Particle Therapy Break-Out session

1st part : 13h30-15h30

Individual presentations, no guidelines

Musical animation by Michael Baumann, Jeens Overgaard, Alejandro Mazal

Thanks to all participants

and to Alberto DiGiovanni for support and notes

1	Niels Bassler(Aarhus) by Denis	Dosimetry in Ion Therapy (specific challenges, nanopart, magnetic fields,..)
2	Hugo Amaldi TERA, (Italy)	CABOTO linac for ion therapy : specs, status, comparisons with synchrotrons
3	Karen Haustermans (Leuven)	Proton Centre: Clinical and Research bunkers (with animal experiments)
4	Denis Dauvergne (Lyon)	RadioBiology, modeling, instrumentation for BIO-LEIR (partner with no beam)
5	Jan Alsner (Aarhus)	Ideas for Bio-LEIR: cells, animals, database, reference beam
6	Jacques Balloso (Grenoble)	France Hadron : all French centers in network. Financing, medical interest, data.
7	Marco Silari (CERN)	GEMPIX applications, in waterphantom, for hadrontherapy. Open cooperation.
8	Rahde MOHAN (MD Anderson)	Points sent to NHI letter of intent research and clinical use of hadrons
9	Tania Mendonça ? (CERN)	New developments of C11 for hadron-therapy and imaging MEDICIS-PROMED
10	Karen Kirkby (Manchester)	UK programme and proton therapy research in Manchester
11	Marco Schippers (PSI)	Designing ligh super-conducting gantry with no ESS at PSI. Would like CERN support
12	Vassilis Vlachoudis (CERN)	Functioning specs of FLUKA @ CERN, what do users and experts want?
13	Giuseppe Battistoni (CNAO)	Experimental activity at CNAO: room, in beam PET, 100h (needs double for Italy)
14	Roberto Orecchia (CNAO)	Italy 2040 plan : Human Technopole 150 M€ Health, nutrition, green nano..Panomics
15	Bleddin Jones (Oxford)	RBE Data, Why do we need a facility at CERN?

Particle Therapy
Break-Out session

2nd part : 16h-18h

Specific questions and answers

Set of questions by Michael Baumann, Jeens Overgaard, Alejandro Mazal

Thanks to all participants

Special thanks to Alberto DiGiovanni, Katia Parodi, Denis Dauvergne for their notes

1. Radiobiology (I)

a) **Do we need a "beyond-proton" facility at CERN ?**
What are biggest challenges for biology (RBE)?
Cells, 3D ? Animals ?   Reference beams ?   Local team?

YES !

✓ **Need to have different types of ions. CERN ideal for that (environment, tools, staff, knowledge,…)**

✓ **Less need for protons (already available in Europe)**

  unless easily available (seems not be the case) or required as a reference or specific trials.

✓ **Capability to change parameters without the constraints of clinical facilities, CE marking, hours, etc.**

✓ **Beware there is also the risk that for "force majeure" due to physics, a Leir experience can be stopped.**

✓ **Be ready for cells and 3D.**

✓ **Include specs for animals as required for the community of users, even with no hosting**

  (but this will be evaluated in the future through Directory, stakeholders, users, ethical comm,…).

✓ **RBE is a priority. Other goals (eg. genomics, drugs,..) can go together, also at medical facilities.**

✓ **Need a reference photon beam.**

✓ **A local team must be identified to prepare and manage the experiences.**

✓ **Biologists could be "external" (eg. Geneva, users, …)**

Action : SPECS (Task group?)

1. Radiobiology (II)

**b) Is it necessary to form a network of distributed facilities? If yes, how to do it ?
Do we need the same equipment/models used in the different labs?**

YES

- ✓ Need to have homogeneous approaches between centres.

- ✓ CERN should not be the "central" element, but part of it.

- ✓ Need formal standard dosimetric intercomparisons and QA protocols (eg through Equal Estro ?).

- ✓ Need also radiobiological standard procedures repeated in all sites.

Action : >Estro (M.Bauman)

c) Do we need a multi-centre database ?

MAYBE YES

- ✓ Can be vast.

- ✓ Verify existing database first (eg. GSI).

Action : Verify (K.Kirkby, K.Parodi,B.Jones ?)

2. Physics

- ***Do we need a facility at CERN for medical physics (Bio-LEIR?)***
- ***What are the big challenges? Detectors, Dosimetry … ?***

YES !

- ✓ **Unique capability at BioLEIR . . CERN ideal for that (phys. environment, tools, staff, knowledge, space…)**
- ✓ **Long setup times allowed, iterative measurements, no need for clearance,…**
- ✓ **Flexibility to tune & vary parameters :**
  - Different ion beams (including protons ?)
  - Pulsing structure (eg. in terms of beam microstructure to synchrotrons, synchro-cyclotrons, cyclotrons,…)
  - Tests of detectors
  - Without the risk of losing clinical certification (CE Label)
  - Radiation hardness tests & high dose rates (special shielding conditions)
  - Study any special question (eg. "incidence of movements on LET" ?)
  - Need imaging, positioner, clinical and beyond clinical specs ....
- ✓ **A table with potential subjects will be distributed among participants.**
  - **Fast feedback required : other subjects, comments, priorities,…**
- ✓ **Typical figures of research lines at clinical centers : Cost 0-7M€ ; 100-200 h/year ; 200-2000 €/hour**

Action : Table (A.Mazal, M.Dosanjh, all)

3. Clinics

a) Should CERN work on Treatment plans (w/ESTRO platform)?

YES

- ✓ Could be problematic as no "clinical" experience.

- ✓ But users can have a large benefit from CERN skills and tools for modeling and dosimetry.

- ✓ Work on physics but also on the interfase between physics and clinics.

- ✓ Ex : MonteCarlo for benchmarking, fast tools, optimizing methods.

- ✓ Links with vendors could be possible.

- ✓ Include CERN experts in ESTRO platform.

Action : >Estro & CERN groups

- ✓ Need CERN to explore & compare with existing systems (commercial, research tools, …)

b) and on Big data processing ?

MAYBE NOT

- ✓ Could be problematic, no "clinical" environment no skills, data will not be sent by clinical partners.

- ✓ Report "yellow card" problems, and Japanese results: should be taken into account, but not here

- ✓ Refer to "Medical Data" group

Action : > Medical Data group

4. Technology (I)

a) *Do we think CERN needs to design and/or construct new accelerator(s), gantries/related technologies ? If yes, which?*
b) *Can CERN really make equipment more cost-effective ?*
c) *Or should CERN better concentrate on "small" requests? (eg.cooling)*

YES

3 Levels have been recognized :

1) **Evolution & cost reduction, without loosing quality :**

   - Cooperate with industry and research institutions under requests and agreements (eg PSI)
   - Exs.: size and/or cost gantries, single room protons, reduce operating costs, scanning, monitoring,…

2) **Design/transfer/construct a new accelerator :**

   - Mainly for heavy ions (studies on linacs, synchrotrons, others?)
   - Single room carbon? Maybe not an optimized approach
   - International cooperative approach and benchmark
        (eg large labs in USA, reduce differences with Japan)
   - Evaluate market

3) **Long future :**

   - Studies on very high Z ions
   - Special clinical ambitious projects (special fractionation, big tumors, track movements,…)

Action : SPECS (Task group?)

4. Technology (I)

Should CERN do work on image guidance and in vivo dose reconstruction for Adaptive hadron therapy?

" YES "

- ✓ CERN is not only pioneer in accelerators
- ✓ BIO-LEIR should also be equipped with best apparatus for imaging, 4D tracking, dose delivery techniques
- ✓ Not everything should be "ask CERN", but "work together with"

Action : SPECS (Task group?) and specific cooperations

Conclusions (still need to be validated)

1. Three domains of work :
   a. Short term & continuous subjects in cooperation with Industry, Labs & Estro.
   b. Bio-LEIR devoted to ions. Specs "as if also animals".
   c. Conception of a mid-term ion accelerator and studies for long-term solutions

2. Need to built specs for them and a scientific program for Bio-LEIR.

3. Work together on the three CERN pillars with the existing structure :
   accelerators, detectors, computers.

4. Include Medical Physics, Biomedical & Biology and "Clinical"
   in Medical Applications with a (small) dedicated team and a research program.

5. Need clear policies for funding
   (work together & no competition with existing centers)

6. "CERN should provide what is unique"