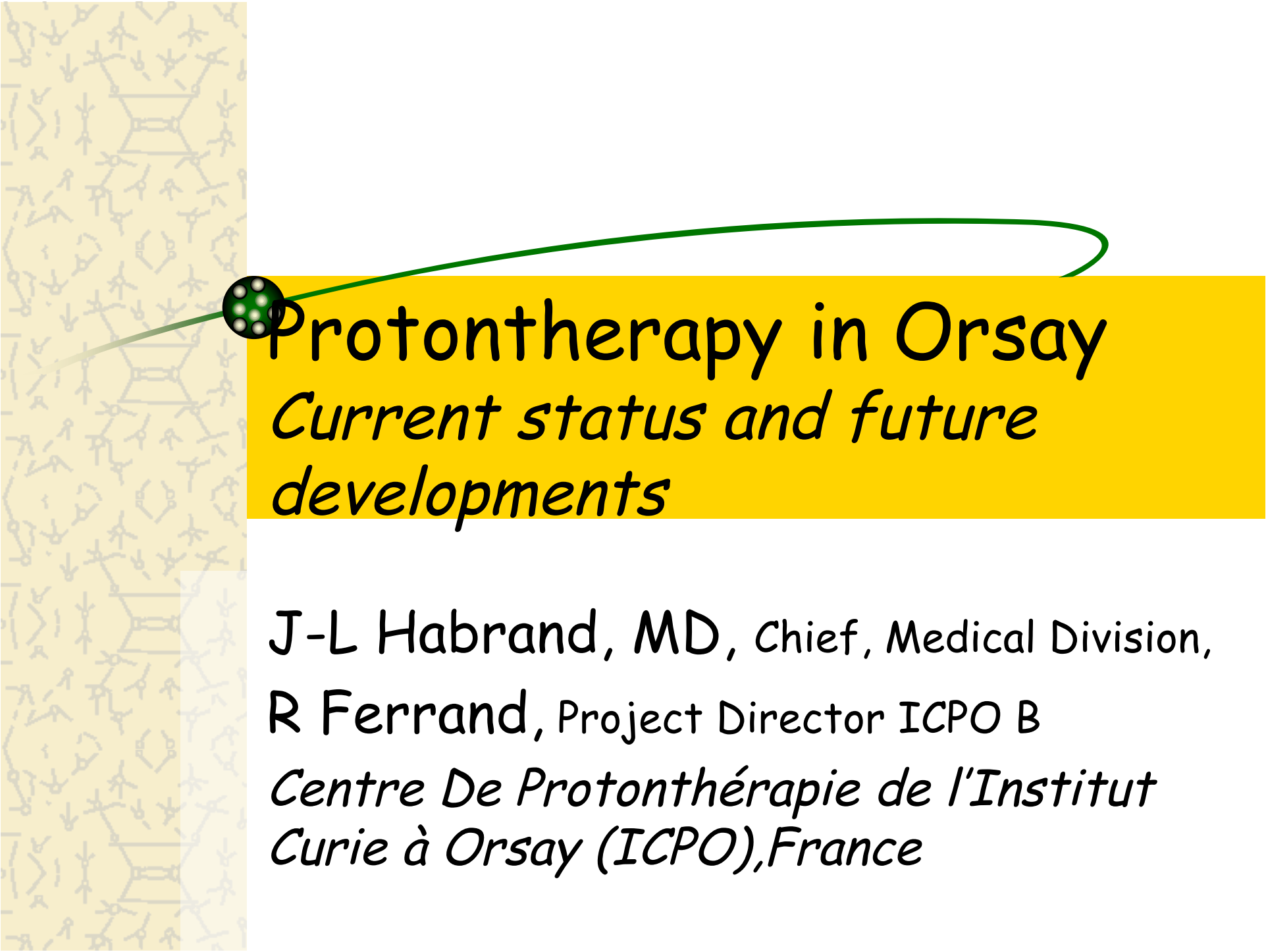


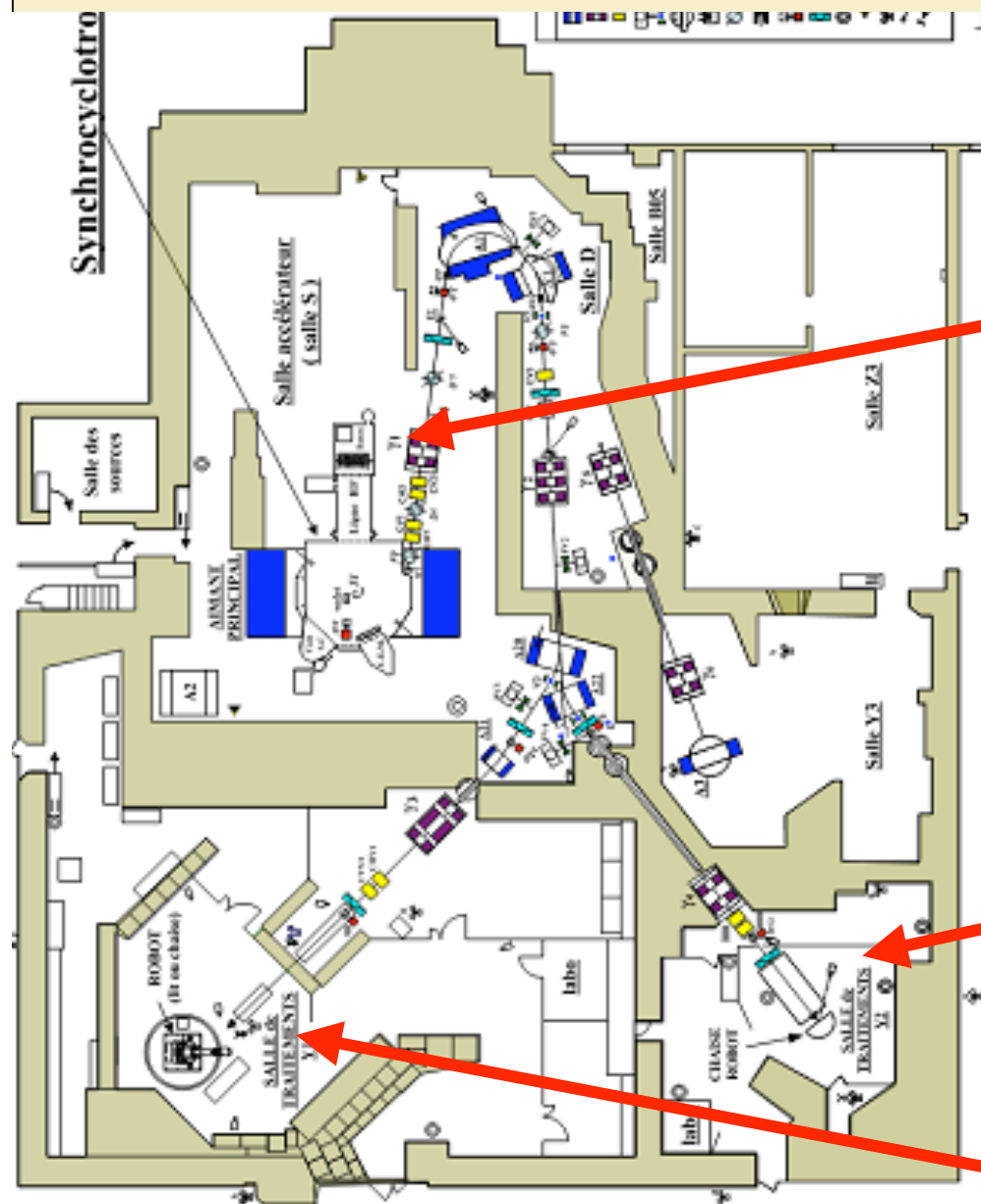


Protontherapy in Orsay

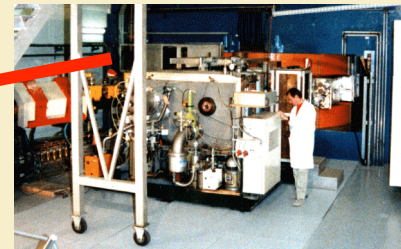
Current status and future developments

J-L Habrand, MD, Chief, Medical Division,
R Ferrand, Project Director ICPO B
*Centre De Protonthérapie de l'Institut
Curie à Orsay (ICPO), France*

Centre de Protonthérapie d'Orsay (1958-1977-1991): > 4000 patients



Synchrocyclotron
200 MeV
1000 tons



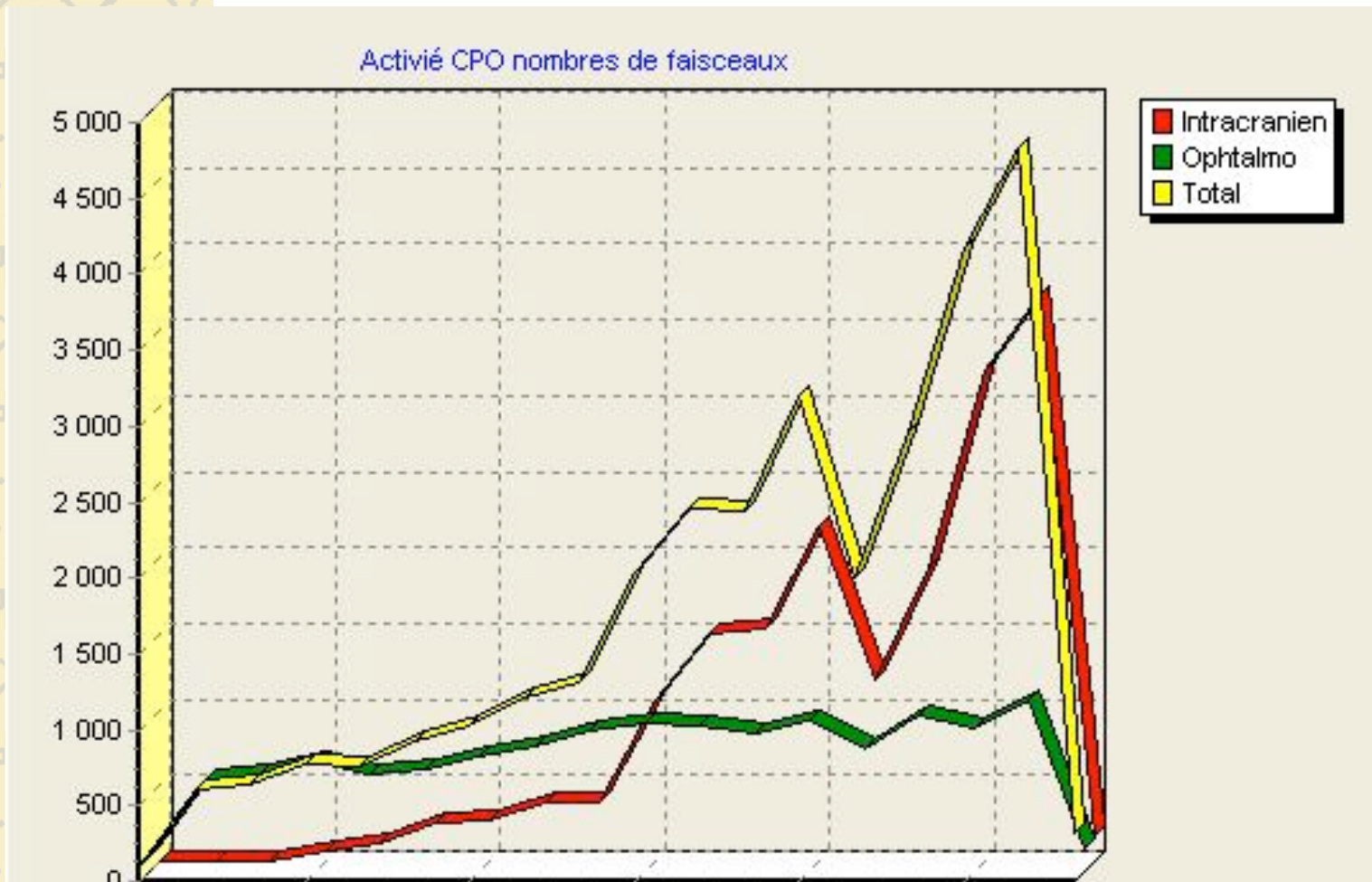
2 treatment rooms



Chair + couch ps



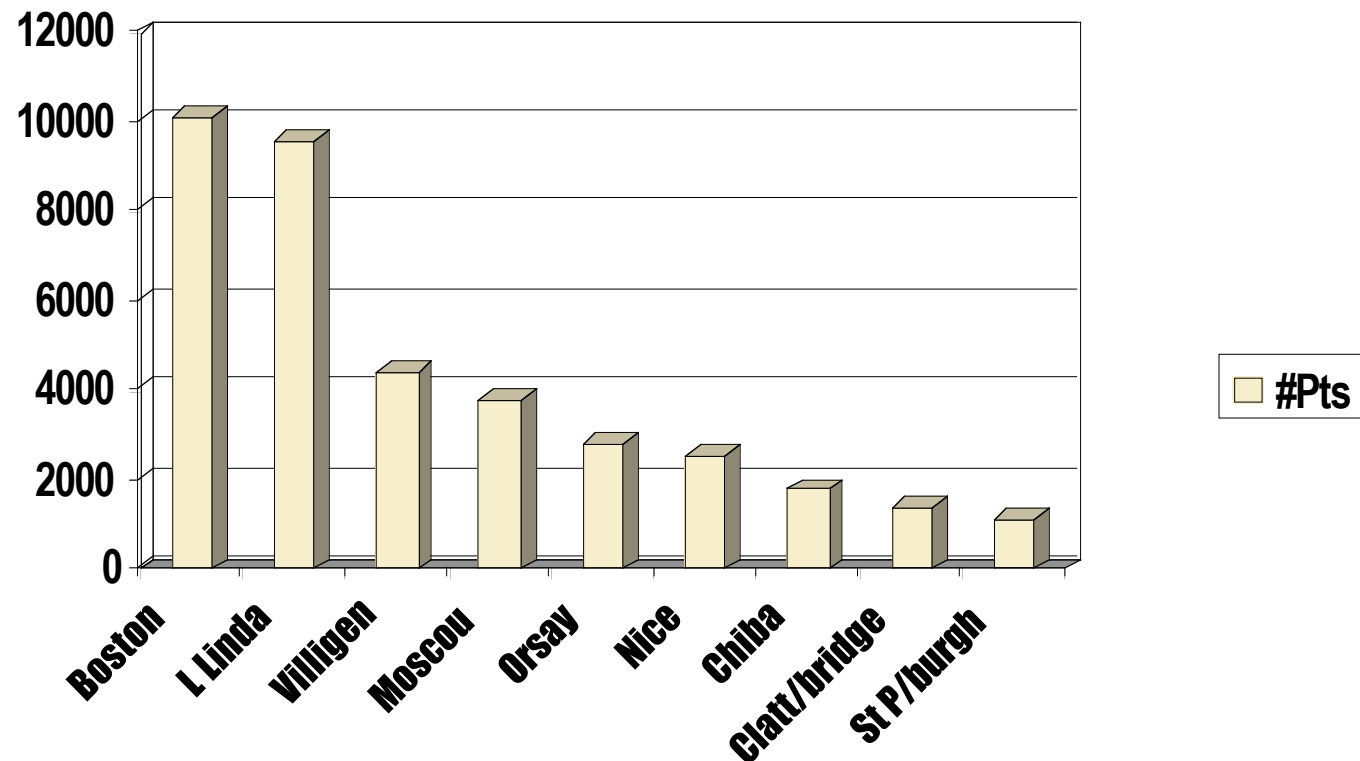
Patient throughput : still increasing with new indications





*CPO: which place ?
Which technology?*

Centers with >1,000 pts treated





THE CENTRE DE PROTONTHERAPIE D'ORSAY UNTIL 2003: A PARISIAN CONSORTIUM !

Institut
Gustave-Roussy
Villejuif

Institut Curie
Paris

Assistance Publique
-Hopitaux de Paris

CPO
Orsay

Centre René Huguenin
Saint-Cloud



THE CENTRE DE PROTONTHERAPIE D'ORSAY SINCE 2003...

Institut
Gustave-Roussy
Villejuif

Assistance Publique
-Hopitaux de Paris

Centre de Protonthérapie
Institut Curie
Paris



Optimization of existing rooms and facility

➤ Continuous upgrade of the equipment

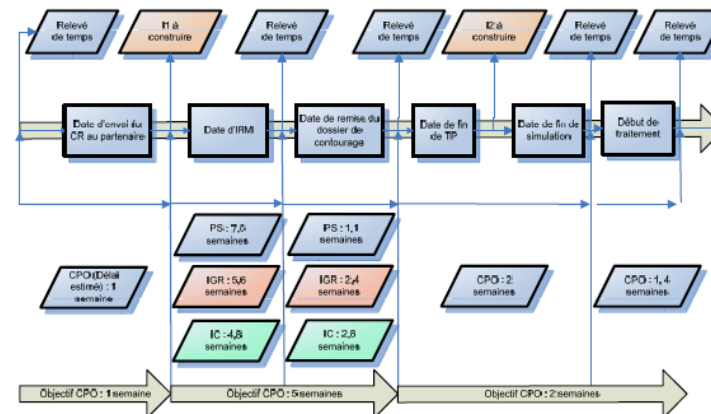
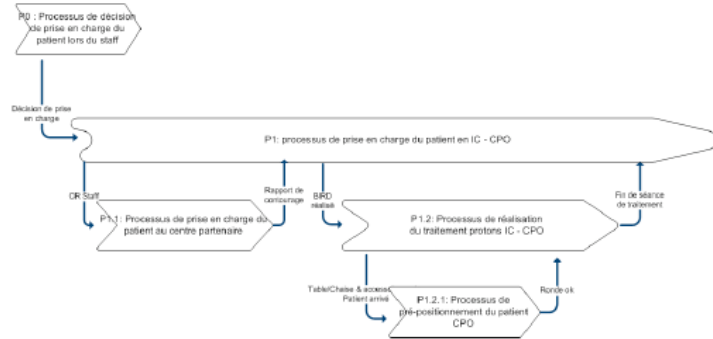
- Machine
- Beamlines
- Treatment rooms

➤ Continuous Research and Development :

- Patient positioning
 - Beam control and dosimetry
 - Treatment planning
 - Workflow
- ### ➤ Optimization and operability studies

● New project : several technical features

Optimisation : (ongoing lean 6σ since 2006) :



Main goals :

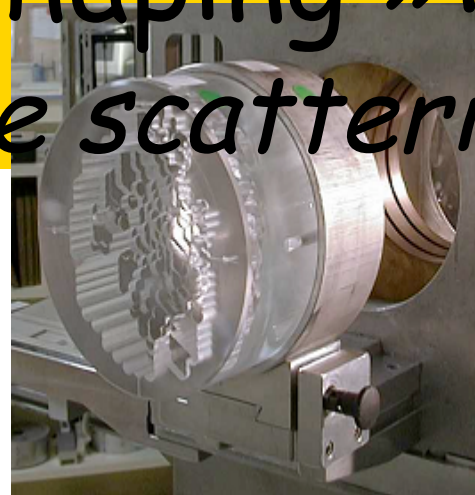
- Throughput optimization
- Fluid process
- Patient care (comfort, delays...)



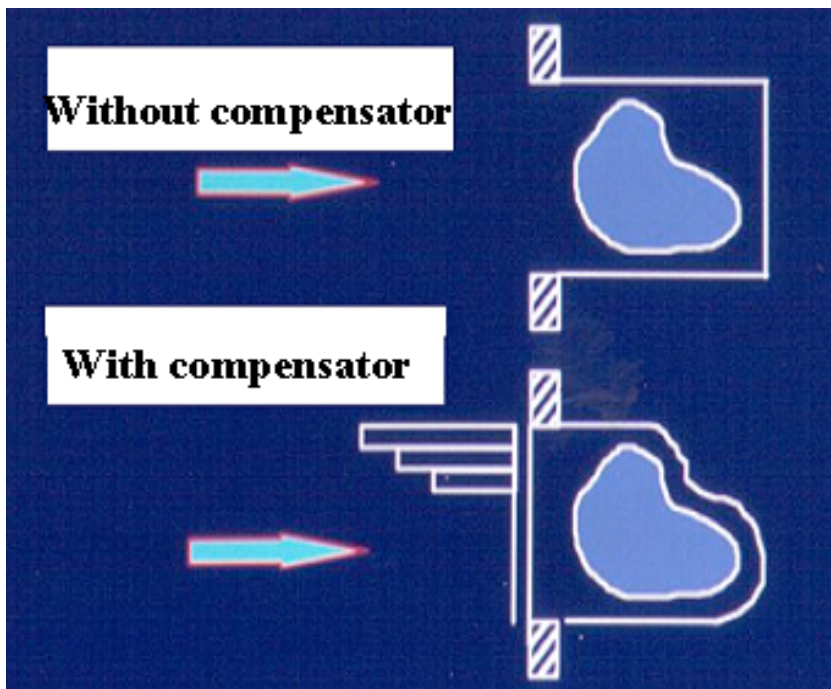
Beam's « shaping »: *passive double scattering*



Collimator



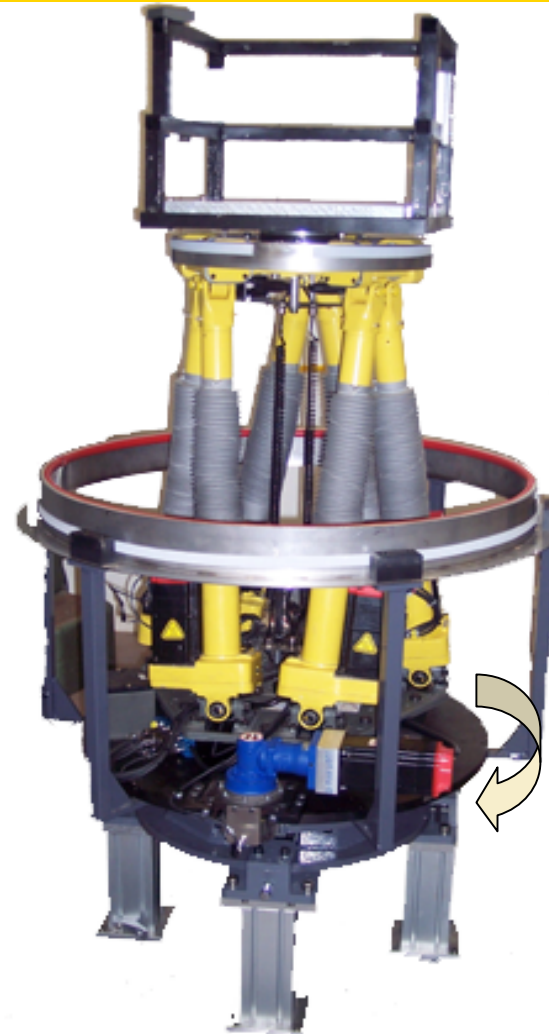
Compensator



● Patient's set-up : *fixed beam : supine + seated*



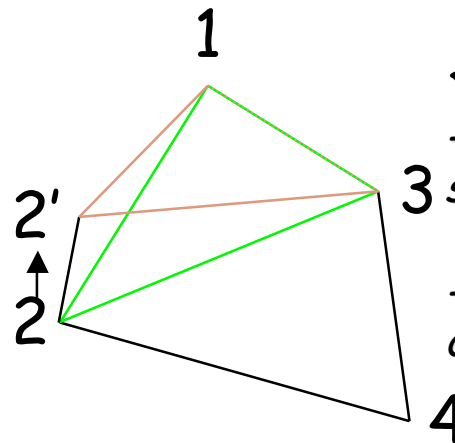
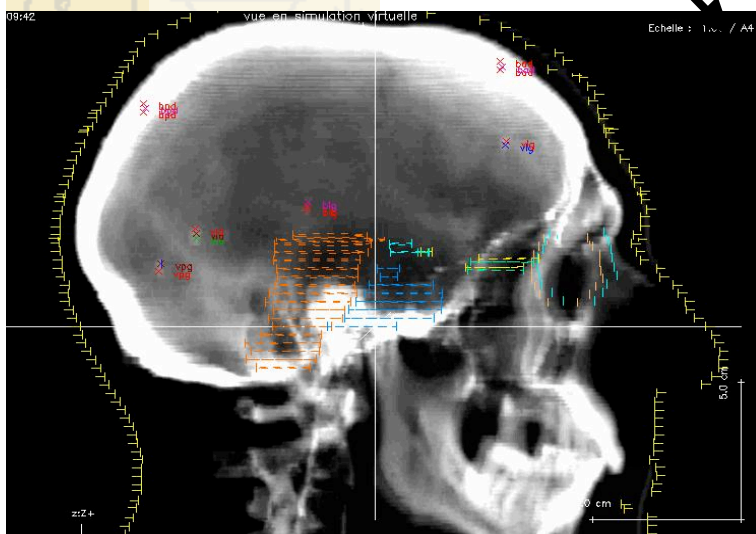
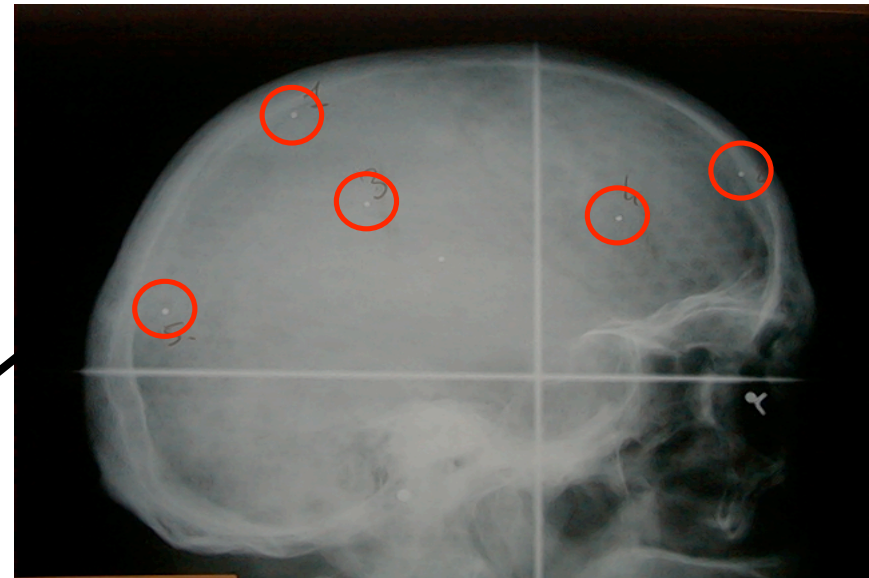
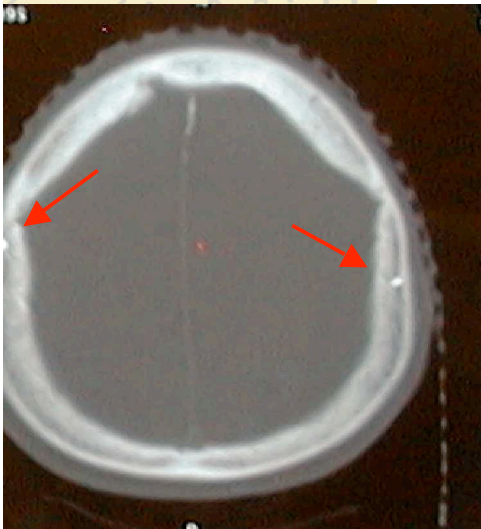
● Patient's positioning : *fixed beam : isocentric*



Stereotactic alignment : invasive fiducial markers

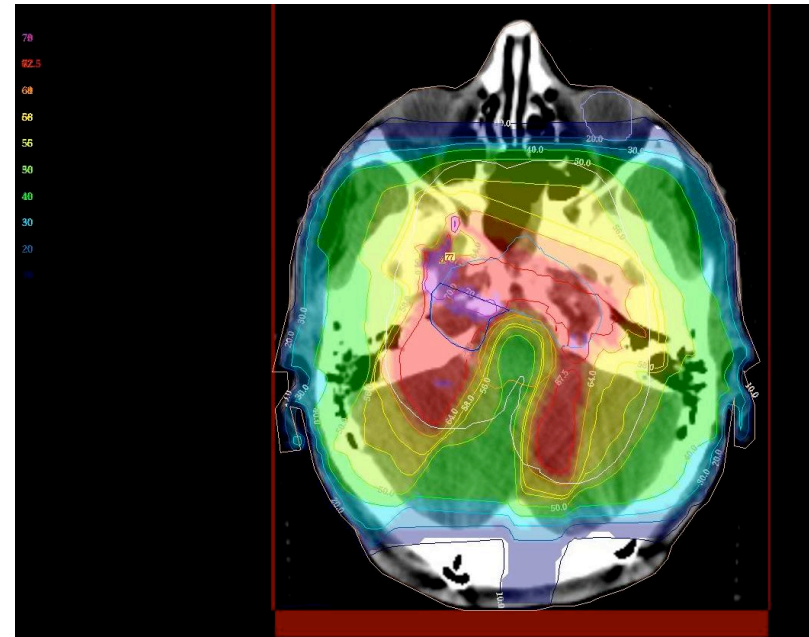
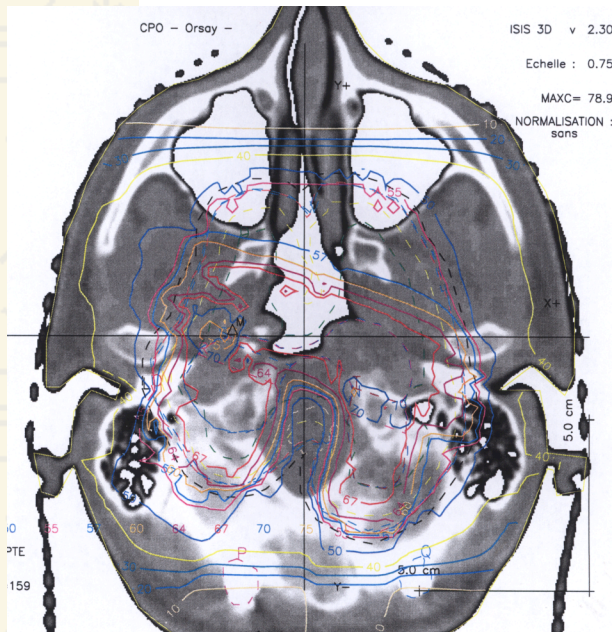


● Stereotactic alignment: daily set-up

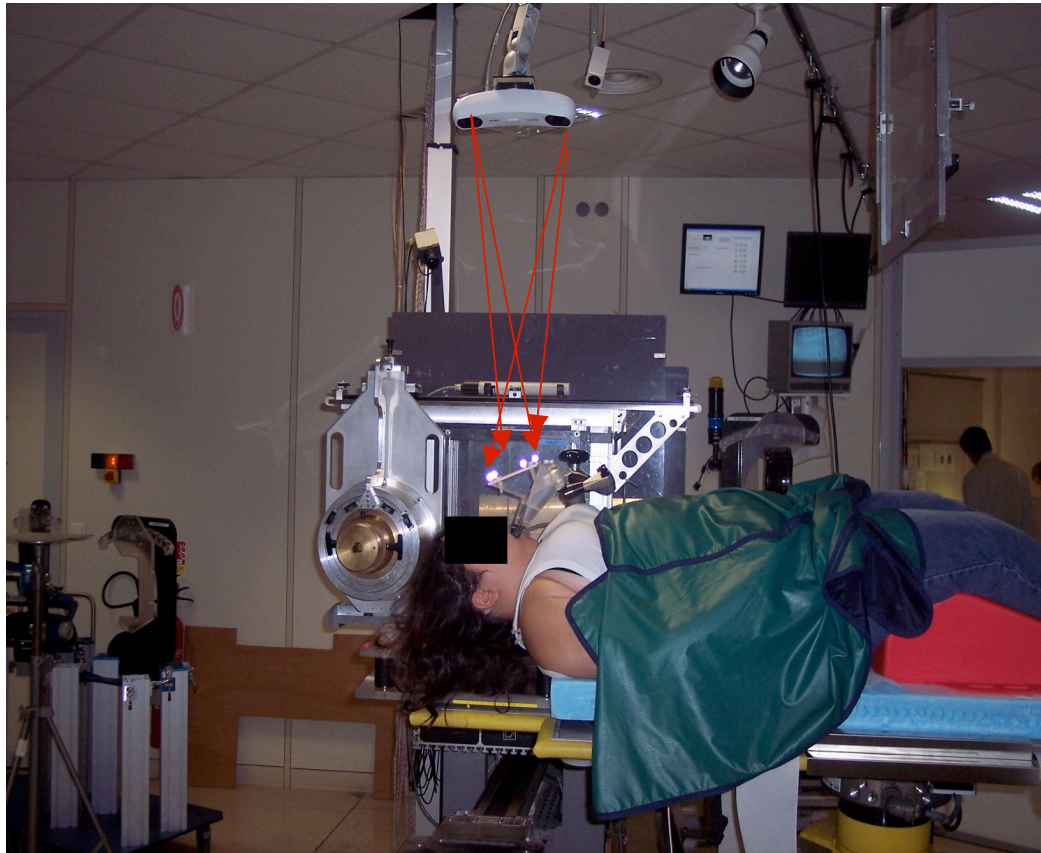


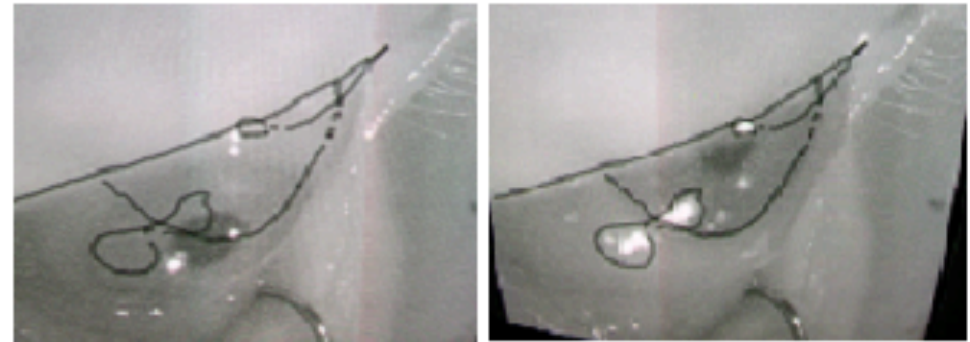
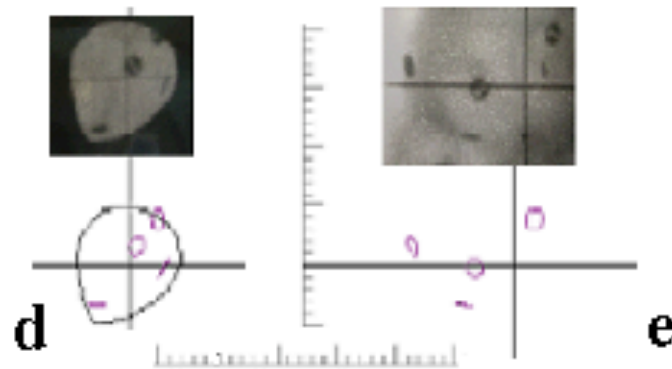
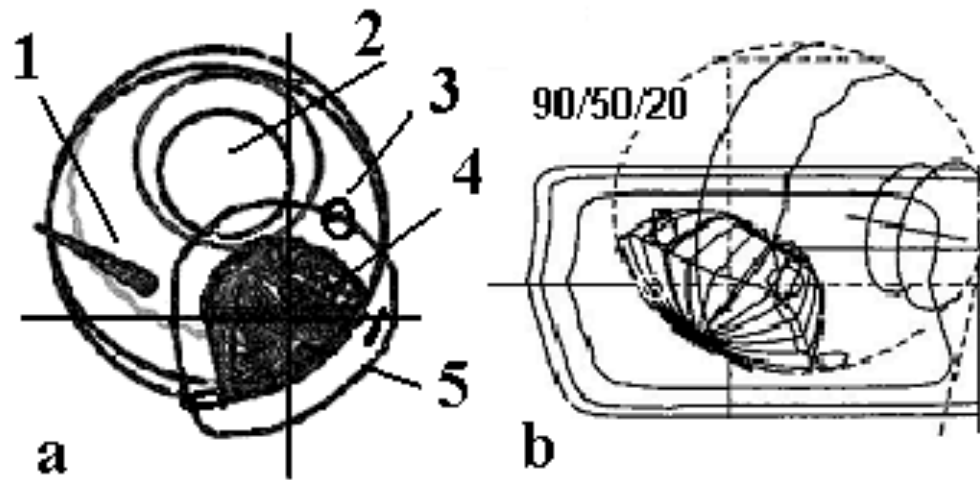
« *Rotaplus* » program:
- Virtual triangles between gold
3 seeds (DRRs)..
- Compared with actual position on
orthogonal X-Rays

New treatment planning (Dosisoft)



● Infra red stereoscopic camera (Polaris)



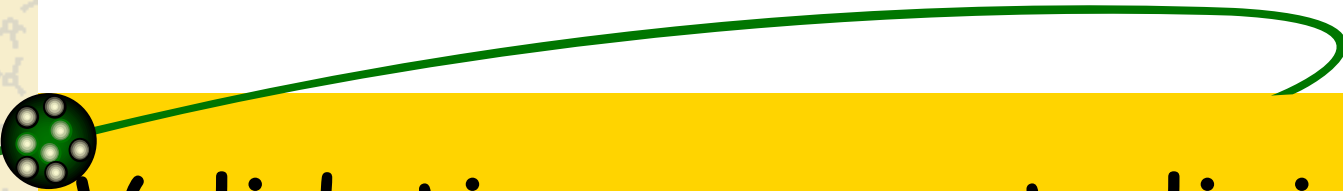


→ Image guided radiation therapy



Clinical program in Orsay

- ✦ Aims at validating currently recognized clinical indications, on highly selected malignancies
- ✦ Also at developing new protocols to explore new avenues esp. in pediatrics
- ✦ Along with necessary technological innovations



Validating current clinical
indications...

Patients' characteristics: Ophtalmological

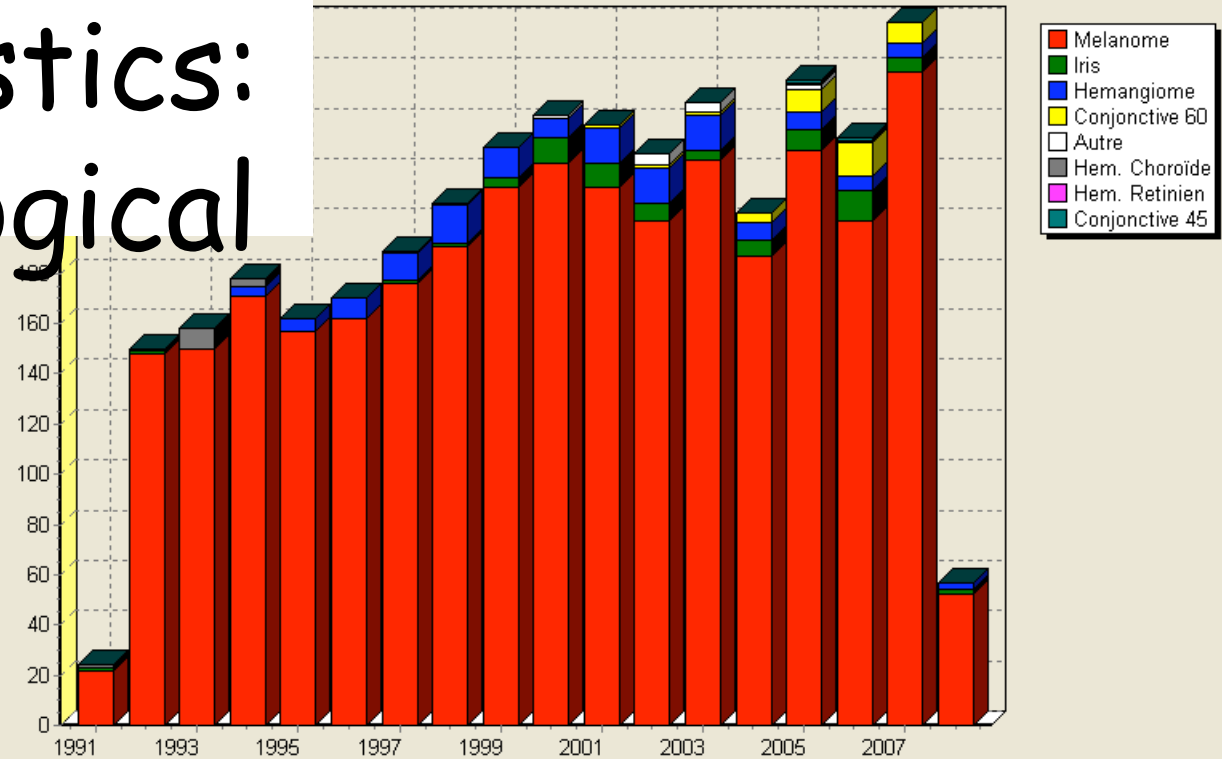
Autre	4		
Hémangiome Choroïde	14	4	30
Hémangiome Rétinien	1	8	30
Conjonctive 45	2	8	45

Répartition par année

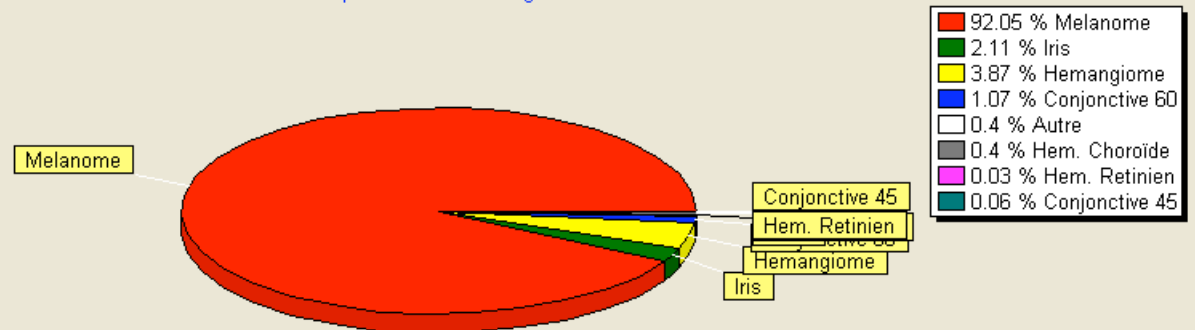
Année	H1	H2	H3	H4	H5	H6	H7	H8
91	22	1	0	0	0	1	0	0
92	148	1	0	0	0	1	0	0
93	150	0	0	0	0	8	0	0
94	171	0	4	0	0	3	0	0
95	157	0	5	0	0	0	0	0
96	162	0	8	0	0	0	0	0
97	176	1	11	0	1	0	0	0
98	191	1	15	0	0	1	0	0
99	214	4	12	0	0	0	0	0
00	224	10	8	0	1	0	0	0
01	214	10	14	1	0	0	0	0
02	201	7	14	1	5	0	0	0
03	225	4	14	1	4	0	0	0
04	187	6	7	4	0	0	0	0
05	229	8	7	9	2	0	1	1
06	201	12	6	13	1	0	0	1
07	260	6	6	8	0	0	0	0
08	52	2	3	0	0	0	0	0

Total : 3459

Evolution des histologies

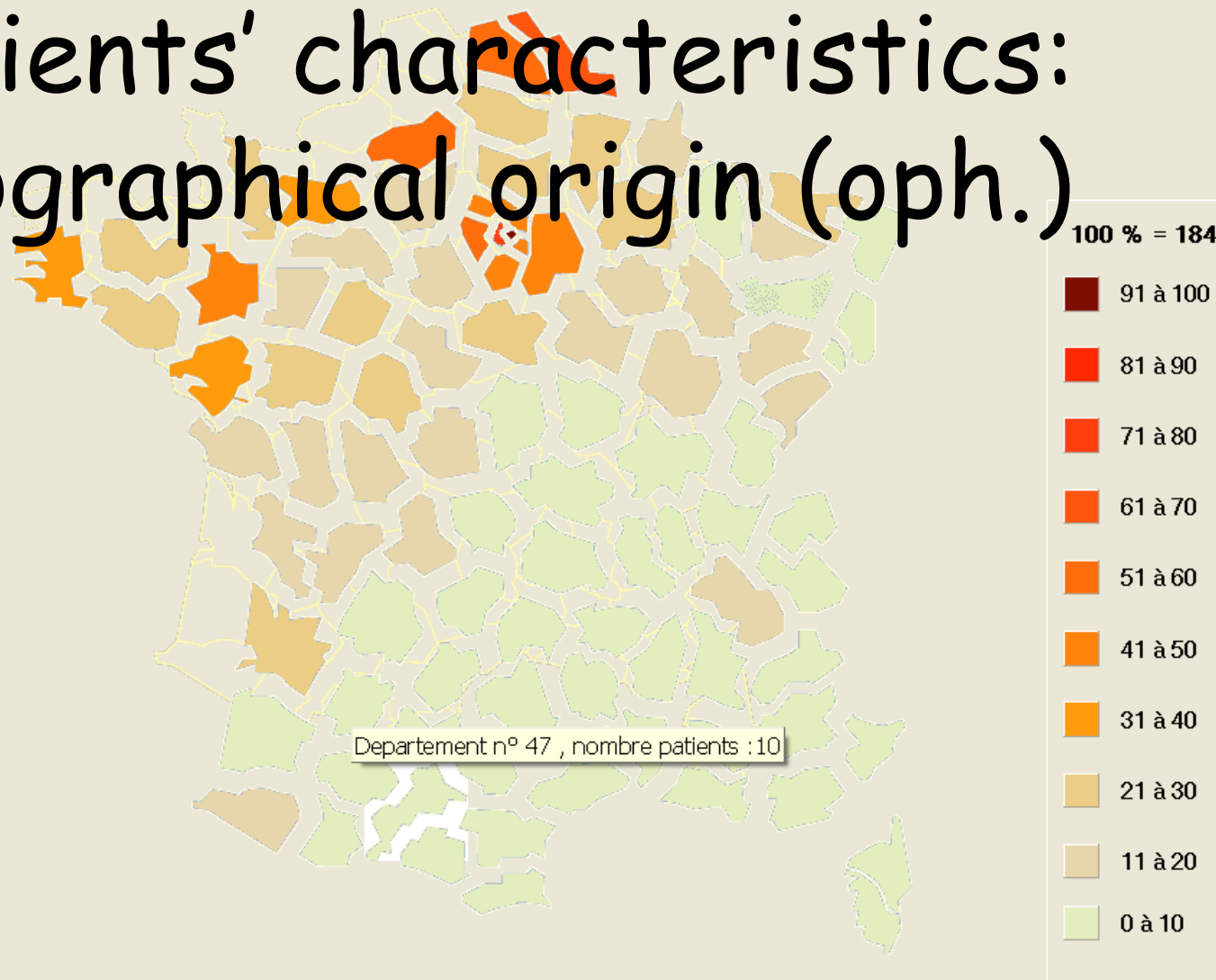


Répartition des histologies



Departements			Pays	
2	51	52	Algérie	26
38	52	19	Allemagne	1
1	53	21	Belgique	2
2	54	25	Bésil	1
5	55	16	Bulgarie	5
2	56	40	Burkina Faso	1
10	57	39	Chine	1
19	58	10	Canada	1
2	59	126	Côte d'Ivoire	1
23	60	52	Égypte	3
4	61	29	Espagne	2
12	62	97	France	325
18	63	2	Grèce	2
65	64	33	Guyana	1
8	65	12	Italie	7
19	66	6	Liban	8
26	67	6	Lithu	1
18	68	3	Liechtenstein	1
14	69	7	Luxembourg	3
2	70	19	Maroc	11
24	71	13	Maurice	1
48	72	38	Pologne	4
5	73	15	Portugal	4
13	74	6	Roumanie	4
26	75	184	Russie	1
6	76	100	Sénégal	3
30	77	86	Tunisie	8
36	78	108	Tuvalu	1
68	79	22		
9	80	50		
14	81	8		
9	82	4		
38	83	3		
10	84	11		
74	85	27		
23	86	23		
55	87	26		
28	88	15		
8	89	28		
16	90	12		
29	91	87		
0	92	135		
1	93	83		
65	94	89		
54	95	78		
5	97	16		
10	98	1		
2	99	1		
47				
42				

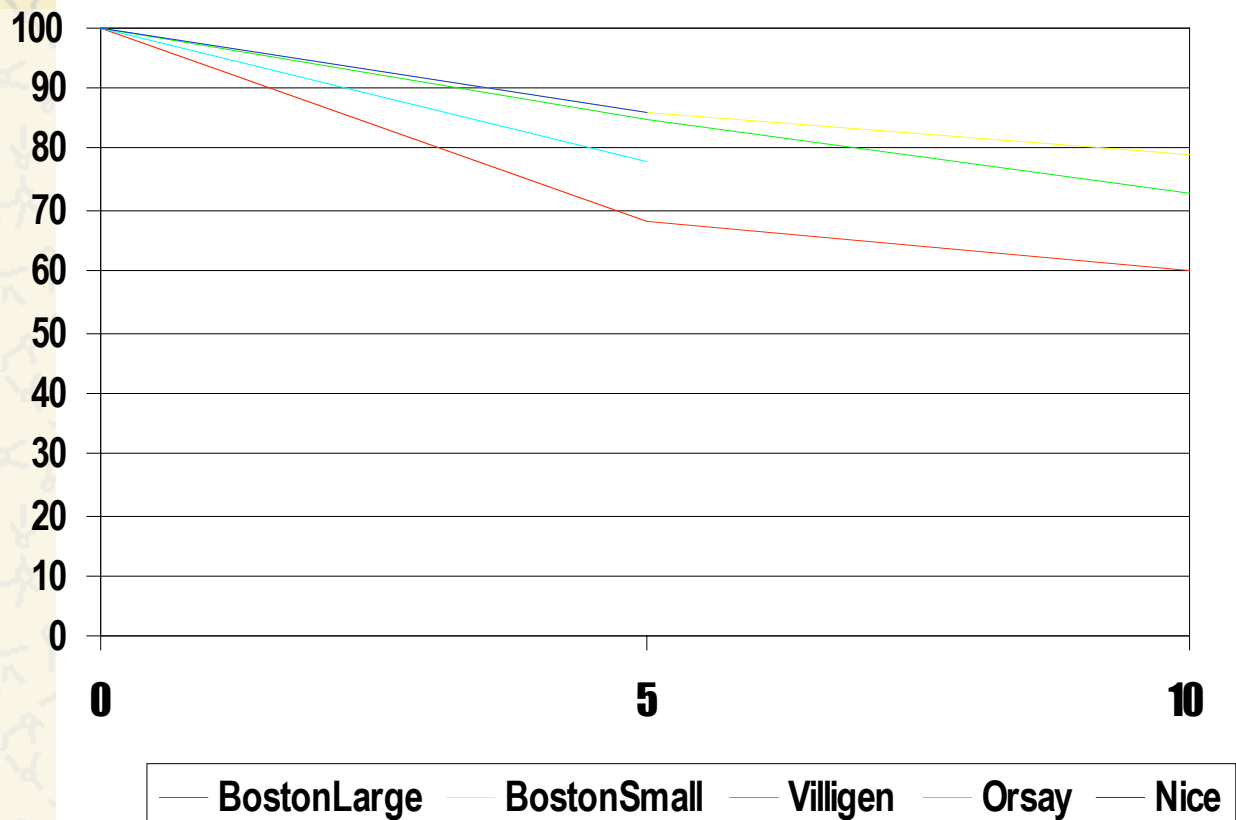
Patients' characteristics: geographical origin (oph.)



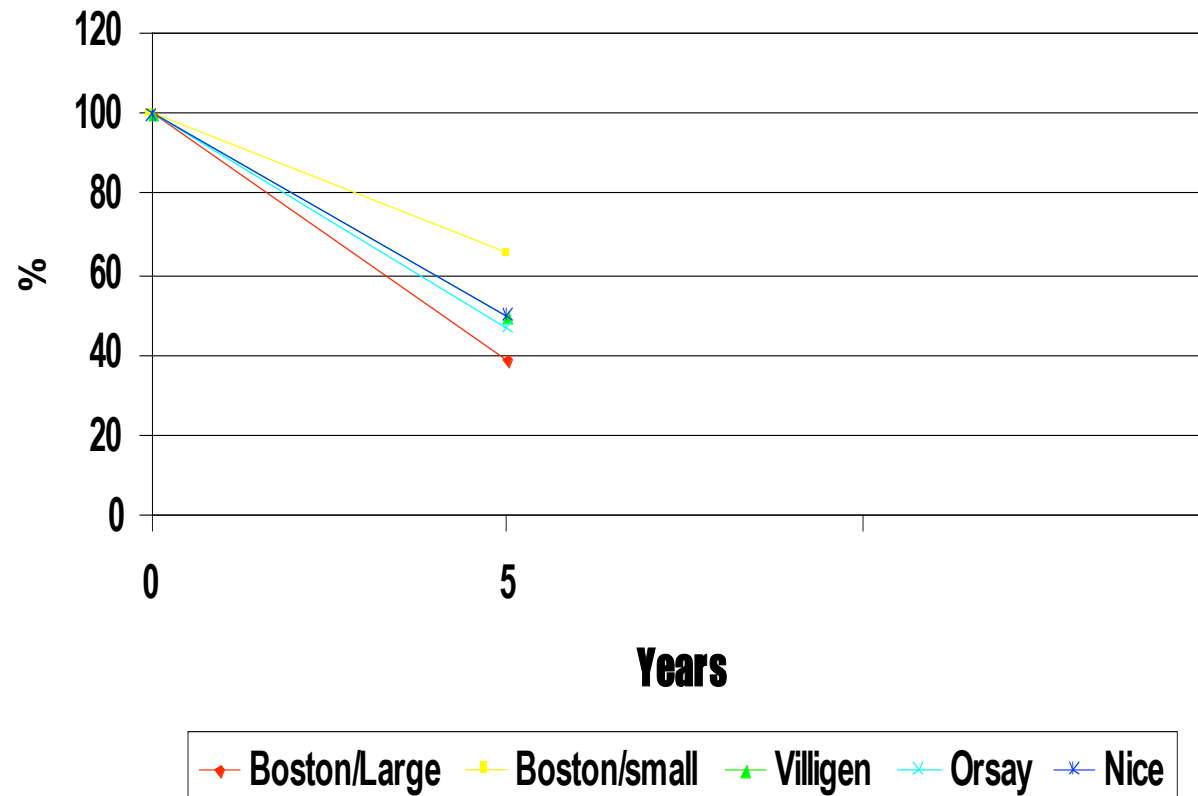
Nombre de patients : 3404

Nombre de patients francais :	3295	96.8	%
Nombre de patients etrangers :	109	3.2	%
Nombre de patients ile de france :	742	21.8	%

Protons in choroidal melanomas: DFS



Visual outcome (5,500 pts)

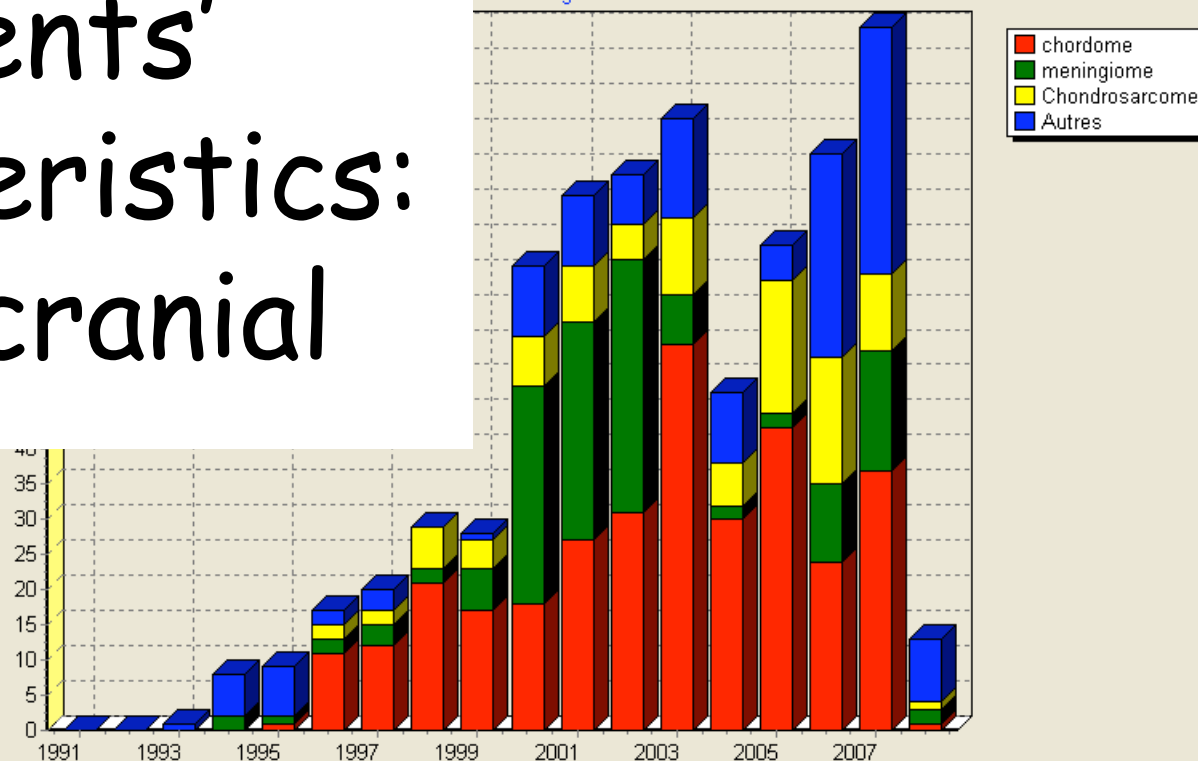


Patients' characteristics: Intra cranial

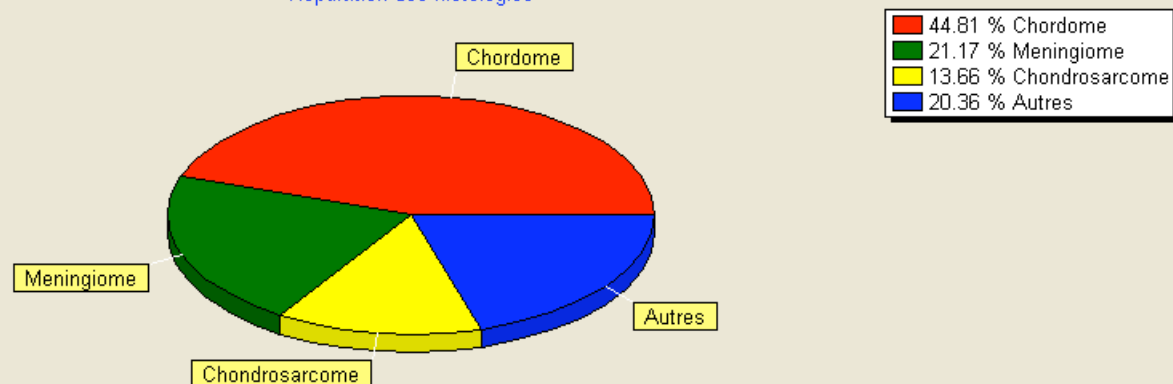
astrocytome	2
odendroglome	4
éoloblastome	3
et	2
tinoblastome	1
abdomvosarcome	9
rcome	3
noviosarcome	1
lénocarcinome	1
thésioneuroblastome	1
rome	1
rosarcome	0
itéosacrome	1
meur à cellules géar	2
meur fibreuse solitaire	3
hwanome	1

Total : 732

es histologies



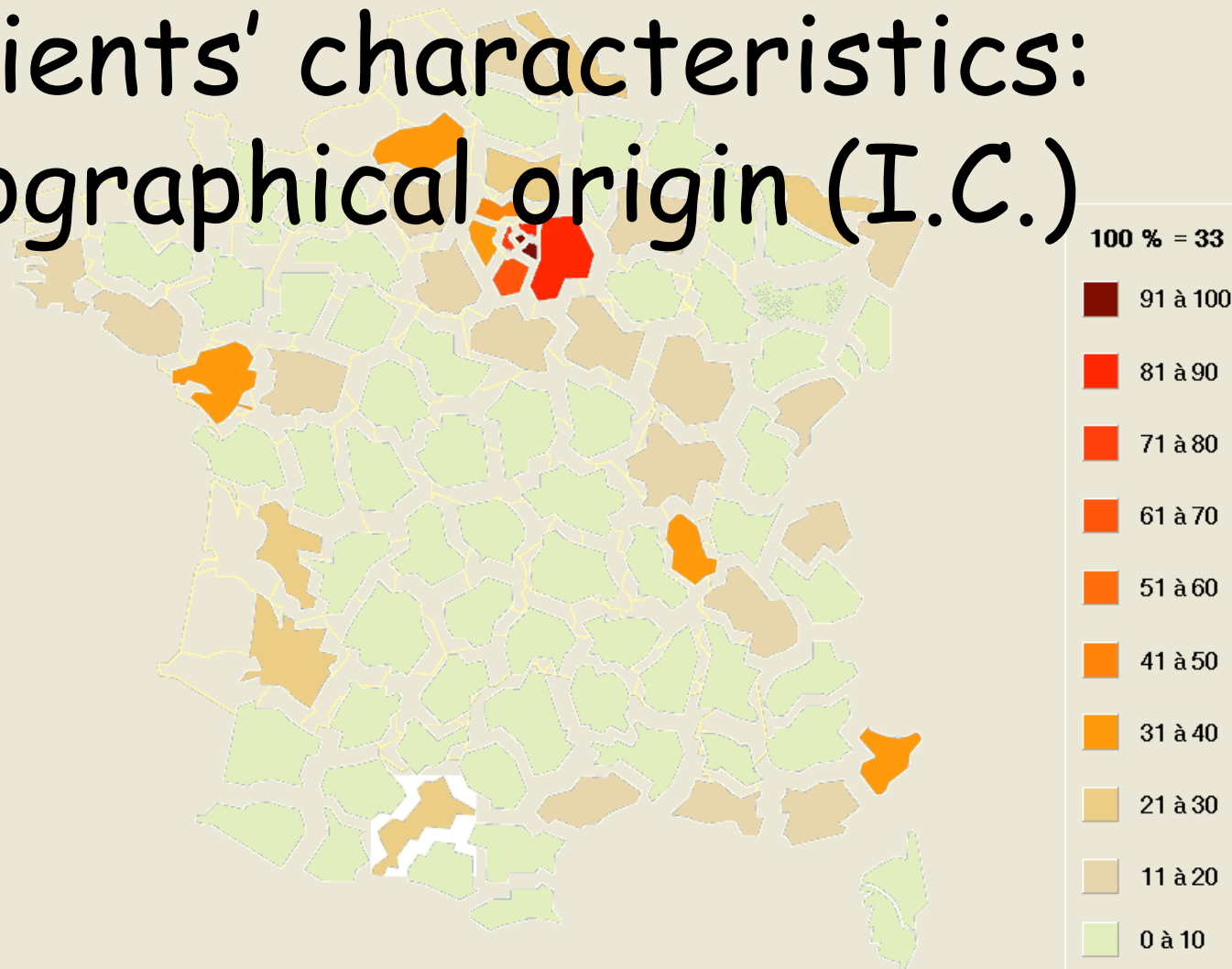
Répartition des histologies



Patients' characteristics: geographical origin (I.C.)

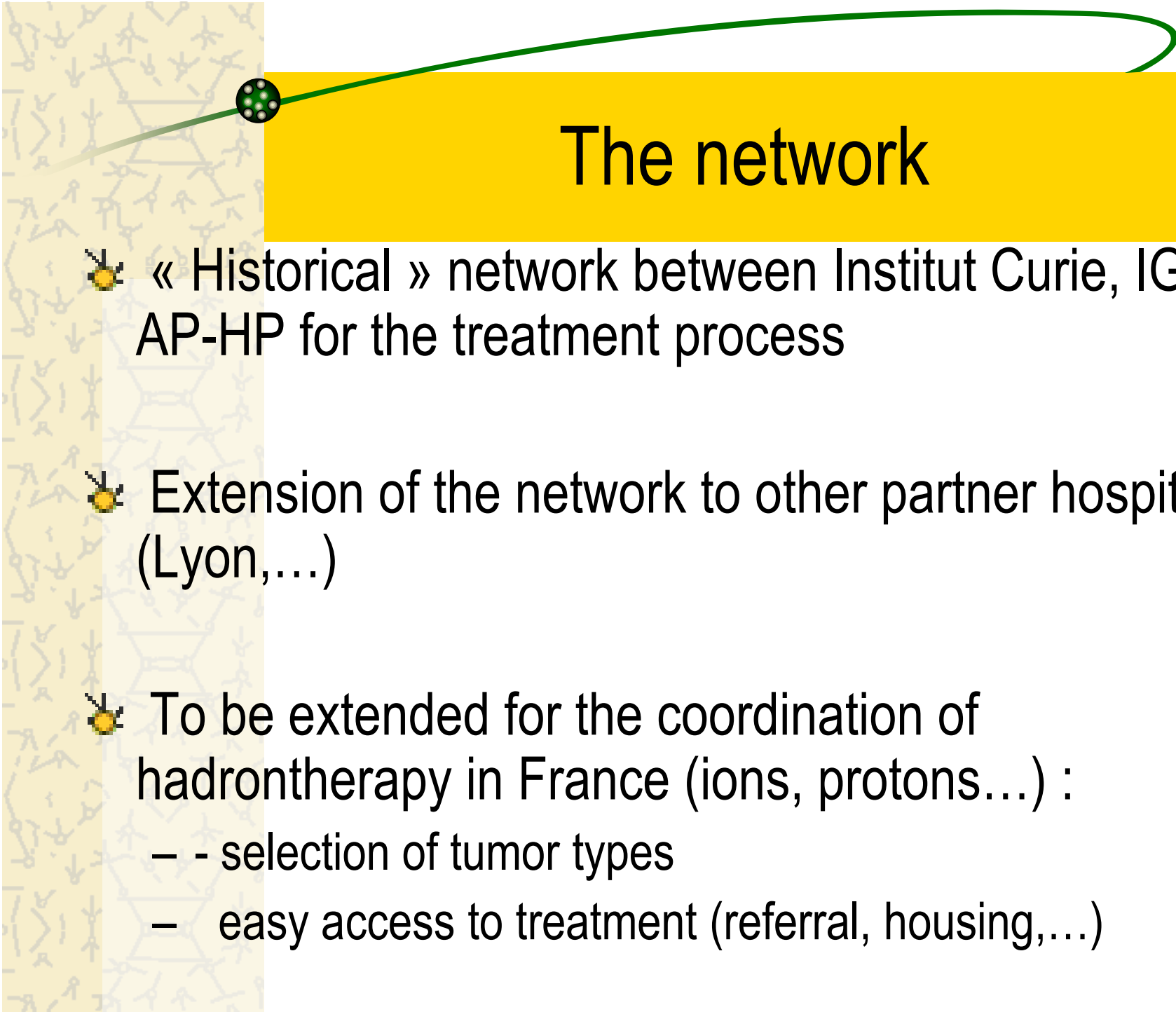
Departements		
2	51	4
1	52	1
2	53	1
2	54	2
2	55	0
12	56	4
0	57	8
0	58	3
1	59	7
3	60	8
2	61	2
1	62	4
5	63	3
3	64	2
0	65	1
1	66	0
7	67	5
0	68	3
1	69	10
1	70	1
4	71	4
2	72	1
1	73	3
2	74	5
5	75	33
2	76	12
4	77	28
5	78	13
6	79	3
0	80	2
7	81	3
1	82	2
7	83	4
5	84	0
3	85	1
2	86	1
2	87	3
5	88	2
2	89	6
0	90	2
2	91	21
1	92	24
2	93	27
12	94	30
5	95	15
1	97	9
0	98	1
0	99	1
4		
3		

Pays	
Allemagne	4
Belgique	9
Burkina Faso	1
Cameroon	1
Cote d'Ivoire	1
Egypte	1
Espagne	41
France	555
Grèce	5
Irlande	4
Israël	8
Italie	12
Lettonie	2
Liban	8
Paraguay	1
Pays-Bas	3
Pologne	7
Portugal	2
Roumanie	8
Royaume-Uni	12
Sénégal	1
Suède	1
Suisse	2
Tunisie	2



Nombre de patients : 757

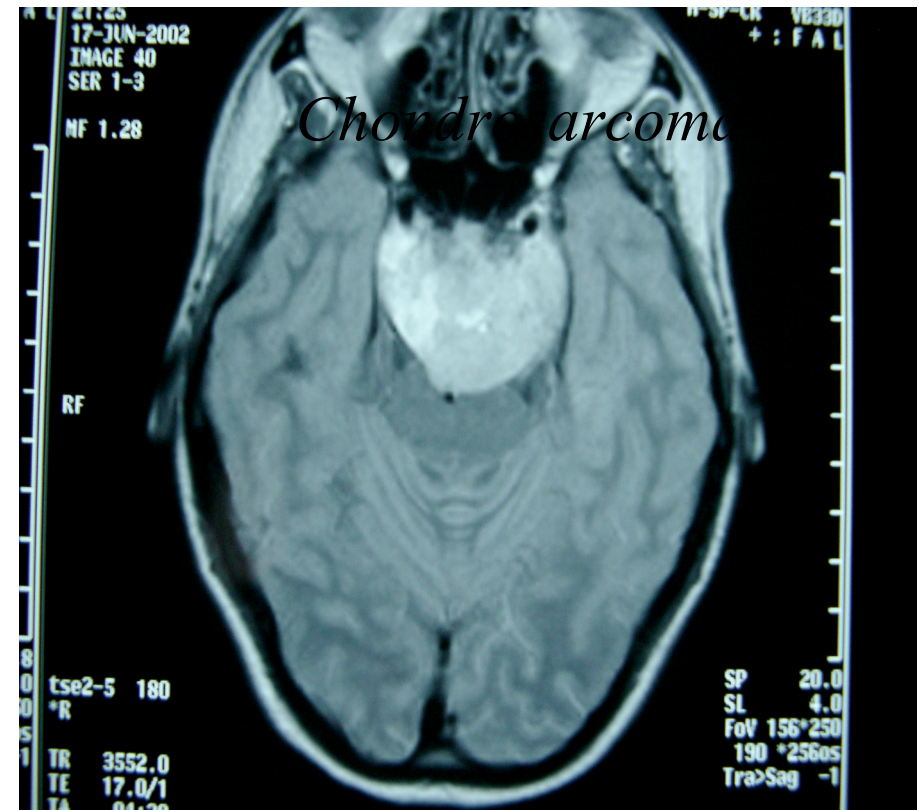
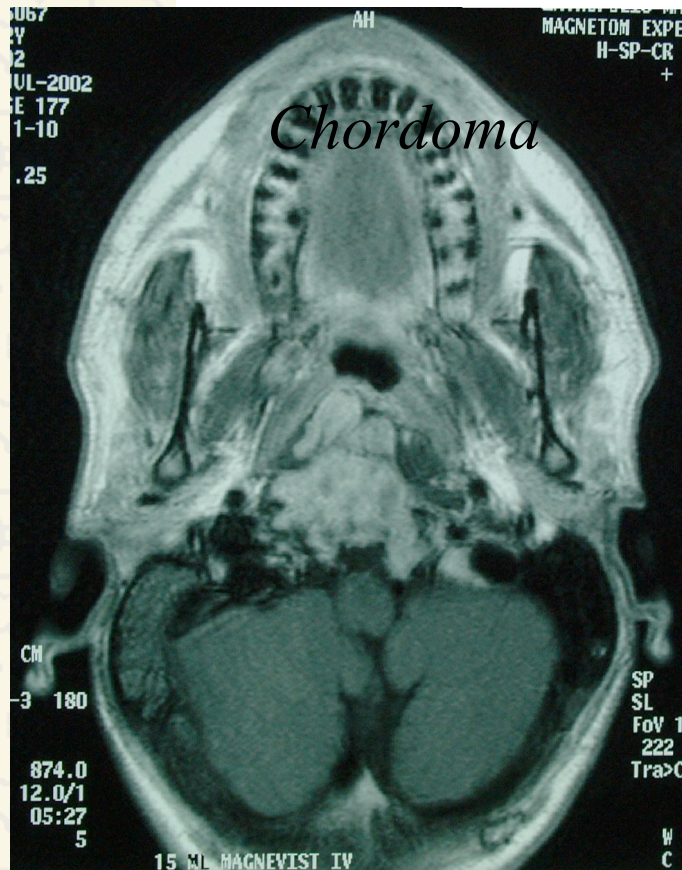
Nombre de patients français :	555	73.3	%
Nombre de patients étrangers :	202	26.7	%
Nombre de patients île de France :	178	23.5	%



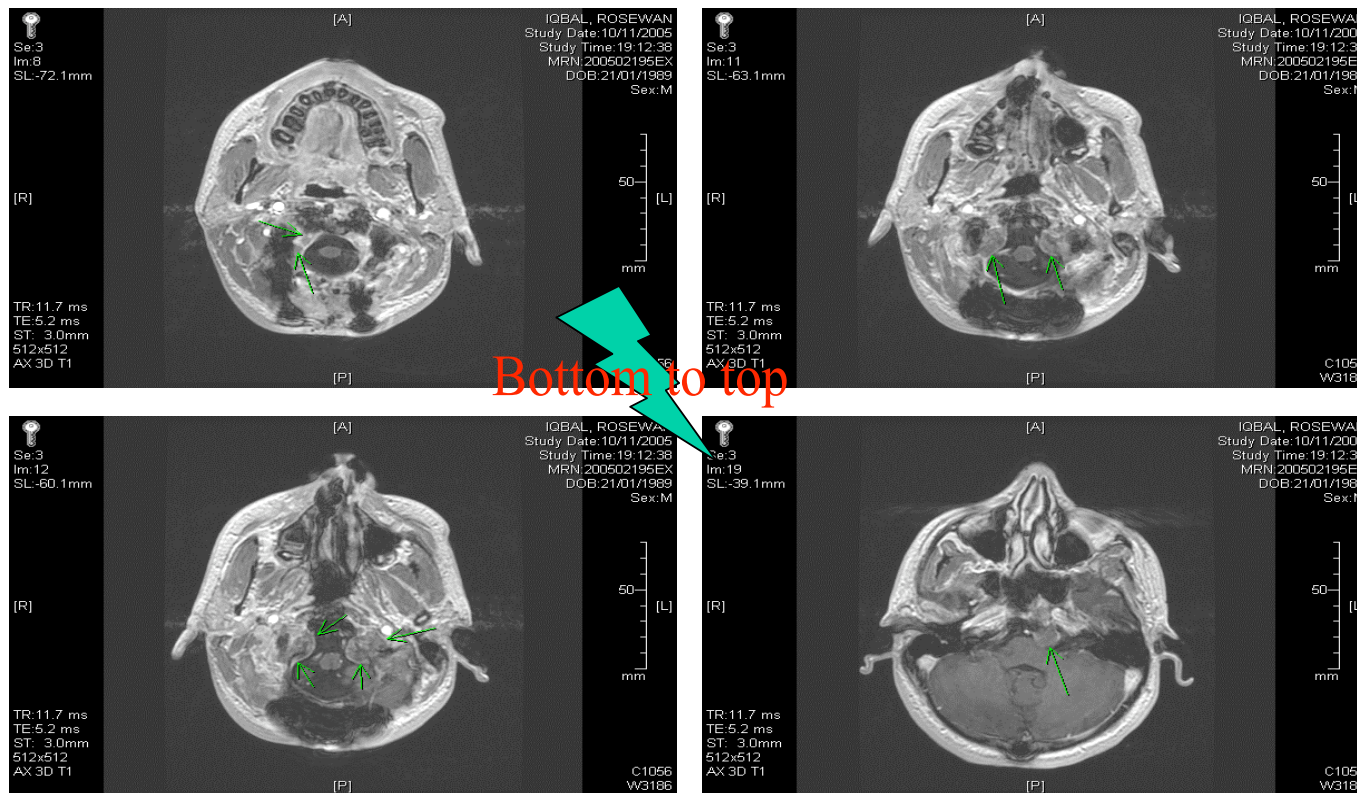
The network

- ✦ « Historical » network between Institut Curie, IGR, AP-HP for the treatment process
- ✦ Extension of the network to other partner hospitals (Lyon,...)
- ✦ To be extended for the coordination of hadrontherapy in France (ions, protons...) :
 - - selection of tumor types
 - easy access to treatment (referral, housing,...)

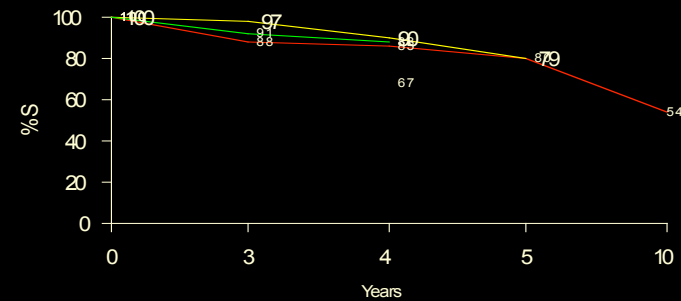
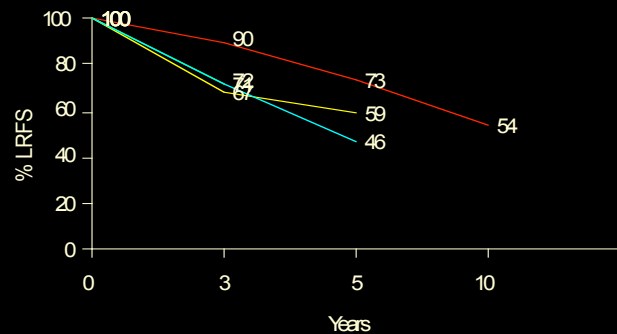
● Radiological aspects, skull base sarcomas



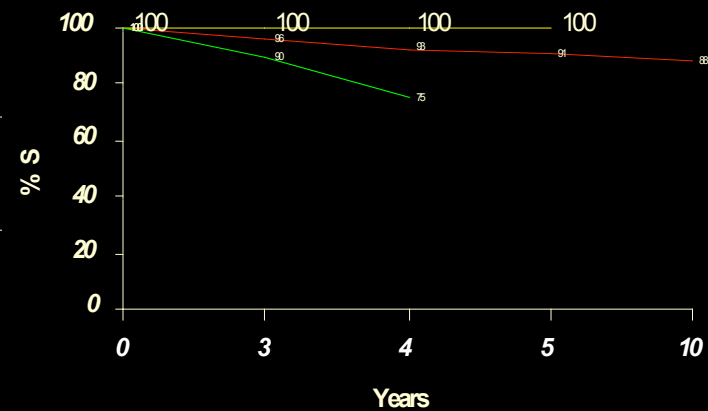
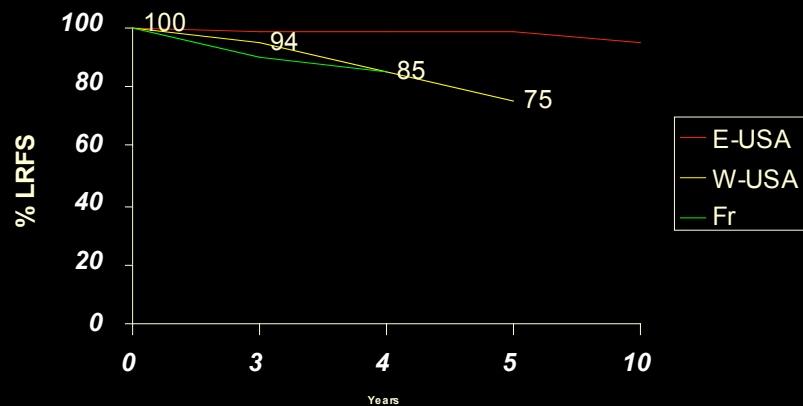
I.R: 16 Y CH, post op imaging

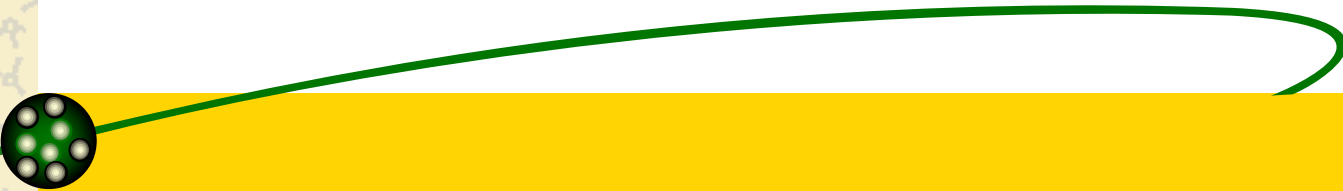


Protontherapy : Skull Base - Cervical Chordomas : Literature



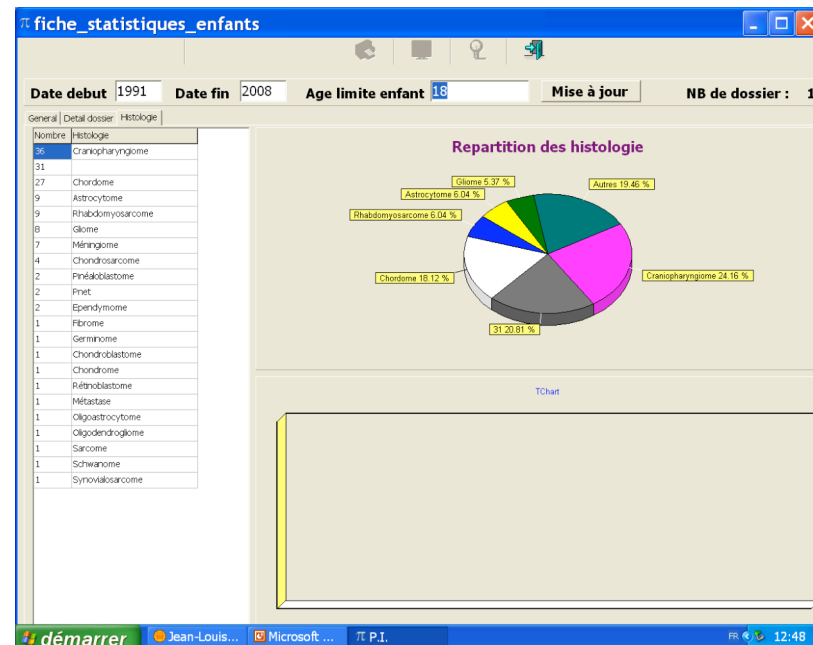
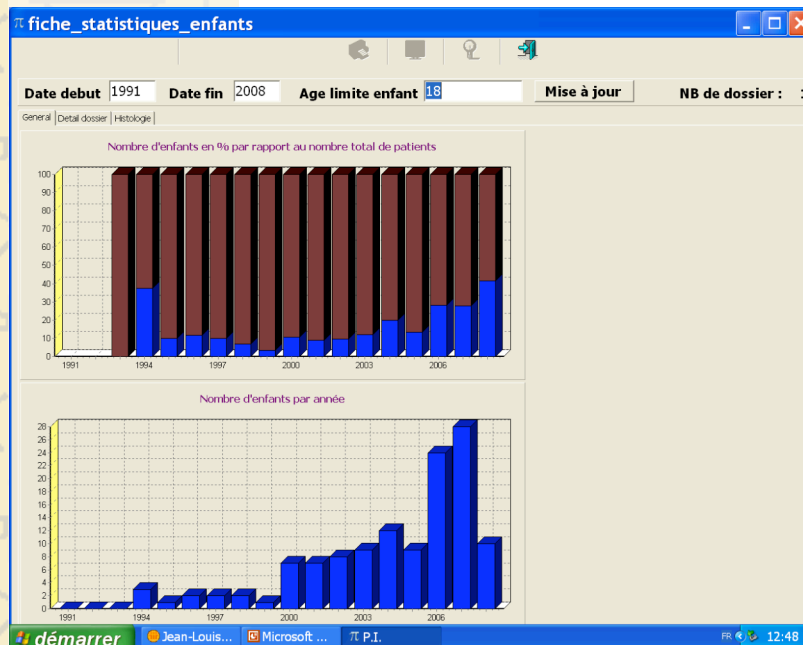
Protontherapy Skull Base - Cervical Chondrosarcomas : Literature





Exploring new indications...

Patients' characteristics: pediatrics



Proton Beam Therapy in the Management of Central Nervous System Tumors in Childhood: The Preliminary Experience of the Centre de Protonthérapie d'Orsay

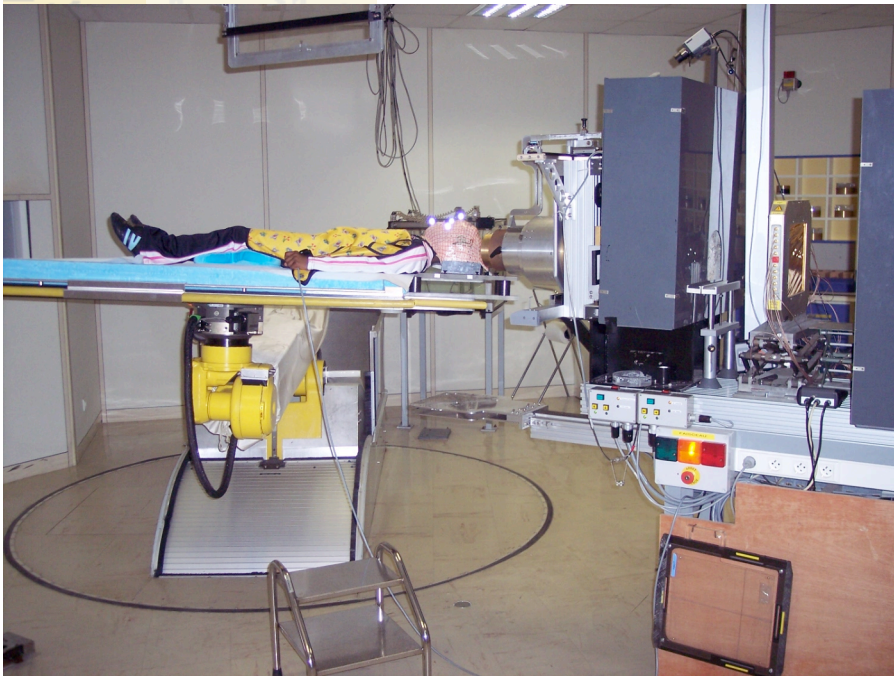
Georges Noel, MD,^{1*} Jean-Louis Habrand, MD,² Sylvie Helfre, MD,³ Hamid Mammar, MD,¹ Chantal Kalifa, MD,² Régis Ferrand, PhD,¹ Anne Beaudre, PhD,² Geneviève Gaboriaud, PhD,³ and Jean-Jacques Mazon, MD, PhD^{1,4}

Background. The purpose of the study was to evaluate clinical results and complications of a combination of proton and photon irradiation administered to 17 children with selected central nervous system (CNS) tumors. **Procedure.** Between July 1994 and September 2000, 17 children, aged from 5 to 17 years (median: 12 years) with intracranial benign (6 cases) or malignant (11 cases) tumors, were treated with photons (median dose: 40 Gy; 24–54) and protons (median dose: 20 CGE; 9–31) at the Centre de Protonthérapie d'Orsay (CPO). **Results.** Mean follow-up was 27 months (3–

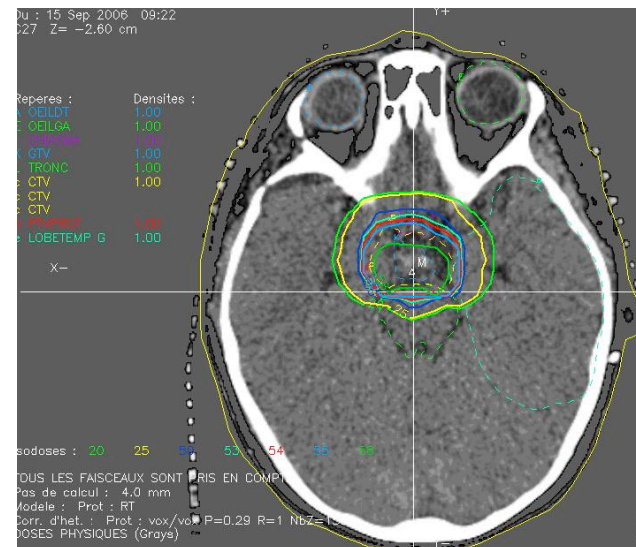
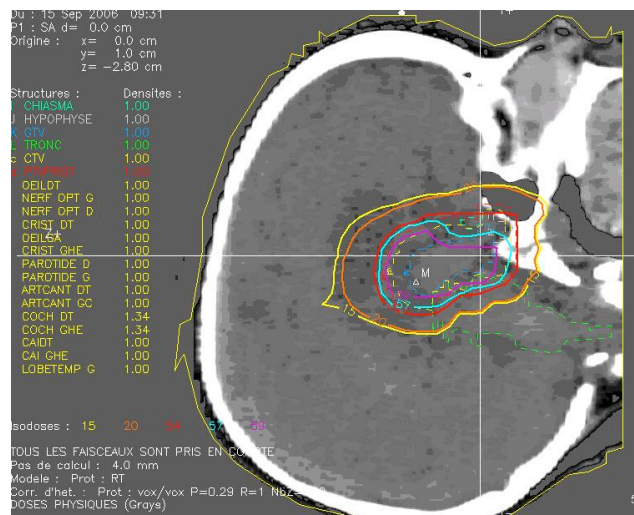
81). Two patients recurred locally (one marginal and one in situ). Fifteen patients are alive and doing well. Overall, 12, 24, and 36-month local control rate was $92 \pm 8\%$ and, 12, 24, and 36-month overall survival rates were $93 \pm 6\%$, $83 \pm 11\%$, and $83 \pm 11\%$, respectively. Clinical initial symptoms remained stable or subsided in all patients. Early toxicities were in the expected range. **Conclusions.** With a mean 27 months follow-up, protontherapy was well tolerated for doses upto 69 CGE and with an excellent local control rate. Med Pediatr Oncol 2003;40:309–315. © 2003 Wiley-Liss, Inc.

Key words: protontherapy; central nervous system tumor; childhood tumor

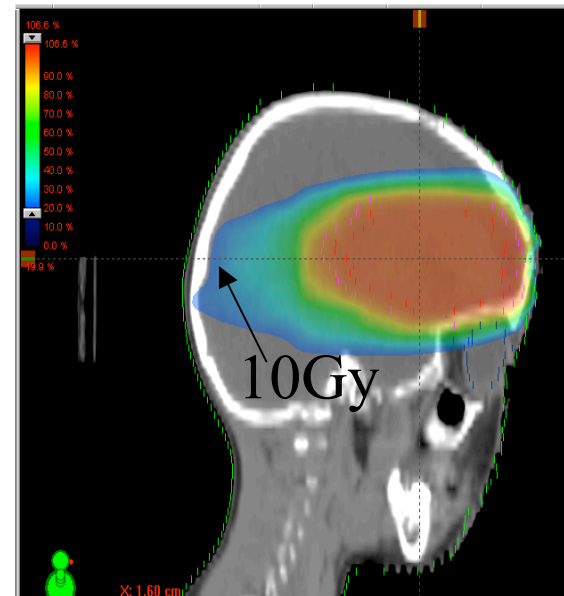
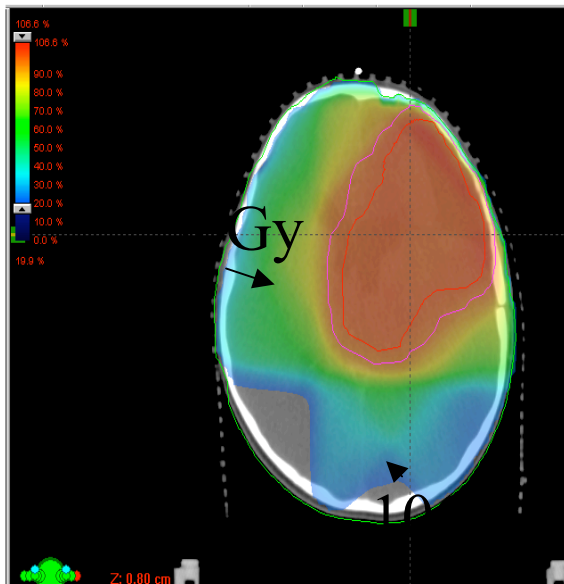
General anesthesia : *Children* < 4Y



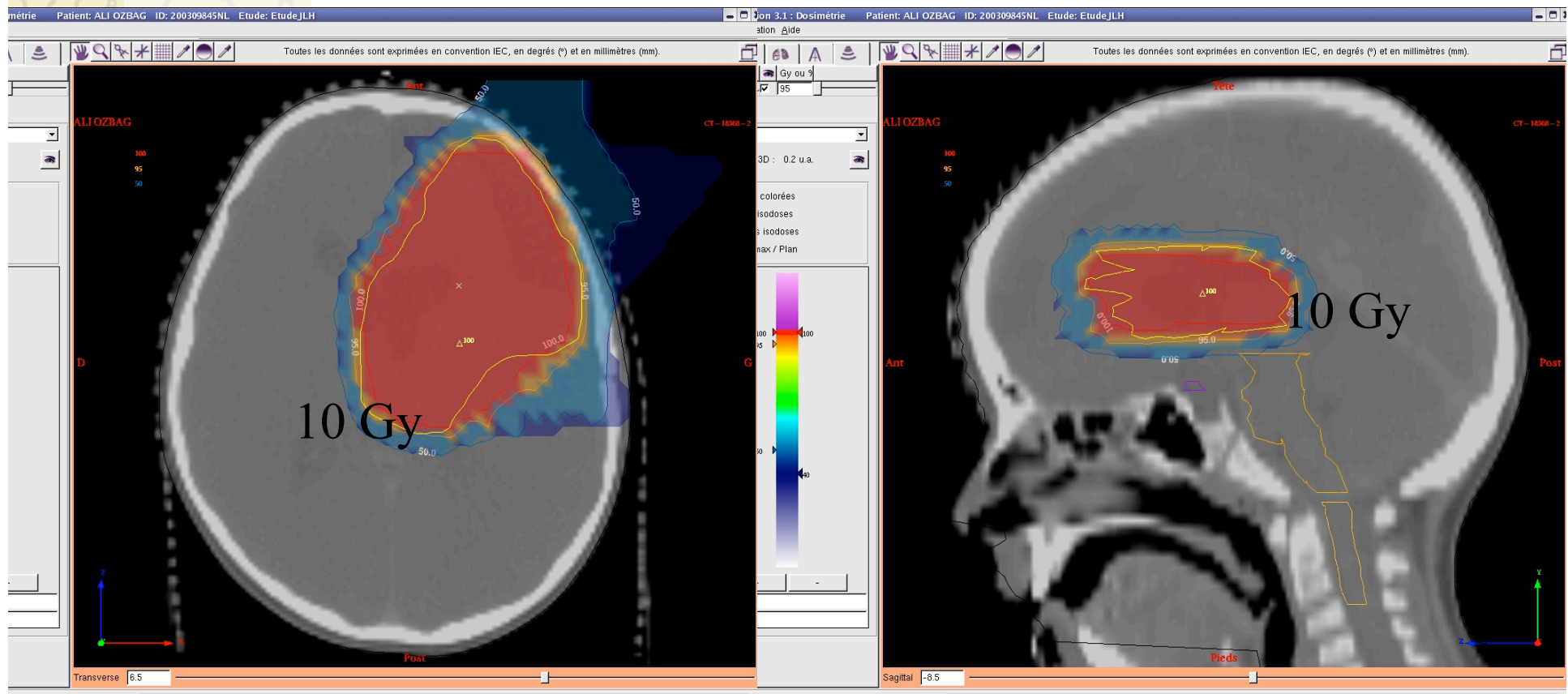
Craniopharyngioma case



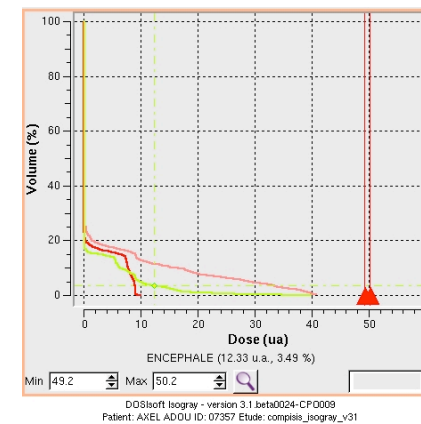
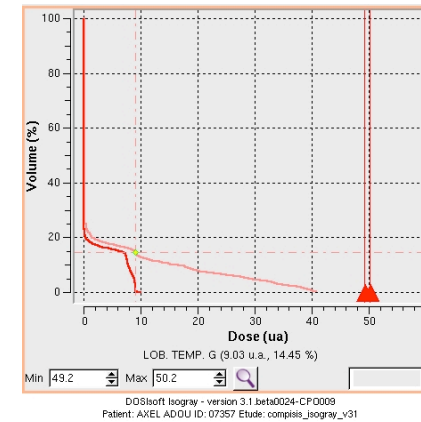
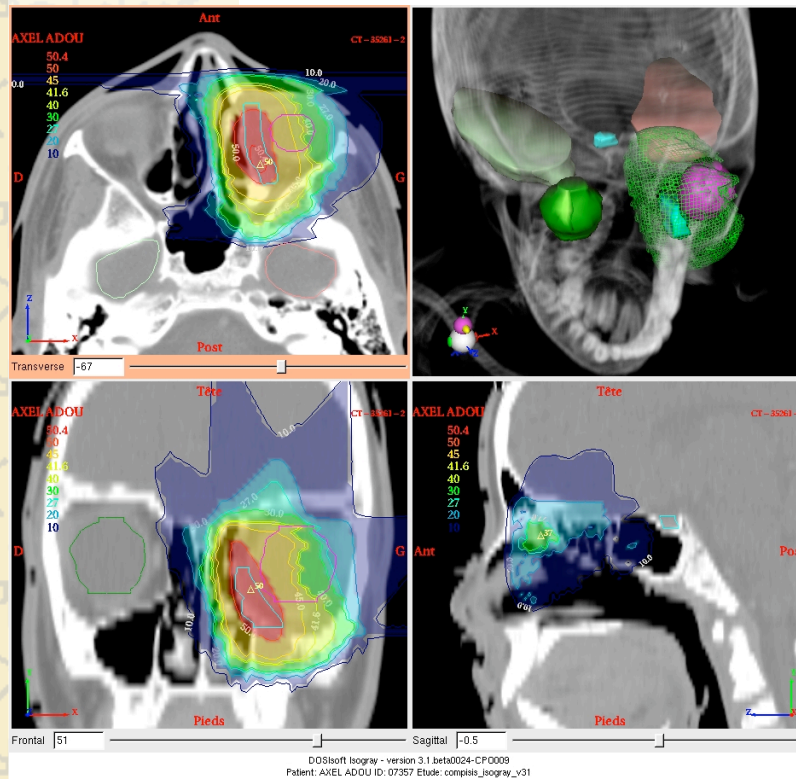
Ependymoma. : IMRT photon planning vs...



Same patient: protons



First Parameningeal RMS



CPO and the new project

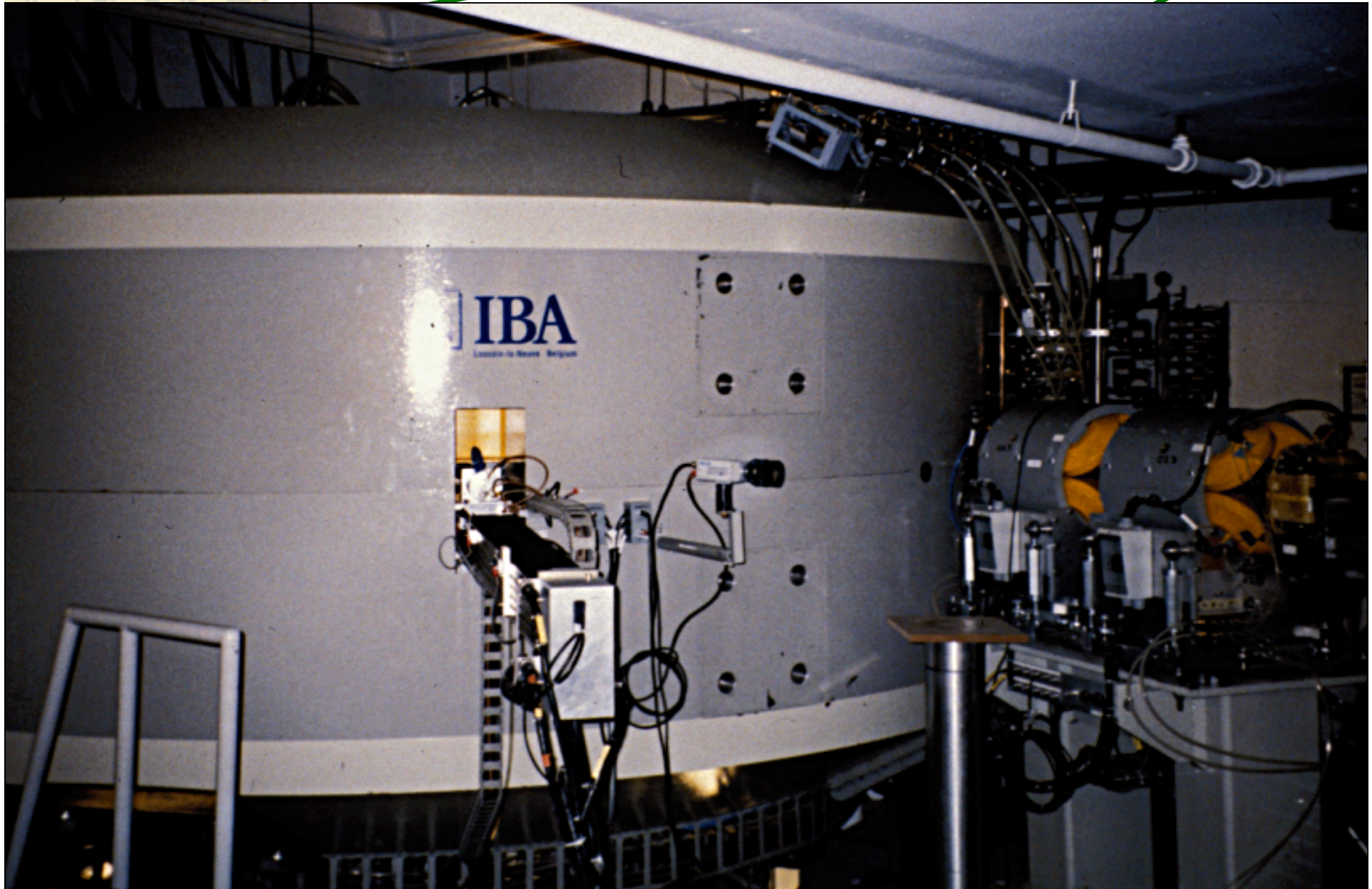
**R. Ferrand, P. Grig, S.
Meyroneinc, JL
Habrand. S. Delacroix**

Research and development



- Curie R&D cluster :
hospital + research
labs
- Network within
University
- National
Hadrontherapy
program





New CPO Center

2 more rooms

Gantry

New machine

7604,534mm

3800mm

3000mm

3000mm

3800mm

3800mm

Capture de E:\partage_bergot\CPO_1\Assemblage\CPO_Projet1.CATProduct - 27/10/2005 17:21:51

The Project







CENTRE DE PROTONTHERAPIE D'ORSAY

I CURIE-CPO :

*S Bolle
C Alapetite
S Helfre
R Ferrand
P Bey*

...

IGR :

F Dhermain

A Beaudré, PhD

Necker-E Malades: ...

*C Sainte-Rose
S Puget
M Zerah*



Thank you !

