

The Cyrce platform



Coordinateur Scientifique: Ziad El Bitar
Responsable Opérationnel : Michel Pellicoli
cyrce-contact@iphc.cnrs.fr

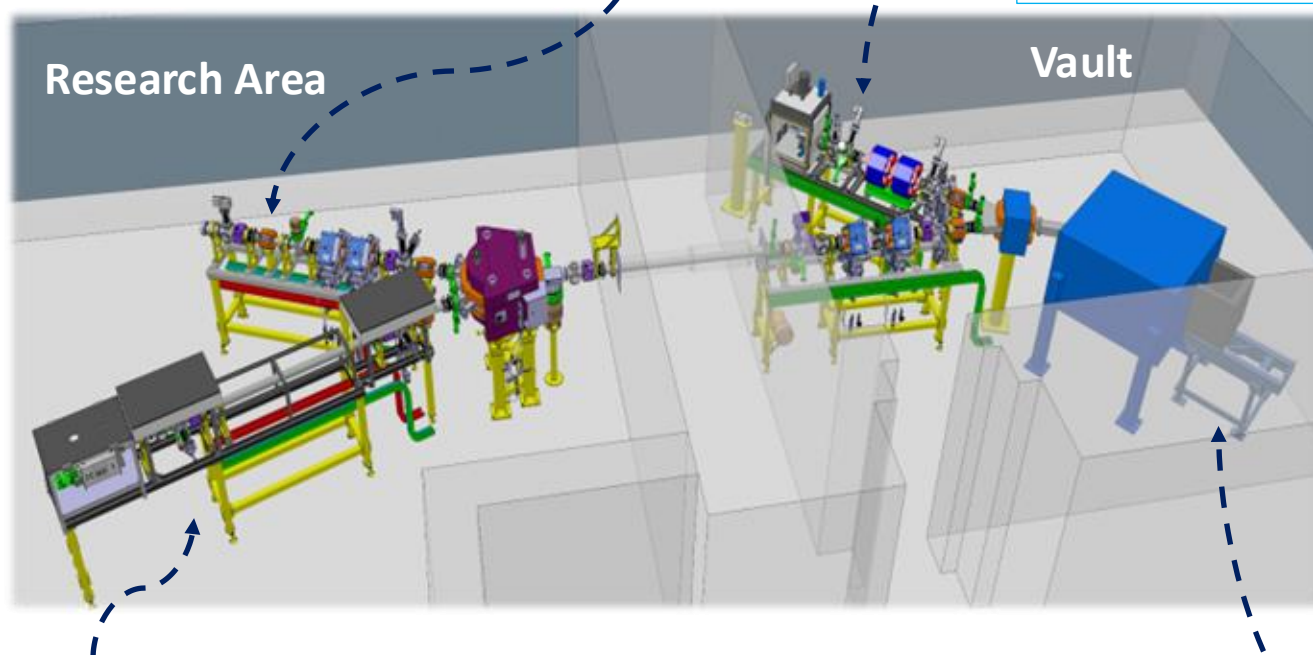
Université

de Strasbourg



Sensor testing under cooling condition, beam telescope, 42MHz bunch rate (instead of native 85) to match the LHC frequency.

*Beam line for high flux irradiation
Location of the future high power target for isotope production (7kW)*



*Precy beam line for radiobiology, radiolysis, sensor testing ...
Beam current up to 100 nA, down to fA.*

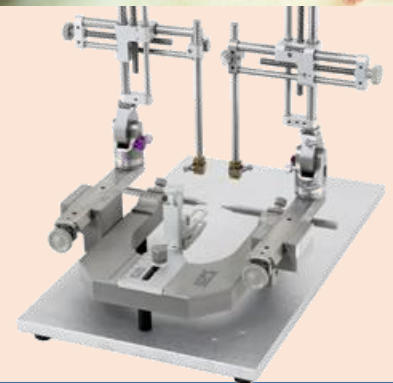
Shielded Targetry station



- *Hot and lukewarm laboratories*
- *In house and commercial synthesisers*
- *Radio labeling and chemistry characterisation*

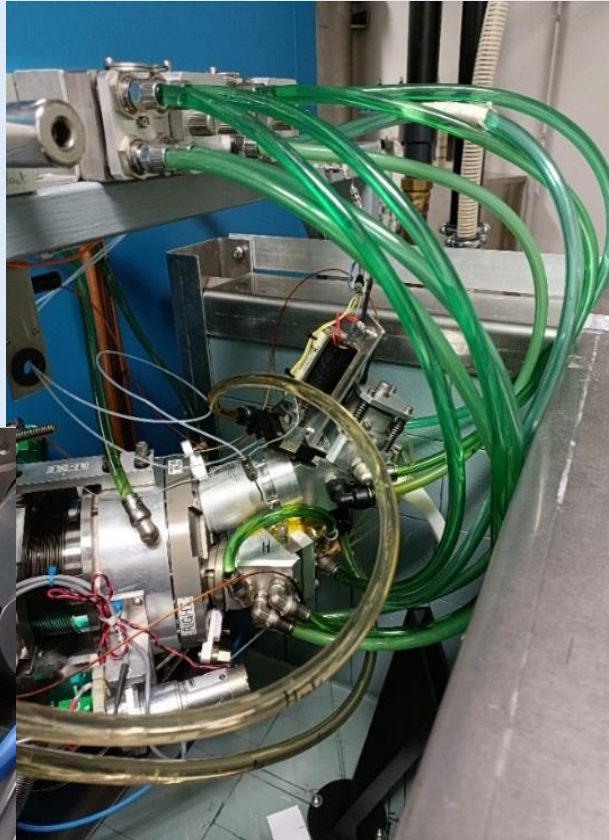


- *Housing of laboratory mice, including infected with viruses and genetically modified animals*
- *Animal breeding, breed preservation*
- *Surgery capacity*
- *Monitoring of experimental protocols*





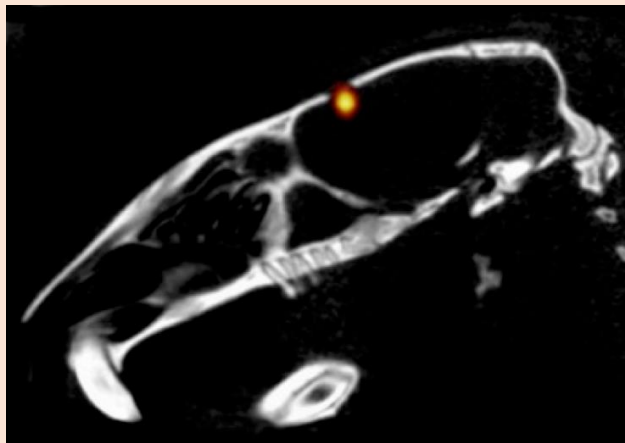
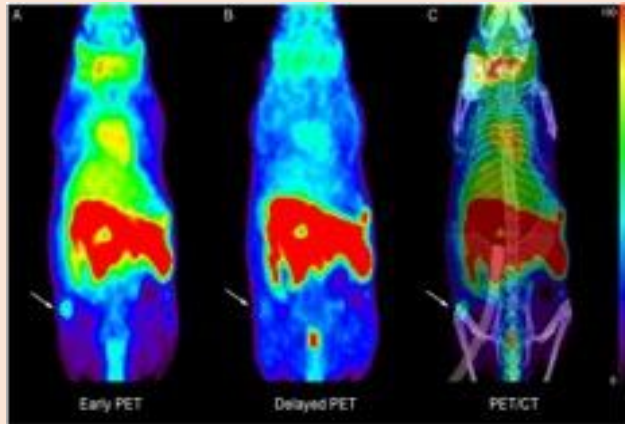
- *Storage and development of cell culture lines*
- *Training and hosting external users*
- *Support for internal or external research programs*



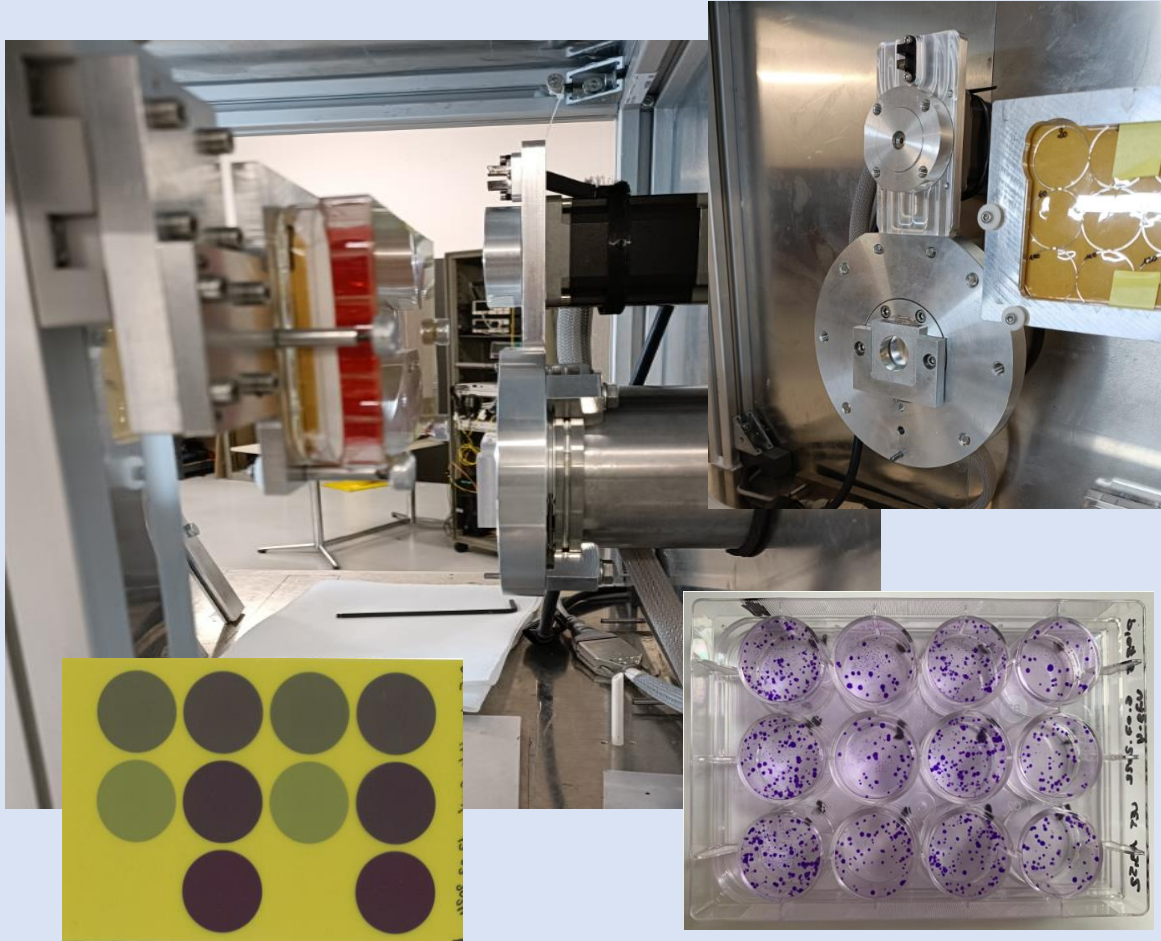
- Four ports irradiation station
- Large F-18 target (200GBq typ.)
- Small F-18 target (30GBq typ. *)
- Solid target for Cu-64, Cu-67, Zr-89, Ga-68 production
- Fully automated system to transport and extract metallic isotopes (*)
- High flux target with in situ treatment for massive isotope production (**)

* in house development

** under development

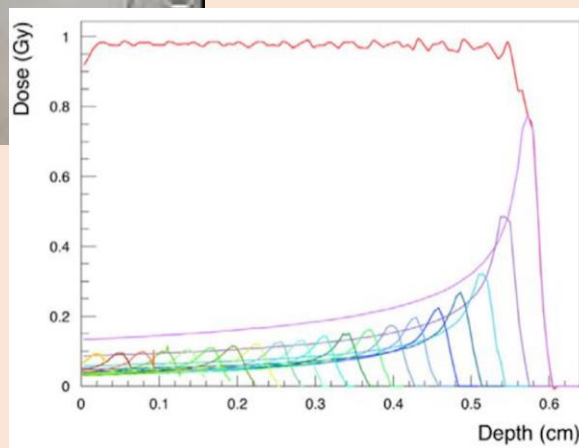
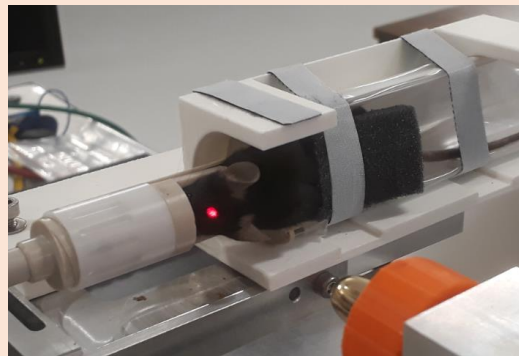


- *Inviscan IRIS μ PET/CT imaging system for small animals*
- *Tumor quantification*
- *Longitudinal monitoring of tumours*
- *Monitoring of metabolic activity (inflammation, apoptosis, hypoxia, cell proliferation)*
- *Autoradiography for organ quantification*
- *HIDEX AMG Gamma counter γ detection up to 2MeV, 78 samples at a time*



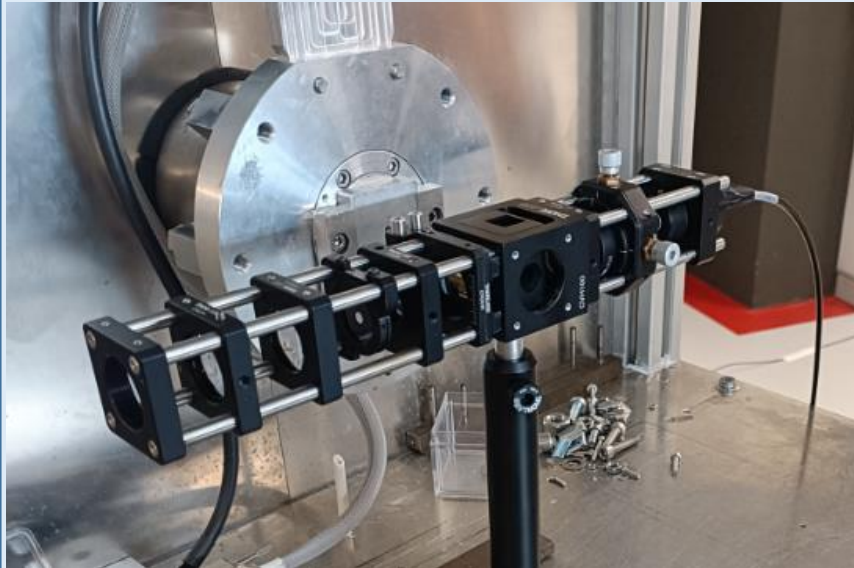
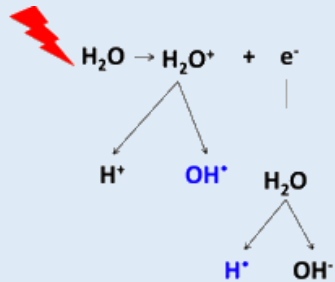
- *Irradiation of cell plate wells vertically*
- *Dose rate from fraction of Gy/min to 10kGy/s*
- *Field of irradiation up to 36 mm diameter (scattered beam)*
- *Dose monitoring with dosimetric films*
- *Ability to switch the beam on and off in 5 μ s (RF kicker) or 1 ms (mechanical shutter)*

In vivo irradiation



- *Mouse underskin tumor irradiation*
- *Irradiation with Spread-out Bragg peak (SOBP)*

Constanzo et al.,
Medical Physics, 46(5), May 2019



Irradiation of 'water samples' with adjustable dose and dose rate



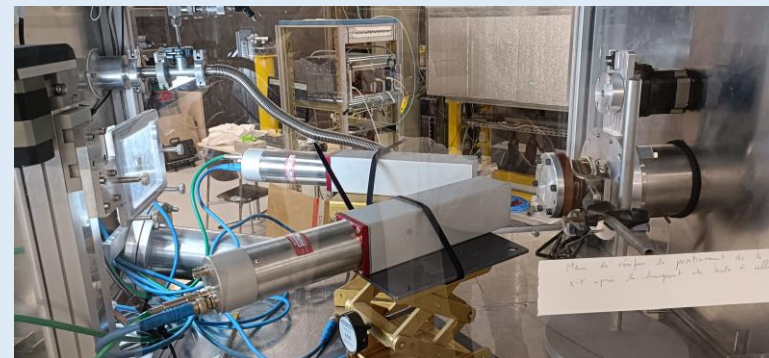
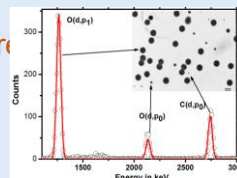
- Pharmaceutical establishment (GMP certificate)
- Development and follow-up of clinical trial files
- Development of analytical method, optimization and automation of manufacturing processes
- Production of radiopharmaceuticals for clinical trials (diagnosis and therapy)



- Beam current range from hundreds proton/s to nA
- Capability of cooling down to -10°C
- Energy range from 16 to 25MeV (native) down to 2MeV with degrader
- X and Y table for sensor positioning or scanning (in the μm range)
- Beam in air or under vacuum

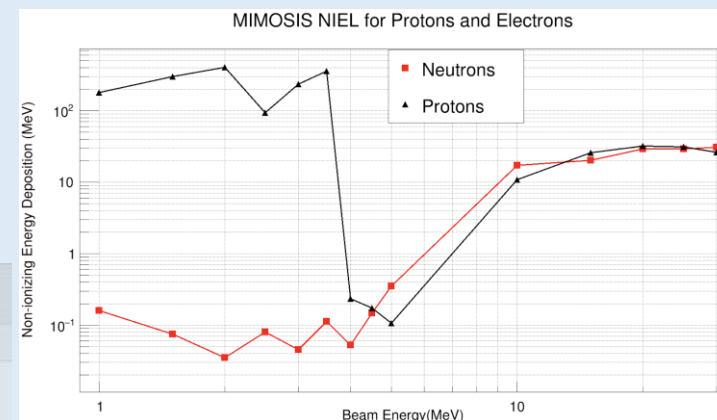
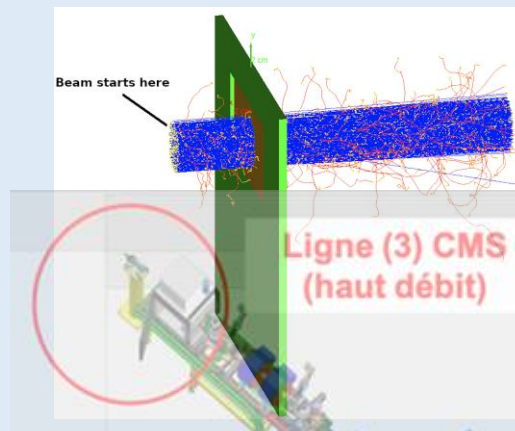
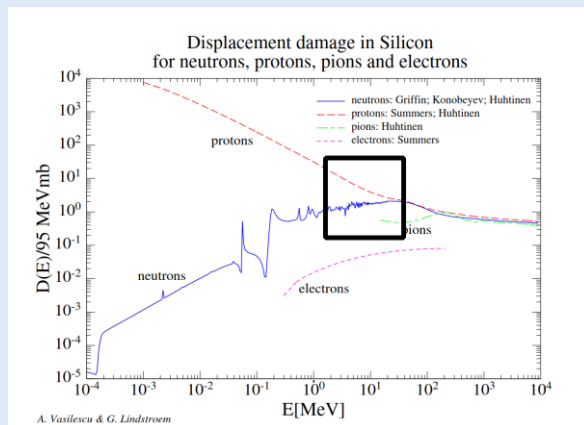
○ Measurement and detection (DNE, DeSIs)

- LaBr_3 et CeBr_3
- Measurements Gamma and neutrons
- DSTN (DéTECTEURS Solides de Traces Nucléaires)



○ Improving the Accuracy of Hardness Factor Measurements

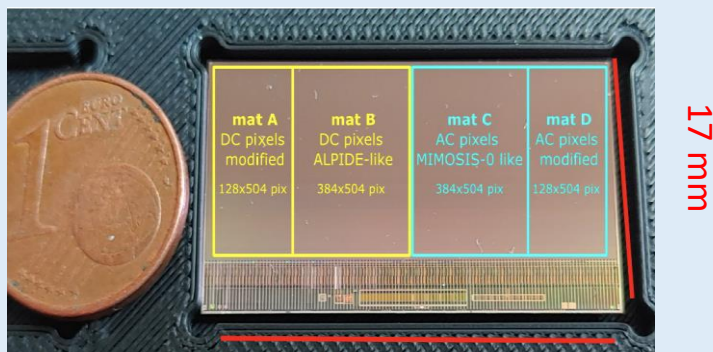
- Protons and neutrons
- All HEP Physics teams: R&D Sensors



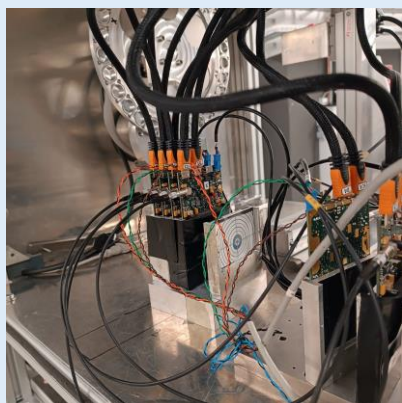
Sensors and components characterization :

Beam profile and rate

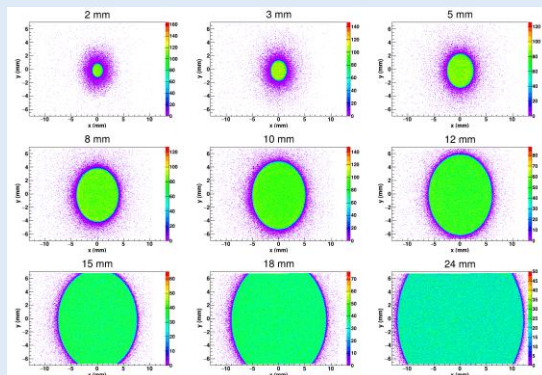
- Real-time monitoring of beam fluence and uniformity.
- Sensor performance in high fluence condition



MIMOSIS

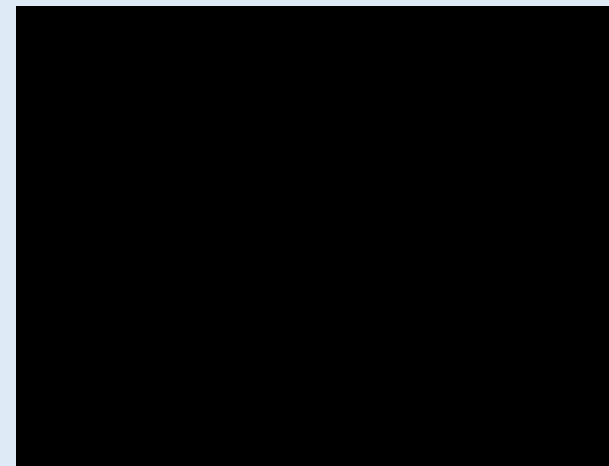


Telescope

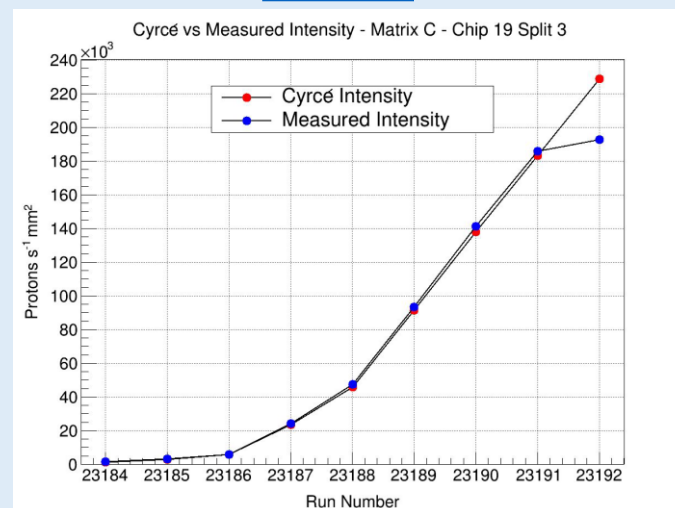


Beam profile

Courtesy of Nico Brosda & Stéphane Higuieret

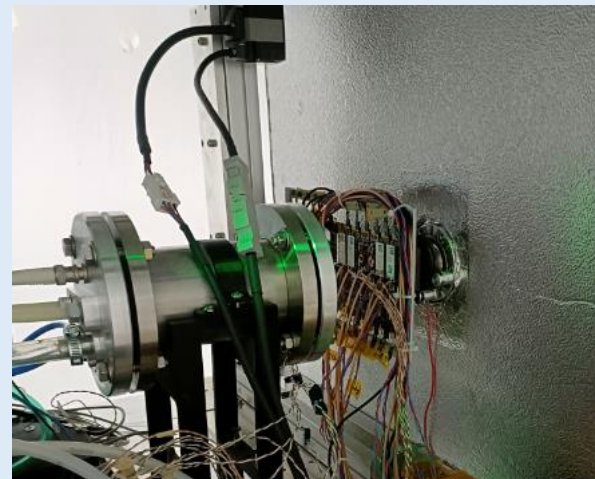
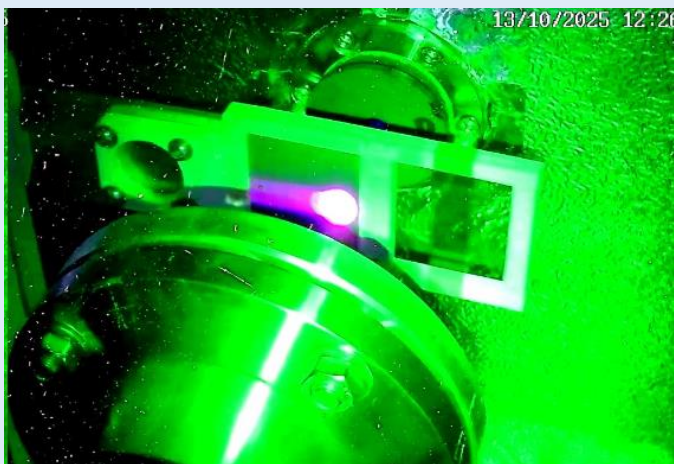
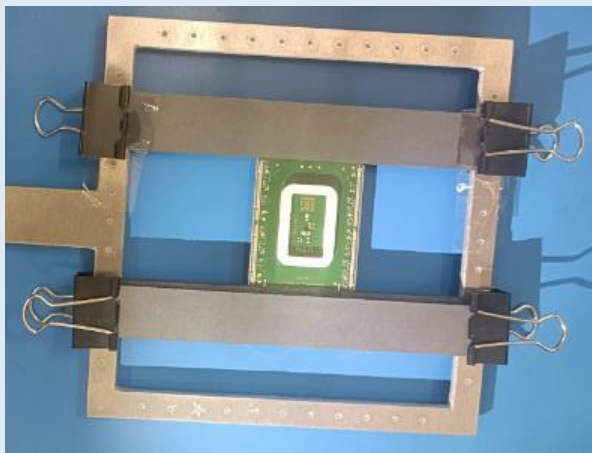


MATRIX



Radiation hardness of sensors and components

Irradiation the bpol component of CMS

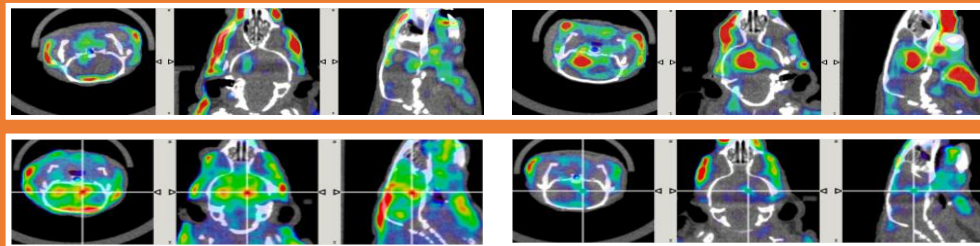


- High dose rate irradiation by scanning, up to 5 μA proton beam in air
- Fluence up to 10^{15} p/cm²
- Capability to irradiate at -20°C
- Scanned area up to 250x250 mm²
- In line beam current monitoring
- Assessment of overall fluence using activation measurements on nickel foils

Faits marquants

Projet: Glioblastomes et Oncovirus (Matteo Negroni – IBMC)
150 souris, 85 examens PET/CT (Imagerie)
Injection virus + radioactivité en environnement A2

Projet PROTOVEC (Laurent Deaffler – Estelle Santiago)
(484 plaques de cellules irradiées traitées en environnement L2
130 souris, 120 examens PET/CT
injection virus+ radioactivité en environnement A2

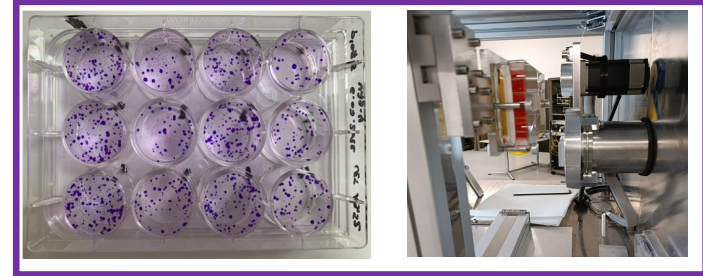


Non responding mice

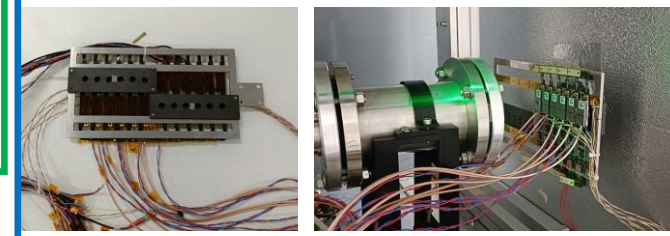
Responding mice

PET/CT #1

PET/CT #3 (J+12)



Irradiation des modules CMS bpol.

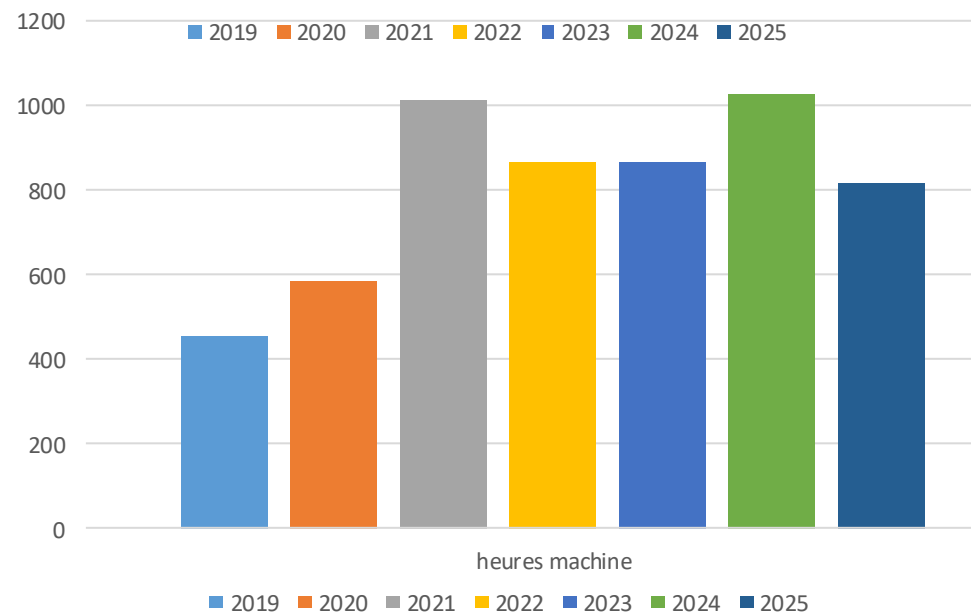
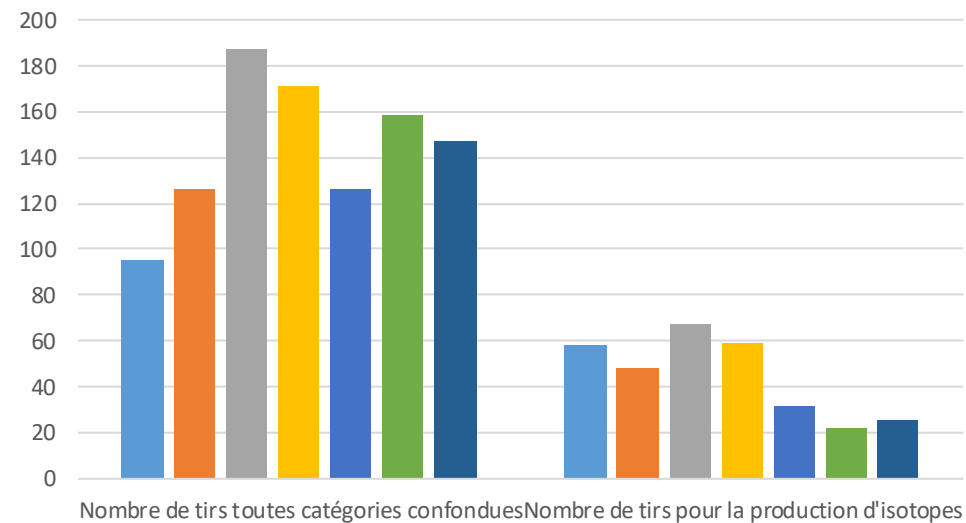
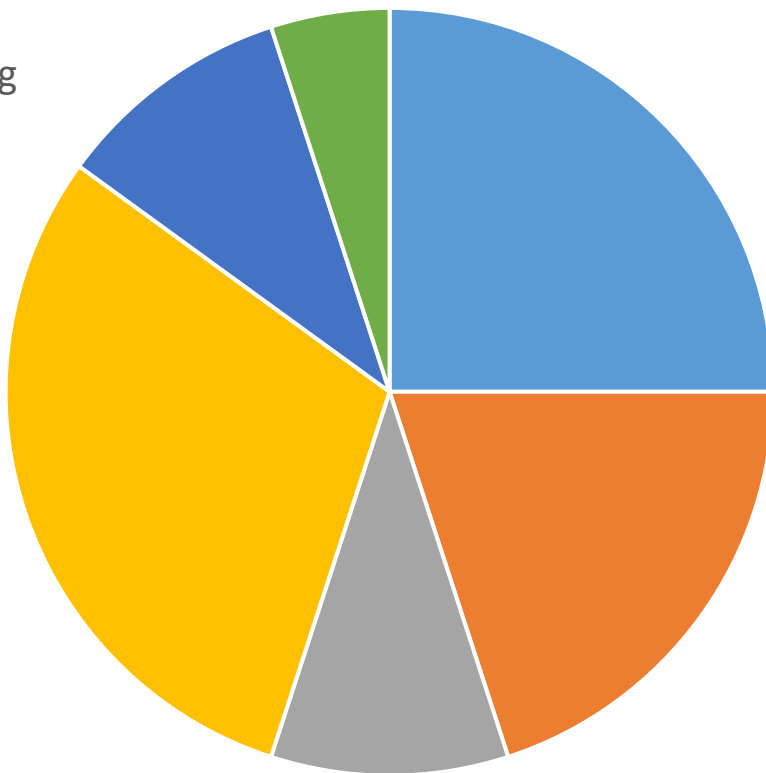


R&D

- Développement d'une formulation innovante du Zr-89 avec l'hôpital La Charité (Berlin), en vue d'essais cliniques pour optimiser la sélection des patients candidats à la radiothérapie interne vectorisée du cancer de la prostate.

Typicall activity repartition

- Sensor testing
- Radiation Hardness
- Isotope production
- Radiobiology
- Radiolyse
- Other tests



- Open to academic or private institutions
- Call for experiment proposal about every 2 months
- Ability to adapt the facility to costumer requirements
- Support for regulatory compliance management (use of animals or cells)
- Management of radiation-related issues
- The price of the service depends on the customer's status :
 - Local Academics (typ. 240 € per cyclotron hour)
 - French academics (typ. 1000€ per cyclotron hour)
 - External- private or other laboratories (2600€ per cyclotron hour)
- Auditable prices available
- Custom quote based on experience



La plateforme CYRCé