CAEN
Tools for Discovery

CAEN EDUCATIONAL
edu.caen.it



HANDBOOK OF EXPERIMENTS

SG6122A β-Spectroscopy

β-Spectroscopy

Nuclear Physics and Radioactivity

EDUCATIONAL KIT

SP5600D

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 · SG6122A

β-Spectroscopy

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

Difficult	Execution Time	Data Analysis	Radioactive Sources
		Yes	Yes

Hardware setup

This experiment guide is referred to the **SP5600D** educational kit.

Equipment: SP5600D – Educational Beta Kit

Model	SP5600	DT5720A	SP5608	Additional Tool
Description	Power Supply and Amplification Unit	Desktop Digitizer 250 MS/s	Scintillating tile	Beta Radioactive source

Purpose of the experiment

After gamma spectrometry, the student is introduced to the measurement and interpretation of β spectra, using a plastic scintillator tile.

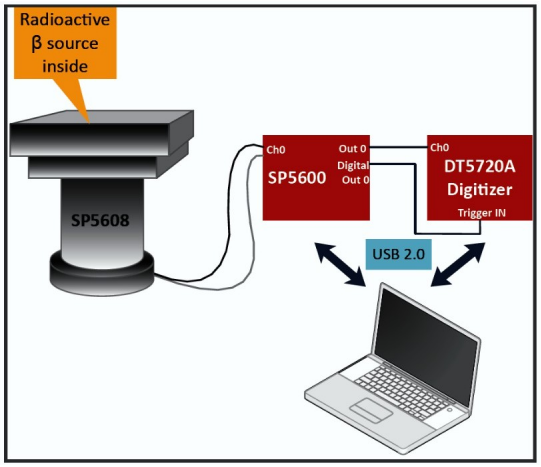
Fundamentals

There are three different beta decays:

- β^- decay (electron emission): $n \rightarrow p + e^- + \bar{\nu}_e$
- β^+ decay (positron emission): $p \rightarrow n + e^+ + \nu_e$
- Electron capture (EC): $p + e^- \rightarrow n + \nu_e$

Where *p* identifies the proton, *n* the neutron and ν the weakly interacting neutrino. Because of the three body kinematics and the energy associated to the neutrino, the β spectrum is continuum up to a maximum energy depending on the isotope under study (and the neutrino mass).

Carrying out the experiment



Experimental setup block diagram.

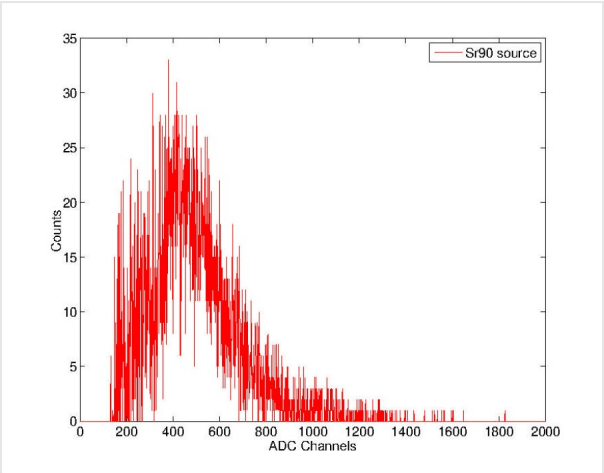
Connect the power and the MCX cables of the SP5608 tile to one channel of the SP5600. Connect the two channel outputs to DT5720A: the analog output to the channel 0 and the digital output to “trigger IN“ of the digitizer. Use the default software values or optimize the parameters to evaluate the contribution not coming from the β source and choose the discrimination threshold in mV. After that, switch off the power supply, open the SP5608 top and place the beta source on the scintillating tile. close the support top, switch ON the power supply and acquire the beta spectrum.

Results

Measurement and interpretation of β spectra introduce the student into the field of special relativity and weak interactions of radioactive decays. Observation of the β spectrum is very important to understand the theory of β decay. Historically, experimental beta-ray spectra introduced enormous problems in the interpretation of beta decay due to the ostensible violation of the energy conservation. The introduction of neutrinos explaining the continuous β-ray spectra solved not the problem conservation of energy, momentum and lepton number. As first approach to beta spectroscopy, it is interesting to determine the maximum energy available in the decay process and to verify that the most probable energy value E_{avg} can be expressed as:

$$E_{avg} = \frac{1}{3} \cdot E_{max}$$

By using several β-sources, different energy values E_{avg} can be estimated, each one corresponds to the total energy released in the specified β decay. An example of ^{90}Sr spectrum is shown in the figure. For a most complete analysis on beta spectrum, other application notes are recommended.



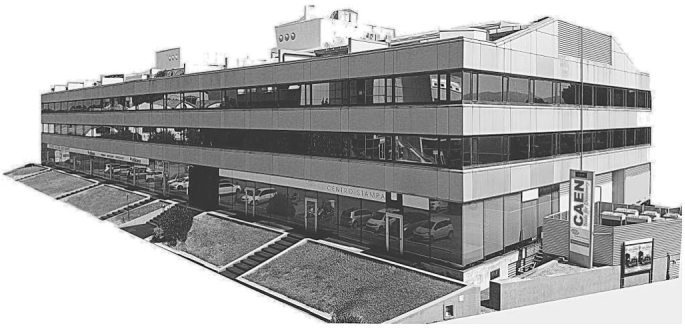
Experimental beta spectrum of ^{90}Sr radioactive source

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