TG11 summary
- Material screening -

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Summary of TG11 parallel session (Yesterday, $17h^{00}$ – $18h^{45}$)

Italy – Australia

1 : 0

Activities since Heidelberg meeting

- Further gamma spectroscopy screening measurements (focus on stainless steel)
- ICP-MS measurements
  - of steel / superinsulation foil in Russia
  - of polymeric films at LNGS (talk of S. Nisi)
- ^{222}Rn emanation measurements
- Cu surface cleaning studies (from ^{226}Ra and ^{222}Rn-daughters)
- R&D: Lucas cell with improved sensitivity

Stainless steel measurements

- 3 samples measured:
  - for PMT encapsulation (from Tuebingen)
    - only γ-spectroscopy
  - 1.4429 from Acelor (same as used for KATRIN spectrometer)
    - γ-spectroscopy and ICP-MS
  - AISI 321 (Outu Kumpu)
    - γ-spectroscopy and ICP-MS
- Matthias L. provided long list of samples measured previously at LNGS

Stainless steel measurements - [all numbers in mBq/kg]

Isotope	AISI 321 Outu Kumpu	for PMT encapsulation	KATRIN steel 1.4429
^{228}Th γ	< 1.7	2.2 ± 0.4	5.0 ± 0.4
^{232}Th ICPMS	0.5 - 0.9		20
^{226}Ra γ	< 1.6	< 2.6	2.0 ± 0.4
^{238}U ICPMS			2.7
^{60}Co	4.0 ± 0.5	17.6 ± 0.3	4.1 ± 0.2

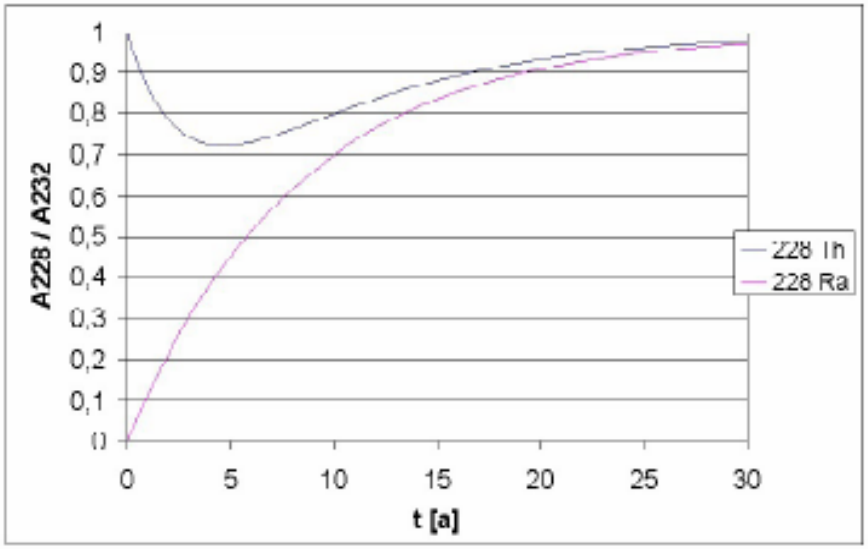
^{228}Th decay chain

^{232}Th → ICPMS

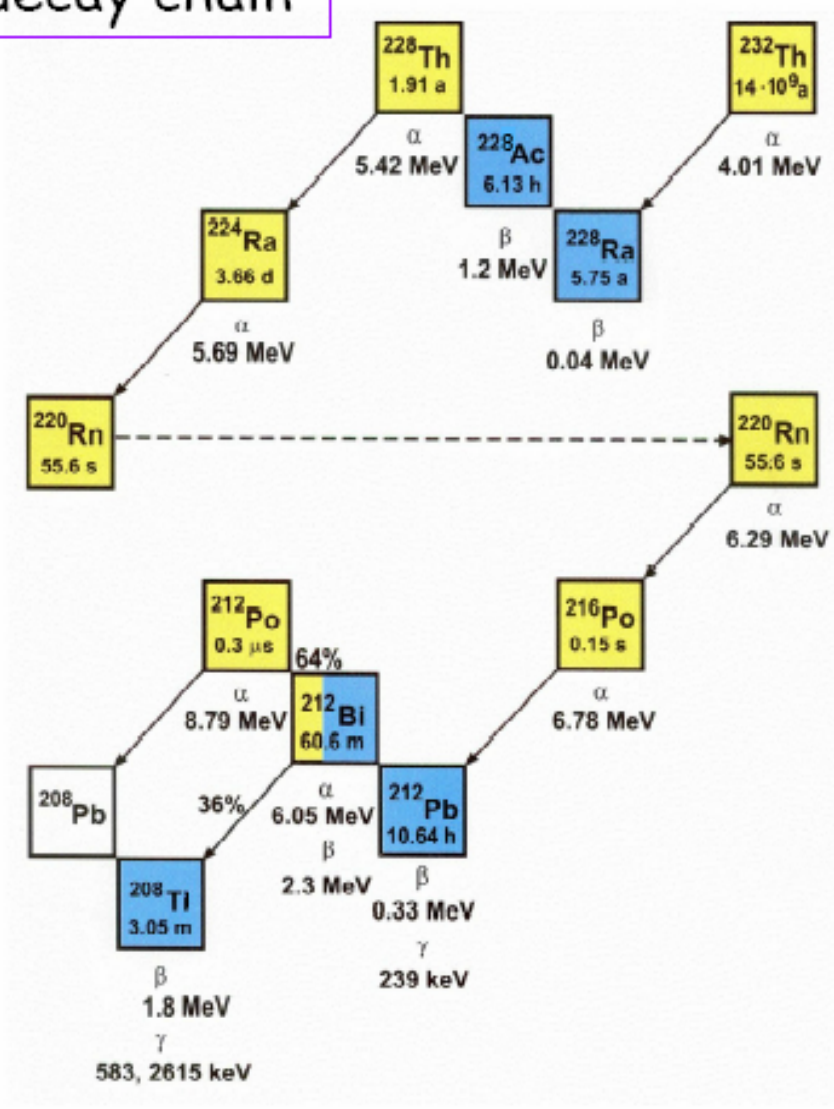
^{228}Th → γ spectrometry

Even if the ^{228}Th/^{232}Th activity ratio is disturbed by chemical treatment (removal or addition of ^{228}Ra) this ratio can never drop below 0.7

→ the ^{228}Th activity must always be greater than 70% of the ^{232}Th activity



^{232}Th decay chain



Stainless steel purity

Some more γ-spectroscopy results

- Superinsulation foil (Austrian Aerospace)
  - ^{226}Ra: 1.1 ± 0.4 mBq/kg
  - ^{228}Th: 2.3 ± 0.6 mBq/kg
- Pogo pins:
  - high in uranium (~10 Bq/kg level), but low in radium (<80 mBq/kg)
  - but high in thorium (430 mBq/kg)

^{222}Rn emanation: Copper foil

^{222}Rn emanation measurements

- Stamped copper foil (200m x 0.3m x 100μm)
  - purified by rinsing just once with quartz-distilled water
- ^{222}Rn emanation rate reduced by 30%
- Further samples for GERDA lock:
  - no major ^{222}Rn sources discovered
- talk by Ingo Wiesler in TG11 session

Cu surface purification studies

- LENS electrolytic copper used to fabricate sample discs (50 mm diameter, 1 mm thickness)

- Discs cleaned applying “Majorana procedure” (5 min in 1% H_2SO_4 + 3% H_2O_2; 5 min in 1% citric acid; rinsing with distilled water)
- Discs placed for 4 months in a strong ^{222}Rn source (1.4 MBq)

Comparing etching with electropolishing

- Amount of removed material:
  - after 7 “Majorana” runs (30 min): 20.9 mg/cm^2
  - after one polishing run (35 min): 5.7 mg/cm^2
- Amount of removed ^{210}Po activity:
  - after 7 “Majorana” runs (35 min, 20.9 mg/cm^2): R_{av} = 2
  - after polishing (1 h, 4.5 mg/cm^2): R_{av} = 30
  - after long-polishing run (3 h, 20 mg/cm^2): R_{av} = 187
- Amount of removed ^{210}Pb and ^{210}Bi activity:
  - one “Majorana” run (5 min, 3 mg/cm^2): R_{Bi} = 40, R_{Pb} > 68
  - electropolishing (1 h, 4.5 mg/cm^2): R_{Bi} = 240, R_{Pb} = 1000

R&D for improved Lucas cell

- Conventional Lucas cells have some limitations due to
  - light loss (no reflectivity)
  - high U/Th concentration in ZnS
- VM 2000: reflecting, pure scintillator
- Status:
  - Prototype is working
  - Discrimination between μ/α still poor
  - Improvment expected by TPB coating
- talk by Georg Frenz in TG11 session