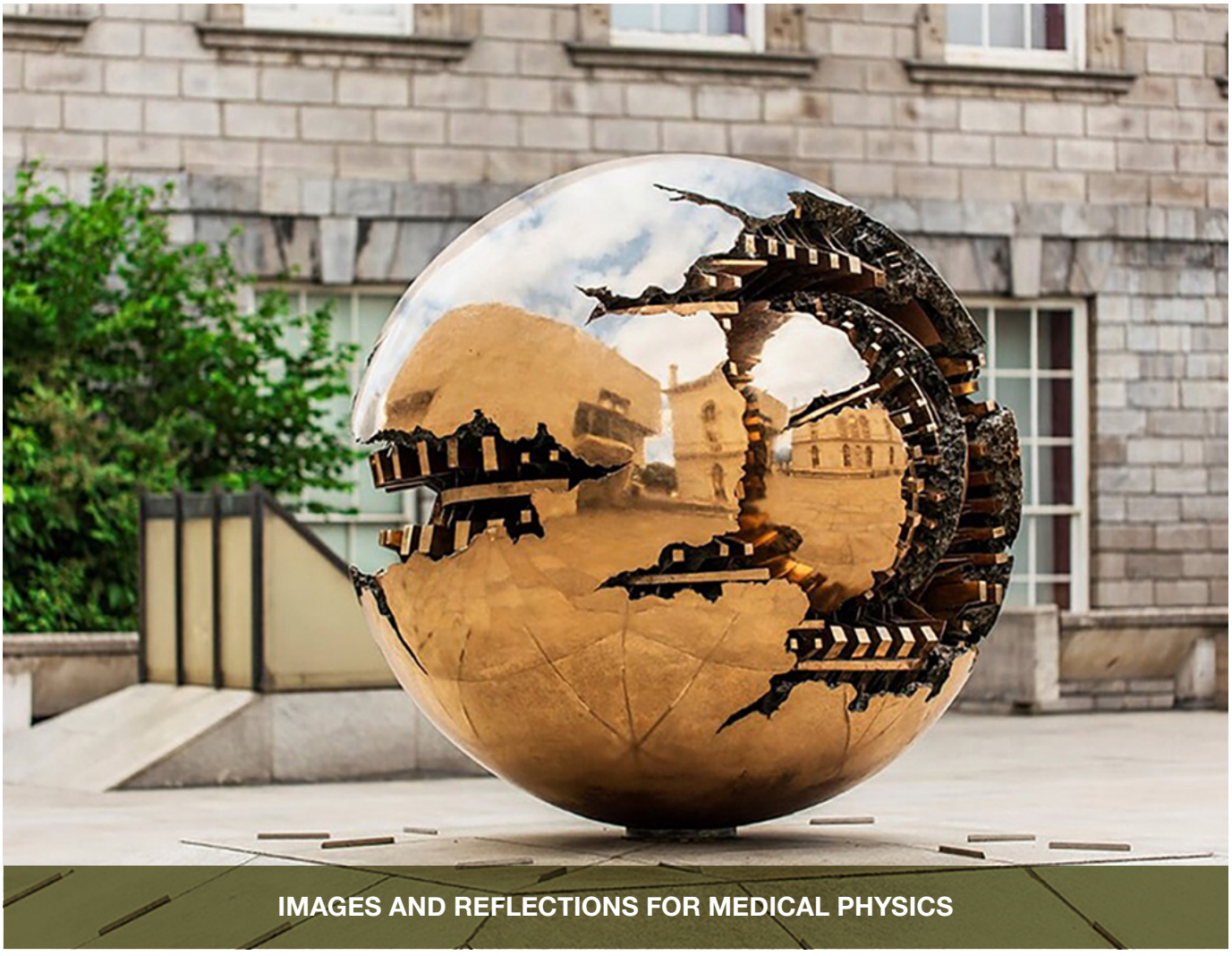
EFOMP

The European Federation of Organisations for Medical Physics Newsletter

European Medical Physics News

ISSUE 03/2021 | AUTUMN



IMAGES AND REFLECTIONS FOR MEDICAL PHYSICS

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Contents

Editorial 3

EFOMP President's Message 5

Company Member Accuray: Expanding image guidance options 7

EFOMP Secretary General's report (June – August 2021) 9

Looking back at the live edition of the 3rd European Congress of Medical Physics 12

Company Member IBA Dosimetry: The myQA SRS detector – clinical validation to clinical application in SRS/SBRT Patient QA 14

Special Interest Group for Radionuclide Internal Dosimetry (SIGFRID) 16

Company Member Varian: Varian's managed services/IT offering reduces risk and boosts resources for NHS Foundation Trust 18

Let's talk about slides, baby! 20

15th International Conference "Medical Physics in the Baltic States 2021" 23

Company Member PTW: Patient QA – why accuracy and independency matter 27

EURAMED (European Alliance for Medical Radiation Protection Research) 30

Looking back: the EUTEMPE / EFOMP webinars 2020-2021 31

Company Member LAP: How 3D patient QA highlights uncertainties and catches errors 32

Physica Medica: Editor's Choice 34

Book Review: "Radiation Therapy Dosimetry: A Practical Handbook", edited by Arash Darafsheh 37

Company Member Sun Nuclear: TG-218 and stereotactic QA – why SRS QA should be measured in the same geometry as the patient will be treated 39

Art to Challenge and Inspire: Images and reflections for Medical Physics 42

The Annual Meeting of the Serbian Association of Medical Physicists 44

Company Member Standard Imaging: The largest radiation therapy podcast in the world, Out of the Gray (Gy) 45

Helping young patients and families understand proton therapy by 3D simulation 46

Development of a PACS system 48

Company Member RTsafe: An innovative methodology for end-to-end QA in MRI-RT applications 50

Evaluation of hand/finger exposure for nuclear medicine staff working with ^{99m}Tc-labelled radiopharmaceuticals 52

Doses in the bone marrow in patients with cervical or endometrial cancer for three radiotherapy techniques: 3DCRT, IMRT, VMAT 54

Company Member Qaelum: Qaelum receives ISO 27001 certification 56

Towards precision medicine in breast cancer imaging: from 3D breast CT radiomics to 4D perfusion 57

Medical Physicist's hobby: Traditional Archery 59

Medical Physicist's hobby: In speleology we explore the underworld! 61

The Aurora project – informing about medical technology through comic strips 63

Upcoming conferences and educational activities 65

Structure of EFOMP 66

EFOMP Company Members 67

Front page photograph: Sfera con Sfera sculpture by Arnoldo Pomodoro, at Trinity College Dublin. Photograph courtesy of Lily Markovich. See the article by Prof. Jim Malone on page 42.

EDITORIAL

Welcome to the Autumn 2021 issue of European Medical Physics News, the quarterly newsletter of EFOMP! As ever, it includes a wealth of material covering a plethora of medical-physics related topics.

The striking photograph on the front cover of this issue shows the sculpture "Sfera con Sfera" by Arnoldo Pomodoro, which is located in the grounds of Trinity College, Dublin. It is featured in the first of a series of articles by Jim Malone, linking art and science through his favourite artworks – please be sure to read this illuminating article. Another new feature, beginning in this issue, is the Educational section. This issue's article is about presentations and slides – what to do and what not to do. The piece was written by Danielle Dobbe, who will be curating the educational articles in EMP News; we welcome her to the Editorial Board of EMP News as Educational Advisor.

The newsletter contains a number of regular features, including a medical physics book review, and an overview of recent papers published in Physica Medica by the journal's Editor-in-Chief, Iuliana Toma-Dasu. Our ever-popular Medical Physicists' Hobbies section contains an article about caving in Serbia and a piece on the subject of archery in Germany; never let it be said that Medical Physicists have boring hobbies! And AURORA's friendly lion cartoon character is back again for another episode of his journey through diagnosis and treatment, demystifying medical technology for the general public.

Back to Medical Physics, and the Autumn Newsletter features three articles under the banner of "Medical Physics in Practice", describing an innovative 3d simulation of proton therapy to aid patients and their families, implementation of an award-winning PACS system in Cyprus, and an evaluation of hand and finger exposure in nuclear medicine. You can also find two "Medical Physics Thesis" articles from recent PhD graduates, summarising their very interesting research projects.

Last, but definitely not least – articles from EFOMP Company Members are always appreciated by our readership, and in this issue you can find very informative articles from nine Company Members.

I hope you will enjoy reading this issue of European Medical Physics News!

David Lurie and the Editorial Team
(pubcommittee@efomp.org)
August 2021

David Lurie holds a Chair in Biomedical Physics at the University of Aberdeen, UK, where he has researched and taught MRI Physics since 1983. His research group works on the technology, methods and applications of low-field MRI. Prof. Lurie was awarded the Academic Gold Medal of IPEM in 2017 and was named as a Senior Fellow of ISMRM in 2021. He is Chair of the Communications and Publications Committee of EFOMP.

Communications and Publications Committee

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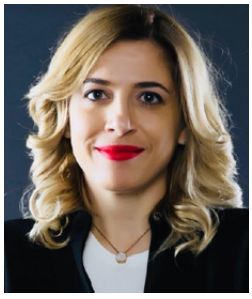

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EFOMP President's Message

EFOMP President Paddy Gilligan writes about the organisation's recent activities, as well as important issues for Medical Physicists

Woodland scene in Coole, Ireland; photo by Darina Gilligan

Greetings Medical Physics colleagues,

Early autumn is always a productive time that we associate with the Harvest, a time when we return refreshed from our summer vacation with renewed energy and vigour to use our physics skills to benefit both patients and staff.

We had the pleasure of hosting a Town Hall Meeting for NMOs at the start of the summer, where we outlined some of the challenges we dealt with in 2021. It is always refreshing to see the achievements and results of hard work from such a great group of volunteers.

We are now happy to report that the transfer of the office to the Netherlands is complete, with functioning bank accounts and a new legal entity based on Dutch law. This has required a lot of support and hard work from the previous and current treasurers, with assistance from Cantrijn and the IPEM office.

ECMP 2020 was a great success, with over 1000 registrants, an excellent scientific programme of over 33 pages, an impressive standard of speakers and posters, and the continued support of vendors. The congress planning committee, the local organising committee and Symposia all deserve praise as do AIFM, the Italian NMO which represented 379 of the delegates.

We now must look forward to the next congress which is being organised in Dublin 17-20 August 2022. As we had to deal with the pandemic delay of the Torino congress our time to organise next year's congress is shorter, so we will need all hands on deck!

We have just put a call out for scientific committee nominations and look forward to a strong response. We would also like your ideas to secretary@efomp.org on how to increase participation, particularly around early careers and young physicists. We would like to see greater representation from all four corners of our geographical EFOMP reach and

urge you to tell your NMO members to start planning to come to Dublin. We hope and trust the meeting will be face-to-face, so do keep an eye out for seat sales from the many airlines that use Dublin as a transport hub.

In addition to an excellent scientific and social programme we will have three ESMPE schools and a EUTEMPE workshop prior to the congress. Remember, this is our EFOMP congress and each EFOMP member's contribution will make it a success. Our theme of "multiple energies single patient focus" means that we want participation from all disciplines in the EFOMP family, from therapies, diagnostics, and nuclear medicine to clinical physics.

As we leave the pandemic the challenge of mobility and qualifications for physicists to address the health care needs of European patients has come to the fore. Recently we have sought clarification from the European radiation competent authorities body HERCA around physics and maths degree requirements in the training of radiation protection experts for medical purposes. A radiation protection expert carries out duties that involve the staff and public; this is different than the medical physics expert whose focus is to look after the patient. In many countries the medical physics expert may also act as a competent radiation protection expert. We would regard proper scientific training in physics and maths as essential requirements for the role of a radiation protection expert.

We have also had queries around medical physicists who want to work in different countries In Europe. It seems remarkable that well-trained medical physics experts with proven competencies are not entitled to use their skills in different countries, even taking account of local cultural differences. To this end we need NMOs to get their national registration schemes recognised by EFOMP. We have five approved to date and are processing a sixth (HAMP, Greece) and seventh (PSMP, Poland). So only 19 % of our NMOS NRS are approved or about to be approved, even though many schemes are off-the-shelf and should get approved by EFOMP with minimal work in a short period of time. To use a football parlance: "We are standing in front of an empty goal, it's now time to score." This is an important part of the recognition of the Medical Physics Expert as a protected title in Europe. Did you know that under EU Directive 2013-55-EU if we get the title recognised in one third of EU member states it may be mandated for the whole EU?

In this brief message it's impossible to summarise all of the many contributions from EFOMP. We have a lot to look forward to: our hybrid therapy school in October, our officers and council meeting, with the EURADOS and EFOMP School in Kaunas, Lithuania at the regional Baltic meeting in November.

In the mean time I will leave you with an extract from 'Wild swans at Coole' by the poet William Butler Yeats which captures the beauty of autumn as it will hopefully moderate what has been an extreme summer for many of you:

The trees are in their autumn beauty,
The woodland paths are dry,
Under the October twilight the water
Mirrors a still sky;

Paddy Gilligan, is President of EFOMP. He is chief physicist in the Mater Misericordiae University Hospital in Dublin Ireland and has over thirty years' experience in diagnostic imaging, He has served on state boards for regulatory radiation protection agencies. He became associate professor in University College Dublin in 2017. He was the chair of the European congress of radiology physics programme in 2019. Prior to becoming President of EFOMP he chaired the successful bid for ECMP 2022 for Dublin. He is a trustee of the Robert Boyle Foundation.

EFOMP COMPANY MEMBER ARTICLE

ACCURAY

Accuray: Expanding Image Guidance Options

ClearRT™: Helical fan beam KVCT imaging technology for the Radixact® System

Executing on a bold vision the TomoTherapy® Platform was the first CT guided radiotherapy system mounted on a ring gantry. A new form specifically designed to make daily image guided, binary collimated, intensity modulated radiotherapy accessible and routine.

Drawing on more than four decades of diagnostic CT imaging experience the dedicated Accuray Imaging Group, in partnership with TomoTherapy Users, have developed new, progressive, image guidance capabilities for the latest generation of the TomoTherapy System, Radixact®.

Integrating helical fan beam kVCT technology enables users to select the imaging options best suited to the intended clinical use of the images on demand.

Key features of ClearRT™ include:

- Continuous scan lengths of up to **135 cm**
- Fast image acquisition with speed **≈2 cm/sec**
- Transverse field of view up to **50 cm**
- Variable beam aperture, a narrower beam for enhancing image quality while a wider beam offers versatility in terms of speed
- Simultaneous acquisition and reconstruction with real-time display
- Full integration with the automated daily adaptive dose monitoring solution PreciseART™ and the real-time adaptive treatment delivery with Synchrony®

Clinical implementation of ClearRT by early adopters has been straightforward due to the seamless integration of the functionality into the existing single user interface which comprises the Treatment Delivery Console (TDC). Thus, maintaining the inherent ease of use of the treatment delivery workflow of Scan, Register, Treat which is consistent across all indications and image based machine and patient quality assurance.

Protocols are available according to anatomy, body size, FOV, scan length, speed, and quality of image needed according to clinical intent.

Imaging dose is displayed on the TDC prior to imaging. This information is present for both MVCT and KVCT as well as for Synchrony kV imaging.

Two new modules have been added to Total Quality Assurance to track and trend important image quality parameters with ser-customizable alerts and the generation of image quality reports for ClearRT kVCT and CTrue MVCT.

ClearRT kVCT and CTrue™ MVCT with Iterative Reconstruction opens a new generation of imaging capabilities for the Radixact System building on the CT image guided legacy of the TomoTherapy platform.

Reference:

Mackie T R, Holmes T, Swerdloff S, et al. Tomotherapy: A new concept for the delivery of dynamic conformal radiotherapy. Med Phys. 1993: 20(6):1709-19.

Article written by **Susan Reid** DDR, MSc, TomoTherapy Product Manager EIMEA

ecmp 4th Dublin 2022

4TH EUROPEAN CONGRESS OF MEDICAL PHYSICS

ECMP 2022

17.-20. AUGUST 2022.

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DUBLIN, IRELAND

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Irish Association of Physicists in Medicine

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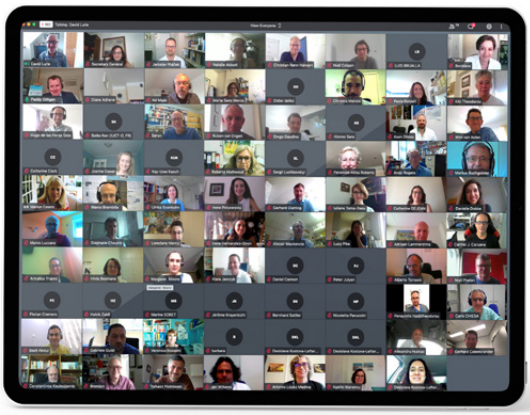
Fáilte Ireland
National Tourism Development Authority

EFOMP Secretary General's report (June – August 2021)

In this article you will find an update on the institutional matters of our organization during the last three months

EFOMP Town Hall Meeting – Summer 2021

EFOMP's first Summer "Town Hall" online gathering was organized in early June. Despite the fact that for many colleagues around Europe summer holidays had just begun, there was a great attendance at the meeting. More than 90 National Member Organisations (NMOs) board members and delegates, committees', working group members and representatives joined virtually. Research projects, scientific events and educational activities were discussed during the 4-hour meeting and a video recording was sent to colleagues who were not able to attend.



Attendees at the Summer Town Hall virtual meeting

Newly appointed colleagues (left to right): Irene Polycarpou, Lorenzo Mazzoni and Federica Zanca

EFOMP Committees, new committee members and roles

We welcome Lorenzo Mazzoni (IT) and Irene Polycarpou (CY) as new members of the European Matters committee. The EFOMP School board welcomes Federica Zanca (BE) as newly elected (by NMOs) member of the scientific committee of the EFOMP School.

NMO Presidents and delegates can nominate colleagues interested in joining EFOMP committees by sending a nomination email to: secretary@efomp.org

EFOMP representatives

Eight Medical Physicists (see table) have been nominated as subcommittee members and reviewers in the ESR "Physics in Medical Imaging" scientific subcommittee of the European Congress of Radiology 2023 (ECR 2023), taking into account the terms of office, geographical distribution and subspecialties of members. The committee will be chaired by Osvaldo Rampado. Subcommittee members are asked to assist their chairpersons in suggesting topics for New Horizons Sessions, Special Focus Sessions and State of the Art Symposia, finalizing of the Refresher Course programme, rating of submitted abstracts and accepted EPOS posters and reporting to chairpersons with suggestions for improvements, new topics and possible new speakers for future consideration. Reviewers' tasks include the rating of submitted abstracts and EPOS posters as well as the evaluation of research paper presentations during ECR.

Chairperson	Osvaldo	Rampado	Turin	IT
Members	Agnieszka	Kuchcinska	Warsaw	PL
	Natalia	Saltybaeva	Zurich	CH
	Roberto Mariano	Sánchez Casanueva	Madrid	ES
	Ioannis	Seimenis	Athens	GR
	Lucie	Sukupova	Prague	CZ
Reviewers	Paola	Baldelli	Dublin	IE
	Ana	Diklić	Rijeka	HR
	Lucy	Pike	London	UK

Prof Loredana Marcu (RO), chair of the EFOMP European Matters committee, was appointed as the EFOMP liaison to the AAPM Global Liaisons Committee of the newly formed International Council. The Global Liaison Committee will have liaisons from all major relevant organizations that are engaged in global health from the perspective of medical physics. Its vision is to have a sustainable, measurable and meaningful impact on global health as it relates to the practice of medical physics, the international medical physics communities and medical disciplines associated with medical physics (e.g. radiology, nuclear medicine and radiation oncology). EFOMP is supporting this initiative which hopefully will lead to harmonization of global health activities.

EFOMP will be involved in the development of the ERS/ESTS/ESTRO/ESR/ESTI Statement on Management of Incidental Findings from Low-Dose CT screening for Lung Cancer (MILCa) project and Dr Matthew Donague (IR) will act as the federation's representative.

New and ongoing calls

- Call for bidding for the organization of the 5th European Congress of Medical Physics (ECMP) in 2024. The deadline for receipt of bids is 30th November, 2021. A summary of each bid and recommendations of the review group will be sent to the EFOMP governing committee on 31st January, 2022 and the contract will be signed within 3 months.

- A call will be launched in September 2021 for nominating colleagues to the positions of Professional Matters, Education & Training, European Matters, Scientific committee vice chairs. Please see all members at the EFOMP Governing committee and advisory committee members web page.

NMO Presidents and delegates – please identify among your members suitable candidates for the positions of vice chairs who will take office in January 2022.

- Preparations for the organisation of the 4th European Congress of Medical Physics (ECMP2022) which will take place in Dublin next year have already started. NMOs are invited to propose colleagues for joining the congress scientific committee. The ECMP congress planning committee will evaluate the proposals based on CVs, specialties, country and gender balance. Inclusion of early career medical physicists will be highly considered.

Collaboration with Affiliated organizations

- The IRPA2022 Europe Congress will be held in Budapest (30th May – 3rd June 2022), organized by the International Radiation Protection Association (IRPA). EFOMP colleagues will take part in the extended scientific committee contributing in education and training, medical applications, radiobiology and young generation network topics.

- EFOMP was among the contributing societies which developed the Joint Position Statement And Call For Action for Strengthening Radiation Protection Of Patients Undergoing Recurrent Radiological Imaging Procedures | IAEA.

- EFOMP cosponsors and endorses the IAEA-ICTP joint virtual Workshop on Radiation Protection in Diagnostic and Therapeutic Nuclear Medicine, on the 11th-15th October 2021. Stephane Chauvie (IT) MPE, will teach in this workshop on behalf of EFOMP. The workshop will consist of a series of lectures on safety aspects related to use of classical radiopharmaceuticals and introduction of new radiopharmaceuticals for diagnosis and treatment, and those related to hybrid imaging (SPECT-CT and PET-CT).

- A joint document with the American Association of Physicists in Medicine (AAPM) on "Estimation of Patient Skin Dose in Fluoroscopy: Summary of a Joint Report by AAPM TG357 and EFOMP" has been recently published. Future collaborations were discussed during an AAPM - EFOMP meeting between AAPM & EFOMP Presidents, officers and representatives from both organisations in June.

Webinars

Please see our Webinars page for full details. A new series of webinars organised by the Nordic Association of Clinical Physics (NACP) will be hosted on EFOMP's digital platform. All events are in English and registration is free.

A video recording of "The role of non-ionizing and ionizing radiation against COVID-19", which was organized by the Hellenic Association of Medical Physicists and the Medical Physics Unit of the 2nd Dept. of Radiology, Medical School, National and Kapodistrian, University of Athens, hosted by EFOMP, can be found on EFOMP's e-Learning platform. Thank you all for your attendance and encouraging feedback about our webinars! An example of the feedback we have received is reproduced here:

"I am a Medical Physicist from Romania and I participated to the workshop "The role of non-ionizing and ionizing radiation against COVID-19". Thank you for the opportunity given with this workshop to learn more about SARS CoV2, about the studies that are in progress around the world against the effects of SARS CoV2, about the use of ionizing radiation for diagnostic and treatment purposes in the fight against Covid19. I hope to hear news on this subject and about other subjects, through other webinars or workshops."

The online webinars platform of EFOMP can be used by all National Member Organisations for their educational activities. Please contact the Secretary General for more information.

Another educational initiative will take place virtually in October. An edition of the EFOMP school jointly organised with COCIR on “Hybrid Approaches in Radiation Therapy” is under preparation by Christoph Bert, Jose Perez Catalayud and Alberto Torresin. All of the lectures will be delivered live and this edition will be available without any cost only for EFOMP IAMs on a first-come, first-served basis. Christos Alexakos and Thomas Amorgianiotis, our web developer team, will help again in the organization of the online school and interconnection of EFOMP digital platforms and issuing of certificates.

I am closing this update hoping that we will meet in person in Kaunas, Lithuania in November, during our Annual General Assembly.

Efi Koutsouveli is a Medical Physics Expert at Hygeia Hospital, Athens, Greece.
She is Secretary General of EFOMP.
Email: secretary@efomp.org

ECMP 2020

Looking back at the live edition of the Third European Congress of Medical Physics

Past ECMP President Mika Kortesniemi writes about the virtual ECMP conference, which took place on-line 16th-19th June. Readers are encouraged to take advantage of on-demand access to the conference sessions, available until the end of 2021!

The 3rd ECMP will go on as an on-demand congress until the end of the year. Please enjoy the recorded talks and e-posters, learn and be inspired of the extensive on-demand access. The virtual ECMP lobby shown here was created by Symposium, the secretariat of the congress.

Dear Colleagues,

I hope that the past summer has brought relaxing moments for all of you. While looking back at the virtual live edition of the Third European Congress of Medical Physics, I would like to thank all of you who made it possible to create a successful virtual event in June! Your dedication to our European community was shown in the number of submitted abstracts, active attendance and discussions, and the feedback gathered after the live part of the ECMP. The live congress reached about 1100 participants, making this the largest medical physics event in Europe so far! This was a wonderful outcome after so many changes along the way regarding the congress timing and format. But again, it showed that our European medical physics community is widely active, adaptive in a changing environment and motivated to gather together, to share valuable knowledge and experiences.

A clear benefit of the virtual event is that logistic efforts and costs (plus carbon emissions) are minimised, creating the possibility to join flexibly from any geographical location. This was shown with excellent talks and live discussions by honoured overseas speakers, and attendance from all around the world – from 64 countries, 29 of them outside of Europe.

The congress programme was extensive and well attended. During the four live days there were over 126,000 clicks to access our scientific programme with over 30 live sessions in two live rooms, and 26 on-demand sessions. The congress covered 87 invited talks, 300 scientific oral presentations and 270 posters, counting 570 final uploaded abstracts. The presence of 36 exhibitors is also highly acknowledged – their presentations and symposia programme created valuable additions to the overall programme. In addition to the actual congress, three pre-congress events were organised beforehand, reaching almost 300 participants. These events discussed artificial intelligence, nuclear medicine dosimetry and patient-specific QA in radiotherapy, providing highly relevant topics in our profession.

Based on the attendees' post-satisfaction survey the congress fulfilled well the scientific and technical expectations. The scientific programme was graded 4.5 (on a scale from 1 to 5) with equal ratings between good and very good evaluations. Technical and organisational aspects were rated equally well, giving a score of 4.5 for the ECMP virtual experience as a whole. As congress organisers, we are happy to see this feedback, along with the dedication of European medical physicists as demonstrated by the attendance figures.

I would like to thank each of you for sending your scientific findings into our congress. These studies were the backbone of the scientific programme.

My gratitude goes also to the members of the ECMP Scientific Committee and Congress Planning Committee who made great efforts in reviewing the abstracts and making it possible to compile the final scientific programme. The Congress Planning Committee, Local Organizing Committee and Congress Secretariat – Symposium – worked tirelessly to make the virtual programme in its final form. The congress also included an enjoyable social programme covering an opening concert with great Italian music and an evening tour to the Egyptian Museum in Torino, bringing a warm touch of Italy to the virtual arena. Additionally, we had the privilege to host special sessions presenting the Galileo Galilei Awards and the EFOMP Medal Award with artworks to inspire our scientific thoughts.

However, the Third ECMP did not end in June! The congress programme will remain accessible with talk recordings and e-posters on the on-demand platform until the end of this year. So, you will have plenty of time to see and digest the ECMP contents for many months ahead. Just go to the congress web site.

We would also like to remind you that Physica Medica – European Journal of Medical Physics (EJMP), will publish a focus issue containing up to 50 selected papers from scientific contributions in ECMP. Furthermore, all abstracts accepted for ECMP are published in a special issue of Physica Medica.

The slogan of the congress was embracing change, sharing knowledge. Thank you all for making that happen!

I am looking forward to meeting you all – finally in person – in Dublin next year, for the 4th ECMP!

Until then, best wishes

Mika Kortesniemi, President of the 3rd ECMP

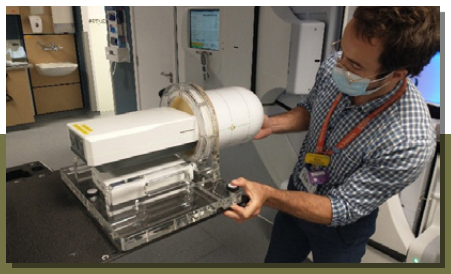
Dr Mika Kortesniemi works as the Chief Physicist and Adjunct Professor in the HUS Medical Imaging Center, University of Helsinki, Finland. His professional focus is on the quality assurance, dosimetry, optimisation and radiation protection in x-ray modalities, especially the evolving CT technology. The research work is primarily related on radiological optimisation, utilizing anthropomorphic phantoms and Monte Carlo simulations. Dr Kortesniemi is the past chair of EFOMP Science Committee. In addition to his primary position in HUS Medical Imaging Center, Dr Kortesniemi is also involved in IAEA, ICRP and ESR collaboration, and quality audits in radiology.

EFOMP COMPANY MEMBER ARTICLE

IBA Dosimetry: myQA® SRS detector – clinical validation to clinical application in SRS/SBRT Patient QA

An interview with Sally Fletcher & Chris Stepanek, University Hospitals Bristol & Weston (UHBW) NHS Foundation Trust, UK

Clinical evaluation confirms that myQA® SRS provides a unique Patient QA capability, verifying stereotactic treatment plans with film-class resolution and the workflow efficiency of a digital detector.



Patient-focused QA: Chris Stepanek (above) of UHBW NHS Foundation Trust, UK, adjusts the myQA SRS set-up during a comprehensive evaluation of the detector, phantom and supporting software using SBRT plans for a range of beam energies and clinical indications. (Courtesy: UHBW NHS Foundation Trust)

The myQA SRS is a game-changer for verifying stereotactic treatment plans in the radiation oncology clinic – enhancing treatment quality, workflow efficiency and patient safety in the process. Developed by IBA Dosimetry, this new 2D digital detector array is designed to support the medical physics team with patient-specific QA and commissioning of their stereotactic radiosurgery (SRS) and stereotactic body radiotherapy (SBRT) systems.

Following release in March, radiation therapy sites are now focused on implementation, evaluation, and validation of myQA SRS in the clinical setting. The detector's capabilities are being tested by several clinics in Europe and the US, creating data on the benefits for patient safety and throughput within the SRS/SBRT workflow.

Innovate, evaluate, validate

University Hospitals Bristol & Weston (UHBW) NHS Foundation Trust in the UK is testing the myQA SRS. Radiotherapy Physicist Chris Stepanek and UHBW's Head of Radiotherapy Physics, Sally Fletcher, carried out their evaluation of myQA SRS, using SBRT plans calculated in the RayStation v7.0 treatment planning system (TPS) for a range of beam energies and clinical indications (including spine, lung, liver and prostate).

In the clinic, the UHBW physicists integrated the detector into the cylindrical myQA SRS phantom (compatible with static and rotational delivery) or in water-equivalent Scanplas. Field and plan measurements were subsequently compared to RayStation calculations using gamma analyses, also with commissioned plan verification systems (e.g., radiochromic film and IBA Dosimetry's CC04 ion chamber).

Workflow efficiency: IBA Dosimetry's myQA SRS solution with the high-resolution detector (right) and advanced software (left) for streamlined SRS/SBRT patient QA measurements and plan validation.

The emphasis on integrated product design is key to the combined detector-phantom assembly, minimizing uncertainties in set-up, calibration, and QA checks. "The detector comes with its own dedicated phantom and inserts for ion chambers and radiochromic film – all of which are straightforward to set up," Stepanek explains. "The myQA software is also very intuitive, enhancing ease of use and efficiency within the SRS/SBRT workflow."

Ease of use translates into a streamlined Patient QA workflow, sidestepping the lengthy and cumbersome process controls needed to get consistently accurate absolute dose data with film dosimetry. "For SRS/SBRT, QA is all about patient safety and workflow efficiency," adds Fletcher. "As such, the myQA SRS detector will speed up time to treatment delivery for the patient, while providing reassurance that what your TPS has calculated is what your stereotactic treatment system is

delivering. That reassurance is doubly important given the steep dose gradients implicit with SRS/SBRT modalities."

The myQA SRS is based on a silicon complementary metal-oxide-semiconductor (CMOS) platform. This enables a compact design, fast read-out, and high pixel density along the x and y coordinates (with each pixel representing a radiation-sensitive element comprising a photodiode, capacitor, and three transistors). Spatial resolution is 0.4 mm, with 105,000 pixels across an active area of 12×14 cm^2.

Stepanek, Fletcher and their UHBW colleagues used ion-chamber measurements to assess myQA SRS dose linearity, dose-rate dependence, and field-size dependence. TPS calculations and radiochromic film enabled assessment of off-axis square fields and step-and-shoot off-axis stripes. "We validated the performance of myQA SRS through the measurement of clinical plans and subsequent comparison with small-volume ion chambers, radiochromic film and TPS doses," explains Stepanek. "The project also evaluated the detector versus a variety of errors simulated within a selection of treatment plans, focusing in the main on sensitivity to single MLC position errors as well as gantry and collimator miscalibrations." Stepanek has presented the full results of the UHBW study at ESTRO 2021.

More information about myQA SRS can be found here

Sally Fletcher is Head of Radiotherapy Physics at the University Hospitals Bristol & Weston (UHBW) NHS Foundation Trust in the UK. She has worked in Radiotherapy Physics for 30 years and has been Head of Dosimetry Development in Bristol Haematology and Oncology Centre (BHOC) for more than 10 years. Sally has collaborated with Bristol University on research into MAPS as a transmission detector. She has a BSc in Physics, is a registered clinical scientist with the Health Care Professional Council, and is a Member of the Institute of Physics and Engineering in Medicine.

Chris Stepanek works as a Radiotherapy Physicist at the University Hospitals Bristol & Weston (UHBW) NHS Foundation Trust in the UK. He has an MSci in Chemistry, MSc degrees in the Physical Sciences of Imaging and in Medical Physics, and a PhD in Supramolecular Chemistry and Nanoimaging.

Special Interest Group for Radionuclide Internal Dosimetry (SIGFRID)

Pablo Mínguez Gabiña from Barakaldo, Spain, provides an update on the activities of EFOMP's newest Special Interest Group

During the last part of Spring and the beginning of the Summer, the SIGFRID has kept up its work promoting dosimetry in clinical practice. The number of members keeps increasing and to date there are 92 SIGFRID members. New applications are always welcome (see below on how to become a SIG member).

The Steering Committee (SC) has had monthly meetings (17th May, 25th June, 23rd July). A general SIGFRID meeting was held on June 4th with the attendance of more than 30 members of the SIGFRID. The Board members introduced themselves, after which SC members gave a brief outline of the tasks/priorities they coordinate, and called for the participation of SIGFRID members. The frequency of general meetings was set to every six months, therefore the next general meeting should be organised in early December 2021.

As a reminder, during the kick-off meeting (March 8th), priorities were identified. As listed below, SC members agreed to act as coordinators to promote the development of each priority/task, but the active participation of SIG members is required. In addition, most activities are undertaken in collaboration with specific EFOMP committees.

1. **Survey on the practice of clinical radionuclide dosimetry (S Peters and C Stokke)**

   Volunteers from the SIGFRID are to collaborate in the preparation of the survey on the practice of clinical radionuclide dosimetry are needed. Some past efforts (EANM Dosimetry Task force, AIFM) will be included as a start to the survey. Existing national groups (British IDUG) will also be contacted.

2. **Available resources, protocols, tools, bibliography (A Denis-Bacelar)**

   Volunteers are needed to initiate a database containing resources relevant to radionuclide dosimetry. As a start, it was decided to provide a list of relevant publications. We are investigating the feasibility of presenting these resources in a SIG specific part of EFOMP's web pages.

3. **Education on radionuclide dosimetry (M Bardiès and G Glatting)**

   A survey on the implementation of education in Europe is planned to be carried out in collaboration with the education committee of the EFOMP. We are looking for colleagues involved in education in their country to provide information on the education content in radionuclide dosimetry (both academic and professional training, + CPD).

4. **Communication (P Minguez Gabiña)**

   This important task includes the production of internal SIG newsletters (2 so far) and the contribution to EMP News on a quarterly basis. A logo contest was initiated in order to find a logo that can represent the SIGFRID. The contest is open to all SIG members and the logo should be selected during the next general SIG meeting.

5. **Scientific issues (E Amato)**

   To promote scientific debates, SIG meetings will be organised with a format designed to allow exchanges: short (max 2 hours) sessions dedicated to a limited number of specific domains, short presentations (10 mins) by volunteers, followed by general discussions. The first edition of (hopefully) a series meeting is set for September 23rd, 15-17h CEST.

6. **EU matters (G Glatting and M Bardiès)**

   A permanent survey of EU calls related to clinical radionuclide dosimetry will be made. The idea is to advertise these calls widely via the mail list, to promote networking and participate in the development of research projects.

7. **Regulatory issues (C Chiesa)**

   EMA-approved radiopharmaceuticals with fixed posology do not allow dosimetry-based patient-specific therapy optimisation. The SIGFRID will try to call attention to this situation, which goes against the EU Directive 2013/59.

8. **Promotion of clinical radionuclide dosimetry (G Flux)**

   A working group will be formed with this aim, trying to include volunteers from countries in which dosimetry is less established, but also establish connections with patient organisations and whoever can participate in the promotion of patient-specific dosimetry.

Relevant upcoming meetings:

- Joint ICTP-IAEA Workshop on Dosimetry in Radionuclide Therapy and Diagnostic Nuclear Medicine. Online. (September 20–October 1). http://indico.ictp.it/event/9593/
- Radiation Research Society's 67th Annual Meeting. San Juan, Puerto Rico (October 3–6) https://na.eventscloud.com/website/23992/rrs21home/
- 34th EANM Annual Congress. Vienna. (October 20–23). https://eanm21.eanm.org/
- 5th European Radiation Protection Week (ERPW). Vienna. (November 22–24). https://www.euramed.eu/erpw/
- Conference on Applied Radiation Metrology (November22–26)https://www.npl.co.uk/events/conference-on-applied-radiation-metrology-2021
- International Training School on "RADIONUCLIDE THERAPY AND THERANOSTICS". Banja Luka (November 22–26) https://ifamp.eu/course2-banja-luka-international.html
- ESMIT Advanced course. Practical Implementation of Clinical Dosimetry in Nuclear Medicine Therapy. Vienna. (December 9–10). https://www.eanm.org/esmit/advanced-courses/practical-implementation-of-clinical-dosimetry-in-nuclear-medicine-therapy/

How to become a SIG member:

The SIG is meant for networking professionals with an interest in radionuclide dosimetry. Membership is open to all EFOMP members. The membership application procedure is explained on the SIG pages of the EFOMP web site:
https://www.efomp.org/index.php?r=pages&id=sigs

The application form and a brief CV should be sent to the SIG secretary: sec.sig_frid@efomp.org

Pablo Mínguez Gabiña has been a senior medical physicist at the Gurutzeta/Cruces University Hospital in Barakaldo, Spain, since 2005. He has also been a part-time professor at the faculty of engineering of the University of the Basque Country in Bilbao since 2011. He has been a member of the Dosimetry Committee of the European Association of Nuclear Medicine since 2019. He is also a member of the Steering Committee of SIGFRID.

EFOMP COMPANY MEMBER ARTICLE

Varian: Varian's Managed Services/IT Offering Reduces Risk and Boosts Resources for NHS Foundation Trust

Cloud-based deployment of Varian software leads to increased flexibility and performance at predictable costs

Never has the radiotherapy IT environment looked so complex, with busy staff under pressure to keep ever-evolving systems updated, secure, compliant, and highly available. This can be challenging for institutional IT groups, which may not have the resources to support advanced radiation oncology clinical programs.

Varian Managed Services is a unique IT solution for deploying Varian software through a fully hosted, cloud-based platform that easily scales to meet changing clinical needs. The offering includes the cloud IT infrastructure, software license subscriptions, and a comprehensive Service Level Agreement (SLA) that covers maintenance, support, training & software upgrades during the period of engagement.

This alternative IT infrastructure offers remote, secure access, continuous proactive monitoring, smooth and rapid upgrades, and more—in flexible options created to support a clinic's objectives and to augment IT resources.

Managed services at the East Suffolk and North Essex NHS Foundation Trust in the UK

Recently, two hospitals in the UK—Colchester Hospital University NHS Foundation Trust and The Ipswich Hospital NHS Trust—merged into a single entity, the East Suffolk and North Essex NHS Foundation Trust (ESNEFT).

Varian's Managed Services team helped with the merger by moving Varian software—the ARIA® oncology information system and Eclipse™ treatment planning—to a cloud-based managed IT environment that is used by both hospitals. Clinicians at the ESNEFT say they are already benefiting from the change, in the form of faster access to new features, better system performance, and improved flexibility.

Reducing risk and managing complexity

A key goal of the Trust's IT strategy was to reduce the risks and management complexity in running the software associated with highly technical treatment delivery systems so that the IT staff could focus their efforts on other infrastructure issues and network requirements across both sites. The Trust was also looking to achieve predictable costs across a 5-year plan. Varian stepped in and coordinated the process of moving the department's software and historical patient data to the cloud-based, managed-IT environment and managed an ARIA upgrade at the same time.

"It was a massive change for us," said Hayley James, head of Radiation Services at ESNEFT. "Not only did it involve an upgrade, but we were doing it during a pandemic, trying to treat patients and implement all kinds of new guidelines and protocols. The Varian implementation team was especially helpful in setting up the systems to support our workflows and interfaces with other systems. For example, our patient demographics are fed in through an HL7 link; we have a CT scanner and a PAC system, and all those functions are critical for service delivery."

Predictable costs based on contracted terms

For the Trust, having Varian manage its ARIA and Eclipse radiotherapy software means less risk of unexpected capital expenditures and predictable costs over the next five years, based on upfront, contracted terms.

"We didn't always know how often we were going to need to do a hardware refresh to keep up with software updates. Now we know exactly how many upgrades we're going to get over the period of the contract with no unpleasant surprises," James explained. "Aligning the two hospitals is much easier now that ARIA and Eclipse are in the cloud. All these elements are setting us up to use what we've got properly and maximize its value. That is so much easier in the hosted environment."

A version of this article previously appeared in Centerline, Varian's online magazine for the clinical oncology community.

Julie Jervis is a California-based science and technology writer. Her articles have appeared in magazines and websites around the world, covering a diverse range of medical and technology topics, and her book, "The World Beneath Their Wings", follows the careers of leading women in aviation. In addition to editorial roles in the private sector, her background includes working for the World Health Organization, the International Maritime Satellite Organization, and NASA Ames Research Center.

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MEDICAL PHYSICS EDUCATION

Let's talk about slides, baby!

In the first of a series of articles connected with teaching and learning, Danielle Dobbe gives some hints and tips on how to (and how not to) design slides for a presentation

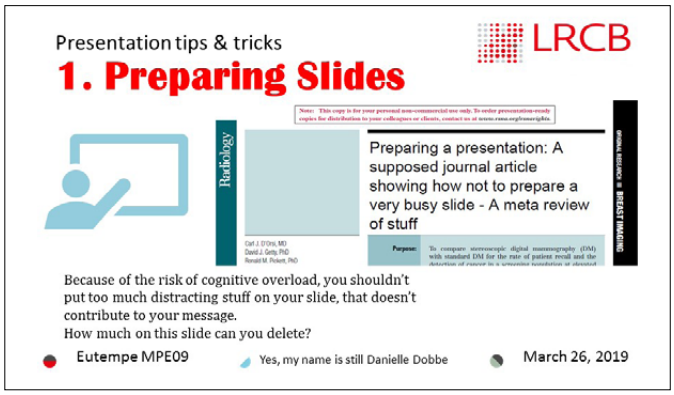
Let's talk about you and me, let's talk about all the good things and the bad things that may be! Let's talk about slides!

We all use slides. I bet you use slides in every presentation you do. There are a lot of good things about them, but honestly, the way they are often used, there are also a lot of bad things about them.

The bad things….

I often see slides with too much text, too much going on, huge tables with too much data, or very complex figures. For some reason people think these slides are helpful, but in many cases, they will actually only distract your audience from what you are trying to convey and make them remember less of your intended message. But why is that?

This has to do with our *working memory*. In order to store information in *long-term memory* and be able to remember that information later, it must first pass through working memory, and that is where the problems start... Our working memory is very limited, in terms of both capacity and duration. So, if we overload it with too many things at the same time, the important aspects get lost in the flood of speech, text, graphs, tables, figures, logos, etc., resulting in your audience not being able to remember what you have just told them.



An example of a slide with too much content

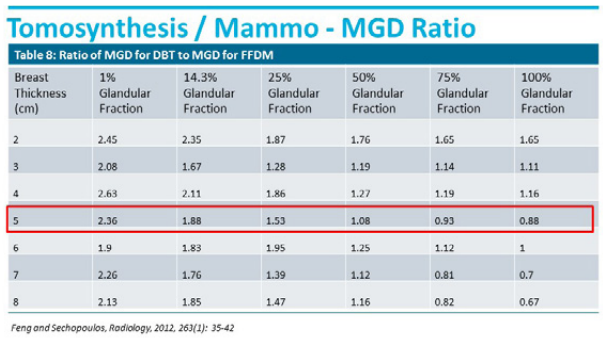
Let us take a closer look at one of the most common mistakes made when presenting: too much text on your slide. Your brain can only process one source of information at a time, so when there is too much text on your slide, people are going to read it, and while they read they cannot pay attention to what you are saying. This means you should either let them read the slide while you say nothing, or just do not use text on the slide! Why are we using so much text anyway? The slides are only there to support your performance, not to summarize your whole presentation! We listen to complete speeches and podcasts, and watch shows from comedians, all without the need of reading along what they are saying. However, when we talk about a topic to an audience, all of a sudden we think the audience should be able to read what we are saying….

In addition, there is also a very persistent myth going around about slides, which states that you should use approximately one slide per minute. As I said, this is a myth, because it totally depends on how you use your slides! I'll discuss this further in the next section.

The good things…

Slides can be your allies when you use them the right way. They can illustrate and even reinforce your message. Remember: "A picture is worth a thousand words"? You can apply this by using visuals to support what you are saying during your presentation. Also, just a few words on a slide will make more impact than long sentences. For tables, do not copy/paste a huge table and then highlight the few values you actually want to show! I recommend you create a new table with only the data that you are actually talking

about. Furthermore, get rid of logos and other unnecessary info, like the date, the name of the conference, or your name on every slide, they are only needed on the first and last one.

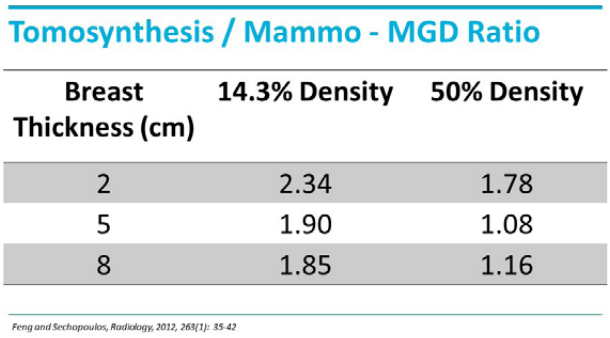


Tomosynthesis / Mammo - MGD Ratio

Table 8: Ratio of MGD for DBT to MGD for FFDM

Breast Thickness (cm)	1% Glandular Fraction	14.3% Glandular Fraction	25% Glandular Fraction	50% Glandular Fraction	75% Glandular Fraction	100% Glandular Fraction
2	2.45	2.35	1.87	1.76	1.65	1.65
3	2.08	1.67	1.28	1.19	1.14	1.11
4	2.63	2.11	1.86	1.27	1.19	1.16
5	2.36	1.88	1.53	1.08	0.93	0.88
6	1.9	1.83	1.95	1.25	1.12	1
7	2.26	1.76	1.39	1.12	0.81	0.7
8	2.13	1.85	1.47	1.16	0.82	0.67

Feng and Sechopoulos, Radiology, 2012, 263(1): 35-42



Tomosynthesis / Mammo - MGD Ratio

Breast Thickness (cm)	14.3% Density	50% Density
2	2.34	1.78
5	1.90	1.08
8	1.85	1.16

Feng and Sechopoulos, Radiology, 2012, 263(1): 35-42

Examples of large and stripped-down tables.
The latter has less information, so is easier for the audience to absorb.

Strip your slides down to only what is really necessary. Less is more!

Instead of the one-slide-per-minute-myth, I use the one-concept-per-slide rule. This means, for example, that instead of a slide with four bullets, I use one slide for each bullet. Instead of a graph and text, use only the graph and let it fill up the slide, and add the text with your voice! This way you will need more slides, but you will go through them much faster and you will keep the attention of the audience on you!

Using this approach might feel a bit unnatural at first, but I challenge you to try it, in order to avoid “death by PowerPoint”, and to feel liberated from the dominant slide regime that has suppressed you until now! 😉

I want to encourage you to experiment a bit, and especially, to have fun with it!

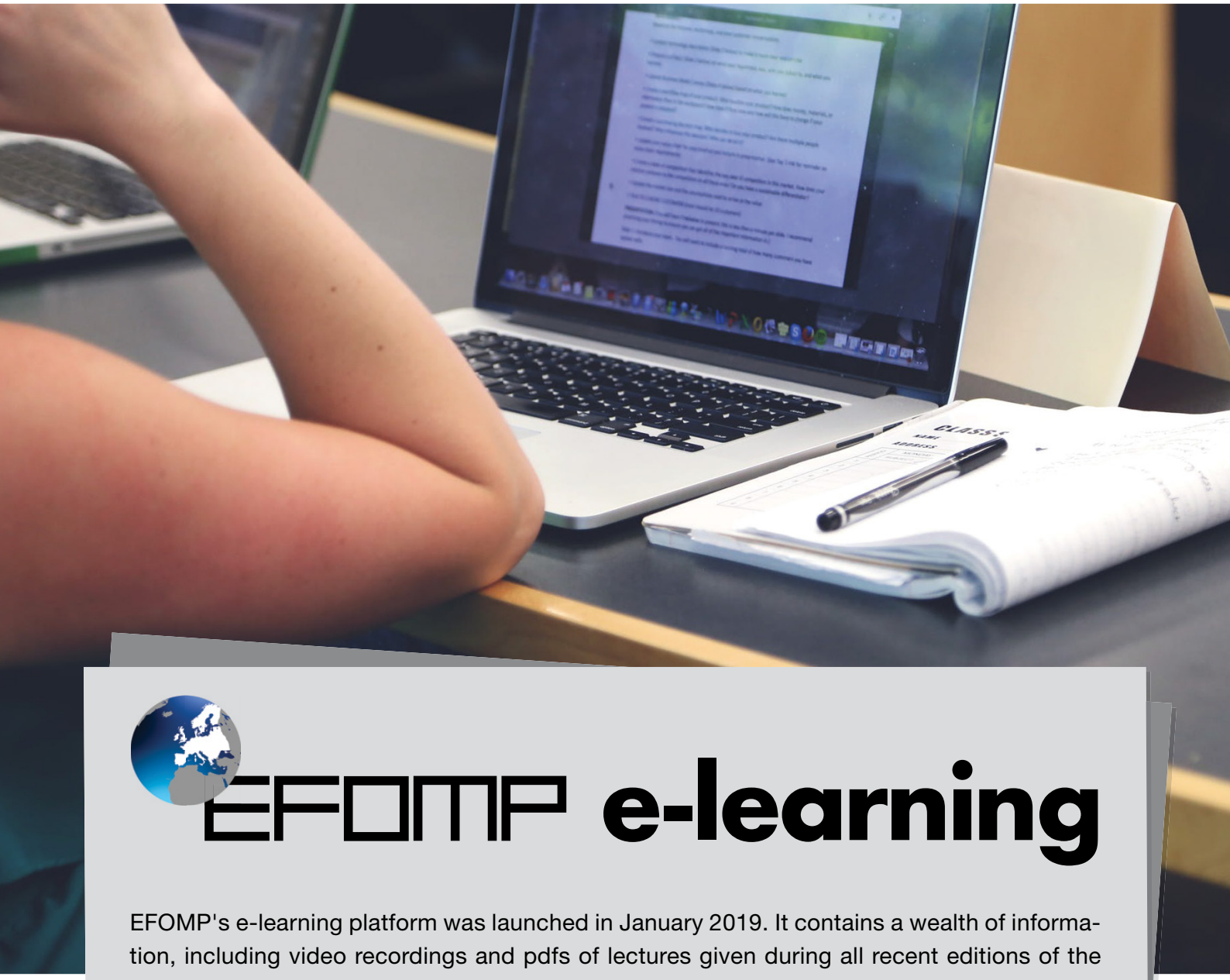
So, what do good slides need again?

Simplicity. Clarity. Direction. Images. Examples. No unnecessary pollution on your slides. As little text as possible. And above all: the focus should be on you and your story! The slides are only there to support you. You are not there to explain the slides.

I hope I have inspired you to make some changes in the way you approach your slides! I would be happy to help, so do not hesitate to contact me if you want to give it a try but have questions or doubts!

Danielle Dobbe-Kalkman is a Senior Learning Specialist at the LRCB, the Dutch Expert Centre for Screening, and the educational expert of the EUTEMPE consortium. She regularly presents on tactics to improve educational efforts and assists with the design of courses to enhance their didactic value. Danielle sits on the Editorial Board of EMP News as an Advisor.

EFOMP COMMUNICATES | EDUCATES | INTEGRATES



EFOMP e-learning

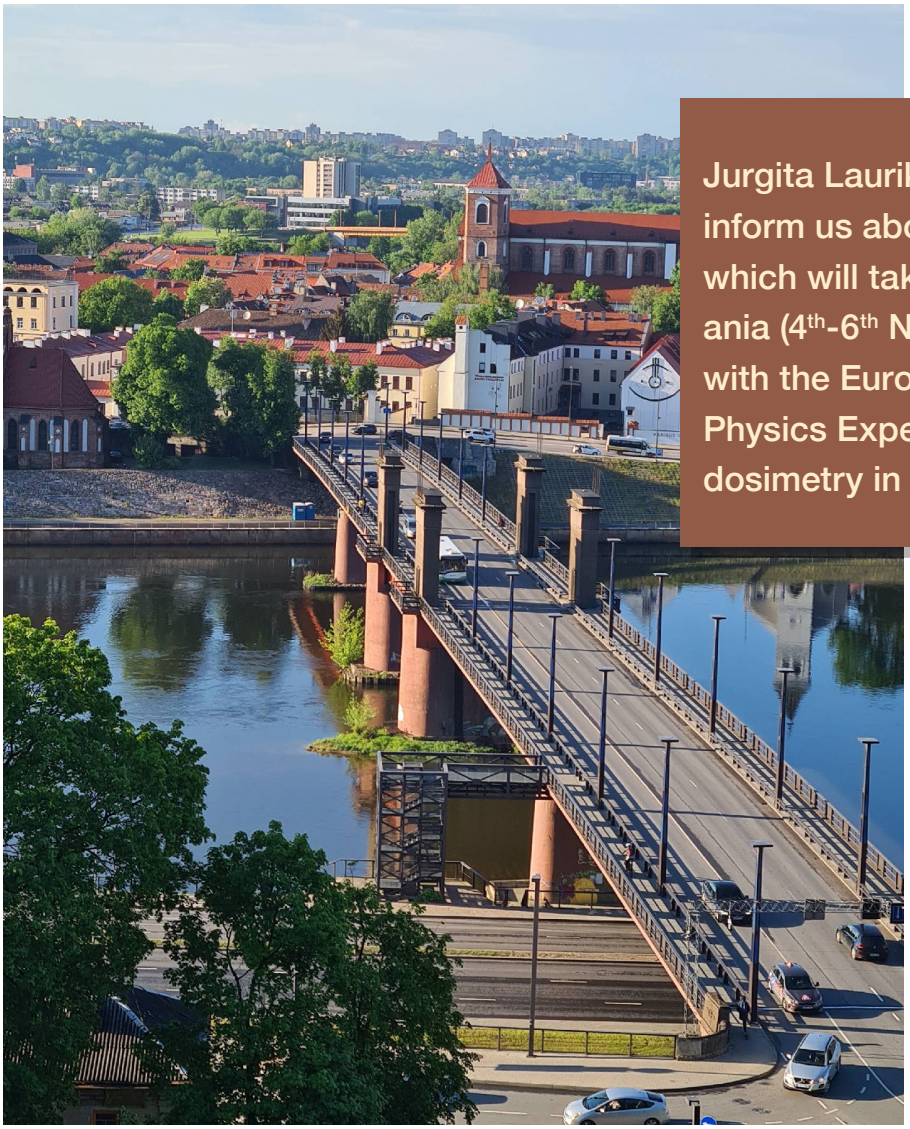
EFOMP's e-learning platform was launched in January 2019. It contains a wealth of information, including video recordings and pdfs of lectures given during all recent editions of the European School for Medical Physics Experts (ESMPE), as well as complete recordings of the many webinars organised by EFOMP and aligned organisations during 2020 and 2021.

Access to the EFOMP e-Learning platform is provided to all **Individual Associate Members (IAM) of EFOMP**. Becoming an IAM is very simple – just complete an online registration form and pay a subscription fee of €15 (renewable annually). You will receive immediate access to the e-Learning platform.

Registration as an EFOMP IAM is available to anyone, in any location (including outside Europe) who is interested in continuing and supplementing their education and training in Medical Physics.

UPCOMING CONFERENCE

15th International Conference "Medical Physics in the Baltic States 2021"



Jurgita Laurikaitienė and Efi Koutsouveli inform us about the Baltic conference which will take place in Kaunas, Lithuania (4th-6th November 2021), together with the European School for Medical Physics Experts edition on "Individual dosimetry in medical applications"

Every second year Kaunas University of Technology (Lithuania), the Society of Medical Physicists of Lithuania (a member of the Lithuanian Association of Medical Physics and Biomedical Engineering Medical Physicist's society) and Malmö University Hospital, Lund University (Sweden) organize an international conference and workshop called "Medical Physics in the Baltic States". This event gathers medical physicists, researchers, radiation protection specialists and other related professionals from various countries, who share their knowledge and experience participating in informative talks and discussions, thus creating new national and international collaborations.

Conference topics cover scientific and clinical aspects of medical physics and consolidates the efforts of engineers, physicians and scientists working in hospitals, clinics, research and education institutions and companies from different countries for solving health care problems related with radiation therapy, diagnostic radiology, imaging, medical and technological information and radiation protection. Participation in this conference also provides a unique possibility for MSc Medical Physics students to present and discuss their ongoing research projects.

This year the 15th International Conference "Medical Physics in the Baltic States 2021" is supported by the European Federation of Organisations for Medical Physics and will be held on the 5th-6th November 2021 at Kaunas University of Technology.

On the day before the conference, 4th November 2021, the EFOMP school jointly with EURADOS and IRPA will organise a preconference satellite edition on "Individual dosimetry in medical applications". During the school advanced tasks of staff dosimetry, sources and levels of occupational exposures, selection, use and maintenance of personal and collective protective equipment will be discussed and all aspects related to the establishment of individual monitoring programme for medical facilities workers will be covered. The school will be accredited by EBAMP (European Board of Accreditation for Medical Physics) as a CPD event for Medical Physicists at EQF Level 8; it is intended for practicing clinical Medical Physicists who are involved in the radiation protection of staff.

Detailed and updated information regarding both events can be found on the website: https://medphys2021.efomp.org/ and https://medphys2021.efomp.org/efomp-school/.

Conference proceedings will be issued in advance. From 2009 until now the Conference proceedings have been included in the CAWoS database (articles without citation index). Medical physicists from Belarus, Belgium, Egypt, Germany, Greece, India, Ireland, Italy, Latvia, Lithuania, Poland, Russia, Sweden, Turkey, Ukraine, and United States have already expressed their interest to participate and share their experience in the field.

The registration fee includes participation in both the conference and the school and can be accessed via this link. Please be aware that we are expecting registration according to the scheme: 1 article - 1 registered presenting author.

We are looking forward to seeing you in person in Kaunas on 4th-6th November, 2021! However, please note that if there will be any COVID-19 related restrictions, remote participation will also be considered.

Jurgita Laurikaitienė has a PhD in Physics. In 2005 she was one of the first graduates of the MSc programme in Medical Physics at Kaunas University of Technology. She is a Medical Physics Expert (Radiotherapy) in Lithuania, recognized by national authorities. Currently Jurgita is responsible for organising the clinical practices for Medical Physics students in the hospitals of Lithuania and is one of the Associate Professors sharing her knowledge and experience during the lectures for the Medical physics students at Kaunas University of Technology. She is a member of the programme committee of the conference.

Efi Koutsouveli works as a Medical Physics Expert in the Medical Physics department of Hygeia Hospital, Athens, Greece. Her professional focus is on radiotherapy units (external radiotherapy & brachytherapy). Her special interest is in Hospital Quality Management Systems and Oncology Information Systems. She is currently the Treasurer of the Hellenic Association of Medical Physicists (HAMP) and is EFOMP's Secretary General. In 2019, she received the IOMP-IDMP award for promoting medical physics to a larger audience.

15th International Conference “Medical Physics in the Baltic States 2021”

ktu kaunas university of technology 1922

4-6 November 2021 at Kaunas University of Technology, Kaunas, Lithuania.

medphys2021.efomp.org

ESMPE European School for Medical Physics Experts

Individual dosimetry in medical applications

4th November 2021, Kaunas, Lithuania

EFOMP in collaboration with EURADOS, IRPA, the Kaunas University of Technology and the Lithuanian Association of Medical Physics and Biomedical Engineering would like to invite you to the next ESMPE in **Individual dosimetry in medical applications 2021**.

The school will be organized as a 1-day satellite Workshop before and in conjunction with the 15th International Conference "Medical Physics in the Baltic States 2021", which will be held on 5th–6th November 2021 in Kaunas, Lithuania.

The school will be aimed at advanced tasks connected with staff dosimetry in medical applications. The school will cover all the aspects related to the establishment of a programme of individual monitoring for workers in medical facilities.

This one-day event will be accredited by EBAMP (European Board of Accreditation for Medical Physics) as CPD event for Medical Physicists at EQF Level 8 and is intended for practicing clinical Medical Physicists who are involved in Staff radioprotection.

Content:

- Sources and levels of occupational exposures
- Dose assessment for workers in medical facilities
- Types of personal dosemeters
- Individual monitoring
- Ambient monitoring
- Selection, use and maintenance of personal and collective protective equipment
- Dose reporting

Organisers:

Alberto Torresin (Chair of the School),
Paddy Gilligan and **Filip Vanhavare** (Scientific Co-Chairs)
Jurgita Laurikaitienė (LMFBIA),
Efi Koutsouveli (ESMPE Board)

Registration:

Registration for the School is via the "Medical Physics in the Baltic States 2021" conference web site

Further information:

Fee information (School and conference) is available here

The maximum number of participants is 100

The study load is 6 hours of lectures and practical demonstrations

Information is available on the ESMPE web pages

EFOMP COMPANY MEMBER ARTICLE

PTW: Patient QA – Why Accuracy and Independency Matter

The goal of patient-specific quality assurance is to identify plan errors before patient treatment, and to detect potential risks during treatment delivery.

There are several methods and approaches for patient-specific QA. Clinics often combine a mix of commercial QA tools and in-house developments to ensure safe patient treatment, e.g. by using phantom measurements, secondary MU/dose calculation, log-file-based or EPID-based evaluations. Patient-specific QA checks can thus be performed individually, depending on the complexity and technique of the treatment.

Accuracy

The quality and accuracy of QA methods have a major influence on the sensitivity of error detection. The AAPM TG-219 report (1) has recently highlighted the importance of this by demanding high standards in the accuracy and precision of secondary 3D dose calculation tools.

Secondary dose calculation tools have become an accepted option for plan checks over the past few years. The current standard of commercial secondary check software includes an analytical 1D or 3D dose calculation algorithm (e.g., Collapsed Cone) and a generic implementation of beam models. These tools can detect major errors in the treatment planning chain. Their sensitivity to catch errors and the possibility to define clinically relevant, patient-centred criteria, are nevertheless limited due to the insufficient quality of beam models and the constrained accuracy in complex anatomical situations.

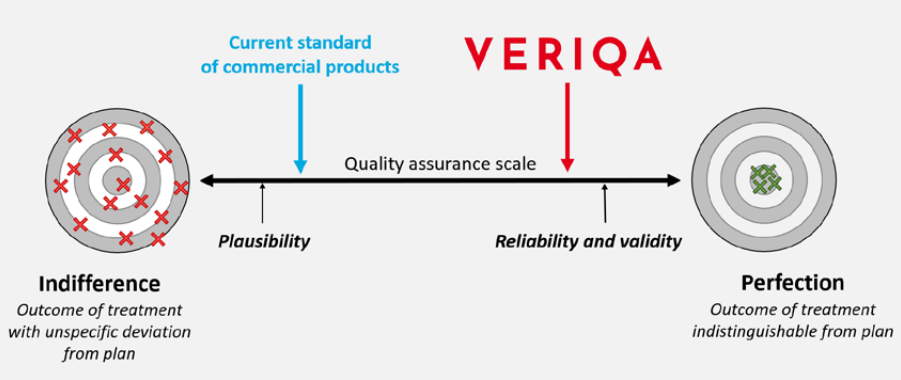
However, secondary dose calculation can provide much more than just a plausibility check of the TPS dose calculation algorithm. It is an ideal tool to complement a measurement-based patient QA approach. While phantom measurements usually neglect the patient's anatomy, secondary dose calculation makes it possible to take anatomical information into account. Although analytical dose calculation algorithms reach their limits in complex anatomical situations, Monte Carlo-based algorithms have proven to be the gold standard to accurately account for heterogeneities (2).

VERIQA RT MonteCarlo 3D: Independent dose calculation algorithm, high-quality beam models

In addition, secondary dose calculation allows to isolate measurement and delivery errors from errors in treatment planning calculation. The AAPM TG-219 report therefore recommends to perform secondary 3D dose calculation for every IMRT/VMAT plan, regardless of the method of measurement-based verification.

Moreover, measurement-based verification methods for patient-specific QA can be very time and resource consuming as they require valuable machine time and additional measurement efforts. Secondary dose calculation, on the other hand, can be fully automated and hardly requires any critical resources.

Of course, secondary dose calculations alone cannot catch hardware delivery errors. Measurement-based methods for patient-specific QA thus cannot be completely replaced by



The quality of secondary 3D dose check software ranges from simple plausibility checks to software ensuring an optimal outcome of patient treatment

independent dose calculation tools. However, as the confidence about the reliability of treatment techniques, such as IMRT, steadily increases, AAPM TG-219 considers it reasonable to re-evaluate measurement efforts in order to reduce QA workload.

The AAPM TG-219 report further recommends commissioning secondary dose calculation tools in a similar way as the primary TPS. As with the primary TPS, the data input into the secondary dose calculation system should match the actual machine output characteristics.

A dose calculation can only be as accurate as its beam model. The accurate fitting of beam models to the specific machine characteristics of an individual linac is, therefore, indispensable for high-quality dose calculations.

Independency

Secondary dose calculation software should be completely independent of the treatment planning system to ensure reliable detection of clinically relevant errors. Both the dose calculation algorithm and the dosimetric input data should thus be independent for a secondary dose calculation tool to be considered truly independent. In order to avoid introducing systematic errors, AAPM TG-219 highly recommends using two different sets of experimentally determined beam data for beam modelling. The tuning of a secondary dose calculation algorithm to the treatment planning system is therefore not suitable for detecting relevant errors in patient QA.

An ideal, future-proof secondary dose calculation tool should therefore combine the following features:

1. Automated workflows to reduce the QA workload
2. A 3D dose calculation algorithm with a high accuracy in heterogeneous anatomies
3. High-quality beam models based on experimentally determined beam data
4. True independency from the treatment planning system

To learn more about PTW's solution for Monte Carlo-based secondary 3D dose calculation, visit https://www.ptwveriqa.com.

References:

1) Zhu, T.C., et al. "Report of AAPM Task Group 219 on independent calculation-based dose/MU verification for IMRT." Medical Physics (2021). https://doi.org/10.1002/mp.15069

2) Papanikolaou, N. and Stathakis S. "Dose - calculation algorithms in the context of inhomogeneity corrections for high energy photon beams." Medical physics 36.10 (2009): 4765-4775. https://doi.org/10.1118/1.3213523

Dr. Katharina Renkamp is a medical physicist at Heidelberg University Hospital, where she is part of the MR Linac team. Her clinical experience and research make her a renowned expert in the fields of Monte Carlo simulations in dosimetry and quality assurance for adaptive radiotherapy.

Dr. Oliver Schrenk is a medical physicist and product manager at PTW Freiburg. He obtained his Ph.D at the German Cancer Research Center (DKFZ), working on solutions for Monte Carlo-based dose calculation in MR-guided radiotherapy. Before joining PTW, he gained several years of experience as a clinical physicist at Heidelberg University Hospital.

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PARTNER ORGANISATION

EURAMED (European Alliance for Medical Radiation Protection Research)

Erato Stylianou Markidou is Chair of the Communication Committee of EURAMED; here, she writes about the organisation and its recent activities

The European Alliance for Medical Radiation Protection Research (EURAMED) represents a consortium of associations involved in the application of ionising radiation in medicine, namely the European Association of Nuclear Medicine (EANM), the European Federation of Organisations for Medical Physics (EFOMP), the European Federation of Radiographer Societies (EFRS), the European Society of Radiology (ESR) and the European Society for Radiotherapy and Oncology (ESTRO), with the goal of jointly improving medical care and its medical radiation protection issues through sustainable research efforts.

For the first time the five medical societies joined forces and agreed on a collaboration to improve the application of ionising radiation in medical care by developing and exploring common research strategies and by actively promoting the translation of results into clinical practice. The vision of EURAMED is to lead the European research activities in Medical RP and assume an umbrella function for the harmonisation of practice to advance European RP safety culture in Medicine.

EURAMED currently collaborates in four active projects:

CONCERT – European Joint Programme for the Integration of Radiation Protection Research under Horizon 2020 aims to contribute to the sustainable integration of European and national research programmes in radiation protection. CONCERT, as a co-fund action, strives to achieve the attraction and pooling of national research efforts in Radiation Protection with EURATOM research programmes in order to make better use of public R&D resources and to tackle common European challenges in radiation protection more effectively by joint research efforts in key areas.

MEDIRAD project studies the "Implications of Medical Low Dose Radiation Exposure" and has received funding from the European Commission under the Horizon 2020 programme. It aims to enhance the scientific bases and clinical practice of radiation protection in the medical field and thereby addresses the need to better understand and evaluate the health effects of low-dose ionising radiation exposure from diagnostic and therapeutic imaging and from off-target effects in radiotherapy.

SINFONIA project will develop novel methodologies and tools that will provide a comprehensive risk appraisal for detrimental effects of radiation exposure on patients, workers, carers and comforters, the public and the environment during the management of patients suspected or diagnosed with lymphoma and brain tumours.

Rocc-n-Roll project aims to propose an integrated and coordinated European approach to research and innovation in medical applications of ionising radiation and related radiation protection based on stakeholder consensus and existing activities in the field (including existing SRAs of radiation protection platforms, EC health and digitisation programmes, EURATOM-funded projects, SAMIRA initiative).

EURAMED is also involved in the 5th European Radiation Protection Week which will be held on 22–24 November 2021 in Vienna, Austria. The conference will be organized as a hybrid event, allowing for onsite and online participation. Registration for participation has opened and the registration deadline is 31st October 2021. The Scientific draft programme is already online and the submission of abstracts is still open.

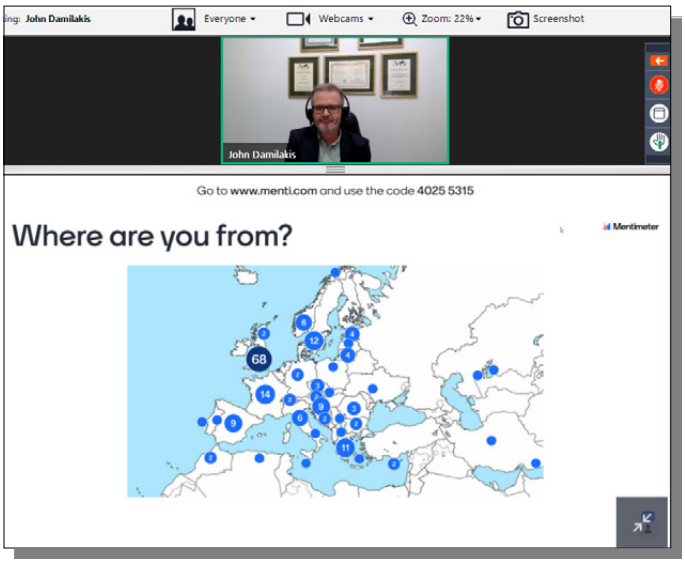
Institutions or organizations active in the field of medical radiation protection research can become full members of EURAMED by paying an annual membership fee. Institutions or organizations that do not actively practice medical radiation protection research but have a considerable interest in the area of radiation protection can become Associate members. Enterprises interested in the activities and aims of the Society can become Corporate members. Any health professional or other scientist committed to the objectives of EURAMED with a completed university or equivalent education may apply for individual membership of EURAMED, provided that he or she is mainly engaged in radiology, nuclear medicine, radiation oncology, medical physics, radiography or related fields. (https://www.euramed.eu/membership/)

Erato Stylianou Markidou is a Medical Physics Expert currently working at the Bank of Cyprus Oncology Centre, Nicosia, Cyprus. She obtained her Bachelor's degree in Physics from the University of Cyprus in 2001 and graduated from Wright State University, OH, USA in 2003 with a Master of Science degree, concentrating in Medical Physics, with honours. She has been working with radiation therapy treatment planning and quality assurance and commissioning of radiotherapy and diagnostic equipment in a very busy department for the last 18 years. She is the Chair person of the Communication Committee of EURAMED and she is the past President of CAMPBE. She is also the president of BRF (Biomedical Research Foundation) and a member of the Cypriot Medical Physics Registry Council. She has been a member of EFOMP's Communications and Publications Committee the last three years.

PARTNER ORGANISATION

Looking back: the EUTEMPE / EFOMP webinars 2020 – 2021

Hilde Bosmans reviews the joint webinars held by EUTEMPE in partnership with EFOMP



John Damilakis posing a question to the online audience during an interactive webinar

Last year was a difficult year all over the world. As EUTEMPE we had to cancel all our modules. However, the pandemic was not able to extinguish our drive to bring education at the highest level to the medical physics community!

Together with EFOMP, we organized a series of didactic webinars, each one followed by a more in-depth online masterclass, all of them free of charge. We were very happy to reach out to a large community of physicists, all over the world. We would like to thank all of you for participating.

Our trademark is excellent education, with a focus on training competences that will allow you to make the difference for the patient. Especially during the masterclasses, we have used different teaching methods to increase your participation and have used your input to illustrate many aspects of medical physics. You were a great audience! We are very grateful for the many team-up moments during the (online) sessions.

During the didactic webinars and master classes, we have covered a wide range of timely topics:

- "Telling ain't teaching" (lead: Danielle Dobbe)
- "Robust QC protocols, also for emerging devices" (lead: Hilde Bosmans & Nicholas Marshall)
- "The philosophy of QC protocols" (lead: Ruben Van Engen and Ioannis Sechopoulos)
- "Strategic and robust leadership in medical physics" (lead: Carmel Caruana)
- "Personnel dosimetry: 2 steps ahead" (lead: Markus Borowski & Martin Fiebich)
- "A guided tour of x-ray CT" (lead: John Damilakis)
- "Innovation with monochromatic x-ray sources" (lead: Paolo Cardarelli & Angelo Taibi)
- "What do the results of MTF and NPS mean?" (lead: Alistair Mackenzie)

If you feel sorry you missed any, we invite you to the EFOMP e-Learning platform, where you can find them all.

Would you line more of this? Take your chance to attend the EUTEMPE modules live, on site, in 2022-2023. You will find the modules announced on EFOMP's website and on www.eutempe-net.eu.

Most regular EUTEMPE modules have an online part, with a specific teaching platform, and an onsite part where you train skills and competences with teachers and peers. Our modules have been updated and will use the experience of the webinars and master classes.

Registration to the EUTEMPE modules will be via the EFOMP website; the physical EUTEMPE office will move to Nijmegen. Please contact Hilde Bosmans (coordinator) for more information or to subscribe to our mailing list.

Hilde Bosmans is team leader of the medical physics experts in radiology in the University Hospital of the KU Leuven and for more than 100 centres in the Belgian breast cancer screening. She is also professor at the KU Leuven. The creation of appropriate QC protocols is a crucial part of her activities. With a team of medical physics experts, PhD students and post doc researchers it is worked to better understand quality and patient dose in radiology and then feed new dose or quality measures back into routine protocols. Hilde Bosmans is also project leader of the EUTEMPE courses for medical physics experts in radiology.

EFOMP COMPANY MEMBER ARTICLE

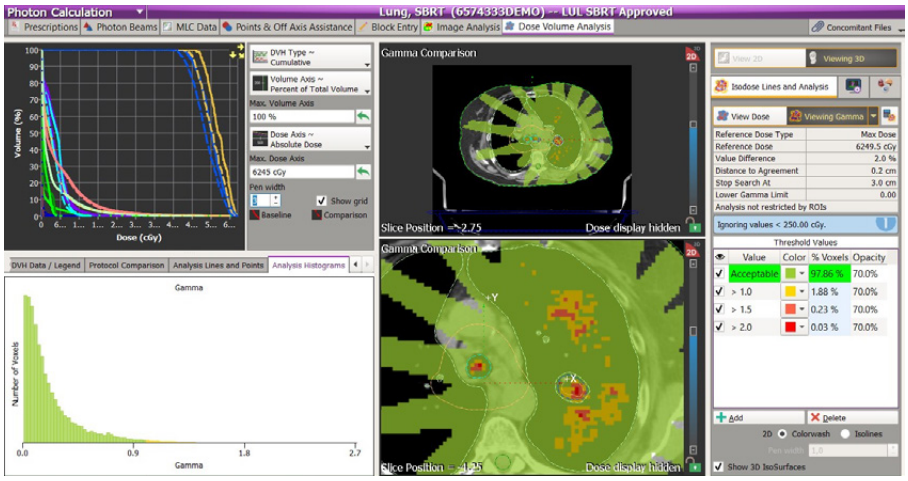
LAP: How 3D patient QA highlights uncertainties and catches errors

The field of radiotherapy has been progressing at a tremendous rate over the last couple of decades, leading to more complex treatments with higher doses, sharper gradients, and reduced margins. In turn, a demand has grown within our community for increased guidance of dose metrics for both the efficacy of the treatments and the associated normal tissue complications. (1,2) Simultaneously, a need to commit to better methods of PSQA has come to light.

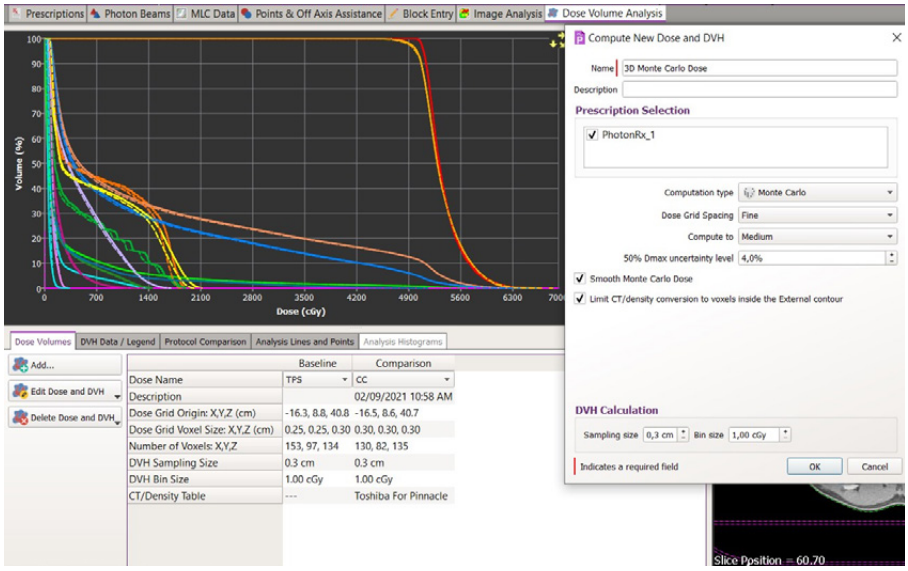
Since 2014, I have been investing in this commitment for 3D secondary check systems. As solutions came to market and evolved, many more in our community envisioned the issues that I, too, encountered at the beginning of my journey. Some of these issues, including the increased sensitivity for errors, the need for automation and better efficiency, were highlighted in a great publication (3) that helped me in my first clinical implementation of an independent 3D secondary check.

I have worked with many members in our community as they transition into using 3D secondary checks and have encountered numerous errors in treatment planning. These errors come from a variety of sources and include modelling of delivery systems, such as: MLC leaf ends, MLC tongue-and-groove effects, leaf/collimator transmission, collimators/MLC penumbra, compensator systems (scattering, beam hardening, alignment), output factors for small field sizes, head backscatter, and off-axis profiles. They also include failures in selection of the appropriate dose calculation grid size and the use and modelling of heterogeneity corrections.

In my experience, 3D secondary checks have caught countless safety



RadCalc provides Percent difference, DVH, Distance to Agreement and Gamma analysis tools to evaluate 3D computations



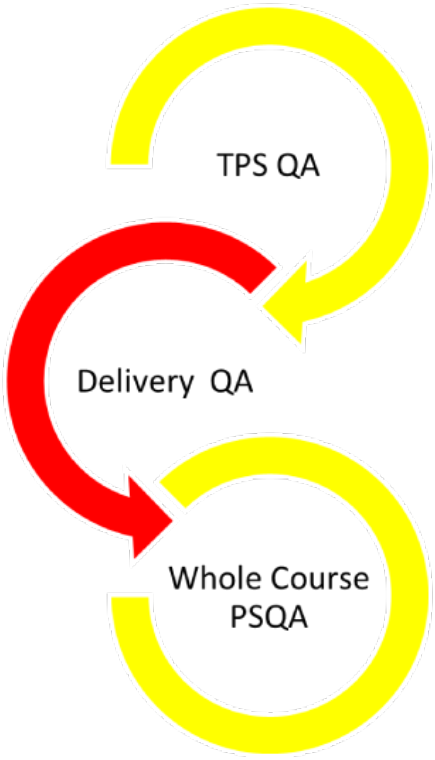
3D calculation algorithms: RadCalc provides Collapsed Cone Convolution Superposition and Monte Carlo based algorithm modules

issues. However, they tend to also highlight many plan quality issues, like demonstrating differences in doses throughout the whole patient, not just at pre-selected points and 2 dimensional planes. This allows for the evaluation of the dose in every voxel, the ability to do DVH analysis and utilize planning protocols to evaluate specific planning criteria automatically and rapidly.

These observed concerns have now been validated in the release of the AAPM's Task Group 219 (4), highlighting the limitations of single point comparisons, and recommending a transition to secondary checks that

compute the dose distribution of the high dose volume. TG-219 also emphasizes the need for the secondary check to be independent. The report does a great job highlighting the key tasks for acceptance and commissioning of secondary check systems.

Nonetheless, the report misrepresented the commercial solutions available in the market at the time of its publication, mainly that of RadCalc (LifeLine Software, Inc., a part of the LAP Group) and its 3D modules which include both Collapsed Cone Convolution/ Superposition and gold standard Monte Carlo. Released in January of 2020 with version 7.1, RadCalc's 3D dose modules utilize your clinically measured beam data to bring excellent accuracy. Furthermore, the previously released RadCalcAIR module brings a comprehensive solution to your clinical workflow with intelligent automation features, evolving directly from customer suggestions.



3D PSQA solutions

RadCalc 7.1 also offers all the tools needed for a thorough evaluation of treatment plans, such as the ability to separate plans into individual beams and options to automatically add analysis points and lines right from RadCalc, eliminating the need to modify plans within your treatment planning system. RadCalc also places the user in control of their QA program with the flexibility to select the hardware used for the 3D dose calculation and the scalability to fit any clinical network.

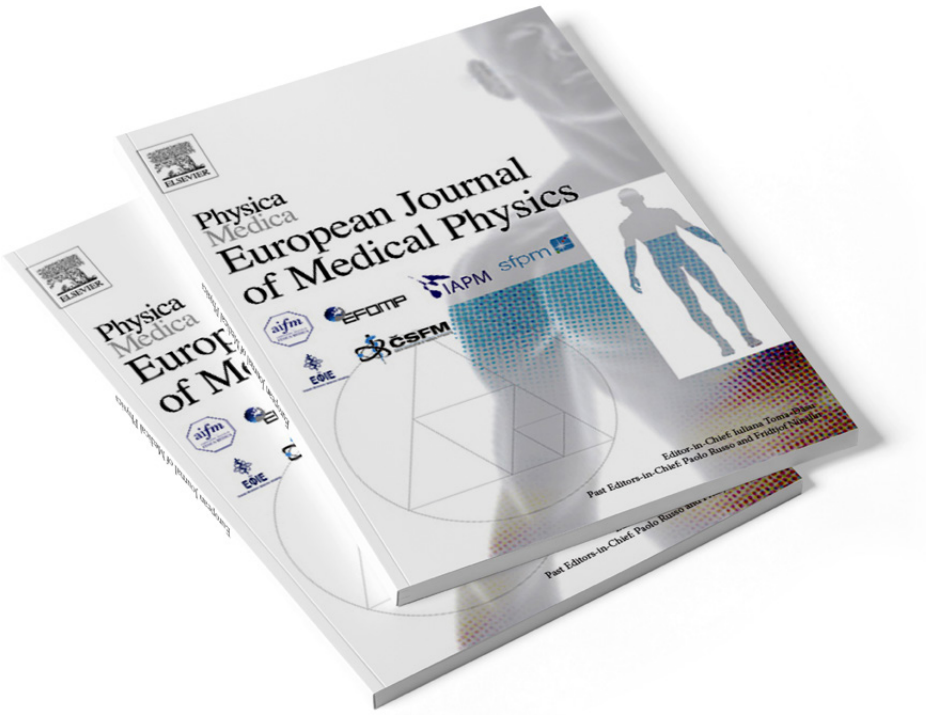
Additionally, the AAPM's Task Group 219, also gives a preview of what's to come with RadCalc as we integrate the EPID tools from Dosimetry Check (Math Resolutions, LLC) for in air and in vivo dosimetry in our upcoming release!

References:

(1) Grimm et al. High Dose per Fraction, Hypofractionated Treatment Effects in the Clinic (HyTEC): An Overview. RedJournal 110 (1), May 2021
(2) Benedict et al. Stereotactic Body Radiation Therapy: The Report of AAPM Task Group 101. Med. Phys. 37 (8), Aug 2010
(3) Pulliam et al. A six-year review of more than 13,000 patient-specific IMRT QA results from 13 different treatment sites. J Appl Clin Med Phys. 2014 Sep; 15(5): 196–206
(4) Zhu et al. Report of AAPM Task Group 219 on independent calculation- based dose/MU verification for IMRT. Med. Phys. July 2021

Carlos Bohorquez, M.S., D.A.B.R. is the Product Manager for RadCalc at LifeLine Software, Inc., a part of the LAP Group. An experienced board-certified Clinical Physicist with a proven history of working in the clinic and medical device industry, Carlos' passion for clinical quality assurance is demonstrated in the research and development of RadCalc into the future.

Physica Medica: Editor's Choice



In this regular feature, Prof. Iuliana Toma-Dasu, Editor-in-Chief of Physica Medica – European Journal of Medical Physics, gives her choice of recently-published articles

For this autumn issue of EMP News I selected the following four articles, recently published in Physica Medica (EJMP), which particularly attracted my attention.

G. Magro et al. **FRoG dose computation meets Monte Carlo accuracy for proton therapy dose calculation in lung** Phys. Med. 2021; 86: 66-74 https://www.physicamedica.com/article/S1120-1797(21)00202-7/fulltext

The FRoG (Fast Recalculation on GPU) computation platform, developed in collaboration between the CNAO facility in Pavia, Italy, and the Heidelberg Ion Beam Therapy Center (HIT) in Heidelberg, Germany, was recently introduced for allowing quick and reliable calculations of the dose and dose-averaged linear energy transfer (LETd) distributions. This new article presents the dosimetric evaluation of FRoG against the commercial treatment planning system (TPS) RayStation Monte Carlo (RS-MC) (RaySearch Laboratories AB, Stockholm, Sweden) benchmarked on a heterogeneous lung phantom. The results were very encouraging, as FRoG's predictions were in good agreement with both the doses calculated by the TPS and measured in the phantom. This opens the possibility of using FRoG for quick and reliable calculations of the dose and LET distributions in lung that could potentially be further used for evaluating the treatment plans in an independent manner from the commercial TPS.

Y. Luo et al. **A situational awareness Bayesian network approach for accurate and credible personalized adaptive radiotherapy outcomes prediction in lung cancer patients** Phys. Med. 2021; 87: 11-23 https://www.physicamedica.com/article/S1120-1797(21)00214-3/fulltext

This paper brings expert knowledge and machine learning (ML) together in a novel manner in order to take us one step closer to personalized adaptive radiotherapy. More specifically, the Bayesian network ML approach is used together with human perception, comprehension and projection factors described as situational awareness (SA) component in an integrated SA-BN approach for radiation outcome prediction in personalised adaptive radiotherapy. While it still needs to be validated on an external independent dataset, the SA-BN approach outperformed the alternatives with respect to the prediction of local control and toxicity for a cohort of lung patients showing therefore high clinical potential.

B. Bednarz et al. **First-in-human imaging using a MR-compatible e4D ultrasound probe for motion management of radiotherapy** Phys. Med. 2021; 88: 104-110 https://www.physicamedica.com/article/S1120-1797(21)00240-4/fulltext

In this technical note, the authors present, as the title says, the first-in-human evaluation of an electronic 4D MR-compatible ultrasound probe designed for hands-free operation in a hybrid MR-LINAC system. This study has a technical character as it is mostly focused on the evaluation of the MR compatibility of the ultrasound components. The use of the probe on actual patients was, however, also tested by taking simultaneous ultrasound and MR scans in five healthy volunteers. The work indicates the potential of using the proposed technology not only as part of motion management strategies in radiotherapy but also for guiding interventional procedures like biopsies and drug delivery.

L. Maigne et al. **CPOP: An open source C++ cell POPulation modeler for radiation biology applications** Phys. Med. 2021; 89: 41-50 https://www.physicamedica.com/article/S1120-1797(21)00260-X/fulltext

Modelling the biological systems and their response to radiation is a very powerful tool for making treatment outcome predictions. This study adds to the existing models an open source platform in C++ based on the Geant4 Monte Carlo toolkit. The outcome of the model is a realistic 3D cell population with their organelles such as nucleus, cytoplasm and membrane, compatible with Monte Carlo simulations that could be used in further studies of the effect of radiation at subcellular level and at population level. It is worth mentioning that the platform is freely accessible at http://cpop.in2p3.fr/ and hence waiting for new applications.

In addition to the above mentioned studies, I would like to mention one more paper recently published in our journal of potential interest for the EFOMP members as it presents a summary of the research activity as reflected by the scientific publications of the Italian Association of Medical Physics and Health Physics (AIFM), one of the National Member Organisations in EFOMP:

L. Placidi et al **The scientific publications of AIFM members in 2015–2019: A survey of the FutuRuS working group** Phys. Med. 2021; 88: 111-116 https://www.physicamedica.com/article/S1120-1797(21)00233-7/fulltext

This paper gives a comprehensive overview of the number and the generic topics of the scientific publications by AIFM members. The study was aimed at providing the background information for developing future AIFM strategies for the scientific activity of medical physicists in Italy. Similar studies might be interest for other European countries for very similar purposes but also for recognising areas in which research competence is lacking or for identifying potential areas and partners for collaboration.

Iuliana Toma-Dasu,
Editor-in-Chief of Physica Medica – European Journal of Medical Physics

ESMPE European School for Medical Physics Experts

Hybrid Approaches in Radiation Therapy

12th–13th October 2021 | Online webinar course with live lectures

EFOMP jointly with COCIR would like to invite you to the next ESMPE in **Hybrid Approaches in Radiation Therapy**. The school will be organized as a 2-day virtual meeting, which will be held on 12th–13th October 2021.

The school will be focused on therapies and devices using hybrid concepts in which the classical radiation therapy is nowadays fused with a second approach to establish the current treatment standard. The aim will be presenting the background, practical methodology, state-of-the-art and future developments. All of the lectures will be delivered live (i.e. not pre-recorded).

This two-day event will be accredited by EBAMP (European Board of Accreditation for Medical Physics) as a CPD event for Medical Physicists at EQF Level 8 and is intended for Medical Physicists Experts who wish to expand their knowledge in hybrid radiation therapy approaches. Certificates of attendance will be issued to those who attend the whole course.

Content:

Radiation therapy concepts
Image guided radiation therapy (IGRT)
Adaptive radiation therapy (ART)
Surface guided radiation therapy (SGRT)
Brachytherapy

Faculty:

A team of experts is lined up to deliver the School, including: Jorge Bonaque Alandi (ES), Dimos Baltas (DE), Oliver Blanck (DE), Kevin Brown (UK), Nathalie Chadeau (FR), Rodolfo Chicas (ES), Luca Cozzi (IT), Eric Deutsch (FR), Taran Hellebust (NO), Marcel Van Herk (UK), Aswin Hoffman (DE), Inger-Karine Kolman-Deurloo (NL), Malin Kügele (SE), Raphael Moeckli (CH), Christian Möhler (DE), Rafael Garcia Molla (ES), Nicole Nesvacil (AU), Paul Retif (FR), Daniela Thorwarth (DE), Conchita Vens (NL)

Organisers:

Alberto Torresin (Chair of the School),
Christoph Bert and **Jose Perez-Calatayud** (Scientific Co-Chairs)
Efi Koutsouveli and **Thomas Amorgianiotis** (ESMPE online platforms)

Registration:

Attendance of the School will be free of charge to paid-up Individual Associate Members of EFOMP
The School is limited to 500 attendees
Registration for the School is open via the IAM pages

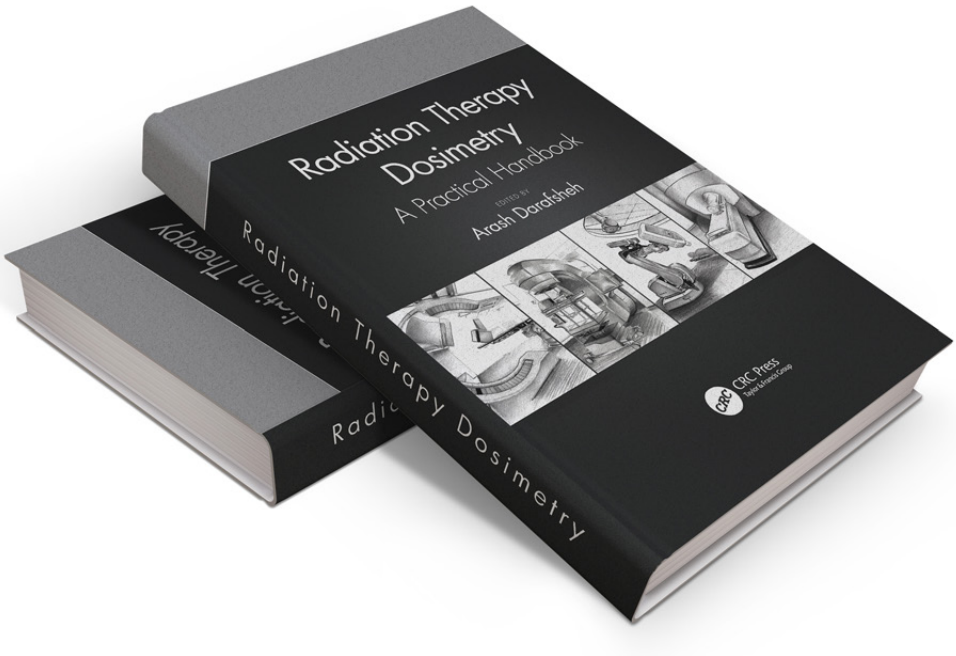
Further information:

Information is available on the ESMPE web pages

BOOK REVIEW

Book Review: "Radiation Therapy Dosimetry: A Practical Handbook", edited by Arash Darafsheh

CRC Press (2021), 504 pages. Hardcover: ISBN 9781138543973 (GBP 190);
eBook: ISBN 9781351005388 (GBP 171). Link to book on publisher's web site



Book cover, reproduced with permission from the publisher. © CRC Press (2021).

The rapid rate of developments and innovations in the field of radiotherapy currently in 2021, requires medical physicists to take stock of existing knowledge and link it to current and future directions. The recent publication by CRC Press, "Radiation Therapy Dosimetry: A Practical Handbook" edited by Arash Darafsheh accepts this challenge. This 504-page book is written by 57 authors, with the majority USA based and the remainder spanning Europe and Australia.

A compendium of theory, measurement methodology, modelling and practical information, this book brings the reader up to date with the kernel of radiotherapy physics, namely quantification of absorbed dose in radiotherapy patients. It does this in a clearly defined way by dividing the book into four sections: Part I: Radiation Dosimeters and Dosimetry Techniques; Part II: Brachytherapy; Part III: External Beam Radiation Therapy; and Part IV: Imaging Modalities. Within each section, the chapter headings are clear and topic specific. This organisation of the book allows it to fulfil the role of "practical handbook" in that each section is self-contained and logically laid out. This permits the reader to dip in and out easily when researching a practical problem or getting up to speed with the latest developments in an emerging technology.

As well as seasoned radiotherapy physicists, the prospective audience for this book definitely includes medical physics trainees or residents who can benefit from the efficient superposition of theory and practical clinical implementation of that theory that this book provides. The book is an outstanding resource for its reference section at the end of each chapter, which spans publications from 1887 up to 2020. The reader can quickly collate the key publications and international recommendations on any topic from this handbook, which is valuable when embarking on new projects and innovations or teaching and mentoring the physicists of the future.

Part I begins with the fundamental physics of dose and summarises cavity theory. From the perspective of dosimetry codes-of-practice, the book is biased towards AAPM protocols (TG21, TG51), but does include references for IAEA. However, it acknowledges that AAPM, ESTRO and IAEA now work collaboratively to improve dosimetry recommendations.

Theory and practical implementation are detailed for each of the dosimetry systems: ionisation chambers, semi-conductors, film, TLDs, OSLDs, EPIDs and optical fibre scintillation dosimeters. Utilising such systems for in vivo dosimetry and exploiting a combination of these systems for patient specific IMRT QA in practice is examined, as is survey monitoring for radiation protection purposes. The emerging field of scintillation imaging dosimetry is explored and provides a nice platform from which to observe evolution of this exciting technology.

Part I ends with a chapter discussing Monte Carlo techniques and summarising the following available codes: Geant4, MCNP, EGS4/EGSnrc, Penelope and FLUKA. This serves as a useful reference for those less familiar with the intricacies of Monte Carlo methods.

Part II on brachytherapy is very comprehensive, including LDR, HDR and beta-emitters. It provides a useful comparison of the traditional correction-based TG43 methodology and the emerging model-based dose calculation algorithms.

Part III concentrates on dosimetry for conventional C-arm linacs including characteristics and measurement challenges posed by Flattening Filter Free beams and small fields used in stereotactic treatments. Chapters are dedicated to specialised radiotherapy treatment devices: Cyberknife and ZAP-X, MR-linacs, Helical Tomotherapy and Gamma-Knife. Kilovoltage X-ray and electron therapy each have a chapter efficiently summarising radiation characteristics and suitable dosimetry systems for measurement.

The final five chapters in Part III are devoted to proton therapy dosimetry and emerging techniques for optimising this mode of treatment including dose monitoring using PET, gamma detection and acoustic methods for verifying proton range measurement The section closes by exploring proton radiography and possible proton based computer tomography.

Part IV tackles the question of dose arising from image-guided radiotherapy, providing a summary of the vast range of imaging modalities and associated reference data tables for organ doses due to IGRT.

This book is indeed a “Practical Handbook” for Radiotherapy Dosimetry in the 2020s and a valuable resource for up-to-date teaching of the next generation of radiotherapy physicists.

Margaret Moore is Head of Radiotherapy Physics at University Hospital Galway in Ireland and a Clinical Associate Director of the Irish National Radiation Oncology Physics Residency Scheme for clinical training of radiotherapy physicists. She is also Adjunct Lecturer at the National University of Ireland Galway, supporting the MSc in Medical Physics programme.

EFOMP COMPANY MEMBER ARTICLE

Sun Nuclear: TG-218 and Stereotactic QA – Why SRS QA should be measured in the same geometry the patient will be treated

SUN NUCLEAR corporation

In recent years there has been a noticeable increase in the utilization of stereotactic delivery techniques in radiation therapy. The continuing COVID epidemic has accelerated this trend even further. This increased prevalence has brought attention to the quality assurance necessary to accurately and safely deliver treatments that target very small volumes with large amounts of radiation.

AAPM Task Group 218 (TG-218) recommends true composite patient specific quality assurance (PSQA) for IMRT and VMAT deliveries "provided the QA device has negligible angular dependence or the angular dependence is accurately accounted for in the vendor software." [1] They further state that these measurements "should not be performed using the PC [Perpendicular Composite] delivery method which is prone to masking delivery errors."

	Target Coverage	V100%	D99%
+/- 1.0° Coll	Ave errors	5%	6%
	Max errors	33%	20%
+/- 1.0° Gantry	Ave errors	2%	4.5%
	Max errors	18%	12%+

Summary of data from Faught et al. publication [2]

Certain stereotactic treatments, such as Single-Isocenter Multiple-Target (SIMT) rely on precise combinations of gantry, collimator and couch rotations. Faught et al. [2] showed that for SIMT treatments, differences in 1.0 degree in gantry, collimator and couch rotations could result in maximum changes to $V_{100\%}$ of 18%, 33% and 5% respectively [2], highlighting the increased need to follow TG-218 QA recommendations to prevent the possibility of potentially catastrophic errors. The most efficient method of performing stereotactic PSQA is an array that utilizes either ion chambers or diodes of sufficient resolution. A new device utilizing a CMOS detector has also recently been introduced. With multiple devices available for SRS quality assurance, care should be taken in determining which provides the most effective QA to ensure safe and precise treatments for a facility's patients. Specifically, clinicians involved in performing these critical measurements need to determine whether a solution meets the requirements for TG-218 true composite measurements. While some arrays claim TG-218 compatibility, in stereotactic deliveries that means being able to manage **angular corrections for gantry and couch rotations simultaneously, including vertex fields**, something only one available device can accomplish.

The Sun Nuclear SRS MapCHECK diode array features a patented method for determining the incident angle of radiation through differing responses of detector pairs. No additional equipment (such as a gantry angle sensor) is needed, reducing setup complexity and the possibility of error introduction from additional devices. The array is fully compatible with evaluating delivered dose with gantry and couch geometries as specified in the patient plan, including vertex deliveries. With 2.47 mm detector spacing and unmatched 0.48 mm detector resolution, the SRS MapCHECK provides film equivalent results that support the additional TG-218 recommendation of tighter tolerances for SBRT such as 3%/1mm or 2%/1mm. Additionally, since nearly all SIMT plans include lesions on multiple planes, the included QA Setup Tool helps users determine the optimal setup(s) to complete QA in as few deliveries as is possible.

For sites seeking commissioning guidance for their SRS programme, Culcasi et al. [3] recently published a standardized set of structures, planning goals and delivery requirements for five increasingly complex stereotactic cases. Modelled after the AAPM Task Group 119 test suite published in 2009 for IMRT Commissioning, the cases include VMAT plans featuring a single arc, two coplanar arcs, a full arc and vertex half arc, and four non-coplanar arcs. [3] The authors used the Sun Nuclear SRS MapCHECK as part of their validation, measuring dose distributions with the planned couch, collimator and gantry angles. They specifically

noted that the array featured diodes with an active measurement area of 0.48 x 0.48 mm, making it compliant with AAPM Task Group 101 recommendations for stereotactic detectors to have a spatial resolution better than 1 mm. [4]

SRS MapCHECK is the only array that meets TG-101 and TG-218 recommendations, and can adequately replace film and mimic the full patient delivery in true composite form. Click here to learn why SRS MapCHECK is becoming the gold standard for film-less SRS and SBRT QA.

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Neal Miller, MBA is a Product Marketing Manager at Sun Nuclear, the leader in quality assurance solutions for radiation therapy and diagnostic imaging. Neal has worked as a medical device marketing professional for over 20 years, mostly in the radiation therapy quality assurance field, bringing timely information to the market about latest technologies and best practices.

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ART AND SCIENCE

Art to Challenge and Inspire: Images and Reflections for Medical Physics

In the first of a series of articles for EMP News, Professor Jim Malone writes about one of his favourite pieces of art, the Sfera con Sfera sculpture in Trinity College, Dublin

The visual arts are rooted in the life of the wider community and may lack explicit scientific or medical physics reference. Nevertheless, they can be influential and may inform/ validate what we do, how we do it, and how we convey it to others. **Sfera con Sfera** is the first in a series of works based on this idea that will appear in the EFOMP Newsletter. Hopefully, you will find them enriching.

I am happy to receive feedback on the choices and commentary at: jifmal@gmail.com

Jim Malone is Professor (Emeritus) of Medical Physics and was Dean of the School of Medicine at Trinity College Dublin/ St James's Hospital. He also works/worked regularly with WHO, IAEA, IEC, ICRP and the EC. He was recently awarded the EFOMP Medal, is an active researcher and has wide interests in the humanities. Recent publications include books on Ethics for Radiation Protection in Medicine, and on Mystery and the Culture of Science.

The drawing above is a study for a portrait of Jim Malone, pencil on card, by Desmond Hickley (gifted by the artist).
The three images on the next page are of Sfera con Sfera, by Arnoldo Pomodoro, with reflections. The work is situated outside the Berkeley Library, Trinity College Dublin.
Photographs courtesy of Lily Markovich.

This is among my favourite pieces. It is called SFERA CON SFERA, Sphere within a Sphere. It is large, taller that a person, and one of the most remarkable pieces of public art in Trinity College Dublin. It is by Italian Sculptor Arnoldo Pomodoro and is endlessly popular with visitors who enjoy photographing it and images of themselves in it. Other versions of Sfera can be seen at the UN in New York, in the Vatican, and elsewhere.

Sfera is an authentic statement about the world, particularly its solidity; but it also captures its fractured complexity. It provides us with a visual metaphor for science, in that the images within the sphere, of surrounding buildings and people are always somewhat distorted. Just as in medical physics. Imperfect representation of reality is the stuff of both science and art. I often use it as the first slide in talks, to which it can provide a scientifically challenging prelude.

MEETING REPORT

The Annual Meeting of the Serbian Association of Medical Physicists

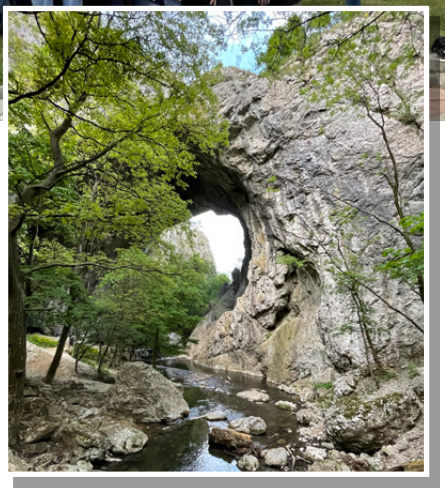
The Annual Meeting of the Serbian Association of Medical Physicists took place on 14th-16th May 2021, in Kladovo, Eastern Serbia. The Serbian Association of Medical Physicists was founded in October 2012; Serbia has been a member of EFOMP since 2013. The Association has 70 members, of which 64 physicists work in the field of radiotherapy, four in nuclear medicine and two in the field of diagnostic radiology.

Attendees at the 2021 Annual Meeting

More than 40 medical physicists from all centres in Serbia attended this meeting. Important topics of the meeting included the exchange of quality assurance protocols and the formation of several working groups whose aim would be to define national QA protocols in radiotherapy, nuclear medicine and diagnostic radiology, in cooperation with the Ministry of Health and the Serbian Radiation and Nuclear Safety and Security Directorate. Medical physicists from all centres presented QA protocols from the different domains that they use in clinical practice. Another topic was the presentation of a document which defines the prerequisites to become a Medical Physics Expert in Serbia; defining this regulation is part of Serbia's EU integration process.

During the two-day meeting in Kladovo, physicists had the opportunity to visit Viminacium, one of the largest and most significant archaeological finds of Roman culture in the Balkans. After the meeting on Saturday participants went to Rajacke Pimnice, a settlement made of stone houses in which wines were made and stored, had a lunch break and then went to the Prerasti Vratne, a unique form of karst morphology through which the Vratna river passes. The day ended with a boat cruise tour through the Iron Gates gorge on the Danube River. On Sunday, after the meeting, physicists were able to visit the Golubac Fortress, a medieval fortified town which was built during the 14th century by the medieval Serbian state.

All participants of the Annual Meeting were very glad to meet again in person and to exchange their knowledge after a one-year break caused by the COVID-19 pandemic!



Prerasti Vratne, natural stone bridge

Jelena Mančev is a Medical Physicist at the Department of Medical Physics at the Oncology Institute of Vojvodina. She graduated with an MSc in Medical Physics from the University of Novi Sad. She is a member of the Serbian Association of Medical Physicists.

EFOMP COMPANY MEMBER ARTICLE

Standard Imaging: The Largest Radiation Therapy Podcast in the World, Out of the Gray (Gy)

Out of the Gray (Gy) podcast features interviews with the most brilliant minds from all aspects of the fields of Radiation Therapy and Radiation Oncology. Episodes focus on guests' journey into the field, innovations, new technology, programs, research, and their visions for the future of the industry.

"We're excited to bring our podcast to the Radiation Oncology and Therapy community where something like this hasn't been done before," said Eric DeWerd, President of Standard Imaging. "We saw an opportunity to give professionals in the field a platform to share their inspiring experiences, ideas, and expertise with the world."

Host Traci Conley, Thought Leadership Manager at Standard Imaging, brings her 15+ years of expertise to the podcast. From her years of clinical experience to her prowess in training and consulting, Conley provides an environment that facilitates thoughtful and impactful conversation unique to each guest.

"Hosting Out of the Gray (Gy) has truly been an honour," said Conley. "I've had the pleasure of interviewing some amazing physicists, therapists, administrators and industry representatives. These are the front-line teams working to fight the battle against cancer every day and I couldn't be more grateful for their willingness to share. Their efforts in the clinics leave an indelible mark on the lives of patients and their families every day, which is something that affects nearly all of humanity. I offer my sincere gratitude to these inspirational folks for their incredible passion and marked dedication toward the growth and development of healthcare. I am excited to continue these conversations and bringing light to the heroes of our calling."

The first episode kicked off with Indra Das PhD, Vice Chair, Professor and Director of Medical Physics at Northwestern Medicine and since then have had guests from all areas of the field including Anil Sethi PhD, Niek Schreuder PhD, Jason Dixon, and even a joint episode from Wendell Lutz PhD, and Chee-Wai Cheng PhD.

"What an honour to spend time talking with Traci about what many of us are so passionate about, helping people going through one of the most difficult times of their or their loved one's life," said Jason Dixon, COO cCARE and podcast guest. "Good people doing great things together. And a huge thank you to Standard Imaging for providing an example and having the vision to invest in a work beyond their bottom line to inspire and educate others in the field of cancer care."

Since its launch in February 2021, the podcast has gained traction from across the globe and has developed a worldwide audience including listeners from France, Japan, United Kingdom, Germany, United States, Australia, India, and more. Listeners can expect weekly episode releases, in addition to bonus episodes and live episodes.

Listen, download, and subscribe to Out of the Gray (Gy). Available on Spotify, Apple Podcast, Amazon Music, and Google Podcasts. Interested in being a guest on our podcast? Reach out to us here.

Standard Imaging is a leading manufacturer of QA instruments for radiation-based treatments. We've dedicated more than 30 years to developing solutions that save you time, while maintaining accurate and precise results. It's your time. Be precise. For more information about our products or company, contact us here!

Matthew Payne is the Director of Sales and Marketing at Standard Imaging, Inc. He has more than 9 years of experience in the medical physics and radiation oncology fields and has been with Standard Imaging since 2012.

MEDICAL PHYSICS IN PRACTICE

Helping young patients and families understand proton therapy by 3D simulation

Originally developed for educational purposes and staff training, a 3D simulation solution has proved to be valuable in patient communication. A visit to the 3D cinema helps the youngest patients and their families visualise and understand proton therapy at the Danish Centre for Particle Therapy (DCPT).

A 3D cinema at Aarhus University Hospital has served a key purpose in the past couple of years, where proton therapy has been implemented in Denmark. Especially for children, adolescents and their families, 3D models and simulations helps to clarify the many aspects of treatment and what proton therapy entails in their specific situation.

"If possible and if the families wish so, we will schedule a visit in the cinema about one or two weeks after the first treatment", explains medical physicist Klaus Seiersen. "As we build experience with this format, the feedback from the families is highly positive", he says.

Medical physicists at DCPT will usually explain to the families in an overall manner how protons are generated in the cyclotron, and how the energy, movements and depth of the proton beam is accurately controlled. Most importantly, patients and their families get to experience a demonstration of how the patient's CT scan is used in treatment planning, how the patient is positioned on the treatment couch in the actual setting to receive the correct radiation dose, and how the treatment beams are directed towards the tumour from different directions.

Key Facts:

- The 3D cinema is located at the oncology department of Aarhus University Hospital, right next to the Danish Centre for Particle Therapy. The cinema is mainly used for education and staff training, e.g. in conventional radiotherapy with photons.
- The cinema is used as part of the national educational programme on radiation oncology, a course which is hosted at Aarhus University Hospital.
- Because of the complexity of the highly specialised treatment with proton therapy, the families of the youngest patients at DCPT are offered a run-through of their own treatment in the cinema. This is optional, and the family decides for themselves whether they wish to make use of this possibility.

An example of a simulation of proton therapy, in the 3D cinema. Photograph by Klaus Seiersen, DCPT

Making each treatment step accessible
A young man named Jacob recently visited the 3D cinema. Even though this was on the final day of his treatment at DCPT, a visit to the cinema provided an understanding of how the treatment actually works.

"I had been asking if I could see or feel the beams, so it was a great experience to visualise my treatment", said 16-year-old Jacob, who brought his family along for the cinematic experience. The family members noted that it helped them understand the radiation effect, and that it created a sense of security for the whole family, that staff members were transparent when explaining the treatment every step of the way. Not least, it made an impression starting from a small scanning image on a computer screen to seeing the images on a big screen in a highly precise 3D model of the actual body.

First proton centre in the world to use 3D solution
A couple of years back, there was no similar proton simulation solution on the market, although the software was already used for educational and research purposes within conventional radiotherapy. By request from and in collaboration with DCPT researchers and clinicians, the company Vertual Ltd. has developed the highly applicable 3D Proton VERT solution, that replicates the treatment rooms and equipment down to every single detail.

"Our goal has always been to help de-mystify the science and technology behind radiotherapy and make it understandable for patients and their families", explains Professor Andy Beavis, Chief Science Officer at Vertual Ltd. "It is a pleasure to continue to be part of this very important work at the DCPT", adds Mr James Ward, the company's Chief Technical Officer.

The medical physicists at DCPT use the same treatment plans and scans for the simulation as are used for the actual treatment. Klaus Seiersen was a part of the initial process and is a keen user of the 3D cinema today. He said: "We are very careful when explaining radiation effect and dose to the patients, and we make sure that they are not unpleasantly surprised by any of the images. Actually, we often experience the opposite, that it helps to reassure the families and that this is an opportunity for them to ask any unanswered questions they might have".

Simone Bertelsen is Communications Officer at the Danish Centre for Particle Therapy. With a background in Anthropology and cross-disciplinary communication, Simone communicates about the centre's activities within radiotherapy research and proton therapy to broad audiences, including patients, health care professionals, international researchers and the general public.

A version of this article was originally published on 22/06/21 on the web site of the Danish Centre for Particle Therapy.

MEDICAL PHYSICS IN PRACTICE

Development of a PACS system

Medical Physicist Demetris Kaolis from Nicosia, Cyprus writes about award-winning work carried out in his home country

Receiving the Silver Award at the Cyprus Healthcare Business Awards in 2020; left to right: Dr. Prodromos Kaplanis (Head of Medical Physics Department), Demetris Kaolis (Project Leader), Charalambos Yiannakkaras (Project Manager).

Medical imaging is crucial in a variety of medical settings and at all major levels of health care. Diagnostic imaging services are essential in confirming, assessing, and documenting the course of many diseases and response to treatment.

The infrastructure of the public hospitals and health centres in Cyprus around 2012 was far from expected, in comparison with the average level of usual international practice. Out of the six largest hospitals in the country, only one had a modern medical imaging management system (Picture Archiving and Communication System – PACS), but with high financial costs of operation and maintenance (exceeding €4.2 million for 10 years).

In 2012, the Department of Medical Physics of Nicosia General Hospital on its own initiative submitted a study for the development of an integrated system for the management of medical images, which would bring the following innovative changes for the public hospitals of Cyprus:

1. Increase the quality of the provided service to the patients, with the complete interconnection of all six hospitals and 40 medical centres with their imaging data;

2. Increase the possibility of a multidisciplinary approach and cooperation between the medical staff, since it would give unlimited access to the doctors to the imaging data of each location and Clinic for the benefit of the patients;

3. Relieve the patients from the hassle of finding and transferring their imaging history in radiological films to each medical appointment;

4. Relieve the patients of the radiation burden of repeating medical imaging examinations due to the loss of radiological films;

5. Make available to doctors new, modern tools for analysis and processing of radiological images for better diagnosis, better planning of medical interventions, and more effective management of patients and their diseases;

6. Bring significant reduction of annual costs for the hospitals, since the system would be developed and maintained by the Medical Physics Department, with the appropriate combination of licensed software and hardware, which would relieve the hospitals of their dependence on suppliers (Vendor Neutral Architecture);

7. Improve the efficiency of hospitals due to the release of space from the abandonment of radiological films.

With the allocation of €15,000, the pilot development of a small system at the General Hospital of Famagusta began. The performance of the system fully met the expectations, and the evolution began. Today, and for the last 8 years, the PACS system of the Medical Physics Department uses equipment worth around €1M, connects all public hospitals and health centres in our country, and can connect additional health care providers or other stakeholders without compromises. Additionally, the system is also used for the breast cancer screening programme of the Ministry of Health, where it made possi-

ble the first diagnosis to be performed at the examination site and the second diagnosis at the central screening Medical Centre, and to create a national digital record with easy access to each woman's examination history in accordance with international standards. In general, the system can provide direct access of treating physicians to imaging data of patients where required, covering up to 14 years.

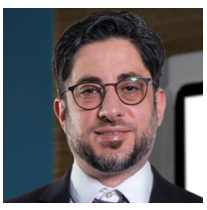
The use of radiographic films in public hospitals is now completely abandoned. At the same time, the connectivity and possibilities of a cooperative evaluation of imaging data by the medical staff of various specialties have significantly improved the approaches to providing appropriate care to the patients. With this development, our hospitals' tertiary care departments, such as the Paediatric Oncology Department of the Archbishop Makarios III Hospital, can cooperate in real-time with doctors and clinics in Cyprus and abroad for the benefit of the patients. In addition, the appropriate infrastructure has been created for future e-health applications so that the provision of health care is wholly modernized for the hospitals but mainly for the final recipients, the patients.

The system currently in operation is subject to strict quality control procedures. It is important to note that internationally, the International Atomic Energy Agency has requested cooperation with the Medical Physics Department to provide training material for the quality control of diagnostic monitors, posted on the official website of the organization.

In a recent evaluation of the Steering Committee for the Integrated Health Information System of public hospitals, the committee unanimously decided due to its excellent technical characteristics and user satisfaction, the maintenance and development of the system through interconnection with future related IT systems of public hospitals. In addition, studies have shown that using the system developed over a decade will result in savings of €6.5-7M, resources that can be used for further improvements to other offered services.

The PACS system of the Medical Physics Department has substantially upgraded the quality of the services offered to our patients. At the same time, its development and use save significant resources for the benefit of society. The situation that existed in 2012 in public hospitals has now turned into an advantage, with international collaborations and transfer of know-how abroad.

For the above reasons, the Medical Physics Department of the State Health Services Organization (SHSO) stood out at the Cyprus Healthcare Business Awards 2021, receiving a silver award in the category of Quality of Services.



Demetris Kaolis is a Medical Physicist currently working at the State Health Services Organization, Nicosia, Cyprus. He obtained his Bachelor's degree in physics from Aristotle University Thessaloniki (GR) and his Master's degree in Medical Physics from the University of Surrey (UK). He has worked with Nuclear Medicine Diagnosis and Therapy and Radiology and currently is with the Medical Physics Department and the Provisioning and Purchasing Department of the State Health Services Organization. During the last 8 years he worked on the development and administration of the Picture Archiving and Communications System (PACS) for the Public Sector.

EFOMP COMPANY MEMBER ARTICLE

RTsafe: An innovative methodology for End-to-End QA in MRI-RT applications

The adoption of Magnetic Resonance Imaging (MRI) in modern Radiation Therapy (RT) applications, such as Stereotactic Radiosurgery (SRS), has paved the way for more accurate treatments due to its superiority in soft-tissue contrast against Computed Tomography (CT) imaging and its ability for functional imaging. In the last decade, the usage of MRI in RT has seen an unprecedented increase either for tumour and Organs-At-Risk (OARs) delineation or on Image-Guided radiotherapy (IGRT) techniques. MRI in intracranial SRS has an essential role during dose planning in combination with CT or as a standalone imaging modality (e.g., Gamma Knife, CyberKnife, linac-based SRS, proton therapy). Moreover, advanced hybrid RT systems, such as MR-linacs and proton-guided modalities, have been designed to perform MR-guided RT treatments in real-time. MRI-based online plan adaptation between sessions at fractionated and hypo-fractionated schemes, as well as during a session, have been proven to improve the clinical outcome.

However, the integration of highly sophisticated hardware and software systems in combination with the potential artifacts that an MR image may suffer, such as geometric distortion, may lead to dosimetric and spatial errors derived from several steps of the treatment chain having an impact on the dose deposition. Therefore, an RT department must perform End-to-End Quality Assurance (QA) tests during commissioning and periodically that include the MRI component of the treatment chain. RTsafe following the trends of modern RT has developed an innovative methodology for End-to-End QA in SRS applications that perform MRI for delineation or image guidance purposes. Specifically, a specially designed delineation insert that may include pre-defined structures of variable size is fitted into the Prime anthropomorphic head phantom (see Figure 1). Spherical and/or elliptical structures with similar T1/T2 values of realistic human tissues are mimicking gadolinium contrast-enhanced brain lesions and can be imaged by clinical MRI pulse sequences. The insert is filled with non-dosimetric polymer gel whereas the rest of the Prime phantom is filled with water, resulting in an adequate contrast in both CT and MR imaging. In combination with the dosimetric kits provided with the Prime phantom for point, 2D and 3D dosimetry, the delineation insert completes the RTsafe's quiver for a true End-to-End assessment. The user can accurately simulate the whole treatment chain from imaging to dose delivery taking into account the contribution of MRI.

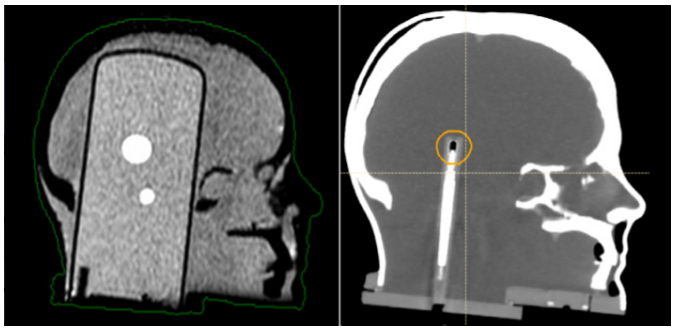
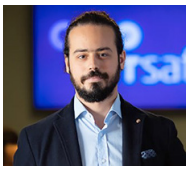


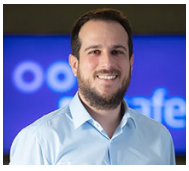
Figure 1: (left) Sagittal MRI slice of the Prime phantom with a delineation insert (two spherical targets are visible) and (right) sagittal CT slice of the Prime phantom with an ionization chamber insert aligned with the upper target.

A recent study has demonstrated the usage of the Prime phantom with a delineation insert for the evaluation of adaptive treatment plans for brain SRS on a hybrid MR-linac system. The insert was designed to include a brain-centred target of 4.8 cc and a smaller off-axis target of 1.4 cc. Random and systematic set-up errors were intentionally inserted during the phantom's positioning daily. The system's ability to perform accurate plan adaptations was evaluated by comparing adaptive plans to reference ones in terms of target coverage, conformity and gradient plan quality indices, V12 or V20 metrics, and time. Moreover, a two-ion chamber insert was used for point measurements at the center of each target in all adapted plans as well as in reference one. The findings of this study strengthen the need for adequate End-to-End tests that include MR imaging used for planning and image guidance.



Georgios Kalaitzakis | Product Manager

Georgios is responsible for the 3D digital design of the 3D printed phantom, the data analysis, the communication and the whole scientific support and guidance of the end user. He has a diploma in Electronic & Computer Engineering, where he focused on the estimation of pharmacokinetic parameters via dynamic contrast enhancement imaging in order to annotate the perfusion of the brain tumour. During his PhD in medical school in the University of Crete, he introduced advanced MRI biomarkers in CNS diseases.



Emmanouil Zoros | Medical Physicist - Product Manager

Emmanouil is responsible for product management, data analysis, and film dosimetry at RTsafe. He has a Diploma in Applied Mathematics & Physics from the National Technical University of Athens and a Master of Science in Medical Physics from the National and Kapodistrian University of Athens. His research interests focus on radiation therapy with emphasis on quality assurance in stereotactic radiosurgery, experimental and computational dosimetry using Monte Carlo simulation techniques.

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MEDICAL PHYSICS IN PRACTICE

Evaluation of Hand/Finger Exposure for Nuclear Medicine Staff Working with ^{99m}Tc-Labelled Radiopharmaceuticals

It is known that nuclear medicine staff working with preparation and administration of radiopharmaceuticals (especially their hands) are under increased risk of radiation exposure. Hand monitoring of nuclear medicine personnel in Lithuania was usually performed by wearing a passive ring dosimeter on the base of any finger without strict definition on which one to use (according to the previous ICRP recommendations it should be worn on a non-dominant hand index finger). These measurements do not reflect the real exposure situation since the dose distribution is inhomogeneous over the hand and the $H_p(0.07)$ doses measured using a ring dosimeter can be lower as compared with the doses to the fingertips which can exceed the recommended 500 mSv/year equivalent dose limit.

The aim of this study was to investigate $H_p(0.07)$ doses at different points of the hands of Nuclear Medicine workers (radiology technologists) in Lithuania.

Hand dose measurements were performed using calibrated TLD-100H (7LiF:Mg,Cu,P) chips encapsulated in plastic envelopes. TLD dosimeters were placed at certain locations of the hands according to the prescribed schemes, as indicated in Figure 1.

Fig. 1: TLD locations on radiology technologist's hands

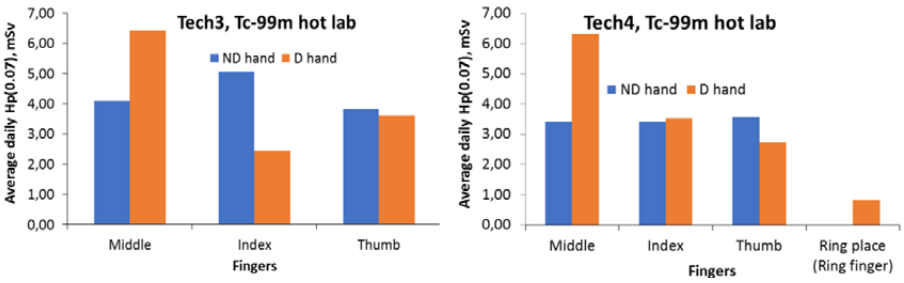


Fig. 2: Average daily dose distribution on the hands of two nuclear medicine technologists working in a ^{99m}Tc hot lab.

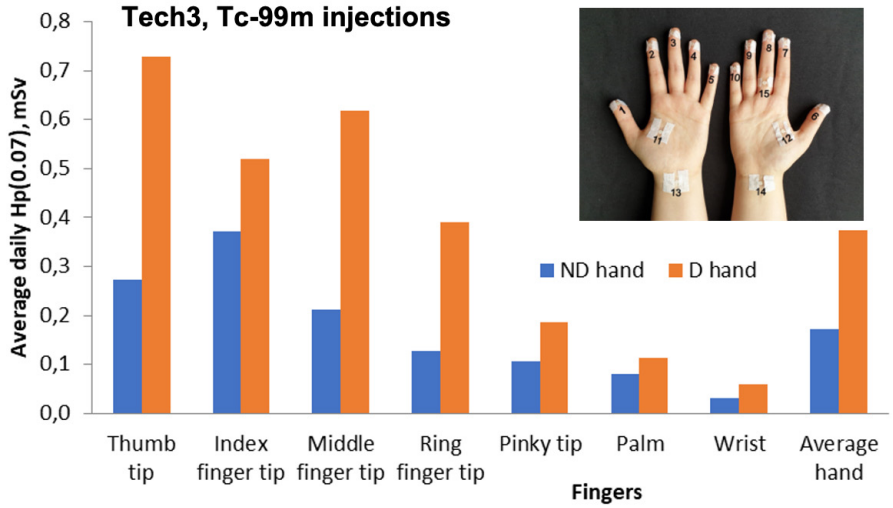


Fig. 3: Average daily dose distribution on the hands of nuclear medicine technologist, received during radiopharmaceutical injections

The ^{99m}Tc source was used for TLD calibration, and doses were verified by the Rialto TLD reader that was used for information readout. Taking into account that the individual exposure of the hands/fingers of nuclear medicine workers depends on the work experience, skills and habits of individuals, it was recommended that the technologists wear ring dosimeter on the self-preferred finger during the investigation period (June-November 2020).

The investigation showed that the doses to fingertips were higher as compared to doses measured with the ring dosimeter (Figure 2), however not necessarily 6 times higher as was suggested by some other studies. Daily exposure tendencies for each fingertip were found to be the same for the same person, but different for others. The study confirmed that the exposure of fingers depends on the individual work of personnel, so wearing of a ring dosimeter on a strictly defined place becomes meaningless.

Analysis of the data revealed that the highest exposure doses were received by two technologists working in the 99mTc hot lab, indicating a real possibility to collect an annual dose which is higher than 500 mGy. The

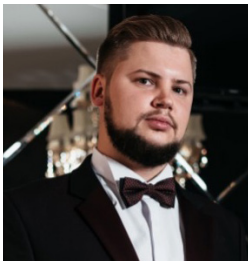
doses to fingertips were differently distributed and almost 10 times higher working in the hot lab as compared to those received by personnel performing radiopharmaceutical injections (Figure 3).

It was found that the doses to fingers of technologists working in the Tc-99m hot laboratory were almost 10 times higher than in the procedure room/injections.

It was found that there were some deviations between fingertip doses of different radiology technologists, as a result of them having different working habits, skills and working experience. Nevertheless, measurements of 14 points (Figure 3) showed that there is a tendency that tips of the thumb, index finger and middle finger are the most exposed parts of both hands and should be monitored most, irrespective of the type of the work being carried out ("hot" laboratory or injections).

Also, this study showed that the recommended multiplier of "6" (if the fingers dosimetry is not performed, for the calculation of fingers doses it is recommended (ICRP 106) to use a ring dosimeter, worn on the index finger of the left hand (for right - handed workers), dosimetric data multiplied by 6) is individual and differs from person to person. Furthermore, at the main nuclear centres in Lithuania it was used as a recommendation for evaluating doses for the fingertips. Due to this reason, the performed investigation contributed to the changes in Lithuanian radiation safety regulations: the recommendation for personnel to wear a ring dosimeter on the finger of which the tip is experiencing the highest exposure was officially approved in December 2020, indicating the need of regular monitoring of doses to fingertips of nuclear medicine workers and of well-organized rotation structure of personnel performing different tasks in nuclear medicine department.

Moreover, work position rotation (radiopharmaceutical preparation, administration, positioning of the patient for the exam) that is performed in the hospital each week helps to ensure the radiation safety of workers.



Laurynas Gilys is a final year PhD student of Physics at Kaunas University of Technology and currently working on lead-free protection materials against ionizing radiation. Additionally, he is a Medical Physicist at the Nuclear Medicine department at the Hospital of Lithuanian University of Health Sciences Kauno Klinikos. During the past three years he has implemented a quality assurance programme at the Nuclear Medicine department, related to gamma cameras and PET/CT quality control, waste management, monitoring of radiation exposure, patients preparation, diagnostic and therapeutic clinical protocols etc.

Inga Andriulevičiūtė graduated at Kaunas University of Technology with a Master's degree in Medical Physics. Currently, she is working as a Medical Physicist at Vilnius University Hospital Santaros Klinikos. Her main interests are radiation protection and safety of patients and medical staff.

MEDICAL PHYSICS THESIS

Doses in the bone marrow in patients with cervical or endometrial cancer for three radiotherapy techniques: 3DCRT, IMRT, VMAT

In this article, Dr. Agata Jodda provides a summary of the research carried out during her PhD, which she completed in 2020 at Poznan University of Medical Sciences in Poland

Rationale

It is currently known that Intensity Modulated Radiation Therapy (IMRT) and Volumetric Modulated Arc Therapy (VMAT), as compared to Three-Dimensional Conformal Radiation Therapy (3DCRT), enable dose reduction in critical organs during radiotherapy of gynaecological tumours. Dose reduction in critical organs is clinically manifested by both lower incidence and decreased symptoms of severe haematologic and gastrointestinal toxicity.

However, (1) there are no standardised guidelines for the development of IMRT or VMAT treatment plans; (2) no analysis was made of the relation between the lower hematologic toxicity and the optimisation pattern used when using the IMRT and VMAT techniques; and (3) the existing comparisons between dose distributions obtained for the IMRT and VMAT techniques have been made for the Planning Target Volume (PTV), bladder, intestines, and rectum. Doses absorbed in the bone marrow have not been compared.

Additionally, it needs to be noted that there is a lack of reports which carefully analyse the impact of the imaging control methods used in irradiation on the way of determining the treatment volumes in gynaecological radiotherapy.

Objectives

My PhD thesis consists of a series of three publications that have been published in reviewed medical journals (detailed information in References). The overall aim of this dissertation was to reduce an ionizing radiation dose in the bone marrow during radiation therapy of cervical and endometrial cancer while keeping a homogenous dose distribution within the target volume and reducing doses in the other critical organs. Detailed tasks defined and performed in that publication series included: (a) elaborating optimal treatment plans scenario that allows most effectively reduce the doses in the bone marrow without decreasing quality of dose distribution in tumour and other organs at risk [1]; (b) determining the relation between doses in the bone marrow and the size of margins added to CTV [2], and (c) dosimetric verification of elaborated treatment plans with particular focus on the relation between the complexity of the treatment plan and discrepancy between the planned and delivered doses [3].

Results

In a study published in 2017 in Physica Medica [1], I showed that inclusion of the bone marrow into the dose optimization process as a structure where dose distribution is optimized largely reduces the dose in the bone marrow for IMRT and VMAT, as compared to 3DCRT. This reduction of doses in the bone marrow is not associated with the growth of doses in the other critical organs, such as the bladder, rectum, and intestines nor deterioration of dose distributions in PTV. Doses in the bone marrow for the IMRT and VMAT techniques where the bone marrow is included into the optimization structure are similar. However, the analysis of normal tissue complication probability (NTCP) for the bone marrow indicated lower potential toxicity for the VMAT technique (see Figure 1).

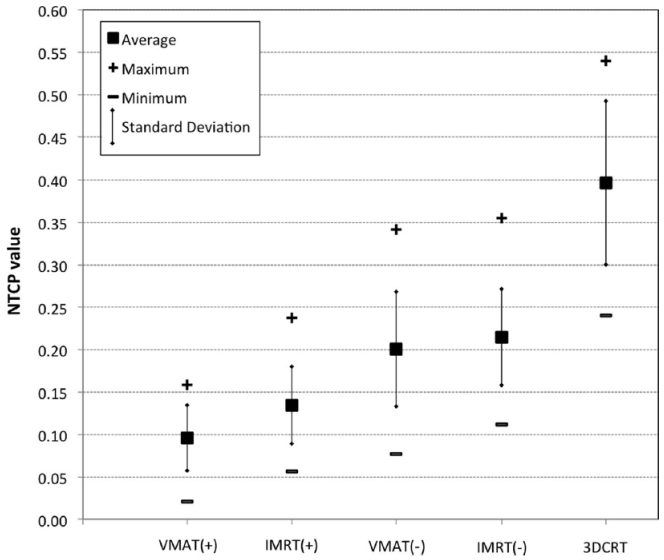


Figure 1: Relations between the NTCP values and five planning scenarios: 3DCRT, fixed-beams IMRT and VMAT with (+) and without (-) the inclusion of the bone marrow as an optimized structure [1].

In the second study, also published in Physica Medica [2], I clearly showed that using various imaging verification schemes affects the size of the margin to be added to particular parts of the CTV. While imaging verification based on bony structures enables smaller margins to be used for the lymph nodes (CTV2) than for the vagina and

perivaginal tissue (CTV1), the imaging verification based on soft tissue allows the opposite strategy (CTV1 smaller than CTV2) (Figure 2). Using smaller margins for the CTV1 enables dose reduction in the bladder and rectum, from another side, larger margins for the CTV2 do not lead to increased doses in the bone marrow. This means that imaging verification based on soft tissue is the best of all imaging modalities analysed.

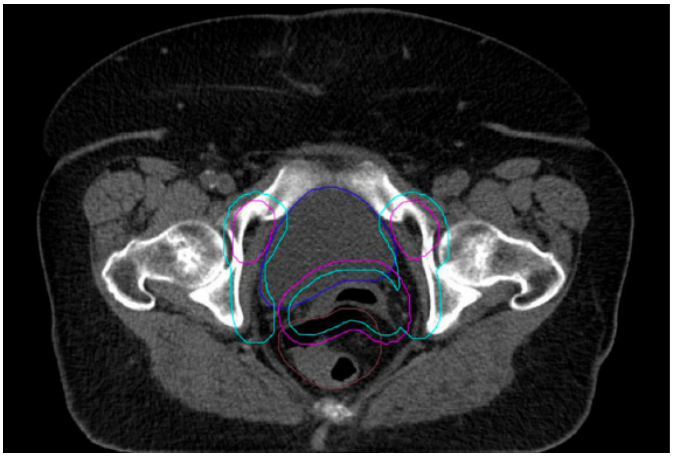


Figure 2: Two sets of the PTV-to-CTV margin applied according to image-guided protocols based on soft tissues (PTVs in cyan colour), and according to bone anatomy (magenta colour). The size of the PTV-to-CTV margins was established according to the study of Jodda et al [2].

Results in [1] and [2] indicate that treatment plans made using the VMAT technique including dose optimization in the bone marrow and verified by soft tissue-based imaging methods are characterized by the best dose distributions. It needs to be noted, however, that those results were obtained based on a study conducted in computer treatment planning systems. For that reason, in a study published in Reports of Practical Oncology and Radiotherapy [3], I analysed the reproducibility of the treatment plans prepared during their delivery on a therapeutic machine. I focused particularly on the relation between the planned versus delivered dose discrepancy and the complexity of the treatment plans. I found that the plans developed for the VMAT technique with dose optimization in the bone marrow and verified by image guidance based on soft tissues were found to be the most complex. However, increasing complexity of treatment plans did not deteriorate the results of dosimetric analysis (Figure 3).

Conclusion

In the above-indicated publications, I demonstrated that the largest dose reduction in the bone marrow in cervical

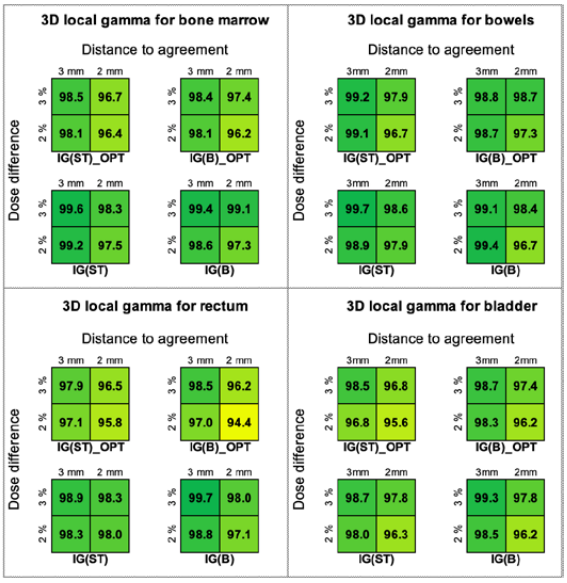


Figure 3. The results of 3D gamma passing rates analysis performed in local mode for VMAT plans, with (_OPT) and without dose optimisation in the bone marrow, that were image-guided (IG) by soft tissues (ST) or bone (B) anatomy [3].

or endometrial cancer patients can be achieved by applying the VMAT technique subject to the following conditions:

a. dose optimization with the inclusion of the bone marrow to the structures where doses are minimized (while preparing the treatment plan);
b. image verification made during radiation (on a therapeutic machine) with imaging methods based on soft tissues.

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Agata Jodda, PhD is a Senior Medical Physicist at the Department of Medical Physics, Greater Poland Cancer Centre (GPCC), Poznań, Poland. Her MSc focused on dosimetric aspects in brachytherapy and was carried out in Physics Faculty at Adam Mickiewicz University, Poznan, Poland. Over time, while working at GPCC, my interests have evolved from dosimetry towards modern techniques of radiotherapy, their optimization methods, and dose modelling. Her PhD project, presented in this short communication was completed in 2020 at Poznan University of Medical Sciences.

EFOMP COMPANY MEMBER ARTICLE

Qaelum Receives ISO 27001 Certification

Leuven, Belgium – 6th August 2021

Qaelum prioritizes the protection of its customers' data, and thus we announce that we have achieved the International Organization for Standardization (ISO) 27001 certification, with the help of CRANIUM. The certification and audit processes were conducted by Brand Compliance. With this certification, Qaelum guarantees the full conformity of its management system for information security controls to this internationally recognized standard.


Brand Compliance

Certificate

312/V5 – Certificate number: NL 639.1.1

Awarded to:
Qaelum NV

Location:
Science Park Arenberg
Gaston Geenslaan 9, B3001 Leuven - Heverlee

Brand Compliance B.V. declares that the management system for information security of the above organization has been assessed and found to be in compliance with the requirements of the standard mentioned below.

Standard:
ISO 27001:2017

Scope:
The secure development, implementation, and support of software solutions for patient safety and quality in healthcare. This also includes de maintenance of our products (both on premise and in the cloud) and the research towards continuous improvement and new features. The cloud enviroment is hosted in an external datacentre.

Part of this certificate is the Statement of Applicability, Qaelum Statement of Applicability ISO 27001 date 24/11/2020

On behalf of the certification body:
Brand Compliance B.V.
Hambakenwetering 8D2
5231 DC 's-Hertogenbosch
The Netherlands

P. Janssen
Quality and Accreditation Manager

Date of issue:
April 8 2021

Date initial certification decision:
April 8 2021

On condition of a continuous and satisfactory operation of the management system, this certificate is valid until: **April 7 2024**

To check the validity of this certificate please call: **+31 (0)73 220 20 00.**

Further information regarding the scope of this certificate and the applicability of the management system requirements can be obtained by contacting the certified organization.

MGMT. SYS. RvA C 548

ISO 27001 is the international standard with more than 100 requirements for the creation of a comprehensive information security management system, or ISMS, requiring companies to use a systematic approach for managing sensitive information and ensuring data security.

As a software solution provider for patient radiation dose management, this certification recognizes our commitment to data security, and also proves to our customers and partners how seriously we take the protection of their data.

About Qaelum

QAELUM is a technologically innovative company, headquartered in Leuven, Belgium (with a subsidiary in New York, US). The company is passionate about eradicating real-world issues that occur in the medical environment by providing solutions to improve the quality and efficiency of healthcare departments around the world. These solutions focus on patient radiation dose monitoring, clinical audits, breast cancer screening, and quality management of medical imaging.

Products

DOSE

Our radiation dose management platform, DOSE, is an advanced tool to automatically monitor, evaluate and report the radiation dose that patients receive in multi-facility and multi-modality imaging environments. It is one of the most powerful and flexible systems of its kind. It has a number of certifications and quality labels, including CE class IIb.

DOSE

1. provides direct insight into the daily dose management, the clinical image quality and the performance of the department.
2. generates regulatory reports and provides an efficient pro-active solution to the labour-intensive regulatory compliance monitoring.
3. monitors different aspects of the medical imaging flow, from the patient and exam dose to the exam quality, and from the performance of protocols to the device workload.

Overall, DOSE provides you with the right tools to identify gaps and systematic errors and optimize where needed, with a focus on patient safety and quality.

COMPLIANCE

Compliance is a cloud-based software solution that helps radiological practices to: Get a "quick-start" with any radiology standard, save time, lower the workload, follow up easily, enhance healthcare quality.

COMPLIANCE

- provides a colour-coded status overview of all criteria to be fulfilled for the specific standard of your department and/or hospital. These criteria can consist of questions or general fields that can be answered according to the standard-specific answer types, by textual responses and/or by uploading "evidence" (such as documents, URL links, and others).
- generates an overview of the progress (also available in chart and diagram form) at any point in time and addresses any shortcomings following an action plan.
- creates action plans with corresponding levels of priority in the software when certain criteria are not met.
- stores the results at the end of each evaluation or audit phase. Tracks the trends over the specified time frame. The results will be "frozen", or stored so that trends can be tracked over the specified time frame.
- automatically generates the reports showing individual responses to each question, the overall and individual levels of progress throughout the evaluation, any action plans and predefined analytics.

MEDICAL PHYSICS THESIS

Towards Precision Medicine in Breast Cancer Imaging: From 3D Breast CT Radiomics to 4D Perfusion

Earlier this year, Dr. Marco Caballo obtained his PhD from Radboud University in the Netherlands. In this article he provides a summary of his PhD research; his thesis can be downloaded from https://hdl.handle.net/2066/230399

Breast cancer is the most diagnosed cancer in women, with an incidence rate of one woman in seven, if she lives to be 80 years old, in many European countries. To decrease its mortality and morbidity, multiple efforts have been undertaken to improve detection, diagnosis, and treatment of breast cancer. In all these applications, medical imaging plays or can play a key role.

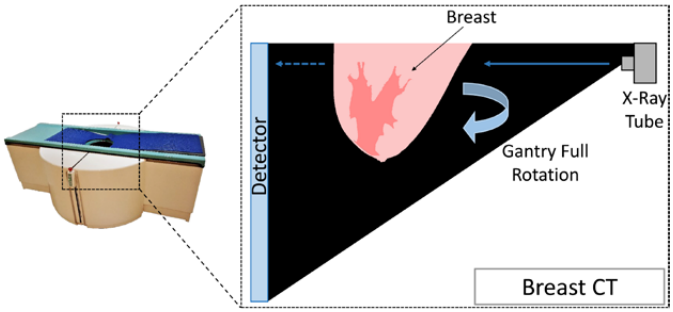

Figure 1: Schematic of the image acquisition in breast CT. The breast CT system shown in this figure was developed by Koning Corp. (West Henrietta, NY).

Among the imaging technologies developed in recent years, breast CT (bCT) is the only fully tomographic x-ray imaging method dedicated to the breast (Figure 1). It can acquire full 3D images of the breast in 10 to 16 seconds, with high spatial and contrast resolution and low radiation dose (Figure 2). Given these properties, bCT could be useful in multiple stages of the breast cancer imaging pipeline, potentially providing meaningful imaging biomarkers that may help characterize the biological signature of breast tumours.

Automated analysis of these images to quantify imaging phenotypes can potentially result in better performance compared to the use of visual perception alone. This approach, called radiomics, aims at extracting quantitative features from tumour images, either through segmentation and subsequent extraction of engineered features describing tumour texture, shape, and margin, or through convolutional neural networks, able to automatically learn the relevant features directly from the images. After these

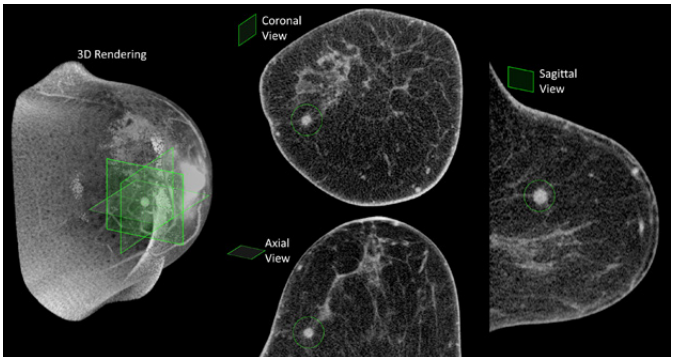

Figure 2: Example of a 3D breast CT image, displaying a breast tumour in the coronal, axial, and sagittal views, and in a 3D rendering of the breast.

quantitative features of the tumour are extracted, they can be used to develop mathematical and Artificial Intelligence (AI) models to aid radiologists in clinical decision-making.

To investigate the power of this approach in bCT imaging, in the first part of the thesis a radiomic model was developed to predict the malignancy of breast masses acquired with bCT. The model leverages both engineered and convolutional features, which are combined in a hybrid architecture. It was trained on 202 mass images from different institutions, and tested on 82. It achieved an area under the ROC curve in discriminating benign from malignant masses of 0.95, thus showing potential in improving mass diagnosis [1-3].

To further improve breast cancer characterization through imaging, in addition to the development of radiomics algorithms, improvements to imaging device and acquisition protocols can be performed. Especially, iodinated contrast enhancing material could be administered prior to bCT image acquisition, and subsequent multiple acquisitions of the patient breast at different times could be obtained. Thanks to the high spatial and temporal resolution of bCT, this could allow for the acquisition of vascular access and, potentially, cellular information from the tumoural environment and individual subregions, yielding important biomarkers of biological signature.

Therefore, the second part of the thesis focuses on the development of a new modality, four-dimensional (4D) bCT, aimed for high-resolution dynamic functional imaging of breast cancer. To this end, a computational method was developed to simulate realistic 4D perfusion bCT images starting from 3D patient bCT images. The method includes the simulation of both the imaged object (the breast) [4, 5], including modelling the enhancement dynamics of breast tissue and lesions [6], and of the envisioned 4D bCT system [7]. The simulation of the system was validated against experimental measurements performed with physical phantoms, yielding accurate results (highest absolute error lower than 10%). This simulation algorithm can be used to develop and optimize (in terms of image quality and associated delivered radiation dose) a future 4D bCT system before patient image acquisition.

Thanks to its spatio-temporal resolution properties, 4D bCT is envisioned to achieve a higher level of breast cancer characterization compared to existing imaging modalities. Especially, if coupled with quantitative radiomics algorithms, it could open the path to a precision medicine approach where cancer treatment can be tailored to each single patient, based on specific tumour-related imaging biomarkers, potential increasing treatment effectiveness and decreasing mortality and morbidity.

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Marco Caballo is a post-doctoral researcher at the Advanced X-ray Tomographic Imaging (AXTI) laboratory in the Department of Medical Imaging of Radboud University Medical Center. His major research interest is the development of image analysis, radiomics, and machine learning algorithms for precision medicine in cancer imaging. He initially studied biomedical engineering at the Polytechnic University of Turin (Italy), from where he graduated in 2016 with an MSc in medical imaging, image processing and analysis, and analysis of biomedical data. Following some experience as a software engineer in Turin, he began his PhD studies at AXTI in January 2017 and graduated from Radboud University in 2021.

WHAT MEDICAL PHYSICISTS DO IN THEIR FREE TIME

Traditional Archery

Jens Heufelder from Berlin (DE) writes about his favourite leisure activity

It is a nice warm and sunny morning. A group of even-minded people talking with each other is following a marked trail through the woods. Reaching a marked spot, I step to the marking peg and look. What awaits me seems to be a large boar standing in a small meadow between trees at about 30 metres distance. Everyone in the group goes quiet. I grab my bow tight, take a deep breath to calm down, fetch an arrow from the quiver, and knock it on the string. I adjust my stance. The feet make a firm connection to the ground and the knees are slightly bent. The upper body is straight. I am looking directly at the spot I want to hit and raise the bow arm. Shoulders are down. I inhale and pull the string. Keeping my focus on the target, I feel the tension in my back muscle raising. The draw hand reaches its anchor position near the ear. Everything feels right at this moment. I release the string, knowing even now that I will hit the target. The bow accelerates the arrow silently. I see it fly straight to the target. With a loud plop, it hits the boar in the chest. During that short moment, when everything carries out perfectly, I feel united with the universe.

Impressions from 3D archery: Jens taking aim at a big (artificial) boar.

By the way, the boar stands there very unimpressed, because it is an artificial boar in realistic size and colour made from foam. Now it is the turn of the other archers to shoot at the boar. After everyone has had their turn, the hits on the boar are examined and the points counted. Arrows that missed the boar are searched for. If everyone is ready, the group follows the trail to the next target. What will it be? A big bear, small rats, a deer or some wild animals or fantasy creatures?

This was a typical impression from a traditional 3D archery tournament. Archery seems to be simple. It is only a stick with a string, which accelerates another stick with a point. One has only to pull the string and release the arrow. This simple technique, probably invented for hunting and used in warfare, developed over the last 5,000 years into a modern sport with many disciplines. For instance, there are Olympic target shooting, known by most people, modern field and 3D archery (described above), historic competitions like the English clout shooting (hitting a target circle over 165 m), the Korean Kuk Kung competition (shooting on a 2 m by 2.5 m target from 145 m) or flight shooting: how far can my arrow fly?

As many different archery disciplines are around, as many different bow designs exist, starting with the simple (primitive) hazel, ash, elm stick with string. Ötzi's yew bow, the famous English longbow and composite bows made from wood, horn and sinew are typical historical bow designs. The latter were used in different styles by many people like Scythians, Huns, Mongols, Turks, Korean, Chinese and many more. Modern materials used in contemporary long- and recurve bows like fiberglass, carbon and metal allowed reducing the draw weight of the bows, increasing their performance at the same time. Nowadays the recurve bow with additional sight and stabilizers is used in the Olympic competitions. Even more advanced and efficient are the compound bows with their special levering system of cables and pulleys to bend the limbs.

I decided to play in the field of traditional archery, shooting an historic composite bow without any technical aids as sights or arrow rests. Instead of Mediterranean release (common in Europe and the US common), pulling the string with the three middle fingers, I prefer the historic thumb release. There, I use my thumb protected by a so-called thumb ring to pull the string. Many people like the Ottomans, Tartars, Korean and Chinese used this technique. Being on our training ground or an archery course, I can switch off from work and relax. Especially on an archery course or during a competition, I enjoy the weather, the company of other archers, and the placement of the targets in the landscape.

In Germany, many traditional archery tournaments are held. In principle, it is possible to attend a tournament or an archery meeting every weekend. I do this once or twice a month. On one weekend in the year, a clout competition is held in Berlin on the Maifeld beside the Berlin Olympic stadium. For me it is interesting to observe for about five seconds the flight of the arrow to the clout in this controversial historical surrounding. In addition, at the same time, a football match takes place nearby.

There is so much more to say about archery. If you have a chance do try it, do it. However, there is the risk to get addicted. Do not tell me that I did not warn you.

Impressions from Clout Shooting nearby the Berlin Olympia Stadium: The clout (red pennant or flag) or area around it should be hit from 180 yards (165 m) distance.

Jens Heufelder is leader (since 2009) of the medical physics group of the Department of Ophthalmology at Charité Universitätsmedizin Berlin. There he is responsible for the ocular proton therapy programme at the Helmholtz-Zentrum Berlin and additionally for the medical physics aspects of intra-ocular brachytherapy. Before joining the Charité he set up the ocular proton beam line OPTIS2 at the Paul Scherrer Institute in Switzerland. He is a member of the German Association of Medical Physics (DGMP), of the German Association for Radiation Oncology (DEGRO), of the Particle Therapy Co-Operative Group, being active there on the OPTIC Subcommittee. As Treasurer, he is a member of the Executive Committee of DGMP.

WHAT MEDICAL PHYSICISTS DO IN THEIR FREE TIME

In Speleology we explore the Underworld!

Ivana Mišković from Belgrade, Serbia, writes about her enthusiasm for caving

I have been an active caver for nearly fifteen years. In the beginning, it was just my way to go into remote places and wilderness. Over time, spending time in the karst underground has become my passion and an inseparable part of my life. To explain, we speleologists are muddy enthusiasts who go to unrevealed caves and pits, explore and document them.

We prepare technically and logistically each caving trip. Every visit to the underworld provides the opportunity to expand the limits of mind and body abilities and fulfils the eagerness to explore all of those lonely spaces, maybe never seen before by humans. This is a different world which dominates timeless hydrogeological and speleothem morphology, but also it is a fragile ecosystem, so wet, dark and cold. Speleology gives me delight, but requires a lot of time and commitment.

High flowstone in Suvi Ponor cave, Eastern Serbia. Photo by Igor Bilas, with permission.

I cave with the Student Speleological Alpinistic Club of Belgrade, which turns 50 this year. The year 2021 has been officially declared as the International Year of Caves and Karst by The International Union of Speleology, thus pointing out the importance of karst to the world.

When exploring a new cave, we measure every passage and present topographic surveys in 2d maps and 3d models, for future cavers, researchers and speleo rescue teams. Maps contain data about calcite deposits, blocks, sand and other cave accumulations, active and fossil waterflows, lakes, many erosive forms embedded in the rock, etc. It is useful to notice geomorphologic phenomena in the stone because it informs us about speleogenesis and possible cave continuation. We face cave beetles and aqueous species running and swimming around, white or translucent, often endemic. I am especially thrilled if we meet a bat colony hidden deep inside a cave gallery, or even if some lonely bat flies in front of my nose! Those troglophiles strongly depend on the cave environment and use it to hibernate and shelter in the reproductive period of their lives. Indeed, great attention is paid to ecology and karst protection in all of our projects. Sometimes we find paleontological material buried down there. A considerable amount of hydrological and petrological data is collected. We are used to interacting with biologists, archaeologists and geographers… or just to make spectacular art photos of unusual spaces.

Speleology is a multidisciplinary science of great research possibilities, if you like to crawl deep down to the hole. This implies some slippery mud, absolute darkness, much water and sometimes ice on your way. No guiding marks, no guarantee that everything will be fine, not even continuation of the passage every time. It can be disappointing, sometimes it is hard and even dangerous. Pit entrances are often far away in the mountains where we carry ropes, caving gear and drilling tools. But landscapes are beautiful and fellow cavers from different regions are great company and reliable comrades, without exception!

I have led many exploring trips in Serbia, mostly in Djerdap National Park and in the south-eastern Serbian mountains. I also like to join speleo-expeditions in the surrounding limestone massifs, where the pits are deeper and the mountains are higher. The Kanin district in the west of Slovenia always left me breathless with its vertical caves thousands of metres deep and entrances over 2000 metres high. I like caving in eastern Herzegovina – it is speleo-heaven on Earth! In Velebit Mt. of Croatia I made my first extreme adventure. Last holiday I was in the Opasna cave system in Montenegro, where our small three-member team had to leave an unexplored pithole at a depth of 610 metres. At least for now – we needed more ropes…

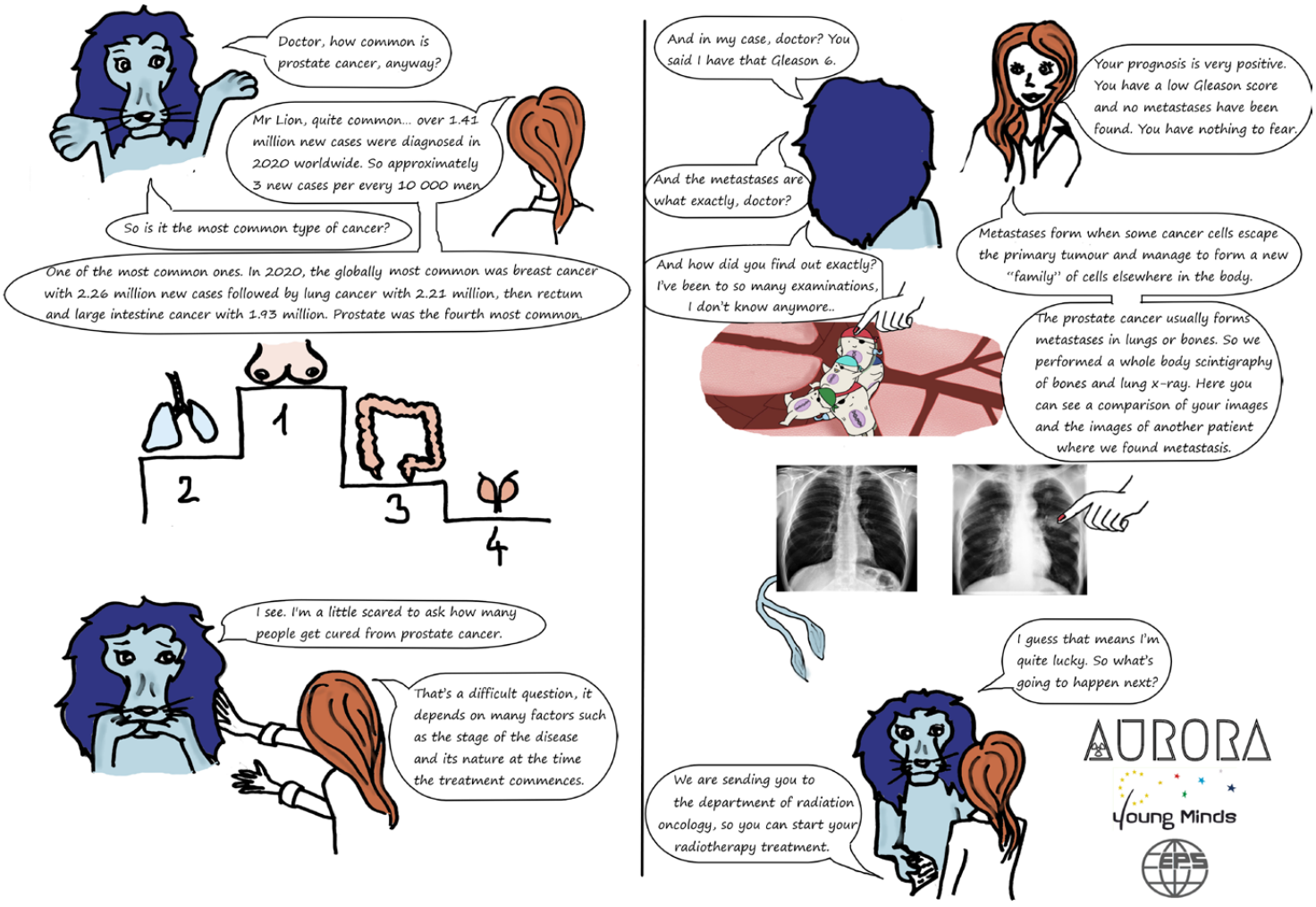
And finally, with dirty nails and scratched skin, bruises everywhere, I am back to my workplace. I have no idea how to explain my adventure. I just smile and say: I was somewhere there… in the hills.

On exit from a three-day stay in Jojkinovac cave, Bosnia and Herzegovina. | Photo by Željko Rogić.

Ivana Mišković is a Medical Physicist Specialist at the Institute of Oncology and Radiology of Serbia, Belgrade. She studied theoretical physics at the University of Belgrade and was employed in Radiotherapy in 2005. She has been dedicated to paediatric radiotherapy. Areas of interest are Biophysics and Clinical Radiobiology. She manages the dosimetry branch of the Physics Department in the Institute.

The Aurora project – informing about medical technology through comic strips

This is the latest comic strip from the Czech Republic's Aurora team, aimed at educating the public about the benefits of technology in medicine, in a highly-original way. In this episode, Lev the lion finds out more about his prostate cancer diagnosis and his upcoming treatment.



Aurora is a project of the Prague section of European Physical Society (EPS) Young Minds. The main aim of Aurora is to spread knowledge about ionizing radiation in general, ionizing radiation in medicine and cancer. And how do we intend to spread this knowledge? For example by creating topical comics. Our team is still expanding. Now, we have two main painters, Markéta Farníková and Anežka Kabátová. Then, there are four people who create stories for the comics, consult with the painters and translate texts, Barbora Dršková, Petra Osmančíková, Jana Crkovská and Anna Jelínek Michaelidesová. Anna is also the coordinator and the person in charge of the whole project.

The Aurora team grants permission and consent to EFOMP and EFOMP NMOs to use the comic strips for educational purposes. In case you would like to translate the comics into another language, email us the translated text and we will modify the comic and send it back to you. No other modifications to the content are allowed. You can contact the Aurora team at aurora@youngminds.cz

The Aurora team are:

Marketa Farníková studied Medical Physics at the Czech Technical University in Prague (CTU), gaining a MSc. degree in 2019. She has been working at the Department of Medical Physics at Hospital Na Homolce since 2018, at the Department of Radiation Dosimetry Nuclear Physics Institute of the Czech Academy of Sciences (CAS) where she has been working on her Ph.D. since 2019 and at the Department of Medical Physics at Motol University Hospital since 2020.

Anežka Kabátová studied Experimental Nuclear and Particle Physics at the CTU and received her MSc. degree in 2020. Since then, she has been working on her Ph.D. project on galaxy evolution at the Astronomical Institute of the CAS. She has been an active member of the Prague section of EPS Young Minds since 2017, acting as a vice-president of the section between 2018 and 2019.

Barbora Dršková finished the Medical Physics master programme at the CTU, Faculty of Nuclear Sciences and Physical Engineering in 2019. Since then, she has been working on her Ph.D. She works as a medical physicist in radiotherapy at General University Hospital in Prague and University Hospital Královské Vinohrady.

Petra Osmančíková graduated from the CTU and holds a MSc. and a Ph.D. degree in Medical Physics. She is a clinical medical physicist in radiotherapy in Motol University Hospital in Prague. She is also a researcher at the Faculty of Nuclear Physics and Physical Engineering of the CTU.

Jana Crkovska received her Ph.D. in High Energy Nuclear Physics from the Université Paris Sud in 2018. Since then, she has continued her research on charmed particles production at the Los Alamos National Laboratory. She is part of the LHCb Collaboration, one of the experiments at the Large Hadron Collider (LHC) in CERN.

Anna Michaelidesová received her MSc. and Ph.D. degree in Medical Physics from the Faculty of Nuclear Physics and Physical Engineering of the CTU. She has been working as a researcher at the Nuclear Physics Institute of the CAS since 2010. In the period 2012-2017, she was employed as a Medical Physicist at the Proton Therapy Center Czech. She has also been working as a researcher at the Faculty of Nuclear Physics and Physical Engineering of the CTU since 2019. From June 2019 until the end of 2020, she was a postdoctoral researcher at the department of Translational Radiooncology and Clinical Radiotherapy of the OncoRay® - National Center for Radiation Research in Oncology at the Medizinische Fakultät Dresden Carl Gustav Carus in Germany. She has been a member of the Prague section of EPS Young Minds and of the leadership committee of the IRPA YGN since 2019.

Upcoming Conferences and Educational Activities

This list was correct at the time of going to press.
For a complete, up-to-date list, please visit our **EVENTS WEB PAGE**

Sep 2nd, 2021 - Sep 4th, 2021

ESHNR 2021
Online

Sep 8th, 2021 - Sep 10nd, 2021

Radiomics Toolbox - Workflow And Quality Management
Pavia Italy

Sep 19th, 2021 - Sep 22nd, 2021

ÖGMP, DGMP and SGSMP- three Medical Physics Societies conference
Online

Sep 20th, 2021 - Sep 24th, 2021

Innovative Radiotherapy Techniques - Isirt
Pavia, Italy

Sep 27th, 2021 - Sep 29nd, 2021

BNMS Virtual Annual Meeting 2021
Virtual

Sep 28th, 2021 - Oct 26th, 2021

ESTRO Research Course in Radiotherapy Physics
Online + Budapest, Hungary

Oct 11th, 2021 - Oct 15th, 2021

Joint ICTP-IAEA Workshop on Radiation Protection in Diagnostic and Therapeutic Nuclear Medicine
Online

Oct 20th, 2021 - Oct 21th, 2021

UT Austin Portugal 2021 Annual Conference
Porto, Portugal

Oct 20th, 2021 - Oct 24th, 2021

EANM'21 - 34th Annual Congress of the European Association of Nuclear Medicin
Virtual

Nov 4th, 2021 - Nov 5th, 2021

BIR Annual Congress 2021
Online

Nov 4th, 2021 - Nov 6th, 2021

15th International Conference “Medical Physics in Baltic States 2021” & Congress (EFOMP school)
Kaunas, Lithuania

Nov 22nd, 2021 - Nov 24th, 2021

5th European Radiation Protection Week (ERPW)
Vienna, Austria

Feb 3rd, 2022 - Feb 5th, 2022

Image Guided and Adaptive Radiotherapy in Clinical Practice Course 2022
London, UK

Mar 21st, 2022 - Mar 23rd, 2022

5th Conference On Small Animal Precision Image-Guided Radiotherapy
Munich, Germany

May 30th, 2022 - Jun 3rd, 2022

6th European Congress on Radiation Protection
Budapest, Hungary

Aug 17th, 2022 - Aug 20th, 2022

4th European Congress of Medical Physics (ECMP 2022)
Dublin, Ireland

Sep 21st, 2022 - Sep 24th, 2022

German Conference on Medical Physics
Aachen, Germany

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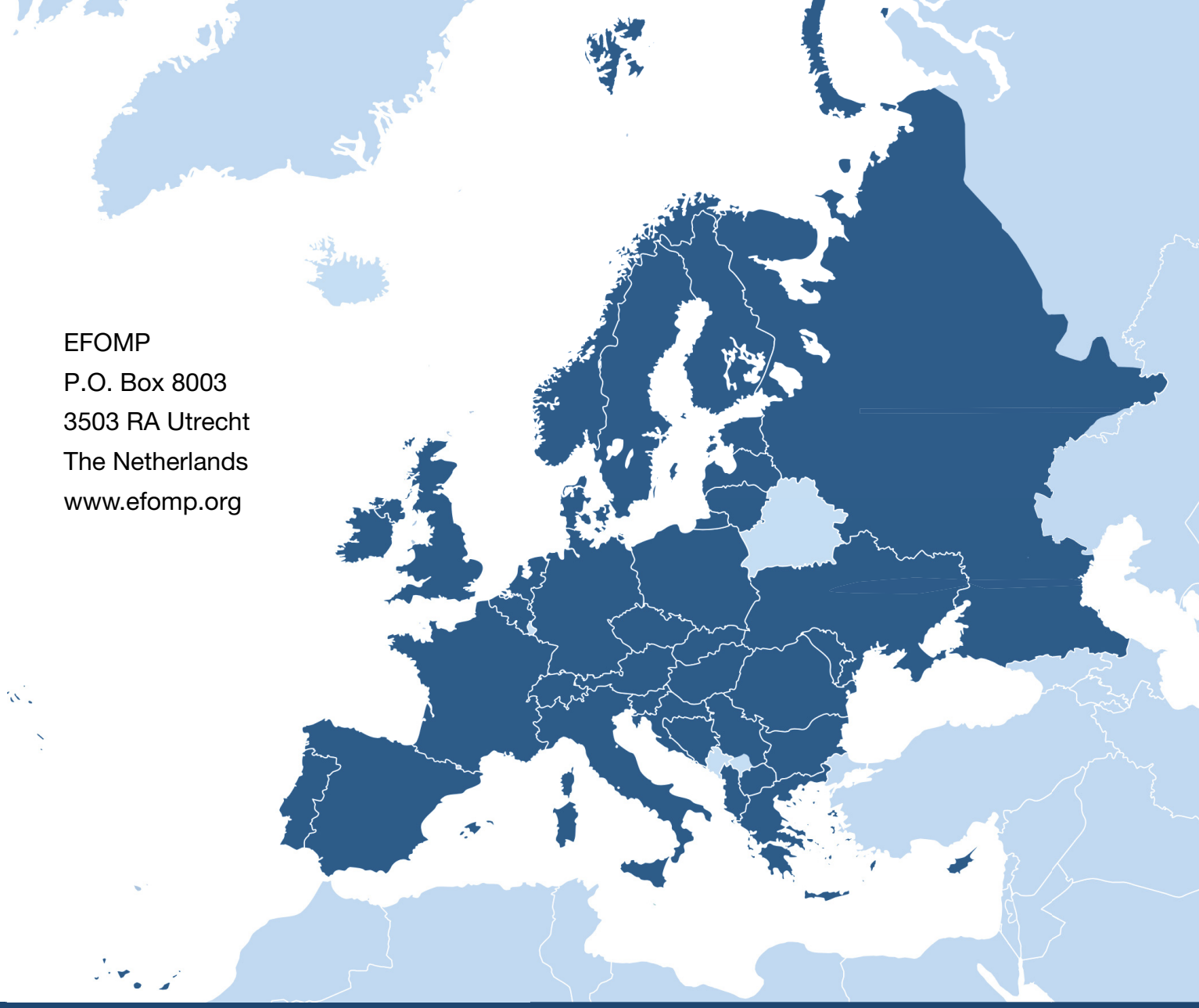

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EFOMP

EUROPEAN FEDERATION
OF ORGANIZATIONS
FOR MEDICAL PHYSICS

The European Federation of Organisations in Medical Physics (EFOMP) was founded in May 1980 in London to serve as an umbrella organisation for medical physics societies in Europe. The current membership covers 36 national organisations which together represent more than 9000 medical physicists and clinical engineers working in the field of medical physics. The motto developed and used by EFOMP to underline the important work of medical physics societies in healthcare is “Applying physics to healthcare for the benefit of patients, staff and public”.

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