TG11 – Overview and ^{222}Rn emanation results

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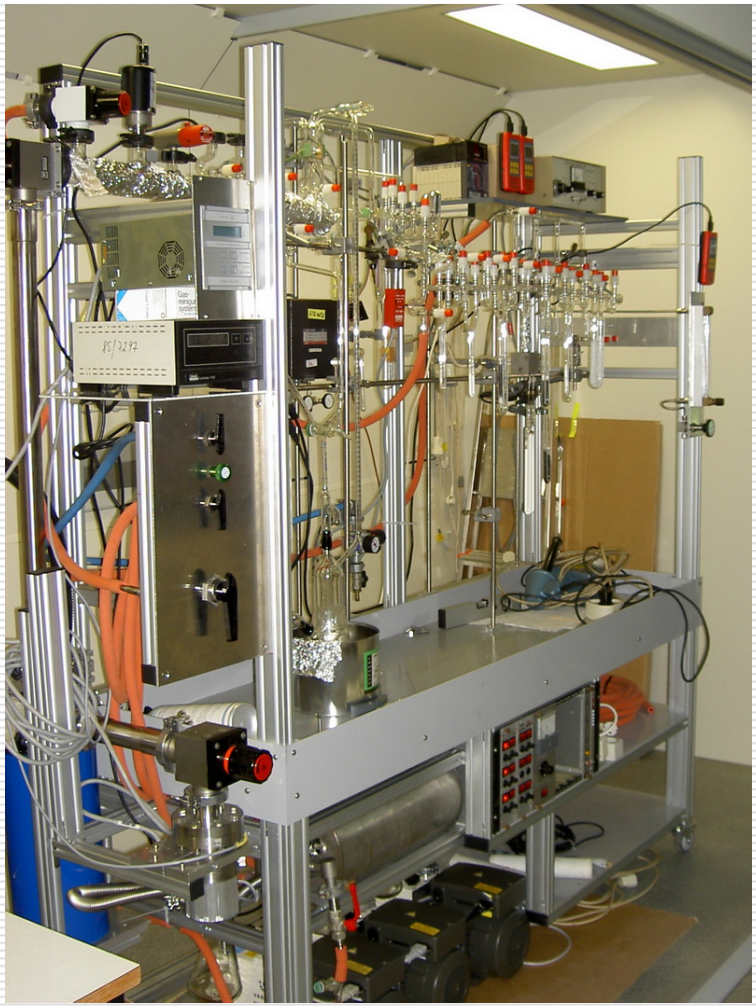
Outlook

- Update on hardware
  - Counter filling line
  - ^{222}Rn monitor
- New results
  - ^{222}Rn and ^{222}Rn daughters in LN_2/LAr (K. Pelczar)
  - Cosmic ray activ. of GERDA steel (G. Heusser)
  - γ ray screening (this talk)
  - ^{222}Rn emanation tests
    - Cryostat
    - Small samples (components of lock, cryostat, ...)
- Future activities

New counter filling line



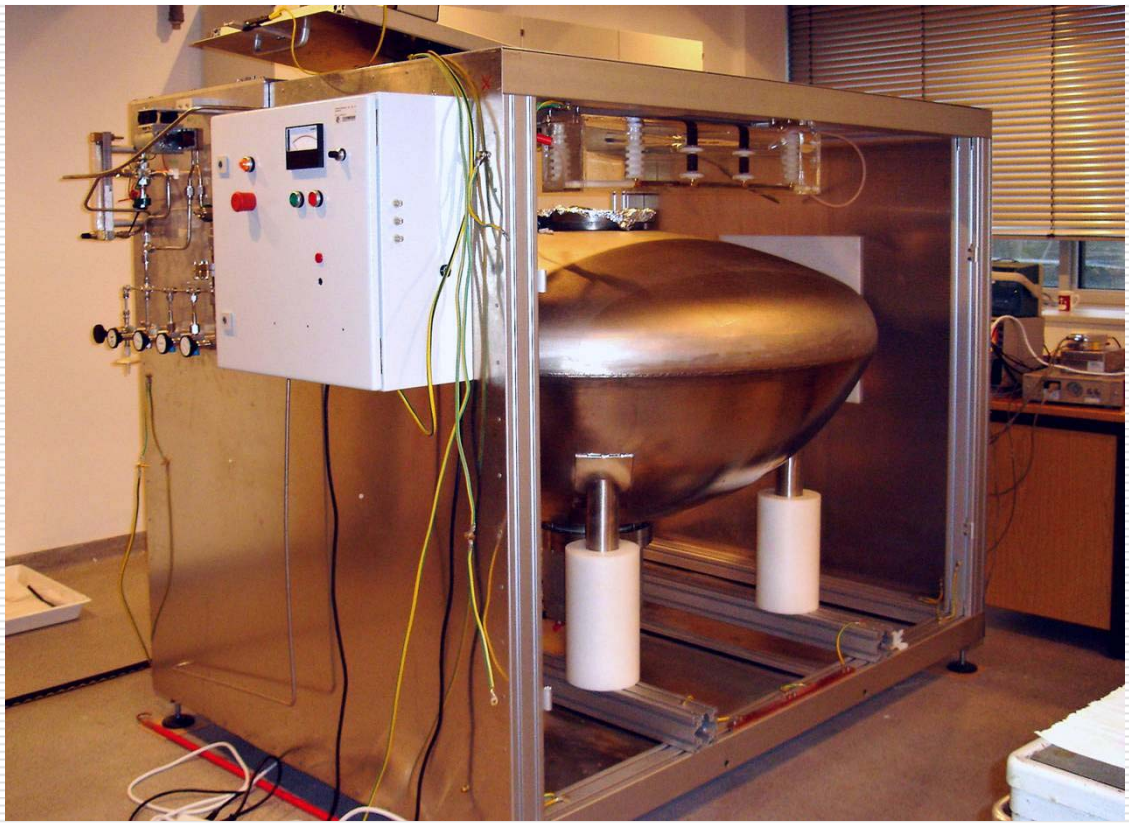
For the further Rn measurements at GS a new counter filling line and a new counting system is needed.

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).

First blank measurements have been performed showing very good performance of the system (B ~2 cpd, comparable with the old line).

Radon monitor



First calibration tests with larger PIN-diode (20×20 mm) have been performed

Air:

HV 37 kV
E_{214} 40 %
E_{218} 25 %

Argon:

HV 10 kV
E_{214} 50 %
E_{218} 30 %

Det. Limit ~200 μBq/m^3

Detector to be ready for shipping in March 2009

New results: ^{222}Rn in LN_2/LAr

- High voltage is not the only one reason for observed ^{222}Rn activity increase in a long time scale
- A Faraday cage around discs (at the same potential) lowers collection efficiency of ^{222}Rn daughters ~4 times
- The activity of ^{222}Rn daughters collected on a steel disc may depend on an impurities concentration in LN_2

New results: activation of steel and Cu

- Cosmic activation of steel and copper (irradiation for ~1 year at the surface) has been investigated (Ge spectr.)
- Interpretation of deviation from secular equilibrium in the U/Th chains: dating stainless steel production?
- Comparison of cosmogenic production rates in Cu with Monte-Carlo simulations.

New results: γ-ray screening

Sample	Specific activity [mBq/kg]				
	^{228}Th	^{232}Th	^{226}Ra	^{40}K	^{60}Co
TEONEX PEN foil, DuPont		< 1.4	< 2.0	< 3.6	
Coax cable from Milano Bicocca	1.3 ± 0.4		1.4 ± 0.4	90 ± 12	< 0.37
Coax cable Habia SM50, Cu alloy, PTFE	1.1 ± 0.5		< 1.4	400 ± 40	< 0.31
Steel for cable guides	0.55 ± 0.15		0.80 ± 0.25		13.0 ± 0.7
Energy chains	2.2 ± 0.4		0.97 ± 0.40	< 3.1	190 ± 40
Hall A Dust (fine and rough)	14800 ± 600		20500 ± 1000	157000 ± 9000	
Hall A dust, (only fine)	18201 ± 933		19689 ± 647	275823 ± 14044	

^{222}Rn emanation - cryostat

- Tolerable value: 14 mBq $\rightarrow$ 10^{-4} cts/(kg·keV·y) assuming homogenous ^{222}Rn distribution (GSTR-07-020)
- The cryostat is closed using a metal-sealed (Helicoflex gasket) flange equipped with necessary ports
- Pumped down to min. 1 mbar (removal of air-born Rn) and filled with ^{222}Rn-free nitrogen (online purification) minimum twice
- After ~2 weeks cold and ^{222}Rn-free nitrogen is filled again (just before measurements) in order to mix the gas inside the cryostat
- Two samples of some 10 m^3 are extracted and the measured activity is scaled to the full volume
- Total time needed for a full test ~21 days

^{222}Rn emanation - cryostat

Sample description	Single results [mBq]	Adopted value [mBq]	Comments
1st test, SIMIC in Nov. 2007	16.9 ± 1.6 29.8 ± 2.4	~30	Empty cryostat after cleaning, no N_2 mixing prior to extractions
2nd test, SIMIC/GS in March 2008	13.6 ± 2.5 13.7 ± 2.8	13.7 ± 1.9	Empty cryostat, additional cleaning performed at SIMIC
3rd test, GS in April 2008	120 ± 5 121 ± 5	121 ± 4	Cu shield inside, after evaporation test
4th test, GS in June 2008	33.0 ± 7.5 35.7 ± 9.3	34.4 ± 6.0	6 weeks after the 3rd test

Measured activity still above allowed level of 14 mBq. Cleaning done in the last week, preparation for following measurements (including check of ^{222}Rn (in)homogeneity in the cryostat) are ongoing.

^{222}Rn emanation – other samples

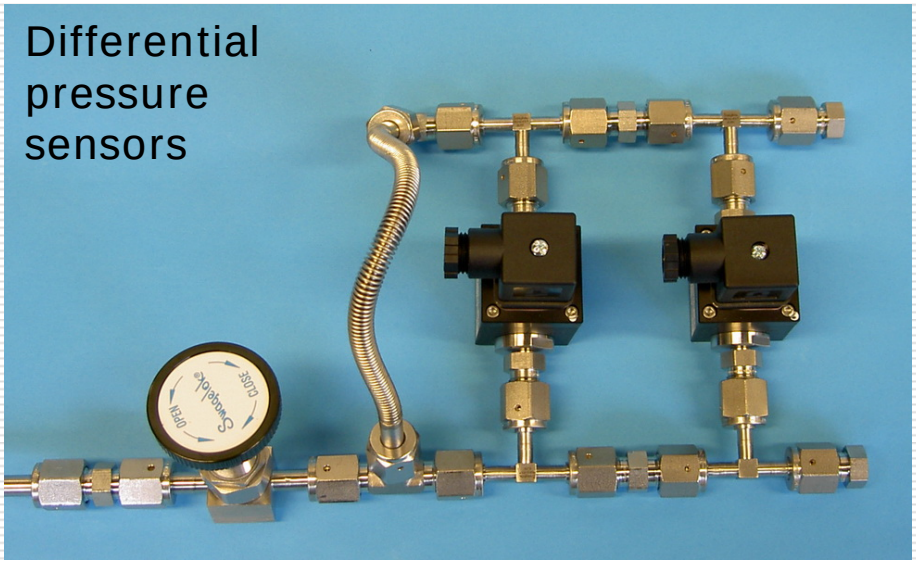
Sample	Emanation rate	Remarks
DG 13 micro switches (smaller)	(1.6 ± 0.6) μBq/piece	Lock
XCG5 micro switches (bigger)	(9.1 ± 1.7) μBq/piece	Lock
BD differential pressure sensors	(39 ± 6) μBq/piece	Lock
Thermovac pressure gauges	< 6.3 μBq/piece	Lock
Contact pins (size 20 IMC)	< 0.4 μBq/piece	Lock
4 wire cable lake shore	< 4.9 μBq/m	
KIMTECH lint-free wipes	(5.7 ± 0.1) μBq/piece	
Polyamide tube (10 m, 8 × 1 mm)	< 7.1 μBq/m	Installed in the cryostat
Vacuum insulated SS tube (10 m)	(24 ± 3) μBq/m	DeMaCo, LAr supply
Flexible SS tube with CF-40 flanges (10m)	(4.8 ± 1.7) μBq/m	To be installed in the cryostat
Swagelok ½“ flexible tube with VCR connectors (15 m)	(32 ± 3) μBq/m	

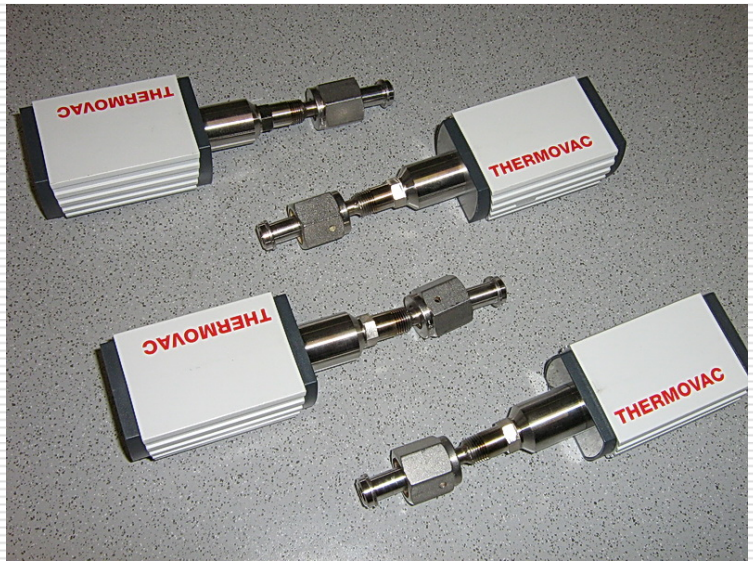
^{222}Rn emanation – other samples

Sample	Emanation rate	Remarks
Single-use nitrile gloves (yellow, batch 1)	(2.1 ± 0.2) mBq/piece	
Single-use nitrile gloves (yellow , batch 2)	(2.7 ± 0.1) mBq/piece	
Multiple use nitrile gloves (green)	(75 ± 5) mBq/piece	Used in clean benches
Multiple use viton gloves (black)	(6.4 ± 1.3) mBq/piece	
SIMIRT O-rings (15.9 × 2.6 mm)	(34 ± 2) μBq/piece	Lock
EPDM O-rings from HiTech	(3.9 ± 0.5) μBq/piece	Lock
Kalrez O-rings (DuPont, black)	(2.3 ± 0.4) μBq/piece	Lock
IGLIDUR bearings	(1.4 ± 0.6) μBq/piece	Lock
Black insulation foam	(99 ± 6) mBq/kg	

^{222}Rn emanation – other samples

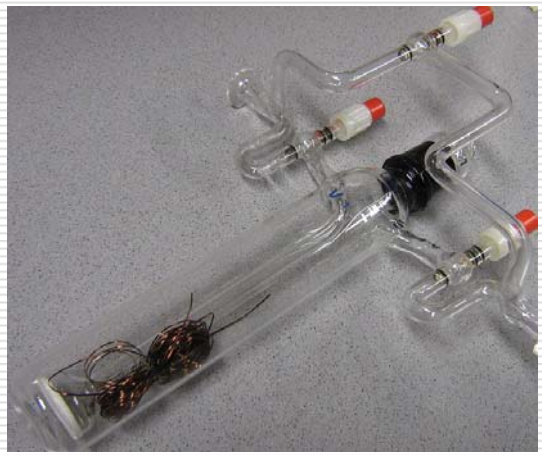
Differential pressure sensors





Thermovac gauges

Contact pins



4 wire cable

^{222}Rn emanation – other samples

KIMTECH wipes

Swagelok ½“ flexible tube

Kalrez O-rings

^{222}Rn emanation – other samples

Viton gloves

IGLIDUR bearings

Insulation foam

Further activities

- Cryostat – ^{222}Rn emanation measurements after cleaning (^{222}Rn homogeneity check)
- Ge spectrometry / ^{222}Rn emanation – regular tests of GERDA components (e.g. systematic investigation of steel welds)
- ^{222}Rn and ^{222}Rn daughters in LAr – further test to understand/control the phenomena (^{222}Rn sweeper, deposition of daughters on Ge)
- ^{222}Rn daughters removal from HPGe surfaces (some of Ge-discs already exposed)
- Final tests of the radon monitor
- Reinstallation of GeMPI III and GeMPI IV at GS
- Construction of an improved Ge spectrometer in HD