

Nuclear Science

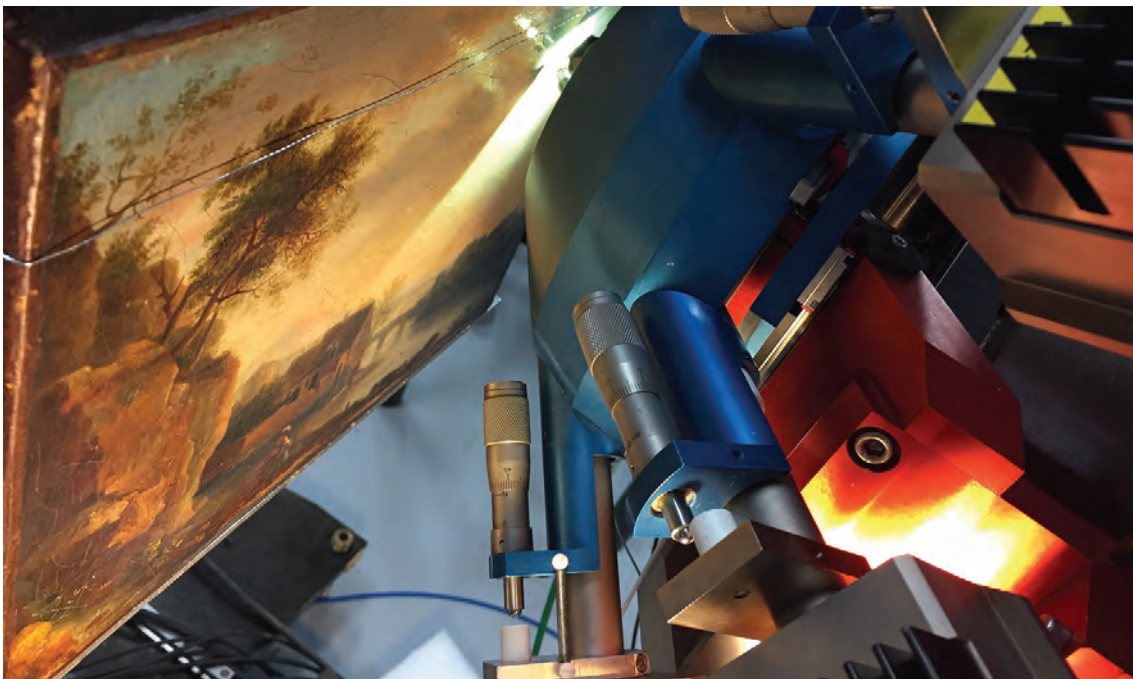
Objective

To support Member States in strengthening their capabilities in the development and application of nuclear science as a tool for their technological and socio-economic development. To support Member States in enhancing sustainable operation and effective utilization of particle accelerators and neutron sources, as well as effective utilization of research reactors, increasing opportunities for access to these facilities and their diverse applications, and in developing relevant qualified professionals.

Atomic and Nuclear Data

Technical Meetings on atomic data for fusion plasma and wall materials resulted in three updated databases for atomic interactions and radiation damage — ALADDIN, CascadesDB and DeFecTdb. The databases were reformatted to make them ready for use in machine learning applications for nuclear fusion.

The Agency collaborated on the International Conference on Nuclear Data for Science and Technology, held virtually, where the accomplishments of Agency projects on nuclear reaction and nuclear structure physics were presented.



Ion beam analysis at the AGLAÉ facility in the Louvre Museum of an untitled and anonymous painting on canvas likely from the French school, dating from the 17th–18th century.

Research and Applications with Accelerators and Neutron Sources

Together with partner organizations, 24 experiments at Elettra Synchrotron Trieste, Italy, and 14 at the Ruđer Bošković Institute, Croatia, were carried out by groups from about 20 Member States.

Expert missions to ion beam accelerators in Ghana and Lebanon diagnosed problems and advised on improved utilization.

The May 2022 edition of the IAEA Bulletin, on Applications of Accelerators and Other Sources of Ionizing Radiation, examines Agency support for accelerator applications in health, agriculture, research, the environment and industry.

Ten scientific papers from the CRP on Enhancing Nuclear Analytical Techniques to Meet the Needs of Forensic Science appeared in a special issue of the *Forensic Science International* journal, and a Training Workshop on the Applications of Accelerator-Based and Complementary Techniques for Forensic Science, held in Lecce, Italy, covered nuclear analytical techniques for forensic applications.

A new e-learning course on Specific Considerations and Guidance for the Establishment of Ionizing Radiation Facilities offers guidance through the phases of planning and establishing facilities.

Training courses and workshops provided hands-on training on analytical techniques and operations and maintenance at ion beam and synchrotron facilities.

The Technical Meeting on Best Practices in Boron Neutron Capture Therapy discussed improved cancer treatment using accelerator-based boron neutron capture therapy facilities.

The Joint IAEA–ANL Training Course on Strategic Planning and Management for Young Leaders and an online course on Strategic Planning and Integrated Management Systems for Ionizing Radiation Facilities and Associated Infrastructure introduced tools and methodologies for the effective management and operation of research facilities and activities.



The trainees working in the Agency's Nuclear Science and Instrumentation Laboratory in Seibersdorf.

Nuclear Instrumentation

The publication *Muon Imaging: Present Status and Emerging Applications* (IAEA-TECDOC-2012) describes some of the main muon imaging techniques, the detector types involved, and a wide variety of practical applications.

More than 200 person-weeks of hands-on training took place at the Nuclear Science and Instrumentation Laboratory in Seibersdorf, Austria, covering gamma spectroscopy, X-ray fluorescence (XRF), radiological mapping, radiotracer applications and neutron science.

The analytical capabilities of 80 laboratories in 52 Member States were improved via proficiency tests.

Group fellowships at the Seibersdorf laboratories provided hands-on exercises on radiation detection and applications using scintillation, gamma spectroscopy, portable detectors, and XRF- and neutron-based techniques.

The Technical Meeting on the Use of Uncrewed Aerial Systems for Radiation Detection and Surveillance held in Brno, Czech Republic, demonstrated the use, capabilities and specifications of such systems for radiation detection and surveillance.

The Joint ICTP–IAEA Workshop on Advanced Solutions for Field Measurements held in Trieste discussed georeferenced measurements in stationary, walking and drone-based surveys.

Nuclear Fusion Research

At the 11th ITER International School, organized in cooperation with the Agency, students were acquainted with advances in fusion research and technology.

The Agency launched a new CRP on Artificial Intelligence for Accelerating Fusion Research and Development with the overall objective of accelerating fusion R&D with AI through the creation of a platform and cross-community network for innovation and partnership.

A five-year CRP involving 13 institutes, working on various practical applications of compact fusion neutron sources, was completed and the results published in *Development of Steady State Compact Fusion Neutron Sources* (IAEA-TECDOC-1998).

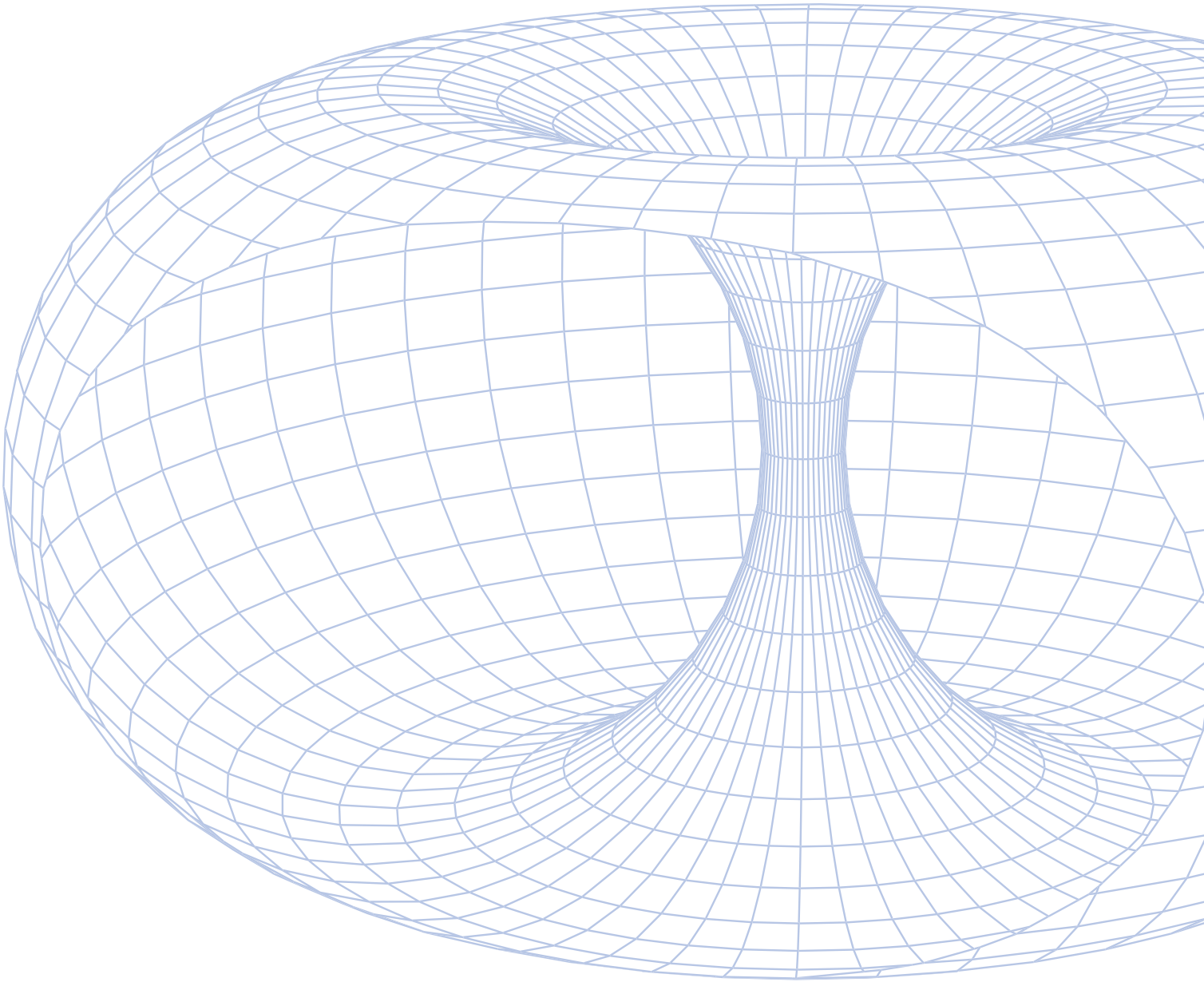
During the Eighth IAEA DEMO Programme Workshop, held in Vienna, experts discussed operational transients, coolant technologies, the tritium fuel cycle and required materials research for future DEMO fusion plants.

Technical Meetings on fusion research and technology enabled information to be exchanged on plasma disruptions and their mitigations, plasma–wall interactions, divertor concepts, long-pulse operations and joint experiments.

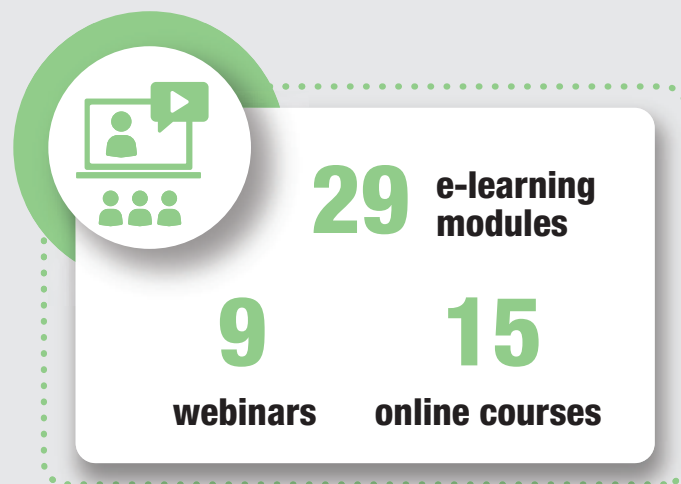
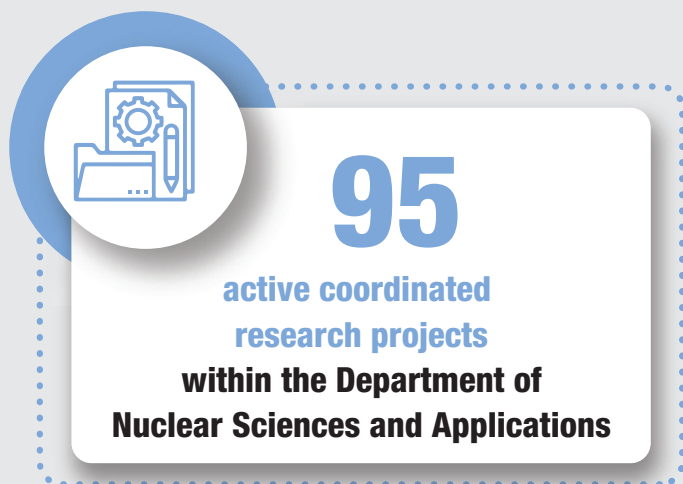
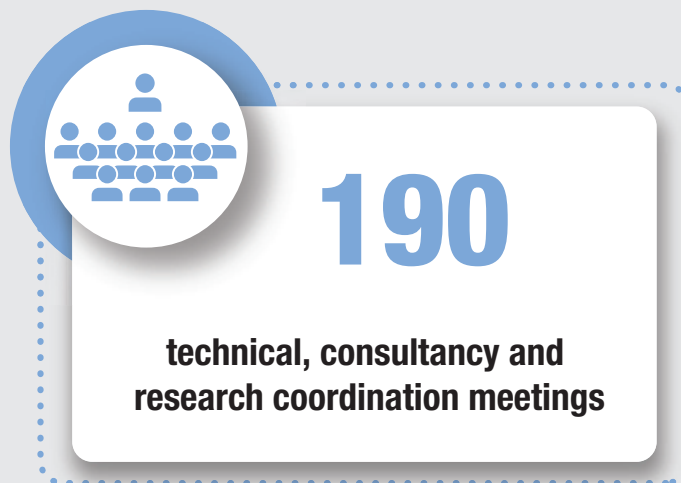
A Joint ICTP–IAEA College on Plasma Physics for Fusion Applications held in Trieste covered the latest developments and emerging applications, including nuclear energy, on the basis of which an e-learning course was developed.

Another e-learning course on Nuclear Fusion and ITER Science and Technology was released, covering the science and technology of ITER and associated research.

The Agency organized the first three webinars in the ‘Building Stars – Breakthroughs in Fusion R&D’ series, focusing on the latest landmark achievements announced in fusion worldwide. The series gives an overview of recent groundbreaking results and puts them in perspective, explaining how such progress brings fusion energy closer to realization.



Nuclear Techniques for Development and Environmental Protection



2022



Human Health Campus

108 445
users

336 789
page views

84%
new users



1082
active
research contracts



165
training courses
and workshops



69
publications

48
guidelines
250
external
publications



44
active Collaborating Centres
within the Department of
Nuclear Sciences and Applications



13
collaboration networks