Faculté
de physique et ingénierie
Université de Strasbourg

Alpha Decay Spectroscopy

experimental work 6

Ahmed Boujnane, Sally Ghazal, Misbah Javed, Evelin Tatiana Mora Carrillo, **Jakub Sochor**

supervised by Mohammad Moukaddam

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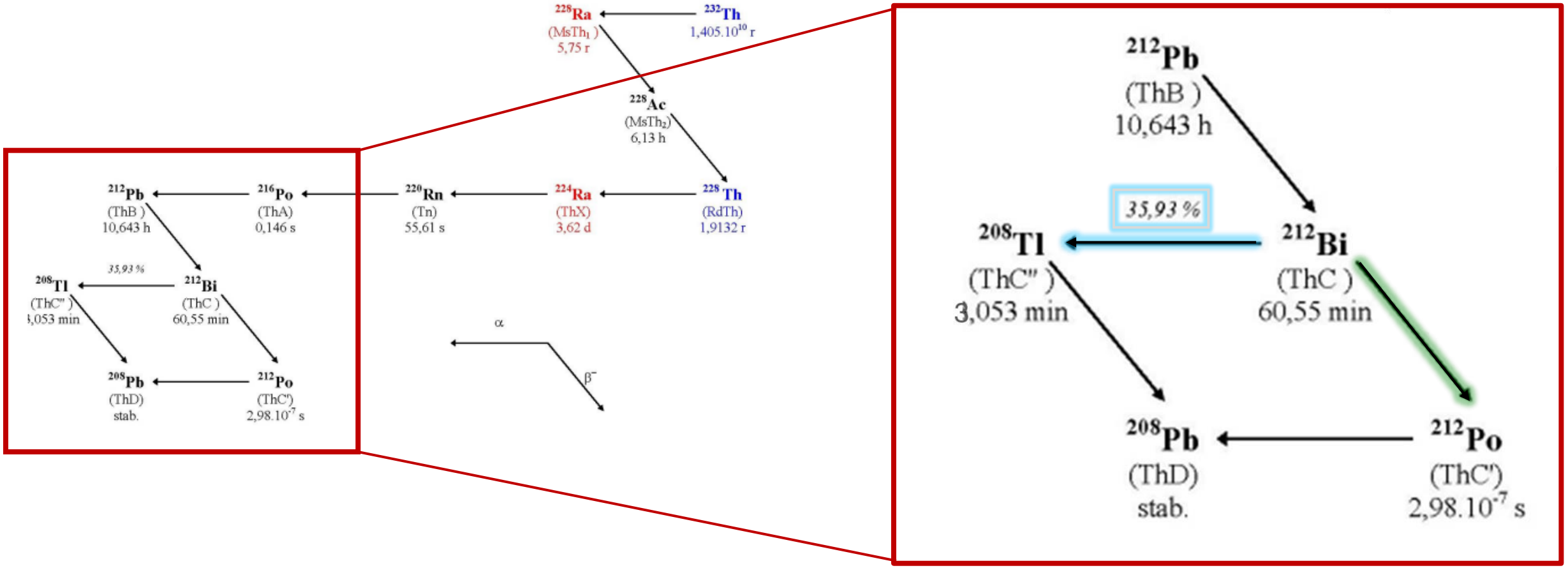
GOALS OF THE EXPERIMENT



Source: MAJER, Vladimír. Základy jaderné chemie. 2., přeprac. vyd. Bratislava: Alfa, 1981.

REACTION ENERGETICS

$$M(^{A}_{Z}X) - M(^{A-4}_{Z-2}Y) - M(^{4}_{2}He) > 0$$

$$\Delta M(^{A-4}_{Z-2}Y) + \Delta M(^{4}_{2}He) - \Delta M(^{A}_{Z}X) > 0$$

$$Q = E_Y + E_\alpha \qquad M_Y v_Y = m_\alpha v_\alpha \qquad M_Y^2 v_Y^2 = m_\alpha^2 v_\alpha^2$$

$$M_Y E_Y = M_Y M_Y v_Y^2 / 2 \qquad E_Y M_Y = E_\alpha m_\alpha$$

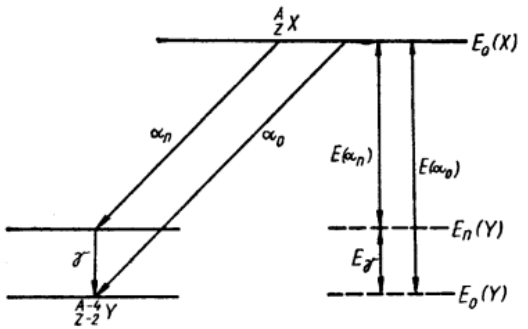
$$Q = \frac{E_\alpha m_\alpha}{M_Y} + E_\alpha = E_\alpha(1 + \frac{m_\alpha}{M_Y}) = E_\alpha \frac{M_Y + M_\alpha}{M_Y} \qquad E_\alpha = Q \frac{M_Y}{M_Y + M_\alpha}$$

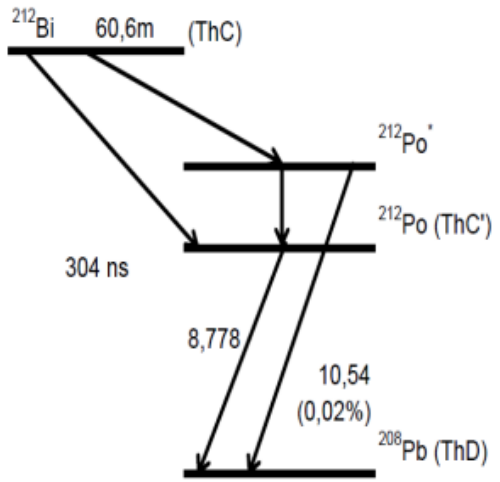
$$E_Y = Q - Q\frac{M_Y}{M_Y + M_\alpha} = Q(1 - \frac{M_Y}{M_Y + M_\alpha}) = Q\frac{M_\alpha}{M_Y + M_\alpha}$$

^{212}Po: 197 423,439 MeV
^{212}Bi: 197 426,200 MeV
^{208}Pb: 193 687,106 MeV
^{208}Tl: 193 692,614 MeV
alpha: 3 727,379 MeV

$$E_{\alpha_n} \rangle E_{\alpha_0}$$

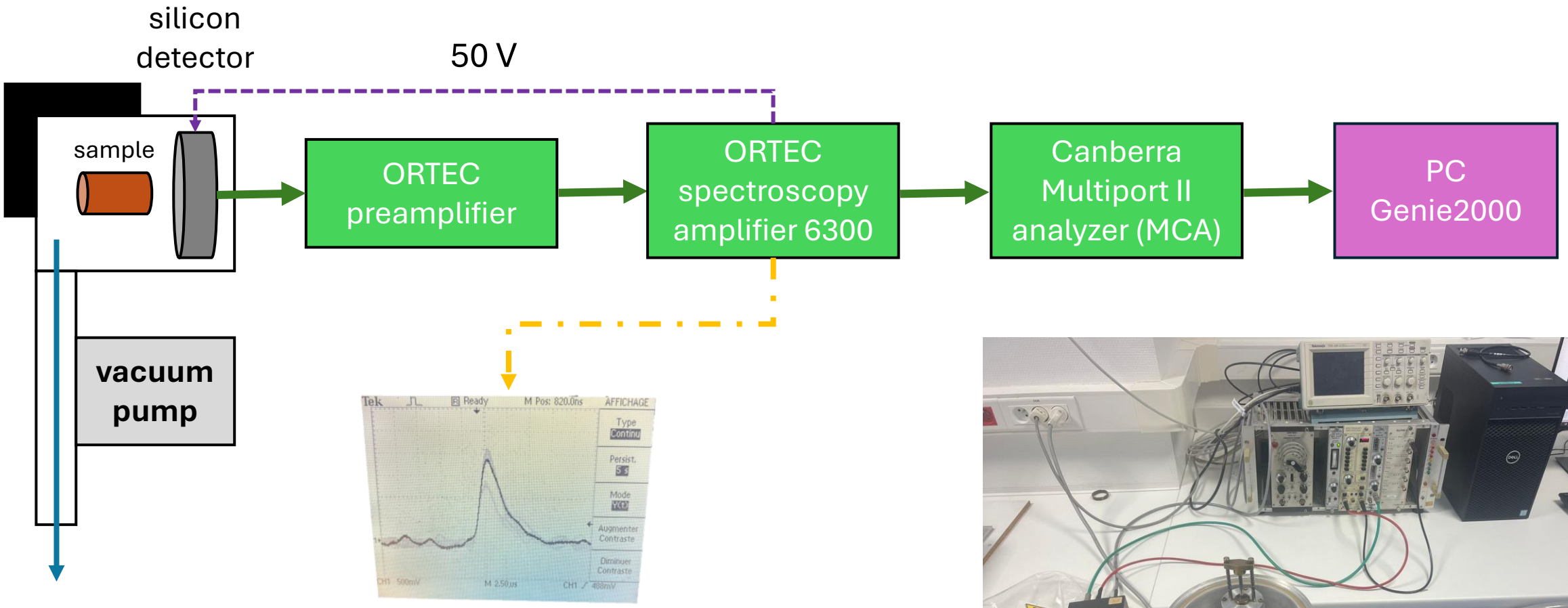
$$E_{\alpha_0} = E_{\alpha_n} + E_\gamma = E_0(X) - E_0(Y)$$





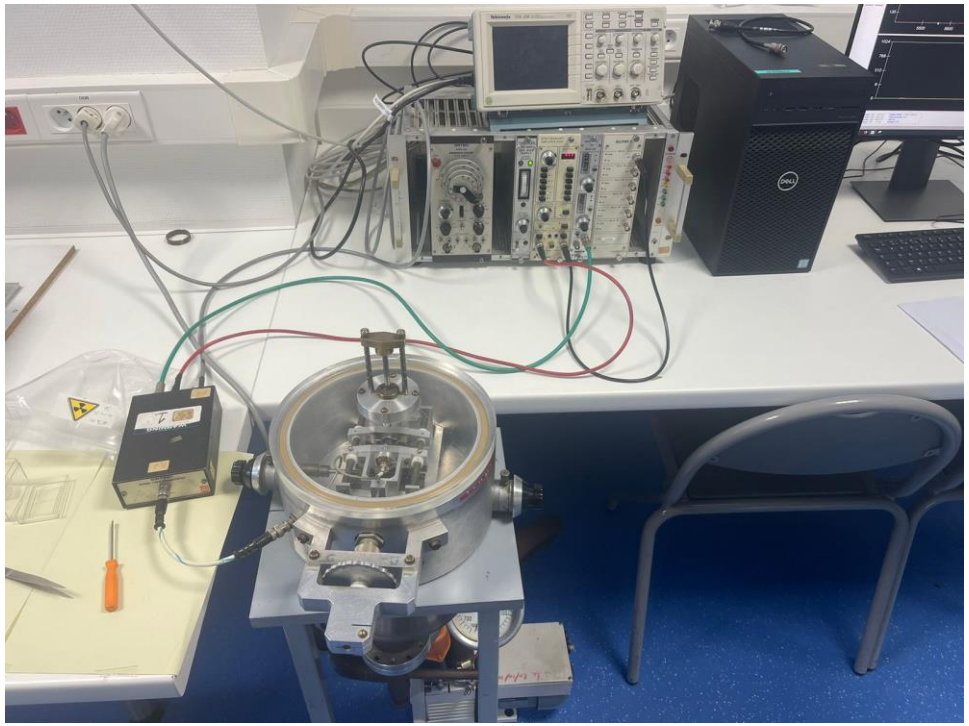
source: JOHN, Jan: Prezentace k předmětu Jaderná chemie I, Praha, 2022

APPARATUS DIAGRAM



Tektronix TDS 220 oscilloscope

rise time, total time, amplitude



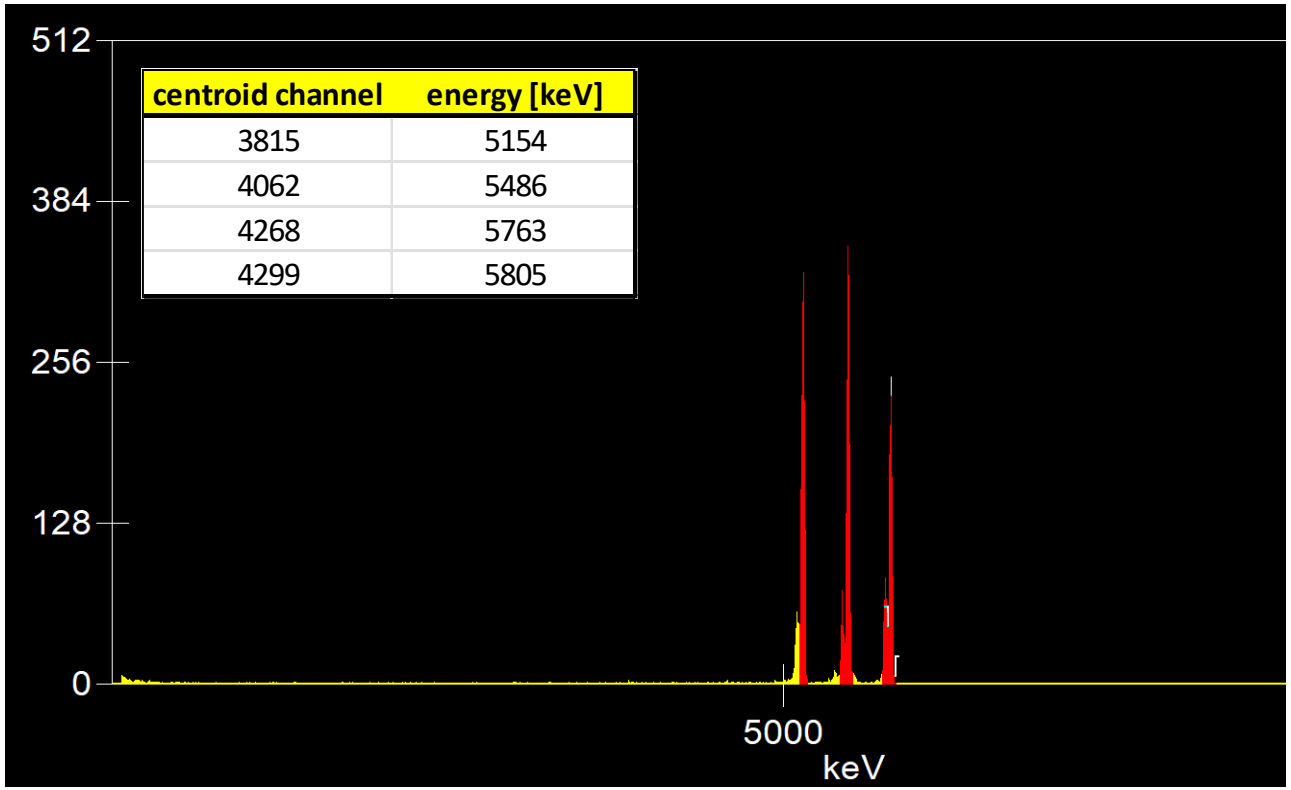
(not in scale)

ENERGY CALIBRATION

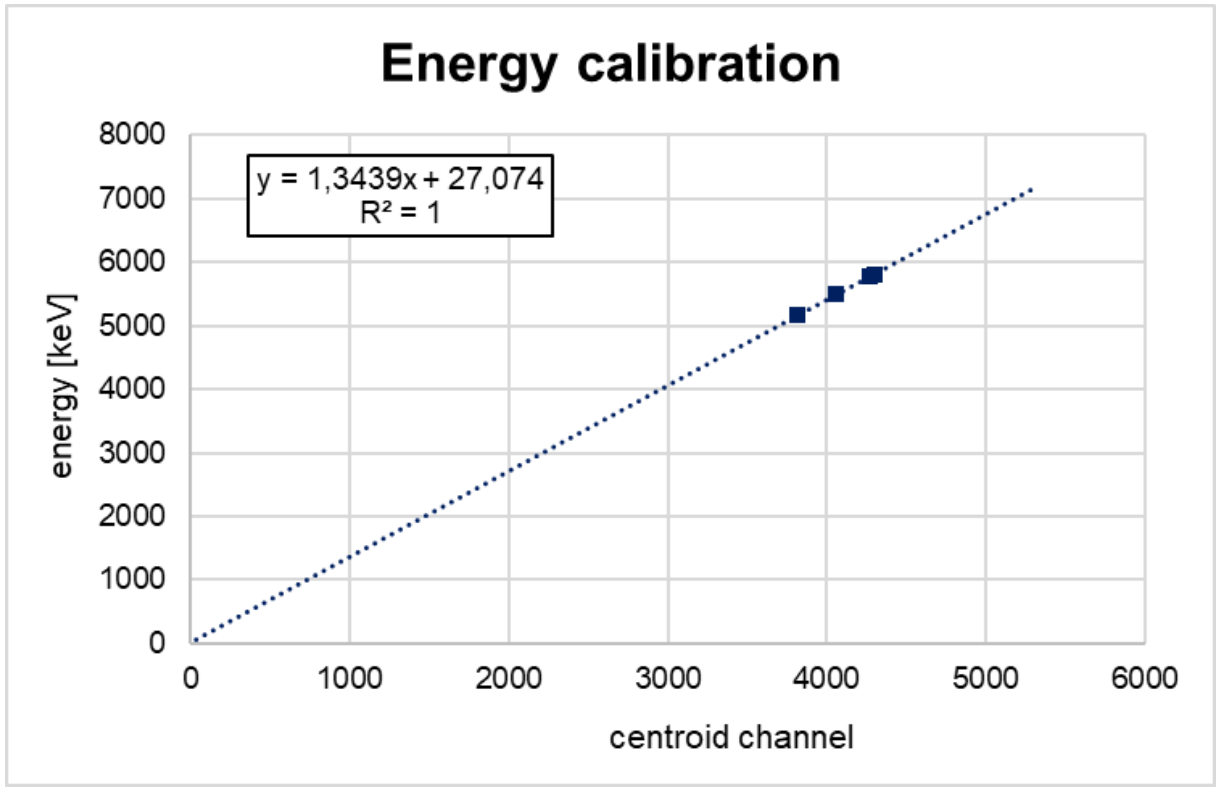
$^{239}Pu + {}^{241}Am + {}^{244}Cm$

386,6 $\alpha \cdot s^{-1}$
20. 7. 2016

Isotope and half-life	E/keV (inc.)	Intensity/% (inc.)	Range in air /cm (inc.)
Pu-239	5105.50 (8)	11.94 (7)	3.830 (25)
24100 y	5144.30 (8)	17.11 (14)	3.873 (26)
	5156.59 (14)	70.77 (14)	3.887 (26)
Am-241	5388.00 (-)	1.660 (20)	4.147 (27)
432.6 y	5442.80 (13)	13.10 (3)	4.210 (28)
	5485.56 (12)	84.80 (5)	4.259 (28)
Cm-244	5762.64 (3)	23.10 (10)	4.585 (30)
18.1 y	5804.77 (5)	76.90 (10)	4.636 (31)



centroid channel	energy [keV]
3815	5154
4062	5486
4268	5763
4299	5805



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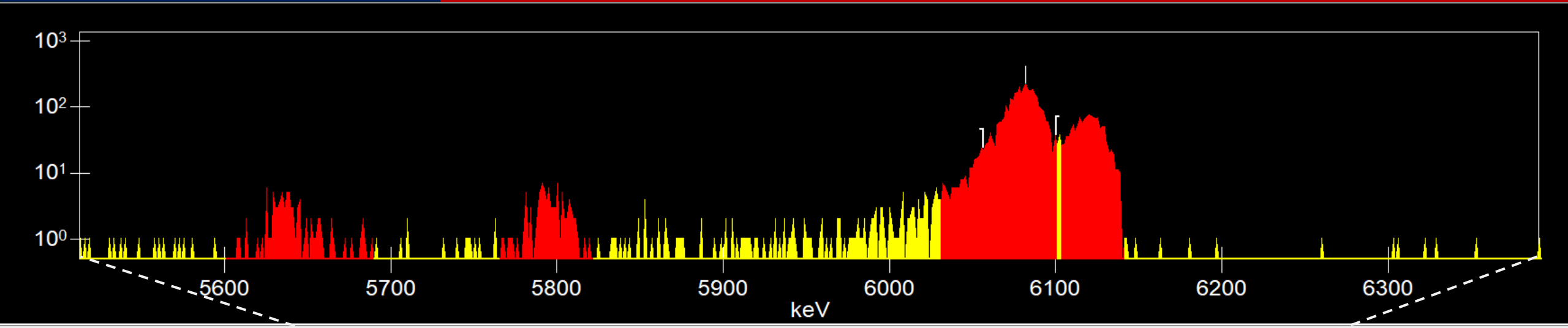
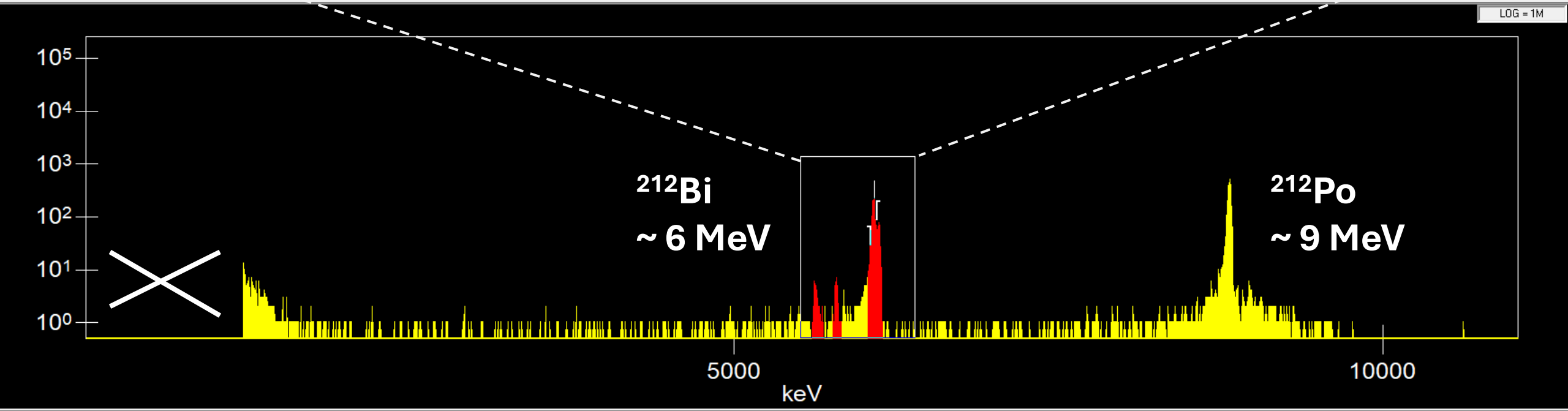
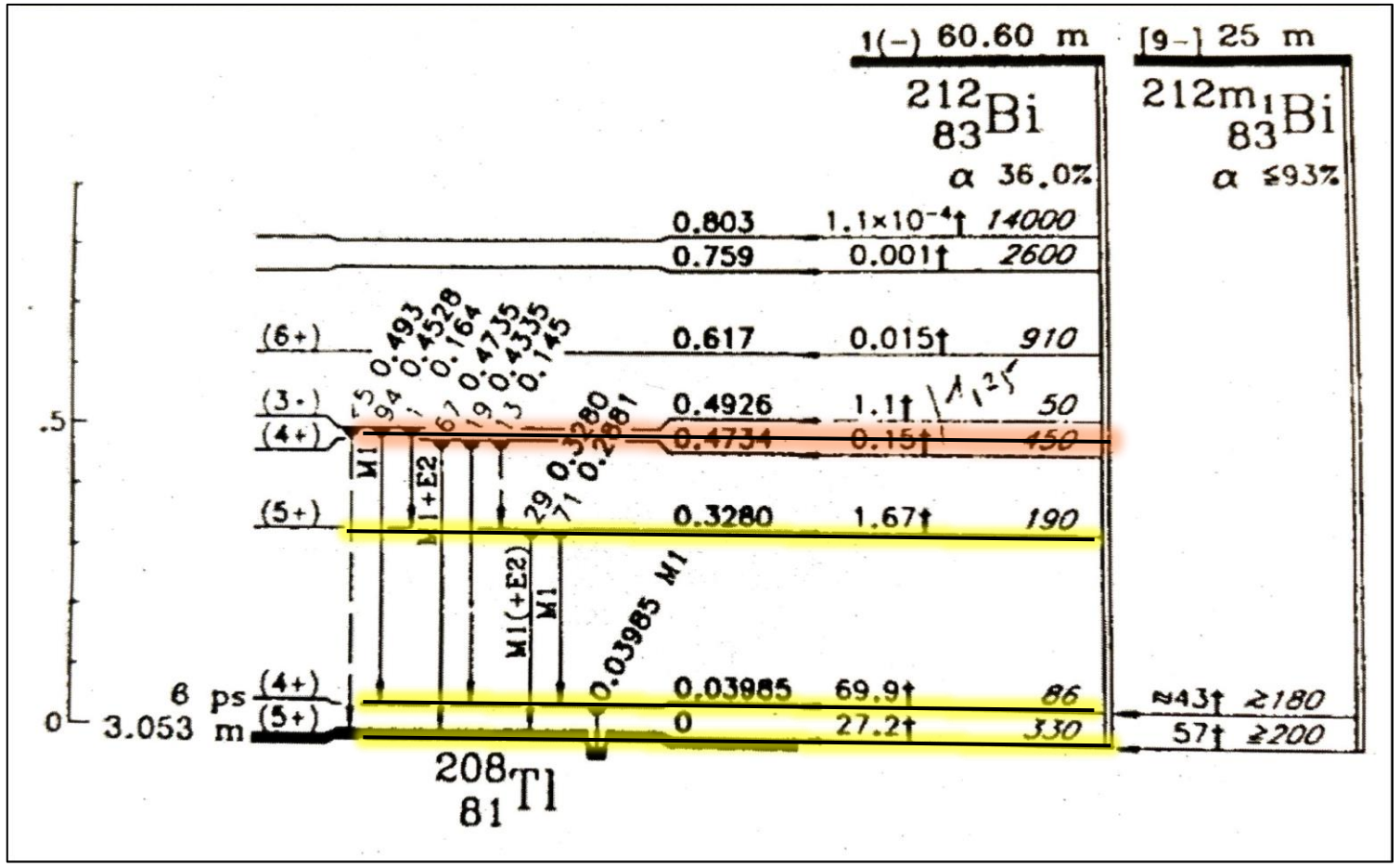
RESULTS



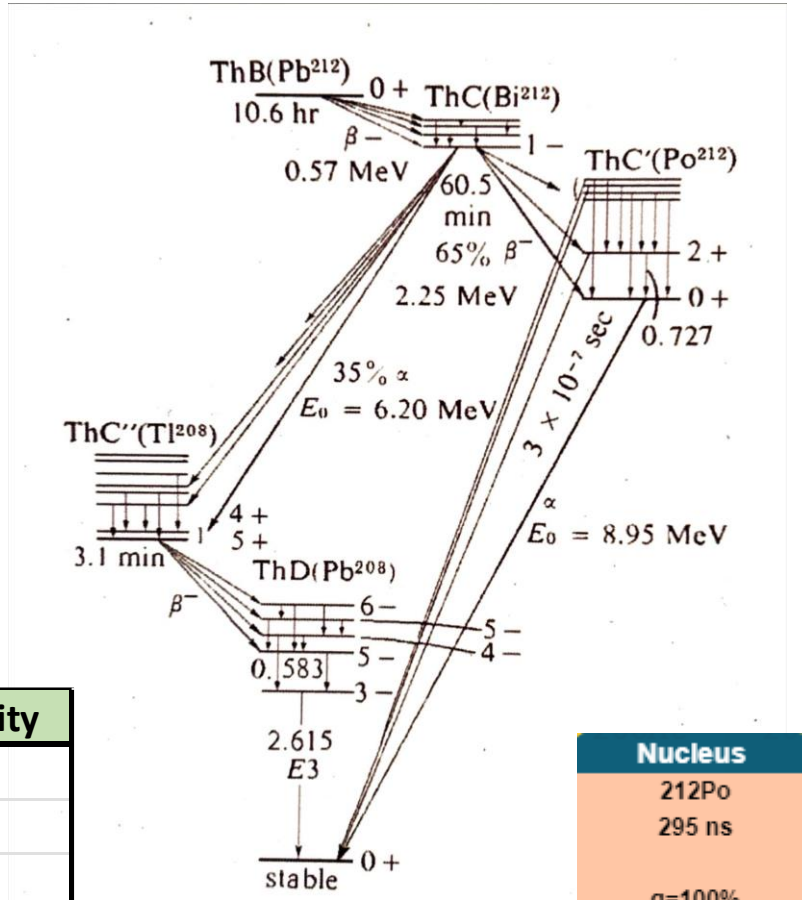


Canal gauche:	4485 : 6054.6 keV	**FWHM, FWTM:**	17.660, 41.491 keV
Canal droit:	4518 : 6099.1 keV	**Coeff. Gaussien:**	1.289
Centroïde:	4503 : 6079.4 keV	**Type RI:**	
Surface:	3367 ± 1.72%	**Intégrale:**	3367

RESULTS



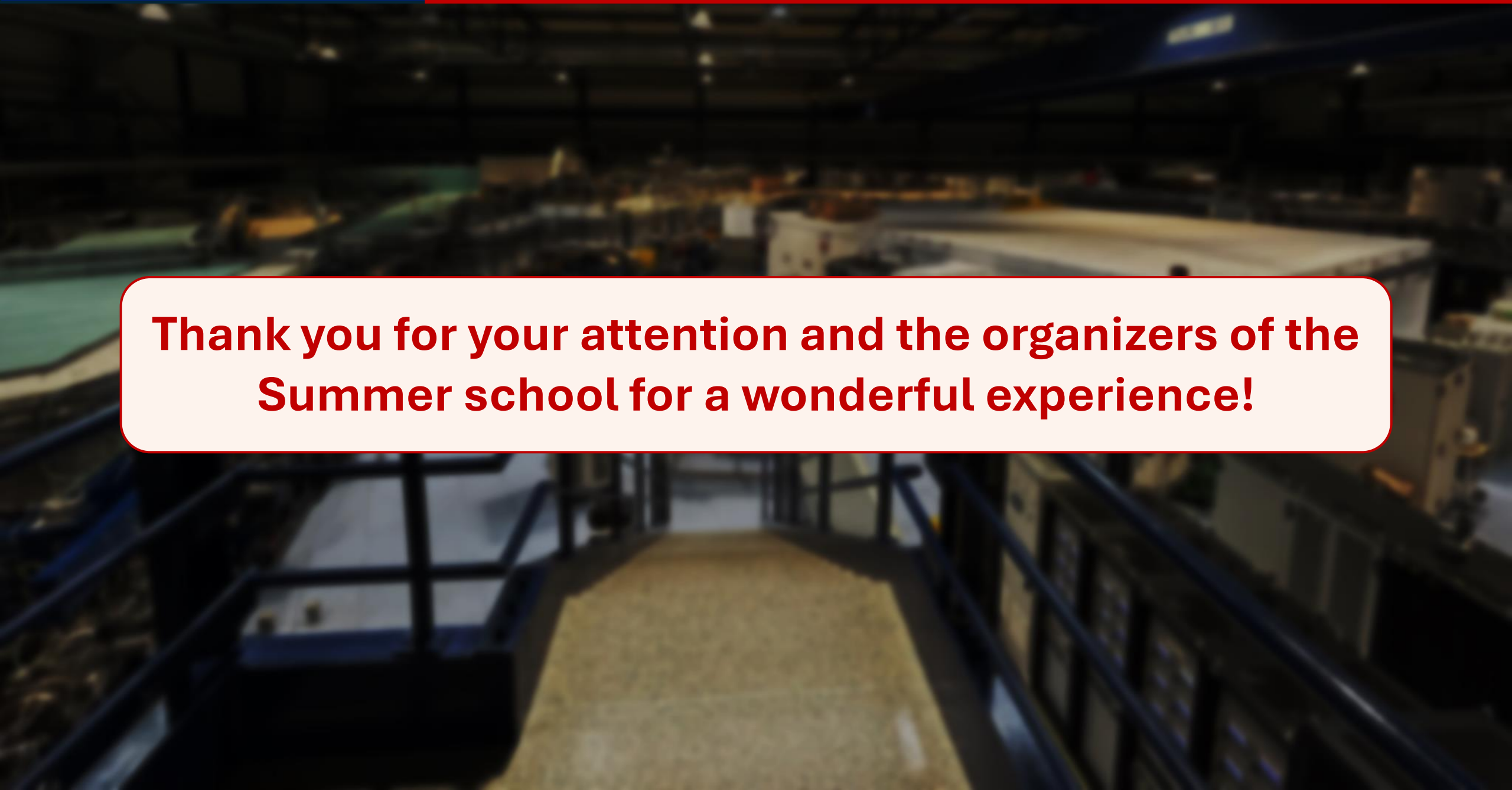
decay Bi212		
% Tl208	35,93%	35,93%
% Po212	64,07%	64,07%



exc. state	over zv keV	energy keV	intensity	energy keV	over zv keV	counts	intensity
0	0	6118	27,20%	6119	0	1298	25%
1	40	6078	69,90%	6078	41	3804	72%
2	328	5790	1,67%	5794	325	94	2%
4	493	5625	1,10%	5637	482	80	2%

Nucleus
212Po
295 ns
α=100%

Farewell



Thank you for your attention and the organizers of the Summer school for a wonderful experience!