PARTICLES

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PROTON THERAPY CO-OPERATIVE GROUP

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

Number 2 June 1988 Editor: Dr. Janet Sisterson HCL

This is the second issue of a newsletter devoted to matters of interest to all those involved, or planning to become involved in proton, light ion or heavy charged particle radiation therapy. For this issue, 14 institutions were contacted for recent news; replies were received from 8; I was very glad to receive news from another institution that I had not contacted. This means that I have even more news in this newsletter than in the first issue; the newsletter is accomplishing its mission! Newsletters can be successful, only if we all contribute to them, so keep the good work by sending me anything of interest.

Information sent to me for inclusion in the newsletter does not need to be extensive but it should be "camera ready" if possible. Again this issue, I have retyped all contributions so that I could use our new laser printer for our Macintosh! Now that we have it , I am using the following format; flush left; left and right margins of one half inch; single spacing using the 12 point New Century Schoolbook, if you have it, and the Times font, or whatever, if you don't. Graphs and line drawings are welcome.

The deadline for the next newsletter is November 311988, hopefully the third issue will come out in January 1989. Address all correspondence to Dr. Janet Sisterson, Harvard Cyclotron Laboratory, 44 Oxford Street, Cambridge MA 02138. Telephone (617)495-2885 or send mail to me via the VAX computer at BITNET%"SISTERSON@HARVHEP"

NEXT PTCOG MEETING -SEPTEMBER 29 & 301988

The next PTCOG meeting is being sponsored by the MGH/HCL group and will be held in Cambridge, Massachusetts on Thursday and Friday September 29 and 30 1988. Details of the agenda, location, and hotel arrangements provided by your secretary, Michael Goitein, are in the separate announcement included with this mailing if you are a PTCOG member. If you are not a member and would like more information, his address is Department of Radiation Therapy, Massachusetts General Hospital, Boston MA 02114.

PTCOG VIII April 1988

PTCOG VIII was held in Vancouver B.C. last April and it was a very successful meeting. Many topics came under discussion and it was very interesting to hear of TRIUMF's plan to add a proton beamline and then to be able to visit the facility to see the actual location and problems. On Saturday, the clinical day designed primarily to inform Canadian physicians of the opportunities available with proton radiation therapy was very exciting and informative.

Throughout the meeting the local arrangements were excellent, the food superb and Vancouver lived up to it's reputation of being a beautiful city (albeit where umbrellas are a necessity on Spring!)

PTCOG News

The following information was received by the beginning of June.

The 65 MeV proton cyclotron **MEDICYC** at **Nice, France** is intended for proton and neutron therapy. A building is in construction and the machine installation will start in autumn 1988. The therapy is scheduled to start at the beginning of 1990. The machine will have an external source and the axial injection has already been tested. P. *Mandrillon, Centre A. Lacassagne, 06054 Nice-cedex, France.*

The design of the **EUropean Light Ion Medical Accelerator, EULIMA, is** based of a 5 m diameter sector focused cyclotron with a single superconducting coil. It will accelerate fully stripped ions, up to Neon, to 400 MeV/nucleon. Design studies are advanced and a feasibility report will be published in 1989.

A EULIMA workshop to review the medical and biological arguments for light ion therapy will be held at Nice from 3-5 November 1988. Those interested in contributing should contact Pr. A Wambersie, UCL Saint-Luc, 10 Ave Hippocrate, 1200 Brussels, Belgium or Dr. P. Chauvel, Centre Antoine Lacassagne, 06054 Nice-cedex, France. *P. Mandrillon, Centre A. Lacassagne, 06054 Nice-cedex, France.*

At the **Harvard Cyclotron Laboratory,** we expect soon to add a second neurosurgical program to the three clinical programs already utilizing the proton beams at HCL. The new program, initiated by Dr. Paul H. Chapman of MGH will differ from the existing neurosurgical program in the methods used for target localization, treatment planning, patient immobilization and positioning. New equipment is being designed by the firm Product Genesis Inc., Cambridge, Mass., under contract with Dr. Chapman and in consultation with HCL staff. Installation and commissioning are expected later this year.

Dr. Suit has requested HCL to plan for a substantial increase in the number of patients treated in the large field program. We are increasing and reorganizing staff in order to provide a schedule of 14 hours of operation per day which should yield up to 12 hours available for treatments. Hospital staff will also have to be increased to provide coverage for the treatments and to handle the additional treatment planning. We estimate that we can accommodate a 45% increase in the number of fractions delivered per year in the large field fractionated therapy program.

Dr. Charles Perret from SIN, Switzerland will be visiting HCL until the end of 1988.

Dr. Mary Austin-Seymour left the MGH group at the end of March. We wish her every success in her new appointment as Assistant Professor in the Department of Radiation Oncology at the University of Washington, Seattle. *A.M. Koehler, Harvard Cyclotron Laboratory, 44 Oxford Street, Cambridge MA 02138.*

SIN has got a new name. As of January 1st 1988, the Swiss Institute for Nuclear Research (SIN), Villigen and the Federal Institute for Reactor Research (EIR) have become a new Institute, the Paul Scherrer-Institute (PSI). Both SIN and EIR, were annex-institutes of theFederal Institute for Technology (ETH), Zurich. By merging the two institutes, which are situated on either side of the river Aare, the federal government expects synergistic effects as well as rationalization. As can be expected from its name, EIR is primarily involved in nuclear energy research and related areas. Several years ago, it expanded into non-nuclear energy research. The activities at SIN on the other side are connected with the high intensity 590 MeV proton accelerator; basic physics research is done in international cooperations. The new merged institute includes a life science division divided into three departments, the department of radiation medicine with pion and proton therapy, the laboratory of radiopharmacy and the department of radiation hygiene.

The name of Paul Scherrer-Institute has been given to the facility in honour of a Swiss physicist. Internationally, Paul Scherrer (1890-1969) has been known for the discovery, together with Peter Debye, of the X-ray diffraction patterns of powders, which was the basis of a widespread technique in crystallography. For Switzerland, Paul Scherrer was even more famous for his excellent physics lectures a the Federal Institute of Technology and for his efforts in getting government and private support for physics research, for which both national (EIR) and international (CERN, Geneva) facilities profited. *Hans Blattman, Department of Radiation Medicine, Paul Scherrer-Institute, CH-5234 Villigen, Switzerland.*

"**Ron Martin** retired from Argonne again last September to accept the third SBIR grant from NCI to his company ACCTEK Associates. This grant is for a Phase II R&D program to produce prototype magnets and vacuum systems for the proton medical accelerator, to develop appropriate H- sources, and carry out a series of beam experiments related to his concept of the synchrotron. To refresh your memory, he proposes acceleration of H^- ions with charge exchange in thin foils as a precisely controlled slow extraction mechanism. Martin says the SBIR route is a slow path, nevertheless steady progress is being made, and he anticipates a successful program and an economical machine.

The Phase I study grant on the beam delivery system was completed some time ago and a proposal submitted for the follow-on Phase II R&D program. If this grant is awarded it would begin about the first of the year and run for 2 years.

Even in retirement Ron works for Argonne a little less than half time and can be reached there. His time at Argonne might have to be reduced further, however, if additional grants are awarded." *Ron Martin, ACCTEK Associates, 901 S. Kensington, La Grange IL 60525.*

News of the **Loma Linda** project: assembly of the accelerator at Fermilab has begun. The vacuum chambers have been installed in the dipole magnets and the magnetic measurements satisfactorily concluded. The trim and extraction magnets are almost completed. The RFQ injector is close to acceptance. The power amplifier for the RFQ is holding up the work. We are now planning for beam studies and first acceleration later this summer.

The Loma Linda project has received a grant of $8.5 million from the U.S. Department of Energy.

A contractor for the building construction has been chosen by NBBJ, the project architect. Work is in progress by SAIC and Fermilab on plans and schedules for installation at Loma Linda in the summer and fall of 1989.

A collaboration between the LBL group led by William Chu and the Loma Linda design team led by George Coutrakon has been formed and is at work on the nozzle design. SAIC is involved in this work for coordination and engineering support. An intensive review was held April 28 1988.

A contract has been signed for the power supplies for the entire facility. Fermilab and SAIC people collaborated on the bid preparation and evaluation effort. P. *V. Livdahl, Fermilab, P. 0. Box 500, Batavia, Illinois 60510.*

News from TRIUMF: π^--meson therapy. A prospective, controlled, randomized trial comparing π^--mesons and photons in astrocytoma, high grade III and grade IV has been designed. It is intended that it become operative in the next treatment run beginning 24 June 1988. In the study, the radiation treatment volume will be confined to the primary tumour with a 2 cm margin of brain tissue around the enhancing ring. The study will compare normal tissue tolerance doses for π^--mesons, estimated at 34.5 Gy in 15 fractions, with a best standard photon therapy, estimated at 60 Gy in 30 fractions.

Patients will be stratified by age, Karnofsky score and extent of previous surgery. Principal end point in the study is a doubling of median survival. It is estimated that patient accrual should be complete in two years.

Protons: Proton therapy beam test will be done at TRIUMF in late May 1988. At 70 MeV, efforts will be made to obtain a good beam spot of approximately 1 cm, then to measure the sharpness of spots of varying diameter vs. the uniformity downstream.

At 200 MeV, the beam will be tested for uniform beam intensity over 8 cm x 8 cm. Beam edge effects and dose distribution will be measured. At both 70 MeV and 200 MeV energies, measurements will be made of neutron and gamma doses at the patient position. *George Goodman, Cancer Control Agency of British Columbia, 600 West 10th avenue, Vancouver, B. C. Canada V5Z 4E6.*

The proposed proton radiotherapy beam line at **TRIUMF.** The TRIUMF cyclotron is designed to deliver simultaneously four beams of protons of different energies and at different intensities. However, only two of these beams have been developed for routine use by experimenters. As early as 1980, after the the pion therapy program had moved into the clinical phase, there were discussions about the possibility of the development of a proton therapy channel using one of these unused beam extraction points. Partly encouraged by the successful development of a proton channel at SIN, there was recently renewed interest at TRIUMF for a similar clinical proton facility. A planning committee and a steering committee made up of a local group of clinicians and physicists from Vancouver have been set up to look into various aspects of such a venture.

There are now two main options for such a development.
A) An existing neutron channel, using 70-110 MeV protons on a beryllium target for radiobiology, can be quickly converted to a low energy proton channel by the removal of the neutron production target.
B) A primary proton beam line, currently used for low intensity (lnA--1µA) physics experiments, can be modified to produce a variable energy (180 MeV and higher) suitable for therapy use. It so happens that both of these beam lines deliver beams to the same irradiation cave and this may greatly facilitate the set-up of a dedicated proton therapy area if both of the above-mentioned channels, which protons of different energy ranges, can be used for therapy. Gabe *Lam, Batho Biomedical Facility, TRIUMF, University of B.C., Vancouver, B. C. V6T 2A3.*

The closing of the 184-inch cyclotron at the Lawrence Berkeley Laboratory. "High on a hillside, under the familiar dome of LBL's 184-inch Cyclotron building, an important chapter in the history of science has come quietly to a close....

The cyclotron that pushed back the frontiers of high-energy physics in the formative years of the nuclear age is being dismantled. Since last fall, workmen have been removing the venerable 4,000-ton machine, piece by piece, to make room for the Advanced Light Source, soon to be the world's most powerful source of soft x-rays and ultraviolet radiation....

The invention of the cyclotron in 1929 by Ernest Lawrence, the founder and first director of the Radiation Laboratory................................ In April 1940, the Rockefeller Foundation and others pledged $1.5 million toward the construction of a 184-inch cyclotron, and five months later, site preparations began on Charter Hill overlooking the UC campus and San Fransisco Bay Architects consider the building, a segmented cylindrical drum with a 24-sided dome, a well-thought out example of Arthur Brown Jr's talent for revitalizing classical design with modern elements. Brown himself saw the structure as a fitting eastern terminus for the UC campus in keeping with the original 1898 campus plan....

The foundation for the structure was poured in 1940, and the magnet yoke installed. The building went up around the huge device, and by March 1942, was essentially complete Meanwhile, the advent of World War II had made steel and copper nearly impossible to acquire.... by early 1942, the cyclotron project had an Al-a priority for steel and the magnet was destined to serve national defense, not pure physics-at least for a time....

But it was some fundamental physics done by Edwin McMillan before the war ended that paved the way for a successful 184-inch machine.... Just before midnight on November 1 1946 the 184-Inch delivered its first beam-of 200 MeV deuterons-at twice the energy Lawrence had envisioned in 1939....

The era of the cyclotron had already a profound effect on biology and medicine. As early as the 1930s, radioisotopes were being discovered, produced on a significant scale, and - under the leadership of John Lawrence, the father of nuclear medicine - used for diagnosis and treatment of disease. The biological effects of neutrons and their use in cancer treatment also were studied.

Despite these early and tentative experiments, a radiotherapy program of lasting success began only with the coming of the 184-Inch Cyclotron. In 1946, Robert Wilson, then a member of the Radiation Lab staff, proposed the therapeutic use of protons, and a biology program began soon after the first beam had been observed. In 1953, a human therapy program was established, and in 1954 the first cancer patient was treated with protons to decrease production of pituitary hormones. Since then more than a thousand patients have been treated for pituitary disorders. Today this kind of therapy is considered the treatment of choice for disorders such as Cushing's disease and acromegaly.

Reconstruction of the cyclotron in the mid-1950s doubled its previous power enabling it to accelerate protons to 750 MeV ....by 1975. Research in heavy-ion radiotherapy was, however, just beginning so the cyclotron was officially bequeathed to the medical community. A cancer therapy program with alpha particles began immediately, systematic treatments of ocular melanomas began in 1980, and arteriovenous malformations were added to the program two years later. More than 100 patients per year were treated at the 184-Inch in its last few years. These programs will continue at LBL's Bevalac synchrotron ....
" *extracted from the Spring issue of the LBL Research Review, sent by John Lyman, Mail Stop 55-121, Lawrence Berkeley Laboratory, Berkeley, CA 94720.*

Note:- Thanks to Dr. Mandrillon, Andy, Hans, Ron, Phil, George, Gabe and John for their contributions to this issue.

RECENT PUBLICATIONS

I received copies of the following papers and titles of internal reports. Although several of these are already published, I include them here, so that we can all update our own files of interesting publications.

B. Larrson and B. Sarby, "Equipment for radiation surgery using narrow 185 MeV proton beams", Acta Oncologica 26 143 1987.

G.K.Y. Lam, R.W. Harrison, R. 0 Kornelson, L.D. Skarsgard, "Beam scanning system for a clinical pi-meson beam", Rev. Sci. Instrum. 57 329 1986.

G.B. Goodman, G.K.Y.Lam, R.W. Harrison, M.Bergstrom, W.R. Martin, B.D. Pate, "The use of positron emission tomography in pion radiotherapy", Int. J. Radiation Oncology Biol. Phys., 12 1867 1986.

G.K.Y. Lam, G.B. Goodman, R.W. Harrison, L.D. Skarsgard, R.O. Kornelsen, "Cancer radiotherapy using negative pi-mesons", Nuc. Inst. and Meth. in Phys. Research B 10/11 1096 1985.

G.K.Y. Lam, "Technique of range modulation for a clinical pi-meson beam", Rev. Sci. Instrum. 53 1067 1982.

B. Gottschalk, " Nozzle zoom strategy: a closer look", HCL internal report 4/26/88.

B. Gottschalk, "Calibrating dosimeter arrays", HCL internal report 6/10/88. B. Gottschalk, "Magnet regulators at HCL", HCL internal report 6/15/88.

WORLD WIDE CHARGED PARTICLE PATIENT TOTALS

The following institutions are/were active in the treatment of patients with protons, pions light or heavy ion beams. Patient totals as of June 1988. Los Alamos and the 184" cyclotron at Berkeley are closed for ever; Uppsala, after a long shut down, should be re-opening soon.

INSTITUTION	LOCATION	TYPE	DATE FIRST RX	CURRENT PATIENT TOTAL	DATE OF TOTAL
Berkeley 184	CA. U.S.A.	p	1955	30	1957
Berkeley 184	CA. U.S.A.	He	1957 and		closed Dec. 1987
Berkeley Bev.	CA. U.S.A.	heavy	1975	2187	May 1988
Uppsala	Sweden	p	1957	73	1976
Harvard	MA. U.S.A.	P	1961	4300	June l 1987
Moscow	U.S.S.R.	p	1965	1359	Oct 1987
Dubna	U.S.S.R.	p	1967	80	1977
Gatchina	U.S.S.R.	p	1975	457	Oct 1987
S.I.N.	Switzerland	π^-	1980	331	Dec 1987
S.I.N.	Switzerland	p	1984	429	May 1988
Chiba	Japan	p	1979	~30	Aug 1986
Tsukuba	Japan	p	1983	67	1987
Los Alamos	NM. U.S.A.	π^-	1974	230	1982 closed
TRIUMF	Canada	π^-	1979	146	May 1988
			TOTAL =	9719	

The following institutions are actively developing proton facilites.

INSTITUTION	LOCATION	COMMENTS
Loma Linda	CA. U.S.A.	Hope to treat the first patient in 1989.
Clatterbridge	England	Building a 62 MeV proton beam line.
Orsay	France	Tests underway for a proton beam.
TRIUMF	Canada	Tests underway for a proton beam line.
N.A.C.	South Africa	Designing a 200 MeV proton beam line.
Nice	France	Developing a proton beam line
Louvain-la-Neuve	Belgium	Hoping to develop a proton beam line.
EULIMA	Europe	Light ion facility; cooperative venture in the planning stages.

These figures represent the best information that I have. Please note the significant change in the number of patients treated at Berkeley; this should be a good number, my previous one was in error. I would be glad to hear from anyone with better or more up-to-date numbers, or from institutions not included in this summary.