CAEN
Tools for Discovery

CAEN EDUCATIONAL
edu.caen.it



HANDBOOK OF EXPERIMENTS

SG6119B γ-Spectroscopy

Activity of the ^{60}Co

Nuclear Physics and Radioactivity

EDUCATIONAL KIT

SP5600EMU

CAEN S.p.A. · Via Vetraia 11, 55049 Viareggio (LU) Italy · www.caen.it — © 2026 CAEN S.p.A. All rights reserved.
Specifications are subject to change without notice.

CAEN EDUCATIONAL · SG6119B

Activity of the ^{60}Co

Categories: CAEN Experiments, Nuclear Physics and Radioactivity | Tags: Spectroscopy, Statistics, γ Spectroscopy

Difficult	Execution Time	Data Analysis	Radioactive Sources
		Yes	No

Hardware setup

This experiment guide is referred to the **SP5600EMU** educational kit. If you don't have this kit, choose your own from the following list to visualize the related experiment guide: SG6119E – Educational Kit.

Equipment: SP5600EMU – Emulation Kit

Model	DT4800	DT5770	Additional Tool
Description	Digital Detector Emulator	Digital Multi-Channel Analyzer	Additional Gamma Radioactive Source

Purpose of the experiment

Determine the activity of a ^{60}Co source from its gamma spectrum. Learn about the meaning of the sum peak, visible in the spectrum of some radioactive sources.

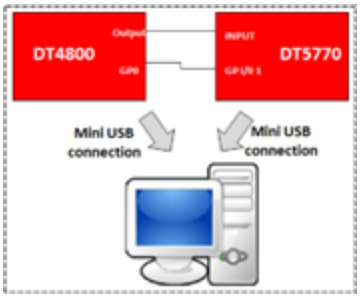
Fundamentals

The ^{60}Co spectrum presents two distinct gamma photopeak in its spectrum, respectively corresponding to photons γ_1 and γ_2 at 1.17 MeV and 1.33 MeV. For the purpose of this experiment, we can assume that each of these gamma rays are isotropically distributed. In other words, if γ_1 departs in a particular direction, γ_2 can go in any direction that it wishes. There is a certain probability that γ_2 will go in the same direction as γ_1. If this occurs the energies of γ_1 and γ_2 will be summed in the detector. Hence a sum peak will show up in the spectrum, at nearly 2.5 MeV. We can estimate the activity of the source by calculating the counts under the two main peaks and under the sum peak, i.e. calculating their area $\sum$. For the case of ^{60}Co, we have that the counts under the sum peak can be evaluated as:

$$\sum(SUM) = \frac{\sum_1 \sum_2}{A\,t}$$

Where A is the activity of the source and t is the acquisition time. Therefore, fitting the peaks with a gaussian and calculating their area, it is possible to estimate the activity of the ^{60}Co source used to record the available spectrum.

Carrying out the experiment

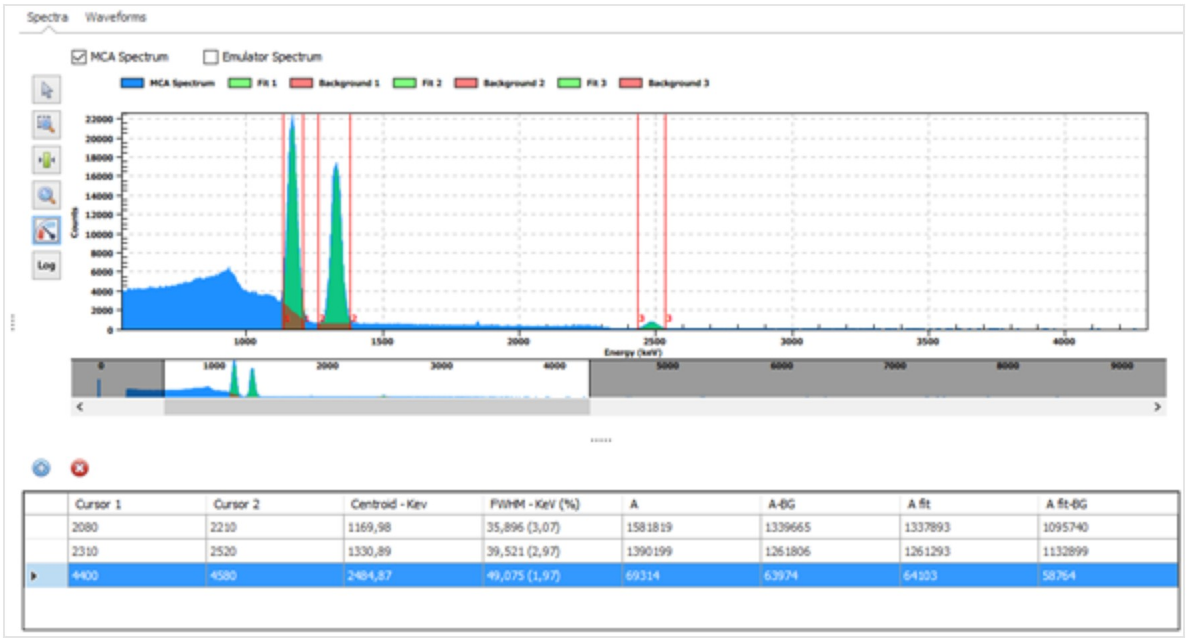


Experimental setup block diagram for the experiment.

To perform the experiment, connect the DT4800 output to the input channel of the MCA DT5770 and use the DT4800 GP0 as digitizer “trigger IN”. The Emulation Control Software Interface allows user to generate exponential decay signals with programmable rise time and fall time and it is possible to emulate signals from ^{60}Co radioactive. The spectrum can be recorded and analyzed by the MCA.

Results

The student should verify that, after the spectrum calibration, the sum peak is nearly at 2.5 MeV. From the formula given above, using the live time in seconds, the student can estimate de activity of ^{60}Co directly in Bq. A calculation made for a spectrum acquired in 100 seconds gives an activity of nearly 264 kBq.



Cursor 1	Cursor 2	Centroid - Kev	FWHM - KeV (%)	A	A-BG	A fit	A fit-BG
2080	2210	1169,98	35,896 (3,07)	1581819	1339665	1337893	1095740
2310	2520	1330,89	39,521 (2,97)	1390199	1261806	1261293	1132899
4400	4580	2484,87	49,075 (1,97)	69314	63974	64103	58764

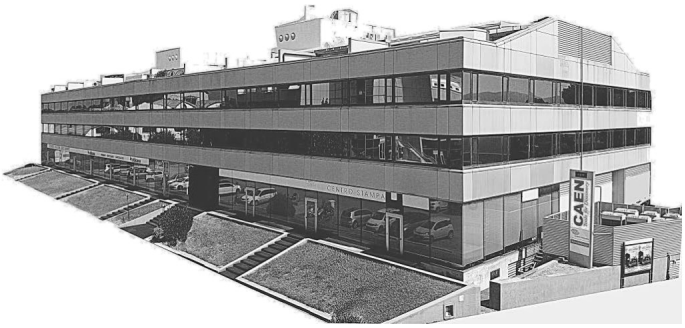
The ^{60}Co complete spectrum acquired by the MCA and plotted by the Emulation Software

HEADQUARTERS

CAEN S.p.A.

Via Vetraia 11
55049 - Viareggio
Italy

Phone +39 0584 388 398
Fax +39 0584 388 959
info@caen.it
www.caen.it



WORLDWIDE

CAEN GmbH

Brunnenweg 9
64331 Weiterstadt
Germany
Phone +49 212 254 40 77
Fax +49 212 254 40 79
info@caen-de.com
www.caen-de.com

CAEN Technologies, Inc.

1 Edgewater Street - Suite 101
Staten Island, NY 10305
USA
Phone: +1 (718) 981-0401
Fax: +1 (718) 556-9185
info@caentechnologies.com
www.caentechnologies.com

CAENspa INDIA Private Limited

B205, BLDG42, B Wing,
Azad Nagar Sangam CHS,
Mhada Layout, Azad Nagar, Andheri (W)
Mumbai, Mumbai City,
Maharashtra, India, 400053
info@caen-india.in
www.caen-india.in

CAENsn SAS

Gare du Nord Business Centre 14,
Rue De Dunkerque
75010 Paris
France
info@caen-sn.fr
www.caen-sn.fr