EFOMP
EUROPEAN FEDERATION OF ORGANISATIONS FOR MEDICAL PHYSICS
Quarterly Newsletter

European Medical Physics News

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International Day of Medical Physics, 2021

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EUROPEAN FEDERATION OF ORGANISATIONS FOR MEDICAL PHYSICS

Contents

Front page photograph: IDMP activities in Greece – photo shows Aggeliki Douvara holding the IDMP poster; Aggeliki is a postgraduate student who is completing her Master's degree thesis in Medical Physics – Radiation Physics at at Attikon University Hospital. See the article on page 51.

EDITORIAL

Welcome to the Winter 2021 issue of European Medical Physics News, the quarterly newsletter of EFOMP!

Readers with a keen eye may have noticed that the front page of this issue is adorned with the brand new EFOMP logo! The new design was created by thiNK studio of Athens (the same people who produce the EMP News pdf), in cooperation with EFOMP Officers. The original EFOMP logo had served the organisation very well for over 40 years, but it was felt that a refresh was needed. We hope you will agree that the new logo looks fresh and modern and ready for use! In fact, we have taken the opportunity to design new logos for all of the EFOMP "family", including ESMPE, EEB and ECMP and these will all come into use over the next few months.

The front cover of this issue shows Aggeliki Douvara, a Master's student from the University of Patras, Greece, holding a poster for the International Day of Medical Physics (IDMP), which took place on 7th November. This annual event, coordinated by IOMP, expands year on year and is always taken up enthusiastically in EFOMP member countries. This issue of our newsletter includes articles about IDMP activities that took place in Greece, Italy, Spain and Romania, together with a piece about the well-deserved winner of the IOMP IDMP award, Dr. José Pérez-Calatayud from Valencia, Spain.

We hope that you have been enjoying the series of articles that we have introduced in recent issues. In the Autumn issue we included the first "Art to Challenge and Inspire" article by Prof. Jim Malone; he has contributed a second article for this issue, on the painting "The Sorceress" by Bartolomeo Guidobono. The Winter issue contains two more first-in-series articles: "Meet the Prof" by our educational advisor Danielle Dobbe-Kalkman, in which she interviews an experienced Medical Physics teacher (modesty forbids me from saying here who that is) and "Hacking Medical Physics", in which Swedish Medical Physicists Jonas Andersson and Gavin Poludniowski give hints and tips on Medical Physics IT and software – this time covering how to work with DICOM data.

Of course, the newsletter includes all our regular features, including a medical physics book review, reports of recent meetings and an overview of recent papers published in Physica Medica by the journal's Editor-in-Chief, Iuliana Toma-Dasu. EFOMP's Secretary General gives an overview of recent activities in the organisation, while our Treasurer provides a summary of EFOMP's accounts and budget. This time, the Medical Physicists' Hobbies section contains an article about modern art appreciation and collecting. You can also find two "Medical Physics Thesis" articles from recent Master's degree graduates, summarising their very interesting research projects, as well as an article from a PhD student about his ongoing research on the use of 3D printed phantoms for dose verification in radiotherapy. Articles from EFOMP Company Members are always appreciated by our readership, and in this issue you can find very informative articles from nine Company Members.

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

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

David Lurie is an Emeritus Professor at the University of Aberdeen, UK. Prior to his retirement in October 2021, he held a Chair in Biomedical Physics, having researched and taught MRI Physics at the University of Aberdeen since 1983. Prof. Lurie was awarded the Academic Gold Medal of IPEM in 2017 and was named as a Senior Fellow of ISMRM in 2021. He is Chair of the Communications and Publications Committee of EFOMP.

New logos for the EFOMP family!

Members of EFOMP's Communications and Publications Committee have worked with graphical designer George Kassalias of Athens-based thINK studio, to create a brand new suite of logos for EFOMP and its family. The main logos are previewed here and will be integrated into web sites and documents over the coming months. We hope you like them!

EFOMP
EUROPEAN FEDERATION OF ORGANISATIONS FOR MEDICAL PHYSICS

ECMP
EUROPEAN CONGRESS OF MEDICAL PHYSICS

ESMPE
EUROPEAN SCHOOL FOR MEDICAL PHYSICS EXPERTS

EEB
EUROPEAN EXAMINATION BOARD

thINK STUDIO

Think studio is an independent design office based in Kallithea of Athens. We undertake the process of visual communication and visual design for the needs of our clients. We apply graphic design for branding, corporate identities, company profiles newsletters and brochures. We also develop graphics and icons, for information design, social media apps, websites and a big range of services in visual communication.

We create a systematic plan to solve a problem and achieve certain objectives, with the use of images, symbols and typography. We create visual communication for concepts and ideas using various graphic elements and tools. Our purpose is to develop great identities for organizations, brands and businesses. We set the bar high in graphic aesthetics and we create a functional design. thINK studio after a process of collaboration with the client targets the result of one effective and clear solution. The creation of strong communication and an outspoken graphic language.

Communications and Publications Committee

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

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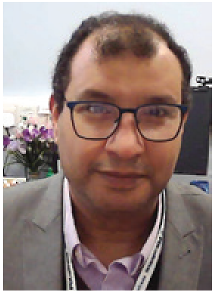

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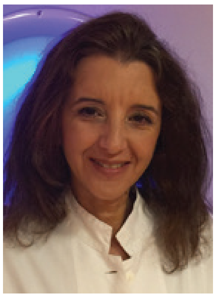

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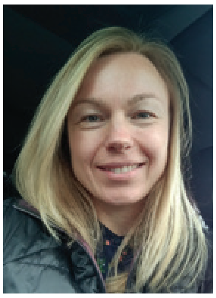

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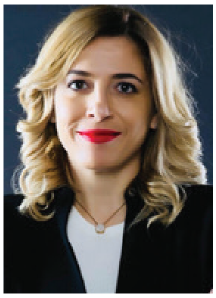

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EFOMP President's Message

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

Statue representing Janus Bifrons in the Vatican Museums

Dear Medical Physics Friends,

Winter is a time for reflection and rebirth. We, like the Roman God Janus, after whom the first month is named, look forward and backward at the same time. Unfortunately, Europe is still in the grip of the pandemic despite the extensive efforts of vaccination. Even with the pandemic, EFOMP volunteers have had a successful 2021 and have made a significant contribution to Medical Physics and patient experience in Europe. We also, like Janus, have had two faces: in presence and online. In November we had our first hybrid council meeting at the Medical Physics in the Baltic States conference. For those of us lucky enough to attend we were very well hosted during an excellent scientific congress, ESMPE School, council, officers and regional meeting in the Kaunas University of Technology, Lithuania. It was reassuring to hear the contributions of our colleagues from the NMOs. EFOMP is happy to support such regional meetings and the board look forward to and encourage invites from your regional and scientific meetings.

Training and standards are key to our identity as medical physicists and to assure the safety and quality of treatments and diagnosis for our patients. EFOMP has been slowly building up the number of EFOMP approved National Registration Schemes that will allow us to get a common training platform across Europe. I hope that by next year we will be in a position to go to the European Commission with a proposal for mobility and identify for medical physics experts in Europe. At a recent meeting of the training body for radiation protection experts, EUTERPE, it was interesting to note that they are on a similar journey toward mobility and standards. We hope that our representatives on the board can align our journeys on this path to benefit patients and staff in a healthcare setting.

Many medical physicists work as radiation protection experts and have been concerned at draft proposals form national bodies recommending that a life sciences Batchelor's degree (e.g. medical, dental or veterinary) rather than a physical sciences degree be considered as an adequate foundation for training. EFOMP is strongly of the view that a physical sciences degree is a necessary foundation to provide expertise in highly scientific areas, like risk assessment, monitoring, dosimetry, shielding and radionuclides.

In Kaunas, the educational platform tender was approved and will be issued shortly. We welcome any suggestions for possible providers of this platform. It is hoped that this will progress the EFOMP aims of education, Integration and communication. The issuing of the tender has also stimulated a strategic debate within EFOMP on the Federation's role in accreditation, training and standards. EFOMP continues to support EBAMP's development without interfering with the independence of EBAMP which is necessary for accrediting EFOMP educational events. From my personal view, I feel that EFOMP could set up a self-funding accreditation system for accrediting BSc, MSc, PhD and training programmes in medical physics as an interim measure. There would be no conflict of interest as we do not provide such programmes. I would like the Education and Training Committee to add a review of this to their exhaustive list of tasks.

The registration and abstract submission for ECMP 2022 in Dublin is open. So please register and submit and encourage your colleagues to build a great congress. We had our first scientific committee meeting this week. We acknowledge the nominations of NMOs who were included in the call. The final membership of the committee is limited and is based on expertise, gender, previous experience and regional representation. There will be further additions and updates on the membership to achieve the "multiple energies single patient focus" goal of the congress.

Indeed, it was reassuring to hear that one of our members who is not far from the Arctic circle was experiencing cold weather. Climate challenge will be a key role that physicists can play a part in and will be a part of the congress programme. We have had keen interest for the hosting of the ECMP 2024. EFOMP realise the hard work of volunteers that go into such bids and therefore have decided to increase the transparency of the process by incorporating an independent member on the bid committee.

Finally, as we usher in new vice chairs of committees, we acknowledge the role and contribution of our past and current chairs as volunteers. None more so than David Lurie's contribution to producing the excellent resource that is European Medical Physics News four times a year. On top of David's enthusiasm, warm personality, integrity and good manners, we have been saved many times by his command of the English language and editorial skills. EFOMP and the patients of Europe are eternally grateful!

Happy Christmas and a Happy New Medical Physics Year

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

UPCOMING MEETING

4th European Congress of Medical Physics, Dublin, Ireland

Naomi McElroy from the ECMP 2022 Local Organising Committee gives an update on preparations for the Congress

It's always an exciting time when you win something, and that was definitely the case when the Irish Association of Medical Physics (IAPM) were told by EFOMP of the successful bid to host the 2022 European Congress of Medical Physics (ECMP) in Dublin. And despite pandemics and cyberattacks, we have been busy behind the scenes and wanted to provide you all with an update on the plans so far for the 4th ECMP due to be held 17th-20th August in Dublin. For all the details please see the Congress website: https://www.ecmp2022.org/

The Scientific Committee has been selected, taking into consideration gender balance and diversity of fields of expertise, resulting in a wide geographical representation. With the official opening of registration and abstract submission just before the International Day of Medical Physics, the Scientific Committee now awaits the hard work and research submissions you wish to present at the 4th ECMP. The deadline for submission is 10th February 2022, with notification to successful applicants from the 12th of April.

Satellite editions of the ESMPE School and EUTEMPE modules are being prepared and, as with previous meetings, there will also be EEB examinations at the Congress.

Ireland is known as the land of saints and scholars, so what better place to host the Congress than where teachers of the next generation are taught! St Patrick's Campus, DCU is one of Ireland's oldest third level institutions and is situated to the North of Dublin City centre in the suburb of Drumcondra. As a centre for excellence in teacher education it aligns well with Medical Physics, a profession keen to share discoveries and educate others in any new found knowledge. We hope you will enjoy meeting colleagues in an atmosphere of knowledge sharing at the Welcome reception being held there on 17th August. There will also be on-campus accommodation available for those of you who are not morning people and want the shortest commute possible to the meeting, all of a 1-minute walk.

The local organising committee have had quite a few thoughts on how best to entertain you when here. In keeping with our "Multiple energies – single patient focus" theme we hope to provide you with a wide variety of events that should have something for everyone:

- As we are keen to work in harmony with each other, what better way to do this than with "EuroFission"? Adjust your frequencies and complete your tuning for a song contest set to take place in Whelan's of Wexford Street, home of good music, on the 17th of August.

- The conference social evening is set to take place in Croke Park Stadium, Ireland's largest sporting arena and the home of the Gaelic Athletic Association (GAA). This is where the champions of the national Irish games of Gaelic Football, Hurling and Camogie are decided annually – so you know you will be getting a unique and truly authentic Irish experience when you dine here on the 19th of August.

- Conscious that meeting time means a lot of stationary time, there will be organised 5k runs in the St Patrick's Campus throughout the congress to get the blood pumping and allow better concentration when you are at the scientific sessions.

- With a little luck, we are hoping to be able to let you experience the Gaelic Games where you need to think quickly and work as a team.

Also worth keeping an eye out for is our social media on twitter @ECMP2022 for the latest updates and news on the 4th ECMP in Dublin.

The organisers are excited to be putting together a fantastic programme of activities for ECMP 2022 – we look forward to welcoming you to Dublin in August!

Naomi McElroy B.Eng. M.Sc. has been working in the field of Medical Physics for almost half her life. She works as a Senior Medical Physicist in St Lukes's Hospital, Rathgar which is part of the St Luke's Radiation Oncology Network (SLRON) in Dublin. Her current work focuses on nuclear medicine therapies, and providing physics support in diagnostic imaging and radiation protection. She is a past Honorary Treasurer for the IAPM, currently serves on the IAPM Council and is registered as an MPE with the Irish College of Physicists in Medicine (ICPM).

ecmp 4th
Dublin 2022

4th EUROPEAN CONGRESS OF MEDICAL PHYSICS

17-20 AUGUST 2022

DCU St Patrick's Campus, Dublin

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iapm Irish Association of Physicists in Medicine

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MEET IN IRELAND

EFOMP Secretary General's report (September – December 2021)

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

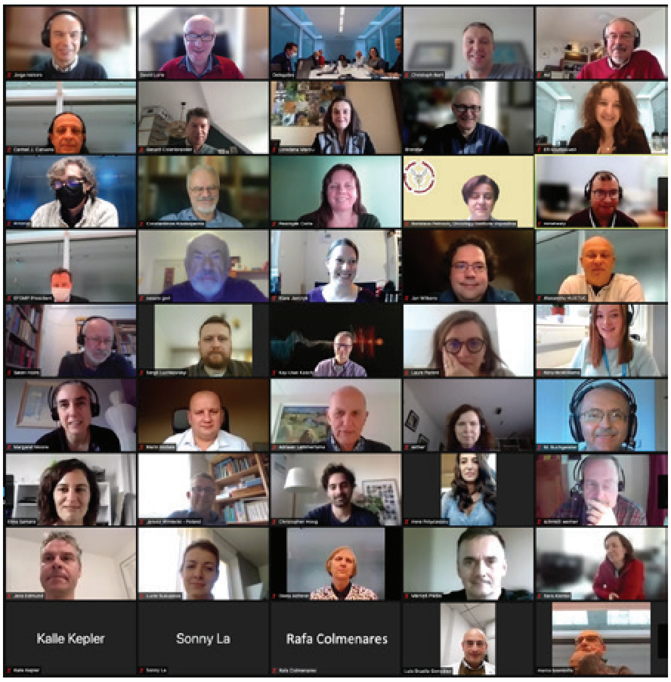
EFOMP executive board Meeting

The executive board of EFOMP met for the first time in person after the onset of the pandemic in the new EFOMP office in Utrecht, the Netherlands, at the end of August. We were delighted to meet with the EFOMP financial administrator, Mrs Romy Steegwijk.

In-person meeting of the EFOMP executive committee at the building (top) where Cantrijn are based. Left to right: Marco Brambilla, Jaroslav Ptacek, Paddy Gilligan, Efi Koutsouveli

EFOMP Officers Meeting and Annual Council

Three excellent in-person and virtual meetings took place in Kaunas, Lithuania during four highly productive days: our fist leadership meeting with representatives from Estonia, Latvia, Lithuania and Moldova and the first post-COVID Officers meeting, followed by the Annual Council meeting. Fifty delegates and officers coming from Albania, Austria, Denmark, Estonia, France, Germany, Greece, Hungary, Italy, Ireland, Lithuania, Latvia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Spain, Switzerland, Sweden, UK, Ukraine reviewed common actions on education and training, professional matters, scientific successes and COVID-19 related impact on our activities. It was great to hear first-hand the National Member Organisations' work over the past year to raise visibility of their novel ideas, experience and approaches which could be adopted by other NMOs in their countries and to identify how EFOMP could help the Medical Physics societies in getting their National registration schemes approved. This is an important part of the recognition of the Medical Physics Expert as a protected title in Europe, as mentioned by EFOMP President Paddy Gilligan.

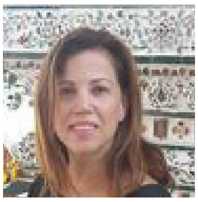
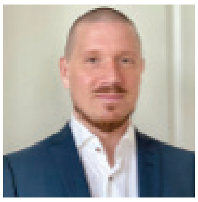
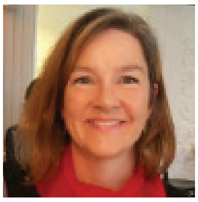


Attendees at the combined in-person and online Annual Council meeting that took place on 6^{th} November 2021. Those present in Kaunas ("Delegates" screen, L-R) were Paddy Gilligan, Marco Brambilla, Jaroslav Ptáček, Efi Koutsouveli, Alexandru Hustuc, Brenda Byrne, Carmel Caruana and Antonio Medina

Our sincere gratitude and appreciation to our Lithuanian team both for their warm hospitality and commitment to excellence. Special thanks to our colleague Benas Gabrielis Urbonavicius for the livestreaming coverage and technical assistance for all meetings offering full digital access to anyone unable to attend in person.

EFOMP Committees, new committee members and roles

We welcome Pola Platoni (GR), Jonas Andersson (SW), Amanda Barry (IE), Samuel Ruiz Arrebola (ES), Stan Heukelom (NL) as new members of the Professional Matters, Science and European Matters committees.

Newly appointed colleagues. Pola Platoni (GR), Jonas Andersson (SW), Amanda Barry (IE), Samuel Ruiz Arrebola (ES), Stan Heukelom (NL)

National Member Organisations Presidents can nominate colleagues interested in joining EFOMP committees by sending a nomination email to: secretary@efomp.org

EFOMP representatives

EFOMP President Paddy Gilligan and Special Interest Group on "Radionuclide Internal Dosimetry" chair Manuel Bardies will present "Medical Physics and quantitative dosimetry: Unlocking the Potential of Radionuclide Therapies", at the 3rd Annual Targeted Radiopharmaceuticals Summit 2021 in Berlin, Germany where the role of Medical Physicists in training and delivering radionuclide therapy dosimetry, at start up and in clinical phase for existing and new therapeutic radionuclides will be highlighted.

EFOMP European committee chair, secretary and members participated in the IEC TC 62 virtual meeting on the 22nd October, 2021 where the results of its ad hoc group 7 and topics related to safety and performance standards for emerging and existing technologies concerning medical equipment, software and systems were discussed. Preparing international standards and publications concerning common aspects of the design, development, installation and application of medical equipment have been also reviewed during that meeting.

EFOMP President Paddy Gilligan will represent the organization in the European Alliance for Medical Radiation Protection Research (EURAMED) board, starting from December 2021.

Affiliated Societies

EFOMP endorsed the "21st Asia-Oceania Congress of Medical Physics (AOCMP)" – the official yearly congress of the Asia-Oceania Federation of Organizations for Medical Physics (AFOMP) hosted by the Bangladesh Medical Physics Society (BMPS) which is going to be held from December 10-12, 2021 at the United International University (UIU), Dhaka, Bangladesh. EFOMP will be represented by Golam Zakaria, DGMP-Germany, an outstanding expert in the field of Medical Physics and member of the EFOMP Artificial Intelligence Working Group. Golam will present "Medical physicist curricular and professional programme to include Artificial Intelligence" based on the recent EFOMP publication in the European Journal of Medical Physics (https://doi.org/10.1016/j.ejmp.2021.01.069).

EFOMP projects

September 2021 marks the official closure of the ENEN+ project. The ENEN+ project supported financially, through mobility grants, students and professionals wishing to carry out education or training activities in medical physics (EUTEMPE modules, EFOMP schools, ESTRO courses...). We will inform you about the new ENEN++ project which is under development in the next couple of months, so stay tuned!

The RAPTOR project, a Marie Curie – Sklodowska innovative training network organizes the first annual event RAPTOR – LOOP. EFOMP is a partner in this project which brings together 13 beneficiaries and 15 partner organizations with one aim in common: to bring adaptive particle therapy to the clinic. EFOMP is represented by Yolanda Prezado, past chair of EFOMP's Science Committee. More information at: https://www.efomp.org/index.php?r=events/view&id=180

EFOMP educational events

Two in person 2½-days EFOMP school editions are planned for 2022:

- Radiation Shielding in Medical Installations, Prague, Czech Republic in February 2022
- Statistics in Medical Physics, Athens, Greece in June 2022

There will also be pre-congress school editions in Dublin, Ireland, in conjunction with ECMP 2022 in August. Specific information will be uploaded on our website.

Don't forget to follow our Webinars page. Registration is free. All events are accredited by EBAMP and the video recordings can be found inside EFOMP's e-learning platform.

I am closing this update, looking forward to meeting you at our in-person events next year!

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

EFOMP COMPANY MEMBER ARTICLE

SUN NUCLEAR corporation

Sun Nuclear: The Importance of Tissue-Mimicking in Diagnostic Imaging Quality Assurance

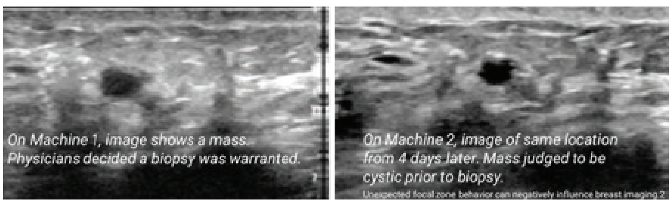
In the Autumn 2021 issue (page 42) of the EFOMP Newsletter, Jim Malone, Professor (Emeritus) of Medical Physics at Trinity College opined on the Sfera con Sfera sculpture on campus (pictured opposite), stating: “It provides us with a visual metaphor for science, in that the images within the sphere, of surrounding buildings and people are always somewhat distorted. Just as in medical physics. Imperfect representation of reality is the stuff of both science and art.”

As a manufacturer of diagnostic and radiotherapy phantoms, Sun Nuclear fully appreciates the challenges of minimizing distortions, over the lifetime of the phantoms we design and manufacture. A critical element of phantom performance is how well the material used matches human tissue.

Tissue Mimicking Materials (TMM) play a key role in the dose calculations for Treatment Planning Systems, and for absorbed dose estimates in radiographic images studies. For Ultrasound, CT, and Mammography applications, phantoms with exquisite tissue mimicking materials can help to find inconsistencies in imaging system performance.

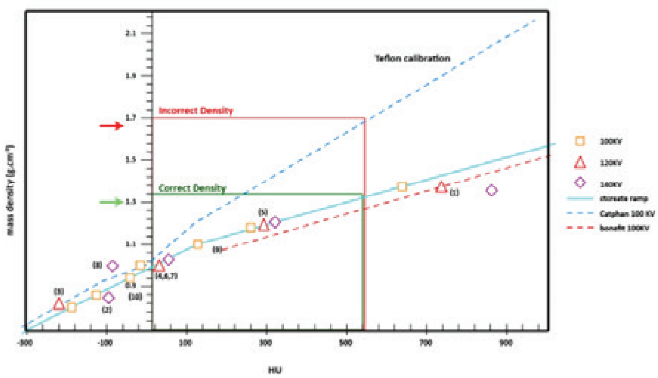
Ultrasound Tissue Mimicking

For Ultrasound imaging QA, the tissue mimicking material used in Sun Nuclear ultrasound phantoms simulates human tissue speed of sound (SOS) and matches the calibrated SOS (1540 m/sec) of the imaging system itself. The material also shows less variability in acoustic velocity and frequency response due to temperature variations than other phantoms [1], impacting geometric accuracy and sensitivity. Recently, the Sono408™ Spherical Lesion phantom found an inconsistency in focal zone settings between two “identical” ultrasound systems, as shown below. [2]



CT for Radiation Therapy Treatment Planning

In radiation therapy treatment planning, CT data is commonly used both to define the patient’s anatomy and to provide tissue density information. Accurate planning, and ultimately delivery, of the treatment is contingent on correctly calibrating the TPS to a CT scanner. Calibrating a Treatment Planning System (TPS) to plastics, rather than patient-like materials, can result in dosimetric errors. Understanding the reasons behind this is key to improving TPS dose agreement.



The figure shown above, published by Verhaegen, et al. [3] (with example and notes added by Sun Nuclear) shows the difference between planning based upon a calibration using body-like materials versus a calibration curve based on materials such as Teflon and Delrin. Those latter materials have been used as proxies for bone based upon their higher densities, but their effective atomic number, and ultimately HU values, are generally inconsistent with bony tissue. If a TPS is using the lower calibration curve based on ICRU-44 definitions, indicated by the green arrow, a given tissue around 550 HU will map to a patient density of around 1.3 g/cm^3. Using the upper calibration curve, indicated by the red arrow, which is based upon Teflon rather than tissue mimicking materials, the TPS would map this same voxel to a density closer to 1.7 g/cm^3. The impact of this is overestimating the patient density which would in turn lead to delivering too much energy, resulting in a higher dose than intended. The Verhaegen paper quantified these dose errors in some regions to be up to 10% for 6 and 15 MV photons and 30% for an 18 MeV electron beam. [3, 4]

Mammography Tissue Mimicking

The 2015 EFOMP Mammography Protocol states that "any phantom is a simplified model of clinical reality…". [5] The choice of materials is also evident in Sun Nuclear's Mammography portfolio.

The Modular DBT™ Phantom uses an epoxy resin-based composition that is highly equivalent to the Hammerstein density and elemental compositions of fat, adipose tissue, skin, and Mammary gland. [6] It is used for quality control of Digital Breast Tomosynthesis systems. Our high quality breast tissue mimicking material along with the modular design allows for thorough testing and characterization of 2D and 3D systems to EFOMP standards.

In Summary

These phantoms, and the materials they are made of, are examples of Sun Nuclear's fervent efforts to minimize clinical impact of "imperfect representations of reality", as Prof. Malone notes on the Sfera con Sfera. Our comprehensive suite of products and analysis software simplifies workflows for today's demanding Quality Management needs.

References

[1] J. Browne, et al., Assessment of the Acoustic Properties of Common Tissue-mimicking Test Phantoms. Ultrasound in Medicine and Biology, 29(7): 1053-1060 (2003)

[2] J. Zabzebski, Ultrasound Instrumentation: An Important Focus for the Medical Physicist. 2018 AAPM Spring Clinical Meeting

[3] F. Verhaegen and S. Devic, Sensitivity study for CT image use in Monte Carlo treatment planning, Phys. Med. Biol. 50: 937-9464 (2005)

[4] K. Ruchala, Sun Nuclear Clinical Note, "Calibrate Your Treatment Planning System to Patients, Not Plastic"

[5] G. Gennaro, et al., EFOMP Mammo Working Group Protocol, March 2015, Quality Controls in Digital Mammography

[6] Hammerstein R., Miller D., White D., et al; Absorbed Dose in Mammography; Radiology 130: 485-491 (1979)

Tom Webb, BSE/Biomedical Engineering

Tom Webb is a Global Product Marketing Manager with Sun Nuclear, the leader in quality assurance solutions for radiation therapy and diagnostic imaging. Prior to Sun Nuclear Tom worked in medical device manufacturing, product management, and marketing for over 30 years in markets ranging from anaesthesia systems, patient monitoring, osteoporosis, and body composition.

EFOMP Treasurer's report and budget

EFOMP Treasurer, Jaroslav Ptáček, provides the financial report for financial year 2021 and the budget for 2022

Financial report for FY 2021:

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Telephone: (+31) 30 6866 561

Treasurer's report of the financial year 2021
&
Budget 2022

This report covers the period from 04/2021 to 10/2021. The EFOMP NL account was still inactive between 01/2021 and 04/2021, and all financial activities were halted.

The EFOMP's bank account has **317 895 EUR** as of October 30, 2021.

Income:

EFOMP was able to function in 2021 thanks to a number of factors:

- subscription fees
  - NMO, IAM, and Company members;
- activities of EFOMP
  - EMP News publishing (advertisement), EEB, ESMPE;
- participation in projects
  - ENEN+;
- European Congress of Medical Physics;
- European Journal of Medical Physics - Physica Medica.

Whereas some of these sources can be considered as "income only", (NMO, IAM, and Company members fees) the remainder are invariably associated with spending.

Because in-person events could not be organized in 2021, there was no income or expenditure associated with EEB or ESMPE. Royalties, EJMP connected NMOs fees from low-income countries, and honoraria for the editor-in-chief and managing editor are all part of EFOMP's cooperation with EJMP. However, according to an agreement between Elsevier (the publisher of EJMP) and EFOMP, all honoraria go to both editors. In order to attain a 13 EUR cost per capita, EFOMP is also required to compensate the difference between the actual number of affiliated low-income NMO members and a threshold of 400 members. The revenue will be reduced by 2 574 EUR (400-202)*13 EUR if this regulation is followed. The situation with other EFOMP actions is similar to this case. Expenses used to cover the activity's organization reduce the income.

A written agreement exists for EFOMP's actions that include a third party, most typically a local organizer. The duties of interested parties are formalized in this agreement, which always includes a declaration concerning income/loss responsibility sharing. Formal agreements are also utilized to ensure that all agreed-upon requirements are carried out. The EFOMP and SEFM agreement on the ECMP2020 organization is an example of such a formal agreement. As a result, EFOMP's ECMP2020 revenue (again based on a written agreement, this time between EFOMP and AIFM) will be decreased by 13% of ECMP2020's overall surplus.

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European Federation of Organisations for Medical Physics,
an association registered in The Netherlands (registered No/KvK code 81350691)

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EFOMP hires contractors for services including website maintenance, graphic design, and EMP News publishing, among others, based on quality/reliability/cost criteria. All payments are made on the basis of invoices.

Expense:

Each part of EFOMP, such as the Governing and Advisory committees, has its own budget. All costs linked to EFOMP activities are listed in the financial report table.

EFOMP has a number of active Working groups, as well as one active Special Interest Group in 2021. The pandemic scenario impacted WGs and SIG expenses in 2021. In 2021, only the WG for the PET/CT/MRI QC procedure met face to face (October).

Budget 2022:

The **income part** of the budget is designed based on expected income trends. The educational activities of EFOMP, such as EEB and ESMPE, will be non-profit. The same is true for ECMP2022, however we do not expect this will be the case. The income and spending are designed to be the same for budgeting reasons. Because of the multiple degrees of freedom in income and expenses, predicting the financial outcome of these activities is challenging.

The budget's **expenses part** is designed with all presently known future expenses in mind. There are elements such as WG expenditures, which are based on the traditionally utilized value of "reasonable expenses" of 500 EUR per participant per meeting. For a basic WG with eight members and two meetings in its two-year term, the annual cost is 4000 EUR. The WG chairmen report to the parent committee chairs on all aspects of the WG's activity.

SIGs, on the other hand, are in a different scenario. SIGs, unlike WGs, may be very large structures. Because there is currently no experience with SIG's activities, the budget is just intended to be symbolic. During the SIG's existence, no face-to-face meetings funded by EFOMP are expected.

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European Federation of Organisations for Medical Physics,
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Income and Expenditure account 2021 and Budget for 2022:

Income and Expenditure Account 2021 and Budget 2022

	Actual 31.10.2021	Budget 2021	Budget 2022
NMO subscription	40 007,83 €	38 000,00 €	39 000,00 €
IAM subscription	12 035,31 €	7 150,00 €	12 000,00 €
Company member subscription	17 183,33 €	10 000,00 €	17 000,00 €
EMP News and Web advertising	11 162,50 €	4 000,00 €	12 000,00 €
Physica Medica – associated NMOs	2 626,00 €	25 000,00 €	2 626,00 €
Physica Medica – royalties	0,00 €	0,00 €	30 000,00 €
Physica Medica – honoraria	24 000,00 €	0,00 €	24 000,00 €
EEB	0,00 €	1 500,00 €	1 000,00 €
ESMPE	0,00 €	4 000,00 €	1 000,00 €
ENEN+	0,00 €	0,00 €	9 687,50 €
ECMP	0,00 €	100 000,00 €	100 000,00 €
Other Income	0,00 €	0,00 €	0,00 €
Total Income	**107 014,97 €**	**189 650,00 €**	**248 313,50 €**
EFOMP board			
President	160,00 €	3 000,00 €	3 000,00 €
Past-President	0,00 €	2 000,00 €	2 000,00 €
Secretary General	0,00 €	1 000,00 €	1 000,00 €
Treasurer	142,80 €	0,00 €	0,00 €
Committee Chairs	-1 258,19 €	0,00 €	3 000,00 €
Officers' meetings/General meeting	2 126,75 €	14 000,00 €	15 000,00 €
Total Expenditure EFOMP board	**1 171,36 €**	**20 000,00 €**	**24 000,00 €**
Communications & Publications Committee	0,00 €	15 000,00 €	
web domain fee	2 072,52 €	0,00 €	200,00 €
website maintenance and administration	0,00 €	0,00 €	3 000,00 €
online platforms maintenance and administration	0,00 €	0,00 €	7 000,00 €
GoToMeeting, GoToWebinar licences	3 838,37 €	0,00 €	4 000,00 €
DOI service fee	0,00 €	0,00 €	300,00 €
graphic art (posters, logos, ...)	0,00 €	0,00 €	1 500,00 €
EMP News production	1 290,00 €	0,00 €	2 000,00 €
Communications & Publications Committee - other	0,00 €	0,00 €	500,00 €
Total Expenditure Comm. & Publ. Committee	**7 200,89 €**	**15 000,00 €**	**18 500,00 €**
European Matters Committee	0,00 €	500,00 €	
EFOMP membership	4 100,00 €	0,00 €	4 100,00 €
Early career Medical Physicists group	0,00 €	0,00 €	1 500,00 €
European Matters Committee - other	0,00 €	0,00 €	500,00 €
Total Expenditure European Matters Committee	**4 100,00 €**	**500,00 €**	**6 100,00 €**
Education & Training Committee		17 000,00 €	
ESMPE	0,00 €	4 000,00 €	1 000,00 €
EEB	0,00 €	2 000,00 €	1 000,00 €
e-learning content creation	0,00 €	0,00 €	10 000,00 €
WG - Training for the healthcare professionals	0,00 €	0,00 €	5 000,00 €
WG - Diagnostic and Interventional Radiology CC revision	0,00 €	0,00 €	5 000,00 €
WG - Nuclear Medicine CC revision	0,00 €	0,00 €	5 000,00 €
Education & Training Committee - other	0,00 €	0,00 €	500,00 €
Total Expenditure Education & Training Committee	**0,00 €**	**23 000,00 €**	**27 500,00 €**
Professional Matters Committee			
WG - Involvement of exp. cycle med. dev.	0,00 €	0,00 €	5 000,00 €
Professional Matters Committee	0,00 €	6 000,00 €	1 000,00 €
Professional Matters Committee - other	0,00 €	0,00 €	500,00 €
Total Expenditure Professional Matters Committee	**0,00 €**	**6 000,00 €**	**6 000,00 €**
Projects Committee			
Projects Committee	0,00 €	1 000,00 €	1 000,00 €
ENEN+	0,00 €	0,00 €	9 687,50 €
Projects Committee - other	0,00 €	0,00 €	500,00 €
Total Expenditure Projects Committee	**0,00 €**	**1 000,00 €**	**10 687,50 €**
Scientific Committee		25 000,00 €	
WG - Breast Tomosynthesis QC Protocol	0,00 €	0,00 €	5 000,00 €
WG - Artificial Intelligence	0,00 €	0,00 €	0,00 €
WG - Angiographic and fluoroscopic syst.	0,00 €	0,00 €	5 000,00 €
WG - Role of MPE in clinical trials	0,00 €	0,00 €	4 000,00 €
SIG - Radionuclide dosimetry	0,00 €	0,00 €	500,00 €
WG_PETCTMRI QC	1 964,80 €	0,00 €	4 000,00 €
Scientific committee - other	0,00 €	0,00 €	13 500,00 €
SIG - Imaging in Dentistry	0,00 €	0,00 €	500,00 €
Total Expenditure Scientific Committee	**1 964,80 €**	**25 000,00 €**	**32 500,00 €**
EFOMP administration			
Bank charges	-99,34 €	1 200,00 €	1 000,00 €
Audit fees	0,00 €	1 500,00 €	1 000,00 €
Association management	27 369,91 €	24 000,00 €	24 000,00 €
Legal and professional fees	1 436,63 €	1 000,00 €	1 000,00 €
Currency fluctuation	122,99 €	1 000,00 €	1 000,00 €
Other institutions annual Subscriptions	0,00 €	2 000,00 €	
Other / contingency	-171,56 €	5 000,00 €	5 000,00 €
Association tax - provision	151,82 €	8 000,00 €	0,00 €
Moving fees	0,00 €	30 000,00 €	0,00 €
Physica Medica – associated NMOs	0,00 €	0,00 €	4 125,00 €
Physica Medica – honoraria	24 000,00 €	0,00 €	24 000,00 €
Total Expenditure EFOMP administration	**52 810,45 €**	**73 700,00 €**	**61 125,00 €**
ECMP			
Expenditure ECMP	9 169,50 €	100 000,00 €	100 000,00 €
Total ECMP	**9 169,50 €**	**100 000,00 €**	**100 000,00 €**
Total Expenditure	**76 417,00 €**	**264 200,00 €**	**286 412,50 €**
Result	**30 597,97 €**	**-74 550,00 €**	**-38 099,00 €**

Balance

	31.12.2020	31.10.2021		31.12.2020	31.10.2021
Assets			**Capital**		
Shares in EIBIR	1 000 €	1 000 €	Balance Brought Forward	238 874 €	275 508 €
Stock	1 083 €	1 083 €	Surplus for year	36 634 €	30 598 €
Debtors	31 451 €	4 642 €		275 508 €	306 106 €
Deposit in transit	0 €	210 €			
			Short term liabilities		
bank balances and cash			Creditors	20 284 €	8 022 €
RABO private account	0 €	317 895 €	Balance EBAMP	0 €	10 000 €
RABO deposit account	0 €	0 €	Question items	0 €	335 €
UK Sterling Account	9 752 €	0 €	Accrued liabilities	0 €	367 €
UK Euro Account	252 506 €	0 €			
Total	**295 792 €**	**324 829 €**	**Total**	**295 792 €**	**324 829 €**

Jaroslav Ptáček works as the head of the Department of Medical Physics and Radiation Protection in the University Hospital in Olomouc, Czech Republic. He is a medical physicist in nuclear medicine and focuses himself mainly on image processing, quality control and radiation protection. He is involved in teaching of medical physics and instrumentation in nuclear medicine and x-ray diagnostics in technologists' education programme. He is also involved in education and training of medical physicists in nuclear medicine in Czech Republic who are working on becoming qualified medical physicist. As a board member of Czech Association of Medical Physicists, he is involved in professional matters of medical physicists in Czech Republic. Since 2013 he has been a part of local organizing committee of ESMPE in Prague. From 2018-20 he was Secretary General of EFOMP and from January 2021 he has been Treasurer of EFOMP.

Radiation Shielding in Medical Installations

10th-12th February 2022, Prague, Czech Republic

EFOMP, in collaboration with the Czech Association of Medical Physicists and the Department of Dosimetry and Application of Ionizing Radiation of Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague invite you to the next ESMPE on **10th-12th February 2022**.

The school will be aimed at advanced tasks connected to site planning and shielding design in medical installation. The school will cover the main radioprotection aspects of the shielding calculations for typical medical installations.

This two-and-a-half day event will be accredited by EBAMP (European Board of Accreditation for Medical Physics) and is intended for practicing clinical Medical Physicists who are involved in the Radiation protection field as Radiation Protection Experts. As in past school editions, there will be an optional examination at the end for those seeking a higher level of certification beyond attendance. ESMPE have decided this event will be in a hybrid format. Participants and lecturers will be on-site in Prague where possible, but the school will also be live-streamed so participants can join live online if they cannot travel to the venue.

Content

Radiation protection principles applied to radiation shielding design
Methodology for Diagnostic and interventional X-ray Shielding (conventional, CT, IR)
Methodology for Nuclear Medicine Shielding (conventional, PET, NM therapy)
Methodology for Radiation Therapy Shielding (LINAC, special equipment, Proton)
Radiation protection surveys
Worked Examples

Final exam

The final exam is voluntary. Participants can gain additional credits when successfully pass the test.

Organisers

Brendan McClean (Chair of the School)
Paddy Gilligan, Marco Brambilla (Scientific Chairs)
Jaroslav Ptáček, Tereza Hanušová (CAMP)

ESMPE
EUROPEAN SCHOOL FOR MEDICAL PHYSICS EXPERTS

Brendan Mc Clean	Saint Lukes Radiation Oncology Network, Dublin/IE
Paddy Gilligan	Mater Misericordiae University Hospital, Dublin/IE
David Sutton	NHS Tayside Dundee, Scotland/UK
Pat Horton	Royal County Hospital Surrey/UK
Colin Martin	University of Glasgow Glasgow/UK
Brenda Byrne	Mater Misericordiae University Hospital, Dublin/IE
Susan Maguire	Mater Private Hospital, Dublin/IE
Jörn Meissner	Meissner Consulting, Munchen /DE
Ana Millan	Technicas Radiofisicas S.L., Zaragoza/ES

Thursday 12th February 2022

	Session	Title	Description	Lecturer
8:00-9:00	**Registration**			
9:00-9:30	Introduction	Setting the scene	Presentation of the ESMPE and introduction to the course	
9.30-10.30	General Concepts in Shielding	Concepts and terminology	Shielding design goals; distance to the occupied area; Occupancy Factor; Workload and Workload distribution; Use Factor.	
12:00-13:30	**Lunch break + Company Lecture**			
13.30-14.30	Diagnostic and Interventional Radiology	General Methodology for Diagnostic X-ray Shielding	Description of the BIR Shielding Model. Interventional Radiology and Cardiology. Examples of Shielding Calculations	
14.30-15.30	Diagnostic and Interventional Radiology	General Methodology for CT scanner Shielding	Description of the BIR Shielding Model. CTDI, Dose-Length Product, Isodose Map Methods. Examples of Shielding Calculations.	
15:30-16:00	**Coffee break**			
16:00-17:00	Diagnostic and Interventional Radiology	Radiation protection surveys	Visual inspections. Transmission Measurements. Survey reports	
20:00-23:00	**Social dinner - participants + lecturers**			

ESMPE
EUROPEAN SCHOOL FOR MEDICAL PHYSICS EXPERTS

Friday 11th February 2022				
	Session	**Title**	**Description**	**Lecturer**
09:00-10:00	Nuclear Medicine	Site planning of a Nuclear Medicine Department	Classification of risk. Structural requirement for ventilation, plumbing, surfaces. Paths for workers and patients. Management of wastes	
10:00-10.30	**Coffee break**			
10:30-11.00	Nuclear Medicine	Shielding requirements for a typical Nuclear Medicine Department	Shielding of examination treatment rooms, hot lab, patient holding rooms	
11:00-12:00	PET/CT	Shielding requirements for a PET/CT facility	Shielding of examination rooms, patient holding rooms. Examples and problems	
12:00-13:30	**Company Lecture + Lunch break**			
13:30-14:30	Radiation therapy	Shielding of LINAC Vaults	Description of the shielding Model. Basic design principles, structural and safety concerns.	
14:30-15:30	Radiation therapy	Doors and mazes	Maze and door designs; Direct shielded doors, Neutrons, Materials	
12:00-13:30	**Company Lecture + Lunch break**			
16:00-17:00	Radiation therapy	Proton therapy	Shielding of a proton therapy installation	
17:00-18:00	Radiation therapy	Brachytherapy and Non-conventional radiotherapy treatment units	Halcyon, HDR Brachytherapy Tomotherapy, MRI Linac, Gammaknife, Cyberknife;	

Saturday 12th February 2022				
	Session	**Title**	**Description**	**Lecturer**
09:00-10:00	Radiation Therapy	Shielding surveys	Construction Inspection; Interlocks, Restrictive Devices, and Radiation Warning Lights and Signs; Survey Reports	
10:00-11.00		Case Studies 1	Where shielding design has had an impact on good and bad patient and staff experience	
11:00-11:30	**Coffee break**			
11:30-12:30		Case studies 2	Where shielding design has had an impact on good and bad patient and staff experience	
12:30-13:30	**Final examination**			

ČSFM
CZECH ASSOCIATION OF MEDICAL PHYSICISTS

ESMPE
EUROPEAN SCHOOL FOR MEDICAL PHYSICS EXPERTS

Course language	English
Level	MPE
MPE	
Registration fee* (2 main meals, 5 coffee breaks, 1 social dinner)	300 € 350 € (from 22nd December 2021)
Reduced registration fee* • subsidized by EFOMP • first-come, first-served policy • deadline for application (20.12.2019)	150 € - for the first 15 attendees (max. 2 from one country) coming from the following European countries: Albania, Belarus, Bosnia & Herzegovina, Bulgaria, Croatia, Cyprus, Estonia, Greece, Hungary, Kosovo, Latvia, Lithuania, North Macedonia, Moldova, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Turkey, Ukraine.
Maximum number of participants	80
Duration	10th – 12th February 2022
Study load	17.5 hours of lectures and demonstrations
Venue	Department of Dosimetry and Application of Ionizing Radiation, Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, Břehová 7, 115 19 Prague 1, CZECH REPUBLIC
GPS coordinates	50°5'27.737"N, 14°24'58.713"E
Accommodation	Individual
Information, programme at:	www.efomp.org
Registration	Electronic registration via EFOMP website
Registration period	22nd November 2021 – 22nd January 2022

* payment must be done in 14 days following the pre-registration, otherwise pre-registration will be cancelled and neither free place nor subsidized or ordinary fee can be granted for repeated registration

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ČSFM CZECH ASSOCIATION OF MEDICAL PHYSICISTS

Women in Medical Physics

Historically, physics was a male dominated field. Like many other STEM fields women were not welcomed by their male colleagues as equals. Despite all odds, there have been exceptional women who fought hard to leave their mark in the field. Starting with the first female double Nobel prize laureate Marie Curie and her priceless work with radioactivity, the field of therapeutic medical physics was paved, with Radium becoming a hot method for the treatment of tumours. According to a recent paper published in the Medical Physics journal, if the number of female AAPM members continues to increase at the current pace of 0.4% per year, it will take nearly 70 years to achieve gender parity.

"With great power comes great responsibility". Women in STEM careers such as Medical Physics are faced with many challenges. Then comes the balance of power of responsibilities. Being a Medical Physicist is indeed a challenging career where most of our work is done in the evenings and weekends. We are looked upon as a safety net and as a resource for quality improvement in patient care. The glue that joins the clinic together, mediating between physicians, dosimetrist, and radiotherapists. Imagine juggling such a career with an equally challenging life at home being a mother, wife or partner and household keeper. As much as we would like to believe that there is gender equality, it is still a struggle for women to actively work and compete in the challenging profession of a Medical Physicist.

Edith Quimby was the first therapeutic medical physicist in 1919, which is over 100 years ago where women were still facing challenges in the field. Her invaluable research on how and where to place radioactive needles directly into the tumour for maximum therapeutic efficiency, was in use for years and resulted in the "Quimby Rules". These were a set of guidelines for the implantation of radium needles and were used up to the 1980s until the introduction of computerised planning. She later became the first woman President of the American Radium Society and went on to suggest the initiation of the American Association of Physicists in Medicine which is now one of the largest medical physics networks in the world. Nowadays women make up approximately 28 % (as per a 2015 report by the International Organization of Medical Physics (IOMP)) of the medical physics workforce and the number of women enrolled in medical physics programmes is increasing.

My first encounter in a radiation oncology department was a visit to one of the first radiation oncologists in Cyprus, Dr. Helen Soteriou. At that time, I was only 16 years of age and I recall taking a flight of stairs to the basement. Little did I know that I would work at a radiation oncology department as a medical physicist in the future.

Coming from a multicultural family and living in several countries made me a traveller from a young age. Exposed to so many languages and cultures made it easy for me to blend in. The true challenge was rising as a female scientist. My love for physics came from my physics high school teacher who put his faith in me and gave me praise and recognition that I was a true physicist at heart. He introduced me to medical physics as one of my A-Level modules. I went to university and to nobody's surprise I chose physics as my major, and I pursued an undergraduate physics programme with my final thesis course in medical physics. It was as if I was destined to be a medical physicist! I was the second female medical physicist in Cyprus, working on commissioning the first modern medical radiation accelerators in 1999. I was blessed and lucky to have a great mentor, Dr. Chris Constantinou, who further supported and nurtured my love for the field. Then unfortunately, I had to leave Cyprus for personal reasons where I had to reprove myself in a new job in Lebanon. As mentioned earlier, being a woman physicist is inspiring, trying to balance both the worlds of being a mother, a wife and housekeeper together with all the responsibilities that come with being a Medical Physicist. The first medical physicist in Lebanon was a female physicist who dedicated most of her life to support the first cancer centres. Female medical physicists are well respected and recognized in Lebanon. There were not many to start with. But as a female medical physicist I always needed to sacrifice hours away from my family and immerse myself in my new role. Finally, after proving my worth we had to move once again from a small country in the Mediterranean to a huge hospital network in the US which was a thrilling new experience. I once again worked hard and grounded myself successfully in the new position where I managed to get promoted to a managerial position in almost less than a year. Yet, here as well, there is by far no gender equity and the female physicists' team is less than 30 percent.

Looking back at my journey, I wouldn't have done anything differently. I am very lucky to be in a family that fully understands the value of this role and have lived with the sacrifices that come with this profession.

References

Covington, E.L., Moran, J.M. and Paradis, K.C. (2020), The state of gender diversity in medical physics. Med. Phys., 47: 2038-2043. DOI: 10.1002/mp.14035

Feature Profile: Edith Quimby: First Woman Medical Physicist, by David J. Brenner. Physicians (columbia.edu)

Tsapaki V, Rehani MM. Female medical physicists: the results of a survey carried out by the International Organization for Medical Physics. Physica Med. 2015;31:368–373. DOI: 10.1016/j.ejmp.2015.02.009

Doris Demetriades Raad has been working as a Clinical Medical Physicist for nearly 20 years with an American Board of Radiology Certification in Therapeutic Medical Physics for over 10 years. Her training and practical experience encompasses shielding calculations, commissioning new technology and programs such as SRS and SBRT, quality assurance and treatment planning for complex and simple techniques in addition to fully supporting the clinic ensuring the best standard of care for patients. She also has experience in HDR brachytherapy mostly for gynecological applications. Currently she provides Therapeutic Physics services for UPMC's Radiation Oncology Department covering the South/ West Region (Beaver, Moon, St. Clair, Uniontown, Washington).

EFOMP COMPANY MEMBER ARTICLE

GE Healthcare: MotionFree – Device-less digital respiratory gating technique, seamlessly integrated in PET imaging routine

Respiratory motion is one of the main factors significantly impacting PET/CT acquisition, as it typically takes several minutes in which breath holding is not an option. It negatively affects about half of all PET/CT procedures, not limited only to the thorax but also to the abdomen and pelvis areas. Since PET is a tomographic technique and uses coincidence photon detection events along a nearly straight line, movement of a source with positron decays will produce events which cover a larger detector area, hence when these events are reconstructed into blurred and fainter images, this may be associated with inaccurate localization of features of interest.

Motion artifacts degrade PET image quality and lead to reduction in lesion detectability. Quantitation accuracy is also impacted by respiratory motion artifacts, resulting in reduction in standard uptake value (SUV) and overestimation in lesion volume. These erroneous results are often hard to detect and may impact diagnosis, treatment planning and follow up.

These artifacts can be eliminated by utilizing GE Healthcare's powerful respiratory motion management techniques: Q.Static, 4D Gated and Q.Freeze.

However, despite the importance of respiratory motion management, it is still not commonly used as part of standard clinical practice. This is because motion management techniques currently offered by the different vendors require external gating devices that are mostly based on a pressure sensor or an infrared camera with a tracking block. The setup and interaction with these external devices are cumbersome and time consuming, making the entire process challenging and not as reliable as needed.

GE Healthcare's MotionFree is the first-ever digital respiratory gating solution that derives respiratory waveforms from PET coincidence data, without requiring an external gating device. It is available as part of protocol definition or prescription, allowing active monitoring of respiratory motion for every field of view (FOV) and every patient. It is fully and seamlessly integrated in the existing Q.Static acquisition protocol, and can be used in every PET/CT procedure. The user is no longer required to decide which FOVs and which patients should have motion correction applied. This is possible thanks to the fact that MotionFree automatically, during live acquisition, detects if a respiratory motion is affecting the current scan FOV and can modify the scan duration according to user preferences. If significant motion is detected, the feature performs quiescent phase-based Q.Static reconstruction.

Being a SW-only option, the feature addresses the challenges of an external gating device. It significantly reduces scan setup time and optimizes overall scan time, and it applies motion correction only if there is significant respiratory motion in the current FOV. MotionFree can be applied prospectively as well as retrospectively on any previously acquired scan without respiratory information recorded from a device, making respiratory motion management accessible at any time for any data.

GE Healthcare has designed MotionFree to leverage the 4-dimensional information encompassed within the coincidence events to derive respiratory waveforms for the current FOV. This makes it superior to a respiratory signal measured at a fixed patient location with respect to the thorax using a device-based approach.

- **You can read or download the full white paper** here
- **To learn more about the Clinical Benefits of MotionFree click** here
- **To learn more about the Workflow Benefits of Motion Free click** here

Hanan Khamis, Ph.D., Clinical Applications Engineer
Scott Wollenweber, Ph.D., Principal Engineer

Physica Medica: Editor's Choice

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

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

K. Fukata et al. **Retrospective comparison of rectal toxicity between carbon-ion radiotherapy and intensity-modulated radiation therapy based on treatment plan, normal tissue complication probability model, and clinical outcomes in prostate cancer** Phys. Med. 2021; 90: 6-12 https://www.physicamedica.com/article/S1120-1797(21)00296-9/fulltext

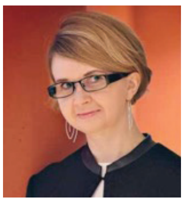
This paper presents the results of a retrospective study on patients treated with carbon-ion radiation therapy (CIRT) and hypofractionated intensity modulated photon radiation therapy (IMRT) for prostate cancer. The patients were followed up for rectal toxicity and the clinical results were compared with the treatment outcome predictions made by applying a normal tissue complication probability (NTCP) model. The actual dose distributions for the carbon-ion treatment plans and the IMRT plans, respectively, as well as the NTCP modelling results predicted a lower probability of rectal complications for the carbon-ion treatments compared to IMRT. However, the actual clinical outcome in terms of rectal toxicity was the same for both modalities, indicating that one has to take into account the possible uncertainties in modelling NTCP in order to make robust predictions.

T. Steinsberger et al. **Extension of RBE-weighted 4D particle dose calculation for non-periodic motion** Phys. Med. 2021; 91: 62-72 https://www.physicamedica.com/article/S1120-1797(21)00324-0/fulltext

This is also a paper on carbon-ion radiotherapy, but in this work the focus is on thoracic tumours and the challenges to treat them with carbon-ion radiation therapy associated with the irregular target motion. The authors present an in-house treatment planning system to calculate RBE-weighted dose distributions in CIRT in case of non-periodic CT image sequences. The theoretical calculations were validated experimentally on a moving, time-resolved ionization chamber array and the impact of irregular motion on treatment quality was assessed using a virtual 4DCT thorax phantom. The work presented in this paper could therefore contribute to further developing motion mitigation techniques that would allow CIRT for moving targets as those in the thorax to be used to its full potential.

L. Vander Veken et al. **Incorporation of tumor motion directionality in margin recipe: The directional MidP strategy** Phys. Med. 2021; 91: 43-53 https://www.physicamedica.com/article/S1120-1797(21)00325-2/fulltext

The target motion was also the reason of concern for this third paper selected to be highlighted. The authors are introducing a Mid-Position (Mid-P) strategy that allows motion directionality to be incorporated into the margins for defining the planning target volume (PTV). Although based on a rather limited number of patients, the study showed that the PTV defined based on the new Mid-P strategy was comparable with the conventionally delineated one and therefore the directional Mid-P method might lead to delivering a higher dose to the gross tumour volume in stereotactic body radiation therapy for lung tumours and hence potentially increasing the probability of tumour control.



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

EFOMP COMPANY MEMBER ARTICLE

Varian: An Industry/ Academic Partnership Yields Fruit - An Ultra-High Dose Rate Beam Monitoring Tool

varian
A Siemens Healthineers Company

Varian, supported by the InspireProject, partnered with two members of the FlashForward Consortium to test a novel ionization chamber for FLASH research

Varian, in partnership with the Danish Centre for Particle Therapy (DCPT) at Aarhus University Hospital and the Cincinnati Children's Hospital/UC Health Proton Therapy Center, has created a specialized dose monitoring tool capable of accurately measuring dose at the ultra-high dose rates involved in FLASH therapy. The new tool—a specialized ionization chamber—was subsequently deployed at Cincinnati Children's in support of FAST-01 (Feasibility Study of FLASH Radiotherapy for the Treatment of Symptomatic Bone Metastases), the first-ever human clinical trial of FLASH therapy using protons.[1]

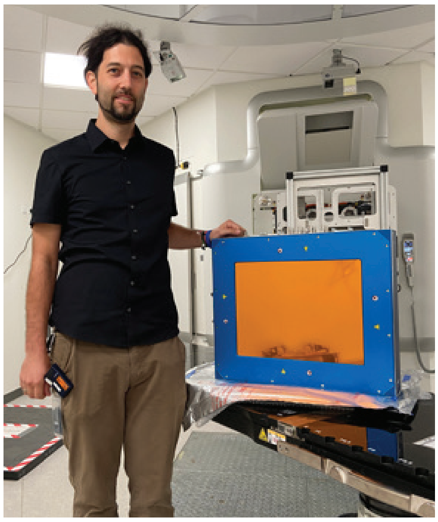
This project received early financial support from Inspire, which was launched in the EU in the Spring of 2018 to promote collaboration and research among clinical proton therapy centres, academic institutions, and industry partners. Led by the University of Manchester in the UK, Inspire (Infrastructure in Proton International Research) secured EU funding to provide a research infrastructure for proton therapy research.

"Our goal was to build a European research infrastructure and develop it through joint research activities, facilitate knowledge exchange and allow best research practices to be shared across centres," said Karen Kirkby, a Professor at the University of Manchester School of Medical Sciences and The Christie NHS foundation Trust who spearheaded the creation of Inspire. "We also wanted to support development of an innovation pipeline for research that could be translated into clinical practice and industrial products. Varian's work with its clinical partner institutions on the ultra-high dose rate monitoring tool fit very nicely with our objectives."

Prof. Karen Kirkby

History of the Project

As far back as 2017, researchers at Varian began discussing the need for an ultra-high dose rate beam monitor that could work with Varian's ProBeam® pencil beam scanning system. According to Simon Busold, research scientist with Varian's Proton Therapy group, the technologies available in 2017 for measuring dose had been developed for conventional radiotherapy dose rates. By contrast, FLASH delivers dose some 100 times faster. None of the tools available in 2017 could handle the ultra-high dose rate of a FLASH treatment. Busold and his colleagues looked at the current technology and came up with a solution that is, he says, "rooted in established ionization chamber technology. We found that, with reasonable modifications, we could make a system that works." The Varian team first built some miniature "proof of concept" devices, and subsequently parlayed that work into a prototype for testing.



Simon Bushold

"This kind of a tool is absolutely necessary for translating FLASH research into patient treatment," added Professor Per Poulsen, Professor of Medical Physics at DCPT. "For clinical use of the technology, we need complete confidence that dose is being delivered correctly. The experiments we are conducting could not be done without this tool, which is helping us to obtain usable, relevant data."[2]

"Manchester, Aarhus and Cincinnati teams are all members of Varian's FlashForward Consortium, a group of institutions from around the world that collaborate on FLASH-related research, clinical implementation, and advocacy efforts," said Adam Earwicker, Development Director for Varian's FLASH program. "We are excited to see these cooperative relationships panning out for the benefit of all, and also deeply appreciate the support that was provided by the Inspire project."

[1] The FLASH-enabled ProBeam® system is an investigational device and is limited by United States law for investigational use.

[2] FLASH therapy is under development and not available for commercial sale.

Special Interest Group for Radionuclide Internal Dosimetry (SIG_FRID)

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

During the last part of Summer and the beginning of the Autumn, the SIG_FRID has kept up its work promoting radionuclide internal dosimetry in clinical practice. The number of members keeps increasing and to date there are 109 SIG_FRID members. New applications are always welcome (see the box below for how to become a SIG member).

The Steering Committee (SC) has had monthly meetings (23/08, 08/09, 04/10, 04/11), and the next general SIG_FRID meeting will be held on December 10th from 9:00 to 11:00 CET.

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

The latest advances in the priorities are summarised below. In those priorities that are not mentioned, the situation is similar to that in the previous issue of EMP News:

1. **Survey on the practice of clinical radionuclide dosimetry**

   The objective of this priority is to collect up-to-date information on the status of radionuclide internal dosimetry in the member countries. A draft version of the questionnaire for the survey has been worked on by the participants in this priority. This version will be tested within the SC to evaluate within different countries whether anything needs to be adjusted.

   After this, the survey will be distributed to NMO representatives to collect all necessary information within the countries. The NMO representatives will be asked to fill one questionnaire per country when possible, however a centre-specific questionnaire will also be provided in case it is deemed preferable.

2. **Available resources, protocols, tools, bibliography**

   The main objective is to provide SIG_FRID members with a list of relevant publications, clinical trials, dosimetry software and data resources. The structure and contents of a public document with that list has been discussed among participants in this priority. This document would be shared through the EFOMP website, which has been discussed with the EFOMP's website team, and will be accessible to all centres.

4. **Communication**

   A monthly newsletter has been issued for SIG_FRID members as well as quarterly updates in EMP News.

   A logo contest is open to all SIG_FRID members in order to find a logo that can represent the SIG_FRID. The logo should be selected during the next general SIG meeting from the proposals sent by SIG_FRID members.

5. **Scientific issues**

   This priority aims at promoting scientific debates. The first Scientific Meeting of the SIG_FRID was held online on September 23rd, from 15.00 to 17.00 CEST, and was followed by up to 60 people!

Attendees of the first SIG_FRID Scientific Meeting

For this ***first edition***, the following talks were given:

- Use of 3D printed phantoms for dosimetry, Jill Tipping.
- The MEDIRAD Project, Jan Taprogge.
- Quantitative imaging comparison exercises from the MRTDosimetry project, Johannes Tran-Gia.
- Monte Carlo patient-specific dosimetry and issues caused by artefacts in functional scans, Daniele Pistone.
- LUTATHERA dosimetry with two SPECT/CT scans, Carlo Chiesa.
- Dosimetry with ^{177}Lu-DOTA-TATE in clinical routine, Lore Santoro.
- Impact of personalized treatment in HCC patients treated with resin ^{90}Y-microspheres: interim analysis of a randomized clinical trial, Lidia Strigari and Giuseppe Della Gala.

During the first meeting, some topics such as determination of calibration factors, or time sampling schedules, goodness of fit and selection of fit functions were proposed as possible topics for specific working groups. As a consequence, a SIG Work Group on "Time-Activity Data Fitting", coordinated by Gerhard Glatting, has been formed and the first meeting was held on October 28th. New WGs are expected to be created in the next future, and some guidance for the creation of SIG WGs will be provided to encourage and facilitate that process.

The ***second edition*** of SIG_FRID scientific meetings will be held in January 2022. The objective is to have these as quarterly events, and the structure was slightly modified as compared to the first edition. The meeting will be focused on time-activity curve fitting, for which a moderator will be nominated. Total duration will be 90 min, with 2–3 talks of 30 min in total, and 60 min for discussion and conclusions.

Relevant upcoming meetings:

- Targeted Radiopharmaceuticals Summit. Berlin. (December 7–9). https://targeted-radiopharma.com/
- ESMIT Advanced course. Practical Implementation of Clinical Dosimetry in Nuclear Medicine Therapy. Vienna. (December 9–10). https://www.eanm.org/esmit/advanced-courses/practical-implementation-of-clinical-dosimetry-in-nuclear-medicine-therapy/
- 4th European Congress of Medical Physics. Dublin. (August 17–20 2022) https://www.ecmp2022.org/

How to become a SIG member:

The SIG is meant for networking professionals with an interest in radionuclide dosimetry. Membership is open to all EFOMP members.

The membership application procedure is explained on the SIG pages of the EFOMP web site: https://www.efomp.org/index.php?r=pages&id=sigs

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

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

Meet the Prof – Interview with a Medical Physics Teacher

EMP News's Educational Advisor, Danielle Dobbe-Kalkman, introduces a new series of articles in which she interviews experienced Medical Physics teachers to see what can be learned from their experience.

The first person to be interviewed was Professor David Lurie, Emeritus Professor at the University of Aberdeen in Scotland and Chair of the EFOMP Communications and Publications Committee. He taught and researched MRI physics from the mid-1980s until his retirement in October 2021.

DD: Can you tell me something about your first experiences as a teacher?

DL: For that, we have to go right back to the start of my academic career. I got my degree in physics at Aberdeen University, and then I went to the University of London to do a Master's degree in radiation physics, followed by a PhD in medical physics. I got my first job as a post-doc researcher in the field of MRI at the Biomedical Physics department of the University of Aberdeen in 1983. Then, in 1985 I was fortunate enough to be appointed to a permanent Lecturer position there. Up to that time I had not done any teaching at all – I had only given one or two lectures at conferences about my research. When I first had to teach it was actually quite scary, and I was a bit nervous to be honest. At that time there wasn't any training for university teachers and apart from my own experiences as a student, and watching other teachers, I didn't really know how to do it at first. Looking back, I don't know how good (or bad) my first lectures were. I was given the task to explain basic MRI physics to post-graduate students. There was no digital projector, just a chalk blackboard and an overhead projector and transparency sheets. For my first lectures I laboriously prepared overhead sheets, using coloured felt tip pens, and then I would go through them to explain the concepts. Once I started doing these lectures, it wasn't quite as scary as I thought it might be. And over time I felt more and more comfortable in the role of teacher.

DD: Did your way of teaching change over the years?

DL: Yes, it definitely did. Right from the start I tried to put myself in the position of the students, not knowing what I know now, and this has always guided my way of teaching. When I started in the mid-eighties I didn't know how to do that properly, but I developed my style of teaching around that premise. I asked myself what is difficult to understand for them. What helped me in this was that I always tried to remember the parts that I found difficult when I started as a new post-doc in MRI, because my PhD wasn't in the field of MRI.

As the years went on I developed my teaching style and one thing I tried to develop was to do things and say things in the lectures that the students would remember, even by sometimes being a bit silly (not so hard for me!), because those are the things that help them to remember. One example is that in MRI physics there's a lot about spins dephasing and rephasing. In trying to get students to remember that concept, I would stand up in front of the class and would do something I called the "gradient echo dance", during which I would wave my hands around, this way and that. I also brought on things to simulate motion, like a toy gyroscope, and would use it in front of the class. And I made things to demonstrate how the signals are produced in MRI, using a rotating bar magnet inside a coil of wire to generate a sine wave signal on an oscilloscope.

DD: How do you think your students would have described you as a teacher?

DL: When I started teaching there was no formal student feedback mechanism. Once we did start getting feedback from the students, it was generally pretty good. I found out that they did appreciate my teaching style, the demonstrations and things like that. I think they thought that I was quite good at explaining science. It has been gratifying that the positive student feedback has continued right to the end of my teaching career.

DD: What did you like most about teaching?

DL: That was definitely the interaction with the students, seeing them learning and hopefully doing well.

Especially the students who then stayed on to do PhDs. It was good to know that I was helping them in their academic journey.

DD: What do you think is the most important feature of a good teacher?

DL: I think that would be engagement with the class and the students and being able to explain things to them. Also, to give the students the opportunity to ask questions and encourage them to ask questions during the lecture, as opposed to just at the end of the lecture. Interactivity is increasingly recognised as very important in teaching and learning.

DD: For scientists in academia, teaching is sometimes considered as an unwelcome chore that's part of the deal. How was that for you?

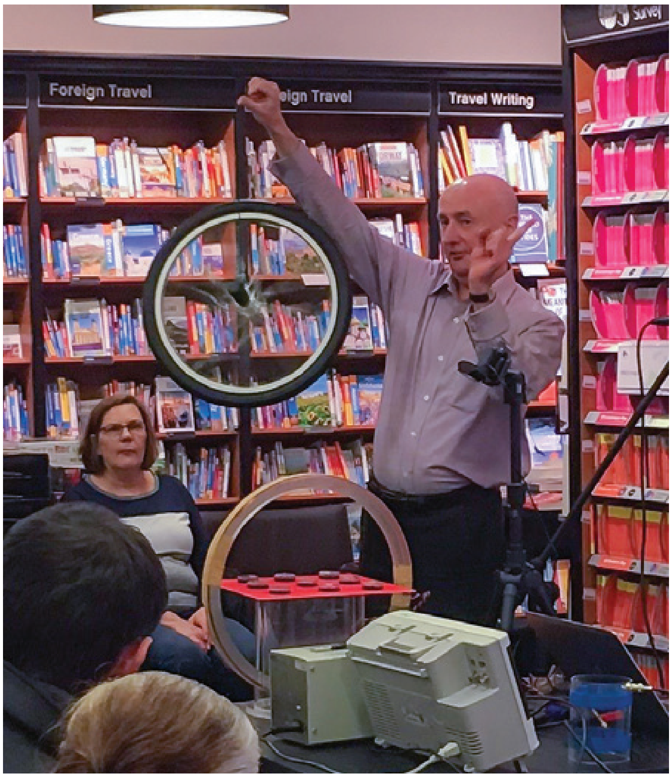
DL: I have never thought of teaching as a chore, and I enjoyed teaching – well, mostly. I think in many ways teaching and research should go hand in hand. Researchers often have an extra insight into their subject, which they can pass on to students through their teaching. Indeed, I feel that as a researcher it is part of your duty to prepare the next generation by teaching.

In the past, teaching activities were perhaps not valued by universities as much as they should have been, but thankfully that's changing now. In Aberdeen University, for example, there are both research and scholarship tracks for academic staff, so that those who are mainly involved with teaching can be promoted and can end up as full professors. I know that many other universities are going down similar routes, which is definitely a good thing.

DD: Can you share a few teaching experiences that stood out to you?

DL: I was involved in organising and teaching on a Summer School on MRI, which took place in our Department for about 20 years, for one week every summer. It was a week of intense teaching, with practical sessions as well as lectures. In the 1990s we took that concept to Thailand after I had developed a collaboration with academics from the North East of Thailand, who I had met at a conference dinner in Nottingham. We ended up delivering the Summer school at Khon Kaen University in Thailand on four occasions, which was a fantastic experience.

In recent years I have been increasingly involved in public engagement. This has involved giving talks for the general public about our research and about how MRI works. There was a series of talks called Café Scientifique. I gave one of these Café Sci events at a local bookshop that they kept open in the evening. I talked for 30 or 40 minutes and gave all my demonstrations with a big bicycle wheel and other toys to demonstrate how MRI works. When you teach to a general public, you can't assume any mathematical knowledge so that changes how you teach, but I really enjoy doing that! And I got a lot of positive reactions.



David Lurie using a bicycle wheel to explain spin precession at a Café Scientifique public engagement event in 2017. Other props can be seen in the foreground.

A couple of years ago I had a very interesting engagement experience – at a prison! This was part of a series of lectures organised by people from the University of St Andrews in Scotland, who had got a grant for a programme called "Science behind bars". This involved taking researchers into prisons to explain science to groups of inmates, as part of their continuing education programme. When I was invited, I hesitated at first, but I talked to people who had already done it and they told me it was actually a very rewarding experience. So I went with two colleagues to a high security prison in the north-east of Scotland, and delivered a session on the theme of magnetism (including MRI), to three separate groups of prisoners. It was a modern prison, so they had a very good teaching facility. We were able to take props with us, like magnets and gyroscopes. In order to make it interactive, we helped the inmates to make electromagnets using steel bolts, insulated wire and batteries; they competed with each other to see which electromagnet could pick up the most paperclips! The participants were very well engaged, and asked many questions, and it was indeed really rewarding to do this.

And in 2018 I was invited to lecture to 70 or 80 trainee medical physicists in Hong Kong. It was very intensive, because for 5 days there were non-stop lectures about MRI physics. But this was also a great experience.

Did you learn something yourself as well by being a teacher?

For sure, yes. For many years I have lectured on different aspects MRI physics, including parts of the subject that I previously didn't know much about, and I found out that one of the best ways of learning is to teach! And over the years I also developed my teaching skills and presentation skills, by teaching and presenting to diverse audiences.

DD: Do you have tips for other teachers or professors?

DL: My main tip would be to make sure you do engage with the students. That's the main thing!

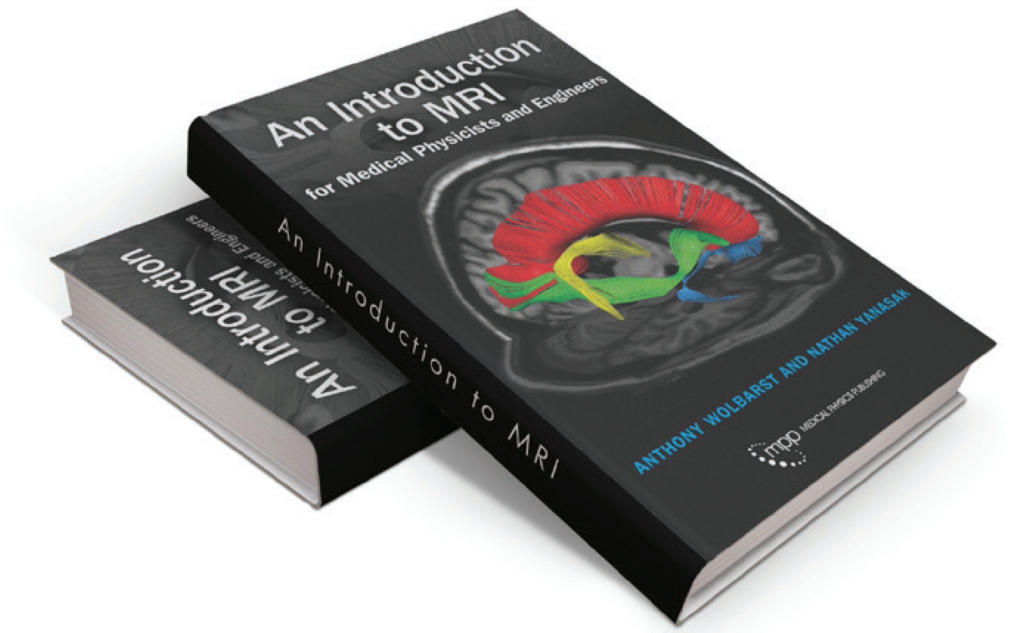
Another tip is about note-taking by students. In the days when I started lecturing, the students had no choice but to take notes and write things down during lectures. Now students get PDFs of the Powerpoint slides, and I don't think that's always a good thing, to be honest. You can see that some students just sit back in their chairs during lectures and I don't think it helps their learning. So I recommend telling students that it's very important to take their own notes during lectures.

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

BOOK REVIEW

Book Review: "An Introduction to MRI for Medical Physicists and Engineers" by Anthony Wolbarst and Nathan Yanasak

Medical Physics Publishing (2019), 318 pages. Hardcover: ISBN 9781930524200; eBook: ISBN 978-1-930524-58-3, $120 (both versions). Link to book on publisher's web site.



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If you already know the book "Physics of Radiology" or one of the others by Anthony Wolbarst, you won't be surprised about the quality of this one on the topic of MRI. For this book he teamed up with Nathan Yanasak, an expert in MRI, adding up 40 years of teaching experience in total. Before I go into details about the 16 chapters of this book, let me tell you what I like the most about it. As the subtitle indicates, this book is not only written as an introduction to MRI for Medical Physicists from undergraduate level on but also for engineers. This can be noticed by the technical facts that are mentioned in various places throughout the book, e.g. when it comes to the "real" implementation of MRI when the authors include the residual readout time (RRT) of MR pulse sequences in extension to the pure physical facts. Besides instructive and well-coloured illustrations, there are numerous well placed exercise questions in the text to guide the reader to work out the essential ideas and concepts of MRI, ideally discussed with course mates.

The introductory chapter 1 (available in part as a free PDF on the publisher's website) gives a good overview of what is to come in the following chapters to make you keen to read on. Chapter 2 on electromagnetism and the quasi-quantum magnetic moment of the proton in a single voxel provides the necessary background and formulae, where most other MRI books would only refer to dedicated books on electromagnetism. The authors are not afraid to provide the full set of formulae to be physically correct, but never forget to catch the reader's interest by down to life comparisons. One example: I like very much the authors' comparison of scanning the NMR-frequency through the proton resonance to slowly tuning the radio frequency during a January blizzard in the Dakotas and suddenly hearing Pink Floyd music from a soft-rock station coming out of the speakers instead of the static noise before!

Chapter 3 deals not only with the MR frequency encoding of a 1D-patient by the use of gradient fields, but also on the basic concepts of image quality parameters reaching beyond the pure MR topic. This might well be because one of the authors has already written about this in one of his famous books, but it adds nicely a broader scope to this introductory book. Chapter 4 extends MR to a more detailed look at the local magnetization of a voxel taking into account the spin dynamics, introducing the first relaxation time T_1. Like the section on image quality parameters before, chapter 5 is another one providing basic background knowledge to the reader about the mathematical machinations like the Fourier transformation and k-space that are needed for a full understanding of MRI by detailed examples and figures. This and others that "look beyond" the pure topic of MRI render this book so valuable to the reader who is new to the field. On top and important to beginners, the authors provide explicit warnings of common misconceptions. Chapter 6 is on the classical approach to proton NMR in a single voxel by the 90°-pulse and the Bloch equations, including the concept of the rotating frame of reference.

Chapter 7 takes the reader stepwise to the MR pulse sequence to read out the MR-signal to get an image of a 1D-patient. The authors provide here not only the full mathematical equations again, but also the technical aspects of sampling the MR-signal in time steps of Δt_{dwel}l to get the data in k-space before the Fourier transformation of it. The more technical interested reader will like chapter 8 on the MRI instrumentation that extends from the main magnet to phased array receiver coils. The RF part is explained by the basic electronic circuit of an AM radio receiver. (Maybe one of the authors is a ham radio fan?!)

The next two chapters 9 and 10 are on the relaxation times T_1 and T_2 and their molecular background, explained by the classic Bloembergen theory. Starting with chapter 11 the reader is first introduced to the spin echo pulse sequence for a simple 1D-patient again, before the authors extend the image reconstruction to 2D in chapter 12 by means of spin warp. Here, from the start on, the true effects of partial saturation depending on the choice of the parameters TR and TE with respect to the relaxation times are taken into account in the formulae. The T_1-, T_2- and PD-weighting is explained in good didactic manner by the help of magnetization-time diagrams as well as the corresponding signal formulae. In this chapter, the need for the refocussing gradient fields in the pulse sequences is not only stated as often found in other books, but explicitly explained by the phase changes introduced by the readout gradient field itself.

The reader is introduced to different concepts of data sampling paths in k-space that are explained in more detail in the following chapter 13 on fast imaging techniques, dealing with echo trains and the gradient echo techniques, multiplexing the slices in time and space as well as undersampling tricks that make use of the inherent symmetries of k-space.

The final three chapters are on MR sequences for fluid motion (MR angiography, perfusion and diffusion tensor imaging and the fMRI BOLD technique), QA and safety advices of an MRI system and a broad look into the horizon of MRI developments for the future by briefly touching the topics of quantitative imaging, compressed sensing, low and high field MRI, CEST for other nuclei, helium free MRI systems, quiet imaging, hybrid PET-MRI and the application of artificial intelligence or quantum computers.

If you wonder now, how Wolbarst and Yanasak manage to get all this information that include besides an extensive index of the book also an appendix with a long list of symbols, their meanings/definitions and their occurrences in the text, tables of MR-relevant units, constants, relationships / principles and the periodic table into only 318 pages, please realize that this book is printed on a page format of 8½ x 11 inches, larger than most other textbooks. Finally, I enjoyed reading this book very much and recommend it to you, too, if you are looking for an excellent introduction to MRI!

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

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

The 3rd EFOMP-COCIR Webinar "IEC standards for diagnostic imaging equipment"
November 26th, 2021, 12.00 - 13.30 CET

Standards play a crucial part in our lives. In healthcare, standards have an indispensable role for the proper functioning of medical devices, for correct transmission of information, for therapy, for monitoring and support in treatment, and much more. Thus, standards help manufacturers to produce safe medical devices with constant high quality and, as such, help competent authorities to ensure that medical devices in their country provide the performance they want for their citizens.The 3rd webinar will cover standards in diagnostic imaging equipment. Both speakers will give examples of the standardization process based on personal experience. The importance of active participation from experts with different background, both theoretical and practical, in the development of the IEC documents will be highlighted. More info here.

The 5th NACP-EFOMP webinar on “Quality Assurance and Patient Dosimetry in Radiology”
Tuesday, December 7th, 2021, 12:00 - 15:00 CET

The purpose of this series was to introduce medical physicists to new tools and methods that can be applied in QA routines to improve efficiency and quality of work. These methods include automation of image-based QA, application of model observers and AI-based image quality analysis. Topics related to patient specific dosimetry, dose tracking and protocol management systems; tools that are essential for a medical physicist have been discussed. Every webinar included a practical demonstration of a QA- or dosimetry-related topic.

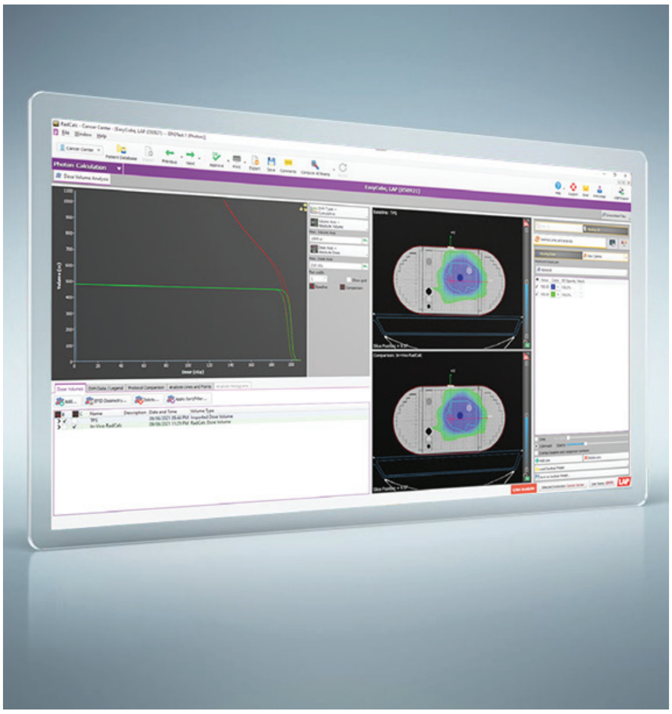
We hope you enjoyed our webinars in 2021.

New webinars in 2022 will be announced on this page.
All video recordings are accessible via EFOMP e-learning platform.

EFOMP COMPANY MEMBER ARTICLE

LAP: RadCalc adds in-vivo dosimetric verification, intelligent automation for independent QA

Customer-driven innovation and continuous improvement are once again front-and-centre in the latest release of RadCalc. With v7.2, RadCalc's portfolio of calculations now encompasses secondary dose checks, with the use of point-dose analysis, 3D Monte Carlo or 3D Collapsed-Cone Convolution Superposition algorithms to identify clinically relevant deviations within the entire patient volume; EPID for pre-treatment dosimetry, in which the software reconstructs the dose from the delivered pre-treatment plan on the patient's original planning CT (giving a direct comparison with both the intended dose from the TPS and RadCalc's 3D dose second check); and EPID for in-vivo dosimetry to reconstruct the dose delivered during treatment, yielding a direct comparison on the actual delivered dose reconstructed on the original planning CT to evaluate intrafraction changes in the patient.



Safety first: the RadCalc software platform provides medical physics teams with independent patient QA at more than 2300 cancer centres worldwide

"We are not aware of any other product on the market able to match RadCalc's in-vivo 3D capability using EPID-based dosimetry," claims Craig Laughton, CTO and co-founder of the RadCalc software portfolio, part of LAP's growing QA product line in radiotherapy. "In the clinic," he adds, "RadCalc 7.2 enables the medical physics team to compare the whole dose volume versus the original treatment plan, measuring what is actually being delivered in-vivo to the patient during radiation therapy."

Such insights are especially powerful given that patients are dynamic systems, always in flux rather than steady-state. Between treatment sessions, for example, patients can gain and lose weight; their stomach, bladder and bowel contents change; their organs may shift, rotate or deform; and their tumours may shrink, move or rotate.

"Our EPID-based module is going to pick up any changes in dose delivery over a course of multiple fractions, triggering a conversation between the clinical physicist and radiation oncologist to understand what's happening inside the patient," explains Laughton. "That dialogue could ultimately mean reimaging and replanning of the patient – another important step towards a more personalized approach to radiation therapy."

What's more, RadCalc's 3D EPID module also has an enabling role to play in supporting the latest hypofractionated and ultrahypofractionated radiotherapy schemes, in which an increased dose per fraction results in significantly fewer overall treatments over a compressed timeframe. The goal, as always, is enhanced targeting accuracy and enhanced dose distribution accuracy – minimizing collateral damage to adjacent organs at risk and critical structures – over a course of treatment running to just one or a few high-dose fractions.

"With a hypofractionated treatment scheme," notes Laughton, "you need to know if something's not right straight away – for example, in the case of a machine error or incorrect patient set-up. You can't afford to wait a week, because in a week the treatment's done and it's too late."

Automate to accumulate

More broadly, intelligent automation remains a long-term fixture on the RadCalc development roadmap, giving medical physicists the power to optimize processes versus their own clinical requirements – customizing which DICOM tags to trigger actions, for example, and new layouts for cleaner workflows. "While we see user-defined automation as a key differentiator," notes Carlos Bohorquez, RadCalc product manager, "automation is ultimately all about patient safety and minimizing human errors and the burden on clinical resources associated with manual QA tasks."

According to Bohorquez, the v7.2 release incorporates significant customizations to the RadCalc AIR import and reporting tool to streamline workflows in the clinical environment. "It's an ever-evolving process to provide clinicians with true and faithful automation for existing and emerging radiotherapy technologies," he explains.

Read the full article on the Physics World web site.

Craig Laughton: "RadCalc 7.2 measures what is actually being delivered in-vivo to the patient during radiation therapy." Craig Laughton is CTO at LifeLine Software, Inc., a part of the LAP Group and co-founder of the RadCalc software portfolio.

Carlos Bohorquez: "Automation is ultimately all about patient safety and minimizing human errors."
Carlos Bohorquez, M.S., D.A.B.R is the Product Manager for RadCalc at LifeLine Software, Inc., a part of the LAP Group.

European Radiation Dosimetry Group EURADOS

Željka Knežević from Croatia and Liliana Stolarczyk from Denmark write about the activities of two EURADOS working groups

The European Radiation Dosimetry Group (EURADOS) is a non-profit association for promoting research and development and European co-operation in the field of the dosimetry of ionising radiation. EURADOS is a network of 81 European institutions and more than 600 scientists, experts in the scientific field of dosimetry, which are organised within different Working Groups (WGs).

WG 9 Radiation dosimetry in radiotherapy

WG9 is working on the assessment and development of existing and potential dosemeters and dosimetric techniques in radiotherapy. Our goal is to improve dosimetric inter-centre harmonisation together with experimental and computational determination of organ doses as an input to epidemiological and late effect studies. The main scientific objectives of the current WG9 research programme are given below:

- Development and assessment of dosimetry techniques for non-target patient doses in x-ray and proton therapy, especially in paediatric radiotherapy. Generation of robust datasets of out of-field doses for development and benchmarking of dose algorithms and analytical models;
- Determination of the total dose to the patient from therapy and imaging (in conjunction with WG12) for input to epidemiological studies;
- Small field photon and proton beam dosimetry;
- Specific developments in proton and neutron dosimetry (spatial fractionation grid therapy, in-phantom and ambient neutron dosimetry and spectroscopy)
- Mailed dosimetry audits of proton therapy beams for inter-centre harmonisation.
- Foetal dose determination;
- Monte Carlo simulation studies to support and enhance experimental programmes;
- Identification of new and emerging dosimetric techniques and materials, and assessment of their potential use in radiotherapy dosimetry.

WG9 is gathering experts from many European laboratories and hospitals, who are working together on the “Photon radiotherapy research programme” with two ongoing tasks: “Small field photon beam dosimetry” and “Out-of-field doses in brachytherapy”.

Sub-Group 9.1 “Computational methods in medical physics” and Sub-Group 9.2 “Hadron radiotherapy” collaborate closely on:

- secondary radiation dose estimation for superconducting synchrocyclotron
- normalisation of secondary radiation doses in spot scanning proton radiotherapy
- development of a new methodology for out-of-field dosimetry in proton radiotherapy. This project received the 2021 EURADOS Grant for young scientists.

In April this year WG9.2 successfully organised a dosimetry audit of spot scanning proton beams, performed in ten European proton radiotherapy centres. Results are expected by the end of the year.

WG12 Dosimetry in medical imaging

WG12 is focused on patient and staff dosimetry in the medical field, excluding radiotherapy. The work is carried out through 2 subgroups: SG 1 Staff dosimetry and SG2 Patient dosimetry. WG 12 of EURADOS is dealing with various aspects of dosimetry for both patients and staff in medical imaging. In line with most recent developments in radiation protection in medicine, a lot of effort has been made in the area of patient dosimetry in medical imaging. One of the current focuses of WG 12 in collaboration with WG 9 is the development and evaluation of dosimetric basis for organ dose and risk estimation in different imaging modalities, in interventional radiology as well as in radiotherapy.

The increasing use of ionising radiation in the medical sector also has an impact on occupational exposures, and there are concerns that practices such as interventional procedures may cause high individual doses both to staff and patients. Furthermore, the recent decrease in the eye lens limit for occupationally exposed personnel sets stricter protocols in individual monitoring from a technical and regulatory point of view. In order to assess the capabilities of the eye lens dosemeters currently in use in Europe, WG 12 organised an intercomparison exercises for eye lens dosemeters in the medical field (IC2014eye and IC 2016eye). Part of the work within WG 12 dedicated to skin doses in interventional radiology resulted in the research project called VERIDIC (Validation and Estimation of Radiation skin Dose in Interventional Cardiology) funded by the EC with a focus on patient-specific dose calculation in interventional cardiology. The project is finished and the future plan is to continue in collaboration with EFOMP to build further on those results and effectively improve skin dose mapping in the clinical environment

The overall aim of the WG12 is focused on dosimetry harmonisation, evaluation and development of dosimetry methods, intercomparisons, literature reviews and measurement campaigns to assess occupational and patient exposure.

Current ongoing tasks in WG 12 are:

SG1 Staff dosimetry

- **Task 1**: Report on individual monitoring in IR, general recommendations
- **Task 4**: Joint task WG2/12 Intercomparison of eye lens dosemeters
- **Task 5**: Eye lens dosimetry recommendations guidelines/double dosimetry
- **Task 7**: Doses received by personnel involved in complex interventional procedures
- **Task 8**: Extremity doses in nuclear medicine focused on the new radionuclides
- **Task 9**: Joint task WG6/7/12. Occupational exposure during the management, preparation and administration of "new" radiopharmaceuticals

SG2 Patient dosimetry

- **Task 1:** Skin dose in interventional radiology
- **Task 2:** Personalized dose in radiotherapy (joint work between EURADOS WG6, WG9 and WG12 and EFOMP)
- **Task 3:** Review of guidelines/recommendations on use of out-of-field shielding in X-ray imaging
- **Task 4:** Dosimetry in pregnancy
- **Task 5:** Organ doses in interventional radiology

Members of WG 9 and WG 12 include experts from the medical physicist community, reference and research laboratories, dosimetry services and regulators.

Both working groups are collaborating with EFOMP on several tasks. The most recent task is the GAPS initiative in which EURADOS, together with EFOMP, EUROSAFE Imaging and The European Federation of Radiographer Societies (EFRS), is working on a European consensus and recommendations on the subject of gonadal and patient shielding in X-ray imaging.

More information

To learn more about EURADOS activities, subscribe to our newsletter

https://eurados.us2.list-manage.com/subscribe?u=1c783adfe2d14e3671674a1d9&id=2b1338d906

and follow us on social media:

YouTube channel: https://www.youtube.com/channel/UC-6T_YO24acrmnFdTEHT4sg

Twitter: @eurados

Linkedin.com/in/eurados

Web page: www.eurados.org

If you want to join WG9 or WG12 please contact WG leaders (directly or apply for associate membership (Application for associate membership of EURADOS).

Željka Knežević: works as a senior research associate and head of Radiation Chemistry and Dosimetry Laboratory at Ruđer Bošković Insitute, Zagreb, Croatia. She works in the field of medical dosimetry, radiation protection and environmental radiation monitoring. She is currently chair of EURADOS WG 12, Dosimetry in medical imaging and is a full member of WG9.

Liliana Stolarczyk: is a medical physicist in the Danish Center for Particle Therapy DCPT in Aarhus, Denmark. She collaborates closely with the Institute of Nuclear Physics PAN Krakow, Poland. She has been a member of EURADOS from 2010, chairing WG 9 from 2019.

MEETING REPORT

Hybrid type meeting of the 15th International Conference “Medical Physics in the Baltic States 2021” and ESMPE European School for Medical Physics Experts “Individual dosimetry in medical applications” in Kaunas, 4th-6th November, 2021

This year on the 4th-6th of November, 2021 we met for a hybrid (held both in-person and virtually) International conference and ESMPE - European School for Medical Physics Experts. The event (which usually occurs every second year) was organised by Kaunas University of Technology, Lithuania, the Society of Medical Physicists in Lithuania (a member of Lithuanian Association of Medical Physics and Biomedical Engineering Medical Physicists society), Malmö University Hospital and Lund University in Sweden and the European Federation of Organisations For Medical Physics (EFOMP). During these two events 87 participants were gathered together (Fig. 1): PhD and Master’s degree students (in medical physics), medical physicists, researchers and other professionals from 17 different countries (Latvia, Lebanon, Lithuania, Russian Federation, Sweden, Greece, Malta, Turkey, Germany, India, Belarus, Nigeria, Ireland, Belgium, Italy, Moldova & France).

Fig. 1: Participants of the Conference and EFOMP school

Fig. 2: Proceedings

Participants shared their insights and knowledge in valuable and informative talks and discussions during the Conference and EFOMP school, creating a possibility for new national and international collaborations. Since 2009 the Conference proceedings (Fig. 2) have been included in the CAWoS database (articles without citation index).

During the EFOMP school “Individual dosimetry in medical applications”, qualified experts presented the main ideas related to advanced tasks of staff dosimetry; Sources and magnitude of occupational exposures (Paddy Gilligan, Dublin/IE); Assessment of occupational exposure (Marie-Claire Cantone, Milan/IT); Types of personal dosemeters; Individual monitoring; Ambient monitoring (Filip Vanhavere, Leuven/BE); Personal and collective protective equipment (Marco Brambilla, Novara/IT). Therefore, the school covered all the main aspects related to the establishment of an individual monitoring programme for medical facilities workers.

More detailed information regarding this event can be found on the conference web site.

Participants were also involved in events to celebrate the International Day of Medical Physics (7th November) “Communicating the Role of Medical Physicists to the Public”. A Medical Physics Quiz game was organised between lectures and attendees lively participated; this was followed by an afternoon visit to the atomic bunker “KGB Spy Museum” in Kaunas. The museum was established in 2014 and is housed in a former nuclear bunker that was once used by the Soviet intelligence service KGB, six metres below street level. It has a large collection of old dosimetry and protective equipment, public safety equipment, all on public display and most of it in working condition. A special room was devoted to high dose radiation tissue effects to the human body by presenting simulated anatomical sites (Fig. 4).

Fig. 3: A team “I love Medical Physics”

Fig. 4. Equipment for dosimetry and anatomy simulators, imitating radiation tissue effects

Everyone who would like to visit Lithuania to share knowledge in the field of medical physics, have interesting and informative discussions or to find or start new collaborations are welcome to the 16th International Conference and Workshop "Medical Physics in the Baltic States 2023", which will be held on the 9th-11th November 2023 in Kaunas.

Prof. Diana Adlienė, PhD was a founder of the MSc study programme "Medical physics" at Kaunas University of Technology in 2003 and contributed significantly to the recognition of medical physicists as the health care professionals in Lithuania. As a supervisor of PhD students, she helps graduates from the Medical physics program to configure their research career and promotes development of research in the medical physics field.

Jurgita Laurikaitienė, PhD was one of the first graduates of the MSc programme in Medical Physics at Kaunas University of Technology in 2005. She is a Medical Physics Expert (in Radiotherapy) in Lithuania, as recognised by national authorities. Currently Jurgita is responsible for organising the clinical practices for Medical Physics students in the hospitals of Lithuania and is one of the Assoc. Prof. sharing her knowledge and experience during the lectures for the Medical Physics students at Kaunas University of Technology

Efi Koutsouveli works as a Medical Physics Expert in the Medical Physics department of Hygeia Hospital, Athens, Greece. Her professional focus is on radiotherapy units (external radiotherapy & brachytherapy). Her special interest is in Hospital Quality Management Systems and Oncology Information Systems. She is currently the Treasurer of the Hellenic Association of Medical Physicists (HAMP) and EFOMP's Secretary General. In 2019, she received the IOMP-IDMP award for promoting medical physics to a larger audience. Since January 2021 she has been Secretary General of EFOMP.

EFOMP COMPANY MEMBER ARTICLE

RTsafe: Highlighting the need for patient specific QA in challenging SRS applications

Single iso multi-focal SRS treatments require high geometrical accuracy in dose delivery. When treating small lesions, especially the ones that are located far from the isocentre, the geometric uncertainty of the final dose deposition is related, among other parameters, to the uncertainties of the patient immobilization and treatment positioning. Thus, patient positioning uncertainty during treatment introduces significant deviations in the cumulative delivered dose distribution, as compared to the intended one.

Recent studies highlight the fact that the dose delivered to a lesion located at treatment isocentre, is mostly affected by the linear translations of the patient position and less by slight rotational uncertainties. On the contrary, off-axis targets (distance > 4 cm from ISO) can reveal a shifted dose deposition, relative to that expected from the TPS, ranging from 1.1 mm to 2.4 mm. In some cases, the spatial error has been found greater than 2.4 mm.

The Encephalon 3D phantom enables high spatial resolution and real - 3D dosimetry, in a specific patient - derived anatomy. The 3D evaluation of the spatial accuracy reveals any minor uncertainties even in the most demanding plans, such as peripheral multiple metastases cases.

A selected case, using the Encephalon 3D phantom, revealing a clear tilt mainly in the sup-inf direction (that causes a miss on the furthest PTVs from the isocentre) is presented in Figure 1, highlighting the aforementioned fact. Post irradiation data processing was applied for further investigation of the shift.

The team repeated the project of that case by making all the necessary corrections, from set-up, image-guidance, and irradiation, and a second dosimetric analysis report was created. This process was implemented to verify the spatial accuracy of dose delivery in an intra-PTV manner. Superb intra-PTV accuracy of dose delivery was detected. Thus, having a successful set-up, image-guidance and irradiation of the phantom, a very good spatial accuracy of dose delivery was achieved as seen in Figure 2.

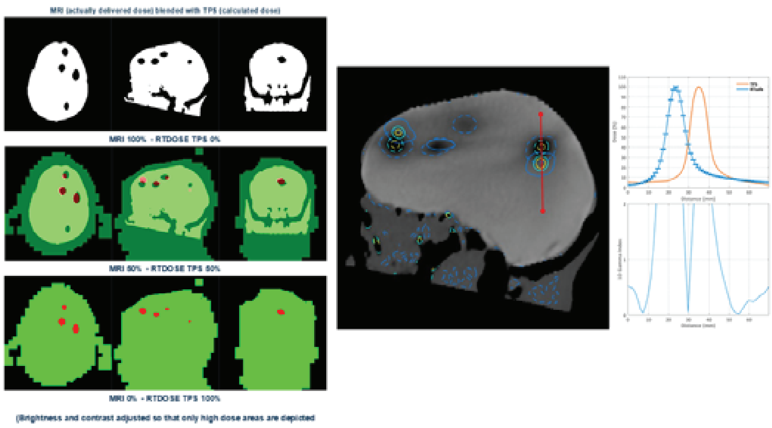


Figure 1. (left) Qualitative comparison between TPS and RTsafe gel dose read out. High dose regions correspond to darker areas. 1D profile comparison between calculated (TPS) and measured (RTsafe) dose distributions (right) at the location depicted by the red line is also presented

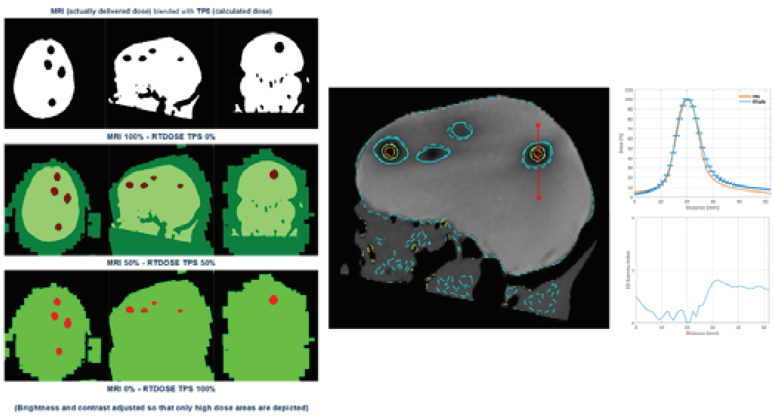


Figure 2. (left) Qualitative comparison between TPS and RTsafe gel dose read out. High dose regions correspond to darker areas. 1D profile comparison between calculated (TPS) and measured (RTsafe) dose distributions (right) at the location depicted by the red line is also presented.

You can find out more in the link here, including two indicative case studies – one multiple metastasis and one single lesion case.

For more information on RTsafe's remote end - to - end dosimetry auditing service contact us at info@rt-safe.com

Georgios Kalaitzakis: Product Manager

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

Kyveli Zourari: Medical Physicist-Product Manager

Kyveli is focused on developing a comprehensive dosimetry audit program dedicated for SRS & SBRT applications. Prior to RTsafe, she gained experience in computational & experimental dosimetry, as well as dosimetry audits in radiotherapy as a scientific associate at the Medical Physics Laboratory of Medical School, National and Kapodistrian University of Athens and medical physics at the Greek Atomic Energy Commission. She has a PhD in Medical Physics from the Medical School of the University of Athens.

MEETING REPORT

Joint Conference of the ÖGMP, DGMP and SGSMP: digital evolution in all areas!

Automation, artificial intelligence and implementation in the clinical setting were important focal points at the Joint Conference ("3-Ländertagung") of the ÖGMP, DGMP and SGSMP 2021, which was successfully held digitally with 279 presentations in 67 sessions and 6 ePoster sessions. Under the excellent leadership of the Austrian Society for Medical Physics (ÖGMP), the scientific exchange was organised together with the German Society for Medical Physics e.V. (DGMP) and the Swiss Society for Radiobiology and Medical Physics (SGSMP). Besides new technological trends, developments and visions in radiotherapy, radiology, audiology and nuclear medicine, a special focus was on the digital evolution in the field of Medical Physics during the three congress days.

Fig. 1: The conference chairs Prof. Dr. DI Dietmar Georg (left) and Prof. Mag. Dr. Wolfgang Birkfellner (right), Medical University of Vienna

Particular emphasis was placed on the rapid development of new computer-assisted methods with artificial intelligence (AI) in diagnostics and therapy in the field of adaptive radiotherapy. As one of the conference chairs, Prof. Dr. DI Dietmar Georg, Medical University of Vienna (Fig. 1, left), emphasised, digitalisation and automation with the use of AI already reached in clinics: "In radiation oncology, we have automated processes with AI methods and have moved from image-based to image-controlled radiotherapy. That doesn't mean that algorithms take over human decisions, but they already offer us very good suggestions for implementing efficient treatment concepts."

Impressive presentations by the participants showed how radiotherapy can be carried out more gently and efficiently due to automated digital processes by taking into account not only anatomical changes – such as synchronisation with breathing movements – but also changes in tumour biology. Furthermore, dose recording in X-ray diagnostics and nuclear medicine as well as highly sophisticated therapy planning in radiotherapy are hardly imaginable without digitalisation.

The trend towards statistical evaluation and modelling was reflected in numerous contributions on "machine learning" and "artificial intelligence" in all areas according to conference chair Prof. Mag. Dr. Wolfgang Birkfellner, Medical University of Vienna (Fig. 1, right): "It is not presumptuous to say that today's medical physics has become a high-tech field of research and application!" This was evident, for example, in the way dosimetry, therapy planning, quality control and imaging technology are increasingly merging with technical developments from the field of informatics, or in innovative approaches in interventional computed tomography such as dose reduction through trajectory planning. "Machine learning and AI have a deeper background. What is actually behind the massive data collection is sophisticated descriptive statistics!" Improved predictive models and standardised treatment protocols will have a positive impact on patient care.

Presentations on advances in particle therapy that have been developed for more than two decades in Germany and Switzerland, as well as for the Austrian particle therapy centre MedAustron, that has been in clinical operation for more than five years now, included MR-assisted proton therapy techniques applied in Vienna and in Dresden, too. The HIT-center from Heidelberg reported on their latest research on new particle beams like helium.

Developments in radiation protection and quality assurance were another topic of the congress. This task of Medical Physicists became apparent, for example, in the meeting of the DGMP working group "Risk Management" on the implementation of the EU directive on the basic safety standards in radiation protection. The preparation of risk analyses in radiation therapy, which is now required by the new radiation protection law in Germany as a consequence of the implementation of the EU directive, is performed by an interprofessional team of experts that analyses the processes in the respective departments. One positive outcome of this work is that the representatives of the different specialist groups make their important work tasks clear to each other. As a positive add-on, this leads to an increase in mutual appreciation among the team members and is an important basis to establish an error culture to optimise the safety of the processes through the open discussions that goes far beyond the purely technical area, which both in fact are goals of the supervisory authorities. In this way, risk management increasingly has the whole person in mind besides technical safety aspects.

AI in imaging was the topic of the presentation "real-time scatter estimation for medical CT using the deep scatter estimation (DSE)" by Dr. Joscha Maier, Heidelberg, winner of the Behnken-Berger Prize 2021 for the development of a neuronal network that can calculate unwanted scattered radiation in the context of CT radiation. Trained with Monte Carlo calculations, this method can very quickly calculate and subtract the noise component from the raw images of a CT. This technique has the potential to further reduce the dose to the patient in CT in the future.

A special highlight was the awarding of the Glocker Medal which is the highest scientific honour of the DGMP to Prof. Dr Wolfgang Enghardt, Dresden, who has achieved worldwide pioneering achievements with his research and development in particle therapy beyond Europe

Fig. 2: DGMP Glocker Medal awardee Prof. Dr. Wolfgang Enghardt, Dresden

(Fig. 2). The latest developments in magnetic resonance imaging were presented in the audience lecture "MRI at High Magnetic Fields – Clinical and Research Potential of 7 Tesla and Higher" by Prof. Dr. Mark Ladd, Heidelberg, vice president of the DGMP. The field of medical optics was represented by a very interesting plenary talk “New Frontiers in Optical Clinical Imaging” by Prof. Dr. Wolfgang Drexler, Medical University of Vienna (Fig. 3).

Fig. 3: Plenary talk “New Frontiers in Optical Clinical Imaging” by Prof. Dr. Wolfgang Drexler, Medical University of Vienna

In the field of nuclear medicine new fascinating developments in PET detector technology were presented. Interesting contributions dealt with new developments in whole-body PET, which enables molecular imaging of physiological processes in the search for metastases or primary tumours. A "hot topic" was the development of more cost-effective variants by using alternative materials for scintillation detectors.

An interesting contribution at the conference was the linking of a robot with an ultrasound head for improving the precision of image guided radiation therapy (IGRT), which can precisely track the beam to a moving target volume with a rapidly controllable accelerator. According to many participants, the so-called ultrasound precision radiotherapy showed that ultrasound is a widely underestimated technology and has a great potential for further developments when linked to innovations from other fields like robotics in this case.

Special attention was again paid to the young scientists at the congress. The scientific sessions, poster sessions and plenary lectures were accompanied by the Young Medical Physics forum with a multi-faceted programme. In a separate session, the training paths to become a Medical Physicist in Germany, Austria and Switzerland were discussed on the basis of personal career presentations of established Medical Physicists. In the area of training, the DGMP has included clinical medical informatics as a new subject area for the certification of Medical Physicists paying reference to the increasing importance of informatics to the clinical work field.

At the end of this successful "3 - Ländertagung" the next 53rd annual conference of the German Society for Medical Physics (DGMP) was announced that will be a joint event with the German section of the ISMRM and will take place with the conference chairs Dr.-Ing. Uwe Heinrichs, University Hospital RWTH Aachen, Dipl.-Phys. Eric Beckers, Gamma Knife Centre Krefeld for the DGMP and Prof. Dr.-Ing. Andreas Bitz, University of Applied Science Aachen for the ISMRM-DS at the Eurogress in Aachen from 21 - 24 September 2022.

Acknowledgement:
I gratefully acknowledge the support by Kerstin Aldenhoff (Conventus Congressmanagement & Marketing GmbH).

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

Dr. José Pérez-Calatayud receives IOMP's IDMP Award 2021

The International Organization for Medical Physics (IOMP) recently announced the results of their International Day of Medical Physics (IDMP) 2021 Awards, with one awardee from each of IOMP's regional organisations. For the EFOMP region, the honour was awarded by IOMP to Dr. José Pérez-Calatayud, from Spain, following his nomination by the Spanish Society of Medical Physics (SEFM).

Dr. José Pérez-Calatayud, pictured above, holds the position of Head of the Department of Medical Physics in Radiotherapy at the University Hospital La Fe in Valencia, Spain, and collaborates intensively in the Hospital Clinica Benidorm in Alicante, Spain. Because of his commitment with his profession and his group, his leadership has promoted this unit to be a benchmark for the Medical Physics procedures applied to every area in patient care. It has also produced significant advances in the development of new devices, especially in the area of brachytherapy.

This level of excellence achieved in clinical aspects has been possible because Dr. Pérez-Calatayud has developed a fruitful research career, aimed at improving the clinical application of radiotherapy, in which he has been a prolific author, with the publication of numerous articles and books with great impact and the direction and participation in many research projects.

As a teacher, Dr. José Pérez-Calatayud has reached a large audience in clinical and university realms, and he has greatly influenced the careers of many young medical physicists. He directs one of the most prestigious teaching units in Spain for the training of residents in Medical Physics, which welcomes its own residents and visitors from all over the country. He has participated as a teacher in courses and training programmes that have contributed to the great development experienced by Medical Physics in Spain, and he has directed doctoral theses initiating many young medical physicists in research.

His presence at the international level has been, and continues to be today, formidable. Dr. José Pérez-Calatayud has led several world-class international working groups for the development of clinical practice recommendations followed today around the world.

He has not only been a relevant and active member of various international organizations, and continues to be, but he has been awarded various awards and honours: he was elected as Fellow of the AAPM in 2020, while in 2013 he was named by IOMP as "one of the 50 Medical Physicist who have made an outstanding contribution to the advancement of medical physics over the last 50 years". Last but not least, his name has been given to a street in his beautiful hometown, Navarrés (Valencia).

Dr. Pérez-Calatayud has developed an extraordinary career in Medical Physics, in which human and personal values have also stood out especially, contributing to its development and serving as an inspiring example to his colleagues, especially young people in training. For these reasons, Dr. Pérez-Calatayud represents a fundamental pillar for the advancement of Medical Physics in Spain, being as well one of its most prominent international representatives. His IDMP award from IOMP is extremely well deserved!

Ana M. Tornero-López is a specialist in Medical Physics at the Hospital de Gran Canaria Dr. Negrín (Spain).

INTERNATIONAL DAY OF MEDICAL PHYSICS 2021

The 19th Romanian Conference on Medical Physics

The Romanian College of Medical Physicists gathered online over two days to celebrate the International Day of Medical Physics (IDMP) through the 19th Romanian Conference on Medical Physics

The flyer for the 19th Romanian Conference on Medical Physics

Our College has celebrated this special day alongside IOMP since 2013. The theme established by IOMP for this year's celebration of IDMP was "Communicating the role of medical physicists to the public". With this occasion, CFMR has also prepared a video to publicize our profession and to explain the role of the medical physicist to the public. This has been published on the IOMP website, together with other IDMP videos prepared by various National Member Organisations.

Organized online, the conference was a great opportunity to gather physicists from all around the world and virtually reunite with Romanian physicists from the diaspora. As well as a number of scientific sessions, we organized a round table that allowed discussions on various professional matters that CFMR is faced with, such as: (1) identifying the best model for certification, recertification of the professionals in our country; (2) implementing the legal environment and regulatory enforcement for the above point; (3) setting up and selecting the examination board, with the involvement of the Romanian diaspora from a number of countries with well-established certification programmes for medical physicists.

A screenshot from the online conference, held to coincide with IDMP

This year we also dedicated a special session to EFOMP-related presentations. Our aim was to present to the Romanian community the work undertaken by EFOMP, the committees and their tasks, and to try to stimulate the interest of our medical physicists to get involved in various EFOMP activities. Furthermore, our special invited speaker was Prof. Iuliana Toma-Dasu, editor-in-chief of Physica Medica, who highlighted the journal as EFOMP's main scientific publication that offers a great platform for research dissemination among medical physicists. Her presentation was an eye-opener for all students that attended the conference. I personally consider that the Romanian medical physics community requires more stimulus to undertake research in different subfields of medical physics and to disseminate the results in journals with high international visibility. Our invited speaker managed to explain to the audience the importance of research and publication in order to advance our field and profession, pointing out that publishing is actually among the duties of the medical physicist. We can only hope to see more involvement in this direction from the Romanian research community.

On behalf of the Romanian College of Medical Physicists I would like to express my appreciation to all invited speakers and participants to the scientific sessions and the round table discussions, for stimulating constructive debates on all aspects of medical physics.

Prof. Dr. Loredana Marcu is Professor of Medical Physics at the University of Oradea, Romania and Adjunct Professor at School of Health Sciences, University of South Australia. She is a radiotherapy medical physicist, being educated and trained in Adelaide, South Australia, where she also worked as a TEAP (Training Education and Accreditation Program) preceptor supervising and co-ordinating the medical physics training and education of the junior physicists in South Australia. Her current research interests cover in silico modelling of tumour growth and response to treatment, radiobiology, targeted therapies, and the risk of second cancer after radiotherapy. She is involved in several professional activities, being a member of the Women in Medical Physics and Biomedical Engineering Task Group within IUPESM. She has been member/chair of the organising/scientific committee of 13 national and international conferences. Since 2018 she has been the President of the Romanian College of Medical Physicists (CFMR).

EFOMP COMPANY MEMBER ARTICLE

INDEPENDENT X-RAY QUALITY ASSURANCE

40 years of X-ray safety & quality

RTI – celebrating four decades of providing X-ray QA

From its beginnings as a late-70s student project at Gothenburg's Chalmers University of Technology, RTI Group – headquartered just outside the city – is today a world-leading manufacturer of X-ray quality assurance (QA) solutions.

The launch, in 1982, of its DIGI-X – the first commercially available multimeter to measure non-invasive kV – meant the company created an entirely new industry in X-ray QA.

With four decades of R&D expertise and a portfolio of world "firsts" – including the Mini-X, PMX-II, Barracuda, and oRTIgo software – RTI's solutions of the Scatter Probe, Piranha and Cobia meters, and Ocean software are utilized worldwide by hospitals, major manufacturers of X-ray equipment, service providers, and government authorities.

The company's co-founders Lars Herrnsdorf and Ulf Toll initially began research & development in alternative energy sources, forming Innova Electronics in the early 1970s when Sweden's oil supplies were severely affected by Middle East conflicts.

RTI Group co-founders Ulf Toll (left) and Lars Herrnsdorf

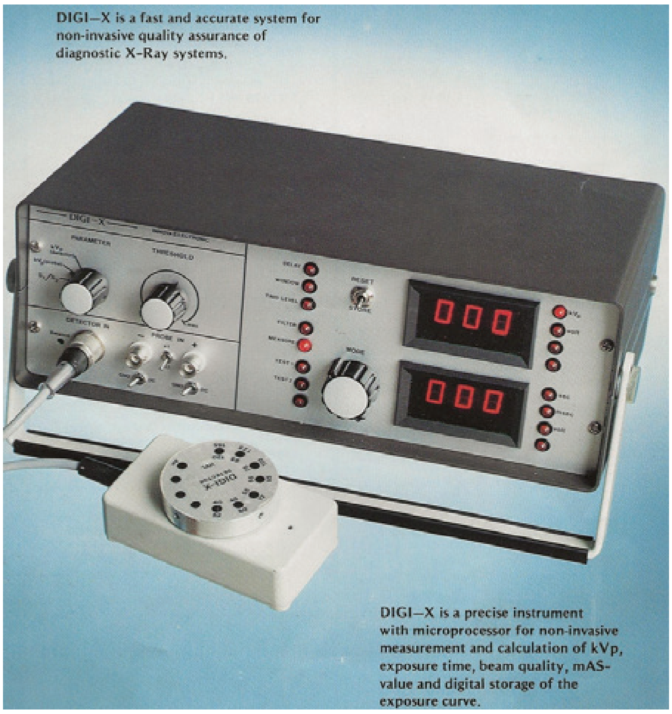
"The first product, developed during our university studies, was a wind speed meter system used to evaluate places and see if they were suitable for wind energy production," explained Ulf, Concept and Feature Leader.

Lars accredits their transition to X-ray safety and decades of research to a combination of research articles, international regulatory agencies, and institutes, as well as key figures and mentors in the industry. These factors enabled the two innovators to evaluate what the market required.

"RTI started from a science article about how to make an electronic penetrometer," explained Lars. "It is still important for the success of the company to publish our new developments in academic publications, to be accepted by big influencers and key customers."

The prototype DIGI-X, eventually launched in 1982, was developed during the introduction of increased regulations worldwide for regular QA of medical X-ray systems used in hospitals. It would be the first commercially available multimeter to measure non-invasive kV.

"The timing was good for this type of solid-state product," said Ulf. "It addressed the need for a small and sensitive dose detector as an alternative to the ion chambers used at the time."



The 1982 DIGI-X was the first commercially available multimeter to measure non-invasive kV

Hans Forsberg Ph.D., responsible for X-ray QA and service at Karolinska University Hospital – then the biggest hospital in Sweden – was significant to the company's early development.

"Good contacts meant the DIGI-X was quickly demonstrated in nearly every Swedish hospital by Hans Forsberg, and then, soon afterward, in Germany with the assistance of a network of sales representatives and the brand Philips," explained Lars.

With the 1991 release of oRTIGo, the impact of software in X-ray QA was not lost on Ulf.

While visiting a major X-ray manufacturer in the USA, he declared that RTI software should be the new Windows OS for QA.

RTI accomplished a further three major software launches since oRTIgo. The third, Ocean Next™, was released earlier this year offering workflow, automatic tests, traceability, and Bluetooth connection to Piranha and Cobia meters. A different world to the great "leap" from ion chambers to basic solid-state technology in 1981!

oRTIgo software, launched in 1991, set the standard for the current Ocean Next™

"And yet, the X-ray industry was slow to catch up," explained Lars. *"Service personnel had not been trained with computers and preferred simple units – even if it took three times longer!"*

Still at the forefront of research and development in X-ray QA, age and time have not wearied Lars or Ulf. Quite the opposite!

Lars, who obtained his Ph.D. in Medical Radiation Physics at the prestigious Lund University in 2018, explained: *"Advances in microelectronics will allow even more sophisticated imaging and diagnosis equipment and software. The internet's impact will provide increased and more accessible data storage."*

Ulf, who continues to influence the major R&D projects at RTI, is more cautious. The lack of uniformity in X-ray legislation enacted globally continues to hinder the full potential of the industry, even as new and upgraded QA technologies are released.

However, a focus on "solutions" rather than meters means the RTI Group is best positioned to help customers improve their processes and be compliant with existing and future regulations.

"RTI has always been leading the development of X-ray QA and many times has introduced new and leading technology," enthused Ulf.

Ewan Waugh is RTI Group's Content Editor. He has been part of the Headquarters' Sales team, based in Mölndal, Sweden, since January 2019 and is responsible for the global marketing and promotion of RTI's corporate image and industry-leading X-ray QA solutions, training, and services (www.rtigroup.com).

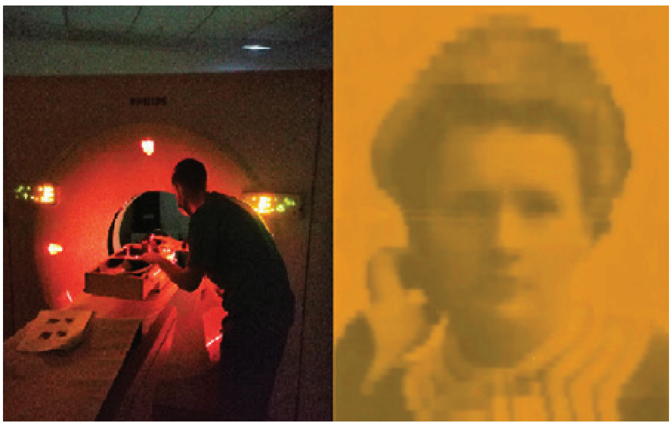
INTERNATIONAL DAY OF MEDICAL PHYSICS 2021

Activities in Spain for the International Day of Medical Physics 2021

On the celebration of the International Day of Medical Physics (IDMP), and during the weeks leading up to November 7th, the Spanish Society of Medical Physics (SEFM) developed several activities focused, fundamentally, on the dissemination through social networks and other communication channels of the work that medical physicists carry out in their daily work. It also spread among its partners and followers the activities carried out by other organizations, especially the IOMP, in commemoration of this day.

The work carried out by the SEFM over the years has been widely recognized among professionals, but very little has yet reached society. We are very aware that it is common to find people who do not know how to describe the role of a “physicist in a hospital”. Indeed, this year's motto for the IDMP, "Communicating the Role of Medical Physicists to the Public" refers to this lack in which we must work intensely.

We really took advantage of the powerful tool that the social networks are, and especially with our younger professionals, fundamental protagonists in achieving the objective of publicizing the great contribution that medical physicists make thanks to their ease of using new communication channels. We tried hard to spread the goodness of our profession, informing people and trying to involve them in further activities related to the IDMP. For instance, it is worth highlighting the photographic contest organized on the main social networks, in which the competitors presented excellent photographs on a free subject but related to Medical Physics. The award consisted in the free registration of the First Curie Day, which was the icing of the cake of this series of activities in honour of Medical Physics and our beloved Marie Curie. The contest was a great success, and the competitors made real works of art, as the ones shown below.



Left: Winning photograph (Author: Mario Martín Veganzones, Hospital de Cruces, Barakaldo). Right: Marie Curie in a radiochromic film (Author: Javier Ponce, Hospital Sant Joan de Reus, Tarragona).

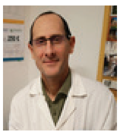
The First Curie Day took place in Valencia on November 6th and was organized by the SEFM Youth Group (see photo below). This was the first face-to-face meeting of the SEFM since the beginning of the pandemic which, added to the fact that the First Youth Day, held in November 2020, was also the first completely virtual meeting organized by our Society, shows the growing role of this group within the SEFM.

First Curie Day (Valencia, Spain, 6th November 2021)

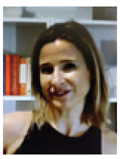
The contents of our First Curie Day were multi-faceted. There were several presentations in different areas of Medical Physics. The presentation of the GAIN (from the acronym in Spanish of support group for novice researchers) programme deserves a special mention: this project was conceived and designed for the promotion and assistance in scientific research of younger Spanish medical physicists. There was also room for humour, with monologues related to science; and for games too, through a contest with questions on "hospital radiophysics",which is the name given to the health specialty equivalent to Medical Physics in Spain.

Without a doubt, this will be the first of many Curie Days, the youngest professionals in our society having the leading role.

The Spanish Society of Medical Physics is enthusiastically committed to the objective of spreading the basic notions of Medical Physics through our society, and although the IDMP is the ideal scenario for doing so, we work intensively during the whole year to reach our goal, and let people know how necessary and relevant Medical Physicists are in the health arena.



Damián Guirado obtained his MSc degree in Physics in 1993 and his PhD degree in 2012, both at the University of Granada (Spain). He works at the Universitary Hospital “San Cecilio” in Granada as Medical Physicist, and he is the President of the Spanish Society of Medical Physics



Ana M. Tornero-López is a specialist in Medical Physics at the Hospital de Gran Canaria Dr. Negrín (Spain). After completing her university studies in Valencia (Spain), she completed her PhD In Particle Physics. Later, she became enormously interested in Medical Physics, an area in which she works with enthusiasm and tenacity.

INTERNATIONAL DAY OF MEDICAL PHYSICS 2021

Celebrating the International Day of Medical Physics in Greece

Regarding the International Day of Medical Physics (7th November) 2021, a noteworthy event reflecting this year's theme: "Communicating the Role of Medical Physicists to the Public" was organized by the Medical Physics Unit of the Attikon University Hospital in Athens, Greece.

The event was held at two places inside the hospital, one at the central lobby and the other at the patients' waiting room of the Radiation Therapy Department. IOMP's 2021 poster was showcased at obvious spots and informational brochures, designed by the organizers, were distributed to attract the attention and interact better with the general public.

IDMP activities at Attikon University Hospital, Athens, Greece

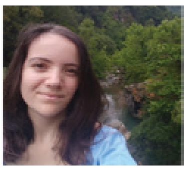
Various activities were designed to raise the awareness of the public about the role of Medical Physicist. In particular, a video was presented at both spots in order to highlight the contribution of the Medical Physicist profession from its infancy to the present. This video (https://youtu.be/hKYcgsLF_VU) emphasizes the impact of the Medical Physicist in specialties that involve radiation, such as Radiology, Radiotherapy, Nuclear Medicine and Radiation Protection. The response of the general public was encouraging based on the variety of questions that were raised, especially about radiation safety issues and non-ionizing radiation.

Moreover, a website was developed to highlight some of the major duties of Medical Physicists and to clear up some myths or misconceptions about ionizing and non-ionizing radiation that tend to confuse the public. Furthermore, a questionnaire was published on the website as an effective way to gain knowledge and to assess what people learned about the role of Medical Physicists.

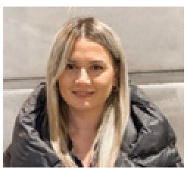
In addition, Medical Physics residents as well as post-graduate students in Medical Physics actively supported the organization of the event under the supervision of the Medical Physics Professors, the scientific associates and the Medical Physics Experts of the Medical Physics Unit of the Attikon University Hospital.

It is worth mentioning that members from the Hellenic Association of Medical Physicists (HAMP) honoured the event with their presence. Last but not least, HAMP supported this event and shared it on social media.

In conclusion, we consider that this event helped to clarify the duties and the responsibilities of the Medical Physicist working in a clinical environment. In the future, it is our hope that more Medical Physics Departments supported by HAMP will organize such events with the additional goal to familiarize the general public with the role of Medical Physicists and to motivate more students to choose Medical Physics/Radiation Physics as a profession.



Anna-Maria Fanou
is currently working on her thesis pursuing a Master's degree in Medical Physics at the National and Kapodistrian University of Athens, Greece. She studied Physics at the National Technical University of Athens, Greece. She is a junior member of the Hellenic Association of Medical Physicists (HAMP).



Eugenia Alamani
is a postgraduate student completing her thesis for her Master's degree in Medical Physics - Radiation Physics at the University of Patras, Greece. She obtained her bachelor's degree in Physics from the University of Ioannina, Greece.

EFOMP COMPANY MEMBER ARTICLE

Qaelum: How DOSE assists medical physicists in identifying and analysing significant events

The ability to identify and process significant events is one of the most important functions of a dose management system (DMS). In the newest German legislation, the criteria for this are specified in relation to:

a) a group of persons: when the diagnostic reference value (DRL) for a certain type of examination is exceeded by more than 200% (i.e. by more than a factor of 3). In this case it has to be checked as to whether it is a one-time event or whether the dose values are permanently considerably above the DRL. The decisive factor is whether the mean value from this examination and the previous 19 examinations of the same type is more than 100% above the DRL (i.e. more than a factor of 2). Only then does the suspicion become a reportable significant event (Fig. 1).

b) individual persons:
   i. in computed tomography, the CTDIvol exceeds 120 mGy for an application to the brain and 80 mGy for an application to the body;
   ii. for X-ray fluoroscopy, the total DAP exceeds the limit of 20,000 cGy.cm^2;
   iii. in the case of interventions for the purpose of examination, the total DAP exceeds the limit value of 20,000 cGy.cm^2;
   iv. in the case of interventions for the purpose of treatment, the total DAP exceeds the limit of 50,000 cGy.cm^2 associated with the occurrence of deterministic skin damage of a second or higher degree, acutely or within 21 days.

In the CBCT application area, the limits for CT or X-ray fluoroscopy apply, depending on which value was exceeded first.

DOSE provides an algorithm that applies the aforementioned criteria for identifying such significant events. In the RF and XA application areas, the total DAP is used for this purpose. In CT application area, the rules for CTDIvol can be applied in both exam level and irradiation event level, depending on the definition of the law in each country.

Identifying such cases, however, is only the first step in the processing of significant events. The actual relevance of a "significant event" is not so much the obligation to report it to the regulatory authority, but rather the associated opportunity to learn from mistakes and avoid similar incidents with excessive radiation exposure in the future. To this end, determining the causes is essential.

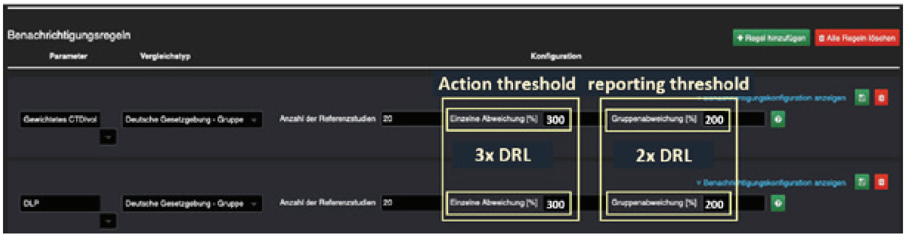


Fig. 1: DOSE-algorithm for the identification of significant events related to group of persons according to the German legislation.

Fig. 2 illustrates this using the example of a combined CCT + carotid CTA examination in which the carotid CTA incl. bolus monitoring had to be repeated. The cumulative CTDI in the body region is 98 mGy, thus above the limit, so DOSE generated a warning message. The function "series overlap" shows that scan series and bolus monitoring of both CTA trials overlap. Therefore, if interpreted as "examination-related", this is a reportable significant event. If interpreted as "series-related", on the other hand, it would not be a significant event, since even the CTDIvol of the first monitoring sequence ("tracker", series 5) with 58 mGy remains below the limit value.

Dynamic and multiphase examinations, as well as changes in dose settings by the operator, are the most serious problems in the field of CT application. Therefore dose monitoring based on the cumulative CTDIvol per examination is the method of choice for this.

The main reasons that lead to suspected significant events are:

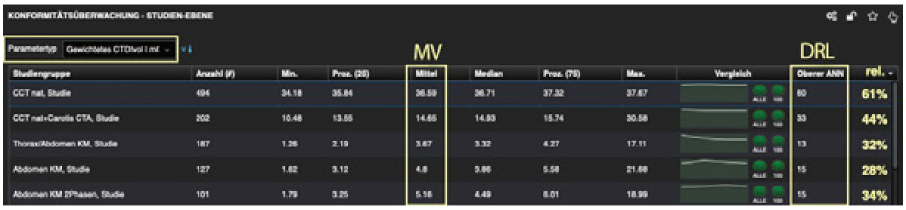
- scan protocols that are not optimized or are insufficiently optimized
- individual case-related protocol modifications by the device operator
- wrong protocol selection
- foreign objects in the scan area
- positioning and centring problems
- excessive scan lengths
- problems with contrast agent administration
- extremely obese patients
- outdated equipment
- equipment technical deficiencies

A practical DMS is characterized by the fact that it provides the information needed to identify the causes as comprehensively as possible. If this is not the case, the information must be obtained from the image and metadata. This is not only time-consuming, but also involves considerable delays, if the possibility of downloading the images or at least viewing the metadata is limited or non-existent.

Several causes are responsible for the majority of suspected significant event cases at the same time. Obesity is only one factor that makes the occurrence more likely. In most cases, it is operating errors and equipment problems that lead to significant overexposure. In the following paragraph, some examples on how DOSE assists in identifying the causes are presented.

Scan protocols not optimized or insufficiently optimized

One indicator for this is the dose level relative to the diagnostic reference level (DRL) for the parameter CTDIvol (Fig. 3). Depending on whether the CT scanner has iterative reconstruction (IR), the mean value for the respective protocol should be about 35% (with IR) and about 65% (without IR) (for CCT protocols: about 60% and 90%, respectively).



KONFORMITÄTSÜBERWACHUNG - STUDIEN-EBENE

Parametertyp: Gewichtetes CTDIvol | ml — MV — DRL

Studiengruppe	Anzahl (#)	Min.	Proz. (25)	Mittel	Median	Proz. (75)	Max.	Vergleich	Oberer ANN	rel.
CCT nat, Studie	494	34.18	35.84	36.59	36.71	37.32	37.67		60	61%
CCT nat+Carotis CTA, Studie	202	10.48	13.55	14.65	14.83	15.74	30.58		33	44%
Thorax/Abdomen KM, Studie	187	1.26	2.19	3.67	3.32	4.27	17.11		13	32%
Abdomen KM, Studie	127	1.62	3.12	4.8	3.86	5.58	21.68		15	28%
Abdomen KM 2Phasen, Studie	101	1.79	3.25	5.16	4.49	6.01	18.99		15	34%

Fig. 3: Mean values and DRL for the parameter "Weighted CTDIvol" per study group, from which the relative dose level can be derived (Note 1: DOSE is configured so that each protocol has its own study group; Note 2: "Weighted CTDIvol" = mean of the CTDIvol values of the individual scan series - localizer scans excluded, weighted according to their scan length).

Positioning and centring problems

Positioning problems such as arms in the scan area or parts of the shoulder in the scan area of head studies lead to problems similar to foreign bodies and are easily identified in DOSE using the localizer images. If the vertical centring is incorrect, the patient is shown reduced or enlarged in width on the localizer image. As a result, the patient effective diameter is miscalculated by the AEC by 0.5 cm per cm of centring error. Depending on the control characteristics of the scanner, this results in incorrect exposure by 5 to 10%. DOSE provides the corresponding information in graphical and numerical form (Fig. 4).

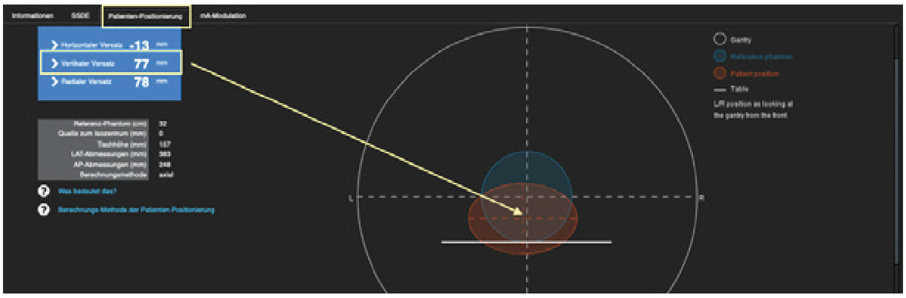


Fig. 4: Example of a study in which the patient was centred almost 8 cm too low. With the particular scanner, the localizer image is generated in the PA projection, i.e. the patient is closer to the radiation source. As a result, the effective diameter was overestimated by 4 cm and the exposure increased by 60%.

Extremely obese patients

The most meaningful and suitable for quantitative estimation of the dose increase is the water equivalent diameter (WED). DOSE determines the WED from the axial image data and displays the value for the centre of the scan area (Fig. 5). In addition, the course of the WED along the entire scan area is shown. In spine studies, where truncation is the rule, it is better to use the effective diameter obtained from the localizer image, which is also provided.

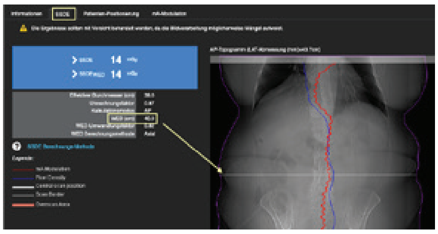
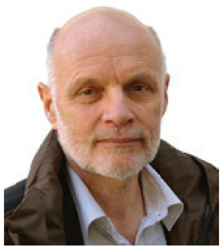


Fig. 5: Specification of the WED (here 40.9 cm) for the centre of the scan area, determined from the axial image data.

As these examples illustrate, DOSE by Qaelum provides the information required to identify the causes of suspected significant event cases in the CT application area to the greatest possible extent. This allows the MPE to avoid the time-consuming retrieval and analysis of image data from the PACS. In the same way, the causes of "normal" DRL exceedances can also be determined.

A practice-oriented DMS is decisive in determining whether the MPEs can adequately perform their tasks within the specified time frame. This becomes particularly evident in a department where the locally available DMS does not provide the desired analyses or cannot provide them due to missing information from the modality.

To read more about this topic, please follow this link:
https://qaelum.com/news/news/how-dose-assists-medical-physicists-in-identifying-and-analysing-significant-events---part-3



Dr. rer. nat. Hans Dieter Nagel worked for many years as a clinical scientist for one of the leading medical imaging manufacturers. In 2009, he founded his own company focusing on MPE services in the application areas of CT and XA.

INTERNATIONAL DAY OF MEDICAL PHYSICS 2021

Celebrating International Day of Medical Physics 2021 in Italy

Every 7th of November (date of birth of Maria Sklodowska Curie), the community of Medical Physicists worldwide celebrates the International Day of Medical Physics, IDMP. "Communicating the Role of Medical Physicists to the Public" is the main theme chosen by IOMP to celebrate the event this year. Following this topic AIFM, the Italian Association of Medical Physicists, which represents more than 1000 professionals, organized a meeting that took place in Parma on Friday November 5th and was attended by almost 100 medical physicists in presence and 130 connected online. The symposium was held at Auditorium Paganini which was designed by Renzo Piano and represents a significant operation in terms of redefining one of the city's main early 20th century industrial areas.

Discussions at the IDMP Symposium in Parma, Italy

The event was dedicated to the concept of communication in the field of medical physics and arises from the need to communicate what is the role of our figure that the general public often does not know well.

It is really difficult to explain to the public what medical physicists do, since generally it is not clear the medical physicists' role in the diagnosis and treatment of cancer and the responsibilities of medical physicists to protect people from the harmful use of radiation.

This need to "communicate" extends to any issue related to patient and population exposure to ionizing and non-ionizing radiation and implies the need to speak and listen, explain and be explained, teach and learn, in one dialogue that becomes a sort of continuous exchange with civil society.

The tools that a medical physicist should put in place to have an effective communication with colleagues from other disciplines, patients and citizens are not obvious and simple to use; for this reason a series of specialists in the sector have proposed in their speeches operational indications to create an empathic connection with others. They have explained how to use an authoritative but understandable language, how to be rigorous but simple, credible and respectful.

Then we had the opportunity to listen to the experience of three medical physicists that are responsible for a web column where everyone can ask about radiation and a citizen representative who has clarified what the public needs in term of communication.

The event closed with a debate on the dose class that must be included in the report of any radiological examination according to the Italian law (D.Lgs. 101/2020, transposition of the EURATOM 2013/53), because this indication constitutes a first direct communication of medical physicists, radiologists and nuclear medicine doctors with family doctors and with patients.

Superheroes at the IDMP event in Parma, Italy

At the same time it was possible for participants and citizens to visit the exhibition "Superheroes and radiation" where it was explained how many superheroes were born and evolved thanks to the use of radiation, another way to bring the public closer to our profession.

Caterina Ghetti is an Italian medical physicist. She is the chief of the Medical Physics Department at the University Hospital of Parma. Her professional interest is mainly in imaging (tomosynthesis, computed tomography, model observer, iterative reconstruction) and radiation protection. She is a member of the directive board of the Italian Association of Medical Physics (AIFM).

EFOMP COMPANY MEMBER ARTICLE

Accuray: CyberKnife® Real-Time Adaptive Radiotherapy

ACCURAY

Almost 20 years ago, Accuray revolutionized tumour and patient motion management with Synchrony® real-time motion synchronization technology

Real-time adaptive radiotherapy is quickly evolving thanks to the vast potential to improve the safety of patients by measuring and correcting for intrafraction motion and anatomical changes during treatment. It allows for more precise tumour targeting, confidence in the accuracy of the dose delivery, and margin reduction, which gives the potential to increase the dose to the target and hypofractionate. The success of real-time adaptive radiotherapy technology is also linked to the potential quality improvement, standardization, and significant workflow optimization by leveraging automation and Artificial Intelligence (A.I.) in treatment delivery, empowering clinicians to work smarter.

Frequent positioning verification before treatment in the context of image-guided radiotherapy is nowadays standard practice. However, the patient image obtained before treatment is immediately old because the exact patient anatomy and tumour positioning are required during the treatment and not before. Tumour movement is complex since it can be caused by normal bodily functions such as respiration, blood circulation and digestion, and the musculoskeletal system. Such motion can occur within milliseconds or over several minutes [1]. Even breathing-induced motion fluctuations range from a few millimetres to centimetres as the cycle changes from day to day. Because we cannot accurately predict the extent of the tumour motion during treatment, any assumptions made on earlier observations should be challenged.

The pioneering Synchrony® technology, introduced by Accuray in 2002, uses AI-powered real-time motion synchronization to track and automatically correct patient and tumour movement during radiotherapy treatment delivery. Synchrony enables Accuray CyberKnife® treatment delivery system to deliver SRS/SBRT with continuous sub-millimeter precision while continually adjusting the beams to tumour motion, with no need for gating or other complex motion-management and immobilization techniques.

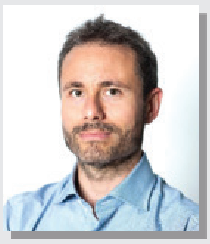
The CyberKnife system can realign the treatment beam with six degrees of freedom in a non-coplanar and non-isocentric manner, therefore being the only robotic delivery system in the market that combines motion monitoring and tracking. The patient imaging system can track and detect tumour motion throughout delivery using two orthogonal diagnostic X-ray sources mounted to the ceiling in conjunction with two flat-panel detectors in the floor – designed to capture real-time images. During treatment, the X-ray images are compared with digitally reconstructed radiographs, and the alignment of each treatment beam with the moving target is maintained in real-time by moving the beam dynamically with the target. Thanks to the Synchrony® Respiratory Tracking System, CyberKnife can also predict and track the exact location of tumours that move with respiration. The position of external optical markers placed on the patient's chest is measured continuously with a stereo camera system. At the start of treatment, the internal tumour position is measured at multiple discrete time points by acquiring X-ray images. A correlation model is generated by fitting the internal tumour positions at different phases of the breathing cycle to the position of the optical markers. During treatment, the internal tumour position is estimated from the external marker positions using the correlation model. This information is used to move the linear accelerator dynamically with the target. The model is checked and updated regularly during treatment by acquiring additional X-ray images [2]. The great advantage of the Synchrony system is that patients can breathe normally during treatment while the robotic manipulator moves the linear accelerator dynamically, with sub-millimeter precision. Synchrony® allows for minimal margins and even enables ITV-free radiotherapy (i.e., no margins, gating, or restraint devices). This extraordinary precision empowers clinicians to confidently deliver (ultra) hypofractionated radiotherapy and radiosurgical treatments that have clinically demonstrated outcomes around cancer control and common side effect incidence reduction [3] while driving powerful efficiencies that make treatment delivery more convenient for patients, allow higher patient throughput and is less costly than any alternative treatment. Accuray created an entirely new paradigm in adaptive radiotherapy: real-time adaptive treatment delivery — without tradeoffs.

References:

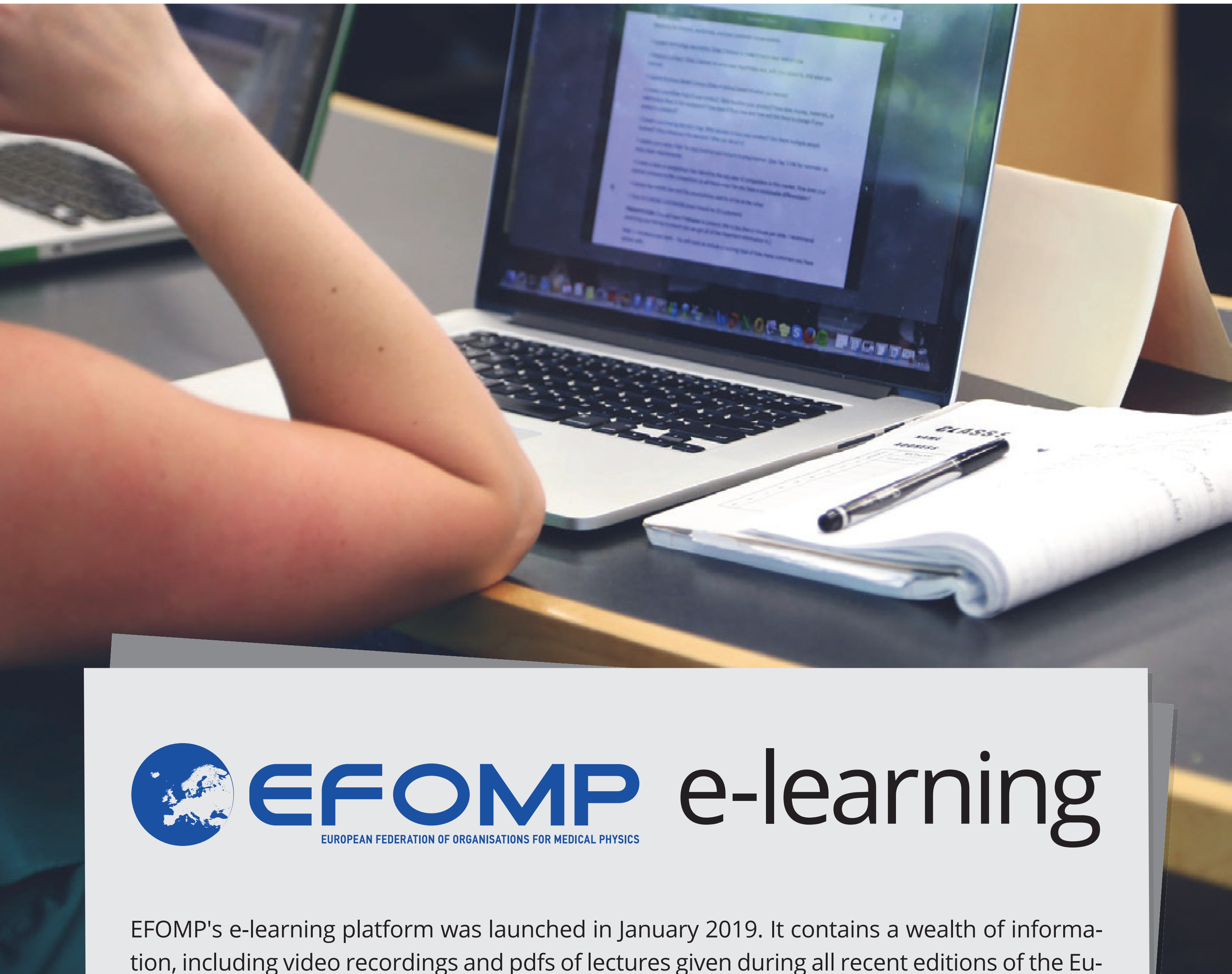
[1] Keall P., Poulsen P., Booth J.T., See, Think, and Act: Real-Time Adaptive Radiotherapy, Seminars in Radiation Oncology, 2019:29 (3): 228-235 https://doi.org/10.1016/j.semradonc.2019.02.005

[2] Sayeh S., Wang J., Main W.T., Kilby W., Maurer C.R. Respiratory Motion Tracking for Robotic Radiosurgery. In: Treating Tumours that Move with Respiration. Springer, Berlin, Heidelberg; 2007: pp 15-29. https://doi.org/10.1007/978-3-540-69886-9_2

[3] Tree A.C. et al., Comparison of side effects at 2 years in the randomised PACE-B trial (SBRT vs standard radiotherapy), OC-0289, ESTRO 2021, 28 – 31 Aug 2021, Madrid, Spain, Vol 161 (1), pp 196-197 https://www.accuray.com/ondemand-webinar-paceb/



Francesco P. La Torre works as the CyberKnife Product Manager EIMEA at Accuray. He has over 15 years of experience in Radiation Physics and Scientific Project Management across the medical device industry and research centres (CERN - European Organization for Nuclear Research in Geneva). Francesco has an MSc in Nuclear Physics, an MAS in Nuclear and Ionizing Radiation Technologies, and a PhD in Applied Physics.



ART AND SCIENCE

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

Professor Jim Malone writes about a painting with an unusual scientific angle.

Italian artist Bartolomeo Guidobono (1654-1709) painted The Sorceress around 1690 and it can be seen at the Cantor Arts Center at Stanford University. The Sorceress is rendered vividly with striking bright, high-quality clothing. Her bustling workshop is imbued with a sense of mystery, magic and energy. Note the flaming cauldron, the scientific instruments, the open books, the many animals, and the magic wand. A second less compelling version was painted around 1700. Hopefully, you will find it rewarding. Feedback is welcome at: jifmal@gmail.com

The Sorceress

(see next page)

What is going on? Is it good or evil? Observe the Sorceress. Her clothing, books, instruments, and demeanour assert that she is aristocratic and knowledgeable on science, the occult, and their offshoots. The church and establishment would have disapproved, laying down hard borders to enquiry – a form of censorship. Yet, scientific leaders including Tycho Brahe, Galileo, Newton, and Robert Boyle crossed the borders, sometimes discreetly and often out of an irresistible curiosity.

The Sorceress is orchestrating a procedure, possibly to bring back to life the dead man on the floor. Her radiant demeanour seems incompatible with an evil intent. Science, medicine, and medical physics have hard borders not just with the occult, but also with religion, the arts, and disciplines addressing similar seams of knowledge (e.g. radiation in medicine). Creativity finds a good home at borders. Though sparsely populated, they are exciting places to spend some of one's life.

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

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

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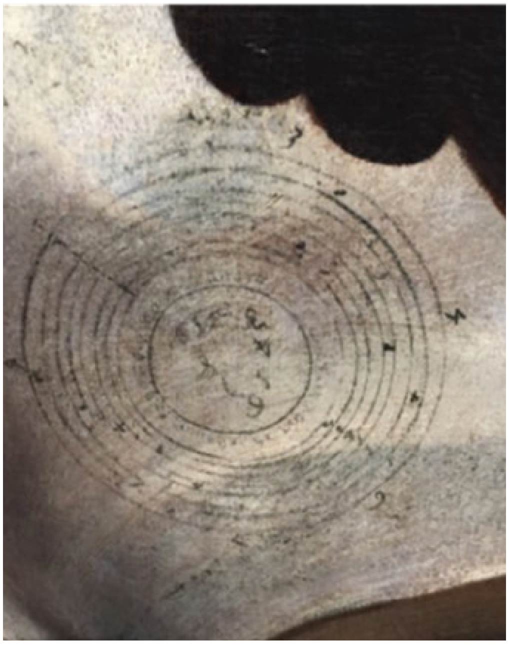

The Sorceress by Bartolomeo Guidobono (1654-1709). (See previous page). Can be seen at the Cantor Arts Center, Stanford University. Details show scientific diagram from open book and a dead man on the floor. The figure under the shelf/table, in the main image, may be the spirit of the dead man.
Photographs by Ulick Malone

MEDICAL PHYSICS IT AND SOFTWARE

Hacking Medical Physics: Part 1 – working with DICOM data

This is the first of a new series of articles, in which Medical Physicists Jonas Andersson and Gavin Poludniowski from Sweden inform the readership and provide practical tips about topical IT issues in medical physics

EMP News will be publishing a series of articles on the topic of software and programming for medical physics. This will cover open-source and commercial applications, as well as programming tips for tasks in our community. "But why?", you may ask.

We could say that the ongoing digitalisation within healthcare and advances in AI are having a profound impact on cost efficiency, quality of service, and patient outcomes. And that naturally, as a part of the healthcare scene, medical physicists and our roles need to change, and our competence needs to evolve with increasing data-driven processes and automation. But what you really want to know is, "how can this make my life easier, or allow me to do my job better?" To borrow the Olympic motto, we hope that we can convince you in this series that increasing our IT savvy can make us "Faster, Higher, Stronger—Together".

To some extent this series is aimed at those who haven't had the opportunity previously to pick up programming skills. But it will also highlight some useful software and programming tips that could be useful to even battle-scarred coders. We encourage you, the reader, to contact us if you have a question or suggestion for a software-related topic that would be of interest to medical physicists.

In this first article we will focus on working with data in the Digital Imaging and Communications in Imaging (DICOM) standard. This covers much of the information available in workflows relevant to medical physics, including both image and metadata. This is a big area to cover and so we won't even try to be comprehensive. We know you will have experience of interacting with DICOM information already, in clinical applications (RIS, PACS, TPS). You may also have used third-party software (i.e., not written by you or supplied by the vendor) capable of reading DICOM files. But there comes a time for every medical physicist when he or she needs to do something simple. Again. And again. We want to make your life easier. We are going to talk about automating processes.

Crucial aspects when working with digital data in healthcare are safety and privacy. When working with patient data, the much talked-about EU General Data Protection Regulation (GDPR) is important–even if you don't share information outside your organization. To learn more about GDPR start within your own healthcare organization, as there should already be legal guidelines in place and competence with GDPR compliance. However, programming projects often start with phantom measurements. Such data is not sensitive! Let's take an example.

You have a CT scan of a phantom consisting of over 100 slices. You want to understand how the longitudinal Automatic Tube Current Modulation (ATCM) is working. You can investigate this by looking at the "X-ray tube current" for each CT slice (DICOM tag: (0018,1151)) and plotting it with position along the z-axis. Which of the following do you do?

A. *Extract the information on X-ray tube current and slice position manually from each slice using your favourite DICOM-compatible application (e.g., in your PACS or clicking Image—Show info in ImageJ) and then cut-and-paste the numbers into Excel to plot*

OR

B. *Write a short computer program to automate the data extraction and plotting*

There is no shame in taking Option A. But at some point, it becomes impractical, or at least incredibly tedious. If you want to take Option B, you don't need to be a computer whizz, you just need to know some simple tools and how to use them. We will discuss using the MATLAB™ and Python environments. Both are great choices for starting to work programmatically with DICOM data. They each feature an interactive interpreter. That is, the programmer can type statements in and have them executed immediately. This is perfect for exploring or visualizing data. Multiple statements can also be saved as scripts for reuse. But what are the differences between MATLAB and Python?

MATLAB is a programming environment for the sciences developed and sold by MathWorks, with a package of tools that have been extended and improved since the 1980s. Many have some experience of it from university studies, but even if you haven't, the chances are one of your colleagues will have. In addition to the core functionality, the Image Processing Toolbox is key for working with DICOM data. Make sure you pay for this in your license. It includes several functions useful for DICOM processing, such as *dicominfo* (for reading metadata), *dicomread* (for reading image data), *dicomreadVolume* (for reading an image volume from a series) and *dicomwrite* (for writing a DICOM file).

Python was born in the 1990s and is a general-purpose programming language that can be used for almost anything. It's completely free. It also has a vast array of libraries available (although in some cases not as well-documented as MATLAB). The *NumPy* and *SciPy* packages are essential for science applications, and the *matplotlib* package is useful for plotting. These are already bundled in some distributions of Python that you can install, such as Anaconda Python. To work with DICOM data, the powerful *pydicom* package is invaluable. Make sure you install it! The *dcmread* function (for reading data) and *save_as* function (for writing a DICOM file) will be essential for you.

Working programmatically with DICOM data requires no special skills but does need a certain amount of detective work and willingness to solve a succession of small problems. Where—or in which DICOM tag—can I find this or that information? Is the information missing? Or in unexpected units? Or in a so-called "private tag", defined by the vendor rather than the DICOM standard? A manufacturer of hard- or software that speak DICOM will have a conformance statement, explaining how they fulfil the DICOM standard. Find it! If things still don't make sense, contact the manufacturer. And if you are struggling with any programming problem there is one friend that will always be available, night or day, to answer questions. The Internet!

Rather than present code here, we have uploaded short scripts and example DICOM data to a software repository at GitHub (see: https://github.com/rvbCMTS/EMP-News). There you will find the files and instructions along with useful references. These scripts provide solutions to the example ATCM task in both programming languages (i.e., Option B!). Note that a software repository is a store for code and associated data, usually with some form of version control. Version control means that you can track changes in code, somewhat like you track change in a Word document. But you don't need to worry about that. Just go to the link and click *Code-Download zip* to download a zip archive of the files. Try it! Each script looks to see how many DICOM files there are in a folder, loops though the files, extracting the tube current and slice position from each, and then plots the data (see figure 1, bottom left pane). Synthetic radiographs are also calculated from the CT image data and displayed (see figure 1, anterior-posterior view in top left pane, and lateral view in top right pane). Finally, the tube current modulation plot is shown over the synthetic lateral radiograph (see figure 1, lower right pane). The scripts take a few seconds to run. We think this approach beats making a few hundred mouse clicks to extract data and it gives you more information too. Do you agree? Let us know!

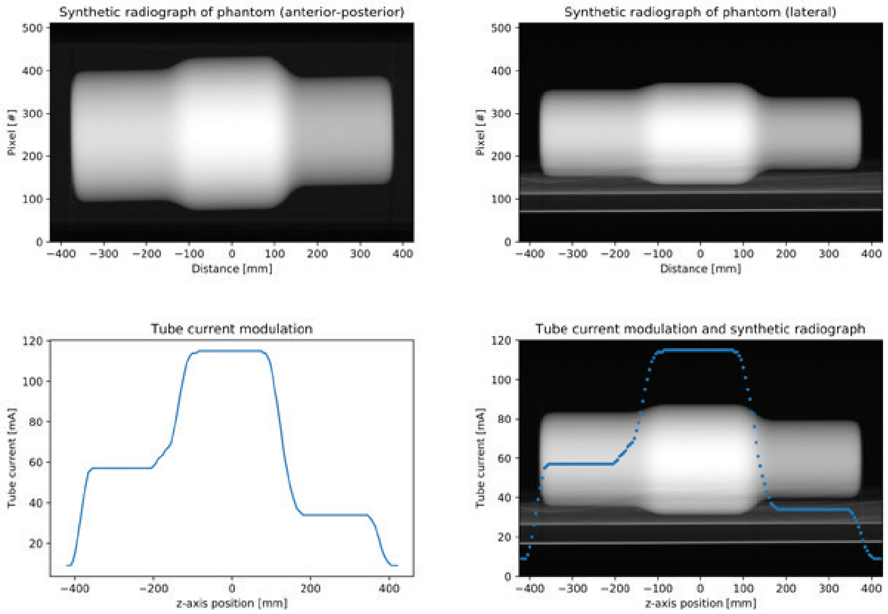

Figure 1: Results from the Python code automating the problem of retrieving X-ray tube current and slice position from all reconstructed axial CT slices of a phantom scan and plotting the results; synthetic radiographs are also generated to compare the physical phantom size with the ATCM function. The DICOM data was provided courtesy of Patrik Nowik.

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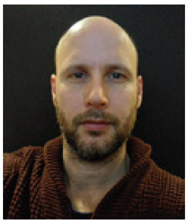

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Development of 3D printed patient specific phantom and bolus for dose verification in radiotherapy

In this article, Antonio Jreije from Kaunas, Lithuania, writes about his ongoing PhD research

Introduction

The application of 3D conformal radiotherapy techniques (IMRT and VMAT) for superficial tumours such as head and neck cancer (HNC) can be challenging since megavoltage photons have a high penetration ability resulting in a skin-sparing effect and tumour underexposure. Therefore, to overcome the build-up region and deliver the pre-planned dose to the target, a compensating structure/bolus could be attached on the patient's skin. Currently, both personalized boluses made from tissue-equivalent materials (i.e. plaster, wax, wet gauze, etc.) and commercial flat bolus are in use clinically. Nonetheless, these boluses present several limitations including laborious manufacturing process for the first type of bolus and lack of surface conformity for flat bolus. Due to this reason *the aim of this study* was to investigate the application of a low-cost 3D printed bolus for the treatment of a real HNC patient while using a 3D printed patient specific phantom replicating the region of interest as a substitute for the patient.

Materials and Methods

Personalized 3D devices (boluses and phantom) were reconstructed from an anonymous HNC patient's computed tomography (CT) scans using open-source software (*slicer.org* and *blender.org)* and printed with a 3D printer (Zortrax M300). The patient-specific 3D phantom of the facial region (nose and cheeks) was designed to be attached to the surface of a standard CT Polymethyl methacrylate (PMMA) head phantom (Fig. 1). Additionally, boluses of two different thicknesses (0.5 cm and 1.0 cm) were printed (Fig. 1). Printing was done with polylactic acid (PLA), choosing 90% infill ratio for 3D phantom and 100% infill ratio for 3D boluses based on our previous experience with 3D printing [1, 2].

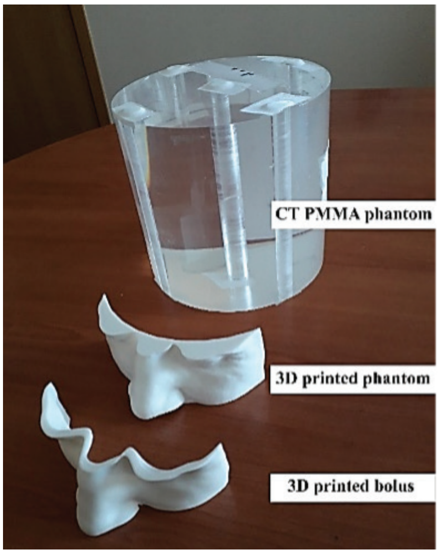

Fig. 1: CT head PMMA phantom, 3D printed phantom and 1 cm thickness 3D printed bolus.

Results

Physical Characterization (Hounsfield Unit and geometric accuracy) of 3D-Printed Objects was performed by comparing the CT scanned objects with the original CT scans of the patient. Hounsfield Unit (HU) measured in the patient specific phantom printed at 90% infill ratio was in the range characteristic for facial soft tissues (-32 HU). In the case of 3D boluses, 100% infill ratio was chosen despite not achieving soft tissue equivalency (469 HU), since while using lower printing infill ratios inhomogeneous dose distribution was observed beneath the thin 3D boluses. This patterned dose distribution was not present in the case of larger objects, thus enabling printing of 3D nose phantom with 90% infill ratio for a more accurate replication of soft tissues. The 3D phantom showed a good geometrical accuracy, which was determined by measuring the overlap between CT image of the 3D phantom and original CT using Dice similarity coefficients (DSC=0.957) [3].

Evaluation of CT scans of the phantom-bolus assemblies showed good bolus fit with air gaps present only in the cheeks area (0.4-2.2 mm for both bolus thicknesses) and nose area (up to 1.4 mm for the 1.0 cm bolus). Observed air gaps were smaller than those previously reported for commercial boluses [4]. Therefore, the results indicated a high conformity between 3D printed bolus and patient's irregular surfaces and result in more accurate surface dose distribution.

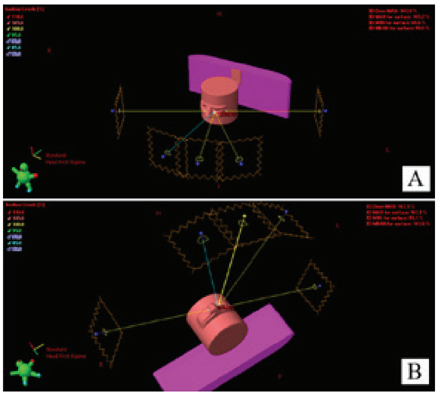

Fig. 2: Three-dimensional presentation of five-field IMRT plans for CT PMMA phantom-3D phantom assembly without (A) and with attached 3D printed bolus (B).

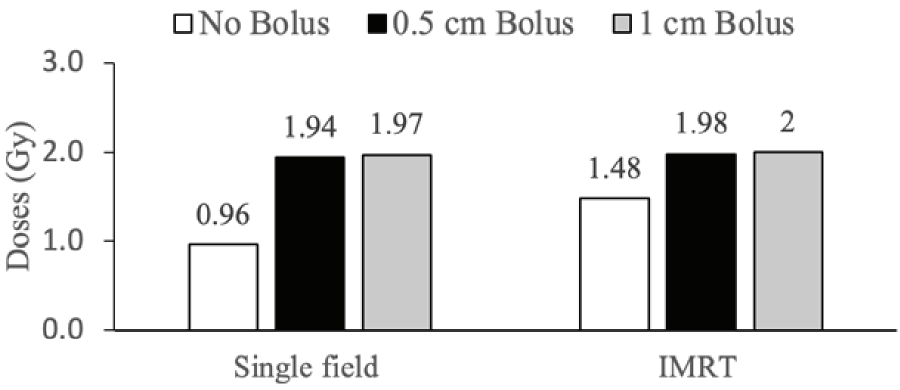

Fig. 3: Dose covering 99% of the target volume (D99%) for single field plans and five field IMRT plans when no bolus, 0.5 cm thickness 3D bolus, 1.0 cm thickness 3D bolus were attached to the surface of the 3D phantom. The prescribed dose to the target was set to 2 Gy/fr.

Dosimetric evaluation of the influence of 3D-printed boluses on surface dose distribution was done using single field treatment plans and five-field IMRT plans (set dose to target of 2 Gy/fr.) created with Eclipse (Varian Medical System, USA) (Fig. 2). For each case, three plans were created for the patient-specific phantom: without a bolus, with 0.5 cm bolus and with 1 cm bolus (Fig. 2). It was found that without 3D printed bolus, only 0.96 Gy and 1.48 Gy of the prescribed dose could be delivered to 99% of the target volume in case of single field and IMRT scenarios, respectively. Additionally, both 0.5 cm and 1 cm thickness boluses are good dose escalating devices, increasing the dose that covers 99% of the target volume by 52% and 26% for single field and intensity modulated fields, respectively (Fig. 3).

Conclusions

This work demonstrated that the application of cost effective, 3D printed patient-specific devices for dose verification in radiotherapy can improve patient treatment outcome.

References

[1] Sevcik, A.; Adliene, D.; Laurikaitiene, J.; Nedzinskiene, R.; Masiulyte, I. Low energy deposition patterns in irradiated phantom with metal artefacts inside: A comparison between FLUKA Monte Carlo simulation and GafChromic EBT2 film measurements. Nucl. Instrum. Methods Phys. Res. B, 478, 142–149 (2020)

[2] Adlienė, D.; Jaselskė, E.; Urbonavičius, B.G.; Laurikaitienė, J.; Rudžianskas, V.; Didvalis, T. Development of 3D printed phantom for dose verification in radiotherapy for the patient with metal artefacts inside. In Proceedings of the World Congress on Medical Physics and Biomedical Engineering, Prague, Czech Republic, 3–8 June 2018; Springer: Berlin/Heidelberg, Germany; Volume 68, pp. 643–647 (2019)

[3] Taha, A.A.; Hanbury, A. Metrics for evaluating 3D medical image segmentation: Analysis, selection, and tool. BMC Med. Imaging 15, 29 (2015)

[4] Butson, M.J.; Cheung, T.; Yu, P.; Metcalfe, P. Effects on skin dose from unwanted air gaps under bolus in photon beam radiotherapy. Radiat. Meas. 32, 201–204 (2000)

Antonio Jreije is a third year PhD student in Material Engineering at Kaunas University of Technology and is currently exploring the different applications of 3D printing in radiotherapy and developing bone equivalent 3D printing material. Additionally, he is a Medical Physicist at Vilnius University Hospital Santaros Klinikos, working in the radiation protection division on periodic quality control of radiology equipment and optimization of diagnostic imaging procedures.

EFOMP COMPANY MEMBER ARTICLE

PTW: E-Learning made in Bangladesh

PTW THE DOSIMETRY COMPANY

Bringing medical physics knowledge to the region of South Asia and out into the whole world: this is the mission of the South Asia Centre for Medical Physics and Cancer Research (SCMPCR) in Dhaka, which was also able to be supported by PTW in 2021. During the corona pandemic it has laid its focus on e-learning – and as such is perfectly in tune with the times. Not to mention, a special highlight for the region's medical physics community is coming up at the end of 2021.

In order to find out more about how the SCMPCR was able to continue its work in the past few months, we conducted an interview with Professor Dr. Golam Abu Zakaria, founding chairman of the SCMPCR, as well as Dr. Frank W. Hensley and Volker Steil, who have been involved with the work at the centre for a number of years and have been supervising exchange projects.

There is good news to report:

As a result of the corona pandemic, the SCMPCR team has transferred its training activities predominantly to the internet. Before the pandemic, experts from around the world would travel to Bangladesh to carry out workshops and lectures for students and practitioners. This included speakers and trainers from our Dosimetry School, who often carried the required dosimetry equipment along as well. The training sessions were financially supported by companies such as the dosimetry specialist PTW Freiburg GmbH, or the German Academic Exchange Service DAAD (Deutscher Akademischer Austauschdienst). The swift and effective changeover to online training courses functioned so well because the SCMPCR and its partnering universities had already set up the required infrastructure, technology, manpower and the technical equipment early on.

200 Applicants for 85 E-Learning Positions

The 2021 e-learning programme offered by SCMPCR is well worth a look: there were four comprehensive programmes offered for medical physicists, all based on different topics; for example, on the subject of brachytherapy or quality assurance in medical imaging. The interest in the courses was overwhelming – the organizers had the difficult task of selecting the 85 most suitable candidates from up to 200 applicants per seminar. In doing this, for people with similar qualifications, it was above all ensured that attention was paid to offering applicants from less developed countries and also women the chance to partake. Each event lasts one week and consists of online workshops by renowned experts in their fields, from all around the world, including Germany, the USA, Canada, India, Japan and Australia. The courses were evaluated beforehand by international medical physics organizations. The participants who attend all days of the seminar and successfully pass the final exam receive a certificate. One positive side-effect: As a result of the courses being offered online, travel and accommodation costs are no longer a factor meaning that not only medical physicists from South Asia can participate, but also those from Europe, Africa and South America.

Furthermore, the SCMPCR workers also organize training for radiation oncologists, radiologic technologists, nursing staff and students. They are now mostly held as hybrid events: this means that they are visited on location by a limited number of participants and at the same time the event is streamed live online, thus allowing hundreds of people to participate. The SCMPCR wants to continue this trend into the future – including preventive programmes, which are aimed at the general public, for example in regard to providing preventive cancer care.

E-learning programmes offered by the SCMPCR training centre in Dhaka, Bangladesh – supported by PTW Freiburg

Hybrid Events for Training and Prevention

Currently, self-help groups or cancer prevention are not widespread in Bangladesh. The SCMPCR team wants to change that by informing women, particularly in remote regions away from the capital city Dhaka, about topics such as cervical cancer or breast cancer prevention. The centre is supported in part by its vast network of universities and hospitals: lots of doctors are familiar with the SCMPCR's programmes and advertise them. The seminars are conducted either in Dhaka or locally in small towns in the more remote regions, which are often home to minorities – this is a unique offer, which is aimed directly at the affected patient and is in high demand. The local people in these communities are informed about the events by vans using loudspeakers. The residents then either participate in person or, due to the limited number of places during the corona pandemic, via livestream on the internet. Additionally, these events are streamed into other towns and projected into large halls, allowing many people to access the programmes.

Uncertain Financing

Besides prevention programmes, the SCMPCR's hybrid hands-on-workshops will play a larger role in the future. Teaching staff will go into hospitals and train the personnel on site using the equipment that is present, with the workshops being streamed online at the same time. The training courses will be financed from donations, just like all the work carried out by the SCMPCR. The centre does not receive any funding from the state, which is why the support of companies such as PTW is vital: the German company has also donated money to the SCMPCR this year, money which was raised during the calendar fund raising event. It is used to fund the wages of the workers, who are responsible for the maintenance and expansion of the e-learning programmes.

Despite the uncertain financing, the SCMPCR team has managed to transform Bangladesh into a significant location for medical physics: Bangladeshi experts are often being asked to carry out the commissioning of new linear accelerators, for example in hospitals in Nepal and Ethiopia. Moreover, a particular highlight for the Bangladeshi medical physics community as a whole is taking place in 2021: for the first time in the congress's history, the "21st Asia-Oceania Congress on Medical Physics" will take place in Bangladesh – of course as a hybrid event.

Further information regarding the SCMPCR's e-learning programmes can be found here: https://scmpcr.org/e-learning-program/

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 is Head of the PTW Dosimetry School, which he initiated in 2014. In his role as the head of school he is responsible for planning, developing and implementing the school's training programme.

MEDICAL PHYSICS THESIS

An open access CT Dose optimization calculator using patients' biometric data – how well does it fare?

In June of this year, Vijayanand Sivakumar graduated with Honours from the Medical Physics MSc programme at the Kaunas University of Technology. Here he summarises his research thesis.

In the field of medical imaging technology, Computed Tomography (CT) stands out with a never-ending demand, accounting for almost 60-70% of total radiological dose, around the world. Since it involves ionizing radiation, patient safety has always been a primary concern and steps to ensure it has become the ultimate goal, while simultaneously preserving the diagnostic image quality. Though CT technology has been subsequently improved over generations by optimizing various influential technical aspects of it, its accurate application over a wide range of patient body habitus is constantly emphasized.

In order to address this issue on hand, the aid of artificial intelligence is being sought out, and many commercial software for the purpose CT protocol and dose management are being introduced. Though many examples are being used in a number of diagnostic centres, cost plays a major role in their effective implementation.

The aim of this work was to develop an open access CT dose estimator, to assist Medical Physicists working in Lithuanian institutions, as a useful tool in optimizing the resultant dose to the patients, based on their biometric data such as their age, size, BMI, etc [1]. The program shall combine different concepts such as Dose output prediction from different Automatic Exposure Control (AEC) approaches, Age & Size based Tube recommendations, Diagnostic Reference Level (DRLs) tracking, and clinical CT protocol management into a single platform.

In order to substantiate this concept, the need for a working prototype program was realized. For this purpose, various exposure patterns for SIEMENS Sensation 64 & 16 slices CT scanners [2, 3] and their CARE Dose 4D TCM were analysed [4]. 182 clinically verified open access CT protocols, along with 12 sets of scientific patient-based tube recommendations and International and Lithuanian DRL data for common adult and paediatric CT procedures were collected. 17 different CT quantifiers concerning tube settings, dose, and image quality [5] were programmed into an approximate 5000 lines of fundamental code syntax in a MATLAB program. The prototype program was named “BioptiDOS”.

The logo of the prototype program

The workflow of the program involves patient data entry such as age, height, weight, etc. The AP and LAT measurements are then carried out manually, from the uploaded scout/Topogram DICOM images.

Once the CT protocol is chosen, different age and size-based tube recommendations are displayed, and the user is able to set the preferred tube parameters. Upon this, the result window (Fig. 1) provides a comparison between results, mainly CTDIvol, SSDE and CNR values, arising from protocol recommended kVp & mA values and different TCM approaches involving patient’s effective diameter (Deff) and BMI. It also allows the user to check if these results are in accordance with the Institutional, National and International DRL values for the chosen procedure.

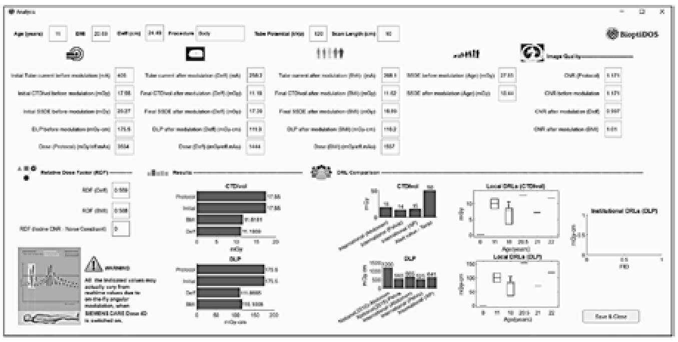

Fig. 1: Results window of the program

In order to validate the proper functioning of the program, the program was tested for different simulated trials for patients of diverse parameters (age, size), for both the head and body examinations, for both the scanner models programmed, which are the SIEMENS Sensation 64 and 16 CTs. A total of 9 patients of varying bodily proportions and age were considered for this purpose.

The dependency between the CTDIvol, tube potential, current and the age of the patient was checked for protocol, Deff & BMI based TCM approaches. Also, the resulting Size Specific Dose Estimate (SSDE), Contrast-Noise-Ratio (CNR) and Relative Dose Factor (RDF) were also calculated, as shown in Fig. 2.

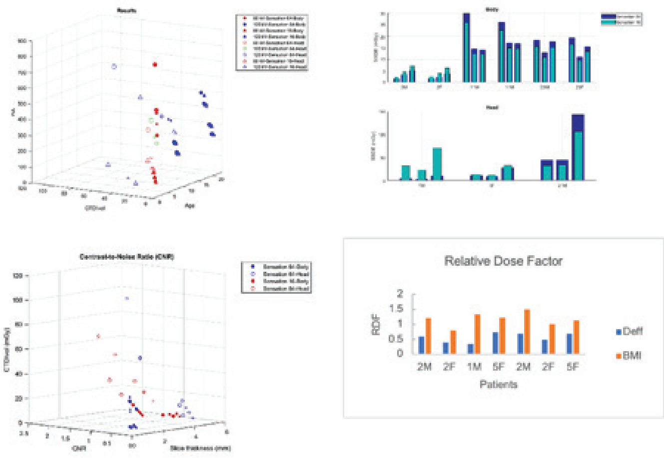

Fig. 2: Validation results

The outcomes of this validation confirmed the physics behind CT. Though mostly the results were sensible, very few inconsistent results were also obtained, namely BMI based results for head CT examinations. Such calculative errors warrant further investigation. Since recommendations from many different scientific articles were used, the accuracy of our calculations needs to be well established. The main limitation of the prototype program was that it was written as a simple script-based program, therefore it requires a considerable amount of time for each execution. Nevertheless, when fully conceived, the program will be developed as a GUI based standalone application.

To analyze the possibilities of further developing the current prototype program for routine clinical usage in the CT department of hospitals, and to discuss the forthcoming implementations, professional advice was sought out from an expert panel, consisting of clinical professionals from Vilnius University Hospital Santaros Klinikos, Vilnius. After discussions it was agreed by both the panel and the authors that the prototype program in its current form requires some improvements, such as patient data security, and emphasized that it has the potential to be implemented for research purposes, when investigating patient dose optimization in Computed Tomography, rather than routine clinical examinations. The source code of the prototype is made open access, for future development of the program, by interested research groups.

References

[1] V Sivakumar, D Adlienė. Development of Patient's Biometric Data Based CT Dose Optimization Algorithm. Medical physics in the Baltic States: Proceedings of the 15th International conference on Medical Physics, Kaunas, Lithuania, 4-6 November 2021. Executive editor Diana Adlienė. Kaunas: Kaunas University of Technology. ISSN 1822-5721. 2021, p. 86-89.

[2] C Anam, et al. A fully automated calculation of size-specific dose estimates (SSDE) in thoracic and head CT examinations. Journal of Physics: Conference Series, 694, 012030, 2016. https://doi.org/10.1088/1742-6596/694/1/012030

[3] C Anam, et al. Volume computed tomography dose index (CTDIvol) and size-specific dose estimate (SSDE) for tube current modulation (TCM) in CT scanning. Int J Radiat Res.; 16 (3) :289-297, 2018. http://ijrr.com/article-1-2277-en.html

[4] RD Macdougall, et al. Size-based protocol optimization using automatic tube current modulation and automatic kV selection in computed tomography. J Appl Clin Med Phys.;17(1):328-341, 2016. https://doi.org/10.1120/jacmp.v17i1.5756

[5] S Mubarok, et al. Parameter-based estimation of CT dose index and image quality using an in-house android™-based software, J. Phys.: Conf. Ser. 694 012037, 2016. https://doi.org/10.1088/1742-6596/694/1/012037

Vijayanand Sivakumar is a graduate with Honours from the Medical Physics MSc programme at the Kaunas University of Technology. Radiation protection being his primary area of interest, during his studies he has also worked in Synthesis and Characterization of Lead-free protection materials. He strongly believes in the significant role played by Artificial Intelligence when it comes to radiation protection.

MEDICAL PHYSICS THESIS

Brain iron deposition, inflammation and obesity

In 2021, Mohammad Ziya Romjon graduated with an MSc in Medical Physics, with Distinction, from the University of Aberdeen, Scotland, UK, having also won the prize for being the top student in his cohort. In this article, he summarises the thesis which formed part of his degree studies.

Overview

Excess of iron catalyses the formation of reactive oxygen species (ROS), causing oxidative stress. Such accumulation and neuroinflammation have been observed in Alzheimer's and Parkinson's diseases [1]. Besides, obesity is characterised by low-grade systemic chronic inflammation [2]. The release of pro-inflammatory cytokines, such as interleukin-6 (IL-6) by the adipocytes, stimulates the secretion of inflammatory proteins such as C-reactive protein (CRP). Also, obesity promotes neuroinflammation and enhances inflammatory response of the brain, culminating towards memory decline [3].

This project uses data of 2481 participants with age 50.5-84.3 years from the UK Biobank to investigate the associations between brain iron deposition, inflammation and obesity in men and women. White blood cell counts and their subtypes, and red blood cell indices characterise the inflammation status and serum blood iron, respectively. T2* relaxation times at the subcortical structures acting as proxies of brain iron were acquired from the brain MRI scans based on multi-echo gradient recalled echo pulse sequence. Body mass index (BMI) was used as an indicator of obesity. This work is believed to be the first to consider these links for human subjects.

The associations between BMI and haematological indices, BMI and T2*, and haematological indices and T2* were assessed using Spearman's rank-order correlation, while adjusting for age. Mediation analysis was used to assess the mediated effect between BMI and T2*, through the haematological indices. All the statistical analyses were performed using the R-software package.

Summary Results

Haematological indices	Men	Women
White blood cells (x10^9 cells/L)	**0.197**	**0.211**
Lymphocytes (x10^9 cells/L)	**0.219**	**0.149**
Neutrophils (x10^9 cells/L)	**0.118**	**0.183**
Red blood cells (x10^9 cells/L)	**0.176**	**0.216**
Haemoglobin concentration (g/dL)	**0.137**	**0.125**
Haematocrit (%)	**0.119**	**0.136**
Mean corpuscular volume (fL)	**-0.106**	**-0.179**
Mean corpuscular haemoglobin (pg)	-0.059	**-0.159**

Table 1: Spearman's correlation coefficients for associations between BMI and Inflammation/Serum blood iron markers, at Bonferroni corrected level of significance of 0.0029.

The positive associations of the white blood cells, lymphocytes and neutrophils with BMI for both sexes (Table 1) reflect the systemic inflammatory condition in obesity whereby the pro-inflammatory cytokines and macrophages are involved [4]. Chronic inflammation suppresses erythropoiesis through the action of hepcidin on iron to give lower levels of red blood cells [5]. However, the results indicate positive relationships of red blood cells, haemoglobin concentration and haematocrit with BMI. Previous studies demonstrated higher ferritin and haemoglobin concentrations in obese subjects [6]. In fact, suppressed erythropoiesis occurred in adolescent obesity leading to iron deficiency and thus lower haemoglobin levels, while in the elderly, this association expires since iron accumulation might be favoured in insulin-resistant men and postmenopausal women [6].

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Mean corpuscular volume (fL)	**-0.106**	**-0.179**
Mean corpuscular haemoglobin (pg)	-0.059	**-0.159**

Table 2: Spearman's correlation coefficients for associations between BMI and T2* (ms) at different brain regions, at Bonferroni corrected level of significance of 0.0036. Statistically significant coefficient is in BOLD. Note: Because iron is paramagnetic, the increased iron content results in higher susceptibility effect, and thus smaller T2* values.

A previous study showed that waist circumference was negatively associated with T2* at the putamen, thalamus, amygdala and hippocampus, but did not find BMI to influence the T2* values [7]. This might be the case because BMI does not truly quantify body fat as it fails to discriminate between fat, muscle and bone density, whereas waist circumference might be more indicative of fat mass. Since the results show increased brain iron content with increasing BMI, it might therefore be assumed to reflect adiposity (see Table 2). A study proved that diet-induced obesity in mice resulted in higher levels of ROS in the brain [8]. Since high iron content enhances oxidative stress, producing more ROS, it might be inferred that obesity contributes to brain iron accumulation.

The indirect effects of BMI on T2* via the haematological indices could be positive or negative, depending on the relationship of BMI with the haematological variables, and that with T2* (Table 3 refers). In fact, the accumulation of adipose tissue macrophages can be caused by the migration of peripheral blood monocytes at the leaky blood-brain barrier, which also contribute to the proliferation of microglia which are resident macrophages in the brain. They thereby promote monocytosis which increases the number of leukocytes in peripheral blood, which appears to mediate the negative indirect effect between BMI and T2* values, raising brain iron content [9]. From the multiple-mediator mediation analysis, it was noted that the competing mediators would cancelled the indirect effect of each other or would reinforced the net indirect effect.

At this stage, it remains difficult to elucidate the cause of brain iron accumulation in obesity, through the effect of these haematological indices with this mediation model. Therefore, it is suggested that further research work is carried out on higher quality data, such as total body fat percentage, CRP and IL-6 levels, serum iron level, ferritin, transferrin and quantitative susceptibility mapping (QSM)-derived MRI brain images. Also, the data collected on participants should be expanded to include additional parameters such as participant's health status, lifestyle, eating habits, amongst others, which can act as covariates. The mediation model can be modified to accommodate for more complex pathways involving the additional mediators and covariates.

	Mediators	Right thalamus	Left caudate	Left putamen	Left pallidum	Right hippocampus	Right amygdala
Men	White blood cells				-0.008		-0.013
	Neutrophils		-0.008	-0.008	-0.008	-0.009	-0.012
	Red blood cells	-0.009			0.007		
	Haemoglobin concentration	-0.012	-0.012			-0.007	
	Haematocrit	-0.007	-0.008			-0.006	
	Mean corpuscular volume		0.011	0.021	0.012		
	Mean corpuscular haemoglobin		0.005	0.021	0.006		
Women	White blood cells					-0.01	-0.015
	Lymphocytes			-0.007	-0.006		
	Neutrophils					-0.008	-0.015
	Red blood cells						-0.014
	Haemoglobin concentration	-0.008	-0.014	-0.011	-0.006	-0.005	
	Haematocrit	-0.008	-0.014	-0.009	-0.006		
	Mean corpuscular volume		0.013	0.012	0.007		
	Mean corpuscular haemoglobin		0.011	0.011	0.006		-0.008

Table 3: Indirect effects in single mediation analysis between BMI (kg/m2) and T2* (ms) via the haematological indices as mediators. The statistical significance of the mediation effect was tested using 10,000 bootstrap samples at 95% confidence interval

References

[1] Urrutia P, Aguirre P, Esparza A. et al. Inflammation alters the expression of DMT1, FPN1, and hepcidin, and it causes iron accumulation in central nervous system cells. Journal of Neurochemistry, 2013;126(4),541-549. https://doi.org/10.1111/jnc.12244

[2] Gonzalez-Dominguez A, Visiedo-Garcia F, Dominguez-Riscart J et al. Iron metabolism in obesity and metabolic syndrome. Int. J. Mol. Sci. 2020;21(15): 5529. https://doi.org/10.3390/ijms21155529

[3] Miller AA, Spencer SJ. Obesity and neuroinflammation: A pathway to cognitive impairment. Brain, Behaviour and Immunity, 2014 Nov; 42:10-21. https://doi.org/10.1016/jbbi.2014.04.001

[4] Vuong J, Qiu Y, La M, et al. (2014) Reference intervals of complete blood count constituents are highly correlated to waist circumference: should obese patients have their own "normal values"? American Journal of Hematology, 2014 Jul;89(7):671-7. https://doi.org/10.1002/ajh.23713

[5] Coimbra S, Ferreira C, Belo L, et al. Impact of weight loss on inflammation and red blood cell biomarkers after laparoscopic gastric banding surgery. Journal of Investigative Medicine. 2018 Feb;66(2):304-308. https://doi.org/10.1136/jim-2017-000528

[6] Aigner E, Feldman A, Datz C. Obesity as an Emerging Risk Factor for Iron Deficiency. Nutrients. 2014 Sep 11;6(9):3587-600. https://doi.org/10.3390/nu6093587

[7] Blasco G, Moreno-Navarrete JM, Rivero M, et al. The Gut Metagenome Changes in Parallel to Waist Circumference, Brain Iron Deposition, and Cognitive Function. The Journal of Clinical Endocrinology & Metabolism. 2017 Aug 1;102(8):2962-2973. https://doi.org/10.1210/jc.2017-00133

[8] Freeman LR, Zhang L, Nair A, et al. Obesity increases cerebrocortical reactive oxygen species and impairs brainfunction. Free radical biology and medicine. 2013 Mar;56:226-33. https://doi.org/10.1016/j.freeradbiomed.2012.08.577

[9] Friedrich K, Sommer M, Strobel S, et al. Perturbation of the monocyte compartment in human obesity. Front Immunol. 2019;10:1874. https://doi.org/10.3389/fimmu.2019.01874

Mohammad Ziya Romjon is a medical physicist in the Radiotherapy Department at Victoria Hospital in Mauritius. He initially obtained his bachelor's degree in Physics at the University of Mauritius, for which he was awarded the Professor Abdus Salam Gold Medal in the year 2015. He earned a Post Graduate Certificate in Education in the year 2016 to work as a physics educator. After a year, he embarked on a more challenging career path, as a medical physicist. In the year 2020, he was awarded the Chevening Scholarship to read for a Master's degree in Medical Physics at the University of Aberdeen, Scotland. He obtained his MSc with Distinction and was awarded the Griffith Prize as the top student from his intake.

Modern Art (and especially Jeroen Henneman)

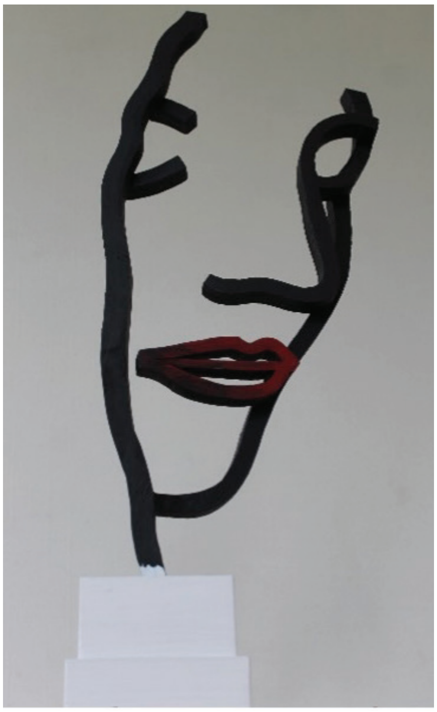
Ruben van Engen from Nijmegen (NL) writes about his hobby and passion

My wife and I are very fond of art. We often visit museums and exhibitions in the Netherlands, where we live, but also go regularly to major European cities to spend a weekend, stroll around, see interesting places, have a good dinner and visit a museum. We also like to visit art galleries and art fairs and occasionally buy pieces of art. When we had our 12.5 years wedding anniversary some years ago (yes, this is celebrated in the Netherlands), we had a big party and asked our guests not to give a present, but to give some money with which we would be able to buy a nice work of art. So, later that year at the PAN art fair we looked around to see whether there was something really nice to buy as a reminder of our wedding anniversary.

At one of the booths we fell in love with a conceptual work of art made by Jeroen Henneman with the name "Scissor". (In conceptual art it is the idea or concept that counts most.) It was one of his early works (from 1970) and consists of a box with a very large scissor, which has just cut a cord. In a way the moment of cutting the cord is frozen in time. Beside that I really liked the work, I was amazed how this object had been achieved technically, the scissor and cord seem to be in free air without any obvious attachments. We did wander around at the other booths of the art fair, but it was clear to us; this particular work of art stood out and we decided to buy it. Our first "Henneman".

The object "Scissor" (1970), which is an example of a work representing a frozen moment in time

After this purchase we noticed that whenever we went to an art fair, this specific artist seemed to have the works we found most interesting. We became acquainted with the holder of the art gallery representing Jeroen Henneman and bought several works over the years. One of the central themes of the work of Henneman is trying to combine the 2nd and 3rd dimension, which he does in very innovative, clever and sometimes technically difficult ways. He is nowadays most famous for his standing drawings in which he makes a line drawing on paper, transfers the lines to thin slabs of wood, cuts these slabs into wooden "lines" and attaches them again as in the original drawing. He then places this wooden object vertically on a pedestal. By doing this the (2D) drawing (often with perspective) can be observed in "free air" as a 3D object. The resulting artwork is really special and interesting. Henneman has made numerous objects in this technique, including portraits of our former queen and current king.



Standing drawing "Head C" (1996), probably representing Caroline, the wife of the artist

In 2020, when the lockdowns due to the coronavirus pandemic started, all congresses, meetings, visits to friends and family gatherings had to be cancelled. This meant that I had time to spend on something completely different: I decided to study Jeroen Henneman and his works of art. I read many interviews and reviews of his work and began to see relationships and the meanings of the works of art. I also found out that he made quite a few illustrations and covers for books and poems. To get an interesting cover of a book, Henneman reads a book or poem many times and writes down key words and short phrases, which he uses to make the cover or illustration. This means that the cover is a not a literal representation of the book or the title, but a more deep representation of the thoughts behind the book. What is also very interesting about Jeroen Henneman is that his work often has a surrealistic or ironic twist, which I think makes the work more interesting. This might not be surprising, as at the start of his career Henneman met the famous Belgian surrealist Magritte, who is supposed to have said at one of the first exhibitions of Henneman "that they were on the same page".

Silkscreen "The bungalow Ynyswidden" (1972) and object "Scissors" (2020), examples of works of art with an ironic twist

I started to write down my thoughts and findings on the artworks, made connections between them and collected the relevant quotes from the artist. Slowly these notes expanded and I decided to make a book out of it, just for myself. When I was finalizing the text, we visited the gallery where Henneman exhibits his work and I just happened to mention the book to the gallery owner. He told me that he would like to have a copy, so I decided to print two copies of the book.

me that Henneman continuously went through the book instead of talking about business. Henneman also kept the book. He wanted to have and got more copies and send some sketches and drawings as a kind of "thank you". One of these sketches is a study of a work of art we have at our home, so you can imagine that I was really pleased with this gift.

And next? Since the start of the corona crisis, Henneman lives in Italy for most

The book produced by the author

A few weeks after the gallery owner received his copy of the book, he contacted me and told me that he showed the book to the artist himself and that he really liked it. The gallery owner showed the book during one of their regular business meetings, and told

of his time, but we are now scheduling an appointment to visit his atelier in Amsterdam when he is back in the Netherlands. It will be a real pleasure meeting him and being able to talk about his work. I am looking forward to that.

Ruben van Engen studied applied physics and is currently physics consultant at the Dutch Expert Centre for Screening (LRCB). He chairs the EFOMP DBT QC working group and previously coordinated the work on the physics chapters of the European Guidelines in mammography, its Supplement and in EUREF. He is a member of the Guidelines Development Group of the European Commission Initiative on Breast Cancer. For the Dutch breast cancer screening he is responsible for the technical quality control protocols, system optimization and typetesting. He has extensive experience in testing all brands of mammography and DBT systems and is involved in developing model observers and AI in image quality evaluations, the development of a new breast dosimetry (AAPM/EFOMP TG 282) with accompanying phantoms (AAPM/EFOMP TG 323). He teaches mammography physics to radiographers, radiologists and physicists and is one of the leaders of the EUTEMPE module on mammography physics. He is currently advising and setting up a quality assurance system for the prenatal screening in the Netherlands. Ruben is very passionate in his work and teaching, but also about (ancient) history, architecture, modern art and linguistics. He likes to go to the theatre, traveling, seeing new countries and cities and experiencing different cultures and cuisines.

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**

Dec 13th, 2021 - Dec 17th, 2021

RAPTOR SCHOOL - LOOP BASIC
Munich, Germany

Feb 3rd, 2022 - Feb 5th, 2022

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

Mar 21st, 2022 - Mar 23rd, 2022

5th conference on small animal precision image-guided radiotherapy
Munich, Germany

Apr 11th, 2022 - Apr 13th, 2022

International Conference on Monte Carlo Techniques for Medical Applications
Antwerp, Belgium

Apr 25th, 2022 - Apr 29th, 2022

International Conference on Individual Monitoring of Ionising Radiation (IM2022) and Neutron and Ion Dosimetry Symposium (NEUDOS-14)
Kraków, Poland

May 2nd, 2022 - May 5th, 2022

Course on Therapeutic and Diagnostic Medical Physics

May 16th, 2022 - May 18th, 2022

BNMS Spring Meeting 2022
Glasgow

May 30th, 2022 - Jun 3rd, 2022

6th European Congress on Radiation Protection
Budapest, Hungary

Jun 13th, 2022 - Jun 17th, 2022

Jubilee RAD 2022 Conference – Spring Edition
Herceg Novi, Montenegro

Jul 25th, 2022 - Jul 29th, 2022

Jubilee RAD 2022 Conference – Summer Edition
Herceg Novi, Montenegro

Aug 17th, 2022 - Aug 20th, 2022

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

Sep 21st, 2022 - Sep 24th, 2022

German Conference on Medical Physics
Aachen, Germany

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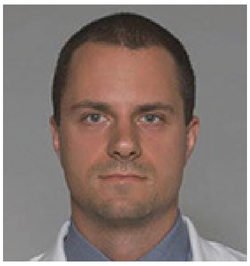

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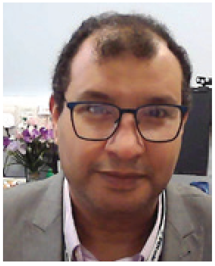

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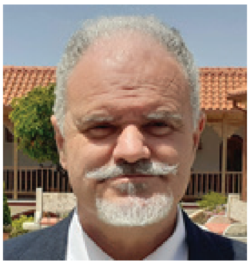

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