Nuclear Instruments

泰坤工业
TAIKUN INDUSTRY

Beijing Tai Kun Industrial Equipment Co.,Ltd.

INDEX

Section One .Laboratory Radiation Measuring Instruments

1．High-Purity Germanium Measurement System

Model：TK-101

Fig. 1 TK-101 high purity germanium measurement system

Ⅰ. Product Introduction

TK-101 high purity germanium measurement system is the first domestic set of high-performance gamma-ray spectrometric system, providing an integral solution which consists of the high purity germanium detector, the refrigeration device, the digital multi-channel spectrometer, the low background radiation lead chamber, the gamma spectrum access and analysis software, the sourceless efficiency calibration software and so on. TK-101 integrates a number of patented technologies of Beijing Tai Kun Industrial Equipment Co.,Ltd.., with advantages of high energy resolution, highly automated radioactivity analysis, high system stability, high analysis result reliability, efficiency calibration without standard sources, complete operation in Chinese and so on. It is suitable for use by radioactive spectrum analysis professionals and non-professionals.

Ⅱ.Technical Specifications

1.1 High purity germanium detector

Model：Gamma-1

P-type coaxial detector, P-type wide energy range coaxial detector, N-type coaxial detector and well-type detector are optional; for typical detector indicators, please see Tables 1 and 2. Table 1 Indicators of p-type coaxial (wide energy range) high purity germanium detector configured with

TK-101

Model	**Relative Efficiency (%)**	**Capability Resolution (KeV)**		**Peak-to-Compton ratio**	**Peak shape (FWHM/KeV)**	
		122keV	1.33MeV		F W. 0 1M	FW.02M.
TK − 10175P	10	0.825	1.75	41:1	1.9	2.65
TK − 15180P	15	0.825	1.80	46:1	1.9	2.65
TK − 20180P	20	0.850	1.80	51:1	1.9	2.65
TK − 25185P	25	0.875	1.85	55:1	1.9	2.65
TK − 30185P	30	0.895	1.85	58:1	1.9	2.65
TK − 35190P	35	0.895	1.90	60:1	1.9	2.65
TK − 40190P	40	1.0	1.90	62:1	1.9	2.65
TK − 50190P	50	1.0	1.90	64:1	1.9	2.65
TK − 60200P	60	1.0	2.0	68:1	2.0	3.00
TK − 70200P	70	1.0	2.0	73:1	2.0	3.00
TK − 80210P	80	1.0	2.1	77:1	2.0	3.00
TK − 100220P	100	1.0	2.2	81:1	2.0	3.00
TK − 120220P	120	1.0	2.2	83:1	2.0	3.00
TK − 140220P	140	1.0	2.2	86:1	2.0	3.00
TK − 160220P	160	1.0	2.2	88:1	2.0	3.00

Table 2 Indicators of well-type high purity germanium detector configured with TK-101

Model	Relative Efficiency (%)	Capability Resolution (KeV)		Well diameter	Volume（CC）
		122KeV	1.33MeV		
TK − 1520W	15	1.1	2.0	10	90
TK − 1522W	15	1.3	2.2	16	100
TK − 2020W	20	1.1	2.0	10	110
TK − 2022W	20	1.3	2.2	16	120
TK − 2522W	25	1.1	2.2	10	130

TK－2523W	25	1.3	2.3	16	140
TK－3022W	30	1.2	2.2	10	150
TK－3023W	30	1.4	2.3	16	160
TK－3522W	35	1.2	2.2	10	170
TK－3523W	35	1.4	2.3	16	180
TK－4022W	40	1.2	2.2	10	190
TK－4023W	40	1.4	2.3	16	200
TK－6023W	60	1.3	2.3	10	280

Table 3 Indicators of N-type high purity germanium detector configured with TK-101

Model	Relative Efficiency (%)	Capability Resolution (KeV)		Peak-to-Compton ratio	Peak shape (FWHM/KeV)
		122KeV	1.33MeV		FW.01M
TK-10180N	10	0.665	1.80	40：1	1.9
TK-15185N	15	0.675	1.85	44：1	1.9
TK-20190N	20	0.690	1.90	48：1	1.9
TK-25190N	25	0.690	1.90	50：1	1.9
TK-30190N	30	0.715	1.90	44：1	1.9
TK-35200N	35	0.775	2.00	55：1	2.0
TK-40200N	40	0.800	2.00	57：1	2.0
TK-45210N	45	0.850	2.10	58：1	2.0
TK-50220N	50	0.900	2.20	58：1	2.0
TK-55220N	55	1.000	2.20	60：1	2.0
TK-60220N	60	1.100	2.20	60：1	2.0

1.2 Digital multi-channel

Model：Gamma-2

Fig. 2 **Gamma-2** digital multi-channel

TK-101 is equipped with digital multi-channel 2 **Gamma-2** with up to 16384 channels, developed by Beijing Tai Kun Industrial Equipment Co.,Ltd..; the multi-channels use military-grade electronic components, with stable and reliable performance. The appearance of 2 **Gamma-2** multi-channel is shown in Figure 2, with Technical Specifications 技术规范 as follows:

- Maximum data passing rate: greater than 100kcps;
- Coarse adjustment gain: 1,2,4,8,16 or 32 optional;
- Fine adjustment gain: 0.45 ~ 1 adjustable;
- Largest channel address: 16384;
- shaping time constant: rise time is adjusted from 0.8μs to 23μs, with 0.2μs per step; flat-top time is ranged from 0.3μs to 2.4μs, with 0.1μs per step, selected by the computer (automatically adjusted under most automatic optimization function);
- Linearity: integral nonlinearity ≤ ± 0.025%; differential nonlinearity ≤ ± 1%;
- Temperature coefficient: gain <35ppm / ° C; zero point <3ppm / ° C;
- Overload recovery: 1000 times overload is recovered to within 2% rated output within 2.5 times non-overload pulse width at maximum gain;
- Pulse anti-accumulation: with field value set automatically, the resolution of pulse pairs is 500ns;
- Signal processing: with digital spectrum stabilization, automatic pole-zero, digital gating baseline recovery and other functions;
- Data memory: 16384-channel non-volatile memory, with 2^{31}-1 counts capacity per channel;
- Memory segmentation (system conversion gain): 16384, 8192, 4096, 2048, 1024 or 512 channels selected by the computer,
- Digital spectrum stabilization: gain and zero point are controlled and stabilized by the computer;
- Automatic digital pore-zero adjustment: controlled by the computer, with manual or automatic setting;
- Count rate display: displayed on the computer screen in real time;
- Dead time correction: accuracy (changed with peak area) <3% (0 ~ 50000cps);

- Communication interface: USB2.0;
- single-channel or twin channel: to provide a single MCA and dual MCA options;
- Dimensions : 252mm × 150mm × 50mm;
- Weight: 1kg;
- Operating temperature: -10 ~ 50 ℃。

1.3、Liquid Nitrogen Re-condensing Refrigerator

Model：Gamma-3

Fig. 1 GAMMA-3 liquid nitrogen re-condensing refrigerator

Ⅰ. Product Introduction

GAMMA-3 liquid nitrogen re-condensing refrigerator is developed by Beijing Tai Kun Industrial Equipment Co.,Ltd. after three years of research and development (shown in Figure 1); the product uses micro-electric refrigerator as the main working part, with ultra-low temperature refrigeration able to transform gaseous nitrogen in the Dewar bottle back to the liquid state, and maintain a long-term liquid nitrogen level. Thereby the labor for frequent addition of liquid nitrogen is avoided to save manpower costs. Also, compared with the electric refrigerator, as refrigeration unit of the liquid nitrogen re-condensing refrigerator does not touch with the liquid nitrogen, without the deterioration to the resolution of the detector, reaching the resolution level of the conventional liquid nitrogen refrigeration, and in case of power failure the low temperature environment is maintained

by reliable liquid nitrogen, thereby better protecting the continuity of the system work.

Ⅱ. Technical Specifications

- The service life is not less than 200,000 hours;
- With LED display, to display the remaining liquid nitrogen volume in real time;
- With a safety relief valve, to prevent risks due to high pressure in case of power failure of equipment itself;
- Unnecessary to add liquid nitrogen for nearly 24 months under the continuous power supply conditions;
- When the 30L liquid nitrogen storage tank is filled with liquid nitrogen, the detector can maintain the low temperature state in case of power failure, with liquid nitrogen supplied for more than seven days;
- Electric pulse tube cooling (Stirling electric refrigerator optional);
- With a numerical display mode: refrigeration time and liquid nitrogen level can be maintained at the refrigeration state, and an alarm can be issued when the refrigeration time remains less than 48 hours;
- Motor is used to collect the evaporated nitrogen and to compress them back to the liquid state;
- The average power consumption is less than 200W.

Ⅲ. Applications

- As the supporting part for high purity germanium detector, and also for other scientific instruments working in the liquid nitrogen temperature zone.

1.4、Energy spectrum analysis software

Model：Gamma-4

TK-101 is configured with a gamma-ray energy spectrum analysis software Gamma-4 that has developed its own distinctive features as well as integrating the advantages of main energy spectrum analysis software products internationally; that is, based on the automatic analysis as navigation, analysis results are exported through the selective precise interactive analysis. Gamma-4 is the only commercial energy spectrum analysis software that is capable of accurate analysis of multiplet.

Gamma-4 integrates hardware control, data access, data analysis, report generation and quality control in one, and can obtain 10 energy spectrum data simultaneously, having good compatibility with Windows7, Windows8 and Windows XP, with the following main function:

- Spectrometer control: achievable parameter settings include: gain fine adjustment, start digital spectrum stabilization, adjustment of high voltage, real time / live time display, and setting of the upper and lower discrimination;
- Energy calibration: to fit precise positioning peak through a unimodal fitting; the user determines the corresponding energy of peak according to the knowledge, and the software provides nuclide peak information real-time query function;
- Peak searching: The first-order derivative and the second-order derivative method is used to find the isolated peak. On the basis of the fitting of the peak shape, the Mariscotti method is used to search the peak secondarily to determine the position of multiplet;
- Efficiency calibration: the software provides two functions. One is to call the efficiency calibration curve measured through test, and the other is to calculate results throughGamma-5 sourceless efficiency calibration software seamlessly connecting with this software; as sourceless efficiency calibration is used, a variety of complex correction functions are no longer required in the spectral analysis, such as solid angle correction and attenuation correction;
- Peak fitting: through background deduction by the peak fitting to distinguish multiplet the net counting rate is obtained. Gamma-4 provides an excellent multiplet resolution function, to accurately analyze 20 multiplet using quasi-Newton method and Monte Carlo method and other numerical calculation method. The non-linear background deduction method is used, to automatically adapt to the trend of changes in energy spectrum. The peak shape adopts a Gaussian

function or a Gaussian function plus front and rear exponential function trailing to fit peak shape, having excellent fitting ability for distorted peak form;

- Radioactivity calculation: For the different γ peak of the same nuclide, activity is calculated through the weighted average by considering the branching ratio and efficiency calibration factor. The nuclide attenuation and dead time correction during the measurement are also taken into account in the calculation of the radioactivity;
- Minimum detectable limit calculation: built-in Currie MDA, KTA MDA, PISO MDA, Critical level and other analytical methods for selection;
- Uncertainty analysis: the uncertainty of energy spectrum measurement results can be obtained by comprehensive calculation of the uncertainty of detection efficiency and uncertainty of the counting rate;
- Nuclide library for analysis: there are more than 3000 radioactive isotope spectral lines from ENSF (Evaluated nuclear structure data file), with spectral line information queried in real time in the use process.
- Software assessment: 100 energy spectrums from 16 international laboratories are used to assess the software, with analysis result accuracy meeting the requirements;
- User Interface: complete Chinese interface or complete English interface;
- Analysis process: Perform automatic analysis at first. Then The user can select the nuclide and energy peak according to the results of the automatic analysis and then conduct high-precision interactive analysis and output the reports. In general, the full automatic analysis is able to meet the users' needs. With the interactive analysis function, the user is allowed to add comments to the sample, to delete false peak in the spectrum, and add peak that is not detected in the automatic processing, and change the shape of fitting peaks;

- Report output: Output reports in TXT, PDF, HTML and XML formats.

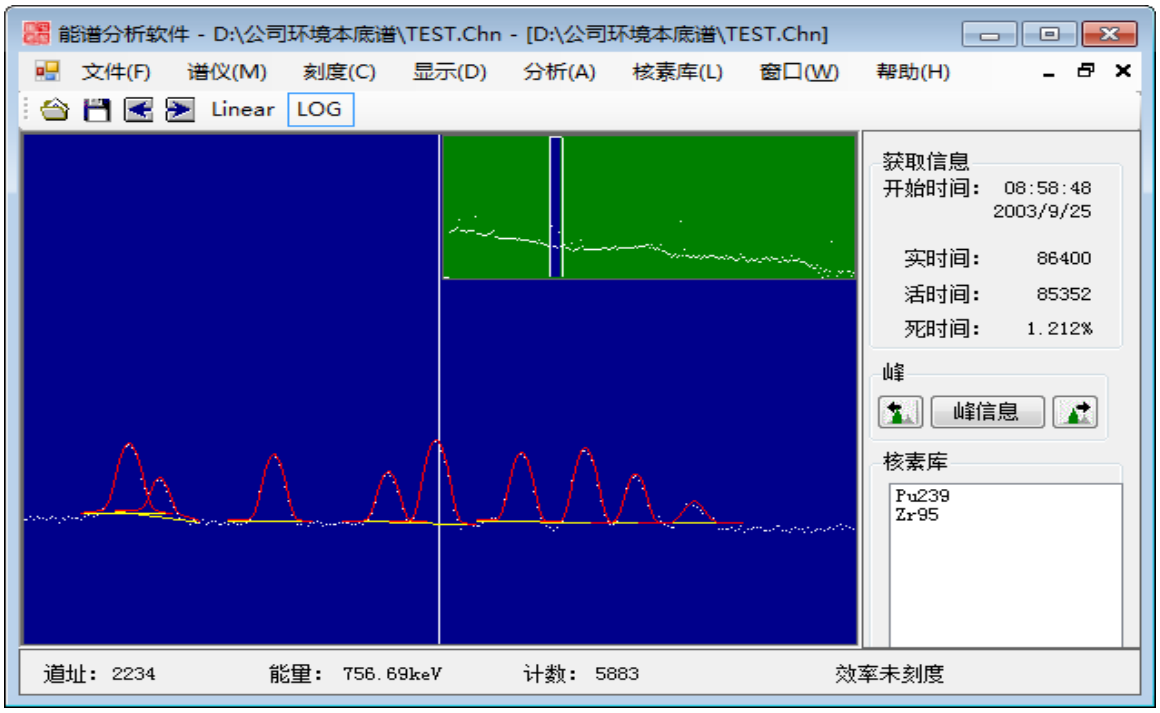


Fig. 3 Typical user interface for Gamma-4 energy spectrum analysis software

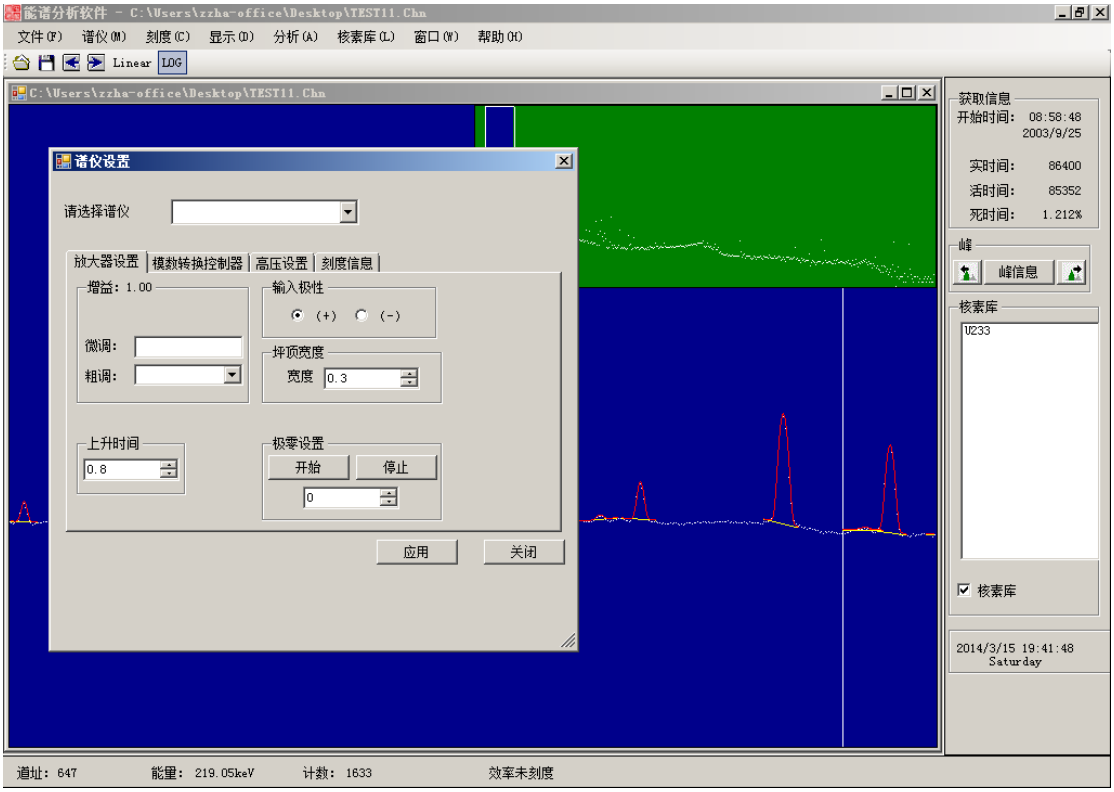


Fig. 4 Typical user interface for Gamma-4 software setting

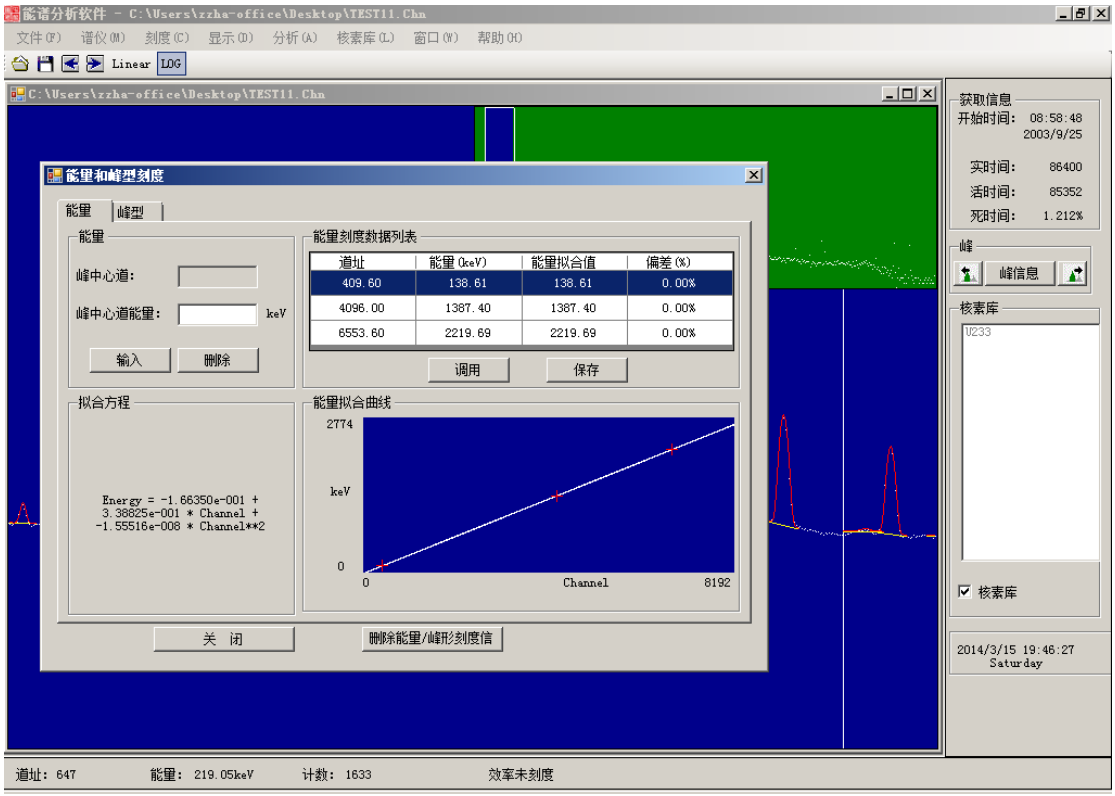


Fig. 5 Typical user interface for energy calibration

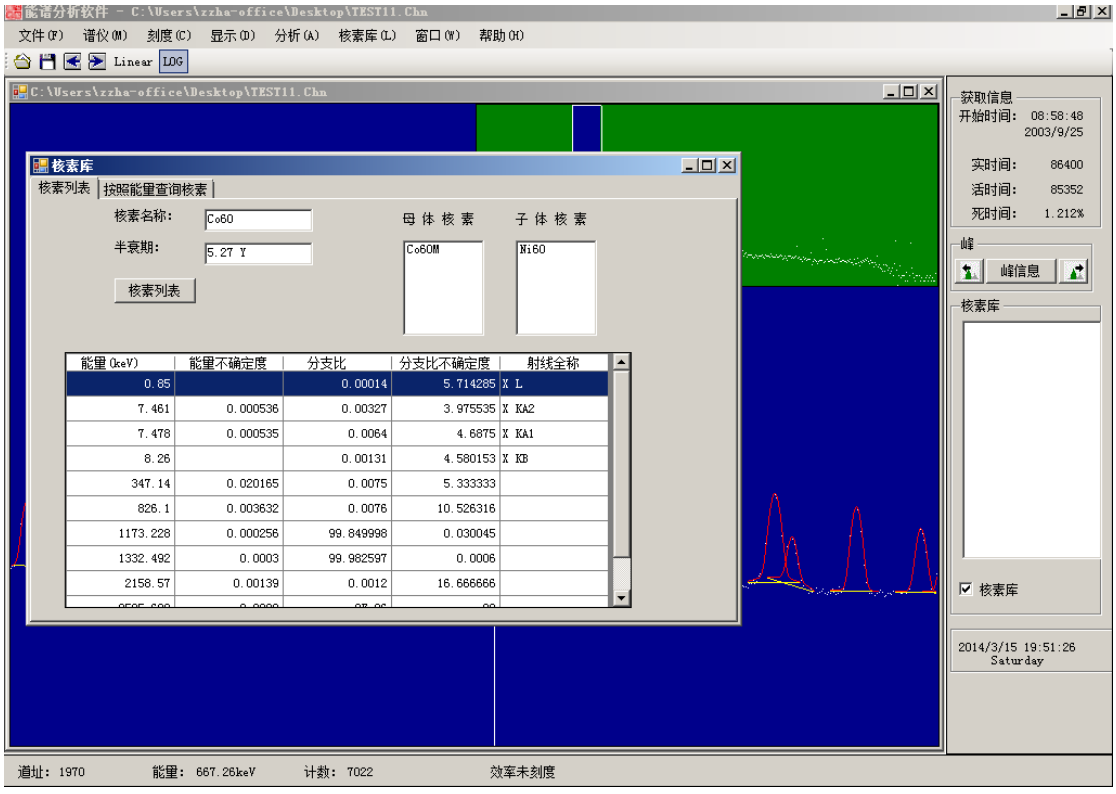


Fig. 6 Typical user interface for Nuclide library

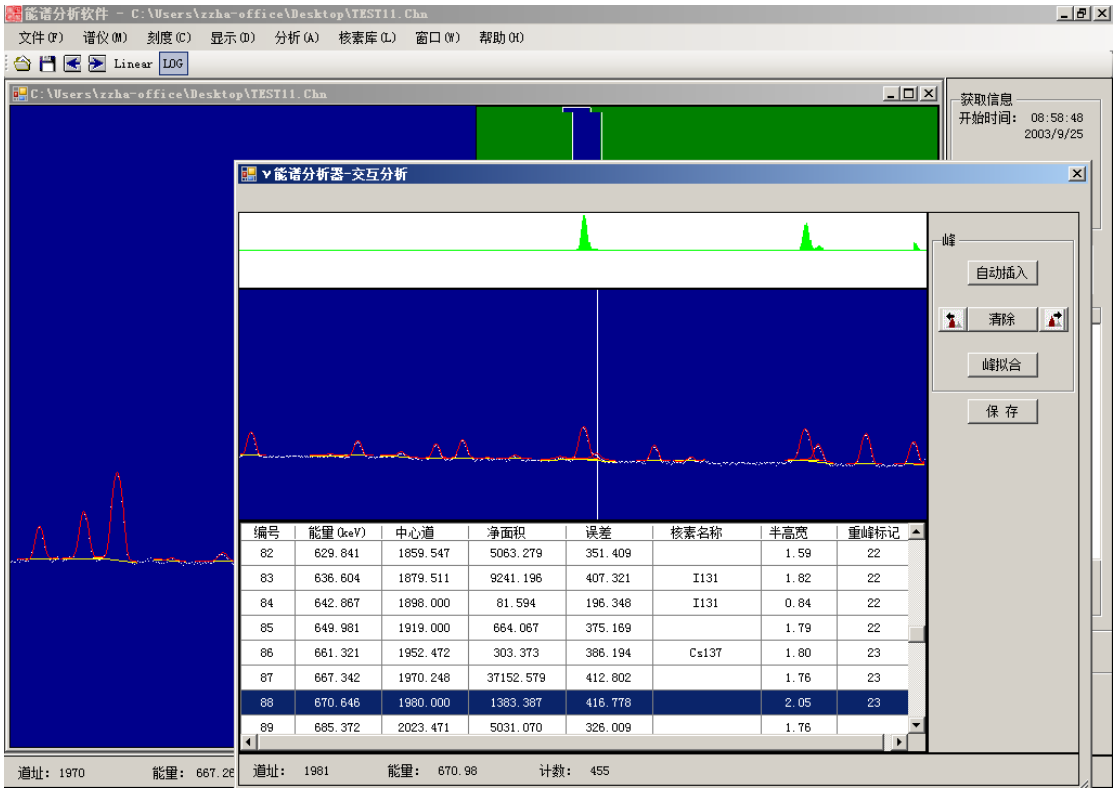


Fig. 7 Typical user interface for interactive analysis

1.5. Sourceless efficiency calibration software

Model：Gamma-5

TK-101 is configured with sourceless efficiency calibration software Gamma-5, which is a patented product for the sourceless efficiency calibration of semiconductor gamma-ray detectors. The software has a powerful geometry and material modeling ability, with high calculation precision, fast speed, simple interface and easy operation. The correctness of the core algorithm is verified by more than 200 pieces of different shapes and energy body sources. The main functions are as follows:

- A powerful CAD software is used for modeling, to achieve rapid visual modeling for any shape of body source.
- The distance from the radiation source to the detector can be ranged from zero to infinity.
- Calibration energy ranges from 45keV to 7MeV.
- Integral control accuracy can be adjusted artificially, with the software default value of 3%. The relative error of the test results of the 200 sources is generally not greater than 10% between 45 keV and 80 keV, and 5% between 80 keV and 7 MeV.
- Efficiency calibration curve calculation time: for symmetrical body source (such as environmental sample source), the calculation costs less than 20 seconds. For asymmetrical body source, the calculation time is generally less than 10 minutes.
- Chinese and English interfaces.

Theory of sourceless calibration

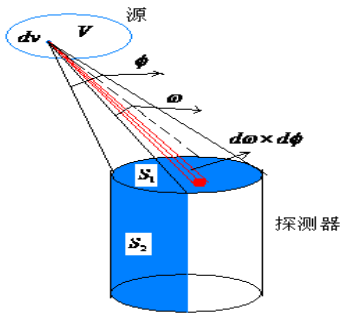


Fig8.γ detector sourceless calibration

V : volume source

dv : volume source element

S_1 : area of detector end face to dv

S_2 ：area of detector side face to dv

$$\varepsilon_{eff,S_1}(E) = \int_{V,\omega\times\phi} \frac{1}{4\pi V} f_{att}(e,\omega,\phi)\times f_{eff}(e,\omega,\phi)\times \sin(\omega)d\omega\times d\phi\times dv \quad (1)$$

$$\varepsilon_{eff,S_2}(E) = \int_{V,\omega'\times\phi'} \frac{1}{4\pi V} f_{att}(E,\omega',\phi') f_{eff}(e,\omega',\phi,)\times \sin(\omega')d\omega'\times d\phi'\times dv \quad (2)$$

$$\varepsilon_{eff}(E) = \varepsilon_{eff,S_1}(E) + \varepsilon_{eff,S_2}(E) \quad (3)$$

（1）define geometric model of detector and volume source ,material model of volume source；

（2）calculate $f_{att}(E,\omega,\phi)$,

（3）calculate $f_{eff}(E,\omega,\phi)$ ；

（4）integral formula（1）and（2)。

Sourceless calibration for volume source:

（1）Building geometric model of detector and material model of samples；

（2）characterization；

（3）3D modeling of volume source；

（4） integral formula（1）and（2).

Advantage:

- No source;
- No contamination;
- High precision ,timesaving ,reliable；
- Strong geometric modeling ability, suitable for any geometry;
- It is not only suitable for calibration of conventional sample, but also suitable for calibration of unusual or difficult to deal with sample, such as cement, steel, gas, soil, air, filters, resin, etc. Suitable for calibration of any material, the density of arbitrary, arbitrary shape, the size of the sample;
- It is suitable for calibration of the samples of any base material and shielding material.
- It is suitable for any collimator and shield.
- Saving sample preparation time. The software can accurately model and calibrate according to

the sample situation, so it does not take a lot of time to prepare samples.

- It can make sample measurement of large scale and avoid unrepresentative caused by sampling process.
- Rapid survey. Save the time and cost of sampling, packing, and transportation preparing sample and testing in laboratory.
- Avoid the risk of accidents caused by sampling, such as high temperature, high pressure, highly corrosive, highly radioactive objects sampling, climbing stairs, etc.
- Avoid sampling of difficult to sample, such as deep cement, steel, soil, radioactive waste in containers, pipes, ground, and etc.

Typical interface of Gamma-5

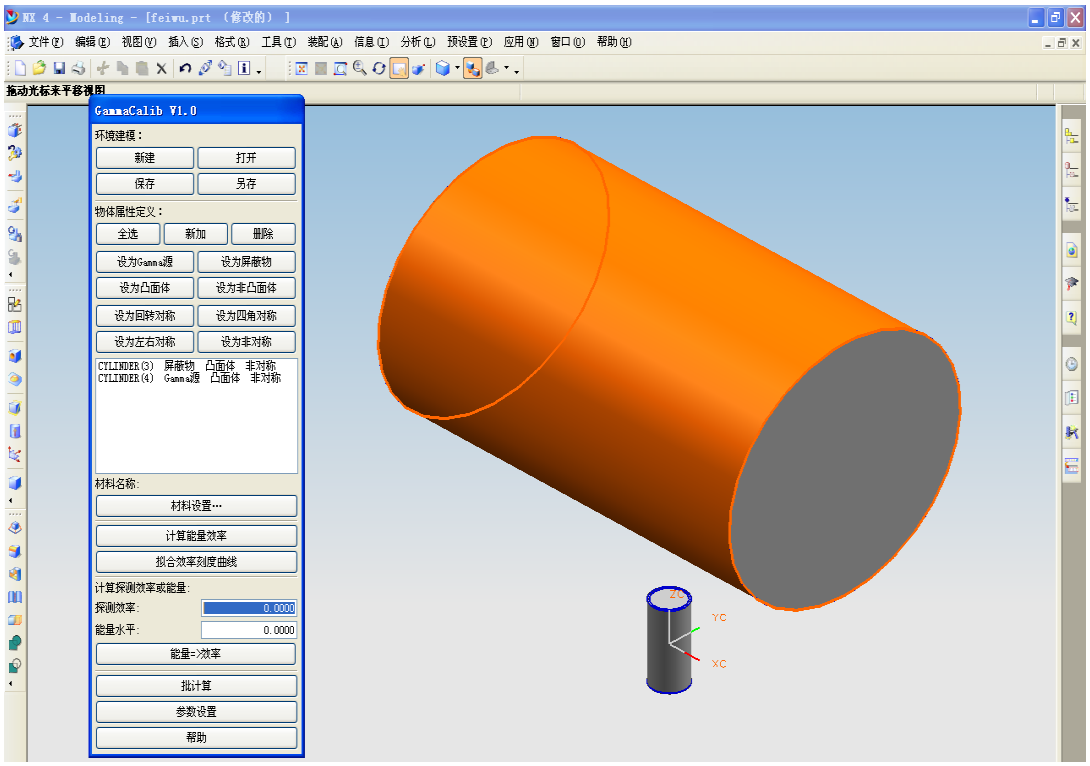


Fig. 9 Typical user interface for barreled radioactive waste measurement

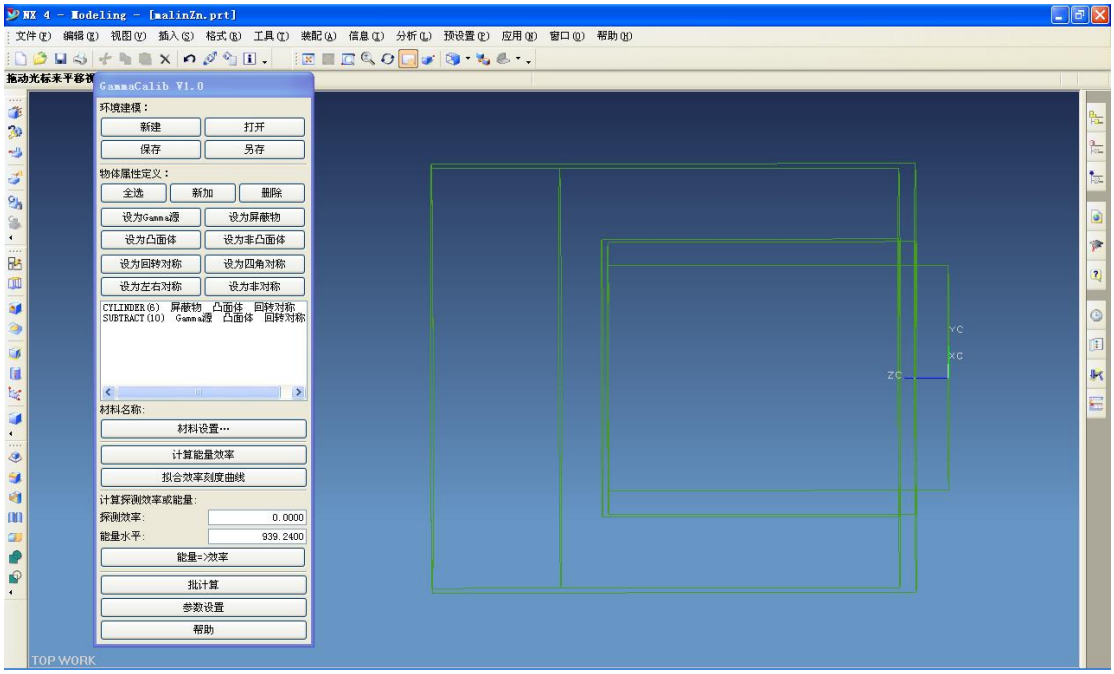


Fig. 10　Typical user interface for Marinelli Beaker measurement

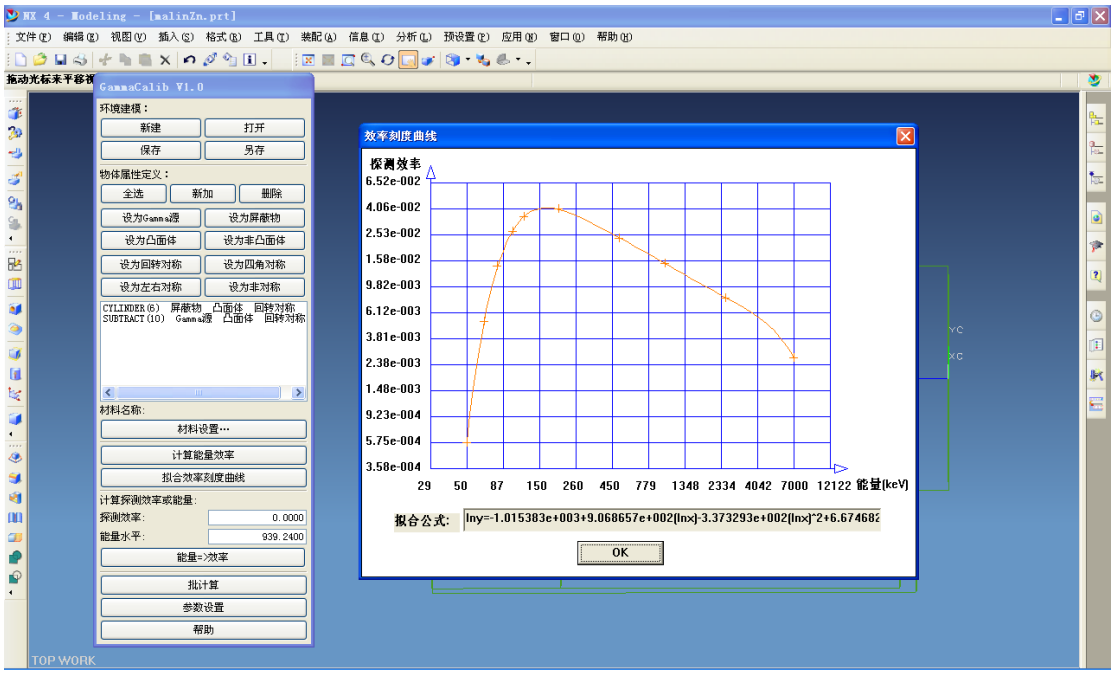


Fig. 11Typical user interface for efficiency calibration graph

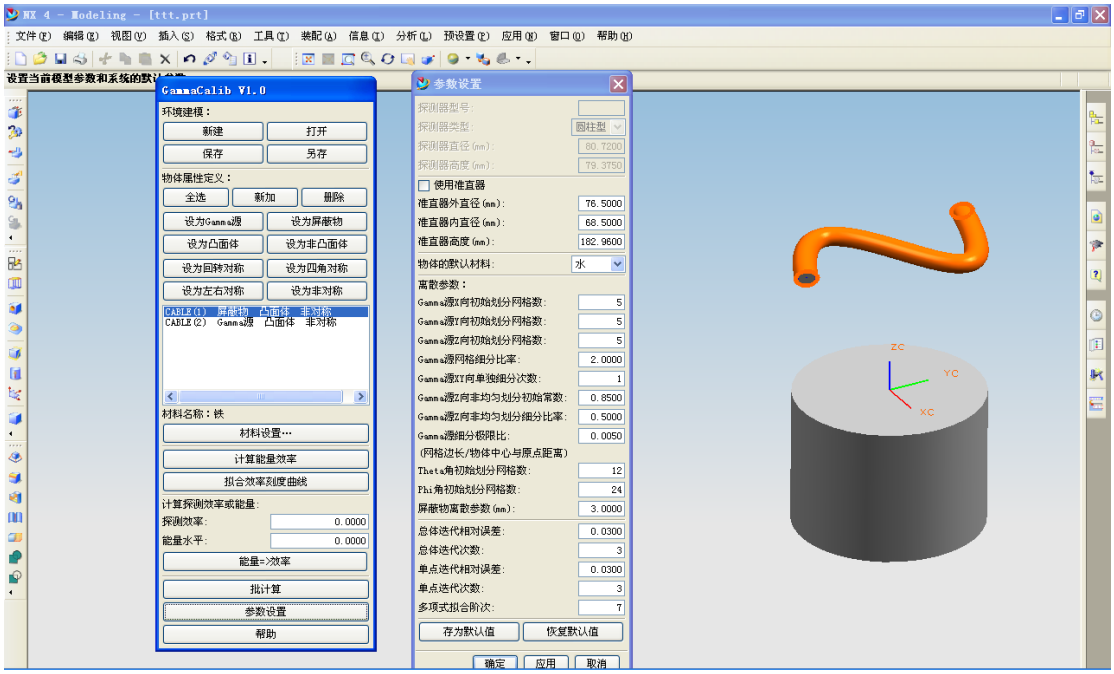


Fig12. Typical user interface for parameter setting

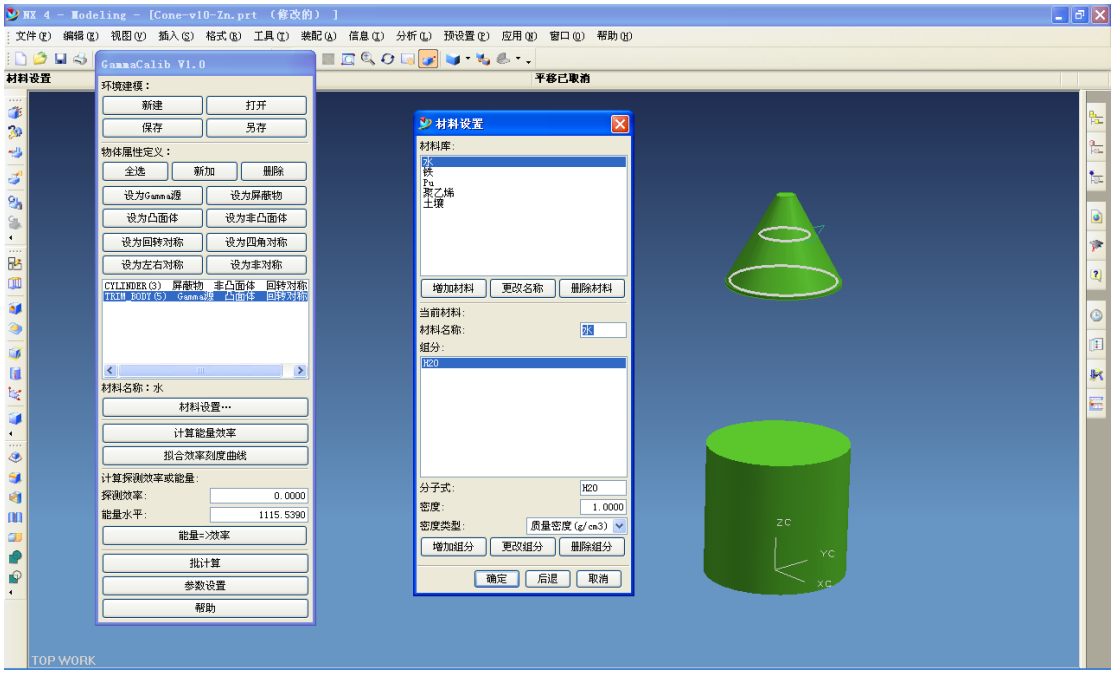


Fig13.Typical user interface for material definition

Precision of Gamma-5 software

- Six kinds of samples：Marinelli Beaker(1L)、cylinder（Φ50×50mm）、cube（40×40×40mm）、Sphere (Φ50mm)、Cone（Φ50mm，H:50mm）and filter paper。For volume source，different detecting position resulting 200 cases in nature.

Fig. 14　six kinds of volume source

- Positing the volume source to the detector from 3 directions.
- Axial：distance to detector 0cm,10cm,25cm,40cm
- Horizontal direction：distance to detector 0cm,10cm,25cm,40cm
- 45° direction：0cm，10×10cm，20×20cm

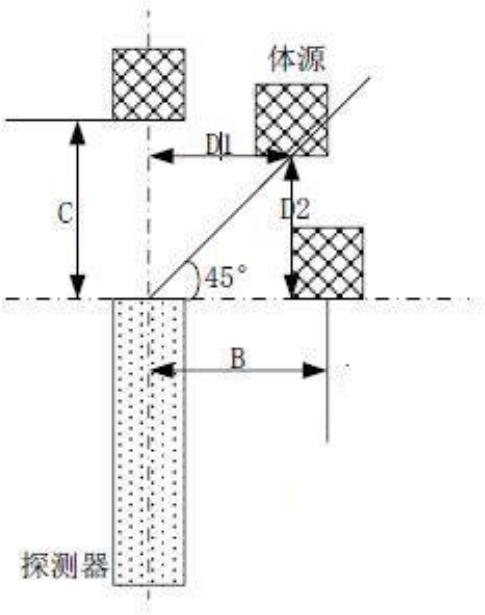


Fig. 15　relative position of volume source and detector

- Volume source with energy from 59.54ke to 3253.4keV，total 18 peaks，the specific activity of samples has been measured in Metrology station .
- Comparing calculation and measuring we find that energy under 80keV，the relative error is 10% , energy over 80keV,the relative error is 5%。

Detector characterization for use of Gamma-5 software

Each detector must be characterized in Metrology Institute before use of Gamma-5 software.

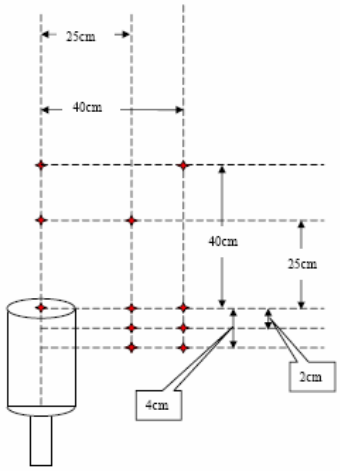


Fig16　position of detector characterization

Table4. Result of characterization

Position	**Result**	**^{241}Am 59.54keV**	**^{137}Cs 661.66keV**	**^{60}Co 1173keV**	**^{60}Co 1332keV**
(0.0 , 0.165)	Results of the experiment	0.3401	0.07555	0.04587	0.04109
	Uncertainty（%，K=1）	0.79	0.91	0.97	0.97
	Calculation	0.3563	0.7568	0.04696	0.04224
	Relative error(%)	0.28	0.75	2.4	2.8
(0.0 , 15.0)	Results of the experiment	0.008721	0.002441	0.001586	0.001442
	Uncertainty（%，K=1）	0.82	0.87	0.78	0.77
	Calculation	0.8692	0.002349	0.001552	0.004014
	Relative error(%)	0.3	3.7	2.2	2.8
(0.0 , 25.0)	Results of the experiment	0.003412	0.001010	0.000662	0.000604
	Uncertainty（%，K=1）	0.82	0.86	0.77	0.76
	Calculation	0.3403	0.0009581	0.0006358	0.000581
	Relative error(%)	0.3	5.1	4.0	3.8
(15.0, 15.0)	Results of the experiment	0.005658	0.001536	0.000988	0.000898
	Uncertainty（%，K=1）	0.82	0.86	0.77	0.76
	Calculation	0.005681	0.001524	0.000994	0.000902
	Relative error(%)	0.4	0.8	0.5	0.5
(25.0, 25.0)	Results of the experiment	0.002274	0.0006174	0.0003933	0.0003586
	Uncertainty（%，K=1）	0.82	0.87	0.77	0.77
	Calculation	0.002309	0.0006202	0.0004004	0.0003626
	Relative error(%)	1.5	0.5	1.8	1.1
(4.30, -1.50)	Results of the experiment	0.1419	0.04361	0.02766	0.02500
	Uncertainty（%，K=1）	0.79	0.89	0.89	0.89
	Calculation	0.1464	0.4196	0.02721	0.02433

	Relative error(%)	3.2	3.8	1.6	2.7
(15.0, -1.50)	Results of the experiment	0.01383	0.003975	0.002525	0.002286
	Uncertainty（%，K=1）	0.82	0.85	0.76	0.76
	Calculation	0.1461	0.004095	0.002623	0.002381
	Relative error(%)	5.7	3.0	3.9	4.2
(25.0, -1.50)	Results of the experiment	0.005007	0.001462	0.000938	0.000847
	Uncertainty（%，K=1）	0.83	0.87	0.78	0.78
	Calculation	0.005228	0.001505	0.000971	0.000873
	Relative error(%)	4.4	3.5	3.6	3.1
(4.30, -2.50)	Results of the experiment	0.1714	0.05197	0.03249	0.02932
	Uncertainty（%，K=1）	0.79	0.88	0.89	0.89
	Calculation	0.1761	0.050223	0.03208	0.02868
	Relative error(%)	2.7	3.4	0.85	2.2
(15.0, -2.50)	Results of the experiment	0.01432	0.004073	0.002593	0.002345
	Uncertainty（%，K=1）	0.82	0.85	0.76	0.76
	Calculation	0.01506	0.004200	0.002695	0.0024409
	Relative error(%)	5.2	3.1	3.9	4.1
(25.0, -2.50)	Results of the experiment	0.005057	0.001473	0.000946	0.000859
	Uncertainty（%，K=1）	0.83	0.87	0.77	0.77
	Calculation	0.005270	0.001524	0.000983	0.0008872
	Relative error(%)	4.4	3.4	3.9	3.3

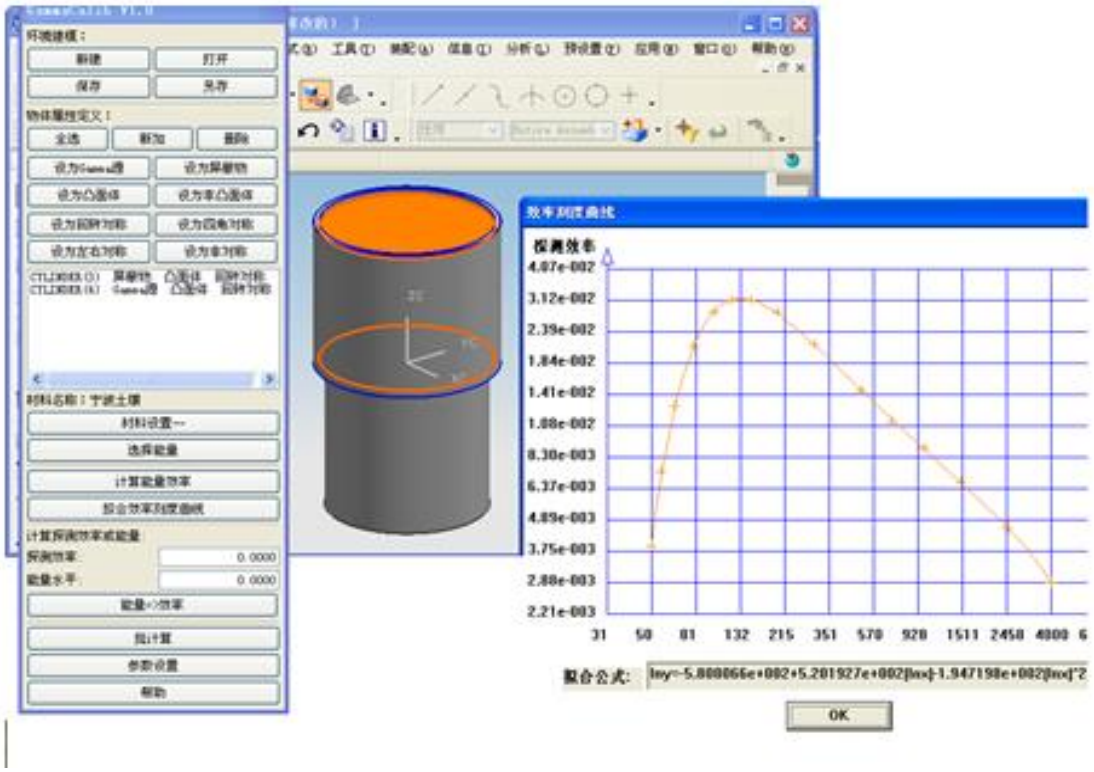


Fig. 17Typical interface of passive efficiency calibration softwareGamma-5

1.6. Lead chamber

Model：Gamma-6

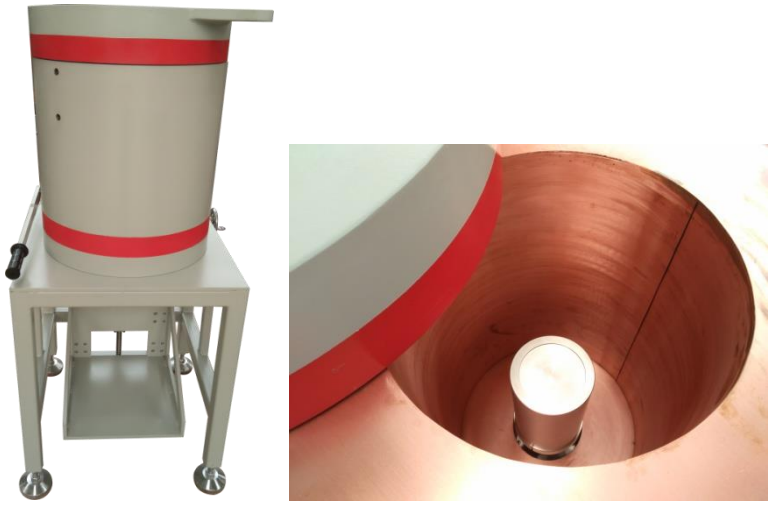


Fig. 5 Gamma-6 lead chamber

TK-101 is equipped with a background Lead chamber-Gamma-6 developed by Beijing Tai Kun Industrial Equipment Co.,Ltd.., as shown in figure 5 below.

- Outer material: 1cm low-carbon steel;
- Middle material: 10cm low background radiation lead 4π direction shielding;
- Inner material: 3 mm oxygen-free copper, to absorb X-ray;
- Press-type open door design with top translation;
- Material of the load-bearing table: low carbon steel;
- Floor area: 65cm x 65cm;
- Cavity size: Φ307mm x 404mm;
- Weight: 1.1 tons.

1.7. Refrigeration device

Model：Gamma-7

Liquid nitrogen refrigeration, electric refrigeration or condensate refrigeration device are optional.

Ⅰ.Main Features：

- Multi-channel, high-voltage modules and other electronic systems use military-grade devices, with a special temperature stability feature provided; the system has excellent long-term stability, and has been working continuously for a month, with the energy resolution maintained less than 1.9KeV at 1460.8KeV.
- Energy spectrum analysis is mainly automatic, with auxiliary interactive analysis,

especially suitable for non-professionals.

- Ray information of more than 3000 isotopes is provided; nuclide library is tightly combined with energy spectrum analysis software for easy operation.
- A powerful multiplet analysis ability, to resolve 20 multiplet.
- Peak fitting results show that users can know the effect of spectrum analysis, which other commercial software can't.
- With a powerful automatic analysis ability, and customizable automatic the energy calibration.
- Standard source is not required for efficiency calibration.

II. Applications

- It can be used for measurement of radioactivity in areas such as industry, scientific research, environmental protection, inspection and quarantine, disease prevention and control, as well as professional laboratories in colleges and universities, applicable to samples of various forms and substrate materials, including food radioactivity measurement, metal radioactivity measurement, measurement of radioactivity of building materials, radioactivity measurement of biological samples, aerosol sampling and measurement, nuclear science research and other fields.

2 . Anti-Compton High Purity Germanium Gamma Spectrometer

Model：TK-102

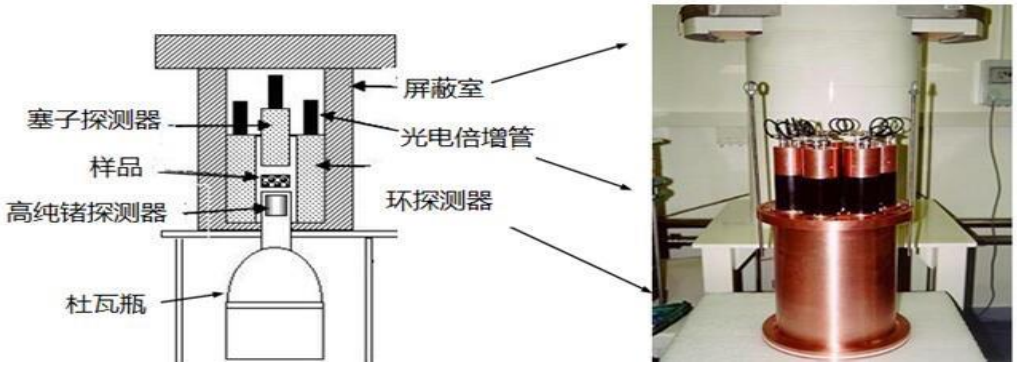


Fig. 1 TK-102 type anti-Compton high purity germanium γ system

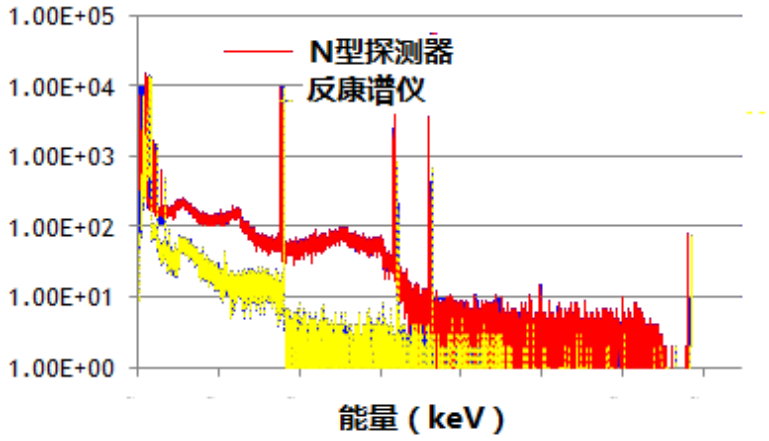


Fig. 2 Diagram of comparison of energy spectrum before and after anti-Compton for TK-102

Ⅰ. Product Introduction

When measuring radioactivity using a gamma-ray spectrometer, the useful information is the all-energy peak of the characteristic gamma ray; for the gamma ray emitted from the source, if a part of energy is deposited in the detector after Compton scattering, this signal can not enter the full-energy peak; this signal is the background for the radioactivity measurement, and its existence will raise the detection limit of the measurement, not conducive to the measurement of low-level gamma radioactivity. The use of anti-coincidence technology can effectively reduce the impact of Compton scattering, and is conducive to reducing the detection limit and to the measurement of low-level radioactivity. TK-102-type anti-Compton high-purity germanium gamma spectrometer uses a high-purity germanium detector as the main detector, and uses a NaI ring detector as the anti-coincidence detector; when the particles produce signals in the ring detector and the main detector simultaneously, it means that the main detector records gamma particles without full energy

deposited, thus the signal is rejected using the anti-coincidence technique in order to achieve suppression of the Compton scattering and to reduce the detectable limit. The TK-102 consists of N-type (or P-type wide energy) high purity germanium detector, sodium iodide ring detector, sodium iodide plug detector, anti-coincidence electronic modules, multi-channel analyzer, lead chamber and sourceless efficiency calibration software, spectrum analysis software and other components. With the joint use of common multi-channel analyzer and anti-multi-channel analyzer, TK-102 can obtain the anti-Compton and non-anti-Compton energy spectrums simultaneously, allowing that the system has advantages of both ordinary laboratory high-purity germanium spectrometer and anti-Compton high-purity germanium spectrometer.

Ⅱ. Main Features

- Combination of Common multi-channel analyzer and anti-Compton multi-channel analyzer enables to obtain the anti-Compton and non-anti-Compton energy spectrums simultaneously.
- With optimized design and low background materials, the system integration background is less than 0.6cps, and the system peak-to-Compton ratio is better than 1000: 1.
- The multi-channel, high-voltage module and other electronic systems use military-grade devices, with a special temperature stabilization design used, so the system has excellent long-term stability; the energy resolution at 1460.8KVV can be maintained less than 1.9KeV during the one-month continuous measurements.
- Energy spectrum analysis is mainly automatic, with auxiliary interactive analysis; the software has a powerful multiplet analysis ability.
- The radial information is provided for more than 3000 kinds of isotopes, with the nuclide library tightly combined with energy spectrum analysis software, for easy operation by user.
- Peak fitting results can be seen by users; users can understand the effect of energy spectrum analysis. Which is not be available by other commercial software.

Ⅲ. Technical Specifications

1. Overall technical indicators

- System peak-to-Compton ratio: ≥ 1000: 1;
- Simultaneous obtain and display the spectrograms before and after anti-Compton;
- Integral background: ≤ 0.6cps (can be lower with customized low-background lead).

2. High purity germanium detector

The N type or P type wide-energy detectors with various types and efficiencies can be optional, with the typical indicators as follows:

- Energy range: 3keV ~ 10MeV;
- Relative efficiency: ≥ 60%;
- Resolution: ≤ 1.1keV@122keV; ≤ 2.2keV@1332keV;
- Peak shape parameters: FW0.1M / FWHM ≤ 2.0, FW0.2M / FWHM ≤ 3.0;
- Liquid nitrogen refrigeration or liquid nitrogen condensation-return refrigeration is used.

3. Ring detector

- 9 "x 9" NaI (Tl) shield ring with a resolution of 9.5% @ 662 keV;
- Six PMT with 2" diameter.

4. Plug detector:

- 3 "x 3" NaI (Tl) crystal, with resolution of 7.5% @ 662 keV;
- One PMT with 3" diameter

5. Digital multi-channel

Special multi-channel for high-purity germanium spectrometer is used, with the main performance characteristics as follows.

- Maximum data throughput: greater than 100kcps;
- Coarse adjustment gain: 1, 2, 4, 8, 16 or 32 optional;
- Fine adjustment gain: 0.45 ~ 1 adjustable;
- Maximum address: 16384;
- Shaping time constant: rise time from 0.8μs to 23μs adjustable, with 0.2μs per step; flat-top time from 0.3 to 2.4μs, with 0.1μs per step, selected by the computer (automatically adjusted under automatic optimization);
- Linearity: integral nonlinearity ≤ ± 0.025%; differential nonlinearity ≤ ± 1%;
- Temperature coefficient: gain <35ppm / ° C; zero point <3ppm / ° C;
- Overload recovery: at maximum gain, 1000 times overload recovers to within 2% of rated output at 2.5 times non-overload pulse width;
- Pulse anti-accumulation: automatically set the field value, the pulse pair resolution: 500ns;
- Signal processing: with digital spectrum stabilization, automatic pole-zero adjustment, digital gated baseline recovery and other functions;

- Data memory: 16384-channel non-volatile memory, with each capacity of 2^{31}-1 counts;
- Memory segmentation (system conversion gain): 16384, 8192, 4096, 2048, 1024 or 512 channels selected by the computer;
- Digital spectrum stabilization: controlled by the computer; to stabilize the gain and zero;
- Automatic digital pole-zero adjustment: controlled by the computer, with manual or automatic setting;
- Count rate display: real-time display on the computer screen;
- Dead time correction: accuracy (changes with peak area) <3% (0 ~ 50000cps);
- Communication interface: USB2.0;
- Single-channel or twin-channel: a single-channel MCA and twin-channel MCA optional;
- Dimensions: 252mm × 150mm × 50mm;
- Weight: 1kg;
- Operating temperature: -10 ~ 50 ℃;

6. Anti-compliance electronic module

TK-102-A anti-Compton electronic module produced by Beijing Tai Kun Industrial Equipment Co.,Ltd. is used, including seven-circuit fast amplifiers, frontier discrimination tripper, delayer and stretcher, as shown in Fig. 3, with specific indicators as follows:

1) Fast amplifier

- Rise time is less than 8 nanoseconds;
- With gated baseline recovery;
- With pole - zero phase cancellation;
- 50-Ω delay line;
- Voltage gain adjustment factor: 0.9 ~ 500;
- Output drive voltage ± 5V (with 50Ω load);

2) Frontier discrimination trigger

- Constant-ratio timing discrimination;
- Excellent time resolution;

- Rejection patterns with differential, integral, constant ratio and slow rise time;
- Upper and lower threshold adjustable, with adjustment range of 30mV ~ 5V;
- Time travel ≦ 75ps (dynamic range: 100: 1);
- Adjustable output pulse width;

3) Delayer

- Four independent input parts;
- 50-Ω calibration delay line for linear or logic signals;
- 0 ~ 63.5ns delay, 0.5ns step;
- Delay accuracy: <+ - 0.1ns or + -1.0% (for each switch);

4) Stretcher

- Delay time: 0.5 ~ 5us adjustable;
- Broadening: 0.5 ~ 5us adjustable.

Fig. 3 Anti-Compton Electronics

7. Lead chamber

- Integral casted, press-type open door design with top translation ;
- Outer layer material: 1cm low-carbon steel;
- Middle layer material: 10cm low background radiation lead 4π direction shield;
- Inner layer material: 1mm thick tin and 3 mm oxygen-free copper, absorb X-ray;
- Area: 65cm x 65cm;
- Cavity size: Φ307mm x 604mm.

8. Energy spectrum analysis software

TK-102 is configured with a gamma-ray energy spectrum analysis software Gamma-4 that has developed its own distinctive features as well as integrating the advantages of main energy

spectrum analysis software products internationally; that is, based on the automatic analysis as navigation, analysis results are exported through the selective precise interactive analysis. Gamma-4 is the only commercial energy spectrum analysis software that is capable of accurate analysis of multiplet. Gamma-4 integrates hardware control, energy spectrum acquisition, data analysis, report generation and quality control in one, able to obtain 10 energy spectrum data simultaneously, having good compatibility with Windows7, Windows8 and Windows XP, with the following main functions:

- Spectrometer control: achievable parameter settings include: gain fine adjustment, start digital spectrum stabilization, adjusting high voltage, real time / live time display, setting the upper and lower discrimination threshold;
- Energy calibration: precise positioning of the peak position by unimodal fitting; the user determines the energy corresponding to the peak position according to the knowledge; the software provides nuclide peak information real-time query function;
- Peak searching: The first-order derivative and the second-order derivative method are used to search the isolated peak. On the basis of the fitting of the peak shape, the Mariscotti method is used to search the peak for the secondary peak searching, to determine the position of multiplet;
- Efficiency calibration: the software provides two functions, with one to call the efficiency calibration curve obtained by the experimental measurement and with the other to use calculation results got through the Gamma-4 sourceless efficiency calibration software seamless connecting wit this software; as the sourceless efficiency calibration is used, a variety of complex correction functions are no longer required in the spectral analysis, such as solid angle correction and attenuation correction;
- Peak fitting: through background deduction by the peak fitting to distinguish multiplet, the net counting rate is obtained. Gamma-4 provides excellent multiplet analysis function, using quasi-Newton method and Monte Carlo method and other numerical methods, to accurately analyze 20 multiplet. The non-linear background deduction is used to automatically adapt to the trend of changes in energy spectrum. The peak shape is fitted with a Gaussian function or a Gaussian function plus an front-to-rear exponential function trailing, having excellent fitting ability for distorted peak shape;
- Radioactivity calculation: For the different γ peak of the same nuclide, the radioactivity is

calculated through the weighted average taking the branching ratio, and efficiency calibration factor into account. The nuclide attenuation and dead time correction during the measurement are also taken into account in the calculation of the radioactivity;

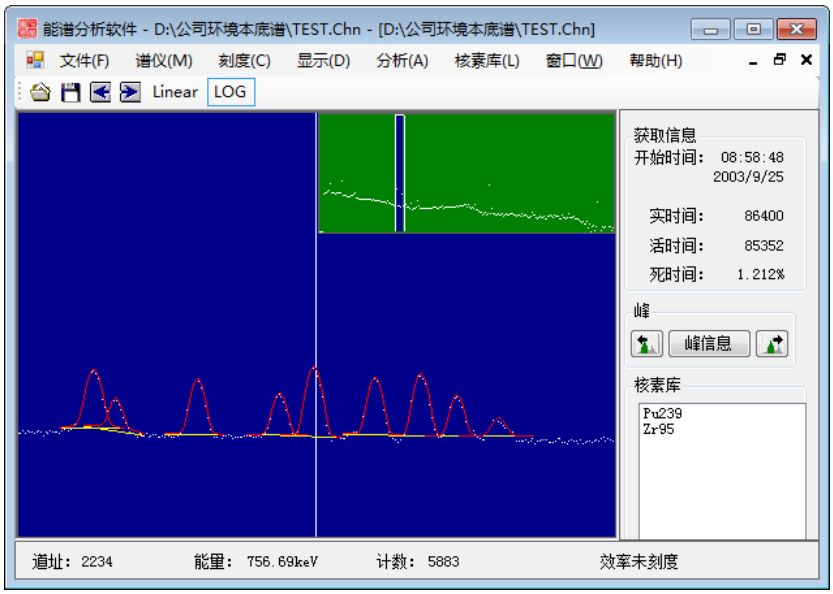


Fig. 4 Gamma-4 energy spectrum analysis software typical interface

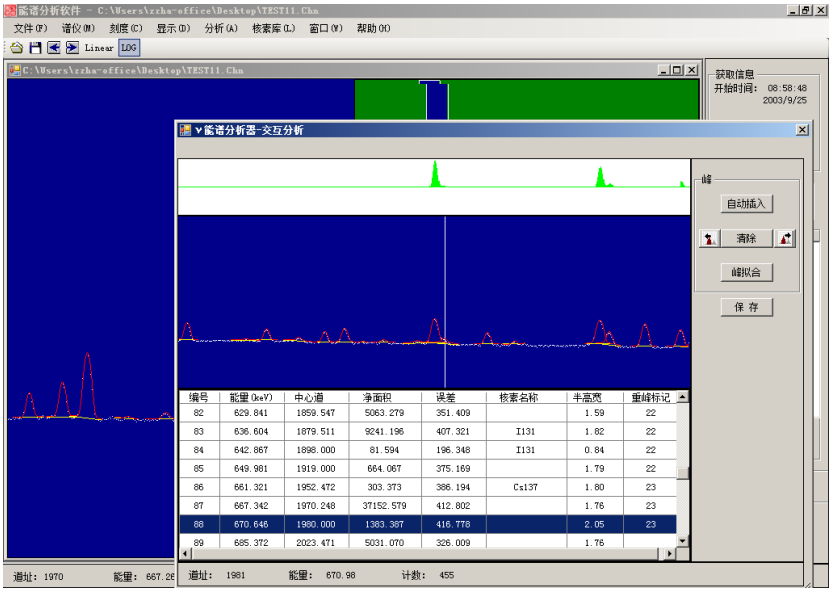


Fig. 5 Gamma-4 energy spectrum analysis software interactive analysis interface

- Minimum detectable limit calculation: built-in Currie MDA, KTA MDA, PISO MDA, Critical level and other analytical methods for selection;
- Uncertainty analysis: the comprehensive calculation of the uncertainty of the detection efficiency and the uncertainty of the counting rate is used to get the uncertainty of energy spectrum measurement results;
- Nuclide library for analysis: from ENSF (Evaluated nuclear structure data file), there are

spectral line systems of more than 3000 kinds of radioisotopes; user can query line information in real time in the use process.

- Software assessment: 100 energy spectrums from 16 international laboratories are compared for software assessment, with the analysis results accuracy meeting the following requirements:

- User interface: complete Chinese interface or complete English interface;

- Analysis process: first full automatic analysis is made; the user selects concerned nuclide and energy peak based on the results of automatic analysis, and then does high-precision interactive analysis, and then outputs the report. In general, fully automated analysis function is able to meet users' needs. With the interactive analysis function, users are allowed to add comments to the sample, to delete false peak in the spectrum, and to add peak that is not detected in the automatic processing, and to change the shape of fitting peaks;

- Report output: Output reports in TXT, PDF, HTML and XML formats.

9. Sourceless efficiency calibration software

TK-102 is equipped with a Sourceless Efficiency Calibration Software Gamma-4, which is a patented product used for sourceless efficiency calibration of semiconductor gamma-ray detector. The software features with powerful geometry and material modeling ability, high calculation precision, fast speed, simple interface, easy operation. The correctness of the core algorithm is verified by experimental measurement results of more than 200 pieces of sources of different shape and energy. The main functions are as follows:

- The use of powerful CAD software modeling is to achieve three-dimensional rapid visual modeling for source of an arbitrary shape;

- The distance from the radioactive source to the detector can be 0 to infinity;

- Calibration energy range: from 45keV to 7MeV;

- Integral control accuracy can be adjusted artificially, with the software default value of 3%. The relative error of the test results of 200 body sources is generally not more than 10% from 45keV to 80 keV, and is not more than 5% from 80keV to 7MeV;

- Efficiency calibration curve calculation time: for symmetrical body source (such as environmental sample source), the calculation time is less than 20 seconds. For the shape of the asymmetric body source, the calculation time is generally less than 10 minutes;

- Chinese and English interfaces.

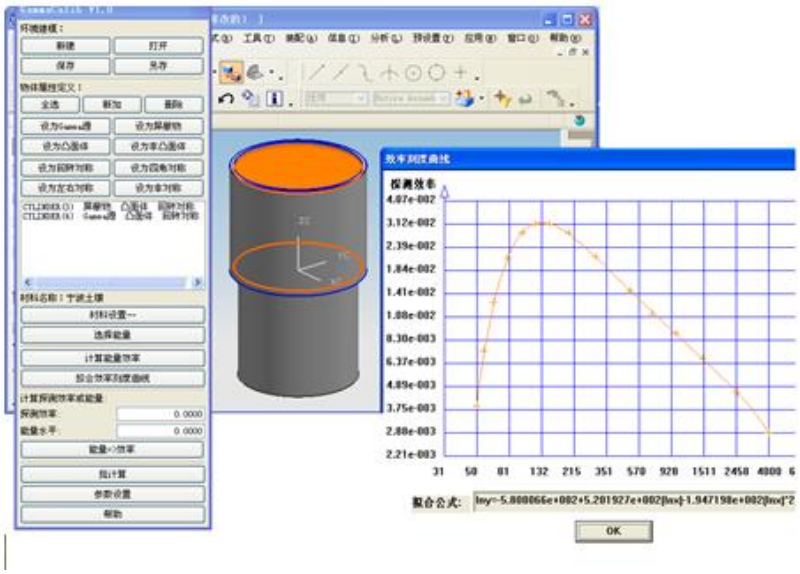


Fig. 6 Sourceless efficiency calibration software Gamma-4 typical interface

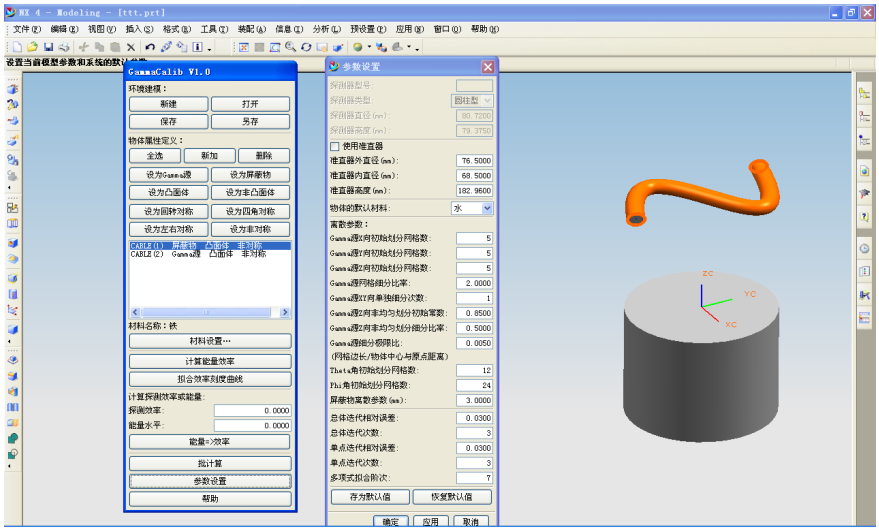


Fig. 7 Sourceless efficiency calibration software Gamma-4 typical parameter interface

Ⅳ. Applications

- Applicable for professional laboratories for measurement of soil radioactivity, food radioactivity, water radioactivivity, metal radioactivity, building materials radioactivity, and biological samples radioactivity, with a particular advantage for measurement of sample containing trace radioactive nuclei.

3. Anti - Cosmic Ray High Purity Germanium Gamma Spectrometer

Model：TK-103

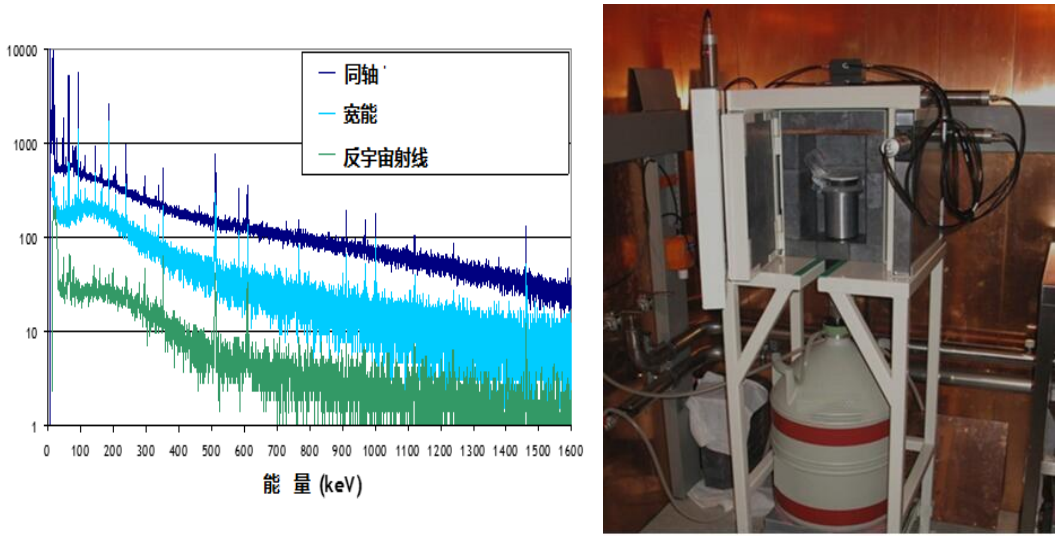


Fig. 1 Comparison of results obtained through anti-cosmic rays (based on coaxial P-type detector) spectrometer and other spectrometer

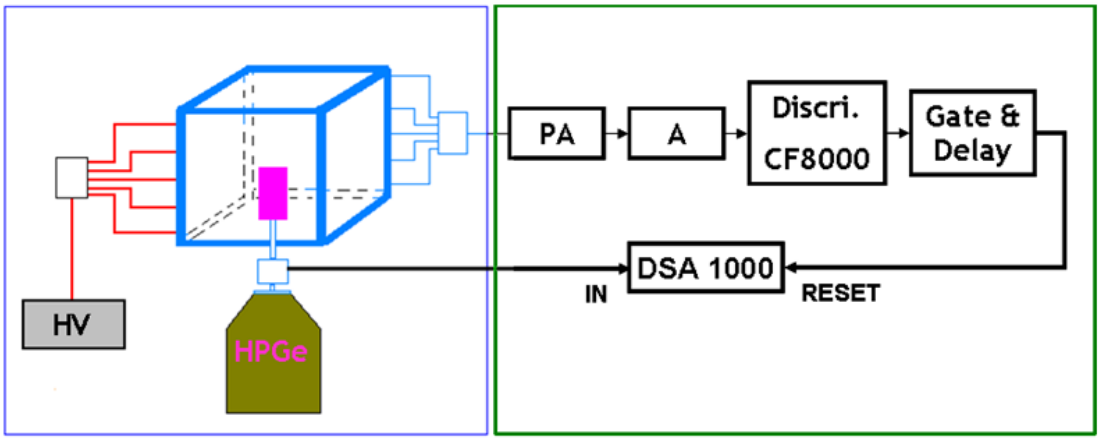


Fig. 2 Schematic diagram of anti-cosmic ray spectrometer

Ⅰ. Product Introduction

TK-103 anti-cosmic ray high purity germanium measurement system consists of HPGe main detector, inner shield, plastic scintillator shield anti-cosmic ray detector and external shielding room, anti-cosmic ray electron module, multi-channel analyzer, energy spectrum analysis Software, liquid nitrogen re-condensing refrigerator and other components; the main detector chamber is filled with nitrogen to further reduce the contribution of radon daughter to the background and cadmium sheet is used to reduce the contribution of thermal neutrons to the background. Figure 1 shows the comparison between measurement results made through the anti-cosmic ray spectrometer and the

general low background spectrometer. Figure 2 shows the schematic diagram for the anti-cosmic ray spectrometer.

Ⅱ. Main Features

- To reduce the background by anti-cosmic rays and absorbing thermal neutrons;
- Automatic energy spectrum analysis, and super multiplet analysis ability, to automatically resolve 20 multiplet;
- Sourceless efficiency calibration software based on CAD modeling allows users to measure radioactive sources of materials of arbitrary shape and arbitrary substrate.
- Optional liquid nitrogen re-condensing refrigeration, without the renewal of liquid nitrogen and the measurement indicators are guaranteed;
- Customizable user reports and software interfaces.

Ⅲ. Technical Specifications

- Detector: P-type wide energy coaxial high purity germanium detector;
- Relative detection efficiency: up to 175%;
- Energy range: 10KeV to 20MeV;
- Energy resolution: 2.1@1332KeV;
- Peak-to-Compton ratio: > 90: 1;
- Peak shape parameters: FW0.1M / FWHM <= 2.0;
- Integral background: (50KeV-2MeV) <0.2cps;
- Complete Chinese interface.

Ⅳ.Applications

- Mainly used in environmental gamma radioactive measurements, low background gamma radioactive measurements, scientific research and other fields.

4. Automatic Sample Changing High Purity Germanium Measurement Device

Model：TK-104

Fig. 1 Automatic sample changing high purity germanium measurement device

Ⅰ. Product Introduction

U-type high-purity germanium detector, pre-amplifier away from the probe, and 30L Dewar bottles

- Lead shield device
- Digital multi-channel spectrometer
- The supporting software functions including spectral processing, nuclide identification and radioactivity calculation
- Spectral analysis software and rich nuclei library
- Souceless efficiency calibration software
- Automatic sample changer with robot arm having a compact controller
- Sample cabinets and safety cabinets
- Barcode reader and barcode printer
- Robot arm control software
- Process management software and main controller

- Liquid nitrogen sensor and display
- 3m cable

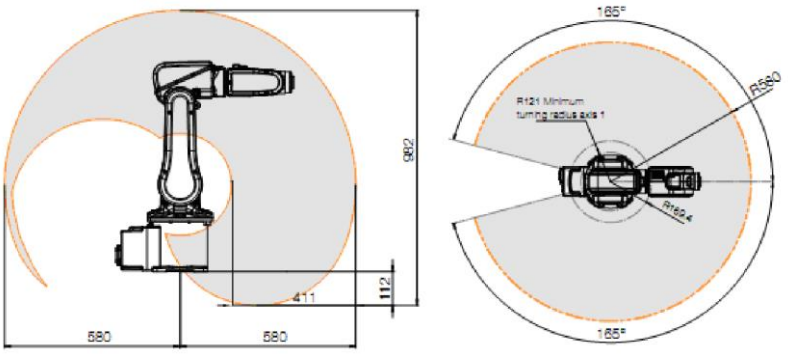
Ⅱ. Technical Specifications

1. Shielded high purity germanium detector

Parameter	Value
Lower limit of radioactivity detection for ^{137}Cs within one hour (Bq / kg)	0.5
Absolute sensitivity of detector with 30% detection efficiency (pulse / quantum)	4.5×10^{-3}
Sensitivity of the instrument background with the energy range from 40 keV to 3 MeV (pulse / keV x sec)	5×10^{-4}
Uncertainty of measurement of Cs radioactivity in one hour (%)	20

2. Automatic sample changing device

- Six-axis manipulator
- Effective load: 3kg
- Reach distance: 580mm
- Accuracy: ± 0.01mm
- Footprint: 180 mm squared
- All machines and devices are closed
- Compact controller



3. Geometric dimensions of sample container

- Sample bottle 500ml
- Sample bottle 250ml
- Tooth tube: 60ml
- Tooth tube: 30ml

Note: The data given above is only for sample size and is not an absolute size limit, and the

system can be flexibly adjusted according to customer needs.

4. Barcode reading and printer

- To ensure proper processing of all data during the measurement and analysis process, a barcode printer connecting to the workstation is used to mark a sample. With the barcode reader, data stored in the database is retrieved before the start of measurement process.

Ⅲ. Applications

Automatic sample changing system is used for measurement and analysis of radionuclide of various environmental samples, such as rocks, minerals, sludge, slag, soil, plants, air and sediment and particulates in water. The automatic sample changing spectrometer system determines the type and activity of radionuclides in the sample by means of gamma spectroscopy. The fully automated sample changer allows the user to measure up to 40 samples without having to operate the spectrometer personally. This reliable manipulator sample changer improves measurement efficiency and mitigates health risks to the operator.

5. Lab LaBr3 Measurement System

Model：TK-105

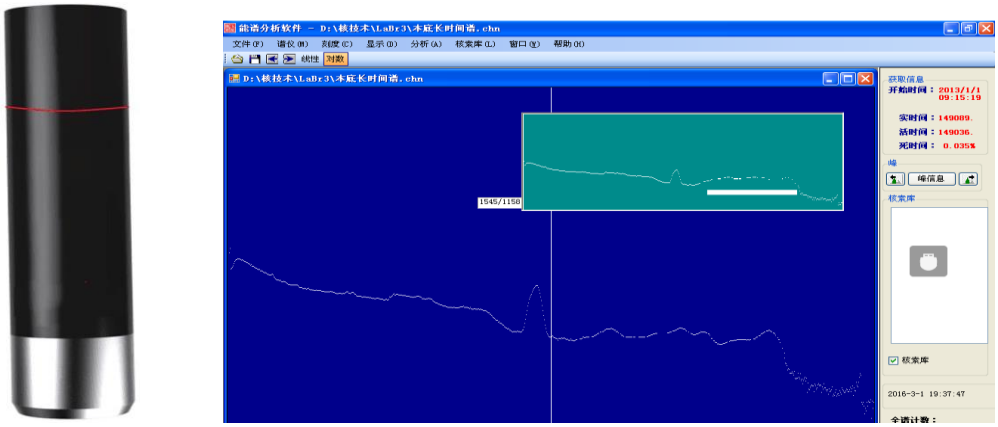


Fig. 1 TK-105 lanthanum bromide spectrometer and measured energy spectrum

Ⅰ. Product Introduction

TK-105 LaBr3 measurement system is a highly integrated, highly sensitive, high-resolution and high-precision laboratory spectrometer developed by Beijing Tai Kun Industrial Equipment Co.,Ltd. for radionuclide recognition and radioactivity measurement. The detector (including multi-channel electronics and high voltage modules) and measured energy spectra are shown in Figure 1.

The main configurations of the system include: LaBr3 detector, multi-channel spectrometer, high voltage module, photomultiplier tube, energy spectrum acquisition and analysis software, and sourceless efficiency calibration software and computer. Among them, LaBr3 probe, multi-channel spectrometer, and high-voltage module tube integration are as shown in Figure 2, and they and are integrated with photoelectric multiplier in the detector shown in Figure 1.

Fig. 1 TK-105 electronic system

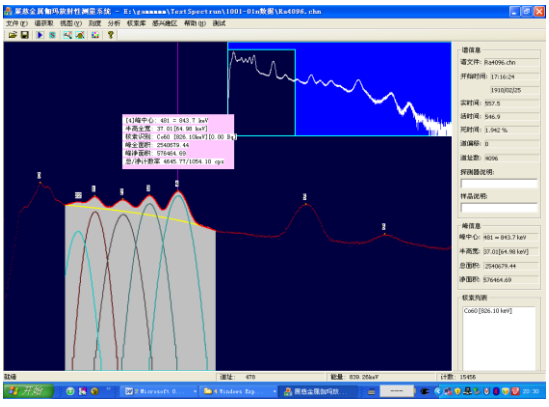


Fig. 3 Demonstration of TK-105-A software analysis for multiplet

TK-105 is equipped with the energy analysis software TK-105-A which is developed for scintillation

detector by Beijing Tai Kun Industrial Equipment Co.,Ltd. The TK-105-A has a sensitive and reliable peak-searching capability, and the super-powerful multiplet analysis ability, as shown in Fig. 3. TK-105-A can resolve the 1435KeV multiplet of La and 1460.8KV multiplet of K-40. TK-105-A is equipped with the latest nuclei library from the Evaluated nuclear structure data file, with the spectral line series of more than 3,000 radioisotopes.

TK-105 is equipped with a powerful TK-105-B Sourceless Efficiency Calibration software that enables the measurement of Gamma radioactivity measurement of any materials of arbitrary shapes and of arbitrary substrate, greatly expanding the Application of the LaBr3 spectrometer. The software interface is shown in Figure 4.

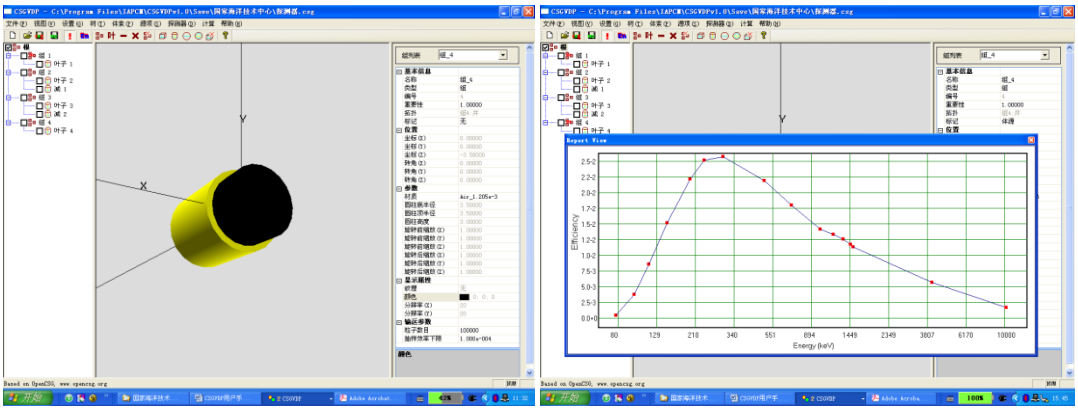


Fig. 4 TK-105-B Sourceless Efficiency Calibration Software Interface

II. Main Features

- Spectrum stabilization with software and hardware combined; energy spectrum drift is controlled in real time, and a long-term continuous measurement is available.
- Sourceless efficiency calibration software uses CAD modeling
- A powerful multiplet analysis ability
- Complete Chinese interface
- System failure can be repaired within 24 hours after receiving the product returned by users
- Free radioactivity measurement consultation

III. Technical Specifications

- Crystal size: 2 inches (3 inch or 1.5 inch crystal optional)
- Energy resolution: 2.4% (for the 661.7KeV characteristic peak of Cs-137)
- Energy range: 30KeV to 3MeV

- Energy linearity: better than ± 1%;
- Multi-channel: 4096 channels (16384-channel high-performance multi-channel optional)
- Radioactivity measurement accuracy: generally less than 10%
- Weight: less than 2Kg
- Temperature range: -10℃ ~ 40℃
- Power supply: USB 5V power supply

Ⅳ. Applications

- For Gamma radioactivity measurement in laboratory, and on-site rapid nuclide identification and radioactivity measurement.

Section Two． Portable Style Radiation Detection Instrument

1．Portable LaBr3 Gamma Spectrometer

Model：TK-201

Fig. 1　TK-201 appearance　Fig. 2 TK-201 multi-channel and electronic systems

Ⅰ. Product Introduction

The TK-201 portable LaBr3 gamma spectrometer has nuclide recognition, dose rate measurement and activity measurement functions. G-M detector is optional, with the measurable dose rate up to 5Sv / h; lithium glass is optional, able to measure neutrons.

Figure 1 shows the appearance of TK-201. TK-201 consists of Labr3 crystal, photomultiplier tube, multi-channel electronic system, high voltage module, smart phone display terminal, battery, data acquisition and analysis software and sourceless efficiency calibration software. The multi-channel, high-voltage module and voltage division circuit are shown in Fig. 2 and are integrated in the metal drum shown in Fig. 1.

In the nuclide recognition, TK-201 uses the fuzzy clustering technology and energy spectrum analysis method, making its radionuclide recognition sensitivity far higher than that of the international similar products, with the false alarm rate also lower than that of the international similar products. Figure 3 shows the interface of TK-201 for natural nuclides identification under natural background. Before the characteristic peaks clearly appear, ^{137}Cs and other artificial radionuclides can be identified. When the contribution of artificial radionuclide to the dose rate exceeds 10% of the environmental dose rate, the artificial radionuclide can be correctly identified within 5 seconds. When the contribution of artificial radionuclide to the dose rate exceeds 5% of the environmental dose rate, the artificial radionuclide can be correctly identified within 20 seconds. Its nuclide recognition speed is faster than that of the international similar products. When the

spectrometer is placed directly in the air, its identification sensitivity to ^{137}Cs in the air is 1.2 Bq / m^3.

TK-201 uses 38KeV and 1468KeV characteristic peaks of La isotopes for detector energy calibration, without the need of adding artificial radionuclides or LEDs for energy calibration. Furthermore, in the long-term measurement process, two characteristic rays are used for spectrum stabilization. Figure 4 shows TK-201 energy calibration interface.

When TK-201 detects ^{238}U and ^{235}U, the activity ratios of ^{238}U and ^{235}U are given, with the error of generally not more than 100%.

TK-201 has an optional sourceless efficiency calibration software special for scintillation detector, developed by Beijing Tai Kun Industrial Equipment Co.,Ltd. to achieve on-site radioactive activity measurement. The software interface is shown in Figure 5.

The TK-201 detector is connected to the hoist via Bluetooth, and they can be detached for remote measurements. The host uses a touch screen display that greatly simplifies instrument operation.

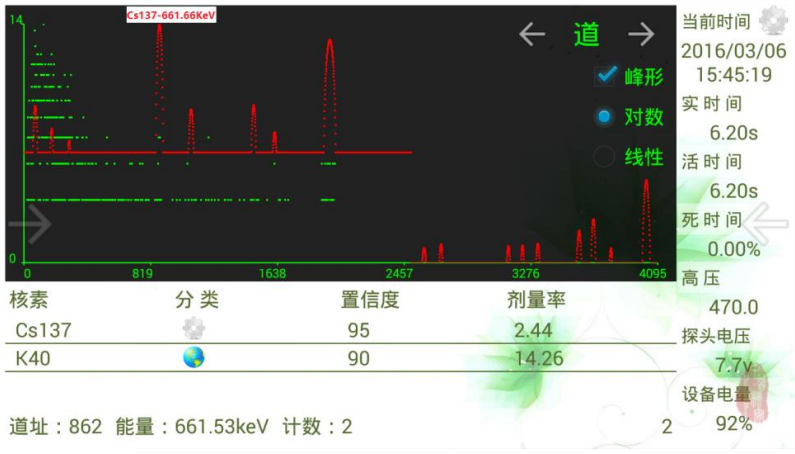


Fig. 3 TK-201 nuclide recognition interface

Fig. 4 Energy calibration using the natural radionuclide in the air

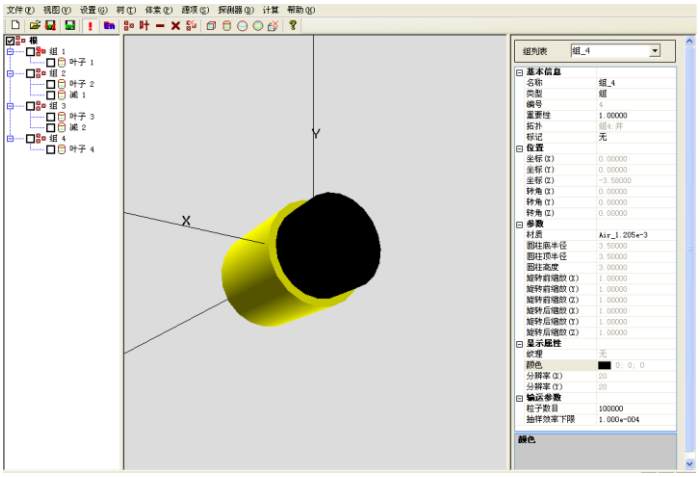


Fig. 5 TK-105-B sourceless efficiency calibration software interface

Ⅱ. Main Features

TK-201 has functions of gamma radionuclide recognition, dose and dose rate measurement, activity measurement and so on.

- TK-201 uses time sequence analysis technology, fuzzy clustering technology and energy spectrum analysis technology, making its radionuclide recognition sensitivity higher than that of the international similar products. The system is equipped with a characterized TK-105-B scintillation detector sourceless efficiency calibration software that enables users to quickly measure radioactivity in situ when artificial radionuclides detected.
- TK-201 uses the self-generated background for automatic energy calibration and peak stabilization, without additional radioactive sources.
- Software and hardware are combined together for spectrum stabilization, so the drift of energy spectrum is controlled in real time, and the accuracy of long-term measurement can be reliably guaranteed.
- The contribution of the artificial radionuclide to the dose rate is given in real time.
- The detector is connected to the host via Bluetooth, and they can be detached for remote measurement.
- 5.5-inch large touch screen smart phone is used as a display, with full Chinese / English interface, having stylish and simple software interface, breaking the problems of complex operation of the traditional LCD display.

Ⅲ. Technical Specifications

- Crystal: 2-inch LaBr3 crystal (optional 1.5 inch or 3 inch LaBr3 crystal); with additional lithium glass used to measure neutron;
- Energy range: γ-ray: 30keV ~ 3MeV;
- Dose rate range: 10nGy / h ~ 0.1mGy / h; with an additional G-M calculation tube, the upper limit of measured dose rate can reach up to 5Sv / h;
- Nuclide library and identifiable nuclide species: The latest nuclide library from the ENSF (Evaluated nuclear structure data file) has spectral lines for more than 3,000 radioisotopes. In the Detective-1 report, the detected radionuclides are classified into industrial, medical, natural and special nuclear materials. The industrial category mainly includes ^{60}Co, ^{133}Ba, ^{137}Cs, ^{192}Ir, ^{241}Am, ^{75}Se, and ^{152}Eu. The medical categories mainly include ^{18}F, ^{67}Ga, ^{99}mTc, ^{111}In, ^{123}I, ^{131}I, ^{133}Xe, and ^{201}Tl. Natural radionuclides mainly include ^{40}K, ^{226}Ra, ^{232}Th, and ^{238}U. Special nuclear materials include ^{235}U, ^{233}U, ^{237}Np, ^{252}Cf and so no.
- Multi-channel analyzer: 4096 channels;
- Energy linearity: better than ± 1%;
- Energy resolution: better than 3% (@ 661.66keV);
- Sensitivity: 3000cps / μSv / h;
- Communication: Bluetooth wireless communication, with the communication distance greater than 5 meters;
- Alarm: sound alarm and vibration alarm
- Calibration: changing with the temperature; natural nuclide automatic calibration spectrum stabilization;
- Power supply: four standards 9V, 680 mAh rechargeable battery packs, with the capacity for the machine working for about 10h after charging.
- Control: three-key keyboard is provided for single-finger operation;
- Storage: at least 100,000 databases stored, with computer connection cables and supporting data communication software;
- Controller display: intelligent display, with 5.5-inch large touch screen;
- Operating temperature: -10 ℃ ~ 50 ℃;
- Working humidity: 10 ~ 90%;

- Dimensions: length x width x height: 313x163x227mm (not including the detector);
- Weight: less than 2kg.

Ⅳ.Applications

TK-201 can be used in the source searching, nuclear security at important sites, dose rate measurement, radionuclide identification, package radioactivity detection, nuclear emergency measurement and other fields. Combined with the sourceless efficiency calibration software produced by Beijing Tai Kun Industrial Equipment Co.,Ltd., the rapid measurement of activity at site can be achieved.

2．Portable NaI Gamma Energy Spectrometer

Model：TK-202

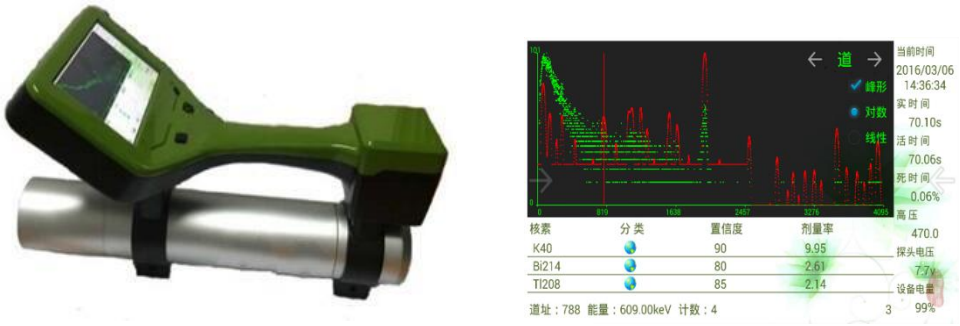


Fig. 1 TK-202 appearance and typical interface

Ⅰ. Product Introduction

TK-202 portable NaI gamma energy spectrometer has nuclide recognition, dose rate measurement and activity measurement and other functions. In the nuclide recognition, the tAime sequence analysis technology, fuzzy clustering technology and energy spectrum analysis technology are adopted, making the radionuclide recognition sensitivity higher in magnitude than that of the international similar products, which is the new generation of product in the similar products. TK-202 consists of NaI detectors, the host and the data analysis software. The detector and the host are connected together over Bluetooth, and they can be detached for remote measurement. The host uses a touch screen display that greatly simplifies instrument operation. TK-202 can identify ^{40}K, ^{214}Bi and ^{208}Tl and other nuclides in the environment in real time, and uses the 609KeV ray of ^{214}Bi, the 1460.8KeV ray of ^{208}Tl, and the 2614.5KeV ray of ^{208}Tl for fast and accurate energy calibration of the measurement system, which is the state-of-the-art energy calibration technology in the current environmental radiation monitoring.

Ⅱ. Main Features

- TK-202 has gamma radioactive nuclide identification, dose and dose rate measurement, activity measurement and other functions.
- TK-202 has the highest sensitivity on the gamma radionuclide recognition among the similar products in the world, and is a highly sensitive hand-held nuclide identification meter having the national independent innovation design. Thanks to the use of time series analysis technology, fuzzy clustering technology and energy spectrum analysis technology, its radionuclide recognition sensitivity is higher than that of the international similar products, with the typical indicators (with 2-inch NaI probe) as follows: "For ^{137}Cs, when

the dose rate is higher than 60% of the environmental background dose rate, the nuclide recognition time is not more than 0.7 seconds; when the dose rate is higher than 30% of the environmental background dose rate, the nuclide recognition time is not more than 7 seconds; for ^{241}Am, when the dose rate is higher than 10% of the environmental dose rate, the nuclide recognition time is not more than 5 seconds; when the dose rate is higher than 20% of the environmental dose rate, the nuclide recognition time is not more than 0.7 seconds; for ^{60}Co, when the dose rate is higher than 80% of the environmental dose rate, the nuclide recognition time is not more than 9 seconds."

- The system is equipped with a characterized TK-105-B scintillation detector sourceless efficiency calibration software that allows the user to quickly measure radioactivity in situ when detecting artificial radionuclides.

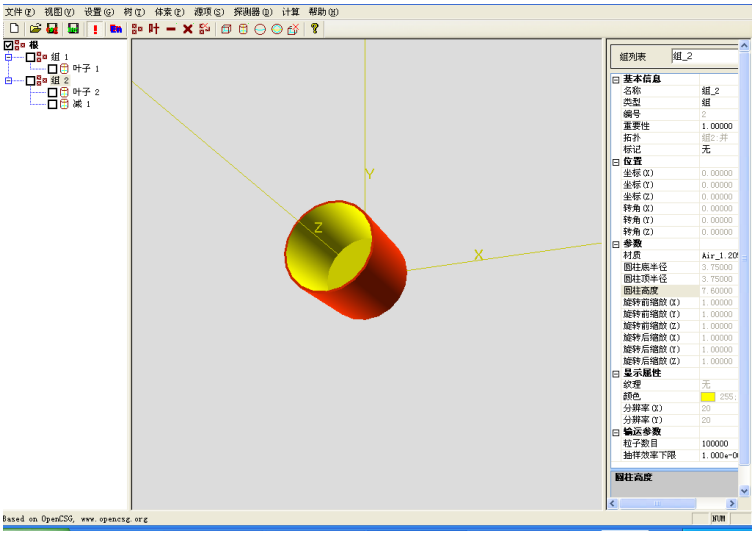


Fig. 2 TK-105-B Souceless Efficiency Calibration Software Interface

- Thanks to the use of the time series analysis technology and fuzzy clustering technology, TK-202 can identify ^{40}K, ^{214}Bi, ^{208}Tl and other nuclides in the environment in real time, and uses the 609KeV ray of ^{214}Bi, the 1460.8KeV ray of ^{40}K, and the 2614.5KeV ray of ^{208}Tl for a quick and accurate energy measurement for the measurement system, which is the state-of-the-art energy calibration technology in the current environmental radiation monitoring.

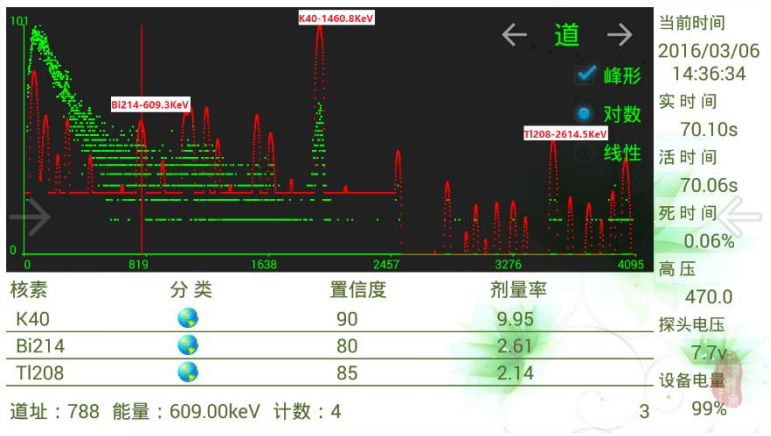


Fig. 3 Energy calibration using the natural radionuclide in the air

- Software, hardware and time sequence statistical analysis are combined together for spectrum stabilization, so the drift of energy spectrum is controlled in real time, and the accuracy of long-term measurement can be reliably guaranteed.
- The contribution of the artificial radionuclide to the dose rate is given in real time.
- ^{6}Li (Eu) is used as a neutron probe crystal.
- The detector is connected to the host via Bluetooth, and they can be detached for remote measurement.
- 5.5-inch large touch screen smart phone is used as a display, with full Chinese / English interface, having stylish and simple software interface, breaking the problems of complex operation of the traditional LCD display.

III. Technical Specifications

- Detector: 2-inch NaI (Tl) detector (optional 3-inch NaI (Tl) detector, 6LiI (Eu) neutron detector and LaBr3 detector);
- Energy range: γ-ray: 25keV ~ 3MeV; neutron: thermal neutron ~ 14MeV;
- Dose rate range: 10nGy / h ~ 0.1mGy / h; with an additional G-M calculation tube, the upper limit of measured dose rate can reach up to 5Sv / h;
- Nuclide library and identifiable nuclide species: The latest nuclide library from the ENSF (Evaluated nuclear structure data file) has spectral lines for more than 3,000 radioisotopes. In the TK-202 report, the detected radionuclides are classified into industrial, medical, natural and special nuclear materials. The industrial category mainly include 60Co, 133Ba, 137Cs, 192Ir, 241Am, 75Se, and 152Eu. The medical categories mainly include 18F, 67Ga, 99mTc, 111In, 123I, 131I, 133Xe, and 201Tl. Natural radionuclides mainly include

40K, 226Ra, 232Th, and 238U. Special nuclear materials include 235U, 233U, 237Np, 252Cf and so no.

- Multi-channel analyzer: 1024 channels (with 4096 channels optional);
- Energy linearity: better than ± 1%;
- Energy resolution: better than 7% (@ 661.66keV);
- Sensitivity: 3000cps / μSv / h;
- Communication: Bluetooth wireless communication, with the communication distance of greater than 5 meters;
- Alarm: sound alarm and vibration alarm
- Calibration: changing with the temperature; natural nuclide automatic calibration spectrum stabilization;
- Power supply: four standards 9V, 680mAh rechargeable battery packs, with the capacity for the machine working for about 10h after charging.
- Control: three-key keyboard is provided for single-finger operation;
- Storage: at least 100,000 databases stored, with computer connection cables and supporting data communication software;
- Controller display: intelligent display, with 5.5-inch large touch screen;
- Operating temperature: -20 ℃ ~ 50 ℃;
- Working humidity: 10 ~ 90%;
- Dimensions: length x width x height: 313x163x227mm (not including the detector);
- Weight: less than 2kg.

Ⅳ. Applications

TK-201 can be used in the source searching, nuclear security at important sites, dose rate measurement, radionuclide identification, package radioactivity detection, and other fields. Combined with the sourceless efficiency calibration software produced by Beijing Tai Kun Industrial Equipment Co.,Ltd., the rapid measurement of activity at site can be achieved.

3. Radioisotope Identification Device

Model：TK-203

Ⅰ. Product Introduction

TK-203 is the latest generation radioisotope identification device with dose rate measurement and identification .Both touch screen and key make it convenient to use.Auto-calibration and stabilization by natural 40K 208Tl 214Bi.

Ⅱ. Main Features

- Dose rate measurement, isotope identification
- More sensitive ,for 137Cs when the dose rate exceeds 60% of the background it can be identified in 0.7s.
- Auto-calibration and stabilization by natural 40K(1460.82keV) 208Tl(2614.5keV) 214Bi(609keV).
- 5.5’touch screen；

Ⅲ. Technical Specifications

- Detector：3’×3’NaI(Tl)
- Energy range：25keV ~ 3MeV；
- Dose rate：10nSv/h ~ 10Svy/h；
- Nuclide library：ENSF（Evaluated nuclear structure data file，more than 3000 nuclides.
- MCA：1024；
- Energy linearity：±1%；
- Energy resolution：＜７.5%（@661.66keV）；
- sensitivity：3000cps/μSv/h；
- Auto-calibration and stabilization by natural 40K 208Tl 214Bi.
- Charge：4×680 mAh.
- Display：5.5’touch screen；
- Temperature range：-20℃ ~ 50℃；
- Relative humidity：10 ~ 90%；
- Weight：＜2kg.

Ⅳ. Applications

- Nuclear industry
- Security
- Nuclear emergency

4. Portable Liquid Nitrogen Refrigeration HPGe Gamma Spectrometer

Model：TK-204

Fig. 1 portable liquid nitrogen refrigeration P-type high-purity germanium spectrometer

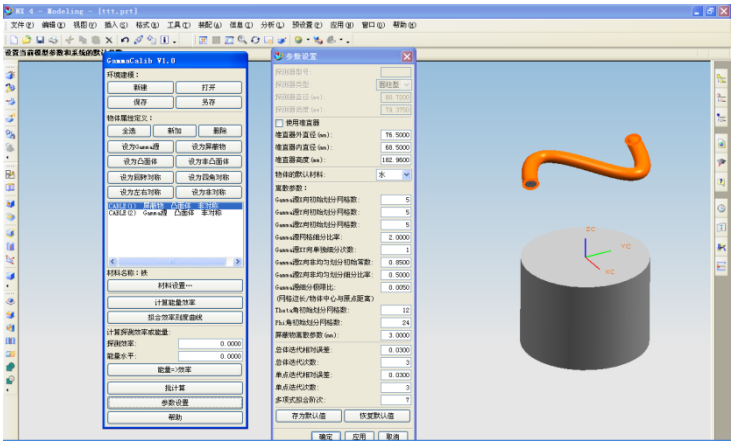


Fig. 2 Efficiency calibration calculation modeling to measure the complex pipelines

Ⅰ. Product Introduction

The TK-204 portable high-purity germanium spectrometer is a high-performance, highly integrated gamma radioactivity measuring device developed as adapted to field measurement requirements (see Figure 1). TK-204 integrates HPGe detector, liquid nitrogen refrigeration unit, multi-channel electronics, energy spectrum analysis software and sourceless efficiency calibration software, military reinforcement data acquisition and processing terminal. As the Gamma-4 sourceless efficiency calibration software based on CAD model is used, the quantitative efficiency calibration is made for the measurement object of any shape made of any base material, making that the system has a strong field Application ability. Figure 2 shows a superior field measurement capacity of Gamma-4 sourceless efficiency calibration software.

Ⅱ. Main Features

Quantitative measurement of activity of radioactive source of any shape and any base material;

- Full Chinese interface, automatic energy spectrum analysis software is provided, so even non-professional can quickly grasp this;
- With more than 3000 kinds of isotope ray information provided, nuclide library and energy spectrum analysis software are combined firmly, user-friendly.
- Multi-channels all use military-grade devices, with high reliability; the entire machine can be replaced in case of failure;
- Detector can be replaced by a spare one stored in the company, to ensure recover within 72 hours.

Ⅲ. Technical Specifications

Parameter	Value
Detector	N-type or P-type coaxial detector is optional
Energy range	Up to 3keV-10MeV
Relative efficiency	20% to 60% optional
Energy resolution • at 122 keV • at 1.33 MeV	 ≤800eV ≤1.8keV
Peak shape parameters FWTM/FWHM FW.02M/FWHM	 ≤1.9 ≤2.65
Peak-to-Compton ratio	62 : 1
Refrigeration time (hours)	4
Autonomous running time (days)	1-5 (related with the capacity of liquid nitrogen tank)
Dimensions	(Related with the capacity of liquid nitrogen tank)
Weight (kg)	5-12 (related with the capacity of liquid nitrogen tank)

Ⅳ.Applications

- Used in the field and on-site gamma radionuclide identification, activity measurement, nuclear emergency measurement and so on.

5. Gamma Spectrometer

Model：TK-205

Ⅰ. Product Introduction

TK-205 is a multi-functional equipment with high sensitivity and accurate radionuclide identification, developed and manufactured by Beijing Tai Kun Industrial Equipment Co.,Ltd. It provides flexible Application, such as radionuclide identification, dose rate calculation and radioactive sources searching, by configuring with different gamma detectors and high-performance 6LiI (Eu) scintillator neutron detector(optional).

Ⅱ. Main Features

Built-in natural nuclide, automatic calibration, with function of automatic and manual radionuclide identification

- Audible and visible alarms, alarm threshold is continuously adjustable
- 3.5" high-definition color LCD touch screen, with two shortcut keys
- With network port, special remote monitoring software can realize real-time remote monitoring and management
- Compliant with GB/T 18268.1-2010，ANSI N42.34 standard

Ⅲ. Technical Specifications

Item	Parameter
Detector	γ: 2″×2″ NaI or 1″×1″LBF or 1.5"×1.5" LCF scintillator, GM tube Neutron: 6LiI (Eu) scintillator
Energy Range	20keV~3.0MeV
Energy resolution	6.8%（@662KeV）
Sensitivity	>1400cps/(μSv/h)@137Cs

Dose Rate Range	10nSv/h ~ 100mSv/h
MCA	1024 channels
Power Supply	Rechargeable lithium battery (≥ 8 hours)
Temp.&Hum.	Temperature: -20℃~+50℃ Humidity: ≤93% (30℃, non-condensing)
Weight & Size	≤2.4Kg (with battery, without neutron detect unit); 267×132×198(l×w×h) (mm)
Communication	USB, network port

Ⅳ. Applications

- Homeland security, customs and border control
- Emergency response and enforcement of CDC, EPA
- Nuclear medicine, health physics
- Nuclear waste disposal, nuclear facilities
- Nuclear transportation monitor

6. CsI Gamma Personal Dosimeter

Model：TK-206

Fig. 1 TK-206 neutron-gamma personal dosimeter

Ⅰ. Product Introduction

TK-206 is a gamma personal dosimeter using CsI crystal as the detection unit, as shown in Figure 1. Compared to the traditional electronic personal dosimeter, its sensitivity is higher more than 1,000 times. A special energy compensation design effectively guarantees the reliability of measurement results. A unique noise reduction circuit design is used, making the lower energy detection limit down to 20keV.

Ⅱ. Main Features

- High-density scintillation crystal is used as a detector, with high sensitivity, to measure the environmental radiation level;
- A unique noise reduction circuit design is used, making the lower limit of energy detection than that of the general personal dosimeter, with the lower limit up to 20keV;
- Energy compensation design is used, providing high data reliability;
- To support networking and GIS, and to achieve the intelligent and networking measurement of the staff dose and site radiation

Ⅲ. Technical Specifications

- Detector: 3CC CsI crystal;
- Photon collection unit: silicon photodiode;
- Detection range of γ-ray energy: 20keV to 3meV; able to detect weapons-grade plutonium;

- Alarm: sound, light and vibration alarms;
- Sensitivity: not less than 600cps (1μSv / h) for ^{137}Cs;
- Dose rate: 0.01μSv / h to 0.1mSv / h;
- Error range: ± 20%;
- Protection level: IP65;
- Response time: 0.25s;
- Standby time: to continuously work for 300h;
- Operating ambient temperature: -30℃ to 50℃;
- Weight: 200 grams;
- Communication: to support USB and Bluetooth communication;
- Storage: 10000 data;
- Ground drop test: 1.5 m height from the cement ground;
- Power supply: built-in lithium batteries; wireless charging.

Ⅳ. Applications

- Used by staff working in the gamma radiation field.

7． Personal Neutron Dosimeter

Model：TK-207

Ⅰ. Product Introduction

TK-207 is a quite sensitive card-type personal neutron dosimeter in the world, developed by Beijing Tai Kun Industrial Equipment Co.,Ltd. It utilizes 6LiI (Eu) scintillator, albedo technology to detect neutron dose. With IR communication, related reader and software, can realize multiple personal dose management.

Ⅱ. Main Features

- High sensitivity 6LiI (Eu) scintillator neutron detector
- Used in turns, maximum for 10 people, cost-effective
- Simultaneously displays both accumulated dose and dose rate
- Audible, visible and vibrative alarm simultaneously or selective
- Alarm threshold is continuously adjustable
- Infrared interface allows instant communication with PC

Ⅲ.Technical Specifications

Item	Parameter
Detector	^{6}LiI(Eu) scintillator
Dose Range	0.1μSv~10Sv
Dose Rate Range	1μSv/h~100mSv/h
Gamma rejection ratio	≥10:1(10 mSv/h, ^{137}Cs)
Energy Range	0.025 eV~14 MeV
Angular response	≤±30%　(0°~±60°@ ^{241}Am-Be)
Relative Error	≤±15% , (10μSv/h~100mSv/h@ ^{252}Cf)
Response time	≤5s
IP Rating	IP67
Temperature	-10°C~50°C
Power Supply	one AAA battery (≥50 hours)
Weight	95g (with battery)
Dimensions	110×55×15(l×w×h)(mm)
Communication	IR

Ⅳ. Applications

- Monitoring personal neutron dose at nuclear power plants, nuclear reactors, particle accelerators, hospitals, oil
- well logging, industrial flaw detection, etc.
- Emergency alarm and inspections of policeman, fireman, customs officers and security guards.

8. Neutron-Gamma Personal Dosimeter

Model：TK-208

Fig. 1 TK-208 neutron-gamma personal dosimeter

Ⅰ. Product Introduction

TK-208 is a neutron-gamma personal dosimeter using the latest international high-sensitive personal dose device developed with a new single crystal, as shown in Figure 1. Compared with the conventional neutron-gamma personal dosimeter using a (CsI+LiI(Eu)) as a detection unit, the structure and circuit are simpler and more reliable, and the gamma energy resolution is higher, and the neutron detection efficiency is higher. The crystal used in NPG-1 has a large volume, with high sensitivity and with high ^{6}Li abundance, and the sensitivity is higher more than 1000 times than that of the neutron-gamma personal dosimeter using semiconductors as a detector. The unique energy compensation design effectively guarantees the reliability of the measurement results.

Ⅱ. Main Features

- A single crystal is used to measure neutrons and gamma-ray simultaneously, greatly simplifying the structure and circuit, and enhancing reliability;
- Energy compensation design is used, to get reliable data;
- n-γ discrimination technology is used, with the neutron and gamma channel interfering effectively controlled;
- High-density crystal is used, with high detection efficiency, which can detect dose rate changes of 10nSv / h; To support the networking and GIS, achieving the intelligent and network measurement of the staff dose and field radiation.

Ⅲ. Technical Specifications

- To measure neutron and gamma dose rate simultaneously;

- Detector: CLYC crystal;
- Alarm: sound, light and vibration alarm;
- Sensitivity: γ: not less than 600cps (1μSv / h) for 137Cs;

  Neutrons: not less than 300cps (1μSv / h) for 241Am;
- Dose rate: γ: 0.01μSv / h to 0.1mSv / h;
- Neutron count rate: 1-999 / s;
- Energy range: γ: 20keV-3MeV; neutrons: thermal neutrons to 15MeV;
- Error range: ± 20%;
- Protection level: IP65;
- Response time: 0.25s;
- Standby time: working for 250h continuously;
- Power supply: built-in rechargeable lithium battery, with wireless charging;
- Operating ambient temperature: -30℃ to 50℃;
- Weight: 200 g;
- Communication: to support USB and Bluetooth communication;
- Ground drop test: at 1.5m from the cement ground.

Ⅳ. Applications

- Used by staff working in nuclear power plants, nuclear submarines, nuclear arsenals and other neutron - gamma radiation field and also by staff working in the site having neutron – gamma radiation field.

9. Mini X, γ Radiation Personal Dosimeter

Model：TK-209

Ⅰ. Product Introduction

This dosimeter is mainly used to monitor the individual cumulative dose equivalent and dose equivalent rate caused by X and γ radiations, issuing a sound and light alarm when the cumulative dose or dose equivalent rate is over the alarm setpoint. The dosimeter is controlled by a low-power singlechip, with the real-time display of measured value, sound and light alarms for over limitations, the EEPROM data storage, alarm threshold parameter settings, the detector failure alarm, and the battery under-voltage detection and other functions. Measured data can be stored without any loss in case of power failure.

Ⅱ.Main Features

- Small size, wide range, and high reliability
- Real-time alarm display; data can be stored without any loss in case of power failure.
- USB port communication is provided, convenient for computer standardized management
- Built-in rechargeable battery, easy to use.

Ⅲ. Technical Specifications

Detector	Semiconductor Detector
Measuring range	Cumulative dose: Hp (10): 0.0μSv~10Sv; Dose rate: Hp (10): 0.1μSv/h~500mSv/h；
Alarm threshold setting	The cumulative dose alarm is continuously adjustable between 1μSv to 10Sv; The dose rate alarm is continuously adjustable between 1μSv / h to 500mSv / h.
Alarm type	The sound and light alarms and LCD indications can be set for the out-of-limit of cumulative dose and dose rate, battery under-voltage, operating overtime or detector failure alarm, and a sound and light indication can be set for cumulative dose increment.
LCDmeasurement value display	Cumulative dose: 0.00μSv~9999mSv； Dose rate: 0.05μSv/h~999.9mSv/h； Working hours: 00:00~99:59(99 hours and 59 minutes)。
Energy response:	<±30%（50keV~1.5MeV）；
Angular response	For Am-241(60keV),< ±50%（0°～75°）； For Cs-137(662keV),< ±20%（0°～75°）。
Temperature characteristics	<±15% （ -10℃~+40℃）。
Humidity characteristics	<±15%, RH 40%~90% ,35℃。
Relative inherent error	<±10% (1mSv/h,Cs-137)。
Overload characteristics	>10Sv/h。
Power supply	A 3.6V rechargeable lithium battery is provided, with a continuous operating time of greater than 100h after each charging; the machine can work more than 8h even if the battery under-voltage indication occurs;
Dimensions	52 ㎜×40 ㎜×14 ㎜。
Weight	About 35g.

Ⅳ. Applications

- Used by staff working in nuclear power plants, nuclear submarines, nuclear arsenals and other neutron - gamma radiation field and also by staff working in the site having neutron – gamma radiation field.

10． Semi-Conductor Detector Personal Dosimeter

Model：TK-210

Fig. 1 TK-210 gamma personal dosimeter　　Fig. 2 TK-210 energy data readout system

Ⅰ. Product Introduction

The personal dosimeter is used to monitor the individual cumulative dose equivalent Hp (10) and the individual dose equivalent rate Hp (10) caused by X-ray and gamma radiation. Dose Equivalent, Dose Equivalent Rate and Accumulated Operating Time values can be read from the LCD display by key. In case of the accumulated dose and dose rate out of the limits, a sound and light alarm as well as an LCD indication will be issued. Measurement data are stored immediately without any loss in case of power failure. Record data are transmitted to the reader through the infrared communication, and then to the computer (workstation) through RS485 interface. The dosimeter can be used separately as well as can be used with the combination of a reader and a computer management system network.

Ⅱ.Main Features

- Wide range, low power consumption, and overload resistance
- Real-time data storage without any loss in case of power failure
- Cumulative dose, dose rate and working time displays are switchable;
- A sound and light alarm and LCD indication for out of limits; alarm thresholds are continuously adjustable;
- The infrared data communication and the system software are provided to facilitate the standardization of dose data management.
- The careful design guarantees the safety and reliability of the measurement.

Ⅲ. Technical Specifications

Detector	**Semiconductor Detector**
Measuring range	Cumulative dose: 0.01 μSv~10Sv; dose rate: 0.1 μSv / h~1Sv / h

LCD display	Accumulated dose: 0.00 μSv~9999mSv; dose rate: 0.01 μSS / h~1999mSv / h; working hours: 0~99 hours and 59 minutes
Alarm value	Cumulative dose: 1μSv~10Sv continuously adjustable; dose rate: 1μSv / h~1Sv / h continuously adjustable Dosage increment: 1μSv~999μSv continuously adjustable Timeout alarm: 1 minute~99 hours and 59 minutes continuously adjustable
Alarm	With sound, light and LCD indications, an alarm will be issued for the cumulative dose and dose rate out of the limits, under-voltage of batteries, working hours out of the limits, failure of the detector, and cumulative dose increment indication. The sound intensity of the alarm is greater than 80dB at 30cm distancing from the dosimeter.
Energy response	<±30%（50keV~1.5MeV）
Dose rate response	<±20% (1μSv/h~10μSv/h) <±15% (10μSv/h~1Sv/h)
Overload characteristics	Greater than 20Sv / h
Power supply	One AA-type 3.6V lithium battery is used, with the battery life of > 2000 hours. The machine can work normally more than 8h when an undervoltage symbol is displayed.
Temperature characteristics	<±15%, -10℃~+40℃
Humidity characteristics	<±10%, 40%~90%RH(35℃)
Weight	90g
Dimensions	90 × 62 × 25 (not including the clip thickness)

Ⅳ. Applications

- For measurement of radiation dose and alarm for nuclear practitioner.

11． Portable Surface Contamination Detector

Model：TK-211

Fig. 1 α, β surface contamination detector and typical interface

Ⅰ. Product Introduction

TK-211 is a large sensitive-area portable α, β surface contamination detector developed by Beijing Tai Kun Industrial Equipment Co.,Ltd, which uses 0.5mm thick plated ZnS (Ag) plastic scintillator as a detection unit, to effectively eliminate the interference of γ ray to β ray, without needing for air flow or inflation, reducing operating costs and maintenance costs. Pulse amplitude screening circuit is used, to automatically distinguish α, β particles and achieve α, β simultaneous measurement, minimizing the mutual impact. The imported G-M tube with the energy compensation is used to measure γ-ray, with a wide γ-ray dose rate range. Ergonomic design is used, with light weight, and a large screen display is used, easy to observe the reading.

Ⅱ. Main Features

- Continuous measurement mode and fixed time measurement mode are optional;
- The measurement time at the fixed measurement mode can be customized;
- The nuclide library is programmed freely;
- To measure α, β radioactivity and unit area activity of specific nuclide;
- With a special double-flash design used, the probability of γ-ray mixing into theβ-channel count is very low;
- To simultaneously measure α, β and γ rays;
- With lagre sensitive detection area;
- A reasonable optical reflection design makes that the detection efficiency of the detector is high, and data are accurate.

Ⅲ. Technical Specifications

- Detection ray type: α, β and γ rays;
- Measurement units: cps, Bq, Bq/cm^2 and μSv / h.
- Instrument background: α: about 0.1cps, β: 10 ~ 15cps;
- Detection efficiency (with a protective grid mesh, 2π): for ^{241}Am, α-ray detection efficiency is greater than 35%; for $^{90}Sr/^{90}Y$, the detection efficiency of β-ray is more than 50%; for ^{137}Cs, the detection efficiency of β-ray is more than 25%;
- Measurement range: α count rate range is 0-40000cps, 1000Bq / cm^2;
  γ-ray counting rate is ranged -40000 cps, 1000 Bq / cm^2;
  The dose rate range of γ ray is 0.1μSv/h-10Sv/h;
- Cross interference: <0.5%;
- Detection area: 170cm^2;
- Alarm function: an independent alarm threshold can be set for α, β and γ rays, with the alarm threshold adjustable and with sound and vibrations alarms provided;
- Background rejection: rejection and non-rejection background can be optional, with the background measurement time of not greater than 60s;
- Operating temperature: -10 ~ 40℃;
- Power supply: two 9V 800mAh rechargeable battery packs are provided; the machine can work for about 5h after charging; with disposable 9V battery available.
- Dimensions: (L × W × H) 255mm × 154mm × 138mm;
- Weight: <1.5kg; carried for a long time.

Ⅳ. Applications

- Used for the radioactive contamination measurement in the hospitals, nuclear power plants, nuclear facilities decommissioning and nuclear waste management

12． Contamination Monitor

Model：TK-212

Ⅰ. Product Introduction

TK-212 is a portable and rugged surface contamination detector with thin plastic scintillator coated with ZnS. With the advantages of high sensitivity, lightweight, ease of use, it has been widely used in law enforcement, emergency response, nuclear plants, customs, border patrol, etc

Ⅱ. Main Features

State-of-the art plastic scintillator detector without filling gas

- Large detection area up to 170cm2
- Detect alpha and beta radiation simultaneously or separately, without external probes
- Alarm threshold adjustable continuously
- 26 nuclides in the freely programmable library, background deducted automatically
- Large LCD with backlight
- User-friendly interface, 4 keys operation by one hand
- Light weight, measuring settings protected by password

Ⅲ. Technical Specifications

Item	Parameter
Detector	Plastic scintillator coated with ZnS, GM tube is optional to expand the gamma detection range
Area of the Detection	170 cm^2
Alarm	Visible and audible alarms
Displaying Units	CPS, Bq or Bq/cm^2
Nuclide Library	26 nuclides, user-specific nuclides can be added
Background Deduct	Background deduct or not can be chose, background measuring time can be set
Background	α: <0.1 CPS; β: <15 CPS

Display	Large size LCD display, 144×64 pixels with backlight
Data Storage	Save more than 1000 groups of data
Communication	USB
Power Supply	2 AA batteries or NiMH rechargeable battery, continuously work for at least 35h
Weight	870g (include battery)
Typical efficiency(2π)	$^{90}Sr/^{90}Y$：35%，^{241}Am α：40%

Ⅳ.Applications

- Environmental protection　　Public security　　Military
- Customs and ports　　Emergency Response　　Nuclear power plant

13．Portable Multipurpose Dose Rate Monitor

Model：TK-213

Ⅰ.Product Introduction

TK-213 is a multi-functional radiation meter developed by Beijing Tai Kun Industrial Equipment Co.,Ltd. It is equipped with several intelligent probes for detecting α、β、γ 、n pollution of environment or staffs. Integrating these excellent probes, TK-213 can be applied in almost the whole radiation protection and measurement.

Ⅱ. Main Features

- Intelligent probes with measuring and date saving functions
- Main unit: 2.8" TFT panel. Automatically identification of different probes
- High sensitivity scintillator, PIPS α/β, wide-range GM tube detector
- 4 m adjustable measuring bar expands the range of measurement.

Ⅲ.Applications

- Personal radiation protection, surface contamination and dose rate measurement.
- Neutron and gamma can be measured simultaneously at complex radiation area.
- Search the hidden radioactive sources.
- Long distance detecting with measuring bar

Ⅳ.Main Unit

- 2.8 inch TFT panel
- Internal energy compensation GM tube

- Dose rate range: 100nSv/h ~ 100mSv/h (can expand to 10Sv/h)
- Weight: 300g

Ⅴ. α、β/γ Detector

- Large laminate scintillator detector, 100cm2
- Activity Response: α: ≥ 12s-1Bq-1cm2（@241Am）

  B: ≥ 20s-1Bq-1cm2@204Ti）
- Background: α<0.1s-1, β<10s-1

Ⅵ. High-sensitivity γ Detector

- 2"×2" NaI scintillator detector
- Energy range: 30Kev ~ 3Mev
- Measurement range: 10nSv/ 100μSv/h
- Sensitivity: 1500cps/(μSv/h)

Ⅶ. Environmental level X &γ dose rate meter

- 76mm*76mm composite scintillator detector
- Energy range: 20keV ~ 7MeV
- Dose rate range: 1nSv/h ~ 100μSv/h

- Sensitivity: >2000cps/μSv/h（137Cs）

Ⅷ. Neutron Detector

- 6LiI(Eu) Crystal material
- Energy range: thermal neutron–16 MeV

Ⅸ. Wide-range γ Detector

- Double GM tube detector
- Energy range: 65Kev ~ 3Mev
- Dose rate range: 0.01μSv/h ~ 10Sv/h

Ⅹ. Telescope Pole

- Adjustable length, 1.2m to 4m
- Can be configured with α,β/γ surface
- contamination detector
- Weight: less than 1.5kg

14. Environmental Level X & γ Dose Equivalent (Rate) Meter

Model：TK-214

Ⅰ.Product Introduction

TK-214 is an environmental level X & γ Dose Equivalent (Rate) Meter, consists of high sensitivity composite scintillator detector and main unit. It can be used to distinguish natural occurring radioactive materials and artificial radioactive materials. With advantages of good energy response, radiation response, accurate measurement, it can make fast response to slight radiation increase.

Ⅱ. Main Features

- Large area composite scintillator detector, wide energy response rang
- High sensitivity, fast response to slight radiation
- Built-in GM tube in main unit, expand measuring range
- Adjustable dose and dose rate warning thresholds
- Automatic shift between high range and low range
- Large LCD with backlight
- Waterproof wear-resistant aluminum shell, corrosion resistance, IP67
- Regular configured with cables, data cable and PC software, convenient for customers to use
- Tripod optional for fixed-point monitoring

Ⅲ.Technical Specifications

Item	Parameter
Detector	Large composite scintillator GM tube(built-in main unit)
Size of Detector	Φ76mm×76mm，13mm×54mm
Energy Range	20KeV~7.0 MeV，65KeV~3.0 MeV
Measuring range	1nSv/h~100μSv/h ，100nSv/h~100mSv/h

Sensitivity	>2000cps/(μSv/h)@137Cs，1.0cps/(μSv/h)
Relative Error	<10%(^{137}Cs)
Power	Rechargeable Li battery, 120h for main unit, 16h for overall unit
IP Rating	IP67
Communication	USB
Temp.&Hum.	- 30℃~50℃; 0~95%
Weight	≤2kg

Ⅳ.Applications

- Homeland security Environmental protection Nuclear power plants Customs Public safety and emergency response

15． X & γ Dose Rate Telescope Meter

Model：TK-215

Ⅰ.Product Introduction

TK-215 high range X, γ dose rate telescope meter adopts dual GM tube as its detector. Special configured telescopic pole makes it applicable for radiation measurements in environments with high radiation dose, or fast surveying in nuclear accident emergency.

Ⅱ. Main Features

- Imported dual GM tube detector, wide dose rate range
- Telescopic pole can be extended to 4 meters, easy to use
- With the searching alarm function
- Three levels of alarm threshold, free to adjust
- Can switch it to the main unit to measure the radiation dose of side
- Equipped with special bag, easy to carry

Ⅲ.Technical Specifications

Item	Parameter
Detector	Dual GM tube, main unit with a inherent GM tube
Measurement Range	100nSv/h ~ 10Sv/h
Energy Response	58keV ~ 3.0MeV
Temperature	0℃ ~ +50℃
Relative Humidity	≤90%(50℃)
Weight	<1.5kg
Power Supply	Lithium rechargeable battery, working time: >80h

Ⅳ.Applications

- Nuclear plants
- Searching for the radioactive resources
- Cargo check on ports
- Radiation protection of nuclear facilities, nuclear regulation departments and the enterprises with radioactive
- sources

16. Personal X & γ Dosimeter

Model：TK-216

Ⅰ.Product Introduction

TK-216 is a highly sensitive personal dosimeter capable of detecting X-ray and gamma radiation dose equivalent rate simultaneously. Its detector is made by CsI (Tl) crystal with silicon semiconductor composite, with multiple energy compensation technology which greatly improves the sensitivity. With the universal USB interface and the related software, can realize management of personal dosimeter.

Ⅱ. Main Features

- Silicon semiconductor and CsI (Tl) crystal composite detector
- Alarm threshold is continuously adjustable；Audible, visible and vibrative alarm
- Electro-magnetic interference(EMI) immunity, compliant with GB/T 13161-2003 standard
- USB communication with related software, make it convenient to manage personal dosage

Ⅲ.Technical Specifications

Item	Parameter
Detector	CsI(Tl) crystal and silicon semiconductor composite detector
Dose Range	0.01μSv~9.99Sv
Dose Rate Range	0.1μSv/h~100mSv/h
Energy Range	48KeV~3MeV
Angular response	<±20% , (0° ~ ±75°@^{137}Cs)
Response time	≤5s (10 uSv/h)
IP Rating	IP65
Temp.&Hum.	Temperature: －30°C~60°C, Humidity: <95%
Power Supply	> 200 hours (Rechargeable Lithium Battery)
Weight & Size	65g (include battery); 86×56×10(L×W×H) (mm)
Data Storage	Large-capacity memory, can store historical data for long period
Communication	USB

Ⅳ.Applications

- Customs and ports
- Environmental survey
- Military
- Fire Departments
- Emergency Response
- Nuclear medicine and nuclear industry
- Nuclear Power Plants
- Civilian "related source" of enterprises

17． Nutron Survey Meter

Model：TK-217

Ⅰ.Product Introduction

TK-217 is a new hand-held radiation survey meter designed for detection of neutron and gamma radiation at the same time. Its neutron detector and gamma detector are ^{6}LiI (Eu) and CsI (Tl) scintillation crystal respectively coupled with photodiode. The neutron detector is surrounded by unique cylindrical moderator which greatly improves the sensitivity of neutron detection.

Ⅱ. Main Features

- Independent neutron/Gamma detection channel and independent alarms
- Freely switch between three detection modes of counting rate, dose rate, accumulated dose
- High-definition LCD with backlight
- Audible, visible and radiation icon alarms simultaneously, alarm threshold is continuously adjustable
- Several shortcut keys make operation easy and convenient
- Electro-magnetic interference immunity, CE compliant
- Compliant with ANSI N42.35 and ITRAP standard

Ⅲ.Technical Specifications

Item	Parameter	
	Neutron	Gamma
Detector	^{6}LiI(Eu)	CsI(Tl)
Energy Range	0.025 eV ~ 14 MeV	30keV~ 3.0 MeV
Sensitivity	0.5CPS/(μSv/h), @^{252}Cf	>130CPS/(μSv/h), @^{137}Cs
Counting Rate	1~999cps	1~9999cps
Dose Rate Range	0.1μSv/h ~ 100mSv/h	0.01μSv/h ~100μSv/h
Dose Range	0.01μSv~ 10 Sv	0.01μSv~ 10 Sv

DER Relative Error	≤±20%（200keV~7MeV）	≤±20%
Display	High definition LCD	
Shortcut Keys	4 function keys	
Power Supply	4 dry batteries, continuous working time: ≥100h	
Data Storage	Can store 100000 groups of data	
Data Storage Ways	Continuous storage: continuous save data according to the preset save time internal. Trigger storage: when alarm is triggered, it will save data every 1s.	
Communication	USB	
Size & Weight	Φ90×267 (mm); 590g(without batteries)	
IP Rating	IP65	

Ⅳ.Applications

- Radiation protection of nuclear facilities, nuclear regulation departments and the enterprises with radioactive sources
- Emergency response for Disease Control Centers and environment monitoring department
- Security of large-scale activities, embassies and consulates abroad
- Prevent illegal transportation of radioactive materials or nuclear terrorist attacks from occurring

18. Gamma Survey Meter

Model：TK-218

Ⅰ.Product Introduction

TK-218 is a handheld gamma survey meter with CsI crystal as its main detector and inherent GM tube to expand its detection range. With the advantages of high sensitivity, wide detection range, convenient data storage, long working time, light&portable and so on, make it a perfect choice for anti-terrorism emergency, mobile law-enforcing, radioactive sources surveying, dealing with radioactive work permit, etc.

Ⅱ. Main Features

- Light and portable, with typical searching alarm function
- Audible and visible alarm simultaneously, alarm threshold is continuously adjustable
- Several shortcut keys make operation easy and convenient
- High definition LCD with backlight

Ⅲ.Technical Specifications

Item	Parameter	
Detector	CsI(Tl)	GM tube
Energy Range	33keV~3.0 MeV	50keV~1.3 MeV
Sensitivity	>250CPS/(μSv/h)@^{137}Cs	0.1CPS/(μSv/h)@^{137}Cs
Range Dose Rate Counting Rate Calculated Dose	0.01μSv/h~60μSv/h 1~9999CPS 0.01μSv~10Sv	50μSv/h~100mSv/h
DER Relative error	≤±20%	
Display	High definition LCD	
Shortcut Keys	4 function keys	
Power Supply	4 dry batteries, continuous working time: ≥120h	
Data Storage	Can store 120000 groups of data	
Data Storage Ways	Continuous storage: continuous save data according to the preset save time internal. Trigger storage: when alarm is triggered, it will	

	save data every 1s.	
Communication	USB	
Size & Weight	Φ90×267 (mm), 590g(without batteries)	
IP Rating	IP65	
Temp. & Humid.	Temperature: -10℃ ~50℃ ,Humidity: ≤90% (30℃, non-condensing)	

Ⅳ.Applications

- Radiation protection of nuclear facilities, nuclear regulation departments and the enterprises with radioactive sources
- Emergency response for Disease Control Centers and environment monitoring department
- Security of large-scale activities, embassies and consulates abroad
- Prevent illegal transportation of radioactive materials or nuclear terrorist attacks from occurring

19. Neutron Survey Meter

Model：TK-219

Ⅰ.Product Introduction

TK-219 is a handheld neutron survey meter with ^{6}LiI（Eu） crystal as its detector. It has the function of surveying radiation and sending alarms, with the advantages of convenient data storage, long working time, light&portable and so on.

Ⅱ. Main Features

- Light and portable, with function of surveying radiation and sending alarms
- High sensitivity with 6LiI（Eu）crystal as its detector
- Freedom switch between the triple detecting functions: Dose Rate, Counting Rate, Calculated Dose
- High definition LCD with backlight
- Audible and visible alarm simultaneously, alarm threshold is continuously adjustable
- Several shortcut keys make operation easy and convenient

Ⅲ. Technical Specifications

Item	Parameter
Detector	^{6}LiI（Eu）
Energy Range	0.025KeV~14 MeV
Sensitivity	0.5CPS/(μSv/h)@^{252}Cf
Range Dose Rate Counting Rate Calculated Dose	0.1μSv/h~100mSv/h 1~999CPS 0.01μSv~1Sv
DER Relative error	≤±20%（200keV～7MeV）
Display	High definition LCD
Shortcut Keys	4 function keys
Power Supply	4 dry batteries, continuous working time: ≥100h

Data Storage	Can store 120000 groups of data
Data Storage Ways	Continuous storage: continuous save data according to the preset save time internal. Trigger storage: when alarm is triggered, it will save data every 1s.
Communication	USB
Size & Weight	Φ90×267 (mm), 590g(without batteries)
IP Rating	IP65
Temp. & Humid.	Temperature: -10℃ ~50℃，Humidity: ≤90% (30℃, non-condensing)

Ⅳ.Applications

- Radiation protection of nuclear facilities, nuclear regulation departments and the enterprises with radioactive sources
- Emergency response for Disease Control Centers and environment monitoring department
- Security of large-scale activities, embassies and consulates abroad
- Prevent illegal transportation of radioactive materials or nuclear terrorist attacks from occurring

20． Neutron Dose Equivalent (Rate) Meter

Model：TK-220

Ⅰ.Product Introduction

TK-220 is a quite light meter in the world for measuring neutron dose equivalent (rate) , which is developed by Beijing Tai Kun Industrial Equipment Co.,Ltd. Its ^{6}LiI (Eu) scintillator detector greatly improves the sensitivity of neutron detection. It is an intelligent, digital instrument with advantages of high sensitivity, excellent gamma rejection ratio, portable, light weight, easy to use, etc.

Ⅱ. Main Features

- High-performance 6LiI (Eu) scintillation crystal neutron detector
- 3.5 " high-definition color LCD screen with digital and analog displays
- Multiple communication interface for data management and remote control
- Audible and visible alarm simultaneously
- Alarm threshold is continuously adjustable, with function of timing dose measurement

Ⅲ.Technical Specifications

Item	Parameter
Detector	^{6}LiI(Eu) scintillator
Dose Range	0.01μSv~1Sv
Dose Rate Range	0.1μSv/h~100mSv/h
Sensitivity	0.6CPS/(μSv/h), @ ^{252}Cf
Energy Range	0.025eV~16 MeV
Angular response	≤±25%(0°~±90°, @ ^{252}Cf)
Repeatability	≤±20%
Gamma rejection ratio	≥100:1 (10m Sv/h, ^{137}Cs)
IP Rating	IP67
Temperature	-10°C~50°C
Power Supply	Rechargeable lithium battery (continuous working for 16 hours)
Weight & Size	4.7kg; 300×175×248(l×w×h)(mm)
Data Storage	Large-capacity memory, can store historical data for long period
Communication	USB, network port , RS485

Ⅳ.Applications

- Neutron dose equivalent (Rate) detection of nuclear power plants, research nuclear reactors, particle accelerators
- and places with isotopic neutron sources
- Emergency response for Disease Control Centers and environment monitoring department
- Anti-terrorism, border control, customs inspection, etc.

Section Three ． Radioactive contamination monitor

1. Whole-body γ Pollution Portal Speedy Monitoring System

Model：TK-301

Ⅰ.Product Introduction

TK-301 whole-body γ pollution speedy monitoring system, is an equipment which is used on the entrances of nuclear power plants or related nuclear facilities. People can pass through the monitor at the normal speed without pause. In this regard, it can satisfy the requirement of people rush hours.

Ⅱ.Main Features

- Complementary and even layout of detectors, no blind measurement area
- Modular design of detector, can expand the neutron detector
- Design of dual cameras and double place holders, realize the bidirectional passing
- The background updates dynamically, measurement value is net counting rate or radioactivity
- 8 inches video type industrial touch screen, display equipment's status
- Whether alarming, fault or abnormal background, it would all send out audible & visible hint
- Can use the handheld device to debug and monitor the monitor within a certain distance
- The software can automatically complete the regular calibration and save the calibration results
- Can be connected to the computers of monitoring center and security duty room , to realize remote monitoring
- All stainless steel shell and IP66 waterproof design

III.Technical Specifications

Item	Parameter
Detector	16 plastic scintillator detectors
Energy Range	50KeV~3 MeV
Thickness of Lead Shielding	25mm
Detector area	80L
Detection area	1600cm2
Pedestrian efficiency	2000/H
Weight	About 1200Kg

IV.Applications

- Entry and exit of nuclear power plant
- Entry and exit of nuclear facilities
- Nuclear medicine, nuclear research, etc

2. Whole Body γ Contamination Monitor

Model：TK-302

Ⅰ.Product Introduction

TK-302 Whole Body γ Contamination Monitor is independently researched and developed by Beijing Tai Kun Industrial Equipment Co.,Ltd.. It is used to detect the γ contamination of the staff who work on the radioactive sanitary outlets at nuclear power stations or related nuclear facilities. This monitor adopts a large area high performance plastic scintillator detector cooperating with the original non-blind spot detection design method. It can fully monitor the γ radioactive contamination of the whole body and indicate the contaminated position.

Ⅱ.Main Features

- Large area high performance plastic scintillatior detector
- Adopt non-blind detection design method, the total effective detection area is 20000cm2
- Speedy scan and detect the radioactive contamination, accurately indicate the contaminated position
- 6 pairs of infrared occupant sensors, accurate detection of the personnel's in and out and occupied
- Chinese or English interface and prompt tone is optional
- The alarm threshold is continuously adjustable
- The non-detection surface adopts lead shielding to reduce the influence of external radiation
- Can be connected with the monitoring center host to realize remote monitoring
- Comply with IEC61098-2003 standard

Ⅲ.Technical Specifications

Item	Parameter
Detector	8 plastic scintillator detectors
Energy Range	5KeV~3 MeV
Thickness of Lead Shielding	25mm
False Alarm Rate	< 0.1%
Detection Limit	1600Bq
Power	220V AC/50HZ
UPS	Working time without power > 2 hours
Display	10.4 inches colorful LCD touch screen
Communication	TCP/IP
IP Rate	IP65
Electromagnetic Compatibility	Comply with CE Standard
Working Conditions	Temperature：-20℃-50℃，Humidity：<95%
Size	Outer Size: 2200H×850W×800D（mm）; Inner Sizer: 2000H×650W×800D（mm）
Weight	About 1200Kg

Ⅳ.Applications

- Entrance and exit of nuclear power plant
- Entrance and exit of nuclear facilities
- Nuclear medicine, nuclear research, etc.

3. Whole Body α β Contamination Monitor

Model：TK-302

Ⅰ.Product Introduction

TK-302 Whole Body α β Contamination Monitor is installed on the radioactive sanitary outlets at nuclear power stations or related nuclear facilities to detect whether there is α β radioactivity on the body surface of passing work staff. If the detected radioactivity is passing the set threshold, it would send out sound & light warning and display the contaminated position on LCD screen. It can find the contamination timely and prohibit its transfer

Ⅱ.Main Features

- High performance thin sheet plastic scintillator with zinc sulfide detector
- Unique nuclear electronics circuit, promoting this monitor's performance
- Reasonable detector arrangement can meet the requirement of whole body contamination monitoring
- On the head position, it is equipped with a lift detector to meet the needs of different heights
- Two-step measurement model
- Rapid scanning and detection of radioactive contamination, accurate location of contaminated areas
- Chinese or English interface and prompt tone is optional
- The alarm threshold is continuously adjustable
- Reserve the installation position of the personal dosimeter reading device
- Can be connected with the monitoring center host to realize remote monitoring
- Comply with IEC61098-2003standard

Ⅲ.Technical Specifications

Item	Parameter
Detector	21 imported plastic scintillator detectors
Total Area of Detector	13000cm^2
Measure Height	160~200cm
Energy Range	α：3~11MeV　　β：50KeV~3MeV
Detection Limit	α： < 0.04Bq/cm^2　　β： < 0.2Bq/cm^2
Detection Efficiency	α：45% @^{241}Am　　β：37% @^{90}Sr
Outer Power	220V AC，50Hz
Display	12.1 inches colorful LCD touch screen
Communication	Ethernet, USB
Electromagnetic Compatibility	Comply with CE Standard
Working Conditions	Temperature：0℃-45℃，Humidity：<95%
Outer Size	2350H×1000W×1200D（mm）
Inner Size	2000H×500W（mm）
Weight	About 500Kg

Ⅳ.Applications

- Entrance and exit of nuclear power plant
- Entrance and exit of nuclear facilities
- Nuclear medicine, nuclear research, etc.

4. NaI Detector Stand-Up Whole-Body Counter

Model：TK-304

Ⅰ. Product Introduction

TK-304 is a stand-up whole-body counter, using two 10 × 10 × 40cm large NaI crystals as a detector to scan the entire body. TK-304 adopts hexagonal shadow shielding design on the structure, which ensures the ultra-low background environment and facilitate the rapid access of personnel, as shown in Figure 1. TK-304 can give a comparison of the body scanning count rate and the background count rate, and also give the radioactive activity measurement results using the built-in efficiency calibration factor for the Chinese standard body model in this instrument. TK-304 uses the modular design, easy to installation and commissioning. Table 1 gives the detection limits in the case of a measurement of 60 seconds.

Compared with the current main international NaI whole-body counter, TK-304 has the most distinctive feature in nuclide identification, which adopts the particle arrival time series analysis and fuzzy clustering method in addition to the energy spectrum analysis technology. With these technologies, the radionuclides recognition sensitivity of TK-304 is far better than that of like products, with very a low misidentification rate, providing a strong support for the staff health protection.

Ⅱ. Main Features

- By using the sourceless efficiency calibration software based on the standard Chinese body model, it is able to carry out accurate measurement without the expensive human body model, which makes the body counter easy to understand and use practically;

- A unique nuclide recognition algorithm is used, with high sensitivity and very low false alarm rate;
- Highly automatic measurement, and automatic generation of reports;
- Integration of measurement and internal irradiation assessment;
- The measurement procedure conforms to the relevant IAEA standards.

Ⅲ.Technical Specifications

Table 1 60s detection limits of typical nuclides

Nuclide	Standard body (Bq)	Air (Bq)
^{60}Co	181	148
^{137}Cs	144	137
^{134}Cs	118	111

- Detectors: two 10 × 10 × 40cm NaI crystals;
- Energy resolution: <9%;
- Multi-channel: 1024 channels;
- Area: 4 square meters;
- Weight: 4.8 tons;
- Power: less than 200 watts;
- Detection limit: see Table 1;
- Operating temperature: -10C° to 40C°;
- Operating Humidity: <92%.

Ⅳ.Applications

- The system is mainly used in internal irradiation inspection for radioactive practitioners in nuclear power plants, nuclear materials production, reprocessing facilities and other fields, and is used as a nuclear emergency equipment in the disease prevention and control center.

5. Hand & Foot Contamination Monitors with Frisking Probe

Model：TK-305

Ⅰ. Product Introduction

TK-305 Hands & Feet Surface Contamination Monitor is mainly used to do the radiation safe detection of the personnel who work in the radioactive site of the Nuclear facilities. It mainly detects whether the surfaces of personnel's hands/feet/coats are contaminated by radioactive rays.
If the detected radioactivity is stronger than the pre-set threshold, it will send out the alarm signal and display the contaminated points and its strength. That can avoid the spread of radioactive contamination.

Ⅱ. Main Features

- Easy & convenient operation
- A colorful & touch-sensitive LCD screen
- If detect the contamination, it would send out the alarm signal and display the contaminated points
- Convenient maintenance without daily work

Ⅲ. Technical Specifications

Item	Parameter	
Detected Rays	α、β	
Detected Points	Surfaces of Hands & Feet & Coats	
Input Window Area of Single Detector	Hand	354cm^2
	Foot	557cm^2
Background Counting	Hand	α <0.1cps; β <15cps
	Foot	α <0.2cps; β<40cps

Response	Hand Sr-90/Y-90：0.36，Am-241：0.42 Foot Sr-90/Y-90：0.40，Am-241：0.42
Display	A colorful & touch-sensitive LCD screen
Power	100~240V AC，50/60HZ
Work Environment	Temperature：-5℃~40℃ Relative Humidity：0~90%
Size & Weight	About 520（W）×1240（H）×760（D）mm; About 50Kg
Standard	JJG1102-2014

Ⅳ. Applications

- The entrance/exit of control area in different nuclear facilities

6. Articles γ Contamination Monitor

Model：TK-306

Ⅰ.Product Introduction

TK-306 Article γ Contamination Monitor is used to monitor the radioactive contaminated condition of tools, laptop, calculator, etc. in the control area of nuclear power plant and other nuclear facilities. Its separate detection unit adopts same size plastic sincitillator matched with high performance photomultiplier. It is shielded with thick lead to reduce the interference of natural background. It can quick detect and indicate the contaminated area. When the detected radioactivity is passing the set threshold, it would send out warning signal to avoid the second contamination.

Ⅱ.Main Features

- Automatic background measurement and update
- Sound & light warning, voice prompt, continuous adjustable warning threshold
- Colorful LCD touch screen, with short-cut keys operation
- Industrial computer control, embedded Windows XP operating system
- LED status display：Normal, Measurement, Pollution, Fault
- Measured value displays: CPS, Bq
- Display the contaminated positions

Ⅲ.Technical Specifications

Item	Parameter
Detected Ray	γ
Detector	Plastic scintillator detector，4 or 6
Energy Range	25KeV～3MeV
Detector Size	300×300×50 mm
Chamber Size	400（W）×550（D）×400（H）(mm)

Detect Items	Tool, laptop, calculator, etc.
Detect Limit	^{60}Co：60Bq，^{137}Cs：110Bq
Thickness of Lead Shielding	25mm
Working Conditions	Temp. : -10～45℃，Humid. : ＜95% (non-condensing)
Weight	About 670kg

Ⅳ. Applications

- Entrance and exit of nuclear power plant
- Entrance and exit of nuclear facilities

Section Four． Radioactive waste measurements

1. Barreled Radioactive Waste Measurement System

Model：TK-401

Ⅰ. Product Introduction

TK-401 barreled radioactive waste measurement system is a non-destructive measuring device having independent intellectual property rights in China for measuring the type and content of nuclear material in nuclear waste, which is an ideal device to measure radioactive waste in nuclear power station and decommissioning nuclear facilities. In the measurement process of the system, the curve of changes in the macroscopic interface of matrix material of the measuring object with the different energy can be obtained through the transmission source axial segmental scanning, and the efficiency calibration curve of each segment can be calculated using a Monte Carlo method based on this, to achieve the measurement of activity by segment. The measurement of non-uniform γradioactive waste activity can be achieved. TK-401 consists of the following three sub-systems:

- Mechanical device sub-system: including sample turntable, transmission source components and lifting devices of the detector combination, automatic weighing module, motor and automatic control device.
- Data acquisition subsystem: including transmission source components (20mCi1^{52}Eu source), P-type wide-energy coaxial HPGe detector, GammaSpectrum-1 digital spectrometer, and electric cooling device.
- Nuclide content analysis software: GammaNDA non-destructive nuclide content measurement software, Gamma-4 sourceless efficiency calibration software, and Gamma-4 energy spectrum acquisition and analysis software.

Ⅱ. Main Features

- With completely independent intellectual property rights, the maintenance and repair services can be provided to user at any time, and other technical service in the measurement process can also be provided at any time;

- Three methods are available to measure the content of nuclear material, including the segmented gamma scanning method (SGS), the sourceless efficiency calibration method and the segmented sourceless efficiency calibration method. If SGS can not work normally, the sourceless efficiency calibration method is used instead of SGS method, thereby increasing the mean time between failures (MTBF) of the system;
- Monte-Carlo method is used to calculate the efficiency calibration factor accurately, which improves the accuracy of SGS measurement.
- Waste barrel loading and unloading sockets can be customizable, to achieve seamless connection with the measurement site;
- The entire shielding room is optional, to achieve measurement of a very low level of radioactivivty;
- Software system is highly integrated, and the control and self-inspection of the mechanical system and the electronic system can be achieved on the main control computer simultaneously, as well as calibration, measurement, analysis, output and report generation;
- Electronic equipment adopts high-reliable redundant design, to ensure high reliability of the system.

Ⅲ.Technical Specifications

- Main measured nuclides: ^{60}Co, ^{137}Cs, ^{59}Fe, ^{241}Am, ^{235}U, and ^{238}U;
- Lower detection limit: 4×10^{3}Bq/kg(^{60}Co);
- Upper detection limit: 1.2×10^{7}Bq/kg(^{60}Co)；
- Energy range: 40keV ~ 10MeV (optional detector);
- Nuclide content accuracy: better than 20%;
- Waste bucket volume: 200L (less than 200L optional; 400L is customizable);
- MTBF: 12000 hours;
- MTTR: ≤ 8 hours.

Ⅳ. Applications

- Used in the measurement of radioactive waste or material in nuclear power plants, reprocessing plants, military, nuclear fuel production enterprises and so on; other non-barreled radioactive waste measurement devices can be customized.

2． In-Situ High-Purity Germanium Gamma Spectrometer Measurement System

Model：TK-402

Fig. 1 In-situ high purity germanium gamma spectrometer measurement system

Ⅰ. Product Introduction

- Plane or coaxial high purity germanium detector is equipped with a pre-amplifier set in the portable refrigeration unit;
- Multi-channel spectrometer;
- Data analysis software package is provided, including hardware settings, energy spectrum acquisition and analysis, and sourcelesse efficiency calibration;
- Lead shielded device with a collimator;
- Trolleys and transport cases;
- Laser range finder;
- Accessories: liquid nitrogen filling funnel, power supply, etc.;
- Cables and text descriptions;
- A specially developed sourceless efficiency calibration software is used to calculate the detection efficiency of the measurement object with complex shape.

Ⅱ. Main Features

- Optimal size and weight for portable Application
- Placed on a trolley of a lead shield collimator;
- With the liquid nitrogen filled, the detector can reach the cooling temperature in a very

short time;

- Simple operation and maintenance;
- Laser measurement instructions;
- In any direction within 360°;

Ⅲ.Technical Specifications

Parameter	Index
Energy range (keV): Standard type Extended type	 40-10000 3-10000
High purity germanium detector efficiency (%):	The typical value is 30; detectors with other efficiency is optional
Energy resolution of 30% efficiency detector (keV) @122keV @1.33MeV	 0.875 1.85
Peak – to – Compton ratio	58:1
Refrigeration time (h)	4**
Automatic running time (days)	1-5**
Thickness of aluminum package (mm)	7
Weight of detector and Dewar bottle:	5-12**

- The front cable connector has a standard NIM interface: DC power supply ± 12V-D-Sub-9 pin
- Detection efficiency of high-purity germanium detector: 10% -100%
- Depending on the volume of Dewar bottle and the efficiency of detector.

Ⅳ. Applications

- The in-situ high purity germanium gamma spectrometer measurement system can be used for measurements of radioactivity of gamma and X-ray, including radioactive substances in the environment, radioactive items in industrial and agricultural products, and enterprises engaging in the storage and disposal of nuclear waste.

Section Five． Underwater Radioactivity Measuring Device

1. Underwater Gamma Spectrometer

Model：TK-501

Fig.1 TK-501 Underwater Gamma Spectrometer

Ⅰ.Product Introduction

TK-501 Underwater Gamma spectrometer is a highly sensitive underwater radioactive qualitative and quantitative monitoring instruments which has the functions of the measurement of Gamma radiation dose rate, recognition of artificial radionuclide and monitoring activity continuous.

The detector of TK-501 can be selected as a NaI or LaBr3(4L NaI/2L NaI/φ3”*3” LaBr3/φ2”*2” LaBr3). The detector is encapsulated in a metal shell and carbon phenolic material. So that,it has strong waterproof and anti-pressure ability and little ray absorption

TK-501 can store the data locally and take out data for playback and analysis as time setting, and can analyze the data in real time on the computer which connected with the spectrometer. Data communication links can be customized.

Ⅱ. Main Features

The waterfall map shows radioactive water. The waterfall map shows radioactive water‘soccurrence and disappearance in real time. User can analyze the spectrum of the radioactive material when it appears(Figure 2).

(1) Showing the the dose rate curve changes by over time.

(2) It has a highly sensitive nuclide recognition function. Fuzzy clustering, particle time series analysis and energy spectrum analysis technology are appliedintegrally to make the sensitivity of nuclide identification much higher than other similar kind of the production. When the dose rate of artificial

radionuclides exceeds 5% of the background, it can be identified in 10 seconds.The false recognition rate is very low.

(3) Activity calculation. A special multi peak analysis algorithm is specially designed to calculate the net counting rate of the multi peak as the poor energy resolution of the scintillation detector. The built-in efficiency scale factor curve varies with the energy change, which is specially designed for the calculation of the saturated water volume of different energy rays.

(4) Natural background deduction technology.Artificial radionuclide alarm is designed by natural background deduction technology.

(5) Data transmission. Store the data locally,transmit the data in real time,wireless remote transmissioncustomizable.

(6) Continuous monitoring and alarm of artificial radionuclides. Data terminal display water dose rate curve, count rate curve, spectrum waterfall chart, and cumulativespectrum change over time. It is alarmed, when the identification of artificial radionuclides, counting rate area integral counting balance is broken,andthe dose rate exceeds the preset threshold.

(7) Continuous display the changes of radioactive activity over time (Fig3).

(8) The built-in temperature control device can heat the spectrometer at low temperature to ensure that the detector works in suitabletemperature.

(9) Spectra-stabilize automatically.

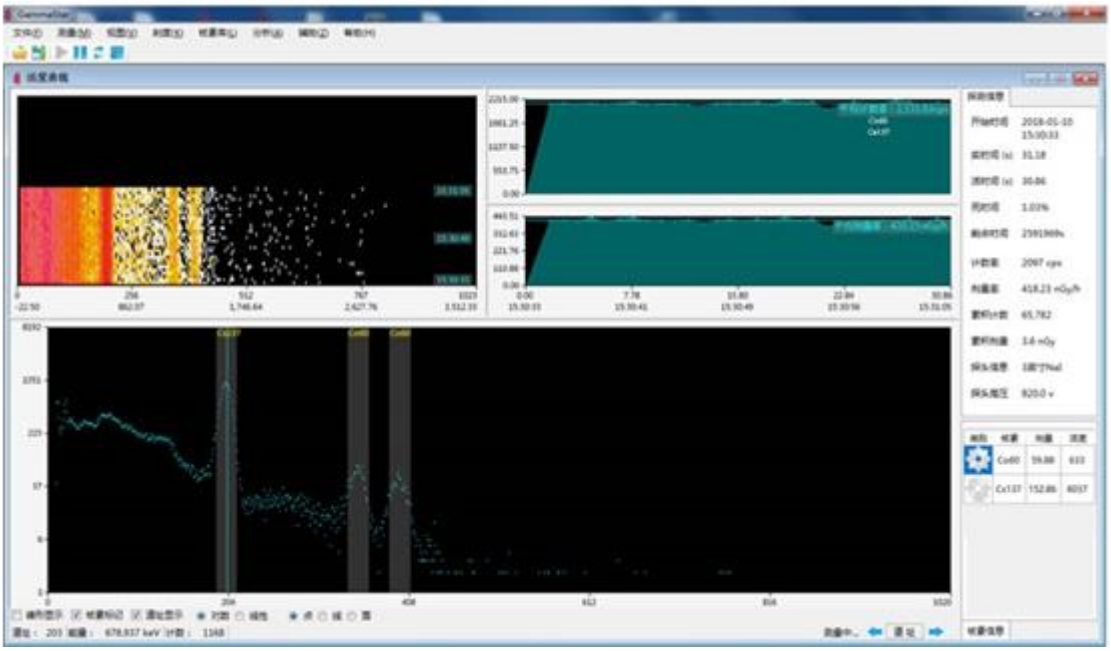


Fig 2 TK-501 software interface（waterfall plot、energy spectrum analysis、dose rate changing curve over time）

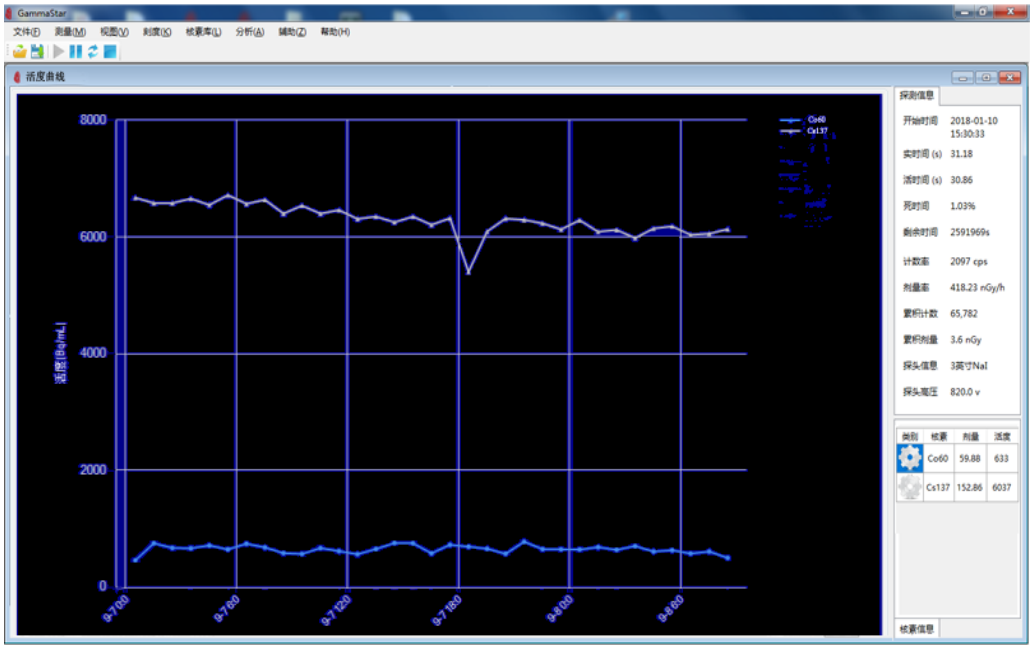


Fig 2 TK-501 software interface(artificial radioactive nuclide changing curve over time)

	Φ17.2*17.2	10*10*40
27	1.24E-05	1.41E-05
47	1.72E-05	2.23E-05
59	2.03E-05	2.72E-05
81	2.55E-05	3.19E-05
100	2.79E-05	3.54E-05
150	3.21E-05	4.00E-05
200	3.54E-05	4.21E-05
300	3.84E-05	4.46E-05
500	4.05E-05	4.31E-05
662	4.16E-05	4.49E-05
1000	4.20E-05	4.29E-05
1173	4.18E-05	4.39E-05
1332	4.19E-05	4.28E-05
2000	4.42E-05	4.32E-05
2500	4.48E-05	4.26E-05
3000	4.62E-05	4.06E-05

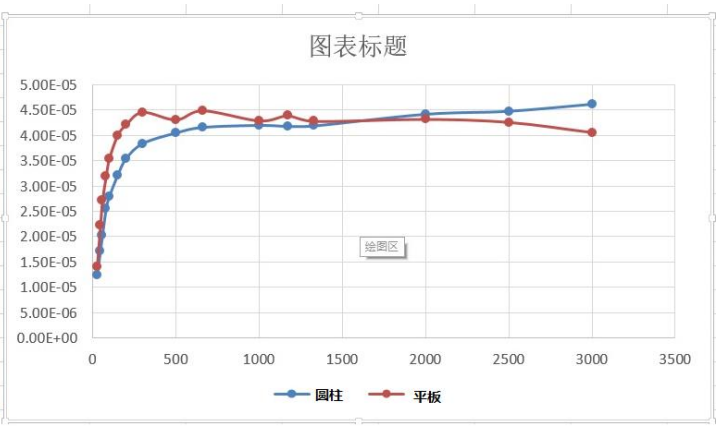


Fig4 Comparison efficiency of underwater detectionof different shape 4 - liter NaI detectors.

Ⅲ.Technical Specifications

- Detector：4L（10cm×10cm×40cm）NaI
- 2L（10cm×10cm×20cm）NaI
- 3'×3'LaBr3
- 2'×2'Labr3
- MCA：1024 or 4096
- Energy resolution：＜8%（NaI,@661.7keV），＜3%（Labr3@661.6keV）
- Casing：Stainless steel ， Aluminum alloy，Carbon phenolics
- Maximum depth：50m(can reach 100m)
- Sensitivity:5Bq/m3 in 10 minutes(Fuzzy clustering, particle time series analysis and energy spectrum analysis technology)
- Automatic energy spectrum analysis , built-in efficiency calibration factor, automatic activity calculation.
- Display by waterfallplot. The artificial radionuclide abnormality is displayed intuitively.
- Alarming:Artificial radioactivity alarm,NNBR

Ⅳ.Applications

- TK-501 Underwater Gamma spectrometer is applied to water radioactivity monitoring form Water plant, environmental protection Department, fought of army , nuclear emergency.

2. GammaSpect Stationary Monitoring System

Model：TK-502

Ⅰ.Product Introduction

GammaSpect is a flexible gamma spectroscopic system.It is designed to used for nuclide identification and gamma contamination monitoring in routine surveillance and emergency situation.It can calculate the ground contamination (Bq/m2),the activity concentration(Bq/m3 in the air or Bq/L in the water) and the dose rate .

Ⅱ. Main Features

- Nuclide identification
- Dose and dose rate
- 3’×3’ NaI(Tl)
- Adapted to air,soil or water application
- Ethernet, 4G/LTE,WIFI
- GPS module
- Can be easily deployed in extreme climate
- Central operation and data storage

- 16GB storage
- Air monitoring ,soil monitoring,water monitoring
- Solar supply for air monitoring and soil monitoring

Ⅲ.Technical Specifications

- Detector：3’×3’NaI（TI)
- Dose rate range ： 10nSv/h － 100μSv/h（with GM tube to10Sv/h）
- Energy resolution ： Cs137（662KeV）<7.5%
- Energy range: 30KeV to 3MeV
- MCA: 1024
- Operation temperature: -40℃ - +60℃
- Power: 2.5W(average)
- Dimension enclosure:Φ200*700mm
- Weight:15Kg
- Protection class:IP68

Ⅳ.Applications

- TK-502 GammaSpect Stationary Monitoring System is applied to water radioactivity monitoring form Water plant, environmental protection Department, fought of army , nuclear emergency.

Section Six． Area Radiation Measurement

1．Area Gamma Alarm &Monitoring

Model：TK-601

Ⅰ. Product Introduction

The AGam area radiation alarm instrument is an area nuclear radiation alarm device developed by Beijing Tai Kun Industrial Equipment Co.,Ltd. The instrument adopts Geiger–Müller tubes with energy compensation and ^{3}He neutron counters with polyethylene moderator as the main detectors. In respect of gamma-ray detection, the two G-M tubes designed for the high and low range can cover both the high and low range and ensure the accuracy of measured data to the greatest extent. In respect of neutron detection, with large ^{3}He neutron counters, the instrument can meet the sensitivity requirement for on-site measurement. The probes communicate over RS485 links, with the maximum transmission distance up to 1.2km. The host computer is equipped with RS485 and RJ45 communication interface, able to conduct network measurement when combined with upper computer software of our company.

The standard configuration of AGam consists of 4 trains of gamma detectors, 4 trains of neutron detectors, and users can set alarm setpoint for each train. The number of neutron detector and gamma ray detector is at customer’s choice

Ⅱ. Main Features

- The detector type and amount can be customized as you like.
- The alarm setpoint is adjustable.
- Users can choose real-time dose mode or accumulative dose mode, and can query the data

in real time.

- The host computer has sound and light alarm, and state indicator. Users can know about the operation state of the host computer and whether the environment dose has reached the critical point via corresponding indicators.
- The host computer has the administrator mode, in order to help users to protect system operations which require higher privileges.

Ⅲ. Technical Specifications

1. Gamma radiation measurement
   - Detectors: Geiger–Müller counter tubes with energy compensation;
   - Energy range: gamma ray: 30keV~3MeV;
   - Measurement range: 0.1 μSv/h ~ 10Sv/h, and can bear overloads of 10 times the upper measurement limit;
   - Inherent error: less than 10% (^{137}Cs);
   - Alarm response time: less than 150ms;
   - Relative error: ≦±20%
   - Isotropic response time: (1) ≦±20%(0°~60°) (2) ≦±50% (>60°)
   - Preheating time: 5min
   - Alarm setpoint: > 10μGy/h (can be set artificially)
2. Neutron detection
   - Detectable range: 0.025eV~25MeV;
   - Measurement range: 10nSv/h ~ 10mSv/h;
   - Gas filling: 103 cm^3;
   - Gas pressure: 10atm;
   - Alarm setpoint: > 0.1μGy/h (can be set artificially);
   - Temperature range: -10℃ ~ 50℃.
3. Total reliability indicators:
   - MTBR: 15,000h;
   - MTTR: 0.5h;
   - Protection level: IP65.

Ⅳ. Applications

- TK-602 can be used in area gamma/neutron radiation detection, dose rate measurement, criticality alarm and other fields. It is applicable for network measurement when combined with upper computer software of Beijing Tai Kun Industrial Equipment Co.,Ltd.

2．Criticality Detection System（Gamma）

Model：TK-602

Ⅰ. Product Introduction

The TK-602 gamma-ray criticality alarm instrument is an alarm device for gamma-ray criticality incident, which is developed by Beijing Tai Kun Industrial Equipment Co.,Ltd. The instrument adopts Geiger–Müller counters with energy compensation as the main detector. With two G-M tubes designed for the high and low range respectively, the instrument can cover both the high and low range, ensuring the accuracy of measured data to the greatest extent. The instrument has three detection probes, and only if more than two of the three probes reach the alarm state under the criticality alarm mode, the critical value is considered to be reached. It has higher detection confidence level than traditional two-probe design. The probes communicate over RS485 links, and the maximum transmission distance is up to 1.2km. The host computer is equipped with RS485 and RJ45 communication interface, able to conduct network measurement when combined with upper computer software of our company.

Ⅱ. Main Features

- f the device, and each probe adopts dual G-M tubes, which has a wider measurement range.

Under the criticality alarm state, the device uses a 2 out of 3 mode to determine the critical state value, which has a higher reliability.

- The alarm setpoint is adjustable.
- Users can choose real-time dose mode or accumulative dose mode, and can query the data in real time.
- The host computer has sound and light alarm, and state indicator. Users can know about

the operation state of the host computer and whether the environment dose has reached the critical point via corresponding indicators.

- The host computer has the administrator mode, in order to help users to protect system operations which require higher privileges.

Ⅲ. Technical Specifications

- Detectors: Geiger–Müller counter tubes with energy compensation;
- Energy range: gamma ray: 30keV~3MeV;
- Measurement range: 0.1 μSv/h ~ 10Sv/h, and can bear overloads of 10 times the upper measurement limit;
- Inherent error: less than 10% (^{137}Cs);
- Alarm response time: less than 150ms;
- Relative error: ≦±20%
- Isotropic response time: (1) ≦±20%(0°~60°)

  (2) ≦±50% (>60°)
- Preheating time: 5min
- Alarm setpoint: > 10μGy/h (can be set artificially)
- MTBR: 15,000h;
- MTTR: 0.5h;
- Protection level: IP65;
- Temperature range: -10℃ ~ 50℃.

Ⅳ. Applications

TK-602 can be used in area gamma radiation detection, dose rate measurement, gamma-ray criticality alarm and other fields. It is applicable for network measurement when combined with the upper computer software of Beijing Tai Kun Industrial Equipment Co.,Ltd.

3. Criticality Detection System(Neutron)

Model：TK-603

Ⅰ. Product Introduction

The TK-603 neutron criticality alarm instrument is a neutron criticality alarm device developed by Beijing Tai Kun Industrial Equipment Co.,Ltd. The instrument uses ^{3}He neutron tubes from American LND company as the probe detectors, with polyethylene as moderator and boric material as energy compensation material which enables the neutron probes to have good energy response to from thermal neutrons to fast neutrons. The criticality alarm instrument has three detection probes.Under the criticality alarm mode, only when more than two of the three probes reach the alarm state, the critical value is considered to be reached, so it has higher detection confidence level than traditional two-probe design. The probes communicate over RS485 links, with the maximum transmission distance up to 1.2km. The host computer is equipped with RS485 and RJ45 communication interface, able to conduct network measurement when combined with upper computer software of our company.

Ⅱ. Main Features

- The three-probe design widens the detectable range of the device, and each probe adopts ^{3}He tubes as the measurement unit.
- The alarm setpoint is adjustable.
- Users can choose real-time dose mode or accumulative dose mode, and can query the data in real time.
- The host computer has sound and light alarm, and state indicator. Users can know about

the operation state of the host computer and whether the environment dose has reached the critical point via corresponding indicators.

- The host computer has the administrator mode, in order to help users to protect system operations which require higher privileges.

Ⅲ. Technical Specifications

- Detectors: ^{3}He neutron proportional counter tubes;
- Detectable range: 0.025eV~25MeV;
- Measurement range: 10nSv/h ~ 10mSv/h;
- Gas filling: 103 cm^3;
- Gas pressure: 10atm;
- MTBR: 15,000h;
- MTTR: 0.5h;
- Preheating time: 5min
- Alarm setpoint: > 0.1μGy/h (can be set artificially);
- Protection level: IP65.
- Temperature range: -10℃ ~ 50℃.

Ⅳ. Applications

- TK-603 can be used in area neutron radiation detection, dose rate measurement, neutron criticality alarm and other fields. It is applicable for network measurement when combined with upper computer software of Beijing Tai Kun Industrial Equipment Co.,Ltd.

4. Base Station Type Unattended Gamma Ray Monitoring Station

Model：TK-604

Ⅰ. Product Introduction

The base station type unattended gamma ray monitoring station, used for stationary monitoring, can be quickly deployed in emergency areas. It can be powered by built-in batteries or solar panels, and communicate through LTE or radio.

Ⅱ. Main Features

- Detects trace artificial nuclides quickly.
- Online spectrum analysis.
- Nuclide identification at the detector.
- Supports international standard data protocol N42.42.
- Needs no base platform to fix on.
- Stable automatic operation under extreme environment.
- Integrated design, easy for maintenance.
- Supports very high protection level of IP68.
- Movable, with telescopic and foldable brackets, easy for installation.
- Wireless data telecommunication.

- Optional GPS module.

Ⅲ. Technical Specifications

- Detector type: NaI(TI) crystal;
- Detector size: 3’×3’
- Dose rate range: 10nSv/h – 400μSv/h (10nSv/h – 100mSv/h with an optional G-M tube)
- Energy resolution: Cs137 (662KeV) <6.9%FWHM
- Energy range: 30keV~3MeV;
- Number of channels: 8192 channels (2048 channels used)
- Detector operating temperature: -40℃ - +60℃
- Power consumption: 2.5W (average)
- Diameter: 80/120mm
- Height: 1040mm
- Weight of the stationary type: 25kg

Ⅳ. Applications

- Monitoring of surrounding areas of nuclear power plants
- Monitoring of laboratories
- Emergency monitoring
- Mobile monitoring network
- Disease control monitoring

5. Reactor primary circuit water radioactive activity on line measurement& Fuel element failure online and real time measurement system

Model：TK-605

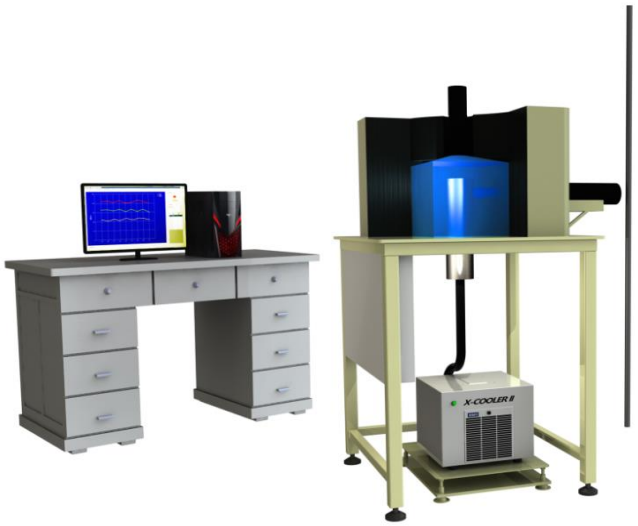


Fig1 Fuel element failure online measurement system

Fig2 Field Application in nuclear plant

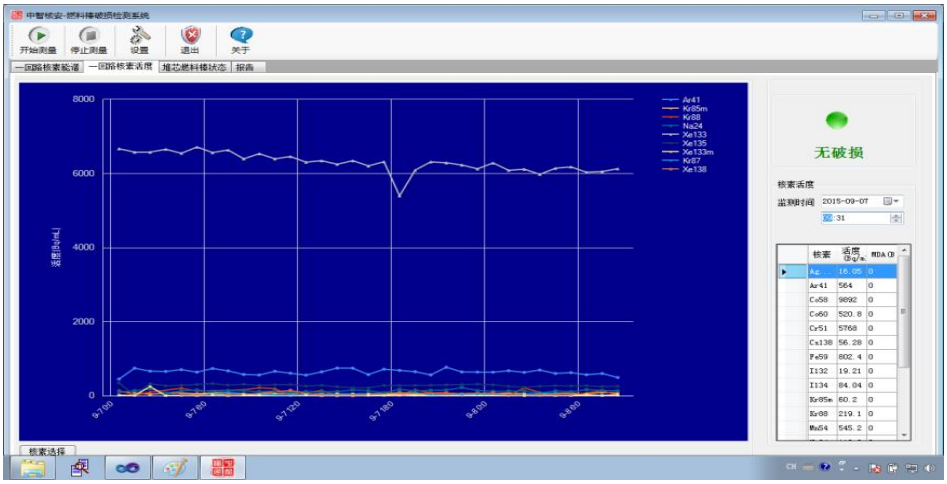


Fig.3 Reactor primary circuit water radionuclide activity curve of over time

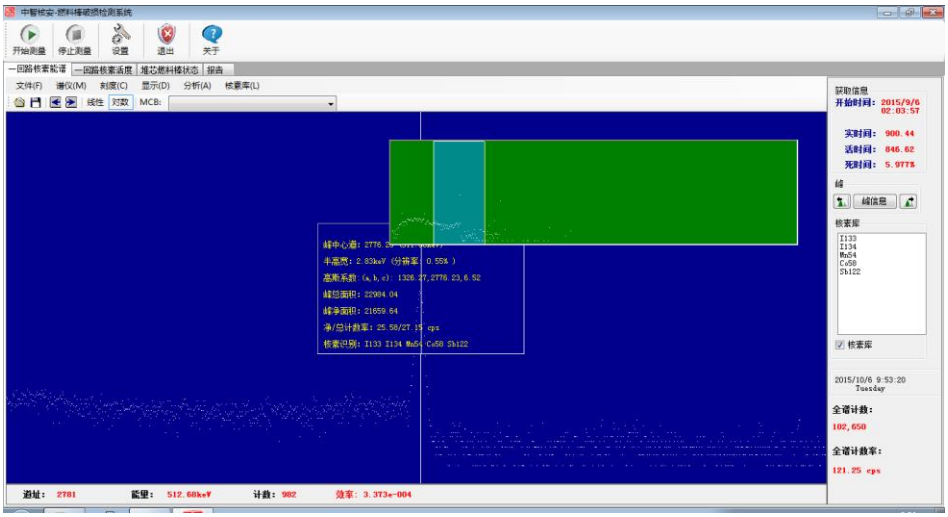


Fig 4 activity analysis interface

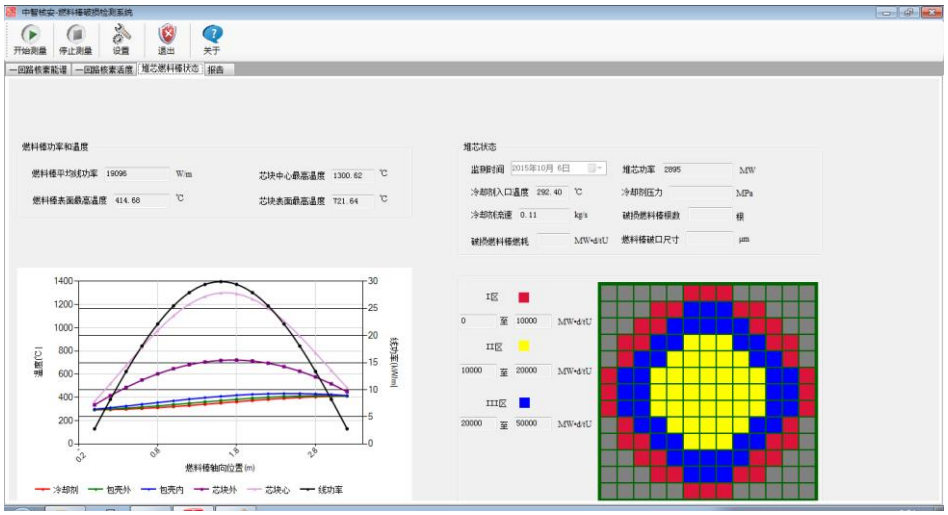


Fig 5 Reactor core fuel rod condition

Ⅰ.Product Introduction

TK-605 Reactor primary circuit water radioactive activity on line measurement& Fuel element failure online and real time measurement system produced by Beijing Tai Kun Industrial Equipment Co.,Ltd is an innovative product with full intellectual property rights.This measurement adopt the principle of online anti – Compton and can detect reactor primary circuit water radioactive activity. It is reached that low energy radionuclide and high energy radionuclide detection efficiency keep balance by well designed. So that the activity of low-energy and high energy γ ray can be measured simultaneously.

TK-605 calculates and analyzes the damage condition of fuel rod including the count of damaged fuel rod, size of damage and the position of fuel rod according to working condition information of reactor and fuel element parameter and key nuclide activity of reactor primary circuit water.

TK-605 Reactor primary circuit water radioactive activity on line measurement& Fuel element failure online and real time measurement system is comprised by Anti-Compton on line measurement subsystem, fuel element damage analysis subsystem and measure information management subsystem. Measurement system consists of HPGe detector, electronic cooler, ring detector, lead shield device, digital MCA, full-automatic spectrum analysis software and source-less efficiency calibration software can make on line continuous monitoring for 3 kev~10 MeV fission and activity product of coolant in reactor primary circuit water. TK-605 has successfully applied in the nuclear plant and it is highly evaluated by users in the accuracy of measurement results and the reliability of long-term operation. .

Ⅱ. Main Features

- TK-605 is the world's first set of Reactor primary circuit water radioactive activity on line measurement& Fuel element failure online and real time measurement anti-Compton HPGe measurement system which is independent researched and developed in China. It is reached that low energy radionuclide and high energy radionuclide detection efficiency keep balance by well designed. So that the activity of low-energy and high energy radionuclide can be measured simultaneously and the effect of Compton scattering on radioactivity measurement is effectively suppressed.
- Fuel damage analysis of TK-605 was tested by two typical cases in the world. Analysis

result is highly consistent with the actual case.TK-605 can make reliable measurement form low energy radionuclide to high energy radionuclide in the Application of one of Chinese plant and the measurement result is consistent with the sampling measurement result in uncertainty。

- The accuracy measurement of TK-605 is consistent with sampling measurement. The long-term stability and accuracy is highly recognized by the users in the operation process in nuclear plant.
- TK-605 adapts to the demand of the online measurement. In order to keep the product's highly availability, we can replace the electronics when it is broken and recover it within 72 hours.

Ⅲ. Technical Specifications

- Major nuclide of measurement：Kr-85m、kr-87、kr-88、Xe-133、Xe-135、Xe-138、I-131、I-132、I-133、I-134、I-135、Cs-134、Cs-137、Cs-138、Co-60、Co-58、Fe-59、Na-24 etc，show the measurement result uniformly spaced 15 mins by 15 mins、30min and 45mins and radionuclide activity curve over time in real time;
- Detection low limit：50Bq/ml（Xe-133），show activity measurement result and minimum detectable limit at the same time；
- Measuring time：15mins~600mins；
- Error of damaged rod account：≤20%；
- MTBF：12000 hours；
- MTTR：≤8 hours。

Ⅳ. Applications

- Radionuclide activity measurement online of Reactor primary circuit water，fuel element failure online measurement in nuclear plant；Radionuclide activity measurement online of Reactor primary circuit water，fuel element failure online measurement in marine power reactor.

Section Seven． Tritium Air Monitors

1．Tritium Monitor

Model：TK-701

Ⅰ. Product Introduction

The TAM series of Tritium Air Monitors are comprised of mains unit and ionization chambers. Main unit is a SCM System based on 8031 sing chip system. These Tritium Air Monitors are designed to have a wide variety of features, including automatic control, automatic zero setting, multi-parameter display, data monitoring, processing and storage, and warning and communication. By employing modular design, this series of Monitors provide optional installation and combination suitable for automatic continuous air monitoring for the presence of tritium in the environment, glove box at nuclear facilities, highly radioactive noble gases and in a wide range of situations.

Type	**TK-C200** **Air tritium monitor**	**TK-C400** **Wide range** **air tritium monitor**	**TK-C600** **Identification type** **air tritium monitor**
Detector	Four cylindrical silk wall ionization chambers with gamma differential compensation, each with effective volume of 2 L	Silk wall ionization chambers, each with effective volume of 1 L	Gas-flow ionization chamber for beta, radon, alpha measurement
Range	40 Bq/L－8.0×10^{7} Bq/L	2×10^{2} Bq/L－2×10^{10} Bq/L	0.01－10^{5} Bq/L
Precision	Relative error≤5% Coefficient of variance ≤2%	Relative error≤20% Coefficient of variance ≤2%	Intrinsic error≤±10%
Response time	Adjustable, recommended as 5 min for environmental monitoring	Automatically adjustable within 3-30s	15min
Discrimination	—	—	compensation coefficient ≥95%
Alarm threshold	Configurable setting within range		
Communication	RS-485 standard interface, baud rate 19200 bps		

Interface	
Total weight	20 kg(TAM-500: 75 kg), detector unit: 15 kg，main unit: 1.25 kg
Power supply	AC 220 V ±10%，50Hz ±10%，power dissipation ≤ 6 W
Operating environment	temperature: 0℃－50℃, relative humidity: 10%－90% at 35℃

Ⅱ. Technical Specifications

No.	Item	Parameter
1	sensitivity	1μCi/m3(0.05DAC)
2	Accuracy	±0.1μCi/m3 from 1 to 100μCi/m3, ±10% from 100μCi/m3 to 20000μCi/m3 or better
3	Range	1μCi/m3 to 199,999μCi/m3
4	Detector	4 matched chambers. two for measuring and two for compensation
5	Measuring chamber effective volume	4000cc (2measuring chambers of 2000 cc each)
6	Flow rate	1.0 L/min
7	Zero stability	±0.1μCi/m3 immediately after unit is powered on or better
8	Background cancellation	Very effective and efficient background cancellation of gamma(all energies) radon and noble gases is required.
9	Compensation	Radon compensation should be included in the software beta other than tritium ,gamma and noble gases compensation is very essential
10	Ion trap	have
11	Dust filter	replaceable easily
12	Noble gas cancellation	No
13	Tritium discrimination	Instrument can discriminate in a field
14	Purge/decontamination	Detective unit made by New structure ,very low tritium remember effect.
15	Display	Graphic touch screen LCD display .unit displays the values
16	Communication	RS485
17	Power supply	220V AC
18	Alarm	Tritium alarms gamma alarms low air flow alarms will all be shown by red LED light and by an audible device
19	Data logging	The tritium and gamma values at logged every minute with current time and date stamp
20	Response time	a) seconds~2min(see tritium readings)

Ⅲ. Applications

- Nuclear power plant
- Nuclear research

泰坤工业
TAIKUN INDUSTRY

Beijing TaiKun Industrial Equipment Co.,Ltd.

Address：Room 2028, JinYanlong building Huilongguan,Changping District, Beijing 100096 P.R.C.

Tel：0086-010-56273432

Fax：0086-010-62712978

E-mail：beijingtaikun@163.com, 13691111138@163.com

http：www.taikunchina.com