

Upgrade of the GERDA Phase II



K. Gusev^{1,2,3} for the GERDA collaboration

¹Joint Institute for Nuclear Research, Dubna, ²Technische Universität München, ³National Research Center "Kurchatov Institute"

Motivation

- Show the possibility to improve the background index
- Improve the energy resolution
- Repair broken JFETs and electronic channels
- Test the new inverted coaxial detectors + increase the mass of ⁷⁶Ge
- Prove the robustness and reproducibility of the GERDA approach

How to reach 10^{-4} counts/(keV kg yr)?

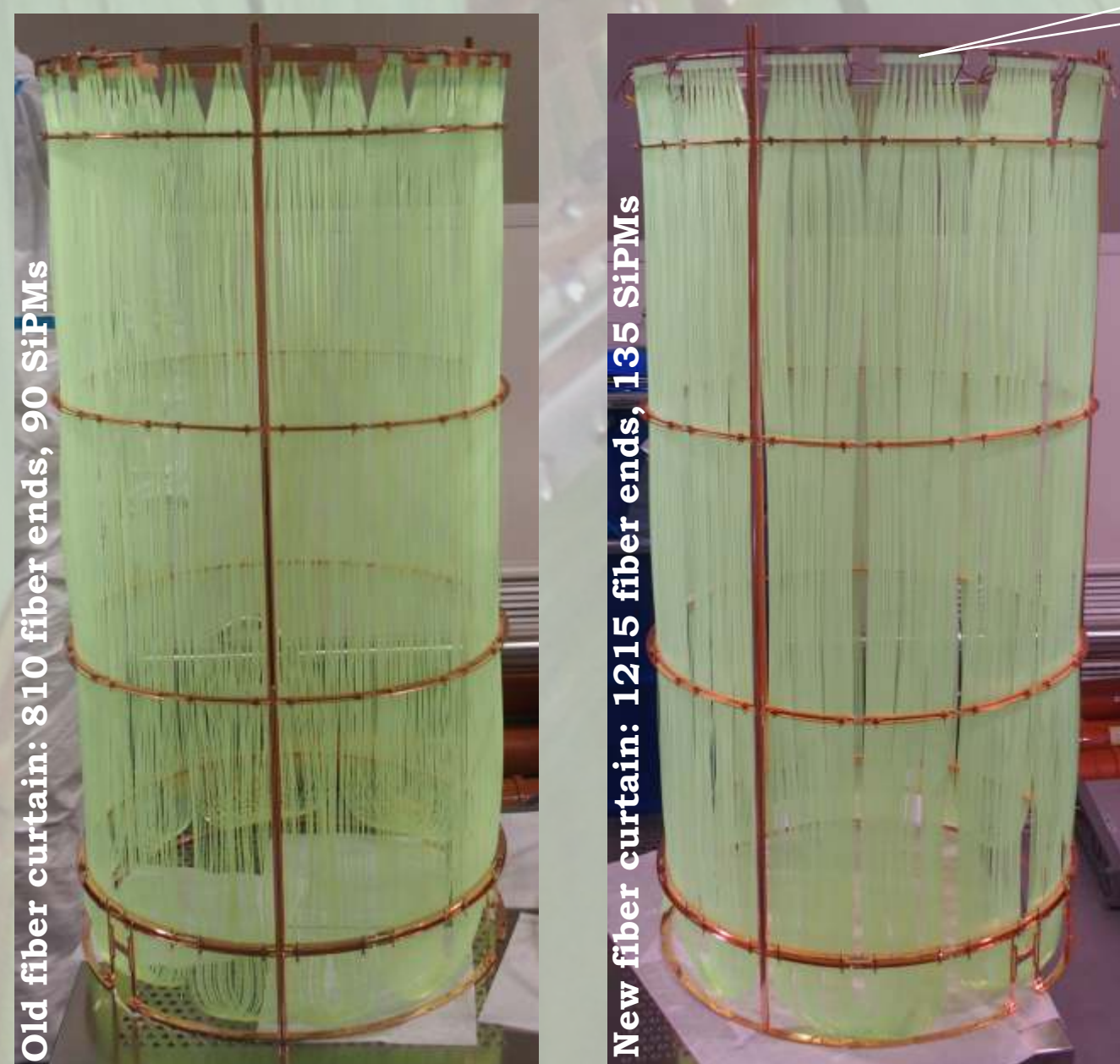
New liquid argon (LAr) veto system

New readout



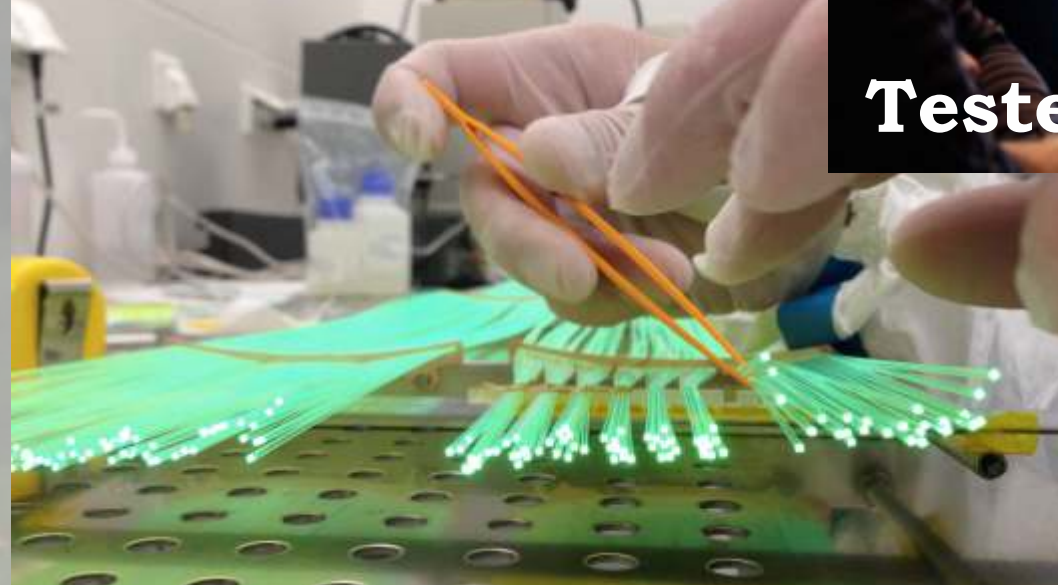
9 SiPMs mounted on fused synthetic quartz substrate

New fiber shroud

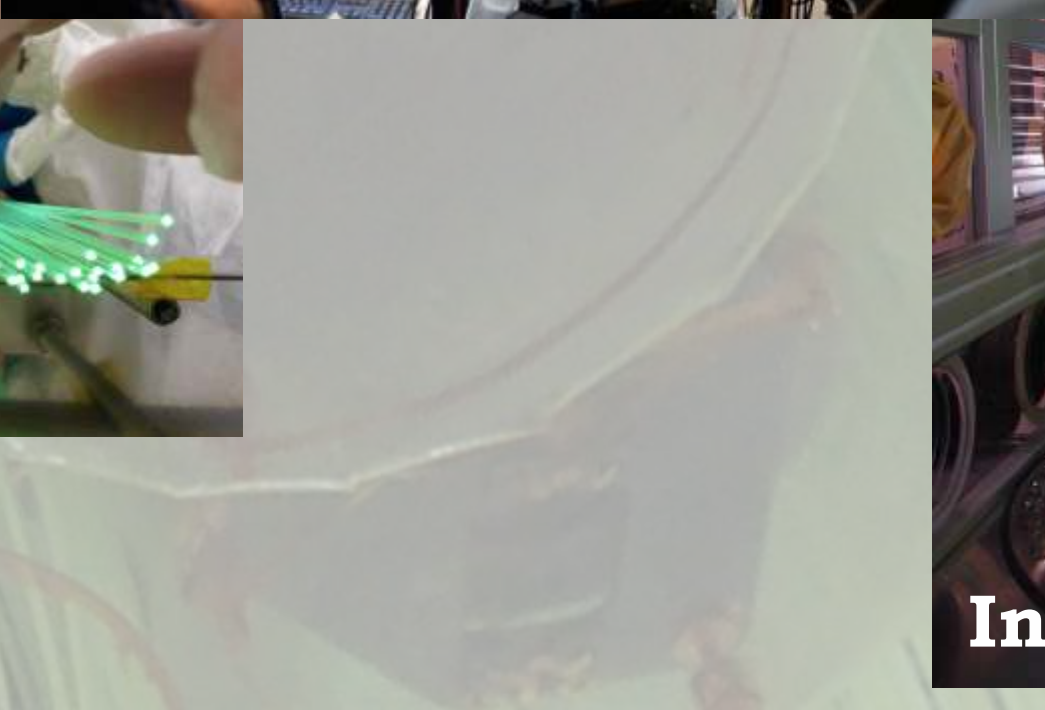


– to increase the light collection

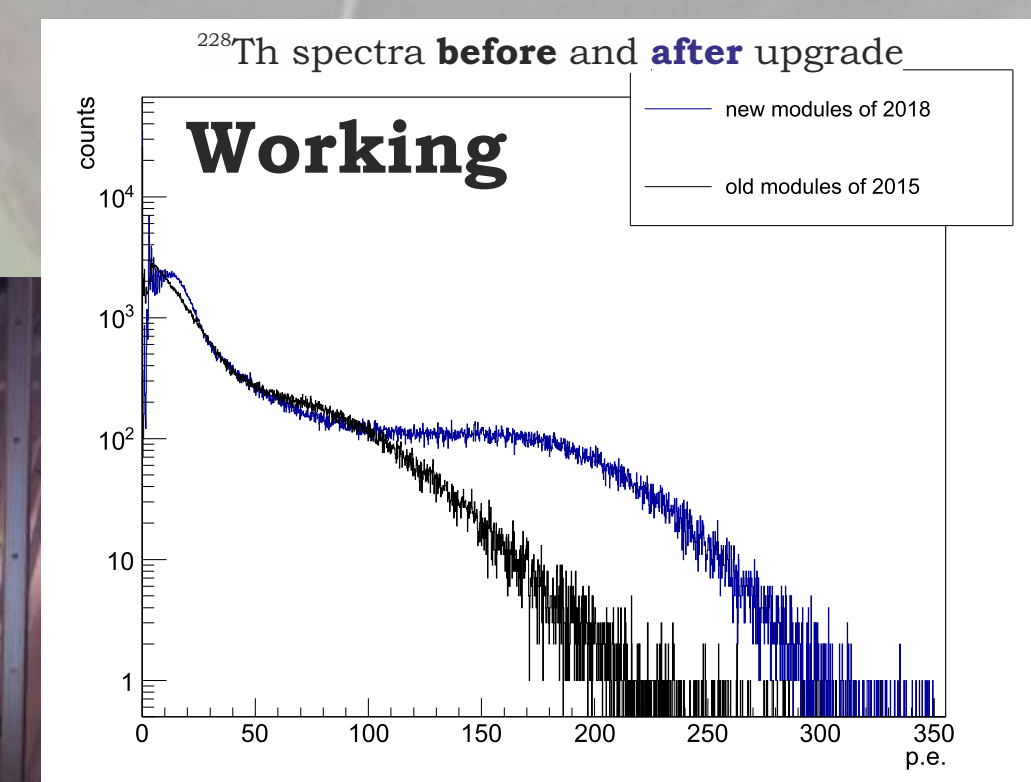
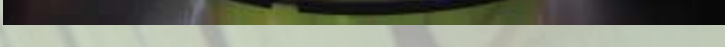
Produced



Tested



Installed



Central module



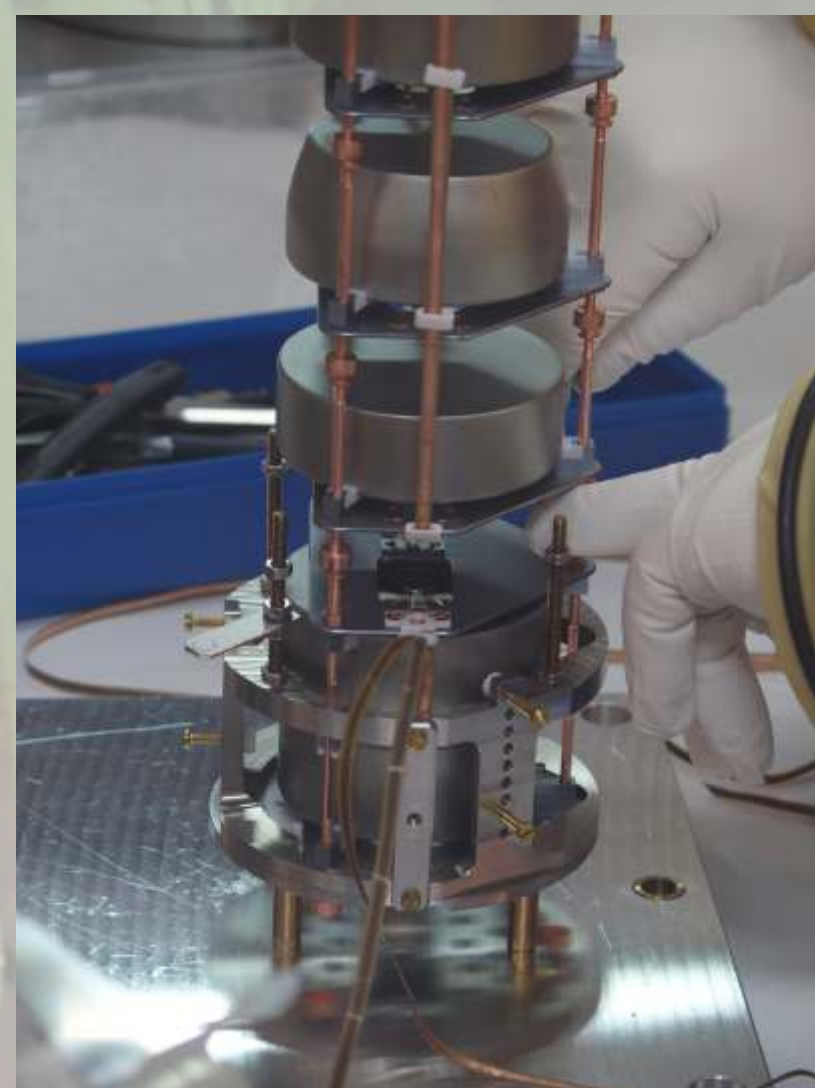
– to view hidden LAr volume

New signal and high voltage cables

Old cables

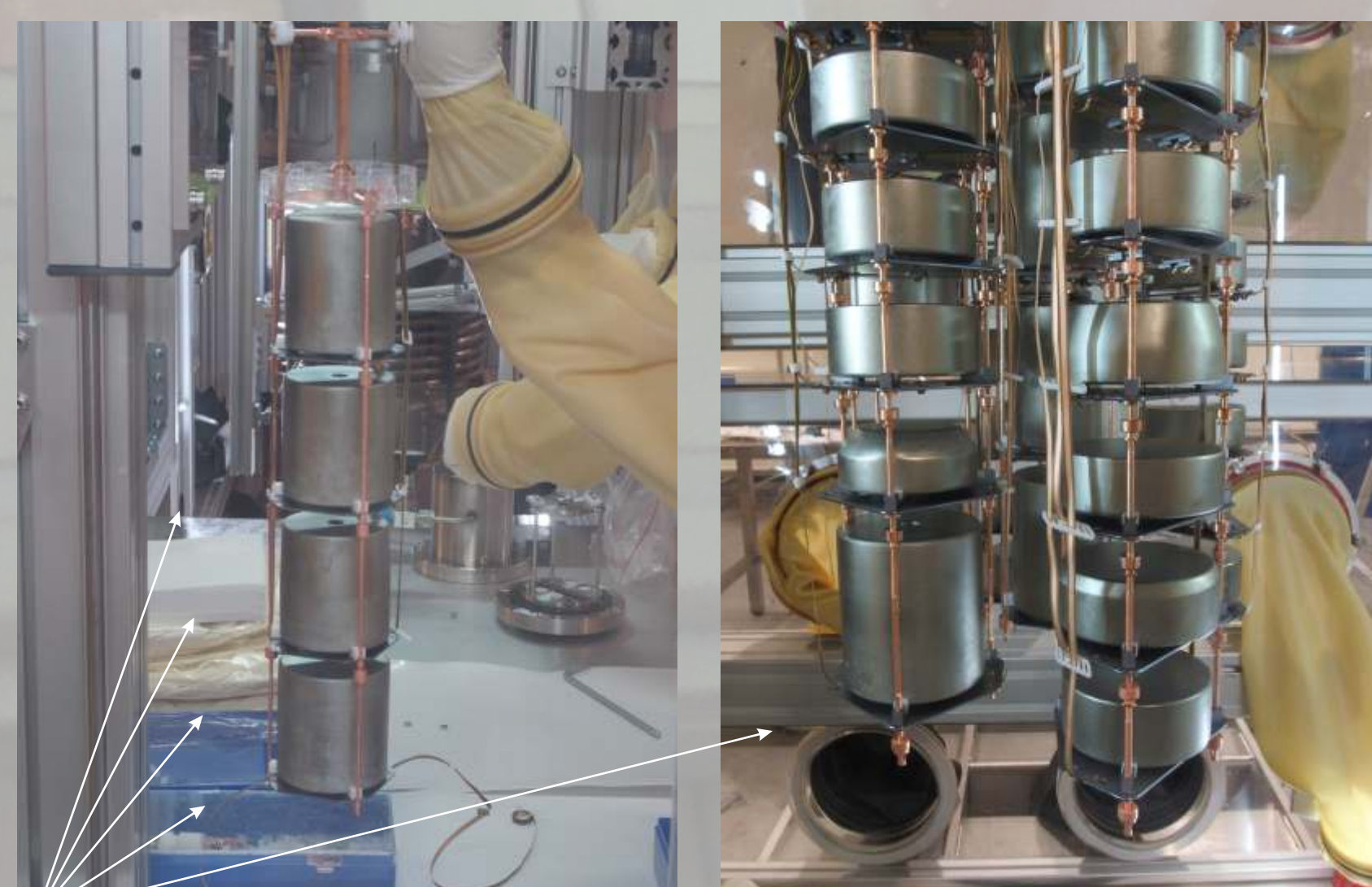
	Pyralux 3 mil TECNOMEC	Cuflon HV Haeffle	Cuflon signal Haeffle
²²⁸ Ra	< 3.8 mBq/kg x 0.5 g → < 2 μBq	(8 ± 2) mBq/kg x 2.7 g → (22 ± 5) μBq	(50 ± 10) mBq/kg x 0.5 g → (25 ± 5) μBq
²²⁸ Th	< 5.5 mBq/kg x 0.5 g → < 3 μBq	< 8.3 mBq/kg x 2.7 g → < 22 μBq	< 21 mBq/kg x 0.5 g → < 11 μBq
⁴⁰ K	(0.11 ± 0.03) Bq/kg x 0.5 g → (55 ± 15) μBq	(0.11 ± 0.03) Bq/kg x 2.7 g → (300 ± 80) μBq	(0.2 ± 0.1) mBq/kg x 0.5 g → (100 ± 50) μBq
⁶⁰ Co	< 0.77 mBq/kg x 0.5 g → < 0.4 μBq	< 2.3 mBq/kg x 2.7 g → < 6.2 μBq	< 17 mBq/kg x 0.5 g → < 8.5 μBq
¹³⁷ Cs	< 1.2 mBq/kg x 0.5 g → < 0.6 μBq	< 2.4 mBq/kg x 2.7 g → < 6.5 μBq	< 10 mBq/kg x 0.5 g → < 5.0 μBq

New cables



All detectors were dismantled from the strings and holders, bonded with new cables and mounted back in the GERDA setup

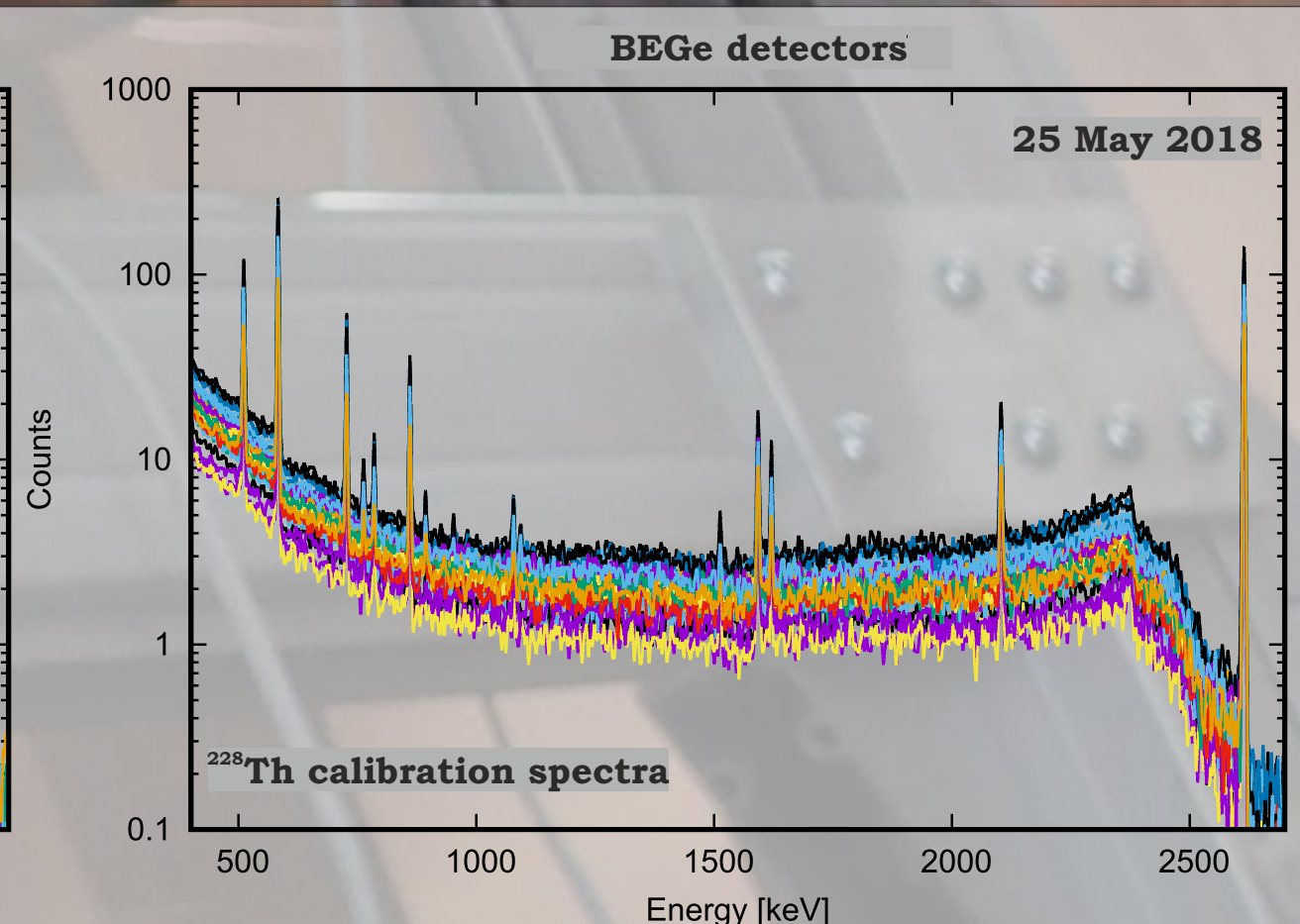
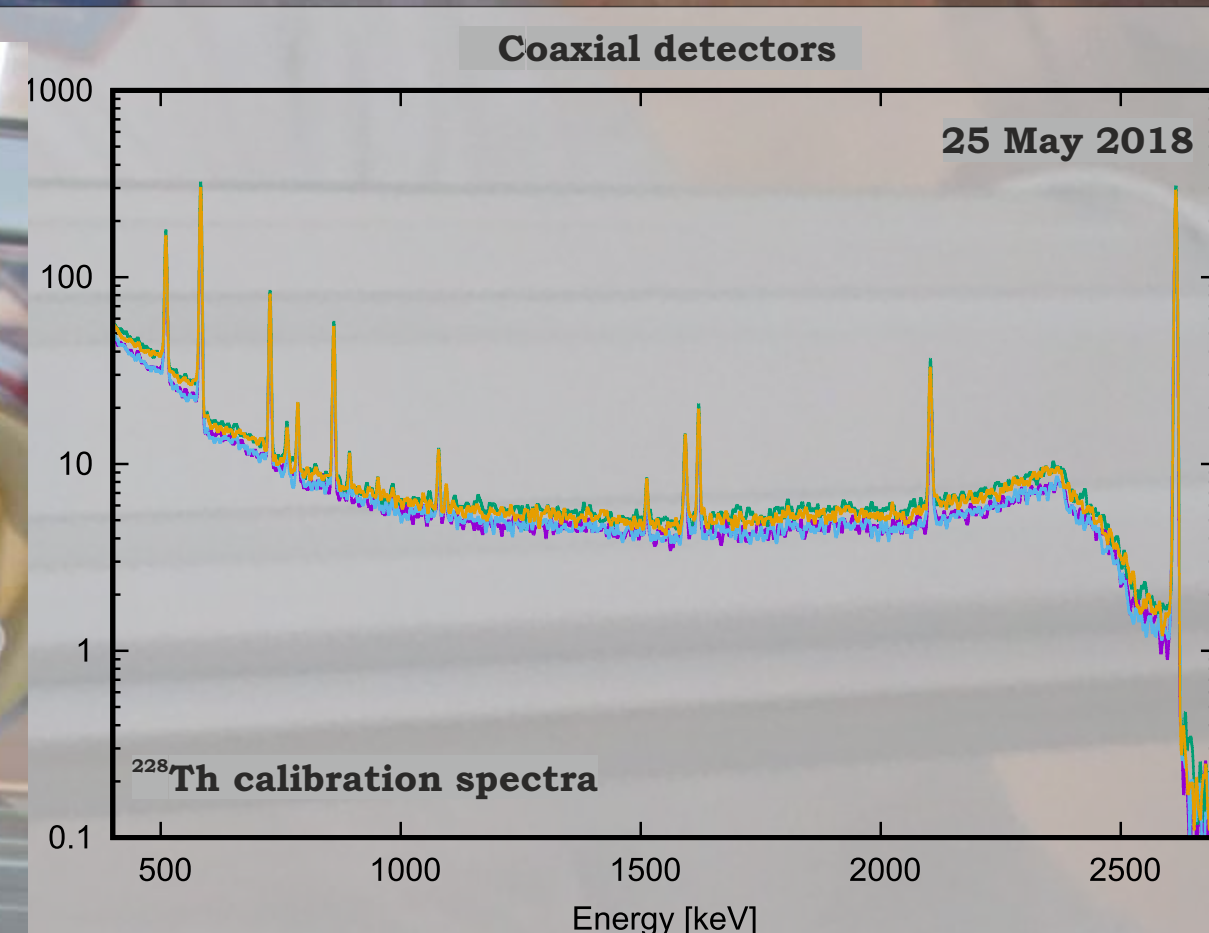
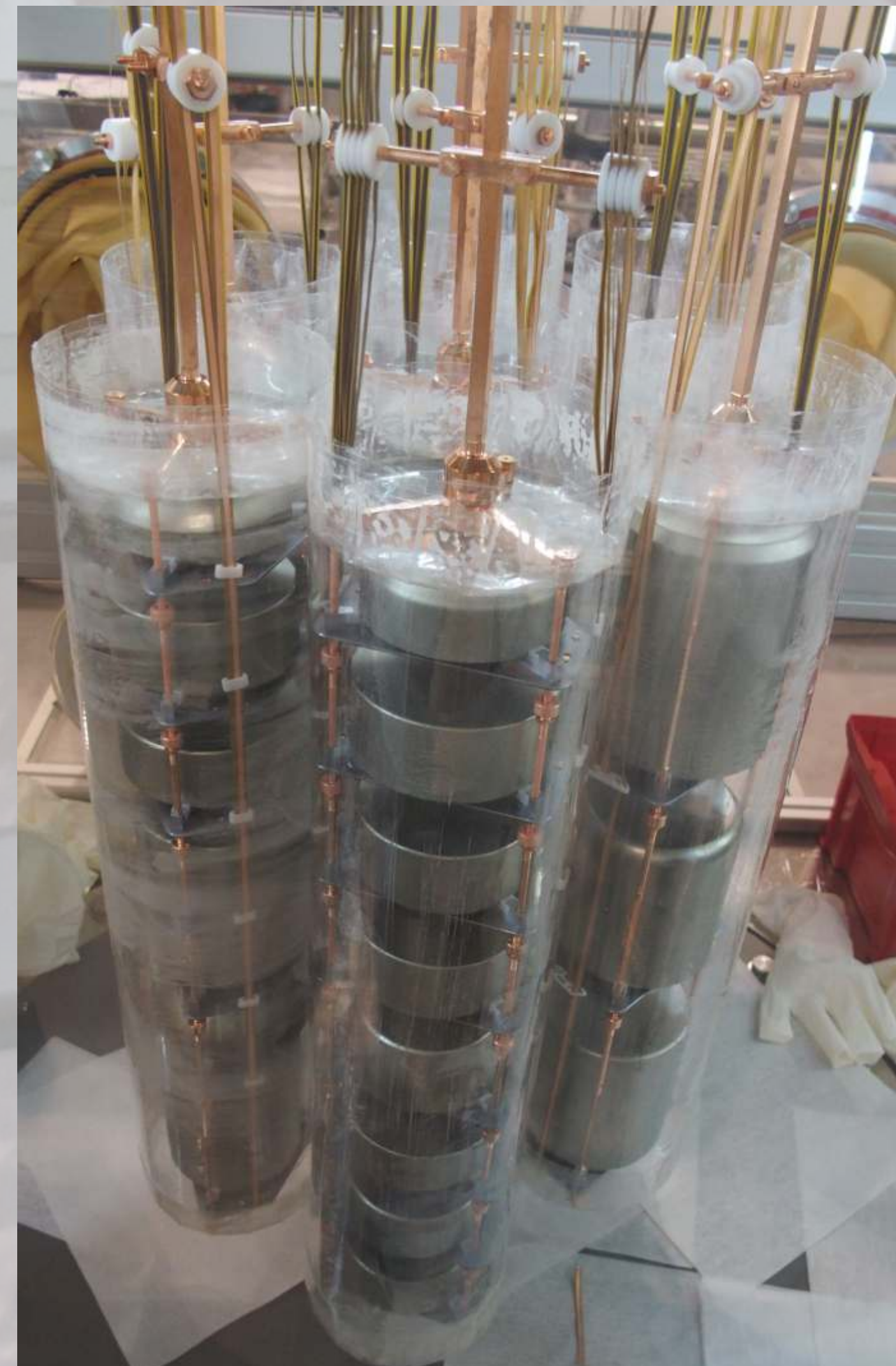
Test of novel detectors in liquid argon



5 inverted coaxial detectors made from ⁷⁶Ge have been produced, characterized and mounted in the GERDA setup to replace the detectors made from natural Ge

Increase of ⁷⁶Ge mass ~ 9 kg!

Upgrade: actual status



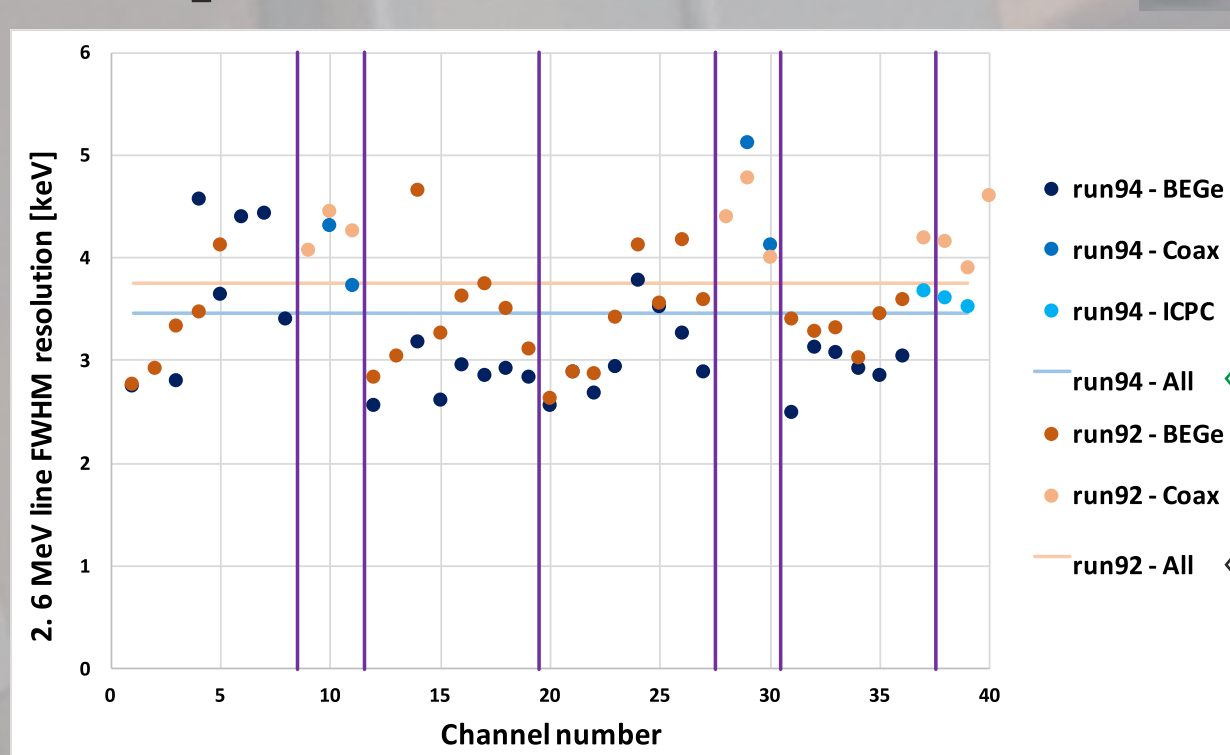
- All electronic channels are functioning
- No deterioration of detectors leakage current
- New fiber shroud and central fiber module are working
- Energy resolutions improved
- 2 out of 5 new detectors have high leakage current
- Will be repaired soon and installed back in GERDA

Electronics and cabling



New signal cables routing should help to reduce the cross-talk and improve the energy resolution

- Protective diodes have been installed for all channels
- Broken channels have been repaired



After upgrade

Before upgrade

The upgrade operation lasted only 1 month!

