Status of the Calibration System

Francis Froborg

University of Zurich

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Mockup

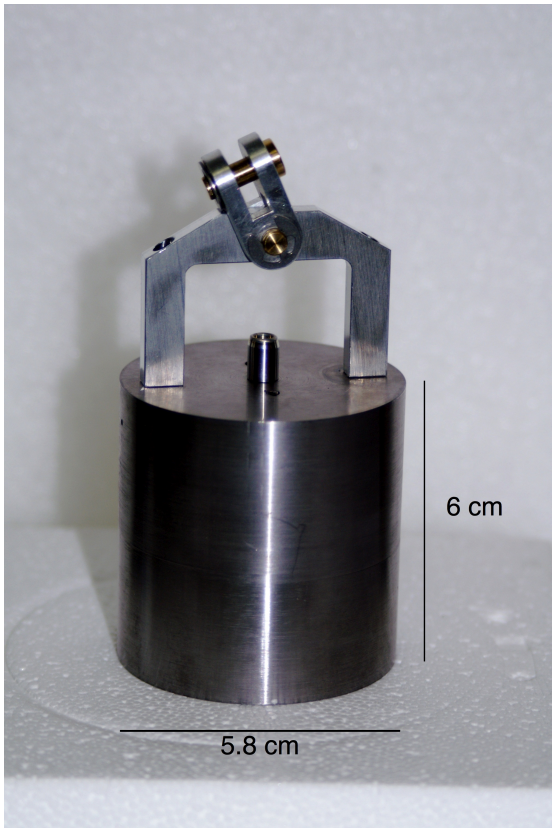
Geometry

- Ta absorber with r = 29mm and h = 60mm
- Capsule made of stainless steel
- Holder made of stainless steel and Co
- Hook analog to the one for the detectors

Tests

- 20 thermal cycles with LN
- 2 slow immersion tests

$\Rightarrow$ No problems so far!

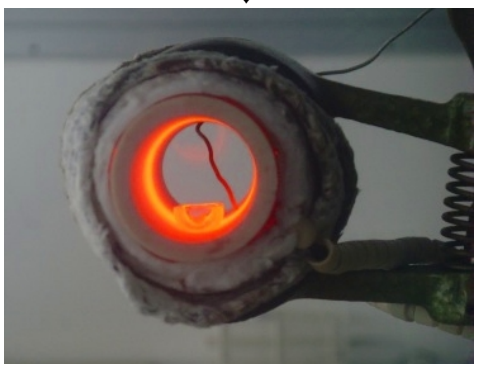


Production

17/03/2009: 20kBq $^{228}ThCl_4$ solution delivered to PSI
30/03/2009: Source preparation
06/04/2009: Encapsulation & certification: Eckert & Ziegler
04/05/2009: Source arrived in Zurich lab

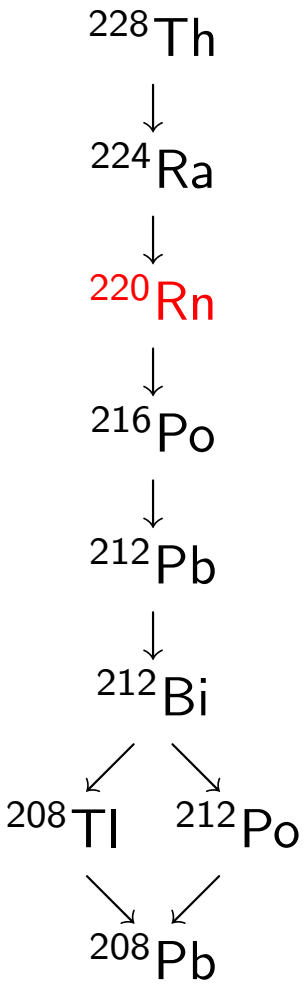
$$3ThCl_4 + 16HNO_3 \longrightarrow 3Th(NO_3)_4 + 4NOCl + 8H_2O + HCl_2$$

750° ↓ 200° ↓



$$3ThO_2 \longleftarrow + 12NO_2 + 3O_2$$

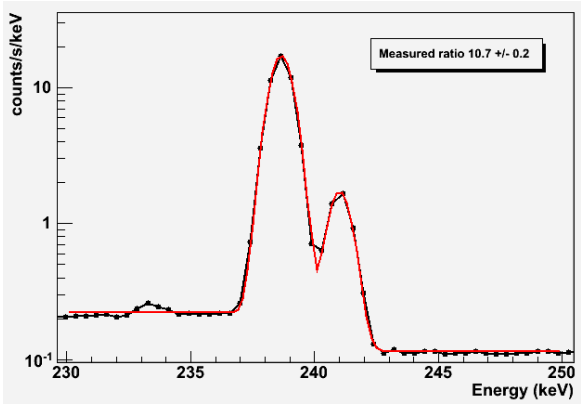
Equilibrium of Decay Chain

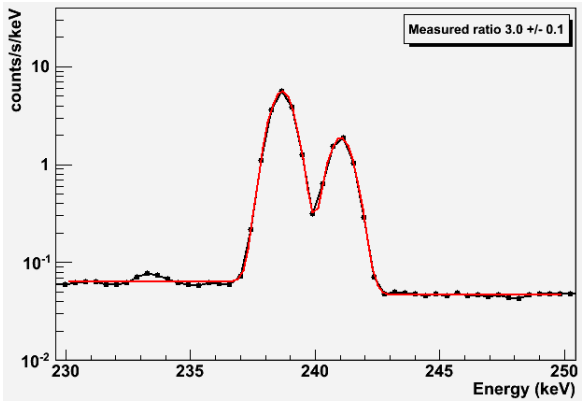


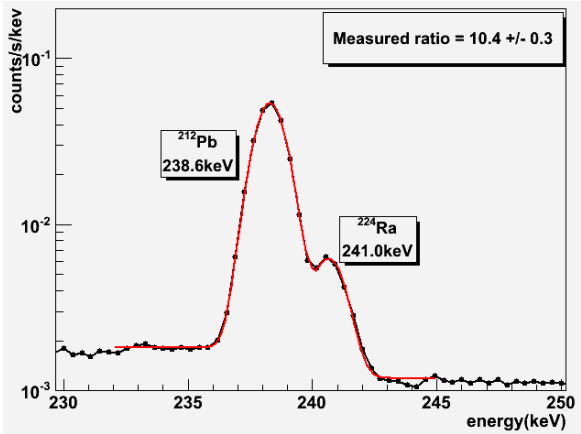
Chain breaks because of evaporating ^{220}Rn

^{224}Ra/^{212}Pb

- Published Value: $43.5/4.1 = 10.6$
- Ratio before treatment: 10.7 ± 0.2
- $\sim$ 1h after treatment: 3.0 ± 0.1
- $\sim$ 2 month after treatment: 10.4 ± 0.3







Activity

PSI

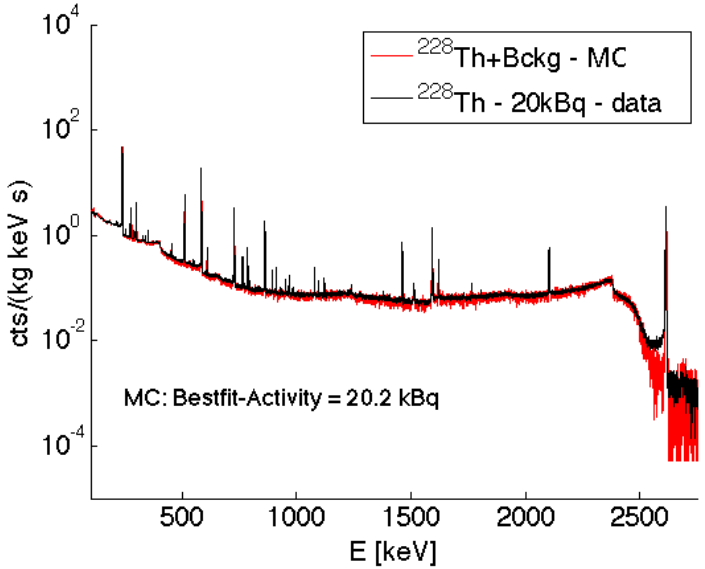
- Comparison of ^{224}Ra peak before and after treatment
- Activity: A $\simeq$ 17kBq

UZH

- Comparison of MCS with UZH measurements
- Activity: A $= 20.2 \pm 1.0$kBq

Gator

- Started measurements
- Analysis ongoing



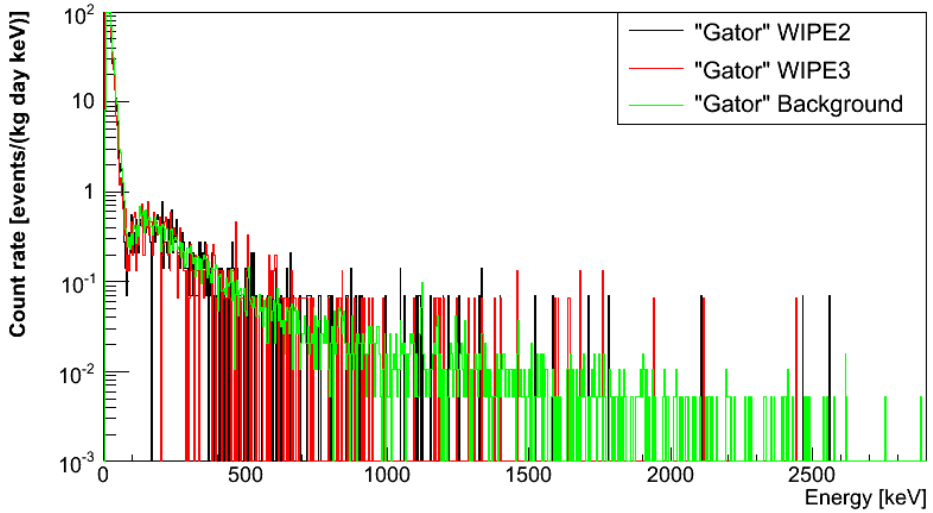
Background
Wipe Test

Test Contamination of Capsule

- Wipe + Ethanol @ empty capsule
- Wipe + Ethanol @ capsule with ^{228}Th
- Capsule + ^{228}Th folded into filter paper immersed in LN for couple of min

Results

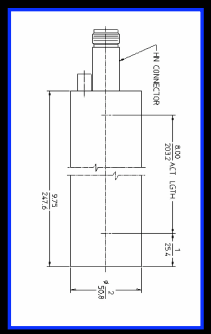
Upper limit from ^{208}Tl line: A $<$ 0.5mBq



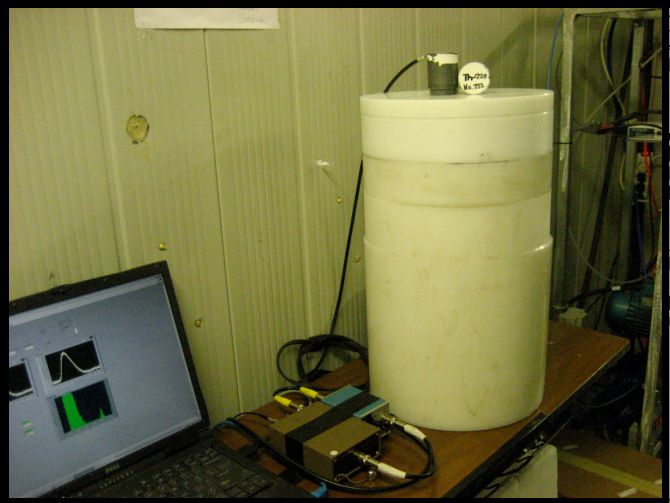
Background
Neutrons

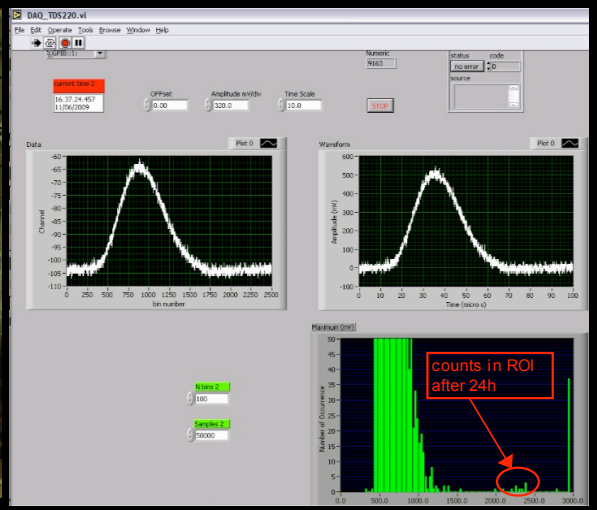
13/06/09

Th228 n measurement with He3 Detector



- ✓ He3 tube — D: 5cm , L: 30cm (20 working).
  Gas Mix: CO_2:Ar:^{3}He = 91:1520:2950 (Torr)
- ✓ PE neutron moderator — cylinder D: 30cm, L: 75cm;
- ✓ Electronics & DAQ — HV (~2000volts), pre-amp., amp, scope and Labview MCA





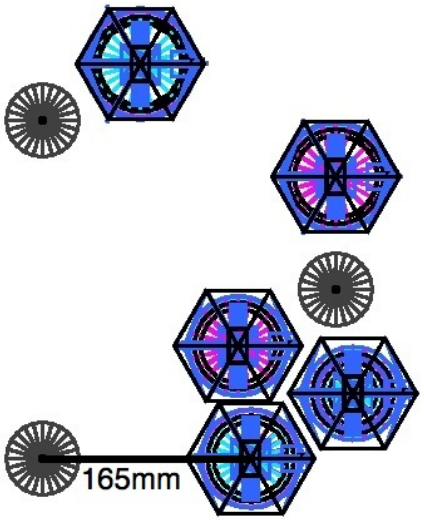
expected live time required to detect signal 5σ above BG (from internal α and ambient n):

~ 20 days

SERENA FATTORI (XENON Collaboration) - GIANMARCO BRUNO (LVD Collaboration)

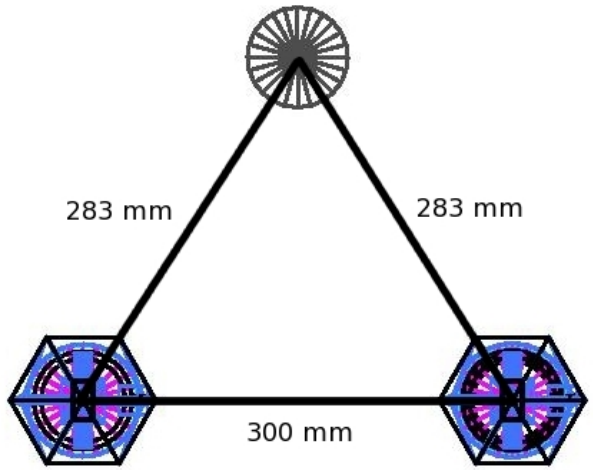
Comparison

Final Lock



Max distance source-det: 165mm
sources: 3

Comm Lock



Distance source-det: 283mm
sources: 1

Optimal Source Position
Comm Lock

Parameters

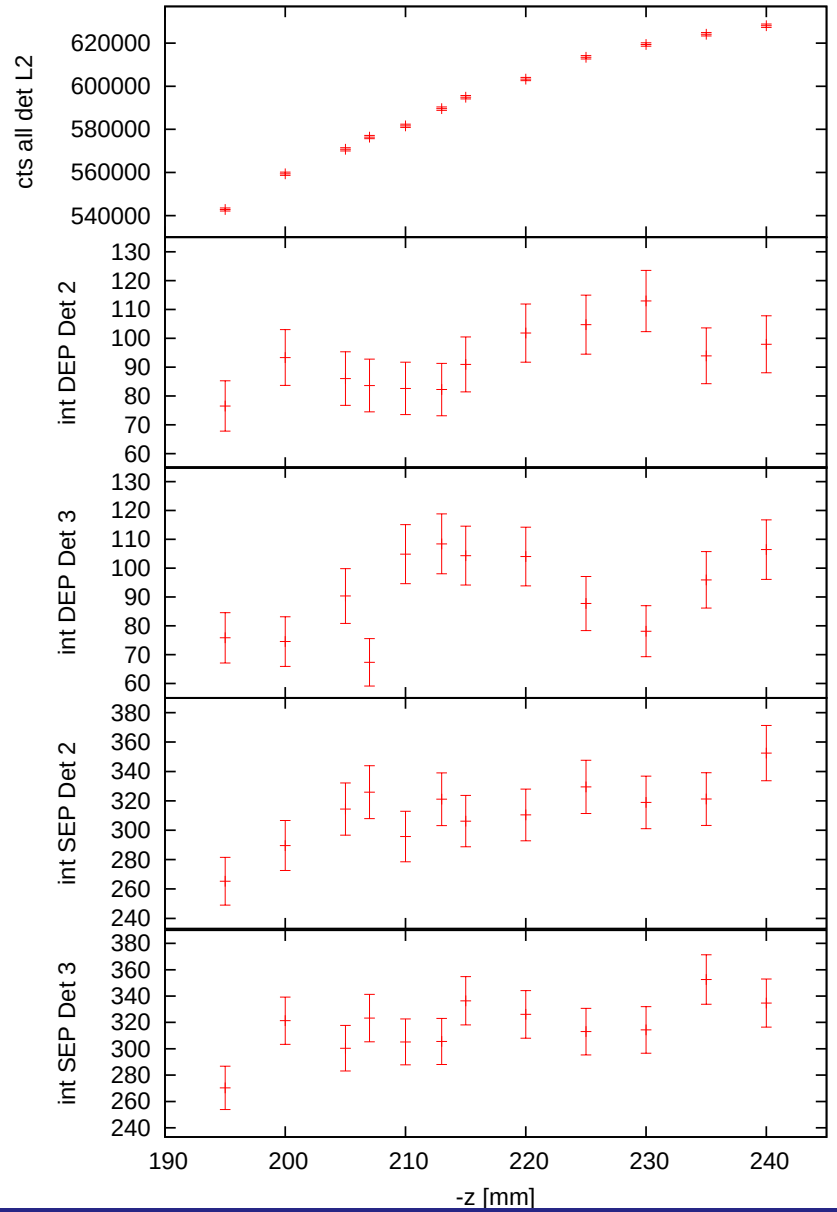
- ANG 2 (108mm), ANG 4 (101mm), RG 1 (84mm)
- ANG 5 (106mm), ANG 3 (94mm), RG 2 (85mm)
- 5e7 ^{228}Th decays per simulation

Analysis

- Analyze each detector seperately
- Fit Gaussian above lin. bgrd to SEP & DEP
- Integration over 3σ region

Results

- Positions $\sim$ 20mm lower than final lock
- Further investigation needed



Source Strength
Comm Lock

Final	9e7	6e7	6e7	18e7	27e7	36e7	CLock
# Events	1637	1073	253	732	1101	1476	# Events
SEP	4.4	4.5	3.3	3.4	3.2	3.3	SEP
# Events	575	375	68	211	341	444	# Events
DEP	2.1	2.1	1.1	1.3	1.3	1.3	DEP

Parameters

- $z = -(80, 220, 380)$ mm
- Integral over 3σ region around SEP & DEP

First Results

Significantly lower statistics in detectors (Factor ~ 4)
Just 1 instead of 3 sources

$\Rightarrow$ **In total factor of 12 higher activity and/or longer run time needed!**

Investigations

Influence of distance between source & detector

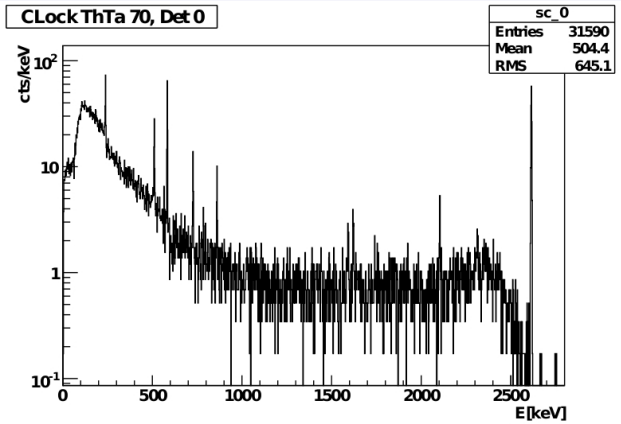
Simulations

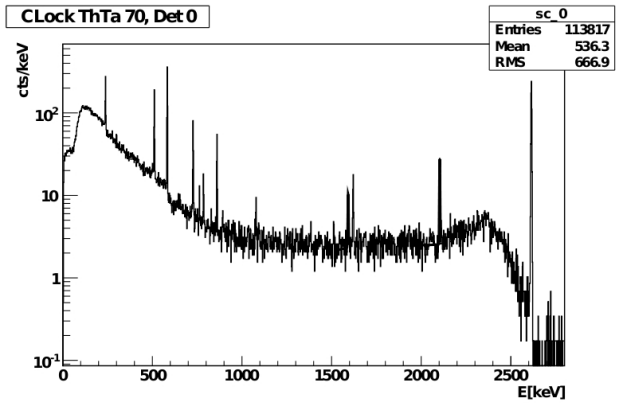
- 1 det string, 1 source on z = -70mm
- 5e6 ^{228}Th decays
- 3 Simulations:
  - Dist in comm lock: 270mm
  - Max dist in final lock: 160mm
  - As close as possible: 90mm

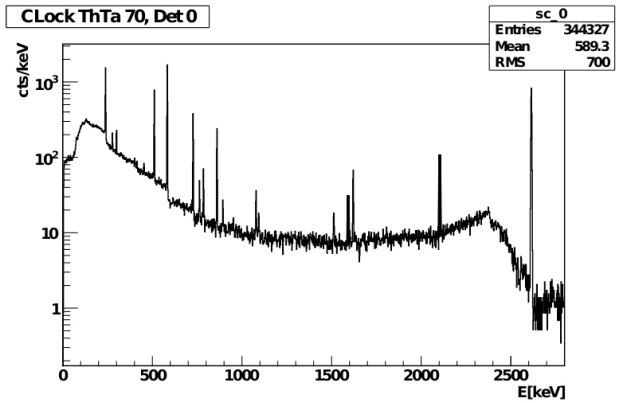
Results

Events: Factor of $\sim$ 11 between min & max dist

P:B SEP: 4.8 (min dist) and 3.3 (max dist)







Spectrum

^{228}Th, Comm Lock, 36e7 decays