Neutron background from CuBe wires

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Code

- W.B. Wilson, et al., SOURCES4A: a code for calculating (α,n), spontaneous fission, and delayed neutron sources and spectra, Technical Report LA-13639-MS, Los Alamos, 1999;
- Modifications and additions, explained in Tomasello et al. NIMA, 595 (2008) 431.
- Validated by comparison of cross-sections with experimental data.
- Still quite a large uncertainty: up to 20-30% (differences between models and data sets) for most isotopes tested.

Results

- Here are the results for neutron yields for CuBe wires (1.9% Be by weight):
- Spontaneous fission of U-238:
  - 1.353×10^{-11} neutrons/g/s/ppb (neutrons per gram per second per ppb of ^{238}U)
- (α,n) reactions:
  - ^{238}U + ^{235}U chains in equilibrium: 2.75×10^{-10} n/g/s/ppb
  - Early ^{238}U (until but not including ^{226}Ra as usually assumed for a broken equilibrium; the break is not at ^{222}Rn) + full ^{235}U chains: 6.65×10^{-11} n/g/s/ppb
  - Late ^{238}U (starting with ^{226}Ra and below): 2.09×10^{-10} n/g/s/ppb (normalised to the concentration of ^{238}U assumed to be in equilibrium)
  - ^{232}Th: 9.13×10^{-11} n/g/s/ppb.
- Conversion:
  - ^{238}U: 1 Bq/kg = 80.34 ppb
  - ^{232}Th: 1 Bq/kg = 246.3 ppb
- Early ^{238}U + full ^{235}U (including SF): 6.43×10^{-6} n/g/s/(Bq/kg) or n/decay.
- Late ^{238}U: 1.68×10^{-5} n/g/s/(Bq/kg) or n/decay.
- ^{232}Th: 2.25×10^{-5} n/g/s/(Bq/kg) or n/decay.