InterACTIONS

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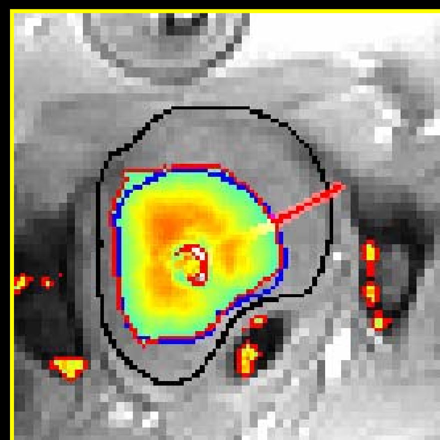
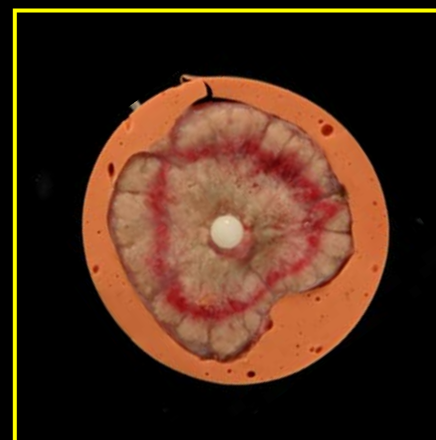
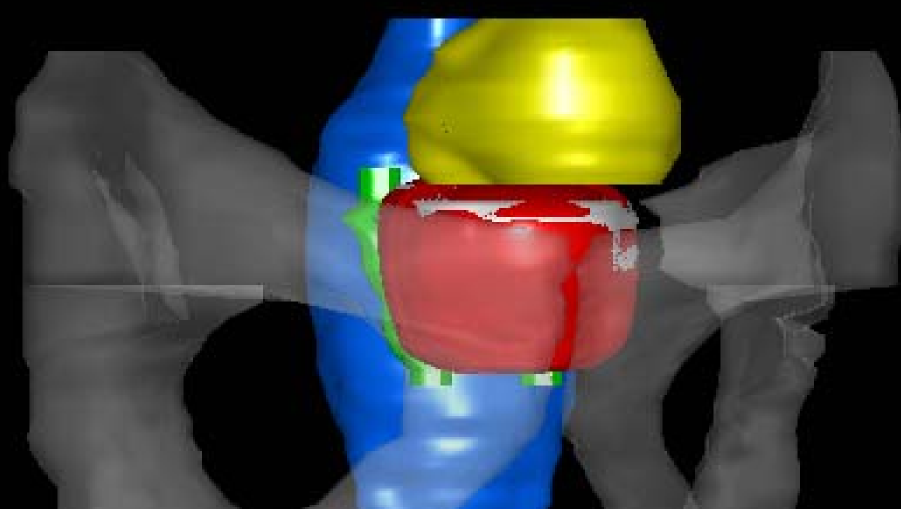




MRI-Guided Transurethral Ultrasound Therapy



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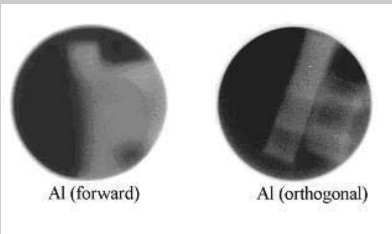

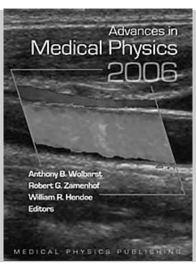

Cover Image

MRI-guided transurethral ultrasound therapy is a minimally invasive approach to treatment of localized prostate cancer which utilizes high-intensity ultrasound energy to generate a precise region of thermal damage within the gland. The cover images illustrate some of the capabilities of this technology observed through experiments and simulations.

The top right panel shows the capability to generate a spatial heating pattern that matches a target boundary (blue) within the prostate gland (black). A temperature of 55°C (red) matching the target boundary was achieved by using active feedback from 5-second MR temperature images to control energy delivery over ~15 minutes in a preclinical model. The top right panel is a photograph of a section of the prostate matching the imaging plane, showing excellent spatial agreement between the target boundary and the resulting thermal damage pattern. These results confirm the benefits of using active MR temperature feedback to guide accurate spatial patterns of thermal damage in the prostate. The bottom panel shows a simulation of a 3D transurethral ultrasound therapy using MRI-derived patient anatomy to quantify accurate shaping of the thermal damage volume (red surface) to the prostate gland (white), while sparing surrounding tissues such as the rectum, bladder, and neuro-vascular bundles.

Images provided by Rajiv Chopra & Michael Bronskill
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Message from the COMP Chair:

Among other changes, you are likely to see, will be the creation of a number of new committees, as well as the consolidation of others, primarily to allow us to address those areas where we need to do better ...

As I write this the COMP Executive has just "emerged" from a number of successful mid-year meetings. The highlight was undoubtedly the Strategic Planning exercise which was carried out on Friday evening and all day Saturday, under the watchful eye of Facilitator, Paulette Vinette. Paulette was selected because of her background in leading similar organisations through this process and her experience showed, surprising even the most cynical of us.

We undertook a number of exercises which allowed us to identify, our mission, a vision, and to develop a number of concrete goals and objectives which could be associated with five strategic "pillars." Prior to the workshop, Paulette had helped us identify the key issues through phone interviews with the COMP executive as well as with a number of COMP members whom we felt could represent key stakeholders or interests. We attempted to get representation from different provinces, from members involved in imaging, radiotherapy and radiation protection, from academics, researchers, members new to the profession as well as those that have been around for many years. Many thanks to Luc Beaulieu, George Mawko, David Rogers, Jodi Pachal, David Chettle, Peter Dunscombe, Aaron Fenster, and John Schreiner who were unable to attend the workshop but who were still prepared to be interviewed.

Also of great value was the response that we received to the Internet survey which was sent out to all members. We received 110 replies (from our now more than 400 members) which is an excellent response and the feedback is summarised elsewhere in this issue. Thank you to

Dr. Stephen Pistorius
COMP President

those who took time to complete the survey and also to David Jaffray, Sheila MacMahon and Katharina Sixel who joined the COMP executive at the workshop. A written report of the workshop will be provided to the COMP executive for review, and a summary will be published in a future issue of Interactions with full details to be posted on the web-site.

Among other changes, you are likely to see, will be the creation of a number of new committees, as well as the consolidation of others, primarily to allow us to address those areas where we need to do better, namely education and to ensure that COMP is the professional voice for all members. I am hopeful that this process will help us become a better and more responsive organisation, and I will be happy to receive your comments and suggestions as to how we can improve further.

Both boards approved the renewal of the contract with AMCES (and Nancy Barrett) for management support.

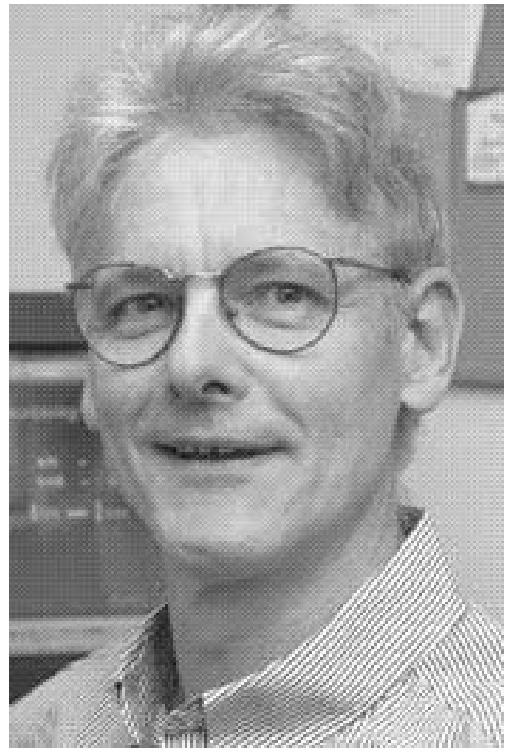
Message from the CCPM President:

The new short question written exam format has been posted on the website for sections III and IV and will be implemented for the 2007 CCPM examination. Although this revision has allowed some much needed editing of the questions, the primary purpose was to split long questions into shorter ones allowing the exam to test the candidate on a broader knowledge base.

29 out of 29 CCPM members successfully recertified in 2006.

The CCPM appoints two CCPM members to the board of CAMPEP, whose primary function is to accredit both residency and graduate programs in Medical Physics. The two current appointees are Peter Dunscombe and Brenda Clark. Brenda Clark is finishing her second and last term on the CAMPEP board at the end of 2006 and will be replaced by Erving Podgorsak beginning January, 2007, while Peter Dusncombe remains on the CAMPEP board.

COMP has started its strategic planning exercise, which included a membership survey. Some of the comments from this survey suggested that there is some confusion regarding the different roles of COMP and the CCPM. The primary function of the CCPM is the certification of medical physicists including the accreditation of medical physicists in mammography. Two functions that the CCPM cannot do is professional lobbying or involvement in setting standards, since those standards may have a statement to the effect that a certified medical physicist is required creating a conflict of interest; the organization that does the certification must be at arm's length from the organization



Dr. Dick Drost,
CCPM President

that controls or influences which functions require certification. If one of the results from the strategic planning exercise is that COMP will continue to represent the professional interests of medical physicists, a likely result based on the survey results, then COMP and the CCPM will have to check whether the organizational structures of the two organizations meet the arm's length criteria.

...comments from this survey suggested that there is some confusion regarding the different roles of COMP and the CCPM. The primary function of the CCPM is the certification of medical physicists including the accreditation of medical physicists in mammography.

Message from the Executive Director of COMP/CCPM: Strategic Planning Process– How your input helped!

The COMP Executive hired a consultant, Paulette Vinette CAE, to gather strategic information that could be used during the COMP Strategic Planning Workshop that was held in Toronto on November 24 and 25, 2006. Fifteen sector leaders were interviewed by telephone. As well, an online survey was sent to our 500+ members in mid-October. 110 members completed the online survey - an excellent and reliable response rate. Thank you for your support! Paulette prepared a report which detailed the findings of both the telephone interviews and the online survey. This report was provided in advance to all those who participated in the planning workshop to ensure that your input provided the basis for our discussions. A copy of this report is available at www.medphys.ca. Here is a summary of the report:

110 members completed the online survey - an excellent and reliable response rate. Thank you for your support!

Ms. Nancy Barrett,
COMP/CCPM Executive Director

Summary of the telephone and online survey findings

Members and COMP leaders welcomed being given the opportunity to comment. They look forward to reviewing the new Strategic Plan and hope the new Plan will:

1. Identify COMP's strategic priorities and action plan for the next three years
2. Address the need to have COMP actively profile the profession
3. Address COMP's position on certification
4. Provide a proactive manpower planning strategy
5. Identify ways to engage youth in the profession and the organization
6. Enhance governance and communications.

High Priority and Emerging Issues

Participants identified the following high priority or emerging issues that should be addressed in the three-year strategic plan:

1. COMP needs to promote the **role of medical physicists in the health care agenda**
2. COMP needs to **raise the profile of the profession and of the association**
3. COMP needs to **raise awareness of the profession to youth**
4. COMP needs to **address the needs of Imaging** and other Science/ Development/Academic sectors
5. COMP needs to **promote professional development opportunities**
6. COMP should be **proactive in working with other, similar or-**

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A Closer look at our 2006 Gold Medal Recipients

At the COMP meeting in Saskatoon at the beginning of June 2006 the inaugural COMP Gold Medals were awarded to three of the outstanding pioneers of Canadian medical physics, all three of whom had strong connections with Saskatoon. What follows is an outline of the presentations made concerning each of the recipients.

Doug V Cormack

By D. W. O. Rogers
Carlton University

It is my great pleasure to introduce Doug V Cormack as one of the three inaugural recipients of the COMP Gold Medal.

Doug was born in Lacombe Alberta and after attending a one room school house graduated from the U of Alberta with a BSc in Physics in 1949 followed by an MSc in 1950. Doug then moved to the U of Saskatchewan where he obtained his PhD in 1953 under the supervision of Harold Johns. His thesis work was about the fundamentals of ion chamber dosimetry although during this period the entire group was helping establish the use of Co-60 for radiation therapy. In 1953-54 Doug benefited from an Exchange Fellowship which allowed him to study in the UK before coming back to the U of S where he worked from 1954 to 1967 in a joint position with the Saskatoon Cancer Commission where he supervised the operation of the radon plant until it was shut down in 1962. From 1967 to 1980 Doug worked at the Manitoba Cancer Foundation in Winnipeg and was involved with the Medical Microbiology department at the U of Manitoba. Doug then became the Director of the Medical Physics Department at the Tom Baker Cancer Centre in Calgary from 1980 to 1989.

Doug has always been deeply involved with Canadian and international medical physics organizations. In 1959-60 he was the Chair of the CAP's Division of Medical and Biological Physics, which was the forerunner of COMP. Doug has been a member of the CCPM since it was founded in 1979 and was the President in 1982-84. On a more technical side Doug was the Chair of the ICRU report committee that in 1969 authored ICRU Report 14 on "Radiation Dosimetry: X-Rays and Gamma-Rays with Maximum Photon Energies Between 0.6 and 50 MeV". For those unfamiliar with this report, it had a major impact on clinical dosimetry protocols and was a forerunner of protocols such as the AAPM's TG-21 or TG-51.

Doug was one of the world's recognized experts in radiation dosimetry. Doug and Harold Johns published a series of important papers on ion chamber dosimetry between 1952 and 1955 after an important 1952 paper with Johns and Fedoruk on data related to the first Co-60 unit (the most highly cited Co-60 paper). In 1959 a paper by Schneider and Cormack became the first paper which shows up in PubMed related to the very important subject of Monte Carlo simulation of electron-photon transport.

Doug is very interested in the history of our profession in Canada and has written a variety of articles and is currently the COMP archivist.

Doug has had an outstanding career in medical physics and has made major contributions both to our institutions and our science. He is a very worthy recipient of one of the inaugural COMP Gold Medals.

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A Closer look at our 2006 Gold Medal Recipients

(Continued from page 8)

J.R. Cunningham

By J. J. Battista, Ph.D., FCCPM, FAAPM
London Regional Cancer Centre

It was my privilege and honour to present the Gold Medal to Dr. "Jack" Cunningham at the Saskatoon Bessborough Hotel – a walk away from his student residence ("Pres Res on the Cres, not far from the Bes") while at the University of Saskatchewan. In 1948, Jack was involved in the operation of the radon plant (1948) and subsequently obtained his Masters degree under the watchful eye of Harold Johns, working on the medical betatron (1951). He later obtained his Ph.D. at the University of Toronto in 1955.

Jack experienced and contributed to the genesis of Canadian medical physics. His achievements in radiotherapy planning software are known to most of you, His career has been marked by important awards including the Kirkby Award of the CAP, Coolidge Award of the AAPM, and the international IUPESM Award. This lifetime of contributions culminated in being named Officer of the Order of Canada in 2005. He continues to serve unofficially as the friendliest international diplomat of Canadian medical physics.

The introduction of computer–aided treatment planning for cancer in the 1960's moved the field from purely 'geometric' considerations to 'physical' descriptions of radiation fields. His work impacted the quality of radiation dose distributions used to treat cancer patients around the globe. How can one objectively judge the impact of any scientist on modern society? In my view, it is indeed quite simple – just "unplug" the contributions and see if anyone notices! I am certain that if the concepts, products, and trainees that are traceable to Dr. Cunningham's inspiration were to be "unplugged" today, radiation treatments of cancer patients would become instantly suboptimal, if not impossible.

Now in his retirement years and living in Camrose, Alberta, Jack continues to teach radiation physics at the University of Alberta. He and Sheila have made it a serious hobby to trace their remarkable genealogical roots, wherever their travels have taken them.

Sylvia O Fedoruk

By Doug V Cormack, Ph.D., FCCPM
Emeritus COMP Member

When I arrived in Saskatoon in the fall of 1950 to do graduate study with Harold Johns, Sylvia was already a celebrity. When she received her BA in 1949 she was awarded the Governor General's Gold Medal as the outstanding graduate in Arts and Science. She had excelled in at least half a dozen individual sports and had been a key member of several championship teams. She has a place on the U of S Wall of Fame as the outstanding female athlete of 1949. When I saw her in action in the betatron lab it was obvious that she was just as handy with a soldering iron as she was with a nine-iron.

The research project which Sylvia tackled for her MA was not, as you might guess, on the development of the Co-60 therapy units but was a systematic study of depth-dose data for orthovoltage X-rays which were

(Continued on page 20)

Beam characterization of orthogonal bremsstrahlung photons for high contrast verification imaging

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1. Introduction

Patient positioning is an important aspect of radiation therapy especially with many of the current conformal treatment techniques. Any slight miss-positioning of the patient or any change in the location of the tumour may result in a geographical miss causing poor treatment outcome and risk of radiation damage to healthy tissues nearby. Patient positioning is usually achieved with the help of megavoltage portal images created by high energy, forward-directed photon beams. The use of the therapy-quality beam to produce 3-dimensional images (3-D megavoltage cone beam CT, or 3D MV-CBCT) has a major advantage in using the same source in both imaging and treatment modes, hence avoiding potential misalignment of the reference coordinates[1]. Although commonly used in many clinics, the images produced by 3-D MV-CBCT suffer from low contrast levels as well as poor signal-to-noise ratios because they are produced with a megavoltage rather than diagnostic quality x-ray beam[2,3]. Another disadvantage of megavoltage cone beam CT is that a relatively large dose is delivered to the patient to obtain acceptable image quality, discouraging the use of this method on a regular clinical basis[4].

Several solutions have been devised and targeted at improving the quality and contrast of images produced by high energy linacs. These include optimization of detectors used for high energy photon imaging[5,6], or modification of bremsstrahlung targets in the linac gantry head in order to produce lower energy beams[7-9]. Flampouri et al.[7] showed that the use of lower atomic number *Z* targets can result in bremsstrahlung photon beams that are softer than those produced by the commonly used higher *Z* targets. They also used this technique for high contrast portal imaging. For most of the low *Z* target studies, both films and high *Z* phosphor screen detectors were used[7-9].

Our group has proposed the use of the orthogonal component of bremsstrahlung beams from low atomic number targets[10-12] for verification imaging purposes. Several papers have been published previously on the strong angular dependence of bremsstrahlung beams[13-15]. Podgorsak et al.[13] and Faddegon et al.[14] showed that the mean energy of the bremsstrahlung photons drops as a function of the angle between the direction of the incident electron beam and the direction of the photon production. They further showed that this drop in energy depends on the atomic number of the target material and is significantly larger for targets of lower *Z*.

Figure 1 compares schematic diagrams of a modified linac gantry head geometry capable of orthogonal imaging and a conventional linac gantry head geometry capable of portal imaging. In contrast to conventional portal images that are produced with the megavoltage forward-directed component of bremsstrahlung beams, the orthogonal imaging technique employs the much reduced effective energy orthogonal component of the bremsstrahlung beams

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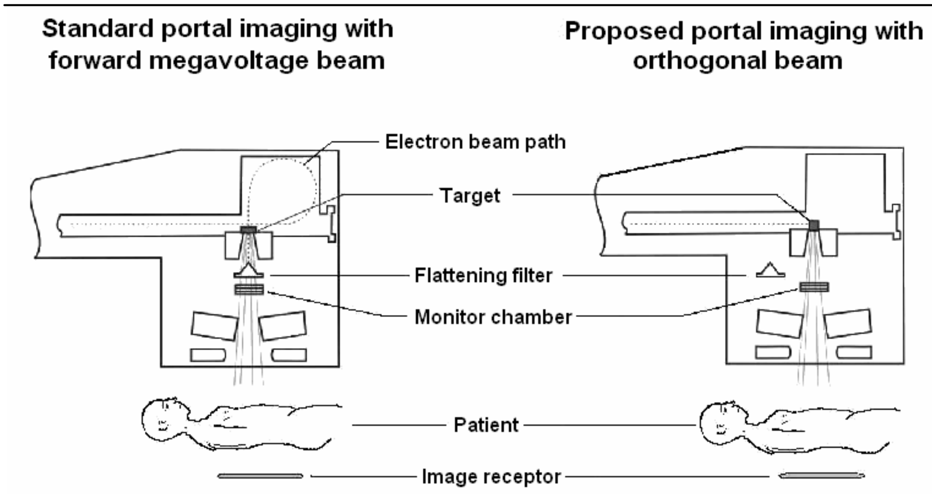

Figure 1 – A schematic diagram for the linac head configuration for current portal imagers operating with the megavoltage forward beam in (a); and our proposed technique for imaging using the orthogonal component of the bremsstrahlung beam in (b).

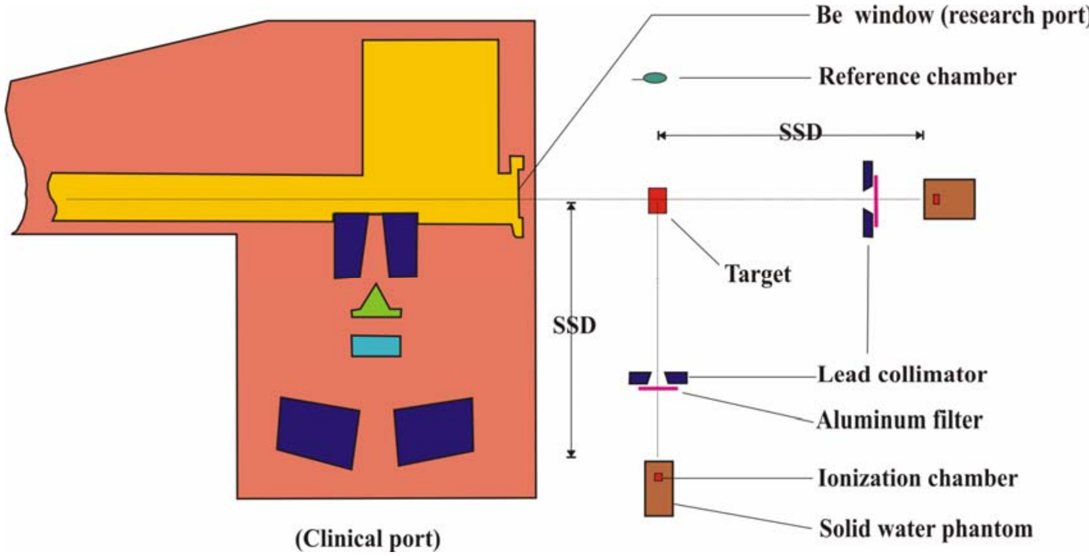

Figure 2 – A schematic diagram for the percentage depth dose measurement setup in the orthogonal beam direction. The thickness of the aluminum filter was 2 mm for carbon targets, and 3 mm for aluminum and copper targets. The linac was operated in the 10 MV photon mode. A fan, not shown, was used at all times to cool the target in order to prevent overheating.

(Continued from page 10)

to acquire images prior to treatment.

2. Methodology

Figure 2 shows a schematic diagram of the Varian Clinac-18 linac installed at the Montreal General Hospital (MGH) that was used to study the characteristics of orthogonal and forward components of the bremsstrahlung beam. The bending magnet of the linac head was turned off, the monitor chambers were disabled, and the primary electron beam was made to exit through a beryllium window in the forward direction (research port). In order to allow the beam to exit centered and in a scatter-free manner, prior to using the research port, the bending magnets needed to be demagnetized by briefly operating them with a reverse current.

To characterize the beam, percentage depth dose (PDD) and attenuation measurements were carried out for both the forward and the orthogonal bremsstrahlung beams produced by three target materials: carbon, aluminum, and copper. Figure 2 schematically shows our experimental PDD measurement setup, while Fig. 3 shows a photograph of the PDD measurement setup in the orthogonal beam direction. Other beam quality factors, such as the effective energy as well as the first and second half value layers (HVL), were determined from these experimental results, and compared with results obtained from Monte Carlo (MC) simulations with the EGSnrcMP code[16]. Further information about the beams including mean energy, level of electron contamination in the beam, and spectral distribution were obtained from the simulations as well.

At the target surface, 40 cm downstream from the exit window, the primary electron beam was found to have a Gaussian distribution with a FWHM of 0.8 cm. The exact direction of electron propagation was determined by shining back a laser pencil beam through the centers of the images produced on two pieces of HD Gafchromic™ films that were placed directly in front of the primary electron beam outside the research port at a separation of 10 cm. The targets were positioned such that in the orthogonal direction, the distance between the center of the electron beam to the target edge was 8.5 g/cm^3 for carbon, 13.5 g/cm^3 for aluminum, and 22.8 g/cm^3 for copper. In the forward direction, the thickness of the target was 11.9 g/cm^3 for carbon, 14.8 g/cm^3 for aluminum, and 40.0 g/cm^3 for copper. The thickness values were optimized

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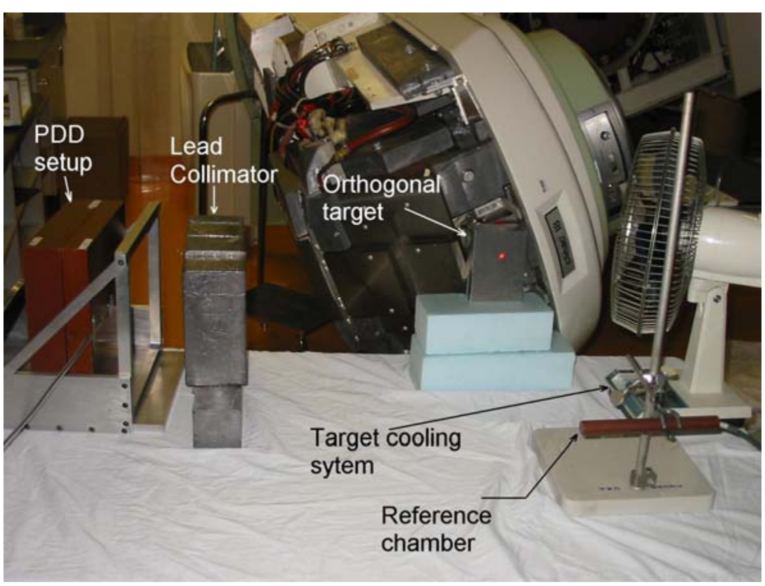

Figure 3 – A photograph of the actual experimental setup for PDD measurements in orthogonal direction. An ionization chamber (model NE2571, Nuclear Enterprises, Reading, UK) was used as a reference chamber; a parallel-plate chamber (model PPC40, Scanditronix Wellhöfer, Germany) was used for measurement of the PDD signal.

(Continued from page 11)

experimentally for our settings in order to minimize the electron contamination emanating from the target.

In the orthogonal direction, PDD measurements were made at 35 cm SSD, while in the forward direction the SSD was 100 cm. For PDD measurements in the orthogonal direction, an aluminum filter was placed after the lead collimators to reduce the electron contamination emerging from the target. The thickness of this filter was experimentally chosen to be 2 mm for the carbon target, and 3 mm for the aluminum and copper targets. The selection was based on a filter thickness that would remove most of the electron contamination without significantly affecting the quality of the radiation beam.

A Wellhöfer PPC40 parallel plate ionization chamber with a collecting volume of 0.4 cm^3 was used to measure the PDD in Solid Water. In the orthogonal direction and only for the attenuation measurement purposes, an Exradin spherical chamber model A4 with a collecting volume of 30 cm^3 was employed. The large volume chamber was selected to maximize the signal to leakage ratio. Since in all our measurements the primary beam did not travel through the linac monitor chambers, an NE 2571 Farmer-type chamber was used as a reference chamber to monitor externally the output fluctuations of the linac. All measurements were corrected for scatter.

Images of contrast objects were taken using both orthogonal and forward beams and contrast levels were quantitatively investigated. A lead collimator was used and Agfa 400 diagnostic films were placed at 35 cm SSD in the orthogonal direction and at 97 cm in the forward direction. A 0.5 cm Lucite filter was placed after the collimator in the orthogonal direction to decrease the electron contamination component in the imaging plane. Since many of the high energy linacs are operated with a 6 MeV mode when portal images are acquired, we also used a 6 MeV primary electron beam energy when measuring image contrast. The time of exposure (in the orthogonal direction) was set to 1.5 min for carbon target in the electron mode. This translates to 0.1 sec, if the linac was to be operated in the photon mode (roughly 1000 times greater electron fluence can be achieved in the photon mode). The time of exposure for other targets was set to lower values due to larger yield.

3. Results and Discussion

3.1 PDD and Attenuation Measurements

Figures 4 and 5 show the results of Monte Carlo calculations and experimental measurements of PDD and attenuation**.** Since the PDD measurements for the forward and orthogonal beams were performed at different SSDs, they cannot be compared directly. Hence, we show in Fig. 6 our PDD data for both the orthogonal and forward beams adjusted to an SSD of 100 cm. Therefore in this figure, the calculated orthogonal and forward PDDs can be quantitatively compared against one another. There was no significant difference between the PDD and attenuation results of the forward component of the beams obtained from various target materials. Therefore in Figures 4 through 6, in the forward direction, only the results for the copper target are shown.

Table 1 summarizes other beam quality specifiers that were used to describe, quantify and compare the orthogonal and forward components of the beams. The effective energy is defined as the energy of a mono-energetic beam that would have the same HVL_1 as that of a heterogeneous beam. Homogeneity coefficient (HC) is defined as the ratio of HVL_1 to HVL_2. In Table 1, except for the mean energy values that were calculated, all the other beam quality specifiers listed were

(Continued on page 13)

Targets	Orthogonal				Forward			
	Mean Energy (keV)	Effective Energy (keV)	HVL_1 (mm Cu)	HC	Mean Energy (keV)	Effective Energy (keV)	HVL_1 (mm Cu)	HC
Carbon	198 ± 7	151	3.29	0.41	1015 ± 3	1335	15.18	0.82
Aluminum	388 ± 2	425	8.50	0.75	1424± 4	1667	16.82	0.88
Copper	958 ± 6	1107	13.78	0.89	1688 ± 4	1789	17.37	0.91

Table 1 – Beam quality measurement results for a 10 MeV electron beam incident on several targets. Mean energy has been determined using MC simulations for our setup, while other values have been determined experimentally. Homogeneity coefficient (HC) is defined as the ratio between the first and second HVL

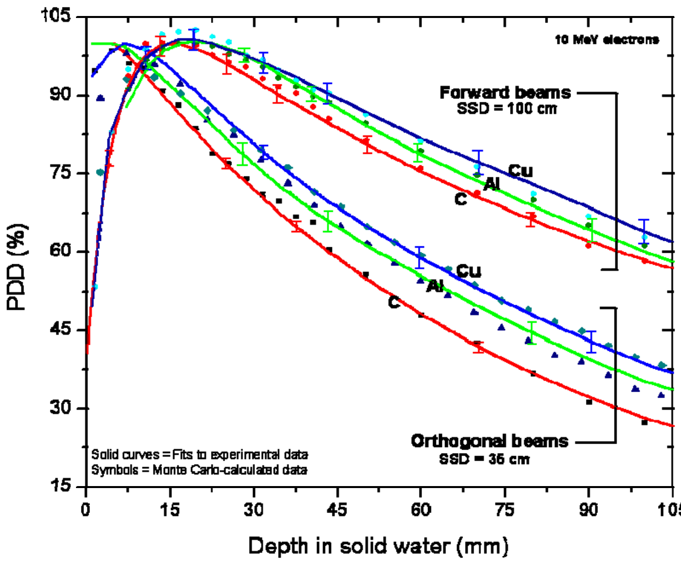

Figure 4 – PDDs in water for forward and orthogonal beams produced by a 10 MeV electron beam incident onto C, Al, and Cu targets. The PDD measurement for the forward beam was performed at an SSD of 100 cm, while in the orthogonal direction the SSD was set to 35 cm.

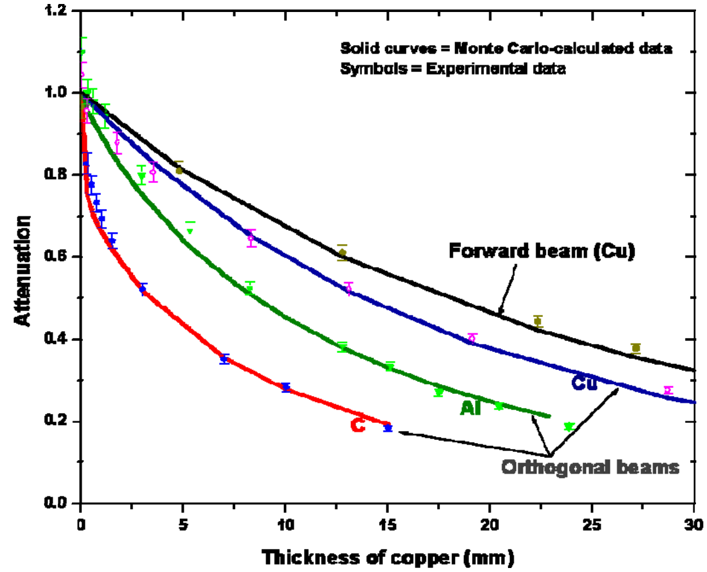

Figure 5–Measured and calculated attenuation curve data for the forward and orthogonal bremsstrahlung beams produced by a 10 MeV electron beam incident on C, Al, and Cu targets. For the forward beam, since the differences between attenuation curves of various targets were minimal, only results for the Cu target are shown. The attenuation measurements for the forward beams were carried out at a depth of 2.5 cm in Solid Water.

(Continued from page 12)
determined from our measurement results.

Our results confirm the strong angular dependence of the effective energy of the bremsstrahlung spectrum. By using the gradient of the drop in the attenuation curve (Fig. 5) and the depth of maximum dose z_{max} and the gradient of the PDD fall-off past z_{max} (Fig. 6) as indicators of a beam's effective energy, we conclude that for a given target material and incident electron energy, the orthogonal component of the bremsstrahlung beam is always softer than the forward component. Moreover, the percentage difference between the effective energies of these two components is strongly dependent on the target material and was found to be significantly larger for lower atomic number targets. In fact from Table 1, the ratio of the effective energy of the orthogonal beam to the forward beam produced by 10 MeV electrons striking a carbon target is 0.11, while the

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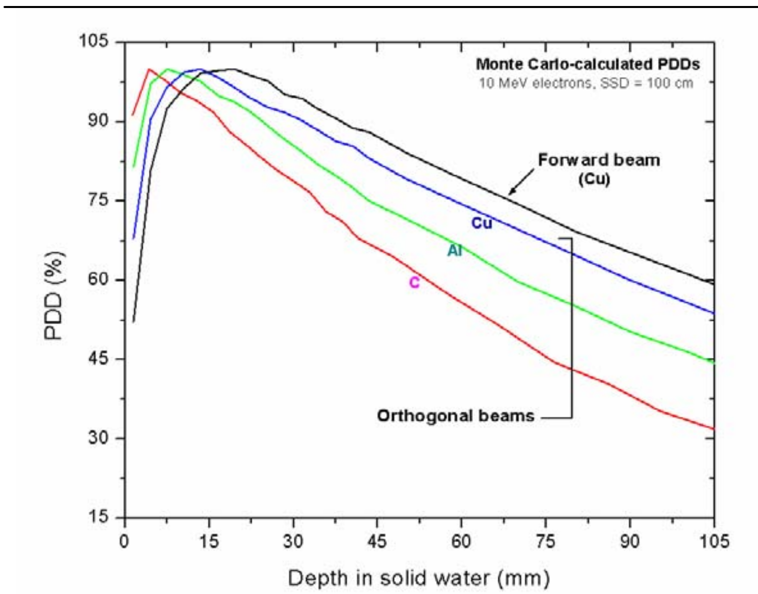


Figure 6– MC-calculated PDD results for forward and orthogonal bremsstrahlung beams produced by a 10 MeV electron beam incident on carbon, aluminum and copper targets. All simulations are carried out for an SSD of 100 cm

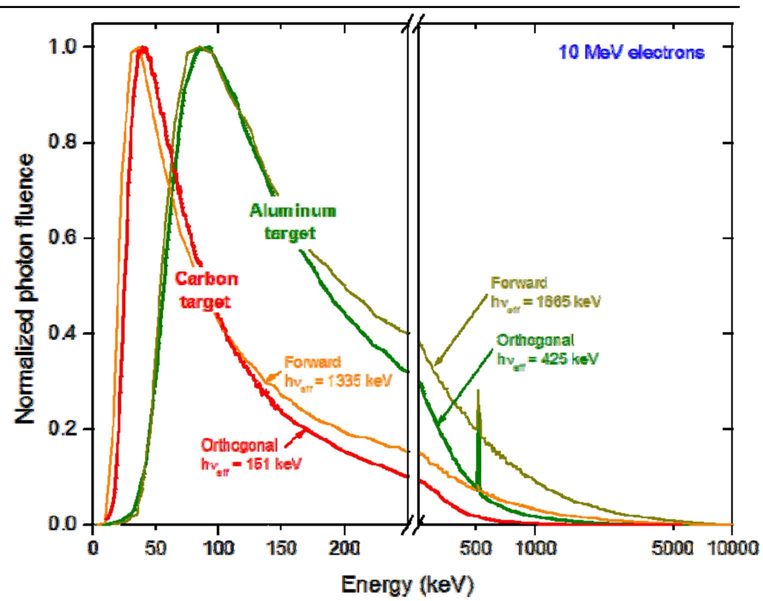
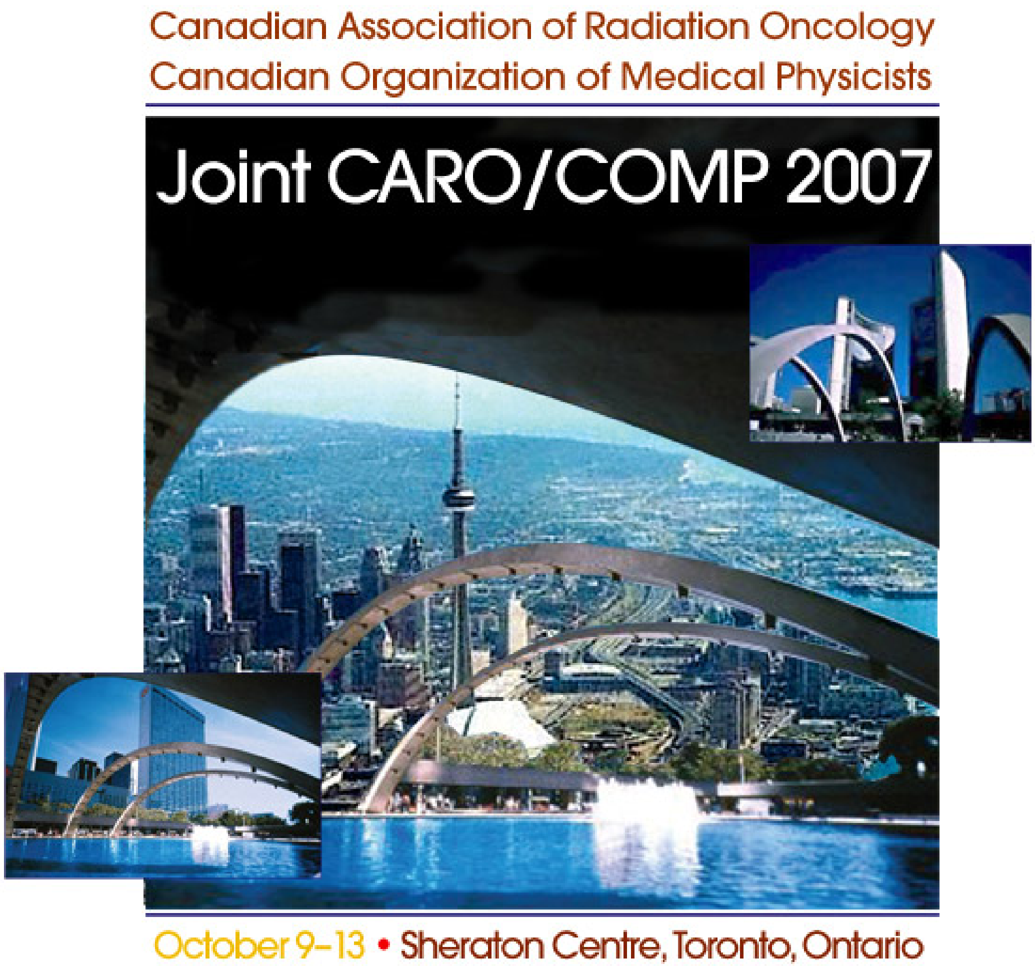


Figure 7– Spectra for various MC-calculated orthogonal and forward beams studied in this work. The spectra correspond to the orthogonal and forward components of beams produced by a 10 MeV electron beam striking targets of aluminum and carbon.

2007·TORONTO



Come to Toronto in 2007 for an integrated Canadian Organization of Medical Physicists / Canadian Association of Radiation Oncology meeting!

The theme is "Image Guided and Adaptive Radiation Therapy" with guest lecturers Dr. David Jaffray, Head, Department of Physics, Princess Margaret Hospital, as the CARO Lecturer and Dr. Glenn Bauman, Chair of Oncology, University of Western Ontario, and Director of Research, London Regional Cancer Program, as the Gordon Richards Lecturer. The Canadian College of Physicists in Medicine will organize a symposium of expert speakers on the theme of the meeting and COMP will present a lifetime achievement award at its Gold Medal session. COMP will also sponsor a presentation by a lecturer from the Canadian Association of Physicists.

To enhance interprofessional learning opportunities, we have planned daily joint sessions between Medical Physics and Radiation Oncology, as well as break out sessions for topics unique to each group.

For CARO, plan to attend the CARO Lecture, the Gordon Richards Lecture, participate in the workshops, the theme symposia, the People's Choice and the Resident/Graduate student session for each discipline. The CARO Pre-conference Symposia will be led by Dr. Cynthia Menard (TBC) and will relate to MRI .

For COMP, plan to attend the Gold Medal Session, the YIS Symposium, the CCPM symposium and the CAP Public Lecture, presented by Radiation Oncologist and Associate Professor, Dr. J-P Pignol from the Toronto-Sunnybrook Regional Cancer Centre

Toronto is always an exciting city to visit with many attractions, shopping, and fine dining.

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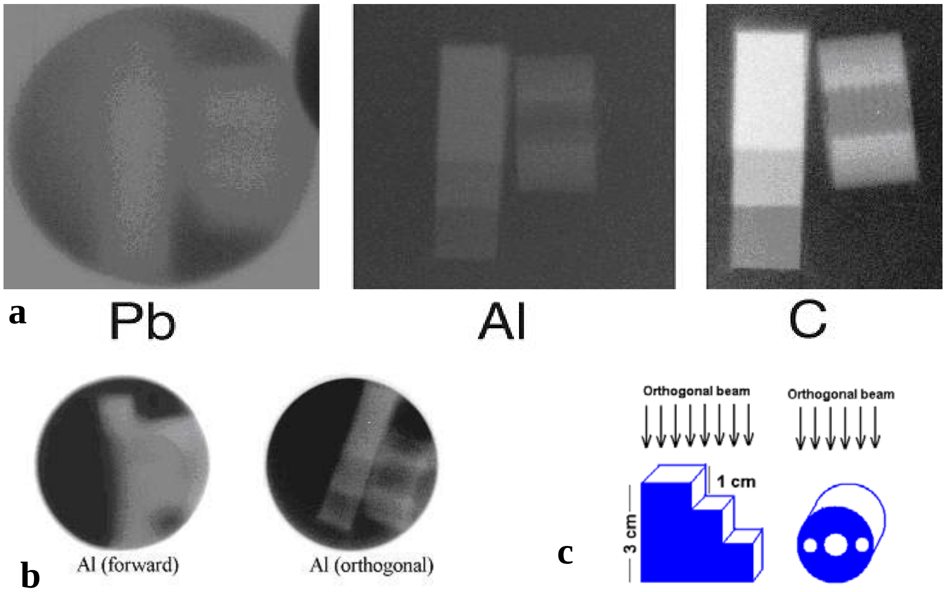

Figure 8 – Image contrast results using Agfa 400 diagnostic films and 6 MeV incident electron beam on various targets. A comparison of image quality for orthogonal bremsstrahlung beam from various targets (a) and for the same target but in both the forward and orthogonal directions (b) has been studied. Contrast test objects used are also shown schematically (c). Please note that the image taken in part (b), using the forward bremsstrahlung beam is intended to show the quality of current portal images.

(Continued from page 13)

same ratio for an aluminum target is 0.25, and for a copper target it increases to 0.63.

Although filters were used to reduce electron contamination, they did not eliminate it completely, since they themselves can create a fixed amount of electron contamination. The electron contamination resulted in discrepancies between experimental and MC calculated results for depths below the depth of maximum dose in PDD measurements (Fig. 4). The electron contamination also resulted in a much higher reading of the first few points of the attenuation measurement (Fig. 5). Especially when no copper attenuator was used, the measured dose was up to 15% higher than the expected values. Because of the copper's high density, most of the contaminating electrons were removed past a thickness of roughly 1 mm resulting in a quick convergence of MC and experimental data.

3.2 Spectral Calculation

Many of the conclusions regarding the beam energy drawn from PDD and attenuation measurements can be explained using the spectral distribution results, shown in Fig. 7. The figure displays the calculated spectra of the forward and orthogonal components of the bremsstrahlung beam produced by 10 MeV electrons striking a carbon and an aluminum target. Since our experimental setup was fully simulated to produce the spectral results, the calculated spectra of the beams are expected to be realistic. As the yield of photons in the forward direction is much higher than the yield in the orthogonal direction, in Fig. 7 all peak fluences have been renormalized to unity.

$E_{\phi,max}$, the energy of a spectrum at which the maximum photon fluence occurs at, depends on the target material but varies only slightly with angle and/or the energy of the incident electron beam. This variation is most significant for low electron energies striking targets of high atomic number, and the precise shape of the spectral distribution is strongly dependent on the geometry and filtration. Given our setup and Fig. 7, $E_{\phi,max}$of the resulting bremsstrahlung spectrum from a carbon target was determined to be 38 keV in the orthogonal direction and 34 keV in the forward direction. For an aluminum target, the value of $E_{\phi,max}$ was calculated to be 93 keV and 90 keV for the orthogonal and forward components of the beam, respectively. Given a target material, since $E_{\phi,max}$ is essentially constant, the higher effective energy of the forward-directed beams can only be attributed to the larger fluence of high energy photons in the forward direction compared to the orthogonal direction. The variation in effective energy of beams produced by different target materials, however, is caused by the variation in $E_{\phi,max}$ as well as the variation in the slope of the photon fluence beyond $E_{\phi,max}$. It is evident from Fig. 7 that the contribution of high energy photons is markedly larger for a beam produced by an aluminum target than one produced by a carbon target.

3.3 Image Contrast Measurement

Using both the orthogonal and forward beam spectra, images of simple Lucite test objects (Fig. 8c) were taken. Quantitative analysis of images obtained using the orthogonal beam setup shows contrast levels ap-

(Continued on page 19)

(Continued from page 18)

proaching those previously obtainable only with diagnostic quality beams. Images produced by the orthogonal component of the bremsstrahlung beam from targets of various atomic numbers are shown in Fig 8(a), while a comparison between images produced with the forward and orthogonal components of the resulting bremsstrahlung beam from an aluminum target are shown in Fig. 8(b).

4. Conclusions

The effective energy of the bremsstrahlung spectrum and its yield depend strongly on the angle between the direction of electrons striking the target and the direction between the point of measurement and the target. In the orthogonal direction, beams with effective energies in the kilovoltage range can be obtained from megavoltage electrons incident on low atomic number targets. Furthermore, we have experimentally shown the feasibility of obtaining images with much greater soft tissue contrast levels (compared to levels commonly attributed to portal images) in a fraction of second using the orthogonal imaging setup. This work therefore potentially opens the door for an integrated, linac-based cone beam imaging system without the need for additional x-ray generators and tubes.

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CAPCA Standards: the continuing saga.

Submitted by: Peter Dunscombe
Calgary, Alberta

There are currently six standards approved by COMP and a further five (i.e. all the draft documents except that on Treatment Planning Systems) are entering the final review stage. All proposed standards are posted on medphys.ca for at least six months to allow the Canadian medical physics community adequate time to comment on and consider the resource and other implications of adopting the standards.

As predicted in previous communications, the CNSC is now starting to assess the performance of licensees against applicable standards so it is worth taking these documents seriously. Although not CNSC related, a standard you might want to pay special attention to is the one on Treatment Planning Systems. This one is still open for comment at this time. My suspicion is that none of us is following this standard very closely and to do so will require the allocation of resources. You are particularly invited to comment on this document. If you recommend changes please justify them and be specific about the changes you would like to see.

The CAPCA Task Group prepared a brief manuscript on this initiative and you will see that shortly in the Journal of Applied Clinical Medical Physics. The Task Group is also looking at consolidating all the documents into one. It's proving very difficult to maintain consistency of even the generic parts with so many documents being developed.

Peter Dunscombe
December 2006
For the CAPCA Task Group

A Closer look at our 2006 Gold Medal Recipients
… continued Sylvia O Fedoruk

(Continued from page 9)

the work horses for radiation therapy before the 1950's. However, in addition to her depth-dose work, she soon became a key member of the Johns' team
which brought the Saskatchewan Co60 unit into clinical service in 1951.

Sylvia was a pioneer in the emerging field of nuclear medicine and in 1989 was invited to give the keynote address to the Canadian Nuclear Association on "The Growth of Nuclear Medicine". The address, which also includes a history of radiation therapy, is on the Web, at http://www.cns-snc.ca/history/fifty_years/fedoruk.html

When Harold Johns left Saskatoon for Toronto in 1956, Sylvia became Director of Physics Services for the Saskatchewan Cancer Commission, a post she held until she accepted Prime Minster Brian Mulroney's invitation to became Lieutenant-Governor of Saskatchewan in 1988. Along the way she had been Chancellor of the University of Saskatchewan and had served on such bodies as the Atomic Energy Control Board, the Science Council of Canada and as consultant on nuclear medicine to the International Atomic Energy Agency.

Succeeding is the coming together of all that is beautiful.

- I Ching

Request for Proposal: COMP Annual Scientific Meeting Local Arrangements Committee

The Canadian Organization of Medical Physicists (COMP) is seeking proposals from groups interested in serving as the Local Arrangements Committee (LAC) for the COMP Annual Scientific Meeting (ASM) for 2009.

BACKGROUND

COMP is the main professional body for medical physicists practicing in Canada.

The membership meets formally once a year, usually in mid-June. Proffered papers on various topics of current research and clinical interest are presented. This is an opportunity for the members to network and keep abreast of colleague's activities. It is also a venue to formally discuss issues of concern to the membership. COMP attempts to ensure that the ASM's are geographically dispersed as much as possible. We also attempt to hold stand-alone meetings at least every second year. The following locations have been confirmed for future ASM's:

2007 – Toronto (joint with CARO)
2008 – Quebec City
2010 – Ottawa
2011- Vancouver (joint with AAPM)

SCOPE OF REQUIRED SERVICES

The LAC is required to do the following:

- Work with the Executive Director to select appropriate meeting space for the ASM and accommodations for the delegates
- Work with the Conference Committee to develop the theme for the ASM and program schedule
- Coordinate all aspects of the public lecture
- Develop a detailed budget for the ASM and manage all related financial transactions
- Plan and execute all social/networking activities
- Coordinate onsite registration
- Coordinate audio visual requirements
- Coordinate the printing of the ASM proceedings
- Following the ASM, present a final report to the Conference Committee which reconciles all financial transactions, outlines what worked well and makes suggestions for improvements. This report will serve as a resource to future LAC's.

INFORMATION REQUIRED

Proposals shall be in a word file of no more than three pages and forwarded by e-mail to nancy@medphys.ca. Proposals should include the following:

- Information about the organization and capabilities of the prospective LAC
- Information about the medical physics community in the proposing city
- Information about prospective venues for the meeting
- A preliminary budget
- Information on similar events hosted

COMP reserves the right to:

- accept a proposal without negotiation
- negotiate changes to the successful proposal
- cancel or reissue this RFP at any time

The COMP contact for the purposes of response to this request for proposal is:

Nancy Barrett
Executive Director
nancy@medphys.ca

Call for Abstracts, and Invitation to
WESCAN 2007 - March 21 -24, 2007
The future of radiotherapy treatment preparation in Canada
Fantasyland Convention Center, West Edmonton Mall, Edmonton, AB

WesCan is a small regional physics meeting open to all physicists, students, therapists and support personnel. Given that COMP is late in 2007 with CARO, please consider joining us to discuss matters of professional interest, practice your AAPM talks, or see what is new at the Cross Cancer Institute. Vendor sponsorship has been tremendous and we can promise you a unique venue with a great scientific and social program (all meals are included during the conference).

To Register for the Meeting, go to www.wescan.org

MEETING HIGHLIGHTS:

- Wednesday: Ice breaker reception, Free skate and Shinny hockey at the West Edmonton Mall (complementary with meeting registration are rental of skates, helmet and hockey stick. If you wish to skate or play hockey, please e-mail Alasdair Syme (alasdair@cancerboard.ab.ca), and indicate your skate size. Full equipment is NOT necessary!)
- Thursday: Keynote Address, proffered talks, posters and banquet.
- Friday: Proffered talks at Fantasyland Convention Center; Symposium at the Cross Cancer Institute, with reception and tour of the Cross Cancer Institute Centre for Biological Imaging and Adaptive Radiotherapy following the symposium.

Saturday: Proffered talks and closed professional session on physicist contract negotiations. Conference closes at noon.

SYMPOSIUM: Today, the standard for radiotherapy delivery is IMRT, and significant new technologies have recently become available for simulation, contouring, automatic beam positioning, automatic beam shaping, scripting, and quality assurance which have the potential to revolutionize how radiotherapy treatments are prepared. This year the symposium will focus on how these new technologies will affect radiotherapy in Canada.

KEYNOTE SPEAKER: Michael Sharpe (Princess Margaret Hospital)

SYMPOSIUM SPEAKERS: Boyd McCurdy (Cancer Care Manitoba), Pat Cadman (Saskatoon Cancer Center), William Ansbacher (BC Cancer Agency), Miller MacPherson (The Ottawa Hospital Cancer Center), Michael Sharpe (Princess Margaret Hospital), Marc MacKenzie (Cross Cancer Institute).

GUIDELINES FOR ABSTRACT SUBMISSION:

- Please send abstracts via e-mail to Marco Carlone (marcocar@cancerboard.ab.ca) on or before March 5, 2007.
- Indicate ABSTRACT WESCAN 2007 in the subject header and preference of poster or talk in the message. If acknowledgment is not received by March 7, 2007, please contact Marco Carlone.
- Abstract format: Please prepare abstracts using Microsoft Word. The abstract word limit is 200. Do not include equations, formulae, or illustrations. An electronic supporting document (in Microsoft Word format) may be submitted if the author(s) would like it to be published in the conference CD. This is not mandatory and will not affect the evaluation of the abstract.
- Abstracts less than 200 words will be published in InterACTIONS.
- Abstracts and supporting documentation (if included) submitted before the deadline (March 5, 2007) will be published in the conference CD.

If your abstract is intended for the professional session, please indicate this at the time of submission.

IMPORTANT DATES:

Early registration deadline: Wednesday, February 21, 2007.
Deadline for discounted hotel rates: February 19, 2007
Deadline for Abstract submission: March 5, 2007

CONTACT INFO:	Web pages of interest:
Scientific Chair: Marco Carlone (marcocar@cancerboard.ab.ca)	www.wescan.org
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Shinny hockey: Alasdair Syme (alasdair@cancerboard.ab.ca)	www.edmontonoilers.com/schedule/2006-07/march.php
Exhibitors: Geetha Menon (geethame@cancerboard.ab.ca)	

Conference Announcements

XVth International Conference on the
Use of Computers in Radiation Therapy
(ICCR 2007)
MARK YOUR CANDAR for June 4 - 7, 2007

You are cordially invited to attend the XVth International Conference on the Use of Computers in Radiation Therapy, which will be held at The Hilton Toronto, Canada on June 4-7, 2007.

This conference will address advancements in radiation oncology through investigations in modeling of biological systems, interactive radiation therapy treatment planning, deformation and shape change, schemes for adaptation/feedback, multi-modality image registration and image segmentation, and systems for fully four-dimensional radiotherapy. It will feature a number of well-known keynote speakers and plenary presentations, a poster discussion and scientific sessions.

The Scientific Committee of the XVth International Conference on the Use of Computers in Radiation Therapy (ICCR 2007) is now accepting abstracts. If you are interested in attending our conference, please log on to www.iccr2007.org to submit your abstract. The deadline for submissions is January 15, 2007.

Please visit our website at: www.iccr2007.org

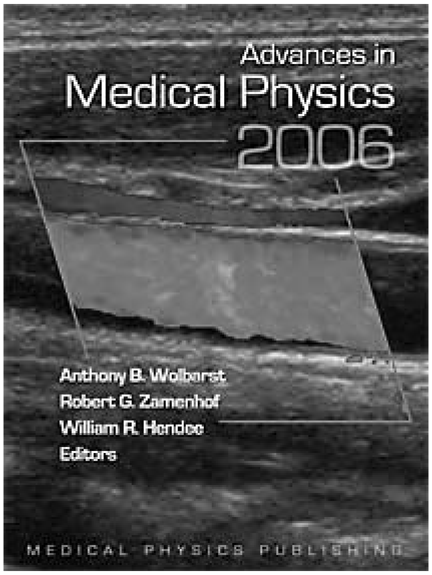
Defining 'Cold' in Melbourne, Australia

Time flies - however, I still remember my time at the London Regional Cancer Centre with great pleasure. After returning to Australia I am probably enjoing the 'Interactions' even more - a great way to keep in touch. Another important Canadian export to the Southern hemisphere has been the Terry Fox run - I had the pleasure to participate in the first Terry Fox run here in Melbourne, down under. My understanding is that this has been the most southerly Terry Fox run in the world and the weather tried its best - it was one of the coldest days in Melbourne, windy but it did not manage the white stuff. Many of the 200 participants were Canadian expats and my son and I spotted lots of familiar Canadian shirts including the ones from previous Terry Fox runs (and some Western Mustangs!). A great time was had by everyone (as can be seen on the attached). A Tim Horton's coffee (double double) would have hit the spot.*

Best wishes
Tomas Kron
Peter MacCallum Cancer Centre
Melbourne, Australia

*According to local Melbournites, 'cold' is defined as temperatures < +15^{o}C; thus, a race-day temperature of 5^{o}C is very cold… relatively speaking, of course.

Book Review:
Advances in Medical Physics
Editors: A. B. Wolbarst, R. G. Zamenhof, W. R. Hendee



Medical Physics Publishing
Madison WI

ISBN:9781930524347
Published: 2006
376 pp.
Hardcover
Price: US $80.00

Submitted by Hans-Sonke Jans
Cross Cancer Institute
Edmonton, Alberta

This text is the first volume of a new biennial series "intended to help practicing medical physicists, technically inclined physicians, and other interested professionals to stay current in medical radiation science and technology – and in particular in subfields of medical physics other than their own…". Congruent with this goal is the well-written style, directed at the "…generalist in medical radiation science and technology, and a notch or two less rigorous than would satisfy the needs of a researcher in his or her own area…" (quotations from the preface), and the broad spectrum of its contents, ranging from various imaging related topics to the biological effects of radiation, radiation therapy and magnetic nerve stimulation.

The first six chapters of the book cover specific imaging modalities: digital radiography and fluoroscopy, mammography, CT, MRI, nuclear medicine and ultrasound imaging. Each gives an introduction into the field, and can easily be studied in small sections at a time, if the reader can not devote time for continuous study. Being the first in a whole series, this volume intentionally provides more scientific and technical background information, but also touches on advanced techniques, such as digital tomosynthesis or dual energy x-ray imaging, MRI perfusion imaging, PET/CT, SPECT/CT, and 4D ultrasound.

Chapters 7 through 9 take up additional imaging related subjects: a fine summary of the current efforts in molecular imaging is presented in chapter 7, featuring a side-by-side comparison of the diverse range of modalities employed. Other subsections are devoted to probes for molecular imaging, including nanoparticles, and current clinical and research findings. Chapter 8 contains an overview of medical imaging informatics and is structured into a section covering PACS and one about electronic medical records. Chapter 9 deals with evolving experimental technologies in medical imaging: it glances at such fascinating fields as terahertz and microwave imaging, thermography, mini and nanotechnology to name but a few; and though they obviously cannot be covered in great detail, it is an inspiring read and motivates additional study of select topics of interest.

The next two chapters are devoted to the interaction of ionizing radiation with biological tissue. Chapter 10 provides radiobiological background and concludes with a critical discussion of the linear non-threshold hypothesis of biological response to radiation. Radiation therapy is described in chapter 11, including sections about Tomotherapy, target localization techniques, 4-D radiation therapy and biological modeling. The volume concludes with a chapter about magnetic nerve stimulation, its history, implementation and clinical and research applications.

This text lives up to its goal of providing an outlook into the wide field of medical physics beyond the readers own area of specialization. The subject matter is presented in a clear, concise manner referring frequently to well-labeled illustrations. Mathematical formulation of the contents is almost entirely absent (the most notable exceptions being the chapters about MR and ultrasound), which makes the text easier to study but also decreases its depth and the reader will have to decide how far this trade-off is to his or her liking; numerous references in each chapter, however, provide useful jump-off points for more in-depth study. In future volumes of this series, one can look forward to more well-written reports from the frontiers of the advancing field of medical physics.

Canadian College of Physicists in Medicine

Examination Schedule 2007

Membership Examination:
Applications due: 5 January 2007
Examination date: Written 10 March 2007
Oral 12 May 2007 (Montreal)
Fee: $450.00
Decisions announced on or before February 23
(Note: Non-Radiation Oncology specialty orals to be held at the same time as Fellowship orals)

Fellowship Oral Examination:
Applications due: 5 January 2007
Examination date: 1-2 days prior to COMP Meeting in Toronto (October)
Fee: $300.00
Decisions announced on or before February 23
(later for those who do the membership exam in the same year)

Note:
The application forms, exam study guide, and sample exams are available on the COMP website under the heading "CCPM Certification". Application forms must be the ones currently posted on the COMP website.
Membership & Fellowship examination application deadlines are set to the same date. This allows the Credentials Committee to review all applications in one time period.
It is critical for the success of your application that you respect the deadlines.

For further information contact the Registrar:

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Victoria, British Columbia, V8R 6V5
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Dosimetry staff in Saskatoon continue (controversial) cloning experiments

Submitted by: Gavin Cranmer-Sargison
Saskatoon, Saskatchewan

In recent years physicist cloning experiments have been limited to single reproductions (see InterActions 49 (1) page 28). The results presented here demonstrate that multiple cloning experiments can be performed simultaneously, and again reveals that unsuspecting physicists are willing to have odd pictures taken of them.

Editor's Note: Hullabaloos and CT scanners

You might have picked up your copy of the newsletter and said "Hey? Where did that… oh, here it is". Yes, we changed the first few pages a bit. It was something that seemed to make a bit of sense, given that the COMP/ CCMP contact information pages do not need to be colorized and there was opportunity to provide some additional advertising space to vendors requesting color. So the back inside sleeve may change from time-to-time.

But to more important matters. Being a westerner for most of my adolescent and academic life, I've come to realize that Torontonians pretty much ignore the rest of Canada and complain a lot. I've embraced this aspect of Toronto with much vigor and realized that there is no better way to waste someone else's time than broadcasting *my* issues to everyone else in Canada. And, hey! I've even got a column in a national publication for it!

Here in Ontario, a recent hullabaloo raised the ire of provincial politicians and various concerned citizens, prompted from the Ontario's Auditor General report (see http://www.auditor.on.ca/en/reports_2006_en.htm , page 14). Specifically,

> "Staff at the two hospitals we visited that performed pediatric CT examinations indicated that, in close to 50% of the selected cases, the appropriate equipment settings for children were not used. As a result, the children were exposed to more radiation than necessary for diagnostic imaging procedures."

With statements like this in a report of this gravity, one eagerly awaits for the political ramifications to unfold, in true dramatic fashion, whereby finger-pointing would be a natural knee-jerk reaction. Putting aside the discussion of 'risks' and 'exposure', a bigger story probably lies in figuring out who actually assumes, and who probably *should* assume, responsibility for x-ray exposure limits from CT scanners.

Legally speaking, a certified diagnostic Medical Physicists who is (arguably) most qualified to inspect such devices, is not allowed to sign-off on the machine because Medical Physicists are not recognized by Ontario as "Health Practitioners". Instead the legally recognized role of the "Radiation Protection Officer" could be assumed by someone else, likely a Radiologist or a Chiropractor (yes, you read that) probably not as well versed in the nuts-and-bolts of acceptance testing and commissioning a CT scanner (if that procedure is actually performed at all).

The fact that I am not a "Health Practitioner" is something I find quite amusing, especially after a heavy day planning and delivering a patient's stereotactic radiosurgery treatment. Clearly, the Medical Physicist's role in Health Care is not well understood by politicians, nor lawyers (including my wife), nor the general public for that matter. By no means do I imply that COMP and CCPM are, therefore, ineffectual organizations who haven't done enough to 'lobby' provincial and federal politicians to recognize Medical Physicists: many of these matters are mostly provincially regulated after all. But each of us could probably do a bit more by contributing on a COMP/CCMP committee, or perhaps make and showcase a giant quilt with famous Canadian Medical Physicists on it, to help not only spread the word out on what we do, but also that what we do actually matters in our Health Care system.

And by the way, that last suggestion was a joke.

Parminder S. Basran
InterACTIONS Editor

(Continued from page 7)

ganizations

7. COMP needs to **increase its strategic communications** to members and stakeholders
8. COMP needs to **provide networking opportunities** for its members and key stakeholders
9. COMP must continue to **develop and update standards**
10. COMP must ensure that its **Governance** model can appropriately address the priorities outlined in the Strategic Plan.

Next Steps

The three-year strategic plan is being finalized and will be published on www.medphys.ca. The plan identifies strategic priorities for each of the three years with associated action plans. By publishing the plan, members will have the information they need to evaluate our progress.

Once again, we thank you for your support of this process. I look forward to working with the Executive to address your strategic priorities over the next three years and as always I welcome your feedback and suggestions.

Wishing you a happy and successful 2007!

All the Best,
Nancy

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