AFOMP Newsletter

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Asia-Oceania Federation of Organizations for Medical Physics

Australia • Bangladesh • China • Hong Kong • India • Indonesia • Japan • Korea • Malaysia •Mongolia Nepal • New Zealand • Pakistan •Philippines • Singapore • Taiwan • Thailand • Vietnam

Vol.8 No.02– December 2016

From the desk of editor

Let me "***wish you all very happy, healthy and prosperous New Year 2017***". I am happy to bring out the December 2016 issue of AFOMP newsletter, the 7th newsletter after I took over as Editor AFOMP newsletter in December 2013. In last three years with support of all of you, I have tried to improve the contents and quality of articles/material in the newsletter. I take the opportunity to thank all the contributors for making the newsletter more useful.

In this issue of newsletter we have New Year message from AFOMP President Prof. Tae-Suk-Suh, an article by Prof. Franco Milano on "**Role of Medical Physicist Organization in Nuclear and Radiological Emergencies**" in addition a very informative article title "**Enhancing Medical Physics Education with Collaborative Teaching-** ***Mission, Model, and Materials***" from Prof. Perry Sprawls, article from Prof. Arun Chougule titled "**Contribution of ICTP to Medical Physics for Developing Countries** "and Dr. Eva Bezak's article "**Applications of Timepix Radiation Detector in Radiation Therapy**"

Hope you will find the newsletter readable and useful. I look forward for your valuable feedback for improving the newsletter as there is scope for it.

Once again I wish you very happy New Year 2017 and look forward to have you in Jaipur, Pink City of India for 17th AOCMP during 4th-7th November 2017 (www.aocmp-ampicon2017.org)

With good wishes to all

Prof. Arun Chougule
Editor, AFOMP Newsletter
Vice President, AFOMP

Prof. Dr.Arun Chougule

INSIDE THIS ISSUE

WELCOME TO PINK CITY JAIPUR

17th Asia-Oceania Congress of Medical Physics "AOCMP - 2017"
In conjunction with
38th Annual Conference of Association of Medical Physicists of India "AMPICON - 2017"

4th - 7th November 2017
Jaipur, India

Organised by
Department of Radiological Physics, SMS Medical College, Jaipur ,India
Under the auspices of
Asia Oceania Federation of Medical Physics (AFOMP) &
Association of Medical Physicist of India (AMPI)

"Advances in Medical Physics: Shaping the Future of Modern Healthcare"

Visit us at:
www.aocmp-ampicon2017.org

AOCMP - 2017

AMPICON - 2017

Prof. Arun Chougule, Org. Chairman

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AFOMP PRESIDENTIAL MESSAGE

Prof. Tae Suk Suh

Dept. of Biomedical Eng., College of Medicine, The Catholic University of Korea, Seoul Korea

I am pleased to greet all of medical physicists in Asia-Pacific regions as a President of the Asia–Oceania Federation of Organization for Medical Physics (AFOMP). I would also like to thank AFOMP members for choosing me as a President of AFOMP for the period of 2015-2018. The former Presidents and many medical physicists of AFOMP have made great efforts for the development of medical physics in Asia-Pacific region, since the first founding of (AFOMP), which was formed to act as one of the regional branches of the International Organization of Medical Physics (IOMP) in 2001, similar to the EFOMP.

The formation of AFOMP aims to provide a solid platform for closer and mutual support among its member organizations, particularly in the promotion of education and training, standard of practice, and professional status of the medical physicists in its affiliated regions. Furthermore, AFOMP aims to facilitate and encourage cross-regional collaboration and interaction on every aspect of medical physics. Many activities have been organized by AFOMP.

One major role of AFOMP is to hold the Asia–Oceania Congress of Medical Physics (AOCMP) every year. The AOCMP has been held 15 times since the first one, which was held in Bangkok, Thailand in 2001. AFOMP have developed the AFOMP policy statement. Five AFOMP policy statements have been developed thus far. Some of them were published in the Australasian Journal of Physics & Engineering Science in Medicine (APESM), which is one of the AFOMP official journals. The first issue of the AFOMP newsletter was published as an e-version in December 2007. The format and contents of the AFOMP newsletter have been improved by a new editor, Prof. Arun Chougule who has been in appointment since 2013. The AFOMP website was initially developed in 2007, improved several times, and, recently, newly designed by a professional company, making it ready for use. There are three journals, which were officially endorsed by AFOMP: the Biomedical Imaging and Interventional Journal (BIIJ), Australasian Physics & Engineering Science in Medicine (APESM), and Radiological Physics and Technology (RPT).

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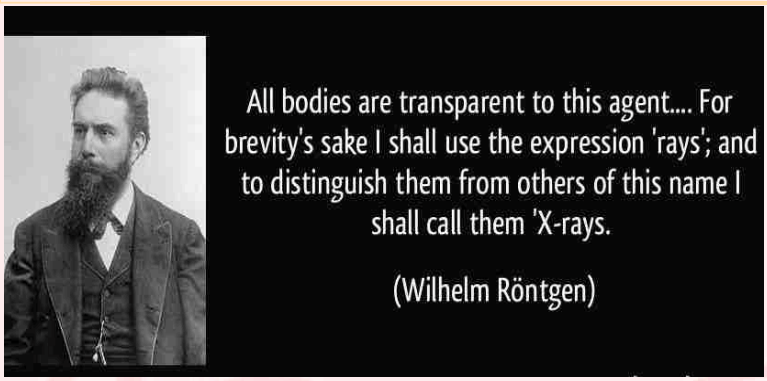
In addition, AFOMP have activities in collaboration with international bodies such as IOMP, IAEA, WHO, etc.

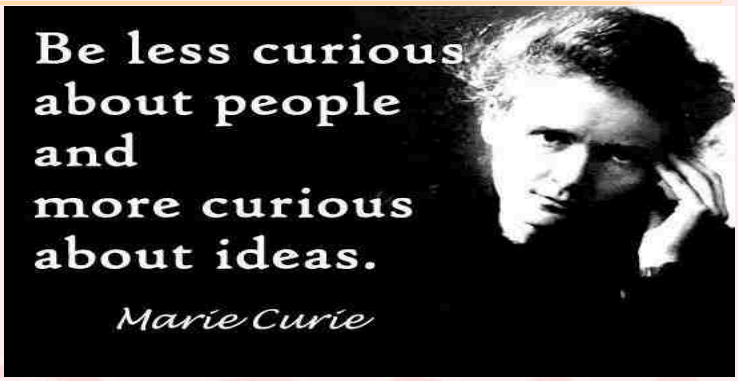
Asia-Oceania has a diverse cultural, social, educational, and economical background. There is a shortage of medical physicists worldwide, especially in the Asia region. The reason for this is there are fewer education and training programs for medical physicists in Asia. The most difficult part of medical physics is in the area of clinical training. Therefore, there are fewer qualified medical physicists. The lack of recognition of medical physics standards of practice is a common issue in many Asian countries. Most of the Asian countries do not have accreditation or certification systems for medical physicists. The role and status of medical physicists in the AFOMP region has gradually improved as can be seen by its increasing recognition in societies. However, neither the governments nor the public has yet recognized the importance of medical physics and the necessity for accreditation. I believe that a well-prepared strategy and a strong action plan are crucial for the AFOMP to move forward. Steps will be taken to solve the relevant issues within the AFOMP. The AFOMP will help build a strong relationship between other sub-regional organizations in the Asia-Oceania region and international bodies such as the IOMP, IAEA, WHO, etc. to share the problems and solve them together.

Finally, I thank all of you once again for your great contribution to the medical physics community. I would also like to take this opportunity to express my many thanks to volunteers who have made and will continue to make sincere efforts for the development of medical physics in Asia-Pacific region.

Thanks to you all.

Prof. Tae Suk Suh,
President of AFOMP





Enhancing Medical Physics Education with Collaborative Teaching *-Mission, Model, and Materials*

Prof. **Perry Sprawls, Ph.D., FAAPM, FACR, FIOMP**

Emory University School of Medicine, Atlanta, USA Sprawls Educational Foundation, www.sprawls.org

The continuing developments in medical imaging technology and methods and the availability in virtually all countries of the world carries with it a critical need for expanding clinical medical physics education in order to maximize the performance and safety of imaging procedures. The internet and the World Wide Web is providing the infrastructure to support educational activities to meet these needs, including the process of *collaborative teaching*.

The Mission

The mission and two specific goals of collaborative teaching are to contribute to more *effective medical physics knowledge* for all medical professionals involved with radiology and medical imaging procedures and to provide medical physics teachers in all countries of the world with resources to help them work at a higher professional and intellectual level.

Medical imaging, or diagnostic radiology, is a major component of modern medicine with its complementary modalities including digital radiography, advancing methods for mammography, ultrasound, CT, MRI, and radionuclide imaging including PET. With these increasing capabilities there is increased complexity in the operation and performance of the clinical procedures that requires a clinical staff with extensive knowledge of the physics in order to optimize the procedures with respect to image quality and other factors including radiation dose to patients.

This advanced knowledge of applied clinical physics is needed by radiologists who have responsibility for procedures, technologists who perform procedures, and clinical medical physicists who function both as members of the imaging team and as the major educators for all.

A significant element of the mission is to utilize the scientific and clinical experience developed within a major medical university and clinical organization to support the educational programs in institutions around the world.

The Model

Let's begin with these perspectives and definitions of two terms that are fundamental to advancing the educational process, *learning* and *teaching*. Learning is the process of building *knowledge structures* in the brain. Teaching is the processes of helping someone build knowledge structures. Teaching as we use it here is not just the transfer of information from one brain to another, from teacher to student. Collaborative teaching is the process where two or more teachers work together to help students/learners build high-effective knowledge structures. This is being achieved through the web-based *collaborative*

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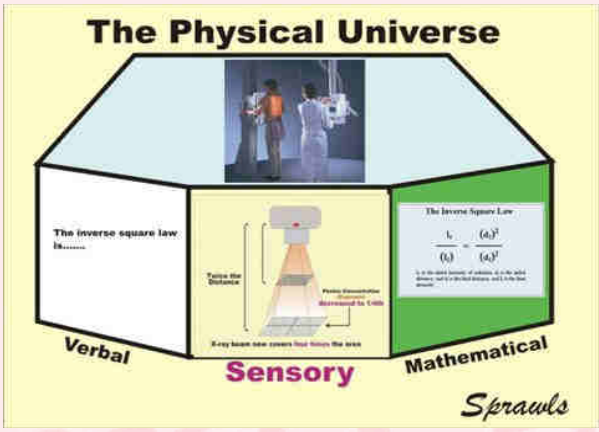
teaching network that connects local teachers anywhere in the world with the experienced clinical medical physicist and educator, the resource teacher.

The great value of collaborative teaching is that both the local medical physics educator/teacher and the resource teacher are contributing to enhanced medical physics education on a global basis. A fundamental issue, and the challenge, is producing the specific *type of physics knowledge* that is needed in the practice of radiology and medical imaging.

Effective Medical Physics Knowledge Structures

Fundamental to the success of collaborative teaching and impact on global health is the development of *effective knowledge structures*. Our knowledge of physics is actually a mental representation of the physical universe in which we live. Here our interest is on the area of medical physics and specifically medical physics relating to radiology and medical imaging. Knowledge consists of a complex network or structure of various elements with two categories being symbolic (words and mathematical symbols) and sensory (especially visual images). The organization of these elements forms a higher level of knowledge including *facts* and *concepts*. Each type of knowledge has its value that relates to the actions and functions that the learner/student is expected to perform. Here we make the distinction between performing well and getting high scores on tests and examinations and applying physics knowledge to optimize medical imaging procedures with respect to image quality and radiation dose--very different requirements. A good example that we use here is the spreading and decreasing concentration of an x-ray beam that we all know as the "inverse-square" effect or law. Knowledge of this can be in three different forms as illustrated below.



The representation of the inverse-square effect using symbols, either verbal or mathematical, has

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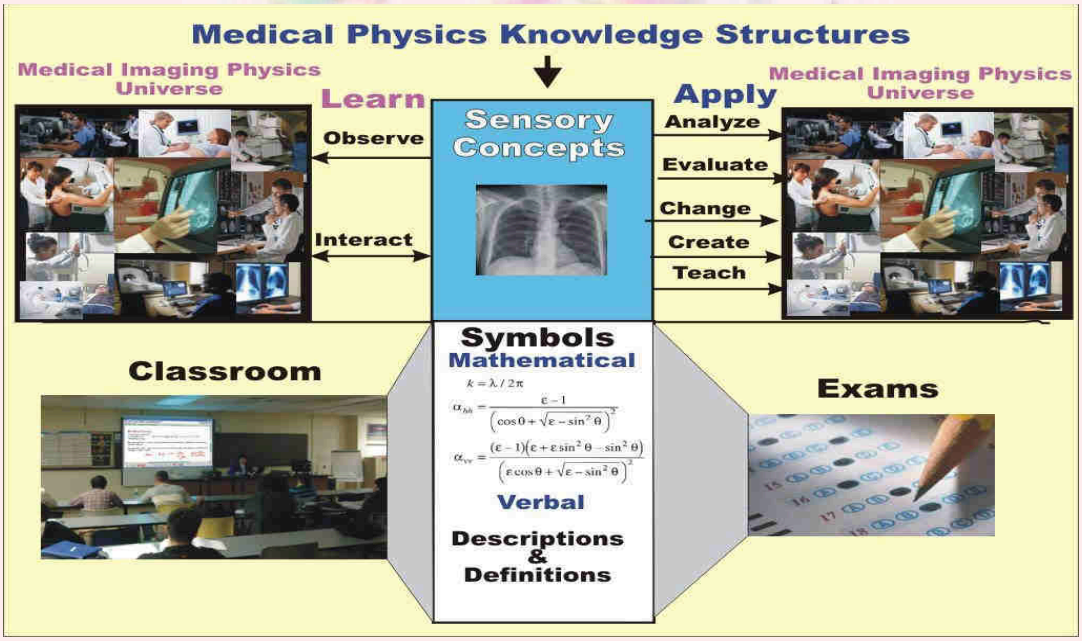
applications. The definitions and equations can be memorized and used to answer questions and solve problems on tests and examinations. It does not provide for the visualization of the process and the formation of a good conceptual knowledge that can be used in understanding and applying in clinical imaging and medical physics activities.

Much of our knowledge of the physical universe, that is physics, is developed by our direct sensory observations, interactions, and experiences. This is the natural way of learning and continues constantly. Within our minds we all have an extensive knowledge structure consisting of visual images, sounds, tastes, etc. As we continue with these ongoing experiences *concepts* are formed that can be considered as a true understanding of the various aspects of the physical universe. Concepts are much more than just remembered images. They include the characteristics and relationships of the various elements and objectives and how they fit into the overall physical universe.

The significance of conceptual knowledge, especially of medical physics, is this: it is what *connects learning to action* and the ability to perform functions like evaluating medical image quality and optimizing imaging procedures as illustrated below.



A major challenge in medical physics education is helping our learner/students develop high-level conceptual knowledge that will prepare them for clinical medical physics activities. This is different from, and often in addition to, knowledge preparing for tests and examinations.

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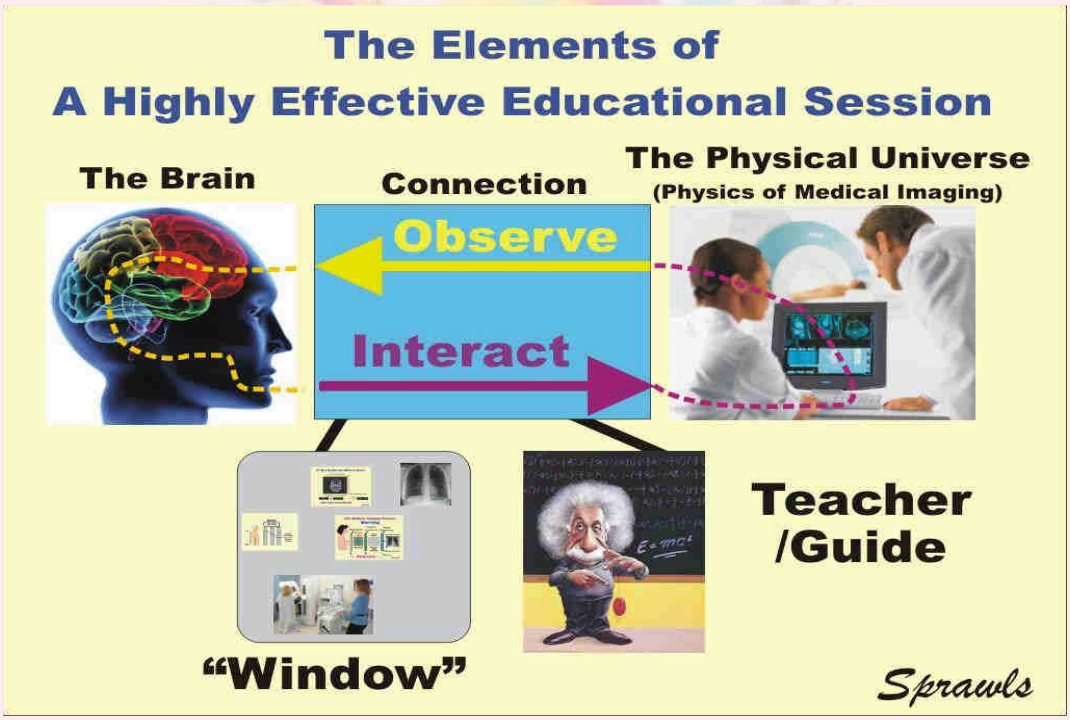
The challenge involves two conflicting characteristics of learning activities; *effectiveness* and *efficiency*. The *effectiveness* of a learning activity is its ability to develop the type of knowledge that supports specific functions, for example optimizing image quality for specific clinical procedures. The *efficiency* of a learning activity is determined by the efforts and expense required to produce it.

An *effective* knowledge structure for applied clinical physics consists of concepts that can be developed through guided experience in an actual clinical environment. For example, the physics learner/student working along with the clinical staff performing CT procedures, and being guided by an experienced medical physicist. The obvious problem is this is not *efficient* for several reasons including access to the clinical activity and the one-on-one guidance by an experienced medical physicist.

A solution provided by the process of *collaborative teaching* is to use high-quality visuals and images to provide "windows" through which the physics of the clinical procedures can be viewed and interacted with under the direction and guidance of the local medical physics teacher as illustrated below.



The resource teacher with extensive experience, both as a clinical physicist and educator, provided the visuals and other educational resources and the local medical physics teacher, learning facilitator, provided significant contributions to the learning process as illustrated below.

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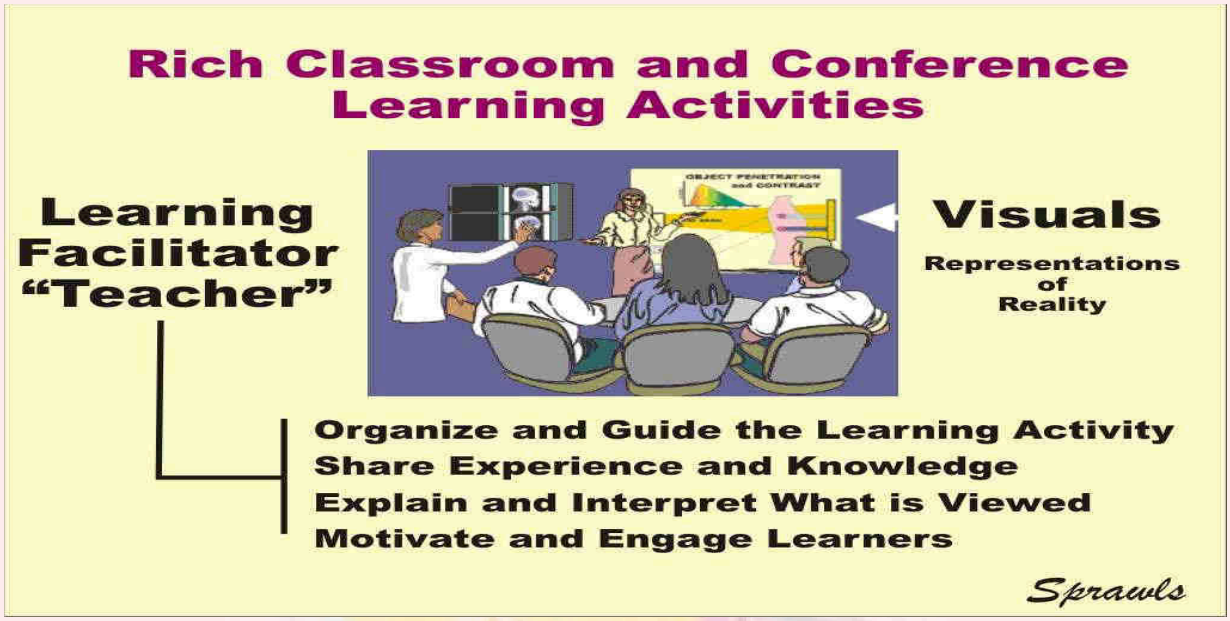
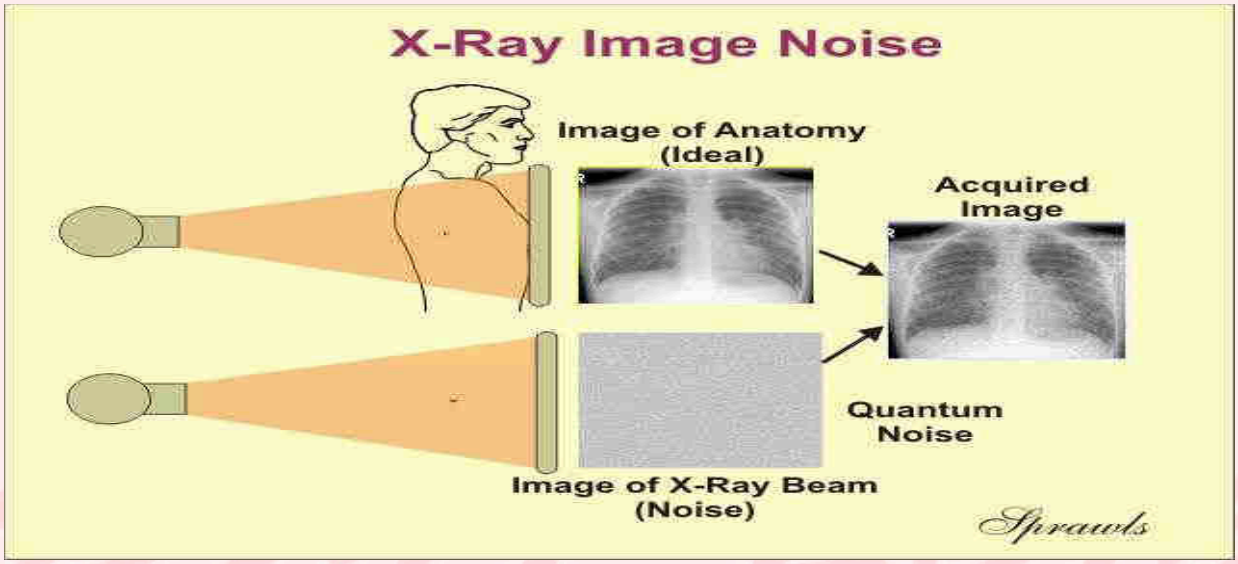


The availability of the resources, especially the visuals, makes it possible for the local educators to devote their efforts to higher levels of professional activities and not having to devote time and effort producing illustrations for their classroom use.

A major challenge in developing effective conceptual knowledge in medical physics is that much of it is invisible. That makes it difficult for learners to visualize items like radiation, electrons, and magnetic fields. This problem is resolved with the availability of high-quality visuals showing the invisible. The example below uses the visualization of the x-ray beam to develop the concept of quantum noise.



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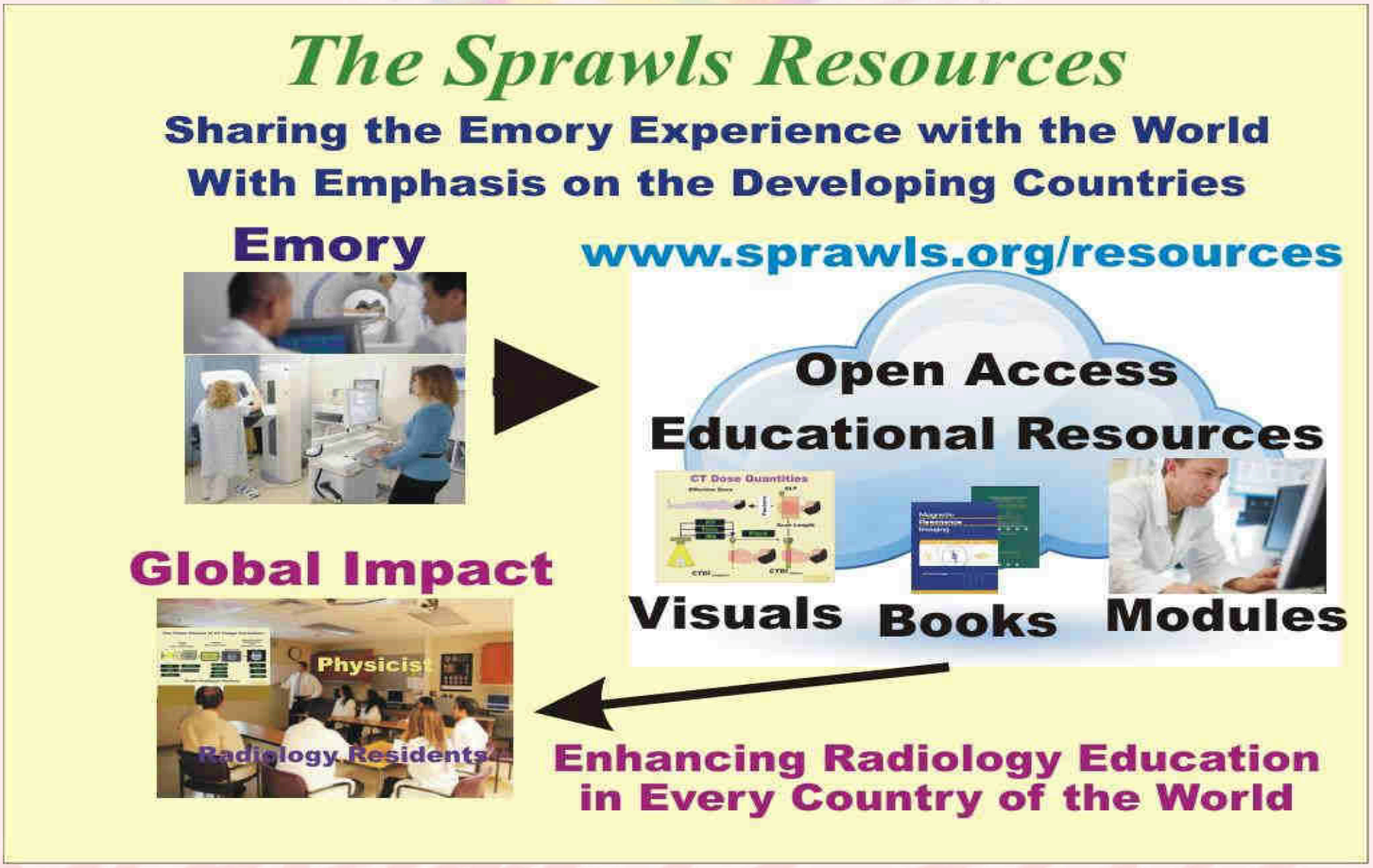
X-ray image noise, specifically quantum noise, is not well understood by many medical imaging professionals. The simple reality is that the quantum noise is just the image of the x-ray beam itself superimposed over the anatomical image as illustrated above. This is just one example of using a visual of the invisible to help the student/learner develop a good effective conceptual knowledge structure of a major image quality characteristic.

The Materials and Resources

The specific materials and resources described here and now available for open and free use by medical physicists in all countries are the *Sprawls Resources* provided by the Sprawls Educational Foundation on the web at www.sprawls.org .

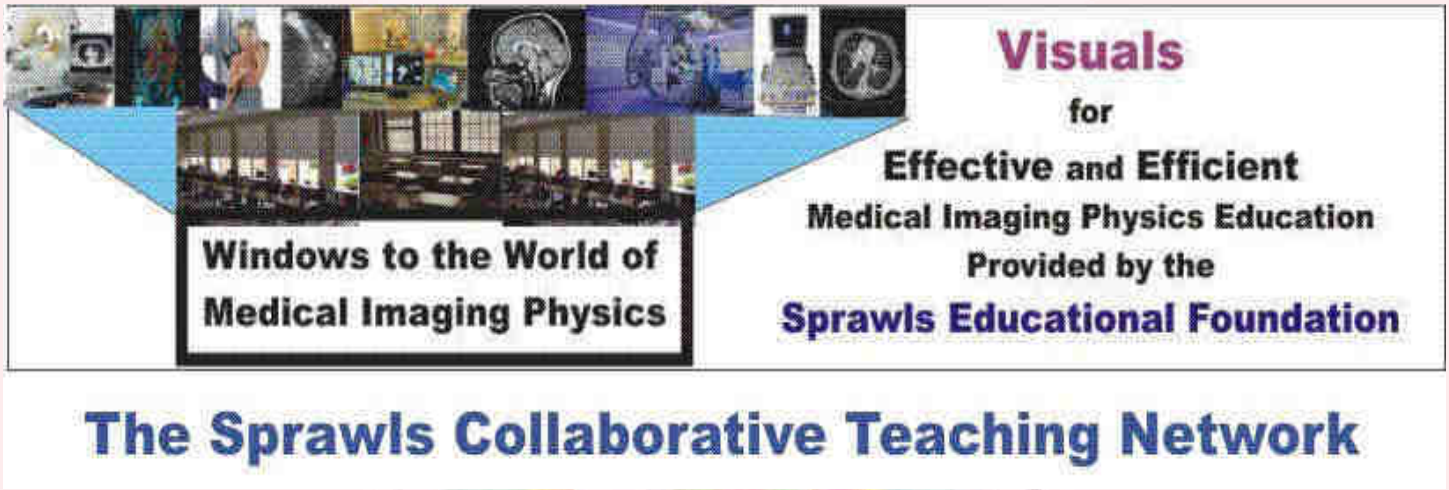
The Sprawls Resources and how they capture the extensive clinical medical physics experience at Emory University School of Medicine, Hospital, and Clinics in Atlanta, and make this available to medical physics educational programs anywhere in the world is illustrated below.



The resources to support collaborative teaching are available through two specific websites. The

comprehensive collection including books, modules, and selected visuals is available at: www.sprawls.org/resources .

The most significant resources to enhance learning activities, especially classroom discussions by local medical physics educators, are visuals that provide "windows" through which the world of medical physics, including the naturally invisible, can be viewed.



This extensive collection of visuals is available through the website: www.sprawls.org/PhysicsWindows .

Summary and Conclusions

Medical physics educators and teachers anywhere in the world now have the opportunity and resources to provide high-quality classroom and conference presentations and discussions to support the effective and safe use of the different medical imaging modalities.

With these resources local medical physicists can function at a higher professional level both as valuable members of the clinical imaging team and especially as educators.

The impact on global health is that now medical physicists in all countries can contribute to higher levels of learning that support clinically applied medical physics.

The great value of collaborative teaching occurs when medical physicists anywhere in the world go to the websites, www.sprawls.org/resources and www.sprawls.org/PhysicsWindows and use the resources, especially the visuals, to enhance their teaching and produce much more effective learning by their students.

Contribution of ICTP to Medical Physics for Developing Countries

Prof. Arun Chougule, Ph. D
Senior Professor & Head Radiological Physics, SMS Medical College & Hospitals, Jaipur, India
Dean, Faculty of Paramedical Sciences, RUHS, President AMPI & Vice President AFOMP

The Abdus Salam International Centre for Theoretical Physics (ICTP) is putting efforts to advance scientific expertise in the developing world for last more than 50 years through cutting edge research, education and training [www.ictp.it]. Although its name contains "theoretical physics", in fact its programmes covers many areas, both of fundamental and applied physical and mathematical sciences.

Today many of the ICTP alumni serve in very high positions as professors, chairpersons of academic departments, directors of research centers in nations throughout the developing world. Many of them have been recognized in their own countries and internationally for their contributions to science and science policy. My association with ICTP started in 2004 as Regular Associate [RA] and I visited ICTP since then as RA and participant in many activities of ICTP. I am immensely benefitted through ICTP activities and widened my horizon in the field of Medical Physics. I own a lot to ICTP for what I am today. I have no hesitation to put on record that the impact of ICTP extends well beyond the Centre's facilities to virtually every corner of the Earth.

To create imprints in future we must know history also and therefore I will talk little about the historical inception of ICTP. ICTP was created in 1964 by the late Nobel Laureate Prof. Abdus Salam with ambitious objectives, few dozen visitors and little money, and has grown consistently through the years and now permanently located in Trieste, Italy. The foundation stone of ICTP was placed on 18 June 1964 and the building was completed in 1968 and since then ICTP has served as a major force in stemming the scientific brain drain from the developing world. Today this institution is truly run by scientists for scientists towards fulfilling the dream and mission its founder Prof. Abdus Salam to Foster the growth of advanced studies and research in physical and mathematical sciences, especially in support of excellence in developing countries. Develop high-level scientific programmes keeping in mind the needs of developing countries, and provide an international forum of scientific contact for scientists from all countries. Conduct research at the highest international standards and maintain a conducive environment of scientific inquiry for the entire ICTP community.

Today ICTP is governed by tripartite agreement between UNESCO, IAEA and Italy. ICTP works with a network of about 400 Italian laboratories to help scientists from developing countries for advanced scientific training in a laboratory setting. ICTP has established several joint master's and doctoral programs with Italian universities to expand educational opportunities for developing world scientists.

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ICTP celebrated its 50 years of success in international scientific cooperation and the promotion of scientific excellence in the developing world during 6 - 9 October 2014. In these 50 years, ICTP has provided scientists from developing countries with countless opportunities to conduct research and to study the latest advances in physics and mathematics. More than 250 distinguished scientists, ministers and others attended the anniversary celebration. Through the adoption of the universal language of science, ICTP has demonstrated the importance of a global approach to address the problems of our time. During its 50 years, ICTP has benefited more 130,000 scientists, although the real impact goes beyond any measurable quantity.

ICTP conducting research at the highest international standards in the area of

1. High Energy, Cosmology and Astroparticle Physics (HECAP),
2. Condensed Matter and Statistical Physics (CMSP),
3. Mathematics (MATH),
4. Earth System Physics (ESP),
5. Applied Physics (AP),
6. Quantitative Life Sciences (QLS) and
7. New Research Areas.

In addition the scientific sections are also responsible for organizing high-level training courses, workshops, conferences and topical meetings throughout the year. These broad seven research area groups are divided into various topics of research. ***Medical Physics is categorized as a part of topic of research in Applied Physics (AP) research group***

ICTP provides Postgraduate Diploma Programme in High Energy Physics, Condensed Matter Physics, Mathematics and Earth System Physics and degree in various subjects in collaboration with various institutes/universities as follows:

PhD in Physics and Mathematics (with SISSA, Politecnico di Torino)

PhD in Earth Science and Fluid Mechanics (with Univ. Trieste, OGS)

Laurea Magistralis in Physics (with Univ. Trieste)

Masters' in Economics (with Collegio Carlo Alberto)

Masters' in Physics of Complex Systems (with SISSA)

Masters' in Medical Physics (with Univ. Trieste)

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Masters' in High Performance Computing (with SISSA)

To strengthen the scientific capability of young scientists and researchers from developing countries ICTP provides **Sandwich Training Educational Programme (STEP)** in Atomic and Nuclear Physics, Nuclear, Isotopes and Laser Techniques, **Synchrotron Radiation and Applications and Medical Radiation Physics.**

The following figures and statistics is sufficient to show contribution of ICTP to science in last 50 years More than 130,000 scientists from 184 countries visited ICTP between 1970 to 2014. Among them, 20 % of ICTP visiting scientists are women. ICTP have 30 staff scientists, 9 staff associates, 78 post docs and long term visitors and 36 consultants making them as a great research hub and place of attraction for scientists all over the world.

For research support, ICTP library holdings include 69,000 books, 267 journal subscriptions and 3246 e-journals.

ICTP organizes more than 60 conferences/ workshops each year.

ICTP welcomes 4,000 to 5,000 scientists from about 130 countries each year.

ICTP attracts an additional 1,000-2,000 scientist in a year through hosted activities.

ICTP has collaboration with more than 400 Italian Research Laboratories, which provide opportunities to scientists from developing countries to work in Italian Research Laboratories through ICTP-TRIL programme.

During the last one year [2015] ICTP beneficiaries are

191 ICTP Associate members from 49 countries, Highest from India (30)

62 TRIL fellows from 29 countries, Highest from India (12)

5670 visitors from 144 nations

51 training activities ON Campus, 21 in Developing countries

11 days average length of visit for conference participants

60 days average for research visitors

58 Postdocs ON Campus (47% from Developing countries)

238 students enrolled in Pre-PhD Educational Programmes

344 scientists engaged in career development programmes

Course participants by research area: CMSP-1259, AP-1039, HECAP-939, ESP-833, MATH-531,

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QLS-141.

21 regional training activities in developing countries

458 participants from India, Highest number in Asia however, Iran is the second one with 283 participants.

1362 female visitors (24%), highest number is from Asia-411, Africa- 173, Latin America- 155, and Eastern Europe 112.

For any research institute the well-established library services is the key in addition to laboratories/ equipment's. To fulfill the needs of the scientists mostly from developing countries where access to international journals is practically nonexistence, ICTP has provide the facility in terms of Marie Curie library. **The library of ICTP collections comprise approx. 70,000 print books and over 3,000 current electronic periodicals, about 200 of which are also received in print. Catalogued e-books are a few hundreds and growing. Several thousand digital documents of different types are in the archives.** ICTP's popular book "One Hundred Reasons to be a Scientist "is translated and available in Urdu, English, Italian, Portuguese, Chinese & Marathi. Further the Marie Curie Library helps libraries in Developing Countries through the donation of scientific books and providing service of e Journals to scientists in least developed countries with current scientific literature.

Further ICTP provides many opportunities to develop scientific career through various schemes and programmes of ICTP such as Associate and Federation schemes and **Training and Research in Italian Laboratories (TRIL)** fellowships. **ICTP's Associate programmes** are especially designed for the promising young scientists who are at early stages of their career. These Associate programmes of ICTP enables individual young scientists from developing country to groom into a good researcher while maintaining a long term formal contact with active participation in scientific activities of ICTP. There is Junior, Regular and Senior Associate programmes which are six years appointment with three time's visit of ICTP, Trieste. The **TRIL Programme offers scientists from developing countries the opportunity to undertake training and research in an Italian laboratory in different branches of the physical sciences which includes Medical Physics.** As per agreement of ICTP with IAEA financial support is provided by the IAEA for research in Atomic and nuclear physics, nuclear isotope and laser techniques, **Synchrotron radiation and medical radiation physics**. The **ICTP- OPEC** Fund for International Development (OFID) provides fellowships for research and training opportunities to PhD students in developing countries

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ICTP provides training and skills to scientists from developing countries. Each year ICTP organizes about 60 (Schools/Colleges/Conferences/Workshops etc.) either on its Trieste premises, or at outside venues, usually in a developing or emerging country. These activities are known as ICTP's Scientific Calendar. Topics for activities are not restricted to theory. The activities are selected on the basis of scientific novelty and impact on the international community, with special emphasis on bringing together scientists from South and North, basic training for younger scientists, and hands-on training for computer-intensive subjects. Scientists and students from all countries that are members of the United Nations, UNESCO or IAEA may attend an ICTP activity.

ICTP activities have no registration fees. A limited number of grants are available to support the attendance of selected participants, with priority given to participants working in a developing country and who are at the early stages of their career.

Medical Physics at ICTP:

Presently the ICTP activities in the area of Medical Physics cover training courses/schools (often in cooperation with the IAEA); they often include practical at the Trieste Hospital and in the ICTP info labs. In addition TRIL and Step-sandwich programme (joint PhD with a home university) are available in medical physics and **ICTP master in medical physics** At ICTP the training activities in **medical physics began in 1983** with efforts of Anna Benini, Sergio Mascarenhas and others with following series of activities in subsequent years

Workshop in Medical Physics, 17 Oct – 4 Nov **1983**

1st workshop on quality control in medical physics x-ray diagnostic equipment 13-18 May **1985**

2nd workshop on quality control in medical physics x-ray diagnostic equipment 14-19 April **1986**

1st Training course in dosimetry and diagnostic radiology, 16-25 March **1994**

2nd training course in dosimetry and diagnostic radiology, 23-27 Oct **1995**

Looking to need of expanding the Medical Physics activity at ICTP so as to start and strengthen the medical physics in developing countries the **series of college on medical physics [CMP] began in 1988 with untiring and devoted efforts by Anna B**enini, John Cameron, Perry Sprawls, Luciano Bertocchi , Slavik Tabakov, Franco Milano and others. To cover selected topics of medical physics the duration was kept of the 3-4 weeks with 50 – 70 participants each [largest participation and longest duration activity as compared to other activities of ICTP] mainly devoted to imaging, radioprotection and dosimetry. Since the

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beginning of CMP in 1988 it is regularly conducted every alternate year. The details are as follows

1. Colleges in Medical Physics [CMP] 10 Oct – 4 Nov, **1988**
2. Colleges in Medical Physics [CMP] 10 Sept.-28 Sept, **1990**
3. **Colleges in Medical Physics [CMP]** 31 Aug –18 Sept **1992**
4. **Colleges in Medical Physics [CMP]** 5 Sept - 23 Sept **1994**
5. **Colleges in Medical Physics [CMP]** 9 Sept -27 Sept **1996**
6. **Colleges in Medical Physics [CMP]** 20 Sept- 15 Oct **1999**
7. **Colleges in Medical Physics [CMP]** 2 Sept -27 Sept **2002**
8. **Colleges in Medical Physics [CMP]** 30 Aug– 22 Sept **2004**
9. **Colleges in Medical Physics [CMP]** 4 Sept – 29 Sept **2006**
10. **Colleges in Medical Physics [CMP]** 1 Sept -19 Sept **2008**
11. **Colleges in Medical Physics [CMP]** 13 Sept– 1 Oct **2010**
12. **Colleges in Medical Physics [CMP]** 10 Sept– 28 Sept **2012**
13. **Colleges in Medical Physics [CMP]** 1 Sept– 19 Sept **2014**
14. **Colleges in Medical Physics [CMP]** 5 Sept -- 23 Sept **2016**

In addition to CMP, ICTP in collaboration and support of IAEA has started conducting advanced schools since 2007 regularly for benefit of medical physicists working in developing counties

1. Joint ICTP-IAEA advanced schools biomedical applications of high-energy beams: 12- 16 Feb. **2007**
2. Joint ICTP-IAEA advanced school nuclear data : medical applications: 12 – 23 Nov **2007**
3. Joint ICTP-IAEA advanced school imaging in advanced radiotherapy techniques: 20-24 Oct **2008**
4. Joint ICTP-IAEA advanced school quality assurance in radiotherapy with emphasis on 3-D treatment planning and conformal radiotherapy: 24 Nov-5 Dec **2008**
5. Joint ICTP-IAEA advanced school Dosimetry and diagnostic radiology and its clinical Implementation: 11 -15 May **2009**
6. Joint ICTP-IAEA advanced school Internal dosimetry for medical physicists specializing in nuclear medicine: 12-16 April **2010**
7. Joint ICTP-IAEA Advanced radiotherapy techniques with emphasis on imaging and treatment planning: 4-8 April **2011**
8. Joint ICTP-IAEA Advanced course on Mammography 3-7 Oct **2011**

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9. Joint ICTP-IAEA advanced school Monte Carlo radiation transport and associated data needs for medical applications: 17- 28 Oct **2011**
10. Joint ICTP-IAEA Training course on radiation protection for patients: 1- 5 Oct. **2012**
11. Joint ICTP-IAEA International training workshop on transitioning from 2d to 3d conformal radiotherapy and IMRT: 10-14 Dec, **2012**
12. Joint ICTP-IAEA advanced training in radiation protection of patients 16-27 Sept **2013**
13. Joint ICTP-IAEA workshop on nuclear data for science and technology: medical applications 30 Sept-2 Oct **2013**
14. Joint ICTP-IAEA workshop on accuracy requirements and uncertainty in radiation therapy, 9-13 Dec. **2013**
15. Joint ICTP-IAEA workshop on determination of uncertainties of measurements in medical radiation dosimetry 9-13 June **2014**
16. Joint ICTP-IAEA Meeting on training in patient safety in radiotherapy 4- 28 Nov **2014**
17. Joint ICTP-IAEA Workshop on Monte Carlo radiation transport and associated data needs for medical applications 16-20 Nov **2015**
18. Joint ICTP-IAEA Workshop on Computed Tomography: Quality Control, Dosimetry and Optimization 2-13 May **2016**
19. Joint ICTP-IAEAWorkshop on Internal Dosimetry for Medical Physicists Specializing in Nuclear Medicine 21-25 Nov **2016**

ICTP also conducting Training Course on Medical Physics for Radiation Therapy: Dosimetry and Treatment Planning for Basic and Advanced Applications since 2013 and has conducted two programmes first during: 25 November – 6 December **2013** and **second** during 13 -24 April **2015.** The **third course** in this series will be organized during 27 March 2017 - 7 April 2017 with theme "**School of Medical Physics for Radiation Therapy: Dosimetry and Treatment Planning for Basic and Advanced Applications**".

In the Golden anniversary year of ICTP in 2014, ICTP took a big step forward and started two degree courses **Masters of Advanced Studies in Medical Physics with University of Trieste** and Masters in High Performance Computing with SISSA for promoting the students from developing countries and low developed countries. This noble step of ICTP of providing degree course of Masters of Advanced Studies in Medical Physics to participants from developing countries in collaboration with University of Trieste

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will definitely help the poor cancer patients from the poorer parts of the world. The first batch of these course awarded degrees in 2016.

ICTP/IAEA Sandwich Training Educational Programme (STEP) in Medical Radiation Physics provides a platform to PhD students to work at ICTP during their PhD in developing countries, having an opportunity to visit ICTP thrice in 6 year study period to carry out research work.

ICTP organizes about 60 School/Colleges/Conferences/Workshops/Meetings every year. In regard to Medical Physics, ICTP hosting 3 to 4 scientific events in the form of Schools, Colleges, Conferences and Workshops, details are available in the scientific calendar year [www.ictp.it]. Since 2014 ICTP and IAEA are organising joint activities largely funded by IAEA and a glimpse of few past and future joint ICTP-IAEA scientific events in Medical Physics are listed below

* Joint ICTP-IAEA Meeting on Training in Patient Safety in Radiotherapy: Nov 2014
* College in Medical Physics (Advances in Medical Imaging Physics to Enhance Healthcare in the Developing Countries): Sept 2014
* School on Medical Physics for Radiation Therapy: Dosimetry and Treatment Planning for Basic and Advanced Applications: Apr 2015
* Joint ICTP-IAEA Workshop on Advances in X-ray Instrumentation for Cultural Heritage Applications: July 2015
* IAEA International School on Radiation Emergency Management: Sept 2015
* Joint ICTP-IAEA Workshop on Transitioning from 2-D Brachytherapy to 3-D High-Dose-Rate Brachytherapy: Nov 2015
* Joint ICTP-IAEA Workshop on Computed Tomography: Quality Control, Dosimetry and Optimization: May 2016
* College on Medical Physics: Enhancing the Role of Physicists in Clinical Medical Imaging: Procedure Optimization, quality Assurance, Risk Management, Training: Sept 2016
* URSI-ICTP School on Radio Physics: Mar 2017
* School of Medical Physics for Radiation Therapy: Dosimetry and Treatment Planning for Basic and Advanced Applications: Mar 2017
* Joint ICTP-IAEA International Workshop on the Implementation of Image Guided Radiotherapy (IGRT): 2017

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In nutshell the contribution of ICTP for growth of Medical physics in developing countries is remarkable and appreciate from my core of my heart. Certainty, these few but firm efforts of ICTP for the upliftment of Medical Physics has helped in the advancement of Medical Physics for shaping the future of modern healthcare in developing countries. In today's era, Medical Physics profession is becoming more demanding with greater skills so as to bring hard core translational research from bench to bed which is made possible by ICTP through several short/long term programmes on hands on training and educational sessions. The scientific programmes of ICTP best suited for serving the purpose. ICTP should look forward to focus more on these kinds of training and educational programmes for the upliftment of Medical Physics, in turn which will result in better medical care of patients around the world.

As President AMPI and Vice President AFOMP I hope and wish that the efforts, initiates taken by ICTP for Medical physics growth are taken to the doors of needy, to improvement of quality of human life in this part of world.

Picture of College of Medical Physics [CMP2016] ICTP participants with Prof. Slavik Tabakov President IOMP and Prof. Arun Chougule Vice President AFOMP in UNESCO Room ,ICTP

Role of Medical Physicist Organization in Nuclear and Radiological Emergencies

Prof. Franco Milano , University of Florence, Italy

Florence, Italy

Recently I was involved in a Tempus EC project named "Human Security (environment, quality of food, public health and society) on Territories Contaminated by Radioactive Agents". The goal of the project was to develop interdisciplinary Master and PhD Programs focused on Human Security of Population which lived on territories suffered by accidents at Nuclear power plants/Nuclear fuel reprocessing plants. In the project these specific specialties were considered: Ecology and Environment Sciences, Food Quality Control and Food Radioactive Contamination, Medicine and Public Health, Political and Social Sciences. EU Universities participated the project together with twelve Universities from Belarus, Ukraine, Russian Federation. The reason was that these Universities are situated in Countries where a large Nuclear Accident happened with heavy consequences on environment and population and the participating Universities have location adjacent or inside the contaminated Regions. Kyshtym (INES 6, 1957), Chernobyl (INES 7, 1986) and Fukushima (INES 7, 2011) accidents have the highest levels in INES (*International Nuclear and radiological Event Scale*) scale [1]. INES uses a numerical rating to explain the significance of events associated with sources of ionizing radiation. In the INES scale events are rated at seven levels: Levels 1–3 are "incidents" and Levels 4–7 "accidents". The scale is designed so that the severity of an event is approximately ten times greater for each increase in level of the scale.

Surely for Mass Media and Public, the catastrophes that happened and can happen in nuclear plants have a tremendous impact but nowadays the problems are not only linked with a remedial action that follow accidents but it is also important to face problems arising from minor incidents whose list is constantly growing (https://en.wikipedia.org/wiki/List_of_civilian_radiation_accidents). Also these minor

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incident can locally produce an exposure and contamination of persons and environment. Since 1995 IAEA established a database incidents of illicit trafficking and other unauthorized activities and events involving nuclear and other radioactive material outside of regulatory control. As of 31 December 2015, the database contained a total of 2889 confirmed incidents (454 incidents involved unauthorized possession and related criminal activities, 762 incidents involved reported theft and loss, 1622 incidents involved other unauthorized activities and events, 71 cases difficult to be classified) (http://www-ns.iaea.org/security/itdb.asp) . There is a widespread use of radioactive materials in education, research, industry where the presence of Medical Physicists is quite common and in medicine the use of radioactive materials surely involves Medical Physicist 's competences and therefore Medical Physicists are in Hospital's staff. On the other side in presence of contamination of persons it is very probable that these persons would be taken to an Hospital for a triage. All these remarks indicate either the Medical Physicist involvement in radiological accident and incident and on the other side a high probability of occurrence of such events. As any other nuclear accident the Fukushima disaster introduces new issues related with a nuclear emergency. It has been recognised that during a nuclear accident involving most of the population it is important to offer a timely and effective public communication. A special nongovernmental Radiological Emergency Assistance Mission went to Japan invited by one of Japan's largest hospital. The mission staff included an emergency physician, a health physicist and a disaster management specialist. Team members conducted investigation in areas affected by the earthquake, tsunami and nuclear accident visiting many cities and towns in the Emergency Evacuation Preparation Zone around the damaged nuclear plant in Fukushima. They had the possibility to visit communities affected by the nuclear accident and met local and central government officials. They exchanged observations, experiences and information with Japanese colleagues and provided radiological information and training to more than 1,100 Japanese hospital and healthcare personnel and first responders. The first "lessons learned" from the accident were published in December 2011[2]. A couple of years later one member of the mission staff published a new paper with additional comments mainly focused on community impacts and responses and public communication issues [3]. In the article's conclusion the Author affirms "*The additional lessons presented in the current article have focused primarily on community impacts and responses, including public communication issues. Topics covered include the problem of communication, myths during a nuclear crisis, the need for multiple redundant mechanisms for reaching the B*

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public, the importance of easy-to-use maps and graphics, the challenges posed by the departure of young families and young professionals (including healthcare professional) and the continuing need for age-appropriate explanations and informational materials for children and youth."

In December 2013 European Council Directive 2013/59/EURATOM "Laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation"was issued (http://eur-lex.europa.eu/LexUriServ/LexUriServ. do?uri=OJ:L: 2014 :013:0001:0073:EN:PDF). European Member States shall adopt laws, regulations and administrative provisions necessary to comply with this Directive within February 2018.

The Directive establishes uniform basic safety standards for the protection of the health of individuals subject to occupational, medical and public exposures against the dangers arising from ionising radiation. This Directive applies also to any planned, existing or emergency exposure situation which involves a risk from exposure to ionising radiation which cannot be disregarded from a radiation protection point of view or with regard to the environment in view of long-term human health protection.

There are many important point related with the Medical Physicist competences and professional activities but here it is important to stress out that in Section 5 on "Emergency Exposure Situation" Articles 97 and 98 introduce respectively an Emergency Management System and an Emergency Preparedness. The introduction into European Country legislation of the concepts included into these two articles will permit to have a chance for Medical Physicists Organization in any European Country to offer their potential complementary roles in nuclear or radiological emergency situations. It is advisable that the Medical Physicist Organization also contribute to the training of other health care professionals and face the communication with population and multimedia. Recently IAEA, whose goal is to promote the safe, secure and peaceful use of nuclear technologies, organized many Workshops on Medical Physics Support for Nuclear or Radiological Emergencies and this action reveals the strong interest of this independent intergovernmental organization, in the United Nations frame, to encourage the embedding of medical physicists in nuclear or radiological emergency and preparedness teams, in cooperation with other professions and organizations. A good example is offered in the U.S.A. by American College of Radiology (ACR), American Association of Physicist in Medicine (AAPM), American Society for Therapeutic Radiology and Oncology (ASTRO) [4]. In conclusion it seems the right time for the International Medical Physicist Community to be involved through the action of the National Medical Physicist Organizations

in this ethical activity in case of a radiological disaster.

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[3] Steven M. Becker, The Fukushima Dai-ichi Accident: Additional Lessons from a Radiological Emergency Assistance Mission, Health Phys, 105(5):455-461; 2013

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IDMP 2016 Celebration and "Conference on Radiation in Healthcare (CRHC2K16)"

SMS Medical College & Hospitals, Jaipur 7th & 8th November 2016

Prof Arun Chougule, Department of Radiological Physics, SMS Medical College, Jaipur

The Department of Radiological Physics, SMS Medical College & Hospitals, Jaipur, India in conjunction with the Association of Medical Physicists of India (AMPI) celebrated the International Day of Medical physics (IDMP) 2016 on the theme, "Education in Medical Physics: the Key to Success" at SMS Hospital Auditorium, Jaipur. A two day "Conference on Radiation in Healthcare (CRHC2K16)" and a public awareness rally were organized to commemorate the birthday of great physicists and Nobel laureates Madame Marie Curie and Bharat Ratna Sir. C. V. Raman. The scientific programme included several lectures on the role of radiation in medicine by eminent speakers across our country. The key highlights and brief description of IDMP celebration and the "Conference on Radiation in Healthcare" are as follows.

The programme started with the video message of Prof. Slavic Tabakov, President of International Organization of Medical Physicists (IOMP) to address the importance of IDMP celebration. The inaugural function started with enchanting *Saraswati* (Goddess of Knowledge & Education) *Vandana* as per the Indian tradition. The Honorable Minister of Health & Medical Education, Govt. of Rajasthan Mr. Rajendra Singh Rathore inaugurated the conference. In his address to the gathering, he explained that Medical Physics Education is important in Medical profession, "as there are about 4 billion radiological procedures per year and more than 6 million patients with cancer treated by radiotherapy". He concluded that, "***without medical physics modern diagnosis and therapy could not function and so quality education in Medical Physics is a must".*** Dr. Arun Chougule, Organizing Chairman, CRHC 2K16, during his inaugural

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address, explained about this year IDMP theme and the revolutions in medicine with Education in Medical Physics. Dr. U. S. Agarwal, Principal& Controller, SMS Medical College & Hospital, Jaipur, during his presidential address, explained the use of radiation in medicine and the role of Medical Physicists in medicine. He concluded his address with a remark that, "Education in Medical Physics is the key to good research in medicine". Dr. S. S. Agarwal, President, Indian Medical Association was the 'Guest of Honour'. The Medical Superintendent, SMS Hospitals, Directors of various healthcare education institutions in and around Jaipur, Head of the departments and faculties of other departments of SMS Medical College and Hospitals, staff and students attended the inaugural function.

A medical radiation poster designing competition was organized with the object of improving awareness among students about the applications of radiation in healthcare and the 1st and 2nd prize winners were awarded with cash prize and certificate of appreciation by the Honorable Minister of Health & Medical Education, Govt. of Rajasthan, Mr. Rajendra Singh Rathore.

About 250 delegates from across the country working in the field of Radiation Oncology, Radiology, and Nuclear Medicine including Medical Physicists, Radiation Oncologists, Radiologists, Nuclear Medicine Physicians, Radiation Technologists, Students and several non-medical Radiation Professionals who are dealing with radiation attended the inaugural ceremony.

Honorable Minister of Health & Medical Education, Govt. of Rajasthan Mr. Rajendra Singh Rathore flagged off the public awareness rally soon after the inaugural ceremony. The rally went to a historical monument of Jaipur, the Albert hall, where visitors from India and abroad frequent. This was a great opportunity to reach out to common public raising awareness about the role of Medical Physics in Healthcare as well as the role of Medical Physicists in Hospitals. Students carried multiple banners, posters and placards which illustrates the applications of physics in different aspects of modern healthcare. More than 400 students actively participated in the rally.

The inaugural function, public awareness rally and all associated activities during the IDMP celebration were well covered by both the printed and the electronic media.

The scientific programme consisted 6 sessions, where eminent faculty in respective fields deliberated on the use of radiation in healthcare. There were 20 invited lectures on various topics of Medical Physics, Radiation Safety, Radiotherapy, Nuclear Medicine and Radio diagnosis. The IDMP best paper award session included 9 oral presentations from young researchers in the fields of Medical Physics,

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Radiotherapy and Basic Sciences. The 1st, 2nd and third prize winners were awarded with cash prize and certificate of appreciation.

In the pleasant evening of the first day, a cultural event also was organized where staff and students performed depicting the colorful cultural heritage of Rajasthan. It was highly appreciated by all delegates. The conference was definitely a good platform for the all-round development of students.

We could wholeheartedly say that the purpose of IDMP celebration initiated by International Organization of Medical Physics (IOMP) is fulfilled in all aspects including awareness about the role and importance of medical physics professionals among fellow medical and nonmedical professionals, students community and general public by the activities organized by the Department of Radiological Physics, SMS Medical College and Hospitals, Jaipur, India. Let the life and work of Madame Curie, Sir. C. V. Raman and Prof. W. C. Roentgen enlighten and inspire us to achieve greater heights.

Photo Gallery

Audience in rapt attention

Inauguration by lighting the lamp

Welcome by Prof. Arun Chougule

IDMP Logo Release

AOCMP-AMPICON2017 Poster Release

Media Briefing by Minister of Health & ME

Public Awareness Rally on occasion of IDMP

Cultural Programme

Dusk Raleigh…See you again!!!

HEARTIEST CONGRATULATIONS
TO
ALL IDMP AWARD 2015-16 WINNERS

FROM
EDITIOR, AFOMP NEWS LETTER

Inaugural award for the International Day of Medical Physics (IDMP Award)

Mr Julio Pinuela, ALFIM 2015
Dr Sandra Guzman, ALFIM 2016
Prof. Tomas Kron, AFOMP, 2015
Prof. Arun Chougule, AFOMP 2016
Dr. Abdalla N. Al -Haj, MEFOMP, 2016
Prof. Anchali Krisanachinda, SEAFOM, 2015
Prof. Kwan Ng, SEAFOM, 2016

The Inaugural IOMP John Mallard Award

Prof. Paul Marsden (IPEM, UK)

The IUPAP Young Scientist Award

Dr Francis Hasford (GHANA Society for Medical Physics)

Elected Fellows of IOMP (FIOMP)

Prof. John Damilakis
Prof. Tomas Kron
Prof. Tae Suk Suh
Dr Virginia Tsapaki

Applications of Timepix Radiation Detector in Radiation Therapy

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[2] School of Physical Sciences, University of Adelaide, Adelaide, Australia
[3] International Centre for Allied Health Evidence, Sansom Insitute, Univeristy of South Australia, Adelaide, Australia
[4] Sansom Insitute for Health Research, University of South Australia, Adelaide, Australia

Timepix

With the rapid development of hadron therapy as well as various particle based targeted therapies, further development in detection and dosimetry technology is required in order to track ionization events on a micrometer or even a nanometer level. In other words, a detector able to monitor individual particle tracks that can also measure the peak energy deposited is needed.

Semiconductor materials have many highly desirable characteristics for charged particle dosimetry, including high density, low energy requirements to produce an electron-hole pair (i.e. high sensitivity and resolution), ability to work in unbiased or biased modes, high efficiency even at low voltage bias, and can measure particle energy and position simultaneously and precisely. Furthermore, they offer high readout speed and have compact designs with both detector and reader generally assembled in a single unit.

Timepix is a radiation detector belonging to the Medipix family of detectors developed under CERN collaborative framework in the last two decades (e.g. Medipix1, Medipix2 and Medipix3) [1, 2]. The various Medipix generations took advantage of novel hybrid semiconductor pixel technologies that had led to the development of efficient low noise radiation detectors with very small pixel size [3-6].

The Timepix detector consists of a semiconductor layer divided into an array of pixels (256 x 256 or 512 x 512 pixels) with individual pixel size of 55 x 55 μm^2 [3, 7]. This array is bump-bonded to a readout ASIC (Application Specific Integrated Circuit) electronic layer (Figure 1). Timepix can be used in three common operation modes: a) Medipix mode to count individual particle hits; b) Time Over Threshold (TOT) mode, recording time over a certain energy threshold allowing direct energy measurement in each pixel; and c) Timepix mode to measure the arrival time of the first particle to the chip [8].

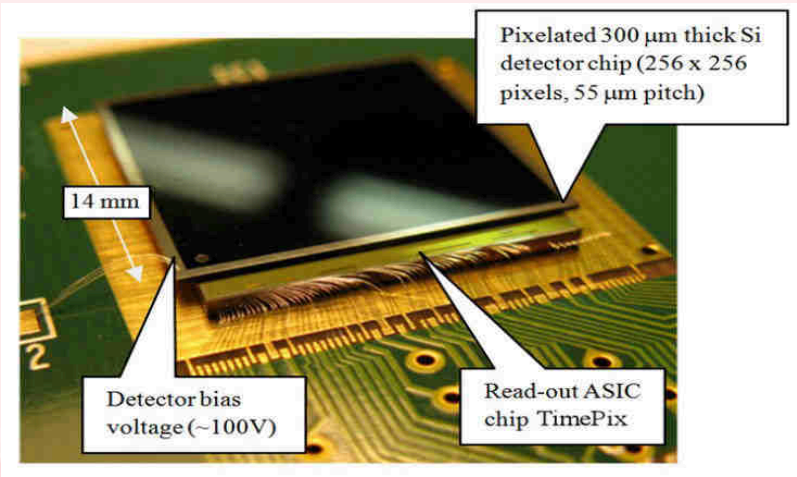

Figure 1: Timepix structure, courtesy of [9].

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Timepix data acquisition is monitored using MS Windows compatible software package Pixelman or Sophy (depending on the manufacturer) when connecting the detector to an integrated USB-based readout interface connected to a PC/notebook [10].

At present, Timepix can be purchased through several companies, including: Amsterdam Scientific Instruments (The Netherlands), X-ray Imaging Europe GmbH (Germany) and X-Ray Imatek (Spain) with cost, on average, for a single Timepix chip of approximately € 10.000.

2. Timepix Applications

Timepix is a versatile device that can be used for experiments and measurements in space physics, nuclear physics, radiotherapy physics, imaging and many others, detecting photons, electrons and heavy particles. Only a selected few studies will be discussed here.

Granja et al. investigated detection and visualization of charged particles using Timepix with the aim to evaluate the spatial, spectral and temporal resolutions of Timepix [10]. Heavy ions with kinetic energies between 4 to 110 MeV and mass range between 3 and 136 emitted from a fission-fragment separator Lohengrin (at the Institute Laue Langevin in Grenoble, France) was used and Timepix was placed on Lohengrin focal plane and the fission fragments were focused to Timepix. Furthermore to case fission, ^{239}Pu and ^{235}U were placed in a neutron flux and then fission products were detected by Timepix.

It was found that the electronic signals from individual pixels were distorted when the energy collected per pixel reached around 1 MeV. This can happen for heavy ions with energies above several tens of MeV, as the detector will gradually saturate with increasing energy. This effect can be managed using a suitable pixel signal baseline, threshold levels, and the bias voltage on the sensor chip. The group concluded that the optimal settings for Timepix were 5 to 10 V bias voltage for the baseline parameter FBK of 128 (this parameter is specified in the data acquisition software) [11]. In addition to detection and visualization of heavy charged particles, Timepix was also used as a stopping or $\Delta E/\Delta x$ detector which means that it can be used in ion therapy applications [10], for example in measurements to determine the radiobiological effectiveness (RBE) of heavy ions.

For neutron detection, Timepix must be combined with a thin plastic scintillator (placed on the Timepix surface). As a result of neutrons hitting the scintillator, protons will be generated and detected by Timepix. This allows Timepix to be used as a spectrometer and a camera of fast neutrons as shown in Figure 2 [12]. This set up enables to measure both energies and directions (i.e. spatial distribution) of fast neutrons.

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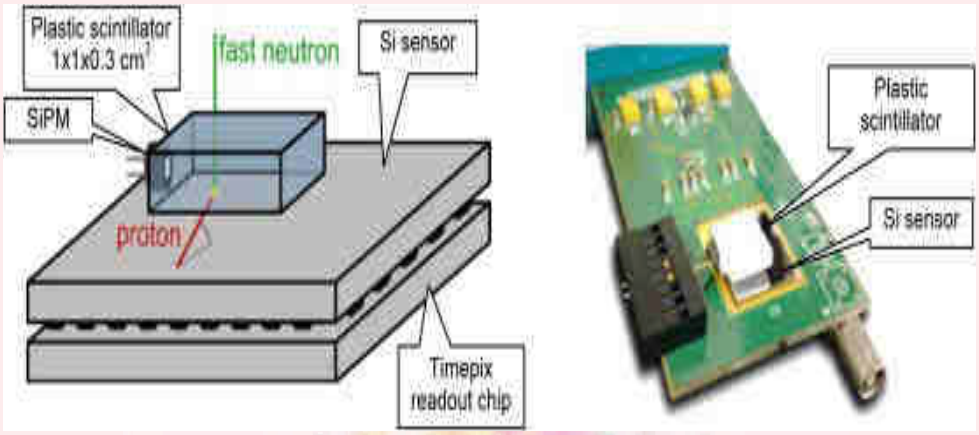

Figure 2: Fast neutron detection using Timepix and scintillator setup, courtesy of [12].

In the work of Opalka et al. from the Heidelberg Ion-Beam Therapy Center (HIT), Germany, Timepix was also applied in hadron therapy [13] to characterize secondary radiations produces by monoenergetic carbon ion beams (250 MeV/u) of 10.1 mm FWHM in a water phantom of 355 × 355 × 420 mm^3 (see Figure 3). The total energy deposited by secondary particles was measured. More than five million events were processed. The study concluded that Timepix allows identification of secondary ions as well as their angular distribution [13].

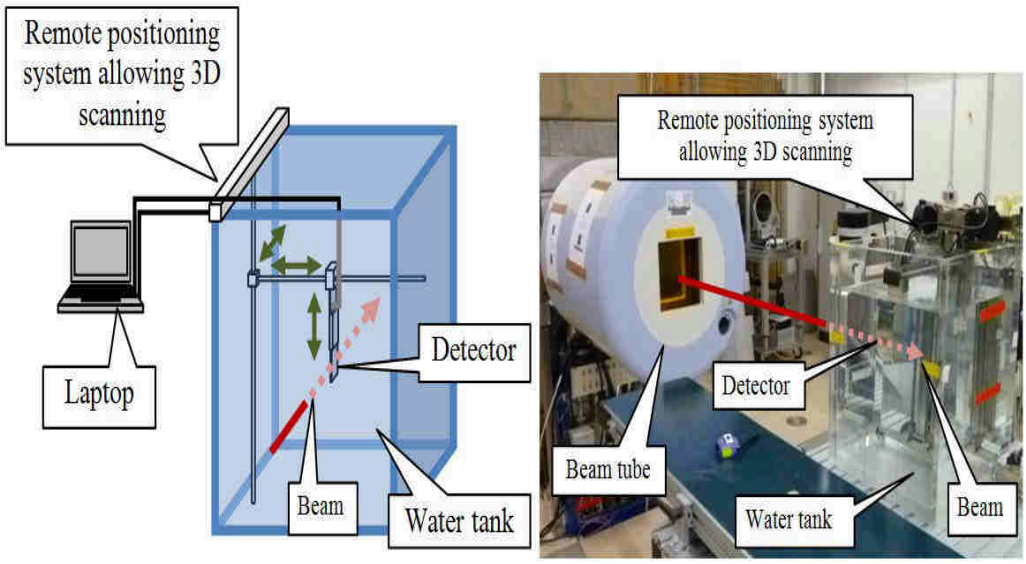

Figure 3: An experimental set up, using Timepix, to measure the distribution of secondary radiations produced by carbon ions in a water tank, courtesy of [13].

Investigation of the heavy ion beam fragmentation during ion beam therapy using Timepix was conducted by Martisikova et al. [14] with the aim to identify secondary ions. These may have different RBE (compared to that of the initial beam) and should be accounted for when calculating the patient dose

and/or associated radiobiological effects. The group tested the Timepix response using proton and carbon ions. The results showed that Timepix was able to identify the primary, scattered as well as secondary ions. Additionally, the group studied the sizes, distribution and energies of charge clusters, detected by Timepix. They found them to be different for protons and carbon ions for the same range in a phantom, confirming that Timepix can be used for spectrometry and for biological effectiveness estimations [14].

Many studies were performed to evaluate Timepix's spatial resolution. One of these studies used alpha particles produced by ^{241}Am decay (alpha particles of 5.5 MeV) penetrating a sample of eight overlapping Mylar foils (4 µm thickness each) [15]. The results demonstrated the possibility to use Timepix to measure the thickness of a thin organic sample with a resolution between 300 to 600 nm. The resolution can be increased by increasing the particle energy [15].

At the other end of radiotherapy applications, Timepix was used in brachytherapy dosimetry [16, 17] when incorporated into a so called BrachyView system. In this work, it was used for real time in-body imaging during prostate brachytherapy to monitor the position of low dose seeds and to quantitatively analyze Timepix's imaging resolution using different thicknesses of tissue-equivalent plastic inserted into a prostate phantom. The study demonstrated the ability of Timepix to identify different soft tissue thicknesses when used with both standard (300 µm) and thick (1 mm) sensor layers. The 1 mm thick sensor resulted in higher detection efficiency and required lower acquisition times compared with the standard 300 µm sensor [17].

3. Timepix in Targeted Alpha Therapy

An autoradiography imaging study to measure radioisotope uptake in targeted alpha therapy (TAT) using the Timepix detector was performed by Al Darwish et al [18]. Lewis Mice with Lewis lung (LL2) tumours were treated with about 18 kBq of 227Th-labelled DAB4 murine monoclonal antibody that bounds to necrotic tumour cells. The rationale is to develop □-particle-mediated bystander of nearby viable tumour cells. To generate more necrotic tumour cells for 227Th-DAB4 binding, some mice also received chemotherapy before injection with Th-227-DAB4. Finally, 5 □m tumour sections were cut from treated mice for autoradiography with Timepix. Each tumour section was mounted onto a slide with front face uncovered to allow emission of □-particles from the tumour section. Variations in tumour uptake of Th-227 labelled RIC based on the necrotic tissue volume [18] were investigated. The □-particle, photon, electron and muon tracks were distinguished by Timepix detector in tumour section images. The results

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(Figure 4) show that the uptake was four times greater when using chemotherapy prior to treatment with Th-227 labelled RIC (p-value of 0.026).

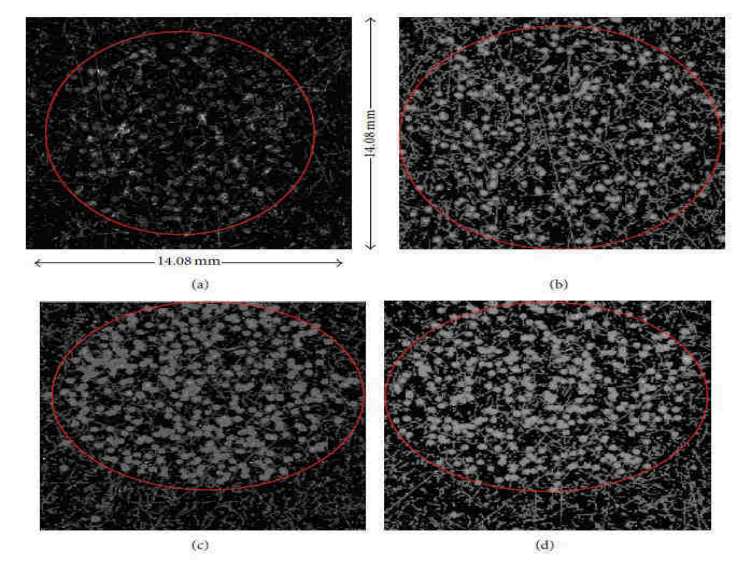

Figure 4: Images of tumour sections from mice treated (a) and (b): with ^{227}Th-DAB4 alone, (c) and (d): with chemotherapy followed by 227Th-DAB4. The red circles represent the approximate tumour section boundaries, courtesy of [18].

In another study Timepix was used as a dosimeter in targeted alpha therapy using Ra-223 and A549 lung carcinoma cells [19]. This work combined Timepix dosimetry with biological dosimetry based on γ-h2ax assay, using a Timepix-based transmission dosimetry design for □-particles (Figure 5). A monolayer of A549 lung carcinoma cells was irradiated with an evaporated Ra-223 source positioned below the cells for ½, 1, 2 or 3 hours. The Timepix detector positioned above the cells was used to determine the number of transmitted alpha particles passing through the A549 cells. Moreover, using γ-H2AX assay, DNA double strand breaks (DSBs) were examined by fluorescence microscopy and compared for irradiated and unirradiated control cells. Approximately 20% of alpha particles were transmitted and detected by Timepix. The equivalent dose delivered to A549 cells was estimated to be approximately 0.66 Gy, 1.32 Gy, 2.53 Gy and 3.96 Gy after ½, 1, 2 and 3 h irradiation, respectively, considering a relative biological effectiveness of alpha particles of 5.5. The absorbed dose was correlated with the observed DNA DSBs as shown in Figure 7 [19].

The study confirmed that the Timepix detector can be used for transmission alpha particle dosimetry. If cross-calibrated using biological dosimetry, this method will give a good indication of the biological

effects of alpha particles.

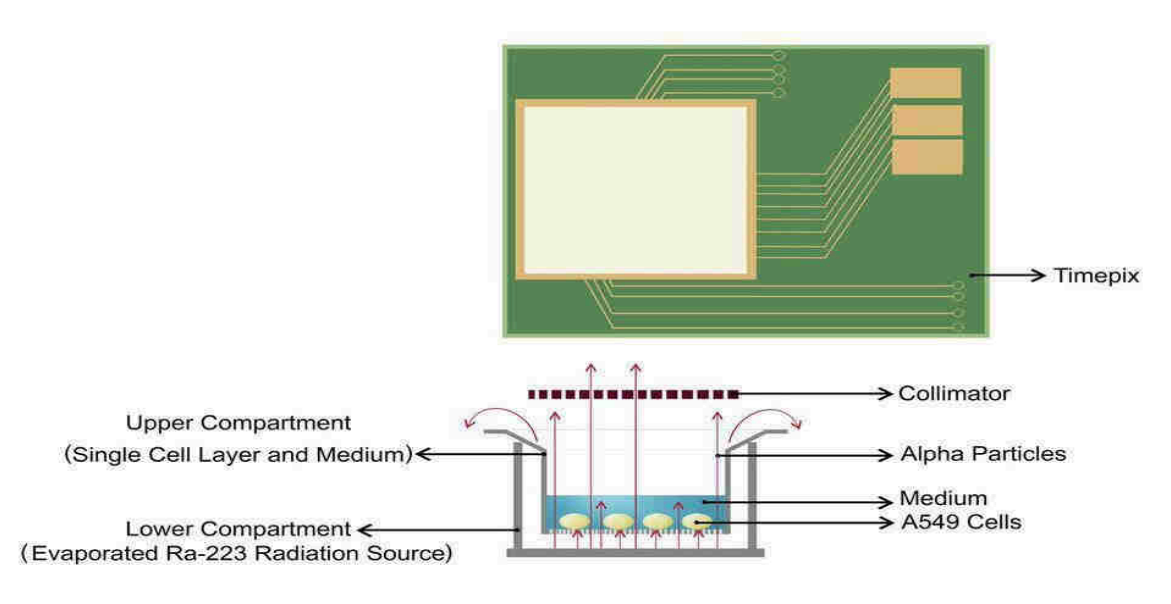

Figure 5. Schematic diagram of the experimental setup showing the transwell system with two compartments: the lower compartment with the evaporated Ra-223 source and the upper compartment with seeded cells (cell diameter: 12.5 µm) and a thin layer of medium (approximately 45 µm height). Transmitted alpha particles are detected by Timepix, courtesy of [19].

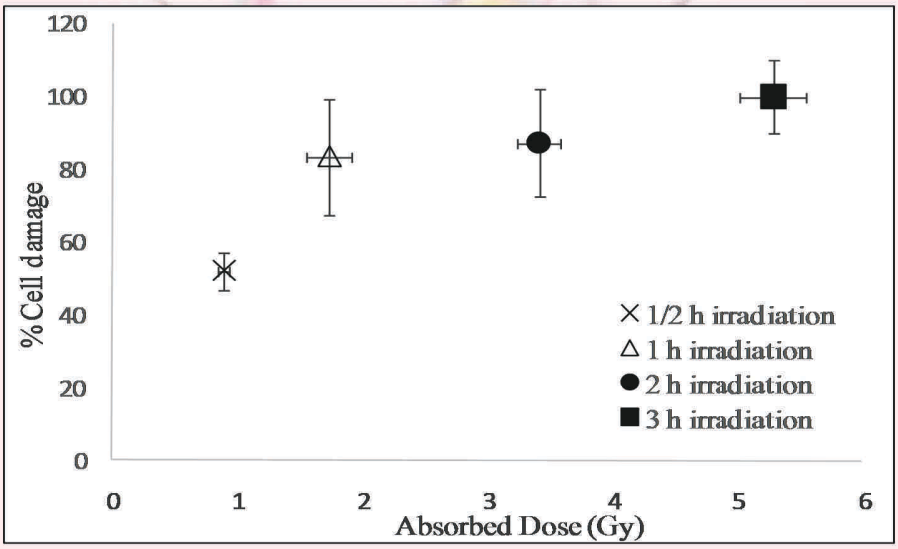

Figure 6. Relationship between the absorbed dose to the cell layer and the media and the % of cell damage ascertained from biological dosimetry (induced by radiation and the environmental factors) after 1/2, 1, 2 and 3 h irradiation times, courtesy of [19].

4. Conclusion

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Timepix is a pixilated semiconductor microdosimeter. Its unique properties offer possibilities for use in a range of fields such as space research, imaging, medicine and radiation protection.

The ability of Timepix to detect photons, neutrons and heavy charge particles as well as to measure their arrival time, energy and number and the ability to produce images of their distributions makes it a highly adaptable detector. Timepix provides an excellent opportunity for researchers in both pure and applied science, including heavy ion radiotherapy and targeted alpha therapy.

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Annual Conference of Bangladesh Society of Radiation Oncologists & Bangladesh Medical Physics Society ACBSROBMPS-2016

Abu Kausar, Joint Secretary
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The Bangladesh Medical Physics Society (BMPS) is a non-profit, non-trade organization primarily engaged in professional, educational and research activities throughout Bangladesh in the field of medical physics including biomedical engineering, especially the application of physics in medical sciences. It represents the interests of Medical Physicists outward and creates education and training possibilities for the scientific rising generation.

For developing the medical physics status nationally and internationally, BMPS performing the several activities since 2009. Actively we are holding EC meeting, quarterly meeting, awareness program in different institutions, monthly report submission, discussion among the members, organizing international conference every three years and many others activities to promote our society. Last month BMPS arranged a annual conference in Dhaka which I mentioned as a short report here.

On 24-25 September 2016, Bangladesh Society of Radiation Oncologists & Bangladesh Medical Physics Society was organized the ***Annual Conference of Bangladesh Society of Radiation Oncologists & Bangladesh Medical Physics Society (ACBSROBMPS-2016).*** The co-organizers who contributed to successful our program are the Department of Medical Physics and Biomedical Engineering (MPBME), Gono Bishwabidyalay; Institute of Nuclear Medical Physics Project (INMP), Bangladesh Atomic Energy Commission (BAEC); Institute of Nuclear Medicine and Allied Sciences (INMAS), Dhaka Medical College Campus; Department of Radiotherapy, Dhaka Medical College Hospital and Bangladesh Society of Radiology and Imaging (BSRI).

The Conference was divided into two parts. On the first day it comprises Inaugural Ceremony, vendor presentation, two scientific parallel sessions, poster session and AGM of BMPS. On the second day, there was a training program entitled on **'Training on TPS & QC of Imaging by Foreign Experts'**. Two German experts both Oncologists and Medical Physicists were conducted the TPS training program. Besides that, QC of imaging training was held in Padma Diagnostic Centre, Dhaka which also guided by the German experts.

Inaugural Ceremony

The conference was inaugurated by the Chief guest Dr. Gowher Rizvi, International Affairs Adviser to the Honourable Prime Minister, Government of the People's Republic of Bangladesh. Prof. Dr. M. Iqbal Arslan, Dean, Faculty of Basic Science and Para clinical Science and Syndicate Member, Bangabandhu

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Sheikh Mujib Medical University (BSMMU) and Dr. Gauranga Chandra Mohanta, Project Director, Higher Education Quality Enhancement Project (HEQEP), UGC was present as a special guest. Dr. med Martina Treiber, Head of the Radiooncology department, caritas clinic, Saarbruecken, Germany.

Prof. Dr. Golam Abu Zakaria, Chairmen and Chief Medical Physicist, Department of Medical Radiation Physics, Gummersbach Hospital, Oberberg clinic teaching hospital, University of Cologne, Germany as a keynote speaker and Prof. Dr. M A Hai as a patron were present in that ceremony.

Figure: Inaugural Ceremony

SCIENTIFIC SESSION

The scientific sessions were divided into vendor presentations, scientific session-I, scientific session-II (parallel session-I), scientific session-II (parallel session-II), and poster session. In vendor presentation, Varian, IBA and Team Best presented their paper about different features of their products. In scientific sessions, more than 25 papers were presented both in oncology, medical physics, nuclear medicine, diagnostic imaging and physics by different presenters. At the end of scientific session was scientific poster session and 16 posters were presented there. Specially, the young scientists were participated this session. In this session, judges selected three best scientific posters among total sixteen posters for the awards. The first, second and third poster awards are sponsored by Varian Medical System, Bangladesh Medical Physics Society (BMPS) and Bangladesh Society of Radiation Oncologists (BSRO) respectively.

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First Award:

Design and construction of Linear Variable Differential Transformer (LVDT); Fazlul Haque Rana; Dept. of Medical Physics & Biomedical Engineering (MPBME), Gono University.

Second Award:

Deep Inspiration Breath Hold Techniques with Homemade LPT system for left breast cancer comparison between 3DCRT and IMRT; Mokhlesur Rahman; M.Sc. Student, MPBME, Gono University.

Third Award:

Deep Inspiration Breath Hold Techniques with Homemade LPT system for left breast cancer using 3DCRT; Md. Hafizur Rahman; MPBME; Gono University.

Annual General Meeting of BMPS

All categoris of BMPS members were present in the AGM-2016. The President, joint secretary, treasurer have discussed the activities and related issues of the last one year. The honorary member and founder member have expressed the future activities and their implementation in AGM. Some new proposal from EC are unanimously accepted by general members.

Training on TPS and QC of Imaging

Training program on TPS conducted by three groups from Bangladesh. In each group one radiation oncologist (RO) and one medical physicist (MP) from Bangladesh discussed our planning process, goals for different types of carcinoma (breast, cervical, prostaste and laryngeal carcinoma).

German experts Dr Martina Treiber, RO and Ms Renate Walter, MP discussed all casses individually with the participants as well as with the planner. It was very interactive learning session between oncologists and medical physicists.

Still now there no established QC protocol in Bangladesh for imaging. On the basis of this, BMPS emphasize in the conference the training on 'Quality Control of Imaging training on Radiography, Fluoroscopy, Mammography and Computed Tomography (CT) which is conducted by two German experts: Mr Daniel Boedeker and Prof Dr G A Zakaria in Padma Diagnostic Center. This is the first time in Bangladesh BMPS has started training program on this issue and consequently will take

necessary steps to establish QC protocols in hospitals through cooperation with the Bangladesh Atomic Energy Commission (BAEC) and Bangladesh Atomic Energy Regulatory Authority (BAERA) and Bangladesh Society of Radiology and Imaging (BSRI).

Figure: Training on TPS

CLOSING CEREMONY

Calendar of Events 2017-18

JANUARY 2017	*13-14 January 2017,* 19th International Conference on Medical Physics, Radiation Protection and Radiobiology, Zurich, Switzerland *26-28 January, 2017* Imaging in Radiotherapy,Prague, Czech Republic *27 January 2017* Estro-Ecco Workshop 1-Towards State of the Art Radiotherapy for every cancer patient what is at stake Amsterdam, the Netherlands, www.eccocongress.org
FEBURARY 2017	*2-4 February 2017* 1st International School of Radiation research(ISSR-2017) Annamalai University, Tamilnadu, India, www. annamalaiuniversity.ac.in *25 February - March 1* Winter Institute of Medical Physics Breckenridge, Colorado,Marc L Ke-ssler, PhD, FAAPM mkessler@med.umich.edu
MARCH 2017	*1 – 5 March 2017* European Congress of Radiology - Vienna Vienna, Austria http://www.myesr.org *10-11 March, 2017* International Conference on Physics in Medicine and Clinical Neuro Electrophy siology (PMCN-2017), Dhaka, Bangladesh www.pmcn2017.info *14-15 March, 2017* Next Gen Immuno-Oncology Congress London, UK *16-18 March, 2017* 6th Ichno (International Conference On Innovative Approaches In Head And Neck Oncology) Barcelona,Spain *27 March – 7 April 2017* ICTP School of Medical Physics for Radiation Therapy: "Dosimetry and Treat-ment Planning for Basic and Advanced Applications Trieste, Italy, http://indico.ictp.it/event/7955

Calendar of Events 2017-18

APRIL 2017	*20 – 22 April 2017* ABS annual meeting 2017 Boston, MA, USA http://americanbrachytherapy.org/meetings/index.cfm#future
MAY 2017	*1 – 2 May 2017* Linac Calibration and Small Fields Dosimetry Course - Wisconsin USA Madison, WI, USA https://uwmrrc.wisc.edu/?q=content/linac-calibration-and-small-field-dosimetry *05-09 May, 2017* ESTRO 36 Vienna, Austria
JUNE 2017	*20 – 23 June 2017* International Conference on Advances in Radiation Oncology (ICARO2) Vienna, Austria http://www.pub.iaea.org/iaeameetings/50815/International Conference on Advances in Radiation Oncology (ICARO2)
AUGUST 2016	29—30 August , 2017 *3rd Medical Physics & Biophysics* London, UK medicalphysics@conferenceseries.net
NOVEMBER 2016	*4– 7 November 2017* 17th Asia-Oceania Congress of Medical Physics "AOCMP - 2017" In conjunction with 38th Annual Conference of Association of Medical Physicists of India "AMPICON - 2017" ,Jaipur, India, www.aocmp-ampicon2017.org *8 - 12 November, 2017* 2nd Indian Cancer Congress 2017 BIEC, Bangalore, www.indiancancercongress2017.com

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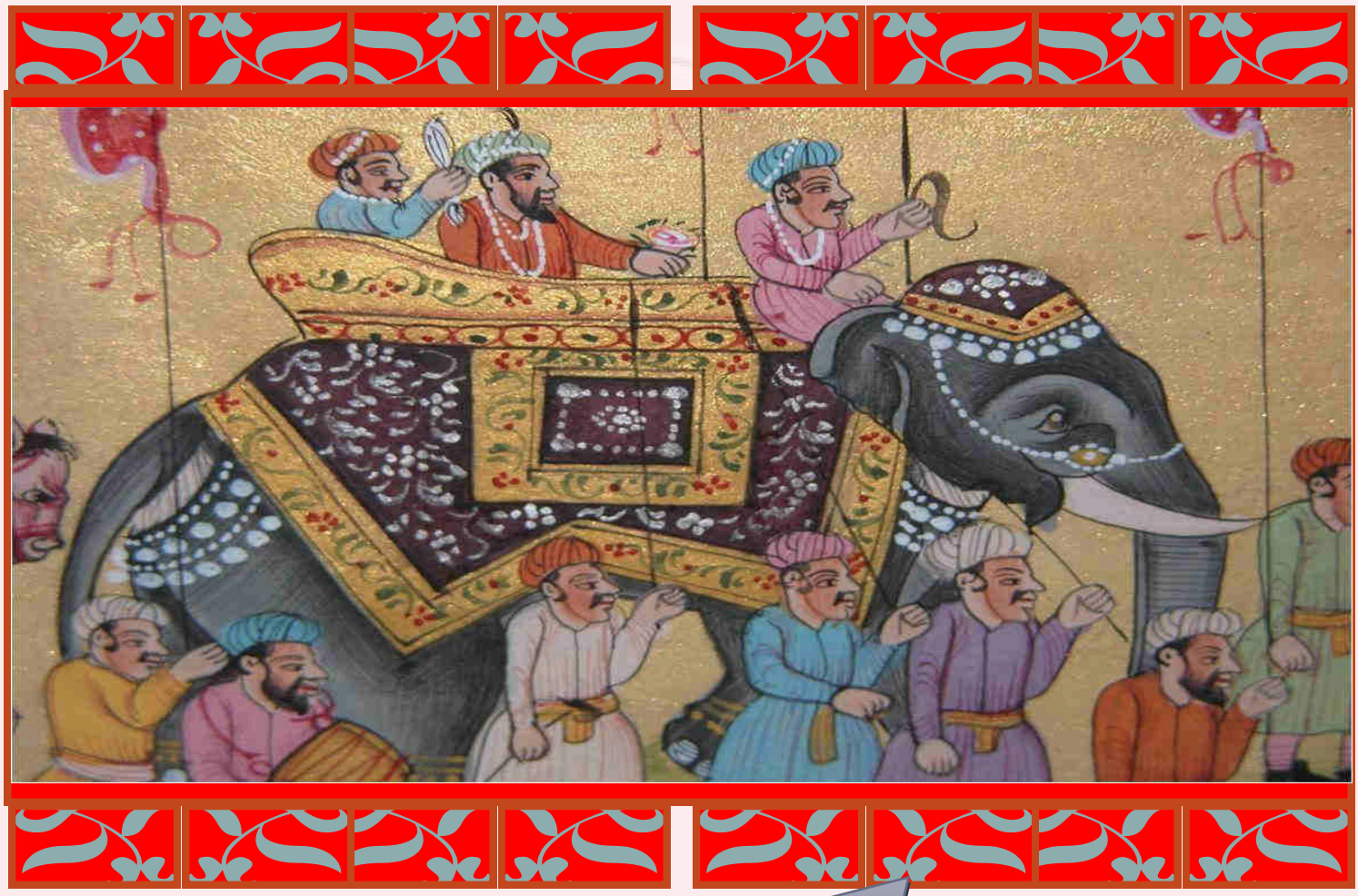

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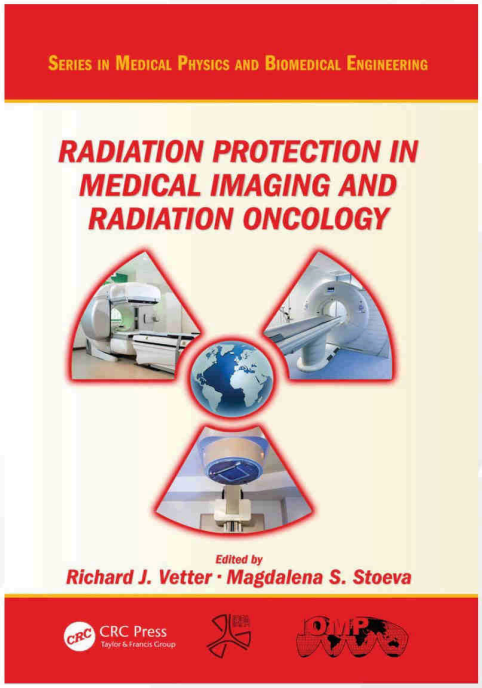

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