



iSolo[®]

Alpha/Beta Counting System



KEY FEATURES

- Portable, manual, single-sample alpha/beta counter
- Automatically identifies and compensates for radon, thoron and progeny interference in air filters
- Can be used for other types of samples without radon/thoron compensation
- PIPS[®] silicon gas-less detector
- Air filter analysis optimized
- NiMH battery power for 10 hours or more
- Universal, auto-sensing power supply
- Cosmic guard detector model available
- Shielded model available
- Compatible with essentially all filter types and multiple sizes
- Compatible with iLink[™] iSeries[™] Communications Software for remote setup and download of data to a computer
- Effective solution for complying with EPRI Alpha Monitoring Guidelines for Operating Nuclear Power Stations
- CE compliant

DESCRIPTION

The iSolo[®] system is a portable, firmware based, single-sample, manual, gas-less alpha/beta counter. The iSolo counter is designed for the analysis of air filters and most other types of alpha/beta samples. When analyzing air filters, the iSolo counter discriminates both radon and thoron and their progeny from transuranic and fission product materials on the air filter samples. The iSolo system weighs as little than 6.5 kg in its lightest configuration. The iSolo counter uses a solid state silicon PIPS detector for alpha and beta detection. The iSolo system can be operated for 10 hours or more with internal batteries and is totally self contained.

AIR FILTER RADON REJECTION

Counting air samples from either CAM units or stationary samplers can pose serious problems for the health physicist. Why? Radon, thoron and their respective progeny emit alpha particles with energies from 6.0 MeV to 8.78 MeV. The low energy peak tails from these detected alphas mask the spectral region where alphas from transuranic (uranium, plutonium, americium and curium) alphas would be (See Figure 1). Even the smallest amount of radon/thoron interference on a filter

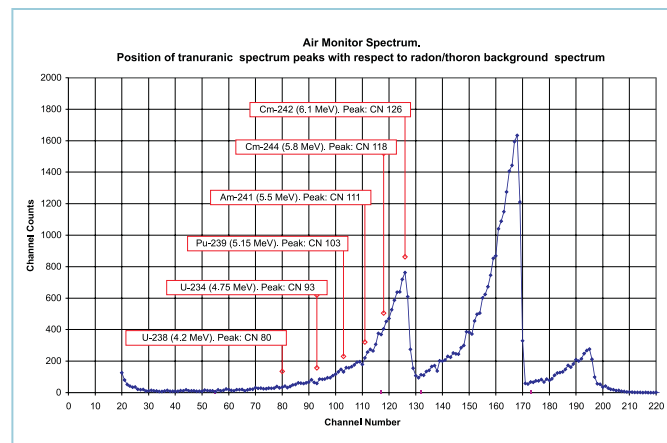


Figure 1
Representative spectrum with radon/thoron interference showing transuranic peak positions.

paper can cause 'falsely' elevated DAC values. Radon/thoron is the problem, but the real difficulty is knowing when the values are false – caused only by radon/thoron interference and not a plutonium or uranium release.

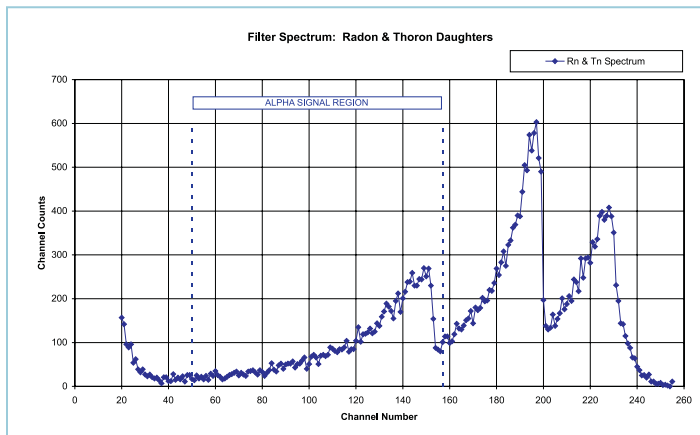


Figure 2
Typical radon/thoron spectrum from an air filter.

THE TRADITIONAL APPROACH TO THE RADON PROBLEM

The traditional approach for determining the activity of long-lived radionuclides present in air is to sample a measured volume of air through a filter, generally in a stationary air sampler. The filter is transported to the laboratory and counted on a gas flow or similar low background alpha/beta counting system. If the reportable alpha DAC value is above maximum permissible limits and radon/thoron is suspected, the filter is quickly counted again. By this time workers have remained in the area for several hours, without respirator protection. When the results from the second count show that the alpha DAC value is still above permissible limits, workers are evacuated from the work area until a determination is made by the lead technician on shift. By the time a ratio calculation is performed and the activity is deemed to be from radon/thoron interference, several more hours have passed. Time is money and downtime is expensive; but employee safety must always come first, and ratios are not always correct. Days may be needed before the alpha activity reported is absolutely identified as radon, thoron and their progeny.

What is iSeries?

iSeries is the Mirion line of instruments designed for the intelligent analysis of samples; *intelligent* because the products provide a new and innovative level of technology. iSeries instruments not only quantify the levels of alpha and beta contamination, but even in the presence of radon, thoron and their progeny on air filters.

Filter counting will never be the same again. The Mirion iCAM™ (*intelligent* Continuous Air Monitor) was the first Mirion instrument to use this technology. The iSolo algorithms are logical extensions of the successful iCAM product technology. The iMATIC™ system extends the functionality of the iSolo counter into a laboratory grade, sample changer based instrument. The iSeries – iSolo intelligence takes the real time monitoring application ability of the iCAM monitor and extends it to the laboratory and field analysis of air filters.

THE ISOLO APPROACH

The Mirion iSolo counter solves this problem with a new and innovative approach. Gone are the days of waiting for hours or even days for radon/thoron interferences to decay away before an actual activity is known. With the iSolo system, you will know within minutes if the alpha activity is due to transuranic or fission product material or naturally occurring radon and thoron. A pulse height spectrum, similar to the one shown in Figure 2, is acquired in a multichannel analyzer in the iSolo counter.

A series of peak evaluations are performed on the original acquired spectrum. When all of the corrections are made, a residual spectrum, similar to the one shown in Figure 3 (shown in red) results and from this residual spectrum the iSolo reports radon compensated, true alpha and beta activity on the front panel LCD display.

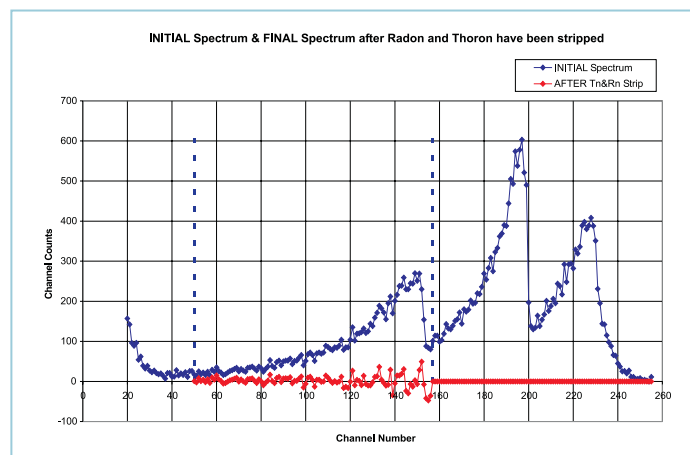


Figure 3
Typical radon/thoron spectrum from an air filter shown in blue with residual spectrum after stripping shown in red.

Not only are the numerical results shown on the iSolo unit's screen, but the 256 channel spectra of both the original and radon compensated data can be seen as well. (See Figures 4). The spectra can be viewed in linear or log scale, and the scale can be set automatically or manually by the user.

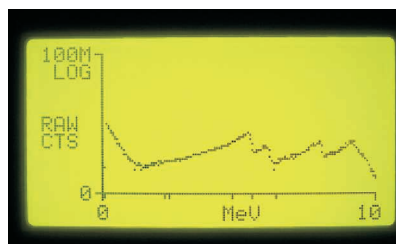


Figure 4
Original data shown in log scale.

COMPLETE SOLUTION

The iSolo system is a complete solution for the analysis of filter and filter type samples. The iSolo counter, unlike any other alpha/beta counter, is based on the same technology as the Mirion iCAM monitor. The iSolo system provides *reliable* measurements of transuranic and fission product activity on filter samples in the presence of radon/thoron interferences. Using a patented technique, the iSolo counter applies auto-adaptive spectrometric compensation for the radon/thoron interferences.

The iSolo radon/thoron compensation algorithm adjusts to all types of filter media from glass fiber filter media to Millipore and Eichrom membrane type filter. The iSolo system adapts to these different filter media types *automatically*. No additional calibrations or special instrument settings are required. The iSolo counter lets health physics technicians focus on their job without calculators, manual ratio calculations, downtime, and guesswork. Two built-in, operator-adjustable alpha and beta alarm levels are provided to alert the operator when a critical limit has been exceeded. The operator can then proceed quickly with the necessary actions without the added worry of making a mistake.

The anti-coincidence guard detector utilizes a customized ‘wrap around’ plastic scintillator. The guard detector surrounds the sample detector optimizing the rejection of low angle external gamma and cosmic events. When throughput and sensitivity are essential, the iSolo unit with optional guard is unsurpassed among other portable alpha/beta counters.

The iSolo counter provides the system operator with gross alpha/beta results, but that is only the beginning of what it does. There is absolutely *no* spillover to compensate for. Pulses from detected charged particles are sorted by energy. Any particle with energy greater than this threshold but less than 2.2 MeV is identified as a beta. A particle with energy greater than 3 MeV and less than or equal to 9.6 MeV is identified as an alpha. The 3 MeV to 6.4 MeV portion of the alpha region is further divided into three overlapping regions; a uranium region, an americium/plutonium region and a curium region. These regions allow the user to reasonably determine which nuclide is present in a sample if a high compensated alpha result is encountered.

STANDALONE INSTRUMENT—NO COMPUTER REQUIRED

The iSolo counter is a firmware based instrument and does not require a computer to set up or operate it. The entire program is stored in flash memory. New programs may be downloaded as a file via HyperTerminal using the RS-232C interface. There are no PROMs to change and no housings to remove to get to them. The entire process to upgrade the iSolo unit program takes less than five minutes.

ILINK ISERIES COMMUNICATIONS SOFTWARE

If computer control and/or the ability to download iSolo results into a Microsoft SQL Server database are desired, iLink iSeries Communications Software is available for this purpose. iLink software provides the operator of iSolo systems the ability to program the majority of the iSolo features with a computer, rather than through the use of front panel buttons. iLink software also includes an embedded version of the Microsoft SQL Server database for the storage of iSolo data.

All iLink functions are controlled via an intuitive graphical user interface. These functions include the ability to enter sources, enter sample and guard detector voltages and thresholds, setup the system printer and print mode, edit or create iSolo report templates, establish iLink and iSolo securities, create User, Calibration and QC procedures, backup and restore iSolo system personalities, and export data in comma separated (CSV) or Tab-Delimited formats. An example screen of the iLink User Procedures Editor is shown in Figure 6.

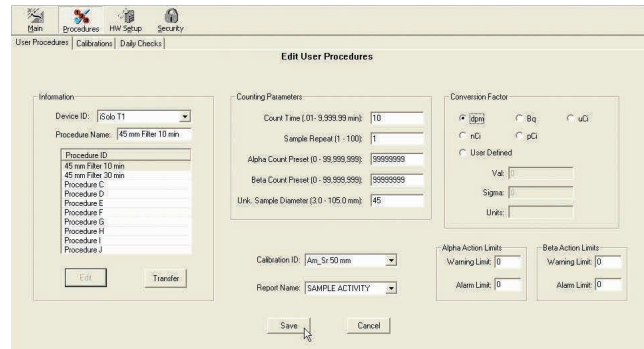


Figure 6 – iLink User Procedures Editor Screen.

iLink software is compatible with the Microsoft Windows 7 Professional 32 or 64 bit operating systems. Multiple iSolo units can be interfaced to one computer depending on the number of available RS-232 ports there are on the computer.

MODEL OPTIONS

The iSolo counter can be tailored for specific applications. Preconfigured models easily allow for a choice of a guarded or unguarded system, with or without passive shielding, and a choice of two different detectors.

Models with a “3” in the fifth digit of the model number (i.e. SOLO300G) include the standard IS-2300 PIPS detector. The 2300 detector is perfect for alpha analyses and most beta analyses. Models with a “5” include the IS-2500 unit which is designed to increase efficiency of lower energy beta emitters such as ⁶⁰Co. The IS-2500 model will improve the response of any beta emitter with a E_β max that exceeds 85 keV, however the higher the energy the less the improvement. The lower the average/endpoint energy of the nuclide of interest the more important this change. As an example, ⁶⁰Co returns an efficiency of 8-10% at 125 keV (IS-2300 model) and 16-20% at 85 keV (IS-2500 model). With the reduction in threshold there is a typical background increase of about 30% so care should be taken when selecting this option of the standard IS-2300 model.

SYSTEM MODELS

- SOLO300U – 300 μm PIPS, No Guard.
- SOLO300G – 300 μm PIPS, Scintillation Guard.
- SOLO300L – 300 μm PIPS, Scintillation Guard and Shielding.
- SOLO500G – 500 μm PIPS, Scintillation Guard.
- SOLO500L – 500 μm PIPS, Scintillation Guard and Shielding.

SPECIFICATIONS

PERFORMANCE

All specifications are based on measurements at the Mirion factory with a 2000 mm² x 300 µm depletion silicon detector unless otherwise noted.

Background: Alpha – 0.08 cpm guaranteed 0.05 cpm typical.

Typical Beta Background Values 300 µm			
System	125 keV Threshold		
	SOLO300U	SOLO300G	SOLO300L
60 nSv/hr	25 cpm	9 cpm	4 cpm
120 nSv/hr	31 cpm	12 cpm	6 cpm
140 nSv/hr	40 cpm	23 cpm	14 cpm
160 nSv/hr	75 cpm	58 cpm	30 cpm

Typical Beta Background Values 500 µm		
System	85 keV Threshold	
	SOLO500G	SOLO500L
60 nSv/hr	12 cpm	4 cpm
120 nSv/hr	14 cpm	7 cpm
140 nSv/hr	42 cpm	16 cpm
160 nSv/hr	80 cpm	33 cpm

Typical 4π Efficiency:

	Threshold	16 mm	50 mm
²⁴¹ Am			
Alpha	125 keV	40%	34%
⁹⁰ Sr Beta	125 keV	30%	25%
⁶⁰ Co Beta	125 keV	12%	10%
⁶⁰ Co Beta	85 keV	18%	16%
⁹⁹ Tc Beta	85 keV	13%	10%

PHYSICAL

- Display – 160 x 80 pixel LCD graphic display with LED backlight (67.2 x 33.6 mm high viewing area with 0.39 x 0.39 mm pixel size).
- Compatible Filter Sizes – Loose filters up to maximum 101.6 mm (4 in.) diameter. Optional holders for NFS/RPS, PAS and SAS card mounted filters.
- Power – 100-240 V, ~1.8 A, 50–60 Hz into ac to dc converter; 9-15 V dc input, 5 A, maximum input to iSolo.
- Size – 25 x 27 x 37 cm including the 3 cm handle (10 x 10.5 x 14.5 in., 1.2 in. handle).
- Weight (approximate) –

System Weight	
SOLOX00U	6.5 kg (14 lb)
SOLOX00G	8.6 kg (19 lb)
SOLOX00L	17 kg (38 lb)

ENVIRONMENTAL

- Operating Temperature – 10 °C to 40 °C (50 °F to 104 °F), non-condensing humidity.

REAR PANEL CONNECTIONS

- Power – 9–15 V, 5 A max. supplied by Universal Power Supply.
- 10/100 Ethernet – Not used.
- USB Peripheral – iLINK Software.
- USB Host – Not used.
- Printer – Parallel port.
- RS-232C – Used to connect the iSolo unit to a computer or data logger for data transfer and for use with iLink software.

ACCESSORIES SUPPLIED

- RS-232C Cable – 1.8 m (6 ft).
- AC/DC Power Converter – Auto sensing 100-240 V ac, 50-60 Hz input, 12 V dc, 5.0 A output.
- Detector installation tool and base.
- Calibration Source Holder – SH-CAL 60 mm x 3 mm deep with SH-SHIM shim kit.

OPTIONAL ACCESSORIES

- Sample Holders
 - SH-25MM, SH-37MM, SH-42MM, SH-47MM, SH-60MM SH-4IN – Sample holders for 25 mm, 37 mm, 42 mm, 47 mm, 60 mm, and 101 mm diameter filters.
 - SH-NFS, SH-PAS, SH-SAS, SH-STD – Sample holder for NFS/RPS Accountability Cards, Personal Air Sample type media, SAS filter media, Series 5 inserts.
- Electroplated Calibration Standards
 - Models CO50MM, CO25MM, SR50MM, SR25MM, AM50MM, AM25MM – Co-60 50 mm, Co-60 25 mm, Sr-90 50 mm, Sr-90 25 mm, Am-241 50 mm, Am-241 25 mm diameter calibration standard.
- Model IS-2300 – Replacement 300 µm detector.
- Model IS-2500 – Replacement 500 µm detector.
- Model ISOLO-BR – Barcode Reader for iSolo unit.
- Model ISOLO-BT – Set of six (6) NiMH replacement batteries, 900 mAh.
- Model ILINK – iSeries Communications Software.



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