

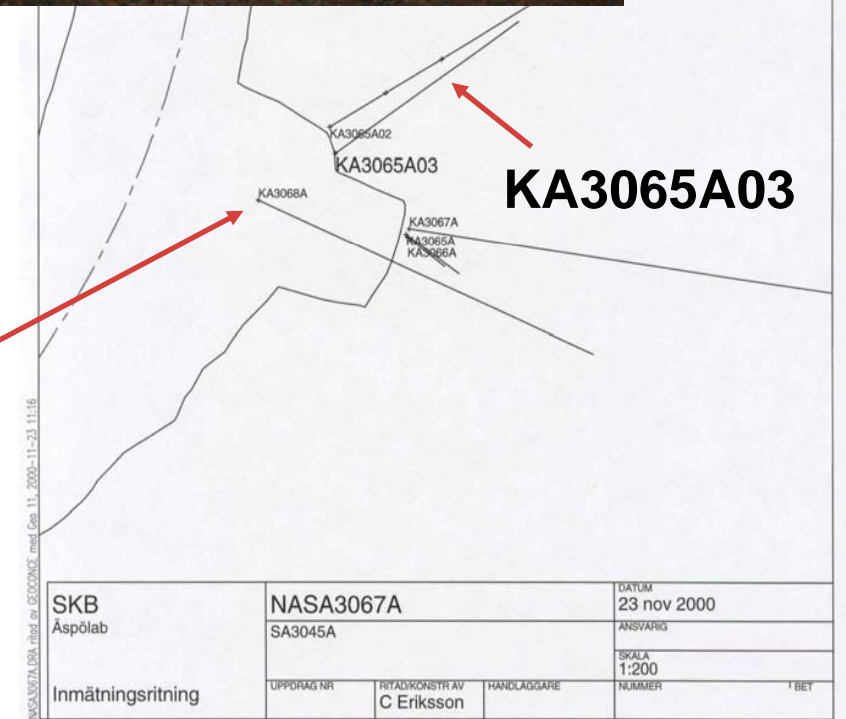
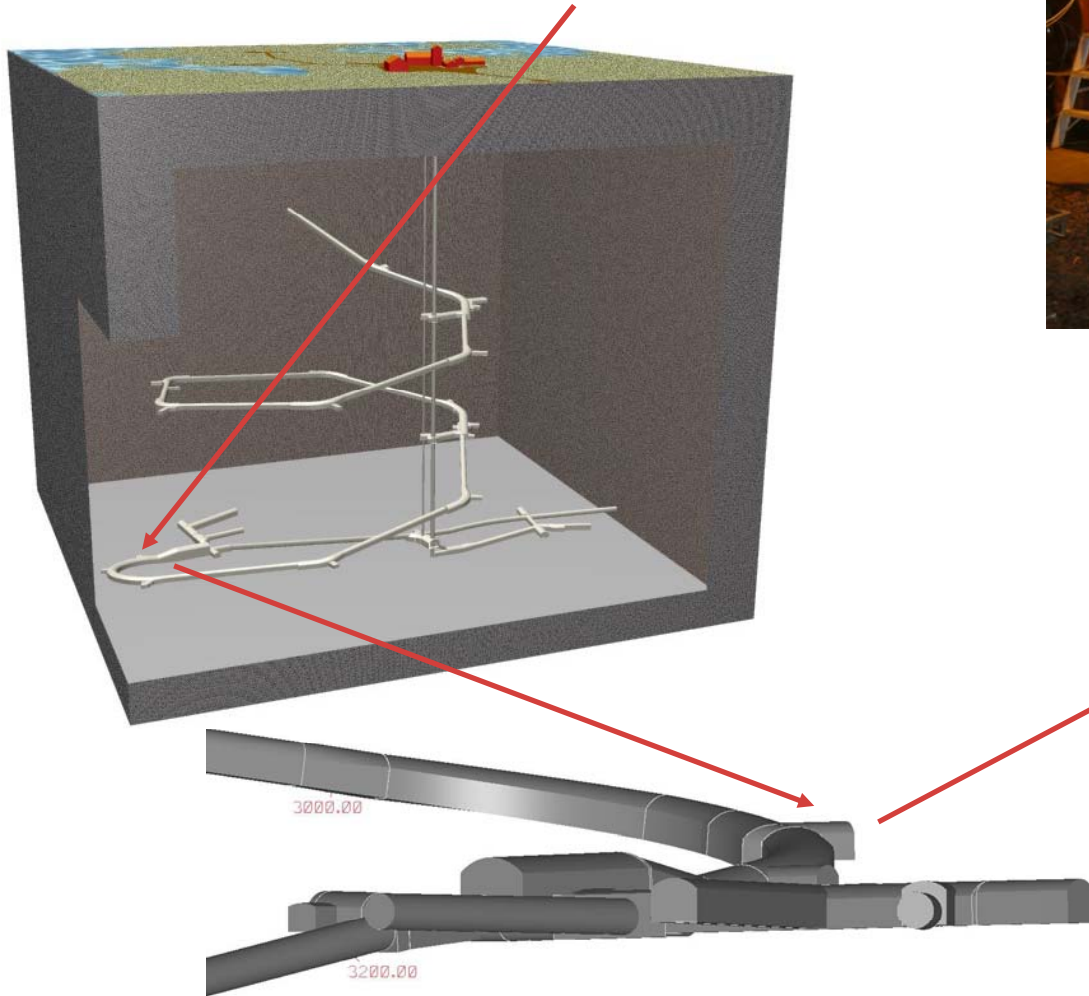


**Chemical separation methods applied on complex water samples,
implications on detection limits for γ -spectrometry**

**LTDE Sorption Diffusion Experiment
(LTDE-SD)**

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Geosigma AB / SKB

LTDE at ÄSPÖ HRL NASA3067 (z ≈ -410 m)



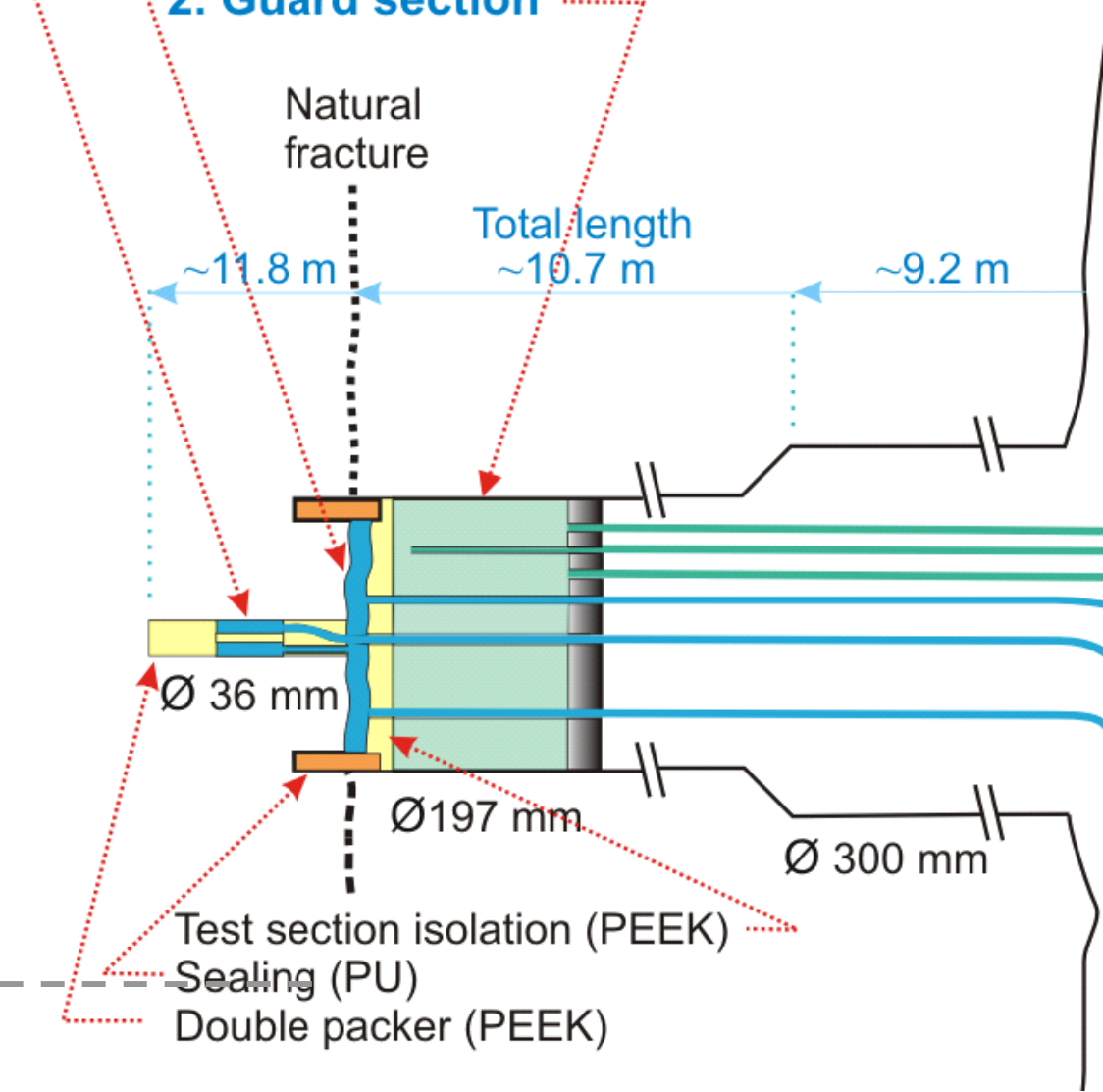
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SKB Äspölab	NASA3067A		DATUM 23 nov 2000	
	SA3045A		ANSVARIG	
Inmätningssritning	UPPDRAG NR	RYDDKONSTR AV	HANDLAGGARE	NUMMER
		C Eriksson		

LTDE-SD, experimentellt koncept

Borehole KA3065A03:

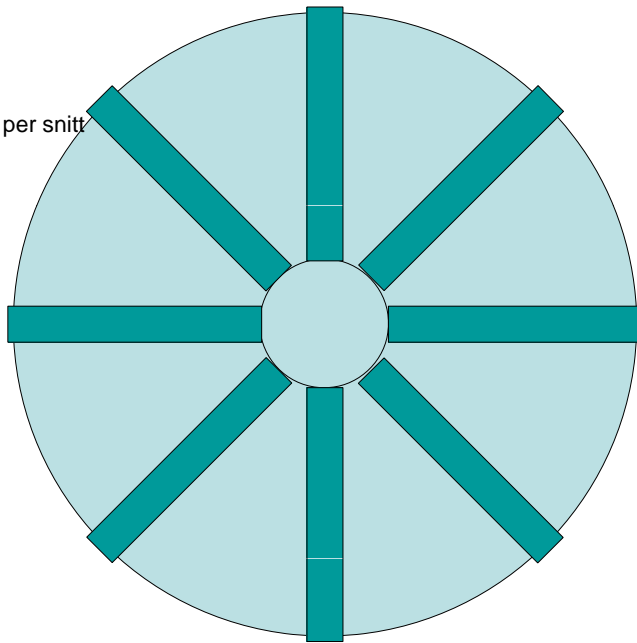
- 1.A. Test section (fracture, "stub")
- 1.B. Test section (slim-hole, $l=300$ mm)
- 2. Guard section



LTDE-SD, händelser 2007

Uttag av 16 st 24 mm dia provkärnor i matrisberget runt testsektionen

d = 10 mm
n = max 8 st per snitt

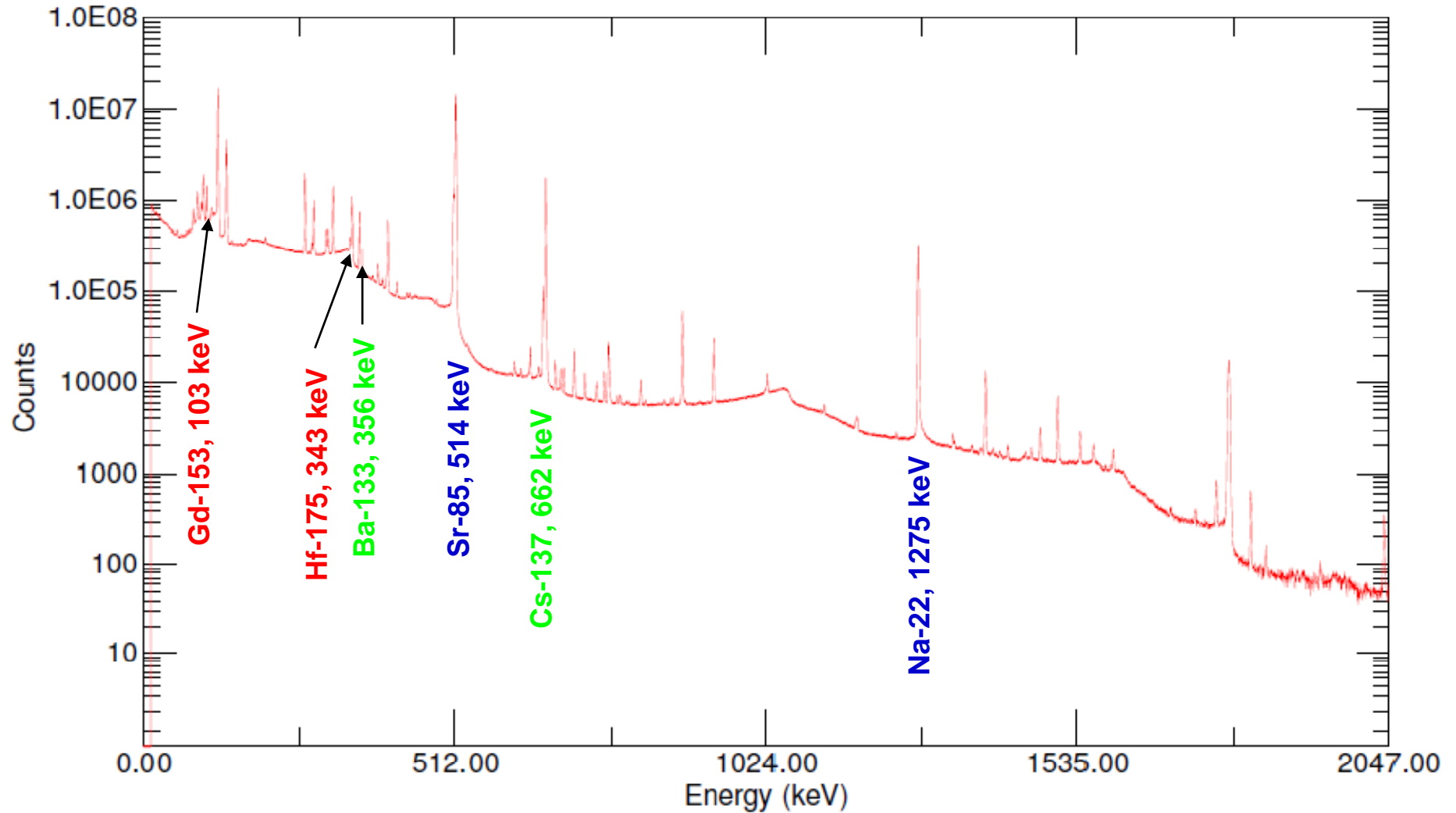


Tracers injected in main sorption diffusion experiment

Tracer	Group	Tracer	Group	Tracer	Group
Na-22	B1	Nb-95	B2	Cs-137	B1
S-35	A	Tc-99	B3	Gd-153	B2
Cl-36	A	Pd-102	B2	Hf-175	B2
Co-57	B2	Cd-109	B2	Ra-226	B1
Ni-63	B2	Ag-110m	B2	Pa-233	B2
Se-75	?	Sn-113	B2	U-236	B3
Sr-85	B1	Ba-133	B1	Np-237	B3
Zr-95	B2				

A non-sorbing tracer, B1 cation exchange, B2 mainly surface complexation, B3 electrochemical reduction dependent

Gammasectrum injected tracers



■ Expected to decrease >99%

■ Expected to decrease <10%

■ Expected to decrease 10-90%

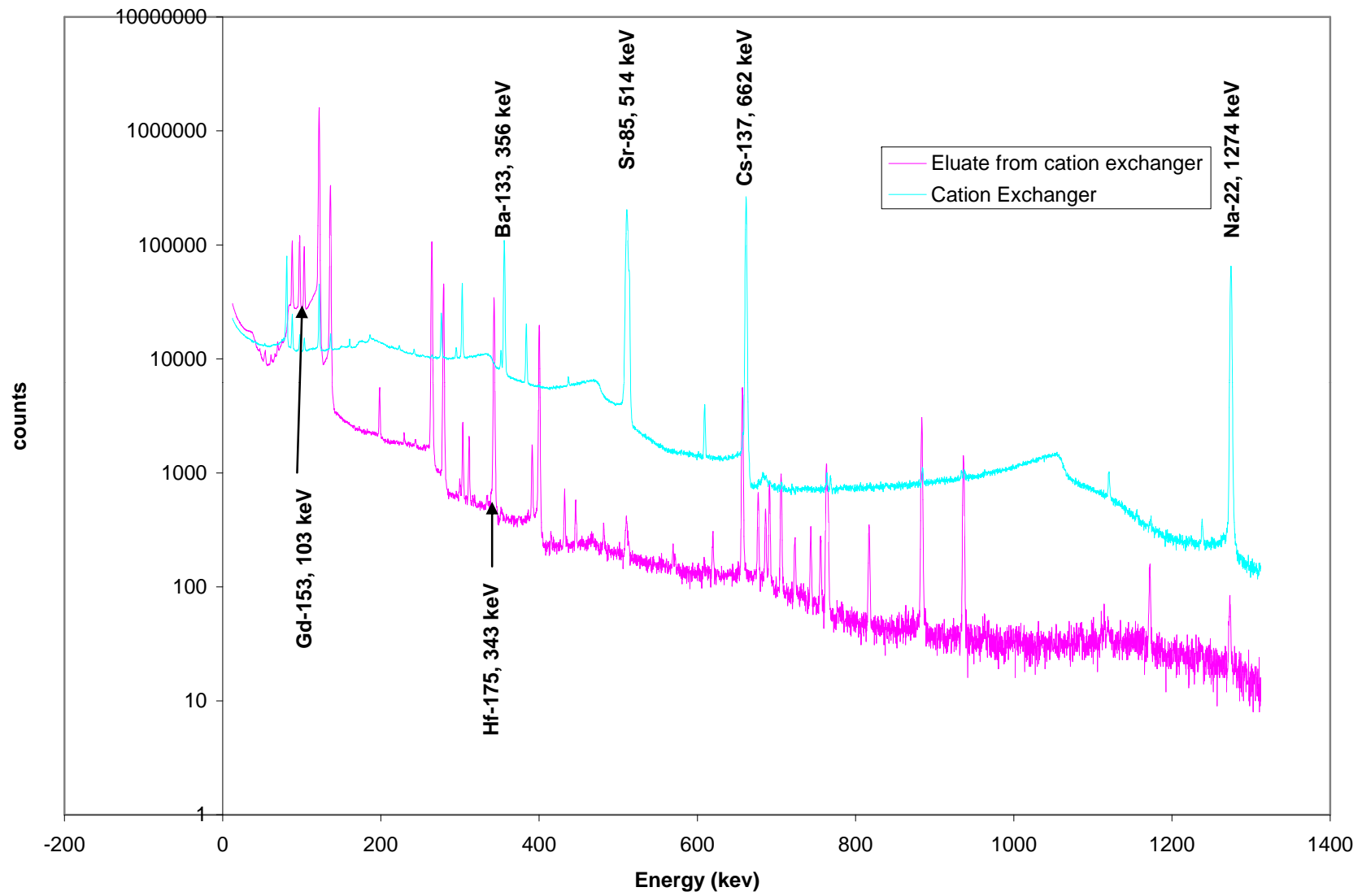
Proposed separation method:

- Addition of DTPA, lower concentration than the natural concentration of Ca, will form negative complex with some of the tracers
- Passing the solution through a cation exchanger (Dowex Wx8)
- Expected outcome:
 - Tri- and tetra-valent cations will be stronger complexed to DTPA than to the sulfonic acids of the cation exchanger
 - Mono- and divalent will form weak complex to the DTPA and will be adsorbed to the cation exchanger

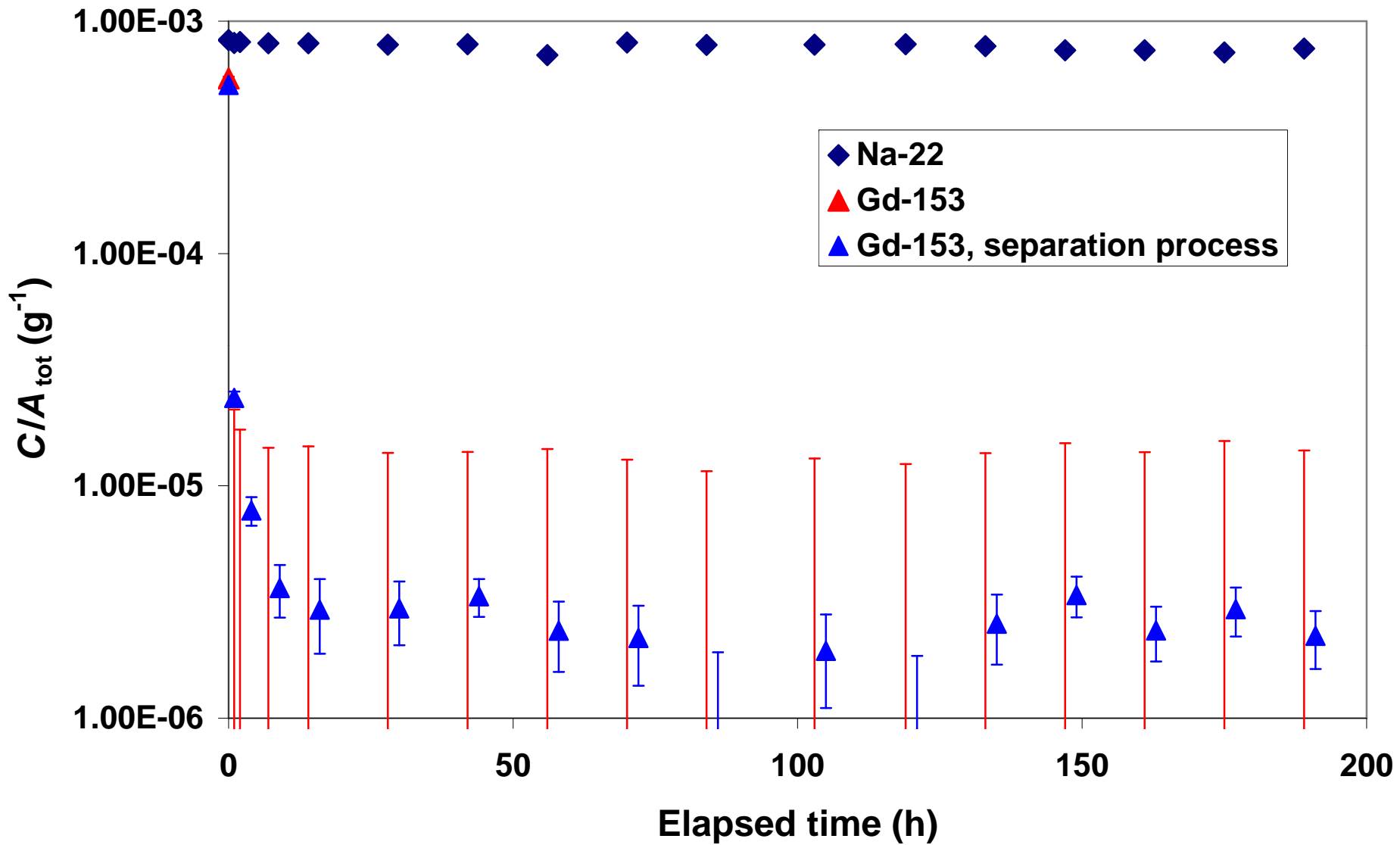
Result of the Cation Exchange/DTPA separation process

	Log K (DTPA)	% in cation exchanger	% in eluate
Na-22	? <3	99.9	0.08
Sr-85	9.77	99.98	0.02
Cs-137	? <3	99.98	0.02
Ba-133	8.87	99.93	0.07
Co-57	19.27	4	96
Cd-109	19.2	16	84
Ag-110m	8.61	19	81
Gd-153	22.56	8	92
Hf-175	35.4	<7	>93

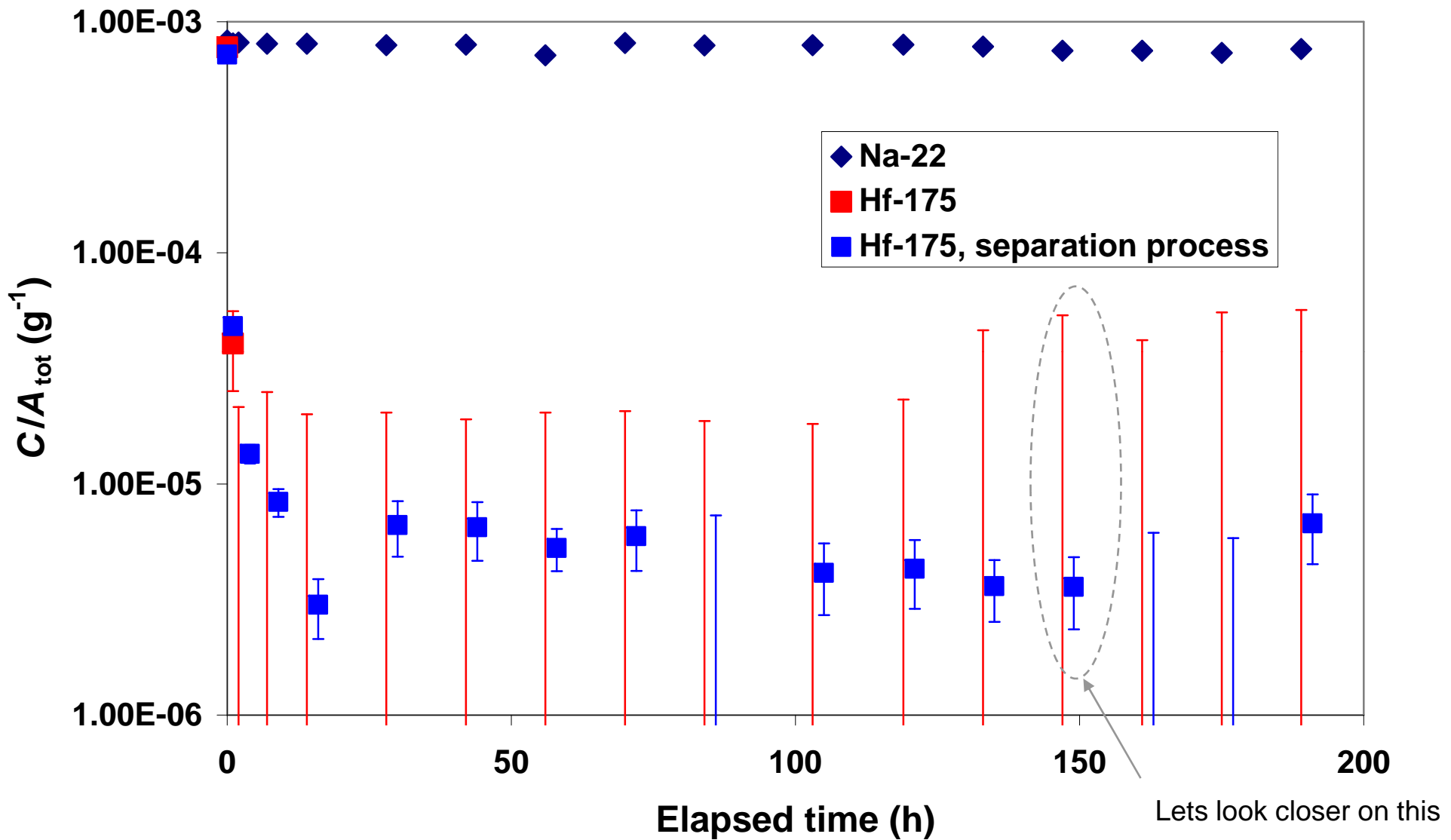
Gamma spectrum after separation



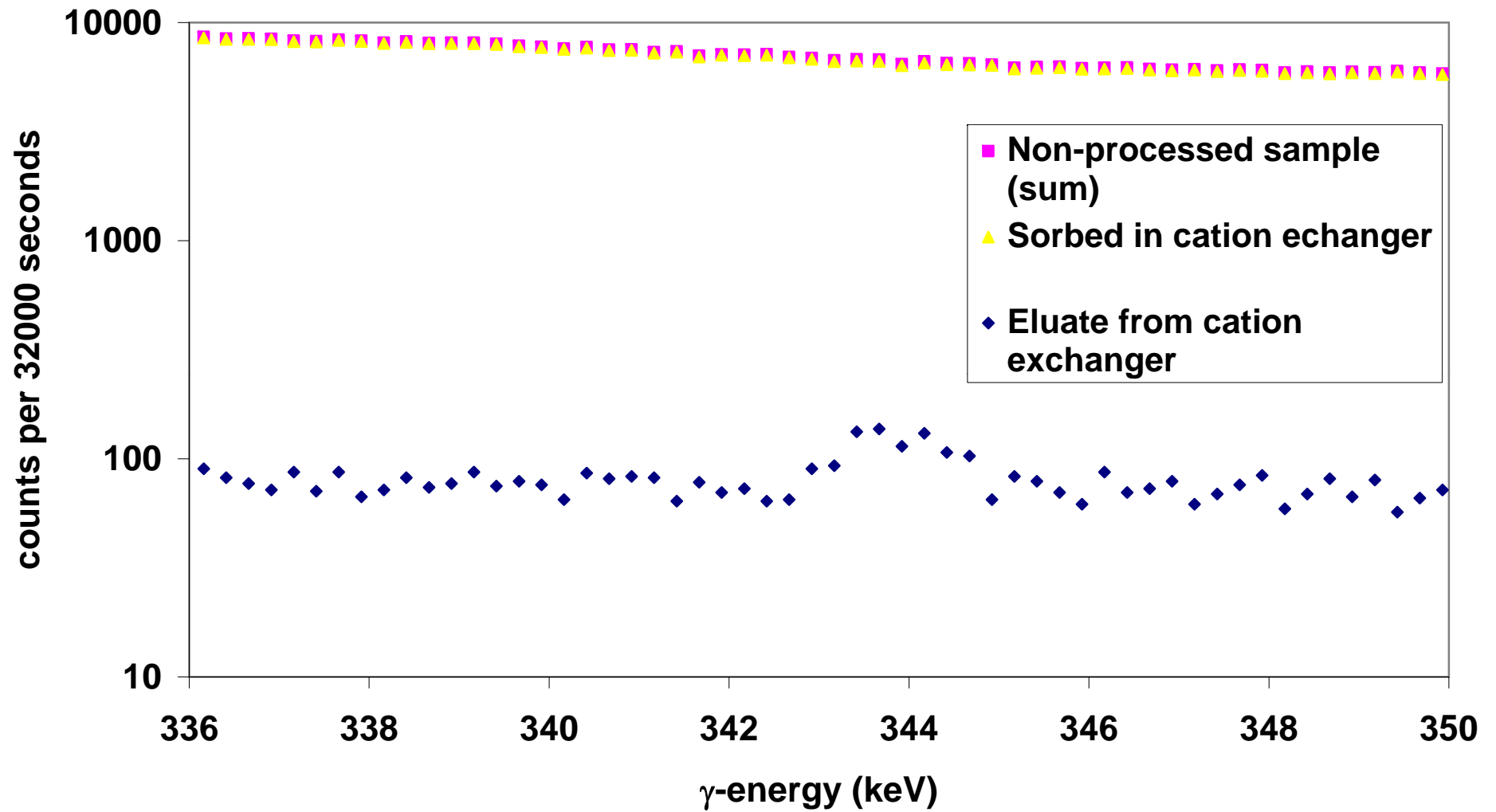
Sorption of Gd-153 during the experiment



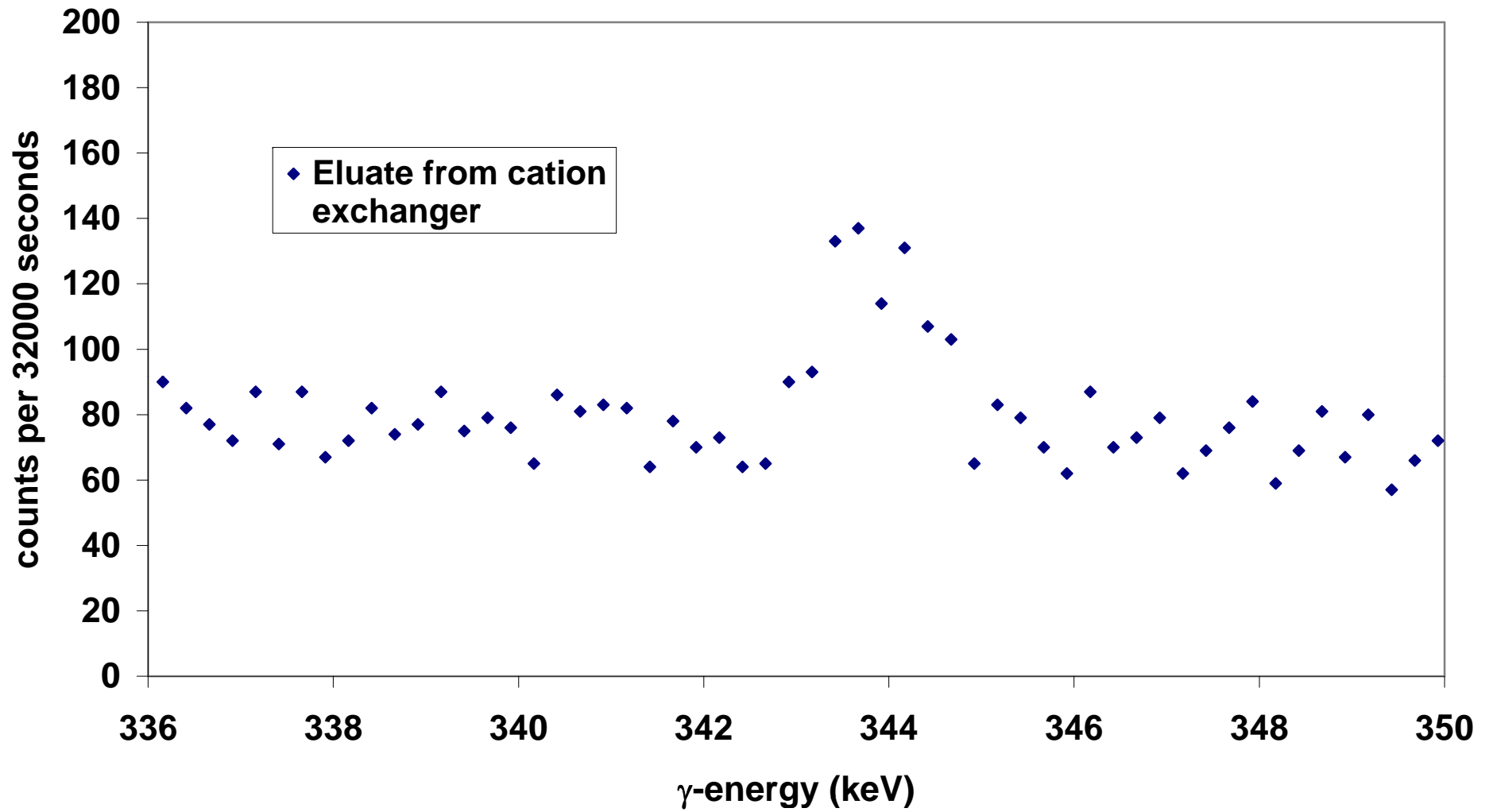
Sorption of Hf-175 during the experiment



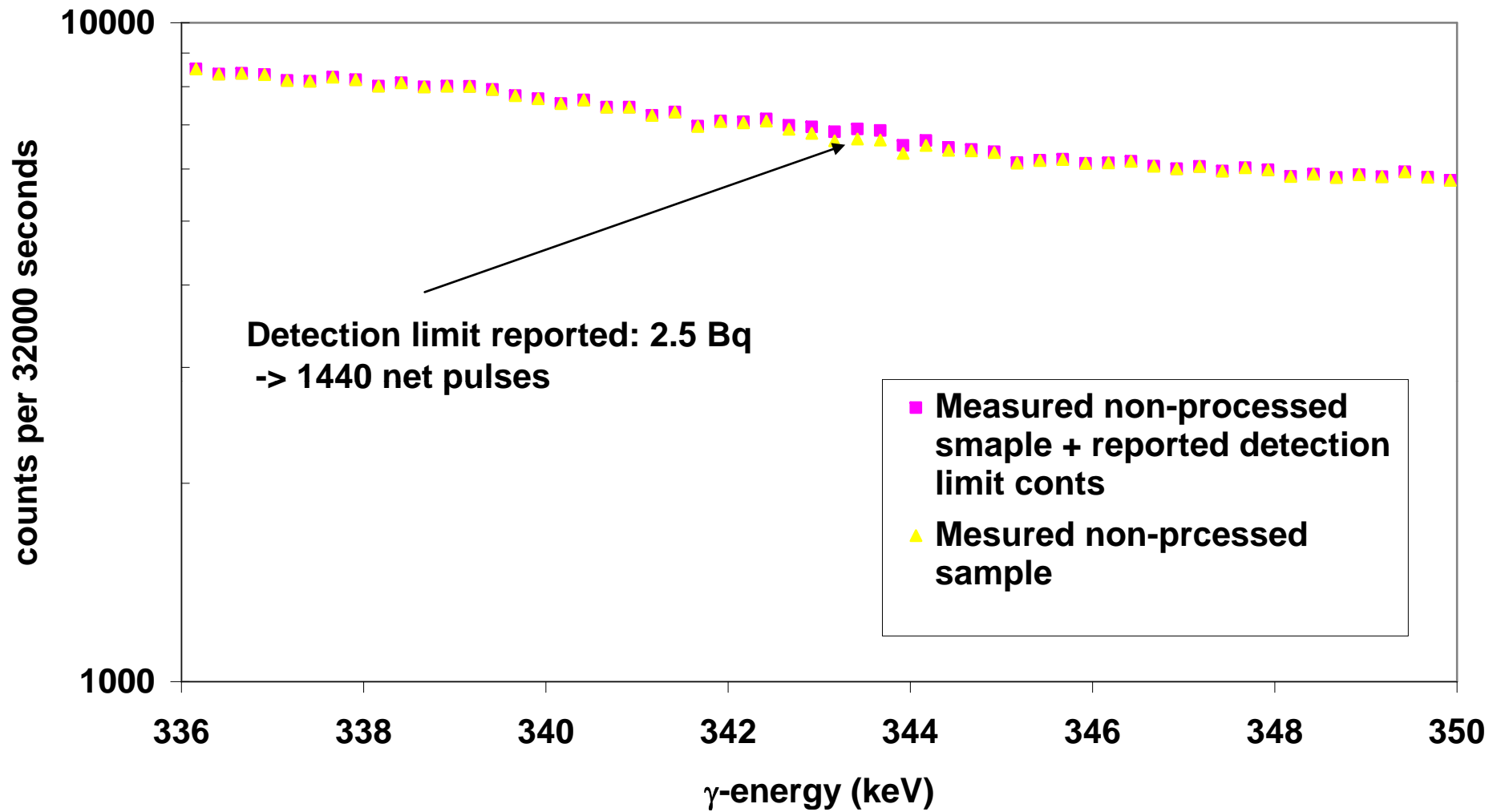
γ -spectrum Hf-175, 343.4 keV



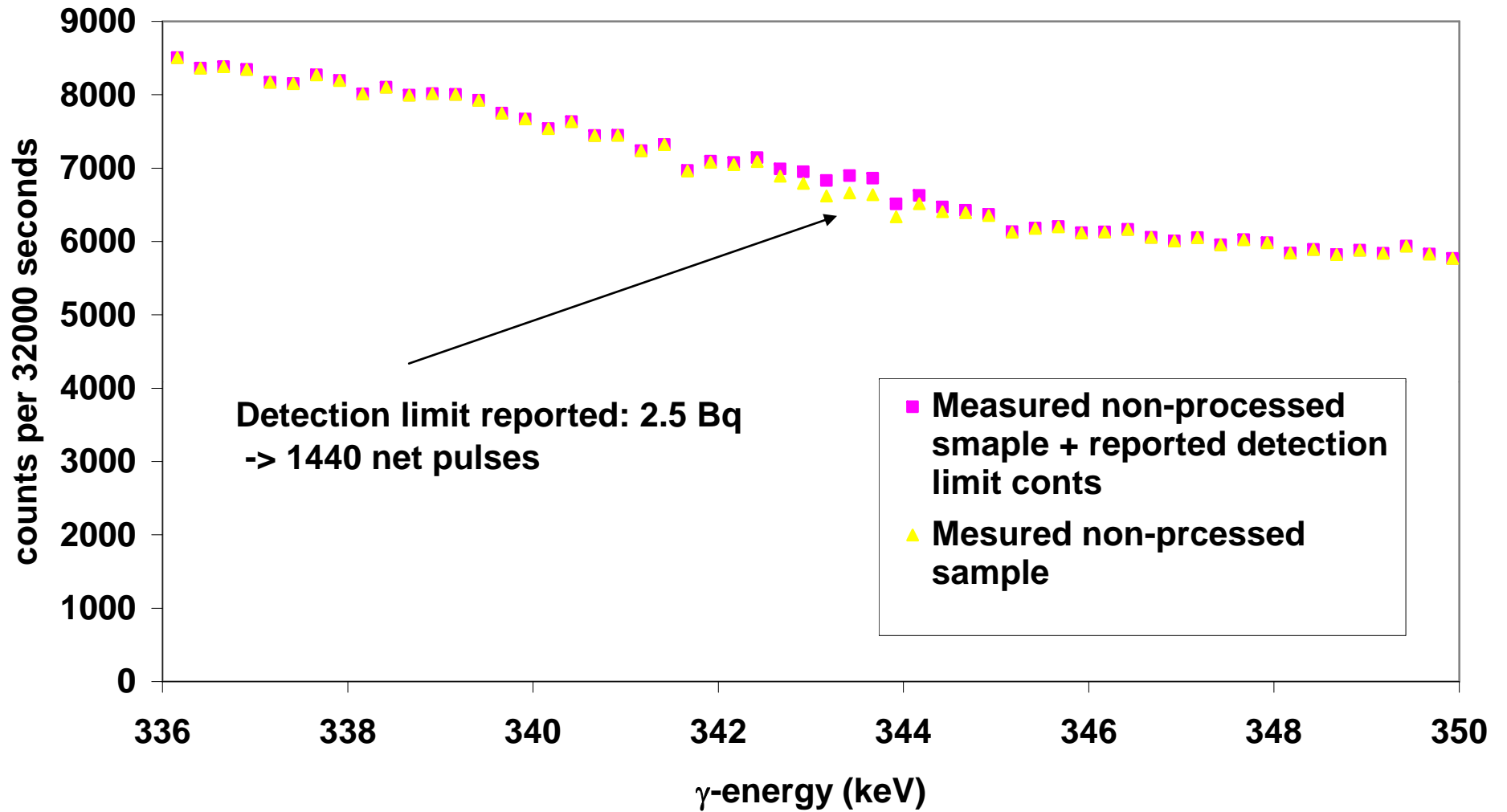
γ -spectrum Hf-175, 343.4 keV



γ -spectrum Hf-175, 343.4 keV



γ -spectrum Hf-175, 343.4 keV



Summary and Conclusions

- A chemical separation method has made it possible to detect and measure tracers otherwise not measurable
- Detection limits?