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Next Generation Noble Gas Systems for the IMS Network

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Abstract

40 out of the 80 radionuclide stations of the Monitoring System Network of the CTBT will be equipped with Noble Gas detection systems. Today 31 of these stations exist with 25 of them being certified. Noble Gas detection system technology for CTBT verification founded its basis with the International Noble Gas Experiment (INGE) more than 15 years ago with the contribution in technology advancement from 4 member states. In continued cooperation with member states and the noble gas system vendors, the IMS Division continues engineering and development efforts on next generation noble gas systems. This poster describes various ED projects which aim to increase data availability, quality and sustainability of current systems, and further improve performance and modularity of the IMS noble gas network.

Background information

The development of NG monitoring systems viable for CTBT verification and to be included in the IMS network started more than fifteen years ago and was coordinated under the International Noble Gas Experiment (INGE) since 1999.

Since then, the different equipment producers have gained large knowledge and experience which has resulted in more robust, sensitive and maintainable designs. In recent years next generation of NG systems have been presented in their prototype form to the PTS.

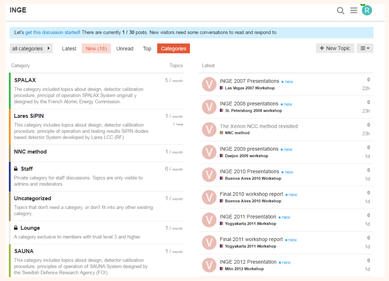
The PTS is closely engaged with providers in order to evaluate their NG systems for possible future integration in the IMS network.

Additional Engineering and Development (ED) projects testing of different components and material of potential interest to the new generation of NG systems.

Establishment of the new INGE portal

The INGE portal has been re-established in order to promote moderated scientific discussions and information sharing on new technologies in the field of NG development and in particular during the production of next generation NG systems.

One of the current topics of interest is the evaluation of the new SPALAX-NG spectral data, which are in high resolution for both gamma and beta detectors (PIPSBox from Canberra) and of intense interest for PTS and the NG community.



Next Generation of NG systems and testing approach by PTS

Under the current IMS acceptance practice, new technologies undergo a minimum of 1-year testing period to demonstrate compliance with IMS requirements. The same approach will be undertaken for the next generation Noble Gas systems and in particular: the SAUNA III from FOI, SPALAX NG from CEA, MIKS from VNIIA, and Xenon International from PNNL


SAUNA III prototype


SPALAX-NG prototype

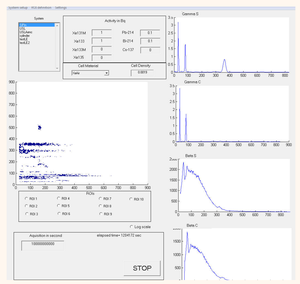


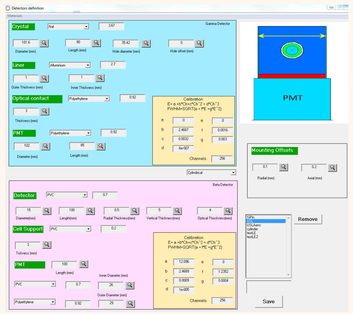
Xe International prototype

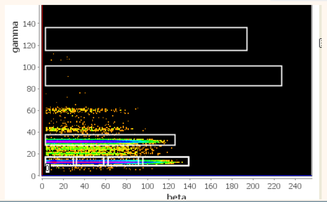

MIKS prototype

VGSL BG prototype

A prototype version of VGSL (VGSL_NG) has been developed in order to simulate different combinations of mid/high resolution spectra in both gamma and beta energy and different geometries representative to the next generation of NG systems. The current templates allow coupling of well-type gamma detector with different shapes of beta detector, such as cube shape for SiPiN or cylindrical shape for SAUNA/MIKS type beta detectors.







Testing new components for NG application

ED for SPALAX

PTS hosts a SPALAX test station (VIX00) at the Vienna International Center. This allowed testing of several components of the next generation SPALAX: in collaboration with CEA, new and increased numbers of N2 membranes, a compressor with higher air flow, and a different type of drying equipment have been tested. SPALAX now operates at VIX00 in 12 h sampling cycles, achieving similar volumes of Xenon as the SPALAX version operational at certified IMS stations.


New N2 membranes (model UBE)


Frigorific dryer “Beko”


Kaeser compressor

E&D for SAUNA

Outcomes from several joint projects between PTS and SAUNA vendor, aiming at improvement of maintainability, standardization and system characteristics, have been implemented into the final design of SAUNA III. The most important are:

- Improved QC mechanism
- Improve system serviceability
- Testing of new absorber material (Ag Zeolite)
- Spike injection enhancement
- HW gain stabilization

LARES SiPin

Another version of SiPin detector developed by Lares has a form factor which allows coupling with the current SAUNA gamma detectors. The PTS is currently testing for long term assessment one this detectors in the SAUNA prototype in UPPSALA.