ENLIGHT HIGHLIGHTS

JANUARY 2013

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FROM THE ENLIGHT COORDINATOR

Credit: Nathalie Hospital for ENLIGHT

10 YEARS OF ENLIGHT: WE HAVE COME A LONG WAY

It was a pleasure to see so many of you at the ENLIGHT 10th anniversary meeting in Pavia, a proof that our hadron therapy community is very much alive and kicking, and full of enthusiasm and hope for the future.

The end of the PARTNER project and farewell to the researchers brought a touch of sadness to the celebration. However, the PARTNER adventure is not finished, as the researchers we have been training and educating are moving on with their careers and are still keeping in touch. They represent, together with the other young scientists trained within ENLIGHT, our future inspiration and leadership.

The scientific outcome of PARTNER will be published as a special dedicated issue of the Journal of Radiation research this year, demonstrating the high quality of research that was carried out within the project. We now need to put in place a strategy for the next decade: some ideas were already expressed in Pavia, and in this coming year we will need to choose and define our priorities.

2013 will also be an important year to understand how ENLIGHT can best benefit from the upcoming Horizon 2020 funding scheme of the European Commission.

I am looking forward to seeing you at the annual meeting in MedAustron, Austria in July, where we will discuss these important issues with our usual collaborative spirit.

M Dosanjh

Manjit Dosanjh

HAPPY BIRTHDAY ENLIGHT

MORE THAN A HUNDRED MEMBERS OF ENLIGHT GATHERED AT CNAO IN PAVIA ON SEPTEMBER 15, 2012, TO CELEBRATE THE 10TH ANNIVERSARY OF THE NETWORK

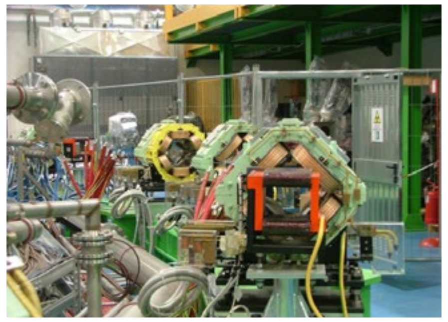
The day started with a series of talks discussing the birth of ENLIGHT, its catalysing role in rallying the major players in hadron therapy in Europe, as well as the challenges that had to be overcome and still lie ahead.

The many talented young researchers had the opportunity to learn how the network came into being through the recollections of two of its founders, Ugo Amaldi (TERA) and Richard Pötter (Medical University of Vienna). Jürgen Debus (University of Heidelberg) outlined the history of the HIT facility, explaining how this pioneering hadron therapy dream became a successful clinical reality.

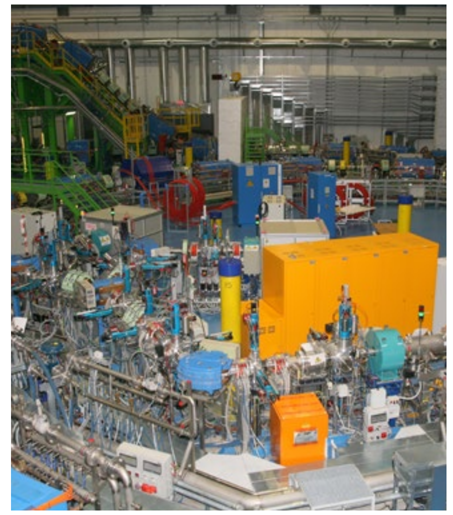
Roberto Orecchia (CNAO) then explained issues related to hadron therapy and evidence based medicine, highlighting how ENLIGHT can help in improving the clinical evidence by establishing well designed clinical trials. Marco Durante (GSI) discussed the future research challenges, emphasising that it will be crucial for ENLIGHT to attract collaborations and funding for innovative technologies and clinical radiobiology research projects. Finally, Bleddyn Jones (Oxford) and Michael Holzscheiter (University of New Mexico and University Hospital Aarhus) reported on the necessity for such an infrastructure and the on-going studies for the implementation of an open access facility for biomedical studies with ion beams, to be established at CERN.

In the afternoon, the participants had the opportunity to visit the synchrotron and treatment rooms of CNAO facility, just one year after the centre began treating patients. Finally, everybody gathered for dinner and a toast in front of the ENLIGHT birthday cake.

After ten years of activity, the ENLIGHT community keeps looking at the future with enthusiasm and a keen interest for new challenges and projects. The ENLIGHT co-ordinator Manjit Dosanjh (CERN) is proud that the collaborative and open-access spirit of the network permeates the projects born under its umbrella. Prime examples are two forthcoming publications: a special issue of the Journal of Radiation Research dedicated to the scientific outcome of the PARTNER project, and a collaborative paper of the ENVISION consortium to be submitted as a Vision 20/20 article for Medical Physics. →



Summarizing the historical perspective, Richard Pötter proposed as a future key task for ENLIGHT, the establishment of a European multicentre hadron therapy collaboration in close collaboration with ESTRO, EORTC and other key stakeholders in radiation oncology. Such an entity would gather under one umbrella the best clinical practices, research and development, together with education and training. He also pointed out that further progress in hadron therapy will come from joint efforts in basic and translational biology, clinical research and physics research, and that young leaders are needed to drive this process forward. Hopefully, the many young and talented participants at the 10th anniversary meeting will rise to the challenge.



FEATURE

CLINICAL PROTOCOLS

Stephanie E. Combs

Department of Radiation Oncology, Heidelberg, Germany

Particle therapy has been in discussion since Robert Wilson first proposed the use of charged particles for tumour therapy in 1946. Since then, the clinical use of protons and heavier ions, mainly carbon ions, has become more widely available. The first clinical evidence was obtained from the treatment of radio-resistant tumours in Berkeley with various ion species. The main advantage of particle beams comes from their physical properties, predominantly the inverted dose profile. This leads to energy-dependent local dose deposition within the treatment volume, and sparing of tissue within the entry channel. The region of high dose deposition is called the Bragg Peak, after the physicist William Henry Bragg. This peak is followed by a steep dose fall-off, sparing tissue behind the target from dose deposition. Thus, a significant reduction of integral dose can be achieved compared to photons. Additionally, heavier charged particles, such as carbon or oxygen ions, are associated with an increased relative biological effectiveness (RBE), while the RBE of protons is commonly accepted to be about 1.1.

To date carbon ion radiotherapy is available in only a few centres worldwide, mainly in Japan, and two centres in Europe (CNAO, Pavia, Italy, and HIT, Heidelberg, Germany).

The availability of proton therapy is higher with more treating centres in the United States, Asia, and a few in Europe. Most clinical data has been reported as smaller series within Phase I/II trials, or retrospectively assembled data from patient subgroups. The only large randomized trial comparing protons to photons was performed in patients with prostate cancer, where proton therapy was applied as a boost in the experimental arm; the results confirmed a benefit in terms of biochemical progression-free survival. Compared to the standard treatment arm, toxicity was not significantly higher. However, photon techniques have improved over time, and dose escalation concepts are now also possible with photons using Intensity Modulated Radiotherapy (IMRT) in combination with Image-Guided Radiotherapy (IGRT) approaches. Perhaps comparable results can be achieved with modern photon treatments, and therefore randomized trials with these approaches should be considered.

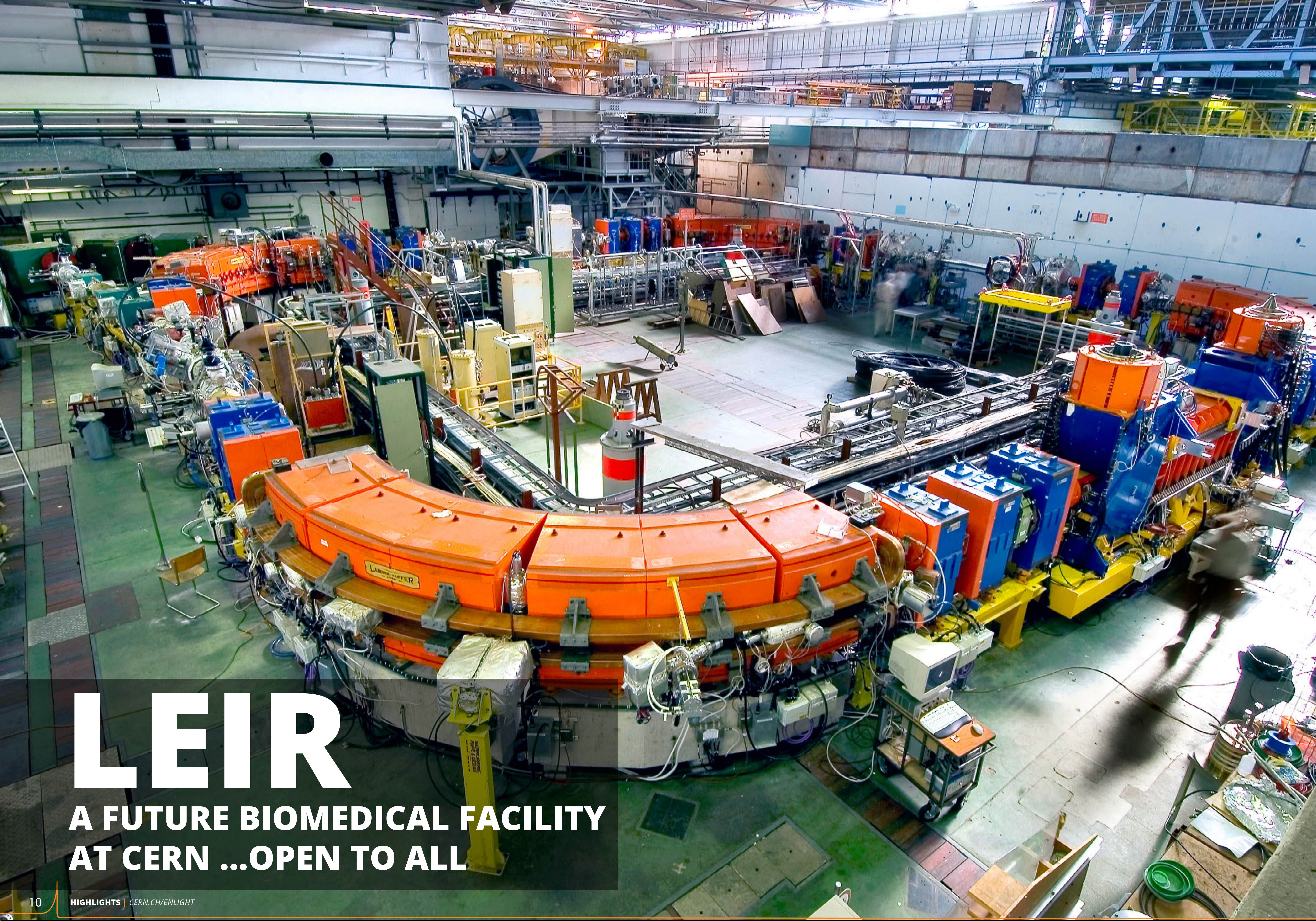
In the meantime, the cost of particle treatments remains a multiple of that of photon radiotherapy. This is of course due to the necessary size of structures and the complexity of technology required, and the resulting investment cost; additionally, capacity for treatment is still limited. In this context current discussions focus on indications for particle therapy. Therefore, besides technical improvements and developments to make particle therapy more affordable and widely available, four main clinical foci are of importance:

- Particle therapy should be integrated into modern multimodal approaches and should not be considered a stand-alone treatment. Comparison with systemic treatment, surgery, and combined approaches should be addressed.
- Radiobiology should be further looked at, and some aspects regarding patient- and tumor-specific RBE for protons and heavier ions alike should be revisited.
- Clinical trials should aim at comparing protons, carbon ions and advanced photon techniques for selected tumour indications.
- For future individualized treatment, a challenge will be the identification of prognostic markers, i.e. molecular characteristics, imaging properties or normal tissue qualities.

To bring together the expertise of various researchers of all stages, including the fields of biology, physics and medicine, and to educate newcomers into the field through dissemination of knowledge, joint European structures were generated as a platform to incorporate protons and heavier ions into modern radiation oncology concepts.

Within the EU-Funded projects and beyond, particle therapy has been brought forward, pre-clinically, and especially clinically. Through uptake of patient treatment at HIT in 2009, and at CNAO in 2011, more patients have been granted access to particle therapy. By December 2012, over 1200 patients have been treated at HIT with protons and carbon ions. Access for European patients, outside and within the ULICE project, has been implemented, successfully providing transnational access.

At HIT, 12 clinical trials are recruiting for various clinical indications. A pure ULICE-generated trial commonly designed and set up according to the prospected ULICE-workflow is the PANDORA-01 trial on recurrent rectal cancer, which started recruitment in December 2012 after full approval of all relevant authorities in Germany and in Italy, as well as a joint-French-German trial.



LEIR

A FUTURE BIOMEDICAL FACILITY AT CERN ...OPEN TO ALL

RADIATION ONCOLOGY AND RADIOBIOLOGY PERSPECTIVE

BLEDDYN JONES
UNIVERSITY OF OXFORD

The treatment of cancer by radiation needs further improvement, better long term prospects of 'uncomplicated' cure, maintaining quality of life and the ability to contribute to society. Positively charged particles (PCP) are attractive for such a role, because of their impressive spatial dose distributions, substantially reducing collateral dose to normal tissues unaffected by cancer compared to conventional x-ray based therapy. Despite the appeal of these physical advantages, PCP therapy retains two major problems which require intensive research:

- the accuracy of dose placement in the body, with its complex density heterogeneities and their changes with time, for different ion species,
- the ultimate biological (and medical) effect given that PCP`s have a higher biological cell killing efficiency per unit dose, reflected in their measured relative biological effect (RBE).

Radiotherapy dose has to be given to a 2% tolerance, with further permitted variation in dose range to target volumes of interest (-5% to +7%). Since RBE is used to determine the actual PCP dose given to a patient, RBE must ideally be known to an accuracy approaching that of physical dose. RBE must also be adjusted to match the dose received in all tissues, because of an inverse relationship that depends on tissue type, and which is not used, for example, in proton therapy.

RBE depends on multiple factors:

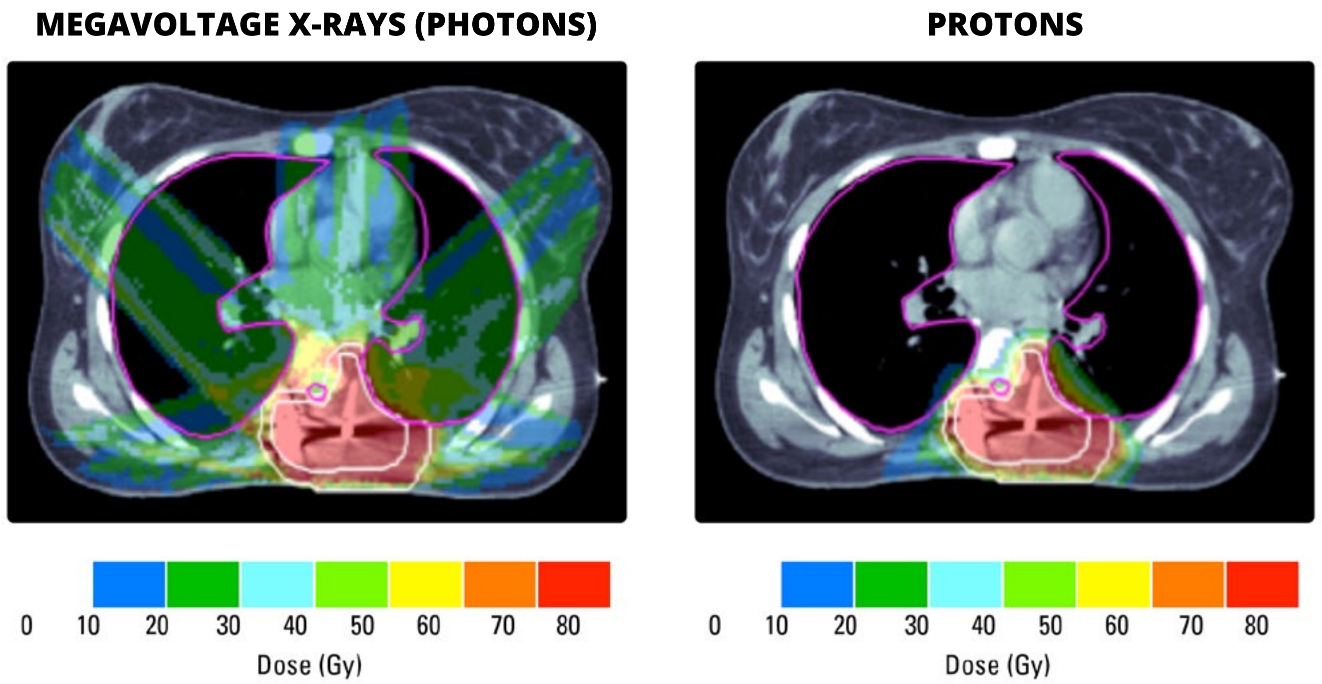
- particle mass, charge, energy (and tissue depth), linear energy transfer (LET),
- dose and treatment volume
- biological properties of the tissue/tumour, especially radiation repair capacity and cellular proliferation status.

The RBE uncertainty, often as large as 10-20% or more, could over-ride a physical dose advantage. If dose placement is also uncertain, then the combined effect of RBE and dose uncertainty can be a cause of concern - and sufficient to produce disappointing clinical outcomes.

A CERN based facility, available for some 9-10 months of the year, would offer unparalleled time for research. Until now, research with PCPs has used limited time in particle physics laboratories or hospital facilities, often 1-2% of total time.

Experiments were often done with suboptimal ranges of particles, energies, limited ranges of and often inappropriate cell types. Most of the older literature has survived as hand drawn graphics, many without statistical error limits. Recent data-mining shows very heterogenous results, making it difficult to conclude about certain relationships between physics and biology, such as between linear energy transfer (LET), RBE and their oxygen dependency for different ions: do cells follow unique relationships, or can they be generalised or predicted from measurable intrinsic biological properties?

By sharing the resources of CERN, the international community can tackle these important issues better, faster and at reduced cost.



Dose distributions displayed on a CT scan of a female patient who has had incomplete surgery for a paravertebral epithelioid sarcoma. The proton 'dose' shown is calculated using an RBE conversion factor of 1.1. (the equivalent x-ray dose divided by 1.1). The required 76 Gy dose to the target volume is achieved in both cases, but the proton plan spares the heart, a considerable volume of lung, and breast tissue, so reducing the later risk of breathlessness on exertion, sudden death and of radiation induced breast cancer. Despite these attractive features, what if the RBE used in the dose calculation is higher than that of the tumour and lower than that of the spinal cord (the small ringed area close to the high dose volume)? Then, there would be enhanced risks of both tumour recurrence and spinal damage (resulting in paralysis of the lower limbs) compared with the x-ray based treatment.

Courtesy of Massachusetts General Hospital

A MUCH NEEDED ACCELERATOR FACILITY FOR RADIOBIOLOGICAL EXPERIMENTS

MICHAEL HOLZSCHEITER
UNIVERSITY OF NEW MEXICO
AND UNIVERSITY HOSPITAL AARHUS

To move the development of particle beam cancer therapy forward and to enable this technique to exploit its fullest potential, a dedicated research facility is needed. The core of the facility, the accelerator, should be able to provide a range of particles from protons up to at least neon (but not all ions in this range would be necessary) at energies from a few MeV up to energies appropriate for therapeutic use (at least for ions up to oxygen). Including space research questions, research in fundamental dosimetry, and radiobiology topics such as track structure theory would call for an even extended mass range up to iron.

For novel treatment strategies to overcome radioresistance of cancer cells now being discussed (i.e. LET painting), rapid switching between ion species would be highly desirable. To allow studies on modern beam delivery mechanism it should be possible to change the energy rapidly, preferably from one spill to the next. And these energy changes should be accommodated in the accelerator and not be achieved by passive scattering systems, which would introduce undesireable changes in the fragmentation spectra due to the degrading process.

The beam delivered to the experimental stations should be well characterized in terms of intensity, energy spread, and beam profile to allow absolute dosimetry at a level of accuracy needed to discriminate between different models. This will necessitate research and development on advanced detector systems currently not available in hadon therapy installations. Pencil beams are the first choice for most researchers, and small spot sizes with sharp penumbras will facilitate studies of out-of-field effects. To cover target volumes of sizes comparable to typical tumours, active beam steering would again be preferred over passive scattering. A majority of studies can be performed with a horizontal beam, but some experiments on cell cultures, especially at lower energies, would highly benefit from the availability of a vertical beam line.

Having two separate beam lines, shielded from each other in order to allow uninterrupted access for setting up experiments at one beam line while the other end station is actively collecting data, would allow utilizing the accelerator at full capacity. And even with the close proximity of medical and bio-molecular research facilities at the University of Geneva a dedicated bio-laboratory for preparation and initial analysis of samples needs to be co-located with the experimental facility.

BRAIN-STORMING FOR LEIR-BIOMEDICAL FACILITY

STEVE MYERS
CERN

One of the key outcomes of the "Physics for Health" workshop was the need for a biomedical research facility to be established at CERN which would be made available to the international scientific community. The facility should provide particle beams of different types and energies to external users interested in radiobiology fragmentation studies and detector development.

Recently, a brainstorming meeting took place at CERN to evaluate the possibility of modifying the "Low Energy Ion Ring" (LEIR) to provide beams for this biomedical research facility.

We are studying the possibility of using the LEIR accelerator, since it is well suited to be converted into a facility providing a range of ions and energies both for radiobiology and for detector developments, and it is only used for LHC operation for part of the year". By using the existing know-how and infrastructures available at CERN in accelerator-related technologies, together with the expertise in biology and medicine, this facility could create a European-wide platform for integrating and producing knowledge that is highly needed worldwide. This would allow experiments to be performed that are crucial for further understanding and development not only in the field of hadron therapy but also for risk estimation of ion exposure. To ensure and guarantee that beam time will be granted to the most meaningful requests, an International Scientific Committee would be formed to oversee the allocated beam time to the proposed experiments.

CERN is already renowned for offering opportunities for collaborations and multi-disciplinary training. Researchers coming to work at the LEIR Biomedical facility will benefit from the existing knowledge at CERN in accelerator physics and experimental techniques. In addition the general infrastructure for hosting researchers already exists at CERN for both shorter and longer stays. In summary, a biology laboratory at CERN will have many unique features and will allow researchers to study in parallel many different biological end points for different ions and energies.

FEATURE

PARTNER'S FAREWELL

PARTNER, the Particle Training Network for European Radiotherapy, was launched in 2008 with the support of the European Commission. Its scope was to train young researchers in hadron therapy and, in doing so, aid the battle against cancer. Last week, a meeting in Pavia (Italy) celebrated the end of the project and its numerous accomplishments.

PARTNER was funded by the European Commission (within the FP7 framework) with a budget of 5.6 million euros, and involved ten institutes and two private companies from around Europe. The project has helped to train a new generation of highly specialised professionals in hadron therapy, a field that is truly multidisciplinary. The 29 Marie Curie researchers, who all came from different backgrounds, had the opportunity to be trained in a wide range of subjects, such as physics, medicine, radiobiology and information technology. The latest results from some of their research projects will be collected and published in a special issue of the Journal of Radiation Research later this year.

Between training courses, scientific conferences and general meetings, the PARTNER researchers had a travel-intensive life. Some of them calculated that they had accumulated over 80,000 km of globetrotting over their years with the project.

"PARTNER was truly a huge success for training," says Manjit Dosanjh, life sciences advisor at CERN and PARTNER Co-ordinator. "Several of our young researchers have received prizes and awards for their outstanding research. The PhD theses and publications that they produced while with PARTNER will be very important for their future careers." Indeed, for many of them a bright career has already started in various institutes and hospitals involved in hadron therapy around the world.

PARTNER had a further positive, but unexpected, outcome: not only have the researchers become highly educated professionals, but also close friends. "The ties they built during the project will live on.

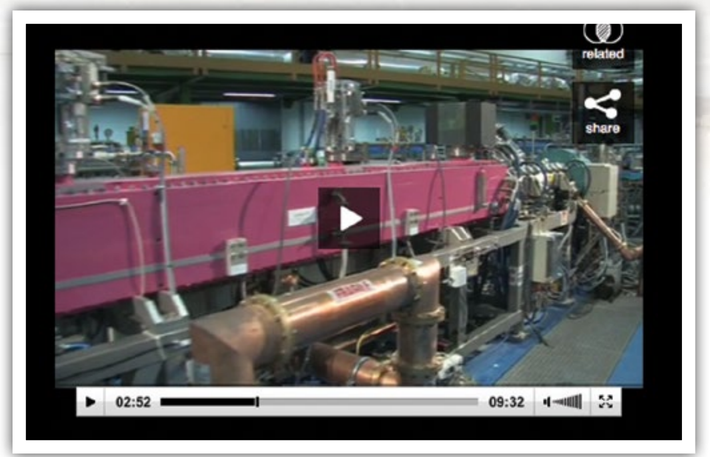
This network will be an invaluable asset for their own future as well as that of the community of hadron therapy experts," says Manjit Dosanjh. "Emotions were running high at this last meeting in Pavia. These young people have been spending weeks together in full-immersion courses and networking events, so it is no wonder that they feel part of a large multicultural, multilingual and multidisciplinary family."

Antonella Del Rosso, CERN

This article was originally published in the CERN Bulletin

PARTNER

MARIE CURIE



WATCH OUR VIDEO OVER AT : HTTP://CDS.CERN.CH/RECORD/1477924

PARTNER is funded by the European Commission under Grant Agreement 215840

PONTE COPERTO, PAVIA, ITALY

IMPRESSIONS

im·pres·sion (ĭm-prĕsh′ən)

n.- An effect, a feeling, or an image retained as a consequence of experience.

JUN –ETSU MIZOE

DIRECTOR
NAGOYA PROTON THERAPY CENTER
NAGOYA CITY WEST MEDICAL CENTER

Working in CNAO for two years during its early days (from January 2010 to December 2011) was a very exciting experience for me. My presence in CNAO also helped to strengthen the collaboration between Japan and CNAO in training the PARTNER researchers.

The original CNAO clinical protocols, and those that followed, were created referring to those from PSI and NIRS. In particular, the translation of NIRS protocols from Japanese to English for CNAO and the free use of them should be very helpful in the future for other institutions to adapt and create their own protocols.

The review board of clinical protocols gave a lot of good and important advice which was highly advantageous and useful for the CNAO clinical studies. There were nearly 20 patients referred from CNAO, who were then treated with carbon ions at NIRS. This was an important opportunity for the CNAO medical staff to make the follow-up studies of these patients, and helped them to gain experience in the follow-up course of carbon ion radiotherapy for various refractory tumours by observing the progress of the patients which had been treated at NIRS.

Even if there was some delay in schedule, the passion and the enthusiasm of CNAO scientists finally resulted in the start of proton therapy in October 2011 and carbon therapy in November 2012. In particular, I felt a strong admiration for their concentration and effort in the double-shift work which they carried out in order to catch up with the previously planned schedule.
In addition, we had a fruitful exchange program with the fresh two new doctors coming from Singapore and India as a part of the PARTNER project and the training of the CNAO personnel. Their research will be very meaningful for the future of particle radiotherapy in CNAO and EU. In the same way, I was intrigued by the future plans of CNAO gantry system and IGPT, showing the magnitude of the activity foreseen by CNAO. Both of these tools will be essential for systems not only for CNAO but also for the world's particle radiotherapy in future. I look forward to our future research and continued collaboration.

I returned to Japan, and I now work for the proton therapy centre in Nagoya since April 2012. It is dedicated exclusively to proton therapy, and the first spot scanning system in Japan has been installed at Nagoya. I believe that the technology of spot scanning and IMPT will be a necessary requirement to show a clear evidence for the advantage of particle beam therapy in the future. We are hoping, if possible, in future collaborations in many fields, such as medicine and physics, with the various facilities in Europe, including CNAO.

ANURITA SRIVASTAVA

PARTNER EXPERIENCED RESEARCHER
FONDAZIONE CNAO

I come from India and have been trained as a radiation oncologist. I joined the PARTNER project as an experienced researcher and was stationed at Fondazione CNAO in Italy. This was my first visit outside of my own country and so working here was not only a change of professional environment, but an entirely new life experience itself.

I had left my family including my 3 year old daughter back home when I undertook this venture. So I was feeling miserable and very lonely when I arrived in Milan. Gradually I got used to the new place and people and settled down. Once I got accustomed to the grey skies, rain, cold temperatures and the language, life became relatively easy. My colleagues were all very cordial and welcoming and it was great to form new friendships once the language barrier was broken.

Coming from a background of photon therapy, transition to particle beam therapy was not easy. There was a lot that I needed to learn about this new technology and most of the time was spent trying to pick up the basics as well as the nuances of particle beam therapy by observing the work at CNAO and asking a lot of questions to the physicians, physicists and engineers. The Fondazione CNAO had not initiated clinical activity at that time, so I had the unique opportunity to learn first hand about the potential problems that might be encountered when starting afresh with particle beam therapy.

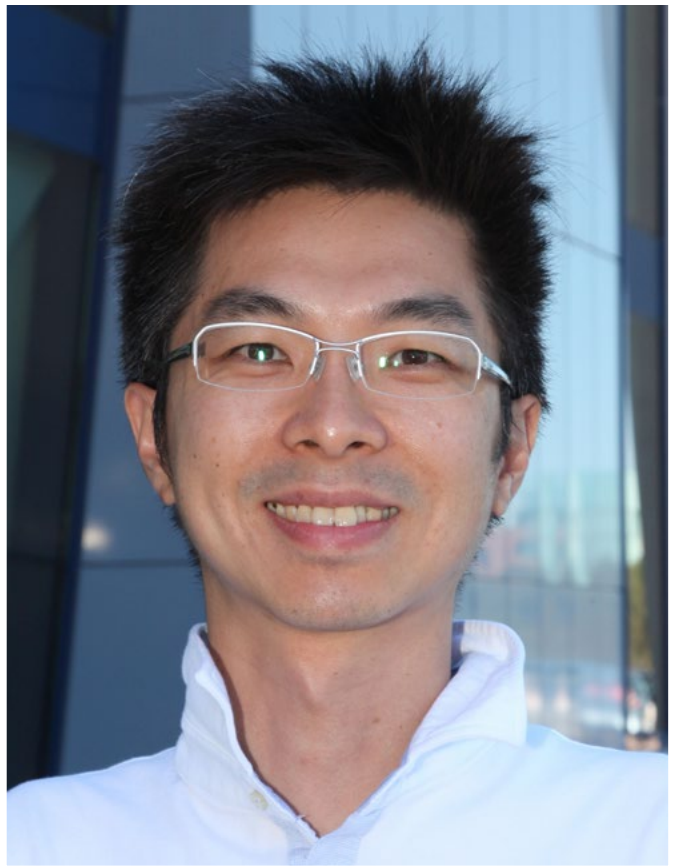
Once clinical activity started at CNAO the learning curve briskly accelerated and most things that were difficult to grasp by just reading were easily understood. I had some reservations when I had first started as to the benefits of this technology, but by the time I neared completion of the project my doubts and reservations were all gone and I realised the immense potential that lies within particle beam therapy for cancer treatments.

Another major change for me was to interact with so many people who work behind the scenes before the treatment itself reaches the patient. The credit for this unique experience goes to the PARTNER project, and the way it was conceived. It was truly stimulating to learn from radiobiologists, software engineers, gantry engineers and physicists in an informal environment, because they were all my fellow researchers. Attending the numerous courses and conferences over the span of two years I learnt a lot and managed to meet some of the stalwarts of the field of radiation oncology.

Last but not the least, I would like to extend my heartfelt thanks to Prof Roberto Orecchia and Prof Manjit Dosanjh for all the help and guidance at each occasion. I am truly indebted to PARTNER for the enriching experience and the amazing training and teaching along with the excellent networking opportunities that I now have.

JEFFREY TUAN

PARTNER EXPERIENCED RESEARCHER
FONDAZIONE CNAO



In October 2010, I came to Pavia, Italy as a researcher within the PARTNER project. Despite not knowing much about this new technology called hadrontherapy (particle therapy) or Pavia, I had thought that it would be easy to adapt to life in Italy after having previously spent 2 years in London, UK. We had enjoyed our time in London and were very excited to move back to Europe. Therefore, I packed my bags, left my job (as a radiation oncologist) and family in sunny and humid Singapore and arrived in Pavia in the cool and foggy pavese autumn.

The first weeks were difficult as I knew very little Italian and conversely; the people in Pavia very little English. However, with the help of people at my new workplace Fondazione CNAO; especially Eliana Tosca and Cristina Bono, I settled down quickly to routine life in Pavia. Two months later, my family of three (wife, baby girl and dog) joined me in Pavia in December. We found a nice apartment within walking distance of work and downtown Pavia and celebrated our first white Christmas in Pavia with a meal at midnight in our friendly neighbour's home. Before long, we were enjoying la dolce vita in Italy.

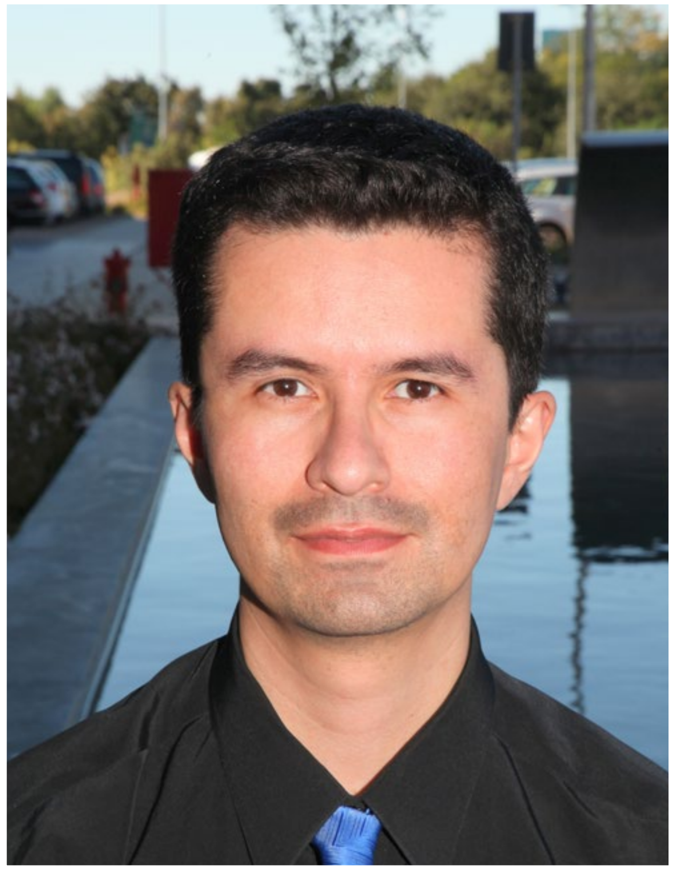
There were many things to learn at work in CNAO about this new technology (hadrons; protons and carbon ions) as well as life, history, customs and (most importantly!) food in Italy. As part of the initial training network, training courses were arranged in many centres throughout Europe; the first being in Vienna in winter! In Vienna I met Manjit Dosanjh, the project coordinator, and other fellow researchers for the first time (at the airport) and was quickly and warmly welcomed into the big family with a nice cuppa at a local Austrian café with stunning views of Stephansdom. The 2 years passed quickly amidst more training courses (PARTNER and others - ULICE, ENVISION etc.), preparatory work for the first patients to be treated at CNAO and (occasional) holidays with the family both within and outside of Italy.

As a result of the dedication of the doctors, physicists, engineers and others, the first patient was treated with protons in CNAO in September 2011. This success was the direct result of a culmination of work done over the last 20 years involving well-known names in the field like Roberto Orecchia, Sandro Rossi, Junetsu Mizoe and Ugo Amaldi (to name a few). It was a proud moment for all of Italy and the particle therapy community when this first patient was successfully treated for a skull base chondrosarcoma with no side effects. Since then, CNAO has now moved on to successfully treat over 40 patients with protons and have started the first patients with carbon ions.

I was fortunate to be part of this initiative and have learnt a lot from my time in CNAO. I now bring back this invaluable experience (and network of new friends) to my centre in Singapore. Here we have plans for the first (also in South East Asia) proton therapy centre in the next 5 years when the National Cancer Centre Singapore moves to its new and bigger location. This will greatly complement our existing radiation oncology services (with 10 state of the art linear accelerators) in cancer treatment for the benefit of our patients.

JHONNATAN OSORIO MORENO

PARTNER EARLY STAGE RESEARCHER
FONDAZIONE CNAO



I said to myself the first day when I moved to Italy to participate in the partner project: "In these suitcases there is at least the half of my life and here I am, starting from the beginning". It was my first time abroad, far from my family and I was a stranger in a foreign country, although the CNAO Foundation staff provided me all the support to make this new life transition easy and smooth.

In Colombia where I'm from, the conventional photon radiotherapy is a well-established therapy technique. This is what I had studied in my MsC, but after the presentation on hadrontherapy that I gave to my colleagues during a seminar, I was impressed by the huge therapy improvements offered by the hadronthrepy and by the complexity of the technology behind the treatment. So I was inspired to learn more about it and to broaden my professional horizons.

Currently I am working at CNAO on a new project for the development and design of the new CNAO experimental room. The opportunity that the partner project provided me really changed my life. Being part of a multi-disciplinary team opened my mind and taught me the importance of working together to reach a common goal. The cooperation with the other Early Stage Researchers (ESR) colleagues and friends was beyond what I could have imagined. The real scientific collaboration network was established during and after the PARTNER project. For example, Walter Tingarelli (now working in Japan) has shared with me very useful information about some experiments in radiobiology.

It was a fascinating experience to be involved in this project which offered me the possibility to work in a hadrontherapy facility and to interact with scientific staff and be part of a cooperative multi-disciplinary team. I remember well Mr. Rossi's happy face and Mr. Pullia's words: "We've done it!" after the first treatment with proton beam at CNAO. I remember also many grateful letters coming from the first patients treated at CNAO. In moments like these I feel very proud to have been part of a great team and very satisfied to see the results of our work.

The Partner Project was more than a job for me, it was a scientific family that provided a set of tools which helped me to become a better researcher in my field. For this and for many things which I have no time to mention here, I have to thank the project coordinator Ms. Manjit Dosanjh.

In conclusion, I would like to thank the CNAO foundation and PARTNER project for this unique experience.

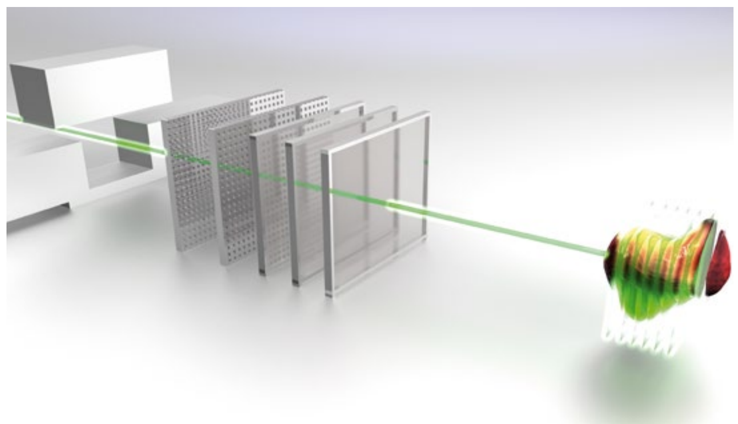
FOCUS ON...

ULICE

WATCH OUR VIDEO

Following up from the last issue of Highlights, a video on transnational access has been produced.

WATCH OUR VIDEO OVER AT : HTTP://CDS.CERN.CH/RECORD/1475404



ULICE is co-funded by the European Commission within the Framework Programme 7 Capacities Specific Programme, under Grant Agreement 228436

FOCUS ON...
ENTERVISION

COMMUNICATION, LEADERSHIP AND TEAMWORK FOR RESEARCHERS

14 ENTERVISION researchers from all over Europe gathered on a cold Monday morning in Guildford. Along with the buzz of excitement there was also a sense of weariness amongst the hard working academics. Of all the skills they felt they were missing in their working life; communication, leadership and teamwork were not on the priority list for most of the participants. Communication skills, leadership development and team working were however, the top of our priority list; as briefed by Manjit Dosanjh, the project coordinator, and Raj Jena, the course organiser.

Our task was to entice exceedingly smart people, to reveal their weaknesses, admit to their strengths, suspend their disbelief and take a lot of risks in the name of improved collaboration and leadership. We did this through team activities, such as manufacturing 'Mega Notepads', creating a team identity, and fulfilling 'The Water Contract'. The tasks on the 5 days get increasingly more difficult, and interpersonal skills are essential to the teams' success.

During the team activities we asked the participants to reflect on John Adair's 'Action Centred Leadership', which gives leaders a framework of 11 things that need to be practised across three areas: achieving the task, building and maintaining the team and developing the individual. This framework is very much about what the leader does and can really boost the confidence of a novice leader or a reluctant leader. So having established a list of 'what' the leaders do, we can ask the question of 'how?' they can do it.

We look to Nancy Kline's 'Thinking Environment' for ideas on how a team and a leader can achieve the culture they want for excellence in thinking and collaboration. Nancy Kline has observed that the quality of our thinking depends on the way we treat each other. To learn 'Thinking Environment' skills, the participants practised, for example: listening in pairs, for five minutes each way without interruption, and the 'go-around', which makes sure everyone has spoken before a free discussion begins.

The two processes we train have particular functions:

1. ***Thinking in pairs*** *gives participants the chance to reflect before they say what they think. If a group of 12 are all thinking in pairs to deepen their understanding and to be creative about their subject, it makes the subsequent discussion and output noticeably richer and more efficient.*

2. ***A go-around*** *makes sure everyone gets a turn to speak before a debate or a discussion begins; this help create a variety of opinion and a sense of equality.*

More recently, we have added the 'SCARF Model' to our repertoire. The 'SCARF Model' is the work of David Rock of The NeuroLeadership Institute, and he among others is looking at neuroscience to help people work well together. SCARF stands for: S – Status, C- Certainty, A-Autonomy, R-Relatedness, F-Fairness; and these categories are aspects that human beings will strongly avoid the loss of, and feel rewarded when they are moving towards them. When humans are avoiding losses, they perform less well than when they are moving towards a goal.

With the help of the three theories I have mentioned above, the leadership and dedication of Manjit Dosanjh, and the enthusiasm and commitment of the researchers, we were able to focus on interpersonal skills. We were very excited to see the ENTERVISION teams build and move all their water in less than five minutes when the average is around 12 minutes. We were also glad to hear how the topics we presented are now higher up the priority list than they were before the course started.

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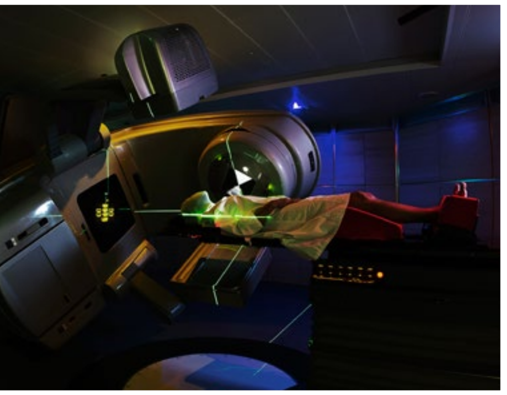
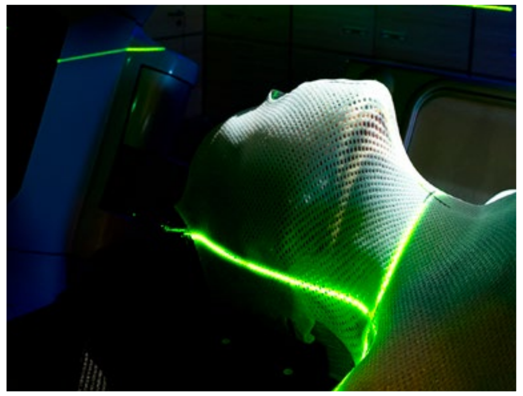
MARIE CURIE ACTIONS

ENTERVISION is funded by the European Commission under the FP7 Grant Agreement 264552.





FOCUS ON...

ENVISION

FROM ENVISION TO PROVISION

A clear "vision" of the target has always been a crucial requirement for the successful eradication of malignant tumour diseases with minimal harm to healthy tissue. In the irradiation of deep-seated tumours with external beam radiotherapy, it was recognized that "If you can't see it, you can't hit it, and if you can't hit it, you can't cure it" (Harold Johns). Over the last few years, technology developments have provided external beam radiotherapy machines with a "super-hero" sight for tumour targeting, with X-ray and infra-red combined "vision" systems being applied in daily clinical practice for the verification of patient set-up and the 3-D precise localization of the tumour. However, the tremendous advances in tumour-dose conformality offered by modern radiotherapy techniques have motivated efforts towards an even more ambitious "vision": the imaging of the dose delivered to the patient in-vivo during the irradiation.

This is particularly important for novel radiotherapy modalities relying on ion beams, to allow prompt detection of even small changes in dose deposition with respect to the treatment plan and thus trigger immediate countermeasures to reduce unwanted underdosage of the tumour and/or overdosage of surrounding critical organs.

The FP7 project ENVISION (European NoVel Imaging Systems for ION therapy) tackles the problem of unveiling the invisible ion beam during treatment delivery. To this end, innovative detection techniques are being investigated to demonstrate feasibility and usability of secondary emerging radiation induced by nuclear interactions between the impinging ions and the irradiated tissue. Small-scale prototypes of time-of-flight in-beam PET detectors and prompt gamma imagers with mechanical (collimated cameras) or electronic (Compton cameras) collimation are being realized and tested, supported by the guidance of sophisticated Monte Carlo simulations. Additional research lines within the project address the cutting edge problem of visualizing the dose delivered into a moving target, chased by actively scanned ion beams, as well as the feedback of in-vivo imaging into the treatment planning system for supporting adaptive treatment strategies. There is no doubt that the results of ENVISION will deliver prototype solutions for novel in-vivo quality assurance strategies in ion beam therapy.

In a new era of image guidance and biological tumour profiling, the merging of novel in-vivo dose monitoring techniques with new means of morphological and biological "vision" of the tumour over the entire course of therapy, from the initial staging to the treatment planning and delivery, appears essential. This combination is believed to be the key advance to tackle those rare malignancies, such as glioblastoma and exocrine pancreatic adenocarcinoma, which still exhibit a dismal prognosis and represent a heavy societal burden within the European Union. Therefore, the consortium has put forward a new project application PROVision (Particle Radiation Imaging Optimisation for Glioblastoma and Exocrine Pancreatic Cancer). This is a clinically led translational research project aiming to combine several imaging technologies (ENVISION results, MRI, ultrasound and optical imaging, PET) and clinical workflows into an integrated technological/methodological platform. Owing to the leading role of SMEs in the project, the expected result is a commercial prototype that combines multiple imaging modalities, with special emphasis on molecular imaging and biomarkers, concurring to increase the quality of tumour delineation and staging, targeting and post-treatment follow-up. The prototype will be tested by medical doctors for personalized treatment effectiveness, increase of patient life-expectancy, quality of life and usability in the clinical environment. PROVision will further increase our "vision" of the enemy and improve our ability to localize and hit the tumour, with an expected positive impact on therapeutic outcomes due to higher target coverage, more effective sparing of surrounding radio-sensitive structures and dose escalation potentialities, in the framework of a personalized adaptive radiotherapy treatment course.

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JANUARY

10 — **ENVISION ANNUAL MEETING**

11 — **ENTERVISION MID TERM REVIEW**

FEBRUARY

21-24 — **ICRSH 2013 - 1ST ANNUAL CONFERENCE OF THE ROMANIAN SOCIETY OF HADRONTHERAPY**

PREDEAL, ROMANIA
WWW.ICRSH.RO

JUNE

2-8 — **PTCOG**

ESSEN, GERMANY

23-27 — **ANIMMA 2013 - INTERNATIONAL CONFERENCE ON ADVANCEMENTS IN NUCLEAR INSTRUMENTATION, MEASUREMENT METHODS AND THEIR APPLICATIONS**

MARSEILLE, PALAIS DES CONGRÈS
WWW.ANIMMA.COM

JULY

12-14 — **ENLIGHT ANNUAL MEETING & ULICE FINAL MEETING**

MEDAUSTRON, AUSTRIA

AUGUST

25-29 — **PARTICLE RADIOSURGERY: A NEW FRONTIER OF PHYSICS IN MEDICINE**

UNIVERSITÄTSZENTRUM OBERGURGL, OBERGURGL, AUSTRIA