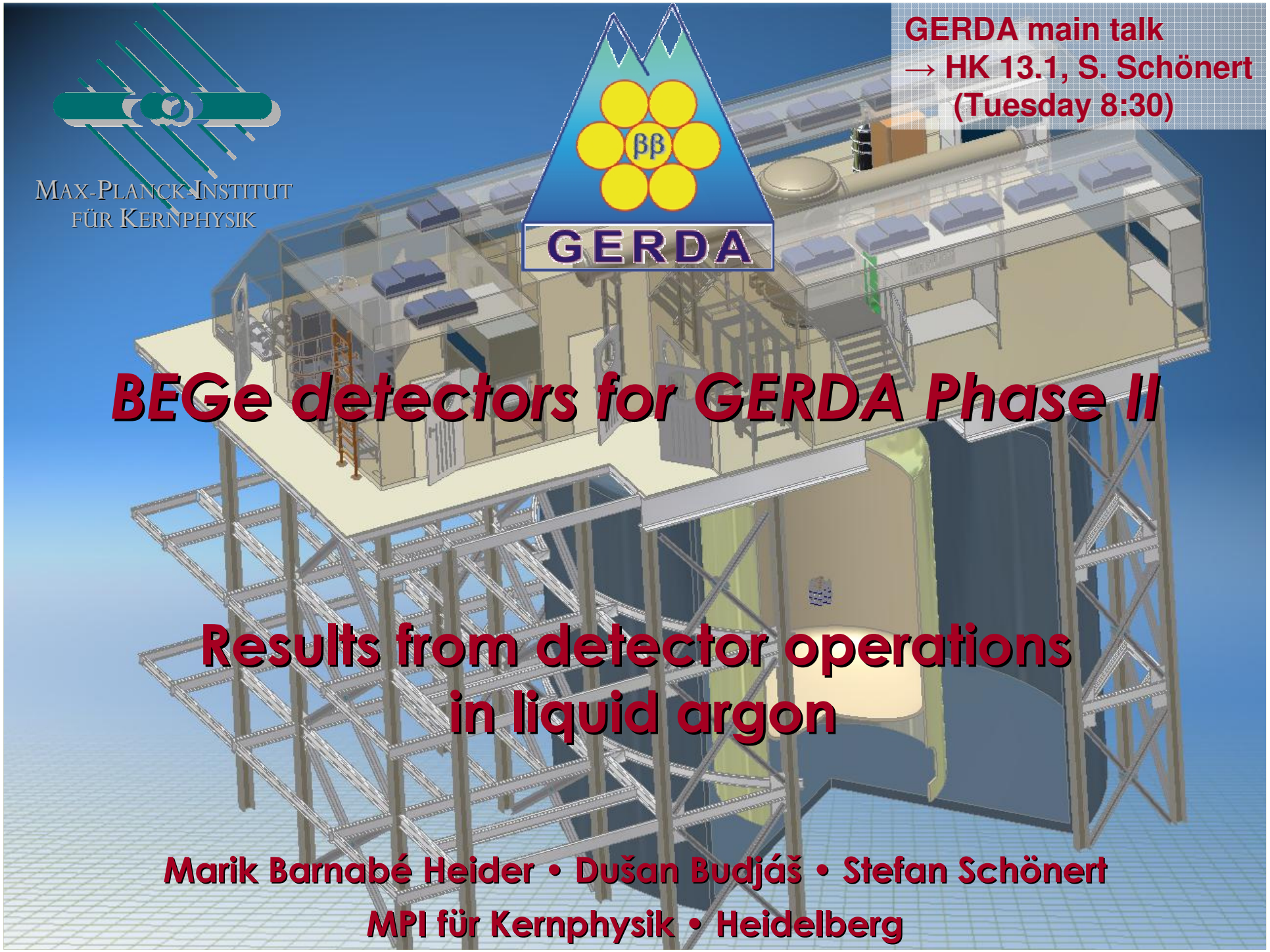
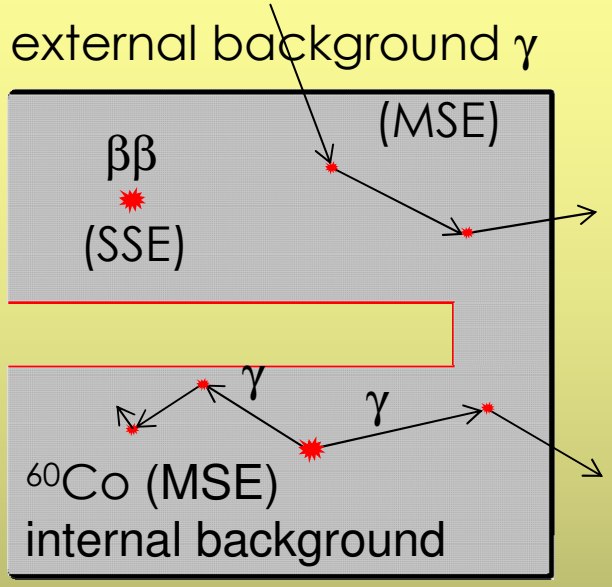

MAX-PLANCK-INSTITUT
FÜR KERNPHYSIK
ββ
GERDA
GERDA main talk
→ HK 13.1, S. Schönert
(Tuesday 8:30)
BEGe detectors for GERDA Phase II
Results from detector operations
in liquid argon
Marik Barnabé Heider • Dušan Budjáš • Stefan Schönert
MPI für Kernphysik • Heidelberg

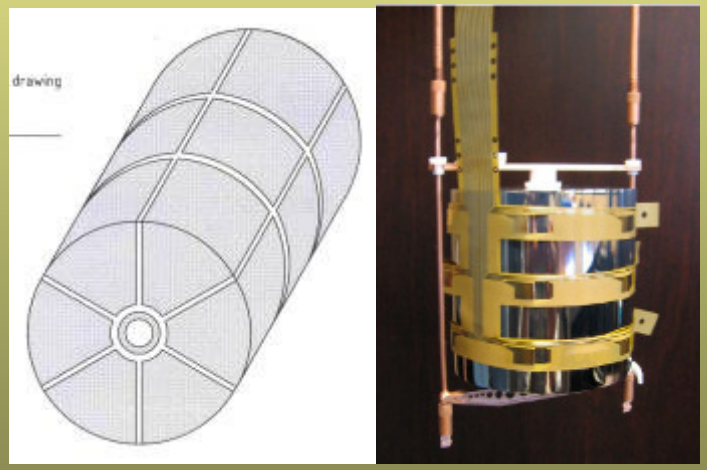
GERDA Phase II Ge detectors

Distinguishing **single-site events (SSE)** from **multi-site events (MSE)** is required for background suppression.



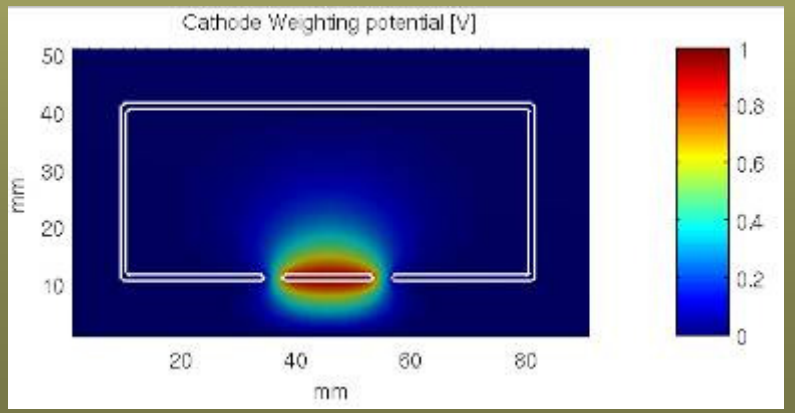
Two approaches:

1. detector read-out **segmentation**



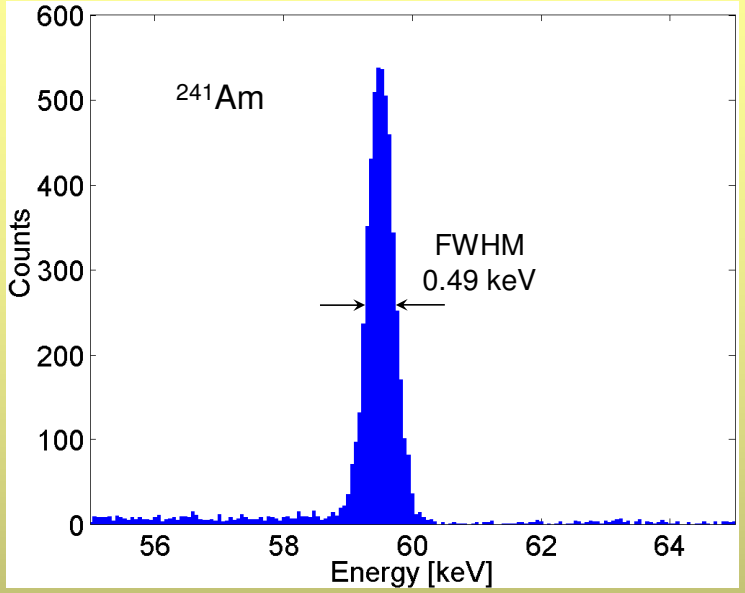
→ talk of A. Vauth (HK 9.2)

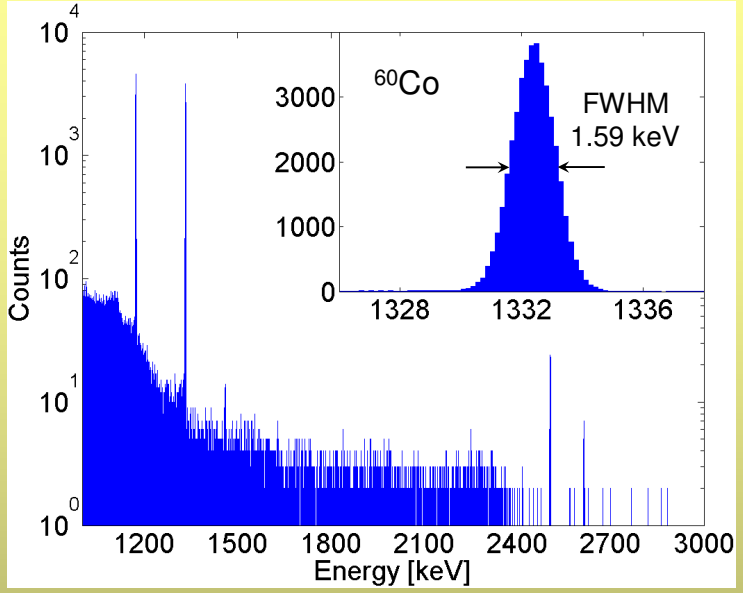
2. unsegmented **BEGe detectors** with enhanced **pulse-shape discrimination (PSD)** properties



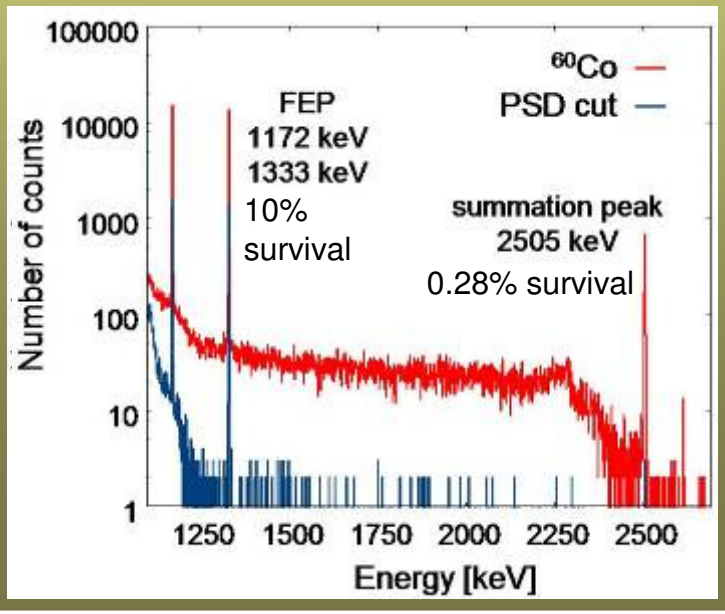
BEGe detector performance

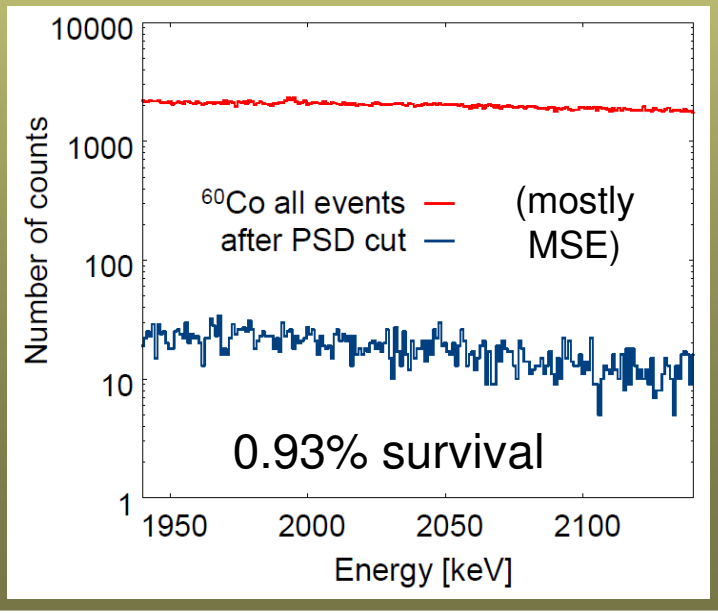
Energy resolution:





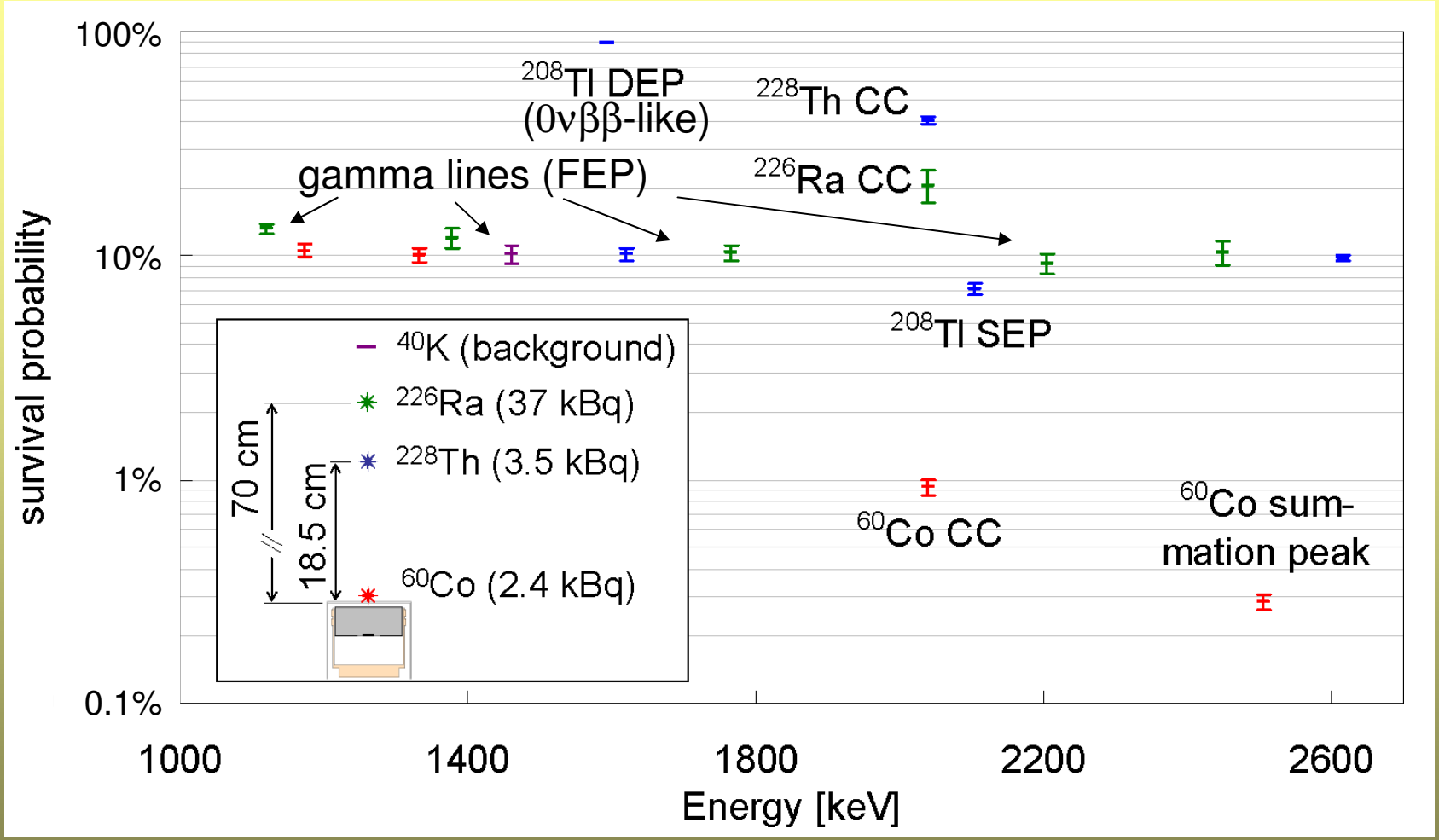
SSE / MSE discrimination (method details – talk of M.Agostini, HK 9.9):





D. Budjas et al., JINST 4:P10007,2009

Pulse-shape discrimination results overview

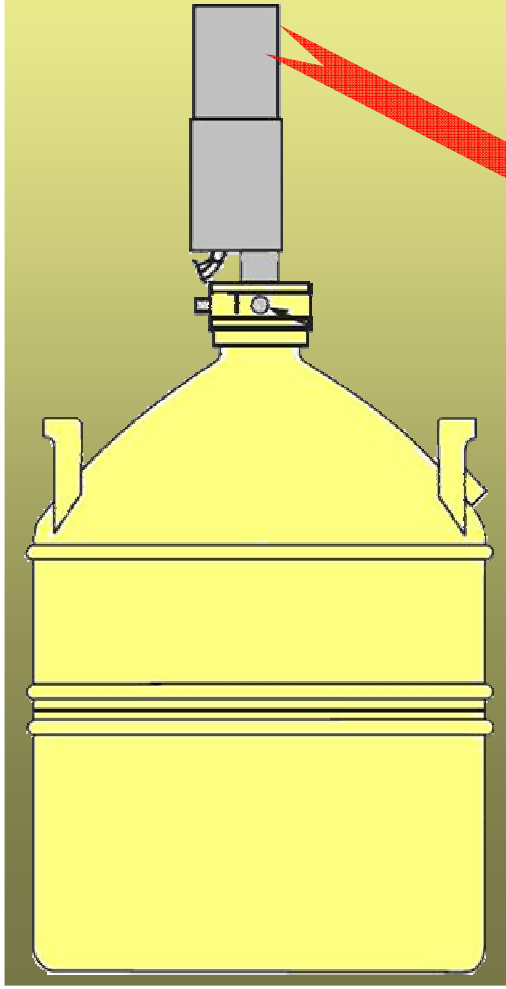


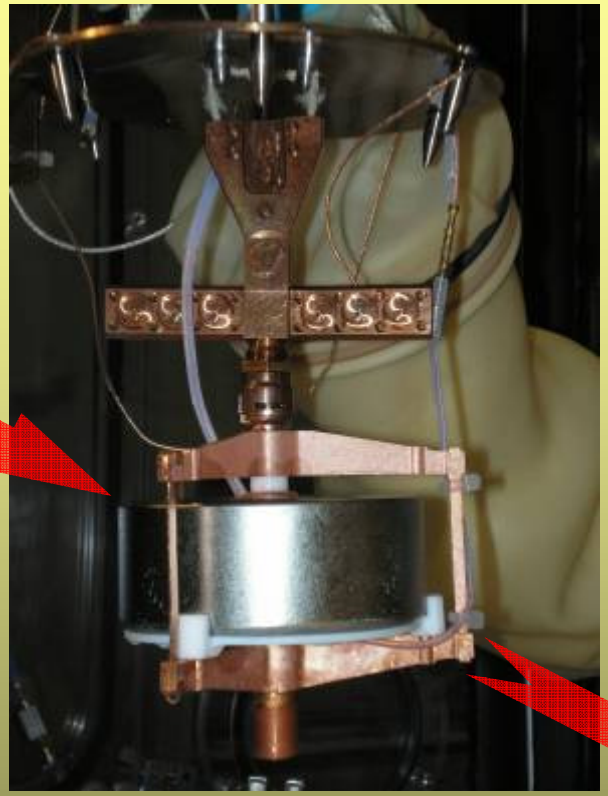
D. Budjas et al., JINST 4:P10007,2009

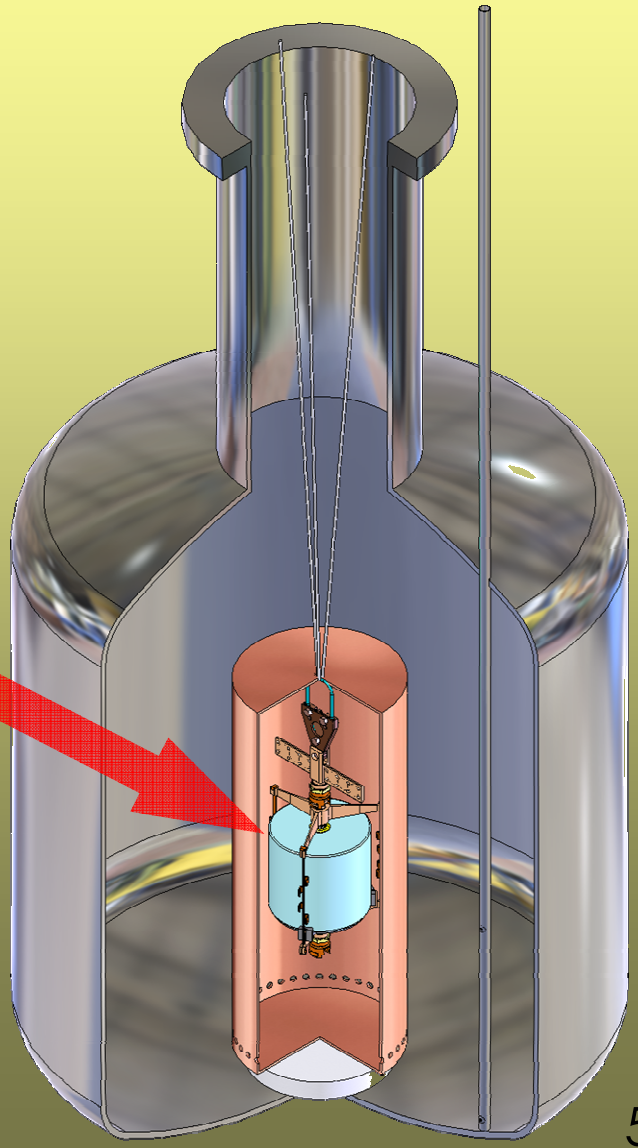
CC = Compton continuum (2039 ± 35 keV → ROI: Q value of ^{76}Ge 0νββ)

source positions represent approximately the background source locations expected in GERDA

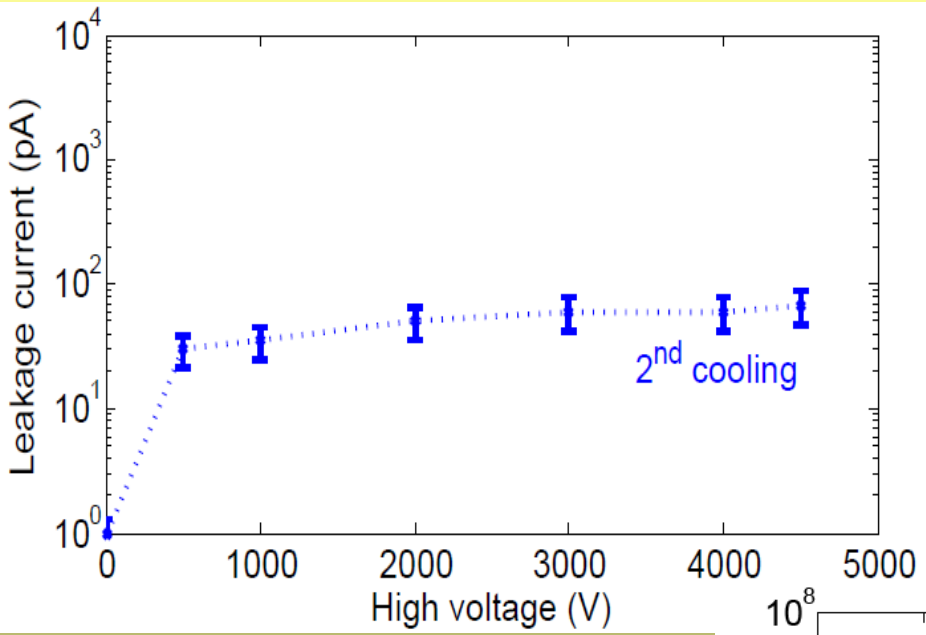
1st time bare BEGe detector in LAr



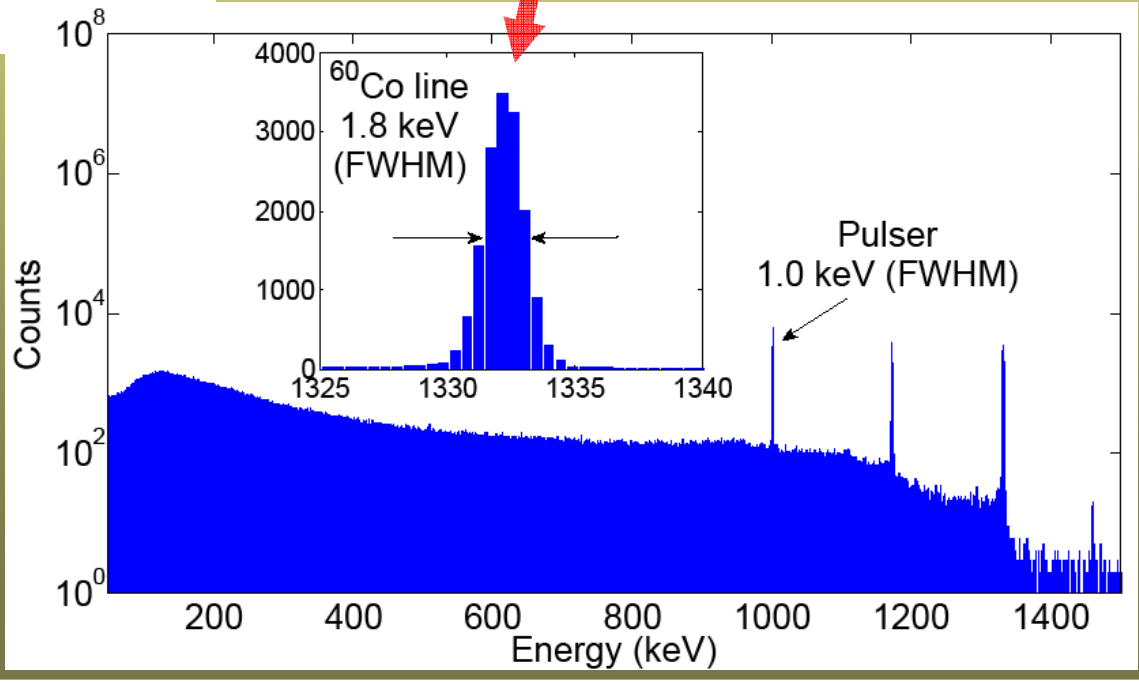




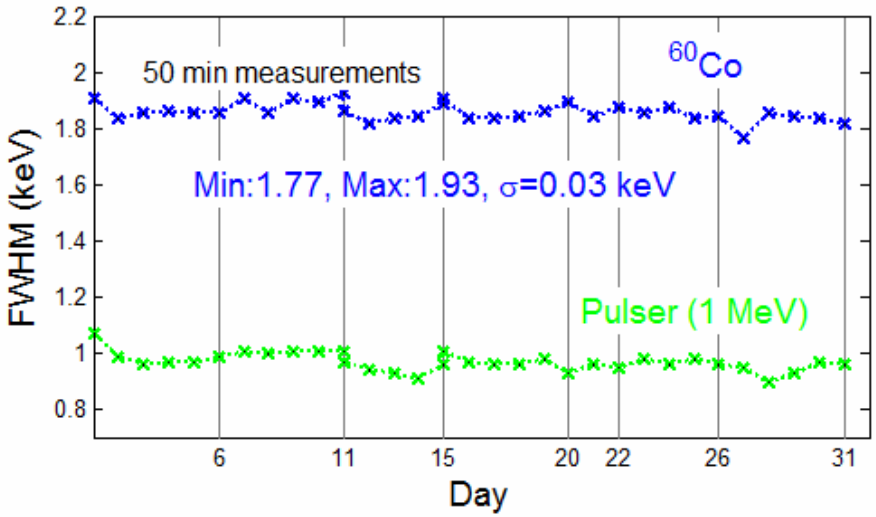
BEGe in LAr: short term test 12. 2009



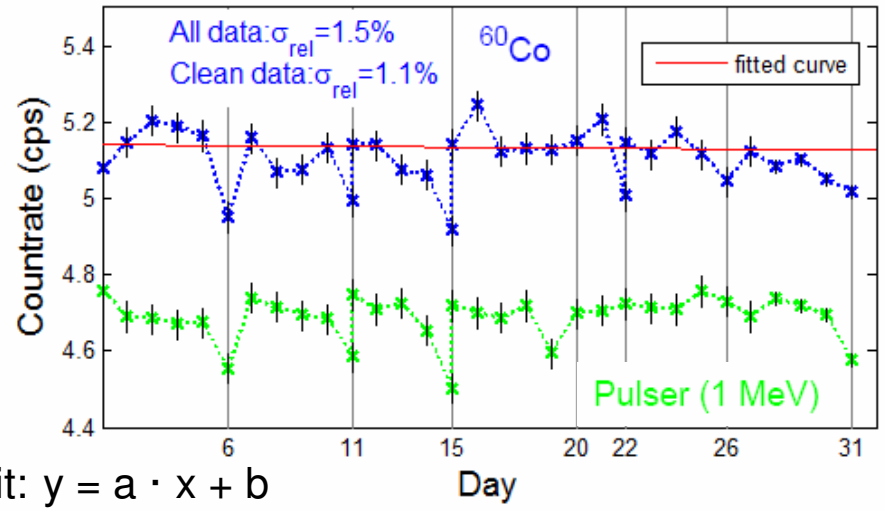
only 0.2 keV increase of FWHM resolution compared to vacuum cryostat



BEGe in LAr: long term test 2. 2010



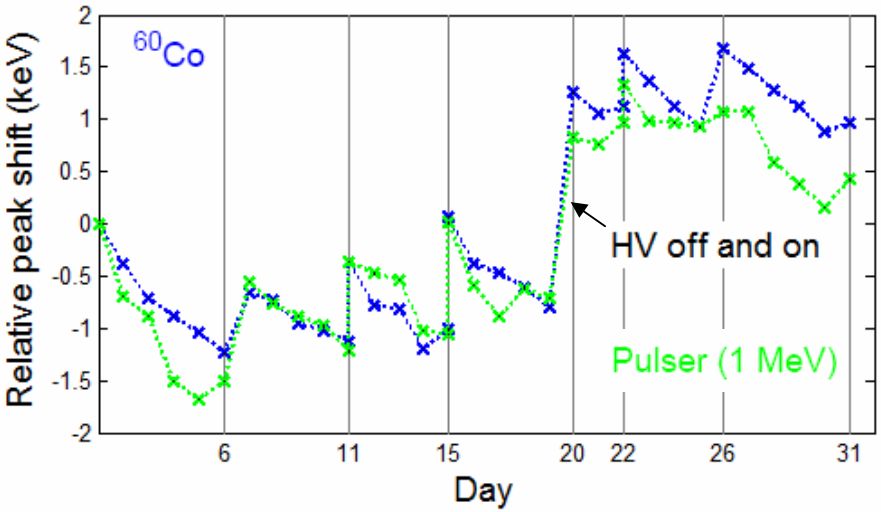
LAr refillings

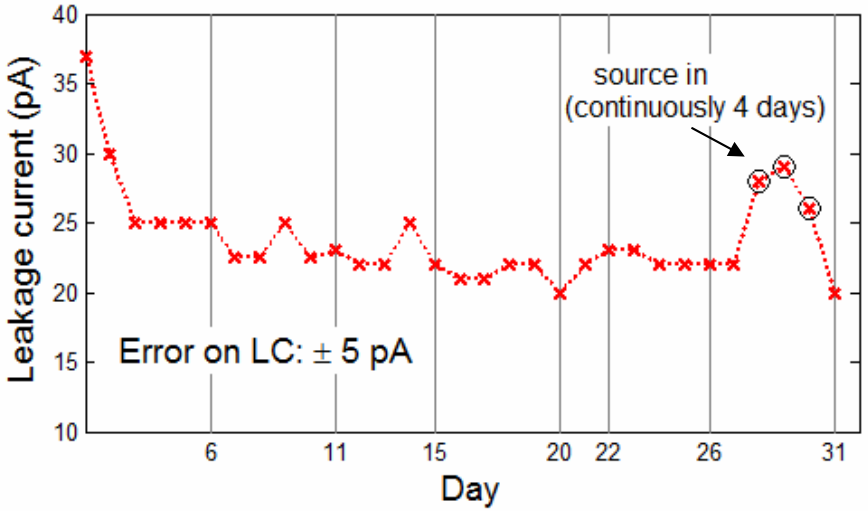


Fit: $y = a \cdot x + b$

$a = (-0.5 \pm 2.5) \cdot 10^{-3}$

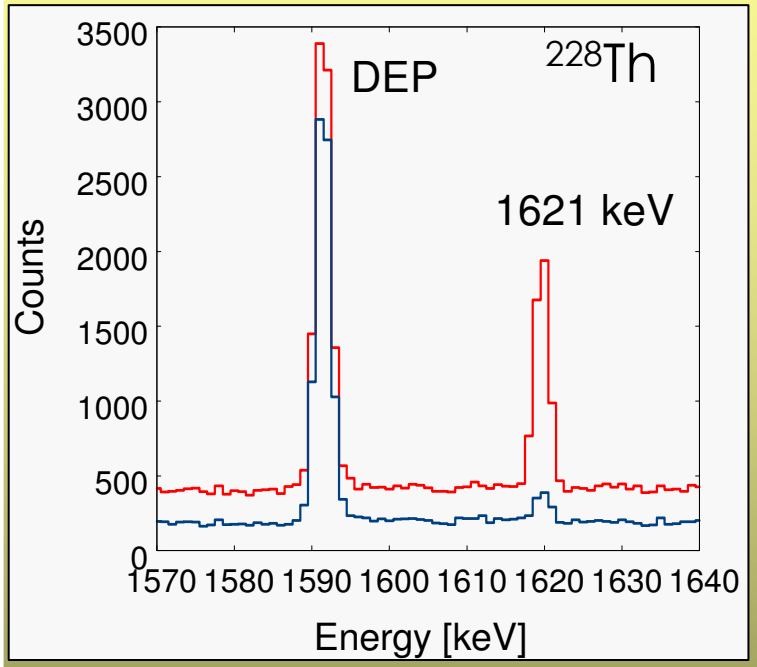
$b = 5.14 \pm 0.04$



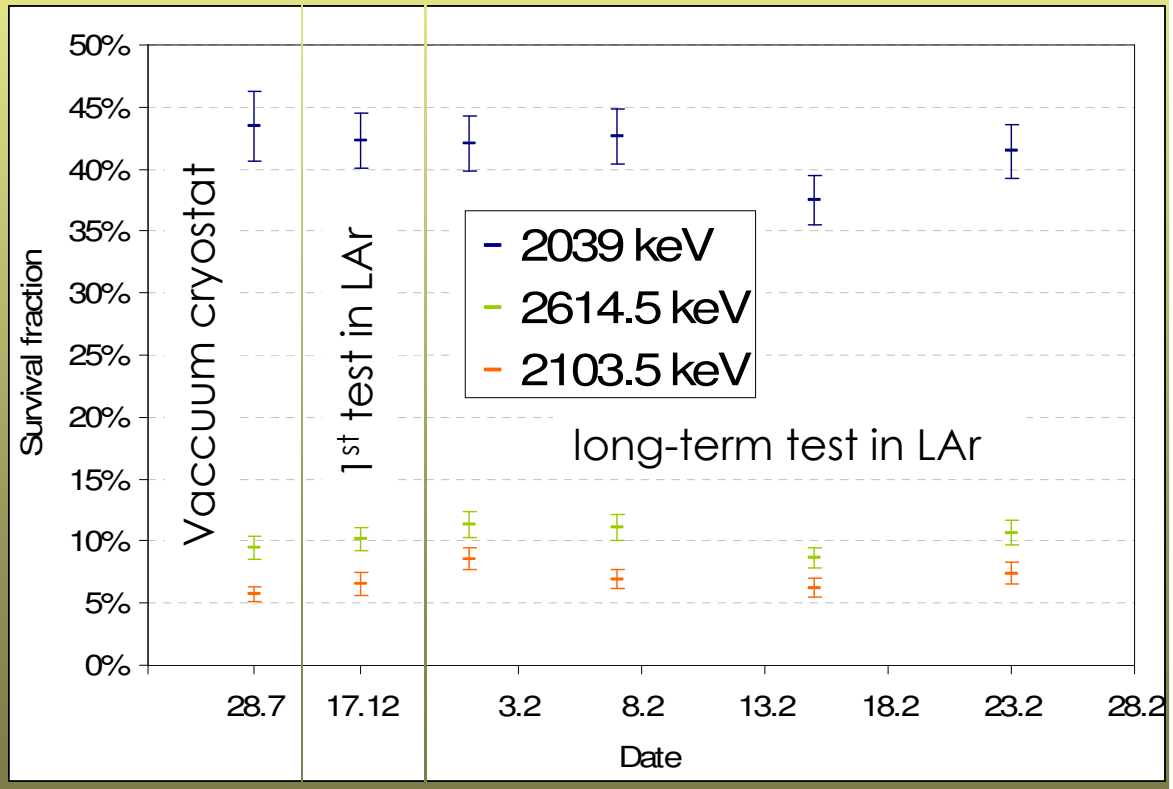


detector performance stable over 1 month period

BEGe in LAr: pulse-shape discrimination results



DEP acceptance fixed at 90%



Error bars include systematic uncertainty of PSD calibration

Summary and conclusions

- unsegmented BEGe detectors showed excellent energy resolution and background rejection power for GERDA Phase II

  → D. Budjas et al., JINST 4:P10007,2009

- BEGe detector succesfully operated in LAr:
  1.8 keV FWHM, stable operation,
  PSD performance same as in vac. cryostat

Outlook

- project to demonstrate that working BEGes can be produced while maximizing the production yield from the isotopically enriched (expensive) germanium material
- isotopically modified Ge procured, purified and Ge crystals pulled in Canberra Semiconductors
- four BEGes ordered, first two will be soon available
- acceptance testing campaign in preparation

Thank you for your attention

The GERDA Collaboration :

1. INFN Laboratori Nazionali del Gran Sasso, Assergi, Italy
2. Joint Institute for Nuclear Research, Dubna, Russia
3. Max-Planck-Institut für Kernphysik, Heidelberg, Germany
4. Institute of Physics, Jagiellonian University, Krakow, Poland
5. Università di Milano Bicocca e INFN Milano, Milano, Italy
6. Institute for Nuclear Research of the Russian Academy of Sciences, Moscow, Russia
7. Institute for Theoretical and Experimental Physics, Moscow, Russia
8. Russian Research Center Kurchatov Institute, Moscow, Russia
9. Max-Planck-Institut für Physik, München, Germany
10. Dipartimento di Fisica dell'Università di Padova e INFN Padova, Padova, Italy
11. Physikalisches Institut, Universität Tübingen, Germany
12. Institute for Reference Materials and Measurements, Geel, Belgium
13. Institut für Kern- und Teilchenphysik, Technische Universität Dresden, Germany
14. Physik Institut der Universität Zürich, Switzerland