PARTICLES

sponsored by

PARTICLE THERAPY CO-OPERATIVE GROUP

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

Number 31 January 2003 Janet Sisterson Ph.D., NPTC

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 is covered in this way, so more financial help is needed from the community. PTCOG 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 "Massachusetts General Hospital" and sent to Janet Sisterson at the address given below.

Facility and Patient Statistics: I continue to collect information about all operating or proposed facilities. Please send me your information. My latest published summary of the worldwide detailed patient statistics through 1999 is:
"Ion beam therapy: overview of the world experience." Author: J. M. Sisterson. CP576, Application of Accelerators in Research and Industry – Sixteenth Int'l Conf., eds. J. L. Duggan and I. L. Morgan, American Institute of Physics, (2001) p865-868. Copies available on request.

Particles Newsletter and Abstracts from PTCOG meetings. Particles and the Abstracts from the last PTCOG meeting will continue to be issued on a CD. Computerized Medical Systems (CMS) in St Louis has kindly offered to cut the CDs. I thank them for their support of Particles.

Particles on the Internet ***** IT'S BACK!!! The MGH/PTCOG/Particles web page ***:**
The URL for the PTCOG and Particles Newsletter is now http://ptcog.mgh.harvard.edu.

Other proton therapy links:

- NPTC, MGH, Boston: http://cancer.mgh.harvard.edu/cancer_radonc_nptc_home.htm
- LLUMC, California: http://www.llu.edu/proton
- U of California, Davis: http://crocker.ucdavis.edu/cnl/research/eyet.htm
- Midwest Proton Radiotherapy Institute: http://www.iucf.indiana.edu/MPRI/index.html
- National Association for Proton Therapy: http://www.proton-therapy.org
- TRIUMF, Canada; protons: http://www.triumf.ca/welcome/proton_thrpy.html
- TRIUMF, Canada; pions: http://www.triumf.ca/welcome/pion_trtmt.html
- CPO, Orsay, France: http://www-sop.inria.fr/epidaure/personnel/bondiau/CPO_base/cpo_base.htm
- PSI, Switzerland: http://radmed.web.psi.ch

- TERA foundation, Italy: http://www.tera.it
- Catania, Italy: http://web2.lns.infn.it/catanaweb/default.htm
- GSI homepage: http://www.gsi.de
- HMI Berlin: http://www.hmi.de/isl/att-i_en.html
- The Svedborg Laboratory, Sweden: http://www.tsl.uu.se
- Clatterbridge Centre for Oncology: http://synaptic.mvc.mcc.ac.uk/simulators.html
- Clatterbridge collaboration with the CASIM project: http://www.casim.ac.uk
- Rinecker Proton Therapy Center, Munich, Germany: http://www.rptc.de
- ITEP, Moscow, Russia: http://www.protontherapy.itep.ru
- Tsukuba, Japan - PMRC: http://www.pmrc.tsukuba.ac.jp/index.html
- HIBMC, Hyogo, Japan: http://www.hibmc.shingu.hyogo.jp/english/aisatu-e_top.htm
- HIMAC, Chiba, Japan: http://www.nirs.go.jp/ENG/particl.htm (ENG case sensitive)
- NAC, South Africa: http://medrad.nac.ac.za/index.htm

ARTICLES FOR PARTICLES 32

The deadline for articles for the Particles 32 is May 30 2003. Please send all articles to:

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Articles for the newsletter should **NOT** exceed two pages in length.

PTCOG BUSINESS and FUTURE PTCOG MEETINGS

The Chairperson, Secretary and Steering Committee members are listed below. The Chairperson and Steering Committee are appointed for 3 years. Their appointments run through June 2004.

Chair: Gudrun Goitein
Paul Scherrer Institute
Division of Radiation Medicine
Villigen PSI CH-5232
Switzerland

Secretary: Janet Sisterson
Northeast Proton Therapy Center
Massachusetts General Hospital
30 Fruit Street
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MEMBERS OF THE STEERING COMMITTEE
Appointed in June 2001

Canada	TRIUMF, BC	E. Blackmore
France	Orsay	G. Noel
Germany	GSI/Heidelberg	J. Debus
	HMI, Berlin	H. Kluge
Italy	Catania, Sicily	L. Raffaele
Japan	HIMAC, Chiba	H. Tsujii
	NCC, Kashiwa	T. Ogino
	PMRC, Tsukuba	Y. Akine
	HIBMC, Hyogo	Y. Hishikawa
	Wakasa Bay, Japan	S. Fukuda
Russia	ITEP, Moscow	V. Khoroshkov
	JINR, Dubna	G. Mytsin
South Africa	IThemba LABS	D. Jones
Sweden	Uppsala	E. Blomquist
Switzerland	PSI	G. Goitein
UK	Clatterbridge	A. Kacperek
USA	NPTC-MGH/HCL, MA	S. Rosenthal
	LLUMC, CA	D. Miller
	MPRI, IN	N. Schreuder
	Berkeley, CA	W. Chu

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

PTCOG XXXVIII	Chester, UK. Hosted by the Douglas Cyclotron, Clatterbridge Center for Oncology	May 14 – 16 2003
PTCOG XXXIX	Open date	Fall 2003
PTCOG XXXX	CPO, Orsay, France	Spring 2004
PTCOG XXXXI	MPRI, Indiana, USA	Fall 2004

Letter from the PTCOG Chairperson

Dear friends and colleagues

Have you been to South Africa? Not only PTCOG is a good reason to go there, the country itself is just breath taking. The home team, under the direction of Dan Jones, has organized a very fine meeting at iThemba Labs. May we congratulate them on eliciting a thought-provoking and intellectually inspiring debate. Like five years ago, the atmosphere of the whole conference was stimulating, collegial, friendly, and we all felt welcome and perfectly taken care of. Thank you to all of you who have been involved in the planning, preparing and running of PTCOG XXXVII! We wish iThemba Labs a successful future, which will probably include a new proton therapy installation – a milestone for South Africa!

It is almost characteristic for medical programs in research centers, that particle therapy is regarded as a first line activity, with great impact on the center's recognition and even future. New facilities are planned "on the campus", based on the large and fundamental knowledge in physics and technology as well as in medicine that has been gained over decades. PTCOG was founded before I came on the scene, but I remember well the idea behind the name: Let's share our knowledge and make protons part of clinical programs. Since then, many outstanding and dedicated people have contributed to treatment results and today's technologies. Particle therapy has grown out of a solid and large base into a complex field where scientists and industry have to find their way together – not around each other! I am sure, we all understand the needs of our time. The interactions between academia and industry have indeed changed, and economic viability has become of the outmost importance in this finance-orientated world. Times are unfortunately over, where one could live from generous budgets. We have to fight for even small amounts of money and large projects have become consequentially often problematic. As a result, we have changed – and had to change - our attitude towards colleagues, partners, other research centers, industries and (potential) customers. Nevertheless, I strongly defend the idea of respect for the achievements we have made as a community, before we were so strongly money-driven and economically competitive. There is a certain culture of togetherness (you see, I like that word …), which includes that we all acknowledge that many basics are not one's own property. New, original inventions and developments may grow out of the basics, but only the new may then be "property". I hope we all can agree to deal with each other as community or as co-operative group, which is characterized by respect and collegiality. Only then will the particle therapy community survive as a strong and successful element of modern cancer therapy.

We have been talking about an educational program within the PTCOG community, to exchange young people amongst centers for training purposes in particle therapy physics, technology and medicine. Our industrial partners are interested in financially supporting these exchanges. May I ask you ever so kindly as to assess how you and your center could offer some educational support, in terms of training, logistics (e.g. accommodation), financial support etc. The coming generation will be very grateful.

PTCOG XXXVIII will be held in England. Of course, the treatment of ocular tumors will be a strong focus, but also other important subjects will be discussed. Andrzej Kacperek is full of exciting ideas, and he and his team will put an interesting program together. I count on you to bring these ideas and potential programs to life.

With best regards and good wishes for 2003

Gudrun Goitein, January 2003

Minutes of the Steering Committee Meeting
held during
PTCOG XXXVII
IThemba LABS on 29 October 2002

The meeting was chaired by Gudrun Goitein.

Future Meetings:
Spring 2003: May 14-16 Chester, UK. hosted by CCO, Clatterbridge. See article in this issue.

Fall 2003: Currently this is an OPEN DATE. If you would like to host a PTCOG meeting at this time, please let Gudrun and Janet know AS SOON AS POSSIBLE.

Spring 2004: CPO, Orsay, France will host this meeting, which may be held in Paris.

Fall 2004: MPRI, Indiana, USA will host this meeting

Several other institutions have offered to host PTCOG meetings from Fall 2004 onwards.

Particles and PTCOG web page: The MGH/PTCOG web page is BACK! It can be found at the following URL:http://ptcog.mgh.harvard.edu**.** In the future, we may use PTCOG.com, which we registered some time ago.

It was suggested that the PTCOG web page include a listing of all jobs currently available in the particle therapy field.

It is recommended that all centers link to the PTCOG web page as well as all other ion beam therapy centers. A good list of these centers is found on pages 1-2 of this issue.

Training and Education: To run our centers –both operating and proposed – with responsibility and quality we need to train people who are members of all the involved professional groups.

Many centers already have training programs, offer scholarships etc. to those wishing to learn the techniques used in proton therapy. We plan to establish a database listing all these opportunities, and we will send a questionnaire to all centers asking them to list the training opportunities available at their center.

We would also like to establish a Training fund. We will welcome donations for this purpose from our industrial partners and anyone else who would like to contribute**.** The way to do this is described on Page 1 of this issue. Please specify that the donation you are making is for the Training fund.

PTCOG meetings can also be used to provide training. Whenever possible, PTCOG meeting organizers are encouraged to arrange for continuing credit for attendees. Teaching workshops could be organized for the day before a PTCOG meeting. These workshops could be focussed on teaching the basic principles of particle therapy in all its aspects and might be one way that the broad knowledge of long-standing PTCOG members could be transferred.

Patents: The patent issue was discussed at length.

PTCOG 38
May 14-17 2003-01-14
Chester UK
hosted by The Douglas Cyclotron, Clatterbridge Centre for Oncology

The 38th meeting of the **'Particle Therapy Co-operative group'** will be hosted by the Clatterbridge Centre for Oncology at the Roodee Race Course in Chester from 14th to the 16th of May 2003.

This year, the meeting will include topics that address technical and clinical issues raised by the proposed SIRIUS/CASIM high-energy proton cyclotron project, at the Daresbury Laboratory near Warrington, as well as the eye therapy, which is long-established at Clatterbridge as a national and international centre.

The Clatterbridge Centre for Oncology, situated in the Wirral, is one of the busiest cancer centres in the United Kingdom treating about 8000 patients every year. The Douglas Cyclotron, initially an MRC unit, was commissioned to perform clinical trials of neutrontherapy. A large proton therapy room was added in 1989, and the Cyclotron, now a part of the CCO, is dedicated to the proton radiotherapy of ocular tumours. Radioisotope production has now become a regular service and research activity of the Cyclotron.

The meeting usually attracts diverse groups including oncologists, specialist clinicians, ophthalmologists, radiobiologists; clinical, treatment staff and cyclotron physicists and engineers. The meeting takes place twice a year and is hosted by a growing number of centres, on four continents. Each meeting may have specific focus sessions as well as general papers. PTCOG 38 proposes sessions on:- difficult brain tumour treatments, paediatric tumours, comparative treatment modalities, facilities including dual-particle therapy machines; the health economics of particle therapies; cellular effects of radiations; proton dosimetry particularly protocols and intercomparisons; reviews of ophthalmologic results covering malignant and benign lesions as well as eye planning procedures and improvements to eye beam lines.

The Roodee Racecourse should provide an interesting venue just outside the Old Walls of Chester (with easy parking), and is a short walk from most of the recommended hotels within Chester.

A Civic Reception/Registration will be held at Chester Town Hall. Of further interest is the venue for the conference banquet, which is at Ruthin Castle, in North Wales, where an atmospheric and memorable evening is assured. (*Medieval costumes are optional*). A Drinks/canapes Reception with entertainment to be held at the Grosvenor Hotel, Chester. A further evening reception will be hosted at the CCO, at Clatterbridge (about 20 minutes from Chester) where the Cyclotron and the main radiotherapy centre may be visited, after ample refreshments.

Registration forms, hotel accommodation forms and travel information plus this information are included separately on this CD. Please note that the booking forms for the hotels must be returned by March 31 2003.

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PTCOG Information/News/Reports:

The following reports and articles were received by January 2003.

The Ion Beam Treatment System and the Results of Clinical Trial at the Hyogo Ion Beam Medical Center (HIBMC): Yoshio Hishikawa, M.D.[1,2], Kazufumi KAGAWA, M.D.[1], Masao MURAKAMI, M.D.[1,2], Akifumi Itano, Ph.D.[1], Takashi AKAGI, Ph.D.[1] , Daisaku Suga, R.T.T.[1]and Mitsuyuki ABE, M.D.[1], [1]Department of Radiology, Hyogo Ion Beam Medical Center (HIBMC), [2]Division of Imaging Medicine and Ion Beam Therapy, Kobe University Graduate School of Medicine

Introduction

In Japan, the mortality rate due to cancer is increasing every year. In Hyogo Prefecture, cancer has been listed as the main cause of death since 1978. As a result, the Prefecture Government decided to proceed with a campaign "Cancerless Hyogo" in 1987. Accordingly, as a part of "anti-cancer campaign in Hyogo", the Hyogo Prefecture Ion Beam Treatment Facility Plan was drafted. On April 1, 2001, the Hyogo Ion Beam Medical Center (HIBMC) was opened as the first facility in the world to provide ion beam therapy using 2 types of beams, proton and carbon ion beams.

System

The ion beam treatment in this center is carried out with a comprehensive system which consists of an irradiation system, a treatment planning system and a treatment verification system.

The irradiation system consists of 1. an injector system, 2. a main accelerator, 3. a high-energy beam transport system, 4. a beam delivery system, 5. a patient positioning system, and 6. a control system for the entire device. Two different types of beams are used for treatment at the center, *i.e.* proton (70-230 MeV/u) and carbon ion beams (70-320 MeV). The injector system consists of two 10-GHz ECR ion sources, 1 MeV/u RFQ linac, 5 MeV/u Alvarez linac and a debuncher. Operation frequency of the linacs is 200 MHz. The main accelerator is a synchrotron and its circumference is 93 m. The beam is slowly extracted by the third-order resonance scheme. The main accelerator and all irradiation ports are connected by a high-energy beam transport system. There are 5 treatment rooms; one with horizontal and vertical beam lines, one with a 45-degree oblique beam line (a 15 cm × 15 cm irradiation field), one with another horizontal line (a 10 cm in diameter irradiation field) and 2 isocentric proton gantry lines (a 15 cm in diameter irradiation field). To conform the Bragg peak to a target volume, the beam lines in the treatment room are equipped with a pair of wobbler magnets, beam scatterers, ridge filters, and multileaf collimators. The ridge filter is designed to produce biologically equal effects along the spread-out Bragg peak (SOBP). The collimator is used to define the lateral outline of the target volume. The patient positioning system consists of an adjustable treatment coach with 5- or 6-directional axial movements, a laser pointer to adjust the patient position and an X-ray device in order to place the target precisely by using frontal and lateral fluoroscopy. The entire system is produced by Mitsubishi Electric Co. As this device is a novel medical device, Ministerial approval was required for a medical use. Therefore, a clinical trial commissioned by Mitsubishi Electric Co., in order to obtain an approval for manufacturing a new medical device, was carried out and it was approved on October 31, 2002.

The treatment planning system consists of a CT (Toshiba Corporation, Tokyo), a MRI (Philips Electronics N.V., Eindhoven, the Netherlands) and a treatment planning device (FOCUS-M; Computerized Medical Systems, Inc., St Louis, MI (CMS) and Mitsubishi, Kobe). FOCUS is manufactured by CMS loaded with a calculation code for the ion beam treatment using the pencil beam method produced by Mitsubishi Electric Co., which consists of a treatment information management server (WS) and treatment planning terminals (WS). The treatment planning terminals are connected with an image fusion terminal (PC) to support treatment planning.

The treatment verification system consists of a positron emission tomography (PET) camera. As charged particles produce short-lived positron-emitting isotopes in tissues, the treated site can be verified by images taken immediately after irradiation using a PET camera (SET-2300W; Shimadzu, Kyoto).

Treatment Methods

A technician sets up an immobilizing device fit to an individual patient using plastic materials on the CT device, and takes CT and MRI images of the treatment target site. The CT and MRI images are then sent to an image server in the hospital.

Treatment planning is carried out using the 3-D treatment planning system (FOCUS-M: Mitsubishi Electric Co.). At this time CT and MRI fusion images are used for treatment planning.

The total treatment plan including the type of ion beams, the energy level and the ridge filter used, the treatment dose per day and the total dose is discussed at the conference room on the day after treatment planning has been carried out. If any question arises, re-planning will be instructed. If not, the plan will be approved. When the director presses the approval button, the approved data are sent to the patient management server at the control system of the ion beam treatment system.

Before treatment, a rehearsal will take place for a patient. The position of the patient is adjusted by a laser pointer and X-ray images.

On the day of treatment, the positioning is performed in the same way as the rehearsal. After positioning, ion beam therapy is started. A respiratory gating system is used for patients with lung or liver cancer.

Verification of the irradiated volume is carried out on the first day of ion beam therapy by using of the PET camera.

Clinical Trial

The clinical trial of proton therapy was done for 30 patients during 7 months (May – November in 2001) and that of carbon ion beams also for 30 patients during 7 months (January – July in 2002). Eligibility criteria for lung and prostate cancers were T1 or T2N0M0.of the UICC TNM staging system. However, in H&N, liver and bone/soft tissue tumors, TN factors were not taken into account but the tumor size within 12 cm in diameter was required for the enrollment of the trial. All patients had an ECOG performance status of grade 2 or less. The acute toxicity was assessed according to the criteria of the NCI-CTC version 2.0 up to 90 days after starting irradiation. Objective tumor response was evaluated at the four to six weeks after completion of the treatment using the WHO criteria.

In the proton clinical trial, 4 head & neck, 5 lung, 5 liver and 16 prostate cancer patients were treated. There were 26 males and 4 females. Prescribed doses were 65GyE/26Fr/7wks in H&N cancer, 80GyE/20Fr/5wks in lung cancer, 76GyE/20Fr/5wks in liver cancer and 74GyE/37Fr/8wks in prostate cancer. Acute local reactions were recognized in most cases but rapidly cured. In measurable 23 cases, two patients were CR, 12 PR and 9 NC. The response rate (CR+PR) was 60.9%. In carbon-ion beam therapy, patients with radio-resistant tumor were treated; 19 H&N including 8 malignant melanomas, 3 lung, 6 liver and 2 soft tissue/bone tumors. There were 17 males and 13 females. Prescribed doses were 57.6GyE/16Fr/4wks in H&N cancer, 68.4GyE/9Fr/3wks in lung cancer, 52.8GyE/8Fr/2wks in liver cancer and 70.4GyE/32Fr/8wks in soft tissue/bone tumors. Acute local reactions were recognized in most cases but rapidly cured. In measurable 30 cases, 2 patients were CR, 13 PR and 15 NC. The response rate (CR+PR) was 50.0%.

References: [1] Kagawa K, Murakami M, Hishikawa Y, *et al.* Preclinical biological assessment of proton and carbon ion beams at Hyogo Ion Beam Medical Center. *Int J Radiat Oncol Biol Phys* 2002;54:928-938. [2] Hishikawa Y, Kagawa K, Murakami M, *et al.* Usefulness of positron-emission tomography images after proton therapy. *Int J Radiat Oncol Biol Phys* 2002;53:1388-1391.

TREATMENT PLANNING SYSTEMS FOR PROTON THERAPY
July 2002

The following Table was originally presented in October 1999 by Skip Rosenthal, MGH at the Workshop on Treatment Planning Systems, PTCOG XXXI Please send corrections/additions to Janet Sisterson.

Year	Created By	System Name	Status
1979-93	LBL	LBL system	Not Available
1980	MGH	Rx	**Distributor MGH**
1980	MGH	EYEPLAN	**Distributor MGH – EYES only**
1990-96	MGH/Seimens	V-Treat(AXIOM)	Not Available
198?,1991	PSI	PSI system/Pion	**Distributor PSI**
1995	DKFZ/Royal Marsden	Voxelplan/Proxelplan	**Adapted by GSI, NAC, DKFZ**
1996	Radionics/MGH/HCL	P-Knife	Not Available
1997	LLUMC/PerMedics	OptiRad 3D	**FDA approved; commercial**
1998	Tsukuba	Hitachi system	In-house system
1998	DKFZ	OCTOPUS	**Under development – EYES only**
1994	Orsay/Curie	ISIS	Distribution ?
1998	CMS/MGH	FOCUS	**Commercial Release 1999**
1998	DKFZ	KonRad Plus Protons	Research Only
1989 – 2000	CCO, Clatterbridge, UK	EYEPLAN v1.6 (VMS)	Available free;eyes only; research only
2000	Varian	Polaris	FDA approved for passive treatment modalities
2001	ITEP (Moscow)	ProGam	Adapted in PTF ITEP
2002	MDS Nordion	Helax-TMS	**FDA approved: commercial**
2002	CMS/Mitsubishi	FOCUS/M	**Commercial Release 2001**
	RenderPlan		?
	Adac		?
	Michigan		?

Proposed NEW FACILITIES for PROTON & ION BEAM THERAPY - January 2003

INSTITUTION	PLACE	TYPE	1ST RX?	COMMENTS
IMP, Lanzhou	PR China	C-Ar ion	2003	C-ion from 100MeV/u at HIRFL expand to 900 MeV/u at CSR; clin. treat;biol. research; no gantry; shifted patients
Wanjie, Zibo	China	p	2003	Under construction. 230 MeV synchrotron, 2 treat rooms.
PSI	Switzerland	p	2004	Addition of a 250 MeV cyclotron, 2nd gantry, new 1 fixed
Shizuoka Cancer Center	Japan	p	2005	synchrotron 235 MeV; 2 gantries; 1 horiz; funded.
Rinecker, Munich	Germany	p	2005	4 gantries, 1 fixed beam, 230 MeV, scanning beams.
NCC, Seoul	Korea	p	2005	235 MeV cyclotron, 2 gantries, 1 horiz.
Heidelberg	Germany	p, ion	2005	1 gantry; 2 fixed beam; p/carbon; int. contr. Raster scan
IThemba LABS, Somerset West	South Africa	p	2006	230 MeV, 1 gantry, horiz. + 30° beams, 1 horiz. + 15° beams
M. D. Anderson Cancer Center	TX, USA	p	2006	250 MeV synchrotron; 3 gantries; 1 fix(2 beams)+1 exp rooms
CGMH, Northern Taiwan	Taiwan	p	2001?	250MeV synchrotron/230MeV cyclotron;3 gantry,1 fixed
Bratislava	Slovakia	p, ion	2003?	72 MeV cyclotron; p; ions; +BNCT, isot prod.
Erlangen	Germany	p	?	4 treatment rooms, some with gantries.
CNAO, Milan & Pavia	Italy	p, ion	2004?	synchrotron; 2 gantry;1 fixed beam rooms;1 exp. room
Med-AUSTRON	Austria	p, ion	2007?	2p gantry; 1 ion gantry; 1 fixed p; 1 fixed ion; 1 exp room
Chang An Information, Beijing	China	p	?	Contract signed with IBA.
Central Italy	Italy	p	?	cyclotron; 1 gantry; 1 fixed
Clatterbridge	England	p	?	230 MeV cyclotron; part of the CASIM project
TOP project ISS Rome	Italy	p	?	70 MeV linac; expand to 200 MeV?
3 projects in Moscow	Russia	p	?	including 320 MeV; compact, probably no gantry
Krakow	Poland	p	?	60 MeV proton beam.
Proton Development N.A. Inc.	IL USA	p	?	300 MeV protons; therapy & lithography

WORLD WIDE CHARGED PARTICLE PATIENT TOTALS

January 2003

WHO	WHERE	WHAT	DATE FIRST RX	DATE LAST RX	RECENT PATIENT TOTAL	DATE OF TOTAL
Berkeley 184	CA. USA	p	1954	— 1957	30	
Berkeley	CA. USA	He	1957	— 1992	2054	June-91
Uppsala	Sweden	p	1957	— 1976	73	
Harvard	MA. USA	p	1961	— 2002	9116	
Dubna	Russia	p	1967	— 1974	84	
Moscow	Russia	p	1969		3539	Dec-02
Los Alamos	NM. USA	π^-	1974	— 1982	230	
St. Petersburg	Russia	p	1975		1029	June-98
Berkeley	CA. USA	ion	1975	— 1992	433	June-91
Chiba	Japan	p	1979		145	Apr-02
TRIUMF	Canada	π^-	1979	— 1994	367	Dec-93
PSI (SIN)	Switzerland	π^-	1980	— 1993	503	
PMRC (1), Tsukuba	Japan	p	1983	— 2000	700	July-00
PSI (72 MeV)	Switzerland	p	1984		3712	Dec-02
Dubna	Russia	p	1987		154	Dec-02
Uppsala	Sweden	p	1989		311	Jan-02
Clatterbridge	England	p	1989		1201	Dec-02
Loma Linda	CA. USA	p	1990		7176	May-02
Louvain-la-Neuve	Belgium	p	1991	– 1993	21	
Nice	France	p	1991		1951	June-02
Orsay	France	p	1991		2157	Jan-02
iThemba LABS	South Africa	p	1993		433	Dec-02
MPRI	IN USA	p	1993		34	Dec-99
UCSF - CNL	CA USA	p	1994		448	July-02
HIMAC, Chiba	Japan	C ion	1994		1187	Feb-02
TRIUMF	Canada	p	1995		77	Dec-02
PSI (200 MeV)	Switzerland	p	1996		99	Dec-01
G.S.I Darmstadt	Germany	C ion	1997		156	Dec-02
H. M. I, Berlin	Germany	p	1998		317	Dec-02
NCC, Kashiwa	Japan	p	1998		161	Dec-02
HIBMC, Hyogo	Japan	p	2001		30	Jan-02
PMRC (2), Tsukuba	Japan	p	2001		145	Dec-02
NPTC, MGH	MA USA	p	2001		229	Dec-02
HIBMC, Hyogo	Japan	C ion	2002		30	Dec-02
INFN-LNS, Catania	Italy	p	2002		24	Dec-02
Wakasa Bay	Japan	p	2002		2	June-02
					1100	pions
					3860	ions
					33398	protons
				TOTAL	38358	all particles