



MIRION
TECHNOLOGIES



Michel CEUPPENS

Sr Sales Director Europe – Zellik, Belgium

FUN FACTS

- 30 years experience in company
- Done almost all functions: Sales, R&D, Marketing, Service, management
- Loves linguistics

NKS Nordic Gamma Spec seminar

Company Overview

A BRIEF OVERVIEW OF MIRION TECHNOLOGIES

- 1800 dedicated collaborators
- Rich history in radiation measurement
- Locations
- Our divisions
- 39 Mirion sites
- SyD is dedicated to Spectroscopy

A BRIEF HISTORY

1950

What would become known as the divisions of Mirion began from various well known companies around the globe.

1974

ICN dosimetry service begins.

1988

Imaging and Sensing Technology is formed as a divestiture from Westinghouse. Additional acquisition of several well known companies expands their diverse product lines.

1986

Acquisition of Packard Instrument Company.

1990

Acquisition of Jomar System: Neutron detector technology

1997

Acquisition of Aquila Technologies Group: Safeguards and Surveillance

1999

Acquisition of Tennelec: Germanium Crystal Growth Capability; Low background alpha beta products

1965

CANBERRA founded with the purchase of Sturup Nuclear

1989

Acquisition of Nuclear Data: Nuclear Data instruments Genie™ spectroscopy software

Acquisition of Harwell: EMS products NDA platform

2002

synOdys Group is formed through the combination of Rados Technology, MGP Instruments and MGPI H&B, creating a global player in radiation measurement and protection market.

2003

Global Dosimetry is formed from the acquisition of ICN Dosimetry, one of the world's largest providers of radiation dosimetry services protection market.

2005

Mirion Technologies is formed throughout the merger of Imaging and Sensing Technology Corporation, Global Dosimetry Solutions, and synOdys SA.

2015

Over 60 years of providing mission critical systems to detect, measure, and analyze radiation.

**2002**

Merger with Aptec- NRC RMS platform, Military and Health Physics.

2015

Canberra commemorates 50 years of serving its customers.

2016

Mirion Technologies acquires Canberra.

2001

Merger with Cogema:
Merger with Eurysis Measures:
Adds handheld HP capability and specialty detectors

A map of the Americas (North and South America) with a grid of light blue hexagons overlaid. One hexagon in the San Francisco Bay Area is highlighted with a brown house icon. To the left of the map, there is a blue arrow pointing right, followed by the text 'Locations – Americas'. Below this, there is a list of 17 city names, each preceded by a blue dot. The cities are arranged in two columns. The background of the map area has a faint grid of light blue hexagons.

Locations – Americas

- **San Ramon, CA**
- Aiken, SC
- Atlanta, GA
- Buffalo, NY
- Cambridge, ON
- Concord, CA
- Englewood, CO
- Horseheads, NY
- Idaho Falls, ID
- Irvine, CA
- Los Alamos, NM
- Meriden, CT
- Modesto, CA
- Naperville, IL
- Oak Ridge, TN
- Richland, WA



Locations – EMEA

- Beaumont, France
- Dounreay, UK
- Farnborough, UK
- Fussy, France
- Hamburg, Germany
- Harwell, UK
- Lamanon, France
- Lingolsheim, France
- Loches, France
- Montigny, France
- Moscow, Russia
- Munich, Germany
- Olen, Belgium
- Russelsheim, Germany
- Saint Paul Trois Châteaux, France
- Sellafield, UK
- Turku, Finland
- Zellik, Belgium





Locations – **ASIA**

- Beijing, China
- Shanghai, China
- Tokyo, Japan

SCIENCE AND EXPLORATION



Mirion detector solutions are in use for **Scientific exploration in the most remote locations on Earth, underground, and in deep space.....**

Health Physics (HPD)

Fixed and mobile systems focused on protecting individuals from hazardous radiation exposure, handheld instrumentation, electronic and passive dosimetry for radiation measurement and monitoring

Radiation Monitoring Systems (RMSD)

Fixed and mobile radiation monitoring systems for safety related, area, process, effluent release and fission by-products applications throughout the nuclear plant life cycle

Spectroscopy (SyD) & Services (SvD)

Radiation measurement solutions for laboratory, in vivo, in situ applications & local experts available around the world to provide consulting services and address any nuclear measurement needs



MIRION
TECHNOLOGIES

OUR DIVISIONS

Sensing Systems (SSD)

Conduit systems used to pass cables through reactor containment structure & detector systems for plant safety and control

Characterization (ChD)

Specialized camera systems for hazardous environments, as well as NDA systems, Measurements & Expertise for decommissioning and waste management

Dosimetry Services (DSD)

Services providing official dose of record reports for workers exposed to radiation

**EVOLVING
OFFERINGS...**

SYD

**INSTRUMENT
EVOLUTION VISION**

EVOLVING OFFERINGS SYD VISION

IoT Gateway – collects sensor data and passes it on

- IPA
- Electric cooler
- Lid Sensor
- Camera
- Barcode
- Scale
- Sample Positioner
- Data Aggregator
- Etc...

FutureCount Room

• Cosmic Veto

• Shield

• Shield Sensors

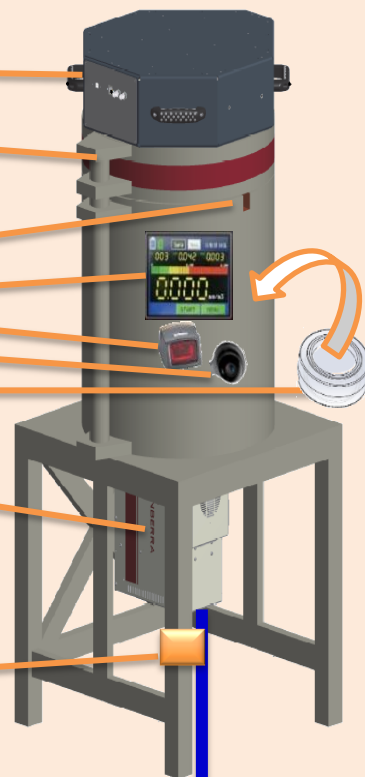
- Lid Sensor
- Display/Touch Panel
- Barcode/Rfid
- Camera(s)
- Sample Positioner
- Communications

Data Aggregator

• Detector

- Ge Detector
- Cooler & Controller
- Smart Preamp
- MCA
-

• IoT Gateway



Supervisory & Dashboard

- Collects data in historical database
- Monitors for alert/alarm conditions
- Sends email notifications
- Monitors health of all instruments
- Provides analytics engine

Apex-Gamma, S3, Genie

- Receives & stores sample results
- Sample data storage
- Serves up data to remote clients
- Sends to the Cloud if desired

Spectroscopy Gateway

- Interface between IoT Gateway and PC software



LAN / WAN



Canberra Services

- State of Health Monitoring & Response
- Expert review & approval
- Report Generation & distribution
- M&E advanced analysis services
- Long term storage & analytics





LAB PULSE

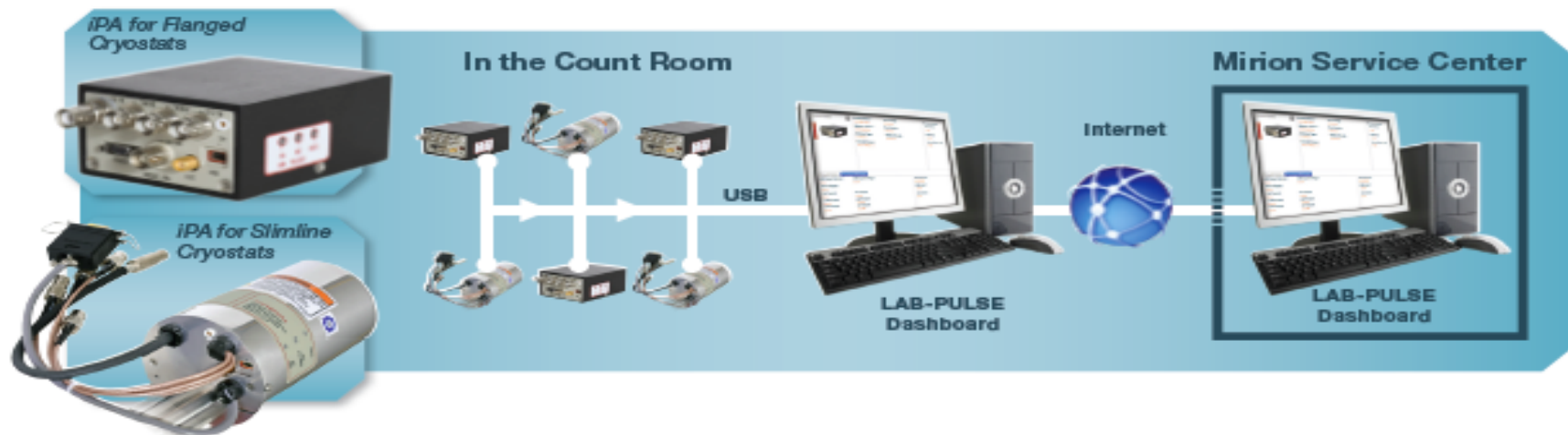


Canberra LAB-PULSE™ Technology

Coming Soon to your lab!

LAB-PULSE offers:

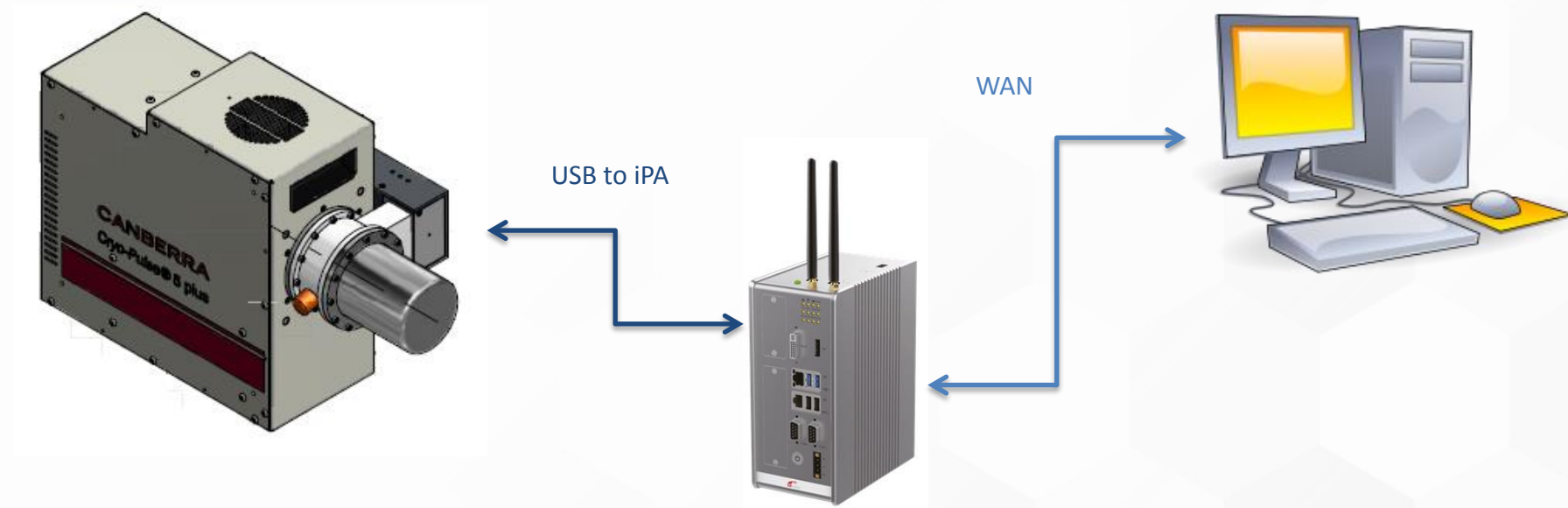
- Intelligent instruments that record vital state of health information
- Local dashboard for data presentation with "out of spec" warnings and/or automatic transfer to a Mirion service center
- Value - Correct a problem before it even happens



iPA Intelligent Pre-amplifier for HPGe Detectors - first in a family of LAB-PULSE compliant products



IIoT Gateway for Remote Monitoring



Under development ...



LAB-PULSE concept & vision

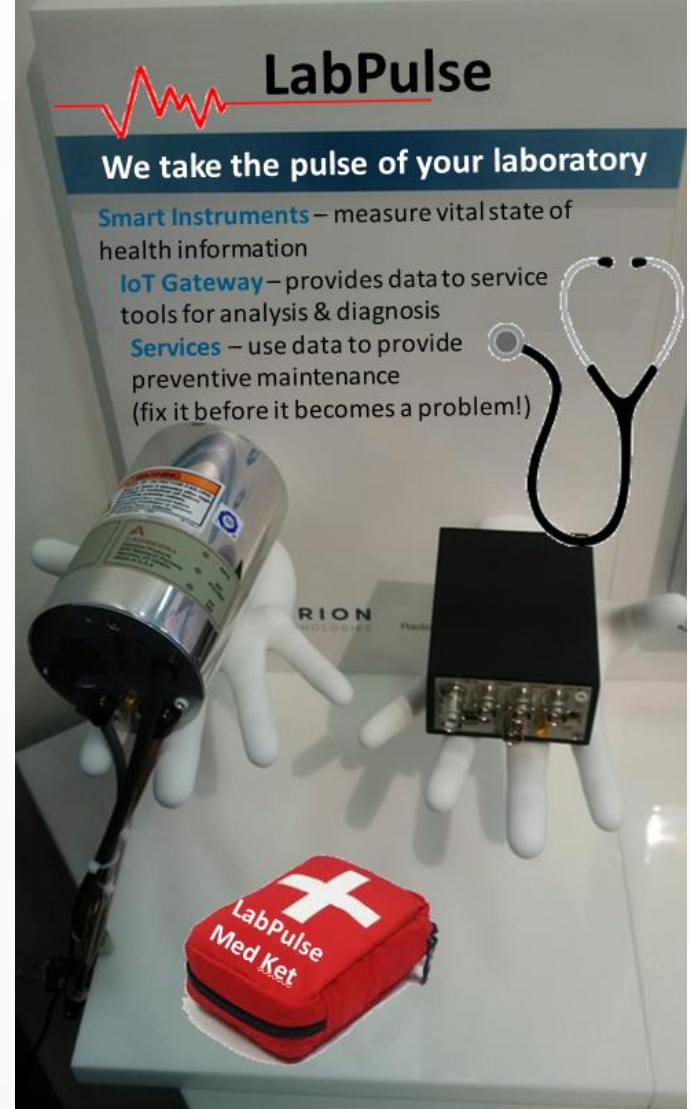
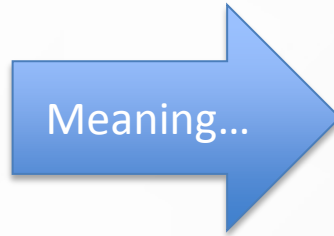
LAB-PULSE concept means:

- ▶ Instruments designed to collect instrument sensor data (SoH, etc.)
- ▶ Designed to share (big) data securely.
- ▶ Software (analytical) tools designed to create smart dashboards for the customer (and the supplier)
- ▶ Software tools designed to automate transactions
- ▶ Smart tools enable predictive service
- ▶ Seamless integration in the next generation hardware and software solutions





LAB-PULSE – The idea





LAB-PULSE means

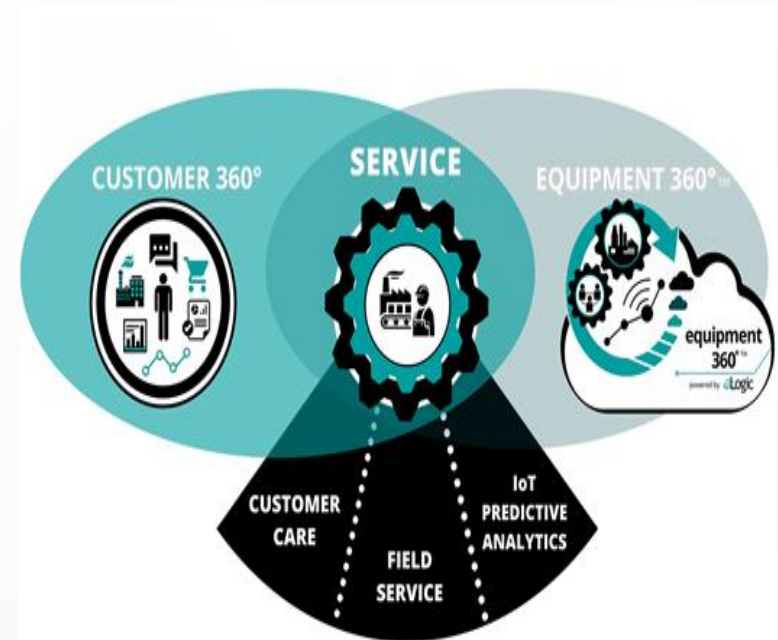
- ◆ Accessibility of the State of Health (SoH) (and other) data of the instrument(s) anyplace, anytime ensuring peak performance and minimal down-time
 - ▶ Predictive service optimizes instrument availability
- ◆ Automated transactions (e.g. service calls) up to full automation into SFDC and ServiceMax, reducing lead time & down-time.
- ◆ Seamless integration in the future software & hardware will enhance the customer experience

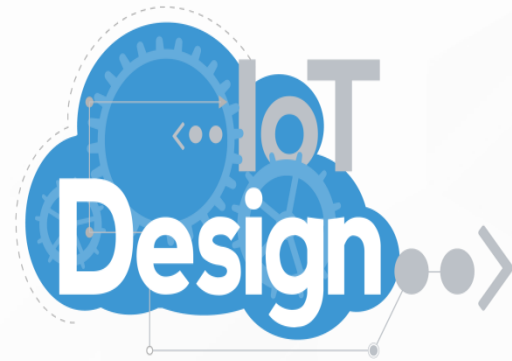


LAB-PULSE also means: Transformed Service

By embracing IoT and Dfs we can become, instead of re-active, we become **proactive and predictive** through:

- ❖ Remote monitoring our equipment/software.
- ❖ Remote diagnostics.
- ❖ Predictive maintenance.
- ❖ Monitoring product usage features.
- ❖ This results in several benefits
 - ❖ Reduce travel costs.
 - ❖ Reduce mean time to repair.
 - ❖ Replacement parts are available on time.
 - ❖ Products will evolve/improve continuously.
 - ❖ Faster time to market for patches and upgrades.
 - ❖ Significant improvements in User eXperience (UX).
 - ❖ Lower Capital Costs
 - ❖ A productive customer
 - ❖ Informed Workforce





HOW Will We Do It!



- **Servicemax/salesforce (force.com Platform)**
 - Cloud Based
 - Collaboration
 - Connected Anyplace/Anytime
 - True Data and Reporting
- **Mobile Solutions**
 - Salesforce1
 - Servicemax Mobile App (2017)
 - Capital Investment in new Equipment



Intelligent Preamplifier

Enabling Intelligent HPGe Detectors



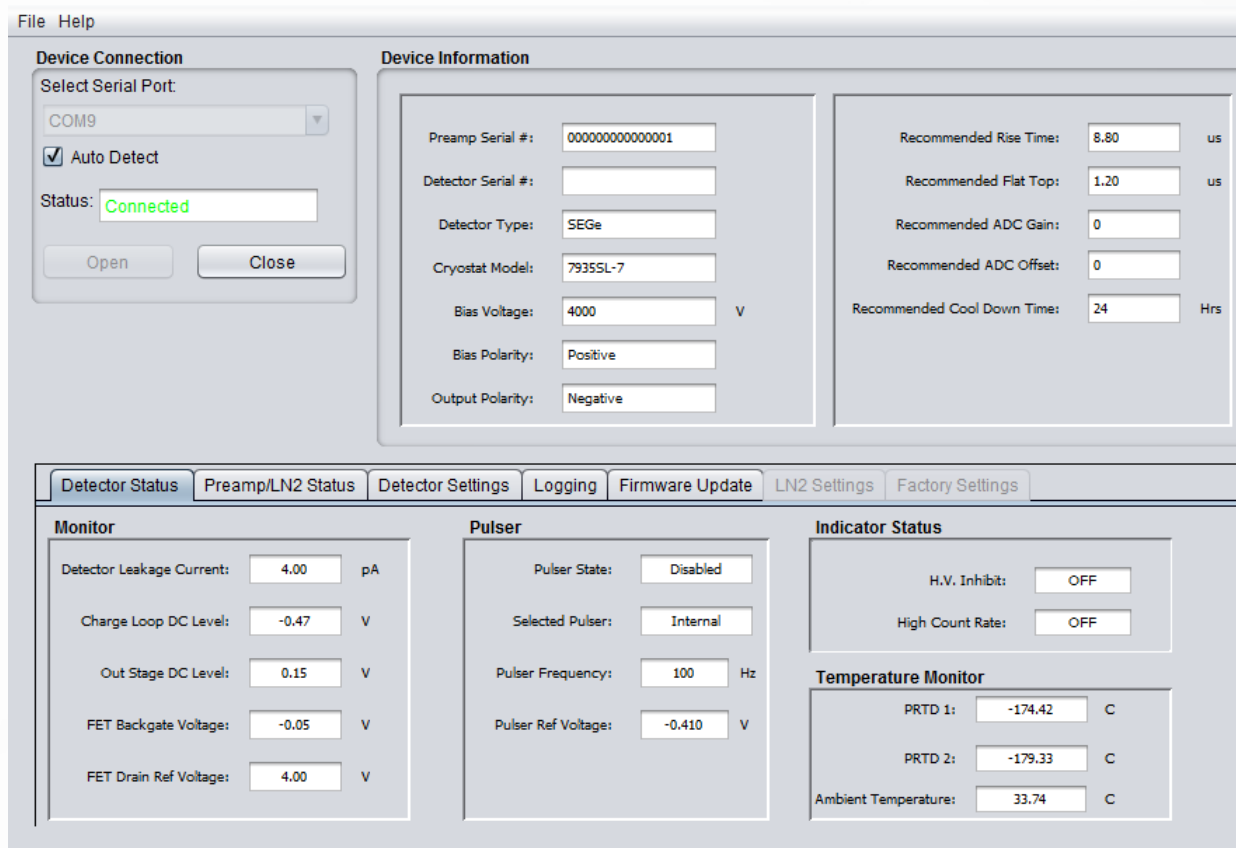


iPA - Summary

- New Intelligent Preamplifier for HPGe detectors
- Features
 - RC-feedback
 - Compact, low-power analog stage
- USB-connection to PC (Or Data Aggregator / IoT gateway)
 - Make use of cryostat sensors to monitor and trend detector health status
 - Internal temperature sensors - 2 Sensors (Crystal & Cold-point)
 - Test Point – Monitors leakage current
 - Input for LN2 sensor (no separate controller needed)
- Enhanced usability and system integration
 - Preamp tuning through digital controls (P/Z, gain,...)
 - All relevant information stored in on-board memory (S/N, model, recommended spectroscopy settings, log files)
 - Built-in pulser for system diagnostics and LT correction

iPA – Software interface

Java based user interface via USB



The screenshot displays the iPA software interface, which is a Java-based user interface accessed via USB. The interface is organized into several sections:

- Device Connection:** Includes a dropdown menu for 'Select Serial Port' (set to COM9), a checked 'Auto Detect' checkbox, and a 'Status' field showing 'Connected'. There are 'Open' and 'Close' buttons.
- Device Information:** A central panel with various fields:
 - Preamp Serial #: 000000000000001
 - Detector Serial #: [Empty]
 - Detector Type: SEGe
 - Cryostat Model: 7935SL-7
 - Bias Voltage: 4000 V
 - Bias Polarity: Positive
 - Output Polarity: Negative
 - Recommended Rise Time: 8.80 us
 - Recommended Flat Top: 1.20 us
 - Recommended ADC Gain: 0
 - Recommended ADC Offset: 0
 - Recommended Cool Down Time: 24 Hrs
- Navigation Tabs:** A row of tabs at the bottom of the main panel includes 'Detector Status', 'Preamp/LN2 Status', 'Detector Settings', 'Logging', 'Firmware Update', 'LN2 Settings', and 'Factory Settings'.
- Monitor:** A section on the left with the following parameters:
 - Detector Leakage Current: 4.00 pA
 - Charge Loop DC Level: -0.47 V
 - Out Stage DC Level: 0.15 V
 - FET Backgate Voltage: -0.05 V
 - FET Drain Ref Voltage: 4.00 V
- Pulser:** A section in the middle with the following parameters:
 - Pulser State: Disabled
 - Selected Pulser: Internal
 - Pulser Frequency: 100 Hz
 - Pulser Ref Voltage: -0.410 V
- Indicator Status:** A section on the right with the following parameters:
 - H.V. Inhibit: OFF
 - High Count Rate: OFF
- Temperature Monitor:** A section at the bottom right with the following parameters:
 - PRTD 1: -174.42 C
 - PRTD 2: -179.33 C
 - Ambient Temperature: 33.74 C



Intelligent Detectors – Key Benefits

- The iPA is focused on usability and serviceability of our detector systems.

- Improved usability:
 - All relevant detector parameters are programmed in, so this information is always handy when setting up the detector.
 - The software application is platform neutral and does not need to be installed on the O/S.
 - The built-in test pulser and LN2 level readout remove the requirement for additional (often NIM based) equipment.

- Serviceability
 - iPA monitors critical detector parameters and stores up to 12 months log data in the on-board memory.
 - Potential degradation can be detected in an earlier stage, allowing for preventative maintenance.
 - Log files can be downloaded and sent to factory/service for remote diagnostics.



Technical Support

Check out our website for **DIY videos** covering many commonly asked questions!

(Do It Yourself)



These videos are meant to assist you in handling some of our most common questions about our products and software. Check back often as the library of available videos will continue to grow.

If you have a suggestion for a video, please let us know:
techsupport@mirion.com

Software How-tos

[How to Perform an Energy and Shape Calibration in Genie-2000](#)

The scope of this DIY video is limited to performing a combined Energy and Shape Calibration for a typical germanium detector.

[How to Restore Microsoft SQL Server Database](#)

In this DIY video we will walk you through the steps on how to restore a backup of your Microsoft SQL Server database.

[How to Install SNAP Protocol Drivers](#)

When you install Genie-2000 software on your computer, it does not automatically install all of the drivers needed to communicate with the various Multi-Channel Analyzers (MCA) Mirion offers. This DIY will show you how to install the SNAP Protocol Driver on your network card.

[How to Perform a Detector Gain Adjustment in Genie-2000](#)

The purpose of this DIY video is to demonstrate how to adjust the Fine Gain setting for a typical high-purity Germanium Detector data source.

[How to Backup Microsoft SQL Server Database](#)

In this DIY video we will walk you through the steps on backing up your Microsoft SQL Server database.

[How to Check the Virtual Data Manager \(VDM\)](#)

In this DIY video we will discuss a few simple steps to find out if

Product How-tos

[How to Install a Cryo Cycle Collar](#)

This DIY video will show you the steps to install a collar on our popular Cryo-Cycle.

More Software How-tos

[How to Create a New MID File for Use in Genie-2000](#)

The scope of this DIY video is limited to creating and saving a new MID file for a special type of MCA called the I2K Simulator.

[How to Install a New ISOCs/LabSOCs Characterization File with Genie-2000](#)

In this DIY video we will demonstrate how to use the utility program named DETUTIL.EXE to install a new PAR file and modify the file named DETECTOR.TXT for use within the standard Genie-2000 software.

[How to Install a New ISOCs/LabSOCs Characterization File with Apex](#)

This DIY video will demonstrate how to install a new ISOCs/LabSOCs detector characterization file for use within Apex Gamma.

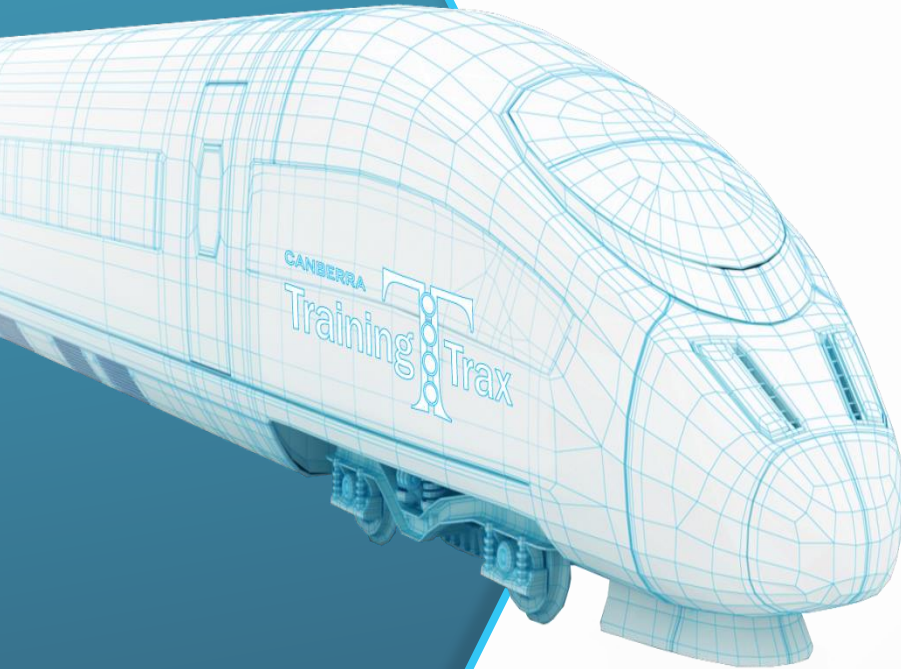
[How to Perform a LabSOCs Efficiency Calibration](#)

This DIY video will demonstrate how to use a previously-created geometry file to perform a new LabSOCs efficiency calibration within the standard Genie 2000 software environment.



Current e-Learning Status:

- ❖ One course fully online as of fall 2016 (GP-101)
- ❖ Second course 75% complete, expected to be online fall of 2017
- ❖ All course attendance, exams, progress tracking and on-line ordering through a complete LMS



GP-101 Principles of Radiation Detection E-Learning



F This training course provides an introduction to the fundamental principles and methods of radiation detection. Covered topics include radioactive decay, types of radiation detectors, and an overview of measurement applications involving gamma spectroscopy, alpha spectroscopy, and alpha/beta counting. This course is presented as a self-directed "E-Learning" experience that allows coverage of the training materials at whatever time and pace is best for each student. This E-Learning course is intended to serve as the first milestone within Canberra's "Training Trax" program, developed to allow students to advance to higher levels of expertise in a variety of specialized software and measurement applications. Students will be required to pass a final exam to confirm and receive credit for successful completion of this course.

This course expires 60 days after registration.



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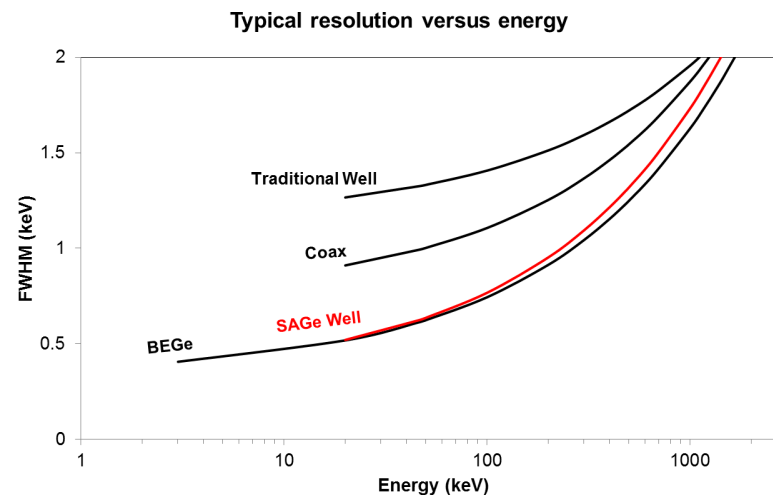
Radiation Safety. **Amplified.**

Small Anode Germanium (SAGe) Well Detector



SAGe Well: Geometry and Advantages

- ◆ SAGe = Small Anode Germanium
 - ▶ Small area contact with short signal lead (like a BEGe)
 - ▶ Very low device capacitance
 - ▶ Maintains energy sensitivity down to 20 keV
- ◆ Advantages:
 - ▶ Low noise provides excellent low-energy resolution
 - ▶ Larger well diameters possible without degrading resolution
 - ▶ Compatible with electric coolers
 - ▶ Excellent performance for well and non-well sample geometries
- ◆ LabSOCS and Cascade Summing Correction
- ◆ Addresses major drawbacks of traditional Well detectors:
 - ▶ Significant reduction in counting times
 - ▶ Expanded field of application



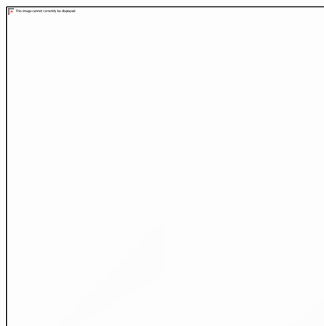


Application benefits

Small Anode Germanium (SAGe) Well detectors

- ▶ Innovative detector geometry addresses the drawbacks of traditional Well detectors
- ▶ Introduces the “universal detector” concept

1. Step-change improvement in count time due to resolution performance
2. Significantly reduce count time with in-well counting
3. Count samples outside the well with similar or better performance than with coaxial detectors



Sample vial in the well



Bottle sample on end cap

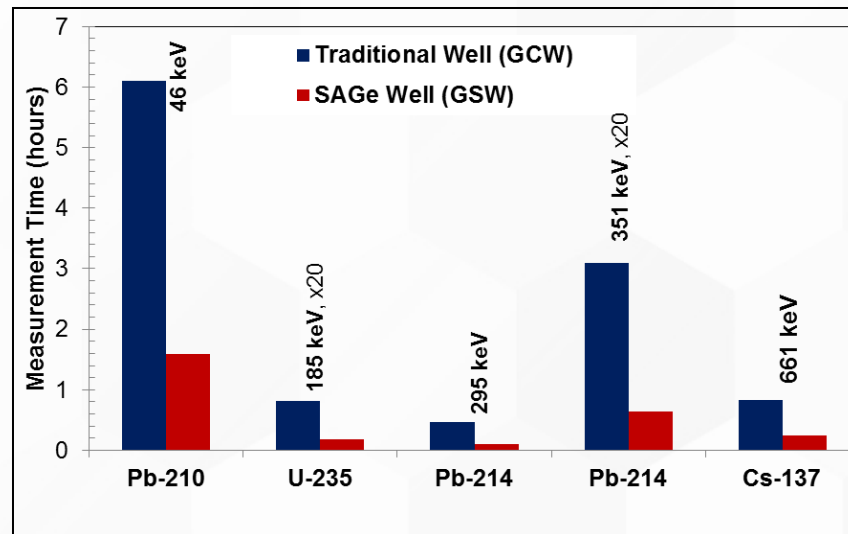
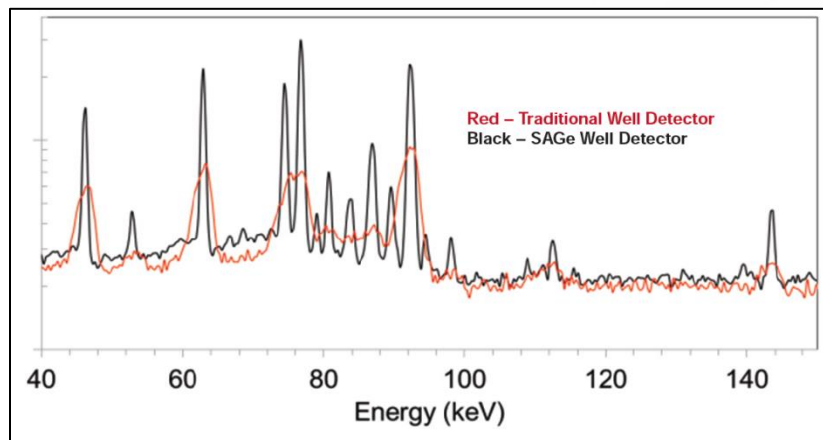


Marinelli sample



Improving existing well applications - Case study: Pb-210

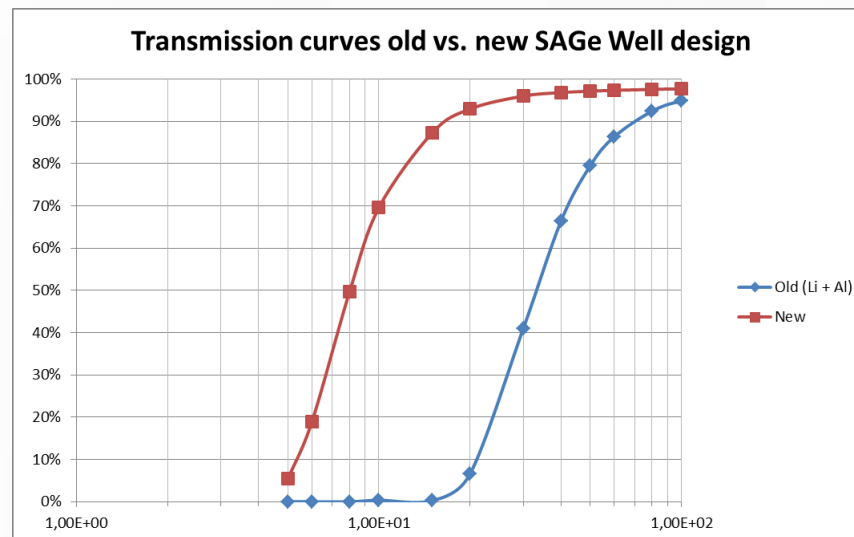
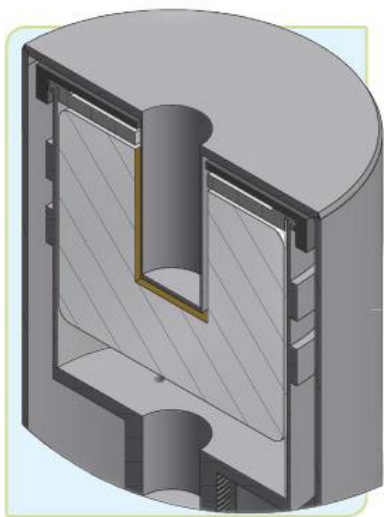
- Count time to MDA is calculated for SAGe Well GSW275L and compared with a Traditional Well detector
- Both detectors have a 28 mm diameter well (custom made GCW)
- Sediment sample in a vial 37 mm fill height
- Factor 4** improvement in counting time for Pb-210





UPCOMING – Thin stable contact and low-Z Well insert

- Replace 100 μ m Li electrode inside the well by a 0.3 μ m stable contact
- Benefits:
 - Better low energy sensitivity (30% improvement at 46 keV)
 - Stable efficiency calibration



CosmicGuard™



*CosmicGuard™
module with Osprey™
Tubebase MCA*



*Frame-Mount
CosmicGuard™
on Model 767
Split-top Shield*

CosmicGuard™

CANBERRA's Cosmic Veto System



Why Reduce Background?

MDA Comparisons

- ▶ What is constant and what can we control?

$$MDA(Bq) = \frac{k^2 + 2k\sqrt{2\dot{B}T}}{\epsilon Y T}$$

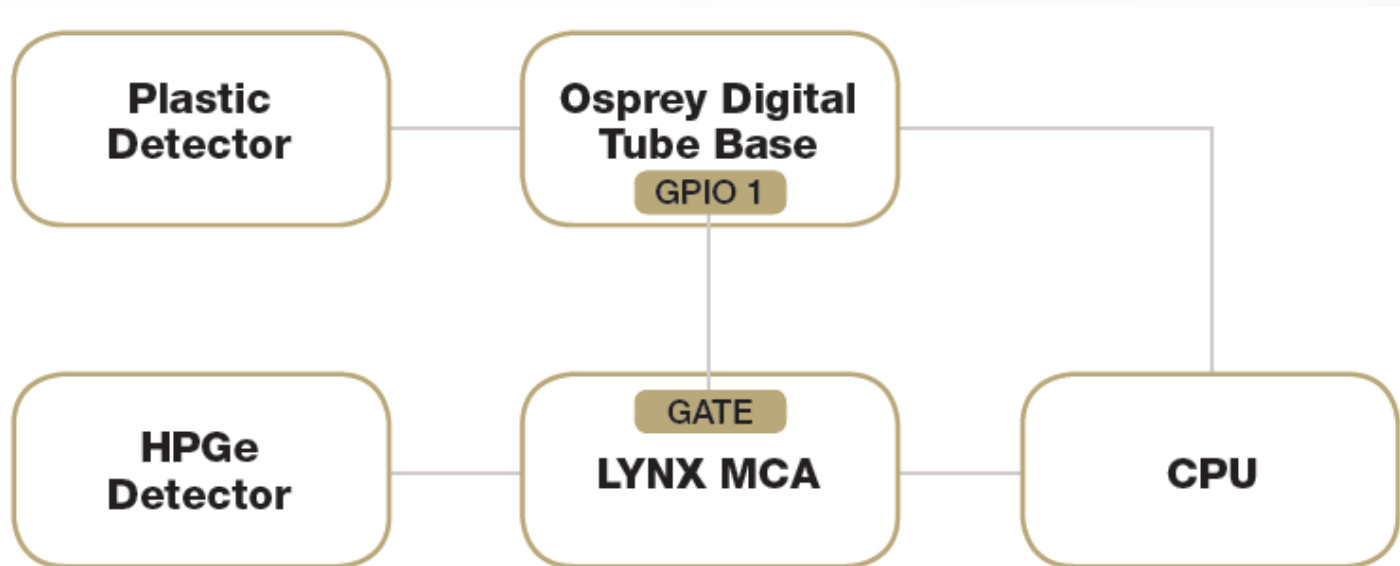
- ▶ **k = constant**
- ▶ **ϵ = Efficiency (assumed constant for any one count)**
- ▶ **Y = yield = constant for any one gamma of interest.**

Therefore, MDA is only a function of Background and Count Time

CosmicGuard, Digital Electronics Schematic

Three Key Elements:

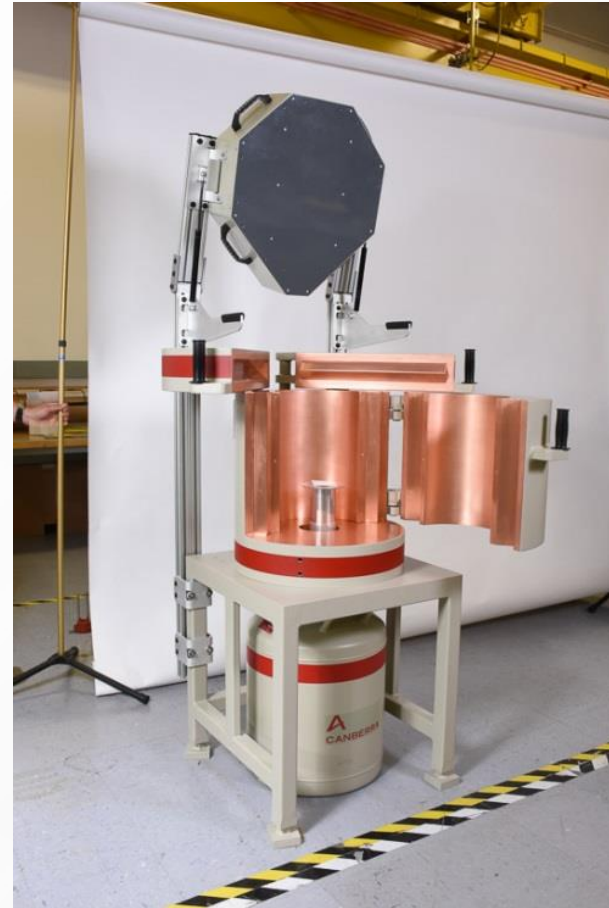
- ▶ Cosmic Veto Panel & Electronics -> CosmicGuard System
- ▶ Configuration of Osprey Output Signal -> CosmicGuard Control App
- ▶ Calibration of Cosmic Veto Gate signal with HPGe events -> Lynx v1.3 MCA





Canberra's Cosmic Veto System: The CosmicGuard

- ◆ Integrated Cosmic Veto System for retrofitting on existing shields
 - ▶ Integrated Osprey MCA
 - ▶ Feedthrough connections for gate signal, control cables
- ◆ Allows for top or side entry
- ◆ Octagonal shape to minimize footprint
- ◆ Intended for a quick & simple install
- ◆ Two Models:
 - ▶ Frame Mount
 - ▶ Top Mount





CosmicGuard: Lid Mount and Frame Mount versions

◆ Lid Mount

- ▶ For circular shields with 20" or 22" solid lid



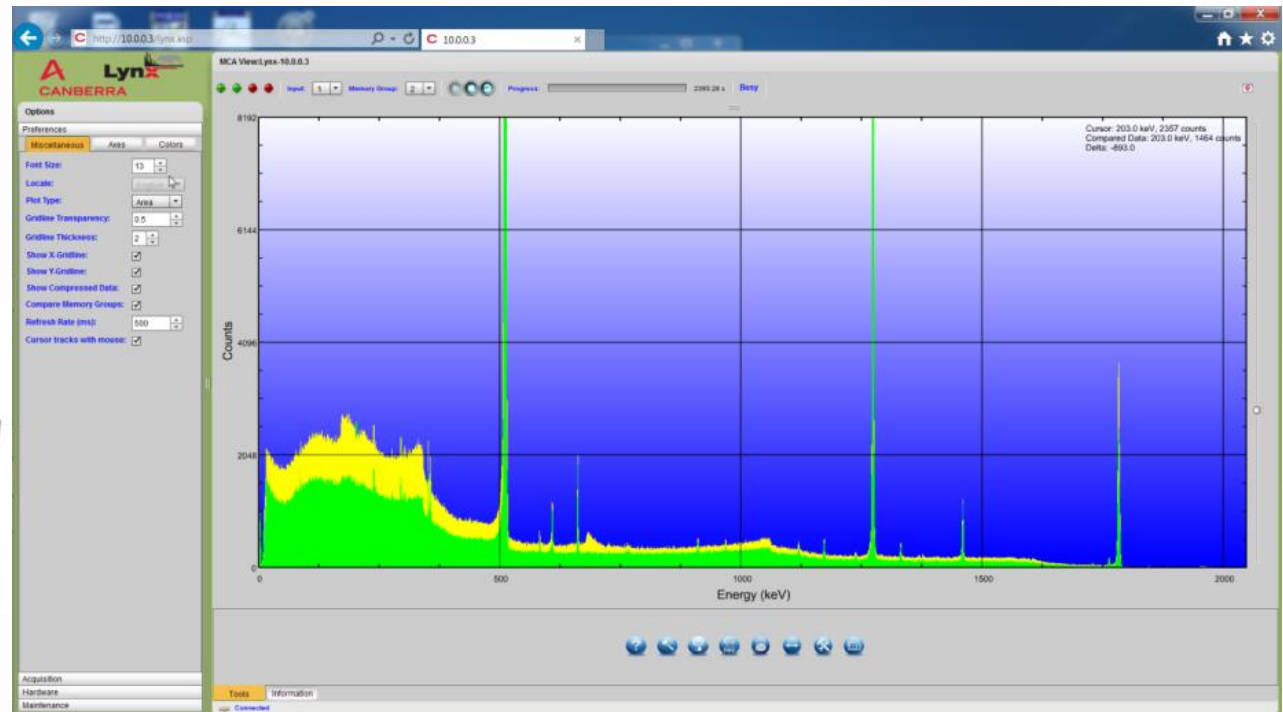
• Frame Mount

- For split top or non-circular shields
- Requires 5x5 cm tube legs



Lynx Cosmic Veto Option

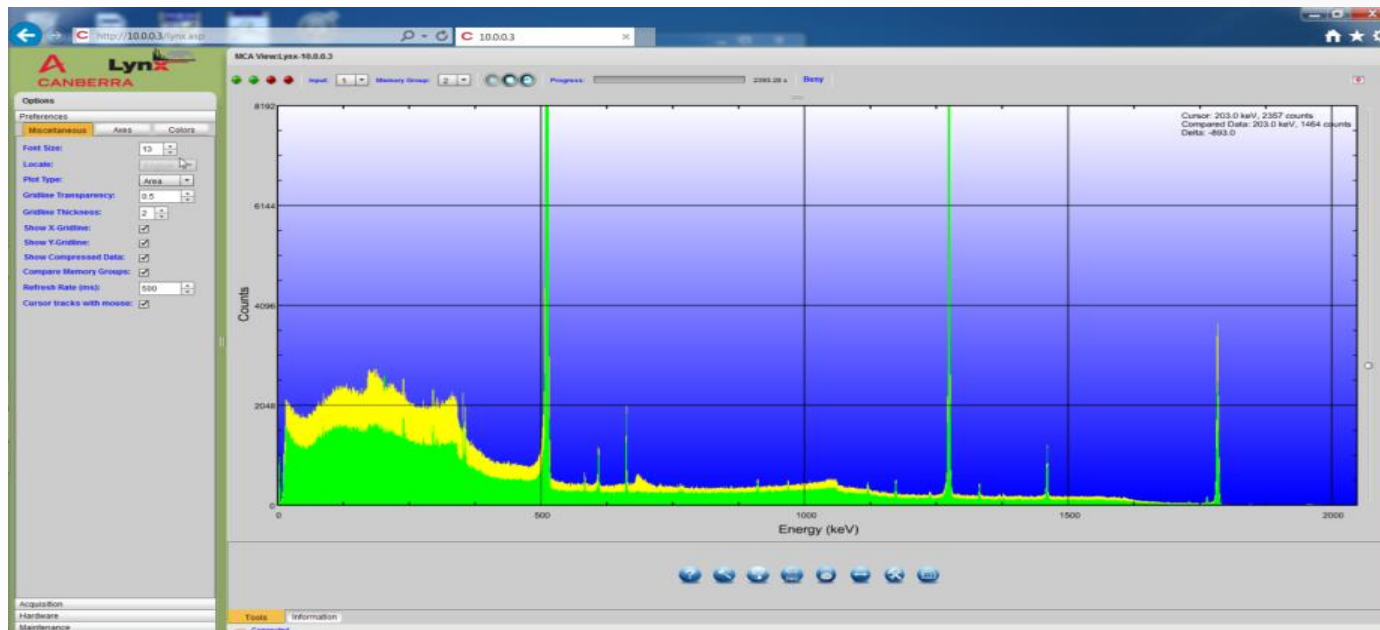
Lynx Electronics to Support Anti-Coincidence (v1.3 required)





One More Useful new Lynx Feature

- Advanced Coincidence & Advanced Anti-Coincidence Modes:
 - Automatically saves both gated and un-gated spectrum
 - Memory Group 1 – Gated Spectrum**
 - Memory Group 2 – un-Gated Spectrum**
- Compare Memory Groups to measure or confirm suppression





Advanced Coincidence Functionality: Software Support

▶ For Genie 2000

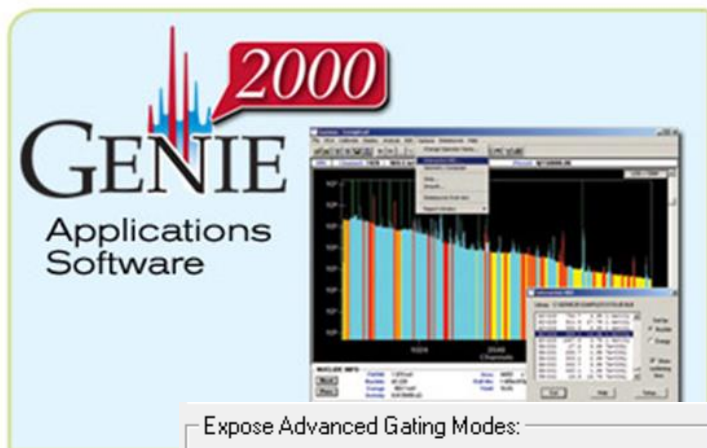
- ▶ V3.4 Now supports Advanced coincidence/anti-coincidence functionality

▶ For Apex-Gamma

- ▶ V1.4 permits coincidence functionality to be enable/disable at setup.
- ▶ If enabled globally, each counting procedure defines if Cosmic veto is active for that procedure.
- ▶ Requires the CosmicGuard application to be installed on both the client and server.

▶ Genie Post NID Scripts

- ▶ A Post NID is provided to
 - Automatically saves reads both memory groups and saves each to a specified filename.
 - From these two files the % suppression can be calculated.



APEX Software Fa



Click for more info



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Water Cooled Option on CP5-PLUS



CP5-PLUS Water Cooled Option – Application Benefits

- ◆ Allows operation of the detector and Cryo-Pulse 5 Plus cryostat up to +50°C
- ◆ Heat (+/- 100W in nominal operation) can be dissipated away from the detector system
- ◆ Benefits various applications
 - ▶ Detectors operating at elevated ambient temperature: NPP stack monitors, waste incinerators, stations in hotter regions with no or limited A/C,...
 - ▶ Detector systems that are still required to operate up to +50 °C under NPP incident/accident circumstances.
 - ▶ Detectors operating in very small rooms or confined spaces with limited air flow.
 - ▶ Synchrotron applications (EXAFS, XRF, XRD)
 - Especially on the recently developed beamlines with nanometer focus, there is a requirement to limit the amount of power dissipated in the experiment hutch.
- ◆ Model: CP5-PLUS/W

