InterACTIONS

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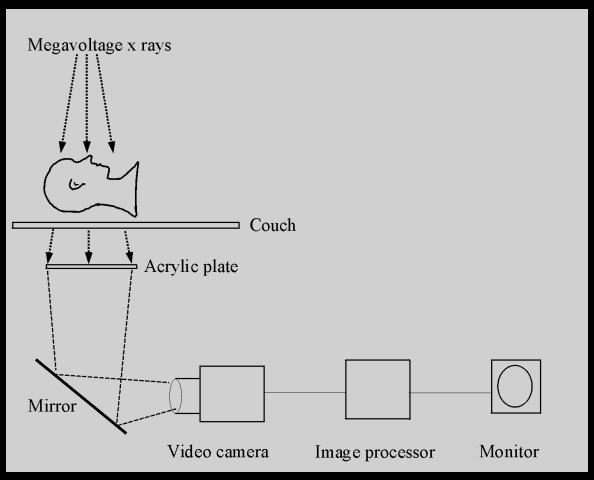
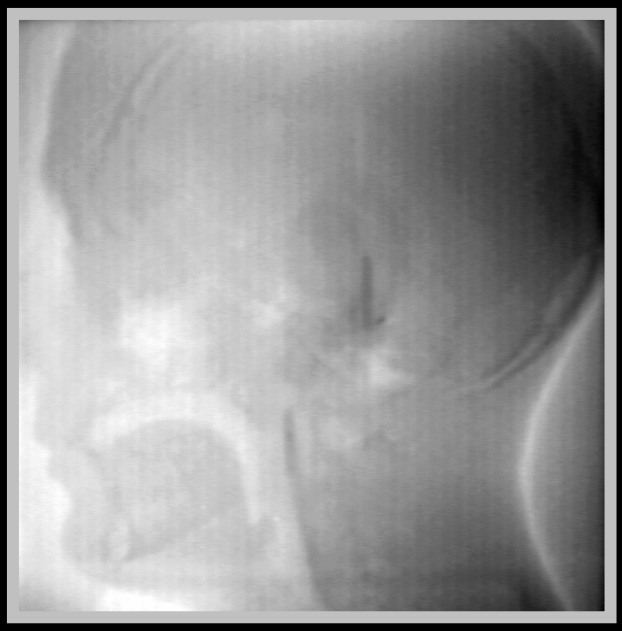
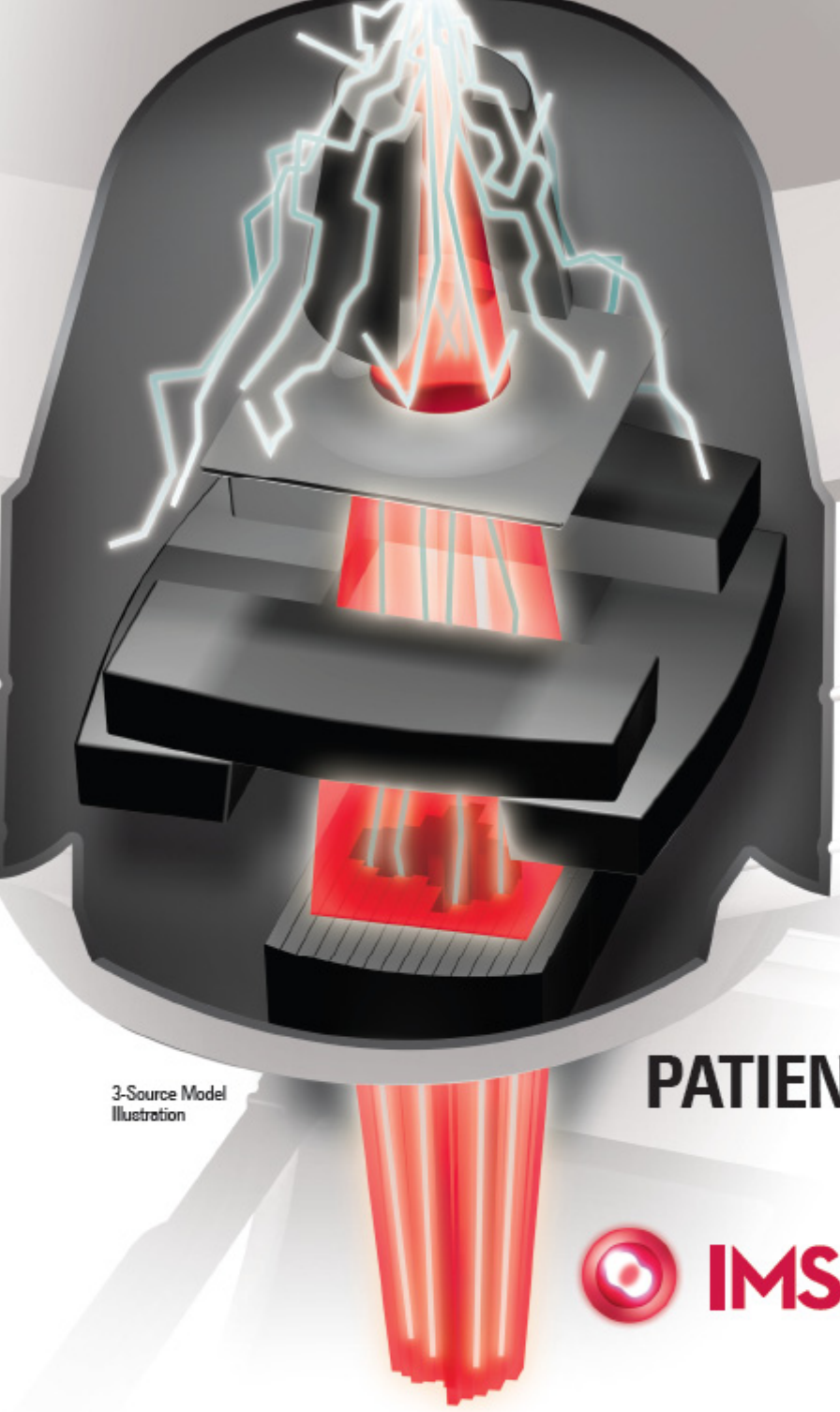




First portal image based on Cherenkov radiation



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1. T. C. Zhu, B. E. Bjarngard, Y. Xiao, and C. J. Yang, "Modeling the output ratio in air for megavoltage photon beams," Med. Phys. 28, 1352–1358 ~2001.


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Volume 53, Number 2– avril/April 2007

Cover Image

At Toronto Sunnybrook Regional Cancer Centre, we are investigating the use of Cherenkov radiation for portal imaging applications. Cherenkov radiation is an electromagnetic shock-wave of light produced by a charged particle (*e.g.*, an X-ray excited electron) passing through a dielectric medium with a velocity greater than the speed of light in the medium. For example, electrons with kinetic energy greater than 260 keV can generate Cherenkov radiation in water. We propose to use the Cherenkov mechanism to develop a new, high quantum efficiency, megavoltage X-ray detector for both geometric and dosimetric verifications in radiotherapy [see Mei, Rowlands, and Pang, Med. Phys. **33**, 4258 (2006)].

The upper figure illustrates a modified video-based electronic portal imaging device (EPID) to demonstrate that images can indeed be obtained using Cherenkov radiation. The clear acrylic plate (~ 1 cm thick) is used to convert X-ray energies into light using the Cherenkov process, in place of the conventional Cu plate/phosphor screen in a video-based EPID. The lower figure shows the Cherenkov image of a Rando phantom taken with the modified system using a 6MV beam.

Image provided by Geordi Pang, Toronto-Sunnybrook Regional Cancer Centre. This work was supported by the Individual Discovery Grant Program awarded by the National Sciences and Engineering Research Council of Canada (NSERC).

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Please submit stories in Publisher 98, Word 6.0, Word 97, or ASCII text format. Hardcopy submissions will be scanned to generate an electronic document for inclusion in the Newsletter. Images in Tiff format at 300 dpi resolution are preferred.

ADVERTISING (both corporate and job) enquiries can be made to:
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Message from the COMP Chair:

In my previous message I described the process which led up to the Strategic Planning workshop which was held in November. Today I am pleased to be able to provide some of the outcomes of this exercise. Since my last message the COMP executive has reviewed the Strategic Planning Report which was prepared for us by Paulette Vinette (the Facilitator) and we will be holding a teleconference in March to implement a communication strategy, gather feedback and ultimately put plans into place to achieve the goals we have set for ourselves.

The input that we had obtained prior to the workshop was gathered from two sources, telephone interviews with key stakeholders from within the organisation (including members of the COMP executive and CCPM board) and from a broader on-line survey. These two groups rated the organisation similarly on how well we were meeting the organizations objectives, which included the promotion and exchange of scientific knowledge and information, and linking to the activities of other similar organizations. We clearly have some work to do, as we were not rated as excellent in meeting any of our six objectives. We were rated as good by both groups for our efforts to develop and protect professional standards and to promote and encourage CCPM certification, while on the down side both groups felt that our efforts to promote educational opportunities was only fair. On a more positive note the ratings for both the scientific meeting and the newsletter were good to excellent.

Building on this and other input we brainstormed a vision and mission which reads in draft form as follows.

Vision: COMP's vision is to champion medical physicists' efforts to support and advance the state of the science of medical diagnosis and therapy through innovation, assurance of quality and safety, and technology.

Mission: COMP's mission is to be the voice of Canadian medical physicists.

We then went on to identify five strategic pillars around which we would develop a number of goals and objectives. In brief, we felt that it was important to foster a cohesive community and to increase membership, to provide a forum to build national consensus on a variety of issues, to improve and expand our educational programs, to raise our profile both nationally and internationally and ensure that COMP operates and manages its resources is the best possible way. Some specific actions included the idea of running a summer school and I am currently drafting terms of reference for a Science and Education Committee which will coordinate activities in this regard. I am also hoping that, through this committee our student members, who are crucial to the future success of this organization, will have some greater input into the activities of COMP. Please let me know if any of these ideas resonate with you.

Those of you who monitor our web-site or that of the IOMP will have noticed that COMP has created (with thanks to BEST Medical Canada for partial financial support) a travel award for senior residents or clinical medical physicists who are within 2 years of completing their residency. This travel award will support travel to and from a developing country, with the award going in alternate years to a Canadian resident and to a resident/trainee from a developing country. In 2007 applications from a resident of a developing country are being considered. For full details please see our web site. If you know of someone from a developing country whom you feel will meet the criteria for this award, please make them aware of its existence. I would also appreciate hearing from you if you are interested in helping evaluate the applications.

Finally, Peter O'Brien is working hard with our colleagues in CARO to put together a very interesting 2007 scientific meeting. As a result of the joint nature of the meeting there will be some differences in the abstract submission process. Please keep your eyes peeled for information as it becomes available.

Dr. Stephen Pistorius
COMP President

Vision: COMP's vision is to champion medical physicists' efforts to support and advance the state of the science of medical diagnosis and therapy through innovation, assurance of quality and safety, and technology.

Message from the CCPM President:

Part of our job function is ensuring patient and public safety. As physicists we naturally concentrate on the physical safety aspects, but this focus may blind us to the overall safety issues of medical procedures. Patient deaths caused by Magnetic Resonance Imaging (MRI), illustrate this point.

Attend a refresher course or read a journal article on MRI safety and most if not all the content will focus on the potential hazards of the strong magnetic field and the radio frequency (RF) fields required for MRI. The strong magnetic field, typically 1.5 to 3 Tesla, will and has attracted ferromagnetic objects such as coins, paper clips, floor polishers, and gas cylinders into the magnet bore. This is sometimes referred to as the "projectile hazard" and the most publicized incident was the death of a young patient after his head was struck by a steel gas cylinder that was pulled into the magnet when the cylinder was inadvertently brought into the magnet scan room.

Most deaths have occurred in patients with cardiac pacemakers, a contraindication for an MRI scan since the static field will alter the pacemaker program and the RF field can cause fibrillation, if the pacemaker leads into the heart happen to form a resonant electrical circuit at the RF field frequency. Ten patients have died during an MR scan where the MR staff was unaware (but should have been aware) that the patient had a cardiac pacemaker. [Several hundred patients with cardiac pacemakers have had MR scans without any adverse effects.] In total, 20 MRI patients have died from MRI scans related to human error since MRI became a medical procedure.

Twenty accidental deaths in 1,000,000,000 MR studies during the past 25 years is an accidental death rate of 0.02 per million making MRI one of the safest medical procedures. Restated more graphically, an ambulatory patient with no electronic implants is much safer inside an MRI system than in their car.

All the above deaths have been caused by human error, i.e., non stochastic events. Many more deaths have been caused by a stochastic event, a severe adverse reaction to the most common clinical MRI contrast agent, Gadolinium-DTPA. The Gd ion is held within the DTPA chelate to prevent the toxic effects of bare Gd. Gd-DTPA is used in about 20% of all MRI studies. The death rate for this agent is 0.4 per million which equals 80 deaths from MRI contrast reactions, a much larger number than the 20 accidental MRI deaths. Those 80 deaths are rarely if ever mentioned at MRI safety talks; many MRI physicists are not aware that more patients have died from MRI contrast than from MRI related accidents.

Recently, a third MRI safety issue has been uncovered. In the past year over a 100 cases of Nephrogenic Systemic Fibrosis (NSF) have been recorded in MRI patients that have been injected with Gd-DTPA contrast and also had very poor kidney function at the time of injection. NSF is a very rare disease that was first formally described in 2004, but cases have now been recognized going back to 1997. The incidence of NSF in contrast injected MRI patients with normal kidney function is zero; the incidence of NSF in contrast injected MRI patients with very poor kidney function is 5%. Since healthy kidneys clear Gd-DTPA within hours from the body the current hypothesis is that the Gd ion breaks loose from its chelate over many days and is absorbed by connective tissue. The free Gd then causes tissue fibrosis, which can be fatal if this process spreads into the lung or heart. Currently, there is no cure, so effectively the total number of deaths related to MRI since its inception has now been matched by the number of MRI patients suffering a permanent, debilitating adverse reaction associated with Gd-DTPA. [Although there is only a statistical association among Gd-DTPA, poor kidney function and NSF, the FDA has issued guidelines to prevent further NSF cases.]

One can look at these numbers from either the glass is half empty or half full perspective. The pessimistic view would be that by concentrating on preventing accidental deaths medical physicists have only or are only able to affect 10% of deaths or severe adverse events from MRI. The optimistic view would be that by concentrating on what can cause accidental MRI deaths medical physicists have helped to successfully reduce these to well below the number of stochastic MRI deaths.

Dr. Dick Drost,
CCPM President

As physicists we naturally concentrate on the physical safety aspects, but this focus may blind us to the overall safety issues of medical procedures.

Message from the Executive Director of COMP/CCPM:

Ms. Nancy Barrett,
COMP/CCPM Executive Director

It is difficult to believe that Spring is upon us already! Winter passed by very quickly this year and was marked by the following COMP activities:

COMP/CARO Conference in Toronto October 10th to October 13th, 2007
This joint conference supports three of the priorities you, our members, identified as part of the strategic planning process:

- COMP should promote professional development opportunities
- COMP should be proactive in working with other, similar organizations
- COMP needs to provide networking opportunities

It has been a pleasure working with my counterpart at CARO on the logistical issues of this conference. An independent website has been created specifically for this conference and there is a link from the COMP site to the COMP/CARO Conference site. While we will be providing regular updates via email, you are encouraged to check this site regularly. COMP is also well-represented on the Scientific Committee for this conference by Peter O'Brien and David Wilkins.

As part of an overall communications plan, we are currently working on a review of our website and our online processing systems to determine how it can be improved to better meet our needs.

COMP Website

As part of an overall communications plan, we are currently working on a review of our website and our online processing systems to determine how it can be improved to better meet our needs. This involves working with the Communications committee to develop a list of improvements for the COMP website and reviewing the websites of other medical/scientific associations to determine best practices. We welcome any suggestions you might have!

Corporate Liaison
Our corporate members continue to support us very generously through advertisements in both InterACTIONS and the Annual Directory and by exhibiting and sponsoring our annual conference. This is an important source of non-dues revenue that supports our activities and we are grateful for this contribution.

2007 Membership Dues Renewal

While we experienced some glitches with the online processing system in December, thanks to the hard work of volunteers **Darcy Mason** and **Michelle Cottreau** and COMP Administrator, **Gisele Kite,** we addressed the challenges and most members were able to renew successfully online. As at March 1st the renewal rates were as follows:
Gisele continues to contact those full and associate members who have not yet renewed in an effort to increase the overall retention rate. CCPM members are reminded that they must be COMP members in good standing in order to maintain their certification.

Membership Category	2006	Renewed for 2007	Renewal Rate
Full	396	362	91%
Associate	9	6	67%
Student	69	43	62%
Retired	7	7	100%
Total	**481**	**418**	**87%**

Both Gisele and I thank you for your support and look forward to continuing to work with the Executive to address your priorities. As always I welcome your feedback and suggestions.

Please feel free to contact me at nancy@medphys.ca or Gisele Kite at admin@medphys.ca at any time.

2006 Professional Survey

Submitted by: Peter McGhee
Thunder Bay Regional Health Sciences Centre, Ontario

The following is the report on the data received from the professional survey conducted in 2006. Because it is perceived as providing valuable professional information, there is significant interest in the results of the survey. Approximately 400 members were contacted at the time of the survey and, although there was quite a good response, as you review the results of the report you may discover some surprising outcomes. The validity of such outcomes is, of course, subject to the completeness of the original data set. The response rate still remains far from providing the data set that would be ideal, which is the long way around to once again encouraging all members to please, in future, take the few minutes required to complete the survey.

The report was prepared under contract by a private firm, Association Management, Consulting & Evaluation Services (AMCES). Particular thanks go to Jarett Kingsbury of AMCES, the principal author of the report. This is also an opportunity to once again acknowledge and express gratitude for the efforts of Dr. Richard Hooper who had, for many years, ably produced the survey. Arrangements are now in place for AMCES to continue with the performance of the survey and preparation of the report. Any comments or feedback would of course be appreciated for refinement of the process, which will again be engaged in 2008.

2006 COMP Professional Survey: Final Report

The 2006 edition of the COMP professional survey provides comprehensive documentation of compensation and benefits currently provided to members. The survey was sent out to all members in late October 2006.

There were 174 Respondents to the survey, which represents 44% of the total membership contacted to participate. This is a marked increase in response rate over the 2003 Survey which had 123 Respondents (or 35% of total membership contacted).

1. Age (n=174).

Age	21 - 30	31 – 40	41 – 50	51 – 60	61+	Average	Median
Men	9	41	51	28	9	44.42	45
	6.5%	29.7%	36.9%	20.3%	5.9%		
Women	7	17	10	2	0	37.33	36
	19.4%	47.2%	27.8%	0.6%			

Of note, the average age for Francophone members was nearly 10 years less than that for Anglophone members, and the average age of women was 7 years less than that of the men. Over half of the women are under 40 and more than half of the men are over 40.

2. Gender (n=174).

In total 138 men (79%) and 36 women (21%) responded to the survey.

3. Location

	BC	AB	SK	MB	ON	QC	NB	NS, NL & PEI	World
2006 Respondents (n=174)	23	18	6	7	65	21	4	11	19
% of total 2006 Respondents	13.2%	10.3%	3.4%	4.0%	37.5%	12.1%	2.3%	6.3%	10.9%
2003 Respondents (n=123)	12	11	3	9	55	20	4	8	N/A
% of total 2003 Respondents	9.8%	8.9%	2.4%	7.3%	44.7%	16.3%	3.3%	6.5%	N/A
Change in response rate	+3.4%	+1.4%	+1.0%	-3.3%	-7.2%	-4.2%	-1.0%	-0.2%	N/A

Over a third of the Respondents are from Ontario. The number of responses from British Columbia and Alberta increased the

(Continued on page 37)

most over the 2003 Survey, while the responses from Quebec and Ontario decreased the most.

4. Please indicate the highest level of education that you have attained (n=174)

Of those who responded to the question, 118 (65%) had earned their Doctorate as their highest level of education, 58 (33%) had earned a Masters Degree and 3 (2%) had earned a Bachelors Degree. The number of respondents with a Doctorate has increase by three percent over the 2003 Survey.

5. Please indicate your certification (n=174).

In the 2003 Survey 58 percent of the respondents had CCPM certification. This now represents 64 percent of all Respondents. A professional certification of some form is held by 81 percent of respondents. Of those who had a certification other than the CCPM, the majority held a DABR.

6. Who is your primary employer (n=174)?

The primary employer for 85 of the 174 Respondents was a Hospital (49%), 59 were employed by a Cancer Institute (34%), 20 were employed by a University, Government or Research Institute (12%), while 10 were employed by another organization (6%). Of those that responded other, the majority (5 out of 10) were Residents.

7. What is your primary function within your workplace (n=174)?

117 of the 174 Respondents (67.2%) worked in a Clinical Service capacity at their organization. 24 (14%) worked in Teaching and Research & Development, 17 (10%) worked in Administration, 3 (2%) worked in Radiation Safety, with the remainder (13 or 8%) working in another capacity.

8. How many years of experience do you have within your field (n=174)?

42 of the 174 Respondents (24%) had worked in the field for less than 5 years. A further 42 (24%) had worked in the field for a period between 5 to 10 years, 36 (21%) had worked in the field for 11 to 15 years, 20 (12%) had worked in the field for 16 to 20 years, with the remainder (34 or 20%) working in the field for more than 20 years.

9. What is your specialty (n=174)?

142 of the 174 Respondents (82%) were specialists in Radiation Oncology Physics. 20 were specialists in Diagnostic Radiological Physics (12%), 12 were specialists in Nuclear Medicine Physics (7%), 11 were specialists in Medical Resonance Imaging (6%), with the remainder (6 or 3%) having a specialty in another field.

10. What was your income for 2004 (n=122)?

10.1 2004 Income by Gender

Income ($CDN)	Less than 50,000	50,000 – 75,000	75,001 – 100,000	100,001 – 125,000	125,001 – 150,000	150,001 – 175,000	175,000+	Average
Men	7	14	17	26	19	11	5	111,087
	7.1%	14.1%	17.2%	26.3%	19.2%	11.1%	5.0%	
Women	5	6	6	5	1	0	0	78,122
	21.7%	26.1%	26.1%	21.7%	4.4%			

10.2 2004 Income by Location

	BC (n=20)	AB (n=16)	SK (n=5)	MB (n=5)	ON (n=57)	QC (n=18)	NB (n=1)	NS, NL & PEI (n=9)	World (n=12)
Income($CDN)	89,731	96,724	90,575	135,720	110,822	76,213	127,770	113,296	135,663
Minimum	20,000	20,000	45,000	118,000	28,000	45,000	127,770	59,000	40,000
Maximum	147,000	180,000	118,300	151,700	210,000	120,000	127,770	185,000	241,500
20th percentile	55,000	54,000	96,000	134,180	76,000	48,000	127,770	68,000	80,000
80th percentile	118,000	136,000	103,000	139,000	141,000	100,000	127,770	151,062	160,000

(Continued on page 38)

2006 Professional Survey: continued...

(Continued from page 37)

10.3 2004 Income by Specialty

Specialty	Average Income ($CDN)	<5 yrs in practice	5-10 yrs in practice	11-15 yrs in practice	16-20 yrs in practice	20+ yrs in practice
Radiation Oncology Physics	103,435	57,770 (n=41)	93,054 (n=33)	118,851 (n=30)	130,233 (n=16)	140,373 (n=22)
Diagnostic Radiological Physics	114,761	n/a	133,067 (n=3)	127,090 (n=4)	79,000 (n=3)	112,750 (n=6)
Nuclear Medicine Physics	102,600	n/a	87,000 (n=2)	n/a	115,000 (n=1)	112,000 (n=3)
Magnetic Resonance Imaging	124,400	n/a	58,000 (n=1)	104,000 (n=1)	n/a	153,333 (n=3)
Other	74,623	n/a		n/a	n/a	n/a

10.4 2004 Income by Level of Education

Specialty	Income ($CDN)
Bachelors Degree	78,000
Masters Degree	94,353
Doctorate	110,389

11. What was your income for 2005 (n=120)?

11.1 2005 Income by Gender

Income ($CDN)	Less than 50,000	50,000 – 75,000	75,001 – 100,000	100,001 – 125,000	125,001 – 150,000	150,001 – 175,000	175,000+	Average
Men	6	11	18	24	16	13	2	115,748
	6.7%	12.2%	20.0%	26.7%	17.8%	14.4%	2.2%	
Women	5	9	7	8	1	0	0	78,432
	16.7%	30.0%	23.3%	26.7%	3.3%			

The increase in income from 2004 for men was $4,661 or 4.2 percent and $310 or 0.4 percent for women. 61.1 percent of men have income over $100,000 and 30 percent of women have income over $100,000.

11.2 2005 Income by Location

	BC (n=20)	AB (n=16)	SK (n=5)	MB (n=5)	ON (n=57)	QC (n=18)	NB (n=4)	NS, NL & PEI (n=9)	World (n=12)
Income($CDN)	93,504	105,164	90,300	125,812	111,907	74,470	112,498	118,788	149,315
Minimum	20,000	10,200	50,000	65,000	22,000	40,000	80,000	41,644	82,000
Maximum	147,000	210,000	119,500	162,500	195,000	125,000	132,493	196,000	258,750
20% percentile	59,000	67,000	72,000	124,000	76,671	49,969	97,000	104,000	100,000
80% percentile	120,725	139,000	107,000	142,000	146,000	95,000	108,000	155,543	173,000
Change from 2004	+4.2%	+8.7%	-0.3%	-7.3%	+0.9%	-2.3%	-11.9%	+4.8%	+10.9

(Continued on page 39)

2006 Professional Survey: continued...

(Continued from page 38)

11.3 2005 Income by Specialty

Specialty	Average Income ($CDN)	<5 yrs in practice	5-10 yrs in practice	11-15 yrs in practice	16-20 yrs in practice	20+ yrs in practice	Change from 2004
Radiation Oncology Physics	105,478	70,829 (n=41)	98,253 (n=33)	108,927 (n=30)	129,990 (n=16)	143,489 (n=22)	+2.0%
Diagnostic Radiological Physics	126,526	n/a	141,250 (n=3)	125,853 (n=4)	105,000 (n=3)	126,750 (n=6)	+10.3%
Nuclear Medicine Physics	107,833	93,000 (n=1)	90,500 (n=2)	n/a	118,000 (n=1)	127,500 (n=3)	+5.1%
Magnetic Resonance Imaging	120,333	n/a	58,000 (n=1)	102,000 (n=2)	n/a	153,333 (n=3)	-3.3%
Other	91,591	n/a	90,500 (n=3)	n/a	n/a	n/a	+22.7%

11.4 2005 Income by Level of Education

Specialty	Income ($CDN)	Change from 2004
Bachelors Degree	78,000	-18.4%
Masters Degree	94,353	+4.6
Doctorate	110,389	+2.7

12. Did you perform any consulting work in 2005 (n=146)?

Only 22 of the 146 respondents or 15 percent of the respondents to this question performed consulting work in 2005.

13. Please indicate your total income from consulting fees (n=19).

Income ($CDN)	1 – 5,000	5,001 – 10,000	10,001 – 15,000	15,001 – 20,000	20,001 – 25,000	25,000+	Average
	9	5	1	0	1	3	10,968

14. Please indicate your nominal consulting hourly rate.

Hourly Rate($CDN)	0 - 50	51 – 100	101 – 150	151 – 200	200+	Average
	0	7	17	1	2	129.26

Of note there were 2 members whose income was solely derived from consulting

15. Do you foresee your income increasing, decreasing, or remaining the same for the next year (n=149)?

118 of the 149 Respondents (79%) felt that their income would increase over the next year. Only 3 (2%) felt that their income would go down, with the remainder (28 or 19%) felt that it would remain the same.

16. How many hours do you work in a normal work week (n=149)?

72 of the 149 Respondents (48%) worked on average between 35 to 40 hours per week. 50 (34%) worked between 40 to 50 hours and 24 (14%) worked more than 50 hours in a week. Only 3 (2%) of the Respondents worked less than 35 hours in a week.

(Continued on page 62)

CNSC Feedback Forum: Class II Nuclear Facilities Licensing Division

Submitted by: Kavita Murthy
CNSC, Ottawa, Ontario

Hello. For those of you unfamiliar with the role of the Canadian Nuclear Safety Commission (CNSC), we are the federal regulatory agency whose role is:

"To regulate the use of nuclear energy and materials to protect health, safety, security and the environment and to respect Canada's international commitments on the peaceful use of nuclear energy"

The Class II Nuclear Facilities Licensing Division of the CNSC is responsible for overseeing the regulation of radiotherapy facilities consisting of medical linear accelerators (> 10MV photons), HDR and LDR brachytherapy remote afterloaders and cobalt teletherapy units. We issue licences to construct, operate, service and decommission these facilities and perform periodic safety inspections.

Medical Physicists play an important role in the day to day implementation of the radiation safety program at Canadian radiotherapy centres. Over the past few years, the Class II Division staff has regularly attended the COMP annual meetings and has established a semi-formal liaison with COMP's Radiation Safety and Technical Standards Advisory Committee (RSTSAC). The CNSC-COMP liaison for the CNSC is Jeff Sandeman (jeff.sandeman@cnsc-ccsn.gc.ca). The aim of these activities is to foster dialogue with the medical physics community, with the goal of maintaining a transparent, predictable regulatory process.

To that end, starting in 2007, we intend to make a regular contribution to COMP Interactions. Our articles will be used to outline CNSC expectations, including the rationale behind them, with respect to regulatory issues related to the facilities we regulate, and to invite your feedback. The core focus of our columns will be radiotherapy; however radiation safety issues related to any other areas in which Medical Physicists must interface with the CNSC are all potential topics for future articles.

In this introductory installment, we provide you an update on some of the CNSC initiatives discussed at RSTSAC meeting last May in Saskatoon. At that meeting, 7 recent CNSC initiatives were discussed.

- Proposed amendments to the Class II regulations
- Prescribed Equipment (PE) Certification Process
- Class II consolidated licence
- New licence format
- Class II Radiation Safety Officer approval process
- Class II Type I inspections (radiation safety program audits)
- Sealed Source Tracking System (SSTS) as it applies to Class II

Of these, the following have been fully implemented

- New licence format - Class II licences have been issued in a new format since July 1, 2006. This format separates the main body of the license from its appendices which contain information regarding nuclear substance types, activities, and locations etc. which, for security reasons, should not to be posted along with the main body of the licence
- Class II Type I inspections - Twelve clinics have had the CNSC Type I regulatory compliance inspections (audits) since April 2006. These differ from the old "snapshot" (Type II) inspections that most licensees had grown accustomed to, in their depth and rigor, but the intention is to perform them at a lesser frequency. The overall response has generally been positive, with the consensus of both Class II and clinic staff being that they provide a much more useful and accurate picture of how the safety programs are operating.
- The SSTS has been fully implemented for high risk sources since January 2006. Facilities subject to the SSTS licence condition must now notify the CNSC at least seven days in advance of transferring these "high risk" sources, and within two days following the receipt of a replacement source. Again, these requirements were necessitated by Canada's international commitments regarding the security of nuclear substances.

With regards to the other activities, the following progress has been made.

- Steps have been taken to formalize the RSO approval process, which we currently use, into an official certification process thus making it a statutory requirement. This will require amendments to the Class II Regulations. The process of amending regulations is quite complex and onerous, so this may take some time. We intend to keep you informed through regular updates and presentations at meetings. These regulatory changes will be subject to the normal public consultation and review process.
- The current set of Class II Regulation revisions have yet to be published in the Canada Gazette Part 1. This will be the final opportunity for stakeholders to comment on the new Regulations and recommend changes prior to their being implemented. Final implementation is hoped to occur later this year.
- The PE certification process is still evolving, but some changes have already been made. A more comprehensive format of certificate has been developed but is not in use as yet. The process of certification is currently being reviewed with the intention of streamlining the application process and eliminating any duplication with Health Canada's medical device assessment process.
- Last but not least, it has taken two years to develop, but consolidated CII radiotherapy facility licences are finally a reality. A pilot clinic is currently in the process of applying for the first consolidated radiotherapy facility licence and a second test site is being sought. This new type of licence will cover all of the activities at a given institution that are regulated under the Class II Regulation. On average it will reduce the number of CNSC licences that must be maintained and administered by each clinic from four or five down to one or two. Once the first couple of licences have been issued and any bugs have been worked out, consolidated licences will be made available as an option to clinics across Canada.

That's it for now. Some of the topics we intend to review in the future include:

- Setting, using and assessing actions levels at Class II facilities;
- Shielding design calculations, what does the CNSC look for?

(Continued on page 41)

RadSim: an educational program to simulate radiation interactions

Submitted by: Frank Verhaegen, François DeBlois
McGill University, Montreal, Quebec

At McGill University a computer program, *RadSim*, was developed to help teach and study radiation interactions as pertinent to medical physics. It was developed by a team of medical physicists and students with a grant from the McGill Teaching and Learning Improvement Fund (MTALIF). *RadSim* was intended to teach non-physicists as well as physicists. The program can run on Mac and PC platforms and is free to download from our website (see below). *RadSim* can demonstrate the following interactions. For photons: Compton scattering, Rayleigh scattering, photo-electric effect and pair-production. For electrons: elastic and inelastic scattering. For positrons: inelastic scattering and annihilation. For alpha particles: Rutherford scattering. *RadSim* can run in two modes: 'Manual' and 'Simulated'.

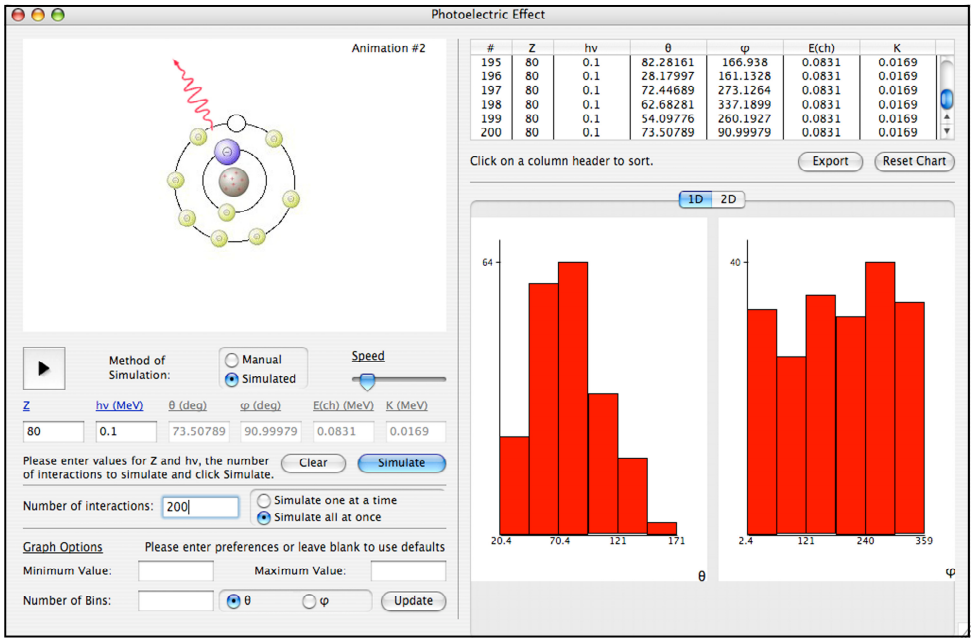
In the Manual mode the program evaluates kinematic equations in a graphical fashion. Say you'd like to know the angle at which an electron is set in motion during a Compton scatter event where the incoming photon had an energy of 2 MeV and scatters backwards at 180°. All you have to is enter the photon energy and scatter angle in the appropriate boxes and all the other kinematic variables are calculated. This is accompanies by an animation of the process (see top left window in the figure). The set of kinematic variables can be saved and exported, and the process can be repeated for a different set of input variables. In the Manual operating mode *RadSim* is a graphical equation evaluator, bringing stuffy textbook equations to life.

In the Simulated mode a Monte Carlo simulation is performed for a particle with a given set of initial kinetic variables. For a specified number of identical particles set in motion *RadSim* selects the outcome of the process randomly, according to probability distributions. The animation shows the different outcomes sequentially, and histograms of the kinematic variables of the particles in the final state are grown. In the Simulated mode *RadSim* performs a 'real life' simulation for a number of identical incoming particles.

In the example shown in the figure photoelectric effect is simulated for a 100 keV photon impinging on a mercury atom. The animation at the top left window shows the stage where a characteristic photon is emitted from the atom. The histograms at the bottom right window show the emission angles for the electron and the characteristic photon.

It is to be hoped that *RadSim* can be used to complement textbook teaching and to promote self-teaching.

Download *RadSim* for free from: www.medphys.mcgill.ca/~radsim/



(Continued from page 40)

- Safety systems, Class II facility expectations: what systems are required, where must they be located, required functionality, QA testing methods and frequencies.
- Practical measures for monitoring radiation safety program performance and ensuring doses remain ALARA.
- Requirements for radiation safety training.
- Regular updates on regulatory issues such as new regulations, regulatory guides and standards, and changes to licensing and compliance policies.

If you have any questions, comments or suggestions for topics which might be of interest to you or your clinic, please contact:

Kavita Murthy, Director
Class II Nuclear Facilities Licensing Division
Directorate of Nuclear Substance Regulation
Canadian Nuclear Safety Commission
kavita.murthy@cnsc-ccsn.gc.ca

Future articles in this column will be written by various members of the Class II Division. We look forward to your comments.

Congrès Francophone de Physique Médicale en 2008

L'Association Marocaine de Physique Médicale (AMPM) has contacted COMP and asked us to support the first ever francophone conference for medical physicists that will be taking place in 2008. Specifically they are looking for:

- A COMP representative to support the organization of the meeting and serve as a liaison between COMP and the CFPM
- A COMP representative to sit on the Scientific Committee
- Support in the promotion of the conference.

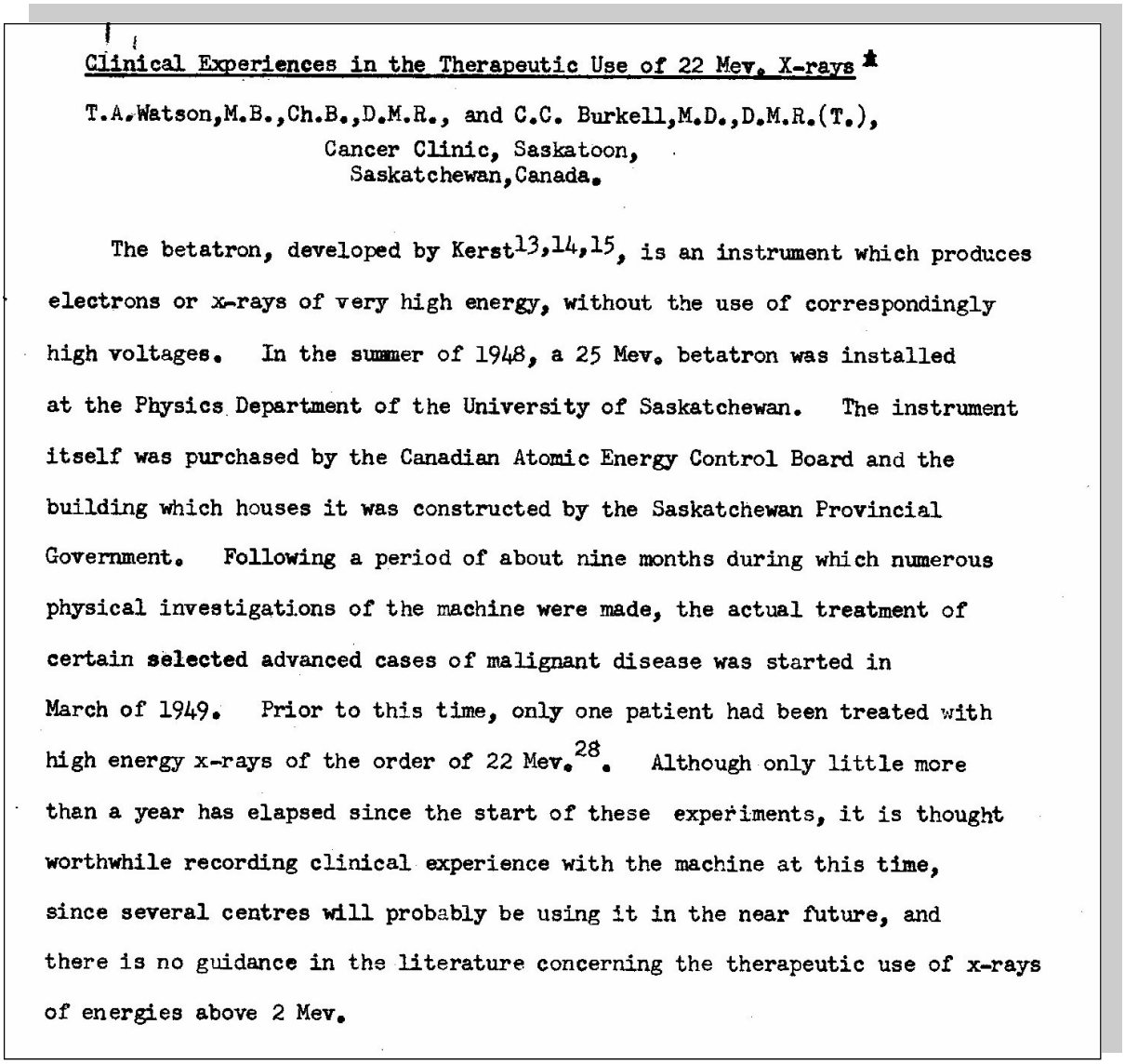
If you are interesting in finding out more about becoming involved, please contact Nancy Barrett at nancy@medphys.ca

Stumbling across a piece of history

Submitted by: Gavin Cranmer-Sargison
Saskatoon Cancer Centre, Saskatoon, Saskatchewan

You wouldn't think organizing a filing cabinet could be anything more than pure drudgery. Sifting through old logbooks and out-of-date user manuals all in hopes of scraping together enough space to store current logbooks and user manuals doesn't appeal to any of us. Yet lying flat, at the bottom of the second drawer down, was a piece of history I didn't expect to find.

In a folder labeled Supervoltage - Clinical Experiences in the Therapeutic Use of 22 MeV X-rays was an original manuscript written by T.A. Watson and C.C. Burkell. In the folder were four bundles of papers: the manuscript, references, figures and letters between the author and the editor at the *American Journal of Roentgenology and Radium Therapy*.



Clinical Experiences in the Therapeutic Use of 22 Mev. X-rays *

T.A.Watson,M.B.,Ch.B.,D.M.R., and C.C. Burkell,M.D.,D.M.R.(T.),
Cancer Clinic, Saskatoon,
Saskatchewan,Canada.

The betatron, developed by Kerst[13,14,15], is an instrument which produces electrons or x-rays of very high energy, without the use of correspondingly high voltages. In the summer of 1948, a 25 Mev. betatron was installed at the Physics Department of the University of Saskatchewan. The instrument itself was purchased by the Canadian Atomic Energy Control Board and the building which houses it was constructed by the Saskatchewan Provincial Government. Following a period of about nine months during which numerous physical investigations of the machine were made, the actual treatment of certain selected advanced cases of malignant disease was started in March of 1949. Prior to this time, only one patient had been treated with high energy x-rays of the order of 22 Mev.[28]. Although only little more than a year has elapsed since the start of these experiments, it is thought worthwhile recording clinical experience with the machine at this time, since several centres will probably be using it in the near future, and there is no guidance in the literature concerning the therapeutic use of x-rays of energies above 2 Mev.

Figure 1: The manuscript was read in London at the *Sixth International Congress of Radiology*, July, 1950. Following his return T.A. Watson submitted the article for publication in the *American Journal of Roentgenology and Radium Therapy*.

Stumbling across a piece of history … continued

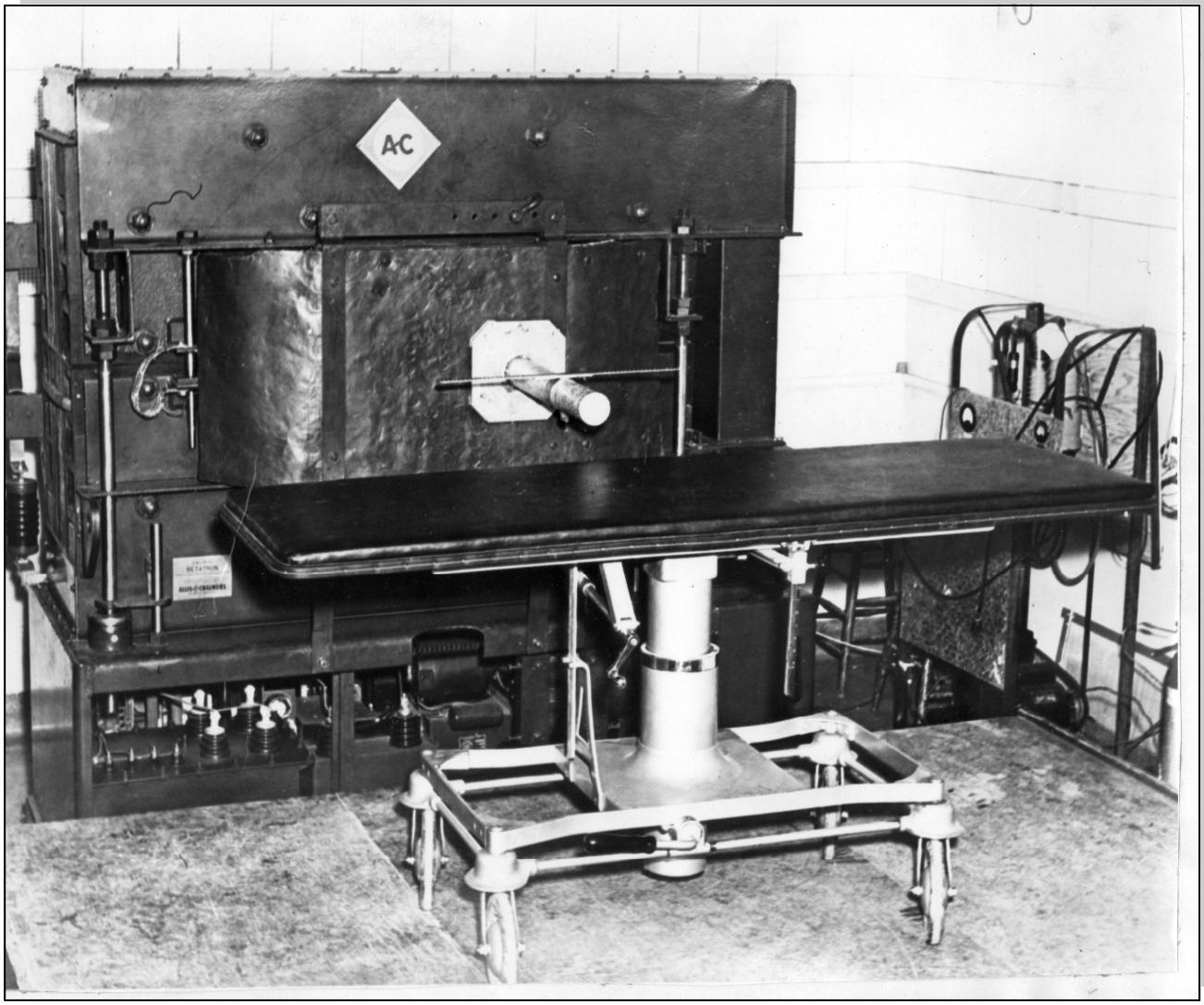


Figure 2: In a 1985 *Canadian Medical Association Journal* article, C. Stuart Houston and Sylvia Fedoruk tell the story of how Drs. H. E. Johns, R.N.H. Haslam and L. Katz visit the Allis-Chalmers Plant in Milwaukee during April of 1948. Due to construction delays at the University of Pennsylvania the Saskatchewan group gets the first production betatron to be installed in any university or hospital.

In his letter dated August 7, 1950 T.A. Watson, the Director of Cancer Services for Saskatchewan, submits the manuscript for publication. The journal editor responds with a letter in September of 1950 accepting the paper for publication. However, due to delays on the editor's part the paper still had not been published by May of 1951 and Watson withdraws the article. The correspondence stops there, and it appears Watson will include new data and submit the work to a different journal.

Continued on page 44

Stumbling across a piece of history … continued

Continued from page 43

One of the main attractions in the application of betatron to radiotherapy is the distribution of dosage obtained in the tissues. With conventional x-rays, the dose is in general at a maximum at the skin surface and becomes less thereafter. With 22 Mev. x-rays, however, the somewhat anomalous result is obtained, that the maximum dose falls at a depth between 3 and 5 cms. whereas the surface of the skin receives almost nothing. If a Victoreen chamber is placed in an x-ray beam of this kind, in air, practically no reading will be obtained. A maximum reading is obtained when the chamber is surrounded with material 4 cms. thick. Isodose curves obtained from the betatron[3,17] show a pointed appearance indicating that the dose in the centre of the field is very high but falls off rapidly towards the sides. This renders the unfiltered beam unsuitable for radiation therapy, as homogeneity of the beam, from side to side, is desirable[1]. Johns has developed a copper compensating filter which flattens the isodose surfaces and thus render radiation therapy practicable[10]. This mechanism does not act as a filter in the ordinary sense, as the quality of the radiation is unchanged. (Fig. 5)

(Picture of isodose curves)

Figure 3: The research starts quickly. As M.D. Schultz states in his historical review "thus started the really first concerted clinical investigation of the usefulness of the multimegavoltage as a radiotherapeutic tool" *American Journal of Roentgenology* (1975). It's obvious from the paragraph above that this work was truly the first of its kind.

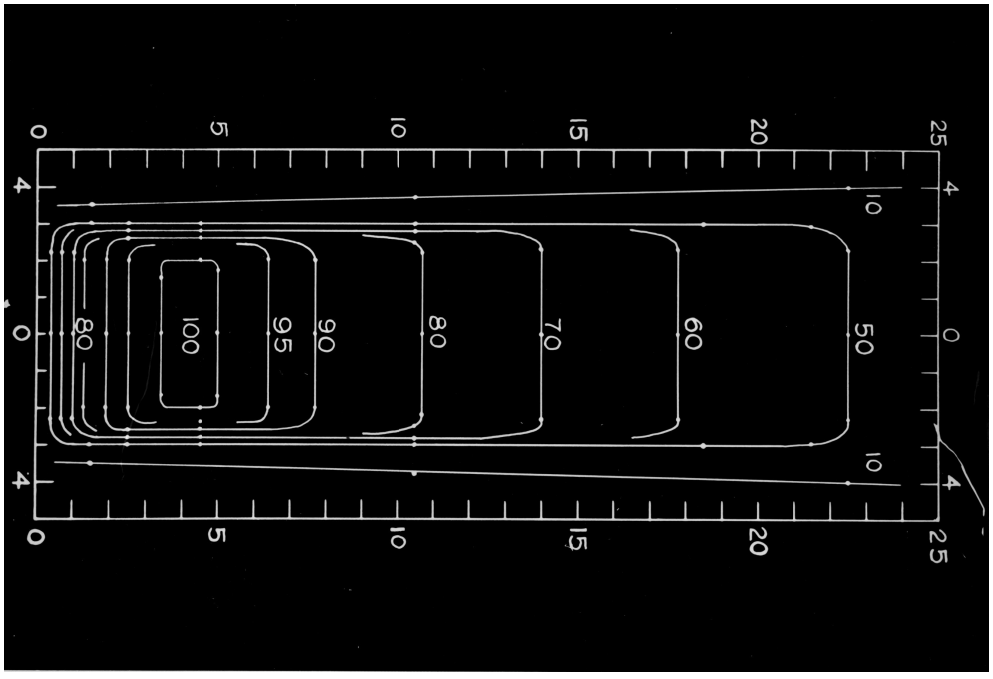


Figure 4: Potentially the first high energy isodose curves.

Continued on page 45

Stumbling across a piece of history … continued

Continued from page 44

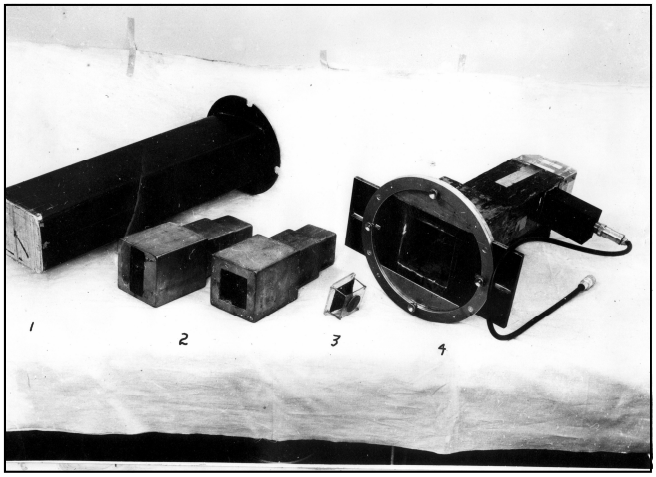


Figure 5: As labeled in the manuscript: (1) Treatment cone (2) Lead delineating cone (3) Copper compensating filter (4) Master collimator and integrating iometer. The author references unpublished data (Johns, H. E., Darby E. K. and Kornelsen R. O.) describing the use of a monitoring device of "the integrating iometer type" used to deliver the predetermined dose.

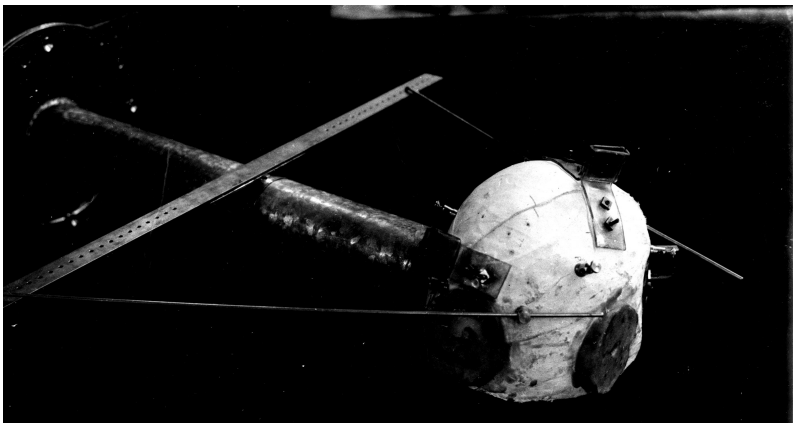


Figure 6: A beam directional appliance worn during the treatment of a post operative recurrence of a cystic craniopharyngioma. The authors report that the patient is alive and well at 7 months.

Canada provides funding for Tanzania RT Training Program

Submitted by: P.S. Basran
Toronto-Sunnybrook Regional Cancer Centre, Toronto, Ontario

In January of 2007, the Honourable Tony Clement, Minister of Health, announced that the Department of Health would provide a one-time allotment of $150,000 for the training of cancer specialists in Tanzania.

Approximately 20,000 people are diagnosed with cancer each year in the country of 38.3 million, where the need for cancer treatment facilities are great. There is but a single cancer treatment facility, the Ocean Road Cancer Institute, located in the city of Dar es Salaam.

The funding is provided through the Programme of Action for Cancer Therapy (PACT), an initiative of the International Atomic Energy Agency.
The minister states:

"By collaborating with the international community and the private sector, Canada is making a difference abroad by contributing to the training of cancer specialists in Tanzania,"

In addition to the funds the Ocean Road Cancer Institute recently received an Equinox cancer therapy machine, donated by Canadian company MDS Nordion.

Dr Ken R. Shortt, Head of Dosimetry and Medical Radiation Physics at the IAEA, helped initiate PACT. Dr Shortt is currently on leave from Carlton University to fulfill this role. He states that :
"*There are serious issues in cancer treatment in developing countries that require the clear thinking of medical physicists*"

Other organizations involved in this initiative include the World Health Organization (WHO) Regional Office for Africa, the International Agency for Research on Cancer (IARC), and a number of private sector companies.

For more details on the funding announcement, please see the following press release from the Government of Canada, Health Canda:

http://news.gc.ca/cfmx/view/en/index.jsp?articleid=268579

3rd Annual Workshop of the AQPMC

Submitted by: Luc Beaulieu
CHUQ-Hôtel-Dieu Québec, Québec, Québec

L'association Québécoise des physiciens médicaux cliniques (AQPMC) held its 3rd annual workshop at the Hôtel-Dieu de Québec research center in the heart of the old city. The theme of this year workshop was Imaging in Radiotherapy. Luc Beaulieu organized the meeting. A scientific committee composed of Luc Beaulieu, François DeBlois (treasurer of AQPMC), Horacio Patrocinio and Jean-Charles Côté was in charge of speaker selection. We also received help from the Quebec medical physics graduate students to make sure that everything was running smoothly. Siemens, Elekta, Tomotherapy, Resonant Medical, Nucletron, Philips and Varian have provided support for the workshop.

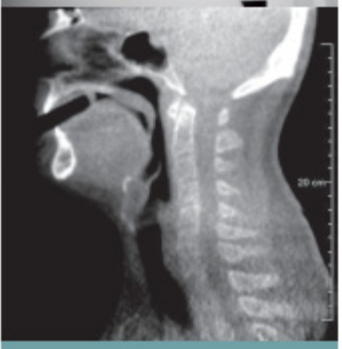
AQPMC (www.aqpmc.ca) is a professional association that represents all clinical medical physicists of the province working in the field of radiotherapy, radiology, nuclear medicine and radiation protection. At this time it has around 80 members of which about 1/4th are graduate students. AQPMC organizes focused workshops to favor continuing education of its members.

Much of the new imaging modalities that have started to or are about to enter our clinics were covered in the workshop. A total of 7 talks (a mix of English and French talks) were presented in a format that left plenty of time for one on one exchange, especially during lunchtime. We have started the day with a presentation by David Jaffray of PMH on the technology, clinical integration and QA of kV-CBCT. This presentation was followed by a similar one on MV-CBCT by Olivier Morin, a senior PhD student of Jean Pouliot at UCSF. The experience of CHUM in upgrading an existing Varian machine with an OBI kV-CBCT imager was presented by Dominique Béliveau-Nadeau. After lunch, we had an interesting presentation on future applications of imaging modalities in radiotherapy in a second talk by David Jaffray. While a bit more speculative in nature, the talk was particularly well received by the audience. Next, Pierre Goulet of CHUM presented an in-depth presentation on the acceptation process of a PET-CT scanner for radiotherapy. It was followed by a talk from Frank Verhaegen of McGill on 3D ultrasound imaging and its comparison to the older 2D technology. Finally Gabriella Stroian of McGill made an overview presentation of 4D CT for planning purposes.

The workshop was well attended with 63 participants. Each of the 10 radiotherapy center were represented by at least one clinical physicist and graduate students from Laval, McGill and Université de Montréal were presents. Some participants stayed overnight to enjoy Quebec winter Carnaval and the discussions moved from the conference room to a close by Pub around a pint!

David Jaffray and Frank Verhaegen.

Discussions during the morning break.



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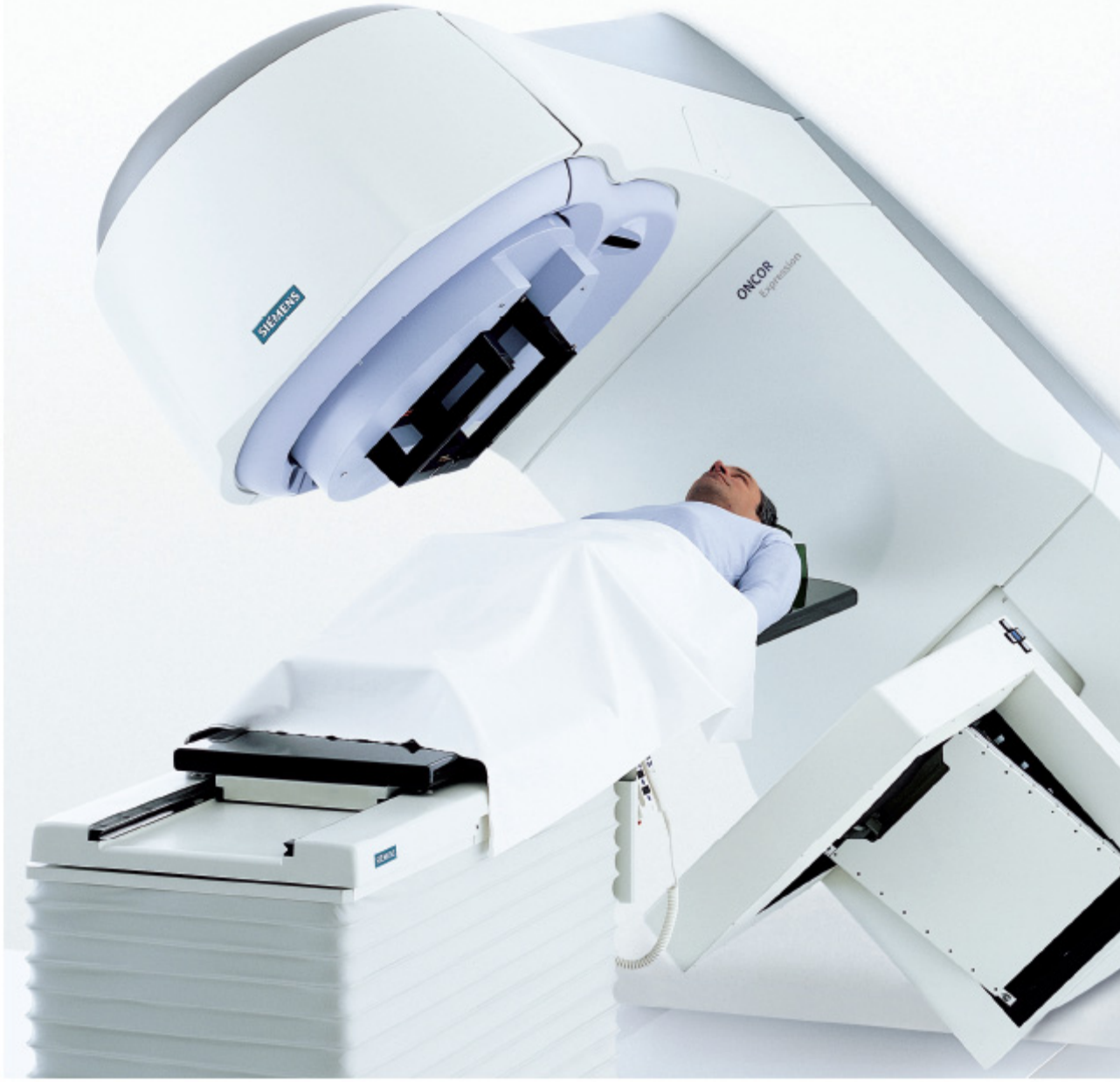

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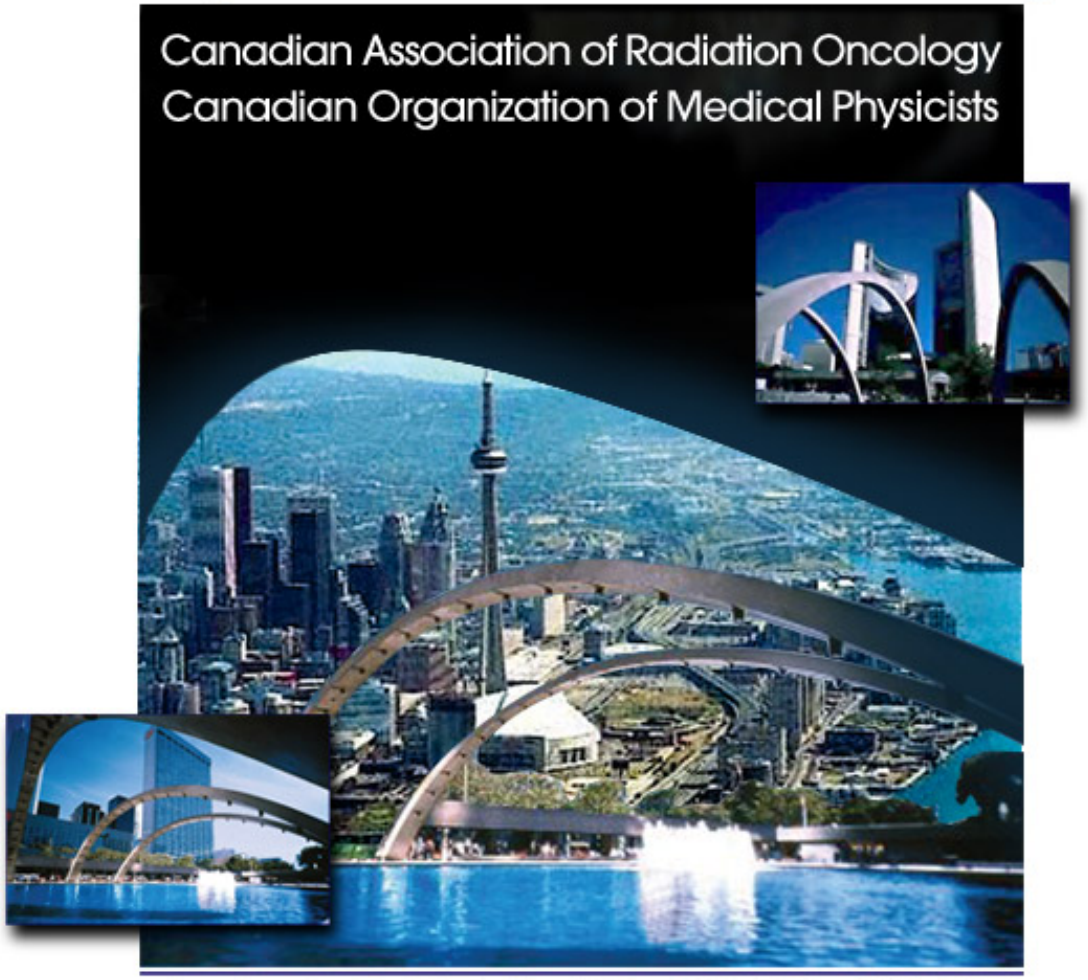

Come to Toronto in 2007 for an integrated Canadian Organization of Medical Physicists / Canadian Association of Radiation Oncology meeting!

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 (PMH) 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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WESCAN 2007 Program: Edmonton, Alberta

Wescan is a Medical Physics Conference held in Western Canadian cities annually in late March. This year, the conference was held at the Fantasyland Hotel at the West Edmonton Mall, Edmonton, Alberta. The theme of the conference symposium was "The Future Of Radiotherapy Treatment Preparation In Canada". The symposium was held at the Cross Cancer Institute on March 23, 2007. The invited Speakers were Michael Sharpe, Princess Margaret Hospital, Boyd McCurdy, Cancer Care Manitoba, Pat Cadman, Saskatoon Cancer Center, Miller MacPherson, The Ottawa Hospital Regional Cancer Center, Will Ansbacher, BC Cancer Agency, and Marc MacKenzie, Cross Cancer Institute. Other invited speakers were Gino Fallone, Cross Cancer Institute, Brad Murray, Cross Cancer Institute, and Jodi Powers of the Tom Baker Cancer Center. The featured student presentation was "Assessing Tumour Xenografts in the Nude Mouse Using 9.4T MRI", by Mathew Larocque, Department of Physics, University of Alberta.

Scientific Chair: Marco Carlone
Local Arrangements: Sherry Connors
Shinny Hockey: Alasdair Syme
Vendor Liaison: Geetha Menon

KEYNOTE ADDRESS

Image-Guided Radiation Therapy: Implications for Treatment Plan Optimization

Michael B. Sharpe, Radiation Medicine Program, UHN-Princess Margaret Hospital , Department of Radiation Oncology, University of Toronto, Toronto, Ontario, CANADA

Local control by radiation therapy relates directly to the dose delivered to the diseased tissue, but limited by the dose tolerated by adjacent structures. This axiom has guided radiation oncology practice into a number of technological shifts over the past several decades. Intensity-modulated radiotherapy (IMRT) has emerged as an important means to achieve higher doses and to intensify treatment, while simultaneously decreasing the dose in normal tissues. However, the proximity of critical normal organs to disease and geometric uncertainties arising from organ movement continue to present significant challenges in some anatomical sites. Advances in image-guided radiation therapy (IGRT) permit more frequent soft-tissue imaging in the course of treatment delivery, and opportunities to enhance the accuracy of target localization during treatment delivery; to increase treatment precision; and, to adapt to anatomical changes that occur during the course of therapy. This presentation reviews the implementation of IGRT at Princess Margaret Hospital and our early clinical experience. It explores opportunities and challenges for treatment planning in the era of IGRT, and offers a framework for assessing and incorporating information acquired using image-guidance.

CNSC REGULATION CHANGES

Proposed Changes to the Class II Regulations Regarding a Formal RSO Approval Process

Colette Pigeon-Jolicoeur, Canadian Nuclear Safety Commission, Ottawa, ON

Purpose: To inform the radiation therapy community on the proposed changes to the Class II regulations regarding a formal RSO approval process. **Background:** The Canadian Nuclear Safety Commission (CNSC) proposes to amend the Class II Nuclear Facilities and Prescribed Equipment Regulations to require that all Radiation Safety Officers (RSOs) be certified by the CNSC. After these amendments come into force, all persons appointed as RSOs at Class II facilities must be pre-certified by the CNSC. The RSO is responsible for the radiation safety of workers, and the public. They are often responsible for facility design, safety procedures and for the maintenance of a good safety culture at the facility. Since the risks associated with the operation of Class II Nuclear Facilities are considered high, the CNSC intends to permit only certified personnel to be appointed RSO for a Class II Nuclear Facility. The presentation will describe the process currently used to evaluate the candidacy of an RSO, and the measures being taken to include the certification of RSOs into those Regulations.

CNSC Certification Of Radiation Safety Officers Of Class II Nuclear Facilities: A Licensee's Perspective

Jodi Powers, Tom Baker Cancer Centre, Calgary, AB

The Canadian Nuclear Safety Commission (CNSC) has implemented a RSO approval process and is moving towards an amendment to the Class II Nuclear Facilities and Prescribed Equipment Regulations to mandate CNSC certification of RSOs of Class II facilities. The CNSC has been very open about this upcoming change by presenting at both the most recent Canadian Organization of Medical Physicists (COMP) conference and the most recent Canadian Radiation Protection Association (CRPA) conference. In addition licensees were mailed a letter in February 2007 detailing the intention of amending the regulations, the motivation, and inviting feedback. That being said, to date licensees have been given little information about the logistics of how the approval process will fit in with the hiring process of the particular facility, and what the approval process will entail exactly.

The response of the radiation protection community to this initiative has been overall very positive. Essentially this process is intended to ensure that an individual, who has been appointed as the RSO of a Class II Nuclear Facility, has the knowledge and skill set to handle the responsibilities of the particular position. Some of the positive changes, from a licensee's perspective include: (1) clarification of the role of a radiation safety officer; (2) identification of inadequate resources early on in the staffing process; (3) new RSOs will have employer's support in professional development initiatives; (4) the facility does not bear the entire responsibility of ensuring the RSO is adequately qualified.

With any change, however, come challenges. Challenges that this change will likely present to both the CNSC and the licensee will be discussed including; (1) Where the approval process fits within the hiring process of an organization? (2) What is the course of action for an RSO who is unsuccessful in the certification process? Where can an individual acquire the competencies identified as weak? (3) Hiring RSOs for Class II Nuclear Facilities is already a challenge. Will this further hinder the recruitment process and discourage newcomers to the profession? (4) Evaluation of administrative skills difficult in an interview, but a large part of an RSO's role. Will the CNSC evaluate this competency in the approval process?

Finally, the question of what both the CNSC and licensees can do to support the process will be explored, including the possible role of professional organizations such as the Canadian Radiation Protection Association.

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FEATURED STUDENT PRESENTATION

Assessing Tumour Xenografts In The Nude Mouse Using 9.4T MRI

M. Larocque[1,2], A. Syme[2], A. Yahya[2] and B.G. Fallone[1,2] (1) Departments of Physics and Oncology, University of Alberta, (2) Department of Medical Physics, Cross Cancer Institute

The Image-Guided Adaptive Radiotherapy Program (IGAR) at the Cross Cancer Institute operates a 9.4T animal MR system. The high magnetic field strength a long with a state of the art gradient system (peak gradient strength 400mT/m) provides high quality images with the ability to resolve dimensions on the order of 50 microns.

The longitudinal relaxation time (T_1), transverse relaxation time (T_2), and apparent diffusion coefficient (ADC) of tissue are properties that can be measured using the 9.4T MR system. All three of these parameters have been shown to increase in cancerous tissue, and some results suggest changes of these parameters in tumours, particularly an increase in ADC, are indicative of positive treatment response. *In vivo* magnetic resonance spectroscopy (MRS) can track changes in individual metabolite concentrations within a tumour during the course of tumour growth and treatment. The use of high-resolution MRI and MRS to monitor subcutaneous xenografts in nude mice is discussed, and examples from the CCI IGAR system are shown.

RADIOTHERAPY SESSION

Monte Carlo Simulation Of X-Ray Dose Distributions For Direct Aperture Optimization Of Intensity Modulated Treatment Fields

Alanah M. Bergman, Vancouver Cancer Centre

An EGSnrc-based Monte Carlo beamlet dose matrix is introduced into a direct aperture optimization algorithm for IMRT inverse planning (named MC-DAO). The goal is to show that this method improves the dose accuracy for IMRT planning compared with commercially available methods that implement the single pencil beam (SPB) algorithm with fluence-based optimization. The presence of small fields and/or inhomogeneous materials in IMRT fields may cause large (>10%) dose errors for algorithms that do not model electronic disequilibrium (e.g. SPB algorithm). This issue affects the IMRT optimization resulting in a convergence error, particularly for difficult treatment geometries such a targets adjacent to low-density materials (e.g. lung). A Varian linear accelerator 6MV x-ray beam is simulated using BEAMnrc. The resulting phasespace is subdivided into $2.5 \times 5.0 mm^2$ beamlets. Each beamlet is projected onto a patient-specific, voxelized phantom and the dose contribution to each voxel-of-interest is calculated using DOSXYZnrc. The multileaf-collimator (MLC) leaf positions are linked to the location of the beamlet dose distributions. MLC step-and-shoot aperture shapes/weights are optimized using DAO. MC simulation calculates the final dose distribution. MC calculates accurate beamlet doses for difficult-to-calculate geometries. DAO increases the radiation delivery efficiency by reducing the number of MU required for treatment.

A Simple Geometric Algorithm To Predict Optimal Starting Gantry Angles Using Equiangular-Spaced Beams For Intensity Modulated Radiation Therapy Of Prostate Cancer

Peter Potrebko, CancerCare Manitoba

Objectives: A fast, geometric beam angle optimization (BAO) algorithm for intensity-modulated radiation therapy (IMRT) was implemented on ten localized prostate cancer patients on the Radiation Therapy Oncology Group 0126 protocol. Methods: The BAO algorithm computed the beam intersection volume (BIV) within the rectum and bladder using 5 and 7 equiangular-spaced beams as a function of starting gantry angle for comparison to the V 75 Gy and V 70 Gy. Results: The class solution 'W' pattern in the rectal V 75 Gy and V 70 Gy as a function of starting gantry angle using 5 equiangular-spaced beams (with two separate minima centered near 20° and 50°) was reproduced by the 5 BIV within the rectum. The BAO algorithm predicted the location of the two dosimetric minima in rectal V 75 Gy and V 70 Gy (optimal starting gantry angles) to within 5°. It was demonstrated that the BIV geometric variations for 7 equiangular-spaced beams were too small to translate into a significant dosimetric effect in the rectal V 75 Gy and V 70 Gy. The relatively flat distribution with starting gantry angle of the bladder V 75 Gy and V 70 Gy was reproduced by the bladder 5 and 7 BIV for each patient. Conclusions: Given the clinically infeasible computation times of many dosimetric beam orientation optimization algorithms, this robust geometric BIV algorithm has the potential to facilitate beam angle selection for prostate IMRT in clinical practice.

Direct Aperture Optimization for On-line Adaptive Radiation Therapy (ART)

Ante Mestrovic, BCCA - Vancouver Centre

This study is the first investigation of using Direct Aperture Optimization (DAO) for on-line Adaptive Radiation Therapy (ART). To simulate interfractional deformations, four different anatomical deformations were created by systematically deforming the original prostate anatomy by various amounts.

We describe a series of techniques for adapting the original DAO treatment plan to correct for the deterioration of dose distribution quality caused by the anatomical deformations. We found that the average time needed to adapt the original plan and arrive at a clinically acceptable plan is roughly half of the time needed for a complete plan regeneration, for all four anatomical deformations. Furthermore, through modification of the DAO algorithm the optimization search space was reduced and the plan adaptation was significantly accelerated.

Finally, we propose an innovative approach to on-line ART in which the plan adaptation and radiation delivery are merged together and are performed concurrently– adaptive radiation delivery (ARD). A fundamental advantage of ARD is the fact that radiation delivery can start almost immediately after image acquisition and evaluation. Most of the original plan adaptation is done during the radiation delivery. As a consequence, the treatment time is increased by only a few seconds as compared to no plan adaptation.

Common attributes and practices found in successful, effective and efficient cancer programs – Enabling your staff to advance with the latest technologies.

Gerry Hogue, IMPAC Corporation

This session will focus on the common attributes found across hundreds of technologically advanced cancer programs worldwide. It will expertly discuss successful program approaches to help the staff adopt and keep pace with the workflow changes.

The lecture will center around four vital areas of interest for cancer organizations that are transitioning or upgrading their core skills and daily operating routines including the environment, the

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technologies, the workflow and the staff's readiness for change. The presentation will end with some practical considerations that will be useful for those wanting to receive more from their technology investments.

IMRT Breast: A case Study
Joe Andreas, Saskatoon Cancer Centre

A technique for treatment of chest wall with IMRT has been developed at the Saskatoon Cancer Centre. The indications for IMRT in this case, the evolution of the technique and some subsequent investigations will be discussed. Our case study patient has a combination of unique anatomical geometry and significant risk of cardiomyopathty. Conventional methods failed to provide an acceptable solution; IMRT was considered as a method of last resort since the Oncologist may not have otherwise offered RT. Our technique consisted of a series of 7 tangent beams intended to deliver dose to the chest wall while avoiding excessive cardiac dose. The problems of patient motion and the ability of Pinnacle to provide flash at the chest wall were items of particular interest during the planning process. The technique arrived at met the needs of the Radiation Oncologist and the Physics Department and treatment delivery proved to be relatively simple and time efficient. Anecdotal comparison of alternative beam arrangements aimed at increasing the percentage of treatment delivered by static beams, and/or improving dose homogeneity shows (based on DVH results) that our approach was reasonable.

"A World Without Film … A Better World": EPI-Based Quality Assurance
Tim Turcotte, Derek Wells, BCCA – Vancouver Island Centre

With the growing development of on-board imaging and the movement toward completely digital analysis, it is important to create new methods of quality assurance (QA) that eliminate the need for film measurements. Two tests that are currently implemented in routine monthly QA for radiation field alignment were adapted for use with an amorphous silicon electronic portal imager (EPI). The first test compared radiation and light field edge coincidence. A square plastic jig, embedded with 2mm metal ball bearings at fixed distances in the xy-plane, was positioned on top of the EPI. Field edges were aligned to the jig and an image acquired. By locating ball bearing and field edge positions, coincidence was quantified. The second test evaluated radiation field alignment with collimator isocentre by obtaining images of four 10x10cm quadrant fields. Junction and non-junction regions of the four superimposed images were compared. A 1mm collimator misalignment corresponded to a 20% change in image intensity at the junction. For both tests pixel interpolation was used to obtain sub-millimeter spatial resolution.

A Review Of Literature From 2000-2006 Of Passive Dosimetry Systems In Radiation Therapy
Vaidyisa Bala, Radiation Physics Consultant, Edmonton, Alberta

A literature review mostly from English language publications from 2000-2006 was done to determine the developments and uses in radiotherapy of passive radiation dosimetry systems. Technologies such as TLD, OSL, PF, EPR ,radiochromic film and BANG Gel are taking the center stage. Especially greater credibility is weighted toward TLD and EPR technologies. International agency such as the IAEA is using EPR for high level transfer dosimetry that is being extended to therapy radiation dose level. The use of inexpensive PF polymeric LiF dosimeter is established in high dosimetry. OSL technology is touted capable of real time dosimetry. The BANG Gel technology offers 3D volumetric and details of complex dose distribution, a vital information for the quality assurance and validation. The technologies are fast developing to replace the supremacy of TLDs. The factors cost, ease, and effectiveness will dictate who is the winner!

Study of Wedged Asymmetric Photon Beams
Yue Qiu, BC Cancer Agency

Many recent advances have been made in the technology used for dose delivery. However, conventional physical wedges are still in clinical use. Algorithms for calculating monitor units in wedged asymmetric photon beams as implemented in treatment planning systems have their limitations. In this work, the dose calculations for rectangular wedged asymmetric fields by the Eclipse TPS were tested by direct comparison to ion chamber measurements and up to 6.5 % discrepancy was found. Monte Carlo simulation by BEAMnrc was used for independent dose calculations. Finally, a correction method was developed for accurate wedged asymmetric dose calculations. The difference in dose between a wedged asymmetric field and the corresponding wedged symmetric field is accounted for by a correction factor. For both 6MV and 18MV photon beams at d_{max} and 10cm, the correction factor is within 1% of the measurement in most cases and the maximum difference is 2%. The dose at the asymmetric field center, which is based on wedged symmetric profiles and the correction factor, is within 2% of the measured dose in most cases. It can be concluded that our simple correction factor is able to calculate dose at the center of wedged asymmetric fields with acceptable accuracy.

TOMOTHERAPY SESSION

Utility of *Planned Adaptive* TomoTherapy software for Head and Neck cancers
Donata Drabik, Department of Physics, University of Alberta and Department of Medical Physics, Cross Cancer Institute

Purpose: Head and Neck (H&N) patients exhibit shrinkage over the course of treatment which affects both immobilization and delivery accuracy. To maintain the desired dose delivery a treatment plan adaptation may be desirable. This project is designed to assess the impact of not adapting plans and adaptive planning implementation. Methods: Twelve H&N patients were analyzed to assess their eligibility to calculate summation doses with Tomotherapy's Planned Adaptive software. The software can only perform non deformable dose summation, so patients were required to exhibit stable, unchanging anatomy toward the end of their course. Only five cases were found to be appropriate. After extrapolation of the recalculated fractions the treatment plan and the delivered dose were compared. Results: Delivered doses were generally greater than predicted by the treatment plan. This led to treatment plans failing in terms of parotid or cord sparing in some cases. Conclusion: Head and Neck cancer patients may benefit from treatment plan adaptation due to better organs at risk sparing. Currently, the introduction of the adaptive radiotherapy using Planned Adaptive may be not time efficient in our centre. Deformable dose summation and auto recontouring in a future release would assist in the routine use of adaptive planning.

Potential for reduced normal tissue toxicity in the treatment of carcinoma of anal canal: a comparison of dynamic intensity-

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modulated radiation therapy (Tomotherapy) and conventional irradiation.

Kurian Jones Joseph, Harvey Quon, Alasdair Syme, Nadeem Pervez, Marc Mackenzie. Colin Field, Departments of Radiation Oncology and Medical Physics, Cross Cancer Institute, Edmonton, AB

Purpose/Objective(s): The combination of chemotherapy and radiotherapy is the standard treatment for non-metastatic carcinoma of the anal canal. Although combination chemotherapy and radiotherapy results in more than 70% colostomy-free survival rates, acute and late morbidity remain substantial. The purpose of this study was to evaluate the feasibility of using Helical Tomotherapy (HT) in patients with anal canal carcinoma to reduce treatment related toxicity. **A** planning study was conducted by comparing the dosimetry findings of helical dynamic IMRT plans with conventional 3DCRT plans of 4 patients who had anal canal carcinoma. **Materials/Methods/Results:** Four patients with anal canal cancer who were treated previously by conventional radiotherapy at the cross cancer Institute, were identified. For each patient, a dynamic IMRT plan was generated using Tomotherapy planning system, using the same targets and optimization goals. Dose distributions were compared for target coverage and normal tissue sparing. **Results:** All tomotherapy plans shows significant sparing of the organs at risk while keeping equivalent target dose homogeneity. **Conclusions:** HT provided a significant sparing of normal tissue structures with a more uniform PTV dose for anal canal carcinoma. This may result significant reduction in radiotherapy treatment related toxicity.

Motion in Tomotherapy: Some Dosimetric Observations

A.W. Lightstone, M. K. Woo, M. G. Skinner, P. F. O'Brien, Y. C. Ung, M. R. Dahele, and J. A. Spayne, Toronto-Sunnybrook Regional Cancer Centre, Toronto, ON

We present results obtained with our commercial helical tomotherapy system and also modeling to qualitatively explain motion-induced dose variations. Tomotherapy is an approach to delivering radiation treatment where the patient is continuously transported through a modulated slit of radiation. Consequently concern arises as to how much the patient's internal motion (e.g. breathing) affects the dose deposited in the anatomy. With our commercial system, typical clinical treatments plan calculations agree very well (usually within 3%) with film results in a static phantom. Using these typical clinical plans, dosimetry films were also irradiated while the phantom was oscillating (+/- 10 mm) to estimate the dose variations. Interestingly, away from the penumbra, in the high dose regions (~250 cGy) the dose variation is only about 7% compared to the static case. These results are consistent with recent independently published data, but are much less than some previous papers had suggested. It is proposed that the surprisingly modest dose variation can be qualitatively understood in terms of: (1) the dose delivery mechanism of our equipment: to obtain a high dose level, a particular voxel of patient anatomy must be irradiated for a long period of time, which intrinsically allows for more averaging of the breathing cycle; (2) the usual CTV dose uniformity requirement encourages angular and hence temporal averaging.

Quantification of Image Alignment Differences for Tomotherapy Prostate Patients

RC Rivest, TA Riauka, AD Murtha, BG Fallone, University of Alberta and Cross Cancer Institute, Edmonton, AB

Registration of MVCT to planning kVCT images is required for daily positioning of patients treated on helical tomotherapy. Due to organ motion, overlaying the prostate, overlaying the pelvic bones, and finding the best overall image overlap can result in three different alignments. The objective is to quantify these alignment differences for research patients and determine the suitability of using the latter two alignments to correct for inter-fraction prostate motion. Daily MVCT images have been retrospectively registered to planning images using three registration algorithms, each designed to produce one of the alignments and does so by using selective planning CT pixels when calculating the registration cost function (mutual information or correlation coefficient). To reduce registration uncertainty and eliminate gross miss-registrations, a multi-start optimization procedure was employed. A maximum translational offset of 6.7mm was observed between bone and image alignments. The mean offset was 2.0mm, with a standard deviation of 1.1mm. Maximum, mean and standard deviation offsets between prostate and bone overlap are 10.7mm, 3.6mm, and 2.1mm. The respective values for prostate and image overlap are 11.5mm, 4.5mm, and 2.3mm. Results conclude that bony anatomy registration is better than overall image registration for the correction of inter-fraction prostate motion in tomotherapy patients.

Helical Tomotherapy MVCT Image Quality Comparison

Sandra Vidakovic, Department of Medical Physics, Cross Cancer Institute

Helical tomotherapy is a relatively new method of delivering cancer treatment using a device that combines features of a linear accelerator and a helical CT scanner. Commercially available HI-ART II, developed by TomoTherapy Inc. (Madison, WI), is a helical tomotherapy device that combines image-guided radiation therapy with intensity modulated radiation therapy and as such allows delivery of precise and powerful radiation beams well conformed to target volume. The system uses the same megavoltage x-ray beam to treat the patient and to generate megavoltage CT images. This provides a means to verify tumor position immediately before irradiating, however, image quality is poorer compared to images obtained with diagnostic CT scanners. We investigated imaging performance characteristics of two HI-ART II systems available at the Cross Cancer Institute. We acquired images of a small water phantom at collimator pitches of 1, 1.6 and 2.4 and compared them in terms of uniformity, spatial resolution and contrast linearity. Both, spatial resolution and contrast linearity of corresponding image sets had comparable values. As well, image uniformity was distorted in a small central region of images in both cases. Our findings indicate that these two HI-ART II systems provide images of similar quality.

ADAPTIVE RADIOTHERAPY SESSION

Novel Linac-MR System for Real-Time ART

Gino Fallone, Department of Physics and Oncology, University of Alberta and Department of Medical Physics, Cross Cancer Institute

A novel design for coupling an MRI to a medical linac to provide real-time tracking of the tumor and healthy tissues during irradiation by the treatment beam is described. Various embodiments are defined in our patents (Fallone, Carlone, Murray) to avoid mutual interference between the MR and the linac. Our method allows rotation of a linac with respect to the subject to allow irradiation of the subject from any angle without disturbing the magnet homogeneity. Magnetic shielding of the linac prevents disturbance from the MRI. RF signal shielding, modifications

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the RF-signal triggering and pulse shaping are used to minimize linac interference of MRI RF read sequences. Various Monte Carlo calculations (EGS4 NRC and Penelope) and finite-element analyses (Comsol) are performed in all design stages. The initial design for the human system involves a bi-planar MRI with 65 cm opening to allow rotation of the shoulders within the bore. A short 6 MV waveguide is coupled to one open end of the MR, and a beam-stop and a projection imaging device (eg, flatpanel) is coupled to the other end. Rotation is provide by two concentric rings, and the permanent-magnet design is preferred in the initial stage to provide stability and lack of electric wiring in the rotation process. Low fields allows very small fringe fields to minimize linac interference yet with adequate image quality of soft tissue for lungs, prostate, GBM, etc. Mutual interference issues and other issues arising externally are calculated and resolved. We have shown the design to be a practical, viable and realizable within a reasonable time frame.

IMAGING AND IMAGE GUIDANCE SESSION

Fighting NSCLC with integrated PET/CT technology

C.D. Igna[1], D.P. Spencer[1,2], A. Pearce[2] and H. Lau[2], Tom Baker Cancer Centre, Calgary, AB, [1]Department of Physics and Astronomy, University of Calgary, [2]Department of Oncology, University of Calgary

Purpose: To determine the feasibility of ^{18}FDG-PET for delineating target volumes for radiotherapy in NSCLC, and to compare the GTV and PTV derived by CT only and PET/CT. The secondary objective is to compare the CT-based treatment plans versus PET/CT-based plans. Method and Materials: We use an integrated Siemens Biograph-16 PET/CT scanner and the Eclipse™ Treatment Planning System. Patients undergo a PET/CT in the treatment position and subsequently this scan is used for both diagnostic reporting and treatment planning. We are examining various tumour volumes drawn by different observers on the CT data only and then on the fused PET/CT data set in order to do inter/intra-observer comparisons. Two treatment plans are generated: one CT-based using the CT tumour volumes delineated by the treating oncologist, and one PET/CT-based using an average of all the PET/CT volumes. The plans are compared using DVH and EUD analysis. Results and Conclusion: As of February 2007, we have acquired data from one patient who has been recently treated using PET/CT information. The results of this study will offer an insight on the importance of 18-FDG-PET for integration into radiotherapy, since ^{18}FDG-PET is currently viewed as an investigational tool in Canada.

The Use of UV Resonance Raman Spectroscopy in the Analysis of Ionizing Radiation-Induced Damage in DNA

Conor Shaw and Andrew Jirasek, Department of Physics and Astronomy, University of Victoria, BC

Ultraviolet Resonance Raman spectroscopy (UVRRS) is a molecular-level probe useful in the study of molecular structure in biologically relevant samples. Here we assess the capability of UVRRS in characterizing molecular damage in simple biological samples irradiated with ionizing radiation. UVRR spectra of long-strand (calf-thymus) and short-strand (24 A-T pairs) DNA were obtained before and after irradiation to 2000 Gy with a Co-60 treatment machine. Incident Raman laser wavelengths of 248 nm, 257 nm and 264 nm were used to selectively enhance different bands in the spectra, thus allowing for detailed molecular analysis. Spectral contributions from individual bases were determined by comparison to UVRR spectra of short strands of unpaired individual bases. Spectral changes due to ionizing radiation were evident in all spectra of irradiated samples, particularly in those of the more complicated calf-thymus DNA. Spectral intensity increases seen in both types of DNA indicated unstacking of the bases, while intensity decreases in the short strand spectra suggested damage to base ring structure. These results show that UVRR spectroscopy, with its high molecular specificity and short spectral acquisition time (~10-30 s) is an effective method of observing ionizing radiation-induced damage to DNA suitable for extension to more biologically relevant samples.

Development of an ultrasound-guided tracking and gating system

Ferenc Jacso, Tom Baker Cancer Centre, Calgary, AB

An ultrasound-guided tracking and gating system for the stereotactic body radiation therapy of liver metastases was developed. The system images tumour motion with the respiratory cycle, and determines the optimum gating level for treatment delivery.

We combined an existing BrainLAB ExacTrac® system with an ultrasound imaging system for tumour tracking, and investigated it by comparing its performance to the current kV x-ray imaging system. A moving phantom suitable for both x-ray and ultrasound imaging was built to enable the comparison between the two systems. Ultrasound video was recorded about the motion of this phantom. Simultaneously, the motion of the US probe was recorded with the infrared tracking system of ExacTrac. Our software reconstructed the motion of the target in room coordinates.

The timing accuracy of the ultrasound and clinical x-ray systems were investigated. We found that for ultrasound the time delay was 22 ± 11 ms at 2.4 s period, and 30 ± 25 ms at 4.8 s period of breathing motion. The same figures for the clinical x-ray system were 81± 29 ms at 2.4 s period, and 5 ± 18 ms at 4.8 s period, comparable to our system's delay.

Comparison of Fiducial Marker and Ultrasound Image Guided Radiation Therapy Techniques for Prostate Cancer

Holly Johnston, Michelle Hilts, Wayne Beckham, Eric Berthelet, BC Cancer Agency - Vancouver Island Centre, Victoria BC

Purpose: To compare 3D ultrasound (US) and fiducial marker (FM) image guided radiation therapy (IGRT) for prostate cancer. **Methods:** For 8 patients, couch shifts required to realign the prostate into planning position were measured using US (Restitu, Resonant Medical, Montreal QC) and electronic portal images of three implanted FMs. US measurements were made using two methods, assisted and manual prostate segmentation. Paired differences between US and FM measurements were examined using Bland-Altman limits of agreement (the range (mm) over which 95% of differences are expected to lie) and by calculating the percentage of differences lying within ±1, ±2, ±3, ±5 and ±10 mm. Differences exceeding ±3 mm were considered clinically unacceptable. Variability in the US and FM measurements was also compared and the effect of US image quality investigated. **Results:** For assisted segmentation, 35.3%, 51.0%, and 48.2% of differences between FM and US shifts (AP, RL, and SI respectively) lie between ±3 mm. For manual segmentation the results are slightly better: 45.3%, 64.1% and 55.2%. Greater variability occurred in the US than the FM measurements in nearly all situations and good US image quality improved agreement between US and FMs. **Conclusions:** US cannot reliably replace FMs for prostate IGRT using either assisted or manual segmentation. Preliminary investigations indicate user variability and US image quality are possible explanations.

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Eye Plaque TPS Powered by Monte Carlo Dosimetry Engine

Iulian Badragan, Genoveva Badragan, Frank C Love Cancer Institute, 1011 N Dewey Ave, Oklahoma City, OK

Background: The planning process for an eye plaque tends to be somehow involved at this time, employing the use of a generic TPS such as Pinnacle in concert with other calculation tools (such as spreadsheets) in order to account for the source decay. Even so, the eye plaque itself is not taken into account and therefore the isodose curves listed with the final plan are not entirely realistic. **Objective:** Design and implement a clinical treatment planning tool targeted specifically towards eye plaque patients. The tool is intended to work very fast and be very accurate, hence the employment of Monte Carlo techniques. **Method:** We used the EGSnrc Monte Carlo system to compute the dose delivered by various eye plaque sizes equipped with Cs seeds in a volume of clinical interest. The results are stored as binary files and used by a specific user interface to compute the required seed activity for each case and display the results in a clinical user friendly way. **Results:** We came up with a new planning tool for eye plaque patients which accurately describes the dose distribution and is very easy and fast to use. **Future Work:** The tool is designed to be extended easily for other kind of isotopes such as I-125 by simply generating additional binary dose files by Monte Carlo means. Also, the user interface may be improved for even more functionality and friendliness.

An alternative approach to EPI MTF measurement

Patrick Rapley, Thunder Bay Regional Health Sciences Centre, Thunder Bay, ON

Since its introduction by Rajapkshe et. al.[1] in 1996 the QC-3 phantom has become the standard for the routine assessment of modulation transfer function (MTF) of electronic portal imaging (EPI) devices for radiation therapy. QC-3 measured f_{50} (frequency of 50% modulation transfer) values for early commercial EPI mirror / video systems typically ranged between 0.2 and 0.3 lp / mm. Flat-panel EPI systems currently standard on most linacs give characteristic QC-3 measurements with values of 0.621, 0.758, 0.819 lp/mm for f_{50} and f_{40} and f_{30} respectively[2]. Recently, Pang and Rowlands[3], and Sawant et. al.[4] have investigated high quantum efficiency detectors with the potential for further improvements in spatial resolution. With its maximum bar pattern spatial frequency of 0.75 lp/mm, the QC-3 phantom is being pushed to its MTF measurement limit by these technological advancements.

The present study introduces a technique of EPI MTF analysis using edge spread function data measured with a prototype phantom. The technique has been evaluated on Siemens Beamview (video-based) and Optiview (flat-panel) portal imaging systems and is shown to give results comparable to the QC-3 phantom. A timesaving improvement over the prototype is proposed with an ESF phantom that can be readily constructed *in-house*.

1. R Rajapakshe, K. Luchka and S. Shalev. Med Phys 23(7) 1237-1244, 1996
2. The 7th International Workshop on Electronic Portal Imaging, EPI2K2, Vancouver BC June 27-29 2002, by R. Clements, K. Luchka, J. Pouliot, J. Sage, S. Shalev
3. G. Pang and J.A. Rowlands, Med Phys 29 (10), 2274-2285, 2002
A. Sawant, L. Antonuk, Y. El-Mori, Li Z. Su, Y.Wang, J. Yamamoto, Q. Zhao, H. Du, Med Phys 32(2) 553-565, 2005

Current State of Magnetic Resonance Methods in Cancer

Patrick Rapley, Thunder Bay Regional Health Sciences Centre, Thunder Bay, ON

Recent advances in magnetic resonance (MR) show promise for powerful, non-invasive tools for cancer patient management. These advancements show the potential for detection of cancer in its early stage of development as well as during metastasis. Cancer diagnosis and treatment can be aided through the ability of MR to differentiation between cancerous and normal tissue as well as between stages of disease progression. Novel MR methods have the potential to assess the response of cancer to external stresses such as therapeutic ionizing radiation and chemotherapy. MR can probe both the tumour microenvironment for tissue specific characteristics such as pH, vasculature, and the extra-cellular matrix as well as for cellular properties such as metabolism, gene expression and biochemistry through molecular targeting.

This presentation provides an overview of the exciting advancements in the field of cancer MR as demonstrated at the October 2006 Cancer Study Group Workshop of the International Society for Magnetic Resonance in Medicine. Novel applications of endogenous MR probes such as spin relaxation T^1 and T^2, chemical exchange and chemical shift (spectroscopy and spectroscopic imaging) will be discussed along with recently developed contrast agents such as targeted antibody-iron oxide complexes and hyperpolarized ^{13}C labeled substrates.

Imaging Performance of Cone Beam CT on Varian's On-board Imager

Satyapal Rathee, Tara Monajemi and Gino Fallone, Cross Cancer Institute, Edmonton, AB

A preliminary evaluation of the CBCT option of the Varian's On-board Imager was performed using standard CT phantoms: CATPHAN600 (Phantom Lab), Tissue Characterization 467 (Gammex-RMI), and standard dose phantoms. We measured CT number uniformity and noise, signal to noise ratio (SNR), CT number accuracy, slice thickness, modulation transfer function (MTF), low contrast details (LCD), and CT number as a function of electron density for both asymmetric (half-fan) and symmetric (full-fan) options. Doses measured at the center (periphery) of 16 cm and 32 cm diameter phantoms were 7 cGy (7cGy) and 2.2 cGy (4.4 cGy) respectively for standard 2 mAs per view at 125 kVp. SNR in the images of uniformity section of the CATPHAN was determined to be almost linear with both the mAs per view and the slice thickness. The measured slice thickness was found to be within ±1mm of the nominal setting. The LCD varied with mAs and slice thickness as expected. The measured MTF depicted large variation with respected to the slice thickness for both full-fan and half-fan scanning modes. For large longitudinal field of view (14 cm), the CT numbers were inconsistent with electron density due to scattered radiation. Experimental details and results will be presented.

Summary of Radiotherapy Data Collection Techniques for Clinical Trials

Colin Field, Cross Cancer Institute, Edmonton, AB

Clinical trials groups and quality assurance agencies (RTOG, NCIC CTG, QARC, RPC, COG, ESTRO) require the submission of radio-

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therapy data in an electronic or hardcopy format. Trial participation also normally requires some form of credentialing, specific to the institution and/or the individual, and a dry (or dummy) run. The dry run is used to demonstrate treatment planning capabilities, compliance with the protocol, and the ability to electronically submit the required data.

The radiotherapy data may be submitted by: mailing or couriering hardcopies or CDs, emailing screen captured images, SFTP of DICOM-RT or RTOG data sets, or using encrypted network transmission. Once this data is received by the host agency it may be organized electronically in DICOM-RT archives, or proprietary databases. The clinical review of the data can then be performed by visual inspection of the hardcopy information or electronically with rapid review software applications. The challenges, and pros and cons of the various techniques will be discussed. Potential solutions and future directions will also be proposed.

Significant efforts are required by the radiotherapy community to establish more standardized techniques for the credentialing, submission, storage, and review of multi-institutional clinical trials.

SYMPOSIUM: THE FUTURE OF RADIOTHERAPY TREATMENT PREPARATION IN CANADA

Current and Future use of IMRT in Canada

Boyd McCurdy, Cancer Care Manitoba

Compared to the United States, Canada has been slow to introduce intensity modulated radiation therapy (IMRT) into the clinic. Estimated rates of IMRT usage in the USA grew from 32% in 2002 to 73% in 2004. In the same years, only 20%(8) and 38%(13) of Canadian centres, were offering IMRT as a treatment option. A recent Canadian IMRT survey of all provincial cancer centres revealed that in 2005, IMRT was offered in 14 locations (41%), with an estimate of just under two-thousand patients treated during the calendar year. An update of this national survey for 2006 indicates that 16 locations now offer IMRT (47%), with eight centres in various stages of active commissioning, and seven centres planning on commissioning IMRT within the next 1-2 years. The estimated number of patients treated with IMRT in 2006 was just over two-and-half thousand, a 25% increase from the previous year. Based on reported commissioning and planned IMRT adoption rates in the 2006 survey, nearly all Canadian centres will be offering IMRT within the next two to three years.

This presentation will discuss the trends observed in the 2005 and 2006 national IMRT surveys, and expected future developments in the Canadian IMRT landscape.

IMRT Perspectives from a Smaller Centre

Pat Cadman, Saskatoon Cancer Centre

The implementation of IMRT in our clinic has brought significant change to our treatment preparation process and has forced us to redefine many of our traditional roles. The challenges and advancements in treatment planning have been numerous. Precise segmentation by our radiation oncologists is a crucial starting point. Inverse planning and optimization have evolved to include the use of an increasing number and mixture of dose/volume objectives and planning ROIs, as planners strive to achieve an optimal, rather than just an acceptable plan. Biological objectives (e.g. EUD) are finding their place but have only had a minor effect on reducing the complexity of the inverse planning process. We find that we are now comfortable using IMRT to produce conformal avoidance for a number of sites, including prostate, brain, breast, and cranio-spinal. The traditional role of the therapist has changed significantly as plans become less intuitive and patient set-up becomes more critical. MV EPID and kV imaging have become essential tools to insure accurate setup and to justify reduced PTV margins. Improved dose calculation accuracy means that we can focus more on potential delivery errors through routine machine QA and plan transfer QA.

Streamlining treatment preparation in the Varian system … and future directions

W. Ansbacher, Vancouver Island Cancer Centre

We have been hit by an avalanche of new technology in recent years. As radiotherapy treatment delivery has become more complex, there has also been a drive to improve efficiency. As a result, processes must become more streamlined, but it is important for the primary users of the technology – physicists, therapists and oncologists – to remain in control. Although the emphasis today is on IMRT, all other types of treatment regimes including even simple field placements are affected by the new technologies.

In this presentation I will explore the impact of Varian's treatment planning and delivery software on clinical operations, and the ways that it can be harnessed to best effect. As with all software, it has some shortcomings along with the excellent features. I will discuss some of the strategies we use to deal with such deficiencies, together with recommendations for future improvements.

Streamlining Treatment Presentation using Tomotherapy

Marc MacKenzie, Department of Oncology, University of Alberta and Department of Medical Physics, Cross Cancer Institute, Edmonton, AB

Helical tomotherapy (HT) is relatively new in Canada, but gaining acceptance, and is now or soon to be available at five Canadian centres. The Cross Cancer experience with HT dates back to the prototype beta unit which arrived in December 2002. Although it was commissioned and accepted, it was never used for treatment, and was upgraded to the commercial production unit in January 2004. The first patient was treated in August 2004.

Patients on HT are treated according to in house research protocols. Once the physician indicates the patient may be eligible for HT, and a research nurse confirms protocol eligibility and obtains patient consent, they are referred on to booking. The patient will be CT scanned with the appropriate immobilisation, contouring is done on an Eclipse workstation, and CT / contours are DICOM exported to TomoTherapy. Since contouring is done using a standard contour template on Eclipse, a standard set of planning constraints can be automatically applied by the TomoTherapy planning software. The planner will set the appropriate overlap priorities (rules for pixel ownership where there is overlap between structures) and laser positions, and then proceed to choose beam parameters (pitch, jaw size and dose resolution) before pre calculating the incident beamlets. Once a plan is approved, it goes to a physicist for a second check, and for Delivery Quality Assurance (DQA).

Discussion will be had with regard to:

- Daily imaging and setup.

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- Handling machine breakdowns and treatment interruptions.
- Use of an internal editable document repository (Wiki server).
- Interesting planning and delivery cases
- Workflow implications and procedures for new options (adaptive planning and patients transfer between machines).

Installation and start of treatment on second clinical HT unit (March 5th, 2007); new sites identified for treatment on the new unit.

Streamlining Treatment Preparation using CMS/IMPAC and Future Directions

Miller MacPherson, Senior Medical Physicist, The Ottawa Hospital Regional Cancer Centre, Ottawa, ON

The Ottawa Hospital Regional Cancer Centre (TOHRCC) is a large academic cancer program treating more than 4000 radiation therapy patients each year at its two Ottawa campuses. This two site model presents unique challenges to pre-treatment workflow and staff communication. This talk will review the difficulties faced in modernizing the planning environment at TOHRCC, and describe how the implementation of a thin-client planning architecture from Computerized Medical Systems (CMS), along with systematic use of the workflow tools provided by IMPAC Multi-Access, has provided a distributed treatment planning environment to meet those challenges. The impact of this model on TOHRCC's planning workflow will be reviewed, and the implications for near future developments in 4D planning and adaptive radiotherapy will be discussed.

Streamlining Treatment Preparation: Now and in the Future

Michael B. Sharpe, Radiation Medicine Program, UHN-Princess Margaret Hospital
Department of Radiation Oncology, University of Toronto, Toronto, Ontario, CANADA

Radiotherapy treatment planning is the bridge between medical prescriptions and the technical elements required to implement a course of therapy. Treatment planning stands on a technical foundation of medical imaging and computing resources. The integration of medical imaging devices with computational algorithms for visualization, dose computation, and automation for the optimization and delivery of treatment provides the tools. Medical and technical staff must collaborate effectively to exploit these technologies to design and implementation of treatment plans, especially with state-of-the-art technologies such as intensity modulated radiation therapy (IMRT). Centres that undertake the implementation IMRT face a number of challenges in acquiring appropriate technology, human resources, and training; as well as in creating a sustainable practice. The implications of adopting IMRT need to consider its impact in every aspect of treatment planning, delivery, and verification.

This talk addresses the development, evolution, and current applications of IMRT at Princess Margaret Hospital. It includes a review of the technological aspects of our programme, changes in clinical practice, our approach to quality assurance, and some of the lessons learned along the way.

PROFESSIONAL SESSION

What can be learned from the recent treatment error in Scotland?

Brad Murray, Cross Cancer Institute

In January 2006 there was an incident at the Beatson Oncology Centre in Glasgow Scotland in which a young girl received an unintentional overdose. The report by an inspector appointed by the Scottish Ministers for Ionising Radiation (Medical Exposures) Regulations 2000, was released in the fall of 2006. It is important for all individuals associated with radiotherapy delivery to understand the factors that cause such incidents and to try to minimize the risks of similar incidents happening again. The root cause of this incident was that a procedure changed after some new software was installed, but an inexperienced planner was unaware of the ramifications of this change. In this case the planner partially followed the old procedure and partially followed the new procedure. This ultimately caused the dose delivered daily to be 67% higher than prescribed. The error was caught after 19 fractions such that the total dose delivered was 58% higher than prescribed. At the Cross Cancer Institute we were commissioning and implementing similar software changes into our clinic at the time the report was made public. Therefore, we were extremely interested in the report describing this incident. In this presentation I will summarize the report by the inspector and discuss the mitigation strategies that we have taken at the Cross Cancer Institute to try to reduce the risk of such a situation arising at our site. A central issue in any such case is always the question of "Was there due diligence?" In order to answer this it is important to understand what our colleagues at other centres are doing in similar situations. Therefore, some questions will be posed to the audience to see how similar the QA programs are at various sites, and how this compares to what had been done at the Beatson Oncology Centre.

POSTER SESSIONS

Theoretical investigation of the effect of inter-tumour heterogeneity on radiobiological parameter ratio estimates

Colleen Schinkel, Department of Physics, University of Alberta and Department of Medical Physics, Cross Cancer Institute

Clinical tumour dose-response data exhibit a population response. For the individual tumour control probability (TCP) model to fit such data, unrealistically low radiobiological parameters are required. However, it is often assumed that *ratios* of parameters (such as α/β) are not affected by presence of inter-tumour heterogeneity within a dataset. This implies that ratios may be estimated by means of the individual TCP model, and that the use of a population model is not necessary. The population TCP model may be expressed in terms of the geometric parameters D_{50} and γ_{50} in the limit of dominant heterogeneity in clonogen number or radiosensitivity. The individual model may also be expressed in terms of these parameters. In this work, the functional forms of the individual and population models were compared, and found to be similar. This similarity facilitated an analytic comparison between the α/β ratio estimates that would be obtained by fitting each model to clinical data. For the case of dominant heterogeneity in clonogen number, the individual and population α/β estimates were found to be identical. However, when heterogeneity in radiosensitivity dominates, the individual model is expected to yield α/β estimates that are lower than those from the population model.

Development of a multi-purpose photon detection device for installation and quality control purposes

Ian Nygren, David P. Spencer, Tom Baker Cancer Center, Calgary, AB

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Since the light field is often used as a proxy for the radiation field, it is beneficial to know the relative locations of the edges of visible light and x-ray fields generated by a medical linear accelerator. These measurements should be as objective as possible to allow for accurate alignment. Additionally, it may be necessary to perform such tests multiple times, and in various orientations, to align both sets of jaws, and using x-ray film for these measurements may become excessively resource intensive and time-consuming. Using a 512x1024 rectangular array of photodiodes, along with an ordinary x-ray intensifying screen, images are captured of the light field and the x-ray field. These images are then analyzed using in-house developed software and the light field and x-ray field may then be compared side by side. The results (attached) indicate that the system developed can be used for measuring radiation-light field coincidence, and has the potential to be useful in many other applications. This work in progress represents a significant step in the improvement in the objectivity, efficiency and reliability of both installation and quality control measurements.

A Simple and Inexpensive Method for Determining Proton Energy in a Medical Cyclotron

K. Gagnon[1,2], S.E. Lapi[1,3], T.J. Ruth[1]; [1]TRIUMF, Vancouver, BC., Dept. [2]Physics and [3]Chemistry SFU, Burnaby BC.

Although Positron Emission Tomography proves useful in distinguishing cancerous from normal tissue, the use of such a technique is often limited by the local availability of short-lived radiopharmaceuticals. As such, the installation of a cyclotron for on-site production of ^{18}F, ^{11}C, etc., may prove economical or necessary. Presented here, is a simple, yet inexpensive method for determining a cyclotron's accelerated proton energy based upon measured activity ratios for dual isotope production within a single irradiation. This ratio is then compared with values calculated as a function of bombardment time, decay constants, and cross-sections. While this method has been previously employed using high-resolution γ-ray spectroscopy (*Radiochim. Acta*(1992); 57:1-5), this study expands to use an ionization chamber which is cheaper and more common than HPGe/Ge(Li) systems. As such, a Capintec CRC-543X® is used to compare the production of $^{63}Zn/^{65}Zn$ obtained from a natural copper foil irradiation. With a nominal post Al-window energy of 12.8 MeV on TRIUMF's TR-13 cyclotron, an average energy of 12.9(6) MeV was measured. In comparison, 12.7(2) MeV was obtained using HPGe detector measurements. Further studies are however needed to verify the Capintec® sensitivity at cyclotron energies greater than 13.5 MeV, whereby the threshold for $^{nat}Cu(p,2n)^{62}Zn$ production is met.

Objective Analysis of Standards of Performance of linear Accelerator

Alejandra Rangel[1,3], Nicolas Ploquin[1,3], Ian Kay[1,2,3], Corinne Doll[2], Peter Dunscombe[1,2,3]
Tom Baker Cancer Centre, Department of Medical Physics (1) and Department of Oncology (2) University of Calgary, Department of Physics and Astronomy (3) and Department of Oncology (4).

Current quality control (QC) practices often require an extensive use of time and resources that are not easily available. The purpose of our research is to explore the application of the Equivalent Uniform Dose (EUD) to the objective setting of standards for linear accelerator performance, to develop a systematic QC program that balances treatment quality with the availability of resources.

Volumetric CT data sets for four prostate patients were available for this study. A series of plans for each data set was generated using a conformal 4 field geometry with MLC defined apertures. The first plan in each series used reference beams, fields and geometries. Subsequent plans in each series were generated by altering, one at a time, parameters of the plans so as to simulate performance deviations which might be encountered during routine linac QC (output, flatness, field size, laser positions and gantry and collimator angle). The ranges of these deviations encompass tolerances and action levels specified in the Canadian Association of Provincial Cancer Agencies (CAPCA) documents (www.medphys.ca). The EUD's of the relevant structures were calculated as a function of deviation of these key parameters from their reference values and the results analyzed for the purpose of this study.

A prototype phantom to evaluate the spatial-resolution of magnetic resonance spectroscopic imaging

A. A. Heikal, K. Wachowicz, S. D. Thomas, B. G. Fallone, Department of Physics, University of Alberta

Biochemical imaging in the form of Magnetic Resonance Spectroscopic Imaging (MRSI) is becoming more practical and effective in the diagnosis and assessment of cancer. Studies have demonstrated that MRSI can detect regions of abnormal activity (tumor) that would not have been covered using conventional imaging and contouring methods. With increased interest in MRSI it is very important that its performance as an imaging modality be investigated. While most spectroscopy phantoms are designed for single voxel applications, little effort has been made to design phantoms to examine the performance of MRSI sequences. In this work a gel-based detail phantom has been developed to assess the ability of the spectroscopic imaging sequences to accurately represent the geometry of tumors. The gel-based phantom is used as an alternative to conventional acrylic or glass based phantoms for use with MRSI. Due to their ease of construction and the reduced artifacts, gel phantoms are a reliable tool for assessing the performance of MRSI sequences.

Error Accumulation: Addition of Time Delays in Gated Radiotherapy

Nathan Becker and Wendy Smith, Tom Baker Cancer Center, Calgary, AB

When commissioning any radiotherapy system, it is imperative to consider the method of accumulation of errors. For example, in gated radiotherapy, the accuracy of treatment delivery is determined by the accuracy with which both the imaging and treatment beams are gated. If the time delay (the time between the IR markers entering/leaving the gated region and the first/last image acquired or treatment beam on/off) for the imaging and treatment systems is in the opposite directions, it increases the required ITV margin, above that indicated by the tolerance for either system measured individually.

We measured a gating system's time delay on 2 fluoroscopy systems, and two linac treatment beams, using a motion phantom of known geometry, varying gating type (amplitude vs. phase), beam energy, dose rate, and period. In the worst case scenario, beam-off for amplitude-based gating (3-5s period), the last fluoroscopic image in the gated region was acquired 0.15 ± 0.08 s (1SD) before the IR markers left the amplitude-gated window, while the treatment beam cut off 0.06 ± 0.02 s after the IR markers have left the same

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region. For a patient with 1 cm amplitude, 4 s period sine wave breathing, this requires a 3.3mm increase in the ITV margin.

Monte Carlo research on modeling of Helical Tomotherapy and treatment planning system verification

Yingli Zhao, Marc Mackenzie, Charlie Kirkby, Steven Thomas, Donata Drabik, B. Gino Fallone, Department of Medical Physics, Cross Cancer Institute, Departments of Oncology and Physics, University of Alberta, 11560 University Avenue, Edmonton, Alberta T6G 1Z2, Canada

Helical tomotherapy (HT) represents the state of the art in intensity modulated radiation therapy (IMRT) and image guided adaptive radiotherapy (IGAR). This work is aimed at carrying out Monte Carlo (MC) dose calculations of tomotherapy deliveries for static and helical deliveries to virtual phantom from assigned or CT data. All MC calculations are carried out with the EGSnrc-based Monte Carlo simulation code, BEAMnrc and DOSXYZnrc. Various MC parameters for variance reduction were investigated (range rejection, photon splitting) and optimized based on the HT unit's geometry and energy spectrum. HT MC model is verified by comparing simulations of percent depth dose (PDD), beam profiles taken at a number of depths, and for differing fully opened lateral field dimensions as well as complicated modulated delivery by the 64 leaf binary MLC against measurements. Clinically relevant treatment plans, which are more complicated deliveries, are simulated on "Cheese Phantom", CIRS homogenous and heterogeneous thorax phantoms. The results are compared to film measurements and Tomotherapy TPS calculation results. Measured and simulated profiles and PDDs are found agree with each other well. In Cheese Phantom and homogeneity phantom, MC and TPS results agree with measurements within 2%/2mm in most of regions. Disagreements are found in heterogeneous.

Patient Specific Distortion Correction using Double Echo Field Maps

LN Baldwin, K Wachowicz, BG Fallone - Cross Cancer Institute

Magnetic Resonance Imaging (MRI) provides excellent soft tissue contrast which is advantageous for tumor delineation. However, the various distortions inherent in MR images limit their clinical applicability: they serve as purely diagnostic scans. For use in radiation treatment planning, they must first be fused with geometrically correct CT data sets. Provided distortions could be corrected for (and electron densities assigned), the role of MRI in radiation treatment planning could be expanded. While gradient distortions can be uniquely determined from a single scan, patient distortions need to be measured for each subject and need to be performed in a fast and accurate manner. We propose using a double gradient echo experiment with a time delay, t_d, to generate a distortion map from a phase difference map. By selecting an echo time delay less than the water-fat chemical shift factor, information about B_0 inhomogeneities as well as patient-specific chemical shift and susceptibility artifacts can be obtained in a single scan. This map can be used to correct a variety of different images provided that the k-space trajectory of each image sequence is known. When such a distortion map is combined with gradient nonlinearity maps, patient images can be fully corrected for geometric inaccuracies.

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

Real Time Internet Projects

Submitted by: M. Woo
Toronto-Sunnybrook Cancer Centre, Toronto, Ontario

Several projects are ongoing at our centre with the objective of taking advantage of the ever-expanding usage and power of the Internet to benefit our profession. One common feature of these projects is their real-time nature. This is one aspect of on-line education that seems to have lots of untapped potential.

The first one is an education project that is a collaboration between TSRCC and the Medical Physics department at the University of Malaya, Malaysia Physicists at TSRCC give sessions of lectures to a class of Medical Physics students at the university in real-time through the use of the Internet. In this particular scenario the Internet turned out to be more practical than a dedicated video-conferencing set-up because of the time difference. The physicist in Toronto would conduct the lecture in the evening from home, when the students attend the class in the morning. The details of the project are available on the following web-site : http://www.neteinfach.com/rrtl/index.htm .

The second project is similar to the above one but actually uses a dedicated video-conferencing facility at our centre. This is a collaboration with the Liverpool hospital in Sydney Australia, where radiation oncologists and physicists at our centre conduct applied physics sessions with radiation oncology residents (registrars) in Liverpool. The use of dedicated video-conferencing facility ensures better video and audio quality, but imposes strict limitations on the location, timing as well as cost of the sessions.

The third project is the real-time web-cast of seminars and lectures. Sunnybrook hospital is the first hospital in the country to provide this feature, where intended audience are invited to access selected lectures in real-time. These lectures are also archived so that a missed lecture could be viewed later. In our Medical Physics department we try to fully take advantage of this valuable facility and are rapidly building up our library of lectures. An example of such a lecture can be viewed at the link below (speaker and software (WMP for example) are required. Copy and paste the link to your browser). To access our other lectures or to contribute to our library please contact the author.

http://alex2.sunnybrook.ca/Mediasite/Viewer/Viewer.aspx?layoutPrefix=LayoutTopLeft&layoutOffset=Skins/Clean&width=800&height=631&peid=2f2ec4b6-9dae-441f-a8d4-3801344 8c6c5&pid=d8e83fa3-2e2a-4862-a45a-85e7859fc7c7&pvid=502&mode=Default&shouldResize=false&playerType=WM64Lite

The fourth project is the promotion and establishment of a real-time audio-video communication network within the Medical Physics community. We have found many applications for this mode of communication (e.g., consultation on how to run a complicated piece of software; remote participation of physicists in our resident sessions; conferencing, etc.). We favor the usage of the software Skype because of its popularity, its features, and its ability to go through most firewalls. For this reason we like to establish a directory of Skype users in Medical Physics. Anyone interested in a listing in this directory please contact the author.

In summary, we feel that many of the above applications are useful to our profession, and the benefit / cost ratio is excellent. The more participation we get from our members, the better and more useful will these tools become.

2006 Professional Survey: continued...

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17. Please indicate which benefits are covered (in part or in whole) by your employer (n=146).

	Yes	No	Unknown
Medical Coverage	93%	4%	3%
Dental Coverage	90%	8%	2%
Term Life Insurance	87%	7%	6%
Disability Insurance	88%	9%	3%
Liability Insurance	34%	32%	34%
Retirement Pension Plan*	95%	4%	1%
Sabbatical Leave	27%	50%	23%
Tuition Benefits (self)	14%	57%	29%
Tuition Benefits (dependents)	8%	69%	24%

*Exclusive of CPP or QPP

18. Do you expect to retire from full-time practice of medical physics within the next 10 years (n=147)?

A significant number of Respondents, 32 in all, representing 18.4 percent will retire in the next ten years. This is up by 47 percent from 12.5 percent

Harold Johns Travel Award Announcement
Deadline for Application: 4th June 2007

The Board of the Canadian College of Physicists in Medicine is pleased to honour the Founding President of the College by means of the Harold Johns Travel Award for Young Investigators. This award, which is in the amount of $2000, is made to a College member under the age of 35 who became a member within the previous three years. The award is intended to assist the individual to extend his or her knowledge by travelling to another centre or institution with the intent of gaining further experience in his or her chosen field, or, alternately, to embark on a new field of endeavour in medical physics.

The H. E. Johns Travel Award is awarded annually by the Canadian College of Physicists in Medicine to outstanding CCPM Members or Fellows proposing to visit one or more medical physics centres or to attend specialized training courses such as the AAPM summer school. The applicant should not have previously taken a similar course or have spent a significant amount of time at proposed institutions. The award is for $2,000 and will be paid upon receipt of a satisfactory expense claim. The deadline for application is four months prior to each CCPM annual general meeting. All applicants must have written and passed the exam for membership in the CCPM within the previous three years. They should supply a one page proposal indicating the course they wish to attend or the name(s) of the institutions they would visit and the reasons for their choice. They should also supply an estimate of the costs involved and letters from their present employer indicating that they are in agreement with the proposal. For a visit to an institution the candidate must have the institution write to the Registrar in support of the visit. The candidate should also provide their curriculum vitae and the names and phone numbers of two references whom the Awards Committee can contact. No reference letters are required. The Awards Committee reserves the right to contact additional individuals or institutions.

Applicants may travel either inside Canada or elsewhere. If their proposed expenses exceed the value of the award, then they should also indicate the source for the additional funds required.

The award is intended both to assist the individual in their medical physics career and to enhance medical physics practice in Canada. Recipients are therefore expected to remain in Canada for at least one year following their travel. Applicants should be working in Canada but need not be Canadian citizens.

Successful candidates will have two years after their application deadline to complete their travel. They will be required to submit a short report to the Canadian Medical Physics Newsletter.

The award recipient will be chosen by a committee consisting of the Chairman of the Examining Board, The Registrar and the President of the College. Their choice will be based upon 1) the written proposal submitted by the candidate, 2) references obtained by the committee and 3) membership exam results. The award will be announced at the Annual General Meeting of the College.

Unsuccessful candidates in any one year who are still eligible in subsequent years may have their applications considered again by writing to the Registrar and providing any necessary updated information.

Applications should be sent to:
Dr. Wayne Beckham
The Registrar
Canadian College of Physicists in Medicine
c/o BC Cancer Agency, Vancouver Island Centre
2410 Lee Avenue, Victoria, BC, Canada V8R 6V5

COMP OCPM

CANADIAN ORGANIZATION OF MEDICAL PHYSICISTS

ORGANISATION CANADIENNE DES PHYSICIENS MÉDICAUX

CALL FOR NOMINATIONS

Councilor for Professional Affairs

(4-year Term from AGM in 2007 to AGM in 2011)

Nominations must be signed by two sponsoring members and by the nominee who by his/her signature agrees to accept the nomination.

Please send nominations to:

APPEL POUR MISES EN CANDIDATURE

Conseiller des affaires professionnelles

(Terme de 4 ans de la RGA en 2007 à la RGA de 2011)

La mise en candidature doit être signée par deux membres actifs et par le(la) candidat(e) qui indique par sa signature qu'il(elle) accepte la mise en candidature.

S.V.P. Envoyez vos mises en candidature à:

Peter F. O'Brien FCCPM
Toronto-Sunnybrook Regional
Medical Physics Dept
2075 Bayview Avenue
Toronto ON M4N 3M5
Tel: 416.480-4622
Fax: 416.480-6801
peter.o'brien@sunnybrook.ca

DEADLINE : JUNE 30, 2007

The results will be reported at the Annual General Meeting in Toronto in October 2007. (See Articles IV.B(6&7) of COMP Bylaws)

Nominee :

Accepted by nominee :

Sponsors: 1)

2)

DATE LIMITE : 30 JUIN 2007

Les résultats seront rapportés à la réunion générale annuelle à Toronto en octobre 2007. (Voir articles IV.B

Candidat(e) :

Acceptée par le(la) candidat(e):

Parrains: 1)

2)

COMP OCPM

CANADIAN ORGANIZATION OF MEDICAL PHYSICISTS

ORGANISATION CANADIENNE DES PHYSICIENS MÉDICAUX

CALL FOR NOMINATIONS

Secretary

(3-year Term from AGM in 2007 to AGM in 2010)

Nominations must be signed by two sponsoring members and by the nominee who by his/her signature agrees to accept the nomination.

Please send nominations to:

APPEL POUR MISES EN CANDIDATURE

Secrétaire

(Terme de 3 ans de la RGA en 2007 à la RGA de 2010)

La mise en candidature doit être signée par deux membres actifs et par le(la) candidat(e) qui indique par sa signature qu'il(elle) accepte la mise en candidature.

S.V.P. Envoyez vos mises en candidature à:

Peter F. O'Brien FCCPM
Toronto-Sunnybrook Regional
Medical Physics Dept
2075 Bayview Avenue
Toronto ON M4N 3M5
Tel: 416.480-4622
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DATE LIMITE : 30 JUIN 2007

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Candidat(e) :

Acceptée par le(la) candidat(e):

Parrains: 1)

2)

Associate Medical Physicist

The Tom Baker Cancer Centre invites applications for a two year term position as an Associate Medical Physicist (Resident) in the CAMPEP approved Radiation Oncology Physics Residency Program.

Physicists within the Department of Medical Physics provide clinical physics services at the Tom Baker Cancer Centre (TBCC) which treats approximately 2500 new patients per year. External beam equipment includes one Cobalt unit, eight Varian linear accelerators and a Novalis stereotactic unit. Three of the accelerators are equipped with OBI/CBCT. Treatment preparation takes place using one of two CT simulators or an Acuity with CBCT, with plans generated by the Eclipse treatment planning system. The TBCC supports active clinical programs in IMRT, brachytherapy including prostate brachytherapy and stereotactic radiosurgery/therapy. There are currently ten physicist positions at the TBCC within a total Medical Physics Department staff of 45. Academic activities are conducted through the Departments of Oncology and Physics and Astronomy at the University of Calgary. A CAMPEP approved graduate radiation oncology physics program is in place with a current enrolment of nine students. In addition, the Department contributes to the teaching of Radiation Oncology residents and Radiation Therapy students. Research activities are generally directed towards on-going clinical programs and are conducted in close collaboration with the Department of Radiation Oncology.

The Associate Medical Physicist position requires a PhD in Medical Physics, Physics or a closely related discipline. Graduation from a CAMPEP accredited graduate program or equivalent academic preparation would provide applicants for this position with a distinct advantage.
The Associate Medical Physicist position (Resident) is a two year term position during which time the incumbent follows a structured program intended to provide practical training in Radiation Oncology Physics and preparation for the certification examination of the Canadian College of Physicists in Medicine.
A strong commitment to the highest clinical standards and highly developed interpersonal and team work skills are required for this position.

For further information please visit www.cancerboard.ab.ca/tbccmedphys Applications with the names and contact information of three references may be submitted to:

Dr. Peter Dunscombe
Director
Medical Physics Department
Tom Baker Cancer Centre
1331 – 29 Street N.W.
Calgary, Alberta T2N 4N2

Closing date: 15th April 2007

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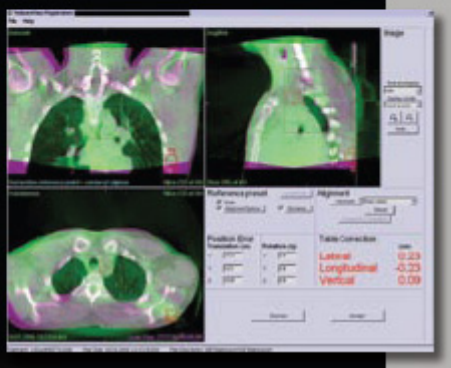

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