

# Security Operative Scenarios

The most efficient Radionuclide Identifying Device (RID)



**CAEN SyS**

Systems & Spectroscopy Division



# The Security Operative Scenarios

The introduction of intelligent systems in nuclear security applications increases the safety of the operators (ALARA - As Low As Reasonably Achievable) and measurements become easier, faster and more reliable than before. A rapid decision-making procedure is an essential requirement, as is the extrapolation of information from a network of sensors. The increase in terrorist attacks in recent years has also highlighted the critical importance of nuclear security and safeguard technologies.

Therefore, CAEN **SyS**, having blended CAEN strong and technical know-how and experience, is introducing a family of security systems to better address nuclear security applications. They integrate smart technologies and data fusion processes to limit the operator exposure to provide real-time information for optimizing emergency response.

It provides state-of-the-art systems designed to detect and identify Special Nuclear Material (SNM), to control all type of nuclear material and other radioactive substances, secure them and detect their diversion or transportation for terrorist use, in order to improve security public health.



## SECURITY OPERATIVE SCENARIOS

### PUBLIC EVENTS

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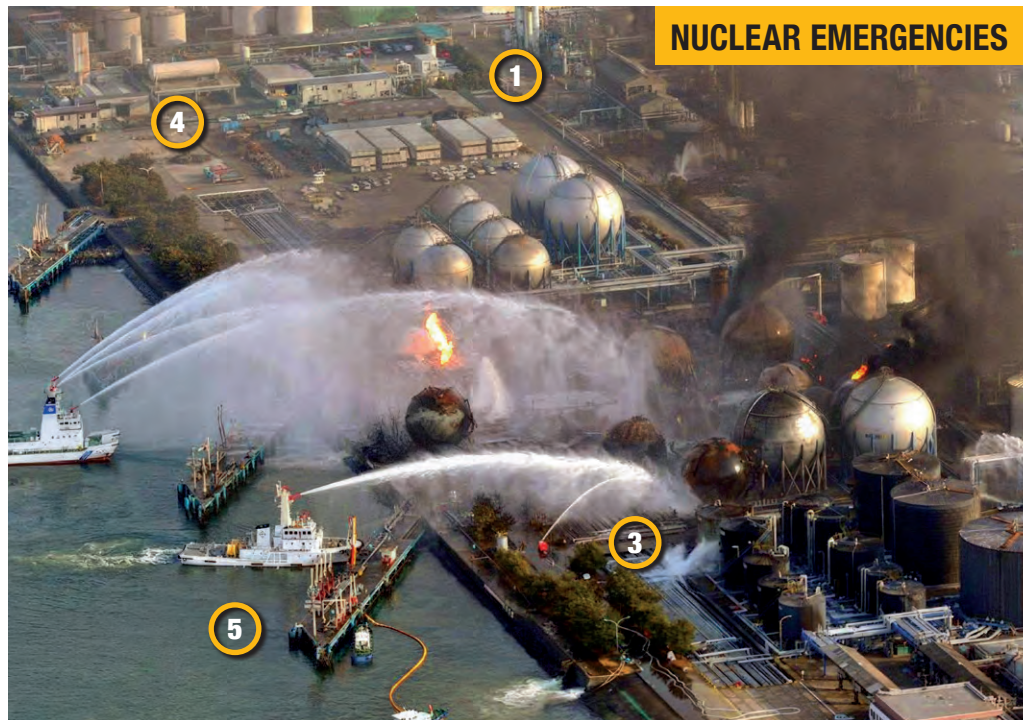
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### NUCLEAR EMERGENCIES



#### 1 GAMON-Drone Dose and Spectrometric Detection Unit, Light Weight

GAMON-Drone is a compact and light weight spectrometer specifically designed for UAV environmental radiation protection, inspection, and site remediation after the dispersion of radiological or nuclear material.

#### 2 GAMON-Mobile Vehicle Mountable Gamma Spectrometric Mapping System

GAMON Mobile is a high-efficiency detection system designed to perform radionuclide identification from a moving vehicle such as e.g., a car, helicopter or boat.

#### 3 Sniper-GN Special Nuclear material Portable identifier

The SNIPER-GN is a radiation detection system designed to be quickly deployed by the nuclear security community for homeland security and/or for emergency response purposes.

#### 4 CLEANDEM UGV SNM identification remoted system for Unmanned Ground Vehicle

The state-of-the-art Unmanned Ground Vehicle (UGV) is engineered to perform remote operations in otherwise inaccessible and heavily contaminated areas.

## ACCESS CONTROL



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## INFRASTRUCTURE SECURITY



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### 5 GAMON-Diver Compact Underwater System for Radionuclides Identification

The GAMON-Diver is a highly efficient spectroscopic measurement system designed to perform for underwater radiometric measurement.

### 6 DiscoverRAD Radionuclide Identifying Device (RID)

The DiscoverRAD is an ultra-compact, rugged, sensitive Radionuclide Identifying Device (RID). It provides superior usability by offering a wider energy range, higher throughput, and better stability in a wearable handheld.

### 7 GAMON S Gamma radiation spectroscopy system for real-time radiation monitor

The GAMON S spectrometer, for outdoor and indoor real-time radiation monitoring, runs automatic isotope identification and isotope related dose rate evaluation.

### 8 UNATTENDED Remote measurement systems

The UNATTENDED System is designed to autonomously monitor and detect the presence of Special Nuclear Material (SNM) without requiring constant human supervision.

# PUBLIC EVENTS

Nuclear security is one of the most urgent policy issues of the 21st century, but it poses serious technical obstacles.

Engineering has been tasked with a series of crucial challenges: discovering all the dangerous nuclear material in the world, tracking and securing and detecting its diversion or transportation for terrorist use.

Improving our ability to secure material and to detect it more quickly and from a further away is crucial to meeting these challenges. Perhaps the most critical issue concerns the detection of hidden (SNM) Special Nuclear Materials for terrorist activities.

Unfortunately, plutonium theft or diversion, while difficult, is not impossible and represents a serious threat to nuclear material today.

## ► Operative Applications

- Airport Security Checkpoints
- Entry-points for concerts, sporting events, and other large public gatherings
- Discrete scanning for advanced detection in crowded public areas
- RDD Search & Detection in Airport and Harbor Cargo Containers
- Preventative Radiation Survey for event protection

The **SNIPER-GN** and the **GAMON-Mobile** are radiation detection systems designed to be quickly deployed by the nuclear security community for homeland security and/or for emergency response purposes.







# NUCLEAR EMERGENCIES

The introduction of automatic systems in nuclear security applications increases the safety of the operators (ALARA - As Low As Reasonably Achievable) and measurements become easier and faster than before. A quick decision-making procedure is an essential requirement, as well as the extrapolation of the information from a network of sensors.

For this reason, CAEN SyS is introducing a family of security systems to better address nuclear security applications. They integrate smart technologies and data fusion processes to limit the operator exposure and providing information in real time for the optimization of prompt intervention.

## ► Operative Applications

- Radioactive sources and SNM Search identification and mapping
- Nuclear facilities and radiation-sensitive areas
- Nuclear Industry Infrastructure access monitoring
- Public infrastructure early warning detection
- Public and Goods transportations



The **GAMON-Drone** is a compact and independent system designed for radiological threat searches.

The **CLEANDEM UGV**, SNM identification remoted system for Unmanned Ground Vehicle.

# ACCESS CONTROL

Nuclear security has attracted world attention to the risk of nuclear terrorism. The impact of nuclear terrorism may be worldwide.

The 11 September 2001 (9/11) terrorist attacks, the accidents at Three Mile Island in 1979, Chernobyl in 1986, Fukushima in 2011 have had a strong impact on emphasizing the importance of international nuclear security and safety.

The overlap of security and safety is crucial since both are concerned with the protection of people, society, and the environment.

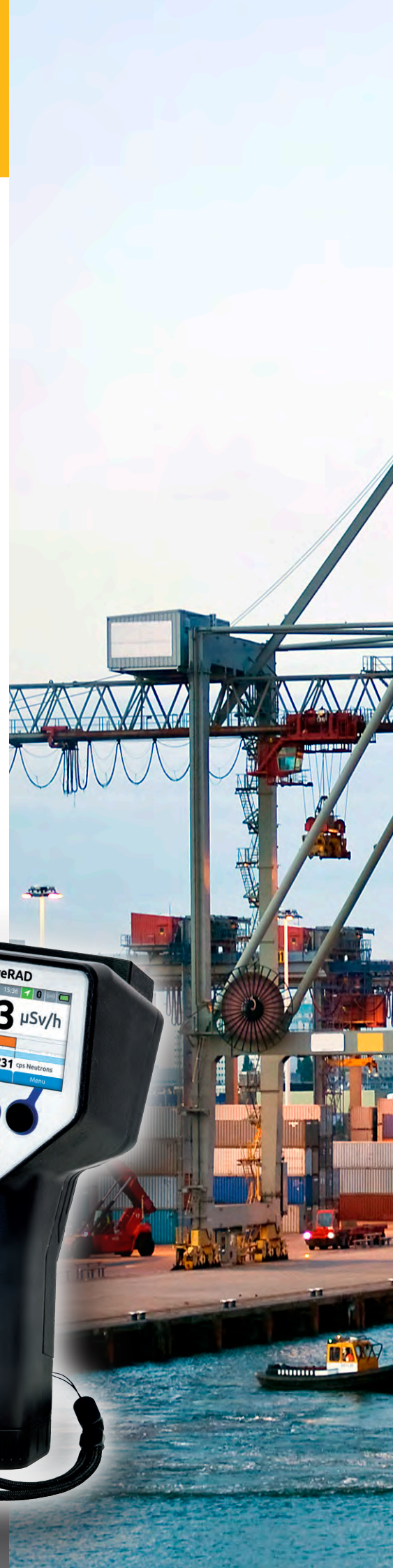
## ► Operative Applications

- Search and Secure operations
- Radiological dispersal device (RDD) detection and identification
- Security access and clearance areas
- First responder prompt intervention
- Customs border inspections



The **DiscoverRAD** is high-efficiency Radionuclide Identifying Device (RID).

The **GAMON-Diver** is a highly efficient spectroscopic measurement system designed to perform for underwater radiometric measurement.







# INFRASTRUCTURE SECURITY

In the rapidly evolving landscape of global security, the protection and resilience of critical infrastructure emerge as paramount.

Our approach to infrastructure security is rooted in a comprehensive risk management framework, integrating advanced technological solutions with robust physical and cyber defense strategies.

Our methodology includes rigorous threat assessments, leveraging cutting-edge surveillance and monitoring systems, coupled with AI-driven threat detection algorithms. This proactive stance is augmented by our commitment to innovation in barrier technologies and access control systems, ensuring a fortified perimeter against a spectrum of threats.

## ► Operative Applications

- Radioprotection of Nuclear facilities
- Emergency Response Planning
- Nuclear Industry Infrastructure access monitoring
- Radioactive sources and SNM Search identification and protection
- Critical Infrastructure Resilience

The **GAMON-S**, an advanced Spectrometer, is pivotal in our infrastructure security strategy, offering real-time radiation monitoring.

Complementing this, the **UNATTENDED** system is a cutting-edge measurement solution designed to detect the presence of Special Nuclear Material (SNM).



# GAMON-Mobile

## Vehicle Mountable Gamma Spectrometric Mapping System



GAMON Mobile is a high-efficiency detection system designed to perform radionuclide identification from a moving vehicle such as e.g., a car, helicopter or boat. The system is very well suited to be operated on-field to assess rapid threats and to monitor large areas via mobile mounting/deployment. It can identify radionuclides and differentiate them by category, e.g., NORM, Medical, Industrial. GAMON Mobile is ideal for scanning sensitive areas, entry points and strategic areas such as embassies, EXPO events, critical infrastructure, airports, railway stations. GAMON Mobile is composed of spectrometric and dosimetric units.

The GAMON Mobile spectrometer performs automatic isotope identification and the isotope related dose rate evaluation. Real-time data processing and defined isotope-based alarm allow GAMON Mobile to detect the presence of artificial nuclides more effectively and in a shorter amount of time than traditional dose meters.

The system can be used in multiple scenarios for gamma radionuclide identification in case of incident mitigation, for access point security or environmental monitoring including both Gamma and Neutron Alarms.

### Main Features

- Discrete housing for outdoor monitoring in public areas
- Spectroscopic and dosimetry probes for the identification of radionuclide gamma emitters
- Neutron probe for detection of neutron emitters
- Extended operation with rechargeable and hot swap battery for more than 8-hour continuous acquisition
- Wide data storage with the capability of saving more than 1-month continuous data acquisition
- Web interface for fast and easy system and isotope-based alarm configurations
- Georeferenced measurement map for real time data visualization
- Scintillator detectors NaI(Tl), CeBr3, LaBr3(Ce) or NaI<sup>TM</sup> for gamma and neutron detection

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# Sniper-GN

## Special Nuclear material Portable identifier

The SNIPER-GN is a radiation detection system designed to be quickly deployed by the nuclear security community for homeland security and/or for emergency response purposes. The SNIPER-GN can “detect and identify” Plutonium, SNM, and spent fuel in just a few seconds and at distances ten times greater than current detection standards (ISO and ANSI) enabling security personnel to immediately recognize and resolve hidden threats without the need to introduce costly secondary detection measures or highly specialized personnel. A patented algorithm allows to identify the SNM through neutron measurements, very difficult to shield and detectable at high distance (this feature is not yet included in any ISO and ANSI standard).

This new compact and portable instrument can be easily hidden in a backpack or a trolley to be used in multiple scenarios ranging from rapid implementation in public events to perimeter monitoring of critical infrastructure. SNIPER-GN can also be employed for radiation monitoring of harbors or airports cargo areas, for customs borders inspection and for first responder.



### Main Features

- Detection and localization of radioactive materials such as Special Nuclear Material (SNM) and Radiological Dispersal Devices (RDD)
- Neutron source identification with discrimination between fissile material, alpha-n source, Plutonium and Uranium
- Identification of gamma ray emitters and NORM sources
- Wi-Fi connection to tablet for data visualization
- Software functionalities: search, mapping and identification
- Backpack or trolley portable system (<10 kg)
- Battery powered with more than 10 hours of autonomy

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# GAMON-Drone

Dose and Spectrometric Detection Unit, Light Weight



GAMON-Drone system is designed to offer the best combination of portability, low power consumption and performance. The unit is assembled in a lightweight enclosure that contains both the Scintillator Detector and the Digital Signal Processing Electronics.

The GAMON Drone spectrometer performs automatic gamma isotope identification and isotope-related dose rate evaluation. Real-time data processing and defined isotope-based alarm allow GAMON-Drone to detect the presence of artificial nuclides in a shorter amount of time and more effectively than traditional dose rate meters.

The GAMON Drone system is designed to offer the best combination of portability, low power consumption and performance. The unit is assembled in a lightweight case that contains both the Scintillator Detector and the Digital Signal Processing Electronics that performs spectrum stabilization. The spectroscopy detector is configured to collect gamma interactions in the energy range from 50 keV to 3 MeV.

## Main Features

- Mobile system for radiological search and monitoring purposes
- Automatic radionuclides analysis with configurable library
- Embedded gamma dose rate and spectrometry measurement units
- Programmable isotope based and dose rate alarms
- Web page for an easy system configuration and visualization of the measurements
- Georeferenced and real time data visualized by the operator
- Compatible with alternative scintillation detectors, e.g. NAIL™ and LaBr3(Ce)
- Internal database for an easy handling of the acquired data
- Count rate alarm and alarm reporting to the operator directly on the notebook
- Embedded Gain stabilization of the detector

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# CLEANDEM UGV

## SNM identification remoted system for Unmanned Ground Vehicle

The state-of-the-art Unmanned Ground Vehicle (UGV) is engineered to perform remote operations in otherwise inaccessible and heavily contaminated areas. Equipped with cutting-edge gamma and neutron radiation probes, this UGV offers a critical advantage in nuclear safety and security. Its advanced instrumentation enables precise measurement of gamma and neutron radiation levels while facilitating the identification of special nuclear materials, all without exposing operators to potentially harmful radioactivity.

The advanced automated Unmanned Ground Vehicle (UGV) boasts cutting-edge gamma and neutron radiation probes. These instruments enable precise measurement of gamma and neutron radiation levels, while also allowing for the identification of special nuclear materials. This high-tech UGV serves a critical role in nuclear safety and security operations, ensuring the accurate detection and monitoring of radioactive substances in various environments.



### Main Features

- UGV mountable gamma and neutron detection system
- Detection and localization of radioactive materials such as Special Nuclear Material (SNM) and Radiological Dispersal Devices (RDD) even when moderated (polyethylene), shielded or masked.
- Remotized UGV to measure gamma and neutron hot spots in unaccessible areas
- High efficiency gamma/neutron detector for neutron source identification.
- Discrimination between fissile material, alpha-n source, Plutonium and Uranium (enrichment estimation level in 1 min).

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# GAMON-Diver

## Compact Underwater System for Radionuclides Identification



The GAMON-Diver is a highly efficient spectroscopic measurement system designed to perform for underwater radiometric measurement. The system can be deployed in multiple scenarios for gamma radionuclide identification in case of accident mitigation, first emergency response or can be installed as a long term monitoring device for sensitive underwater locations as port access points, nuclear facilities and Oil&Gas infrastructures.

The GAMON-Diver can be deployed in salt and freshwater. It can be used for dynamic mobile underwater searches or stably mounted on a buoy for gamma spectroscopic measurements in real time. For long term environmental monitoring the data is transmitted to a central monitoring station that gather together the information of the deployed sensor network.

The hermetic case allows the instrument to operate at depths of 450 meters (45 ATM in water). GAMON-Diver can identify gamma-emitting radionuclides and differentiate them based on the category they belong to, distinguishing between NORM, medical and industrial.

### Main Features

- Underwater system for up to 450 m depth (45 ATM) in both fresh or salted water for radiological search by diver operator or in static conditions
- Rechargeable and Hot Swap battery for daily measurements (8h of operation with battery)
- Integrated GPS used for easy mapping of the measurements
- Wired communication during the measurement session and also wireless capability for the configuration of the system
- Easy probe cleaning

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# DiscoverRAD

## Radionuclide Identifying Device (RID)

The DiscoverRAD is the most efficient Radionuclide Identifying Device (RID) currently available on the market.

The DiscoverRAD provides in a user friendly interface:

- Dose rate mode: with neutrons and dose rate (in Sv/h or R/h) real-time values and alarm thresholds displayed simultaneously. Radioprotection alarms are provided by audible and vibration alarms
- Survey mode: with gamma, neutron and dose rate real-time values and gamma and neutron alarm thresholds displayed. An audio alarm with a tone proportional to the count level warns the user of the severity of the threat
- Easy finder mode: provides directionality to easily localize the source
- Identification mode: with live spectrum visualization and automatic report generation including: identified isotopes, their category (IND, NORM, MED, SNM) and confidence level of the identification



### Main Features

- Detects and identifies nuclides in mixed, shielded, and heavily masked configurations including Special Nuclear Material
- Spectra view and analysis with data storage (25 GB) for reach back
- Small, lightweight (< 1,25 Kg, <2,7 lbs)
- Underwater operation to 10 meters (IP68)
- High accuracy dose measurement

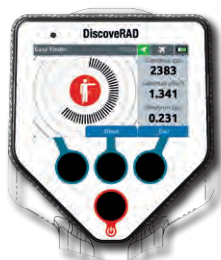
- Spectrometry at up to 1 million cps between 10 keV to 10 MeV
- User Interface with day and night view
- Finder mode with directionality

#### PUBLIC EVENTS

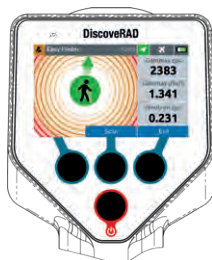
#### NUCLEAR EMERGENCIES

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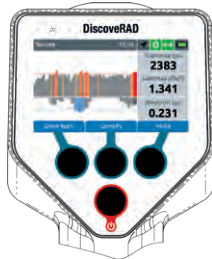
Easy Finder while scanning



Easy Finder with direction



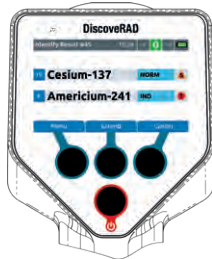
Dose rate mode



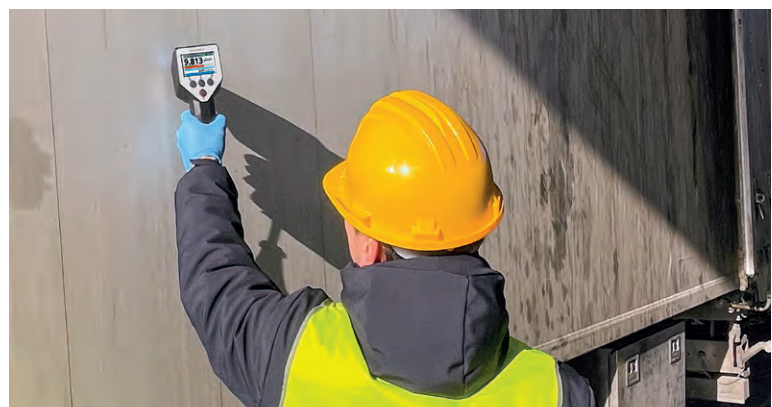
Finder mode



Identification mode



Identification results



# GAMON-S

## Gamma Radiation Spectroscopy System for Real-Time Radiation Monitor



The GAMON-S spectrometer series has been designed for outdoor and indoor real-time radiation monitoring, for early environmental warning and emergency response. It can operate in harsh weather conditions and is protected from rain and moisture.

The GAMON-S can be deployed in a wide range of scenarios, as in permanent ring monitoring as well as in moving monitoring stations. Thanks to the integrated GPS the system position can be easily monitored real time. The GAMON-S spectrometer runs automatic isotope identification and isotope related dose rate evaluation. The real time data processing and the defined isotope-based alarm allow GAMON-S to detect the presence of artificial nuclides in a short time window and more effectively compared to traditional dose rate meters.

### Main Features

- Gamma radiation spectroscopy system based on scintillation detector and Geiger-Mueller counter
- Based on an active standalone MCA device for the digitization of outdoor gamma spectroscopy signals (patented)
- Onboard web interface for easy configuration of isotope based alarms
- Internal database for summary reports and plots, easily generated by the embedded web interface
- Robust spectrum stabilization algorithms
- Big onboard data storage for long autonomous data taking
- Designed for operating outdoor in extreme weather conditions from -40 to +60 °C
- Robust case, designed to guarantee IP68, including the power and the communication connectors
- Suited for marine environmental survey thanks to the optional fiber glass external case
- Design for easy wall and pole mounting
- Wired and Wireless communication interfaces: USB 2.0, Ethernet, WiFi and 3G/4G LTE
- Configurable list of communication interfaces for selecting primary and backup interfaces
- Quick and easy to install and commission thanks to onboard web graphical interface
- Autonomous delivery of email and SMS on alarm to a configurable list of recipients

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# UNATTENDED

## Special Nuclear Material Remote Measurement Systems

The UNATTENDED Special Nuclear Material (SNM) Remote Measurement System is designed to autonomously monitor and detect the presence of special nuclear materials with simultaneous gamma & fast neutrons measurements and without requiring constant human supervision.

It is based on the use of High Efficiency Gamma CeBr3 detectors with a Full Width at Half Maximum (FWHM) less than 4.0%, and 4x Fast Neutron Detectors for both neutron counting and coincidence measurements.

This type of system is crucial for security and nuclear non-proliferation efforts.



### Main Features

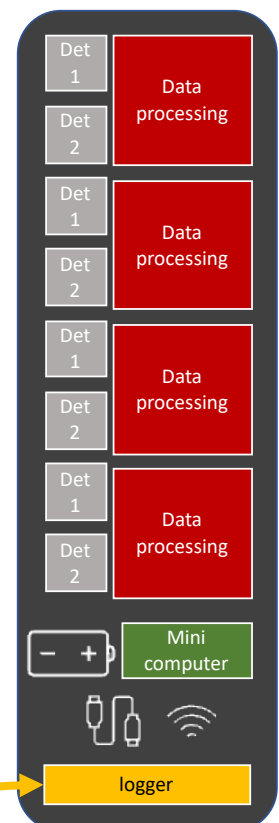
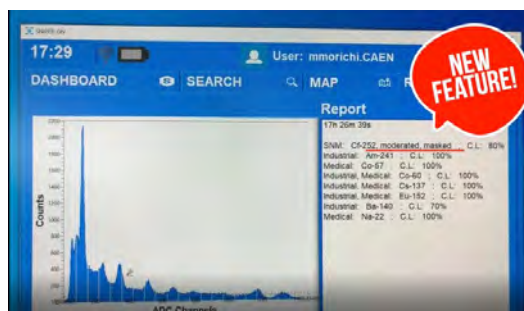
- Radiation detectors (Spectro Gamma & n);
- Electronic for Internal data processing;
- Mini-computer for internal data logging;
- Battery powered (battery backup);
- Wi-Fi connection for data visualization;
- Fault tolerant system;
- Spectrum saving over a configurable time window;
- Count saving over a configurable time window;
- Automatic identification over the cumulated spectrum at the moment of the triggered alarm;
- Spectrum cumulating over a moving time window;
- Logger placed in the sealed cabinets;
- Web interface for managing the functionalities;
- Possibly integrated in the present UDL1.

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CAEN SyS, the new Systems & Spectroscopy Division of CAEN SpA, is a worldwide leader in development of Radiation Measurements Systems and Spectroscopy Solutions, engaged with high performance operations involving Nuclear Facilities, Measurements Laboratories, Security and Safeguards Applications.

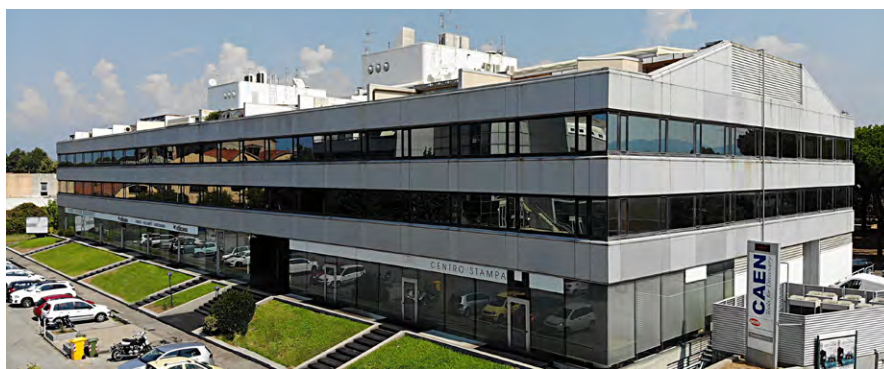
CAEN SyS Systems & Spectroscopy Division is built upon CAEN traditions of teamwork and partnership.

The CAEN Network Companies is a cluster of Companies with excellence know-how. Decades of collaboration and co-development with very large international research projects have maximized CAEN SyS capability to translate customer's needs and expectations into cost-effective and reliable solutions.

CAEN SyS enormously benefits from its foundational relationship with CAEN, a world leader in designing multi-input electronics for a wide range of radiation detectors, and nowadays is involved in several leading-edge R&D collaborative projects, to continue expanding and developing expertise in high-level electronic design, and to extend competence and skills into complementary and relevant applications for the benefit of the community.

CAEN SyS is committed to delivering exceptional nuclear measurement instrumentation, expertise and technical support, offering radiation detection instrumentation and integrated turn-key solutions with added value and operational benefit for customers, enhancing safety and security through nuclear measurements in the SECURITY, SAFETY and LABORATORIES areas.

**For more information visit: [www.caensys.com](http://www.caensys.com)**



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# CAEN SyS Spectroscopy Division

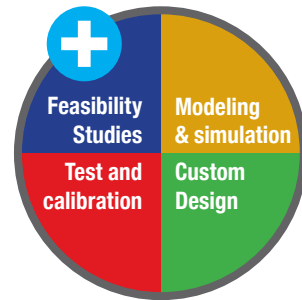
CAEN SyS: Systems & Spectroscopy Division of CAEN SpA, is a worldwide leader in development of Radiation Measurements Systems and Spectroscopy Solutions for Nuclear Facilities, Nuclear Power Plants, Nuclear Security and Nuclear Safeguards Applications.

CAEN SyS is committed to delivering exceptional nuclear measurement instrumentation, expertise, offering radiation detection instrumentation and integrated turn-key solutions with added value and operational benefit, enhancing safety and security through nuclear measurements.



## EXPERIENCE

Over 40 years of experience in design and manufacturing of Nuclear Electronics; executed several thousands of signal processing and data acquisition systems for fundamental research applications, particle accelerators, and nuclear applications, including extensive projects for CERN, USA DOE Laboratories (Oak-Ridge, Los Alamos, Sandia, Idaho, ARGONNE, Jefferson, Berkley, Fermi Laboratories; ENEA, INFN, IAEA, CEA, IRSN, PSI, AREVA, ORANO, SCK-CEN, EURATOM, and several International nuclear physics facilities such ITER, TOKAMAK...



## CAPABILITIES

Full electronic design with customization also with Radiation Hardening MCNP and GEANT4 Modeling and simulation for gamma & Neutron system design support Irradiation Laboratory and Calibration Laboratory Static & Dynamic testing of Nuclear Measurement Systems Environmental testing & EMC verification of Instrumentation.



## NUCLEAR INSTRUMENTS PRODUCED

- Radiation Monitoring Systems (GAMON-S and GAMON-D)
- Radiological Survey Systems (Gamon-Mobile, Gamon Drone)
- Nuclear Waste Characterization System: Gamma & Neutron: Passive and Active interrogation MICADO, DIgiWaste-RadHand
- Underwater Measurements (GAMON-Diver)
- Nuclear Safeguards Unattended (CAEN Shift Register)
- Nuclear Security (SNIPER G-N and DiscoverRad)
- Health Physics : Low Background Whole Body Counter
- Neutron Measurements (Counting and Position)

## SERVICES OFFERED

- Feasibility Studies for Nuclear Measurements Applications
- Design of Customized Nuclear Systems (Fuel Cycle, Nuclear Power, D&D Nuclear Safeguards analysis and design of solutions)
- Nuclear Waste Characterization System Design with Digitization & AI.



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