FREE RELEASE WASTE ASSAY COUNTER

AURAS 3000

MAIN FEATURES

- ***Standard worldwide system for precise waste characterization***
- ***Versatile measurement geometry***
- ***Sub-sections scanning procedure to allow characterization of big containers***
- Free Release Assay of large waste containers up to 3 m^3
- On-line weighting up to 3000 kg
- Full Quantitative Assay of all detectable gamma emitters, with non-gamma emitter estimates by correlated scaling factors
- Up to four large area HPGe detectors
- Individual and averaged activity and MDA reporting
- Automated computer control
- Extensive Safety Protection
- MDA (Cs-137): down to 0.0037 Bq/g (40 min)

DESCRIPTION

AURAS 3000 is a highly automated system for scanning and characterising a variety of sample sizes and forms (bags, boxes, drums, and B25 containers), with densities in the range 100 kg/m^3 to 2000 kg/m^3. The system is equipped with up to four electro- or nitrogen-cooled HPGe detectors. The main components of **AURAS 3000** are:

- Main rail with moving platform for materials to be monitored
- Cross rail with two detector towers (up to 2 HPGe each); the towers can be positioned to best fit the measurement geometry, and each detector can be independently moved along the vertical direction
- Remote PC control station and local PLC interface

Analysis of spectra is performed with a waste assay algorithm operating under the control of a proprietary software.

Optionally, the system can be designed with a fixed platform for materials loading and with moving detector columns; in this case, the scanning would be performed moving the detectors along the platform with the materials, reducing the length of the mechanical structure when space is an issue.

Principle of operation

The container is first positioned by crane or forklift onto the heavy-duty platform. The operator starts the scan through the user interface, and selects the container type to be scanned from a pre-set table. This results in an adjustment of the detector position under computer control as required by the counting geometry. Bookkeeping data such as container description is entered at this stage.

The scan begins and the heavy-duty platform is moved to the measurement area. The HPGe detectors start acquisition from predetermined sub-sections of the containers.

At the end of the measurement process, the system provides the following results:

- Spectra from each detector/position combination, saved and analysed individually
- Activity value of the container calculated by each detector (individual)
- Activity value of the container calculated by all detectors (average)
- “Hot spots” identification and analysis
- Individual and averaged MDA values

April 2019. rev 4

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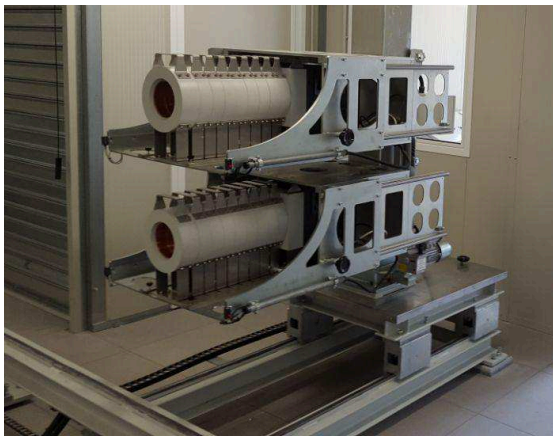
MECHANICAL STRUCTURE

The platform is of very robust design. It can accommodate containers as big as B-25 ISO (3 m^3), smaller boxes and standard drums, such as 220L sizes. The maximum payload of the platform is 3000 kg. An automatic weigh scale with a resolution of 1 kg is integrated.



The movement sequence takes place through a computer-controlled automatic procedure, which places the platform into three different positions: loading area, weighting/measurement area and unloading area. Two tower detector assemblies are positioned on both sides of the container and the detector-to-container distance can be adjusted manually.

The vertical positioning of the detectors is also carried out under computer control with a resolution of 1 mm to handle different container sizes. All machinery movements are implemented and controlled locally by a PLC and are managed remotely by a host PC which provides the system operator interface.

Mechanical structure

- Typical dimensions: 8.8 x 5.5 x 2.5 m (LxWxH)
- Typical total weight: 5000 kg

Operator console

The electronic hardware, with the exception of the spectroscopy systems, is controlled by means of a PLC. The PLC can be locally managed through a built-in user interface, which features a touch-screen LCD allowing system set-up and calibration (for example, test of the scale accuracy), as well as manual positioning of the platform and the detectors. The positioning functions, useful to perform radiometric calibrations and test measurements, can be performed both through visual feedback and set up of precise coordinates.

The local interface is locked when the PLC is executing remote procedures, to avoid conflicts with PC-commanded automatic operations. The PLC firmware also manages all the system safety devices (barriers, anti-collision sensors, etc.), immediately stopping any running motor if a security input is triggered. Diagnostic messages are issued and archived by the PLC whenever anomaly conditions occur.

DETECTION EQUIPMENT

The spectroscopy system is based on HPGe detectors, consisting of HPGe crystal, Stirling or nitrogen cooler, Digital Signal Processing MCA, high voltage supply, and high-speed USB communication. It uses standard, low-current mains power.

HPGe detectors are rugged and designed for long, reliable service, and are interchangeable, resulting in high system availability and limiting down time to an absolute minimum. Hardened cryostats are designed for long operational life and can be temperature cycled at any time, even from partial warm-up, eliminating the problems associated with loss of electrical power. If the power is turned off, it will automatically restart when the power is turned back on.

HPGe features

- Energy range: from 30 keV to 7 MeV
- FWHM for Co-60 (1332.5 keV): ≤ 2.3 keV
- Efficiency: from 15% to 150% (Nitrogen-cooled), from 50% to 150% (electro-cooled)
- Cooling type: electro-cooling or Nitrogen-cooling

SOFTWARE

In routine operation, the system is controlled by the operator through the software installed on the host PC.

The operator can interact with the system through the user-friendly graphical interface**,** which provides hardware control, analysis set-up, and measurement process management.

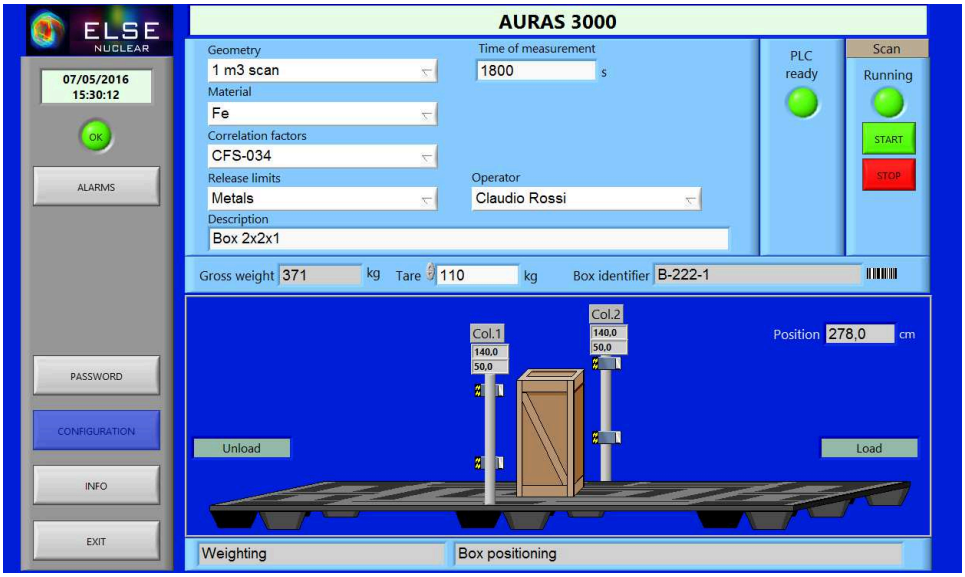
Routine Measurement Process

To start a routine scan, only five inputs are required from the operator:

- Measurement geometry (container type and number of counting positions)
- Material (chosen from a drop-down list of database materials)
- Correlation factor table (which may vary depending on the waste material type and origin)
- Concentration limit table (which may vary depending on the material type: metal, concrete, etc.)
- Preset time for the spectrometric measurement in each position

The measurement positions are automatically calculated depending on the number of counting positions required. Every position generates up to four entries in the scan configuration, one for each detector. Vertical detector positions can be computed, set manually, or learned by moving the detector to the desired height using the operator console. The program warns the user if the computed detector coordinates are out of range or would lead to a detector collision.

Multiple limit tables can be edited and saved depending on waste material type. No user intervention is required once the measurement sequence is started.



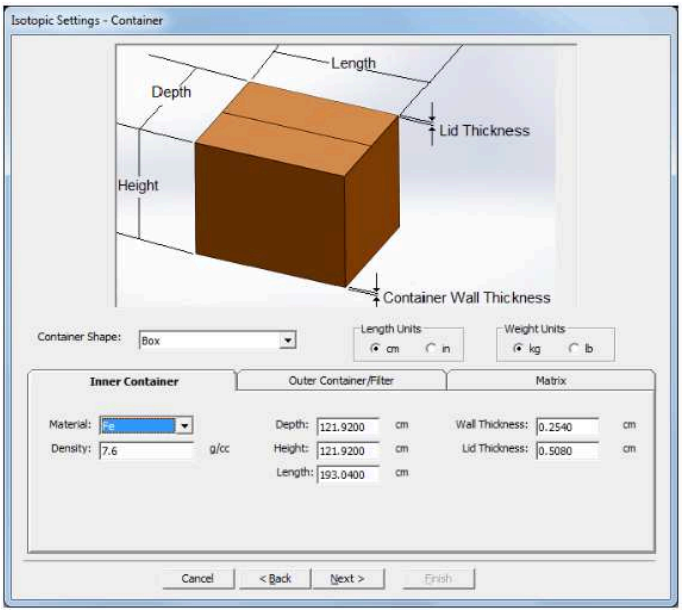
Software main operations and tasks

- Records the container weight after its loading
- Moves the platform and the detectors to the target positions
- Performs post-processing analysis to produce a set of release indexes for each nuclide, based on a customizable isotope release concentration limit table
- Using a customizable correlation scaling factor table, adds to the spectrometric results low or non-gamma emitting nuclides that cannot be seen directly, but are known to be present. Scaling factors can be referred to a given date to consider the isotope decay. Multiple scaling factor tables can be edited and saved, depending on the type and origin of the waste material. It is also possible to specify a list of unrelated isotopes known to be present in a given (fixed) concentration
- Compares analysis results to a table of release limits (if desired, multiple tables may be used)
- Produces a final report where all relevant input data are listed, together with the results of the scan. Different sections of the sample are compared graphically in order to display hot-spots. A final release index value is shown that marks the item as releasable or not depending on a user defined level. The report can be saved and printed
- If the user accepts the report, all relevant data (settings, spectra files, post-processing tables, etc.) are saved and can be later retrieved for re-analysis. Multiple scans of a single item are supported with no overwriting

TYPICAL PERFORMANCE

The table below presents typical MDA values for uniform waste and matrices. No special measures were taken to enhance these values.

	MDA on Single Spectrum (1 m³ container)		MDA Averaged on Multiple Spectra (1 m³ container)	
Radionuclide	**0.4 g/cc, 40 min**	**1.8 g/cc, 4 hr**	**0.4 g/cc, 40 min**	**1.8 g/cc, 4 hr**
Mn-54	0.0030	0.0004	0.0011	0.0003
Co-60	0.0019	0.0003	0.0007	0.0002
Sb-125	0.0102	0.0013	0.0039	0.0009
Cs-134	0.0032	0.0005	0.0013	0.0003
Cs-137	0.0037	0.0005	0.0014	0.0004
Eu-152	0.0131	0.0019	0.0049	0.0013
Eu-154	0.0080	0.0013	0.0028	0.0007
Am-241	0.0655	0.0066	0.0270	0.0037



Container configuration for detector positioning.

OPTIONS

Please note that AURAS 3000 stations can be adapted to specific requirements through a customization of the basic configuration here described. The customisation can be applied to the mechanical layout of the rails (length) and/or to the measurement equipment.

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