IAEA
International Atomic Energy Agency

IAEA activities in support of Nuclear Physics Research & Applications

Danas Ridikas

IAEA Physics Section
Division of Physical and Chemical Sciences
Department of Nuclear Sciences and Applications

Outline

- Organization and programmatic structure
- Selected examples and recent updates
- Future plans

The IAEA: Atoms for Peace and Development

Statute: The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world.

Mission: To assist its Member States, in the context of social and economic goals, in **planning for and using nuclear science and technology for various peaceful purposes**.

IAEA Director General **Rafael Mariano Grossi** (since Dec. 2019)

2005 : IAEA Receives Nobel Peace Prize

Three Pillars - Main Areas of Activity

Safeguards & Verification

Safety & Security

Science & Technology

Science and Technology

Food & Agriculture

Promoting food security and sustainable agricultural development

Human Health

Improving the diagnosis and treatment of diseases and nutrition

Science & Industry

Providing knowledge & expertise for science & industry

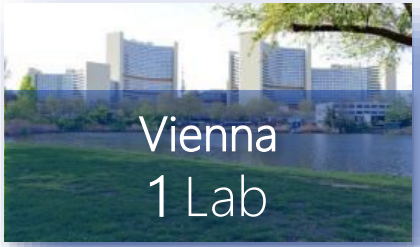
Water Resources

Making more, and cleaner water available to more people

Environment

Understanding and protecting the environment

12 dedicated laboratories



Water Resources

Food & Agriculture

Human Health

Nuclear Science

Environment

Marine Environment
The only marine environment laboratories in the UN system

Division of Physical & Chemical Sciences (NAPC)

Nuclear Data, Nuclear Science, Physics, Radiation and Isotope Sciences & Applications, Water resource management

Nuclear Data

- Data Development
- Data Services
- Atomic & Molecular Data

Physics

- Accelerator & Research Reactor Applications
- Nuclear Instrumentation
- Nuclear Fusion

Radiochemistry & Radiation Technology

- Medical Radioisotope production, Radiopharmaceuticals
- Radiotracers, NCS & NDT in industry
- Radiation technology applications
- Terrestrial Environment

Isotope Hydrology

- Isotopic methods for groundwater assessment
- Water resource management
- Scenario modelling

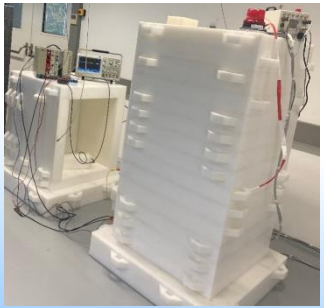
Physics Section: main technical areas

1.4.2 Research & Applications with Accelerators & Neutron Sources

(incl. RR applications)

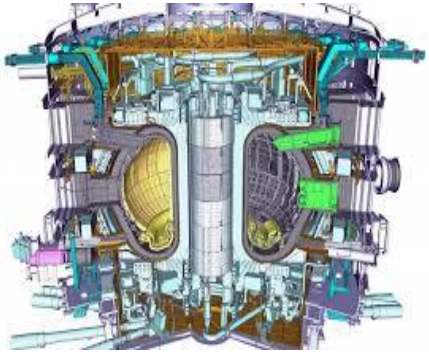
1.4.3 Nuclear Instrumentation

(incl. laboratory in Seibersdorf)



1.4.4 Nuclear Fusion Science & Plasma Physics

(incl. coop. with ITER)



Modalities of IAEA activities

- Technical Meetings
- Training Workshops

Coordinated Research Projects

Publications

Expert Missions (PRS & AS)

IAEA Research Reactor
Information Resources (Databases)

Support CP through
Technical Cooperation

Outline

- Organization and programmatic structure
- Selected examples and recent updates
- Future plans

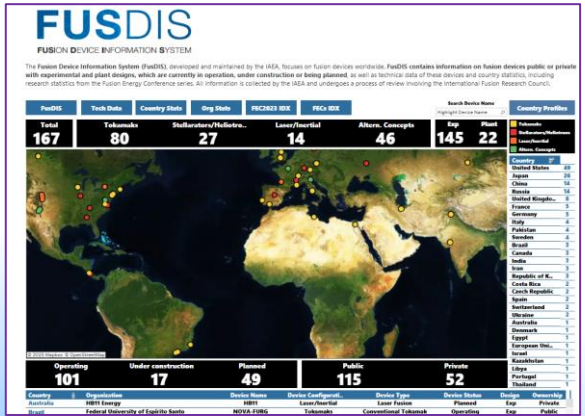
E.g. managing thematic portals and data bases

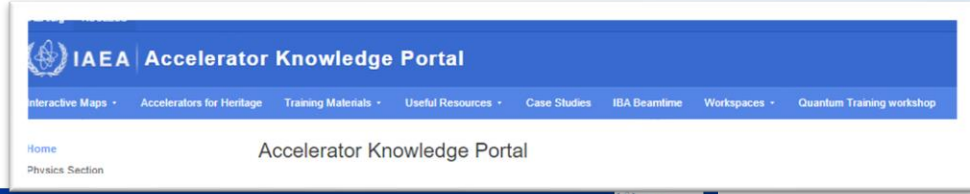
1) **Accelerators:** https://nucleus.iaea.org/sites/accelerators/
2) **Neutrons:** https://nucleus.iaea.org/sites/neutrons/
3) **Instrumentation:** https://nucleus.iaea.org/sites/nuclear-instrumentation
4) **Fusion:** https://nucleus.iaea.org/sites/fusionportal/

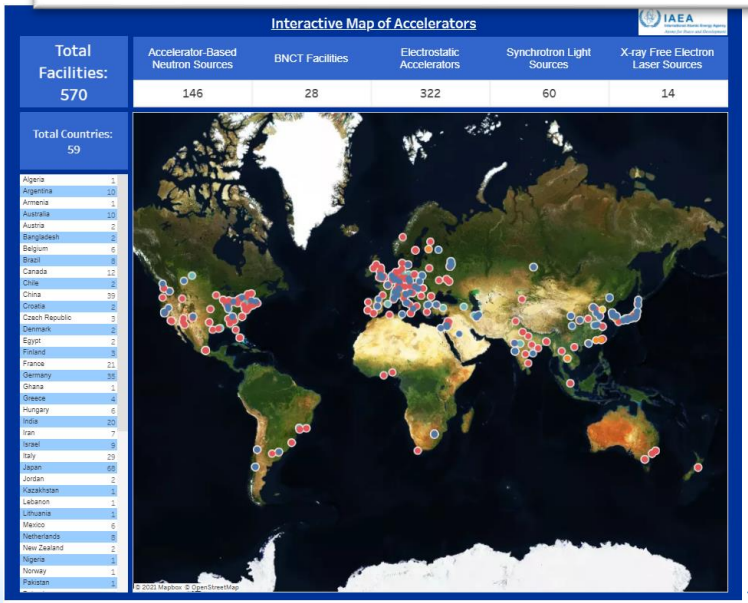
E.g. Physics thematic Portals

20000+ visitors/users in 2024; our interactive maps include

- **570+ ion beam accelerators**
- **1200+ medical cyclotrons**
- **400+ neutron beam instruments**
- **1300+ XRF facilities**
- **165+ fusion devices**







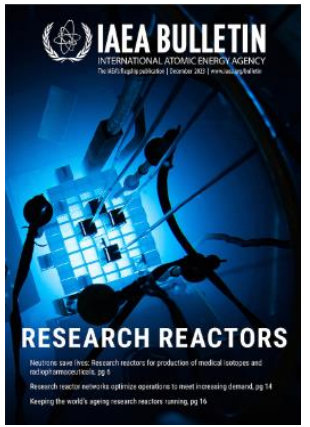
E.g. IAEA International RR Conference, 11-15 Nov. 2024

300+ in person and 200+ virtual participants, over 80 Member States, organized jointly with NE and NS departments

- 80+ oral presentations
- 130+ posters
- 5 side events
- Conference proceedings: in progress

Thematic areas:

- Utilization and Applications of Research Reactors
- Research Reactor Operation and Maintenance
- New Research Reactor programmes
- Safety of Research Reactors
- Security of Research Reactors
- Research Reactor Fuel Management
- Common Management Considerations for Research Reactors



→ https://www.iaea.org/events/conference-on-research-reactors-2024

Call for participation

The 30th IAEA FEC2025 will gather 1000+ participants and will cover

- **OV Overview talks**
- **EX Magnetic Fusion Experiments**
- **TH Magnetic Fusion Theory and Simulation**
- **TEC Fusion Energy Technology**
- **IFE Inertial Fusion Energy**
- **IAC Innovative and Alternative Fusion Concepts**
- **PWF Pathways to Fusion**

It will be jointly opened with **World Fusion Energy Group (WFEG)**

It will include **side events, technical tours, exhibitions** and much more!

More information: https://www.iaea.org/events/FEC2025

Call for synopses and participation

The AccConf2026 in Vienna will

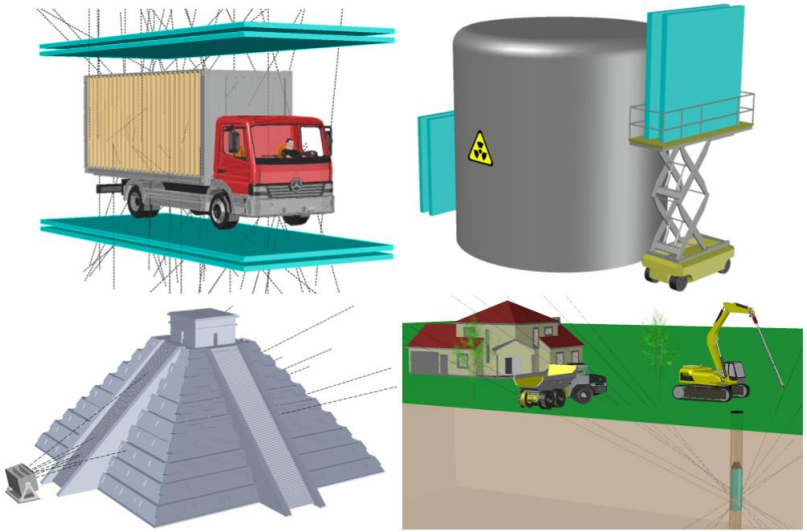
- showcase advances in **particle accelerator technologies and their applications across research, industry, and innovation**;
- highlight accelerator-based solutions with **significant societal and economic impact**, in areas such as health, environment, food safety, energy, and cultural heritage;
- exchange **best practices in establishing and operating accelerator facilities,** from compact systems to large-scale infrastructures;
- foster **new collaborations between academia and industry** in order to address global challenges through accelerator technologies.

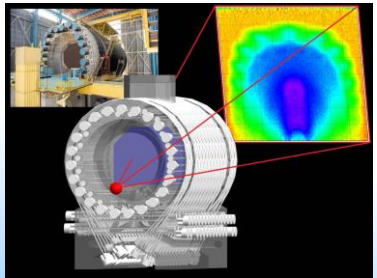
More information: https://www.iaea.org/events/AccConf2026

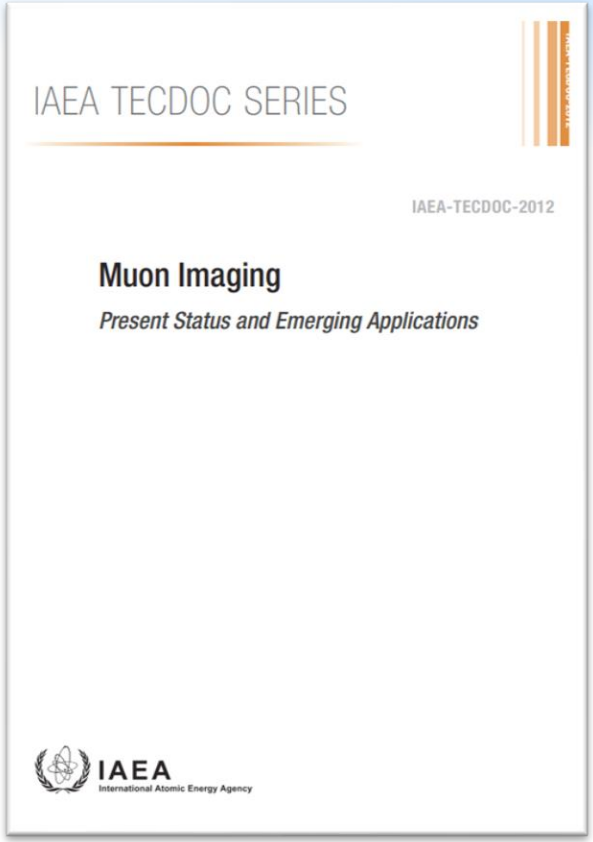
Synopses by 31 Oct. 2025: https://conferences.iaea.org/event/426/

E.g. Organization of Technical Meetings/Workshops

Technical Meeting on Non-destructive Testing Using Muon Radiography: Present Status and Emerging Applications

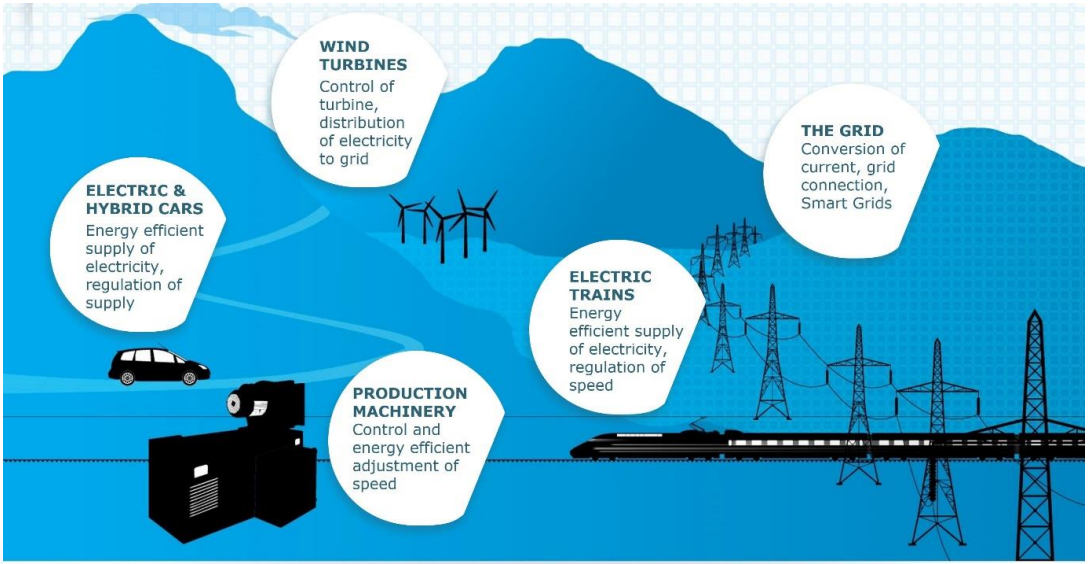


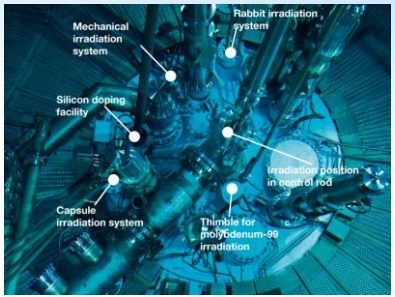




E.g. Organization of Consultancy Expert Meetings

Consultancy Meeting on The Current Status and Future of Neutron Transmutation Doping of Silicon (NTD Si) at Research Reactors





Start of NTD Si 4 Net Zero initiative

E.g. Organization of Training Events

IAEA
International Atomic Energy Agency

Press centre Employment Contact

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Home / News / New IAEA Neutron Facility Delivers First Hands-on Training

New IAEA Neutron Facility Delivers First Hands-on Training

Michael Amdi Madsen, IAEA Office of Public Information and Communication

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Home / News / IAEA Conducts First Virtual Training on Using Ion Beam Techniques and Applications

IAEA Conducts First Virtual Training on Using Ion Beam Techniques and Applications

Aleksandra Peeva, IAEA Department of Nuclear Sciences and Applications

APR
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2021

Related Stories

- First IAEA Webinar to Encourage Women for Careers in Accelerator Science and Technology
- Cyclotrons – What are They and Where Can you Find Them
- IAEA, Australian Nuclear Science and Technology Organisation to Work Together on Sustainable Environment
- New Year's Eve Special: Particle Accelerator Creates Miniature 'Lightning Storm'

All demonstration videos from the First Virtual Training on Using Ion Beam Techniques and Applications are available here. (Image: IAEA)

ICTP
The Abdus Salam International Centre for Theoretical Physics
IAEA unesco

6 ICTP 1964-2024

Joint ICTP-IAEA Fusion Energy School

end two week-long intensive school lectures from the academia and the velop a wider understanding of fusion them opportunities to connect with

ering an exciting new era with several large facilities al milestone of net energy gain. To create sustained el must be heated to 100 million degrees. The fuel is a, which is extremely difficult to confine and control, s using high energy lasers and superconducting on the way to reliable fusion energy but there are vercome. This school will prepare to address these will be introduced to the skills in computational physics, and conduct cutting-edge research and uidance of leading international scientists and l have the opportunities to interact with world-class rts, making the Fusion Energy School an excellent st in fusion and prepare for a career in this field.

OPTIONAL LECTURES:

- High Performance Computing
- AI/ML Methods in Fusion
- Low Temperature Plasma Science and Technology
- Laser Interactions and High Density Plasmas
- Astrophysical Plasmas
- Lasers and Atom-Light Interactions
- Nuclear Data

6 - 17 May 2024

Trieste, Italy

Applications and Deadlines:

For applicants requesting financial aid/or visa support: **15 February 2024**

For all other applicants: **1 April 2024**

DIRECTORS:

M. BARBARINO, IAEA, Austria
R. KAISER, ICTP, Italy
S. MAHAJAN, University of Texas, USA
R. WAGNER, IAEA, Austria

GRANTS:

A limited number of grants are available to support the attendance of selected participants, with priority given to participants from developing countries.
There is no registration fee.

FURTHER INFORMATION:

E-mail: smr3936@ictp.it
Web: https://indico.ictp.it/event/10474/
Female scientists are encouraged to apply.

E.g.: development of e-learning tools

https://elearning.iaea.org/

1. Strategic Planning for National Nuclear Institutions
2. Specific Considerations & Guidance for Establishment of Ionizing Radiation Facilities
3. Introductory training course for research reactor personnel (English/Spanish)
4. Neutron Activation Analysis
5. Neutron Imaging
6. Nuclear Analytical Techniques for Forensic Science
7. Portable X-ray Spectrometry Techniques for Characterization of Valuable Archaeological/Art Objects
8. Quality Assurance of X-ray Fluorescence Analysis of Airborne Particulate Matter
9. Introduction to Total reflection X-ray Fluorescence
10. Introduction to X-ray Emission Spectrometry
11. Introduction to electrostatic accelerators: from basic principles to operation and maintenance
12. Ion-beam Engineering of Materials for Quantum Technologies
13. Accelerator Mass Spectrometry Radiocarbon Dating for Heritage and Forensic Science
14. Introduction to in-situ techniques for radiological characterization of sites

E.g. active CRP on fusion materials research

CRP F13021 Towards the Standardization of Small Specimen Test Techniques for Fusion Applications – phase II; 2023-2027

→ **Emphasis** on the applicability of available guidelines and methodologies with relevance to high temperature (HT) conditions and suited for hot cell (HC) environment

→ **Partners** (10) from Argentina, Belgium, China, Germany, Spain, UK, Hungary, Japan, USA

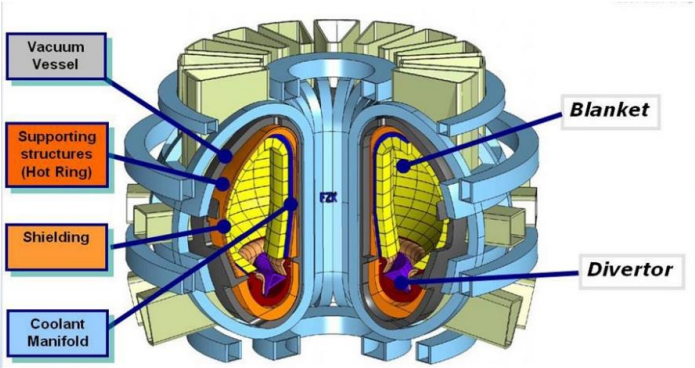


FIG. 8.1. Simplified schematics of the main types of components and materials that will be exposed to the most severe environmental conditions in a fusion power reactor (courtesy of KIT).

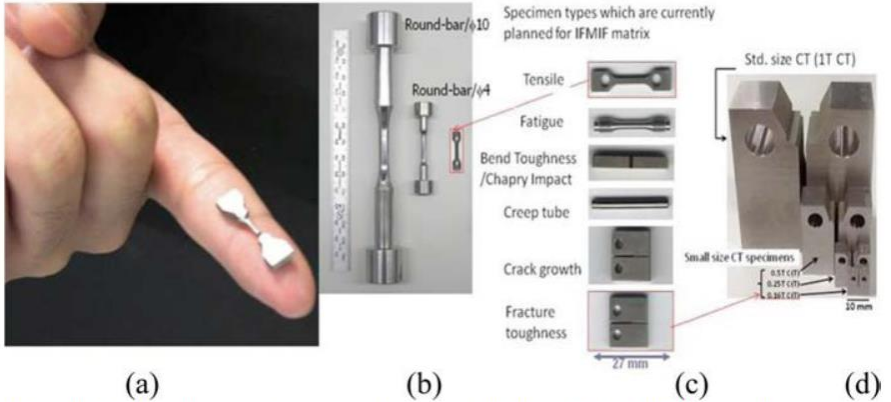
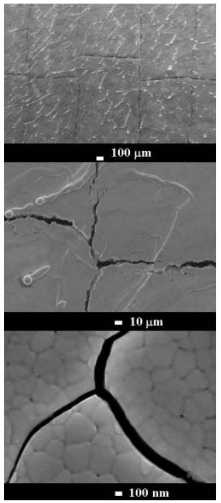


FIG. 8.26. Small sample test technique (SSTT). (a) An SSTT tensile specimen compared to a human finger; (b) and (c) SSTT tensile specimens, fatigue and creep tube compared to standard tensile specimens machined out of a rod with diameter of 10 mm or 4 mm; (c) and (d) SSTT fracture toughness specimens compared with standard compact tension specimens (reproduced from Ref. [8.73] with permission).



E.g. new CRPs: call for project proposals

CRP F12027: Expanding Neutron Beam Capabilities at Low and Medium Flux Neutron Sources

Objective: Increase the utilization of low and medium neutron flux sources of Member States through expanded neutron beam applications

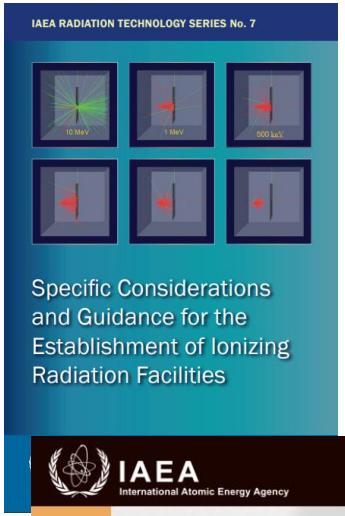
CRP F11026: Preservation and Protection of Cultural Heritage through Synergistic Authentication and Provenance

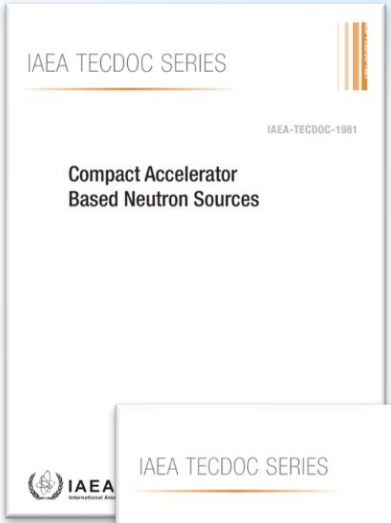
Objective: Improve authentication and provenance of heritage objects from historical, artistic, societal, raw material, composition and structure, manufacturing technology and legal point of view for their protection and preservation.

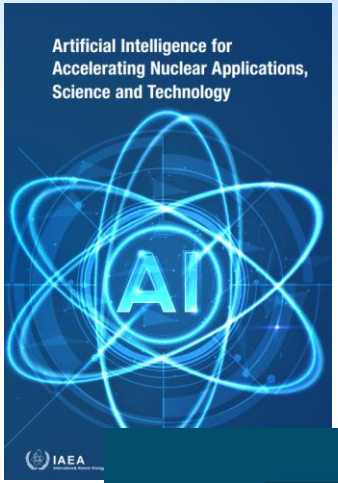
https://www.iaea.org/projects/coordinated-research-projects

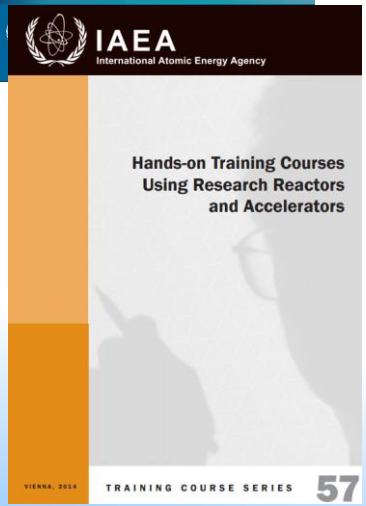
E.g.: publishing technical reports and guides

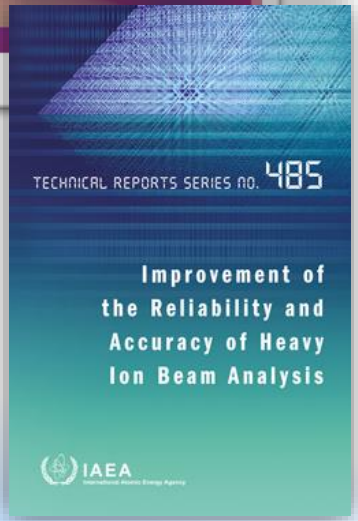
https://www.iaea.org/publications

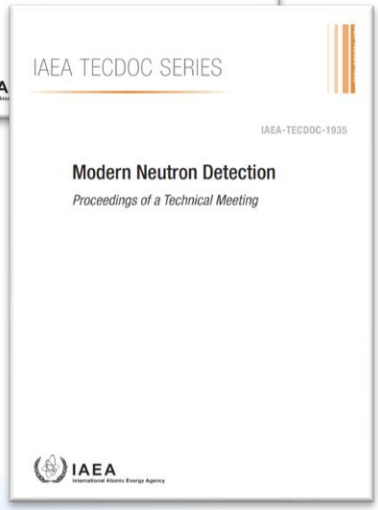


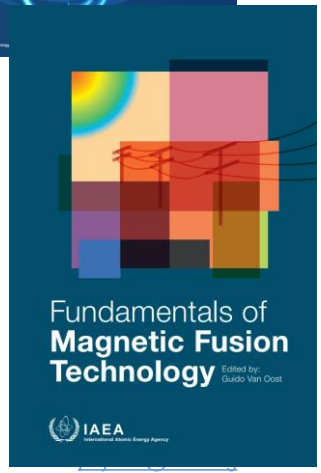










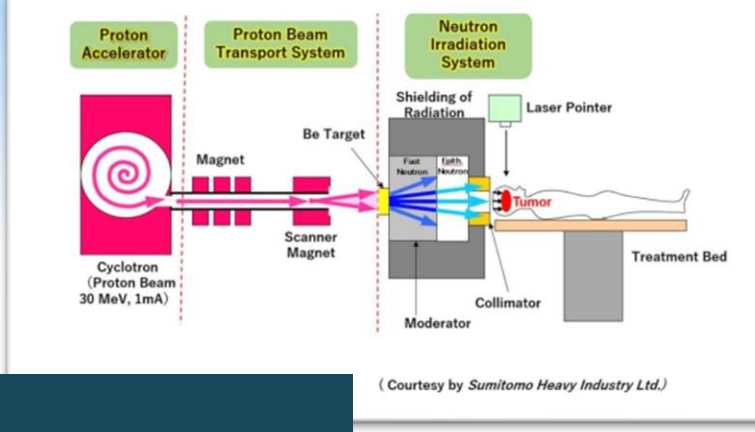


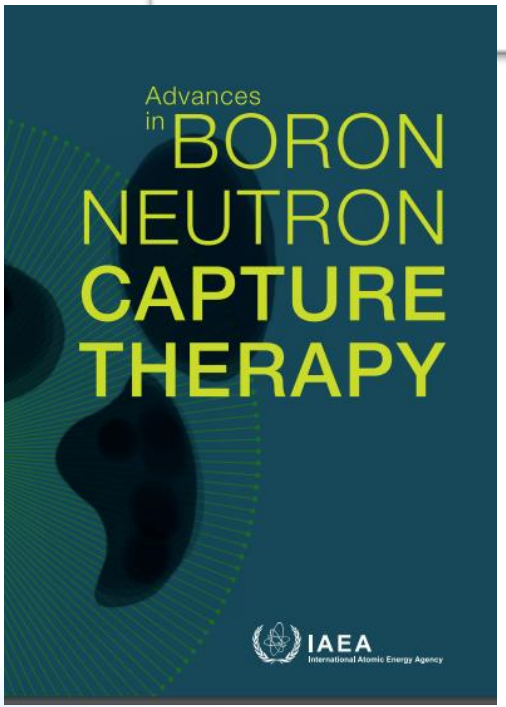
E.g. Publication:

Advances in Boron Neutron Capture Therapy, Non serial Publication (2023) +350 pages

1) Introduction
2) Accelerator based BNCT
3) Beam design
4) Dosimetry and neutron field parameters
5) Facility design
6) Operation and management
7) Pharmaceuticals and radiopharmaceuticals
8) Boron concentration determination
9) Radiobiology
10) Methods and models for dose calculations
11) Treatment planning
12) Reporting
13) Clinical trials

+ a number of Appendices, Annexes and Protocols, including regulatory aspects and facility examples



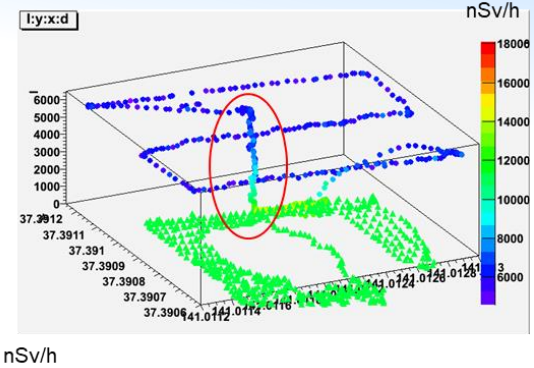


In TOP 10 at IAEA!

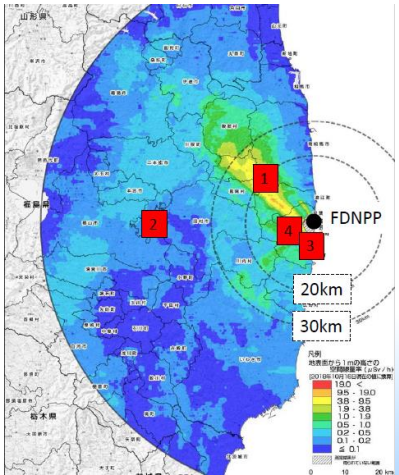
E.g. Support to Fukushima Prefecture (Japan)

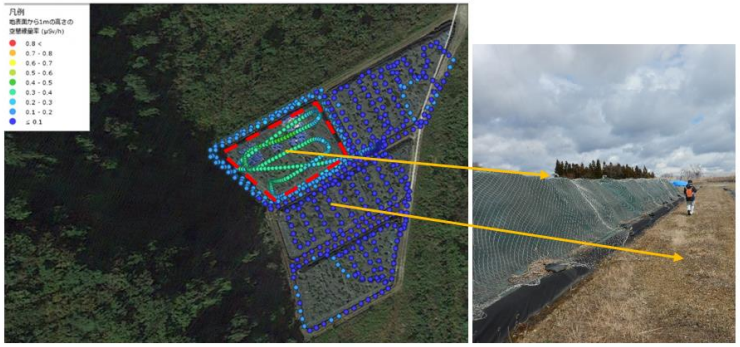
Developed/adapted hardware/software

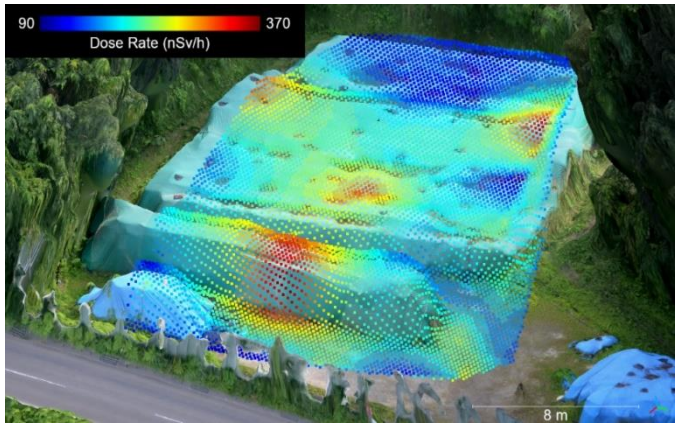
Developed/adapted methodology



A number of trial measurements completed



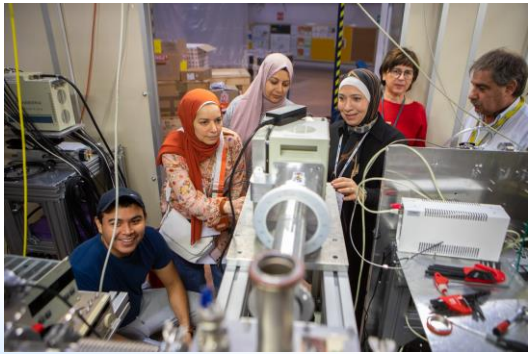




E.g. Access to state-of-the-art accelerator facilities

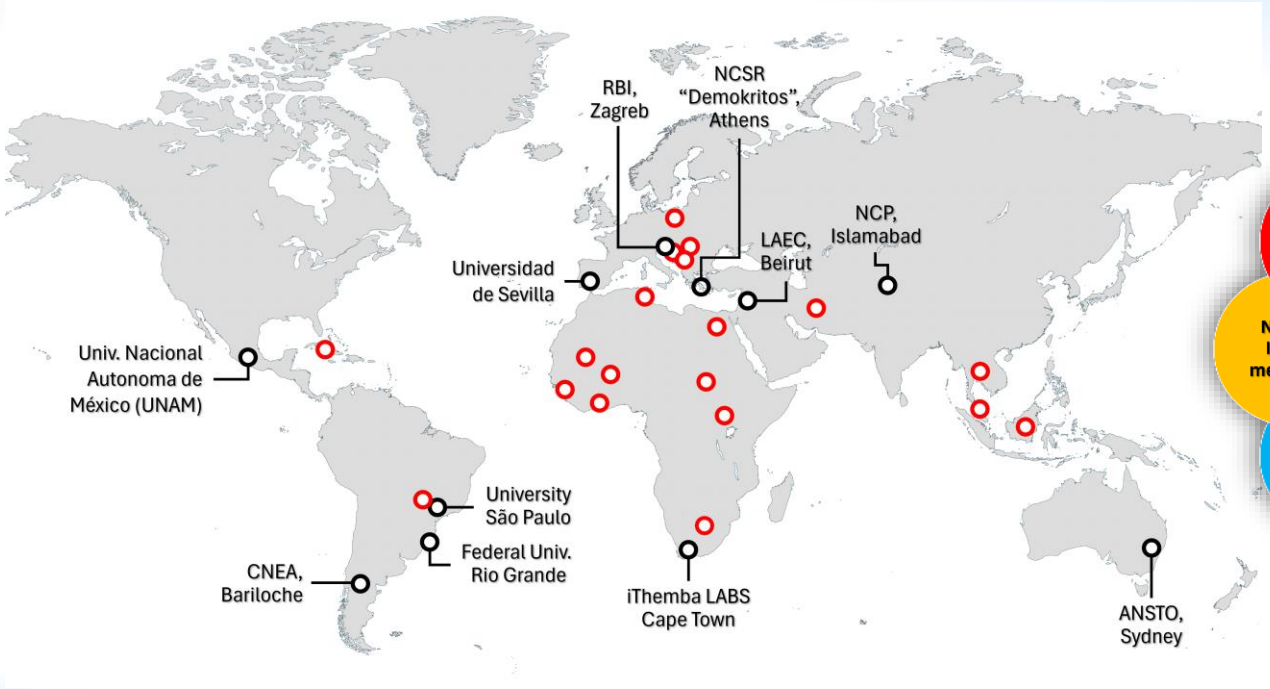
- **IAEA-RBI agreement; co-shared ion beam facility**
  - **20 days of the beam time** available for the developing countries
  - **Annual training workshops**, with emphasis on hands-on-training
  - New He ion source for **dual-beam capability** available (fusion research)

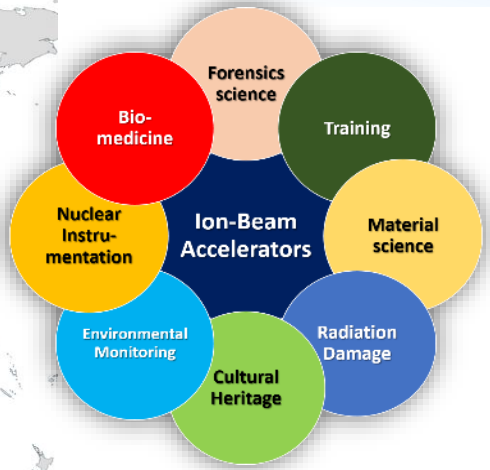
- **IAEA-Elettra agreement; joint XRF beamline**
  - **Dedicated beam-time for users**; +20 research groups from +15 MSs annually
  - **Annual training workshops**, with emphasis on hands-on-training
  - Recent improvements of the beam line and end-station



E.g. Access to state-of-the-art accelerator facilities

CRP G42008 Facilitating Experiments with Ion Beam Accelerators (2019-2025)





- Host Laboratories (10) were assessed and selected in all regions (in black)
- User groups (21/31) from 19 countries performed their experiments (in red)

E.g. Integrated RR Utilization Review missions

Objectives

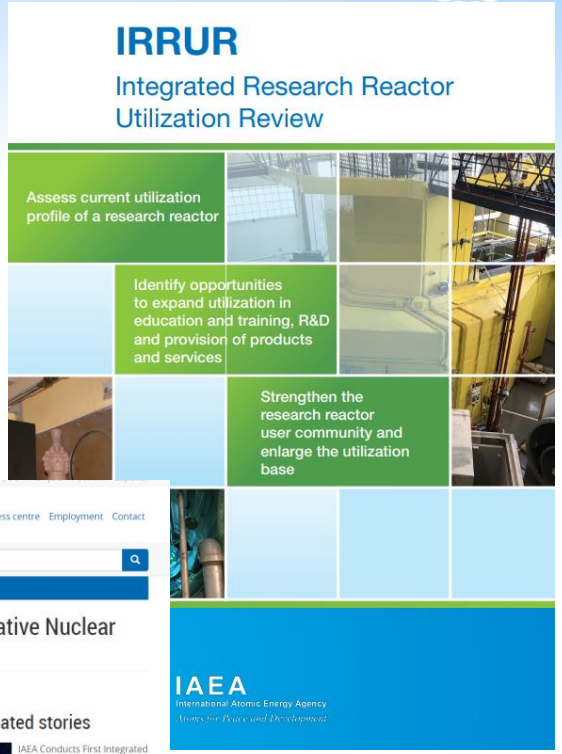
- Assess current utilization profile
- Identify opportunities to expand utilization
- Strengthen user community and enlarge the utilization base

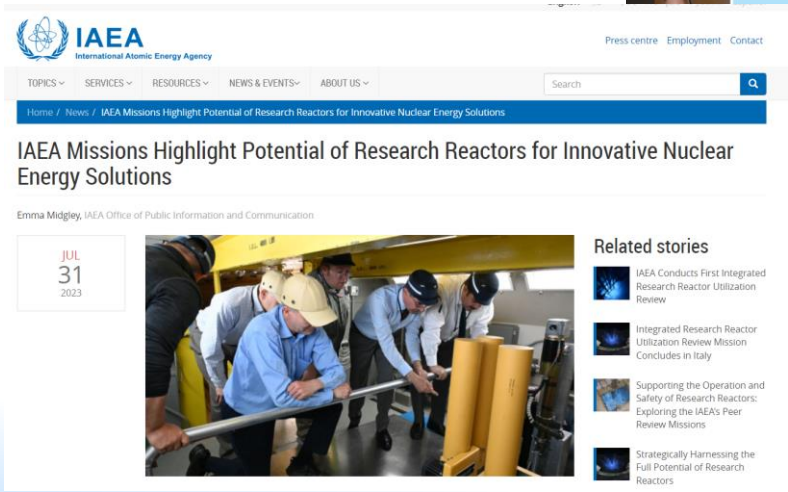
7 full scope missions implemented since 2022

- Chile (RECH-1): 5MW
- Peru (RP-10): 10 MW
- South Africa (SAFARI-1): 20 MW
- Iran (Isfahan): 30kW, critical/sub-critical assemblies
- USA (NRAD): 250 kW
- USA (MITR): 6MW
- Canada (McMaster): 3 MW

1 mission planned in 2025

- *Ghana (GHRR-1): 30 kW*





E.g. Direct support to accelerators through TC projects

- Feasibility studies
- Technical support in setting up dedicated facilities, beamlines and end-stations
- Technical assistance in maintenance and upgrades
- Technical assistance in equipment procurement
- Training of personnel
- Utilization plans


Accelerator facility in Lebanon


Accelerator facility in Bangladesh


Accelerator facility in Nigeria

- Algeria
- Bangladesh
- Croatia
- Egypt
- Ghana
- Greece
- Lebanon
- Italy
- Mexico
- Nigeria
- Slovakia
- South Africa
- Syria
- Thailand
- Uzbekistan

Proficiency Tests for NAA & other Analytical Techniques

Organized twice a year in support IAEA Member States laboratories to:

- identify analytical problems
- improve the quality of their analytical results
- acquire / maintain their accreditation
- provide a regular forum for discussion and technology transfer in this area
- **In 2025: +100 analytical laboratories participate, representing +50 countries**

Scheme of the proficiency test:

- Provision of various samples at no cost
- Full anonymity of laboratories is granted
- Issue of final reports

Previous Proficiency Tests

PTNATIAEA/21	May 2023 - March 2024	soil sample with elevated mass fractions of elements plant sample	Download PDF final report
PTNATIAEA/20	April 2022 - December 2022	clay sample plant sample	Download PDF final report

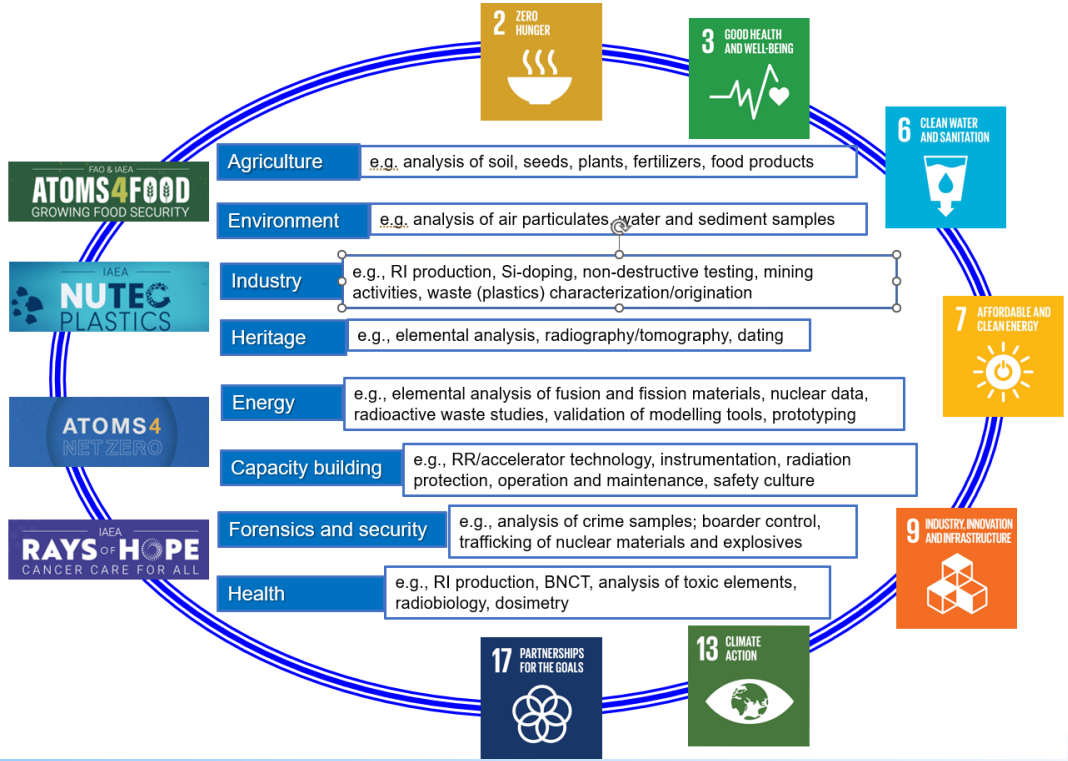
More info: http://www.pt-nsil.com/

Outline

- Organization and programmatic structure
- Selected examples and recent updates
- Future plans

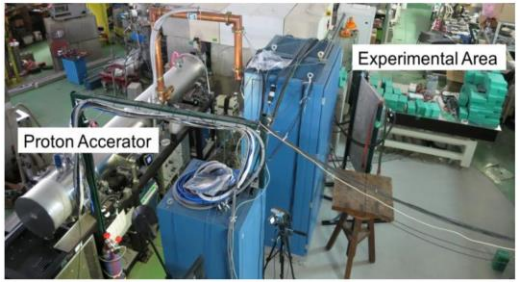
Neutrons4NA initiative: rationale

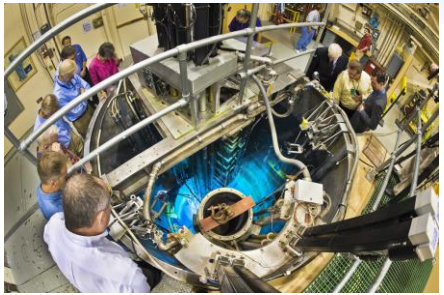
Tailored and stepwise approach through promotion, capacity building, technology transfer and facilitated access to **Neutrons4NA** and resulting socioeconomic development in the Member States



Neutrons4NA: objective

Bridging the gap between neutron generators, CANS and RRs: tailored and stepwise approach



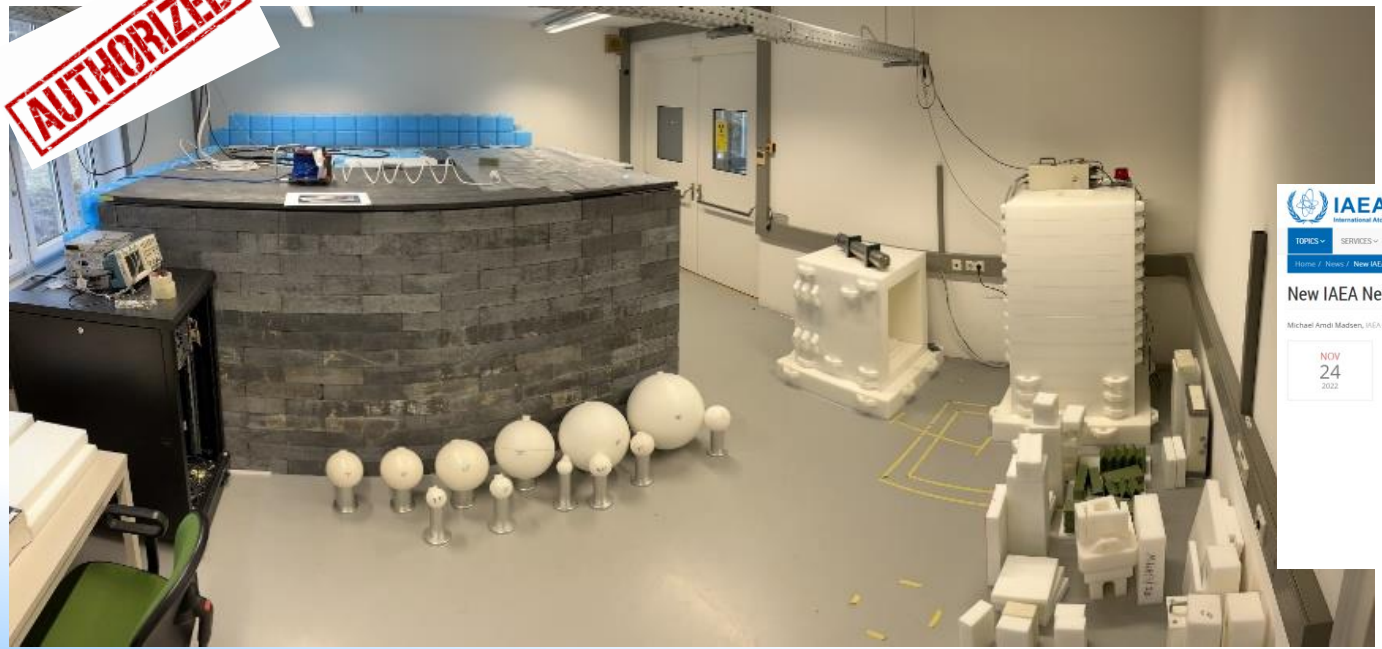


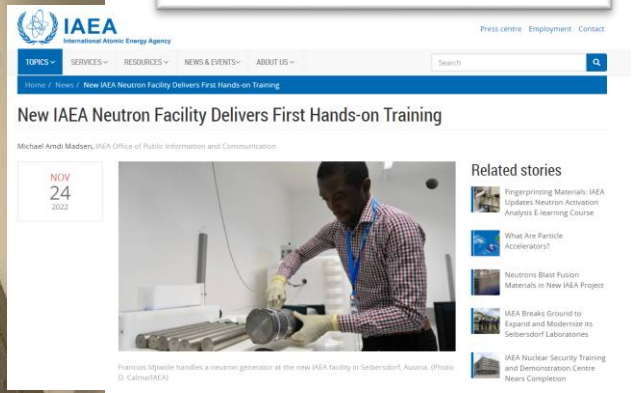
	Neutron generator	Compact accelerator-based neutron source	Research reactor / spallation source
Neutron source, n/s	$<10^{10}$	$<10^{14}$	$>10^{15}$
Capital cost, €M	0.1-0.2	3-10	60-700
O&M costs, €M	0.02	0.2-1.0	3-100
Staff, number	1	2-3	10-100

E.g. IAEA Neutron Science Facility (NSF) at SEIB

NSF is based on two neutron generators, **operational since 2022**

- **D+D reaction → 2.45 MeV neutron source** (fission-like neutrons, 5e6 n/s)
- **D+T reaction → 14.1 MeV neutron source** (fusion-like neutrons, 5e8 n/s)





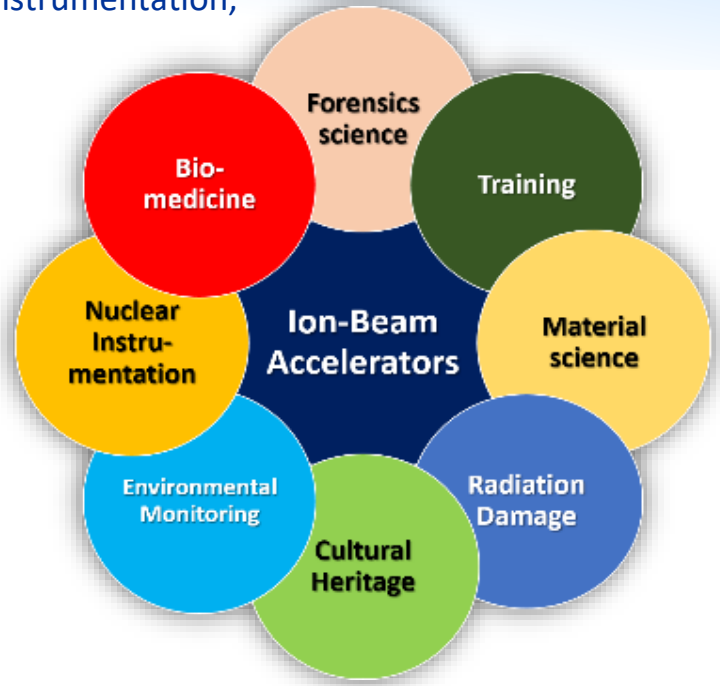
E.g. IAEA Ion Beam Facility (IBF) project at SEIB

Comprehensive survey conducted high interest from the user communities
(>60 replies from 40countries (out of 59 operating accelerators) as well as internally within IAEA:

→**Training** in accelerator technology, applications and associated instrumentation,
→**Services** relevant to ion/neutron beam analysis and irradiations,
→**Enhanced access** to and use of ion/neutron beam techniques.

Feasibility study showed that, to match the NSIL's mission and stakeholder needs, the most **optimal and cost-effective technology option would be 3.0 MV tandem.**

Total capital costs:	**10.4 M€**
Staff required:	**3 persons**
Operational costs:	200 k€/year



Call for Extrabudgetary Support and Contributions in kind:
UN Global Market https://www.ungm.org/Public/Notice/275529

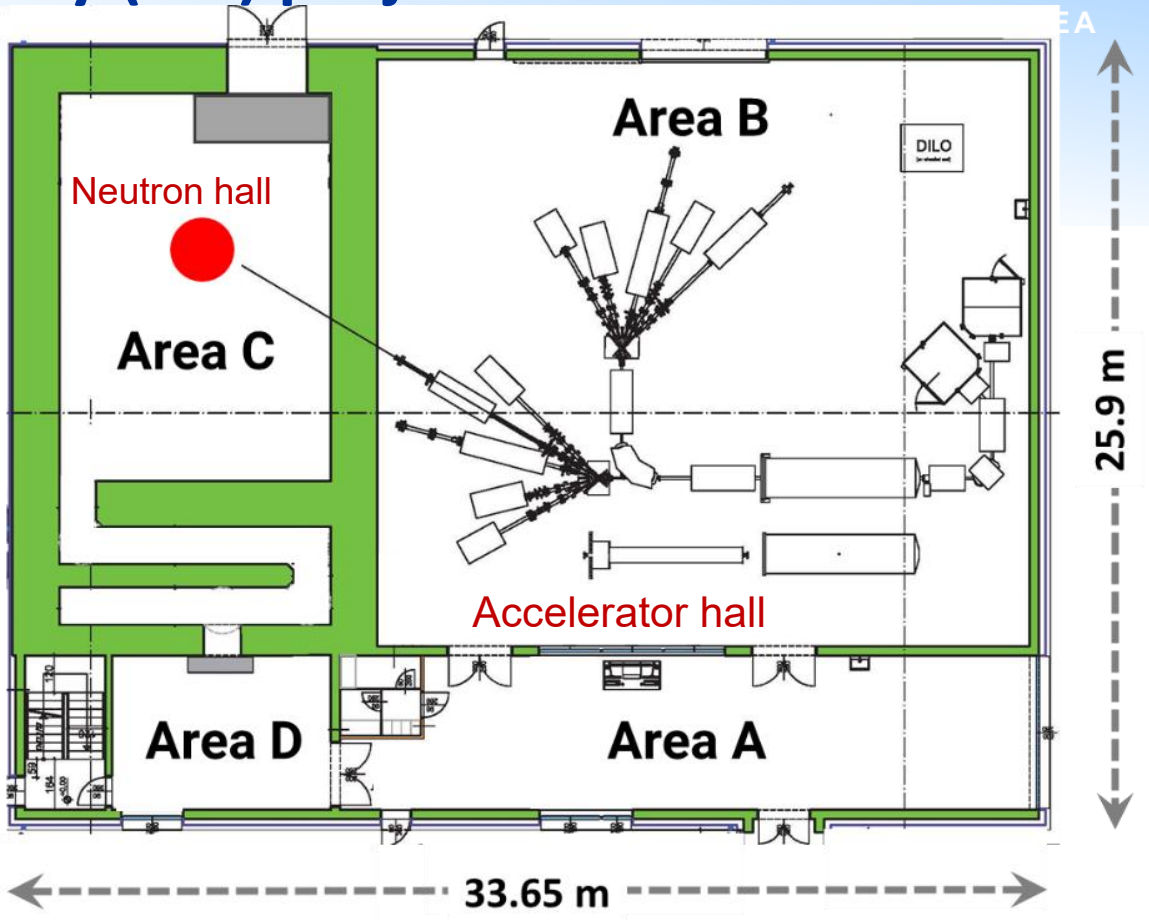
E.g. IAEA Ion Beam Facility (IBF) project at SEIB

→ 6MeV protons (up to 50μA current) + heavier ions

→ Multiple beam lines/end-stations (PIXE, PIGE, RBS, Microbeam, implanter…

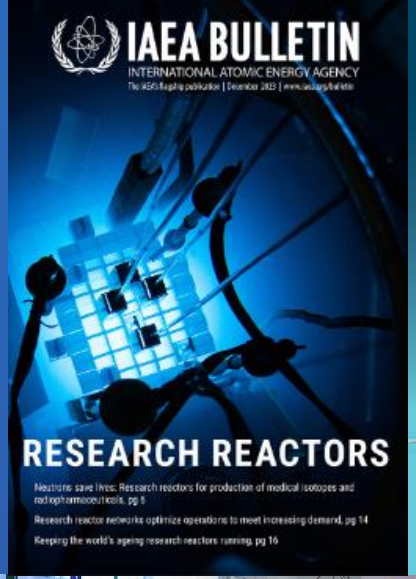
→ **Neutron production capability**

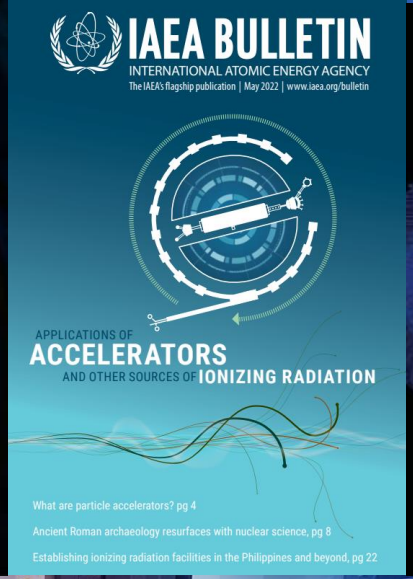
- **Max. source intensity: 5×10^{11} n/s**
- **Max. thermal flux: 10^6 n $s^{-1}cm^{-2}$**

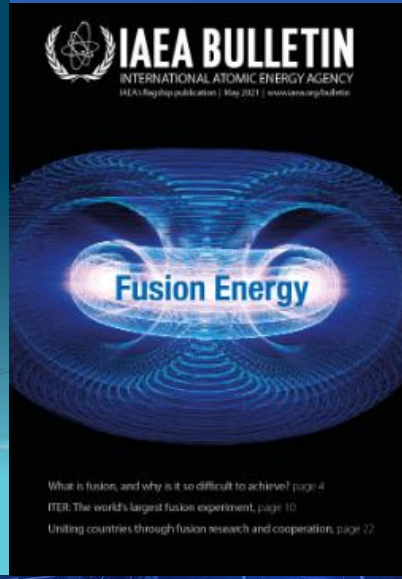


IAEA
International Atomic Energy Agency

Thanks for your attention!







physics@iaea.org