

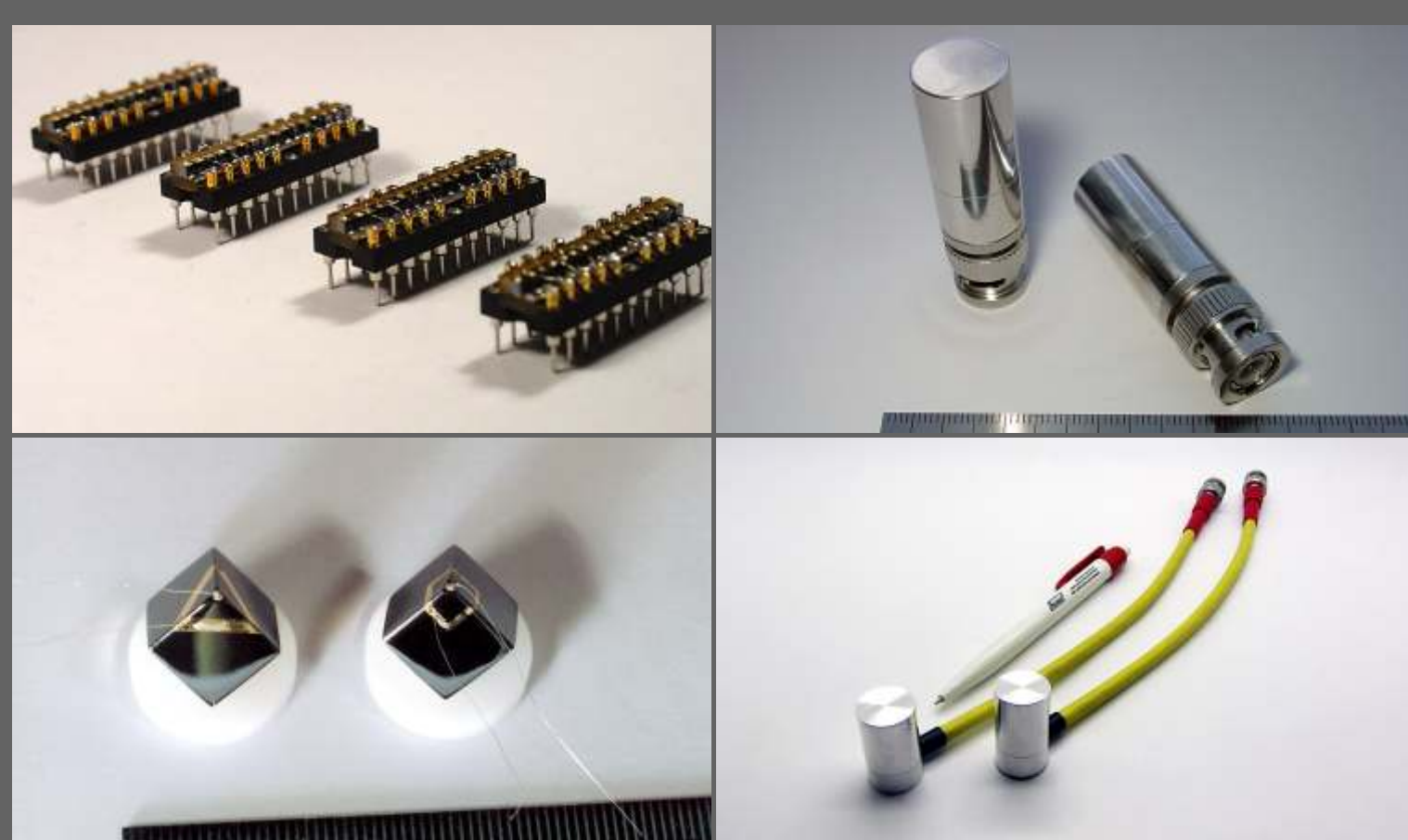
CdZnTe Detectors for Various Applications

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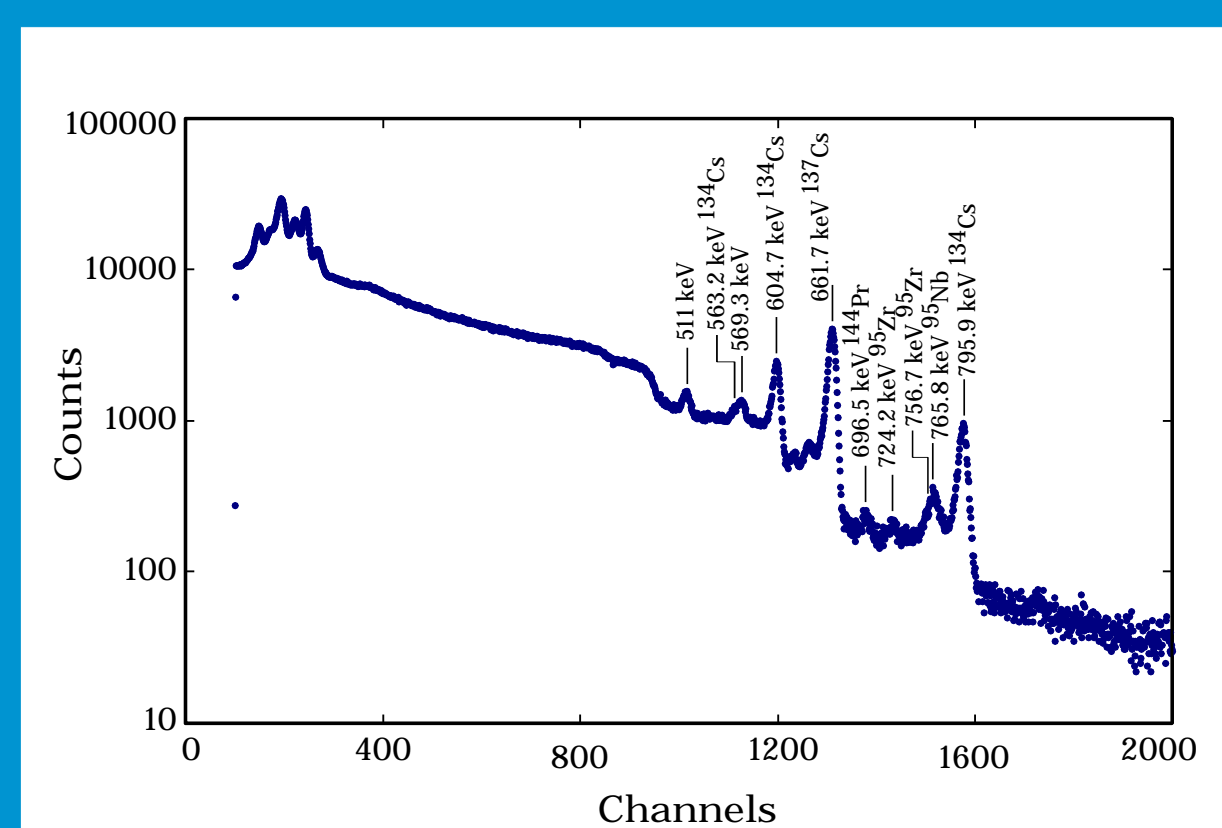


Mounted CdZnTe Detectors

CdZnTe is a wide band gap (1.6 eV) semiconductor material with a high value of the atomic number (49.1) and high density (5.8 g/cm³). CdZnTe nuclear radiation detectors of various designs and sizes are widely and successfully used for various applications due to their favorable detection properties – high detection efficiency, good room temperature performance, small dimensions and weight and are well suited for the compact and reliable detection systems. Depending on a task simple planar detectors or various detectors of unipolar design can be used. One of the unipolar detectors is hemispherical or quasi-hemispherical detector. CdZnTe detectors with sensitive volumes from a very low of 0.5 mm³ to a few cubic centimeters, high quality spectroscopy quasi-hemispherical detectors and planar counter grade detectors for various applications are available. There are different mounting styles of the detectors: single or as a linear array, on a PCB, encapsulated in a plastic or metallic box, in a case without or with connector or in a custom designed case. As usual CdZnTe detectors are used with a charge sensitive preamplifiers. RITEC produces various devices with CdZnTe detectors some of which are shown here.



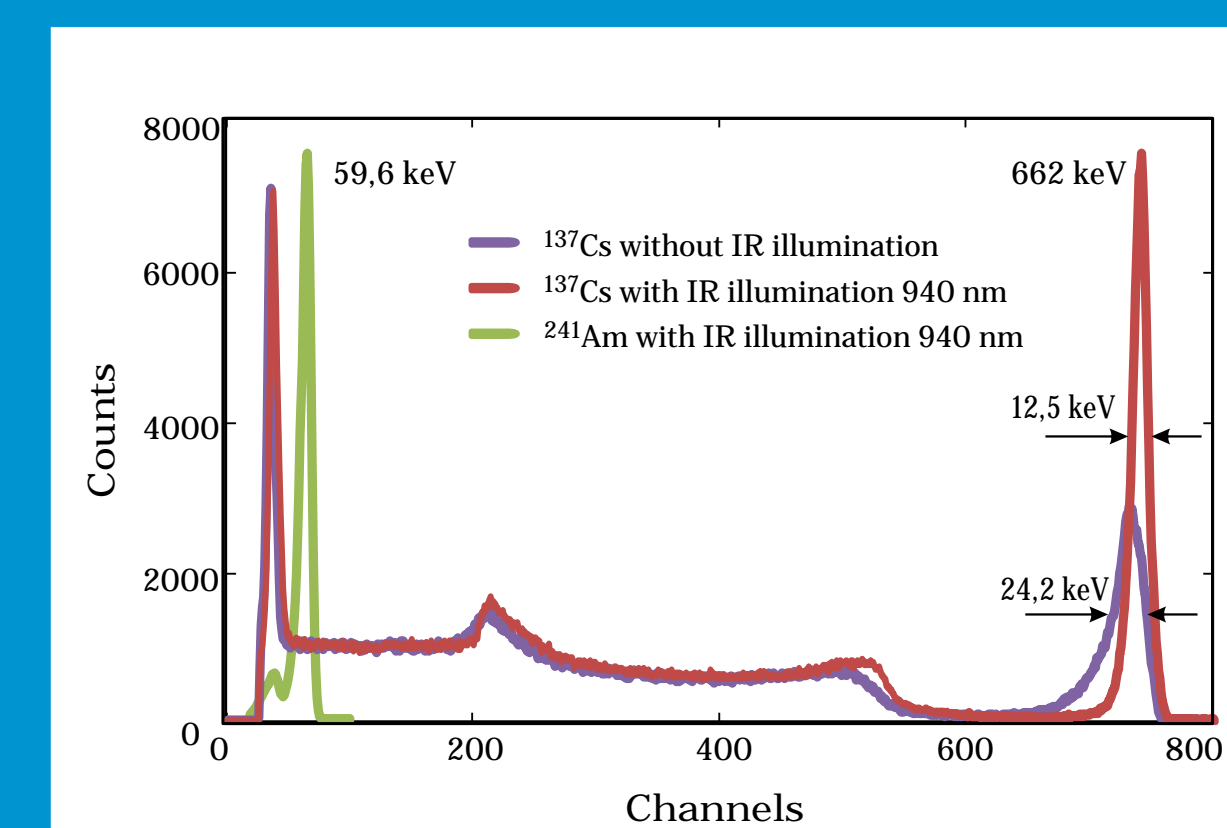
Spectrometric Detection Probe SDP310



Spectrum of nuclear spent fuel assembly obtained with the SDP310/Z/20S

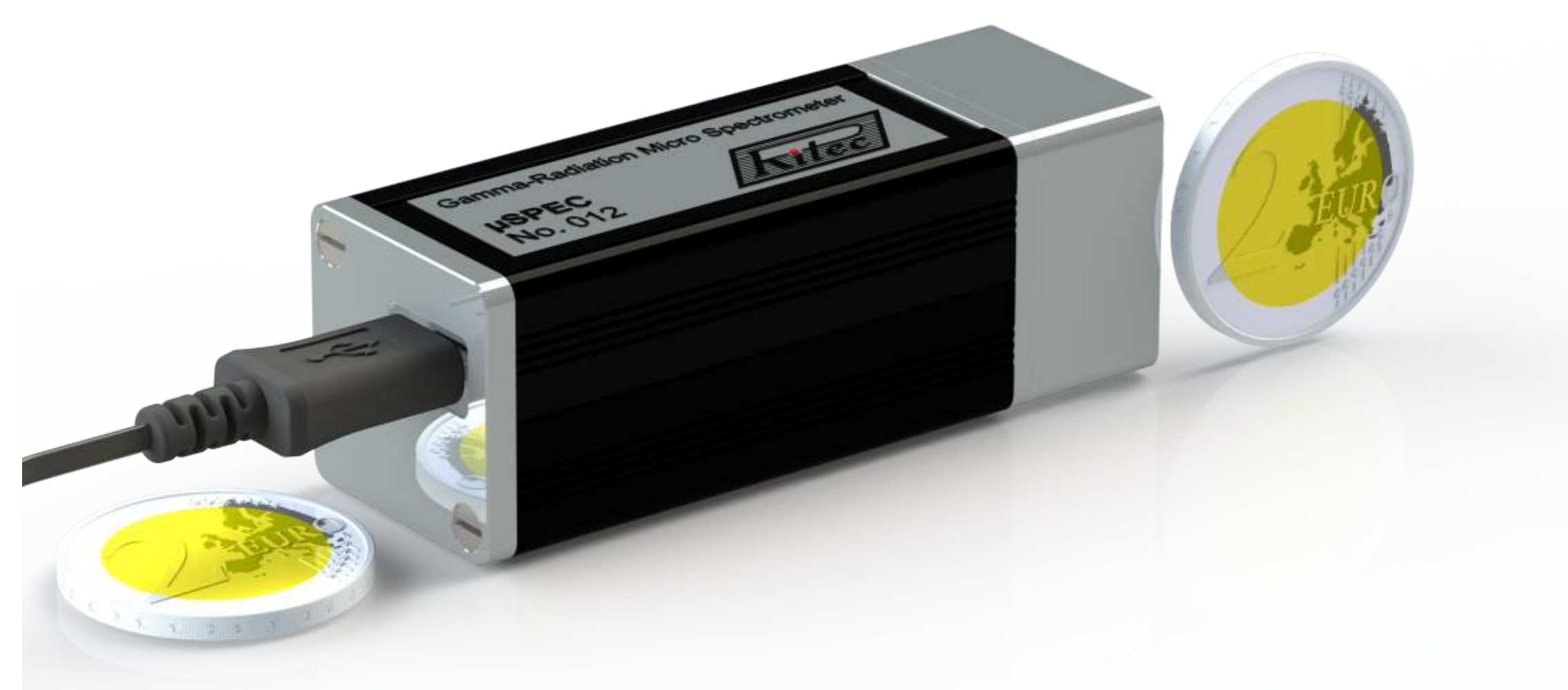
Spectrometric quasi-hemispherical CdZnTe detectors are used in various commercially available miniature detection probe types SDP310, SDP500 and SDP1500. These probes are very convenient for application in difficult for access places. Probes type SDP310 with the small volume CdZnTe detectors from 1 mm³ to 60 mm³ are intended for measurements in high intensity gamma-radiation fields. For example its can be used for spectra measurements of high activity nuclear spent fuel at NPP. These probes are widely and successfully used safeguards applications in the International Atomic Energy Agency's verification practice. Probes SDP500, SDP1500 and SDP4000 with the large volume CdZnTe detectors of 500 mm³, 1500 mm³ and 4000 mm³ correspondingly can be used for the control of radioactive pollution and waste at industrial sites, environmental monitoring, in home land security devices to identify the isotopes and for other applications where rather weak gamma-radiation must be measured. New technological development based on the application of a low-intensity monochromatic optical stimulation with infrared light allowed significantly improve spectroscopy performance of the large volume quasi-hemispherical CdZnTe detectors and increased possibility of their application.

Spectrometric Detection Probes SDP500, SDP1500, SDP4000

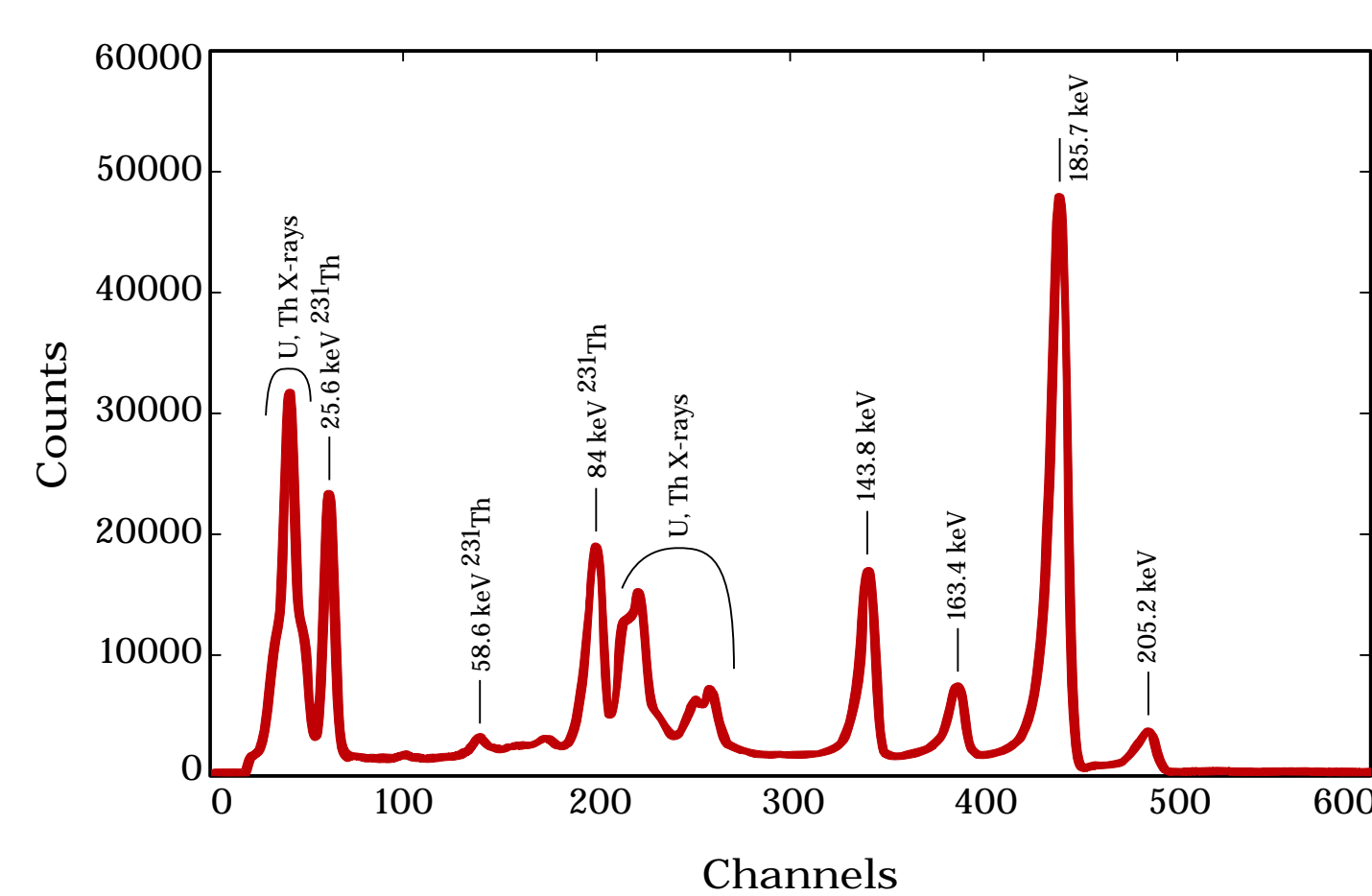


Spectra of ¹³⁷Cs and ²⁴¹Am obtained with the SDP4000 without and with IR illumination

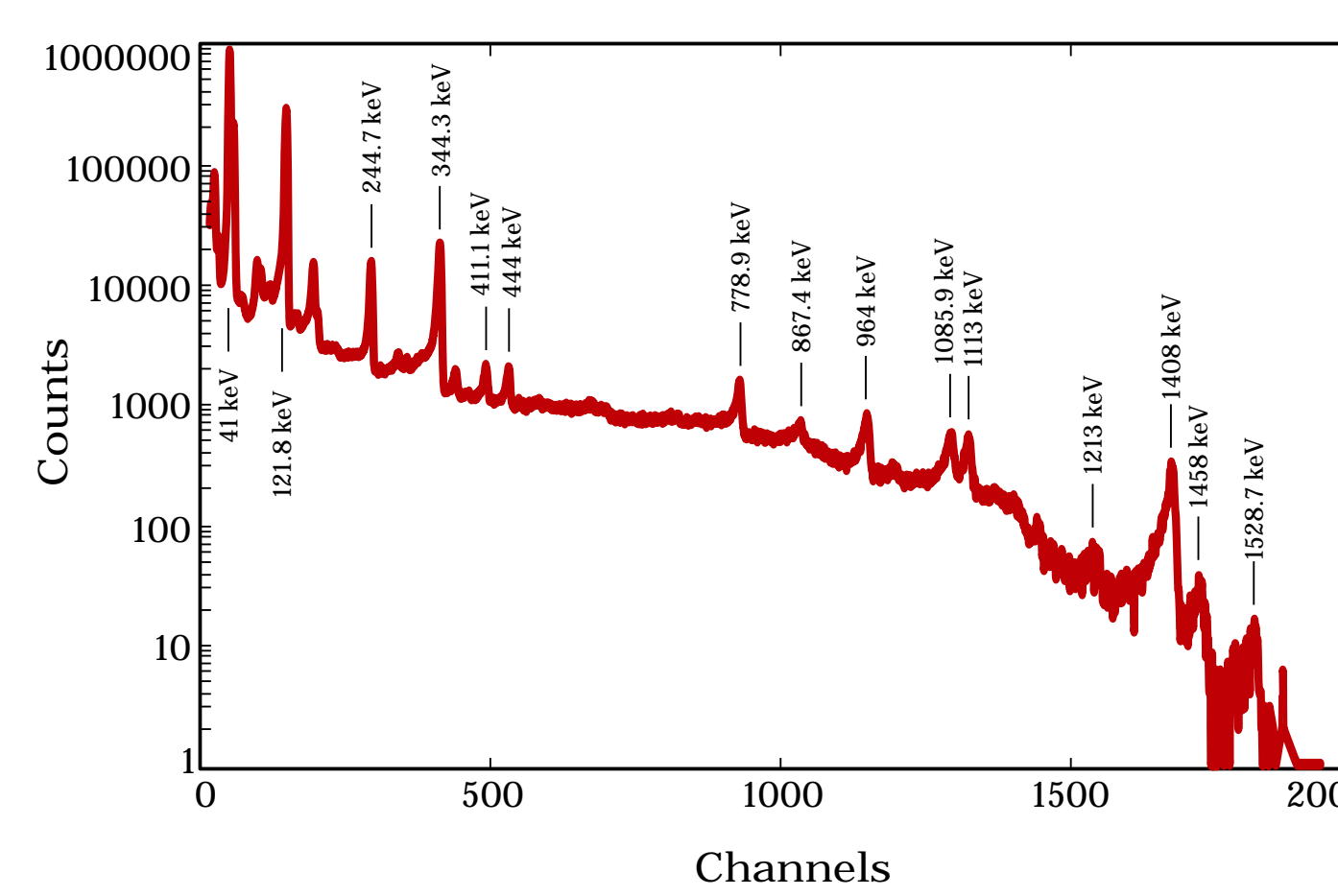
Gamma-Radiation Microspectrometer uSPEC



Based on application of high quality spectrometric quasi-hemispherical CdZnTe detectors Gamma-Radiation Microspectrometer μ SPEC was built. The μ SPEC fulfils measurements of gamma-radiation spectra and storing it for processing in a PC. It is a self-sufficient very compact device consists of the high quality CdZnTe detector, charge sensitive preamplifier, main amplifier, digital signals processor, high and low voltages power supplies and computer interface. Ability to use different replaceable detection modules with CdZnTe detectors of volumes 60 mm³, 500 mm³ and 1500 mm³ is outstanding feature of the device. The μ SPEC communicates with and powered from the PC via USB port.



Spectrum of ²³⁵U registered by the μ SPEC500



Spectrum of ¹⁵²Eu registered by the μ SPEC1500

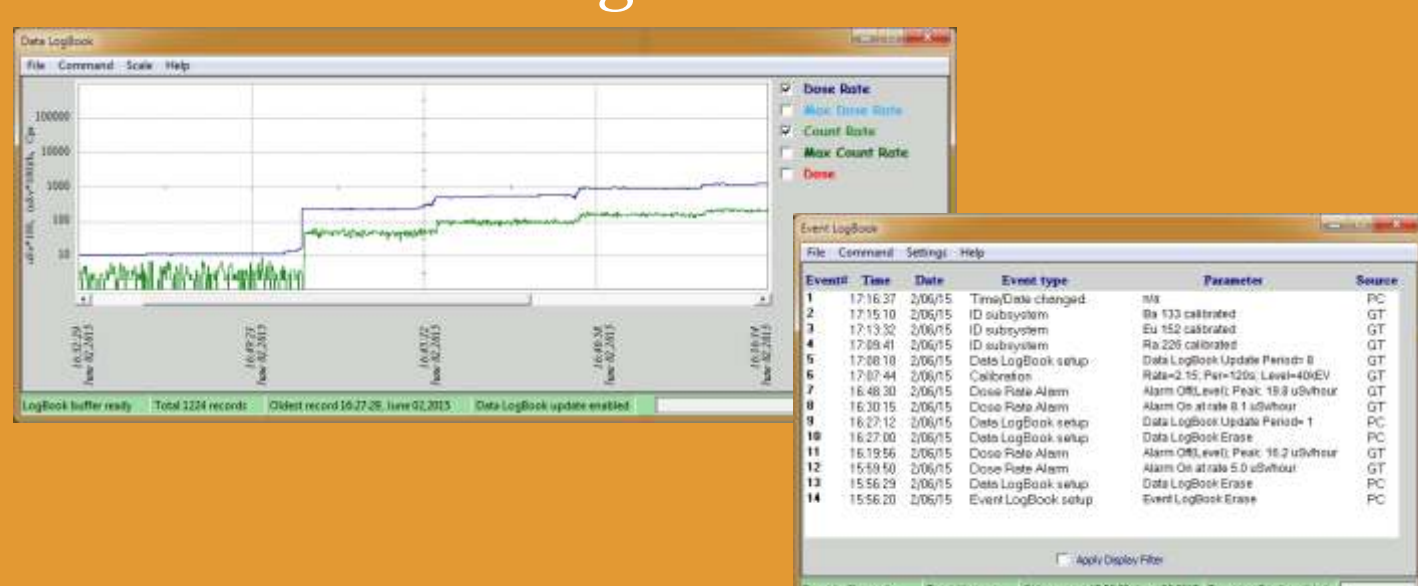


Personal Gamma-Radiation Detector -Tracer GT2-1

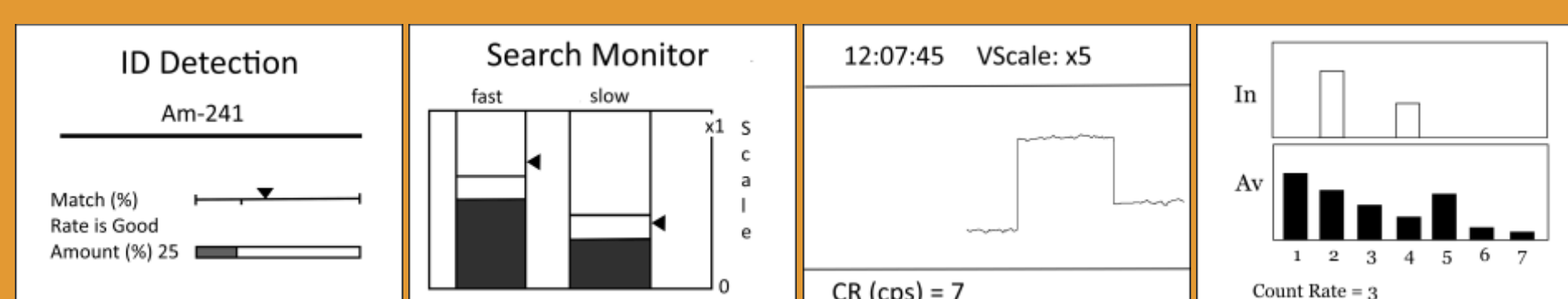


Personal Radiation Detector (PRD) -Tracer GT2-1 is a high sensitivity gamma radiation detection and dose rate measurement instrument. The GT2-1 uses a 0.4 cm³ counting-grade planar CdZnTe detector. The advanced pocket-size -Tracer PRD was developed with a focus on gamma-radiation searches and detection for a rather small CdZnTe detector volume and energy discrimination down to 30 keV. It offers a gamma-radiation source localization function, enhanced PRD features such as multi-channel scaling, library-driven isotope identification and a data logger. The GT2-1 was designed with power consumption in mind; its typical lifetime after a full battery charge exceeds 600 hours in measurements mode. Energy compensation technique is employed for the dose rate calculation. The typical accuracy of the device in the energy range 30–1500 keV is better than 10% for factory-calibrated devices. All essential parameters can be quickly accessed via Quick Set Menu and Main Menu options. The full set of run-time parameters may be modified using the free PC software tool GT2 Configurator. The dedicated search algorithm implementation allows the device to be used as a homeland security detector by services responsible for the control of the relocation of radioactive materials, such as those at airports, border control checkpoints, and tolls.

User Interfaces of the GT2 Configurator Software



Main Modes Windows



Surgical Gama-Detection Probe SGDP



A simple non-imaging intraoperative surgical gamma detection probes are intended for intraoperative detection and localization of small foci with a low amount of radioactivity in the human body during surgery. These probes are simple, inexpensive to perform, not time consuming and do not require exotic or costly equipment. Now intraoperative gamma-detection probes are becoming valuable tools for surgeons, for example in the identification of sentinel nodes and

detection of recurrent, residual or occult tumors. Application of the planar CdZnTe detector with dimensions $\varnothing 8$ mm x 5 mm and internal cellular tungsten collimator provides high sensitivity, good spatial resolution and protection from scattered radiation at a small external size of the probe. Probe head diameter is 16 mm. An ethylene oxide gas can be used for the probe sterilization. The probe is connected to control unit by an interface cable.

