

Welcome to the ORTEC Newsletter

One of the themes in this issue is automation in the Gamma Spectroscopy laboratory, and two of our key products in this area are featured; Global Value and the ASC2.

Global Value software is our key product used for automation of sample analysis procedures, data review and data management within the laboratory. It is a companion product to our Gamma Analysis software - GammaVision-32.

Taking the next step in terms of laboratory automation, we also discuss our ASC2 Automated Sample Changer system. The combination of Global Value and the ASC2 being the ultimate in terms of automation of the Gamma Spec lab.

We hope you find this newsletter useful and of course we would appreciate any feedback on how we could make improvements, or if you have any specific topics that you would like us to cover in subsequent issues.

Demo Stock Sale

ORTEC has on hand and ready for immediate delivery an assortment of used demonstration equipment. All of these instruments are fully tested and include a full 90-day warranty.

Even if your budget is tight, it is still possible to acquire ORTEC equipment for your spectroscopy needs. Please contact us at ortec.uksales@ametec.co.uk for more details and availability.



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HPGe Mechanical Cooling - Proven Technology

Since 1994, ORTEC has been manufacturing a mechanical cooler which eliminates the need for Germanium detectors to be cryogenically cooled using LN2. With over 1,000 X-Cooler II units in operation, many users are benefiting from the numerous advantages mechanical cooling can bring when compared to LN2, such as:

- No LN2 safety hazard, so that it is safe to use in unattended situations
- No bulky storage tanks or unwieldy plumbing systems – the X-Cooler II is lightweight and compact
- Low cost – the annual cost of running an X-Cooler II can be less than that of an LN2 detector
- No dewar filling operations

The X-Cooler II is particularly reliable, thanks to its patented design which solves the problem seen with traditional coolers.

These can fail because oil from the compressor mixes with the refrigerant, migrating to the heat exchanger and clogging it, thus causing the detector to warm up. The X-COOLER II's patented design cleans the oil out of the refrigerant continuously. Similar coolers using this design have logged over 38,000 hours of operation without failure, and are still running!

Should you wish to upgrade your existing PopTop™ detector, the process couldn't be easier as the X-Cooler II will retrofit to existing detectors. Routine maintenance is a simple procedure - due to the unique design of both detector and X-Cooler II, either product can be swapped in the field as needed.

For further information, please visit www.ortec-online.com/pdf/x-cooler.pdf or contact your sales engineer.



X-Cooler II with PopTop™ detector

Automated Gamma Spectroscopy system for Counting Labs

Many counting laboratories may be frustrated by the fact they can count samples only while there is someone available to do so - i.e., someone to change a sample and re-start a measurement. Those labs which have a large number of samples to count, or need to count sample for a long period of time (several hours) could be missing out on valuable counting time during hours when the laboratory is closed, due to this lack of man-power.

The ORTEC ASC2 Automatic Sample Changer can eliminate this 'wasted' counting time as it allows users to take advantage of time available during the night, and can keep the laboratory productive during hours when nobody is working! It's no surprise that this system has become the top choice for those performing high-resolution gamma spectroscopy, and looking for an integrated, automotive system for unattended analysis of bulk samples. Benefits of the system include:

- Unattended acquisition and analysis of multiple high-resolution gamma-spectroscopy samples
- Low background design: no moving parts inside lead shield
- Completely safe - totally enclosed!
- Easy to use
- Variety of sample geometries and number combinations available
- No need to purchase new detector - the ASC2 can be easily added onto an existing system.

A complete ASC2 system, as pictured, comprises an ORTEC HPGe detector in a low-background shield; a safe ultra-reliable automatic sample changer; ORTEC spectroscopy electronics; ORTEC GammaVision analysis software and control via a unique GV Automation software package. No dedicated PC is required to be near the system since an Ethernet cable between the electronics and PC allows control of the sample changer to take place remotely via the network. Assuming the ASC2 is used in conjunction with a DSPEC, these integrated electronics are all that is required at the system itself.

Safety was considered to be of paramount importance during the design of the ASC2. Interlocks are built in which prevent the motor arms from moving when the doors are opened meaning the shield can not accidentally cause injury if someone reaches into it while the system is in operation. An emergency stop button is also prominently mounted on the front of the system.

The ASC2 accommodates a wide variety of size/sample number combinations, including a variety of Marinelli beakers. The twenty standard 1-litre containers are perfect for holding scintillation vials, small beakers, charcoal and paper filters, and various sample bottles. Optional sample carriers such as the Marinelli beakers can be used on the same system as the standard 1-litre carriers. There are no screws to remove, nor carriers to dismantle. Simply pull out one set of carriers and install the new set. A command to the X-Y-Z controller resets the positioning mechanism to pick up the new carriers. When the other set is needed, simply reverse the process. Total time to change out a carrier set is <5 minutes.



Samples to be counted are first registered into a loading jig, from which they are sequentially taken into the counting chamber by the pre-programmed action of X-Y-Z robotic arm. The sample count starts as soon as the data for the first sample has been entered, thus maximising count time. The sliding top of the lead shield is rolled back smoothly under computer control to allow for sample changing. When the sample is in place, the robotic arm releases it, and returns to its rest position as the shield lid closes and the count starts.

Through the use of the automation software, different sample types can be completed in one batch. Simply choose the right template for each sample to be counted, and the automation software will handle the rest.

During normal operation, no computer control is necessary. All communications are through the 'CHANGE SAMPLE' and 'SAMPLE READY' BNC connectors on the ORTEC MCB.

The ASC2 is designed to operate with a variety of spectroscopy electronics systems. It also brings the advantage that it can be fitted to an existing gamma-spectroscopy system helping to fully utilise all counting time available.

High Resolution Radiation Portal Monitoring

Increasing efforts to prevent the illicit trafficking of nuclear materials, particularly across national borders, has led to a growing requirement for monitors of all types capable of detection of radioactive materials. The precise form of the monitoring system depends on the Concept of Operations or "CONOPS" at the crossing or facility. It is of greater importance these monitors are resistant to all forms of incorrect result: false negatives, false positives and false alarms, thus implying that the system must provide highly reliable nuclide identification.

The majority of gamma-ray emissions from Special Nuclear Materials (SNM) are in the 100 to 600 keV range, and the detection efficiency in this energy range will depend mainly on the surface area of the detector. In germanium detectors, for example, a depth of 46 mm absorbs 90% of all 400 keV gamma rays incident on the face of the detector. Thus, surface area of the detector crystal is more important than depth.

Large area, high purity germanium (HPGe) detectors meet these needs, but historically, had one major limitation - that they be cooled to cryogenic (LN₂) temperatures. Recent developments in high reliability cryocoolers resulted in the increased use of mechanical cooling for HPGe. Certain types of Stirling-cycle mechanical coolers typically have a design life in the order of 50,000 hrs or more of continuous operation, thereby greatly reducing the need for service intervention. Advances in spectroscopic signal processing using Digital Signal Processing (DSP) techniques have improved the spectrum quality both in terms of resolution improvements and stability, with respect to temperature change and other causes of long term change in the position of the gamma-ray peaks. DSP technology allows pulse-by-pulse corrections to be applied to the data stream to eliminate deleterious effects such as degradation of the resolution by periodic noise.

The **ORTEC Detective-ASP Series Interchangeable Detector Module (IDM)** is a gamma-ray detection "building block" incorporating latest developments in these areas. It is a completely self-contained subsystem comprising a single, large surface area mechanically cooled high-purity germanium (HPGe) detector and all necessary electronics in a RUGGED package. It is everything needed to detect gamma rays and send the energy histogram or digitised pulse stream to a PC for analysis.

An IDM can be used in a variety of systems where nuclide identification/monitoring is needed as a "building block" component for the construction of portal monitors for pedestrians, packages, vehicles, cargo containers, and rail freight cars (goods wagons) as well as for vehicle and airborne mobile search systems.

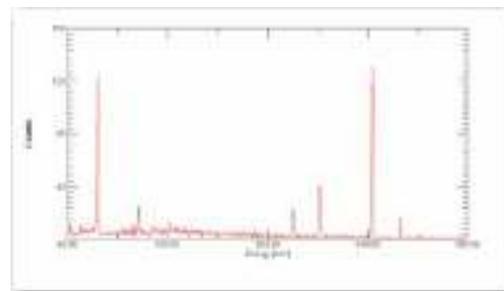
IDM Benefits

- Large area 85 mm diameter x 30 mm thick HPGe crystal
- High-reliability Stirling cycle cooler cools rapidly to operating temperature
- Can be temperature cycled at any time, even from partial warm up
- High performance, digitally stable signal processing
- "Hot swap" of IDM modules while in operational state – reduced downtime
- USB 2.0 data communications
- Low power consumption
- Low Frequency Rejector (LFR) improves spectrum resolution in noisy environments



As mentioned earlier, the majority of the gamma-ray emissions from special nuclear material (SNM) are below 1 MeV. Extensive modelling has shown that a detector size of 85 mm diameter by 30 mm deep is an excellent geometry for detecting these gamma rays. The HPGe crystal geometry is nominally the same in all IDMs.

The plot opposite shows the summed spectrum over a 1-second time window for 4 IDM units configured as a pedestrian Portal Monitor with a test source moving through the portal. It was taken using a test source comprising 2.5 MBq ¹³³Ba, 110 kBq ⁵⁷Co and 728 kBq ⁶⁰Co. The source was placed in the centre of the detection zone; corresponding to a horizontal distance between the source and detector front face of 50 cm and vertical distances from the floor of 10, 57.5, 105, 152.5 and 200cm.



The IDM cryostat design does not use molecular sieve as a cryo-pump material like conventional cryostats, but instead incorporates all metal seals and very clean construction methods in the vacuum system resulting in a robust long-life cryostat which can be temperature cycled, either completely or partially, indefinitely. The cooler can be turned off and on at any time, greatly aiding service operations.

Data from the IDM can be collected in a histogram mode (the traditional mode for Pulse Height Analysis) and transferred to a PC for further analysis. There is a small dead time while the data is being transferred which prevents new data from being collected. List mode data collection is essential in situations where no data can be missed and has been successfully used in many real-world situations e.g. when the sample is moving relative to the detector and it is important to measure an activity profile as a function of time or position, or for aerial and land-based surveying. When moving at 50 kph, a 100 millisecond gap in data collection means a gap of nearly 1.5 meters in the data collection profile. In the list mode of operation, data is stored directly to memory, event by event, with a time stamp (200 nanoseconds). This wealth of data can then be reconstructed into separate spectra by time, energy, or position within a portal. This feature of the IDM greatly enhances its detection sensitivity.

Global Value - The Optimum solution for the Busy Counting Lab

The ORTEC GammaVision gamma analysis software has been the back-bone of ORTEC gamma spectroscopy systems for many years and is in widespread around the world. GammaVision software is used in many different applications from research through to high productivity radiochemistry counting laboratories applications.

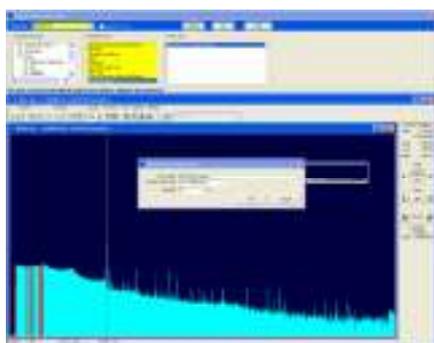
In order to minimise data entry errors and maximise productivity many counting laboratories now see the need to automate as much of their counting procedures as possible as well as establish a rigorous quality assurance and sample analysis review processes. To meet these needs ORTEC has developed a suite of add-on programs for GammaVision called Global Value.

At the heart of the Global Value system is a high productivity user interface used for managing large numbers of Gamma detector systems. Global Value incorporates comprehensive data management, electronic data review, custom reporting and QA tools and uses GammaVision to perform the basic functions such as data analysis, system calibration, nuclide library editing etc.

Key features of Global Value include –

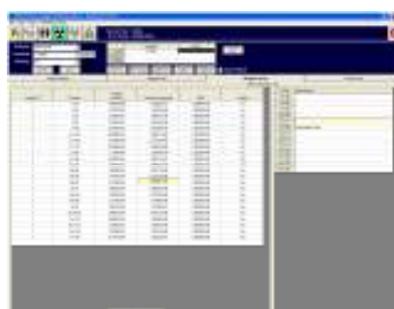
- Completely automated analysis routines
- Analysis routines can started from any PC on a network running Global Value
- Advanced data management with instant access to analysis data and reports.
- Analysis data and QA data stored in security protected Microsoft Access database
- Electronic analysis report editing, digital signatures and encrypted PDF reports.
- Custom reports can be produced with NO special expertise or software required
- Quality Assurance module with data review, evaluation and custom report features
- Analysis log for easy, filtered searching and recall of report data
- Seamless integration with Microsoft Excel for unlimited calculations, QA data evaluation, and post-analysis data processing

The Quick Start utility which is the launch pad for starting automated analysis procedures within Global Value allows the user to select the specific detector to be used. The software automatically checks to see if the selected detector is already being used by another system on the network. In addition, a QA status check is also automatically performed which prompts indicating any QA failure for the specific detector selected during the sample analysis routine.



Isotope	Activity
U-235	1.10E-08
U-238	1.10E-08
Th-232	1.10E-08
Pa-231	1.10E-08
Ac-227	1.10E-08
Fr-223	1.10E-08
Ra-226	1.10E-08
Ac-228	1.10E-08
Th-230	1.10E-08
Pa-230	1.10E-08
U-234	1.10E-08
Th-232	1.10E-08
Pa-231	1.10E-08
Ac-227	1.10E-08
Fr-223	1.10E-08
Ra-226	1.10E-08
Ac-228	1.10E-08
Th-230	1.10E-08
Pa-230	1.10E-08
U-234	1.10E-08
Total	1.10E-08

Global Value includes sophisticated Sample Administration program to allow electronic review, editing and publishing of analysis reports. Any changes made by the reviewer to the report data are automatically marked.



The QA program allows for complex statistical analysis of QA data via an Excel Add-In utility and export to Excel feature. It also includes historical data review, charting an electronic notebook function and a QA log book for easy searching and recall of QA data.



Global Value also includes a range of additional tools including a utility for generation of Source Certificate Files used for detector efficiency calibration, a timer control feature for setting specific start times for analysis procedures and a database utility program.

Global Value is designed to be setup specifically to meet the requirements of individual laboratories. A key part of the Global Vale service is that a member of our Technical Support Group will visit the laboratory to install the software and set up any specific analysis procedures, custom reports and other custom routines. At the end of the installation process the laboratory automation is complete with all procedures in place, staff fully trained and the system in full operation. Typically this process takes 2-3 weeks depending on the amount of site specific work required.

For more information on the Global Value software or to arrange a demonstration please contact your sales engineer

New Algorithms for Waste Characterisation

With many nuclear facilities now moving into a decommissioning phase the need to characterise and assay possible waste materials is becoming an increased priority. One of the most useful and flexible techniques is the use of In situ High Resolution Gamma Spectrometry.

A typical system comprises a portable detector which may be electrically cooled, data acquisition electronics, and waste characterisation software. Such specialist software allows the user to model a point source and traceable on-site calibration to a variety of sample types such as drums, pipes, walls and even soil.

A key advantage of ISO-TOPIC - ORTEC's waste characterisation software is this on-site calibration, which allows the user to incorporate any detector into the system and then trace their measurements to national standards. However, until now, results were less accurate in situations where the detector needed to be placed close to the object being measured, either because of physical constraints or due to the signal attenuation from the walls of the storage container. The software algorithms would assume a reasonable distance between object and detector, thus only counting gamma-rays entering through the front face of the crystal.



trans-SPEC and ISO-CART Waste Assay System

With the release of ISO-TOPIC V4, these algorithms have been updated to allow for these 'close geometry' measurements to be made with confidence and accuracy. The algorithms break down the object being measured into voxels (three dimensional cells) and then calculate the interaction of gamma rays from each voxel onto both the front face and sides of the detector. With the newer algorithms, accuracy has been found to have improved in a variety of measurement situations and it is now possible for objects to be placed as close as 10cm to the detector, with no loss of accuracy.

During initial setup, the user enters various detector parameters into the software, including crystal diameter and length, germanium dead layer thickness and can thickness. Default information can be changed to allow detectors from other manufacturers to be used with the software.

For further details please contact us for a copy of the technical paper presented at INMM in July 2007, or alternatively download it from www.ortec-online.com/papers/inmm07-waste.pdf.

High Sensitivity Neutron Counter for Security Applications

The detection of illicit radioactive material is highly important in homeland security applications worldwide. There is great concern about Radioactive Dispersal Devices (RDDs), but the destructive power of these terrorist weapons is small compared to that of a nuclear explosion produced by an Improvised Nuclear Device (IND) or state-built nuclear weapon. Even a crude nuclear device could have an explosive power equivalent to 250 Kilotons of TNT.

A nuclear explosion requires the presence of so-called Special Nuclear Material (SNM), that is, Uranium or Plutonium. The major technical challenge is to detect and identify SNM rapidly and with certainty. The most common approach to the detection of RDD or IND devices is through their gamma-ray signatures. However, heavy metal shielding may ultimately defeat such methods.

The ORTEC Fission Meter aids the interdiction of illicit trafficking by augmentation of gamma-ray identification with a neutron detector of very high sensitivity which, in addition, can specifically identify fission neutron sources by the inherent characteristics of the decay process.



Fission Meter

Gamma-rays are 100 times more abundant than neutrons so the gamma-ray nuclide identifier such as the ORTEC Detective will always be first choice, providing the easiest way of source location. However identification, not simply detection, of gamma-rays and neutrons is required; both exist in normal background and their signatures may be similar to those of illicit nuclear material. Circumstances arise where reliance on a gamma-ray detector alone comes into question; the package may be large enough to contain significant shielding, or the gamma-ray background may be seen to drop when measuring a particular package—indicating heavy shielding. The hand-held identifier's neutron detector may show an elevated neutron count rate, or the gamma-ray spectrum may “see” evidence of gamma-rays from neutron reactions.

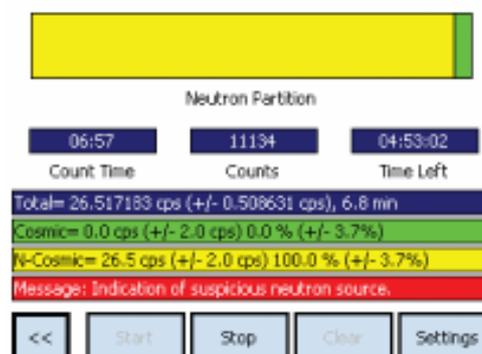
Many neutron detectors exist, but all other neutron detectors which might be used in the field are limited to basic counting. They can register the presence of neutrons, but nothing else. What is needed is a way to check a package or the environment for the existence of neutron sources beyond what would be expected from background.

The Fission Meter is a sophisticated portable neutron detector system. It can identify fissionable Uranium (U) and Plutonium (Pu), by evaluating the distribution in time of neutrons that are emitted spontaneously by these materials. The Fission Meter Technology is the most advanced technology available to segregate threat from non-threat neutron sources. The technology has been developed at Lawrence Livermore Laboratory* and is licensed to AMETEK's Advanced Measurement Technology ORTEC Division.

Fission Meter has three operational modes: Mobile Search, Static Search (identification) and Characterization Data Collect. Mobile Search is the mode used to locate the neutron source. Static Search mode is next used for deciding if there are shielded “non-cosmic” real neutron sources present, that is neutrons due to a fissioning source, as opposed to a high neutron background due to cosmic ray interactions. Characterization Data Collect mode allows for the collection of much more data (~1 million counts) for expert analysis elsewhere.

To summarise, Fission Meter offers the following capabilities –

- “Proof Positive” identification of fission neutron sources through multiplicity analysis.
- Ultra-low level false positive and negative rates, even in the presence of high neutron background.
- Immune to cosmic background fluctuations.
- Highest sensitivity in a portable package.
- Easy to operate.



* LLNL License TL-01962

Improvements to NaI Search System Software

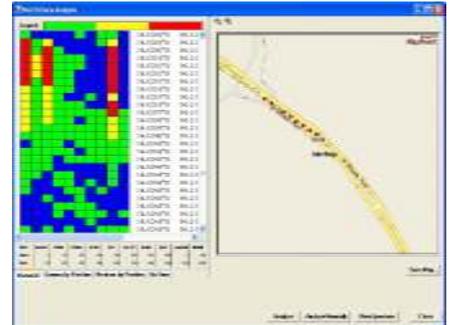
The ORTEC Sodium Iodide Search System (NaI-SS), was first developed in the aftermath of 9-11. It provides a compact and portable system to detect and identify radioactive materials that could be used in an Improvised Nuclear Device (IND), a Radiological Dispersion Device (RDD), or just 'orphan' sources that have been lost or undocumented, and could be used for malicious purposes.

The system comprises one or more NaI detectors to measure gamma rays, moderated He3 detectors to identify neutron flux from special nuclear material, together with GPS, laptop computer and data analysis software. System components are housed in two Pelican cases, which can be placed into a car boot or roof carrier. Alternatively the system can be carried in an aircraft for aerial surveys.

NaI offers two advantages in this application. It is sensitive, allowing sufficient data to be collected from a moving vehicle and it also gives better resolution than many other techniques.

The latest version of NaI-SS software, version 2.5, includes many experience based improvements suggested by customers. An example is the 'breadcrumb' trail which shows where data has been collected on a map, and highlights any alarm conditions. The user can then scroll back and select this data for quantitative analysis and report.

Other improvements include an option to re-analyse historic data, more choice of background subtraction methods with a 'rolling average' option, and greater flexibility in setting alarm thresholds. The new software version also allows for custom built systems with multiple detectors.



'Breadcrumb trail'

Updated ORTEC website

Please take the time to visit our updated website, at www.ortec-online.com. Extensive changes have been made over recent months and we hope you will find the new look easier to navigate and more user-friendly.

Articles have been added to help ensure you choose the product best suited to your needs, further supported by an Application Spotlight which changes regularly and may help give some ideas as to how to run your systems at their optimum performance levels. We have also added a Product Suggestion Form where you can tell us about product modifications or developments you would like to see. You can even take a look at past editions of the ORTEC newsletter and some of the products we have highlighted in them.

All the information available through the previous version of the website is still available, including product brochures, technical papers and details of our service facilities. You can also take a look at our latest range of stock detectors, available for immediate delivery.

Go on-line and let us know what you think - we would welcome any thoughts/suggestions you may have.

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If you would like us to remove your details from our database please send an email to ortec.uksales@ametek.co.uk. All requests will be completed within 5 working days of receipt.

Contact details incorrect? Send an email to ortec.uksales@ametek.co.uk with your correct details and we will update our database

High Performance Dual Input MCA



Since its release a year ago, the ASPEC-927 has become one of our more popular Multi-Channel Analyser (MCA) systems perhaps due to its two completely independent high performance MCA units in a compact single-width NIM module.

With its built-in USB-2 interface, connecting the ASPEC-927 to a computer becomes simple, and it comes supplied with our Maestro-32 MCA software - the industry standard benchmark software for MCA applications.

Multiple ASPEC-927 units can be connected to a single computer via the USB connection either directly or by the use of USB hubs. The Maestro-32 software allows live data from multiple units to be displayed simultaneously in real time.

Whether you are building a completely new spectroscopy system or upgrading an existing system, the ASPEC-927 offers high performance at a very economical price.

- Dual-Input MCA with two independent 16k Resolution ADC's
- Fast 1.25ms conversion time ADC's for high throughput applications
- Loss Free Counting mode
- Hardware I/O control for Automatic Sample Changers

Lowest Cost NIM MCA available

If you are looking to construct a Spectroscopy system and your budget is limited we may have the answer - the 926-M32-USB - a compact MCA unit packaged in a single width NIM module with a USB interface to the host computer.

Suitable for use with all types of radiation detector systems, it offers excellent performance at an extremely attractive price.

- Single-input MCA with 8k Resolution ADC
- USB connection to PC
- Maestro-32 software



Forthcoming Exhibitions & Training Courses

We will have a stand at the **Technology Show at Sellafield** on **October 9th**, and will be happy to discuss any product requirements you may have:

GammaVision Training Course

We are planning on running our next GammaVision training course in March/April 2008. Historically, this course has been well received, and participants learn about all operational aspects of the GammaVision software, along with associated hardware. For those new to Gamma Spectroscopy, we offer an optional extra day, covering the more foundation areas of Gamma technology.

Past delegates have found the lab work particularly useful and have gained from knowing more about the various calibration techniques. We also offer a course dinner that gives everyone a chance to relax and get to know each other, away from the pressure of the training room!

The GammaVision course has in the past run at full capacity so please let us know as soon as possible if you or a colleague would like to attend.