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Abstract

INVAP has designed a stack monitor based on a HPGe detector that meets the Hardware and Software requirements defined by the STAX (Source Term Analysis of Xenon) project.

The STAX project is an experiment focused on the development of a worldwide MIP stack detector network to measure radionuclides released from MIP facilities and use that data to help develop and test methods to improve discrimination between industrial activities and nuclear explosions.

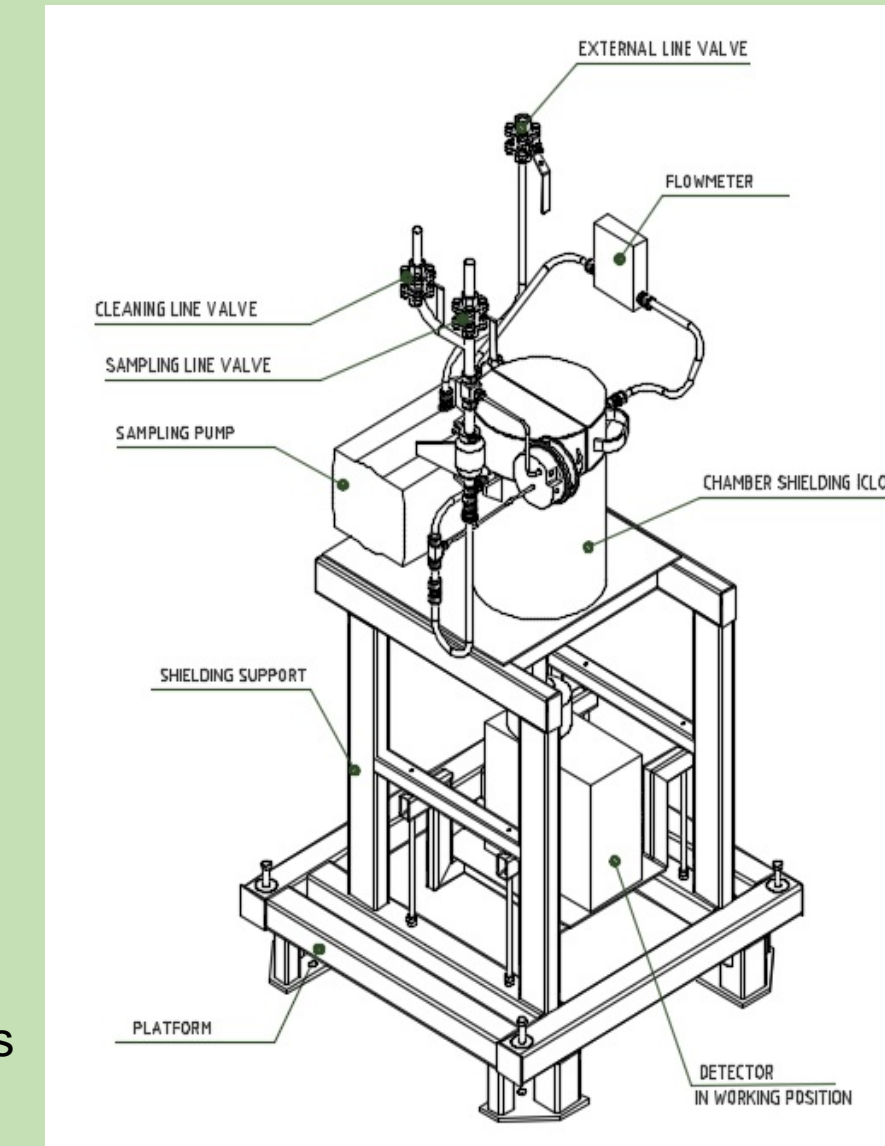
INVAP monitor can be adapted to broad emissions regimes of different MIPFs.

The monitor has a modular design which allows for an easy installation, fulfilling the different requirements that facilities that already have a stack monitoring system may have.

In the framework of a contract with PNNL, INVAP is manufacturing the stack monitor.

Sampling System

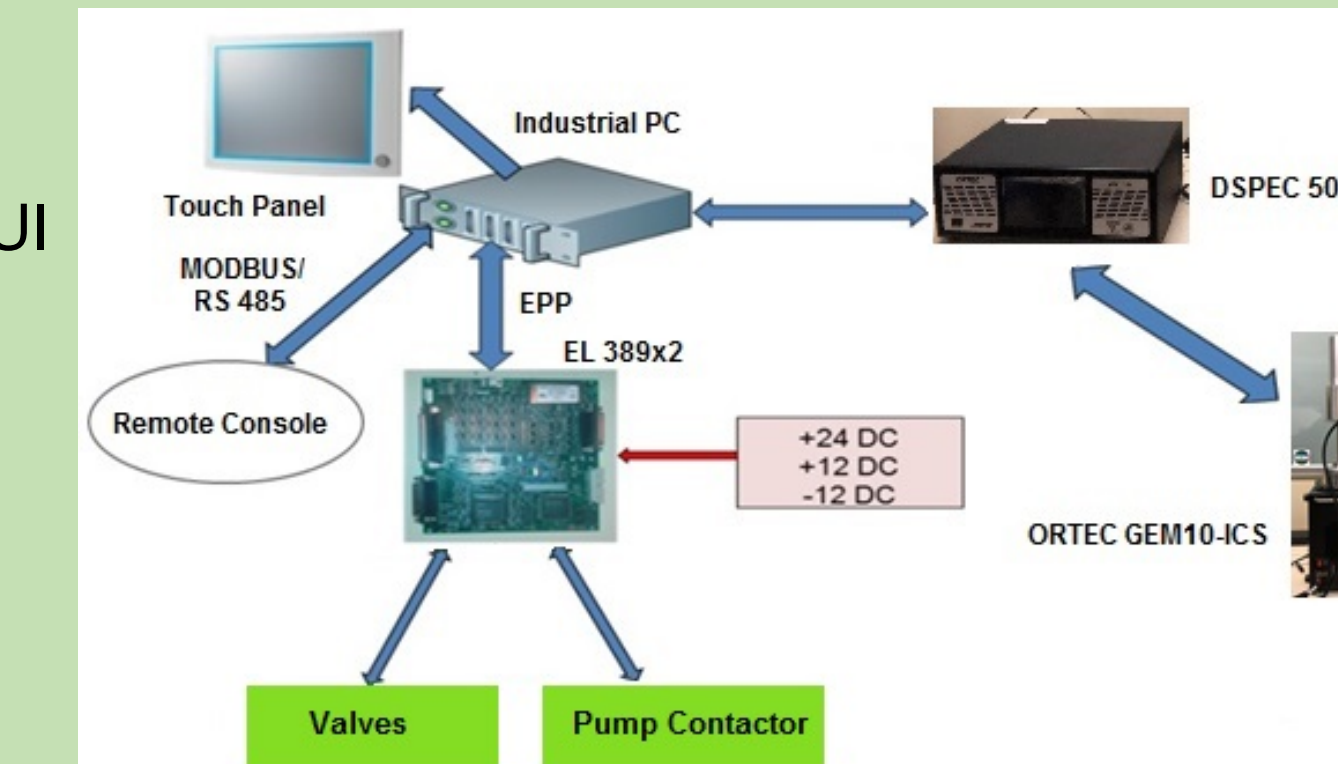
- Pump
- Flow meter
- Stainless Steel piping
- COTS aerosols filters and charcoal cartridges
- Custom designed measuring chamber



Actual manufacturing status

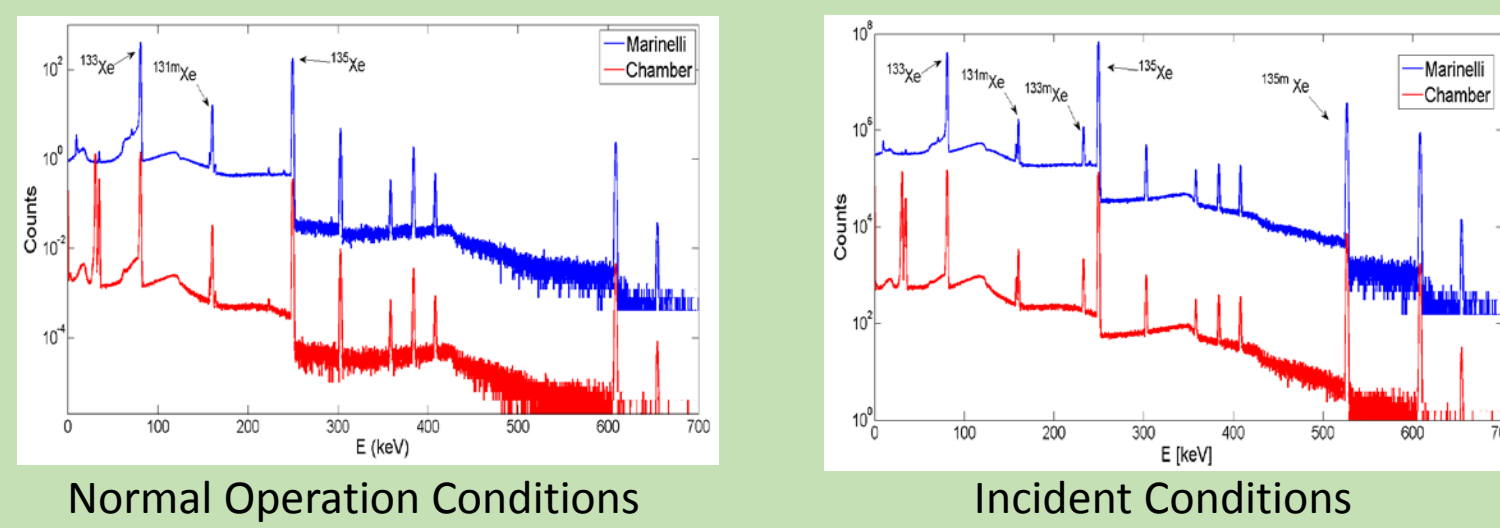
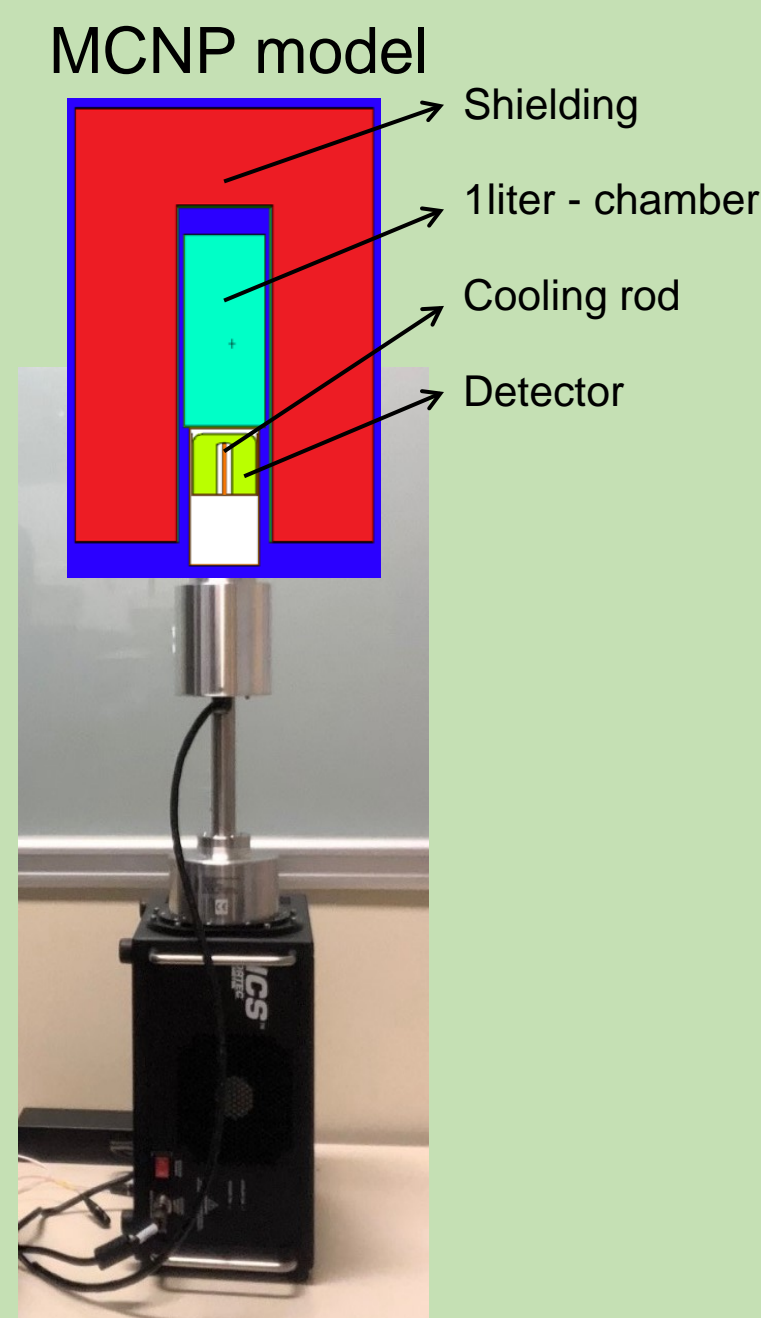
Software

- Control and monitoring of sampling system electro-valves
- Calculation of net counts for user defined ROIs in each isotope of interest
- Storage of spectra data, SOH data, emissions, system status in a relational database
- Spectra extraction from the MCAs
- SOH extraction from the HPGe detector
- System measurement status shown in GUI



HPGe detector

- GEM10-70-ICS-E-PL ORTEC (Coaxial P-type HPGe Gamma-Ray Detector with Integrated Cryocooling System)
- ICS external preamplifier (-ICS-E)
- Ultra-High Count-Rate Preamplifier (transistor-reset preamplifier), can handle input count rates up to 1000000 counts/s at 1 MeV, with no feedback resistor.
- 10% Relative efficiency

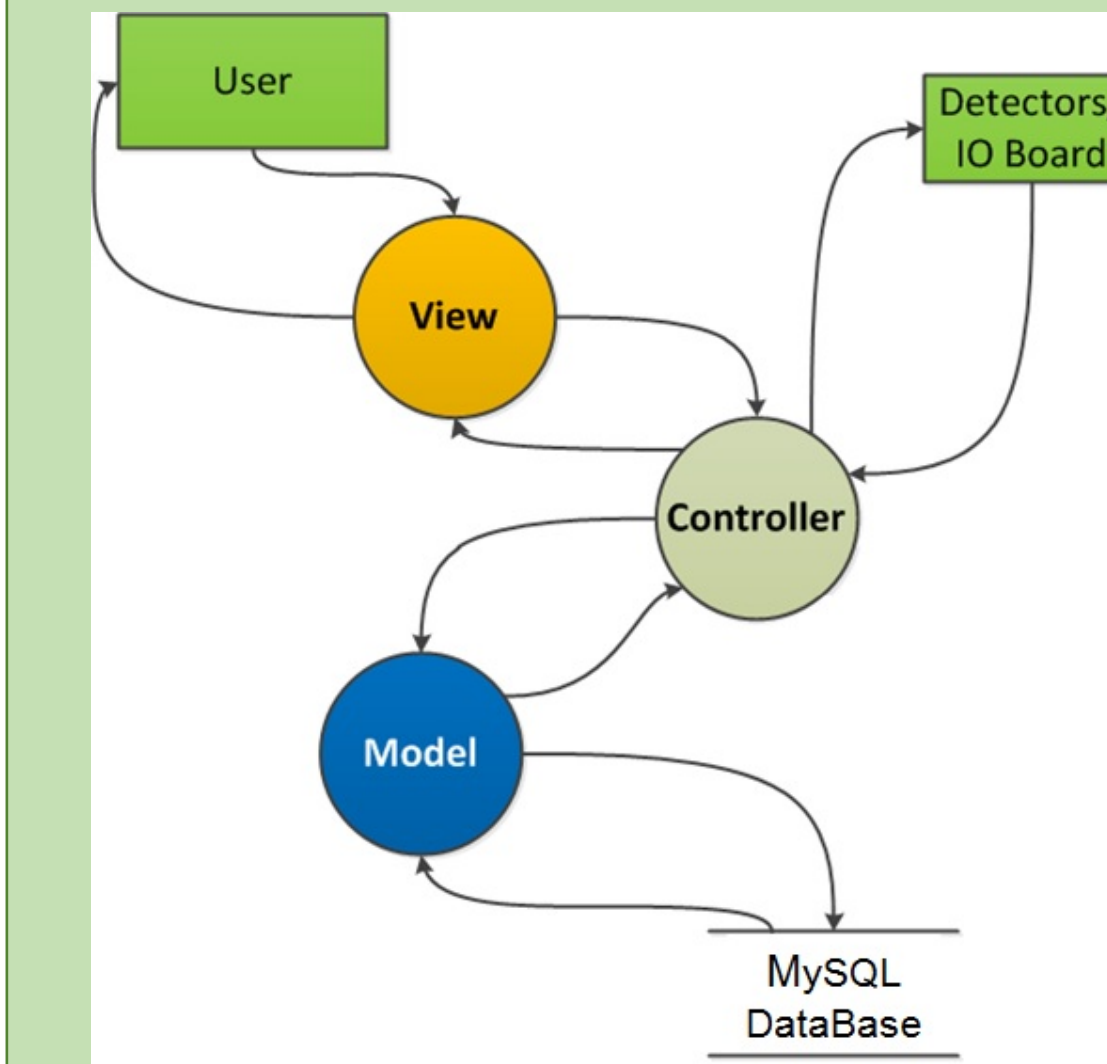


Measuring Rack

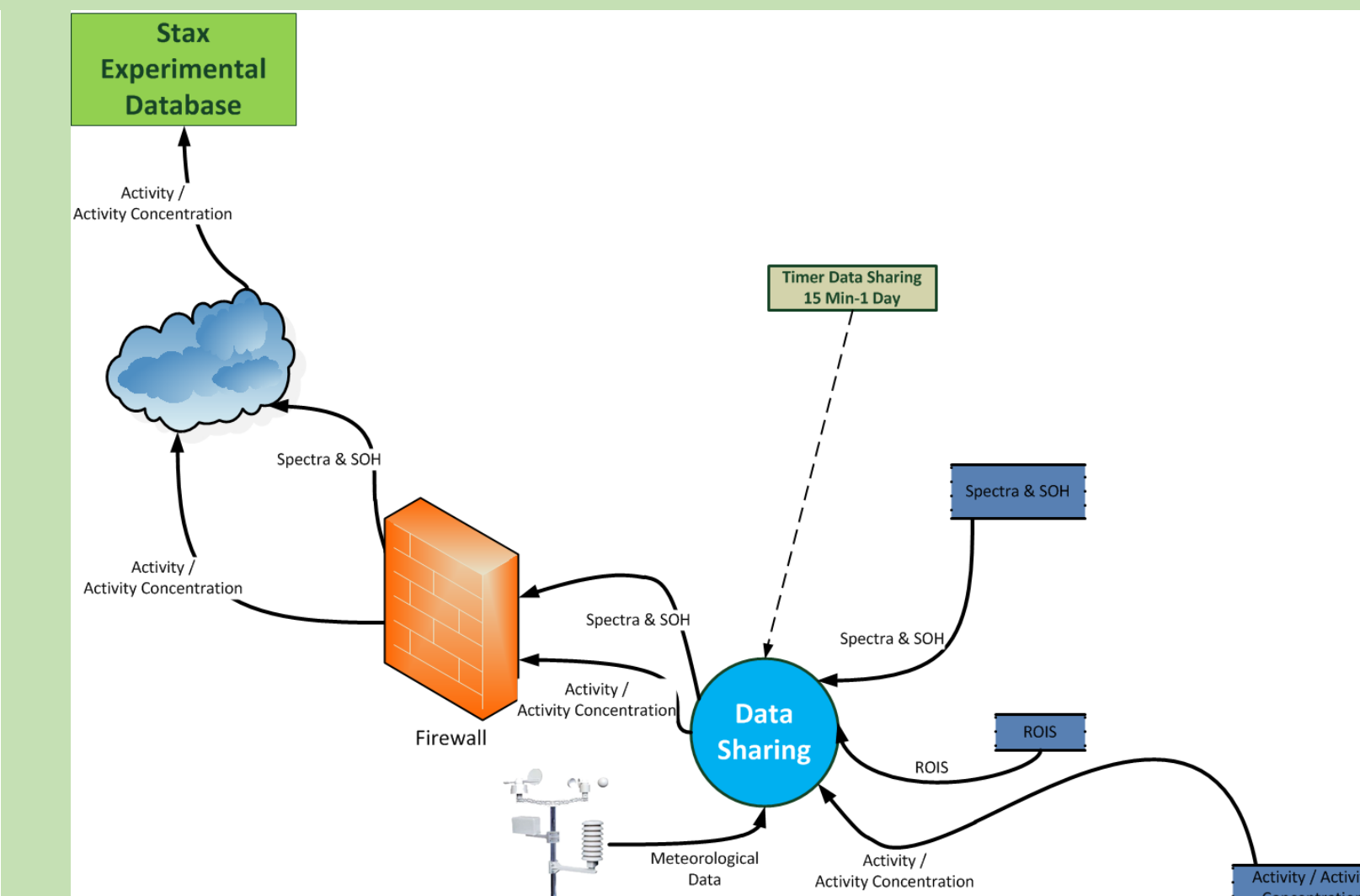
- Control panel
- Sampling system
- HPGe detector
- Electrical cooling system
- Shielding
- Air pump
- Filter holders



AEMI SW Level 1 Diagram



AEMI SW Data Sharing Add-In



Graphical User Interface

- Evolution of each ROI is followed in real time
- Number of counts in ROIs are calculated with spectroscopy software with background subtraction
- All the spectra are stored
- Historical spectra are stored for future analysis if needed



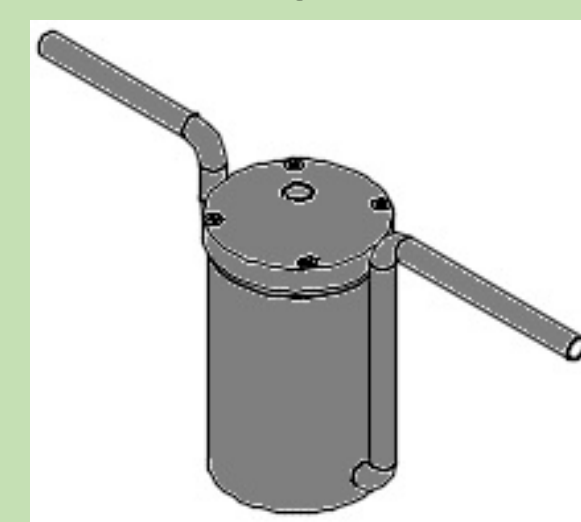
Conclusion

INVAP is constructing the stack monitor with a tailored design to meet the Hardware and Software requirements defined by the STAX project.

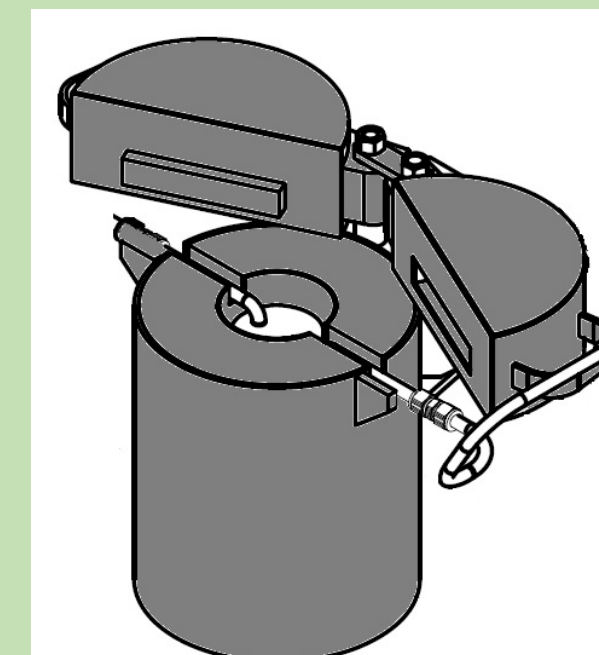
The monitor production is underway and on schedule. Its delivery is due early in 2020.

Custom Designed Measuring Chamber

Custom Designed Measuring Chamber



Modular Lead Shielding



Gas-like Calibration Source



Actual manufacturing status

Control panel and Measuring Chain

Control Panel in 600 x 800 mm Rack

Processing Unit

- 19" Panel PC
 - Intel I5 Core
 - 4 GB RAM
 - HD 500 GB
- Communication Ports
 - 2 Ethernet



Measuring Chain

- HPGe Detector
- Integrated Cryocooling system
- Ultra-high-count-rate Preamplifier
- Digital/analog signal processing
- MCA