

iMatic™

Gas-Less Automatic Alpha/Beta Counting System



DESCRIPTION

The iMatic system is a firmware based, automatic, low background, gas-less alpha /beta counter designed specifically for the analysis of air filters and smear or swipe samples. The iMatic system discriminates both radon isotopes and their progeny from transuranic and fission product materials on the samples. It uses a solid state silicon PIPS detector for alpha and beta detection; can be operated continually for over six hours with internal batteries and is totally self contained. The iMatic system represents a major technological breakthrough in air filter analysis.

THE PROBLEM IS RADON

Counting air samples from either CAM units or stationary samplers can pose serious problems for the health physicist. Why? Radon isotopes 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 interference on a filter paper can cause 'falsely' elevated DAC values. Radon is the problem,

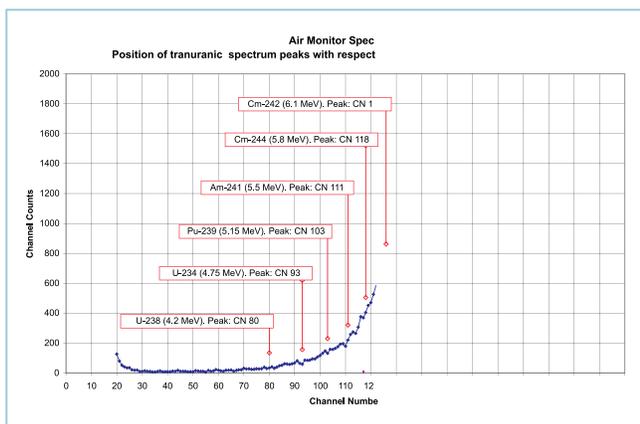


Figure 1: Spectrum showing radon/thoron interference and transuranic peaks.

but the real difficulty is knowing when the values are false – caused only by radon interference and not a plutonium or uranium release.

FEATURES

- Automatic sample changer with 50 or 100 sample capacity
- Automatically identifies and compensates for radon, thoron and progeny interference
- PIPS® silicon gas-less detector
- Developed primarily for air filter analysis
- NiMH battery power provides 6+ hours of continuous operation
- Universal, auto-sensing power supply
- Scintillation cosmic guard detector
- Molded low background passive lead shielding with interlocking design, 4 in. thick
- Compatible with essentially all filter types and sizes from 25 mm to 60 mm diameter
- Carriers available for NFS, PAS and SAS mounted filters
- Includes mobile cart
- Stores up to twenty-six standards; allows for up to ten counting procedures and ten independent calibrations
- Automatic system calibration for background, alpha and beta efficiencies for all ten calibrations with no operator intervention
- Automatic daily QC checks of alpha and beta backgrounds and alpha and beta efficiencies
- Compatible with iLink™ iSeries™ Communications Software for remote setup and download of data to a computer
- CE compliant

THE IMATIC APPROACH

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

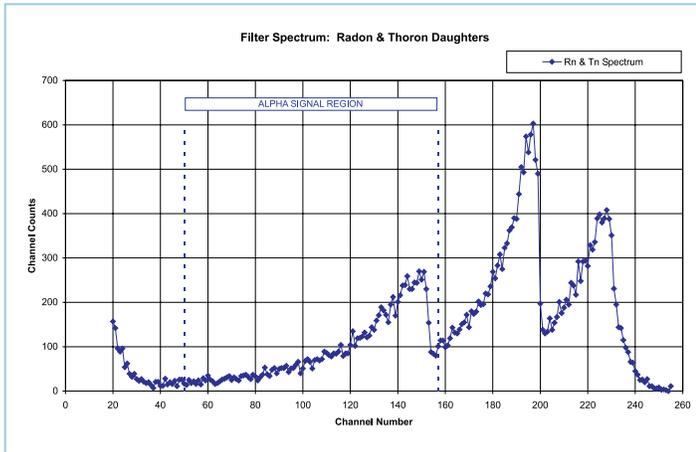


Figure 2
Typical radon/thoron spectrum from an air filter.

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. It is from this residual spectrum that the iMatic system reports radon compensated, true alpha and beta activity on the front panel LCD display.

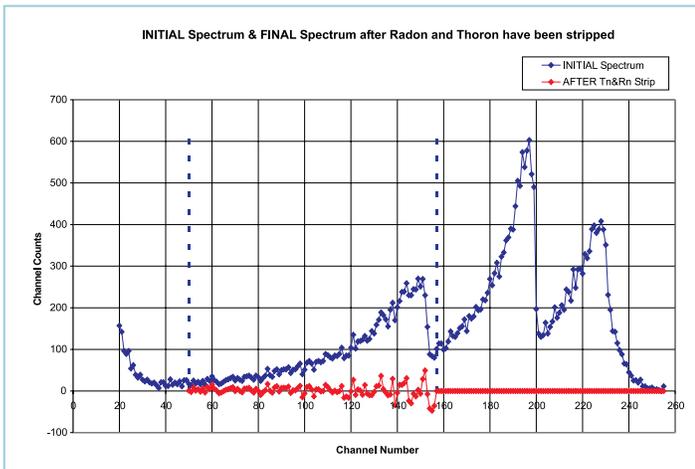


Figure 3
Typical radon/thoron spectrum from an air filter shown in blue with residual spectrum after stripping shown in red.

Not only are the numerical results shown on the iMatic unit's screen, but the 256 channel spectra of both the original and radon compensated data can be seen as well. (See Figures 4 and 5). The spectra can be viewed in linear or log scale, and the scale can be set automatically or manually by the user. The X axis of a compensated spectrum is shown in the middle of the display to accommodate channels with negative data.

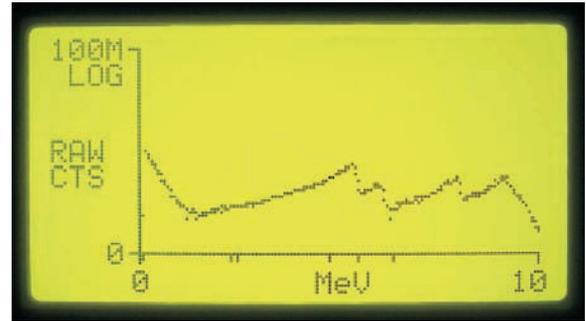


Figure 4
Original data shown in log scale.

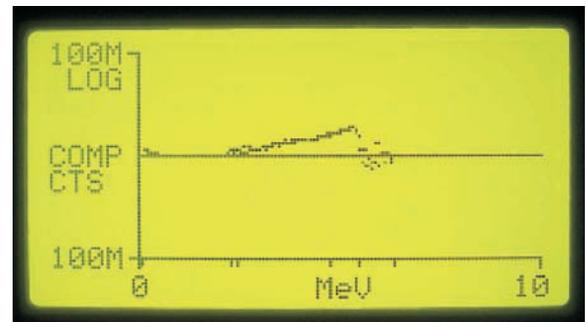


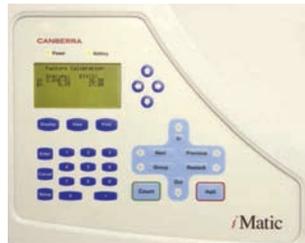
Figure 5
Compensated data shown in log scale.

COMPLETE SOLUTION

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

The iMatic radon compensation algorithm adjusts to all types of filter media from glass fiber filter media for smear analysis to Millipore or Eichrom membrane type filter media for air sampling. The iMatic system adapts to these different filter media types automatically. No additional calibrations or special instrument settings are required. The iMatic 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 iMatic anti-coincidence guard detector provides rejection of external gamma and cosmic radiation to minimize the overall system alpha and beta background.

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. The light pulses generated within the scintillator are coupled to a photomultiplier tube where the light is converted into an electrical signal that is used to anti-coincidence gate the data collection of PIPS sample detector events. When throughput and sensitivity are essential, the iMatic system is unsurpassed.



Control touch panel.

The iMatic counter provides the system operator with gross alpha/beta results, but that is only the beginning of what it does. Pulses from detected charged particles are sorted by energy. A lower level discriminator is set at 125 keV and 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. The following regions may be selected to be reported on the iMatic hardcopy printout. Energy values are approximate.

- Total Alpha Region: 3.0 MeV to 9.6 MeV
- Uranium Region: 3.0 MeV to 5.0 MeV
- Uranium, Am and Pu Region: 3.0 MeV to 5.6 MeV
- Curium Region: 3.0 MeV to 6.4 MeV
- Total Beta Region: 125 keV to 2.2 MeV

STANDALONE INSTRUMENT – NO COMPUTER REQUIRED

The iMatic system is a firmware based instrument and does not require a computer to set up or operate. 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 iMatic program takes less than five minutes.

iLink iSeries COMMUNICATIONS SOFTWARE

If computer control and/or the ability to download iMatic results into a Microsoft SQL Server database are desired, iLink iSeries Communications Software is available for this purpose. iLink provides the operator of iMatic systems the ability to program the majority of the iMatic 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 iMatic 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 iMatic report templates, establish iLink and iMatic securities, create User, Calibration and QC procedures, backup and restore iMatic system personalities, and export data in comma separated (CSV) or Tab-Delimited formats.

iLink software is compatible with the Microsoft Windows 7 Professional 32 and 64 bit operating systems. Multiple iMatic units can be interfaced to one computer, depending on the number of available ports there are in the computer.



Rear view of shield.

CUSTOM OPTIONS

The iMATIC2000 model is available for users who want to customize a system for specific needs. The preconfigured versions always include a 300 µm detector, guard detector, lead and cart. One of the most important choices is for the detector. Users can choose the standard IS-2300 or the optional IS-2500 model.

The IS-2500 model will improve the response of any beta emitter with a $E_{\beta \text{ max}}$ 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, ^{60}Co 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.

SPECIFICATIONS

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

PERFORMANCE

Background: (Sample detector threshold set at 125 keV and guard detector discriminator set at 10%).

- Alpha: 0.08 cpm guaranteed 0.05 cpm typical
- Beta: 0.75 cpm guaranteed 0.60 cpm typical

Note: Alpha background for 3.0 MeV to 9.6 MeV and Beta background for 125 keV to 2.2 MeV.

Guaranteed 50 mm efficiency:

- 41Am: alpha 30.0%
- 90Sr: beta 22.0%

Typical 4π efficiency:

Source	16 mm	25 mm	36 mm	50 mm
241Am alpha	39.9%	39.5%	38.2%	33.8%
90Sr beta	29.6%	29.3%	28.4%	25.1%
60Co beta	12.0%	11.8%	11.5%	10.1%

Note: Efficiencies based on a 2000 mm² area, 300 µm sensitive depth PIPS detector.

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 from 25 mm to maximum 60 mm 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 iMatic system.
- Size – 50 sample, table top: 75 x 58 x 76 cm (29.5 x 23 x 30 in.) (H x W x D).
 - 100 sample, table top: 124 x 58 x 76 cm
 - (49 x 23 x 30 in.) (H x W x D).
 - Cart with casters: 76 x 58 x 76 cm
 - (30 x 23 x 30 in.) (H x W x D).
- Weight – Table top system: 332 kg (730 lb).
 - Cart: 54 kg (120 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.
- Printer – Parallel port.
- RS-232C – Used to connect the iMatic system 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 Carriers – Model IS-CAL, three provided, coded 1, 2 and 3 mm deep by 60 mm diameter standards.



ORDERING INFORMATION

Domestic Models

- IMATIC2000, Automatic iSeries Alpha /Beta Counter with Radon Compensation for Custom Configuration, includes base unit only
- System requires selection of detector (IS-2300 or IS-2500); 50 Sample (IS-SS50) or 100 Sample (IS-SS100) Capacity; Standard Height Cart (IS-CART), Short cart (IS-SCART), or no selection if tabletop configuration is desired; Anti-coincidence guard (IS-GUARD) or none (IS-DETMNT); Lead (IMATIC-LD) or no selection if leadless form factor. Additional Options are available consistent with the pre-configured iMATIC models.
- IMATIC2305, Automatic iSeries Alpha /Beta Counter with Radon Compensation, with 2000 mm², 300 micron deep PIPS detector, 50 sample capacity, mobile cart and printer.
- IMATIC2310, Automatic iSeries Alpha /Beta Counter with Radon Compensation, with 2000 mm², 300 micron deep PIPS detector, 100 sample capacity, mobile cart and printer.

Export Models

- IMATIC2000E, Automatic iSeries Alpha /Beta Counter with Radon Compensation for Custom Configuration, includes base unit only.
- See IMATIC2000 model for configuration requirements.
- IMATIC2305E, Automatic iSeries Alpha /Beta Counter with Radon Compensation, with 2000 mm², 300 micron deep PIPS detector, 50 sample capacity and mobile cart.
- IMATIC2310E, Automatic iSeries Alpha /Beta Counter with Radon Compensation, with 2000 mm², 300 micron deep PIPS detector, 100 sample capacity and mobile cart.

REQUIRED ACCESSORIES

Choose Sample Carriers/Rings that match samples to be counted.

- Model IS-LM1 – Loose Filter/Swipe Carriers with inserts for 25 mm, 37 mm, 43 mm, 47 mm and 60 mm diameter filters, BCD coded 1 to 50.
- Model IS-LM2 – Loose Filter/Swipe Carriers same as IS-LM1 except BCD coded 51 to 100.
- Model IS-LM3 – Loose Filter/Swipe Carriers same as IS-LM1 except BCD coded 101 to 150.
- Model ISRINGS-25 – Retainer Rings for 25 mm diameter Loose Filters/Swipes, 50 each.
- Model ISRINGS-37 – Retainer Rings for 37 mm diameter Loose Filters/Swipes, 50 each.
- Model ISRINGS-43 – Retainer Rings for 43 mm diameter Loose Filters/Swipes, 50 each.
- Model ISRINGS-47 – Retainer Rings for 47 mm diameter Loose Filters/Swipes, 50 each.
- Model ISRINGS-60 – Retainer Rings for 60 mm diameter Loose Filters/Swipes, 50 each.
- Model ISADAPT – Carrier inserts for 25 mm, 37 mm, 43 mm, 47 mm and 60 mm Filters/Swipes, 50 each.
- Model IS-STDC1 – Standard BCD coded carriers, coded 1 to 50 plus 50 each 2 in. by 1/8 in. SS Inserts.
- Model IS-STDC2 – Standard BCD coded carriers, coded 51 to 100 plus 50 each 2 in. by 1/8 in. SS Inserts.
- Model IS-STDC3 – Standard BCD coded carriers, coded 101 to 150 plus 50 each 2 in. by 1/8 in. SS Inserts.

IMATIC2000 CONFIGURABLE MODELS

- Model IS-2300 – 2000 mm², 300 µm depletion iSeries PIPS detector.
- Model IS-2500– 2000 mm², 500 µm depletion iSeries PIPS detector.
- Model IS-GUARD – Anti-coincidence guard system.
- Model IS-DETMNT – Mount for use in IS-DETMNT is not present. IS-DETMNT detector mount is required when IS-GUARD is not selected.
- Model IS-SS50 – 50 Sample Capacity.
- Model IS-SS100 – 100 Sample Capacity.
- Model IS-CART – Standard Height Cart.
- Model IS-SCART – Short Cart.
- Model IMATIC-LD – Lead shielding.

OPTIONAL ACCESSORIES

- Model IS-SCART – Short Mobile Cart and Shipping Crate, 30 in. long by 23 in. wide by 21 in. high. 9 in. shorter than standard cart, no panels or printer table, excellent for 100 Sample Systems.
- Model ISOLO-BT – Set of six (6) NiMH batteries, 900 mAH.
- Model AM50MM – 241Am 50 mm diameter calibration standard.
- Model AM25MM – 241Am 25 mm diameter calibration standard.
- Model SR50MM – 90Sr 50 mm diameter calibration standard.
- Model SR25MM – 90Sr 25 mm diameter calibration standard.
- Model CO50MM – 60Co 50 mm diameter calibration standard.
- Model CO25MM – 60Co 25 mm diameter calibration standard.
- Model IS-CAL – Carrier for Calibration Standards, 3 mm deep by 60 mm diameter opening.
- Model ILINK – iSeries Communications Software with SQL Server Database.
- Model IS-PRT1 – Dot matrix printer, Parallel Port, 120 volts. Okidata 320 Turbo or equivalent.
- Model IS-PRT2 – Dot matrix printer, Parallel Port, 240 volts. Okidata 320 Turbo or equivalent.
- Model IS-2300 – 2000 mm², 300 µ deep iSeries PIPS detector.
- Model IS-BCR – Bar Code Reader for iMatic System.



CANBERRA

