



SAUNA-II

The Industrial Automated Radionuclide Xenon Detection System



About Gammadata

Founded in 1986, the Gammadata Group is now a leader in the research, development and application of specific 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 Gammadata Group is creating instrumentation and solutions for radiation analysis and high-resolution spectroscopy.

Production

The Gammadata R&D and production team have since 1986 successfully challenged the difficult task to produce and worldwide install small series of advanced and very complex analysis systems for the surface- and nuclear science industry. The production and test facilities consist of 500 m² and manufacturing and control tools used, are of highest industrial standards.

Service and Support

The Gammadata service and support team provides a total solution and commitment to our SAUNA-users by providing a 24 hours on-call technical support service. Trained customer support and technical teams are dedicated to provide our SAUNA-users with the level of support they need when they need it. On-site service agreements, preventative maintenance agreements, training and extended warranties are available to provide added level of protection.

Gammadata Product line

With a basis in Professor Kai Siegbahn's Nobel Prize winning ESCA method, Gammadata has developed, and continues to develop, instrumentation for surface physics measurements systems. With SAUNA II, in the light of the 2005 Nobel Peace Prize awarded to IAEA, this tradition has continued. The SAUNA II system represents another example how the Nobel Prize traditions and Swedish technical development sometimes goes hand-in-hand.



Alfred Nobel 1833-96
- Scientist and founder

Alfred Nobel, the founder of the Nobel price was born in Stockholm 1833. As a chemistry student in Paris he met Ascanio Sobrero, the man who invented nitroglycerine. His interest in explosive materials resulted in a patent of dynamite 1867 and an establishment of companies and laboratories all over the world. In 1895 Nobel signed his last will providing for the establishment of the Nobel Prize. His wish was to award those who have or had done their best for humanity in the fields of physics, chemistry, physiology or medicine, literature and peace.

In 1901 the first Nobel Prizes were awarded.



Alva Myrdal 1902-86
- the first Swedish disarmament minister

Alva Myrdal remains one of the most well-known and respected personalities in international affairs due to her engagement in nuclear disarmament. During two decades she spent all her time fighting for these matters, both as ambassador and member of the Swedish Cabinet.

Alva Myrdal was awarded with the Nobel Peace Price in 1982 for her long and tireless effort in favor for nuclear disarmament in general and her criticism of the nuclear weapons powers for failing to live up to their commitments under the Non-Proliferation Treaty.



Dag Hammarskjöld 1905-61
- the world's most impossible job

Dag Hammarskjöld is one of the most admired and respected Swedish citizens in modern time. As the General-Secretary of the United Nations (1953-61) he became a role model for a lot of people through his courage, engagement and integrity. During his negotiations he followed a neutral strategy and stressed the United Nations assignment to protect the small states against the superpowers. He also made a proposal to establish a commission for a peacekeeping force that should monitor and observe peace processes that emerge in post-conflict situations.

He came to impersonate the ideal of the UN-constitutions and was after his death awarded with the Nobel Peace Prize in 1961.



Excellent development and collaboration

With more than 20 years of experience and traditions in xenon detection from the Swedish Defence Research Agency (FOI) in combination with the industrial skills of Gammadata, the industrial version of the SAUNA system was made commercially available in 2004. Using the most sensitive detector system based on coincidence beta-gamma detection, in combination with industrial modular design for optimum reliable performance, the new radionuclide xenon detection system, SAUNA II is improved in terms of detection sensitivity, reliability, modularity, maintainancy and support availability.

The aim for FOI – development of the prototype

The aim for the development was the global need of long-term, unattended, ultra-high sensitive monitoring of nuclear explosions using radioxenon signatures. The prototype system named SAUNA (Swedish Automatic Noble Gas Analyser) was developed and built by the Swedish Defence Research Agency FOI and extensively tested in the framework of an international collaboration. The SAUNA prototype is used at the CTBT NOX49 station at Spitzbergen reporting data with only occasional interruptions since end of 2001.

The aim for Gammadata - Industrialisation

In a unique collaboration between the developers (FOI) and their industrial and commercial partner Gammadata, the SAUNA-system has been engineered to meet highest industrial standards. The prototype SAUNA-system already met or exceeded the Comprehensive Test Ban Treaty (CTBT) requirements for near real-time ultra-sensitive field measurement of short lived noble gases. The industrialisation of the SAUNA-II system have added not only improved detection sensitivity but also improved reliability, modularity, maintainancy and support availability.

Quality Assurance

The SAUNA II production and extensive test (FAT) follows the methods defined in the Gammadata quality assurance system. The Gammadata QA-system is certified according to SS-EN ISO 9001:2000. This includes e. g. sub-contractor and supplier evaluations, overall traceability, documentation standards etc. Our methods also follow the environmental quality system EMAS and SS-EN ISO 14001.



THE SAUNA II CONCEPT

- Modular approach throughout the whole design.

Compactness and modularity

When SAUNA II was designed, a key word was modularity. In order to design a state-of-the-art system that fulfills the latest demands on flexibility, reliability and serviceability, a modular system is essential. In SAUNA-II, all components are placed in modules according to functionality. As a result of that SAUNA-II is:

- A system that is easy to understand and troubleshoot.
- A system where all modules are individually exchangeable.
- A system that allows fast installation and fast on-site response times for service and maintenance.
- A flexible system ready for potential upgrades.

User friendliness - Two interfaces and access levels

Great care is taken to obtain a clean, logical and intuitive design. The system uses two interfaces for versatile functionality:

- *Front - For system operators:*
Only the most important system parameters are displayed on the front panel of each module. The current process mode of the system will be visible by means of LED's. A State-of Health alarm system is installed on all SAUNA-II units. This considerably simplifies routine monitoring and troubleshooting for system operators on site.
- *Rear - For service engineers:*
The rear side of the system is used for service and maintenance. That is where the different modules are interconnected.
- *Different levels of access*
 - Duty Operator Access
 - Senior Operator Access
 - Operations Manager Access



Reliability

A number of features make the SAUNA-II system reliable and well adapted to its purpose, suitable for uninterrupted and unattended use.

- An advanced State-of-Health system diagnosis the system parameters, which can be remotely accessed.
- Only components of industrial standards are used in the system.
- The design is optimised to reduce the number of external connections in order to simplify service and maintenance.
- All components are mechanically and electrically screened, thus minimising the risk for physical damage and disturbances caused by a hostile electromagnetic environment.

Remote diagnostic possibilities

The system control and monitoring can be accessed through its own web server, thus enabling remote access to the system through the local network.

The SAUNA II OSI concept

On-site compatibility

The modular design and the flexibility of the system have allowed us to design a mobile version of SAUNA-II. This system is specifically designed for field-use with a mobile sampling unit that comprise exchangeable process columns. Sampling of xenon is done in the field and the exchangeable process column containing the xenon sample is then transferred to another destination for automatic processing and activity analysis.

The SAUNA II Lab concept

Laboratory version

Due to the fact that high sensitivity can be achieved with the beta-gamma detection technique, the SAUNA laboratory system can be suitable for re-analysis of xenon gas samples. The laboratory system is a manual system for quantification of the amount of stable xenon followed by an activity measurement. Because of the modularity, it is quite easily fitted to different laboratory needs.



Sampling-Processing-Quantification-Detection

SAUNA-II is based on a unique non-cryogenic sampling technique followed by preparative gas chromatography and a high sensitivity beta-gamma detection system.

Sampling

Uninterrupted sampling of atmospheric xenon is performed using charcoal beds at ambient temperature. Moisture and carbon dioxide is removed from the air using thermoelectric coolers and molecular sieves.

Processing

Sample preparation including radon separation is performed by preparative gas chromatography.

Quantification

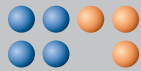
The xenon volume is quantified using a thermal conductivity detector.

Detection

The xenon activity is measured using a beta-gamma coincidence technique recording the energy of the electrons and gamma rays produced in the decay of ^{135}Xe , ^{135}Xe , $^{131\text{m}}\text{Xe}$, and $^{133\text{m}}\text{Xe}$. The coincidence technique reduces the ambient background and the recording of the beta energy allows for high sensitivity measurements of the metastable states.

Performance

The SAUNA II technical specifications and performance meet or exceed the specifications defined by the CTBT requirements. Detailed technical information can be required from Gammadata.



gammadata

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