The Nuclear Science and Instrumentation Laboratory

The current role of the Nuclear Science and Instrumentation Laboratory (NSIL)

The NSIL is part of the Physical and Chemical Science Division and implements the nuclear science programme. It provides support to Member States in the development of a broad range of nuclear applications and effective use of related-instrumentation.

NSIL carries out Adaptive Research & Development (AR&D) in, for example, X-ray fluorescence spectrometry used for testing of materials in diverse fields such as bio-medicine, pharmaceuticals, agriculture, environment, and for the analysis of cultural heritage objects. The NSIL assists Member States by developing portable systems and analytical methodologies for in-situ materials testing and environmental assessments. Training is provided through national and regional technical cooperation projects and on-site at NSIL with the nuclear instrumentation.

Meeting Member States’ needs: the future challenges

Testing and research in the fields of bio-medicine, pharmaceuticals, agriculture etc. and materials testing technologies are expanding areas of concern for Member States, and are important for industrial development and trade.

Nuclear instrumentation underpins most or all nuclear techniques and the training provided via NSIL seeks to equip the next generation of the scientific workforce using best modern practices including long distance learning and the one-on-one mentoring of undergraduate, graduate and postdoctoral level technical personnel.

Particle accelerators are emerging and rapidly expanding as a key industrial and scientific technology for applications ranging from sterilisation of medical products to computer chip manufacturing.

An IAEA Ion Beam Accelerator (IBA) will provide expanding opportunities for AR&D and training. NSIL has developed extensive experience in the use of accelerators and accelerator technologies through its cooperation agreement with the Ruder Boskovic Institute (RBI) in Croatia, and the installation of an X-ray fluorescence (XRF) beam line at the Elettra synchrotron in Italy. The new Elettra beam line is a logical continuation and extension of the longstanding X-ray fluorescence expertise at NSIL. These instruments enable more advanced investigations in materials analysis, testing and AR&D than it is possible with in-house table-top laboratory experiments.

Current limitations on the work of NSIL

Globally, access to particle accelerator beam time is increasingly scarce, and NSIL as with the Member States, faces challenges on accessing beam time for providing training, for performing experiments and for developing innovative solutions to Member States’ needs.

NSIL is currently limited by the available equipment and instrumentation. The lack of critical modern nuclear instruments does not permit trainees to work with the equipment or to the standards that they would expect use in their home countries.

Laboratory space is currently severely restricted, in some cases raising safety concerns. The available office space to accommodate the NSIL staff, trainees, interns and fellows is spread across the current site and thus limits the cohesiveness of the laboratory.
Equipment needs to meet future challenges

An Ion Beam Accelerator is needed at NSIL in order to provide aspiring MS with the support they need to access and develop their nuclear science workforce to utilise particle accelerator technologies.

This IBA needs to be equipped with updated X-ray and gamma spectrometry instrumentation and other nuclear instrumentation necessary for NSIL to maintain and, where needed, expand services to Member States.

To meet future challenges, the current space of 450 m² would need to be supplemented by 532 m² of net additional laboratory, office, training and storage space with a primary focus of providing the necessary facilities needed for installing an ion beam accelerator.

### NSIL estimated requirements

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<tr>
<td>Total net space required</td>
<td>982 m² (450 m² existing and 532 m² new)</td>
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<td>New equipment</td>
<td>€1 800 000 estimated costs at current prices</td>
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### The benefits of the ReNuAL project

The installation of an IBA and other modern nuclear analytical instrumentation will provide advanced, relevant practical training, overcoming restricted opportunities elsewhere in the world. The NSIL will be able to serve as a model facility and reference Quality Assurance / Quality Control laboratory for ion beam techniques worldwide. The basis for industrial development through nuclear technology in Member States will be increased.

Across the NA programmes, this NSIL IBA project has the potential to further strengthen interactions and collaborations amongst all the IAEA Seibersdorf Laboratories. The IAEA inter-disciplinary nuclear technology applications will substantially benefit from the synergies generated by the versatility and capability offered by an Ion Beam Accelerator.