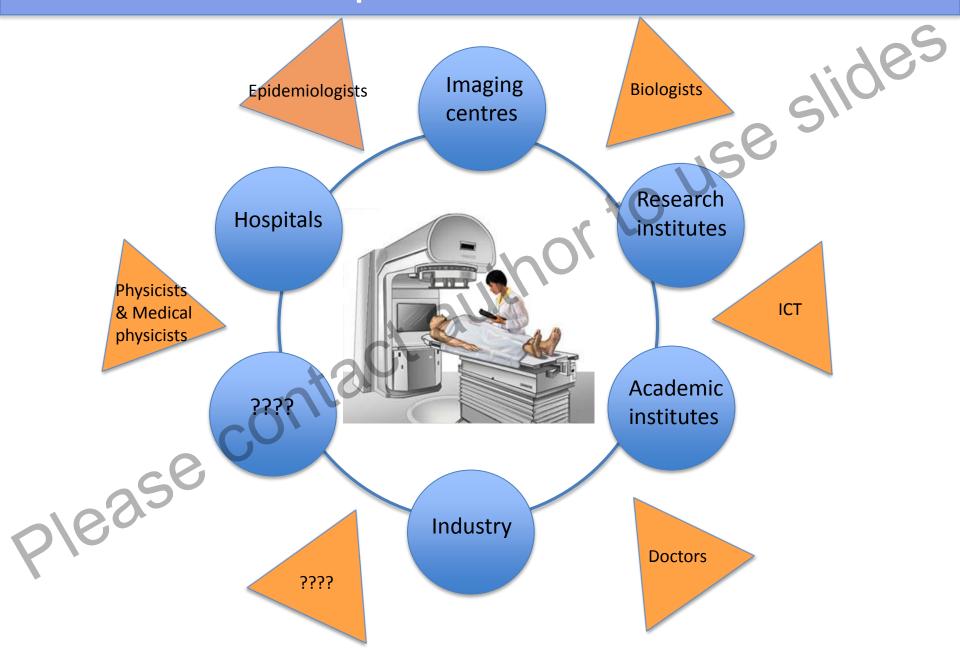
ENLIGHT is a open collaborative network

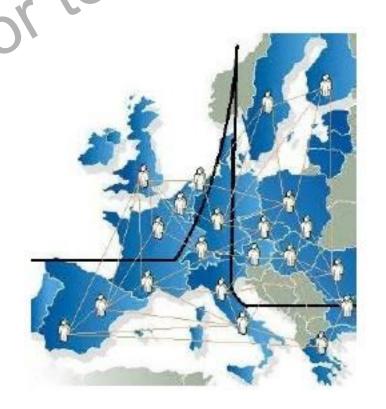


ENLIGHT: where did we come from?

- The idea germinated in 2001 by ESTRO HT group at Med-AUSTRON meeting
- ENLIGHT was launched in 2002 to coordinate European research in hadrontherapy
- The Network was funded by the European Commission between
 2002 and 2005
- In 2006 the community decided to continue with ENLIGHT even without funding since it was found to be essential catalyst for collaboration
- We are still here in 2015!!

ENLIGHT was established to

- Create common multidisciplinary platform
- Share knowledge:
- Share best practices
- Harmonise data: challenging
- Provide training, education
- Identify challenges
- Innovate
- Lobbying for funding
- _____



- Create common multidisciplinary platform: e.g.
 annual meetings, initiating and implementing projects, ICTR-PHE, jobs,
 opportunities, continuity since 2006 and is on-going
- Share knowledge: website, ENLIGHT Highlights, ESTRO newsletter/flashes, publicity via flyers, articles, animations videos, provide support via letters and talks in member institutes/countries, Open access journal articles for ENLIGHT publications e.g. JRR, Frontiers in Oncology etc
- ENLIGHT office: organisation of meetings, future perspective,
 Enlight open membership kept informed no payment
- Share best practices: reports, visits, ENLIGHT meeting moves around, posters/prizes for visibility for young people
- Harmonise and share data: challenging

ENLIGHT has done...... 2

- Provide training, education: training young generations, training, hands on experience, short term/mid term fellowship, being done well (eg PARTNER researchers at MedAustron),
- Identify challenges: need involvement of young medical researchers/staff
- Innovate: always work in progress
- Lobbying for funding: great success in FP7, Horizon2020 challenging
- ENLIGHT office: organisation of meetings, future perspective, Enlight open membership kept informed, no payment, ENLIGHT members ges involved in many new initiatives e.g. ICTR-PHE, APAE, young researchers in CERN Open Day, European Researcher's Night

But this is not all... (M. Baumann' slides

Currently particle therapy is by far more expensive and by far more dependent on a huge team of highly skilled experts

Range of beam is needed

Novel approaches need to be investigated (discovery and basic research) and translated into the clinics (development)

Education and Training

Societal challenges: Innovation and health economy research

But this is not all...

Motion, anatomic changes during treatment, biological changes during treatment

Taking full advantage of particle therapy in terms of physics requires:

- Full image guidance (real time)
- Reduced range uncertainties (real time beam imaging)
- In vivo dosimetry
- Highest level treatment planning
- Adaptive algorithms incluing all items above
- Very rapid and exact dose delivery (repaiting, tracking)
- •

But this is not all...

- ¹⁰ Biology based treatment stratification and treatment planning requires:
 - RBE assessment for a large range of beam qualities, energies and positions on the depth curve and beyond
 - RBE assessment for a large range of clinical relevant cell systems and organ systems
 - In the context of combinations used in patients
 - Under knowledge of emerging molecular biomarkers and functional imaging
 - Mechanistic understanding
 - Systems biology approaches for development of comprehensive models for patient use

But this is not all...

Currently particle therapy is by far more expensive and by far more dependent on a huge team of highly skilled experts

Range of beam is needed

Novel approaches need to be investigated (discovery and basic research) and translated into the clinics (development)

Education and Training

Societal challenges: Innovation and health economy research

European particle network

Brussels Meeting 2015: All European centers, ESTRO, EORTC, CERN, ENLIGHT/ULICE

- Scoring and endpoints
- Technology, dosimetry, QA
- Trial inventory (Website); towards joint clinical trials
- Image guidance in PT
- TPS in PT
- Radiobiology, RBE
- Health Economy



1st Particle Therapy Meeting, Brussels (8th April 2015)



MA	T '11.	Converted Convellent and
WP	Title	Suggested Coordinators
1	Scoring of normal tissue reactions and tumor response particle/photon RT; endpoint definitions, outcome database	Hans Langendijk, Mechthild Krause, Roberto Orrechia
2	Dose assessment, quality assurance, dummy runs, technology inventory	Dietmar Georg, Oliver Jäckel, Sairos Safai
3	Trials inventory (website); "Towards joint clinical trials"	Karin Hausterman, Cai Grau, Daniel Zips, Jacques Balosso
4	Image Guidance in particle therapy	Aswin Hoffmann, Alessandra Bolsi
5	TPS in particle therapy	Hakan Nystrom, Tony Lomax
6	Radiobiology, RBE	Bleddyn Jones, Jörg Pawelke, Jan Alsner, Martin Prutschy, Manjit Dosanjh
7	Health Economy	Yolande Lievens, Klaus Nagels

+ Education and Training

2nd Particle Therapy Meeting, Brussels, 2016



2nd Particle Therapy Meeting

When: Wednesday, May 18th 2016

Where: ESTRO office, Brussels, Belgium

2/632e C/

The 7 CERN Initiatives

- Radio-Isotopes (imaging and possibly treating)
- Detectors for beam control and medic
 Diagnostics and Dosimetry (pot) for diation
- Biomedical Facility
 - creation of a facility at CERN that present types and energies to external users for race
 - Iterative experimental verific
- Large Scale Computity Simulations, treatment planning telemed:
- Computer Sim (100 Medical Applications)
- New Update Accelerator Design
 - coordination to design a new compact, cost-eff
 coordination to design a new compact, cost-eff
 coordination to design a new compact, cost-eff
- (C < A Contractions; Ablative Therapies...



OPENMED Slides

Conceptual Design Report ISC-meeting
September, 2015 – Krakow, Poland

Background and context

- 2011 brainstorming meeting: "community call for a dedicated radiobiological research facility"
- Concepts presented and discussed, e.g. in Brainstorming Meeting on LEIR in 2012
- Proof of principle also presented, e.g. in global feasibility study (Abler et al.) and study of transfer line (Abler et al.)
- Need to go beyond this initial work and establish a coherent proposal based on solid requirements and assumptions
- Should reflect the views of a "community" and not of a single institute
- CDR is basis for initial approval of a project
- Then a Technical Design Report, following R&D and detailed technical studies.
 - is basis for construction.
- A CDR is also the fruit of a Collaboration, whereby several institutes elaborate the concept together.



Contents lists available at SciVerse ScienceDirect

Radiotherapy and Oncology



A community call for a dedicated radiobiological research facility to support particle beam cancer therapy

Michael H. Holzscheiter **, Niels Bassler **, Manjit Dosanjh *| Brita Singers Sørensen *, Jens Overgaard *

Recently more than one hundred researchers followed an invi-Recently more than one hundred researchers followed an invi-tation to a businstorming meeting at CERN on the topic of a funite dedicated bookingoistal and replysical research contents. Many more jobs disposal and seven standard aday of presence tations and discounting the way contents and aday of presence development exists, resulting in a community call for the construc-tion of a dedicated laboratory. Below we comment on the essential points.

Over the last decade particle beam cancer therapy has develover the last decade particle beam cancer merapy has dever-oped into a major treatment option. Many new centers have been built, and more are under construction. Currently 35 proton ther-Journal and more are under construction. Currently 35 proton therappy centers and six carbon ion centers are in operation and 24 apy centers and six carbon ion centers are in operation and 24 and 4, respectively are in construction or in the planning stage and 4, respectively are centers are driven by financial consideration and are heavily financial considerations, under garbein numbers it was actually financial considerations, under garbein numbers it was actually financial considerations, and not rechnical or medical ones, which the properties of the permature closed flow new carbon facilities in Germany, This situation encourages neither large-scale fundamental research nor clinical use for complicated and non tactimes in Germany. This situation encourages neither targe-scale fundamental research nor clinical use for complicated and scale fundamental research nor clinical use for complicated and high-risk cases (blowing the positive experiences of the initial re-search at GSI, Darmstadt [2] and the recent start-up of the Heidelseater, at vor, Dalmstaut [a] and the recent start-up of the resus-berg Ion Therapy Centre (HIT) [3–5] this situation is expected to

sange.

Particle therapy is believed to have a physical advantage over Farticle therapy is believed to have a physical advantage over even them not modern X-ray delivery methods (IMRT) based on of the dose to tissue in the Bragg peak, minimizing the dose to the other than the deliverine virtually no dose beyond of the crose to fusure in the bragg pear, minimizing the dose to the entrance-hand delivering virtually no dose beyond the distal edge of the Bragg peak, Hewler ions (i.e. carbon). in addithe distal edge of the Bragg peak. Heavier ions (i.e. carbon), in addi-tion, due to the higher density of ionization events along the par-ticle track, exhibit a higher relative biological effectiveness than tice track, exhibit a higher relative biological effectiveness than X-rays or protons, especially in the Bragg peak region, making Actays or protons, especially in the mags peak regions making them prime candidates for the treatment of radio-resistant tumors

Still, all these advantages are mere speculations based on a scat-Mill, all these advantages are trees executions beared the ter of physical and biological studies, spread over many years, and

performed in multiple centers under different conditions, rest performed in multiple centers under universal conductors, resources in significant extractions [8]. The criticism that no large-scale clinical or pre-chinical studies are available to support these performances are considered to the conductors of the conductors are considered to the conductors of th clinical or pre-clinical studies are available to support these per-ceptions seem seems to the consequently, to fully utilize the benefits of particle therapy, a concerned research effort is called for to proof particle therapy, a concerted research effort is caused for to pro-vide the biological and physical data set to help clinicians in their vide the biological properties of the second properties of the second decision on which the most appropriate cancer incidences for this tections on which the most appropriate cancer inchences for this advanced therapy are, and to give guidance to the biologists and obscious an advanced the property of the pro aurances menapy are, and to give guidance to the indugates and physicists on how to improve the potential capabilities of particle

therapy.

This need is widely recognized in the community [9] but existing centers do not have the beam time available for the basic research efforts needed. Their focus is on clinical 100e, and research
search invited to a few bourc at a time, no ardenuate for
a few bourc at a time, no ardenuate for search errors needed, their focus is on crimcal use, and research time is often intered to a few hours at a time, not adequate for well-organized data campaigns, Obviously a dedicated center for weir-uganizen und campagist. Unyquisty a deuxaneu center tor physics and radiobiology research, offering extended blocks of beam time, with a variety of ions and energies provided, is desper-

What is it needed for?

Particle irradiation and the impact in vitro have been reported in a number of publications, resulting in a large range of RBE data from a number of different cell lines and endpoints [6]. These studies have been used to render the confirming to a large extent the Iron a number of different cell lines and endpoints [8]. These stud-ies have been very useful in confirming to a large extent the hypothese fine effect of particle irradiation. Monetheless, the heterogeneity between the different studies makes it hard to com-late the observation of the many and defined final roundwisting.

neterogeneity between the outerent studies makes it hard to com-bine the obtained data and to draw any definite final conclusions. At this point, for further use in clinical research, there is a need re this point, no surmer use in chinical research, there is a necu for a large range of systematically obtained in vitro data, using tot a large tinge or symmittaning optioneer in vitro man, using dentical cell lines in the same setup and under identical condinormal car mees in the same serup and under memoral condi-tions, enlightening the effects and side effects of particle irradiasous, enugatering the enects and since enects of particle fragila-tion. This will require a broad panel of different cell lines, tion. This will require a broad paner of uniterest test mess, statements garder cells from a range of different fissues, cancer estem cells, and virus infected cells (e.g. Human Papilomavirus, statem cells, and virus infected cells (e.g. Human Papilomavirus, statements). stem cens, and virus infected cens (e.g. runnan rapidomavirus, which has been demonstrated in head and neck cancer to have which has been demonstrated in head one next collect to force an effect on outcome of radiotherapy [10], irradiated with different particle types and LET-values.

I particle types and LE1-values.

A similar systematic approach must be used to test the effect of A similar systematic approach must be used to the time time to control control of the control of text with particle irradiation [11–14].

As with particle firstnation [11-14].

Ultimately, to be able to study the impact on both tumor and Ontinately, to be able to study the impact on both tumor and lormal tissue in the more complex situations presented in a living

vess: michael.holzscheiter@gmail.com (M.H. Holzscheiter).

It is time for reflection

ENLIGHT Organisation

ENLIGHT General Assembly

Should be representative of all centres, all disciplines, ENLIGHT members

Core Group

Desired composition

50% medical members 50% scientific technical members How many members

Desired prerequisite

Interest, availability and time Country distribution

What was? What is?
What is the future?

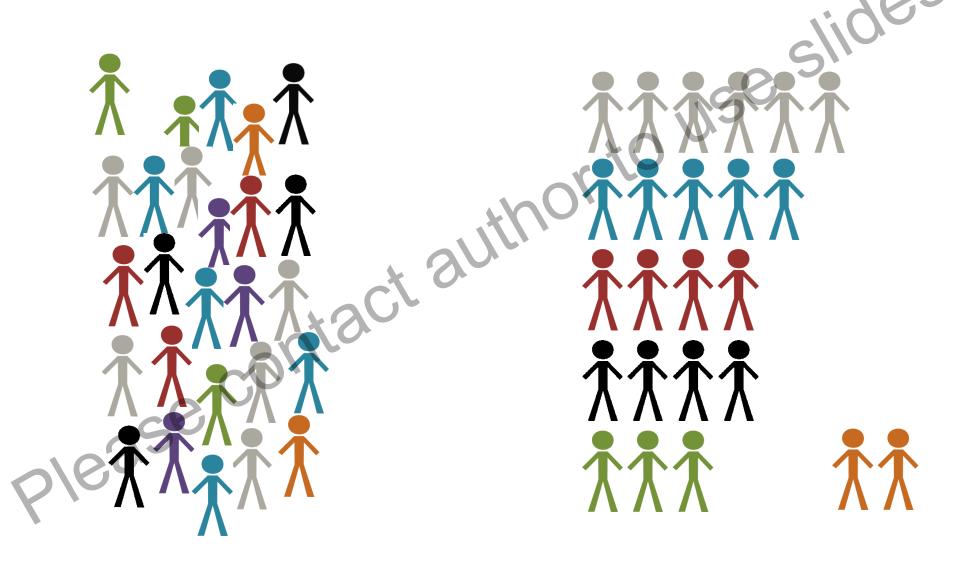
ntact author to use slides Points for discussion today

European Platform (ESTRO+all centres.....

PTCOG

Future (....next meeting)

Personalized precision oncology



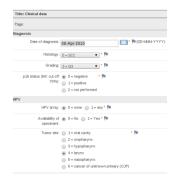
Personalized precision oncology

- Small numbers per center
- Particle trials more affected than photon trials:
 - less centers
 - less patients,
 - additional stratification factors
 which are less relevant for X-rays

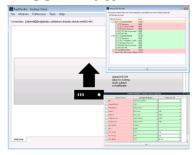
DOSE PLAN DATA BANKS RADPLANBIO (DKTK ROG)

1. Clinical data

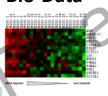
eCRF



DICOM Data



Bio-Data



2. Dataexport

- Data sets
- Statistics
- -DICOM data port (offline)
- -DICOM data port (online = WADO)







ating a data exchange strategy for radiotherapy research: Towards federated databases and anonymised public datasets

Tomas Skripcak a,*, Claus Belka b, Walter Bosch c, Carsten Brink d,ae, Thomas Brunner e, Volker Budach f, Daniel Büttner^a, Jürgen Debus^g, Andre Dekker^h, Cai Grauⁱ, Sarah Gulliford^j, Coen Hurkmans^{k,l} Uwe Just ⁿ, Mechthild Krause ^{a,n,o,p}, Philippe Lambin ^h, Johannes A. Langendijk ^q, Rolf Lewensohn ^r, Armin Lühr a.o, Philippe Maingon Ir, Michele Masucci s, Maximilian Niyazi b, Philip Poortmans t, Monique Simon a, Heinz Schmidberger u, Emiliano Spezi v, Martin Stuschke w, Vincenzo Valentini x, Marcel Verheij y, Gillian Whitfield z, Björn Zackrisson aa, Daniel Zips ab,ac,ad, Michael Baumann a,n,o,p

*German Cancer Consortium (DKTK) Dresden and German Cancer Research Center (DKFZ) Heidelberg; *German Cancer Consortium (DKTK) Munich and German Cancer *German Ganeer Gousentium (DIKT) Develon and German Ganeer Research Center (DKF2) Heidelberg,**German Ganeer Gousentium (DKT) Muterials and German Ganeer Research Center (DKF2) Heidelberg, *German Ganeer Gousentium (DKT) Muterials (Fig. 16), and (DKF2) M

3. Data analysis

- Advanced (Re) TPS
- Spatially resoluted dose corrected outcome
- **Radiomics**
- TCP/NTCP
- **Complex models**
- trial hypotheses secondary analysis
 - machine learning



