

JANNuS-SCALP

Irradiations/Implantations



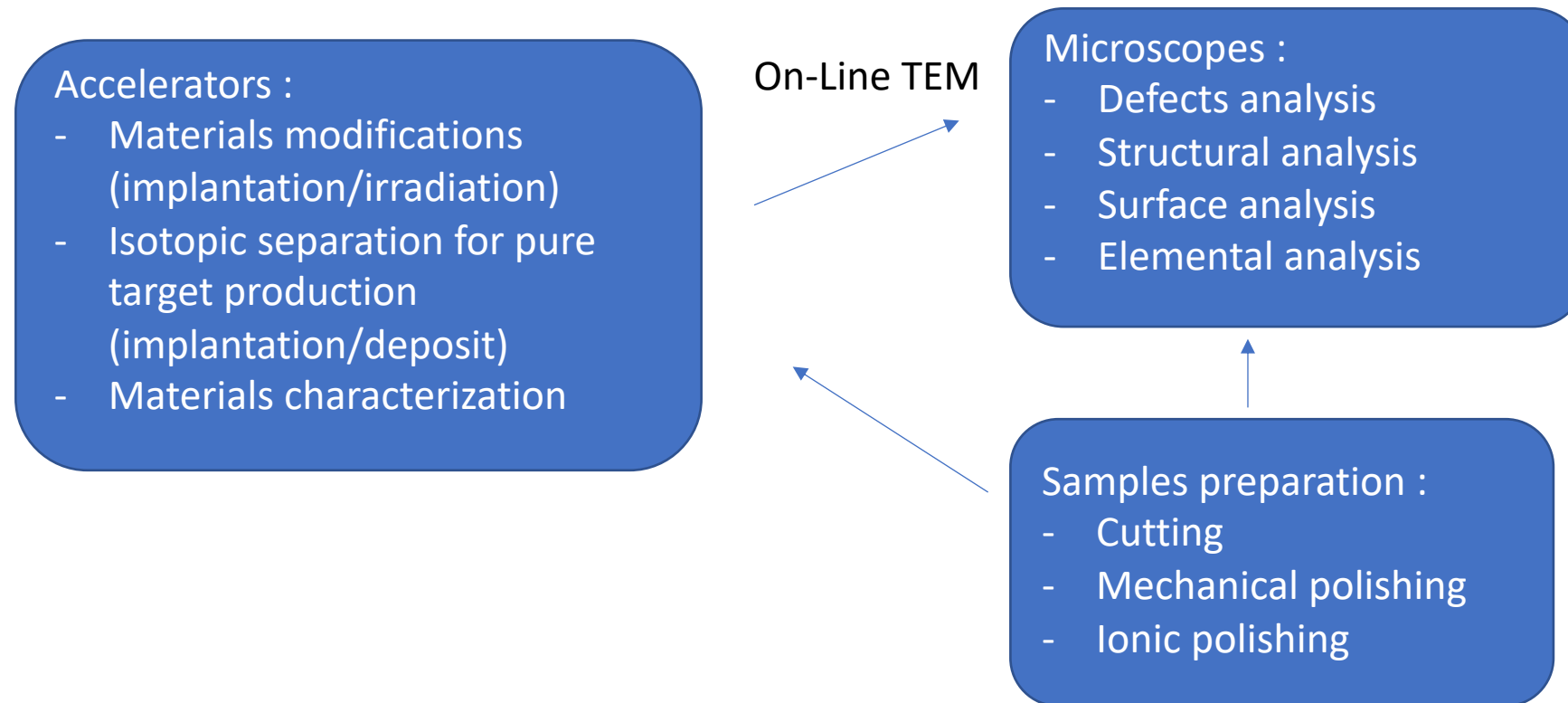
Operations manager: Dr Cyril Bachelet
Scientific leader: Dr Aurélie Gentils



JANNuS-SCALP Plateform

JANNuS: Joint **A**ccelerators for **N**anosciences and **N**uclear **S**imulation

SCALP: **S**ynthesis and **C**haracterization using ion **A**ccelerators for **P**luridisciplinary research





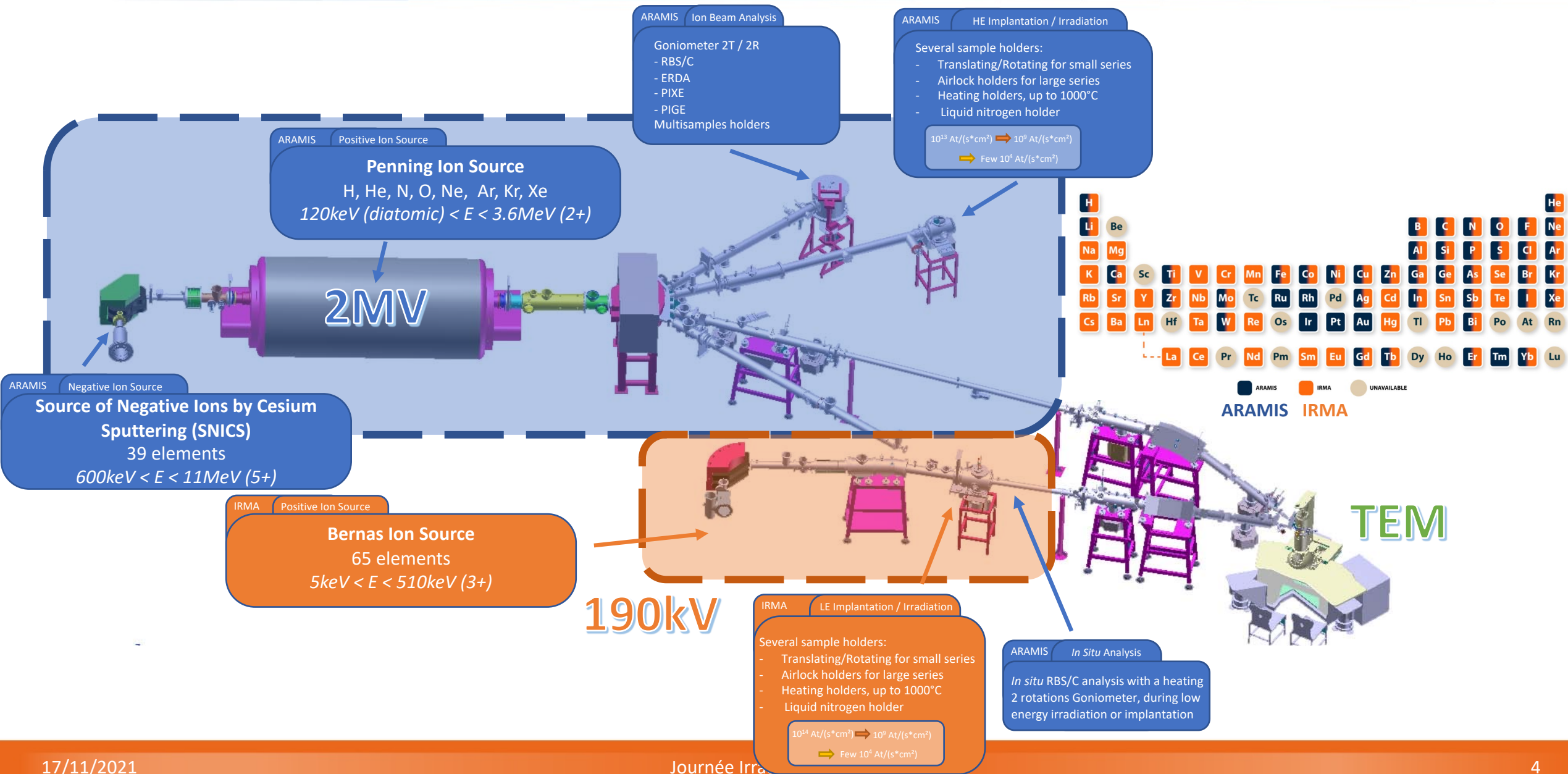
Staff

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ARAMIS (1989) - IRMA (1979)





TEM (2007)

FEI TECNAI G² F20 Twin

200 kV LaB₆

Resolution: 0.27 nm

Sample-holders:

- Single tilt from LN₂ to 1300° C
- Double tilt from LN₂ to 1000° C

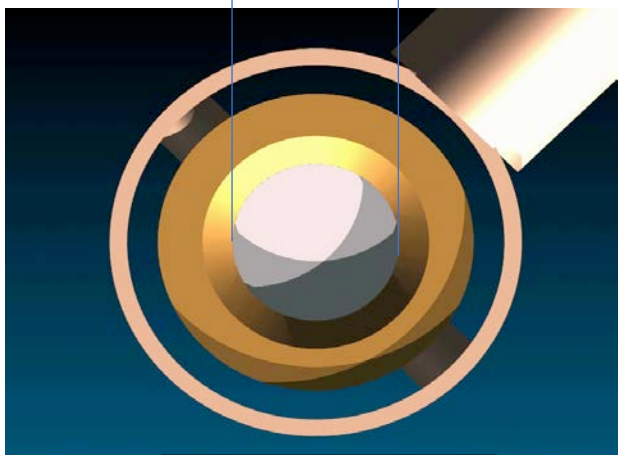
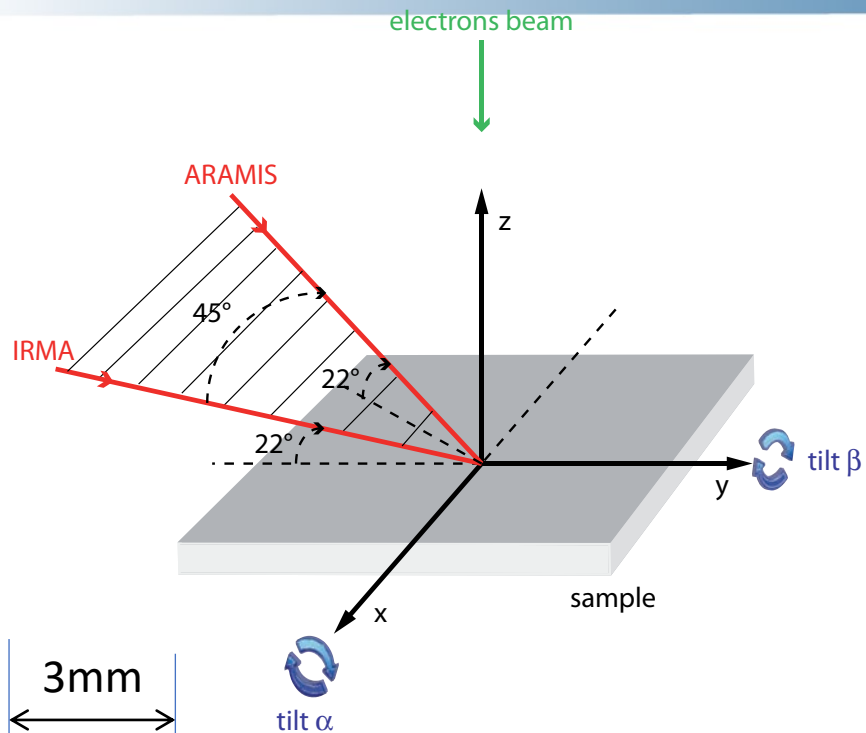
Instrumentation:

- HR Camera
- Wide Angle Camera
- Energy Filtered TEM (using the GIF)
- EELS (using the GIF)
- STEM mode (HAADF)
- EDX

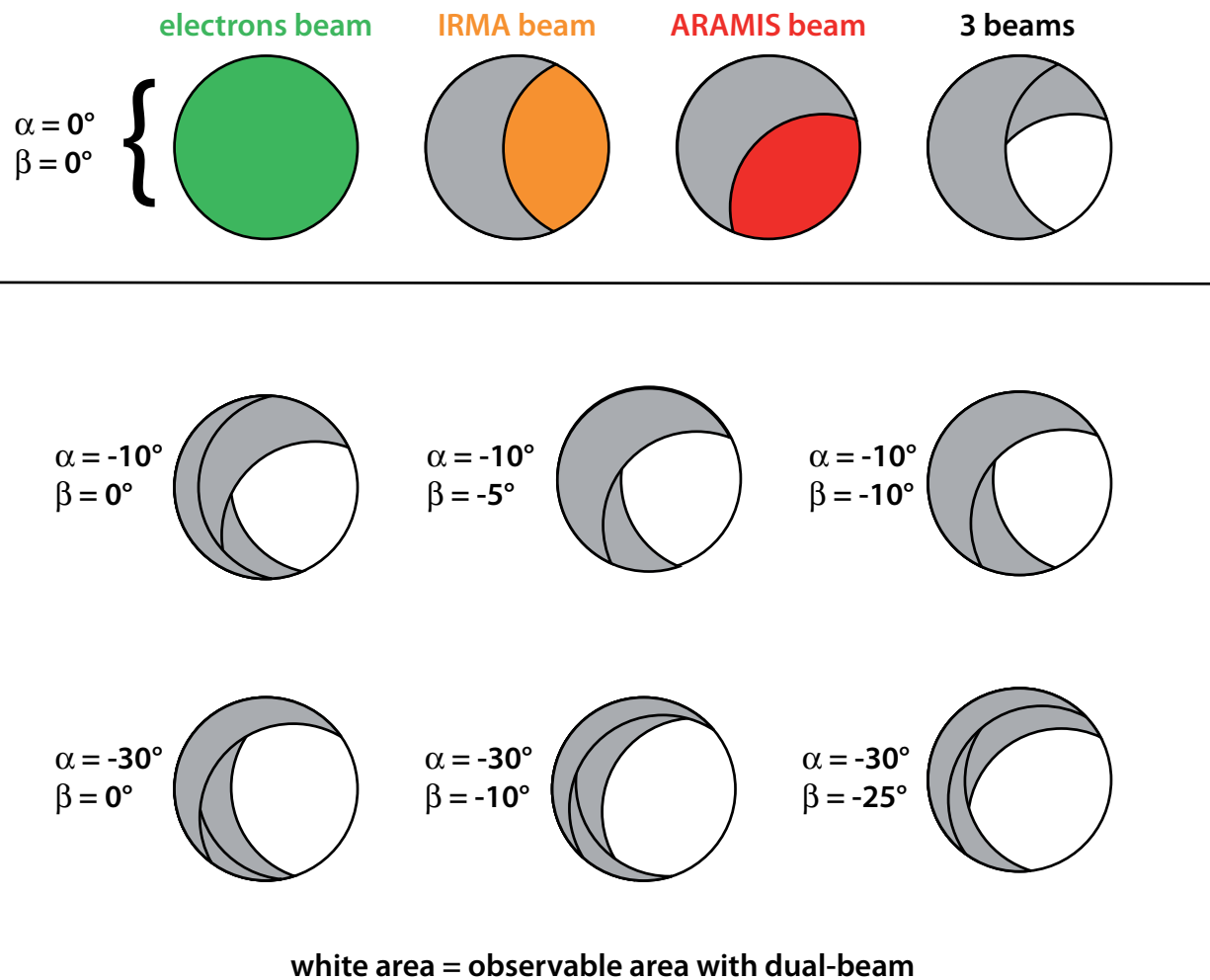




TEM *in-situ*



Sample-Holder





SIDONIE (1969)

SIDONIE Positive Ion Source

Bernas Ion Source
65 elements
 $10\text{keV} < E < 40\text{keV}$

Deceleration $\rightarrow 100\text{eV}$

40kV

$M/\Delta M \sim 2000$

135°
Magnet

Implantation or
deposit with high
isotopic purity
beams



« Big » rejuvenating:

Phase 1: 30k€ (2020-2021)

Phase 2 (Fiabilisation): 100k€ (2022-...)



A new pool of microscopies

Dans une salle climatisée sur dalle stabilisée et en légère surpression



MEB Hirox SH-3000, « MEB de table » :
équipé d'un analyseur EDX ; résolution spatiale : 15 nm ; Energies disponibles 1, 5, 10 15, 20 et 25 KV



AFM / MFM Park systems NX10 : cartographie topographique de la surface à l'échelle atomique, et topographie magnétique des échantillons

En cours de remise en état / Fiabilisation

MEB LEO 440 :
résolution spatiale : 2 nm sur Si ; Energie : de 0,1 à 30 KV



→
\$ Détecteurs EDX \$
←



MEB JEOL JSM 5900LV :
5 nm de résolution spatiale ; Energie de 1 à 30 KV



Samples preparation

Mechanical polishing



Ionic polishing



Electrolytic polishing



Binocular microscope



Cutting

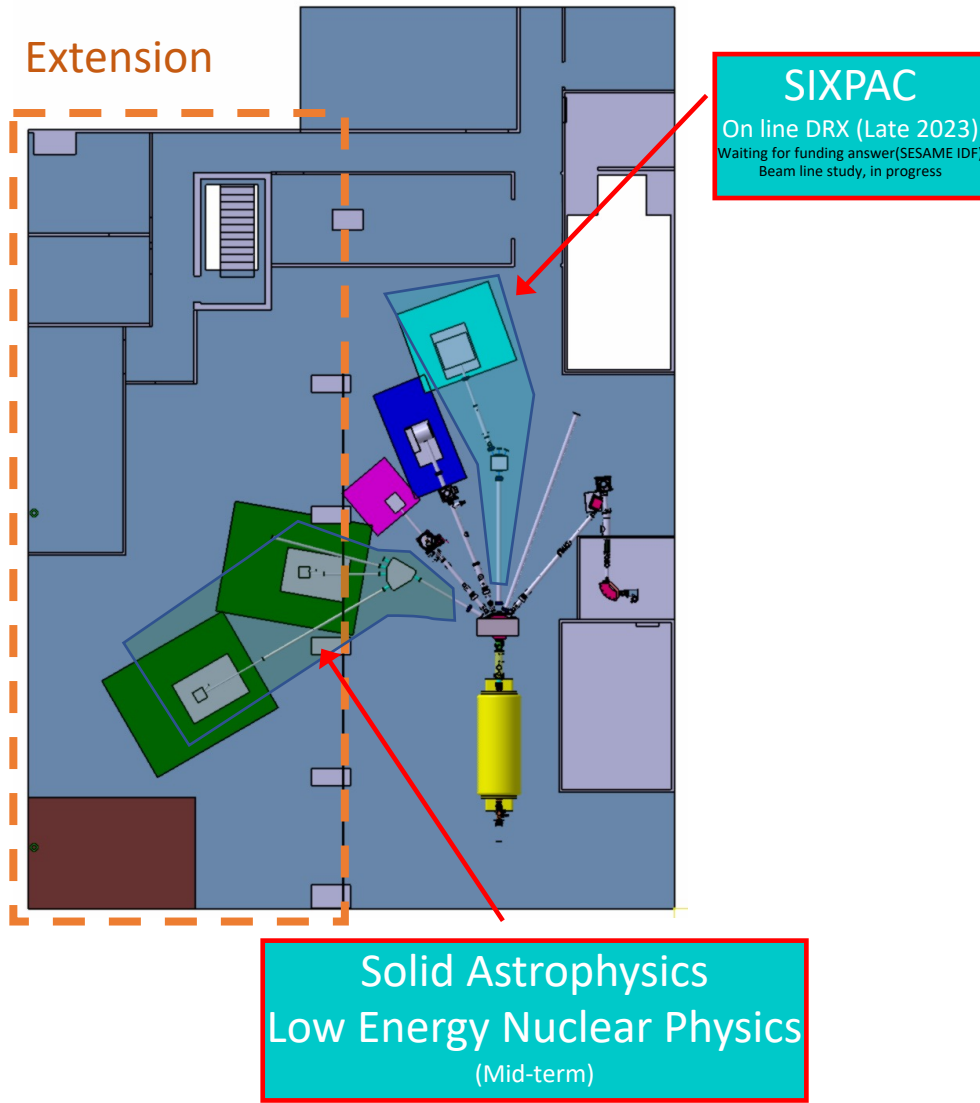




Extension

In the CPER framework, a 280m² extension of the building for an overall budget of 1.6 M€

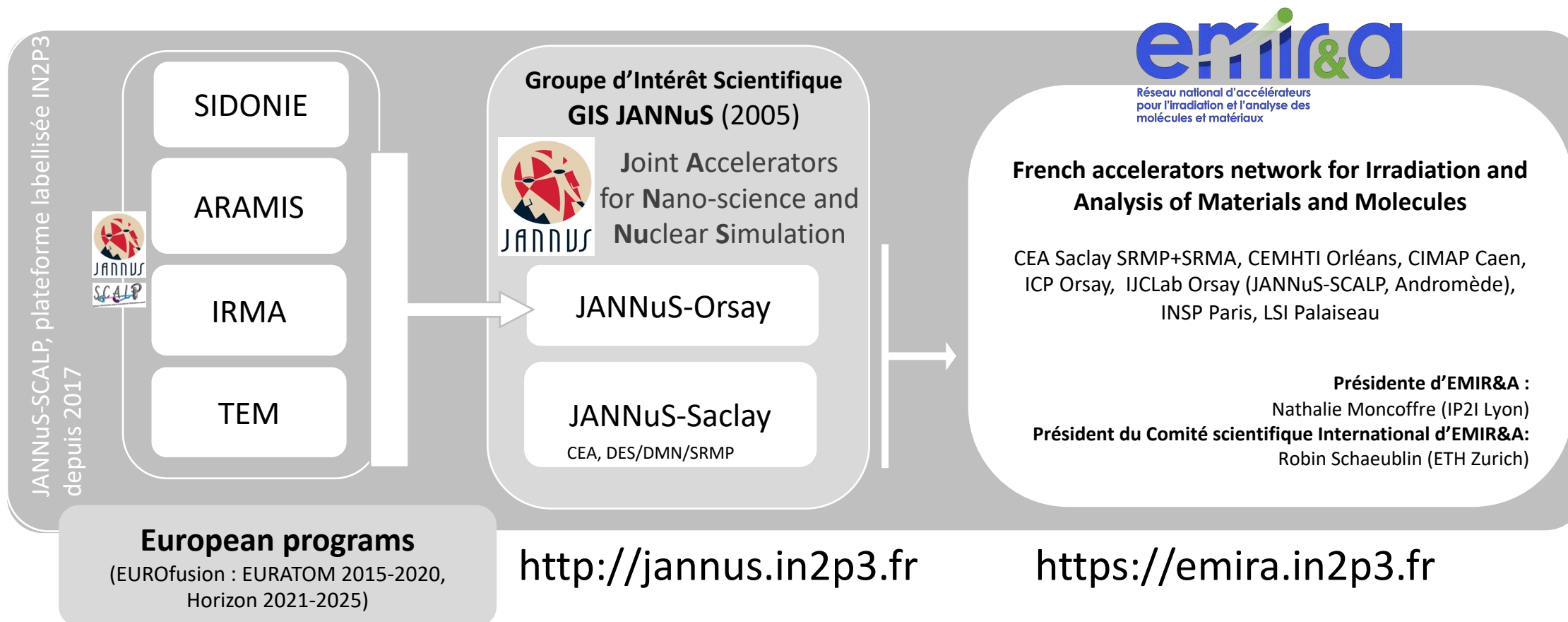
- Experimental area → 415m²
- Practical work room
- Office + Living room
- New control room





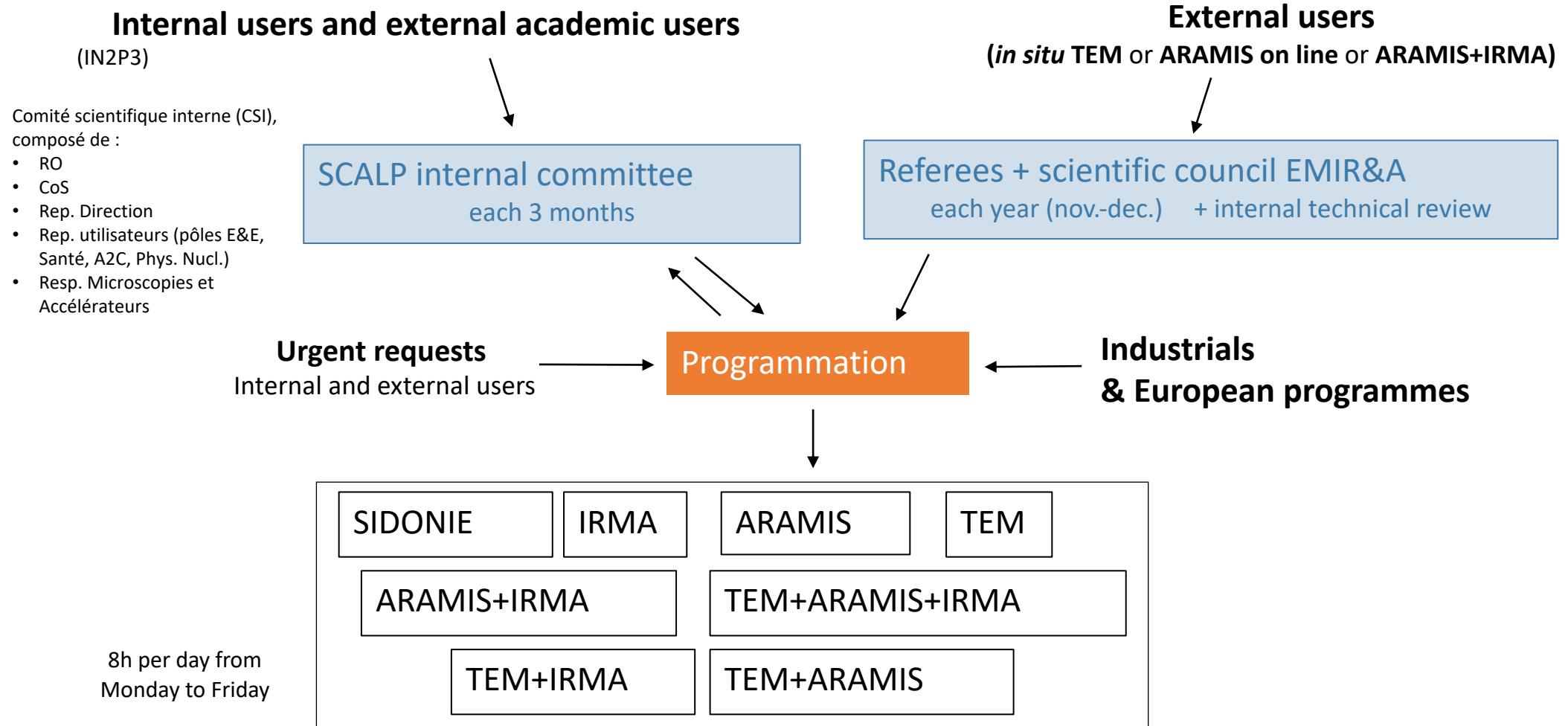
Position on the national scale

JANNuS is a funding member of french network of accelerators for materials under irradiation called **EMIR**, in 2009. Became a CNRS federation in 2014 and an Infrastructure de Recherche in 2018 and 2021 roadmaps. The federation is renamed **EMIR&A** in 2019 with the addition of radiolysis and Ion Beam Analysis platforms



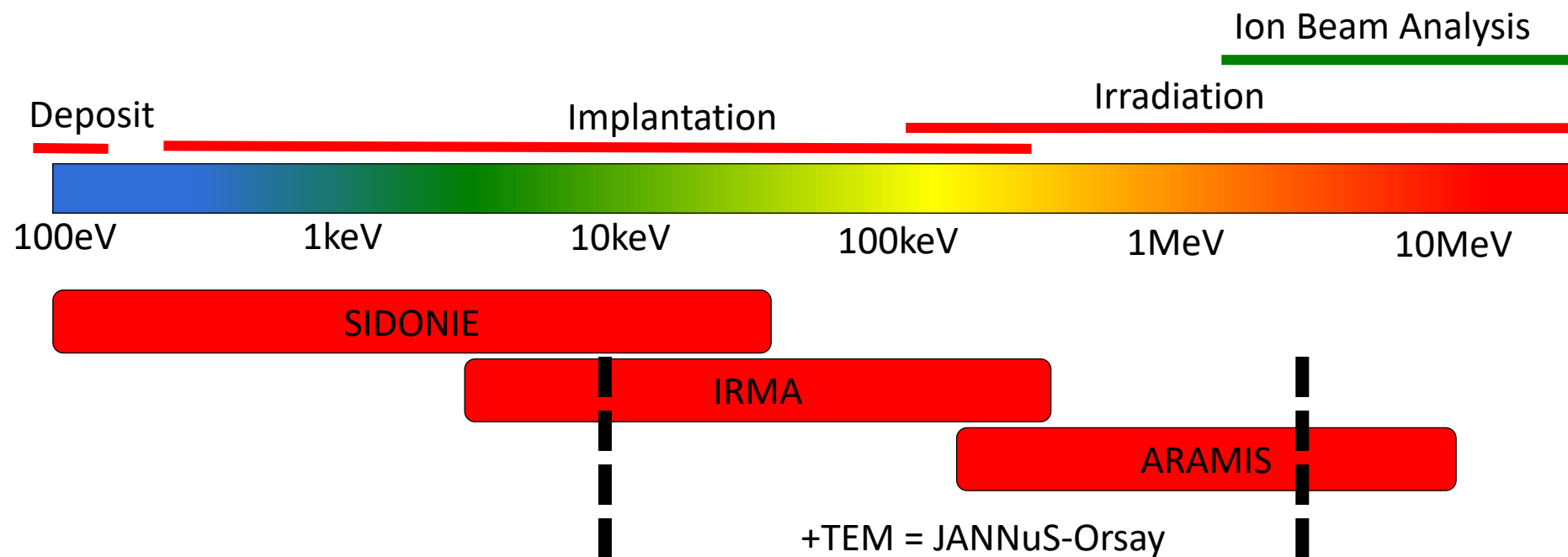


Beam Time programmation





Ion energy range

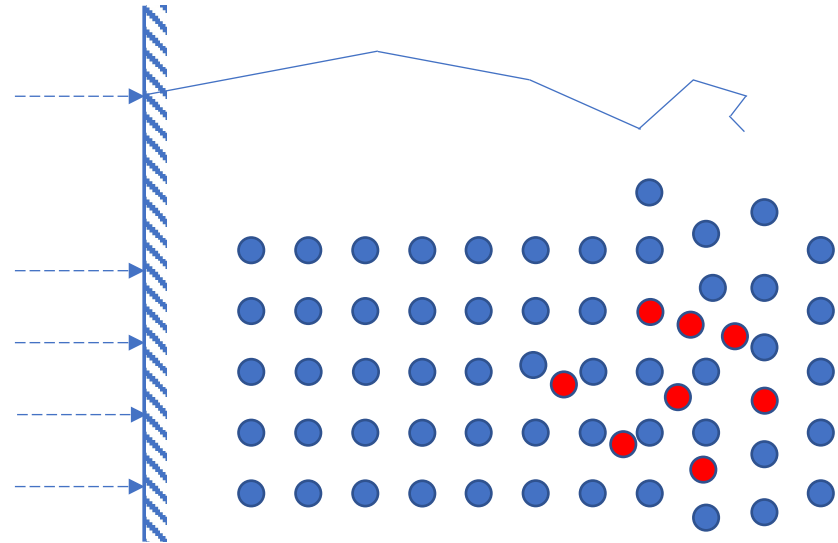


Necessity to produce the largest number of elements as ion beam

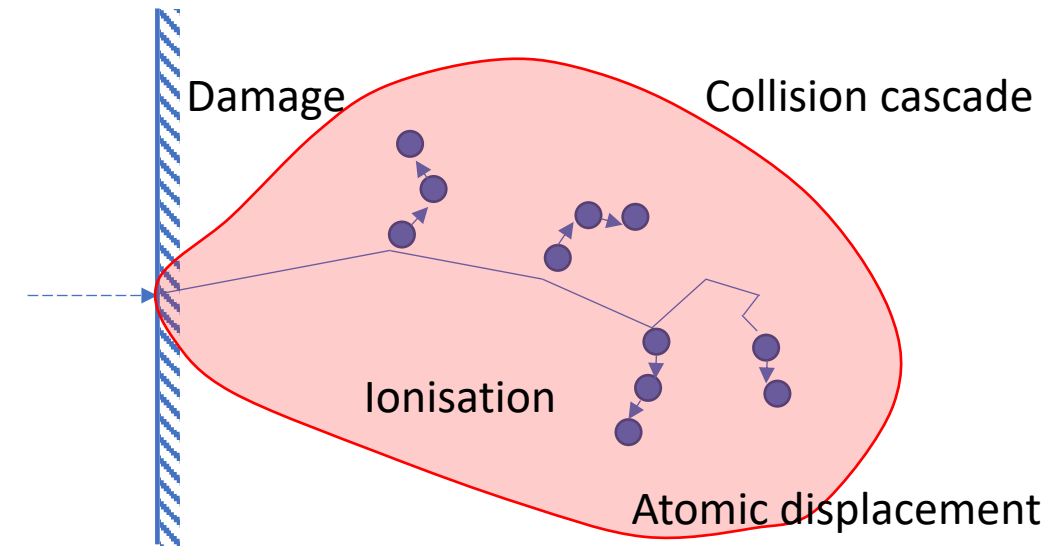


Implantation & Irradiation

Implantation: Where the ions are stopped



Irradiation: Where the ions pass through



Two beams

Synergy



Opto-Electronic Components

Refractive index tuning for waveguides

Wavelength tuning of quantum dots lasers

Capacity or resistivity tuning

Saturable absorber mirrors tuning
(*Li Fang thesis - 2014*)

Protons

As, Fe

Solar Cells

Defects control in heterojunction solar cells
(*Alice Defresne thesis - 2016*)

Ar

Aging studies of solar cells in space conditions

Protons

Diffusion of alkaline elements in CIGS cells

Na, F, K



Nuclear materials

Irradiation effect on hydrogen absorption in new zirconium alloy
(*Benoit Queylat thesis - 2020*)

Studies of metals and alloys under irradiation, under stress, under gas
(*Nesrine Gharbi - 2015 ; Pierre Lapouge - 2016; Marine Gaume – 2017; Olga Emelianova - 2020*)

Glass matrices for radioactive waste

Irradiation effect on nuclear fuel (*Yara Haddad 2017*)

Simulation of neutron with heavy ions (*Marie-José Saleh-Afif 12/2021*)

Ion beam synthesis of (Y,Ti) nano-oxides in FeCr (*Martin Owusu-Mensah 2019*)

PF and/or
neutrons
simulation with
ions
(H, He, Au, Self
irradiation)

Y, Ti, O

Ion-matter interactions

Integrated approach coupling experiments, simulations and modelling of irradiation effects in materials
(*Mohamed El Bakouri Thesis*)



Scientific topics

Detectors

Electrodes metallization of thermal sensors (NTD for LUMINEU)

B
implantations

Health

Target of pure stable isotopes for theranostic radioisotopes production (ANR TTRIP)

Gd deposits &
implantations

Solid Astrophysics

Production of noble gas references for solid astrophysics

He, Ne, Ar, Kr, Xe implantations

Irradiation of ice and meteorites analogs with infrared *in situ* measurements (INGMAR)

H irradiations

Geology

Crystalline defect evolution for geothermochronology (*Dee Jay Cerico thesis 12/2021*)

He Implantation/Irradiation

+
Bi Irradiation
+
RBS/C *in situ*

Self healing of monazite

He + Au
irradiations

Radiation Induced D/H in clays

He
irradiations

Merci pour votre attention

Envoyez vos demandes à : jannus-scalp@ijclab.in2p3.fr