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Return to Archive Home Page

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Home Page

EDITORIAL

Welcome to Vol. 19, No. 1 of the IRPS Bulletin - nearly two months behind schedule, but we hope that the delay has only deepened your anticipation (and are, of course, grateful for your patience).

But then perhaps the respite also has given you time to reflect upon directions you would like to see taken by the Bulletin or the overall organization? Maybe you have had a few ideas about roles you could play to extend the reach of the Society, be it with regard to recruitment of new members or technical content of its publications and associated activities? The President's Column for this issue, from Richard Pratt, presents several ideas for involving yourself in current and prospective activities of the Society. We urge you to compare his suggestions with thoughts you might have had already about how you could contribute fruitfully to make the Society more successful and valuable to its membership and society at large. And, please, take him up on the offer to put you in contact with Society resources that could assist with implementing your ideas.

Dr. Pratt's first suggestion concerns contributions to the Bulletin. We are pleased to report that the present issue includes contributions from Oman, Egypt, and the U.S.

In a farewell gesture to 2004, we start off with an article of cultural and historical interest from Sameen Ahmed Khan (MECIT, Sultanate of Oman), concerning anniversaries of three major world centers for physics research : CERN, ICTP and ESRF.

From M.A. Gomaa (AEA, Egypt), we have a collection of abstracts from award-winning papers delivered at the 7th Radiation Physics and Protection Conference, held last November in Ismalia, Egypt. The collection as a whole represents a wide cross section of radiation science, but is particularly notable for consisting entirely of contributions from junior radiation physicists.

Looking forward, from Larry Hudson (NIST, US) we have a short article concerning the upcoming 20th International Conference on X-ray and Inner-shell Processes, to be held this July in Melbourne, Australia.

And, finally, a contribution on computational radiation physics from Paul Bergstrom (NIST, US) that provides a high-level overview of technical articles he expects to publish in forthcoming issues of the Bulletin. Paul's article represents something of a segue, since, as of this issue, he is sharing editorial responsibilities with Larry Hudson and me.

In closing this out, let me emphasize that we would very much appreciate hearing from you. Articles are encouraged, of course, but any suggestions regarding content will be most welcome. I look forward to working with Paul and Larry on the Bulletin and to meeting some of you in Ontario in a few short weeks.

Ron Tosh

Home Page | Next

PRESIDENT'S REPORT

As I wrote in my first Column, we encourage our members both to be active in the affairs of the Society and to recruit more members. You may have your own ideas as to what you would like to do, and I encourage you to contact me at rpratt@pitt.edu to discuss them. But I thought it might also be helpful to give a list of some possible activities.

I've gone back through the Minutes of meetings of our Council, and I give below some activities which have been suggested. If any of these seem possibly interesting to you, please contact me. In many cases there would be a member of Council who has expressed some interest, and who could help you and serve as a resource; I will put you in touch with them.

1. Bulletin: Contributions to this Bulletin are, of course, always welcome. You could contact the Editor directly with contributions or to explore your ideas for contributions. But you could also work with the Editor to solicit contributions in an area of interest to you, as in subject matter or geographical region. One could imagine a theme-oriented issue of the Bulletin. Another possibility would be to serve as Book Review Editor, working to identify books of interest and getting them reviewed.

2. Publicity: We could use someone who would work on the production and distribution of press releases and other publicity related to Society activities. Updating and circulating brochures, flyers, posters, etc. regarding the Society is another possibility, also its emblems and logos.

3. Membership: One could work on recruiting members in a region or developing and implementing strategies for recruitment, for retention, etc.

4. Regional Meetings: One could work to organize regional meetings concerning radiation physics or its subfields. In some cases this could be combined with a meeting of the IRPS Council, utilizing members of the Council as participants in the meeting. The regional meeting in Chengdu, China last November is a recent example, as is the Conference on Accelerators and Radiation Physics Research (in memory of Prof. A. M. Ghose) just held in Kolkata. A series of regional meetings also has been held in Egypt.

5. Resource Book: It has been suggested that the Society could issue or promote Fact Books, Resource Books, Booklets, Textbooks, Data Bases etc. An editor or co-editors could organize any one such enterprise.

6. Liaison: We could use someone who would work at developing the channels of liaison and communication with other international and national organizations, societies, journals, etc.

7. History: Information on the history of the Society and the field could be identified or collected. Accounts (oral or written) could be solicited. Work could be undertaken in organizing and indexing the Archives of the Society (now in the University of Pittsburgh Libraries), as well as in collecting other materials to be added to the Archives.

I hope this list gives you some ideas that you may find interesting, and I will hope to hear from you.

Richard Pratt

MEMBER'S PAPER

2004 - The Year of Jubilees

Fifty Years of CERN
Forty Years of ICTP
Ten Years of ESRF User Operation

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Introduction

Physicists love to celebrate anniversaries. It enables them to get together, to evaluate, reflect and look ahead. The year 2004 provided three anniversaries in a row from the life of institutions. We shall briefly review the origins and achievements of the three institutions: CERN (European Laboratory for Particle Physics, in Geneva, Switzerland), ICTP (Abdus Salam International Centre for Theoretical Physics, in Trieste, Italy), and ESRF (European Synchrotron Radiation Facility, in Grenoble, France).

50 Years of CERN

On 29 September 2004, CERN (the European Laboratory for Particle Physics, in Geneva, Switzerland) celebrated its 50th birthday. The origins of a European laboratory can be traced back to the 1940s. The idea was publicly voiced before the larger scientific community and policymakers by Nobel Laureate Louis de Broglie at the European Cultural Conference held in Lausanne in December 1949. Louis de Broglie proposed setting up a new European laboratory to halt the exodus of physics talent from Europe to North America.

In June 1950 at the UNESCO General Assembly, held in Florence, Italy, the Nobel Laureate Isidor Isaac Rabi put forward a resolution calling on UNESCO (United Nations Educational, Scientific and Cultural Organization) "to assist and encourage the formation and organization of regional centres and laboratories in order to increase and make more fruitful the international collaboration of scientists." The Florence resolution was carried forward with support from many quarters and persuasion in some instances.

The idea of a European laboratory was not readily accepted by all scientists and governments. Specifically, Niels Bohr, James Chadwick, and Hendrik Kramers, some of the most eminent members of the European physics establishment, questioned the practicality of starting a new laboratory from scratch (see ref [1], p. 12). The conventions establishing CERN came into force on 29 September 1954. It was signed by twelve countries then and has twenty member states now: Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland and the United Kingdom.

It was the effort of several scientists and diplomats which made the above possible.

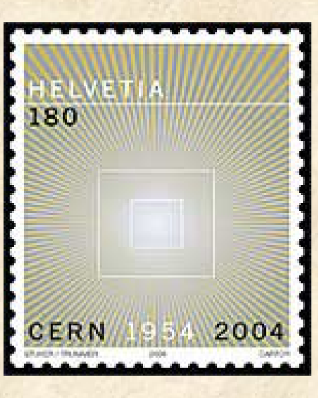
Here, it would be relevant to cite the efforts of Edoardo Amaldi [1-2], a very interesting and voluminous piece of history which is beyond the scope of this short note. Amaldi divides the prehistory of CERN into three parts, with the first extending from about 1948 to 15th February 1952. At that date eleven European countries had signed in Geneva the so-called "Agreement" establishing a provisional organization. The second period, the so-called "Planning Stage," extends from February 1952 to 1st July 1953, when the convention establishing the permanent Organization was signed by the twelve European governments. The third period, called the "Interim Stage," runs from July 1953 to 29 September 1954, when the Convention entered into force.

CERN has developed into the largest physics research centre in the world. CERN employs about three thousand people, representatives of a wide range of skills: physicists, engineers, technicians, craftsmen, administrators, secretaries, and workmen. Some seven thousand scientists, over half the world's particle physicists, use CERN's facilities. They represent some 500 universities and over 80 nationalities [3].

Besides advancing the understanding of nature, CERN has produced practical technology and feats of engineering that have pushed the state-of-the-art to its outer limits. Among the laboratory's more noteworthy technical accomplishments are:

- ***World Wide Web:***
  The enormously numerous and complex data generated in CERN's accelerators were of limited value if they could not be shared with physicists around the world. So it was at CERN that Tim Berners-Lee invented a file sharing protocol and added it to his hyper text markup language (HTML), to form the basis of the Web.
- ***Grid Computing:***
  Today, together with the Argonne National Laboratory in Illinois, CERN is leading the way in the development of distributed supercomputing for numerous large-scale applications, from climate prediction to genome analysis.
- ***Superconducting Magnets***:
  Those developed for CERN's accelerators have produced fields unequaled by any used in similar large-scale applications. The ones for the LHC (Large Hadron Collider), cooled with liquid helium, are designed to generate fields of nine Tesla! This is to be compared with the fields in a typical MRI (Magnetic Resonance Imaging) device, which generates 1.5 Tesla.
- ***The All-Electronic Detector:***
  A generation ago, particle collisions were tracked in a cloud chamber. Images had to be analyzed manually and scrutinized carefully for evidence of specific sought-after events. Working at CERN in the late 1960s the physicist George Charpak invented the first all-electronic detector. Called a multiwire proportional chamber, the detector is in trials now for use in medical X-ray imaging, where it could greatly reduce the amount of radiation needed to form an image.
- ***Stochastic Cooling:***
  CERN engineer Simon van der Meer developed arcane control techniques to make bundles of particles cohere that would otherwise tend to fly apart, so as to boost the probability of collisions in a particle detector. Together with Charpak's detector, the technique led to the discovery of the W and Z particles.

The Swiss Post Office issued a stamp to commemorate the 50 years of CERN. It was designed by the Swiss artists Christian Stuker and Beat Trummer. This stamp is much different from the other stamps as it does ***not*** use any of the existing CERN imagery and is very symbolic. The radiating design portrays an opening, a spreading out towards infinity, which reflects CERN's fundamental goals of research and the transmission of knowledge.



40 Years of ICTP

On 4-5 October 2004, ICTP (Abdus Salam International Centre for Theoretical Physics, in Trieste, Italy) celebrated its 40th anniversary with an international conference, Legacy of the Future. The conference attracted more than three hundred scientists and policymakers from around the world. Significantly, the conference held a roundtable discussion on the future of science in the developing world. What makes ICTP unique, since its inception in 1964, is this concern for the developing world.

The name of ICTP is forever linked to its founder Abdus Salam, a co-winner of the 1979 Nobel Prize in Physics and the founder and long-time director of ICTP. Salam was born in 1926 in Jhang, then part of India. Jhang became part of Pakistan after the division of the subcontinent in 1947. Salam returned to Pakistan in 1951 after a brilliant start to a research career in Britain. In Pakistan he experienced the difficulty of trying to perform scientific research and advanced studies in the relative isolation of a developing country. Without access to conferences, journals and other forms of support, Salam made the very difficult decision of leaving his home country to continue his work in physics. He joined Imperial College in London and established a research group with extraordinary distinction. Salam's firsthand experience in coping with scarce resources and the remote location of his country prompted him to create ICTP with an aim to foster the growth of advanced scientific studies and research in developing countries. Salam's vision has been fulfilled.

Abdus Salam decided to create an international centre dedicated to theoretical physics that would pay special attention to the needs of scientists from the developing world. In 1960, Salam outlined a proposal for the Centre, at the Tenth Annual International Conference on High Energy Physics, in Rochester, NY, USA. The same year he presented the proposal before the delegates attending the General Conference of the IAEA (International Atomic Energy Commission), in Vienna, Austria.

Salam's brainchild met with enthusiastic support from eminent physicists including the Nobel Laureate Niels Bohr (who had earlier expressed reservations about creating CERN) and later hisson Aage Bohr (who received the Nobel Prize in Physics in 1975). But Salam's ongoing efforts to secure support for the creation of the Centre encountered a series of obstacles set in place by the IAEA's Scientific Advisory Committee (SAC). The Committee (including Nobel Laureate Isidor Isaac Rabi and Homi Jehangir Bhabha, the father of the nuclear energy programme of India) suggested that the creation of fellowship programmes at existing centres of theoretical physics could prove more cost-effective and easier-to-implement than creating a new centre from scratch. Committee members also expressed concerns that a centre in theoretical physics would have no practical applications for developing countries struggling to improve their living standards (see ref [4], p. 7). It is very curious that Rabi, who had drafted the Florence resolution urging UNESCO to create regional science centres, had opposed the creation of ICTP.

Sigvard Eklund, a strong believer in Abdus Salam's vision, was appointed the Director-General of IAEA in 1961. This was the turning point, and Salam's idea triumphed. The IAEA soon realized that the new Centre could not be created solely with its own funds. Financial offers came from the government of Italy for Trieste as the candidate site, from Denmark for Copenhagen, from Pakistan for Lahore, and from Turkey for Ankara. The most generous offer came from Italy, and the man behind this was Professor Paolo Budinich, a famous theoretical physicist in Italy. Budinich argued that the Centre would help ease East-West tensions due to the Cold War.

After slow but clear sailing for four years in the corridors of policymakers, Salam's proposal became a reality. On 5 October 1964, a group of high officials, mostly from Italy, joined eminent physicists from around the world for the inaugural meeting of the newly-created International Centre for Theoretical Physics (ICTP). A seminar on plasma physics served as a platform from which ICTP was officially launched. Abdus Salam, who spearheaded the drive for the creation of ICTP by working through IAEA, became the Centre's director. Paolo Budinich, who worked tirelessly to bring the Centre to Trieste, became ICTP's deputy director. After residing for four years in downtown Trieste, ICTP moved to its permanent location near the Miramare Park in 1968. Soon UNESCO also joined in extending support to the new Centre.

Since its birth four decades ago, several scientific bodies have spawned with headquarters in and around ICTP. Collectively, they are known as the Trieste Science System, which includes SISSA (International School of Advanced Study) and TWAS (Third World Academy of Sciences). ICTP is encouraging science in developing countries through its various visiting programmes. It is also recognizing their talent through the prizes and medals it has instituted. This is reflected in:

- Around two thousand scientific activities (from introductory schools to advanced workshops) that have been organized on the ICTP's premises.
- Around one-hundred thousand scientific visitors that have been to ICTP. About half of them came from developing countries, and many of them regard ICTP as a scientific home away from home.
- Thousands of research papers that have resulted from the work of the ICTP community.
- That almost every physics PhD in the continent of Africa has some link with ICTP.
- That many prestigious scientists have lectured at ICTP, including more than eighty Nobel Laureates.

In 2004, ICTP had 7134 participants in about fifty meetings, totaling to 4327 person-months. 69% came from developing countries. In all 124countries were represented. ICTP has successfully evolved from a vision to a system [5]. ICTP was renamed as Abdus Salam ICTP on the first anniversary of Salam's death, in November 1997.

CERN and ICTP are international institutions of advanced scientific research with similar aspirations, and, understandably, their histories are intertwined. Two members of the CERN Theory Division, Jacques Prentki and Léon van Hove, took part in the panels of experts that encouraged the setting up of ICTP. The Scientific Council of the ICTP (after it was setup) has been served by Léon van Hove, Victor Weisskopf and Herwig Schopper (all three were Director-General of CERN). Alvaro de Rújula, a researcher from ICTP became the director of the CERN Theory Division. Abdus Salam, the founding director of ICTP, served for several years on CERN's scientific policy committee.

There is a deep and strange link between ICTP and particle physics. In the year 1964 (the year ICTP came into being), the Nobel Laureate Murray Gell-Mann introduced the term quarks for the subnuclear particles. Gell-Mann was inspired by Dublin-born poet James Joyce's Finnegans Wake, which has the line "Three Quarks for Muster Mark!" Joyce had spent over a decade in Trieste, where he wrote his masterpiece Ulysses. Joyce was driven by rhyme and Gell-Mann by symmetry!

10 Years of ESRF User Operation

Inauguration of the ESRF (European Synchrotron Radiation Facility, in Grenoble, France) on 30 September 1994 marked the end of its construction period. However, the idea of a joint European facility dates back to 1975. Its construction began in 1988, and the first fifteen beamlines were opened to users in 1994. ESRF is supported by eighteen countries, twelve of which are 'Contracting Party' countries: France, Germany, Italy, United Kingdom, Spain, Switzerland, Belgium, The Netherlands, Denmark, Finland, Norway and Sweden. The remaining six (Portugal, Israel, Austria, Poland, Czech Republic and Hungary) have been associated through 'Bilateral Agreements.' All of them contribute to the annual budget of about

seventy million US$. The 6.0GeV facility is constantly pushing experimental possibilities to new limits. It is one of the three most powerful hard X-ray facilities along with the 8.0GeV SPring-8 (Super Photon Ring, in Japan) and the 7.0GeV APS (Advanced Photon Source, in Argonne, USA). Owing to their extremely high energy these synchrotrons have their specific problems, and have forced the development of new techniques in the field of optics and detectors to ensure the required high stability of the electron beam. In view of the very unique challenges arising due to the extremely high energy, the three most powerful synchrotron laboratories have signed a 'Framework of Agreement for Collaboration.'

Now, ESRF has forty beamlines. Every year over three thousand scientists use the facility carrying out research in physics, chemistry, materials and life sciences. In the year 2003 there were 5140 user visits for 1282 experimental sessions with 14,273 shifts. These figures are steadily on the rise [6].

Concluding Remarks

The anniversaries were celebrated not only by physicists but by the global scientific community. They drew the attention of the media and the public at large. It is time to look ahead.

CERN is one of Europe's first joint ventures. It has become a shining example of international collaboration. Its success paved the way for other joint initiatives such as the ESRF and the ESA (European Space Agency). All three institutions have provided a common platform, where governments across Europe could work jointly towards common goals. This definitely had a bearing on the formation of the European Union.

CERN is continually adapting by carrying out new experiments to test new species of theories, each tested for survival against further experimental evidence. Particle physicists are trying to explore frontiers beyond the reach of CERN. The proposed International Linear Collider (ILC) is a likely candidate for a joint initiative in accelerator physics and will possibly involve participation from all continents. Global projects rely on collaboration. Historically particle physics has developed an exemplary culture of international collaboration to build and operate large-scale experimental facilities. ILC is also known as the Global Linear Collider (GLC). Building the ILC/GLC will herald a new era among nations in scientific collaboration and in developing new technologies.

The generous support by the Italian government for ICTP has set a unique example in North-South cooperation. From the very beginning ICTP has been addressing the problems faced by developing countries. ICTP held a "Conference on Physics of Tsunamis" in March-2005, which is further evidence of its deep involvement in developing countries.

Salam had dreamt of creating twenty ICTPs around the world. As part of that vision, he actively promoted the idea of advancing the cause of science and technology in developing countries, not only by having researchers from the region work with their colleagues in the developed world, but also by having the region develop its own facilities. For the Middle East, he had suggested facilities including a synchrotron laboratory. SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East) synchrotron facility, hosted by Jordan, has been a significant development. Regional Synchrotron Radiation Facilities (RSRF) modeled after ESRF, in the continents of Africa, Asia and South America, can be a step towards that dream [7]. Will the decision-makers in developing countries take heed?

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MEMBER'S REPORT

An Introduction to Computational Radiation Physics

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Computations have long played an essential role in radiation physics. The uses of computation initially took supporting roles such as relating measured quantities like current or temperature changes to quantities that more appropriately describe the effects of radiation on matter such as KERMA or dose.

Advances in computer technologies have mapped directly to advances in the realm of computational radiation physics. The sophistication of tools for performing radiation physics calculations now enables one to imagine computing nearly any scenario of interest. Another manner in which the advances in computer technology in general have aided in the advance of computational radiation physics is in the accessibility of information. In many cases, the necessary research papers, databases and computer codes are available on the internet for free or for a nominal charge, providing a mechanism to get nearly-instantaneous access to these capabilities.

The foundation of any method for solving problems in computational radiation physics is a database containing the necessary cross sections. Tabulations of data in journals have been the primary source of such cross sections. These journals provide wonderful archival value but are not easily used as source materials. If electronic copies of the databases are not also available, the lengthy and error-prone process of capturing the information in electronic form must be undertaken. Furthermore, the necessity to restrict the size of any single issue of a journal to what may be reasonably published and mailed may also compromise the level of detail contained in such databases. Many of these old databases are now available on the internet. Newer, more expansive ones are being added. In the next article in this series, a number of the database resources available on the internet will be identified and analyzed.

Computational radiation physicists have utilized these cross sections in a wide variety of algorithms. Along with a number of simpler methods, ray tracing, deterministic methods, and Monte Carlo codes have all been applied successfully in this field. Ray tracing provides accurate answers relatively quickly if secondary processes are unimportant. Other deterministic methods model systems more exactly if complicated details of geometry and boundary conditions can be handled. Monte Carlo transport codes can simulate a system to any level of detail for which the user has the patience to construct the model and to wait for a result of satisfactory statistical precision. The third article in this series will discuss the strengths and weaknesses of a number of the computer codes available on the internet.

The series of articles will conclude with an article on the supporting hardware and software upon which one might expect to perform one's calculations. In particular, internet resources will be identified that can help one to assemble a capable parallel machine. The software that simplifies the use of such machines will also be discussed. Performing a "poor man's" parallel calculation on these resources will be discussed.

Previous | Home Page | Next

Abstracts of contributed papers awarded Junior Radiation Physics Medal

at the 7th Radiation Physics and Protection Conference, Ismailia, Egypt
27 - 30 November, 2004

Determination of the Equilibrium Factor and Dose Equivalent from Radon and its Progeny by SSNTDs

On the Source - Detector Efficiencies for Gamma-rays

Age Dating Using Lead Isotopic Ratios by ICP-MS

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A radiological survey on the Egyptian Iron and Steel Company raw materials, by-products and waste samples, stored in stacks along the "Autostorade Road", was carried out.

U-238 (Ra-226) series, Th-232 series and K-40 activity concentrations were determined using hyper pure germanium detector. Pb-210 was measured directly by its gamma line 46.5keV. Self absorption correction due to sample composition was carried out. Effective dose rate and annual effective dose for workers due to direct exposure to gamma radiation, dust inhalation and material dumping were calculated.

Ten samples of raw material and by-products from the factory were collected from the period April 2003 - May 2004. 24 samples from the waste stacks on the Autostorade Road representing very old, intermediate and very new in storage were also collected and analyzed.

Key Words : NORM / Gamma emitters / Non-Nuclear Industry/Steel Industry

Angular Energy Distribution of ^{252}Cf Neutrons for Polyethylene, Graphite and Iron Shields

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Integral experiments were performed to measure the angular energy distribution of neutrons when various slab shield of polyethylene, graphite and iron samples were exposed to a collimated beam from Californium-252 neutron source. Fast neutrons were measured by using a stilbene scintillator, and discrimination against undesired pulses of gamma rays was achieved by a pulse shape discrimination method based on the zero cross over technique. A computer program NSPEC was used to analyze the data to obtain a neutron spectrum. The obtained results are represented in the form of displayed fluxes and energy distributions for neutrons measured behind samples of different thickness.

The fluxes transmitted directly in the same line of the incident beam from the samples were compared with those transmitted at different angles from the direction of the direct beam (0, 15, 30 and 45 degree). Total neutron for the whole energy range (1.4 - 9 MeV) and macroscopic cross-sections have been obtained at different energies. These data were compared with another published data for a point isotropic source and a reactor collimated beam. An empirical formula has been derived to calculate the integral neutron fluxes for polyethylene, graphite and iron at different thickness and different angles from the direction of the direct beam. Good agreement between measured and calculated values has been obtained. The results show that graphite is a good reflector and it can be used as a primary shield material for high temperature reactor. Polyethylene is a better neutron attenuator than graphite and iron. It can be used in mobile reactors and in other applications where the shield is not exposed to high temperature. Also it can be used as a good shield for portable neutron sources.

Key Words : Angular neutron flux/ Polyethylene/ Graphite/ Iron/ Californium source.

Thermal Analysis of the ITER Blanket First Wall

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The 3D temperature distribution in the First Wall (FW) of the International Thermonuclear Experimental Reactor (ITER) blanket is studied. The effect of FW exposure to different heat fluxes and heat generation rates on the temperature distribution inside the wall is also examined. The design of FW adopted by ITER council in 2001 is taken as a reference design for the FW through the analysis. The study reveals that the maximum and minimum temperatures increase linearly along the poloidal direction according to the specified incident heat flux and heat generation. The study also indicates a linear variation for the coolant temperature along the cooling channels throughout the poloidal direction.

Key Words: ITER Blanket/ Heat Transfer Analysis/ Blanket First Wall/ Heat Equation

Fast Neutron Irradiation Effects on CR-39 Nuclear Track Detector for Dosimetric Applications

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The effect of neutron irradiation on the dosimetric properties of CR-39 solid-state nuclear track detector have been investigated.

CR-39 samples were irradiated with neutrons of energies following a Maxwellian distribution centered about 2 Mev. These samples were irradiated with different doses in the range 1-10 Sv. The background and track density were measured as a function of etching time. In addition, the dependence of sensitivity of CR-39 detector on the neutrons dose has been investigated.

The results show that the CR-39 sample irradiated with 4 Sv neutrons dose were characterized with higher sensitivity, so this sample was chosen to be a subject for further study to investigate the effect of gamma dose on its properties. The sample irradiated with 4 Sv was exposed to different doses of gamma rays at levels between 10 and 80 kGy.

The effect of gamma doses on the bulk etching rate V_B, the track diameter and the sensitivity of the CR-39 samples was investigated.

The results show that the dosimetric properties of CR-39 SSNTD are greatly affected by both neutron and gamma irradiation.

Key Words: SSNTDs; nuclear tracks; sensitivity; neutrons; gamma rays.

Effect of Acquisition Orbits and Matrix on the Accuracy of SPECT Imaging:
Quantitative Evaluation in Cardiac Phantom

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Non circular orbit, 180° acquisition with 64 matrix size is considered standard for cardiac SPECT imaging. Theoretically, a 360° acquisition orbit with 128 matrix size is preferred because of more complete Fourier spectral information on projection data and better resolution. We assessed quantitatively (homogeneity, contrast and FWHM) in phantom studies the differential effect of acquisition orbits (180° and 360°), circular and non circular orbit and the matrix size (64,128).

Methods: SPECT imaging with a dual-head gamma camera was performed on normal cardiac phantoms filled with a 99mTc solution, using different acquisition orbits and matrix. The cardiac phantom was inserted inside the chest phantom and imaging without and with the founding of attenuation and scattering media (water). The homogeneity of count distribution, contrast, and FWHM (characterizing the spatial resolution of the imaging system) in the three short axis slices of the cardiac phantom was analyzed.

Results: When the cardiac phantom was placed in the attenuation and scattering media, homogeneity, contrast and spatial resolution were degraded, and all were improved with the applying attenuation and scattering correction. 180° orbital motion, non circular orbital type and 128 matrix size showed improved contrast and FWHM (P-values were statistically significant). On the other hand, orbital motion 360°, circular orbital type and 64 matrix size had better homogeneity rather than 180°, non circular orbit and 128 matrix size.

Conclusion: Applying of attenuation and scattering corrections are very important for accurate quantification of myocardial imaging. SPECT images acquired with a 360°, circular orbit and 64 matrix size, may be significantly erroneous in contrast and FWHM, but improved the homogeneity. In contrast, SPECT images acquired with 180° orbital motion, non circular orbital type, and 128 matrix size may provide more contrast and FWHM. Cardiac imaging should have good contrast and FWHM with a reasonable homogeneity, so the best quality of cardiac imaging can be obtained with 180° orbital motion, non circular orbital type and 128 matrix size.

A Dosimetry Study Comparing NCS Report 2 Versus IAEA TRS 398 Protocol for High Energy Photon Beam:
an Experimental Study at NC1 Cairo

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In this work a dosimetry study is presented in which we compare the results of absorbed dose determined at reference condition according to the IAEA TRS 398 protocol and the NCS 2 report.

The IAEA TRS398 protocol for absorbed dose calibration is based on ionization chamber having absorbed dose to water calibration factor ND,w while the NCS 2 dosimetry report for absorbed dose calibration is based on an ionization chamber having air kerma calibration factor NK.

This study shows that the dose changes are within 0.6% in Cobalt 60 and 0.9% for 6MV photon bewn. The chambers used are PTW 30001 and 30004 which. have calibration factors NK and ND,w traceable to the BIPM (Bureau International des Poids et Mesures).

In Situ Measurement of Particle Size Using Laser Light Scattering Technique

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A versatile technique for measuring the size of microscopic small particles and clusters in the dynamic state using Laser Light Scattering (LLS) is presented.

Particle size with diameter of tens down to few micrometers could be determined from angular scattering distribution measurements at different angles of laser light scattered from powder particles. The angular scattering distribution of the LLS for the determined scatterer size is generated using a coinp~itet. simulation code for fitting the experimental data with the calculation and for determining the particle size accurately. A comparison between ***in situ*** LLS technique and ***ex situ*** Scanning Electron Microscope (SEM) is held to verify the accuracy of die used ***in situ*** LLS technique.

Energy Levels, Oscillator Strengths And Lifetimes Of Excited States In Sodium And Sodium-Like Ions