

Semiconductor Detectors & Nuclear Electronics for Radiation Measurements



HPGe Detector Types



Detector Series	Type	Energy Range	Typical Application	Range of sizes
GCD	P-type coaxial	40keV – 10MeV	Counting Laboratory, Health Physics	10% to >160% relative efficiency
GCDX	Extended range P-type coaxial	3keV- 10MeV	As GCD but enhanced sensitivity at ~60keV and below, e.g. for Am-241 measurement	10% to > 100% relative efficiency
GCDX-OS	Extended range P-type Over-Square shape	3keV- 10MeV	Better energy resolution in energy range from 100 keV to 662 keV	10% to > 100% relative efficiency
GPD	Planar	3keV-1.5MeV	X-ray measurements in research and medicine, nuclear safeguards	20mm diameter to 36mm diameter
GWD	Well type coaxial	20keV-10MeV	Small volume sources eg, forensics	15% to >70% relative efficiency
GWDX	Well type coaxial with point contact	20keV-10MeV	Outstanding energy resolution at 122 keV	15% to >70% relative efficiency

Baltic Scientific Instruments, Ltd.

Baltic Scientific Instruments (BSI) was established in 1994 on the basis of Riga Research and Development Institute for Radio-Isotope Apparatus (RNIIRP, est.1966), which belonged to the Ministry for Atomic Energy of the former Soviet Union. RNIIRP had Union-wide responsibility for the development of instruments for radiation detection and measurement for the atomic energy industry, mining, oil and gas industries, space and military applications. RNIIRP developed a broad range of products, and the highest level of technical knowledge and skills to meet the most sophisticated technological demands of the Soviet Union. These are the foundations of the capabilities that BSI now brings to global markets.

Since its founding as a private enterprise BSI has specialized in the development and fabrication of devices for spectrometric analysis based on semiconductor and scintillation radiation detectors. Our products are applied in multiple industries: nuclear power; environmental monitoring; geophysics and the mining industry; medicine and healthcare; research including space sciences; security systems and customs control; and other spheres. To succeed in global markets for radiation detection and analysis equipment BSI has mastered the most demanding quality standards in each market where we have chosen to compete. See our Quality Policy.

BSI is headquartered in Riga, Latvia, one of the most livable cities in Europe with an exceptional cultural life, attractive homes, good schools and within a short drive of rural Latvia as well as some of the finest beaches in Northern Europe. Riga has been called the culture capital of Europe and has been featured as a prime tourist destination.

The Company Baltic Scientific Instruments is certified to ISO 9001:2015 by TÜV Rheinland.

Cryostat Models

Description	Model
Ln2 Cryostats	
Streamline vertical dipstick	CRT-VE
Streamline horizontal Dipstick	CRT-HO
Hand-held Portable cryostat	CRT-PO
Downlooker	CRT-DL
L-type	CRT-L
L-type remote preamplifier	CRT-LR
U-type remote preamplifier	CRT-UR
U-type Inverted remote preamplifier	CRT-UIR
Borehole cryostat cryoaccumulator	CRT-BH-CA
Borehole cryostat Stirling Cryocooler	CRT-BH-SC
Borehole cryostat LN2 cooled	CRT-BH-LN
Electric Cryostats	
EMC Closed-loop gas-cooled refrigerator	CRT-EMC
MONOLITH Stirling Cycle refrigerator cryostat	CRT-MON
Nicole LN2-Electric Hybrid refrigerator	CRT-NIC
DEWARS	
30 L Dewar	DEW-30
25 L Dewar	DEW-25
30 L Offset port Dewar	DEW-30-OP
30 L downlooker Dewar	DEW-30-D
Dewar for hand held Portable cryostat	DEW-PO-1 (1-7 Liter)



P-type HPGe Coaxial Detectors GCD

(Liquid Nitrogen cooled)

Application

Detection of Gamma-rays in nuclear energetics and environmental control, in industry and scientific research, in medicine and other applications.

Complete set (standard)

- HPGe coaxial detector
- Preamplifier with cooled input stage
- Dewar vessel
- Cable set
- Documentation

Accessories (optional)

- Multichannel Analyzer (Digital or Analog-Digital)
- Analytical Software packages:
 - quantitative and qualitative analysis
 - γ -spectra modeling & efficiency registration calculation for complex geometry objects
 - extended radionuclide library
- Liquid nitrogen storage and filling system
- Liquid nitrogen sensor and monitor
- Cable set extension

Features

- 10% - 160% and higher efficiency HPGe coaxial detectors are available
- Energy range 40 keV - 10 MeV
- Input window materials: Aluminum
- Built-in or Remote Preamplifier types are available depending on application
- Low instrument background
- High energy rate up to 200000 MeV/s
- Excellent peak symmetry & high resolution
- HV supply protection if detector is warm
- High count rate indicator
- Variable cryostat design modifications

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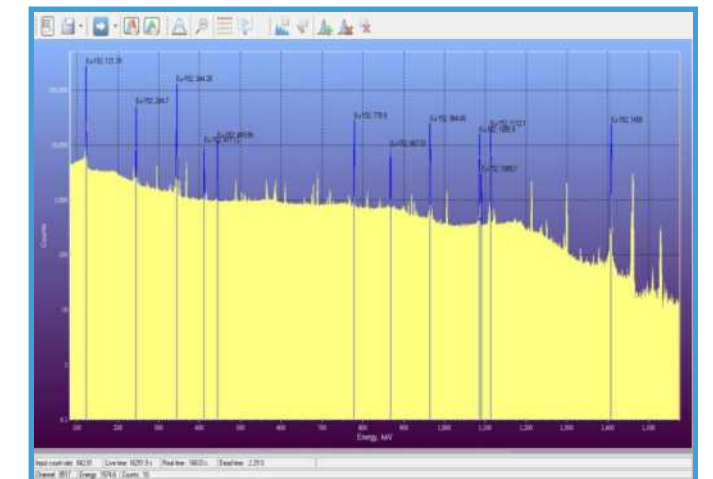
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Specification

Model	Relative Efficiency, %	Energy resolution		Peak/Compton ratio	Peak Shape	
		122 keV, (eV)	1.33 MeV, (keV)		<u>FW.1M</u> FWHM	<u>FW.02M</u> FWHM
GCD - 10 175	10	825	1.75	41:1	1.9	2.65
GCD - 15 180	15	825	1.80	46:1	1.9	2.65
GCD - 20 180	20	850	1.80	51:1	1.9	2.65
GCD - 25 185	25	850	1.85	55:1	1.9	2.65
GCD - 30 185	30	875	1.85	58:1	1.9	2.65
GCD - 35 190	35	875	1.90	60:1	1.9	2.65
GCD - 40 190	40	895	1.90	62:1	1.9	2.65
GCD - 50 190	50	895	1.90	64:1	1.9	2.65
GCD - 60 200	60	1000	2.00	68:1	2.0	3.00
GCD - 70 200	70	1000	2.00	73:1	2.0	3.00
GCD - 80 210	80	1000	2.10	77:1	2.0	3.00
GCD - 100 220	100	1000	2.10	81:1	2.0	3.00
GCD - 120 220	120	1000	2.10	83:1	2.0	3.00
GCD - 140 220	140	1100	2.20	86:1	2.0	3.00
GCD - 160 220	160*	1150	2.20	88:1	2.0	3.00

* Detectors with other relative efficiencies are available.

Plenty of cryostat geometries available





P-type HPGe Coaxial Detectors GCDX

(with extended energy range)

Application

Detection of Gamma-rays in nuclear energetics and environmental control, in industry and scientific research, in medicine and other applications.

Complete set (standard)

- HPGe coaxial detector
- Preamplifier with cooled input stage
- Dewar vessel
- Cable set
- Documentation

Accessories (optional)

- Multichannel Analyzer
- Analytical Software packages:
 - quantitative and qualitative analysis
 - γ -spectra modeling & efficiency registration calculation for complex geometry objects
 - extended radionuclide library
- Liquid nitrogen storage and filling system
- Liquid nitrogen sensor and monitor
- Cable set extension

Features

- 10% - 100% and higher efficiency HPGe coaxial detectors are available
- **Extended energy range 3 keV - 10 MeV**
- Input window materials: Aluminum, Beryllium or Carbon-fiber
- Built-in or Remote Preamplifier types are available depending on application
- Low instrument background
- High energy rate up to 200000 MeV/s
- Excellent peak symmetry & high resolution
- HV supply protection if detector is warm
- High count rate indicator
- Variable cryostat design modifications

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Specification

Model	Relative Efficiency, %	Energy resolution			Peak/Compton ratio	Peak Shape	
		5.9 keV, (eV)	122 keV, (eV)	1.33 MeV, (keV)		FW.1M FWHM	FW.02M FWHM
GCDX - 10 175	10	400	720	1.75	41:1	1.9	2.65
GCDX - 15 180	15	450	740	1.80	46:1	1.9	2.65
GCDX - 20 180	20	460	760	1.80	51:1	1.9	2.65
GCDX - 25 185	25	480	775	1.85	55:1	1.9	2.65
GCDX - 30 185	30	500	800	1.85	58:1	1.9	2.65
GCDX - 35 190	35	550	830	1.90	60:1	1.9	2.65
GCDX - 40 190	40	600	850	1.90	62:1	1.9	2.65
GCDX - 50 190	50	620	875	1.90	64:1	1.9	2.65
GCDX - 60 200	60	670	900	2.00	68:1	2.0	3.00
GCDX - 70 200	70	700	950	2.00	73:1	2.0	3.00
GCDX - 80 210	80	750	950	2.10	77:1	2.0	3.00
GCDX - 100 210	100*	800	1000	2.10	81:1	2.0	3.00

* Detectors with other relative efficiencies are available

Energy range:

3 keV - 10 MeV with Be input window

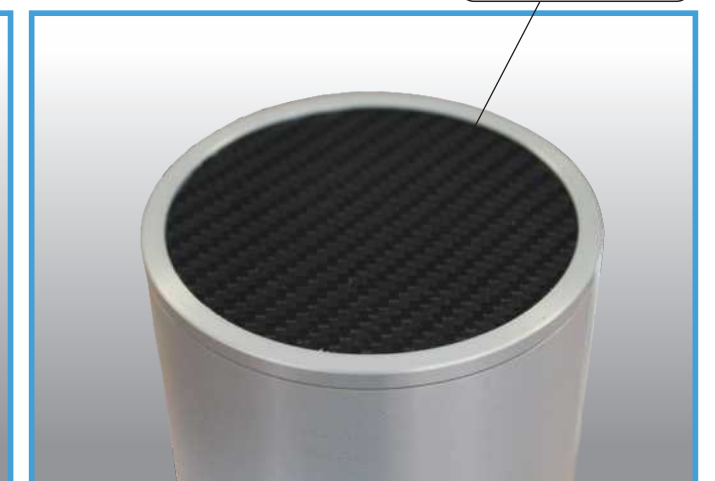
5 keV - 10 MeV with carbon fiber input window

Advantages

- HPGe detectors with extended energy range GCDX provide outstanding performance not only as regular coaxial detectors but also allowing to go lower in energy range down to 3 keV.
- Thin contact structure of the HPGe detector accompanying with input window made of Beryllium or Carbon fiber guarantee low energy photon transition to the HPGe crystal and its registration.
- Input window of the detector is integrated into the end cap of the detector by using high-tech vacuum-tight materials



Beryllium input window



Carbon fiber input window

Specification

Model	Relative Efficiency, %	Sensitive area, mm ²	Thickness, mm	Energy resolution		
				at 5.9 keV (eV)	at 122 keV (eV)	at 1.33 MeV (keV)
OS-06350	6	1590	15	350	650	1.75
OS-07390	7.5	2000	15	390	650	1.80
OS-10350	9	2000	20	350	650	1.90
OS-12375	12	2000	35	375	680	1.90
OS-13400	13	2800	20	400	700	1.90
OS-18400	18	2800	25	400	700	1.90
OS-20450	20	3800	20	450	750	1.90
OS-26450	26	3800	25	450	750	1.90
OS-34450	34	3800	30	450	750	1.90
OS-37500	37	5000	25	500	750	2.00
OS-48500	48	5000	30	500	750	2.00
OS-60500	60*	6000	30	500	750	2.00

* Detectors with other relative efficiencies are available.

Energy range:

3 keV - 10 MeV with Be input window

5 keV - 10 MeV with carbon fiber input window

Advantages

- HPGe detectors with extended energy range GCDX-OS are different from GCDX by its shape. It is still allowing to go lower in energy range down to 3 keV and thin contact structure of the HPGe detector guarantee low energy photon transition to the HPGe crystal and its registration.
- Input window made of Beryllium or Carbon fiber of the detector is integrated into the end cap of the detector by using high-tech vacuum-tight materials.
- GCDX-OS HPGe detectors are showing way better performance, such as resolution improvement, if you consider energy range from 100 keV to 662 keV. This is vitally important for those applications where radionuclides with lower energies are required to measure and analyze.
- Over-square shape HPGe crystals of the GCDX-OS detectors provide better efficiency while measuring relatively compact samples like bottles, vials, petri dishes, etc.
- Increase of efficiency is observed due to the fact that HPGe crystal is having similar volume to GCD and GCDX detector but larger diameter in relationship to its height. Therefore, relative intensity and efficiency are higher in energy range 1.5-2 MeV.



Over-Square shape HPGe crystal

P-type HPGe Over-Square shape Detectors (with extended energy range) GCDX-OS

Application

Detection of Gamma-rays in nuclear energetics and environmental control, in industry and scientific research, in medicine and other applications.

Complete set (standard)

- HPGe coaxial detector
- Preamplifier with cooled input stage
- Dewar vessel
- Cable set
- Documentation

Accessories (optional)

- Multichannel Analyzer (Digital or Analog-Digital)
- Analytical Software packages:
 - quantitative and qualitative analysis
 - γ -spectra modeling & efficiency registration calculation for complex geometry objects
 - extended radionuclide library
- Liquid nitrogen storage and filling system
- Liquid nitrogen sensor and monitor
- Cable set extension

Features

- 10% - 100% and higher efficiency HPGe coaxial detectors are available
- **Extended energy range 3 keV - 10 MeV**
- Input window materials: Aluminum, Beryllium or Carbon-fiber
- Built-in or Remote Preamplifier types are available depending on application
- Low instrument background
- High energy rate up to 200000 MeV/s
- Excellent peak symmetry & high resolution
- HV supply protection if detector is warm
- High count rate indicator
- Variable cryostat design modifications

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Specification

Model	Diameter, mm	Detector Sensitive Area		Energy resolution, eV	
		Area, mm ²	Thickness, mm	5.9 keV	122 keV
GPD - 05 145	5	20	6	145	465
GPD - 08 155	8	50	6	155	485
GPD - 12 165	12	100	7	165	490
GPD - 12 160	12	100	10	160	490
GPD - 16 180	16	200	11	180	495
GPD - 25 300	25	500	13	300	545
GPD - 36 360	36	1000	13	360	585
GPD - 36 300	36	1000	15	300	560

* Detectors with other parameters are available

Features

- Built-in or Remote Preamplifier types are available depending on application
- Ability to increase energy rate to 20000 MeV/s
- Energy range from 3 keV to 1500 keV (2500 keV)
- Input window materials: Aluminum, Beryllium or Carbon-fiber
- Excellent peak symmetry & high resolution
- HV supply protection if detector is warm
- High count rate indicator
- Variable cryostat design modifications

Plenty of cryostat geometries available



HPGe Planar Detectors GPD

(Liquid Nitrogen cooled)

Application

Detection of Gamma and X-rays in nuclear energetics and environmental control, in industry and scientific research, in medicine and other applications.

Complete set (standard)

- HPGe planar detector
- Preamplifier with cooled input stage
- Dewar vessel
- Cable set
- Documentation

Accessories (optional)

- Multichannel Analyzer
- Analytical Software packages:
 - quantitative and qualitative analysis
 - γ -spectra modeling & efficiency registration calculation for complex geometry objects
 - extended radionuclide library
- Liquid nitrogen storage and filling system
- Liquid nitrogen sensor and monitor
- Cable set extension

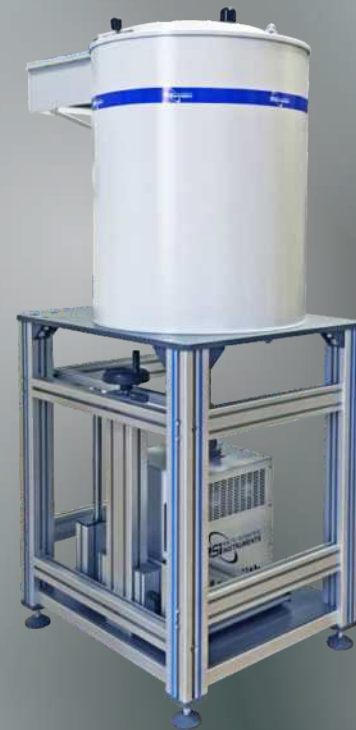
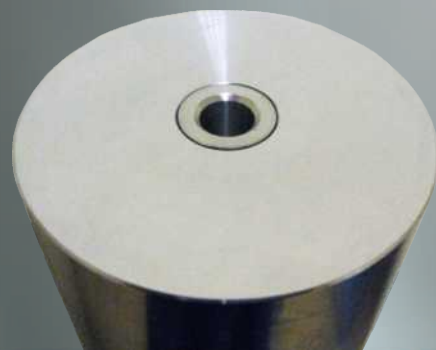
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Specification

Model	Well diameter	Nominal volume (cc)	Energy Resolution	
			FWHM 122 keV	FWHM 1332 keV
GWD - 15 20	10	90	1.1	2.0
GWD - 15 22	16	100	1.3	2.2
GWD - 20 20	10	110	1.1	2.0
GWD - 20 22	16	120	1.3	2.2
GWD - 25 22	10	130	1.1	2.2
GWD - 25 23	16	140	1.3	2.3
GWD - 30 22	10	150	1.2	2.2
GWD - 30 23	16	160	1.4	2.3
GWD - 35 22	10	170	1.2	2.2
GWD - 35 23	16	180	1.4	2.3
GWD - 40 22	10	190	1.2	2.2
GWD - 40 23	16	200	1.4	2.3
GWD - 60 23	10	280	1.45	2.3
GWD - 70 24	10	360	1.45	2.4
GWD - 70 24	16	360	1.45	2.4

* Detectors with other parameters are available.



Well-type HPGe Detectors GWD

(Liquid Nitrogen cooled)

Application

Detection of Gamma-rays in nuclear energetics and environmental control, in industry and scientific research, in nuclear medicine and other applications.

Complete set (standard)

- HPGe Well-type detector
- Preamplifier with cooled input stage
- Dewar vessel
- Cable set
- Documentation

Accessories (optional)

- Multichannel Analyzer (Digital or Analog-Digital)
- Analytical Software packages:
 - quantitative and qualitative analysis
 - γ -spectra modeling & efficiency registration calculation for complex geometry objects
 - extended radionuclide library
- Lead Shielding for cutting background
- Liquid nitrogen storage and filling system
- Liquid nitrogen sensor and monitor
- Cable set extension

Features

- 15% - 70% and higher efficiency HPGe Well-type detectors are available
- Sensitive volume available from 90 cm³ to 360 cm³
- Energy range from 20 keV to 10 MeV
- Well materials: Aluminum or Carbon-fiber
- Thin "dead" layer to provide excellent efficiency
- Built-in or Remote Preamplifier types are available depending on application
- Almost 4 π geometry measurement
- Low instrument background
- High energy rate up to 200000 MeV/s
- Excellent peak symmetry & high resolution
- HV supply protection if detector is warm
- High count rate indicator
- Variable cryostat design modifications

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Plenty of cryostat geometries available



Specification

Model	Well diameter	Nominal volume (cc)	Energy Resolution	
			FWHM 122 keV	FWHM 1332 keV
GWDX - 15 20	10	90	0.75	2.0
GWDX - 15 22	16	100	0.8	2.2
GWDX - 20 20	10	110	0.75	2.0
GWDX - 20 22	16	120	0.8	2.2
GWDX - 25 22	10	130	0.75	2.2
GWDX - 25 23	16	140	0.8	2.3
GWDX - 30 22	10	150	0.8	2.2
GWDX - 30 23	16	160	0.85	2.3
GWDX - 35 22	10	170	0.75	2.2
GWDX - 35 23	16	180	0.8	2.3
GWDX - 40 22	10	190	0.75	2.2
GWDX - 40 23	16	200	0.8	2.3
GWDX - 60 23	10	280	0.8	2.3
GWDX - 70 24	10	360	0.8	2.4
GWDX- 70 24	16	360	0.85	2.4

* Detectors with other parameters are available.

Well-type HPGe Detectors GWDX

(Liquid Nitrogen cooled)

Application

Detection of Gamma-rays in nuclear energetics and environmental control, in industry and scientific research, in nuclear medicine and other applications.

Complete set (standard)

- HPGe Well-type detector
- Preamplifier with cooled input stage
- Dewar vessel
- Cable set
- Documentation

Accessories (optional)

- Multichannel Analyzer (Digital or Analog-Digital)
- Analytical Software packages:
 - quantitative and qualitative analysis
 - γ -spectra modeling & efficiency registration calculation for complex geometry objects
 - extended radionuclide library
- Lead Shielding for cutting background
- Liquid nitrogen storage and filling system
- Liquid nitrogen sensor and monitor
- Cable set extension

ADVANTAGES

- Detection of Gamma-rays in nuclear energetics and environmental control, in industry and scientific research, in nuclear medicine and other applications.
- Dead layer of the GWDX detectors inside of the well is thinner if to compare to GWD detectors. Therefore, lower limit of the energy range for this type of detectors is way lower than of GWD well-type detectors and is much lower than 20 keV.
- Moreover, special production technology of GWDX detectors allow to guarantee energy resolution at 122 keV not worse than 750-850 eV. Energy range of GWDX HPGe well-type detectors can reach 5 keV.

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Plenty of cryostat geometries available



Specification

Parameter	Value
HPGe detector relative efficiency	30 %*
Energy resolution**	
at 122 keV	< 1000 eV
at 1.33 MeV	< 2000 eV
Peak to Compton ratio	52 : 1
Energy range of detector operation	3*** keV – 3 MeV
Peak shape	
FWTM/FWHM	< 2
FW.02M/FWHM	< 3
Endcap window material	Al / Be / Carbon fibre
Cooling time of the detector, hours	8-10
Autonomous operation time, hours	24/7
Orientation in space	At any angle
AC Power supply	230 V, 50/60 Hz
Power consumption, max	< 250 W
Power consumption, nominal	< 120 W
Range of the operating temperatures, °C	0 ... +40

* Other detector types are available.

** Energy resolution measured in accordance with ANSI/IEEE Std. 325-1996, using spectrum analyzer MCA527.

*** Depending on detector type and input window.

No LN₂
required



MONOLITH HPGe Detectors with Stirling-cycle refrigerator

Complete set (standard)

Detection unit Monolith consist from the following integrated components:

- HPGe detector (any BSI type)
- Preamplifier with cooling input stage
- Long-lasting Stirling cooler with low power consumption
- Controller for the Stirling cooler
- Protective housing

Accessories (optional)

- Multichannel Analyzer
- Analytical Software packages:
 - quantitative and qualitative analysis
 - γ -spectra modeling & efficiency registration calculation for complex geometry objects
 - extended radionuclide library
- Collimator set
- Lead shield with supporting table
- Hand-cart or tripod

Features

- 10% - 160% efficiency HPGe p-type coaxial detectors are available;
- Energy range from 40 keV to 10 MeV for GCD model;
- Energy range from 3 keV to 10 MeV for GCDX/GCDX-OS models;
- High efficiency of radiation detection;
- High energy rate up to 200000 MeV/sec;
- Excellent peak symmetry;
- Detection of radiation in any spatial orientation depending on cryostat modification;
- Low background and Ultra - low background materials are available.

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Laboratory HPGe Detector with Lead Shield

(Liquid Nitrogen cooled)

Application

Radionuclide monitoring of environmental objects (solid, powder, liquid), medicine and biological objects, materials and food.

Features

- Available in Vertical and U-type cryostat
- Adopting precision gamma-spectrometry methods
- Radionuclide identification and determination of their specific activity
- Low instrumental background
- Low threshold for radionuclide detection
- Separate and simultaneous measurement of activity of 100 radionuclides
- Several grades of instrument material (Al, Cu, etc.) radiopurity are available (ref. p. 59):
 - Standard
 - Low-background
 - Ultra low-background

Complete set (standard)

- HPGe coaxial detector
- Preamplifier with cooled input stage
- Dewar vessel
- Lead Shield with a supporting table
- Liquid nitrogen sensor and level monitor
- Cable set
- Documentation

Accessories (optional)

- Multichannel Analyzer (Digital or Analog-Digital)
- Analytical Software packages:
 - quantitative and qualitative analysis
 - γ -spectra modeling & efficiency registration calculation for complex geometry objects
 - extended radionuclide library
- Liquid nitrogen storage and filling system
- Electrically driven lead door
- Cable set extension

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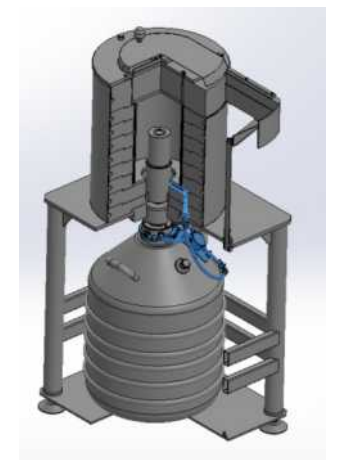
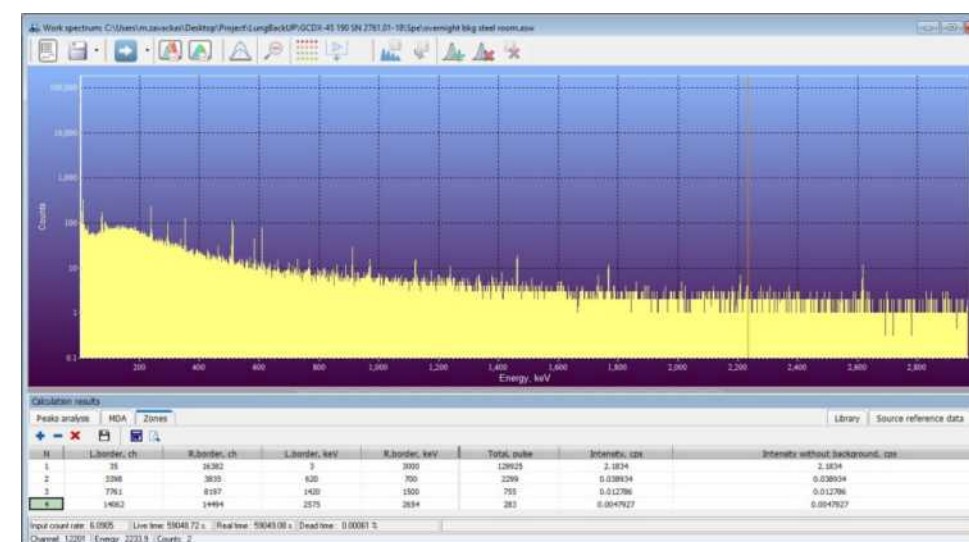
Specification

Parameter	Standard	Low background	Ultra low background
Detection limit for ^{137}Cs radionuclide specific activity, 30%* efficiency detector, measurement time 1 hour, Bq/kg	0.7	0.3	0.1
Absolute sensitivity to gamma flux for 30%* efficiency detector, pulse/quantum	4.5×10^{-3}	4.5×10^{-3}	4.5×10^{-3}
Instrumental background intensity for energy range from 40 keV to 3 MeV, pulse x s	< 4.5	< 1.5	< 0.5
^{137}Cs radionuclide specific activity measurement error for 1 hour measurement time, %	< 20	< 20	< 20
Shield thickness			
Lead wall, mm	100	100	100 - 150
Copper wall, mm	6	9	6 - 10
AC power supply			
Voltage, V	230	230	230
Frequency, Hz	50	50	50
Lead Shield internal diameter (without liners)**, mm	200	200	200
Lead Shield internal height (without liners)**, mm	280	280	280
Detector with Lead Shield weight, kg	760	760	> 760

* Detectors with higher efficiency are available

** Possible to order other Lead Shield dimensions

Purge port is available for your lead chamber to decrease influence of Radon while measuring



LN₂ Monitor

Th-232, Cs-137, K-40



Portable HPGe Gamma-ray Detectors

(Liquid Nitrogen cooled)

Application

Detection, accumulation and processing of gamma spectra in field and industry conditions were small dimensions and weight of spectrometer are important.

Complete set (standard)

- HPGe coaxial detector
- Preamplifier with cooled input stage
- Dewar vessel
- Cable set
- Documentation

Features

- Light weight aluminum construction
- Detection of radiation in any spatial orientation
- Compact low-consuming electronics
- Available with HPGe Coaxial or Planar detector
- Transportation and storage without cooling
- Input window materials: Aluminum, Beryllium or Carbon-fiber
- Dewar vessels available with different volumes from 1l to 7l

Accessories (optional)

- Multichannel Analyzer
- Analytical Software packages:
 - quantitative and qualitative analysis
 - γ -spectra modeling & efficiency registration calculation for complex geometry objects
 - extended radionuclide library
- Hand-cart for Multichannel Analyzer, battery, transformer, etc.
- Additional batteries
- Charger
- Collimators
- Transport case
- Tripod
- Liquid nitrogen storage and filling system
- Cable set extension

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Specification

Parameter	Value
Energy range, keV	
Standard	40 - 10000
Extended	3 - 10000
HPGe detector efficiency, %	30*
Energy resolution for 30% efficiency detector, keV at energy	
122 keV	0.875
1.33 MeV	1.85
Peak to Compton ration	58:1
Time of cooling after filling with liquid nitrogen, h	4 - 8**
Time of continuous operation, days	1 - 5**
Al end cup thickness, mm	0.7
Weight of detector with empty Dewar vessel, kg	5 - 12**
Preamplifier cables have standard NIM connectors: POWER DC $\pm 12V$ – D-Sub-9pin, HV – SHV, OUT – BNC, TEST – BNC	

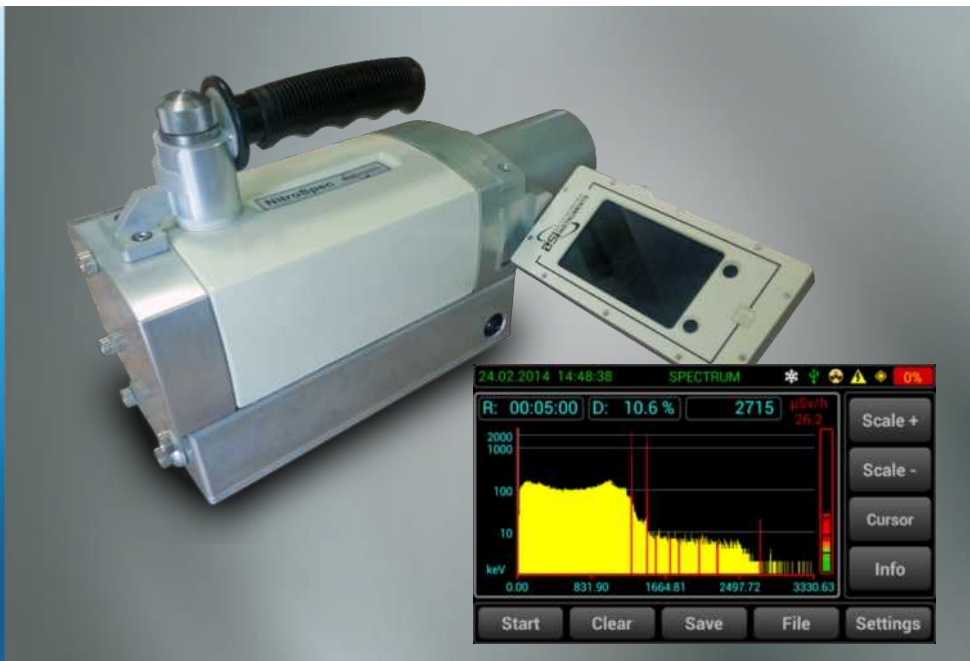
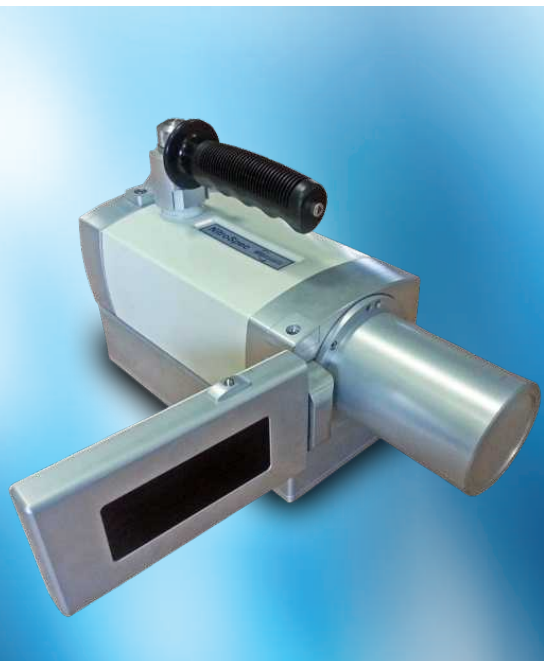
* HPGe Detectors are available with efficiency from 10% to 100%

** Depending on Dewar vessel volume and/or detector efficiency



Accessories





NitroSPEC

HPGe Hand Held Spectrometer

Application

- Customs and Homeland security
- Environmental monitoring
- Waste Management
- Nuclear Industry
- Nuclear Medicine
- First Response

Features

- Reliable;
- Low cost;
- Easy to operate;
- Ready for operation in slightly over 1 hour;
- 20 hours of autonomous operation;
- Simple in maintenance;
- No additional vibrations;
- Minimal size and weight;
- No high costs for servicing;
- Completely integrated solution;
- Can be placed in an ordinary case;
- Minimal time to reach the operating temperature.

NitroSPEC is the world's smallest liquid nitrogen cooled Spectrometer which is based on High Purity Germanium (HPGe) semiconductor detectors. NitroSPEC is providing the complete range of functions and features which are offered by regular laboratory Spectrometer based on HPGe detectors but in a really miniature composition of all major components. During the development of the NitroSPEC, Baltic Scientific Instruments R&D specialists were aimed at HPGe detector, Dewar vessel for liquid nitrogen, MCA with software package and visualization monitor integration in only one miniature monounit to provide easy and comfortable use. Due to the fact that during the measurement no cables are needed, the operator is unrestricted in his mobility. Power supply is no longer an issue as everything is integrated.

NitroSPEC can be equipped with a wide range of HPGe detectors depending on the application. HPGe planar GPD detectors are available for analysis of Gamma and X-rays. HPGe coaxial GCD detectors are available with relative efficiencies up to 20%. Standard or with extended energy range (X series).

NitroSPEC includes preamplifier, Digital MCA with 16K channels, High and Low Voltage power supply and a set of batteries to provide maximal flexibility.

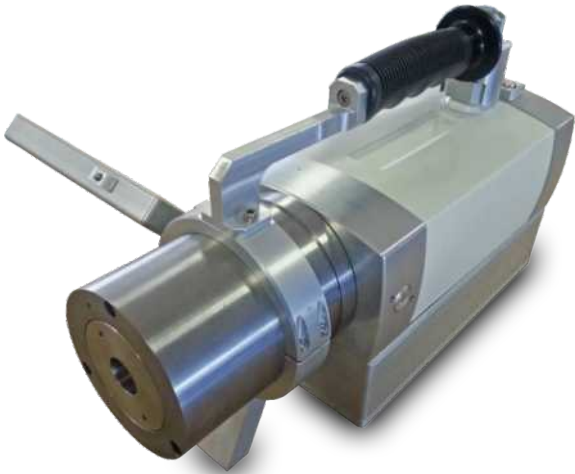
In field mode NitroSPEC is used as identifier simultaneously acquiring and saving data for performance of quantitative and qualitative analysis in laboratory conditions. Communication between working station and NitroSPEC is possible via USB or wireless connection.

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Specification

Parameter	Value
Relative efficiencies available, %	10 to 20
Energy range, keV	40 - 3000*
Energy resolution for 10% efficient coaxial detector at energy 122 keV, eV	850
at energy 1.33 MeV, keV	1.80
Dewar vessel volume, l	0.6
Time for reaching of operating temperature after liquid nitrogen filling, h	1.5
Detector holding time, h	> 20
Li-Ion Battery operation time, h	> 8
Navigation system	GPS
Operational temperature range, °C	0...+40
Maximum number of quantization levels of ADC	16K
Channel capacity	2 ³²
Integral nonlinearity, %	< 0.04
Differential nonlinearity, %	< 1
Temperature instability, %/°C	< 0.01
Dimensions, mm	154 x 324 x 217
Weight, kg	< 4.9
Power consumption, W	< 3.5
Voltage, V	12
Ingress Protection	IP42



Accessories (optional)

- Shielding with collimators
- Hand-cart
- Hard-sided transport case
- Funnel for LN₂ filling
- Car charger
- Spare Battery
- Shoulder belt





HandSPEC

HPGe Hand Held Spectrometer
(Electrically cooled)

Application

- Customs and Homeland security
- Environmental monitoring
- Waste management
- Nuclear industry
- Nuclear Medicine
- First Response

Features

- Integrated solution with HPGe detector, MCA, power supply, etc.
- No Liquid Nitrogen needed
- Long autonomous operation time up to 6 hours
- Really portable and hand held device
- Good energy resolution provided by Pulse tube application
- Rugged and designed for outdoor use in wide range of temperature and humidity

Radionuclides Identifier for Gamma Analysis HandSPEC is a complete spectrometer based on high-purity germanium detector. Cooling system of HandSPEC consists of special cryostat which incorporates Stirling-cycle cryocooler with Pulse tube. HandSPEC is intended for gamma-radiation registration, spectra processing, radionuclides identification and their activities determination by various methods.

HandSPEC has internal processor and spectrometric device to control all spectrometer parameters, perform measurements and store spectra and analysis results in internal memory. Visualization of the results and control of spectrometer parameters is made via built-in touch screen having resolution 800x400 pixels and diagonal 10.8 cm. Battery status indicator in the right upper corner of the screen shows time to recharging of the instrument. Internal processing digital electronics on the basis of 16k channels MCA and is controlled from touch screen. High voltage supply for detector and preamplifier power supply are integrated as well as an internal coarse amplifier and digital filtering and analysis.

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Specification

Parameter	Value
Energy range, keV	
Standard	40 - 10000
Extended (X Series)	10 - 10000
HPGe detector efficiency, %	10*
HPGe detector physical dimensions, mm	Ø50, h = 30
Energy resolution for 10% efficiency detector, keV	
at energy 122 keV	1.1
1.33 MeV	2.0
Peak to Compton ration	41:1
Time of cooling, h	24
Time of continuous operation, h	6
Size of the Spectrometer, mm	426 x 172 x 346
Weight of of the Spectrometer, kg	~ 12

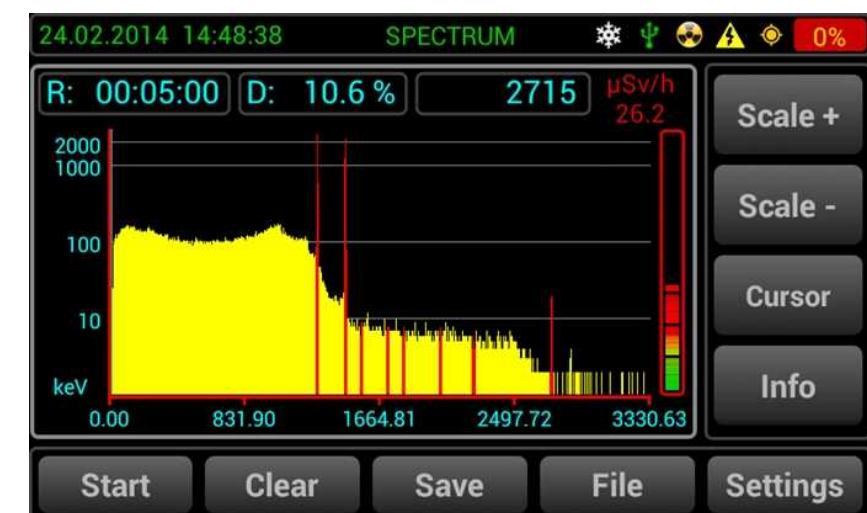
* HPGe Detectors are available with efficiencies: 10%, 15% and 20%

Multichannel Analyzer

Parameter	Value
Channel splitting	128, 256, 512, 1k, 2k, 4k, 8k and 16k
Input count rate, cps	0 - 150000
Shaping time (adjustable) in the range	0.1 – 25 µs
Integral non-linearity	<0.025%
Differential non-linearity	<1%
High Voltage supply	+/- 3.6 kV (up to 5 kV)

Complete set

- HPGe coaxial or planar Detector
- Preamplifier with cooled input stage
- Miniature Stirling-cycle cryocooler with Pulse tube
- Cryocooler controller
- Digital Multichannel Analyzer
- Internal processor with LCD and touch screen
- Analytical software (onboard and for PC)
- Inbuilt GPS module
- Dose rate meter
- Rechargeable Li-Ion batteries
- Cable set
- Documentation
- Available accessories: car adaptor, transport case, charger, spare battery, Hand-cart, tripod, etc.





Robotic Gamma Spectrometer with Sample Changer

(HPGe detector based)

Complete set

- Gamma-ray detector based on HPGe detector with LN2 or Electrical cooling;
- Lead shield;
- Multichannel Analyzer;
- Software for spectra processing, identification of radionuclides and calculation of their activities;
- As option available: advanced analysis software and software for complex geometry sample calibration using Monte-Carlo method;
- Automatic sample changer based on Robot arm;
- Table with sample holders and safe cabinet;
- Barcode reader together with Barcode printer;
- First level software for Robotic Spectrometer control.

Application

Robotic Gamma Spectrometer is intended for the detection and analysis of radio nuclides from various types of environmental objects such as rocks, minerals, sludge, slag, soil, plant, sediment and particulate matter in air and water. The spectrometric system is able to determine the composition of a sample based on the photon energy and the activity based on the photon flux. The low-background lead shielding together with the HPGe detector gives precise results even for low activity materials.

The fully automated sample changer enables the user to measure more than 56 samples, without having to interact with the Robotic Spectrometer. This reliable robotic sample changer increases the productivity and reduces the possibility of health risks for the operator.

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Specification

HPGe detector with Lead Shield

Parameter	Value
Detection limit for Cs ¹³⁷ radionuclide specific activity, measurement time 1 hour, Bq/kg	0.5
Absolute sensitivity to gamma flux for 30%* efficient detector, pulse/quantum	4.5×10^{-3}
Instrumental background intensity for energy range from 40 keV to 3 MeV, pulse/keV x sec	5×10^{-4}
Cs ¹³⁷ radionuclide specific activity measurement error for measurement time 1 hour, %	20

* HPGe Detectors are available with efficiencies from 10% to 100%

Automatic Sample Changer

- Machine vision
- 7-axis manipulator
- Payload: 3 kg
- Reach: per request
- Accuracy: +/- 0.01 mm
- Fastest 7-axis robot
- All motors and cablings enclosed
- Compact controller

Samples

Measurement geometries are:

- Bottle 500ml,
- Bottle 250ml,
- Denta 60ml,
- Denta 30ml,
- Marinelli,
- Petri vessels,
- etc.

Given numbers are applicable to a specific model but it is not a limitation. The system is flexible enough to be adjusted in accordance to specific requirements.

Barcode Reader and Printer

To assure the correct processing of all data during the measurement and analysis process, the samples are marked by using a barcode printer that is connected to the workstation. Using the bar code reader, the information stored in the database is retrieved for each sample before the measurement process is started.



Specification

Parameter	Value
HPGe detector relative efficiency	45 %*
Energy resolution	
at 5.9 keV	< 500 eV
at 14.4 keV	< 650 eV
at 122 keV	< 700 eV
at 1.33 MeV	< 1900 eV
Peak to Compton ratio	60 : 1
Energy range of detector operation	3 keV – 3 MeV
Peak shape	
FWTM/FWHM	< 2
FW.02M/FWHM	< 3
Endcap window material	Carbon fibre

* Other detector types and relative efficiencies are available.



Whole body counter WBC HPGe detector based

Complete set

Spectrometer:

- One, two or more HPGe detectors (scintillation detectors optional)
- Multichannel analyzers MCA (or one MCA with multiple input channels)
- Analytical software for quantitative and qualitative analysis
- Liquid nitrogen monitors (in case detectors are cooled with LN2)
- Automatic filling station with LN2 (in case detectors are cooled with LN2)

Main assembly:

- Steel Fixing platform
- Detectors holders and positioning mechanisms
- Ergonomic chair with hydraulic mechanism for changing position of the body
- Crate for electronics

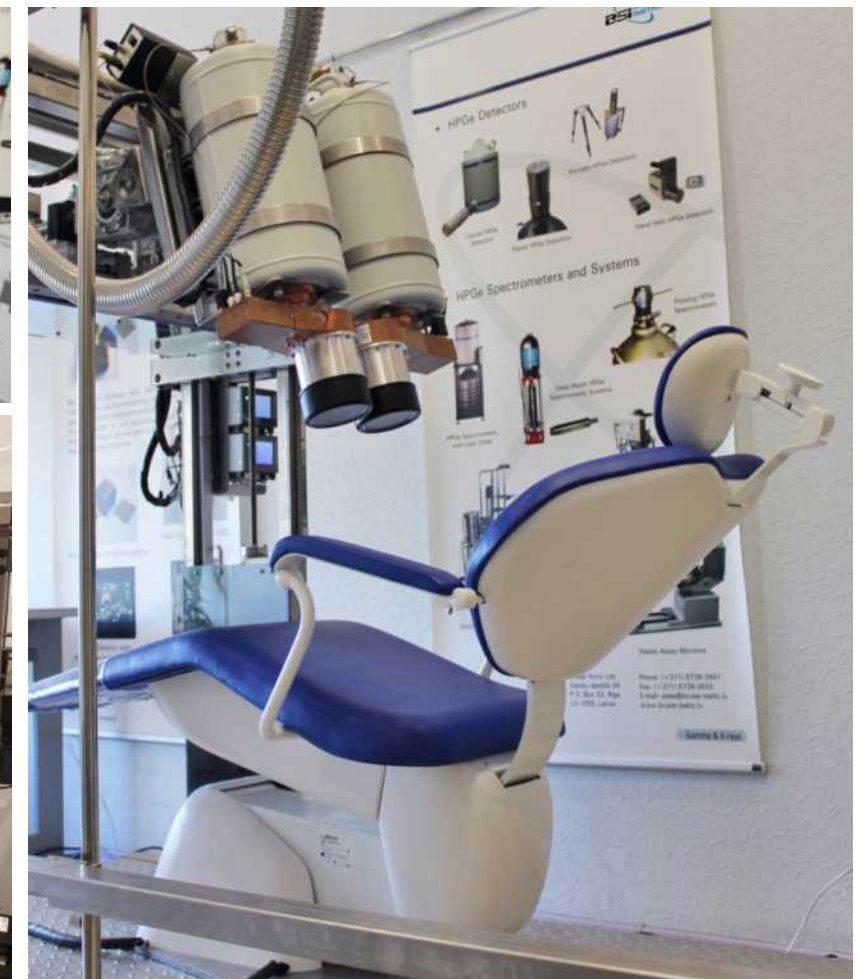
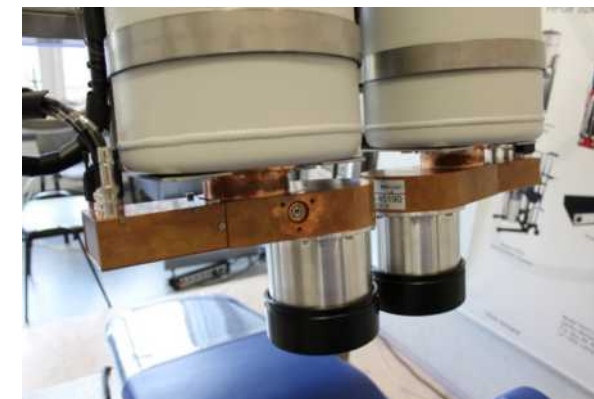
Related cables and connectors

Features

- Quantitative and qualitative analysis using high-resolution HPGe detectors (GCDX-OS suggested)
- Adjustable to measure any part of the body
- Comfortable for the examined person
- Available with one or multiple HPGe detectors
- HPGe detectors can be LN2 or electrically cooled
- Option: available with scintillation detectors like NaI, LaBr, SrI, etc.
- Simple and intuitive software interface
- Automatic filling station for LN2 (in case detectors are cooled with LN2)

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Specification

Parameter	Value
Energy resolution, MeV	0.05 - 2.8
HPGe detector efficiency, %	10*
Detection limit for ^{131}I radionuclide specific activity, measurement time 600 s, Bq/l	0.8×10^3
Absolute sensitivity to gamma flux for 30% efficiency detector, pulse/quantum	7.3×10^5
Continuous autonomous operating time after filling with liquid nitrogen, days	18
Ambient temperature, °C	+5 to +40
Supply voltage, V/Frequency, Hz	220+10 / 50+60
Overall dimensions	
Lead shield, support and detector, mm	1300 x 580 x 480
Spectrometric device Multispectrum, mm	490 x 230 x 490
Lead shield, support and detector weight, kg	170

* Detectors with higher efficiency are available

Installations



HPGe Spectrometer with Lead Shield for Liquids and Gaseous Flows Radionuclide Analysis

Application

HPGe Spectrometer with shield is designed for defining the composition and activity of radionuclides in the flow of liquids and gases in automated technological processes such as those in nuclear energetics, environmental monitoring and industrial applications.

Complete set

- HPGe coaxial detector
- Multichannel Analyzer
- Lead Shield with a supporting table
- Control unit with valves
- Sensors for liquid and gas flow
- Emulation and analysis software
- Cable set

Features

- Definition of composition and activity of radionuclides in real time mode
- Display of current values for specific activity of controlled radionuclides
- Indication of activity level increase of any chosen radionuclide
- High registration efficiency
- Wide range of measured activities
- Operation rates in fully-automatic mode: measurement, washing, purging, pre-starting
- Liquid nitrogen level indicator with alarm system

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HPGe Mobile Spectrometer WAM Mobile

Application

Registration of Gamma and X-ray spectra for the radiological control of environmental objects, industrial and agricultural products, objects and plants of nuclear energetics and enterprises dealing with the storage and processing of radioactive wastes

Complete set

- HPGe detector for gamma spectroscopy
- Multichannel analyzer of operating with a laptop PC or tablet PC
- Software packages for quantitative and qualitative analysis
- Advanced software package for characterization using Monte-Carlo calculations
- Lead Shielding with collimator set
- Manual or electrically driven trolley
- Laser distance meter
- Cable pack and documentation

Features

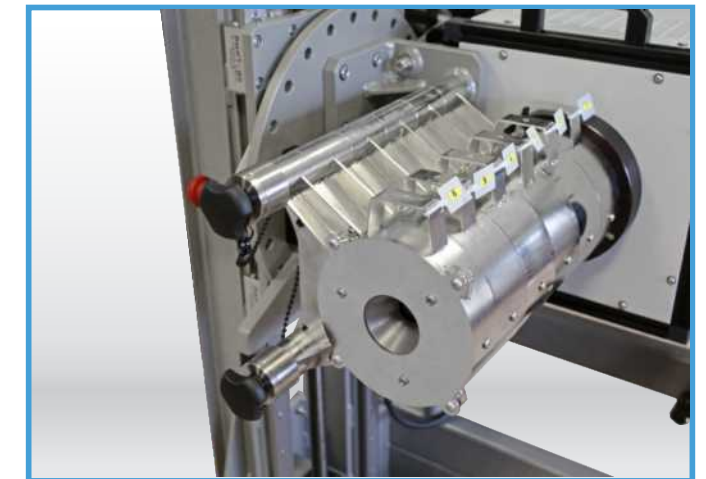
- Optimal sizes and weight for mobile application
- Detection unit is placed on a manually or electrically driven trolley
- Trolley is equipped with a lead shield and collimator set
- Lead shield thickness can be 25mm or 50mm depending on the application
- Detection unit can be LN2 or electrically cooled
- Possible to equip with large capacity batteries for autonomous operation in the field even with electrically cooled detection unit
- Equipped with laser distance meter for more accurate measurement
- Complete spectrometer can be characterized at factory
- Simplicity of operation and servicing

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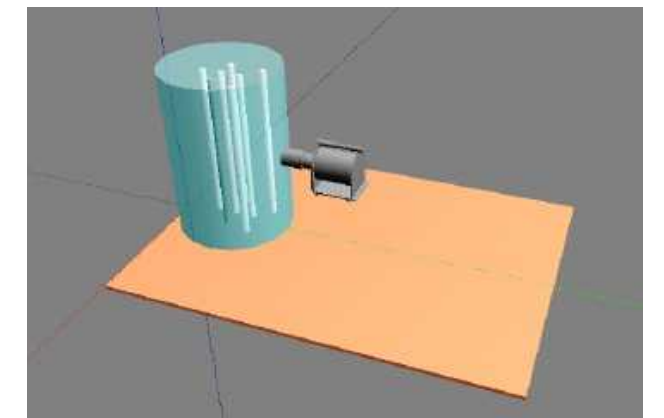
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Specification

Parameter	Value
Top measurement point in horizontal position, mm	1250
Bottom measurement point in horizontal position, mm	450
Bottom measurement point in vertical position (looking down), mm	95
Maximum speed on flat (for electrically driven trolley)	Slow Mode - 1.25km/h Fast Mode - 4.00km/h
Complete system dimensions (L x W x H), mm	1498 x 722 x 1588
Wheelbase, mm	945
Ground Clearance, mm	100



Advanced software package allows to calibrate the system for complex geometry samples like different size drums, boxes, metal or concrete containers, etc. User has a choice of more than 20 ready geometries or it is possible to create your own. While performing characterization, different collimators can be considered, shielding and orientation of all objects involved. Monte-Carlo calculations are used.



Specification

Parameter	Value
Energy range, keV	40 - 3000
HPGe detector efficiency, %	30*
Energy resolution for 30% efficiency detector, keV at energy	
122 keV	0.9
1.33 MeV	1.9
Deterioration of energy resolution at 622 keV line as compared with resolution of detector cooled by liquid nitrogen, %	< 5
Overall dimensions	
Detector capsule, mm	Ø90 x 130
Detector capsule with cryocooler, mm	Ø114 x 350
Compressor, mm	445 x 357 x 281
Weight	
Detector with cryocooler, kg	2.9
Compressor, kg	31.8
Maximal distance between detector and compressor, m	15
Consumed power, W	570
Voltage, V	220
Frequency, Hz	50

* HPGe Detectors are available with efficiency from 10% to 100%

No LN₂ needed



Gamma-ray HPGe Detector

(Electrically cooled)

Application

Detection, accumulation and processing of gamma and x-ray spectra in conditions, when HPGe detector's cooling by liquid nitrogen is not possible

Accessories (optional)

- Multichannel Analyzer (Digital or Analog-Digital)
- Analytical Software packages:
 - quantitative and qualitative analysis
 - γ -spectra modeling & efficiency registration calculation for complex geometry objects
 - extended radionuclide library
- Cable set extension

Features

- No liquid nitrogen necessary
- Detection of radiation possible in any spatial orientation
- Automatic restart after power supply switch-off
- Long-duration continuous operation
- Coaxial or Planar detector can be used

Complete set (standard)

- HPGe coaxial detector with heat exchanger
- Preamplifier with cooled input stage
- Gas compressor cooling system with built-in cryocontroller for the provision of automatic monitoring and control of operating modes for HPGe detector and cryosystem
- High pressure gas pipes for connecting the cryosystem to the Detection Unit heat exchanger
- Cable set
- Documentation

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Specification



Flowing HPGe Spectrometer

(Liquid Nitrogen cooled)

Application

Highly efficient control of radionuclide materials with low activity in on-line mode (fresh fuel rods, liquid and gas flows)

Accessories (optional)

- Multichannel Analyzer (Digital or Analog-Digital)
- Analytical Software packages:
 - quantitative and qualitative analysis
 - γ -spectra modeling & efficiency registration calculation for complex geometry objects
 - extended radionuclide library
- Liquid nitrogen storage and filling system
- Liquid nitrogen sensor and monitor
- Cable set extension

Features

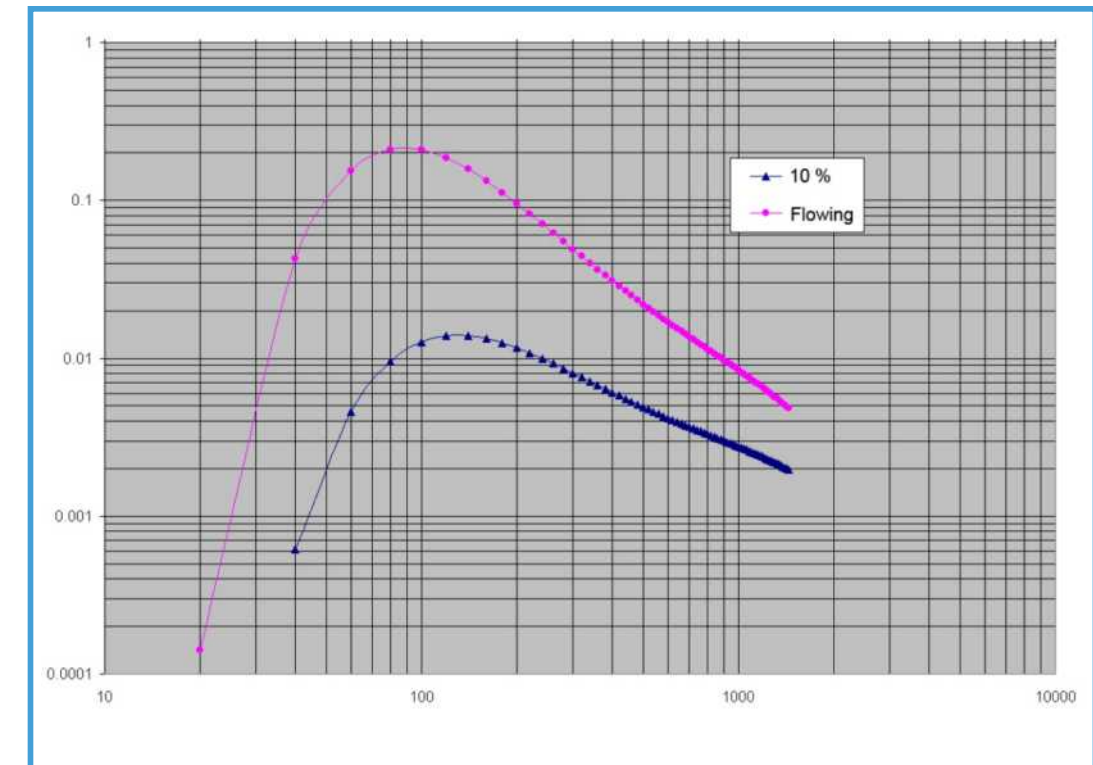
- Detection unit performs 4 π geometry measurements as measuring product is moving inside germanium detector
- Radionuclide efficiency registration is dozen times higher than efficiency registration of standard coaxial detection unit of the same dimensions
- HPGe detector flowing geometry can be developed based on the crystal with equivalent efficiency from 10% to 100%

Complete set (standard)

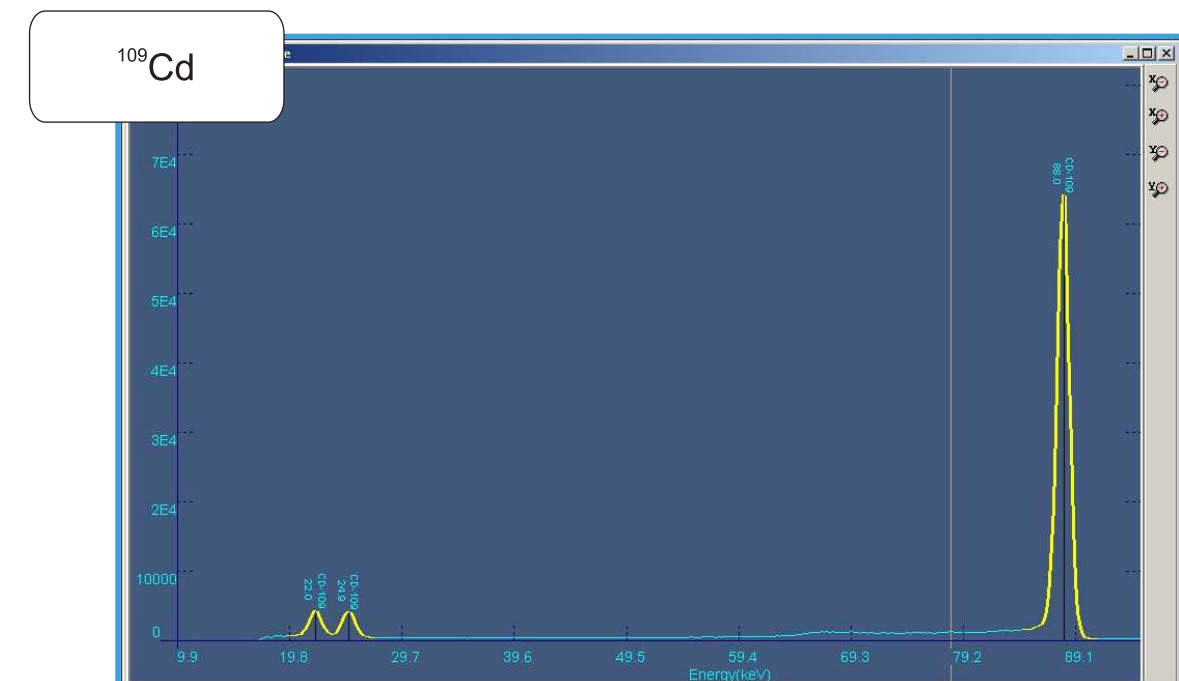
- HPGe coaxial detector
- Preamplifier with cooled input stage
- Dewar vessel
- Cable set
- Documentation

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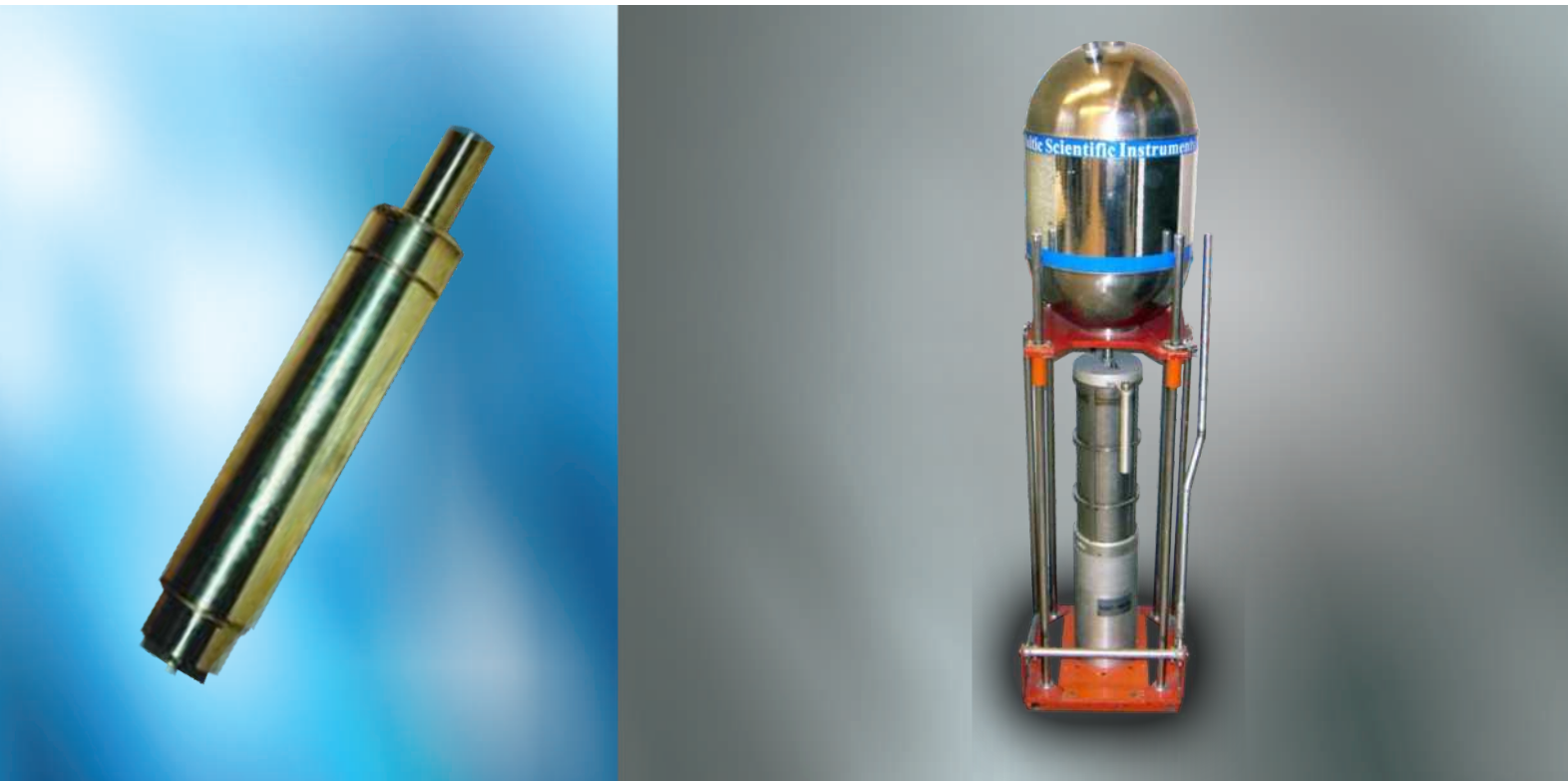
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Absolute efficiency registration comparison curves during gamma-emitting sample positioning inside and outside detector



Spectrum of wire sample containing source ^{109}Cd of low activity



Deep-water HPGe Gamma Spectrometer

Application

Deep-water gamma spectrometer is applicable to the registration of gamma-radiation from radionuclides in monitoring of the sea bed for objects from marine accidents, submarine storage of radioactive wastes, search of lost nuclear charges, inspection of radionuclide migration, etc.

Features

- Long-lasting independent functioning at great depths
- Programmable control with inbuilt microprocessor device
- Independent detection and accumulation of gamma spectra for a predetermined time
- Recording and storage of gamma spectra for an unlimited time period
- Possibility of reading and processing data using computers after retrieving the spectrometer

Complete set

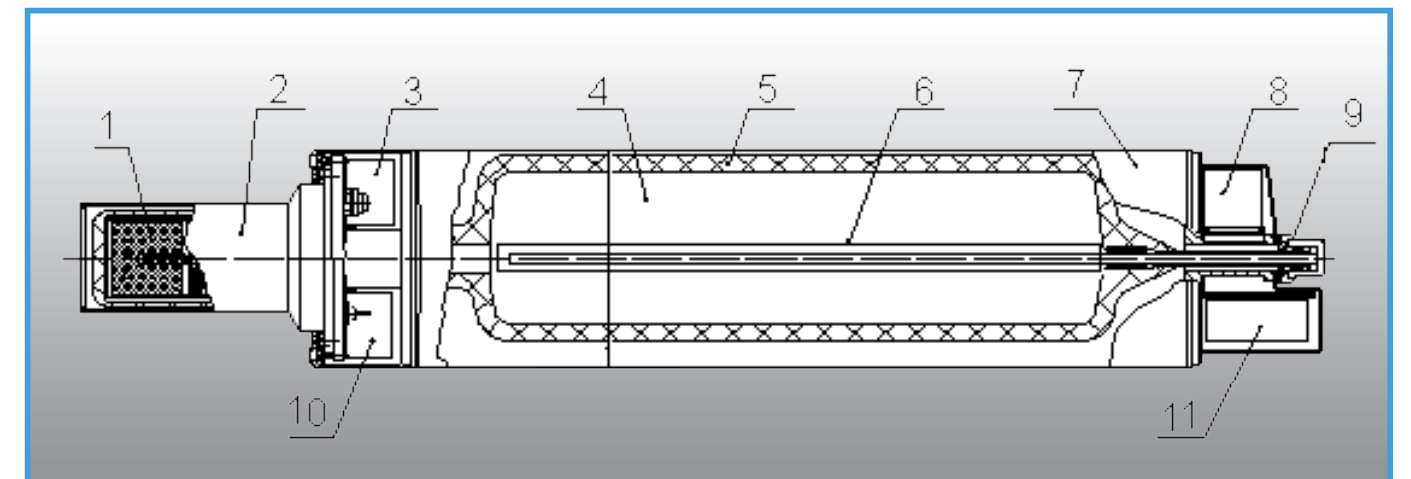
- HPGe coaxial detector
- Cryostat combined with cryoaccumulator for detector cooling
- Spectrometric device with microprocessor and data transfer devices
- Durable waterproof housing with power supply for the spectrometer, allowing spectrometer to dive to depths of up to 100, 500, 1000 or 3000 meters depending on requirements
- External equipment for cryoaccumulator cooling and refilling with liquid nitrogen
- Work station equipped with software for spectra visualization and radionuclide identification

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Specification

Parameter	Value
Energy range, keV	40 - 3000
HPGe detector efficiency, %	30*
Energy resolution for 30% efficiency detector, keV at energy	
122 keV	0.9
1.33 MeV	1.9
Detection limit for specific activity of radionuclides during 1 hour measurement time, Bq/l	
¹³⁷ Cs	0.259
⁶⁰ Co	0.222
⁵⁴ Mn	0.222
²³⁵ U	0.333
²⁴¹ Am	7.4×10^{-3}
Number of spectra recorded during autonomous operation	100
Maximum diving depth, m	3000
Cryoaccumulator cooling time, h	8
Continuous operation time after cryoaccumulator cooling, h	50
Weight of spectrometer without protective housing, kg	30
Weight of equipment for cryoaccumulator cooling by liquid nitrogen, kg	56



- | | |
|----------------------------------|-----------------------------|
| 1. HPGe semiconductor detector; | 7. stainless steel coating; |
| 2. cover of titan alloy; | 8. HV power supply; |
| 3. compartment for preamplifier; | 9. filling nozzle; |
| 4. cryoaccumulator; | 10. HV filter; |
| 5. vacuum insulation; | 11. shaping amplifier. |
| 6. cold finger; | |



Waste Assay Monitor HERCULES

(based on HPGe and/or scintillation detectors)

Application

Waste Assay Monitor Hercules is intended for the measurement and determination of activities, activity concentration, total activities and total activity concentrations of selected radionuclides which emit gamma radiation in a range from 100 to 1500 keV. Solids and subjects are measured with average density up to 2055kg/m³ located in standard drums with volume of about 0.2m³ and 0.4m³ and not standard packages of wastes of different matrixes.

Features

Waste Assay Monitor Hercules is a complex measuring system which is intended for monitoring of radioactive waste in standard 200-litre drums and not only.

Hercules includes following systems:

- Spectrometric unit based on High-resolution HPGe detector (or multiple HPGe detectors) suitable to perform segmented gamma-spectrometric scanning for determination of activities of selected radionuclides in individual drum segments with vertical motion and collimator,
- Dose rate monitor, which measures dose rate of the segment in defined distance from the drum,
- Dose rate monitor measures the background dose rate,
- Rotary table,
- Control and power supply switchboards.

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Specification

Parameter	Value
Energy range, keV	100 to 2500 keV
Radionuclides measured *	¹³⁴ Cs, ¹³⁷ Cs, ⁶⁰ Co, ⁵⁴ Mn, ⁵⁹ Fe, ⁹⁵ Nb, ⁶⁵ Zn, ⁹⁵ Zr, ⁵⁸ Co, ⁵¹ Cr, ¹⁴⁴ Ce, etc.
Measuring range	from 2.5 kBq (for background of 300 nSv/h, for ⁶⁰ Co in 0.2 m ³ drum with an average material density of 300 kg/m ³ and measuring time of 30 min.) up to 1GBq
Measurement precision	+/-20% (for the uniform activity distribution and the density in the volume measured) maximum 50% for the material density of 1000 kg/m ³ in the drum
Material density	up to 2500 kg/m ³
Material volume	up to 0.4 m ³ (or other by request)
Material weight	up to 1000 kg (or other by request)
Measured object	Different drum, boxes, containers made of steel concrete, etc.
Detector	HPGe, NaI, LaBr, Srl and other
Dimensions	2500 x 700 x 2200 mm (depends on modification)
Communication interface	X2X, CAN, RS-485, Wi-Fi
Protection Marking	IP 54 or better

* Nuclide list can be changed accordingly

Modifications



Equipped with roller based conveyor



Segmented scanner based on scintillators

Specification

Parameter	Value
Energy range, keV	50 - 3500
HPGe detector efficiency, %	38*
Energy resolution for 30% efficiency detector, keV at energy	
122 keV	1.0
1.33 MeV	1.9
Detection limit for ^{137}Cs radionuclide specific activity, measurement time 1 hour, Bq/m^3	200
^{137}Cs radionuclide specific activity measurement error for measurement time 1 hour, %	30
Integral nonlinearity, %	0.05
Instability of specific activity measurement from calibration source, %	10
Time of operation mode setting, h	0.5
Time of continuous operation, days	30

* HPGe Detectors are available with efficiency from 10% to 160%

Automated System for Water Activity Measurement

Application

Automatic monitoring of gamma-ray radionuclide specific activity directly in water reservoirs in the regions of nuclear weapons testing, near nuclear storage, nuclear power plants and other objects of nuclear energetics

Features

- High sensitivity of radionuclide activity detection
- Full autonomy of measurement station data transfer via radio channel or cable channel into the point of information receiving, processing and archiving
- Operation simplicity and system high reliability
- Dewar vessel filling one a month
- Data transfer through radio channel or cable
- Total activity transmit every minute, spectrum transmit every hour

Complete set

Floating monitoring station that is situated on the platform on pontoon and contains:

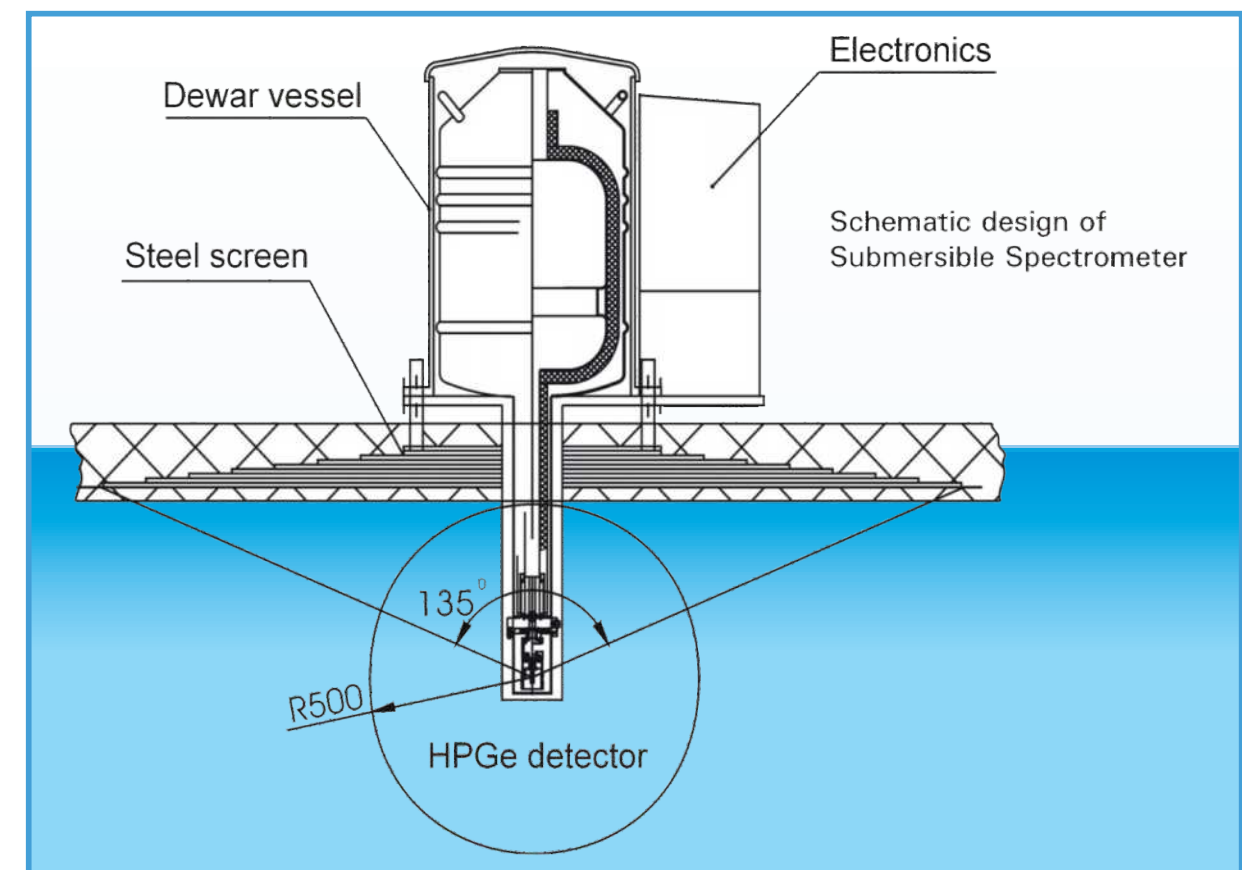
- Gamma-ray spectrometer based on submerged high purity germanium or scintillator detector;
- Transmitter receiver;
- Microprocessor device for interfaces necessary for automatic operation, self-diagnostic, calibration;
- Backup accumulators (up to 100 hours);
- Accessories for station control, calibration.

Station for receiving, processing and archiving information including:

- Radio station;
- Decoding modem connection device with personal computer;
- Software for spectra description, nuclides identification, calculation of their specific activity;
- Internal memory for data storage;
- Metrological assurance, set of accessories and necessary instruments.

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NICOLE

Hybrid cooling system (LN₂ / Electrical)

Application

The NICOLE hybrid cooling combines liquid nitrogen and electro cooling. Combination of these two cooling systems provides continuous operation for at least 10 months without liquid nitrogen refilling.

Complete set

- Stirling-cycle cryocooler
- Cryocooler controller
- 20L Dewar vessel
- Liquid nitrogen sensor and level monitor
- Pressure sensor with digital indicator



Parameter	Value
Type of Stirling-cycle cryocooler	Free-piston
Cooler Power	250 W
Dewar vessel volume	20L/28l
Liquid nitrogen holding time when cryocooler is operating (period between refilling)*	>10 months
Cryocooler MTBF	>45 000 h

* In case of cryocooler failure cooling system remains functional, but periodic refilling of liquid nitrogen once per 18 days is required

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Ultra Low-background HPGe Detectors

Application

Ultra low-background HPGe detectors are widely used in underground laboratories for determination of radionuclides activities in environmental or industrial samples at $\mu\text{Bq/kg}$ levels and in scientific experiments such as investigation of magnetic moment of neutrino, dark matter search, etc.



Design

- Task related design (U-type, vertical, down-looking or portable cryostat)
- Remote not cooled part of preamplifier
- Zeolite is placed near warm part of preamplifier in order to be outside measuring chamber

Cryostat materials

- Certified materials with low radiation impurities
- Ultrapure aluminium – silicon alloy with U + Th content < 1, 0.5 or 0.2 ppb for detector holder and endcap
- Freshly produced electrolytic copper for coldfinger and pedestal
- Tested on radiopurity selected stainless steel screws and sapphire insulators

Technology

- Transportation of HPGe crystal and cryostat materials by road transport
- Minimal fabrication time when materials are not shielded
- Assembly in a cleanroom
- Cleaning and passivation of copper surfaces
- Storage of crystal and cryostat materials in a container made from materials effectively slowing down and absorbing neutrons (water and Cd)

Design features

- Fabrication of large volume HPGe detectors without bulletization
- Front end electronics made on low-background Teflon substrate
- Passive screen between front end electronics and HPGe crystal made from Pb with Bi-210 radioactivity < 0.1 Bq/kg
- Double-crystal HPGe detector design
- Multi-crystal HPGe detector design



Borehole Gamma Spectrometer

(Several cooling options)

Application

Borehole Gamma Spectrometer is used for:

- Determination of underground orientation of transuranium ores in their natural beddings (headings, mines, boreholes);
- High precision gamma-spectrometry of radionuclides at inspection of sea bed, water sealed mines, water filled boreholes, radionuclide migration in groundwater;
- Gamma-spectrometry at neutron-activation method of substance analysis.

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Specification

Parameter	Value		
	Cryoaccumulator	Stirling cryocooler	Liquid nitrogen
Relative efficiency (with respect to 3" x 3" NaI detector and ⁶⁰ Co source mounted 25 cm above the detector) at 1.33 MeV g-photon*, %		10	
Resolution at 122 KeV at 10 ³ s ⁻¹ , keV	< 1.0	< 1.5	< 1.0
Resolution at 1.33 MeV, keV	< 1.9	< 3.2	< 2.0
Energy range of detector operation, keV		100 - 3500	
Diameter of protective housing, mm	65	80	70
Length of Borehole Probe, mm	1450	1250	1550
Cooling time, h	10	12	8
Autonomous operation time, h	8	15000	10

* Borehole detection unit can be equipped with HPGe detector with efficiency up to 40%

Complete set

Borehole Gamma Spectrometer consists of:

- Spectrometric Probe
- Ground workstation

Spectrometric probe consists of:

- Spectrometric gamma-radiation detection unit based on high-purity germanium detector with built-in preamplifier of signals.
- Alternatives for Cooling System:
 - Cryoaccumulator,
 - Stirling cryocooler;
 - Liquid nitrogen,
- Spectrometric device;
- Protective housing;
- Well-logging borehole connection cable;

Ground workstation consists of

- Data processing and analysis software SpectraLineGP;
- Personal computer;
- Borehole cable and connectors set.



Gamma Spectrometer All-In-One

(based on NaI Detector)

Description

Gamma Spectrometer combines NaI(Tl) crystal of different sizes, a photomultiplier tube, a high voltage power supply, a preamplifier and a multi-channel analyzer module from within one rugged housing.

The whole system is entirely powered from the USB interface. Due to the integration of all hardware components required for a gamma spectroscopy system in one package, only one USB cable is required to connect the detector to a computer. This simplifies the usage and lowers the total costs of the gamma spectrometer. Gamma Spectrometer is operated with SpectraLineGP software package. The only requirement is that the host computer has an integrated USB high power hub or host port.

Features

- Spectrum stabilization
- Entirely Powered from USB Interface
- Low Power Consumption,
- Well Suited for Laptop Operation
- Small Size, Compact Housing
- Only one Cable Required for Operation
- High Integration
- Useable with many Application Programs
- Easy to Use
- Low Price

Complete set

- Gamma Spectrometer based on NaI or other scintillation detector;
- GammaPRO software package;
- 2m USB cable;
- Documentation.

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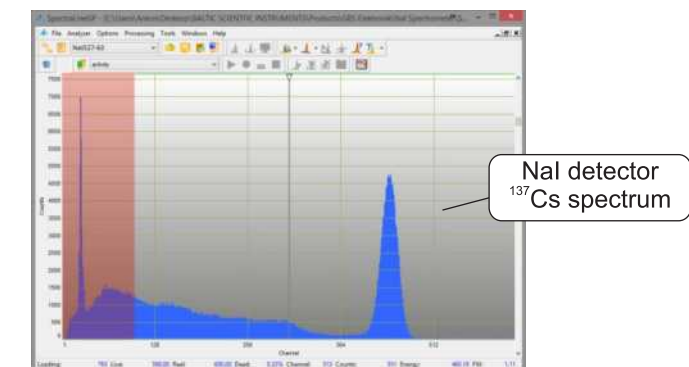
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Specification

Parameter	Value
Crystal Size	63mm x 63mm*
Energy Resolution (FWHM @ 662keV)	6.2% typ. / 7% max
Energy Range	20keV to 3MeV
Number of Channels	128, 256, 512, 1024, 2048
Digital Filter	adjustable
Maximum Throughput	>100,000cps
Special Features	- Integrated Temperature Sensor - MCS-mode
Computer Interface	USB2.0 compliant, Micro-B Receptacle
Power	Supply entirely powered from USB
Power Consumption (typical)	<1W (Idle / Measurement)
Dimensions	83.5mm x 296mm
Operating Temperature Range	0°C to 40°C
Weight	1350g

Accessories (optional)

- Tripod;
- Lead shield;
- Marinelli beakers, etc.

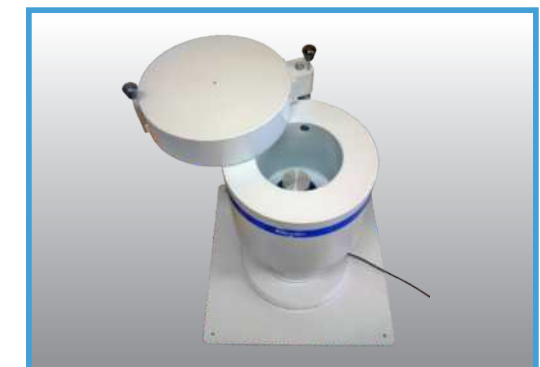


	Dimensions, DxH	Energy Resolution at 662 keV, %	Energy Range, keV	Efficiency, %	Advantages
NaI(Tl)	51x51	<7	20keV to 3MeV	0.65	Low price
	63x63	<7,5		1.2	
	76x76	<8		2	
	150x100	<12		7.5	
LaBr3(Ce)	51x51	<3,1	20keV to 3MeV	1	High resolution
	63x63	<3,3		1.5	
	76x76	<3,5		2.5	
CeBr3	25x25	<4,2	20keV to 3MeV	0.14	Low background and MDA
	38x38	<4,3		0.4	
	51x51	<4,3		1	
Srl2	25x25	<2,8	20keV to 3MeV	0.14	Low background and MDA
	38x38	<2,9		0.4	

Stabilization:
LED system or Am source

Specification

Parameter	Value
Type of detectors	NaI(Tl)
	CsI(Tl)
	LaBr3(Ce)
	Polystyrene
	ZnS(Ag)
Energy range, keV	
	- for gamma radiation 40-3000
	- for beta radiation 65-4000
	- for alpha radiation 1500-10000
Relative energy resolution on the line 661,7 keV,	
	- for NaI(Tl) (63x63mm) < 8,5
	- for NaI(Tl) (76x76mm) < 9
	- for NaI(Tl) (150x100mm) < 12
	- for CsI(Tl) (50x50mm) < 9
	- for LaBr3(Ce) (38x38mm) < 3,5
Relative energy resolution on the conversion electron line 624 keV	
	- for Polystyrene detector < 15
Integral nonlinearity in the gamma energy range from 40 to 3000 keV, %	< 1
Integral nonlinearity in the beta energy range from 65 to 4000 keV, %	< 2
Detection sensitivity for beta radiation of 90 Sr-90Y (energy range 550-2300 keV), cps/Bq	
	- for Polystyrene detector > 0,15
Detection sensitivity for alpha radiation of 239 Pu, cps/Bq,	
	- for ZnS(Ag) detector > 0,3
Maximum throughput, cps	> 5·10 ⁴



TRIO α , β , γ - spectrometer – radiometer

Application

Spectrometer TRIO is intended for measuring energy distribution of gamma- and beta - radiation, identify gamma-emitting radionuclides, and also for measuring the activity (specific and volumetric activity) natural radionuclides ²²⁶Ra, ²³²Th, ⁴⁰K, ²²²Rn, and technogenic radionuclides (¹³⁷Cs, ¹³⁴Cs, ⁶⁰Co, ^{99m}Tc, ⁹⁰Sr and etc.) in different samples. Also it is used for measuring gross specific activity of beta- and alpha- emitting radionuclides in water.

Complete set (standard)

- Multichannel analyzer Binom
- Spectrometric detectors of gamma – radiation based on NaI(Tl), CsI(Tl) or LaBr3(Ce) crystal
- Spectrometric and Radiometric detectors of beta – radiation based on plastic scintillator (polystyrene)
- Spectrometric Si-detectors of alpha – radiation
- Radiometric detectors of alpha – radiation based on ZnS(Ag) crystal
- Low-background protective chambers
- Vacuum chamber and vacuum gauge with pressure display
- Software for spectrometric analysis

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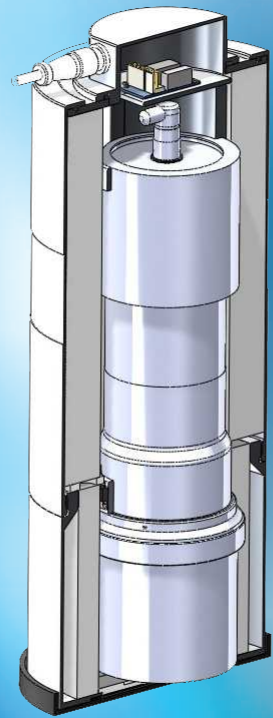
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Specification

Parameter	Value
Detector type	NaI(Tl) Ø51x51mm
Energy range, keV	50 - 3000
Energy resolution at 661,7 keV	< 8
Detection efficiency in the full energy peak of radionuclide ¹³⁷ Cs (661,7 keV), %	1,2
Integral nonlinearity in energy range 50 to 3000 keV, %	< ± 1
Maximum throughput, cps	> 5·10 ⁴
Range of the measurements of specific effective activity for NORM, Bq/kg	50 - 20000
Range of the measurements of mass fractions of NORM in rocks, %	
⁴⁰ K	0,5 – 15
U (²²⁶ Ra)	0,0005 – 0,05
²³² Th	0,0005 – 0,10
Range of the measurements of surface activity of ¹³⁷ Cs, kBq/m ²	2 - 5000
Channels quantity in the spectrum	1024, 2048
Data transfer interfaces	Ethernet, RS-485, USB
Shell protection level	IP68
Ambient air temperature, °C	-30 ÷ +60
Air relative humidity, %	up to 100
Atm. pressure in the range, kPa	84 ÷ 106,7



Software functions: spectra measurement and record; identification of radionuclides in accordance to the library list; calculation of activity, volumetric activity, MDA, dose rate; count rate measurement in regions of interest (ROI); sensors polling and obtained parameters record.



Spectrometer AirSPEC

Application

Scintillation gamma-ray spectrometer AirSPEC is intended for measuring scintillation spectra and also for determination of activities and specific activities of radionuclides in prepared and natural samples in 2π and 4π geometries. Spectrometer can be used for radiation monitoring and various tasks like definition of specific effective activity of naturally occurring radionuclides (NORM) in building materials (granite, crushed stone, gravel, etc.), raw materials, products, waste industrial production and rocks without sampling. In addition, AirSPEC is applicable for measurement of surface activity of the radionuclide ¹³⁷Cs (and other), mass fraction of NORM in rocks and resins the conditions of their natural occurrence on a surface, in boreholes and in warehouses and transport containers. Moreover, AirSPEC can analyze surface contamination of soil, as well as prospecting and exploration of mineral deposits. The spectrometer can be used for operating in laboratory and in the field conditions.

Description

- The spectrometer AirSPEC is a monoblock unit, comprising connectors, outputs and hardware for data transfer. Inside of the spectrometer housing has scintillation detector NaI(Tl) inside, photoelectronic multiplier (PMT), spectrometric stabilization system, HV converter, amplifier, multichannel pulses analyzer (MCA) and processor unit. The spectrometer is placed into thermostabilising and damp proof housing.
- AirSPEC measurement system is autonomous and automated. Operator is able to access the spectrometer remotely through Ethernet, able to execute the analysis of the measured spectra using modern and full-featured software.

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Specification

Parameter	Value
Relative energy resolution for LaBr ₃ (Ce)	3.5%
Registration efficiency for LaBr ₃ (Ce)	at least 0.6%
Energy range	40 keV ÷ 3000 keV
Integral nonlinearity	< ±1.0 %
Energy conversion function (during 24 hours)	< ±1.0 %
Maximum throughput of the spectrometer	at least 5·10 ⁴ cps
Speed range of the electric vehicle	
fast mode	4 km/h – 25 km/h
slow mode	0.5 km/h - 4 km/h
Operation setting time	<10 minutes
Continuous operation time	at least 8 hours
Completely charged	10 hours
Temperature range	from -10°C to +55°C
The average MTBF	10000 hours



Mobile Radiation Monitor GammaCART

Application

Mobile spectrometric system Mobile Radiation Monitor is designed to measure gamma radiation energy distribution, identify gamma emitting radionuclides, as well as calculate specific and surface activity of gamma emitting radionuclides under conditions of their natural occurrence and at nuclear industry premises. In addition, the system can be used for radiation monitoring, e.g., for examination of large areas, searching lost or stolen gamma radiation sources, study of radionuclide precipitation near radiation hazardous sites without preliminary sampling.

Accessories

There are various modifications of system Mobile Radiation Monitor:

- Containing spectrometer with 1 or 2 NaI(Tl) scintillation detectors;
- Containing spectrometer with 1 or 2 LaBr₃(Ce) scintillation detectors;
- Containing spectrometer with 1 or 2 HPGe detectors

Complete set (standard)

- Electric vehicle as a mobile platform
- Gamma radiation spectrometer containing:
 - Gamma radiation detector(s);
 - Multichannel channel analyser Polynom;
- Thermostabilization system (for NaI(Tl) or LaBr₃(Ce) detectors) containing:
 - Thermostabilizing housing with a built-in heat exchanger;
 - Cooling and heating system box;
 - Hoses for circulation of the cooling liquid;
- Navigation system including a external antenna;
- Shockproof toughbook operable in harsh conditions;
- Router with antenna which provides connection between the analyser, navigation system and toughbook;
- Fixation and positioning system for the detection units;
- Charger for the electric vehicle.

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Surface activity measurement		
Distance between the detector's surface and the ground, cm	Radionuclide	Activity measurement range, Bq/kg
25	¹³⁷ Cs	0.035 ÷ 1300
	⁶⁰ Co	0.021 ÷ 650
	¹³⁴ Cs	0.024 ÷ 500
40	¹³⁷ Cs	0.04 ÷ 1400
	⁶⁰ Co	0.023 ÷ 720
	¹³⁴ Cs	0.025 ÷ 560
60	¹³⁷ Cs	0.046 ÷ 1600
	⁶⁰ Co	0.028 ÷ 820
	¹³⁴ Cs	0.028 ÷ 620

AMGRI

Automatic Monitor for Radioactive Aerosols

with automatic cartridge changer and on-line spectrometric analysis



Features

Main operational functions:

- Cartridge control (including Δp and inlet air temperature) and cartridges changing
- Flow-rate control and measurement
- Live spectrum acquisition
- On-line Spectra analysis and readout
- Pb-214 peak automatic compensation
- Evaluation of Iodine concentration in air
- System parameters set-up
- Two programmable thresholds (alert and alarm) for radiological events
- Intrinsic automatic control of system operation, machine failure alarm messages in case of equipment operational failure (i.e. mechanics or pneumatics failures)
- Built in test procedures
- Data communication

Setup parameters:

- Station identifier: identifier of the station
- Sampling Time: total sampling time (ST) for cartridge (in hours and minutes)
- Data period: data files issuing period
- Iodine Alert Threshold: alert trip point for Iodine concentration
- Iodine Alarm Threshold: alarm trip point for Iodine concentration
- Flow Alarm Threshold: flow-rate trip point for 'low flow' alarm ($X.XX \text{ m}^3/\text{h}$).
- Flow Filter Threshold: flow-rate trip point for filter change ($X.XX \text{ m}^3/\text{h}$).
- MCAs set-up: coarse gain, fine gain, shaping, threshold, HV
- Network: IP address, firewall, time synchronization



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AMRA α , β , γ

Automatic Monitor for Radioactive Aerosols



Features

Main operational functions:

- Filter control (including Δp and air inlet temperature) and filters changing
- Flow-rate control and measurement
- Live spectrum acquisition
- On-line Spectra analysis and readout
- Gamma background compensation
- Evaluation of activities on filter and concentrations in air
- System parameters set-up
- Two programmable thresholds (alert and alarm) for radiological events on each measurement chain (Alpha, Beta and Gamma emitters)
- Intrinsic automatic control of system operation, machine failure alarm messages in case of equipment operational failure (i.e. mechanics or pneumatics failures)
- Built in test procedures
- Data communication

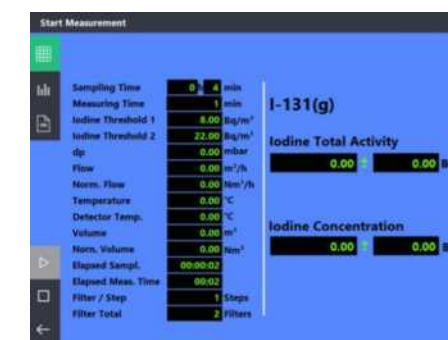
Setup parameters:

- Station identifier: identifier of the station
- Sampling Flow Rate: sampling flow-rate ($X.XX \text{ m}^3/\text{h}$)
- Sampling Time: total sampling time (ST) for each filter (in hours and minutes)
- Data period: data files issuing period
- Alpha Alert Threshold: alert trip point for alpha concentration
- Beta Alert Threshold: alert trip point for beta concentration
- Alpha Alarm Threshold: alarm trip point for alpha concentration
- Beta Alarm Threshold: alarm trip point for beta concentration
- Gamma ROI Alert Thr.: ten ROI independent trip point set-up
- Gamma ROI Alarm Thr.: ten ROI independent trip point set-up
- Flow Alarm Threshold: flow-rate trip point for 'low flow' alarm ($X.XX \text{ m}^3/\text{h}$).
- Flow Filter Threshold: flow-rate trip point for filter change ($X.XX \text{ m}^3/\text{h}$).
- MCAs set-up: coarse gain, fine gain, shaping, threshold, HV
- Network: IP address, firewall, time synchronization

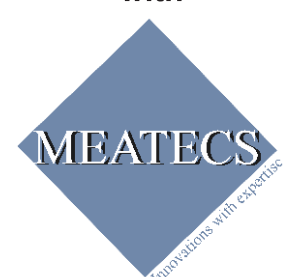
AMRA-Sr is the State of the Art among Aerosols Monitors, in terms of advanced design solutions and performances of the Alpha/Beta and Gamma spectrometric measurement chains.

It is a budget friendly alternative to its higher performance version AMRA-Ge equipped with electrically cooled HPGe detector.

The innovative unique use of a $\text{SrI}_2(\text{Eu})$ crystal with its very low intrinsic background and very high photonic yield makes possible at a reasonable cost the implementation of an industrial grade equipment with laboratory grade analytical performances on-line.



Developed
and
manufactured
in cooperation
with





Multi Channel Analyzer BOSC

Complete set

- Bosc MCA with software
- Color LCD display with touchscreen
- HV power supply unit
- Preamplifier power supply unit (+/- 12 V; +/- 24 V)
- MCA state display indicator
- Connectors: input; protection control output analogue and digital.
- Available interface to connect to computer: USB, LAN, RS-232.
- Connector for preamplifier power supply unit. Two HV connectors for detector HV power supply. GATE signal connector. Outer power supply connector.
- AC/DC adaptor
- Bosc MCA has control for all operation modes by the program installed in remote computer

Features

- Bosc MCA acquires and displays spectra with overlapping by energy range up to 1000 times
- No resolution deterioration at operation in the beginning of spectrum energy range
- Stable operation with preamplifiers of TPR type with output voltage swing up to +/- 10 V and reset duration up to 250 us
- Automated P/Z adjustment
- Improved dead time correction
- Spectrum stabilization
- Setting and control of all parameters using colour LCD display with touch screen
- Complete remote control of Bosc MCA via software from PC
- Dead time correction
- Base Line Restorer (BLR)
- Operation with preamplifier TPR
- Built-in oscilloscope

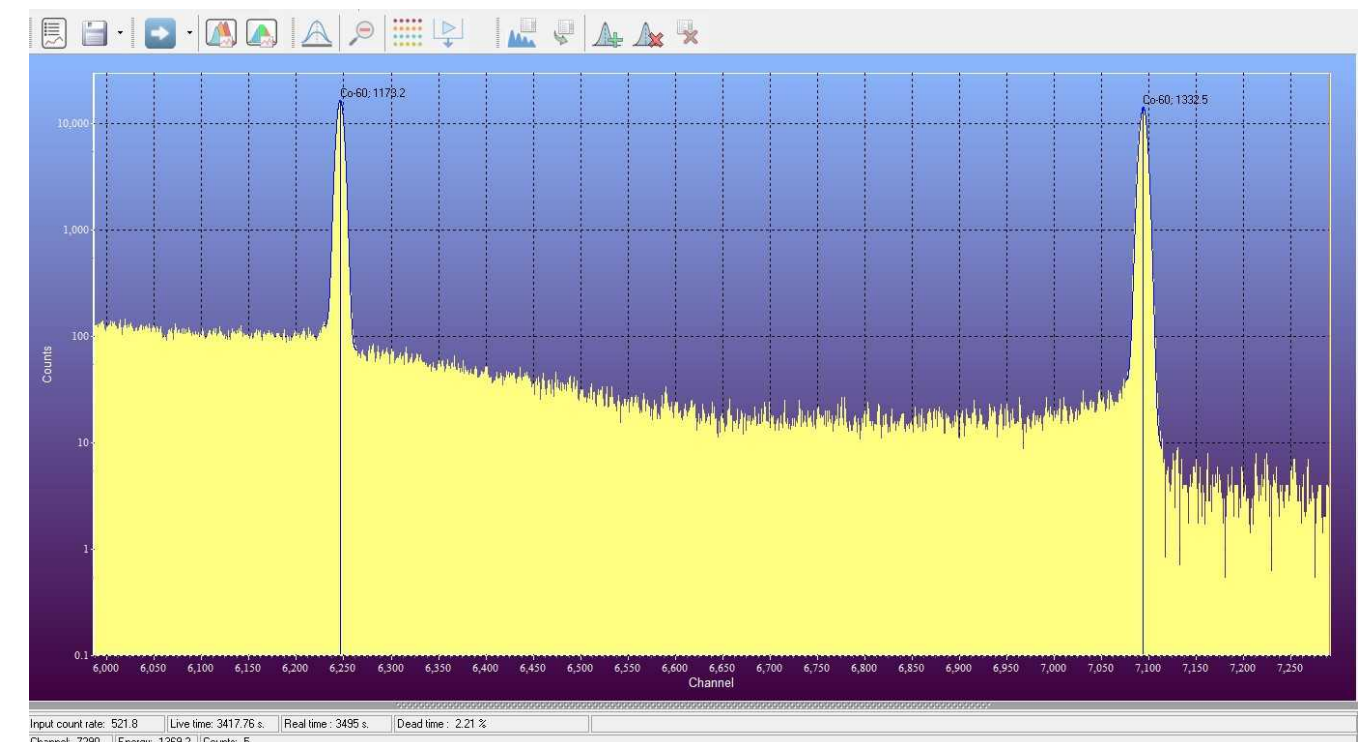
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Specification

Parameter	Value
Shaping time constant	4 shaping time constant 0,5...24 us (by request)
Coarse gain	5,10,20,40,80,160,320,640 (by request)
Fine gain	1...2
Input signal polarity	+/-
TRP preamplifier	Yes
Integral nonlinearity	+/- 0,025%
Differential nonlinearity	<1%
Gain temperature coefficient	<50 ppm/oC
MCA, chn	16k
Input count rate	up to 200000cps
Power preamplifier	+/- 12V 60mA +/- 24V 40mA
HV	+/-5000 V or +/-2000 V / 0.5 mA
Power supply	+9... 18 V
Consumed power	12 W
Indication	TFT color touchscreen 3.2"
Communication interface	USB; Ethernet; RS-232 or I/O control by request

Software package



Specification

The GammaPRO software enables solution of specific spectrometric problems such as:

- calculation of activity of naturally occurring radionuclides and effective specific activity in situ and in samples
- calculation of conformity factors for food and materials
- calculation of radon flux density and volumetric activity in different conditions
- calculation of radionuclide activity applying methods of physical and radiochemical concentrating
- calculation of radionuclides activity in a human body and its organs as a part of whole body spectrometer measurements

The matrix method enables automatic calculation of activity of a sample provided its radionuclide composition is known. The method is used for routine measurements of food, building materials, water and other substances subject for permanent radiological control.

The superposition method is mainly used for control of correctness of activity calculations in case of hard-to-analyse (multiple peak) low-resolution spectra (acquired by scintillation detectors). Such a tool enables visual estimate of the degree of similarity between an acquired and calculated spectrum. Additionally, calculation data can be adjusted until the spectra completely coincide.

The Software features an integrated system for report generation which provides automatic creation of measurement results. The settings for report generation can be adjusted by user.

GammaPRO software package

Features

GammaPRO provides all the tools necessary for separate peak analysis, namely:

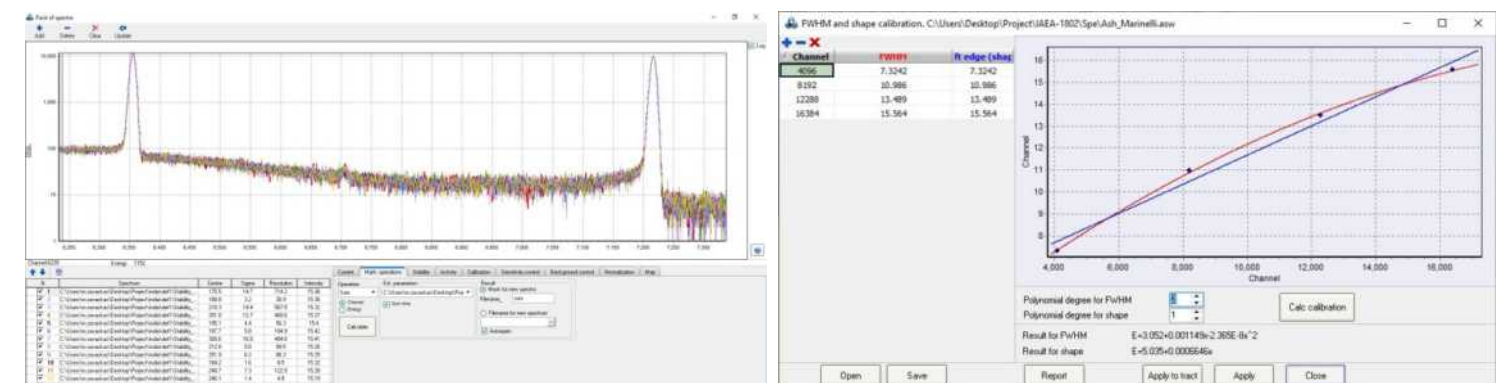
- energy calibration;
- direct peak search in spectrum and peak search considering the radionuclides and their peak energies specified in the library;
- peak and multiplet fit by Gaussian and other functions;
- automatic identification of peaks;
- considering count sample density as a calculation parameter; considering background as a calculation parameter;
- calculation of efficiency curves (efficiency calibration), FWHM calibration, peak shape calibration.

The GammaPRO software features multiple window interface and enables a number of opportunities for spectrum analysis such as:

- visualization of spectra and spectrum acquisition progress;
- peak search and identification of radionuclides;
- calculation of efficiency curves and sensitivities;
- mathematical operations (sum, subtraction, normalization etc);
- processing of set of spectra;
- calculation of integral nonlinearity;
- conversion into other formats and translation into other applications such as MS Word, Excel, MS Access, MatLab;
- calculation of ambient dose equivalent rate in auto mode.

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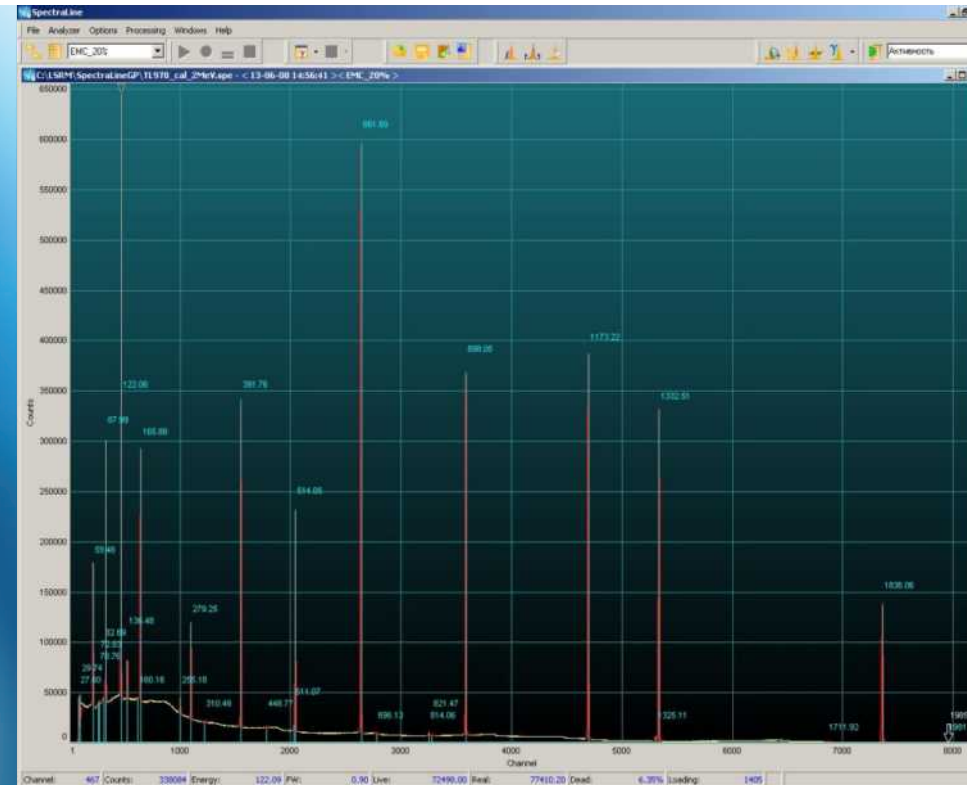


The GammaPRO software provides the following additional service options for optimization of routine measurements:

- auto adjustment (quality assurance), that is, control and adjustment of a spectrometric tract without user's involvement;
- database which provides transfer and storage of measurement results in a database (MS Access etc);
- log which provides automatic registration and storage of measurement and quality assurance results; radionuclides library editor. This module is necessary for creation of library files used for calculation of activity of radionuclides;
- TRIOMAP is a module for performing measurements in field and mapping;
- barcoding is an integrated system of barcode identification which enables input of sample data in the software by means of a barcode scanner;
- sample loader is a module for automatic measurements using various types of count sample loaders.

Specification

- Automatic peak search with the required level of detection (peak search results are stored in files).
- Calibration by energy, half-width, and peak shape.
- Calculation of the peak parameters (position, half-width, area), with storing the results in a text file.
- Calibration by efficiency; construction of approximate efficiency curves.
- Activity calculation by different methods;
- Correction for true summation in view of the subsequent gamma-ray intensity correction.
- Storing the measured spectra and results of processing in the database in order to analyze the repeated measurements for convergence in the given criteria (the quality estimation).
- Simultaneous processing of an arbitrary (optional) number of spectra; the use of several spectra peaks from different energy ranges at calibration by shape.
- Quantitative and visual control over the calibration quality.
- Connection of an arbitrary (optional) number of measuring channels.
- Independent control, start, stop, spectra storage and visualization in all measuring channels.



Specification

- detectors and measurement geometries parameters setting and saving in database;
- lines and radionuclides lists creation;
- calculation of detection efficiency and correction factors for true coincidence using Monte-Carlo method;
- data filtering;
- creation and addition of correction factors for true coincidence library;
- data viewing and saving in detection efficiency library;
- correction of gamma-radiation intensities in radionuclides library;
- batch processing possibility for several geometries and energy ranges.

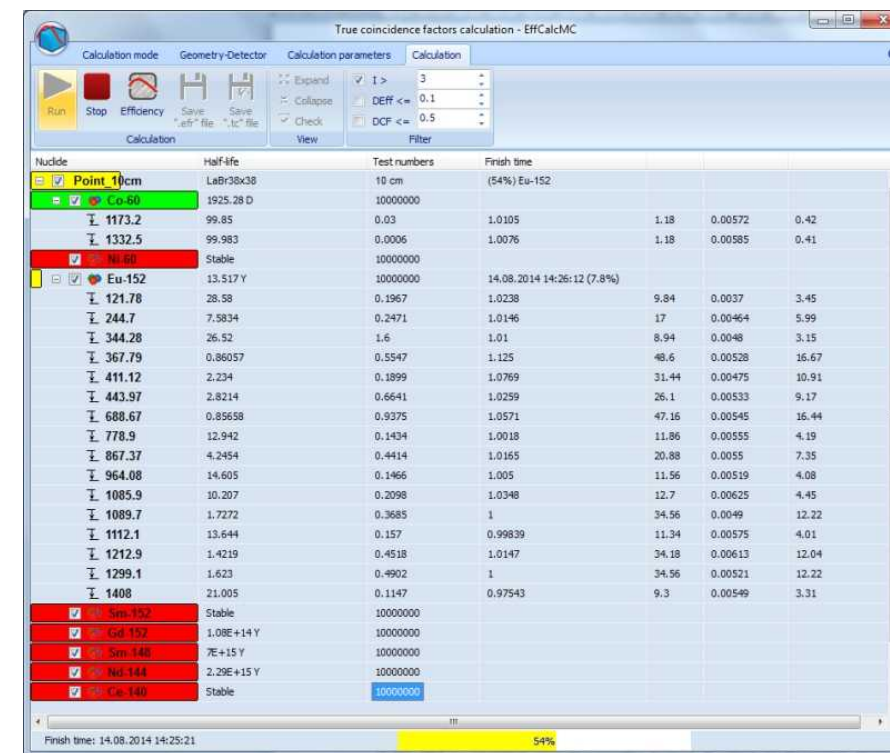
Nuclide Master Plus software package

Application

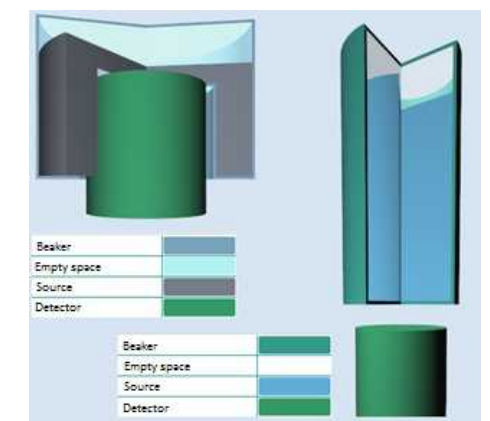
Nuclide Master Plus software package has been developed for calculation of detection efficiency and correction factors for true coincidences. It is also used for correction of gamma radiation intensities in radionuclides library. EffCalcMC (Efficiency Calculation Monte-Carlo) is the main program.

The calculation is based on Monte-Carlo method using parameters of the required nuclides from the library of evaluated nuclear structure data ENSDF. The factors can be calculated for different detectors types (semiconducting and scintillation) which are saved in database compatible with EffMaker software. Marinelli vessels, cylinder and point can be used as the measurement geometries.

TCCFCALC (True Coincidence Correction Factor CALCulation) utility is created to solve true-coincidence summing in/out effect problem in different applications of gamma-spectrometry. It allows to perform calculations for any known gamma-emitting radionuclides and for a wide set of measurement geometries including scintillation and HPGe detectors with point and volumetric sources (Marinelli or cylindrical beaker with arbitrary dimensions).



Nuclide	Half-life	Test numbers	Finish time			
Point 10cm	LaBr3x38	10 cm	(54%) Eu-152			
Co-56	1925.28 D	10000000				
1173.2	99.85	0.03	1.0105	1.18	0.00572	0.42
1332.5	99.983	0.006	1.0076	1.18	0.00585	0.41
Stable		10000000				
Eu-152	13.517 Y	10000000	14.08.2014 14:26:12 (7.8%)			
121.78	28.58	0.1967	1.0238	9.84	0.0037	3.45
244.7	7.5834	0.2471	1.0146	17	0.00464	5.99
344.28	26.52	1.6	1.01	8.94	0.0048	3.15
367.79	0.86057	0.5547	1.125	48.6	0.00528	16.67
411.12	2.234	0.1899	1.0769	31.44	0.00475	10.91
443.97	2.8214	0.6641	1.0259	26.1	0.00533	9.17
688.67	0.85658	0.9375	1.0571	47.16	0.00545	16.44
778.9	12.942	0.1434	1.0018	11.86	0.00555	4.19
867.37	4.2454	0.4414	1.0165	20.88	0.0055	7.35
964.08	14.605	0.1466	1.005	11.56	0.00519	4.08
1085.9	10.207	0.2098	1.0348	12.7	0.00625	4.45
1089.7	1.7272	0.3685	1	34.56	0.0049	12.22
1112.1	13.644	0.157	0.99839	11.34	0.00575	4.01
1212.9	1.4219	0.4518	1.0147	34.18	0.00613	12.04
1299.1	1.623	0.4902	1	34.56	0.00521	12.22
1408	21.005	0.1147	0.97543	9.3	0.00549	3.31
Stable		10000000				
Sm-152	Stable	10000000				
Gd-157	1.08E+14 Y	10000000				
Sm-146	7E+15 Y	10000000				
Nd-144	2.29E+15 Y	10000000				
Ce-140	Stable	10000000				



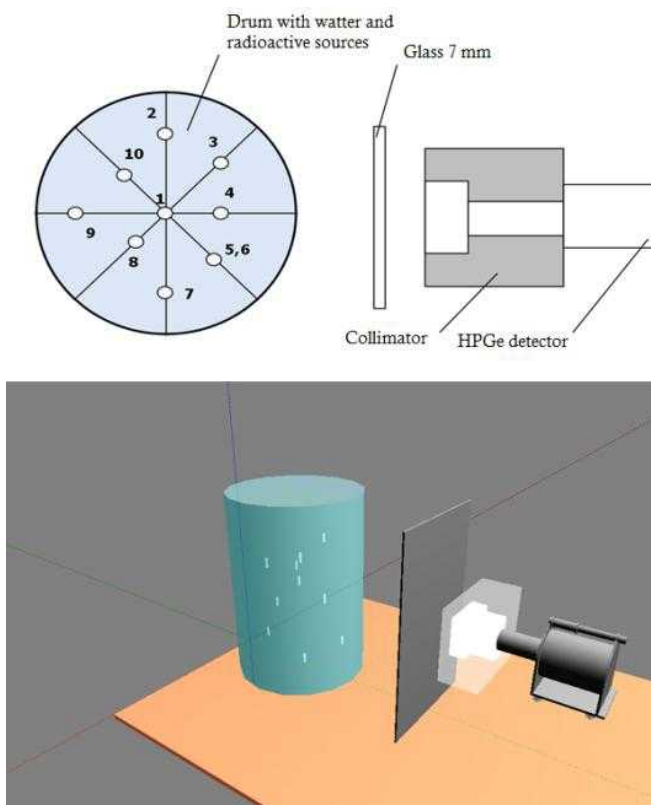
TCCFCALC (True Coincidence Correction Factor CALCulation) utility has been added to Nuclide Master for:

- calculation of true coincidence correction factor and correction of gamma radiation intensities in radionuclides library;
- calculation of detection efficiency.

Specification

Modelling of gamma-spectra and calculation of registration efficiency for complex shaped objects

EffMaker performs mathematical efficiency calibration (without using calibration sources) of the detector for arbitrary measurement geometries, different shapes and dimensions of the source, disposal and distance from the detector, content and density of the matrix. The calculation of registration efficiency is carrying out on the base of Monte-Carlo method by the EffMaker software for containers with arbitrary geometries and composition such as (sphere, cylinder, parallelepiped etc.).



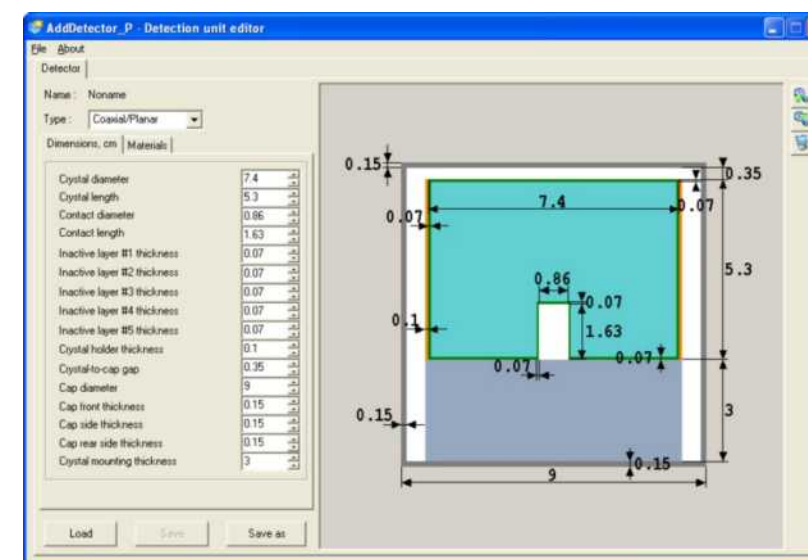
Detector characterization and for example the following templates of geometries could be provided:

- Complex parallelepiped;
- Complex cylinder;
- Pipe;
- Marinelli;
- Pipe with internal/external contamination;
- Square pipe with internal/external contamination;
- Room/parallelepiped with contaminated internal surface;
- Wall/plate;
- Other geometries according to customer needs including multilayer geometries.

Mathematical characterization of measuring object, detector and collimator based on Monte-Carlo method by means of EffMaker program

EffMaker software package modules

- Module for creating and editing parameters of spectrometers – detector, analyzer, collimator
- Module for response functions calculation
- Module for response matrices of gamma spectrometers calculation
- Module for measuring objects creation and editing
- Module for energy spectra generation
- Module for physical spectra generation
- Module for apparatus spectra generation



Detector characterization window of EffMaker software

EffMaker software package

Application

Software complex EffMaker is designed for modeling of gamma-spectra and the calculation of registration efficiency for complex shaped objects that are obtained with the use of semiconducting and scintillation detectors of gamma radiation. The modeling is realized by Monte-Carlo method. For the increase of the calculations' speed for the prescribed detector there is modeled its response function that represents a set of spectra for monochromatic radiation in the prescribed range. The response function is transformed to the response matrix which takes into account number of channels of present spectrometer and its resolution. The gamma spectrum of the object (the physical spectrum of the source) in the point of the detector's location is modeled independently. The apparatus spectrum of the source is obtained as convolution of the physical spectrum with the detector's response matrix.

The main possibilities of the software EffMaker are :

- Detectors characterization to use detector parameters to calculate registration efficiency;
- Calculation registration efficiency and activities of radionuclides for objects with arbitrary geometries and composition;
- Multiple matrix correction, density, transmission correction;
- Calculation of activities of radionuclides for nonuniform distribution of activities of radionuclides in containers;
- Test beam;
- Collimator modeling tool.

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α


Silicon Ion Implanted Alpha Particle Detectors SIID

Application

Ion Implanted Silicon Alpha Particle Detectors is a product for the precise alpha spectroscopy. The thin entrance window of the detector provides good energy resolution even in close location of the alpha radioactive source and also provides high efficiency registration of alpha particles.

Features

- The detectors can operate without hermetization due to location of P-N junction inside of the detector crystal
- Contacts are formed using ion-implantation method and provide thin, well-formed junction
- Relatively thin dead layer (less than 500 Å)
- High solidity entrance window
- Possibility to work in vacuum
- Possibility of annealing the detectors up to 100 °C
- The detectors may be equipped with BNC or MICRODOT connectors adapted for different customer needs.
- The detectors are manufactured with open window as well as with metalized window.

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Specification

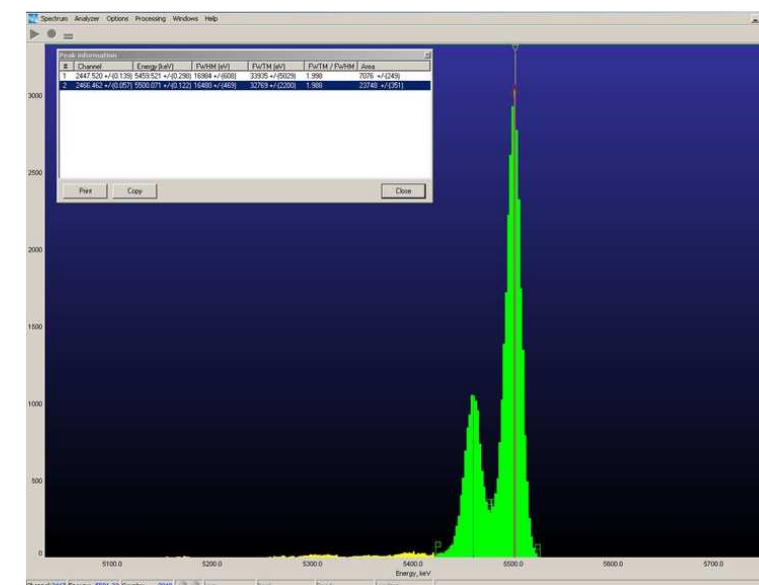
Detector area, mm ²	Energy resolution*, keV		Detector type	Thickness, μm	Detector bias voltage, V
Alpha	Beta				
50	12	6	Open	300 +/- 30	50 - 70
100	14	8	Open	300 +/- 30	50 - 70
300	16	14	Open	300 +/- 30	50 - 70
450	20	15	Open	400 +/- 30	50 - 70
450	25	17	Metalized	400 +/- 30	50 - 70
600	25	23	Open	400 +/- 30	50 - 70
600	30	20	Metalized	400 +/- 30	24 - 48
900	25	20	Open	400 +/- 30	50 - 70
1200**	35	30	Open	400 +/- 30	50 - 70

* Shaping time – 1 μs.

**The detectors of other sizes are available.

The Ion Implanted Silicon Alpha Particle Detectors with metalized coating of entrance window can be used as a part of radioactive aerosol monitors. This is special version of the detectors having following features:

- Allows the detector operation in ambient light
- The metal coating provides mechanical and chemical protection. The thickness of entrance window is less than 2 μm
- Opportunity of operation at bias voltage - from +15 to +24 V.



²³⁸Pu spectrum





Alpha Spectrometer Amber

Features

Alpha Spectrometer is intended for the amplification, analogue filtration of the electric pulses coming from alpha radiation detectors. The complete spectrometer consists of vacuum chamber from stainless steel, power supply, preamplifier, pulse generator, discriminator, counter. Vacuum chamber allows to put in the majority types of detectors, including Ion Implanted Silicon Alpha Particle Detectors SIID with high resolution and up to 1200 mm² square. Sample holder inside vacuum chamber allows to adjust the distance between sample and the detector from 4 to 48 mm with 4 mm step.

- Device management with external PC software
- Vacuum gauge with pressure display and control via software
- Detector current meter from 1 nA to 10 μ A
- High Voltage inhibit in case of vacuum breaking
- Reverse bias on the sample holder
- Integrated Multichannel Analyzer
- Calibration pulser
- Vacuum chamber from stainless steel
- Fits up to 50 mm (2 inches) diameter samples
- Possibility to use alpha detectors up to 1200 mm²
- Adjustable sample-detector distance from 4 to 48 mm (with 4 mm step)

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Specification

Parameter	Value
Registration energy range, keV	up to 10000
Shaping time constants, μ s	1
Integral nonlinearity, %	< 0.04
Maximum value of High Voltage, V	+150
Operation temperature range, $^{\circ}$ C	+5...+35
Temperature instability, %/C	< 0.01
Time of continuous operation, hour	> 24
Consumed power, Wt	< 10
Supply voltage, V	+/-12 +/-24
Energy resolution at 5.49 MeV for 450 mm ² detector, keV	< 20
Absolute detection efficiency, %	> 20

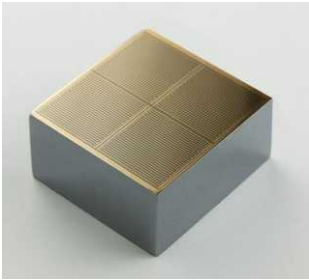
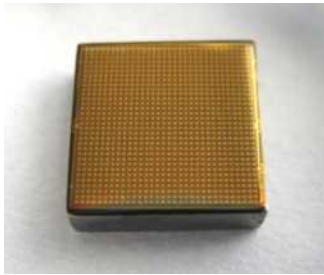
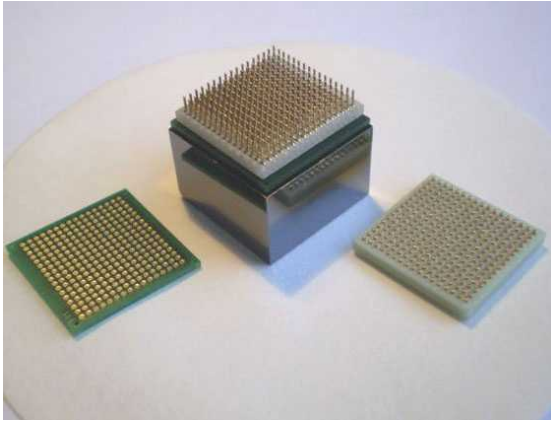
Analytical software package AlphaPRO allows to:

- Execute spectra acquisition for the set time,
- Mark and select regions of interest and examine them on a separate plane,
- Increasing or reducing scale on horizontal and vertical axes,
- Perform energy calibration of spectra on two known energies;
- Determine centroids and area of peaks with background deduction and without background deduction;
- Make an estimation of energy resolution at one second and one tenth height of full absorption peak;
- Carry out an automatic serial spectra acquisition with automatic record on a disk;
- Print out spectrum window;
- Compare different spectra in one window simultaneously reducing or decreasing scale;
- Calculation of activities of alpha emitting radionuclides.



CdZnTe/CdTe detectors and associated electronics

CdZnTe/CdTe is a room temperature semiconductor which allows to create X- and gamma-ray detectors with comparably high energy resolution and high count rate capability without cooling. Detectors performance allow to use CdZnTe/CdTe detectors successfully in Nuclear Industry and Medicine, Safeguard and Homeland Security, many others industrial and laboratory applications.



Baltic Scientific Instruments develops and fabricates detectors based on CdZnTe/CdTe and accompanying electronics for them base on general electronic components and ASICs. We are flexible in our technological processes and provide engineering design service and custom fabrication of small and medium volumes of devices.

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μSPEC Gamma-Radiation CZT Micro Spectrometer

Gamma CZT Micro Spectrometer μSPEC is a high performance device based on room temperature CdZnTe semiconductor detectors and MicroMCA527. The μSPEC allows measuring, storing and processing gamma-radiation spectra in a PC through the USB port. The Spectrometer has changeable CdZnTe quasi-hemispherical detectors of different volumes of 60 mm³, 500 mm³ or 1500 mm³.

Detector type
Detector volume
Energy range
Energy resolution at 662 keV
μSPEC60, μSPEC500
μSPEC1500
Maximal throughput
Number of channels
PZC adjustment
Connector
Dimensions, mm
Weight, gram

CdZnTe
60-1500mm³
20keV - 3.0MeV

<2.5%
<3.5%
<100 kcps
128, 256, 512, 1k, 2k
automated
Micro USB
25 x 25 x 70
80



y-Tracer GT2-1 Personal Radiation Detector (PRD)

y-Tracer is a portable hand-held device with an inbuilt room temperature operated CZT detector. y-Tracer can be used as a dosimeter and for detecting and searching gamma-radiation sources. y-Tracer is an energy-compensated device allowing accurate evaluation of the dose rate and dose equivalent of the X-ray and gamma radiation. It automatically monitors environment and alerts user in case of the radiation threat.

Detector type
Detector volume
Energy range
Dose rate
Dose
Sensitivity for 137Cs

Alarm type
Data recording
Connector
LCD type
Environmental protection
Operating time
Dimensions, mm
Weight

CdZnTe
400mm³
30keV - 3.0MeV
0.05μSv/h - 100μSv/h
0.05μSv/h - 10Sv
15 s⁻¹/(μSv/h); 0.15 s⁻¹/(μR/h)
LED, audio, vibration
up to 3000 events
Micro USB
monochrome
Ip65
up to 500h
122 x 69 x 33
200 gram



SDP500, SDP1500, SDP4000 Spectrometric Detection Probes

Spectrometric Detection Probes SDP310/Z, SDP500S, SDP1500 and SDP4000 are room temperature operating portable devices with large volume CZT detectors. The detection probes are designed for application in equipment for recording and analysis of gamma-radiation energy spectra. The detection probes consists of the CZT detector and charge sensitive preamplifier.



Detector	Probe head dimensions, mm	Detector volume, cm ³	Bias Voltage, V	Energy Resolution at 662keV, %	Peak/Compton at 662keV
SDP500	Ø24 x 58	0.5	≤ 1500	< 2.5	> 4.0
SDP1500	Ø32 x 58	1.6	≤ 2500	< 3.5	> 4.0
SDP4000	Ø40 x 58	4.0	≤ 3000	< 4.0	> 4.0