Complete Gamma Ray Spectrometer GAMMA-RAD5

Includes

- 76 x 76 mm NaI(Tl) scintillator with PMT
- Digital pulse processor with charge sensitive amplifier, shaping amplifier, and MCA
- All power supplies (low voltage and high voltage)
- Interface hardware and PC software

Features

- Ruggedized scintillator and PMT
- Gain stabilized in software
- Ethernet & USB interfaces for robust communications
- USB powers entire system
- Flexible architecture for tailoring interfaces
- For OEMs and custom users

Detector

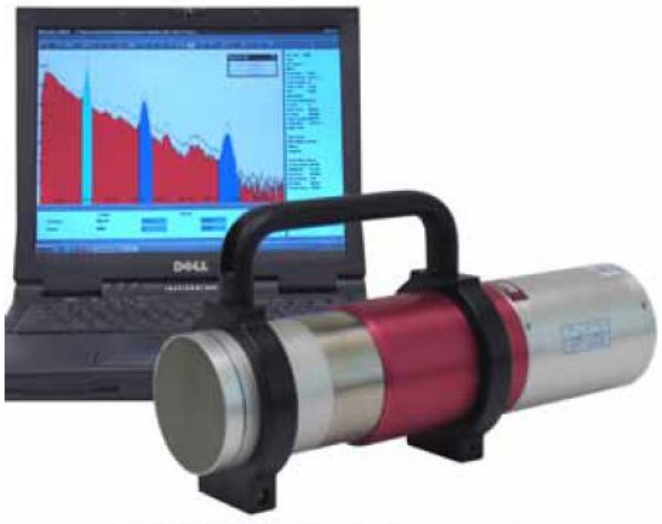
- Standard detector size: 76 x 76 mm (3 x 3″) NaI(Tl)
- Custom detectors available, including:
  - 76 x 152 mm (3 x 6″) NaI(Tl)
  - 10 x 10 x 40 cm^3 (4 x 4 x 16″) NaI(Tl)
  - 2.5 x 2.5 cm (1 x 1″) $LaCl_3$
  - 76 x 76 mm (3 x 3″) BGO

Standard Performance

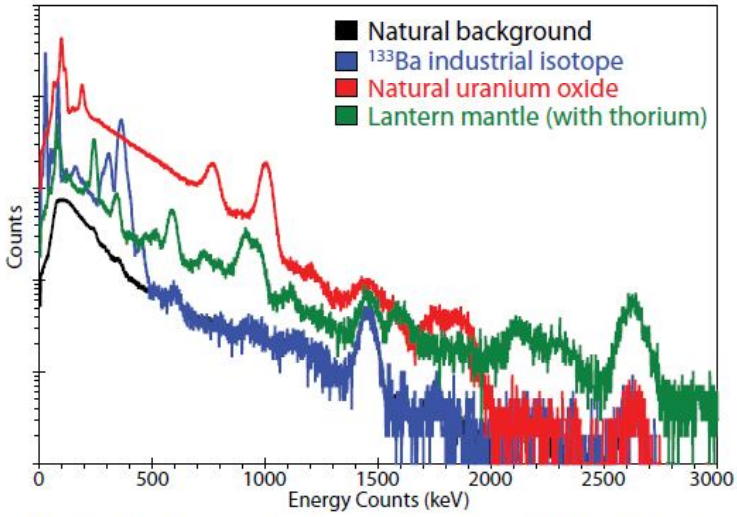
- Dynamic range: 10 to 3000 keV
- Resolution: <7% FWHM @ 662 keV, <5% @ 1.33 MeV
- Count rates: to 200,000 cps
- Power: 750 mW typical

Applications

- **Homeland security:** portal monitors, shipping containers, handheld monitors
- First responders and emergency workers
- Nuclear safeguards verification
- Toxic dump site monitor
- In situ processing
- Environmental or industrial monitoring
- Teaching and research



GAMMA-RAD5 with a laptop computer - a complete γ-ray measurement solution.



Measured γ-ray spectra of naturally occurring radioactive materials (NORM), an industrial ^{133}Ba isotope, compared to natural background with no sources present.

Overview

The GAMMA-RAD5 is a complete, integrated γ-ray spectrometer. It includes a scintillator and PMT, a charge sensitive preamplifier, a digital pulse processor and MCA based on Amptek's DP5G, all the hardware and software necessary to control and communicate to a PC, and all power supplies. It is a single, integrated, portable module.

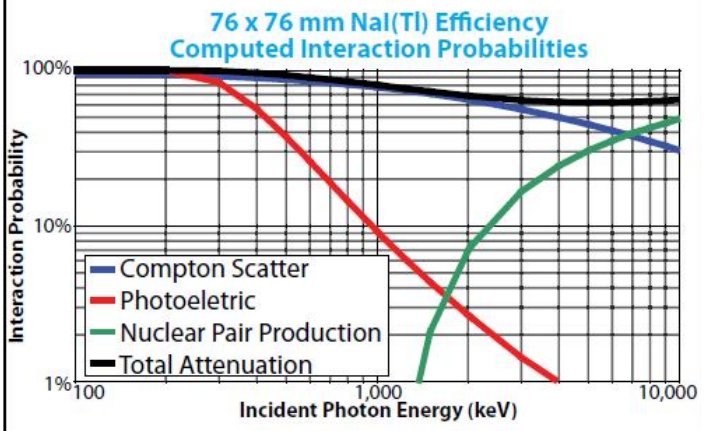
Several key innovations make this system ideal for field use. First, the scintillator and PMT are ruggedized to protect against mechanical shock and vibration. Second, the Ethernet interface permits operation over long distances: 100 m via Ethernet or, with Internet software, globally while the USB interface permits a single connection (power and data) to virtually any computer. Third, it has a flexible digital architecture so it can be easily tailored for specific applications. The GAMMA-RAD5 is ideally suited for a wide range of γ-ray spectroscopy measurements, from lab applications to most harsh field homeland security applications.

GAMMA-RAD5 Specifications

Detector

The detector is a ruggedized scintillator and PMT. The 76 x 76 mm NaI(Tl) is considered standard, but many different configurations are possible. Contact Amptek for details.

The detector performance (resolution, stopping power, photofraction, etc.) are determined by the scintillation crystal.



Pulse Processing Performance

Gain Settings	Four software selectable coarse gain settings are available: 3 MeV full scale to 750 keV full scale. Fine gain is adjustable between 0.75 and 1.25.
Pulse Shape	Trapezoidal, typically set to 2.4 µs peaking time (1 µs shaping time constant), software selectable from 0.8 to 102.4 µs. The flat top has 63 software selectable values for each peaking time. The fast channel, used for pile-up rejection and pulse shape discrimination, has a pulse pair resolving time of 0.25 or 0.5 µs.
Gain Stabilization	The gain from the NaI(Tl) and PMT is well known to vary with temperature. A software gain stabilization algorithm is available.
Maximum Count Rate, Dead Time, and Throughput	With the typical configuration, T_{peak}=2.4 µs, the maximum input count rate is 1.5 x 10^5 cps with a throughput of >50% and good baseline stability and pile-up rejection. At T_{peak}=0.8 µs, the maximum input count rate is 2 x 10^5 cps.
Custom Configuration	The DP5G is set at the factory for either a 20 MHz or 80 MHz clock. For NaI(Tl), the 20 MHz is standard, yielding the specifications listed above. The 80 MHz setting allows for peaking times down to 0.1 µs in the slow channel and 0.05 µs in the fast channel but draws about 50% more power. The 80 MHz setting is recommended for custom scintillation materials with faster decay times, fast pulse shape discrimination, or other unique requirements

MCA Performance

Number of channels	Commandable to 8k , 4k, 2k, 1k, 0.5k,or 0.25k channels.
Presets	Time, total counts, counts in an ROI, counts in a single channel. Minimum acquisition time is <10 ms.

External Connections

USB	Standard 2.0 full-speed (12 mbps). Provides both serial data and power for the entire GAMMA-RAD5.
Ethernet	10Base-T or UDP, DHCP or fixed IP.
RS232	Standard serial interface 115 Kbaud.
DAC Output	Single pin LEMO connector.
Aux I/O	Gate, 8 SCAs

Power

+5 V	Average current 150 mA. Entire GAMMA-RAD5 can be powered from USB.
Range	3.0 to 6.4V.
High Voltage	A stabilized, high efficiency Cockroft-Walton power supply provides PMT bias. HV is software controlled.

Physical (76 x 76 mm NaI(Tl))

Size	31.5 cm X 9.2 cm (dia)
Mass	3.6 kg

Interface Software

DPPMCA is a standard data acquisition and control package, for use with all of Amptek's digital processors and MCAs, including the GAMMA-RAD5. This package provides the capability to configure the GAMMA-RAD5 and acquire and save data. It is described in detail on Amptek's website, where it may be downloaded.

Amptek provides a software developer's kit so that users can write their own interface software. Also included are example routines, written in Visual Basic and Visual C++, which can be used to control data acquisition. These can be tailored for specific uses.

GAMMA-RAD5 Architecture