IAEA activities in support of electrostatic accelerator facilities

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Outline

IAEA at a glance

Physics section activities in support of electrostatic accelerator facilities

Electrostatic accelerator in Seibersdorf project

IAEA

IAEA at a glance

- Established 1957
- 172 Member States (September 2020)
- 2500+ staff from over 100 Member States
- HQ in Vienna
- Labs in Seibersdorf, Monaco & Vienna
- Regional offices in Toronto and Tokyo
- Liaison offices in New York and Geneva

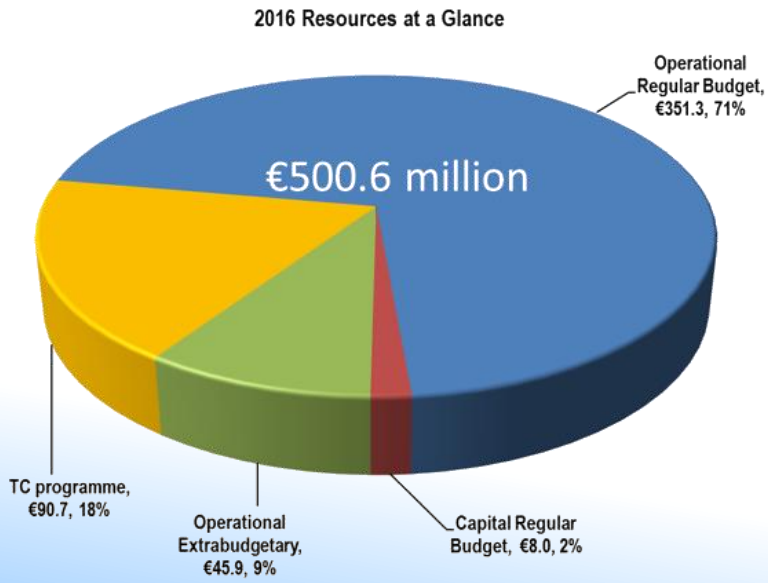
IAEA mission in short

- **Peaceful uses**: Promoting the peaceful uses of nuclear energy by its Member States

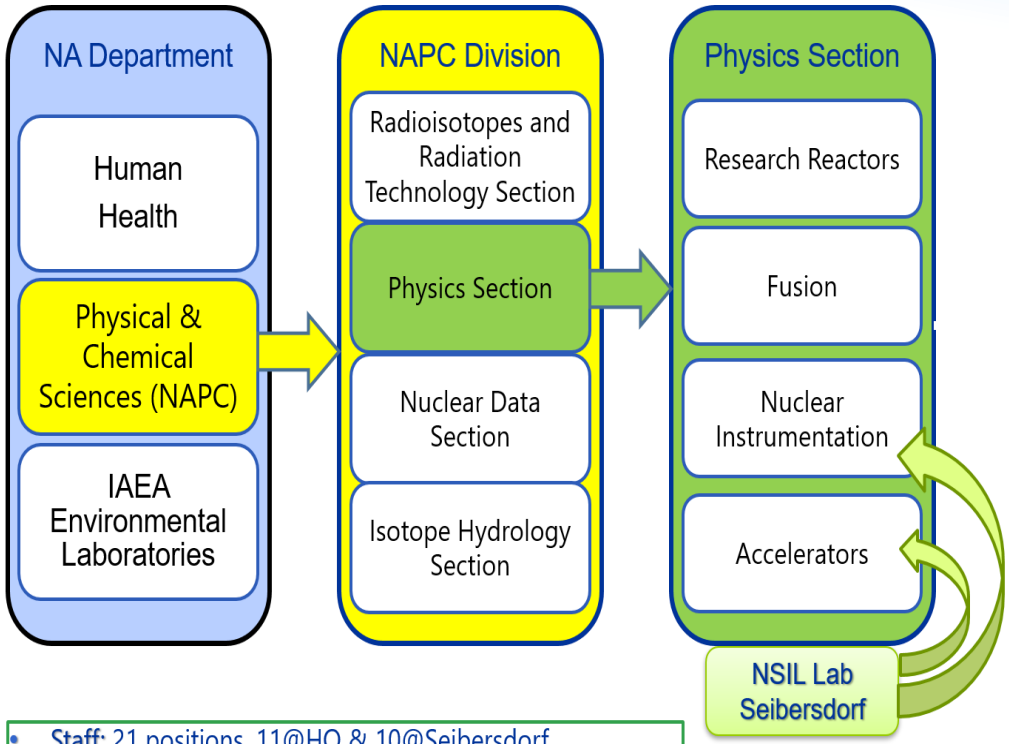
- **Safeguards**: Implementing safeguards to verify that nuclear energy is not used for military purposes

- **Nuclear safety**: Promoting high standards for nuclear safety

IAEA structure & budget



NA Department and The Physics Section



- **Staff:** 21 positions, 11@HQ & 10@Seibersdorf,
- plus consultants, interns, fellows; TOTAL: ~30-35
- **Budget:** ~4M Euros RB under 4 sub-programmes

Implementation tools and modalities

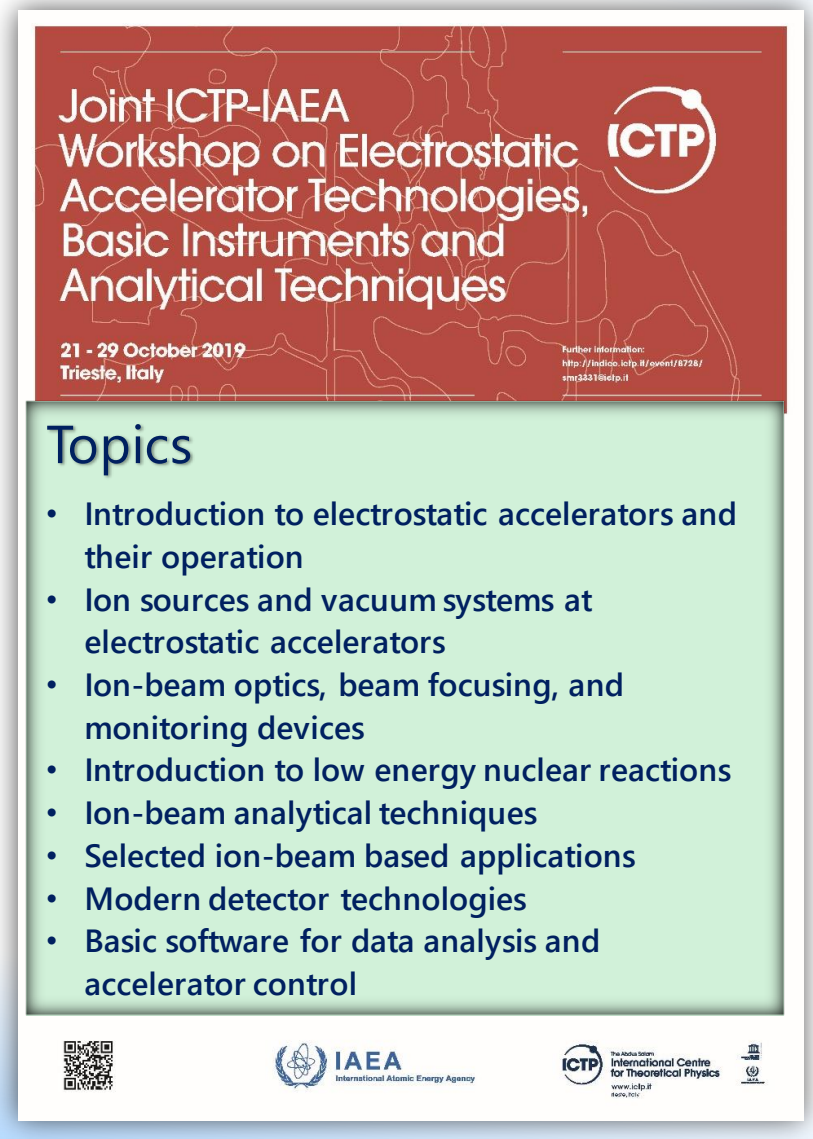
- Consultancy Meetings: 5 to 10 experts are invited to provide specialized advice and recommendations on particular scientific or other aspects of relevance for the IAEA's programmes and activities.
- Technical Meetings/Workshops: Technical events with 30-40 participants, aiming at enhancing interaction among experts, share knowledge and expertise, establish scientific collaborations and create topical networks.
- Coordinated Research Projects (CRPs): Networks of 10-15 research institutes from developed and developing countries that work in coordination for 3-5 years to acquire and disseminate new knowledge/technology. Periodic meetings are organized to report progress and plan/coordinate future activities.
- Training Workshops, Courses and dedicated Schools: Events enabling participants to acquire specific knowledge – theoretical or practical or both – on a given subject of interest. Organized at IAEA laboratories, ICTP Trieste, or at labs in member states
- Publications of technical documents and guides: Publications of reported results, shared good practices and lessons learned; produced by CRPs or Technical Meetings.
- National, regional, interregional Technical Cooperation (TC) projects: projects to build capacity via Expert Missions, training of personnel, purchase of equipment, assistance in establishing new facilities, …

Direct support to accelerator labs through Technical cooperation (TC) projects

- facilitating hands-on training of scientific & technical personnel in accelerator operation and maintenance;
- assistance in refurbishment and modernization of beam lines and associated instrumentation;
- assistance in feasibility and design studies, business and strategy plans;
- providing technical support in specifications, procurement, installation, repairs & upgrades of exp. devices.

Direct support to ~ 20 laboratories in recent years through TC

Workshops and trainings:
Joint ICTP-IAEA Workshop: 21-29 Oct. 2019



http://indico.ictp.it/event/8728/

7 Lecturers **(22 lectures; 4 hrs excercises on PC)**

- L. Conradie (iThemba LABS, Cape Town, SAF)
- M. Jaksic (RBI, Zagreb, Croatia)
- A. Lagoyannis (NCSR "Demokritos", Athens, GR)
- P. Pelicon (JSI, Ljubljana, Slovenia)
- D. Zafeiropoulos (INFN-LNL, Legnaro, Italy)
- N. Skukan (IAEA)
- S. Charisopoulos (IAEA)

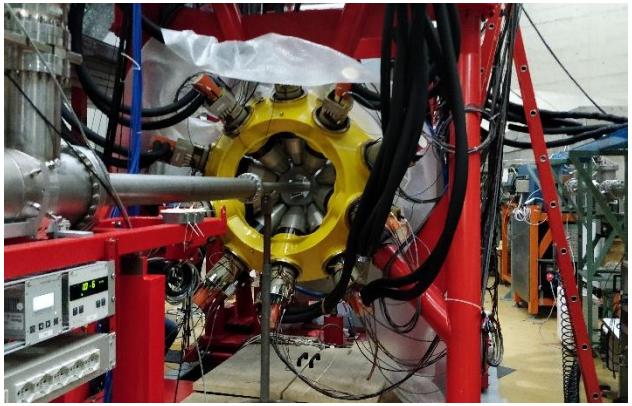
17 Trainees from 13 countries

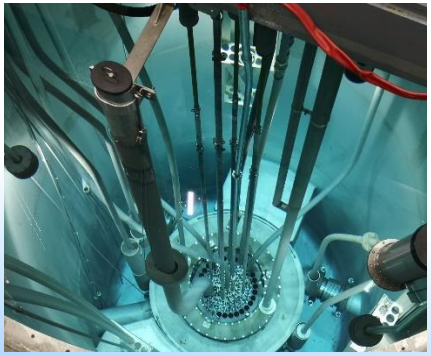
<age>=33; 1/3 women

2 Lab visits (full day)

- Laboratori Nazionali di Legnaro, Italy
- Jozef Stefan Institute, Ljubljana, Slovenia

Joint ICTP-IAEA Workshop (lab visits: LNL and JSI)





1st Training Workshop on Hands-on Operation and Maintenance of Electrostatic Accelerators

RBI, Croatia, December 2019

IAEA 60 Years Atoms for Peace and Development

Topics (theory and practical)

- Vacuum + leak detection
- Ion sources (duoplasmatron, sputtering, RF)
- Beam optics/optical elements
- Accelerator control and stabilization
- TV calibration

- 8 participants (2 f/6 m) from 8 countries
- A successful workshop as the first one of this type

Lessons learned

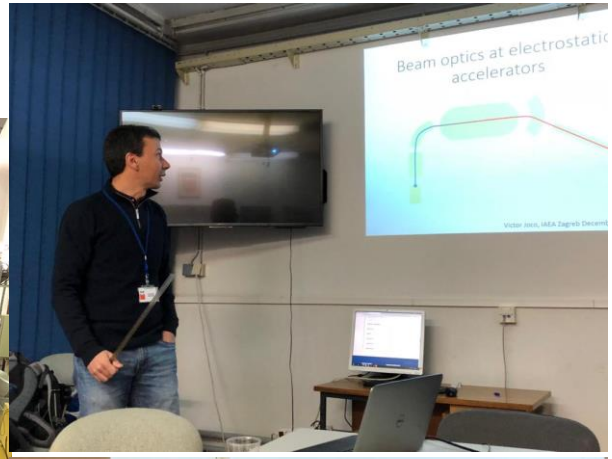
- Less topics but elaborate more
- More hands-on exercises
- Small groups (max 3 per hands-on exercise)

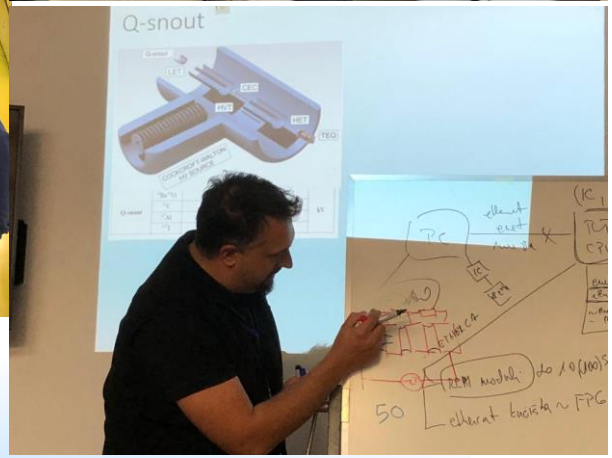
1st Training Workshop on Hands-on Operation and Maintenance of Electrostatic Accelerators

IAEA 60 Years Atoms for Peace and Development

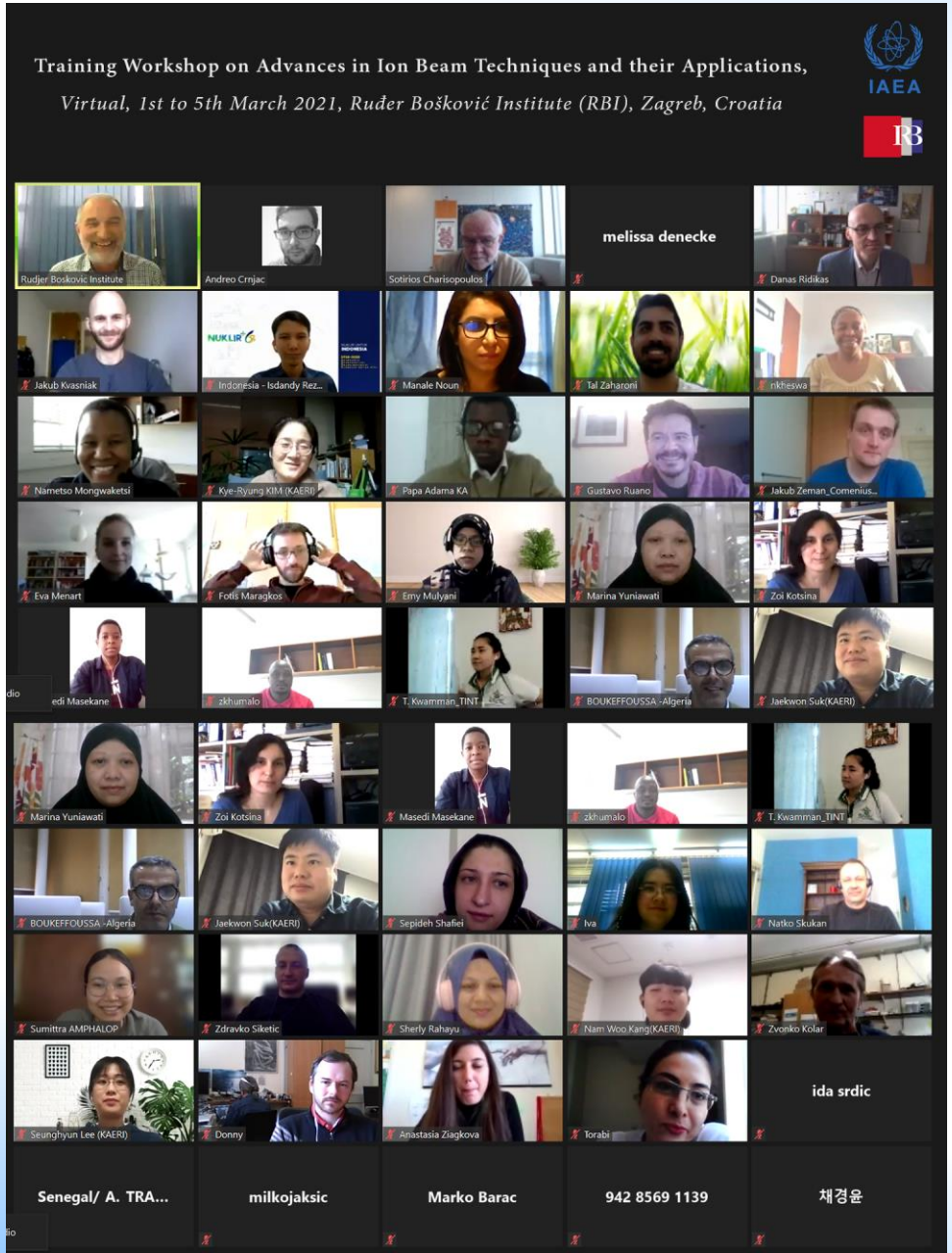
RBI, Croatia, December 2019

Planned to be organized biannually on specific topics
Will alternate with:
Training workshop on advances in ion beam techniques and their applications (IBA techniques)





Virtual Training Course on IBA techniques; In cooperation with RBI Mar 2021



Ion energy loss
PIXE
Data acquisition
Detectors for IBA
NRA and PIGE
RBS
ERDA
Microprobe system, basics and experiment
Microprobe – PIXE imaging
MeV SIMS
Microprobe – low current techniques – Ion beam induced charge (IBIC) and single ion implantation
-4 MOVIES PRODUCED:
https://nucleus.iaea.org/sites/accelerators/Pages/IBA-video-demonstrations.aspx

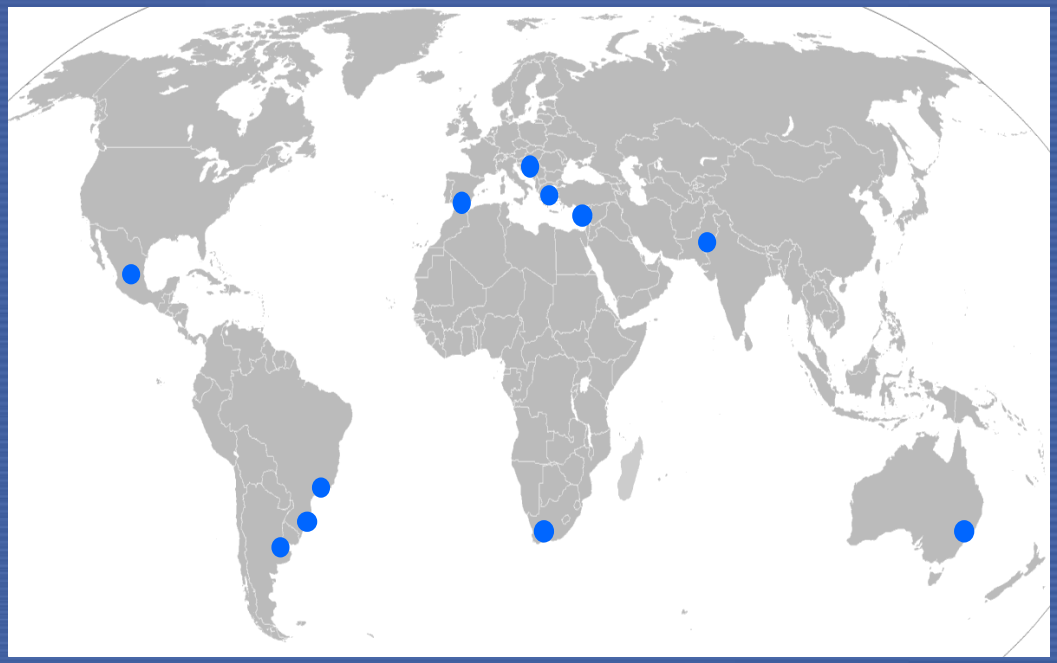
- 34 participants
- Physical trainings of this type: 8-10 participants
- Some of the trainings can be conducted virtually but not all!

CRP G42008:
Facilitating Experiments with Ion Beam Accelerators

Transnational access to IBA facilities on the world level (2019 →)

Currently: 11 centres strategically distributed in different areas of the world

(where potential users are most expected)



Scientists from countries without IBA accelerator facilities can apply for the beam time

Goal ~16 Projects/year Budget ≈400 k€/5 yrs

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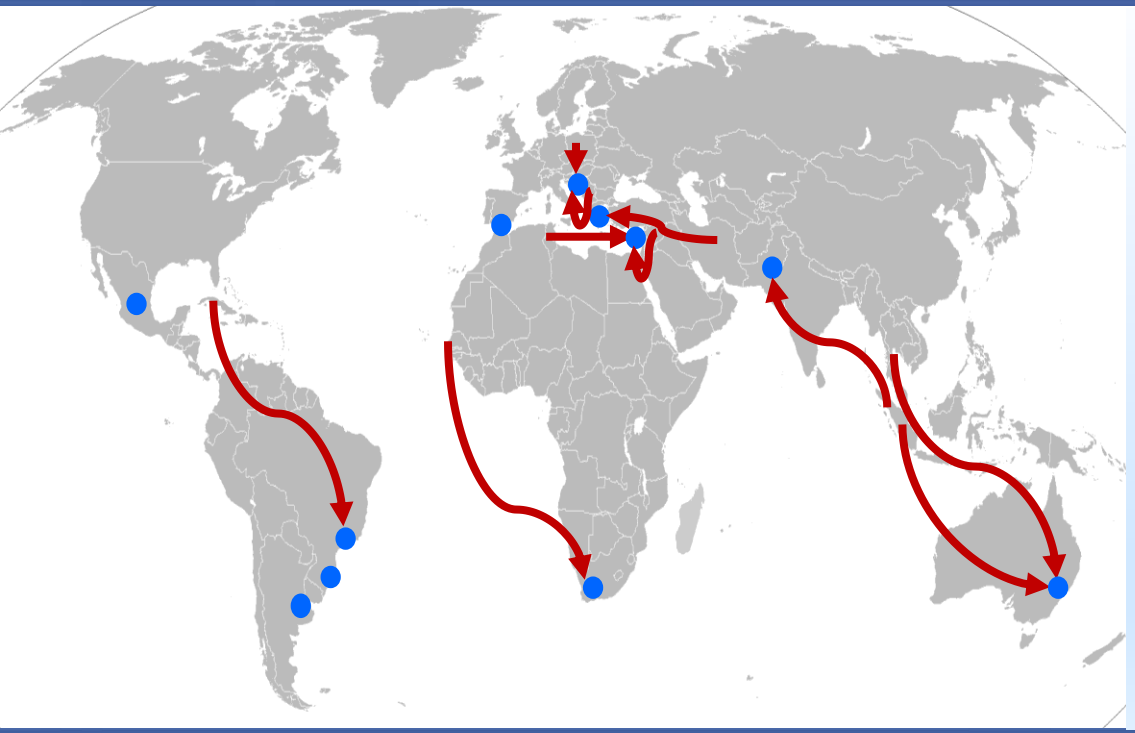
https://nucleus.iaea.org/sites/accelerators/Pages/beamtime.aspx

CRP: Facilitating Experiments with Ion Beam Accelerators

Planned or performed experiments- COVID influenced the implementation (travels)



13 experiments to 7 beam providers; IBA and nuclear physics:

Geology (2)

Air quality/ecology (3)

Biomedical

Biology

Agriculture

Archaeology

Materials science (2)

Detector (semiconductor) physics

IBA/Nuclear physics

(cross-sections measurement)

https://nucleus.iaea.org/sites/accelerators/Pages/beamtime.aspx

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IAEA publications

TecDoc and other series

Use of accelerator-based neutron sources

Ion beam techniques for the analysis of light elements in thin films, including depth profiling

Development of a Reference Database for Ion Beam Analysis

Trends of Synchrotron Radiation Applications in Cultural Heritage, Forensics and Materials Science

Hands-on Training Courses Using Research Reactors and Accelerators

Integration of Nuclear Spectrometry Methods as a New Approach to Material Research

Utilization of Accelerator Based Real Time Methods in Investigation of Materials with High Technological Importance

Improvement of the Reliability and Accuracy of Heavy Ion Beam Analysis

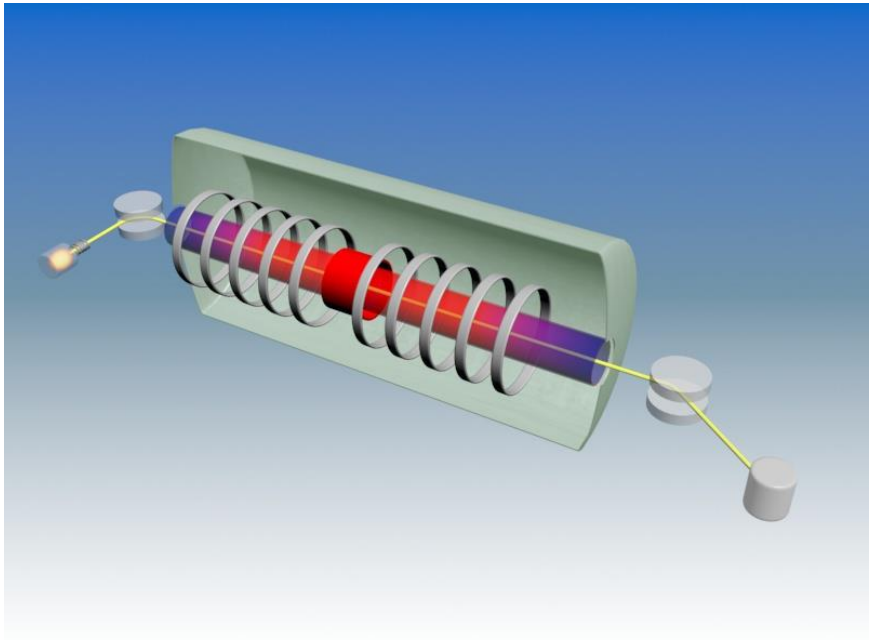
https://www.iaea.org/publications

New TecDoc tentative title:

Operation and Maintenance Guidelines for Low Energy Electrostatic Accelerators

- The document drafting started years ago (also some SNEAPers were involved)
- Updated with some new topics
- "a source of useful information and knowledge to supplement and complement that provided by equipment manufacturers, and to provide educational and training material for accelerator personnel and users"
- Will be released soon (a few months)

E-learning courses



Examples:

Introduction to electrostatic accelerators: from basic principles to operation and maintenance

Ion-beam Engineering of Materials for Quantum Technologies

Introduction to X Ray Emission Spectrometry

Neutron Activation Analysis

Neutron Imaging

Nuclear Analytical Techniques for Forensic Science

https://elearning.iaea.org/ → Nuclear Technology & Applications → Sciences and Applications →Nuclear Techniques

https://elearning.iaea.org/m2/course/index.php?categoryid=108

Forthcoming trainings and workshops

IAEA Training Workshop on
"Ion Beam Driven Materials Engineering: New Roles for Accelerators for Quantum Technologies"
Virtual event
IAEA Headquarters
Vienna, Austria
4–7 May 2021 – just running (78 participants)!
Ref. No.: EVT1904257

Target Audience:
PhD students and early career researchers (up to 7 years after PhD degree) actively involved in ion beam techniques working in an accelerator laboratory and/or in the field of quantum technologies.

Nomination deadline: 24 March 2021;

https://www.iaea.org/events

2nd Training Workshop on ~~Hands-on~~ Operation and Maintenance of Electrostatic Accelerators

IAEA 60 Years Atoms for Peace and Development

To be organized virtually end of November 2021

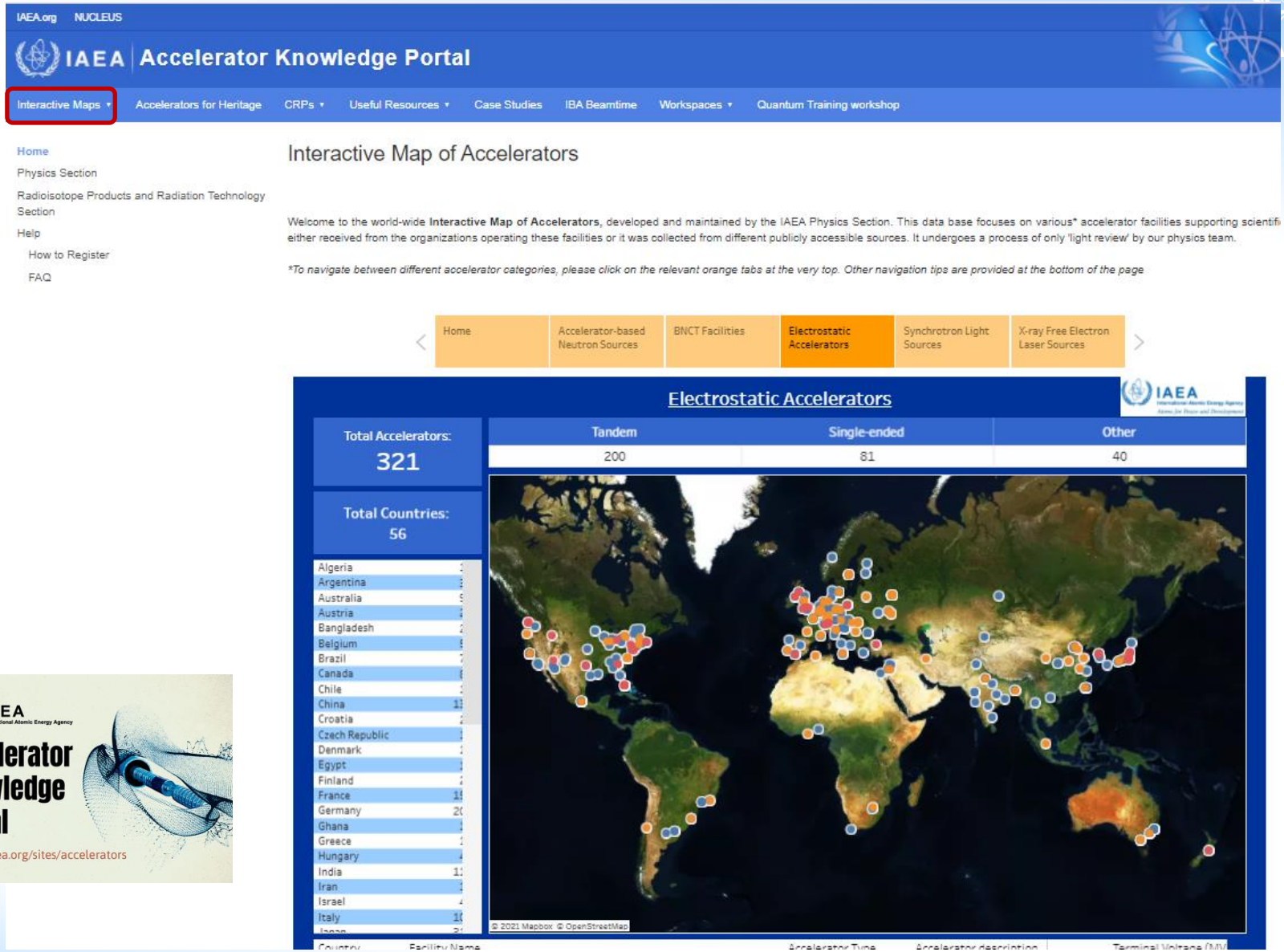
Target Audience:

Young accelerator operators, engineers and scientists working at accelerator facilities

Form:

- Short videos/presentations regarding O&M issues
- "Round table" discussion from experienced and developing laboratories
- Possible several presentations from experienced laboratories in the field of O&M
- Experienced laboratories interested in participation – giving opinions/advices please contact me: n.skukan@iaea.org
- Plan: to create a database of videos in O&M-please video-record your O&M; the video you may think is "straightforward" could help laboratories with less expertise

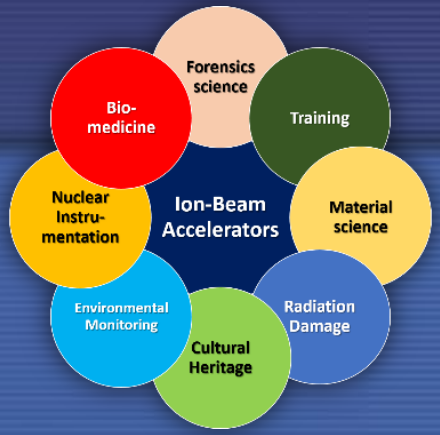
Accelerator Knowledge Portal & Interactive maps of accelerators



https://nucleus.iaea.org/sites/accelerators

email: physics-DB@iaea.org

Ion Beam Accelerator Project



Feasibility study conducted in 2018 defined needs for:

- Training in Accelerator technology and applications,
- Services relevant to ion beam and nuclear microprobe analysis,
- Enhanced access to Ion Beam Analysis techniques.

To match the IAEA Member States and internal IAEA users' needs:
1.7 MV Tandem or a 3 MV Tandem


1.7 MV Pelletron® Accelerator Lab.
East Carolina University, Greenville, USA

Total investment cost:

3 M€ for 1.7 MV and 5 M€ for 3 MV accelerators.

Staff required 3 to 5 persons

Annual operating cost : 100 to 150 k€

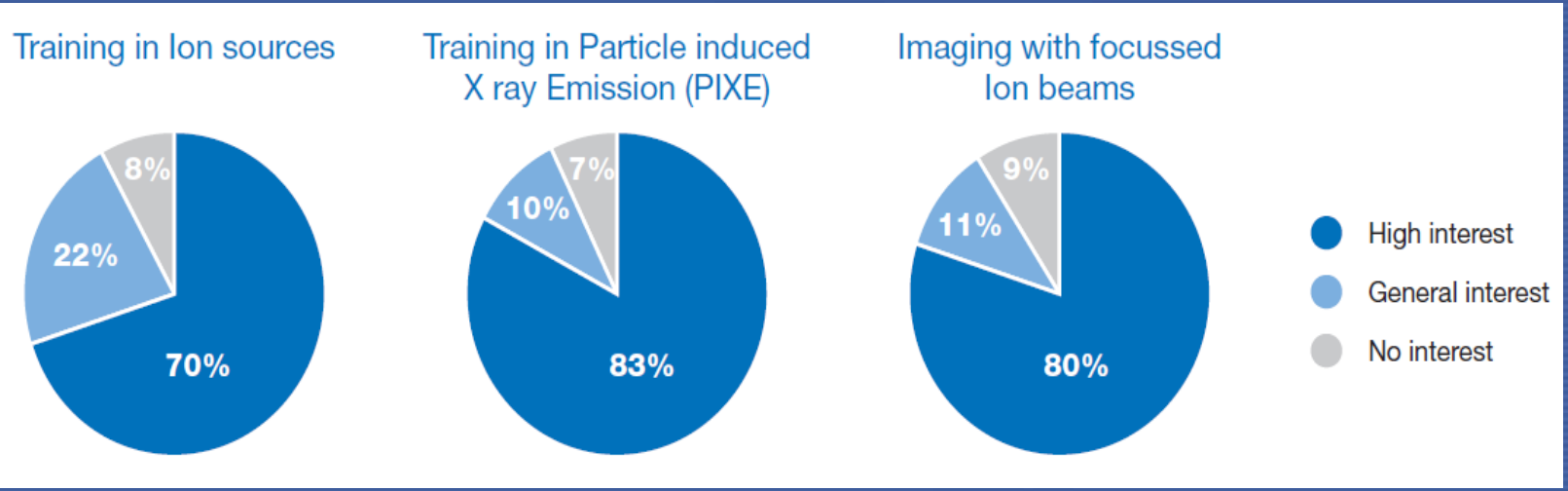
Call for Extrabudgetary support
from Member States for the Accelerator Project

IAEA

Contact information: nsil@iaea.org & physics@iaea.org

Ion Beam Accelerator Project

Level of interest for applications of an Ion Beam Accelerator at IAEA Laboratories, according to the feasibility study conducted in 2018:



List of useful links

IAEA events
https://www.iaea.org/events

IAEA publications
https://www.iaea.org/publications

IAEA e-learning
https://elearning.iaea.org/

IAEA accelerator portal
https://nucleus.iaea.org/sites/accelerators

IAEA Nuclear science and instrumentation portal
https://nucleus.iaea.org/sites/nuclear-instrumentation

Get beamtime through IAEA
https://nucleus.iaea.org/sites/accelerators/Pages/beamtime.aspx

IBA methods – practical demonstrations
https://nucleus.iaea.org/sites/accelerators/Pages/IBA-video-demonstrations.aspx

Thanks for your attention!

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IAEA

International Atomic Energy Agency