



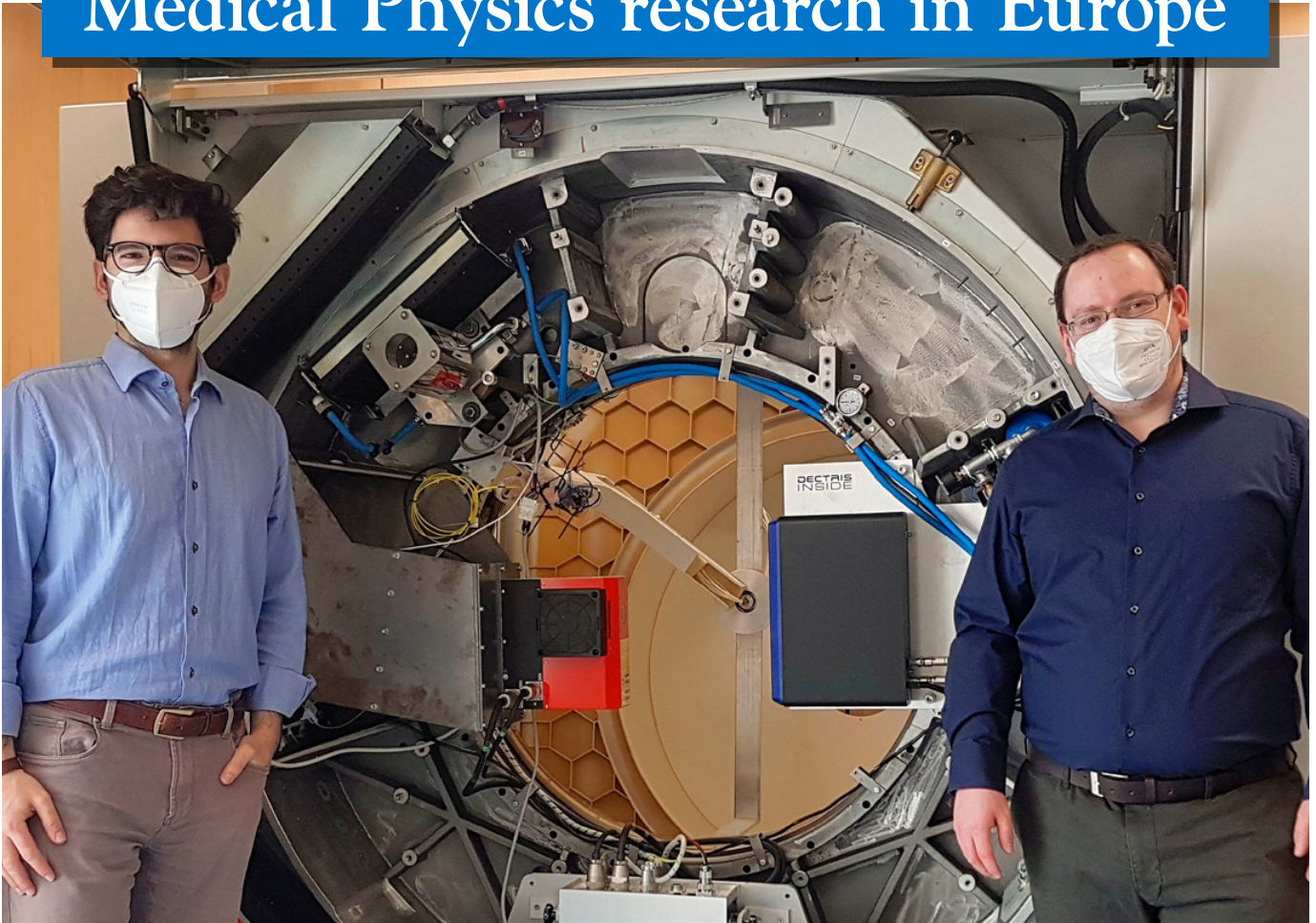
EFOMP

The European Federation of Organisations
for Medical Physics Bulletin

European Medical Physics News

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Medical Physics research in Europe



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Cover photograph shows PhD student Carlo Amato (left) and postdoctoral researcher Dr. Stefan Sawall (right), standing next to the experimental CT gantry at DKFZ in Heidelberg; the gantry is equipped with a micro focus x-ray source and a photon counting detector. See the article on page 55 of this issue.

Editorial

Spring is a time of hope, as we see the snow melting (in Athens as well as in more northern climes!) and the spring flowers appearing. The pandemic still occupies every news bulletin and dominates our home and work lives, but there are definite signs of hope there too, with infection numbers in decline in many areas and vaccines being steadily rolled out. But the proliferation of COVID-19 over the winter months has taught us that we must be ever-cautious if we are to avoid further waves of infection. So, while we are all hoping that we will be able to meet in person some time in 2021, it is looking like we may have to gather virtually for a few more months. At the time of writing, it has just been decided that the ECMP 2020 conference will be held as an online-only event in June. But what an event it will be – with almost 750 abstracts submitted and sessions covering all aspects of medical physics, it promises to be the event of the year for European Medical Physics!

The theme of this issue of EMP News is Medical Physics Research in Europe, and the newsletter contains eight articles on this topic. These include reports of research on topics as diverse as CT and PET technology, particle therapy and fluid mechanics. Also included are articles on the activities of EFOMP's Projects and Scientific committees, an overview of EURAMED and a guide to applying for funding from ERC.

On a sad note, the newsletter contains two obituaries of medical physicists who recently passed away: Dr. Maria Kotzarsalidou who died at age 54 (a victim of COVID-19) and Prof. John Mallard who passed away at the grand age of 94. Both are greatly missed.

The Spring newsletter contains a number of regular features, including a medical physics book review, and two overviews of recent papers published in *Physica Medica*, by the journal's newly-appointed Editor-in-Chief, Iuliana

Toma-Dasu and Deputy Editor, Claudio Fiorino. Our popular Medical Physicists' Hobbies section contains an article about wooden photo album design by a Serbian medical physicist and one about singing from a Maltese colleague. Following a break, you will also be pleased to hear that AURORA's friendly lion cartoon character is back for another episode of his myth-busting exploits.

Articles from EFOMP Company Members are always appreciated by our readership; in the Spring issue you can find highly informative articles from seven Company Members.

Last but certainly not least, in this issue we include the results of the 6th EFOMP Photo Contest, the theme of which was "The Sky at Night". I am sure you will agree that the winning pictures are truly stellar examples of Medical Physicists' creative endeavours! You are strongly encouraged to enter the 7th EFOMP Photo Contest – details are in the article.

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

David Lurie and the Editorial Team

(pubcommittee@efomp.org)

March 2021



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

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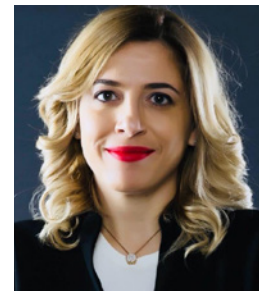
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Incoming President's Editorial

Paddy Gilligan became President of EFOMP in January 2021; here he gives his first President's message, in a piece based on his recent EJMP article

2020 was a challenging year for medical physicists in Europe. We had to deal with two seismic events, Brexit and coronavirus, that were outside of our control and that have had major effects on the future of our organisation and profession. As we approached the end of the year, we had some good news on both fronts with a vaccination programme in sight and an agreed trade deal.

2020 also saw the end of Marco Brambilla's successful presidency. The phrase "hard act to follow" immediately comes to mind. One can go back to the editorial written in 2018 [1] which shows that the ambitions have largely been achieved by Marco, and the dedication of the board, committees and council. This year I am humbled and honoured to assume the presidency of a federation of 36 National Member Organisations (NMOs) that is in good shape and has moved from strength to strength. Indeed, it is the strength of the organisation that has helped us get through the challenges that we have faced. In the following paragraphs and Table 1 I will outline some of the developments and ambitions that I would like to build on as well as some of the necessary consequences of the most extraordinary year that was 2020. Ursula van der Leyen highlighted the TS Eliot quote [2], which resonates in this transitional period:

"What we call the beginning is often the end. And to make an end is to make a beginning. The end is where we start from."

1. Move of the administration function to the Netherlands:

EFOMP celebrated forty years in 2020 from when Professor John Clifton inaugurated the federation in London. Britain voted to leave the European Union in 2016. However, real change in regulatory and other matters will only be experienced from January 2021. For EFOMP, access to funding from the EU, data protection and other regulations influenced our decision to move our administrative headquarters to the Netherlands. EFOMP operates a non-profit making company that is able to receive and distribute funding to achieve the advancement of medical physics in Europe. For forty years, this company ran successfully in York in the UK. The immense contribution of IPEM, the UK NMO, and Fiona McKeown to this success must be acknowledged. This move does not alter the status of the relationship with either the UK or Dutch NMOs, however, the work in assisting the move by both organisations is much appreciated. The new entity in the Netherlands will be administered by the company Cantrijn, which performs a

similar role for NVKF, the Dutch NMO. This move of offices and bank accounts may lead to some short-term technical issues around administration and financial transactions; however, in terms of EFOMP's role in advancing medical physics in Europe, "business as usual" will apply.

2. Medical Physics response to the pandemic

December 2020 had both sad and hopeful moments. We were saddened by the loss of our Hellenic Association of Medical Physics colleague Maria Kotzasarlidou, due to COVID. Dr. Kotzasarlidou made a significant contribution to the education of young medical physicists in the Nuclear Medicine field. On the positive side, we were happy to see the tweeted images of Italian NMO president Michele Stasi receiving the vaccine. The pandemic had a devastating effect on health services, patients and staff during the last year. Medical physicists in Europe adapted to maintain existing services, treat patients and rapidly develop new facilities in response to the pandemic. EFOMP assisted by sharing knowledge and experience through its online COVID forum [3]. It also provided lockdown lectures, webinars in collaboration with EUTEMPE and our first successful online ESMPE school on particle therapy. The recording of these events on our educational platform has created a unique resource that points a way forward for EFOMP. The success of the online information sharing is down to the volunteers who give their time and commitment. It is intended that EFOMP will assist in the provision of digital resources, such as access to webinar platforms for NMOs, to maximise the benefit of our volunteers.

3. ECMP 2020 and 2022

The pandemic led to the inevitable postponement of the European Congress of Medical Physics, (ECMP) 2020 till June 2021 and the moving online of all EFOMP face-to-face meetings. At the time of publication of this editorial in *Physica Medica* we had hoped that due to the rapid development of coronavirus vaccines that Torino could go ahead face to face in June 2021. However, safety must always be our priority. It now looks like the face to face congress we had hoped for cannot happen and the congress will take place online. You can rest assured that the organising committee will work tirelessly to make a special online ECMP. The recent ECMP warm up webinar by Federica Zanca, Leonard Wee and Mika Kortesenieni which had over 500 attendees and the high numbers of abstracts received augur well for the online event. The flexibility of the Spanish NMO in postponing their annual congress to facilitate ECMP has been acknowledged by EFOMP.

Prior to my role as Vice President of EFOMP I had chaired the bid for ECMP 2022, which was successful for Dublin against strong competition. It is planned to go ahead with the ECMP in Dublin 2022 as a blended event. The ambition of the outgoing president to exceed one thousand registrants should be achievable and we will do whatever we can, particularly for young medical physicists from all 36 countries of EFOMP, to facilitate their participation.

The willingness of NMOs to put in so much effort in competing to host such events, schools, administrative functions is a bedrock of the federation. Although not everyone can be successful for each event, the experience gained in compiling such bids will ensure that future bids can be successful for such events and increase the quality of the congress.

4. What to expect during the next Presidency

EFOMP is an organisation with clear ambitions and structures [3]. NMOs are the essential elements of the federation. The committees carry out the essential work of the federation. The new Individual Associate Membership category reflects the increasing capability of EFOMP to deliver its aims of communication, integration and education through its digital platform. It also helps us to create access in countries where NMOs are not yet established. Although this is my first time as part of the board of EFOMP, there is a wealth of dedicated experience surrounding me on the board thanks to these structures. However, our future is only as good as the next volunteer or participant who is nominated by the NMOs. When possible, I will continue the previous policy of visiting NMOs for leadership meetings face-to-face or online at local and regional meetings.

The recent creation of a special interest group for dosimetry in therapeutic nuclear medicine allows for development of special medical physics centred activity groups that can be accommodated using existing structures and that have an appropriate home in EFOMP.

5. Professional development

EFOMP under the guidance of the professional matters committee has recognised four national registration schemes (NRS) to date. It should be possible that the majority of NRS can be accredited by the end of the current presidency; this would increase the mobility of physicists in our community. When travel is permitted, the restoration and expansion of exchange programmes and mentorship is something to look forward to. The European Examination Board (EEB) will assist in setting standards for mobility and harmonisation.

Although the European Board for Accreditation in Medical Physics (EBAMP) is independent from EFOMP, a mechanism for European accreditation of academic elements of the NRS is something I would also like to see.

In different countries medical physicists assume different roles outside of EU directive 13/59 [4]. For example, in the Netherlands they are involved in invasive and non-invasive therapies

and physiological monitoring. The recent publication of the updated statement on the role of the physicist in MRI shows how patient experience may be benefitted and can help make business cases for medical physicists in new roles. The desire to use scientific expertise in new ways is something that we are all passionate about. EFOMP will continue to drive the visibility of the physicist in bringing patient benefits.

The directive underpins the requirement for future medical physics expertise. The recent issues of European Medical Physics News [3] highlight the very strong role of early-career medical physicists within our NMOs. During my presidency, I hope that we can increase EFOMP's relevance to these young physicists who are the future of medical physics and that we can set up structures and communication channels to consolidate their involvement.

6. New challenges

The recent pandemic showed how quickly medical physicists could adapt their science to face new challenges. There are some new important areas that are being developed and that will figure strongly over the term of the next presidency. Some current themes are the increasing availability of particle therapy, flash therapy, dosimetry in nuclear medicine therapy, assessment of image quality for optimisation in CT and mammography. These are only parts of a long list. The need for expertise in these new technologies underpins the important role of research in medical physics in Europe. EFOMP plays a vital role in many European consortia through its Projects and European committees. I hope that in the next few years our visibility will be enhanced even further, through these bodies and the medical industry representative bodies such as COCIR. The contribution of artificial intelligence (AI) in medical physics is something that needs to be planned and trained for with clearly defined roles. The Working Group (WG) structure in EFOMP provides a mechanism for delivering the best expertise in these areas and the enthusiasm for participation is welcome. The joint ESTRO EFOMP WG on the core curriculum (CC) in Radiotherapy points to the role that EFOMP plays as the voice of medical physicists in Europe and how the medical physics voice is strengthened by our collective identity as EFOMP. Similar updates are required for Nuclear Medicine and Radiology CCs. The interactions with other organisations as defined by our memoranda of understanding should be collaborative and complimentary, created by a strong EFOMP identity which articulates the role of the medical physicist in the hospital, university, research or industry setting.

The WGs have been producing quality control protocols and guidance. One of my themes will be the relevance of EFOMP in medical physicists' everyday activities. The use of common software tools in combination with these protocols is something that will increase their relevance further.

The development of digital communication tools by the Communications and Publications committee over the last number of years has been impressive. The development of the educational platform is also very impressive. Although face-to-face teaching is preferred, in many cases it is not always possible.

Throughout the pandemic, EFOMP showed that significant education can be imparted through the use of these platforms. With this in mind the Education and Training committee will see how we can enhance the use of these resources in a sustainable manner.

It is also time to acknowledge the contribution of Paolo Russo who finishes as editor in chief of the European Journal of

Medical Physics after eight years. Since 2017 the impact factor has increased from 1.99 to 2.5 indicating the strong voice, the research contribution and identity for medical physics in Europe. We welcome the new editor Iuliana Toma-Dasu. It is my hope that through the use of digital media with the help of Elsevier we can boost the impact factor even further.

Area	
Education	<ul style="list-style-type: none"> • Increased online access and content on EFOMP education platform. • Liaison with EBAMP and EEB to look at accreditation of MSc and PhD programmes. Continuation and development of ESMPE school editions.
Identity	<ul style="list-style-type: none"> • Increased relevance of EFOMP in day-to-day medical physics activities through WG. • Increased participation of young and early career physicists in EFOMP structures and a voice for their future, reflecting inclusion and diversity. • Enabling tools such as science writing, ethics, mentorship in research. • Development of medical physics profile activities and volunteerism in non-ionising physics: MRI, ultrasound, laser, AI. • Increased EFOMP accreditation of National Registration Schemes • Look at potential to provide software resources, procurement, risk assessment tools and spread through EFOMP. • Double number of IAMs. • Create a European medical physics mailing list, for information and regulation distribution.
European Congress of Medical Physics	<ul style="list-style-type: none"> • Increased participation through online communication. • Increased profile and support from vendors to facilitate further resources for NMOs.

Table 1. Areas of interest for the current presidency

Finally, I would like to quote a phrase from the Irish language which resonates with the role of EFOMP for medical physics in Europe:

“Ni neart go chur le cheile”
There is no strength compared to working together.

References

[1] Brambilla M. Editorial: New President of the European Federation of Organizations for Medical Physics, 2018;45:207-209. <https://doi.org/10.1016/j.ejmp.2018.01.002>.

[2] Remarks by President Ursula von der Leyen at the press conference on the outcome of the EU-UK negotiations https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_20_2534

[3] EFOMP website <https://www.efomp.org/>

[4] European Council Directive 2013/59/Euratom on basic safety standards for protection against the dangers arising from exposure to ionising radiation and repealing Directives 89/618/Euratom,90/641/Euratom,96/29/Euratom,97/43/Euratom and 2003/122/Euratom. OJ of the EU. L13;2014, 57: 1–73.



Paddy Gilligan, President of EFOMP

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Cantrijn: a new point of contact for EFOMP

As a result of Brexit, EFOMP's administrative headquarters has moved from the UK and is now based in Utrecht in The Netherlands, within the capable hands of Cantrijn

Cantrijn is one of the iconic organisations in the Netherlands dedicated to the professional support of associations. Among the dozens of clients belong associations, (professional and branch organisations), foundations, project organisations, network organisations, domes and platforms. These associations are active in several sectors, from health care, construction, industries to professional and social services, IT and charities.

The clients of Cantrijn are mainly recognized by the absence (or limited presence) of an own support organisation. Cantrijn shapes and gives content to this support, so that

managers and executives are able to focus on professional issues and subject-related contacts. After all, that is what they are good at. Cantrijn takes care of this, on a continuous flexible base, by supporting all occurring and often time-consuming organizational activities, as well as strategic, tactical as operational. Often Cantrijn organizes the entire office organisation, but if desired, partial support can be offered as well.

The Domus Medica building,
where Cantrijn is based



The different skills of 35 professionals are combined by Cantrijn from two establishments in the centre of the country (Gorinchem/Utrecht). In Utrecht, Cantrijn has an establishment at Domus Medica, which is the central building (see the photo), where all important medical Dutch associations are united. Together, the colleagues provide secretarial, financial, administrative, communicative and quality support. Cantrijn has been supporting the Dutch Association for Clinical Physics (NVKF), member of EFOMP, since 2007. Because of that connection, EFOMP enlisted the support of Cantrijn by establishing a new European federation, based in the Netherlands. A one-to-one relocation of the existing organisation from the UK to the Netherlands was not possible; therefore, a whole new federation had to be

established, founded on Dutch law. During 2021 all EFOMP UK activities will be transferred to EFOMP NL and EFOMP UK will be dismantled. Cantrijn has been allowed to supervise this whole process in cooperation with lawyers and tax specialists from the Netherlands, as well as from the UK.

Cantrijn is proud to have accomplished this and to support the financial administration from now on. The contact for financial/administrative support is Romy Steegwijk and the contact for office support is Lotte van Vliet. Cantrijn stands for continuity, so Romy and Lotte are supported by other colleagues.

Cantrijn looks forward to a pleasant cooperation!

Key contacts at Cantrijn



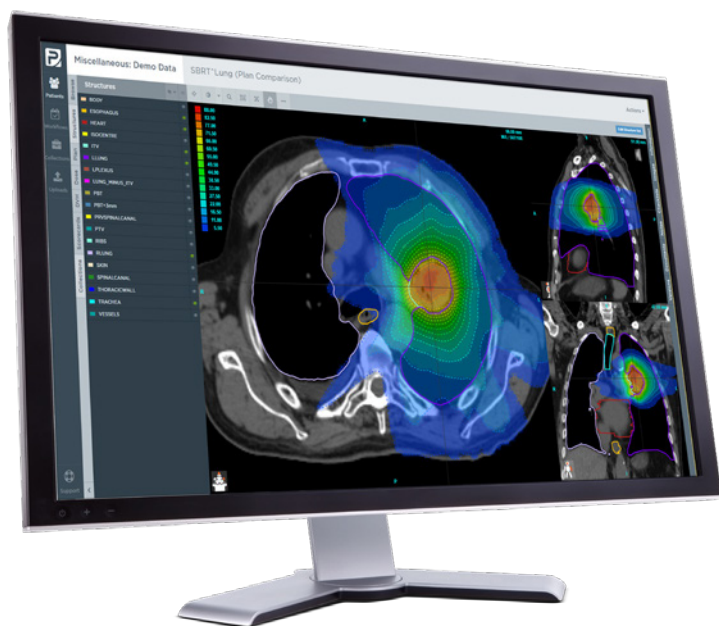
Edward van der Meijden



Romy Steegwijk



Lotte van Vliet



Elekta ProKnow

Improving treatment plan quality through standardization



RT-PACS



Distributed contouring



Remote peer review



Big data analytics



Outcomes studies

Sun Nuclear: Stereotactic QA Arrays – Resolution and Detector Spacing



With the increased popularity of linac-based stereotactic treatments over the recent years, the need for dedicated patient-specific quality assurance (QA) equipment is also increasing. Among the key distinguishing characteristics of such equipment are high spatial resolution and sampling frequency of the detector array.

The resolution is dictated by the active volume of the detector, or to be more precise, by its point spread function. The width of the point spread function decreases with increasing density of the detector medium, giving solid-state detectors an advantage over their air- or liquid-filled counterparts. In fact, for diode detectors, the width of their point spread function is typically smaller than their physical size.

The sampling frequency of a QA array is represented by the detector spacing and is related to, but distinct from the detector resolution. As stated by the Nyquist-Shannon sampling theorem, a distribution can be fully sampled if the sampling frequency is twice the highest frequency occurring in that distribution. Therefore, the question of adequate detector spacing can be answered by evaluating typical stereotactic dose distributions in the frequency domain and comparing their frequency spectra against the sampling frequency of a QA array. If the sampling frequency is lower than twice the maximum frequency in the dose distribution, the effects can be approximated by applying an anti-aliasing low-pass filter, i.e., discarding the higher-frequency components of the distribution.

Figure 1 shows an example of such estimate for the Sun Nuclear SRS MapCHECK (2.5 mm detector spacing, 0.47 mm² active detector area). The figure shows a dose distribution for a spine SBRT treatment. The frequency spectrum (Fig. 1(b)) corresponds to a profile taken along the y-axis (through the isocentre and perpendicular to the plane of gantry rotation). This is the direction of the highest dose gradient and thus represents the upper limit of the frequencies found in this distribution.

SRS MapCHECK's detector spacing of 2.5 mm allows to sample frequencies up to 0.2 mm⁻¹, or $1/(2 \times 2.5\text{mm})$. The impact of not sampling the small contributions of frequencies exceeding this limit can be visualized by applying a low-pass filter, converting the 2D frequency spectrum (not shown) back to spatial domain, and comparing it to

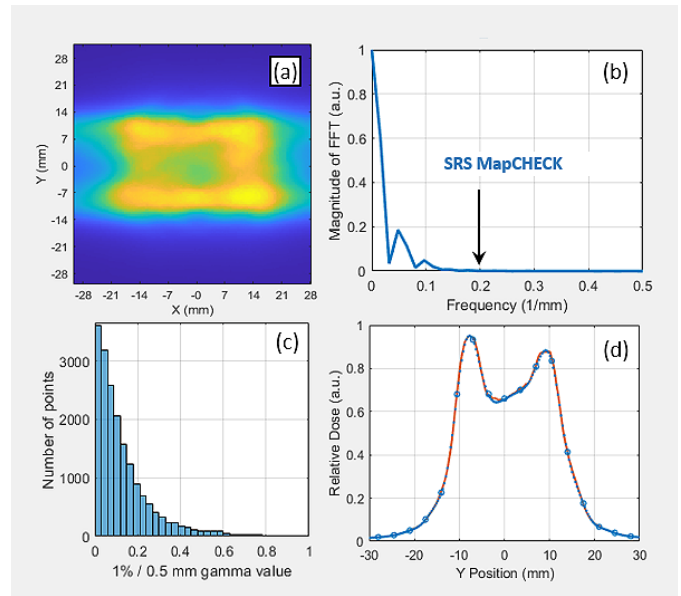


Figure 1. a) 2D dose distribution for a spine SBRT delivery. The dose was measured via film dosimetry (0.35 x 0.35 mm² pixel size). b) Frequency spectrum along the Y-axis of the 2D Fourier transform of (a). The arrow shows the maximum frequency sampled by SRS MapCHECK. c) Distribution of gamma values for 1%/0.5 mm gamma comparison of filtered and original dose distributions. d) Y-axis profile through the original (orange line) and filtered (blue dots) dose distributions. Larger blue circles correspond to SRS MapCHECK detector positions.

the original dose distribution. The results of these operations are shown in Figure 1(c) and (d). 2D gamma analysis was used to compare the filtered and original dose distributions with 1% and 0.5 mm dose difference and distance-to-agreement criteria, respectively, and yielded the passing rate of 100%. This example illustrates that SRS MapCHECK's 2.5 mm detector spacing is sufficient to adequately sample typical stereotactic dose distributions.



Lena Tirpak, Ph.D.

Lena Tirpak is a Product Physicist at Sun Nuclear, the leader in quality assurance solutions for radiation therapy and diagnostic imaging. Lena supports product research and development and played a key role in the development of the SRS MapCHECK system. She holds a doctorate in solid-state physics and a master's degree in medical physics.

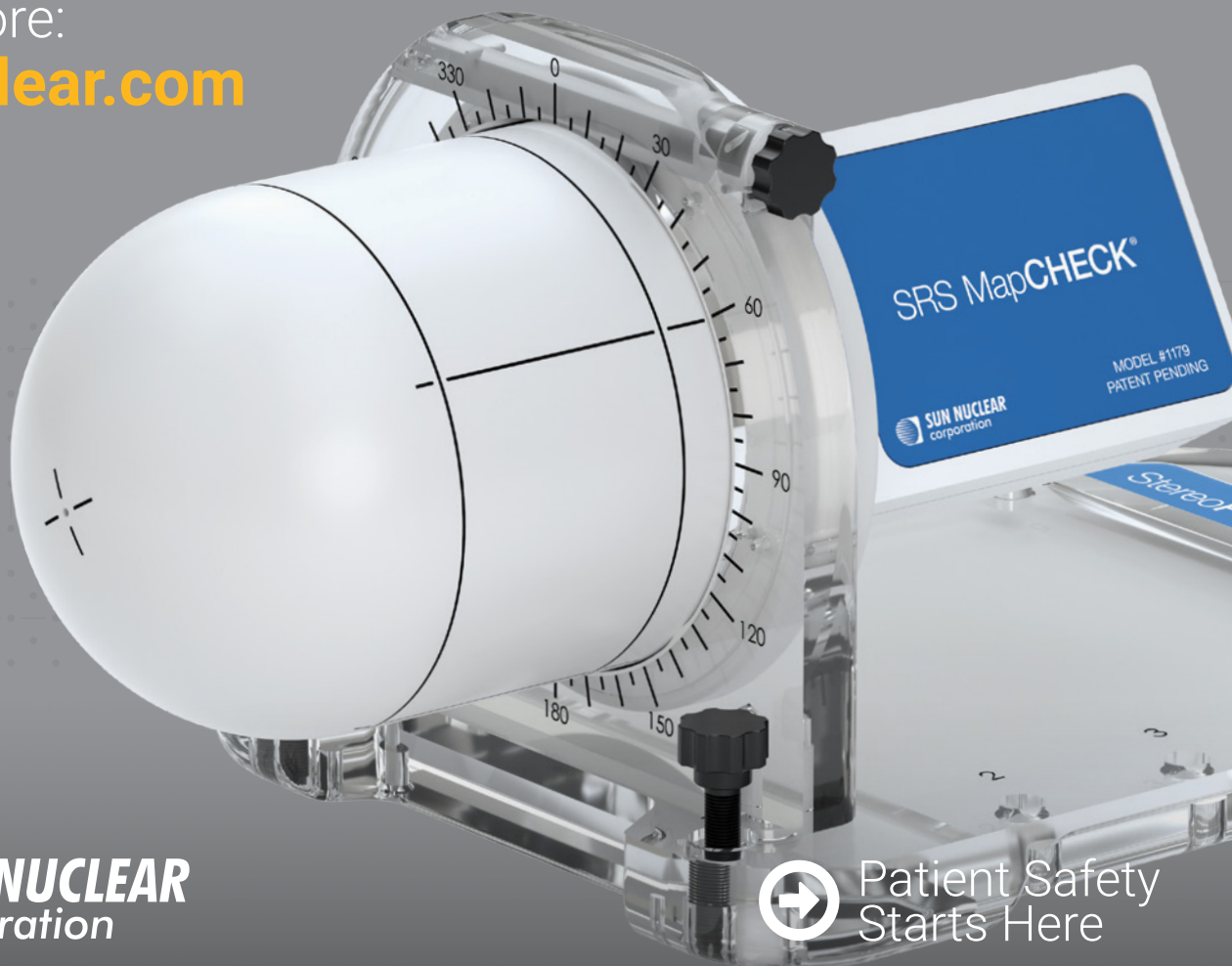
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Update: The Third European Congress of Medical Physics – ECMP 2020 – goes on-line!

ECMP President Mika Kortensniemi and EFOMP President Paddy Gilligan write about the upcoming virtual ECMP conference, taking place on-line 16th-19th June, providing a medical physics highlight of 2021



The year 2021 began with anticipation of light at the end of the tunnel, as we all have experienced the pandemic during the past year. Now, we face the third wave of COVID hitting many European countries. Despite these continuous challenges we will not give up. We look forward and provide another means to come together as a community. The current situation of the pandemic prevents us from organising the ECMP face to face, as medical physicists' health and safety is our first priority. **Therefore, we have made a decision to change the ECMP to an on-line congress.** Now, we are moving fast forward

with optimisation of our programme into on-line format, with a robust virtual technical platform. Most importantly, **we will cover entirely our planned scientific, educational and professional programme which will now serve an even larger medical physicist community, without borders.** Thus, we hope to bring continuation and clarity into our medical physics community during these demanding times. The conference motto has now depth which was not anticipated, but it is as topical as it can be – embracing change, sharing knowledge. We need that, as individual professionals and as a community.

As ECMP organisers, we are happy to see the enduring interest and dedication of European medical physicists which is also shown in the number of abstract submissions – altogether 750 in total! These studies are the forefront of the on-line ECMP scientific content. The abstracts cover all eight main topic areas: radiotherapy, diagnostic and therapeutic nuclear medicine, diagnostic and interventional radiology, radiation protection and dosimetry, biomedical engineering, informatics, professional issues and finally, education and training. The review of the abstracts is in progress by our scientific committee, which will give the basis to finalise the on-line scientific programme with on-demand oral and e-poster presentations.

We are pleased to be able to offer reduced participation fees for the on-line congress:

- Standard participants €100
- Students / low income country participants €60
- Industry participants €200

These updated fees apply throughout the registration time, without an early registration deadline.

Congress secretariat Symposium will be in contact with all registered participants, abstract authors and speakers with additional information. All presenters will get clear instructions for live and pre-recorded lectures.

Preparation of ECMP happens on many levels. One important precursory activity is the organization of two warm-up webinars while approaching the on-line ECMP. The first warm-up webinar was already broadcast on-line on 28th of January with the title “AI in Medical Physics”. The topic was chosen to address what we may see today as one of the most prominent gamechangers in our field. This first webinar approached AI from two perspectives: on its professional impact and by looking at the combination of Big Data and AI on enabling predictions of clinical outcome. The webinar turned out to be great success with fully booked participation and highly positive feedback. In order to respond to the interest on the webinar which grew much higher than the technical platform could allow, the webinar recording was also made available through the EFOMP e-learning platform for almost 1,000 originally registered participants and other Individual Associate Members. This Spring, we will present another warm-up webinar on a radiotherapy topic. More information about this second webinar will be given later through our social media channels – stay tuned for it!

We would like to remind you that *Physica Medica* – European Journal of Medical Physics (EJMP), will publish a focus issue containing up to 50 selected papers from contributions (oral or poster) from ECMP. The papers will be selected by the guest editors and the new editor-in-chief Prof. Iuliana Toma-Dasu on the basis of the high scientific quality of the presentations. Furthermore, all abstracts

accepted for ECMP will be published in a special issue of *Physica Medica*.

You can find further information on the congress web page (www.ecmp2020.org) and the EFOMP web page (www.efomp.org) as well as social media ([LinkedIn](#), [Facebook](#), [Twitter](#), [Instagram](#)) for constant updates.

The Congress Planning Committee and local organisers remain firmly committed to the success of our on-line ECMP. Our focus is to serve the European community of Medical Physics to come together – now virtually, and in future again also in person. We are looking forward to meeting you on-line in June!

Best wishes,
Mika Kortensniemi,
President of ECMP 2020

Paddy Gilligan,
President of EFOMP

Embracing change, sharing knowledge.



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



Paddy Gilligan works as chief physicist in the Mater Private Hospital in Dublin Ireland. He 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.



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- Full registration fee: € 100,00
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A Warm Welcome to the EFOMP Headquarters in the Netherlands!

Jeroen van de Kamer and Gerard Colenbrander from Dutch NMO NVKF welcome EFOMP's headquarters to its new home in their country

Recently, EFOMP's General Council decided to move the EFOMP Headquarters from York, UK, to Utrecht in the Netherlands. Hereby, the Dutch NMO (NVKF) warmly welcomes the EFOMP office. It is good to see the EFOMP organization being facilitated by Cantrijn Service Agency, which supports NVKF as well for already a number of years. An introduction of the Cantrijn Group is given elsewhere in this issue of EMP News.

NVKF wishes, at the beginning of 2021, that EFOMP office services may continue in the way they were supported by IPEM the last 40 years. A professional support guarantees a stable EFOMP organization which is capable to carry out its ambitious agenda.



In the meantime, we express our hope that CoVID-19 will be on its way out in 2021 as a result of the large vaccination campaign, and we can meet each other in good health, in June 2021 at the ECMP in Torino, Italy.



Courtesy by Arie van 't Riet, MPE

The Netherlands are a small but densely populated (over 17 million citizens) country of which about half of the land is beneath sea level. That's even before global warming! Although famous for its tulips, canals and wooden shoes, the Netherlands has more to offer. The country has a good infrastructure including one of Europe's main hubs, Schiphol Airport. The official language is Dutch, but English has penetrated Dutch society thanks to TV, pop culture and many immigrants. The city of Utrecht dates from 50 AD and is on a crossroads between European cities, e.g., no more than 2½ hours from Brussels by train or car. This may very well help in intensifying EFOMP's contacts with the European Union.

The Dutch medical physics society, NVKF, was founded in 1973. Cur-

rently, it has over 600 members of which 450 are registered MPEs and 80 MPE residents. MPEs in Dutch are called "klinisch fysici", which literally translates to "clinical physicists" and shows their close relation to primary health care. The Dutch MPEs are working in 80 hospitals of which 8 are University Medical Centres. They are working in the fields of Radiotherapy, Medical Imaging (Nuclear Medicine and Radiology), Hospital Physics (OR, ICU, etc.) and Clinical Audiology. NVKF is a full and well-respected member of the Dutch Federation of Medical Specialists.

This big welcome to EFOMP ends with a wish. The NVKF wishes EFOMP a prosperous future, well founded in the Dutch clay and hopes it may prosper in this fertile soil. With more than enough rainy days, conditions for growth are excellent. And, of course, NVKF will be at EFOMP's service when needed.



Jeroen van de Kamer is a Medical Physics Expert (MPE), specialized in PET imaging for radiation oncology and head and neck oncology. He works at the Netherlands Cancer Institute (NKI) in Amsterdam, the Netherlands. Jeroen is board member of the Dutch NMO, the Society for Medical Physics of the Netherlands (NVKF), and he chairs the NVKF committee on European Affairs.



Gerard Colenbrander is a Medical physicist (MPE) in two general hospitals in Leiden and Haarlem. At the moment he is secretary of the NVKF committee on European Affairs. He is a member of a national auditing committee and developed in close cooperation with the National Federation of Physicians (FMS) a guideline for introducing new technologies in hospitals.

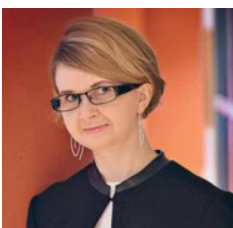
A Few Words from the New Editor-in-Chief of Physica Medica

On 1st January 2021 I stepped in as the new Editor-in-Chief of Physica Medica – European Journal of Medical Physics (EJMP). The first words that would come to my mind at the end of this month are Responsibility and Dedication, with capital letters – the huge responsibility to serve the medical physics community and the dedication to carry on the work done by my predecessors – as they would describe the closest my state of mind and spirit at the end of this first month as Editor-in-Chief.

Physica Medica has seen a fantastic growth during the last decade in terms of high quality submissions that led to the increase of the number of issues per year from quarterly to monthly. This sheer increase in the number of published papers was accompanied by an overall increase in the recognition of the quality of the publications as reflected by the Impact Factor, which almost doubled in the past ten years. All these achievements are obviously the result of the sustained hard work done by the Editorial team with the support of the Publisher, the reviewers and, of course, the authors. And who are the authors that choose to publish in Physica Medica and the reviewers that generously put their time and experience in the service of our Journal? Those that we are proud to serve – the members of the European Federation of Organisations for Medical Physics, as well as their colleagues and collaborators from the rest of Europe and the rest of the world since Physica Medica has seen an unprecedented increase in submissions and publications from all around the globe. We can therefore say that we have managed to reach far, but the work is not done, we should now strive to reach not only towards the physicists but also towards their colleagues and collaborators with other specialities and from other professional categories.

Indeed, the EFOMP newsletter would probably be a very good forum to bring up the need to make visible the exciting scientific ideas and results and the technical innovations published in Physica Medica to our colleagues with different specialities and to attract their contributions to this very complex field. There are subjects in medical physics that are narrowly regarded as being the exclusive territory of physicists, but there are also research and development areas lead by medical physicists or where medical physicists have key roles that are at the crossroad of various disciplines. The intrinsic core of the profession of a medical physicist involves integrated work within the clinical team made of medical doctors, nurses, technologists and engineers, as well as radiation protection experts. Furthermore, on the research side, the collaboration between physicists, biologists and radiation oncologists has been notoriously prolific, several of the major breakthroughs in radiotherapy, for example, owing their discoveries and subsequent developments to this interdisciplinary cooperation.

In the spirit of fostering this multidisciplinary collaboration in order to gain synergistic results, we should aim at making Physica Medica visible and attractive to our colleagues from outside the medical physics community. The Editorial team will do the best to invite review articles of interest across disciplines and to publish manuscripts that are within the scope of the Journal but not strictly addressed to the medical physicists, but also to the other professional categories. It is, however, up to all the EFOMP members to help along this effort and I would therefore like to use this short article as an opportunity to invite you all to share the papers published in Physica Medica with your colleagues and to promote the journal outside our community in order to gain the most from this combined effort.



Iuliana Toma-Dasu, Stockholm University and Karolinska Institutet, Stockholm, Sweden

Iuliana Toma-Dasu is Professor in Medical Radiation Physics and the Head of Medical Radiation Physics Division at the Department of Physics at Stockholm University and the Medical Radiation Physics Group Research Leader, Department of Oncology and Pathology, Karolinska Institutet, Stockholm, Sweden. Since 1st January 2021 she has been the Editor-in-Chief of Physica Medica – European Journal of Medical Physics.

Dr. Claudio Fiorino appointed as new Deputy Editor of Physica Medica (EJMP)



EFOMP, AIFM and the whole Editorial team of Physica Medica – European Journal of Medical Physics (EJMP), are delighted to announce that Claudio Fiorino is the new Deputy Editor of the journal.

EJMP is devoted to serving the European and International community of medical physicists by publishing rigorously peer-reviewed, timely and innovative research articles in Medical Physics.

EJMP also provides an international forum for publication on topics of Education and training and Professional issues in Medical Physics.

We extend our welcome to Claudio in his new role.

Paddy Gilligan, President of EFOMP
Michele Stasi, President of AIFM



Dr CLAUDIO FIORINO

- MSc in Physics and graduation in Medical Physics, Statale University Milano
- Senior Medical Physicist at San Raffaele Scientific Institute, PI of many research projects funded by National and International funding agencies
- University national certification for Professorship (Applied Physics)
- Teacher at the Vita-Salute San Raffaele University, Milano and at the Medical Physics post-graduate School, Statale University, Milano. Member of the Faculty of the ESTRO European school of radiotherapy
- Past member of the ESTRO Physics Committee and of the ESTRO Board of Directors. Member of the steering Committee of the E2Radiate ESTRO-EORTC joint initiative
- Associate Editor of EJMP since 2014 (and Board member since 2002)
- Board member and Editor of other relevant journals in the field of radiotherapy and oncology. Author of more than 230 full papers with more than 5500 citations

His main interest covers:

Predictive models of toxicity and outcome in Radiotherapy; Planning optimization including knowledge-based approaches and automatic planning; Image guidance, SBRT and Adaptive radiotherapy; clinical (and pre-clinical) Radiobiology; quantitative imaging; Radiomics and machine learning in radiology and oncology; Sinergy between scientific and professional roles in Medical Physics, with the activation (and coordination up to 2020) of the FutuRuS (AIFM) and of the ESTRO_Future (ESTRO) Task groups



Physica Medica (EJMP) – Announcement of New Managing Editor

The Editorial team at EFOMP's scientific journal has recently been joined by a new member of the team, Dr. Marta Lazzeroni, who is introduced here



Marta Lazzeroni is Associate Professor in Medical Radiation Physics at the Department of Physics, Stockholm University (Sweden).

Marta was born in Italy and studied at the University of Pisa, where she obtained a BSc degree in Physics (2005) and an MSc degree in Applied Physics, curriculum Medical Physics (2008). Her MSc project related with the development of a SPECT prototype for breast cancer imaging and was conducted under the supervision of Prof. Alberto Del Guerra (former president of EFOMP and honorary editor of Physica Medica – European Journal of Medical Physics). In 2009, she moved to Sweden to pursue her scientific career at the Karolinska Institute as a Marie Curie PhD student within the PARTNER (Particle Training Network for European Radiotherapy) project within the ENLIGHT (The European Network for LIGHT ion Hadron Therapy) collaboration. In 2013, she defended her PhD thesis in Medical Sciences, entitled “Production of

high quality ^{11}C beams for radiation treatment and accurate PET-CT dose delivery verification” under Prof. Anders Brahme's supervision. After her PhD, she was employed as a post-doctoral researcher at the Karolinska Institute in Prof. Iuliana Toma-Dasu's group. During the Post-Doc years, her research interests expanded towards radiotherapy with photons and gained a more clinically oriented perspective. She worked on treatment planning adaptation and individualization based on the early assessment of tumour responsiveness to treatment through repeated PET images. The research was conducted within the European project ARTFORCE (Adaptive and innovative Radiation Treatment FOR improving Cancer patients' treatment outcome). In parallel with her postdoctoral studies, she followed the MSc programme in Medical Radiation Physics at Stockholm University and in 2015 she was granted the MSc degree and the licence as Medical Physicist by the Swedish National Board of Health and Welfare.

Since 2013, she has been deeply involved in teaching on different courses for undergraduate and graduate students having different backgrounds. She has been working as Senior Lecturer in Medical Radiation Physics since 2017, being main lecturer, coordinator and examiner for various courses. She has been supervisor of several students at BSc, MSc, PhD level and part of many examination committees in tertiary education. In 2021, she was appointed Associate Professor at the Physics Department at Stockholm University. She is the

Stockholm University representative in the academic centre of excellence for radiation science (Swedish Academic Initiative for Nuclear Technology, SAINT).

Her research interests cover: light ion therapy with positron emitter beams, dose delivery verification in particle therapy, biologically optimised adaptive radiotherapy, and mathematical modelling of tumour infiltration.

Starting in January 2021, she now serves as EJMP Managing Editor. In this role she works in close collaboration with the Editor-in-Chief, Prof. Iuliana Toma-Dasu, to ensure to EJMP contributors and readership a timely and rigorously peer-reviewed publication process. She supervises the daily activities connected with the whole review process. Her tasks include assigning the submitted manuscripts to the Associate Editors, enforcing deadlines and keeping the communication with reviewers, authors and Associate Editors. She is dedicated to maintaining the high quality standards and contributing to the growth of EJMP.

She will also ensure through the network of young and enthusiastic medical physicists and researchers that she established during her collaborations that EJMP will involve high profile junior members in its editorial activities. The EJMP can gain from their enthusiasm, at the same time offering them educational and career-enhancing opportunities.

EJMP and EFOMP welcome Marta to the team!

John Rowland Mallard (14/1/1927 - 25/2/2021)

Medical Physics pioneer and visionary, Professor John Mallard, has passed away at the age of 94

And your young men shall have visions
And your old men, dream dreams
Acts 2:17



If I was asked to sum up John Mallard in two words they would be “determined visionary”.

John was brought up in the English town of Northampton where his father was a grocer. When I asked John what had inspired him to make his career in medical imaging, he told me that it was the bacon slicer in his father’s shop! He recounted using the machine, in which you pulled down a handle and it cut a slice off a joint of bacon, and then stacking up the slices to reform the joint. Why, he thought, could you not produce images of thin slices of the body to facilitate diagnosis, what we now know as tomographic imaging.

John took a degree in physics at Nottingham which, at that time, was a college of the University of London, and then went on to take his doctorate on “The magnetic properties of uranium and uranium-iron alloys”. An interesting choice given his later career! His move from academia into medical physics was, in part, due to his poor hearing, being very deaf from an early age. He was told by his adviser at Nottingham that this would be a great disadvantage for him as a lecturer and he should look for other opportunities. An advert for a physicist to work in radiother-

apy led him to his first appointment as Assistant Physicist at the Liverpool Radium Institute in 1951. But this was where his involvement in imaging also started. He used hand-held radiation detectors to map the distribution of ^{131}I in the thyroid gland.

He moved to the Hammersmith Hospital and Postgraduate Medical School in 1953 to set up an NHS radioisotope laboratory, becoming Head of the Physics Department in 1957. There he built a rectilinear scanner to automatically build up a picture of the distribution of a radiopharmaceutical in the body. This used a moving bed and a tapper mechanism to print out a colour coded image on a sheet of paper. This was the first whole body scanner in the world and with it he pioneered clinical in vivo radioisotope scanning of the brain, liver, spleen, kidneys and joints. The MRC cyclotron unit was nearby. At that time the cyclotron was being used for trials of neutron therapy, but it could also produce radioisotopes. Using a pair of scintillation detectors, John showed how positron emitting isotopes of arsenic could be used to image brain tumours.

After a brief spell at Guy’s Hospital, in 1965 he applied for the newly created chair in medical physics at Aberdeen University. His wife, Fiona, whom he met in London, came from Aberdeen and so he knew the city although he claimed that she was not very enthusiastic about moving back! He arrived in Aberdeen together with his rectilinear scanner, which formed an important part of the nuclear medicine service for many years, allowing imaging over larger areas of the body than with the early gamma cameras. But John’s vision was broader than just nuclear medicine. He had published a paper in *Nature* in 1964 showing how electron spin resonance

(ESR) could differentiate between normal and malignant tissue. His two earliest appointments to posts in the new department were Jim Hutchison and Meg Foster (later Meg Hutchison). Jim had expertise in magnetic resonance and Meg was a biologist. John’s vision was to explore the potential of ESR as a new medical imaging modality. At the same time, he had another group looking at microwave imaging. Neither approach proved feasible at the time but, when in 1971 Damadian in the States demonstrated with there was a difference in NMR signals between different tissues, Aberdeen was in a position to exploit this.

Not only did they confirm Damadian’s findings but, following work done by Lauterbur, they constructed a small NMR imager and produced the first image of a mouse in March 1974. This clearly demonstrated that the technique could produce images showing body structure but, as it required an hour to produce an image, the mouse had first to be killed – somewhat of a problem if the technique was to be used clinically.

At this point John took a decision that was to have profound consequences for MRI. Rather than continue an incremental approach building bigger and bigger imagers, the Aberdeen group would build one capable of whole-body human images. This is where his determination and vision really showed themselves.

It took 18 months but eventually the Medical Research Council awarded him a grant of £30,000 to build the machine, although some of the grant’s referees later admitted that they were very sceptical about the chances of success. A second grant allowed him to expand the team and, with the help of some inventive

engineering from the department's mechanical workshop, built what was to be the first whole body clinical MR imager. By employing pulse sequences repetitively, they were able to reduce imaging time to about 20 minutes. One problem still remained though. All attempts to produce 3D images were spoilt by any organ motion. This meant that imaging the trunk, in particular, proved impossible. Finally the team came up with the solution that was to prove the breakthrough that MRI needed – the spin-warp imaging pulse sequence.

Several weeks of trial imaging on team members ensued until they were satisfied of its safety. On 26th August 1980 the nuclear medicine consultant at Aberdeen, Dr Frank Smith, provided the first patient, a gentleman with advanced cancer of the oesophagus. The images were impressive, showing not only the known tumours but additional ones in the spine.

John was due to make a presentation at a conference in Heidelberg in 5 days' time, so there was a rush to get everything ready. The presentation of this first clinical whole body MR imaging was unusual as the conference was one on Nuclear Medicine. So John started his talk by announcing that he wasn't going to talk about nuclear medicine, but the new technique of MRI. Not surprisingly, John recounted that the audience was rather challenged by this!

In November John was invited to Japan, where this time the audience included representatives from all the major Japanese companies. They were keen to have access to this new technology, but they weren't prepared to pay for the privilege!

So the issue arose as to how to proceed. John realised that if the intellectual property was to be protected then a patent would need to be taken out before anything was published. After some debate, the team agreed. Fortunately, the UK government had an agency that had been set up to develop intellectual property and they prepared the patents. Having a patent is one thing, getting companies to respect it is quite another. Almost inevitably the big medical device companies tried to break the patent. The ensuing court case ran up costs of £1.5 million pounds, though fortunately this was carried by the government agency. We won the case

and John reckoned that over the 20 years that the patent ran it generated about £34 million of income. Without the support of a government body with deep pockets, there would have been no income.

John's next step was to build a second imager which would be located inside the hospital. However, the MRC refused to fund it as it was not regarded as new research. Instead, he reached an agreement with the Japanese company Asahi Chemical Company, who in return for providing the funding would get access to the know-how.

At the same time John set up a company to manufacture the imager. However, it was undercapitalised and they sold just 3 machines. In comparison, Asahi sold 145 machines in Japan and Asia before selling on the technology to Siemens. I once asked John what he would do differently. His advice was to get a wealthy pop star to put up the money and not be lumbered with a Board of Directors appointed by an Enterprise Organisation!

John's vision on using ESR was not dead and imaging technology derived from this concept was developed in Aberdeen by Prof David Lurie.

John's interest in the use of radioisotope imaging had also not waned. During the 1970s he built two single photon emission tomography (SPECT) imagers using scanning detectors and one using a rotating gamma camera, so producing medical digital tomographic images several years before Hounsfield's X-ray CT imager was invented. He also introduced the first computer linked to a gamma camera in the UK.

In his inaugural lecture in 1965 he talked about the potential of Positron Emission Tomography (PET). In 1976, following a public appeal, he bought a site for a PET centre. He successfully obtained a second-hand cyclotron from the MRC, once they had finished using it for neutron therapy trials in Edinburgh, and shipped it up to Aberdeen. He also obtained a second-hand PET imager from the MRC PET unit at the Hammersmith hospital. So, he set up the second PET centre in the UK, on a shoe-string! When I took over from John on his retirement in 1992, I managed to obtain a new cyclotron and imager and persuaded the hospital to give me a site

and building for it. It is now named as the John Mallard Scottish PET Centre.

Despite all this activity on the medical imaging scene, John maintained his view of the importance of professional activity in medical physics. He set-up an MSc course in Medical Physics in 1968 which, over 50 years later, is still running. He was a past President of the Institute of Physical Sciences in Medicine (IPSM), the Biological Engineering Society (BES), the International Organisation for Medical Physics (IOMP), the Founder Vice-President of the European Nuclear Medicine Society, the Founder President of the European Society of Magnetic Resonance in Medicine and Biology, and the Founder President of the International Union of Physical and Engineering Sciences in Medicine (IUPESM) and succeeded in obtaining its Associate Membership of the International Council of Scientific Unions (ICSU).

He received many honours and prizes during his career, including the Landau Memorial Plaque of the American Association of Physicists in Medicine, the Academic Enterprise Competition Prize of the British Technology Group, the Royal Society Wellcome Prize and Gold Medal, the George Van Hevesey Memorial Lecture Medal, The Royal Society Murrill award and the Gold Medal of the Royal Society of Edinburgh.

He was awarded the OBE in the Queen's Birthday Honours List in 1992, the Freedom of the City of Aberdeen in 2004 and the Freedom of his birthplace, Northampton, in 2018.

John was a visionary, not just about medical imaging but also on how our profession of medical physics should develop. I once asked him whether, if he had his time again, would he still go into medical physics. He said yes, but he felt that the future would be in radiotherapy rather than imaging.

With his passing, have we come to the end of an era? I am sure that John would have disagreed. Those of us who have now retired can dream, but for the younger ones – follow John's example and be a determined visionary!

Peter Sharp, Emeritus Professor of Medical Physics at the University of Aberdeen, UK.

Maria Kotzasarlidou

(1/7/1966 – 22/12/2020)

Beloved Greek peer passed away in December 2020 from COVID-19 complications, just days before she was supposed to be vaccinated

Maria Kotzasarlidou, a medical physicist from Thessaloniki, Greece, died on 22nd December 2020 from complications of COVID-19; she was 54 years old. She worked at “Theageneio” Cancer Hospital and was a consultant in the EFOMP Working Group (WG) on “PET/CT and PET/MR QC Protocol” operating under the Scientific Committee. Maria’s passing probably marks the first death from COVID-19 in the EFOMP community.

The Board of the Hellenic Association of Medical Physicists (HAMP), in which Maria served as the communication officer, wrote in a statement: “We are devastated to announce our Maria’s passing. Maria had such a positive spirit and a tremendous commitment.” Any loss of life is a tragedy, but the grief cuts especially deep when we mourn such a beloved and vivid person. “We will fondly remember your smile and your laugh will eternally echo in our souls”, the Board said. HAMP president Thomas Maris addressed Maria with a highly sentimental note at 3:00 am, exactly 24 hours after her passing: “We have been awakened by your leaving. Your proposal for setting up a committee to highlight the role of ionizing and non-ionizing radiation in the fight against coronavirus and COVID-19 will be materialized. We owe you this.” In a new message, the HAMP Board announced, “We wish to provide stipends in remembrance of Maria for students attending the Medical Physics Master’s degree running in Athens. Additionally, we will organise a series of scientific events in her memory.” The first event dedicated to Maria, a workshop on PET-CT, took place on 6th February 2021. It constituted the first webinar organized by an EFOMP National Member Organisation and was hosted by the EFOMP platform. EFOMP President Paddy Gilligan addressed the



participants and expressed his deepest condolences on the loss of Maria by using the first verse of the poem “The river” from Irish poet Jane Clarke: “What surprises me now is not that you’re gone but how I go on without you, as if I’d lost no more than a finger.” He also referred to Maria in the “Incoming President’s editorial”, published in the European Journal of Medical Physics, Volume 82, February 2021.

Born on July 1, 1966, Maria graduated from the Physics Department of the Aristotle University of Thessaloniki before obtaining a Master’s degree in Medical Physics from the University of London in 1989. She successfully defended her Ph.D. thesis on Nuclear Medicine Physics at the Democritus University of Thrace in 2000, whilst in 2012 she completed a two-year postgraduate course in the Management of Health Services. She worked privately as a medical physicist since 1991, while in 1999 she was employed in the newly established “Papageorgiou” General Hospital. After assisting in setting up Nuclear Medicine there, in 2004 she joined “Theageneio” Hospital as the radioprotection expert in the Nuclear Medicine Department. Maria is survived by her husband, one daughter, one son and her mother.

Maria was apparently healthy, not at high risk of serious coronavirus complications. On the evening of November 19 2020, when she got a fever she wasn’t particularly worried. After all, she had been vaccinated for H1N1 on that morning. Furthermore, the rapid test was negative the next day. On Saturday the 21st, she was celebrating her name day. She decided to take a RT-PCR test but she couldn’t get an appointment for nasopharyngeal specimen collection.

Therefore, she proceeded with a self-collected throat swab. An ambiguous result led to a second molecular test which turned out to be positive. As she headed to her house to quarantine, Maria was still optimistic. She was in good shape and knew the statistics were on her side. But as the disease ran its course, fear would come. Then desperation. And finally, unspeakable sadness.

Even with personal protective equipment, medical workers are among those at the highest risk of contracting the coronavirus. In the second wave of the COVID-19 pandemic in Greece, almost 1 out of 7 workers at “Theageneio” Hospital got infected with coronavirus, manifesting the fast and furious spread of the virus within a hospital environment. Maria’s story is only one of the many from healthcare workers who have died doing their jobs during the current pandemic. As the death toll among healthcare workers continues to rise, it is our duty to ensure these sacrifices are not going unnoticed and unacknowledged.

In the days after Maria’s passing, her loved ones were flooded with sympathy messages from friends. Colleagues who had worked with her reached out, too, each with a similar message: Maria was one of the kindest and most compassionate persons they’d ever known. “We will always remember her excitement about the opportunity to assist medical physics trainees and her devotion to her job”, one young colleague commented in social media.

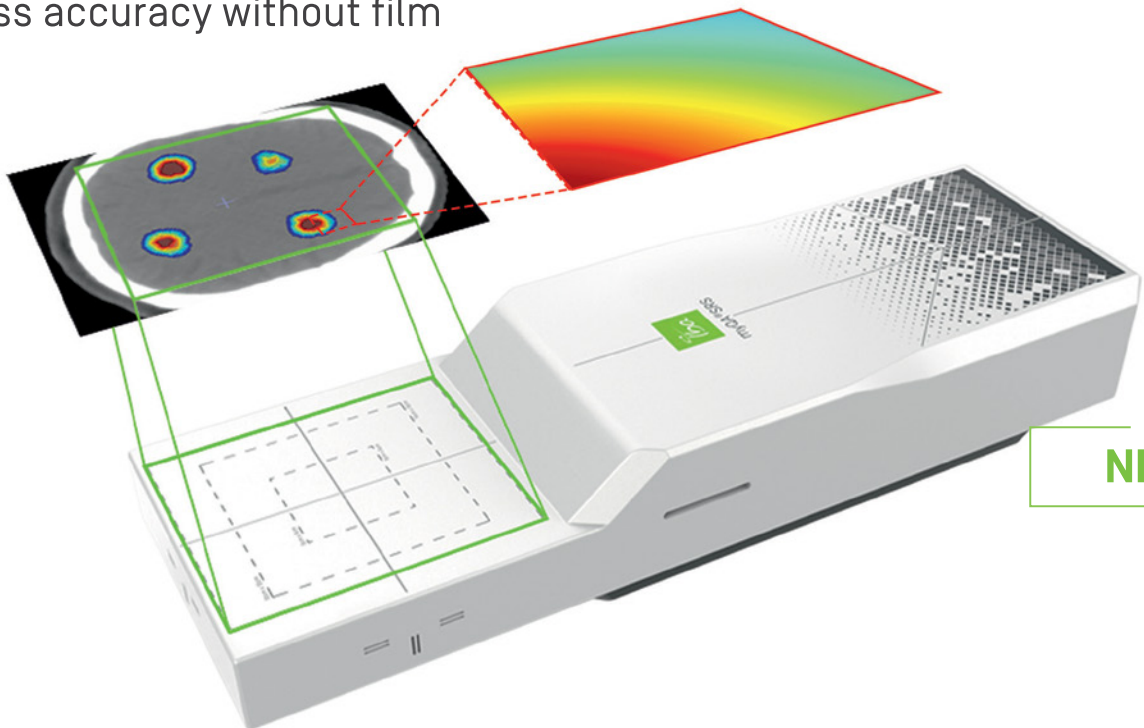
On January 12th 2021, on what would have been a day of hope, staff of the Medical Physics Department at “Theageneio” Hospital got the first shot of a COVID-19 vaccine. “It isn’t fair”, Anna Makridou, the chief medical physicist, thought, fighting back a new surge of emotions. She imagined Maria talking loudly about the vaccination, if she’d only been able to avoid the virus for a couple of months longer...

Ioannis Seimenis, PhD, Professor in Medical Physics, National and Kapodistrian University of Athens, Greece.

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Accuracy and safety are key elements in radiation therapy. The Monte Carlo calculation method is considered the most accurate. In addition to that RadCalc's 3D Monte Carlo offers flexible implementation options that help to increase speed and productivity while maintaining uncompromised accuracy.

The Lake Constance Radiation Oncology Center, Singen-Friedrichshafen has offered radiotherapy services for optimal patient treatment since 2007. Traditionally, calculations by the therapy planning system are verified using phantom-based measurements. This was further supported by the introduction of an iRT IQM detector in 2018 allowing for real-time verification during patient treatment. Recently RadCalc was introduced as a secondary check system to further enhance the already advanced QA process. RadCalc is used at the centre for recalculating complex IMRT and VMAT plans.

LAP is already known to the Lake Constance Radiation Oncology Center, Singen-Friedrichshafen through laser systems for patient marking and positioning. With the use of RadCalc, the cooperation will be further expanded. We asked Mike Froehlich, qualified radiation specialist in training about his experiences with RadCalc.

What advantage did you expect from the Monte Carlo recalculation?

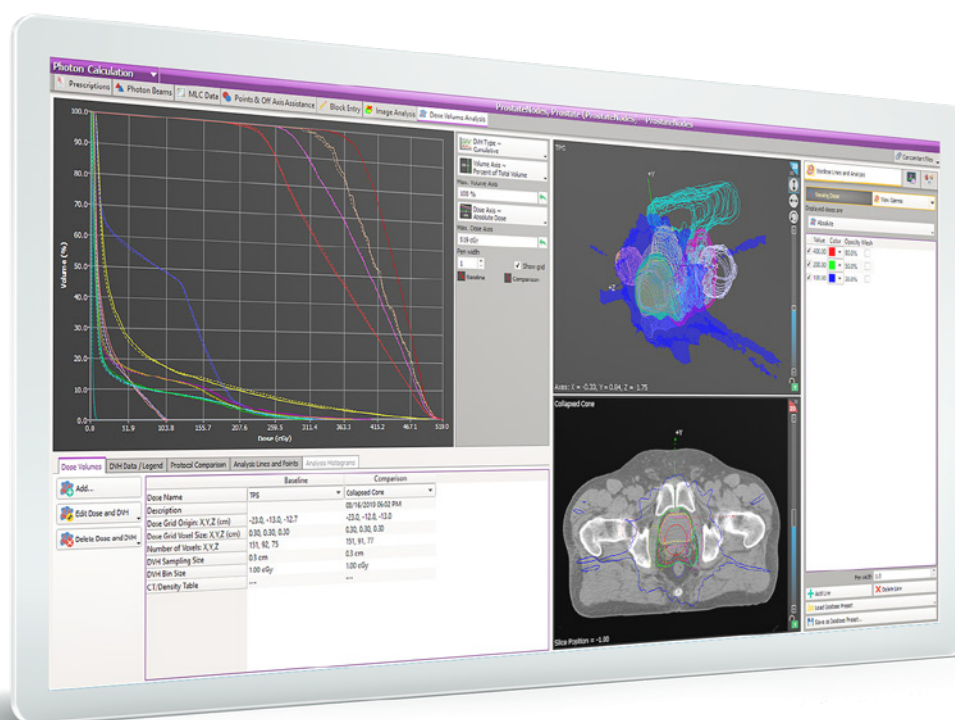
Mike Froehlich: We wanted to use an independent second algorithm to verify the results of our well-known calculation system. Monte Carlo based calculations are the current most accurate way to do secondary checks.

Do you think software-based verification will replace phantom-based measurements?

Mike Froehlich: Phantom-based measurements cannot be abolished, we need real values, but software is important for process optimisation. We are now implementing RadCalc in our process landscape to help the physicists and save valuable time. A software-based solution brings added value.

What experiences have you had with the use of RadCalc's Monte Carlo?

Mike Froehlich: The basic installation of the software is intuitive and very easy to carry out according to current standards of a software installation. However, the first "quick runs" revealed some challenges. It turned out that our iRT IQM detector had to be implemented as well. With the help of expert support from Lueneburg and the USA, we were quickly able to achieve first results.



That is right, the feature was not yet considered in the software at the time of implementation and was then programmed accordingly. Did that work out well?

Mike Froehlich: In the meantime, it looks that we are on the right way. Other providers seem to have difficulties with it. By the way, the duration of the MC calculations is impressively short.

You also did the calculations remotely, didn't you?

Mike Froehlich: Yes, first on the remote workstation via the VPN connection with upload of anonymized patient plans. After implementing the proxy solution via our gateway, the entire system runs flawlessly. In my opinion, this is a clever method that enables efficient use of resources.

What do you consider most challenging in patient QA/ secondary check these days?



Annette Schindler, Marketing Manager at LAP, studied business administration & management at Wirtschaftsakademie Hamburg. She has a track of over 15 years of marketing experience, holding positions as Head of Identity & Communication, CSR consultant and running a foundation in Hamburg. Entering the healthcare market in 2019 she is now responsible for the operational healthcare marketing at LAP.

Mike Froehlich: Patient QA must not become a self-fulfilling prophecy. We use the IQM software for online verification and want to investigate the combination of these systems what value contribution the systems can make to minimising errors thus maximising patient safety. The value of the evaluations should not end up as "meeting legal requirements".

Together with the results of online-dosimetry (iQM), RadCalc's MC and future exit-dosimetry we learn more about the edges of "accuracy" and weakpoints of the sub-systems. Goal is to tell the patients that they have received a secure and safe treatment.

The full evaluation of our overall QA process including RadCalc will take place within the framework of a special project, which will start soon. So there is more to come...



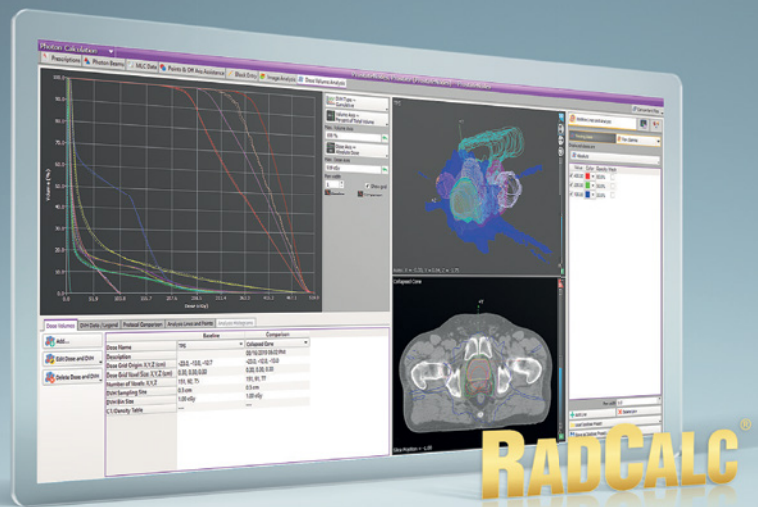
After studying business informatics, **Mike Froehlich** came to Elekta via detours and finally to radiation therapy. He decided to come to Singen mainly because of the proximity, the interesting field of work and the excellent staff. To underpin the change to this new working world, he is studying medical physics part-time and completing the internal training to become a medical physicist expert (MPE). In addition to his duties in physics, he is also responsible for the IT in the company.



RadCalc

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- Fast calculation of treatment plans
- Fully automated performance
- Vendor independent



EFOMP's new Secretary General, Efi Koutsouveli, reports on EFOMP matters for the period November 2020 - February 2021.

My term as Secretary General of EFOMP started in January 2021 following a successful term of office by Jaroslav Ptáček, who has taken on the role of EFOMP treasurer.

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

EFOMP Annual General and Council Meeting

This year's Council meeting took place online for the first time on the 21st of November, using the tele-conference platform of EFOMP. Since there were several voting items in the agenda Google forms questionnaires were used and all answers were recorded. Thirty seven delegates from 27 countries voted for the 2020 treasurer's report and 2021 budget, the appointment of examining accountants (auditors) and the move to new EFOMP headquarters in Utrecht, The Netherlands.

During the meeting, EFOMP new Chairs and Internet Manager were introduced: Loredana Marcu, Romania (European Matters committee), Brendan McClean, Ireland (Science committee), Brenda Byrne, Ireland (Professional Matters committee), Constantinos Koutsojannis, Greece (Projects committee), Emer Kenny, Ireland (Internet Manager).

EFOMP president Marco Brambilla and chair of Professional Matters committee Ad Maas presented the National Registration Scheme (NRS) certificate to French delegate Laure Parent (Societe Francaise de Physique Medicale - SFPM). The EFOMP board recently approved the Irish NRS as well. Congratulations to our Irish colleagues and Irish Association of Physicists in Medicine (IAPM)!

Depending on the status of the COVID-19 pandemic, the next council meeting will be most probably in Kaunas, Lithuania in conjunction with the Baltic Conference of Medical Physics (November 2021) which will be supported by EFOMP.

EFOMP Committees and new committee members

New chairs are organizing virtual meetings with their committee members to define the aims and goals of the committees in 2021.



First online Projects Committee meeting in 2021

We are welcoming Antonio Lopez Medina (Spain), Luis Brualla (Spain), Jérôme Krayenbühl (Switzerland), Chantelle Said (Malta) and Dafina Xhako (Albania) as new committee members. NMO Presidents and delegates can nominate colleagues interested in being involved in EFOMP activities by sending a nomination email to: secretary@efomp.org.

Policy statements

A postal ballot on the Revision of the EFOMP Policy Statement PS14 "EFOMP PS 14 – The role of the Medical Physicist in the management of safety within the magnetic resonance imaging environment: EFOMP recommendations" has been launched in November 2020 and ended on 10th January 2021. Council approved the addendum which you can find on our [website](#).

Special Interest Group (SIG)

A new SIG entitled "Radionuclide Dosimetry" was been recently created and is open for members, consultants and observers. The SIG will serve as a network of colleagues working in the specific domain where members can seek advice and practical hints and exchange practices on therapeutic applications in nuclear medicine. More details on the [website](#).

Collaboration with Affiliated organizations

EFOMP contributes in this year’s online European Congress of Radiology with a workshop on “New European Quality Controls for state-of-the-art innovations in Radiology and Artificial intelligence: The role of the Medical Physicist”, where EFOMP working group chairs provide an overview of the advances toward harmonization in Europe of QC protocols for different classes of radiological equipment, artificial intelligence and clinical trials and a joint ESR-EFOMP session. Related papers are being published in the European Journal of Medical Physics.

EFOMP is a supporting organization of the IAEA – 3rd International Conference on Advances in Radiation Oncology (ICARO-3) and participates with two lectures: “Spatially fractionated radiation therapy: from photons to charged particles” by Yolanda Prezado and “EFOMP activities in education and training of medical physicists in Europe” by Brendan McClean.

EFOMP endorsed the IAEA “Joint position statement and call for action for strengthening radiation protection of patients undergoing recurrent radiological imaging procedures”.

EFOMP will take part in the IAEA – Technical meeting on “Developing Effective methods for Radiation Protection Education & Training of Health professionals”.

EFOMP endorsed the 2021 Virtual MEFOMP (Middle East Federation of Organizations of Medical Physics) Conference where Lucie Sukupova (Czech Republic), member of the angiographic and fluoroscopic systems Working Group, will present recent updates on QC protocols.

The joint EFOMP-ESTRO group on the update of the ESTRO-EFOMP Core Curriculum for Medical Physics Experts in Radiotherapy continues its work and the second draft has been circulated to NMOs for comments and suggestions. The updated draft will be presented at ECMP2020 in June 2021 with an aim to be approved during ESTRO2021 in August 2021.

EFOMP digital platforms

Quick login links have been added on the [EFOMP website homepage](#) for facilitating access to EFOMP platforms. NMOs – please update the NMOs Information System (NIS) with your society’s details!



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

Login Links

- IAM Login
- E-learning Platform Login
- NIS Login for NMOs
- EFOMP Officers' Reserved Area

Access to EFOMP platforms from the front page of the EFOMP web site

Webinars series

Following the success of the lockdown and EFOMP-EUTE-MPE webinar series, a series of EFOMP-COCIR webinars on IEC standards are underway and a series of EFOMP-EU-RADOS **webinars** will be developed. Follow our website for updated information and watch the video recordings of webinars and masterclasses via the [EFOMP e-Learning platform](#).



Medical Physicists are getting vaccinated all over Europe (Clockwise from top left Denmark, Ireland, Lithuania, Greece, Lithuania, France).

With vaccinations already started and ramping up across Europe, let’s hope that we can all meet in person sometime soon!

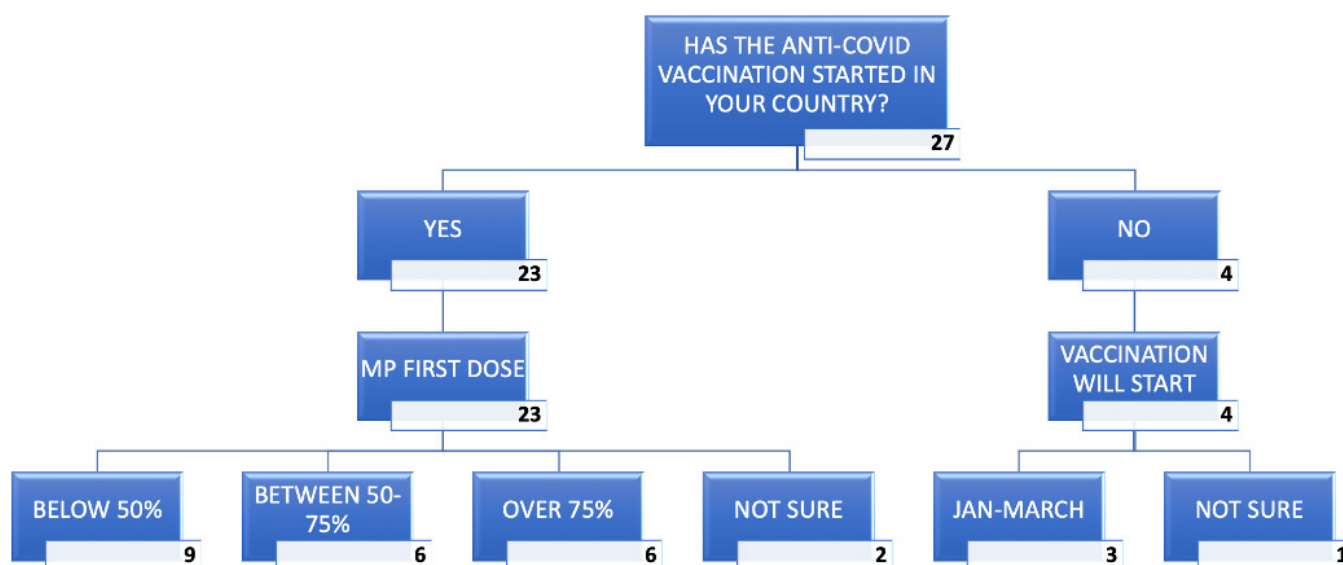
Survey of anti COVID-19 Vaccination of Medical Physicists in EFOMP member countries

Loredana Marcu, Chair of EFOMP’s European Matters committee writes about this illuminating survey and its results

EFOMP’s European Matters committee has recently designed and carried out a survey on COVID-19 vaccination among medical physicists in Europe. The vaccine will have benefits for patient safety maintaining treatment and diagnostics for the services we, as medical physicists, contribute to, as well as making us safe and able to exchange ideas in person.

The chart below shows the current status of vaccination on a country level and among medical physicists (MPs). In 23 countries the vaccination campaign has already started, while 4 expect the start of vaccination soon (Jan-March 2021). Six countries reported a high vaccination rate among medical physicists (over 75%); another 6 countries reported a rate between 50-75%, while in 9 countries the vaccination rate is below 50%. Two responding countries had no reliable data to report in this regard.

The results of the survey are presented here. Out of 36 EFO- MP member countries, 27 NMOs responded by the deadline (2nd February 2021).



NMO responses to the survey

Most countries stated that emergency (frontline) healthcare workers, healthcare workers in general and the elderly have priority for vaccination. In 23 out of 27 countries medical physicists are receiving the vaccine as healthcare workers. Of these, in 6 countries MPs are included in the frontline healthcare workers, while in another 6 countries only certain MP categories are considered in the frontline (medical physicists who might be exposed to COVID patients - e.g. diagnostic physicists and emergency radiology workers).

among MPs, with 12 countries achieving over 50% rate, while for 9 countries this forecast is uncertain or unknown.

A number of countries also responded to the question regarding the need for EFOMP support of the NMOs during the vaccination programme. Below are some of the answers:

- By supporting them with the vaccination if their country doesn't cover it.
- Circulate the answers to the FAQs about the vaccines where people have concerns to encourage maximum uptake.

It is considered that during the vaccination programme (by June/July), six countries will reach a vaccination rate of 100%

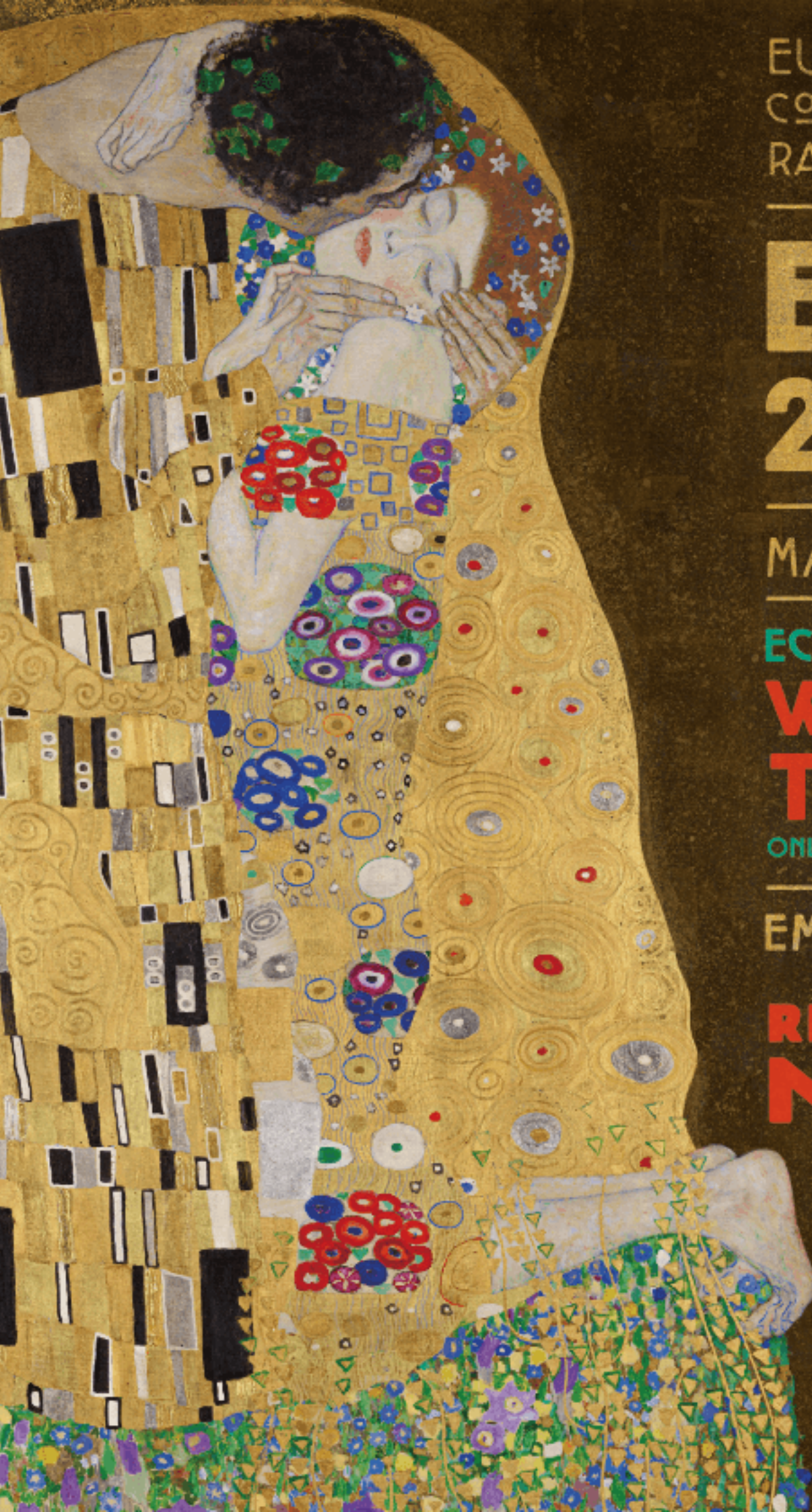
- More information about vaccination, types and modality.
- Possibly by promoting the safety of the vaccine among EFOMP members and members of national medical physics societies.
- By providing more information on contraindications and applicability of different vaccines.
- Clarifying the professional risk for the medical physicists and providing more information about different kind of vaccines.
- Sharing the up-to-date information related to the COVID-19 vaccination.
- EFOMP can use the data from NMOs to influence and persuade the authorities that Medical Physicists are in the frontline health workers group, thus they should be included in the vaccination programme.
- Send supporting statements to show our involvement with patients and that vaccination is important for the profession.
- Promote designation of clinical medical physicists as healthcare workers within the patient pathway and hence support the need to vaccinate medical physicists as part of an overall protection programme for all in the healthcare community and society in general.

As shown by the survey results, while some countries are more advanced in their vaccination programme, others are only starting the campaign with the hope to cover frontline healthcare workers and high-risk groups in the coming months. A number of NMOs consider that EFOMP could support the vaccination programme in various countries by providing more information on the vaccine's efficacy and safety, as well as societal effects in order to encourage vaccination and to curb the current pandemic.

Note: all answers were processed confidentially, without disclosing the NMO's country of origin.



Loredana G. 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. She is the current chair of the European Matters Committee within EFOMP and co-chair of WiMPBME within IUPESM.



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Book Review: “The CT-Handbook: Optimizing Protocols for Today’s Feature-Rich Scanners” by Timothy Szczykutowicz

Medical Physics Publishing (2020), 580 pages. Hardcover: ISBN 978-0-944838-53-2, eBook: ISBN 978-0-944838-57-0, US\$165. [Link to book on publisher’s web site.](#)



Book cover, reproduced with permission from the publisher. © Medical Physics Publishing (2020)

The subtitle of this book indicates already its main intention: to provide the necessary background for the practical understanding and optimizing of the use of CTs in the clinic. In this context, the term “protocol” in the subtitle has a broader meaning including the whole workflow of the patient CT-scan from patient positioning (this is given a chapter of its own!), contrast agent and injector handling as well as the technical factors influencing the dose and the image quality of CT-scans. On top, it includes also hints for optimizing the expensive time of a service technician or application specialist upon installa-

tion of new protocols or tips on how to select networking options to other dedicated workstations, too.

Among the 17 chapters of this 580-page book are the usual basic ones on CT history, reconstruction techniques, image quality and CT-dose parameters providing all the necessary background for understanding the practical protocol optimization that is discussed in following chapters. For deeper scientific information on the theory and special reconstruction techniques of CT, the author refers to already existing well-known publications by Buzug, Hsieh, Kak, Kalender or published reviews in journals. Only a reference to the recent book by Samei and Pelc is missing, maybe because it was also published in 2020. A note to teachers: Each chapter has its list of well-selected references at the end which makes it a well-suited material for teaching purposes having students work on the topic of the chapter as a project. Nevertheless, this book is not a simple collection of lumped together chapters, since the author guides the reader very well through his book by giving references to other sections or chapters. While the main emphasis of the book is on medi-

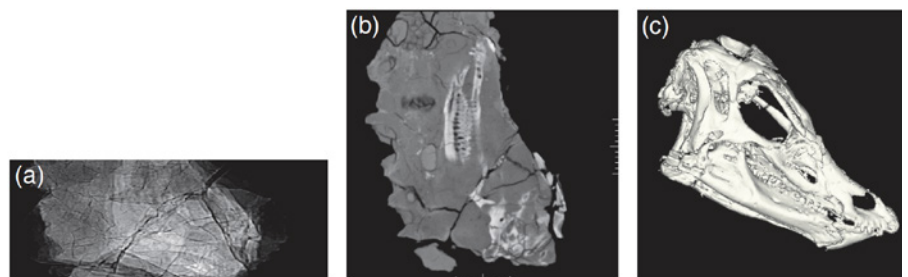


Fig. 1: Example of non-medical use of CT for separating rock from bone for a mineralized dinosaur fossil: a) localizer, b) sagittal reformat, c) volume-rendered view of the dinosaur skull. (Figure 14.17 from the book, reprinted with permission).

cal diagnostic CT, there is also a chapter on CBCT e.g. in radiotherapy and the use of non-diagnostic CT in science and industry, as shown in Figure 1 where a CT-scan is used for non-destructively separating rock from bone of a mineralized dinosaur skull.

A very valuable feature of this book to clinical medical physicists is that the author addresses the differences in CTs of the main vendors (GE, Canon/Toshiba, Philips, Siemens) not only for special features like dual-energy but also for more basic differences in their automatic exposure control (AEC) algorithms. Another “red line” followed throughout the book is that valuable guidelines and checklists are given not only for configuring protocols of already existing CTs but also for selecting an efficient set of its features when a new CT is to be ordered for the clinic or department.

It is quite noticeable that the author addresses not only medical physicists, but also explicitly radiologists and radiographers/technologists with special remarks from time to time. The “CT protocol team” consisting of these professions is an important feature in designing and optimizing the CT protocols based on the “master protocol concept” introduced by the author. This is a result of his long practical experience in CT and in its pitfalls that are very well summarized in this book. An explicit example is an extensive chapter (72 pages)

on artefacts. As an additional feature, there is a table of the figures of artefacts that are shown in this book in the appendix, where they are categorized by different characteristics for identifying the cause of the artefact. While the book, in general, is very well illustrated with images and coloured figures, many CT images are reproduced rather small in “thumb-size anatomy”, at least in the printed book. Strong artefacts are still visible in these images, but others can only be recognized with the help of arrows added. Again a note as a lecturer: This nice collection of CT artefacts would be a good source for practical teaching if the images could be provided in electronic format as a separate added value – best as anonymized DICOM files such that students need to find out the proper window settings themselves. Another suggestion for the next edition of this wonderful book would be to add a list of abbreviations and acronyms since not all are spelt out upon first use and international readers or students new to this subject might not be familiar with these English acronyms. An index of the book could be helpful for readers at least of the printed version, too.

Finally, this excellent CT-handbook is a must-have for all those who are or going to be in charge of optimizing the workflow and protocols of the modern “workhorse CT” of today’s radiology department and who want to have it at hand in one volume!



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

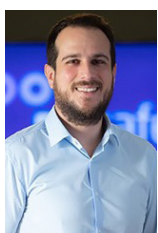
Markus Buchgeister entered the field of medical physics in radiation therapy at the university clinic of Tübingen in 1995. In 2010, he received a call for a position as professor for medical radiation physics at the Beuth University for applied sciences at Berlin. Since 2003, he is engaged as co-opted 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 German EFOMP delegate for a second round.

RTsafe: PseudoPatient® Technology – A Personalized Treatment Verification in SRS

The efficacy and superiority of Stereotactic Radiosurgery (SRS) against conventional radiotherapy techniques (i.e., Whole Brain Radiotherapy) for the management of brain lesions, such as malignant primary and metastatic tumours, benign tumours, and functional disorders, have been proved the last decade from the scientific community. The main advantage of SRS is the ability to deliver highly accurate radiation dose with millimeter precision, in a single or hypofractionated treatment scheme. However, the high dose levels delivered in the brain anatomy increase the requirements of accuracy and precision highlighting the need for personalized Quality Assurance (QA) procedures. The main reason for this necessity is the reported possibility of significant side effects occurrence, caused even by a small deviation of the delivered dose from the intended, as predicted by the radiotherapy treatment plan.

RTsafe offers a highly precise, wholly individualized solution dedicated to brain radiotherapy patients, the PseudoPatient®. PseudoPatient® methodology has been redesigned to cover the dosimetric and spatial evaluation of each patient's treatment. Specially produced 3D-printed head phantoms derived from the patient's planning Computed Tomography (CT) dataset are equipped with appropriate inserts for point dosimetry and polymer gel (covering the whole brain anatomy) for 3D dosimetry. Point dosimetry is performed by the end-user using the PseudoPatient® IC and the department's equipment at pre-defined targets and/or organs-at-risk evaluating the delivered dose accuracy. In combination with the PseudoPatient® 3D that detects the delivered dose pattern in the 3D space, the physician and the medical physicist can verify both dosimetric accuracy and spatial precision for challenging clinical cases taking into account the anatomical and pathological particularities of each patient.

This way, by simply using any clinical Magnetic Resonance (MR) sequence (either a T1w or T2w), the team can examine the spatial agreement between these two 3D dose patterns. Spatial co-registration is performed by the end-user between the treatment plan files (i.e., CT, dose, and structure files) and the clinical MR images for a qualitative comparison of the 3D dose structures. Then at a second level, the team has also the choice to proceed with the quantitative assessment of the spatial accuracy through a comprehensive analysis performed by RTsafe.



Emmanouil Zoros - Medical Physicist - Product Manager

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

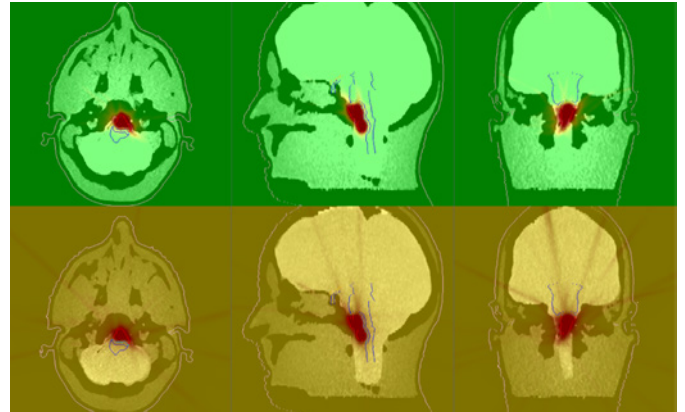
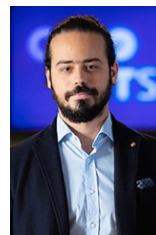


Figure 1. Spatial co-registered images of the post-irradiation MRI dataset of the PseudoPatient® 3D and the Treatment Planning System (TPS) dose data with delineated structures for trial case 2. This is to demonstrate the coincidence of the delivered dose in the treated target to the planned location.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

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

For more information on RTsafe's remote end-to-end dosimetry auditing service contact us at info@rt-safe.com. <https://pseudopatient.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 in order to annotate the perfusion of the brain tumour. During his PhD in medical school in the University of Crete, he introduced advanced MRI biomarkers in CNS diseases.



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

L. Berta et al. **A patient-specific approach for quantitative and automatic analysis of computed tomography images in lung disease: Application to COVID-19 patients** Phys. Med. 2021; 82: 28-39 [https://www.physicamedica.com/article/S1120-1797\(21\)00005-3/fulltext](https://www.physicamedica.com/article/S1120-1797(21)00005-3/fulltext)

The reason this manuscript drew my attention is obvious: it is very timely in the context of the COVID-19 pandemic and it attempts and, furthermore, succeeds to provide quantitative metrics to be used in lung computed tomography (CT) images for the estimation of well-aerated volume of lungs in CT images (WAVE) accounting for the inter- and intra-subject variability. In addition, WAVE and the metrics derived from it are able to act as a local biomarkers to quantify the severity of the disease, independently of the observer. The number of patient/cases included in the study was rather limited, but the results were statistically relevant and the metrics for quantitative CT assessment appeared unbiased towards the technical and physiological factors. Obviously, further validation is needed before the method is implemented in the clinic but it gives hope for the future.

C. Harrer et al. **Prediction of multi-criteria optimization (MCO) parameter efficiency in volumetric modulated arc therapy (VMAT) treatment planning using machine learning (ML)** Phys. Med. 2021; 81: 102-113 [https://www.physicamedica.com/article/S1120-1797\(20\)30317-3/fulltext](https://www.physicamedica.com/article/S1120-1797(20)30317-3/fulltext)
One of the current topics of discussion in the medical phys-

ics community is the increasing role of machine learning in treatment decisions and outcome predictions. This paper confirms that machine learning is a tool that has the potential, if correctly used, to impact the clinical work by helping in this particular case finding relevant optimization parameter ranges prior to optimization. Although the work was based on a research version of a specific treatment planning optimizer, the techniques introduced in this paper are not exclusively specific to a particular commercial solution and therefore are applicable to other optimizers and therefore have a very generic character appealing to the radiotherapy community.

K. Yasui et al. **Dosimetric response of a glass dosimeter in proton beams: LET-dependence and correction factor** Phys. Med. 2021; 81: 147-154 [https://www.physicamedica.com/article/S1120-1797\(20\)30313-6/fulltext](https://www.physicamedica.com/article/S1120-1797(20)30313-6/fulltext)

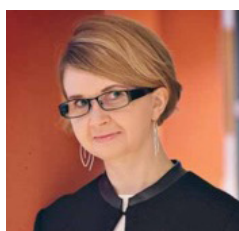
The number of clinical proton radiotherapy centres has seen an unprecedented increase in recent years. The interest in developing dosimeters for the verification of the treatment plans and generally for quality assurance in proton radiotherapy has proportionally grown. This study presents the response of a radiophotoluminescent glass dosimeter (RGD) to beam quality and a linear energy transfer (LET)-corrected dosimetry protocol in a therapeutic proton beam and it could be regarded as a step forward towards establishing a postal audit system and in-vivo dosimetry system using RGD for proton beams.

O. Diaz et al. **Artificial intelligence in the medical physics community: An international survey** Phys. Med. 2021; 81: 141-146 [https://www.physicamedica.com/article/S1120-1797\(20\)30312-4/fulltext](https://www.physicamedica.com/article/S1120-1797(20)30312-4/fulltext)

With this paper we bring up again the discussion regarding the role of the artificial intelligence (AI) in medical physics and, related to that, the changes that are expected to result from the extensive use of AI-based solutions in medical physics and the need for proper education and training of medical physicists in AI. In order to answer some of the questions inherently rise around this topic, a web-based survey was designed and distributed within EFOMP. The survey was aiming at a rather comprehensive set of questions regarding the education and personal knowledge, as well as regarding the needs for further education and research on AI algorithms and applications in medical physics. The results were quite eye-opening as they revealed that the community of medical physicists thinks that AI is here to support their daily work. At the same time, it pointed out the insufficient education and training on AI of medical physicists prompting immediate actions in improving the educational curricula of medical physicists within EFOMP.

This paper presents a study conducted by a working group established by the French Association of Medical Physics (SFPM) on the very critical and timely issue of small dosimetry. Indeed, small fields as often encountered in radiosurgery, present particular dosimetric challenges. There were 23 radiosurgery centres involved in the study. The results of the work are quite comprehensive, consisting of over 400 measurements using more than 50 detectors and performed on 19 different linacs used for radiosurgery as well as on CyberKnife machines. The results reported as mean field output factors, absolute standard deviation and number of measurements are meant to be used for cross verification between centres performing measurements in similar conditions as well as for comparisons and assessment of the robustness of individual measurements. The authors should therefore be commended for the amount of work put into this study and its clinical relevance.

S. Dufreneix et al. **Field output factors for small fields: A large multicentre study** Phys. Med. 2021; 81: 191-196 [https://www.physicamedica.com/article/S1120-1797\(21\)00002-8/fulltext](https://www.physicamedica.com/article/S1120-1797(21)00002-8/fulltext)



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

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Editor's choice, EJMP Focus Issue: 125 years of X-Rays



With this newsletter, we wish to start a new sub-section of the traditional Editor's choice corner dedicated to the Focus issues appearing in our EJMP. This looks like a natural extension of the effort of keeping alive and possibly corroborate the link between EFOMP members and their journal. Focus issues are dedicated on very relevant topics, often containing a number of high-level educational reviews written by leading scientists of our field and deserve particular attention.

We start today with the recently published Focus issue on "125 years of X-Rays" (November 2020), edited by Prof A Del Guerra, Prof F Nüsslin and Prof P Russo. Despite its title, this is far from being a mere celebrative exercise: the issue (which is free to download for one year from [this link](#)) is a highly balanced mix of past, present and future of the medical use of X-Rays.

Several articles investigate well the roots of this fascinating story, including the birth and the evolution of medical physics building medical physicists as the central experts (and guardians) of radiation. The reading of these papers is very fluent and give us the opportunity to better know the origins, which is very important to understand the present and to orient the future: in this category lie the papers by J Malone (looking to the origins of radiation protection, governance and ethics in medical imaging), F Nüsslin (a short and great summary of the personal and scientific life of WC Roentgen), C Martin et al. (the history of the effective dose) and Behling (a really comprehensive overview of the history of X-Ray technology, it should be read by all medical physics students!).

Several "precious" papers give a comprehensive overview of the evolution and the present applications and challenges of a number of very topical issues, also reaching the goal of

In the first of a new series, EJMP Deputy Editor Claudio Fiorino writes about a recent Focus Issue of *Physica Medica – EJMP*.

being high-level educational tools. They deal with dose monitoring in CT (IA Tsalafoutas et al.), dose optimization in radiology (V Tsapaki), dual-source CT (B Schmidt & T Flohr), X-Ray imaging of breast (L Heck & J Herzen), radiation therapy with X-Rays sources (D Y Breikreutz et al.), Photon-counting CT (T Flohr et al.) and dark-field phase-contrast imaging (M Ando et al.). Despite the fact that these papers are mostly high-level comprehensive reviews making the reader more aware of the evolution of the respective fields, they do not miss to discuss present challenges, showing some clear vision for the future.

And the coming future, including recent (and on-going) developments, is the major focus of the remaining papers: from the use of synchrotron radiation for functional lung imaging (S Bayat et al.) to the highly topical issue of patient dose in imaging procedures (MM Rehani & D Nacouzi); from the translation of phase imaging into clinical use (A Momose) to the application of artificial intelligence in image reconstruction (R Singh et al.); from spectroscopic imaging at compact inverse Compton sources (S Kulpe et al.) to 3D breast phantoms (K Bliznakova).

In conclusion, we can well affirm that the effort of the editors of this issue (and of the past Editor-in-Chief) was clearly successful. The medical physics community may benefit from an excellent, free-to-download, comprehensive, high-level collection of papers.

And, not secondarily, the intrinsic "sober celebration" component of this Focus Issue is also of high importance, increasing the awareness and the visibility of our amazingly important (and continuously evolving) role in the medical field and in our societies.



Claudio Fiorino, Deputy Editor of EJMP

Claudio Fiorino is Senior Medical Physicist at San Raffaele institute since 1991 and University teacher at the post-graduate school of Medical Physics (Statale University) and at the Vita-Salute San Raffaele University in Milano. His main research activities are in the field of Radiotherapy, predictive models in Oncology and Radiomics. He is Board member of several journals in the field of Radiotherapy and of Oncology and Deputy Editor of *Physica Medica - EJMP*, having previously served in the same journal as Associate editor (2014-2020) and board member (2002-2014).

IAM Registration update

Due to EFOMP's move from the UK to NL, IAM registration has been suspended as a result of banking complications.

Registration will be available from mid-March. We apologise for any inconvenience.



EFOMP e-learning

EFOMP's e-Learning platform was launched in January 2019. It contains a wealth of information, including video recordings and pdfs of lectures given during seven recent editions of the European School for Medical Physics Experts (ESMPE), as well as complete recordings of the highly-informative "Lockdown webinars" organized by EFOMP and IAPM in Spring 2020 and didactic webinars and masterclasses organized by EFOMP and EUTEMPE in Autumn - Winter 2020.

New webinars will be organised in 2021 jointly with COCIR as well as ECMP2020 'Warm Up' ones.

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

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

Previously-registered IAMs will have access to the e-learning platform until the end of March, after which user accounts will be deactivated until membership is renewed.

The 2013/59/EURATOM Directive: from the “Magna Charta” to the clinical practice

In this article, Roberta Matheoud writes about this key EC Directive and how it has been transposed into law across the EU.

The Euratom Treaty provides the establishment of uniform safety standards to protect the health of workers and of the general public, in particular Article 30 defines “basic standards” for the protection of the health of workers and the general public against the dangers arising from ionising radiations, in order to harmonize the protection in the Member States.

Since the first time in 1959, the Community revised the basic standards several times to consider the new recommendations of the International Commission on Radiation Protection (ICRP), in the light of new scientific evidence and operational experience.

The last Directive on this topic, 2013/59/EURATOM (ED59-2013) was issued by the European Council in December 2013, repealing previous Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom. It should have been transposed into national legislation by Member States by February 6th, 2018. ED59-2013 considers the recommendations of the ICRP Publication 103 and covers all exposure situations and all categories of exposure, namely occupational, public, and medical.

Three main innovations concerned with medical exposures have been introduced by ED59-2013: the definition of the responsibility and of the optimization process (Article 57), the availability of the information relating to patient exposure (Article 58) and the training and recognition requirements (Article 59) for the individuals involved in the optimization process.

The referrer (a medical doctor, dentist or other health professional who is entitled to refer individuals for medical radiological procedures to a practitioner) is responsible for the justification of the medical exposure in conjunction with the practitioner (a medical doctor, dentist or other health professional who is entitled to take clinical responsibility for an individual medical exposure) who is responsible for the medical exposure of the patient. The optimization of the medical exposure is a joint responsibility of the practitioner, the medical physics expert and those entitled to carry out the practical aspects of medical radiological procedures.

These three points appear to be particularly relevant when considering that the concept of the multidisciplinary work in radiological procedures has been growing steadily in recent years and, consequently, the attention to the patient’s exposure. Radiological procedures are currently performed in the fields of cardiology, gastroenterology, urology, nephrology, orthopaedics-traumatology and neuro and vascular surgery. In this context, the responsibility of the medical exposures involves not only the professionals who traditionally have been working with ionizing radiations (radiologists, nuclear medicine physicians, radiation oncologists), but also those who are rather “new” in this field. The adequate training claimed by Article 59 aims at guaranteeing that the professionals referred to in the justification and optimization processes are currently updated and informed about patient’s radiation protection.

Moreover, particular attention is required for all the radiological procedures performed on paediatric patients, especially in interventional radiology, for which the intrinsic high doses are associated to a three-fold increased risk for stochastic effects due to the age of these patients.

In this context, the harmonization of the protection against the dangers arising from ionising radiations is of utmost importance across European Countries.

Thus, it seemed of interest to acquire information on the transposition of the ED59-2013 into the national legislation of the Member States to provide a general overview of the situation across Europe: thanks to the collaboration of Medical Physics Experts from different European countries, data on the date of transposition, the reference of the legislation and website of publication were collected.

Each Member State transposed the ED59-2013 in one or in several steps. The Table lists how and when the transposition took place. The national transposition is the essential step, to translate the “theory” into clinical practice, according to the local habits but always respecting the “major statements”.

EU member	Country	Transposition date	Reference	Website
Yes	Austria	July 2020	Bundesgesetzblatt II Nr. 339/2020	https://www.ris.bka.gv.at/eli/bgbl/II/2020/339 https://www.ris.bka.gv.at/eli/bgbl/II/2020/353/20200731
Yes	Belgium	May 2018	Amendment of the FANC law 2018/202303	https://fanc.fgov.be/nl/system/files/20180517-publicatie-wet-medische.pdf
		February 2020	Report 9511 Royal Decree	https://www.health.belgium.be/en/report-9511-medical-exposures-ionising-radiation
		February 2020	2020/20132, Royal Decree amending the Royal Decree of 20 July 2001	https://fanc.fgov.be/nl/system/files/20200220-publicatie-kb-medjury.pdf
Yes	Bulgaria	February 2018	Ordinance № 2 of 5 February 2018	https://www.mh.government.bg/media/filer_public/2018/02/14/nared-ba2-5-02-2018-uslovia-red-osigurqvane-zashita-medoblychvane.pdf
Yes	Croatia	May 2018	Ordinance 9 May 2018, Official Gazette 42/18	https://narodne-novine.nn.hr/clanci/sluzbeni/2018_05_42_814.html
Yes	Cyprus	December 2018	Radiological Safety and Security Law L.164(I)/2018	http://www.mlsi.gov.cy/mlsi/dli/dliup.nsf/All/4155482043318AA9C2257E29001F7E86?OpenDocument
Yes	Czech Republic	January 2017	Atomic law (263/2016 Sb.) and Radiation protection regulation (422/2016 Sb.)	not available
Yes	Denmark	January 2018	Act on Ionising Radiation and Radiation Protection ACT No. 23 of 15/01/2018	https://www.retsinformation.dk/eli/ta/2018/23
Yes	Estonia	February 2018	32013L0059	https://www.rigikantselei.ee/sites/default/files/content-editors/Failid/EL/direktiiv-id_koondtabel_31.12.2019.pdf
Yes	Finland	December 2018	Radiation Act 859/2018	https://finlex.fi/fi/laki/alkup/2018/20180859
		November 2018	Government Decree on Ionising Radiation 1034/2018	https://finlex.fi/fi/laki/alkup/2018/20181034
		November 2018	Ministry of Social Affairs and Health Decree on Ionising Radiation 1044/2018	https://finlex.fi/fi/laki/alkup/2018/20181044
Yes	France	June 2018	Decree No. 2018-434	Décret no 2018-434 du 4 juin 2018 portant diverses dispositions en matière nucléaire
		June 2018	Decree no. 2018-437	Décret no 2018-437 du 4 juin 2018 relatif à la protection des travailleurs contre les risques dus aux rayonnements ionisants
		June 2018	Decree no. 2018-438	Décret no 2018-438 du 4 juin 2018 relatif à la protection contre les risques dus aux rayonnements ionisants auxquels sont soumis certains travailleurs
Yes	Germany	June 2017	Law on the protection against the harmful effects of ionizing radiation	https://www.gesetze-im-internet.de/strlrschg/
		November 2018	Ordinance on protection against the harmful effects of ionizing radiation	https://www.gesetze-im-internet.de/strlrschv_2018/
Yes	Greece	November 2018	Presidential Decree P.D. 101/2018 194/A/20.11.2018	https://eeae.gr/en/radiation-safety/regulatory-control/ionizing-radiation/regulatory-framework
Yes	Hungary	July 2018	Decree of the Minister of Human Capacities No. 21/2018	https://net.jogtar.hu/jogszabaly?docid=A1800021.EMM
Yes	Ireland	January 2019	Regulation 2018 SI No.256	https://www.lawsociety.ie/gazette/Top-Stories/radiation-scrutiny-transfers-to-hiqa/#:~:text=Last%20month's%20transposition%20of%20European,as%20part%20of%20cancer%20treatment.
Yes	Italy	July 2020	Law decree n.101 31 July 2020	https://www.gazzettaufficiale.it/eli/gu/2020/08/12/201/so/29/sg/pdf
Yes	Latvia	not available	not available	not available
Yes	Lithuania	November 2018	Lithuanian hygiene standard HN 73: 2018	https://www.e-tar.lt/portal/lt/legalAct/TAR.751B6F8BF451/mreNWpyxDs
		November 2015	HN 95: 2015	https://www.e-tar.lt/portal/lt/legalAct/TAR.07B72FE9B4AF/fEuwkNSMnr
		May 2015	HN 31: 2008	https://www.e-tar.lt/portal/lt/legalAct/TAR.539C640DDFD5/fjIhXbMpGu
		May 2016	HN 77: 2002	https://www.e-tar.lt/portal/lt/legalAct/TAR.43FC01D4BF9B/ARYPqucyXB
		October 2017	HN 78: 2009	https://www.e-tar.lt/portal/lt/legalAct/TAR.8ED408A891FA/mpUnMzUiii
		September 2017	Orders of the Director of the radiation safety center	https://www.e-tar.lt/portal/lt/legalAct/89f5bf70a4d611e78a4c904b1afa0332

Yes	Luxembourg	May 2019	Journal Officiel du Grand-Duché de Luxembourg Memorial A N 389 7jun2019	http://data.legilux.public.lu/file/eli-etat-leg-loi-2019-05-28-a389-jo-fr-pdf.pdf
		August 2020	Journal Officiel du Grand-Duché de Luxembourg Memorial A N 528 5aug2020	http://data.legilux.public.lu/file/eli-etat-leg-rgd-2019-08-01-a528-jo-fr-pdf.pdf
Yes	Malta	July 2018	Suppliment tal-Gazzetta tal-Gvern ta' Malta Nru. 20,020, 3 ta' Lulju, 2018 L.N. 210	not available
Yes	Netherland	October 2017	404 Besluit van 23 oktober 2017, houdende vaststelling van regels ter bescherming van personen tegen de gevaren van blootstelling aan ioniserende straling (Besluit basisveiligheidsnormen stralingsbescherming)	not available
Yes	Slovakia	not available	not available	not available
Yes	Poland	June 2019	Atomic Law Act 1593	https://paa.gov.pl/aktualnosc-465-zmiana_ustawy_prawo_atomowe.html
Yes	Portugal	December 2018	Decree Law 108/2018	https://data.dre.pt/eli/dec-lei/108/2018/12/03/p/dre/pt/html
Yes	Romania	not fully transposed	Reglementations on basic radiological safety requirements 186-2019	not available
Yes	Slovenia	December 2017	Ionising Radiation Protection and Nuclear Safety Act	https://www.uradni-list.si/glasilo-uradni-list-rs/vsebina/2017-01-3698?sop=2017-01-3698
		January 2018	Update of Ionising Radiation Protection and Nuclear Safety Act	https://www.uradni-list.si/glasilo-uradni-list-rs/vsebina/2019-01-1196?sop=2019-01-1196
Yes	Spain	October 2020	BOE n.262	partial transposition (justification and optimization), waiting for dose limits
Yes	Sweden	April 2018	Radiation protection act 2018:396	https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/stralskyddslag-2018396_sfs-2018-396
No	Switzerland	January 2018	RS 814.501 Ordinance on radiation protection (ORaP)	https://www.fedlex.admin.ch/eli/cc/2017/502/
No	UK	January 2018	The Ionising Radiations Regulations 2017	https://www.legislation.gov.uk/uksi/2017/1075/introduction/made , 1st January 2018.
		May 2019	The Radiation (Emergency Preparedness and Public Information) Regulations 2019	https://www.legislation.gov.uk/uksi/2019/703/contents/made , 22nd May 2019.
		February 2018	Ionising Radiations (Medical Exposures) Regulations 2017	https://www.legislation.gov.uk/uksi/2017/1322/contents/made , 6th February 2018.
		May 2018	Environmental Permitting (England and Wales) (Amendment) (No. 2) Regulations 2018	https://www.legislation.gov.uk/uksi/2018/428/made , 2nd May 2018.
		May 2018	The Ionising Radiation (Basic Safety Standards) (Miscellaneous Provisions) Regulations 2018	https://www.legislation.gov.uk/uksi/2018/482/introduction/made , 8th May 2018.
		April 2019	The Carriage of Dangerous Goods (Amendment) Regulations 2019	https://www.legislation.gov.uk/uksi/2019/598/contents/made , 21st April 2019

Table: 2013/59/EURATOM Council Directive transposition in European Countries.



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RaySearch: Case study at Leeds Cancer Centre – Deep Learning Segmentation for Lung Delineation During Breast Radiation Therapy



Located on Level -2 of the Bexley Wing at St James's Hospital, Leeds Cancer Centre's radiotherapy department is one of the largest single-site centres of its kind in the UK. The centre's clinicians deliver personalized treatment plans using machine-learning functionalities available in treatment planning system RayStation®*. These functionalities include deep learning segmentation for lung contouring during breast radiation therapy. The latest innovation in this area is the RaySearch thorax deep-learning auto-contouring (DL-AC) solution, which outperforms AutoBreast.

*Subject to regulatory clearance in some markets.

UP-TO-DATE TREATMENT, CARE AND SUPPORT

Leeds Cancer Centre opened in 2008 and is part of Leeds Teaching Hospitals NHS Trust, which has more than 18,000 employees. More than 7,500 new patients are treated annually from a catchment population of around 2.8 million people. Specialists at Leeds Cancer Centre diagnose and treat cancer for the people of the city and the nearby Yorkshire region, providing some of the most up-to-date treatment, care and support for cancer patients.

Radiation therapy treatments available include external beam radiotherapy, brachytherapy and gamma knife. A total of ten clinical linear accelerators (li-

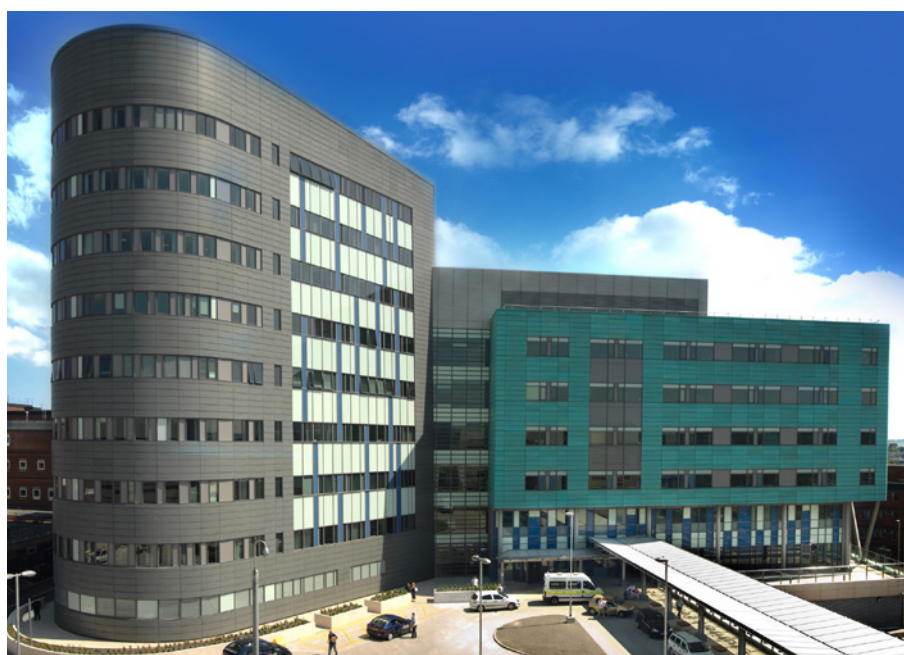
nacs) are installed at the centre, along with two dedicated research-funded linacs with advanced image-guided radiation therapy capabilities.

A major equipment refresh programme will see ten new Elekta Versa HD and three Phillips CT-Sims installed by the end of 2020. The centre also uses state-of-the-art imaging, treatment planning and treatment equipment and is committed to refreshing and updating the technology regularly.

ACCURATE CONTOURING

During breast radiation therapy planning, accurate lung contouring is crucial for estimating the organs at risk dose. Previously, automatic lung contours produced by the AutoBreast method in RayStation typically required manual editing to improve accuracy. Clinicians at Leeds Cancer Centre found that RaySearch thorax DL-AC model provides fast and excellent performance for ipsilateral lung contouring in the hypofractionated breast radiation therapy scenario. Given the positive results from RaySearch thorax DL-AC model, radiation oncologists in Leeds are now working closely with RaySearch to develop other machine-learning models for the safe and effective clinical implementation at other treatment sites.

We investigated the geometric and dosimetric accuracy of our new RaySearch thorax deep-learning auto-contouring (DL-AC) solution by comparing them to both reference (manual) contours and contours from the AutoBreast method for a cohort



The Leeds Radiotherapy Research Group is a growing multi-professional group focused on research and innovation in radiotherapy with a large portfolio of funded projects including clinical trials. Leeds Cancer Centre delivered the second highest clinical trial recruitment to radiation therapy trials in England from 2015 to 2017.

of 10 cancer patients, including left and right sided breast and chest wall treatments. Comparison of the two methods indicated that DL-AC produces accurate contours and V8Gy values, which closely approximate the reference values. AutoBreast generally over-predicts lung volume relative to reference, with less geometric and absolute dosimetric performance. However, for relative DVH statistics, error cancellation renders the overall result close to that obtained with both reference and DL-AC lung contours.

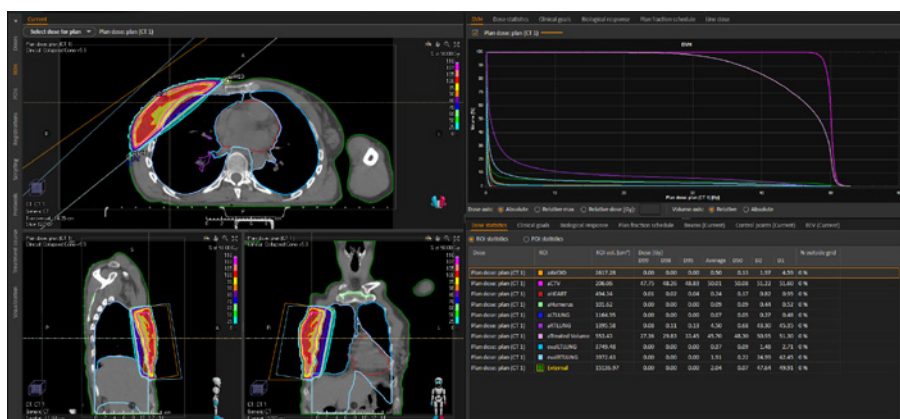
A RETROSPECTIVE STUDY

10 retrospective breast patient plans were used for this analysis. These cases all contained AutoBreast lung contours from planning and had 40Gy in 15 SMLC FFF plans, which was standard practice at Leeds Cancer Centre. Further ipsilateral lung contours were generated by two methods in RayStation. Firstly, the RaySearch thorax DL-AC model was run to produce left and right lung contours. Secondly, reference ipsi-

lateral lung contours were produced by use of the 3D-region growing tool and manual editing.

SMALLER MEAN ABSOLUTE ERRORS

On all metrics, the RaySearch thorax DL-AC model showed smaller mean absolute errors relative to the reference, with a smaller range than AutoBreast.



This analysis and visual inspection suggest that the inbuilt thorax DL-AC model in RayStation 8B is a highly accurate method for lung delineation in breast radiation therapy.

SCRIPT-DRIVEN QUALITY MANAGEMENT WORKFLOW

The team at Leeds Cancer Centre is now developing a script-driven quality management workflow for both DL-AC model training on local data and semi-automated evaluation. This approach will provide clinical confidence in models produced locally from clinical data. Assessment of clinical confidence and utility in RayStation deep learning technologies in Leeds hinges on assessment of the following criteria:

1. Geometric accuracy
2. Dosimetric impact
3. Efficiency
4. Independent, automated checking of patient specific DL-AC output

As a result of this comprehensive approach, coupled with the quality of the DL-AC contours produced by the RaySearch model, clinicians in Leeds were able to implement DL-AC derived organs at risk structures for clinical use.

lateral lung contours were produced by use of the 3D-region growing tool and manual editing.

Threshold values were adjusted to fully contour lung and exclude as much airway as possible. Holes and small contours (<1cc) were removed using the standard tool. Manual editing was performed on a lung window, to exclude diaphragm and airways, and to include any lung not contained in the grown region and correct any other visually detected errors.

Dice similarity coefficient (DSC) was computed for AutoBreast and RaySearch thorax DL-AC lung contours, relative to the reference. DSC was also calculated for the AutoBreast and RaySearch thorax DL-AC model lung intersections with V25% ROI, again with the intersection volume of the manual delineation as reference. Total volumes and V25% overlap volumes were compared for all three sets of lung contours. Absolute (cc) and rela-

AutoBreast appears to consistently over-predict lung volume, whereas the RaySearch thorax DL-AC model shows a volume difference 95% confidence interval containing zero. DSC is generally high, >0.9, which is expected for large and relatively simple structures such as lung.

RaySearch thorax DL-AC model outperforms AutoBreast on both mean and minimum DSC. Absolute dosimetric errors are smaller with RaySearch thorax DL-AC model, again showing less systematic error than AutoBreast. Relative dosimetric errors are more consistent, although the range of the RaySearch thorax DL-AC model errors is smaller than that for AutoBreast, due to error cancellation when considering relative volumetric parameters.

IMPROVED ADHERENCE OF THE LUNG CONTOUR

Adherence of the lung contour to chest wall is improved using RaySearch thorax DL-AC model, yet small amounts of lung are on occasion excluded at the anterior medial aspect and at the inferior. Airways are correctly excluded as per current contouring guidance. Lung contours appear to be clinically acceptable although manual editing could result in marginal improvements. AutoBreast tends to contour into airways, chest wall and heart. Reference contours can vary between operators but appear broadly similar to those generated by the RaySearch thorax DL-AC model.

HIGHLY ACCURATE METHOD

This analysis and visual inspection suggest that the RaySearch thorax DL-AC model is a highly accurate method for lung delineation in breast radiation therapy. Geometric and dosimetric errors relative to manual lung contouring are small and the mean DSC of 0.97 indicates excellent correspondence with reference contours. The high-dose region, defined as the intersection of lung with the 25% isodose, is also well contoured, resulting in absolute DVH statistics which are very similar to those derived from the reference contours and a significant improvement over those derived from AutoBreast lung contours.

QUOTES FROM USERS:

“We are really pleased with the new planning innovations that RayStation is bringing to our radiotherapy service. Deep-learning auto-contouring is a highly advanced ‘next-step’ that will provide further efficiencies to how we plan breast radiotherapy.”



– Dr Vivian Cosgrove, Head of Radiation Therapy Physics, Leeds Cancer Centre

“The functionality that is available as standard in RayStation is impressive and we’re sure that it will bring many benefits to planning our patients. We’re confident that the improved functionality and efficiency savings that we’ll be able to make will bring major benefits to the patients that we treat at the Leeds Cancer Centre.”

– John Lilley, Head of External Beam Radiotherapy Physics, Leeds Cancer Centre

RaySearch Laboratories

RaySearch is advancing cancer treatment through pioneering software. Software has unlimited potential, and we believe it is now the driving force for innovation in oncology. Medical science never stands still, and neither does RaySearch. We work in close cooperation with leading cancer centres to bring scientific advancements faster to the clinical world. Today, our solutions support thousands of clinics worldwide in the fight against cancer. And this is just the beginning.



IT'S PERSONAL

Oncology Treatment planning technology is evolving to meet the needs of our growing world population. We've developed machine learning tools* capable of transforming valuable real-time information into predictive and consistent organ segmentation, plan generation and optimization. Almost 10 million people die from cancer annually and treatment planning with machine learning is our latest contribution to the fight. For us, it's personal.

*Subject to regulatory clearance in some markets.

ADVANCING
CANCER
TREATMENT



ECR online 2021: A Wealth of Sessions Related to Physics in Medical Imaging!

For the online edition of ECR2021, the Physics in Medical Imaging subcommittee has created an inspiring programme, ranging from basic physics principles to the latest technological features and scientific findings

For the second year in a row, the European Congress of Radiology (ECR 2021) will take place virtually. With at least four parallel live streams, the congress will offer a mixture of live, pre-recorded and interactive sessions featuring state-of-the-art science, education and research.

The Physics in Medical Imaging subcommittee has created an inspiring programme that tackles the latest developments in radiology imaging technology and patient safety.

Looking over the online and on-demand programme reveals a multidisciplinary and symbiotic approach that encompasses a huge range of scientific and clinical interests.

Below you can find details of 25 live and 21 on-demand sessions that are considered as the most interesting for the medical physics community.

ECR 2021 PROGRAMME – LIVE SESSIONS

Wednesday, March 3

08:00 - 09:00 CET	Eurosafe imaging session - jointly organised by EUROSAFE Imaging and IAEA	Building capacity and quality/safety awareness in Africa
10.30 - 11.30 CET	Refresher course:	RC 414 - Imaging and protecting the foetus
11:45 - 12:45 CET	Advanced course:	E ³ -25A - Basic principles and magnetic field interactions
14:15 - 15:15 CET	Coffee & talk (open forum) session - organised by EIBIR	Joint EIBIR-EURAMED session on European radiation protection research
16:45 - 17:45 CET	Research presentation session:	RPS 113 - The ultimate goal: improvement of image quality

Thursday, March 4

08:00 - 09:00 CET	ESR table talks:	TT3 - ESR's new EU project: European co-ordinated action on improving justification of computed tomography
08:00 - 09:00 CET	Professional Challenges Session	PC 4 - Safety challenges in everyday clinical practice
11:45 - 12:45 CET	EUROSAFE imaging session - jointly organised by EURO-SAFE imaging and ECR subcommittee on paediatric:	EU2 - Avoiding or reducing ionising radiation in children: the ALARA principle
14:15 - 15:15 CET	Joint session of the ESR and EFOMP:	High-field vs low-field MRI: time for a re-think?
15:30 - 16:30 CET	ESR audit and standards session:	The role of clinical audit in radiology service improvement
16:45 - 17:45 CET	Refresher courses:	RC114 - Communicating imaging justification

Friday, March 5

09:15 - 09:40 CET	ESR Table Talks	TT 7 - Update on EuroSafe Imaging and the role of imaging on the global health agenda
11:45 - 12:45 CET	Research Presentation Session	RPS 114 - Quality improvement in radiography
14:15 - 15:15 CET	ESR QuADRANT Session - Jointly organised by the ESR Audit and Standards Subcommittee and EuroSafe Imaging	Quality improvement through audit in diagnostic radiology, radiotherapy, and nuclear medicine: a European project on behalf of the European Commission
15:30 - 16:30 CET	Refresher Courses	RC 113 - Blue skies and current trends in digital radiography (DR), computed tomography (CT), and interventional radiology (IR)

Saturday, March 6

08:00 - 09:00 CET	EFOMP workshop: new European quality controls for state-of-the-art innovations in radiology and artificial intelligence: the role of the medical physicist	European quality controls (QC) in diagnostic and interventional radiology
08:00 - 09:00 CET	Professional Challenges Session:	PC 1 - Subspecialisation vs despecialisation
15:30 - 16:30 CET	EFRS Workshop:	EFRS WS - Radiographers and patient-centred care
18:00 - 19:00 CET	EuroSafe Imaging Session:	EU5 - "Yield the shield": new approaches and challenges in the use of gonadal shielding during radiography in children
19:45 - 20:45 CET	Research Presentation Session:	RPS 214 - The radiography profession: a life-long learning experience

Sunday, March 7

14:15 - 15:15 CET	Research Presentation Session	RPS 213 - Patient dose: the neverending story
15:30 - 16:30 CET	Professional Challenges Session	PC 5 - The state-of-the-art of everyday radiation: benefit-risk communication
16:45 - 17:45 CET	Coffee & Talk (open forum) Session - Organised by EuroSafe Imaging	C 15 - Image quality and dose: a practical guide for radiologists
18:00 - 19:00 CET	Coffee & Talk (open forum) Session	C 6 - Professional regulation and opportunities across Europe
19:45 - 20:45 CET	E ³ - Rising Stars Programme: Basic Session - Organised by the EFRS:	BS 1 - Challenges in cross-sectional imaging

ECR 2021 PROGRAMME – ON DEMAND

E ³ - European Diploma Prep Sessions	E ³ 323 - Principles of imaging and radiation protection
Refresher Courses: Emergency Imaging	RC 317 - New technologies in emergency imaging;
Refresher courses: Physics in Medical Imaging	RC 413 - Radiation dose monitoring systems (RDMS): from commissioning to effective use; RC 513 - Quantification of magnetic resonance imaging parameters in clinical practice;
E ³ - Advanced Courses: Artificial Intelligence	E ³ 122 - Artificial intelligence (AI) in radiology: the basics you need to know; E ³ 222 - Artificial intelligence for image reconstruction: towards deep imaging?; E ³ 322 - Artificial intelligence and translations to clinical practice; E ³ 422 - Radiomics: principles and applications; E ³ 622 - Challenges and solutions for introducing artificial intelligence (AI) in daily clinical workflow;
E ³ - Rising Stars Programme: Basic Sessions	BS 3 - Radiation dose and image quality optimisation
E3 - The Beauty of Basic Knowledge: Understanding MRI Technique and MRI Safety	E ³ 25B - Static magnetic fields; E ³ 25C - Time varying electromagnetic fields; E ³ 25D - MRI in the presence of implants; E ³ 25E - Working in the MRI environment;
E ³ - European Diploma Prep Sessions	E ³ 323 - Principles of imaging and radiation protection
EFOMP Workshop: New European Quality Controls for State-of-the-Art Innovations in Radiology and Artificial Intelligence: The Role of the Medical Physicist	EF 2 - European quality controls (QC) in innovation, safety, and artificial intelligence (AI)
EuroSafe Imaging Sessions:	EU 1 - Ethics and radiation protection of the patient: a focus on medical imaging EU 3 - Essential requirements for dose management systems (DMS): what do we really need? EU 4 - A historical overview of CT dose exposure: past, present, and future EU 7 - Medical radiation exposure of patients
Special Focus Sessions	SF 18 - Deep learning and image quality;

You are warmly welcomed to participate in our exciting online and on-demand programme!



Vesna Gershan, Chair of ECR 2021 Physics in Medical Imaging subcommittee

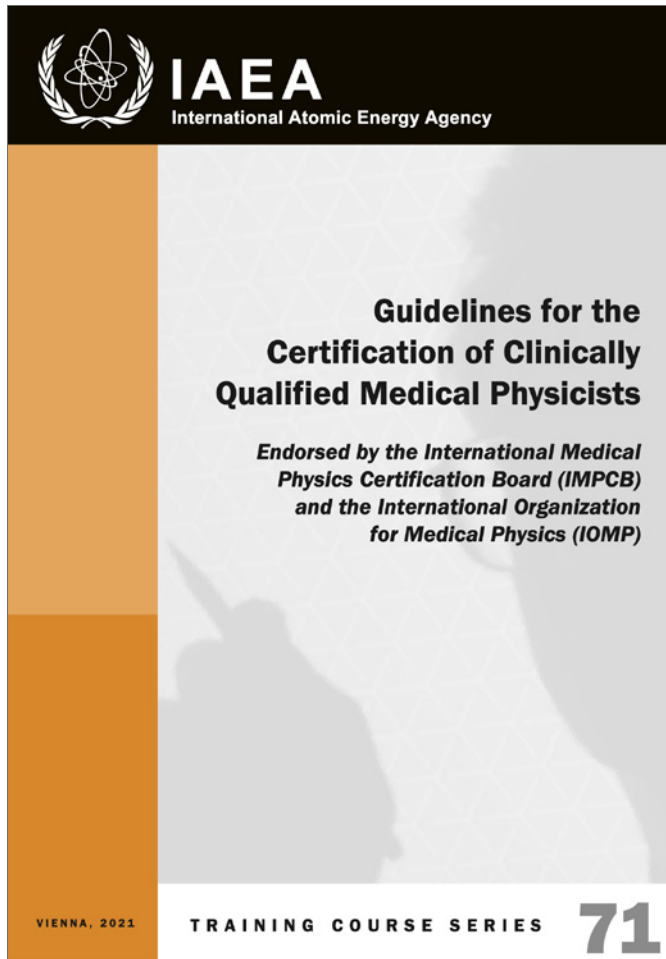
Vesna Gershan is a Professor at Ss. Cyril and Methodius University, Faculty of Natural Sciences and Mathematics, Physics Department in Skopje, North Macedonia. She is a clinically certified medical imaging physicist, and her areas of interest are protocol optimization and patient dosimetry in CT and other radiology modalities.



Annalisa Trianni, EFOMP representative on Programme Planning Committee of ECR 2021

Dr Trianni is Chief Medical Physicist at the S. Chiara Hospital, Trento, Italy. Her primary field of application is medical imaging, with a focus on dose and image quality optimisation for the different X-ray imaging modalities and a special interest for interventional radiology and CT. Dr Trianni is involved in IAEA missions and expert groups, and in several international working groups (Chair of DICOM WG28, member of DICOM WG02, board member of EUSOMII, radiation protection WG for ESR). She has been Coordinator of the Working Group on Digital Radiology of the Italian Association of Medical Physicists and currently coordinates the EFOMP WG on QC protocol for angiography systems.

IAEA Promotion of Recognition of Medical Physicists as Health Professionals



As the title already indicates, TCS 71 provides **guidelines for (the road to) certification of Clinically Qualified Medical Physicists** (CQMP), in Europe known as Medical Physics Experts (MPE). The report is especially useful for those countries that do not have a certification process in place, but it also contains useful information for anybody who is interested in medical physics and the need for a recognised position of the MPE. The report contains chapters on certification frameworks, establishing a certification process, and maintaining certification (including continuing professional development) and, as such, is compulsory reading for any MPE (in training).

An IAEA press release publicly announcing the new document can be found at <https://www.iaea.org/newscenter/pressreleases/iaea-launches-guide-to-promote-recognition-of-medical-physicists-as-health-professionals>.



Prof. Adriaan A. Lammertsma, PhD, has been active in PET research since 1979. He is the 2012 recipient of the Kuhl-Lassen Award from the Society of Nuclear Medicine and the 2015 recipient of the ESMI Award from the European Society of Molecular Imaging. As (vice)-chair of the EFOMP Education & Training Committee he took part, as EFOMP representative, in a meeting in 2018, organised by the IAEA, to formulate the framework of the report that has now been published as IAEA Training Course Series No 71.

Report on the XIIIth National Medical Physics and Biomedical Engineering Conference NMPEC 2020

Simona Avramova-Cholakova, President of BSBPE 2016-2020 and Chair of the Organising Committee, reviews the recent national medical physics and biomedical engineering conference in Bulgaria

During the period 2-13 November 2020, the Bulgarian Society of Biomedical Physics and Engineering (BSBPE) organised the XIIIth National Medical Physics and Biomedical Engineering Conference NMPEC 2020 with international participation (<http://nmpec2020.bsbpe.org>).

Due to the COVID-19 pandemic, this was the first conference organised by the BSBPE which was completely run on a digital platform. The theme of the Conference was “Physics and Engineering: Unlocking doors in Medicine Together” and it was dedicated to the International Day of Medical Physics, which was held this year under the motto “Medical Physicist as a Health Professional”. We are proud to announce that this conference was conducted along with cooperation of the Medical University of Plovdiv, endorsed by the European Federation of Organisations for Medical Physics and kindly sponsored by the International Organisation for Medical Physics.

We were privileged to have eminent speakers from all over the world, among them Prof. Michel Israel (Bulgaria), Prof. Alexandre Loukanov (Japan), Prof. Paolo Russo (Italy), Dr. Antonio Sarno (Italy), Prof. Kristina Bliznakova (Bulgaria), Prof. Magdalena Stoeva (Bulgaria), Prof. Ventseslav Todorov (Bulgaria), Prof. Slavik Tabakov (UK), Prof. Silvia Tsvetkova (Bulgaria), Prof. Ehsan Samei (USA), Prof. Jenia Vassileva (Austria), Prof. Parham Alaei (USA), Dr. Eduard Gershkevitch (Estonia), Prof. Assen Kirov (USA), Dr. Marco Brambilla (Italy), Prof. Sigrid Leide Svegborn (Sweden). We also had rising stars such as Dr. Emil Georgiev (Bulgaria), Dr. Ivan Tonev (Bulgaria), Dr.

Todor Bogdanov (Bulgaria) and Dr. Dimitar Petrov (Belgium). During the Conference educational webinars were presented in all fields of medical physics and biomedical engineering, as you can see if you download the conference programme.

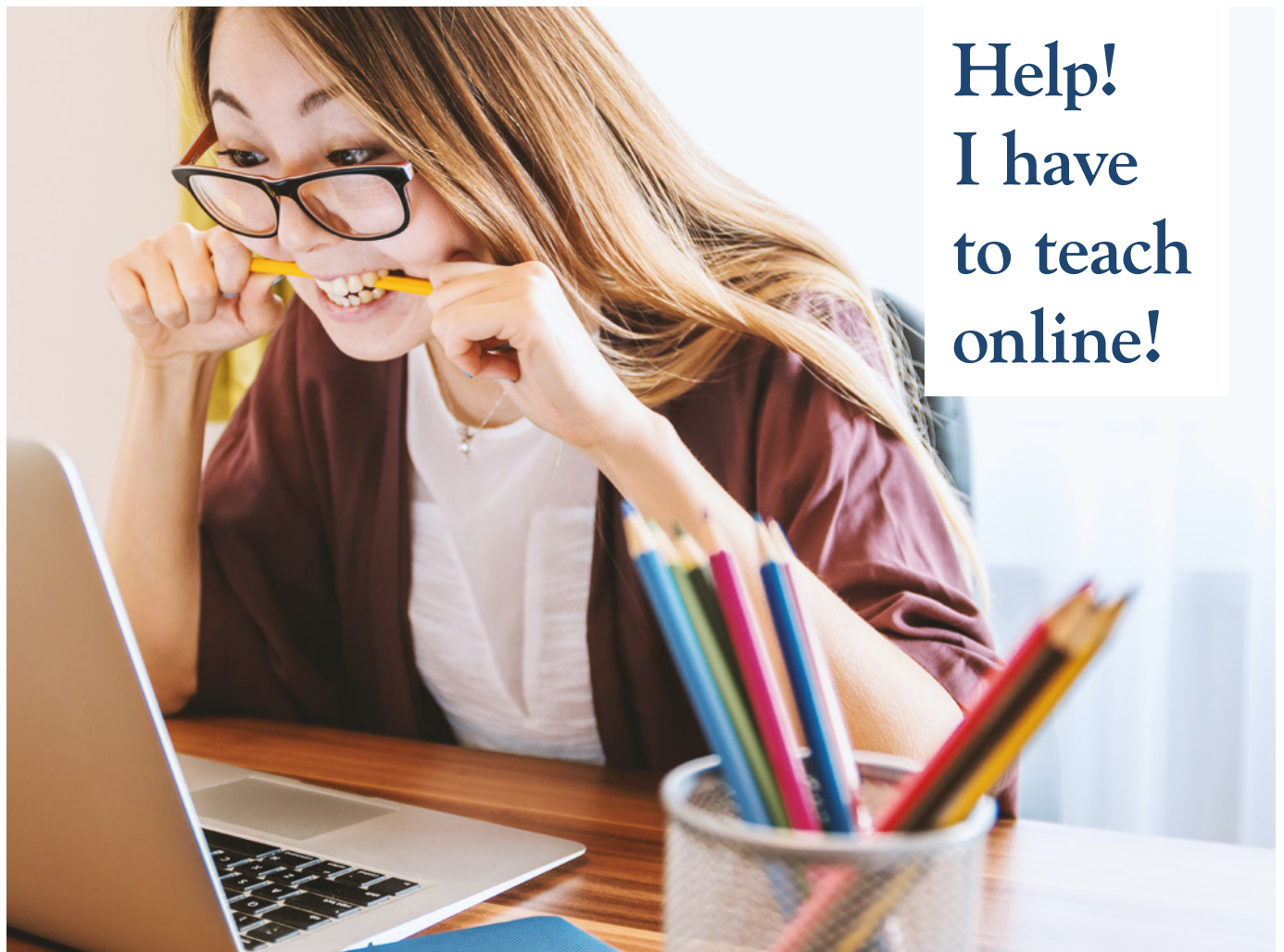
The conference was a great success! A total of 162 participants registered for the conference. They were from all over the world: Algeria, Austria, Belarus, Belgium, Brazil, Bulgaria, Cyprus, Czech Republic, Cote d'Ivoire, Ecuador, Estonia, Ethiopia, India, Indonesia, Ireland, Israel, Italy, Japan, Kazakhstan, Latvia, Libya, Lithuania, Malaysia, Mali, Morocco, Nepal, Nigeria, Oman, Pakistan, Philippines, Poland, Portugal, Romania, Russia, Sudan, Sweden, Thailand, Trinidad and Tobago, Turkey, Ukraine, United Kingdom, USA, and Yemen. The registration for the scientific sessions was independent of the conference registration and a total of 524 participants registered to watch the webinars. Recordings of the invited talks, for which permissions were obtained, will be uploaded to YouTube. Due to the pandemic restrictions, the contributed papers could be

accepted only for poster presentations, which we felt would provide an adequate alternative. The abstracts from the event were published in the peer-reviewed journal *Folia Medica* and are available at <https://foliamedica.bg/article/60412/>.

I would like to use the opportunity to thank and acknowledge our eminent speakers, the Organising, Local Organising and Scientific Programme Committees for their hard work and dedication. We are also thankful to all participants for their important contributions.




Dr Simona Avramova is a medical physicist with more than 25 years of experience, currently working at Imperial College Healthcare NHS Trust, London. She was involved in radiation therapy and nuclear medicine, but over the past 15 years she has specialised in the field of diagnostic radiology. She has extensive teaching experience and participated in many IAEA missions.



**Help!
I have
to teach
online!**

Educational expert Danielle Dobbe-Kalkman gives her advice on embracing online teaching

If you teach once in a while, chances are you have been forced to move your teaching online lately. And I bet that you weren't very happy with it... Which is totally understandable!

If you like teaching, you probably thrive on the contact and interaction with your participants. They give you energy, spark your enthusiasm, and you adjust and improvise as necessary, because you're able to tell whether they're with you or not. Thus, if you need to teach online, the things that make teaching most satisfying are being taken away from you...

However, in this article I'm going to try to help you to make online teaching a different, but still satisfying, experience, for you, and moreover, for your participants as well!

Start over

When moving to online teaching, a lot of people's default would probably be trying to convert or translate their existing course directly into an online course. However, by doing that, you ignore the differences between offline and online teaching, and their distinctive features and possibilities.

So, instead of trying to transform your course that was originally designed for offline teaching, it would be a better idea to actually start over, and embrace the opportunities that online teaching has to offer!

No matter what kind of teaching you want to develop, always start with the ultimate goal in mind! Start with what you want the participants to have learned from the course, and consider what teaching methods would be most suitable to achieve those objectives. Although the ultimate goal of the new course can be the same, the most suitable methods to achieve those objectives are different for offline and online teaching.

Examples of online activities

Asynchronous

- Forum where participants can introduce themselves
- Quiz to test their knowledge
- Self-paced modules
- Short videos to explain difficult concepts
- Assignment: solving real job cases, participants submit their comments
- Test

Synchronous

- Quiz
- Webinar (including polls and chat)
- Discussion and assignment in breakout rooms
- Presentations of small group assignments
- Q&A session

Consider both asynchronous and synchronous learning

One thing that you should first consider when redesigning your course, is can you take advantage of the unique qualities of both synchronous and asynchronous learning.

We talk of asynchronous learning when all participants can absorb the subject matter at their own pace, and at the timing they choose. Examples of asynchronous learning are classic e-learning modules, videos, forums, etc. Synchronous learning on the other hand is 'live' learning, when all participants are online at the same time, doing the same activities, like webinars and Q&A sessions.

Asynchronous learning is especially adequate when you need flexibility and want to allow participants to really process (new) content more deeply, to practice, and to have time to respond to discussions and contributions. When you need real-time social interaction, for support, communication, discussion, sharing, and insights, synchronous

learning is most appropriate. With synchronous learning immediate answers and feedback, as well as real-time guidance, are possible.

Therefore you should consider your objectives and match them to the right modality.

Make contact and activate

In online teaching we experience a larger distance between us, the teachers, and our participants. Not only physically, but also psychologically, and communicatively. This makes engaging the participants complex. If you and your participants have the opportunity to interact, it will be more likely they'll have a more satisfying learning experience. There are different ways to achieve this. For example, when you're teaching a smaller group, you should allocate some time to let the participants introduce themselves. Another way to interact with participants is via the chat function which is usually available on learning platforms. By asking them questions they can answer using chat, you can encourage participants to get involved. This way you will also learn whether they are understanding the content or not. In addition, it's very important to give participants the opportunity to ask questions themselves as well!

Besides the chat function, most platforms offer the use of breakout rooms. These breakout rooms are very well-suited for discussion and collaboration in smaller groups, contributing to a more active participation, which in turn leads to better understanding and remembering the content.

Furthermore, you might want to consider using online quiz tools like Mentimeter, Kahoot or Socrative, to activate participants in a fun, attractive way.

I realise online teaching is often harder, and less fun than offline teaching. Nevertheless, I believe it can still be rewarding if you stop seeing it as a bad version of live face-to-face teaching, but start seeing it as something different. A new opportunity that allows you to continue your previous teaching, and, perhaps expand it since now it is easier to reach a global audience! When using the right methods and activities you can still make a satisfying experience for both yourself and your participants!



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.



2nd ENEN NUCLEAR SUMMER SCHOOL FOR BSC STUDENTS

5-9. JULY 2021 BUDAPEST, HUNGARY

**NEW CALL
2021**

PARTICIPANTS

The Summer School is targeted to BSc students with an interest in the nuclear field, who are currently enrolled in their university studies in European States.

All expenses will be covered by the ENEN+ project.

In the participant selection procedure we emphasize the role of a clear motivation and a recommendation letter from a supervising professor.

SUMMER SCHOOL WEBPAGE

<https://summerschool2020.enen.bme.hu>

The registration for the summer school should be via webpage.

TOPICS

Participants will be introduced to the multi-disciplinary present and future challenges in four core topics:

1. Nuclear energy
2. Medical applications
3. Radiation protection
4. Waste management, geological disposal

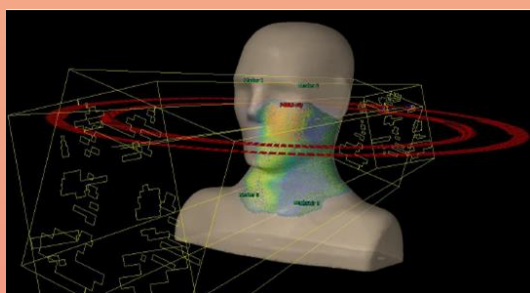
NEW KEY DEADLINES

Registration:

1st January - 30th April 2021

Results & Notifications

20th May 2021



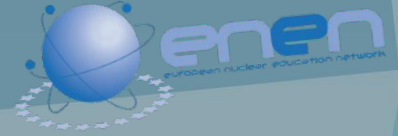
Coordinated Support Action in the H2020 EURATOM NFRP12
Support for careers in the nuclear field (2016-2017)

VENUE

Budapest University of Technology and Economics,
Institute of Nuclear Techniques
Budapest, Hungary

**NEW CALL
2021**

SECOND EUROPEAN NUCLEAR COMPETITION FOR SECONDARY SCHOOL PUPILS 5-9 JULY 2021 BUDAPEST, HUNGARY



PARTICIPANTS

The competition is open to secondary school pupils, who are currently enrolled in secondary schools in European States. Teams must have two pupil members and one teacher. The 15 finalist teams will be invited and supported to attend the summer school in Budapest, Hungary.

TASKS AND TOPICS

The task of the participants is to compose a 3-minute video on one or more of the four nuclear disciplines. Suggestions for topics include, but are not limited to:

- Jobs in nuclear
- Create a story about nuclear
- History of nuclear science and technology
- Future of nuclear technology
- Nuclear in daily life
- Radiation for health

E-MAIL ADDRESS

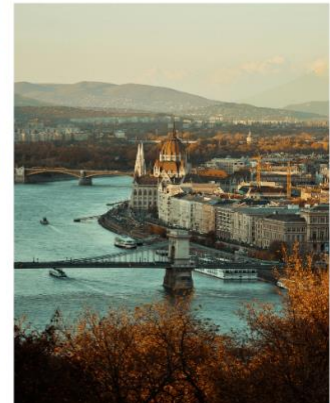
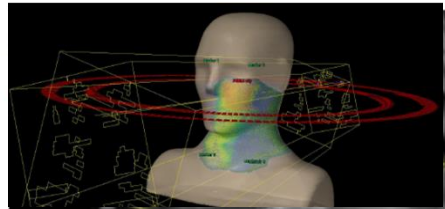
nuclear.competition@reak.bme.hu



COMPETITION WEBPAGE

<http://nuclearcompetition.enen.bme.hu>

Submissions for the competition (registration and video) should be via webpage.



NEW KEY DEADLINES

1st January 2021

Video submission opens

1st May 2021

Video submission deadline

20th May 2021

**Deadline for nomination of
15 finalists**

Coordinated Support Action in the H2020 EURATOM
NFRP12 Support for careers in the nuclear field (2016-
2017)

PTW: The Dosimetry School – Furthering and Exchanging Knowledge Worldwide



Since 2014, the PTW Dosimetry School

has been offering education and training throughout Germany and worldwide – in particular for medical physics experts, but also for all medical technology personnel. The school, which was initially set up as a pilot project, is now well established; the number of courses is continuing to grow, along with the number of satisfied participants.

The school's comprehensive course programme imparts relevant knowledge in dosimetry and quality assurance. Courses are by no means based on dull lectures. Alongside the theory part, they offer lots of practical know-how on the background of medical physics, as well as providing a platform for sharing information and networking. The Dosimetry School is a recognized educational institution – which means that participants receive credits for their attendance. Its courses are suitable for experienced as well as new medical physicists.

Our course programme is changing continuously: content is being expanded and also adapted to local needs since requirements and levels of training can vary depending on the country. All the teaching staff are recognized experts in their respective fields and are currently working in hospitals, universities and research centers around the whole world, or are employed by PTW or one of its subsidiary companies. The PTW Dosimetry School is focused on the participants gaining knowledge – course fees are therefore reasonable, even in the case of courses with a duration of several days. While I was working as a medical physicist in a private clinic, I recognized that there was a need for a dosimetry school. During my time there I wished for the opportunity to gain a better background knowledge of dosimetry, further to that acquired during my studies. Following my move to PTW, with the support of the management, I developed a concept that initially started out as a pilot project.

Aim: To increase background knowledge in dosimetry

The Dosimetry School is now well established: Training is offered worldwide by the most varied teaching staff, including those from industry, universities and standards committees. Our courses do not only skim over the surface, they go much deeper; for example, regarding the subject

of reference dosimetry: These measurements are carried out under very strict, prescribed conditions. The reference dosimetry course at the Dosimetry School is one of the few seminars, which deals with this topic extensively – and not just on a theoretical level, but also with practical exercises. Beginners learn practical aspects and can gain knowledge of the background. Experienced medical physicists, who already know a lot about reference dosimetry, learn to understand why certain things are established in the relevant standards or guidelines.

Large base of knowledge and experience with over 30 teachers

The Dosimetry School has access to an immense knowledge base, including approximately ten experts from PTW and more than 30 external scientists. Currently, around ten different courses covering different medical physics related topics are offered – as theoretical courses or combined with practical exercises. Since 2014 more than 100 courses have been carried out worldwide, with great success. The participant feedback, which is monitored regularly, shows us again and again that we have made the right decision by focusing on knowledge transfer in medical physics rather than product training. Our participants appreciate the fact that our courses are not a sales push or advertising campaign – which could quite easily be presumed, but is definitely not the case.



PTW Dosimetry School – sharing and enhancing knowledge and practice in clinical dosimetry



A good mix of theory and practice – training course on relative dosimetry held in Milan, Italy

Regardless of whether the course deals with the background of relative and reference dosimetry, or provides specific knowledge on small field dosimetry or patient plan verification: The participation in a course at the PTW Dosimetry School always comes highly recommended and often features as a highlight for attendees – which makes us at PTW very proud. There are even some participants who have already attended all the available training courses.

Credited by various professional organizations

It is not without reason that the German Society for Medical Physics (DGMP) awards credits for attending courses at the Dosimetry School. The courses are also recognized by the AAPM and other local medical physics organizations of the countries in which the seminars take place. Furthermore, the Dosimetry School has already offered courses for the installers from linear accelerator manufacturers, as well as an IMAT training course implemented for physicians from emerging countries.

It is particularly rewarding for us to see that our courses are very well received and high in demand, not only from the participants but also from their employers. In this respect, we view the Dosimetry School, which is now in its seventh year, in a very positive light. PTW continues to fully support this educational initiative, and we are looking forward to being able to offer numerous further courses and receive many more participants in the future.

Further information regarding the Dosimetry School's courses can be found at: www.ptwdosimetry.com/en/services/education-training.



Tino Ebneth, Head of PTW Dosimetry School

Tino Ebneth is a Medical Physics Expert. He initiated the PTW Dosimetry School in 2014. In his role as the head of school he is responsible for planning, developing and implementing the school's training programme.

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Basic CT and PET Physics Research at the DKFZ

Professor Marc Kachelrieß is leader of one of the largest academic CT research groups in Europe – here he describes ongoing research activities in his group

The division of X-Ray Imaging and CT of the German Cancer Research Center (DKFZ), Heidelberg, Germany, is dedicated to basic research in the field of medical imaging with ionizing radiation. We focus on the widely available workhorse modalities x-ray computed tomography and positron emission tomography. The CT research not only covers diagnostic CT but also all aspects of cone-beam CT, as it is used in radiation therapy, in interventional imaging, in dental imaging or in preclinical imaging.

Regarding diagnostic CT, one focus is patient dose reduction. Even though today's systems use tube current modulation and iterative reconstruction there are further significant improvements possible that could be implemented by the vendors. We currently evaluate the dose reduction potential possible with added prefiltration that is available in finer gradations than in today's systems (which, if at all, offer a single removable tin filter of either 0.4 mm or 0.6 mm or 0.7 mm, depending on the CT system). Our findings are that filters should be available in steps of 0.1 mm up to a thickness of several millimeters such that, ideally, instead of adjusting the tube current to the patient size one should rather adjust the filter thickness to the patient size and use the maximum available tube current. Dose reduction values of up to 50% are possible with such simple modifications (Figure 1). Similarly, tube voltages lower than 70 kV would be highly beneficial in terms of dose for contrast-enhanced exams. Since 50 or 60 kV are unlikely to be seen in the near future an alternative would be using contrast agents with k-edges at higher energies than iodine.

	Child (15 cm x 10 cm)	Adult (30 cm x 20 cm)	Obese (50 cm x 40 cm)
Soft tissue (reference)	30 mAs, 90 kV	100 mAs, 130 kV	600 mAs, 150 kV
Soft tissue, Sn	0.6 mm, 1000 mAs, 75 kV 15%	1.0 mm, 1000 mAs, 120 kV 32%	0.2 mm, 1000 mAs, 150 kV 25%
Soft tissue, Cu	1.6 mm, 1000 mAs, 70 kV 17%	3.4 mm, 1000 mAs, 125 kV 31%	0.8 mm, 1000 mAs, 150 kV 29%
Iodine (reference)	50 mAs, 70 kV	120 mAs, 90 kV	720 mAs, 120 kV
Iodine, Sn	0 mm, 210 mAs, 50 kV 39%	0.1 mm, 1000 mAs, 70 kV 40%	0.0 mm, 1000 mAs, 105 kV 39%
Iodine, Cu	0.4 mm, 1000 mAs, 50 kV 57%	0.2 mm, 1000 mAs, 65 kV 49%	0.0 mm, 1000 mAs, 105 kV 39%

Figure 1: Patient-specific prefilters can help to significantly reduce dose, as this simulation shows. Today's CT systems do not have a large variety of prefilters. Only some of them offer an optional tin prefilter. This table shows the dose reduction values (in %) possible compared with a reference protocol for two different filter types (Sn and Cu), for two applications (soft tissue contrast and iodine-enhanced imaging) and for three body sizes (child, adult, obese). It can be seen that the dose reduction values achievable with prefilters adapted to the patient size can be quite substantial. For iodine-enhanced imaging the effect seen is not only due to the prefilter but also due to using tube voltages below 70 kV.

Our division also investigates the use of the upcoming photon-counting detector technology. We have two such systems installed: an experimental whole-body photon-counting system (Siemens Somatom Count) and a self-built small animal photon counting CT equipped with Dectris detectors: (see the front page of this issue of EMP News).. Manifold benefits have been found: lower dose, also due to the “small pixel effect” and due to the “iodine effect”, spectral images on demand, and more flexibility due to binning each scan into several energy bins. Apart from that we are also involved in the development of photon counting detectors and in the development of contrast agents dedicated to energy-selective CT.

Another field of research is motion compensation (MoCo) where we design algorithms that estimate the patient motion from the raw data and use the estimated motion in a subsequent reconstruction step to avoid motion blurring or to display motion in real-time. We successfully use MoCo in diagnostic cardiac CT to minimize the motion artifacts of the coronaries and of the heart valves, and we use MoCo to calculate 4D or even 5D (3 spatial dimensions + respiratory + cardiac temporal dimension) volumes of sparsely sampled CBCT data (important for radiation therapy), MR data and PET/MR data, thereby providing information about organ or tumour motion, and sharper images. Motion estimation may or may not include the use of neural networks.

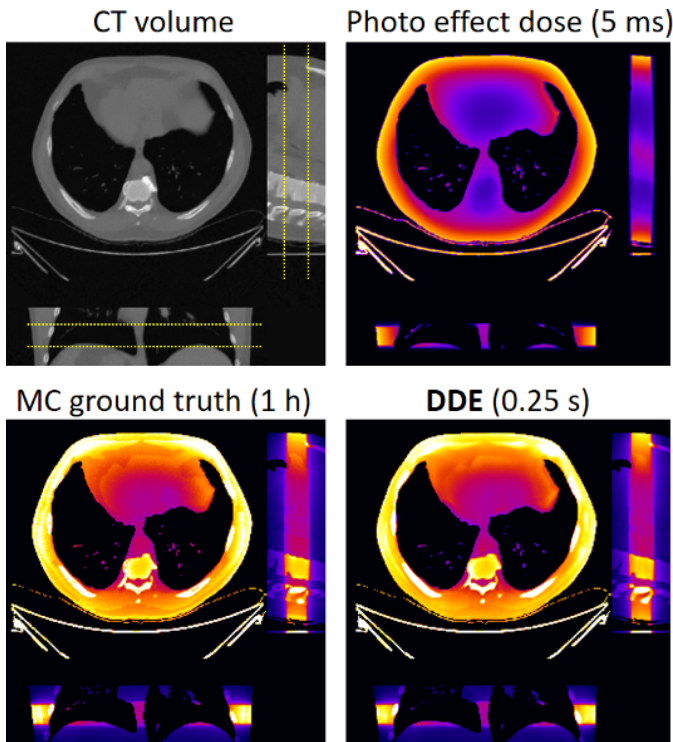


Figure 2: Dose distributions for a diagnostic circle CT scan (collimation indicated by the yellow dashed lines in the coronal and sagittal reformations of the CT volume). Given the CT volume and a first order dose estimation the deep dose estimation (DDE) neural network estimates the dose distribution of the patient within about 0.25 seconds. The Monte Carlo (MC) dose estimation requires about 1 h of computation time.

With the advent of deep learning, our division was able to achieve a couple of breakthroughs of formerly far unseen performance. Our deep scatter estimation (DSE) algorithm allows to compute the scatter contribution to an x-ray image in real-time, thereby enabling scatter estimation and scatter removal in diagnostic single- and dual-source CT and in flat detector-based CBCT within less than a second. Compared to competing algorithms such as Monte Carlo or Boltzmann transport-based scatter calculations, DSE is at least two orders of magnitude faster, and computationally less demanding. Similarly, our deep dose estimation (DDE) is able to calculate a patient-specific dose distribution for a complete CT or CBCT scan in a couple of seconds (Figure 2). Combined with automatic segmentation approaches it is now possible to estimate the radiation risk, such as the effective dose, for example, individually for each patient and each scan protocol within a few seconds. We currently use this technology to develop a risk-minimizing tube current modulation (riskTCM), as opposed to the conventional mAs-product-minimizing TCM (mAsTCM). Further dose reductions in the order of 10 to 20% are anticipated (Figure 3).

Apart from research in computed tomography we also work in PET imaging where some of our CT algorithms had inspired developments for PET, PET/CT and PET/MR. One aspect here is the estimation of attenuating objects invisible to the MR system (bone, coils, headphones, ...), as those are needed for PET attenuation correction. This can, for example be solved by the xMR-MLAA algorithm that uses the MR information and the PET consistency conditions to reconstruct such objects even if they are outside the MR field of view. Moreover,

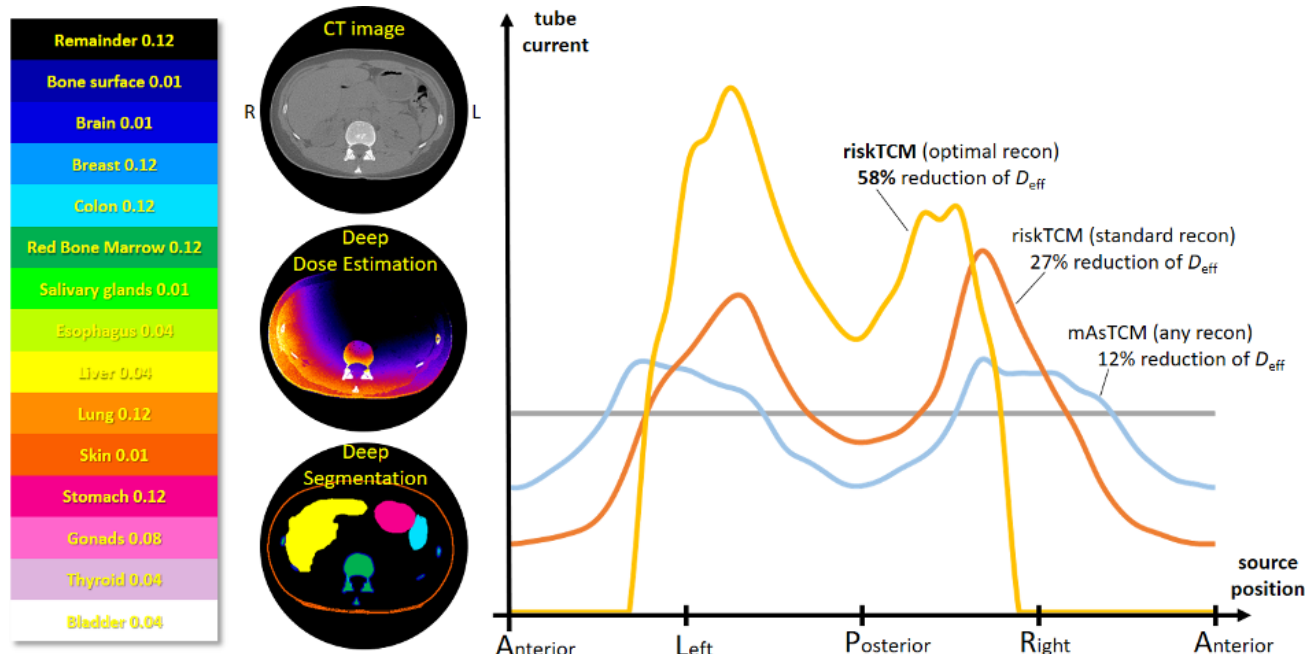


Figure 3: Predicting the CT image from the topogram(s) allows to segment the ICRP 103 organs. Combined with the fast deep dose estimation (DDE) algorithm the patient risk can be quickly estimated as a function of the planned tube current modulation curve. Rather than optimizing the tube current curve for minimal mAs product (today's TCM) our method finds the TCM curve that minimizes the patient's radiation risk (riskTCM). The plot shows the conventional TCM, the riskTCM assuming classical image reconstruction and the riskTCM curve for reconstruction algorithms that perform a statistically optimal combination of complementary rays. The dose reduction values are relative to a situation with constant tube current (gray horizontal line) and correspond to the shown slice scanned at 70 kV

we develop algorithms for motion compensation for PET/MR and for cardiac PET. An interesting ongoing project, that will gain in importance with the upcoming DFKZ installation of a very long FOV PET system (Siemens Biograph Vision Quadra), is the deep scatter estimation for PET. Inspired by the CT-DSE algorithm, PET-DSE is trained with Monte Carlo estimates of PET scatter to predict the scatter contributions within the list mode measurements. Input to PET-DSE are the list mode data themselves, as well as the attenuation values of each line of response. Once trained, PET-DSE takes a few seconds to perform the scatter estimation which is then input, together with the measured counts and the estimated randoms, to the PET reconstruction algorithm. Adaptations to time-of-flight PET are currently ongoing in our lab.

Last but not least, we further focus on multiple aspects of artifact correction in CT, on CT perfusion, on calibration techniques and on image quality assessment. Our work is not only useful for diagnostic or medical applications, but is, to some extent, also applied to industrial CT.

Summarizing, there are a multitude of basic physics and algorithmic developments that cover a broad variety of aspects going on in our lab. Our aim to improve image quality, to reduce patient dose and to develop new imaging applications shall finally lead to solutions that can be easily translated to the patient.

References

Selected publications as well as our conference presentations can be found at www.dkfz.de/ct.



Prof. Dr. Marc Kachelrieß is chair of the division of X-Ray Imaging and CT of the German Cancer Research Center (DKFZ) in Heidelberg, Germany. After finishing his diploma in theoretical physics he started his PhD research on metal artifact reduction in CT in 1995. In 2002 Marc Kachelrieß completed all post-doctoral lecturing qualifications (habilitation) for Medical Physics and in 2005 he was appointed Professor of Medical Imaging at the University of Erlangen-Nürnberg. Since 2009 Marc Kachelrieß additionally holds an Adjunct Associate Professor position at the Department of Radiology at the University of Utah, USA. In 2014 Marc Kachelrieß was appointed full Professor of X-Ray Imaging and CT at the German Cancer Research Center (DKFZ) in Heidelberg, Germany. His research interests are basic algorithmic and physics aspects of tomographic imaging with ionizing radiation, with a focus on x-ray computed tomography.

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ERC Consolidator grants: Funding for the next big step... (...in medical physics)

Ioannis Sechopoulos of Radboud University Medical Center in the Netherlands is holder of a prestigious ERC grant (“BREAST4D”) – here, he gives his insight into the scheme and the application process

ERC Consolidator grants are aimed at mid-career scientists; researchers are eligible to apply between seven and twelve years after obtaining their PhD.

However, there is a lot more to it than correct timing. ERC is interested in funding “high risk, high gain” science, and this makes preparing an ERC application different from others. It is important that the project have various aims, some of them of lower risk, and, of course, at least one pie-in-the-sky, oh-my-god-it-actually-worked envisioned outcome. Of course, the ERC is ambitious, but it is not crazy; even for the most ambitious part of the project, you have to have laid the groundwork to convince the panel that it is not a leap into the great unknown. You should have done enough work on the subject area to convince the panel that, in essence, you know what you are doing. But this goes beyond just discussing potential problems and alternative strategies, like in any other grant application. In the case of these applications, the panel should see that you and your team can adapt and, if needed, bring in the knowledge needed to face unforeseen issues. After all, although this is a personal grant, we are in the era of team science, and nobody can successfully tackle research of this magnitude alone. As also mentioned in the ERC website, an excellent research team is needed, but also, I believe, one needs a team in the multi-disciplinary, multi-institutional, and even multi-national sense of the word.

In our field of medical physics, a truly impactful project needs to have both strong technical and clinical components. Ours is an applied field, and therefore cool technology that does not address a real problem in healthcare is just that – cool technology – but not impactful. A successful medical physics Consolidator applicant should have a track record of working with clinicians, listening to them, and aiming to address

their problems. And, importantly for a successful application, the applicant should

be able to explain the clinical aspects of the application just as well as the technical ones. And again, this takes years.

The application process itself is quite long, but not much longer than that of other funding mechanisms. The application has two parts, one including a 5-page synopsis of the project and a 4-page description of the applicant; the other consisting of a 15-page description of the project. Although both parts need to be submitted together, the second one will only be read if the applicant passes the first stage. And only a portion of the applications that pass the second stage are invited to an in-person interview with the review panel in Brussels. The exhilaration of making it this far is accompanied by the anxiousness to prepare for these very quick 30 minutes, on which your next 5 years of research depend.

Depending on your experience in writing grants, preparing a Consolidator application could take you from one month (I suggest you take longer!) to a year. From submission to funding notice takes approximately 10 months. However, truly, the process takes many years. Writing those 20 pages and preparing those interview slides is just the final (arduous) step, the fun begins much earlier! Start setting the groundwork during your first academic research appointment, and you’ll be ready when the time comes!



Ioannis Sechopoulos is an Associate Professor and chair of the Advanced X-ray Tomographic Imaging (AXTI) lab in the Department of Medical Imaging of Radboud University Medical Center, and at the Dutch Expert Center for Screening (LRCB). His ERC Consolidator project, BREAST4D, is aimed at developing dynamic perfusion breast CT for breast cancer treatment personalization.

“Are you a scientist who wants to consolidate your independence by establishing a research team and continuing to develop a success career in Europe? The ERC Consolidator Grant could be for you.”

- European Research Council (ERC) website



ESMPE European School for Medical Physics Experts

MRI in Radiation Therapy Planning

5th–6th May 2021

Online webinar course with *live* lectures

EFOMP would like to invite you to the next ESMPE in **MRI in Radiation Therapy Planning**. The school will be organized as a 2-day virtual meeting, which will be held on 5th–6th May 2021.

The school will be focused on the Medical Physics aspects of Radiation Therapy Planning using MRI and will be aimed at presenting the background, practical methodology, state-of-the-art and future developments. All of the lectures will be delivered live (i.e. not pre-recorded) and there will be live Q&A sessions.

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

Content will include:

- MRI physics – basic and advanced
- Artefacts and spatial distortion
- Pulse sequences for RT planning
- Hardware and software for MRI RT planning
- Image segmentation techniques
- MRI in external beam, gamma knife and brachytherapy planning
- Workflow and quality control
- Real-time MR-guided external beam radiation therapy

Speakers: A team of experts is lined up to deliver the School; those who have agreed so far include: Paul Davenport (Dublin/IE), Paddy Gilligan (Dublin/IE), David Lurie (Aberdeen/UK), Ian Paddick (London/UK), Geoffrey Payne (Southampton/UK), Bas Raaymakers (Utrecht/NL), Maria Schmidt (London/UK), Ioannis Seimenis (Athens/GR), Maria Francesca Spadea (Catanzaro/IT), Daniela Thorwarth (Tübingen/DE), Vincenzo Valentini (Rome/IT)

Organisers:

Alberto Torresin (Chair of the School),
David Lurie and Brendan McClean (Scientific Co-Chairs)
Efi Koutsouveli and Christos Alexakos (ESMPE online platform)

Registration:

Attendance of the School will be free of charge to paid-up [Individual Associate Members of EFOMP](#)

The School is limited to 500 attendees

Registration for the School will open in mid-March

Further information:

Information and a registration link will be available on the [ESMPE web pages](#)

EFOMP Scientific Committee activities in 2020

The many activities of the Scientific Committee are summarised by Yolanda Prezado and Brendan McClean

The EFOMP Scientific Committee (SC) is an advisory committee to the EFOMP Council and had Yolanda Prezado as Chair for 2020. The main output of the SC is through Working Groups covering a range of specific topics of interest to medical physicists. These groups are established through a pathway beginning with ideas generated by EFOMP medical physicists, directly from members of the SC or through joint discussions with other organisations. Requests to establish working groups are discussed by the SC before making a recommendation to the EFOMP Council. Once established, the working groups are supported by EFOMP to complete their work in a defined timeframe and undertake to publish guidelines and other documentation relevant to the topic under investigation.

Work Groups in 2020 included the following:

AAPM/EFOMP Breast Dosimetry.

Chair Ioannis Sechopoulos.

This WG has completed a breast dosimetry model together with Monte Carlo simulations to establish a new model to estimate the average glandular dose to breast. Empirical validation using a breast dosimetry phantom is ongoing.

Digital Breast Tomosynthesis (DBT).

Chair: Ruben van Engen

The aim of this WG is develop a QC protocol for DBT systems which incorporate the breast dosimetry model from the AAPM/EFOMP WG described above. Drafts of texts outlining all methods of measurements have been circulated for comment to members of the WG.

Artificial Intelligence.

Chair: Federica Zanca

This WG undertook a survey on the role of AI in medical physics which has been accepted with minor revision by Physica Medica. The WG has an advanced draft of guidelines for training in AI ready for publication. The aim is to include AI in the curricula for MPE and professional programmes.

Angiographic and Fluoroscopic Systems QC protocol.

Chair: Annalisa Trianni

The aim for this WG is to develop a QC protocol, consistent with IEC, for angiographic and fluoroscopic equipment.

Revision of EFOMP PS14 - Safety of MRI.

Chair: Simone Busoni

This WG has been working on revising the policy statement to address the minimisation of accidents and incidents in an MRI environment. The revision has been discussed with NMO's and will be ready for publication soon.

PET/CT and PET/MRI QC Protocol.

Chair: Roberta Matheoud

This WG aims to define guidelines for QC in PET/CT and PET/MRI scanners along with providing reference values and tolerances. A European survey has been launched and analysed and a draft of the QC protocol defined.

Role of the MPE in Clinical Trials.

Chair: Nathalie Abbott.

This WG had a virtual meeting in October and the first discussions on the future work and outcomes of the WG are quite advanced.

FLASH Radiotherapy. Joint AAPM/EFOMP/ESTRO.

Chair: Dimitris Mihailidis

This WG has now been approved by the AAPM Therapy Physics Committee and the AAPM Science Council. Yolanda Prezado, Faustino Gomez and Alejandro Mazal represent EFOMP on this joint WG.

Guidelines for the evaluation of tumour auto-segmentation approaches in PET images.

Joint AAPM/EFOMP. Chair E. Spezi

The proposal for this WG is on the list for consideration by AAPM Therapy Physics Committee.

There is also a new special interest group on Nuclear Medicine Dosimetry under the chairmanship of Manuel Bardies. The SIG will facilitate networking, education, research and professional exchanges in radionuclide dosimetry.

The Scientific Committee works with NMO's and ESMPE in facilitating meetings and workshops and cooperate on a range of subjects with other organisations. The SC worked together with ESMPE to organise the ESMPE Particle Therapy course in December 2020. Examples of collaboration with other organisations in 2020 included: a joint effort with COCIR and ESTRO to draft a document outlining the information on risk required from radiotherapy equipment manufacturers as part of the transposition of the BSS Directive, and a joint approach to the development of a TEC-DOC with IAEA to utilise the detection of unusual patient responses as a measure of detecting radiotherapy errors.

Another good example of EFOMP supporting medical physicists is shown by an initiative from Yolanda as Chair in 2020 in establishing a mentoring in research programme. This initiative is designed to support early career medical physicists who have limited access to research resources. The mentoring group finalised the approach toward the end of 2020 and had a first virtual meeting with mentees in January 2021. Of course, COVID travel restrictions have slowed down progress in many areas as a result of being unable to meet face to face where many ideas and discussions often lead to creative leaps in progress. However, at least the use of video conference platforms has allowed work to continue in some form for many groups and we all look forward to being able to interact face to face again.

As always, the SC relies on the input from EFOMP members. If you have any ideas for future WGs, please contact sciencecommittee@efomp.org.



Dr. Yolanda Prezado is Past Chair of EFOMP's Scientific Committee. She is the founder and head of the interdisciplinary team "New Approaches in Radiotherapy (NARA)" based at the Laboratory Imaging and Modelling in Neurobiology and Cancerology (National Scientific Research Center - CNRS, Orsay, France). The main research avenue of the team NARA is the conception and development of innovative methods based on the use of the spatial fractionation of the dose. Yolanda Prezado is a board certified medical physicist (Spain). She has been developing her research in radiotherapy, first at Hospital Universitario de Salamanca (Spain), then at the Biomedical Beamline of the European Synchrotron Radiation facility (Grenoble, France) and at CNRS since 2011. Her research interests include dose calculations (Monte Carlo simulations), small field dosimetry and radiobiology. She has acted as coordinator of the radiotherapy cluster of the CNRS research network Mi2b ("Modélisation et instrumentation pour l'Imagerie Biomédicale") and elected as member of the counsel of the Medical Physics Group of the Spanish Society of Physics.



Dr. Brendan McClean is Chair of EFOMP's Scientific Committee. He is currently Director of Physics at St Luke's Radiation Oncology Network in Dublin, Ireland. Prior to this appointment in 1995 he worked at the Cross Cancer Institute in Edmonton, Canada as a radiotherapy medical physicist. He has an Adjunct Professor position and co-supervises PhD students at University College Dublin School of Physics. He teaches at graduate and undergraduate physics courses and for the Specialist Registrar Fellowship training programme. He is also active in ESTRO and was part of the ESTRO Physics Committee for many years. He has an ongoing interest in dose calculation in radiotherapy and has been part of the faculty of the ESTRO Dose Modelling and Verification course since 2008. He is the programme director for the CAM-PEP accredited Irish Radiotherapy Physics Residency programme. Since 2005 he has served as physics lead to the Irish National Cancer Control Programme.

Update on EFOMP's Mentoring in Research programme

Yolanda Prezado writes about the programme and how it can be of benefit to early-career medical physicists embarking on research

The new EFOMP programme "Mentoring in Research" aims at supporting early career Medical Physicists (MPs) who want to set up a research project. It is about mentors helping mentees who have little access to research resources. The programme aims to establish high-level exchanges to foster the personal development of the mentee.

Potential mentees are early career medical physicists (less than 7 years' experience in the field of medical physics after their undergraduate degree) in situations where it is hard or impossible to find an experienced MPE (or a medical doctor / radiobiologist) who is willing to advise on a research programme or innovation.

The first virtual meeting of the Mentoring in Research programme (<https://www.efomp.org/index.php?r=pages&id=mentoring-about>) was held online on the 19th of January. The meeting was devoted to initial

conversations about expectations, needs and the main challenges to be faced between mentors (<https://www.efomp.org/index.php?r=pgroup&id=efomp-mentors>) and selected mentees. Four mentees attended the meeting. They explained their situation and spoke to the mentors about their expectations. Some first-hand advice was given to the mentees to help them achieve their goals. After the meeting, additional individualised written advice was provided to the mentees.

Another meeting is planned during the forthcoming EC-MP2020, to be held in June 2021. We invite all young medical physicists interested in setting up a research project to attend the meeting. Please bring your ideas and we, as the EFOMP Mentors' Team, will try to help you to give them shape. If you are interested, please send an email describing your situation in brief to sciencecommittee@efomp.org.



Dr. Yolanda Prezado is Past Chair of EFOMP's Scientific Committee. She is the founder and head of the interdisciplinary team "New Approaches in Radiotherapy (NARA)" based at the Laboratory Imaging and Modelling in Neurobiology and Cancerology (National Scientific Research Center - CNRS, Orsay, France). The main research avenue of the team NARA is the conception and development of innovative methods based on the use of the spatial fractionation of the dose. Yolanda Prezado is a board certified medical physicist (Spain). She has been developing her research in radiotherapy, first at Hospital Universitario de Salamanca (Spain), then at the Biomedical Beamline of the European Synchrotron Radiation facility (Grenoble, France) and at CNRS since 2011. Her research interests include dose calculations (Monte Carlo simulations), small field dosimetry and radiobiology. She has acted as coordinator of the radiotherapy cluster of the CNRS research network Mi2b ("Modélisation et instrumentation pour l'Imagerie Biomédicale") and elected as member of the counsel of the Medical Physics Group of the Spanish Society of Physics.

The proton research beam line of the Holland Proton Therapy Centre of Delft – HollandPTC

HollandPTC (HPTC) is the proton therapy centre of Delft in The Netherlands, that has been established by TU Delft, Leiden University Medical Centre and Erasmus University Medical Centre Rotterdam. Starting to treat patients in 2018, this facility provides a unique opportunity to introduce technological innovations. The whole facility focuses, in fact, not only on patient treatment, but also on clinical and pre-clinical research to show the added value of using protons in cancer treatment. In order to accomplish this purpose, HPTC created a research programme where clinical trials can be carried out to contribute to the development of next generation particle therapy. Moreover, advanced technology studies are performed to improve the efficacy and efficiency of proton therapy and broadening the application of this treatment to other tumour types. To achieve this, a better and deeper knowledge of the radiobiological mechanisms caused by protons needs to be acquired. For this reason, HPTC is provided with a dedicated experimental room supported by three laboratories for biology, physics and chemistry activities and a short-stay animal housing room. Inside a well-constructed research programme, the scientists of the consortium can perform radiobiological and advanced technology experiments. For this purpose, the experimental room is equipped with different types of detectors to measure the beam characteristics even during irradiation. An innovative concept of removable and modular target station has been customized and built. Motorized target supports of different types, camera and laser system defining three room isocentres are available. The single pencil beam of the R&D bunker needs to be characterized in terms of particle fluence, beam spot size, beam positioning, energy and range. Moreover, a passive beam line has been designed for radiobiology research in order to have different field size and a spread-out Bragg peak. A specific work is conducted to measure high dose rate in order to perform FLASH experiment.

The Facility

HPTC is a Varian centre, where the ProBeam cyclotron serves four different rooms: two clinical gantries, one eye treatment room and one experimental room. The cyclotron produces therapeutic beams from 70 up to 240 MeV with intensity range going from 1 to 800 nA at beam extraction. One of the main purposes of the experimental beam line is to perform both physical and radiobiological experiments, including animal irradiations. In order to support this type of research, the beam needs to be fully characterized in terms of dose, shape, size and energy, and homogeneous fields of different sizes have to be produced.

In order to characterize the beam and perform experiments, the bunker is equipped with different types of diagnostic devices that suit different purposes, such as a beam monitor ionization chamber, multi strip ionization chamber for beam positioning, multi-layer ionization chamber for Depth Dose deposited (DDD) curves, scintillating screen for beam images and a Faraday cup for current measurements.

The proton beam line of HPTC is fixed and horizontal producing a single pencil beam and it is equipped with a dual ring scattering system, inspired by the design of Takada [1] [2], used to produce large, homogenous, modulated field. A similar solution was adopted by Tommasino et al. [3] at the Trento proton therapy R&D facility. The setup was built and customized by HPTC in collaboration with the DEMO department of TUDelft. The beam line is equipped with two dual ring setups: one to make fields up to 6cm diameter with higher fluence and a thicker one to make fields up to 24cm with lower fluence.

The proton beam exiting the vacuum window, passes through the first scattering foil of lead which produces the initial beam lateral spread. A beam monitor ionization chamber is placed upstream in order to monitor the number of protons delivered online during irradiation. The beam will then traverse the dual ring scattering composed by an outer ring of aluminum and an inner ring of lead. The latter will offer an increase of the lateral spread of the beam produced by the first foil with a homogeneous intensity. The inner ring, in fact, produces a Gaussian-like profile, while the outer ring produces an annulus-shaped profile. To achieve maximum beam uniformity in the field of different sizes, alignment between the beam and the dual ring is critical together with the right distance between the first foil and the dual ring. In order to find the best alignment, a customized system was built to support the dual ring in order to have alignment of 0.1mm in all directions. Remote controlled screwed have been used for this purpose, together with linear motorized stage for z-direction (beam direction) movement.

In order to spread the monoenergetic beam in the longitudinal direction, a 2D range modulator [4] is used. The modulator is a stationary device composed of an array of 2D pins. The thickness of the pins determines the pristine peak range, while their width relates to the weight. The output is then a Spread-Out-Bragg peak with a width of 2.5 cm.

The proton bunch coming out at the isocentre of the experimental room has been characterized in terms of shape, size, energy and current. As shown in Fig. 1, the beam is

characterized by a Gaussian profile which was studied at different beam energies.

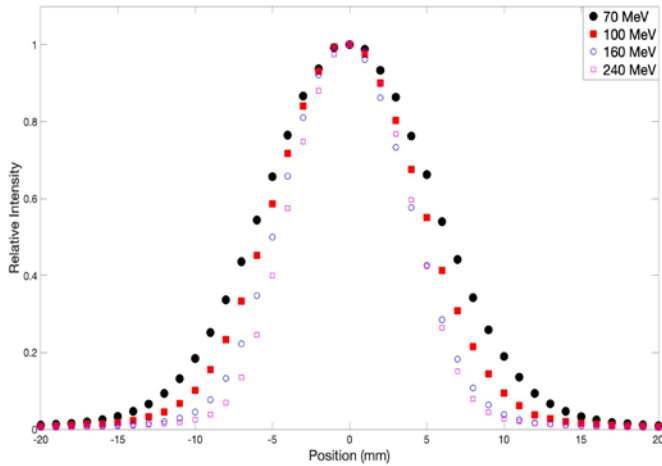


Figure 1: Normalized beam profiles measured at the isocenter in x-direction at 70, 100, 160 and 240 MeV. Measurements have been performed with the NextQ detector. On the x-axis the position of the detector strips is shown

The dual ring setup allows to go from a pencil beam shape (as shown in Fig.1) to a large field with a uniformity of 98%. Results for a 10x10cm field size with a 98% uniformity is shown in Fig. 2.

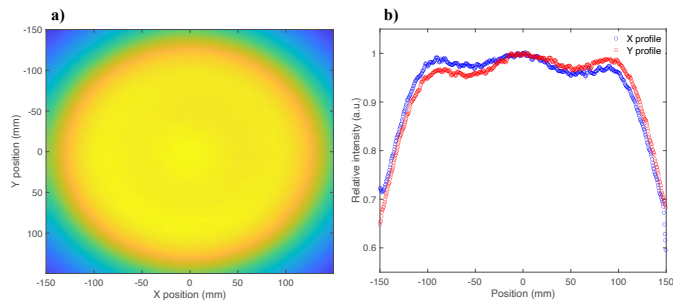


Figure 2: Measurements of large field produced with the big dual ring setup. The Lynx detector have been used for the measurements in a position of 200cm from beam exit window. Beam uniformity of 98% was reached with field sizes up to 10cm. a) shows the 2D image of the field and b) the X-Y profiles extracted from it.

The Spread-Out-Bragg peak produced with the 2D range modulator is shown in Fig. 3 with uniformity of 99% over a 2.5cm width.



Dr. Marta Rovituso is the beam line scientist of the R&D proton beam line of HollandPTC since January 2019. Her research mainly focuses on advanced beam line technology in order to equip the proton beam line to perform any kind of radiobiological experiments which go from cell to animal irradiations, physics, advanced technology, dosimetry and space applications.

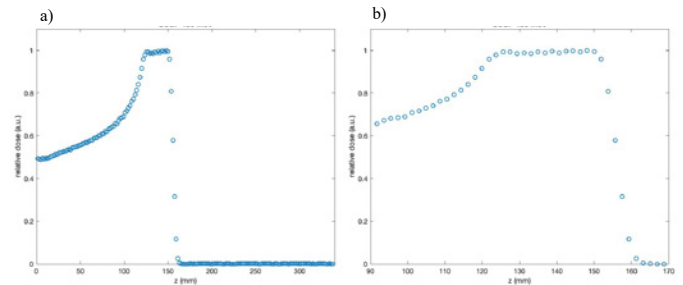


Figure 3: Experimental data of SOBP for a 150MeV proton beam taken with QubeNext detector. In a) the whole curve is shown while b) is a zoom in a smaller range of the same curve.

Because of the Varian ProBeam cyclotron, the beam current that can be reached at isocentre is high in respect to other facilities, allowing HPTC to have beam in FLASH mode. Currently, experimental work on FLASH dosimetry is under development in collaboration with DE.TEC.TOR in order to support FLASH radiobiological research.

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Varian: Institute Verbeeten Puts Patient Safety Front and Centre with IDENTIFY



The Institute Verbeeten team at Tilburg in The Netherlands

The IDENTIFY™ system from Varian helps ensure that patients get the treatment meant for them—from patient check-in through setup and treatment. The system integrates within the standard workflow of patient identification, CT acquisition, accessory and patient setup and treatment delivery, helping to minimize treatment variables and reducing opportunities for error.

Institute Verbeeten in Tilburg, the Netherlands, specializes in radiation therapy and nuclear medicine and runs three hospital facilities in different locations, with a total of eight linear accelerators. In 2015, staff started investigating surface scanning. Their first project involved delivering radiotherapy treatment without masks for palliative patients. Their ultimate goal is to use surface monitoring with all patients as a standard.

When Varian introduced IDENTIFY, Institute Verbeeten decided that its unique capabilities and the long-term partnership opportunities with Varian would be the best fit. It purchased ten IDENTIFY systems—eight for its Varian linear accelerators, and two for their CT rooms.

Institute Verbeeten clinicians are using IDENTIFY to offer maskless treatments for certain whole brain patients and for providing deep inspiration breath-hold (DIBH) treatments for breast cancer patients.

“Our first applications for the IDENTIFY system were whole brain treatments, and then breast cancer patients,” says Willy de Kruijff, head of the physics department at Institute Verbeeten. “We intend to use it for other types of tumours

as well, starting with lung cancer patients. The set-up camera situated directly above the patient is helpful to confirm breast and chest positions for treatment, as there are arm and mediastinum rotations that cannot be accounted for just through imaging.”

“The motion monitoring for head patients is very accurate. You can see the positioning clearly and with confidence that it’s correct,” explains Mariska de Smet, a medical physicist and the project lead for the IDENTIFY installations at Institute Verbeeten. “For breast cancer patients, having the visual confirmation of the deep inspiration breath hold gives the RTTs the confidence that positioning of the patient is accurate.”

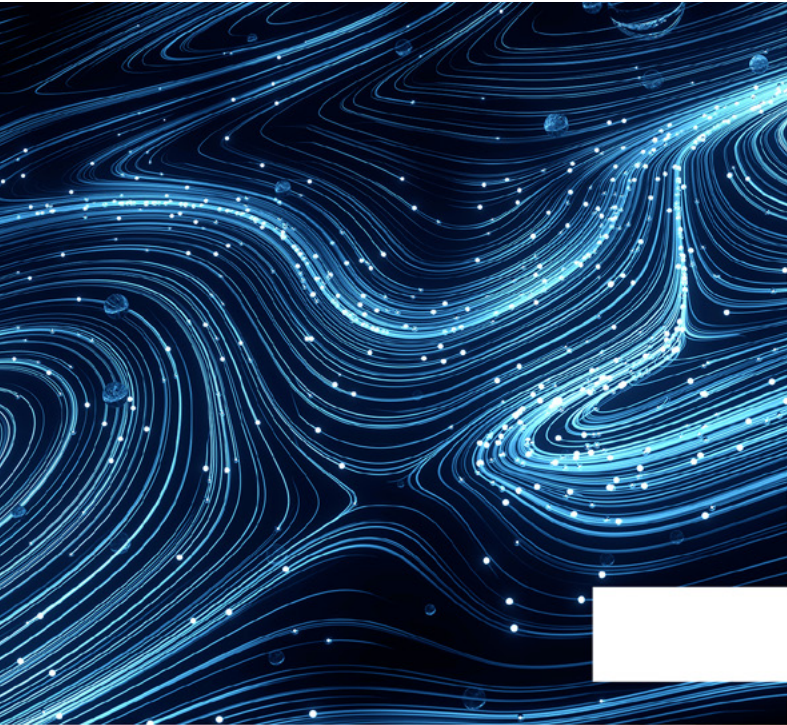
“After treating just five patients, I saw how much more confident the RTTs were with the system,” de Smet says. “Treatment times are decreasing and the RTTs particularly appreciate the quick refresh rate for an almost real-time image. I’m confident they’ll quickly become experts and be able to teach others how to use it.”

The Institute Verbeeten team is looking forward to the next systems being installed to enable a standardization of care for all patients. As early adopters of IDENTIFY, they are also keen to support future product development, which supports their mission of giving patients the best possible care and comfort.

“We are running a clinical trial to investigate how IDENTIFY helps improve positioning, without the use of tattoos,” de Smet says. “This will also help us optimize our workflows.”

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

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Medical Radiation Physicists participate in published research introducing change of Laplace's law

In medical practice, cardiothoracic surgeons apply this law to the Ascending Thoracic Aorta (ATA) indirectly, by monitoring the rate of increase of the aneurismal aorta's size and proceed to surgical intervention when the aortic diameter exceeds the limit of 5-5.5 cm. However, ascending aortic dissection cases have been encountered at smaller diameters. Nearly 60% of them refer to aortic diameters less than 5 cm, which are not considered of high priority for close clinical monitoring. This phenomenon is known as the ascending "Aorta Size Paradox" (ASP). Factors additional to hypertension and aortic lumen enlargement that increase the wall stress and pose a risk for dissection is ascending aorta elongation with age, emotional stress, sporting activity or aerobic and strenuous resistive exercise, such as isometric exercise. Aerobic exercise can produce arterial blood pressures up to 220 mmHg whereas in weightlifting, systolic pressure can reach or exceed 320 mmHg. Measurements of aortic length by computed tomography imaging show that the length of the ascending aorta as well as the angular span and its diameter increase with age. ATA diameters and lengths varying between 3.5 to 9 cm the first and 7.3 to 15.5 cm the second have been reported and an average midline length of healthy ascending aortas is 7.1 cm. It is known that in a

non-straight tube, curvature generates hydrodynamic stresses. Consequently, as ATA is curved, its aortic wall is continuously under hydrodynamic and static stresses. An accurate estimation of the intramural circumferential stress is crucial because it may reveal possible cases which previously were considered of lower risk and can serve, in combination with other medical indexes, in the decision making for an in time surgical intervention.

Recently, in the January issue of the journal *Physics of Fluids*, published by the American Institute of Physics, appeared a research paper by Karachaliou et al., that changes Laplace's law ("The missing role of hydrodynamic stresses on ascending aortic dissection", <https://doi.org/10.1063/5.0029346>).

More specifically, by incorporating Laplace's law into a newly-generalized and analytical mathematical expression, it is possible for the first time to accurately calculate the wall stress on a curved tube containing a moving fluid.

The generalization of Laplace's law arose because of fluid mechanics' attempt to interpret the ASP in the ATA. As already described, ASP is defined as the phenomenon in which, in clinical practice, there are multiple cases of rupture of the ATA aneurysm

with a diameter < 5.5 cm and which until now could not be interpreted by Laplace's law. This work, with the generalization of Laplace's law, interprets this medical paradox.

This interpretation is potentially of great clinical importance because, with appropriate treatment (in less than 5.5 cm aneurysms in the general population), the fatal complication of rupture of the ATA aneurysm can be prevented in the future.

The formulation of a new generalized expression, through a new mathematical theory, for the prediction of the rupture of an ATA aneurysm, was the result of a collaboration between Physicists of Fluid Mechanics (George Karahalios, Vassilios Loukopoulos & Marina Karachaliou), an experienced Radiologist in large vessels imaging and disease pathophysiology (Petros Zampakis), and Medical Radiation Physicists (Gerasimos Messaris form. HAMP president & Constantinos Koutsojannis EFOMP PC Chairperson)¹.

HAMP and EFOMP congratulate our colleagues for this achievement!

¹ Departments of Physics, Medical Physics, Health Physics & Computational Intelligence and Radiology, University of Patras, Greece



Dr. Constantinos Koutsojannis is Professor of Medical Physics at the Physiotherapy Department and also works on research and teaching at the Medical Department and the Computer Engineering and Informatics Department of University of Patras, Greece. He is also head of the Health-Physics and Computational Intelligence Lab, with rich activities on Health Professional Training projects on Informatics, Digital Skills, and new Medical Technologies. He has published more than 70 papers in international journals, edited volumes, international conferences, and workshop proceedings related with health professional safety approaches. He has participated as scientific coordinator or team member in several National and international or European research, educational or vocational training projects, including Erasmus+ KA2, RIS, Archimedes III, Pythagoras II, Erasmus Mundus Lot 2 and Grundvig II. He is currently consultant in the Artificial Intelligence Working Group and Chair of the Projects Committee of EFOMP.

Towards positronium imaging with total-body PET from plastic scintillators

Professors Pawel Moskal and Ewa Stępień from the Jagiellonian University in Cracow, Poland, describe their research aimed at developing new PET scanners

The Jagiellonian Positron Emission Tomography (J-PET) research group is developing cost-effective technology based on plastic scintillators for the construction of total-body PET scanners. The state-of-the-art PET systems are built from crystal scintillators arranged radially into rings surrounding a patient. The Total-Body J-PET (TB-J-PET) scanner will be constructed from modules composed of axially arranged cost-effective plastic scintillator strips read out by SiPM at the ends. The J-PET scanner may be constructed as a modular, light and portable device, enabling re-configuration of the tomographic volume, which may help to extend PET diagnosis in patients who cannot be examined by standard PET due to obesity or claustrophobia. Fig. 1 shows the prototype of the modular J-PET tomograph. Application of plastic scintillators and axial arrangement enables construction of economic PET with long axial field-of-view (AFOV), up to 2.5 m and more. This approach allows high sensitivity imaging of the whole human body, with high and uniform sensitivity over the whole patient from the brain to the feet.

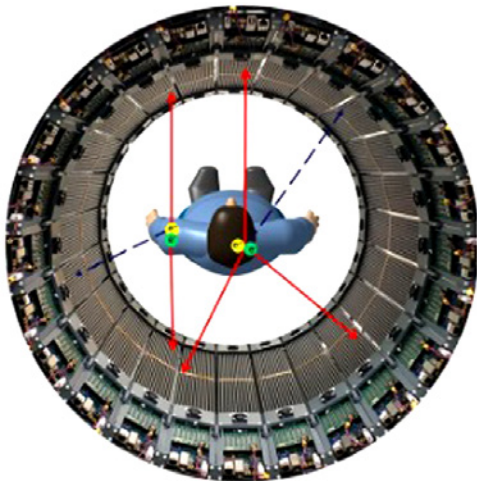


Fig. 1: Photograph of the single layer (with 50 cm axial field-of-view (AFOV)) modular J-PET prototype with superimposed representations of electron-positron annihilation in the patient's body for two and three photon events (red solid arrows) and the associated prompt gamma rays (blue dashed arrows) emitted by the $\beta+\gamma$ radionuclide such as e.g. ^{44}Sc . The single-layer J-PET prototype with AFOV = 50 cm weighs only about 60 kg. It consists of 24 modules each built from plastic scintillator strips (black) read out at both ends by SiPMs equipped with the dedicated front-end and digitizing electronics visible in the foreground (Moskal and Stępień, 2020).

Plastic scintillators are more than an order of magnitude less expensive than crystals. In addition, in the case of TB-J-PET, the cost of electronics is proportional to the trans-axial cross section of the detector while in the case of crystal-based TB-PET they are proportional to the area of the detection cylinder. Overall, the plastic TB-J-PET may be more than a factor of five less expensive than the crystal-based TB-PET, making it a realistic cost-effective solution for broad clinical applications. The prospects and clinical perspectives of total-body PET imaging using plastic scintillators has been recently discussed in a review (Moskal and Stępień, 2020). Here we only shortly summarize the main advantages that TB-J-PET may provide for diagnostics.

High sensitivity TB-J-PET will open opportunities for application in PET scans of events with the emission of three or more photons. Some examples of multi-photon events are shown pictorially in Fig. 1. The data acquisition system of the J-PET tomograph enables detection of double, triple and in general multi-coincidence events. In particular, it enables registration and identification of two ($e^+e^- \rightarrow 2\gamma$) and three photon ($e^+e^- \rightarrow 3\gamma$) annihilations, as well as prompt gamma emitted in the case of some isotopes referred to as $\beta+\gamma$ emitters, such as e.g. ^{44}Sc , ^{66}Ga or ^{82}Rb . In the current PET imaging procedures, prompt gammas constitute a source of unwanted background. However, these multi-photon coincidences may be useful for diagnosis. The capability of TB-J-PET to register and identify the signals from prompt gammas and from 2γ annihilations will allow for tagging the events originating from various isotopes. Therefore, in the case of the $\beta+\gamma$ emitters, TB-J-PET may be used for simultaneous multi-tracer imaging, and for the newly-developed positronium lifetime imaging, which is a promising approach for the in-vivo assessment of tissue pathology. Recently proposed positronium imaging can deliver information complementary to the currently used SUV based parameters. During PET imaging a positron emitted by the radionuclide annihilates with the electron in the patient's body, directly or via formation of the metastable positronium atom (an atom built from an electron and a positron). In the human body, positronium atoms are formed in up to about 40% of cases of positron-electron annihilations. In tissue, the ortho-positronium mean lifetime strongly depends on the size of intra-molecular voids (free volumes between atoms), while its formation probability depends on the void's concentration. Fig. 2 shows pictorial representation of the basic processes involved in positronium imaging, with the example of examination of the prostate cancer.

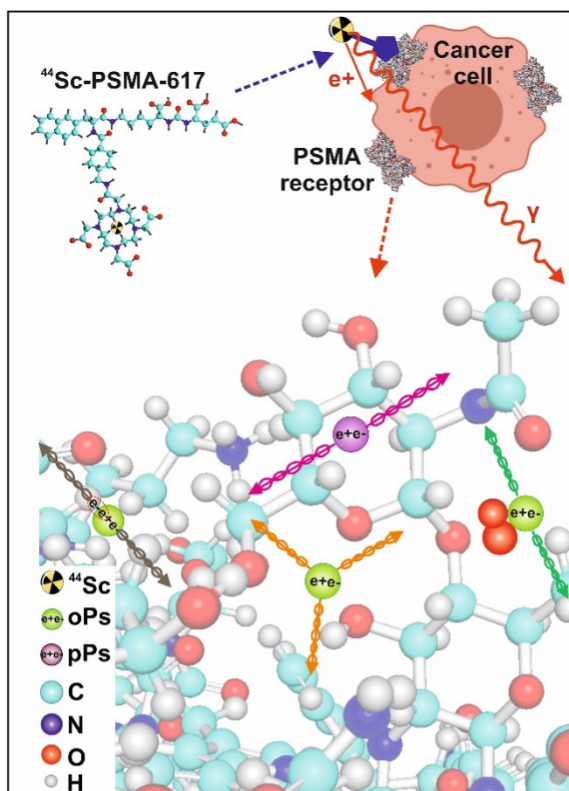


Fig. 2: Pictorial representation of the basic processes involved in the “positronium imaging” using the example of examination of the prostate cancer. The prostate-specific membrane antigen (PSMA-617 ligand) labeled with radionuclide ^{44}Sc attaches to the PSMA receptors highly expressed in prostate epithelial cells. ^{44}Sc isotope emits positron (e^+) and prompt gamma (γ) via following process: $^{44}\text{Sc} \rightarrow ^{44}\text{Ca}^* e^+ \nu \rightarrow ^{44}\text{Ca} \gamma e^+ \nu$. Positron interacting with electrons may form positronium atoms (indicated as oPs or pPs) inside cell molecules including intermolecular voids in PSMA receptors as indicated in the lower part of the sketch. Prompt gamma may be detected in the tomograph to give the signal about the time of positronium formation. Arrows indicate photons originating from the annihilation of para- and ortho-positronium inside free space between atoms (magenta and orange arrows), respectively. Black arrows indicate annihilation of ortho-positronium through the interaction with the electron from the surrounding molecule and green arrows illustrate photons from the conversion of ortho- into para-positronium via interaction with the oxygen molecule and subsequent decay of para-positronium to 2γ (Moskal and Stępień, 2020).



Prof. Pawel Moskal is an inventor of positron emission tomography based on plastic scintillators and method of in-vivo pathology based on positronium imaging. He is Professor of physics and the head of the Cluster of Nuclear Physics Departments as well as the head of the Department of Particle Physics and Applications at the Jagiellonian University and serves as a Member of the Committee on Medical Physics, Radiobiology and X-Ray Imaging, Polish Academy of Sciences.



Prof. Ewa Stępień is the head of the Medical Physics Department at the Jagiellonian University and serves as a president of the Experimental Cardiology section of Polish Society of Cardiology and a member of the Committee of Physiological and Pharmaceutical Sciences of Polish Academy of Sciences. She received the 2nd award from the Polish Ministry of Health and Social Security named “Evidence Based Medicine in practice”.

The main objectives of the J-PET group for the coming years are the construction of the TB-J-PET and elaboration of the combined (i) dynamic SUV imaging, (ii) kinetic parametric imaging, and (iii) positronium imaging which may serve as a biomarker enabling not only detection of the presence of diseased tissues, but also allowing to distinguish among the inflamed, infected, and cancerous tissues and permitting assessment of the grade of cancer malignancy.

The TB-J-PET project is led by Prof. Pawel Moskal (imaging technologies development) and Prof. Ewa Stępień (preclinical bio-medical studies) and is carried out by an interdisciplinary group from the Jagiellonian University, the University Hospital in Cracow, National Centre for Nuclear Research, Institute of Nuclear Chemistry and Technology, Heavy Ion Laboratory at the University of Warsaw, and the Medical University of Warsaw. It interfaces technologies from a variety of disciplines including biology, biophysics, computer science, electronics, engineering, physics, medical physics and medicine. J-PET is seeking new candidates for the research positions offering competitive salaries.

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Introduction

EURAMED is the European Alliance for Medical Radiation Protection Research, a non-profit organisation created as a consortium by five medical associations involved in the use of ionising radiation in medicine: the European Association of Nuclear Medicine (EANM), the European Federation of Radiographer Societies (EFRS), the European Society of Radiology (ESR) and the European Society for Radiotherapy and Oncology (ESTRO) and the European Federation of Organisations for Medical Physics (EFOMP). EURAMED's main objective is the promotion of radiation protection research with one voice, facilitating the development of joint research strategies between different specialists. One of the EURAMED's main publications is the [strategic research agenda](#) (SRA), where the main research priorities in radiological protection agreed between the five European Societies are collected.

How does EURAMED interact with other research platforms?

EURAMED has expanded its influence by joining the MEENAS group, signing a memorandum of understanding. The MEENAS umbrella group is a consortium formed by several ionising radiation research platforms, namely Multidisciplinary European Low Dose Initiative (MELODI), the European Radiation Dosimetry group (EURADOS), the European Radioecology Alliance (ALLIANCE), the Nuclear and Radiological Emergency Response and Recovery group (NERIS) and the European Network for Social Sciences and Humanities (SHARE). All of them have contributed for years in the design of the priorities in ionising radiation research, and now EURAMED gives its particular vision, focusing on the translation of the radiation protection investigation results to hospitals and patients.

Why is EFOMP in EURAMED?

EFOMP, as a founding member of EURAMED, has a voice to remark on the important contribution of the Medical Physics community to research in diagnostic imaging, radiotherapy, nuclear medicine and other medical specialities using ionising radiation. EFOMP is represented in EURAMED's Executive Board and also in different committees of the organisation.

The implementation of the Council Directive 2013/59/EURATOM has posed several challenges to professionals involved in the medical use of ionising radiation. To mention just a few examples, there are areas such as dose management in diagnostic radiology, dose calculation in nuclear medicine therapy, risk management in radiotherapy and the radiation protection training of the professionals involved. The Medical Physics community has much to say, has much to offer.

Klaus Bacher and Roberto Sánchez explain what EURAMED is: about and how it can benefit medical physicists

EURAMED in European research projects

EURAMED currently collaborates in three active projects: MEDIRAD, EURAMED rocc-n-roll and SINFONIA. MEDIRAD studies the "Implications of Medical Low Dose Radiation Exposure" and brings together 34 organisations from 14 countries and more than 70 scientists (<http://www.medirad-project.eu/>). The EURAMED rocc-n-roll project aims to propose a strategic research agenda in the field of medical radiation protection. It involves 29 projects from 17 countries (<https://roccnroll.euramed.eu/>). SINFONIA will develop novel methodologies to provide a comprehensive risk appraisal for detrimental effects of radiation exposure during the management of lymphoma and brain tumors patients. 14 partners from 8 countries work together in this project (<https://www.sinfonia-appraisal.eu>).

Recently, the European Council has reached an agreement on EURATOM research and training programmes, and EURAMED together with other platforms, has succeeded in securing an EU budget for medical radiation protection research for the period 2021-2025.

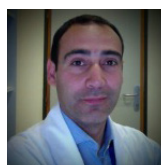
EURAMED is also involved in the organisation of the 5th European Radiation Protection Week, where more than 20 topics on radiation protection will be discussed, including radiological protection in the medical area. The focus week had to be postponed due to the COVID-19 pandemic. For more information, see <https://erpw2021-portugal.eu/index.php>

Institutions like Universities and Hospitals can become EURAMED members and participate in its activities and committees. To find out more about EURAMED go to <https://www.euramed.eu/>

Acknowledgements: The authors would like to thank Urlike Mayerhofer-Sebera and Klaus Bacher for their valuable suggestions.



Klaus Bacher, Professor of Medical Physics at Gent Universiteit, is the current EURAMED president.



Roberto Sánchez is a Medical Physicist at Hospital Clínico San Carlos, working mainly in diagnostic and interventional radiology. He is an Associated professor at Universidad Complutense (Madrid, Spain), teaching Medical Physics to Medicine Grade and to Master of

Biomedical Physics students. He is also a Member of the executive board in the Spanish Society of Radiological Protection and a member of the Interventional Radiology Working Group in Ask, the Eurosaf initiative from the European Society of Radiology. He is the EFOMP delegate in EURAMED.

EFOMP Projects Committee reorganization, activities, future

Constantinos Koutsojannis writes about the work of the EFOMP Committee which he chairs

EFOMP participates in projects to improve the status of Medical Physicists (MPs) in Europe and/or promote scientific research that could have a positive impact on healthcare as well as advance radiological protection. Consequently, the Projects Committee (PC) is one of the established committees that manages all the internal and external requests of EFOMP participation for projects, appoints committee members or other persons to take part in projects, monitors current projects in terms of progress and outcome and prepares comprehensive information about the projects for the EFOMP Board. Projects Committee specific tasks include following and participating in the work of EIBIR of which EFOMP is a shareholder, submitting project proposals under the European Framework programs, representing EFOMP at IAEA projects for which EFOMP is invited to participate, preparing and maintaining a list of institutions in NMO countries that conduct research relevant to the aims and objectives of EFOMP in order to distribute information to medical physics institutions on research calls and maintaining a list of medical physicists that work in research.

As a first task for the PC, it has been suggested that new project proposals should target funding opportunities concerning education and training matters, including placement to provide certified knowledge on MP specific skills. Two specific actions will be considered, namely setting up (i) a European training e-learning platform and (ii) a European internship programme for MP experts. The e-learning platform could be the core of a project prepared and submitted by EIBIR. During an initial meeting with EIBIR new information was provided on all new programmes with a second meeting to be held on March 25th (Joint Meeting of Scientific Advisory Board and Industry Panel). In addition, the PC chair participated in EURATOM's 1st workshop, and in a consequent EU survey for the next year's funding strategy. As already established, participating in projects may include either no financial support (any necessary resources are funded by

EFOMP), financial support for travel expenses in connection to meetings only, or financial support for work performed within a project. Consequently, these terms determine what kind of agreement needs to be signed after proper consideration of the Treasurer and the President of EFOMP before agreeing to the terms and conditions of a project.

A second suggested task for the PC concerns the development of cooperation with educational organizations, universities etc., promoting EFOMP as partner on the educational activities of universities or organizations by giving lectures at MSc programmes, defining generic methods on how to train MPs and promoting high level clinical practice. Within this context one paradigm would be the use of the e-learning platform by these organizations in the same way as the Italian Association of MPs is using modules of the material for the training of MPs.

Finally, the PC is very proud to inform you that the committee's secretary Dimitris Visvikis received two important awards last year. In June he received the prestigious Edward J. Hoffman Award of the Society of Nuclear Medicine and Molecular Imaging, "for contributions to advances in PET imaging and to education and dissemination of findings within the scientific community". He was also the recipient of the 2020 IEEE Nuclear and Plasma Sciences Society Medical Imaging Technical Achievement Award, "for contributions to PET/CT imaging methodological developments dedicated to respiratory motion correction, image reconstruction, detector modelling and automated image analysis and processing for predictive modelling in oncology". We are proud to count him as part of the EFOMP Projects Committee and congratulate Dimitris for his achievements!

Finally, we would like to encourage all of you interested in helping the EFOMP projects committee to realize its short-term objectives; please consider nominating yourself – we need your expertise!



Dr. Constantinos Koutsojannis is Professor of Medical Physics at Physiotherapy Department and also works on research and teaching at Medical Department and the Computer Engineering and Informatics Department of University of Patras, Greece. He has also long experience in teaching undergraduate and postgraduate courses. He is also, head of Health-Physics and Computational Intelligence Lab, with rich activities on Health Professional Training projects on Informatics, Digital Skills, and new Medical Technologies. He has published more than 70 papers in international journals, edited volumes, international conferences, and workshop proceedings part of related with health professional safety approaches. His published work has collected more than 1000 citations. Additionally an adequate number of them are related to He has also participated as scientific coordinator or team member in several National and international or European research, educational or vocational training projects as Erasmus+ KA2, RIS, Archimedes III, Pythagoras II, Erasmus Mundus Lot 2 and Grundvig II. He is currently consultant in the Artificial Intelligence Working Group and Chair of the Projects Committee of EFOMP.

Accuray: The “Hype” of Hypofractionation

The effects of the global pandemic have been catastrophic on the growing global cancer burden. Some countries across Europe reported an approximate 25% reduction in the numbers of patients receiving Radiation Therapy during the first wave of the pandemic, leading us to question for how long we will continue to see the knock-on effects of COVID-19 [1].

As the Radiotherapy community begin to look at alternative approaches to keep patients safe, despite the drop in overall radiotherapy referrals, we see a significant rise in the need for hypofractionation. But this is far from a new concept, in fact it was well-documented in the 1970s for use in palliation of gynaecologic malignancies in whole pelvic treatment with 10 Gy in a single fraction in a study by Boulware et al. from M.D. Anderson Cancer Center [2].

The clinical requirements for modern hypofractionation may have changed, but with dose escalation and margin reduction, the clinical and technical requirements of the modern radiotherapy system become even more critical. The Accuray CyberKnife® System has been delivering hypofractionated radiotherapy since the late 1990s and with over 20 years of clinical evidence, this pioneer of hypofractionation continues to evolve with its latest evolution, the CyberKnife® S7™. See <https://www.accuray.com/deliveringmore/20-years-of-evidence/>

The CyberKnife S7 System has been developed with a focus on speed, precision and motion synchronization. The capability to plan and treat patients quickly, without compromising treatment quality becomes more important as departments get busier and maintaining a high patient throughput is essential. The CyberKnife treatment planning optimizer, VOLO™ delivers a 95% reduction in optimization time and up to 50% faster treatment delivery, bringing optimization times down to a few minutes for even the most complex cases and users reporting procedure times of less than 20 min per day for a five fraction prostate SBRT compared to previous versions of the CyberKnife System. See the web page: [Planning with the CyberKnife® VOLO™ Optimizer: Hear from the experts](#)

With dose escalation it becomes even more essential not only to be able to create a complex plan, but to be able to accurately deliver it. The CyberKnife 7 robotic architecture uses its 6-degree freedom of movement and truly three-dimensional workspace to allow non-isocentric, non-coplanar beam delivery. With a range of different collimation options from a 5 mm diameter fixed collimator allowing submillimeter precision for frameless stereotactic radiosurgical treatments of even the smallest neurosurgical indications [3] to the InCise™ Multileaf Collimator, expanding capabilities to larger stereotactic body radiotherapy and IMRT style treatments, the CyberKnife S7 architecture is primed for safe, accurate, hypofractionated delivery of even the most complex cases. See the web page: [Tips and Tricks to Treat Central Lung Tumors with the CyberKnife® System](#)



When it comes to dealing with target motion, the CyberKnife System enables a completely different approach that shifts the paradigm. Real-time adaptive treatment delivery. Automated, real-time tracking, detection and beam correction, synchronizes beam delivery with target motion in real time, enabling more accurate, more efficient, more comfortable, personalized radiotherapy treatments. Clinicians can be confident in the ability to safely and accurately deliver complex SRS/SBRT, fully adapted to real time intrafraction motion without the need of cumbersome immobilization techniques, difficult breath holds or lengthy beam gating.

The fight against cancer has never been easy but we've come a long way in terms of treatments and outcomes, but the burden is growing. The global cancer incidence is higher than ever and it's on the rise, with an increasingly significant economic impact. So when it comes to the complex challenges faced by our radiation oncology teams, lets leverage the power of the CyberKnife S7 System, the pioneer in hypofractionation, to work alongside our clinicians to help deliver better cancer treatments, to more patients, faster than ever.

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Kirsti Gordon BSc (Hons), MSc
Marketing Director, EIMEA – Accuray, Inc.

Results of the 6th EFOMP Photo Contest

For the sixth EFOMP Photo Competition, we received an excellent selection of entries on the theme of “The Sky at Night”. The submitted photographs were evaluated by members of the Communications and Publications Committee. **We are very happy to announce that the results were:**

First place

Orion Nebula by James Ross

(United Kingdom) ↓



James Ross is a lecturer in cardiac magnetic resonance physics at the University of Aberdeen in Scotland. His main research focuses are probing cardiac energetics using ³¹P spectroscopy and the development of new hardware and applications for Fast Field-Cycling MRI. James told us about his photograph: “This is a photo of one of the brightest emission nebulae in the night sky: The Orion Nebula, located just below the well-known Orion’s Belt constellation. This nebula is a huge stellar nursery located some 1500 light-years from Earth, where vast clouds of dust and gas are forming new stars. In total I took 40x100s exposures using a hydrogen bandpass filter and 21x100s exposures using an oxygen filter before the clouds rolled in. These 61 images were then registered and combined in offline postprocessing (Pixinsight). The equipment used was an 8-inch Newtonian reflector telescope (focal length 790 mm, f-ratio 3.9), attached to a dedicated astronomy camera (ZWO ASI1600), all mounted on an equatorial mount (Skywatcher EQ6-r).”



Second Place

The Moon
by Georgina Fröhlich
(Hungary).

←

Georgina Fröhlich is a senior medical physicist at the National Institute of Oncology in Budapest, Hungary, with 10+ years broad clinical research experience in radiation oncology, especially dose optimisation algorithms and biological dose integration of external beam- and brachytherapy. She has extended expertise in research methodology and biomedical statistics. Speaker at several radiotherapy conferences, founder of a 'Medical Biophysics' M.Sc. module at the Eötvös Loránd University in Budapest, lecturer at the Semmelweis (medical) University in Budapest, supervisor of B.Sc., M.Sc. and Ph.D. students, member of international working groups, author of 40+ scientific articles, recipient of several scientific scholarships and awards. She is a mother-of-three, a triathlete and an ultra-long distance runner.



Third place

"Bonsai Sky"
by Chiara Valero
(Italy).

→



Chiara Valero is a 27 year-old medical physicist from Turin (Italy). She has just obtained the title of Medical Physicist Expert cum laude, after the three year post-graduate School of Medical Physics at Turin University, with a thesis on the development and implementation of new dose management strategies in compliance to the Italian regulation D.Lgs. 101/2020 (transposition of Council Directive 2013/59/Euratom), conducted at the A.O. Ordine Mauriziano Hospital of Turin. She is passionate about flowers and plants of all types. Writing about her photograph, she says: "The Ficus Retusa bonsai tree in the photo was my "lockdown companion" and it's a gift from a very special person!"

EFOMP Calendar 2021 now available!

A selection of entries from the first five EFOMP Photo Contests has been made into a beautiful calendar, [which is available for free download.](#)

7th EFOMP Photo Contest

Would you like to display your talents as a photographer? Then you should enter the 7th EFOMP Photo Contest by submitting a photograph, on the theme "Historical buildings from an unusual perspective". Entries close on 30th April 2021. [Details on how to enter can be found here.](#)

Singing – my favourite activity!

In his spare time, Paul Bezzina is a busy musician

After a hard day at work, there's nothing else that helps me unwind more, than playing my piano or guitar and to compose or listen to some music. I listen to all genres of music, be it pop, rock, indie, reggae or classical, depending on my mood.

I am the middle child of seven siblings, all of whom sing or play at least one instrument. My parents are also very musically oriented and they have instilled in me the passion for music from a very young age.

Music has been a big part of my life ever since I can remember. At age 7 I had my first audition and joined the Malta Children's Choir. Being part of the choir was very important in terms of developing my musicality and discipline. This also introduced me to singing in front of an audience.

I started learning piano at age 12. That was however short-lived as I slowly started to gain more interest in learning guitar. I was mostly influenced by my father, who is a classical guitarist. After a few years of learning from my father I also started to play guitar in bands, in front of audiences, at weddings and events, or for weekly entertainment in restaurants.

Together with my siblings, I often sing at concerts and events throughout the year. Currently, I am also a singer in two bands, *The Tailors* and *The Beatroots*. I am usually very busy with both bands with weddings throughout the year. Unfortunately, weddings and most other music events have been scarce during the past year due to the pandemic, but am hopeful that things will get back to normal soon enough. I am also a member of the band *Auntie's Yellow Sofa* with whom I play piano and synths, and are currently in the process of working on recording our debut album.

As much as I enjoy playing music or singing in front of an audience, I enjoy working on my own material and writing songs during my free time. I was also asked to organise song writing workshops for children at the Young People's Unit at Mount Carmel hospital in Malta. After a year of songwriting sessions, the children managed to write their own original song, which we recorded together with my brother Gianluca on vocals, who most people recognise from his participation in the Eurovision Song Contest.

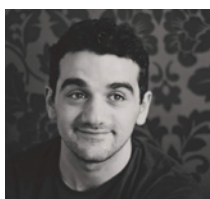


During my medical physics traineeship in Leeds, UK, I had also participated in the Malta Song Festival – once as a guest singer and once as a competitor, together with my siblings.

I am currently in the process of preparing to record the first album with songs that I have written throughout the last few years. This is something I have been looking forward to accomplish and will hopefully be finalised by the end of this year.



As all of my fellow musicians, I am hoping to be able to get back on stage and share my music as soon as possible. In the meantime I am making the most of this time to practice and work on my music!



Paul Bezzina is Medical Physics Expert in Radiation Oncology, employed as a Medical Physicist at the Sir Anthony Mamo Oncology Centre, Malta. He graduated with an MSc in Medical Physics from the University of Malta (UoM), and completed his traineeship at Leeds Cancer Centre, UK. Before entering the Medical Physics field, Paul also graduated as an Electrical Engineer from the UoM.

Wooden Photo Albums

Creating unique handmade photo albums is Mirjana Papic's hobby

Did you ever persistently try to find the perfect item that fits your needs but it simply wasn't available on the market? It recently happened to me with a photo album. I wanted it to be unique, personalised, able to fit a lot of photos but be affordable. I looked for a long time, but nothing checked all the boxes and matched what I had imagined.

I had two options - to wait for such an album to appear on the market or try to make one myself. The latter seemed not only fun but also gave me the option to express my creativity and get the perfect product. I slowly started thinking about what I would need and how I would put it together into a unique, beautiful and functional photo album. I started experimenting with different materials and methods. The process itself was very interesting and I was very optimistic that it would turn out perfect. However, the first prototype was a big disappointment to me. It was heavily flawed and I thought I would not be able to make a photo album.

I didn't give up! The next day I came up with a new idea on how to fix the shortcomings. My second prototype was not ideal either, but I felt pleased that I managed to solve at least one of the problems. It gave me faith that I could fix other things.

Through persistent testing and analysis, I came up with the perfect combination of materials, the size of each of the parts, their processing and finally their way of joining together. I was very happy with the final product!

I chose wood as the cover of the album because it is sturdy. I could put a large number of photos between the two pieces of wood and I could use a pyrograph to further personalise it and make each cover unique. I use the pyrograph to write and draw on wood as easily as on paper, so the possibilities for the album cover variations are endless.

The inside of the album is made of thick, durable paper which can be found in all colours imaginable and also contributes to the uniqueness of the album. The wood pieces are held together by textile so the choice of colours and patterns are countless.

The first photo album I made for myself now keeps the memories from my travels. After seeing it, my friends asked me to make them their own, for a smaller number of photos for occasions such as weddings and children's birthdays. I was more than happy to tackle the challenge of personalising each album and transform what was



imagined into a perfect photo album by choosing the perfect combination of wood, paper and textile colours.



I was a physics teacher in elementary school for a few years but recently transferred to the position of a Medical Physicist in Radiotherapy. There is so much in front of me that I need to learn and I am very excited about it. This is the biggest challenge of my life so far so when I need a break from studying, I take all the necessary materials and tools for my wooden photo albums and let my brain relax and design new albums.

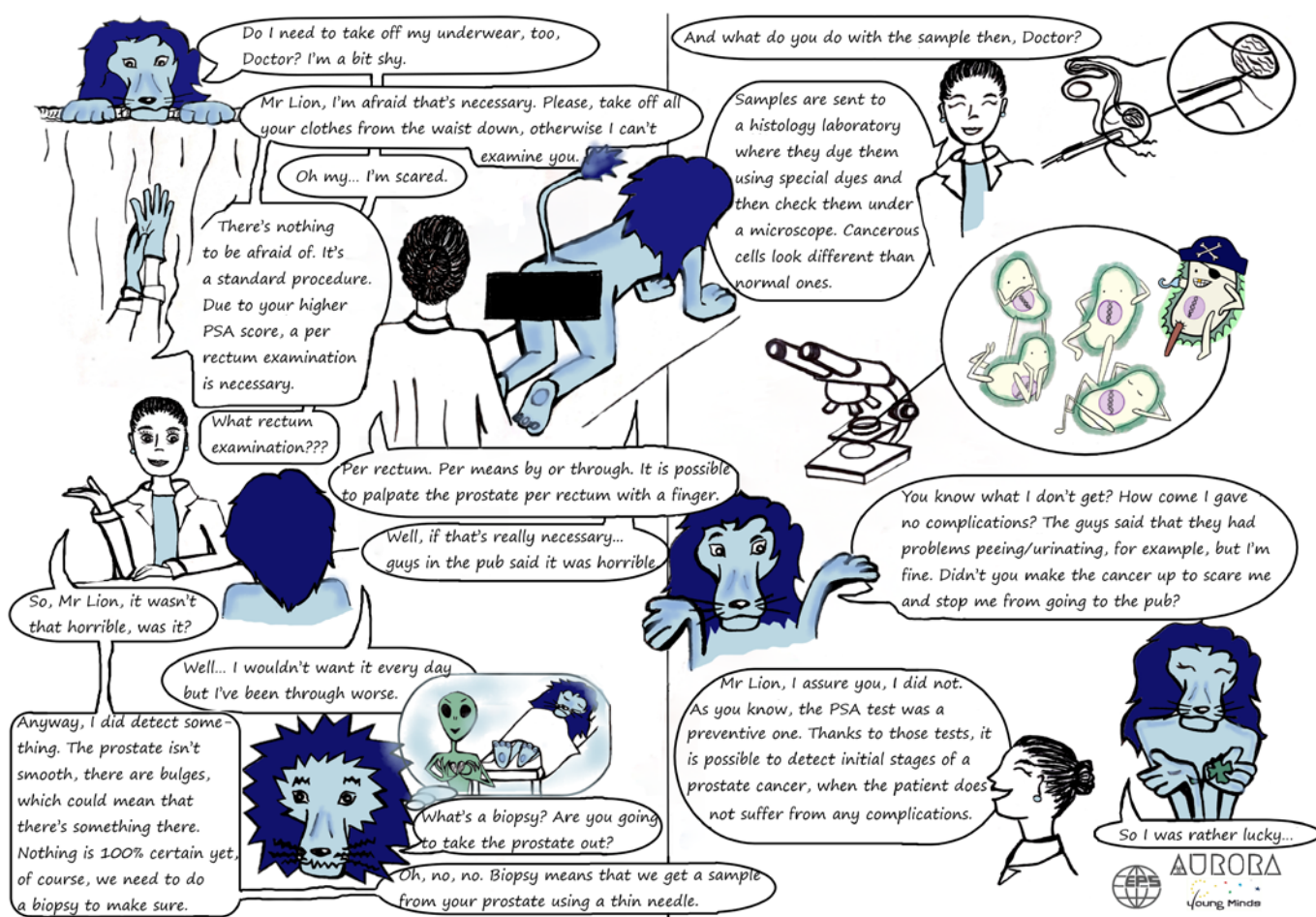


Mirjana Papic is a Medical Physicist at the Department of Medical Physics at the Oncology Institute of Vojvodina, Serbia. She is a member of the Serbian Association of Medical Physicists.

The Aurora project – informing about medical technology through comic strips

Note from the Editor: This is the fourth comic strip from the Czech Republic's Aurora team, aimed at educating the public about the benefits of technology in medicine, in a highly-original way.

In this episode, Lev the lion undergoes more prostate cancer tests...



Aurora is a project of the Prague section of the European Physical Society (EPS) Young Minds initiative. The main aim of Aurora is to spread knowledge about ionizing radiation in general, ionizing radiation in medicine and cancer. And how do we intend to spread this knowledge? For example, by creating topical comics! Our team is still expanding. Now, we have two main painters, Marketa Hurychova and Anezka Kabatova. Then, there are four people who create stories for the comics, consult with the painters and translate texts, Barbora Drskova, Petra Osmanickova, Jana Crkovska

and Anna Michaelidesova. Anna Michaelidesova is also the coordinator and the person in charge of the whole project.

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

The Aurora team are:



Marketa Hurychova

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



Anezka Kabatova

has been studying Experimental Nuclear and Particle Physics at the Czech Technical University in Prague since 2015. After receiving her MSc degree, she plans to start a PhD in Astronomy. She has been an active member of the Prague section of EPS Young Minds since 2017, acting as a vice-president of the section between 2018 and 2019.



Barbora Drskova

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



Petra Osmancikova graduated from the Czech Technical University in Prague and holds MSc and a PhD degrees in Medical Physics. She is a clinical medical physicist in radiotherapy in Motol University Hospital in Prague.



Jana Crkovska

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



Anna Michaelidesova received her MSc and PhD degrees in Medical Physics from the Faculty of Nuclear Physics and Physical Engineering of the Czech Technical University in Prague. She worked as a researcher at the Nuclear Physics Institute of the Czech Academy of Sciences from 2010 to mid 2019. In the period 2012-2017, she was employed as a medical physicist at the Czech Proton Therapy Center. From 2018 to mid 2019, she also worked as a researcher at the Faculty of Nuclear Physics and Physical Engineering of the Czech Technical University in Prague. Since June 2019, she has been a postdoctoral researcher at the department of Translational Radiooncology and Clinical Radiotherapy of the OncoRay® - National Center for Radiation Research in Oncology at the Medizinische Fakultät Dresden Carl Gustav Carus in Germany. She has been a member of the leadership committees of the Prague section of EPS Young Minds and of the IRPA YGN since 2019.

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 at www.efomp.org/index.php?r=events

Jan 15th, 2021 - Mar 31st, 2021

The promises and Dark Sides of Artificial Intelligence in
NMR, MRI and Neuroscience
Virtual

Feb 22nd, 2021 - Mar 5th, 2021

Joint ICTP-IAEA Workshop on Risk Assessment in
Advanced Radiotherapy Techniques
Online

Mar 3rd, 2021 - May 16th, 2021

ICTP Applications

Mar 3rd, 2021 - Mar 7th, 2021

ECR2021
Online and on-demand

Mar 10th, 2021

The 3rd EURADOS WEBINAR - Accreditation of Individual
Monitoring Services – EURADOS Report 2020-02
Online

Mar 23rd, 2021 - Mar 26th, 2021

ETRAP 2021 Conference
Online

Apr 5th, 2021 - Apr 7th, 2021

2021 MEFOMP Medical Physics Conference
Online

Apr 11th, 2021 - Apr 13th, 2021

NACP 2020/21 Symposium - Digital Edition
Online

Apr 19th, 2021 - Apr 21st, 2021

Virtual 8th MR in RT Symposium
Online

Apr 26th, 2021 - Apr 30th, 2021

BHPA symposium 2021
Online

Apr 29th, 2021

IPEM: MR-SIG: Quality Assurance in MRI one day meeting
Online

May 5th, 2021 - May 6th, 2021

EFOMP School for Medical Physics Experts
(MRI in radiation therapy planning)
Online

May 18th, 2021 - May 19th, 2021

BNMS Virtual Spring Meeting 2021
Online

Jun 16th, 2021 - Jun 19th, 2021

EFOMP - 3rd European Congress of Medical Physics
Online

Sep 19th, 2021 - Sep 22nd, 2021

ÖGMP, DGMP and SGSMP- three Medical Physics
Societies conference
Vienna, Austria

Feb 3rd, 2022 - Feb 5th, 2022

Image Guided and Adaptive Radiotherapy in Clinical
Practice Course 2022
The Royal Marsden NHS Foundation Trust, London, UK

EFOMP Structure

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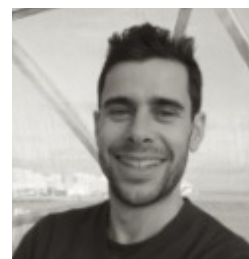
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EFOMP

EUROPEAN FEDERATION
OF ORGANIZATIONS
FOR MEDICAL PHYSICS

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

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