Gain Stabilization Methods

Gain stabilization techniques are used to prevent loss of resolution due to gain drifts in PMTs and system electronics when making measurements over long time periods. Depending upon your requirements, we can supply detectors incorporating any of the following types of stabilization techniques:

- Electronics based
- LED based system
  Fiber optic cable
- Radioactive source
  ^{241}Am
  ^{137}Cs

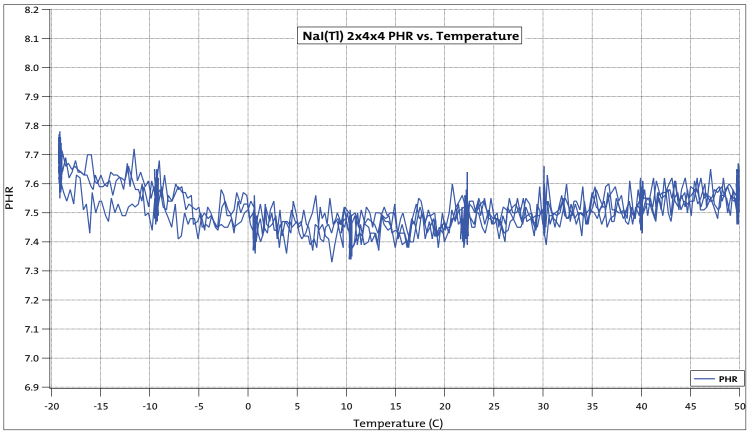
Design Parameters	Electronics based	LED	Radioactive Sources
Lowest background contribution	x	x	
“On/Off” switch performance	x	x	
Minimal mechanical design interface	x		x
Minimum drift with temperature	x		x
Space-qualified	x	x	x
Radiation license			☹
Turnkey solution	x		
Cost	$	$$	$$$

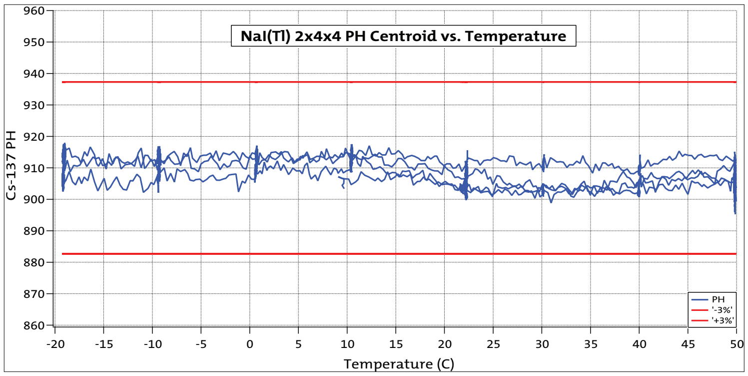
Electronic Based Gain Stabilization

In this method, the detector firmware automatically adjusts the relevant parameters, such as integration time and pile-up rejection as a function of temperature. A built-in temperature-compensated LED provides a reference light pulse that is used to ensure gain stability over time and temperature.

Once a detector has been calibrated and gain stabilization enabled, the autopilot routine within the detector firmware, takes over and maintains the gain while adjusting the parameters in order to ensure optimum detector performance (stability of ±5% between -20°C and +50°C). The routine preserves the energy window of interest while ensuring a near constant pulse height resolution.

Typical performance data collected with NaI(Tl) model 2X4H4/2A-LED-MCA-X





For additional details, please see Sensor Kit based Performance Stabilization information sheet.

Gain Stabilization Methods

Simulating Scintillation Pulses with an LED Light Pulser

LED stands for Light Emitting Diode. It is a special type of diode that emits light when an electric current flows through it. It can be used to simulate a scintillation pulse to test the electronic circuits in the measurement system.

To use LEDs as a gain stabilizing method, external electronics are needed. These systems have internal feedback loops to control the stability of the light output.

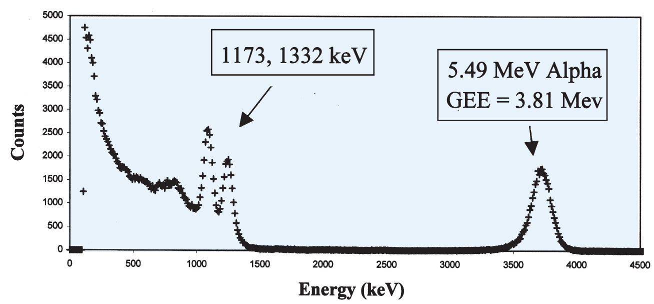
Radioactive Sources

A reference light source is incorporated into the detector assembly. These light sources produce a peak in the spectrum outside the region of interest. The system adjusts the gain to keep this peak's position constant in the measured spectrum.

A very small ^{241}Am source (<1000 Bq) can be mounted inside a scintillation detector. The α-particles emitted by the ^{241}Am cause scintillation events in the crystal that are detected by the PMT of the detector. For NaI(Tl), the α-peak appears at an equivalent γ-ray energy of 2.6 MeV. The Gamma Equivalent Energy (G.E.E.) can be adjusted upon request (see table). Standard count rates are 50, 200 and 1000 cps. The position of the pulser peak is used as a reference to compensate for the previously mentioned variations in detector response. It should be noted that besides the α-peak, some other peaks (at low energies) are produced. These are caused by ^{241}Am X-rays. This limits the use of these pulsers to detectors for γ-rays or X-rays with energies above 80 keV.

Spectrum stabilization can also be achieved at low energies using an encapsulated ^{241}Am source (which provides a 59.5 keV reference peak) or at medium energies with a ^{137}Cs source (which provides a peak at 662 keV).

Properties of Am-pulsers	
Isotope	^{241}Am
Half-life	458 years
Emission	Alpha particles, 59.5keV Np L-X-rays
Gamma Equivalent Energy	1.5 to 3.5 MeV
Tolerance on G.E.E.	±15%
Count Rate	10 to 2000 cps
FWHM	3 to 5%
Temperature Range	4°C to 40°C
Host Crystal	NaI(Tl) or CsI(Na)



2 x 0.5 NaI(Tl) with ^{241}Am Pulser

For further information on a specific gain stabilization methods, please contact a sales representative.

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Manufacturer reserves the right to alter specifications.

(06-18)