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International Atomic Energy Agency

Agence internationale de l'énergie atomique

Международное агентство по атомной энергии

Organismo Internacional de Energía Atómica

Vienna International Centre, PO Box 100, 1400 Vienna, Austria

Phone: (+43 1) 2600 • Fax: (+43 1) 26007

Email: [Official.Mail@iaea.org](mailto:Official.Mail@iaea.org) • Internet: <https://www.iaea.org>

In reply please refer to: **EVT1904269**

Dial directly to extension: (+43 1) 2600-21706

The Secretariat of the International Atomic Energy Agency (IAEA) presents its compliments to the IAEA's Member States and has the honour to draw their attention to the **Technical Meeting on Imaging Using Ionizing Radiation to Address Biological Challenges** (hereinafter referred to as "event") to be held virtually via Cisco Webex from **30 November to 3 December 2020**.

The purpose of the event is to review the state of the art in the field of imaging using ionizing radiation from synchrotron, neutrons, ion beams and radioisotopes for in-vivo visualization of biological processes both structurally and chemically.

The attached Information Sheet provides further details of the event.

The event will be held in English.

Member States are invited to designate one or more participants to represent the Government at this event. Member States are strongly encouraged to identify suitable women participants.

Designations should be submitted to the IAEA through the competent national authority (Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) not later than **2 November 2020** using the attached Participation Form (Form A). Completed and authorized Participation Forms should be sent either by email to: [Official.Mail@iaea.org](mailto:Official.Mail@iaea.org) or by fax to: +43 1 26007 (no hard copies needed). Copies should be sent by email to the Scientific Secretaries of the event, Ms Aliz Simon (Email: [Aliz.Simon@iaea.org](mailto:Aliz.Simon@iaea.org)) and Mr Ian Swainson (Email: [I.Swainson@iaea.org](mailto:I.Swainson@iaea.org)), both of the Division of Physical and Chemical Sciences, Department of Nuclear Sciences and Applications, and to the Administrative Secretary, Ms Rozanne Bojdo (Email: [R.Bojdo@iaea.org](mailto:R.Bojdo@iaea.org)). The Scientific Secretaries of the event will liaise with the participants directly concerning further arrangements, as appropriate, once the official designations have been received.

The IAEA takes no responsibility for, and the provider of the virtual meeting services has represented and warranted that the Services shall not contain, and that no end user shall receive from the software used to hold the virtual meeting, any virus, worm, trap door, back door, timer, clock, counter or other limiting routine, instruction or design, or other malicious, illicit or similar unrequested code, including surveillance software or routines which may, or is designed to, permit access by any person, or on its own, to erase, or otherwise harm or modify any data or any system, server, facility or other infrastructure of any end user (collectively, a "Disabling Code").

The Secretariat of the International Atomic Energy Agency avails itself of this opportunity to renew to the IAEA's Member States the assurances of its highest consideration.



2020-10-13

Enclosures: Information Sheet

Participation Form (Form A)

Form for Submission of a Paper (Form B)



# **Technical Meeting on Imaging Using Ionizing Radiation to Address Biological Challenges**

**Virtual Event**

**30 November–3 December 2020**

**Ref. No.: EVT1904269**

## **Information Sheet**

### **Introduction**

In what defines life, the levels of biological organization from the subcellular level to the whole-organism are complex, spanning enormous spatial and temporal scales. Life, however, is not static but is constantly changing as it interacts and adapts to an everchanging environment. While we recognize the need for imaging technologies that can capture life's processes across vast temporal scales (nanometers-to-meters), we also recognize the need to capture the dynamics of these processes.

The biggest problem is that no single tool or technology for visualizing complex biological systems can satisfy this goal. The physiological and biochemical processes that define how life interacts with the environment can span 13-15 orders of magnitude in time and space, respectively. Hence, integration of quantitative imaging technologies is the only way to achieve this goal.

Imaging using ionising radiation from synchrotron, neutrons, ion beams and radioisotopes has key advantages such as the penetrating nature enabling in-vivo visualisation of biological processes both structurally and chemically and ability to quantify those processes.

National research organizations and the IAEA sustainable development goals highlight the need to solve the grand biology challenges of today in areas such as protecting human health and understanding the food, energy and water nexus. These challenges will not be solved by one discipline alone, but require convergence and merging of ideas, approaches and technologies from widely diverse fields of science to stimulate innovation and discovery.

This has led to this virtual meeting to discuss the present status and future developments in imaging technologies based on ionizing radiation, and how these technologies can aid researchers in finding solutions to present and future challenges in human health and global food security.

## **Objectives**

The objectives of the technical meeting are to:

- 1) Identify key challenges in cell, tissue, and plant imaging tools;
- 2) Review the state-of-the-art imaging techniques in the above fields;
- 3) Explore how the IAEA can foster research and development in this field.

## **Target Audience**

The event is open to experts working in the application of ion beams, PET/SPECT, synchrotron light, and neutron beams for imaging in the topical areas of the Technical Meeting.

## **Working Language(s)**

English

## **Expected Outputs**

A Book of Abstracts will be compiled for free distribution during the meeting to every participant.

## **Structure**

The meeting will be virtual and follow a format used previously for such virtual Technical Meetings.

The event will be organized around the topics listed below.

All participants are invited to submit a presentation in the form of a PowerPoint or Adobe PDF file, with embedded audio if desired, to an IAEA SharePoint site at least 2 weeks prior to the dates of the event. This will allow time for the content to be viewed by all participants prior to the Webex events.

The Webex events will consist of overviews of specific themes followed by open discussion among the participants. The timing and duration of sessions determined in part by the themes of the contributions and in part by the geographic distribution of participants. The Webex events will be recorded and placed alongside the contributions on the IAEA Share Point site.

Diversity: Geographical and gender balances are encouraged.

## Topics

World experts will come together to discuss applications, recent results, as well as common challenges in their field with scientific examples and the need for multimodal imaging techniques across different spatial (sub-cellular to whole organism – nm through um to meter scale - resolution and Field of View requirements) and temporal (millisecond through minutes to months) scales.

Multimodal imaging modalities may include multidimensional and hyperspectral imaging techniques available in synchrotron and ion-beam based imaging. Limitations of single imaging modality vs advantages of multi-modal and correlative imaging techniques-discussing the instrumentation, sample preparation, and applications using case studies for non-destructive and live/in-situ imaging. Radiation damage and effects on samples from sub-cellular to whole plant will be discussed.

### **1. Plant imaging**

- Neutron radiography/tomography; e.g. for water transport or roots in soil
- Phase contrast imaging and related synchrotron-based techniques; e.g. for plant morphology and phenotyping
- High resolution ion beam analysis and imaging of plants
- Positron emission tomography applied to plants for the study of plant metabolism, signaling etc.
- XRF/XANES mapping and speciation of elements in plant tissues: nutrients and toxins
- Recent applications/research achievements
- Current challenges/limitations and development needs

### **2. State-of-the art single-cell imaging for cell structure and cell response studies**

- Case studies using synchrotron, ion-beam, and radio-isotopes based imaging
- Recent applications/research achievements
- In-situ/live imaging
- Limitations of single imaging modality vs. advantages of multi-modal and correlative imaging techniques
- Spatial resolution and efficiency for real world applications
- Radiation damage effects
- Sample preparation aspects
- Current challenges/limitations and development needs

### 3. Data analytics

- Acquisition, storage and post-processing challenges of large data sets
- Potential standardization of data formats
- User friendly visualization and quantification tools

## 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, participants are requested to send the **Participation Form (Form A)** to their competent national authority (e.g. Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) for onward transmission to the IAEA by **2 November 2020**. Participants who are members of an organization invited to attend are requested to send the **Participation Form (Form A)** through their organization to the IAEA by the above deadline.

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

## 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 700 words. It should be sent electronically to the Co-Chairs of the event (see contact details below), not later than **2 November 2020**. Authors will be notified of the acceptance of their proposed presentations by **6 November 2020**.

In addition, participants have to submit the abstract together with the **Participation Form (Form A)** and the attached **Form for Submission of a Paper (Form B)** to their competent national authority (e.g. Ministry of Foreign Affairs, Permanent Mission to the IAEA or National Atomic Energy Authority) or their organization for onward transmission to the IAEA not later than **2 November 2020**.

The abstract may be text only or contain figures and graphics but must only be one page. The abstract must contain the authors' names, affiliation and email addresses. Acceptable file formats are Microsoft Word (preferred) or PDF. The filename should be in the following format: "lastname.firstname.filetype".

Please indicate at the end of the abstract which **topic** you are contributing to.

**The abstract** shall be prepared according to the following instructions:

- 1) Page size: A4 (297mm by 210 mm) – vertical orientation
- 2) Margins 25mm all around

3) Layout:

**Title:** single-spaced, 14-point size, Times New Roman Font, **bold**

**Authors:** single-spaced, 12-point size, Times New Roman Font

**Affiliation:** single-spaced, 12-point size, Times New Roman Font, *italic*

**Text:** 1.5 spaced, 12-point size, Times New Roman Font

**Length:** one page

Authors must make sure that the files do not include copyrighted fonts or any other impediments for reproduction. The abstracts will be reviewed and selected by the meeting Co-Chairs. Authors will be informed of the acceptance of their contributions via email by **6 November 2020**.

## Important Deadlines

<b>2 November 2020</b>	Nominations to be sent to the IAEA and submission of abstracts according to the instructions above for selection.
<b>6 November 2020</b>	Participants will be informed about the acceptance of their contribution.
<b>6 to 13 November 2020</b>	Letter of invitations are sent to the accepted participants by the IAEA.
<b>6 to 16 November 2020</b>	Registration with the SharePoint site dedicated to this TM and upload of presentations to the site
<b>25 November 2020</b>	Webex invitations sent to all participants.
<b>30 November 2020</b>	Meeting begins.

# IAEA Contacts

## Scientific Secretaries:

### Ms Aliz Simon

Division of Physical and Chemical Sciences  
Department of Nuclear Sciences and Applications  
International Atomic Energy Agency  
Vienna International Centre  
PO Box 100  
1400 VIENNA  
AUSTRIA

Tel.: +43 1 2600-21706

Email: [Aliz.Simon@iaea.org](mailto:Aliz.Simon@iaea.org)

### Mr Ian Swainson

Division of Physical and Chemical Sciences  
Department of Nuclear Sciences and Applications  
International Atomic Energy Agency  
Vienna International Centre  
PO Box 100  
1400 VIENNA  
AUSTRIA

Tel.: +43 1 2600-24215

Email: [I.Swainson@iaea.org](mailto:I.Swainson@iaea.org)

## Administrative Secretary:

### Ms Rozanne Bojdo

Division of Physical and Chemical Sciences  
Department of Nuclear Sciences and Applications  
International Atomic Energy Agency  
Vienna International Centre  
PO Box 100  
1400 VIENNA  
AUSTRIA

Tel.: +43 1 2600-21754

Fax: +43 1 26007

Email: [R.Bojdo@iaea.org](mailto:R.Bojdo@iaea.org)



# Participation Form

## Technical Meeting on Imaging Using Ionizing Radiation to Address Biological Challenges

### Virtual Event

**30 November–3 December 2020**

To be completed by the participant and sent to the competent national authority (e.g. Ministry of Foreign Affairs, Permanent Mission to the IAEA, or National Atomic Energy Authority) of his/her country for subsequent transmission to the International Atomic Energy Agency (IAEA) either by email to: [Official.Mail@iaea.org](mailto:Official.Mail@iaea.org) or by fax to: +43 1 26007 (no hard copies needed). Please also send a copy by email to the Scientific Secretaries [Aliz.Simon@iaea.org](mailto:Aliz.Simon@iaea.org) and [I.Swainson@iaea.org](mailto:I.Swainson@iaea.org), and to the Administrative Secretary [R.Bojdo@iaea.org](mailto:R.Bojdo@iaea.org).

Participants who are members of an invited organization can submit this form to their organization for subsequent transmission to the IAEA.

**Deadline for receipt by IAEA through official channels: 2 November 2020**

Family name(s): (same as in passport)	First name(s): (same as in passport)	Mr/Ms
Institution:		
Full address:		
Tel. (Fax):		
Email:		
Nationality:	Representing following Member State/non-Member State/entity or invited organization:	
If/as applicable:		
Do you intend to submit a paper?	Yes	No
Would you prefer to present your paper as a poster?	Yes	No
Title:		





# Form for Submission of a Paper

## Technical Meeting on Imaging Using Ionizing Radiation to Address Biological Challenges

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Participants who are members of an invited organization can submit this form to their organization for subsequent transmission to the IAEA.

**Deadline for receipt by IAEA through official channels: 2 November 2020**

Title of the paper:		
If applicable: Abstract ID in IAEA-INDICO:		
Family name(s) and first name(s) of all author(s): e.g. Smith, John	Scientific establishment(s) in which the work has been carried out	City/Country
1.		
2.		
3.		
Family name and first name(s) of author presenting the paper: e.g. Smith, John	Mr/Ms:	
Mailing address:		
Tel. (Fax):		
Email:		

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**Date:**

**Signature of main author:**