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IEEE Standard Test Procedures and Basis for Geiger-Mueller Counters

Sponsor

Nuclear Instruments and Detectors Committee
of the
IEEE Nuclear and Plasma Sciences Society

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Abstract: Test procedures for Geiger-Mueller counters that are used for the detection of ionizing radiation are presented so that they have the same meaning to both manufacturers and users. Also included is information on bases (i.e., connections) for the counters.

Keywords: gas counter, Geiger-Mueller, radiation detectors

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Introduction

(This introduction is not part of IEEE Std 309-1999/ANSI N42.3-1999, IEEE Standard Test Procedures and Bases for Geiger-Mueller Counters.)

This standard is a revision of the 1970 version. It presents standard test procedures for Geiger-Mueller counters that are used for the detection of ionizing radiation. Also included is information on standard and typical bases for the counters. This revision has been approved by the Nuclear Instruments and Detectors Committee (NIDCom) of the IEEE Nuclear and Plasma Sciences Society and by the Accredited Standards Committee N42 on Nuclear Instrumentation of the American National Standards Institute (ANSI) for which the IEEE serves as the Secretariat.

These detectors, originally announced by Geiger and Müller in 1928, represented a major step forward in the detection and counting of individual radioactive events. The amplitude of the output signal is independent of the energy of the event. Therefore, when only the counting of radioactive events is required, without regard for the type of radiation or its energy, Geiger-Mueller counters are useful. The output signal is large enough to operate a scaler without additional amplification, the regulation requirements of the power supply can be far less than that required for the solid state detectors, and, unlike germanium detectors, no cryostat is required.

The principal attributes of the Geiger-Mueller counters are their low cost and simplicity, which accounts for their wide usage in many applications. Ionization chambers and the subsequently developed scintillation counter and semiconductor radiation detectors are capable of distinguishing between different types of radiation and their energies and can therefore be used for spectroscopy as well as for counting. The scintillation and semiconductor detectors, because they are solid rather than a gas, are highly efficient for the detection of gamma rays. The principal attributes of the scintillation counters are high efficiency and moderate energy resolution; whereas, the semiconductor detectors have outstanding energy resolution.

Ionization chambers, scintillation counters, and semiconductor detectors are dealt with in other standards publications.

An excellent description of Geiger-Mueller counters and their operation is provided in Chapter 7 of Glenn F. Knoll's book, Radiation Detection and Measurement. (See Knoll [B4] in Annex A.)

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IEEE Standard Test Procedures and Bases for Geiger-Mueller Counters

1. Overview

1.1 Scope

This standard applies to Geiger-Mueller (G-M) counters that are used for the detection and counting of individual particles.

1.2 Purpose

The purpose of this standard is

- a) To establish test methods and test procedures so that they have the same meaning to both manufacturers and users.
- b) To present additional information regarding G-M counters, such as information about the counters' bases.

2. References

This standard shall be used in conjunction with the following publications. When the following standards are superseded by an approved revision, the revision shall apply.

ANSI N42.12-1994, American National Standard—Calibration and Usage of Thallium-Activated Sodium Iodide Detector Systems for Assay of Radionuclides.¹

ANSI N42.22-1995, American National Standard—Traceability of Radioactive Sources to the National Institute of Standards and Technology (NIST) and Associated Instrument Quality Control.

ANSI N42.23-1996, American National Standard—Measurement and Associated Instrumentation Quality Assurance for Radioassay Laboratories.

¹ANSI N42 standards are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA (<http://www.standards.ieee.org/>).