



Center for Proton Therapy :: Paul Scherrer Institut :: #1_10/2013

Dear Colleagues

Welcome to the first-quarter edition of this PSI newsletter. It is of utmost importance that PSI's Center for Proton Therapy (CPT) informs radiation oncologists and medical physicists working in Switzerland of the clinical program and foreseen technical developments of proton therapy at PSI. As such, I have made the decision, and commitment, to publish info-news several times yearly in order to keep the Radiation Oncology community informed.

In this edition, two of our inserts deals with prospective clinical trials of proton therapy for sarcoma and breast cancer patients. Importantly, these trials are open to all Swiss-resident cancer patients. Should you have any queries, please contact the respective PIs. It is of paramount importance that patients should be accrued in prospective clinical trials in Switzerland and

abroad, given the lack of prospective trials demonstrating clear benefit over other radiation treatment options that are currently available. The keen interest in proton therapy is based on mainly theoretical advantages. Key to these is to reduce radiation-exposure to normal tissue and the possible minimization of acute and long term side effects. As we move toward comparative effectiveness research, value-based medicine, care paths, and emphasis on cost-effective care, the value and benefit from protons will have to undergo additional scrutiny. Unfortunately, little consensus exists on whether the dosimetric advantages translate to better outcomes, except for pediatric cancers, and skull base and sacral tumors. **In my opinion, it is important that current and future users of this technology participate in clinical trials, apply this treatment modality cautiously, and conduct treatment and follow-up that can assess the true**

added value of this therapy to patients and society. This was indeed the mission given by the Highly Specialized Medicine scientific committee of the GDK to CPT. This will allow proton therapy to more fully reach its potential as a valuable and effective treatment to help fight cancer for Swiss patients. At CPT, protons are used currently for a number of cancers, including, but not limited to, cranial meningiomas, pediatric cancers and skull-base or sacral tumors. In this newsletter we also give some information on our new treatment unit Gantry 2, which has just been clinically commissioned. The beam characteristics are a game changer in the proton therapy field, with beam sigma values of 2.2 mm for Pencil Beam Scanning (PBS) at high energy. This Gantry will enable the CPT team to deliver PBS to cancer patients in an unmatched conformation, with rescanning and repainting capabilities in due time.

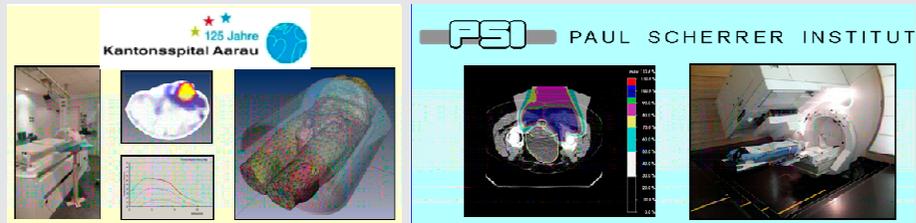
Lastly, intra- and inter-fractional motion is a major issue for PBS. Our forth insert deals with 4Dplanning for proton therapy. Parenthetically, a workshop is organized end of November at PSI. For more information, do not hesitate to visit our web site: <http://www.psi.ch/4d-treatment-planning-workshop-2013/>. Ultimately, careful science and clinical expertise are keystones for proton beam therapy moving forward. I value the expertise in the Swiss Radiation Oncology, be it from the physician's side or the medical physicist's side. As in the previous decade, CPT is open to any initiative stemming from this community. As Chairman, I can only stress on the significance of networking. Should you have any input to give in our program, do not hesitate to contact one of my team or myself. Let us bring together this technology in full clinical maturity together.

Sincerely,

Prof. Damien Charles Weber, Head of CPT

Radio-Oncology News

Phase I/II Study of Concurrent Hyperthermia and Proton Beam Radiotherapy in Primary and Recurrent Unresectable Soft Tissue Sarcoma (HYPROSAR)



The proposed study is a non-randomized phase I/II study using combined hyperthermia and spot scanning based proton therapy for unresectable soft tissue sarcomas as a novel therapeutic approach. The therapy will be reimbursed by the health insurance. The study will be open for patient accrual in November 2013 for all institutions in Switzerland.

Objective:

Achievement of complete tumour removal – both macroscopic and microscopic (R0 resection) – without functional disability and loss of organ

structure and function after preoperative combined hyperthermia and proton therapy.

Main Inclusion Criteria:

- Men and women over age 18;
- Histopathologically proven primary or recurrent soft tissue sarcomas (STS) of extremities and trunk;
- Deemed inoperable by the surgeon;
- ECOG performance scale 0 and 1

For any information, please refer to CPT,

Dr. Ralf Schneider,
Tel. 056 310 37 89,
ralf.schneider@psi.ch

Phase I/II Study of Postoperative Proton Radiotherapy for Loco-Regional Breast Cancer Irradiation for Women with Left Side Stage III-A or III-C Breast Cancer with and without unusual anatomy (Study ID: PSI-CPT-02)

The study is designed as a single center non-randomized phase I/II study evaluating the feasibility of spot scanning based proton therapy as postoperative loco-regional radiotherapy modality in non-metastatic left breast cancer. The therapy will be reimbursed by the health insurance. The study will be open for patient accrual in December 2013 for all institutions in Switzerland.

Objectives:

- To determine the technical safety, the feasibility and the reproducibility of the daily patient positioning of postoperative spot-scanning based proton radiotherapy for complex loco-regional irradiation in women with left-sided breast cancer;
- To determine the rates of acute toxicity.

Main Inclusion Criteria:

Women, ≥ 18 and ≤ 65 years old, with stage IIIA (T1N2 with internal quadrants tumor, or T2N2 or T3N2 with tumor of any quadrant) or stage IIIC (T1N3, T2N3, T3N3), invasive ductal or lobular carcinoma of the left breast, with no evidence of metastatic disease. Women must have undergone either breast conserving surgery or modified radical mastectomy.

Main Exclusion Criteria:

Patients presenting with synchronous multifocal or bilateral invasive or non-invasive breast cancer; or receiving neo-adjuvant chemotherapy; or with positive surgical margins at pathologic evaluation; or with pre-existing severe pulmonary or clinically active cardiac disease.

For any further information, please refer to CPT,

Dr. Carmen Ares

Tel. 056 310 54 12

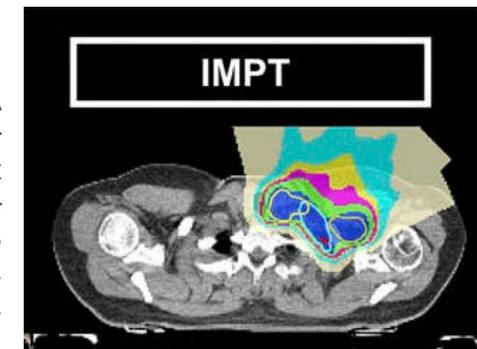
carmen.ares@psi.ch

or

Dr. Ulrike Kliebsch

Tel. 056 310 55 82

ulrike.kliebsch@psi.ch



Physics News: Gantry 2

Getting ready for patient treatments with PSI's next generation of scanning gantry

The technical commissioning of the second gantry at PSI was finished towards the end of last year. The main work during this year was the clinical commissioning, establishing the quality assurance program and the communication with the responsible authorities for permission. This Gantry 2 is based on 17 year patient operation with the first gantry and includes many improvements. The two dimensional sweeper magnets offer now a quicker beam scanning and fast

energy changes below 100 ms were reached for typical energy steps.

For energy modulation, a degrader system right after the cyclotron is used which substitutes the range shifter right in front of the patient. The advantage is a small spot size of 5 mm sigma for low energy (70 MeV) down to 2.2 mm sigma for the high energy (230 MeV.)

Optimal access to patient in every treatment configuration is achieved by the iso-centric layout of Gantry 2 and restricting the gantry rotation to 210°. Despite this limitation, 4 pi treatments are still possible in combination with the flexible treatment table.

For imaging, the new approach is to use an in-room CT (16B) for patient positioning as opposed to the out-of-room positioning of Gantry 1. This commercial CT-on-rail is in reach of the patient table and is complemented by a Beam's-Eye-View (BEV) X-ray system installed on the gantry. Gantry 2 fulfills all requirements for discrete spot scanning and is technically ready. Since a few weeks, regular dummy treatments and machine specific measurements are performed for practice and staff training in order to start successfully with patient treatments.



Gantry 2 treatment room with sliding in-room CT and extracted beam's-eye-view imager.

Announcement

PSI Winter School for Protons 2014
25th – 29th of January 2014

Topics:

- Basics in radiation physics, radiation biology of particles and Proton RBE
- Accelerator and beam line technology
- Active beam scanning
- Clinical outcomes of proton radiation therapy
- OAR Constraints and toxicities
- Integral dose, neutron irradiation, second malignancies
- Treatment planning for scanned proton beams, IMPT
- Future of proton therapy

This seminar is almost fully booked. Further information can be found under <http://www.psi.ch/winterschool/>



4D treatment planning workshop

In 2009, a workshop on topics related to the treatment of moving targets was organized by the research team of the proton therapy center at PSI. The workshop focused on technical aspects of 4D treatment planning and delivery in the context of intrafractional motion. The topics included:

- methods to take into account intra-fractional, non-rigid anatomical changes and resulting variations in densities through the use of deformable image registration and dose calculation techniques, together with the inherent uncertainties of these approaches;
- advanced treatment planning approaches including 4D optimization for proton and heavy ion therapy;
- treatment simulations and experimental validation of scanning in the presence of motion to quantify the effects for different delivery strategies;
- latest developments in beam tracking, gating, and rescanning.

About 20 people from 4 institutes (GSI, DKFZ, University of Tübingen and PSI) attended this initial workshop. A special report was published as a result of the discussions in the plenary sessions [1]. It summarizes recommendations for the treatment of mobile targets with actively-scanned particle beams and contained a list of requirements to elaborate on and apply these guidelines. The paper was awarded with the SGSMP/Varian recognition award 2010. Following this initial success, this first workshop turned into an annual series of workshops. In 2010, the 2nd edition was carried out at GSI with about 30 participants; the 3rd edition 2011 at the CNAO facility, Pavia, Italy attracted more than 40 participants. The 4th edition of the workshop last year was held at the University of Erlangen-Nuremberg, Germany and included around 60 participants from 15–20 institutions, with also representatives of commercial vendors present. To restore the original aim of the workshop, i.e., an informal platform to discuss current approaches, challenges and future research directions in 4D treatment planning, the partic-

ipants agreed on capping the attendance for the future format of the meeting. To achieve this aim, the number attendants per institute will be limited to two people. To stimulate discussions on confidential research projects, and to enable an open controversy about failures, representatives of commercial vendors will be excluded. An annual report will be established to summarize all innovations reported in the meeting. For last year's workshop in Erlangen this report was published in a special issue of TCRT journal [2] and reported recent progress in the field of mobile tumor treatment with scanned particle beams.

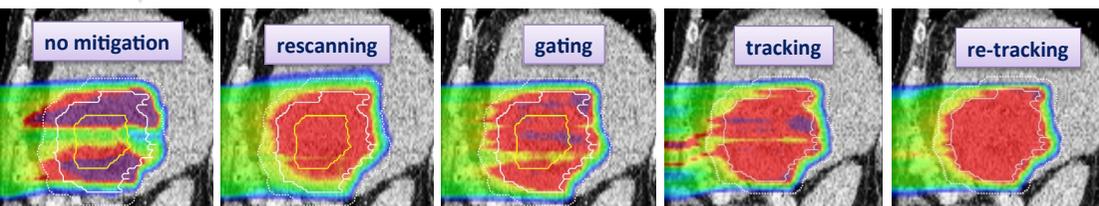
The 5th workshop will take place on the 28th–29th of November 2013 at PSI.

Further information can be found under <http://www.psi.ch/4d-treatment-planning-workshop-2013/>

This year, the topics of the workshop have been extended to include treatment of moving targets with conventional radiotherapy. Speakers from 10 institutes (PSI, University Hospital Heidelberg, NKI, Aarhus University Hospital, Hokkaido University, CNAO, ICR, HIT, MGH, GSI) will give talks in 5 different sessions focusing on clinical aspects of the treatment of mobile targets, 4D dosimetry, motion monitoring and modeling, 4D treatment planning and 4D optimization. We are looking forward to an informal, lively and fruitful 4D workshop!

- [1] Knopf et al 2010 “*Special report: workshop on 4D-treatment planning in actively scanned particle therapy-recommendations, technical challenges, and future research directions*” *Medical physics* 37, 4608-4614
- [2] Bert et al 2013 “*Advances in 4D treatment planning for scanned particle beam therapy – report of dedicated workshops*” special issue ICTR

4D planning using different motion mitigation strategies.



Imprint

Editor

Dr. Ulrike Kliebsch

Chairman

Prof. Damien C. Weber

Chief Medical Physicist

Prof. Tony Lomax

Design and Layout

Monika Blétry

Contact

Center for Proton Therapy

CH-5232 Villigen PSI
 protonentherapie@psi.ch
 www.protonentherapie.ch
 Tel. +41 56 310 35 24
 Fax +41 56 310 35 15

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