

Semiconductor Detectors & Nuclear Electronics for Radiation Measurements



Baltic Scientific Instruments, Ltd.

Baltic Scientific Instruments was established in 1994 on the basis of Riga Research and Development Institute for Radio-Isotope Apparatus (RNIIRP, est.1966)

In 2003 the company has entered the group of BRUKER companies and in 2007 has change the name to Bruker Baltic. In June, 2010 the company has bought out its shares from Bruker AXS and returned its name Baltic Scientific Instruments (BSI).

The company Baltic Scientific Instruments specializes in the development and serial production of the spectrometric devices based on silicon, high-pure germanium and cadmium-zinc-tellurium detectors. Our products are applied in nuclear energetic and ecology, geology and mineral resource industry, medicine and research activities, customs control and other spheres.

Our goal is to secure a position among the leading manufacturers of precision equipment in nuclear physics in the world to arrange for the development and production of high-quality equipment meeting modern requirements and to provide support in the operation of products manufactured by Baltic Scientific Instruments.

The Company Baltic Scientific Instruments is certified to ISO 9001:2008 by TÜV Rheinland.





Specification



P-type HPGe Coaxial Detectors GCD (Liquid Nitrogen cooled)

Model	Efficiency, %	Energy resolution		Peak/Compton ratio	Peak Shape	
		122 keV, (eV)	1.33 MeV, (keV)		FW.1M FWHM	FW.02M 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 higher efficiency are available

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

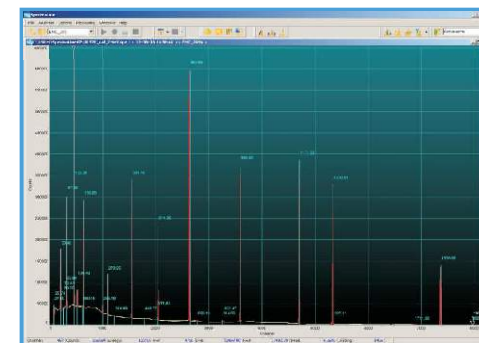
Accessories (optional)

- 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: Standard 40 keV - 10 MeV (GCD)
Extended 3 keV - 10 MeV (GCDX)
- Input window materials: Aluminum, Beryllium or Carbon-fiber
- Built-in or Remote Preamplifier types are available depending on application (ref. p. 58)
- 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 (ref. p. 57)

Plenty of cryostat geometries available



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Specification

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

* Detectors with higher efficiency 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

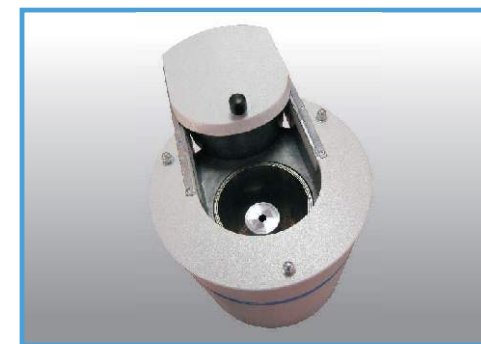
Accessories (optional)

- 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% - 60% and higher efficiency HPGe Well-type detectors are available
- 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 (ref. p. 58)
- 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 (ref. p. 57)

Plenty of cryostat geometries available



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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 - 16 180	16	200	11	180	495
GPD - 25 300	25	500	13	300	545
GPD - 36 360	36	1000	13	360	585
GPD - 50 400	50	2000	15	400	600



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

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

- Built-in or Remote Preamplifier types are available depending on application (ref. p. 58)
- Ability to increase energy rate to 20000 MeV/s
- Energy range from 3 keV to 1500 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 (ref. p. 57)

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Plenty of cryostat geometries available





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
- Pre-amplifier with cooled input stage
- Dewar vessel
- Cable set

Features

- Light weight aluminum construction
- Detection of radiation in any spatial orientation
- Compact low-consuming electronics
- Available with HPGe Coaxial (p. 2) or Planar detector (p. 6)
- 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 (Digital or Analog-Digital)
- 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
- Recharger
- Collimators
- Transport case
- Tripod
- Liquid nitrogen storage and filling system
- Liquid nitrogen sensor and monitor
- 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**
Time of continuous operation, days	1 - 5**
Al end cup thickness, mm	0.7
Weight of detector with empty Dewar vessel, kg	5 - 12**
Pre-amplifier 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





HPGe Hand Held Spectrometer HANDY

(Liquid Nitrogen cooled)

Application

Registration of Gamma and X-ray spectra in safeguard and homeland security, radiological control of environmental objects, materials and products of industry and farming, objects and plants of nuclear energetics, enterprises dealing with storage and processing of radioactive wastes

Complete set

- HPGe Planar or Coaxial detector
- Preamplifier with cooled input stage
- Multi Channel Analyzer
- Software package
- Cable set

Accessories

- Lead Shielding with collimators
- Hand-cart
- Hard-sided transport case
- Accessories: funnel for LN₂ filling, recharger, etc.

Features

- Minimal size and weight
- Can be placed in an ordinary case
- Opportunity of installation of planar or coaxial detectors
- Minimal time for reaching operating temperature (less than 1 hour)
- Minimal time for Dewar vessel emptying from remains of liquid nitrogen
- Convenience and simplicity of the device running and service
- Software features specially developed for:
 - Fuel rod enrichment level analysis
 - Plutonium content analysis in different fields of application

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Specification

Parameter	Value
Standard dimensions of planar detector	
Sensitive area, mm ²	500*
Thickness, mm	15
Energy resolution for 500 mm ² sensitive area detector at energy 122 keV, eV	545
Maximal efficiency of coaxial detector, %	8
Energy resolution for 7% efficient detector at energy 1.33 MeV, keV	1.8
Dewar vessel volume, l	0.6
Detector holding time, h	> 20
Time for reaching of operating temperature after liquid nitrogen filling, h	1
Maximum number of quantization levels of ADC	16k
Integral nonlinearity, %	0.05
Differential nonlinearity, %	< 1
Dimensions, mm	
Detection unit	270 x 190 x 195
Case	460 x 330 x 150
Weight, kg	
Detection unit	2.4
Case with spectrometer set (including detection unit)	6.5
Detector power supply	
Voltage, V	+/- 12
Current, mA (for each polarity)	35

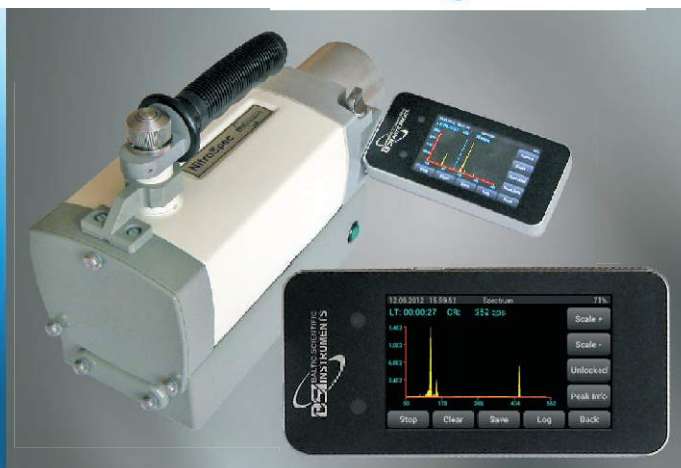
* Planar Detectors are available with other sensitive area

The smallest ever





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 about 1 hour;
- 24 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.

The NitroSPEC the world's smallest liquid nitrogen cooled Spectrometer which is based on High Purity Germanium (HPGe) semiconductor detectors. The 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.

The 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).

The 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 the 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 the NitroSPEC is possible via USB or wireless connection.

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Specification

Parameter	Value
Relative efficiencies available, %	10, 15, 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	+5...+35
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	4.95
Power consumption, W	< 3.5
Voltage, V	12
Ingress Protection	IP65

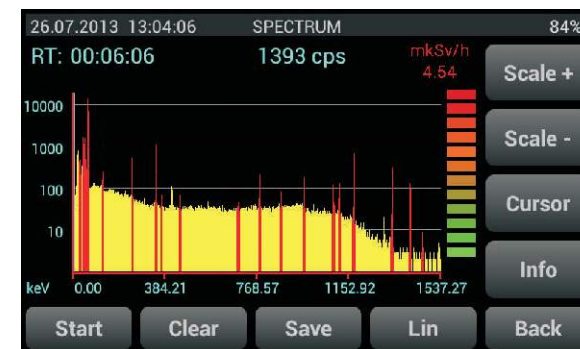
* Available with extended Energy range (X series)

Complete set (standard)

- HPGe detector (Coaxial or Planar)
- Digital Multi Channel Analyzer
- Analytical software package
- Touch screen display
- Dewar vessel
- Communication interface (USB, wireless)
- Adaptor

Accessories (optional)

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





HandSPECT

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

HandSPECT 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*
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	15

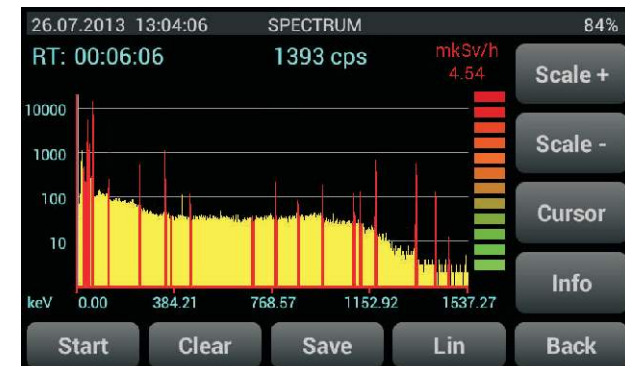
* HPGe Detectors are available with efficiency from 10% to 20%

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 μ s
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.





Specification



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. 58):
 - Standard
 - Low-background
 - Ultra low-background

Complete set (standard)

- HPGe coaxial detector
- Preamplifier with cooled input stage
- Dewar vessel
- Lead Shield for lower back signal with a support
- Liquid nitrogen sensor and level monitor LN₂ Monitor
- Cable set
- Documentation

Accessories (optional)

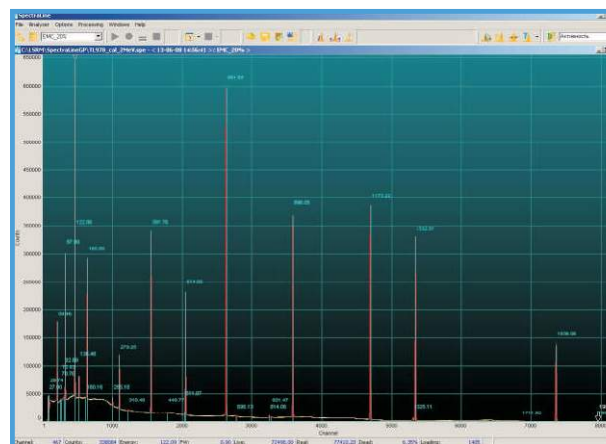
- Multichannel Analyzer (Digital or Analog-Digital)
- Analytical Software packages:
 - quantitative and qualitative analysis
 - γ -spectra modeling & efficiency registration calculation for complex geometry objects
 - extended radionuclide library
- Liquid nitrogen storage and filling system
- Cable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

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Parameter	Value
Detection limit for ¹³⁷ Cs radionuclide specific activity, 30%* efficiency detector, measurement time 1 hour, Bq/kg	0.7
Absolute sensitivity to gamma flux for 30%* efficiency detector, pulse/quantum	4.5 x 10 ⁻³
Instrumental background intensity for energy range from 40 keV to 3 MeV, pulse/keV x s	< 5 x 10 ⁻⁴
¹³⁷ Cs radionuclide specific activity measurement error for 1 hour measurement time, %	< 20
Shield thickness	
Lead wall, mm	100
Copper wall, mm	10
AC power supply	
Voltage, V	230
Frequency, Hz	50
Detector with Lead Shield dimensions, mm	1300 x 580 x 480
Detector with Lead Shield weight, kg	760

* Detectors with higher efficiency are available



Spectrum of source Lt978 in 1l Marinelli beaker, including:
²⁴¹Am, ¹⁰⁹Cd, ⁵⁷Co, ¹³⁹Ce, ²⁰³Hg,
¹¹³Sn, ⁸⁵Sr, ¹³⁷Cs, ⁸⁸Y, ⁶⁰Co



LN₂ Monitor



Automated Spectrometer for radionuclide analysis

(HPGe detector based)

Complete set

- Gamma-ray detector based on HPGe detector in U-type cryostat with remote preamplifier and 30L Dewar vessel;
- Lead shield;
- Multichannel Analyzer Multispectrum HYBRID;
- Software for spectra processing, identification of radionuclides and calculation of their activities SpectraLineGP;
- Spectra analysis software Nuclide Master Plus;
- Software for efficiency calibration of arbitrary shaped objects EffMaker;
- Automatic sample changer based on Robot arm with compact controller;
- Table with sample holders and safe cabinet;
- Barcode reader together with Barcode printer;
- Control software for robotic arm;
- Master controller with process managing software;
- Liquid nitrogen sensor and monitor;
- Cable set of 3m length.

Application

The Automated 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 highly pure germanium (HPGe) p-type detector gives precise results even for low activity materials.

The fully automated sample changer enables the user to measure up to 40 samples, without having to interact with the Automated Spectrometer. This reliable robotic sample changer increases the productivity and reduces the possibility of health risks for the operator.

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Specification

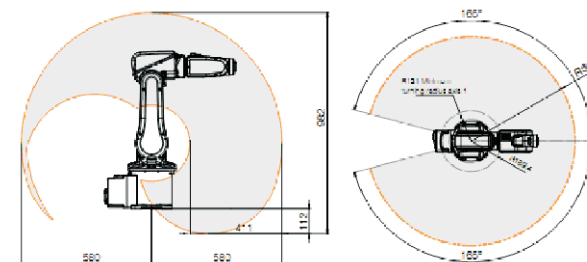
HPGe detector with Lead Shield

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^{-1}
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

- Six-axis manipulator
- Payload: 3 kg
- Reach: 580 mm
- Accuracy: ± 0.01 mm
- Footprint: 180 mm squared
- All motors and cabling enclosed
- Compact controller



Samples

Measurement geometries are:

- Bottle 500ml,
- Bottle 250ml,
- Denta 60ml
- Denta 30ml.

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 Writer

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
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	1.5×10^3
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 Shield for Radionuclide Analysis of Liquids and Gaseous Flows

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 (Digital or Analog-Digital)
- Lead Shield for lower back signal with a support
- Control unit with valves
- Sensors for liquid and gas flow
- Emulation and analysis software

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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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**
Time of continuous operation, days	1 - 5**
Al end cup thickness, mm	7
Weight of detector with empty Dewar vessel, kg	5 - 12**

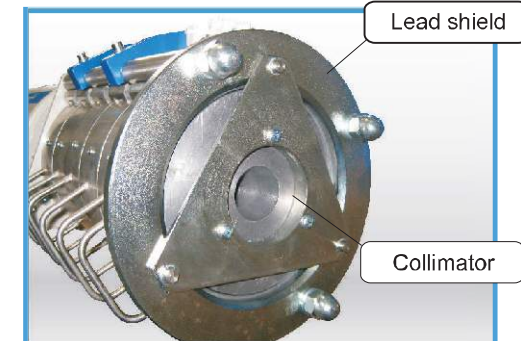
Preamplifier cables have standard NIM connectors: POWER DC $\pm 12V$ - D-Sub-9pin, HV - SHV, OUT - BNC, TEST - BNC

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

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



Robust and waterproof protective case



Lead shield

Collimator



HPGe Mobile Spectrometer for Field Application

(Liquid Nitrogen cooled)

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

Features

- Optimal size and weight for mobile application
- Placed on a hand trolley with lead shield set with collimators
- Minimal time to reach the proper temperature mode for the detector after filling with liquid nitrogen
- Simplicity of operating and servicing the device
- Laser measuring point indication
- 360° orientation
- Highest detector position is up to 1.3m

Complete set

- HPGe semiconductor detector for Gamma spectroscopy with planar or coaxial detector with preamplifier in portable cryostat
- Multichannel Analyzer (Digital or Analog-Digital)
- Analytical software package
- Lead shielding with collimators
- Hand trolley and transport case
- Laser range indicator
- Accessories: funnel for liquid nitrogen filling, recharger, etc.
- Cable pack and documentation

Specially developed software package allows simulation of gamma spectra and spectrometer registration efficiency calculation for complex shape objects using Monte-Carlo method.

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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
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

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

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

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 for complex geometry objects
 - extended radionuclide library
- Liquid nitrogen storage and filling system
- Liquid nitrogen sensor and monitor
- Cable set extension

Features

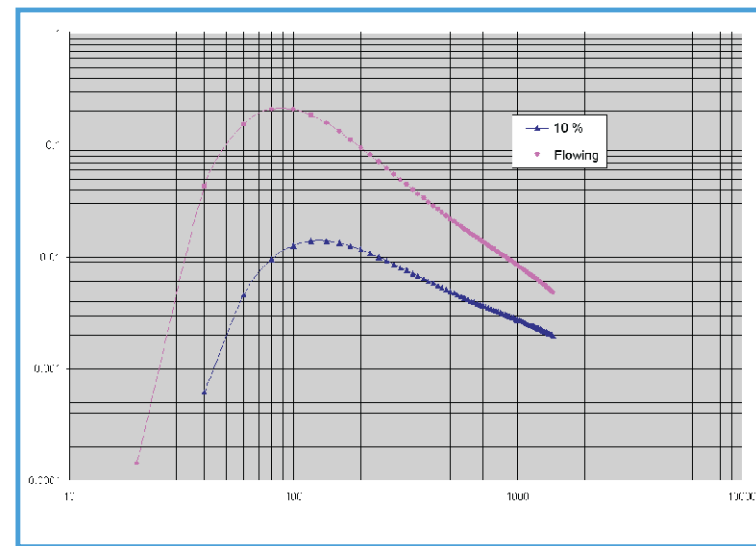
- Detection unit performs 4 π geometry measurements as measuring product is moving inside germanium detector
- Radionuclide efficiency registration is dozen times higher than efficiency registration of standard coaxial detection unit of the same dimensions
- HPGe detector flowing geometry can be developed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

Complete set (standard)

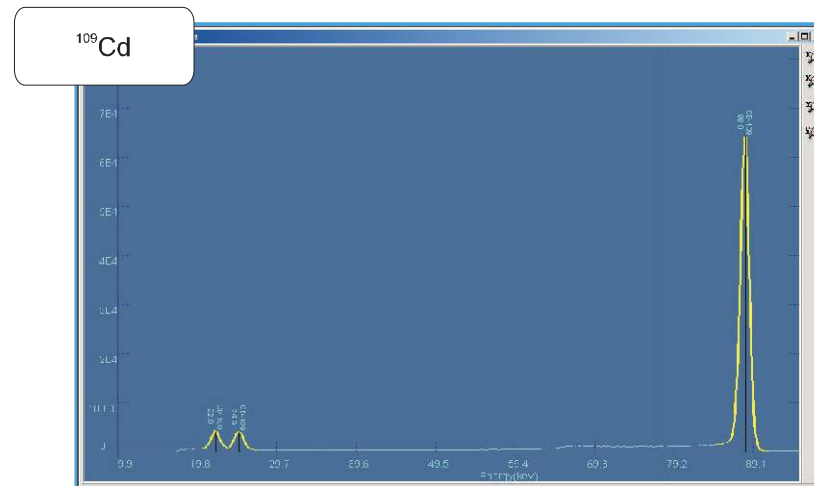
- HPGe coaxial detector
- Preamplifier with cooled input stage
- Dewar vessel
- Cable set
- Documentation

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



Spectrum of wire sample containing source ¹⁰⁹Cd 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

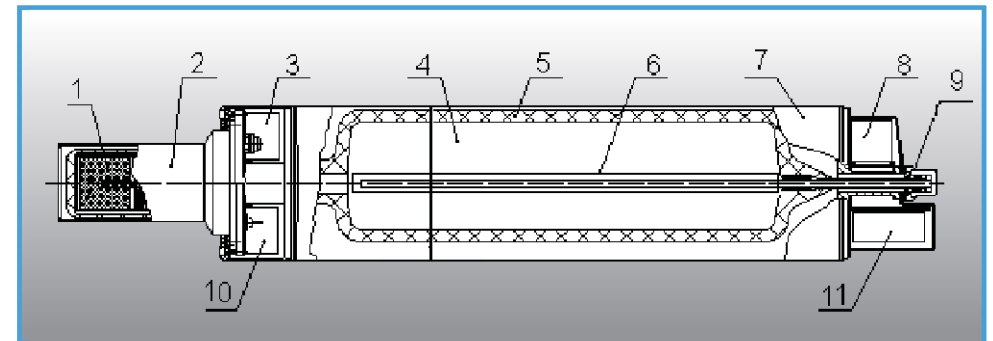
- HPGe coaxial detector
- Cryostat combined with cryoaccumulator for detector cooling
- Spectrometric device with microprocessor and data transfer devices
- Durable waterproof housing with power supply for the spectrometer, allowing spectrometer to dive to depths of up to 100, 500, 1000 or 3000 meters 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 x 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;
2. cover of titan alloy;
3. compartment for preamplifier;
4. cryoaccumulator;
5. vacuum insulation;
6. cold finger;
7. stainless steel coating;
8. HV power supply;
9. filling nozzle;
10. HV filter;
11. shaping amplifier.



Waste Assay Monitor WAM-201

(Liquid Nitrogen cooled)

Application

WAM-201 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.

Features

Waste Assay Monitor is a complex measuring system which is intended for monitoring of radioactive waste in standard 200-litre drums. WAM includes following systems:

- Monitor - a fixed segmented gamma-spectrometric monitor for determination of activities of selected radionuclides in individual drum segments with vertical motion and collimator. Transfer system is used for moving measuring part from/to the drum measured,
- MDG-125 dose rate monitor, direction-dependent, measures dose rate of the segment in defined distance from the drum,
- MDG-02 dose rate monitor measures the background dose rate,
- Rotary table,
- RS01 and Rs02 control and power supply switchboards.

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Specification

Parameter	Value
Energy range, keV	100 to 1500 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, ¹⁸¹ Hf, ¹⁰³ Ru*
Measuring range	from minimum detectable activity of 3.7 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 0.2 m ³
Material weight	up to 700 kg (maximum drum weight)
Drum measured	Type I – average of 600 mm, height of 860 mm, wall thickness from 1.4 to 1.5 mm Type II - average of 600 mm, height of 800 mm, all thickness of 4 mm
Detector	HPGe, efficiency of 30%** , resolution < 2 keV at 1.33 MeV
Dimensions	2500 x 700 x 2200 mm
Weight	1700 kg
Communication interface	X2X, CAN, RS-485
Protection from external influence	IP 54
Power supply	220 V +22/+33 V, 50 Hz, 2 kW, maximum power interruption up to 20 ms. TN-S power supply system

* Nuclide list can be changed accordingly

** Can be used with other efficiency





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.



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

Complete set

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

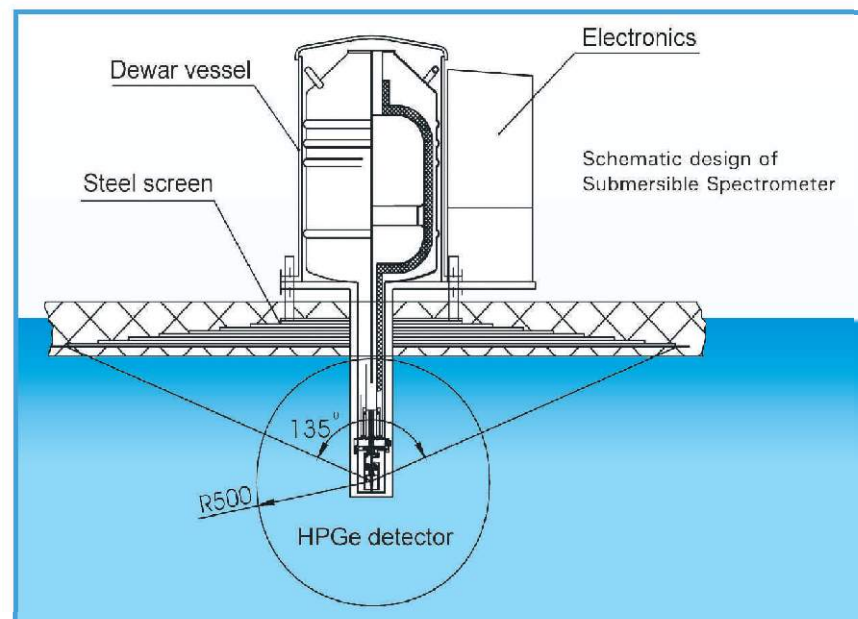
- Gamma-ray spectrometer based on submerged high purity germanium or scintillator detector;
- Transmitter receiver;
- Microprocessor device for interfaces necessary for automatic operation, self-diagnostic, calibration;
- Backup accumulators;
- Accessories for station control, calibration.

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;
- Device for information CD ROM recording.
- Metrological assurance, set of accessories and necessary instruments.

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NICOLE

Hybrid cooling system (LN₂ / Electrical)



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 not cooled 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 surface freight
- Minimization of fabrication time (location of materials above ground)
- 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

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
- 30L Dewar vessel
- Liquid nitrogen sensor and level monitor
- Pressure sensor with digital indicator

Parameter	Value
Type of Stirling-cycle cryocooler	Free-piston
Nominal Cooler Input Power	180 W
Power Supply	DC 32V
Dewar vessel volume	30L
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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Multi Channel Analyzer MS Hybrid

Application

Amplification, optimal filtering, analog-digital conversion of signal from semiconductor detectors of ionizing radiation, the accumulation of spectra and transfer to a PC via an RS-232 or USB, the formation of the necessary voltages for detecting units (high voltage for semiconductor detector and power for preamplifier). Hybrid is designed to work with HPGe or SiLi detectors produced by Baltic Scientific Instruments or other manufacturers.

Complete set

- Analog processor - ADC;
- Microprocessor unit with memory and I/O port RS-232 or USB;
- Power supply for detector and preamplifier;
- Cable set;
- Emulation software.

Features

- High speed;
- Low self-noise;
- Analog signal processing of the spectrometric signal;
- Rejection of superimposed pulses and taking into account the dead time of the spectrometer;
- High linearity of the amplifier path;
- Simultaneous registration of signals in the eight energy ranges;
- Via PC or manual control of the spectrometer;
- Switch on and off collecting spectra for a preset time;
- Collecting spectrum by "live" or real-time;
- Setting the number of channels by software;
- The possibility of energy calibration;
- Definition of energy resolution, centroids of the peaks of total absorption and peak areas with and without taking into account the background under the peak;
- Works with I/O ports RS-232 or USB;
- Compatibility with spectra processing software LSRM, SpectraLine, ANGAMMA, AXILL.

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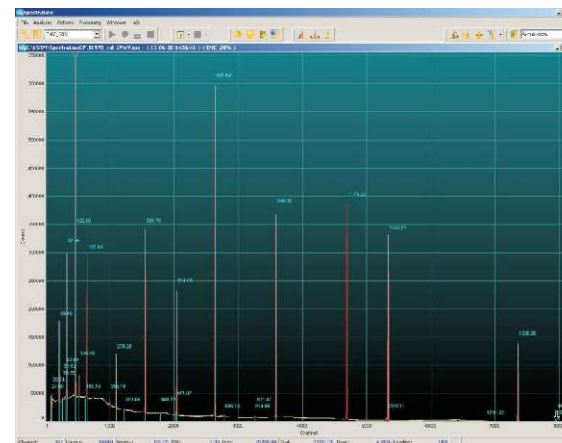
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Specification

Parameter	Value
ADC conversion time, μ s	7
Number of channels	1024, 2048, 4096, 8192, 16384
Channel capacity	$2^{32}-1$
Gain, adjustable (manual transmission)	
gradually	1 -2,5
roughly *	X1, X2, X4, X8
Noise level (adducted to the entrance), mV	<5
Integral non-linearity, %	<0.04
Temperature instability, %/ $^{\circ}$ C	<0.01
Shaping time constants (switchable)** , ms	1-16
Output load frequency control (for each of the outputs)	TTL
Power supply range, V	+/- 0-5000
Dimensions, mm	305 x 210 x 85
Weight, kg	2,8
Power consumption, W	<10
Supply voltage, V	220
Frequency, Hz	50

* 4 fixed settings are set by the manufacturer depending on the detection unit.

** 2 fixed settings are set by the manufacturer depending on the detection unit.



Software package

SpectraLineGP spectra processing includes calibration, peaks parameters determination, nuclides identification, activities calculation and using the true-coincident factors for the gamma-emission intensity correction. Non-parametric model for pattern of the full energy peak provides a correct model for a line in any energy range. Adjustment of the DigiSpectrum parameters.

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.

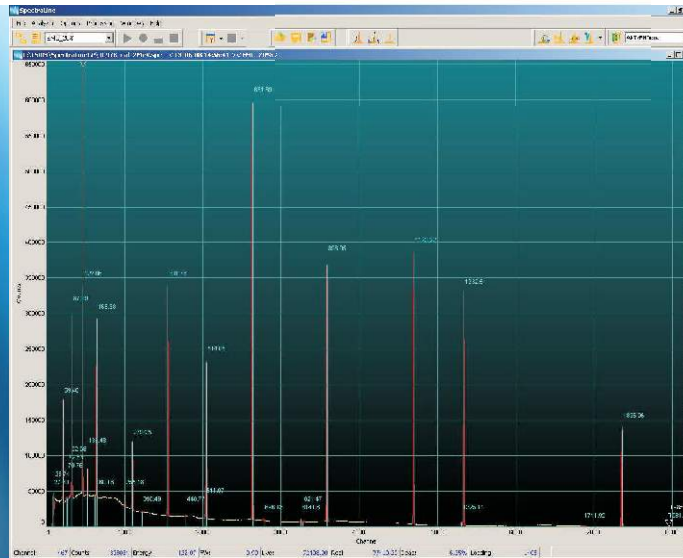
SpectraLineGP software package

Application

SpectraLine Gamma Precision (GP) software has been developed for a wide range of application tasks in spectrometry using gamma-ray semiconductor detectors.

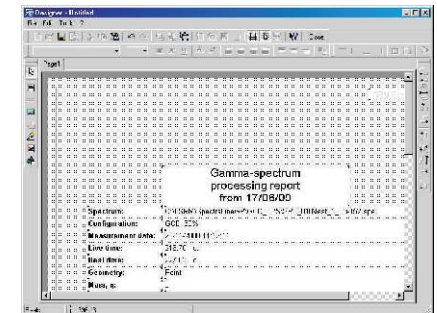
The tasks are as follows:

- Examination and certification of food products and building materials.
- Radiation monitoring of environmental and other objects.
- Certification of radiation samples.
- Determination of the enrichment level for uranium, plutonium and other elements.
- Fuel analysis in scientific research, etc.



Radionuclide	Half-life
Ag-110m	249.75 day
ANNIGL	1E009 year
Na-22	2.6019 year
I-127a	1274.543
K-40	1.28E009y.
Tl-204	53 year
Mn-54	312.116 day
Co-56	77.9 day
Co-57	271.81 day
Co-60	5.2714 year
Zn-65	244.12 day
Y-88	106.817 day
Zr-95+	64.02 day
Ru-103	38.36 day
Rb-106	367 day
Cd-109	453 day
Sr-90	32.89 year
Sr-90	2.77 year
Ra-226	1600 year
Co-134	2.062 year

It is possible to create libraries of arbitrary (optional) configuration depending on the task to be solved is involved in the program. Information is provided on the radionuclide designation, its half-life period, line energy, line intensity, and absolute error.



SpectraLineGP Software has a user-friendly interface and offers the following options:

- Color scheme adjustment of the window.
- Data copying into the spectrum windows.
- Addition/deletion of peaks and zones in a spectrum.
- Viewing the parameters of indicated zones or separate peaks.
- Zone integration or splitting into smaller zones;
- Viewing of calibration results, corrections, calculations, etc.

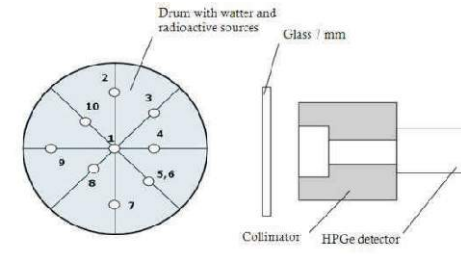
The program has a built-in editor, which allows making up the reports of various forms and connecting external programs.



Specification

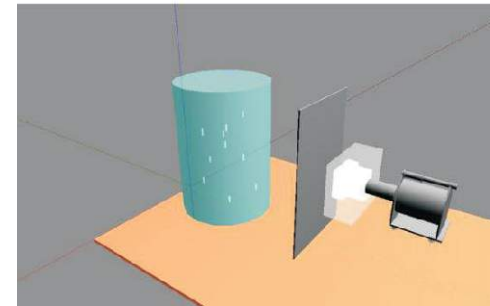
Modelling of gamma-spectra and calculation of registration efficiency for complex shaped objects

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:

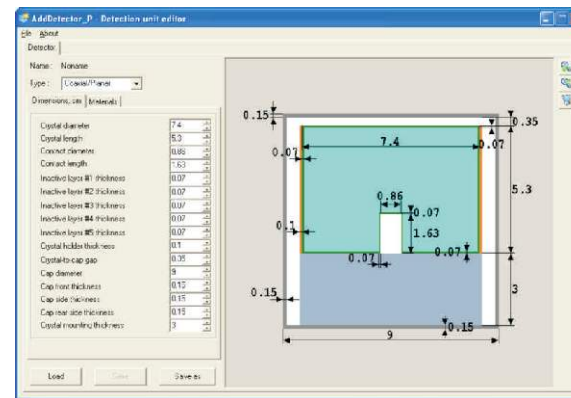
- Complex parallelepiped;
- Complex cylinder;
- Pipe;
- Marinelli;
- Pipe with internal/external contamination;
- Square pipe with internal/external contamination;
- Room/parallelepiped with contaminated internal surface;
- Wall/plate;
- Other geometries according to customer needs including multilayer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



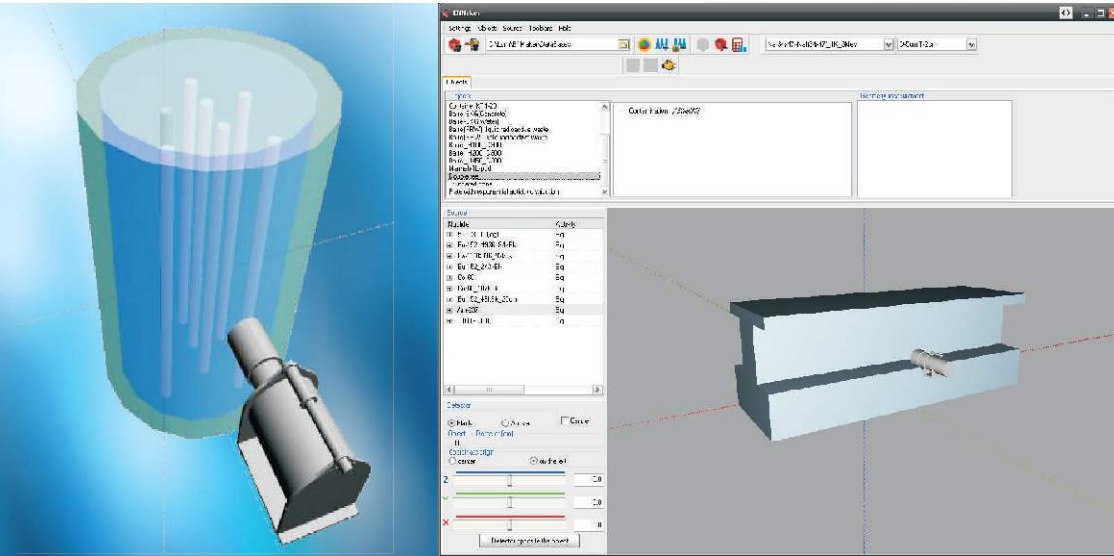
Mathematical characterization of measuring object, detector and collimator based on Monte-Carlo method by means of EffMaker program

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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Specification

Model	Detector Sensitive Area Diameter, mm	Area, mm ²	Energy Resolution on 5.9 keV
SXRD - 04 140	4	12.5	140
SXRD - 05 150	5	20	150
SXRD - 06 155	6	30	155
SXRD - 08 160	8	50	160
SXRD - 12 175	12	100	175
SXRD - 16 195	16	200	195
SXRD - 25 300	25	500	300



Plenty of cryostat geometries available



SiLi X-ray Detectors SXRD

(Liquid Nitrogen cooled)

Application

Detectors are applied for X-rays registration in X-ray fluorescence and X-ray diffraction analysis devices, in laboratory measurements etc.

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

- Low instrument background
- Built-in or Remote Preamplifier types are available depending on application (ref. p. 44)
- High energy resolution
- High count rate - 500 MeV/s and ability to increase it up to 1000 MeV/s
- 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 (ref. p. 44)

Complete set (standard)

- Si(Li) semiconductor detector SXRD
- Preamplifier with cooled input stage
- Dewar vessel
- Cable set
- Documentation

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Specification

Parameter	Value
Energy range, keV	1 - 60
Detector sensitive area, mm ²	20*
Energy resolution at 5.9 keV, eV	
at shaping time constant 16 μs	138
at shaping time constant 1 μs	268
at count rate 10 ⁵ cps and shaping time constant 1 μs	275
Peak to background ration	4000
Ambient temperature, °C	+5 to +38
Operation mode	Continuous
Spatial orientation of detection unit	Any
Voltage, V / frequency, Hz	200 / 50-60
Power Supply, W	60
Overall dimensions	
Detection Unit, mm	80 x 135 x 150
Compressor, mm	140 x 160 x 300
Weight	
Detection Unit, kg	1.8
Compressor, kg	7.5



X-ray SiLi Detectors ELSiX (Electrically cooled)

Application

The X-ray SiLi detector with electric cooling is designed for X-ray fluorescence analyzers, X-ray diffractometers and X-ray spectrometers, where detector cooling by liquid nitrogen is undesirable or impractical.

Complete set (standard)

- Si(Li) semiconductor detector
- Compressor unit
- Connecting gas lines
- Preamplifier with cooled input stage
- Dewar vessel
- Cable set
- Documentation

Features

- No liquid nitrogen
- High energy resolution
- Thin Be windows with rust-proofing
- Allows for any spatial orientation of detection unit
- Automatic restart after the power supply is switched off
- Long-duration continuous functioning
- Lightweight and compact design

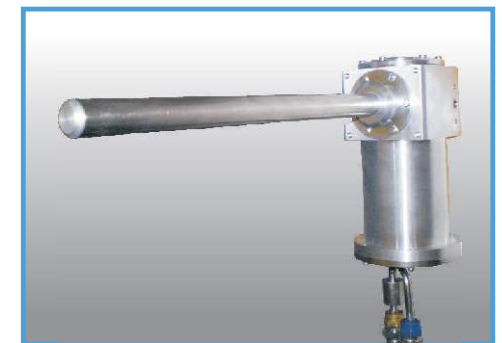
Accessories (optional)

- Multichannel Analyzer (Digital or Analog-Digital)
- Analytical Software packages:
 - quantitative and qualitative analysis
 - extended radionuclide library
- Cable set extension

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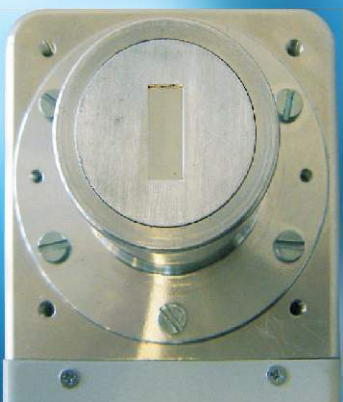
Any spatial orientation



Specification

Parameter	Value
Energy range, keV	1 - 60
Detector sensitive area, mm ²	20*
Energy resolution for 20 mm ² sensitive area detector, eV at energy	
5.9 keV	180
59.6 keV	450
Integral nonlinearity, %	0.05
Peak to background ration	2500
Time instability during 8 hours of continuous work, %	0.05
Input count rate, pulse/s	1.5×10^5
Dimensions of detection unit, mm	Ø90 x 210
Dimensions of Multi Channel Analyzer, mm	300 x 180 x 80
Weight of detection unit, kg	2
Weight of Multi Channel Analyzer, kg	2.8
Power consumption, W	100
Power Supply, V	220
Frequency, Hz	50

* Detectors with 20 - 100 mm² sensitive area are available



SiLi X-ray Spectrometers

(Peltier cooled)

Application

Detection, accumulation and processing of X-ray spectra when detector cooling by liquid nitrogen is inconvenient or impossible.

Complete set (standard)

- Detection unit with SiLi detector and Peltier cooler
- Preamplifier with cooled input stage
- Self-contained unit for water cooling the Peltier cooler hot seal
- Cable set
- Documentation

Features

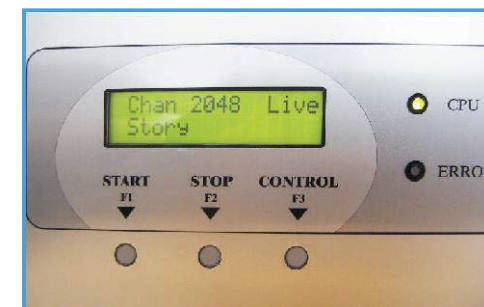
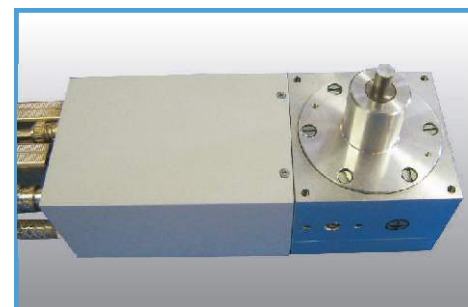
- Thermoelectric cooling of detector and input stage of preamplifier, thin Be window, possibility of installing ultra-thin polyamide windows
- Encapsulated hermetically sealed case for the detection unit
- Detection of radiation in any spatial orientation
- Closed-loop system of water cooling using Peltier cooler hot seal
- Mobile spectrometer with power supply from car accumulator is available

Accessories (optional)

- Multichannel Analyzer (Digital or Analog-Digital)
- Analytical Software packages:
 - quantitative and qualitative analysis
 - extended radionuclide library
- Cable set extension

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Silicon Ion Implanted Alpha Particle Detectors

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 working 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

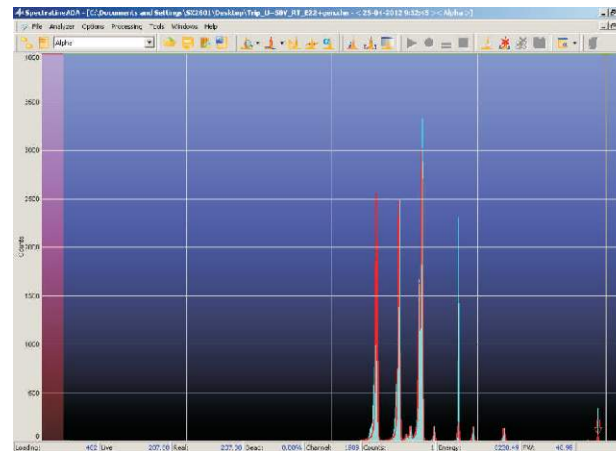
Detector area, mm ²	Guaranteed energy resolution*, (keV)		Detector type	Thickness, μm	Detector bias voltage, V
	Alpha	Beta			
450	20	15	Open	400 +/- 30	50
	30	17	Metalized	400 +/- 30	
300 - 1200**			Open	400 +/- 30	50
			Metalized	400 +/- 30	

* 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, ²³⁹Pu, ²³⁵U spectrum

Alpha Spectrometers include:

- Vacuum chamber with vacuum control system,
- Preamplifier,
- Amplifier,
- Discriminator,
- High voltage supply,
- Test-generator
- Digital multichannel analyzer.

Alpha spectrometer same as vacuum control are operated by software which also allows to process acquired spectra and analyze measurement results.



Specification

Parameter	Value
Registration energy range, keV	up to 10000
Shaping time constants, us	1
Integral nonlinearity, %	< 0.04
Maximum value of High Voltage, V	+150
Operation temperature range, °C	+5...+35
Temperature instability, %/C	< 0.01
Time of continuous operation, hour	> 24
Overall dimensions, mm	300x221x68
Weight, kg	2.8
Consumed power, Wt	< 10
Supply voltage, V	+/-12 +/-24
Energy resolution for 450 mm ² square open detector, keV	20



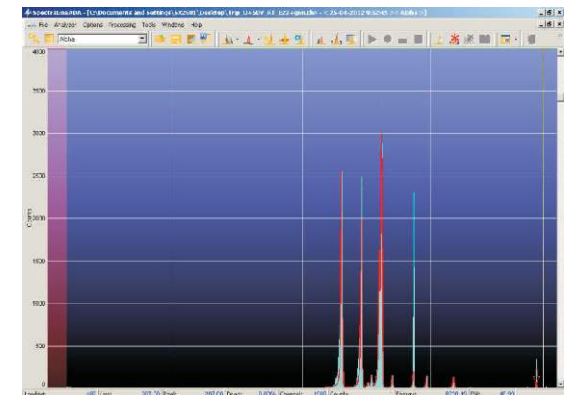
ALPHA SPECTROMETER

The Alpha Spectrometer is easy to use because of LCD display, intuitive interface and 3 control buttons on the front panel.

Adjust settings of High Voltage, discriminator and pulse generator will be saved in memory even after switching off the device.

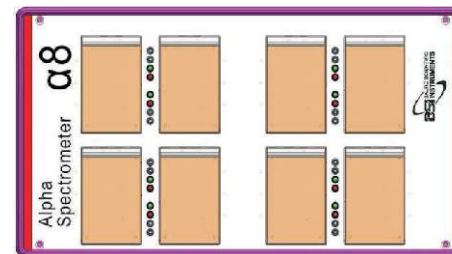
Integrated High Voltage power supply supports fine HV adjusting within 0 to + 150 V DC. In order to avoid premature HV rise on the detector while pressure is inappropriate Alpha Spectrometer contains internal inhibit.

Due to analog and digital output Alpha Spectrometer can be used with analog electronics and as a standalone device when applied to external PC with software.



LCD displays:

- Button functions menu (main menu)
- HV measurement and detector current menu
- HV setting and control menu
- Pressure measurement in chamber and threshold setting menu
- Vacuum valve control menu
- Count rate Indication and binding threshold setting menu
- Discrimination threshold for lower levels setting menu
- Generator control menu
- Operation mode menu
- Menu of the section readiness for the measurements



1 to 12 channel Alpha Spectrometers are available with all necessary equipment and accessories.

Features

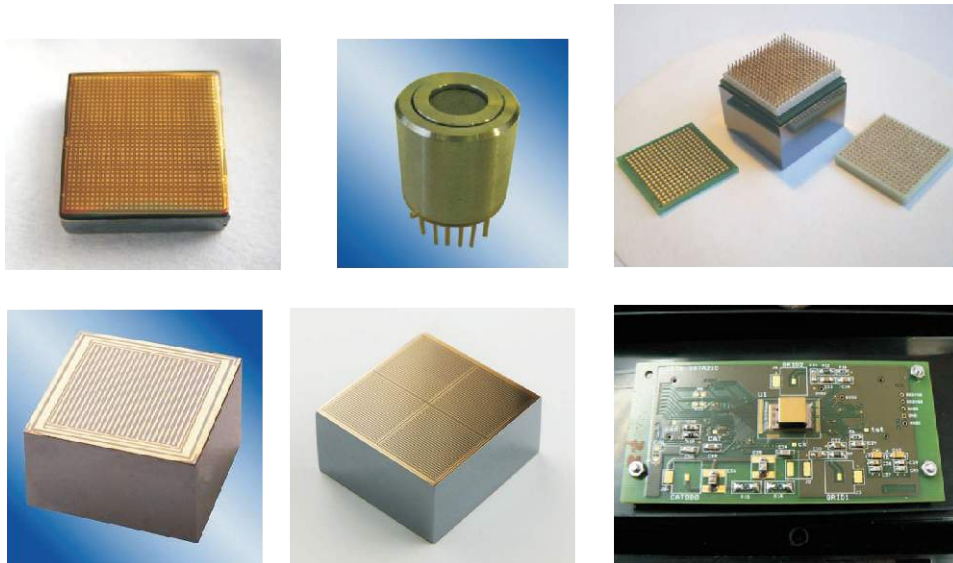
- Double-wide NIM module
- LCD status display
- Device management with control buttons on the front panel or from an external PC software
- Vacuum gauge with pressure display on the indicator
- Detector current meter from 1 nA to 10 μA
- High Voltage inhibit in case of vacuum breaking
- Reverse bias 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)
- Analog and digital output

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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.

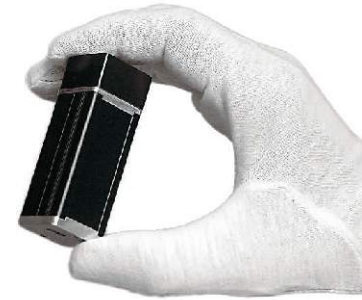
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μSPEC Gamma-Radiation CZT Micro Spectrometer

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	CdZnTe
Detector volume	60-1500mm ³
Energy range	20keV - 3.0MeV
Energy resolution at 662 keV	
μSPEC60, μSPEC500	<2.5%
μSPEC1500	<3.5%
Maximal throughput	<100 kcps
Number of channels	128, 256, 512, 1k, 2k
PZC adjustment	automated
Connector	Micro USB
Dimensions, mm	25 x 25 x 70
Weight, gram	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	CdZnTe
Detector volume	400mm ³
Energy range	30keV - 3.0MeV
Dose rate	0.05μSv/h - 100μSv/h
Dose	0.05μSv/h - 10Sv
Sensitivity for 137Cs	15 s ⁻¹ /(μSv/h); 0.15 s ⁻¹ /(μR/h)
Alarm type	LED, audio, vibration
Data recording	up to 3000 events
Connector	Micro USB
LCD type	monochrome
Environmental protection	Ip65
Operating time	up to 500h
Dimensions, mm	122 x 69 x 33
Weight	



SDP310/Z, SDP500S, 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
SDP310/Z	Ø8 x 90	4.0-62.0	600	< 20	> 1.6 - 2.5
SDP500S	Ø24 x 58	0.5	< 1500	2.5	> 4.0
SDP1500	Ø32 x 58	1.5	< 2500	3.5	> 4.0
SDP4000	Ø40 x 58	4.0	< 3000	4.0	> 4.0

Cryostat geometry modifications

Baltic Scientific Instruments develops and manufactures cryostats and vacuum chambers according to customer's requirements.

Current catalogue includes only examples of the most popular cryostat geometries.

Do you have specific requirements?

Tell us!

We will bring you a solution.

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Examples

