EFOMP
EUROPEAN FEDERATION OF ORGANISATIONS FOR MEDICAL PHYSICS
Quarterly Newsletter

European Medical Physics News

ISSUE 02/2023 | SUMMER

EUROPEAN MEDICAL PHYSICS NEWS WANTS YOU!

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Message from Carmel J. Caruana, a member of the Communications and Publications Committee

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EDITORIAL

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

The word "summer" in many European languages is synonymous with development and maturation, particularly in reference to cultivated plants. Summer is, in fact, the season during which cultivated plants experience the highest amount of growth in areas that get significant amounts of summer rainfall. Summer is also perceived as adulthood after spring's birth and youth. Many writings show a character's initial experiences with love, sorrow, and growing up to maturity. For many people, romance blooms at the peak of summer. Warmth and bright weather represent happiness and joy, and the change of the seasons usually means that this love is growing more serious or maybe dying away. On the other hand, early in the morning or late in the afternoon during the summer, when the sun's beams are less powerful, are the best hours of the year for reading outside. This makes it the perfect time for the EFOMP summer newsletter, which has just been issued! The usual assortment of professional, scientific, educational, artistic, technical, interview, book review, commercial, etc. themes may be found in this edition as well. So, it's important enough to read in full.

As the cover page of this edition suggests, the theme of this issue is to inspire you to join the authoring team. Small aspects of your professional identification and activity can be shown. Do not be hesitant to tell us about how you feel and what you do in your leisure and professional times. We always appreciate your views, and it is always beneficial to share your experiences with others.

You will find in this release that EFOMP President **Paddy Gilligan** writes about his recent meetings with leaders and physicists from the National Members Organisation at various events, where he has discussed many essential topics as well as prominent affairs for medical physicists since our last EMP news. **Efi Koutsouveli**, the EFOMP's Secretary General and Vice President, provides an update on the institutional matters of our organisation in her report. **Brenda Byrne**, the Chair of the EFOMP Professional Matters Committee and the current Assistant Secretary General of EFOMP, and **Jaroslav Ptáček**, the treasurer of EFOMP, give an overview of human and professional experiences and thoughts about their recent long journey with the EFOMP officers to Reykjavik, Iceland, from March 30th to April 1st, 2023, to participate in the combined conference of Danish, Finnish, Icelandic, Norwegian, and Swedish associations, as well as to attend the EFOMP officers meetings that were planned as part of the journey's programe. **Irene Hernández-Girón**, who was recently appointed as Secretary of the EFOMP Scientific Committee, wrote an overview of her professional career for the EFOMP newsletter.

For this Summer issue of EMP News, **Danielle Dobbe-Kalkman**, Educational Advisor at EMP News, spoke with **Dr. Colin Martin**, a leading expert in the fields of diagnostic radiology physics, and radiation protection in the United Kingdom, for the fifth instalment of this series. Dr Colin Martin is an honorary senior lecturer at Scotland's Glasgow University.

In this edition, **Iuliana Toma-Dasu**, Editor-in-Chief of Physics Medica, selected three articles from the most recent issue of Physica Medica (EJMP) on the following topics: machine learning in the interpretation of MRI images, a new use for the Geant4-DNA Monte Carlo toolkit, and a shift in how we think about the relative biological effectiveness of proton radiotherapy. **Liene Balode** also summarises her thesis on the MRI Field-Cycling Imaging (FCI) technique conducted at the University of Aberdeen, Scotland, and **Gavin Poludniowski, Markus Hulthén, Artur Omar, Jonas Andersson** and **Christoffer Granberg** continued their article series: Hacking Medical Physics Part 5: Python-powered X-ray Beam Predictions.

In addition, our popular Medical Physicist's art and hobby collection includes the Images and Reflections for Medical Physics by Professor **Jim Malone** about Minnie Cunningham at the Old Bedford (1892), painted by Walter Sickert (1860-1942). **The Aurora Team** continued their Project: Cancer and Its Treatment from the Inside Through Comic Strips: PART II. **David Scicluna** also shares his experiences of growing crops in Malta, which is his way to rest his mind from Medical Physics work.

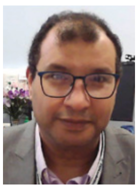
In terms of professional matters, we have a few articles here that would interest you: **Carmel J. Caruana** announces the New Policy Statement (PS18) of Teaching Medical Physics to the NON-PHYSICS Healthcare Professions, which was approved by the NMOs and which you can find in Physica Medica **Katryna Vella** encourages newcomers to the medical physics profession to join EFOMP's Early Career Special Interest Group; and **Pablo Mínguez Gabiña** provides his regular update on Special Interest Group for Radionuclide Internal Dosimetry (SIG_FRID) activities.

In this release, there are three messages from the national member organizations: **Agnese Katlapa** reports on the social and educational activities in the Latvian Medical Engineering and Physics Society; a Dissemination Action on Radiological Protection Aspects by the Spanish Society for Radiological Protection (SEPR) and the Spanish Nuclear Safety Council (CSN) for Patients with the aim of making knowledge on safety issues in the use of ionising radiation in medicine accessible to the general public was reported by **Roberto Sánchez**, **María Luisa Tormo**, and **Mª Teresa Macas;** and Marta Sans, President of the Swiss Society of Radiobiology and Medical Physics, wrote a letter giving an overview of the Society for Radiobiology and Medical Physics (SSRMP).

There are a good number of meeting reports, training courses, and meeting announcements in this release: the Symposium on Molecular Radiotherapy Dosimetry will be held in Athens from the 9th to the 11th of November 2023, according to **Manuel Bardiès;** the Summer School in Medical Physics 2023 in Chile: The Role of Imaging in the Radiotherapy Process, which is led by **Oliver Jäkel** and **Caprile Etchart;** and the 5th Summer School in Medical Physics 2023: Data Science and Machine Learning in Radiotherapy, which is hosted by **Oliver Jäkel** and **Jürgen Debus** and led by **Kristina Giske** and **Kristina Giske;** The Italian Association of Medical Physics National Congress that will be held June 8th–12th, 2023, in Palazzo Vecchio, Florence, Italy according to **Cinzia Talamonti;** and the 16th International Conference & Workshop "Medical Physics in the Baltic States 2023" in Kaunas, Lithuania (9-11 November 2023), as per **Diana Adlienė** announcement.

Here is a collection of recent articles written by EFOMP company members for your reading pleasure. Reading about the companies they operate and the products and services they provide is bound to be informative and entertaining. Whatever article you choose to read in this edition of European Medical Physics News, I hope you enjoy it. This is a frequent feature of the journal.

Finally, I would like to reiterate the announcement of the emergence of the EFOMP mailbase discussion list: for anyone who has not joined yet, please send a subscription request by visiting the public subscription page at the following link and following the instruction: 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, FIPEM, 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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EFOMP President's Message

In this article, EFOMP President **Paddy Gilligan** writes about his recent meetings with leaders and physicists from the National Members Organisation at various events, where he has discussed many essential topics as well as prominent affairs for medical physicists since our last EMP news.

You know we've travelled all around the Sun
You know it's taken us one whole year
Well done everyone, Well Done'
From the "Dance of the Cherry Trees" by John Spillane

Dear Medical Physics Friends,

Early summer is such a joyous time of year. Lengthening evenings, nature in full bloom, and the dance of the cherry trees. It is also a very productive time of year when we up our game for greater productivity before a well-deserved vacation. Since I wrote the spring newsletter, I have had the pleasure of many EFOMP activities, events, and meetings with sister organisations. We have had the policy statement "Policy Statement 17: The role and competencies of medical physicists and medical physics experts in the different stages of a medical device life cycle" published. The updated Malaga declaration has been endorsed by the Federation. The policy statement on dosimetry in molecular radiotherapy is ready to be sent out to N.M.O.s. Many tasks and work packages are at various stages of progress in our busy projects committee. ECMP 2024 has had its kick-off meetings, and there is a wonderful excitement and freshness to what is going to be a wonderful conference to attend in Munich in 2024. We have had webinars and many meetings with agencies such as the IAEA and the ICRP where EFOMP's voice has been heard.

I have had the pleasure of meeting leaders and physicists from the Maltese, Swiss, Austrian, Icelandic, Danish, Norwegian, Italian, Finnish, Swedish, Belgian, and UK NMOs at various events and have discussed many important topics since our last EMP news. The common themes have remained and been reinforced to me regarding the importance of what we have in common as medical physicists, regardless of the area we work in. Of particular interest are the core curricula and the training of the medical physicist. Themes and discussions that have arisen are the entrance requirements to and content of training programmes for medical physicists and whether we should be trained in a single specialty, e.g., radiotherapy, or trained across disciplines. While there is a range of views on the topic, the majority of feedback has been that medical physicists should be trained in a number of key medical physics disciplines. The entitlement to access to training programes also defines our identity and merits consideration. In some countries, such as Italy, this is exclusively restricted to applicants with physics degrees. In most countries, however, degrees with large components of math and physics are acceptable.

One of the missions of EFOMP is to harmonise education and training standards. It is important we discuss these issues, particularly as we move towards mutual recognition, a common training platform, and our submission to the European Union's DG Growth for mutual recognition of the medical physics expert. It is interesting to note that there is a trend toward reducing the role of academic qualifications in training healthcare professionals in general. For instance, academic training is not a key part of the DG Growth directive, and in certain countries, there are moves towards professional education in a number of medical areas that do not mandate academic qualification. The heterogeneity of current interpretation will be a challenge for EFOMP in harmonising training standards. The universities play an important role in medical physics training and also foster research, which is very important for the advancement of the profession. There is universal acceptance among NMOs that patients need greater access to an increased medical physics workforce and that funded training programmes are essential. Quantifying that need, funding the training positions, and also funding those to train the next generation of medical physicists are key priorities for all NMOs.

In our recent leadership meetings with ESTRO, EANM, and Nuclear Medicine Europe, our common aims as organisations trying to improve patient care were evident. Joint core curriculums were discussed in light of the above training requirements. The updated EFOMP-ESTRO core curriculum is complete and is an excellent document and resource. The EFOMP-EANM core curriculum is well underway. The high level of cooperation with our sister clinical societies rather than competition is something we encourage in EFOMP, and the core curricula are evidence of this ethos. I think it is essential that we maintain and strengthen these collaborations. It is also evident that we can have the possibility of combining efforts to implement different elements of our training programmes (and indeed in other areas such as guidelines production). We look forward to seeing how our new educational platform, on which we hope to roll out our first courses by 2023, fits in with this approach.

Finally, I had the pleasure of engaging with Silke Guddat from Elsevier and Editor Iuliana Tomas Dasu on our journal, EJMP/Physica Medica. I have also been seeking the views of our NMOs through the leadership engagement events. The journal plays a key role in our identity as European medical physicists and is a key part of EFOMP's mission to foster scientific exchange. Many of the KPIs are positive: increasing impact factor, massive increase in downloads, recently cited articles, and positive financial contribution. However, we know that we can deliver better for a truly European medical physics journal, and we have the desire to place the journal as Q2 in radiology publications, increase readership and access to the journal, and increase its profile as an attractive place to publish medical physics research in Europe. The interrelationships among all of the above are quite complex and interesting. We are planning to propose some initiatives at our officers' meeting in Novi Sad in the autumn that we hope will help further deliver the above. We hope to receive any ideas you may have to achieve the above and submit your best articles for EJMP. It's your journal!

Yours in Physics,
Mise Le Meas

Assoc. Prof. Paddy Gilligan, President of EFOMP.

EFOMP Secretary General's Report

In this article, **Efi Koutsouveli**, the EFOMP's Secretary General & Vice President, provides an update on the institutional matters of our organisation

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

Three positions on the scientific committee of the European School for Medical Physics Experts were open for election in 2023. Elected members took office in May 2023 (Figure 1).

Fig 1. Elected colleagues by the National Member Organisations of EFOMP are Rafael Ayala (Spain) on the left, Stephane Chauvie (Italy), and Ioannis Tsougos (Greece) on the right.

Rafael Ayala is a senior medical physicist working at Gregorio Marañón Hospital in Madrid. Rafael has more than ten years of experience in the field of radiotherapy. His areas of interest are external and intra-operative radiotherapy, although early in his career he was also involved in image quality assessment for X-ray devices. He is especially focused on designing tools for scientific computing that improve treatment safety, refine quality controls of the linacs, and/or streamline treatment planning workflows. He is actively involved in several training courses for medical physicists organised by the Spanish Society of Medical Physics (SEFM).

Stephane Chauvie is a medical physics, nuclear magnetic resonance safety, and III-degree radiation protection expert. Since 2012, he has been director of the health physics division at Santa Croce and Carle Hospital, where he has been working since 2004. He also serves as a consultant for the International Atomic Energy Agency and for several organs of the Italian Ministry of Economy and Health. He has long-standing activities in the professional teaching of medical physicists and other healthcare professionals. Since 2012, he has been the head of Cuneo Imaging Corelab, performing clinical trials qualification on behalf of several international onco-haematological associations. He is a member of the Italian Society of Medical Physics (AIFM).

Ioannis Tsougos is a Professor of Medical Radiation Physics in the Medical School of the University of Thessaly, Larissa, Greece, and a visiting Faculty Member at King's College London, Department of Neuroimaging. He has authored more than 100 research papers, 11 book chapters, and an international book on advanced MRI techniques. His main research interests are advanced magnetic resonance imaging techniques and AI applications, radiation biology, and nuclear medicine. He is the head of the Master's program "Biomedical Imaging and Radiation Protection" and the head of the Medical Informatics and Biomedical Imaging Lab. He is a member of the Hellenic Society of Medical Physics (HAMP).

EFOMP Working Groups (WGs)

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 phase since January 2023. A postal ballot was launched in February 2023. We received votes from 58% of the delegates. The Policy Statement was approved by a majority of valid votes. The PS has been published in the European Journal of Medical Physics.

A new Working Group "Volumetric Modulated Arc Therapy – Breast will operate under EFOMP Science Committee from March 2023 to December 2024. The chair of the WG is Tuomas Koivumäki (Finland). The chair, members and consultants are presented here: EFOMP website

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

National Medical Physics Congresses

Together with EFOMP President Paddy Gilligan, we joined the 38th Symposium of the Belgian Hospital Physicists Association (BHPA) hosted by the Institut Jules Bordet and the Hôpital Universitaire de Bruxelles in the magnificent Square Centre in Brussels (Figure 2). Busy sessions on scientific and professional matters, a full house during the general assembly, more than 450 participants, a great commercial exhibition, and lots of discussions on history and common goals for both organisations. It is worth mentioning the social event and dinner party at the Centre D'entreprise Les Ateliers des Tanneurs.

Figure 2. BHPA General Assembly in Brussels

Projects

Medical Applications of Radiation – Learning from Incidents and Near Misses- MARLIN

The European Institute for Biomedical Imaging Research (EIBIR), in cooperation with EFOMP and ESTRO, has been awarded the European Commission Tender 'Medical Applications of Radiation – Learning from Incidents and Near Misses'. EFOMP is an active partner in this study on reporting and learning from patient-related incidents and near misses in radiotherapy, interventional cardiology, nuclear medicine, and interventional and diagnostic radiology. The project will help with the implementation of Council Directive 2013/59/Euratom by giving a full report on the status of incident reporting and creating consensus guidelines with recommendations for reporting and learning from patient-related incidents and near misses in radiotherapy, interventional cardiology, nuclear medicine, interventional and diagnostic radiology in Europe. The project has launched a survey on the practice and regulation of incident learning systems (ILSs) in Europe (EU-27 plus Norway and Switzerland) in all areas using ionising radiation in medicine, with regard to the implementation of Directive 2013/59/Euratom. The survey has been designed in three versions to target national authorities, national professional societies, as well as public and private hospitals covering all radiation risk areas. We appreciate the National Members active participation.

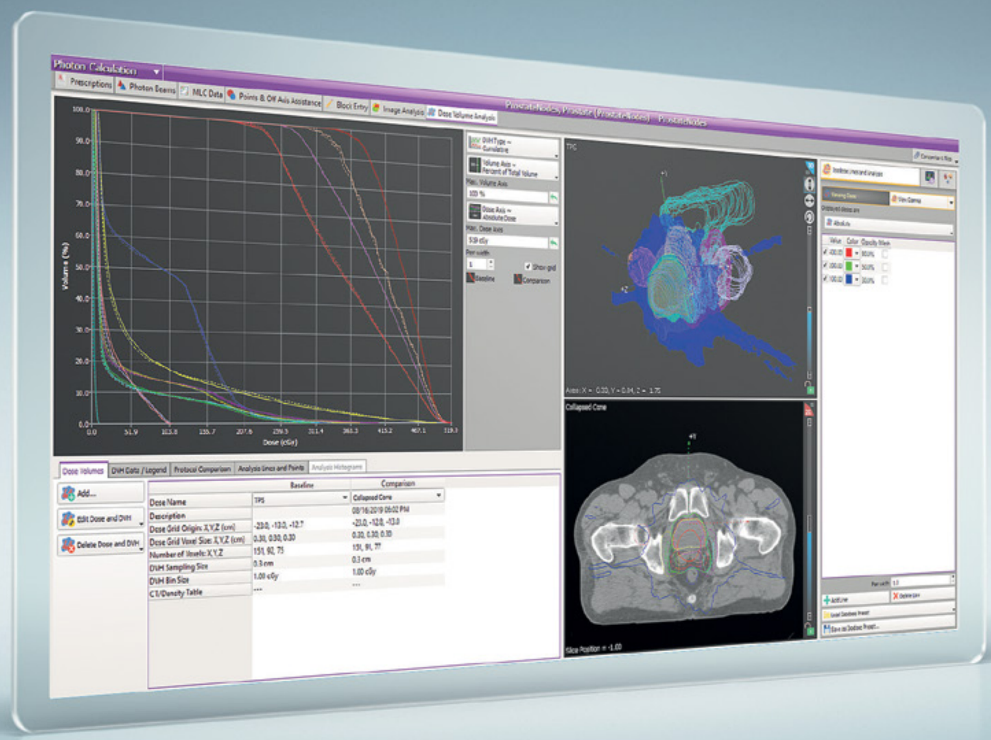
SAMIRA study on the implementation of the Euratom and the EU legal bases with respect to the therapeutic uses of radiopharmaceuticals- SIMPLERAD

The European Institute for Biomedical Imaging Research (EIBIR), in cooperation with EFOMP and EANM, has been awarded the European Commission Tender 'SAMIRA study on the implementation of the Euratom and the EU legal bases with respect to the therapeutic uses of radiopharmaceuticals'. A workshop has been set for December 11–12, 2023, in Brussels to present and validate the results of the work carried out and discuss issues relating to regulations, development, and use of therapeutic nuclear medicine with the relevant stakeholders.

EFOMP Annual Council 2023

Do not forget the EFOMP Annual Assembly which will be held in Novi Sad, Serbia on the 20th October 2023 in conjunction with the 11th Alpe Adria Medical Physics Meeting. The venue of the Council Meeting will be the University of Novi Sad, Serbia.

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



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EFOMP COMPANY MEMBER ARTICLE

How Low Is the Low Dose? Establishing Deep Learning-based Protocols At Planar Radiography Dose Levels

Clinical evaluation of the CT image dose and quality of the (GE Health-Care, Waukesha, WI, USA) platform combined with deep learning-based image reconstruction (Truefidelity™) is presented in this article by **Stathis Despotopoulos**[a], **Kostas Dimos**[a], and **Andreas Stratis**[b]. This combination demonstrates superiority in terms of image sensitivity and quality while reaching a new inferior level in patient dose cost.

Introduction

While X-Ray (XR) is still the first-line modality for assessing chest pathology, recent advances in Computed Tomography (CT) have diminished the CT-associated radiation risk burden, allowing physicians to exploit the benefits of 3D chest imaging at effective doses (ED) below 0.2 mSv. Taekker et al (2022) reported that Ultra-low-Dose CT (ULDCT) offers superior sensitivity compared to XR in detecting pneumonia and pneumothorax and similar diagnostic accuracy for assessing cardiogenic pulmonary edema and pleural effusion [1]. Kroft et al. (2019) demonstrated the added value of ULDCT, showing evidence of a 20% reduction in false-positive and false-negative XR investigations [2]. In a systematic review by Taekker et al (2021), ULDCT was reported to provide higher diagnostic accuracy for pneumothorax, consolidations, and ground glass opacities compared to standard dose CT [3]. Gheysens et al. (2022) reported on the high efficiency of ULDCT in detecting solid lung nodules with a clinically relevant volume (> 50 mm^3) in lung cancer screening, irrespective of patient size [4]. A 512-slice Revolution APEX (GE HealthCare, Waukesha, WI, USA), with a 16-cm detector coverage and deep learning-based image reconstruction (DLIR), i.e., Truefidelity™ (TF), has been recently installed in our radiology department. The aim of the study was to optimize exposure and reconstruction settings of adult chest ULDCT protocols following the principle of "As Low As Diagnostically Acceptable".

Methodology

A series of acquisitions with different exposure parameters (kV, pitch), DLIR strengths, i.e., low (DLIR-L), medium (DLIR-M), high (DLIR-H), STD reconstruction algorithm, and different edge enhancement filters (E1-E3), were performed on the chest region, 39.7 cm long, of a dedicated CT whole body phantom (PBU-60, Kyoto Kagaku) (Table 1). All scans were performed with a fixed current of 10 mA, resulting in a max $CTDI_{vol}$ of 0.3 mGy. A radiologist with more than 25 years of experience assessed the image quality (IQ) of the datasets based on the *European Guidelines on Quality Criteria for Computed Tomography* (1999) [5]. Those datasets with the best subjective image quality were subsequently ranked based on Contrast-to-Noise (CNR) metrics and dose-independent figure of merits (FOM)s. To this end, 0.5 cm^2-regions of interest (ROI)s, were positioned bilaterally in the anterior, middle, and posterior lung parenchyma to provide $CT_{lung,mean}$(HU) and SD_{lung} (Figure 1). Equally large ROIs were placed in the right inferior pulmonary vein to assess the CT_{pv} and in the left ventricle to calculate the CT_{heart} (Figure 1). Equations 1-3 were applied to assess the IQ of lung parenchyma (CNR_{lung}), mediastinum (CNR_{med}) and the respective FOMs.

$$CNR_{lung} = |CT_{lung,mean} - CT_{pa}|/((SDI_{ung}{}^2 + SD_{pa}{}^2)/2)1/2 \quad (1)$$

$$CNR_{med} = |CT_{heart} - CT_{pa}|/((SD_{heart}{}^2 + SD_{pa}{}^2)/2)1/2 \quad (2)$$

$$FOM = CNR_i^2/CTDI_{vol}, \text{ with I standing for lung or med} \quad (3)$$

The parameters leading to images with the best combination of subjective and objective IQ were applied in clinical routine.

Table 1. Exposure settings for ULD lung CT

Acquisition mode	Helical STD	Axial STD
Collimation (mm)	80	160
Tube voltage (kV)	100-120-140	100-120-140
Tube Current modulation	No	No
Tube current (mA)	10	10
Pitch	1.375,1.531	/
rotation time (sec)	0.28	0.28
Slice thickness	0.625	0.625
DLIR	L-M-H	L-M-H
Edge Enhancement	E1-E2-E3	E1-E2-E3

Results

For lung parenchyma, E3-reconstructed images from helical scans provided the best subjective IQ and were qualified for FOM_{lung} – based assessment. Top 5 protocols are presented in Table 2. Protocol 4 exhibited the best combination of subjective and objective IQ with an ED of 0.117 mSv (Figure2). For mediastinum, axial STD scans demonstrated the best subjective IQ and were further evaluated based on FOM_{med}. Table 3 presents the top 3 axial protocols. Protocol 7 at 120 kV with an ED of 0.12mSv was the best candidate for mediastinum assessment (Figure 2).

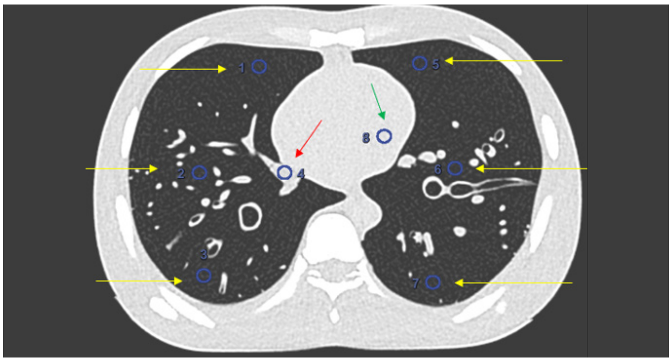

Figure 1: ROIs 1-3 and 5-7 (yellow arrows) for assessing CTI_{lung}, ROI 4 (red arrow) to assess CT_{pa} and ROI 8 (green arrow) to assess CT_{heart}

Table 2. Top 5 helical protocols for lung parenchyma assessment

Protocol #	kV	mA	pitch	slice thickness (mm)	DL strength	reconstruction	CTDIvol (mGy)	Effective dose (mSv)*	**CNRlung**	**FOMlung**
1	100	10	1.531	0.625	DLIR-H	STD/E3	0.07	0.040	20.41	5949
2	120	10	0.992	0.625	DLIR-H	STD/E3	0.19	0.109	22.53	2672
3	120	10	1.531	0.625	DLIR-H	STD/E3	0.12	0.069	17.83	2649
4	140	10	1.375	0.625	DLIR-H	STD/E3	0.20	0.117	21.87	2392
5	140	10	1.531	0.625	DLIR-H	STD/E3	0.18	0.105	19.19	2046

* Effective dose based on conversion factors by *Deak et al (2010) (7) and ICRP publication 103 (8)*

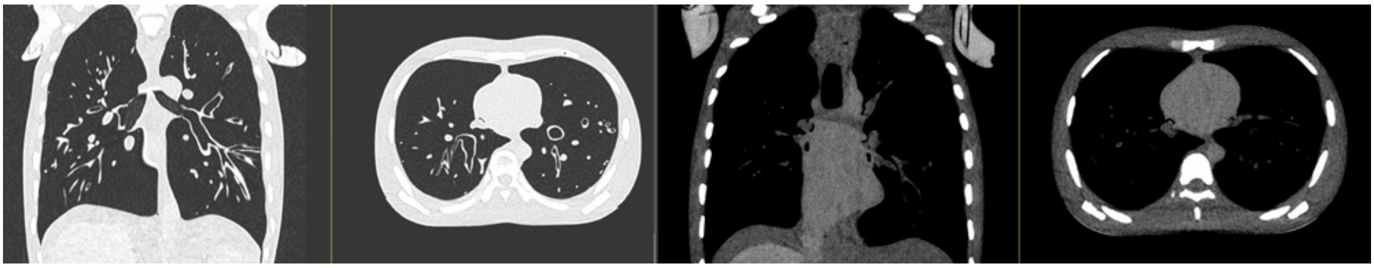

Figure 2: Left image; Protocol 4 for lung parenchyma assessment provides the best combination of objective and subjective IQ. Right image, protocol 7 for mediastinum assessment.

Table 3. Top 3 axial protocols for mediastinum assessment

Protocol #	kV	mA	pitch	slice thickness (mm)	DL strength	reconstruction	CTDIvol (mGy)	Effective dose (mSv)*	**CNRmed**	**FOMmed**
6	100	10	/	0.625	DLIR-H	STD	0.14	0.08	3.45	12719
7	120	10	/	0.625	DLIR-H	STD	0.21	0.12	3.64	9705
8	140	10	/	0.625	DLIR-H	STD	0.32	0.18	4.03	8216

* Effective dose based on conversion factors by Deak et al (2010) [7] and ICRP publication 103 [8]

Discussion

Deep Learning Image Reconstruction, TrueFidelity^{TM}, suppressed noise, retained sharpness in lung parenchyma at diagnostically acceptable levels, and provided parenchymal and mediastinal CNRs that allow us to scan patients at extremely low dose levels. In clinical routine, for average patient scan lengths, we scan at ED levels of 0.08 mSv (Figure 3), well below the mean ED of a chest XR in Greece (0.13 mSv), reaching the global mean ED of a complete chest XR as reported by *UNSCEAR (2021)* [6].

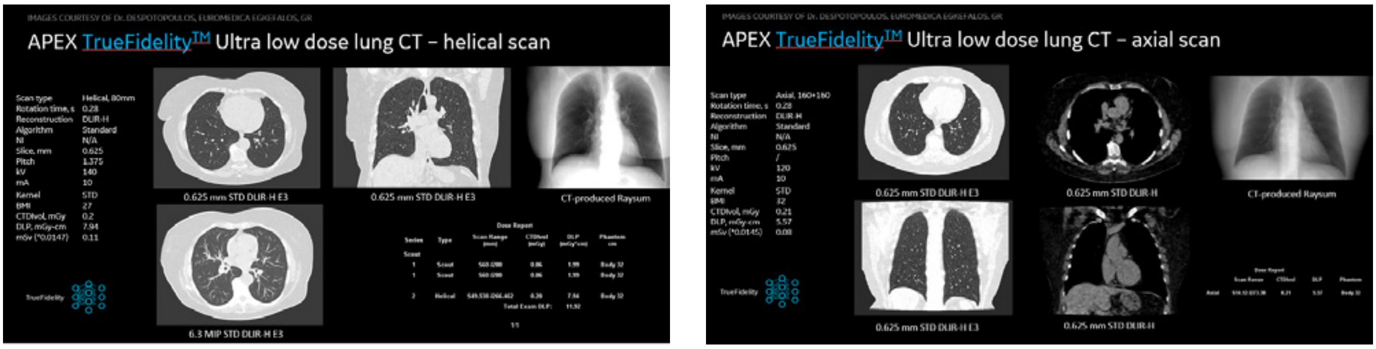

Figure 3: Applying ULDCT protocols in clinical routine, left: helical scan of a BMI-27 patient at an ED of 0.11 mSv, right: axial scan of a BMI-32 patient at ED of 0.08mSv.

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Dr. Efstathios Despotopoulos, MD, MSc, serves as the Chief Radiologist and Director of the Computed Tomography Department at Euromedica in Greece. With over 25 years of experience, Dr. Despotopoulos has dedicated his career to advancing the understanding and diagnosis of cardiovascular conditions through advanced imaging techniques, specifically computed tomography. His exceptional expertise in heart imaging has made him a speaker at numerous conferences, where he shares his insights and findings with fellow experts and medical professionals. In addition to his current role, Dr. Despotopoulos has also served as the former Director of the Computed Tomography Department at the 251 General Air Force Hospital in Greece, further solidifying his reputation as a leading authority in the field.

Mr. Konstantinos Dimos, a senior MSc student in Biomedical Engineering and Technology at the University of West Attica, holds a BSc degree in Radiology and Radiotherapy. He serves as the lead Radiology Technologist in the Computed Tomography Department at Euromedica "Egkephalos" in Chalandri, Greece. Specializing in Medical Imaging, Mr. Dimos is actively engaged in the areas of image processing and analysis, protocol optimization methods, and Artificial Intelligence

Andreas Stratis is the GE HealthCare CT and Molecular Imaging Clinical Leader in Eastern Europe. He is a certified Medical Physicist with a Ph.D in Biomedical Sciences from Katholieke Universiteit Leuven, BE. His research has been focused on Monte Carlo dose simulation studies for wide cone beam CT dosimetry. He has a long experience in optimizing CT and Molecular Imaging clinical protocols, aiming to enhance the diagnostic value of advanced clinical studies and applications.

MEDICAL PHYSICS EDUCATION

Ask the professor: Colin Martin

In this article, **Danielle Dobbe-Kalkman**, Educational Advisor at EMP News, spoke with Dr. Colin Martin, a leading expert in the fields of diagnostic radiology physics, and radiation protection in the United Kingdom, for the fifth installment of this series. **Dr Colin Martin** is an honorary senior lecturer at Glasgow University, Scotland

Colin Martin worked as a Medical Physicist in Scotland for over 30 years. He has retired from the NHS but is an honorary senior lecturer at Glasgow University. Colin is Vice-Chair of ICRP Committee 3 and chair of ICRP Task Group 108, which is preparing two reports on the optimization of radiological protection in digital radiology. He is an honorary fellow of SRP and was awarded the IPEM Healthcare Gold Medal in 2018. He has co-authored/edited several textbooks on radiation protection, written over 170 papers in peer-reviewed journals, and is a member of the Editorial Boards for JRP and RPD.

DD: It is an honour to meet you, Professor Martin! I hear that you have written a few books.

I would like to talk about that later. But first: what was your first experience with teaching?

CM: My career in medical physics started at Aberdeen University in 1976. I joined the Department of Bio-Medical Physics and Bioengineering to work in ultrasound. The department ran an MSc course, and I started giving a course of 16 lectures on ultrasound the following year after attending a one-week course on teaching. This included a session during which you were videoed, which revealed your mannerisms and allowed you to hear your own voice, which is not quite as you expected.

DD: In my profession, they say if you want to learn something, you have to teach it!

CM: Yes, you can teach all you know, but students always ask different questions, and that lets you see things from different angles and identifies things that you haven't thought about. I think teaching and doing research are both good ways of learning. If I want to learn about something, I start looking into the subject and end up doing research on it because I want to find things out, and that gives me the incentive to read papers in detail and analyse findings.

DD: Okay, and then you started teaching for a while?

CM: I taught other courses and supervised a lot of MSc student projects and a few PhD students. The department in Aberdeen was predominantly responsible for health service provision. I did clinical work in thermography, ultrasound obstetric scanning, and echocardiography, which involved analysing echocardiogram traces and monitoring patients in the Burns Unit, maintaining them in a clean air environment, and using radiant heat to offset heat losses.

DD: So that's how you started your career?

CM: I did a PhD in crystallography and worked as an electron microscopist for a couple of years. I felt early on that the research I was doing didn't have practical applications. So I liked the idea of medical physics and applied for the post in Aberdeen. At that time, medical physics was a smaller speciality and was not something that was talked about during my physics degree; it was through reading articles in the Physics Bulletin, the magazine of the Institute of Physics, that I found out about it.

DD: And you've seen the profession develop and grow over the years?

CM: Yes, very much! When I started in medical physics, other imaging techniques were developing. The ultrasound laboratory was shared with nuclear magnetic resonance, and in 1977, John Mallard, the Head of Department, and Jim Hutchison obtained a grant from the Medical Research Council (MRC) to build a whole-body Magnetic Resonance Imaging (MRI) scanner. Jim, together with Bill Edelstein, designed an imager that, in 1978, produced the first whole-body MRI image, and everything developed from there.

DD: Well, that must have been really exciting to be around at that time!

CM: The equivalent that was happening in ultrasound was that phased array transducers were being developed that could get two-dimensional pictures in real-time, so you could see the heart pumping. But I realised that with my lack of electronic expertise, ultrasound probably wasn't the area to stay in, so I took up a lectureship in radiation protection and have stayed in that field because things have been constantly developing, particularly in diagnostic radiology, and there are always new things to learn about and understand.

DD: You've witnessed a lot of developments in the field! What attracted you to the field?

CM: A job came up. The Aberdeen group was making measurements of radionuclide activities in coastal environmental samples for local councils in the Highlands at the time when the Chornobyl accident occurred. We carried out studies of activities in milk, meat, and vegetables at that stage, and following radioactivity in the environment was interesting.

DD: I heard that you wrote a few books that are often used as study material for different physics courses. How did that start?

CM: The first edition of our textbook came out in 2002. Oxford University Press had published textbooks in nuclear medicine and radiotherapy physics and was looking for somebody to prepare a textbook in radiological protection and diagnostic radiology. They asked me, as I had written a fair number of papers. I approached my friend David Sutton from Dundee, and we put together a plan. We identified the chapters we needed and then decided which ones we were going to write ourselves and which ones we would approach friends and colleagues for. Again, writing a book was a good or even better way of learning about the subject. We published a 2nd edition in 2015. I've learned everything the fun way by having problems or tasks put in front of me and having to think about how to tackle them.

DD: But I guess that's also a great way of teaching students - to present them with a realistic problem that they have to solve. Can you tell me more about the problems you have tried to solve in your career?

CM: Not long after I started in radiation protection in the mid-1980s, the National Radiological Protection Board (NRPB) carried out surveys of patient doses for x-ray examinations in different UK hospitals across the country. This triggered a movement, considering how doses could be reduced. I wanted to link X-ray measurements with doses to patients, so following discussions with radiographers in the early 90s, we started courses for X-ray radiation protection supervisors (RPSs) in radiology departments throughout the Grampian Region. In 1989, the NRPB published reference doses that were the precursors of diagnostic reference levels. We obtained exposure factors from every department for each examination and used our measurements to calculate patient entrance surface doses for each examination. We produced bar charts, comparing the doses from each centre with the reference dose in our QA reports. We found that doses for one particular examination were much higher than the reference dose in all departments due to the technique, while several were higher in some departments, either due to the film/screen combination used or the tube potential.

DD: So by doing this, you've been able to help the different facilities understand and realise that their exposures were not optimised and help them?

CM: We decided what changes in practice to recommend and then assembled all the RPSs in the region and discussed our recommendations. We first covered radiography, and then in subsequent years we did the same for fluoroscopy and later CT, in each case working out how the X-ray units vary the exposure for thicker or heavier patients, designing phantoms to make the assessments, and understanding the implications of results when they are not what you expect. I have continued this work in Glasgow, where I moved in 1995. There are a lot of problems these days in learning how X-ray units operate as they become more complex. Medical physicists need to stay critical and aware of how the equipment operates.

DD: There's still a lot of research on optimization and things like that. Do you think there are going to be more breakthroughs?

CM: Well, yes, because things are changing all the time. I joined the International Commission on Radiological Protection in 2013 on the Medical Protection Committee. I set up a Task Group on Optimization in Digital Radiology in 2017, and we have prepared two reports that should come out either this year or next. We identified three components, professionalism with physicists, radiographers, radiologists, and other clinicians working together as part of an optimization team; methodology and expertise for evaluating what we're doing; and processes to ensure tasks are completed. The second report deals with practical aspects of the individual modalities; radiography, fluoroscopy, and CT.

DD: You need to make sure that people stay critical and aware of what they're doing.

CM: Yes, part of the process is almost like having a quality management system. You're making sure that people are doing things and thinking about them at regular intervals to move things forward.

DD: I've heard you've been given an award. What was it exactly?

CM: I was awarded the Society for Radiological Protection (SRP) Founder's Medal in 2005 for contributions to radiation protection, given an honorary fellowship by SRP in 2015, and awarded the UK healthcare gold medal from IPEM in 2018. Last week I gave the Dunster Lecture at the Annual SRP Conference, at which I talked about the Radiation Revolution in Medicine and the development of medical imaging over the last fifty years.

DD: Considering the things you've done, what do you feel is your greatest contribution?

CM: I think it is the steady pushing forward with optimization in radiology and building understanding and techniques along the way. But there are lots of other little things, like looking at the best way of carrying out dosimetry on different staff groups and identifying problems with optical dosimetry for ultraviolet phototherapy.

DD: Looking into the future a little bit, are there things you think might change for medical physicists or in the fields that we need to be aware of?

CM: Artificial Intelligence (AI) is certainly coming in with the greater computing power now available. There are already deep learning algorithms used in optimizing CT images, which should enable patient doses to be lowered. I have colleagues in the States trying to develop X-ray equipment that will give narrow energy X-ray beams that might be used in hospitals, and this could give us better contrast and definition between different tissues if it takes off. There will be increased use of techniques such as MRI, which don't use ionising radiation, to replace CT where applicable, although they are more expensive, so there is a balance with funding. In ICRP, we are looking at whether we should calculate more accurate doses for individual patients for CT scans based on libraries of phantoms of varying sizes or directly from organ presentations in CT images in the future.

One of my current ICRP Task Group concerns is imaging in radiotherapy. We have carried out surveys of the use of imaging in radiotherapy in nine countries through the ICRP Mentorship programme. Recording the frequencies with which radiotherapy centres use imaging during treatments, the techniques they use, and the consideration given to doses from imaging. We discovered that few centres outside Europe record doses from imaging with cone beam CT. Yet they may image at every treatment fraction, and the images expose large volumes of surrounding normal tissues. We now have 22 mentees from countries across North and South America, Asia, Australasia, Africa, and Europe. Not all radiotherapy departments have access to CT phantoms and pencil chambers, so we're looking at alternatives with the materials and instruments they have available in their radiotherapy centres. They provide us with information on how things are done and the equipment and materials they have available in their countries. We hope that all will benefit from the exercise.

DD: And so they can actually improve things in their own countries?

CM: Yeah, hopefully. Just from noting down a few of the exposure factors and a few measurements in the early stages, we have been able to advise some mentees to modify factors to reduce the imaging doses in their departments already.

DD: That is fantastic! Thank you so much for this interesting conversation about your career and your contributions to the field!

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.

EFOMP COMPANY MEMBER ARTICLE

PTW: Ambitious Medical Physics in Bangladesh

The South Asia Centre for Medical Physics and Cancer Research (SCMPCR) in Bangladesh has made an essential contribution in recent years both in the field of cancer education among the population and in the training of the country's medical physicists. PTW will continue to provide support over the next three years.

One of the goals of the SCMPCR is to raise and strengthen cancer awareness among the people of Bangladesh. A lot has happened in this field in recent years: A programe was launched together with the government of Bangladesh with the aim of significantly increasing the number of women undergoing breast cancer screening. SCMPCR staff travelled to different parts of the country to inform the population about breast cancer screening at various events. Professor Golam Abu Zakaria, Founding Director of the SCMPCR, now hopes to be able to purchase ultrasound and X-ray equipment since breast cancer screenings are to be carried out at a healthcare centre in a village in northern Bangladesh. “PTW's commitment to supporting us for another three years makes our work easier and enables us to plan for the long term,” Zakaria points out.

At the new hands-on workshop titled “Modern Quality Assurance in Modern Radiotherapy”, trainers from Germany, Belgium, and India shared their knowledge with the participants. Image: SCMPCR

Quality assurance in modern radiotherapy – a new hands-on workshop

An important activity of the SCMPCR is the organization of training programmes on cancer prevention, diagnostics, therapy and rehabilitation. In the fields of radiation therapy and diagnostic radiology, workshops have been regularly held since the SCMPCR was founded in 2018. E-learning courses, which were established in 2020 as a result of the COVID-19 pandemic, have become a firm part of the education programme. Medical physicists from all over the world, including Germany, China, Singapore, and the USA, participated in them. Courses are accredited, which means that participants receive certificates proving their qualifications. In addition, the Senior Experts Service, a foundation of German business for international cooperation that provides volunteer specialists and executives, regularly sends experts from Germany to Bangladesh.

Starting in 2023, hands-on training will be provided again. The SCMPCR is in close contact with PTW for this purpose. At PTW's Dosimetry School, a comprehensive training programme on quality assurance in radiotherapy was developed in close cooperation with Professor Zakaria and the SCMPCR team. This new hands-on workshop titled “Modern Quality Assurance in Modern Radiotherapy” was first conducted by the SCMPCR in February 2023 and offered a good mix of theory and hands-on training sessions. 25 participants attended the training. Among them, 18 were from Bangladesh, two were from India, and five were from Nepal. The trainers came from Germany, Belgium, and India. The training occurred at Labaid Cancer Hospital and Super Speciality Centre in Dhaka.

In the practical part of the course programme, participants were trained in a variety of modern dosimetry and QA equipment used in clinical routine, had the opportunity to ask questions, and were also allowed to lend a hand themselves. The team at PTW was very pleased to be able to support the SCMPCR with this programme personally and on-site. The exchange of knowledge and direct contact with medical physics experts worldwide are very valuable and irreplaceable.

PTW has been furthering the SCMPCR and the medical physics community in Bangladesh for many years. In addition to financial resources, PTW also supports the

SCMPCR with technical support by regularly sending experts and medical physics equipment for hands-on training in Bangladesh. Both sides are happy to continue their successful cooperation in the future.

The hands-on workshop also included training on the OCTAVIUS 4D patient QA system by PTW, which is used for the verification of radiotherapy treatment plans. Image: SCMPCR

Further information regarding SCMPCR's e-learning programmes can be found here: A. Would you like to make a donation to support the SCMPCR's work? More information can be found here: https://alobhubon.org/scmpcr/.

Tino Ebneth is a medical physics expert. He initiated the PTW Dosimetry School in 2014. In his role as head of the school, he is responsible for planning, developing, and implementing the school's training program.


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MEETING REPORT

EFOMP Officers Spring Meeting Iceland 2023

Brenda Byrne, the Chair of the EFOMP Professional Matters Committee and the current Assistant Secretary General of EFOMP, gives an overview of the trip and her thoughts on the meetings and social events that took place during the EFOMP officers' time in Iceland at the combined Nordic Association of Clinical Physics Symposium in Reykjavik, Iceland, on March 30th through April 1st, 2023.

Day 1: Officers Meeting Photo (from left to right): Brenda Byrne, Jaroslav Ptáček, Efi Koutsouveli, Paddy Gilligan, Kirsten Hansine Helen Bolstad, Veronica Rossetti and Eeva Boman - Friday morning (March 31, 2023)

Each year, the EFOMP officers meet twice to discuss topics related to the functions of EFOMP and the development of our profession for the benefit of our NMOs. This year we were delighted to be invited to hold our spring officers meeting alongside the Nordic Association of Clinical Physics Symposium, "New Technologies from Bench to Bedside." The Nordic Association for Clinical Physics was founded in 1962 and promotes Nordic cooperation within the field of clinical physics in scientific work, developments, education, training, and accreditation programs. The Icelandic Medical Physics Society in conjunction with the Norwegian and Danish Associations of Medical Physics hosted the symposium this year in Reykjavik, Iceland. It was originally planned to have this symposium in Reykjavik in 2020, but due to the COVID pandemic, the symposium was moved online. The NACP symposium was very well attended, with over 185 medical physicists from across the Nordic countries and as far away as Malta!

Our meeting got off to a great start when we received the good news of the official foundation of the Icelandic Society of Medical Physicists, with a membership of 16 medical physicists. The president of the Icelandic Society of Medical Physicists is Hanna Björg Henrysdóttir, Chief Medical Physicist and Head of the Department of Radiotherapy at Landspitali University Hospital, Reykjavik. EFOMP looks forward to receiving their application to become our 37th National Member Organisation.

The officers' meeting got underway on Friday morning (March 31) in a boardroom provided for our use by the NACP symposium. Six of the EFOMP officers were present in Iceland, with others joining online in a hybrid-style meeting. There were many items for discussion and approval. The agenda of each officer's meeting is based on the officer's report from each committee chair (6 in total) and the reports from the president, secretary general, and treasurer.

Before lunch, the officers attended part of the NACP symposium and listened to an invited speech by EFOMP President Paddy Gilligan. He spoke on "New Core Curricula in Medical Physics". There was lots of lively discussion and audience interaction during Paddy's talk when he used online survey tools to ask the audience members their thoughts on the core curricula and the plans underway by EFOMP to apply to the European Commission to add Medical Physics Expert as a Regulation Profession under EU Directive 2005/36/EC. This directive is designed to allow EU citizens to transfer their qualifications and skills between member states. It works on the principle that a qualified professional in one member state is qualified to exercise the same profession in another member state. After Paddy's talk, we had a light lunch and looked around the sizable exhibition area, which was well-supported by businesses and poster displays.

On Friday evening, after the conclusion of the officers' meeting, we attended the NACP conference dinner, which took place at the Hotel Reykjavík Grand in their Háteigur Room, a unique venue with spectacular views across the city. The dinner was a great occasion to mingle and chat with other NACP symposium attendees while enjoying some local Finnish food, music, and dancing.

Leadership meeting with representatives from each of the Nordic countries involved in NACP. Pictured here with the EFOMP Officers are Toni Ihalainen, NACP President (Finland), Veronika Tømmerås (Norway), Hanna Björg Henrysdóttir (Iceland), Rebecca Titternes (Sweden) and Kirsten Hansine Helen Bolstad (Norway). Absent from photo is Heidi Staghøj Rønde (Denmark) - Saturday, April 1, 2023.

On Saturday morning, the EFOMP officers held a leadership meeting with representatives from each of the Nordic countries involved in NACP. Paddy Gilligan gave an overview of current EFOMP activities and future plans. Items discussed included the European Journal of Medical Physics, EFOMP projects, ECMP 2024, and EFOMP approval of National Registration Schemes.

Veronica Rossetti (left), Efi Koutsouveli, and Brenda Byrne (right) at the Gullfoss Waterfall.

Following two busy days of meetings, some of the EFOMP officers joined one of the post-symposium tours, which gave us further opportunities to meet with the symposium delegates while experiencing some of the amazing Icelandic scenery. The Golden Circle Tour brought us to Thingvellir (or, in Icelandic, Þingvellir) which is the only place in the world where you can stand between two continental plates. We also visited the Geysir, the hot spring area, and Gullfoss Waterfall. It was a great day out, with over 50 medical physicists in attendance. Well done to all involved in the organisation of the NACP 2023 symposium, and best wishes to the organisers of the 2026 symposium which will be held in Sweden. The EFOMP officers returned home with many tasks and some great memories of their trip to Iceland.

Brenda Byrne is a Principal Physicist working at the Mater Misericordiae University Hospital in Dublin, Ireland. Her primary areas of interest are diagnostic radiology, nuclear medicine, and radiation protection. She has been a registered radiation protection adviser (RPA) since April 2000 and is a recognised medical physics expert (MPE). Brenda is the current Assistant Secretary General of EFOMP and Chair of the EFOMP Professional Matters Committee. In January 2024, Brenda will become the Secretary General of EFOMP.


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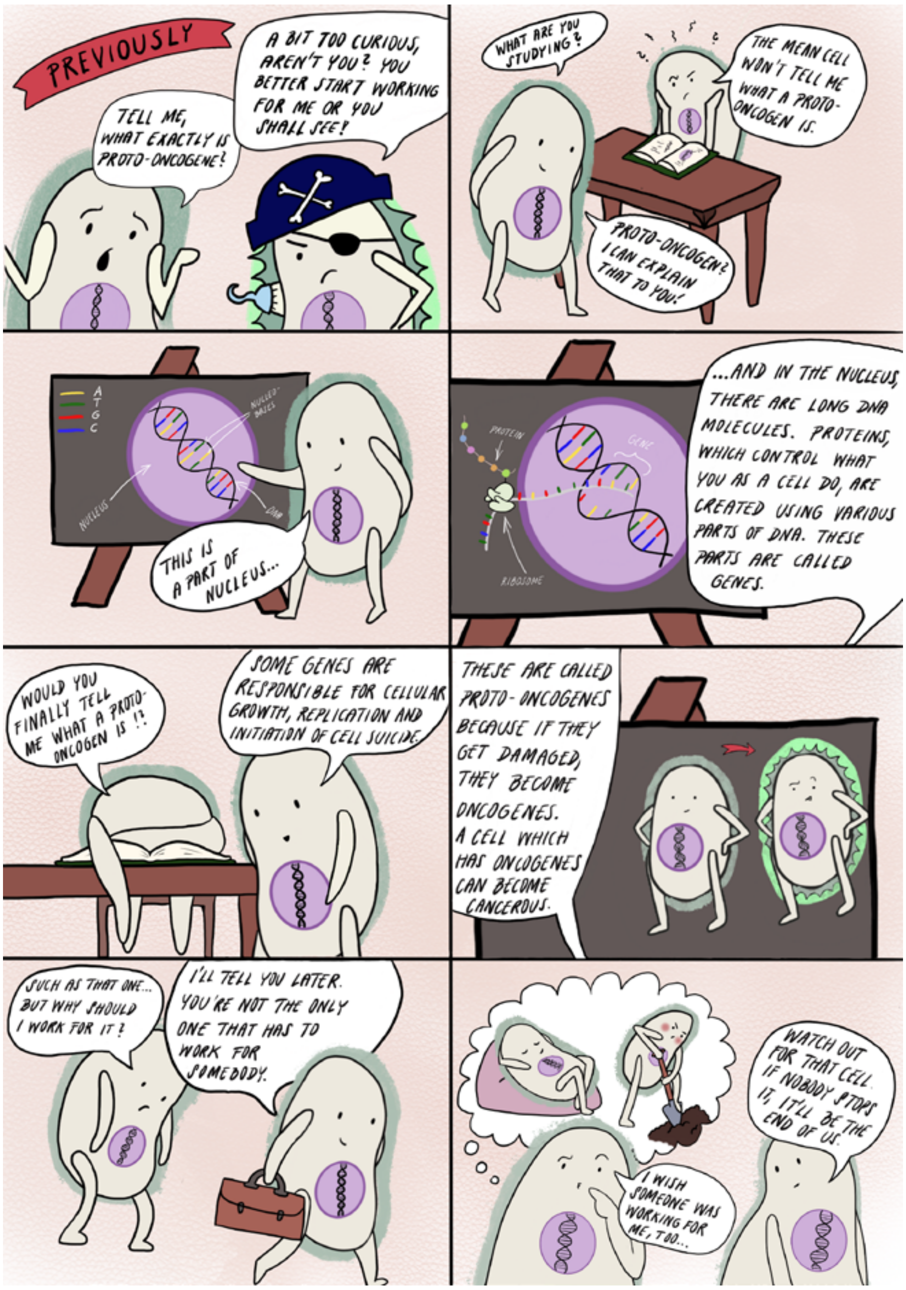
The Aurora Project: Cancer and Its Treatment from the Inside Through Comic Strips: PART II

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



Almost every cell in the body contains a nucleus, where DNA molecules are stored. The information in these molecules is called the genome. The genome consists of genes that serve as a kind of template for the creation of proteins using ribosomes. Proteins have a very diverse range of functions. Some serve as enzymes, others regulate events in the body, others have a supporting function or mediate the transport of substances, and much more.

The transformation of a cell into a cancerous one occurs after mutations in "the right places." The "right places" are the so-called proto-oncogenes and tumour suppressor genes. In simpler words, these are groups of genes that are common in cells and are responsible for their reproduction. If a mutation occurs on a proto-oncogene, it becomes an oncogene, and the cell thus loses the correct instructions for reproduction. Tumor suppressor genes regulate the rate of reproduction. The mutation of both types of genes is highly undesirable, as it can lead to uncontrollable cell proliferation and thus the creation of tumours.

Aurora is a project of the Prague section of European Physical Society (EPS) Young Minds. The main aim of Aurora is to spread knowledge about ionizing radiation in general, ionizing radiation in medicine and cancer. And how do we intend to spread this knowledge?

For example, by creating topical comics. Our team is still expanding. Now, we have two main painters, Markéta Farníková and Anežka Kabátová. Then, there are 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:

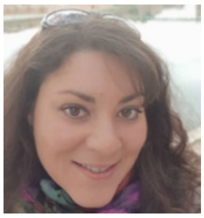
Markéta Hurychová studied Medical Phy-sics at the Czech Technical University in Prague, gaining an MSc degree in 2019. She worked at the Department of Medical Physics at Hospital Na Homolce from 2018, at the Department of Radiation Dosimetry Nuclear Physics Institute of the Czech Academy of Sciences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

Barbora Dršková 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 Crkovská 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.

Anežka Kabátová 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 Osmančíková 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 Michaelidesová 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.

ART AND SCIENCE

Art to Challenge and Inspire: Images and Reflections for Medical Physics (8)

Professor **Jim Malone** writes about a remarkably beautiful painting of a nineteenth century music hall entertainer, Minnie Cunningham, that has something to teach us.

Walter Sickert painted Minnie Cunningham at the Old Bedford (1892). She was a strong, successful music hall performer, often writing her own songs. Sickert was fascinated by music halls and regularly painted scenes from them, exploring unusual angles, gestures, and lighting. He had many styles and left excellent portraits, urban scenes, and a series of paintings of fleshy naked women, which were unsettling at the time but subsequently influential. Novelist Patricia Cornwell (among others) espoused the theory that Sickert was Jack the Ripper (or an associate), though this is now largely discredited. Hopefully, you will find this unusual, beautiful picture rewarding. Feedback: jifmal@gmail.com

Minnie Cunningham at the Old Bedford

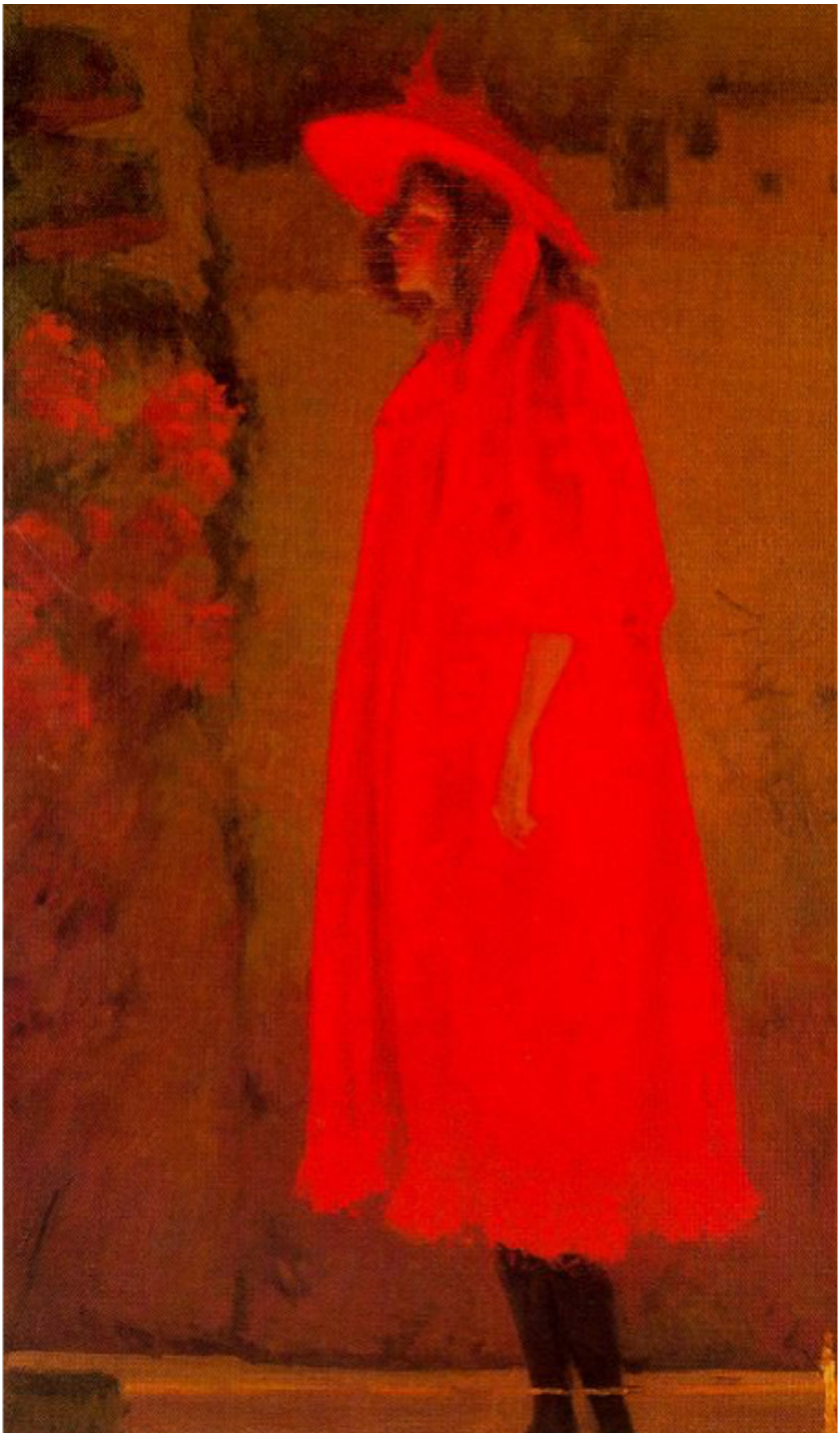
(See next page.)

Sickert's painting is beautiful, and beyond that, it requires no justification. He chooses a point of view that leaves the singer peering, reaching out beyond what is visible to her. She wants to meet the audience where they are, and her demeanour invites communication that could otherwise fail. She charms and engages them. Sickert's art often deals with failed or inadequate communication.

What can be taken from this for medical physics? In discussing difficult topics such as the LNT hypothesis et al., we should try to meet those from other professions, friends, and patients where they are. No talk of Sieverts or other arcane physics? They are miles (or is it kilometres?) out of reach. We must find a better way. Just as Sickert found a new way to immortalise this compelling entertainer.

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).

Minnie Cunningham at the Old Bedford (1892) by Walter Sickert (1860-1942). (See previous page).



Oil on canvas. Support: 765 × 638 mm frame: 915 × 787 × 69 mm. Tate London Collection, not on display. Creative commons.

EFOMP COMPANY MEMBER ARTICLE

Dosisoft Launches New ThinkQA Secondary Dose Check Solution Designed for Adaptive Radiotherapy Workflows

DOSIsoft, a leading provider of patient-specific imaging and dosimetry software solutions for Radiation Oncology and Nuclear Medicine, is proud to announce its latest innovation - ThinkQA Secondary Dose Check, a fast, reliable, and independent 3D dose calculation for online adaptive workflows.

Figure 1. DOSIsoft New product launch ThinkQA Secondary Dose Check

CE-marked on April 14th, 2023, the new software product will succeed the current MU2net solution and offer a technological breakthrough and cost-effective solution for secondary dose calculation and verification. It will be of great value for Radiation Therapy (RT) departments to perform routine Patient-specific Quality Assurance (QA) and meet the QA requirements of the latest adaptive radiotherapy equipment and practices.

Fast and reliable 3D secondary dose calculation and verification for the adaptive RT market

Resulting from 3 years of intense Research & Development, leveraging DOSIsoft dose calculation and Treatment Planning System (TPS) expertise, ThinkQA Secondary Dose Check combines dose computation accuracy, relevant dose comparison metrics, and ergonomic web design to provide a fast and reliable secondary dose check.

The advanced model-based independent 3D dose calculation engine, a specifically adapted Collapsed Cone Convolution (CCC) algorithm, is compatible with both conventional and adaptive RT workflows.

Intuitive and user-friendly, the ThinkQA web platform and dashboard allow comparison of 3D dose distributions with key dosimetric indicators, such as whole matrix differential and cumulative DVH (Dose Volume Histograms) and Gamma Index Agreements (GIA) on automatic or target volumes.

Compliant with AAPM Task Group 219(1) recommendations

The implementation of new treatment techniques in External Beam Radiation Therapy (EBRT) departments increases the complexities of dose planning and delivery, thus increasing the potential for serious errors or uncertainties. It is also even more true for the new adaptive radiotherapy. Catching errors before actual RT treatment begins is an essential part of the verification steps for a complete patient-specific QA.

The recent AAPM Task Group 219 has issued specific recommendations to help physicists address these challenges and meet QA regulatory compliance [1]. The ThinkQA Secondary Dose Check complies with these AAPM recommendations, in particular:

- Fast, simple and automated system to be used for every plan
- 3D dose distribution comparison providing analysis with respect to specific automatic volumes (High dose, High gradient, Mean dose and Low dose) as well as 3D Gamma Passing Rates (GPR) for High Dose / High Gradient regions and PTVs
- Fully independent algorithm and implementation
- Flexibility to define tolerance limits and action levels, such as the proposed 90% 3% - 2mm.

1st commercially available solution tailored to Elekta Unity MR-Linac

To support the Elekta Unity online adaptive workflow, ThinkQA Secondary Dose Check provides a Collapsed Cone Convolution algorithm adapted to the Unity beam (7MV FFF) with a 3D kernel wrapped in a 1.5T magnetic field. From the primary plan, it automatically handles the adapted plan, taking into account day-to-day patient anatomy changes before each treatment fraction. Providing dose calculation and verification results within minutes, the solution is fast enough to be used for all primary and adaptive plans.

Equipped with a ready-to-use Unity beam model template and a customizable MR cryostat transmission map, the solution allows easy commissioning and can be seamlessly integrated into Elekta's Unity planning workflow.

Early clinical feedback confirms accuracy and ease-of-use

Tested extensively at partner clinical sites, ThinkQA Secondary Dose Check has been found to be highly intuitive and user-friendly providing reliable verification results within minutes. Feedback from the testing sites suggested that the software is helpful in ensuring patient safety and is a much better alternative to existing point-based solutions.

"ThinkQA Secondary Dose Check is not only a real innovation, but also a reusable asset and technology for other purposes in the future. It is a true achievement for DOSIsoft." highlighted Marc Uszynski, CEO of DOSIsoft. "As an important part of complete patient QA, together with EPIbeam for pretreatment beam verification and EPIgray® for in vivo dosimetry, ThinkQA Secondary Dose Check offers great benefits in securing further patient treatments, in particular for the new "adaptive" treatment techniques, like Elekta MR-Linac. We are confident it will help radiation therapy centers meet reporting and reimbursement needs, ensure compliance in plan quality, and gain confidence in patient safety."

About ThinkQA

ThinkQA Edition 2 Secondary Dose Check is CE marked as a class I medical device in Europe, under the new European Medical Device Regulation (EU) 2017/745. As with the other DOSIsoft Patient-QA solutions, ThinkQA Secondary Dose Check is distributed exclusively by Elekta www.elekta.com

About DOSIsoft

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.

References:

[1] OI: 10.1002/mp.15069 Report of AAPM Task Group 219 on independent calculation-based dose/ MU verification for IMRT Medical Physics. 2021;48:e808–e829.

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

Physica Medica: Editor's Choice

For this summer issue of EMP News, **Iuliana Toma-Dasu**, the Editor of Physica Medica (EJMP), selected the following three articles, recently published in the EJMP, that particularly attracted her attention.

L. Ubaldi et al **Deriving quantitative information from multiparametric MRI via Radiomics: Evaluation of the robustness and predictive value of radiomic features in the discrimination of low-grade versus high-grade gliomas with machine learning** Phys. Med. 2023;107: 102538

https://doi.org/10.1016/j.ejmp.2023.102538 https://www.physicamedica.com/article/S1120-1797(23)00015-7/fulltext

This article published in the Focus Issue "Towards quantitative MRI for the Clinic" on methods for standardisation, accuracy, reproducibility, and harmonisation in MRI, edited by M. Tosetti, G. Hagberg, X. Golay, A. Retico, L. Mazzoni, M. Bock, A. Torresin, and D. Lurie, is focused on a very important clinical issue, namely the classification of glioblastoma using Magnetic Resonance Imaging (MRI). The results showed that image normalisation and intensity discretization had a very large influence on the performance of machine learning classifiers based on radiomic features, and by properly using them, the performance in glioma grade classification was rather impressive, with an area under the curve larger than 0.9. This study has a straightforward clinical implication as well as application, as gliomas are the most frequent primary brain tumours in adults, and the grading of gliomas is of key importance in relation to treatment choice, prognosis, and patient survival.

F. Chappuis et al **Modeling of scavenging systems in water radiolysis with Geant4-DNA** Phys. Med. 2023;108: 102549

https://doi.org/10.1016/j.ejmp.2023.102549 https://www.physicamedica.com/article/S1120-1797(23)00026-1/fulltext

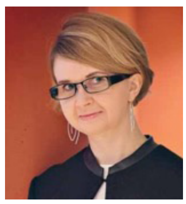
A new paper highlighting the potential of the Geant4-DNA Monte Carlo toolkit to help answer key questions for FLASH irradiation is presented. There are two examples of application areas highlighted in the paper: one of more general aspects of water radiolysis relevant for radiochemistry, and one more directly related to the FLASH-effect that caught my attention in particular, focused on the oxygen depletion in liquid water irradiated with 1 MeV electrons. The results showed that Geant4-DNA simulations with scavengers were feasible and reliable, and this could therefore open up the possibility of working further into understanding the oxygen depletion hypothesis presented as one of the key mechanisms behind the FLASH-sparring effect.

F. Tommasino et al **Does variable RBE affect toxicity risks for mediastinal lymphoma patients? NTCP-based evaluation after proton therapy treatment** Phys. Med. 2023;108: 102569

https://doi.org/10.1016/j.ejmp.2023.102569

https://www.physicamedica.com/article/S1120-1797(23)00046-7/fulltext

The third paper selected for this issue concerns one of the hottest topics in proton radiotherapy, namely the change of paradigm regarding the constant 1.1 relative biological effectiveness (RBE) of protons. More and more evidence is gathering pointing towards the fact that the proton RBE is not constant but depends on the linear energy transfer (LET), the dose per fraction, and the type of tissue, and this should be taken into account when accepting clinically a treatment plan made for protons. The study focused on mediastinal lymphoma patients, a choice with high clinical relevance. The overall conclusion of the study was that the normal tissue complication probability models might be able to identify patients associated with a higher toxicity risk if the RBE for protins is not constant, which is of crucial clinical importance.



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

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End-to-End QA

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True-to-life human's anatomy

SBRT phantom is an anthropomorphic 3D-printed phantom that simulates the anatomy of an abdominal case, with bone and tissue-equivalent materials. The unique advantage of having realistic bone and soft-tissue contrast in both CT and MR imaging, makes SBRT phantom an excellent tool for online adaptation of advanced SBRT techniques.

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MEETING REPORT

The 8th Joint Congress of the Spanish Society of Medical Physics and The Spanish Society of Radiological Protection - May 23rd to 26th, 2023

Manwuel Vilches gives his feedback on the recent Spanish Societies of Medical Physics (SEFM) and Radiological Protection (SEPR) Congress that was held in Oviedo, the capital of the Principality of Asturias.

From May 23rd to 26th, the 8th joint congress of the Spanish Societies of Medical Physics (SEFM) and Radiological Protection (SEPR) took place. This time, the meeting was held in Oviedo, the capital of the Principality of Asturias. "Asturias, natural paradise" is the well-deserved motto of this autonomous community of Spain that stands out for the beauty of its mountains and beaches, such as the beach of silence, photographed at sunset by our partner José Fernández García, head of the section of Medical Physics for Radiotherapy in the Central University Hospital of Asturias.

That is why the rooms in the Oviedo Congress Palace were designated for the occasion with the names of emblematic places: Urriellu, Sella (Seya), Gulpiyuri, Covadonga (Cuadonga), Taramundi, Naranco, and Muniellos. But Asturias is also culture, art, and history, and the congress image (created by our partner Cevents) contains, in addition to the Urriellu Peak, lord of the regional landscape, two emblematic examples of Asturian pre-Romanesque art: a stone rosette from San Miguel de Lillo and the small and beautiful church of Santa María del Naranco.

Sunset on the Asturian coast. Photograph of our colleague José Fernández (Central University Hospital of Asturias) with an unusual view of the Playa del silencio. This is one of the many beautiful beaches that you can find if you visit our community. You can enjoy José's photos at www.josefernandezgarcia.eu

Since 2009, the biennial congresses of both societies have been held jointly, given that the majority of SEPR members are also SEFM members because, in Spain, radiological protection in healthcare centers is legally the responsibility of medical physics.

The congress slogan focused on the challenges faced by professionals working in physics applications and radiation in medicine, given emerging new technologies, particularly artificial intelligence, and increasingly stringent regulations related to safety and quality.

The congress began, as usual, with pre-congress courses on current topics: dual CT, deformable registration, and dosimetry in radionuclide treatments. Simultaneously, an open day was held, organized by the youth group, to bring medical physics closer to university students and professors, in which participants received an introductory talk and toured the scientific and commercial exhibition, accompanied by some of our partners.

Wednesday's schedule began with five update courses: radiobiological challenges in radiotherapy, standardization in PET and SPECT, optimization in radiology, operational RP criteria in facilities, and operational RP optimization in interventional radiology. Following these, scientific sessions began in which patient and worker dosimetry and clinical applications of artificial intelligence played a prominent role. The day also featured a debate on the impact of statistical quality control on linear accelerator control programs, a specific session for young members of the SEFM, and a roundtable discussion on the challenge of communication and scientific dissemination in our field.

The day concluded with the general assembly of the society, in which several issues were discussed, among which we highlight the unanimous approval of the four issues submitted to vote: the award of the SEFM gold medal to José Pérez Calatayud, Head of Radiophysics at La Fe Hospital in Valencia and one of our partners with greater international recognition, the choice of Toledo as the venue for the next 9th joint Congress of the SEFM and the SEPR, the professionalization of the management of the SEFM, with the creation of the figure of the manager of the company, which will be specified soon by the board of directors, and the progressive increase in the membership fee that will be carried out over the next three years.Thursday started with five other refresher courses: RT planning based on synthetic CT, new techniques in nuclear medicine, new imaging modalities in radiology, dose management for patients in radiodiagnosis, and management of radioactive material outside regulatory control. The plenary talk of the day was dedicated to the MEDIRAD project on the risks of medical exposure at low doses. Also during the assembly, the award for the best scientific article published in the Journal of medical physics in 2022 was presented to our partner Montserrat Carles Fariña, for her article "Radiomic model with PSMA-PET for the discrimination of patients with high-risk prostate cancer" (https://doi.org/10.37004/sefm/2022.23.2.002).

On Thursday, another five update courses started: planning of RT based on synthetic CT, new techniques in nuclear medicine, new imaging modalities in radiology, patient dose management in radiology, and management of radioactive materials outside regulatory control. The plenary talk of the day was dedicated to the MEDIRAD project on the risks of medical exposure to low doses.

Additionally, our associated members (companies) conducted their technical sessions to present their novelties on Thursday.

Friday started with four more update courses covering in-vivo dosimetry with EPID, new techniques in nuclear medicine, optimization in CT and DRLs, and new magnitudes in external dosimetry (ICRU 95), as well as the presentation of the best congress posters chosen by the scientific committee. The topics of the day included adaptive radiotherapy, PET/RM hybrid equipment, challenges in proton therapy, and patient safety. The day concluded with a plenary talk on the ICRP system for radiological protection.

The congress also included a symposium for specialist technologists, a group of professionals for whom the SEFM wants to become a scientific reference, which necessarily involves giving them a greater role in society and designing a range of activities that meet their specific professional needs. The symposium took place on Thursday and Friday and included presentations on current topics such as accelerators/RM systems, new radiation techniques in RT, proton therapy, BNCT, new equipment in nuclear medicine, and gyroscopic radiosurgery, as well as sessions for the presentation of their scientific work.

The congress also featured an awards ceremony where José Antonio Terrón, director of the Journal of Medical Physics, presented the award for the best article published in 2022 to Monteserrat Carles Fariñas, from La Fe Health Research Institute, Biomedical Imaging Research Group (GIBI230-PREBI).

José Antonio Terrón, director of the Journal of Medical Physics, presents the award for the best article published in 2022 to Monteserrat Carles Fariñas, from La Fe Health Research Institute, Biomedical Imaging Research Group (GIBI230-PREBI).

The social program was also intense: the welcome cocktail consisted, as is obligatory here in Asturias, of an "espicha", a festive meal around cider, the typical drink of the region. On Wednesday, two parallel sporting events were held: a paddle tennis tournament and a popular race. The dinner of the day consisted of a typically Spanish tapas route through the city centre. The program closed on Thursday with the obligatory closing dinner, which was preceded by a guided tour of the historic centre, in which visitors could learn about the history of the city, headquarters for 120 years of the Asturian monarchy, the germ of our nation, starting point of the primitive pilgrimage route to Santiago de Compostela and one of the most important cities of the industrial period in Spain, as reflected in the good number of palaces and mansions present in its urban area. Oviedo, the Vetusta of Clarín, is a city that deserves to be known, and you deserve to know it.

Manuel Vilches is a doctor in physical sciences and a part-time professor in radiation physics at the University of Oviedo. He has been working as a medical physicist for 32 years, having been the Head of Radiological Protection at the Virgen de las Nieves Hospital in Granada and a 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: Quality Assurance Throughout the Entire Radiotherapy Treatment Course

myQA® iON is the IBA Dosimetry's browser-based software solution that provides an automated independent secondary dose check that evaluates 3D dose distributions, DVH, clinical goals, 3D gamma results (overall and per structure), plan complexity scores, MU checks, and more in only a couple of minutes.

To ensure safe and effective patient treatment, common themes surround patient-specific QA programs: efficiency, accuracy, and independent verification.

Current patient-specific workflows and common QA methods widely found in the literature outline the three points during the patient treatment course that require verification: (a) dose calculation in the TPS; (b) data transfer to the treatment device; and (c) irradiation at the treatment device.

Independent Secondary Dose Check with Monte Carlo

It is suggested that clinics use a system independent from their TPS to perform a secondary dose check to evaluate workflow errors and validate the quality of beam data measurements. Currently, there are two methods for achieving an independent check: using software that focuses on the dose to a point or performing a 3D dose check.

Point dose (1D) checks have been used historically. 1D checks are limited because the entire pass/fail metric of the test relies on the reference point position. This reliance causes the test to lose clinical relevance since the result can be altered by the user only evaluating a location that displays a passing result. Conversely, the Monte Carlo algorithm is robust in its calculation approach—it performs the recommended independent dose calculation and provides 3D dose deviations directly on the CT for all treatment protocols, including stereotactic.

myQA® iON, displayed in Figure 1, is IBA Dosimetry's browser-based software solution that provides an automated independent secondary dose check that evaluates 3D dose distributions, DVH, clinical goals, 3D gamma results (overall and per structure), plan complexity scores, MU checks, and more in only a couple of minutes.

Using the advanced Monte Carlo algorithm for patient-specific QA highlights areas of underdose or overdose that would not be apparent using a lower-quality algorithm for calculations [1].

Machine Log File Analysis

Many clinics use the gold standard of detector array measurement for patient-specific QA, but it is a very manual and time-consuming process.

Along with detector measurement and independent dose calculation, there is the third aspect of patient QA evaluation to be considered – log file analysis. Treatment delivery log files are created with each delivery

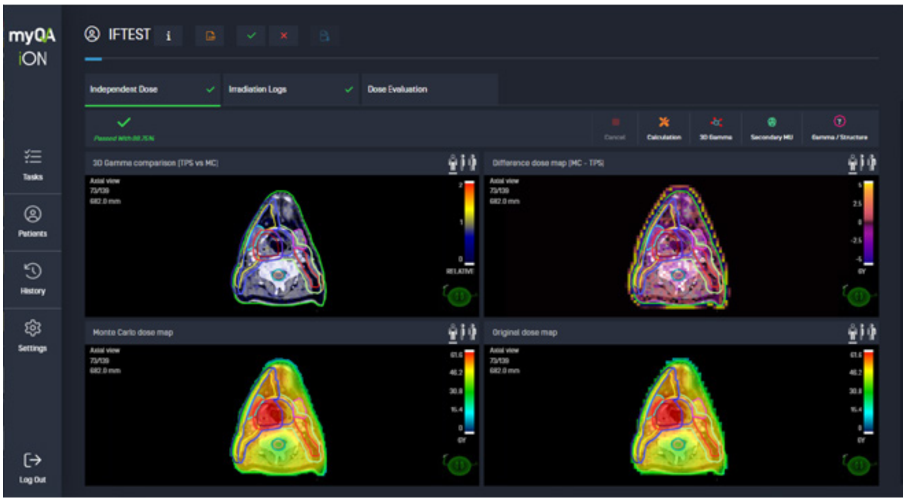


Figure 1. Independent dose evaluation: Monte Carlo calculation compared to TPS calculation with 3D gamma analysis on patient CT.

on the linac from pre-treatment to the treatment end, no matter the complexity or treatment modality. Using the delivery log files along with the Monte Carlo dose algorithm, myQA® iON performs a full 3D dose reconstruction for every fraction on the patient CT and structure set. Dose calculations based on log file analysis provide insight into how the machine's performance during delivery impacts the dose delivered to the patient, as seen in Figure 2.

Providing clinically actionable results directly on patient anatomy, log file analysis can be used in place of or complementary to an existing detector-based patient QA program, which adds more efficiency to patient QA. myQA® iON provides fractional information to evaluate potential issues during treatment; such issues would otherwise go unnoticed without fractional log file analysis.

Balancing Accuracy and Efficiency

myQA® iON impacts the entire patient treatment workflow with the ability to analyse pre-treatment, fractional daily, and post-treatment patient QA. myQA® iON's customised Monte Carlo beam model for independent secondary dose calculation and log file analysis from the linac delivery, in combination with detector measurement, ensures the highest quality of IMRT and VMAT patient-specific QA.

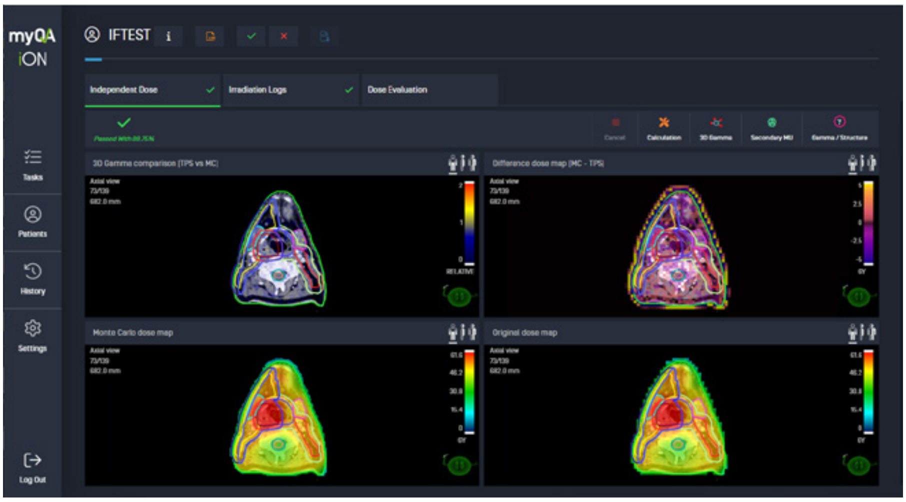
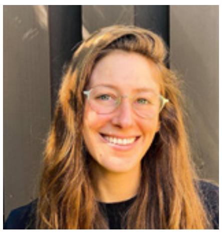


Figure 2. myQA® iON dose evaluation provides an overview of dose per structure, DVH, clinical goal comparison between TPS calculation, Monte Carlo second check, and Monte Carlo calculated from treatment system log files.

Reference:

[1] Knoos et al. – Comparison of dose calc algorithms for treatment planning in external photon beam therapy in clinical situations. Phys Med Biol 2006;51(22) 5785-807



Meghan Boone, MSc, is a Product Manager at IBA Dosimetry. Throughout her career, she has worked in the industry in support, training, and product validation, as well as clinically, with a focus on commissioning and clinical program implementation. Her main area of interest is software and workflow optimization.

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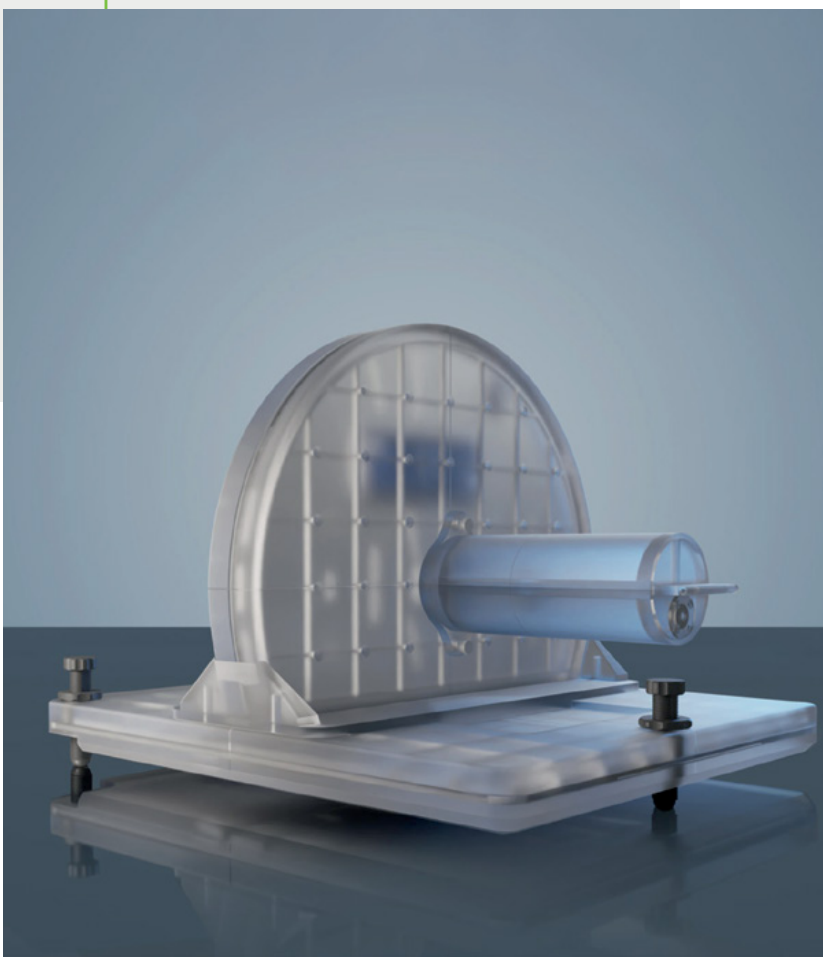

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Kindle Your Medical Physics Career: Join the EFOMP Special Interest Group for "Early Career Medical Physicists"

Newcomers to the medical physics profession are supported through EFOMP's Early Career Special Interest Group (SIG). In this article, Katryna Vella encourages you to join this SIG so that you may network with other rising specialists in the field and develop professionally alongside them.

Are you an aspiring, young, or early-career medical physics professional looking to connect with like-minded professionals, expand your knowledge, and contribute to the European Medical Physics community? EFOMP presents the Early Career Special Interest Group (SIG), which is an exclusive platform designed to support and empower those at the beginning of their journey in the field [1]. The early-career professionals of today will be the leaders of national and European medical physics tomorrow. Hence, we invite you to join this SIG and embrace the opportunity to collaborate, coordinate, learn, and grow alongside early-career professionals to ensure an ever-growing medical physics community.

About the Early Career SIG

Forming a vital part of EFOMP, the Early Career SIG focuses on addressing the unique needs and challenges faced by early-career professionals in the rapidly evolving medical physics field. It was officially created in 2022, and the kick-off meeting was held on December 9, 2022. There are currently just over 60 members in this SIG, and anyone can apply to join anytime (refer to the section 'How to Join' in this article to become a member). We aim to create a nurturing, inclusive environment where aspiring and early-career medical physicists can:

- Network with other early-career medical physics professionals and established experts across Europe.

- Organise and take part in scientific events (professional matters, education and research activities) within the ECMP which occurs every two years (upcoming: Munich 2024).

- Engage in mentorship, teamwork and knowledge-sharing opportunities through education and training courses for early-career medical physics professionals targeting different hot topics and streams falling under the umbrella of medical physics and radiation protection.

- Participate in skill-building workshops, webinars and educational activities tailored to early-career needs.

- Exchange opinions and data in a positive feedback loop on a communication platform.

- Collaborate on research projects and initiatives which have the power to impact the future of medical physics.

Meet the Steering Committee and Board Members

The Steering Committee consists of seven early-career medical physics professionals (members of the SIG) elected by the Early Career SIG members through a ballot organized by the parent committee; EFOMP European and International Matters Committee in March 2023:

- *Leticia Irazola, Spain*
- *Jesus Ovejero, Spain*
- *Anna Maria Fanou, Greece*
- *Nefeli Tzoumi, Greece*
- *Katryna Vella, Malta*
- *Agnese Katlapa, Latvia*
- *Antonio Jreije, Lithuania*

A meeting on March 29, 2023, took place to select the Board members. The Board consists of three members:

- Convener: Leticia Irazola, Spain

- Vice Convener: Antonio Jreije, Lithuania

- Secretary: Agnese Katlapa, Latvia

These young members from different countries, with different perspectives and experiences, have come together to create a unique, vibrant, energetic, and enthusiastic community where collaboration and innovation thrive, ensuring both personal and professional development.

Why join the Early Career SIG?

Becoming a member of this SIG will provide you with vast opportunities, such as the following:

- Connect with a diverse community of early-career and experienced medical physics professionals eager to support your professional growth.

- Access resources, tools, and learning opportunities designed to address the challenges faced by those starting their careers in medical physics.

- Stay informed about the latest developments and trends in the field, as well as potential job opportunities and career paths.

- Suggest and contribute to special issue topics in the Physica Medica journal.

- Contribute to the advancement of medical physics in Europe by participating and collaborating in international research projects, working groups, and policy development.

How to Join

If you are not yet an EFOMP member, ensure you have an active membership through your affiliated National Member Organisation or by becoming an Individual Associate Member.

All EFOMP members (members of their National Member Organisation or Individual Associate Members) can apply to join this SIG electronically by sending a professional CV and member application form (accessed here) to board.sig_frec@efomp.org. NMOs can also nominate representatives.

Joining the EFOMP SIG for "Early Career Medical Physicists" is a unique and rewarding opportunity for aspiring and early-career medical physics professionals from all around Europe. Take advantage of the resources, networking, and mentorship opportunities available to you to not only develop research and scientific skills but also the necessary soft skills needed in such a fast-paced hospital domain. These skills help you embark on a journey of professional growth and collaboration with other like-minded professionals. Together, we will shape the future of the medical physics profession and contribute to the continued advancement of patient care throughout Europe. Make your vision a reality today!

Reference:

[1] Marcu LG, Caruana CJ, Lopez-Medina A, Mazzoni LN, Polycarpou I, Manetou A, Koutsouveli E. Early career medical physicist groups in Europe: An EFOMP survey Phys Med. 2022;95:89-93.

Katryna Vella is a Medical Physics Trainee in the area of Diagnostic and Interventional Radiology, practising 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 Steering Committee member of the Early Career SIG 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. Katryna is also a novelist and poet, a critique partner, and a beta reader for writers and authors.

Meeting Report

Officers Meeting in Conjunction with NACP2023

In this article, Jaroslav Ptáček, the treasurer of the EFOMP, shares his human and professional experiences of his recent long journey with the EFOMP officers to Reykjavik, Iceland, from March 30th to April 1st, 2023, to participate in the combined conference of Danish, Finnish, Icelandic, Norwegian, and Swedish associations, as well as to attend the EFOMP officers meeting that was planned as part of the journey's programe.

EFOMP is a federation of national member organizations (NMOs), and many, if not all of them, are based on volunteer work. There are numerous tasks that can be conducted using online services and have always been carried out in this manner. However, the COVID era of the past few years has forced the world to use online facilities for nearly all tasks. Despite the fact that it can be quite comfortable in many situations—sitting at home in your pyjamas with a cup of hot coffee just behind you—the majority of normal human beings quickly realized that without social interactions, people truly suffer. Since EFOMP officers consider themselves normal, to some extent, this was also our case.

We have individuals of different nationalities on EFOMP's board, and each person has distinct personal characteristics. I don't consider myself to be socially above average; in fact, my actual daily level of social interaction is probably below average, as I spend most of my working hours alone in the office. Don't get me wrong; I don't suffer from it. I actually enjoy it. However, being part of EFOMP has revealed something unexpected. I greatly enjoy being in personal contact with my EFOMP colleagues. Despite the fact that it takes me out of my comfort zone, involves communication in a non-native language, and sometimes transforms calm debates into arguments, I find it beneficial for enhancing my social skills. Just as I regularly swim in cold waters to strengthen my body, I immerse myself in EFOMP matters to strengthen my personality. I welcome EMP News readers to try both, or at the very least, give EFOMP a try if cold waters seem too daunting.

But let's return to the officers' meeting that took place during the Nordic Association for Clinical Physics 2023 (NACP2023) conference. EFOMP relies on NMOs for many activities, including finding a location for officers' meetings and annual general assemblies. In 2022, EFOMP received an invitation from NACP to participate in NACP2023. This conference serves as a wonderful example of collaboration within the medical physics community. The Danish, Finnish, Icelandic, Norwegian, and Swedish associations came together to organize a joint conference, which happened to be held in Reykjavík, Iceland from March 30th to April 1st, 2023. Being a host to any medical physics conference is an extraordinary experience. All NMOs, regardless of their size, foster vibrant communities of highly motivated, intelligent, and friendly individuals. This has been my personal experience during my time at EFOMP. It's no surprise that NACP2023 was the kind of conference one would eagerly want to attend. Moreover, visiting Iceland provided an additional opportunity to witness the natural beauty of the country. Needless to say, due to the time of year, Iceland presented itself in a more untamed form compared to the summer.

Even though EFOMP officers try to address many issues through emails and teleconferences, there was still a rather extensive meeting agenda. Those who were unable to attend in person in Reykjavik joined us online, and we reached agreements on all the matters that were discussed. The EFOMP board also held a leadership meeting with the boards of all the NACP associations to exchange information about EFOMP's goals and their own goals for the future.

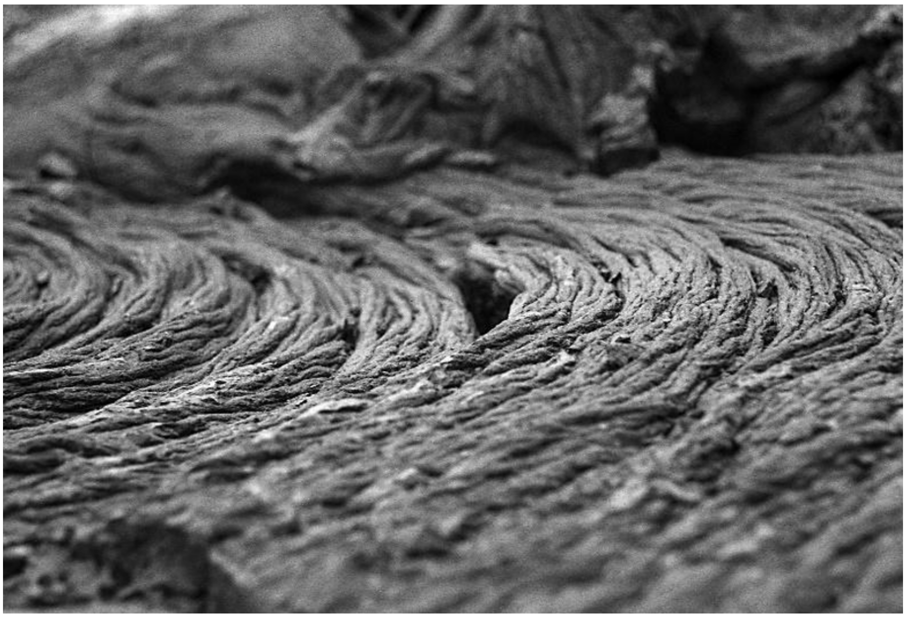
This was as close as I was able to get to frozen water.

Since my flight to Reykjavík allowed me to have two extra days for travel, on the first day, I took a walk along the coast to the Grótta Island Lighthouse. The original plan was to go glacier hiking, but the weather prevented that. On the second day, I visited the Fagradalsfjall Volcano, the city of Grindavík, and the famous Blue Lagoon. The weather was slightly better, but everything still appeared black and white, which perfectly suited the style of photography I enjoy.

During lunch in Grindavík, I shared a table with three strangers. One of them turned out to be a fish factory process auditor, the second was a mechanical engineer (if I remember correctly), and the third was a teacher. The auditor was a lady from France, so we asked her about the current strikes there. She told us the story of the French pension system and the government's intention to raise the pension age from 62 to 64 years. In Czechia, we are fine with this since it's 64 years for us anyway (and it will be more). Moreover, I spend most of my days thinking, which can be challenging, but it's not physically demanding work (except for the body part in contact with the chair). I mentioned this, and the teacher asked about my occupation. "I'm a medical physicist," I replied. "Interesting, my husband is here for the NACP2023 conference. He is a medical physicist too, and he operates in the same way," she said.

Life in EFOMP is full of surprises. You never know who you are going to meet. And as I learned from Harald Risnaes, the NACP2023 organizer who gave me a ride from the airport to the hotel after I found out my pre-booked ride was cancelled, "It's the way it is."

Grótta Island Lighthouse - the beach was closed due to bird protection (from May 1st to July 31st... naturally). So, this was the closest I could get. There were no birds on the beach anyway. In fact, there was nobody around.



Natural lava art created by Fagradalsfjall Volcano.

Jaroslav Ptáček – University Hospital Olomouc, Jaroslav studied Medical Physics at the Czech Technical University in Prague, earning a master's degree in 2003 and a PhD degree in 2014. He has been working at the Department of Medical Physics and Radiation Protection at University Hospital Olomouc since 2003, where he has been a clinical medical physicist in nuclear medicine since 2006 and became the head of the department in 2009. He was a member of the board of the Czech Association of Medical Physicists between 2006 and 2010, and its president from 2010 to 2018. From 2013, he became involved in EFOMP, first as one of the organizers of ESMPE editions in Prague, then in 2017 as an Assistant Secretary-General. He served as Secretary-General from 2018 to 2020 and has been Treasurer since 2021.

PRUSA POLYMERS by JOSEF PRUSA

The Prusament PETG Tungsten 75%: A 3D Printing Solution for Custom-Made Radiation Shielding Components

Prusa Polymers, a Prague-based company, has developed and manufactured a PETG filament filled with fine tungsten powder. The material is used in FFF 3D printing to produce complex radiation-shielding components more efficiently and quickly compared to traditional methods.

High-density materials commonly utilized for radiation shielding are often challenging to machine, costly, or even toxic. The inherent properties of these materials render the classic manufacturing methods less than ideal. Additive manufacturing provides the potential to create complex, individualized shielding components more easily and, in some cases, at a reduced cost. That's why we have developed the tungsten-filled filament.

Radiation shielding and mechanical properties

The Prusament PETG Tungsten 75% is filled with tungsten powder (75 % in mass). The following table clarifies the shielding properties of Prusament PETG Tungsten 75% compared to pure lead and tungsten.

	pure Pb	PETG Tungsten 75%	pure W
Density ($g*cm^{-3}$)	11.3	4.0	19.3
Linear attenuation coefficient (140 keV, ^{99m}Tc) μ (cm^{-1})	27.11	4.95	36.23
Half-value layer HVL (mm)	0.256	1.402	0.191
Multiple of pure W HVL	1.34	7.34	1.00

Figure 1: A comparative analysis of radiation shielding properties between Prusament PETG Tungsten 75% and common shielding materials. The linear attenuation coefficient of pure lead [1] and pure tungsten [2] was calculated using the physics.nist.gov database and values presented in the article that investigates attenuation properties of 3D-printed tungsten for gamma camera collimator applications [3].

The results presented in the table (density, μ, and HVL) are theoretical values for pure lead and pure tungsten. The density of Prusament PETG Tungsten 75% (4 g*cm-3) was determined by calculating the mass and dimensions of the filament. Its μ value was derived from the series of attenuation measurements conducted by Ing. Jaroslav Ptáček, Ph.D. in the Department of Medical Physics and Radiation Protection at University Hospital Olomouc. The HVL value was calculated using experimental data.

Measurement method

All measurements were performed using metastable Technetium (99mTc). During the attenuation measurements, a Prusament PETG Tungsten 75% sample of a specified thickness was irradiated by a source of radioisotope 99mTc. The attenuation for each sample was determined using narrow beam geometry. In nuclear medicine diagnostics, 99mTc is the most commonly used medical radioisotope. As a radioactive tracer, it emits detectable gamma rays with a photon energy of 140 keV.

The test objects were 3D printed with Prusament PETG Tungsten 75% and had varying thicknesses of 0.1; 0.2; 0.3; 0.5; 1; 1.5; 2; and 3 mm. Measurements were taken perpendicular to the surface of the sample. After taking the measurements, the HVL values were calculated.

Tungsten fine powder was combined with PETG (Polyethylene Terephthalate modified with Glycol) due to its good printability, and resistance to radiation and chemicals, such as various disinfection solutions.

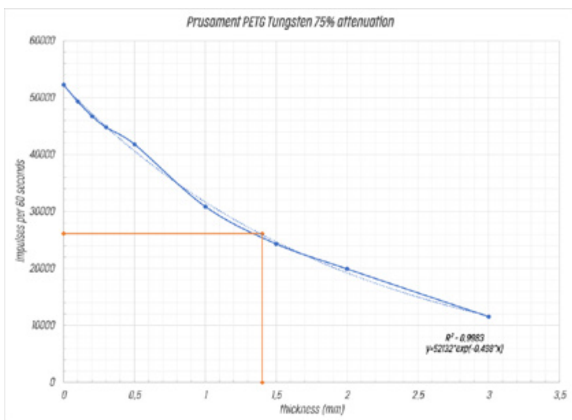


Figure 2: Attenuation measurements results. The Y-axis shows the amount of gamma radiation passing through the tested sample, the X-axis represents the sample thickness. The calculated HVL for Prusament PETG Tungsten 75% is 1.402 mm (orange mark). For comparison, the HVL for pure lead is 0.256 mm, HVL for pure tungsten is 0.191 mm.

How does it work in practice?

We developed a proof of concept: a shielding apparatus for syringes used with nuclear medicine radiopharmaceuticals. We've used the Prusament PETG Tungsten 75% for printing a desired part with its shielding approx. 8 mm thick. This is equal to 5.7 HVLs (based on 99mTc). This apparatus was designed specifically for the radiopharmaceuticals infusion system used at University Hospital Olomouc in its laboratories. With our 3D-printed part, the hospital staff can switch between multiple syringe shieldings.

Figure 3: Prusament PETG Tungsten 75% 3D-printed shielding

Although the 3D-printed shielding was significantly thicker than the pure commercially-used tungsten, producing it using 3D printing was significantly faster, taking into account ordering, transportation and other factors. In some instances, obtaining replacement parts may be overly complex and the Prusament PETG Tungsten 75% can provide a suitable alternative. This shows great potential for rapid repairs and improvements in radiological instruments. Furthermore, additive manufacturing is not only time efficient, but also a cost-saving solution.

Typical applications

We primarily designed the Prusament PETG Tungsten 75% for medical applications, such as radiology. However, our aim is to target the entire radiation shielding industry. There are numerous areas where radiation shielding filaments may be used, including aerospace, nuclear energy, non-destructive testing, and x-ray imaging devices. Unlike most filaments, the Prusament PETG Tungsten 75% is not intended for the general 3D-printing community but rather for specialized research and high-end engineering applications.

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Martina Kukrálová works as a material engineer at Prusa Polymers. Her task is the development of new materials for 3D printing, one of them is Prusament PETG Tungsten 75%. Martina graduated in Chemical Engineering at the University of Chemistry and Technology in Prague.

Jaroslav Ptáček studied medical physics at the Czech Technical University in Prague, gaining a master's degree in 2003 and a PhD degree in 2014. He has worked at the Department of Medical Physics and Radiation Protection at University Hospital Olomouc since 2003; he has been a clinical medical physicist in nuclear medicine since 2006, and he became the head of the department in 2009. He was a member of the board of the Czech Association of Medical Physicists between 2006-2010 and its president from 2010-2018. In 2013, he became involved in EFOMP, first as one of the organizers of ESMPE editions in Prague, then in 2017 as an Assistant Secretary General, for the period 2018-2020 Secretary General and he has been a treasurer since 2021.

WHAT MEDICAL PHYSICISTS DO IN THEIR FREE TIME

My Journey in Agriculture

In this article, **David Scicluna** shares his experiences of growing crops in Malta, which is his way to rest his mind from Medical Physics work

Agriculture has been established in Malta since the Neolithic period, some 7,500 years ago. The culture of agriculture has therefore been engrained in the Maltese population since birth. Agriculture, as many seasoned farmers will tell you, requires resources such as land, water, equipment, experience, and time. I am quite lucky, as most of the resources needed for agriculture were passed down to me by my grandparents, who have always supported me. A few years ago, I became acquainted with a very experienced farmer who encouraged me to take up agriculture as a hobby, and he was more than willing to share his experience with me. It was then up to me to manage the time to tend to the crops while juggling my studies in Engineering and Medical Physics at the same time.

But where to start? Reading the recommended practices on the internet and in books is informative, but given the geographic location of Malta, not all knowledge can be directly transferred to the climatic conditions of a sunny island in the middle of the Mediterranean. At the time, the sowing season was at its end and winter was on its way; however, the weather was still quite warm and the days were full of sunshine. This meant that sowing could still be carried out, but if the seeds took long to germinate, the plants might be caught in cold weather, which stunts their growth and eventually kills them. I asked my father which crop he would like to eat, and he suggested green beans. I proceeded to buy the seeds, and after tilling the land and preparing the soil for sowing, I proceeded to sow a small part of the land with green bean seeds. For this crop, it takes approximately two to three weeks for the seedling to sprout from the soil. My inexperience was apparent as the spacing between one seedling and another was too small, requiring transplantation for almost a quarter of the seedlings. This creates quite a burden on young plants and may result in the plant dying due to the unnatural stress of replantation (although, for the most part, this was not the case and most of the plants survived my inexperience!). After about a month and a half, the plants started flowering (green beans are self-pollinating; however, bees may still visit their flowers, collecting nectar and pollen), which was a good sign as this is the first step towards producing the bean. It then takes around another month to first start harvesting the green beans, with frequent harvests for around three weeks.

Following this attempt, I also tried my luck with carrots, zucchini, peas, chickpeas, broad beans, and potatoes.

So far, I've had the greatest success with green and broad beans. I find the process of taking care of the land and crops a good exercise to let off steam after a day of medical physics and office work. What is most satisfying, however, is seeing the crops grow from seeds to seedlings to plants and, after so much care, providing products that can be shared with family and friends.

David Scicluna 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. He is a member of the Malta Association of Medical Physics (MAMP). David's key international achievement in medical physics so far was presenting his Master's dissertation at the Nordic Association for Clinical Physics (NACP23) in Iceland.

EFOMP COMPANY MEMBER ARTICLE

Qaelum: Automatic CT repeat software applied to pulmonary embolism protocols

Qaelum released new software (FOQAL-CT Repeat, Qaelum, Belgium) to automatically identify intra-study repeats, employing an algorithm developed and patented by the University of Wisconsin-Madison

In order to achieve diagnostic image quality in computed tomography images, the clinical practice requires scans to be repeated for reasons including incorrect protocol selection by the operator, patient positioning or motion, contrast timing, or the need to adjust scan parameters like tube current modulation and tube voltage (among others). Although repeated scans can be a sign of good clinical practice, high repeat rates indicate sub-optimal practices and contribute to unnecessary patient radiation exposure, contrast usage, time, and financial losses.

Qaelum released new software (FOQAL-CT Repeat, Qaelum, Belgium) to automatically identify intra-study repeats, employing an algorithm developed and patented by the University of Wisconsin-Madison [1]. The software uses DICOM metadata to identify standard protocol patterns and deviations from them; the flagged repeated scans are classified by repeat type including localizer, bolus tracking acquisition, helical or axial overlap, and extension scans. Imaging scenarios where the number of scans commonly varies may not be frequent enough to create an independent protocol pattern, for example, contrast protocols with delayed contrast phases. In these cases, a "whitelisting" function is utilized to exclude series descriptions attributed to these scans from the flagged repeats. Whitelisting may also be beneficial for protocols frequently repeated in clinical practice to avoid generating false positive repeats.

CT Repeat identifies normal repeat rates, highlights areas to target for optimization e.g. specific protocols, operators, and exam types, and allows tracking of any improvement trajectories implemented to minimise unnecessary repetitions. Moreover, the impact of repeated scans on department resources like contrast agent volume, device time, tube lifetime, image storage, and financial costs is quantified automatically based on user-selected configurations.

The software was previously validated and applied for retrospective analysis of 61k studies by Dr. Tim Szczykutowicz and his team [1]. The sensitivity and specificity of the algorithm were evaluated and reported as 92 and >99%, respectively, when excluding rare protocols that are not classified into common protocol patterns. Repeat rates were reported as 1.1, 1.8, 3.4, and 4.3% for helical overlap, helical extension, localizer, and bolus tracking scans, respectively, in the academic institution.

In a collaboration between Qaelum and the Maastricht University Medical Center (MUMC), repeat rates in pulmonary embolism (PE) exams were investigated. The

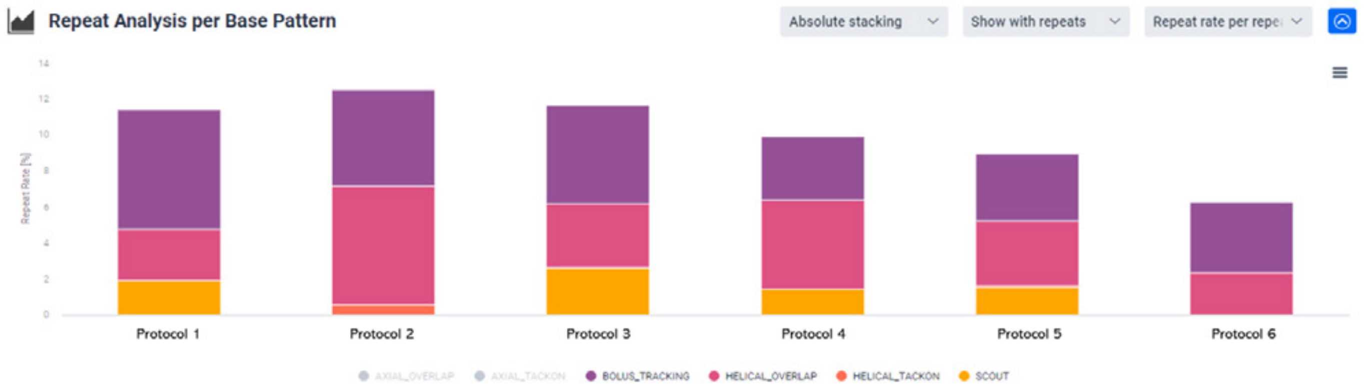

Figure 1. Repeat analysis by protocol pattern, one of the analysis sections of Qaelum's FOQAL-CT repeat software showing repeat rates separated by type for each identified protocol pattern, prior to whitelisting.

hospital team determined repeat rates for helical scans via manual analysis. They quantified the number of helical scans with series descriptions occurring more than once in exams normally containing one scan with a given series description. These repeated series were then evaluated by a radiologist to exclude cases that were clinically indicated, for example, scans corresponding to different contrast phases. Qaelum's novel FOQAL-CT repeat software was employed to perform an automatic analysis on the same dataset of 4481 exams and compare the determined repeat rates to the manual results.

Both manual and automatic analyses reported a repeat rate of 3% for PE scans, including helical overlap and extension scans. The automatic algorithm also quantified repeat rates for localizers and bolus tracking scans as 2 and 5%, respectively.

These results were presented at ECR 2023 in Vienna [2] and are currently being applied to determine the impact of repeated scans on additional resource usage and time.

If you want to know more about Qaelum's vendor neutral FOQAL-CT Repeat solution to automatically identify waste in repeated scans and optimize efficiency visit qaelum.com/solutions/ct-repeat or send an email to info@qaelum.com.

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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.

Niki Fitousi, PhD, is a certified medical physicist with professional experience in all fields of Medical Physics (Radiation Therapy, Diagnostic Radiology, Nuclear Medicine, Radiation Protection). She is currently the Head of Research and Applications in Qaelum, focusing mostly in the fields of radiation dose management, quality and efficiency in medical imaging. She is also a member of the Medical Physics World Board of the International Organization for Medical Physics.

MEDICAL PHYSICS THESIS

Strategies for Automatic Shimming of A 0.2 Tesla Field-cycling MRI Scanner

In 2022, **Liene Balode** graduated with an MSc in Medical Physics from the University of Aberdeen, Scotland. Here she summarises her thesis, which was part of her degree.

Introduction

Field-Cycling Imaging (FCI) is a novel imaging technique developed at the University of Aberdeen. The FCI technique allows the magnetic field B_0 to be switched during the scan, enabling the measurement of the spin-lattice relaxation time (T_1) as a function of the strength of the B_0 field. This results in a new type of contrast known as T_1 dispersion contrast, which has been shown to be a potential biomarker in a range of pathologies [1-3].

To avoid image distortions that can make the interpretation of FCI images difficult, shimming is performed to improve B_0 homogeneity. Shimming is performed for each patient; therefore, it is important to use a shimming method that functions in a short period of time.

Shimming based on a traditional iterative method that uses the free induction decay (FID) signal to optimise shim current values is a time-consuming method [4]. Therefore, this project aimed to investigate if a projection-based method based on the popular FASTERMAP can be used to shim our FCI scanner and compare the results with traditional shimming methods.

Methods

The project was performed using a home-built field-cycling MRI scanner with a maximum field strength of 0.2 T. The scanner is equipped with shim coils up to 4th order to generate a magnetic field (Figure 1) that cancels unwanted spherical harmonics in the inhomogeneous field. The scanner is controlled using a custom interface designed using MATLAB and Labview along with a commercial console (MR Solutions, Guildford, UK).

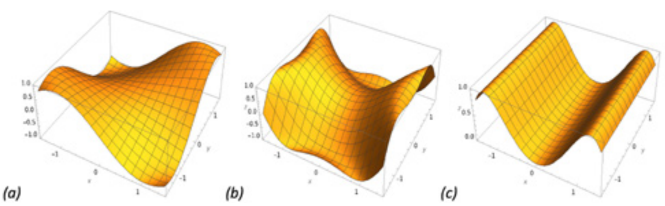

Figure 1: Field produced by 2nd order shim coils (a) xy shim coil, (b) x^2-y^2 shim coil, and (c) z^2 shim coil. The axes of the plots are arbitrary, and the plots are for illustrative purposes.

Our implementation of the FASTERMAP shimming method uses a semi-adiabatic sequence to acquire a pure spin-echo and an asymmetric spin-echo along six column projections (Figure 2), from which phase differences can be calculated [5]. The advantage of using adiabatic pulses is that they are insensitive to the inhomogeneity of the radiofrequency field B_1 [6].

The acquired phase difference corresponds to the B0 distribution along the projection. A weighted polynomial regression on the obtained phase difference values was performed to determine the 1st and 2nd order polynomial coefficients, which correspond to the 1st and 2nd order field inhomogeneity terms and were used to determine the current value for the corresponding shim coil.

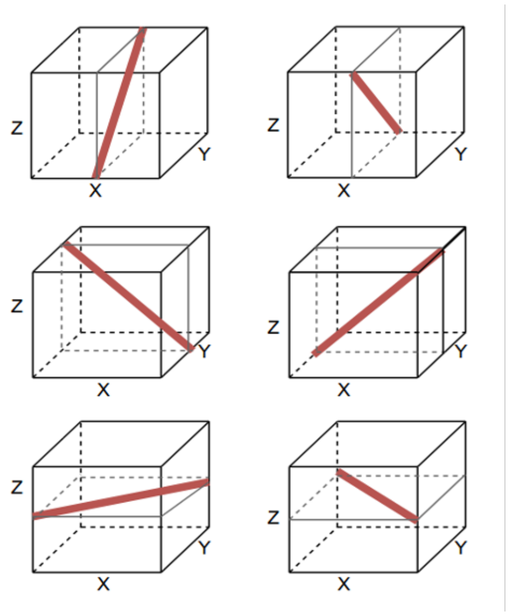

Figure 2: 1D projections along six directions used to determine the B_0 field map

For iterative shimming, we used a method adapted from teaching-learning-based optimisation (TLBO) to optimise shim current values using the integral of the FID signal as an optimisation criterion [7].

We used in-house developed MATLAB code to implement this algorithm (using six learners with a maximum of 50 iterations) and determine the optimum current values. The iterative shimming method was used for two experiments - one that shimmed over the entire volume (global shimming) and one that optimised the shim over a single slice of the American College of Radiology (ACR) MRI accreditation phantom.

Results

The FASTERMAP shimming method produced large variations in shim current values during repeated experiments and did not produce repeatable results. One reason for this may be that in FCI, the B0 field is produced by a resistive magnet, which is sensitive to resistive heating that creates B0 field variations (thermal drift), causing phase variations that confound the FASTERMAP method. Another reason may be that the resistive magnet of FCI is known to have significant 3rd order field inhomogeneity, which the original FASTERMAP method does not address.

We found that the iterative method for both global and slice selective shimming resulted in images that were notably improved (Figure 3). The global shimming gave a distortion error of 9.58%, while the slice selective shimming resulted in a smaller distortion error of 6.31% due to fewer phase variations present in smaller volumes.

Conclusion

The FASTERMAP method did not produce repeatable results and is therefore not currently suitable for shimming the 0.2 T FCI scanner.

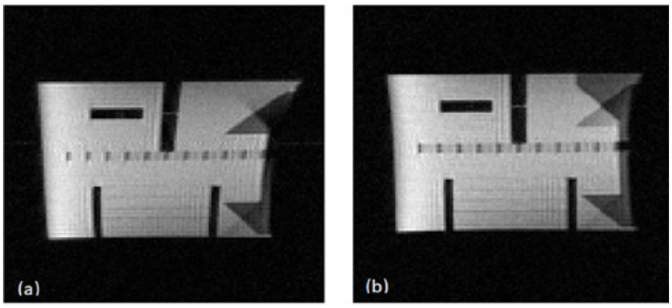

Figure 3: Sagittal slice acquired with shim coil currents obtained from (a) global shimming and (b) slice selective shimming methods

The FASTERMAP shimming method might be more suitable for MRI scanners with fewer temporal B0 field fluctuations and a stronger B0 field, as homogeneity is better for these scanners and therefore a more accurate B0 distribution from the linear projections can be acquired.

The limitation of the FASTERMAP method is the assumption that the B0 field distribution can be described with only 1st and 2nd order spherical harmonics, ignoring the higher-order spherical harmonics that would be corrected by the higher-order shim coils. One improvement to the FASTERMAP method might be if more than six column projections were obtained to account for the higher-order field variations.

The iterative shimming method using the TLBO algorithm is a more suitable method for shimming the FCI scanner. However, it is a time-consuming process, particularly if shimming for each slice is needed.

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Liene Balode is a graduate of the Medical Physics MSc programme at the University of Aberdeen. Currently, Liene is a first-year PhD student in Medical Sciences at the University of Aberdeen and is investigating the use of T_1 rho MRI for detecting cardiac fibrosis at 3 T.

EFOMP COMPANY MEMBER ARTICLE

Radformation: Clearing the Path to Better Cancer Care

RAD formation

Discover the ground-breaking work of TROG Cancer Research as **Alisha Moore**, the Radiation Therapy Manager at TROG, shares her insights in this exclusive interview with **Tyler Blackwell**

Tyler Blackwell (TB): Thank you for joining us. Can you provide some background on TROG?

Alisha Moore (AM): TROG stands for the Trans Tasman Radiation Oncology Group. We're a not-for-profit, collaborative clinical trials group specialising in research involving radiation medicine.

Our mission is to conduct world-class research that leads the global effort to better control and cure cancer. We focus on high-quality research, practice-changing clinical trials, and improving outcomes for people affected by cancer.

We're a member-based organisation and work with a range of stakeholders, organisations, and community groups. Care, participants, and the community are at the centre of everything we do.

TB: And what is your role at TROG?

AM: I'm the Radiation Therapy Manager at TROG. I oversee the Quality Assurance Department and focus on incorporating new techniques and technology into clinical trials. I manage the imaging and radiation therapy, QA program, and framework and am involved in clinical trial protocol development.

TB: What role does TROG play in the Australian and global radiation oncology communities?

AM: TROG represents the interests of the entire radiation oncology community, including public and private centres, and has a multidisciplinary approach with radiation oncologists, medical physicists, radiation therapists, plus trial coordinators, and data managers.

We've collaborated with hundreds of centres in Australia, New Zealand, and internationally. TROG has conducted 115 investigator-initiated clinical trials, with more than 15,000 clinical trial participants.

Our research has led to changes in both policy and practice, leading to improved outcomes for patients affected by cancer.

TB: What trials do you have going on at the moment?

AM: Currently, we have 21 trials open for recruitment, inactive patients, or follow-up. Plus, there are 12 trials in development that include various anatomical regions, including the liver, prostate, endometrial cancer, breast, lung, and skin.

TB: Radformation partnered with TROG, which has been using ClearCheck. How is TROG using ClearCheck?

AM: One of my focuses is quality assurance in clinical trials and ensuring standardisation and compliance with protocol constraints (Figure 1).

We embarked on this idea of machine learning and knowledge-based planning to gather additional insights into plan quality and incorporate it as part of our QA program.

ClearCheck has been integral to our knowledge-based planning work. Knowledge-based planning uses dose and anatomy information from a predefined cohort of existing plans. We use machine learning to train a model, and that model is used to estimate dose distributions in new patients.

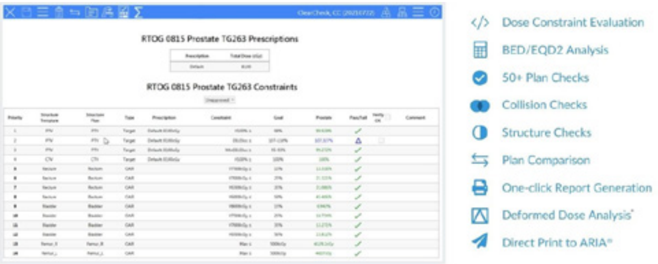


Figure 1: ClearCheck's interface showing RTOG protocol dose constraint comparison.

With ClearCheck, we can do this auto-assessment easily. ClearCheck allows us to customise a reporting template.

We compare the site-submitted clinical plan with the knowledge-based plan. ClearCheck makes comparing these plans very easy.

> **“ClearCheck has critically underpinned our ability to provide feedback for our knowledge-based planning (KBP) projects. ClearCheck allows us to very easily customise a reporting template and compare site-submitted clinical plans with our KBP-generated plans, enabling us to see differences in trial dose constraint metrics, DVH comparisons, and plan and contouring checks.”**
>
> **Alisha Moore**
>
> Radiation Therapy Manager at Trans Tasman Radiation Oncology Group (TROG)

Highlights of the usage of ClearCheck at TROG

Using ClearCheck, we can look at the child dose constraint metrics, the DVH comparisons, and the plan and contouring checks. It is amazing to do it so easily. The software is easily adaptable to different clinical trial scenarios.

TB: Is there a ClearCheck feature everyone enjoys?

AM: The whole package is customizable. If there is a protocol amendment, you can make changes quickly and apply them to the template. We like the ease of being able to make those changes and also the layout - having a nice, clean presentation to send back to sites.

TB: How do you see technology like automation and AI contributing to improvements in care overall?

AM: Both clinically and in the clinical trials space, there are growing demands on human resources. We need to work smarter and leverage technology wherever possible. Tools that help automate workflows, learn from cohorts of data, and improve insights and interoperability of data are absolutely going to help improve care overall.

Note: The interview has been edited for length and clarity.

Watch the full interview here: https://bit.ly/3VASFZl

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.

NMO ARTICLE

A Letter From Marta Sans, President of the Swiss Society of Radiobiology and Medical Physics

SGSMP SSRPM SSRFM

Dear colleagues,
It's a pleasure for me to be able to communicate with you for the first time via the EMP Journal. I have been thinking about what I could share with you in this letter. As this is our first communication, I would like to give you a little overview of the country before introducing our Society for Radiobiology and Medical Physics (SSRMP).

Switzerland is a small country with 8.7 million inhabitants, 26 cantons, and four national languages (German, French, Italian, and Romansh). Even though we are well known for our mountains, lakes, watches, banks, chocolate, cheese, etc., we also have the nation's society for our medical physicists, the SSRMP.

The SSRMP was founded in Geneva in 1964 with Professor Dr. Hedi Fritz-Niggli as its first president. At that time, the aims of society were to gain recognition and advance knowledge in the field of radiation biology, as well as to educate medical doctors and scientists in the fundamentals of radiation physics and radiation protection. Nowadays, the aims of the SSRMP have evolved with society's needs and are focused on patient care by supporting clinical practice, promoting research, and teaching in the fields of radiobiology, medical physics, and radiation protection. The SSRMP brings together and represents individuals who are active in these areas and who are interested in interdisciplinary collaboration and the scientific development of these disciplines.

Since 1982, the society has been actively producing recommendations on a variety of medical physics-related topics, developed by working groups for particular areas of activity. Much work is still being done in these groups today, and the resulting recommendations and reports are very useful not only to the medical physics community but also to people outside our society. In addition, reports are issued on various individual comparative studies or other topics of interest. To promote the exchange of information among members, a society's "Bulletin" appears three times a year. It was already introduced in 1981, when, initially, it appeared only annually. Moreover, "biweekly news" is sent to the members by email with the news. Additionally, our community organizes a meeting every year where members present numerous and varied scientific contributions. In society, we promote scientific work by providing research grants and prizes.

As with many other societies, we have our internal committees: the professional affairs, education, and scientific committees, and of course a board consisting of the president, the vice president, the secretary, the treasurer, the chair of our committees, and other members. From my side, I've been elected president only recently, in the autumn of 2022, but I have to say that I'm very positively impressed by the number of things that are ongoing. Our internal committees, the board, and the delegates deal with not only internal issues but also contact with other societies at the national and international levels. Our place among these societies is well-assured thanks to the work of our former presidents, boards, committees, and delegates. Not to mention, the relationship between our society and EFOMP is far from new. In 1980, our society was involved in founding the "European Federation of Organizations for Medical Physics" (EFOMP), represented by the president of the society at the time, Prof. Poretti. Moreover, in 1982, our society also joined the "International Organization for Medical Physics" (IOMP).

In order to meet the increasing need for qualified medical physicists and to ensure a high level of training, the society has drawn up guidelines and granted professional recognition (board certification) in medical physics as of 1988, in accordance with international guidelines; the board certification has been fully in compliance with the EFOMP directive since 2000. The medical physicist in Switzerland must have in-depth knowledge in one of the two following disciplines: "Medical Radiation Physics" or "Medical Imaging". Each discipline is made up of several specialties. For Medical Radiation Physics there are three specialties: radiation oncology, nuclear medicine, and diagnostic radiation. For medical imaging, there are three specialities: nuclear medicine, diagnostic radiology, and diagnostics with non-ionizing radiation. The medical physicist, after 3 years of education and training, has the knowledge and in-depth practical experience in the area of specialization. Nowadays, we have 319 medical physicists affiliated with the SSRMP. However, we care not only about the education and training of medical physicists in these specialities but also about the entire medical physicist community. Therefore, we offer every year one or more continuous education days.

Last but not least, I'm very proud of our SSRMP society, and as president, I will do my best to make our society move forward and maintain a strong position among all other international and national societies; for this, I hope I can rely on your help. Thank you in advance!

Marta Sans Merce is a medical physicist at the University Hospital of Geneva (HUG). She studied physics in Barcelona, Spain. She came to Geneva, Switzerland, in 1996, for training at CERN. She did her PhD and fellowship at CERN in particle physics, where she learned many things concerning experimental particle physics, hardware, and Monte Carlo simulations. Then she moved to the "Institut de Radiophysique" (IRA-CHUV) where she worked as a radiation protection expert at the HUG and where she had the opportunity to get her training as a medical physicist. In 2012, she got her certificate as a Medical Physicist in the field of Medical Imaging from the SSRMP. Since October 2022, Marta has served as president of the SSRMP.

EFOMP COMPANY MEMBER ARTICLE

RTsafe Press release

RTsafe announces first use of its PseudoPatient patient-specific quality assurance process by Fundación Instituto Valenciano de Oncología (IVO) - Spain's renowned centre of excellence recognises importance of verifying radiosurgery plans ahead of patient treatment

PseudoPatient: the RTsafe's individualised patient quality assurance solution, the CT image used for stereotactic radiosurgery planning is "recreated" in a 3D-printed polymer gel-filled phantom for a treatment delivery test. Changes in the gel's magnetic properties reveal the treated areas in the phantom's MRI images

Athens, 9 February 2023 RTsafe [1], the leading provider of quality assurance products and services in stereotactic radiosurgery, announces that Spain's Fundación Instituto Valenciano de Oncología (IVO) [2] has conducted its first simulated therapy for brain metastases using PseudoPatient, RTsafe's patient-specific quality assurance process that comprises an anatomically faithful model of each patient's head aligned to dosimetric evaluation services. The technology enables medical physicists and clinicians to verify the entire treatment process before the actual patient is subjected to radiotherapy.

Commenting on the announcement, Evangelos Pappas, Founder and Chief Scientific Officer at RTsafe said: "We are delighted that IVO, Spain's internationally renowned centre of excellence in cancer treatment, has embraced the concept of assuring patient safety and treatment efficiency through human-like simulation of the stereotactic radiosurgery process."

The simulation was carried out ahead of IVO's first patient treatment using the new TrueBeam linear accelerator from Varian Medical Systems, a Siemens Healthineers company that integrates radiotherapy and image-guided radiosurgery on the same platform. The machine was acquired as part of the ongoing efforts by IVO's Radiation Oncology Service to increase patient safety and treatment quality.

A case study published by a medical technology distribution company, Aplicaciones Tecnológicas de la Física, points out that due to the complexity of administering SRS plans, periodic quality control protocols and pre-treatment dose verification procedures based on the actual patient anatomy are advisable and could improve treatment efficiency.

The PseudoPatient treatment verification process begins with the construction of a 3D-printed phantom based on the individual patient's CT scan, accurately reproducing the bone anatomy. Then, a unique polymer gel that RTsafe developed serves as both a soft tissue equivalent and a 3D dosimeter is filled into the phantom. The end-to-end radiosurgery procedure is then performed just as it would be on the real patient. The irradiated phantom is then MRI-scanned, and changes in the gel's magnetic properties reveal the treated areas. RTsafe then provides a comprehensive quantitative and qualitative report in order to assist the clinical team in either verifying the treatment plan or making adjustments to it.

Conventional patient-specific quality control methods involve dose measurements on a standard-shaped phantom equipped with several detectors, with the aim of verifying the treatment plan. However, dose treatment verification based on the actual patient anatomy may be critical to minimising unwanted exposure to radiation. RTsafe's development of PseudoPatient seeks to solve the limitations presented by generic phantoms, thereby achieving more rigorous quality control in stereotactic radiosurgery (SRS) treatments.

Evangelos Pappas added: "Brain metastases can occur in more than 30% of all cancer patients, and, while SRS is a good treatment option for many patients, its complexity means that accurate pre-treatment dose verification could make a difference to treatment outcomes should an adjustment to dosage or targeting be indicated by the simulation process. The approach improves the confidence of both medical professionals and patients in this exacting treatment method."

Read the full case study here.
For further information please contact:
Gareth Zundel, Marketing Director, RTsafe
gzundel@rt-safe.com +44 7967 678309

References:

[1] RTsafe website www.rt-safe.com

[2] Spain's Fundación Instituto Valenciano de Oncología www.ivo.es

[3] Case study from the RTsafe: http://bit.ly/3i1Lxp7

About RTsafe

RTsafe is a medical technology company that has developed a unique approach to quality assurance that is making a contribution to the safety and accuracy of radiotherapy for cancer and other medical conditions. It combines proven expertise in medical physics with highly accurate 3D printing technology to create pseudo-in-vivo dosimetry phantoms for use in end-to-end commissioning, benchmarking, and patient-specific quality assurance in stereotactic radiotherapy. The anatomically accurate effigies enable medical professionals to simulate therapeutic interventions for each patient ahead of actual treatment and help radiotherapy technology innovators verify the performance of their products. See www.rt-safe.com.

About IVO

The Valencian Institute of Oncology Foundation (IVO) is a private, non-profit entity, whose assets and resources are devoted entirely to the fight against cancer in all its aspects: prevention, diagnosis, treatment, research, and teaching. With more than 40 years of experience, the IVO is recognized nationally and internationally as a reference center in oncology. In 2021, IVO will be distinguished among the 50 best cancer hospitals in the world by Newsweek magazine. See www.ivo.es

About Aplicaciones Tecnológicas de la Física

Aplicaciones Tecnológicas de la Física is a Spanish technological company dedicated mainly to the distribution of medical technology in the fields of radiotherapy and radiological protection. We have more than 35 years of experience and strong technical and sales capabilities.

Evangelos Pappas, Founder and Chief Scientific Officer, RTsafe. He is also an Associate Professor of Radiotherapy Medical Physics at the University of West Attica and a Research Associate at UT Health San Antonio, MD Anderson Cancer Center. His research interests focus on addressing the geometric and dosimetric challenges present in modern SRS applications. He holds a PhD from the Medical School of the University of Athens.

Gareth Zundel, Marketing Director, RTsafe. Gareth oversees RTsafe's communications and is a member of the Board of Directors. He holds a BSc from City University, London, and joined ITT in 1979 as a Commercial Intelligence Officer before becoming a partner at Harvard PR, most recently as Chairman of the Healthcare Division. He is also the communications advisor to the Libra Group.

Hacking Medical Physics Part 5: Python-powered X-ray Beam Predictions

In this article, you will learn the ropes of the SpekPy toolkit to determine the absolute output of an X-ray tube, the spectrum shape, and the air kerma at the patient entrance reference point, among other advanced computations such as background signal-to-noise ratio and contrast-to-noise ratio, given a simple detector model. **Gavin Poludniowski**, **Markus Hulthén**, **Artur Omar**, **Jonas Andersson** and **Christoffer Granberg** report

There are many situations where you might want to estimate a spectrum from an X-ray tube. You might be teaching students about X-rays. Or want to infer the filtration of a tube. It might be to explore the optimization of beam quality or to perform a dose estimate. It could even be purely for research purposes, as an input into a sophisticated simulation of a prototype imaging system.

Spectra can be measured, of course, but for most of us, this is neither an easy nor practical thing to do. A convenient alternative is to use some form of software to predict a spectrum based on simple inputs (e.g., tube potential, filtration, etc.). A physicist has never been short of software options. Want the software in the form of an Excel spreadsheet? You got it! [1]. Want a standalone executable with a simple graphical interface? You got it! [2]. Want a powerful MATLAB or Python package with a nice interface? [3, 4]. You got it! Want a web app you can access in a web browser from any computer or smartphone with an internet connection? You got it! [5].

All the above options are based on a graphical interface or provide a major way to interact with the software. This is often perfect for our needs. There are situations, however, where the limitations of a point-and-click approach begin to show. You may want to automate many calculations, plot data exactly how you want, or derive quantities the programmers didn't happen to implement. In such scenarios, scripting can be invaluable. There are several X-ray spectrum software libraries for the MATLAB and Python programming languages [3, 4, 6, 7]. We will focus on the SpekPy toolkit here.

SpekPy is a package of utilities rather than a program. If you want to use it, you will have to write a Python script or type commands yourself. Fortunately, SpekPy is easy to use, and both it and Python are free. For installation instructions, see the toolkit's website [7]. Assuming that you have installed it, here is a Python code snippet showing how to generate and plot a spectrum.

```python
import spekpy as sp # Import the SpekPy toolkit
from matplotlib import pyplot as plt # Import a plotting library

# Generate unfiltered spectrum. Tube pot'l: 80 kV, anode angle: 12 deg.
s=sp.Spek(kvp=80,th=12)
# Filter the spectrum (3 mm Al, 0.1 mm Cu)
s.filter('Al',3.0).filter('Cu',0.1)
# Get energy values and fluence arrays (return values at bin-edges) and plot
k, f = s.get_spectrum(edges=True)
plt.plot(k, f)
```

Of course, like good physicists or engineers, we should also add axis labels and the appropriate units. We have done this in a full example script (called spectrum_example.py) available in the repository accompanying this article series [8]. The final plot should look something like Fig. 1.

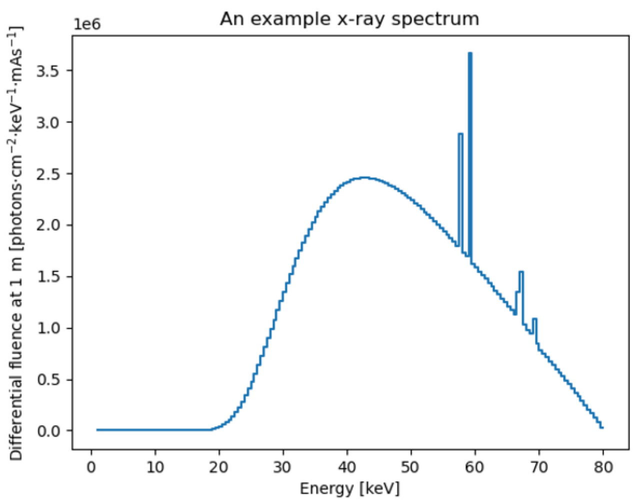


Figure 1. An example X-ray spectrum

If we want to extract beam metrics for a spectrum, this is straightforward too. Here are a few examples.

```
hvl1 = s.get_hvl1() # 1st half-value layer for default material [mm Al]
hvl2 = s.get_hvl2(matl='Cu') # 2nd half-value layer for copper [mm Cu]
ftot = s.get_flu() # Total photon fluence at 1 m [cm^-2 mAs^-1]
ka = s.get_kerma() # Air kerma at 1 m [uGy mAs^-1]
print(hvl1, hvl2, ftot, ka) # Print the results to screen
```

There is much more the toolkit can do, but you can discover that for yourself. Instead, we will demonstrate how you can use a toolkit like SpekPy to perform more sophisticated calculations.

Let's consider an X-ray system used for radiography or fluoroscopy. We might be interested in how the HVL changes with tube potential and the added filtration of copper. This is straightforward to investigate with SpekPy. A plot is shown in Figure 2 for the previous tube model (3 mm Al, 12 deg.). For the code we used, see our repository (see hvl_copper.py).

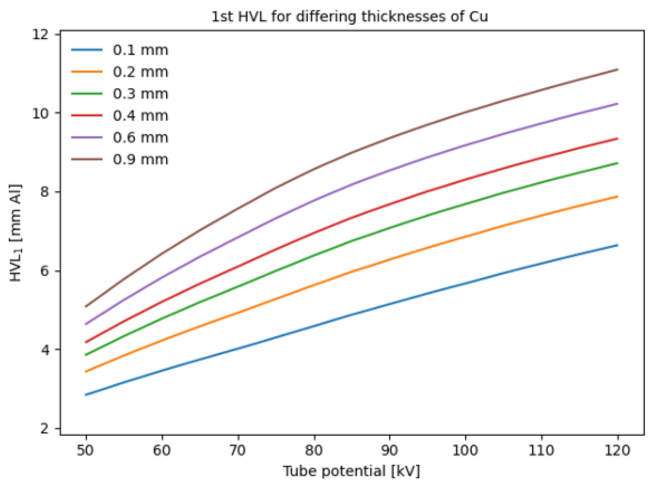
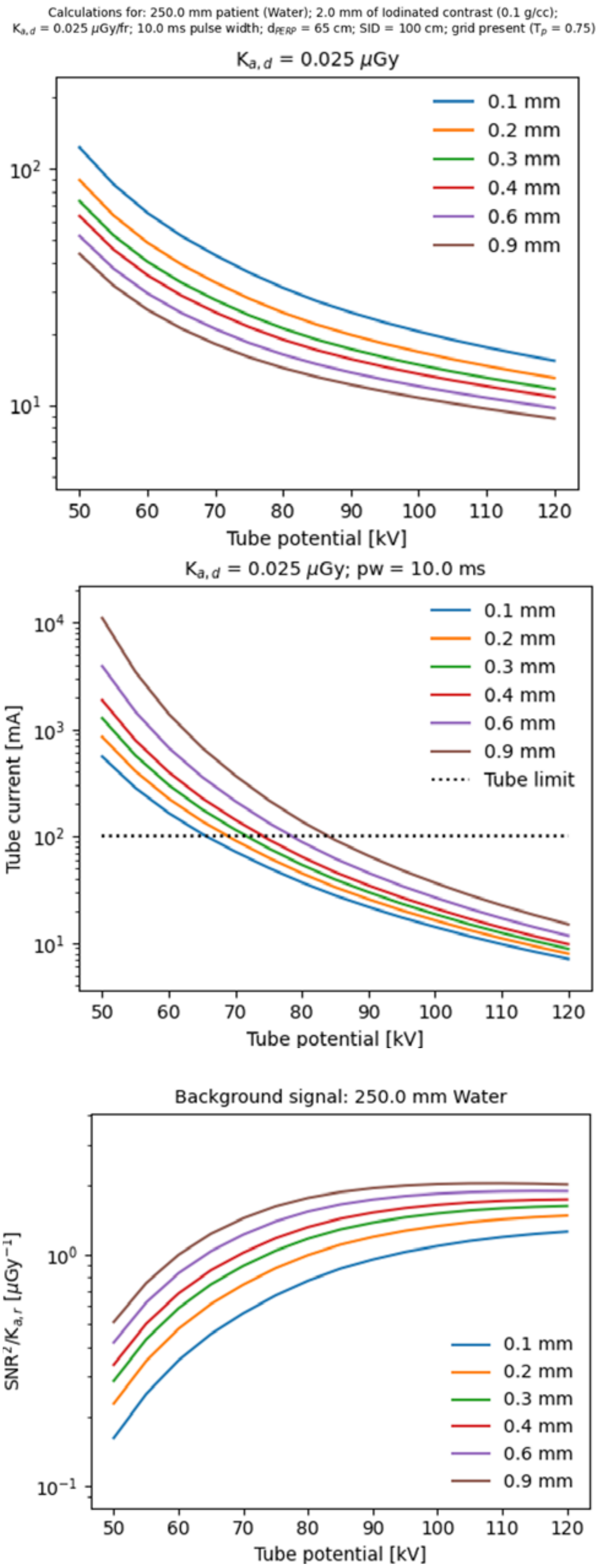


Figure 2. First half-value layer values against tube potential for several copper filtrations

Let's go on to the next level. Because SpekPy provides the absolute output of an X-ray tube as well as the spectrum shape, it's possible to estimate the air kerma at the patient entrance reference point ($K_{a,r}$) and the tube current (mA) for a specified detector air kerma ($K_{a,d}$). Further, given a simple model for the detector, we can estimate the signal-to-noise (SNR) for the background or the contrast-to-noise (CNR) for a feature, such as iodine contrast media. We will calculate SNR and CNR for an image frame at the level of the energy deposited in a detector and the associated noise (due to the finite number of X-rays striking a pixel). For several reasons, these will not agree closely with experimental determinations. They remain interesting as figure-of-merits (FOMs) from the perspective of optimization (i.e., maximising the value). Note that some of our physics approximations (e.g., neglecting system spatial resolution and residual scatter) can be overcome and that it is possible to relate such a CNR to "Rose SNR" [9]. Now let's get down to business!

In Figure 3, we present estimates of $K_{a,r}$, mA, $SNR^2/K_{a,d}$ and $CNR^2/K_{a,d}$. The code that generated the subplots can, again, be found in our repository (see calc_250.py and metrics.py).



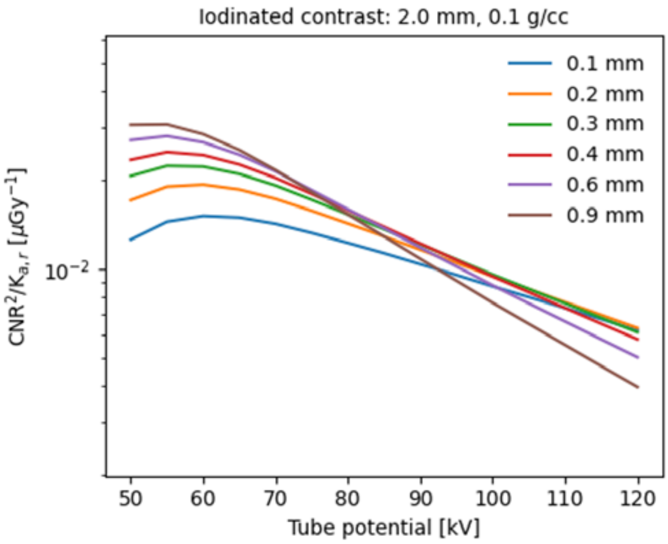


Figure 3. Metrics of interest (Ka,r, mA, SNR2/Ka,d and CNR2/Ka,d) against tube potential for several copper filtration

As we might expect, the patient's air kerma reduces as the tube potential and filtration increase for a fixed detector dose. Further, as the tube potential is reduced and the filtration is increased, the tube current required escalates, eventually exceeding our hypothetical limit. The SNR FOM increases with tube potential and filtration, indicating lower relative noise in the detector for a given patient dose. Conversely, however, the CNR FOM favours low tube potentials with high amounts of copper for visualising iodine (a fact known for decades). The gains above 0.4 mm Cu, however, are debatable in this case, especially in view of the impossibility of delivering sufficient tube current at the lowest tube potentials.

This article is not a research paper, but the results are intriguing. This is what we can do with SpekPy. What can you accomplish with a spectrum toolkit and a little scripting? Whatever it is, we bet it will be interesting. Hopefully, this article has given you a start!

References

[1] TASMICS Excel file; see: https://doi.org/10.1118/1.4866216
[2] SpekCalc application; see: http://spekcalc.weebly.com/
[3] Spektr 3.0 MATLAB package; see: https://github.com/I-STAR/SPEKTR
[4] xpecgen Python package; see: https://github.com/Dih5/xpecgen
[5] SpekPy Web webapp; see: https://spekpy.smile.ki.se/

[6] xrTk MATLAB package; see: https://bitbucket.org/DRPWM/code/src/master/chapter16/

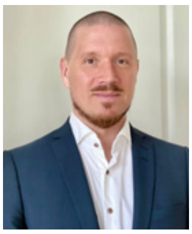
[7] SpekPy Python package; see: https://bitbucket.org/spekpy/spekpy_release

[8] Hacking Medical Physics repository; see: https://github.com/rvbCMTS/EMP-News

[9] Burton CS, Mayo JR, Cunningham IA. Med Phys. 2016;43(11):5925.

Gavin Poludniowski is a physicist at Karolinska University Hospital, Region Stockholm, Sweden.
E-mail: gavin.poludniowski@regionstockholm.se


Markus Hulthén (left) and **Artur Omar** (right) are medical physicists at Karolinska University Hospital, Region Stockholm, Sweden.
E-mails: markus.hulthen@regionstockholm.se,
artur.omar@regionstockholm.se, respectively.




Jonas Andersson (left) and **Christoffer Granberg** (right) are medical physicists at Umeå University Hospital, Region Västerbotten, Sweden.
E-mails: jonas.s.andersson@umu.se,
christoffer.granberg@regionvasterbotten.se, respectively.

EFOMP COMPANY MEMBER ARTICLE

Standard Imaging: Annual QA Built for the Future: DoseView™ 3D

The DoseView™ product family launched more than 12 years ago with the introduction of our first generation DoseView™ 3D water phantom and software. Since then, Standard Imaging has continually advanced the development of the hardware and software components of the system.

Building on their experience with providing the best in high-quality QA devices and drawing from the team's expertise in developing numerous reference class electrometers, Exradin Ion Chambers, and several world-class software QA tools, Standard Imaging expanded their portfolio through a careful progression to encompass the development of this highly accurate and easy to use 3D scanning system.

2nd Generation Hardware

Standard Imaging recently introduced the 2nd Generation DoseView hardware, which features cutting-edge advancements including an extruded Aluminum frame and machined corner braces for unparalleled rigidity and accuracy. Maintaining 0.1mm accuracy across all axes provides better raw data that requires less post-scan processing while also enabling a faster and more direct pathway for the user to complete scan data for Commissioning, Acceptance, TPS Beam Modeling, and general beam QA.

In response to the ever-changing topography of our field, the 2nd Generation hardware development was completed with tomorrow's technology in mind. The DoseView 3D scanning tank has been engineered to fit within the bore of the Varian Halcyon® Treatment System and features a wireless pendant and wireless software connectivity. With thoughtful and elegant design elements, practicality is the core essence of the DoseView 3D tank, with its easy-to-use Chamber Alignment Jig providing accurate and straightforward chamber placement, so you can get scanning tasks completed easily and efficiently.

Figure 1: The DoseView 3D Water Phantom set up for scanning and commissioning inside the Varian Halcyon® Linac.

Updated Intuitive Software

In addition to updated hardware, Standard Imaging strives to continually improve the software component of the

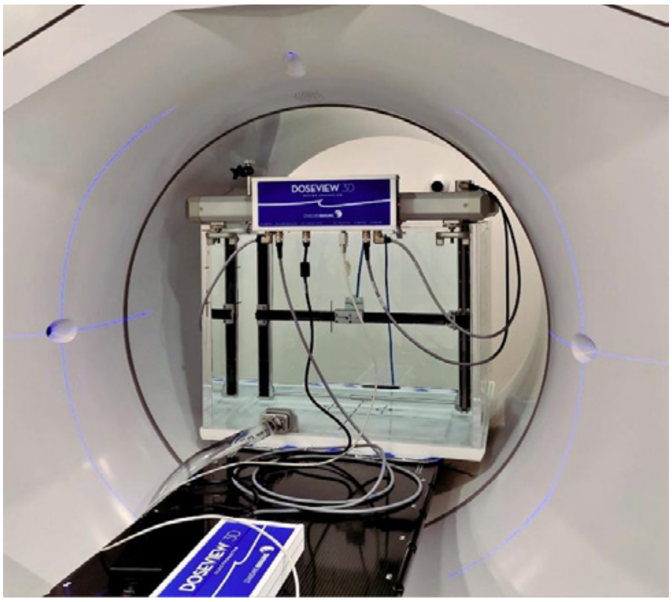


Figure 1: The DoseView 3D Water Phantom set up for scanning and commissioning inside the Varian Halcyon® Linac.

DoseView Phantom family with regular upgrades that add new features and functionality. Already a comprehensive tool for scan analysis, the software features an intuitive, user-friendly interface that provides straightforward navigation to all the tools necessary for scanning, collecting, and processing scan data, including numerous post-scan filters and reference scan comparison options.

The scan queue creation and editing functions make scan queue generation fast and eliminate repetitive tasks, offering significant time savings in setting up scan lists. With the latest iteration of the software, scan queues are loaded, and data is acquired and then immediately stored in a database for future access, analysis, and export. Raw scan data and any applied custom modifiers are stored in the database as well, so your team can reliably access your raw data, including records of how your data were

Figure 2: DoseView Software displays scan comparisons with visual overlays and gamma comparisons against the selected reference scans.

processed. DoseView also offers export capabilities to all major reporting and treatment planning systems to ensure a fluid and comfortable user experience.

Additionally, with the release of DoseView Software version 3.0, Standard Imaging has added functionality for the DoseView™ 1D Water Phantom. Partnering the DoseView 1D Water Phantom with Standard Imaging's SuperMAX™ or Max4000 electrometer provides straightforward and comprehensive depth dose and single-point measurements. Standard Imaging has worked to ensure our Total QA Solutions provide a complete, cohesive answer to the QA requirements of modern radiotherapy.

From the smallest device detail to the simplest software function, the DoseView line of Water Phantoms and software has been carefully crafted with the Medical Physicist in mind. It makes task completion and meeting scanning requirements more efficient, so you can focus on helping patients. Standard Imaging has been a highly respected provider of radiation oncology quality assurance equipment for more than 30 years. Nowhere is this more evident than in the continued advancement of the DoseView line of water phantoms and software.

Hugh Petersen is a Product Manager at Standard Imaging. Hugh's product portfolio includes solutions for Daily, Monthly, and Annual QA. With more than 17 years of experience at Standard Imaging, Hugh has helped advance product lines and contributed to the company's growth.

NMO ARTICLE

Social and Educational Activities in Latvian Medical Engineering and Physics Society

In this article, **Agnese Katlapa**, a member of the Latvian Medical Engineering and Physics Society, highlights the organization's efforts to spread information about the field throughout Latvia using formal and informal educational channels, as well as social media.

The Latvian Medical Engineering and Physics Society (LMEPS) represents medical physicists and medical engineers in Latvia. Some of our aims are: to promote the development and progress of the medical physics and medical engineering fields in Latvia; to popularize the achievements of medical physics and engineering among the population, and to attract young people to the direction of medical physics and engineering. To achieve our goals, LMEPS has introduced several social and educational activities in the past few years.

One of our activities had been visits to high schools to tell about our profession. As a medical physicist and medical engineer is a profession that is usually not widely known in society (at least in Latvia), we sent the offer to the majority of high schools in Latvia to introduce our profession. The response from high schools was high enough. Several LMEPS members visited different high schools remotely, and each of them told about their experience working in the field as well as during their studies at the university. We hope that with this activity we not only attracted some of the young people to study medical engineering and physics in university but also popularized our profession in general society.

Another activity that we organize regularly is educational seminars about different topics connected with medical physics and medical engineering. They are meant not only for professionals but also for general society to popularize developments in the medical engineering and physics fields. Some of the topics until now have been: physics and technologies in ion therapy; joint biomechanics and smart implants; artificial intelligence and virtual reality in medicine; electrosafety of medical devices; the use of Rb-82 in PET examinations, and patient doses in radiology. The seminars are organised four times a year, and with these seminars, we hope to show how different the field of medical technologies is and how rapid technological development is. The seminars are also useful for medical engineering and physics students to see career possibilities in the field.

Among social activities, there is, of course, the use of social media. Our main information channel is Facebook, but we also use Instagram and recently introduced profiles on LinkedIn. To celebrate Medical Physics Day, we organized a photo contest called "Medical Physics in My Daily Life," where everyone was asked to send in a photo connected with medical physics (e.g., a selfie with his/her favourite medical physicist). Later, the photos were published on our social media accounts to show what medical physicists are doing and where they are working.

Social and educational activities for our members and other interested parties are organized by the Social Workgroup and Event Workgroup of LMEPS. The workgroups consist of active LMEPS members and are found to be an efficient way to organize different activities.

Agnese Katlapa is a medical engineer/medical physicist at the Children's Clinical University Hospital in Latvia, a member of the Latvian Medical Engineering and Physics Society, and the leader of LMEPS's Social Workgroup. Her previous work experience includes working in the field of radiation safety for a national regulatory body. Has studied at Riga Technical University and the University of Eastern Finland.

EFOMP COMPANY MEMBER ARTICLE

Single detector approach to small field reference dosimetry

Sun Nuclear presents a single detector approach to both measure the field and monitor output fluctuations, performing the roles of both field and reference detector.

Accurate dosimetry is essential for ensuring patient safety and improving treatment outcomes, which has led to the development of various dosimetry techniques and technologies. One such technique is the use of reference detectors, which are designed to provide highly accurate measurements of the relative radiation dose. Reference detectors are used as a normalization benchmark to distinguish field shape from output fluctuations. The International Atomic Energy Agency (IAEA) and the American Association of Physicists in Medicine (AAPM) have published several reports and guidelines on the use of reference detectors. The convention established by these groups is to normalize the field signal to a reference detector at a fixed location within the field.

The challenge occurs when attempting to engage in small-field dosimetry. There are limited viable suggestions on how one might monitor the output of the beam without perturbing the small field. IAEA TRS 483 suggests a few different approaches: coupling to the linac chamber, using a transmission chamber, using a dedicated reference detector port (if available), or placing the detector at the bottom of the tank. All these approaches have various technical and physical challenges or limitations that may make one or all of them unviable.

Sun Nuclear presents a single detector approach to both measure the field and monitor output fluctuations, performing the roles of both field and reference detector. Our approach depends on the use of a high temporal resolution electrometer (approximately 1-microsecond time constant) to measure individual pulse counts during delivery. These pulses, in many circumstances, have a consistent duration and amplitude, and output fluctuations can be attributed to an increase or decrease in the frequency of these pulses. Therefore, recording the number of pulses collected in each cumulative update and then normalizing against that pulse count would yield a similar representation of field shape to that acquired using a reference detector. The benefits of this approach are immediately clear solely because it relies on a single detector to scan. The single-detector approach mitigates many of the challenges presented with small-field scanning using a reference detector.

Figure 1 depicts a comparison of two crossline scans, one taken with single-detector pulse normalization and the other taken with a reference chamber. When applying gamma criteria of 0.5% and 0.5 millimetres, scans agree at a 100% 1D gamma passing rate.

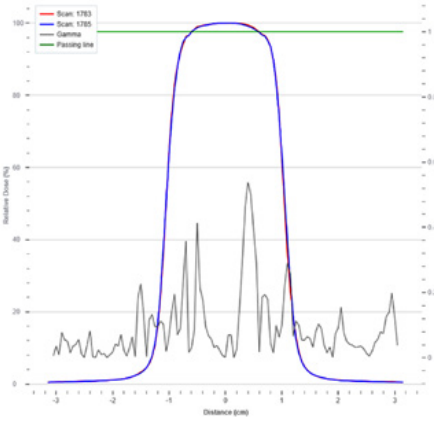


Figure 1: 1D Gamma comparison of a 2 cm x 2 cm field using a reference detector and single-detector pulse normalization. Scan 1783 uses pulse normalization and Scan 1785 uses a reference. Gamma scores show 100% passing using gamma criteria of 0.5% and 0.5 millimetre.

Due to the technique's dependence on pulse characteristics, there are limitations on how and when pulse normalization can be used. Many linac manufacturers rely on applying dose servos during deliveries. In older models, this meant adapting the pulse frequency to meet delivery needs, but in modern systems, the pulse width is often modulated. For this reason, dose servos violate pulse normalization's assumption of consistent pulse width. It is recommended that dose servos be turned off for any deliveries where pulse normalization would be used. In addition, some delivery systems use adaptive control of the pulse amplitude to meet delivery needs. Since a consistent pulse amplitude cannot be assumed, pulse normalization cannot be used in those systems, and it is recommended to use the provided reference port present in many of these systems for small-field scanning.

With consideration of its limitations, single-detector pulse normalization scanning is a viable solution to the problems presented by small-field scanning. It provides an equivalent scanning experience to scanning with a reference while providing the advantage of not worrying about how to place a reference or how to best monitor output fluctuations.

Andy Murray, MSc., is a Sun Nuclear Medical Physicist. Andy is a product physicist at Sun Nuclear, a Mirion Medical Company, where he supports product development spanning Patient QA and Machine QA, including for stereotactic treatments as well as dosimetry. Andy received a master's degree in Physics and Material Sciences from Florida State University.

EFOMP COMPANY MEMBER ARTICLE

Varian: At the Edge of Innovation in Radiosurgery

Varian's Asia-Pacific group recently produced a series of webinars and podcasts on current trends, recommendations, and best practices for stereotactic radiosurgery (SRS) and stereotactic body radiation therapy (SBRT), plus much, much more. Now, recordings of these webinars and podcasts are available to you!

Cancer care clinics are discovering that HyperArc® high-definition radiotherapy, delivered using Varian's Edge® radiosurgery system, amounts to an ideal end-to-end solution for taking advantage of the latest clinical trends and treatment techniques.

Varian's Asia-Pacific group recently produced a series of webinars and podcasts on current trends, recommendations, and best practices for stereotactic radiosurgery (SRS) and stereotactic body radiation therapy (SBRT). The sessions, which featured leading radiation oncology and cancer care experts, covered current themes of interest, from the use of LINAC-based SRS to HyperArc hints and tricks, from SBRT of the spine to set up an SRS program in the clinic—plus much, much more.

Now, recordings of these webinars and podcasts are available to you! Please check out The Edge of Innovation in Radiosurgery (www.varian.com/EdgeWebinars), a digital booklet of program summaries, with links to webinar and podcast recordings that you can stream at your own convenience.

Julie Jervis is a California-based science and technology writer. Her articles have appeared in magazines and websites around the world, covering a diverse range of medical and technology topics, and her book, 'The World Beneath Their Wings,' follows the careers of leading women in aviation.

Teaching Medical Physics to the NON-PHYSICS Healthcare Professions – an EFOMP Project and a New Policy Statement (PS18)

Carmel J. Caruana reports that this policy statement presents a mission statement and a curriculum development model for Medical Physicists teaching non-physics users of medical devices and physical agents. It has been published in Physics Medica

At the meeting in Budapest, from left to right: Diego Burgos, Violeta Karenauskaite, Petro Julkunen, Carmel Caruana, Csilla Pesznyak, Emmanouil Papanastasiou, Loredana Marcu

Although Medical Physics educators have historically contributed to the education of the non-physics healthcare professions, their role has not been studied in a systematic manner. In 2009, EFOMP set up a group to research the issue. In their first paper, the group carried out an extensive literature review regarding physics teaching for non-physics healthcare professions. Their second paper reported the results of a pan-European survey of physics curricula delivered to the healthcare professions and a Strengths-Weaknesses-Opportunities-Threats (SWOT) audit of the role. The group's third paper presented a strategic development model for the role based on the SWOT data. A comprehensive curriculum development model was subsequently published, and plans were laid to develop the present policy statement. This policy statement presents mission and vision statements for Medical Physicists teaching non-physics users of medical devices and physical agents, best practices for teaching non-physics healthcare professionals, a stepwise process for curriculum development (content, method of delivery, and assessment), and summary recommendations based on the aforementioned research studies. We hope the policy statement will lead to a quantum leap in the quality of our teaching, improve the harmonisation of what we teach, and help young Medical Physicists in the very difficult early days of exercising the teaching component of their role. *The policy statement has been approved by the NMOs and has been published in Physica Medica – The European Journal of Medical Physics.*

The list of authors:

Carmel J. Caruana, Medical Physics, Faculty of Health Sciences, University of Malta

Richard A. Amos, Department of Medical Physics and Biomedical Engineering, University College London, London, UK

Diego Burgos, Medical Physics Department, Hospital Universitario San Cecilio and Department of Radiology, Granada University, Granada, Spain.

Stan Heukelom, Radiotherapy Department, Amsterdam UMC, Amsterdam, The Netherlands

Marija Z. Jeremic, University Clinical Center Kragujevac, Department of Nuclear Medicine, Kragujevac, Serbia

Petro Julkunen, Department of Technical Physics, University of Eastern Finland and Diagnostic Imaging Centre, Kuopio University Hospital, Kuopio, Finland

Violeta Karenauskaite, Laser Research Centre, Faculty of Physics, Vilnius University, Lithuania

Loredana Marcu, Faculty of Informatics and Science, University of Oradea, Oradea, Romania and School of Health Sciences, University of South Australia, Adelaide, Australia.

Emmanouil Papanastasiou, Faculty of Health Sciences, School of Medicine, Aristotle University of Thessaloniki, Greece

Csilla Pesznyak, National Institute of Oncology and Budapest University of Technology and Economics, Budapest, Hungary

This article is written by Carmel J. Caruana in memory of Jan H. Meijer formerly of the Dept. of Physics and Medical Technology, VU University Medical Center, Amsterdam, Netherlands - a very nice guy, and sorely missed!

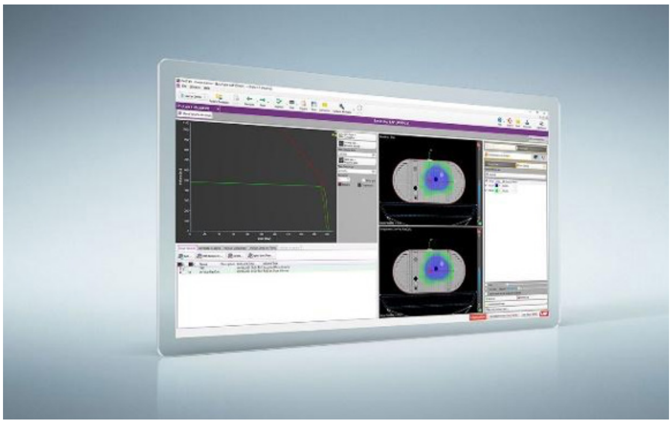
Carmel J. Caruana Ph. D., FIPEM is Professor and Head of Medical Physics at the University of Malta. Professor Caruana specializes in diagnostic and interventional radiology and legislative, professional and Education and Training issues in Medical Physics. He is past-chairperson of the EFOMP Education and Training committee, lead author of the role and education and training chapters of the EU document 'European Guidelines on the Medical Physics Expert' and author of several EFOMP policy statements. He is also the main author and leader of the EUTEMPE-EFOMP module on leadership in Medical Physics.

EFOMP COMPANY MEMBER ARTICLE

LAP: Increasing Treatment Quality and Patient Safety Through an Automated 3D in Vivo Dosimetry Procedure in Radiotherapy

RadCalc's EPID module is the unique commercial solution in everyday clinical practice to develop a fully automated workflow to perform and evaluate an in vivo dosimetry measurement in selected cases for each radiation fraction

In modern image-guided radiotherapy, the complexity of radiation techniques is constantly increasing, and safety margins are shrinking in favor of higher individual doses. This change underlines the importance of patient-specific quality assurance. So far, however, the usual methods, such as pre-treatment QA and Monte Carlo-based secondary dose calculation, have only a limited ability to detect (part of) possible irradiation errors. [1] For this reason, there are recommendations and, in some cases, already regulations for the use of in vivo dosimetry (IVD), a method for measuring the applied dose during the irradiation session. This can ensure that the treatment has been administered as intended. In doing so, IVD can be complex and time-consuming, which has hindered or prevented its widespread establishment in routine practice. [2]



RadCalc's EPID for pre-treatment and in-vivo workflows allows for the reconstruction of 3D dose in the patients' anatomy for any IMRT and VMAT plans.

Modern linear accelerators are usually equipped with an MV electronic portal imaging device (EPID). This is used for patient positioning control but can additionally be used for dose verification in pre-treatment QA and for IVD. Compared to conventional methods, this IVD approach allows a fully automated implementation into the daily clinical routine. In addition, the necessary hardware is already available in most radiotherapy clinics, which favors widespread establishment.

There are two approaches to EPID-based IVD (EPID-IVD): In the forward projection method, the integrated EPID signal is predicted by the radiation planning system (TPS) and compared with the measured signal. In the back-projection method, the measured signal of each gantry angle is back-projected onto the patient's planning CT, resulting in a 3D dose distribution that is directly compared with the 3D dose of the radiation plan. The latter allows a simpler interpretation of the IVD result due to the higher information content, as usual means of plan evaluation (e.g., comparison of dose-volume histograms) can be used. However, a disadvantage is that this calculation is very computationally intensive, and there has been no commercial solution for a long time.

This is where RadCalc's EPID module becomes relevant. I have been using this unique commercial solution in everyday clinical practice for six months and have used it to develop a fully automated workflow to perform and evaluate an IVD measurement in selected cases for each radiation fraction.

In the planning process, it is specified in the TPS that EPID images are to be taken for each irradiation fraction. As soon as RadCalc detects new EPID images for known irradiation schedules, the software starts the back projection calculation. A specially developed C# script provides access to the IVD results and flags problematic fractions, which can then be examined in more detail by a medical physicist and/or physician.

Initial experience shows that IVD results allow a similar conclusion as a CBCT, whereas CBCTs, in comparison, often do not take place at every fraction and mean an additional imaging dose for the patient. In addition, the use of IVD can ensure that patients have not moved in a relevant way during treatment and that deviations from the irradiation plan have been avoided, e.g., due to an incorrect positioning aid or incorrect MLC movement (MLC stands for multi-leaf collimator).

Some workflow optimizations based on the presented EPID-IVD methods can be found in the literature. [3] I myself have evaluated about 400 irradiation fractions so far and found that the variability of the shoulders is often underestimated and not sufficiently imaged in neck cone beam CTs. As a result, it was decided to increase the field-of-view to ensure better imaging of the shoulders.

Future efforts will be to extend the EPID-IVD method enabled by RadCalc to additional linear accelerators and patient populations to further improve treatment quality and patient safety.

Sources

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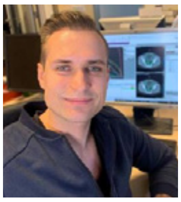
[2] MacDougall ND, Graveling M, Hansen VN, Brownsword K, Morgan A. In vivo dosimetry in UK external beam radiotherapy: current and future usage. Br J Radiol 2017; 90: 20160915.

[3] Bossuyt, Evy, et al. "Evaluation of automated pre-treatment and transit in-vivo dosimetry in radiotherapy using empirically determined parameters." Physics and Imaging in Radiation Oncology 16 (2020): 113-129.



Maximilian Grohmann, M.Sc. (Medizinische Physik) is a Medical Physics Expert at the Universitätsklinikum Hamburg-Eppendorf.

NMO ARTICLE

A Dissemination Action on Radiological Protection Aspects for Patients

The Spanish Society for Radiological Protection (SEPR) together with the national authority for radiation protection, the Spanish Nuclear Safety Council (CSN), have promoted a dissemination action with the aim of making knowledge on safety issues in the use of ionising radiation in medicine accessible to the general public. **Roberto Sánchez, María Luisa Tormo** and **Mª Teresa Macías** report.

The main product of this action is the production of a 5-minute long video (in Spanish with English subtitles), showing the joint effort made by all the professionals involved in the medical exposure of patients (radiologists, medical physicists, radiographers, and radiation therapists) to warrant radiation safety, by means of a strong commitment with the justification and optimisation of the medical procedures.

Watch the video at this link:
Radiation protection and safety in the medical use of ionising radiation - YouTube

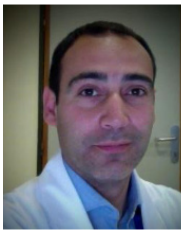
One of the recommendations from the 2010 *Bonn Call for Action* by the International Atomic Energy Agency (IAEA) and the World Health Organisation (WHO) was to *"support the improvement of risk communication skills of healthcare providers and radiation protection professionals – involving both technical and communication experts, in collaboration with patient associations, in a concerted action to develop clear messages tailored to specific target groups"*. This is an important task in which many medical physicists are involved that also helps to place value on the role of Medical Physics in patient safety and improving diagnostic and therapeutic outcomes.

A task group with medical physicists, radiation protection experts, and communication experts in the SEPR has developed a variety of dissemination materials about radiation protection and safety in the medical use of ionising radiation. Societal aspects have been considered in the design of the material. New formats, such as infographics and videos, have been used as they are more easily shareable. The information included in the different pieces has been endorsed by the Spanish Societies for Medical Physics, Medical Radiology, Nuclear Medicine, and Molecular Imaging. All these materials have been shared through the Spanish Society for Radiological Protection's web page.

This action has also produced posters (in Spanish) to be used in health centres, informing about the importance of justification and optimisation of medical procedures with ionising radiation in paediatric and general radiology, nuclear medicine, as well as occupational radiation protection for workers directly or indirectly involved with these medical procedures.

The SEPR hopes that this visual material can be of help to the entire medical physics community in Europe in the dissemination of the important work of medical physicists.

We want to acknowledge Esther Angulo, Eva Corredoira, Miguel Angel Peinado, Juan Carlos Sánchez and Fernando Caudepón for their contributions to this action.



Roberto Sánchez is a member of the executive board of the Spanish Society for Radiological Protection, member of the EFOMP E&T committee, medical physicist at Hospital Clínico San Carlos and associate professor at Universidad Complutense de Madrid.

María Luisa Tormo is a member of the executive board and director of communication of the Spanish Society for Radiological Protection, as well as an international relations advisor on radiation protection matters at the Spanish Nuclear Safety Council (CSN).

Mª Teresa Macías is president of the Spanish Society for Radiological Protection and Radiation Protection Expert at Instituto de Ciencias Biomédicas del Consejo Superior de Investigaciones Científicas y la Universidad Autónoma de Madrid, Spain. She is also a member at the UNSCEAR committee.

Introducing Irene Hernández-Girón

Irene Hernández-Girón, Secretary of the EFOMP Scientific Committee, was recently appointed. She wrote an overview of her professional career for the EFOMP newsletter.

My name is Irene Hernández-Girón and I am currently an Assistant Professor and Ad Astra fellow at University College Dublin (UCD) in the School of Physics. I started working at UCD in January 2023 and am involved in the CAMPEP-accredited MSc Medical Physics Programme at the same university as a student project supervisor. I am also a member of the UCD Centre for Physics in Health and Medicine (CPHM) which brings together colleagues of different disciplines working at the university and healthcare institutions to enable bringing fundamental physics into the clinic. I am starting to build my network of collaborators within the welcoming Irish medical physics community and their society (IAPM).

I have over 15 years of experience in radiodiagnostic imaging, with a big focus on Computed Tomography (including dosimetry and image quality), though I also work on other X-ray-based techniques such as mammography, dental cone-beam CT and interventionism. CT has been a lifelong friend of mine since I did my MSc project on cardiac-CT dose evaluation at Universidad Complutense de Madrid with Alfonso Calzado. I learned this modality inside out during my first job, performing QA for an independent audit company in hospitals all over Spain, thanks to Juan José Morant and Esteban Velasco. That practical boot camp experience shaped my future research, grounded in the practical aspects of technology, as I realised the impact on patients' diagnoses of a robust evaluation methodology.
One of my main research interests is the creation of objective, advanced methods for the image quality evaluation of diagnostic medical imaging devices that are closer to the clinical reality of patients. I work on task-based image quality metrics, such as model observers, to incorporate detectability or discrimination indexes of lesions in QA. I started working in this field during my part-time PhD, during which I was hired as a teaching and research fellow at Universitat Rovira I Virgili in the Unitat de Física Mèdica (led by Miguel López and later Marçal Salvadó). In that period, I taught physics to students of varied fields from Medicine, Physiotherapy, Nutrition and Chemistry and I realized the large impact we can have if we are involved in training our future colleagues in healthcare.

To evaluate the technological developments and increasing complexity of our imaging systems (for instance, with iterative and AI-based reconstruction methods), we need test objects or phantoms that mimic the attenuation, morphometry, tissue texture, and potentially disease staging of patients. For this, I design mathematical anatomical models that can become customised physical phantoms using 3D printing. This started during my work as a postdoc at the Leiden University Medical Centre (LUMC) in The Netherlands (staying there since 2015 till I joined UCD), first in the CLUES project (led by Wouter Veldkamp), where we started 3D printing phantoms, and then as a PI with a personal Veni-grant inside the Talent Programme funded by NWO. In the latter, I was motivated by the increasing inception of AI and computer-aided diagnosis tools in clinical practice (also for image reconstruction), and our need to rethink what "good" image quality means when your observer is no longer a human.

My approach to research is transversal, collaborating hand in hand with professionals from different fields, including the end users of medical images, radiologists and clinicians, our radiographers that produce them and are hands-on with our devices, medical physicists, engineers, computer scientists, and manufacturers. At the Leiden University Medical Centre, I was involved in different projects and protocol optimization initiatives together with a wide team of colleagues, including the medical physics group (first led by Jacob Geleijns and then by Floris van Velden), in parallel with my research. The reality in our hospitals is frequently far from the ideal situation we envision in a university hospital with unlimited resources, but I believe that optimization of imaging protocols can happen at any level in the imaging chain and will always benefit the patients. During my Veni grant, I was welcomed inside the Division of Image Processing (LKEB, led by Boudewijn Lelieveldt) at LUMC and collaborated closely with Berend Stoel in the evaluation of automated methods for lung function and vessel characterization. Most of my colleagues in LKEB were computer scientists involved to different extents in AI, which helped me get another valuable point of view on healthcare applications.

I am a service-oriented person and started working in the medical physics field to be able to help people, in particular patients. This motivated my active involvement in initiatives of the Sociedad Española de Física Médica (SEFM) and later EFOMP. I have been the Secretary of the Scientific Committee (representing SEFM) since

2021, first working side by side with our former chair, Brendan McClean, and now with our recently appointed new chair, Eeva Boman, until I hand the job over. We are motivated to have a more active committee, learn how we can improve our service, scout experts in our community, and identify knowledge gaps in our field. But we are "only" a small group of people, and we can only go so far without your help. Our committee trunk, though, has many growing branches thanks to the working groups and special interest groups. I want to use this forum to encourage you all to have a look at the EFOMP website, see the open calls, be active in our community, and engage in the ongoing working groups and special interest groups. I also ask you to propose (either as individuals, directly contacting us, or through your NMOs) new questions or initiatives that may be interesting or needed under our competence as the EFOMP Scientific Committee.

I have been involved in several EFOMP working groups, and though it requires effort, it is always worth it, as we need to standardise and keep our guidelines up to date with the continuous changes, both in technology and regulation, that we face in our field. I worked in the EFOMP CBCT working group, which produced the Quality Control in cone-beam Computed Tomography (CBCT) EFOMP-ESTRO-IAEA protocol (2017, led by Hugo de las Herasy Alberto Torresín) and I was also involved in the working group for Expanding the Medical Physicist Curriculum and Professional Programme to include Artificial Intelligence (led by Federica Zanca). At present, I am a member of the EFOMP AI-school committee, and I have been a teacher in several editions of the EFOMP Computed Tomography course in Prague. Back home in Spain, I am a member of the Scientific Committee of SEFM and also involved in the Scientific Committee of our national medical physics conference. I am also a member of ICRP Task Group 108 for Optimization of Radiological Protection in Digital Radiography, Fluoroscopy, and CT in Medical Imaging (led by Colin Martin).

I was honoured to be appointed Secretary of the EFOMP Scientific Committee, and I hope to be able to keep on working with you and our medical physics community in this role for a little while.

Irene Hernández-Girón is a Spanish medical imaging researcher and Assistant Professor (Ad- Astra Fellow) at the School of Physics at University College Dublin (Ireland). Her professional focus is diagnostic radiology imaging, in particular, clinical objective image quality evaluation and the development of affordable, customised anthropomorphic phantoms based on 3D printing. Her main modality of expertise is Computed Tomography, though she is also collaborating with other groups on other imaging modalities. She is the Secretary of the EFOMP Scientific Committee and a member of the Comisión Científica of the Sociedad Española de Física Médica (SEFM).

MEETING ANNOUNCEMENT

16th International Conference & Workshop "Medical Physics in the Baltic States 2023" in Kaunas, Lithuania (9-11 November 2023)

Diana Adlienė announces the hybrid International Conference and the Pediatrics Workshop organized by Kaunas University of Technology in Lithuania, the Society of Medical Physicists in Lithuania (a member of the Lithuanian Association of Medical Physics and Biomedical Engineering Medical Physicists Society), Malmö University Hospital, and Lund University in Sweden.

The international conference and workshop "Medical Physics in the Baltic States" is organized every two years by Kaunas University of Technology in Lithuania, the Society of Medical Physicists in Lithuania (a member of the Lithuanian Association of Medical Physics and Biomedical Engineering Medical Physicists Society), Malmö University Hospital, and Lund University in Sweden. This event brings together medical physicists, researchers, radiation protection experts, and other experts from many nations who share their expertise and experience via research, educational sessions, and roundtable discussions and contribute to the fostering of new national and international collaborations.

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

This year, the 16th International Conference "Medical Physics in the Baltic States 2023" is endorsed by the European Federation of Organizations for Medical Physics and will be held on 10-11 November, 2023 at Kaunas University of Technology. One day before the conference (9 November 2023), a dedicated workshop on some specific topics in paediatrics will be organized.

The conference is devoted to the celebration of the International Day of Medical Physics (7th November) "Communicating the Role of Medical Physicists to the Public". This year it will be a special occasion to celebrate: our MSc study program "Medical Physics" has already run successfully for 20 years at Kaunas University of Technology!

Conference proceedings will be issued in advance. From 2009 until now, conference proceedings have been included in the CA WoS database (without a citation index).

More detailed information regarding this event can be found on the website. Detailed information about the registration fee can be found via this link. Please be aware that we are expecting registration according to the scheme: 1 article - 1 registered presenting author.

A team "I love Medical Physics" from the previous 15th International Conference and Workshop "Medical Physics in the Baltic States 2021".

This event will be organized as a hybrid one; however, everyone who would like to visit Lithuania and share knowledge in the medical physics field, have interesting and informative discussions, and find or start new collaborations is invited to visit Kaunas on 9-11 November 2023!

Mark the date in your calendar, register, and/or submit your abstract, and of course come to Kaunas to meet our amazing team "I love Medical Physics"!

Prof. Diana Adlienė, PhD in Physics, is one of the founders of the MSc study program "Medical Physics" at Kaunas University of Technology in 2003 and has significantly contributed to the recognition of medical physicists as health care professionals in Lithuania. Being a supervisor of PhD students, she helps graduates from Medical physics programs configure their research careers and promotes the development of research in the medical physics field.

EFOMP's Special Interest Group for Radionuclide Internal Dosimetry (SIG_FRID) Update

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

The number of SIG_FRID members is currently 163. New applications are always welcome (see below how to become a SIG member).

Last term, the Steering Committee (SC) had virtual meetings on March 6th, April 3rd and May 2nd. A General Meeting of the SIG_FRID was held on February 24th with the attendance of more than 30 people. The next general meeting of the SIG_FRID will be held on June 30th (14-16 h CEST).

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

- Priority 1. Scientific meetings.
- Priority 2. Workgroup management and follow-up.
- Priority 3. Teaching/Education/Dissemination.
- Priority 4. Communication.
- Priority 5. Professional/Regulatory/Economic matters.

A summary of the last activities performed in those priorities is provided below. Note that some priorities may not be mentioned when there is no recent advance.

Priority 1. Scientific meetings

A Scientific Meeting on pre-therapeutic dosimetry in thyroid diseases was organised on March 15th with talks given by Dr. Walter Jentzen, Dr. Elisa Richetta and Dr. Jan Taprogge. A Case Report Meeting on lung dosimetry in pneumonitis cases after radioembolization with 90Y glass microspheres was held on April 26th with a talk given by Dr. Carlo Chiesa.

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

- Wednesday 14/06, 3:00-500 pm CEST.
- Wednesday 20/09, 3:00-5:00 pm CEST
- 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 3 x 30 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:

- Tuesday 25/07, 12:00-1:00 pm CEST
- Tuesday 24/10 12:00-1:00 pm CEST

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.

Please use the following link to subscribe to the SIG_FRID Scientific and Case Report meetings: https://www.efomp.org/index.php?r=pages&id=webinars-2023.

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 Bardiès (manuel.bardies@inserm.fr) and Gerhard Glatting (gerhard.glatting@uniklinik-ulm.de).

Priority 3. Teaching/Education/Dissemination.

Among the plans for 2023 is arranging an EFOMP webinar series on Dosimetry in Targeted Radionuclide Therapy. Any volunteer to participate in this is welcome. Please contact Priority 3 responsible SC members (Ana Denis-Bacelar (ana.denisbacelar@npl.co.uk) and Caroline Stokke (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 Mínguez (pablo.minguezgabina@osakidetza.eus) or Gerhard Glatting (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, is the link between that committee and the SIG_FRID regarding SIG_FRID communication-related activities.

Priority5.Professional/Regulatory/Economicmatters.

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 (Glenn.Flux@icr.ac.uk) or Carlo Chiesa (Carlo.Chiesa@istitutotumori.mi.it). On 21st March '23 Carlo Chiesa met in person with the chair of the patient association Cancer Patients Europe. Carlo introduced nuclear medicine therapy and its possible optimisation with dosimetry.

INCOMING MEETINGS

[I] **The 10th International Symposium on the Physical, Molecular, Cellular, and Medical Aspects of Auger Electron Processes. (September 6-8). Montpellier, France.**
https://auger-symposium.com/

[II] **The 36th EANM Annual Congress (September 9-13). Vienna, Austria.**
https://www.eanm.org/congresses-events/future-congress/

[III] **The 1st Symposium on Molecular Radiotherapy Dosimetry: The Future of Theragnostics (November 9-11). 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!

The first announcement was posted on Dec 19th:
https://smrd2023.efomp.org/
Registrations/calls for abstracts are open.
Since the event will be restricted to 120 participants, early registration is recommended!

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: https://www.efomp.org/index.php?r=pages&id=sigs

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

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.

MEETING ANNOUNCEMENT

Symposium on Molecular Radiotherapy Dosimetry: The Future of Theragnostics

The Symposium will be held in Athens, from the 9th to the 11th of November 2023, **Manuel Bardiès** says "Can't wait to see you there..."

The EFOMP Special Interest Group for Radioisotope Internal Dosimetry (SIG_FRID) is organising a 3-day topical event on Molecular Radiotherapy Dosimetry: https://smrd2023.efomp.org/

The objective is to put together medical physics experts, clinical scientists, and students to discuss the advances in this rapidly evolving field.

The Symposium on Molecular Radiotherapy Dosimetry (SMRD) will be held in Athens from the 9th to the 11th of November 2023. It is hosted by the Hellenic Association of Medical Physicists (HAMP) in Argyriadis Hall, National and Kapodistrian University of Athens, 30 Panepistimiou Str., 10679, Athens.

The venue is very central and accessible by public transport. Restaurants and hotels are available in the vicinity of the venue.

Scientific content:

- Scientific sessions will include invited talks/keynotes by specialists in the field, followed by selected oral communications. The format of the meeting (Figure 1) is designed to allow ample discussions and exchanges between professionals. The preliminary list of invited speakers is available on the SMRD website. They will cover various aspects of the domain, including artificial intelligence applied to clinical dosimetry, multi-centre trials, regulatory issues, clinical dosimetry applied to various clinical indications but also methodological aspects of the various steps that go from activity quantification to absorbed dose calculation.
- The results of a survey on the current practice of clinical dosimetry in Europe performed within the SIG_FRID will be presented.
- The EFOMP policy Statement n° 19 on Dosimetry in Molecular Radiotherapy, currently in preparation, will be introduced and discussed during the symposium.
- A round table involving different stakeholders (clinicians, regulatory specialists, and patient representatives) will be organised.
- A specific manufacturer session will allow sponsors to present and discuss their products.
- Continuous Professional Development early sessions will provide refresher courses on clinical dosimetry aspects such as pharmacokinetics modelling and development of quality assurance in clinical dosimetry.

Practicalities:

- The call for abstracts is **open** and will close on **July 2nd**.
- Due to the limited number of attendants (110), **early registration is advised**.
- The registration (early registration: 300€ until July 31st) includes participation in the symposium, coffee breaks and one meeting dinner on November 10th. To favour the presence of students, half-price (150€) registration is available for the first 30 registered students (on a first-serve basis).

This is the first EFOMP event of its kind. The SIG_FRID is very proud to have been chosen to test the formula! We hope that this meeting will be the first of a series of EFOMP topical events

About the SIG_FRID:

	Thursday Nov 9th	Friday Nov 10th	Saturday Nov 11th
08:30	Registration	Continuous Professional Development	Continuous Professional Development
09:00	Opening		
09:30	Session 1	Session 4	Session 7
10:00			
10:30			
11:00	Coffee Break	Coffee Break	Coffee Break
11:30	Session 2	Session 5	Session 8
12:00			
12:30			
13:00	Lunch Break	Lunch Break	Closing
13:30			
14:00			
14:30	Session 3	Session 6	
15:00			
15:30			
16:00	Coffee Break	Coffee Break	
16:30	Round Table	Manufacturer session	
17:00			
17:30			
20:00		Gala Dinner	

Figure 1: Preliminary programme and session planning

The objective of the SIG_FRID is to establish a network of medical physicists working in radionuclide dosimetry. The SIG_FRID aims to fulfil the need for networking, education, research and professional exchanges in this field.

The SIG_FRID members have identified priorities, and specific Workgroups on various topics related to clinical dosimetry have been created and are at various stages of advancement.

The SIG_FRID is also proposing 2 types of webinars, Scientific meetings and clinical dosimetry Case reports: https://www.efomp.org/index.php?r=pages&id=webinars-2023

Registration to the SIG is required to attend the Scientific Meetings, but attendance to Case reports is open to all and available in EFOMP's eLearning Platform to EFOMP's Individual Associate Members (https://www.efomp.org/index.php?r=pages/index&id=e-learning).

The number of SIG_FRID members is currently 164. New applications are always welcome. Membership is open to all EFOMP members.

The membership application procedure is explained on the SIG_FRID pages of the EFOMP website: https://www.efomp.org/index.php?r=pages&id=sig-frid.

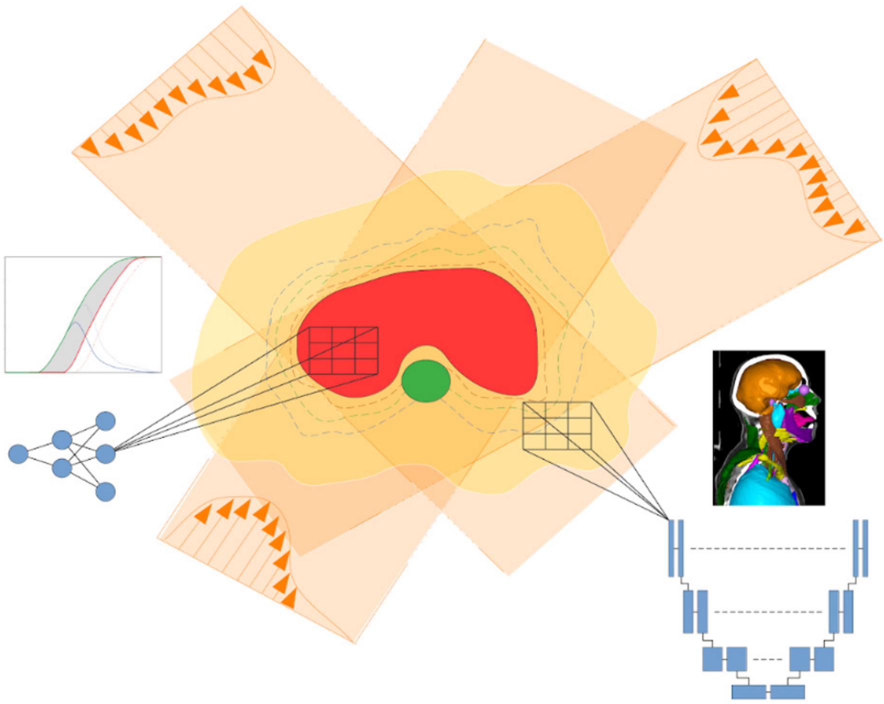
The application form (https://www.efomp.org/uploads/files/EFOMP_SIG_member_application.pdf) and a short professional CV should be sent anytime to: board.sig_frid@efomp.org.

Manuel Bardiès is a senior research scientist at the Montpellier Institute of Cancer Research, France, which belongs to the French National Institute of Medical Research (INSERM). He's been working for 30+ years in radiopharmaceutical dosimetry, at different scales (cell, small animal, clinical). He's the current chair of EFOMP's recently created SIG_FRID.

TEACHING COURSE ANNOUNCEMENT

5th Summer School in Medical Physics 2023: Data Science and Machine Learning in Radiotherapy

The course hosts, **Oliver Jäkel** and **Jürgen Debus**, and the course leader **Kristina Giske** provide an overview of the course in this report



Methods of Data Science and Artificial Intelligence are disrupting radiotherapy: not only computational methods in image processing and physical modelling are changing, but also clinical workflows and decision-making are challenged. Future research and practice will hardly thrive without consideration or awareness of these methods. Thus, we are happy to announce our 5th Summer School in Medical Physics about Data Science and Machine Learning in Radiotherapy.

The course is subdivided into an online phase of about three weeks and an attendance phase in Heidelberg, Germany, of one week, following the hybrid mode, so all sessions of the attendance phase are additionally available online as a live online phase via Zoom. Participants can decide to follow the course online and on-site or 100% virtually.

The online phase introduces the basics of machine learning, focusing on 3D voxelized geometries, its most frequent applications, and methodological as well as ethical aspects with ca. 10 pre-recorded lectures (each lasting 45 minutes) as well as 4 live online sessions via Zoom (each lasting 90 minutes) with experts from Germany and other countries. The hybrid attendance phase will then discuss how machine learning disrupts radiotherapy workflows in detail: It will deepen the knowledge of deep learning methodologies for image synthesis, organ and target segmentation, and image registration in the context of radiotherapy. Applications in computational dosimetry and plan optimization will be discussed, ranging from dose prediction to guided plan optimization and treatment outcome prediction.

Scheduled interactive sessions during the course will allow attendees to exchange thoughts and ideas with each other and the lecturers. Furthermore, the poster session and the science slam during the hybrid attendance phase allow participants to present their current research projects to foster scientific exchange within the group. Based on our long-lasting experience with fully online or hybrid teaching settings, we ensure an interactive learning experience, no matter if participants attend 100% virtually or on-site in Heidelberg.

The summer school is dedicated to national and international students at different levels (BSc, MSc, or PhD). Participation is limited, and we are happy to receive your application!

Dates:

1. Application Period: **March 01st 2023 – June 15th 2023**
2. Online Phase: **Aug. 28th – Sep. 17th 2023**
3. Attendance phase in Heidelberg or live online phase via Zoom: **Sep. 18th – Sep. 22nd 2023**

Program:

The program can be downloaded from the website: www.dkfz.de/summer_school2023_de

Contact:
Local Organizing Team

Anna Moshanina, Simone Barthold-Beß, PhD, Marcel Schäfer

Division of Medical Physics in Radiation Oncology

German Cancer Research Center
Im Neuenheimer Feld 280
DE-69120 Heidelberg, Germany
E-Mail: symposium.medphys@dkfz-heidelberg.de
Web: www.dkfz.de/summer_school2023_de

Hosts::

Prof. Oliver Jäkel, PhD, 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 has been a full professor at the Medical Faculty Heidelberg of Heidelberg University.

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

Kristina Giske, PhD, is a postdoctoral Researcher and the Research Group Leader: Computational Patient Models of Medical Physics in the Division of Medical Physics in Radiation Oncology, German Cancer Research Center, Heidelberg, Germany, working towards the full exploitation of digital patient twins in radiation therapy treatments. This implies bridging machine vision and image processing research with biomechanical simulation methods embedded in software prototypes utilizing parallel hardware architectures.

Niklas Wahl, PhD, is an expert in physical modeling, uncertainty quantification and scientific programming for radiotherapy treatment planning. He is a postdoctoral Researcher and the Research Group Leader: Radiotherapy Optimization within the Division of Medical Physics in Radiation Oncology which focuses on the development of novel algorithms for treatment planning, numerical dose simulation and uncertainty quantification. lty Heidelberg of Heidelberg University and, since 2014, its Vice Dean. He is also Chairman of the Department of Radiation Oncology at the Heidelberg University Hospital.

TEACHING COURSE ANNOUNCEMENT

Summer School in Medical Physics 2023 in Chile: The Role of Imaging in the Radiotherapy Process

The course leaders **Oliver Jäkel** and **Caprile Etchart** provide an overview of the course in this report

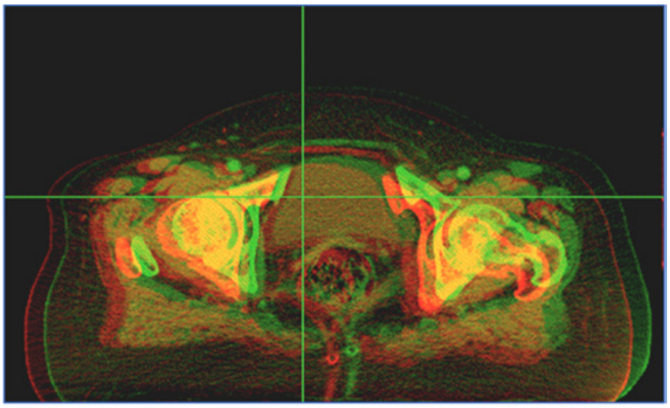


Figure SEQ Figure * ARABIC 1: Image Registration during treatment process

An effective radiation dose in the tumour tissue while sparing the surrounding tumour organs is crucial for the success of radiation therapy. On the one hand, this requires precise focusing of the radiation on the tumour to be treated, and on the other hand, the precise determination of the tumour location with the highest possible accuracy. Today's radiotherapy treatment techniques are no longer conceivable without the integration of imaging. The integration of imaging enables a therapy that is adapted and optimized for each patient and for all possible anatomical changes of the tumour and surrounding organs at risk.

Our summer school will focus on the role of imaging in the radiotherapy process, discussing the benefits and challenges.

The course is subdivided into an online phase of about two months and an attendance phase in Santiago de Chile of one week, following the hybrid mode. All sessions of the attendance phase are additionally available online as a live online phase via Zoom. Thus, participants can decide to follow the course online and on-site or 100% virtually.

The online phase repeats important imaging techniques such as CT or MRI. Participants are also introduced to the physics of treatment techniques such as the Cyberknife or the MR-Linac. Furthermore, treatment planning, radiobiology, and dosimetry are presented as well. In total, 23 pre-recorded video lectures (4 lectures lasting 30 minutes, 19 lectures lasting 60 minutes), as well as 4 interactive live online sessions via Zoom, allow individual learning as well as intensive discussions with all participants and experts.

The hybrid attendance phase in Santiago de Chile will then discuss the radiotherapy workflow and the role of imaging. Lectures during the morning as well as interactive discussion rounds and practical sessions during the afternoon with our teaching staff from Germany and Chile ensure interesting sessions for everyone, no matter if participants attend 100% virtually or on-site in Chile.

The summer school is dedicated to national and international students on different levels (BSc, MSc, or PhD) as well as young professionals working in the fields of radiotherapy and radiology.

Thanks to funds from the German Academic Exchange Service (DAAD), participation is free of charge, but limited, and we are looking forward to receiving your application.

Dates:

1. Application Period: **May 15th 2023 – July 17th 2023**
2. Online Phase: **Oct. 16th – Dec. 10th 2023**
3. Hybrid attendance phase in Chile or live online phase via Zoom: **Dec. 11th – Dec. 15th 2023**

Program:

The program can be downloaded from the website: www.dkfz.de/summer_school2023_cl

Financial Support:

The summer school is funded by the Federal Ministry of Education and Research (FMER) as well as by the German Academic Exchange Service (DAAD).

FMER https://www.bmbf.de/bmbf/en/home/home_node.html

SPONSORED BY THE Federal Ministry of Education and Research

DAAD

Contact: Local Organizing Team
Anna Moshanina, Simone Barthold-Beß, PhD, Marcel Schäfer
Division of Medical Physics in Radiation Oncology
German Cancer Research Centre
Im Neuenheimer Feld 280 DE-69120 Heidelberg, Germany
E-Mail: medphyschile@dkfz-heidelberg.de

11th Alpe Adria Medical Physics Meeting with EFOMP Dosimetry School

19 -22 October 2023, Novi Sad, Serbia

https://aampm2023.pmf.uns.ac.rs

TOPICS:

- Medical Physics Education
- Medical Physics professional matters
- Radiation protection
- Radiation therapy physics
- Nuclear medicine physics
- Diagnostic radiology physics
- MRI, ultrasound, lasers

SUPPORTED BY

EFOMP

IAEA International Atomic Energy Agency

ORGANIZED BY

HDMF CROMPA, OGMP, Aifm, SMA

Thursday 19th Oct 2023

EFOMP School – Out-of-field Dosimetry in Radiotherapy

Friday 20th Oct 2023

8.00 Registration

8.45 Welcome and opening ceremony

MEDICAL PHYSICS EDUCATION AND PROFESSIONAL MATTERS

P. Gilligan – *Current issues and future perspectives of medical physics in Europe (EFOMP)*

Cs. Pesznyak – *Mobility opportunities for medical physics professionals and medical physics students (ENEN)*

R. Padovani – *Opportunities for medical physicists in ICTP*

P. Knoll – *IAEA activities to support Nuclear Medicine Medical Physics* (online)

C. Caruana – *Leadership in medical physics*

J. Swamidas – *Recent IAEA guidelines to auditing clinical training programmes, certification and Ethics in Medical Physics*

DIAGNOSTIC RADIOLOGY PHYSICS

M. Brambilla – *Optimization of recurrent exposures: reference levels for cumulated effective dose*

N. Krzanovic – *Diagnostic radiology dosimeter response dependence of mammography anode/filtration setup*

Saturday 21st Oct 2023

8.00 Registration

NUCLEAR MEDICINE PHYSICS

P. Gilligan – *Beyond QC and compliance: the role of the physicist in the life cycle of medical equipment*

J. Ptáček – *EFOMPs PET/CT QA Protocol*

RADIATION THERAPY PHYSICS

J. Swamidas – *National networks in dosimetry audits – structure, methodology*

E. Gershkevitsh – *SBRT/SRS dosimetry audits-possibility for improvement*

Sunday 22nd Oct 2023

8.00 Registration

RADIATION THERAPY PHYSICS

E. Boman – *Stereotactic RT treatment accuracy and future possibilities*

P. Alaei – *IGRT QA and its importance in stereotactic delivery accuracy*

M. Zivanovic – *National intercomparison of well chambers in Serbia*

RADIATION PROTECTION AND RADIOBIOLOGY

L. Marcu – *Radiobiological challenges of personalised radiotherapy*

E. Koutsouveli – *The role of the Medical Physicist in Laser Safety Management in a hospital's environment*

POSTERS

AWARDS

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**

Jan 1st, 2023 - Oct 31st, 2023
European School for Medical Physics Experts (ESMPE) | Artificial Intelligence in Medical Physics 2023
Prague, Czech Republic and online

Mar 17th, 2023 - Oct 15th, 2023
SynthRAD2023 Grand Challenge announcement
The Netherlands

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 7th, 2023 - Jun 9th, 2023
61st SFPM annual meeting
Nancy, France

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

Jun 28th, 2023
Innovating Against Cancer: Advancing Cancer Treatment with VHEEs
Online via Google Meet

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

Aug 28th, 2023 - Sep 22nd, 2023
5th Summer School in Medical Physics 2023: Data Science and Machine Learning in Radiotherapy
Online or online& on site in Heidelberg/ Germany

Sep 9th, 2023 - Sep 13th, 2023
EANM'23 – 36th Annual Congress of the European Association of Nuclear Medicine
Austria Center Vienna (ACV) - Bruno-Kreisky-Platz 1, 1220 Vienna – Austria

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

Sep 21st, 2023 - Sep 23rd, 2023
Data Analysis with Python for Medical Physicists
Online

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

Oct 4th, 2023 - Oct 7th, 2023
ESMRMB Congress 2023
Basel, Switzerland

Oct 9th, 2023 - Oct 13th, 2023
European Radiation Protection Week 2023
University College Dublin, Ireland

Upcoming Conferences and Educational Activities

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For a complete, up-to-date list, please visit our **EVENTS WEB PAGE**

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

Nov 2nd, 2023 - Nov 5th, 2023
34th Annual Congress of the Romanian Society for Radiotherapy and Medical Oncology / 9th National Congress of the Romanian Cancer Societies Federation | "From Research to Daily Clinical Practice - Sharing Experience"
Cluj-Napoca, Romania

Nov 9th, 2023 - Nov 11th, 2023
16th International Conference & Workshop "Medical Physics in the Baltic States 2023"
Kaunas University of Technology, Kaunas

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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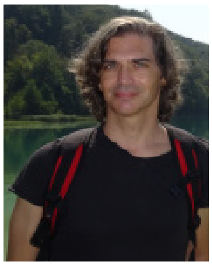

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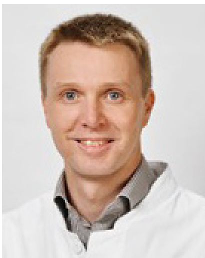

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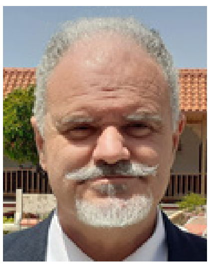

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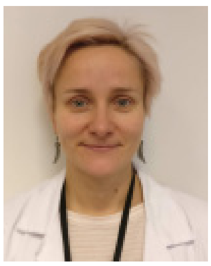

Eeva Boman

Past Chairperson

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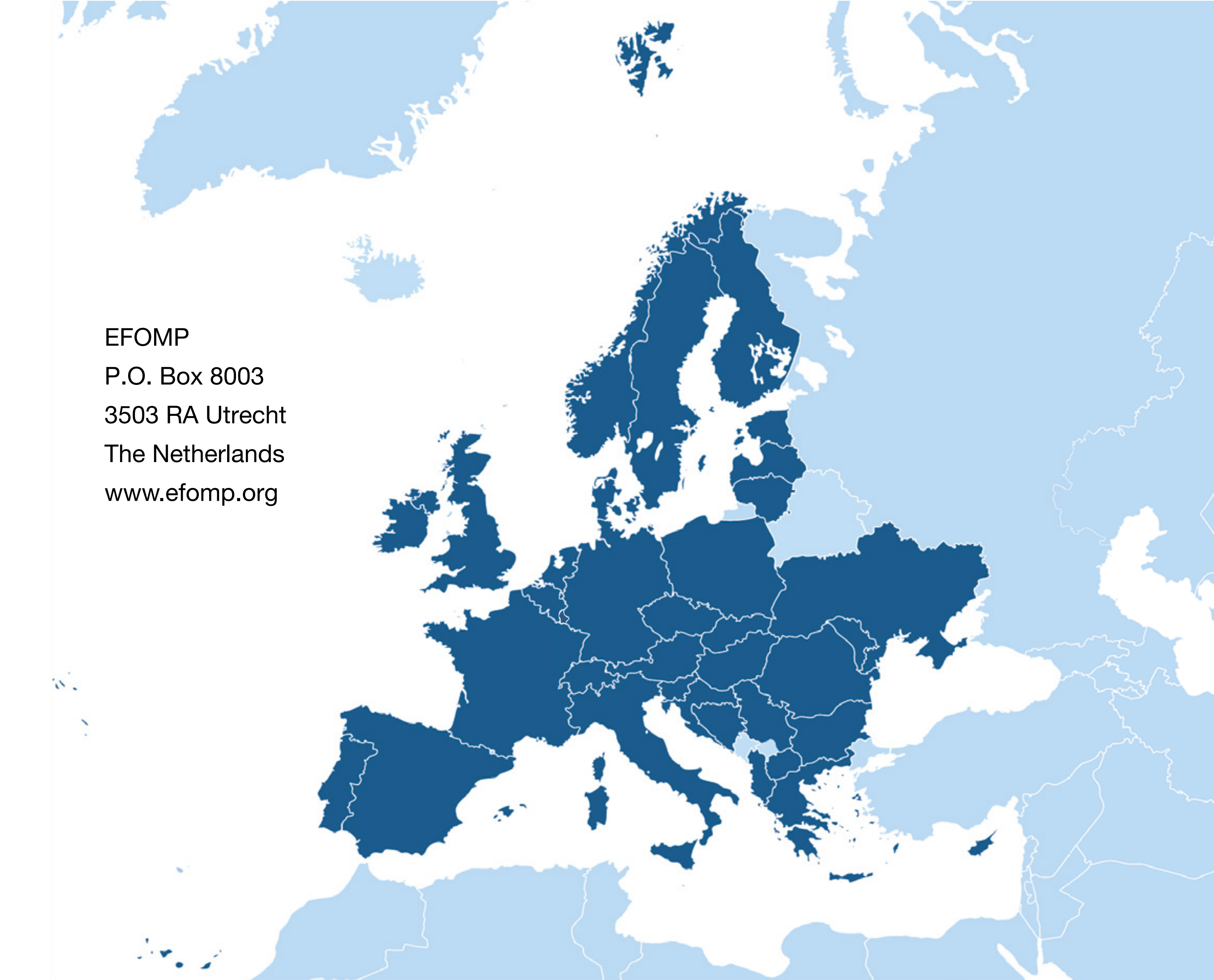

EFOMP
P.O. Box 8003
3503 RA Utrecht
The Netherlands
www.efomp.org

EFOMP

EUROPEAN FEDERATION
OF ORGANIZATIONS
FOR MEDICAL PHYSICS

The European Federation of Organisations in Medical Physics (EFOMP) was founded in May 1980 in London to serve as an umbrella organisation for medical physics societies in Europe. The current membership covers 36 national organisations which together represent more than 9000 medical physicists and clinical engineers working in the field of medical physics. The 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".

For more news and information about EFOMP activities please follow us on social networks or visit our website

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