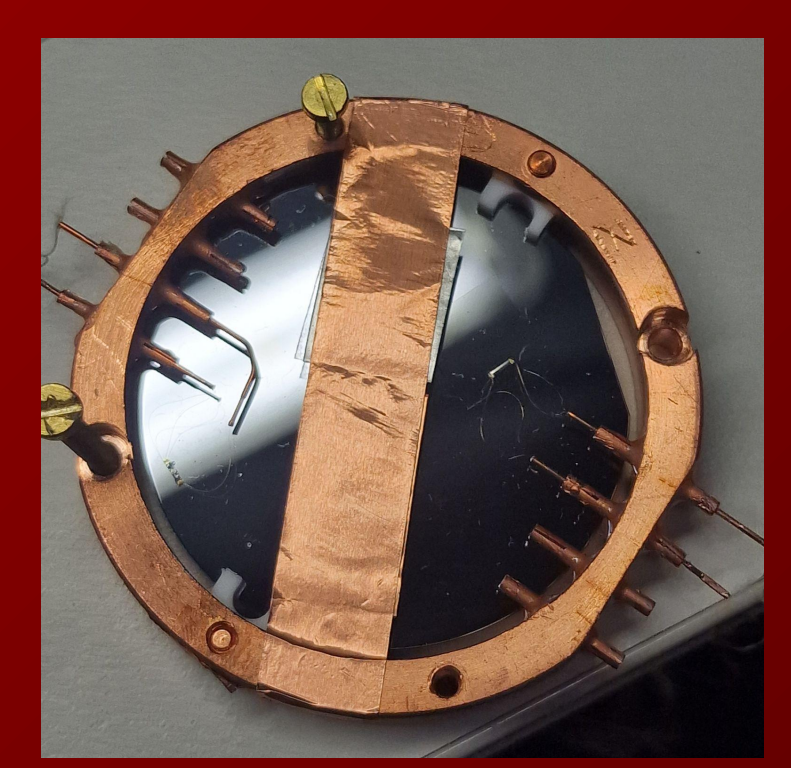
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Project

DAREDEVIL project want to develop a detector able to access Dark Matter (DM) candidates with mass below 1 GeV range.

- Realising and characterising low temperature detector prototypes
- with **low threshold**, very **high-resolution**.
- Different expertise brought together for new class of detectors.
- The project involves 5 Units: **CNR-AQ, LNGS, GSSI, UnivAQ, INRIM.**
- Founded by the Italian Research Ministry PRIN program 2022



Experimental set-up

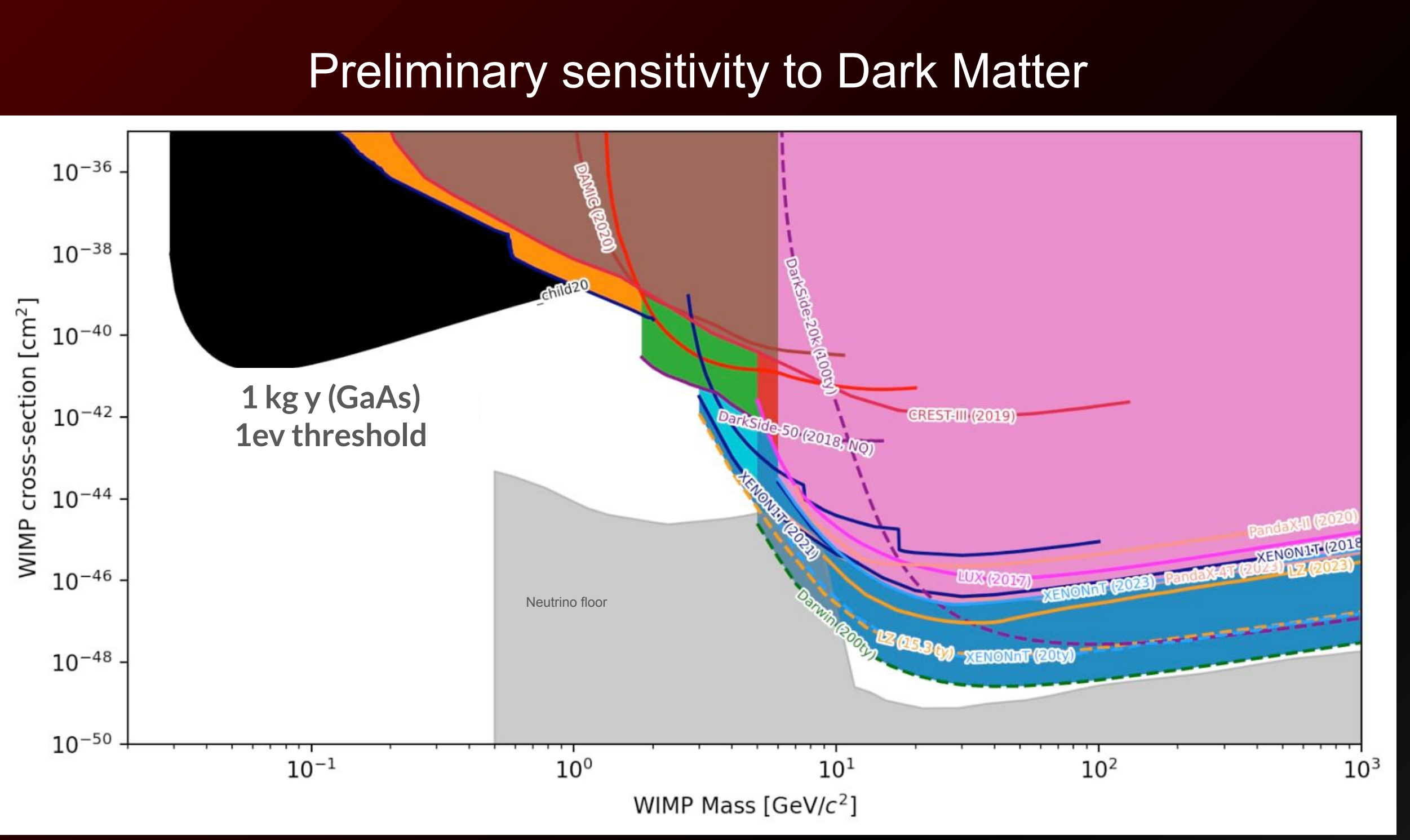
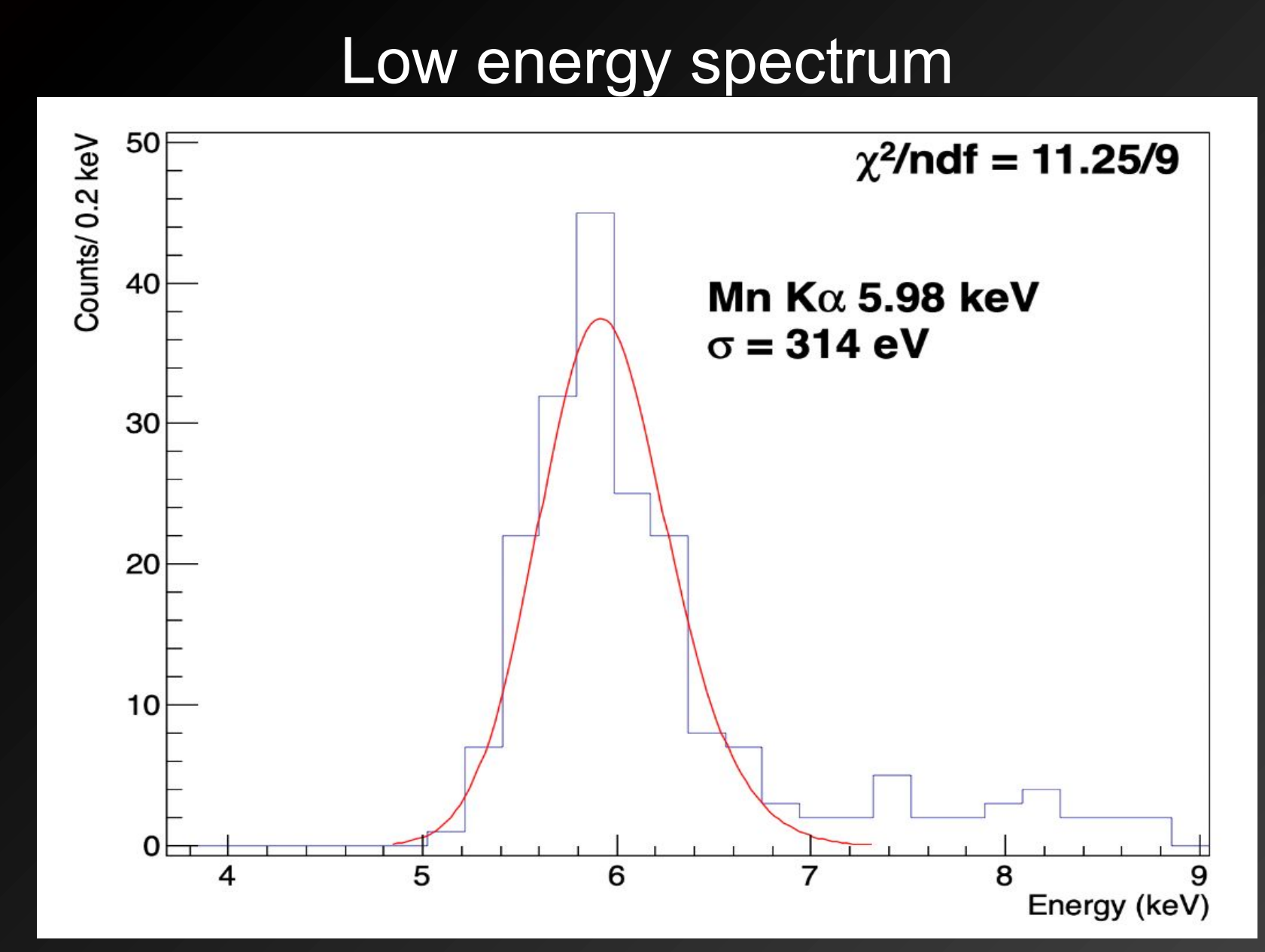
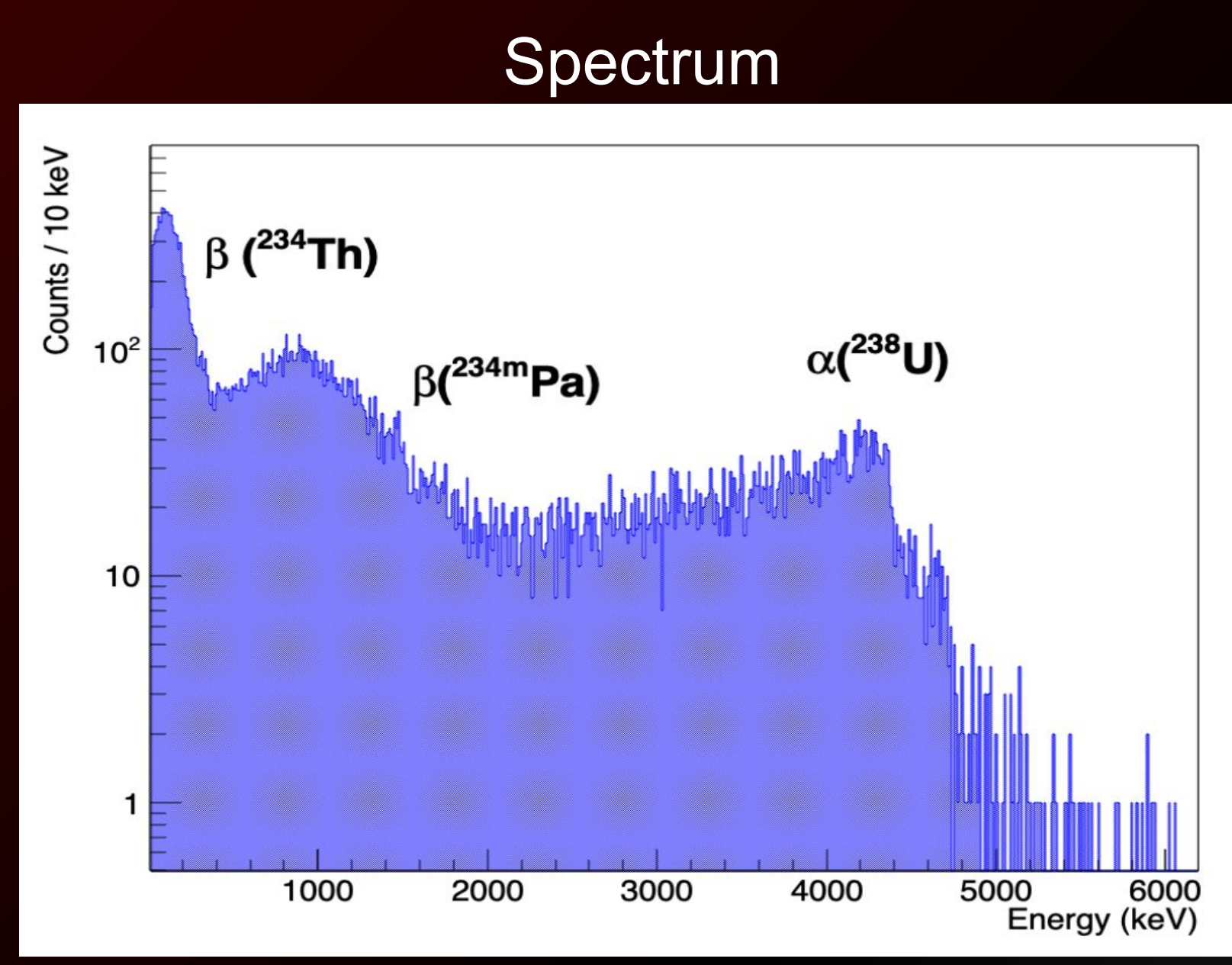
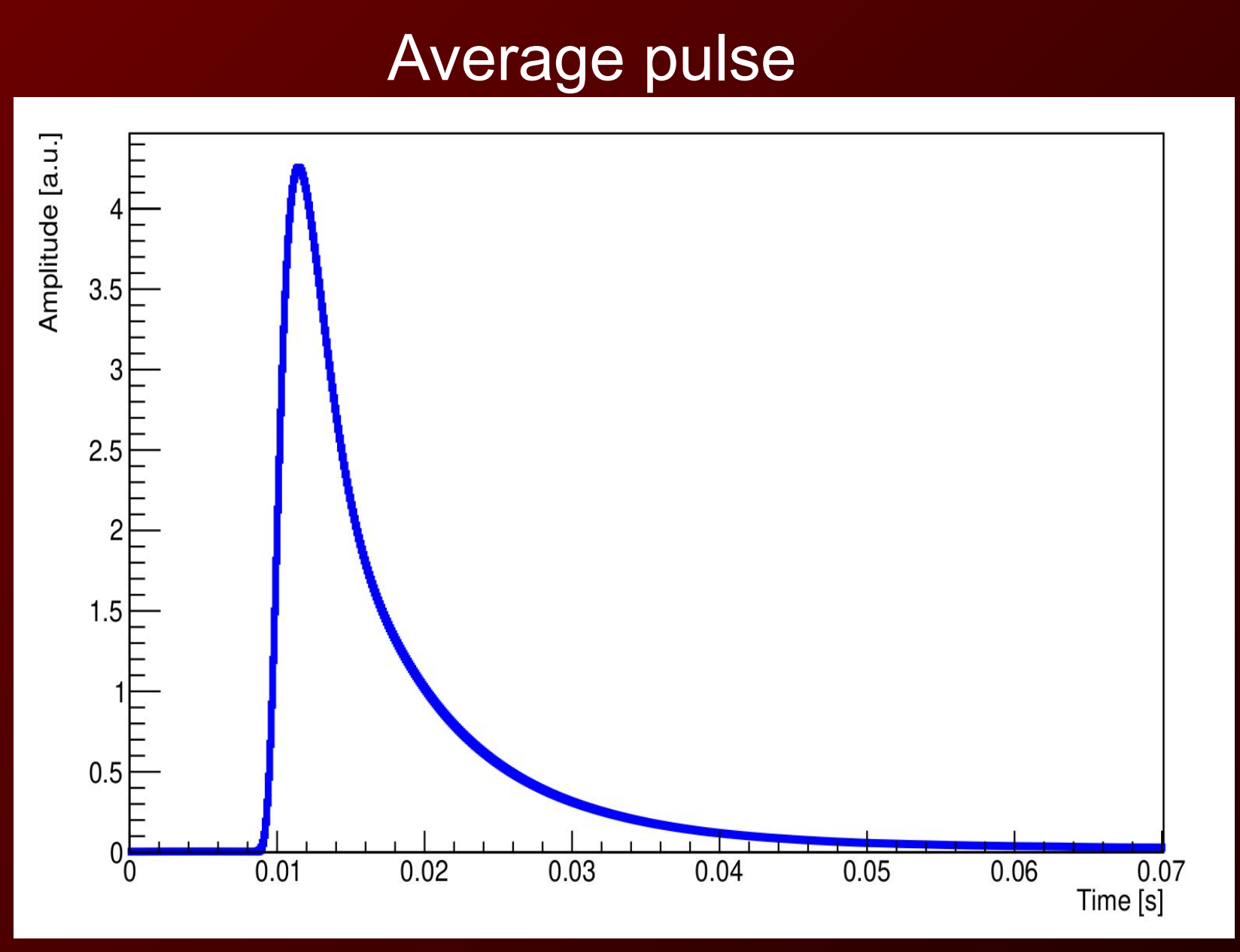
First measurement of Gallium Arsenide as a **low temperature calorimeter**.

Measure it at the **Gran Sasso National Laboratories in Hall C**, using a pulse tube assisted dilution refrigerator at **15 mK**. As phonon sensor we use a NTD Germanium (Neutron Transmutation Doped Ge thermistor).

Data Analysis and Results

We conducted a 12-hour long calibration with ^{55}Fe X-ray source and ^{238}U α -source. As energy estimator we use **Optimum Filter** that maximises signal to noise ratio

- Rise time 1.2 ms
- Decay time 10.8 ms
- Baseline resolution (RMS) 283 eV



Conclusion and Next steps

These results are highly promising (Published on arXiv [[arXiv:2404.15741](https://arxiv.org/abs/2404.15741)]) for the search for low-mass dark matter using GaAs crystals. As a future development we plan:

- **Double readout** of light channel (scintillation photons) heat channel (phonon) to particle identification
- **Luke amplification** to increase the phonon signal
- **Charge collection** installing electrodes
- **TES (Transition Edge Sensors)** as a thermal sensor