



MIRION
TECHNOLOGIES

Radiation Safety. **Amplified.**

Canberra

Part of Mirion Technologies

Represented by Canberra Packard CE GmbH.



CANBERRA



First, some recent history ...

- Mirion Technologies acquired Canberra Industries on July 1, 2016



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CANBERRA

- ~ 980 employees in 7 countries
- 11 factories (in US, Canada, France, Germany, UK, Finland)
- Built up from successive mergers since 2003
- Key Industry Player in:
 - Dosimetry Services
 - Health Physics
 - Radiation Monitoring Systems
 - Reactor Sensor Systems
 - Imaging Systems
 - Maintenance / Repair Services

- ~ 930 employees in 9 countries
- 6 factories (in US, Canada, France & Belgium)
- Built up from numerous acquisitions between 1965 and 2002
- Key Industry Player in:
 - Spectroscopy
 - Health Physics
 - Radiation Monitoring Systems
 - Non-Destructive Assay Systems
 - Maintenance / Repair Services
 - Training, Measurement & Expertise



Corporate Legacies

■ Mirion Technologies had five Divisions



■ Canberra had three Divisions



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



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OUR DIVISIONS Today

Provides opportunity to build on the strengths of both companies

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



Mirion *Spectroscopy Division (SyD)*

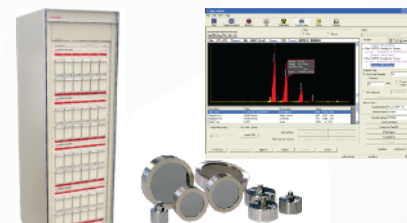
■ The **Spectroscopy Product Line** includes traditional Canberra products in the following areas:

▶ Laboratory Gamma Spectroscopy

- Standard & Specialty HPGe / Silicon Detectors
- Lab Electronics
- Gamma Spec & Database Software



▶ Alpha Spectroscopy



▶ Alpha/Beta Counting



▶ In Situ and Portable Gamma Spectroscopy

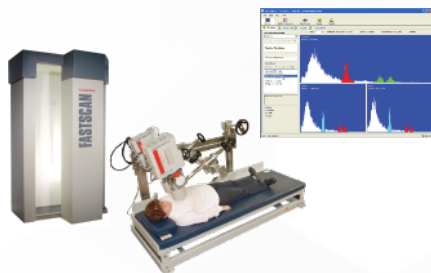


▶ Environmental Monitoring

- Supervisory Software
- Env. Gamma Monitor



▶ In Vivo Counting





Mirion *Characterization Division (ChD)*

■ The **Characterization Product Line** includes Canberra products in the following areas:

▶ **Waste Characterization Systems**

- for assay of drums, boxes or bags to quantify nuclides and/or separate free release from contaminated materials

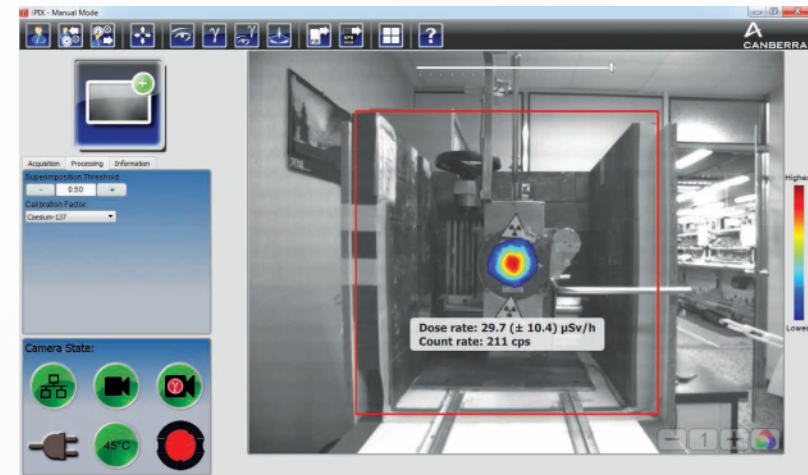




► Mirion *Characterization Division (ChD)*

◆ iPIX™ Ultra Portable Gamma-Ray Imaging System

- ▶ Complete tool for *in situ* gamma imaging
 - Saves time, cost and dose
- ▶ High performance to quickly and precisely locate hot spots
- ▶ Estimates dose rate at the measurement point
- ▶ Real-time acquisition and immediate display
- ▶ Excellent spatial resolution for localization of gamma-ray emitters
- ▶ High detection sensitivity even at low energies
- ▶ Easily decontaminated - IP65 rated
- ▶ Compact and lightweight for ultra portability
 - 2.35 kg (5.5 lb.)
- ▶ Remote control operation including pan and tilt via optional motorized tripod
- ▶ Single Ethernet cable between tablet PC and camera (up to 80 m long)
- ▶ Battery, Power over Ethernet or direct AC powered





Mirion *Health Physics Division (HPD)*

Contamination Monitoring Systems - Personnel

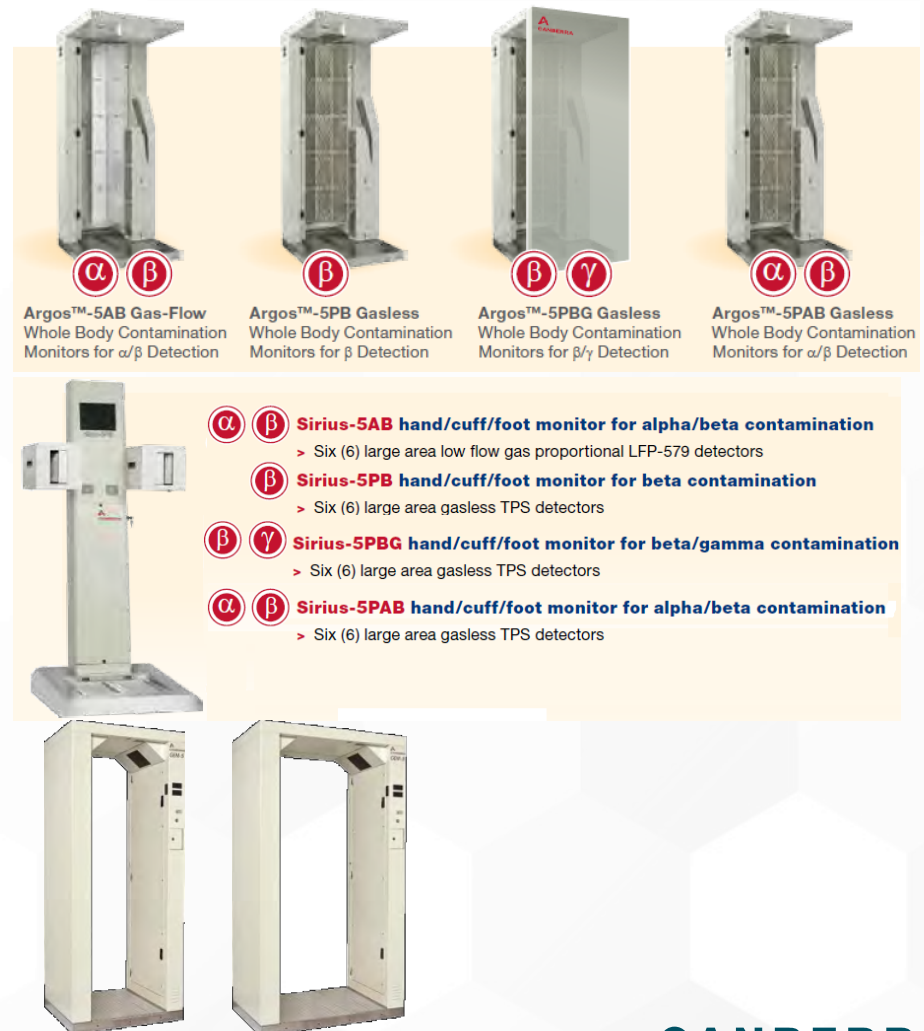
Systems are available to monitor the whole body or extremities for:

- ▶ Alpha & Beta radiation
- ▶ Alpha, Beta & Gamma radiation
- ▶ Beta radiation only
- ▶ Beta & Gamma radiation
- ▶ Gamma radiation only

Alpha/Beta Systems are available with gas-flow or gasless Thin Plastic Scintillation detectors

- ▶ All other systems are gasless

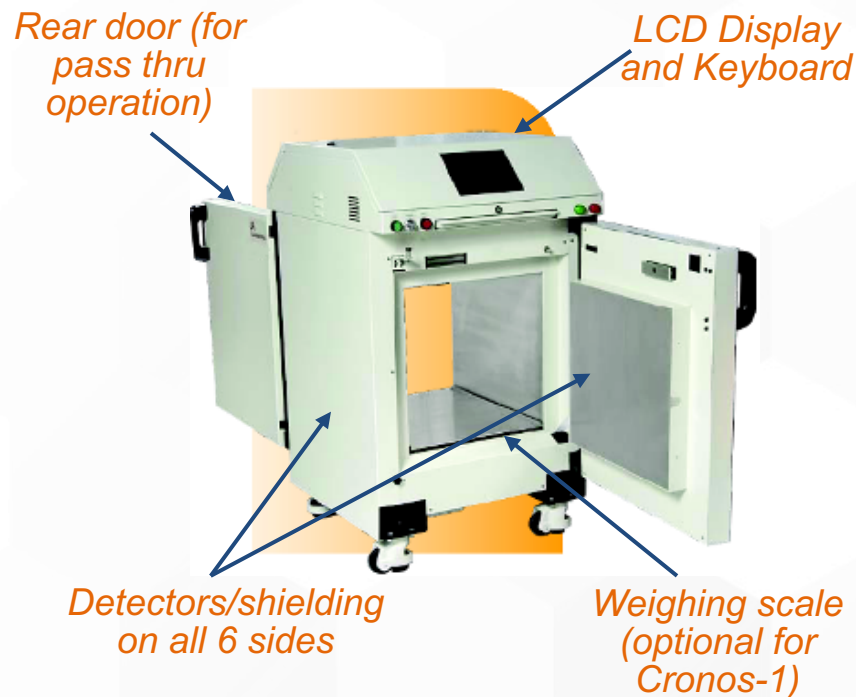
Gamma Exit Monitors available in various widths





Mirion *Health Physics Division (HPD)*

- Contamination Monitoring Systems - Objects
- This type of monitor is used for checking gamma radiation from waste bags, tools and other miscellaneous objects
 - ▶ Determines if the item is contaminated
- Systems with associated internal counting capacity include:
 - ▶ **Cronos -1** – 43 L (1.5 cu. ft.)
 - ▶ **Cronos -4** – 129 L (4.5 cu. ft.)
 - ▶ **Cronos -11** – 345 L (12 cu. ft.)





► Mirion *Health Physics Division (HPD)* Contamination and Dose Monitoring

- ◆ Two main types:
 - ▶ **Survey Instruments:** Provide gross alpha, beta and/or gamma counts and dose measurements to determine if radiation is present
 - ▶ **Nuclide Identifiers:** Provide gamma spectral data and dose (optionally neutron counts) such that nuclides can be identified and quantified
- ◆ Both types are designed for portability and ease of use and are battery-powered – completely self-contained
- ◆ Multiple Uses:
 - ▶ Identify and monitor contaminated or high dose areas
 - ▶ Check tools and other objects for contamination in association with Object Monitors
 - ▶ Check parts of the body (especially hands and feet) for contamination in association with Personnel Monitors





Survey Instruments

◆ The **CANBERRA Smart Probe™ (CSP)** Family of survey instruments includes:

- ▶ Survey Meters
 - Hand-held Models
 - Desktop Models
- ▶ Probes for contamination and dose measurements
 - Wide variety for various applications and radiological environments
- ▶ Accessories for:
 - Wireless communications
 - Poles for extended reach
 - Programming libraries for special data handling applications via computer



Colibri Hand-held



Avior Desktop



CSP Contamination Probes Summary



- ◆ SPAB-15 Multi-purpose Alpha/Beta
 - ▶ Durable PIPS Detector 15 cm²
- ◆ SG-1R Gamma medium sensitivity
 - ▶ 1"x1" NaI(Tl)
- ◆ SG-2R Gamma high sensitivity
 - ▶ 2"x2" NaI(Tl)
- ◆ SA-20-2 Alpha for small area
 - ▶ ZnS 20 cm²
- ◆ SB-20 Beta for small area
 - ▶ Thin plastic 20 cm²
- ◆ SABG-100 Alpha/Beta/Gamma for large area
 - ▶ Phoswich Detector 100 cm²
- ◆ SA-100 Alpha only for large area
 - ▶ ZnS 100 cm²
- ◆ SB-100 Beta only for large area
 - ▶ Thin plastic 100 cm²

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CSP Dose Probes Summary



- ◆ **STTC Wide Range Dose-rate**
 - ▶ Background up to 10 Sv/h (1000 R/h)
- ◆ **STTC-W Waterproof STTC with 20 meter (65 ft) cable on a reel**
- ◆ **TELE-STTC TeleProbe**
 - ▶ 10.9-foot extendable pole allows:
 - Operator to be at safe distance from radiation source
 - Access hard to reach areas
- ◆ **SVLD Very Low Dose-rate**
 - ▶ 10 nSv/h to 1 mSv/h (1 μ rem/h to 100 mrem/h)
- ◆ **STHF-R Very High Dose-rate**
 - ▶ High cumulative dose capability up to 1000 Sv/h (100 000 R/h)
 - ▶ Waterproof with 50 meter (164 ft) cable on a reel

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Nuclide Identifiers

Two types of instruments for identifying and quantifying nuclides – based on detector technology

▶ **InSpector™ 1000 Scintillation Detector**

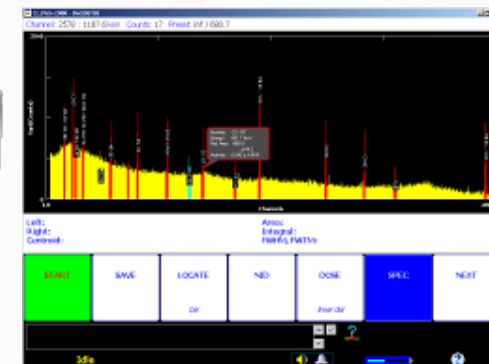
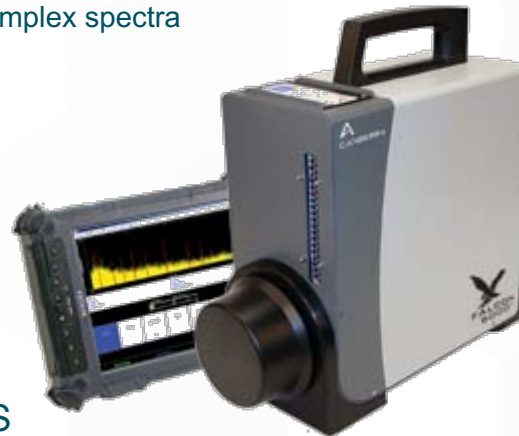
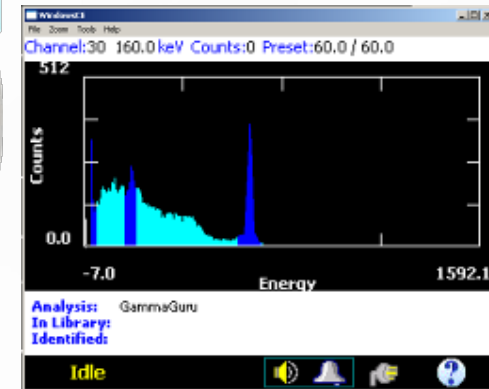
- Smaller and lighter
- Room temperature detector
- Poorer peak resolution, but still has NID capability
- Built-in CPU and spectral display

▶ **Falcon® 5000 HPGe Detector**

- Larger form factor and weight
- Detector is maintained at cryogenic temperatures with an electrically cooled cryostat
- Excellent peak resolution for analysis of more complex spectra
- Unit includes Tablet PC and wireless interface

Both instruments:

- ▶ Have source locator capability
- ▶ Provide dose information
- ▶ Have optional Neutron Detection Probe
- ▶ Are battery-powered and self-contained
- ▶ Are compatible with Genie 2000 and ISOCS Spectroscopy Software

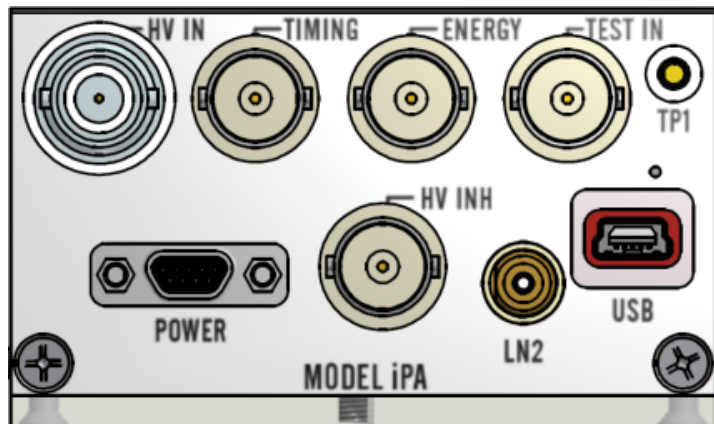


Intelligent preamplifier for HPGE detectors



Features

- ▶ RC-feedback
- ▶ Compact, low-power analog stage
- ▶ USB-connection to PC
- ▶ Make use of cryostat sensors to monitor and trend detector health status
 - Internal temperature sensors
 - 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, ISOCS-files,...)
 - Built-in pulser for system diagnostics

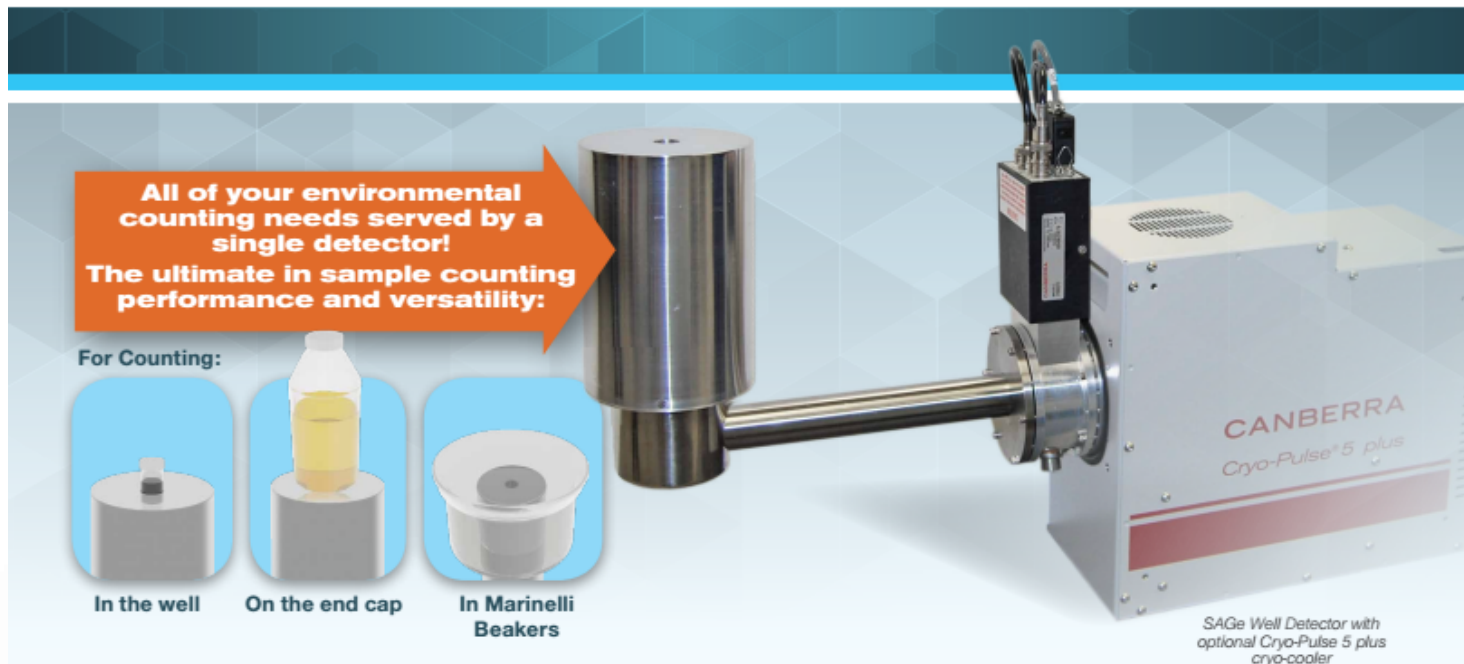




SAGe Well Detector

CANBERRA's SAGe Well Detector

Faster counting for a full range of sample sizes and geometries



The SAGe Well is a germanium detector with the efficiency benefits of a Well, the resolution performance of a BEGe and the aspect ratio of a standard coaxial detector.



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CosmicGuard™

CANBERRA's

Cosmic Veto System



CANBERRA



GR1 & GR1-A Gamma ray detection integrated solution

Compact Gamma Ray Detection solution

▶ CZT detector and his MCA in the same compact box

- Solid state CZT 1 cm³ detector
- Preamplifier
- Shaping amplifier
- Base line restorer
- Pulse height digitizer
- HV supply
- USB interface
- Room temperature operation in a compact and easy to handle package
- Generic Characterization for calibration software ISOCS / LabSOCS



Dimensions 25 x 25 x 63 mm

Weight 60g



SIGMA integrated solution

Compact Fully Integrated Csl detector

- ▶ Csl crystal (Cesium Iodine)
- ▶ SiPM preamp (Silicon Photomultiplier)
- ▶ MCA (Multi Channel Analyzer)
- ▶ Compact for mounting and shielding
- ▶ Operating in ambient temperature
- ▶ Mini-USB connection





TN-15 integrated solution

Thermal Neutron Solid Scintillator

- ▶ *High sensitivity equivalent to 100mm x 13mm Ø 3He at 4 atmospheres*
- ▶ *Excellent gamma rejection*

SiPM Silicon photomultiplier

- ▶ *More robust than Tube photomultiplier*
- ▶ *Insensitive to magnetic fields*
- ▶ *Fast rise time*

Mini-USB PC connection

- ▶ *Powered (250 mW)*
- ▶ *Signal acquisition*

