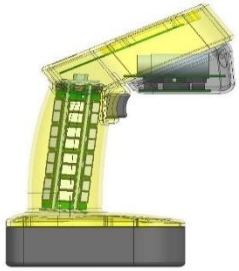
innovative physics

Introducing Innovative Physics

NDA Supply Chain Event, 21/07/2022

Introduction

- Founded in 2002 (under Radiation Watch Ltd.) to commercialise an IP portfolio of radiation detection technologies
- Privately owned and funded
- UK-grown company; trading office on the Isle of Wight
- Representatives in BeNeLux, China, Japan, USA, South Korea and Singapore
- Consultancy, Contract Design/Development/Product Portfolio
- Markets including, Civil Nuclear, Homeland Security and Defence, Environmental Protection, CBRNe and Medical



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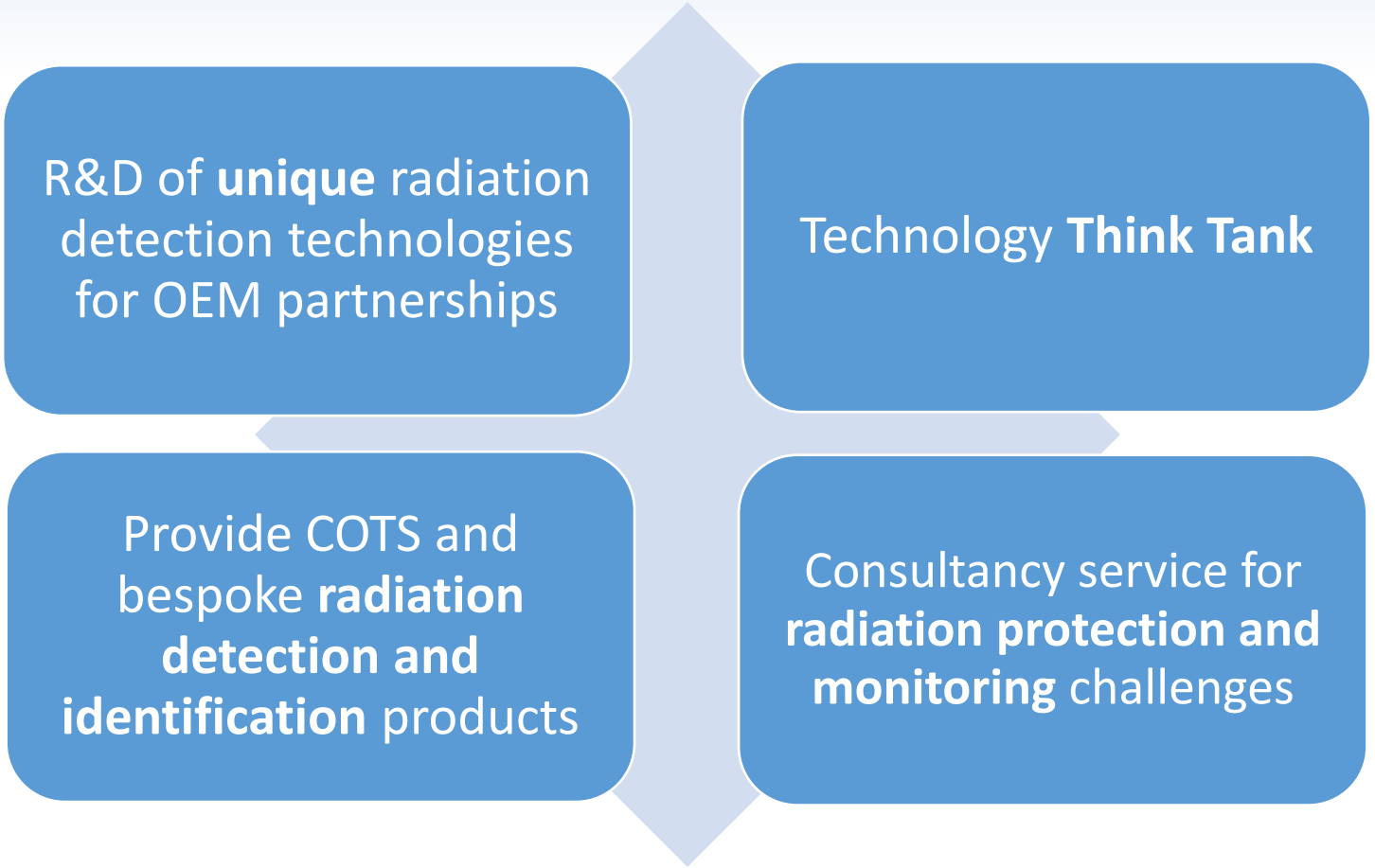
Service and Product Offerings



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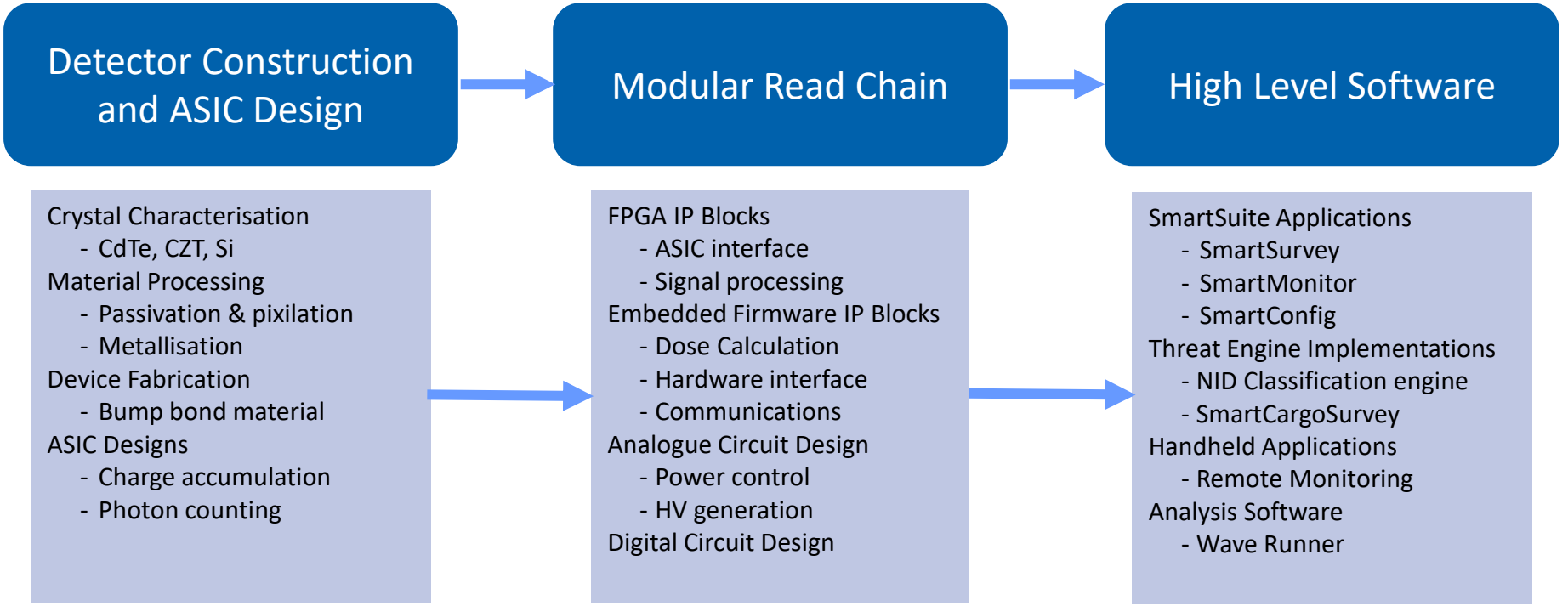
Capabilities Summary



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Technology & Services

- Hardware –detectors
  - Neutron
  - Gamma
  - X-ray
- Imaging Technology
  - Coded Aperture
  - Compton Camera
- Software
  - Medical/Industrial Imaging
  - Spectral
  - 3D imaging
  - Artificial Intelligence – Niche Solutions.
- Systems
  - Integration
- Consultancy

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Artificial Intelligence

- IPL specialise in combining real-time sensing technology, with the latest algorithmic interpretation approaches to provide vertical solutions in several sectors including
- The industrial sector, nuclear power, oil and gas, and industrial inspection
- Medical imaging, AI assistant tools for radiologists for the CRO (clinical research organisations), for use in drug trials.
- The security sector, our work is primarily related to the detection of contraband materials at ports of entry.

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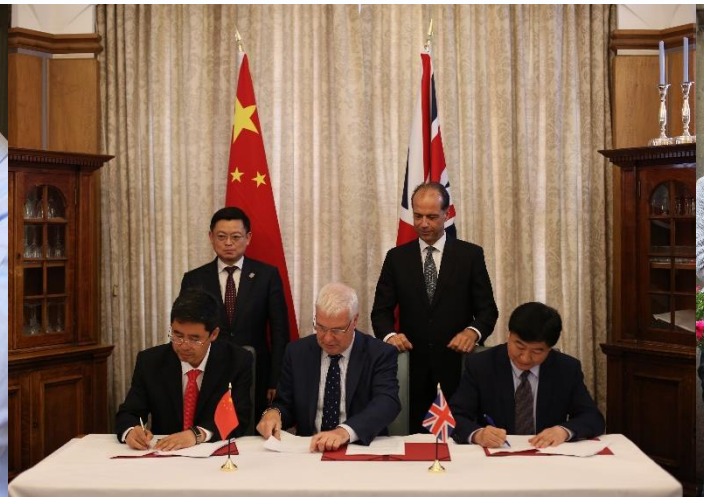
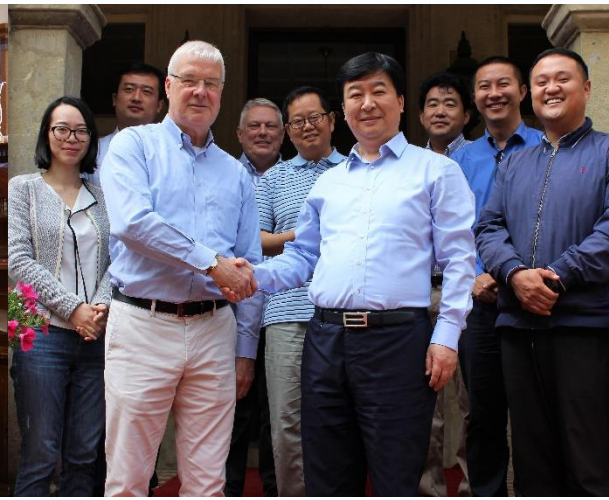
Current Experience in China

Landmark international agreement was signed in 2019 between Innovative Physics and the China Institute of Radiation Protection (part of China National Nuclear Corporation, CNNC).

Projects include:

- R&D of onsite source item measurement equipment
- R&D of rapid measurement of equipment for Very Low-Level Waste materials
- Joint sensor development i.e. LaBr

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Introducing RadiationMetriX™

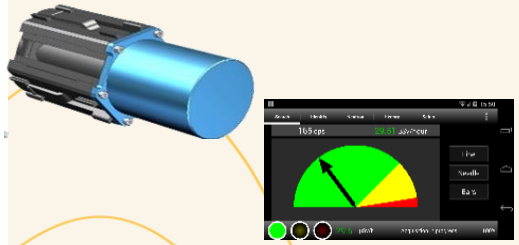
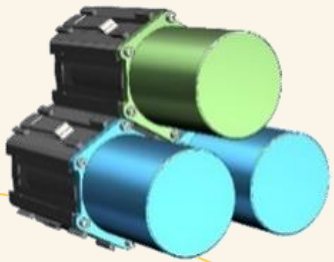
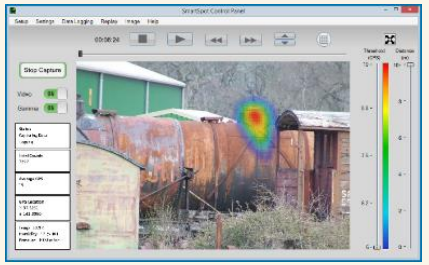
A Brand of Innovative Physics...

RadiationMetriX

Why RadiationMetriX™?

- To separate Innovative Physics project work from its off-the-shelf product line
- To explore new market opportunities with RMX branded products, which could open doors for IPL project work
- Simplify the message for customer driven focus
- To ensure a future-proofed brand identity structure, that needs little to no change over time
- To compete with competitors such as Mirion, Createc and Kromek

Example Technology/Products

Survey Meters/ Measurement Pods	Handheld Spectrometers	Gamma-Ray Camera
		
		

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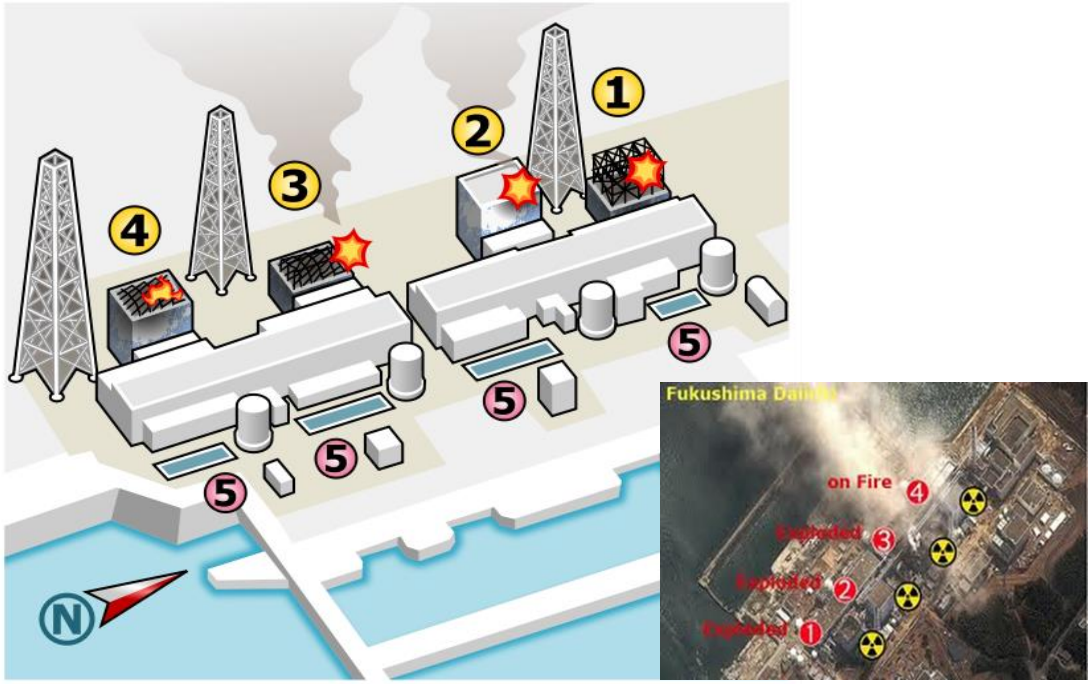
Fukushima Dai-ichi Accident



- On 11th March 2011, Pacific Ocean was struck by a magnitude 9.0 earthquake
- Followed by a large tsunami over 10m in height
- Over 10,000 casualties, and over 200,000 displaced by the damage
- Fukushima Daiichi Nuclear Power Plant – critical loss of power to the cooling systems caused significant damage

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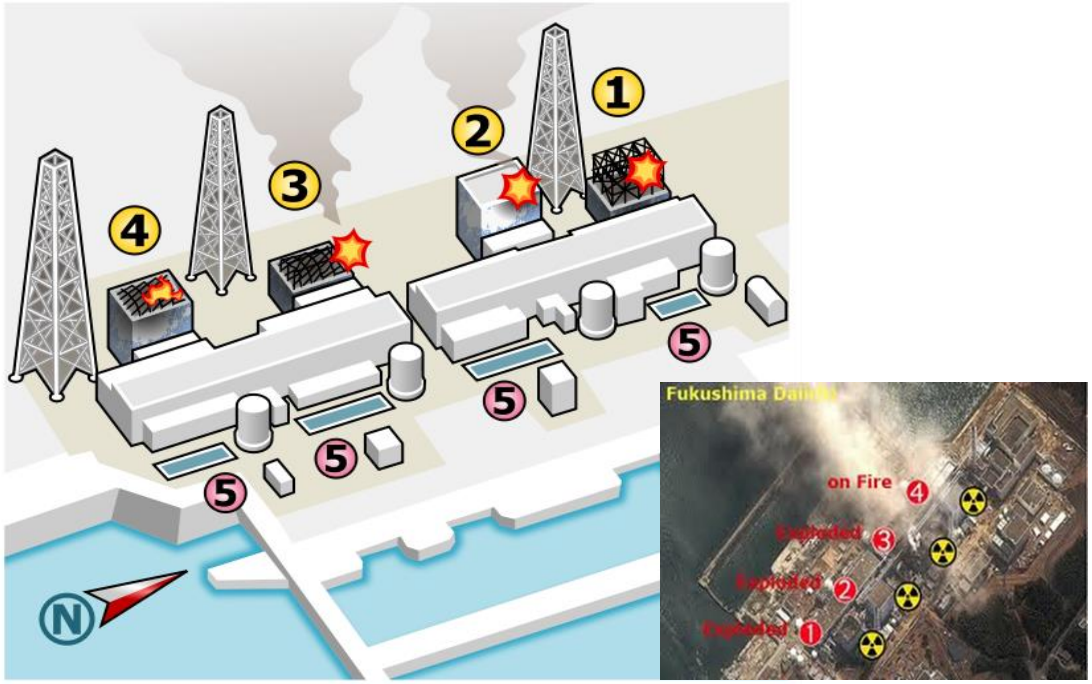
Fukushima Dai-ichi Accident



- Hydrogen explosions in reactor buildings 1, 3 and 4
- Core meltdowns in buildings 1, 2 and 3
- Units 5, 6 largely undamaged
- Exact distribution of corium unknown
- Mapping and extraction to take place over several years, potentially decades
- Risk of criticality events if mishandled

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The Challenge

- Identifying the exact location of radioactive hotspots is becoming ever more relevant
  - Decontamination
  - Decommissioning
  - Pre and Post Site Surveys
  - Long-term monitoring/public reassurance
  - High Risk Installation monitoring
- Current devices have a number of constraints:
  - Heavy/difficult to move around sites
  - Long capture times

The Solution: RMX-RAY Products

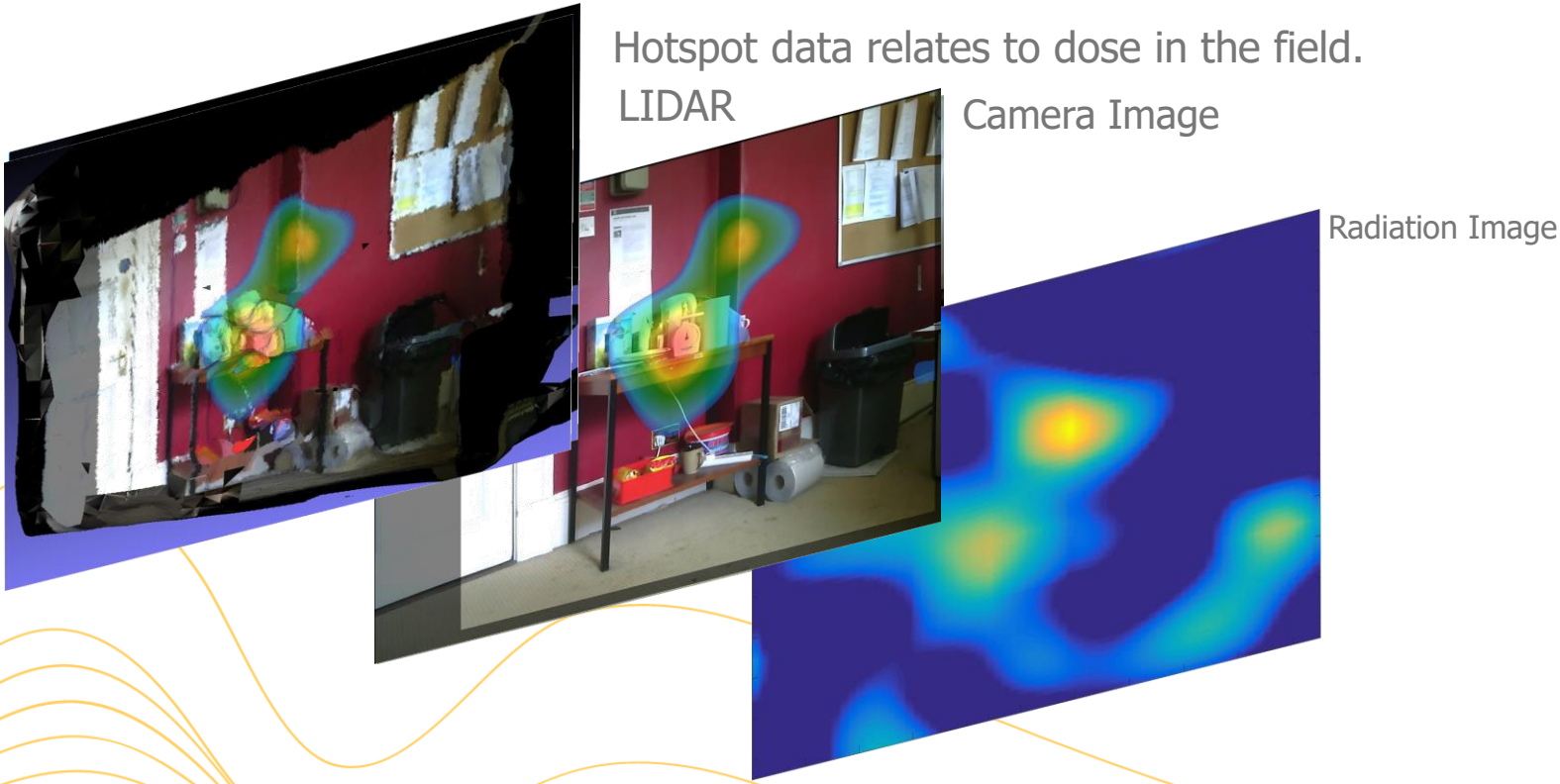
Making the Invisible, Visible...

Three main factors to take into consideration when choosing the right technology:

- Sensitivity
- Speed
- Accuracy
- Ease of use

The Solution: RMX-RAY Products

..Through Image Merging



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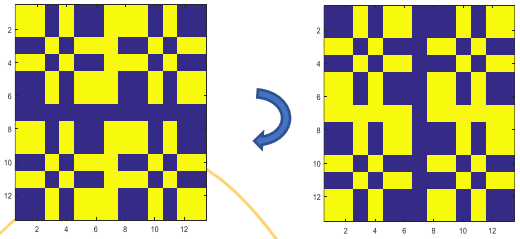
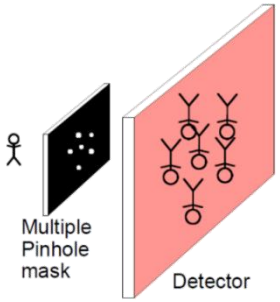
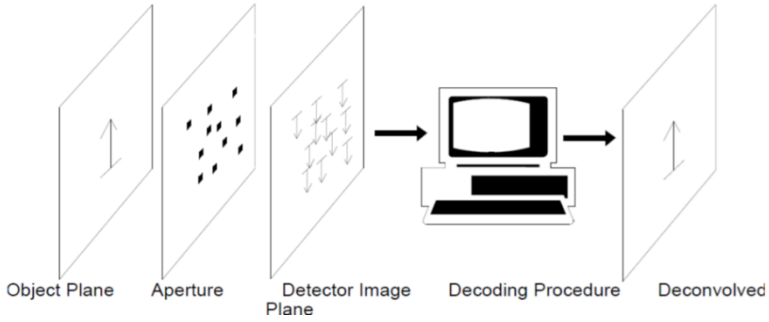
The Technology

- Coded aperture is essentially multiple pinholes.
- It works similar to a pinhole camera except has multiple holes, there multiple images are produced.
- These images are then run through an algorithm that matched the specific coded aperture used which will be the final reconstructed images.



Cyclic arrangement of order 7 MURA coded aperture.





Deconvolution algorithm

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Thank You

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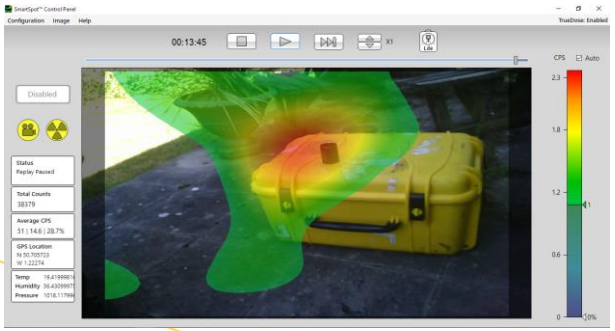
RMX-RAY

Detector	CsI
Radiation Detected	Gamma
Gamma Sensitivity	5nSv/h (300kBq ^{137}Cs @2m)
Energy Range	50keV –1.5MeV
Isotope Library	N/A
Software	SmartSpot™
Power Supply	Lithium ion battery pack
Battery Life	~ 8 hours
Dimensions (H x W x D)	261 x 204 x 276 mm
Weight	6.5kg

- ✓ Real-time colour coded images of radiation
- ✓ Highly Sensitive
- ✓ Wide dynamic range
- ✓ Good angular resolution
- ✓ Easy to operate



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RMX-RAY C

Detector	CsI
Radiation Detected	Gamma
Gamma Sensitivity	5nSv/h (300kBq ^{137}Cs @2m)
Energy Range	50keV –1.5MeV
Isotope Library	N/A
Software	SmartSpot™
Power Supply	Integrated Lithium ion battery pack
Battery Life	~ 8 hours
Dimensions (H x W x D)	190 x 350 x 183 mm
Weight	4.2kg

- ✓ Real-time colour coded images of radiation
- ✓ Highly Sensitive
- ✓ Wide dynamic range
- ✓ Good angular resolution
- ✓ Easy to operate
- ✓ Portable

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RMX-RAY S

Detector	CsI (8% Spectral Resolution)
Radiation Detected	Gamma
Gamma Sensitivity	5nSv/h (300kBq ^{137}Cs @2m)
Energy Range	50keV –1.5MeV
Isotope Library	Pre-sets Cs_{137}, Am_{241}, Co_{60}
Software	SmartSpot™ Spectral
Power Supply	Lithium ion battery pack
Battery Life	~ 8 hours
Dimensions (H x W x D)	264 x 250 x 229 mm
Weight	8kg

- ✓ Real-time colour coded images of radiation
- ✓ Highly Sensitive
- ✓ Wide dynamic range
- ✓ Good angular resolution
- ✓ Easy to operate
- ✓ Pre-Set Spectral Identification

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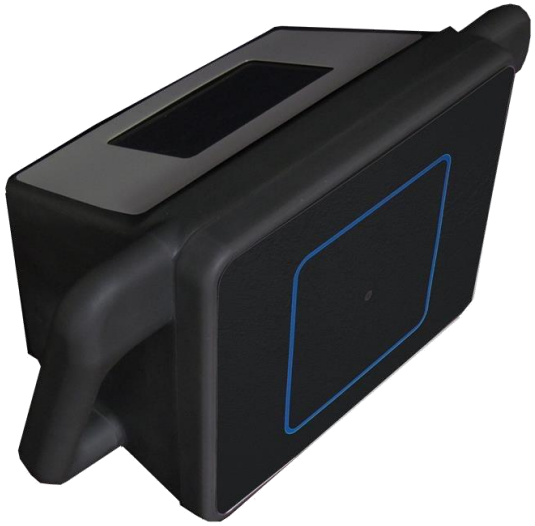
RMX-RAY SC

Detector	CsI (8% Spectral Resolution)
Radiation Detected	Gamma
Gamma Sensitivity	5nSv/h (300kBq ^{137}Cs @2m)
Energy Range	50keV –1.5MeV
Isotope Library	Pre-Sets Cs_{137}, Am_{241}, Co_{60}
Software	SmartSpot™ Spectral
Power Supply	Integrated Lithium ion battery pack
Battery Life	~ 8 hours
Dimensions (H x W x D)	190 x 350 x 183 mm
Weight	4.5kg

- ✓ Real-time colour coded images of radiation
- ✓ Highly Sensitive
- ✓ Wide dynamic range
- ✓ Good angular resolution
- ✓ Easy to operate
- ✓ Portable
- ✓ Pre-Set Spectral Identification



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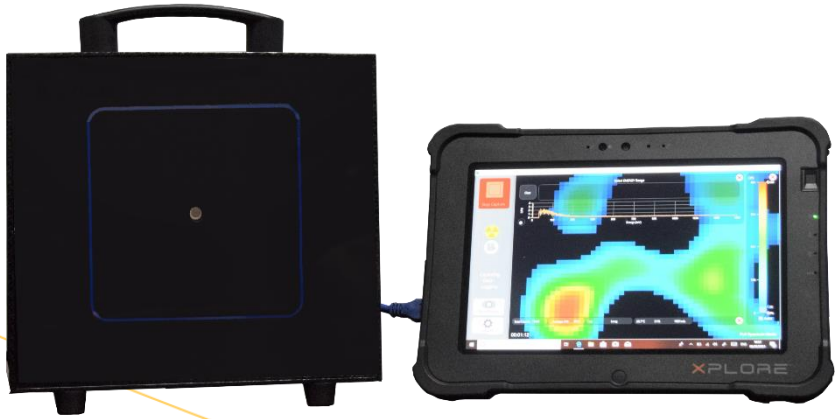
RMX-RAY ISO

Detector	LaBr3 (<=4% Spectral Resolution)
Radiation Detected	Gamma
Gamma Sensitivity	5nSv/h (300kBq ^{137}Cs @2m)
Energy Range	50keV –1.5MeV
Isotope Library	ANSI Standard N42.34
Software	SmartSpot™ Spectral
Power Supply	Lithium ion battery pack
Battery Life	~ 8 hours
Dimensions (H x W x D)	264 x 250 x 229 mm
Weight	8kg

- ✓ Real-time colour coded images of radiation
- ✓ Highly Sensitive
- ✓ Wide dynamic range
- ✓ Good angular resolution
- ✓ Easy to operate
- ✓ Isotopic Identification to ANSI Standard N42.34

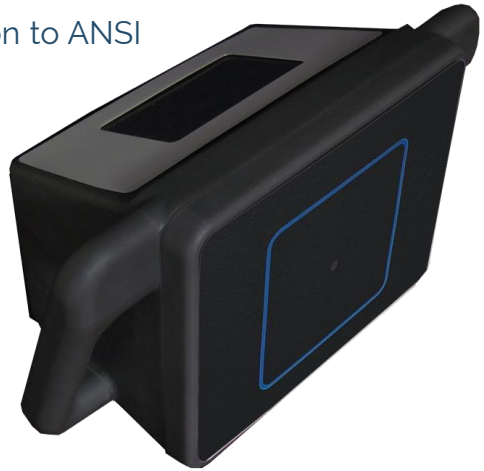


RadiationMetriX

RMX-RAY ISO C

Detector	LaBr3 (<=4% Spectral Resolution)
Radiation Detected	Gamma
Gamma Sensitivity	5nSv/h (300kBq ^{137}Cs @2m)
Energy Range	50keV –1.5MeV
Isotope Library	ANSI Standard N42.34
Software	SmartSpot™ Spectral
Power Supply	Integrated Lithium ion battery pack
Battery Life	~ 8 hours
Dimensions (H x W x D)	190 x 350 x 183 mm
Weight	4.5kg

- ✓ Real-time colour coded images of radiation
- ✓ Highly Sensitive
- ✓ Wide dynamic range
- ✓ Good angular resolution
- ✓ Easy to operate
- ✓ Portable
- ✓ Isotopic Identification to ANSI Standard N42.34



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RMX-RAY MINI

Detector	CdTe (7% Spectral Resolution)
Radiation Detected	Gamma
Gamma Sensitivity	<30 seconds detecting Cs_{137} generating 2µSv/h
Energy Range	50keV –1.3MeV
Isotope Library	Multiple isotope libraries for different applications
Software	SmartSpot™ Spectral
Power Supply	Passive PoE
Battery Life	~ 8 hours
Dimensions (H x W x D)	150 x 70 x 70 mm
Weight	0.6kg

- ✓ Real-time colour coded images of radiation
- ✓ Highly Sensitive
- ✓ Wide dynamic range
- ✓ Good angular resolution
- ✓ Easy to operate
- ✓ Portable
- ✓ Isotopic Identification
- ✓ Passive PoE

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RMX-RAY Specs Table

	Sensor	Sensitivity	Energy Range	Spectral Resolution	Isotope Library	Weight (Kg)	Dims (H x W x L)	Generic Advantages	Variant Advantages
RMX-RAY	CsI	300kBq Cs_{137} @2m (5nSv/h)	50keV-1.5MeV	-	-	6.5	261 x 204 x 276mm	• Highly Sensitive • Quick and easy to use • Multiple hotspots of radiation • Accurately displayed • Instant start up, no warm-up/ cool down period required • Quick detection of radioactive contamination	Check for radioactive contamination
RMX-RAY C						4.2	190 x 350 x 183mm		Portable, deployable by 1 person
RMX-RAY S				8%	Pre-sets Am_{241}, Cs_{137}, Co_{60}	8	264 x 250 x 229 mm		Pre-set spectrum and energy selection modes
RMX-RAY SC						4.2	190 x 350 x 183mm		Portable, deployable by 1 person. Pre-set spectrum and energy selection modes
RMX-RAY ISO	LaBr3			<=4%	ANSI Standard N42.34	8	264 x 250 x 229 mm		Full spectrum mode and energy selection mode Enhanced isotope identification, with large isotope library Capable of identifying multiple isotopes
RMX-RAY ISO C						4.2	190 x 350 x 183mm		Full spectrum mode and energy selection mode Enhanced isotope identification, with large isotope library Capable of identifying multiple isotopes Deployable by 1 person
RMX-RAY MINI	CdTe	<30s Cs_{137} generating 2µSv/h	50keV-1.3MeV	7%	Multiple isotopes for different applications	0.6	150 x 70 x 70mm		Extremely light with isotopic identification

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RMX-RAY Features

	Sensor			Spectral Resolution			Isotope Library		Optional Features
	CsI	LaBr3	CdTe	<=4%	7%	8%	Pre-sets C_{137}, Am_{241}, Co_{60}	ANSI Standards N42.34	
RMX-RAY	✓								✓ Automated Pan and Tilt ✓ TrueDose 2D or 3D Software ✓ Gammarama (panoramic imaging) ✓ Multi-position stereography ✓ Multi-camera solution
RMX-RAY C	✓								
RMX-RAY S	✓					✓	✓		
RMX-RAY SC		✓				✓	✓	✓	
RMX-RAY ISO		✓		✓				✓	
RMX-RAY ISO C		✓		✓				✓	
RMX-RAY MINI			✓		✓				

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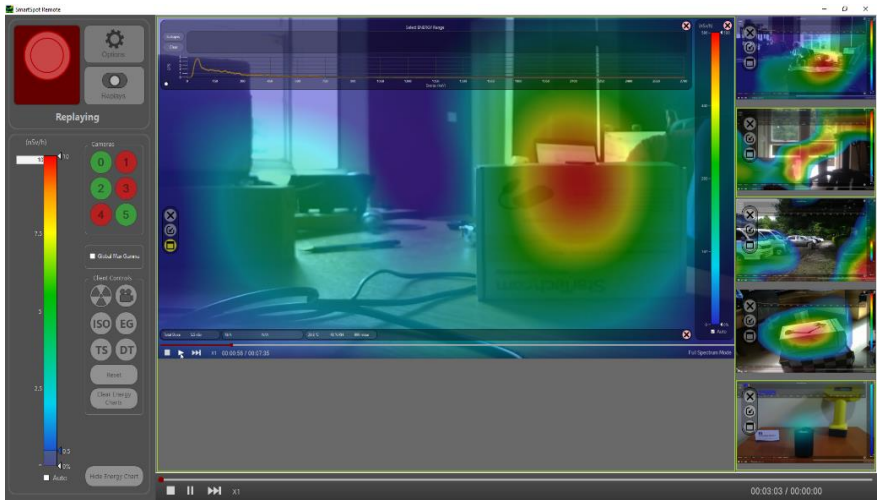
RMX-RAY Benefits

	Portable	Handheld	Highly Sensitive	Multiple Hotspots Detected	Instant Start Up	No Cooling/ Warm Up	View Isotopes	Isotope Identification	Multiple Isotope Identification
RMX-RAY	✓		✓	✓	✓	✓			
RMX-RAY C	✓	✓	✓	✓	✓	✓			
RMX-RAY S	✓		✓	✓	✓	✓	✓		
RMX-RAY SC	✓	✓	✓	✓	✓	✓	✓		
RMX-RAY ISO	✓		✓	✓	✓	✓	✓	✓	✓
RMX-RAY ISO C	✓	✓	✓	✓	✓	✓	✓	✓	✓
RMX-RAY MINI	✓	✓	✓	✓	✓	✓	✓	✓	✓

Add-Ons: MultiScreen

- A consolidated view of multiple cameras on a single monitoring station.
- IP comms based command and control solution, which allows capture and playback feeds from multiple RMX-RAY units to be displayed and controlled from a single station.
- Deployable virtually anywhere, even geographically disparate locations.
- The RMX-RAY units can be named, grouped and controlled individually or as a group; thus allowing operator flexibility to control and monitor the RMX-RAYs as needed.
- Feeds can be undocked, allowing free movement between multiple screens, when required.



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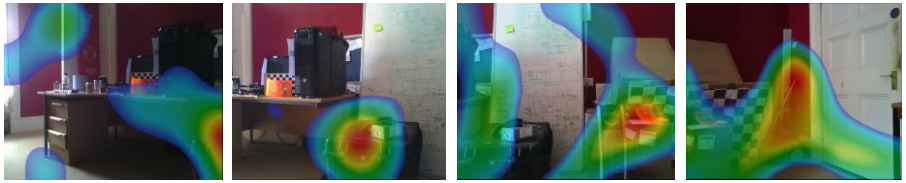
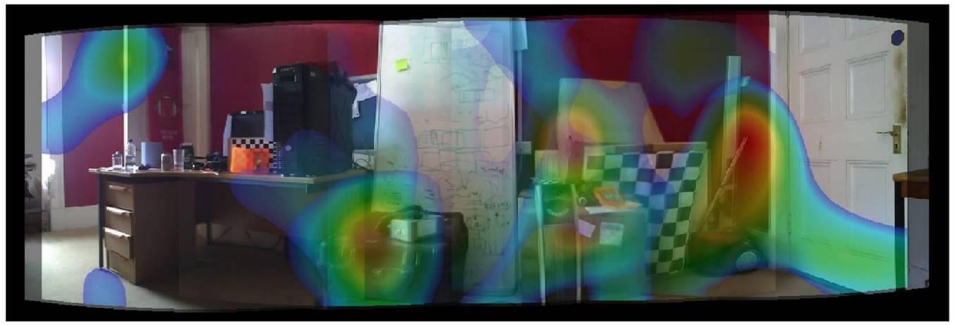
Add-Ons: GammaRama

Panoramic Imaging

- View hot spots within a large area, with GammaRama. This additional feature provides panoramic, 360 degree images and overlays gamma information.

- GammaRama enables end users to survey entire areas (i.e. contaminated rooms) on site, quickly and easily with no post-processing. End users can analyse contamination patterns; determining and prioritising regions to be decontaminated/decommissioned first.





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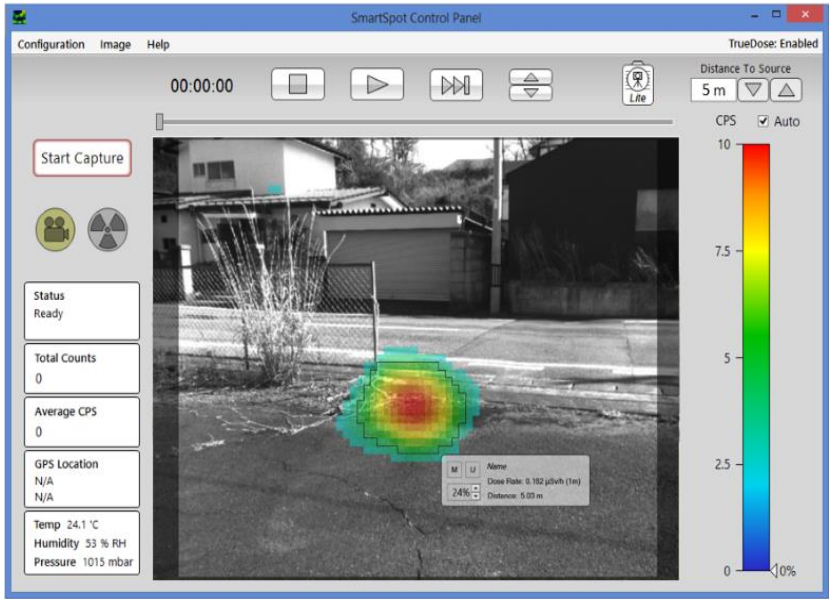
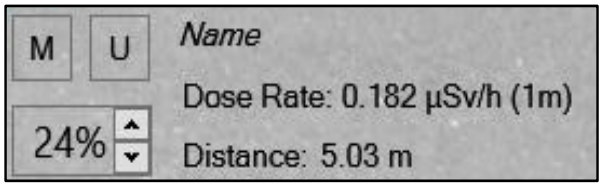
Add-Ons: TrueDose2D

Enabling the user to measure an identified hot spot(s), TrueDose 2D is simple to use. By pointing a laser range finder at the target, the distance is measurement is transferred to the RMX-RAY software, where calculations are discretely performed to provide an indicative dose rate measurement of the hot spot.





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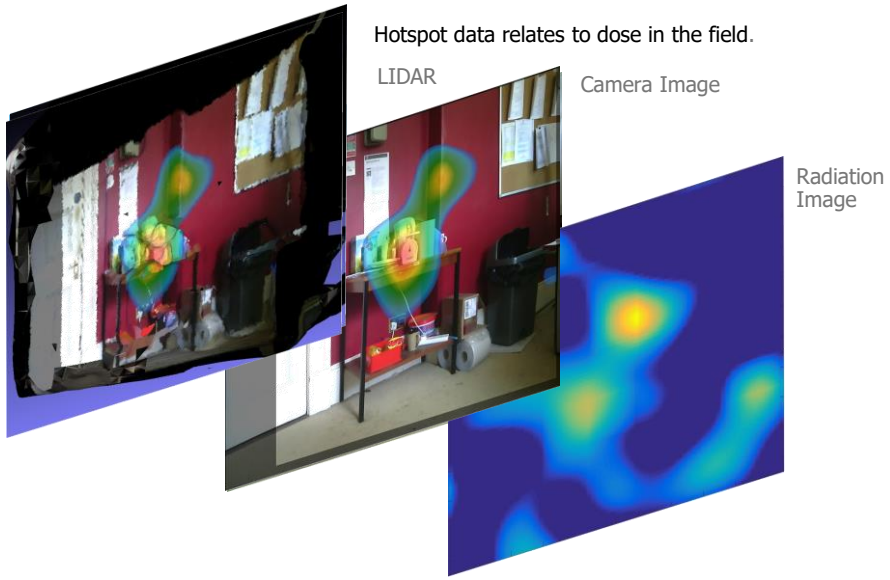
Add-Ons: TrueDose3D

- LIDAR, 3D analysis provides the RMX-RAY with enhanced dose information.
- The current RMX-RAY offerings provide 2D images, with a video image superimposed with a gamma image.
- LIDAR, provides an additional 3D layer, which combined with the video image and gamma image displays hot spots that relate to dose in the field.



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