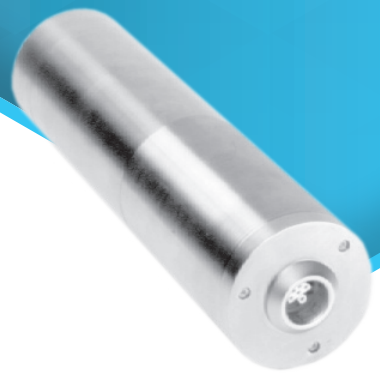
MIRION TECHNOLOGIES

DETECTORS

NAID™

NaI Detector

This detector is designed to be used in a variety of environments.



FEATURES

- Americium seed with thermistor provides total automated energy calibration capability
- Ruggedized, housing integrates all detector components, including preamplifier
- Splash resistant design
- Extended temperature operation range: –10 to +50 °C
- Rugged, integrated connector simplifies detector connections for error free operation

DESCRIPTION

The NAID is a NaI detector specially designed for use in the measurement of uranium enrichment, and is used by the International Atomic Energy Agency in Vienna, Austria, and other safeguards related organizations. This detector is designed to be used in a variety of environments and, when combined with the Mirion IMCA uranium enrichment analyzer, permits automation of the energy calibration and temperature compensation. This detector employs a ^{241}Am seed and thermistor mounted together with the 5.1 cm diameter by 1.3 cm thick NaI crystal. The americium acts as a pulser that produces a photopeak at the gamma-equivalent-energy (GEE) of approximately 3.0 MeV which is high enough to prevent interference with the 185.7 keV gamma peak produced from the decay of ^{235}U. The seed and thermistor combination allows for automation of the energy calibration and compensation for differences in temperature drifts between the 185.7 keV peak and the 3.0 MeV GEE peak. The entire detector assembly is located within an integral, sealed housing.

The NAID is the detector of choice for situations demanding robust performance. The rugged housing of the NAID protects and secures the fragile internal components against minor impacts, and is splash resistant. The heavy duty LEMO single piece connector greatly simplifies setup with no individual BNC connectors to contend with and is extremely strong. It snaps securely into the detector and is easily disconnected with gloved hands.

Every NaI detector has a unique gain drift as a function of temperature. Each NAID may be optionally characterized by placing the detector in a temperature chamber and plotting the drift in the 185.7 keV and 3.0 MeV GEE peaks and thermistor value over a temperature ranges of –10 to +50 °C. This data is provided to the IMCA software in the form of a table. Stability of the system is 0.5% from –10 to +50 °C. This technique eliminates the individual temperature matching of NAIDs to analyzers, and allows any detector to be used with any IMCA.

Mirion offers the NAID with LEMO connector, cable, and temperature characterization service that enables operation with full automatic stabilization and energy calibration of the IMCA in PMCN mode. See IMCA literature for details.

SPECIFICATIONS

Scintillation crystal: NaI (Tl)

- Diameter: 2.0 inch (5.1 cm)
- Thickness: 0.5 inch (1.3 cm)

Detector housing

- Entire structure with integral preamplifier base is sealed against splashing water
- Dimensions: 20-24.4 cm x 6.4 cm (7.9-9.6 x 2.5 in.)
- Weight: 1.9 kg (4.25 lb)

Resolution (FWHM)

- 662.5 keV (^{137}Cs): <12.5%
- 122 keV (^{57}Co): <15%

NAID performance parameters

- Energy range of interest: 60 keV to 2.1 MeV
- Count rate of samples: <25 kcps
- Peak shift with count rate: <1% to 25 kcps
- Stability and repeatability: <1%

^{241}AM pulser

- Count rate: 800 to 1020 cps
- Gamma equivalent energy (GEE): 3.5 MeV ±15%
- Resolution: <7%

Photomultiplier tube

- Operating voltage: +500 to 600 V (+550 V nominal)
- Magnetically shielded
- Peak shift with position or orientation: <1%

Preamplifier

- Power requirements
  - +12 V dc at <15 mA
  - –12 V dc at <15 mA
- Output pulse
  - Positive, unipolar tail pulse with peak amplitude linearly proportional to the charge delivered from the PMT
  - Decay time constant 50 µs
  - Z_{out} = 93 Ω
  - DC level 0 V, nominal
- Performance
  - Integral non-linearity <0.04% for up to 10 V output

Overall gain

- Not to exceed 15 mV and not be less than 7.5 mV at 122 keV

Thermistor

- 1 kΩ ±10% at 25 °C

Connector

- Compatible with LEMO FFA3E707CTAC85Z (cable connector)
- Storage and operating temperature range –10 to +50 °C

ORDERING INFORMATION

- NAID-TC: Temperature Characterization for NAID
- C1727-5: NAID/InSpector™ Cable; 5 feet (~1.5 meters)
- 7419B: NAID Carrier/Shield

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