TG11 – Overview

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Outlook

- Update on hardware
  - Ge-spectrometers (HD-Ge, GeMPI III/IV)
  - Counter filling line
  - Rn monitor
- New results
  - Rn daughters in LN_2/LAr, Po removal from Ge (K. Pelczar)
  - Rn daughters removal from steel (M. Wojcik, this talk)
  - γ ray screening (this talk)
  - Rn emanation tests
    - Cryostat – following talk
    - Other samples – Hardy's talk
- Future activities

Ge detectors

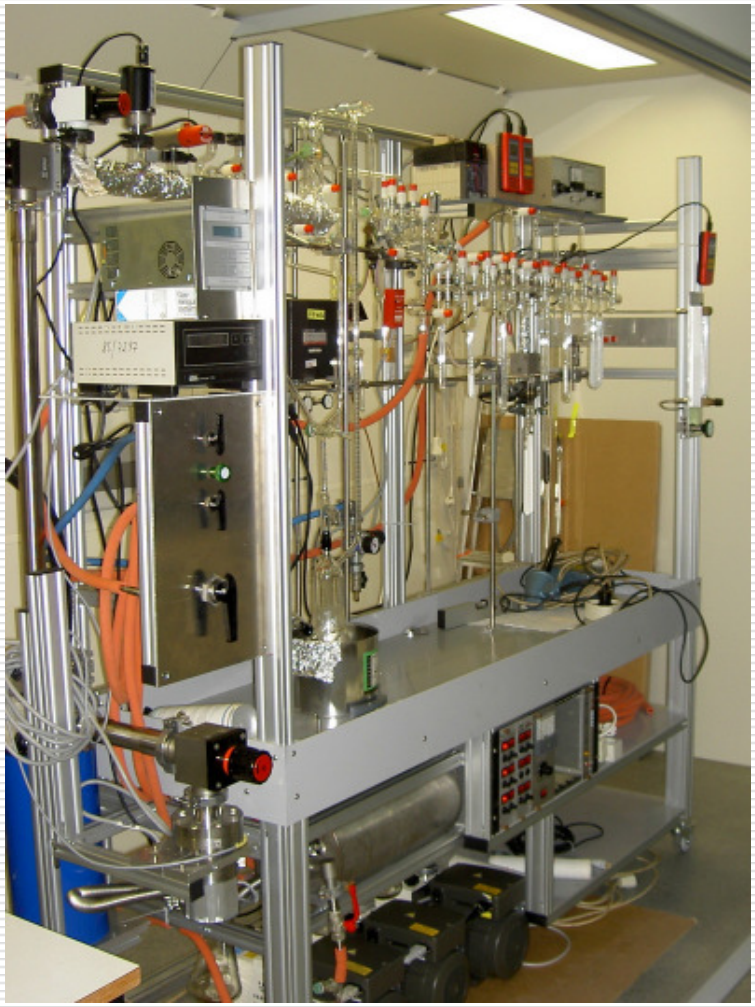
Heidelberg

- Bruno and Corrado are working
- Adam – no muon veto, underground unknown
- Dario – not working
- A new detectror with improved sensitivity to be installed in the LLL in the next future by G. Heusser

Gran Sasso (GeMPI's)

- The detectors suffered from the ^{207}Bi contamination, which could not be removed by etching of the cryostat parts (GeMPI IV)
- In April GeMPI III was removed from the shield and with GeMPI IV transported to Heidelberg
- The crystals will be refurbished and mounted in electropolished cryostats (soft parts new) by Canberra
- Installation of the detectors at GS should happen this year

New counter filling line

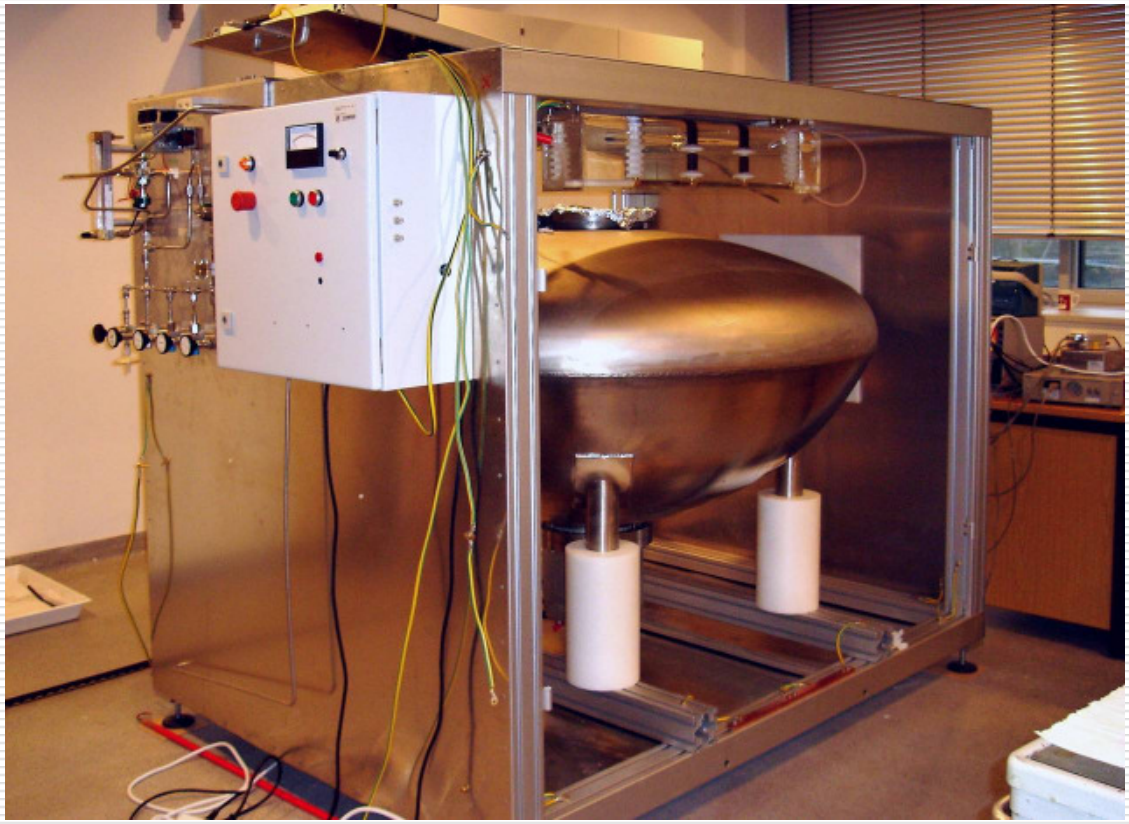


For the further Rn measurements at GS a new counter filling line and a new counting system is needed.

A new glass line is ready at MPI-K. After tests measurements it will be shipped to GS and installed in front of the GALLEX/GNO Faraday cage (space is available).

It was also decided to dismount the GNO electronics and install instead a new counting system based on a fast FADC (similar system is used in HD).

Radon monitor



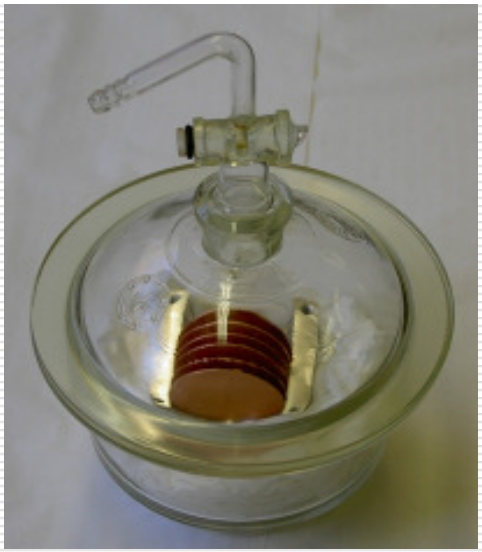
First calibration tests have been performed

Nitrogen gas:
HV ~30 kV
t ~ 24 h
D.L. ~100 μBq/m^3

Argon gas:
HV ~9 kV
t ~ 24 h
D.L. ~200 μBq/m^3

Detector to be ready for shipping in Sept. 2008

Rn daughters removal from Cu



- Screening of ^{210}Po with an alpha spectrometer
  50 mm Si-detector, bcg ~ 5 α/d (1-10 MeV)
  sensitivity ~ 20 mBq/m^2 (100 mBq/kg, ^{210}Po)
- Screening of ^{210}Bi with a beta spectrometer
  2×50 mm Si(Li)-detectors, bcg ~ 0.18/0.40 cpm
  sensitivity ~ 10 Bq/kg (^{210}Bi)
- Screening of ^{210}Pb (46.6 keV line) with a Ge spectr.
  25 % - n-type HPGe detector with an active and a passive shield, sensitivity ~ 20 Bq/kg
- Only small samples can be handled – artificial contamination
  needed: copper discs (50 mm diam.) loaded with ^{222}Rn daughters (1.4 MBq source, few months exposure time)
- Etching and electropolishing was tested

- Etching does not affect ^{210}Po and removes most of ^{210}Pb and ^{210}Bi (> 98 %)
- Long electropolishing reduces ^{210}Po activity by a factor of ~ 400 – much more effective than etching
- Electropolishing removes ^{210}Pb and ^{210}Bi more effective than etching (99.5 % ^{210}Bi and 99.9 % ^{210}Pb removed)
- Multi-stage polishing with fresh electrolyte each time seems to be the right strategy for effective copper surface cleaning

Rn daughters removal from steel

Discs exposed to Rn for 6 months. Cleaning according to the "BAMA" recipe: - etching in 20 % HNO_3 + 1.7 % HF + water
- passivation in 15 % HNO_3 + water
- rinsing with distilled water

Is	Original activity [cpm]	After 1st cleaning [cpm]	Reduction factor R	Amount of removed Cu	Remarks
^{210}Pb	6.87 ± 0.08 1.48 ± 0.09	0.15 ± 0.01 0.030 ± 0.004	46 49	3.1 mg/cm^2 4.0 μm	Etching time = 50 min
^{210}Bi	147 ± 3 18.6 ± 0.4	4.0 ± 0.1 0.60 ± 0.03	37 31		
^{210}Po	16.5 ± 0.5 1.83 ± 0.04	0.88 ± 0.07 0.41 ± 0.02	19 45		

Rn daughters removal from steel

Is	Original activity [cpm]	After 2nd cleaning [cpm]	Reduction factor R	Amount of removed Cu	Remarks
^{210}Pb	0.15 ± 0.01 0.030 ± 0.004			0.84 mg/cm^2 1.1 μm	Etching time = 90 min
^{210}Bi	4.0 ± 0.1 0.60 ± 0.03	0.21 ± 0.02	19		
^{210}Po	0.88 ± 0.07 0.41 ± 0.02				

Is	Original activity [cpm]	After 3rd cleaning [cpm]	Reduction factor R	Amount of removed Cu	Remarks
^{210}Pb	0.15 ± 0.01 0.030 ± 0.004	< 0.0044 < 0.0049	> 34 > 6	1.1 mg/cm^2 1.4 μm	Etching time = 120 min
^{210}Bi	0.21 ± 0.02 0.60 ± 0.03	0.048 ± 0.019 0.017 ± 0.019	4 35		
^{210}Po	0.88 ± 0.07 0.41 ± 0.02	0.029 ± 0.003 0.014 ± 0.002	30 29		

Rn daughters removal from steel

Is	Original activity [cpm]	After cleaning [cpm]	Reduction factor R	Amount of removed Cu	Remarks
^{210}Pb	6.34 ± 0.07 2.11 ± 0.03	0.0318 ± 0.0025 0.0159 ± 0.0020	199 132	4.3 mg/cm^2 5.5 μm	Etching time = 120 min Solution stirred during etching
^{210}Bi	138 ± 2 36.7 ± 0.4	0.79 ± 0.06 0.21 ± 0.02	174 174		
^{210}Po	24.7 ± 0.2 5.2 ± 0.1	0.55 ± 0.02 0.30 ± 0.01	45 17		

- Etching removes ~μm of material
- Removal efficiency for ^{210}Pb, ^{210}Bi, ^{210}Po and ^{226}Ra is high (better than for Cu)
- Passivation makes the process less effective
- Electropolishing still to be tested

γ-ray screening

Sample	Specific activity [Bq/kg]			
	^{228}Th	^{232}Th	^{226}Ra	^{40}K
TEONEX foil, DuPont (AS)		< 0.0014	< 0.002	< 0.0036
Cu etching solution (HS)	< 0.3		< 0.15	0.97 ± 0.55
Hall A Dust (HS)	14.8 ± 0.6		20.5 ± 1.0	157 ± 9
Clean room dust, rough fraction (HS)	14.0 ± 2.7		12.6 ± 1.1	458 ± 27
Clean room dust, fine fraction (HS)	232 ± 9		105 ± 2.4	1227 ± 69
PMT Glass, DC (HS)	0.12 ± 0.06		0.99 ± 0.02	0.38 ± 0.20

Further activities

- Cryostat – further emanation measurements
- Ge spectrometry / Rn emanation – regular tests of GERDA components
- Rn and Rn daughters in LAr – further test to understand/control the phenomena (Rn sweeper, deposition of daughters on Ge)
- Rn daughters removal from steel (electro-polishing) and Ge surfaces (for Ge the procedure to be defined)
- Calibration of the radon monitor
- Reinstallation of GeMPI III and GeMPI IV at GS
- Construction of a new Ge spectrometer in HD