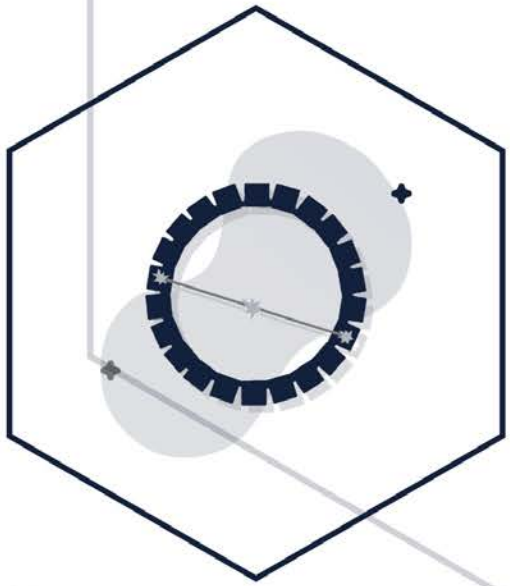
CAEN
Tools for Discovery

CAEN EDUCATIONAL
edu.caen.it



HANDBOOK OF EXPERIMENTS

SG6133G Nuclear Imaging – PET

Two-dimensional Reconstruction of a Radioactive Source

Nuclear Physics and Radioactivity

EDUCATIONAL KIT

SP5700

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 · SG6133G

Two-dimensional Reconstruction of a Radioactive Source

Categories: CAEN Experiments, Nuclear Physics and Radioactivity | Tags: Nuclear Imaging, Nuclear Physics, PET

Difficult	Execution Time	Data Analysis	Radioactive Sources
		No	Yes

Hardware setup

This experiment guide is referred to the **SP5700** educational kit.

Equipment: SP5700 – EasyPET

Model	SP5700	Additional Tool
Description	EasyPET	^{22}Na Radioactive source (recommended: 1/2 inch disc, 10 µCi)

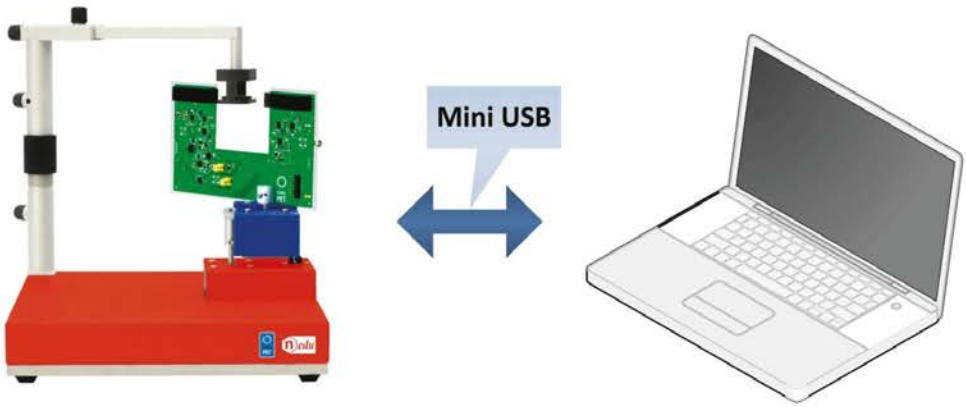
Purpose of the experiment

Understanding the technique of the nuclear imaging and the setup optimization of the parameters by performing two-dimensional image reconstruction of ^{22}Na radioactive source.

Fundamentals

The EasyPET operation principle is simple: two detector modules move together and execute two types of independent movements, around two rotation axes, so as to cover a field of view similar to that of a complete ring of detectors. The rotation movements are executed by two stepper motors. The bottom motor has a fixed axis, whose position defines the center of the field of view. The bottom motor supports and performs a complete rotation of a second motor, in predefined steps of amplitude α. The axis of the top motor is thus always positioned within a circumference of radius equal to the distance between the two axes. The top motor, in its turn, supports and moves a U-shaped printed circuit board, where a pair of aligned and collinear detector modules is mounted, performing a symmetric scan of range θ around the center, for each position of the bottom motor. In this way, EasyPET can reconstruct an image of a radioactive source placed anywhere within a cylindrical field of view between the pair of detectors. The diameter of the field of view is defined by the amplitude of θ, the range of the top motor scan.

Carrying out the experiment

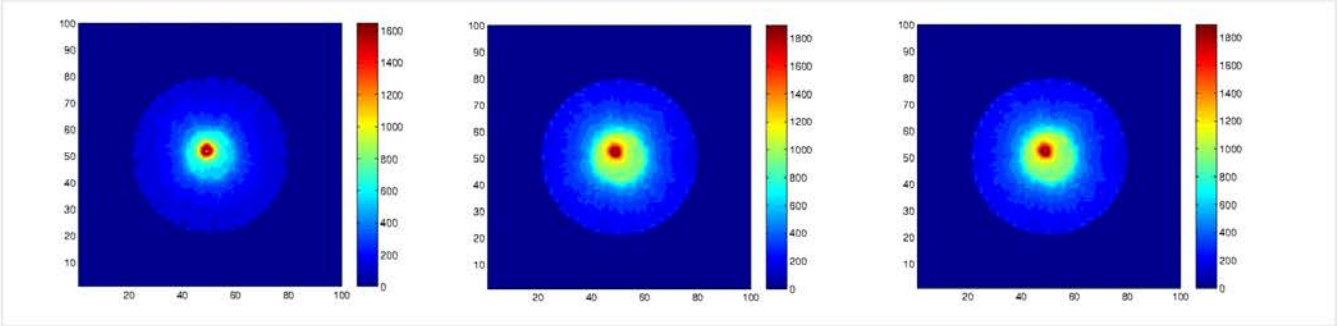


Experimental setup block diagram.

- Mount the arm of the source holder on the column fixed on the system base, fix the U–shaped board to the top stepper motor and connect the flat cable to the U-shaped board and to control unit.
- Connect to PC and power ON the system. The parameters involved in the setup optimization for the two-dimensional reconstruction of the source image are three: the detectors operating voltage, the coincidence time window and the threshold.
- Place the source holder between the two detector modules and tune the parameters to estimate the DCR contribution.
- Place the ^{22}Na radioactive source in the holder and repeat the measurement tuning the parameters in order to obtain a good image reconstruction of the radioactive source.

Results

By tuning the parameters, the students can directly observe and understand their effects on the imaging measurements. At fixed threshold, the image contrast changes due to the time window width. The use of the lowest possible coincidence time window of the system is mandatory to achieve a good image contrast. Fixing the bias voltage and the time window, it is interesting to observe how the threshold affects the image contrast. This parameter choice is dictated by a trade off between the signal to noise ratio and efficiency maximization. The threshold value and the coincidence time window should be set by choosing the best compromise.



^{22}Na source distribution image as a function of coincidence time window, at fixed threshold and bias voltage.

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