

PARTICLES

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GROUP

A **Newsletter** for those
interested in proton, light ion and
heavy charged particle radiotherapy.

Number 17

January 1996

Editor: Janet Sisterson Ph.D., HCL

Mailing Lists: PLEASE help to keep the Particles mailing list up-to-date by sending me **address**, **telephone** number, **fax** number and **e-mail** additions/corrections. If you live in the UK, I NEED your new phone numbers!

Costs: At PTCOG XIX, the Steering Committee decided that part of the registration fee for PTCOG meetings would be used to help produce both Particles and the abstracts of the PTCOG meetings. Only part of the costs are covered in this way, so more financial help is needed from the community. HCL is always happy to receive financial gifts; all such gifts are deductible as charitable contributions for federal income tax purposes. The appropriate method is to send a check made out to the "Harvard Cyclotron Laboratory". We thank Professor Akine of Tsukuba for his generous contribution which we have used to cover some of the costs of producing this issue of Particles.

Facility and Patient Statistics: I am still collecting information about all operating and proposed facilities, regarding patient statistics, machine scheduling, and treatment characteristics. Please send me up-to-date information.

Particles on the Internet: I am setting up a Particles Home Page on World Wide Web. I hope that it will be ready by the beginning of 1996. At that time, you will be able to download the whole newsletter, an article of interest, meeting information etc. Sometime in 1996, I plan to have all back issues of Particles and abstracts from selected PTCOG meetings on-line. Only the PTCOG meeting abstracts that I circulated with Particles will be available on WWW.

E-mail address Directory: I do have e-mail addresses for many PTCOG members, but not enough to set up a formal directory. So, PLEASE send me your e-mail addresses to add to those I have.

ARTICLES FOR PARTICLES 18

The **deadline for news for Particles 18 is May 31 1996**, for the July 1996 issue. I will send reminders by fax or e-mail.

Address all correspondence for the newsletter to:

Janet Sisterson Ph. D.
Harvard Cyclotron Laboratory
44 Oxford Street
Cambridge MA 02138

Telephone: (617) 495-2885
Fax: (617) 495-8054
E-mail: SISTERSON@HUHEPL.HARVARD.EDU

Articles for the newsletter can be short but should **NOT** exceed two pages in length. I **DO** need a good clean copy of your article and figures as I am using a scanner to get everything into the computer. If you FAX me an article, please send a good copy by mail. The best method, however, is to send the article as an ASCII file using e-mail which I can down-load to my MAC.

NOMINATING THE PTCOG STEERING COMMITTEE

Michael Goitein and Janet Sisterson
June and December 1995

PTCOG is holding an election for the Steering Committee which meets at each PTCOG meeting and has the responsibility of guiding PTCOG's plans and policies - which are always ratified at the subsequent PTCOG business meeting. The steering committee's meetings are open and interested members are encouraged to attend and participate in the committee's deliberations.

The names of all those nominated have been placed on a ballot and now we can elect a Steering Committee. Please see the enclosed flyer for details and the ballot that is to be returned to Janet Sisterson by one of the ways listed in this issue of Particles.

QUESTIONS ABOUT PTCOG?

If you have questions about **PTCOG**, please contact the secretary of PTCOG:

Dan Miller,
Department of Radiation Oncology,
Loma Linda University Medical Center,
11234 Anderson Street,
Loma Linda CA 92354.
Telephone (909) 824-4378. Fax (909) 824-4083
e-mail: dmiller@prolit.llu.edu

FUTURE PTCOG MEETINGS

The times and locations of the next PTCOG meetings are as follows:-

PTCOG XXIV	Detroit, Michigan, USA	April 24-26 1996
PTCOG XXV	PSI, Switzerland	September 9-10 1996
PTCOG XXVI	Boston Massachusetts USA	Spring 1997

At the PTCOG meeting in San Francisco in April 1995, two issues were raised at the Steering Committee meeting:-

- Should PTCOG meet once or twice a year.
- Should some effort be made to coordinate PTCOG meetings with other meetings, in particular EORTC (European Organization for Research and Treatment of Cancer) in Europe.

After lengthy discussion, it was decided that:-

- For the time being we would still have **TWO** meetings a year, roughly alternating between Europe and North America.
- Michael Goitein should discuss the possibility of combining EORTC and PTCOG meetings with the secretary of EORTC. This was done, and the meeting at PSI in September 1996 will be a combined PTCOG and EORTC meeting.

Abstracts for PTCOG XXIV

Authors are encouraged to submit an abstract of their talk, which will be published with the July 1996 issue of Particles.

Abstracts will be collected at the meeting or they can be sent directly to Janet Sisterson by one of the methods listed above in "articles for Particles". THE VERY BEST WAY is by **e-mail**. The **deadline** for accepting abstracts will be **May 30 1996**.

The space allocated for each abstract is ONE HALF page; PLEASE try and keep to this length. Each abstract must have a title and a list of authors with addresses; graphs and line drawings are welcome.

PTCOG XXIV & INTERNATIONAL PARTICLE THERAPY MEETING
“Current status and future directions in particle therapy”
April 24-26, 1996.
Atheneum Hotel, Detroit, Michigan, USA.

The meeting will include papers on proton therapy, heavy ion therapy, external beam neutron therapy and ²⁵²Cf neutron brachytherapy. The meeting is also held in conjunction with the European Heavy Particle Therapy Group and the European Clinical Heavy Particle Dosimetry Group (ECHED). A NATO sponsored Advanced Research Workshop (ARW) will be run in parallel with the International Particle Meeting. Further information on submission of abstracts, registration and hotel reservations will be mailed to all PTCOG members and others interested in attending by the end of January 1996.

The following information will assist you in planning your trip to Detroit:

Registration Information: The registration fee for the International Particle Meeting & PTCOG XXIV is US \$160; including lunch on Wednesday and Thursday, the conference Dinner on Wednesday and a reception at the Gershenson Radiation Oncology Center on Thursday. Daily registration is US \$50 (Wed. & Thurs. including lunch) and US \$25 (Fri. no lunch). There will be a reception and conference dinner at the Detroit Institute of Arts on Wednesday evening. The cost of this conference dinner for daily registrants and guests will be \$50 per person. There will be no charge for the Thursday evening reception. Facilities for payment of the registration fee by Visa or Mastercard will be available. A Hospitality Suite will be available at the Atheneum Hotel on the evening of Tuesday April 23rd from 6:00 - 10.00 p.m., where participants may register and meet colleagues prior to the meeting. Snacks and soft drinks will be provided and a cash bar will be available.

Conference Dinner: This will take place at the Detroit Institute of Arts (DIA). This will include a private viewing of the special exhibit “The Treasures of Venice”, before dinner. The Power’s Lecture in recognition of the contributions of William E. Powers, M.D. to the field of particle therapy will take place in the Lecture Theater at the DIA after dinner. Transportation will be provided between the Atheneum Hotel and the DIA.

Hotel Registration: Reduced rates are available at the Atheneum Hotel and reservations must be received by **March 23, 1996** to receive the special meeting rate of \$89+14% Tax. If you wish to make a reservation before receiving the full registration package you may phone the hotel [Tel:(800) 772-2323 or (313) 962-2323]. A block of rooms is reserved under the name of the International Particle Therapy Meeting.

NATO Advanced Research Workshop: The NATO workshop, “Californium - isotope for 21st century radiotherapy,” will take place in parallel with the International Particle Therapy Meeting and PTCOG XXIV. A separate information sheet and application form for attendance of this workshop will be included in the registration package

If you have any questions concerning PTCOG XXIV please contact Cay Bernock at (313) 745-2484, or Richard Maughan at (313) 745-2487 e-mail: maughanr@kci.wayne.edu.

PTCOG News: The following reports were received by December 1995.

A New ICRU Report on Proton Dosimetry

L. Verhey, P. DeLuca, A. Wambersie, and G. Whitmore

Since its establishment in 1928, the goal of the International Commission on Radiation Units and Measurements (ICRU) has been to provide those involved in the use of ionizing radiation with:

- a coherent and practical set of quantities and units;
- recommendations for methods of measuring these quantities;
- definitions of terms and concepts which are required for the exchange of relevant information.

In radiation therapy, the need for uniformity is especially important when new techniques or new types of beams are introduced. Therefore, in 1989, the ICRU published Report 45 on "Clinical Neutron Dosimetry, Part I" which is currently considered as a reference in the neutron therapy centers worldwide.

Due to the excellent clinical results reported from a number of proton facilities and the resulting rapid development of proton beam therapy, the ICRU appointed a Report Committee for proton dosimetry in 1991 with the task to reach an agreement, and then to make recommendations for determination of absorbed dose in a homogeneous phantom in reference conditions, which could be universally accepted. The composition of the Report Committee was as follows: L. Verhey (Chair), H. Blattmann, P. DeLuca, D. W. Miller (Members), P. Andreo, H. Bichsel, D.T.L. Jones and S. Vynckier (Consultants). H.H. Rossi and A. Wambersie served as Sponsors from the Main Commission.

At its recent meeting in Remscheid-Lennep (Germany) in September 1995, the ICRU approved the Report entitled:- "*Clinical Proton Dosimetry, Part I: Beam Production, Beam Delivery and Measurement of Absorbed Dose*".

The rationale for using protons to treat cancer can be traced to a paper published in 1946 by Robert Wilson (WILSON, 1946), who recognized that protons, with their well-defined range and limited scattering potential, could be an ideal radiation modality for improving physical dose localization to a target. The earliest treatments of human disease took place in 1954 at Berkeley, California at the 184" cyclotron built by Ernest Lawrence (TOBIAS et al., 1955). Proton treatments were also begun in Uppsala, Sweden in 1957 and at the Harvard Cyclotron Laboratory in Cambridge, Massachusetts in 1961. Three separate facilities in the Soviet Union have also treated significant numbers of patients with protons beginning in 1968. To date, the majority of proton treatments have been for patients with intracranial arterial-venous malformations (AVMs), benign pituitary disease, tumors of the eye, tumors near the base of skull or spinal cord and tumors of the prostate. For most of these disease sites, adequate dose localization with photon beams was judged to be difficult or sometimes, impossible.

Until recently, all proton treatment facilities were based on accelerators devoted to research and converted later for medical treatments. In the late 1980's, the first hospital-based facility for proton treatments was designed at the Loma Linda University Medical Center in California (SLATER et al., 1988). This facility uses a synchrotron to accelerate protons to energies as high as 250 MeV which are then guided into one of four treatment rooms. Three of these rooms have gantry-mounted isocentric beam delivery systems, allowing the delivery of protons to a fixed patient from arbitrary directions. This facility began treating patients with protons in 1990.

The process by which protons interact with matter is primarily through electromagnetic interactions with atomic electrons. Since protons are much more massive than electrons, in a single interaction they lose only a tiny fraction of their energy and are deflected by only small angles. Therefore, for a given incident energy, the range of a proton is well-determined to within an uncertainty which is small compared to the range (approximately 1.5% per cm depth in water). This produces an absorbed dose

distribution which decreases rapidly beyond the end of range. By modulating the energy of the incoming protons, the absorbed dose can be spread out to cover the proximal extent of the target from each beam direction. Thus, by careful tailoring of the range of the beam at each point in a small number of shaped beams, absorbed dose distributions in the patient can be obtained which conform to the 3-dimensional shape of an irregular target and which fall off rapidly outside the periphery of the target, while remaining uniform within the target.

In the beginnings of proton beam therapy, the lack of uniformity in dosimetric methods used in different centers resulted in differences of up to 10% in the dose delivered to the patient. These differences were due in great part, but not entirely, to different numerical values adopted for quantities such as w/e , stopping powers, etc. The need for uniform standards thus became evident, resulting in two separate protocols for the dosimetry of proton beams which were developed and published by the AAPM in North America (AAPM, 1986) and by the ECHED in Europe (VYNCKIER et al., 1991; VYNCKIER et al., 1994). These protocols were in basic agreement as to the use of ionization chambers, calibrated by national or international standards laboratories in ^{60}Co beams, to determine absorbed dose to a phantom irradiated with proton beams. They were also in agreement that universally available ionization chambers should be recommended as the dosimeter of choice for the sake of uniformity, rather than calorimeters or fluence measuring devices such as Faraday cups. There was not, however, agreement on the values of the quantities needed to convert a ^{60}Co calibration factor to a proton calibration factor. In particular, the recommended values of the electronic mass stopping powers and the value of w/e , the average energy required to form an ion pair in the gas of an ionization chamber, for protons as a function of energy, is different in the two protocols. Agreement on these values is critical for comparison of clinical results between proton centers and also for comparison between the results of patients treated with protons and x-rays.

A recent ICRU Report (ICRU, 1993) has re-evaluated electronic stopping powers for protons as a function of energy, including recently published experimental results. This Report is now generally accepted as the best compilation of stopping powers and is recommended for use in proton dosimetry.

New experiments which directly or indirectly (through comparison with calorimetry) measure w/e for proton energies commonly used in radiotherapy, have recently become available. Reviews of these experimental results led the present Report Committee to recommend a value of 34.8 J C^{-1} ($\pm 2\%$) for w/e , somewhat different than the value of 35.2 J C^{-1} ($\pm 4\%$) recommended previously in ICRU Report 31 (ICRU, 1979) which was based on measurements at very low proton energies.

In addition to recommendations on the values of the parameters used to convert from a ^{60}Co calibration factor to a proton calibration factor, the present Report makes recommendations (1) that standard, appropriately sized thimble ionization chambers with walls of A-150 tissue equivalent plastic or graphite be selected as the reference dosimeter, (2) that the residual energy of the proton beam at the measurement point in the phantom be used to select the appropriate electronic mass stopping power, (3) that absorbed dose be measured in water or water-like material and specified as absorbed dose to water and (4) that calorimetry be used, where available, to confirm the proton calibration factor of the reference chamber.

It is anticipated that adoption of the recommendations of the present Report on proton dosimetry will ensure an agreement on proton absorbed dose to within $\pm 2\%$ between proton centers, and an accuracy which is similar to that achievable with x-rays. Recent dosimetric intercomparisons performed at Loma Linda University (Spring, 1995 involving 13 centers) and at NAC-Capetown (Autumn, 1995 involving 5 centers) have shown that an agreement of about $\pm 1\%$ on the dose delivered in reference conditions could be achieved if a common dosimetry protocol such as the present ICRU protocol would be applied worldwide.

A new Report Committee was appointed by the ICRU Main Commission at the Remscheid-Lennep meeting which will soon begin the drafting of Part II of Clinical Proton Dosimetry. This Report will deal with the influence of patient shape and tissue heterogeneity on dose distribution and the description of

treatment planning considerations. Recommendations on dose specification for reporting proton beam therapy and specification of radiation quality in relation to microdosimetry and RBE of proton beams will also be prepared.

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Heavy Ion Therapy at GSI, Darmstadt, Germany: A progress report:

Since July 6 1995, carbon beams are delivered regularly in the new medical cave for test of the new raster scan system and of the fast position sensitive transmission counters. These counters measure the beam intensity and the position independently in time intervals of 100 microseconds and compare it to the requested values. In the tests, first and simple scan patterns have been recorded. In dosimetry measurements, energy loss values in phantoms are compared to calculated values based on CT numbers. In addition, calibration measurements of different dosimeters are performed. In radiobiological experiments, the reaction of the pig skin is compared between x and carbon irradiation. In these experiments three fields at six minipigs are exposed to different x-ray doses and compared to three carbon fields. The RBE for the fractionated exposure (5 fractions in five days) was calculated according to a biophysical model, and carbon doses were chosen which are expected to result in the same early response compared to the equivalent x ray doses.

In addition each pig was irradiated in the same fractionation schedule in the lung with a 4 x 4 cm field in order to measure the accuracy of the repositioning and the dose calculations. Using a CT scanner the irradiated field can be detected two month after exposure. For the first minipig pilot experiment in April excellent agreement has been found between treatment planning and verification.

In accelerator experiments the energy variation - 256 steps between 80 and 430 MeV/u has been tested. The variation of beam intensity and focusing - 15 intensities and 7 beam diameters - will follow later. These tests include an automatic beam tuning to the medical cave within one pulse (2 sec). Difficulties are found for the lower energies while the higher energies are not problematic. Finally, the construction of the medical annex will be completed in the second week of December. *G. Kraft, GSI mbH, Planckstrasse 1, D-64291 Darmstadt, Germany.*

News from St. Petersburg, Russia:

Perspectives of the radiophotoluminescent (RPL) method application to clinical medicine.

In this report we present the technique to measure of the depth dose fields, based on RPL method. The principle of RPL process lies in the fact that, there are some materials (silver-activated metaphosphat glasses for instance), in which stable luminescent centers or dose centers (DC) are produced under irradiation. The output information is realised by UV light activation of DCs and by registration of photon of luminescence. So that to allow the multiple dose readout. The dose information can be rubbed off only after annealing RPL glasses at the temperature 350 - 380 centigrade. Another feature of the RPL-method is connected with the very low fading (less than 1% per year).

The existence of background centers (BC) in RPL glasses is the lower limit of application of RPL method. The nature of BC is not very clear, but it is known that the number of BC is independent on the dose but only on the purity of the glass. Due to the development of UV lasers techniques and working out of lownoise photomultipliers, working in one electron regime and due to the progress in RPL glasses production the counting method can be used in RPL technique rather effectively and lower limit of measured doses can be decreased. In 1988-1990 independently and practically simultaneously the two devices were created. They are FGD-10 (Japan, TOSHIBA) and KID RPL-2 (Russia, PNPI) to guarantee the lower level of measurements from 0.003 sGr. The KID RPL-2 was checked on glasses, destined to individual dosimetry of gamma-irradiation, developed in GOI, St. Petersburg, Russia.

The principles of KID RPL-2 device are presented below. The nitric laser is used as the source of the UV light. The seven percent of intensity of laser's pulse due to plane-parallel quartz plate, placed under 45 degrees to laser beam, are deflected to the monitor PM, working in linear regime. The amplitude of the signal from the monitor PM is proportional to the intensity of the laser pulse and simultaneously the monitor signal is used as the start for the measurement of DC and BC. The photons of luminescence are detected by the counting PM, working in the one electron regime, in counting (CG) and background (BG) gates. Since the form of background spectrum is constant from one glass to another, then there is a possibility to recount the background from BG to CG and to select the real dose. To avoid reloading and to provide a possibility of dose measurements in wide range without rebuilding the device, measurements are carried out not in one but in several counting gates.

To measure of the depth dose fields, used for irradiation of pathologic centers of head during the biaxial rotation on the medical proton beam of PNPI's 1 GeV synchrocyclotron, the special device was constructed. It includes two-dimensional moving system (error of coordinate determination is 0.2 mm), two PM, UV laser with wavelength 337 nm and frequency 100 1/s. The RPL glass with geometrical sizes 80 x 50 x 1 mm was prepared. Laser's beam was collimated to the size $x = 1$ mm, $y = 1$ mm. To check the system, the RPL glass was irradiated by the doses 100 Gr, 10 Gr, 2 Gr at the medical beam of PNPI's synchrocyclotron (diameter of the beam 6 mm). The measurements showed the right ratio between brought doses (error 10%) and gave the diameter of the beam 6 mm.

To test the homogeneity of glass properties, RPL plate was irradiated by dose 100R. The homogeneity of measured dose keeps with 6% error.

The irradiation of glass in standard phantom of head at the PNPI's system of proton stereotactic therapy was the final test. Measured widths at half of distribution height was $x=6$ mm and $y=11$ mm (the time of one point measurement is about 30s). The form of the dose distribution obtained by RPL method coincide to the measurements done by the thermoluminescent technique.

Results of our measurements appear encouraging and we'll continue our experiments in this field.
D.L. Karlin, V.P. Koptev, I.V. Panteleev, S.M. Mikirtichyants, G.V. Scherbakov, Central Scientific Research, Institute of Roentgenology and Radiology, Gatchina, PNPI, St. Petersburg 188350, Russia.

News from the **Harvard Cyclotron Laboratory, USA:**

Our present major project is installing an “upstream everything” beam spreading system in the large-field radiotherapy room. If the fixed absorber and modulator in a passive system are moved upstream so that they become the effective proton source, the lateral penumbra of the dose distribution is significantly improved, particularly if the point of interest in the patient is shallow. We already do this by switching to a single scattering system but this is only an option for fairly small fields.

The new system selects one of a set of lead/lexan sandwich modulators and uses it along with lead and/or beryllium degraders selected from binary sets. The whole thing acts as a first scatterer. The second scatterer will be the usual compensated contoured variety. In the relatively few cases (shallow fields) where this does not work due to overscattering the same hardware can fall back to our present “downstream” configuration or, for small fields, to single scattering. In sum, we will be able to treat even large fields with the smallest possible penumbra.

We are taking advantage of the project to upgrade our beam diagnostics. Beam range will be monitored by a multilayer Faraday cup mounted on the beam shutter. A segmented ion chamber (IC), further downstream, will perform a nondestructive flatness measurement which will, using a PC-based system, activate steering magnets to center the beam, which we currently do by hand. This has been tested with a prototype chamber and centers the beam (which is pretty good to start with) in the first two seconds of treatment.

We also plan to use a central pad of the same IC as our beam monitor. This will simplify the calibration function compared to our present system which uses a large chamber that intercepts a large and hard to predict fraction of the scattered beam. This procedure, too, has been checked with the prototype IC. The entire system uses many of the same techniques proposed for NPTC so that the experience gained, and much of the actual hardware, will carry over to that project. *B. Gottschalk, Harvard Cyclotron Laboratory, 44 Oxford Street, Cambridge MA 02138.*

Status report: the **Northeast Proton Therapy Center, at Massachusetts General Hospital, Boston, MA USA:**

A groundbreaking ceremony for the Northeast Proton Therapy Center (NPTC) was held at Massachusetts General Hospital (MGH) on September 14, 1995. The event began with a luncheon at noon for invited guests, followed by a Scientific Symposium which featured Professor Allan Cormack, a Nobel Laureate in Physics from Tufts University, Dr. Zvi Fuks from Memorial Sloan-Kettering Hospital, New York City, and Dr. James Slater from Loma Linda University Medical Center. The groundbreaking reception was held under the Bulfinch tents on the campus of MGH and included addresses by Samuel Thier, M.D., the President of MGH; Yves Jongen, President of IBA; Walter Bell, Senior Vice President of Bechtel; Francis Mahoney, Ph.D. of the NCI Radiation Research Program; Herman Suit, M.D., Chief of Radiation Oncology at the MGH; and several other distinguished speakers and guests. In the evening a dinner was held in honor of Dr. Suit. The presence of many proton patients and friends of the ongoing clinical program at the Harvard Cyclotron Laboratory made the day a very memorable occasion.

The Building: The NPTC will have 44,000 gross square feet of space and will be located on the MGH campus (see Figure 1. for artists concept of the facade of the building as seen from a point near the MGH main entrance). The facility will have two main floors: the lower level will house all of the patient activities and the ground floor will contain administrative offices,

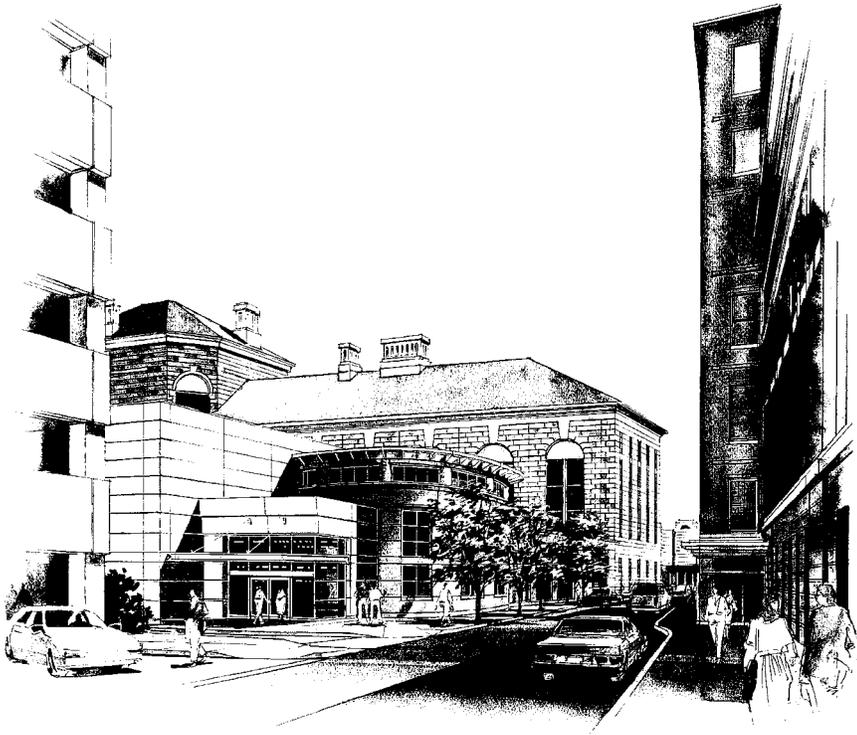


Figure 1.

treatment planning, and other administrative and physics support areas. The lower level (shown in Figure 2.) will contain the cyclotron, three treatment rooms, two with gantry capabilities and one fixed beam room having an eye treatment station, a stereotactic radiosurgery station, and an experimental/treatment station for large field irradiations. Also on this level will be exam rooms, immobilization fabrication and storage areas, mechanical, electrical and vacuum shops, and space for a CT scanner and a simulator, both of which will be installed in the future.

The construction of the building began in September, 1995 and is progressing on schedule and budget. To date, 48% of the entire construction bid packages have been awarded and the total amount of the trade contract awards remain under the Guaranteed Maximum Price contract amount. The Bechtel Corporation is the lead firm and provides the project management, radiation shielding, and construction management services. Bechtel is teamed with Tsoi/Kobus and Associates, Architect; McNamara/Salvia, Inc., Structural Engineer; McPhail Associates, Geotechnical Engineering; and John Moriarty and Associates, Construction Contractor and Preconstruction Services. The construction effort is expected to last through December of 1996.

The Equipment: IBA, teamed with General Atomics, is furnishing the equipment which includes the cyclotron, energy selection system, beam transport systems, gantries and nozzles, patient positioning system, and the control and safety systems. We are currently about one and a half years into the approximately four year equipment procurement. The cyclotron magnet has been fabricated and is currently being field-mapped. Early indications are that the measured magnetic field agrees very well with the three-dimensional TOSCA simulations that were done during the design stage. The cyclotron RF cavities have been delivered to IBA. It is expected that preliminary tests with full energy beam will begin in the spring of 1996. All other systems are in an advanced stage of design. The construction readiness review for the cyclotron is scheduled for January 1996. Procurement of some of the beamline elements has already begun. Work is ongoing in the final design of the patient positioning system and the beam

delivery system. The equipment is on schedule to be delivered during 1997 and early 1998 after the building is ready for occupation.

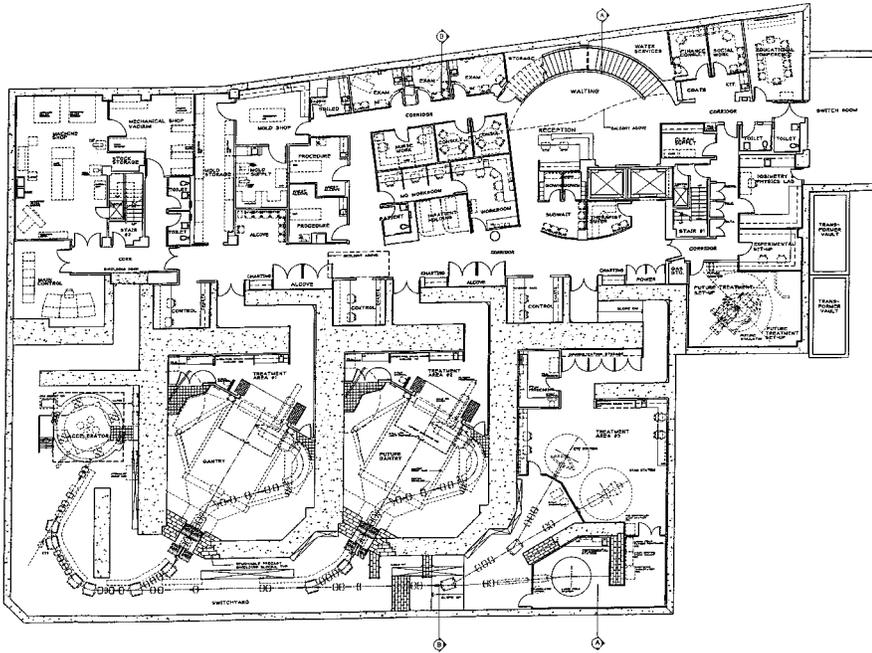


Figure 2.

Project Completion: The project schedule targets the initiation of patient treatments in the last quarter of 1998. The transition of the proton treatment program from the Harvard Cyclotron to the Northeast Proton Therapy Center will require several months and it is our plan to have the transition completed by the end of 1998. *Michael Goitein, Alfred Smith, Jacob Flanz, Stanley Durlacher, Susan Woods, Chris Tarpey The Northeast Proton Therapy Center, Massachusetts General Hospital, Boston, MA 02114, USA.*

News from the TRIUMF PROTON THERAPY FACILITY, Vancouver, Canada:

After two years of development, we have finally commissioned the TRIUMF Proton Facility for the irradiation of ocular melanoma. The first patient was treated on 21 August and the tally for 1995 year end is five. The therapy is a cooperative program amongst the British Columbia Cancer Centre, the Eye Care Centre and TRIUMF. The Facility is based on the TRIUMF Beamline 2C with an extraction energy of 70 MeV at a nominal current of 5 nA, which corresponds to an average treatment time of 90 sec. The treatment planning is based on the standard EYEPLAN as obtained from the Clatterbridge Cancer Centre. A range modulator program was developed in-house to provide SOBP dose uniformity to about 1%. The therapy RBE value of 1.2 was taken from in vitro and in vivo radiobiological measurements performed on the same dosimetry configuration as used in therapy. A dose prescription of 50 proton grays (which corresponds to 60 cobalt grays equivalent) in four daily fractions is used.

Our radiobiological measurements indicate a slight increase of RBE with depth in the order of about 2 - 3% per cm for the SOBP's of a 70 MeV beam. Hence, it may be necessary to modify the range modulator designs to provide a more uniform effective dose profile. For the treatment of superiorly located tumors without eyelid retraction, MRI scans were made to provide a better estimate of the eyelid

and periorbital tissue structures. Lastly, the beamline can deliver a beam of 120 MeV with a range of over 10 cm, we are examining the feasibility of treating some relatively shallow-seated AVMs with a minor upgrading of the eye facility. *Roy Ma, Gabe Lam, BC Cancer Agency, 600 W 10th Avenue, Vancouver BC V5Z 4E6, and Proton Therapy Group at TRIUMF, University of British Columbia, Vancouver, BC V6T 2A3, Canada.*

News from the Centre de Protonthérapie d'Orsay (CPO), France:

The CPO has treated 673 patients in four years since the beginning of clinical applications in 1991. Most of them are patients with uveal melanomas (636), some angiomas (20) and intracranial targets (17), including some pediatric cases, and we are preparing the first cases of chordomas of the base of the skull. All of them are treated in the first treatment room. A change in energy (73 to 200 MeV), intensity (300 nA to 10 nA) and beam modifiers (collimators, scattering foils, ...) is performed once a day, to move from ophthalmic to intracranial conditions. The preliminary statistics on clinical results of first 341 ophthalmic patients with follow-up from one to four years are under evaluation, showing an actuarial survival rate at one year of 99%, and 91% at two years. Local recurrences were observed in 9 cases (5%). Complete results will be published elsewhere.

The intracranial program is based on: the use of fiducial ball bearings implanted in the skull, a treatment planning system developed in collaboration with the Institut Curie, patient contention with masks, and the same treatment chair used for the eye treatments. The number of patients is increasing slowly but steadily. A clinical program for stereotactic irradiations is under discussion for 1996.

Two PhD works have been finished: on the implementation of our beam lines (C. Nauraye) and on microdosimetric measurements at Orsay and Clatterbridge in cooperation with a Birmingham team (V. Cosgrove). Two other PhD thesis will be presented soon on the treatment planning system (R. Belshi) and on the specific problem of inhomogeneities (R. Oozeer). The annual technical report of 1994 has been devoted to an internal communication of the activities of each sector, as the beginning of a new Quality Assurance program. Dosimetric intercomparisons have been done at Orsay with people from Uppsala (J. Medin), and we participated in the comparisons at Loma Linda (S. Delacroix) and Faure (R. Ferrand). A physicist from Berlin, H. Fuchs, spent some months with us as part of the preparation for the new medical room to be installed at their facility. Participants of the Dynarad european project for conformal radiotherapy visited the center during the meeting organized in Paris in 1995.

For the second treatment room at CPO, preliminary specifications and drawings have been done (Fig. 1) and shielding measurements have been performed with the participation of K. Gall, from Boston. The results will be submitted for publication soon.

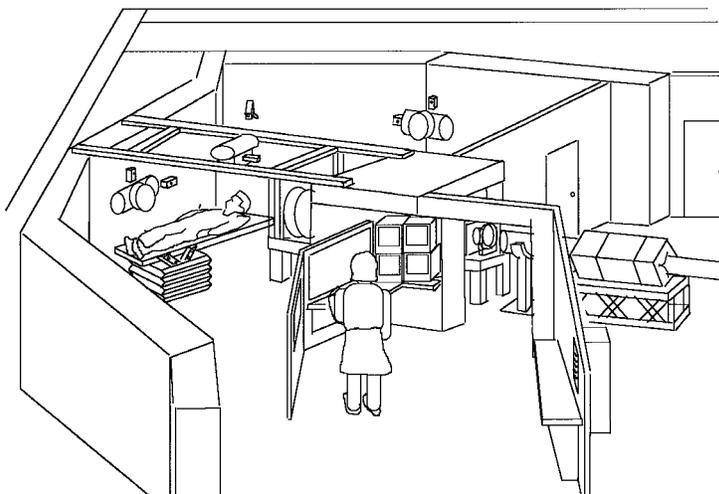


Figure 1. Second treatment room

The approach for the patient positioner could be based on industrial robotics as is shown in Fig. 2.

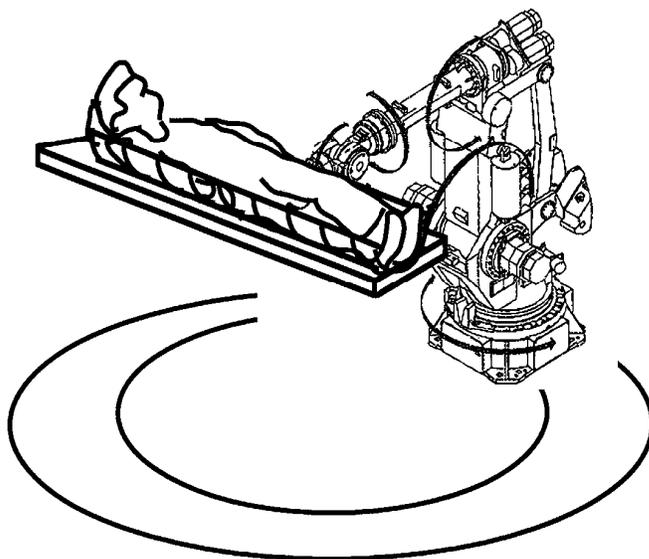


Figure 2. Possible design for a patient positioner

A formal request for proposals will be done in January 1996. At a first step, passive scattering will be used to get fields of 25 cm diameter. If the financial support is obtained, we plan to develop this room in approximately one year (expected date: mid 1997). A third treatment room is under study, including an isocentric gantry, for the mid term.

The staff of the CPO includes today 26 positions (4 administrative, 2 MD, 3 medical physicists, 2 engineers, 12 technicians and 3 technologist). The physicians and physicists of the partners participate in the preparation and the treatment of their patients. Operating costs are about 3 M\$/year including salaries, electricity and machine upgrade. The number of patients increased from 150 pat/year to nearly 180 pat/year, and should evolve towards 300 pat/year in the next 5 years. Comparative planning is performed against alternative techniques (I125 plaques, conformational techniques including stereotactic irradiations with photons,...) for different localisations.

PLEASE NOTE OUR NEW POSTAL ADDRESS, PHONE AND FAX NUMBERS: Tel. (33) (1) 69.29.87.29 / Fax (33) (1) 69.07.55.00. We did not move the synchrocyclotron !, so the visiting address is still: Building 101. Campus Universitaire. Orsay. France. *Ale Mazal, J.L. Habrand, L. Desjardins, P. Schlienger, J.C. Rosenwald. Centre de Protonthérapie d'Orsay./ BP 65 / 91402 Orsay Cèdex. France.*

New facility plans in Japan:

The National Cancer Center has obtained funds for its plan to build a dedicated proton therapy facility at its Kashiwa campus (about 30 km apart from its Tokyo campus which is located at the central Tokyo). Amount of money allocated to the project by Ministry of Health and Welfare is about 8.3 billion yen (83 million dollars). They will start building the facility next year. Details of the plan are being formulated.

The Agency of Science and Technology of the Japanese Government has decided to help a couple of regional governments build dedicated proton therapy facilities. They are negotiating with the Ministry of Finance to get their plan funded. We should wait to see if the plan is approved.

The regional government of Hyogo (where the earthquake took place) is pursuing its plan to build a medically dedicated heavy particle therapy facility. Their initial plan includes both proton therapy and heavy ion therapy, however, it is still possible that proton therapy only will be chosen.

University of Tsukuba again failed to get funded for its plan to build a dedicated proton therapy facility at the university campus. We are continuing to work at the facility in National Laboratory for High-Energy Physics. *Yasuyuki Akine, M.D., Institute of Clinical Medicine, University of Tsukuba, 1-1-1 Tennoudai, Tsukuba, Ibaraki 305, Japan.*

BOOK REVIEW

“Ion Beams in Tumor Therapy”, U. Linz (ed.), Chapman & Hall, London, 1995. 387 p., 150 figures (some in color), 61 tables. ISBN-No. 3-8261-0063-8, ca. \$100.

This volume covers clinical and biological, physical and technical aspects of proton and light ion beam therapy. It is an up-to-date and comprehensive review of the field. Over 40 experts from the US, Japan, South Africa and 7 European countries representing all the relevant ion beam therapy facilities in the world have contributed to it.

The seven major sections of the book are:

- I. Ion Beam Therapy in Perspective. - 4 chapters.
- II. Models and Preclinical Studies. - 6 chapters.
- III. Clinical Results and Indications. - 8 chapters.
- IV. Medical Accelerators and Beam Line Design. - 4 chapters.
- V. Beam Preparation and Control. - 5 chapters.
- VI. Patient Positioning and Treatment Planning. - 5 chapters.
- VII. Individual Facilities. - 7 chapters.

**Proposed NEW FACILITIES for PROTON & ION BEAM THERAPY
December 1995**

INSTITUTION	PLACE	TYP E	1ST RX?	COMMENTS
P.S.I	Switzerland	p	1996	200 MeV, var. energy, gantry, dedicated line
Berlin	Germany	p	1996	72 MeV cyclotron; eye treatment beam line.
G.S.I Darmstadt	Germany	ion	1996	First Carbon beam in the medical cave 7/6/95
KVI Groningen	The Netherlands	p	1997?	plan:- 200 MeV accel.; 2 rms; 1 gantry; 1 fix.
NPTC (Harvard)	MA U.S.A.	p	1998	at MGH; 235 MeV cyclotron; gantry; 4 horiz beam
NC Star	NC U.S.A.	p	1999?	synchrotron; 70-300 MeV; 2 horiz; 1 gantry
Regensburg	Germany	p	1999?	gantry; 1 fixed beam; 1 eye beam.
Hyogo	Japan	ion	2000	protons & ion; 2 gantries; 1 horiz; 1 vert; 1 45 deg.
TERA	Italy	ion	2000?	H- accel; 60-250 MeV p; +BNCT; isotope prod.
AUSTRON	Austria	ion	?	protons and light ions.
Beijing	China	p	?	250 MeV synchrotron.
Brookhaven	NY U.S.A	p	?	linear accelerator.
Clatterbridge	England	p	?	upgrade using booster linear accelerator.
IATEP Moscow	Russia	p	?	3 horiz.-1 fix beam, 2 gantry, 1 exp., H- accel.
Jülich (KFA)	Germany	p	?	exp. beam line; plans for therapy.
Kashiwa	Japan	p	?	no details yet; will start construction in 1996.
Krakow	Poland	p	?	60 MeV proton beam.
Kyoto	Japan	p	?	250 MeV synchrotron; gantry; 1 fixed horiz beam.
Proton Development N.A. Inc.	IL USA	p	?	300 MeV protons; therapy & lithography

WORLD WIDE CHARGED PARTICLE PATIENT TOTALS

January 1996

WHO	WHERE	WHAT	DATE FIRST RX	DATE LAST RX	RECENT PATIENT TOTAL	DATE OF TOTAL
Berkeley 184	CA. U.S.A.	p	1954	— 1957	30	
Berkeley	CA. U.S.A.	He	1957	— 1992	2054	June-91
Uppsala	Sweden	p	1957	— 1976	73	
Harvard	MA. U.S.A.	p	1961		6626	Jan-96
Dubna	Russia	p	1967	— 1974	84	
Moscow	Russia	p	1969		2877	May-95
Los Alamos	NM. U.S.A.	π^-	1974	— 1982	230	
St. Petersburg	Russia	p	1975		969	Dec-95
Berkeley	CA. U.S.A.	heavy ion	1975	— 1992	433	June-91
Chiba	Japan	p	1979		86	June-93
TRIUMF	Canada	π^-	1979	— 1994	367	Dec-93
PSI (SIN)	Switzerland	π^-	1980	— 1993	503	
PMRC, Tsukuba	Japan	p	1983		462	July-95
PSI (SIN)	Switzerland	p	1984		1785	Dec-94
Dubna	Russia	p	1987		39	July-95
Uppsala	Sweden	p	1989		65	Spring-95
Clatterbridge	England	p	1989		656	Dec-95
Loma Linda	CA. U.S.A	p	1990		1262	April -95
Louvain-la-Neuve	Belgium	p	1991		21	Nov-93
Nice	France	p	1991		636	Nov-95
Orsay	France	p	1991		673	Nov-95
N.A.C.	South Africa	p	1993		106	Dec-95
IUCF	IN USA	p	1993		1	Dec-94
UCSF - CNN	CA U.S.A	p	1994		50	Oct-95
HIMAC, Chiba	Japan	heavy ion	1994		55	Aug-95
TRIUMF	Canada	p	1995		5	Dec-95
					1100	pions
					2542	ions
					16506	protons
				TOTAL	20148	all particles

**See Page 15
For
The Proposed New Facilities Table**