ELSE NUCLEAR

peo DETECTION

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Else Nuclear

ELSE NUCLEAR S.r.l. is an Italian OEM company specializing in advanced radiation-detection and environmental-monitoring systems for nuclear safety, industry and research.

ELSE NUCLEAR S.r.l., headquartered in Italy, designs and manufactures high-precision systems for radiation detection, measurement and monitoring in applications ranging from nuclear power-plants to hospitals, research centres and environmental agencies.

Their product portfolio includes spectrometry systems, environmental monitoring networks, radiation portals, in-vivo counting equipment and emergency-response solutions — many of them custom-engineered to meet specific client needs.

ELSE NUCLEAR emphasises innovation, reliability and client support: their team collaborates with universities and international labs via R&D to push detection technology forward, and their systems are installed in more than 20 countries worldwide.

RADIATION DETECTION

peo DETECTION

GM-1, MERCURY

According to the measurement requirements, different versions of Geiger-Müller detectors are available:

- GM-1: single-Geiger detector (up to 1 mSv/h)
- MERCURY: double-Geiger detector (up to 1 Sv/h)

All models employ energy-compensated tubes, lodged in high-protection aluminium cylinders, together with a built-in HV board.

MERCURY detectors are equipped with 2 Geiger-Müller tubes to reach a wider measurement range. An internal electronics automatically switches to the suitable GM tube according to the count rate level.

Both the GM-1 and the MERCURY detectors are connected to and managed by a SATURN ratemeter, which provides power supply, signal processing and data visualization. Each detector-ratemeter couple forms a monitoring unit, which can be connected in a network to a central host PC running 5700 sMON management software.

Among the special versions and accessories available, we mention in particular:

- Stand-alone version of GM detectors for direct connection to PC
- IP65 housing for MERCURY for outdoor installations
- PS-ZB accessory for MERCURY, providing battery-operated power supply and ZigBee Wireless communication, and ZB-TC receiver connected to the ratemeter to acquire the data
- GPS locator for PS-ZB

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Radiation Detection › Environmental Monitoring

HERMES GSU

HERMES GSU is a portable gamma spectrometry system designed for rapid and precise in-field analysis of environmental samples. As part of the HERMES product line, it features a rugged, modular, and self-contained design housed in a high IP-rated technical case, ensuring durability and reliability in demanding conditions.

HERMES GSU quantifies isotope activity concentrations based on a rich built-in, yet fully-editable, isotope library. Its portability and autonomous operation make it ideal for both routine monitoring and emergency response scenarios.

Samples can be directly collected from the field, placed in 500 ml Marinelli beakers, and inserted into the built-in 1 cm lead-shielded well, minimizing background radiation for immediate, on-the-spot, low MDC analysis, and enhancing measurement accuracy and sensitivity. The system automatically calculates activity concentrations, making it a powerful tool for in-situ, laboratory-grade measurements.

HERMES GSU features advanced routines for gain stabilization, dead time correction, and automatic energy calibration (relying on natural background only, thus not requiring any radioactive reference source).

Efficiency calibration curves are generated using validated Monte Carlo simulations. Predefined efficiency curves are available for different sample matrices, including soil, water, and foodstuffs, across various densities. Custom calibration curves can be provided upon request.

THYMON

THYMON is a compact NaI(Tl)-based detector specifically conceived to fast, yet reliably, measure I-131 contamination in thyroid. Its compactness, ruggedness, light-weight, together with its simple and intuitive built-in software interface, make the device perfectly suited for emergency screening applications. The instrument can be used either hand-held or hands-free. The instrument is composed by three main subparts:

- Detector probe: a 1.5” x 1.5” collimated NaI(Tl) crystal coupled to a SiPM matrix and extremely compact readout electronics and MCA
- Extendable support: designed as both table-top and standalone, providing the possibility of hands-free operation
- Control tablet: IP65 water- and dust-proof 8” capacitive screen, wired-connected to the probe

The mechanics of the probe is specifically conceived to ensure the best alignment between the probe and the thyroid, guaranteeing excellent crystal-to-thyroid alignment, and reducing positioning uncertainties.

The control and analysis software installed on the control tablet is designed to be simple and intuitive, yet advanced and comprehensive. This is accomplished by combining a simple and intuitive interface with advanced calculation routines, which run automatically as the measurement start, without the need of operator intervention.

Data are stored locally on the tablet internal memory, and can be analysed and downloaded with dedicated software routines.

The automatic I-131 activity calculation is given for pre-defined age groups: 1 yo, 5 yo, 10 yo, 15 yo (Adult Female), Adult Male. Counts-to-activity conversion coefficients are calculated by dedicated Monte Carlo simulations based on detailed detector and thyroid numerical models. The simulations are always validated for the specific system through experimental tests performed with reference radioactive sources.

The activity is compared to 2 User-defined threshold levels, each defined per each age group, following the two Action Levels logic.

MDA as low as about 100 Bq can be achieved in 2 min screenings. The MDA can be further lowered by enabling the background subtraction option.

FOOMON

FOOMON is a portable fully-integrated instrument specifically conceived for screening of I-131, Cs-134 and Cs-137 accumulated in food samples. Its “on-the-field” design allows deploying the device in any kind of situation, such as routine campaigns or emergency procedures.

The whole device is self-contained in a portable high-IP-grade technical case, for an overall weight < 25 kg. The food samples are to be placed in 500 ml Marinelli beakers, which then are lodged inside a 1 cm thick lead shielding well upon the detector’s end cap. The complete setup and deployment of the system requires less than 5 minutes.

The User can manage FOOMON through the user-friendly control and analysis software installed on the embedded panel PC, automatically calculating the specific activity and the Minimum Detectable Concentration (MDC) of the sample (in Bq/kg). Data are stored locally and can be analysed and downloaded with dedicated software routines.

The measured activity concentration is compared with isotope-specific and food-group-specific alarms. In the case of an alarm, the measurement output is clearly labelled and the alarm status is clearly displayed on the software, which also activates the acoustic alarm.

The counts-to-activity-concentration conversion coefficients are calculated by means of dedicated Monte Carlo calculations.

The MDC achievable in 1 minute, with an average indoor background (150 nSv/h), is as low as about 150 Bq/kg for Cs-137 and Cs-134, and about 90 Bq/kg for I-131. Under the same conditions, MDC as low as about 30 Bq/kg for I-131, and about 40 Bq/kg for Cs-134 and Cs-137, can be achieved in about 10 minutes.

If enabled, the automatic background subtraction subroutine allows further lowering MDC and measurement uncertainty without increasing the counting time.

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HERMES

HERMES systems are rugged, portable units for radiation detection, designed and tailored for a wide range of operational scenarios such as gamma and neutron detection, dose rate measurement, gamma spectroscopy and more. HERMES systems are suited for emergency response activities, as they are mounted inside robust and high-IP technical cases, which can be handheld or vehicle-mounted.

The HERMES product line includes customisable configurations, such as:

- HERMES NAI or CSI, with NaI(Tl) or CsI(Tl) detector and MCA to perform gamma spectrometry
- HERMES GMT or PLA, with Geiger-Muller or plastic detector for high-sensitivity gamma monitoring
- HERMES NEU, with ^{10}BZnS neutron detector and plastic moderator for artificial neutron source detection
- HERMES SENTINEL, combining NaI(Tl), GM tubes and neutron detector for comprehensive radiation surveillance

HERMES units support remote operation via LAN or Wi-Fi through a smartphone or a tablet. According to the configuration, the proprietary software provides real-time dose rate data, nuclide identification, alarms, and interactive heat mapping. Scan results, GPS coordinates and events are automatically logged into the local memory for off-line processing.

HERMES units incorporate advanced gain stabilization, dead time correction, and automatic energy calibration based exclusively on natural background radiation (no source needed to calibrate).

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Radiation Detection › Laboratory Equipment

LEM – LIQUID EFFLUENT MONITORING SYSTEM

The LEM system is designed to sample the liquid effluents and to perform a spectroscopic analysis in Marinelli geometry.

LEM system is composed of the following main parts:

- Stainless steel frame
- Electrical and command board with touch-screen panel PC
- NaI(Tl) detector, 1 l Marinelli, 5 cm thick lead shielding well
- Self-priming pump (*)
- Software for system management, data acquisition and processing

The measurements are visualised in real time by the software, expressed in terms of specific/total activity through spectroscopic analysis.

LEM status and parameters are managed by the ELSE NUCLEAR software. The system provides also I/O contacts through dedicated connectors:

- Good functioning status output
- Alarm status output
- Pump activation input from customer PLC (*)
- Spare available I/O contacts (to be defined when necessary)

The software provides a calibration routine, to be used with a Marinelli calibration source (available as accessory).

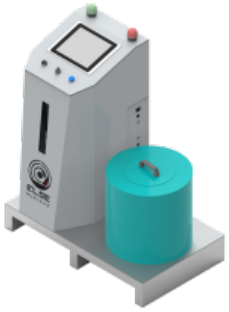
A test program is also available, separate from the main application, to be used for maintenance or periodical quality controls.

(*) If not available in the sampling/hydraulic equipment which LEM shall be connected to

MISTRAL XM

MISTRAL XM is a system designed to sample and monitor the gamma activity concentration resulting from air activation, in Marinelli geometry.

In particular, MISTRAL XM Rooms is designed for free air monitoring, whereas MISTRAL XM Stack is used to monitor the air expelled from a chimney or a stack. In both cases, “X” indicates the number of sampling points: up to 5 (Rooms) or 1 (Stack).



The system is composed of:

- acquisition and processing unit: APU
- sampling and detection unit: SDU-XM

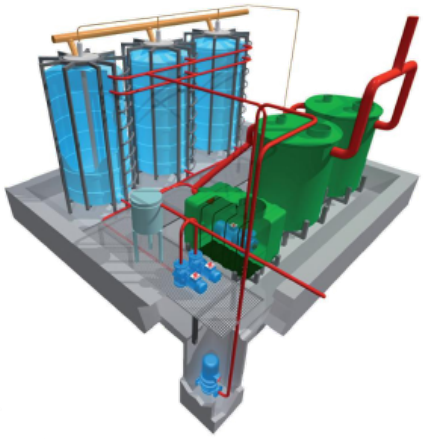
The APU is the main user interface with the system, and it consists in a command and control console including: a panel PC, the system electronics, a control flow meter for the pump, and an array of electrovalves (if needed). The SDU-XM includes the NaI(Tl) detector with MCA, a lead shielding well, and a pump for air sampling. The system also manages the expulsion of the monitored air.

The Stack version includes a flow rate meter (STACK-DFM), to calculate the specific activity of the expelled air volume.

The software installed on the PC displays in real time the measurement, controls the system status, and allows to set the operative parameters, such as the alarm thresholds. The user can define specific regions of interest (ROIs) and thus determine the specific activity (Bq/g) of the sampled air.

WDMS NT-VK

The WDMS NT-VK system is designed to collect and monitor radioactive wastewaters, which can be released only after their radioactivity drops below a defined value. The main application of such a system is related to diagnostic and therapeutic procedures involving radioactive substances, and their partial elimination through the patient’s metabolism.



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The WDMS NT-VK main components are:

- Purification group: Imhoff tanks designed to collect the wastewaters and to separate liquid from solid waste
- Sorting group: pumps and conduits pouring the wastewaters in the decay tanks
- Decay group: tanks array where the wastewaters are poured and stocked until their radioactive level drops below a defined value
- Sampling system: valves and pumps used by the system to wash the sampling circuit and to sample the stocked wastewaters, allowing the measurement in Marinelli geometry
- Release group: pumps and conduits releasing the wastewaters in the sewers, if allowed by the monitoring results
- Safety groups and devices: level and pump sensors installed in all the system critical stages, stopping the wastewaters flow in case of detected anomaly, and safety flooding well which can collect and stock wastewaters potentially overflowing from any system group

The entire system is locally managed by a PLC, which is commanded by a remote management software installed on a PC.

Through the interactive synoptic interface of the software the operator can activate the system automatic cycles, set the measurement parameters, visualize the alarms and release archives, and monitor the system’s status (filling levels, pump stages, measurements, alarms). Depending on the measurement results, and as defined by the procedures in force, the operator can also activate the monitored wastewaters release in the sewers.

NAUSICAA 2IC

The NAUSICAA 2IC system is designed to quantify the beta activity in air or gas streams, due to the presence of tritium or other noble gases, while compensating for the environmental gamma background.

NAUSICAA 2IC can be used in activities involving air sampling from rooms, stacks, hoods, or other effluent passages, process piping, glove boxes, and similar.

NAUSICAA 2IC is composed of:

- two identical, cylindrical, 10 litres, stainless-steel ion chambers
- a pneumatic sampling system
- an electrometer to amplify and manage the (typically very weak) ionisation current
- a local control unit with display and software

Ambient air is sampled in the upper chamber, while the lower one is sealed and filled with clean reference air. Ionizations occurring in the upper chamber are due to both environmental gamma background and beta contamination, whereas inside the lower chambers only gamma background interactions occur. The two chambers are provided with an opposite-polarity HV: the resulting output current is thus the difference of the two single outputs, i.e. the net beta contamination of the sampled air, expressed in activity concentration. An accessory equipment for filtering and drying the sampled air helps limiting as much as possible any spurious signals.

The NAUSICAA 2IC control unit manages data acquisition, processing and visualization. A touch-screen display allows parameters' setting and data visualization. A built-in acoustic and luminous alarm column provides proper warnings in case of alarm or malfunctioning.

NAUSICAA 2IC can be connected to a host PC through RS485 or ETH connection for remote data visualization.

With a 600 V value each camera can generate currents up to 10^{-8} A, with a saturation error < 20%.

BSS – BONNER SPHERE SPECTROMETER

The Bonner Sphere Spectrometer consists of an array of He-3 proportional counter thermal neutron detectors, each housed in a spherical HDPE moderator of different diameters.

BSS is proposed in two main configurations, adjustable according to the requirements, for single or multiple detectors.

An unfolding software (RUFUS), used to calculate the neutron spectrum, is also available for both configurations.

Each proportional counter is connected to a compact electronic module (2.5 cm diam. x 7.6 cm), providing:

- Precision wide-band charge-sensitive pre-amplifier and amplifier
- Discriminator circuit
- High voltage adjustment 0-2200 V
- Amplifier gain and discriminator threshold adjustment
- Analogue test points for shaped signals and HV

A user-friendly dedicated acquisition software can be installed on the PC managing the BSS, allowing the user to start and stop the measurements, to modify the parameters and to visualize the saved data.

The BSS standard set, designed to cover the neutron energy range from 1 meV to < 100 MeV, includes the following HDPE moderators: Ø 3”, Ø 3.5”, Ø 4”, Ø 4.5”, Ø 5”, Ø 6”, Ø 7”, Ø 8”, Ø 10”, Ø 12”, Ø 15”, Ø 18”.

The available configurations of BSS are:

- Single detector: includes only one He-3 proportional counter, to be inserted in one moderator sphere at a time. The detector is managed by a Counter Module and the user interface is the “Single counter” software.
- Multiple detectors: includes up to 16 He-3 proportional counters, and up to 16 moderator spheres (12 standard + 4 accessory), to be employed at the same time. The detectors are managed by a Datalogger and the user interface is the “DLOG” software.

NAUSICAA IC-T, ICP-T

NAUSICAA is an ion-chamber-based gamma radiation monitoring unit, available in two versions:

- IC-T for environmental measurements (9 decades electrometer)
- IC-T-PF for pulsed field measurements (7 decades electrometer)

Both versions include an ion chamber detector, an electrometer and a CPU-based acquisition and control unit.

The display visualises the dose rate value and status messages, while a built-in buzzer and coloured LEDs provide additional status indications.

The alarm thresholds, the operational parameters and the measurement data are saved in the internal memory. The user can set the parameters through the external keyboard or 5700 sMON software (if provided).

The standard NAUSICAA configuration, suitable for indoor use, is composed by a 3U 63HP table box housing the electronics modules, and the ion chamber directly installed on top of it. Wall mounting accessory and trolley kit are also available, as well as an IP54 enclosure.

It is possible to connect one or more units to a host PC (running 5700 sMON software) through Ethernet or serial communication.

The ICP-T detector is identical to NAUSICAA, but it does not include the CPU, being connected to and managed by a SATURN ratemeter.

The DISCOVERY IC-T unit is a special version of NAUSICAA, assembled in a IP65 housing, designed to operate outdoor; data can be transmitted through a wireless connection or downloaded through a dedicated utility.

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SATURN 5702

SATURN 5702 is a mobile station equipped with two detectors for gamma and neutron dose rate monitoring. The station includes:

- Ion-chamber-based gamma radiation monitoring unit: ICP-T or ICP-T-PF
- Neutron rem counter for pulsed fields: LUPIN BF3

The detectors and the electronics are housed in a trolley-mounted mechanical structure. The height of the trolley can be customized according to the customer needs, for example to centre the detectors with the beam line height.

Each detector can be removed from the trolley to be employed remotely, up to 20 m. An ALU alarm column is mounted on the top, providing luminous and acoustic warning signals related to the status of the mobile station (good functioning, pre-alarm and alarm). SATURN 5702 stations can also manage external devices through 4 sets of relay contacts.

The detectors are connected via external cables to a standard 19” electronics rack equipped with two dedicated SATURN ratemeter units (rack version). Each ratemeter features a display, 3 function keys with status LEDs, and a connector for TOUCHKEY2 external keyboard.

SATURN 5702 can be connected to a remote host PC running a data management software (5700 sMON) through ETH or RS485/422 connection.

SATURN I, SATURN II

The SATURN ratemeter is a compact acquisition and control unit, designed for managing and processing signals from any ELSE NUCLEAR connected detector.

- SATURN I: standard wall-mounted version
- SATURN II: wall-mounting version compliant with “Good Manufacturing Practice” requirements (no external cable or connectors)

All the ratemeter versions feature local function buttons with status LEDs, internal acoustic buzzer and a relay connector, used to manage external alarm columns or interlocks.

The SATURN ratemeter continuously acquires and processes the data coming from the connected detector, and compares results with user-defined alarm thresholds.

Two user-selected measurements can be displayed at the same time on the display, such as instantaneous or average count rate, dose rate, activity concentration, counts, dose or activity integrated values.

The user interface is accessible through an external keyboard, which allows local interaction with the full range of parameters (advanced setting is password protected). Measurements, thresholds and operating parameters are stored into an internal, non-volatile memory.

The ratemeter can communicate to and be remotely managed by a host PC through an Ethernet or RS485 network.

LUPIN BF3

LUPIN BF3 is an environmental monitoring unit for neutron H*(10) measurements, with unique excellent performance for neutron detection in pulsed fields.

The rem counter is composed of:

- BF_3 proportional counter
- Cylindrical moderating assembly
- Built-in power supply, signal management and control electronics

The electronics processes the signal coming from the detector and elaborates the instantaneous H*(10) rate value every second.

If required, the radiation sensitive electronics can be housed in a separate rack. An accessory IP54 version is also available

Data are sent to the connected SATURN ratemeter acquisition and control unit, which locally displays the instantaneous H*(10) rate and the integrated values and compares them to the pre-set alarm thresholds.

A LUPIN BF3 LITE version is also available, featuring a lighter build and a narrower energy range, suitable for all the applications that do not require to detect neutrons with energy above 20 MeV.

Papers published in international scientific journals:

- M. Caresana, M. Ferrarini, G.P. Manessi, M. Silari and V. Varoli, LUPIN, a new instrument for pulsed neutron fields, Nuclear Instruments and Methods in Physics Research Section A 712 (2013) 15-26.
- M. Caresana, C. Cassell, M. Ferrarini, E. Hohmann, G.P. Manessi, S. Mayer, M. Silari and V. Varoli, A new version of the LUPIN detector: improvements and latest experimental verification, Review of Scientific Instruments 85 (2014) 065102.

GSU – GAMMA SPECTROMETRY UNIT WITH NaI(Tl)

The GSU gamma spectrometry units employ a 3″x3″ NaI(Tl) crystal coupled to a photosensitive detector (either PMT or SiPM) and an MCA. The detector is installed in a 5 cm thick lead shielding well, with additional inner layers of tin and copper for enhanced background reduction.

GSU is designed to perform gamma spectrometry analyses of small samples, such as foundry casting samples, air particulate filters, environmental samples (rocks, soil, biological samples), positioned in sample holders which can be tailored to meet specific measurement requirements, or Marinelli beakers.

The User can manage the system through the proprietary ELSE NUCLEAR GSU system software, calculating the specific activity and the Minimum Detectable Concentration (MDC) of the sample expressed in Bq/kg, Bq/l, Bq/m^3, etc. The built-in background subtraction subroutine improves the MDC without increasing the measurement time. The software includes fully-customisable isotope libraries as well as User-settable isotope-specific activity alarm thresholds, available through password-protected functions.

The GSU-NORM is a special version of system specifically conceived to perform Naturally Occurring Radioactive Material (NORM) analysis of environmental samples, such as rocks, sediments or soils. Through its MCA and its dedicated software, the GSU-NORM system allows determining the specific activity of NORM isotopes, i.e. K-40, Th-232 and U-238, expressed in Bq/g, %K, ppm eU and ppm eTh.

The sample holders are custom-made supports that fit directly on the detector’s head, used to hold casting samples, test sources or other similar objects.

The Marinelli beakers are used to contain geological samples or other similar materials. Several volumes are available, from 250 ml up to 1 l, with different geometrical features.

Each GSU system includes efficiency curves and coefficients implemented in the analysis software, calculated through Monte Carlo simulations for each specific configuration, acquisition chain and measurement geometry. The simulations are always validated through experimental tests performed with reference radioactive sources.

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Radiation Detection › Laboratory Equipment

W-PIE – WIDE ENERGY ACTIVE NEUTRON SPECTROMETER

The W-PIE neutron spectrometer is a unique device designed for on-line neutron spectrometry measurements. The system features an extremely high counting efficiency, making it suitable to perform neutron spectrometry and absolute flux measurement for applications such as:

- homeland security
- cargo inspections
- calibration laboratories
- background suppression in high-energy physics experiments
- cosmic ray neutron sensing (CRNS) in agriculture
- snow water equivalent (SWE) measurements in hydrology

W-PIE employs ^{6}Li as neutron converter, ^{4}He as scintillating medium, and 24 independent low-voltage SiPMs as photosensitive components. The detector is surrounded by increasingly thick moderating assemblies, defining 4 detection sub-volumes each optimised for a specific spectral region. Signals are acquired and analysed by the built-in electronics and unfolding algorithm, or they can be saved as raw data for off-line analysis.

The response function of W-PIE, calculated via Monte Carlo simulations, is available for either on-line and off-line analysis. The response function and unfolding algorithm have been validated after thoroughly testing with reference radioactive sources, with quasi-monoenergetic neutron fields, and in the high-energy reference neutron field facility CERF at CERN.

The device is available in two configurations:

- W-PIE – standard, high-energy version, with Cd and Pb inserts, designed to be sensitive to neutrons up to 10 GeV
- HERMES W-PIE – lightweight and standalone low energy version, without high-Z inserts, designed to be sensitive to neutrons up to about 100 MeV

The W-PIE version is powered over Ethernet and communicates with a PC through Ethernet connection.

The HERMES W-PIE version is a standalone unit featuring a single board computer, a 4G router, a GPS and a dual-SIM system allowing remote control.

SP2 – SINGLE-SPHERE NEUTRON SPECTROMETER

The single-sphere neutron spectrometer SP2 is a unique device that allows performing active neutron spectrometry measurements by employing a single instrument instead of the usual multi-sphere BSS.

SP2 is characterized by the same high sensitivity and precision as BSS in determining the neutron flux over the entire energy range, while removing any reproducibility uncertainty. When employed with the on-line unfolding tool, SP2 can also perform real time measurements.

SP2 is equipped with 32 active ^{6}LiF-covered Silicon neutron detectors installed over six concentric layers inside the moderating assembly, so that they reproduce the spectrometric performance of a six-sphere BSS. The signals are acquired by the built-in electronics and can be either analysed on-line by the built-in unfolding algorithm, or saved as raw data for off-line analysis.

SP2 can be used in a great number of activities in scientific research: homeland security, cargo inspections, calibration laboratories, characterization of stray radiation fields for radiation protection purposes, periodical quality check of the neutron stray radiation field, all applications involving the need of a fast and precise measurement of the neutron spectrum.

A SP2 LITE version is also available, featuring a lighter build and a narrower energy range, suitable for all the applications that do not require to detect neutrons with energy above 20 MeV.

The response function of the device, calculated via Monte Carlo simulations, is available for either on-line and off-line analysis. The response function and unfolding algorithm have been validated after thoroughly testing with reference radioactive sources.

SP2 is the ideal device for performing active neutron spectrum measurements in every radiation environment, including mixed stray radiation fields, workplaces characterized by high gamma background and reference calibration laboratories.

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Radiation Detection › Portable Isotope Identifiers

B-RAD

B-RAD is a hand-held radio-isotope identifier (RIID) for gamma dose rate survey and spectrometry measurements, specifically designed to work in magnetic fields up to 3 T. For comparison, conventional devices fail to operate at intensities as low as 0.1 T.

Light and compact, B-RAD is ideal for radiation surveys and for local measurements of contamination or residual radioactivity in hot spots. The built-in software and algorithm allow performing accurate gamma spectrometry and dose rate measurement with a single instrument.

B-RAD employs a high sensitivity $LaBr_3(Ce^{3+})$ crystal directly coupled to a SiPM matrix. Its excellent scintillation properties, high energy resolution (3.3% FWHM at 662 keV) and fast response, together with the built-in pile-up and dead-time correction algorithms, allow the device to cover an extremely wide dose rate range (100 nSv/h to > 20 mSv/h).

This technology has been originally developed at CERN (*) and has become the standard for radiation surveys in the Large Hadron Collider (LHC) experiments. It is commercialized under an official license granted by CERN, with the “CERN Technology” label.

PORTABLE ISOTOPE IDENTIFIERS

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The measured activity concentration is compared with isotope-specific and food-group-specific alarms. In the case of an alarm, the measurement output is clearly labelled and the alarm status is clearly displayed on the software, which also activates the acoustic alarm.

The counts-to-activity-concentration conversion coefficients are calculated by means of dedicated Monte Carlo calculations.

The MDC achievable in 1 minute, with an average indoor background (150 nSv/h), is as low as about 150 Bq/kg for Cs-137 and Cs-134, and about 90 Bq/kg for I-131. Under the same conditions, MDC as low as about 30 Bq/kg for I-131, and about 40 Bq/kg for Cs-134 and Cs-137, can be achieved in about 10 minutes.

If enabled, the automatic background subtraction subroutine allows further lowering MDC and measurement uncertainty without increasing the counting time.

THYMON

THYMON is a compact NaI(Tl)-based detector specifically conceived to fast, yet reliably, measure I-131 contamination in thyroid. Its compactness, ruggedness, light-weight, together with its simple and intuitive built-in software interface, make the device perfectly suited for emergency screening applications. The instrument can be used either hand-held or hands-free. The instrument is composed by three main subparts:

- Detector probe: a 1.5” x 1.5” collimated NaI(Tl) crystal coupled to a SiPM matrix and extremely compact readout electronics and MCA
- Extendable support: designed as both table-top and standalone, providing the possibility of hands-free operation
- Control tablet: IP65 water- and dust-proof 8” capacitive screen, wired-connected to the probe

The mechanics of the probe is specifically conceived to ensure the best alignment between the probe and the thyroid, guaranteeing excellent crystal-to-thyroid alignment, and reducing positioning uncertainties.

The control and analysis software installed on the control tablet is designed to be simple and intuitive, yet advanced and comprehensive. This is accomplished by combining a simple and intuitive interface with advanced calculation routines, which run automatically as the measurement start, without the need of operator intervention.

Data are stored locally on the tablet internal memory, and can be analysed and downloaded with dedicated software routines.

The automatic I-131 activity calculation is given for pre-defined age groups: 1 yo, 5 yo, 10 yo, 15 yo (Adult Female), Adult Male. Counts-to-activity conversion coefficients are calculated by dedicated Monte Carlo simulations based on detailed detector and thyroid numerical models. The simulations are always validated for the specific system through experimental tests performed with reference radioactive sources.

The activity is compared to 2 User-defined threshold levels, each defined per each age group, following the two Action Levels logic.

MDA as low as about 100 Bq can be achieved in 2 min screenings. The MDA can be further lowered by enabling the background subtraction option.

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Radiation Detection › Environmental Monitoring

HERMES GSU

HERMES GSU is a portable gamma spectrometry system designed for rapid and precise in-field analysis of environmental samples. As part of the HERMES product line, it features a rugged, modular, and self-contained design housed in a high IP-rated technical case, ensuring durability and reliability in demanding conditions.

HERMES GSU quantifies isotope activity concentrations based on a rich built-in, yet fully-editable, isotope library. Its portability and autonomous operation make it ideal for both routine monitoring and emergency response scenarios.

Samples can be directly collected from the field, placed in 500 ml Marinelli beakers, and inserted into the built-in 1 cm lead-shielded well, minimizing background radiation for immediate, on-the-spot, low MDC analysis, and enhancing measurement accuracy and sensitivity. The system automatically calculates activity concentrations, making it a powerful tool for in-situ, laboratory-grade measurements.

HERMES GSU features advanced routines for gain stabilization, dead time correction, and automatic energy calibration (relying on natural background only, thus not requiring any radioactive reference source).

Efficiency calibration curves are generated using validated Monte Carlo simulations. Predefined efficiency curves are available for different sample matrices, including soil, water, and foodstuffs, across various densities. Custom calibration curves can be provided upon request.

ENVIRONMENTAL MONITORING

peo DETECTION

SP2 – SINGLE-SPHERE NEUTRON SPECTROMETER

The single-sphere neutron spectrometer SP2 is a unique device that allows performing active neutron spectrometry measurements by employing a single instrument instead of the usual multi-sphere BSS.

SP2 is characterized by the same high sensitivity and precision as BSS in determining the neutron flux over the entire energy range, while removing any reproducibility uncertainty. When employed with the on-line unfolding tool, SP2 can also perform real time measurements.

SP2 is equipped with 32 active ^{6}LiF-covered Silicon neutron detectors installed over six concentric layers inside the moderating assembly, so that they reproduce the spectrometric performance of a six-sphere BSS. The signals are acquired by the built-in electronics and can be either analysed on-line by the built-in unfolding algorithm, or saved as raw data for off-line analysis.

SP2 can be used in a great number of activities in scientific research: homeland security, cargo inspections, calibration laboratories, characterization of stray radiation fields for radiation protection purposes, periodical quality check of the neutron stray radiation field, all applications involving the need of a fast and precise measurement of the neutron spectrum.

A SP2 LITE version is also available, featuring a lighter build and a narrower energy range, suitable for all the applications that do not require to detect neutrons with energy above 20 MeV.

The response function of the device, calculated via Monte Carlo simulations, is available for either on-line and off-line analysis. The response function and unfolding algorithm have been validated after thoroughly testing with reference radioactive sources.

SP2 is the ideal device for performing active neutron spectrum measurements in every radiation environment, including mixed stray radiation fields, workplaces characterized by high gamma background and reference calibration laboratories.

GSU – GAMMA SPECTROMETRY UNIT WITH NaI(Tl)

The GSU gamma spectrometry units employ a 3″x3″ NaI(Tl) crystal coupled to a photosensitive detector (either PMT or SiPM) and an MCA. The detector is installed in a 5 cm thick lead shielding well, with additional inner layers of tin and copper for enhanced background reduction.

GSU is designed to perform gamma spectrometry analyses of small samples, such as foundry casting samples, air particulate filters, environmental samples (rocks, soil, biological samples), positioned in sample holders which can be tailored to meet specific measurement requirements, or Marinelli beakers.

The User can manage the system through the proprietary ELSE NUCLEAR GSU system software, calculating the specific activity and the Minimum Detectable Concentration (MDC) of the sample expressed in Bq/kg, Bq/l, Bq/m^3, etc. The built-in background subtraction subroutine improves the MDC without increasing the measurement time. The software includes fully-customisable isotope libraries as well as User-settable isotope-specific activity alarm thresholds, available through password-protected functions.

The GSU-NORM is a special version of system specifically conceived to perform Naturally Occurring Radioactive Material (NORM) analysis of environmental samples, such as rocks, sediments or soils. Through its MCA and its dedicated software, the GSU-NORM system allows determining the specific activity of NORM isotopes, i.e. K-40, Th-232 and U-238, expressed in Bq/g, %K, ppm eU and ppm eTh.

The sample holders are custom-made supports that fit directly on the detector’s head, used to hold casting samples, test sources or other similar objects.

The Marinelli beakers are used to contain geological samples or other similar materials. Several volumes are available, from 250 ml up to 1 l, with different geometrical features.

Each GSU system includes efficiency curves and coefficients implemented in the analysis software, calculated through Monte Carlo simulations for each specific configuration, acquisition chain and measurement geometry. The simulations are always validated through experimental tests performed with reference radioactive sources.

LUPIN BF3

LUPIN BF3 is an environmental monitoring unit for neutron H*(10) measurements, with unique excellent performance for neutron detection in pulsed fields.

The rem counter is composed of:

- BF_3 proportional counter
- Cylindrical moderating assembly
- Built-in power supply, signal management and control electronics

The electronics processes the signal coming from the detector and elaborates the instantaneous H*(10) rate value every second.

If required, the radiation sensitive electronics can be housed in a separate rack. An accessory IP54 version is also available

Data are sent to the connected SATURN ratemeter acquisition and control unit, which locally displays the instantaneous H*(10) rate and the integrated values and compares them to the pre-set alarm thresholds.

A LUPIN BF3 LITE version is also available, featuring a lighter build and a narrower energy range, suitable for all the applications that do not require to detect neutrons with energy above 20 MeV.

Papers published in international scientific journals:

- M. Caresana, M. Ferrarini, G.P. Manessi, M. Silari and V. Varoli, LUPIN, a new instrument for pulsed neutron fields, Nuclear Instruments and Methods in Physics Research Section A 712 (2013) 15-26.
- M. Caresana, C. Cassell, M. Ferrarini, E. Hohmann, G.P. Manessi, S. Mayer, M. Silari and V. Varoli, A new version of the LUPIN detector: improvements and latest experimental verification, Review of Scientific Instruments 85 (2014) 065102.

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SATURN I, SATURN II

The SATURN ratemeter is a compact acquisition and control unit, designed for managing and processing signals from any ELSE NUCLEAR connected detector.

- SATURN I: standard wall-mounted version
- SATURN II: wall-mounting version compliant with “Good Manufacturing Practice” requirements (no external cable or connectors)

All the ratemeter versions feature local function buttons with status LEDs, internal acoustic buzzer and a relay connector, used to manage external alarm columns or interlocks.

The SATURN ratemeter continuously acquires and processes the data coming from the connected detector, and compares results with user-defined alarm thresholds.

Two user-selected measurements can be displayed at the same time on the display, such as instantaneous or average count rate, dose rate, activity concentration, counts, dose or activity integrated values.

The user interface is accessible through an external keyboard, which allows local interaction with the full range of parameters (advanced setting is password protected). Measurements, thresholds and operating parameters are stored into an internal, non-volatile memory.

The ratemeter can communicate to and be remotely managed by a host PC through an Ethernet or RS485 network.

SATURN 5702

SATURN 5702 is a mobile station equipped with two detectors for gamma and neutron dose rate monitoring. The station includes:

- Ion-chamber-based gamma radiation monitoring unit: ICP-T or ICP-T-PF
- Neutron rem counter for pulsed fields: LUPIN BF3

The detectors and the electronics are housed in a trolley-mounted mechanical structure. The height of the trolley can be customized according to the customer needs, for example to centre the detectors with the beam line height.

Each detector can be removed from the trolley to be employed remotely, up to 20 m. An ALU alarm column is mounted on the top, providing luminous and acoustic warning signals related to the status of the mobile station (good functioning, pre-alarm and alarm). SATURN 5702 stations can also manage external devices through 4 sets of relay contacts.

The detectors are connected via external cables to a standard 19” electronics rack equipped with two dedicated SATURN ratemeter units (rack version). Each ratemeter features a display, 3 function keys with status LEDs, and a connector for TOUCHKEY2 external keyboard.

SATURN 5702 can be connected to a remote host PC running a data management software (5700 sMON) through ETH or RS485/422 connection.

NAUSICAA IC-T, ICP-T

NAUSICAA is an ion-chamber-based gamma radiation monitoring unit, available in two versions:

- IC-T for environmental measurements (9 decades electrometer)
- IC-T-PF for pulsed field measurements (7 decades electrometer)

Both versions include an ion chamber detector, an electrometer and a CPU-based acquisition and control unit.

The display visualises the dose rate value and status messages, while a built-in buzzer and coloured LEDs provide additional status indications.

The alarm thresholds, the operational parameters and the measurement data are saved in the internal memory. The user can set the parameters through the external keyboard or 5700 sMON software (if provided).

The standard NAUSICAA configuration, suitable for indoor use, is composed by a 3U 63HP table box housing the electronics modules, and the ion chamber directly installed on top of it. Wall mounting accessory and trolley kit are also available, as well as an IP54 enclosure.

It is possible to connect one or more units to a host PC (running 5700 sMON software) through Ethernet or serial communication.

The ICP-T detector is identical to NAUSICAA, but it does not include the CPU, being connected to and managed by a SATURN ratemeter.

The DISCOVERY IC-T unit is a special version of NAUSICAA, assembled in a IP65 housing, designed to operate outdoor; data can be transmitted through a wireless connection or downloaded through a dedicated utility.

GM-1, MERCURY

According to the measurement requirements, different versions of Geiger-Müller detectors are available:

- GM-1: single-Geiger detector (up to 1 mSv/h)
- MERCURY: double-Geiger detector (up to 1 Sv/h)

All models employ energy-compensated tubes, lodged in high-protection aluminium cylinders, together with a built-in HV board.

MERCURY detectors are equipped with 2 Geiger-Müller tubes to reach a wider measurement range. An internal electronics automatically switches to the suitable GM tube according to the count rate level.

Both the GM-1 and the MERCURY detectors are connected to and managed by a SATURN ratemeter, which provides power supply, signal processing and data visualization. Each detector-ratemeter couple forms a monitoring unit, which can be connected in a network to a central host PC running 5700 sMON management software.

Among the special versions and accessories available, we mention in particular:

- Stand-alone version of GM detectors for direct connection to PC
- IP65 housing for MERCURY for outdoor installations
- PS-ZB accessory for MERCURY, providing battery-operated power supply and ZigBee Wireless communication, and ZB-TC receiver connected to the ratemeter to acquire the data
- GPS locator for PS-ZB

NAUSICAA 2IC

The NAUSICAA 2IC system is designed to quantify the beta activity in air or gas streams, due to the presence of tritium or other noble gases, while compensating for the environmental gamma background.

NAUSICAA 2IC can be used in activities involving air sampling from rooms, stacks, hoods, or other effluent passages, process piping, glove boxes, and similar.

NAUSICAA 2IC is composed of:

- two identical, cylindrical, 10 litres, stainless-steel ion chambers
- a pneumatic sampling system
- an electrometer to amplify and manage the (typically very weak) ionisation current
- a local control unit with display and software

Ambient air is sampled in the upper chamber, while the lower one is sealed and filled with clean reference air. Ionizations occurring in the upper chamber are due to both environmental gamma background and beta contamination, whereas inside the lower chambers only gamma background interactions occur. The two chambers are provided with an opposite-polarity HV: the resulting output current is thus the difference of the two single outputs, i.e. the net beta contamination of the sampled air, expressed in activity concentration. An accessory equipment for filtering and drying the sampled air helps limiting as much as possible any spurious signals.

The NAUSICAA 2IC control unit manages data acquisition, processing and visualization. A touch-screen display allows parameters' setting and data visualization. A built-in acoustic and luminous alarm column provides proper warnings in case of alarm or malfunctioning.

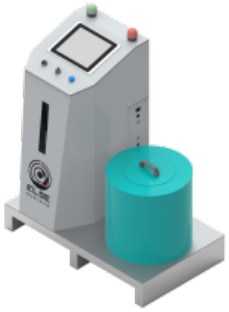
NAUSICAA 2IC can be connected to a host PC through RS485 or ETH connection for remote data visualization.

With a 600 V value each camera can generate currents up to 10^{-8} A, with a saturation error < 20%.

MISTRAL XM

MISTRAL XM is a system designed to sample and monitor the gamma activity concentration resulting from air activation, in Marinelli geometry.

In particular, MISTRAL XM Rooms is designed for free air monitoring, whereas MISTRAL XM Stack is used to monitor the air expelled from a chimney or a stack. In both cases, “X” indicates the number of sampling points: up to 5 (Rooms) or 1 (Stack).



The system is composed of:

- acquisition and processing unit: APU
- sampling and detection unit: SDU-XM

The APU is the main user interface with the system, and it consists in a command and control console including: a panel PC, the system electronics, a control flow meter for the pump, and an array of electrovalves (if needed). The SDU-XM includes the NaI(Tl) detector with MCA, a lead shielding well, and a pump for air sampling. The system also manages the expulsion of the monitored air.

The Stack version includes a flow rate meter (STACK-DFM), to calculate the specific activity of the expelled air volume.

The software installed on the PC displays in real time the measurement, controls the system status, and allows to set the operative parameters, such as the alarm thresholds. The user can define specific regions of interest (ROIs) and thus determine the specific activity (Bq/g) of the sampled air.

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Radiation Detection › Environmental Monitoring

HERMES

HERMES systems are rugged, portable units for radiation detection, designed and tailored for a wide range of operational scenarios such as gamma and neutron detection, dose rate measurement, gamma spectroscopy and more. HERMES systems are suited for emergency response activities, as they are mounted inside robust and high-IP technical cases, which can be handheld or vehicle-mounted.

The HERMES product line includes customisable configurations, such as:

- HERMES NAI or CSI, with NaI(Tl) or CsI(Tl) detector and MCA to perform gamma spectrometry
- HERMES GMT or PLA, with Geiger-Muller or plastic detector for high-sensitivity gamma monitoring
- HERMES NEU, with ^{10}BZnS neutron detector and plastic moderator for artificial neutron source detection
- HERMES SENTINEL, combining NaI(Tl), GM tubes and neutron detector for comprehensive radiation surveillance

HERMES units support remote operation via LAN or Wi-Fi through a smartphone or a tablet. According to the configuration, the proprietary software provides real-time dose rate data, nuclide identification, alarms, and interactive heat mapping. Scan results, GPS coordinates and events are automatically logged into the local memory for off-line processing.

HERMES units incorporate advanced gain stabilization, dead time correction, and automatic energy calibration based exclusively on natural background radiation (no source needed to calibrate).

FOOMON

FOOMON is a portable fully-integrated instrument specifically conceived for screening of I-131, Cs-134 and Cs-137 accumulated in food samples. Its “on-the-field” design allows deploying the device in any kind of situation, such as routine campaigns or emergency procedures.

The whole device is self-contained in a portable high-IP-grade technical case, for an overall weight < 25 kg. The food samples are to be placed in 500 ml Marinelli beakers, which then are lodged inside a 1 cm thick lead shielding well upon the detector’s end cap. The complete setup and deployment of the system requires less than 5 minutes.

The User can manage FOOMON through the user-friendly control and analysis software installed on the embedded panel PC, automatically calculating the specific activity and the Minimum Detectable Concentration (MDC) of the sample (in Bq/kg). Data are stored locally and can be analysed and downloaded with dedicated software routines.

The measured activity concentration is compared with isotope-specific and food-group-specific alarms. In the case of an alarm, the measurement output is clearly labelled and the alarm status is clearly displayed on the software, which also activates the acoustic alarm.

The counts-to-activity-concentration conversion coefficients are calculated by means of dedicated Monte Carlo calculations.

The MDC achievable in 1 minute, with an average indoor background (150 nSv/h), is as low as about 150 Bq/kg for Cs-137 and Cs-134, and about 90 Bq/kg for I-131. Under the same conditions, MDC as low as about 30 Bq/kg for I-131, and about 40 Bq/kg for Cs-134 and Cs-137, can be achieved in about 10 minutes.

If enabled, the automatic background subtraction subroutine allows further lowering MDC and measurement uncertainty without increasing the counting time.

THYMON

THYMON is a compact NaI(Tl)-based detector specifically conceived to fast, yet reliably, measure I-131 contamination in thyroid. Its compactness, ruggedness, light-weight, together with its simple and intuitive built-in software interface, make the device perfectly suited for emergency screening applications. The instrument can be used either hand-held or hands-free. The instrument is composed by three main subparts:

- Detector probe: a 1.5” x 1.5” collimated NaI(Tl) crystal coupled to a SiPM matrix and extremely compact readout electronics and MCA
- Extendable support: designed as both table-top and standalone, providing the possibility of hands-free operation
- Control tablet: IP65 water- and dust-proof 8” capacitive screen, wired-connected to the probe

The mechanics of the probe is specifically conceived to ensure the best alignment between the probe and the thyroid, guaranteeing excellent crystal-to-thyroid alignment, and reducing positioning uncertainties.

The control and analysis software installed on the control tablet is designed to be simple and intuitive, yet advanced and comprehensive. This is accomplished by combining a simple and intuitive interface with advanced calculation routines, which run automatically as the measurement start, without the need of operator intervention.

Data are stored locally on the tablet internal memory, and can be analysed and downloaded with dedicated software routines.

The automatic I-131 activity calculation is given for pre-defined age groups: 1 yo, 5 yo, 10 yo, 15 yo (Adult Female), Adult Male. Counts-to-activity conversion coefficients are calculated by dedicated Monte Carlo simulations based on detailed detector and thyroid numerical models. The simulations are always validated for the specific system through experimental tests performed with reference radioactive sources.

The activity is compared to 2 User-defined threshold levels, each defined per each age group, following the two Action Levels logic.

MDA as low as about 100 Bq can be achieved in 2 min screenings. The MDA can be further lowered by enabling the background subtraction option.

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Radiation Detection › Environmental Monitoring

HERMES GSU

HERMES GSU is a portable gamma spectrometry system designed for rapid and precise in-field analysis of environmental samples. As part of the HERMES product line, it features a rugged, modular, and self-contained design housed in a high IP-rated technical case, ensuring durability and reliability in demanding conditions.

HERMES GSU quantifies isotope activity concentrations based on a rich built-in, yet fully-editable, isotope library. Its portability and autonomous operation make it ideal for both routine monitoring and emergency response scenarios.

Samples can be directly collected from the field, placed in 500 ml Marinelli beakers, and inserted into the built-in 1 cm lead-shielded well, minimizing background radiation for immediate, on-the-spot, low MDC analysis, and enhancing measurement accuracy and sensitivity. The system automatically calculates activity concentrations, making it a powerful tool for in-situ, laboratory-grade measurements.

HERMES GSU features advanced routines for gain stabilization, dead time correction, and automatic energy calibration (relying on natural background only, thus not requiring any radioactive reference source).

Efficiency calibration curves are generated using validated Monte Carlo simulations. Predefined efficiency curves are available for different sample matrices, including soil, water, and foodstuffs, across various densities. Custom calibration curves can be provided upon request.

LABORATORY EQUIPMENT

peo DETECTION

BSS – BONNER SPHERE SPECTROMETER

The Bonner Sphere Spectrometer consists of an array of He-3 proportional counter thermal neutron detectors, each housed in a spherical HDPE moderator of different diameters.

BSS is proposed in two main configurations, adjustable according to the requirements, for single or multiple detectors.

An unfolding software (RUFUS), used to calculate the neutron spectrum, is also available for both configurations.

Each proportional counter is connected to a compact electronic module (2.5 cm diam. x 7.6 cm), providing:

- Precision wide-band charge-sensitive pre-amplifier and amplifier
- Discriminator circuit
- High voltage adjustment 0-2200 V
- Amplifier gain and discriminator threshold adjustment
- Analogue test points for shaped signals and HV

A user-friendly dedicated acquisition software can be installed on the PC managing the BSS, allowing the user to start and stop the measurements, to modify the parameters and to visualize the saved data.

The BSS standard set, designed to cover the neutron energy range from 1 meV to < 100 MeV, includes the following HDPE moderators: Ø 3”, Ø 3.5”, Ø 4”, Ø 4.5”, Ø 5”, Ø 6”, Ø 7”, Ø 8”, Ø 10”, Ø 12”, Ø 15”, Ø 18”.

The available configurations of BSS are:

- Single detector: includes only one He-3 proportional counter, to be inserted in one moderator sphere at a time. The detector is managed by a Counter Module and the user interface is the “Single counter” software.
- Multiple detectors: includes up to 16 He-3 proportional counters, and up to 16 moderator spheres (12 standard + 4 accessory), to be employed at the same time. The detectors are managed by a Datalogger and the user interface is the “DLOG” software.

SP2 – SINGLE-SPHERE NEUTRON SPECTROMETER

The single-sphere neutron spectrometer SP2 is a unique device that allows performing active neutron spectrometry measurements by employing a single instrument instead of the usual multi-sphere BSS.

SP2 is characterized by the same high sensitivity and precision as BSS in determining the neutron flux over the entire energy range, while removing any reproducibility uncertainty. When employed with the on-line unfolding tool, SP2 can also perform real time measurements.

SP2 is equipped with 32 active ^{6}LiF-covered Silicon neutron detectors installed over six concentric layers inside the moderating assembly, so that they reproduce the spectrometric performance of a six-sphere BSS. The signals are acquired by the built-in electronics and can be either analysed on-line by the built-in unfolding algorithm, or saved as raw data for off-line analysis.

SP2 can be used in a great number of activities in scientific research: homeland security, cargo inspections, calibration laboratories, characterization of stray radiation fields for radiation protection purposes, periodical quality check of the neutron stray radiation field, all applications involving the need of a fast and precise measurement of the neutron spectrum.

A SP2 LITE version is also available, featuring a lighter build and a narrower energy range, suitable for all the applications that do not require to detect neutrons with energy above 20 MeV.

The response function of the device, calculated via Monte Carlo simulations, is available for either on-line and off-line analysis. The response function and unfolding algorithm have been validated after thoroughly testing with reference radioactive sources.

SP2 is the ideal device for performing active neutron spectrum measurements in every radiation environment, including mixed stray radiation fields, workplaces characterized by high gamma background and reference calibration laboratories.

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Radiation Detection › Laboratory Equipment

W-PIE – WIDE ENERGY ACTIVE NEUTRON SPECTROMETER

The W-PIE neutron spectrometer is a unique device designed for on-line neutron spectrometry measurements. The system features an extremely high counting efficiency, making it suitable to perform neutron spectrometry and absolute flux measurement for applications such as:

- homeland security
- cargo inspections
- calibration laboratories
- background suppression in high-energy physics experiments
- cosmic ray neutron sensing (CRNS) in agriculture
- snow water equivalent (SWE) measurements in hydrology

W-PIE employs ^{6}Li as neutron converter, ^{4}He as scintillating medium, and 24 independent low-voltage SiPMs as photosensitive components. The detector is surrounded by increasingly thick moderating assemblies, defining 4 detection sub-volumes each optimised for a specific spectral region. Signals are acquired and analysed by the built-in electronics and unfolding algorithm, or they can be saved as raw data for off-line analysis.

The response function of W-PIE, calculated via Monte Carlo simulations, is available for either on-line and off-line analysis. The response function and unfolding algorithm have been validated after thoroughly testing with reference radioactive sources, with quasi-monoenergetic neutron fields, and in the high-energy reference neutron field facility CERF at CERN.

The device is available in two configurations:

- W-PIE – standard, high-energy version, with Cd and Pb inserts, designed to be sensitive to neutrons up to 10 GeV
- HERMES W-PIE – lightweight and standalone low energy version, without high-Z inserts, designed to be sensitive to neutrons up to about 100 MeV

The W-PIE version is powered over Ethernet and communicates with a PC through Ethernet connection.

The HERMES W-PIE version is a standalone unit featuring a single board computer, a 4G router, a GPS and a dual-SIM system allowing remote control.

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Radiation Detection › Environmental Monitoring

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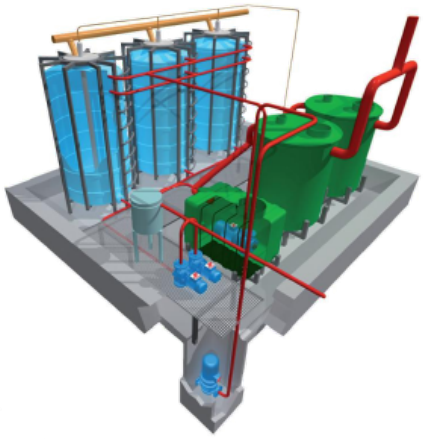
The ratemeter can communicate to and be remotely managed by a host PC through an Ethernet or RS485 network.

WDMS NT-VK

The WDMS NT-VK system is designed to collect and monitor radioactive wastewaters, which can be released only after their radioactivity drops below a defined value. The main application of such a system is related to diagnostic and therapeutic procedures involving radioactive substances, and their partial elimination through the patient’s metabolism.



The WDMS NT-VK system is designed to collect and monitor radioactive wastewaters, which can be released only after their radioactivity drops below a defined value. The main application of such a system is related to diagnostic and therapeutic procedures involving radioactive substances, and their partial elimination through the patient’s metabolism.

The WDMS NT-VK main components are:

- Purification group: Imhoff tanks designed to collect the wastewaters and to separate liquid from solid waste
- Sorting group: pumps and conduits pouring the wastewaters in the decay tanks
- Decay group: tanks array where the wastewaters are poured and stocked until their radioactive level drops below a defined value
- Sampling system: valves and pumps used by the system to wash the sampling circuit and to sample the stocked wastewaters, allowing the measurement in Marinelli geometry
- Release group: pumps and conduits releasing the wastewaters in the sewers, if allowed by the monitoring results
- Safety groups and devices: level and pump sensors installed in all the system critical stages, stopping the wastewaters flow in case of detected anomaly, and safety flooding well which can collect and stock wastewaters potentially overflowing from any system group

The entire system is locally managed by a PLC, which is commanded by a remote management software installed on a PC.

Through the interactive synoptic interface of the software the operator can activate the system automatic cycles, set the measurement parameters, visualize the alarms and release archives, and monitor the system’s status (filling levels, pump stages, measurements, alarms). Depending on the measurement results, and as defined by the procedures in force, the operator can also activate the monitored wastewaters release in the sewers.

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Radiation Detection › Laboratory Equipment

LEM – LIQUID EFFLUENT MONITORING SYSTEM

The LEM system is designed to sample the liquid effluents and to perform a spectroscopic analysis in Marinelli geometry.

LEM system is composed of the following main parts:

- Stainless steel frame
- Electrical and command board with touch-screen panel PC
- NaI(Tl) detector, 1 l Marinelli, 5 cm thick lead shielding well
- Self-priming pump (*)
- Software for system management, data acquisition and processing

The measurements are visualised in real time by the software, expressed in terms of specific/total activity through spectroscopic analysis.

LEM status and parameters are managed by the ELSE NUCLEAR software. The system provides also I/O contacts through dedicated connectors:

- Good functioning status output
- Alarm status output
- Pump activation input from customer PLC (*)
- Spare available I/O contacts (to be defined when necessary)

The software provides a calibration routine, to be used with a Marinelli calibration source (available as accessory).

A test program is also available, separate from the main application, to be used for maintenance or periodical quality controls.

(*) If not available in the sampling/hydraulic equipment which LEM shall be connected to

RADIATION MOBILE DETECTION SYSTEMS

peo DETECTION

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SATURN 5702

SATURN 5702 is a mobile station equipped with two detectors for gamma and neutron dose rate monitoring. The station includes:

- Ion-chamber-based gamma radiation monitoring unit: ICP-T or ICP-T-PF
- Neutron rem counter for pulsed fields: LUPIN BF3

The detectors and the electronics are housed in a trolley-mounted mechanical structure. The height of the trolley can be customized according to the customer needs, for example to centre the detectors with the beam line height.

Each detector can be removed from the trolley to be employed remotely, up to 20 m. An ALU alarm column is mounted on the top, providing luminous and acoustic warning signals related to the status of the mobile station (good functioning, pre-alarm and alarm). SATURN 5702 stations can also manage external devices through 4 sets of relay contacts.

The detectors are connected via external cables to a standard 19” electronics rack equipped with two dedicated SATURN ratemeter units (rack version). Each ratemeter features a display, 3 function keys with status LEDs, and a connector for TOUCHKEY2 external keyboard.

SATURN 5702 can be connected to a remote host PC running a data management software (5700 sMON) through ETH or RS485/422 connection.

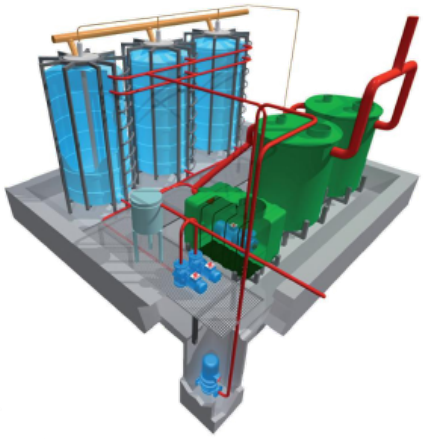
WASTE & RECYCLING MANAGEMENT

peo DETECTION

Radiation Detection › Laboratory Equipment

WDMS NT-VK

The WDMS NT-VK system is designed to collect and monitor radioactive wastewaters, which can be released only after their radioactivity drops below a defined value. The main application of such a system is related to diagnostic and therapeutic procedures involving radioactive substances, and their partial elimination through the patient’s metabolism.



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The WDMS NT-VK main components are:

- Purification group: Imhoff tanks designed to collect the wastewaters and to separate liquid from solid waste
- Sorting group: pumps and conduits pouring the wastewaters in the decay tanks
- Decay group: tanks array where the wastewaters are poured and stocked until their radioactive level drops below a defined value
- Sampling system: valves and pumps used by the system to wash the sampling circuit and to sample the stocked wastewaters, allowing the measurement in Marinelli geometry
- Release group: pumps and conduits releasing the wastewaters in the sewers, if allowed by the monitoring results
- Safety groups and devices: level and pump sensors installed in all the system critical stages, stopping the wastewaters flow in case of detected anomaly, and safety flooding well which can collect and stock wastewaters potentially overflowing from any system group

The entire system is locally managed by a PLC, which is commanded by a remote management software installed on a PC.

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Radiation Detection › Laboratory Equipment

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