Lessons learned and new questions for a team operating a Protontherapy facility

for Workshop on Accelerator Operations 2021 organized by ALBA

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summary

1. Presentation of the protontherapy facility and missions of the team

2. What happened during the crisis

3. Some lessons learned and some new questions

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1. Presentation of our facility

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The Institut Curie Group is a dedicated cancer center working on treatment, and basic, translational, clinical research

➢Hospital Group (2100 pers)

- Paris Hospital
- Proton therapy center in Orsay (60 pers)
- - René-Huguenin Hospital in Saint-Cloud

➢Research Center (1100 pers)

15 units in Paris and Orsay
which are associated with the CNRS, Inserm, and universities.

➢ Translational Research Department

to the transfer of scientific innovations to the bedside to improve patient care and/or to research designed to improve understanding of cancer by performing preclinical studies.

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The 8 most important dates for Institut Curie

1909
Marie Curie created the **Radium Institute** associating research and medical applications for radiation to treat cancer.

1920
The Curie Foundation, 1st historical center for cancer treatment.

1922
New treatments combining surgery and radiotherapy are perfected. (A dispensary is opened at Institut Curie).

1970
Merger of the Curie Foundation and the Radium Institute, which officially became Institut Curie in 1978.

1977
The Pediatric Oncology unit opens, it is one of the first in France.

1995
The center for research into the Biology of cancer is created.

2010
Institut Curie merges with the René Huguenin Center.
New Pronton Therapy center.

2017
Immunotherapy center for research and clinical activities:
85 Researchers
60 Clinicians
20 Beds, 1400 m^2

1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2017

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- 1957 Research physical center

- 1990: Creation of CPO (network)
- 1991: 1st Ocular treatment

1 Room – Fix. Line

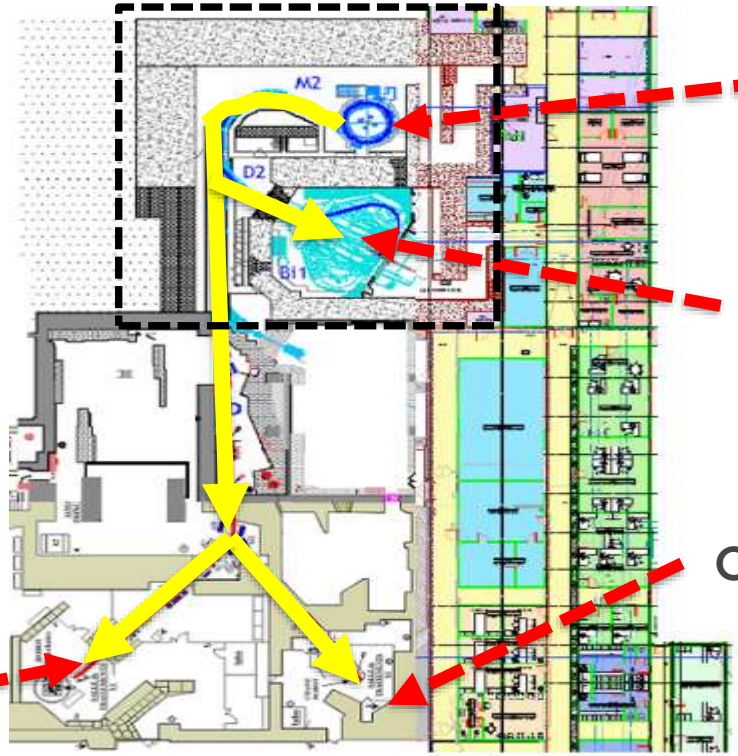
- 1993: 1st intracranial treatment

2 Rooms – Fix. Lines

- 2004: Integration

into the Institut Curie

- 2006 1st General Anesthesia
- **2010 New cyclotron + 1 Gantry**
- 2011 1Gantry +2 rooms (Horiz line)
- 2019 11 000 fractions/year - %PBS



Cyclotron 230 Mev (IBA)

Gantry Room: All tumors (IBA)

Y2 Room: Ophthalmic Tumor (Home made)

Y1 Room: Intracranial tumors (Home made)

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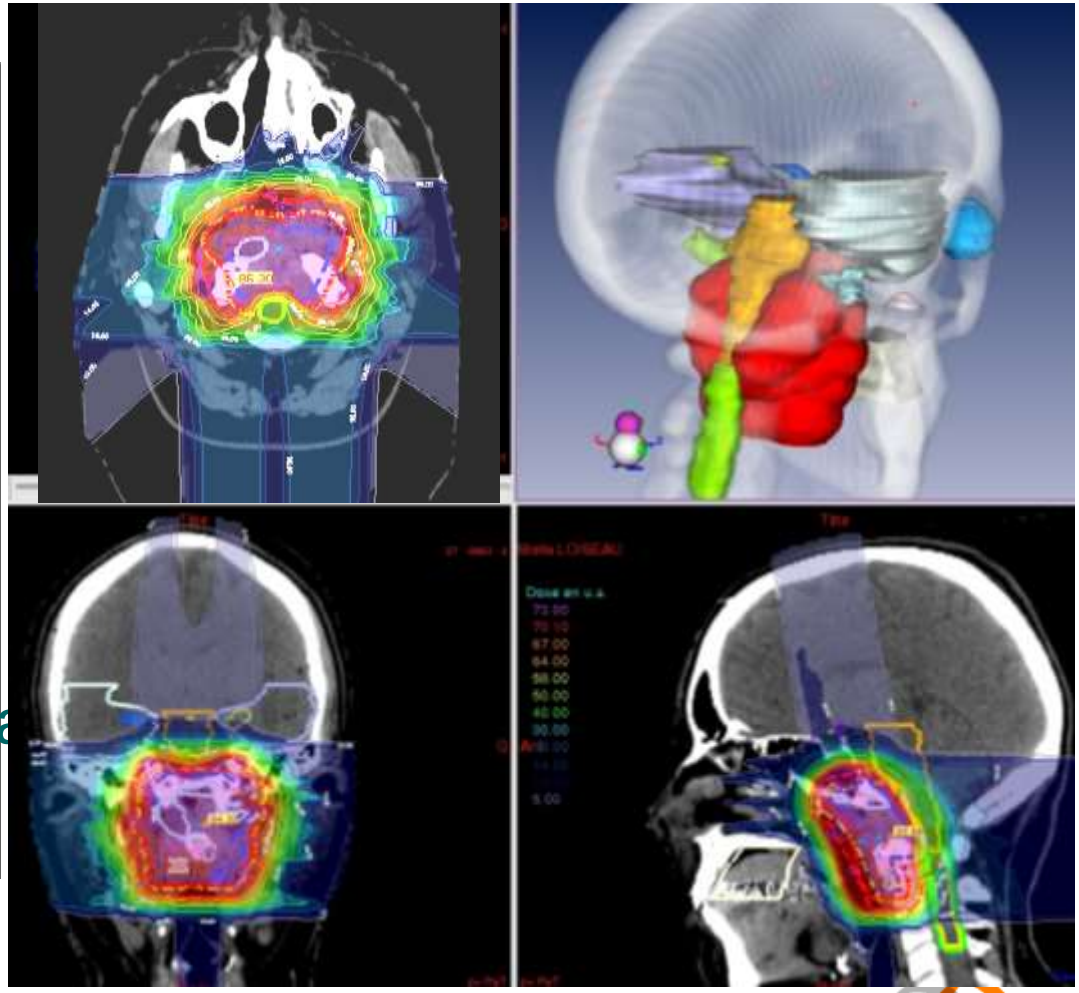
Examples of Treatment achieved

BASE OF SKULL TUMORS

- Chordoma
- Chondrosarcoma
- Sarcoma
  (e.g. Ewing sarcoma, rhabdomyosarcoma)
- Salivary gland tumor
  (eg. Cystic adenoid carcinoma)
- Glomic tumor
- Nasopharyngeal carcinoma
  (boost)



How protontherapy works (for beam considerations)

Video (from IBA/youtube)

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Operational Features

Typical day

6h30 - 7h30 technical startup and warm-up
2 days per week with 30 minutes of maintenances
7h30 - 8h30 Beam checks (by users)
8h30 – 19h15 – use for clinics (treatment or Quality Control) - **11 hours of operations for treatments**

after 19h15 several options
Extra-time to finish the clinical activity
(if case of large activity or delays during the days)
evening session for Quality & Periodic Tests
evening session for experimentations
(physics, or mainly radiobiology in vitro or in vivo)

Typical week

5 days of operation
Some saturday morning or week-end of maintenance

Typical year

52 weeks of treatment
Only 4 fridays + week-end for large quarterly maintenance sessions

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Organic distribution of the Biomed-Tech-Ing team staff of 5 engineers and 8 technicians

kinds of activities		machine-lines	IT-control	mechanical	tt rooms	utilities
operation-production	3	2		1		
support	3	1	0,5	0,5	0,5	0,5
maintenance-consolidation	3,5	1,5	0,5	0,5	0,5	0,5
development	3,5	0,5	1,5	1	0,5	
	13					

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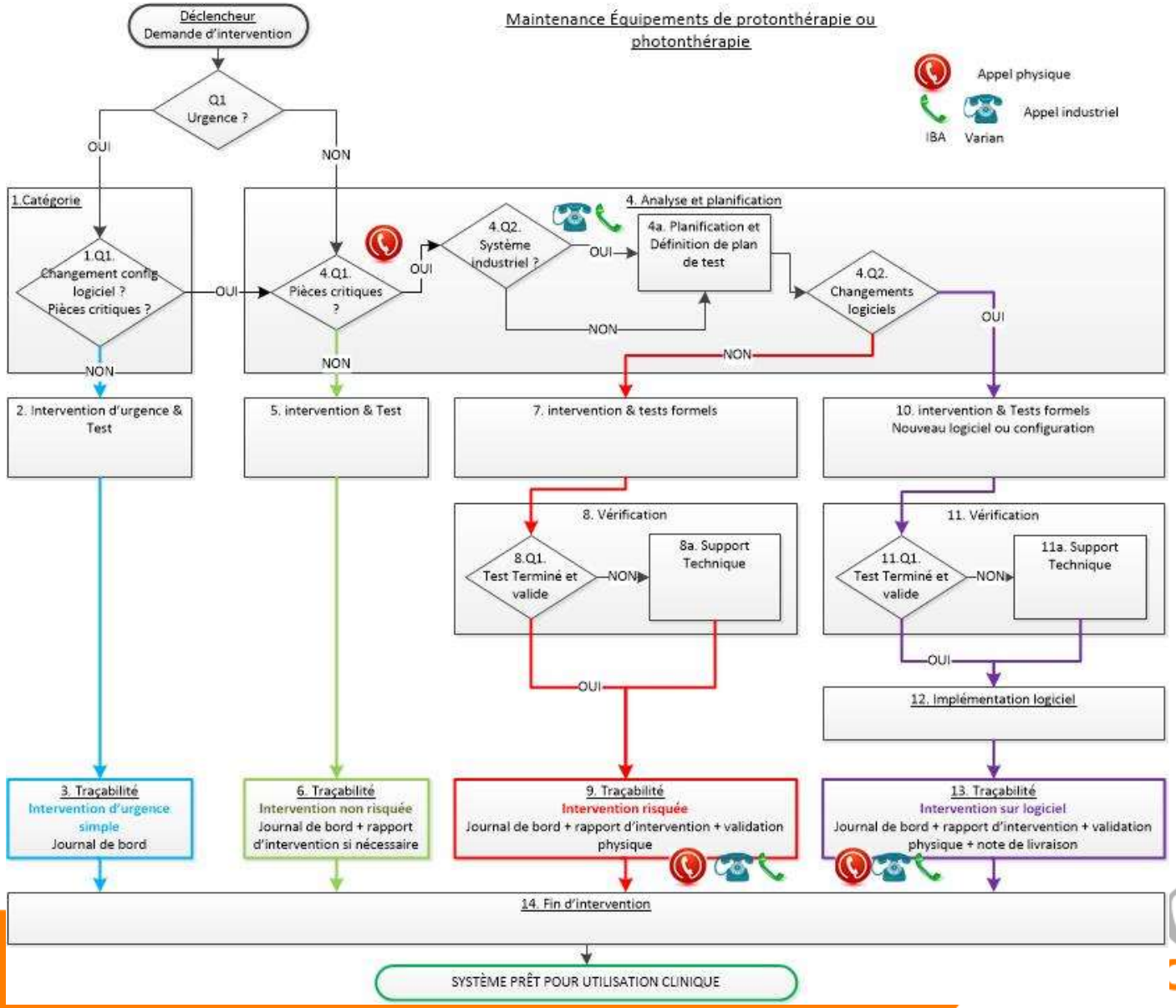
Operations

Monitoring

Maintenances

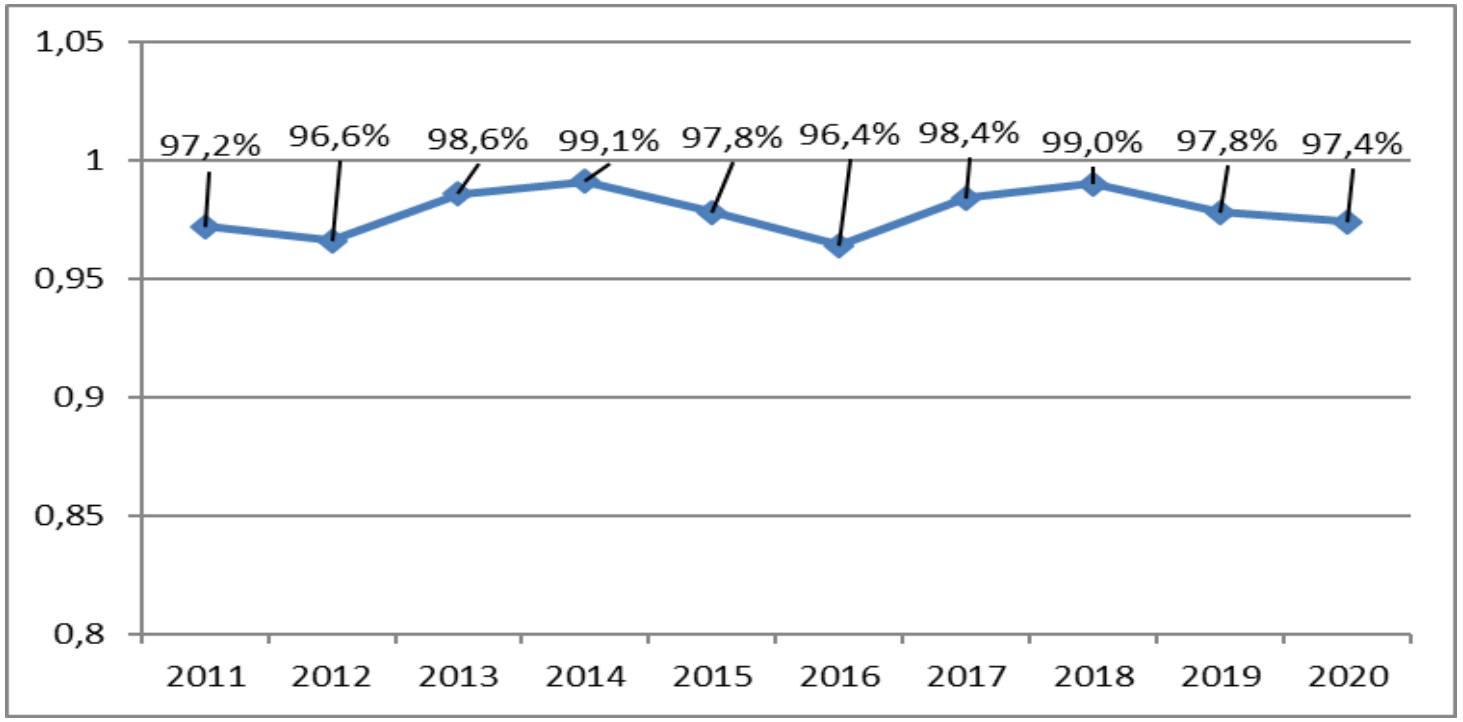
Upgrades and maintenances

Protocols to respect QA medical devices standards



Uptime of the facility of protontherapy:

(% of patients treated the D day)



années	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
nb séances	3904	5658	7253	8757	9567	9637	11141	11444	11090	10110
report 3 salles	2,8%	3,4%	1,4%	0,9%	2,2%	3,6%	1,6%	1,0%	2,2%	2,6%

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WAO facilties / Curie Protontherapy Facilty

Common features

Accelerator

Operations-Maintenance

Including issues of the facilities

In order to optimize uptime

multi-users (% research)

Specific features

Size (1,3 MWatt, staff tech : 13)

Shared contract of maintenance

within the Treatment process and wokflow

Low level of evolution since 10 years

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2. What happened during the (pandemic) crisis

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During the crisis

- **the treatment activity did not stop**
- **the experimental activities were stopped till beginning of 2021**

Sanitary rules

- **major impact on the process of patients for caregivers (bareer gestures, cleaning process, …)**
- **sollicitation for technical support (ex: design and realization of plastic visors)**

Lockdown

- **what is the minimal personal on site ??**
- **what are the essential preventives maintenances ??**
- **slowdown and lack of reactivity of sub-contractors**
- **% staff perturbated to be « pushed out » in remote work**
- **opportunities: writing proceedures, debriefing on the optimization of team works, learning of the tools to work remotely, etc …**

Governance-Management

- **Hospital entity with crisis board meeting (daily, weekly)**
- **Information: a lot of information-instructions multi-channel**
- **Uncertainties, Benevolence**

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Sanitar rules and required behaviours

1 more sly risk, where are the real risks ?
paradoxal injonction: keep distances and do not work alone
importance to keep real visits in the facilities to hear, smell, feel…
opportunities to increase the remote control

Distancial et telework

opportunities: remote meeting, more capacity to interact with new people
risks: invasion of private life (« blurring »),lower presence for reactivity

Management of crisis

circuit of decision and information (to rethink about)
how keep detection on weak signals (systems, people) ?
what is the level of empowerment for people for normal work during the crisis ?

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What is the part of beer / part of foam during the crisis ?
(real risks, real activity of people,,…)

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Some lessons learned and some (2) new questions

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Lessons learned

Operational people need to be on the field

We could have worked differently before (ex: remote tools)

Hospital is « wired » to live with the crisis

PCA (Plan for the Continuity of Activities) can be useful in some situations

….

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Question #1

Principles of Management (Fayol)

Division of labor
Authority
Discipline
Unity of command
Unity of direction
Subordination
Remuneration (fair).
Centralization
Scalar chain.
Order
Equity.
Stability.
Initiative.
Esprit de corps

Henri Fayol
(french engineer, 1841 – 1925)

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Questions #1

How keep the « Esprit de corps » of a team with % of remote work ?

(Esprit de corps: team spirit ?, collective empowerment? , solidarity ?, etc)

What is the admissible ratio of % of remote work ?

What are the ways to compensate ? To optimize ?

Questions #2

About sly risks: an increasing panorama

Risk	sly ?	Rare ?	informations	training
Covid	yes	No then yes	High	No
Radiations	Yes	no	High	Yes
Electricity	Partly	No	Medium	Yes
Magnetic field	Partly	No	Low	Low
Fire	no	Yes	Medium	Yes
Gaz (ex: SF6)	Partly	Yes	Low	Low
Biological	Partly	No	Low	Low
Terrorism-attack	No	Yes	Crisis	Yes
harassment	no	Yes ?	higher	Low
…	…	…	…	…

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management of the sly risks

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…	…	…	…	…

+ management of the risks of the potential failures

reliability

+ management of the risks on the medical operations and devices

Safety
of treatments

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Questions #2

- On the risk issues: what is the admissible mental load possible for operators, and managers ?

- How many different considerations of risks they can really integrate ?

(in order to avoid mistake, non-considerations , burnout, …)

- What are the ways to have realistic and sustainable principles ?

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Thank you !

your position and feedback on these questions

other questions ? Discussions ?

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