

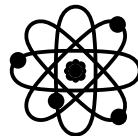


GSU, GSU NORM

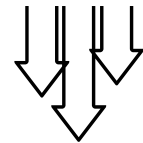
GAMMA SPECTROMETRY UNIT WITH NaI(Tl)



High sensitivity, short measurement time



Isotopic identification software with customisable libraries



Background subtraction to lower MDC

High-sensitivity NaI(Tl) spectrometer

Calculation of specific activity (e.g. Bq/g)

Possibility to customise type and geometry of the measured sample

NORM-dedicated version available

Dedicated experimental and Monte Carlo characterisation

GSU gamma spectrometry units employ a 3"x3" or 2"x2" NaI(Tl) crystal coupled to a photosensitive detector (either PMT or SiPM) and an MCA. The detector is installed in a 5 cm thick lead shielding well with tin and copper inner layers.

GSU performs gamma spectrometry analyses of small samples, such as foundry casting samples, air particulate filters, environmental samples (rocks, soil, biological samples), positioned in sample holders or Marinelli beakers designed according to the requirements.

The User can manage the system through the proprietary ELSE NUCLEAR **GSU** system software, calculating the specific activity and the Minimum Detectable Concentration (MDC) of the sample expressed in Bq/kg, Bq/l, Bq/m³, etc. The built-in background subtraction subroutine lowers the MDC without increasing the measurement time. The software includes fully-customisable isotope libraries as well as User-settable isotope-specific activity alarm thresholds, available through password-protected functions.

The **GSU-NORM** is a special version of system specifically conceived to perform Naturally Occurring Radioactive Material (NORM) analyses of environmental samples, such as rocks, sediments or soils. Through its MCA and its dedicated software, the **GSU-NORM** system allows determining the specific activity of NORM, i.e. K-40, Th-232 and U-238, expressed in terms of both Bq/g and %K, ppm eU and ppm eTh.

The sample holders are custom-made PVC supports that fit directly on the detector's head, used to hold casting samples, test sources or other similar objects.

The Marinelli beakers are used to contain geological samples or other similar materials. Several volumes are available, from 250 ml up to 1 l, with different geometrical features.

Each GSU system includes efficiency curves and coefficients implemented in the analysis software, calculated through Monte Carlo simulations for each specific configuration, acquisition chain and measurement geometry. The simulations are always validated through experimental tests performed with reference radioactive sources.

TECHNICAL SPECIFICATIONS

General characteristics

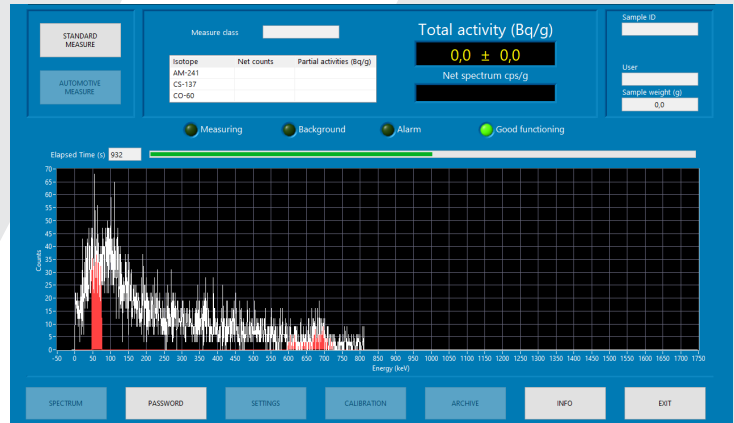
- NaI(Tl) dimensions: 3"x3" or 2"x2"
- Resolution at 662 keV: <7.5%
- Lead shielding: 5 cm thick, with 1 mm tin + 1 mm copper layers
- Total weight: 240 kg (including support)
- MCA channels: 1024 (2048 optional)
- Communication: Ethernet, USB

Specific characteristics – GSU

- Typical MDC
 - Casting samples: 0.02 Bq/g for 300 s meas. (Cs-137)
 - Environmental analyses: see table
- Energy Range: 30 keV ÷ 2 MeV

Specific characteristics – GSU-NORM

- Typical MDC: 0.002 Bq/g (40-K), 0.001 Bq/g (238-U), 0.003 Bq/g (232-Th) for 6 h meas.
- Typical MDC for 6 h meas. (assuming secular equilibrium): 0.005 %K, 0.1 ppm eU, 0.7 ppm eTh
- Energy range: 50 keV ÷ 3 MeV



GSU software interface

Isotope	Measurement time, minutes		
	5	10	30
⁶⁰ Co	9.2	6.4	3.7
¹⁰⁶ Ru	122.8 [38.7] ^{511 keV}	86.3 [27.2] ^{511 keV}	49.4 [15.6] ^{511 keV}
¹³¹ I	6.2	4.4	2.5
¹³⁴ Cs	12.6	8.0	4.6
¹³⁷ Cs	10.2	7.2	4.1
¹⁴⁴ Ce	34.0	23.9	13.7
¹⁹² Ir	8.33	5.9	3.4

GSU MDC in Bq/kg of soil (1l Marinelli, typical 200 nSv/h background H*(10) rate, no background subtraction)

OPTIONS

- 10 cm thick lead well to further lower MDC
- LaBr₃(Ce³⁺) scintillator instead of NaI(Tl), for higher sensitivity and better resolution

ACCESSORIES AVAILABLE UPON REQUEST

- Calibration source:
 - Contaminated steel samples (isotopes and activity to be defined)
 - Gel matrix in Marinelli beaker (isotopes and activity to be defined)
 - Certified soil matrix containing NORM in Marinelli beaker
 - Natural potassium salt for periodically quality controls
 - Cs-137 point source, < 10 kBq, for periodical quality controls
- Warranty extension from 12 months to 24 months

