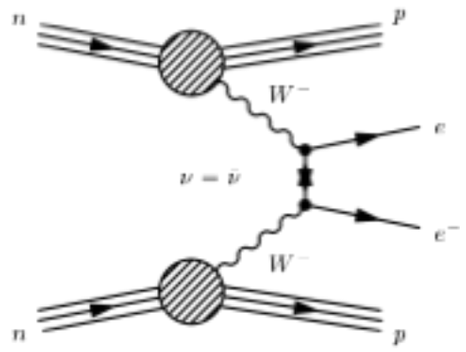
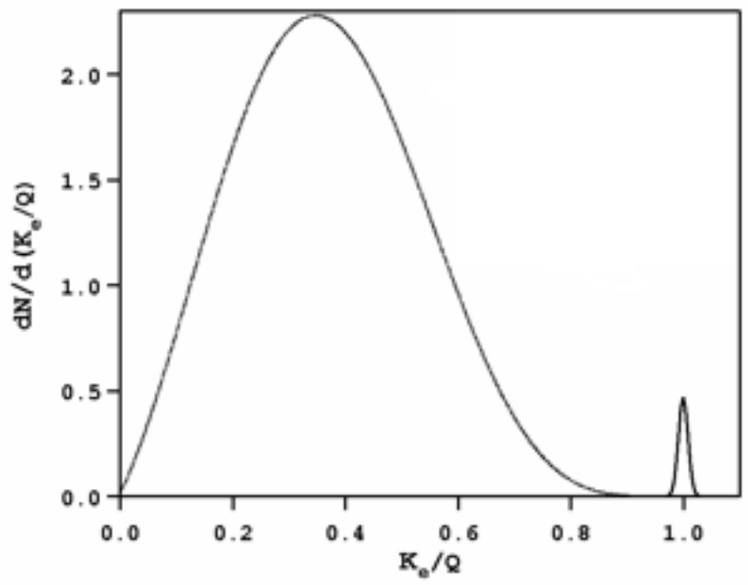
Commissioning of GERDA

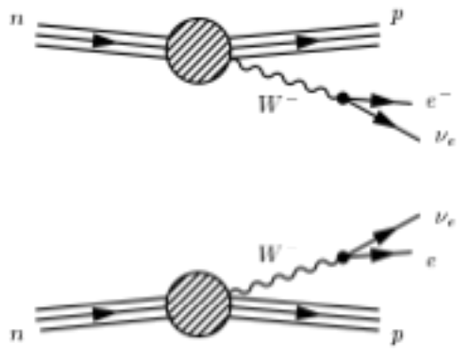
J. Janicskó-Csáthy for the GERDA collaboration

0ν2β decay



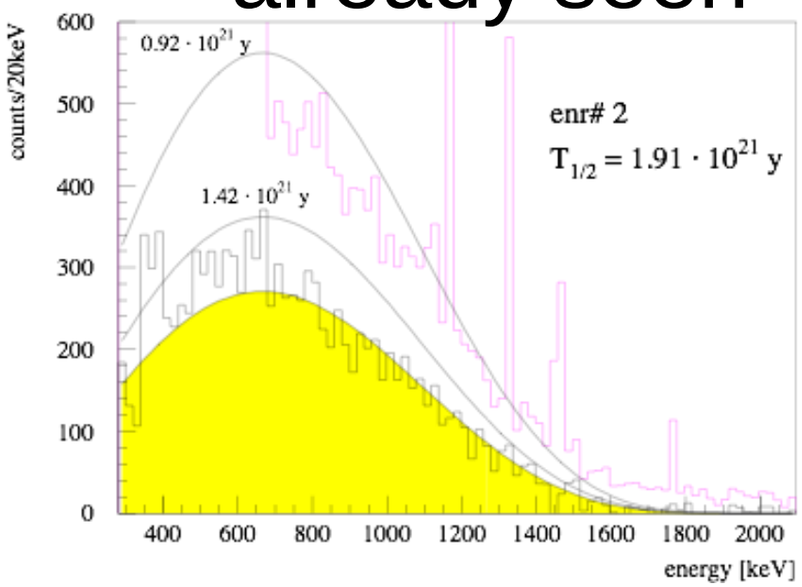
2β decay with 2 neutrinos





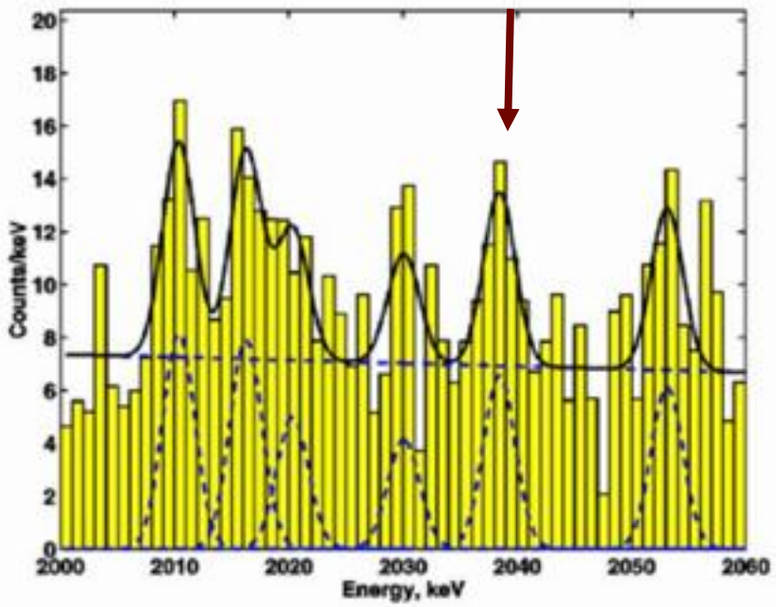
2β decay with 0 neutrinos

2ν2β decay in ^{76}Ge was already seen



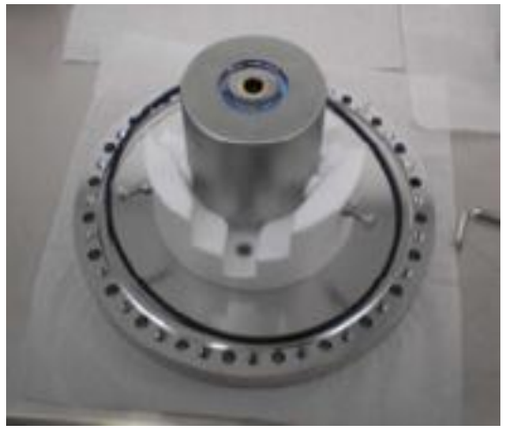
Phys. Rev. D 55 (1997) 54

Claim: $T_{1/2}=1.2 \cdot 10^{25}$ y



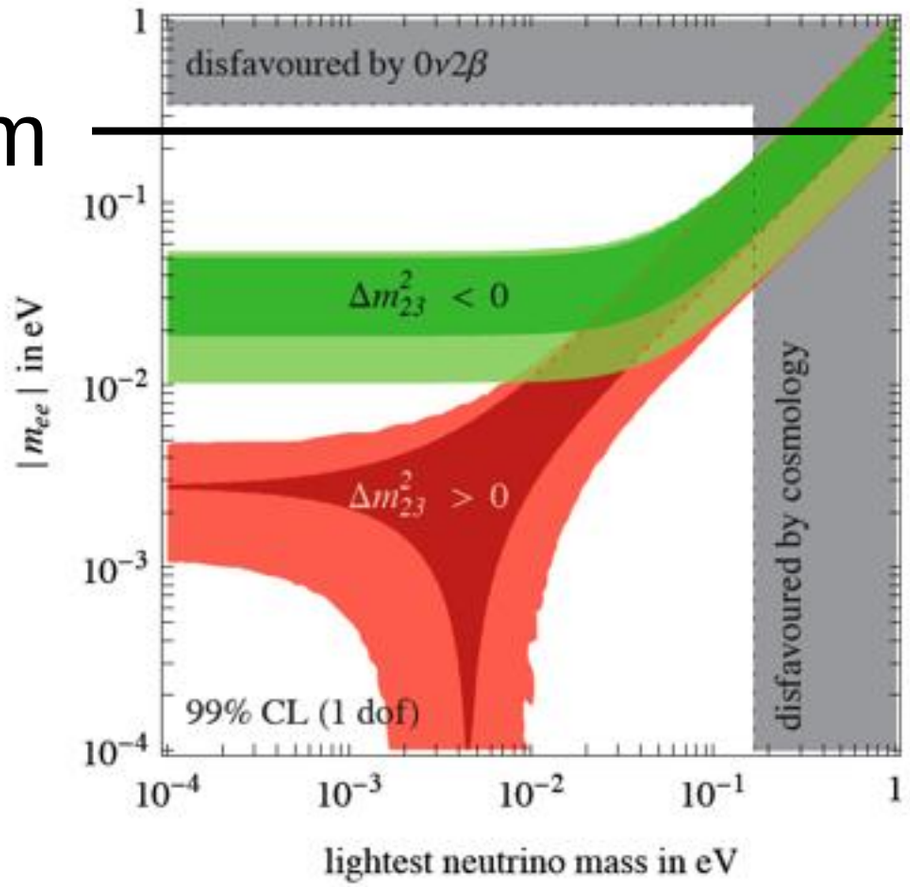
Phys.Lett. B 586 (2004) 198

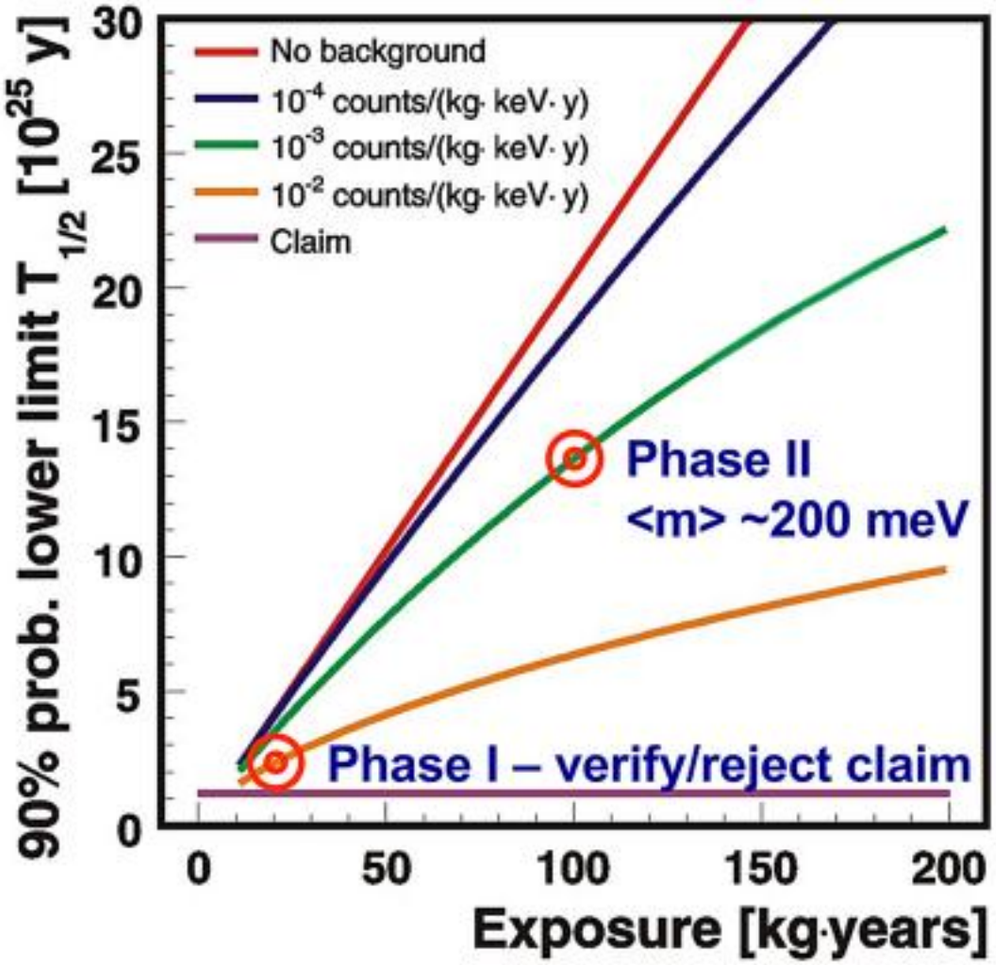
GERDA



- GERDA is built to test the Claim
- Phase I: HM and IGEX detectors will be redeployed. total mass 17.66 kg with a projected background level of 10^{-2} cts/(keV kg y)
- Phase II: 36.6 kg enriched ^{76}Ge is available for detector production. Projected background level 10^{-3} cts/(keV kg y)
- Phase III: 1 tone experiment?

Claim





The Collaboration

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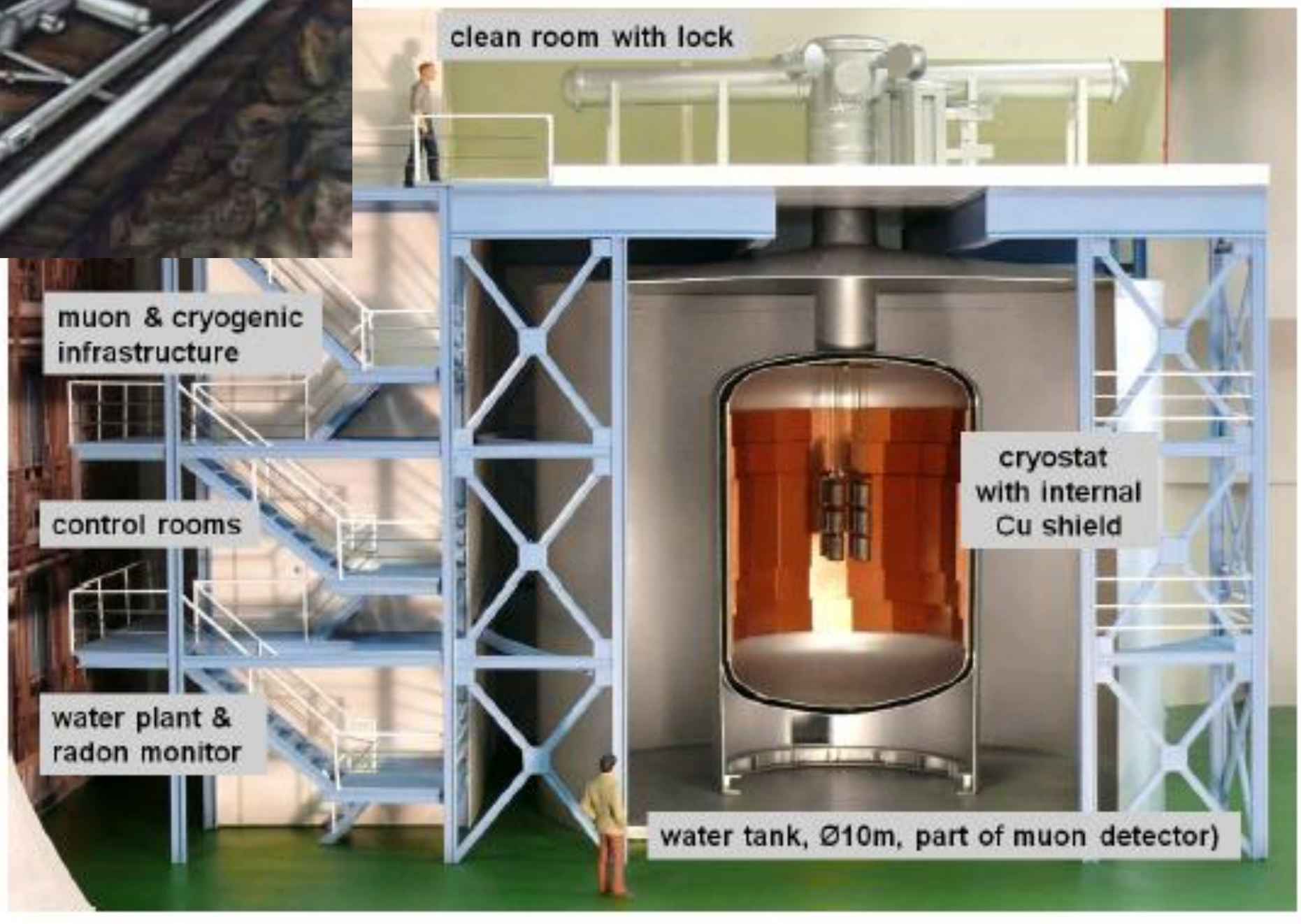
- about 100 members
- 19 institutions from 6 countries

GERDA at Gran Sasso

Located at Gran Sasso (LNGS)
Hall A , 3400 m w.e.



GERDA Milestones

Cryostat delivered March 2008

Water tank completed May 2008

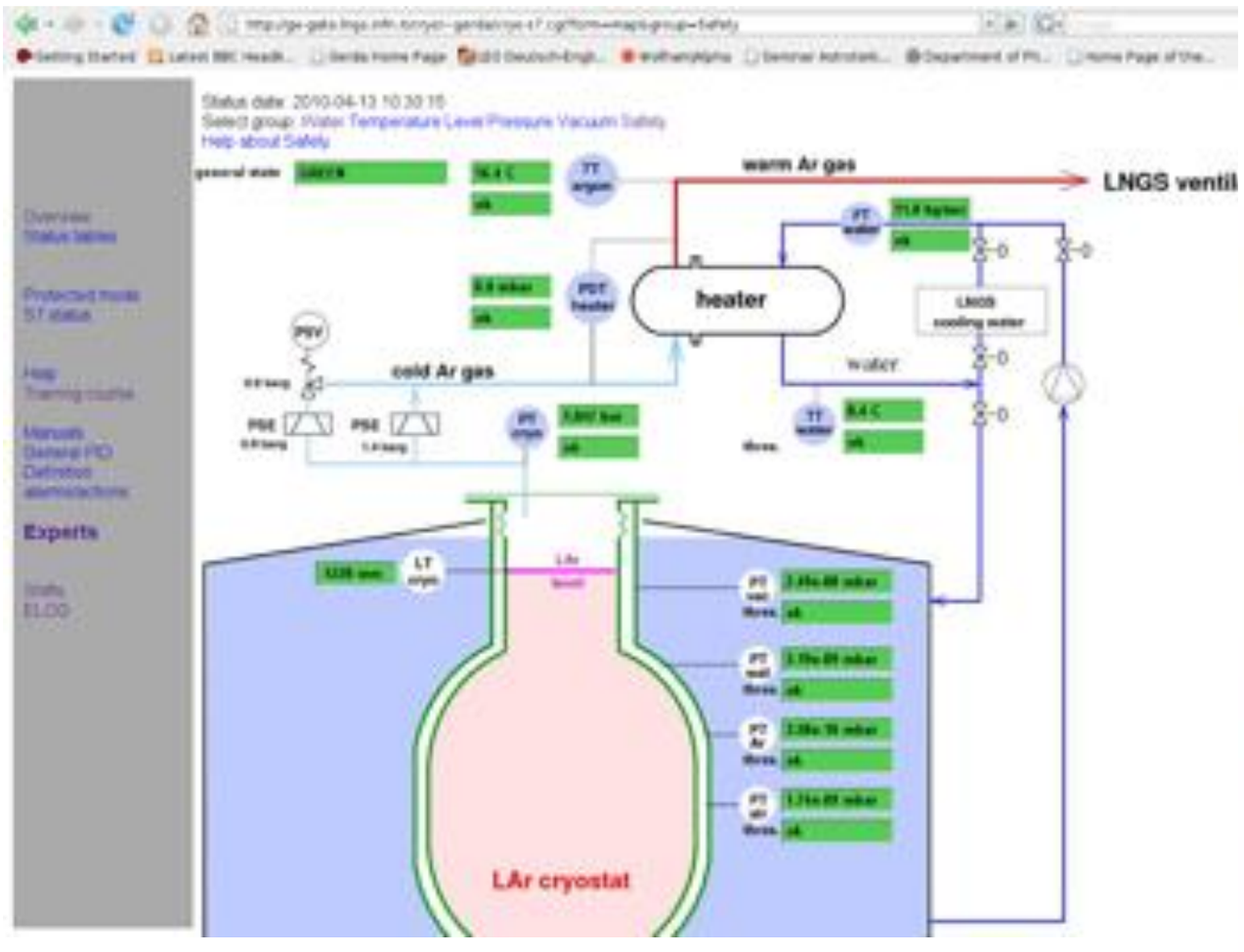
2009 April Clean Room built up

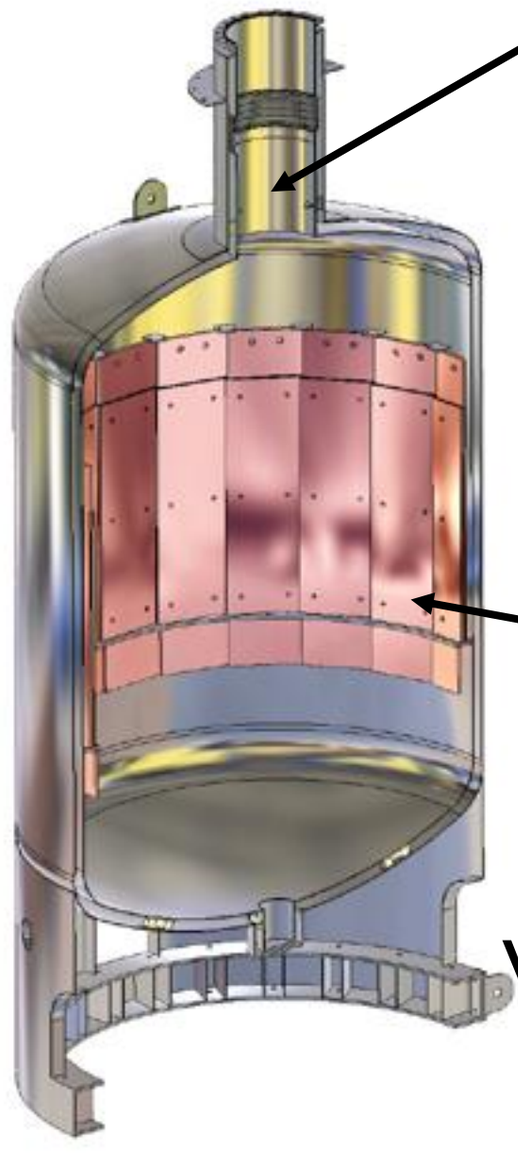
2009 construction completed:

In Nov. 2009 started filling with LAr

Cryogenic Infrastructure

- LAr level stable, no evaporation losses: active cooling with LN
- Slow control with web interface
- Operating since 2009, Nov





Cooling circuit

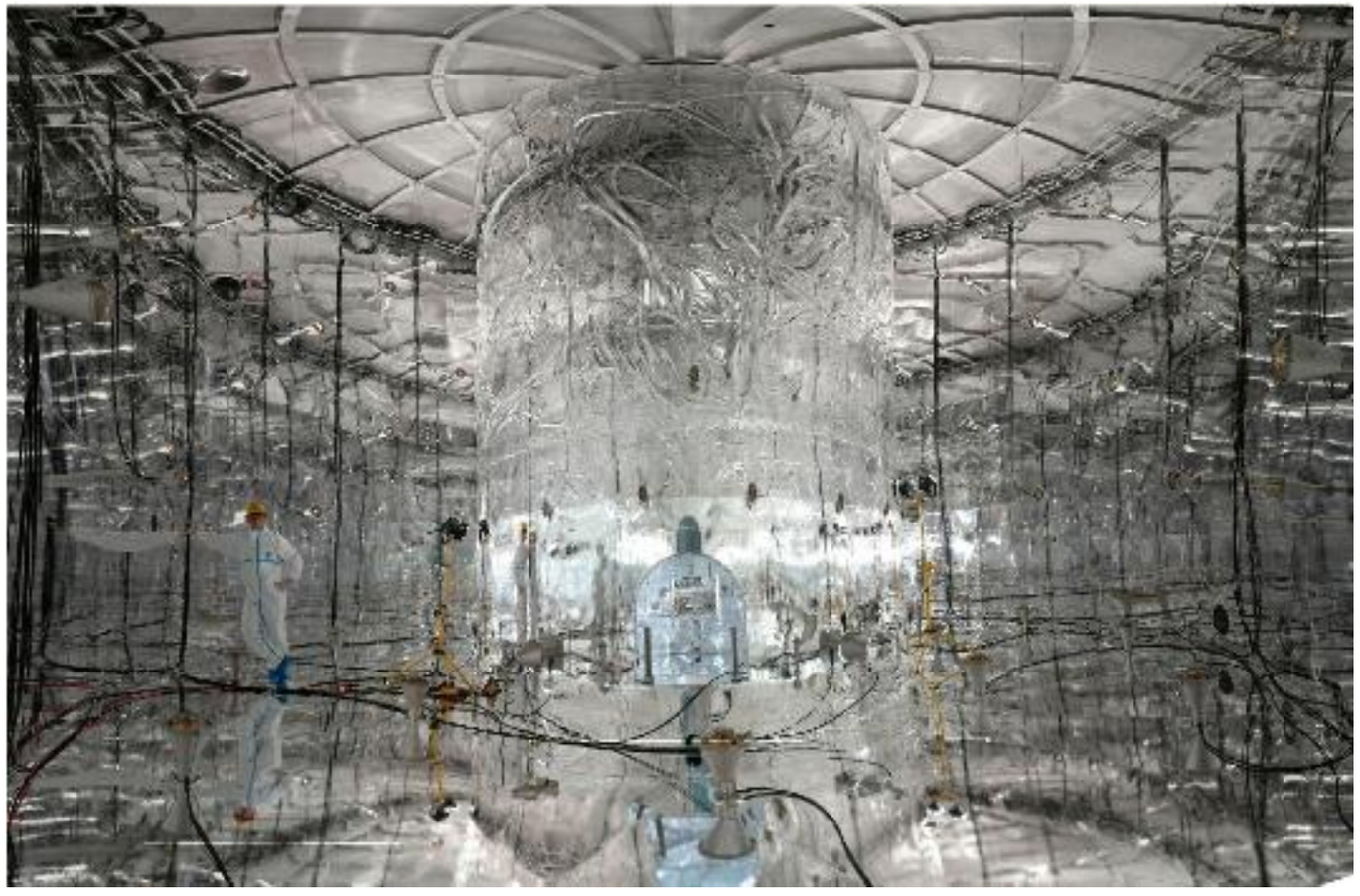
Cu shield

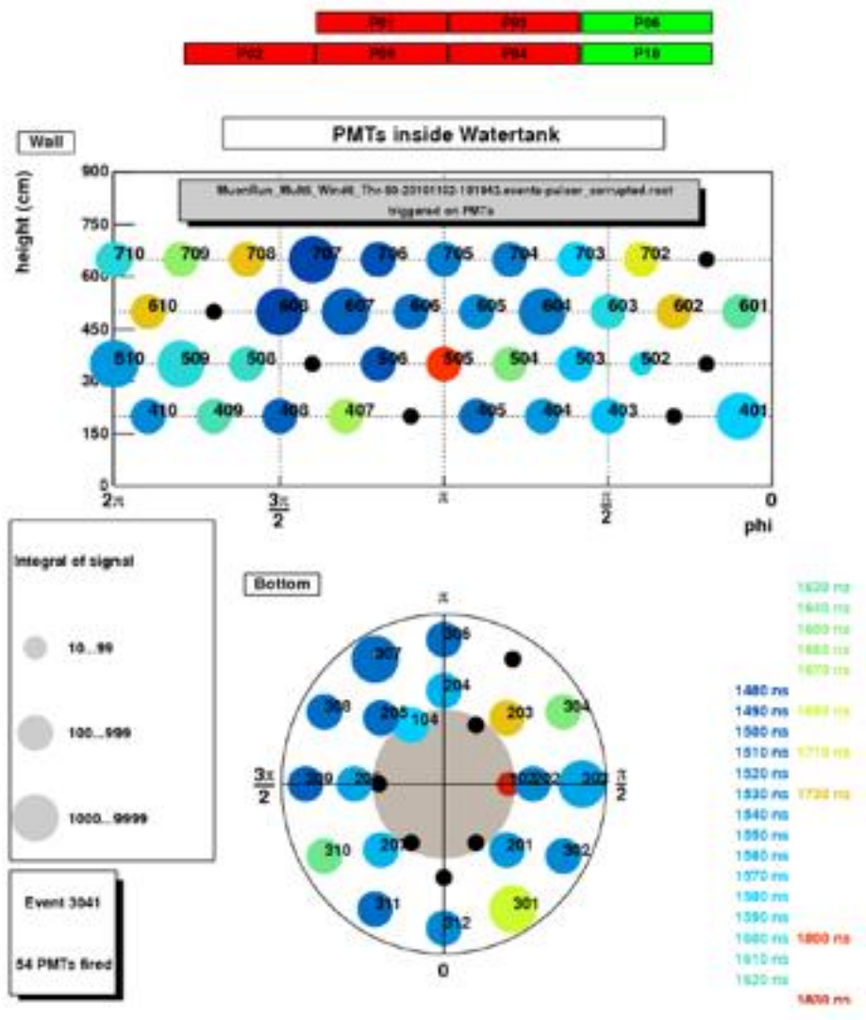
Vacuum insulated steel cryostat

Muon veto

- 580 t of water instrumented with 66 PMTs
- 4 m^2 plastic scintillator panels on the top
- Completed in 2010, fully functional

See talk T108.4





Detector handling

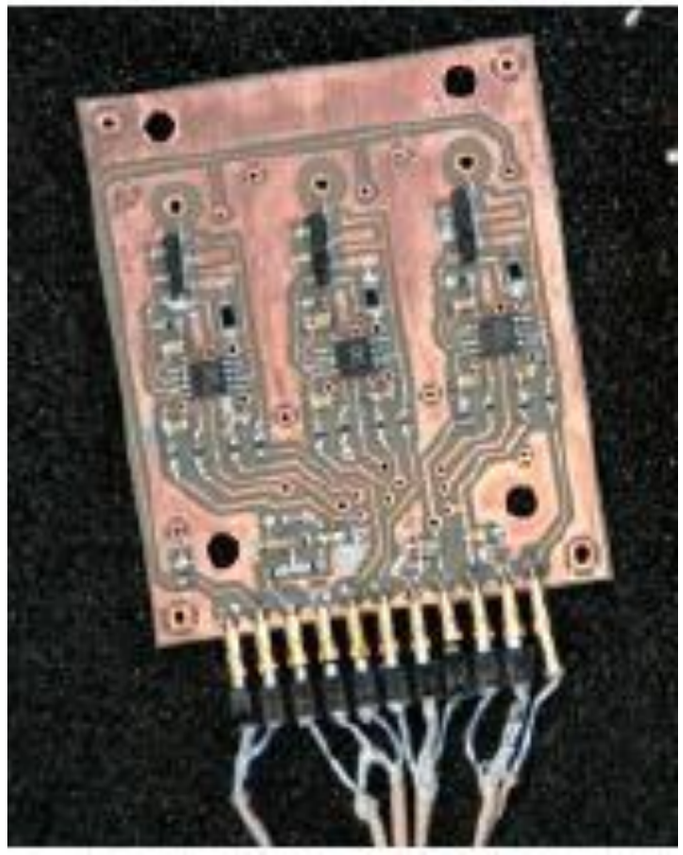
- Class 10000 clean room with a class 100 flow box inside for detector handling
- HPGe detectors never come in contact with air:
  - ★ Stored in vacuum
  - ★ Mounted in flow box in N_2

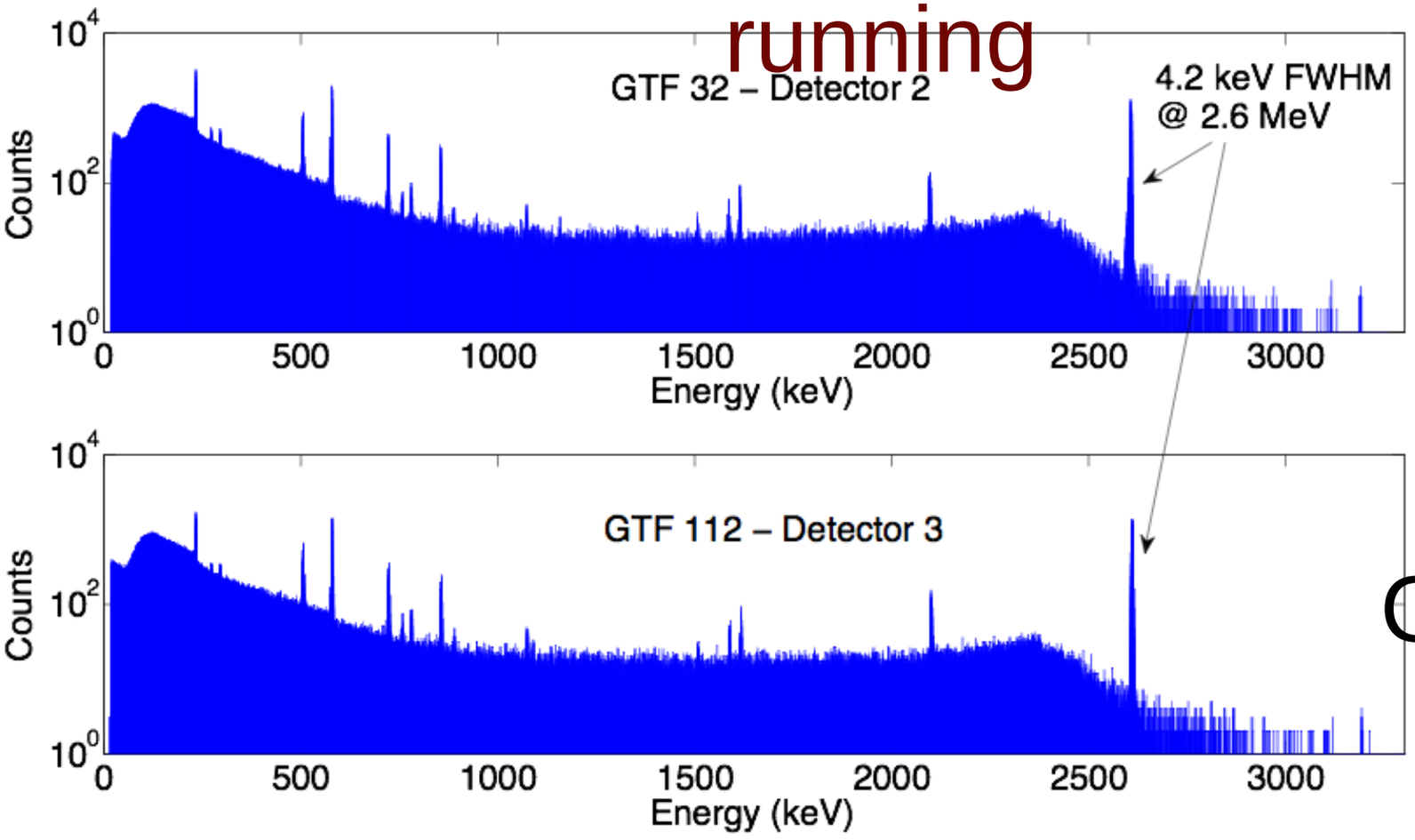
Read-out chain

- DAQ with FADCs
- Amplifiers have to be close to the HPGe

★Cryogenic **low activity** front-end

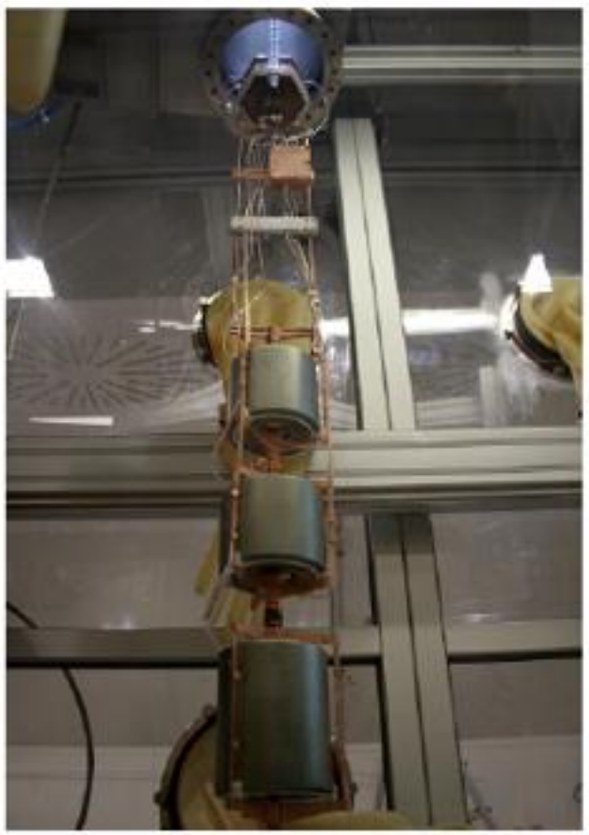
All up and running



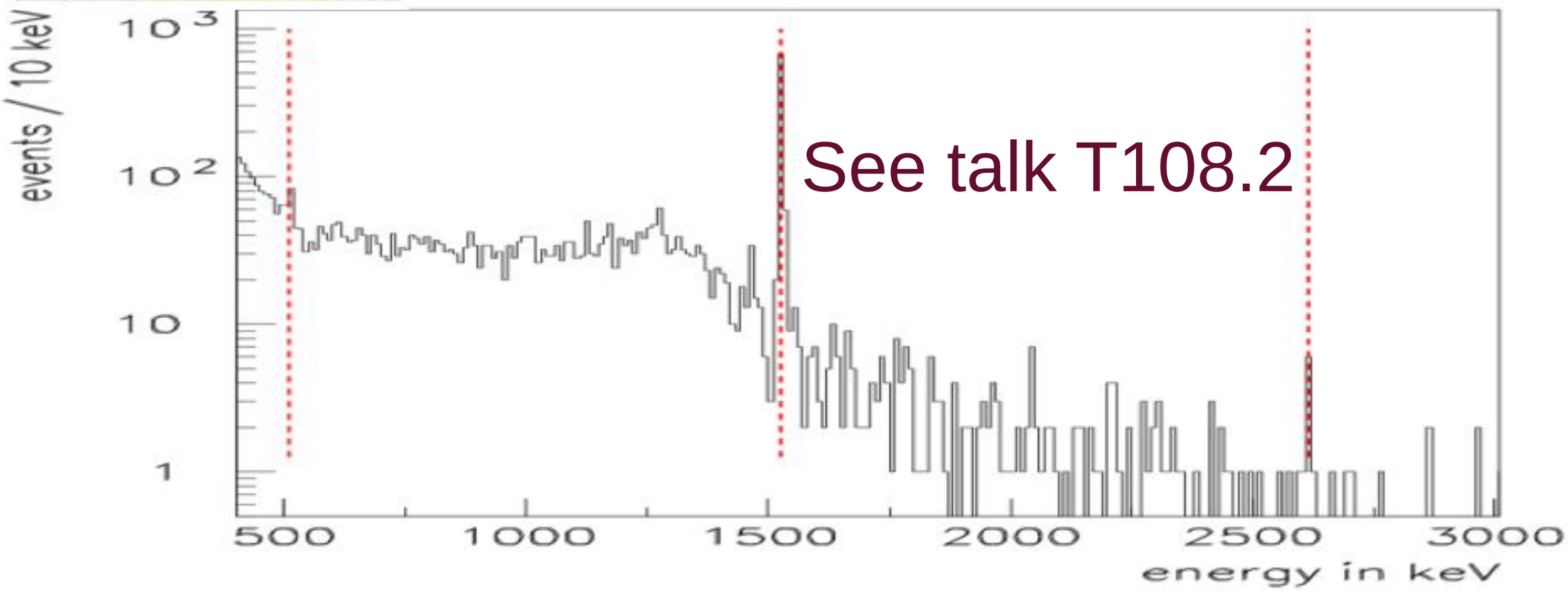


Calibration Spectra with ^{228}Th source

Commissioning runs

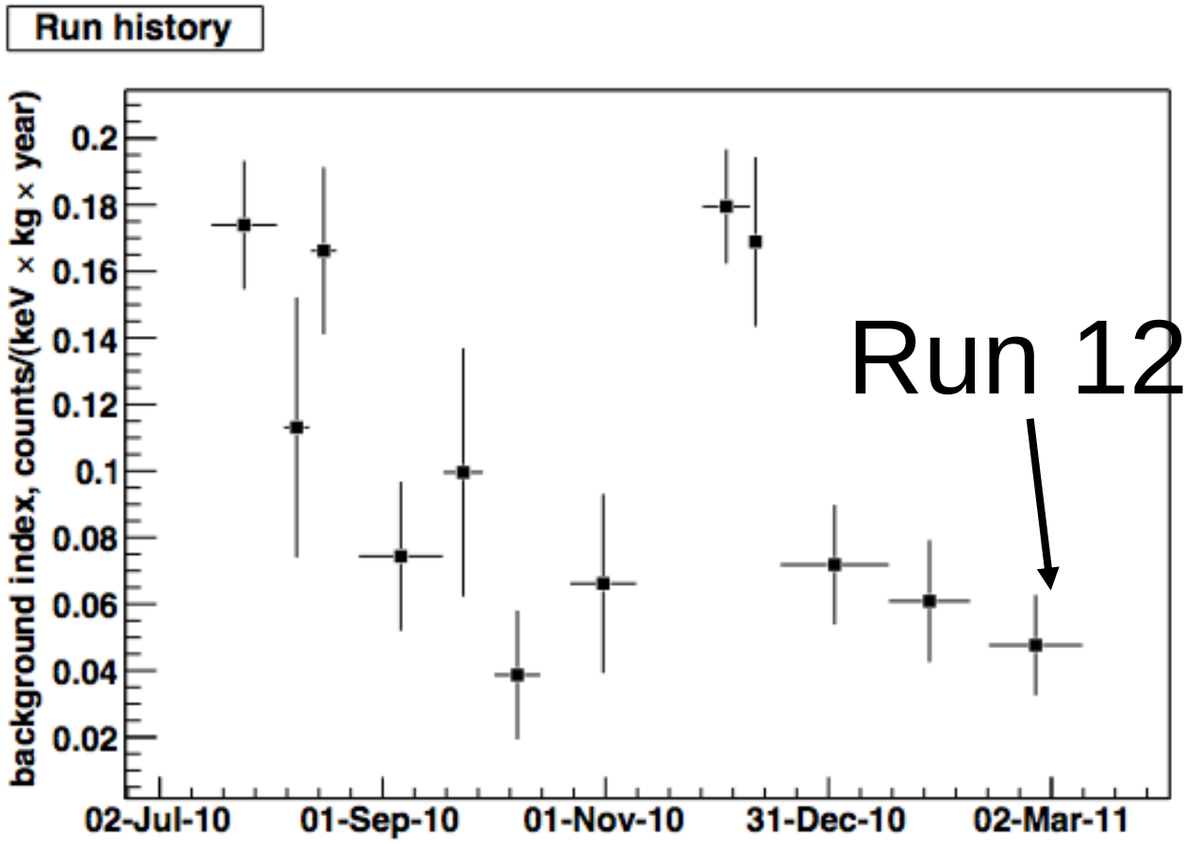


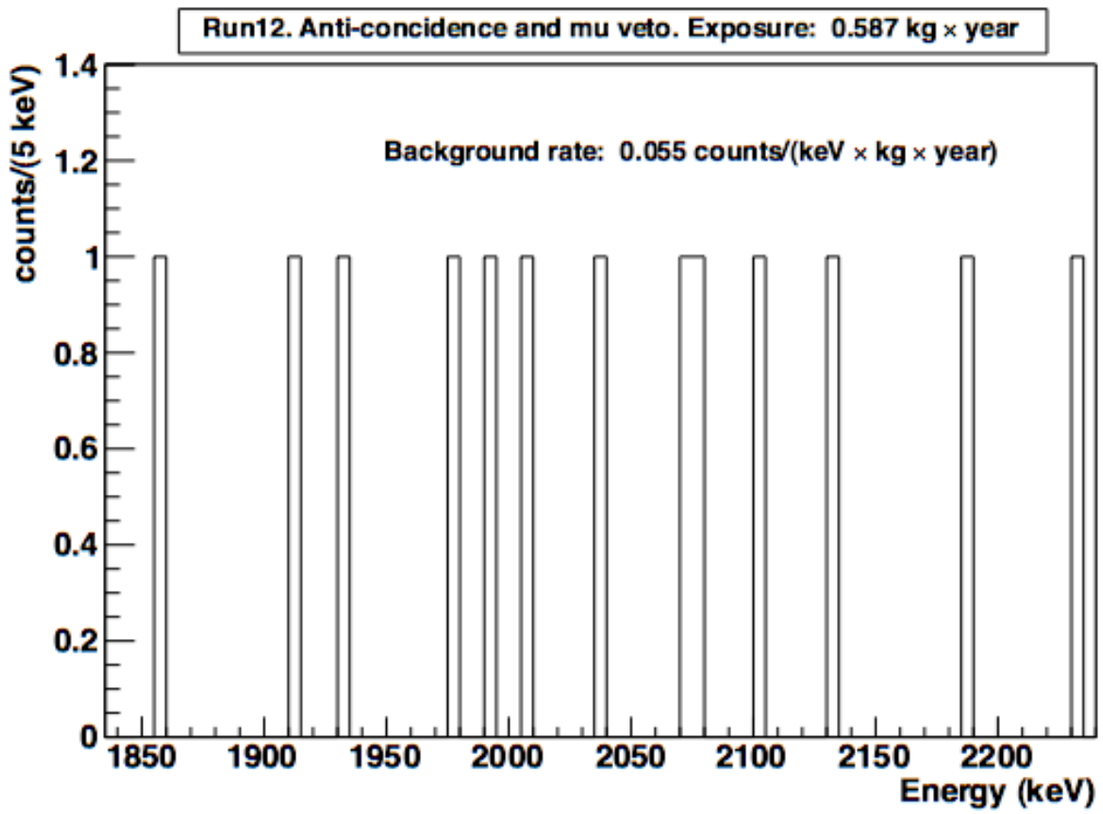
- One string operated with 3 natural Ge detectors
- Taking data since June 2010
- 1.7 kg/y data collected with non-enriched detectors
- Background level already better than in the H-M experiment
- Main background source $^{42}Ar/^{42}K$



See talk T108.2

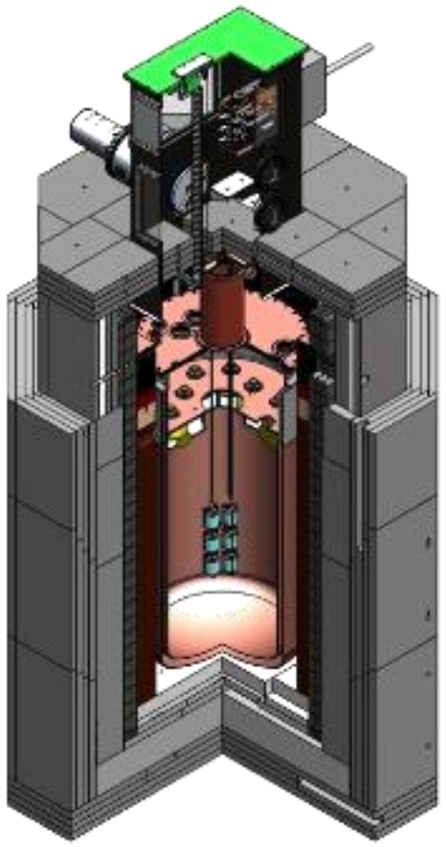
Commissioning runs





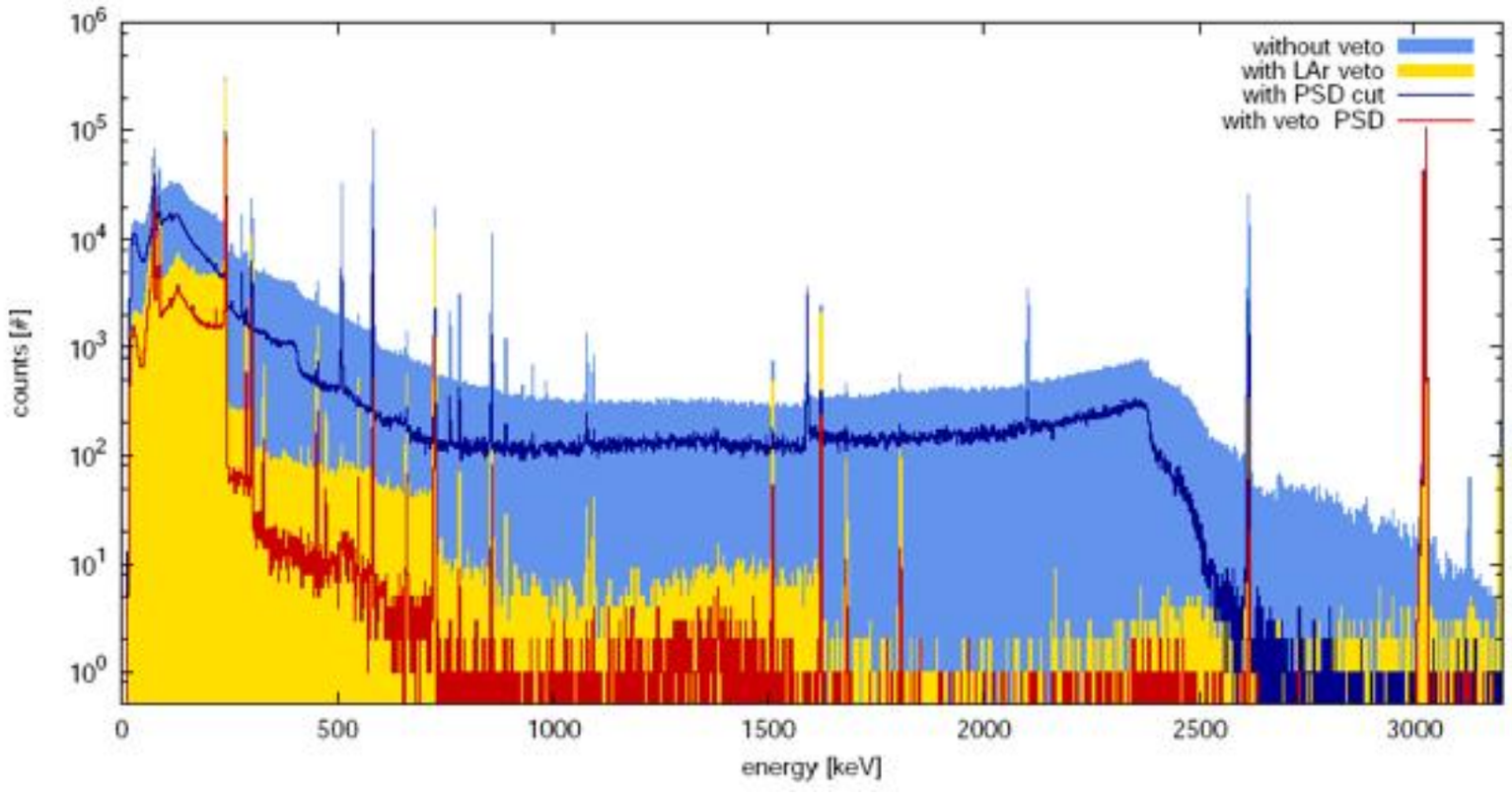
- Background level of 0.055 cts/(keV kg y) reached.
- Commissioning will take some time because we need weeks to see a few hits

LArGe facility at LNGS



- R&D project for LAr instrumentation
- 1t LAr low background cryostat at LNGS
- LAr scintillation light read out with 9 PMTs
- + low background HPGe detectors

Spectacular suppression of the Compton background around 2MeV



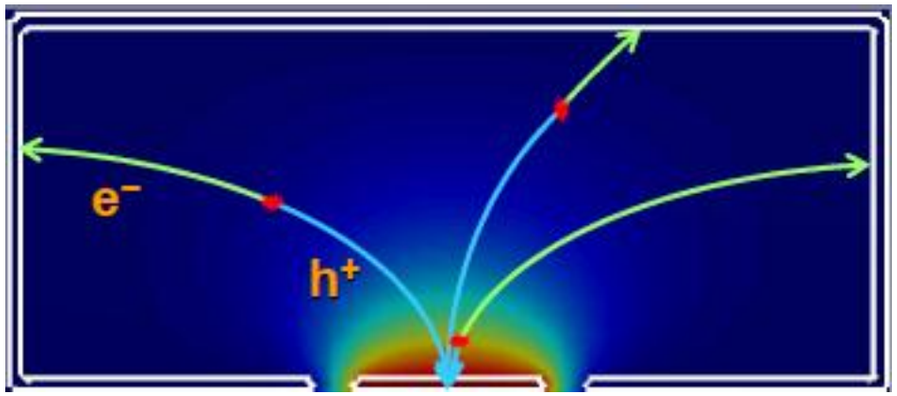
R&D for Phase II

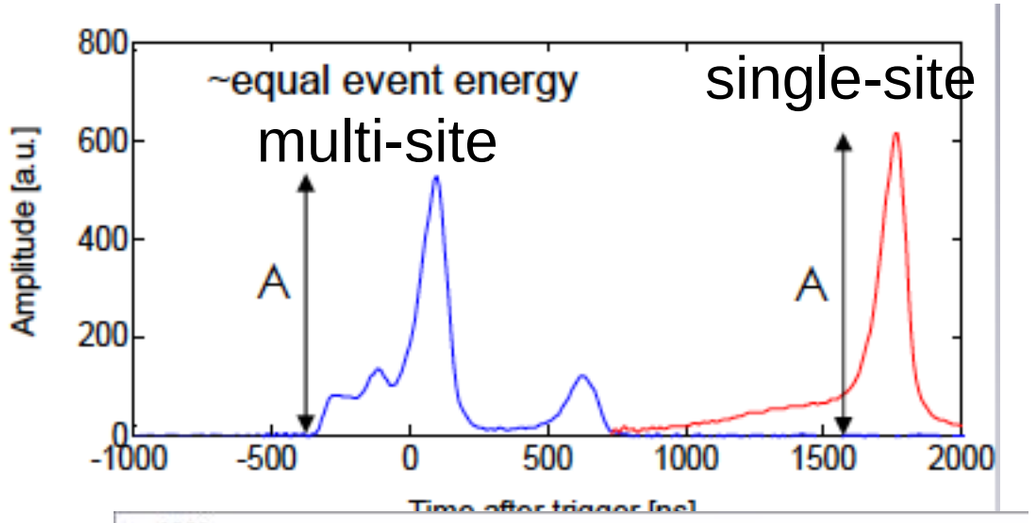
- 53 kg of enriched GeO_2 reduced and purified
- 36.6 kg Ge metal produced out of which 35.4 kg is 6N purity and is available for detector production
- Stored underground in the Rammelsberg mining museum, Goslar

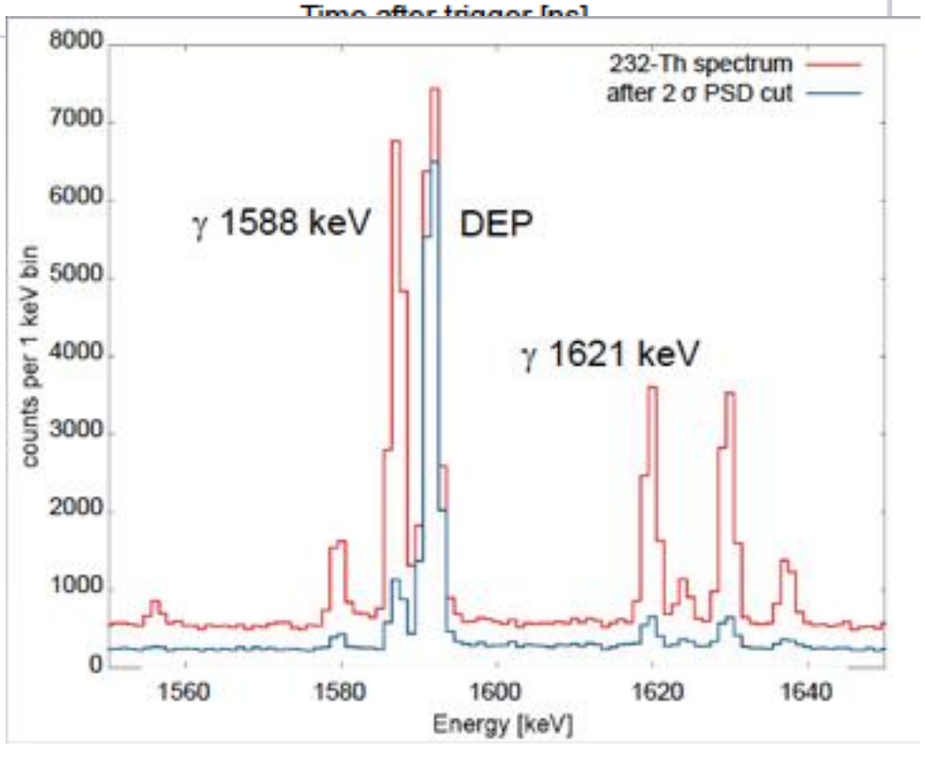
- Cosmogenic ^{68}Ge and ^{60}Co two orders of magnitude less than in equilibrium

R&D for Phase II

- BeGe's are the preferred candidates for Phase II
- Good Pulse Shape Discrimination capabilities and commercially available
- BeGe detectors produced from depleted Ge



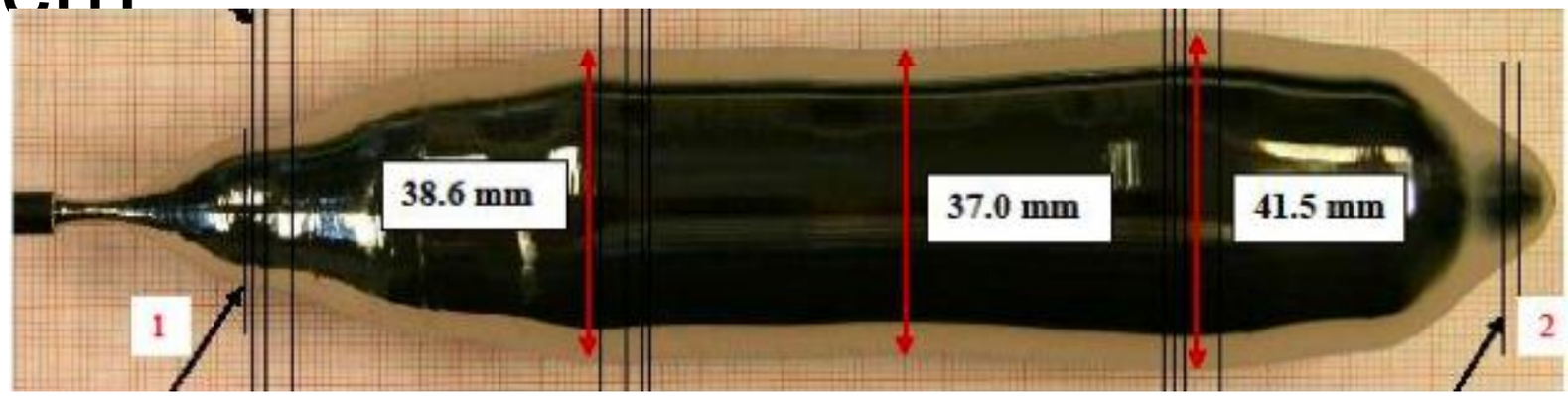


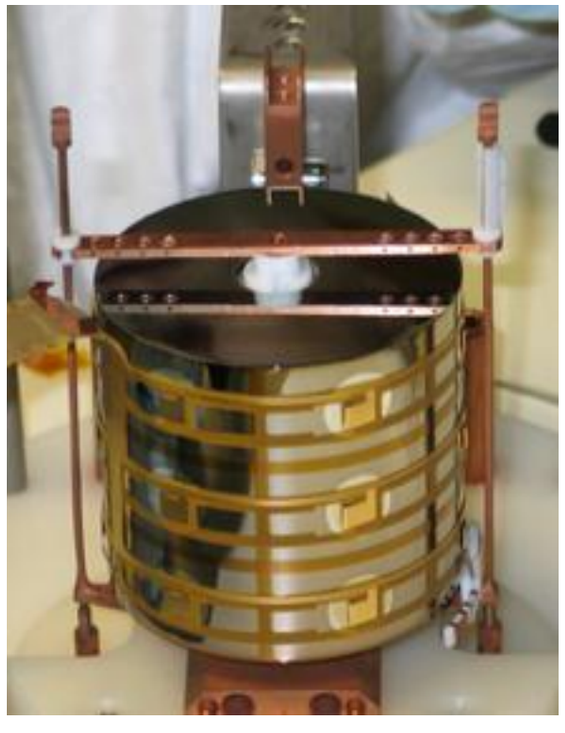


See talks T104.5, T108.3

R&D for Phase II and beyond

- Crystal pulling at Institute für Kristallzüchtung (IKZ) continues
  - One crystal with imp. conc. 4×10^{10} / cm^3





- Segmented detector R&D is continuing

See talk T61.7

Conclusion

- Construction of GERDA is finished
- We are taking data with natural Ge detectors
- Background level already lower than in the H-M experiment
- Enriched detectors will be deployed soon
- The preparation of Phase II is progressing