

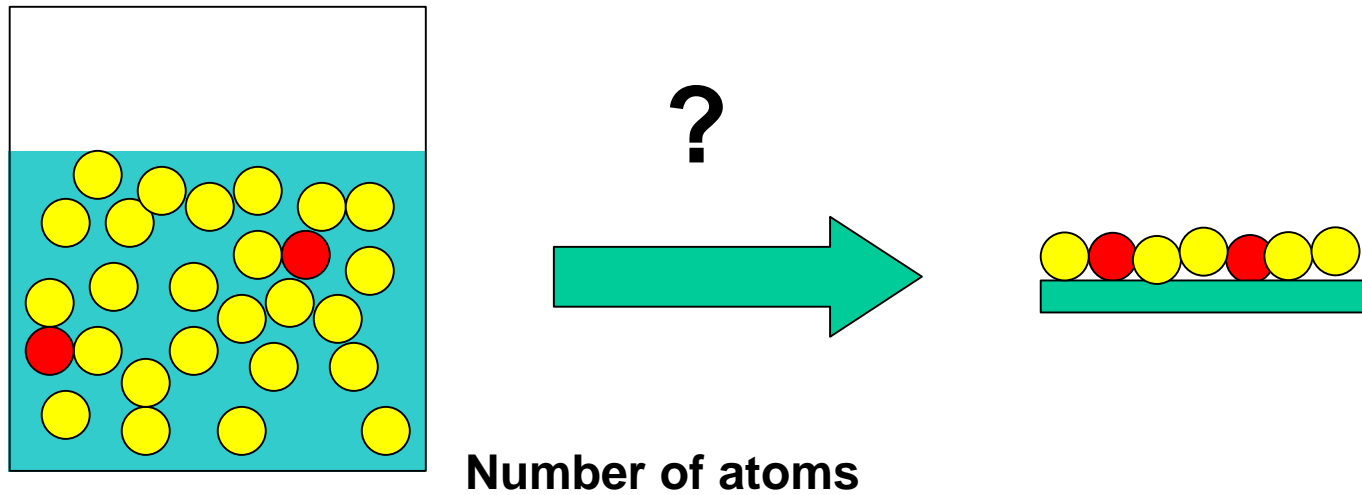
The NucfilmDisc method to prepare water samples for alpha spectrometry

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**Main problem when preparing water samples for alpha spectrometry :
how to selectively concentrate radionuclides of interest in a thin layer**

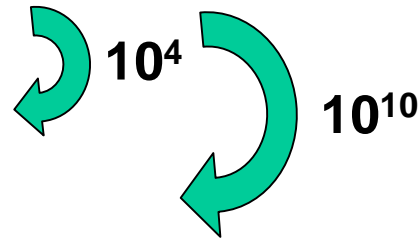


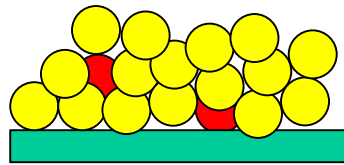
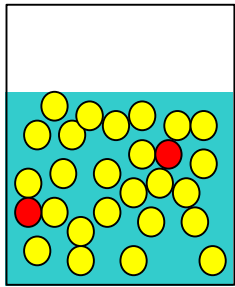
Number of atoms

100 mg Ca : $N = 1.5 \times 10^{21}$

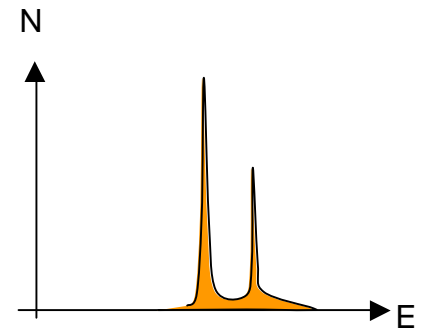
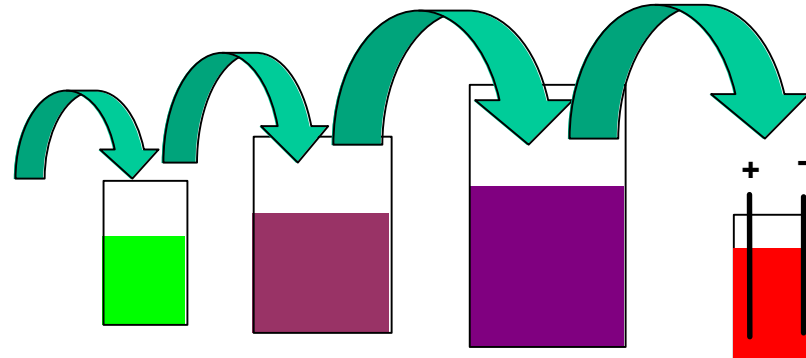
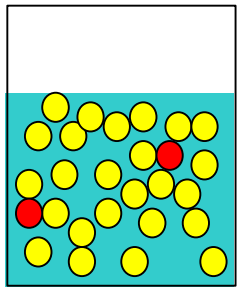
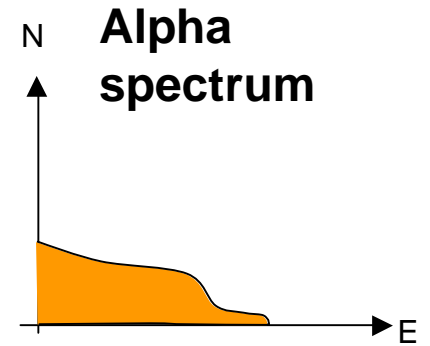
1 Bq ^{238}U : $N = 2.1 \times 10^{17}$

1 Bq ^{226}Ra : $N = 7.2 \times 10^{10}$

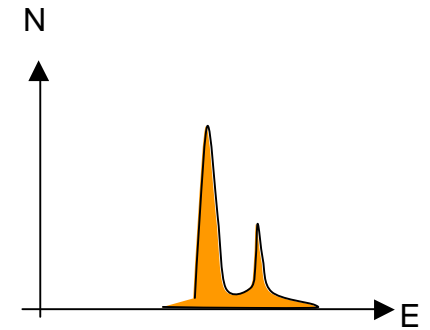
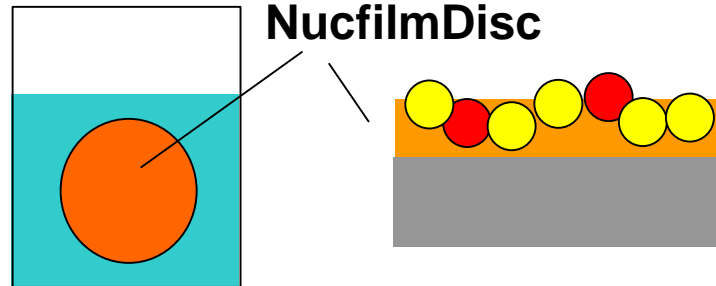
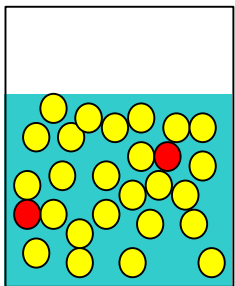




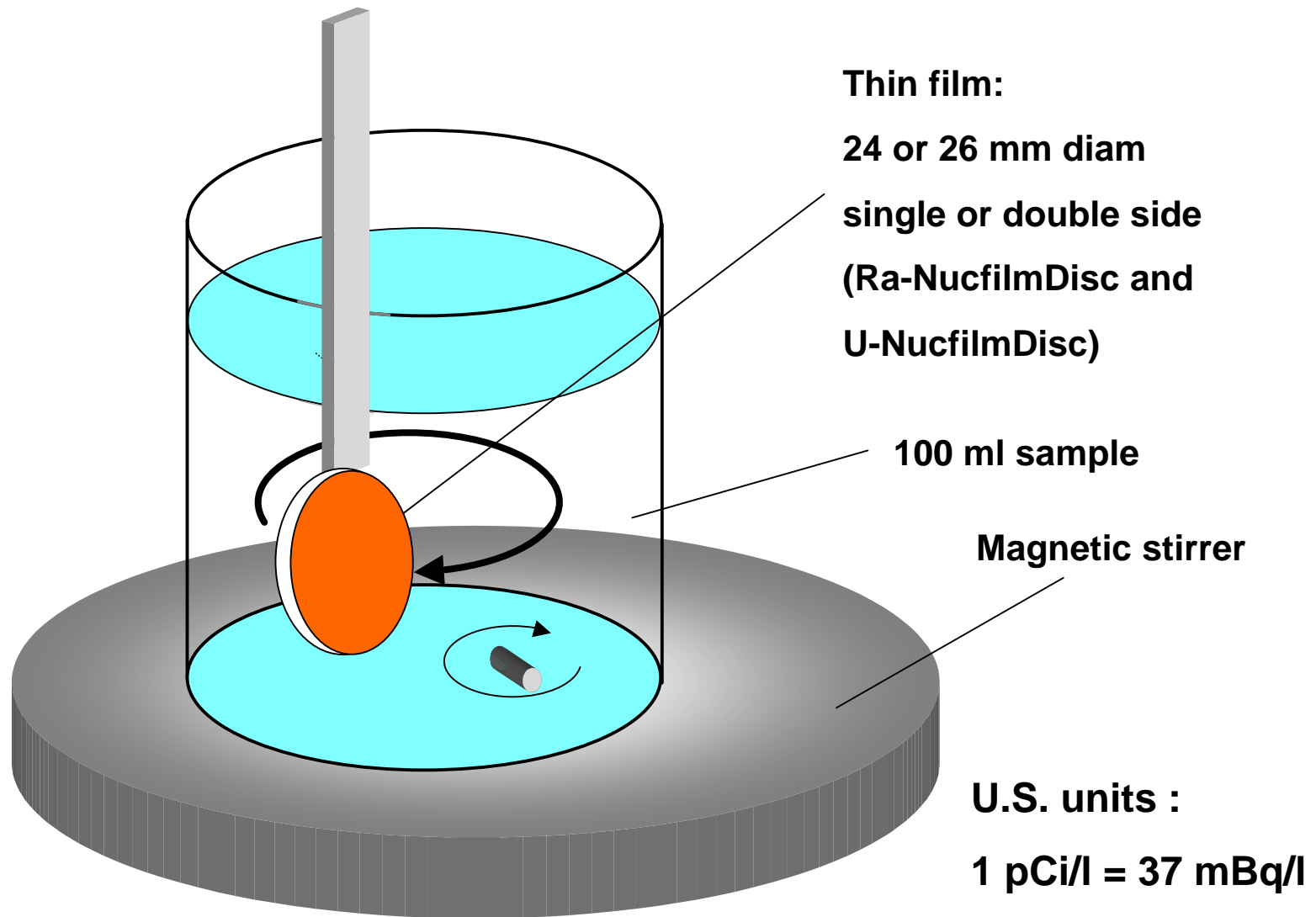
Evaporation, leads to thick film



Radiochemistry, expensive, produces toxic waste



Selective adsorption on thin film, cheap, produces no toxic waste

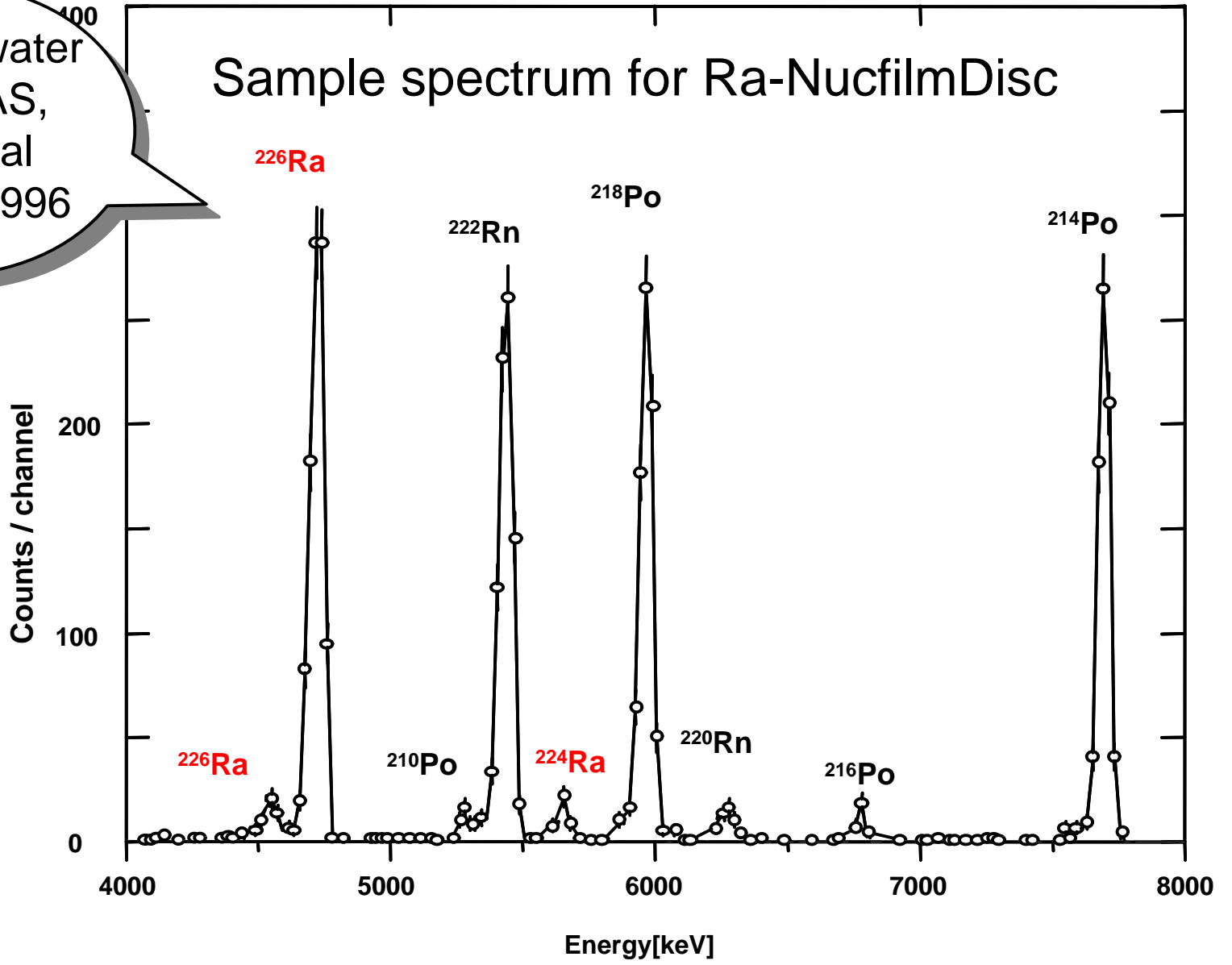


Ra : 6 h exp. @ pH 4-8 \longrightarrow **> 90 % adsorbed, LLD ~ 5 mBq/l**

U : 20 h exp. @ pH 2-3 \longrightarrow **> 90 % adsorbed, LLD ~ 5 mBq/l for ($^{238}\text{U} + ^{234}\text{U}$)**

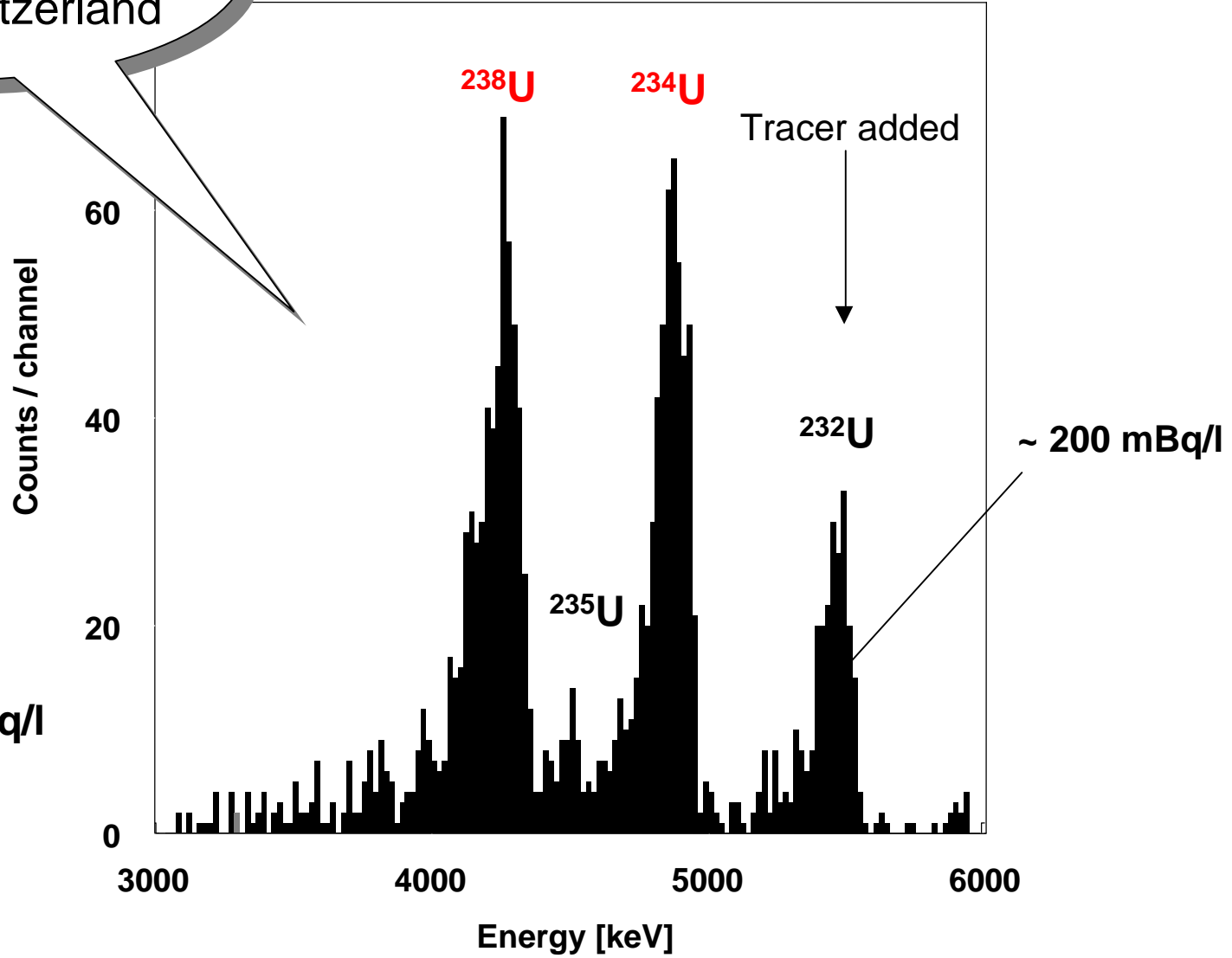
LLD given for measurement with 900 mm² Si-detector at 10 mm distance, measurement time 80'000 s

Mineral water
PEDRAS,
Portugal
vintage 1996



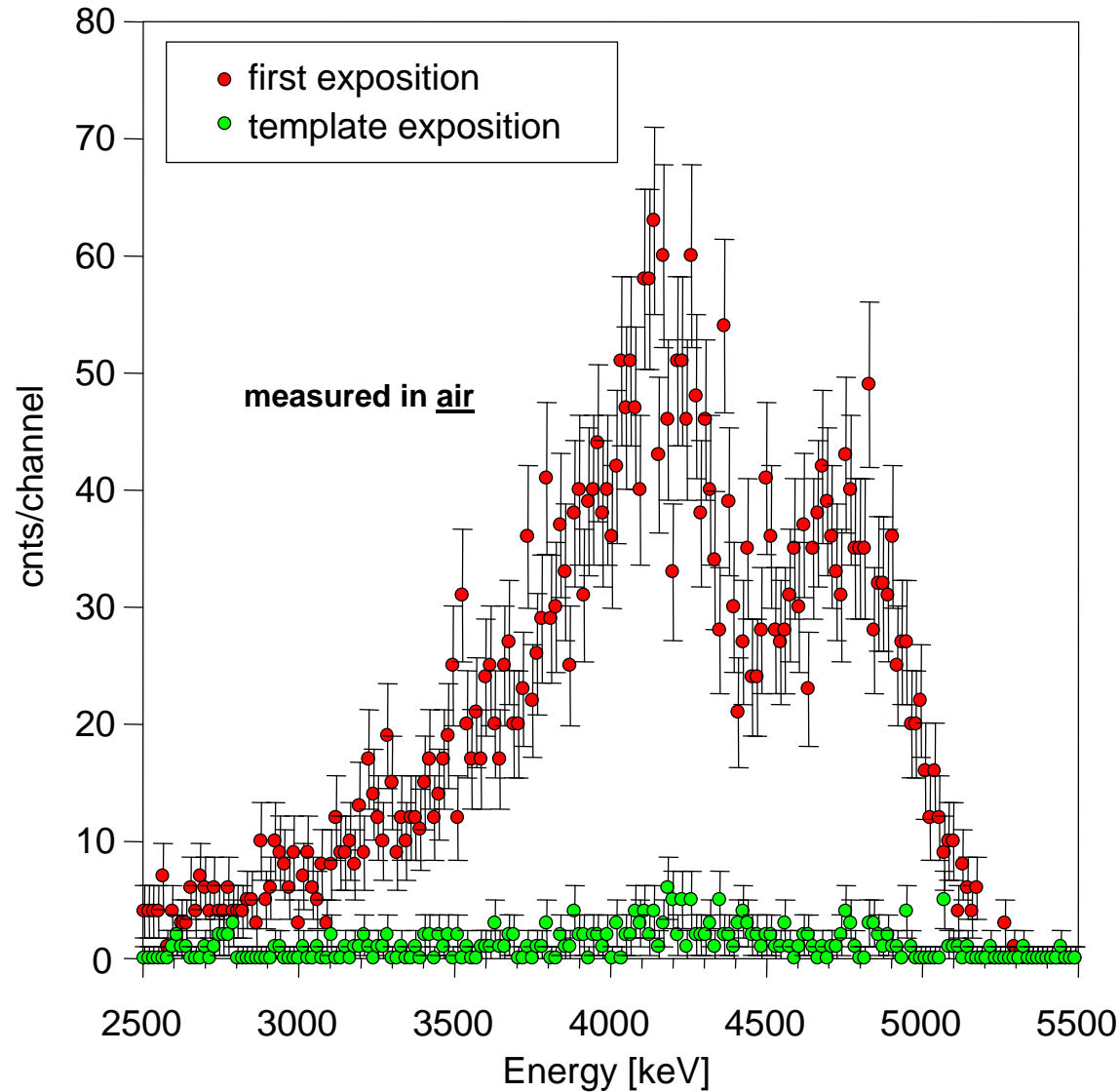
Sample spectrum for U-NucfilmDisc

Mineral water
« Ancienne »,
Aproz, Switzerland



U.S. units :
1 pCi/l = 37 mBq/l

Ra-NucfilmDiscs and U-NucfilmDiscs adsorb selectively, reducing interferences considerably so you don't need a very good energy resolution. You can also measure in air.



Adsorption efficiency for U-NucfilmDiscs, prod. December 2009, determined by template exposition.

Alpha spectra measured in air

Sample : 100 ml spring water "Source Poisson, Saxon"
, ^{238}U + ^{234}U : ~ 3.8 Bq/l, + 0.5 ml formic acid conc.
(80%) --> pH ~ 2

Adsorbing discs used : U-NucfilmDisc, prod.

December 09, diam. 24 mm

Exposition time : 20 h per disc

Measured with 400 mm² Si-detector at sample detector distance of 7.5 mm

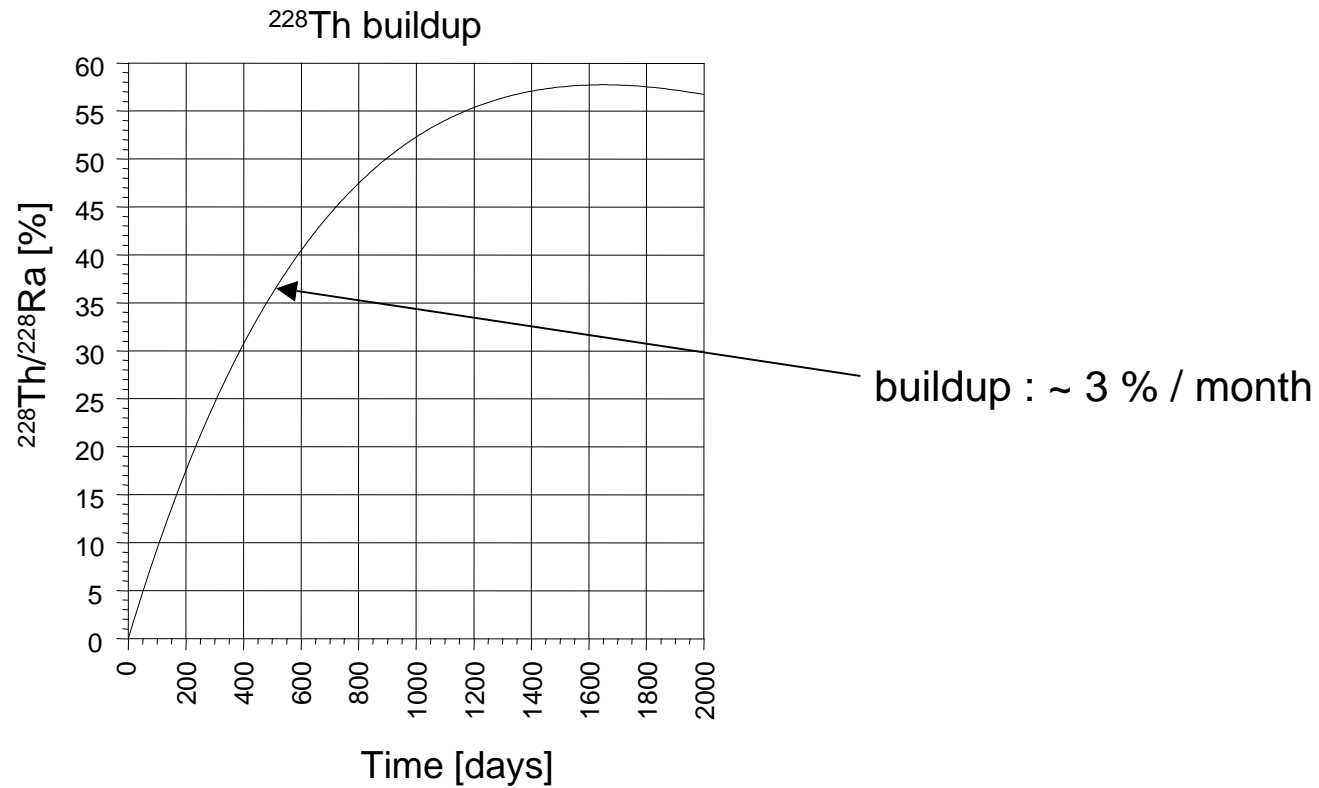
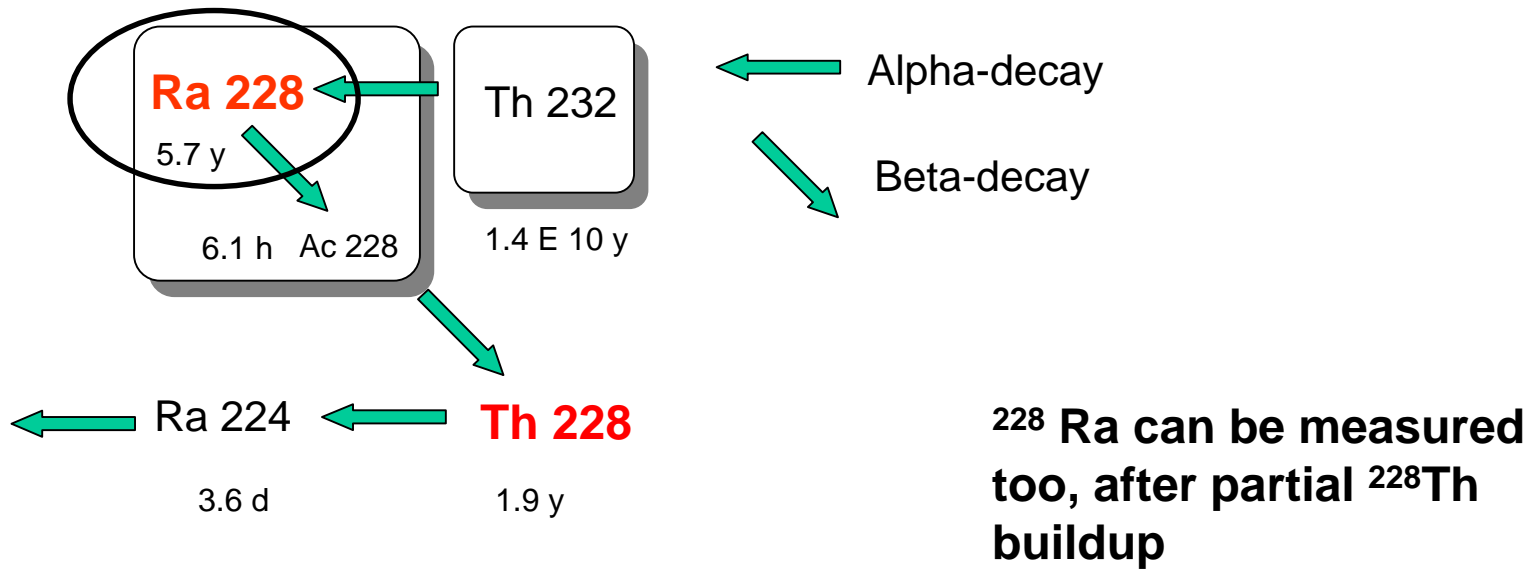
Acquisition time : 80'000 s per disc

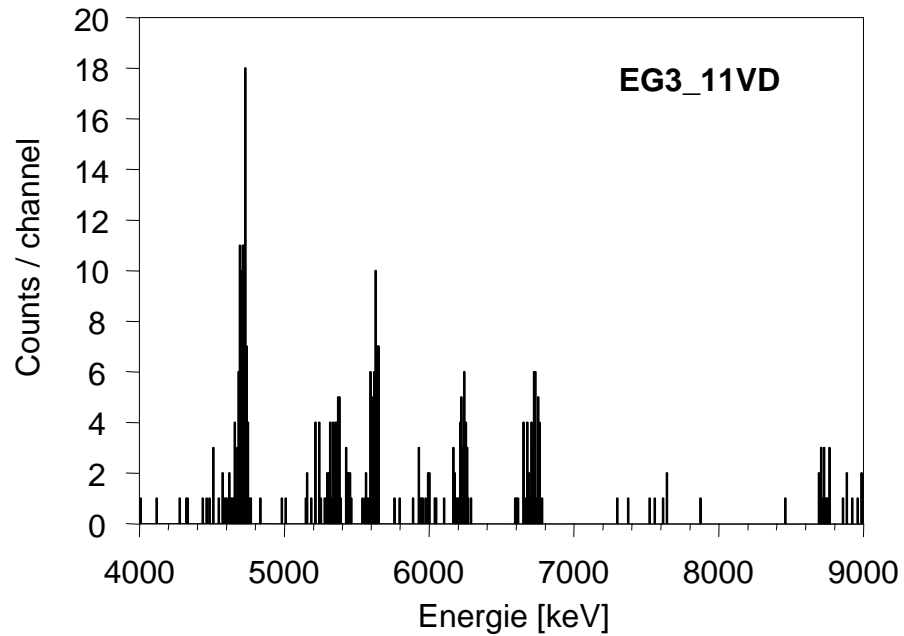
First exposition : 53.65 cnts/ks (ROI 2'500 keV to 5'500 keV)

Template exposition : 2.72 cnts/ks (ROI 2'500 keV to 5'500 keV)

Background : 0.13 cnts/ks (ROI 2'500 keV to 5'500 keV)

--> adsorption efficiency : (95 +/- 1) %





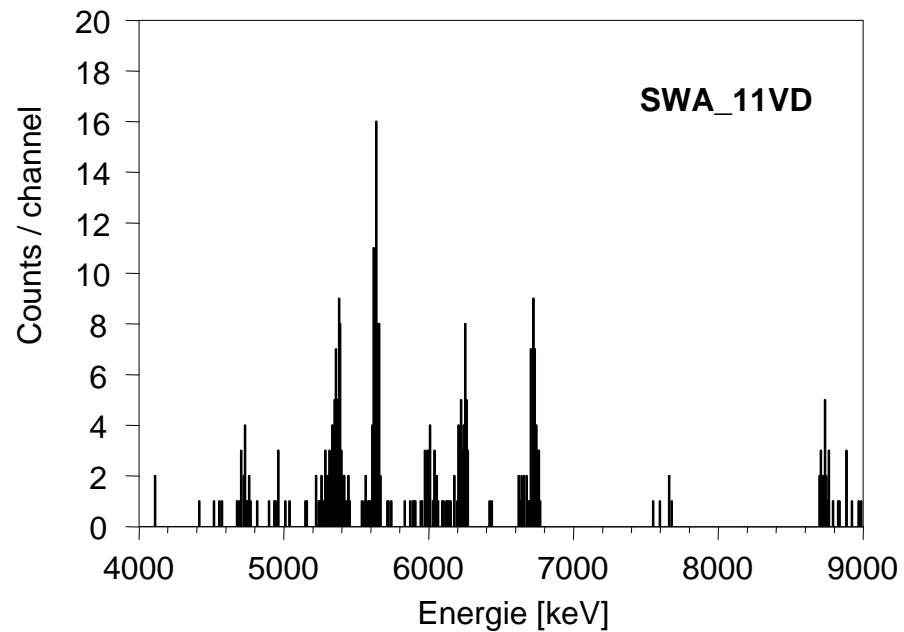
Sample spectra

**MnO₂-thin film (Ra-NucfilmDisc)
exposed approx 2 years ago.**

EG3_11VD :

²²⁶Ra : (90 ± 10) mBq/l,

²²⁸Ra : (100 ± 10) mBq/l



SWA_11VD :

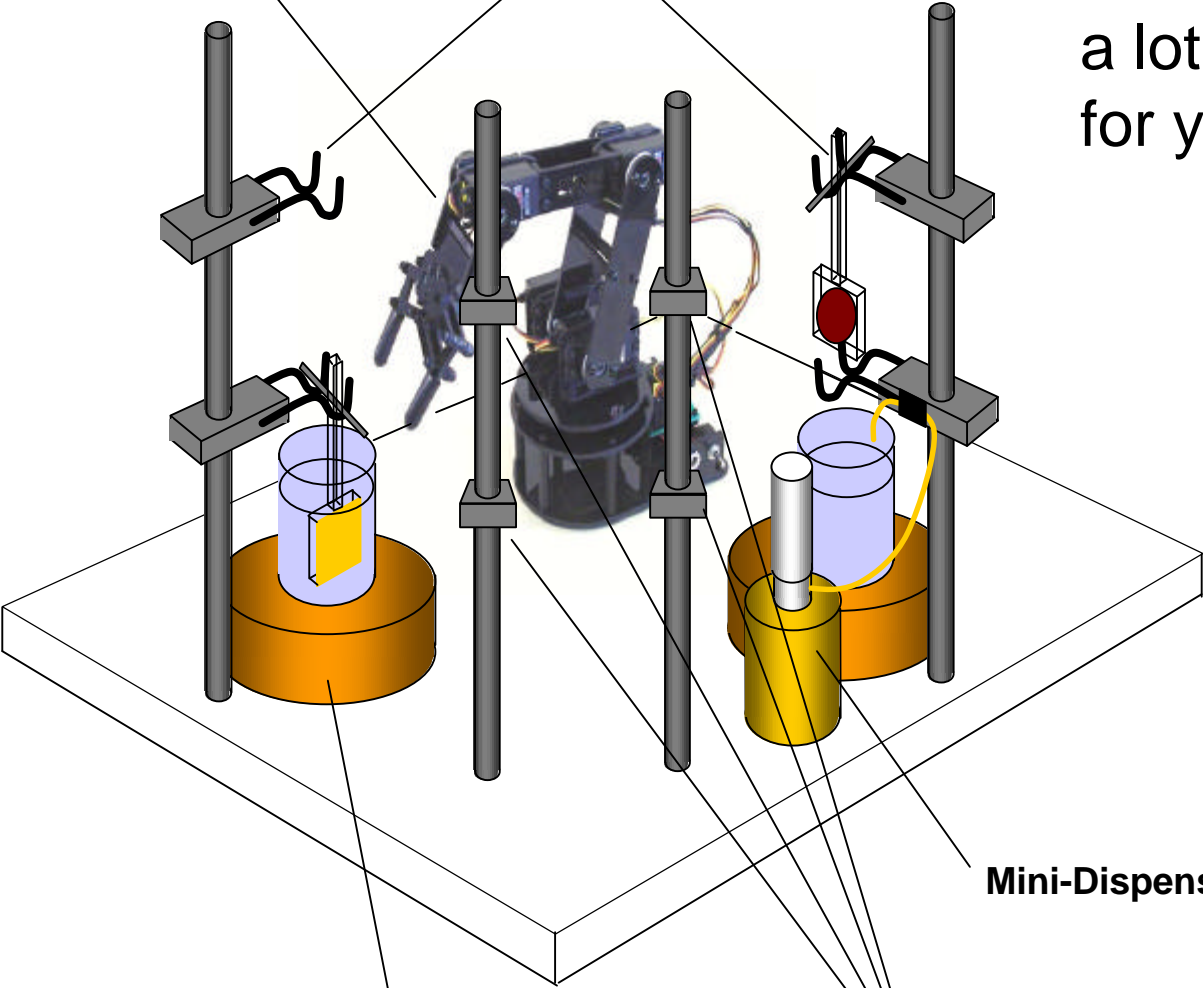
²²⁶Ra : (30 ± 10) mBq/l,

²²⁸Ra : (160 ± 20) mBq/l

Lynxmotion 5-arm-robot

Storage positions

A simple robot can do a lot of work for you



Magnetic stirrer

Mini-Dispenser

Storage positions