

PROTECTING OUR PLANET

Solutions for Automated Radionuclide Xenon Detection



APPLYING EXPERTISE & INNOVATION AROUND THE WORLD

SCIENTA GROUP

Founded in 1986, the Scienta Group is now a leader in the research, development and application of applied nuclear, atomic and surface physics. With a large number of researchers and staff members, close ties to the academic community and operations throughout the world, the Scienta Group creates instrumentation and solutions for radiation analysis and high-resolution spectroscopy.

SCIENTA SAUNA SYSTEMS

A project team was established in 2003 to finalize the development of the first commercially available SAUNA system based on noble gas acquisition. Today, installed systems are in operation all around the world. Stringent quality assurance and an innovative approach form the basis for an extremely high quality, modular concept. The company's SAUNA II system exceeds the Comprehensive Test Ban Treaty (CTBT) requirements for near real-time ultra-sensitive field measurement of short lived noble gases. A range of products are now available to meet specific needs and different applications. All systems offer excellent reliability and easy maintenance and are supported by worldwide support.

UNIQUE COLLABORATION

The first SAUNA system became commercially available in 2004 as the result of a unique collaboration between Scienta SAUNA Systems and the Swedish Defence Research Agency (FOI). A prototype system was developed by FOI, and extensively tested in INGE (The International Noble Gas Experiment) during the late 1990's and early 2000's. The project was initiated to meet the global need for long-term, unattended, ultra-high sensitive monitoring of nuclear explosions using radioactive signatures. Scienta SAUNA Systems has applied its own expertise and industrial skills to further develop the technology and build the current range of products. The company still works in close cooperation with FOI, drawing on more than 20 years of xenon detection expertise.

Vision: To be the pre-eminent supplier of effective, user-friendly solutions for the detection of ionizing radiation on the international market.

SAUNA II installed in
Rio de Janeiro, Brazil,
2008.



SAUNA – SWEDISH AUTOMATIC UNIT FOR NOBLE GAS ACQUISITION

A leading solution for nuclear explosion detection

SENSITIVITY

The highly sensitive beta-gamma detection technique results in low detection limits for all four relevant xenon isotopes. The technical specifications and performance of the system meet, and in many cases exceed, the specifications defined by the CTBT requirements.

RELIABILITY

An advanced state-of-health (SOH) system monitors performance and provides real-time alerts regarding system parameters. Data from the local SOH database can be displayed for any sensor with high time resolution, providing possibilities for long term stability studies and remote troubleshooting.

MODULARITY

SAUNA is a flexible concept with a high degree of modularity. All modules are individually

exchangeable, with components being placed in modules according to functionality. This facilitates potential future upgrades and simplifies troubleshooting.

USER FRIENDLY

System design is both intuitive and logical. It includes front and rear interfaces providing versatile access and functionality. The front side provides limited features with only the *most important* parameters displayed. Access to the system for daily routine operation and monitoring is through the SOH software. The rear side, where the modules are interconnected, is used for service and maintenance.

REMOTE DIAGNOSIS

System control and monitoring can be accessed by remote login, enabling remote access through the local network.

SAUNA II installed
on Easter Island,
Chile, 2009.



Cutting-edge technology from sampling to detection

1

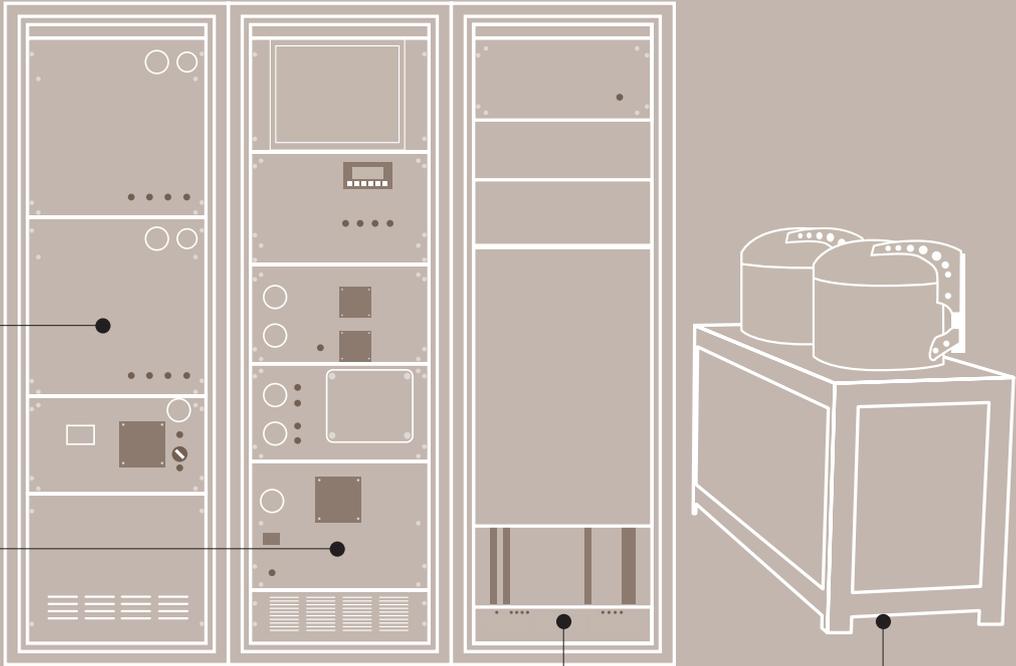
SAMPLING: Uninterrupted sampling of atmospheric xenon is performed using charcoal beds at ambient temperature. Two ovens work in parallel, collecting xenon from more than 16 m³ of air. Before entering the charcoal traps, moisture and carbon dioxide is removed from the air using membrane dryers and molecular sieves.

2

PROCESSING AND QUANTIFICATION: During processing, the sample is purified further by preparative gas chromatography. Lighter gases are removed and important radon separation is performed before the sample enters the gas chromatograph for quantification using a thermal conductivity detector. A time window around the xenon peak further purifies the xenon as a final step prior to entering the detector cell for activity measurement.

3

DETECTION: Xenon activity is measured using a beta-gamma coincidence technique recording the energy of the electrons and gamma rays produced in the decay of ¹³³Xe, ¹³⁵Xe, ^{131m}Xe and ^{133m}Xe. Ambient background is reduced and the recording of beta energy allows for high sensitivity measurement of the meta-stable states, which can be crucial for distinguishing a nuclear test from other sources.



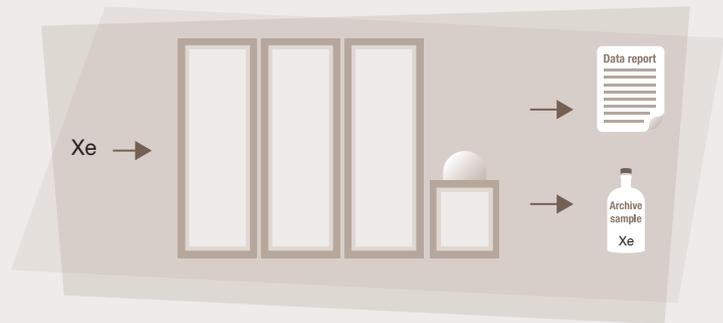
SAUNA SYSTEMS PRODUCT RANGE

The modular design and robust detection method of the SAUNA concept has allowed the development of new products to meet specific customer needs. The product range includes solutions for automated continuous monitoring and reanalysis of gas samples, as well as mobile sampling and subsequent processing and analysis.

Continuous monitoring

Requiring no day-to-day human intervention

- 1 Sampling
- 2 Processing and Quantification
- 3 Detection



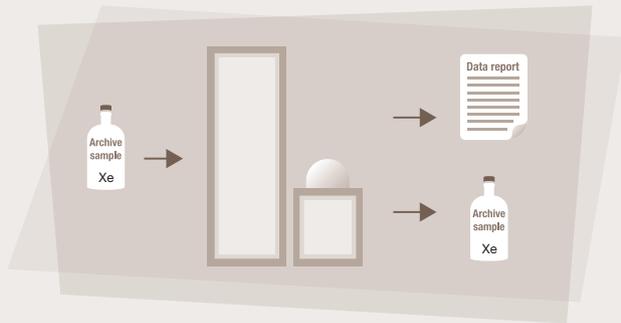
SAUNA II

- Fully automated, state-of-the-art system for continuous monitoring
- Based on a unique non-cryogenic sampling technique followed by preparative gas chromatography and a high sensitivity detection
- Technical specifications and performance meet or exceed CTBT requirements
- 12 hour data resolution with preliminary spectral data and SOH-data reported every second hour
- Highly sensitive beta-gamma detection system gives low detection limits for ^{133}Xe , ^{135}Xe , $^{135\text{m}}\text{Xe}$, and $^{131\text{m}}\text{Xe}$
- State-of-health monitoring system generates alerts on deviations from normal



Reanalysis of gas samples

For confirming measurements with the possibility to increase analysis sensitivity



- 2 Processing and Quantification
- 3 Detection

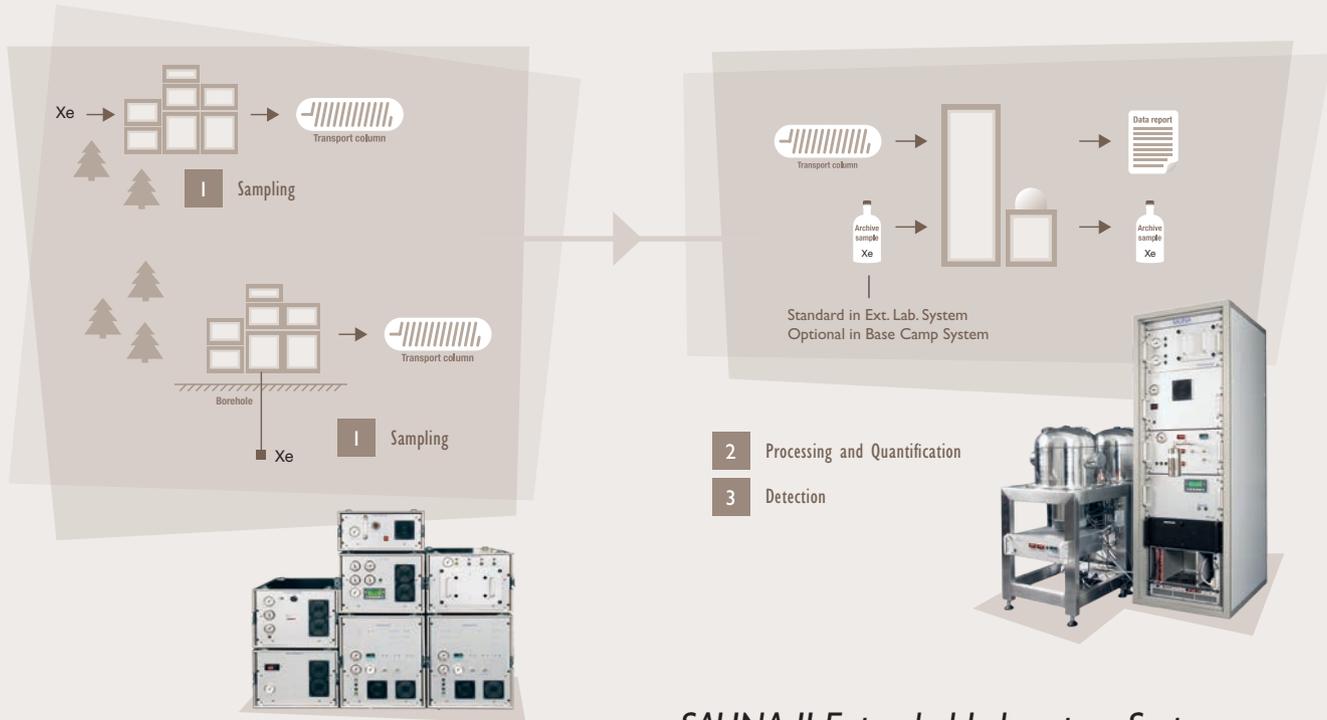
SAUNA II Laboratory System

- Manual system offering maximum analysis flexibility
- Analysis of archive gas samples with standard connectors
- Efficient transfer of the archive sample to the gas chromatograph for quantification of the stable Xe
- Separation of lighter gases, and further gas separation in the gas chromatograph
- Activity measurement of ^{133}Xe , ^{135}Xe , $^{133\text{m}}\text{Xe}$, and $^{131\text{m}}\text{Xe}$ using a beta-gamma coincidence detector with the ability to increase sensitivity, by extending the data acquisition time of the SAUNA detector system



In-field sampling with laboratory analysis

For collecting xenon samples close to the potential source of a nuclear explosion



SAUNA II Mobile Sampling Unit

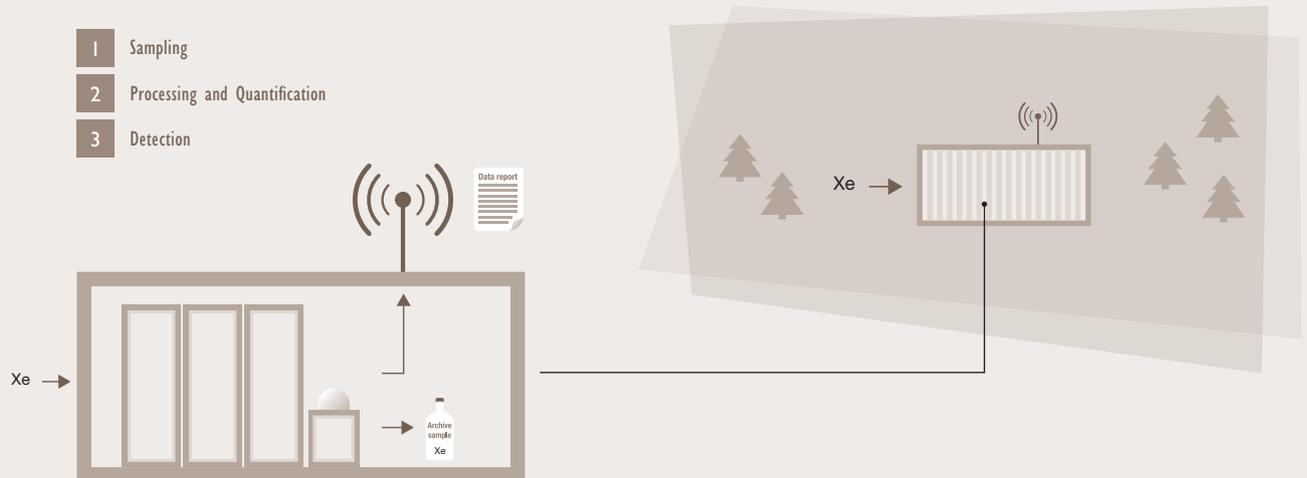
- Robust mobile unit for in-field sampling
- Continuous or single sampling
- Short setup time – 20 minutes
- Modules mounted in easy-to-carry boxes
- Easy transportation to Extended Laboratory System or Base Camp System for carrying out processing and analysis
- Possibility to collect subsoil samples

SAUNA II Extended Laboratory System

- Manual system with capability to process and analyze samples from the Mobile Sampling Unit
- Reanalysis of gas samples by using an extra ATU module
- Increased capability to separate other gases, compared to the SAUNA Laboratory System
- Increased radon separation factor, compared to the SAUNA Laboratory System
- Activity measurement of ^{133}Xe , ^{135}Xe , $^{133\text{m}}\text{Xe}$, and $^{131\text{m}}\text{Xe}$ using a beta-gamma coincidence detector

Transportable xenon laboratory

A transportable SAUNA II system – the complete solution with all infrastructure integrated



Transportable Xenon Laboratory (TXL)

- A container solution for a transportable SAUNA II system
- Complete solution for deployment worldwide
- All infrastructure integrated
- Fast start up for continuous monitoring
- Fully automated SAUNA II system for continuous monitoring
- Same high performance as specified for SAUNA II standard configuration
- Activity measurement of ^{133}Xe , ^{135}Xe , $^{133\text{m}}\text{Xe}$, and $^{131\text{m}}\text{Xe}$ using a beta-gamma coincidence detector



Technical solution developed by PNNL (Pacific Northwest National Laboratory) in 2009

WHEREVER AND WHENEVER YOU NEED US

SAUNA SYSTEMS' SERVICE AND SUPPORT CONCEPT is based on a proactive approach and an acute understanding of system user needs. Our commitment to providing a total service solution means we can offer support at every stage, from installation and training to maintenance and performance evaluation.

Flexible service programs are offered based on the level of support you require. This can include preventive maintenance, on-call service, emergency repairs with short response times and comprehensive telephone support. We can also provide a full remote technical evaluation of system performance, facilitated by the advanced state-of-health monitoring system and the local database solution.

The modular concept, intuitive design and system configuration greatly simplify maintenance, troubleshooting and repairs. Our team of service engineers are all trained to high theoretical and technical levels and are available for a wide variety of support activities.

Training programs are also adapted to user needs, from standard installation training to advanced practical and theoretical training courses. Training can either be performed on-site during installation or using the training facilities at our head office.

Our people are your people!

SAUNA II installed at
Spitsbergen, Norway,
2006.



ANSWERING TOMORROW'S QUESTIONS

Technology does not stand still. We are more than aware of this at Scienta SAUNA Systems. Solutions include a high degree of modularity providing the possibility to implement new technical developments and upgrades.

Continued cooperation with leading scientists from academia and FOI means we are able to stay ahead of all the latest developments in the field. At the same time, our open approach ensures we can respond to specific customer needs, providing new innovations and specialized support.

We are fully committed to supporting the entire life cycle of our solutions as well as the continued development of the IMS. Partnering with Scienta SAUNA Systems means partnering with the future!

SAUNA II installed
on Chatham Island,
New Zealand, 2007.





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