SEIBERSDORF
LABORATORIES

FREQUENTLY ASKED SOLUTIONS

FOOD AND MATERIAL PROBE LMS-3

FOOD AND MATERIAL PROBE LMS-3

The LMS-3 food and material probe was designed for the quantification of radioactivity and identification of nuclides in various sample types. The current LMS 3 is a third-generation instrument in this line of devices first developed after the Chernobyl nuclear reactor disaster, which have since undergone continuous improvement from generation to generation.

Originally intended for use in the food industry, this probe is now extensively used in other industries, too. Users appreciate the user-friendliness of the device in combination with its suitability for complex measurement tasks.

TYPICAL APPLICATIONS INCLUDE THE MONITORING OF:

Foodstuffs, juices, pet fodds and animal fodder, dietary supplements

Raw materials, waste water, sewage sludge, waste products

Finished products, alloys, components, test specimens

LMS-3 BENEFITS

COMPLEX MEASUREMENT GEOMETRIES AND SAMPLE MATRICES

In addition to basic calibration for a sample density of 1 g/cm^3, calibration for higher or lower densities and/or various chemical sample compositions (sample matrices) are also available. Calibration is carried out by combining test measurements using references (standards) and Monte Carlo computer simulations. The accuracy achieved through this method of calibration makes it possible to determine the uranium and thorium content in high-density ores, for example, a process which usually requires high-purity germanium detectors that are considerably more expensive.

EASY HANDLING

Our extensive experience in the laboratory working with gamma spectroscopy has enabled us to optimize this instrument's user-friendliness, facilitating easy handling of routine operations. The software has been customized to efficiently manage complex measurement tasks. The LMS-3 probe is designed so that no specialist knowledge of gamma spectroscopy is required to achieve reliable results in routine operations.

Fig 1: Food and material probe LMS-3

OPTIMIZED FOR ACCREDITATION

Automatic functions for quality assurance have been implemented into the routine operations of the LMS-3 probe with the requirements for an accredited laboratory in mind.

The measuring process, documentation, and monitoring of key parameters such as energy calibration, resolution, quantum efficiency, and background rate, are automated to guarantee a high degree of reliability and facilitate the application of the instrument in an accredited laboratory.

SAVE TIME AND MONEY

The LMS-3 food probe is a cost-efficient alternative to high-purity germanium-based laboratory systems. The measurement process and maintenance of this instrument are straightforward, saving time and resulting in very reliable operation.

HARDWARE AND SOFTWARE UPDATES

Hardware and software can constantly be upgraded to the most up-to-date version thanks to available updates. New firmware can be imported via USB to upgrade the control of the hardware, while the software is updated by simply replacing a few files.

FULL INSTRUMENT CONTROL VIA SOFTWARE

All relevant device parameters are managed by the software, which allows for easy remote support, since our experts can check the system setup and make changes if necessary. The most important settings are contained in a single .INI file that is easy to exchange. All settings are stored together with a spectrum to facilitate complete and detailed documentation.

COST-EFFECTIVE UPGRADE FOR LMS-1 AND LMS-2

First and second-generation instruments can be upgraded to become full-fledged LMS-3 devices. In this cost-effective process, the existing housing and detector are retained, while the old electronics and software are replaced with new and improved equipment.

FUNCTIONALITY

- Intuitive operation thanks to customer-specific customization of the measurement process and graphical user interface
- Full control and configuration of the hardware from the PC facilitates remote support
- Customized configuration for customer-specific measurement tasks (radio nuclide, thresholds, labeling of samples, measuring process, logging)
- Automatic, iterative two-phase energy calibration (gain adjustment in the 1st step, calculation of the calibration function in the 2nd step)
- Measurement, analysis, monitoring, and documentation of the energy calibration, detector resolution (FWHM), quantum efficiency, and background count rate for quality assurance, as recommended for an accredited laboratory
- Continuous graphical display of all measurement results and spectra
- Saving, reloading, and re-analysis of spectra via PC (IEC-1455 data format)
- Export of spectra into other analysis systems by conversion of the IEC-1455 file format into any other spectra format (Cambio)
- Preset measurement times and measurement uncertainties
- Comprehensive visual overview of measurement results and automatic assessment in terms of thresholds using a traffic-light concept (red = exceeded, yellow = unknown, green = not exceeded) and stating the percentage of permitted concentration
- Automatic acquisition stop when the measurement value has gone above or below the limit
- Quick drop-down selection of thresholds by sample category (e.g., baby food, milk, pet food, material number)
- Wide measurement range from 30 keV to 3 MeV

Fig. 2: Main window of the graphical user interface.

TECHNICAL DATA

MEASUREMENT SENSITIVITY

The minimum detectable activity (MDA) depends on the measurement time. The graph below shows the MDA for the key radionuclides ^{131}I, ^{137}Cs, ^{192}Ir and ^{60}Co as function of the measurement time.

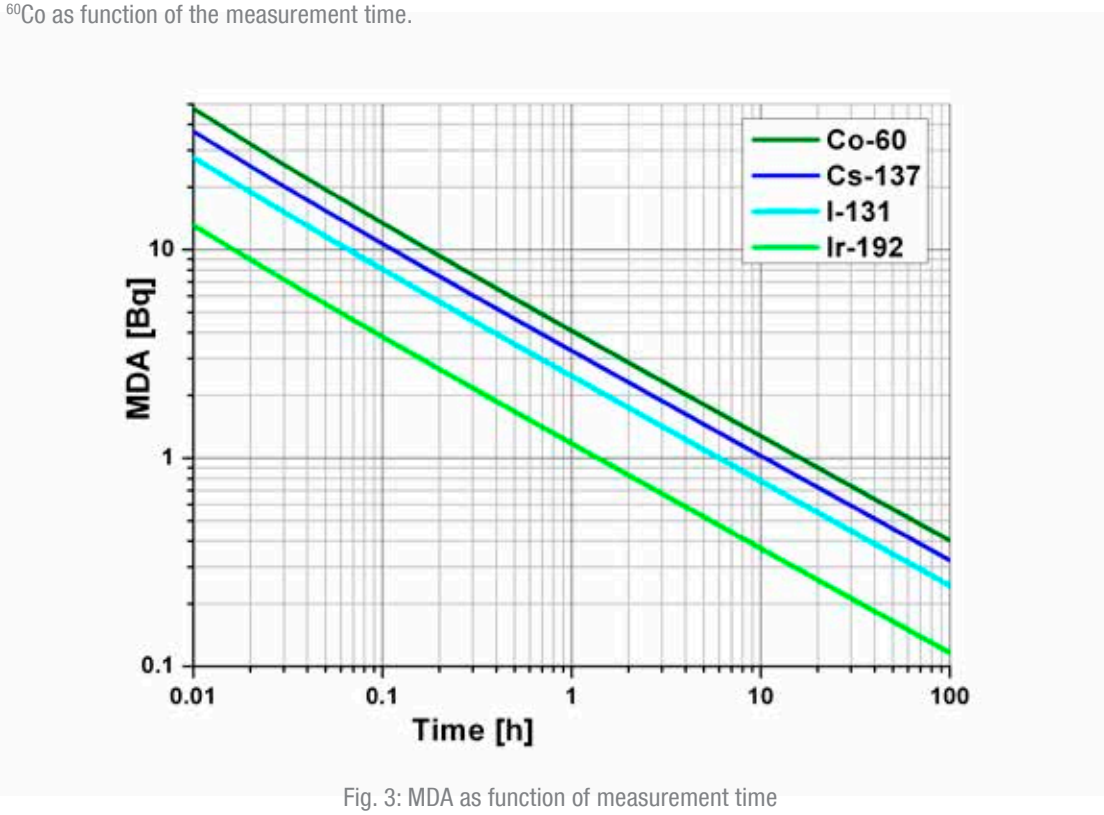

Fig. 3: MDA as function of measurement time

The instrument achieves a high degree of sensitivity through the effective shielding of environmental background radiation and the focus on a small energy range. This allows fast and accurate measurement of low-level samples. Typical regulatory limits for foodstuffs or raw materials are in the range of 100 Bq/kg and can be reached within less than a minute of measurement.

Users with less experience in gamma spectroscopy often find it difficult to determine the required measurement time and end up measuring longer than necessary to be on the safe side. The LMS-3 software takes on this task itself and calculates the optimum required measurement time for each sample.

Given the same average measurement time, samples with low radioactivity are automatically measured for longer than those containing more radioactivity, and a higher degree of measurement sensitivity is achieved as a result.

PRESENTATION OF SPECTRAL DATA

To highlight details in the spectral data, two different transformations for the x-axis and the y-axis are provided. The classical logarithmic scale on the y-axis increases the dynamic range. It allows the spectrum to be clearly displayed even with strongly diverging peak heights and over a wide energy range.

A newly developed transformation of the x-axis (SQ transformation) compensates for the energy-dependent detector resolution, resulting in extensively constant peak widths (FWHM). This is achieved by stretching in the low-energy range and compressing at higher energies, which considerably improves the visibility of small peaks.

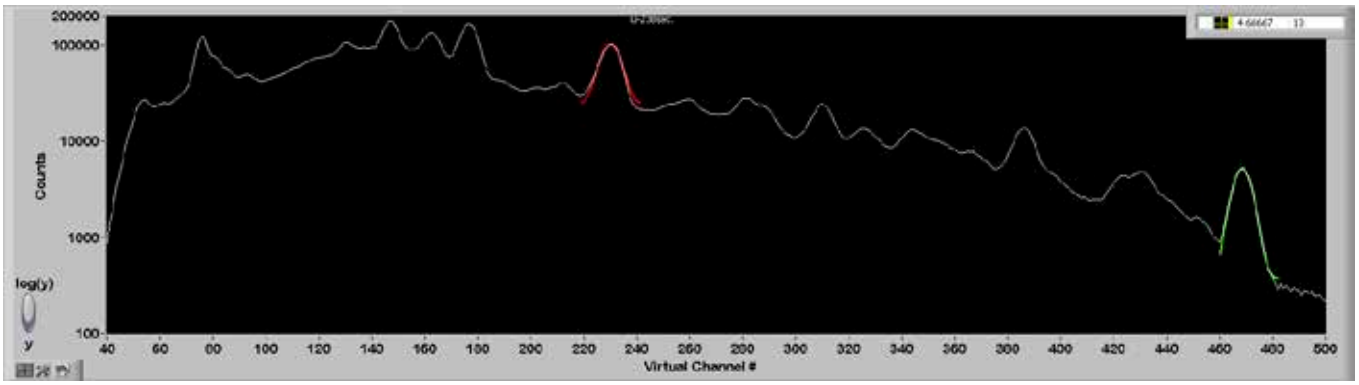

Fig. 4: Spectrum transformation

TECHNICAL SPECIFICATIONS

- Fully digital multi-channel analyzer (3rd generation, 2000-channel resolution)
- Highly sensitive Marinelli beaker measurement geometry (500 ml)
- 2” x 2” NaI(Tl) scintillation detector (typical resolution 8% at 662 keV)
- Traceable instrument calibration for 137Cs in water (additional radionuclides optionally available)
- Optional calibration of sample fill level or calibration of special sample geometries such as test specimens
- Optional calibration on various density and sample matrix (chemical composition)
- Power supply via USB or external mains adaptor
- Connection to PC via USB 2.0
- 25 mm lead shielding to reduce environmental background radiation
- Instrument weight: 33 kg
- Dimensions: (23 x 29 x 44) cm

SCOPE OF SUPPLY AND OPTIONAL ACCESSORIES

SCOPE OF SUPPLY

- Food and material probe LMS-3
- Robust transport box for probe
- Software
- Mains adapter (5 V)
- User manual
- USB connection cable (type A male connector to type A male connector)
- 10 Marinelli beakers (500 ml)

OPTIONAL ACCESSORIES

- Calibration source (<10 kBq ^{137}Cs)
- Customer-specific calibration or software upgrades for special sample matrix (depending on sample fill level, density, and chemical composition)
- High-resolution detector (LaBr3) featuring a resolution of 3-4% (FWHM at 662 keV)
- External detector (e.g., for in-line measurement during the production process)
- Automatic stabilizer to reduce drift caused by fluctuations in the ambient temperature or to compensate for long measurement times
- Additional Marinelli beaker
- PC (typically provided by the user him/herself)
- Customization of software to suit special customer requirements (e.g., extended quality assurance, database connection, and new input fields)

Fig. 5: Calibration source in Marinelli geometry(<10 kBq ^{137}Cs)

CONTACT

Seibersdorf Labor GmbH
Radiation Safety and Applications
2444 Seibersdorf, Austria

www.seibersdorf-laboratories.at
Fax: +43 (0) 50550 - 2544

Office
+43 (0) 50550 - 2545
radiation@seibersdorf-laboratories.at