The Nuclear Fuel Cycle, Lab

In the first part of the laboratory activities, the assistant will demonstrate different detectors for measuring ionizing radiation. In the second part the students are supposed to work more or less without supervision. Prepare by considering how the task shall best be performed.

The following text describes how the laboratory experiments are to be performed. Read in the textbook about how the different detectors work in general.

(**8.2.3** *Pulse shape and dead time* 202-204
8.3 *Gas counters* 204-206
8.3.3 *GM-counters* 210-211
8.4 *Semi-conductor detector* 212-213, 215-217
8.5 *Scintillation detectors* 218-222
8.7.5 *Multi-channel analyzers* 226
8.7.6 *γ-spectroscopy* 226-228

Ion chamber / Geiger-Müller counter

Three different Geiger-Müller counters will be demonstrated

- Determine the β_{max} of a sample by first determining the half-thickness of an absorber (see appendix)
- Determine the measuring efficiency of the detector for β- and γ-radiation. Assume that the detector is working in the ion chamber region (even though it's not)
- Remember to take the background into account.

Scintillation detector

- Determine the specific activity [Bq/g] of a sample. A solution with known specific activity will be provided for the isotope.

Multi-channel analyzer

- Record the spectrum of Eu-152
- Determine the measuring efficiency of the detector at three different energies, using data for Eu-152 provided in the appendix.

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Commissariat à l'Energie Atomique
Bureau National de Métrologie

Référence Multigamma ^{152}Eu

ource étalon type EGMA 2 — N° 5179
ate de référence : le 05.09.1977 à 12 h 00(1)

ENERGIE (2) KeV		Taux d'émission photonique (3) γ/s/4π	Incertitude (4) %
121,78 ± 0,02		1,168.10⁴	2,4
244,69 ± 0,02 251,76 ± 0,08	244,7 (5)	3,072.10³	2,6
295,94 ± 0,03		1,751.10²	3,7
344,28 ± 0,02		1,093.10⁴	2,1
367,76 ± 0,03		3,479.10²	4,2
411,12 ± 0,02 416,04 ± 0,07	411,3 (5)	9,524.10²	3,1
443,98 ± 0,02 444,00 ± 0,10	444,0 (5)	1,273.10³	2,2
564,02 ± 0,04 566,36 ± 0,08	564,5 (5)	2,538.10²	6;1
686,4 — 688,69 ± 0,08	688,6 (5)	3,516.10²	3,5
778,90 ± 0,03		5,383.10³	2,3
867,38 ± 0,03		1,723.10³	2,0
963,43 ± 0,08 964,05 ± 0,03	964,0 (5)	5,996.10³	2,2
1085,83 ± 0,03 1089,72 ± 0,04	1086,4 (5)	4,903.10³	2,7
1109,2 — 1112,08 ± 0,04	1112,0 (5)	5,611.10³	2,1
1212,94 ± 0,04		6,048.10²	2,8
1292,86 ± 0,07 1299,13 ± 0,04	1298,7 (5)	7,218.10²	3,6
1408,03 ± 0,03		8,571.10³	2,0

I.P. N° 2 - 91190 - GIF-SUR-YVETTE - FRANCE Tél. 941.80.00 - Télex 69641 F Energat Saclay


152Eu - spectre γ:
Comptage
Energie
0
500
1000
1500
121,78 KeV
244,69&
251,76 KeV
295,94 KeV
344,28 KeV
367,76 KeV
411,12&
416,04 KeV
443,98&
444,00 KeV
564,02&
566,36 KeV
686,4&
688,69 KeV
778,90 KeV
867,38 KeV
963,43&
964,05 KeV
1085,83&
1089,72 KeV
1109,2&
1112,08 KeV
1212,94 KeV
1292,86&
1299,13 KeV
1408,03 KeV

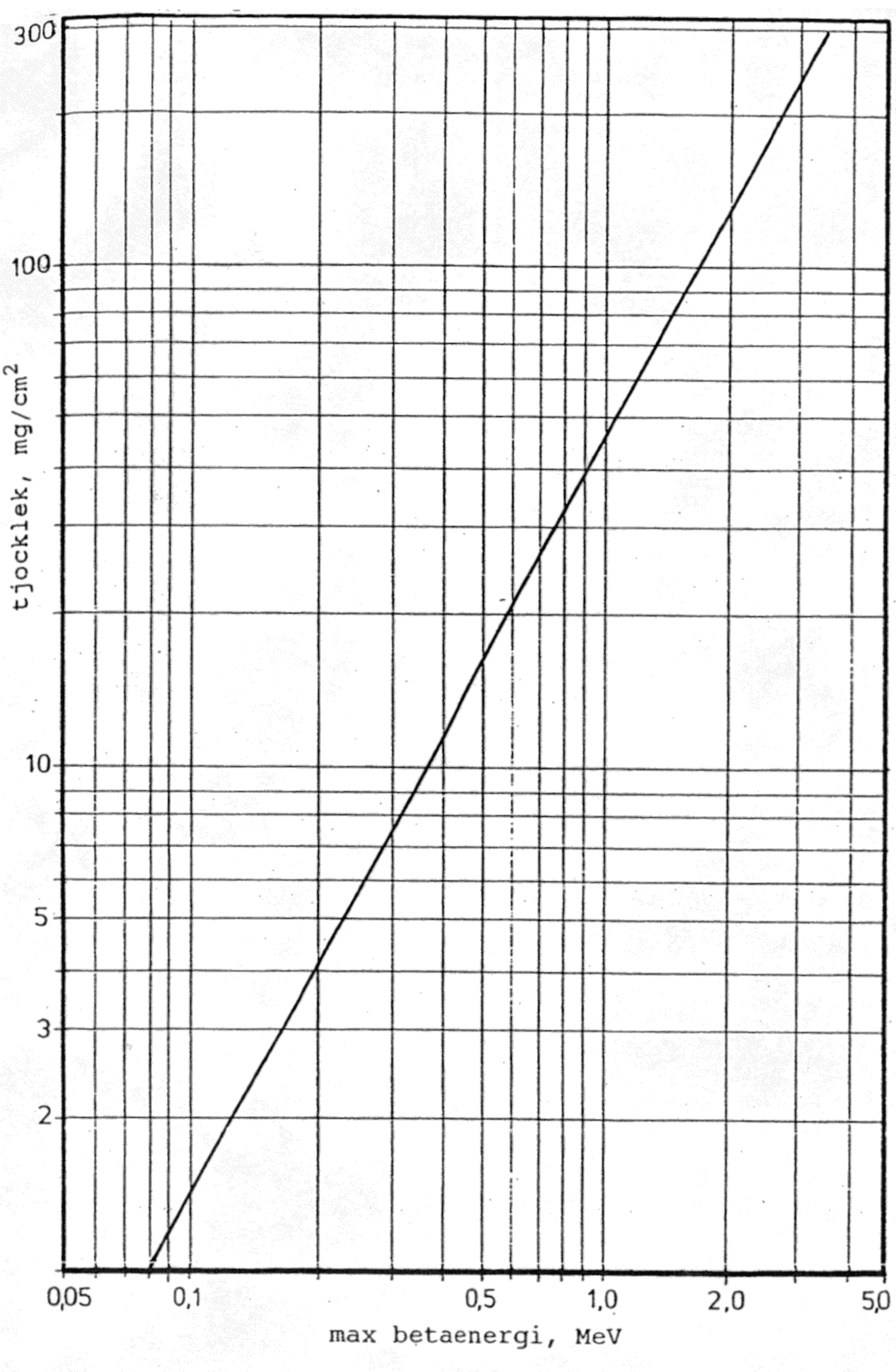

Fig. 6 Halveringstjockleken för betapartiklar som funktion av energin