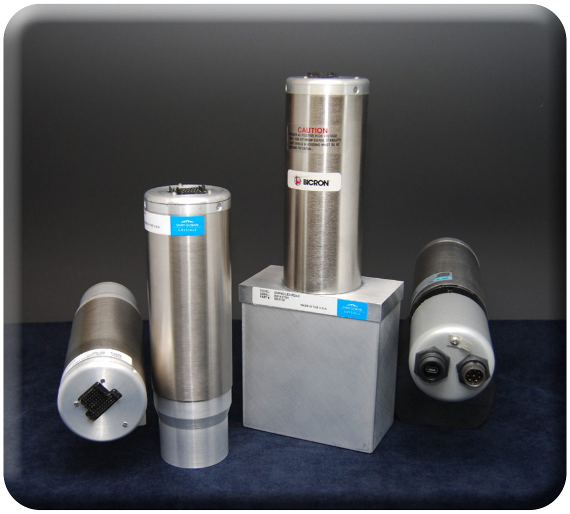
SENSOR KIT Based NaI(Tl) Performance Stabilization

It is known that NaI(Tl) based scintillation detectors exhibit gain change over their operating temperature range. Typically, when coupled to a bialkali photomultiplier tube and operating with an integration time of 1μsec, the NaI(Tl) detectors will exhibit an overall gain change between -20°C to +50°C of ≈30%. This change in gain reduces the low-energy sensitivity of the detector while operating at high temperatures, and clips the maximum measurable energy when the detector is cold.

In addition, NaI(Tl) scintillators exhibit several decay time constant components. The primary single exponential decay constant is 250nsec at room temperature. As the temperature decreases, the longer time constant components increase in intensity. When operating a system with a fixed integration time, an artificial degradation in pulse height resolution (PHR) will be observed. At room temperature, 1μsec integration time is sufficient to collect approximately 90% of NaI(Tl) scintillation pulse. At 0°C this time increases to ≈2μsec and at -40°C it is ≈6μsec. Without collecting 90% of the scintillation pulse light, the energy resolution will degrade and overall system performance will suffer.

Finally, any attempt at pile up rejection does depend on the pulse shape. The pulse shapes change with temperature (getting slower below room temperature, and faster above). The parameters governing the pileup rejection must change accordingly, to maintain strong pile-up rejection over the temperature range.



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.

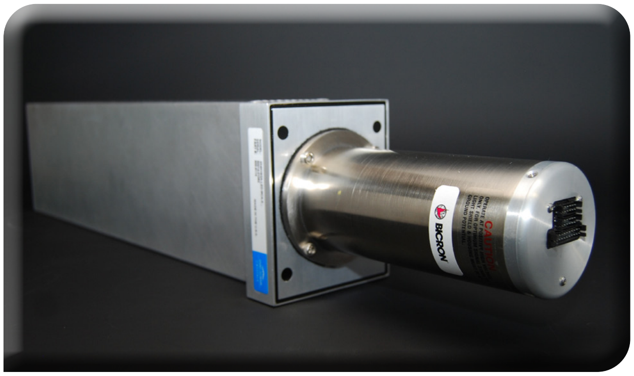
Once a detector has been calibrated and gain stabilization enabled, the autopilot routine within the detector firmware, takes over and maintains the gain while adjusting the parameters in order to ensure optimum detector performance (stability of ±5% between -20°C and +50°C). The routine preserves the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

Our stabilized detector solution addresses all three challenges by:

Providing a constant gain over the operating temperature range

Providing a constant energy resolution over the operating temperature range

Maintaining the best possible pileup rejection



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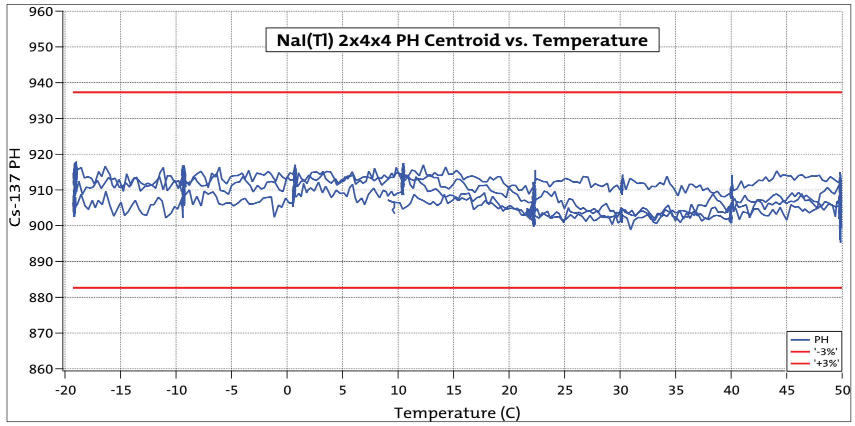
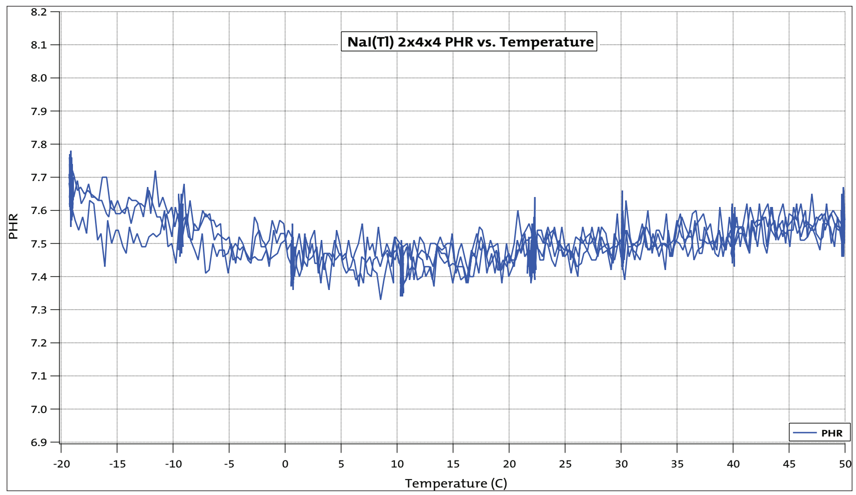
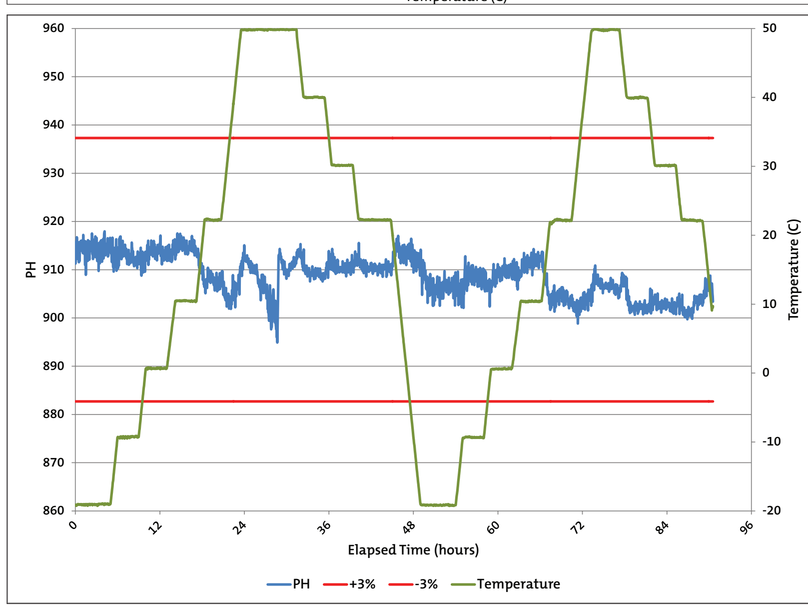
Typical Performance Operation

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







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The data presented are believed to be correct but are not guaranteed to be so.

Manufacturer reserves the right to alter specifications.