

HPGe Hand Held Spectrometer **NitroSPEC**

1. APPLICATION

The NitroSPEC is intended for Gamma and X-radiation registration and analysis. It is used in the radiological control of environmental objects, materials and products of industry and farming, nuclear facilities and during storage and processing of radioactive wastes.

The NitroSPEC is the world's smallest liquid nitrogen cooled Spectrometer. It consists of HPGe detector, Dewar vessel for liquid nitrogen, MCA with software package and visualization monitor integrated in one miniature mono-unit to provide easy and comfortable use.

The NitroSPEC is applicable in:

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



2. FEATURES

- Minimal weight and size;
- Ready for operation slightly over 1 hour;
- Autonomous operating time up to 20 hours;
- Simple and cheap in maintenance and service;
- Easy to use.

3. COMPLETE SET

- HPGe detector, preamplifier and Dewar vessel;
- Built-in Digital 16K Multi Channel Analyzer;
- Analytical software package;
- Touch screen display;
- Communication interface (USB, wireless);
- Documentation set in English;
- Accessories:
 - Spare battery;
 - Adaptor for charging;
 - Funnel for liquid nitrogen filling;
 - Lead shield with 3 collimators;
 - Hard-sided transport case.

Technical characteristics of the spectrometer NitroSPEC based on coaxial detector

The NitroSPEC is applied for conversion of gamma and X-ray energies into proportional by amplitude electrical signals, spectra processing, identification of radionuclides and calculation of their activities.

#	Parameter	Value	
1.	Relative efficiency (with respect to 3" x 3" NaI detector and Co-60 source mounted 25 cm above the detector) at 1.33 MeV γ -photon	10 %	20%
2.	Resolution at 1.33 MeV, not over	≤ 1.8 keV	≤ 1.85 keV
3.	Resolution at 122 keV, not over	≤ 850 eV	≤ 875 eV
4.	Peak to Compton ratio	$\sim 41 : 1$	$\sim 51 : 1$
5.	FWTM / FWHM	1.9	
6.	FWFM / FWHM	2.65	
7.	Energy range of detector operation	40keV – 3 MeV	
8.	Entrance window material	Aluminum	
9.	Thickness of entrance window	0.7 mm	
10.	Cooling time	1.5 hours	2 hours
11.	Dewar vessel volume, L	0.6	
12.	Battery operation time	8 hours	
13.	Autonomous operation time at filled Dewar	20 hours	18 hours
14.	Touch screen <ul style="list-style-type: none"> • Resolution, pixels • Diagonal, cm 	800x400 10.8	

15.	Autonomous operation time of the internal batteries, h	8	
16.	Weight, kg	5.9	6.1
17.	Overall dimensions, mm	154 x 324 x 217	
18.	The range of the operating temperatures ,° C	from 0 to +40	
19.	Ingress Protection	IP64	
20.	Preamplifier with resistive feedback with cooled FET.		

Technical characteristics of the spectrometer NitroSPEC based on planar detector

#	Parameter	Value
1.	Energy range of detector operation	3 keV – 1.5 MeV
2.	Energy resolution* at <ul style="list-style-type: none"> • 5.9 keV • 122 keV <i>*at input count rate 1000 imp/s, shaping time 6 μs</i>	< 400 eV < 600 eV
3.	Detector sensitive area	500 mm ²
4.	Detector thickness	13 mm
5.	Endcap window material	Al – 0.7 mm Carbon – 0.7mm Be – 0.2 mm
6.	Endcap diameter	74 mm
7.	Cooling time	1.5 hours
8.	Dewar vessel volume, L	0.6
9.	Battery operation time	8 hours
10.	Autonomous operation time at filled Dewar	20 hours
11.	Touch screen <ul style="list-style-type: none"> • Resolution, pixels • Diagonal, cm 	800x400 10.8
12.	Autonomous operation time of the internal batteries, h	8
13.	Weight, kg	4.95
14.	Overall dimensions, mm	154 x 324 x 217
15.	The range of the operating temperatures ,° C	from 0 to +40
16.	Ingress Protection	IP64
17.	Preamplifier with resistive feedback with cooled FET.	

Digital spectrometric device technical characteristics

Amplifier

- Coarse amplifier pre-filter with amplification in steps of 2-5-10-20-50, corresponding to a full scale;

- ADC input range from 12V to 500mV;
- Input DC coupled, offset adjustable and depending on polarity of input signal;
- Linearity is better than 0.1 %.

ADC

- 14bit, 10 MSps;
- Integral linearity is better than 0.05 %;
- Temperature stability TK 50.

Digital signal processing

- Double differential trigger filter, or single differential low energy low count rate trigger filter;
- Pile-up-suppression, pulse pair resolution ~ 400 ns, depending on trigger filter;
- Automatic and manual adjustment of trigger threshold;
- Shaping time (Integration time / rise time of filter divided by 2) adjustable in the range 0.1 – 25 μ s;
- Flat top adjustable 0 – 5 μ s;
- Fine adjustment of amplification in steps of < 0.05 %;
- Channel splitting 128, 256, 512, 1k, 2k, 4k, 8k and 16k;
- Differential non-linearity <1% for 4k channels and 1 μ s shaping time;
- Base Line restorer with adjustable averaging;
- Optimum spectroscopic performance for 50 μ s preamp decay time constant;
- PZC adjustment, detector decay time constants from 40 μ s to 1 ms can be compensated.

Basic spectrometry software

In find mode a continuous measurement is performed upon pushing a single button, the information is updated every second. Dose rate is calculated from integral spectrum and is visualized on a display in μ Sv/h. In case of excess of dose rate over user defined threshold instrument gives visual and acoustic alarm. Energy calibration is available by using the touchscreen. Identification of radionuclides is performed automatically according to the library of radionuclides. List of identified radionuclides and corresponding count rates with background deduction appears on the screen. Depending on the categories each identified radionuclide is marked by different index and color:

- Natural radionuclides are marked by N index, for example Th-232...N, and have green color;
- Industrial radionuclides are marked by I index, for example Co-60...I, and have blue color;
- Radionuclides used in medicine are marked by M index, for example F-18...M, and have red color;
- Illicit trafficking radionuclides are marked by UPu index, for example Am-241...UPu, and have black color;
- Other radionuclides are not marked, for example Eu-152, and have grey-50% color.

In advanced mode the user can select regions of interest in the spectrum or ratios of regions of interests and calculate corresponding areas or ratios of areas.

Energy calibration of NitroSPEC spectrometer, automatic radionuclides identification with corresponding count rates and ROIs selection can be performed by using the touch screen.

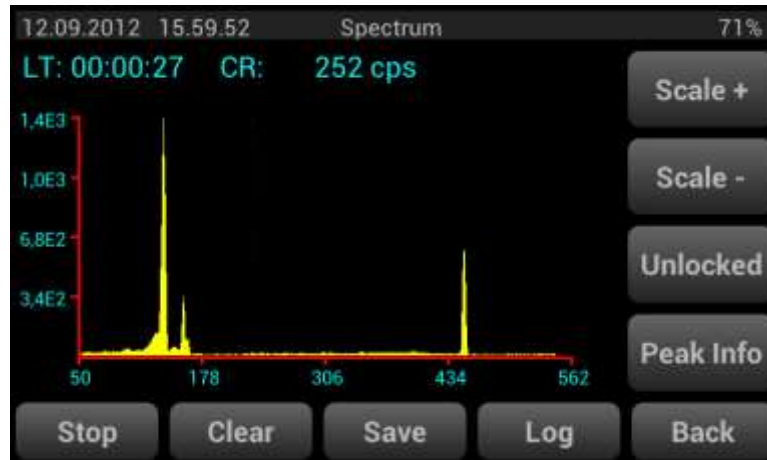


Fig. 1. Operating window screen shot

SpectraLineGP analytical gamma spectrometry software

The NitroSPEC could be easily connected to Laptop via wireless or wired communication for operation with SpectraLineGP software for analysis of spectra, identification of radionuclides and determination of their activities by commonly used methods.

Software functions:

- Automatic peaks find with the required sensitivity level;
- Energy, and peak shape calibration;
- Peaks parameters determination — position, FWHM, area;
- Automatic radionuclides identification;
- Registration efficiency curves creation and radionuclides activities calculation;
- Saving of the measured spectra and processing results to database;
- Repeated measurements analysis;
- Simultaneous processing of several spectra, using several spectrum peaks from different energy intervals for the calibration by peaks shape;
- Calibration control by values and visually;
- User processing scenarios;
- Interactive processing of spectra intervals;
- Library of radionuclides;
- User-friendly interface.

EffMaker program (optional)

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 EffMaker program for containers with arbitrary geometries and composition such as (sphere, cylinder, parallelepiped etc.).

Detector characterization and the following templates of geometries will be provided:

- Complex parallelepiped;
- Complex cylinder;
- Pipe;
- Marineli;
- Pipe with internal/external contamination;
- Square pipe with internal/external contamination;
- Room/parallelepiped with contaminated internal surface;
- Tank, partly filled with liquid.

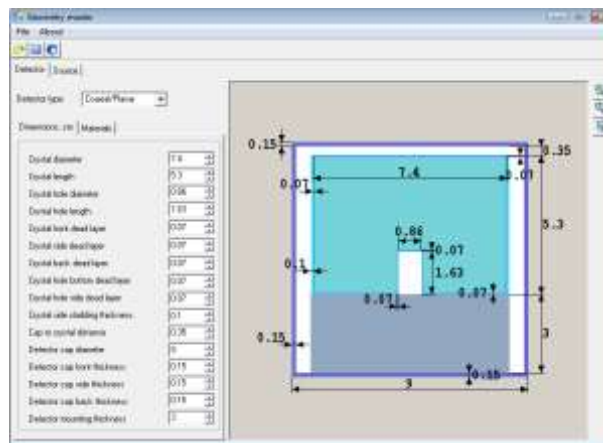


Fig.6. Detector characterization tool

The main possibilities of the program 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.

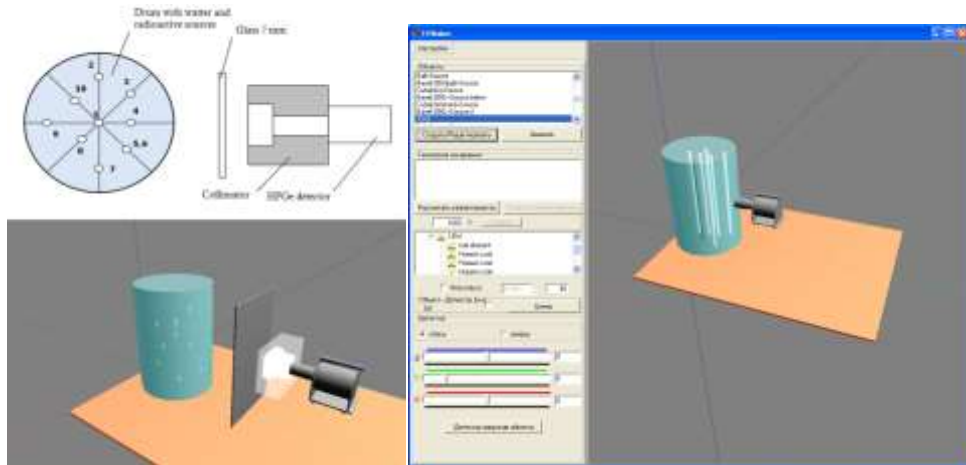


Fig.7. Mathematical characterization of measuring object, detector and collimator based on Monte-Carlo method by means of EffMaker program

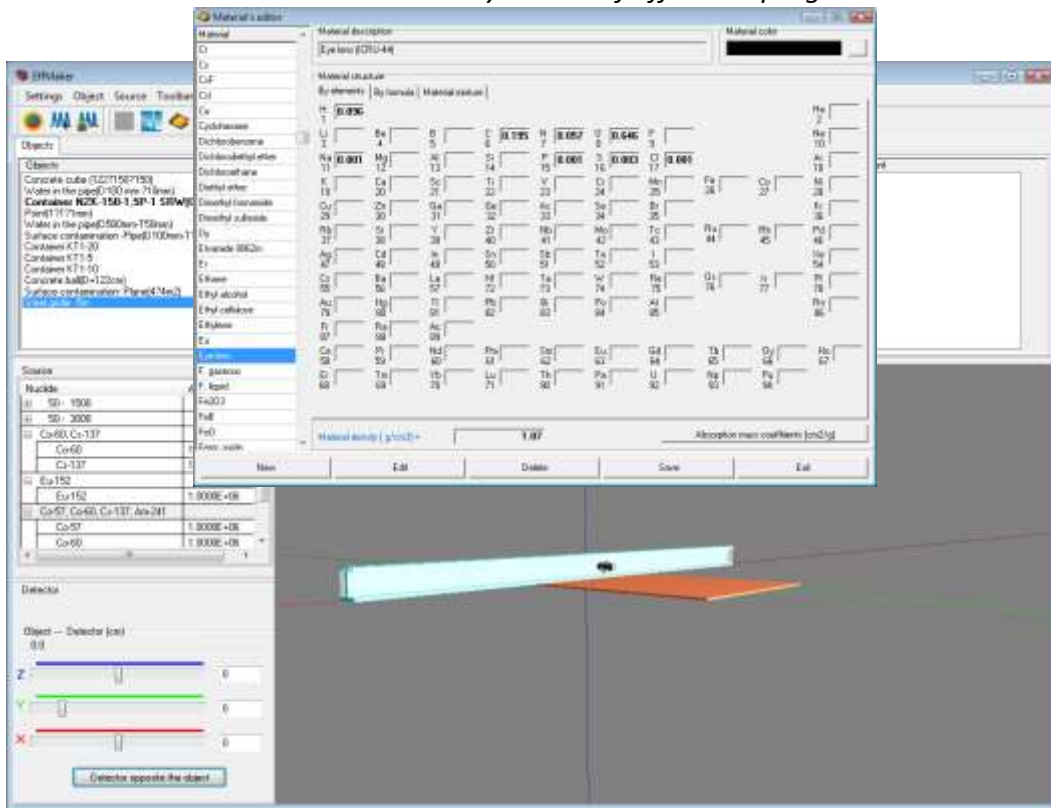


Fig.8. Example of template

DELIVERY SET AND PRICE

No	Unit	Q-ty	Price, GBP
1.	HPGe Hand Held Spectrometer NitroSPEC based on GCD-10175 detector.	1	£37,375.00
2.	HPGe Hand Held Spectrometer NitroSPEC based on GCD-20180 detector.	1	£40,500.00
3.	HPGe Hand Held Spectrometer NitroSPEC based on GPD-25300 detector.	1	£33,125.00
Additional accessories (optional)			
1.	Tungsten shielding with a set of 3 collimators;	1	£2,650.00
2.	Shoulder belt;	1	£65.00
3.	Hard-sided transport case;	1	£780.00
4.	EffMaker software package;	1	£5,875.00

TERMS AND CONDITIONS

Delivery conditions	FCA
Payment conditions	Wire transfer
Delivery terms	4 months ARO
Warranty	12 months