



SPECTRO**TRACER**

Intelligent γ -spectrometric probe



- ❖ Online spectroscopy in air and water
- ❖ Compact, robust, reliable
- ❖ LaBr₃:Ce or NaI(Tl)-detector (GM tube option)
- ❖ Digital MCA (up to 8k channel and 80MHz sampling rate)
- ❖ Nuclide identification
- ❖ Calculation of H*(10) dose rate
- ❖ Low power, solar operation option
- ❖ Mobile and stationary use (GPS option)
- ❖ Built-In Communication options: LAN, WIFI, GPRS/3G, Satellite SkyLINK

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PRESENTATION

1. Introduction

SpectroTRACER has been designed for continuously monitoring gamma contamination in air, on the ground and in water. It is intended to be used for radiological surveillance of air and liquids. The monitor performs a spectrometric analysis of the measurement to identify the radionuclides detected.

The compact design includes:

- The NaI or LaBr3 detectors,
- High Voltage supply,
- Preamplifier,
- 80 MHz digital MCA board,
- Low power industrial computer with LAN interface and 2 Gbytes flash memory
- Optional GPRS/3G/GPS/Satellite / Skylink/ShortLINK interface
- Optional GM board for dose rate range extension

The instrument is designed for low maintenance operation under harsh conditions. Low power consumption (2.5 W; 10-24V) allows stationary or mobile application (in combination with battery back-up or solar power supply).

For data transmission, several options are available:

- GPRS/3G,
- Satellite,
- LAN,
- WIFI,
- Proprietary SkyLINK/ShortLINK radio. The SkyLINK and ShortLINK radio technology assures reliable data transmission even in case of emergency or an accident while publicly accessible wireless or wire-bound networks probably will fail due to traffic overload. SkyLINK and ShortLINK allow transmitting the activities of identified main nuclides.

2. Typical applications

SpectroTRACER is used for air and water monitoring whenever a standard gamma dose rate monitor is not efficient enough and if it is necessary to qualify the nature of the γ radiation. Considering the easy installation (no hydraulic circuit, no pump...), *SpectroTRACER* is best suited for:

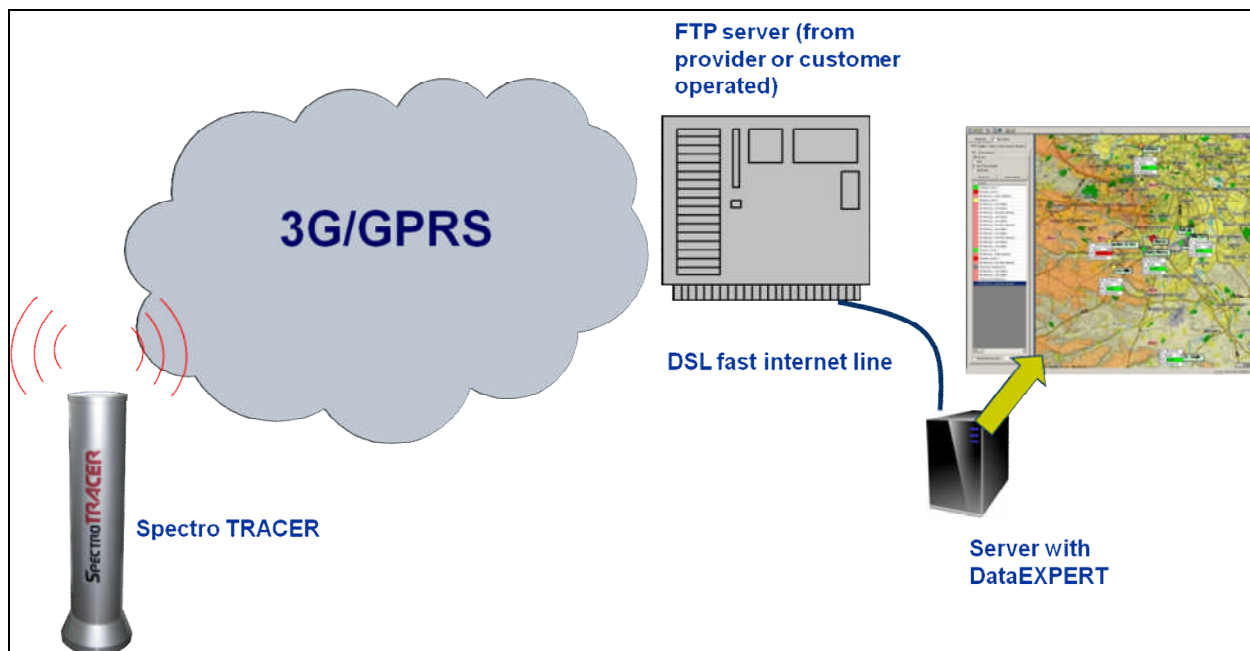
- Air monitoring under normal conditions in order to detect very low up to increased activity levels.
- Air monitoring in accidental conditions in order to monitor the radioactivity released and hence take appropriate decisions regarding the protection of population and environment.
- Ground contamination monitoring in accidental conditions in order to monitor the radioactivity released and hence take appropriate decisions regarding the protection of population and environment.
- Surveillance of released water of nuclear power plants, hospitals, sewage water treatment plants ...
- Control of sewage water in decay tanks of nuclear power plants and hospitals before being released.
- Monitoring of activity levels in rivers and lakes.
- Filter monitoring when combined with an aerosol sampler like Saphymo PAIS 100



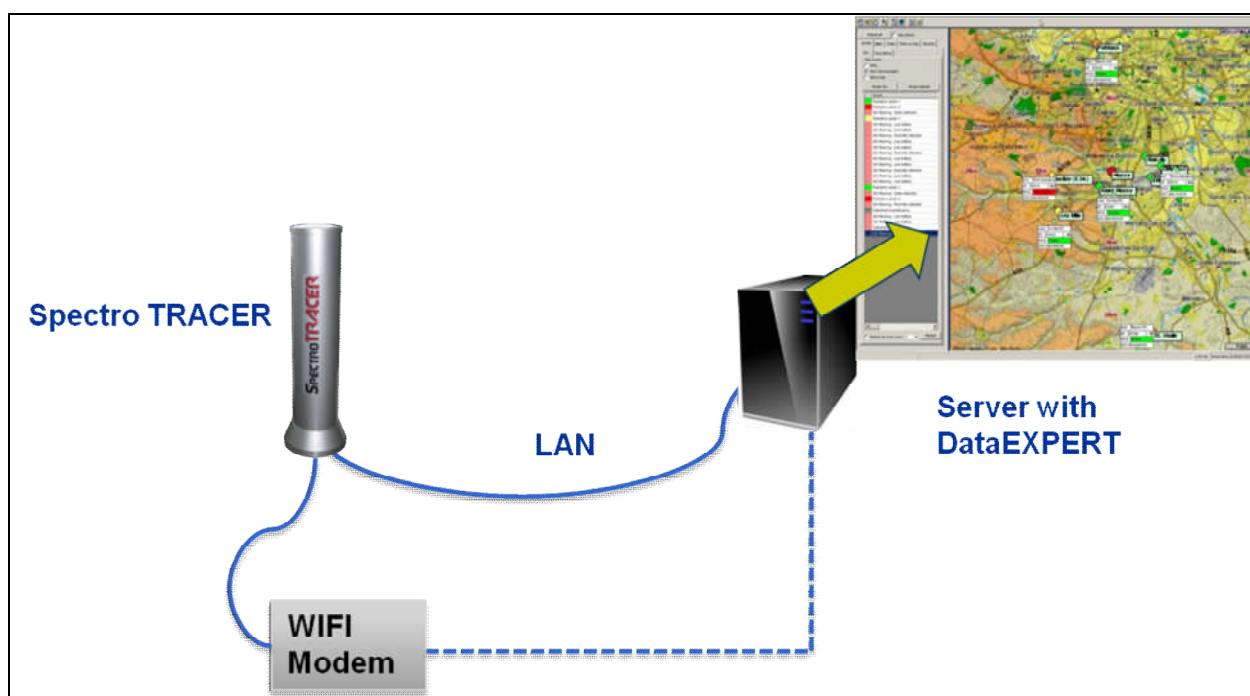
3. System Architecture

Different data transmission modes can be proposed:

3.1 3G/GPRS

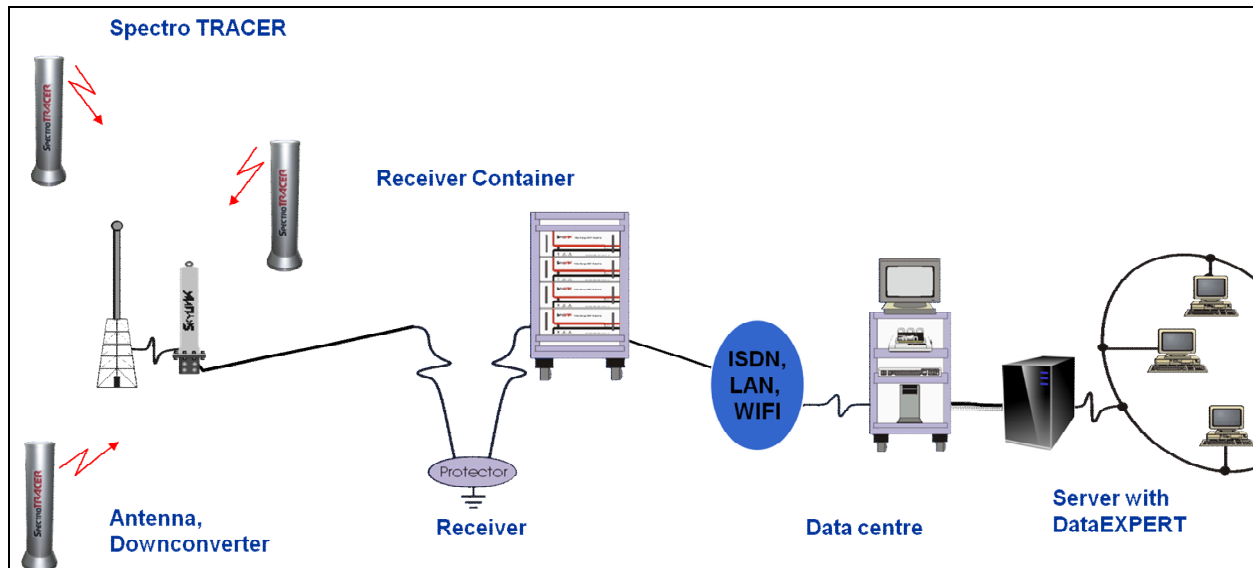


3.2 LAN/WIFI

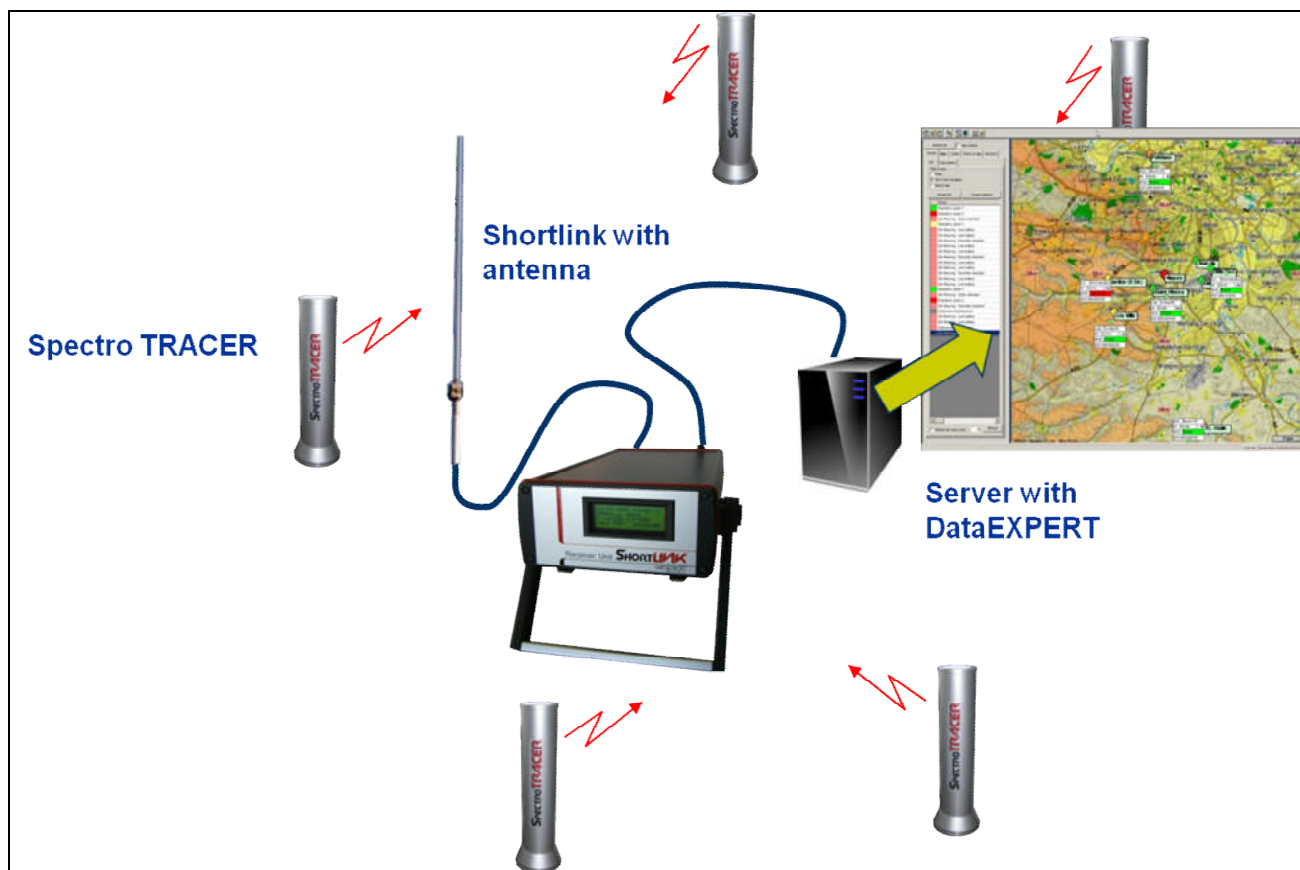


3.3 SKYLINK/SHORTLINK

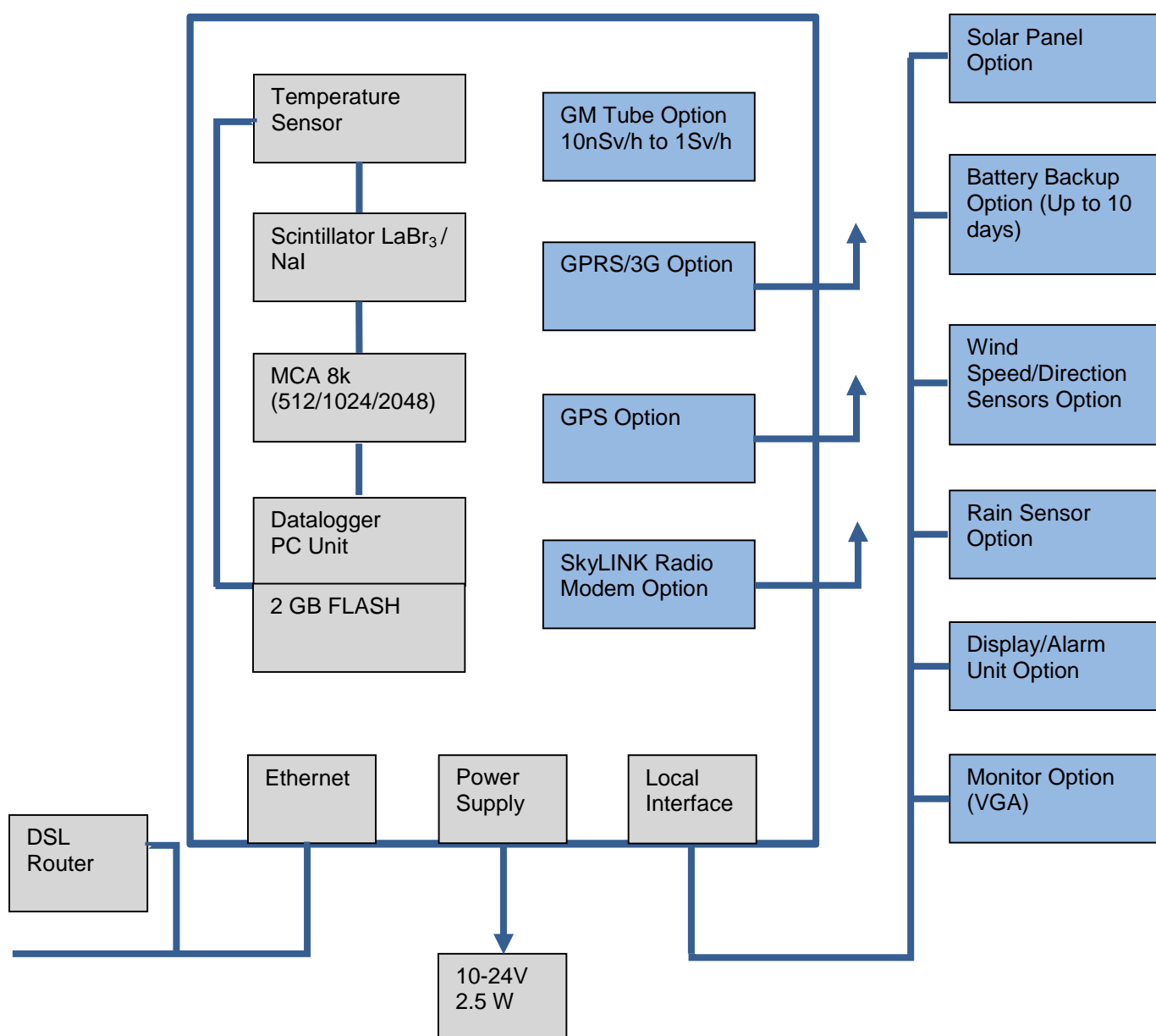
SkyLINK:



ShortLINK:



3.4 Monitoring Station Architecture



4. Operation

SpectroTRACER is composed of following main components:

- A detector for measuring the gamma radiation consisting of a NaI or a BRILLANCE LaBr₃ crystal available in different sizes and offering high performance, the High Voltage board, the Preamplifier, the MCA board, the low Power industrial PC and a power supply. A GM tube can be integrated optionally.
- As an option, a small weatherproof cabinet for housing the backup battery and the connection to external solar panel can be provided.

The probe permanently checks and adjusts the stabilization of the detector in order to guarantee correct channel-energy allocation and periodically performs a gamma spectrum out of up to 8192 channels using a high performance digital MCA. The data acquisition interval can be set from 1 minute to 24 hours.

The monitor performs different types of measurements and generates respective alarms:

- Accumulation of count rates in regions of interest (maximum 10)
- Identification of the contribution of 15 different nuclides (user adjustable from the built-in library), based on the spectrum analysis (output unit depending on probe type in Bq/m³, Bq/m², Bq/l, nSv/h). Each analysis result is associated with a confidence factor and an uncertainty value. The nuclides to be searched can be remotely selected by the user (for example Tm, Cs, I,...).

SpectroTRACER is able to manage pre-alarms and alarms for each of these measurements.

The monitor also calculates the dose rate contribution for each identified nuclide and the H*(10) dose rate for the complete spectrum.

All data are stored under N 42.42 format which allows:

- easy display with N 42.42 viewer
- easy data transmission to third party software
- easy remote configuration

The user can set two independent cycle times (TC1, TC2) by which the probe automatically calculates and stores the spectrum as well as the identified nuclides. The results (spectra, identified nuclides, QA data) are stored on the local FTP server for later download by polling or to be automatically pushed to the data center (DataEXPERT) on a periodical basis for automatic analysis, storage and visualization. The cycle time can be adjusted from 1min to 24hrs.

Stationary and mobile operation



- The mobile setup (left) is compact and quickly to install within a few minutes (up to 10 days operation without solar panel at worst case conditions including redundant communications)
- The stationary setup (right) protects all components from corrosion and theft

DESCRIPTION



1. *SpectroTRACER* Probes

The probe includes:

- The scintillator / PMT detector (Brilliance LaBr₃ : 1,5" x 1,5" or 1" x 1", NaI(Tl) : 2"x2" or 3" x 3")
- A 8192 channel DSP-based MCA board (Multi Channel Analyser), sampling rate 80 MHz
- High voltage generator with active divider for best stability at high count rates
- Low power reliable PC unit
- Optional extensions : GM board, external sensor interface, GPRS/3G, Satellite, SkyLINK, GPS

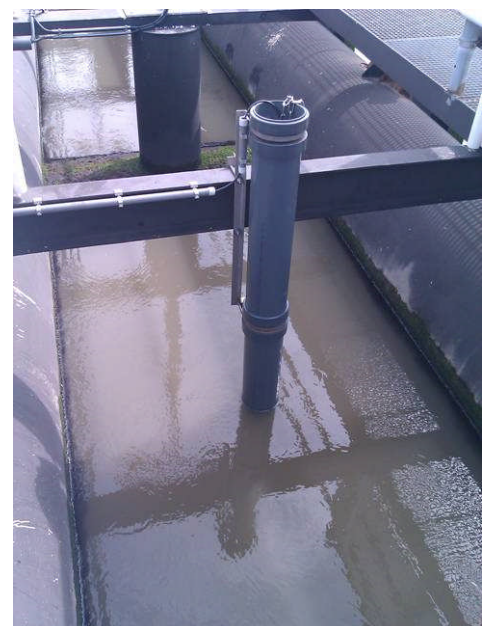
The probe is power supplied by the remote processing unit in 24V DC.

Its housing is suitable for use in harsh environments (sewage treatment plants....). Probe can be immersed down to 100m below surface (more on request).

The cable connecting the probe to the processing unit is shielded and has very high resistance to corrosion and mechanical stress.

Typical energy resolution at 662 keV is <2.9% for LaBr₃ probe and <6.9% for NaI probe. Besides the resolution, another advantage of LaBr₃ is the very stable gain over a long time period and a very good linearity over the entire energy range.

The built-in isotope identification utilizes several algorithms and optimized peak search methods in order to achieve high stability and low detection threshold. The better resolution of a LaBr₃ detector allows a more accurate peak discrimination and thus leads to better isotope identification results.



SpectroTRACER inserted
in a holder pipe

2. Power supply options and external weatherproof cabinet (option)

The probe is available in various versions, in order to offer best flexibility :

- A built-in battery for 1 day autonomous use
- An external battery back-up for up to 4 or 10 days autonomous operation
- An external battery back-up in association with a solar panel

For the protection of the external battery and associated components a weatherproof cabinet is available. This cabinet is customized for mobile or fixed installations and available in different sizes for wall or ground based installation. It also can hold further components like

- A WIFI Modem with WIFI Antenna for up to 3 km transmission distance line of sight
- Meteorological sensors (rain, wind, temperature etc.)
- Alarm output option
- Display option

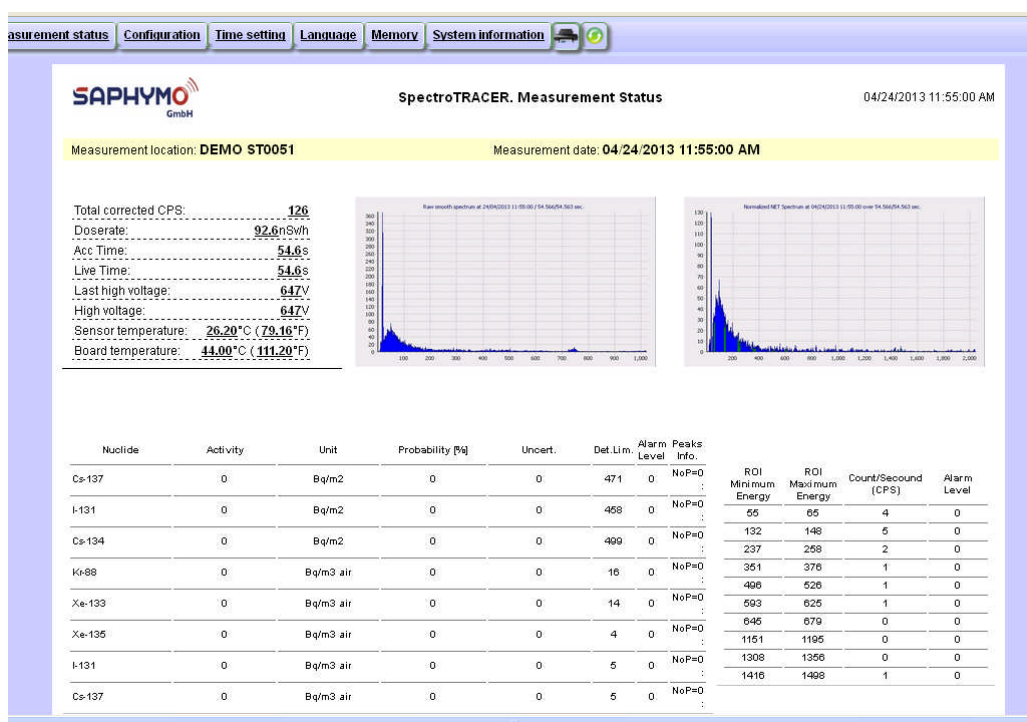
3. Maintenance and data collection software

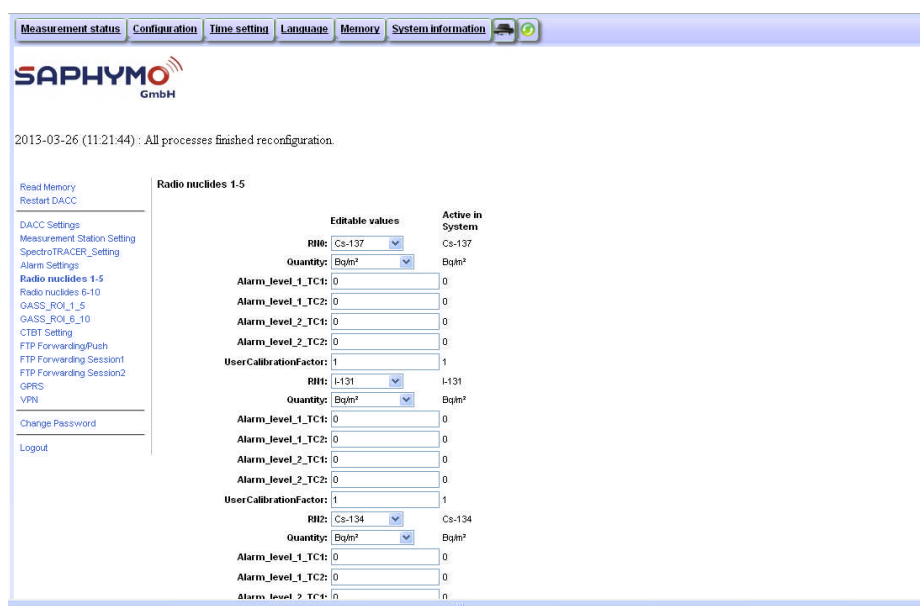
A web browser software allows to display:

- System quality status
- Nuclide and ROI results
- Spectrum

It also allows the configuration of:

- Measurement Cycle for TC1 and TC2
- Selecting the nuclides
- Setting of ROI
- Setting the two alarm levels for nuclides, ROI, H*(10) dose rate, the number of channel that will be used (512, 1024, 2048)





TECHNICAL CHARACTERISTICS

1. Physical characteristics

- *SpectroTRACER* NaI: 3"x3" or 2"x2" NaI detector
- *SpectroTRACER* LaBr₃: 1"x1" or 1,5"x1,5" Brilliance LaBr₃ detector
- 10 radionuclides can be automatically identified
- Built-in nuclide library contains : ¹³⁷Cs, ¹³⁴Cs, ⁴⁰K, ¹³¹I, ^{99m}Tc, ⁵⁷Co, ⁵⁸Co, ⁶⁰Co, ⁵⁹Fe, ²²⁶Ra, ¹⁵²Eu, ¹⁵⁴Eu and more, can be enhanced on user demand
- Measurement cycle: 1 min to 24h, user configurable
- Energy range: 30 keV to 2 MeV (optional 3 MeV)
- Measurement range LaBr₃ (1,5"x1,5"): up to 1 mSv/h
- 512 – 1024 – 2048 channels adjustable
- Storage capacity: 2 Gbytes storage (allow local storage of up to 1 year data in 10min mode)
- Optional GM tube: 10 nSv/h to 1 Sv/h

LaBr₃ detector offers improved energy resolution and excellent temperature and linearity characteristics compared to NaI detector.

2. Environmental characteristics

- Operating temperature: -20°C to +50°C. Option: -30°C to +60°C
- Max depth for use in water: 100 m (*SpectroTRACER* -Aqua) (more on request)
- IP index: hermetically sealed, IP 68
- Relative humidity: 100%
- Integrated sensors for temperature and humidity.

3. Mechanical characteristics

- Length: 540 mm
 - Diameter: 120/160 mm
 - Weight: ~ 4,8 kg
 - Housing material: Aluminium
- Option: SpectroTRACER / Aqua with teflonized housing for sea water

4. Electrical characteristics

- Power supply: 230 V~ 50Hz or 10-24V, 2.5W
- Electromagnetic compatibility:
 - European directive 2004/108/CE
 - IEC standards: IEC 61000
 - Electrostatic discharge IEC 61000-4-2 level 3
 - Electromagnetic immunity IEC 61000-4-3 level 3
 - DUCT Radiation Conducted interference IEC 61000-4-4 level 3
 - Surge immunity IEC 61000-4-5 level 3
 - Oscillatory Waves immunity IEC 61000-4-12 level 3
 - Radio-frequency disturbance EN55022 A
 - Power supply test according to the IEC 61000-4-11 standard

5. Interfaces and options

- Standard interface: Ethernet/LAN with N42.42 data storage. Built-in FTP server (push or pull mode). Data can be sent to two different destinations, allowing easy setup of redundant server systems.
- Data transmission options :
 - GPRS/3G module
 - Satellite module
 - Combined GPRS/3G and SkyLINK/ShortLINK radio module (offers high availability even in catastrophe scenario when cellular network is down)
 - WIFI (up to 3 km / 1,86 miles line of sight)
 - DSL modem
- GPS option
- Rain sensor option (maintenance free rain sensor with quantitative measurement)
- GM tube option (10nSv/h ... 1Sv/h)
- Solar operation option: Backup battery / charger and solar panel (size depending on country location)
- Battery backup option
- Display/Alarm module output option
- VGA monitor output option