



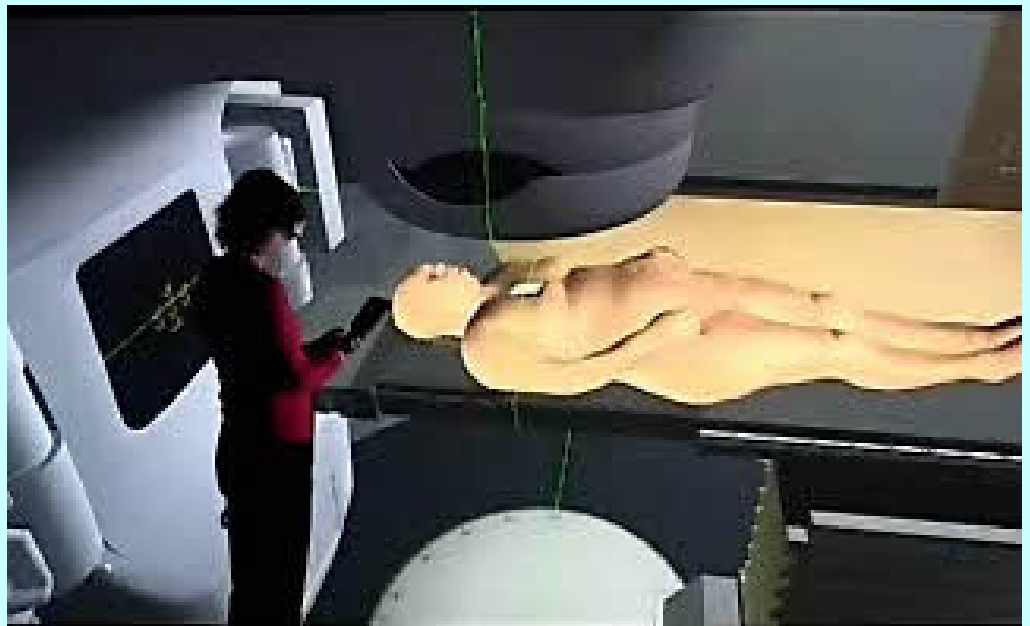
European Medical Physics News

Summer 2010

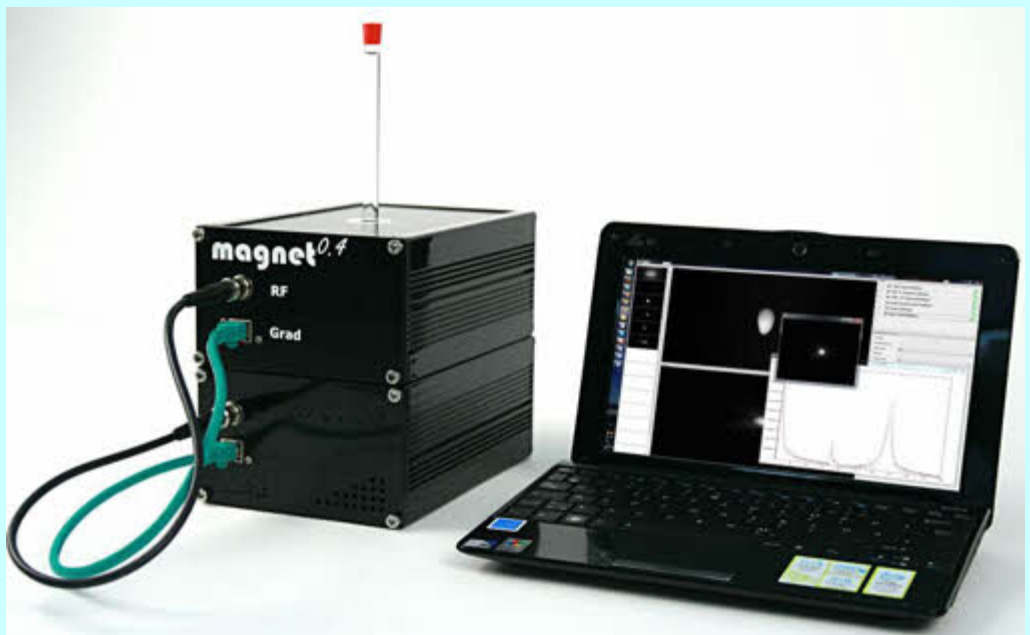
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So **BIG** a linac,
but **virtual**



So **small** an MRI,
but **REAL**



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Editorial

Dear Reader,

Temperatures in Germany have dropped by more than 15 degrees over the last couple of days - a sure reminder that summer does not last forever and we need to get a grip on our summer issue of the news.

The German-Spanish editorial team survived the nerve-wrecking half-finals of the world cup - and democratically accepted the result. Sometimes luck wins over capability ;-).

At the end of the day soccer is just a game though. When it comes to research and development, cooperation should win over competition. Exchange across borders, both country-wise and in the approach of multidisciplinary is a prerequisite of success. One example is the Institute of Applied Medical Engineering (AME) at Aachen/Germany. The report on page 4 gives a glimpse on processes in highly interdisciplinary co-operations of biomedical engineering.

Life-long learning - another key to success. The University of Heidelberg is offering the first online Master course in Medical Physics. It's especially designed to do it 'on the side' - not regarding the energy and efforts putting in but you can do it besides your job - its an extra-occupational course. See a brief introduction on page 7.

We have a first survey from our Science Special Interest Groups (SIGs) under the umbrella of the EFOMP Science Committee. We as EFOMP think it would be a good idea to coordinate some

of the national groups who are doing basically the same - sometimes without knowing of each other. Thanks to Alberto, our Science Chair who is putting a lot of effort into this.

MRI can be made portable! Want to know how? Read the report of the Würzburg MRI group on page 11.

If you can't stand the sight and smell of your linac anymore - virtual reality offers you an alternative within (if you or your boss can spare the money) a cozy lecture theatre. Find out on page 18 how that might work for you.

Well, we hope, you will find the one or the other article that interests you. We are even entering the shaking ground of art this time - with John Mallard, an EFOMP Medal holder becoming a work of art himself. Find out how this happened - on page 9.

And last but not least:

One of our editorial team members changed coordinates lately - locally and professionally. If you had a look at the email address below you realize that Markus Buchgeister and myself are colleagues now - at the Beuth University of Applied Sciences in Berlin. We hope and think that this gives some synergies - the talks over lunch and coffees or the occasional chat in the hallway. Not being at the very heart of routine medical physics anymore we need your support even more though. Please keep that in mind and continue sending us contributions from your fields, experiences and different work environments.

Have a nice summer - or what is left of it !

Your editorial team

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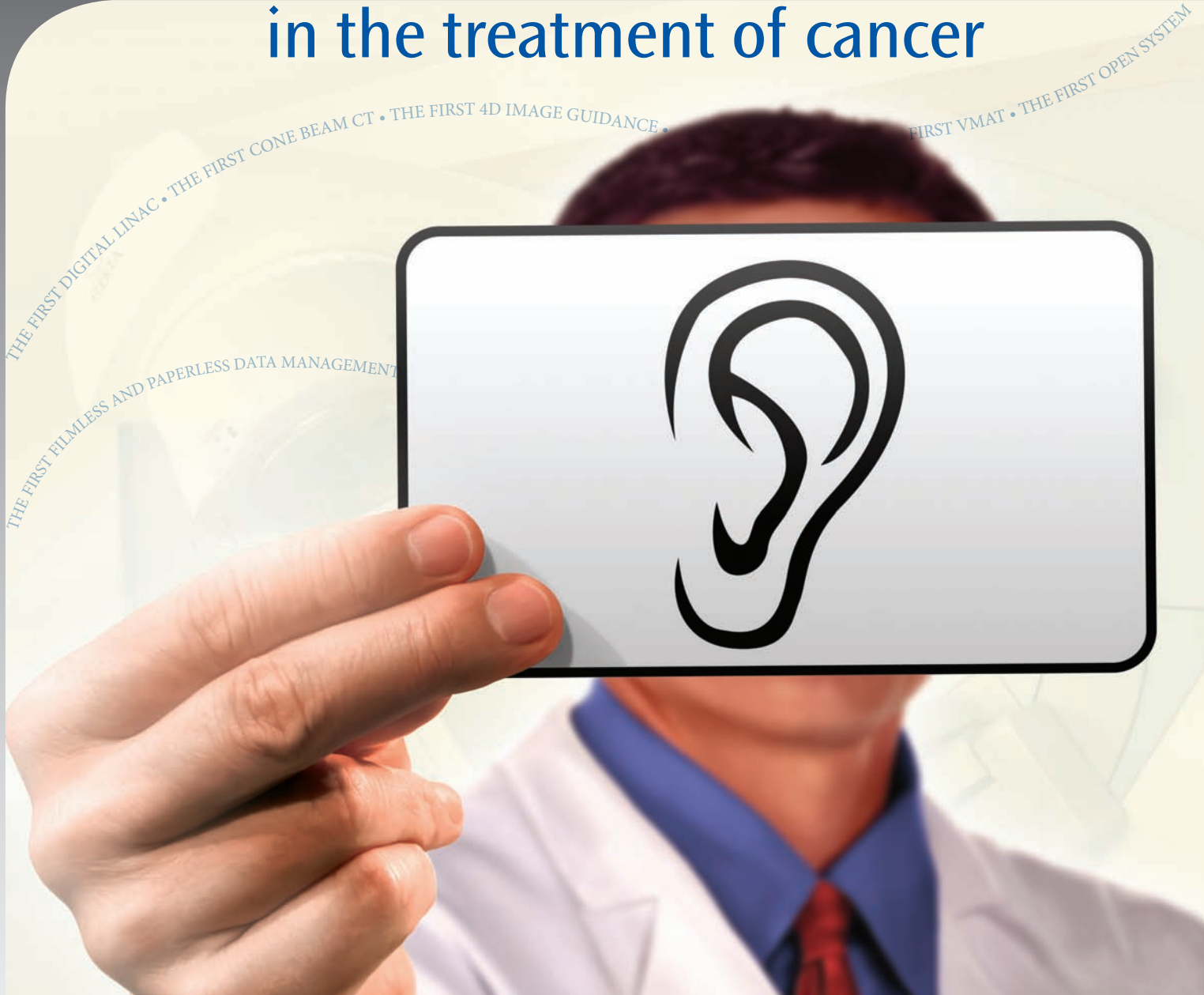
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When working at the riverbanks of multidisciplinary, you have to build bridges in order to avoid getting wet feet

A glimpse on processes in highly interdisciplinary cooperations of biomedical engineering

The Institute of Applied Medical Engineering (AME) is a division of the Helmholtz Institute Aachen which consists of more than 10 professorships which belong to 4 different faculties. In the tradition of the brilliant natural scientist Herman von Helmholtz, more than 120 scientists and researchers work on not less than 50 scientific projects. They collaborate with several other Helmholtz and RWTH Aachen University institutes and with the institutions of the University Hospital, as well as with regional, national and European institutions and companies. As a part of this highly multidisciplinary structure, the Magnetic Nanotechnology (MNT) group spans the field of medicine, engineering, physics and chemistry combining theory, experiment and practical application and, consequently, transfers research to practice.

Different views on one single target

The AME institute is rooted in the Medical Faculty of the RWTH Aachen University. Due to his profound professional qualifications as both a medical doctor and an engineer, Prof. Dr. T. Schmitz-Rode, the director of the AME institute, has an excellent insight in clinical routine and technical frameworks. Together with his very interdisciplinary staff, he established an excellent exchange between lab and clinic working on projects that combine medical knowledge and clinical needs with technological research. New staff is usually recruited from diploma, bachelor or master students. During their thesis, they get the opportunity to work on interdisciplinary projects and to acquire both further qualifications in research and essential key competencies, and, in this way, qualify for a career in academia or industry. The AME institute offers students from classical natural sciences,

mathematics, mechanical engineering, electrical engineering and medicine the possibility to contribute significantly to biomedical engineering projects by introducing their own creative ideas and by supporting basic research. Ideas for new projects and products are frequently developed. More often than not they evolve *en passant*, i.e. while working on other projects or during social talks in the cafeteria. When the respective idea stems from a potential user, this is called a *demandpull* approach, whereas the *technology-push* approach describes an inventive idea that has been elaborated in science labs. Within the MNT group the latter approach was recently successfully used after conducting two diploma theses on vessel flow dynamics of magnetic nanoparticles and on simulations of iron nanoparticle driven hyperthermia treatment in the prostate gland. The involved scientists thought about combining both approaches applying them noninvasively to hollow organs of the intestinal tract.

The impact of soft skills

When thinking of a new project based on preliminary work, it is most important to ask for expertise from all involved disciplines in a first meeting and initiate creative processes to





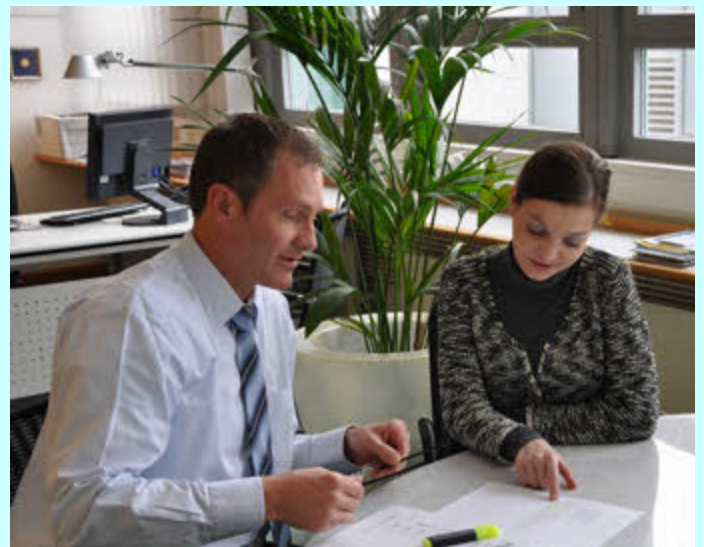
identify new sparkling ideas, threatening icebergs, risky pitfalls and still hidden chances. Fortunately, the variety of accepted and creative group interactions goes far beyond semi-productive discussion rounds or the somewhat old-style brainstorming. With methods such as “Brainwriting”, “4-Corner-Method”, “Walt Disney”, or “Headstand” and others, it is possible to combine effective group work and even productive fun in meetings, even if they last several hours. Two additional aspects must not be forgotten during this important start-up phase: the integration of refreshing breaks is vital, and the integration and interference of third parties, consisting of staff not related to the project and future users, is supportive. These outsiders are likely to provide different views on the subject and, thus, enrich the discussion contributing with new ideas. For the described project of the MNT group, this approach has already been successfully practiced. The key staff has been identified. They established a highly collaborative exchange between natural scientists, engineers and clinicians in well coordinated and harmonised meetings addressing the major challenges of the project. In this way, they systematically developed strategies and realistic solutions, and, in the end, they came up with a roadmap for the upcoming year.

Getting it on the road

Once the goal has been identified, specific targets are defined and broken down to smaller working packages with exact definitions of persons in charge and deadlines. The preparation of each team meeting according to an agenda prevents the meetings from being a waste of time. Meeting rules are set up and agreed on in the take-off meeting, dealing with protocol, delays, responsibilities and publication culture. To-do lists which answer the questions “who”, “what”, “until when” and “reporting whom” guarantee for a strict schedule.

Networking

The good location of Aachen at the borders of Germany to Belgium and The Netherlands brings a lot of advantages. The German-Dutch-Belgian cross-border cooperation provides the premise for high performance medicine and top-level research. This leads to synergy effects and facilitates the development of exiting strengths on each side, for example in the field of cancer treatment. The three university hospitals from Aachen, Maastricht and Liège plan to found a centre of particle therapy as an international platform for oriented radiation therapy and European collaboration in research and education. In this way, a transnational comparison of approaches and concepts of radiation therapy will take place. This association is called PTC-GmbH and will start to build its technical facilities by the end of 2010 in the Science and Business Park of the “cross-border” Avantis campus.



*Prof. Dr. med Dipl.-Ing. Thomas Schmitz-Rode (left), Director of the Institute of Applied Medical Engineering
Ioana Slabu, (right) Scientific Co-Worker
PD. Dr. Martin Baumann, Group Leader Medical Nanotechnology*



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New online Master's program for Medical Physicists

University of Heidelberg offers extra-occupational education

Starting from October 2010, the Medical Faculty at Heidelberg University will launch a new extra-occupational Master of Science program on the subject of "Advanced Physical Methods in Radiotherapy". This course of studies for medical physicists was developed in close collaboration with the Radiological University Hospital and the German Cancer Research Center. The two-year course of studies is directed at graduates of Diploma, Master's and Bachelor's programs in a field of physics or equivalent area who have two years of professional experience as well as the required knowledge in Medical Physics.

The program covers current fields of research and development such as IMRT, IGRT, ART, as well as proton and heavy ion beam therapy, which currently do not play a major role in existing trainings. Within the application of these methods lies a great potential for the accurate treatment of different tumor regions and the minimization of risk for adjacent organs.

The new extra-occupational Master's program comprises four semesters and aims on expanding student's knowledge of medical basics in the fields of anatomy, physiology and medical imaging. It imparts theoretical and practical basics of IMRT, IGRT, ART and particle therapy plus the latest developments in these fields, such as the implementation of the methods for the treatment of patients. It deepens knowledge regarding dosimetry and quality assurance and applies them to advanced methods in radiotherapy. Graduates will be able to take over scientific and clinical duties at modern radiotherapy facilities independently.

In order to make the program available to prospective students throughout Europe, lectures and learning will mostly take place in online-based training. Internships and eight brief attendance phases (three days each) in Heidelberg,

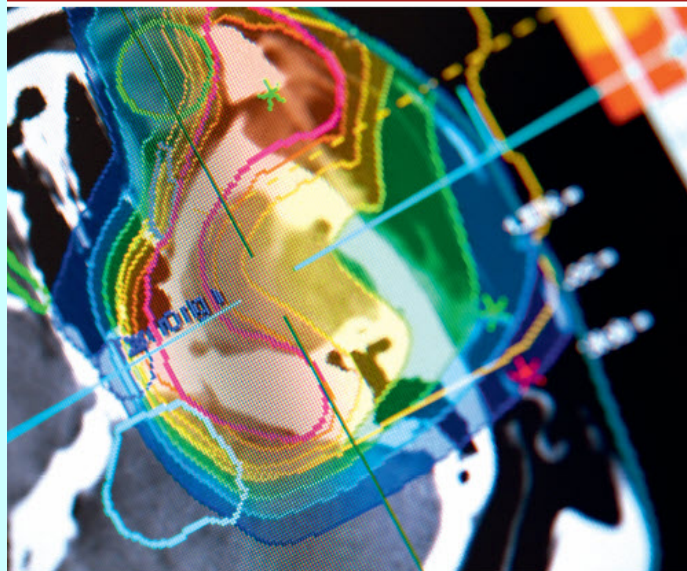
Germany complement the curriculum.

Prof. Dr. Dr. Jürgen Debus (Radiological Hospital of the University of Heidelberg) and Prof. Dr. Wolfgang



The scientific directors:
Prof. Dr. Dr. J. Debus (left) and
Prof. Dr. W. Schlegel (right)

Extra-occupational studies
for Medical Physicists



MASTER ONLINE

ADVANCED PHYSICAL METHODS IN RADIOTHERAPY

Schlegel (DKFZ Heidelberg) are the scientific directors of the program. Lecturers include habilitated medical physicists, experts in the field of medical physics and physicians from the faculty of medicine (Heidelberg University) as well as the German Cancer Research Center. The team is supported by lecturers from international co-operations, especially from the Royal Marsden Hospital London and the Massachusetts General Hospital Boston, Harvard Medical School.

The M.Sc. Advanced Physical Methods in Radiotherapy is open for applications until July 15. Later applications may be accepted after the deadline depending on the number of participants.



The course of studies is financially supported by the Ministry of Science, Research and Art of the German state of Baden-Württemberg as part of the "Master Online" funding program.

For further information please contact:

Dr. Ina Niedermaier
E-Mail: apmr@uni-hd.de

www.apmr.uni-hd.de

ESMRMB-EFOMP activities on Advances in High Field MRI

during IVth European Conference of Medical Physics
at Udine (Italy), 22-25 Sept. 2010

The societies EFOMP and ESMRMB collaborate in order to promote each other's educational and scientific activities and events for the mutual benefit of both organisations and their members. Inside this general strategy, the JOINT ESMRMB-EFOMP Conference in Udine is planned to provide deep insight into various areas of high field MRI techniques and applications for a broad audience. The conference is focused on basic and advanced MRI applications in clinical practice, especially taking into account the most important physical problems at high field strength.

The conference is organised jointly by the European Federation of Organisations for Medical Physics (EFOMP), Italian Association of Medical Physics (AIFM), the European Society for Magnetic Resonance in Medicine and Biology (ESMRMB), the Italian Society of Radiology (SIRM) and the "S. Maria della Misericordia" University Hospital of Udine.

Every day, new advances in the medical use of magnetic resonance are announced, and medical physicists and clinicians are more and more involved in research and clinical activities in this prosperous field. Specific training and platforms for exchange of knowledge and experience are important in medical imaging. So the major aim of the conference in Udine is to share and discuss the cutting edge solutions in the use of high field systems in Europe.

In order to support the training of medical physicists, the AIFM Medical Physics School "Caldirola" (Italy) in collaboration with ESMRMB, will organise a parallel training course on "Advanced Techniques in MR". Theoretical and practical sessions on image and data processing will take place, with the support of the most relevant manufacturers and developers.

A refresher course is dedicated to medical physicists and other health professions as an introduction to the advanced topics of the Conference.

The objectives of the refresher course are:

- a) to provide basic knowledge on MR phenomena
- b) to give an introduction to the scientific sessions of the day
- c) to inform about data processing with hands-on practice evening sessions

Course directors are Alberto Torresin (AIFM, EFOMP) and Klaus Scheffler (ESMRMB).

We have the pleasure to invite you to the European Conference of Medical Physics, focused on the Advances in High Field Magnetic Resonance Imaging.

The objectives of the Conference on Advances are:

Development of methods and technology for high-field MRI (Aimed to cover major methodological and technological advancements) , Recent advancements in MR applications (MRI Applications: from 1.5 Tesla to 7 Tesla), Body applications, Neuroimaging, Quality Assurance, Safety issues and Education and training

Submission of scientific abstracts to the conference is welcome. Please send your abstract for an oral presentation and a poster session as soon as possible to

www.udine2010.fisicamedica.org.



Alberto Torresin,
Chair of EFOMP
Scientific Committee



Fritz Schick,
Membership Officer
of ESMRMB

EFOMP Medal Holder becomes a work of art



A 3D effect is created showing John reaching down from the top to touch Mr Suttie reaching up from the bottom, rather reminiscent of Michelangelo's God creating Adam in the Sistine Chapel. The whole structure is meant to provide a permanent reminder of the pioneering work in MRI carried out at Aberdeen by medical physicists.

Creating the work proved less than straightforward as it proved difficult to get John's bent back into the 3T imager. The first set of images showed him without a head so a second session had to be arranged to put his head back on again!

Also, at a special ceremony, John presented all 30 of his Honours - medals, awards, and plaques - to the President of the Aberdeen Medical-Chirurgical Society as a gift in perpetuity. The Society, which promotes medical education and hosts many scientific meetings in its rooms adjacent to the Medical School, was founded in 1789 and is one of the oldest Medical Societies in the world: it has a collection of portraits, medical artefacts, and archives, which is of national importance.

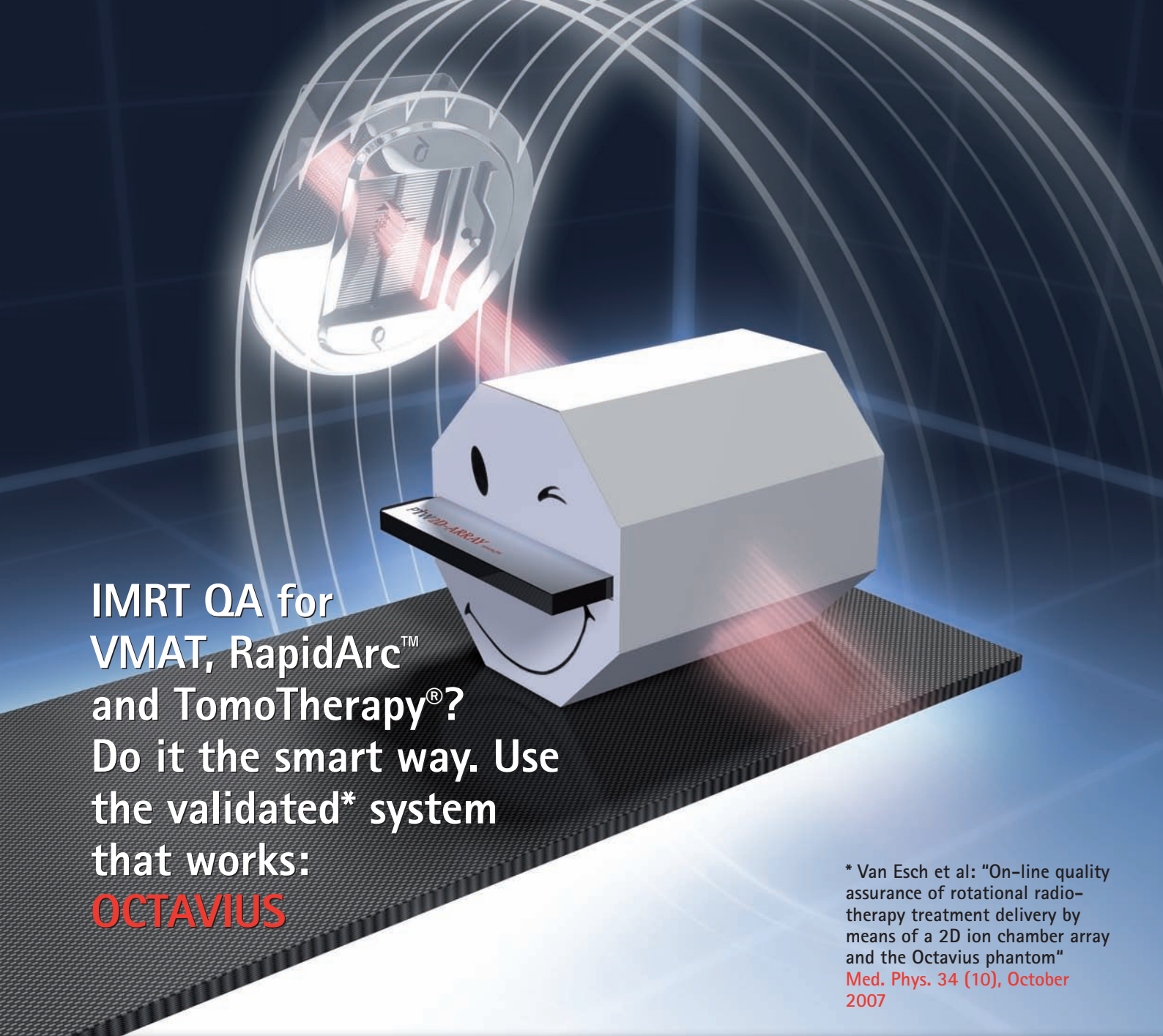
Professor John Mallard, emeritus Professor of Medical Physics at Aberdeen University and EFOMP Medal Holder, has been honoured in a unique and most appropriate way. The atrium of the new Centre for Teaching and Learning in Healthcare, on the site of the Aberdeen Royal Infirmary and University of Aberdeen Medical School, has as its centrepiece a large piece of MRI art, some 19 metres high, created by Marilene Oliver.

The installation consists of a large number of acrylic sheets suspended on stainless steel wires, each sheet imprinted with an MRI transverse section – using a modified IR sequence – across the bodies of John Mallard, and a Mr Suttie who made a very generous donation towards the cost of the building, see photograph.

The 30 awards include Gold Medals from the Royal Society (London), the Royal Society of Edinburgh; and the Royal College of Radiologists, as well as his Order of the British Empire and the EFOMP Medal.



J. R. Mallard and P. F. Sharp



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* Van Esch et al: "On-line quality assurance of rotational radiotherapy treatment delivery by means of a 2D ion chamber array and the Octavius phantom"
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KNOWING WHAT RESPONSIBILITY MEANS

Magnetic resonance imaging made mobile: Gathering information in the lab and outdoors

Magnetic resonance imaging (MRI) has grown in the past decades to a powerful tool for biologists, chemists and clinicians. Well known to the broad public from hospital applications, this technique offers quite more than the possibilities for a confident clinical diagnose. The magnetic resonance signal is very rich in measurable characteristics - including initial strength, frequency of oscillation, and rate of recovery and decay - that reflect the nature of a population of atoms, the structure of their environment, and the way in which the atoms interact with this environment. Furthermore, one can manipulate the external magnetic environment in space and time to modify the NMR signal without significantly affecting material structure.

At the Research Center Magnetic Resonance-Bavaria (MRB), located in Würzburg, Germany,



Figure 1: The mobile MRI-scanner is based on state-of-the-art electronics.

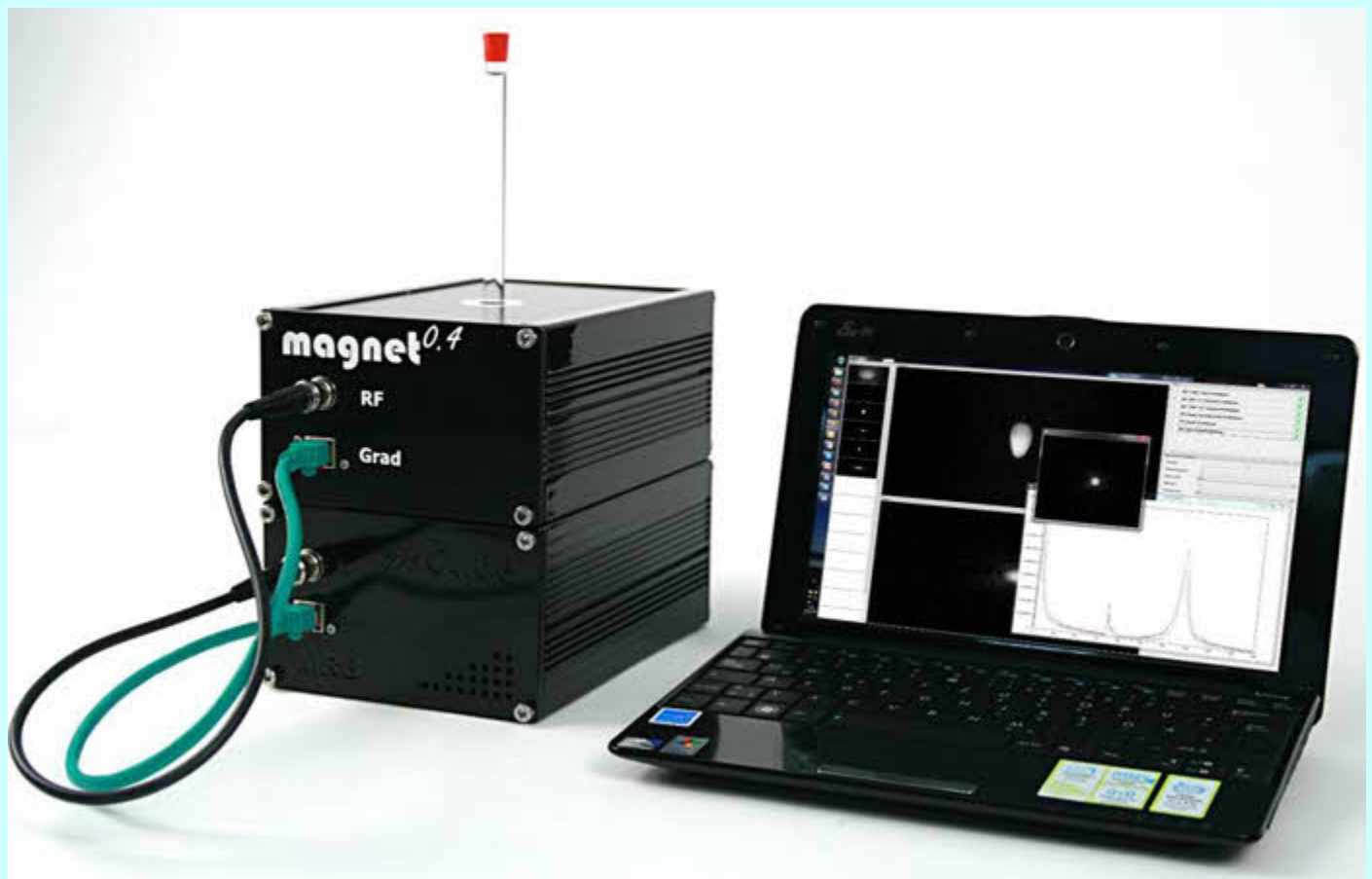


Figure 2: The complete mobile MRI including a 0.4 Tesla magnet weights about 30 kg.



Scientists and electrical Engineers developed a small lightweight but state-of-the-art MR-imager. As typical available MR-scanners are stationary, this new instrument offers new possibility for research and laboratory. One of the major advances of magnetic resonance is the fact, that this a non invasive technique with the total absence of radiation resulting in significantly reduced demands for working conditions. Legal stipulations applying to e.g. x-rays as a for some purposes comparable method, do not apply here.

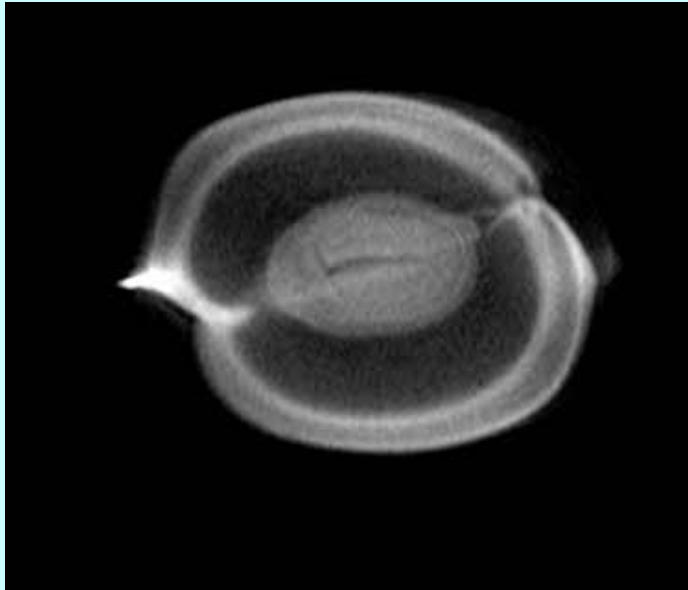


Figure 2: Spin Echo image from phaseolus vulgaris (garden bean) with a resolution of 70µm * 100µm (Matrix=512*512).

With this both laboratory and outdoor suitable scanner one can measure the whole bandwidth of MR-accessible information like anatomy, material parameters for development or quality control, flow and functional parameters.

The first released mobile MRI-scanner is optimized for teaching purposes. It offers access to all relevant parameters of typical measurement, including real-time feedback of the acquired signal. Different to all conventional scanners, signal can be observed at all time including excitation and contrast evolution periods, making the basics of MRI easily interpretable.

Work in progress, and shortly ready to routine, is a small animal magnet system. This allows phenotyping of these animals as well as drug development on-site and therefore can reduce costs

and speed up the development process. In actual research and development processes, all animals and testing objects have to be delivered to measurement sites, where conventional MR-scanners are installed.

Mobile MRI has a long tradition in Würzburg. The first "mobile" Imager was developed 1990, still weighting over 100 kg and limited technical possibilities. However, it offers for the first time the opportunity to image plants in their natural environment. Remembering the difficult job of education, in the following a simple but instructive MRI scanner for teaching purposes have been developed. This equipment, optimized for training purposes, was based on well known analogue electronics and still limited for current laboratory and scientific needs.

The novel mobile MRI-scanner is designed from scratch with state-of-the-art electronics, based on the rapid advances in modern telecommunication. The fully digital control can manage any magnet system from earth-field to 3 Tesla, with timing accuracy in the ns range. And with its weight, 30kg including the magnet system, it can truly be called mobile. Based on customers needs, it can be configured as an on-button instrument for special purposes in daily routine as well as a research instrument with unlimited opportunities of measurement design.

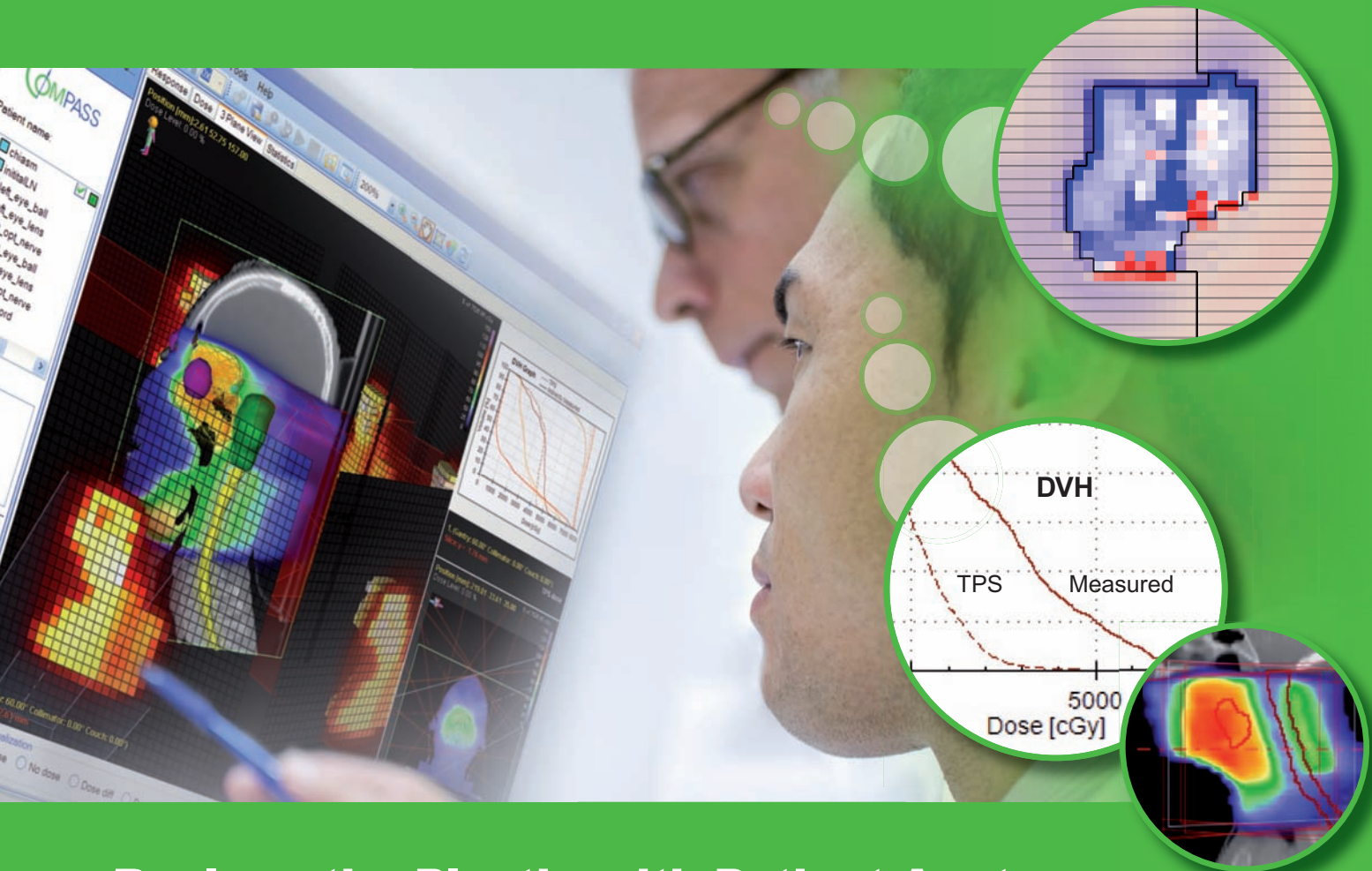
If you are interested in more details, please, do not hesitate to contact the Research Center Magnetic-Resonance-Bavaria (www.mr-bavaria.de).



Florian Fidler
Email: fidler@mr-bavaria.de



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EFOMP inside: The Science Special Interest Groups (SIGs)

The Science Special Interest Groups (SIGs), proposed by the EFOMP evolution documents will operate under the umbrella of the Science Committee. Each SIG will consist of individual Medical Physicists with an interest in the field of each particular SIG.

Within the Science Committee, we worked on a survey of SIGs already existing within the various National Member Organizations (NMOs).

Nine countries have working SIGs with their number varying between one in Norway and 21 in Germany. In toto, we have 72 SIGs with about 1200 active medical physicists.

So far, themes taken into consideration by the various groups are not always well defined in the different areas of work. For example, within the Radiotherapy field of application, the European SIGs are involved in the following areas of interest:

- Total Body irradiation,
- Afterloading-Dosimetry,
- Hyperthermia,
- Clinical solid state dosimetry,
- Proton and heavy ion therapy,
- Physics and Technique of Stereotaxy,
- Radiotherapy,
- IMRT,
- Treatment planning systems,
- IGRT,
- Quality Assurance in Radiotherapy,
- Stereotactic radiotherapy-Recommendations on dosimetry procedures and Quality Control,
- Guidelines for Quality Assurance of Cyberknife and Helical Tomotherapy.

Inside the Radiology field of application, the European SIGs are involved in the following area of interest:

- Quality control of CT-scanners,
- QA in digital radiology,
- Protocols for acceptance tests of diagnostic equipment,
- Quality control in digital mammography,
- Diagnostic Radiology,
- Magnetic Resonance, digital radiology,
- Ultrasound and Non Ionising Radiation.

In the Nuclear Medicine field of application, the European SIGs are involved in the following area of interest:

- In vivo-QA in nuclear medicine,
- Physics in Nuclear Medicine,
- Quality assurance for nuclear medicine instrumentation

Besides these, there are groups that are dealing with particular aspects of our profession such as bioethics or Medical Physics in developing countries.

One result that was not unexpected is the overlap of many groups, i.e. they are basically working on the same issues.

Different groups use web sites to exchange information and groups contacts. Some groups use the general NMO web site resources. Other groups have their own web pages, for examples:

<http://www.strahlenheilkunde.uni-freiburg.de>,

<http://kvist.nrpa.no>,

<http://bvm.uke.uni-hamburg.de>,

<http://www.dgmp.de>.

The web content is generally written in the national language; in this way useful information may circulate with more difficulty at the European level even if the national language makes the scientific exchange easier among people coming from the same cultural tradition.

All national SIGs expressed an interest to coordinate their activity at European level. Therefore EFOMP has made a strategic decision to sponsor the origin of European Special Interest Groups with the aim of fostering communication between groups in Europe working on similar areas of interest and promoting advance in medical physics science and technology at the European level. For those NMOs which do not have any SIGs within their medical physics community EFOMP SIGs will represent a good opportunity to start such activities directly at the European level.

The EFOMP Science Committee has preliminarily identified the following themes as possible subjects of investigation for European SIGs:

- Radiotherapy,
- Mammography,
- Monte Carlo simulation,
- Dose in CT.

Terms of reference and statements of work for each SIG shall be defined in due course.

We think that in the future it will be important for EFOMP to have the capability of publishing rapid communications such as "short reports" or information connected with specific events. We envisage that SIGs could be also useful in supporting such activity, possibly through a special section of the EFOMP website.

We would like to thank everyone involved with the survey: the NMO representative and the



Alberto Torresin
(*Science Committee Chair*)

different SIG coordinators. This work looks promising. A step in the right direction would now be to connect different Medical Physics Communities at the European level.

Collaboration Agreement between the European ALARA Network (EAN) and EFOMP

Since 1980 the ALARA principle has been part of the European Basic Safety Standards and has been progressively introduced into national regulations. In the Euratom Directive 96-29 ALARA was re-emphasised as the cornerstone of the radiological protection system. Throughout the 1980s and early 1990s ALARA was integrated into many organisations radiation protection programmes, particularly in the nuclear industry. However there was still much to be done especially in the non-nuclear industry as well as for the management of internal exposure.

The European ALARA Network

In 1996 the European Commission created a European ALARA Network (EAN) to further specific European research on topics dealing with optimization of all types of occupational exposure, as well as to facilitate the dissemination of good ALARA practices within all sectors of the European industry and research. CEPN (Centre d'étude sur l'Evaluation de la Protection dans le domaine Nucléaire, France) took on the role of the Network Coordinator with NRPB (National Radiological Protection Board, UK) providing support. The key outputs were to be twice yearly Newsletters and an annual themed Workshop that was to provide recommendations to the EC and other stakeholders involved in radiation protection.

For 9 years the European Commission provided funding to enable the Network to establish itself.

In June 2005 the EAN Steering Group unanimously adopted a Cooperation Charter and the Terms and Conditions of the EAN, for defining the new goals and means for the next decade. The Steering Group also decided to set up a legal entity for managing the network coordination and financing in a self sustainable way. This legal entity has been set up in July 2005 as a not for profit association called "Réseau ALARA Européen – European ALARA Network, EAN" registered under the French law.

The original objectives of EAN were:

- To promote the wider and more uniform use of optimisation techniques in the various fields of occupational application in Europe
- To provide a focus and a mechanism for the exchange and dissemination of information from practical experience
- To propose topical issues of interest that should be subject of European meetings, workshops or research projects

These objectives have been progressively expanded. Similarly the scope of the Network, which was originally limited to improving occupational exposure in industry and research only, was expanded; first to include occupational exposure in medical and Naturally Occurring Radioactive Materials (NORM) areas, and then

to other types of exposures as stated in the current signed Terms and Conditions:

- To maintain, enhance and develop competence in radiation protection, with special emphasis on the implementation of the ALARA principle for occupational, public and patients exposures both in routine operations and emergency situations
- To contribute to the harmonisation of radiation protection policies and practices, particularly concerning ALARA, both at regulatory and operational levels within European countries
- To contribute to the integration and effective co-operation of expertise in radiation protection that is available in the European countries
- To cover all types of practices within the different sectors: nuclear, industrial, medical, research, and work with naturally occurring radioactive materials (NORM).
- To cover radiation protection themes relevant to all sectors, as well as themes specific to one or more sector(s).

For more details about the management, participating organisations and the products of EAN, visit its website at <http://www.eu-alara.net>.

The Collaboration Agreement

In December 2009, a collaboration agreement was signed between EAN and EFOMP. Both parties have noticed that they are following common objectives in terms of improving the radiological protection of workers and patients in the medical field within the European countries, and they have agreed to establish a partnership in order to:

- exchange information of interest to both on their activities and on the situation dealing

with optimisation of protection issues with regard to worker and patient exposures in Europe,

- cooperate in a European Medical ALARA Network dealing with workers and patient exposure management, harmonising national radiation protection requirement guidelines for the promotion of good ALARA practices in the medical sector,
- work together in particular in the following areas of activity:

formulation of the ALARA approach to radiation protection culture,

collection and distribution of examples for good ALARA practice in medicine,

organisation of the 13th ALARA Workshop in Oslo in June 2011 which will be devoted to ALARA in medicine.

Both parties agree that they shall find resources for reaching their common objectives.

The parties agree that all common results or recommendations from common actions will be free for use by each of the parties.

The parties agree to inform their members about the projects/actions when needed.

The parties agree to envisage setting up any other common action of interest for both, taking care of any opportunity that should occur.



News about the activities under this collaboration agreement will be posted regularly on the websites of both organisations.

S. Christofides
(EFOMP President)

IV European Conference of Medical Physics on ADVANCES IN HIGH FIELD MAGNETIC RESONANCE IMAGING Udine, Italy 23–25 September 2010



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VERT: An Innovation in Radiotherapy Training

Delivery of Radiotherapy is understood to be a complex, multi-stage, process. It is key that staff receive good quality training in order to deliver it efficiently and in an error free manner. Typically the training received by healthcare professionals is initially classroom based followed by, or integrated with, practical experience gained in clinical departments. However, once qualified the ever developing and changing nature of radiotherapy demands that they continue to train and learn new techniques throughout their careers.

In the classroom phase of initial training, radiotherapy is taught on the 'white board', that is diagrams, photographs and discussions are used to illustrate the processes that are used to treat patients. Following this it becomes necessary to move the students into a clinical environment but it there are difficulties in allocating sufficient time on clinical treatment machines for basic training of students or for staff development when introducing new techniques. Even where time is identified, the student experience is limited by the strict necessities of the clinical situations. For example, when observing a complex case, even though the trainee may not immediately understand the set-up, repeated attempts to explain and demonstrate are not possible given the risk of undermining the patient's confidence in the staff. Furthermore, slowing down the clinical throughput is not a luxury available in most busy departments!

Radiotherapy equipment is expensive and as previously stated the potential for errors occurring in the delivery process are very real and not insignificant. In the unfortunate situation when an error does happen, the patient, trainee and training staff could all potentially suffer a variety of radiation, mechanical and other injuries. This scenario is not dissimilar to a number of other professions or training situations, for example, such as an airline pilot learning to fly a passenger jet. Here a freshman pilot would not be expected to prove he can master the controls and then successfully land a plane with a cabin full of passengers! Furthermore pilots are not expected to rely on some brief instruction from the manufacturer of a new aircraft prior to flying it full of passengers. Of course the airline indus-

try, the military and the space agencies use flight simulators for their training needs for basic instruction and on-going training for new equipment. Finally, it is worth reflecting on one of the greatest rescue missions of all time. When severe equipment failure during the Apollo 13 mission left the crew in mortal danger, the chances of their safe return were certainly increased massively by their colleague running through the 'power-up procedures', in the command module simulator, that were custom designed under duress.



Image taken at Birmingham City University by Matt Wain and courtesy of Christie Digital

The Virtual Environment for Radiotherapy Training (VERT) system [1] is essentially a flight simulator for Radiotherapy trainees. Since 2004, it has been developed to provide a viable alternative to students having to gain experience on clinical equipment. The design team comprised of an experienced clinical Radiotherapy Physicist and two Computer Scientists. The virtual Linac is controlled via actual hand pendants and, using optional touch screen technology, all couch controls can be simulated. The virtual Linac 'does everything' its clinical counterpart 'does' except provide ionising radiation. Treatment plans can be loaded from any commercial treatment planning system using an integrated DICOM interface. Therefore, VERT provides the opportunity to practice controlling the Linac and setting a patient up, and even learning by making mistakes within a totally safe environment without any danger to the patient or any participant. Visualization of the treatment beams, dose distribution, internal anatomy, CT planning data in situ with the patient on the treatment couch within the

simulation provide the trainee with added insights into the complexity of radiotherapy. Features such as the 'Set-up Error' tool allow the trainees and tutors to use the system to explore dosimetric and geometrical consequences of incorrect set-ups and patient mis-alignments. Treatment modalities such as electron treatments, IMRT (including volumetric modulated arc therapy delivery) and IGRT processes have been implemented enabling the system to be used to help experienced professionals learn new techniques. Ongoing developments include simulation of physics dosimetry equipment and simulation of cone beam CT and associated image registration.

The National Radiotherapy Advisory Group (NRAG) in England were persuaded by the above argument for improving trainee experience by introducing simulation-based training and recommended in its 2007 report [2] the adoption of this approach. Subsequently, the Department of Health and National Cancer Action Team accepted their recommendation [3] and launched an 18 month program to roll-out VERT throughout England. This program provided auditorium based simulation VERT facilities at all 10 University providers of the clinical education/ radiotherapy degrees, and meeting room VERT systems at radiotherapy clinics. Details on the implementation of this VERT roll-out project, the use of VERT and student and tutor experiences are reported in the recent report Virtual Environment for Radiotherapy Training (VERT) Final Project Report [4].

Today, VERT is in use at over 60 institutions worldwide and is being used to teach the complex theoretical concepts of radiotherapy, the principles of treatment planning and treatment delivery.

References

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[3] Cancer Reform Strategy, NHS, 2007. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_081006

[4] Virtual Environment for Radiotherapy Training (VERT) Final Project Report, project leads Appleyard R and Coleman L. doc-lib.sor.org/listtitles/title/vert

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www.udine2010.fisicamedica.org

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