ORTEC® News

Autumn/Winter 2009

Welcome to the *ORTEC* Newsletter

Its hard to believe that we are coming to the end of 2009 which has been a tough year for many organisations but hopefully the outlook for 2010 looks much more positive. We at ORTEC are certainly approaching the new year with enthusiasm and with a host of new products which we believe will be of significant benefit to our customers.

In this issue we cover some of these new products and product developments which have applications that range from counter-terrorism activities through to fundamental research. Perhaps the most significant development announced in this newsletter is the release of our new completely integrated Laboratory Detector Module (LDM) which introduces a new concept in High Purity Germanium detector systems for laboratory applications.

Inside this issue:

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Laboratory Gamma Spectroscopy systems enter the next generation!

It is well understood that High Purity Germanium (HPGe) detectors are the only option when it comes to performing High Resolution Gamma Spectroscopy. However, one of the fundamental limiting factors or drawbacks of HPGe detectors is the need to cool them down to liquid nitrogen temperatures in order for them to perform correctly.

For many applications using liquid nitrogen is just simply not practical or possible and in order to solve this problem liquid nitrogen free electro-mechanical cooling systems have been produced for several years. However the typical electrically cooled system designed for laboratory use still has some limitations. For example if the electrical power is lost and the HPGe detector starts to “warm up” typically the complete system needs to be taken through a full thermal cycle. This can mean a significant amount of time before the system is ready for use again. The risk of having to take a system through a full thermal cycle can be mitigated to a degree by using an uninterruptible power supply (UPS) to maintain power to the cooling system compressor during the power outage.

In addition these systems can also have a limited ambient operational temperature range; this is usually more than adequate for normal laboratory applications but can be a limitation when it comes to “industrial” applications or where the detector needs to be installed in an environment with limited or no ambient temperature control.

ORTEC addressed all these issues and many others in the development of the **DETECTIVE** range of HPGe hand-held radiation identifiers which have been hugely successful. We have now migrated technology from the Detective products to the laboratory system - enter the LDM!

LDM

……\continued on page 2

Laboratory Gamma Spectroscopy systems enter the next generation!

The LDM is another unique product from ORTEC in that it integrates a complete high resolution gamma spectroscopy system into a single unit designed primarily for laboratory applications. In the LDM a P-type HPGe detector of ~ 40% relative efficiency (crystal dimensions are 65mm diameter x 50mm length) is combined with a "run-forever" Stirling cycle cryogenic cooling system. Importantly the detector is also mounted in our "hardened cryostat" design developed from the Detective product range. In the hardened cryostat the HPGe detector can be partially thermally cycled at any time without affecting the system performance. Standardisation of the size of HPGe crystal means that LDM units can be interchanged with minimal effect on the system performance.

As well as the HPGe detector, cryostat and cooling system the LDM also integrates a high performance 16,382 channel resolution Digital Signal Processor (DSP).

The DSP interfaces to the host computer via an integral USB-2 interface. In fact in the LDM there are only two external electrical connections to make when the system is installed. One is the 12-17 V DC input power connection, the other the USB-2 communications connection.

The LDM has also been designed so it can be integrated into the typical laboratory setup with the minimal of effort. To this end the system is supplied with a removable stand which can be used for mounting the unit in a typical low background lead shield found in most laboratories as you can see illustrated in the picture opposite.

Illustration above showing the LDM100-GEM installed in a standard low background lead shield assembly

The high voltage required by the detector is also factory set and high voltage is automatically applied as soon as the detector reaches the correct operating temperature. With Plug-n-Play connectivity to the computer via all the standard ORTEC software packages system setup is simple. The digital filter parameters for the detector are factory set so the only setup required by the operator when installing the system is adjustment of the channel resolution and then the system gain to define the energy range required.

Another key benefit of the LDM is its integrated "State-of-Health" technology. Key detector parameters are monitored continuously and if they fall outside limits automatic warnings are displayed to warn the operator via the standard ORTEC Connections-32 software such as Maestro-32, GammaVision-32 and Iso-Plus-32.

So the LDM integrates all this technology into a single instrument but what happens in the event of a power failure, surely the HPGe detector will start to warm up and data acquisition has to stop?

No, the LDM also incorporates an internal battery backup which maintains the complete system operation for more than 3 hours. This means that data on the LDM can still be acquired even if the power is interrupted. Even after the 3 hours has expired and the detector eventually starts to warm up, as soon as power is re-applied the system will automatically start to cool down again. Also, as the LDM only requires a small amount of power, <30W, it is easy to extend the battery backup time simply by adding additional batteries or an uninterruptible power supply (UPS).

Although originally designed for use in radiochemistry laboratories with all these benefits the LDM has applications in many areas including mobile laboratories, industrial/plant systems, it can even be configured with our ISO-CART system for Waste Assay applications such is its versatility.

The LDM, truly the start of a new revolution in laboratory Gamma Spectroscopy systems!

State of the art in Portable Gamma Spectroscopy

As more nuclear sites move into the decommissioning phase, the need to perform high resolution gamma spectrometry measurements in-situ is growing dramatically. In-situ measurements offer the advantages of speed and can reduce the issues of sampling error that can be introduced when representative samples are taken back to a laboratory for analysis. However, until recently the option to perform high resolution measurements in-situ was restricted by the need to maintain the HPGe detector with liquid nitrogen and thus generally difficult to achieve.

In 2004, ORTEC introduced the Detective™ hand-portable radiation identifier which incorporated an HPGe detector with a miniature battery powered cryogenic cooling system. The Detective™ was targeted at the security application primarily to identify illicit materials. From this ground-breaking technology ORTEC developed a range of derivative products, one being the Trans-Spec system.

Trans-SPEC-DX-100 and Micro-Trans-Spec

Key to these Trans-Spec systems is an HPGe detector with a miniature, high-reliability, "run for ever" Stirling-cycle cooler and hardened detector cryostat, plus high stability digital electronics all in one rugged package. It is designed to be a general purpose instrument that could be used in applications ranging from nuclear safeguards to environmental monitoring.

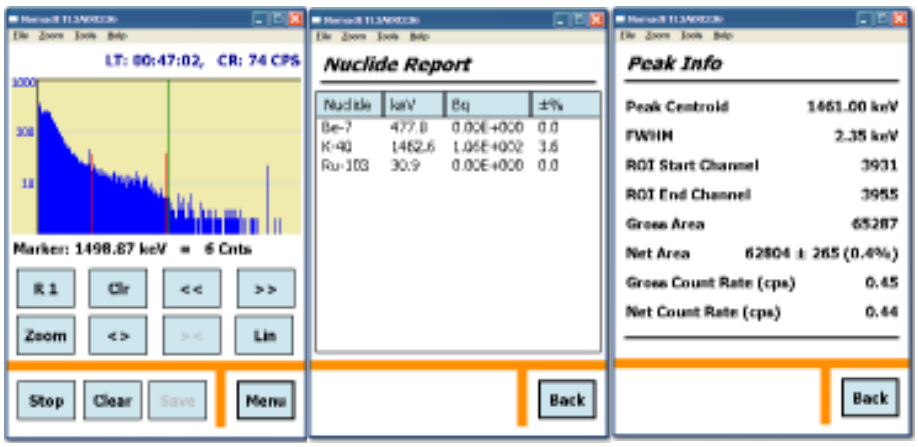
The user interface in the Trans-Spec operates like a traditional MCA with simple Region-of-Interest (ROI) analysis and reporting functions. It is designed to be used either completely “stand-alone” or with standard ORTEC software packages for more detailed application specific analysis. ORTEC software supported by the Trans-Spec includes:

- **GammaVision-32** for general gamma spectrometry measurements
- **Isotopic-32** for waste assay, decommissioning and wide-area soil surveys
- **PC/FRAM** for nuclear safeguards and accountancy

The Trans-Spec “line-up” has recently been updated to comprise of two new products, the Micro-Trans-Spec and the Trans-Spec-DX-100. Common features of both the new instruments include: fully battery powered (12v DC); self-contained system, does not require a separate PC for operation; full wireless or wired remote control plus GPS

The Micro-Trans-Spec

As the name suggests, the Micro-Trans-Spec takes the technology one-step further and shrinks the system by ~50% in volume compared to the original Trans-Spec system, whilst still incorporating the same 50mm diameter by 30mm thick HPGe detector. The enclosure, display, and all connections are sealed against moisture and dust and the system is water spray resistant.



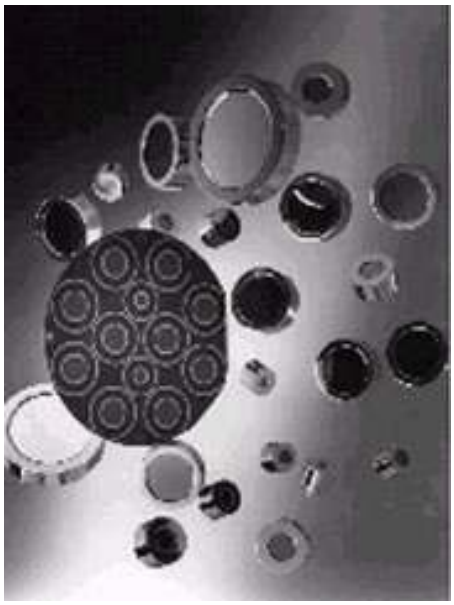
Examples of the Trans-SPEC-DX-100 and Micro-Trans-Spec User Interface

The Trans-Spec-DX-100

With this system the emphasis is on detection efficiency so the HPGe detector size is increased significantly to 65mm diameter by 50mm thick. This makes the DX-100 ideal in applications such as waste monitoring and waste characterisation, particularly when employed as part of an ORTEC ISO-CART system.

Product Feature: Silicon Detectors

Silicon detectors are a valuable tool in the field of radio metrics, particularly charged particle measurements, where they are used for both spectroscopy and the counting of alpha and beta particles, protons and heavy ions. Their manufacture became possible after the creation of large silicon single crystals in the manufacture of transistors over 50 years ago. The detector is created by forming a rectifying junction on a wafer of material sliced from a silicon crystal and is essentially a reverse biased diode of p and n type silicon.



Silicon Detectors

Once bias voltage has been applied, a depletion layer forms around the p/n junction. Incoming charged particles collide with and transfer their energy to electron hole pairs in the depletion layer. These electron hole pairs are then swept to the detector anode and cathode creating a signal, collected as a charge by a preamplifier, converted to a voltage and then processed by further electronics.

There are two types of silicon charged particle detectors: surface barrier and ion implanted. To make a surface barrier detector, a gold contact is placed on the obverse face, and aluminium on the reverse face of the silicon wafer. The advantage of this surface barrier technology is that it allows production of transmission detectors as thin as 10 um or as thick as several mm.

ORTEC manufactures 8 different classes of silicon surface barrier detectors, with applications ranging from heavy ion spectroscopy to high energy particle physics. Detectors are either fully or partially depleted. There are numerous detector options within each class, offering wide choices of active area, depletion depth and measurement resolution.

Ion implanted detectors are made from n type silicon wafers; they go through a process of oxide passivation of the surface, followed by ion implantations of boron and arsenic and then annealing. Aluminium contacts are placed on front and back surfaces and then the detector is placed in a gold plated can.

ORTEC makes three standard ranges of ion implanted detectors, ULTRA, ULTRA-AS and ULTRA CAM. ULTRA detectors are used for high resolution, high efficiency alpha and beta spectroscopy. ULTRA-AS is a low background version for alpha spectroscopy; it is made with special low background materials and an optimised depletion thickness to minimise background counts from cosmic rays.

ULTRA CAM is designed for counting in an adverse environment. It is light tight with an aluminium evaporation layer and then protected even further with a polymer front contact coating. ULTRA CAM is primarily used for counting, or rough spectroscopy of alpha particles from filters used with continuous air monitors. This application demands that they work in air, with exterior light and uncontrolled ambient conditions.

The biggest seller from these three is the ULTRA-AS range, bought by counting laboratories for low background alpha spectroscopy. They are typically used with the Octete-Plus Integrated Alpha Spectrometer, which allows 8 samples to be counted simultaneously, with each sample and detector inside its own vacuum chamber. A specialist software package, AlphaVision, collects and manages the data collected and allows calculation of sample nuclide activity. ORTEC also makes individual vacuum chambers and NIM electronics suitable for a range of silicon detector applications.

There is a wide choice of mounting arrangements for both the surface barrier and ion implanted detectors. The most common have rear microdot or BNC connectors, microdot connections on the side of the can are also available.

Custom silicon detector designs are also possible. ORTEC recently received an order for a batch of specially modified ULTRA detectors which will be used on space satellites comprising the new ‘Galileo’ global navigation system.

There is more information about silicon detectors available at: http://www.ortec-online.com/detectors/cargedparticle/cp-detectors.htm

New digiBASE-E: Faster and more flexible

The digiBASE revolutionised gamma spectrometry for scintillation detectors when it was released by ORTEC just over six years ago. The preamplifier, high voltage power supply, amplifier and MCA were combined into a small photomultiplier tube base using digital electronics. The package was completed with USB connection to a computer running the MAESTRO-32 MCA emulation program for spectral display and analysis. ORTEC have now developed a new high performance version of the instrument called the digiBASE-E.

At the heart of the new instrument is a trapezoidal filter, which has almost three times the maximum throughput of the bipolar filter, used in the original digiBASE. The new filter and associated pulse processing electronics is ideal for the new faster scintillation detectors such as lanthanum bromide now appearing on the market.

The digiBASE-E communicates and draws power from a 'PoE', Power over Ethernet connection rather than USB. PoE is a more flexible option where the instrument must be positioned a long way from the host computer or connected directly into a Local Area Network (LAN). It also allows the connection of an array of digiBASE-E instruments for monitoring or homeland security applications.

digiBASE-E

New gating signal options can be used to start or stop spectral acquisition and storage, opening up new applications for the equipment. For example the 'routing gate' feature allows data to be recorded into different spectra. This is useful for neutron interrogation systems where the 'prompt' gammas (those occurring when the sample is exposed to neutrons) and the 'activated' gammas (those occurring after exposure to neutrons) can be recorded separately in the device.

As with the original digiBASE, the new instrument can also be used in 'List' mode. When this feature is enabled, the digiBASE-E records data with a time stamp allowing gamma activity to be resolved against time as well as energy. One application of the resulting data is mobile surveys of gamma radiation, where it is useful to plot activity and energy against time and position.

Full details of the digiBASE-E are available to download at: http://www.ortec-online.com/pdf/digibase-e_ds.pdf

ORTEC continues to offer the 'classic' version of the digiBASE, which is ideal for routine spectroscopy applications.

Training Course Update

2009 was our busiest year for training courses with a range of topics covered, as follows:


September GammaVision Training Attendees

GammaVision - due to high demand, two courses were run in 2009, in April and September. Taking place over 4 days the course provides an introduction to gamma-ray spectroscopy for those new to the subject as well as potential improvements to existing working practices to those already engaged in the field. As always the course was well received and spaces are already being reserved on the next course in April (dates to be advised).

ISOTOPIC - following a customer request a specially tailored 4 day course was delivered, covering setup of a complete waste assay system for the modelling of standard waste drums and containers. Modelling software such as ISOTOPIC is becoming increasingly popular with many nuclear facilities facing decommissioning.

Alpha Spectrometry - held at the National Physical Laboratory (NPL) in Teddington, this 5 day course introduced those new to the techniques to the fundamental methods, whilst more experienced analysts gained from exposure to a review as well as the presentation of new and developing techniques. Students received classroom instruction and worked in small groups in the laboratory with close supervision from the instructors.

If you would like to receive training on any of the ORTEC product range please contact Clare Payne for information.

The Most Advanced hand-held Radioisotope Identifier in the World?

In 2004 ORTEC released the world's first commercially manufactured hand portable radioisotope identifier that incorporated a High Purity Germanium (HPGe) detector. This was the original Detective and was unique in that it utilised a compact cryogenic cooling system and was completely battery powered.

Since 2004 we have added a number of new products and derivates to the "Detective Family" offering improved performance or optimised for specific applications. One of the latest additions to this range is the Micro-Detective-HX which is a derivative of the standard Micro-Detective originally released in January 2008.

MicroDetective-HX

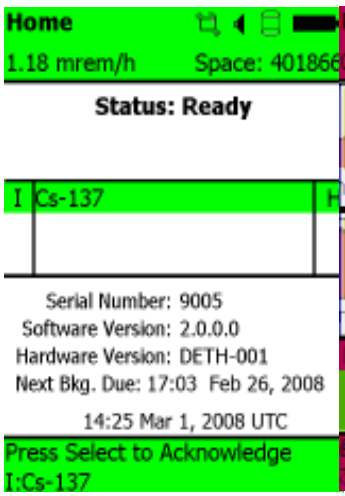
The Micro-Detective hardware was developed initially as part of the U.S. Department of Homeland Security (DHS) Human Portable Radiation Detection Systems (HPRDS) program with the remit to develop the next generation of hand-held identification devices.

As part of this program we also developed new software for the system the result of which is a completely new software user interface plus additional new hardware controls and indicators. As well as the standard touch-screen interface the –HX version now includes two pushbutton switches incorporated into the carrying handle to allow for one handed control of all the instrument functions. In addition to this we have also incorporated colour coded LED indicators above the main display of the instrument which indicate the current "threat status". The LED's indicate the following status; THREAT, SUSPECT, INNOCENT plus a fourth LED which indicates if there is a system error.

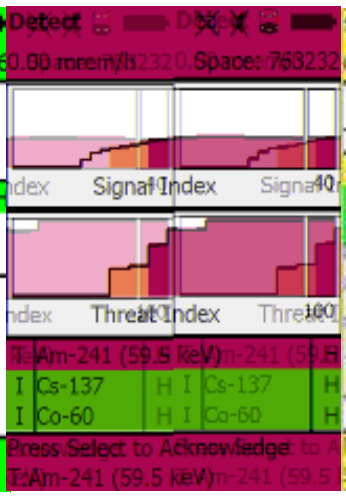
In the –HX version of the Micro-Detective an Identification measurement does not have to be initiated by the operator, the instrument is always trying to identify any radioactivity. Even when in the initial start-up or **Home** (Passive Monitor) mode of the software the system starts accumulating data automatically and tries to identify any material present based on the data accumulated in the last 8-second sliding time window.

When in the **Detect** survey mode, in addition to the nuclide identification the system also displays a Signal and Threat index plot. The Signal Index plots the total activity of all nuclides identified and the Threat Index plots only the activity of the Threat nuclides identified. These plots greatly aid the location of the radioactive material.

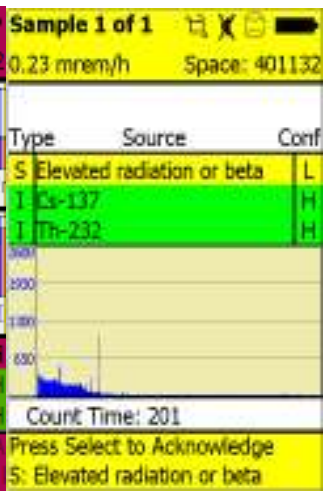
Finally there are two **Sample** modes, Long Sample and Fixed Sample for use when you want to confirm the initial identification by way of a much longer count time. All data accumulated during either the Detect or Long/Fixed Sample modes is automatically saved to internal memory or a removable SD memory card.



Home Screen



Detect Screen



Sample Mode

An "offline" analysis software utility is provided with each system. This utility allows the user to reanalyse the spectral data saved to the SD memory card. It also allows the operator to export the data into standard ORTEC format files so it can be analysed by other ORTEC software.

The nuclide library has also been expanded in the -HX and now has the ability to be configured to a certain extent by the operator. In the –HX library specific radionuclide's are classified as "Threat Isotopes" and any identification of one of the Threat Isotopes results in the display screen colour changing to red plus the Threat LED illuminating. These default Threat Isotopes cannot be changed however certain other radionuclide's in the library can be configured by the operator as Threat Isotopes.

Background subtraction is now included with the system which prevents the indication of activity which is actually due to background in the environment. The background measurements are automatically updated periodically to allow for changing background situations. Another new feature is the "SMART" digital stabilizer; this facility automatically locks on to ^{40}K peak if present to ensure the calibration is maintained even in extreme environmental conditions. The stabilizer is smart so if there is no ^{40}K activity present in the background or there is a potential gamma-ray interference with the ^{40}K peak no adjustment is made by the stabilizer.

As well as all the additional new features the –HX still includes all the key features of the standard Micro-Detective including 50mm diameter by 30mm thick HPGe detector, integral neutron detector, GM dose-rate detector plus built-in data processor with sunlight readable TFT display, GPS, USB and Wi-Fi connectivity and an SD card expansion slot. All this packaged in a rugged enclosure. In summary the Micro-Detective-HX offers the following benefits over earlier Detective family products:

- **Easier to Use** — touch screen or pushbutton with indicator warnings.
- **Lighter to Carry** — <7kg in weight.
- **More Rugged** — dust and water resistant.
- **Expanded Capabilities** — larger nuclide library, user configurable.
- **Revised Algorithms** — more resistant to false positives and negatives.
- **Background Subtraction –** correct identification even in high background areas
- **SMART Digital Stabilization –** rock solid stability

SMART-1 Technology for EVERYONE

ORTEC introduced the SMART-1 detector interface module as an option on our range of HPGe detectors several years ago as a major enhancement to operational quality assurance data and chain-of-custody integrity. The module incorporates a computer controlled high voltage power supply plus detector "State-of-Health" (SOH) monitoring electronics and is "hard-wired" directly to the HPGe detector via a short captive cable. The SOH monitoring facility in the SMART-1 equipped detector continuously monitors and reports on vital system functions as follows:

- Preamplifier +24 and +12 V values (read-only)
- Detector element temperature (read-only)
- Detector high voltage value (read-only)
- Detector high voltage state (on/off)
- Detector overload state (read-only)
- Detector HV shutdown state (read-only)
- Detector serial number (read-only)
- Detector authentication code (read/write)

SMART-1 Detector system with digiDART

SMART-1 also integrates all the electrical connections to-from the detector via a single cable that connects between the Multichannel Analyser (MCA) or Digital Signal Processor and the detector. It is supported directly through all standard ORTEC software (Maestro-32, GammaVision-32 etc.) and SOH parameters are displayed as required on the LCD display of the attached MCA or via the ORTEC software on the computer.

Until now, a SMART-1 equipped detector could only be used with specific ORTEC MCA products, however with our new SMART-INTERFACE it is possible to interface a SMART-1 equipped detector with any MCA system. The SMART-INTERFACE connects directly to the SMART-1 detector and allows for control of the detector high voltage and display of the SOH parameters via a simple Windows software application provided. What's more interfacing it to the computer is simple via USB-2 Plug-n-Play connection. The SMART-INTERFACE is provided with all the relevant detector output signal and preamplifier power cables to allow connection to standard HPGe detector signal processing electronics from any manufacturer.

Product Announcement: digiDART-LF

The Multichannel Analyser (MCA) or Digital Signal Processor (DSP) found at the centre of many experimental measurements, performs the multiple functions of collecting data, providing a visual monitor, and producing output, either in the form of final results or data for later analysis.

For practitioners of in-field spectroscopy, the digiDART has long proved an essential piece of equipment as a market leading, high performance, portable HPGe DSP MCA. For customers using NaI, LaBr or other scintillation detectors, the high specifications of the digiDART were often deemed to be 'overkill' for requirements, and it was sometimes outside budget allowances. In order to keep the day-long battery life, these users were often left using older technology without the technological advances and convenience of the newer in-situ MCAs.

ORTEC is pleased to announce the availability of the digiDART-LF which has many of the great features of the digiDART but with a completely new DSP optimised specifically for use with NaI(Tl) and modern scintillation detectors, such as Lanthanum Halides. Key features include:

- Digitally stable: consistent answers for long counts, changing count-rates and temperatures.
- Holds >150 2k channel spectra in the internal memory
- Battery life >12 hours
- Built-in backlit LCD display and control keypad – Live display of acquiring data
- Nuclide ID and activity calculation for nine predefined Regions of Interest

digiDART-LF

The digiDART-LF can be entirely computer controlled or alternatively controlled via a built-in alpha-numeric keypad controller and LCD display - a dramatic advance from the current generation of portable MCAs.

This high-quality display and easy to use keypad mean it can perform a variety of tasks without an attached PC. For in-field applications, a PC is difficult to carry and operate, but without a display you can't see the spectrum or results. The digiDART-LF's built-in, backlit LCD display panel and keypad provides the confidence that your data is good. A clear spectral display is provided and start/stop control is accomplished by a single keypad entry.

The unit can also perform nuclide ID and activity calculations using internally stored calibration information, at the touch of a button. Everything is user controlled: the library for analysis, displayed peak labels, unit labels and calibration parameters. Instrument settings and parameters are all easily downloaded to the digiDART-LF by the standard ORTEC Maestro-32 software included with the system.

All parameters can also be changed in-field to adapt to your changing needs. Activity is calculated for a list of up to 9 nuclides. The spectral data can be saved and later, if required, re-analysed in more detail using a more sophisticated PC-based analysis package such as ScintiVision-32.

Figure 2: digiDART-LF Integrated detector module

The digiDART-LF is available in a variety of packages to include a detector interface module to the detector, or as part of a complete system with integrated detector module comprising a NaI detector and DIM-296 PMT base assembled in a weatherproof, rugged and corrosion resistant housing (Fig 2).

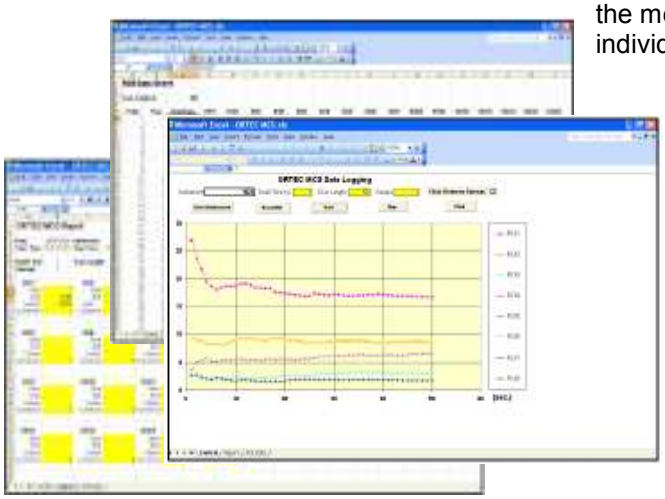
This complete, lightweight, fully portable system is ideal for anyone needing to make radiation measurements 'on-the-move' or in the field. It is the most appropriate replacement or upgrade to the ORTEC MicroNOMAD MCA. Further information can be found at: http://www.ortec-online.com/pdf/digidart-lf_ds.pdf.

For those needing a higher conversion gain, the digiDART which offers 16k channels remains the spectrometer of choice.

MSC Data Logger Freeware Software Application

The new ORTEC Multichannel Scaling Data Logger (MCSDL) software utility is currently available as a free download from http://www.ortec-online.com/MCSDL_Form.htm. MCSDL is an Excel-based tool which we hope you will find useful in many routine data logging operations which use ORTEC MCA's. It performs time-correlated counting on user-defined regions of interest (ROI), generates plots of the count rate data and records all this data into several pre-defined tables in real time. The count rate in each energy region is monitored by dividing the ROI count by the live time for a series of short acquisitions. Up to sixteen ROIs can be specified within MCSDL, covering sixteen discrete energy ranges. Alternatively, a single ROI can be selected covering the entire energy spectrum being processed by the MCA if gross count rate logging.

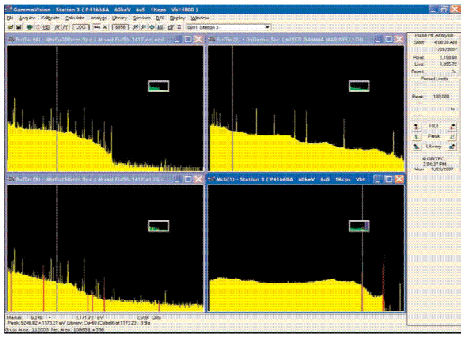
The spreadsheet contains 3 worksheets shown below. The Control worksheet includes the setup and control functions for the measurement as well as displaying the plots of time vs. counts for each ROI selected. The minimum dwell time selectable for a measurement is one second with effectively no limitation on the maximum dwell time. The report worksheet provides the test parameters and the total counts recorded for each ROI during the measurement. The data worksheet lists the counts for each individual data point in the scan.



An important aspect of the MCSDL-B32 is that the Visual Basic (VBA) code used for communication with the instrument is available for modification. This should provide a useful starting point if you wish to develop your own software and communicate directly with the MCA. Most commonly, the part of developments of this type which users find most troublesome is hardware control. The intention here is to bypass that initial difficulty by providing this starting point.

Receive a 10% discount voucher for an ORTEC EASY-MCA when you download this software.

New Version of GammaVision allows ISO reporting



GammaVision is a comprehensive, all in one software package for the analysis of gamma ray spectra acquired with high purity germanium detectors. The program includes hardware control, advanced MCA display, data analysis algorithms and an array of corrections to manage sample, nuclide and spectrum related effects.

The software is the result of 25 years of incremental product development by ORTEC scientists and the latest version, 6.08, includes several improvements and additions.

The most significant allows the user to report parameters as defined by the International Organisation for Standardisation (ISO). Decision threshold, detection limit and limits of confidence interval are calculated as defined by ISO/DIS 11929, dated 21st November 2007. There is also a formatted report consistent with the requirements of the standard.

The new version also includes improved analysis engines and library reduction algorithms. The improvements are designed to identify extremely small peaks in the most complicated spectra, decreasing the number of unidentified peaks.

Software subscriptions are now available for GammaVision, lasting between 2 and 5 years. During the subscription period, users receive automatic updates as they become available. The option allows customers to take full advantage of improvements as soon as they appear and learn new techniques incrementally, rather than taking a big jump every few years. More information about GammaVision can be found at: http://www.ortec-online.com/software/gammavision.htm

Product Feature: Fast-Timing Electronics

As part of our on-going commitment to the research business ORTEC is pleased to announce the following new products:

976 Quad 250-MHz Counter/Timer
Ideal for labs where multiple counting experiments are performed, such as universities, physics and chemistry labs, or national laboratories, the 976 offers four independent 8-digit counters, each with their own display and capable of accepting up to 250MHz input rates. It operates independently of a PC.

Counters can be cascaded to increase the word length to 16-digits for two counters, or 24-digits for three. Counters 2 and 4 have a 'carry' or overflow output to allow this cascading. Counters 1 and 3 have a set of bridged gate connectors to allow a single gate to be used on multiple counters. If required the unit can be easily converted to have a fifth counter (up to 80-MHz), timer, rate divider or delay.
Further details can be found at: http://www.ortec-online.com/electronics/ctr/976.pdf

978 Dual Timer/Pulse Generator
The 978 houses two identical flexible triggered pulse generators. It produces NIM and ECL pulses whose widths range from 50 ns to 10 s when triggered. A pulse end-marker output signal is provided which can be used to re-trigger the timer for repeat mode. The trigger START can be provided either via an external signal or manually via a front panel switch. The veto input can act as an inhibit gate for the start input signal. Coarse adjustment of the output width is provided via a 10-position rotary switch, whilst fine adjustment is via a rotary knob. The two timers may be cascaded to form a pulser with both variable width and rate.

This product appears to be a unique NIM - although there are various pulse generators available, none are in the NIM configuration. The 978 provides a simple and versatile trigger, trigger delay, timer or gate for researchers experimenting in applications in chemistry, biology, physics and optics. It is targeted at those looking to manually or automatically start, stop or provide timing of an instrument that needs to run at only specific time intervals during an experiment. Further details can be found at: http://www.ortec-online.com/electronics/ctr/978.pdf

New ORTEC NIM Electronics

499 Fast/Slow NIM Logic Converter
Aimed towards research applications where logic conversions can make timing or triggering of systems much less complex, the 499 allows the user to convert between two of the most widely used logic types - fast negative NIM (negative 800mV) and TTL (positive 2V). It provides eight channels of fast NIM to TTL logic conversion, and vice versa - a total of 16 channels - all of which can be inverted with front panel switches. It is designed to provide corrected logic type and/or pulse polarity for signals used to trigger events; to provide pulses to be counted; or to time specific events in timing or counting applications for nuclear, optical, chemical, or biological processes. Further details can be found at: http://www.ortec-online.com/electronics/delay/499.pdf

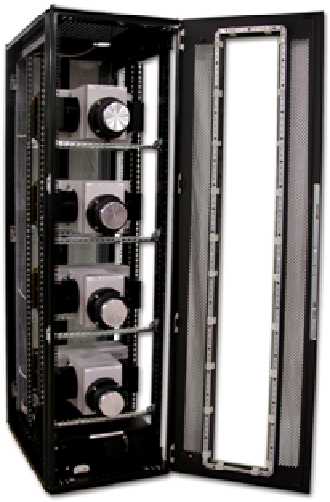
9309-4 Quad Fast Amplifier and 9310-16 Sixteen Channel Fast Amplifier
Both these fast amplifiers provide gain for multiple detector systems for counting and timing applications in optics, chemistry, biology and physics.

The 9309-4 offers four channels of variable gain amplification up to a gain of 10 solving the problem faced with various fast detection devices that have different signal amplitudes needing amplification to be counted or time discriminated. Two channels can be cascaded for a gain of up to 100 if required. An offset adjustment and DC coupling allow for higher counting rates and less baseline distortion encountered with AC coupled amplifiers. It is ideal for experiments using photomultiplier tubes, electron multipliers, microchannel plates or photodiodes. Dual outputs from each channel reduce the need for an additional fan-out for counting and timing applications.

For those signals require greater amplitude, the 9310-16 provides 16 channels in a single-width NIM. Further details can be found at: http://www.ortec-online.com/electronics/amp/amplifiers.htm

Delivery of First ORTEC Portal Monitor: New Mexico

In February 2009, ORTEC was awarded a contract to supply the state of New Mexico Motor Transportation Police with a High Purity Germanium (HPGe) Detective-ASP Series Advanced Spectroscopy Portal Monitor (ASP). It has since been installed at one of the state's busiest ports of entry for commercial vehicles with the aim of locating and identifying radionuclide's in interstate cargo. By providing positive identification for radioactive and special nuclear materials, this high resolution, HPGe-based system has been put into service to adjudicate alarms produced by other low resolution, radiological screening systems.



Portal Monitor IDM Configuration

The system offers the best available detection capabilities of any technology for the prevention of illicit/illegal movement and trans-shipment of radioactive materials in a wide variety of scenarios. Moreover, this technology can readily detect and identify 'normal' sources of radiation, found in cargo every day. These sources cause frequent alarms on other portal monitor technologies, slowing the flow of traffic and causing a nuisance to operators.

The portal is designed around a gamma-ray detection 'building block' - the Interchangeable Detector Module (IDM) - featured in our previous newsletter. Pictured right in Portal configuration, it is a completely self-contained subsystem, comprising a single HPGe detector with associated electronics. It may be swapped out for service as necessary, resulting in a system with a high degree of availability, and limited down time. Over time, the 'swappable' technology means the portal can be upgraded or reconfigured, protecting initial investment.

The Detective-ASP design is simple to operate, requires no operator input to initiate detection and identification, automatically identifies specific radionuclide's, and determines the position of source activity within vehicles and their cargo as they are driven through the monitor. All spectroscopic files, nuclide reports, photographs of vehicle exterior and identifying marks, radiological alarms, and Detective-ASP system state-of-health data are saved electronically for each vehicle measurement. The low false alarm rate of the Detective-ASP (less than 1 in 1000 measurements), and its intrinsically high detection and identification probability (greater than 95%), make it the radiological monitor system of choice when the need to be certain is imperative.

New Mexico Portal Monitor

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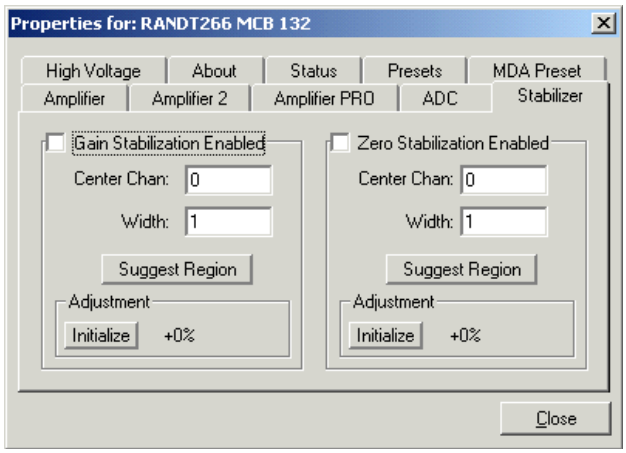
Frequently Asked Questions - Automatic Gain Adjustment

Even in the best detector systems there will be some movement of the gain in the electronics chain. Digital signal processing systems limit this problem but, variation due to temperature change in the preamp and other analogue electronics stages cannot be avoided and should be considered a normal contributor to systematic errors. In the majority of cases any movement of the system energy calibration is typically attributed to gain variation rather than movement of the zero position. Any trend moving away from a mean position or range might indicate the onset of problems in the detector system. For this reason it is always recommended to use a QA procedure which allows the lab manager to monitor the system for unusual trends in the gain movement, for example:

1. An initial energy calibration of the system is used to optimise the system.
2. At regular intervals a QA check spectrum is acquired using a reference calibration source.
3. The positions of one (or more) reference peaks are checked against their known energy.
4. If the reference peak(s) is within an acceptable deviation from the correct energy then the system data is recorded and the system passes the QA check.
5. If the peaks' positions are outside the allowed deviation, a new energy calibration is performed.

A limitation of this recalibration method is that the correction cannot be quantitatively related to a reference channel once recalibration is carried out - so it can be difficult to determine the deviation trend. If instead, a specific calibration peak is always placed in the same channel, the number (+/-) of channels required for the adjustment can be recorded and each deviation from the specified channel provides a meaningful data point which can be recorded and inspected for unusual trends.

If a reference peak monitored during a QA measurement is found to be outside the allowed deviation then step 5. above can be replaced by a procedure which re-establishes the reference peak in the correct channel position. This way the trend can be easily identified and the system returned to normal operation with the minimum of operator intervention.



Gain Stabilisation Properties Window

An automatic procedure utilising the digital gain stabilisation function in certain ORTEC MCA systems can be used to automate this procedure. The gain stabilisation feature operates by adjusting the gain to keep a peak centred on a pre-defined channel. The gain stabilisation centre channel position is the channel which the peak will be adjusted to and the width is the range within which the stabiliser will look for the peak. While gain stabilization is enabled, the software will continuously determine the position of the peak centroid and adjust the gain appropriately so that the peak is at the defined channel. Immediately following this adjustment a final QA check should be performed to verify the system performance.

```
SET_DETECTOR 1
DESCRIBE_SAMPLE "AUTO GAIN STABILISATION"
SEND_MESSAGE "DISABLE_ZERO_STABILIZATION"
SEND_MESSAGE "DISABLE_GAIN_STABILIZATION"
SEND_MESSAGE "SET_GAIN_CHANNEL 5330"
SEND_MESSAGE "SET_GAIN_WIDTH 30"
SEND_MESSAGE "ENABLE_GAIN_STABILIZATION"
ASK_CONFIRM "ENSURE QC SOURCE IS ON THE DETECTOR!"
SET_PRESET_CLEAR
SET_PRESET_LIVE 600
LOOP 3
CLEAR
START
WAIT 2
WAIT
END_LOOP
SEND_MESSAGE "DISABLE_GAIN_STABILIZATION"
```

Example Job File with automatic gain adjustment

An ORTEC Job file (macro) created using Maestro-32 or GammaVision-32 software can be used to automate this entire procedure. The example shown opposite initiates the appropriate settings and starts data acquisition. During the acquisition the gain stabiliser is switched on and the gain automatically adjusted to correct the reference peak position. At the end of the procedure the gain stabiliser is switched off but the gain adjustment is retained. This procedure can be easily modified to include an automatic QA check on completion.

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