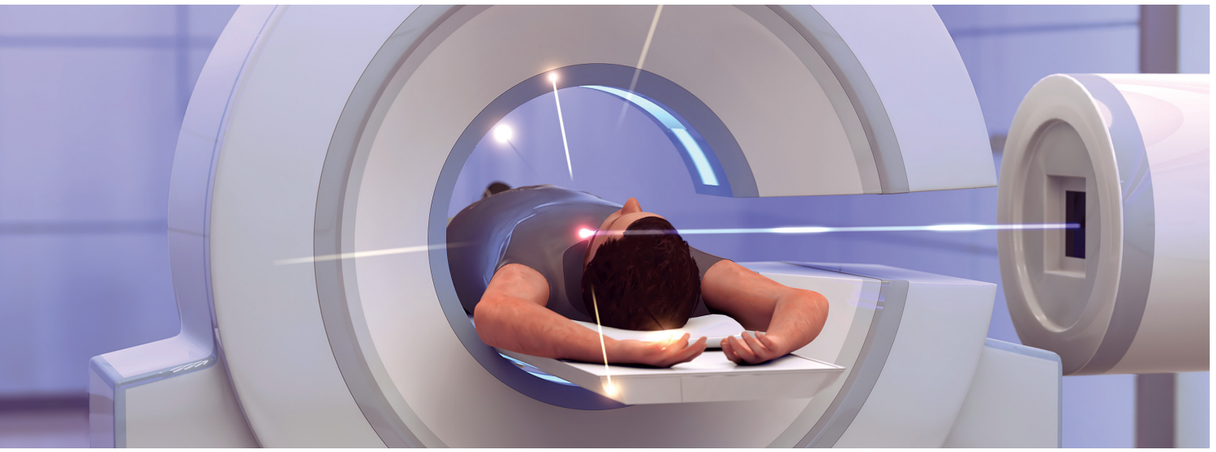
HIGHLIGHTS

January 2014

ENLIGHT



ENLIGHT COORDINATOR
Manjit Dosanjh

ENLIGHT COORDINATION OFFICE
Audrey Ballantine
Manuela Cirilli
Helen Dixon-Altaber
Ilias Floros
Sparsh Navin
Elena Mirabela Puianu
Iustin Tudosescu

PHOTO CREDITS
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For more information and contact details please visit the ENLIGHT website - enlight.web.cern.ch

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Credit: Nathalie Hospital for ENLIGHT

FROM THE ENLIGHT COORDINATOR

FROM PIONEERING TO STATE-OF-THE-ART

The year 2014 marks the 60th anniversary of the first proton therapy treatment of a cancer patient in Berkeley. The upcoming ICTR-PHE conference in Geneva will be an occasion for our community to celebrate these first six decades of hadron therapy with many of its pioneers from different fields.
In particular, we will have the privilege of listening to Ellie Blakely, whose early radiobiological research supported the hadron therapy programme at Berkeley Lab, and to Ugo Amaldi, who will give a public lecture on one of his most cherished topics: "Physics is beautiful and useful". 2014 marks also an important round birthday for him, and I do hope that many of you will come to celebrate this occasion.
This year will also see two more of our projects, ULICE and ENVISION, coming to the end of their brilliant research and infrastructure programmes. With the first calls for Horizon 2020 coming out, we must rally to submit proposals and obtain funds to pursue our goals: hadron therapy has made remarkable steps forward in the last two decades, but more efforts are needed to turn it into an economically viable and clinically proven method.
We will discuss these topics again at our annual ENLIGHT meeting. It just so happens that 2014 is also the 60th anniversary of CERN, and so it seemed fitting to bring the ENLIGHT community back to where we all gathered in 2002 to launch the network. It will be a pleasure to welcome you at CERN in July 2014.

Manjit Dosanjh

ENLIGHT
Annual Meeting 2013

On 12th July 2013, around 100 members of the ENLIGHT network (European Network for Light Ion Hadron Therapy) met at MedAustron in Wiener Neustadt, Austria to discuss the progress of ULICE.

The ULICE (Union of Light Ion Centres in Europe) EC-cofunded project was launched in 2009 to respond to the need for sharing the clinical experience and the complex technical aspects of hadron-therapy treatment in Europe. During this year's meeting Roberto Orecchia, the project coordinator from CNAO, Pavia, Italy was pleased to announce that, after four successful years of activity the project would now continue for another year, offering the available beamtime, thanks to an extension from the European Commission.

Up until a few years ago, the landscape of hadron-therapy in Europe was booming in a localised way and facilities were being built without a common and shared approach. EC-cofunded projects such as ULICE, PARTNER, ENVISION and ENTERVISION contributed towards building a unified platform where the different – private and public – stakeholders share their views and practical experience in the field.

Today, although some of the mentioned projects are over, their legacy stays and becomes the ground for new projects. One of the achievements of the ULICE programme is to provide patients and their referring physicians, as well as researchers, with free access to hadron beams at particle treatment facilities available across Europe. "Existing facilities in Heidelberg and CNAO have agreed to provide a total of 691 hours of beamtime for research and clinical activity, after judging applications on scientific quality and clinical relevance." says Manjit Dosanjh, in charge of life sciences at CERN and CERN representative in the ULICE consortium. "The clear benefit of such an activity has prompted the European Commission to extend the ULICE project by 12 months to the end of August 2014."

The extended beamtime is an important acknowledgement to the whole hadron-therapy community in Europe. Specialized centres for the treatment of tumours are acquiring precious experience, which is being shared by all the involved experts, thus remarkably benefiting patients. New centres, such as MedAustron in Austria, are also important stakeholders in this process. The successful ideas, such as ULICE's transnational access, will be implemented also in new facilities like ours," says Ramona Mayer, Medical Director at MedAustron. "Our centre is approaching the operational phase and thus we will benefit a lot from the experience of four former PARTNER researchers to provide the best possible treatment for our future patients."

Thanks to the initiative by Ramona Mayer, the meeting also provided the opportunity for young researchers from multiple disciplines to present their work to the ENLIGHT community and 4 of them being awarded with a prize for their efforts. This shows not only the important role which projects like ULICE play in training the next generation of experts, but also the importance of the network which gives future experts the chance to meet and benefit from the knowledge of the experts of today.

This article was originally published in CERN's Bulletin

http://cds.cern.ch/record/1595293?ln=en

ENTERVISIONERS AT EUROPEAN RESEARCHERS' NIGHT AND CERN OPEN DAYS

On Friday 27th September 2013, ENTERVISION researchers came to CERN's Globe of Science and Innovation to take part in Origins 2013, a European Researchers' Night event. Along with researchers from other projects they spent the evening "speed-dating" to show the human face of research to the general public. They were then able to take part in the CERN Open Days which followed and in particular participating in CERN's Knowledge Transfer exhibition "Technologies that change your life". Here they share some of their impressions.

The researchers' night was a pleasant face to face meeting with the visitors in a relaxed atmosphere. I think that the visitors enjoyed speaking to the researchers and asking questions, and we researchers enjoyed having such interested listeners. Nevertheless, some questions were really difficult to answer, especially those made by teenagers... What happened before the Big Bang? How big is the universe? Well, curiosity is the motor of science....

The Open Days were a nice opportunity to transmit the applications of science and physics to society, to the general public and help to reduce the distance between scientific institutions like CERN and the rest of the society. Visitors of many countries passed through the "Knowledge Transfer" stand and asked about hadrontherapy in several languages. I liked the real interest of many people, eager to know new things and ask questions, learn and understand as much as possible when hearing our answers. Most of them were surprised about the potential of hadrontherapy, thanked us and encouraged us to work further in our respective research projects and reach our goals. That was a really nice feedback and energy input for us. Let us work hard and not disappoint their hope!

Fernando Hueso González

Although volunteering at the CERN Researchers' Night and Open Days was hard work - being a scientist I normally don't spend all day on my feet almost constantly talking, sometimes in languages I hardly speak - it was very rewarding to get to meet so many people from the public and tell them about why our research field matters. Many of the visitors seemed genuinely interested and the atmosphere among volunteers at different stands was great; when you had few seconds to dislodge your jaw you could always learn something interesting from your neighbours.

This said, the highlight of the weekend was still when, on our (not so) free afternoon, we heard that there were spare tickets and we managed to slip out for a couple of hours to go down to see the tunnels at Point 6.

The only question the guide couldn't answer was how they could have a seemingly normal toilet when there is no plumbing...

Joakim da Silva

I enjoyed taking part in the researcher's night and the CERN open days. On both days CERN was very busy with people coming from all around the World and I was really surprised to find out how far people had travelled to take part..

It was also very interesting to see the enthusiasm of everyone . One of my proud moments was when I was explaining my project to few people and without realising these few people transformed into a small group. But I also had few bumpy moments especially when I had to try and explain in languages which I am not fluent in, but I was glad to see the eagerness of the attendees to learn.

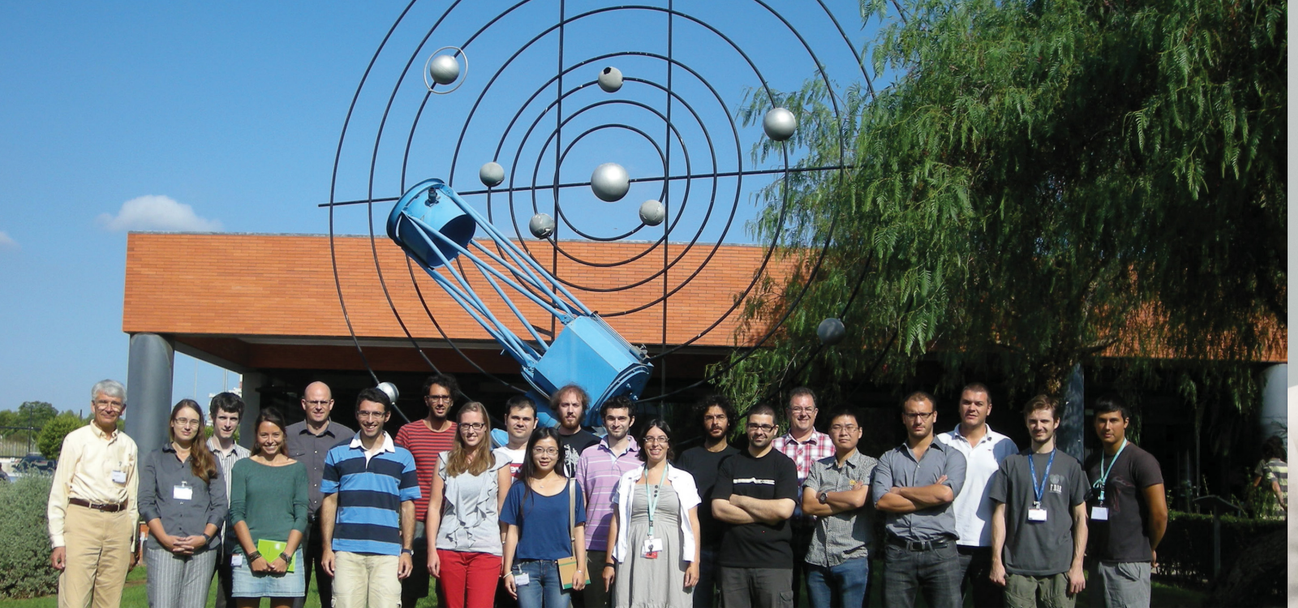
And of course, it was great to see the other Entervisioners as we always enjoy meeting up.

Thiago Viana Miranda Lima

I am very happy that I had the chance to attend and volunteer in both the European Researchers' night and the CERN Open Days. The first event was a very interesting initiative as it gave us the opportunity to explain the vision and goals of ENTERVISION to people, one by one. This concept of presentation gave the chance for people to get a better insight of our work. The CERN Open Days had a slightly different and amusing character. There was a nice collaborative spirit especially when trying to find someone speaking a specific language! But it was rewarding that so many people were interested in the projects presented at the Knowledge Transfer exhibition.. Both events were amazing and I would definitely like to participate again!

Antonios Georgantzoglou

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



ENTERVISION
TRAINING COURSE...
Detectors and Electronics

On September 9th 2013 the ENTERVISION researchers met for the course on Detectors and Electronics at IFIC (Instituto de Física Corpuscular) in Valencia, Spain. This was a continuation of the Detector Course held in Lyon earlier this year with the clear goal of getting to the nuts and bolts of the state of the art devices for medical imaging and, in particular, for hadron therapy monitoring.

The course began with a tour of the of the institute's laboratories so that our ENTERVISION researchers could get a glimpse of the detector development for some of the future experiments in Particle Physics like the Xenon TPC for NEXT , the calorimeter and the silicon track detectors for ATLAS at the HL-LHC upgrade or the pixel detectors for Belle II at SuperKEKB among others.

This was followed by a very gentle reminder of the basics of detectors, how particles produce the electrical signal that the detector electronics have to cope with, an overview of the different detectors proposed and developed in ENVISION and, why not, also the origin of the ubiquitous Bragg peak.

During the rest of the course the mornings were devoted to very interesting lectures by renowned experts on their topics. Helmuth Spieler rewarded us with one of his fantastic lectures explaining the basics of electronics for detectors with special emphasis on "why things do not work". This was complemented by a superb lecture by Peter Dendooven about the basics of detectors for emission tomography in medical imaging. Finally, Fine Fiedler explained to us in her own inimitable, very teaching style, how to build, from the building blocks explained earlier, the state of the art devices used or to be used for hadron therapy monitoring and David Meer explained to us wonderfully the basics of accelerators and told us about the harsh conditions in which the monitoring devices would have to work.

Since the key goal of the course was to give the researchers a chance to work with the detectors themselves, the afternoons were dedicated to hands on sessions in the laboratory where the researchers had the opportunity to operate silicon detectors, assemble scintillating detectors, use them to determine positions and operate them in coincidence to emulate PET or Compton Telescope modes.

To tell the truth not all the activities were academic and we all had a well deserved break in the middle of the week when we enjoyed an unusual mix of meat and see-food paella by the Mediterranean sea and tried to see the sunset aboard a boat in the, unfortunately, least sunny day of a week that otherwise had a magnificent blue sky and temperatures that certainly did not invite us to be in a seminar room for the whole day.

Carlos Lacasta, IFIC, Valencia, Spain

Ugo Amaldi with the certificate of the Zuppinger medal, accompanied by Saverio Braccini (left) and Daniel M. Aebersold (right)

PROFESSOR UGO AMALDI HONOURED
AT THE ZUPPINGER SYMPOSIUM 2013

The Zuppinger Symposium is a bi-annual conference on radiation medicine – in remembrance of one of the key exponents of radiation oncology in the 20th century, Adolf Zuppinger (1904 – 1991).

It is organized by the "Bernische Radiumstiftung", a foundation originating from times when radium was used as a primary and very precious source for brachytherapy. The topic of the symposium, which took place in Bern/ Switzerland on June 13th 2013, was "Particle radiation therapy: Status 2013 and future prospects". Experts from all-over Europe gathered to share with the audience their expertise in various aspects of particle therapy: In line with the strong tradition of transdisciplinary collaboration, the talks included topics from medicine, physics, engineering sciences and – last but not least – economics.

The highlight of the symposium was the ceremony to present the Zuppinger medal, which is awarded by the Bernische Radiumstiftung to excellent contributors in the field of radiation medicine. The 2013 Zuppinger medal was awarded to Professor Ugo Amaldi from CERN and also founder and president of TERA for his unprecedented and outstanding life's work in the field of particle accelerator physics and technology. During his speech, Saverio Braccini, pointed out that Ugo Amaldi had a tremendous impact not only on science and technological developments in a narrower sense, but also on numerous scientists' lives as he has been an enthusiastic , inspiring teacher and mentor for many decades. Subsequent to the speech , we experienced this expesrtise and passion first hand from Ugo. Congratulations!

Daniel M. Aebersold, President of the Bernische Radiumstiftung
Inselspital, University of Bern

JOINT SYMPOSIUM ON **CARBON ION RADIOTHERAPY**, USA

The Inaugural Joint Symposium on Carbon Ion Radiotherapy was held on May 2nd and 3rd, 2013 in Rochester, Minnesota. It was jointly sponsored by the Mayo Clinic, the Northern Illinois University (NIU) Institute for Neutron Therapy at Fermilab, and the National Institute of Radiological Sciences (NIRS) of Japan. The conference successfully brought together 80 participants from 12 countries to share their experiences in hadron therapy and to discuss future plans for reintroduction of light ion therapy in the United States. The stimulus for this event was the recent funding opportunity announcement issued by the National Cancer Institute of the United States, PAR-13-096 Planning for a National Center for Particle Beam Radiation Therapy Research (P20) to encourage and support planning efforts for establishing a Center for Particle Beam Radiation Therapy (PBRT) Research.

The first day of the conference was divided into two sessions. The first was devoted to presentations of the latest clinical results from NIRS on the clinical use of carbon ion therapy in the treatment of cancer. Hirohiko Tsujii of NIRS presented an overview of the history of ion beam therapy and Tadashi Kamaa provided an overview of carbon ion therapy at the Heavy Ion Medical Accelerator at NIRS. Clinical reviews summarized recent results in the treatment of head and neck tumours, bone and soft tissue tumours, non-small cell lung cancer, liver cancer, prostate cancer, and gastrointestinal tumours from NIRS faculty Naoyoshi Yamamoto, Hiroshi Tsuji, Takuji Furukawa and Shigeru Yamada. The second session contained presentations on radiobiology and US and European perspectives on light ion and carbon ion radiotherapy. David Brenner of Columbia University and Kathryn Held of Boston presented the radiobiology of hypo-fractionation and particles, respectively. Robert Miller of Mayo Clinic presented Mayo's vision for hadron therapy and James Welsh of NIU did likewise for NIU's Institute for Neutron Therapy at Fermilab. Stephanie Combs of Heidelberg University and Manjit Dosanjh of CERN presented European perspectives on hadron therapy. Bhadrasain Vikram of the US National Cancer Institute reviewed challenges and opportunities in particle therapy research. The first day of the conference ended with a dinner at Mayo Clinic's historic Foundation House, a mansion originally owned by one of the original Mayo Brothers, where Steve Hahn of the University of Pennsylvania delivered the Mayo 2013 Mayo Clinic Oncology Society lecture on advances in particle therapy.

The second day of the conference focused on technology and physics presentations. In the morning sessions, Koji Noda, Toshiyuki Shirai, Naruhiro Matsufuji, Takuji Furukawa, Taku Inaniwa, and Shinichiro Mori, all of NIRS, presented on the NIRS experience with ion beam technologies, focusing on the NIRS scanning system and new NIRS particle therapy facility. In the afternoon session, US ion beam technologies were highlighted. Michael Zisman of the Department of Energy, John O'onnell of Walter Reed Medical Center, and Chris Beltran of Mayo Clinic summarized the results of the recent Department of Energy/National Cancer Institute Workshop on Ion Beam Therapy held in Bethesda, Maryland in January 2013. George Coutrakon of NIU and Carol Johnstone of Fermi Lab finished the technical presentations with a talk on Carbon/Proton CT image-guidance and advanced accelerator technology for ion therapy. Douglas Packer of Mayo Clinic delivered the final presentation of the conference with a talk progress at Mayo Clinic in the use of carbon ion therapy for cardiac disease. The day ended with a tour of the Mayo Clinic and construction site of the Mayo Clinic Beam Therapy Center construction site.

The conference provided an excellent opportunity for US participants to learn from the experiences to date in Japan and Europe in the clinical implementation of cancer therapy with carbon ions. Proton radiotherapy in the United States is rapidly maturing and expanding in indications. A number of academics are currently considering their options to reintroduce light ion therapy into the United States. The assistance of our international partners is greatly appreciated in helping us reach towards this goal.

Robert C. Miller, MD Mayo Clinic

PARTICLE RADIOSURGERY WORKSHOP, AUSTRIA

The workshop "Particle radiosurgery: a new frontier of physics in medicine" was held in Obergurgl, a mountain retreat of the University of Innsbruck in Tyrol, on August 25-29, 2013.

The workshop, sponsored by the GSI Helmholtz Center, University of Innsbruck, IBA, Verein zur Förderung der Tumortherapie e.V., and ESTRO, attracted 45 participants from Europe, USA, and Asia to discuss the present status of stereotactic body radiation therapy (SBRT) and its extension to charged particle therapy (CPT) with protons and heavier ions with an emphasis on treatment of non-cancer diseases.

Thanks to the tremendous improvements in image-guided radiotherapy (IGRT), there is nowadays a tendency to reduce the number of fractions and increase the dose per fraction (hypofractionation). The advantages for the patient and for the economy are enormous. X-ray SBRT and CPT are both pushing hypofractionation toward the region of 1-3 fractions (oligofractionation) with a very high dose/fraction (up to 25-30 Gy). For non-small cell lung cancer (NSCLC) and oligometastases, SBRT has proven high control rates, durable local control and little normal tissue complications. According to the conventional linear-quadratic model used in fractionated radiotherapy, hypofractionation leads to very high biologically effective doses (BED). This was not possible in the past, because of the damage to the normal tissue, but it can now be spared, at least for parallel organs, with the modern image-guided techniques. In NSCLC, BED correlates with the tumor control probability (TCP) over a wide range of fractionated conformal radiotherapy and SBRT regimes. At very high dose, the vascular injury, i.e. damage to the endothelial cells supplying the cancer tissue with oxygen and nutrients, may become a dominant pathway for tumor suppression. Damage to the tumor stroma at high doses was originally demonstrated by researchers at the Memorial Sloan Kettering Cancer Center (MSKCC, NY, USA) and the question remains open whether oligofractionation can only be justified by the improved physical dose distribution in IGRT and consequently very high BED or it requires a different radiobiological mechanism involving vascular damage and possibly reperfusion. In the opening lecture by Carlo Greco (Champalimaud Foundation, Lisbon, Portugal), the present status and the interpretation of the clinical data were described.

The high conformity obtained by the Bragg peak makes CPT ideal for radiosurgery (see the image below for a comparison of treatment plans). Jürgen Debus (University of Heidelberg, Germany) and Hirohiko Tsujii (NIRS, Chiba, Japan) described recent results with heavy ions. Michael Scholz (GSI, Germany) showed how the local effect model, used in heavy ion therapy treatment planning at HIT and CNAO, can be used to predict the relative biological effectiveness (RBE) at very high dose/fraction. A potential advantage of CPT in hypofractionation is the reduced oxygen enhancement ratio (OER) using high-LET radiation. Hypoxia is one of the main factors reducing local controls in solid tumors, and fractionation in radiotherapy has one of the main reasons in the possibility of re-oxygenation of the hypoxic areas. Re-oxigenation will be reduced in hypofractionation, and finally lost in single-fraction/high-dose radiosurgery. Combinations with hypoxic sensitizers have been proposed for SBRT. Owing to the reduction of OER using heavy ions, CPT may be an alternative. Targeting specifically hypoxic regions can be achieved with strategies of dose- or LET-painting . For oligofractionation or single fraction/high dose treatments, use of ions heavier than carbon (such as 16O) may be beneficial, because with these ions the OER can be further reduced in the clinically relevant hypoxia region. Painting strategies for intra-tumor heterogeneity were described by Philippe Lambin (MAASTRO Clinics, The Netherlands).

Dose cuts of Patient 1 (top) and 2 (bottom), with SBRT left and CPT (right). Patient 1 presents two lesions in close proximity to the spinal cord, while patient 2 has a single centrally-located lesion in the left lung. The actual treatment plans on a TrueBeam (Champalimaud Foundation, Lisbon) are compared to simulated treatment with C-ions using TRiP98 on a 4D-CT acquired for the IMRT treatment. Image courtesy of Kristjan Anderle, GSI.

Particle radiosurgery is very attractive for several noncancer diseases, where only local control is necessary for complete cure. Clinical results of proton radiosurgery for benign diseases at the STAR facility of the Massachusetts General Hospital were reviewed by Jay Loeffler (Harvard University, USA), and the applications to atrial fibrillation, macular degeneration, and trigeminal neuralgia by Douglas Packer (Mayo Clinics, USA), Wayne Newhauser (LSU, USA), and Sebastian Lettmaier (University of Erlangen, Germany), respectively.

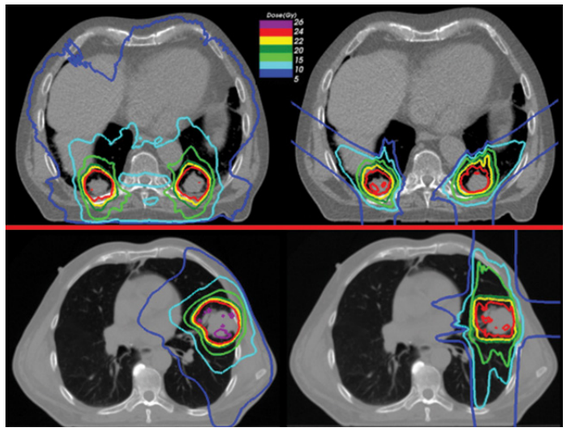
In conventional radiotherapy, the interplay between beam scanning and organ motion is partially compensated when many fractions are applied. However, this effect is lost in hypofractionation, especially for single-fraction high-dose treatments. The issue of range uncertainties and motion mitigation strategies in particle therapy were discussed by Alejandro Mazal (CPO Orsay, France), Shinichi Shimizu (Hokkaido University, Japan), Antje Knopf (PSI, Switzerland) and Christian Graeff (GSI, Germany). As a possible tool in online range monitoring, proton radiography is now rapidly expanding. The technique was described by Uwe Schneider (University of Zurich, Switzerland), Katia Parodi (LMU, Germany) and Dmitry Varentsov (GSI, Germany).

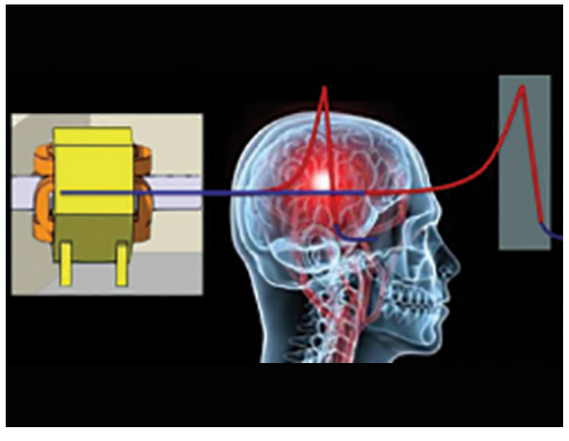
Several posters were presented and the awards were given to Matthias Prall (GSI, Germany) for his poster on Proton Tomography of Biological Samples at Los Alamos National Laboratory; Aafke Kraan (INFN Pisa, Italy) who presented on Proton range monitoring with in-beam PET: Monte Carlo activity predictions and comparison with CATANA data; and Florian Kamp (TU Munich, Germany) describing an Variance-based Sensitivity Analysis of Biological Uncertainties in Carbon Ion therapy. The winners presented their main results in short presentations on the last day.

The workshop allowed plenty of time for discussion partly during hikes in the rainy, but still beautiful environment. It was clear that particle radiosurgery has an enormous potential for cancer and non-cancer diseases, but needs research especially in high-dose particle radiobiology of cancer and normal tissues and management of intra-fractional organ motion. These research topics could be pursued in future EU grants under the umbrella of ENLIGHT, whose history and success in funding of several projects in FP7 were described by Manjit Dosanjh (CERN, Switzerland).

More information on the workshop can be found on the webpage
http://transidee-conference.uibk.ac.at/particle-radiosurgery/
Proceedings will be published in Physica Medica – European Journal of Medical Physics (www.physicamedica.com) in 2014.

Marco Durante - GSI Helmholtz Center, Darmsatdt, Germany
Christoph Bert - University of Erlangen, Germany





PROTON THERAPY
IN GREECE

The Greek scientific community in the domain of nuclear & particle physics, radiation physics, radiation protection, radiation treatment of medical applications, radiopharmaceuticals and medicine scientists have been working for many years on the development of proper conditions in order to proceed to the realization of the proton therapy facility in Greece.

On 26 July 2006, during the community's first meeting, representatives from Greece's most significant institutes discussed many subjects, including simulation studies of tumor treatment with proton beam, neutron therapy and Boron Neutron Capture Therapy (BNCT), Alpha-Immunotherapy, Small Animal PET/CT scanner, New generation PET devices, GRID computing power for PET data storage, New radio-pharmaceutical traces.

It is expected that this scientific community will play a predominant role in the facilitation of innovative projects related to the proton therapy facility and will assume a leading role in bringing together the public and private sectors. It will become an example to follow as the mediator in Technology Transfer activities that take place in Universities, Research Centres, Technological Institutes and Public Hospitals.

After this first meeting many activities have taken place. There has been a series of scientific talks given by international experts in this field to both scientific and public audiences To name a few of them, Prof. Dimitri Nanopoulos, Dr. Manjit Dosanjh, Prof. Ugo Amaldi, Prof. Emmanuel Tsesmelis, and also many research projects cooperating with international research groups from Europe and USA.

Also involved are many Greek graduate students from the NTU-Athens, UoAthens and other universities who have worked on their MSc and PhD theses in this domain transferring know-how on the radiation physics and medical applications.

It is significant that three major geographical regions of Greece, FIG.1, have shown great interest to host the proton therapy facility in their territory. The Region of THESSALY recommending the University Hospital of Larisa, the Region of EAST MACEDONIA-THRACE recommending the University Hospital of Alexandroupolis and the Region of CRETE recommending the University Hospital of Heraklion. In addition, we have many visits to CERN for information and discussion about the possible technical help and technology transfer provided for the realization of such a project.

- July 2012, The Governor of the Region of Thessaly, Prof. Konstantinos Agorastos
- May 2013, The Minister of Health, Mr. Andreas Lykourentzos
- June 2013, The Governor of the Region of East Macedonia-Thrace, Mr. Aris Giannakidis
- 27 Nov 2013, The Deputy Minister of Health Mrs. Zoi Makri and the Governor of Thessaly, Prof. Konstantinos Agorastos.

The Deputy Minister of Health Mrs. Zoi Makri, informed the CERN management the final location of the Proton Therapy facility at the Larisa city in the Region of Thessaly, as recommendation of her Ministry to the Greek Government.

So

A new era comes to Greece for the Proton Therapy Facility, the realization of the project via the steps:

- Working Group composition
- Design of the machine
- Construction, Assembly, Installation, Commissioning
- Patient treatment

Evangelos Gazis, National Technical University of Athens

STATUS OF PARTICLE THERAPY IN NORWAY

Tuesday September 3rd 2013, the Minister of Health and Care Services in Norway, Jonas Gahr Støre, announced the go ahead for the build-up of proton therapy in Norway.

The announcement implied that Oslo University Hospital (OUS) in Oslo, St. Olav's Hospital in Trondheim and Haukeland University Hospital (HUS) in Bergen were given the task of planning for a proton therapy facility located at each of these 3 regional hospitals.

During a meeting on September 27th 2013, between the Ministry of Health and Care Services and all the Norwegian Regional Health Care Administrations, it was announced for the first time that the Government's initiative was made even broader; each of the 4 Norwegian Health Care Regions will be included in the decision to start planning for regional proton therapy facilities, i.e. the University Hospital of Northern-Norway (UNN) in Tromsø, was included in the list of facilities hosting proton therapy in Norway. It was announced that the tentative startup with clinical proton beams was projected to be around the year 2017.

The background for this important political decision on healthcare was an analysis of a report from a National Planning Group, which started its work in November 2012, which delivered the report: Planlegging av norsk senter for partikkelterapi (Planning for a Norwegian Facility for Particle Therapy), to the Norwegian Ministry of Health and Care Services, on June 15th 2013. In this report, the National Planning Group presented suggestions and recommendations for how to build up particle therapy as a part of radiation therapy in cancer treatment in the public healthcare service infrastructure in Norway.

In summary it was concluded in a report of June 15th 2013 that the National Planning Group regards it important to immediately, without further delay, start with the (detailed) planning for building of the facilities and organization of the required training of the necessary personnel in order to induce a swift startup of particle therapy in Norway.

Furthermore; the National Planning Group recommended as the first priority that the Government in Norway builds a national dual beam facility with capacity for particle therapy with both protons and carbon ions. And, as recommended by Japanese experts from NIRS, that Norway in such a national facility installs two accelerators, one machine for proton therapy and one machine for carbon ion therapy. The National Planning Group also recommended that a research room was built in this national facility, in order for Norway to contribute in the international endeavour in facilitating information and knowledge about the biological effects of radiation with heavy ions, including and beyond carbon ions, in therapy.

The National Planning Group estimated that Norway in the initial phase, i.e. within the next 5-7 year period, will need to build and operate 4 treatment rooms in order to maintain a capacity for treating 12-15% of the patients that today receive photon therapy in Norway, with particle therapy, please see figure 1 which displays the number of patients receiving radiation treatment in Norway during the years 2001-2010.

If the Norwegian Government decides that 4 regional proton facilities (Oslo, Bergen, Trondheim and Tromsø) will be built, it is expected that each site will host one proton gantry in the initial phase. It is also assumed that some of the facilities will build a research room in order to build up R&D infrastructure related to particle therapy. Figure 2 displays schematically which part of the treatment will be performed locally and which part of the treatment that will be performed at each regional facility.

In October 2013 there was a change of government in Norway as a consequence of the results from the General Election held the 9th of September 2013. The incoming and present Government has so far upheld the ambitions of the outgoing Government with respect to pace and directions for the planning work.

During 2014, the National Planning Group will continue its work and sort out which part of the planning work for particle therapy that should be done on a national level with respect to synchronization of the regional plans in order for these to be aligned with the National guidelines and requirements, and also what part of the planning work for particle therapy that can be done by each of the Regional Health Care Administrations in order to optimize each facility with respect to the regional situations.

The Government stated in a September 27th 2013 meeting with the Regional Health Care Region Administrations; "We recognize that the alternative with establishment of smaller regional proton therapy facilities is a good alternative in order to facilitate a swift introduction of proton therapy in Norway, and also in order to facilitate a possible establishment of a national carbon ion facility in Norway in the longer term".

Based upon this quite broad guideline, the Health Regions and the National Planning Group will embark on the next part of the work, which hopefully will yield a robust and realistic timeframe for buildup of competence and infrastructure for particle therapy in Norway.

The European and the International Particle Therapy community will no doubt continue to play an instrumental role in the shaping of the Norwegian facilities. Special attention will be paid to the question of how to now build for proton therapy while at the same time enable a next step into heavy (carbon) ion therapy in the not too-distant future.

Exciting times has come to the Norwegian radiation therapy community.

Odd Harald Odland, Haukeland University Hospital, Bergen, Norway

PARTNER:
EXCELLENCE IN TRAINING AND RESEARCH

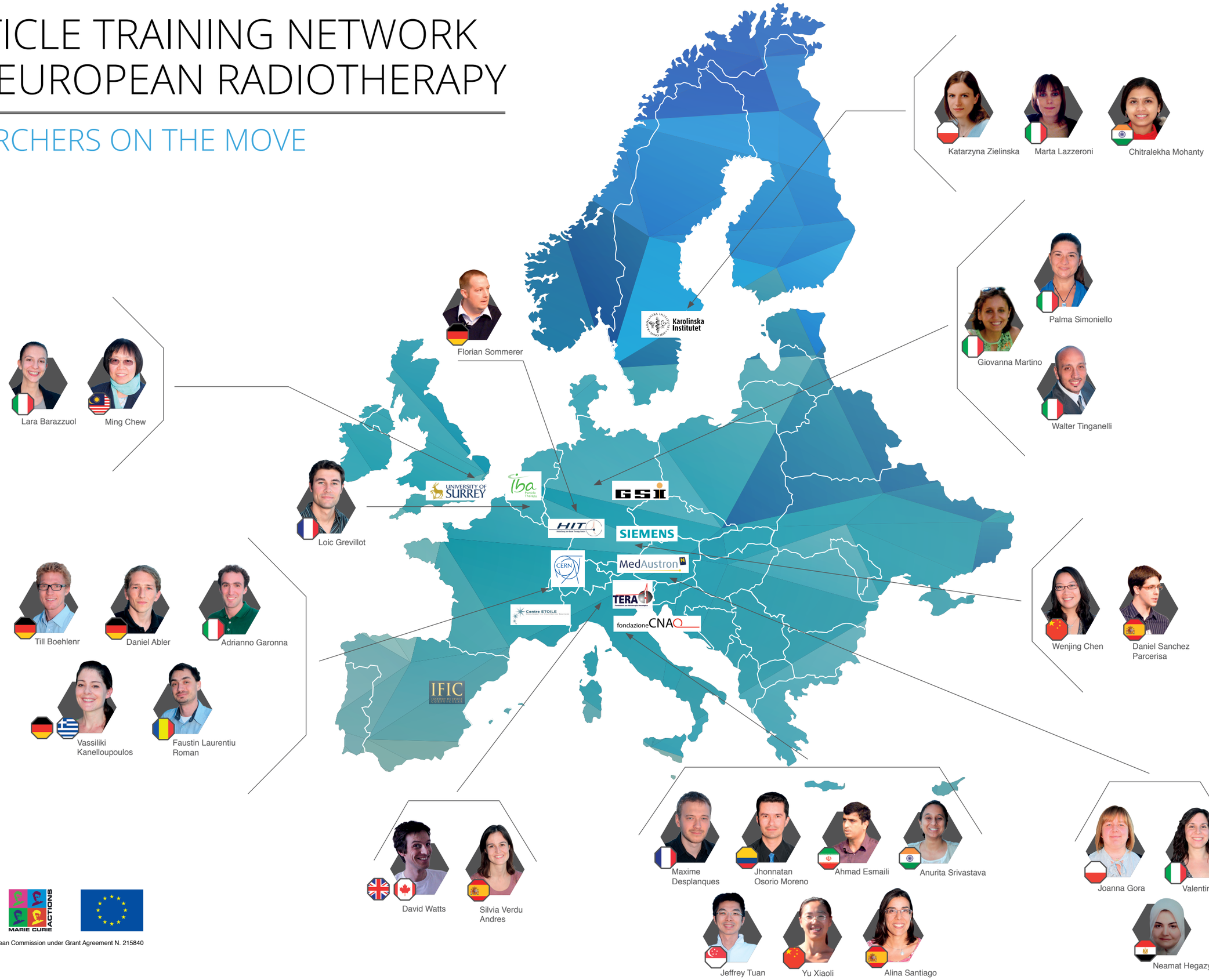
Between 2008 and 2012, PARTNER trained 29 young researchers from many different countries and scientific backgrounds, who had the opportunity to attend multidisciplinary training courses and to perform high-level research in hadron therapy.
More than 90% of the PARTNER researchers have found positions shortly after the end of the project, thanks to the expertise acquired at the most advanced European hadron therapy centres and to the networking opportunities provided by the ITN: the medical doctors coming from India and Singapore went back to their countries and hospitals, while most of the other researchers are now working in hadron therapy facilities, in Europe as well as in the US and in Japan.

In 2013, results from several PARTNER research projects were published in a special issue of the Journal of Radiation Research. In line with the collaborative and open-access spirit of ENLIGHT, this peer-reviewed publication is available freely. The papers collected in this issue demonstrate the variety of subjects and disciplines dealt with by the PARTNER researchers, which were grouped in five major themes.

PARTNER
Particle Training Network for European Radiotherapy

PARTICLE TRAINING NETWORK FOR EUROPEAN RADIOTHERAPY

RESEARCHERS ON THE MOVE



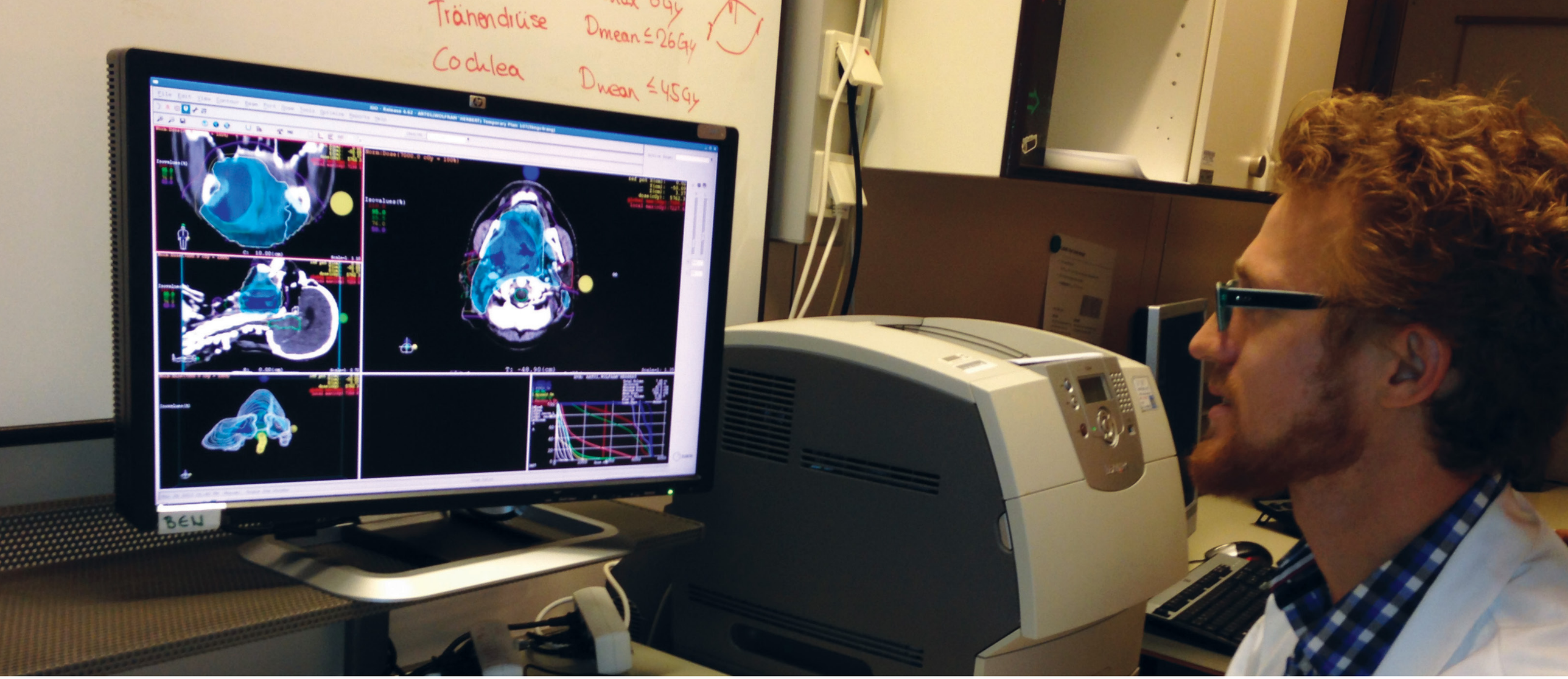
PARTNER

PARTNER is funded by the European Commission under Grant Agreement N. 215840

FROM PARTNER TO **MEDAUSTRON**

Training of specialised professionals for the upcoming European Ion Beam Facilities was seen as a clear necessity for ENLIGHT in the Seventh Framework Programme (FP7) call. Therefore in 2007, the Particle Training Network for European Radiotherapy (PARTNER) was established in this rapidly emerging field. PARTNER was an interdisciplinary, multinational initiative that had the primary goal of training researchers who will help to improve the overall efficiency of ion beam therapy in cancer treatment. All collaborators were known worldwide in the diverse, but complementary, fields associated with particle therapy: clinical, radiobiological and technological. Thus, the network covered a unique set of competencies, expertise, infrastructures and outstanding training possibilities for young researchers. CERN was the coordinator of the 4-year PARTNER project, which was funded by the EC to train 29researchers in member states throughout Europe. MedAustron is a centre for Ion Beam Therapy and Research in Wiener Neustadt, Austria. It will provide protons and carbon ions in four rooms, three dedicated to patient treatment and one dedicated to non-clinical and translational research. To put such a complex facility into operation, a remarkable amount of interdisciplinary work has to be performed, from accelerator physicists to medical physicists, from specialists in radiation oncology to radiation technology therapists, from IT specialists and engineers to quality assurance specialists. MedAustron was strongly involved in the PARTNER project from the beginning, also hosting one training course in Wiener Neustadt and co-organizing another course at CERN. At the end of the project it was obvious to offer positions to these well trained and highly motivated researchers. Four of the former PARTNER researchers are now employed by MedAustron, three medical physicists and one specialist in medical IT, and another physicist will join in 2014. Faust, Joanna, Loic and Till are now well integrated in the Medical team and are all working hard to make it possible to treat the first patient end 2015.

Ramona Mayer, MedAustron



TILL BÖHLEN

MedAustron, a new dual ion beam treatment facility is in the state of creation close to Vienna. It will provide an innovative and effective treatment option for cancer patients from Austria and neighbouring countries in the near future. This exciting and versatile project aims, once in operation, not only to provide cutting-edge health care to its patients but has also the strong ambition to endorse clinical and non-clinical research on site and in co-operation with other institutes and facilities. For me, it was a natural continuation in my career to start working as a medical physicist in this upcoming ion beam facility a few months ago.

Working as a graduate technical student at GSI (Darmstadt), the pioneering institute for carbon ion therapy in Europe I got my first glance at the field of ion beam therapy. Soon after my graduation I was happy to be offered a grant for a Marie Curie fellow position at CERN (Geneva) and the Karolinska Institute (Stockholm). The position was with the EC-funded FP7 PARTNER project which was funded from 2008 to 2012. Back then I knew that it would be a jump into new waters for me and that it would probably impact my future career path. A deep dive into the field of ion beam therapy while working at the world's most renowned centre for particle accelerators. Today, I can say that carrying out my PhD studies in the framework of the PARTNER project with an international group of PhD students and young researchers from different institutes, universities and companies around Europe was certainly a very stimulating experience. On the various meetings, courses and conferences in connection with the project, we had ample opportunities to broaden our knowledge about ion beam therapy not only concerning our own field of research, but we were also encouraged to think beyond one's own teacup and to explore other related disciplines and perspectives. Besides the professional training, the PARTNER project also formed a well-connected group of young researchers and I am happy that today some of us are actually meeting again here at MedAustron to help put it into operation. Although still at the beginning of our professional careers, I believe that the solid educational foundation which was laid in the past years will be beneficial for our new positions. Sometimes I like to think of the new task as a leap forward from training to put some of this accumulated knowledge into practice. The research which I performed during my PhD studies in the framework of PARTNER and afterwards spanned the fields of basic interactions of particles, treatment planning, biological modelling and treatment monitoring for ion beam therapy. All these are topics with direct relevance for the medical physicist team at the MedAustron facility during the initial phase. Being part of this centre already from this initial, preclinical phase is at the same time a very gratifying and … yes, I admit, sometimes also a bit frightening thought given the amount of sticks and stones usually on the way to put such an innovative project into regular clinical operation. However, this small concern won't stop me from looking forward to the coming years of work with my new colleagues at the MedAustron facility.

JOANNA GORA

It has been a while since the PARTNER project finished, however for me it dosen't feel like that at all. Quite the opposite, actually, it feels like nothing has been changed. I still do the job, which I like and moreover still work with the people, who over last few years of the project became my friends.

From four of us, I think I've worked here the longest. It was over 4 years ago, when I joined the PARTNER project. From the very beginning I was based in MedAustron as a researcher, but it's only since last year that I have been employed as a medical physicist.

During my research times I was working on adaptive treatment planning with particles. The PARTNER project allowed me to conduct my PhD studies and get essential knowledge and experience in the radiotherapy field, which I will be able to put into practice when our facility starts running.

Moreover, years of participating in the PARTNER project were full of unique opportunities.

While, my PhD programme was more directed into specialisation in treatment planning, the courses, training and workshops organised for us by PARTNER were more interdisciplinary, more diverse and always organised by the leading experts of their specialisations. Participation in such training gave us a glimpse of each complimentary field related to particle therapy. The general overview of clinicians', physicists', Biologists' and engineers' work brought all specialisations together and showed us how to join efforts and work as a team.

However, knowledge was not the only thing which I gained from the participation in the PARTNER project. Every meeting and every conference I was attending brought me not only a number of contacts and colleagues in the "particle" world, with whom new ideas and collaboration opportunities have been initiated, but more importantly I found good friends. Therefore, even though the particle therapy community rapidly grows, it feels like one big family.

Right now I am finishing my education in order to be an accredited medical physicist in Austria. Until September next year I will be still be based in the General Hospital in Vienna, where I am gaining practical experience in the clinic. My main tasks include IMRT/VMAT treatment planning for various tumour sites, verification of the treatment plans, patient and machine quality assurance measurements, periodic checks etc. Also while I am in Vienna Iam trying to get as much knowledge and practice as I can regarding radiochromic film dosimetery as that will be one of the tools used during the commissioning part at MedAustron, which I will be involved in.

When I relocate to Wiener Neustadt I will be joining the team focusing on acceptance and commissioning our treatment planning system and also the beam delivery system. As much as I still have to learn, I believe that working for PARTNER project was essential for me to get to the point where I am now and prepare for this exciting challenge which is about to come.

It has been great to witness over the last 4 years how our facility has emerged. When I first came to MedAustron there was nothing except the huge field of grass and an amazing idea. Now the plans became a reality and an empty field transformed into a big, well organised and operating facility, which is now at a turning point. The date of first patient treatment is approaching quite fast; loads of work must be done and challenges to overcome before we can start. However, as difficult as it may seem for me those are very exciting times, to be a part of that process is incredible and to work among friends is the most rewarding thing.

Where would I be now if I have never joined the PARTNER project?? - I guess I will never know.

Would I be able to work in the particle therapy field without PARTNER project? – Probably.

Would I be able to get such preparation and knowledge in the particle therapy field without it? Would I get such an experience somewhere else? Would I meet so many people working in that field without the PARTNER project? Or would I change this job for something else? – Definitely not!!

FAUSTIN LAURENTIU ROMAN

My journey into ion beam therapy started in February 2009 in my hometown Bucharest, Romania with a phone call from Dr. Evangelia Dimovasili, the PARTNER project technical coordinator at that time, advising me that I had been selected to join the PARTNER project at CERN. I knew little of hadron therapy but I remember my excitement at joining this European project hoping to make a difference in the fight against cancer. As an IT consultant with a background in nuclear physics, coming to CERN – the world's largest particle accelerator and the web birth place – I was absolutely convinced I had a lifetime chance to learn and grow next to the very best minds around.

As a Marie Curie Early Stage Researcher (ESR) my task was to design and implement a prototype system to share medical data across hadron therapy centres, together with 2 other ESRs at CERN and several other experts from 7 institutes. We focused on the need to collect and analyse the side effects of the patients during and after therapy. The result - Hadron therapy Information Sharing Platform (HISP) – allows doctors and researchers to securely query data across a federation of heterogeneous databases using an easy-to-use web portal. The system uses semantic web and metadata technologies to facilitate semantic annotation of data and the support for versioning of patient-reported outcome and objective adverse-event measures. The advantages of HISP are in the novel data integration and reporting methods, and the software sustainability achieved through the use of community-supported open-source components.

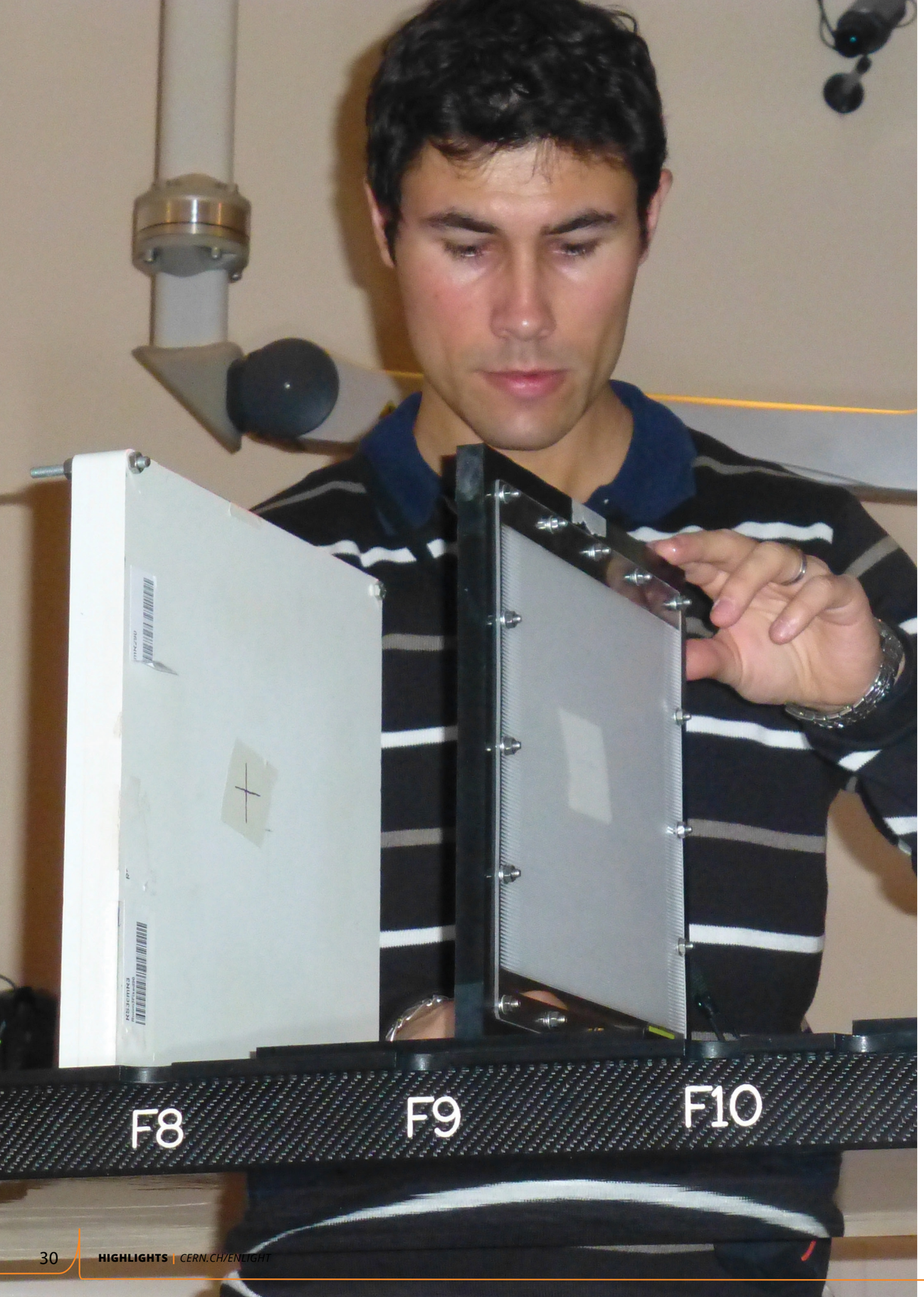
A lesson learned during HISP implementation was that technical challenges can be overcome yet the legal-ethical-socio-political ones around cross-border medical data sharing are far more complex. Nevertheless, I am confident that the recent year's data liberation movement will be serving as a push in the right direction for medical data. A sign of this might have been the nice surprise by the poster award at the last PTCOG meeting for the content analysis of proton therapy related traffic on Twitter.

PARTNER was not only work but also lots of multidisciplinary training courses, too many to list here, but I should mention those where I had lots of fun: the Valencia accelerator and grid technology, hands-on radiobiology at Darmstadt and the leadership course in Surrey. During all these courses I was together with the PARTNER "family" - medical doctors, physicists, radiobiologists, IT experts and engineers of all sorts – and this really broadened my horizons, my understanding of different cultures, ways of thinking and professions.

After PARTNER finished in 2012, Prof. Ramona Mayer asked me if I would be interested in working at EBG MedAustron GmbH on something called the Treatment Control System. I was happy to join this project which I had heard about so many times during the PARTNER courses, but I was also a bit scared since this was a critical part of the therapy process. The knowledge gathered in PARTNER was of great help for this task: it was like all the pieces of the puzzle now started to shape into a big picture of the therapy system and its challenges. And equally important, knowing already the business domain helped me to act as a bridge for the stakeholders, medical doctors, IT, accelerator and the management colleagues.

Currently, I head the Medical IT in MedAustron IT department, managing the medical software systems, in particular ensuring a successful implementation of requirements from medical users. I am the link between the medical business domain and the IT-department as well as to all the medical systems on the operational level. Recently, I also took the responsibility for the Therapy Accelerator (TA) IT in terms of business requirements, IT-architecture, and special TA-IT services. It feels like I am in a very similar "family" as the PARTNER one.

It is clear that my success in this position is highly influenced by my PARTNER experiences and the friends I made along my journey. And something that all my friends know is that I could not do all this without my family support to which I am most grateful.



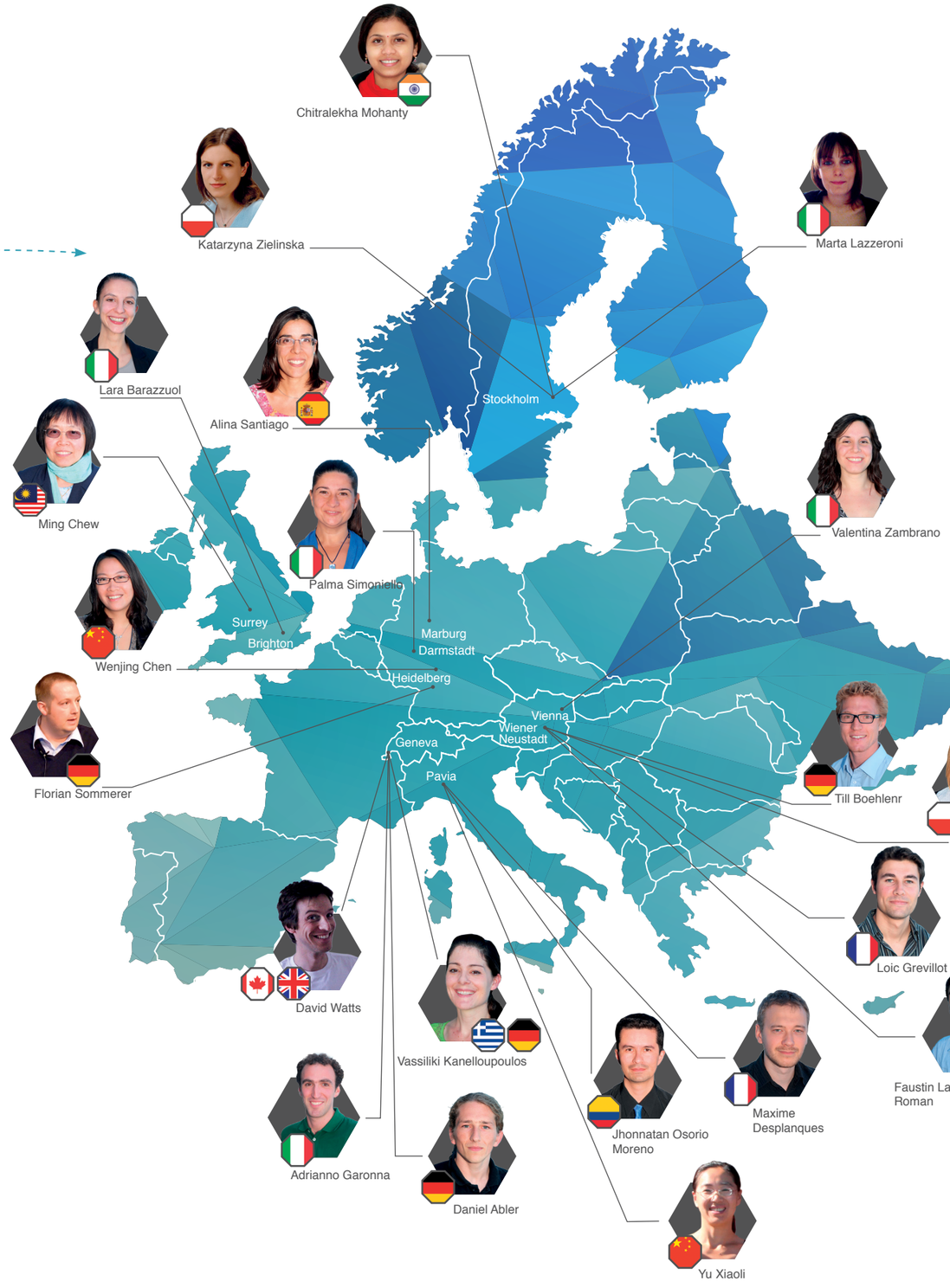
LOÏC GREVILLOT

I started the PARTNER program on January, 1st, 2009. I was based at the Ion Beam Application (IBA) Company in Louvain-la-Neuve in Belgium and I was working in collaboration with the University of Lyon in France (CREATIS, CNRS, INSERM laboratory) and the ETOILE project. This project offered me the opportunity to see the world of industry in the leading company providing cyclotron-based proton therapy centers and at the same time the possibility of evolving in a rich academic environment. PARTNER provided also the organization of over 10 training courses in 3 years, creating a strong bond among the PARTNER fellows. Today, most of us are still in contact, which is very important for the future. The PARTNER program created the opportunity to attend international conferences and European meetings, in which I was in touch with leading people in the field of ion therapy. I believe the context of my PhD was unique and all conditions were brought together to achieve a successful outcome. During my PhD thesis, I developed a Monte Carlo model of the IBA proton therapy dedicated gantry with Gate/Geant4, which I validated against measurements. Later, I interfaced a treatment planning system (TPS) with the Gate Monte Carlo code and evaluated the accuracy of the TPS. This work was concluded by the publication of four articles in well recognized international journals and several presentations atinternational conferences. Apart from the scientific aspects, PARTNER allowed me to develop my personality and prepare myself for the future. On October 10th, 2011, I successfully defended my PhD thesis in front of an international committee. I was told that nobody should applaud during a PhD defense. When the jury members started to applaud instead of asking questions, for me that was an unforgettable moment (especially before the long series of questions...). I obtained oral congratulations and was qualified as "extremely knowledgeable member of an international hadrontherapy research network". I sincerely hope to be up to it in the future. In 2012, I worked as resident medical physicist in the hospitals of Lyon and got certified in order to work as Medical Physicist Expert (MPE) in the hospitals. During this practice, I obtained clinical experience, faced the reality of patient treatments and understood the position of medical physicists in hospitals. The cherry on the cake happened on September 2012, when I received a call telling me that I was Laureat of the Young Researcher Award of the city of Lyon 2012, category "Global health and Society". I received this prize at the city hall of Lyon on September 28th from the hands of Gérard Collomb, Mayor and Senator.

I remember the mid-term review PARTNER meeting where the European Commission was present. We were asked to present our work and our vision for the future. At that time, I explained my dream of working in an ion therapy center, doing partly research, in close collaboration with industry. These three pillars are in my opinion necessary to develop the field of ion therapy and I actually have the chance of realizing this at MedAustron. During my PhD, I collaborated with Professor Ramona Mayer, Medical Director of MedAustron on many occasions. Today, I have a key position as MPE at MedAustron and I am responsible for the medical commissioning of the beam delivery. This task requires using MPE skills of course, but the background of my PhD is a must. I am using Monte Carlo simulation, which a recognized necessary tool for the medical commissioning of the ion therapy facility. My academic background and network is of primary importance to achieve this task. I am also interacting with many external companies and different MedAustron engineering teams, including information technology, accelerator physics, electronics and mechanical aspects. PARTNER was the springboard for me, which allows me today to work as medical physicist in one of the first European ion therapy facilities.

PARTICLE TRAINING NETWORK FOR EUROPEAN RADIOTHERAPY

NOW WORKING IN...



PARTNER

PARTNER is funded by the European Commission under Grant Agreement N. 215840

VISUALISING SCIENCE

Communicating scientific concepts is a key aspect of science but can be a daunting task. Topics are often complex, and they usually have to be explained in a short time. In addition, the average adult attention span keeps shrinking: informing, as well as inspiring, an audience has become a real challenge.

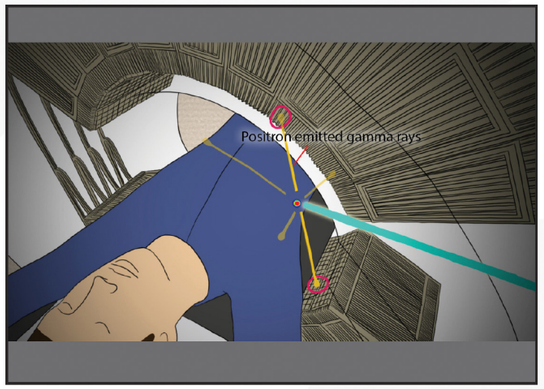
Adopting Hollywood techniques can be a worthwhile solution, although scientists are still unaware of their potential. For small research projects, scientists might consider taking the visualisation route themselves, although they will have to set aside a considerable amount of time to create a compelling visual.

This is exactly how we began approaching visualisation, as a tool to communicate our own projects. We soon found out that it is difficult to combine research and visualisation when projects grow larger, as both tasks demand time and dedication. We created Nymus3D to tackle the visualisation of large and complex scientific projects: these are best approached in stages that are very similar to thos of an animated blockbuster movie.

First a script is set up, on the basis of an initial brainstorming and of additional information such as scientific publications. The script gives a detailed description of all the important steps in the story.

"06. The ion beam is directed at the chest of the patient, opposing γ-ray trajectories hit the PET detectors."

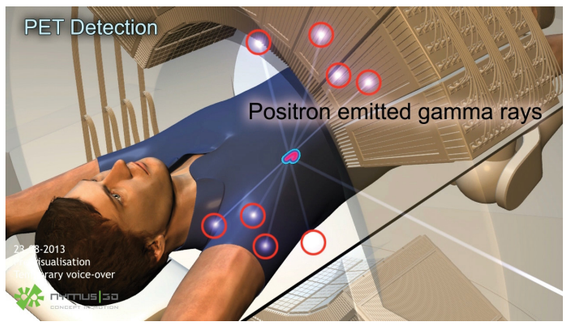
Once the script is approved, rough thumbnail sketches are drawn for all shots. These are further refined into a full storyboard that reads like a comic book and depicts all elements that need to be visualised.



11 Cut back to the outside view. Positron emitted gamma rays are pointed out. The PET detectors flash where the gamma rays hit. A data voxel is placed within the body.

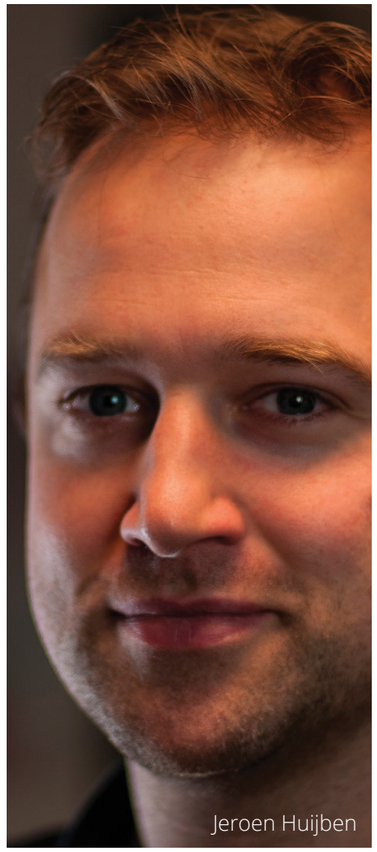
This storyboard is taken to the "pre-visualisation" stage in which a very rough and animated version of the visualisation is generated. Look and detail are kept rough on purpose in order to focus on timing and to allow quick iterations. At the same time a voice-over script is written which will eventually accompany the pre-visualisation for approval.

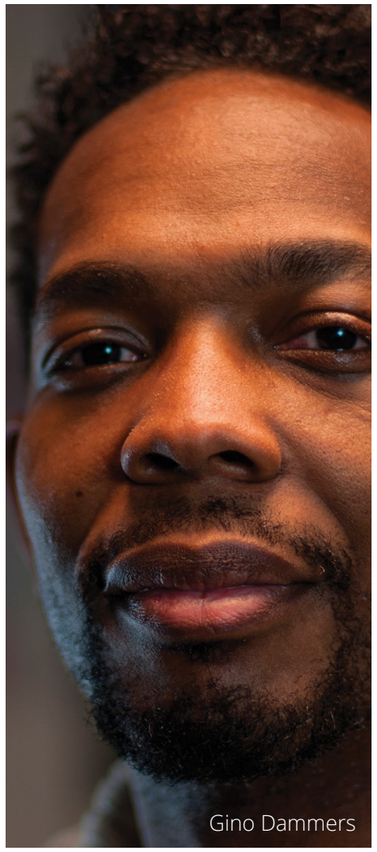
The last stage brings detail to all digital scenes, which are then calculated or "rendered" to image sequences on a large server farm. These images are post processed and composited into the final visuals. For improved offline and online usability, this video is combined with composed background music and with voice-over by a professional voice actor. The result delivers a carefully considered story in a modern way, to captivate and inform an audience while leaving a lasting image.



Jeroen Huijben , Nymus 3D


Vincent Bos


Jeroen Huijben


Gino Dammers

VISUALISING SCIENCE...

THE TEAM BEHIND IT

Founded in 2006 during the PhD project of Jeroen Huijben, the company was a part-time business at first. It was the direct result of a long time hobby in animation and the application of those concepts in personal research projects. Part-time at first, the company provided scientific visualizations for a few directly related research groups and an institute at the University of Twente. Before long, some serious support was needed to keep up with demand and Vincent Bos joined. Both Jeroen and Vincent started studying physics together but Vincent had since moved on and spent time studying math at Leiden University and photography at the Royal Academy of Arts, the Hague. His affinity with math, engineering and art was a perfect fit and both continued on together. The company was slowly shifting to a full-time occupation at the time and it needed another partner, someone with specific experience in design and animation. If visualizations were to be taken to the next level, someone with a wholly different background was needed. Just such a person was found in Gino Dammers. He had worked on top productions in the game industry but was open for a leap of faith. Not in the least because it involved moving to little known Enschede after living in Amsterdam, Stockholm and London. Together we have worked on productions for a wide range of institutes in Europe and the USA. Since 2012 our office is located directly next to the University of Twente, on the high tech and green Kennispark. At the end of 2013, after a successful internship of 5 months, college graduate Rebecca Bertram was hired full-time to complement the team.

In 2013, Nymus3D realised an animation for the ENVISION project. View it at: http://cds.cern.ch/record/1611721?ln=en

nymus|3D
CONCEPT IN MOTION

AGENDA

JANUARY

01 HORIZON 2020 STARTS

FEBRUARY

10-14 ICTR-PHE 2014
GENEVA, SWITZERLAND
HTTP://CERN.CH/ICTR-PHE14

11 *18:30* PUBLIC TALK – "PHYSICS IS BEAUTIFUL AND USEFUL"
PROFESSOR UGO AMALDI
CICG, GENEVA, SWITZERLAND
CERN.CH/ICTR-PHE14/PUBLIC_TALK.HTML

APRIL

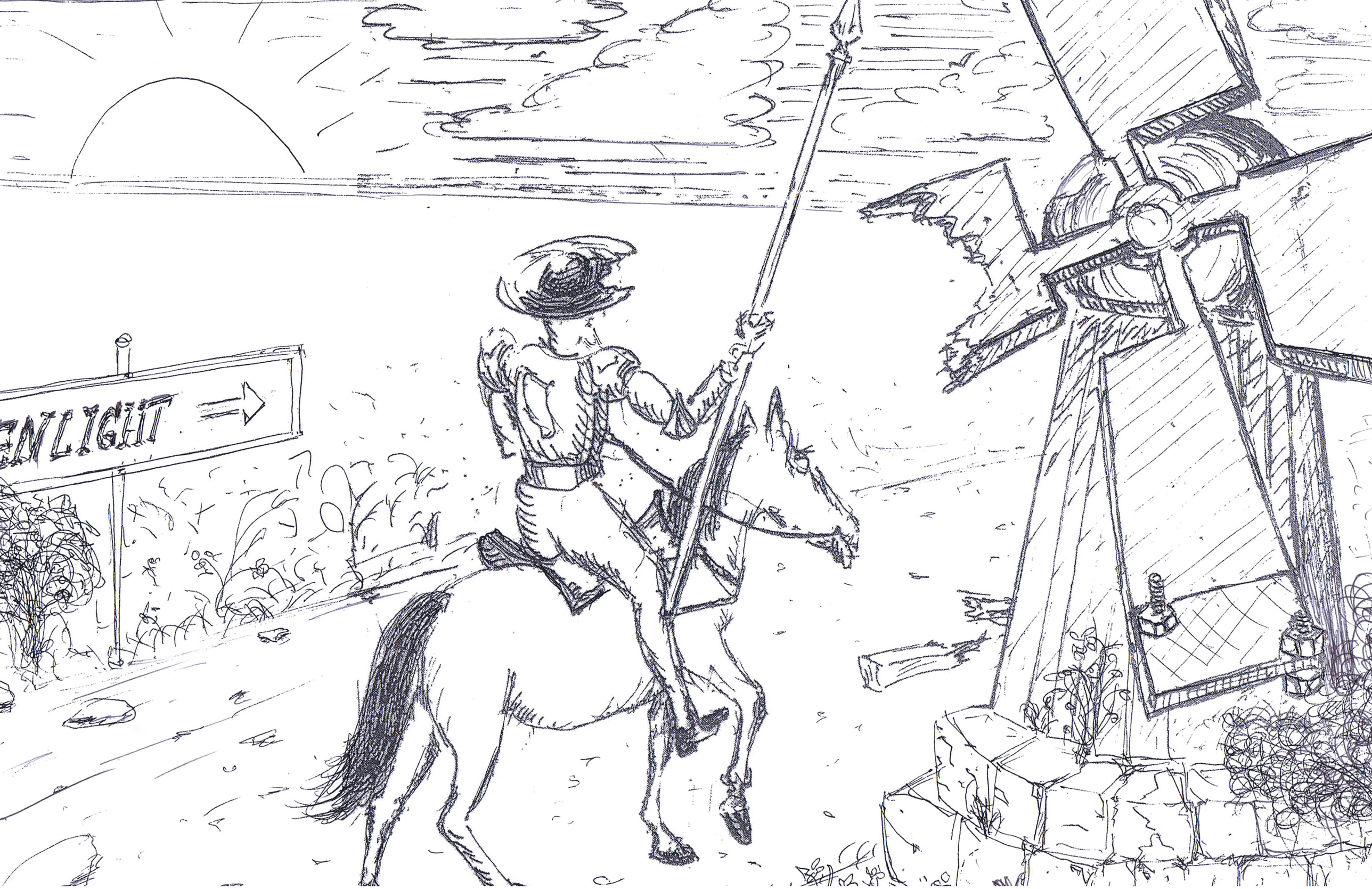
04-08 ESTRO 33
VIENNA, AUSTRIA
HTTP://WWW.ESTRO.ORG/CONGRESSES-MEETINGS/ITEMS/ESTRO-33

JUNE

08-14 PTCOG 53
SHANGHAI, CHINA
HTTP://WWW.PTCOG53.ORG/EN

JULY

10-13 ENLIGHT ANNUAL MEETING,
ENTERVISION ANNUAL MEETING,
ENVISION FINAL MEETING,
ULICE FINAL MEETING,
GENEVA, SWITZERLAND



Contributing Artist : Grigory Fiofilov