

**MIRION**  
Connect **21**  
Annual Users' Conference



# Contamination & Clearance

## Technologies, Innovations & Applications

**Dr. Tobias Baer – Product Line Manager C&C**

Mirion Connect | Annual Users' Conference 2021  
Aurora, CO



# Agenda

- Whole Body Contamination Monitoring
- Hand Foot Monitoring
- Gamma Portal Monitoring
- Tool, Object, Waste and Clearance Monitoring
- Conveyor Monitors
- Vehicle Monitoring
- Supervision Systems



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- Whole Body Contamination Monitoring
- Hand Foot Monitoring
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# Argos™-3/5



## Application

Whole body surface contamination monitors are used to clear personnel from various Radiological Controlled Areas (RCAs) and Boundary Zones in both Nuclear Power Plants as well as other industries such as fuel cycle, laboratories, etc.

- **Alpha, Beta and/or Gamma Monitoring**  
including discrimination
- **Gas Flow or Gasless detectors**
- **Resolving Issues with Radon Progeny**



# Argos™-3/5



## Key Features

- Available in different detector configurations:
  - **Argos-3/5AB**: with alpha/beta gas-flow detectors (discriminated)
  - **Argos-3/5PB**: with beta plastic scintillation detectors
  - **Argos-3/5PAB**: with alpha/beta plastic scintillation detectors (discr.)
  - **Argos-3/5PBG**: with beta/gamma plastic scintillation detectors (discr.)
  - **ZEUS** option: Large volume gamma plastic scintillation detectorsCombinations of different detectors on single monitor possible
- Available in three versions:
  - **Argos-5**: Full coverage model with 25 detectors
  - **Argos-3**: “Economy” model with 18 detectors
  - **Argos-3 Compact**: version with small footprint
- **Outstanding body coverage** and radiological performance
- **Radon progeny rejection** (optional)
- Comprehensive Monitor Software based on Windows 10 IoT v9.07 now available (improved alarm testing)
- Many Options & Accessories available  
(see „contamination monitor configuration guide“)

Purge Detector plumbed  
and installed in Cabinet

NEW

Over **1700 Argos-3/5** monitors delivered (June 2021)

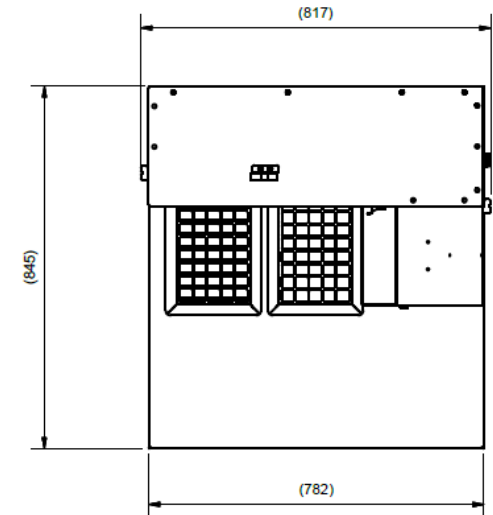
# Argos-3 Compact

NEW



## Key Features

- **Compact dimensions:** ~30.8 x 86.0 x 33.3 in.<sup>3</sup> (78.2 x 218.5 x 84.5 cm<sup>3</sup>) (W x H x D)
- 15 detectors for coverage of body, head, legs, arms, hands & feet.
- Various detector combinations possible:
  - Argos-3AB Compact with LFP-579 **alpha/beta gas-flow detectors**
  - Argos-3PB Compact with TPS-B-579 **beta plastic detectors**
  - Argos-3PAB Compact with TPS-AB-579 **alpha/beta plastic detectors**
  - Argos-3PBG Compact with TPB-BG-579 **beta/gamma plastic detectors**
- Optional casters/wheel for easy movability
- Integrated 8.4" touch display
- Featuring the identical comprehensive monitor software platform used on other Argos-3/5, Sirius™-5, Cronos®-1/4/11 and GEM™-5 contamination monitors



See Argos-3PAB Compact  
in demo room

# Argos-3 Compact

NEW



## Applications

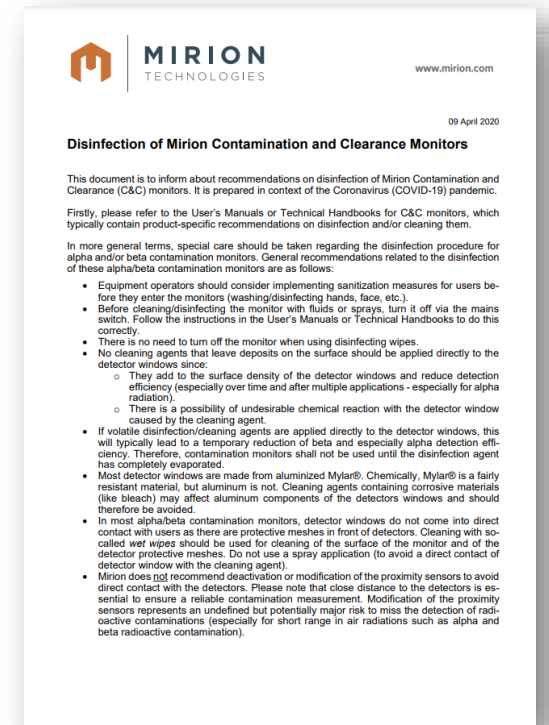
- **Exit-Monitor at locations with size-constraints**  
used at exit of RCA in environments where a regular Argos-5 monitor does not fit due to size-constraints. Typical version: Argos-3 Compact + 9 additional detectors (24 detectors in total).
- **Mobile body contamination monitor**  
used at temporary checkpoints (for example at work-sites) inside or outside of the RCA.  
Typical version: Argos-3P\*\* Compact + casters option.
- **Low-budget monitor**  
exit monitor for operators with low budget and relaxed radiological measurement requirements.
- **Entrance monitor**  
installed at the entrance to the RCA to check for contamination before entering.  
Typical version: Argos-3PBG Compact.
- **“Quick-Scan Monitor”**  
installed outside the RCA for quick check of internal contamination.  
Typical version: Argos-3PBG Compact.
- **Pre-Monitor**  
installed in radiologically controlled area before the “official” exit-monitor (for example in case of change room in RCA).



# Disinfection of Argos Monitors

## Context

- Whole body contamination monitors (WBM)s are unique concerning the fact that **many persons come with the face** (incl. mouth and nose) in **direct contact to the same surface. This poses a risk for spread of infectious diseases.**  
→ Disinfection of WBM)s has always been a topic of concern for users, operators and Mirion
- In context of Covid-19 pandemic many operators have implemented more rigorous processes to disinfect whole body contamination monitors (WBM)s. However, these processes are typically manual and have various drawbacks.
- Mirion has published dedicated recommendations on 19th Nov. 2009, 16th March 2020 and 9th April 2020.



# Automatic Disinfection for Argos Monitors

NEW



Mirion Technologies is proud to introduce the **automatic disinfection option for Argos-3/5** whole body contamination monitors. This allows a fully automatic disinfection of the face and hand area of Argos-3/-5 monitors by **high-power Ultraviolet C (UV-C)** light. This option can be **factory installed** into new Argos-3/5 monitors, or can be ordered as a **field-installable upgrade** to existing Argos-3/5 monitors.

## Technical Specifications

- **Disinfection method:** High-power UV C LEDs with 275 nm wavelength installed on the movable head detector and in hand unit to disinfect the face and hand area of an Argos-3/5 monitor.
- **Required time for disinfection:** Less than 110 seconds for an energy deposition of 52.6 mJ/cm<sup>2</sup>.  
According to “Ambulance Disinfection using Ultraviolet Germicidal Irradiation (UVGI): Effects of Fixture Location and Surface Reflectivity”, William G. Lindsley et al. (CDC) and “Ultraviolet Disinfection of Radiological Instrumentation Technical Basis Document” (Doc number RPP-RPT-62241 Rev. 1), an energy deposition of 52.6 mJ/cm<sup>2</sup> inactivates 99.999% of many pathogens
- **Safety features:** The disinfection option avoids by design any direct exposure of persons to UV C light. The Argos -3/-5 monitor offers comprehensive safety features including audible and visual annunciation when disinfection is active as well as immediate abort of the disinfection when a person enters the Argos monitor (details are configurable in the Monitor Software).



# Automatic Disinfection for Argos Monitors

NEW

## Comprehensive configuration possibilities

>UVC<  
Disinfecting

60

>UVC<  
Disinfecting  
Stay Back

### UVC Disinfection Configuration

Board 254 ID 2 Sensor Board ASSY:D216540 SCN:816540

F6 = Set Factory Default  
Ctrl+F6 = Set All Factory Defaults  
Ctrl+F7 = Recall Previous Settings  
▲, ◀, ▶, ▼, Enter = Select Item  
+, - = Change Value  
Esc = Factory Setup Menu

UVC Disinfection Enabled **YES**  
UVC Disinfection Type **Moveable Header Detector Mount**  
UVC Disinfection Enable Key **None**  
Disinfect Output **TB05 Relay 3**  
Overcurrent Input **TB16 Spare 3 Latched**  
Overheated Input **TB17 Spare 4 Latched**  
Disinfection Duration **120 s**  
Occupants between Disinfections **10** (normal)  
Occupants between Disinfections **1** (after aborted disinfection)  
Maximum Aborted Disinfections **20** (before fault)  
Abort when Position Sensor is Active **YES**  
Abort when Occupied Sensor is Active **YES**  
Abort when Approach Sensor is Active **NO**

See **Argos-5AB** with automatic disinfection feature in **demo room**

# Agenda

- Whole Body Contamination Monitoring
- Hand Foot Monitoring
- Gamma Portal Monitoring
- Tool, Object, Waste and Clearance Monitoring
- Conveyor Monitors
- Vehicle Monitoring
- Supervision Systems



# Hand and Foot Monitors



## Application

- Used where whole body monitoring is not required
- In space constrained areas
- At temporary work areas
- Medical/laboratories applications

## Key Features

- **Alpha, beta and/or gamma detection available**
- **Gas-flow** (Sirius-5) Or **gas-free** (HFF / Sirius-5)
- **Frisking options available**
- **Radon progeny rejection available** (Sirius-5)

# Sirius-5

## Sirius-5PAB

- 6x gas-free TPS-579-AB detectors.
- alpha/beta detection (with discrimination)
- Ideal for environments with (high) gamma background

## Sirius-5AB

- 6 x LFP-579-AB gas-flow detectors
- alpha/beta detection (with discrimination)
- Based on the identical comprehensive monitor software platform used on Argos-3/5, Cronos®-1/4/11 and GEM™-5 contamination monitors
- Similar spare parts as Argos-3/5, Cronos®-1/4/11 and GEM™-5 contamination monitors



See **Sirius-5** in demo room



# HandFoot-Fibre™

## Key Features

- 8x gas-free RFD fibre detector
- Excellent movability, plug & play operation
- Detachable probe for monitoring of cloths

Available in three versions:

### HandFoot-Fibre™ XL

- alpha + beta sensitive RFD485 detectors
- Suitable for all backgrounds incl. (high) gamma background

See **HFF XL** in  
**demo room**

### HandFoot-Fibre™ A+

- alpha/beta sensitive (with discrimination)
- Suitable for all backgrounds incl. (high) gamma backg.

### HandFoot-Fibre™ MED

- alpha, beta and gamma sensitive RFD 4.8/3.8 HybridFibre™ detectors
- Particularly high sensitivity for (low-energy) gamma radiation.
- Well suitable for medical or laboratory environments with low gamma background. Not suitable for high gamma backgrounds

NEW

Delivered by default with new **Lighthouse** user software and **Windows 10 IoT** operating system



# Lighthouse New Monitor Software Platform

## Lighthouse is a new monitor software platform for Mirion Contamination & Clearance Monitors

NEW

- User interface similar to previous HandFoot-Fibre software (intuitive usage)
- Based on Windows 10 IoT operation system
- New expert tools:
  - novel semi-automatic check procedure for detector calibration (no calibration required)
  - Possibility to perform automatic calibration (no calibration required)
- Improved compatibility with external devices
- Enhanced IT security
- And many more

→ see **HandFoot-Fibre** monitor with **Lighthouse** software in the **demo room**

Lighthouse Software

Monitor type	Number of deliveries and upgrades with Lighthouse software
	92
	51
	63
	27
	9
	1
	1
	244

As of today, Lighthouse is available for RTM860TS, TwoStep-PRE (RTM870), HandFoot-Fibre™, RTM750, FastTrack-Vehicle™, FastTrack-Vehicle™ XL, FastTrack-Fibre™. These monitors are by default delivered based on Lighthouse.

Upgrades of existing monitors are possible/available – contact us in case of interest.



# Agenda

- Whole Body Contamination Monitoring
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- **Gamma Portal Monitoring**
- Tool, Object, Waste and Clearance Monitoring
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# Gamma Portal Monitors



## GEM-5

- Bi-directional operation: Walkthrough, Wait-in and two step.
- 8 large volume gamma plastic scintillation (side, top and bottom)
- Opening widths of 61 cm (24 in.), 80 cm (31.5 in.), 93 cm (36.6 in.), and 100 cm (39.4 in.)
- Based on the identical comprehensive monitor software platform used on Argos-3/5, Cronos®-1/4/11 and Sirius-5 contamination monitors
- Similar spare parts as Argos-3/5, Cronos®-1/4/11 and GEM™-5 contamination monitors

See **GEM-5** in  
**demo room**



## FastTrack-Fibre™

- Up to 14 large volume GammaFibre™ detectors: 96 l detector volume
- Innovative dynamic measurement approach to eliminate false alarms.
- Bi-directional operation or Wait-in
- Multiple widths of 60 cm (~24 in.) or 90 cm (35 in.)
- Also available as **Outdoor** and **Mobile** version
- Delivered by default with Lighthouse software

# MiniSentry 2

## Application

Screening of pedestrians or vehicles for gamma emitting radiation in **emergency scenarios** or for **security applications**

## Key Features

- **Quick and Easy Setup and Operation**
  - Transportable gamma portal monitor (weight: <43kg / 95 lb)
  - Rapid deployment and set-up: Single person 5 Minutes
  - Automatic start-up and operation
  - Very little training or expertise in radiation detection needed
- **Flexible Solution**
  - Suitable for in- and outdoor operation (IP54, -25°C - 50°C / -13°F – 122°F)
  - Powered by battery (up to >65 hours autonomy<sup>1</sup>), USB or 110 / 240V
  - Different measurement modes available, bi-directional operation
  - Connection of CSP probes possible (e.g. for SAB-100 or SN-S)
  - Many options available (e.g. vehicle monitoring kit, extended passage width)
- **State-of-the-art Radiological Performance**
  - Detection of 1 µCi <sup>137</sup>Cs-137 in walk-through mode
  - High sensitivity plastic scintillation detectors with 10.6 litres active volume
  - Wide energy range: 30keV – 2 MeV
  - Compliant with FEMA-REP-21 from US Federal Emergency Management Agency and IEC 62244

<sup>1</sup> with optional battery extension module





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# Tool & Object Monitors



See **Cronos-1** in  
demo room

## Cronos® Family

- **Cronos-1** Gamma Object/Tool Monitor
  - 43 L (1.5 cu. ft.) internal volume
- **NEW Cronos-1PBG** Beta /Gamma Object/Tool Monitor
  - 42 L (1.4 cu. ft.) internal volume
- **Cronos-4**, Gamma Object/Tool Monitor
  - 129 L (4.5 cu. ft.) internal volume
- **Cronos-11**, Gamma Object/Tool Monitor
  - 345 L (12 cu. ft.) internal volume

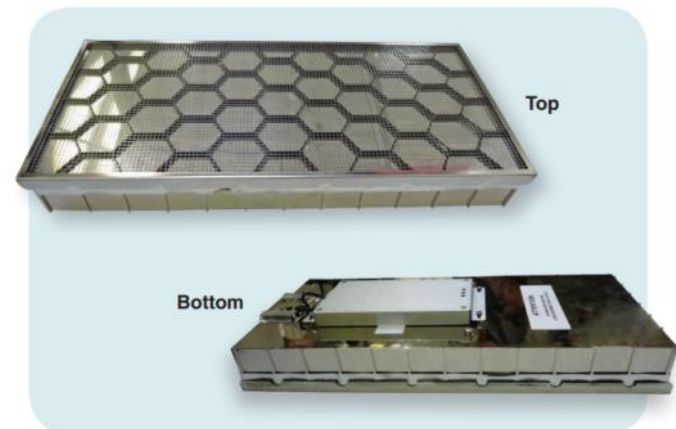
## Common features

- 6x large volume gamma plastic scintillation detector (Cronos-1/-4/-11)
- 1" or 2" lead shielding
- 2 doors (for single or dual side operation)
- Based on the identical comprehensive monitor software platform used on Argos-3/5, Sirius-5 and GEM™-5
- Similar spare parts as Argos-3/5, Sirius-5 and GEM™-5 contamination monitors

# Cronos-1PBG

## Cronos-1PBG

- ▶ Tool/Object monitor with **beta/gamma** measurement capability (with discrimination)
- ▶ Based on up to 12x TPS-BG-579 detectors (Argos PBG, Sirius PBG)
- ▶ MDA: **8 Bq Cl-36 (beta), 45 Bq Co-60** in 15s



# Large Item Clearance Monitors

NEW



## RTM662/300

(CGO-Smart LNC)

Volume: 307 litres

- ▶ Measurement of large objects, tools, bags
- ▶ Innovative Smart Technology, with gamma spectrometry based on plastic scintillators
- ▶ Improved “Leading Nuclide Correlation” for easy handling of complex nuclide vectors



## RTM661/440

Volume: 440 litres

- ▶ Measurement of large objects, tools, bags
- ▶ Separate electronics cabinet



## RTM661/540

Volume: 540 litres

- ▶ Measurement of 200l drums
- ▶ 6 gamma plastic detectors
- ▶ Conveyor system

NEW

available soon: RTM662/440

NEW

available soon: RTM662/440C



# Large Object Monitoring



## RTM644Inc

Volume: 1870l

- Measurement of grid boxes, palettes
- 24 large volume gamma plastic detectors
- High throughput: 12 tons per hour
- Many options: Integration in container, spectrometry integration etc.



available soon:

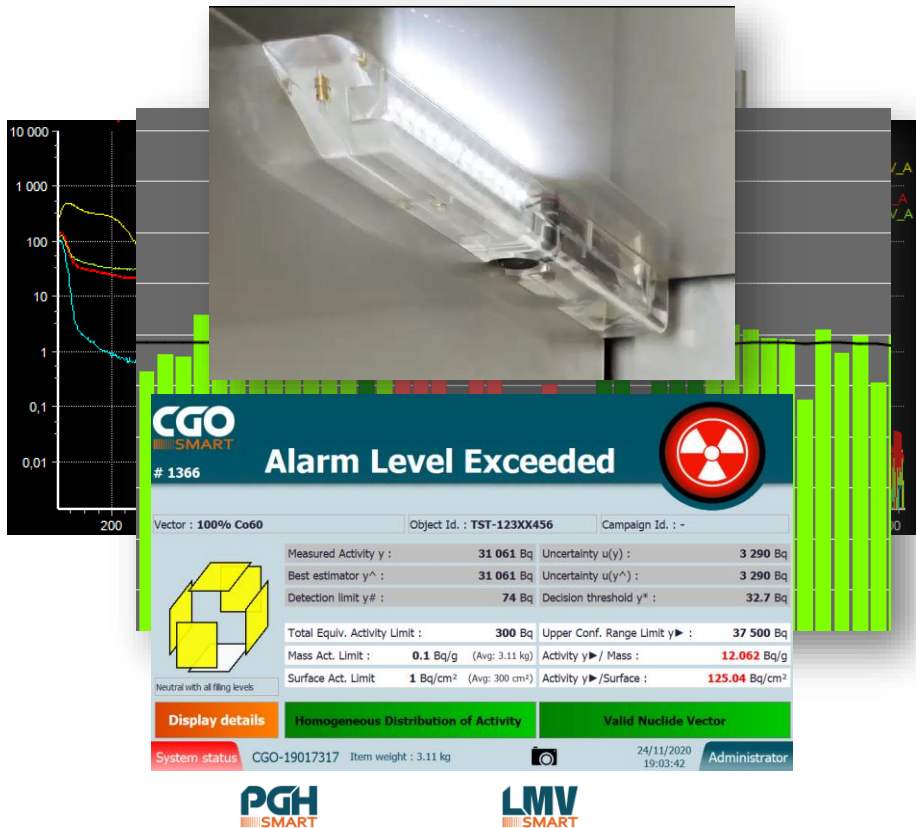
**RTM644Inc-Smart**

## GasBottle-Monitor

- Clearance of Pressurized Gas Bottles
- 33 HybridFibre™ detectors for measurement of beta and gamma contamination



# Smart Technology



## Technology Principles

- **Energy-windowing** based on **plastic scintillation detectors**
- **Validation of nuclide vector**
- Improved compensation of **NORM** and **background**
- Improved **Energy correction of LNC-factors**
- Automatic gain-stabilization → **Temperature compensation**
- Co-60 Coincidence mode
- **“Smart” background variation suppression** and quick background change recovery
- Quick decision algorithm
- Camera for object detection & measure tracking
- Intuitive User interface (based on Windows 10 IoT)
- **>200 Smart Technology Monitors in use, worldwide**



# Agenda

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# Conveyor Belt Monitoring



## RTM750

- Measurement of laundry, small items and scaffolds
- 2 detector trays (below and above belt)
- Height of upper detector tray adjustable
- Automatic speed control
- Various detector types/combinations available: beta gas-flow, beta plastic, gamma plastic
- Optional transverse sorting conveyor
- Optional configuration for scaffolding and heavier items

NEW

Based on Lighthouse software and Windows 10 IoT operating system

# Agenda

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# FastTrack-Vehicle™

## Application

Screening of vehicle, cars, trucks, trains, bicycles and/or pedestrians for gamma emitting radiation

## Key Features

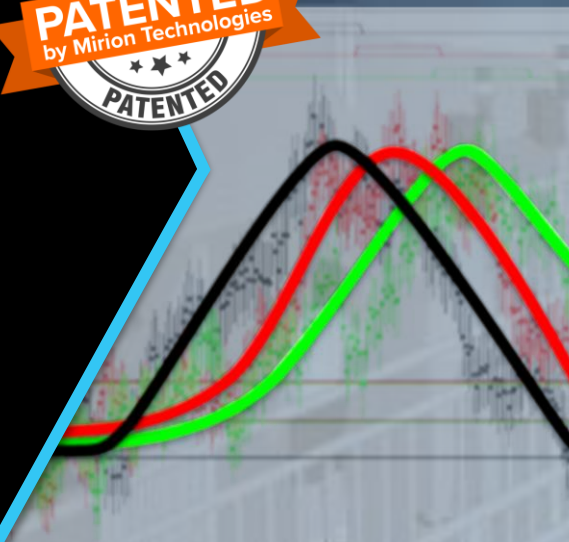
- Available in two versions:
  - **FastTrack-Vehicle XL** 6 GammaFibre™ detectors per monitor cabinet with 8 litres active volume each (total active volume: **96l**)
  - **FastTrack-Vehicle** 3x GammaFibre detector per cabinet
- Advanced FastTrack algorithm to avoid false alarms  
**well-proven in millions of real-life measurements**
- High sensitivity: 40 kBq (Co-60, FTV XL)
- Constant performance up to 20 km/h
- Neutron detector (optional)
- Web server interface for remote services
- Source localization within vehicle
- Mirion Lighthouse user software based on Windows 10 IoT operating system
- Many options and accessories available





# FastTrack-Technology

*Mirion Technologies (2012). U.S. Patent 8,119,993 B2.  
Hamburg, DE: U.S. Patent and Trademark Office.*



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TECHNOLOGIES



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TECHNOLOGIES

## Advantage: FastTrack-Technology

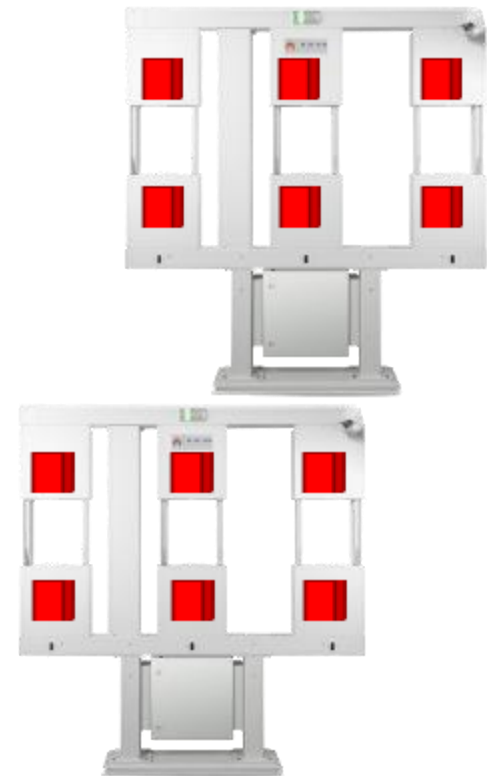
Conventional Design



**Major challenge:**

Monitor is sensitive to dynamic background fluctuations

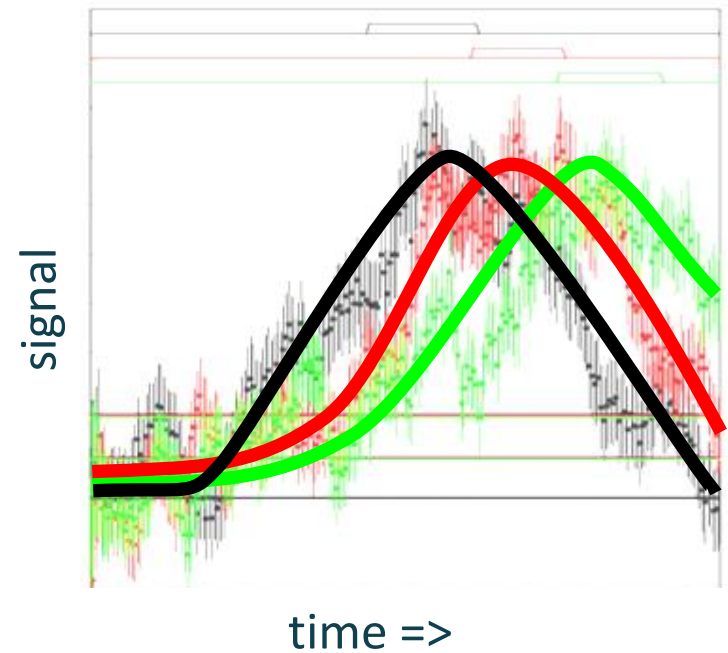
FastTrack Design



## Time Resolved Fit



Time resolved fit algorithm

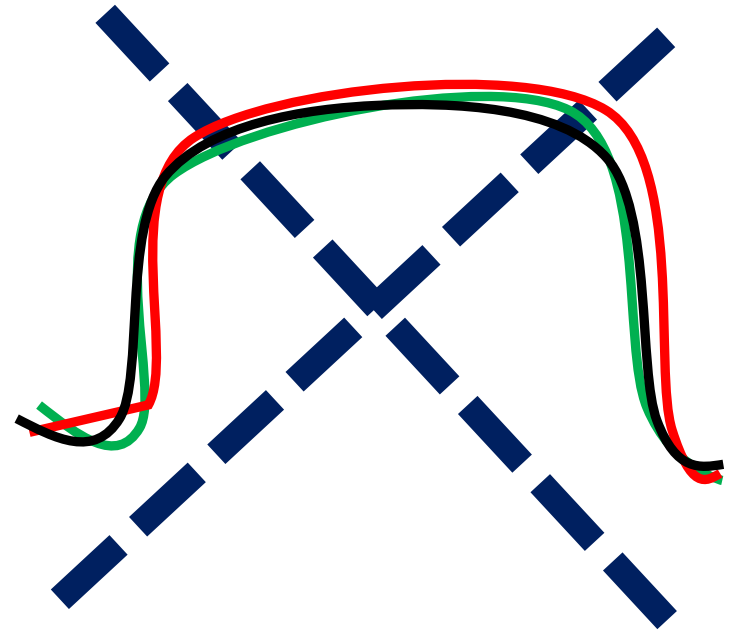




## Non-Dynamic Filter



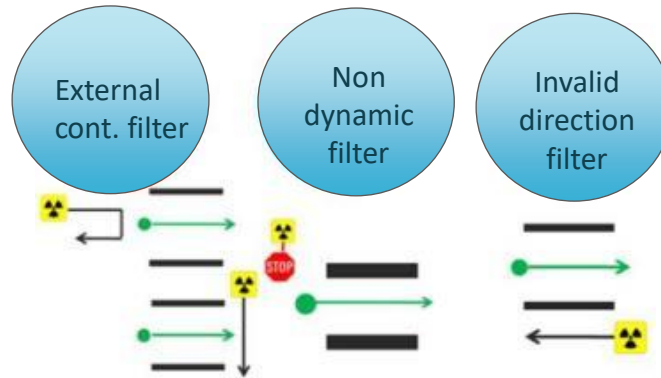
Non-dynamic filter



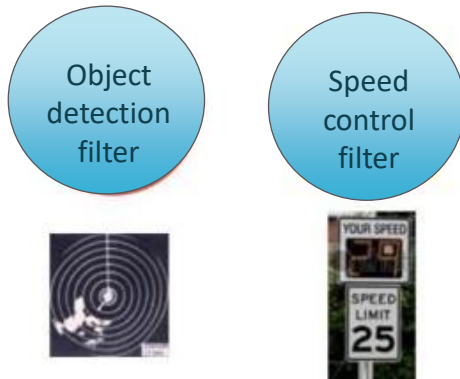
nothing moves

# Advanced Algorithm Filters

## FastTrack Filters



## Object Filters



## Radiation Filter

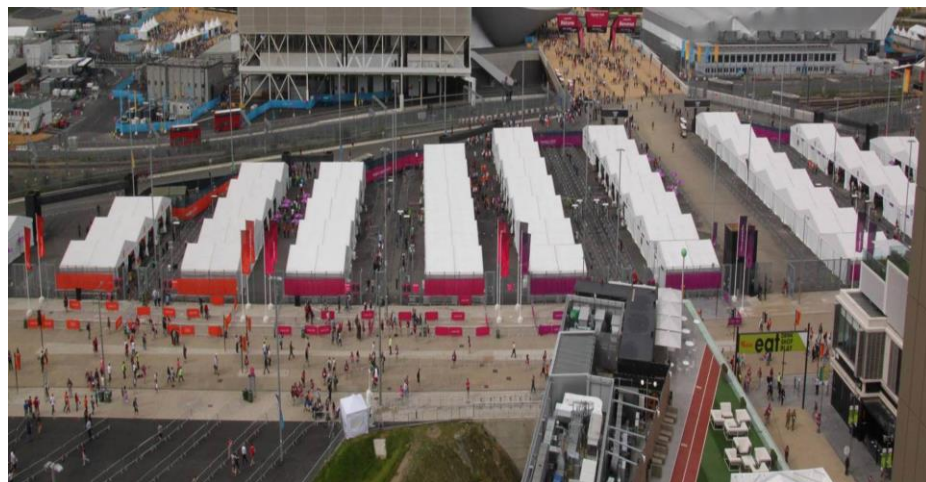


**Result  
validation**

# Proven Technology

## Largest radiological screening program in the world for single events:

- 100% monitoring of all entries
- Over 4.5 million measurements
- 72 alarming events (all medical contamination)
- **No false alarms**





# FastTrack-Vehicle at US Decommissioning site



FastTrack-Vehicle at decommissioning site. Mobile installation.

# FastTrack-Vehicle at Garbage Incineration plant in Sweden



FastTrack-Vehicle used for monitoring of waste at entrance to garbage incineration plant.

# FastTrack-Vehicle in Jordan



FastTrack-Vehicle used for monitoring at airport in Jordan.  
Including neutron detector option.



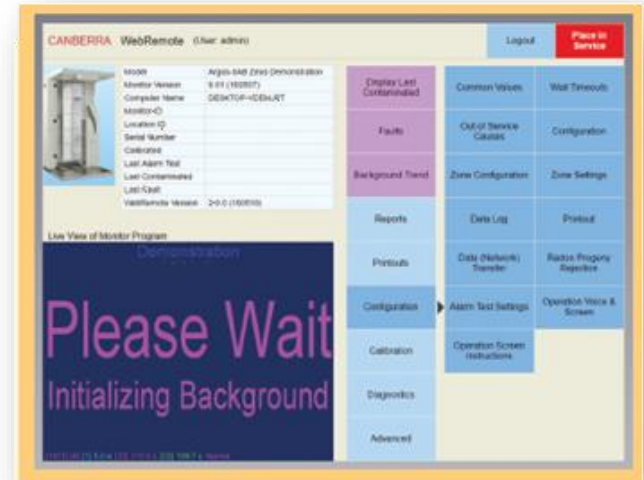
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# WebRemote™ and Dashboard™

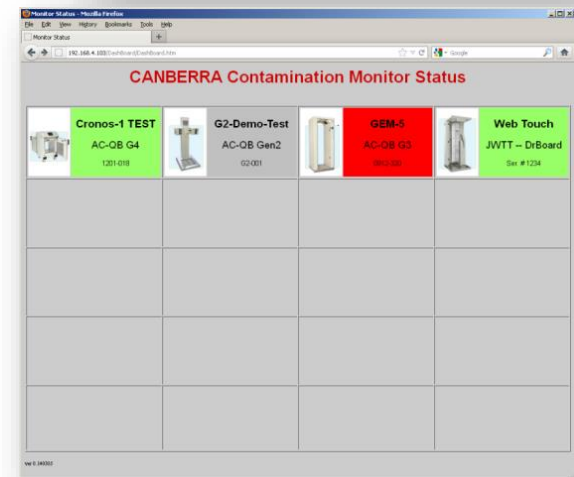
# WebRemote™

- Web-based and local user interface software
- Provides intuitive user interface to monitor results, change parameters and view status of monitors via system's touchscreen or using a desktop or a tablet PC
- Offers graphical selection of detectors for setup and calibration
- Any contaminated regions can easily be identified
- **Included by default in any Argos-3/5, Cronos-1/4/11, GEM-5 and Sirius-5**



# Dashboard™

- Web-based Monitor Overview Interface
- Provides color-coded status overview of all networked Contamination Monitors on one screen
- Access via browser from any PC linked to the monitor network (Ethernet or Wi-Fi®) without any proprietary program or interface
- Contamination monitors can be selected from Dashboard to inquire the details, and
- **Included by default in any Argos-3/5, Cronos-1/4/11, GEM-5 and Sirius-5**





# CeMoSys





# CeMoSys

## Application

Centralized supervisory, data analysis and reporting for contamination monitors

## Key Features

- Central database for all Mirion contamination monitors:
  - Monitor Status overview and history
  - Measurement results
  - Calibrations/source check records
- Central status overview
- Comprehensive analysis & export functionalities
- Remote access per web-browser

See CeMoSys  
in demo room

The image displays the CeMoSys software interface, which is used for monitoring contamination levels. The main screen shows a floor plan with various monitoring points marked by colored squares (green for OK, red for contamination, orange for emergency passage, and yellow for not ready to measure). A legend on the right explains these colors. Below the floor plan, there is a table of results with columns for Date/Time, Monitor type, Monitor location, Monitor ID, Identification, Name, Result, and Detector groups. The table shows a list of measurements with their corresponding results (Clean, High, Medium, or Low). A measurement result overlay is also visible, showing a date/time of 3/15/2021 5:08:14 PM, monitor type of HandFoot-Fibre™ XL, and a measurement result of Medium. The overlay also shows a channel number of 272.07 Bq.

**CeMoSys**  
V1.43 © 2009 RADOS Technology GmbH

**Overview**

Overview Results Monitor Status System Check

Basement 1st Floor

Status OK Client not active Emergency passage Out of service Service Contamination Not ready to measure

**Results**

Overview Results Monitor Status System Check User Out

Statistics Selection Export Delete Print

Auto refresh

Date/Time	Monitor type	Monitor location	Monitor ID	Identification	Name	Result	Detector groups
3/15/2021 12:30:39 PM	TwoStep™-Exit II	TSE2_No_2	Clean				
3/15/2021 12:29:01 PM	TwoStep™-Exit II	TSE2_No_2	Clean				
3/15/2021 12:28:19 PM	TwoStep™-Exit II	TSE2_No_2	Medium				
3/15/2021 10:26:59 PM	TwoStep™-Exit II	TSE2_No_2	Medium				
3/15/2021 10:21:56 AM	TwoStep™-Exit II	TSE2_No_2	Clean				
3/15/2021 10:15:24 AM	TwoStep™-Exit II	TSE2_No_2	Medium				
3/15/2021 10:05:35 AM	TwoStep™-Exit II	TSE2_No_2	High				
3/15/2021 7:40:18 PM	FastTrack-Vehicle XL	FTV_on_FTF	Clean				
3/15/2021 7:40:11 PM	FastTrack-Vehicle XL	FTV_on_FTF	Clean				
3/15/2021 5:10:52 PM	TwoStep™-Exit II	TSE2_No_2	Clean				
3/15/2021 5:10:19 PM	HandFoot-Fibre™ XL	HFF_XL	Clean				
3/15/2021 5:09:09 PM	HandFoot-Fibre™ XL	HFF_XL	Clean				
3/15/2021 5:08:56 PM	HandFoot-Fibre™ XL	HFF_XL	Medium				
3/15/2021 5:08:42 PM	HandFoot-Fibre™ XL	HFF_XL	Clean				
3/15/2021 5:08:30 PM	HandFoot-Fibre™ XL	HFF_XL	Clean				
3/15/2021 5:08:14 PM	HandFoot-Fibre™ XL	HFF_XL	Medium				
3/15/2021 5:08:00 PM	HandFoot-Fibre™ XL	HFF_XL	Medium				
3/15/2021 5:07:45 PM	HandFoot-Fibre™ XL	HFF_XL	Medium				
3/15/2021 5:07:32 PM	TwoStep™-Exit II	TSE2_No_2	High				
3/15/2021 5:06:08 PM	FastTrack-Vehicle XL	FTV_on_FTF	Clean				
3/15/2021 5:05:12 PM	TwoStep™-Exit II	TSE2_No_2	High				
3/15/2021 3:57:12 PM	FastTrack-Vehicle XL	FTV_on_FTF	Clean				
3/15/2021 3:57:06 PM	FastTrack-Vehicle XL	FTV_on_FTF	Clean				
3/15/2021 2:47:10 PM	TwoStep™-Exit II	TSE2_No_2	Clean				

Measurement result: **Medium**

Date/Time: 3/15/2021 5:08:14 PM  
Monitor type: HandFoot-Fibre™ XL  
Monitor ID: HFF\_XL  
Card ID:

Channel 6  
272.07 Bq

**MIRION TECHNOLOGIES**

# CeMoSys Examples

## References

- >65 systems worldwide
- Bruce Power in Canada (>300x monitors)
- EDF UK: centralized supervision system for 7x NPP (>270 monitors)
- Olympic Games (approx. 4 million measurements within 2 weeks)
- Ringhals & Forsmark NPP Sweden (approx. 250 monitors)





# Thank you for your attention!

