



Training C

Germanium detector

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Outline

- Introduction
- Exercise
- Summary



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Introduction

- **Ge:**
 - **Atom number is 32;**
 - **Semiconductor;**
 - **Is available as a radiation detector.**
- **Compared with other detectors:**
 - **Advantage : high resolution, high count rate;**
 - **Disadvantage : low temperature.**





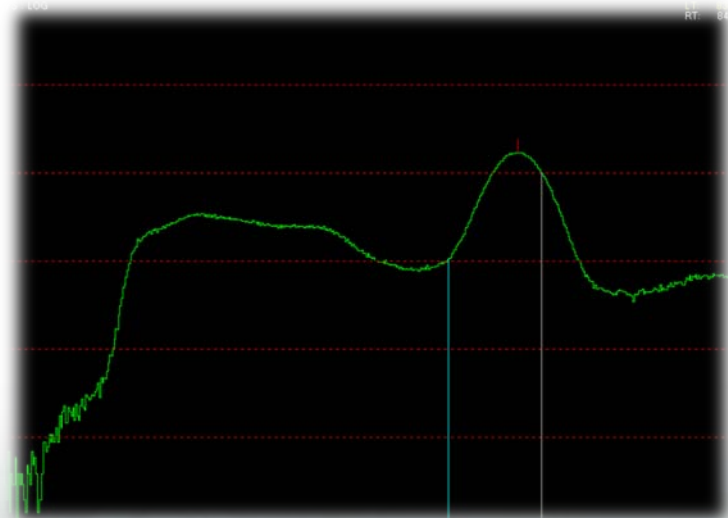
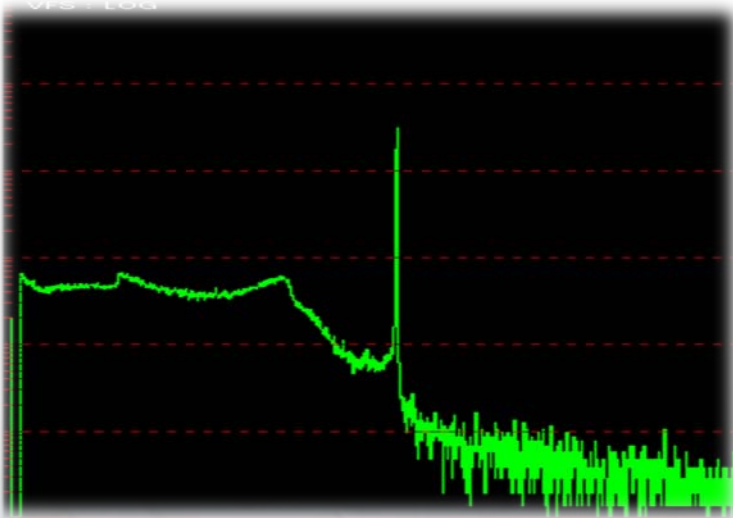
Exercise

- Measure gamma rays emitted from standard sources:

^{137}Cs : 662keV

^{60}Co : 1.17MeV, 1.33MeV

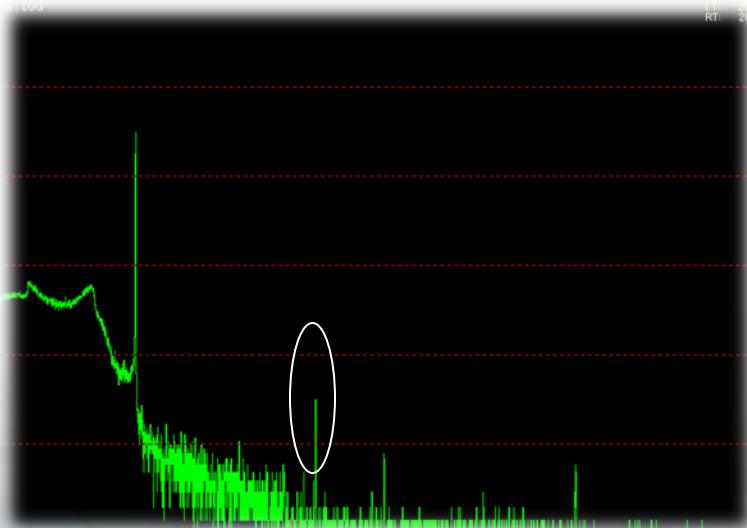
^{22}Na : 1.27MeV



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Exercise

- Make an energy calibration by standard sources.
- We found that one of the high energy background peaks had the energy of 1.464MeV.



We got the conclusion that it was come from the decay of ^{40}K , according to *Table of Isotopes*.



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Exercise

- **Change the gain of shaping amplifier.
Adjust our range of measurement of energy up to 3MeV.
Calibration again.**
- **Measure the resolution of the energy using the peak of ^{60}Co (1.33MeV):**

FWHM=5.33 channel

Peak=2397 channel

Get:

$\Delta E=2.96\text{keV}$



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Exercise

- **Absolute efficiency of the detector using ^{152}Eu source:**

$$\varepsilon = \frac{N_r}{I * P * LT}$$

No	1	2	3	4	5	6	7	8
E/keV	217.817	344.2785	778.9045	964.1	1112.074	1212.948	1299.140	1408.11
Nr	74085	33077	8105	7670	6238	712	517	7970
P/%	28.37	26.57	12.97	14.63	13.54	1.626	1.412	20.85
ε	4.74e-3	2.26e-3	1.13e-3	9.51e-4	8.36e-4	7.34e-4	7.98e-4	6.44e-4

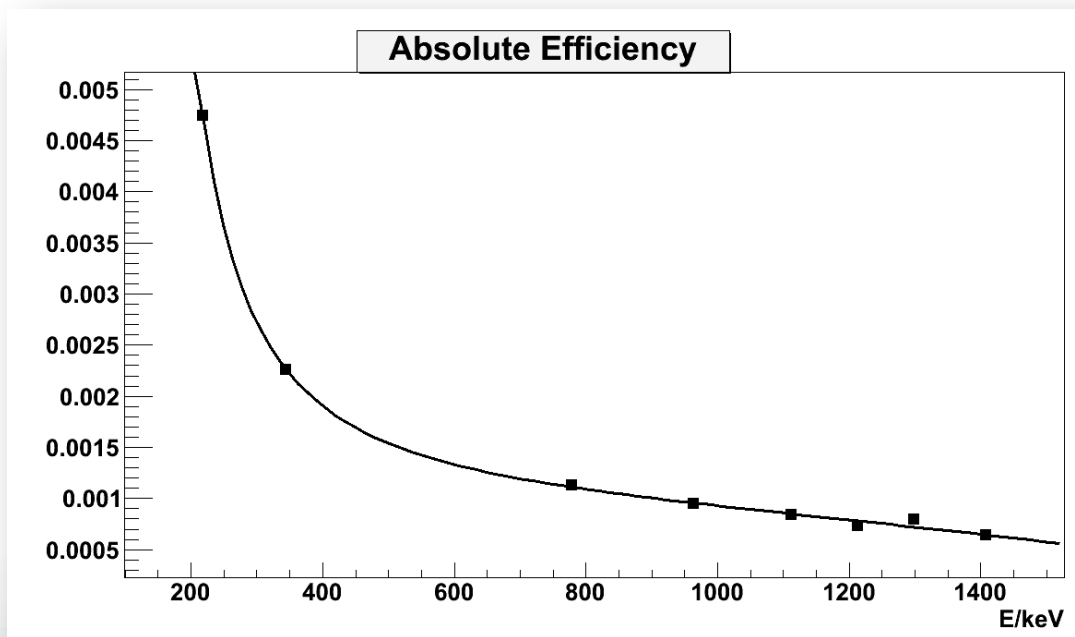
LT=220s



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- **Evaluation strength of stand source using efficiencies we have determined above.**



	^{60}Co		^{137}Cs
E/keV	1173	1332	662
Nr	11208	10469	81250
LT/s	115	115	200
P/%	99.857	99.983	85.1
ϵ	$8.07\text{e-}4$	$6.97\text{e-}4$	$12.41\text{e-}4$
I/kBq	121	131	385

Drawn by Xu zijun



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Summary

- **The basic theory of Ge detector;**
- **How to use Ge detector;**
- **The spectrum taken by Ge detector;**
- **Using Ge detector to do some calculate;**
- **.....**





**Thank you for your
guide and help!**

ありがとう



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