IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Training Workshop on Advanced Use of Neutron Imaging for Research and Applications

Hosted by the
Government of Czech Republic

through the
Department of Nuclear Reactors, Faculty of Nuclear Science and Physical Engineering (FNSPE), Czech Technical University (CTU)

Prague, Czech Republic

6 – 10 October 2025

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Information Sheet

Introduction

The IAEA supports Member States in deployment and utilization of advanced nuclear science and technology and promotes enhancement of the quality of products and analytical services. Neutron imaging technique allows for studies of a material's characteristics including the internal structure providing insights on fabrication methods, provenance, authenticity verification and manufacturing technology, without inflicting permanent damage to the material itself. The advantage of neutrons, compared to X rays, is that they are sensitive to many light elements, have deeper penetration length in metals and heavy elements, and are also sensitive to magnetic structures or externally applied fields. Today the major fields in which neutron imaging is applied include cultural heritage, archaeology, the mining, oil and petroleum industries, car and aviation industries, environment and building materials, biology, medicine, physics, and the energy sector (ranging from the nuclear power industry to new technologies such as hydrogen fuel cells and lithium batteries). Furthermore, as neutron imaging technology has advanced, the individual techniques based on this type of imaging have become more precise and efficient as well as much faster, specifically in the field of digital radiography (two-dimensional), computed tomography (three-

dimensional), energy-selective neutron imaging or dynamic (real-time) neutron imaging. The last ten years have seen extraordinary growth in direct digital methods, which now provide excellent image quality and increase the manageability of computational analytical power and the ability to better process and analyse data. Enhanced sensitivities of CCD and CMOS imaging systems have reduced barriers to deploying neutron imaging and developing capability at more modest neutron sources such as low and very low power research reactors and compact accelerator-based neutron sources.

There are currently 239 research reactors worldwide in operational or temporary shutdown status.[1] Of these, 67 in 35 countries report activity in neutron imaging. In addition, there is a number of additional neutron imaging facilities installed or planned at accelerator-based neutron sources in several countries. However, the actual growth in use of these neutron imaging facilities is still well below its potential, particularly in developing countries, for a number of reasons: the need for modernization of instrumentation and software; insufficient experience and qualifications of the personnel involved in these advanced subjects; an inclination to adapt the technology to specific user needs; and the establishment of new protocols and standardization procedures, including the development of marketing strategies.
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During the last decade, through a comprehensive survey that was jointly prepared and coordinated by the IAEA and the International Society for Neutron Radiology (ISNR), a specific database of neutron imaging facilities was launched and established. This database contains detailed technical information from 50 neutron imaging facilities worldwide. In addition, some dedicated round robin exercises have been organized by the IAEA, with the main purpose being to characterize and evaluate the performance capabilities of operational neutron imaging facilities, and to develop concrete actions for enhancing their performance and utilization. Also, the IAEA e-learning course on neutron imaging is available to Member States at Neutron Applications Portal - Home.

In addition to the activities mentioned above, the IAEA has been supporting capacity building opportunities in neutron imaging with hands-on-training component. This training workshop is already the 5th in the series of the IAEA workshops on Advanced Use of Neutron Imaging for Research and Applications (AUNIRA) with the 1st held in Berlin (Germany) in 2013, the 2nd in Villigen (Switzerland) in 2015, the 3rd in Garching (Germany) in 2017, the 4th in Daejeon (Republic of Korea) in 2019, and the 5th in Pretoria (South Africa) in 2023.

Objectives

The purpose of the event is to introduce and deliver the most recent, concise, information on the use of neutron imaging - also known as neutron radiography and tomography - for both basic research and industrial applications. This workshop will also aim to disseminate technology, knowledge and experience related to neutron imaging applications. It also serves to strengthen contacts and cooperation between methodology experts, facility managers and end users.

[1] IAEA Research Reactor Database: https://nucleus.iaea.org/RRDB.

Topics

The meeting will include presentations by experts and others, in sessions devoted to specific topics, with subsequent discussions and breakout sessions. Some limited time will be also allocated for the workshop participants to present their research work.

In addition to the lectures delivered by the experts, the workshop will include in-situ sessions at experimental set-ups and instruments, and post-experimental analysis in small groups thanks to the facilities made available by the VR-1 and LVR-15 research reactors, located in Prague and Řež respectively, Czech Republic.

The workshop programme will be designed to cover a range of topics that are relevant to Member States, especially developing countries, that are considering starting or upgrading their neutron imaging facilities. The main training objective of the workshop is to contribute to the enhancement of scientific-technological knowledge, innovation in infrastructure and human resources training in the area of neutron imaging using neutron beams for fundamental research and diverse applications. This will include:

- Introduction to neutron sources and neutron beams: reactor and accelerator based
- Introduction to fundamentals and advances in neutron imaging techniques
- Guidelines on required
    - neutron beam requirements and characteristics, including beam design
    - equipment installation and commissioning, including hardware and software
    - experimental setup, data taking, and data analysis
    - requirements of techniques with respect to various applications
    - staff training and qualification programmes.
- In-situ sessions at experimental set-ups and instruments in neutron radiography and neutron tomography
- Tutorials on neutron imaging in small groups: demonstration of software on experimental data handling, post-experimental analysis, image reconstruction and examination, finalization of results, based on practical applications of neutron imaging.

Target Audience

The meeting is intended for individuals involved in the utilization of neutron imaging techniques, particularly at low and medium flux accelerator- and research reactor-based neutron sources, or in the development or design of new neutron imaging experimental facilities.

Member States are invited to designate one or more participants for this meeting. Member States are strongly encouraged to identify suitable women participants.

Working Language(s)

The working language of the meeting will be English. No simultaneous interpretation will be provided.

Participation and Registration

All persons wishing to participate in the event have to be designated by an IAEA Member State or should be members of organizations that have been invited to attend.

In order to be designated by an IAEA Member State or invited organization, participants are requested to submit their application via the InTouch+ platform (https://intouchplus.iaea.org) to the competent national authority (Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) or organization for onward transmission to the IAEA by **30 June 2025,** following the registration procedure in InTouch+:

1. Access the InTouch+ platform (https://intouchplus.iaea.org):
   - Persons with an existing NUCLEUS account can sign in to the platform with their username and password;
   - Persons without an existing NUCLEUS account can register here.

2. Once signed in, prospective participants can use the InTouch+ platform to:
   - Complete or update their personal details under 'Complete Profile' and upload the relevant supporting documents;
   - Search for the relevant event under the 'My Eligible Events' tab;
   - Select the Member State or invited organization they want to represent from the drop-down menu entitled 'Designating Authority' (if an invited organization is not listed, please contact InTouchPlus.Contact-Point@iaea.org);
   - If applicable, indicate whether financial support is requested and complete the relevant information (this is not applicable to participants from invited organizations);
   - Based on the data input, the InTouch+ platform will automatically generate the Participation Form (Form A) and/or the Grant Application Form (Form C);
   - Submit their application.

Once submitted through the InTouch+ platform, the application, together with the auto-generated form(s), will be transmitted automatically to the required authority for approval. If approved, the application, together with the applicable form(s), will automatically be sent to the IAEA through the online platform.

NOTE: The application for financial support should be made, together with the submission of the application, by **30 June 2024**.

For additional information on how to apply for an event, please refer to the InTouch+ Help page. Any other issues or queries related to InTouch+ can be sent to InTouchPlus.Contact-Point@iaea.org.

Selected participants will be informed in due course on the procedures to be followed with regard to administrative and financial matters.

Participants are hereby informed that the personal data they submit will be processed in line with the Agency's Personal Data and Privacy Policy and is collected solely for the purpose(s) of reviewing and assessing the application and to complete logistical arrangements where required. The IAEA may also use

the contact details of Applicants to inform them of the IAEA's scientific and technical publications, or the latest employment opportunities and current open vacancies at the IAEA. These secondary purposes are consistent with the IAEA's mandate. Further information can be found in the Data Processing Notice concerning IAEA InTouch+ platform.

Papers and Presentations

The IAEA encourages participants to give presentations on the work of their respective institutions that falls under the topics listed above.

Participants who wish to give presentations are requested to submit an abstract of their work. The abstract will be reviewed as part of the selection process for presentations. The abstract should be in A4 page format, should extend to no more than 1 page (including figures and tables) and should not exceed 500 words. It should be sent electronically to Ms Valentina Semkova, the Scientific Secretary of the event (see contact details below), not later than **30 June 2025**. Authors will be notified of the acceptance of their proposed presentations by **31 July 2025**.

In addition to the registration already submitted through the InTouch+ platform, participants have to submit the abstract, together with the Form for Submission of a Paper (Form B), to the competent national authority (e.g. Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) or organization for onward transmission to the IAEA not later than **30 June 2025**.

Expenditures and Grants

No registration fee is charged to participants.

The IAEA is generally not in a position to bear the travel and other costs of participants in the event. The IAEA has, however, limited funds at its disposal to help meet the cost of attendance of certain participants. Upon specific request, such assistance may be offered to normally one participant per country, provided that, in the IAEA's view, the participant will make an important contribution to the event.

The application for financial support should be made, together with the submission of the application, by **30 June 2024.**

Visas

Participants who require a visa to enter Czech Republic should submit the necessary application as soon as possible to the nearest diplomatic or consular representative of Czech Republic.

IAEA Contacts

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Subsequent correspondence on scientific matters should be sent to the Scientific Secretary/Secretaries and correspondence on other matters related to the event to the Administrative Secretary.