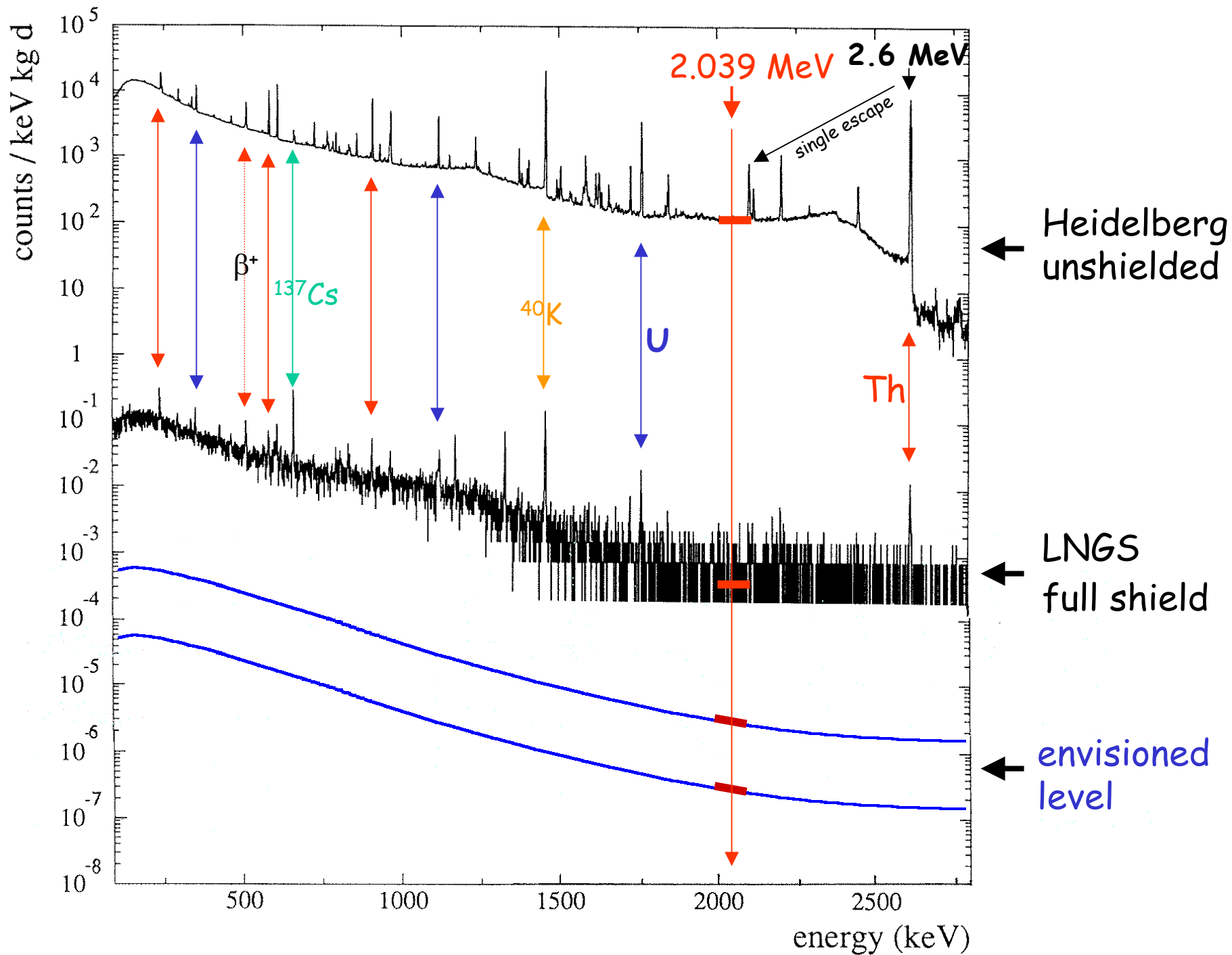


background empirical

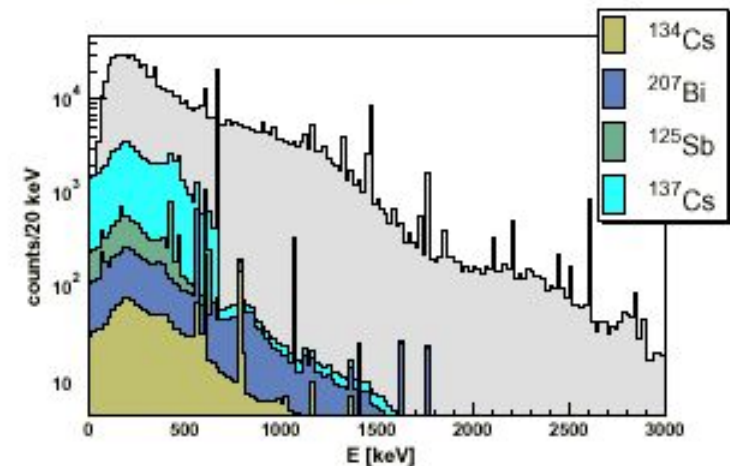
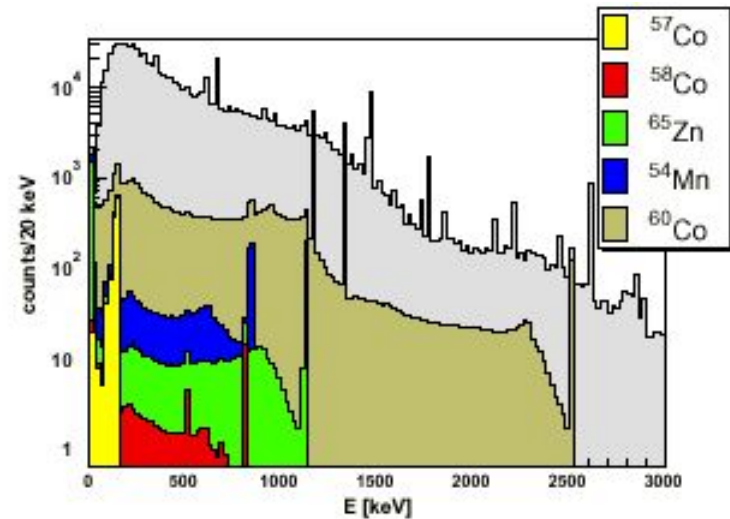
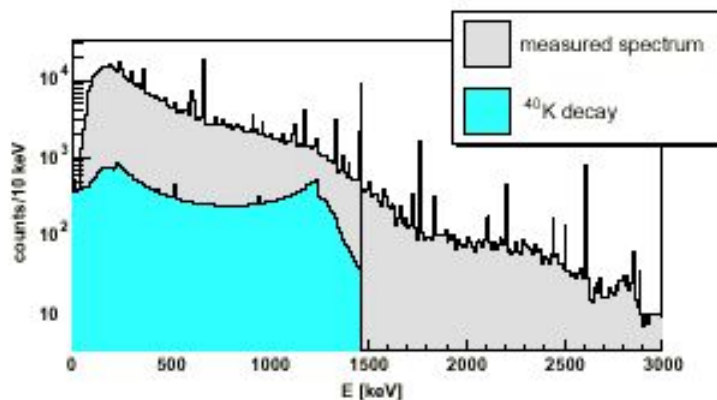
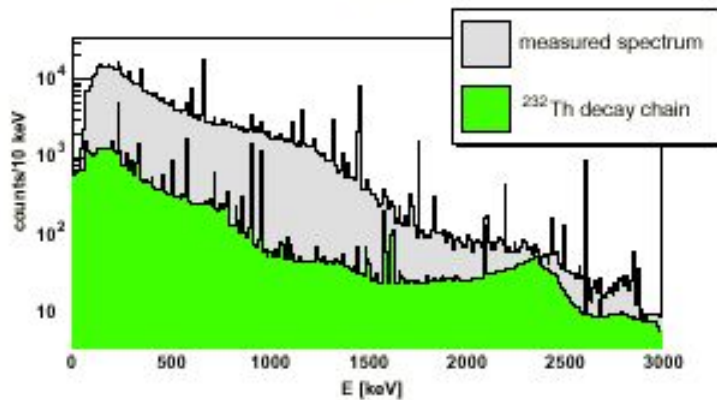
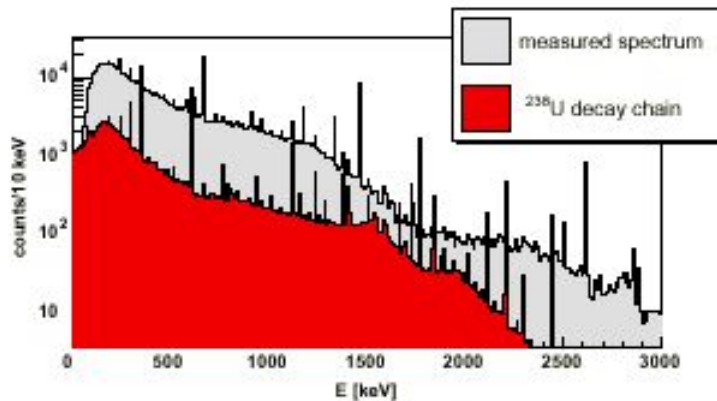
Gerd Heusser

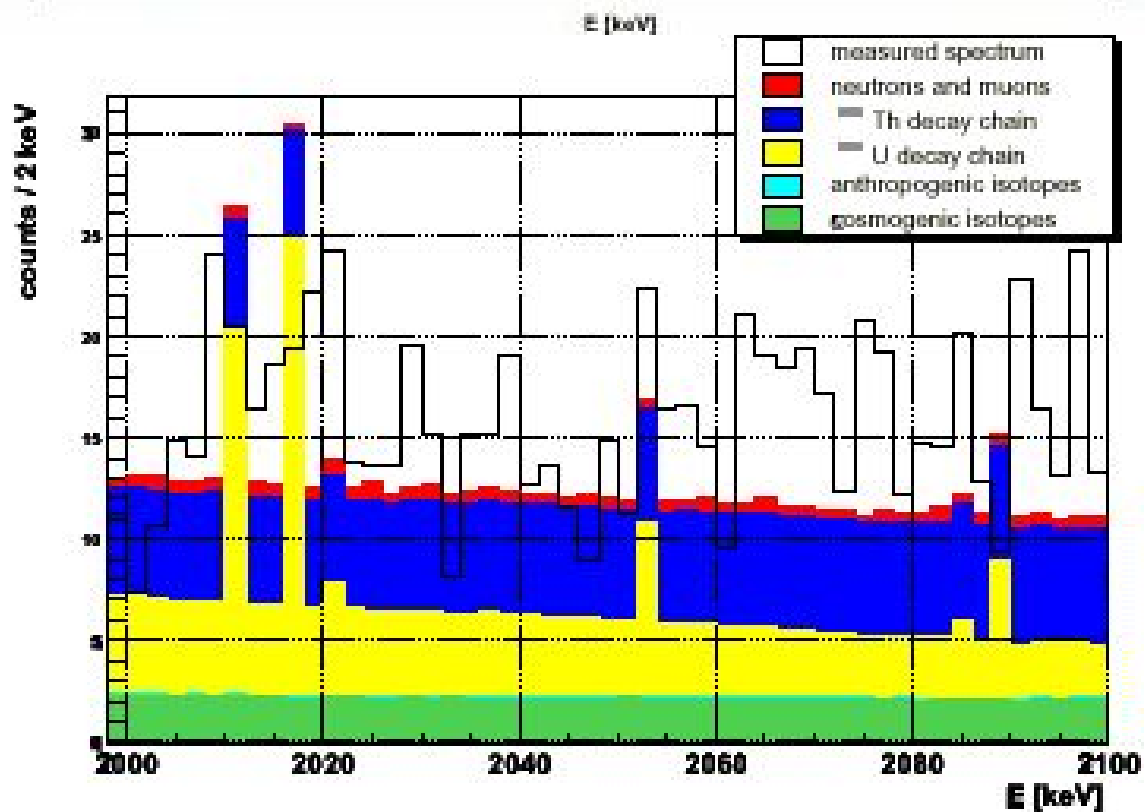
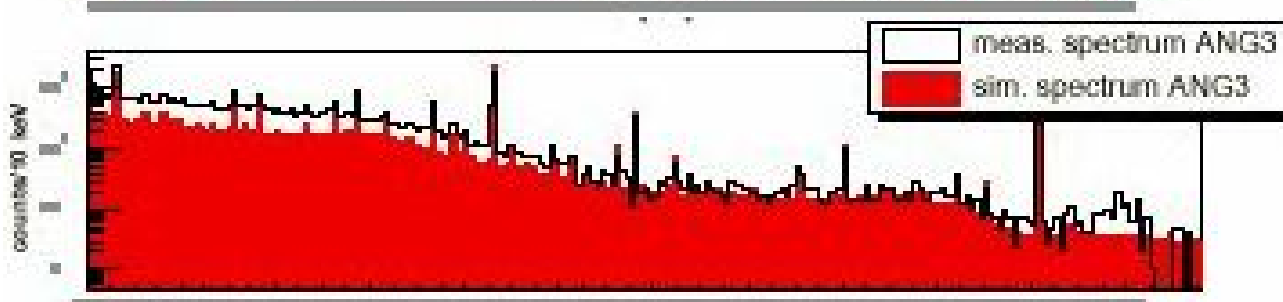
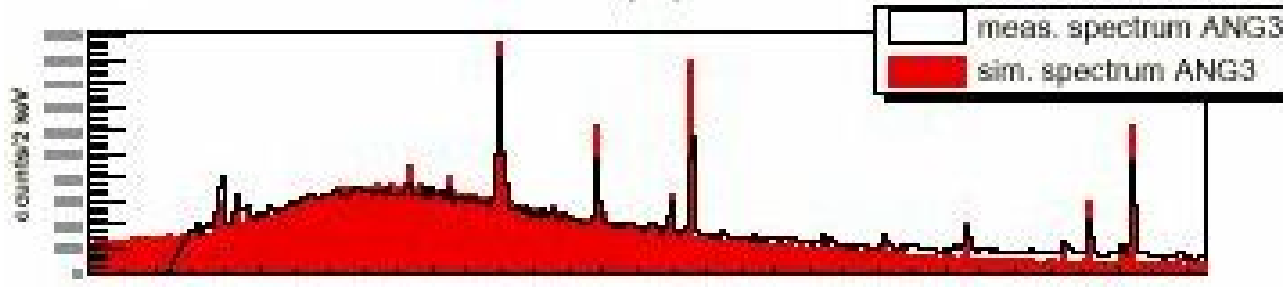
Max-Planck-Institut für Kernphysik, Heidelberg, Germany
(gerd.heusser@mpi-hd.mpg.de)



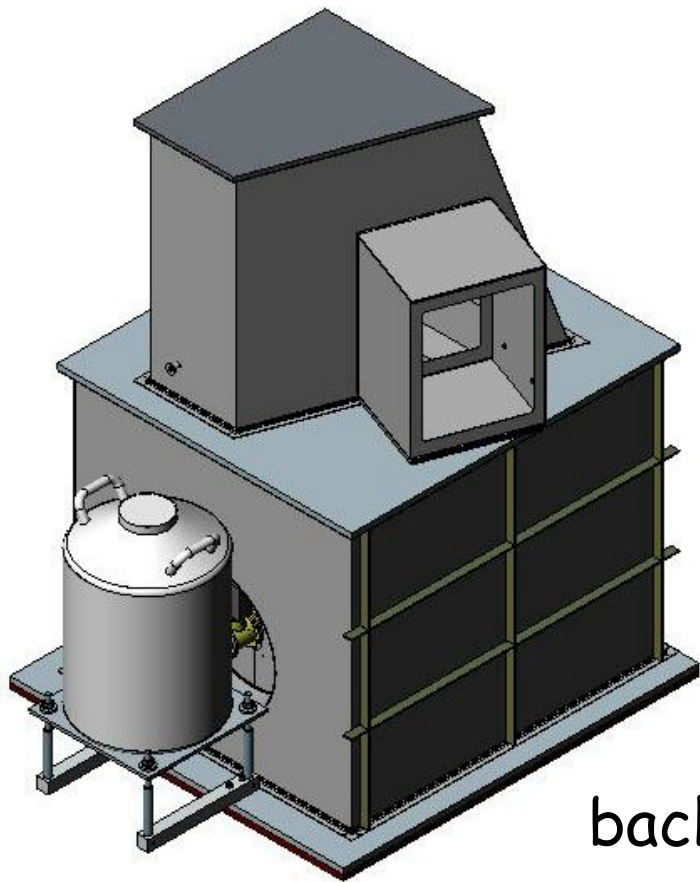
Background components found by Monte Carlo simulation

C. Dörr, HV Klapdor-Kleingrothaus, NIM A 513 (2003) 596-621



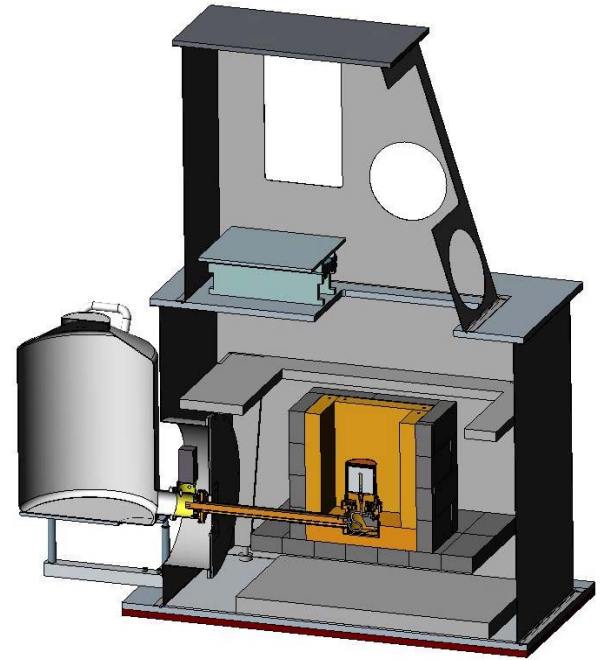


C. Dörr, HV Klapdor-Kleingrothaus, NIM A 513 (2003) 596-621



GeMPI

Operated at LNGS
(3500 m w.e.)



background (peak) count rates [c/kg y]

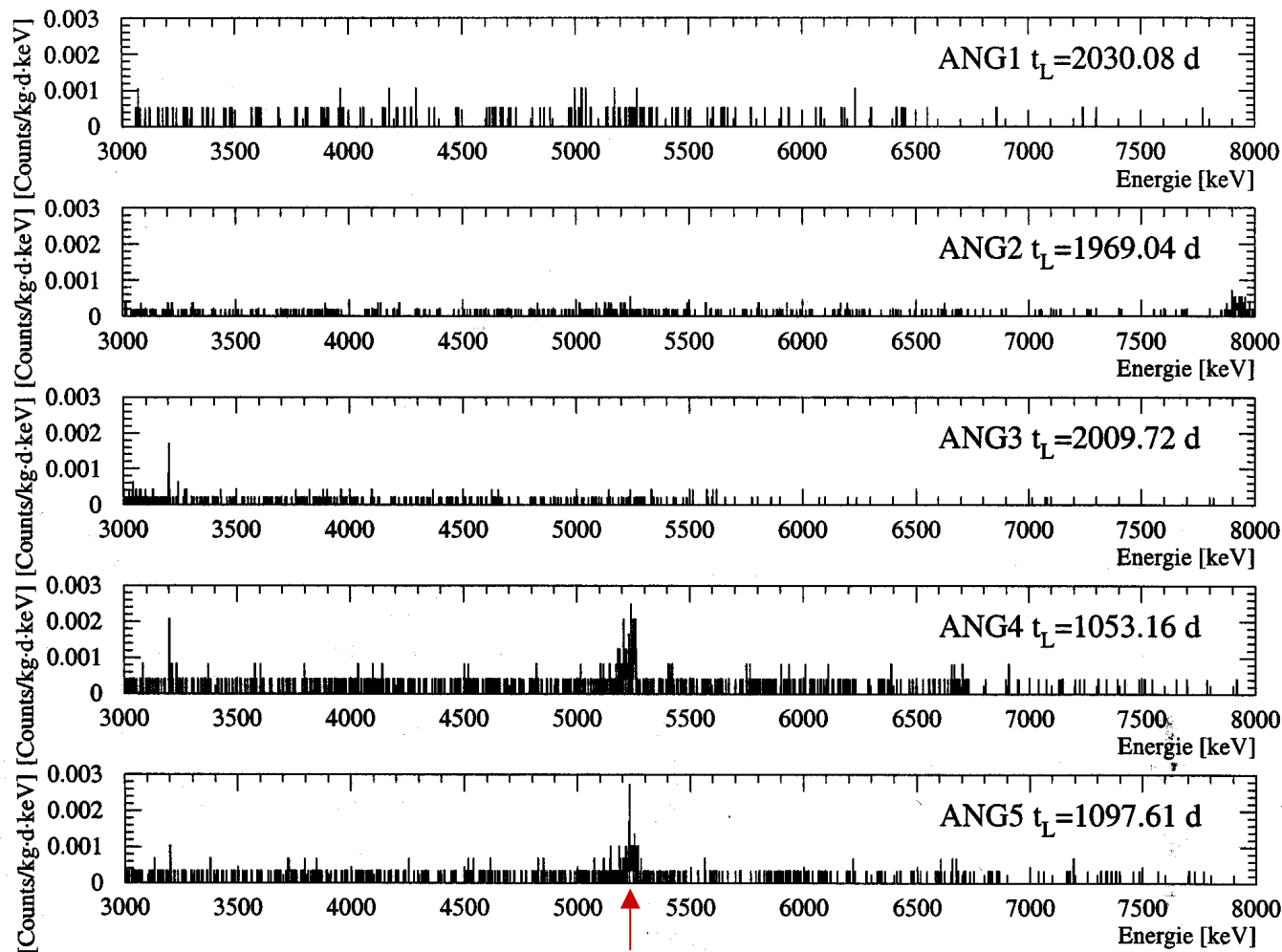
| Energy [keV] | GeMPI | HD-Moscow det. # 1-5 |
|--------------|-------------|----------------------|
| 352 (U/Ra) | ≤ 31 | 110 - 180 |
| 609 (U/Ra) | ≤ 30 | 96 - 140 |
| 583 (Th) | ≤ 23 | 18 - 42 |
| 2615 (Th) | 17 ± 5 | 11 - 22 |
| 1461 (K) | 90 ± 13 | 74 - 290 |
| 100-2730 keV | 9760 | 12300 |

Contamination of Cu [$\mu\text{Bq}/\text{kg}$]

| | ^{226}Ra (U) | ^{228}Th (Th) | ^{40}K |
|----------------------------------|-----------------------|------------------------|-----------------|
| Cryostat of ANG1* | 168 ± 8 | 84 ± 7 | 236 ± 61 |
| Cryostat of ANG2* | 91 ± 4 | 10 ± 3 | 78 ± 22 |
| Cryostat of ANG3* | 105 ± 5 | 84 ± 5 | 927 ± 46 |
| Cryostat of ANG4* | 115 ± 3 | 87 ± 4 | 199 ± 4 |
| Cryostat of ANG5* | 100 ± 4 | 26 ± 4 | 1632 ± 49 |
| same quality measured with GeMPI | ≤ 20 | ≤ 23 | ≤ 88 |

* Monte Carlo simulation of measured spectra (thesis Ch. Doerr)

$$1 \mu\text{Bq}/\text{kg} \begin{cases} 8,1 \times 10^{-14} \text{ g/g } ^{238}\text{U} \\ 2,46 \times 10^{-13} \text{ g/g } ^{232}\text{Th} \\ 3,23 \times 10^{-11} \text{ g/g } ^{40}\text{K} \end{cases}$$



Dipl. Thesis
A. Dietz

^{210}Po (^{210}Pb) in P+ contact core

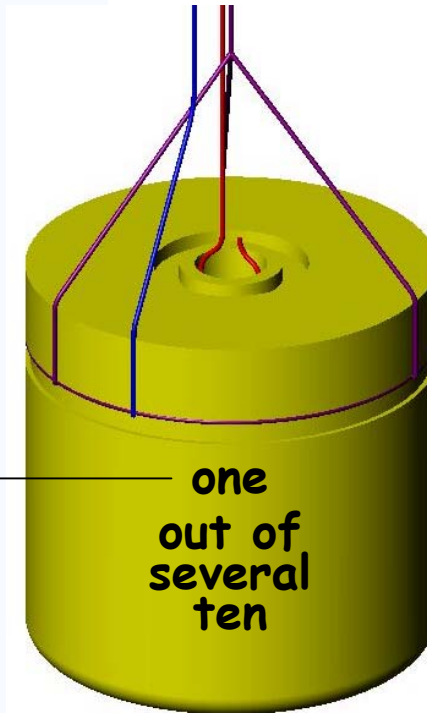
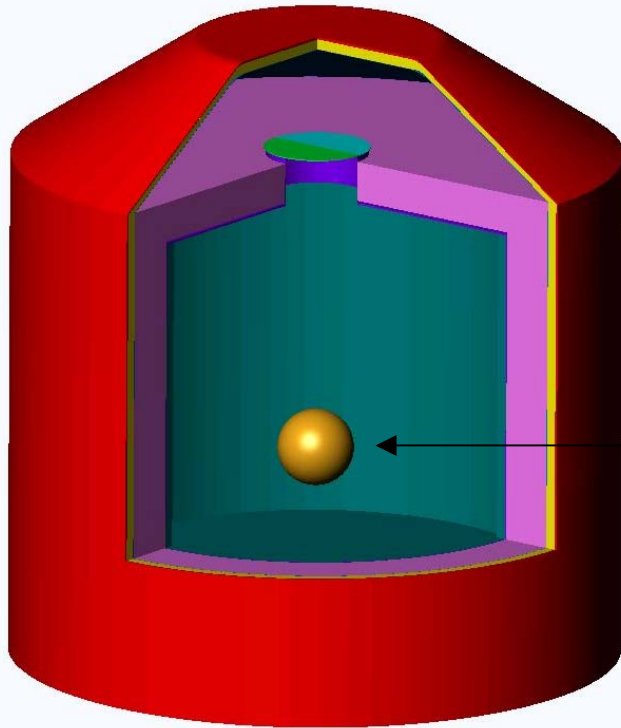
count rate variation among detectors about factor 30

⇒ surface contamination in ANG4 core: about $550 \mu\text{Bq}/\text{m}^2$

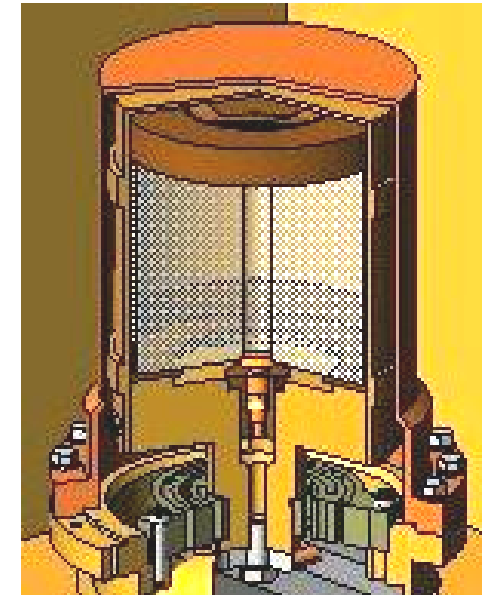
required all-surface radiopurity of naked Ge crystal e.g. for U/Ra: $\leq 5 \mu\text{Bq}/\text{m}^2$

naked Ge-crystals deployed in liquid nitrogen

(cooling medium and shield)



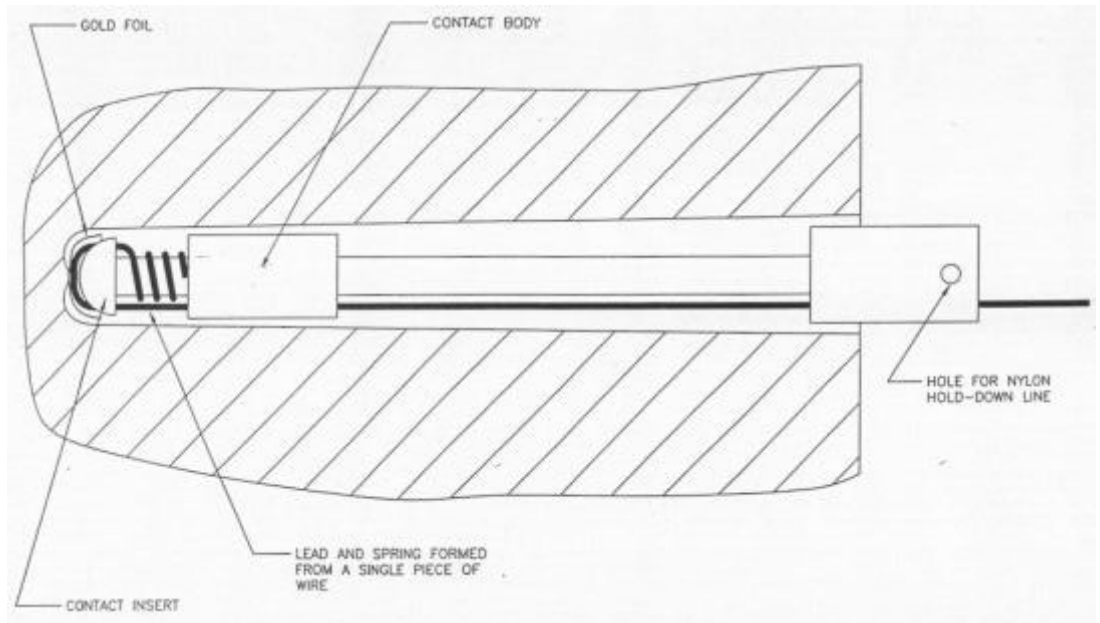
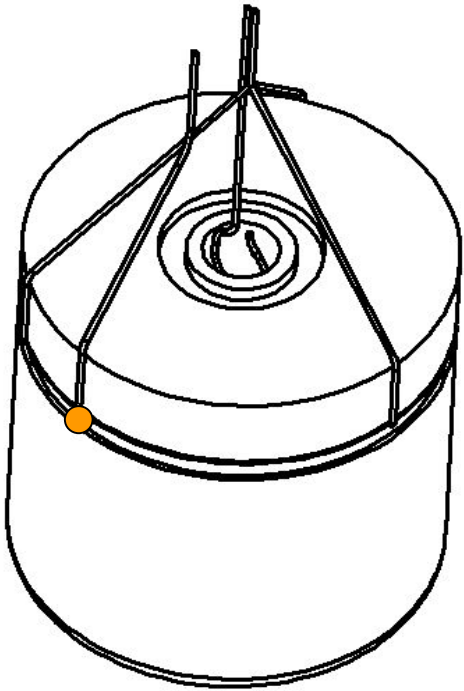
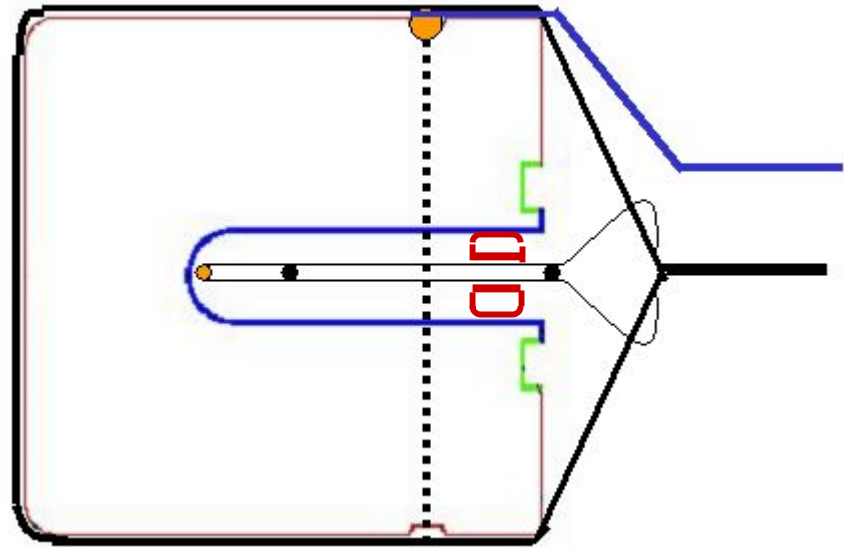
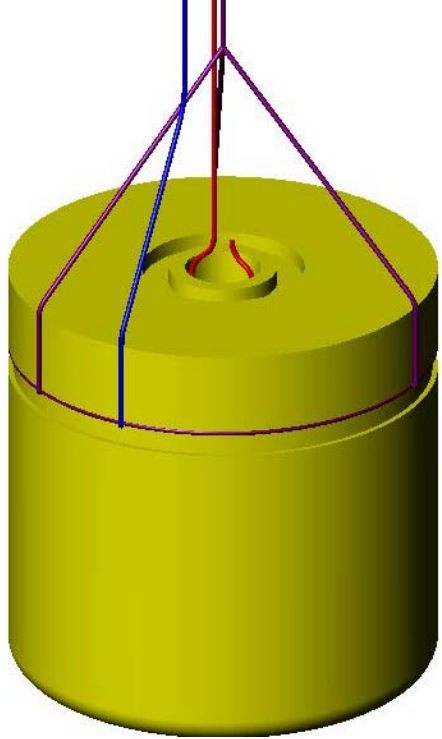
conventional detector
crystal gladding



reduction of contact and gladding material:
about factor **7000** in mass, **200** in surface

| material | activity [$\mu\text{Bq/kg}$] | | | |
|--------------------------|---|-------------------------|-----------------|---|
| | ^{226}Ra (U) | ^{228}Th (Th) | ^{40}K | various |
| lead (DowR) | ≤ 29 | ≤ 22 | 440 | 98 ^{207}Bi ; 180 ^{60}Co ; 2.7 E+7 ^{210}Pb ; |
| lead (Boliden) | ≤ 46 | ≤ 31 | 460 | ≤ 13 ^{207}Bi ; 2.3 E+7 ^{210}Pb ; |
| lead LC2 ^{HDM} | ≤ 11 (27 \pm 8) | ≤ 0.9 (12 \pm 6) | 310* | ≤ 4 E+3 ^{210}Pb * |
| copper (Lens) | ≤ 20 | ≤ 23 | ≤ 88 | ≤ 10 ^{60}Co |
| steel (foil) | 600 | 200 | 1800 | 17000 ^{60}Co |
| steel (Lens) | 1200 | 7100 | ≤ 3000 | 300 ^{60}Co |
| water | ≤ 1 | 0.04 - 0.008 | ≤ 2 | |
| liq. nitrogen | ≤ 0.3 (^{222}Rn) | | | 0.007 ^{39}Ar ; 0.03 ^{85}Kr |
| liq. argon | 600 (^{222}Rn) | | | 1.1 E+6 ^{39}Ar ; 30 ^{42}Ar |
| | other materials relevant for the nitrogen tank | | | |
| concrete _{LNGS} | 8 E+6 | 1 E+7 | 9 E+7 | |
| foam glass | 9 E+6 | 1 E+7 | 3 E+8 | |
| perlite | 5 E+7 | 3.5 E+7 | 8.5 E+8 | |
| polysterol | 7300 | 2100 | 8000 | |

* independent measurement



Comparison of different background measurements

