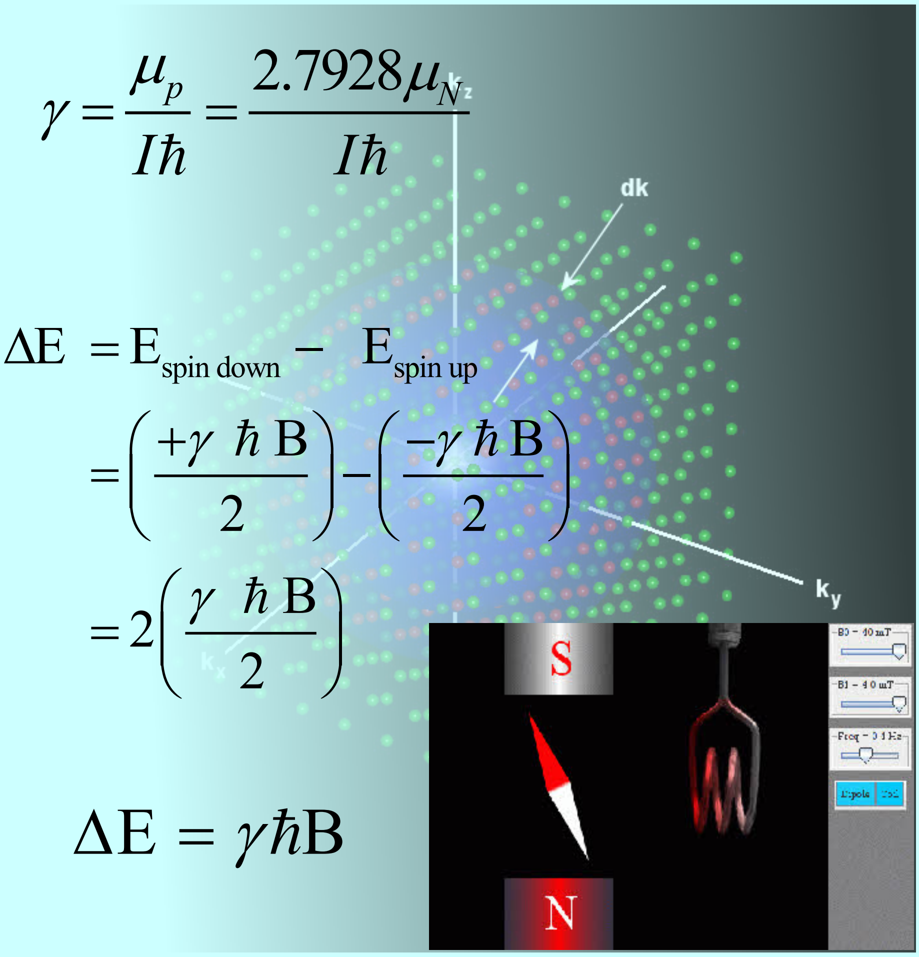
European Medical Physics News

EFOMP

Summer 2012

Contents:



Modern Concepts in Teaching Magnetic Resonance Physics; page 17 in this issue

EUROPEAN MEDICAL PHYSICS AND ENGINEERING CONFERENCE
SOFIA 18-20 October 2012

Editorial

Dear readers,

Summer in full swing, blazing sun even up in the northerly parts of Europe with everybody heading off for vacations but the editorial team keeps up the Olympic spirit slaving in front of their computers to get the latest edition of the news out for you ....

Apropos Olympics: Have you ever had the feeling that the understanding of MRI needs a long breath? And there you haven't even been thinking about explaining it to others! Today, MRI is ubiquitous and Medical Physicists are more and more involved in teaching MRI physics to various staff members, not only their peers. Here visualization helps a lot, more than the famous handwaving and not so famous mathematical scaffold. One of the tools for teaching magnetic resonance concepts is being introduced on page 17 of this issue. Have a look and try it out, maybe you will find a completely new perspective here and there.

Another training tool introduced (further) in this issue is VERT, a virtual physics training for radiotherapy (cf. page 22) .Since its first launch and its first introduction here in the news it has evolved quite a bit. Have a look.

Have you ever had questions about the organization of your department? The Karolinska group had a lot of questions and as a consequence they reorganized their department from scratch. Read on page 9 how it came along and what the status is now. Maybe you get some ideas on your way home ...

EFOMP again contributed to the physics program at ECR. Read about this and other aspects of EFOMP's involvement at ECR on page 21.

Two EFOMP Presidents are talking to you in this issue, the current one Peter Sharp and the past one Stelios Christofides. Both have their views and comments, not only about the way they came to this job but also about the insides of EFOMP. Have a look at pages 4 and 6.

And just before you go back to your lazy chair and cool summer drinks let's stir your brain a bit with a Medical Physics quiz on page 14. One of the editorial team members, together with two colleagues, came up with it for the last year's joint congress of the Austrian, Swiss and German National Societies in Vienna. The promised amazon vouchers are gone by the way, just in case that would be the only incentive for you ;-).

Have a beautiful summer or what is left of it, from our side all the best for whatever awaits you in the second half of this year.

Your editorial team

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Message from the New President of EFOMP By Peter Sharp

Having just taken up office as the President of EFOMP, the editor suggested that it might be helpful if I introduced myself.

I am the Professor of Medical Physics at the University of Aberdeen and also the Clinical Director of Medical Physics for NHS Grampian. Although my official employer is the university, my salary is paid jointly by the university and the hospital so both expect me to do a full-time job for them! Actually the arrangement is very useful for me too as working with medical staff in my NHS role gives me opportunities for spotting research projects that I can then carry out in my university role.

How did I get into Medical Physics? When I was in my final year of my BSc degree I was approached by Professor John Mallard, who had taken up the post of Professor of Medical Physics at Aberdeen a few years earlier, to be his PhD student. He had a project looking at measuring the quality of nuclear medicine images. At the end of that I was fortunate to get a full-time post at Aberdeen and there I have stayed for the whole of my working life.

So why have I spent all my time in one department? Well the simple answer is that there was (and still is) a lot of interesting scientific work going on in Aberdeen and I wanted to be part of it. In the early 1970s we built two SPECT scanners, the first in the UK and predating the X-ray CT scanner. We later mounted a gamma camera on the stand from an old cobalt machine to produce an early SPECT camera. In the early 1980s we developed the first clinical whole-body MR imager, although unfortunately I wasn't part of that team. In the mid-1980s we set up a cyclotron and PET centre in Aberdeen, the first in the UK apart from the MRC PET Centre at Hammersmith Hospital. This involved dismantling a cyclotron that had been used in a radiotherapy project in Edinburgh, shipping it up to Aberdeen (with the help of the army) and then reassembling it. We were also given a second-hand PET scanner that had previously been at the Hammersmith PET centre. We didn't even have anywhere to put the equipment so we had to raise money to buy an old farm building which we then converted it into a PET centre with a radiochemistry facility. It was fun, although it didn't always seem like that at the time.

Apart from a very brief period when it was thought I might work in radiotherapy, I have spent most of my career in nuclear medicine. That provided a series of challenges both scientific and managerial. I remember being the first human volunteer for the brain blood flow imaging agent CERETEC. The fact that the uptake in my brain was the lowest of all the volunteers that we imaged has been something that I have never lived down!

When Professor John Mallard retired in 1992 I was given his chair and became head of both the university and NHS departments. While I still retained an interest in nuclear medicine it was no longer possible for me to run the section so I had to give up that job. One of the things I am most proud of is persuading the hospital to pay for a new building for the PET Centre, this time on the hospital site, raising money for a new cyclotron and radiochemistry facility and purchasing a new PET imager. A few years later the Scottish government wanted to know if PET was likely to be of value in the management of cancer. I was asked to chair an advisory group and we worked with a team of statisticians, health economists, and experts in health technology assessment to come up with advice. This required us to build a model showing how PET would be used in the clinical setting, populate it with measures of the sensitivity and specificity of PET for various cancers, work out the likely costs of a PET service and then demonstrate that it would be cost effective. The main problem was that there was very little good research to show how effective PET was at detecting different cancers. Despite this we managed to persuade the Scottish Government that they should invest in PET scanners, which by this time were PET/CT scanners, and equip the 5 cancer centres in Scotland. I was honoured to receive the Norman Veal Medal of the British Nuclear Medicine Society in 1999 in recognition of my contribution to nuclear medicine.

In the university we have a strong research group interested in the biology of diabetic eye disease. This disease is the most common cause of blindness in the working age population. Initially they approached us to see it we could develop a scanning laser ophthalmoscope. This was a device that scanned a laser beam over the retina of the eye and built up a picture from the reflected light. There is an image of it on the EFOMP website. We went further and built a machine that used three lasers at different wavelengths, to give a full colour, rather than monochromatic image. We also went on to modify it so that it would image individual blood cells as they flowed through the retinal vasculature in rats and genetically modified mice. This allowed us to measure the speed and number of cells. The reason for doing this was that in certain vascular diseases it was believed that the blood cells would stick to the walls of the vessels. We were able to give them the tools to investigate this effect.

We were then approached by a group of ophthalmologists who were running a diabetic retinal screening service in Scotland. Every person in Scotland with diabetes has images of their eyes taken each year to look for early signs of eye disease. Retinal screeners were being trained to examine the tens of thousands of images and clearly that was extremely time consuming, expensive and not very reliable. Our task was to develop software that would analyse the retinal images for the pathology that was indicative of early eye disease. If none was found then the person was simply told to return the next year for another picture. If there were some abnormal features then the images were passed on to a human screener for further analysis. Not only did we develop the software but to get it accepted into clinical practice we had to run trials involving thousands of patients to show that it was reliable and cheaper than employing human screeners. A licence on the software was taken up by a company and the system is now in routine use in the Scottish Screening Service.

We have just finished another trial, this time looking at how we might automate the detection of macular oedema, fluid under the retinal surface. We also have projects looking at whether diabetic eye disease is a predictor of CVD and another looking at the information in serial retinal photographs.

In 2000 we were awarded the Queen's Anniversary Prize for Higher and Further Education, in recognition of the department’s "Pre-eminence in medical imaging technology for over 30 years". This was a wonderful recognition of the work that the department had been doing.

I am also a committee man! I have had the privilege of being the President of the Institute of Physics and Engineering in Medicine in 1997. I have chaired the Association of Clinical Scientists which is responsible for accrediting medical physicists for statutory registration with the Health Professions Council. I was also responsible for setting up RPA2000, a company undertaking the certification of Radiation Protection Advisers on behalf of the UK Health and Safety Executive. I have just stepped down as its chair.

I was until recently the Chair of the Scottish Forum for Healthcare Science which works closely with the Scottish Government on issues around the development of training and regulation of medical physicists, and other medical scientists, in Scotland. I also sit on the Registration Authority for the Science Council which awards chartered scientist status.

I am afraid that I am one of those people who “lives to work” rather than “works to live”. But I do find time for some outside interests. I am chair of the Administration Board for the Diocese of Brechin in the Scottish Episcopal Church. Several years ago I was appointed as an Honorary Sherriff, which in the Scottish legal system is the equivalent of a judge. But I’m not allowed to hear a trial by jury.

I enjoy classical music, especially opera, and I also believe that the Kindle is one of the most useful devices to have been developed in the past 10 years.

Finally I retire in August of this year, having reached the tender age of 65 years. I am a strong believer in the founding principles of EFOMP and I hope that with more time on my hands I will be able to make a useful contribution to the development of medical physics in Europe.

Professor Peter Sharp
EFOMP President

Being the President of EFOMP by Stelios Christofides

To be an efficient and productive President of any organisation you need first to understand the culture of the organisation and how things are done within it. The same holds true for EFOMP.

Although I was the delegate of CAMPBE, the Cyprus Association of Medical Physics and Biomedical Engineering, since CAMPBE joint EFOMP back in the early 1990's, I did not understand how things were done within EFOMP till I was elected as the Chairperson of the EFOMP Science Committee in 2004 with 2007).

During my first months as the Chairperson of the EFOMP Science Committee I started to understand the then EFOMP culture which I must admit I did not particularly like since it appear to me to be a closed shop used by most individual Officers to promote their own personal agendas. I, as a newcomer, I was faced by most of its other members as an outsider till I proved myself a worthy member. I did not like this attitude and as a fighter, that I regard myself to be, I started to push my ideas for change and openness. Although at first I was ignored, gradually my ideas and proposals started to be accepted and some of them started to be implemented. At that time EFOMP had typical, may I dare say superficial, relations with other European Organisations, apart from the European Society of Radiology, with which there was already a close collaboration in the organization of the EFOMP workshop during the European Congress of Radiology (ECR).

Similar efforts were initiated with other organisations such as ESTRO, ESMRMB and more recently with EANM. In 2007, I was elected as the Vice President of EFOMP with term of office from the 1st of January 2008 to December 2008. I must admit that this was a one horse race since I was the only candidate. If there was a second candidate I do not think that I could possibly have been elected. This was for me a one way road: One year as Vice President, three years as President and two years as Past President.

Although I am reasonably good in being able to judge and evaluate my performance and my abilities, till today I cannot evaluate or judge my performance and I cannot say that I was a good President for EFOMP and that what was achieved during my presidency was good or bad for the Medical Physics Profession. It is up to others to judge the achievements made if any. I have started my Vice Presidency and continued during my Presidency to promote our Profession with the aim to bring it to the level it deserves and be accepted as a Health Profession with the admiration and status it deserves, alas I did not complete this ambition.

I like to think of myself as the person that kicked up the back side the dormant giant called EFOMP. This giant gradually has awaken and is seen again, at least within Europe, if not internationally, as an organisation to be reckoned with.

The kick was in the form of initiatives some of which are:

1. The EFOMP evolution. A move to make EFOMP more democratic and more approachable by its National Member Organisations (NMOs) and even the individual medical physicists of Europe through the Special Interest Groups (SIGs) that operate under the Science as well as the Education and Training Committees.

2. The involvement of EFOMP in a number of European Commission funded

projects, for which EFOMP was and is a major and indispensable partner.

3. The closer collaboration with other European organisations such as the EANM, ESMRMB, ESR and ESTRO where joint activities relevant to medical physics are organised at each other's annual conferences.

4. The closer collaboration with the International Atomic Energy Agency (IAEA).

If I would be asked to name two of the highlights of my Presidency I would say that these are:

1.The Guidance on the Medical Physics Expert, and

2.The creation of the Special Interest Groups that operate under the Science and Education and Training Committees.

The first, I believe will be the start of the recognition of Medical Physics as a recognised profession by the European Union and assist in the mobility of medical physicists within the European Union Member States and the second because it gives the opportunity of young medical physicists to get involved within EFOMP and to explore their scientific, education and training ideas with other medical physicists with similar interests.

As a last wish I like to say that the kick I gave to the dormant giant called EFOMP will prove one day to have been beneficial for the Medical Physics Profession.

Stelios Christofides,
EFOMP Past President.

EUROPEAN MEDICAL PHYSICS AND ENGINEERING CONFERENCE

SOFIA 18-20 October 2012

The European Medical Physics and Engineering Conference, which incorporates 11th National Conference of the Bulgarian Society of Biomedical Physics and Engineering (BSBPE) and **6th Conference of the European Federation of Organizations for Medical Physics (EFOMP)**.

This important scientific event will give an unique opportunity to medical physicists, engineers and professionals of other sciences to share their experience and exchange knowledge on a wide range of topics. The invited speakers will present novel concepts and innovations related with the role and contributions of medical physics and biomedical engineering on development of the contemporary medicine.

CONFERENCE TOPICS

" Physical Factors
" Biomedical Engineering
" Biophysics
" Methods for Diagnostics and Therapy
" Modeling and Information Technology
" Radiation Protection
" Risk Management and Communication
" Legislation and Standards
" Metrology
" Education and Training

Official language: English

REGISTRATION

The Registration form is available for downloading from the Conference website at **empec2012.bsbpe.org**.

The participants are kindly requested to complete the registration form and e-mail it to the Organizing Committee: empec2012@bsbpe.org.

Conference website:

empec2012.bsbpe.org

Medical Physics Department Organisation at the Karolinska University Hospital, Stockholm, Sweden

I believe many of us who have had the opportunity to work in the different areas of clinical Medical Physics, both in imaging (Diagnostic and Interventional Radiology, DIR; Nuclear Medicine, NM; Magnetic Resonance, MR) and Radiation Therapy (RT), will have experienced how knowledge in one area is of use also in other areas of Medical Physics. At the same time, and from a management point of view, as the techniques evolve and increase in complexity we see the need to focus the skills and professional development of our staff to relatively narrow areas in order to obtain the know-how necessary not only to maintain the physics services, but also to perform R&D in those areas. This is a situation not trivial to manage. In the best of worlds we would have all the staff we would ask for, and unlimited resources for their professional development.

This brings to my mind the words of a Louis Armstrong song ...*Oh, what a wonderful world* that would be! As this will never happen, we need to find ways so that the specialized skills and competencies of our staff can "flow" into other areas and to plant seeds of knowledge that will make all our gardens to flourish with a large variety of flowers. The extensive implementation of imaging in RT procedures, and the introduction of hybrid imaging systems (SPECT-CT, PET-CT, PET-MR, etc), present two clear examples of the need for exchange of knowledge between the different areas of Medical Physics. In addition, we experience how our medical counterparts become more *diagnosis* oriented than *technique* oriented. This puts also new demands on the expertise and collaboration within the physics community. We should be able to discuss with our colleagues physicians topics such as imaging perfusion, not from the standpoint of the technique used, but rather *what are the pros and cons with different techniques when imaging perfusion*?

The use of multi-modality imaging in defining the target and the critical organs, and in the follow-up of RT, is another example of the need to join forces, so that the full capacity of techniques available to us are also explored and put into practical use for the benefit of the patient.

Responsibilities of the Medical Physics Department at Karolinska

In order to address these challenges we have decided to start restructuring our clinical Medical Physics Department. Before giving you the details on what we have done, and how we try to work today, some background information is needed.

Our department at the Karolinska University Hospital in Stockholm provides physics services to about 45 other departments which are geographically located at three different sites within the Stockholm area. The two hospitals that actually form part of Karolinska since 2004, are situated about 35 km apart. One of them (Karolinska Solna) performs activities in all areas of radiation medicine (imaging and radiotherapy), whereas the other site (Karolinska Huddinge) does not include a radiotherapy service. In the third hospital, Södersjukhuset, situated "in between" the others, Karolinska runs a "satellite" radiotherapy unit that is fully integrated into the unit at Karolinska Solna. In addition, our department manages and runs the clinical nuclear medicine services at the two Karolinska sites, and is also in charge of the Radiation Safety programme of the hospital. The latter includes radiation safety of the Karolinska Institutet, the academic counterpart of the hospital. Our department is also in charge of the clinical aspects of the academic programme in Medical Physics at the University of Stockholm. Currently our department has close to 60 medical physicists, with approximately a 60/40 percentage ratio between imaging and radiotherapy (including radiation safety in both).

In addition, our staff include about 25 NM nurses, 10 engineers (mostly in RT), and staff for administration. In total, we are close to 110 staff members, with offices at 7 geographically separated locations in the three hospitals.

Previous organisation

Prior to the restructuration, the different areas of physics (DIR, NM, MR, RT) were organised as separate sections at Karolinska Solna, and Huddinge had a joint imaging section covering all the

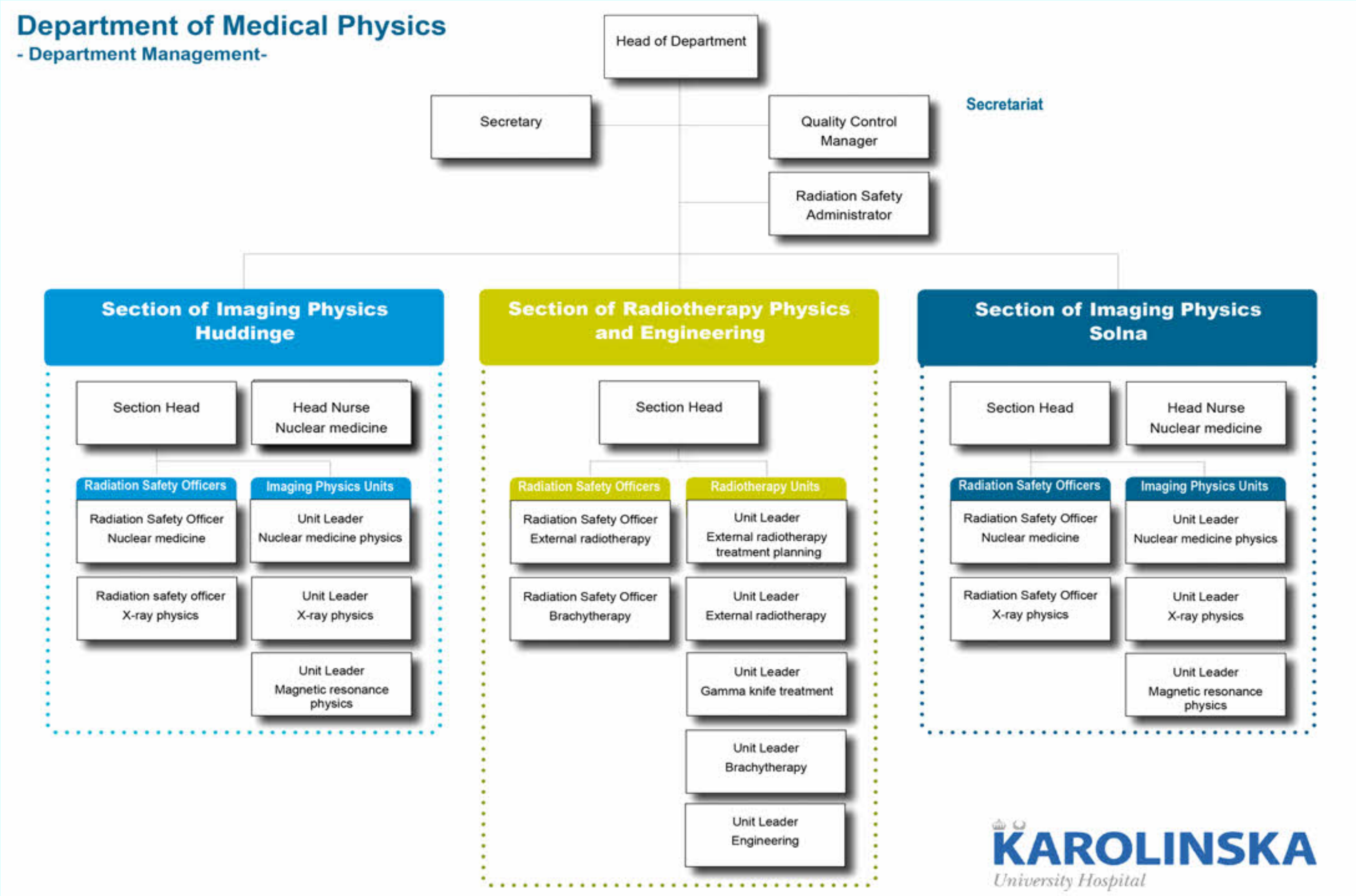

Fig. 1: Organisation of the Medical Physics Department at the Karolinska University Hospital.

areas. Radiotherapy Physics, including both Solna and Södersjukhuset, has been run as a single section since 2004. This was a large and relatively complex structure, not only for us, but also for the departments we provide services to. Thus, what could be done to improve this structure, taking into account the needs for a more transparent organisation and at the same time increasing the interaction between the different physics areas?

New organization

The current structure of our Department is shown in Figure 1. All imaging areas at each site have been joined into a single *Section of Imaging Physics*, with one physicist Section Head at each site (Huddinge and Solna). The clinical nuclear medicine programme at each site forms part of the Section, with a head nurse being in charge of its clinical activities. The *Section of Radiotherapy Physics and Engineering* includes, as before, all related activities at Karolinska Solna and Södersjukhuset, with one physicist Section Head supervising both sites. In the three sections, *Units* have been created for the different subareas indicated in the figure. All the operative aspects of daily routine duties within each unit are under the responsibility of a Unit Leader. They interact within the Section, and with unit leaders in the other sections, in order to promote exchange of competence between Units/Sections. The Radiation Safety programme is managed by a group of Radiation Safety Officers from the three Sections. They meet regularly to discuss radiation safety issues common to all areas and are, together with the Head of the Department, responsible for the activities defined during the yearly revision of the Radiation Safety programme of the hospital. Each Section is managed by the *Section Management Team*, which includes the Section Head, the Head Nurse (in Imaging Physics), Unit Leaders, and Radiation Safety Officers. Strategic issues are the responsibility of the *Department of Medical Physics Management Team*, and ultimately by the Head of Department.

Our experience after 8 months since the implementation of the new organisation is that the different Units and Sections have started to collaborate to a significantly larger extent than before. This has been observed in all physics-related areas, including clinical duties, R&D, teaching, and radiation safety. Also, as the communication channels have broadened, the flow of ideas and the understanding of the various skills and competencies of others within the department are improving

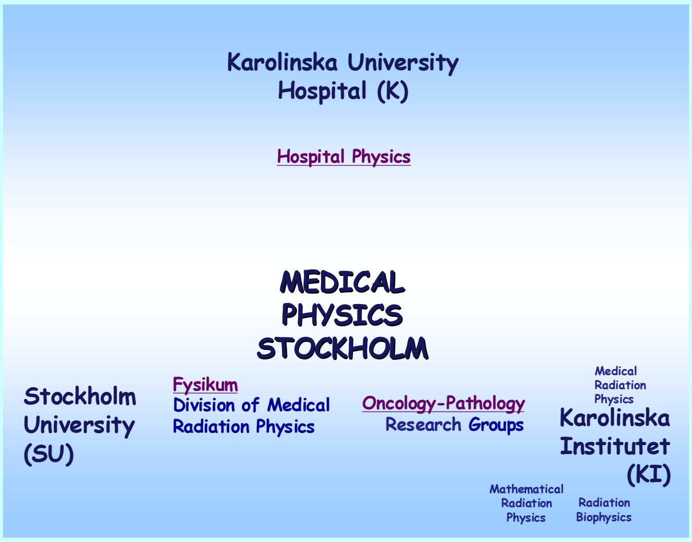

Fig. 2: The academic platform of medical radiation physics in Stockholm.

Future challenges

The next goal of our Department will be the definition and implementation of staff competence programmes. Specifically, we will focus on the creation of Residency and Specialist programmes for physicists, and on competence development programmes for nuclear medicine nurses in hybrid imaging. Considering the complexity of the IT-structure in modern RT, the role and competence of the engineers, as well as programmes for their professional development, are additional, important areas to address. In parallel, there are on-going discussions on how the academic and R&D platform in medical radiation physics in the Stockholm area should look like in the future, incorporating the contribution of Karolinska University Hospital, Karolinska Institutet and Stockholm University (Fig. 2). This is definitely of utmost importance to the medical physics profession in the region, and our current efforts to implement professional development programs in medical physics will rely on that such a platform is defined and implemented in the near future.

Annette Fransson-Andreo

5th International Conference on Education and Training in Radiological Protection

Education and training are basic pillars for safety in the workplace. Practitioners who work with radiation sources will have a wide range of responsibilities depending on the radiation practice, but all need:

(a) A basic education as well as specific training providing the required level of knowledge, skills and competencies regarding the management of radiation,

(b) Standards for the recognition of skills and experience,

(c) Opportunities to refresh, update and test acquired knowledge, skills and competencies on a regular basis.

Four ETRAP conferences on education and training in radiological protection have already been organised. These meetings focused on benchmarking current experiences and practices and introduced a harmonised approach to education and training at the European level. The first meeting was held in Saclay (France) in 1999, the second took place in Madrid (Spain) in 2003, the third in Brussels (Belgium) in 2005 and the fourth 2009 in Lisbon (Portugal). In order to build further on what has been achieved up to now, the Seibersdorf Laboratories and the European Nuclear Society are organizing the 5th international conference on education and training in radiological protection, ETRAP2013, in Vienna from 13 - 15 March 2013.

The conference intends to address the largest potential audience, covering all areas of radiation use including the medical sector. Furthermore, it aims to reinforce the contacts between various organisations, individuals and networks dealing with education and training policies in radiological protection. Special attention will also be paid to attracting and inviting young professionals to ensure knowledge transfer and to help build the future of radiological protection.

EFOMP is involved in the organization of ETRAP2013 through its E&T Committee. For further information and the Call for Papers please follow the ETRAP2013 link from the EFOMP website. Conference Proceedings with reference number ISBN 978-92-95064-17-1 will be published.

Carmel J. Caruana
Chair, Education and Training Committee

MEDRAPET Workshop: Medical Radiation Protection Education and Training

April 21- 23, 2012, Athens, Greece

This workshop was organized as part of the MEDRAPET project.

The professional organizations involved in the MEDRAPET project are the European Society of Radiology (ESR) as coordinator, as well as the European Federation of Organizations for Medical Physics (EFOMP), the European Federation of Radiographer Societies (EFRS), the European Society for Therapeutic Radiology and Oncology (ESTRO), the European Association of Nuclear Medicine (EANM) and the Cardiovascular and Interventional Radiological Society of Europe (CIRSE).

The aim of the Workshop was to present the current status, difficulties and future opportunities in the field of education and training in radiation protection and to provide data for the development of the Guidelines on Radiation Protection Education and Training of Medical Professionals in the European Union.

The workshop included presentations from guest speakers and members of the MEDRAPET project. It consisted of five round table sessions:

- MEDRAPET Project presentation
- Current status in Radiation Protection Education and Training of Medical Professionals in Europe: Results of MEDRAPET Project.
- Education and Training in Radiation Protection for Professionals Involved Directly with the Use of Radiation: The views of Experts
- The Role of International and National Organizations in Medical Radiation Protection Education and Training
- Education and Training in Radiation Protection for Medical Professionals: The views of European Societies

The Workshop was also complemented by a poster session. It was attended by 108 participants from 29 countries, among them three EFOMP Officers who chaired a number of sessions and also made the following presentations in the order presented:

a) WP3: European Guidance on Radiation Protection Education and Training (S Christofides).

b) European Guidelines on Education and Training in Radiation Protection for Medical Exposures: Do they need an Update? (S. Christofides)

c) The Cypriot Experience on Radiation Protection Education and Training of Health Care Professionals using Ionising Radiation (S. Christofides)

d) Knowledge, Skills and Competencies Requirements in Radiation Protection of Medical Physicists (C. J. Caruana)

e) Education and Training in Radiation Protection for Medical Professionals: The View of EFOMP (P. Sharp).

The workshop conclusions, session reports and the workshop Abstracts will comprise the Workshop proceedings and will be available on the Project's website together with a gallery of photographs at: www.medrapet.eu.

Participants experienced and enjoyed not only a journey through the latest developments in the field of radiation protection education and training, but also Athens, the birthplace of arts, sciences and democracy.

Stelios Christofides
Past President of EFOMP

Medical Physics quiz at the ÖGMP-DGMP-SGSMP Congress at Vienna 2011

At the last 3-country congress of the German speaking Medical Physics organizations of Austria, Germany and Switzerland an almost kind of tradition continued that started 2007 on the previous 3-country congress at Bern. A quiz questionnaire (fig. 1) was distributed among the participants of the congress consisting of serious and some not so serious questions on Medical Physics and the national societies. The 12 questions were created by a team formed by Wolfgang Birkfellner (ÖGMP), Markus Buchgeister (DGMP) and Angelika Pfäfflin (SGSMP). The intention was to motivate the participants to cross borders to other specialties of Medical Physics and ask one of the expert colleagues present at the congress. Three prizes of 200€, 100€ and 50€ in form of Amazon book vouchers were sponsored by the congress for the best returned questionnaires.

The questions covered topics not necessarily related to Medical Physics to have also an “entertaining factor”. This was a question to the ever lasting soccer competition between Austria and Germany or to the historic person Sigmund Freud who is connected to the venue where the congress was situated (see Fig. 1 for the questions in German). But also an estimate of the DGMP members with DGMP certification was asked for or how many female industry representatives are present at the industry exhibition of the congress.

For your own interest, here are translations of questions related to Medical Physics. You may try to answer yourself. The correct solution are marked in the German version that can be found at the DGMP website at; www.dgmp.de/akoeff/FreieDateien/Quiz_Wien2011_Losung.pdf

1. EFOMP is the “European Federation for Organizations in Medical Physics”. Its purpose is
   a) to lobby at the European parliament at Brussels and Strasbourg.
   b) to promote the exchange, the education and harmonization in Medical Physics between the national member societies in Europe. To this end, also individuals can participate directly in EFOMP special interest groups.
   c) to organize interdisciplinary congresses in physics.
   d) as a sub-organization of IOMP, EFOMP has no special aim of its own.

2. The abbreviation SIRT stands for:
   a) Simultaneous Integrated Radiation Targeting
   b) Seldomly Irradiated Radiation Trauma
   c) Selective Internal RadioTherapy
   d) Standard Integrative and Radiosensitive Therapy

SGSMP SSRPM SSRFM — MEDIZINISCHE PHYSIK ÖGMP — **3 Länder Quiz**

Abgabeschluss: Freitag, 30.09.11, Mitternacht.
Abgabeort: Box auf dem Infotisch der Gesellschaften
Autoren: Markus Buchgeister(DGMP), Wolfgang Birkfellner(ÖGMP) und Angelika Pfäfflin(SGSMP)
Zu gewinnen sind Buchgutscheine von Amazon: 1.Preis: 200 €, 2.Preis: 100 €, 3.Preis: 50 €!

Nur **vollständig ausgefüllte** Quizbögen werden akzeptiert, daher bitte **eine Antwort pro Frage** eindeutig und deutlich kennzeichnen. Ebenso müssen die Kontaktdaten für die ggf. notwendige Benachrichtigung ausgefüllt sein. Bei mehreren richtigen Einsendungen entscheidet das Los. Der Rechtsweg ist selbstverständlich völlig ausgeschlossen. Die Bekanntgabe der Gewinnerinnen und Gewinner findet auf der Abschlussveranstaltung der Tagung statt. Bei Unklarheiten entscheidet ausschließlich das Organisationstrio. **Lassen Sie sich Fragen aus einem fremden Fachgebiet lieber von einem Kollegen oder einer Kollegin erklären, statt abzuschreiben!**

Die Fragen:

1. Wie hießen der Tormann und der Kapitän der österreichischen Auswahl bei der Fussball WM 1978?
   a) Friedl Koncilia und Robert Sara
   b) Friedl Koncilia und Hans Krankl
   c) Pepi Hickersberger und Matthias Sindelar
   d) Esi Finger und Franz Klammer

Fig. 1: Start of the German Medical Physics quiz questionnaire of the 3-country congress at Vienna with questions of national content.

3. In MRI the origin of the MR signal is linked to the local magnetic field strength by the Lamor equation. Due to the chemical shift of proton e.g. in fat, this tissue is reconstructed at a wrong position. How can this error be prevented or minimized?
   a) By a diet of the patient previous to examination.
   b) By an increased receiver bandwith and taking into account the in phase relation between water and fat protons.
   c) By superposition of two images with opposite frequency coding directions.
   d) Parallel imaging with the CPMG pulse sequence will minimize this effect directly during measurement.

4. The proton therapy center next to you sends a patient to your site for a palliative RT treatment of the spine. The target volume has already been treated by 3x8 Gy with protons. You have to discuss now, if the patient could be treated in a second course with 10x3 Gy with Photons. What do you have to take into account to estimate the correct total dose for the treated volume?
   a) Nothing. The dose is given by the plan as stated, the rest is up to the decision of the radio-oncologist.
   b) Since the first dose is of protons, it is twice as much as the one of the photons. A second treatment is excluded.
   c) The proton dose of 24 Gy is small, even further reduced by the factor of 1.1, such that a second treatment of the spine is possible.
   d) Since the dose by protons is biologically more effective, it is more likely to be equivalent to a by a factor of 1.1 higher photon dose. The radio-oncologist has to be informed about this.

The last question was a "brainteaser": Which letter is missing?

D	F	I	M
C	P	D	R
Q	I		X
F	V	M	E

On the last day, 31 questionnaires had been returned to the collection box of which 2 had answered all questions correctly. Two additional ones had just one wrong answer, so that an additional prize of 50€ was sponsored. Among these best four, three were women!!

It might be specially noted that the only 100% correctly answered question was the one related to EFOMP! The SIRT and proton dose question was solved by about 90%, but the MR question only by approx.. 50%. This indicates that among the participants were mostly radiotherapy related colleagues, for whom the field of MRI is not so familiar.

A last optional question – not taken into account for the competition- was a kind of poll about which level of education is regarded as practically relevant for a medical physicist in radiotherapy. The four option were:

a) A Medical Physicist is in this field more or less equal to a technician such that more an apprenticeship that an university degree is sufficient.
b) Comprehensive knowledge of radiation effects is necessary that only a master degree in physics can cover. The practical training must consist of a catalogue of theoretical and practical topics that are examined in a final test.
c) A university degree in natural science or engineering plus courses in radiation protection and proof of clinical working experience without further examination is sufficient.
d) A specialized university degree in Medical Physics combined with clinical work at a cooperating site is necessary.

None of the responders had opted for answer a). The other three were almost equally distributed with 9, 10 and 11 markings. This indicates, that the level of education in the judgment of the current Medical Physicists has to be an university degree. But there is no clear indication for the need of a specialized Medical Physics degree, neither if the practical knowledge should be examined prior to certification as Medical Physicist in radiotherapy.

This was the second time, that such a Medical Physics quiz was organized at an international German speaking congress. There were already requests for a continuation at the next ÖGMP-DGMP-SGSMP congress. Maybe other Medical Physics organizations have made a similar quiz at their meetings, too. It would be interesting to know, so please contact the author at Buchgeister@Beuth-Hochschule.de !

Markus Buchgeister,
Berlin, Germany

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Tools and methods for teaching magnetic resonance concepts and techniques

Abstract

Teaching of MRI methodology can be challenging for teachers as well as students. To support student learning, two graphical simulators for exploration of basic magnetic resonance principles are here introduced. The first implements a simple compass needle analogy implemented for day one of NMR and MRI education. After a few minutes of use, any user with minimal experience of magnetism will be able to explain the basic magnetic resonance principle. A second piece of software, the Bloch Simulator, aims much further, as it can be used to demonstrate and explore a wide range of phenomena including RF interactions, relaxation, weighting, echoes, imaging principles and more. Both simulators run in almost any browser without installation of software, but are also freely available for download. Example uses are documented in a series of short videos available on YouTube.

Introduction

Teaching and learning MRI can be frustrating as many needed concepts are foreign to typical students. Medical physicists are often involved in teaching of technical as well as non-technical staff, e.g., radiologist and radiographers who need a basic understanding of MRI to perform well, especially when measurements do not give the expected results. Besides facing the challenge of understanding MRI themselves, medical physicists therefore also need to explain vector dynamics and field interactions to people who are not familiar with such concepts. They need to understand precession, excitation and relaxation, as well as more complicated time courses central to MRI, e.g. spin evolution during imaging sequences. Many MRI teachers have desperately been waving their arms to illustrate vector dynamics. Probably equally often, the frustration has been on the student side, as math and hand waving not always convey sufficient understanding.

Based on these experiences, graphical simulators tailored for education were developed. The latest versions run directly from the Internet in almost any browser, and are also freely available for download. The "*JavaCompass*" [1] can be

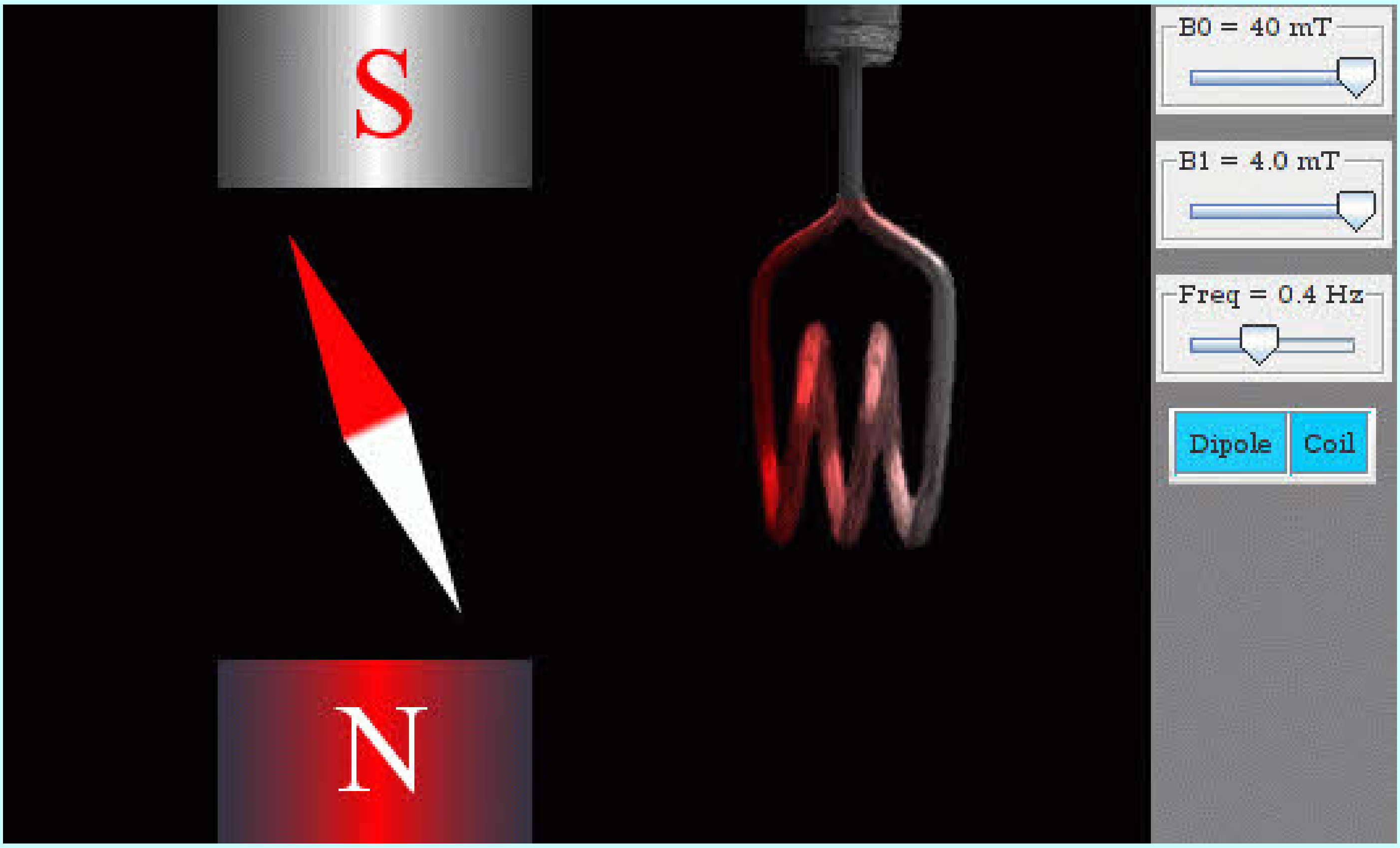

Fig 1: The simplest magnetic resonance phenomenon can be explored using the JavaCompass.

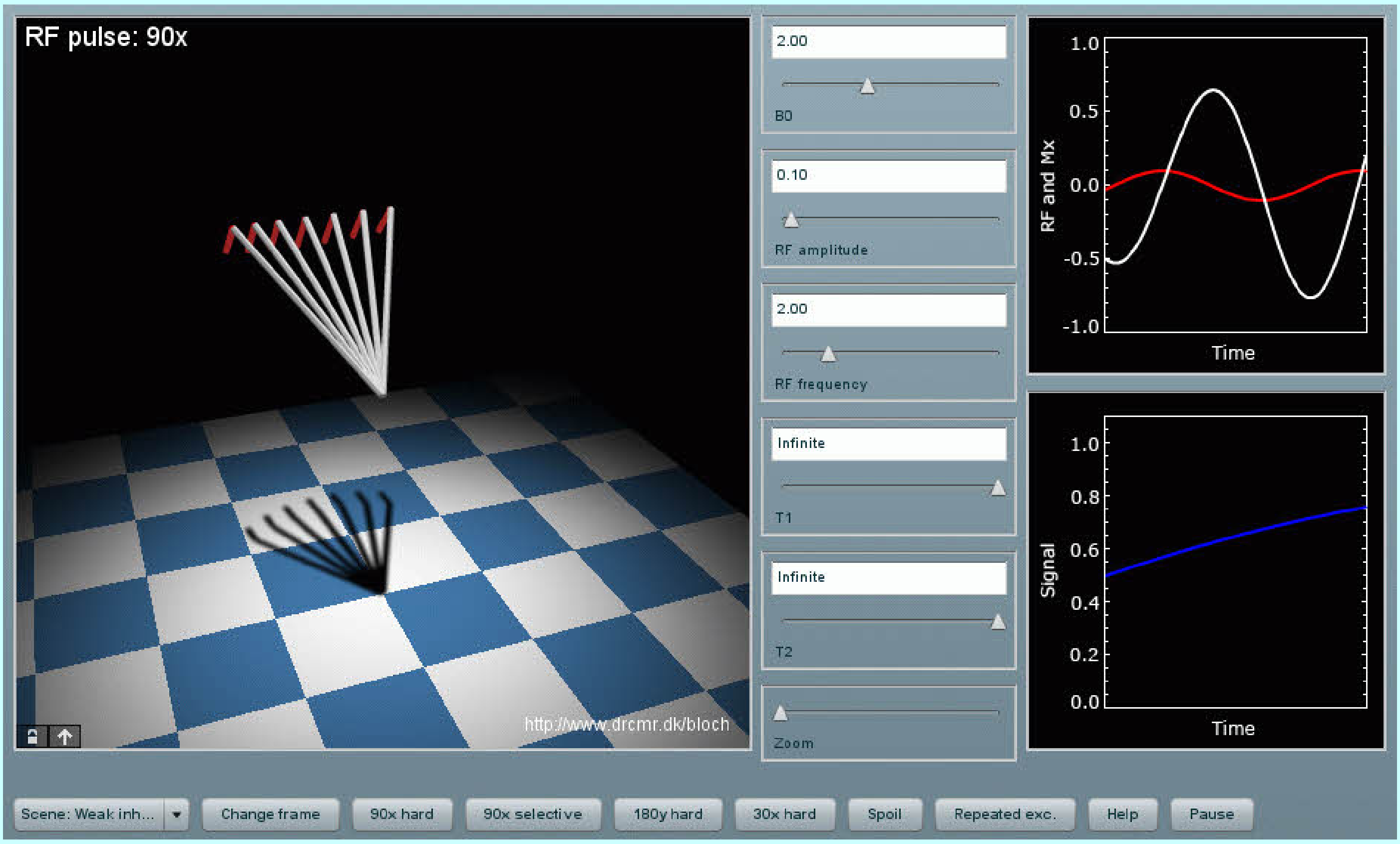

Fig 2: Seven spin isochromates are here manipulated interactively using sliders and event buttons of the Bloch Simulator.

used to demonstrate basic magnetic resonance, transmission, reception, excitation and relaxation. The more advanced "*Bloch Simulator*" [2] implements Bloch dynamics in presence of varying fields as employed during MR sequences, including gradients. This article reviews the software and thoughts behind.

Day One of MR education - the JavaCompass

Even when aimed at non-technical staff, typical introductions to NMR basics take outset in the quantum mechanical eigenstates, spin up and spin down. It is often stated that quantum mechanics (QM) enforces nuclear spins to align parallel or anti-parallel to the polarizing field used in NMR. This claim should be sufficient to confuse most thinking students. In particular they should wonder why nearly half the nuclei align against the field, which is the least energetically favourable and classically least expected orientation. Besides being non-intuitive, that starting point for explaining NMR is actually wrong as quantum mechanics predicts a near-isotropic, slightly skewed distribution of spin orientations, as does classical mechanics [3]. The spin-up and spin-down states are mathematical conveniences (form a basis) that plays no role for the understanding of MR, and employing them in the first introduction may do more harm than good. Instead, the basic MR phenomenon can advantageously be described using *classical mechanics*, and it can be shown using QM that such an explanation is exact in all situations relevant to MRI. Later, quantum mechanics can be introduced for those who need it, e.g., physicist in need of describing advanced spectroscopic methods. Many of those require no QM to be understood, but QM offers a convenient and complete mathematical description.

The *JavaCompass* is a simple piece of software offering an alternative introduction to MR. A suggested use is illustrated in a *YouTube video* illustrating how a Compass needle may, or may not, be excited resonantly when placed in a static field and an orthogonal oscillating magnetic field. The software does not illustrate NMR, which involves angular momentum and therefore differs significantly. Nevertheless, the JavaCompass that illustrates the simplest magnetic resonance phenomenon serves as a convenient starting point for education. When the simple compass dynamics are understood after a few minutes of software use, the role of spin can be added to the explanation to make it pertain to NMR and MRI, differing since the associated angular momentum causes precession rather than vibration. The *software homepage* links to a page where only the Java application itself is displayed *with no additional text*. This is useful when the JavaCompass is introduced in an *exercise* aimed at letting students discover MR for themselves.

Beyond the very basics: The Bloch Simulator

After the basic MR phenomenon is explored, and the role of angular momentum is explained, the real educational challenge starts. The Bloch equations [4] form the basis for almost all MRI techniques, but the enormous potential for advanced applications is not obvious from the equations alone. The student's motivation can be increased and intuition cultivated by supplementing the mathematical descriptions with good visualizations. It is not trivial to visualize basic NMR concepts, but another piece of software, *the Bloch Simulator* [5], comes in handy for illustrating concepts and techniques such as ensemble dynamics, precession, on- and off-resonance excitation, relaxation, dephasing, refocusing, sequences, phase rolls, slice selection, k-space imaging, stimulated echoes and more. The software offers a 3D view of MR vector dynamics controlled interactively via a graphical user interface. A *series of YouTube videos* demonstrates a few example uses. Videos can be used in education but it is much more powerful to use the software interactively for classroom demonstrations [6], which allows for spontaneity and exploration in response to student questions. It is also well suited for exercises where the students operate the software themselves. To facilitate this, the user interface is kept near a bare minimum, and flexibility is to some extent traded off for the simplicity needed in education.

The Bloch Simulator is available in several versions that largely have the same functionality [5]. The latest version implemented in Flash/ActionScript executes in basically any internet browser without installation of software.

Alternatives

A wide range of other software and educational videos are available. In particular, there is a whole range of graphical Bloch equation solvers, which in principle are similar to the Bloch Simulator (e.g. *SpinDemo*, *JEMRIS*, *SIMRI*, *Odin*, and *SpinBench*). Some of these have a quite different focus, however, as they aim at generation of artificial images or simulation of programmed sequences. Whereas interactive use of simple software such as the Bloch Simulator or SpinDemo may be advantageous in most introductory contexts, the more advanced/precise/complicated/flexible software is better in other situations, e.g. for exercises later in courses.

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EFOMP in ECR 2012

One of the highlights of the conference season, so far as those working in radiology are concerned, is the European Congress of Radiology. A very popular conference with over 20,000 participants and while much of the meeting is aimed at the clinical community, EFOMP makes an important contribution to the physics programme. In particular, this year we organised a workshop on "New Technology in Diagnostic Radiology: Frontiers in Interventional Radiological Imaging."

Prof Peter Sharp, President of EFOMP , Alberto Torresin, Scientific committe chair and Virginia Tsapaki, Communication & Publications Committee chair in front of the EFOMP booth in ECR 0212.

The first session, a general overview, started with a plea from Jim Reekers of Amsterdam for the European notified bodies to start to handle registration of new medical devices and implants in the same way as they do with new drugs. He argued that this would be a great stimulus for good research, better patient care and most likely a reduction in medical treatment related costs. Marc Kachelriess from Heidelberg explored the use of c-arm systems for acquiring tomographic information. He discussed a promising new technique that allows for 4D interventional imaging employing a new mathematical framework called compressed sensing is used for image reconstruction. Janet De Wilde, from Edinburgh, then gave a paper on interventional MRI techniques. She described the role of MR imaging in areas such as image-guided biopsies, MR-guided thermal ablation and more complex surgical procedures such as cardiovascular repairs.

The first session was rounded off by a presentation on US interventional techniques by L. Solbiati from Busto Arsizio in Italy. He argued that while in the last 30 years, imaging-guided percutaneous aspiration biopsies of nonpalpable targets, drainages of fluid collections and, more recently, thermal ablations with radiofrequency, microwaves, cryotherapy, laser, etc . have extensively entered clinical practice, their success depended on the availability of precise, reliable imaging techniques, for careful pre-procedure planning. He described how this was provided by ultrasound.

The second part of the workshop, on technology assessment, started with a presentation by Annalisa Trianni from Udine on angiographic equipment performance assessment. Her concern was that while different methods based on contrast-to-noise ratio and various figures of merit have been developed to evaluate dosimetric characteristics and image quality performance, rarely have these measurements been correlated with subjective evaluation of clinical images. She argued that new test objects that reflected more closely the clinical situation should be investigated.

Eliseo Vano from Madrid looked at patient and staff radiation issues in angiography. As many different medical specialties are using fluoroscopy-guided procedures due to many clinical benefits. But with X-ray systems becoming more complex and many imaging protocols being available, the potential for high-radiation doses for patients and staff has increased. It was therefore essential to implement specific radiation safety and quality assurance programs. In particular the radiation risks for patients need to be understood by clinicians and dose values considered as part of the optimisation strategies.

The workshop finished with a panel discussion with angiographic equipment manufacturers.

With 128 attendees over the two sessions, this had obviously made an important contribution to the conference. The organisers are to be congratulated.

Report by Peter Sharp,
EFOMP President

VERT: Virtual Physics training

As a radiotherapy community we are constantly trying to improve the quality and scope of the training we undertake for students entering the profession and for experienced professionals. Recently there has been a lot of interest in the use of simulation training which has been shown to provide great value in other professions such as the airline industry. In a previous article [1] we introduced the VERT (Virtual Environment for Radiotherapy Training) system which is essentially a flight simulator for radiotherapy education. In that article the analogy was drawn between the potential benefits that are achievable from VR or simulation training for radiotherapy, drawing on examples in the aerospace industry. An important feature of the system is its ability to allow the user to explore situations with errors, such as patient mis-positioning errors, safely without any risk to the patient or equipment.

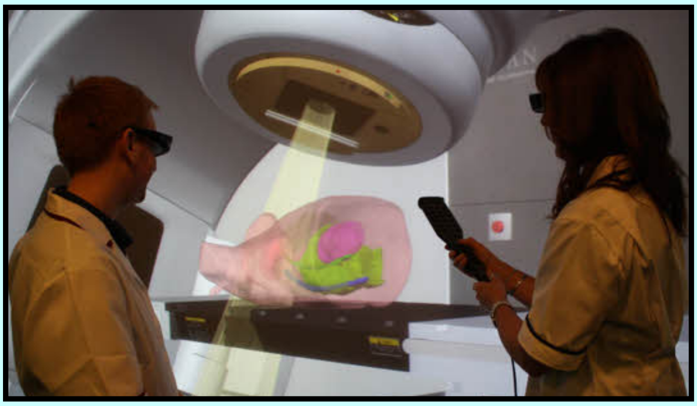

Fig. 1: The virtual Linac is operated using the real hand pendant controls.

The VERT system has become established within the radiotherapy community with 81 installations worldwide in 14 countries. The system is used in a mixture of RTT schools and clinics where it is used for basic training and continuing education/introducing new techniques respectively [2,3]. Initially, in the UK VERT was aimed at RTT (or Radiographer) training however it's features have always made it useful for training the multi-disciplinary team involved in radiotherapy. It has become well established in the RTT/ Radiographer teaching programmes in the UK, having been used for four years thereby having seen a completed (three year) degree course. The scope of the system has recently been expanded with the introduction of the 'Physics Module' which enables physics/QC workflow to be accurately simulated on the virtual Linac. These additions, along with new features that allow demonstration of the effects of the mis-calibration of the Linac have broadened the appeal of VERT to Physicists and Dosimetrists.

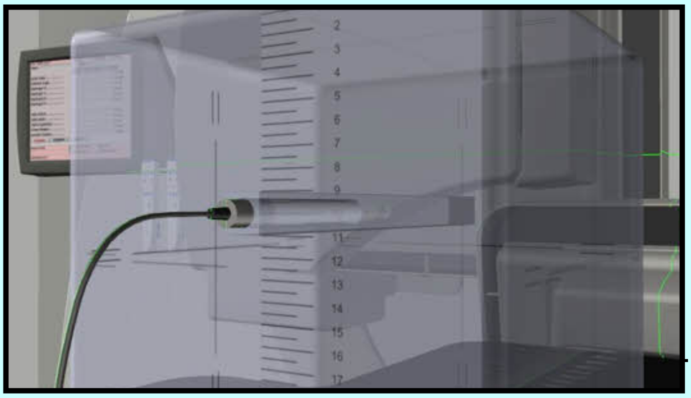

Fig. 2: VERT Physics showing the virtual Ion chamber to take machine measurements.

sionals alike to have the experience of operating a Linac away from the treatment bunker. A fully articulated, 3D, interactive Linac is operated using authentic hand pendants and provides all the functions expected of its real world counterpart, with the obvious exception that it doesn't produce ionising radiation. In conjunction with some specifically designed features it is possible to demonstrate or explain all the basic features and concepts to aid understanding of the operation of a Linac. For example, the isocentre or the role of the lasers, to name but two. Treatment plans can be loaded, using the DICOM interface, from treatment planning systems; CT data, target volumes and OARs can be displayed along with dose in the form of surface colour wash or isodose clouds. Full support is given for contemporary IMRT and IGRT technologies available on the major conventional Linear Accelerators and these features allow the user to explore the planning and delivery of radiotherapy. However it is the ability to demonstrate the effect of simulated patient positioning errors on the dose distribution and verification images that provides the greatest benefit in this context. The system can also be used in 'flight simulator mode' to practice setting up patients for difficult techniques, such as direct electron fields [4] to the breast.

The new 'Physics tools' were designed to interactively demonstrate QC activities on the virtual Linac; however their functionality also allows them to be used in a variety of ways. There are five activities included: Output measurement QC block with Farmer chamber, scanning water phantom, water phantom to perform ion chamber calibration, light field-radiation field coincidence plate and laser alignment phantom. Each activity has a control panel that can be displayed and interactively used on a separate touch-screen, iPad or regular monitor. The virtual Linac has a 6MV and 15MV beam model associated with it and these are used to provide accurate characteristic measurements for each of these activities.

A Farmer chamber can be placed at different depths within the QC block and the 'measured output' is displayed, which is sensitive to the depth that the chamber is placed in the block, along with SSD and field size. This activity can be used to demonstrate the measurement of an output curve, depth dose curve or TPR curve for both the 6MV and 15MV beams. Furthermore it can be used as a simple surrogate for a patient and therefore used to illustrate dose calculations.

Fig.3: VERT Physics showing the simulated measurement of a percentage depth dose curve.

The scanning water phantom can be used to plot depth dose curves and profiles for a selection of field sizes at each beam quality. A simulated water tank is placed underneath the virtual Linac and an ion chamber is used to sample the radiation beam with configurable range and step size. There is a graphing function which allows beam plots for different field sizes and beam qualities to be compared and quantitatively examined. Small spirit levels on the side of the tank show that it is correctly aligned, however, it is possible to misalign it compare 'badly acquired' plots with others. It is possible to explore and simulate the process of calibrating an ion chamber against a reference class chamber using one of the international protocols. A small water phantom with a farmer ionisation chamber and reference class ionisation chamber mounted side by side allows them to be simultaneously 'irradiated'. The Quality Index that characterises the beam quality can be determined in order to select the appropriate calibration factor for the reference chamber, which in turn is used to calculate the Farmer chamber factor once the comparison irradiation has been performed. Appropriate factors can be configured within the system in order to allow 'local factors' to be used and these factors ensure the responses of the virtual chambers are correct. The output characteristics of the beam can be configured to exhibit measurement uncertainties and the temperature and pressure within the virtual bunker are altered when the software is loaded, ensuring the user must correctly set the appropriate correction factors.

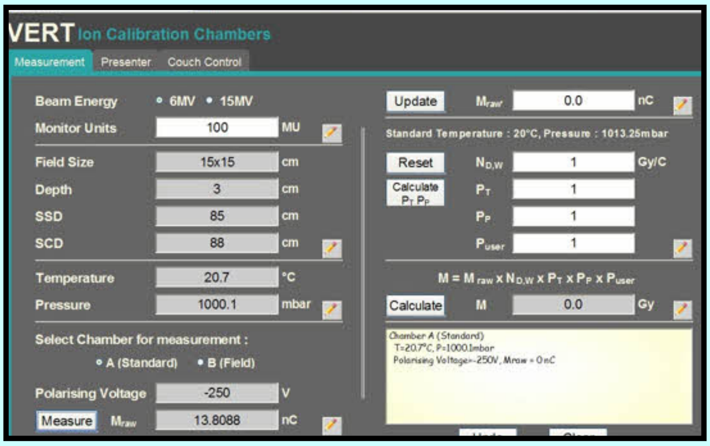

Fig. 4: Touchscreen display for VERT Physics, showing the chamber calibration parameters.

The remaining two activities are simpler QC phantoms, yet like their real world counterparts they can be used in a variety of ways.

A light field-radiation field coincidence phantom is available which fluoresces when 'irradiated' and can also be used in a simple manner to clearly demonstrate the effect of beam divergence. The Laser Alignment phantom demonstrates the integrity of the laser calibration and can be used to check the couch translation accuracy.

To complement these QC features, the system has also been designed to support the investigation of 'error conditions' within the configuration of the Linac. The software allows the user to mis-calibrate a number of machine parameters such as the collimators, the SSD/ODI indicator, couch translations and gantry motion, even introducing gantry 'sag', the set-up lasers can also be altered. In conjunction with the QC phantoms or with a patient plan the impact of these mis-calibrations can be investigated in a safe environment and their implications understood.

In summary, the VERT system has become established in the Radiotherapy community in 14 countries. The expanding user community is continually developing their use of VERT and actively sharing their knowledge and experiences of the system. In a wider context, the use of simulation in education or training is becoming more widespread in medicine, owing to the ability to explore scenarios which would be difficult or dangerous in clinical practice, but which can be effectively and safely trained in a virtual environment.

Christian Hermsdorf

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EFOMP recommendation on DAP display

During the month of May 2012 EFOMP has lead a postal ballot for DAP/KAP display recommendations. The statement has been produced by a working party consisting of Medical Physicists, Radiologists and Radiographers.

Dose/Kerma Area Product (DAP/KAP) is a required display on radiography and fluoroscopy equipment as in the IEC standard. It is essential that the value displayed is readily understood by the user who may be working with many other items of X-ray equipment from multiple manufacturers. The SI unit for DAP/KAP is Gy m². However, the IEC Standard specifies that SI prefixes are permissible and a multiple of different combinations are presently in use. The problem then arises that the units themselves are not always displayed and when different equipment is being used in the same clinical environment, differences in magnitude of the numerical values obtained can cause problems of interpretation. The following issues concern the SI prefixes used on the display:

- *The SI prefixes used for the display should be a combination that is familiar to the user.*
- *For ease of interpretation of dose data, it is desirable that the SI prefixes are the same for all equipment within an organization carrying out the same examinations.*
- *The sensitivity of the display must be sufficient for the lowest doses likely to be delivered for any examination to be carried out on that equipment.*
- *The SI prefixes used and the number format (i.e. number of digits following a decimal point) should be identical at all locations at which DAP/KAP is displayed, e.g. on the generator and on the image display monitor.*

It is proposed that standard prefixes be used (across Europe at least), are either Gy cm² or cGy cm² and that the chosen unit is indicated on the equipment so that the numerical values for DAP/KAP are in a reasonable range for interventional radiology in the first case (Gy cm²) and all other diagnostic radiology in the second case (cGy cm²). Consequently, EFOMP adopted the following statement with respect to DAP/KAP units:

The display of DAP/KAP should be in one of two possible units, Gy cm² or cGy cm². The choice of which unit to display should be determined by the institution where the equipment is installed. Institutions that want to have a single unit across all modalities can do so, and institutions that want one unit for interventional fluoroscopy (for the higher cumulative values) and one unit for the rest of radiology can do so also. The decision on the appropriate unit should normally be taken between the Medical Physics Expert and the Radiology Service Management.

The results of the vote were the following: EFOMP NMOs delegates: 47, 30 votes were received (29 yes and 1 No). 17 delegates did not expressed their votes. Council has now approved this recommendation.

Marco Brambilla
EFOMP Secretary General

Scientific Meetings

6-9 September 2012
3rd Romanian Conference on Medical Physics
Sibiu, Romania
Info: www.ecmp2012.ro

10-12 September 2012
Institute of Physics and Engineering in Medicine (IPEM) Medical Physics and Engineering Conference
Oxford, U.K.
Info:
ww.ipem.ac.uk/Conferencesandevents/mpec/Pages/default.aspx

17-19 September 2012
IMA Conference on Mathematics of Medical Devices and Surgical Procedures University College London
London, UK
Info:
www.ima.org.uk/conferences/conferences_calendar/maths_of_medical_devices_&_surgical_procedures.cfm

26-29 September 2012
Annual Meeting of the German Society of Medical Physics (DGMP)
Jena, Germany
Info: www.conventus.de/dgmp2012/

4-6 October 2012
29th Annual Scientific Meeting of the ESMRMB 2012
Lisbon, Portugal
www.esmrmb.org/index.php?id=/en/index/esmrmb_2012_congress.htm

10-12 October 2012
International Symposium on Biomedical Engineering and Medical Physics
Riga, Latvia
Info: www.bini.rtu.lv/isbemp

18-20 October 2012
6th Conference of the European Federation of Organizations for Medical Physics (EFOMP) and the 11th National Conference of the Bulgarian Society of Biomedical Physics and Engineering (BSBPE) Sofia, Bulgaria.
Info: empec2012.bsbpe.org/

27-31 October 2012
EANM'12 Annual Congress of the European Association of Nuclear Medicine
Milan, Italy
Info: eanm12.eanm.org/

28-31 October 2012
54th ASTRO Annual Meeting
Boston, USA
Info: www.astro.org/Meetings-and-Events/2012-Annual-Meeting/Index.aspx

4-8 November 2012
7th International Conference on 3D Radiation Dosimetry
Sydney, Australia
Info:ic3ddose.org

25-30 November 2012
RSNA Annual Meeting, Radiological Society of North America
Chicago, USA
Info:www.rsna.org/Annual_Meeting.aspx

3-7 December 2012
International Conference on Radiation Protection in Medicine-Setting the Scene for the Next Decade
International Atomic Energy Agency (IAEA)
Bonn, Germany
Info: *www-pub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=41578*

7-11 March 2013
European Congress of Radiology (ECR)
Vienna, Austria
Info: www.myESR.org

1-6 December 2013
RSNA Annual Meeting, Radiological Society of North America
Chicago, USA
Info: www.rsna.org/Annual_Meeting.aspx

27–30 May 2014
The Second International Conference on Radiation and Dosimetry in Various Fields of Research
Nis, Serbia
Info: www.rad2014.elfak.rs