

# Physics Group Activities – 2000

## Group Members

Paul Cho, Ph.D.  
Robert Giansiracusa, M.S.  
Jon Jacky, Ph.D.  
Ira Kalet, Ph.D.  
Mark Phillips, Ph.D.

Dalong Pang, Ph.D.  
Alina Popescu, Ph.D.  
Ruedi Risler, Ph.D.  
Karen Singer, M.S.  
Peter Wootton, B.Sc.  
Lori Young, Ph.D.

## Transitions

Departed: Brian Hopkins, Ph.D.

Arrived: Dalong Pang, Ph.D.

## Clinical Program

- Provided clinical support. As part of our routine work, we provided clinical support for the following programs at UWMC and at the VA-Puget Sound.
  - External beam therapy (x-rays, electrons, neutrons)
  - Intra-operative radiation therapy with electrons
  - Total body irradiation
  - Total skin irradiation
  - Stereotactic radiotherapy
  - Stereotactic radiosurgery
  - General brachytherapy
  - Eye Plaques
  - High Dose Rate brachytherapy
  - Permanent prostate implant brachytherapy
  - Permanent implant brachytherapy for other sites
- Provided quality assurance and maintenance support. As part of our routine work, we provided quality assurance and maintenance support for the following departmental systems:
  - Linear accelerators
  - Cyclotron
  - Stereotactic radiosurgery equipment
  - Radiocamera system
  - High dose rate afterloader
  - Brachytherapy systems
  - Treatment planning systems:
    - \* External beam therapy with x-rays and neutrons (Prism)
    - \* Stereotactic radiosurgery

- \* Stereotactic radiotherapy
- \* High dose rate brachytherapy
- \* Permanent prostate implant brachytherapy
- Departmental computers for research and treatment planning
- Service transferred to the VA. During the replacement of the CI 2500, clinical service was performed at the VA hospital using an Elekta accelerator under a lease arrangement. Physics staff commissioned treatment planning data for the machine, performed routine linac QA procedures, and provided quality assurance for clinical treatments.
- Commissioning of SL20C. The Clinac 2500 was replaced with a three energy (6, 10, and 18 MV x-rays + electrons) Elekta linac with multileaf collimator. A new operating system (RT Desktop) was installed, becoming one of the first clinically operating machines in the U.S. using the operating system. The machine was acceptance tested and commissioned.
- IORT. The IORT program had originally been implemented on the CI 2500. After its replacement, the program was recommissioned on the SL20C with the old hardware, while currently awaiting a new system.
- Commissioning of the Harborview Gamma Knife. The stereotactic radiosurgery program was transferred from the SL20A at UWMC to the Gamma Knife, located at Harborview. The machine was installed, acceptance tested and commissioned. This was a Model C, which provides for isocenter placement under computerized patient positioning. This was the first clinically operational unit in the U.S.
- FHCRC TBI Program: As part of the changes wrought by the Seattle Cancer Care Alliance, the FHCRC TBI patients were moved to the UWMC. The SL20B was commissioned for TBI irradiations after the CI 2500 was removed. A dose monitoring system using diodes was commissioned for use with the TBI program.
- In Vivo Dosimetry with diodes: As a continuing development in quality assurance, an *in vivo* dosimetry system was purchased. It was implemented for use on TBI patients, with continuing effort to extend its use to all external beam x-ray fields.
- Prism: During this past year, a number of enhancements were included in Prism.
  - Tape measure in views (including BEV)
  - Added OpenGL support, provides image magnification in all drawing tools and views!
  - Better autocontouring, at least for skin contours; extended to do all images in a set at the same time
  - Reorganized beam panel and block panel to draw all blocks on one panel instead of a separate panel for each block instance
  - Sped up DRR, cached and used in MLC and block paneltoo
  - Created Prism DICOM facility and Conformance Statement
  - Added IRREG facility
- Prescription transfer from Prism treatment planning program to Elekta accelerators over hospital network using DICOM-RT protocol first demonstrated on small data sets, but not yet suitable for routine clinical use (with Bob Giansiracusa)
- Minor revisions and upgrades to neutron therapy control system installed July 1999, to improve efficiency and usability (with Ruedi Risler, Dave Reid, Rob Emery)

- Utilities for automated analysis and summary of neutron therapy treatment records and event logs for patient quality assurance, machine maintenance and troubleshooting. Invoked nightly and at longer intervals.
- Seattle Cancer Care Alliance: Members of the group actively participated in the planning and implementation of the radiation therapy department at SCCA. Commissioning of the simulator and the linac were also begun.

## Journal Articles

1. Cho, P.S. and Marks II, R.J. Hardware-sensitive optimization for intensity modulated radiotherapy. *Physics in Medicine and Biology* 45:429-440 2000.
2. Fuller, S., Kalet, I.J., Tarczy-Hornoch, P. Biomedical and Health Informatics Research and Education at the University of Washington. Yearbook of Medical Informatics 2000, pp. 107–113, International Medical Informatics Association (IMIA), 2000.
3. Phillips, M.H., Parsaei, H., and Cho, P.S. Dynamic and omni wedge implementation on an Elekta SL linac. *Medical Physics* 27:1623-1634 2000.
4. Phillips, M.H., Singer, K., Miller, E., and Stelzer K. Commissioning an image-guided localization system for radiotherapy. *Int J Radiat Oncol Biol Phys*, 48:267-276 2000.
5. Popescu A, Lai K, Singer K, Phillips M. Wedge Factors dependence with depth field size and nominal distance. *Med. Phys*, 26: 541-549, 1999.
6. Popescu A, Lai K, Koh WJ, Singer M, Phillips M. Dosimetric Properties of an Intraoperative (IORT) Electron Beam System, *Recent Advances and Research Updates*, 1(3): 61-74, 2000.

## Proceedings

1. Cho, P.S. Computerized Segmentation of Clustered Seeds in Prostate Brachytherapy. pp. 105–107, in “Proceedings of the Thirteenth International Conference on Computers in Radiotherapy”, W. Schlegel and T. Bortfeld, eds. Springer-Verlag, Heidelberg, 2000.
2. Jacky J. Formal Safety Analysis of the Control Program for a Radiation Therapy Machine, pp. 68–70, in “The Use of Computers in Radiation Therapy: XIIIth International Conference”, W. Schlegel and T. Bortfeld, eds. Springer-Verlag, Heidelberg, 2000.
3. Kalet, I.J., Giansiracusa, R.S., Avitan, D. A New Design for a DICOM-3 Server. “Proceedings of the Thirteenth International Conference on Computers in Radiotherapy”, pp. 76–78, Wolfgang Schlegel and Thomas Bortfeld, eds., Springer-Verlag, Heidelberg, Germany, May 2000.
4. Kuterdem, H.G., Cho, P.S., Marks II, R.S., Phillips M.H., Parsaei H. Comparison of Leaf Sequencing Techniques: Dynamic vs. Multiple Static Segments. pp. 213–215, in “Proceedings of the Thirteenth International Conference on Computers in Radiotherapy”, W. Schlegel and T. Bortfeld, eds. Springer-Verlag, Heidelberg, 2000.
5. Lam, S.T., Marks II, R.J., Cho, P.S. Prostate Boundary Detection and Visualization in TRUS Images. pp. 99–101, in “Proceedings of the Thirteenth International Conference on Computers. in Radiotherapy”, W. Schlegel and T. Bortfeld, eds. Springer-Verlag, Heidelberg, 2000.

6. Parsaei H., Phillips M.H., Cho P.S., Kuterdem H.G., Kippenes H., Gavin P. Delivery and dosimetry verification in IMRT. pp. 283–285, in “Proceedings of the Thirteenth International Conference on Computers in Radiotherapy”, W. Schlegel and T. Bortfeld, eds. Springer-Verlag, Heidelberg, 2000.
7. Phillips M.H., Parsaei H., Cho P.S., Kuterdem H.G., Kippenes H., and Gavin P. Image Correlation and In Vivo Dosimetry in IMRT. pp. 377–379, in “Proceedings of the Thirteenth International Conference on Computers in Radiotherapy”, W. Schlegel and T. Bortfeld, eds. Springer-Verlag, Heidelberg, 2000.

### Abstracts

1. Antonuk, L.E. and Cho, P.S. Flat panel and cone-beam reconstruction of therapy beams. *Radiology* 217(P), 88 (2000).
2. Cho, P.S., Phillips, M.H., and Parsaei, H., Clinical implementation of IMRT for paraspinal tumors using inverse planning and sliding window technique. Elekta International Symposium: Intensity Modulated Radiation Therapy, Thomas Jefferson University, Philadelphia, PA, March 17-18 2000.

### Invited Talks

1. Cho, P.S. “Flat panel detectors and cone-beam reconstruction of therapy beams”, RSNA Refresher Course RC721, Chicago, IL, November 26–December 1, 2000.
2. Cho, P.S. “Quality assurance for IMRT”, Session Chair, XIIIth International Conference on Computers in Radiotherapy, Heidelberg, Germany, May 22–25, 2000.
3. Cho, P.S., Phillips, M.H., and Parsaei, H. “Clinical implementation of IMRT for paraspinal tumors using inverse planning and sliding window technique”, International Symposium: Intensity Modulated Radiation Therapy, Thomas Jefferson University, Philadelphia, PA, March 17–18, 2000.
4. Phillips M.H., Cho P.S., Parsaei H, Kippenes H, Gavin P., Verification of dynamic IMRT with *in vivo* and phantom dosimetry. 19th Annual Meeting, European Society for Therapeutic Radiology and Oncology, Istanbul, Turkey, Sept. 19-23 2000.

### Technical Reports

1. J Jacky and R Risler, “Clinical Neutron Therapy System Reference Manual”, 99-10-01, Department of Radiation Oncology, University of Washington, October, 1999, (revised November 2000. 233 pages.) Kalet, I., Young, G., Giansiracusa, R., Cho, P. and Jacky, J. Prism Dose Computation Methods, Version 1.3. Technical Report 2000-04-01, Radiation Oncology Department, University of Washington, Seattle, Washington, April, 2000.
2. Kalet, I. SLIK Programmer’s Guide, Version 2.0. Technical Report 2000-06-01, Radiation Oncology Department, University of Washington, Seattle, Washington, June, 2000.
3. Kalet, I., Phillips, M., Jacky, J., and Giansiracusa, R. Prism User’s Reference Manual, Version 1.3. Technical Report 2000-07-01, Radiation Oncology Department, University of Washington, Seattle, Washington, July, 2000.

## Academic Milestones

- Funding of Biomedical and Health Informatics under University Initiatives Fund: Ira Kalet led a team that established a Master's Degree program in Biomedical and Health Informatics, an interdisciplinary program housed in the Medical Education department, and involving Radiation Oncology and about 15 other departments in eight different schools and colleges. Approved by the Board of Regents in October 2000.
- Prostate Seed Grant: Paul Cho received an RO1 from the National Cancer Institute for a project designed to develop improved methods of automatically sorting seeds from images...
- Advanced Radiotherapy Techniques Grant: Mark Phillips and Paul Cho received a grant from Elekta Oncology Systems to work on IMRT and other advanced radiotherapy techniques.
- Adjunct Faculty: Jon Jacky became an adjunct faculty member at Evergreen State College and taught a computer science course.
- Any graduate students graduate?

## Notable Accomplishments

- Mark Phillips: Chairman, International Symposium: Intensity Modulated Radiation Therapy, Thomas Jefferson University, Philadelphia, PA, March 17–18, 2000.
- Mark Phillips: Co-chair, International Consortium on Intensity Modulation, sponsored by Elekta Oncology Systems.
- Alina Popescu: Eminent Scientist of the Year 2000, International Research Promotion Council (IRPC)