



Université
de Strasbourg

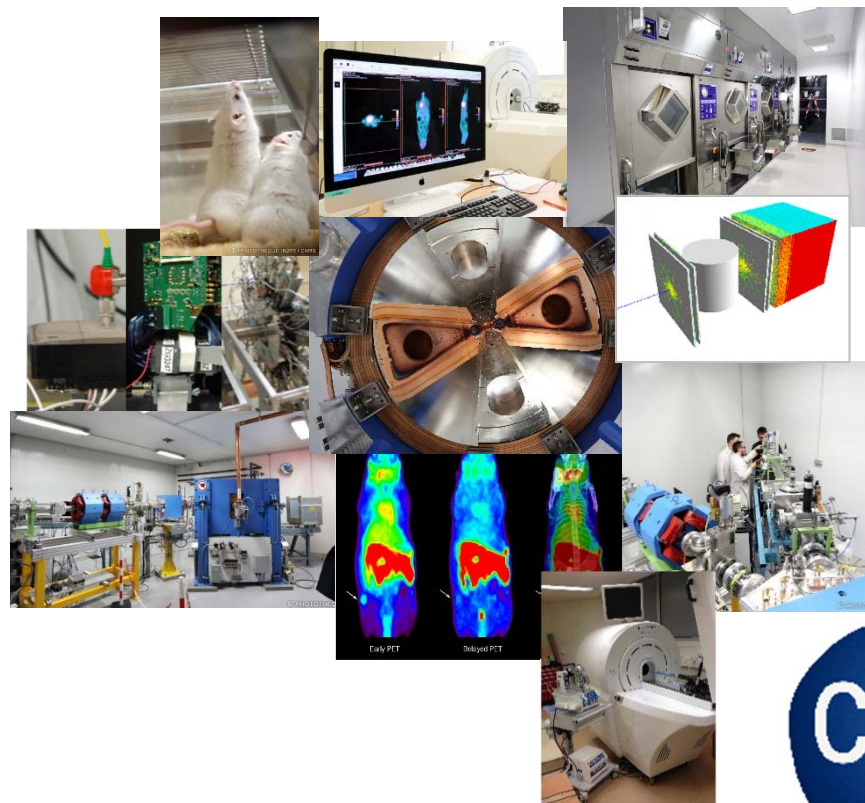


CS IN2P3

Cyrcé

CoS : Patrice Laquerriere

RO : Michel Pellicoli



UNIVERSITÉ DE STRASBOURG



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1. Description
 2. Scientific goals
 3. Platform environment
 4. Futur of the platform
 5. Human ressources and funding
 6. SWOT

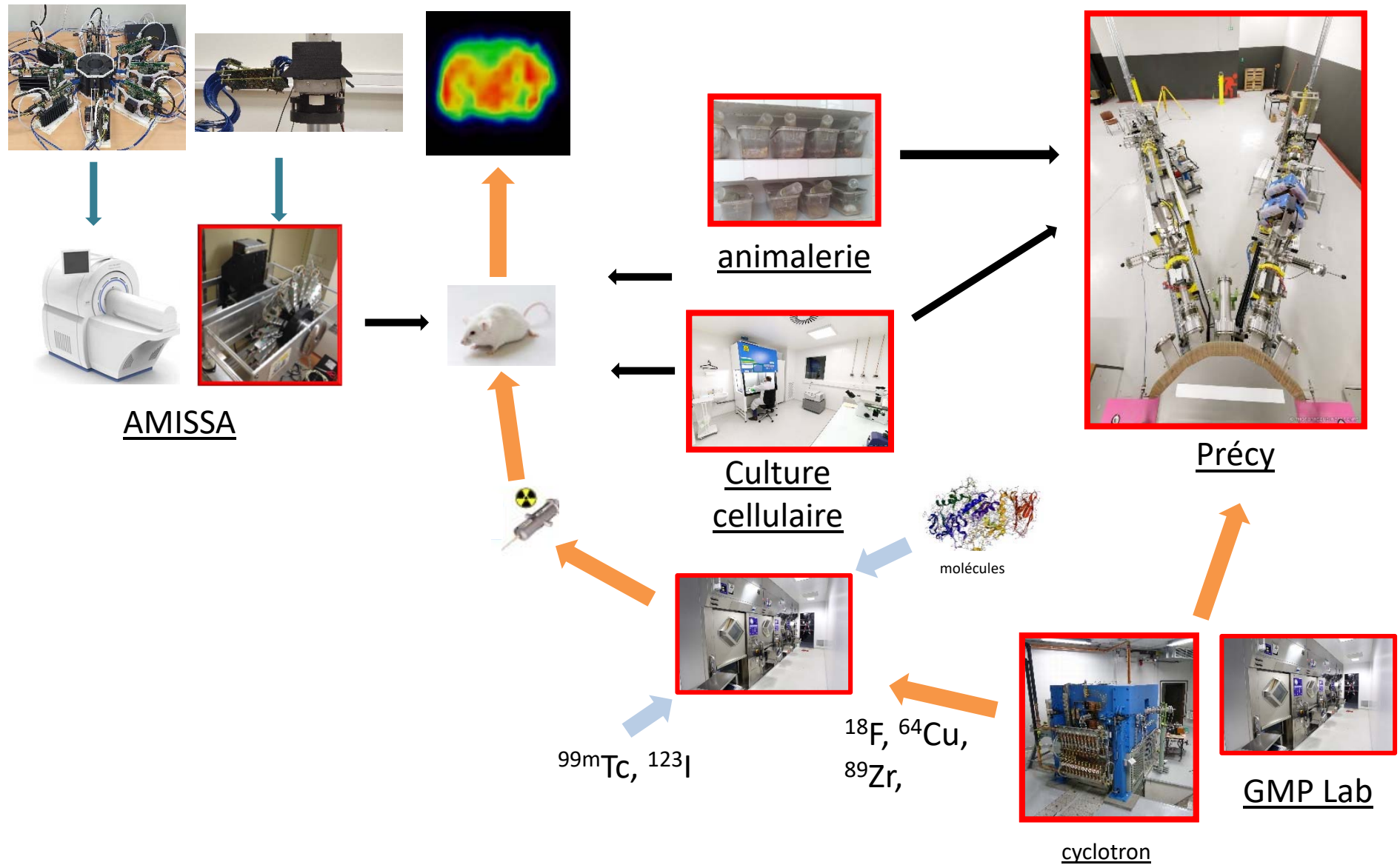
1. Description (DRHIM)

From multi-scale diagnostic to personalized therapy
Through pluridisciplinary and translational research (from pre-clinical to clinical)

- ✓ What are the new instrumental concepts that will permit the development of new PET and SPECT imaging systems ?
- ✓ Is it possible to develop new methodologies to help the diagnostic and prognostic in nuclear imaging?
- ✓ What is the impact in the treatment scheme in radiotherapy of a better understanding of fundamental mechanism (physics and biology)?

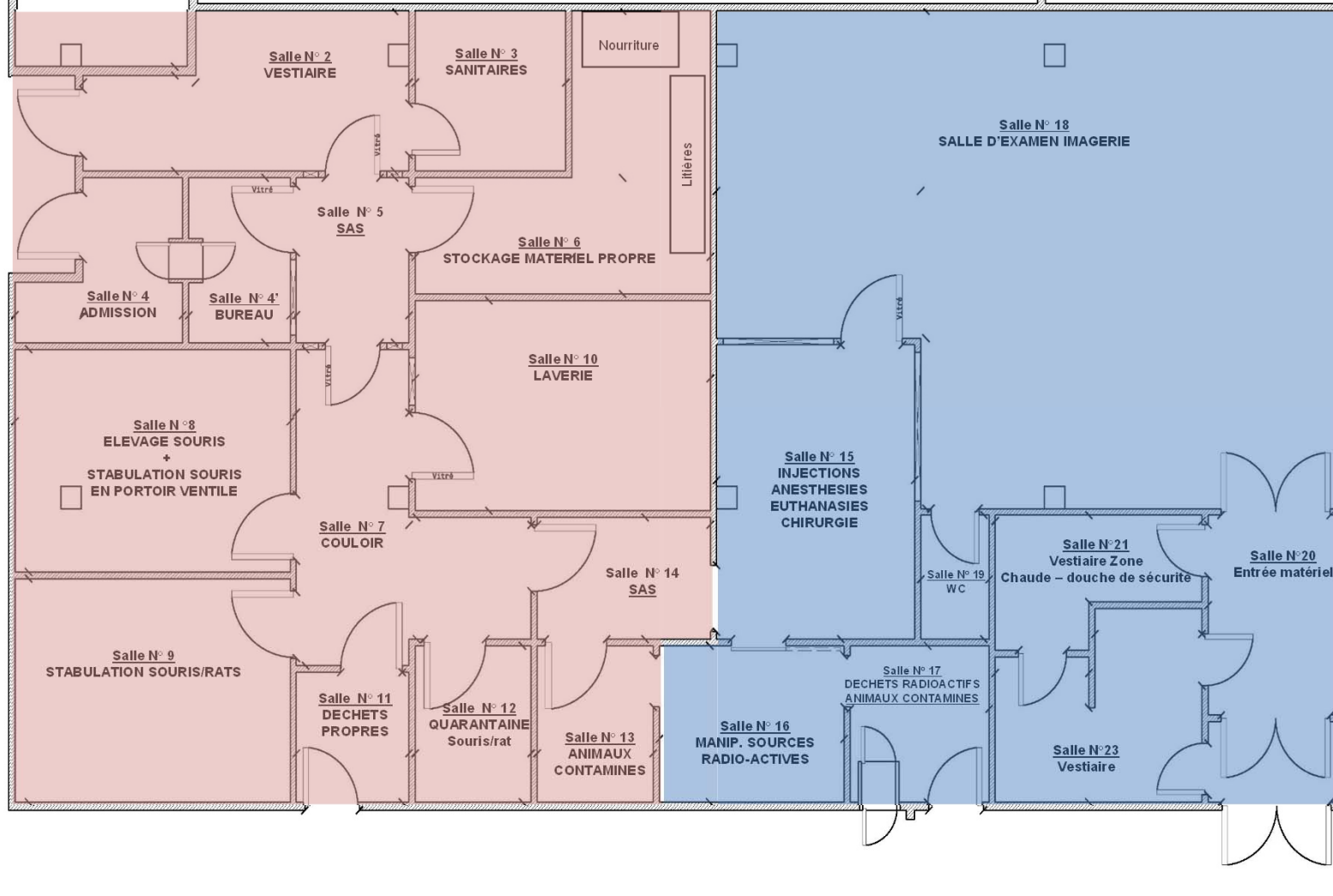
Need of Research Infrastructure

1. Description



Animal house : 100m²

AMISSA : 100m²



ANIMAL HOUSE

Regular cages



isolated cages



Quarantine room



Max : 500 mice or 200 rats

AMISSA

SPECT-CT



SPECT :
FOV : 0,9 cm
Spatial Res : 0,8 mm
Sensitivity : 0,03%

CT :
Spatial Res : 75 μ m

PET-CT



PET :
FOV : 10 cm
Spatial Res : 1.1 mm
Sensitivity : 10%

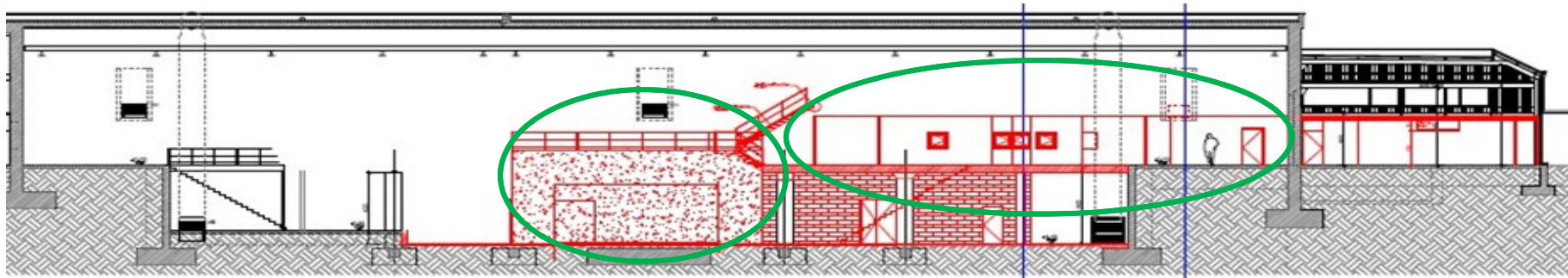
CT :
Spatial Res : 75 μ m

HIDEX



γ up to 2MeV
51 isotopes
78 samples at a time

Irradiation facility : isotope production



CYRCé:

isotope production

Radiotracer production



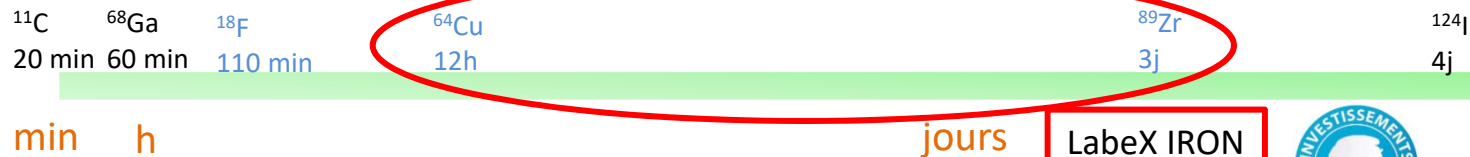
Cyclotron TR24 (ACSI)

- Energie proton 16 à 25 MeV
- Courant : 300 μ A
- 2 sorties faisceau

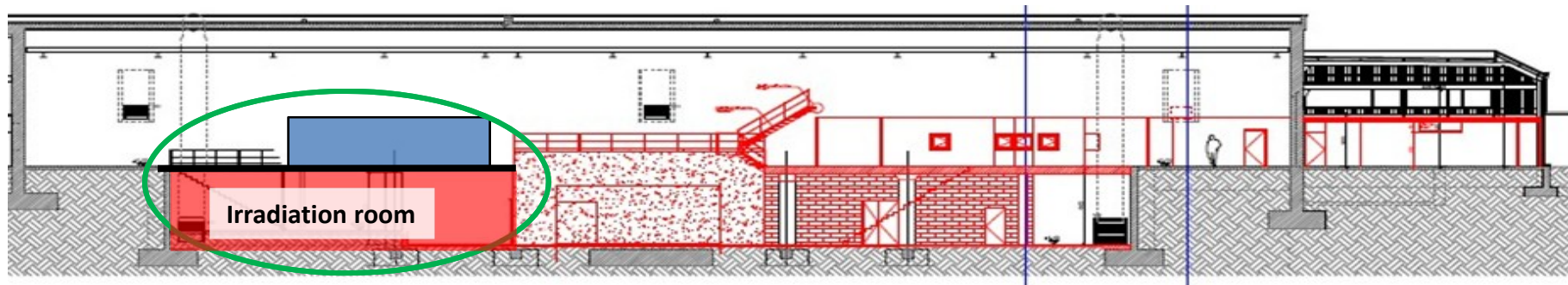


250 m² de laboratoires

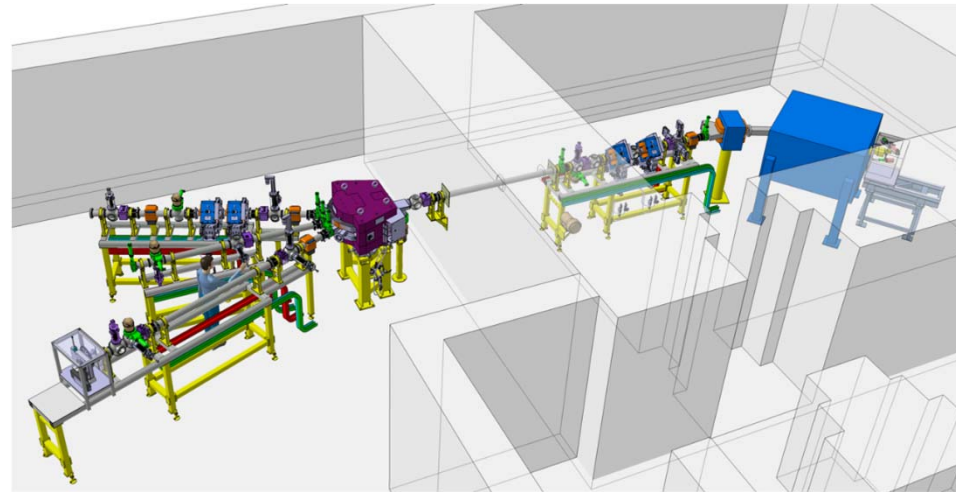
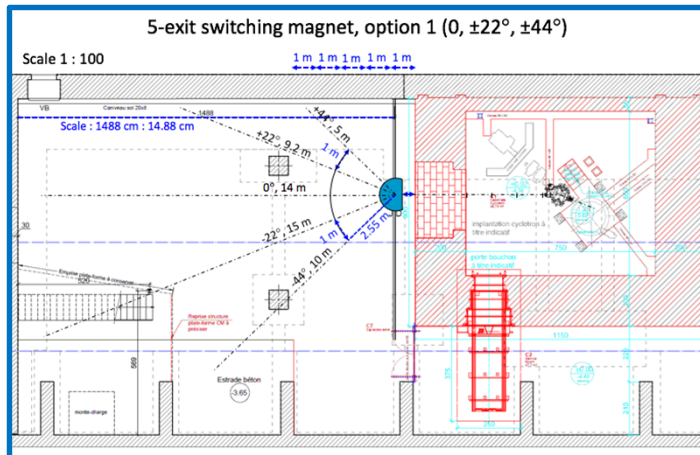
- 4 hotcells pour la recherche
- 6 hotcells standard GMP
- 1 laboratoire de chimie « tiède »



Irradiation facility : PRECy



PRECy:
Irradiation room (CPER)

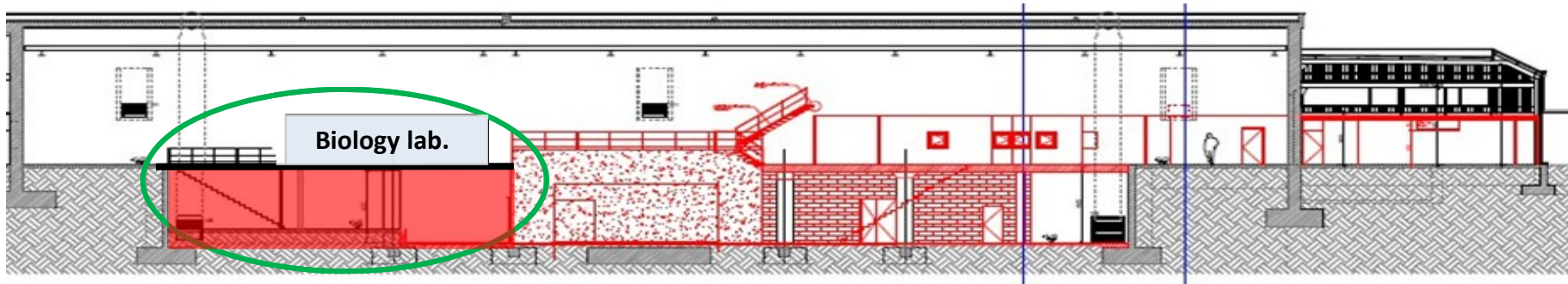


Salle expérimentale

- 210 m²
- Courant : 100 aA à 100 nA
- Aimant d'aiguillage 5 sorties
- 2 lignes d'irradiation

Irradiation of sensors, plants, cells, mice.

Biology Laboratory



Laboratoire biologie

- 70 m²
- Classe L2
- Biologie cellulaire
- Biologie moléculaire



Cell culture, molecular biology

Organisation

❑ Steering committee (M. Pellicioli, L. Thomas, B. Jessel, E. Santiago + DRHIM researchers)

- meeting once a month
- planning (next 2-3 months)
- ongoing projects (potential problems)
- new proposal evaluation
- technological survey

❑ Scientific committee (since 2018)

- J.M. Chezal (radio-chemistry/preclinical imaging)
- J. Colin (physique)
- F. Haddad (radio-chemistry/isotop production)
- G. Karcher (nuclear medicine)
- N. Foray (radiobiology)

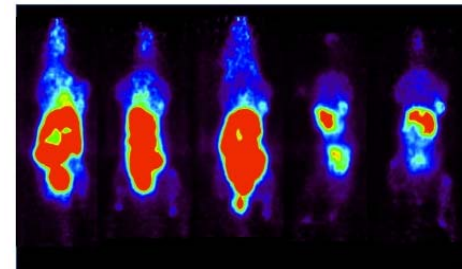
Collaboration & services 2018-2020

□ Internationales :

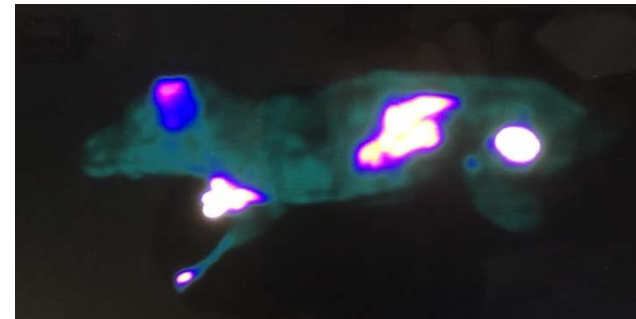
Belgique, Namur-Liege University (nanoparticles, in vivo irradiation x2w)

Israël, Weissman Institut (breast cancer, ^{64}Cu and in vivo imaging x8x3d)

Suisse ETH (^{64}Cu production x2)



Suisse, CHU Geneve (glioma, ^{18}F and in vivo imaging) (funded by Fond National)



Chine, l'Université Shanghai Jiao Tong (glioma, ^{64}Cu and in vivo imaging x12 + 3m)
(funded by French embassy in China)

□ Nationales :

Clermont-Ferrand UMRS 1240 (^{18}F -DOPA)

Maisoniais-Besset A., et al, Base/cryptand/metal free automated nucleophilic radiofluorination of [^{18}F]DOPA from iodonium salts : importance of hydrogen carbonate counterion. Eur. J. Organic Chem. 2018;48 : 7058-7065

Nantes Arronax (^{89}Zr) (PhD funded by region Alsace-Arronax)

Nantes CRCINA (^{64}Cu x1)

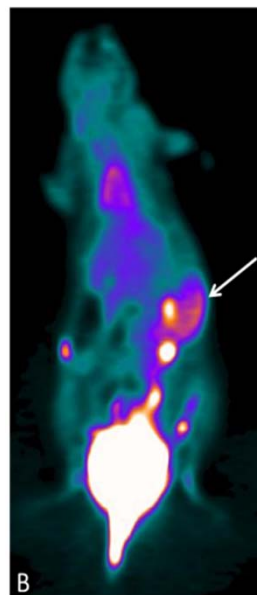
Caen LPC (cross section β^+ production 1w)

Caen LPC (dosion)

Nancy GIE Nancyclotep (^{89}Zr x3)

Nancy IADI (pancreas cancer, ^{64}Cu)

Dijon CLCC (colon cancer, p+ irradiation) funded by Ligue contre le cancer



☐ Locales

Icube (neuroendocrine, ^{18}F),

Imperiale A. et al. O-(2- ^{18}F -Fluoroethyl)-L-Tyrosine (^{18}F -FET) Uptake in Insulinoma: First Results from a Mouse Model and Human, *Nuclear Medicine and Biology*, 2017; 53 : 21-28

IGBMC (prostate cancer and colon cancer, ^{18}F),

De Arcangelis. et al.. Hemidesmosome integrity protects the colon against colitis and colorectal cancer, *Journal of Cellular Biochemistry*, 2017; 1748-1760

LBP (glioma, ^{18}F) (PhD 80 Prime ongoing)

IBMP (plant stress, p+), (grant asked to MITI)

BSC (neurolupus, ^{18}F), (funded by MI Imag'In)

UMRS 1110 (HCC, ^{18}F , p+), (PhD, Grand-Est Region/INSERM, ongoing)

UMRS 1113 (gastric cancer, ^{18}F) (INCa grant asked)

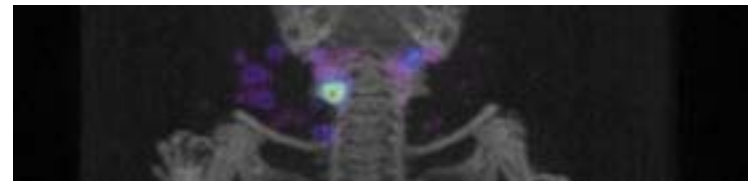
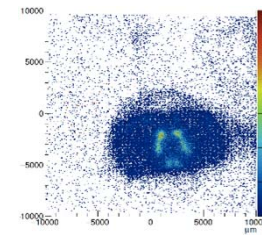
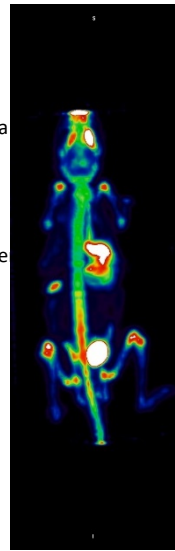
UMRS 1255 (thrombosis, $^{99\text{m}}\text{Tc}$) (INCa TENPLAMET)

Ouadi A., et al. Imaging Thrombosis with $^{99\text{m}}\text{Tc}$ -labeled RAM.1-Antibody *in vivo*, *Nuclear Medicine and Biology* 2018, 61; 21-27

UMRS 1260 (tooth growth, CT)

Keller Let al. Nanoengineered implant as a new platform for regenerative nanomedicine using 3D well-organized human cell spheroids, *International Journal of Nanomedicine*, 2017, 12, 447

GEPROVAS (Stent imaging)



□ Internes (80%)

DRS (detector assessments (CMS, Picisel, Desis), p+ irradiation)

DSA (chemotherapy potentialisation/⁸⁹Zr chelators (80 PRIME)/⁶⁴Cu chelators, ¹⁸F, p+ irradiation, ⁶⁴Cu, ⁸⁹Zr)

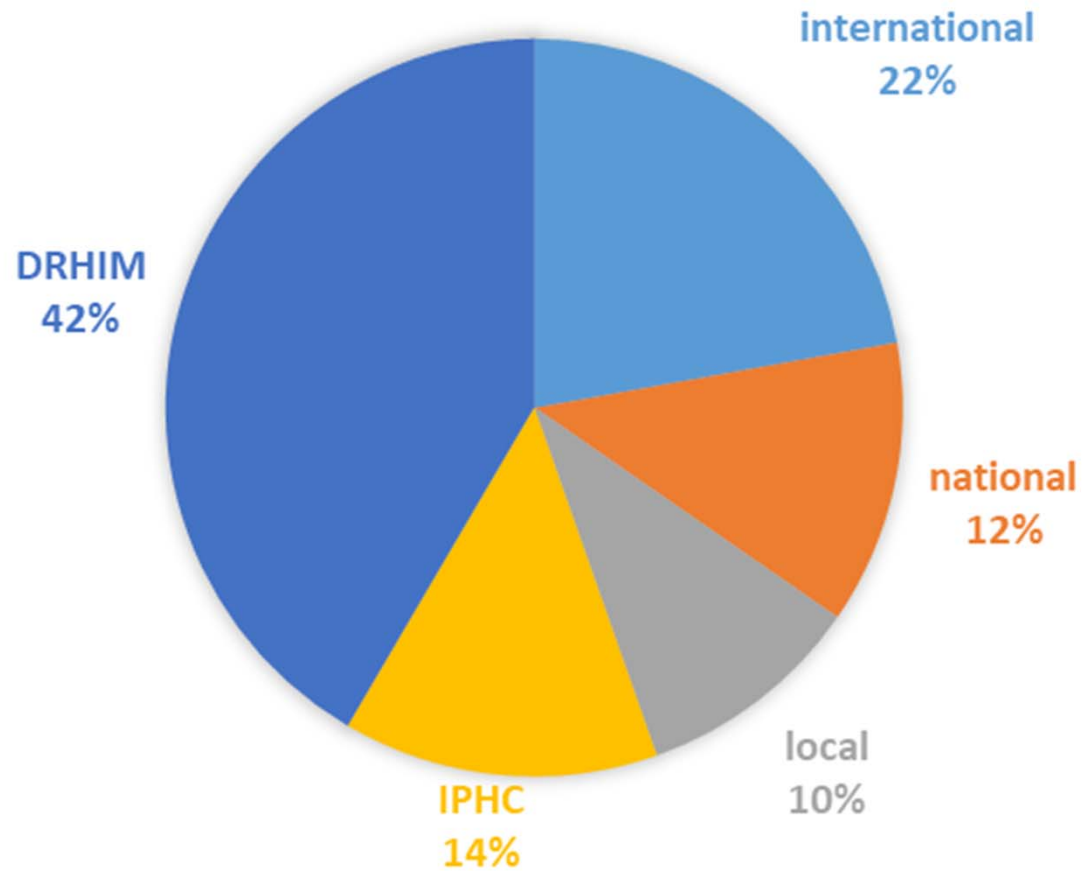
DEPE (mandarin, flash irradiation, ¹⁸F, p+ irradiation, CT)

DRHIM : rpPET + PhD (funded by INCa), Dulaglutide radiolabelling, pancreas cancer (funded by Ligue contre le cancer), new radiotracers, instrumentation and beam line developments

Vanstalle, M., et al.. Analytical dose modelling for preclinical proton irradiation of millimetric targets Med. Phys. 2018;45(1):470-478.

Constanzo J., et al. Characterization of a CMOS sensor array for small field fluence measurement of low energy proton beam. NIMB-A (2018) 910 : 1-8

Average (research 81%, 19% services)



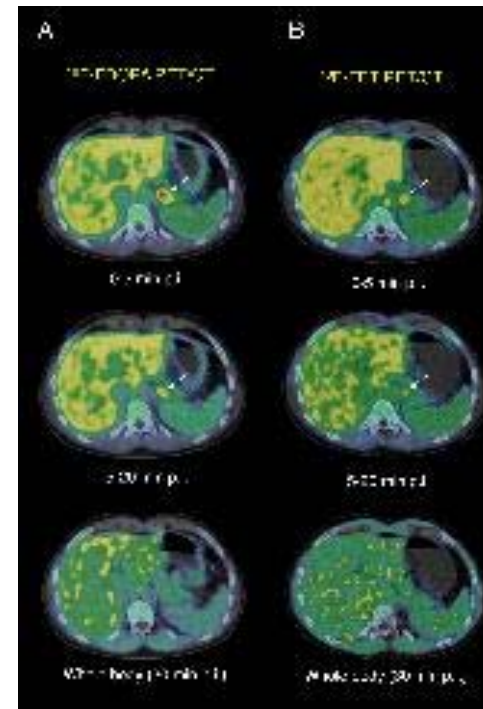
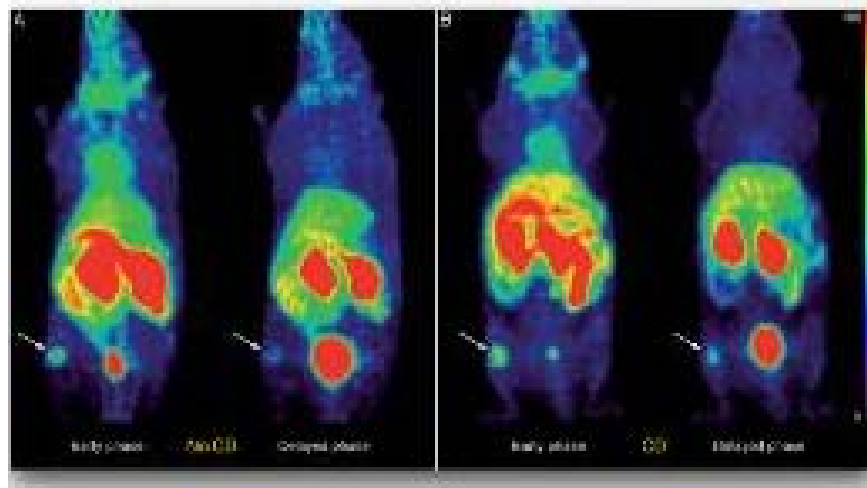
Fees

□ Four different fees :

- University of Strasbourg (CNRS-INSERM)
- French universities
- Foreign universities
- Companies

2. Scientific goals

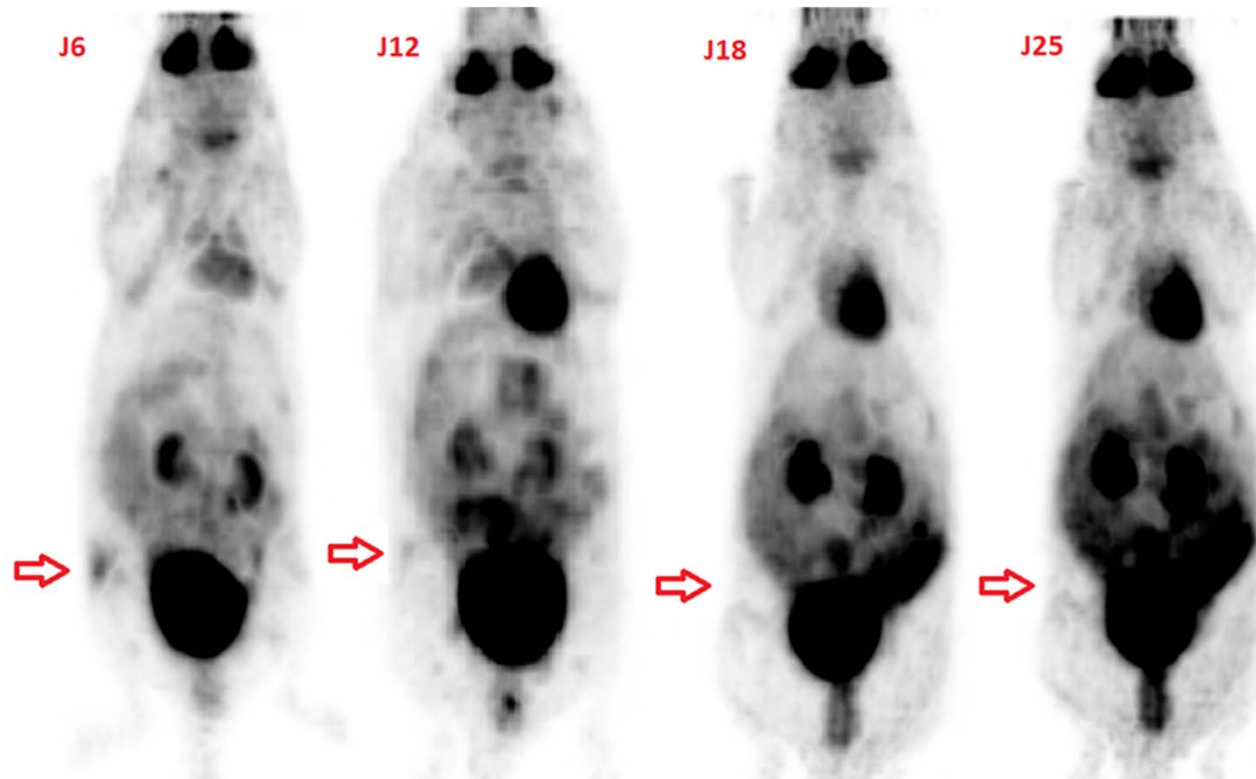
i. FET as a translational radiotracer in insulinoma.



Animal house, imaging facility, 18-F production

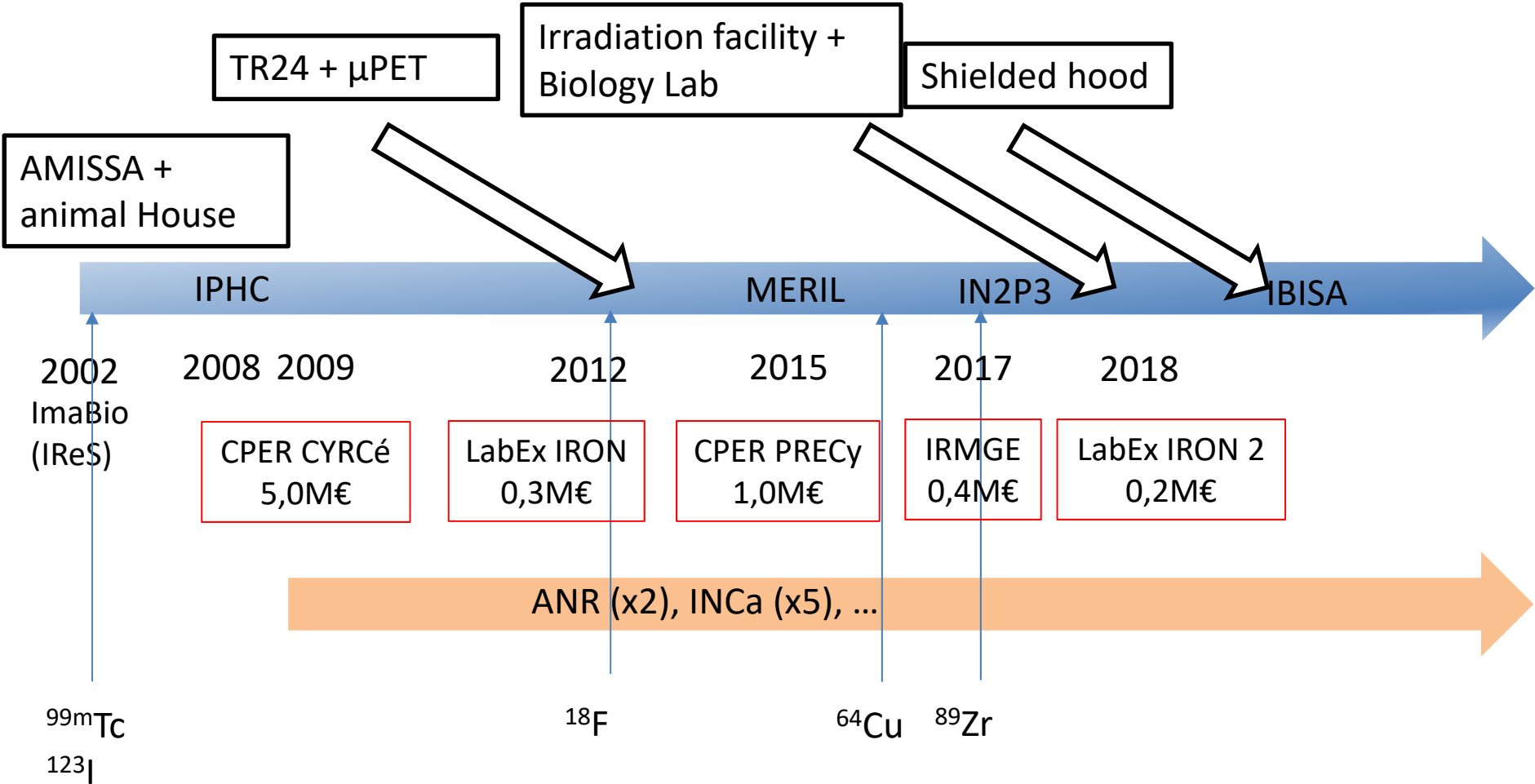
O-(2-¹⁸F-fluoroethyl)-L-tyrosine (¹⁸F-FET) uptake in insulinoma: first results from a xenograft mouse model and from human **Nucl Med and Bio** 53 (2017) 21-28

ii. HCC treatment with proton : a PET study (rpPET project, INCa)

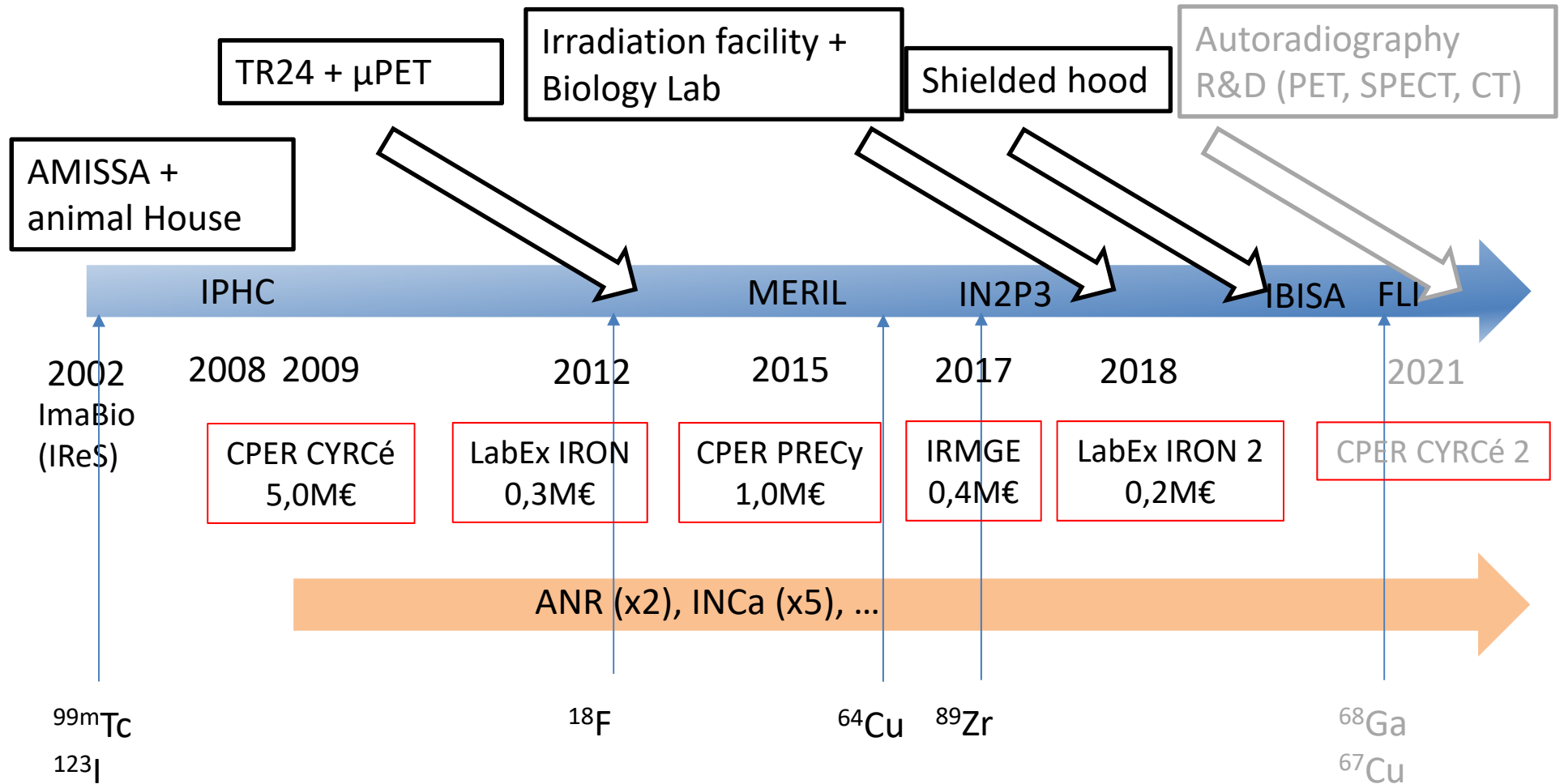


Animal house, imaging facility, 18-F, p+ irradiation

3. Platform environment



3. What's next?



2020-2023 : IPHC projects

□ Molecular imaging :

- 2 PhD (20d/y) funded by 80 PRIME and region Grand-Est
- FBP (15/yd) funded by Fond National Suisse
- Oncolytic viruses (10d/y) INCa grant asked
- Theranostic $^{64}\text{Cu}/^{67}\text{Cu}$ (5/yd) funded by LabEx IRON 2
- ^{89}Zr chelators (5d/y) funded by 80 PRIME

□ irradiation

- new protocols (10/y)
- Plant irradiation (5d/y) grant asked to MITI
- flash irradiation (PhD) (15 d/y)
- hibernation (CNES), (5d/y)
- CMS (100 d/y) funded by CMS

TOTAL : 55+135 d/y (over the last 3years : 120d/y)

5. Human Resources & Funding

Irradiation facility

- ❑ Michel Pellicioli IRHC (1 homme/an)
- ❑ Thierry Foerhenbacher IR2 (0.3 homme/an)
- ❑ Jacky Schuller IEHC (1 homme/an)
- ❑ Nathalie Dick AI (1 femme/an)
- ❑ Cedric Mathieu IECN (0.3 homme/an)
- ❑ Clément Haas (1 homme/an) CDD TGIR CMS

Biology laboratory:

- ❑ Estelle Santiago AI (0,8 femme/an)

5,7+1 FTE

Imaging facility

- ❑ Lionel Thomas IR2 (0.6 homme/an)

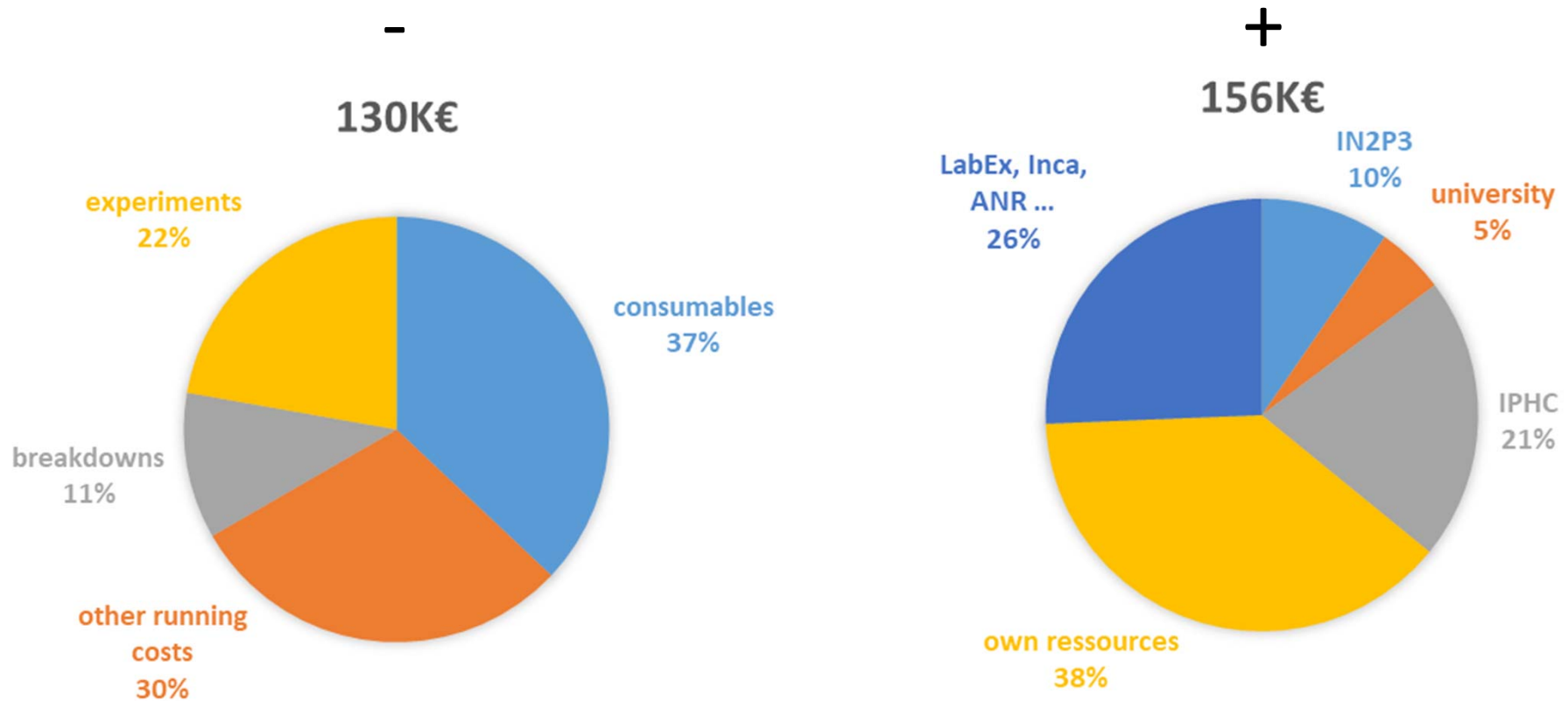
Animal house

- ❑ Bruno Jessel AI (0.7 homme/an)

radiochemistry

- ❑ ??? AI (0.9 homme/an)

2017-2019



Investments : equipment maintenance or R&D or unknown risk or human resources

6. SWOT

- S :
 - research infrastructure (irradiation + isotope production + biology laboratory + preclinical imaging facility+animal house) unique in France (Europe) : 1 site,
 - High qualified staff (IN2P3) in a favourable scientific environment,
 - wild possibility of cyclotron stable current (from few aA to mA),
 - complementary (isotope production, irradiation) compared to others national RI
 - strong connection with industrial partners
 - teaching (BS, M1-M2)

- W :
 - lack of dedicated radiochemist technician
 - dependent on PI success to proposals
 - expensive equipment (CPER, EquipEx, ...) : dependant on CNRS support
 - difficult to keep human resources

- O :
 - pluridisciplinary projects/teams (IPHC),
 - GMP lab (translational research)
 - ITI
 - new FLI node
 - complementary RI at the national level (existing collaborations RESPLANDIR, IRON)

- T :
 - big (expensive) breakdowns
 - Retirement (1 x 1962, 2 x 1965) : expertise loss
 - unbalanced between research and services



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