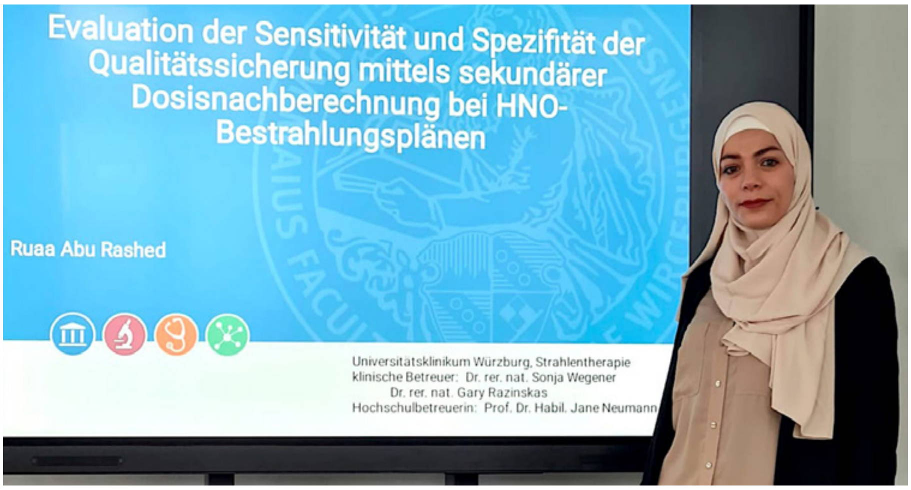
EFOMP
EUROPEAN FEDERATION OF ORGANISATIONS FOR MEDICAL PHYSICS
Quarterly Newsletter

European Medical Physics News

ISSUE 01/2023 | SPRING

Building Careers in European Medical Physics Educational Facilities: Multicultural Learning Success Stories!



Ruaa Abu Rashed, from Damascus, Syria, just obtained a Master degree in Medical Engineering from the University of Applied Sciences Jena, Germany.

Xhulia Dosti, from Tepelena, Albania, is granted MSc in Engineering Physics and an Advanced Masters in Medical Physics from the University of Trieste, ICTP, Italy.

Pratiksha Shahi is a medical physicist devoted to improving radiological practice in Nepal after graduating from the International Centre for Theoretical Physics (ICTP) in Trieste, Italy.

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EDITORIAL

Welcome to the Spring 2023 issue of European Medical Physics News, the quarterly newsletter of EFOMP.

The bleakness of winter has passed, and in its place are trees and skies that are stunning in their simplicity. You may not even notice the breeze if you are focused on something else; spring has pushed back the chillier temperatures of winter. Although winter should still be in effect, spring has already pushed back to more mild temperatures. This blossom has been opening, but already its pink hue is more intense than it was when it was still a closed bud. Beautifully reflecting this issue's theme of "Building Careers in European Medical Physics Educational Facilities: Multicultural Learning Success Stories!" is the gradual flower opening as the spring background moves from grey to bright light, accompanied by the embrace of kindness in the warmth and dewy atmosphere. Albanian Xhulia Dosti, Nepalese Pratiksha Shahi, and Syrian Damascene Ruaa Abu Rashed are just three examples of the European Medical Physics Society's dedication to creating a safe and healthy workplace and learning environment for its members that are highlighted in this release, as the cover art revealed.

As usual, this release has a combination of topics covering the whole spectrum of European medical physicists' interests: professional, scientific, educational, artistic, technical, interview, book review, commercial, etc. Therefore, it is really worth the time to read it in full.

In this edition, EMP News' Educational Advisor Danielle Dobbe-Kalkman has conducted an interview with one of the most renowned medical physicists and academics in the UK, Professor Andrew Reilly, the Scientific Director of the Department of Clinical Physics and Bioengineering (DCPB) at NHS Greater Glasgow & Clyde, Scotland.

For this Spring issue of EMP News, Iuliana Toma-Dasu, Editor-in-Chief of Physics Medica, selected three articles from the most recent issue of Physica Medica (EJMP) on: adaptive proton therapy, Neuroimaging Network, and proton irradiation for V79 cells using Geant4-DNA code; and Ramon Ortiz has presented a summary of his PhD work titled "Dosimetric studies for proton minibeam radiation therapy", conducted at Institute Curie, France.

The book reviews in this release was conducted by Jamema Swamidas, who has given a brief overview of the IAEA book tilted as "Comprehensive Audit for Radiotherapy Practice: A Tool for Quality Improvement – Second Edition Published in 2022– IAEA", and Markus Buchgeister, who has summaries his review on the book titled as "Introduction to Medical Physics" By Steven Keevil, Renato Padovani, Slavik Tabakov, Tony Greener, Cornelius Lewis.

In addition, our popular Medical Physicist's art and hobby collection includes, the article by Professor Jim Malone and Fran Hegarty, who wrote about the experiences and challenges of creating a visual arts event for MPEC 2022, a major medical physics and engineering congress; the second part of the new comic Strips series of the Aurora Project: "Cancer and Its Treatment from the Inside through Comic Strips: PART II;" and Katryna Vella exhibits the talent that she possesses as a science fiction writer by outlining the history of the genre as well as its future.

In terms of professional content, we have four articles that you might be interested in: Lorenzo Nicola Mazzoni discusses his experiences serving for one year as the representative of the EFOMP to the ICRP, the Implementation of the Medical Devices Regulation (MDR) by Erik Gelderblom and Rens Wientjes, the Position of the Medical Physics Expert in the Netherlands by Oleksandra Ivashchenko, and the New Spanish Society Website development by Manuel Vilches. This issue also includes Pablo Minguez Gabina update on the activities of this EFOMP Special Interest Group.

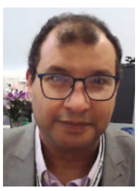
There are a respectable number of meeting reports and meeting announcements in this release; one of them will be held in Iceland [from March 30 to April 1], which will host the EFOMP officers' spring meeting this year. The meeting title is "Welcome to Iceland and the Triennial Symposium for the Nordic Association of Clinical Physics!" Stine Korreman and Kirsten Bolstad have announced. There are two meeting announcements: the PTCOG Meeting 2023 in Madrid Subtitle: For the first time, Particle Therapy Co-Operative Group (PTCOG) will hold its annual meeting in Spain [June 10 - 16, 2023], Marco Durante's report, and the Join the Uk's Largest Imaging and Oncology Event [June 5-7, 2023] - Liverpool, UK, Rizwan Malik's report. There is also a couple of interesting meeting feedback reports: Giuliano Perotti Bernardini and Anna-Maria Fanou reported the 2nd RAPTOR School as a huge success! Held at Cosylab in Lju-

bljana, Slovenia, from September 4–9, 2022; and Oliver Jäkel provides positive comments on the virtual courses in the field of Particle Therapy took place successfully from Oct. 17th to Nov. 25th 2022 under the auspices of the Heidelberg Institute for Radiation Oncology (HIRO)
Regarding the educational and training matters we have in this issue, they are: A call by the EFOMP E&T Committee for more volunteer centers to help construct a pan-European network by Carmel J. Caruana, Christoph Bert and Kiki Theodorou; Teaching Course on Stereotactic Body Radiotherapy (SBRT) - Prague, Czech Republic, July 13–15, 2023, announced by Oliver Blanck and Serenella Russo and the International Conference on Education and Training in Radiation Protection (ETRAP2023) – Groningen, The Netherlands.

This collection now includes a number of pieces contributed by EFOMP company members, all of which can be found here. I have no doubt that reading about the activities and services offered by the companies would be interesting to do, since I am sure that it will be. If you decide to read any of the articles that are included in this issue of European Medical Physics News, I truly hope that you will find them to be interesting. This is something that the publication does on a regular basis.

Lastly, I'd like to remind you that the EFOMP mailbase discussion list is now up and running. If you haven't joined yet, please send a request to join by going to the public subscription page at the link below and following the instructions:

https://lists.efomp.org/mailman/listinfo/europeanmedicalphysics then you can send your first message or messages to the group using the email address: europeanmedicalphysics@lists.efomp.org



Mohamed Metwaly, PhD, is a lead consultant clinical scientist and registered medical physics expert (MPE) in the RPA2000 record – UK. He is the head of Dosimetry and Imaging quality assurance service –radiotherapy physics - the United Lincolnshire Hospitals NHS Trust. He is the editor-in-chief of the Institute of Physics and Engineering in Medicine [IPEM] Report Series and the IPEM Rep to EFOMP. Since 2018, he has been an MPE reviewer at the Health Research Authority (HRA), where he reviews and approves ionising radiation exposure for research and clinical trials. He joined the UK Accreditation Service (UKAS) technical evaluation team for BS70000 in 2018. Since 2022, he has been a Care Quality Commission (CQC) Specialist Advisor – radiotherapy.

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To contact the Committee, send an email to pubcommittee@efomp.org.

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EFOMP President's Message

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

Figure 1. Statue of St. Brigid, Co. Kildare Ireland, Photograph Tom mc Cutcheon, www.kildareheritage.com

Dear Medical physics friends and colleagues

Now we have broken the back of winter and can look forward to rejuvenation and growth in medical physics in the ongoing post-pandemic period.

We have already had a busy first quarter in EFOMP. I have been privileged to hold leadership meetings in person with four national member organizations (NMOS): Slovakia, Albania, the Czech Republic, and Belgium. During these meetings, common themes emerged, including the difficulty in translating the requirements for RP 174 and the common training platform for medical physicists to state-recognized schemes (Regulated Profession Database (europa.eu), and recognition of the medical physicist as a healthcare worker, and funding models for medical physicist training and CPD. Another theme that has been raised is the low number of diagnostic medical physicists per head of population in some of the countries. In some countries, the completion of quality assurance of radiological equipment (sometimes by persons qualified as medical physics expects sometimes by persons who are not!) is regarded as meeting the needs of the patient and compliance with the BSS directive. This can be particularly true for non-hospital-based quality control or medical physics services.

According to the recent WG policy statement 17 on the role of the equipment life cycle, such as procurement optimization and training, medical physicists play a much bigger role in making sure planned treatments and diagnoses are safe and effective. There were some concerns over the use of the title "medical physics professional" in this statement, but this was not intended to compete with or undermine the medical physics expert definition but rather show that physics roles can extend beyond ionizing radiation. The term is also consistent with those used in earlier policy statements.

To make our voices heard, we need evidence-based data that regulators and professional bodies can use to advance physics-based healthcare. Our busy projects committee has worked tirelessly to establish us as a partner on many projects, looking at the implementation and training requirements. These surveys are very important in looking at differences in requirements and implementation and will serve as drivers for addressing the training, qualifications, and funding issues above. So, we express gratitude to those who help with these surveys that allow our voice to be heard. These surveys will also feed into our mobility and identity projects to gain mutual recognition of medical physics experts in the European economic area. The combination of professional training, education, science, and relationships with other bodies involved in physics-based health care is an area where EFOMP can deliver improvements. I have been impressed at the level to which different societies incorporate these combined themes into their agendas. For instance, the Belgian hospital physicist association has become a union, which has improved consultation with their health services and regulators.

Of course, the key pillars of EFOMP are to communicate, integrate, and educate. The recently run ESMPE CT school in Prague made this concept very clear, offering online and in presence teaching with an excellent faculty. Of course, nothing beats being there, but the hybrid option can offer a lower cost to people without having to travel. These offerings will be further enhanced by the educational platform initiative from education and training, which is in progress. Access to benefits from EFOMP for all of the National Member Organisations of the Federation is key to our four corners (North, South, East, and West) of the EFOMP philosophy.

In Ireland, we recently celebrated a new public holiday to acknowledge the contribution of health care workers and our first female saint, Brigid, who some say predated Christianity. The legend of St. Brigid is that in 470 AD, the king was dismissive of her appeal to give her land for a new monastery. She said she would accept a field the size of her small cloak. She took off her cloak, and she instructed her four followers to hold a corner each and keep walking until the cloak stopped them. The magic cloak grew from each corner, making a fine monastery and many acres of land, which still host a church and round tower to this day.

We are delighted to welcome Luxembourg into the fabric of EFOMP. On the theme of the magic cloak and our four corners policy, we are pleased that we will be supporting the regional NMO organization of Alpe Adria at our EFOMP council meeting in Novi Sad, Serbia, in the autumn. So, enjoy reading about the activities of EFOMP members and company members in this newsletter edition, and thanks to all the volunteers who make our Federation deliver physics-based health care benefits to patients and staff in Europe. Remember, once we are members of an EFOMP NMO, we are members of EFOMP too.

Le gach dea-ghuí

With very best wishes

Assoc. Prof. Paddy Gilligan, President of EFOMP.

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EFOMP Secretary General's Report

In this article, the general secretary of the EFOMP, **Efi Koutsouveli**, provides an update on the institutional matters of our organization during the last three months (December 2022 - February 2023).

Governing committee (2024 - 2026 term of office) - European School for Medical Physics Experts scientific committee (2023 - 2025 term of office)

After a successful electronic ballot that ended on December 20, 2022, Itembu Lannes (Sweden) was elected as vice chair of EFOMP's Professional Matters Committee (Fig. 1). We acknowledge the commitment of those who put their names forward for this position.

Fig. 1. Itembu Lannes: Vice chair of Professional Matters.

The position of Vice Chair of the European and International Matters Committee opened for nominations this year. Nominations were received in February 2023, and an electronic postal ballot is ongoing.

Three positions in the scientific committee of the European School for Medical Physics Experts are open for election in 2023. Elected members will take office in May 2023. Nominations should be sent by **17rd of March 2023** to secretary@efomp.org.
Nomination calls are posted on the EFOMP website.
https://www.efomp.org/index.php?r=news/view&id=311

EFOMP Committees, new committee members and roles

We are welcoming Sonja Wegener (Germany) as a new member of the Communications & Publications committee, Eduard Gershkevitsh (Estonia) and Lotta Lundgren (Sweden) new members of the European & International Matters committee, Marta Anguiano (Spain) new member of the Projects committee and Christina Zacharatou (Ireland) new member of the Science committee. (Fig 2).

Fig 2. Nominated colleagues by the National Member Organizations of EFOMP. Sonja Wegener on the left, Eduard Gershkevitsh, Lotta Lundgren, Marta Anguiano and Christina Zacharatou on the right.

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

EFOMP Working Groups (WGs)

The members of the Working Group entitled "EFOMP Policy Statement 17 - The Role and Competences of Medical Physicists and Medical Physics Experts in the Different Stages of a Medical Device Life Cycle" chaired by Wim van Asten (Netherlands), presented the final draft of Policy Statement PS 17 in November 2022. The PS17 has been through a consultation phase and a postal ballot by all National Member Organisations. We received votes from 56% of the delegates. The Policy Statement was approved by a majority of valid votes. The PS will be published in the European Journal of Medical Physics.

The members of the Working Group entitled "EFOMP Policy Statement 18 - Medical Physics Education for the non-physics Healthcare Professions," chaired by Carmel Caruana (Malta) presented the draft Policy Statement 18, which has been under consultation since January 2023. A postal ballot will be launched in March 2023.

Name	Role	NMO
Petro Julkunen	Chair	Finland
Panagiotis Bamidis	Member	Greece
Carmel J. Caruana	Member	Malta
Jessica Fitzpatrick	Member	Ireland
Alexei Katashev	Member	Lithuania
Tiina Laitinen	Member	Finland
Torsten Rahne	Member	Germany
Onur Sander	Member	Netherlands

Name	Role	NMO
Adam Adamopoulos	Consultant	Greece
Ciarán Finucane	Consultant	Ireland
Constantinos Koutsojannis	Consultant	Greece
Jan de Laat	Consultant	Netherlands
Ad Maas	Consultant	Netherlands
Michiel Sinaasappel	Consultant	Netherlands
Cristina Simoes-Franklin	Consultant	Ireland
Bert van Zanten	Consultant	Netherlands

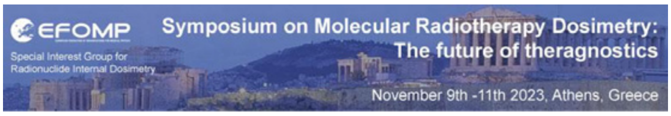
Fig. 3 Chair, members, and consultants of WG-PS20

A new Working Group entitled “EFOMP Policy Statement 20 - Physiological Measurements and Medical Physicists” was formed in January 2023. The WG will operate under the Professional Matters Committee and the chair, members and consultants are presented below (Fig. 3)

EFOMP Special Interest Groups (SIGs)

The Radionuclide Dosimetry SIG is organizing a symposium on molecular radiotherapy dosimetry in Athens, Greece. Website: https://smrd2023.efomp.org/

Registration and abstract submission are now available. Young professionals can apply for ENEN++ and PIANOFORTE grants. Website: https://www.efomp.org/index.php?r=pages&id=enen-pianoforte-grants-young-professionals



Moreover, in 2023, there will be a series of scientific and educational webinars that will be open to anyone who wants to attend. Webinars subpage: https://www.efomp.org/index.php?r=pages&id=webinars-2023

The Dental Imaging SIG is open to members, with the following expected outcomes:

- Revise and specify the Medical Physicist's role in dentistry and evaluate current practice of QA/QC/DRLs in CBCT and shielding in dentistry.
- Discuss and, where relevant, prepare statements regarding the uptake of new technologies e.g., AI tools, dental MRI.
- Evaluate Medical Physics involvement in dental undergraduate and postgraduate curricula.

Website:
https://www.efomp.org/index.php?r=news/view&id=300

Projects - Quadrant

The European Commission has now published the Recommendations and Guidance document on Current Status and Recommendations for Improving Uptake and Implementation of Clinical Audit of Medical Radiological Procedures as part of their Radiation Protection Series (No. 198) and it is available on their website.

Implementation of the Medical Device Regulation

On the EFOMP website, you can find a letter from the Council of the EU with respect to the implementation of the Medical Device Regulation. The Commission has listened to the concerns expressed by the Member States, and it has considered an extension of the translational period depending on the risk class of devices. Those deadlines could be 2027 for class III and class IIb devices (i.e., devices with a higher risk) and 2028 for class IIa and class I devices (i.e., devices with a lower risk) that need the involvement of a notified body in the conformity assessment.
More information here: https://www.efomp.org/index.php?r=news/view&id=308

EFOMP Meetings
Spring Officers Meeting 2023 in Reykjavik

Our Spring officers meeting will take place in Reykjavik, Iceland, on the 31st of March 2023, hosted by the Norwegian and Danish Association of Medical Physics during the Nordic Association of Clinical Physics Symposium “New technologies from bench to bedside." This year, NACP's triennial conference is organized in collaboration with the Icelandic Society of Medical Physics.

Autumn Officers Meeting & Annual Council 2023 in Novi Sad

Our annual council will take place in Novi Sad, Serbia, on October 21, 2023, hosted by the Serbian Association of Medical Physicists.

It will be held together with the 11th Alpe Adria Medical Physics Meeting and one day of EFOMP School. These meetings are organized biannually in cooperation with the Medical Physics Societies of Austria, Bosnia and Herzegovina, Croatia, Italy, Hungary, North Macedonia, Serbia, Slovenia, and Slovakia.

Efi Koutsouveli works as a Medical Physics, Radiation Protection Expert and Laser Safety Officer 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 EFOMP’s Secretary General & Vice President. In 2019, she received the IOMP-IDMP award for promoting medical physics to a larger audience. Email: secretary@efomp.org

EFOMP COMPANY MEMBER ARTICLE

GE HealthCare: AIR™ Recon DL PROPELLER for Motion-insensitive and Distortion-free Imaging

Unlike standard DICOM image filters, AIR™ Recon DL removes image noise and truncation or ringing artefacts from raw data. Following scanning, the user can select an SNR enhancement and generate images at the MR console.

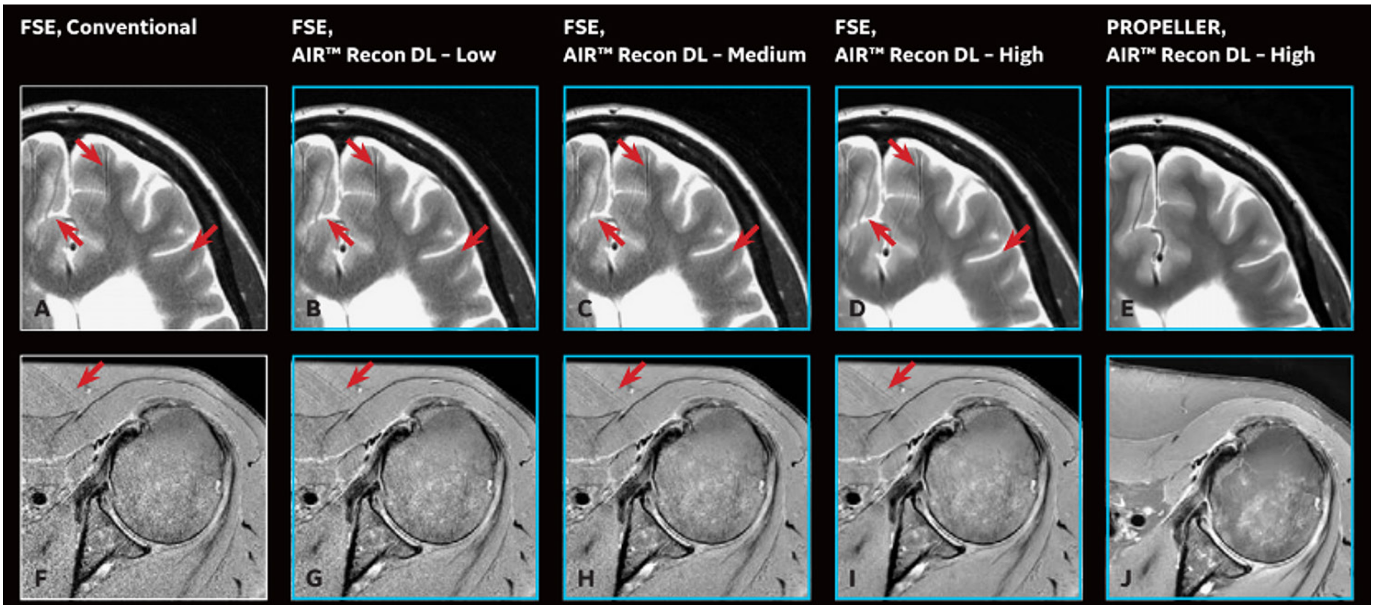
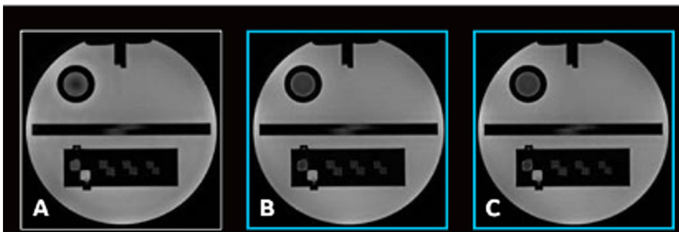


Figure 1. Representative FSE and PROPELLER images in the brain and shoulder in the presence of motion. (A, F) Cartesian 2D FSE shows evident motion artifacts, which become increasingly conspicuous with AIR™ Recon DL (B-D, G-I) with Low, Medium and High settings. No motion artifacts are observed with 2D PROPELLER (E, J). Images A-D and F-I were reconstructed with the same raw data.



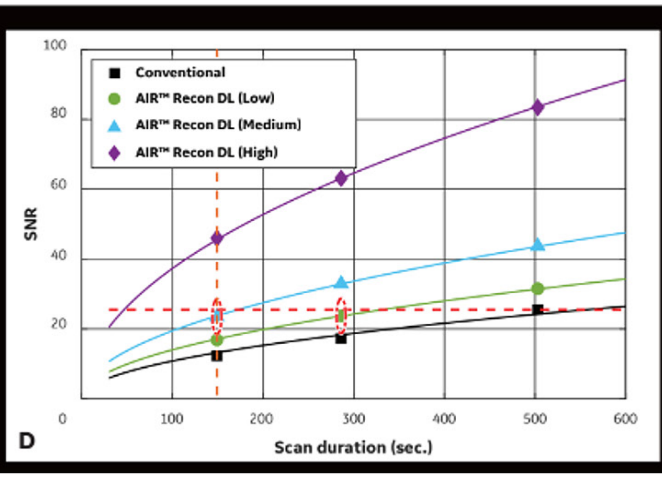


Figure 2. PROPELLER phantom image showing SNR as a function of scan time. Shown are (A) conventional reconstruction with a 503 sec. scan time, (B) AIR™ Recon DL Low reconstruction with a 286 sec. scan time, and (C) AIR™ Recon DL Medium reconstruction of a 149 sec scan time, all showing equivalent SNR. (D) The SNR of the four different reconstruction methods with varying scan times. The red horizontal dashed line indicates the SNR level of the image that was acquired in 503 seconds and reconstructed with a conventional reconstruction method.

AIR™ Recon DL is a commercially available, deep-learning-based MR imaging reconstruction that delivers higher SNR and sharper images while enabling shorter scan times. AIR™ Recon DL is available for all anatomies and supports most 2D and 3D Cartesian acquisitions of k-space with and without partial Fourier and parallel-imaging acceleration. Unlike conventional DICOM image filters, AIR™ Recon DL improves image quality at the foundational level by making use of raw data to remove image noise and truncation or ringing artifacts. It also allows the user to set a preferred level of SNR improvement and generate images directly at the MR console on scan completion. The clinical benefits of AIR™ Recon DL have been extensively described and evaluated.

AIR™ Recon DL for PROPELLER

AIR™ Recon DL is now US FDA approved for use with 2D PROPELLER (Periodically Rotated Overlapping Parallel Lines with Enhanced Reconstruction). In this article, we focus on the clinical benefits of AIR™ Recon DL with PROPELLER, where SNR, in-plane resolution, and scan time are often considered the primary competing factors.GE Healthcare's 2D PROPELLER application is a radial (non-Cartesian) FSE-like acquisition technique that can deliver all of the same contrasts and weightings as 2D FSE, including T1-, T2- and PD-weighted imaging. Rather than filling k-space line by line, it completes the k-space acquisition through rotated FSE echo trains, so-called "blades," acquired at a particular kx/ky angle. The result is a motion-insensitive acquisition that has proven successful in applications that are prone to motion, such as the shoulder and abdomen. In addition, PROPELLER supports DWI, which produces the least amount of distortion compared to other methods such as EPI.

SNR, spatial resolution and scan time

In the context of 2D FSE, the most common ways to reduce PROPELLER scan times are to reduce the number of signal averages (NEX) and increase the parallel-imaging (ARC) acceleration factors. But, these changes come at the expense of SNR. Generally, the SNR of an MR image varies with the square root of scan time, so a reduction of scan time by a factor of 2 leads to a reduction in SNR of approximately 1.4.

Figure 2 describes the SNR of PROPELLER as a function of scan time as measured in a phantom. In Figure 2D, we see how the measured SNR varies with the expected square root behavior with conventional and the Low, Medium and High settings of AIR™ Recon DL. In this example, the conventional image acquired in 503 seconds (Figure 2A) has an equivalent SNR to the images reconstructed with AIR™ Recon DL Low (286 seconds) and Medium (149 seconds). From the chart in Figure 2D, we might extrapolate to assert that an equivalent SNR could be attained with AIR™ Recon DL High in approximately 50 seconds, thus representing an approximate 10-fold reduction in scan time compared to the conventional-reconstructed image.

In addition, the results in Figure 2D demonstrate that, with a fixed scan time, SNR is significantly improved with AIR™ Recon DL, increasing by an approximate factor of 4, when compared to conventional reconstruction with AIR™ Recon DL High.

References:

Discover how AIR™ Recon DL PROPELLER works in the full article here
https://signapulse.gehealthcare.com/air-recon-dl-propeller-for-motion-insensitiv-ga1g9

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Robert D. Peters, PhD, Global Product Marketing Director

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Yuko Snow, Global Product Marketing Director

MEDICAL PHYSICS EDUCATION

Meet the Profs: An Interview with the Medical Physics Professor Andrew Reilly

In the fourth article in this series, EMP News's Educational Advisor **Danielle Dobbe-Kalkman** has conducted an interview with one of the most renowned medical physicists and academics in the UK: **Professor Andrew Reilly**, The Scientific Director of the Department of Clinical Physics and Bioengineering (DCPB) at NHS Greater Glasgow & Clyde, Scotland.

Professor Andrew Reilly.

Professor Andrew Reilly is Scientific Director of the Department of Clinical Physics and Bioengineering (DCPB) at NHS Greater Glasgow and Clyde, Scotland. Throughout his career, he has supported the clinical use and development of radiotherapy imaging technologies and worked towards improved systems integration. He is the founder of the IQWorks project, co-led the Radiotherapy Imaging User Group, and provides physics support under the national NRIG mentoring programme for IGRT implementation. Andrew served as Chair of the BIR Radiation Physics and Dosimetry Committee until 2009, was a member of the BIR Council from 2010 to 2013, represented the BIR on the DH Medical Physics Expert Working Group, was the inaugural chair of the BIR Informatics and Clinical Intelligence special interest group, and is currently director of the IPEM Science, Technology, and Engineering Research and Innovation Council (STERIC).

He has a particular interest in bridging the gap between different imaging disciplines and optimizing imaging across the radiotherapy process.

DD: Can you tell me something about that aim and how you've been working towards the goal of bridging the gap between different imaging modalities and radiotherapy?

AR: There are two aspects to this. One is that, certainly in the UK, because of the way our medical physicist training was organized, an individual would do some generic training and then we'd train specifically to be a radiotherapy physicist or end up working in imaging. As a result, there was quite a significant divide between these two communities about ten years ago. And when new imaging modalities were beginning to be implemented and become available in radiotherapy, we found that everyone would be very excited about welcoming the new modality, but they would treat it as if they were the first ones ever to be implementing it rather than as if it had already been implemented in diagnostic imaging. So, some of this is about joining up the different perspectives to encourage different teams to work together.

Moreover, when the legislation changed back in 2017 and the new role of the medical physics expert was really recognized across Europe, it very much encouraged people to work more closely together and respect each other's relative expertise. In addition, that is something I have been trying to do in my own department.

There was also recognition through EFOMP that to do the job properly, you needed to have specific skills in each area or experience in each distinct area, and this encouraged people to work together. So in radiotherapy, the involvement of the diagnostic medical physics expert was welcomed. We generally see much better collaboration now.

The reason I got into all this was because when I started out, I was trained as an imaging physicist. Then my first job was in radiotherapy because that was where the jobs were. I ended up being an imaging physicist in radiotherapy, but then essentially retrained to become a radiotherapy physicist. This always made me remember that there were different perspectives. Moreover, you couldn't reconcile the two perspectives to begin with, because communities viewed things very, very differently. So that's where bridging the gap came in as an idea in trying to encourage people to work together because I could see both sides.

Then the other aspect of it was a project I did for my PhD. We were looking at all the imaging modalities that were available in radiotherapy and thinking: "Why is it that in CT scanning resolution we do it one way, but in our megavoltage planar imaging we do it in a completely different way?" And what I was finding was that each specialty practically implemented the same science in slightly different ways, so we would have different standards in different areas. For example, how you look at resolution in an MRI scanner versus a CT scanner is different. So, part of it is about thinking: "OK, we're all working with the same science. Yes, we might have different clinical endpoints, but is there a way we can use the same metrics across different imaging modalities?" We've really made some progress there. I think there's a lot more progress still to be made. And I think it really surprised me how embedded the historically accepted techniques are within the different specialties.

DD: Have you also found out that both communities also complement each other and learn from each other in such a way that having these different views is enriching?

AR: Yes, absolutely. I think when people come together and they've got different approaches and they discuss why they're different, usually they go away having learned something, and either understanding the depth of their practice a little bit better or thinking about how the practice might evolve. So yes, I have seen that, and the analogy I would give would be in the medical community. There's encouragement when thinking about a patient pathway for the doctors from all the different specialties to speak with each other and debate, and they all have their own opinion about what they think is right. But actually, together, they come up with a more informed set of options for the patient, and I think it's the same for us. If we all speak to each other and are open to how the techniques might refine, then we usually come up with a better solution.

DD: Do you think it's also important to learn together with and from different professions in the field outside of medical physics?

AR: Yes, and I think this is an area where we actually struggle. It's really important for medical physicists to understand what doctors see, what they're trying to achieve, and how they've been trained. And radiographers as well. In my last job, I was involved in setting up a cancer center, and I remember that what the radiographers are expecting in terms of certainty is quite different from what the physicists think is acceptable. But if you don't realize that, you can make people very afraid and uncertain. So being able to work with others as part of learning is helpful because it helps your communication and teaches you to respect what the strengths of other professions are.

In the UK, there was an exercise called 'Modernizing scientific careers'. It was maybe ten years ago or something like that. The idea was to bring scientist education in line with the model that was in place for medical education.

I also teach in one of the MC programs, and through that program, we have a cohort where there are medical physicists, engineers, and some informatics professionals and scientific computing professionals as well. The idea is they all learn together because, when they progress, they'll all be clinical scientists in the end, but they'll then know who to speak to, and they're already building the networks.

DD: Can you now tell me something about your own teaching experiences?

AR: I have been involved in teaching throughout my whole career, but I was lucky that when I used to work at one of the cancer centers and educational institutions that was linked with the University of Liverpool, which was one of the ones chosen to provide the master's course for the new modernizing scientific careers programme. I've developed that course over the years and tried to make it something that allows physicists to think about clinical computing through the lens of a medical physicist. So, for example, we cover topics like information governance, which might not seem exciting.

I got involved in the assessment process for our doctoral programme, and the national scheme for medical physics experts as well. In addition, that has been interesting because you see the difference in practice across different centers and actually across different parts of the UK as well, and you see some of the challenges around this subject. Being involved in this has allowed me, through assessing candidates, to make sure that in the training programs I'm involved with and also in my own department, we help junior staff prepare for the assessments better.

DD: What do you enjoy most about teaching?

AR: I enjoy the interaction with the students and hearing their own thoughts, particularly when they disagree with what you're telling them, because it allows you to explore the subject. They can then understand more deeply, and I learn as well.

I also very much enjoy it when you teach somebody something, and then you come back maybe six months later and you see them applying it in a way you didn't think possible or hadn't imagined. I think that's really powerful because it means that they've taken it on and taken it to the next stage.

DD: So it's actually helping people grow and develop themselves. That

is really rewarding.
AR: Yes, that's right.

DD: You just said that you enjoy the interaction with students a lot. Can you tell me how you do that? Because it does not always happen automatically or to everybody.

AR: Some cohorts are much more difficult to engage than others are, or so I find. But I try to take the material and present it in such a way that it opens up questions for them, so they are themselves questioning the material and trying to work out why it's relevant to them. And I don't want them to just absorb it; hopefully they will then actually agree or disagree with me. And that could be quite difficult to do. Sometimes I find it really good when a small number of people in the class are really are interested, and engaged, because then the whole class engages too. Occasionally, if you have somebody who really isn't enjoying it at all, they take the whole class down with them.

But yes, it's trying to give them opportunities to speak up and object. But it's also recognizing that not everybody will speak up as well, but they need to feel that they can. Sometimes group work and practical sessions help with that. Students tend to enjoy it and use it as an opportunity to ask additional questions that they maybe wanted to ask but didn't have another way to do so.

DD: I also think you try to give them opportunities to speak up, and this proves that you can create an atmosphere where they also feel safe and feel that they are allowed to speak up. Sometimes students might feel there is a huge distance between them and the professor. And I think that doesn't help.

AR: That's like a good point, actually. What I sometimes do is give them examples from my own experience. So I might say: "These are the rules here, and you know, you have to be careful because you might make this kind of mistake that I've made." It shows them that you are human and genuine, too, because sometimes they think of you as just a lecturer telling them all this. But if you can take it back to real life, they'll understand that they can really learn useful things, and you can tell them you've made mistakes because one of the things they've got to realize is that it's all right to make them.

DD: How do you think your students would describe you?

AR: I don't know. I think they would probably say I'm enthusiastic. Usually, they're quite positive. And hopefully they would describe me as receptive as well, because I do genuinely try to listen to feedback and respond to it.

DD: Can you perhaps share a teaching experience in your life that really stood out to you?

AR: I can give you two different examples. The first one was where the students had been set for an exercise in groups. And after they went away, they came back, and I saw that in what they presented back, they had taken into account what I taught them. And it was very clear they had genuinely approached the exercise wholeheartedly, and they brought back additional information. They did it properly, and it felt like they weren't just doing it to tick a box. I really enjoyed that because it made me realize that teaching is more than just telling the students what they need to learn; it's actually more of an experience where you're looking at your future peers and encouraging them to develop. And for yourself to realize that you're not so far away from them that you can't learn something yourself in this process.

The other thing that I found really valuable was during the process of reviewing the curricula for the different medical physics programs. There were representatives from the different student cohorts, and there was a family of courses that had been quite challenging for the students, and they were looking to try to remove some of the courses. When they were doing that, the course that I was doing, was within scope for one group of trainees to be removed. But when they were going through the courses, one of the representatives said: "Hold on a minute; that particular course we need to keep, because that's something we don't get anywhere else." And I thought that was really great because I didn't know that. You never get feedback like that from the students. So when they were thinking about future trainees, they wanted to preserve the course I would put together. And I thought that was really quite nice.

DD: That's very nice indeed. In your first example, I can imagine that sometimes it can feel like students just want to pass the exam and that is it, but when you see that, they are intrinsically motivated, and do the extra work, that is beautiful to see.

Do you have tips for other teachers or professors?

AR: Yes. I would suggest being mindful of the students and being open to them because some of them are paying a lot of money for the courses now. This is the first step in what they would like to be their career, and sometimes it's easy to forget that. We need to respect the students as much as you would like to be respected yourself as well. And also, be patient with them as part of that, but also be patient with yourself because sometimes when you're delivering material, the students aren't giving feedback. This is particularly the case now that we have a mix of online and in-person. Be patient with yourself as well, because sometimes you don't know until much later whether what you've done was valued and effective. Furthermore, it's important to realize that whatever feedback you get, whether positive or negative, you can learn from. And you mustn't take it personally. Finally, I would suggest being yourself. I think this is a key thing because sometimes you see material just being packaged in a way that is generally considered the right way to do it, but I believe the teacher's personality must come across as well. Otherwise, it just looks bland, and the students are not going to listen.

DD: Is there something maybe you want to share about teaching or that you think is interesting?

AR: It is important to be involved in more than one institution, because then you find out what different people are doing. I am an external examiner for a course and it is quite good to see what others do because you learn a lot about different educational practices. And I think as scientists we were not always trained in teaching, so you don't know what the different options are or what the current thinking is, so it's quite good to keep an open mind with it.

DD: Did you have any teaching training?

AR: Only very superficial. I was just thrown in and then learned over time what worked and what didn't work. I only had examples of what previous people had done, but now there is a course at my current institution, and we are benefiting from training from the university in what good practices are. It does not mean we have to change everything, but it allows us to challenge what we have previously put together and helps us understand why we have maybe had difficulties in certain areas that we want to focus on.

But I'd very much encourage junior staff to get involved with education and training because it's only by teaching that you can really test yourself on your understanding of the topic because when you get asked questions, you always have to be a step ahead. It really stimulates you, and I would encourage junior staff to not be afraid of it because they have more experience than they probably realize. It gives them confidence if they can go in and teach others and then realize that others are actually listening.

DD: It is true that when you are able to explain something to somebody else, it means that you understand and grasp it yourself, and teaching is an excellent way to learn about a topic. I do think it is really important to not be afraid of not knowing everything. Some people are scared that they do not know the answer if somebody asks a difficult question. However, I think it is ok to be yourself and to not know everything, and that is important to realize because you do not have to know everything in order to be seen as an expert.

AR: Yes. When that happens to me, we often then look it up together, because it is good for them to realize that you cannot be expected to know everything, and nobody does. It is totally acceptable to not know everything.

DD: Maybe, especially in a very scientific or challenging and competitive environment, they need to learn that it is ok to be vulnerable sometimes. So that's an important message, and a great solution is to look it up together and find the answer together!

AR: That point about people being able to be vulnerable is actually quite important. One of the things I've tried to introduce in my last job is training junior staff in a way that they learn that it's OK to fail and how to fail safely. Of course, these people are being trained in a clinical environment, so maybe they are doing measurements or something like that. It is important that they learn to make mistakes in such a way that they are not seen as personal failures and that they know what to do next. And to create an environment where there's no need to cover it up and share what you've done, because it happens to senior staff all the time.

DD: Yeah, because that's also where you learn. You learn from making mistakes, and if you're in an environment where people get scared to make mistakes, it's a very difficult environment to be creative or to try new things and to learn and evolve. If you can't experiment and can't learn from mistakes, then there's no progress. So it's an important thing!

Thank you so much for your valuable insights!

AR: Thank you.

Danielle Dobbe-Kalkman is an educational advisor at the Radboud University Medical Centre, and the eeducational 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.

Art to Challenge and Inspire: Images and Reflections for Medical Physics (7)

Professor **Jim Malone** and **Fran Hegarty** write about the experiences and challenges of creating a visual arts event for ECMP 2022, a major medical physics and engineering congress.

Introduction

Medical Physicists and the clinicians they support spend a lot of time with images. From them, they derive much that could not be revealed by the unformatted raw data. Incorporating a visual art presence into a major medical physics congress could be a real opportunity to connect the artworks and the content/practice of medical physics. There are many aspects to this, but, for example, it would help breach boundaries that are essential to the day-to-day functioning of professional life (e.g., rigid adherence to protocols or evidence-based approaches). Although these are essential, they can inhibit creativity and imagination. After all, Einstein observed that *"I am enough of an artist to draw freely upon my imagination. Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world."* The visual arts, music, poetry, and literature provide a bridge. They free the imagination and are essential to opening us to possibilities beyond the empirical. Some would argue that they are essential for personal development for physicists and engineers in medicine [1].

A Visual Art Experience for ECMP

In consultation with the President of EFOMP over an 18-month period, the authors considered several options that could provide a presence for the visual arts in the ECMP 2022 in Dublin. This was also discussed with the Robert Boyle Foundation, a registered charity committed to interdisciplinary and multidisciplinary interventions and sympathetic to funding such an event.

Initial discussions centered on a dedicated session of invited papers. In addition, a walkthrough artwork display at a suitable location within the congress venue was considered. Unfortunately, both ideas were eventually dropped, the first possibly because of uncertainty about the viability of the invited session. It was possible or even probable that a session might not be attractive to the programme committee, although Physica Medica had carried an extended review paper on the area [1]. The idea of a walkthrough gallery like display also failed, but for more practical reasons (below).

Problems and Solutions: Walkthrough 'Gallery' Display and Installation

The authors felt it would be valuable to break away from the presenter/ audience format with a view to enhancing more open discussion. A planned walkthrough display of artworks could facilitate it. An apparently suitable, well-lit, high-ceilinged area was identified on the floor above the main exhibition and lecture theaters. Participants would be invited to view the works at any time, but on a few occasions during the lunch break, guided walking tours would be organized. These would provide a jumping off point for discussion relating the images to the context and content of medical physics.

The possibility of having some original works was considered but quickly rejected due to insurance and security considerations. Instead, the authors adopted a display norm of large, high quality well mounted prints. A selection of > 20 relevant art works was curated, and each could be directly and dramatically related to medical physics and/or its practitioners.

So, what happened?

Large, printed works failed on cost and quality grounds. The space was remote from the rest of the congress, and there was insufficient room for a good presentation of the images unimpeded by preexisting artworks (which could not be moved), doors, other openings, fire extinguishers, etc. There were also issues with how to mount images/ installations safely and securely and make good on any damage

To address this, the proposal was modified to involve several unused rooms with 4K displays that were available nearby. These would allow presentation of high-quality images and retention of the walking element by going from room to room. In addition, an installation was designed and built to unobtrusively project some of the images onto a screen that appeared to be floating in midair in the corridor.

Eventually, this also failed, partially due to image quality issues with the 4K displays. But there were also problems with the floating display, which had been designed and tested in situ. In the opinion of many, it was likely to be the most memorable part of the event. It required permissions/ support for minor work in the building that was not forthcoming. On the days immediately before the congress, these issues were compounded upon learning that the events had been omitted from the published and online congress programs.

The failure to achieve a new format had numerous interlocking causes that are worth noting for the future without attributing blame in any direction. Perhaps the intervention had aspired to do too much, i.e., to introduce the visual arts, a completely new topic, and to use a new form of presentation that, for practical purposes, aspired to be a temporary art exhibition. Either, on its own, would be a challenge. But both overwhelmed a system that was already stretched to capacity. Perhaps we (the authors) failed to appreciate the constraints on the organizers.

Many of the difficulties can readily be identified, and awareness of them could help in the future. There were ongoing problems/ misunderstandings with the venue, the local organizers, and the congress organizing company. This was at variance with the apparently solid support from EFOMP. With the benefit of hindsight, most of the problems probably arose from the novelty of the topic and the approach, and because we had not been through the usual processes of abstract submission etc.

Discussions with the company and venue tended to start from their assumption that this was an independent activity, possibly part of the commercial exhibition, or a social event that might carry an admission charge. The authors, on the other hand, assumed they were contributing to bringing the humanities into focus in the scientific programme. Examples of the kinds of misunderstandings that arose include being told we had to pay separately for the rooms we used as though they were outside the conference. Also, we were advised by the venue that the art event would require a separate insurance policy and that facilities could not be allocated without one.

The problems were resolved by EFOMP on the day before the event, but by then it was too late to mount the floating display. We were disappointed to have to revert to using a PowerPoint presentation to a static audience but were surprised and pleased by an exceptionally warm response. Despite the challenges, the authors were resilient and committed to providing a strong experiential event. However, it is worth noting that even if the alternative option had succeeded, there is a possibility (from experience of small perturbations introduced during the presentations) that it might have been resisted by the audience. Finally, it is worth noting that a month later, a single track related Scientific Symposium devoted its final session to art-based presentations. It was probably the most popular session in the symposium [2].

Concluding observations

Given all the difficulties, the event(s) were surprisingly well attended, attracting about 7% of those who registered. While the aspiration to have a radically different type of event on a novel topic failed spectacularly, the event that occurred was generally regarded as spectacularly successful. It was worthwhile, well received, and confirmed that such sessions have a place in large conferences, and are likely to be appreciated. Our experience would be helpful to those trying to plan something similar. Good communication and the use of due process at all levels are essential and cannot be overlooked. On a different note, it is rewarding to see that the AAPM will hold a similar session at its annual meeting in Houston this year (2023) and that its conference motto is "The Art of Science. The Science of Care."

We are grateful to EFOMP President Paddy Gilligan for his unwavering support and encouragement, to the MPEC conference committees, and to ABBEY conference/ event organizers for their help even when much communication and patience were required.

1. Malone J. 2022. Reflections and images: A place for art in medical physics? Physica Medica. 2022. 98:63-79. DOI: 10.1016/j.ejmp.2022.04.004 See: https://www.physicamedica.com/article/S1120-1797(22)01960-3/pdf (Link is slow. Paper is also available at JM's ResearchGate page).

2. International Symposium on Ethics and Environmental Health (largely devoted to radiation issues) 2022. Budweis, Czech Republic. Last session devoted to art expression of legacy communication and caring; aiding understanding and communication of ethics in medical radiation protection, and exploring social and ethical issues in radiological sciences.

Figures 1&2. The floating display was temporarily mounted at the end of a corridor, and some participants were keen to closely examine the imaging.

Figure 3. Some participants relax during the presentation.

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 the 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 to the left is a study for a portrait, pencil on card, by Desmond Hickey (gifted by the artist).

Fran Hegarty is the Chief Medical Physicist in Children's Health Ireland. His areas of interest are Clinical Measurement, Clinical Engineering and Informatics. Fran is also an accomplished musician and has been known to bring creative processes to bear when solving engineering or process problems in Healthcare.

EFOMP COMPANY MEMBER ARTICLE

ACCURAY

Accuray: Advanced Radiosurgical Planning Features on the CyberKnife® System

The latest software enhancements of the Accuray Precision® Treatment Planning and iDMS® Data Management Systems are an important step forward in the evolution of the CyberKnife platform as it expands its capabilities to meet the needs of the neurosurgical community.

The CyberKnife® S7TM System is a robotic, non-invasive radiation therapy device that offers highly precise treatment for cancerous and benign tumors throughout the body, as well as functional neurologic disorders. It is routinely used to treat conditions in the brain while helping minimize the dose to brain tissues involved in important functions such as hearing and vision, as shown in Figure 1 [1]. The CyberKnife System combines state-of-the-art robotic architecture with fully integrated image guidance and continual delivery adaptation and motion synchronization, enabling the delivery of stereotactic radiosurgery with sub-millimeter precision and accuracy.

Since the introduction of the first commercially available model, the CyberKnife System has experienced significant technological advancements and software upgrades that have improved its targeting and tracking accuracy, optimized treatment planning, enhanced dose calculation accuracy, and expanded the applicability of CyberKnife treatments to lesions throughout the body. The latest release of the Accuray Precision® Treatment Planning and iDMS® Data Management Systems introduced significant software enhancements to provide seamless image transfer and advanced radiosurgical planning features. This is an important step forward in the evolution of the CyberKnife platform, as it expands its capabilities to meet the needs of the neurosurgical community.

To support functional targets in the brain, advanced imaging capabilities such as standard atlas definition were introduced. A 3-dimensional coordinate system of the human brain, also known as Talairach stereotactic space, is widely used for facilitating functional target identification. This Talairach coordinate system, which is defined by a line passing through the superior edge of the anterior commissure (AC) and the inferior edge of the posterior commissure (PC) [2], is now being included in the Accuray Precision® v3.4 release (Figure 2). In functional brain imaging, the AC-PC plane and the Talairach atlas are used to map the location of brain structures regardless of individual variations in the size and overall shape of the brain. The use of such stereotactic space allows clinicians to identify the proper target location for thalamotomy [3], and this is now an available tool in the Accuray Precision® Treatment Planning System.

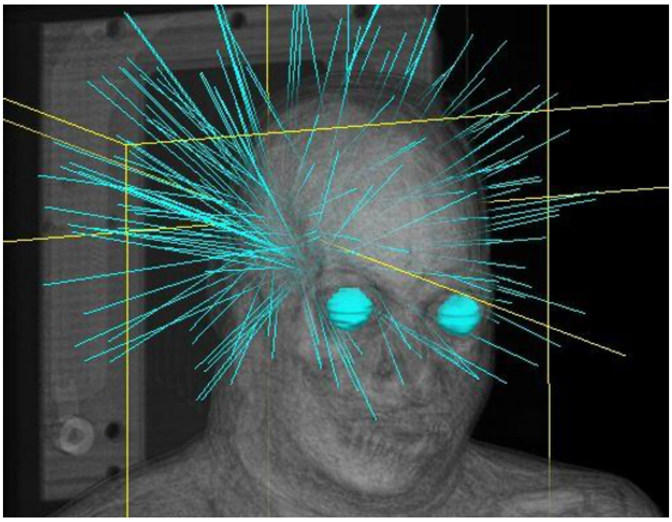

Figure 1. Example of the CyberKnife highly non-coplanar and non-isocentric approach. The figure illustrates a 3D view of the 172 beams in light blue for a case with 4 brain metastases. The spared eyes can be seen as well.

Figure 2. The Tailarch stereotactic space, Anterior-Posterior Commissure (AC-PC) referenced, is supported as from the Accuray Precision® v3.4 release.

Apart from the addition of the tools for facilitating functional radiosurgery, there are several other improvements in the recent Accuray Precision® release.

The planning workflow for multiple brain metastasis has been greatly simplified thanks to a new method which allows users to group metastases together, hence permitting different prescription dose levels (called dose intent) in the same plan, and more efficient optimization tools like improved collimator dialog messaging and targeting approach when Iris™ or fixed collimators are utilized, and easier achievement of steeper dose fall-off outside the lesions.

The gradient index (GI), defined as the ratio of the volume which receives 50% of the prescription isodose divided by the volume of the prescription isodose. This has been added as a new target coverage metric to the dose statistics table, for facilitating the plan review and assessment for the physicians. The conformality index (CI), defined as the ratio of Volume of the prescription dose compared to the volume of the tumor covered by such prescription dose of the volume, is now calculated for each target individually.

The new VOLO® Snapshots feature allows users to capture the optimization state of a plan at a point in time so that it is possible to restore it later for comparison purposes or to backtrack on changes to a plan. The user can compare dose statistics, estimated treatment time and DVH information between the snapshots. This feature was already available in the past for Radixact optimization and it has been proven to be very useful for the planners. Its availability has been extended also for the optimization of the CyberKnife System.

These neuro features implemented in the 3.4 version of Accuray Precision® and iDMS® are currently being installed at select sites throughout the Americas and extended European regions. We have already received incredibly great customer feedback.

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Francesco P. La Torre is the CyberKnife Product Manager EIMEA at Accuray. He has over 15 years of experience in radiation physics and scientific project management across the medical device industry and at research centers such as CERN - European Organization for Nuclear Research in Geneva. Francesco has an MSc in Nuclear Physics, a MAS in Nuclear and Ionizing Radiation Technologies, and a Ph.D. in Applied Physics.

Raffaele Meroni is the Clinical Training & Support Team Leader as Accuray, performing customers training on the CyberKnife system. He has 20+ years' experience in radiosurgery having had the privilege to cooperate with the first European sites who were the pioneers in the adoption of the CyberKnife System in the European region. Raffaele is graduated in Biomedical Engineering from Polytechnic University of Milano, Italy.

The Aurora Project: Cancer and Its Treatment From the Inside Through Comic Strips: PART II

This is the latest comic strip from the Czech **Republic's Aurora** Team, aimed at educating the public about cancer and its treatment from the inside in a highly original way.

Each of us should realise that a cancer cell is actually our own cell that just lost control over itself. In the first part of the comic, we showed that the cell was damaged after being hit by a damaging factor and then felt different. Of course, this is a simplification. A single mutation (permanent change on the DNA chain) usually does not lead to the formation of a cancer cell. It takes several mutations in the "right places" to turn a normal cell into a cancer cell.

As mentioned in the last comic strip, in more than 99.9% of cases of damage, the cell will be repaired, and no problem will occur. If it is not repaired, there is a high probability that the cell will undergo apoptosis (cell suicide), and the problem will not occur again. However, it is possible that everything fails and, after several mutations, a normal cell transforms into a cancerous one.

In this comic, the cell claims to have gained special powers and is now immortal. This is one of the characteristics of cancer cells. These cells are capable of multiplying indefinitely; they produce their own signals that lead them to further reproduction; they ignore commands to self-destruct; they can reach other surrounding and distant organs; and they can also "manage" other cells to their advantage.

Aurora is a project of the Prague section of the European Physical Society (EPS) Young Minds. The main aim of Aurora is to spread knowledge about ionising radiation in general, ionising 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 three people who create stories for the comics, consult with the painters, and translate texts: Barbora Dršková, Petra Osmančíková, and Anna Jelínek Michaelidesová. Anna is also the coordinator and the person in charge of the whole project.

The Aurora team are:

Marketa Hurychova studied Medical Physics at the Czech Technical University in Prague, gaining an MSc degree in 2019. She worked at the Department of Medical Physics at Hospital Na Homolce from 2018, at the Department of Radiation Dosimetry Nuclear Physics Institute of the Czech Academy of Sciences from 2019 and since 2020 she has worked at the Department of Medical Physics at Motol University Hospital.

Barbora Drskova finished her Medical Physics Masters programme at the Czech Technical University in Prague, Faculty of Nuclear Sciences and Physical Engineering in 2019. Since then, she has been working on her PhD. She works as a medical physicist in radiotherapy at General University Hospital in Prague and University Hospital Královské Vinohrady.

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

Anezka Kabatova has been studying Experimental Nuclear and Particle Physics at the Czech Technical University in Prague since 2015. After receiving her MSc degree, she plans to start a PhD in Astronomy. 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.

Petra Osmancikova graduated from the CTU and holds an M.Sc. and a Ph.D. degree in Medical Physics. She is a clinical medical physicist in radiotherapy in Motol University Hospital in Prague.

Anna Michaelidesova received her MSc and PhD degrees in Medical Physics from the Faculty of Nuclear Physics and Physical Engineering of the Czech Technical University in Prague. She worked as a researcher at the Nuclear Physics Institute of the Czech Academy of Sciences from 2010 to mid 2019. In the period 2012-2017, she was employed as a medical physicist at the Czech Proton Therapy Center. From 2018 to mid 2019, she also worked as a researcher at the Faculty of Nuclear Physics and Physical Engineering of the Czech Technical University in Prague. Since June 2019, she has been 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 leadership committees of the Prague section of EPS Young Minds and of the IRPA YGN since 2019.

WHAT MEDICAL PHYSICISTS DO IN THEIR FREE TIME

Science Fiction Writing

In this article, **Katryna Vella** exhibits the talent that she possesses as a science fiction writer by outlining the history of the genre as well as its future

The granddaughter's clock struck one, and I was lying in bed staring at the ceiling, darkness infiltrating through the window. It had been a chaotic day, and I longed for a good night's sleep. I heard the minutes tick by… then the voice of a girl cutting through the still air. It was a distinct, urgent voice - but a voice I couldn't recognize. I got up and ran towards the window, but the street was deserted. I checked on my family, but everyone was sleeping soundly. Shrugging, I dragged my feet back to my room and tried to sleep. A few minutes later, the same voice perked my ears, this time louder and more urgent. I sat up and shook my head. I must be going crazy! Then, I heard it again – now screaming in my head. The words struck me with such force that my vision starred into blinding white light; dizzy, I felt sudden ringing in my ears.

I sat at the desk, powered on my laptop, and typed the words I heard. "Please get me out of here!" And suddenly, the chaos lifted, and all was clear. As I looked at the words, I felt like I had just freed a trapped girl. Now, she's waiting for me to write the rest of her story. I can attempt to shape her character, but there's something strange about writing characters; they don't let you write whatever you want! She speaks to me, telling me what decisions she's making and on what journey she'll be embarking. She is an individual being separate from me and making her own decisions…

This is how my love of writing was born, the wish of giving a voice to otherwise voiceless creatures. Yet, these are creatures that teach us lots, and I see myself in them, leaving a part of me in every character I beget. A huge part of me is my scientific background. As an engineer and a medical physics trainee, it comes as no surprise that my writings have a scientific touch to them. My mind often wanders in dimensions not yet comprehendible; to bridge the ideal-reality gap, I present my visions by creating new worlds through writing. Behold, science fiction!

To be clear, science fiction is not the making up of imagined science or the twisting of scientific facts. It is just a made-up story in a scientific world, but it requires a huge amount of research! No one appreciates inaccurate science or downright scientific falsities. It'll only mean that the author did not bother spending their time researching to write good quality work. The beauty of science fiction is that it can be either standalone or combined with any other genre - from comedy to horror - making it any reader's cup of tea.

What do I write about?

Stemming from my engineering background, I hold robotics close to my heart. I enjoy writing about "androids", which are robots bearing some resemblance to human beings. Android robotics is a developing area but still based on the most fundamental aspects of robots, such as kinematics, actuators, sensors, programming, end effectors, and ethics, to name a few. What if android brains had to bear some resemblance to the human brain? The brain as we know it is still a black box, so the fictional capacity of the mind may be endless, from completely logical to bearing magical powers.

How does this come together?

By creating androids modeled on Myers-Briggs personalities and leaving a segment of myself in each of them, I design the world in which these creatures dwell and their relationships with humans. So far, we have always seen the human-robot relationship as a master-slave one, but with the rapid advancements in technology and AI, can the roles be reversed? What will happen in the year, say, 2089?

Katryna Vella is a Medical Physics Trainee in the area of Diagnostic and Interventional Radiology, practicing within the Medical Imaging Department at Mater Dei Hospital, Msida, Malta. She is a member of the Malta Association of Medical Physics (MAMP) and a founding member of the Early Career Special Interest Group of EFOMP. Katryna's key achievements in medical physics so far are presenting her Master's dissertation at the European Congress of Medical Physics (ECMP) in Dublin and the MAMP conference in 2022, and publishing her first paper in the IOMP Medical Physics International Journal regarding strategic planning for a Diagnostic Radiology constancy testing programme in Malta. Apart from being a writer herself, Katryna is also a critique partner and beta reader for writers and authors, targeting short stories, novels, poetry, and dissertations.

Physica Medica: Editor's Choice

For this spring issue of EMP News, Iuliana Toma-Dasu selected the following three articles, recently published in Physica Medica (EJMP), which particularly attracted my attention.

G. Zhang et al **A plan verification platform for online adaptive proton therapy using deep learning-based Monte–Carlo denoising** Phys. Med. 2022;103: 18-25

https://doi.org/10.1016/j.ejmp.2022.09.018

https://www.physicamedica.com/article/S1120-1797(22)02059-2/fulltext

The use of proton therapy is currently growing at an unprecedented rate, with many centers under construction in Europe and around the world. The use of the intensity modulated proton therapy modality for planning and delivering the treatment is also increasing. The treatments are becoming more complex with respect to the dose distributions, and hence there is a greater need than ever before for online treatment adaptation. This paper is therefore very timely as it presents an approach for performing an independent verification of the treatment plans for proton adaptive therapy in the form of an integrated end-to-end Monte Carlo (MC) platform. The approach makes use of a deep learning model to reduce the computation time without increasing the noise, the result is the calculation of the dose with the accuracy of MC codes while the elapsed time is significantly reduced. The method has the potential, therefore, to be used for online adaptive treatment planning in proton radiotherapy.

F. Palesi et al **MRI data quality assessment for the RIN - Neuroimaging Network using the ACR phantoms** Phys. Med. 2022;104: 93-100

https://doi.org/10.1016/j.ejmp.2022.10.008

https://www.physicamedica.com/article/S1120-1797(22)02069-5/fulltext

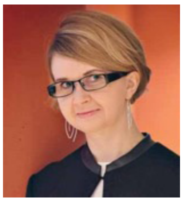
This multicentric study for quality control in MRI was performed within the framework of the RIN - Neuroimaging Network), which consists of a consortium of twenty-three clinical and research institutes distributed throughout Italy. The study presents the results of using an optimized and harmonized protocol established by the RIN – Neuroimaging Network for assessing the intra- and inter-site reproducibility of geometrical and image contrast parameters in MRI. The study clearly demonstrates the relevance of having a quality control practice follow this model. This is particularly important in the current context of gathering image data from multiple centers and the creation of "Big Data" to be further used for predictive purposes based on imaging biomarkers derived from quantitative MRI. The article is part of the Focus Issue of Physica Medica and is entitled "Towards quantitative MRI for the clinic."

D. Sakata et al **Prediction of DNA rejoining kinetics and cell survival after proton irradiation for V79 cells using Geant4-DNA** Phys. Med. 2023;105: 102508

https://doi.org/10.1016/j.ejmp.2022.11.012

https://www.physicamedica.com/article/S1120-1797(22)02103-2/fulltext

Radiobiological models and simulations provide the link between the physical processes of radiation interaction with matter and the biological consequences. They inherently have many limitations given the complexity of the systems and processes that are supposed to be taken into account. Most of the simulation platforms based on track structure Monte Carlo (MC) codes have so far focused, and, to some extent succeeded, in simulating the initial energy depositions and the subsequent DNA damages. Fewer initiatives attempted to simulate the next steps, namely the repair of the DNA damage and the expected cell survival. This study, however, not only attempted but also succeeded in implementing a model for both the cell surviving fraction and the DNA rejoining kinetics in a realistic cell geometrical model simulated by full track structure MC simulations at the DNA level and for various LET. This was done within the Geant4-DNA frame. To the best of my knowledge, this is the first demonstration of the feasibility of this kind of modeling. In light of the interest in particle therapy concerning both the therapeutical and radiation protection implications, this is a very important study that bridges the physics and biology sides.



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

MEDICAL PHYSICS THESIS

Advancing in the Dosimetry for Proton Minibeam Radiation Therapy

This article provides an overview of **Ramon Ortiz's** PhD thesis on "Dosimetric studies for proton minibeam radiation therapy," conducted at the Institute Curie, France. The complete thesis can be freely accessed at [1]

Despite the numerous advances in radiotherapy (RT) in the last decades, the radio-induced toxicity in normal tissues remains one of the main limiting factors in the treatment of radioresistant tumours (e.g. glioblastomas), pediatric cancers, and tumours close to highly radiosensitive organs. Proton minibeam radiation therapy (pMBRT) [2] is an innovative technique that aims to overcome this limitation. pMBRT is based on delivering very narrow (400-1000 μm) proton beams separated spatially by a certain distance (various centimeters), creating a pattern of high doses intercalated by low-dose regions (see Figure 1). It has already shown a remarkable increase in the therapeutic index in preclinical studies in terms of a remarkable tissue sparing along with high efficacy regarding tumour control, as compared to conventional techniques. However, some aspects of this techniques are not fully characterized yet and need further study. The thesis presented in this article addresses three mains of those facets.

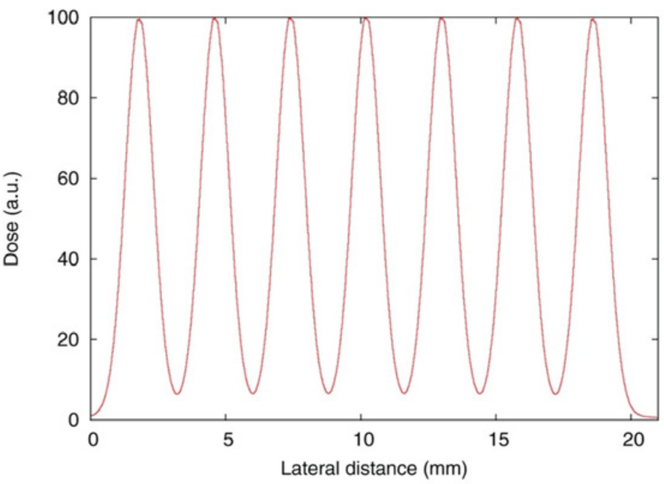


Figure 1. Lateral dose profile in pMBRT [1].

In the first place, it optimizes the dosimetric practice in preclinical investigations and proposes guidelines and protocols to ensure reproducible irradiations, which is paramount in the development of a new technique to reliably correlate physical quantities and biological endpoints. In this context, this work validates the use of different detectors, i.e., RAZOR diode, microdiamond detector, and radiochromic films, for accurate measurement of the highly heterogeneous dose distributions in pMBRT. In addition, it recommends appropriate values for Monte Carlo (MC) simulation parameters in those conditions. It also presents a robustness analysis where the increased sensitivity of pMBRT dose distributions to uncertainties in key setup and irradiation parameters is revealed and characterized. The complete study is published at [3].

In the second part of the thesis, the potential of pMBRT for treating different clinical indications (i.e., bulky brain, liver, and lung metastases) is evaluated by a treatment planning study in the context of preparing pMBRT clinical trials. That study shows that pMBRT treatments can provide a similar or superior target coverage than the standard of care for those malignancies (i.e., stereotactic radiotherapy), while reducing the dose to organs-at-risk. In addition, the dose to the normal tissues remains below the tolerance dose limits, contrary to conventional proton therapy for equivalent fractionation schemes. pMBRT treatments are proposed to be delivered in one fraction and using one or two fields only, which may imply more favorable treatment delivery regimes compared to conventional techniques since the decreased number of fractions and fields could reduce treatment costs and inter-fraction uncertainties. An example of dose distribution in these treatments is shown in Figure 2. Overall, these results, along with preclinical biological results, support the initiation of clinical investigations for this technique. Further details on this work can be found at [4].

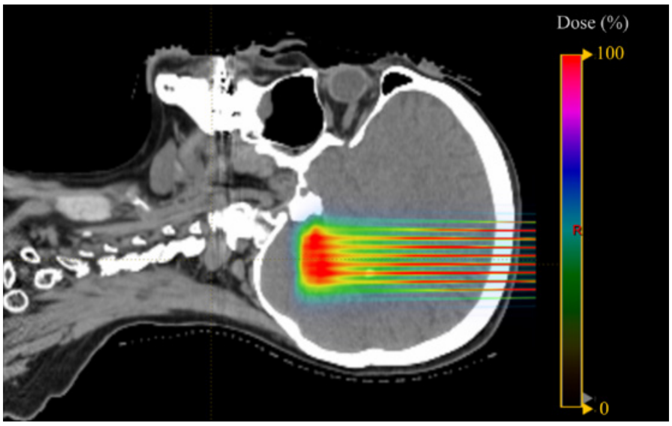


Figure 2. Example of dose distribution in the pMBRT treatment plan for one of the clinical indications (i.e., brain metastasis) studied in the thesis.

Finally, this thesis proposes the combination of pMBRT with a complementary RT technique already implemented in clinics (i.e., proton arc therapy) and assesses its potential benefits. Delivering proton minibeam arrays through arcs results in the preservation of the beneficial spatial fractionation of the dose in normal tissues as well as the dose and LET escalation. Therefore, this proposed new approach is expected the further enhance the potential of pMBRT in the treatment of radioresistant tumours, as discussed in [5].

In summary, the work performed in this PhD thesis contributes to the further development of pMBRT by advancing the present (preclinical stage) and future (clinical implementation) prospects of this technique.

References:

[1] R. Ortiz., Dosimetric studies for proton minibeam radiation therapy (Doctoral dissertation, Université Paris-Saclay, France). Available at https://theses.hal.science/tel-03957981

[2] Y. Prezado, G.R. Fois, Proton minibeam radiation therapy: A proof of concept, Medical Physics 40, 031712 (2013). DOI: https://doi.org/10.1118/1.4791648

[3] R. Ortiz et al., Preclinical dosimetry in proton minibeam radiation therapy: robustness analysis and guidelines. Medical Physics 49, 5551 (2022). DOI: https://doi.org/10.1002/mp.15780

[4] R. Ortiz et al., Proton minibeam radiation therapy and arc therapy: Proof of concept of a winning alliance, Cancers 14, 116 (2022). DOI: https://doi.org/10.3390/cancers14010116

[5] R. Ortiz et al., Proton minibeam radiation therapy for treating metastases: A treatment plan study, Med Phys 1 (2023). DOI: https://doi.org/10.1002/mp.16203

Ramon Ortiz is a postdoctoral researcher in medical physics at the University of California, San Francisco. He recently obtained a PhD degree from the Université Paris-Saclay for his studies on the dosimetry of proton minibeam radiation therapy. Nowadays, his work is focused on micro and nanodosimetry for innovative radiotherapy techniques, such as particle therapy and FLASH radiotherapy.

EFOMP COMPANY MEMBER ARTICLE

DOSIsoft: Constant Innovation In "patient-specific" Dosimetry For Precision, Safety and Quality Cancer Care

"We are convinced that the breakthrough technological advances will make it possible in the near future to treat people with cancer based on 'who' they are, and not only 'where' their cancer is located." says **Marc Uszynski**, CEO at DOSIsoft

Over the past few decades, the technology and delivery of radiotherapy treatments – either External Beam Radiation Therapy (EBRT) or Internal Molecular Radio-Therapy (MRT) - have rapidly advanced. In consequence, cancer patient concerns have evolved with a focus on individualization of cancer treatment and thus mandatory patient-specific quality assurance (QA).

In this momentum, DOSIsoft strives to contribute to RT industry progress and bold changes. DOSIsoft collaborates closely with its unique network of "best-in-class" - a whole ecosystem with clinical, scientific, academic, and industrial partners - to help the RT medical community meet and exceed current standard practices and regulatory requirements related to dose delivery verification.

Rooted in its "dosimetry" software expertise and in line with its "patient-specific" vision, DOSIsoft highlights the important work and latest innovation in its product portfolio to advance the field of Radiation Oncology & Nuclear Medicine:

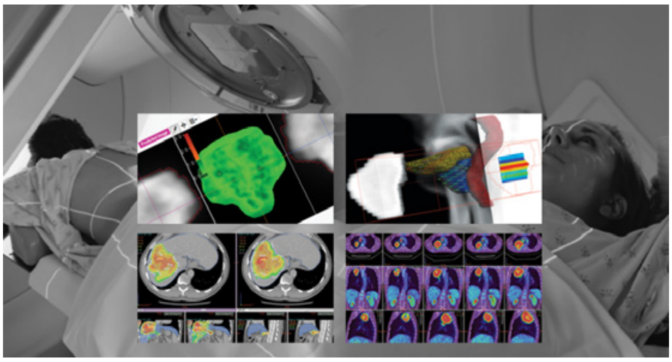


Figure 1. DOSIsoft cutting-edge software portfolio based on "patient-specific" dosimetry

1ST dosimetry algorithm specially designed for online RT adaptive workflow

DOSIsoft revolutionizes its secondary dose check solution by adapting Collapsed Cone Convolution algorithm to the Elekta Unity MR-Linac and providing valuable TPS plan verification for each patient, each plan, and each day. The new product verifies independently the dose calculations performed by the Treatment Planning System (TPS) for all patient plans of the day and takes into account patient day-to-day changes before each treatment fraction. The solution handles automatically adapt-to-position and adapt-to-shape plans and is equipped with Linac ready-to-use beam model template to facilitate its commissioning.

Fast, simple and cost-effective pre-treatment dose verification

Facing with time constraints for pre-treatment verification carried out on Linacs, DOSIsoft provides a Patient QA platform "ThinkQA" based on the use of existing electronic portal imaging device (EPID), to decrease workload, due to complex & laborious traditional equipment set-up. Integrated naturally into radiotherapy workflow, the solution allows automatic and systematic pre-treatment beam controls so that the verification tasks can also be allocated to "non-expert" staff and be integrated into the daily planning of treatment machines.

Modern, integrated and informative 3D In Vivo Dosimetry (IVD)

"IVD is a radiation measurement that is acquired while the patient is being treated and contains information related to the absorbed dose in the patient. This definition implies that an IVD system must be able to capture errors due to equipment failure, errors in dose calculation, patient/applicator positioning errors, and patient anatomy changes." [1]

DOSIsoft offers a 3D EPID-based in vivo transit dosimetry tool: an ideal technique to check independently all RT fractions during the treatment course. It is accurate enough to detect machine, patient, and plan relevant errors, and the dose monitoring insights can be shared via its user-friendly web dashboard within the department. Clinically proven, providing also various statistics, the solution helps centre physicians to raise and standardize QA practices.

Voxel-based personalized dosimetry for SIRT & MRT

The recent European legislation mandates that MRT treatments should be planned according to the radiation doses delivered to individual patients, as is the case for EBRT. The directive also specifies that verification of the radiation doses delivered should be performed.

DOSIsoft expands its leading position in patient-specific Theragnostics by extending the features of its PLANET® Dose solution dedicated to the new promising Radionuclide-based Cancer Therapies (^{90}Y/^{177}Lu/^{131}I/^{166}Ho). PLANET® (Molecular Imaging and Radiotherapy) software platform allows 3D personalized treatment planning and dosimetry to bring consistency and precision, optimize therapy for better tumor control and safety, as well as monitor patient treatment and improve traceability.

Application of AI-based technologies and texture analysis features

An emerging and promising field powered by Artificial Intelligence (AI) technologies like "Big Data Analysis" and "Machine Learning" is likely to change the landscape of radiotherapy and show new potential in the prognosis, improvement, and personalization of cancer therapies.

Based on the principle of Radiomics – development of statistical models characterizing tumors at their molecular level, extracted automatically from multimodal patient medical images – DOSIsoft, with its PLANET® Onco solution, has the ambition to provide in the future additional tools to help physicists and physicians in their decision-making process based on patient-specific information.

Complex treatments and sophisticated techniques drive the need for more QA checks and treatment verification that should be seamlessly implemented in clinical practice and easily performed by RT professionals.

Last year (2022), DOSIsoft reached 20 years of innovation. DOSIsoft will always be part of this major scientific and industrial revolution with its **"patient-specific" dosimetry** commitments to:

- put the cancer patients at the heart of its dosimetry-based software development,
- offer exclusive and distinctive features in patient diagnosis, treatment planning, dose computation, quality assurance and cancer disease follow-up,
- help Radiotherapy professionals deliver safe, quality & personalized cancer treatments.

For more information About DOSIsoft please visit:
www.dosisoft.com

References:

[1] Olaciregui-Ruiz et al. *In vivo dosimetry in external beam photon radiotherapy: Requirements and future directions for research, development, and clinical practice.* Physics and Imaging in Radiation Oncology, Volume 15, 2020, 108-116

Founded in 2002, DOSIsoft designs, develops & delivers patient-specific imaging & dosimetry software solutions in Radiation Oncology & Nuclear Medicine to improve cancer patient safety & treatment quality. 20 years of innovation and R&D investments have led to world leading software used in over 300 hospital centres in 60 countries. Spin-off between Gustave Roussy and Institut Curie, DOSIsoft constantly innovates in partnership with the major cancer institutes and research centres in the world It is now recognized as a key player in the dosimetry market.

Marc Uszynski is the Chief Executive Officer at DOSIsoft, France. 30-year-experience in product and business development in the software, media, and digital sectors has brought the company to the next level of international development.

NMO ARTICLE

New Spanish Society Website Development

SEFM SOCIEDAD ESPAÑOLA DE FÍSICA MÉDICA

In this article, **Manuel Vilches** from the Spanish Society of Medical Physics "Sociedad Española de Física Médica", SEFM, gives an in-depth demonstration of the newly established organization's website, during which he discusses the obstacles that were in the way and how they were overcome.

The current board of the Spanish Society of Medical Physics established with one of its primary objectives being to improve the social recognition of medical physics (especially the certified specialty known in Spain as Hospital Radiophysics) and of the SEFM itself and its members using social networks and digital communication channels.

To this end, the already existing SEFM Communication and Networks Committee (CCR) was renewed and reactivated, and under the direction of the communication member of the board, the organization had to undertake, as the main project but not the only one, the renewal of the web page, www.sefm.es, whose content was oriented towards members, in order to turn it into a channel mainly oriented towards the dissemination of medical physics among the general public. In addition, keeping a section for members with information on scientific and training activities, job opportunities, and restricted access documents was also a priority.

At first, we began to work on modifying the existing page, building two well-differentiated accesses for the two groups of visitors: the public and members. It would also be necessary to lighten the cover to facilitate navigation for non-specialists and incorporate aids for content search on the page itself and visitor orientation. The project will be developed with the help of CEVENTS SL (https://cevents.es/), the company that manages our technical office and which has been responsible for the creation and management of the website, and VITAMINA ESTUDIO SL (https://vitaminaestudio.com/), the company that will be responsible for the WEB consultancy (SEO study) and the design of the new page. Nevertheless, it soon became apparent that organizing all the content accumulated over the years on our page was a highly complex task, and in any case, the result would not be optimal, either for the operation of the page or as a communication strategy. Therefore, the advice of the VITAMINA ESTUDIO specialists was to create a new website whose name would be immediately identifiable, and which would be exclusively aimed at the public, with minimalist and accessible navigation menus, well-categorized sections, and a more modern, brighter, and more open design that avoided an excessive density of information and content. The web project was accompanied by an update of the corporate image, which was postponed until September 2022, and which sets the graphic style of the entire page (Figure 1).

Figure 1. Home page.

The domain www.fisicamedica.es was acquired, and the main sections were decided:

Medical Physics (Figure 2)

The first section will be dedicated to describing what medical physics is, what the role of the medical physicist is in health processes, the history of medical physics (worldwide and in our country, through a dynamic timeline), and information on access to the health specialty (which in Spain is regulated like the rest of the specialties in health sciences) and on the homologation of foreign titles, information aimed at those who consider medical physics as a professional opportunity.

Figure 2. What does a medical physicist do?

How does it work? (Figure 3)

This section explains, through sliding slides, the characteristics of some of the applications of physics in medicine, especially those that use ionizing radiation and that are, in Spain, the subject matter of the specialty: radiotherapy, proton therapy, SPECT, PET, CT, mammography... but also MRI, ultrasound, and others

Figure 3. Example of the section "How does it work?"

FAQs (Figure 4)

This section answers, organized by subject, some of the frequently asked questions that we receive in our public mailboxes or that our partners receive in their daily activities from colleagues, patients, or relatives of patients.

Figure 4. Example of the FAQ's section.

Glossary (Figure 5)

The page allows access to the main definitions, including the official glossary of the SEFM. The entries are arranged alphabetically, and a related image accompanies each definition.

Figure 5. Example of glossary entry.

Calculator

This section summarizes the most relevant information on the dose levels associated with the different radiological practices using the DRLs recommended by European professional societies.

How much do you know? (Figure 6)

A simple game of questions, organized by theme, allows the visitor to test the knowledge they have acquired during their visit. Each answer is evaluated on the spot and is accompanied by a brief explanation.

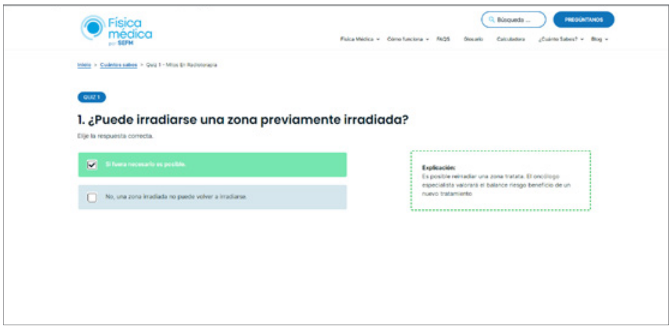


Figure 6. Example of quiz in "How much do you know?" section

Blog (Figure 7)

The website will include a blog with contributions from our partners on issues related to medical physics. This blog was born as a continuation of the blog www.desayunoconfotones.org, a blog outside the SEFM, created in 2014 by three of its partners, Naia Pereda, Gáspar Sánchez and whoever writes this (as editors), and 43 collaborators (most of them specialists in hospital radiophysics and members of the SEFM), in which 287 posts were published. Many of these posts, especially those that were better received by the public, have been transferred to the new website.

Figure 7. Blog entry example

In addition to the fixed sections, the website will have a consultation channel ("Ask Us") through which the visitor can ask us any question related to medical physics and the medical applications of radiation. We intend to take advantage of these consultations to introduce our professionals. For this reason, these questions, or at least those that, in the opinion of the CCR, arouse greater interest among the public, will not be answered impersonally by the own committee. Instead, they will be answered by some of our most outstanding partners, who will take the occasion to publicize their curriculum, their image, and their workplace. We are proud of our partners, and we believe that the entire Spanish society should feel proud. However, above all, we want patients and their families to feel at ease knowing that behind each medical application of physics and radiation, there are professionals specially trained to guarantee the quality and safety of the treatments and diagnostic techniques.

One of the most significant obstacles for the start-up of the new website is the preparation of content (a task in which a few partners are already collaborating) and obtaining images that illustrate this content. It is possible to obtain some freely accessible content on the Internet, some of it of acceptable visual quality, and today it is even possible to use artificial intelligence applications to create synthetic images to illustrate our entries. Neither these nor those comply with the founding principle of the new website: to publicize our society, its members, and the work they do in their hospitals or research centers. Because it is these partners and the work that make up the best presentation card of the SEFM, and the SEFM is or should be the organizational instrument that guarantees the synergy of all our efforts. In a necessary and inevitable symbiosis, everything that positively impacts the image of our partners will also impact the image of our society and vice versa. We can, and want to, brag about our work as specialists. For this reason, I do not want to stop taking advantage of these lines to insist to our partners on how necessary their involvement in this project is, an effort that, in addition, must be continued since the web must be a living place, which is permanently updated. I also invite colleagues from all EFOMP companies to collaborate by sending content or images of their daily work. Our publication policy implies giving credit to the professionals and institutions behind each published piece of content or image.

In these times of social networks, where the possibility of interacting directly with professionals or professional societies of any specialty allows for immediate information on any question related to clinical procedures, we might think that the static content of a web page lacks interest and meaning. Nevertheless, the truth is that this stable, serene presence, which allows the visitor to solve their concerns, at least partially, by their own means, is, or can be, a way of connecting the public with our society and a gateway to our communication channels in social networks. Furthermore, putting a face to our specialists, and getting to know their tools, their activities, and their work methods, is the best possible way to value the high professional level of our specialty and our society.

Manuel Vilches is a doctor in physical sciences and part-time professor in radiation physics at the University of Oviedo. He has been working as a medical physicist for 32 years, being the Head of Radiological Protection at the Virgen de las Nieves Hospital in Granada and tutor of specialists in training for ten years at the San Cecilio Hospital of Granada. Nowadays, he works at the Asturias Medical Centre and at the Institute of Oncology and Molecular Medicine of Asturias (IMOMA), as the Head of the Medical Physics and Radiological Protection departments. He is a board member and communication coordinator for the Spanish Society of Medical Physics. He has also been an IAEA advisor for the start-up of medical physics services in Bosnia-Herzegovina.

EFOMP COMPANY MEMBER ARTICLE

IBA: When Accuracy and Resolution Matter - CyberKnife® Patient QA

DOSIMETRY

Cutting-edge Solution for Your CyberKnife® Patient QA

Precise delivery of the high radiation dose to the target volumes and sparing of the organs at risk are the two main goals of SRS/SBRT treatments. To ensure precise delivery, regular QA is required. This becomes especially complex when radiation is delivered on the advanced robotic radiation delivery system CyberKnife®, which is capable of delivering field sizes as small as a few millimeters.

Until recently, the resolution of the available QA array solutions was not suitable to accurately measure doses in such small field sizes. With myQA® SRS and its film-like resolution, CyberKnife® users will be able to precisely QA even small targets without losing any information about the dose delivered to the surrounding tissues.

Figure 1. myQA® SRS used for CyberKnife® QA

myQA® SRS for CyberKnife®

myQA® SRS is based on silicon complementary metal-oxide semiconductor (CMOS) technology. This enables a compact design, fast read-out, and high pixel density along the x and y coordinates. Spatial resolution is 0.4 mm, with 105,000 pixels across an active area of 12 by 14 cm^2.

With the above-mentioned specifications and specialized CyberKnife® components, including multiple fiducials for precise positioning and angular and source to target corrections, myQA® SRS is well-suited for CyberKnife® QA procedures.

Patient specific QA with angular and source to target corrections

From the experience at classical C-arm Linacs, it is known that the response of myQA® SRS depends on the angle of incident irradiation and on the applied dose rate. Both effects are successfully compensated for in the myQA® software. Although the CyberKnife® Linac operates at a fixed dose rate, a variation in dose per pulse is introduced due to different SAD values during a treatment delivery. The relevant SAD corrections are seamlessly applied in the myQA® software for each respective treatment.
myQA® SRS QA measurement results for all CyberKnife® modalities—cones, Iris, and MLC, and different target sizes—show great agreement with the planned doses.

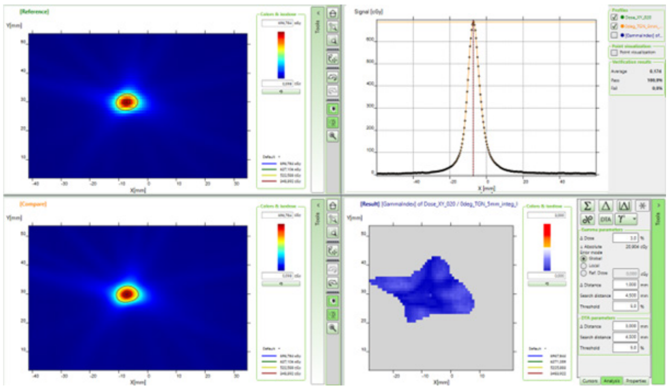


Figure 2. Pre-treatment validation of the CyberKnife® plan with a small 5 mm target. Top left—TPS calculated dose, bottom left—myQA® SRS measured dose; top right— profile through the target volume center with representation of the measurement points; bottom right—gamma analysis at 3%/1mm with a 100% passing rate.

QA of multiple metastases cases

With the increased incidence of multiple metastases treatments, QA is becoming even more complex and time consuming due to the importance of ensuring correct dose deliveries to multiple targets in the course of the same delivery. With the myQA® SRS Plane Viewer Tool, CyberKnife® users can easily visualize full 3D dose distribution and find the best myQA® SRS setup to effectively evaluate multiple targets at once.

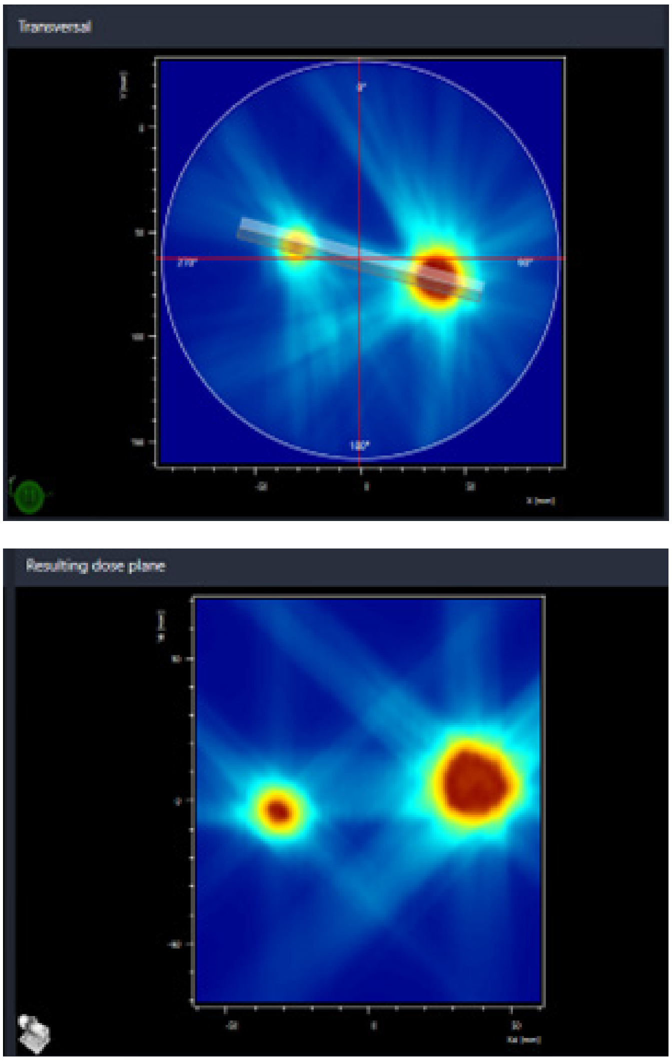


Figure 3. myQA® Plane Viewer Tool— with the detector rotation of ~15 degrees (left), one is able to QA high dose regions of both target volumes at the same time (right).

Monte Carlo calculation-based patient specific QA

IBA Dosimetry continues to develop and maintain high level patient QA solutions for CyberKnife® users. Although measurements are considered the gold standard for patient specific QA, due to extensive Linac time requirements, Monte Carlo-based secondary dose checking is widely adopted as a valuable alternative. For that purpose, our automated Monte Carlo secondary dose calculation offers full 3D Monte Carlo-based recalculation in just a few minutes, including instant feedback regarding achievement of planning objectives in DVH and patient anatomy.

Independent of the selected pre-treatment patient QA method, IBA Dosimetry provides you with suitable solutions: a high-resolution measurement array and/or a fast Monte Carlo-based secondary dose check.

Sandra Kos, MSc., is a Product Manager at IBA Dosimetry. She started her professional career as a Physicist in the radiation therapy department at University Hospital Zagreb, Croatia. More than 10 years ago, she moved to the industry part of RT to actively support clinics and the innovative RT industry. Her main point of interest is patient QA.

Jochen Krimmer works as an R&D Physicist Expert at IBA Dosimetry. After receiving his Ph.D. in experimental physics from the University of Tuebingen (Germany), he had research stays at the University of Mainz (Germany) and IPNL Lyon (France), where his interests developed towards medical applications of ionizing radiation. In 2017 he joined the physics team of IBA Dosimetry where he is involved in the development of new hardware and software products.

NMO ARTICLE

Profile and Position of the Medical Physics Expert in the Netherlands

In this article, Oleksandra Ivashchenko demonstrates the responsibilities of the Medical Physics Expert (MPE) in line with the Dutch Association for Clinical Physics - Nederlandse Vereniging Voor Klinische Fysica (NVKF). **Oleksandra Ivashchenko** report

The European Medical Physics community has been actively working on the European profile and the international definition of the MPE profile for some time now [1]. As part of this journey, the Dutch Association for Clinical Physics formulated an international definition of the profile and position of the MPE in the Netherlands, which I would like to share with the rest of the European medical physics community in this article.

Definition of the MPE

The Medical Physics Expert is a medical specialist in health care with comprehensive knowledge of physics and associated mathematics and their application in health care. The Medical Physics Expert ensures that existing and future medical devices and all techniques are used effectively, safely, efficiently, and in an optimized manner for the diagnosis and treatment of patients [1].

Background and Positioning

The MPE is a physicist with postgraduate training who works in a clinical environment. After a university MSc degree in physics and associated mathematic or equivalent he or she has completed a four-year training as a Medical Physics Expert (and is registered by the Foundation for MPE Education & Training (OKF)) [2]. Recognition as a medical support specialist is valid for a period of five years, after which re-registration is required. The title of MPE is legally protected by Article 34 of the Dutch BIG Act concerning professions in the Dutch healthcare system [3].

The training of the physicist provides extensive expertise in the fields of mechanics, acoustics and ultrasound, electricity, and magnetism, ionizing radiation and nuclear physics, light and lasers, MRI, and, in a broad sense, conducting scientific research, including experimental work, systems analysis, and performing risk and incident analyses. The four-year advanced training as an MPE extends this knowledge to medicine, clinical practice, and patient care.

With this broad knowledge of medical physics, biophysics, and physiology, the MPE, as an advanced specialist in medical care, can contribute to and take joint responsibility for the diagnosis and therapy of both individual patients and patient groups. MPEs are employed in general hospitals, university medical centers, radiotherapy institutes, audiological centers, and rehabilitation centers.

The MPE is as a member of the medical staff of the healthcare institution, and a representative of the profession, the Society for Medical Physics in the Netherlands (NVKF) is a member of the Dutch Federation of Medical Specialists (FMS).

Tasks and responsibilities

As an expert, the MPE is responsible for the adequate and responsible application of medical physics principles in healthcare. This includes diagnosis and therapy such as in audiology and radiotherapy, as well as advanced patient monitoring, diagnosis, and therapy with ionizing radiation and other physical agents. The MPE's knowledge in the field of physics, measurement techniques, and the processing and interpretation of measurement data means that the MPE bears responsibility for the correct interpretation of image information and physiological data. The MPE also oversees the accurate implementation of physical-mathematical principles and assesses the application of the technology of medical devices and/or applied software. The MPE has the authority to act on or advise on radiation protection issues surrounding medical exposure.

The task of the MPE is to optimize and guarantee the deployment, effectiveness, and safety of the existing medical-technological infrastructure. Depending on the subspecialty of the MPE, the type of institution, and its system of work, the MPE can act as a scientist, an innovator, a policy maker, a technical advisor, a manager, a supervisor, or a combination of these roles. In specific cases, the MPE can also act as a primary practitioner and coordinator. Additionally, the MPE in a healthcare system takes on the role of medical technology officer and often that of Radiation Protection Expert as laid down in the Radiation Protection Ordinance. The MPE is also trained to explain and educate both medical and nursing staff as well as patients about medical-physical aspects of care.

Furthermore, the MPE has a central role in drafting medical policy insofar as this is related to the application of medical physics. A close involvement in the life cycle of the medical-technological infrastructure of the institution is also part of the MPE's range of duties. Together with other professionals, the MPE's professional expertise and scientific training contribute to the development of guidelines for all aspects of medical physics, which makes effective cross-professional connections that would otherwise be overlooked.

Lastly, because a medical physicist's area of expertise is so broad and changes all the time, a solid background in basic sciences like physics and math, as well as continuous training in medical physics, allows the MPE to respond quickly to new developments.

References:

[1] Medical Physics Expert is referred as 'klinisch fysicus' in the Netherlands. The title MPE is used in EU law (Directive 2013/59/EURATOM of the Council, 5/12/2013).

[2] The clinical physicist training foundation (OKF) and preparatory courses https://www.stichtingokf.nl/vooropleidingen/ (in Dutch).

[3] The BIG-Act profession in the Netherlands. Other professions | Registration | BIG-register (bigregister.nl)

Oleksandra (Sasha) Ivashchenko is a medical physicist at the University Medical Center Groningen in the Netherlands. She works in the Department of Nuclear Medicine and Molecular Imaging. She is a member of the European Matter Committee of the NVKF and, since January 2023, vice-chair of the Communications and Publications Committee.

EFOMP COMPANY MEMBER ARTICLE

LAP: THETIS Phantom Detects Image Distortions to Support MR-based Treatment Planning

LAP and Siemens Healthineers have co-developed a versatile phantom to counter the effects of MR image distortion in radiotherapy treatment planning

The THETIS 3D MR Distortion Phantom (Figure 1) helps medical physicists quantify, as well as track over time, potential distortions that can arise in MR images used for radiotherapy treatment planning. Developed by laser and radiotherapy QA specialist LAP, the THETIS phantom enables the multidisciplinary care team to deploy MRI systems safely in a radiotherapy context and, in so doing, maximize clinical effectiveness through the precision targeting of diseased tissue.

Figure 1. THETIS 3D MR Distortion Phantom.

In the treatment suite, MRI delivers clinical upsides along multiple coordinates, not least its superior soft-tissue contrast (versus CT) and the ability to visualize a matrix of functional information – including diffusion processes, blood volume and oxygenation, and localized metabolic activity within tumour sites. Equally compelling is the fact that MRI interrogates the patient using non-ionizing radio waves – a major plus when treating children and in cases where serial imaging scans are needed to track tumour response through multiple radiation fractions.

LAP developed THETIS to enable the radiation oncology team to generate MR images of the highest geometrical accuracy – detecting possible distortions of the MR images reliably and quickly.

Such potential distortions have their origins in tiny perturbations to the uniformity of the MRI scanner's magnetic field and the field gradients used to image the patient. By extension, when the MRI scanner's imaging sequences are not optimized, problems can occur downstream and introduce errors into the patient's treatment plan. THETIS makes it easy to determine where distortions are affecting the image and whether the scanner's magnetic field has changed over a period of time.

Enabling independent QA

In terms of specifics, the THETIS phantom exploits a square grid of embedded silicon markers, each of which provides a strong, localized MR signal (with 258 signal sources per measurement plate). The phantom – which is aligned to the isocenter or image center of the MRI scanner using LAP's MRI laser systems and its integrated leveling aids – can detect residual image distortions from gradient nonlinearities or main-magnet inhomogeneities to ensure they are within acceptable limits. In this way, the silicon markers help the medical physicist to visualize the loss of geometric fidelity with distance from the magnet isocenter, preventing a potentially inaccurate view of organs located in the outer areas of the MR image.

THETIS offers streamlined workflows when it comes to systematic QA of MR image distortions over the lifetime of the MRI scanner – ensuring, for example, the geometric fidelity of MR images after major hardware and software upgrades to the imaging system. Clinical teams need a granular view of how such upgrades affect MR image quality. At the same time, THETIS supports the regular QA monitoring of

MR image quality – for example, as part of the monthly or quarterly checks of image distortion and how it changes over time.

Collaborative innovation

Operationally, the clinical and commercial release of the THETIS phantom is the outcome of an R&D collaboration between the LAP product development team and the MRI technology division at Siemens Healthineers, Germany (Figure 2). The latter is increasingly providing dedicated MRI systems into the radiotherapy clinic and, as such, wants to offer a reliable and affordable image distortion phantom tailor-made for its MRI equipment portfolio.

We moved quickly from prototyping and evaluation into product development and construction – just six months in all before we entered beta-testing. Geographical proximity certainly helped to streamline the product innovation cycle, with LAP's Nuremberg manufacturing facility just 20 km or so from the Siemens Healthineers MRI technology hub in Erlangen. Key to successful delivery was being able to jointly test, iterate, and optimize the THETIS phantom with our colleagues in the MRI R&D team at Siemens Healthineers.

Excerpt from the original interview with Torsten Hartmann published in Physics World.

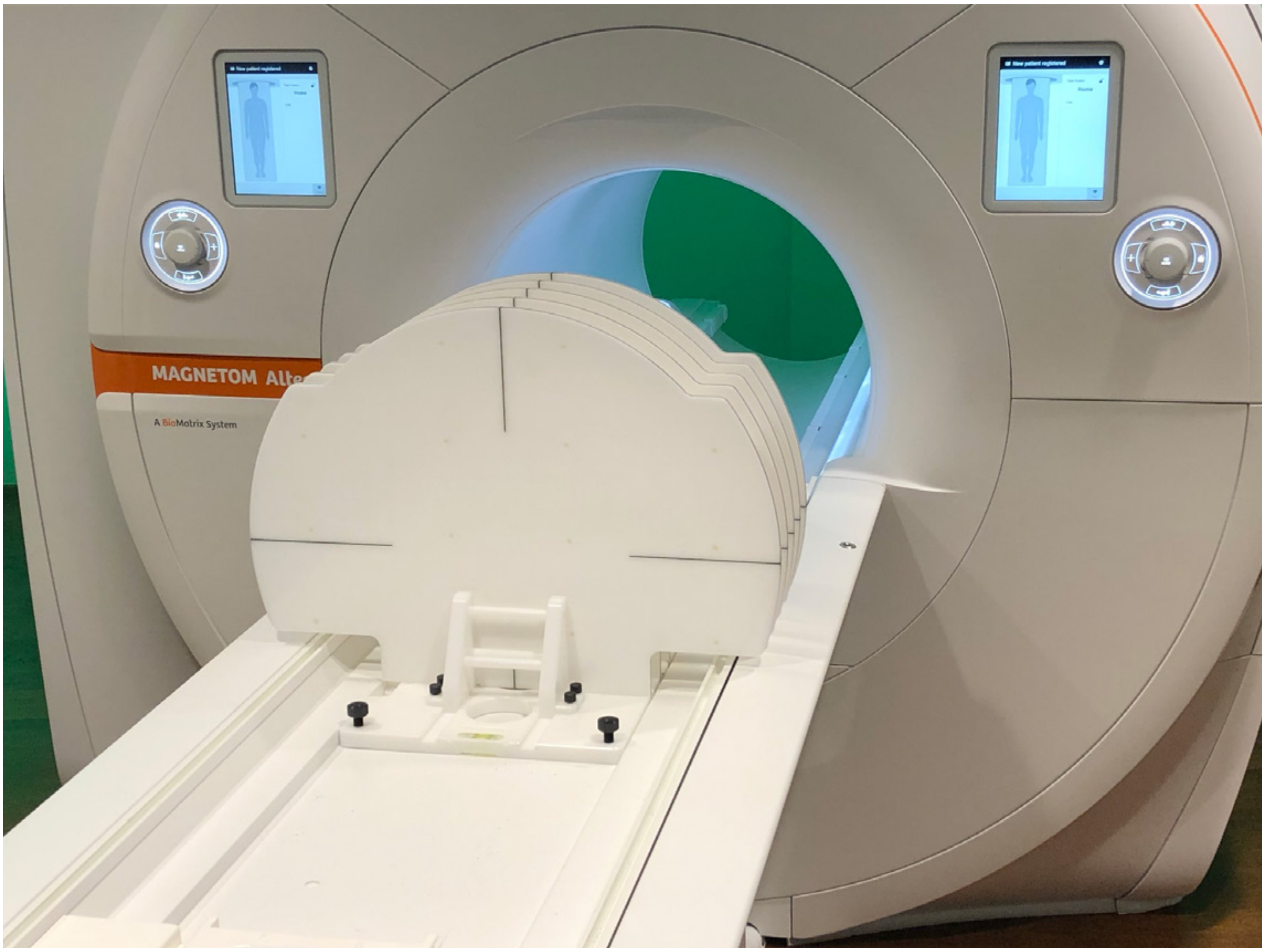


Figure 2. Enhanced imaging, enhanced outcome: the THETIS 3D MR Distortion Phantom enables streamlined QA workflows for the safe deployment of MRI systems in a radiotherapy setting.

Torsten Hartmann – Director Product Management Healthcare. LAP GmbH Laser Applikationen

PROFESSIONAL MATTERS

How to Make Something Beautiful Out of the Obstacles in Our Path

Just a few weeks ago, Ruaa Abu Rashed received her Master's degree certificate. While this event marks a special day in the life of every student, she can be especially proud of herself for having come so far despite all the obstacles in her way. Sonja Wegener reports

Figure 1. Ruua Abu Rashed during her Master's degree presentation.

Ruaa finished school at the age of 17 in 2011 in Damascus, Syria, the same year the war started. Having considered working in the medical field since her childhood, she had the desire to help and reported to a local hospital after bombings in her home town. “All the injuries, all the blood... The situation sometimes brought me to my physical and mental limit." I continued. "I just couldn't stop helping," she recalls of that time. In the following years, all through the war, she was trained and qualified as a Medical Technical Assistant. When the situation worsened, she felt forced to leave her country with her mother and her younger brother in September 2013.

Her road led her to Germany. “We never really wanted to leave our home and we had no clear plan where to go“, she describes the two months before her arrival in Germany. Refugees were evenly distributed within the country. Ruaa and family were transferred to the city of Lüneburg in the north of Germany. She explains that she had no knowledge of German at that time and was eager to learn, but access to language classes was restricted to those with an approved refugee title. Once she had obtained her approval as a refugee and was granted the right to stay for a longer period, she immediately started German classes up to C1 level. She eventually started training as a nurse.

Her dream of university studies flared up from time to time during practical experiences in different hospital departments. A highly demanded one-year preparatory course stood between her and starting her studies. Only 80 places were available for roughly 600 applicants. Ruaa got a place in Nordhausen, a small town in the east of Germany, and discontinued her practical training to become a nurse. She passed the preparatory course with an incredibly good mark, but it was not sufficient for studying Medicine. Instead, she started studying Medical Engineering in 2017 and finished her Bachelor's in 2020.

Finding a job at the beginning of the COVID pandemic proved difficult, so Ruaa continued in a Master's programme. “The first time I came into contact with the field of Medical Physics was through a course in my second Master's semester. "I was surprised that radiotherapy treatment plans are individually planned for each patient," she summarizes what prompted her to look for a topic for her thesis at an external hospital's radiotherapy department.

At the university hospital in Würzburg, in the south of Germany, Ruaa investigated the optimal metrics and decision thresholds for plan-specific quality assurance based on recalculations with an independent software solution. She sums up her impression as follows: “Every single plan is for a patient. Errors can have severe consequences. Medical physicists ensure high quality, and they do this with passion.“ Ruaa considers a career in Medical Physics herself. Alternatively, she will apply her skills to research and development as an engineer in the medical field.

Studying in a foreign language was difficult at times, especially when writing the thesis. She shares one of her worst moments: “I once approached a lecturer, asking if she provided a written script." Listening to her oral presentation and writing down my own notes was very difficult. She told me that I could always consider giving up my studies if my language skills were not sufficient.“ Ruaa emphasizes that she did not want to be given an advantage to obtain better marks but just hoped for some consideration of her additional difficulties. Language skills and access to information are key. Therefore, Ruaa volunteers at a medical aid organization and has just taken a course to become a trainer for first aid courses. She will soon start teaching courses to refugees, including first aid and an overview of the German health system, providing translations into Arabic where necessary. To others in the same situation, Ruaa recommends to never give up: "Sometimes you have a horrible day or you are treated unfairly - just continue."

Ruaa Abu Rashed just obtained a Master degree in Medical Engineering from the University of Applied Sciences Jena, Germany. She wrote her Master thesis at the University Hospital Würzburg, Germany, in the Radiotherapy Department.

Sonja Wegener is a medical physicist in radiotherapy and radiology and deputy leader of the physics team at the University Hospital Würzburg, Germany. She supervised Ruaa Abu Rashed’s master's project.

EFOMP COMPANY MEMBER ARTICLE

Qaelum Announces Release of a Novel Software Solution for MRI Efficiency

Leuven, Belgium — Qaelum, an advanced software provider focused on radiology, is releasing a novel module for monitoring and improving performance in MRI departments: foqal – MRI efficiency. The new vendor-neutral solution automatically collects all MRI study information to create an advanced data model and analyse MRI device utilization, highlight quality issues and empower optimization in the radiology department. MRI efficiency is a standalone module of Qaelum's foqal cloud platform, comprised of multiple quality and efficiency management tools including CT repeat, Contrast, and Forms. It was officially launched during RSNA 2022

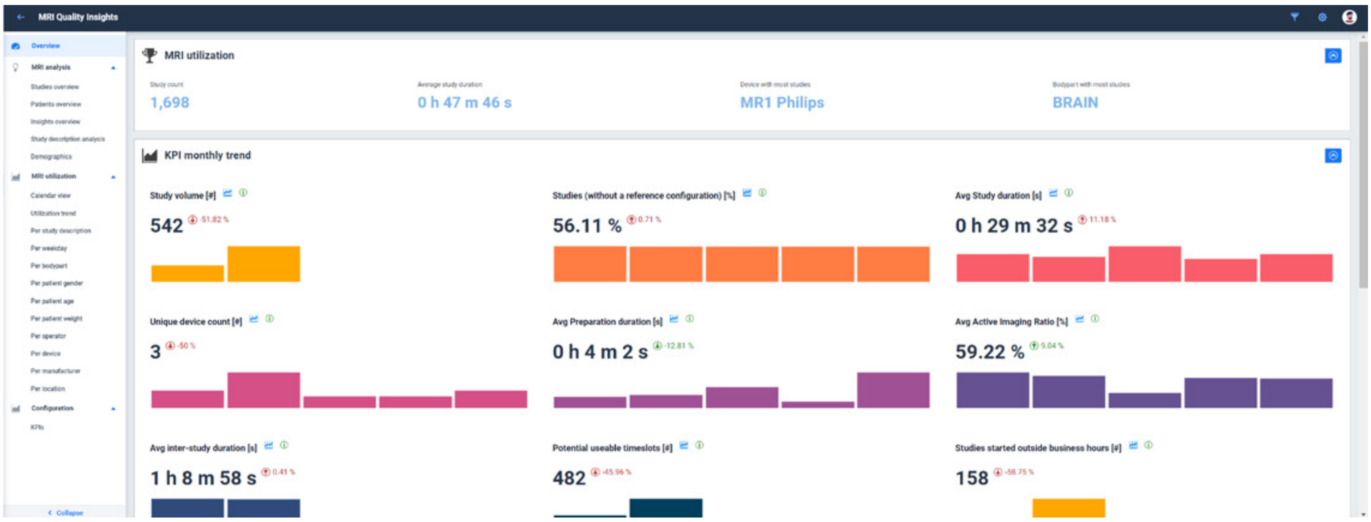


Figure 1. Qaelum software for MRI Quality.

Magnetic Resonance Imaging (MRI) is a common imaging modality due to its superior ability to visualize soft tissue that does not require patient exposure to ionizing radiation. It has seen a steady growth in usage and is characterized by higher costs compared to general X-ray, computed tomography, ultrasound, and fluoroscopy. However, managing and analysing MRI device usage, service turnaround times, throughput, and staff/patient scheduling is currently a complex task that requires ample time in the already busy radiology environment, especially considering the variety of MRI modality vendors. MRI efficiency by Qaelum offers a solution with the following capabilities:

Automatic and vendor neutral data collection

- MRI efficiency flawlessly integrates with any PACS or scanner directly
- Analyses are performed automatically in the background requiring minimal to no supervision

Key performance indicators

- Performance metrics for study duration, preparation time, study composition, inter-sequence duration, and many more are customizable and available directly on the overview page

- Patient safety metrics ensure specific energy dose (SED) and specific absorption rates (SAR) do not exceed limits, facilitating awareness of potential radiofrequency injuries to patients resulting from higher than optimal tissue temperatures
- Device utilization metrics track occupancy rates and allow more patients to be imaged without requiring extra time

Trend monitoring

- Trend charts are automatically compiled for users to quickly spot outliers, such as excessive idle time and imbalances in device workload
- Coil usage trends between devices result in informed decisions on new coils and optimal returns on investment (ROI)

Protocol usage

- Protocol usage is monitored and compared between scanners in terms of composition, settings, coil usage and time requirements
- Insights are created to highlight protocol inhomogeneity between MRI devices and repeated sequences, guiding users towards potential improvements

Performance and cost analysis

- Technologist performance is analysed and automatic insights are created for cases where training would be beneficial
- Financial liability assessment is performed employing customized cost configurations

For more information, please visit Qaelum's website https://www.qaelum.com/

QAELUM NV 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 and providing solutions to improve the quality and efficiency of healthcare departments around the world. Such solutions include patient radiation dose monitoring, efficiency tools for contrast management, CT quality, MRI utilization, clinical audits, quality monitoring in breast cancer screening and efficient management in medical imaging.

Anna Romanyukha received her Ph.D. degree in medical physics from the Centre of Medical Radiation Physics (UOW, Australia) and her M.Sc. degree in health physics from Georgetown University (Washington DC, USA). She worked as a post baccalaureate and pre doctoral fellow at the National Cancer Institute (NIH, Washington DC) on various projects including radiation dose estimation from diagnostic exposures. She now works in Qaelum NV, focusing on advanced software tools in patient radiation dose management and quality.

MEETING REPORT

Patient Specific Quality Assurance Workshop on Advanced Radiotherapy Dosimetry Techniques

Enikő Koszta and **Szilvia Gazdag-Hegyesi** share their experiences on the Workshop on Advanced Radiotherapy Dosimetry Techniques - Patient Specific Quality Assurance that was held in Novi Sad, Serbia on December 1-4, 2022.

Figure 1. Participants during the event.

Patient specific quality assurance (PSQA) workshop on advanced radiotherapy dosimetry techniques was hosted by the Serbian Association of Medical Physicists, the Oncology Institute of Vojvodina Sremska Kamenica, and the Faculty of Sciences University Novi Sad - Department of Physics. The four-day event started at the beginning of December and took place in Novi Sad, the European Capital of Culture in 2022. On the first two days, scientific lectures were presented by invited speakers from different countries: Parham Alaei, Joanna Iżewska, Csilla Pesznyák, Krzysztof Ślosarek, Eduard Gershkevitsh, Maria do Carmo Lopes, and Ignasi Méndez. Available methodologies such as EPID dosimetry, secondary calculation, film dosimetry, treatment planning system verification, and end-to-end tests were introduced as tools of patient specific quality assurance. Professionals from different institutions shared their experience and up-to-date products about dosimetry tools and systems. Moreover, the course included a two-day clinical practice in the Radiotherapy Department, Oncology Institute Vojvodina. New developments, innovative and independent quality assurance solutions were presented by IBA Dosimetry, Sun Nuclear, PTW, ScandiDos and LAP/RadCalc. Worldwide, the number of medical physicists is relatively low. One of the most important aims of our clinical work is to destroy cancer cells, while protecting the healthy ones. The delivered treatment or dose received by the patient can never be reversed, so to achieve our objective, we need to prevent potential errors. Each treatment is optimized for the anatomy of the given patient; consequently, quality control must also be ensured on an individual basis using reliable, accurate, and time-efficient dosimetry and data analysis methods. In the second half of the workshop, the companies demonstrated the use of their devices during test measurements, which helped us compare the different methods and select the most appropriate one.

Figure 2. Clinical practices during the workshop.

During the two-day - IMRT/VMAT and SRS/SBRT focused - clinical practice portion of the workshop, we were divided into groups, led by medical physicists with the knowledge and experience of everyday practice. Therefore, organizers could pay more attention to individuals and answer our questions directly from their clinical point of view. Considering different treatment techniques, evaluations allowed us to get to know the tools used by companies to control treatments and learn about the software background. Devices can also be used to perform many other quality assurance measurements in addition to the specific monitoring of patient treatments. That means expensive dosimetry instruments do not have to be purchased for each function.

Last but not least, we would like to thank the organizers. In addition to the professional aspects, we would like to highlight the social significance of this event. Sharing our experience and building relationships can also advance our clinical work. The in-person workshop allowed participants to get closer to the international point of view via discussions, social events, and coffee breaks. The kind welcome and hospitality of the organizers and the after - training programs facilitated not only making acquaintances but also developing friendships.

Enikő Koszta is a young Medical Physicist in Hungary. She has received her master degree from the University of Technology and Economics, Budapest. She has been working in the National Institute of Oncology in Budapest since 2020. She is a member of the Hungarian Society of Medical Physics, the Hungarian Society for Radiation Oncology and the European Society for Radiation Oncology.

Szilvia Gazdag-Hegyesi is a young Medical Physicist at the National Institute of Oncology and a PhD student at the Budapest University of Technology and Economics. Since 2019, she has been working in the field of radiotherapy. Her primary interest is the dosimetry of ionization imaging devices. She is a member of the Hungarian Society for Radiation Oncology, the Hungarian Society of Medical Physics, the European Society for Radiation Oncology and the European Federation of Organisations for Medical Physics.

PROFESSIONAL MATTERS

Implementation of the Medical Devices Regulation (MDR)

Erik Gelderblom and **Rens Wientjes** from the Netherlands share their firsthand experiences with MPE involvement in the Implementation of the Medical Devices Regulation (MDR)

The Medical Devices Regulation may not be a subject that many Medical Physicists are occupied with on a daily basis. However, these new rules for the introduction and use of medical devices on the European market will most likely have a serious impact on all of us. In this article, we will give a short recap of the most important changes this regulation has brought forward, both on paper and in practice. Secondly, we will update the reader on recent developments regarding the transition period and relevant guidelines.

The goal of the MDR is to ensure safe and effective medical devices for the European market. In contrast to the former Medical Devices Directive (MDD) stemming from 1993, the MDR demands more effort from a manufacturer to put and keep a device on the market. For instance, the requirements for clinical evaluation of the performance and safety before market approval have been reinforced and manufacturers are forced to carry out post market surveillance in a structured manner.

There are approximately 500,000 types of medical devices on the market in Europe, ranging from low-risk products, such as wheelchairs, to intermediate risk products, such as planning software, to high-risk devices, such as pacemakers and linear accelerators. All these devices require at least an evaluation and update of their technical dossier, and all devices from risk class IIa and higher have to be re-certified by a so-called "notified body" (e.g., TÜV or BSI). Notified bodies themselves had to be redesignated by the competent authorities based on more stringent criteria.

Because of the increased workload and fewer notified bodies, the availability of medical devices is threatened, even though a transitional period is in place until 2024. On top of that, the COVID pandemic and global energy crisis have contributed to shortages by disrupting the supply chain. As a result, hospitals are busy finding alternative products for backorders on a daily basis.

Especially in niche markets such as pediatrics, devices have a higher chance of being withdrawn from the market as it is more difficult to obtain clinical evidence through clinical studies involving children. The European Committee (EC) is still looking for a tailored solution for orphan devices that are crucial for treating small groups of patients.

In the Netherlands, Medical Physics Experts are involved in these matters when alternative products have to be assessed or the risk of using a device that is subject to a field safety notice. Last year, in several cases, coordinated actions were set up in conjunction with a national healthcare purchase network and the Ministry of Health, for instance, for fetal spiral electrodes and disposable sets for extracorporeal life support systems.

The EC has proposed to extend the transition period as the market operators are still insufficiently prepared. This means that devices with expired CE-certificates may be sold until 2028, depending on the risk class and under the conditions that the manufacturer has started the process of recertification and no known safety issues exist [1].

The EC itself also has work to do in order to wrap up the implementation of the MDR. The Eudamed database, which will contain all relevant information on medical devices and economic operators in the EU, still isn't finished. It will also include all clinical investigations with medical devices and is expected to be fully operational not before the end of 2024.

In the meantime, the EC still publishes guidelines with additional information on topics covered by the MDR. The first to appear this year was the guideline on in-house development of medical devices, including software (MDR Article 5.5) [2]. This document gives some more insight on how to fulfill the requirements set out in the MDR. For instance, what areas should be covered by an 'appropriate quality management system' that a hospital must have in place. Examples of other documents relevant to hospitals that have been published are the guidelines on custom-made devices and medical device software.

References:

[1] Medical Devices Coordination Group, MDCG Position Paper on the application of Article 97 MDR to legacy devices for which the MDD or AIMDD certificate expires before the issuance of a MDR certificate (MDCG 2022-18). https://health.ec.europa.eu/system/files/2022-12/mdcg_2022-18_en_1.pdf

[2] Medical Devices Coordination Group, Guidance on the health institution exemption under Article 5(5) of Regulation (EU) 2017/745 and Regulation (EU) 2017/746 (MDCG 2023-1). https://health.ec.europa.eu/system/files/2023-01/mdcg_2023-1_en.pdf

Erik Gelderblom is a Medical Physics Expert at the Radboud University Medical Center in Nijmegen, The Netherlands. Positioned within the Med. Tech. department he has a broad scope of interest and experience with various fields of Physics within the hospital, including regulatory affairs such as the MDR. Currently, his focus is on the safe implementation of medical device software containing artificial intelligence and other innovative (non CE-marked) techniques.

Rens Wientjes is a medical physicist expert working in the University Medical Center Utrecht, the Netherlands. His main interests are hospital physics, hospital safety, quality systems, MDR, operating room and intensive care.

MEETING REPORT

Special Interest Group for Radionuclide Internal Dosimetry (SIG_FRID)

The objective of SIG_FRID is to establish a network of medical physicists working in radionuclide dosimetry. The SIG_FRID aims to fulfill the need for networking, education, research, and professional exchanges in this field. This article represents a regular update from the SIG.

Report from **Pablo Mínguez Gabiña**

Since the start of the SIG, the number of SIG_FRID members has grown to 152. New applications are always welcome to join the initiative (see below for how to become a SIG member).

Activities that took place in the past quartal

Last term, the Steering Committee (SC) had virtual meetings on November 2nd, December 13th, January 9th and February 6th. A General Meeting was held on November 10th, a Scientific Meeting on preclinical dosimetry was organized on December 12th, and the first Case Report Meeting was held on January 31st.

During the last general SIG meeting, a summary of SIG_FRID activities since its foundation (early 2021) was presented, and some changes to the SIG_FRID operational procedures were voted on by the assembly. These mostly relate to internal operations, the relationship between the SIG_FRID Board and SC, etc. The procedure for SC renewal was also updated to avoid having to replace the whole SC at the same time.

Following the last general SIG_FRID meeting, a new priority list was adopted:

- Priority 1. Scientific meetings
  Responsible: Ernesto Amato and Steffie Peters
- Priority 2. Workgroup management and follow-up
  Responsible: Manuel Bardiès and Gerhard Glatting
- Priority 3. Teaching/Education/Dissemination
  Responsible: Ana Denis Bacelar and Caroline Stokke
- Priority 4. Communication
  Responsible: Pablo Minguez Gabiña and Gerhard Glatting
- Priority 5. Professional/Regulatory/Economic matters
  Responsible: Carlo Chiesa and Glenn Flux

The latest advances in the priorities of SIG_FRID (listed in previous EMP news) are summarized below.

Priority 1. Scientific meetings

The first case report meeting was held on January 31st from 12-13h CET. A case report on clinical dosimetry was presented by Nicolas Varmenot and Ludovic Ferrer from Nantes Cancer Centre (France).

The agenda for the scientific meetings in 2023 is as follows:

- Wednesday 15/03, 3:00-5:00 pm CET. Topic: Pre-therapeutic dosimetry
- Wednesday 14/06, 3:00-5:00 pm CET
- Wednesday 20/09, 3:00-5:00 pm CET
- Wednesday 13/12, 3:00-5:00 pm CET

You are kindly invited to propose topics for the scientific meetings. As a reminder, a scientific meeting usually includes three 20 min talks followed by a general discussion (30 min).

Please send your proposals to: ernesto.amato@unime.it and steffie.peters@radboudumc.nl.

The agenda for **Case Report meetings in 2023** is as follows:

- Wednesday 26/04, 12:00-1:00 pm CET
- Tuesday 25/07, 12:00-1:00 pm CET

- Tuesday 24/10 12:00-1:00 pm CET

You are kindly invited to propose interesting cases of clinical internal dosimetry to be reported and discussed during the Case Report meetings.

Please send your proposals to: ernesto.amato@unime.it and steffie.peters@radboudumc.nl.

A link to subscribe to the SIG_FRID Scientific and Case Report meetings is here.

Priority 2. Work-group management and follow-up.

The updated WGs and leaders are as follows:

- WG0 Survey: Caroline Stokke/Steffie Peters
- WG1 Time activity curve fitting: Gerhard Glatting
- WG2 Treatment planning system: Lidia Strigari
- WG3 Absorbed dose-effect relationship: Lidia Strigari
- WG4 Voxel S values: Julia Brosch-Lenz/Marta Cremonesi

It is possible to propose new work groups. Any request for info, etc., should be addressed to manuel.bardies@inserm.fr and gerhard.glatting@uniklinik-ulm.de.

Priority 3. Teaching/Education/Dissemination.

Educational webinars on nuclear medicine therapy dosimetry have to be prepared in 2023. Any volunteer to participate in that task is welcome. Please get in touch with ana.denisbacelar@npl.co.uk and carsto@ous-hf.no.

Priority 4. Communication.

In the last year, we have generated 12 newsletters and 4 contributions to EMP News.

Please send your suggested contributions to the EMP News to pablo.minguezgabina@osakidetza.eus or gerhard.glatting@uniklinik-ulm.de.

Slack has been implemented as a communication tool among SIG_FRID members.

Leticia Irazola, secretary of the Communications and Publications committee and member of the SIG_FRID, will be the link between that committee and the SIG_FRID regarding SIG_FRID communication-related activities.

Priority 5. Professional/Regulatory/Economic matters.

The Work Group on the Communication of the Role of Physics in Therapies with Radionuclides is seeking members. If you are interested in telling the world what you do, please contact Glenn Flux or Carlo Chiesa.

Latest news:

AAPM Grand Challenge 2023: Understanding Time-Activity Curve and Time-Integrated Activity Variations in the Radiopharmaceutical Therapy Challenge (TACTIC) [1].

This is the first-ever AAPM Grand Challenge to focus on dosimetry in radionuclide therapy and is open to new entrants until March 15, 2023 at this link. Congratulations to the organizers of the challenge, mainly members of SIG WG1.

Incoming meetings:

1) The 12th International Targeted Alpha Therapy (TAT12) Symposium will take place on February 27-March 2, Cape Town, South Africa [2]. Register and learn more here!

2) The 2nd International Workshop on Radiobiology of Molecular Radiotherapy will take place on March 13-14, London, UK [3]. Register and learn more here!

3) 36th EANM Annual Congress will take place on September 9-13, Vienna, Austria. Abstract submission platform is open until April 25. Register and learn more here!

4) The 1st Symposium on Molecular Radiotherapy Dosimetry: The future of theragnostics, will take place on November 9-11, in Athens, Greece. ***This is the first EFOMP event of its kind. The SIG_FRID is very proud to have been chosen to test the formula!*** Abstract submission platform will open shortly. Since the event will be restricted to 120 participants, be reactive when the registration process opens! Register and learn more here!

5) The next general meeting of the SIG_FRID will be held on February 24th (13-15h CET).

Advertisement of the 1st symposium on Molecular Radiotherapy Dosimetry (https://smrd2023.efomp.org)

How to become a SIG_FRID member:

The SIG_FRID 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_FRID pages of the EFOMP website [4].

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

References:

[1] TACTIC AAPM Grand Challenge 2023: https://www.aapm.org/GrandChallenge/TACTIC/default.asp

[2] TAT12 Symposium: https://tat-12.com/

[3] International Workshop on Radiobiology of Molecular Radiotherapy: https://www.eanm.org/congresses-events/future-congress/

[4] Subpage of the SIG_FRID: https://www.efomp.org/index.php?r=pages&id=sigs

Pablo Mínguez Gabiña (PhD Lund University) 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 SIG_FRID.

PROFESSIONAL MATTERS

My Journey from Nepal to ICTP in Italy

In this report, Nepalese scientist **Pratiksha Shahi** shares her personal and professional experiences at the International Center for Theoretical Physics (ICTP) and University of Trieste

Figure 1. Pratiksha Shahi at ICTP.

I am Pratiksha Shahi, a Medical Physicist devoted to improving radiological practice in Nepal. Nepal, a naturally blessed developing country in Southeast Asia, is a land of diverse cultures, religions, and stunning scenery, making it one of the most enchanting countries in the world. Although we have made steady progress in the medical arena, there are still lots of challenges, especially in the area of radiation practice. I wish to help improve the quality of radiation practice in Nepal and make the most of existing resources. Although many Nepali medical physicists practice in Nepal and abroad, I am the only female medical physicist currently based in Nepal and have a predominantly diagnostic background.

I am a recent medical physics graduate of the International Center for Theoretical Physics (ICTP) in Trieste, Italy. Previously, my curiosity and love of science led me to pursue undergraduate and graduate degrees in physics. During my MSc Physics dissertation research, I worked in a hospital for a year and also visited several others for data collection regarding the radiation workforce. During this time, I was able to gain a deeper understanding of the major underlying issues in this field. I became aware of the lack of a specialized workforce in radiation physics within Nepal and the pressing need for qualified medical physicists. This experience helped solidify my decision to specialize in medical physics and seek more advanced training in this field. I worked diligently towards the attainment of this goal.

Consequently, I applied to ICTP for the Master of Advanced Studies in Medical Physics (MMP), a two-year programme jointly run by ICTP and the University of Trieste. This programme features one year of theoretical classes and practical sessions in Trieste hospitals, followed by one year of clinical training in one of three subfields of medical physics in a network of hospitals across Italy. In 2019, I attended a workshop at ICTP, Italy, and received valuable advice from Dr. Renato Padovani, the coordinator of the medical physics programme, on improving graduate school applications. Finally, in 2021, I was accepted into the programme.

After I arrived in Trieste on January 24, 2021, I began a life-changing journey amid the Covid-19 pandemic and a new environment with unfamiliar cuisine, culture, and online classes. Thankfully, with the motivation and support from the professors and ICTP staff, I adjusted to the new environment and challenges. I had the opportunity to meet my colleagues and professors in person only after the 1st semester, which was entirely online. During my time at ICTP, I had the privilege of partaking in various outstanding training opportunities. Among them, the highlight was the opportunity to work in a hospital with experienced and knowledgeable professionals in the field of medical physics. The clinical training enabled me to apply theoretical concepts to real-world scenarios. I am eternally grateful to ICTP, the International Atomic Energy Agency (IAEA), my professors, my thesis supervisor, and all the staff at ICTP and Azienda Ospedaliera Universitaria Integrata Verona for their help and support throughout my studies.

Now, I am back in Nepal, determined to utilize my knowledge and training to develop the field of radiological practice and help elevate the growth of medical physics to improve the quality of care. Moving forward, I will focus on improving both the radiation safety standards and the accessibility of radiological care. I will help establish a comprehensive radiological quality assurance programme to ensure radiation safety from both diagnostic and therapeutic standpoints. Finally, I will look to collaborate with other national and international medical professionals to promote the use of radiological services and technology in Nepal.

Pratiksha Shahi is a Medical Physicist devoted to improving the radiological practice in Nepal. She is a medical physics graduate of the International Center for Theoretical Physics (ICTP) in Trieste, Italy.

EFOMP COMPANY MEMBER ARTICLE

A Dosimetry Pioneer Is Leaving

THE DOSIMETRY COMPANY

Dr. Christian Pychlau has been Managing Partner at PTW since 1996 and managed the family-owned dosimetry company in the third generation. He retired at the end of January 2023. In this interview, he provides personal insights into his time at PTW, medical physics, and entrepreneurship in general.

Figure 1. Caption: Dr. Christian Pychlau has been managing partner of PTW since 1996. He retired at the end of January.

Dr. Pychlau, if you take a look back at your time at PTW: How has the company changed over the past 30 years?

PTW has clearly become more international during this time. When I started working in our company, PTW was basically a company in Germany for Germany. We sold 80% of our products in Germany at the time. Today, we sell more than 80% outside Germany. The first country in which we established a subsidiary was the USA. That was in 1995. By the way, with the nice address: PTW New York, Park Avenue. Unfortunately, it wasn't on Park Avenue.

What other changes have you seen in the industry?

The regulatory requirements for companies – and this is especially true for medical technology – have increased considerably. Today, PTW has to deal with a large number of mandatory standard procedures that must be applied: SOPs, procedure instructions, work instructions, test instructions, and test equipment lists. And this is just a partial list. We have to be careful not to overdo it.

What do you mean precisely?

I mean excessive regulation in Europe and in Germany. We owe a significant part of our prosperity to industry, but we risk restricting its ability to act in such a way that it loses its innovative strength and international competitiveness. This is particularly evident in medical technology. With the introduction of the Medical Device Regulation (MDR), the regulatory requirements for manufacturers are being tightened further without realistically weighing the consequences. But this will make it much easier for those companies to which it is intended to apply, because they deliberately circumvent regulations. Companies that have always adhered to the rules are squeezed out of the market in the worst case. The way to counter this is to drive growth and internationalization. PTW is well positioned for these challenges, since we have grown strongly over the past 30 years. Today, there is a critical minimum size for medical technology companies to ensure sustainable economic success. There is a dispute as to whether it is 50 or 100 employees.

What consequences do you think this has for entrepreneurs?

Basically, it means the end of inventors in small companies. The beginning of PTW, as it took place in 1922, would no longer be possible today. Garage companies are history. Although I always say proudly that we have never been a garage company; everything started for us in the laundry room and in the garden shed. Today, this is practically no longer possible in medical technology because an inventor in a small company cannot meet the regulatory requirements of the MDR. He can only exist with his company if he procures enough risk capital, i.e., if he puts himself in the hands of investors from the outset.

***Has this also changed the work of medical physicists in** hospitals?*

Yes, because they too are subject to regulation. Until the 1990s, PTW built special devices according to customer requirements. An example: we connected a DIAMENTOR DAP chamber to an IQ4 for a children's clinic. The IQ4 was a high-precision measuring device for radiotherapy. At that time, the children's clinic carried out X-ray examinations on premature babies and needed a measuring device for monitoring radiation exposure with a resolution that was many times higher than that of an ordinary DIAMENTOR. And we found a solution by adapting a DIAMENTOR chamber to an IQ4. The medical physicist then worked with it on his own responsibility. Such "off label" applications are now almost inconceivable.

We have talked a lot about change. Is there also something that has remained the same?

Yes, our open corporate culture. At PTW, it is possible, even desired, for employees to tell their superiors if they want to do something different. Working without a ban on thinking is one reason for our success story and the many product innovations from PTW that have prevailed on the market. It also helps us in difficult situations – so far, we have always found a solution for every problem.

Can you think of a specific example?

A wonderful example of this is the first linear array we developed. At that time, we were looking for a solution to measure the dose precisely when using virtual wedge filters. One developer approached my father, a physicist who was managing director at the time, with his idea of developing an array. My father was skeptical and said that the idea could not work for physical reasons. But the developer was not discouraged. We then built this linear array, it worked, and we sold it with great success for many years. This example shows how passionate PTW was in its search for solutions. This is what distinguishes PTW to this very day, and I am sure that it will continue to do so in the future.

Dr. Christian Pychlau was managing partner of PTW and headed the dosimetry company in the third generation until his retirement. He first studied physics until his bachelor's degree, trained as a precision mechanic afterward and then became an engineer. He joined the family business in 1992 and took over the management in 1996.

MEETING REPORT

Virtual Courses in the Field of Particle Therapy 2022

Prof. Dr. **Oliver Jäkel** provides positive comments on the virtual courses in the field of Particle Therapy took place successfully from Oct. 17th to Nov. 25th 2022 under the auspices of the Heidelberg Institute for Radiation Oncology (HIRO)

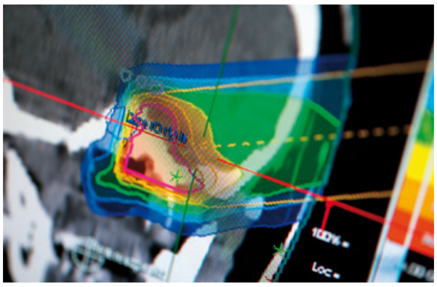


Figure 1. SEQ Figure 1: A typical particle therapy treatment plan, showing the distinct dose drop-off at the distal end.

The online phase was scheduled from Oct. 17th to Nov. 20th 2022. The live online phase from Sep. Nov. 21st to Nov. 25th 2022 was hosted on Zoom. We were very happy to welcome 41 participants from 15 countries all over the world with backgrounds in Medical Physics or Radiation Therapy. Students, Post-Docs and experienced researchers in the field fostered interesting discussions throughout the course.

During the **online phase** of about five weeks, participants were introduced to the physical as well as the biological basics of particle therapy. The technical aspects (accelerator techniques, dosimetry and quality assurance) were explained to continue with the clinical application of particle therapy and its benefits and challenges.

The **live online phase** started with interactive sessions: first, participants discussed with Prof. Karger from the German Cancer Research Center the topic **Advanced Radiobiology** and its differences in particle therapy (compared to conventional therapies). Secondly, participants presented different **clinical cases** and how they would treat them. The discussions of their own results with Prof. Jäkel from the DKFZ and Dr. Harrabi from the Heidelberg Ion Beam Therapy Center (HIT) were a very useful and interesting part of the course because different treatment approaches could be critically reviewed and discussed. During our **virtual internship** about treatment planning in particle therapy with Dr. Wahl and Dr. Amit Ben Anthony Bennan (both: DKFZ), all students could download and work with **matRad**, an open-source software for radiation treatment planning of intensity-modulated photon, proton, and carbon ion therapy, developed at the DKFZ in the division of Medical Physics in Radiation Oncology (https://e0404.github.io/matRad/). The remaining lectures mainly focused on **clinical indications** for particle therapy as well as radiobiology and **current technical standards** in particle therapy.

All participants successfully passed the two mandatory online tests; thus, everyone received the certificate of attendance, including **4 ECTS** points as well as **52 CPD points** from the International Organization for Medical Physics (IOMP). It was a pleasure to host such virtual courses for participants from around the globe for the third time. The virtual setting of the course allowed us to accept international participants to initiate interesting discussions with our teaching experts from Heidelberg.

For 2023, we are happy to already announce the next round of our courses, following the **hybrid mode**, meaning participants can decide to attend the courses **100% virtually** or with **online phase** and **attendance phase in Heidelberg** at the DKFZ in Heidelberg. This round will also offer sessions on **particle therapy with FLASH** and takes place in October and November 2023.

Course Leaders:
Prof. Oliver Jäkel, PhD
Head of the Division of Medical Physics in Radiation Oncology, German Cancer Research Center, Heidelberg, Germany
Prof. Jürgen Debus, MD, PhD
Head of the Department of Radiation Oncology and Radiotherapy, Heidelberg University Hospital, Heidelberg, Germany

Contact:
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Web: www.dkfz.de/particle_course_en

Prof. Dr. Oliver Jäkel is head of the Division of Medical Physics in Radiation Oncology at the German Cancer Research Center. He holds a PhD in Physics and since 2014 he is a full professor at the Medical Faculty Heidelberg of Heidelberg University.

Prof. Dr. Dr. Jürgen Debus is a Medical Doctor in radiation oncology and holds a PhD in Physics. Since 2003 he is a full professor at the Medical Faculty Heidelberg of Heidelberg University and since 2014 its Vice Dean. He is also Chairman of the Department "Radiation Oncology" at the Heidelberg University Hospital.

EFOMP COMPANY MEMBER ARTICLE

Radformation: Game-changing Updates to AutoContour, ClearCheck, and ClearCalc That Elevate Your Contouring and Plan Evaluation

With headline features such as MR models, rigid and deformable registration, a new chart rounds module, and RadMonteCarlo, these updates from version 2.2 provide new and improved clinical tools for your contouring and plan review workflows.

Over the past several months, we've worked hard to bring major new features to AutoContour, ClearCheck, and ClearCalc.

AutoContour

After releasing AutoContour—our automated AI contouring program—in 2021, we've focused on making it the best it can be, releasing additional models and improving functionality.

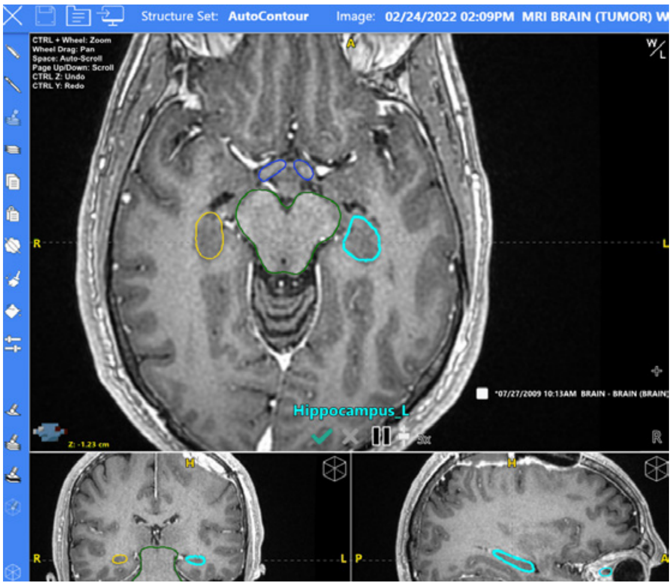


Figure 1. AutoContour's registration workspace showing MR and CT overlays.

MR Models

Complementing our expanding list of CT-based contours, we now offer structure models trained using MR images for cranial anatomy. These provide greater accuracy for structures that generally exhibit poor contrast resolution on CT images. Following guidelines established by the EPTN Consensus Neuro-Oncology Atlas [1], the models utilize T1 post-contrast data sets, which are most commonly used for contour generation for cranial SRS or hippocampal sparing treatments.

Registration Functionality

Registering multiple image sets, including deformable registration, is now available directly within AutoContour. In addition to viewing Eclipse and DICOM registrations, users can overlay CT and MR image sets using internal registration tools.

With the registration workspace integrated directly into the main viewing window, users can execute any desired registration operations simultaneously while structure contouring results stream in. Once a rigid or deformable registration is made, transfer structures made on one structure set directly to another with AutoContour. Contour on MR, transfer to CT, and get planning!

ClearCheck

ClearCheck, our automated plan evaluation program—which now features deformed dose assessment and a Chart Rounds Module for multidisciplinary plan review—delivers even more insightful information for intuitive plan review and reporting.

Multidisciplinary Team Meetings

ClearCheck now supports multidisciplinary team meetings for thorough reviews of patient plans. A new Chart Rounds section presents information needed for multidisciplinary plan review, including prescription, dose constraints, DVH information, and more. Users can create worklists based on multiple filters, assign review status to all plans discussed, and save comments for each patient reviewed. All captured information is retained for each patient and can be included in the ClearCheck report.

ClearCheck Now Offers Deformed Dose

Visualising reshaped dose is helpful when accumulating dose between images where the anatomy is not consistent. Leveraging new deformable registration capabilities, ClearCheck can utilise an AutoContour registration to deform a dose distribution from one image to another. As with other plan sums, it's possible to calculate constraints, view the DVH and dose distribution, compare plans, or calculate BED or EQD2 dose, all with deformed datasets.

ClearCalc: Introducing RadMonteCarlo

RadMonteCarlo is a new algorithm offered as an optional adjunct to ClearCalc, Radformation's secondary calculation software. A cloud-based solution, RadMonteCarlo brings Monte Carlo accuracy to the pre-treatment workflow, complimenting ClearCalc's current calculation capabilities for the department's most challenging plans.

New Proton Support

With RadMonteCarlo, ClearCalc now supports protons (modulated pencil beam scanning), adding to the other supported modalities: photons, electrons, and brachytherapy (TG-43 only). With the inherent challenges that come with proton planning, it's imperative to have a robust, reliable secondary dose calculation algorithm.

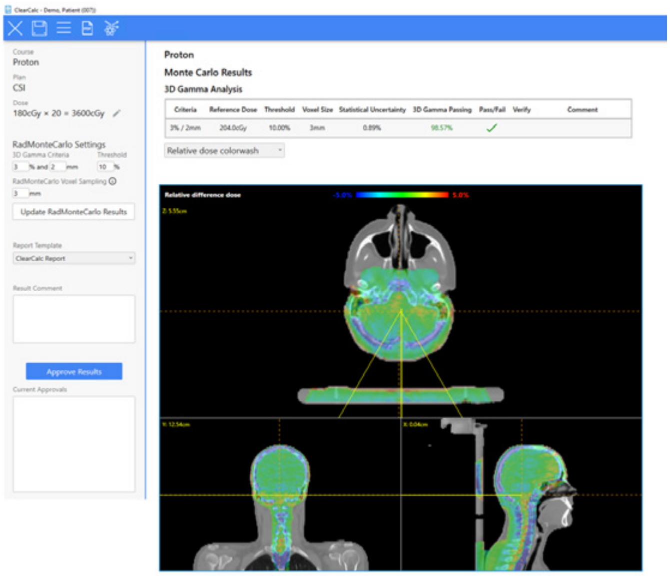
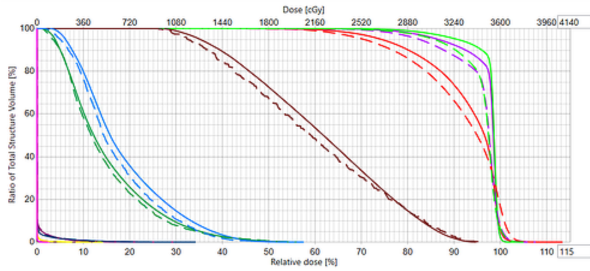


Figure 2. Secondary calculations in ClearCalc showing RadMonteCarlo volumetric 3D gamma analysis for a CNS proton plan.

Like you, we value efficiency and accuracy. For our Monte Carlo algorithm, a cloud-based computing platform performs particle transport and interactions with speed and accuracy—with between 400 million and 2 billion particles simulated depending on field size. The cloud confers these benefits with no need for additional (and costly) hardware installation and maintenance.

New 3D analysis tools provide additional confidence in your primary treatment plan verification:

- 3D Gamma Criteria
- 3D Gamma Mask
- RadMonteCarlo Dose Cloud
- RadMonteCarlo Dose Volume Histogram
- Statistical Uncertainty



CSI	TPS Volume (cc)	TPS Mean Dose (cGy)	TPS Max Dose (cGy)	ClearCalc Mean Dose (cGy)	ClearCalc Max Dose (cGy)
PTV_Low	301.56	3339.4	4081.0	3293.0	3963.5
Heart	445.56	0.3	97.3	0.2	116.1
Kidneys	275.05	1.4	511.4	1.3	459.9
Liver	1252.26	0.3	474.1	0.2	430.7
Eye_R	7.96	542.4	2035.7	519.5	2011.9
Lung_R	1391.04	9.8	1223.0	9.8	1089.1
Lung_L	1110.79	8.8	1231.9	9.8	1166.1
OpticNerves	1.34	2210.1	3408.9	2143.2	3430.3
PTV boost	316.22	3515.8	3712.0	3454.9	3781.1
PTV_Brain	1432.06	3490.5	3808.4	3442.9	3872.0
Eye_L	6.50	661.7	2070.6	608.2	1942.2

Figure 3. 3D dose volume histogram and dose constraint information for a proton plan with ClearCalc and RadMonteCarlo.

Conclusion

These V2.2 additions to AutoContour, ClearCheck, and ClearCalc amplify the impact for departments utilizing these tools for the pre-treatment workflow. Visit us at ESTRO, Booth 430, to see how Radformation's intelligent automation solutions can help your clinic do more in less time while increasing plan quality, safety, and efficiency.

References:

[1] https://www.cancerdata.org/resource/doi:10.17195/candat.2021.02.1

Tyler Blackwell, MS, DABR, is a medical physicist at Radformation focused on clinical collaborations and community engagement. Before joining Radformation, he spent a decade working as a clinical physicist. He is active on several committees for the American Association of Physicists in Medicine, including the board of directors, and volunteers for the American Board of Radiology.

BOOK REVIEW

Comprehensive Audit for Radiotherapy Practice: A Tool for Quality Improvement - Second Edition Published in 2022- IAEA. Jamema Swamidas reports

Figure1. Second edition of the IAEA QUATRO methodology – Comprehensive audits of radiotherapy practice: A tool for quality improvement published in 2022.

Comprehensive quality audits in radiotherapy

The IAEA has a long history of providing assistance for dosimetry audits to its Member States. Together with the World Health Organization, it has operated postal dose audit programmes to verify the calibration of radiotherapy beams since 1969. The programme currently covers 139 countries.

Quality audits can be of various types, either reviewing specific critical parts of the radiotherapy process (dosimetry audit) or assessing the whole process (comprehensive audit) including staff, equipment and procedures, patient protection and safety and the overall performance of the department. An independent external audit (peer review) is important to ensure adequate quality of practice and treatment delivery and is also a requirement of the IAEA International Basic Safety Standard [1]. The IAEA, through its technical cooperation programme, has received numerous requests from low- and middle-income countries to perform comprehensive audits to assess the entire radiotherapy process. In response to this request, the IAEA has developed a methodology for the comprehensive audit in radiotherapy called Quality Assurance Team for Radiation Oncology (QUATRO), with an objective to review and evaluate the quality of all components of the radiotherapy programme, including professional competence, with a view to quality improvement.

QUATRO methodology

The QUATRO audit is performed by a multidisciplinary team of experts composed of a radiation oncologist, a medical physicist, and a radiotherapy technologist, who are highly respected professionals in their discipline and have received additional training in auditing procedures. The auditors are selected by the IAEA and spend 3-5 days onsite at the audited facility. A major part of the audit is patient oriented, and follows the clinical path of the patient, from diagnosis, decision to treat, prescription, planning, and delivery, to the end of the follow-up process, excluding the treatment outcome. Staffing levels, professional education, and training programs are given special attention. The methodology consists of the application of various checklists, questionnaires, reviews, observations, staff interviews, and onsite dosimetry measurements to evaluate the quality of all elements involved in radiotherapy. It does not represent one radiotherapy standard applicable to all visited departments but provides a general methodology that can be applied in a range of economic settings. A preliminary assessment of the radiotherapy programme is provided to the institution at the conclusion of the visit followed sometime later by a detailed written confidential report with recommendations for quality improvement. Adoption of the auditors' recommendations is purely at the discretion of the audited institution.

The methodology for conducting comprehensive clinical audits was published in 2007 as Comprehensive Audits of Radiotherapy Practices: A Tool for Quality Improvement [2] and has been successfully applied in more than 100 clinical audits worldwide.

Second edition (2022)

In the light of developments in techniques and equipment in radiotherapy, and lessons learned from past audits, an updated second edition of the QUATRO guidelines was published in 2022 [3]. It includes guidelines for auditing new technologies, incorporated in the form of 42 checklists. The new features of the second edition include the modified criteria for centre of competence, quality management system, considerations for the introduction of new technology, communication, education, and clinical training programme in compliance with IAEA curricula [4-6]. The publication is freely available to download from the IAEA website Comprehensive Audits of Radiotherapy Practices: A Tool for Quality Improvement | IAEA.

The QUATRO methodology has been endorsed by the European Federation of Organisations for Medical Physics(EFOMP), the European Society for Radiotherapy and Oncology(ESTRO), and the International Organization for Medical Physics(IOMP). The availability of an internationally harmonized guidance document, endorsed by professional societies, would be a significant contribution towards the improvement of radiotherapy practice all over the world.

References:

[
1] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Standards Series No.GSR Part 3, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards. 2014

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Comprehensive audits of radiotherapy practices: A tool for quality improvement, Quality Assurance Team for Radiation Oncology (QUATRO) First Edition 2007

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Comprehensive audits of radiotherapy practices: A tool for quality improvement, Quality Assurance Team for Radiation Oncology (QUATRO) Second Edition 2022

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA Syllabus for the Education and Training of Radiation Oncologists, IAEA Training Course Series No. 36, IAEA, Vienna (2009).

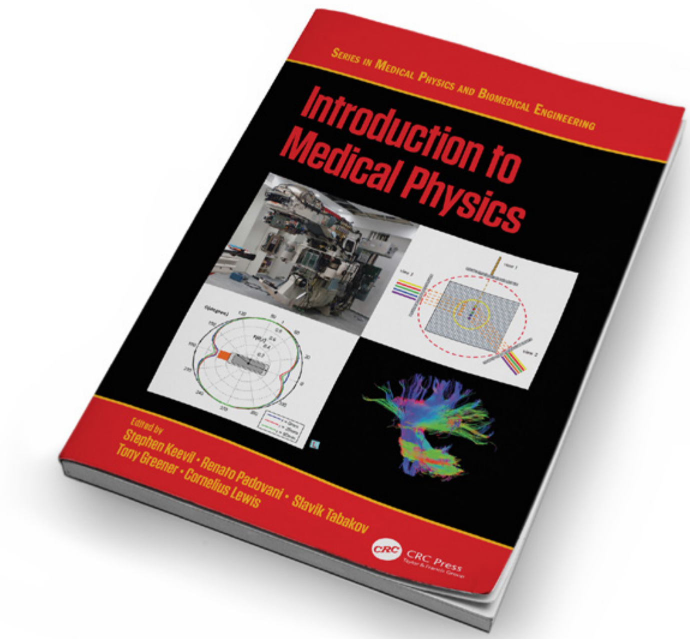
[5] INTERNATIONAL ATOMIC ENERGY AGENCY, Postgraduate Medical Physics Academic Programmes, IAEA Training Course Series No. 56 (Rev. 1), IAEA, Vienna (2021).

[6] INTERNATIONAL ATOMIC ENERGY AGENCY, A Handbook for the Education of Radiation Therapists (RTTs), IAEA Training Course Series No. 58, IAEA, Vienna (2014).

Jamema Swamidas is the Head of the IAEA Dosimetry Laboratory and the audit officer, responsible for the IAEA / WHO postal dosimetry audit programme and the comprehensive audits in radiotherapy. She worked as a radiotherapy medical physicist before joining the Agency, and has wide experience in clinical service, research, and education.

BOOK REVIEW

"Introduction to Medical Physics" By Steven Keevil, Renato Padovani, Slavik Tabakov, Tony Greener, Cornelius Lewis



CRC Press, 1st edition 2022, 500 Pages
40 Color & 303 B/W Illustrations,
Contents: 15 chapters.
Hardcover: ISBN 9781498744799, £74.99;
eBook: ISBN 9780429155758, £56.24

This "Introduction to Medical Physics" is the result of a British-Italian cooperation in the series on Medical Physics and Biomedical Engineering by CRC Press. The authors mention undergraduate as well as postgraduate students as mainly intended readership in their preface. I may add interested readers to their list who are in active clinical service and wish to have a profound overview of the main fields of Medical Physics in one book at hand. To this end, the extensive register of 12 pages is of great value, too.

The 15 chapters start with an introduction setting the outline of this book by Perry Sprawls who is well known for his free available teaching resources, especially on imaging physics. This is one item I noticed when reading this book, that some chapters put a special emphasis to list mainly free available resources and e-learning material as references. These are published by international organisations like the IAEA or can be found at the European EMERALD or EMITEL (Encyclopedia of Medical Physics) project website. The latter two projects pioneered the e-learning concept in medical physics and were led by Slavik Tabakov and his wife and many more collaborators, of which some have contributed to this book, too.

Chapters 2 to 4 are on the basics that are necessary for the following chapters on applications of ionizing radiation with the titles: "Radiation Interaction and Dosimetry" by Renato Padovani and Charles Deehan, "Ionising Radiation Detectors" by Elizabeth Benson and "Biological Effects of Ionising Radiation". In the subchapter on KERMA of chapter 2, the formulas with double fraction expressions are not typeset in the same way as in other parts of this chapter, maybe to save space. At least some more parentheses would be needed to ensure correct reading in my view. Chapter 3 is a nice and compact overview of the various types of detectors. The authors of chapter 4 refer to EUD (Equivalent Uniform Dose) which they refer to be defined in equation 4.2, but this is the definition of the Survival Fraction (SF) of irradiated cells. This is one of the few errors I found in this book besides the transposed digits on p. 55 putting Röntgen's discovery in the year 1985 and a wrong reference number [6] on p. 308 that does not exist.

Chapters 5 to 8 deal with the different imaging techniques with the titles: "Introduction to Diagnostic Radiology (X-ray and Computed Tomography Imaging" by Slavik Tabakov and Paola Bregant, "Nuclear Medicine Imaging" by Elena De Ponti and Luciano Bertocchi, "Magnetic Resonance Imaging" by Stephen Keevil and Renata Longo and "Ultrasound Imaging and Therapy" by Raffaele Novario and Sabina Strocchi. The first chapter in this topical section has almost 50 pages and is with the one on MRI of 62 pages and the chapter on radiotherapy of 60 pages in the following section somewhat bigger than the other chapters of about 20 to 40 pages. The authors manage to cover all necessary content starting from the basics to current techniques used in the field of their subjects. I liked the notes at the end of the chapter on MRI giving some nice background information that especially undergraduate students will appreciate. The chapter on ultrasound seems to be an update of a review paper by Novario et al. of 2003 since many figures are taken from this publication. In general, the figures in these chapters on imaging are well reproduced, some even in colour where necessary.

Chapters 9 to 11 address the different therapy techniques in Medical Physics with the titles: "External Beam Radiotherapy" by Rony Greener, Emma Jones, and Christopher Thomas, "Brachytherapy" by Mauro Carrara and Francesco Ziglio and "Molecular Radiotherapy" by Lidia Strigari. As mentioned above, the chapter on external beam radiotherapy is one of the biggest in this book. It starts with an overview of the common equipment in external beam therapy and continues with aspects of dosimetry, especially regarding water phantom measurements, that are necessary input for the treatment planning software. It includes also short sub-chapters on whole body treatments including whole skin treatments that are illustrated with photos of the setup used. Among the ICRU publications 50 and 62 on the various volume definitions mentioned in the sub-chapter on treatment planning, I am missing ICRU publication 83 which introduces e.g. the homogeneity index definition for plan evaluation as well as mentions plan verification and quality assurance techniques that are linked to modern methods of intensity modulation of treatment beams. The chapter on brachytherapy together with the following on molecular radiotherapy are the ones with the most references listed at the end. Both chapters deal well with technical information on the isotopes used and specific problems regarding treatment planning and dosimetry in both fields.

The final set of chapters 12 to 15 are entitled "Optical and Laser Techniques" by Elizabeth Benson and Fiammetta Bedele, "Ionising Radiation Protection" by Cornelius Lewis and Jim Thurston, "Image Processing" by Andrew King and "Emerging Techniques" by Aichele Avanzo, Tony Greener, Luigi Rigon and Slavik Tabakov. The first chapter of this section deals only with the different sources of optical radiation including Lasers and optical radiation protection thereof. Even if this is the biggest chapter with 37 pages in this section, I would have expected at least some examples of the modern applications of optical methods like fluorescence and STED-microscopy (STED: STimulated Emission Depletion, Nobel prize in 2014) or optical tomography. The following chapter on radiation protection from ionizing radiation is a brief but solid summary of all necessary topics in this field including exposures in pregnancy. The short chapter on image processing seems a bit misplaced in this section and should be moved to the end of the imaging section. As this book is intended for students, too, the author of this chapter uses public domain software (ImageJ) as well as sample image data including e.g. some sample pseudocode to explain a region growing algorithm.

To summarize, this book is not intended to be a workbook including exercises for students except the one example mentioned above, but more as a reference book that accompanies a series of lectures on Medical Physics. To this end, the last chapter on emerging techniques of phase contrast X-ray imaging, radiomics and ultra-high dose radiotherapy (FLASH) techniques serves well the purpose of showing students, what more interesting topics are currently up in Medical Physics and keeping them interested in future developments. For this and all other purposes mentioned above, I recommend this book to all interested readers!

Prof. Dr. Markus Buchgeister, Berliner Hochschule für Technik Berlin, Germany.

Markus Buchgeister entered the field of medical physics in radiation therapy at the university clinic of Tübingen in 1995. In 2010, he received a call for a position as professor for medical radiation physics at the Berliner Hochschule für Technik (university of applied sciences and technology) at Berlin. Since 2003, he is engaged as co-opted DGMP board member for public relations and communications of the German Society for Medical Physics. Parallel, he served as chairman of the EFOMP Communication and Publications Committee 2003-2009 and from 2009-2015 as German EFOMP delegate. In 2017-2018 he was chairman of the EFOMP Education and Training Committee and is now German EFOMP delegate for a second round.

EFOMP COMPANY MEMBER ARTICLE

RTsafe: Pseudopatient® Technology: A Personalized Treatment Verification in SRS

RTsafe offers a highly precise, wholly individualized solution dedicated to brain radiotherapy patients, the PseudoPatient®. PseudoPatient® methodology has been redesigned to cover the dosimetric and spatial evaluation of each patient's treatment.

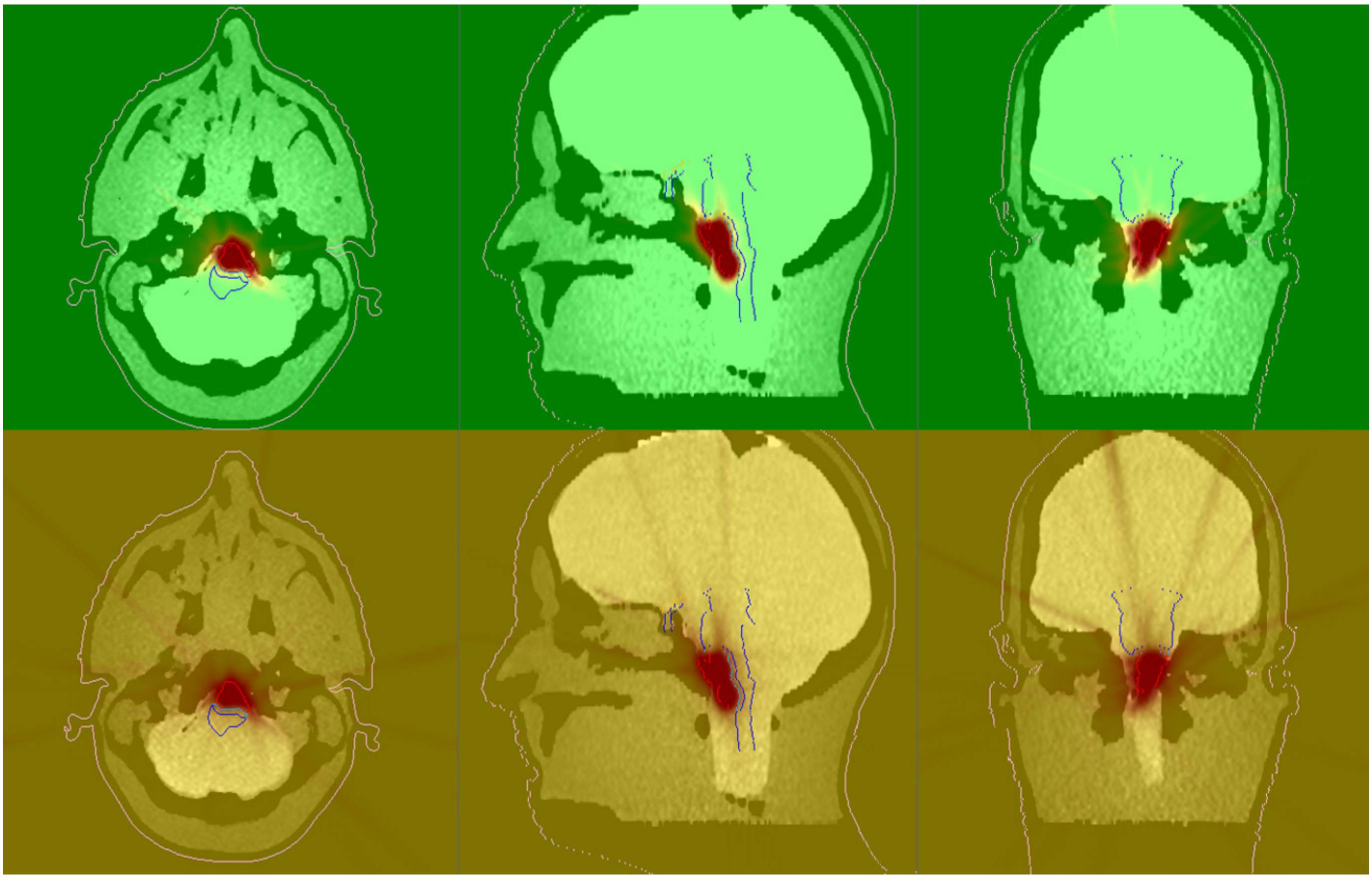


Figure 1. Spatial co-registered images of the post-irradiation MRI dataset of the PseudoPatient® 3D and the Treatment Planning System (TPS) dose data with delineated structures for trial case 2. This is to demonstrate the coincidence of the delivered dose in the treated target to the planned location. Brightness and contrast adjusted so that only high dose areas are depicted (Upper Row), and also low dose areas (Lower row). The caption for the graphic should be included underneath the graphic, in italic font.

The efficacy and superiority of Stereotactic Radiosurgery (SRS) over conventional radiotherapy techniques (i.e., whole brain radiotherapy) for the treatment of brain lesions, such as malignant primary and metastatic tumors, benign tumors, and functional disorders, has been proven by the scientific community over the past decade. The main advantage of SRS is its ability to deliver a highly accurate radiation dose with millimeter precision, in a single or hypofractionated treatment schedule. However, the high dose levels delivered into the anatomy of the brain increase the requirements for accuracy and precision, highlighting the need for personalized Quality Assurance (QA) procedures. The main reason for this need is the reported possibility of significant occurrences of side effects, even caused by a small deviation of the administered dose from the intended one, as predicted by the radiotherapy treatment plan.

RTsafe [1] offers a highly precise, wholly individualized solution dedicated to brain radiotherapy patients, the PseudoPatient® [2]. PseudoPatient® methodology has been redesigned to cover the dosimetric and spatial evaluation of each patient's treatment. Specially produced 3D printed head phantoms derived from the patient planning computed tomography (CT) dataset are equipped with appropriate inserts for point dosimetry and polymer gel (covering the entire brain anatomy) for 3D dosimetry. Point dosimetry is performed by the end-user using the PseudoPatient® IC and the department's equipment at predefined targets and/or organs-at-risk, evaluating the delivered dose accuracy. Combined with the PseudoPatient® 3D detecting the delivered dose pattern in 3D space, the clinician and medical physicist can verify both dosimetric accuracy and spatial precision for challenging clinical cases, taking into account the anatomical and pathological specifics of each patient. In this way, by simply using any clinical Magnetic Resonance (MR) sequence (either a T1w or T2w), the team can examine the spatial similarity between these two 3D dose patterns. Spatial co-registration is performed by the end user between the treatment plan files (i.e., CT, dose, and structure files) and the clinical MR images for a qualitative comparison of the 3D dose structures. Then at the next level, the team also has the choice to proceed with the quantitative assessment of the spatial accuracy through a comprehensive analysis performed by RTsafe.

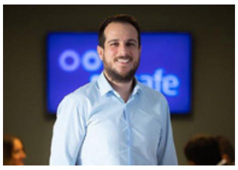
The advanced PseudoPatient® pre-treatment verification methodology combining point and 3D dosimetry was applied with great success in two extremely demanding SRS cases. The first trial was conducted for an adult female patient diagnosed with 7 intracranial metastatic tumors and treated with a Varian Edge linac-based SRS system. Conventional QA methodologies and equipment proved inadequate in this case due to the number and size of the tumors. PseudoPatient® IC measurements verified the dosimetric accuracy within 2% at one target and the brainstem, whereas PseudoPatient® 3D gel measurements revealed a sub-millimeter accuracy for all targets. The second trial was a reirradiation of recurrent pediatric ependymoma in the proximity of the skull base and the brainstem. This case was treated with a CyberKnife SRS system after a pre-treatment evaluation of the delivered dose in both tumor and brainstem using the PsudoPatient® solution (see Figure 1). This integrated personalized QA solution enables clinicians to build confidence in advanced and challenging SRS treatments towards minimal risk and maximum efficiency.

For more information on RTsafe's PseudoPatient® solutions contact us at info@rt-safe.com or visit PseudoPatient

References:

[1] RTsafe company website: https://rt-safe.com

[2] RTsafe's PseudoPatient® solutions https://pseudopatient.com



Emmanouil Zoros is a medical physicist and a 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 an emphasis on quality assurance in stereotactic radiosurgery and experimental and computational dosimetry using Monte Carlo simulation techniques.

Georgios Kalaitzakis 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 tumor. During his PhD in medical school in the University of Crete, he introduced advanced MRI biomarkers in CNS diseases.

MEETING ANNOUNCEMENT

International Conference on Education and Training in Radiation Protection (ETRAP2023) – Groningen, The Netherlands - Hielke Freerk Boersma report

ETRAP

International Conference on Education and Training in Radiation Protection

From 27 – 30 June 2023, the 8th International Conference on Education and Training in Radiation Protection (ETRAP) will be held in Groningen, the Netherlands.

The ETRAP conference is a well-established event in education and training in radiation protection. The first edition was held in Saclay in 1999, followed by meetings in Madrid (2003), Brussels (2005), Lisbon (2009), Vienna (2013), and Valencia (2017) and an online meeting in 2021.

ETRAP 2023 intends to bring together training providers, academics, policy makers, radiation protection professionals, regulators and authorities, and end-users of education and training in radiation protection. It offers the opportunity for learning and discussing about the latest findings and developments in education and training in radiation protection and facilitates networking amongst the different stakeholders. The main themes of ETRAP 2023 are:

- Competence standards for trainers
- Online and hybrid learning: innovation and experiences gained
- Competence based systems vs. qualification based systems
- Attracting and preserving a competent workforce
- Integration of social sciences and humanities and public engagement

The 8th ETRAP conference will be hosted by the Groningen Academy for Radiation Protection in the Academy building of the University of Groningen (Figure 1), in the historical centre of the city. This conference is organized by University of Groningen and SCK CEN in cooperation with IAEA, EUTERP and IRPA and supported by – among others – EFOMP.

Figure 1. Academy Building UG © UG – photo by Silvio Zangerini.

We invite you to submit your abstract for this conference no later than March 1st 2023 through www.etrap.net.

Finally, we note that the 9th EUTERP workshop will immediately precede the ETRAP workshop in Groningen on 26 & 27 June 2023. For details on this workshop, visit www.euterp.eu.

Register now for both events. We are looking forward to meeting you in Groningen in June!

Figure 1. Groninger Museum.

Figure 2. Lage der A – Groningen.

Figure 3. Main lecture room.

Hielke Freerk Boersma is Radiation Protection Expert and E&T manager at the University of Groningen with over 25 years of experience. He is past president of the Dutch Society for Radiological Protection and currently board member of EUTERP. Furthermore, he is involved in the development of E&T programs in Suriname and the Caribbean area.

RESEARCH AND DEVELOPMENT

People, Not Numbers: How Data Science Can Give Cancer Patients a Voice

Early detection, dose de-escalation, innovative treatment methods, and decent healthcare have boosted cancer survivorship and improved the quality of life.

Sofia Spampinato report

An increasing number of radiotherapy clinical trials are therefore using morbidity as their primary endpoint. However, comparing treatment arms is not trivial. The broad spectrum of potential side effects is often simplified as the worst symptom in a domain (gastrointestinal, urinary, fatigue, etc.) at a given follow-up time. [1]. This strategy fails to represent the total long-term treatment burden, as QoL depends not only on symptom severity but also on timing (onset, duration, pattern), location (organ-related or systemic), and other exacerbating or alleviating factors [2].

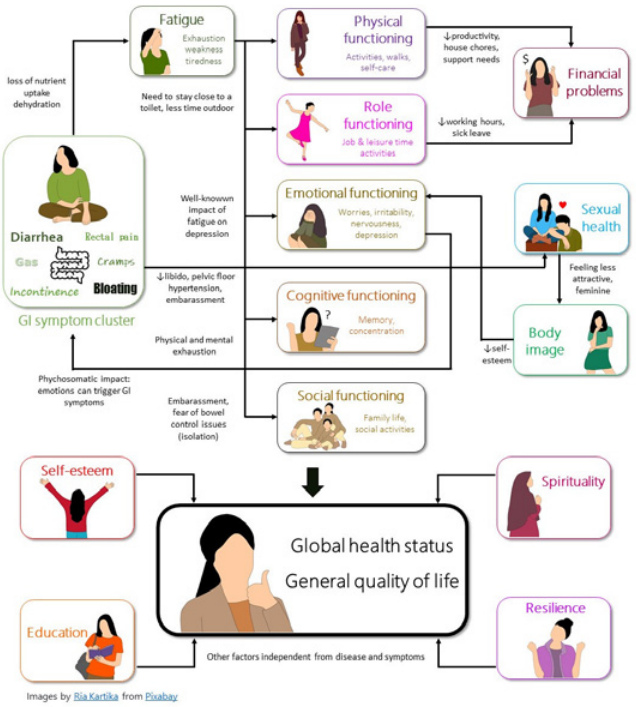


Figure 1. Schematic representation of the complex association of gastrointestinal (GI) symptoms on functioning aspects and global health status/general QoL according to the European Organisation for Research and Treatment of Cancer [14]. Cause-effect pathways are not always in one direction, and factors independent from disease or treatment may also contribute.

Although historically, morbidity after radiotherapy was considered irreversible, it is now established that many symptoms can have a reversible or fluctuating pattern. In addition, the simple grading for symptom severity is not always straightforward to interpret. Mild-to-moderate but persistent symptoms may impose limitations on health and daily activities. On the other hand, severe adverse events can often be solved by successful interventions. Despite this trivial insight, a review showed that the duration of symptoms was never included in prospective radiotherapy trials [3].

The GEC-ESTRO Gynaecology network designed the EMBRACE studies to evaluate the clinical outcome of image-guided radiotherapy in locally advanced cervical cancer (LACC). The prospective, international and observational EMBRACE-I study (2008-2015) enrolled 1416 patients [4]. EMBRACE-II (2016-2021) was initiated as a prospective interventional study and enrolled 1452 patients (www.embracestudy.dk). With the amount of prospective longitudinal data on symptoms and QoL, the EMBRACE studies offer a unique opportunity to investigate the above-mentioned issues.

The EMBRACE research group introduced a methodology to identify cancer survivors with late, persistent, substantial, and treatment-related symptoms (LAPERS), considering both severity and duration [5]. This approach was implemented in EMBRACE-I and used in analyses aimed at identifying risk factors for different symptoms [6]–[11].

The LAPERS methodology was also used to quantify and rank the longitudinal association of persistent symptoms with QoL in EMBRACE-I survivors. A new procedure was implemented to evaluate the overall integral difference in QoL between patients with and without persistent symptoms over a 5-year follow-up. As a result, fatigue and pain were the most detrimental symptoms, while abdominal cramping was the organ-related symptom with the largest effect on QoL [12].

Ranking symptoms according to their impact on QoL leads to several implications: 1) providing evidence-based priorities on treatment planning, 2) raising awareness among professionals for routine follow-up, and 3) incentivizing multi-disciplinary and targeted morbidity management.

In view of future studies, the EMBRACE research group is developing a "Total Toxicity Burden" (TTB) score that summarizes the treatment burden by weighing symptoms based on their impact on QoL. TTB was originally introduced as a more sensitive endpoint for assessing morbidity differences between treatment arms, but symptom weights were assigned by physicians [13]. Integration of patient's perspective can ensure that evidence from clinical trials will be relevant for cancer survivors. However, QoL is a multi-faceted concept: number of factors involved, intercorrelations, time patterns, and cause-effect pathways are difficult to disentangle with classical statistics (Figure 1). Therefore, more advanced mathematical approaches are needed to uncover relevant associations.

EMBRACE is promoting the use of advanced statistical algorithms applied to prospective clinical data within an international and interdisciplinary framework. Several projects are currently active on hierarchical symptom clustering, symptom trajectory analysis for time patterns, and Bayesian Networks for predictive modeling. Results will be presented at the next ESTRO 2023 conference.

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Sofia Spampinato is an Italian Medical Physicist and currently post-doc at Aarhus University Hospital, Denmark. Sofia works within the largest studies in locally advanced cervical cancer (EMBRACE), with interest in morbidity and QoL. Current projects aim to include patients' perspective in clinical trials bringing together radiotherapy professionals and data scientists.

EFOMP COMPANY MEMBER ARTICLE

Standard Imaging: Just How Easy Can Machine QA Be?

The newly released QA StereoChecker™ v2.0 software sets the new standard with just one click.

Standard Imaging, a leader in radiation therapy QA, has a long history of advancing stereotactic quality assurance solutions that include many firsts, the QA StereoChecker being one of them. Not only was the QA StereoChecker the first filmless solution for performing CyberKnife® machine QA tests, but it also remains the highest resolution detector available with fully integrated image acquisition and analysis software. High speed and high-resolution QA images constitute a solid foundation for CyberKnife QA, but the question we asked clinical physicists and therapists was this: what more is needed to maximize efficiency? The answers are found in QA StereoChecker v2.0.

Minimize Setup Efforts

QA StereoChecker setup is accomplished in just one trip into the vault. Users align the device in clinical mode using the Target Localization System to perform a comprehensive suite of CyberKnife machine QA tests including Iris™ QA in a single batch test, patented PANDA tests that replace film based AQA™ tests, and MLC Garden Fence and Picket Fence tests. The flat panel imager (aSi) built into the device is large enough to capture all 26 InCise™ MLC leaf pairs without any special alignment or repositioning required.

Simplify and Automate the Software

Our software engineering team worked with clinical partners to identify workflow-based improvements to streamline the user experience. The resulting sleek web page design allows users to navigate easily through the software without annoying pop-up windows, manual data input, or excessive clicks to complete assigned tasks. In fact, once the user selects a QA test and clicks the start button, the software automatically acquires, analyzes, reports, saves and trends all test images and metrics.

The initial response from those who have already upgraded to version 2.0 has been extremely positive, with comments like:

"It is a lot easier to analyze results and quickly identify issues using the new version." – UK

Figure 1. QA StereoChecker set up on CyberKnife couch.

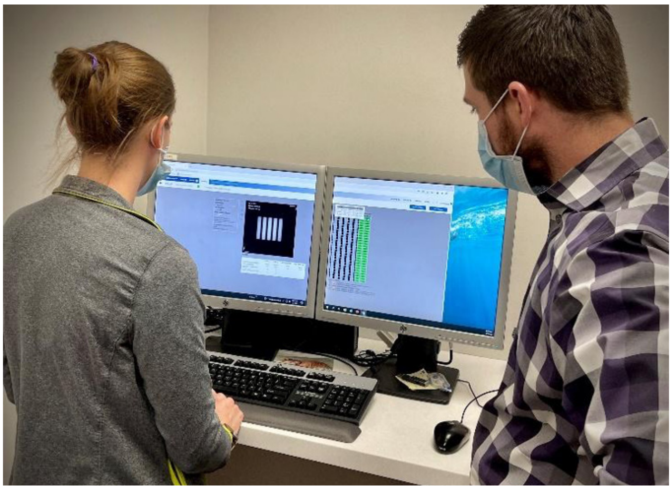


Figure 2. Physicists reviewing their MLC Garden Fence Test results.

"This version is a MAJOR upgrade to the previous version. It's very easy and logical to use." – Finland

"My therapist is raving about the time savings of the new software and how easy it is to use." – USA

Provide More Data

Performing QA tasks regularly helps ensure machine uptime and patient safety, but it isn't the only factor. Clinicians need comprehensive data collected over time to have a robust understanding of machine performance and to aid in diagnosing mechanical issues before they become clinically relevant. To that end, the updated software now includes a fully trended database of each QA test and all test metrics, not just a select few. Both test images and results are automatically saved to the database for easy retrieval and review.

Several tests have also been enhanced to provide more detailed information. The Iris Batch test, for example, now provides a radial profile comparison at every 5 degrees in addition to the average radial profile comparison. The MLC Garden Fence test has been upgraded to report absolute leaf position using Accuray test criteria. Single Field Analysis (SFA) tests have also been improved to provide full inline and crossline profiles.

Note that SFA tests may now be performed on non-CyberKnife systems for field sizes up to 15 x 15 cm, and manual QA mode allows users to composite up to 10 images and generate DICOM image files for export for both CyberKnife and non-CyberKnife systems.

All that QASC v2.0 offers is summed up nicely by a clinician who stated, "It's automated and streamlined for daily use, but can also be used as a research tool with advanced controls and freedom of acquisition."

Andrea Zens is a Product Manager at Standard Imaging. Andrea's product portfolio includes QA StereoChecker, stereotactic QA phantoms, QA Pilot - SaaS QA Management Software, and brachytherapy products. Her passionate curiosity and extensive experience in sales, marketing and product management are instrumental to Standard Imaging's strength in providing the highest quality QA solutions that delight users.

PROFESSIONAL MATTERS

My Success Story at the International Center for Theoretical Physics

In this article, **Xhulia Dosti** demonstrates how treatment with equality and dignity in such learning facilities can truly be the key to our future success

Following my first master's, I joined and later became head of the radioprotection department of University Hospital Center Mother Teresa in Albania. In my daily work, I continuously feel the need to acquire more knowledge of medical physics and to have the same background as other medical physicists all around the world. This was the main reason for my decision to seek educational opportunities in this field.

Unfortunately, the onset of COVID-19 made it impossible for me to start any clinical training outside of Albania, so I began researching postgraduate degrees in medical physics. The Abdus Salam International Center for Theoretical Physics stood out, not least because it offered a full year as a residential student in a hospital. So, I was delighted to accept their offer of a scholarship, even though it meant giving up my family and job.

I started the first year of my postgraduate course in January 2021, together with 23 other students from 17 different countries. It was undoubtedly a challenging year, fully packed with lectures, difficult exams, and the challenges of living away from home. We also had to face pandemic time restrictions. Despite these, we were determined to succeed and knew we could rely on the extensive support of the ICTP staff. Under their guidance, I became well acquainted with the main theoretical concepts in Radiotherapy, Nuclear Medicine, Radiology, MRI, and Radioprotection.

When I was given the choice between specialization in nuclear medicine, radiology, and radiotherapy, I chose the latter, and in my second year I ended up in the radiotherapy department of the "Santa Maria Annunziata" hospital in Florence. Involvement in routine clinical work introduced me to many highly specific problems, and therefore complimented the broad portfolio of study organized by the university. By the end of my placement, I gained valuable experience in quality assurance, dosimetry, in vivo dosimetry, and clinical treatment planning, to name a few!

The study culminated in my thesis, **"Small Field Dosimetry with the New Generation Exradin W2 Scintillator Detector,"** which will soon be published as a paper. The skills I developed through this experience proved to be particularly relevant to my work after graduating as a researcher. In this role I will continue to work with my supervisors and teachers.

Finally, I would like to mention the work that has been done in every hospital in the network. The medical physicists we worked with treated us all equally and with dignity. I can honestly say that they are the key to our success tomorrow.

I was highly motivated during this course, and it was a great experience for me. My dedication paid off when I finally graduated as the best student of the year!

Xhulia Dosti is from Tepelena, Albania. She holds an MSc in Engineering Physics and an Advanced Masters in Medical Physics from the University of Trieste, ICTP, Italy. She currently works as a research scientist at TRUEinvivo Ltd, developing microsilica bead dosimetry systems that can be used for internal dosimetry or as a portable device during radiotherapy treatments.

EFOMP COMPANY MEMBER ARTICLE

SUN NUCLEAR: A More Versatile Phantom for CT Image Quality Evaluation

When performing Quality Control (QC) on a CT system, it is important to have a phantom that fits the scanner's capabilities. A phantom that is over-spec'd for a system is not only a waste of money; it can altogether fail to provide necessary QC information. The new IQphan™ from Sun Nuclear addresses this issue.

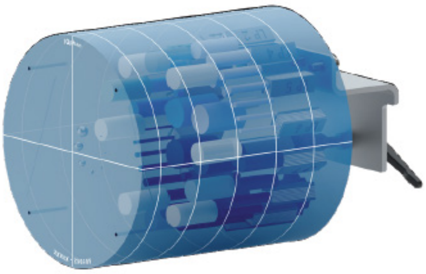


Figure 1. IQphan, shown partially-transparent for illustration purposes only.

The test objects should usefully probe the system limits without being exceeded, and more curiously, without all being "too good" for this system. This problem can impact conventional diagnostic scanners and is even more acute for some different CT implementations, such as radiation therapy cone-beam CT (CBCT) and Megavoltage CT (MVCT). QC phantoms developed for one system may not provide much analytical value for another system. Another issue is that phantoms that were originally designed for manual or visual evaluation might not be optimally suited for automated analysis.

Thus, many clinics might be hindered in their ability to achieve a basic goal: **to simplify testing equipment with a single phantom that can usefully test a variety of scanner types, whether in one department** or spanning multiple departments.

The test range specifications were re-evaluated to create a versatile phantom with useful analysis ranges for a diverse array of CT systems, in both the diagnostic and radiation therapy spaces.

One key example regards low contrast detectability (LCD). This test is designed to evaluate how well a CT system can detect faint objects. It is common for CT phantoms to have test objects that span a range of sizes and contrasts, typically maxing out around a 1% contrast at 15 mm. This is generally appropriate for typical diagnostic CT scanners. However, CBCT and MVCT systems, as well as systems running low-dose applications, may not see even the largest object at that contrast.

The IQphan phantom rectifies this by adding objects with both higher contrasts, up to 2%, and larger sizes, up to 25 mm. Appropriately, these additional targets are more visible, especially on RT imaging systems, and also reflect the size and contrast of common visualization targets.

This is demonstrated in the CBCT image of IQphan taken on a Varian TrueBeam system (Figure 1). The section highlighted in green is the quadrant of 2% contrast objects, as well as a 1% contrast object in a 25 mm size. Numerous objects are visible in this green region, meaning that this phantom could usefully evaluate system performance. Conversely, contrast objects maxing out at 1% and 15 mm are not visible, making them unsuitable for this imaging task. As such, if those objects in the red section were the most attenuating ones in a phantom, then that phantom would not suffice for evaluating low contrast detectability of the system.

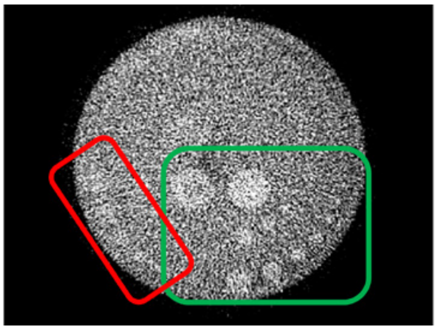


Figure 2. Low Contrast Detectability of a CBCT scan on IQphan. The higher contrast and larger diameter objects are critical for achieving useful measurements.

In conclusion, an image quality phantom needs to have specs that encompass the characteristics of the imaging systems being tested. As illustrated by the example of low contrast detectability, the new Sun Nuclear IQphan was designed with a broad range of CT scanner needs in mind, to create a versatile solution that can improve and standardize testing.

Kenneth Ruchala, PhD, is a Product Manager at Sun Nuclear Corporation and represents CT phantoms, RT phantoms, and diagnostic software. Prior to this role, he earned a degree in Medical Physics from the University of Wisconsin – Madison and worked in R&D for radiotherapy delivery systems and imaging.

MEETING ANNUNCEMENT

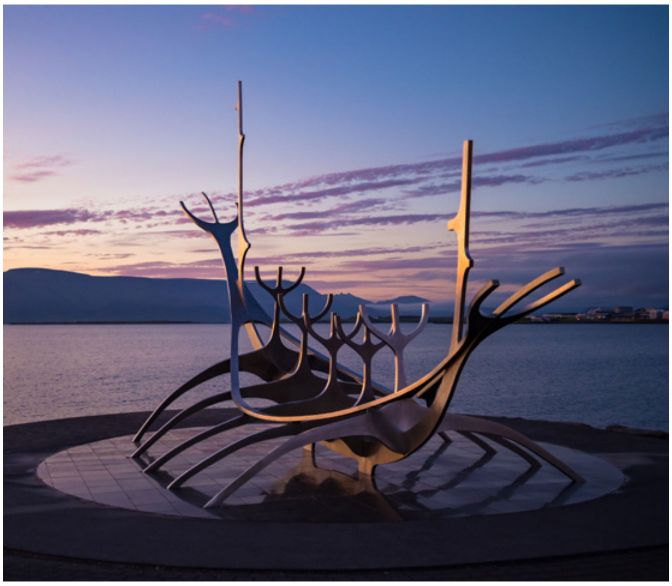
Welcome to Iceland and the Triennial Symposium for the Nordic Association of Clinical Physics!

Stine Korreman and **Kirsten Bolstad** report

The Nordic Association of Clinical Physics (NACP) [1] was founded in 1962 as an umbrella organization for the Nordic National Member Organizations (NMOs). The triennial NACP symposia have been integral in promoting Nordic co-operation and exchange of scientific research within clinical physics and related fields. The hosting role of the NACP symposiums rotates between the Nordic NMOs. In 2023, the NACP symposium will be held in Reykjavik, Iceland, as a collaboration between the Norwegian Association of Medical Physics (NFMF) [2] and the Danish Association of Medical Physics (DSMF) [3] together with the Icelandic Society.

An important vision for the NACP 2023 symposium is to facilitate dialogue and interaction between medical physicists working at different institutions within clinical practice as well as research and industry. The theme of the NACP 2023 symposium is "New technologies from bench to bed," including topics such as artificial intelligence in medical physics, new technologies within therapy and diagnostics, and translating new technologies into clinical practice.

Explore Reykjavik and visit Harpa, one of Reykjavík's most striking landmarks and a center of cultural and social life in the very heart of the city. Photo by Michael Held on Unsplash.



The Sun Voyager, Sólfar in Icelandic, is a sculpture in Reykjavik, a popular attraction in the capital city. Photo by Yanshu Lee on Unsplash.

The programme includes an array of highly recognized invited speakers from the Nordic as well as other European countries. The speakers will enlighten participants on some of the newest progress and innovations within a broad range of medical physics specialties. In addition, there will be sessions for proffered papers as well as a guided poster session, based on selection among the submitted abstracts.

As a new feature, the programme will include interactive thematic workshops in which participants will have the opportunity to contribute and discuss challenges and best practices from daily clinical life.

The NACP Symposium is a meeting primarily for medical physicists and will cover subjects of interest for medical physicists working within the fields of diagnostics and therapy. As our European and international friends and colleagues, you are very welcome to join us! Meet and mingle with old friends and new acquaintances and listen to excellent speakers presenting their newest research in informal and spectacular surroundings in Iceland! The symposium is endorsed by EFOMP and will host the EFOMP officers' spring meeting. Please visit NACP's official website [4] to join us.

References:

[1] NACP's website https://www.nacp-nordisk.org

[2] NFMF's website https://medisinskfysikk.wpcomstaging.com

[3] DSMF's website https://dsmf.org/dsmf/english

[4] NACP Symposium 2023, official website www.nacp2023.org

Important information:

Abstract submission deadline: December 12, 2022
Registration deadline: January 30, 2023
Symposium dates: March 30 – April 1, 2023

Programme, registration and further information:
www.nacp2023.org

Scientific committee (DK):

Stine Sofia Korreman (chair)
Claus Behrens
Vibeke Nordmark Hansen
Jesper Thygesen
Thomas Lund Andersen

Organizing committee (NO):

Kirsten Bolstad (chair)
Kristine Indahl Helle

Stine Korreman is Professor of Medical Physics at Aarhus University Hospital and Qualified Medical Physics Expert within radiation oncology. She has more than 20 years' experience in medical physics, and now runs a research group in computational medical physics with focus on use of artificial intelligence and big data. She is presently deputy director of the Danish National Radiotherapy Research Center and chair of ESTRO working group "Artificial Intelligence in Radiation Oncology".

Kirsten Bolstad is a Qualified Medical Physics Expert within diagnostic radiology (X-ray and CT) and the head of the X-ray physics group at Haukeland University Hospital. She has nearly 20 years of experience in medical physics. Kirsten Bolstad is currently the elected president of the Norwegian Association of Medical Physics.

EFOMP COMPANY MEMBER ARTICLE

varian
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Varian: HyperArc Radiosurgery for Benign Indications

Cancer care centres across the globe are taking advantage of HyperArc® high-definition linac-based radiotherapy for frameless cranial radiosurgery to treat benign lesions of the brain quickly and with flexible fractionation schedules tailored to each patient's condition. Here we spotlight one centre in Belgium. (To access a longer article highlighting clinical deployments in Latin America, the United States, and Asia, visit www.varian.com/centerline).

At University Hospitals (UZ) Leuven, Belgium's largest university hospital, Jean-Francois Daisne, MD, is a radiation oncologist specializing in neuro-oncology. He uses HyperArc to treat benign tumours of the brain, including acoustic neuroma. Though acoustic neuroma is a rare tumour, these cases are frequently referred to UZ Leuven. "We merge strong expertise in radiotherapy and neurosurgery. We take multidisciplinary decisions about the best treatment to propose to the patient," said Prof. Daisne. Patients with acoustic neuroma are offered treatment if there is a growing tumour or if there is a decrease in useful hearing. Radiosurgery is proposed if the distance between the tumour and the brainstem is not too narrow.

"The advantage of stereotactic radiotherapy on a linear accelerator platform is the flexibility to choose the fractionation scheme for the situation of the patient, be it one fraction of 12 Gy, three fractions of 6 Gy, or five fractions of 5 Gy, or even thirty fractions of 1.8 Gy," said Prof. Daisne. Decisions about the best fractionation scheme depend on accurate delineation of targets and surrounding tissue. For this reason, Prof. Daisne emphasizes that multimodal image registration and contouring is essential for benign lesions that are often complex and irregular. "Having an accurate delineation is very important, not only for tumour control, but also for organs at risk protection, to offer the best possible fractionation schedule to the patient."

In 2020, UZ Leuven introduced HyperArc for treating multiple brain metastases and benign brain tumours. "HyperArc is a Varian product and is fully integrated to our full Varian workflow."

Figure 1. University Hospitals (UZ) Leuven. Inset: Prof. Jean-Francois Daisne, MD

The UZ Leuven team found many aspects of HyperArc surprising, starting with the speed of optimization. "In less than half an hour, the dosimetrist can provide me a fully compliant and satisfactory plan," reported Prof. Daisne.

Also surprising were the steepness of the dose gradient and the speed of delivery at the machine. "The most significant impact of HyperArc is the reduction of the timeslot at the machine, from one hour to 24 minutes. The four arcs themselves are delivered in 11 minutes on average. It has had a significant operational impact also for us, for the nurses at the linear accelerators, and of course, for the patient," Prof. Daisne said.

"HyperArc was specifically designed to automate and simplify sophisticated treatments like stereotactic radiosurgery and make them more readily available to cancer patients around the world," said Kevin O'Reilly, President, Radiation Oncology Solutions at Varian. "We are very gratified to hear from clinical teams that they are realizing the gains in simplicity and efficiency, and that patients are benefitting."

This article was excerpted from a longer one available on Varian's website at www.varian.com/centerline.

Nancy Heifferon has been writing about medical technology and advances in cancer care for two decades. Before that she was a communications programs manager for IT companies and a college lecturer.

MEETING ANNOUNCEMENT

PTCOG Meeting 2023 in Madrid

PTCOG 61
MADRID 2023

For the first time, Particle Therapy Co-Operative Group (PTCOG) will hold its annual meeting in Spain [June 10 - 16, 2023], which promises to be the best ever: **Marco Durante** reports

Founded in 1985, the Particle Therapy Co-Operative Group (PTCOG; www.ptcog.ch) is a non-profit organization of scientists and professionals interested in charged particle radiotherapy. The mission of PTCOG is to promote science, technology, and the practical clinical application of particle therapy with the ultimate goal of improving treatment of cancer to the highest possible standards in radiotherapy. The PTCOG Steering Committee includes representatives of all particle therapy centers worldwide.

The annual PTCOG meeting is an unmissable event for all professionals involved in particle therapy and scientists interested in this type of radiotherapy. Cancer treatments using accelerated charged particles started about 70 years ago at the Lawrence Berkeley National Laboratory and in Uppsala [1]. The number of patients receiving particle therapy is now experiencing an exponential growth (Figure 1) [2], reflecting the clinical success of cancer therapy using protons or heavier ions [3, 4].

Over 300,000 patients have been treated worldwide with charged particles for many different types of cancer, and approximately 85% of those patients were treated with accelerated protons [5].

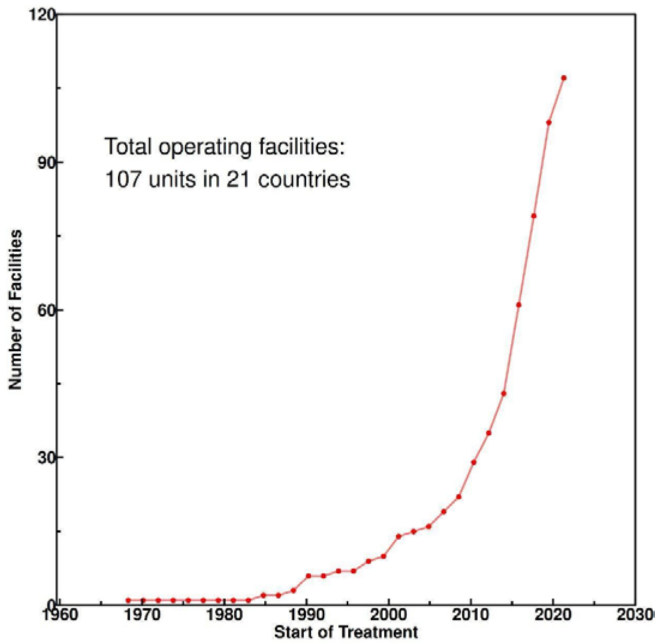

Figure 1. The growth of the particle therapy centers worldwide. Data from PTCOG [2].

Figure 1 shows that particle therapy is now at a crucial point. Particle therapy technology is complex and requires dedicated training by physicists and physicians. The results are dependent on pre-clinical and clinical research, which is ongoing intensively worldwide. PTCOG is playing a decisive role both in education and research. The 61st meeting will be held in Spain (Figure 2), certainly not by chance. With 2 centers in operation in Madrid and 11 planned all over the country, Spain will become the leading European country in proton therapy. The first two days of the PTCOG meeting are always dedicated to educational sessions. This year, in recognition of the role of the hosting country in proton therapy, the first day will be in the Spanish language to facilitate the participation of future employees in the many Spanish proton therapy facilities. Following the educational sessions, PTCOG will open the scientific meeting. We had an historical record of 720 abstracts submitted to the scientific sessions, and are planning many outstanding invited lectures and debates.

The PTCOG61 conference theme is "Integrative Particle Therapy and Complementary Care" reflecting the importance of integrating particle therapy into comprehensive cancer care. The Steering Committee elected new members of the Executive Committee during the PTCOG60 meeting in 2022, and this will be the first meeting for the new PTCOG chair and vice-chairs, as well as for the new chairs of the Educational Sub-Committee. We hope that in Madrid all of you will participate in one of our 14 active Sub-Committees. We will also launch for the first time the PTCOG Scholar-in-Training (PTCOG-SIT) group, where young students will have the opportunity to participate more actively in the life of the society.

PTCOG61 is expected to be the best meeting ever in particle therapy. If you want to know more about this advanced cancer treatment and want to participate in the amazing Spanish programme, you cannot miss the conference.

References:

[1] Smith AR. Proton therapy. *Phys Med Biol* (2006) 51:R491–R504. doi:10.1088/0031-9155/51/13/R26

[2] PTCOG. Particle therapy facilities in operation. (2022) Available at: https://www.ptcog.ch/ [Accessed December 12, 2022]

[3] Durante M, Orecchia R, Loeffler JS. Charged-particle therapy in cancer: clinical uses and future perspectives. *Nat Rev Clin Oncol* (2017) 14:483–495. doi:10.1038/nrclinonc.2017.30

[4] Durante M, Debus J, Loeffler JS. Physics and biomedical challenges of cancer therapy with accelerated heavy ions. *Nat Rev Phys* (2021) 3:777–790. doi:10.1038/s42254-021-00368-5

[5] PTCOG. Patient statistics. (2022) Available at: http://ptcog.ch/ [Accessed December 12, 2022]

Marco Durante is a professor of physics at the Technical University of Darmstadt and the head of the Biophysics Department at the GSI Helmholtz Center in Germany. He has been working on charged particle research for 35 years and was elected president of the PTCOG at the 60th meeting in Miami.

MEETING REPORT

The 2nd Real-Time Adaptive Particle Therapy of Cancer (RAPTOR) School: "Loop Requirements"

The 2nd RAPTOR School was a huge success! Held at Cosylab in Ljubljana, Slovenia, from September 4–9, 2022, **Giuliano Perotti Bernardini** and **Anna-Maria Fanou** report

Figure 1. Participants at the 2nd Raptor School in Ljubljana.

This second event of the three-part RAPTOR training series organized by the RAPTOR project - A MARIE SKŁODOWSKA-CURIE INNOVATIVE TRAINING NETWORK (ITN) - brought together a talented group of young scientists with remarkable experts in the field. Want to learn more about the RAPTOR Consortium?
Visit our website: https://raptor-consortium.com/

With two scholarships available, the school provided a unique opportunity for external young scientists to delve into the exciting world of real-time adaptive particle therapy.

The primary goals of the school were to educate and inspire the next generation of researchers who will shape and standardize the implementation of adaptive particle therapy (PT) in the clinic. By covering topics ranging from adaptive PT to entrepreneurship, certification of medical devices, clinical Monte Carlo, and healthcare economics, attendees left with a well-rounded understanding of the industry and the tools they need to turn their research into impactful clinical products.

The school kicked off with a motivational lecture from Dr. Mark Plesko, CEO and co-founder of Cosylab. He shared his personal experience in entrepreneurship and encouraged attendees to turn their ideas into tools that will benefit the clinic.

During the school, attendees learned about the use of machine learning and AI for imaging and treatment planning, as well as the importance of managing big data in a clinical setting. The complexity of delivering an accurate proton beam dose to a moving target and the value of using machine logfiles for 4D dose reconstruction were discussed. The role of imaging in an adaptive workflow was highlighted through discussions on prompt gamma imaging and deformable image registration techniques.

The school also covered the challenges of operating a PT centre and the clinical needs for adaptive PT, ensuring that attendees had a complete understanding of the field. A highlight of the event was a public lecture by the renowned medical physics expert and entrepreneur Dr. Thomas Mackie, who shared his insights on the latest innovations in medical physics.

In addition to the engaging lectures, the school hosted a poster session where the 15 RAPTOR early stage researchers (ESRs), the two fellowship awardees, and other participating researchers showcased their work and received valuable feedback from the audience (Figure 1). To wrap up the week, Cosylab organized a thrilling Hackathon challenge that put attendees' programming skills to the test. Working in groups, attendees had to solve a complex exercise that challenged them to think creatively and collaboratively.

Figure 2. Poster session during the 2nd RAPTOR School at the Josef Stefan Institute in Ljubljana, Slovenia

The 2nd RAPTOR School wasn't just about lectures, it was also about networking and socializing with fellow attendees and making memories (Figure 2). In the middle of the school, attendees took a break from the lectures and visited the stunning village of Bled, surrounded by breathtaking scenery. This was the perfect opportunity to get to know each other better, indulge in delicious local cuisine and immerse themselves in the culture of Slovenia. The trip to Bled showcased the importance of networking and social activities in creating a strong and supportive community of researchers and scientists.

The Hackathon challenge was a fitting conclusion to an event that inspired and empowered the next generation of researchers and scientists in the field of adaptive particle therapy.

If you're looking to immerse yourself in the exciting world

Figure 3. Some of the participants of the 2nd RAPTOR School and ESRs networking and having fun

of real-time adaptive particle therapy and have a unique learning experience, don't miss the next RAPTOR School on 9-15 September 2023. So mark your calendars and be ready to take your understanding of adaptive particle therapy to the next level at the next RAPTOR School!

Giuliano Perotti Bernardini is an early-stage researcher (ESR) from the RAPTOR Consortium, doing a Medical Physics PhD project: ESR15 “Proton Radiography for real-time Intensity Modulated Proton Therapy” at the UMCG in the Netherlands. He completed an equivalent master's degree in Nuclear Engineering in Argentina and was working on Boron Neutron Capture Therapy (BNCT).

Anna-Maria Fanou was awarded one of the scholarships to attend the 2nd RAPTOR School as an external participant. She is currently a Resident Medical Physicist in the Nuclear Medicine department at ‘Evangelsimos’ General Hospital, Athens, Greece. Her primary research interest is Radiation Oncology Physics.

MEETING ANNOUNCEMENT

UKIO
UK IMAGING & ONCOLOGY

Join the UK Largest Imaging and Oncology Event – in a Fully Reviewed Format

UKIO, the UK's largest multidisciplinary imaging, oncology, and radiological sciences event, will return to Liverpool, UK, in June. We can't wait to return once again to the ACC Liverpool for UKIO 2023 - Synergy and Symbiosis: Breaking Down Healthcare Obstacles, June 5-7: Rizwan Malik reports

After our return to an in-person congress last year, we're delighted that UKIO– the UK's largest multidisciplinary imaging, oncology, and radiological sciences event – will be returning to Liverpool, UK, once again in June. We saw last year that nothing truly replaces the value of networking and face-to-face learning, and so we can't wait to be back again **on June 5-7 at the ACC in Liverpool with UKIO 2023 - Synergy and Symbiosis: Breaking Down Barriers in Healthcare.**

This time, though, we are returning with a new and improved format. We've spent the last few months reviewing what our delegates have told us; how external pressures are affecting the NHS and its workforce, and what UKIO should look like in the times we now find ourselves in. This has brought about the planning for a new and improved Congress that will reflect the world we live in today by delivering a stream-lined and delegate-focused programme and increasing accessibility and 'recession-busting' pricing, with fees starting at just £75 for full attendance and access to all content. UKIO will continue to be the place to go for cutting-edge, practice-based content for a multidisciplinary audience, to join up with like-minded professionals, up to three days of CPD, and a large professional exhibition of the latest state-of-the-art equipment, services, and technology. As always, the Congress will deliver:

A cutting-edge programme for a multi-disciplinary audience

UKIO is a three-day congress and exhibition and the only event in the UK aimed at a multidisciplinary audience in the diverse fields of diagnostic imaging, oncology, and radiological sciences - delivering a cutting-edge programme that aims to address the medical, scientific, educational, and management issues of the audience's fields of work. The programme provides more than 100 sessions to choose from - there is something for everyone. The full programme will be released later in February; look out for updates at ukio.org.uk/programme-2023.

Sessions for medical physicists

The physics and radiation protection stream is again being expertly led by Dr. Mohamed Metwaly, a lead consultant clinical scientist in the NHS, registered medical physics expert, and Chair of EFOMP's Communications and Publications Committee. He has put together a diverse and relevant programme with sessions on nuclear medicine and radiology physics, MRI physics, professional matters, and more.

The latest research

As part of the new-look congress, we're placing research at its heart, with more proffered paper sessions to present your work, expert sessions on refining research proposals and power pitches, and a dedicated research hub.

An interactive exhibition

As well as the scientific sessions, you'll also be able to attend the exhibition, which will feature all the key suppliers under one roof, displaying the latest state-of-the-art equipment, services, and technology available in the industry.

Figures 1&3. Participants at the Uk Largest Imaging and Oncology event.

We hope you'll join us in Liverpool in June. For full details and to book a place, visit https://www.ukio.org.uk/.

A focus on networking

As always, networking remains a key element of the congress, with lots of opportunities for formal and informal networking, including a full social programme.

Dr. Rizwan Malik, president of UKIO, is a leading radiologist with an interest in health tech, digital imaging, and the potential of AI to support clinicians and patients.

PROFESSIONAL MATTERS

One Year of Official ICRP-EFOMP Liaison!

In this article, Lorenzo Nicola Mazzoni discusses his experiences serving for one year as the representative of the EFOMP to the ICRP

The International Commission on Radiological Protection (ICRP) is an independent, international, non-profit organization that advances for the public's benefit the science of radiological protection. The ICRP's structure comprises a main commission, a scientific secretariat, and four commissions dedicated respectively to radiation effects, doses, medicine, and the application of recommendations [1].

The main document that ICRP publishes is the General Recommendations, where the overall system of radiological protection is described.

"... The system of radiological protection is based on the current understanding of the science of radiation exposures and effects, and value judgements. These value judgements take into account societal expectations, ethics, and experience gained in the application of the system. As the understanding of science and societal expectations have evolved over time, so too has the system of radiological protection. The legislation in most countries adheres closely to ICRP recommendations. The International Atomic Energy Agency (IAEA) and International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources are based heavily on ICRP recommendations." [extract from 1]

The General Recommendations were last published in 2007 [2], and the ICRP is currently working on the new recommendations, which should be published as drafts open for consultation in the next 6-8 years. The ICRP develops relationships with a wide range of stakeholders as it revises the radiological protection system. Some organizations whose work is relevant to the ICRP mandate may be granted Special Liaison Organization Status with the ICRP. EFOMP applied for special liaison status and received it in December 2021. I am the current representative.

As Medical Physicists, we are all familiar with the ICRP, and we are well aware of the impact that its recommendations have on society in general and, in particular, on much of our activities. Therefore, it is easy to understand how important it is to have our voice represented in the ICRP.

Since December 2021, EFOMP has been represented at many events (i.e., the Rome, Estoril, and Vancouver meetings), including the annual meeting between ICRP and

Figure 1. Lorenzo Nicola Mazzoni and Mika Kortesniemi at the 2021+1 ICRP Congress in Vancouver.

representatives of organizations with special liaison status. Comments have been sent on the draft document "ICRP Calls for Action to Strengthen Expertise in Radiological Protection Worldwide", on the "Topics Identified as a Priority for Review to Prepare the Next General Recommendations" (an open access paper will be published with EFOMP contribution) and on the draft open for consultation dedicated to optimization in medical imaging [3].

Points raised on behalf of EFOMP included: the need to further investigate the non-cancer effects of ionizing radiation, the importance of uncertainties, especially in low dose and low dose rate dose estimates, the need to provide more practical information on the use of dose constraints, and the importance of promoting individual optimization in medical imaging. Moreover, as EFOMP, we agree with ICRP that research and collation of information are continuously required in relation to the best use of ionizing radiation and radioactive materials in medical diagnosis and treatment [4], in particular when novel systems and procedures are employed (MR-LINAC, flash radiotherapy, novel tracers, etc.). More generally, the need to provide adequate staffing levels for medical physicists to ensure an effective and optimized use of ionizing radiation in medicine was underlined.

Finally, the need to involve an increased number of students, young professionals, and researchers in the field of radiological protection, which is so important for medical physics but still has many challenges to face, was highlighted. Our group of Early Career Medical Physicists could be actively involved with ICRP in the future [5]. 2022 was the first year of the official ICRP-EFOMP liaison, which we hope will be more and more fruitful in the coming years!

References:

[1] https://www.icrp.org/

[2] ICRP, The 2007 Recommendations of the International Commission on Radiological Protection. ICRP Publication 103. Ann. ICRP 37, 2-4 (2007).

[3] https://www.icrp.org/consultation.asp?id=94DD12D6-8688-413F-9BD3-15B2E91F0702

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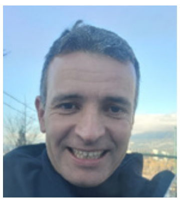
[5] L.G. Marcu et al., Early career medical physicist groups in Europe: An EFOMP survey, Physica Medica 95, 89-93 (2022). DOI: https://doi.org/10.1016/j.ejmp.2022.02.001



Lorenzo Nicola Mazzoni is a Medical Physics Expert at the Medical Physics Unit of Prato-Pistoia, AUSL Toscana Centro. His activity is mainly focused on medical imaging and radiation protection. He is member of the EFOMP European and International Matters Committee and the current primary contact of EFOMP with ICRP.

European Erasmus+ voluntary traineeships for physics and engineering students

A call by the EFOMP E&T Committee for more volunteer centers to help construct a pan-European network. **Carmel J. Caruana, Christoph Bert, Veronica Rossetti, Kiki Theodorou, Niall Colgan** report

As you are probably aware, two years ago the EFOMP E&T Committee launched the Erasmus+ voluntary traineeships in Medical Physics and/or Radiation Protection. The general aim of the traineeships is to attract more physics and engineering students (from Bachelor's and Master's programmes) to the Medical Physics profession by providing them with a voluntary opportunity to experience the work in a clinical and/or academic Medical Physics department (public or private) outside their own country. The role of the EFOMP E&T Committee is to advise supervisors taking part if need be (write to Carmel J. Caruana at carmel.j.caruana@um.edu.mt). The first adopters have been the University of Malta (Carmel Caruana), University of Thessaly, Greece (Kiki Theodorou), University Clinic Erlangen, Germany (Christoph Bert, Ulrich Hoppe, and Frederik Laun), and the National University of Ireland, Galway (Niall Colgan). **The E&T Committee would like to expand the Erasmus network with more centers. Our vision is to have a wide network with centers all over Europe.** If your department of medical physics (academic or clinical) is interested in participating in the Summer 2024 scheme (or later), please contact Carmel Caruana (carmel.j.caruana@um.edu.mt). More info on the EFOMP website at https://www.efomp.org/index.php?r=structure/view&id=7

An article by a group of students from Malta who visited Greece can be found on the EMP Winter 2022 edition page 38. https://www.efomp.org/uploads/f41a2d34-a85a-4eb3-9efa-bae02127eb0e/EFOMP%20Newsletter%20Winter23-1.pdf

Here is the only information you need if you would like to volunteer to join the network (EFOMP has kept the scheme simple to avoid administrative burden on centres taking part)

1. The scheme is an Erasmus STUDENT VOLUNTARY TRAINEESHIP. No ECTS credits are associated with the scheme. This has the major advantage that that there is **no need for an inter-university formal agreement** which would mean an extensive administrative burden for centres taking part. So the Offer letter and Erasmus+ 'tripartite agreement' is an agreement between Students and Sending and Receiving Organizations.

2. The traineeship aims at students at end of third year or later so that students would be sufficiently mature. The traineeships will be held in summer so **that there will not be interruption of the academic year** which would again create problems (July to September, dates by agreement between student and Supervisor, but Erasmus is flexible if one needs to eventually change dates).

3. Universities can only send students to other countries if they offer to receive students themselves.

4. The traineeships will be for **60 days as this is the minimum** for the students to receive Erasmus funding.

5. Programmes should follow the following structure (based on 60 days):

   - *Introductory Week:* Introduction to the department/s and familiarization of the working environment/s and structure of the traineeship programme, programme requirements (e.g., attendance record, keeping of a diary of daily activities) and legal requirements (e.g., local safety rules, issuing of personal radiation monitor). Preparatory readings on relevant Medical Physics topics.

   - *Six-week placement in clinical and/or academic Medical Physics department/s:* Students will be expected to help out in the daily work of the Receiving Department/s in order to acquire practical experience. Trainees will shadow and assist academic and/or clinical staff in whatever they are doing at the time of the traineeship. There is no need for a specially set up programme. Professional responsibility for patients and equipment remains with the supervisors at the receiving institution, unless there is negligence on the part of the trainee. Trainees are expected to act diligently, carefully, responsibly, and respectfully at all times.

- *Wrap-up Period (11 days):* Report write-up and career advice. Participants will be required to write a formal report of their experiences based on a diary of activities kept during the entire traineeship. Participants will be advised of the variety of work and career opportunities in Europe.

For your convenience, we have prepared exemplars of the above for you on the EFOMP website. However, those volunteering to receive students should discuss these and modify them in conjunction with their local Erasmus office if need be. Local regulations should be checked by the receiving institution before volunteering to receive students.

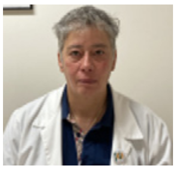
Funding

It is the **students' responsibility to apply for funding** from their own university Erasmus office which will guide them on what they need to do (including which insurances they would need to buy). It is important to tell your outgoing students to contact their university Erasmus office 1.5 to 2 years before the traineeship, as applications for Erasmus+ funding take time.

Carmel J. Caruana is Professor and Head of Medical Physics at the University of Malta. He is a member of the EFOMP E&T Committee, represented EFOMP on the European Guidelines for the MPE, MEDRAPET, ENETRAP, and EUTEMPE projects, and authored several EFOMP policy statements.

Christoph Bert, University Clinic Erlangen. Immediate Past-Chair EFOMP E&T Committee.

Veronica Rossetti, University Hospital Città della Salute e della Scienza, Torino. Chair EFOMP E&T Committee.



Kiki Theodorou, University of Thessaly. Member EFOMP E&T Committee.

Niall Colgan, National University of Ireland, Galway. Member EFOMP E&T Committee

TEACHING COURSE ANNOUNCEMENT

Teaching Course on Stereotactic Body Radiotherapy (SBRT) - Prague, Czech Republic, July 13, 2023 - July 15, 2023

Stereotactic Body Radiotherapy (SBRT) is a selected topic for the European School for the Medical Physics Expert (ESMPE) scheduled for 13th -15th July 2023, at the Czech Technical University in Prague: **Oliver Blanck** and **Serenella Russo pre-course** report

SBRT is a largely adopted radiation therapy approach in which high radiation doses are delivered in few fractions focused on small extracranial tumors with rapid dose falloff outside the target. In particular, SBRT is becoming an elective therapy in several anatomic regions, both for primary tumors and for metastatic lesions. With the irradiation at high doses per fraction to a small moving tumor volume, SBRT is considered a complex technique which requires an in-depth analysis of aspects of the treatment chain which contribute to the result of the treatment. Technological progress both in imaging and in treatment delivery has favored the adoption of this technique in the recent past. However, a multidisciplinary effort with the strong involvement of highly qualified and skilled professionals is strongly recommended for performing this kind of treatment procedure.

The school will focus on different aspects of SBRT, from the basics to treatment imaging and planning, to motion management, quality assurance, and image guidance. The objective of this course is to provide a current overview of the method and to share the technical/clinical and scientific aspects. Moreover, it will cover current hot topics, such as Cardiac SBRT (radioablation) and FLASH radiotherapy (extremely high dose per pulse). The goal of this three-day course is to help medical physicists working in both large and small centers, learn the proper implementation of effective SBRT treatment practices and to provide support in education, training, and the continuous professional development of MPE regarding the peculiarities of SBRT and its possible pitfalls. The role of medical physicists in clinical SBRT trials will also be presented and discussed.

Each day of the course will be divided into four sessions. The lectures will be held by international specialists in the subject, and at the end of each day there will be practical presentations by expert users of specific tools and systems in order to engage in a hearty discussion with the industry providing SBRT solutions. Each session will finish with “Question and Answers” from the audience and the faculty. The first session will be an introduction to the history and terminology of SBRT, followed by the indications and the radiobiological rationale for the use of this technique. Then, procedural and quality requirements for SBRT will be discussed, and reference dosimetry protocols dedicated to small fields used in SBRT treatments will be illustrated. This will be followed by presentations on patient preparation, imaging, and motion management, with a special focus on the use of artificial intelligence for handling multi-imaging. SBRT treatment planning will be a key point in this course in the afternoon of the first day, starting with an overview of practical guidelines for SBRT planning, followed by requirements for dose prescription and reporting, and a practical presentation of different methods adopted by various treatment planning systems.

The second day's lectures will be devoted to dose calculation and beam modeling, with special regard to robust planning and lessons learned from large multiplatform benchmarks. The second part of the day will be dedicated to quality assurance requirements and options for SBRT, including both machine and patient specific quality assurance. Risk management in SBRT will also be presented and discussed. Practical quality assurance for various systems and devices will be presented in the afternoon, with a special focus on automation. The third day will complete the lectures on image guidance and treatment delivery, with a dedicated focus on adaptation, and include the highlight talks on FLASH and cardiac SBRT. The course will finish with an exam for those seeking further accreditation points.

School Programme: https://www.efomp.org/index.php?r=pages&id=esmpe-upcoming-editions
Registration: https://www.efomp.org/index.php?r=regforms/application&id=13

Oliver Blanck studied computer science with a focus on SBRT planning systems and received a PhD for his preclinical work on cardiac SBRT (radioablation) from the University of Lübeck (Germany). Currently, he is the chief officer of operations, medical physics, research and development at the university driven Saphir Radiosurgery centers in Kiel and Frankfurt (Germany) and the coordinator of multiple clinical trials on SBRT in Germany. He is a board member of the working groups for Stereotactic Radiotherapy of the German Radiation Oncology and Medical Physics societies (DEGRO/DGMP) and the lead coordinator for quality assurance of the EU-Horizon-2020 STOPSTORM Consortium project.

Serenella Russo has a Master degree in Physics from the University of Florence (Italy). She worked as Medical Physics Expert from 1999 to 2008 at the Careggi Univeristat Hospital and then she moved to the Medical Physics Unit of the Azienda USL Toscana Centro in Florence, Italy. Currently, she has a Senior position as Medical Physics Coordinator for Radiotherapy, dedicating her efforts mainly to attend the organization, design and control of planning and dosimetric verification activities for highly complex treatments and the management of the physics staff involved in radiotherapy. She is a board member of the Italian Working group on Physics of SBRT for the Italian Association of Medical Physics (AIFM) and Coordinator of the AIFM-ENEA project for national radiotherapy audit for megavoltage photon beams.

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**

Mar 30th, 2023 - Apr 1st, 2023
NACP 2023
Reykjavik, Iceland

Jun 2nd, 2023 - Jun 7th, 2023
AAPM 2023 Summer School
University of Minnesota - Twin Cities

Jun 5th, 2023 - Jun 7th, 2023
UK Imaging and Oncology Congress 2023 (UKIO 2023)
ACC Liverpool, UK

Jun 26th, 2023 - Jun 27th, 2023
9th EUTERP Workshop
Groningen, NL

Jun 27th, 2023 - Jun 30th, 2023
International Conference on Education and Training in Radiation Protection (ETRAP2023)
Groningen, Netherlands

Jul 3rd, 2023 - Jul 7th, 2023
Radboud Summer School on Basic Dosimetry and Radiobiology for Radionuclide Therapy
Radboud University, Nijmegen, The Netherlands

Jul 13th, 2023 - Jul 15th, 2023
European School for Medical Physics Experts (ESMPE) | Stereotactic Body Radiotherapy 2023
Prague, Czech Republic

Sep 9th, 2023 - Sep 15th, 2023
4D workshop and RAPTOR - LOOP ENGAGEMENT coordinated events
Ascona, CH

Sep 27th, 2023 - Sep 30th, 2023
54. Jahrestagung der Deutschen Gesellschaft für Medizinische Physik
Magdeburg - Germany

October 5th, 2023 - October 7th 2023
European School for Medical Physics Experts (ESMPE) | Artificial Intelligence in Medical Physics 2023
Prague, Czech Republic

Oct 19th, 2023 - Oct 22nd, 2023
Joint EFOMP/EURADOS dosimetry school and 11th Alpe Adria Medical Physics Meeting
Novi Sad, Serbia

Nov 9th, 2023 - Nov 11th, 2023
EFOMP Symposium on Molecular Radiotherapy Dosimetry: The Future of Theragnostics
Athens, Greece

Sep 11th, 2024 - Sep 14th, 2024
5th European Congress for Medical Physics
Munich, Germany

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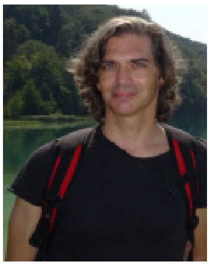

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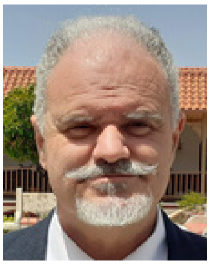

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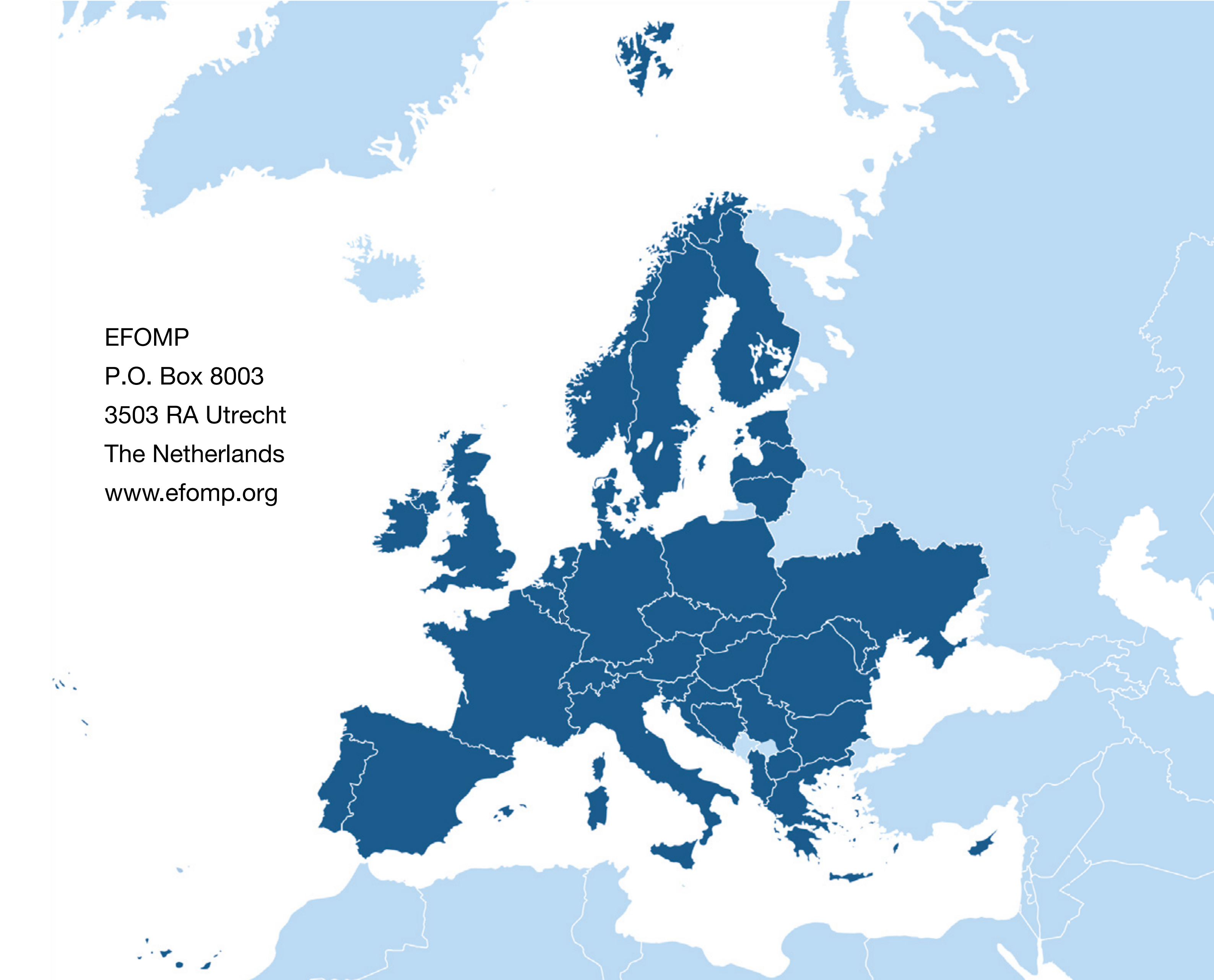

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EUROPEAN FEDERATION
OF ORGANIZATIONS
FOR MEDICAL PHYSICS

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 office moved to Utrecht, the Netherlands, in January 2021.

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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