Physics

Facilitating the Peaceful and Practical Uses of Nuclear Science and Technology

The IAEA Physics Section helps Member States establish frameworks for the efficient, sustainable and safe use of advanced nuclear technologies such as particle accelerators, research reactors, nuclear fusion facilities and associated instrumentation. Applications of these nuclear technologies help advances in various fields such as energy, health, food and agriculture, nuclear safety and security, cultural heritage, forensic science, industry and the environment.

Four Key Areas

Accelerator Applications
Accelerators are used in both fundamental and applied research to characterize and qualify materials and objects, and to provide education and training for professionals in the nuclear sector. Major focus areas include: applied research with three complementary probes such as X-rays from synchrotrons; neutrons from spallation sources; and ion beams from small accelerators.

Research Reactor Utilization
Research reactors play an important role in the development of nuclear science and technology. They are used worldwide to produce radioisotopes for medical and industrial purposes. They also provide neutrons for research in physics, biology, the environment, materials science and energy, as well as for education and training of scientists and engineers.

Fusion
Fusion could be a safe and environmentally friendly source of energy in the future. The international fusion R&D programme is constructing the largest magnetic confinement experimental reactor called ITER. Currently, 35 countries are involved in its construction and over 100 more are engaged in fusion research as members of laboratory networks.

Nuclear Instrumentation
Successful use of nuclear technology depends on reliable instruments, monitoring and diagnostics equipment. These instruments allow the accurate measurement of both natural and man-made radiation.

By the Numbers

The IAEA Physics Section currently is leading

13 COORDINATED RESEARCH PROJECTS COVERING MORE THAN **150 RESEARCH INSTITUTIONS AND ORGANIZATIONS**

Supporting more than

50 TECHNICAL COOPERATION PROJECTS IN MORE THAN **50 MEMBER STATES**

Our databases and information portals include the most recent developments of

225 RESEARCH REACTORS OPERATING IN **53 MEMBER STATES**

218 ION BEAM ACCELERATORS OPERATING IN **53 MEMBER STATES**

57 SYNCHROTRON LIGHT FACILITIES OPERATING IN **22 MEMBER STATES**

40 SMALL-MEDIUM SIZE EXPERIMENTAL FUSION DEVICES OPERATING IN **15 MEMBER STATES**

The IAEA Physics Section offers access to the state-of-the-art facilities through

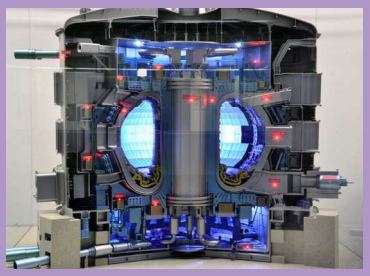
2 IAEA COLLABORATING CENTRES (TU DELFT, NETHERLANDS AND ANSTO, AUSTRALIA)

2 BILATERAL AGREEMENTS WITH ELETTRA, ITALY AND RBI, CROATIA.

Key Activities

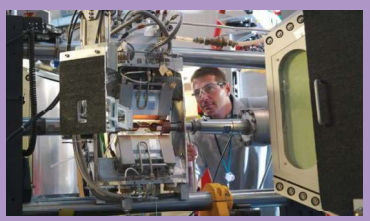
- Promoting the **utilization of accelerators and research reactors** in support of fundamental and applied research to irradiate or characterize materials, produce radioisotopes and provide training.
- Enhancing utilization of existing infrastructures through enabling **facility access for developing countries** without such facilities.
- Assisting in planning and **establishing new facilities**.
- Assisting Member States' laboratories in designing, installing, operating and maintaining the **nuclear instrumentation** needed for their research.
- Implementing training workshops and hands-on-training courses, including those at the IAEA **Nuclear Science and Instrumentation Laboratory** in Seibersdorf, partner laboratories in the Member States or in cooperation with the International Centre for Theoretical Physics, in Trieste, Italy.
- Facilitating **global fusion research and development** by fostering scientific and technological progress through international collaboration; supporting education and training; strengthening interactions between **ITER** and non-ITER members.

Success Stories



The IAEA's biennial Fusion Energy Conference (FEC) is the largest global platform for sharing latest research and development results in fusion. The conference aims to close the scientific and technological gaps towards fusion energy. The event attracts around 1000 participants from more than 40 Member States. The next FEC will take place from 22 to 27 October 2018 in Ahmedabad, India. More information at **https://nucleus.iaea.org/sites/fusionportal/**

Through a coordinated research project, the IAEA Physics Section supported the development of large sample neutron activation analysis as the only existing method to measure non-destructively the bulk mass fractions of the elements present in samples up to kilograms in mass. Examples include archaeological artefacts, excavated rock samples, large samples of assorted ore, and nuclear reactor components. More information at **https://nucleus.iaea.org/rrdb/**



A novel ion beam accelerator-based analytical technique, MeV-SIMS, has been recently developed and internationally coordinated by the IAEA Physics Section. It can map organic molecule concentrations with micrometer-size details in samples of interest to art, archaeology, materials science, organic electronics, forensics, geology and biomedical science. By combining MeV-SIMS with conventional ion beam analysis both elemental and molecular information can be determined.

The Accelerator Knowledge Portal is broadly used by an international community of accelerator scientists and users, and service providers worldwide. It offers a database of research particle accelerators from all over the world and has several networking and community features to bring together the accelerator community. More information at **https://nucleus.iaea.org/sites/accelerators**

Organization and facilitation of annual laboratory proficiency tests using analytical techniques have been recently enhanced by a dedicated web portal. In 2018, a set of samples for analysis were provided to analytical laboratories for more than 50 Member States. More information at **http://www.pt-nsil.com**

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