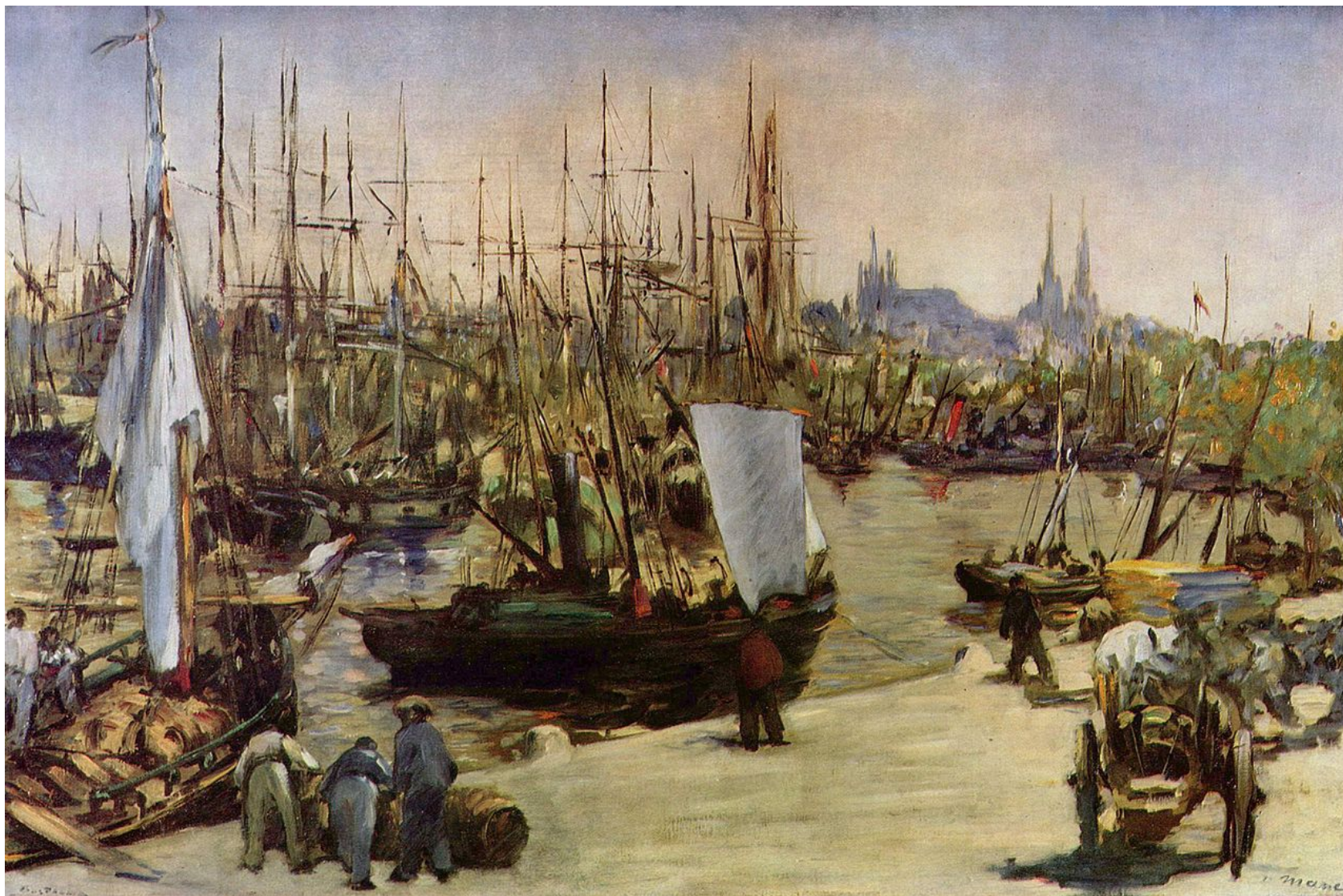


Centre d'Etudes Nucléaires de Bordeaux-Gradignan

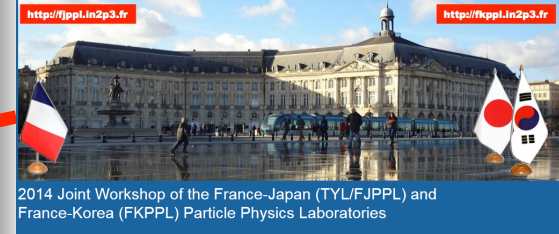
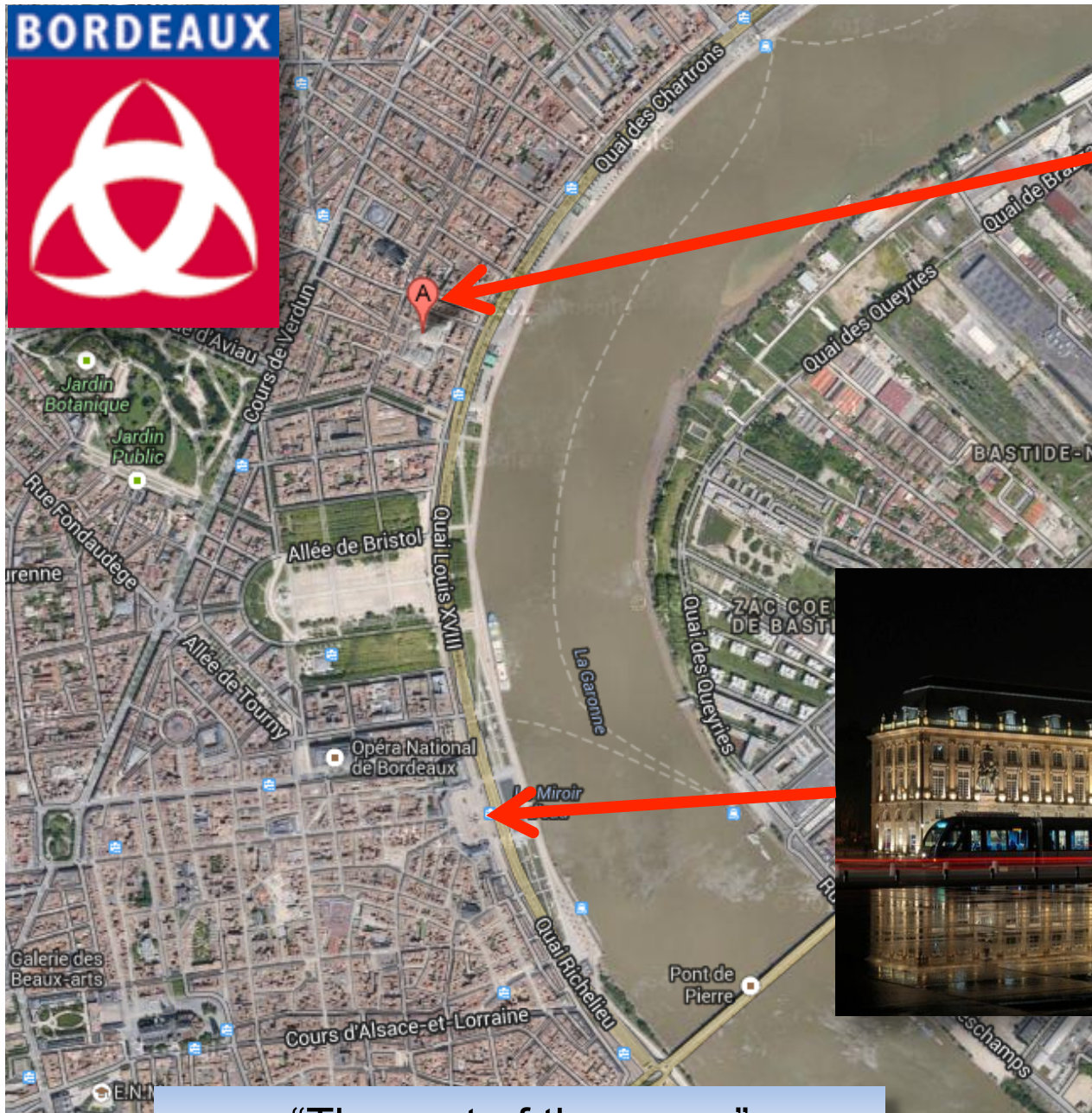


université
de **BORDEAUX**



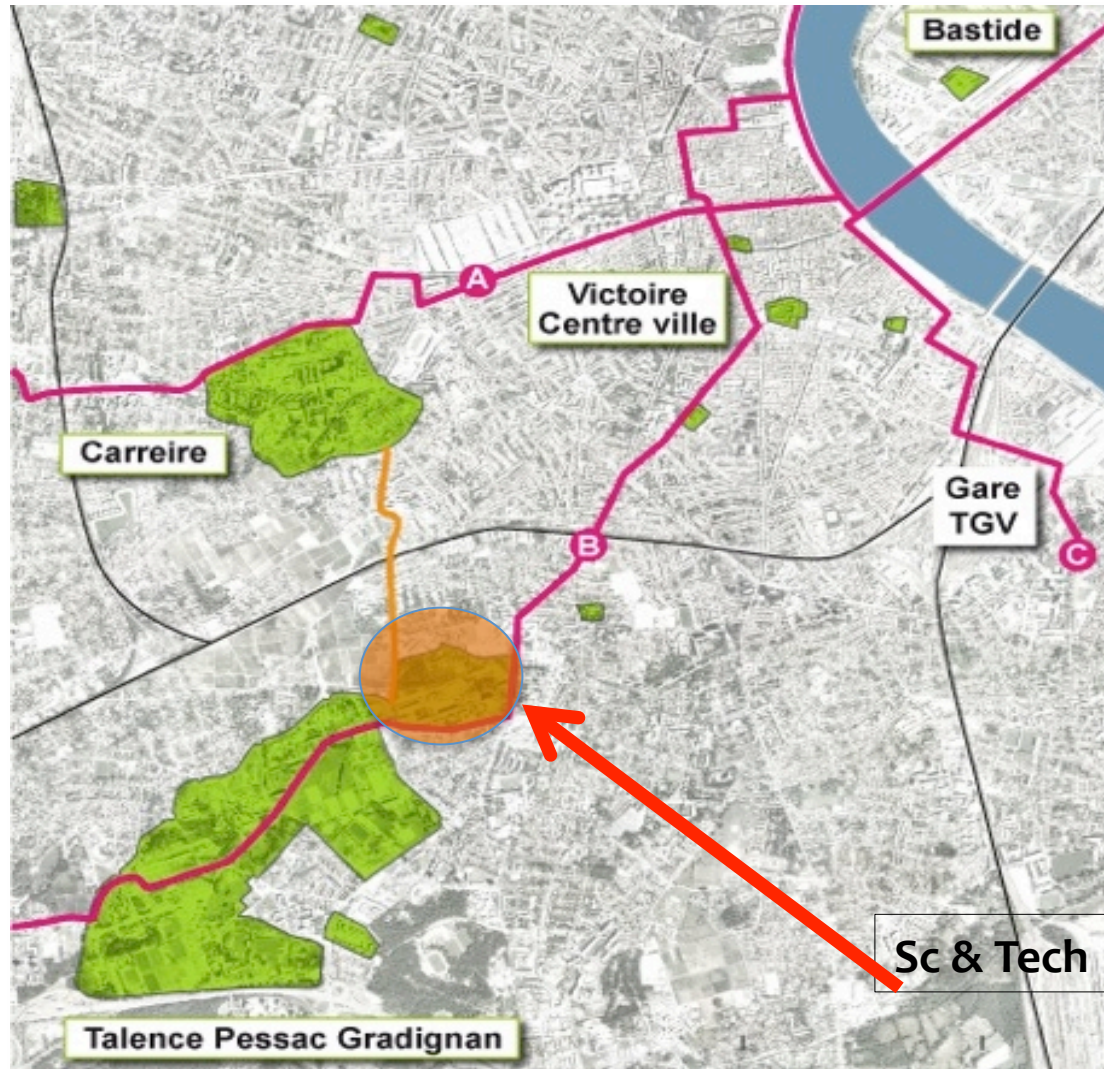
Edouard Manet, 1871, Gabares in the port of Bordeaux

BORDEAUX



« Place de la Bourse »

“The port of the moon”



3,300 research and teaching staff
3,900 other personnel (tech, adm.)
62,000 students, including
3,000 doctoral students



université
de **BORDEAUX**

Superficies :

- 240 000 m² (buildings)

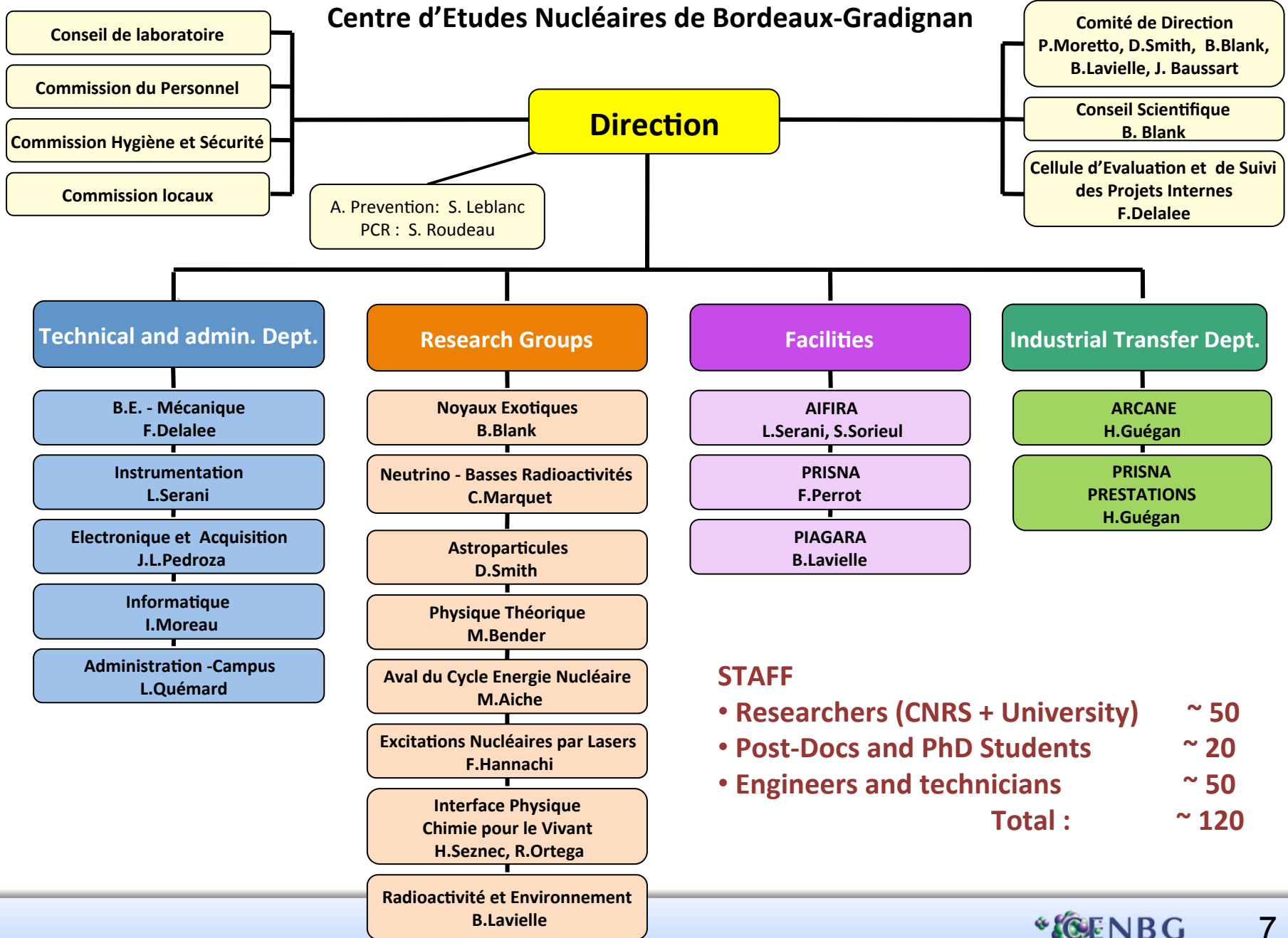
27 research laboratories

people

- 9,500 students
- 990 PhD
- 590 professors & assistants
- 850 other staff (engineers, administratives, technicians)
- 700 CNRS researchers and technicians



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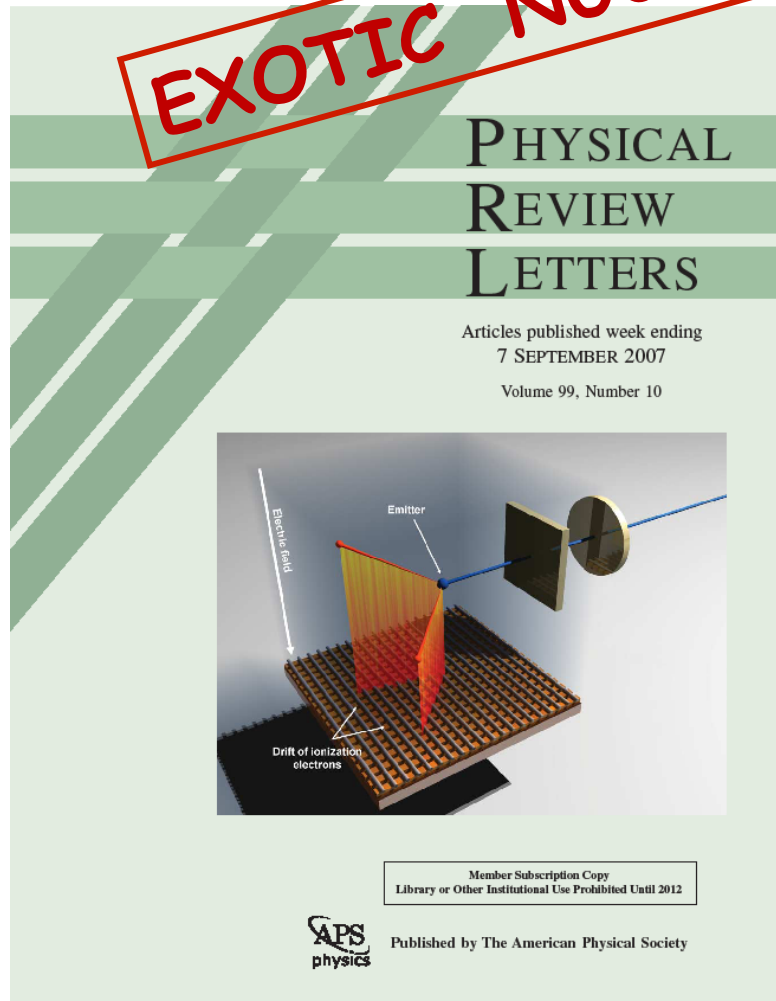
STAFF

- Researchers (CNRS + University) ~ 50
- Post-Docs and PhD Students ~ 20
- Engineers and technicians ~ 50

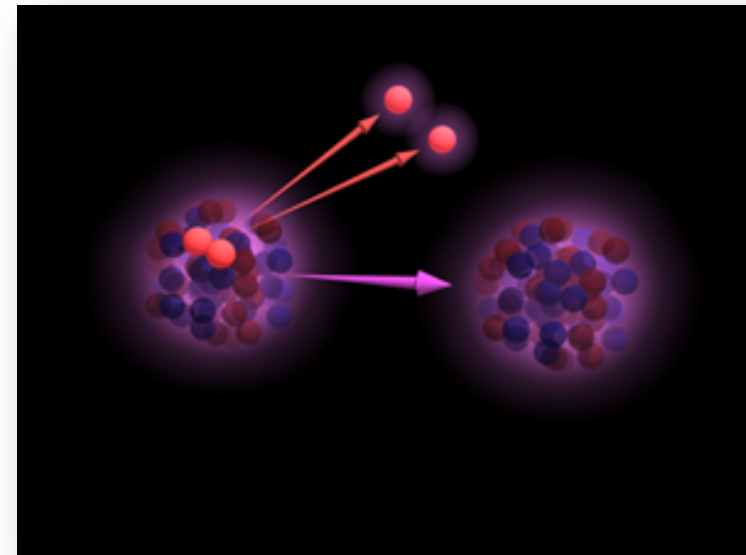
Total : ~ 120

Two-protons Radioactivity

EXOTIC NUCLEI



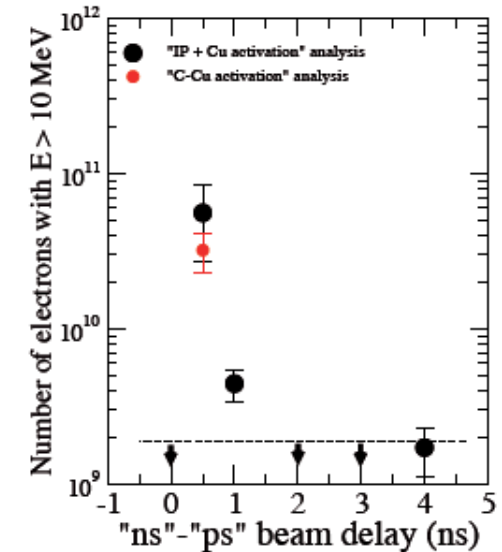
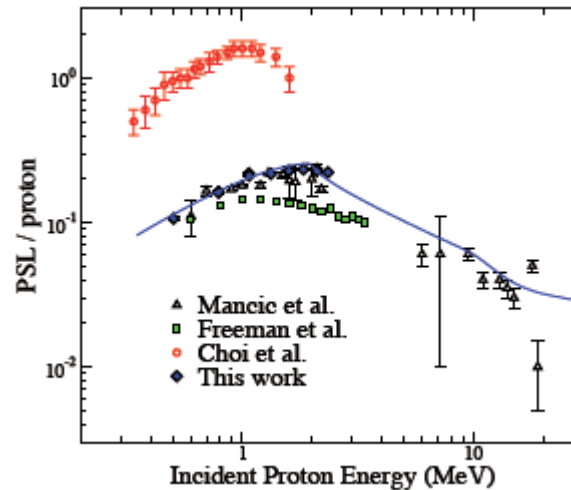
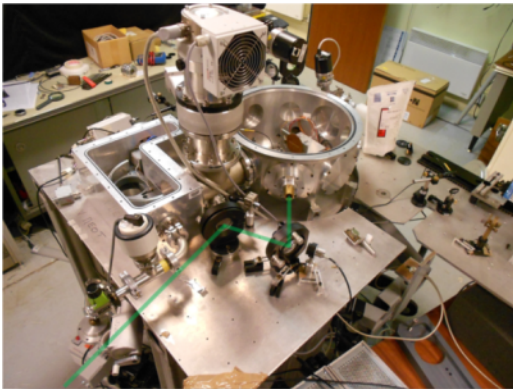
^{45}Fe , ^{54}Zn



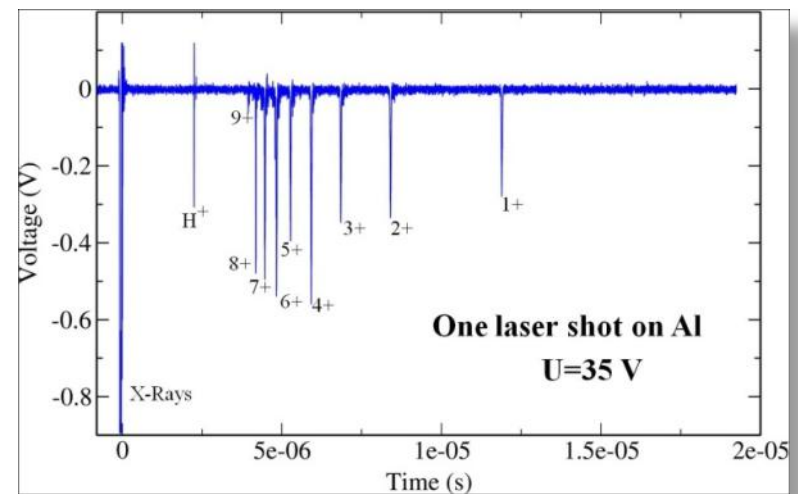
- Discovered in 2002
- No direct observation of protons
- ➔ Construction of TPC

Laser induced nuclear excitations & optimisation of sources of particles

- Characterization and optimisation of laser produced X-rays, electrons and protons sources



- Excitation yield of the first excited state of ^{201}Hg in plasma - prediction for the charge state $42+$ and NEET effect.



3

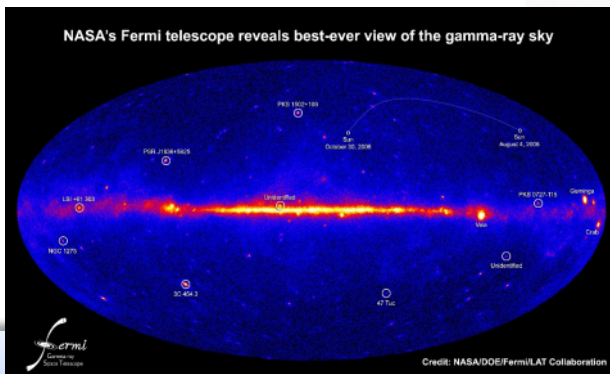
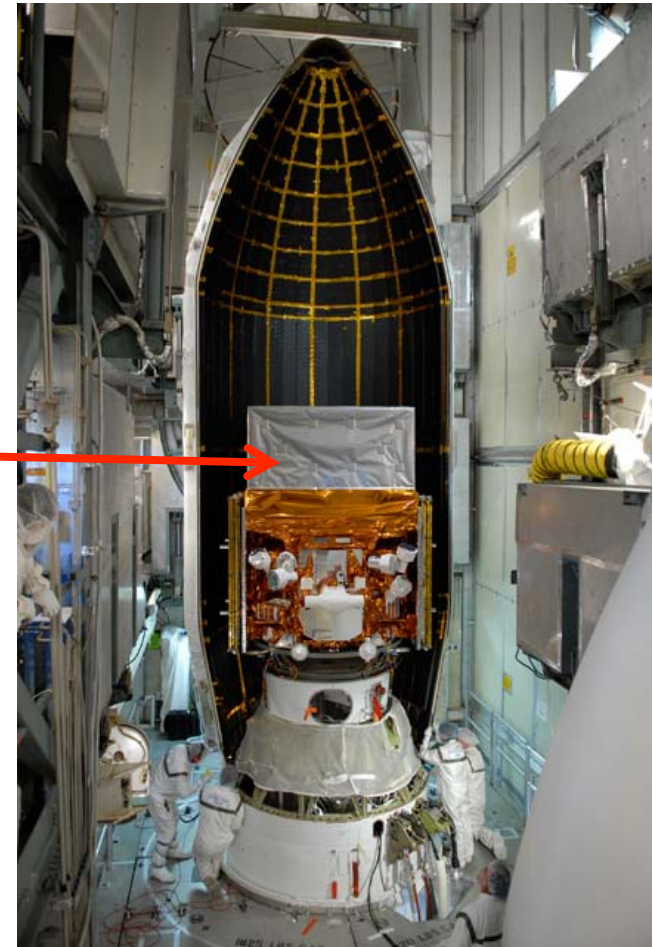
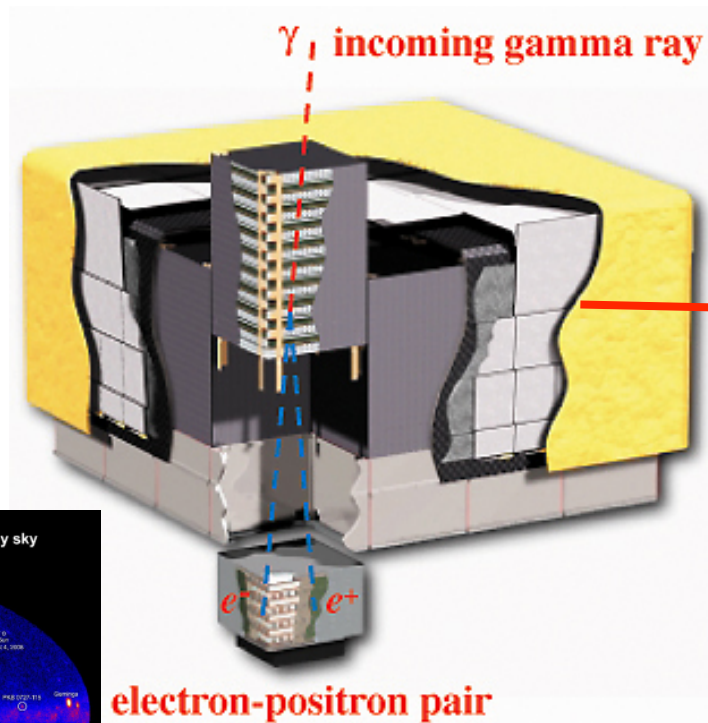
Gamma Rays Astronomy (from GeV to TeV)

FERMI satellite launched 2008 June

- ✓ CENBG involved in
 - Calorimeter characterisation
 - Chronometry of pulsars
 - Data reduction



Large Area Telescope
30 MeV - 300 GeV



4

Neutrino Physics : search of the $bb0n$ decay

NEMO experiment (Neutrino Ettore Majorana Observatory)

Goal : to determine the nature of neutrino to measure its mass

Way : existence of the double β neutrinoless decay scheme ($bb0n$)

Expérimental challenge : $T_{1/2} > 10^{25}$ years (a few events expected per year)

➔ to overcome the effects of all possible background sources

- **cosmic rays** : NEMO3 detector was installed in the Modane underground laboratory (under 1700 m of rocks)
- **natural radioactivity** of the detector materials :
 - sources bb
 - photomultiplieur (PM)
 - ...

Selection of materials for their radio-purity using low background gamma ray spectrometry

For NEMO3 (200 tons): $A(^{40}\text{K}) \sim 500$ Bq



4

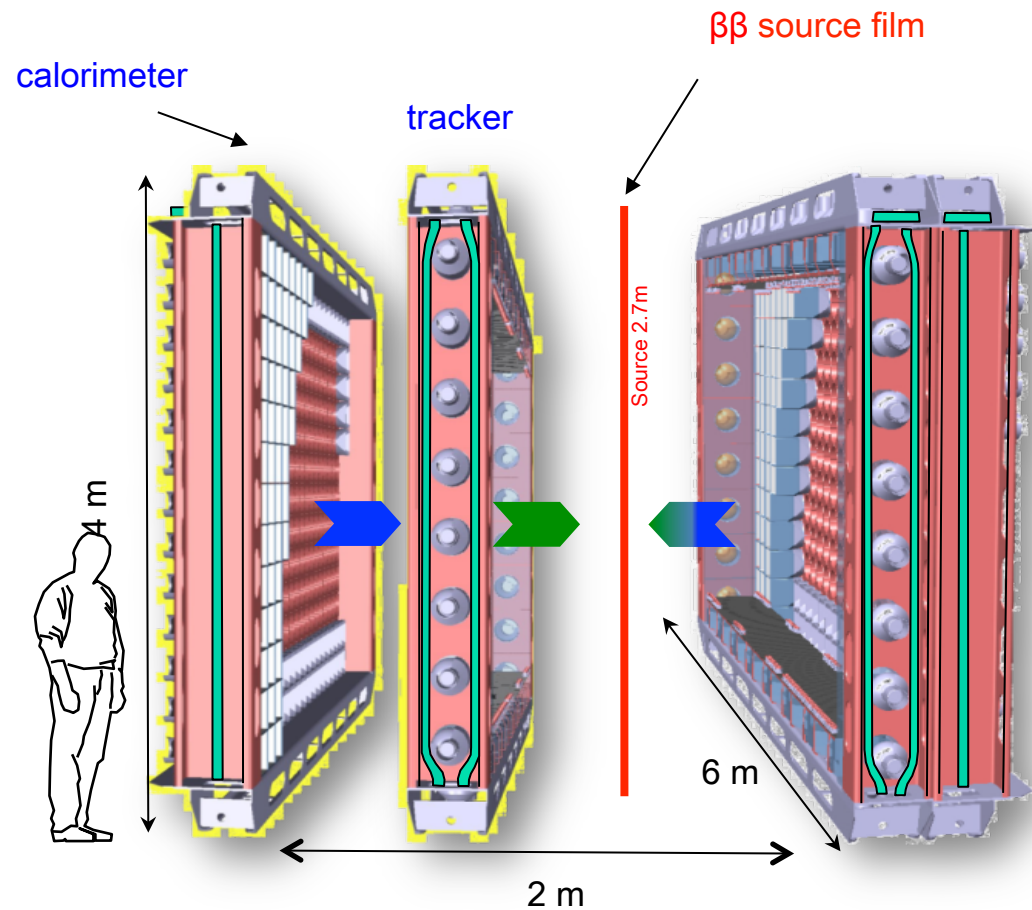
The SuperNEMO experiment



~ 100 physicists

Goal : to observe the $bb0n$ decay with $T_{1/2} > 10^{26}$ years and to measure the effective mass of neutrino at the 0,05 eV level (10 fold factor in sensitivity) using 100 kg of ^{82}Se

Construction of the calorimeter demonstrator : 2013-2016



Neutronics data for GEN IV power plants

Waste management
(transmutation)

- present Cycle -

Innovative Cycles (Energy production)

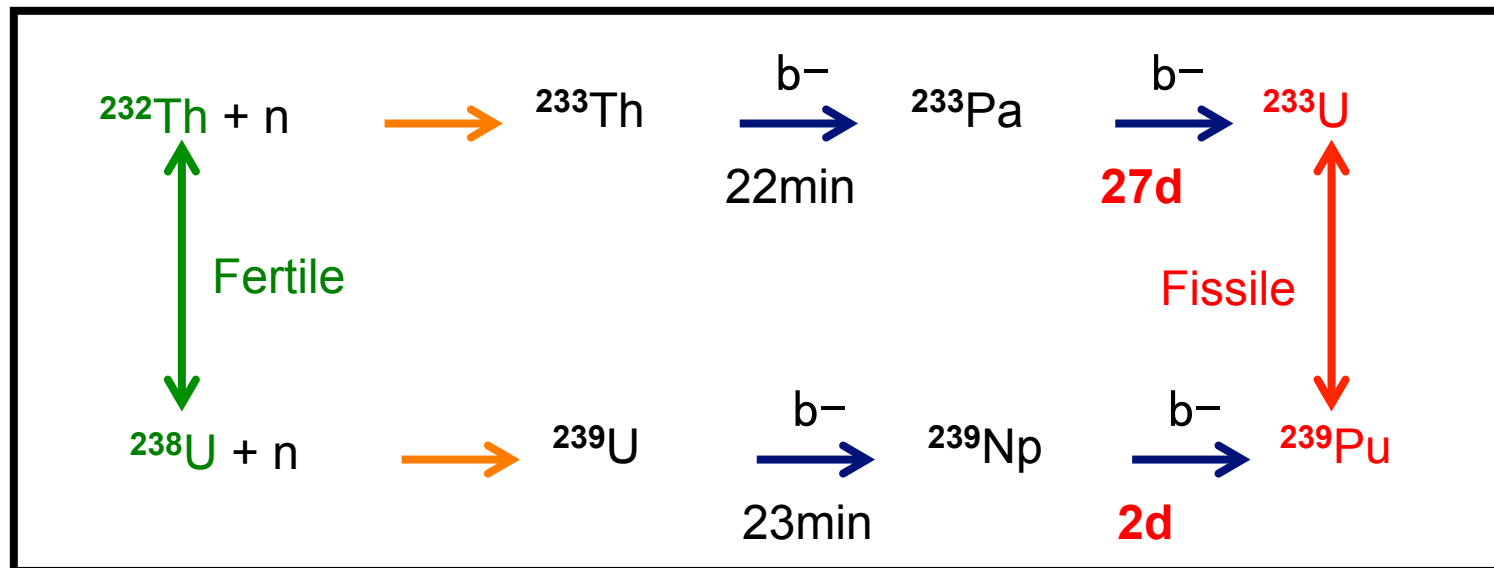
Minor actinids (Am, Cu)

$^{238}\text{U}/^{239}\text{Pu}$

$^{232}\text{Th}/^{233}\text{U}$

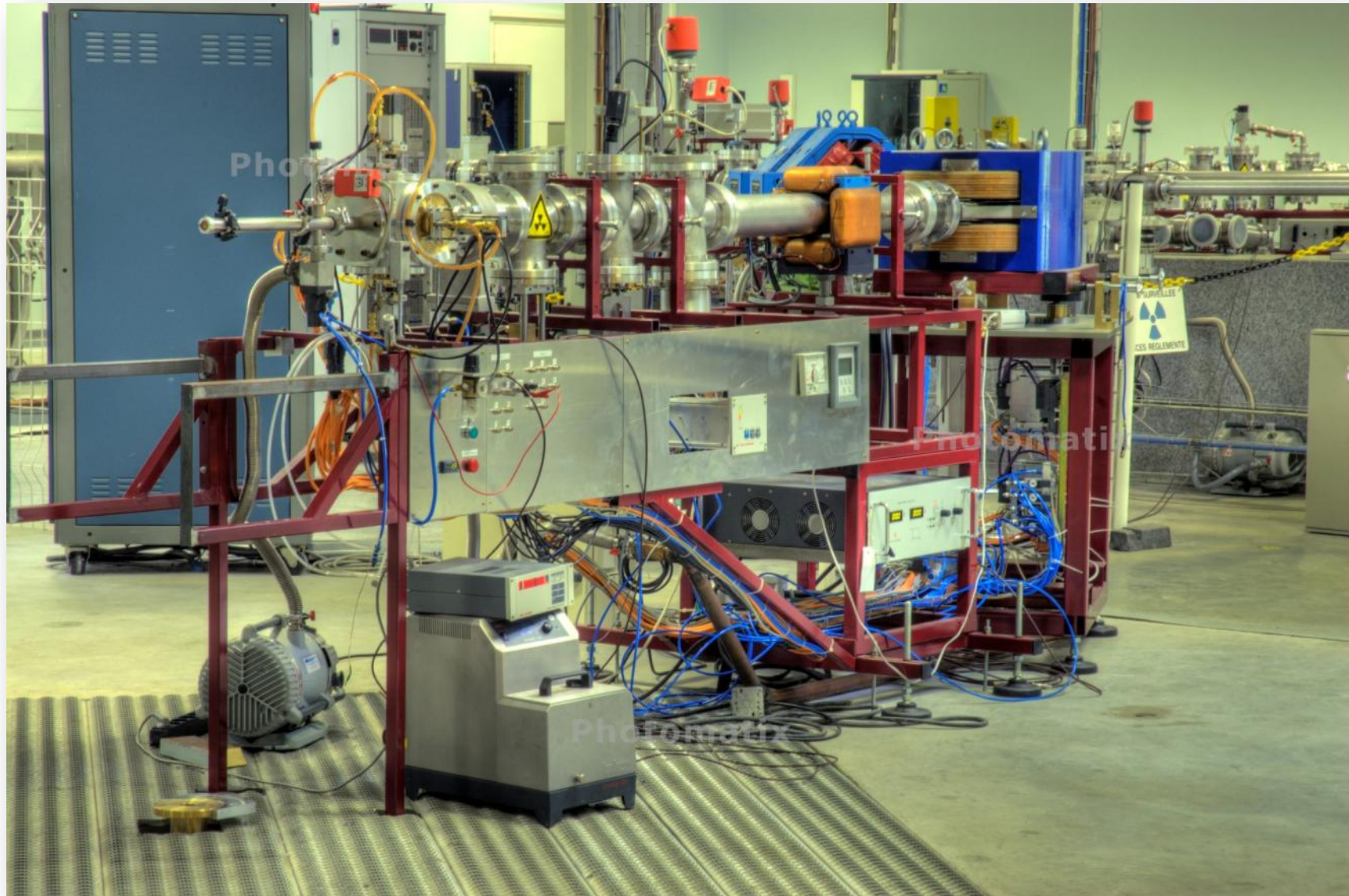
Cross sections measurement (fission, capture) / Fission yields $Y(A, Z, E^*)$

Cycle Th-U



Cycle U-Pu

Neutrons production Beamline @ AIFIRA



Geant4 International Conference at the Physics-Medicine-Biology frontier (October 7-11, Bordeaux)

Geant4-2013
Program
Registration
Paper submission
Venue & hotels
Organization

Geant4 2013 International User Conference

The Geant4 toolkit at the Physics-Medicine-Biology frontier



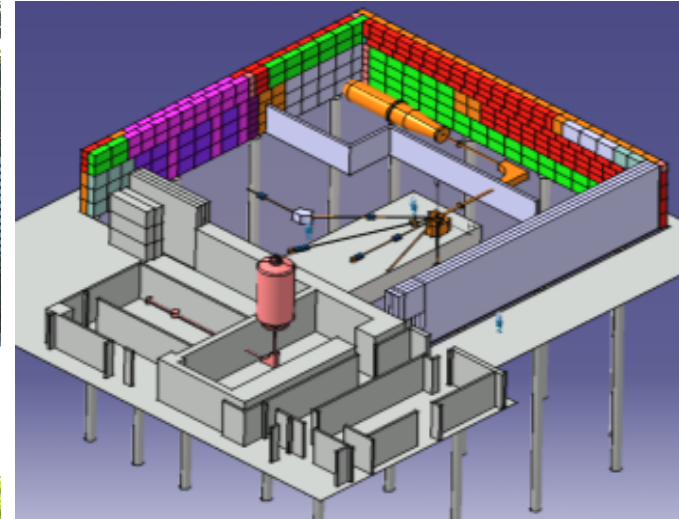
<http://geant4.in2p3.fr/2013/>

- Registration opening
Will open mid-February
- Abstract submission deadline
July 1st, 2013
- Abstract acceptance notification
July 8th, 2013
- Registration deadline
July 15th, 2013
- Full paper submission deadline
March 31st, 2014

The **Geant4 2013 International User Conference** will take place on **October 7-9, 2013** in [Bordeaux, France](#).

The conference will gather during **2.5 days** developers and users of the [Geant4](#) Monte Carlo general purpose simulation toolkit. It will focus on **Medicine and Biology applications of the toolkit**. These include the use of Geant4 for external and internal radiotherapy, for proton/hadrontherapy and for radiobiology.

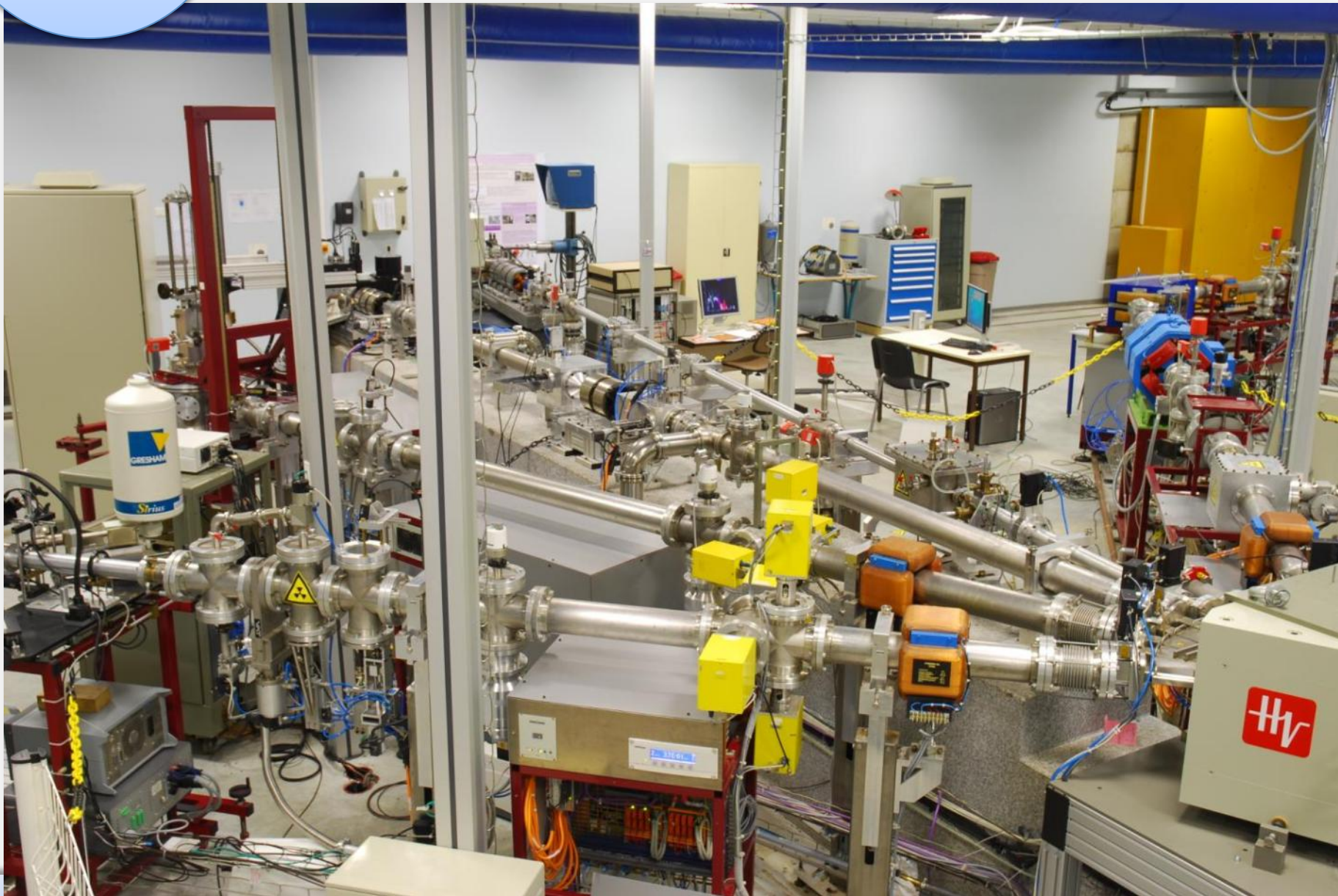
It will be followed by a **Geant4 2-day tutorial** (October 10-11, 2013) with special focus on medical physics.



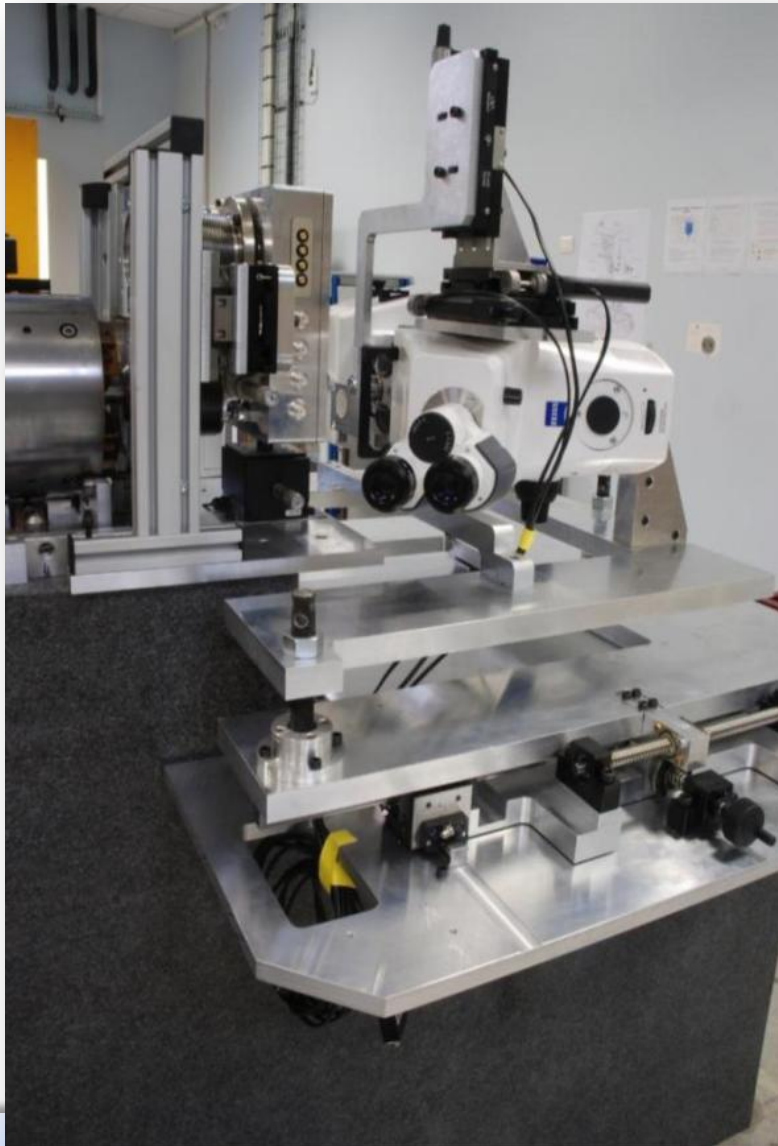
Singletron™ HVEE 3.5 MV
 Light ion beams: H⁺, D⁺, He⁺
 High energy stability ($\frac{\Delta E}{E} \sim 2.5 \cdot 10^{-5}$)
 High brightness ($18 \text{ A} \cdot \text{rad}^{-2} \cdot \text{m}^{-2} \cdot \text{eV}^{-1}$)

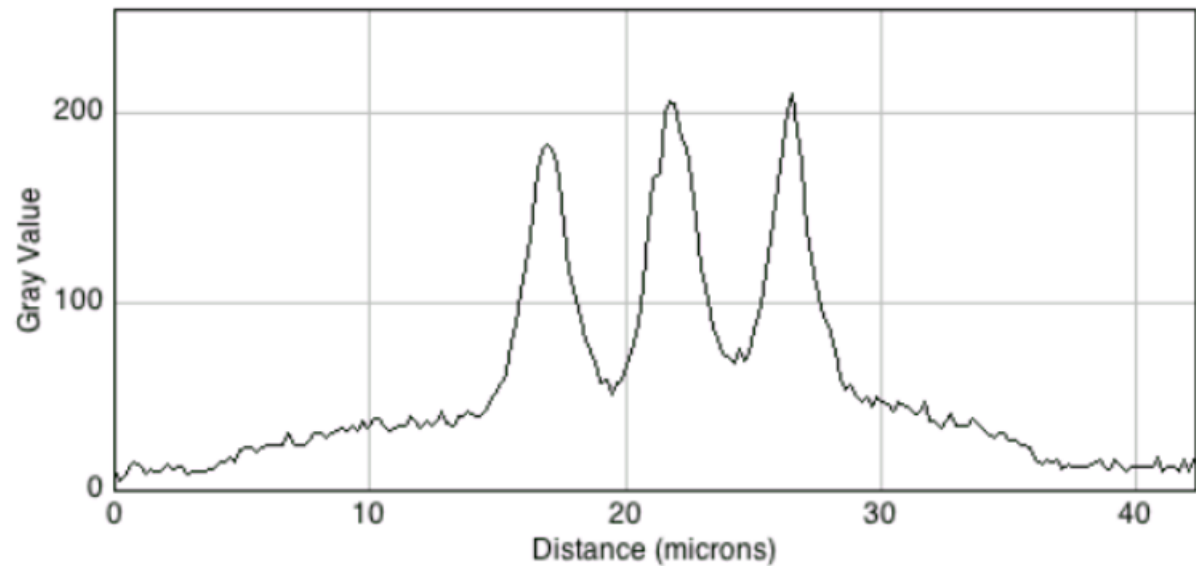
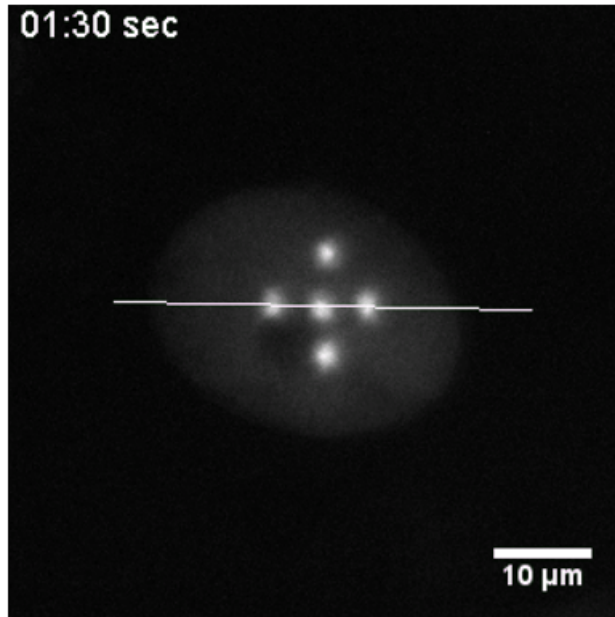
8

AIFIRA : beamlines

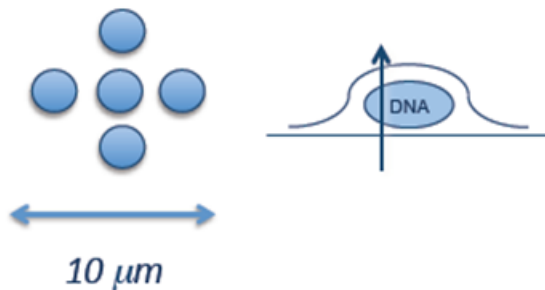


Micro-irradiation set-up @ CENBG/AIFIRA





Cross pattern irradiation in live cell nucleus



Hela (CCL2/ATCC) transitory transfected for XRCC1-GFP (courtesy of A. Yasui, Japan)

Micro-irradiation with 3 MeV H⁺ (1084 ± 34 particles/pt)

Image J – Dynamics of re-localization for XRCC1-GFP

The PRISNA Facility

PRISNA : Plateforme Régionale Interdisciplinaire de Spectrométrie Nucléaire en Aquitaine

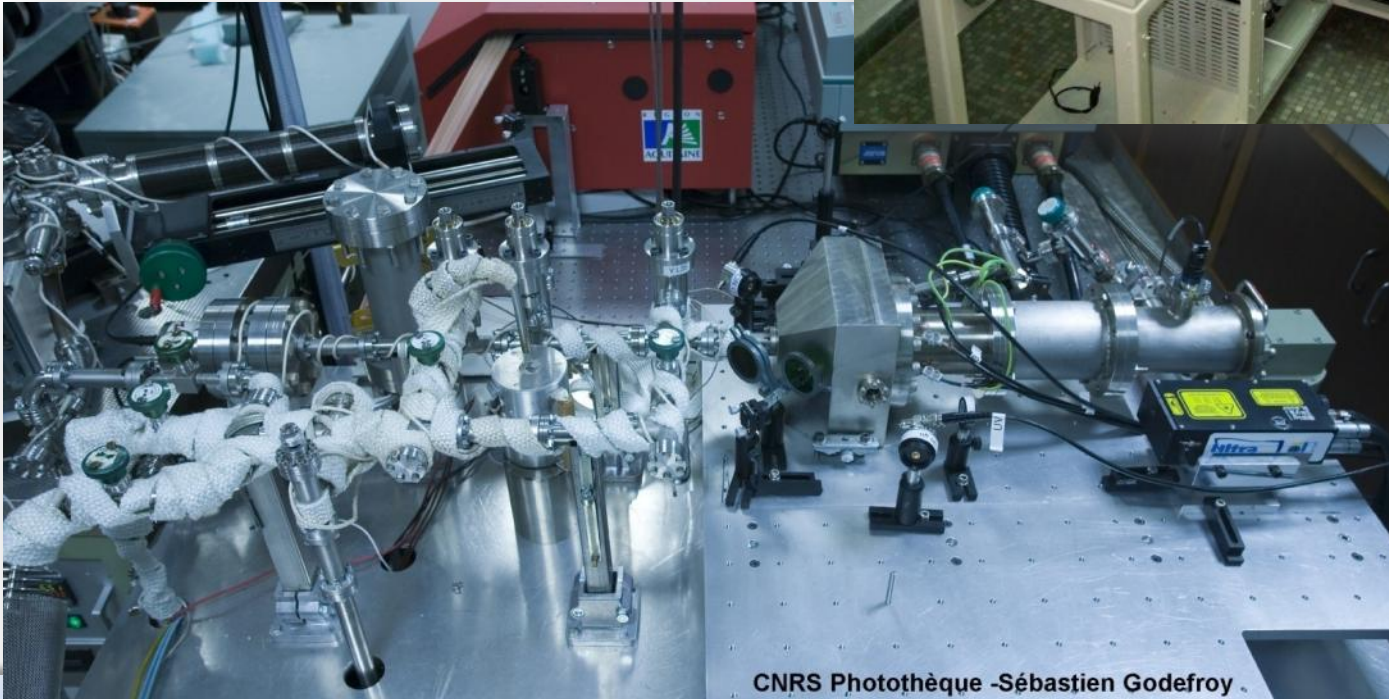
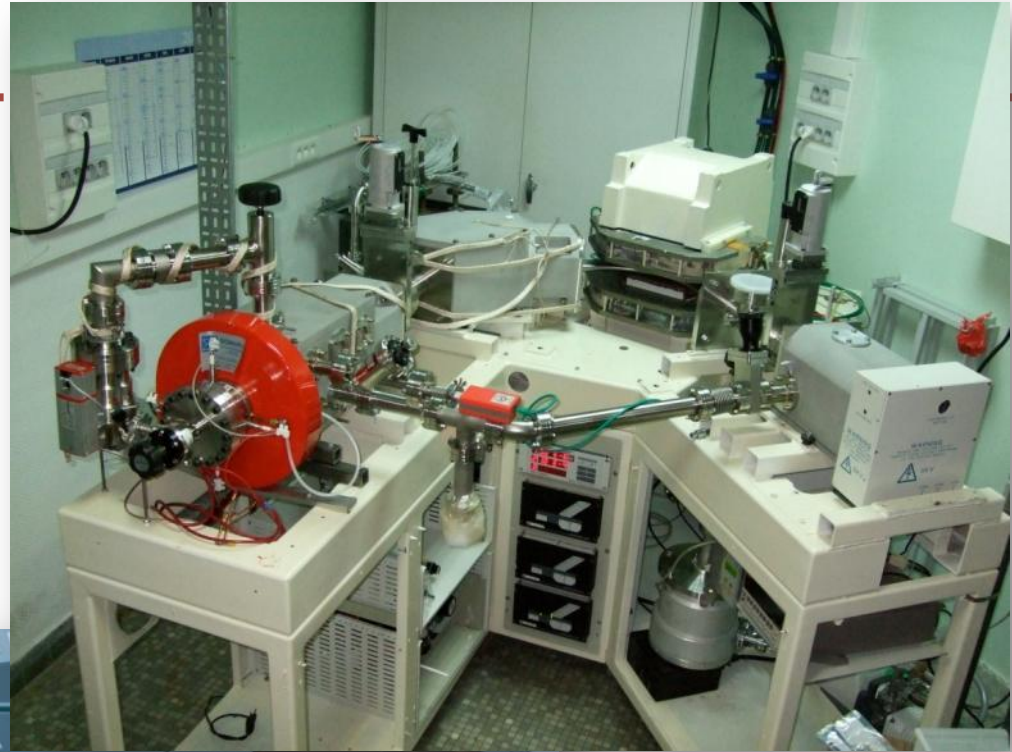
- Ge low background detectors for measuring the purity of materials using γ ray spectrometry
- Radon gaz detectors



- Bulding (150 m²) with 6 m water equivalent shielding

10

The PIAGARA Facility

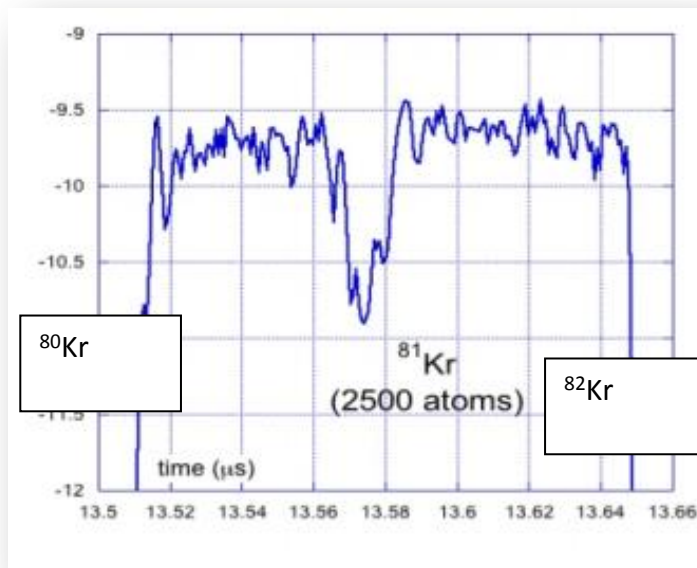


CNRS Photothèque - Sébastien Godefroy .

^{81}Kr (T : 229 000 ans) is a cosmogenic product in the atmosphere

→ concentration is homogeneous and constant along the last million years

- Underground water dating (50 000 – 800 000 ans) : site Andra Meuse Haute/ Marne
- Dating of polar antarctic ice fields
- Cosmochemistry: history of meteorites and the evolution of cosmic radiations

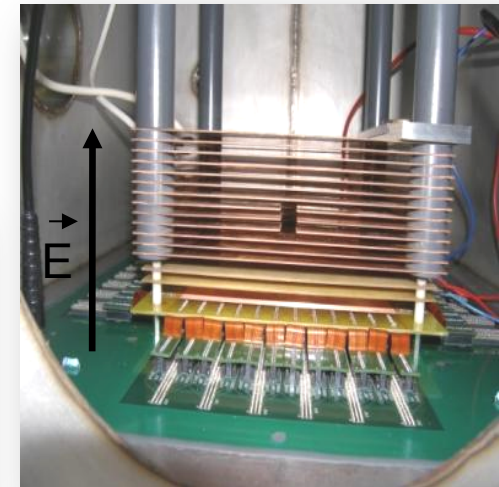
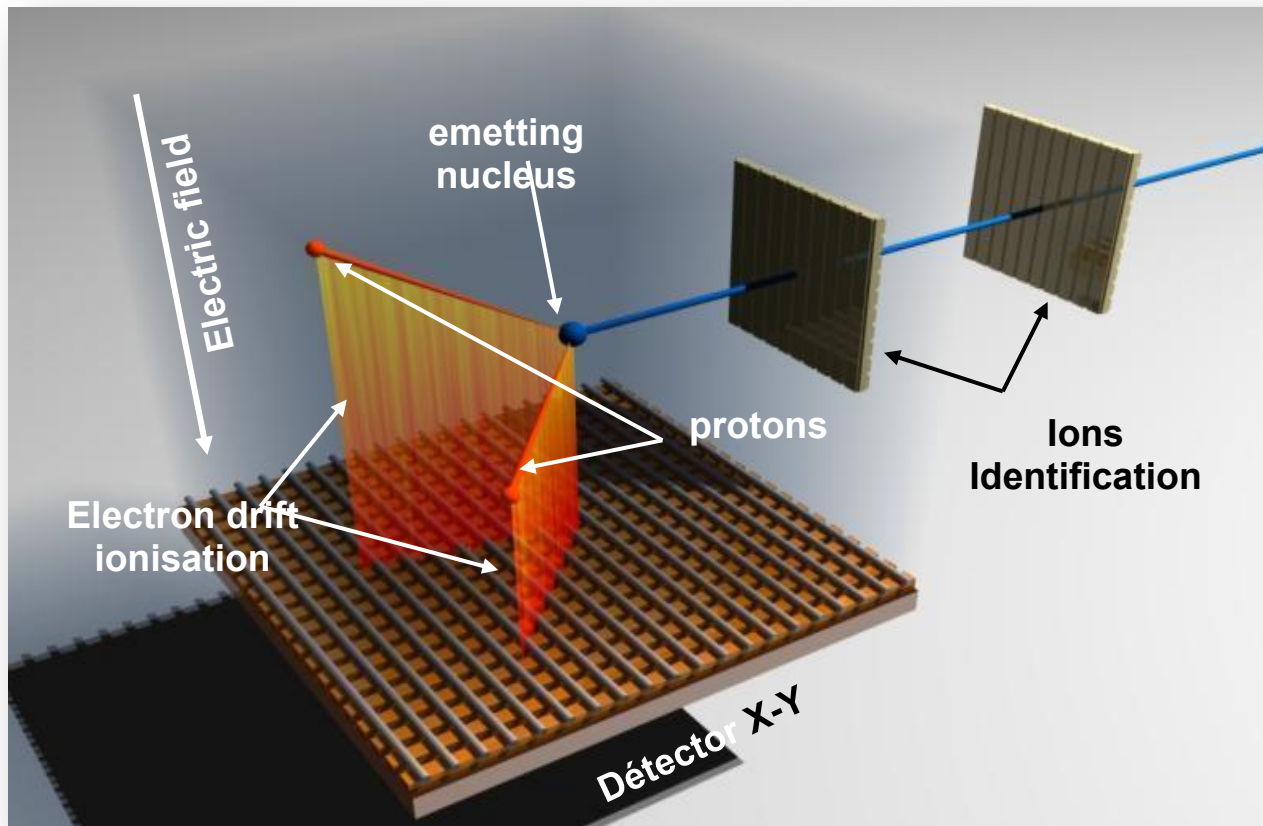


3 steps analysis having required each the developpement of complex mass spectrometry instruments :

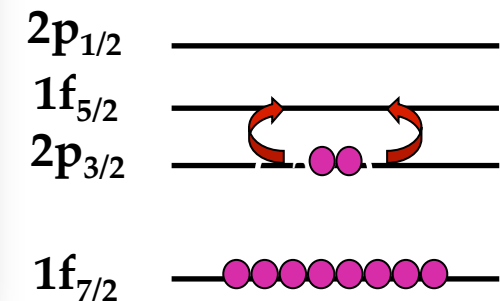
- 1) extraction and purification of Kr from wayter or air**
- 2) isotopic enrichment in ^{81}Kr et ^{85}Kr**
- 3) isotopic analysis using RIS-TOF (MDL of a few thousands of Kr atoms)**

Signal ^{81}Kr : 2500 atoms

Time Projection Chamber



^{54}Zn : 30 protons



Radioactive Beams @ GANIL

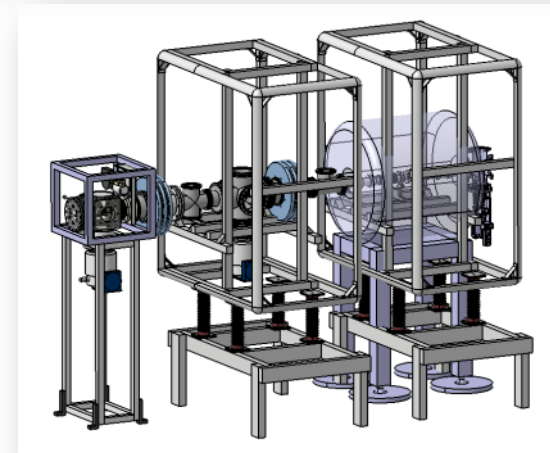
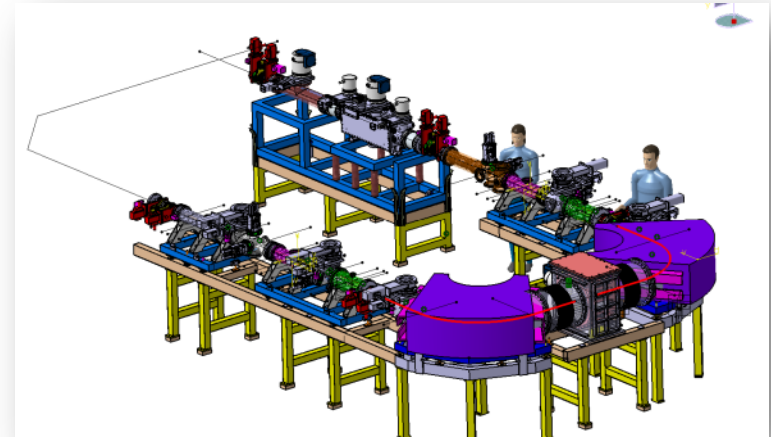
- ✓ High Resolution Separator (HRS)

funding: SPIRAL2(PP)

- ✓ Double Penning Trap PIPERADE

**funding: IPF, UBxI, CRA, ANR, IN2P3,
MPI-Heidelberg**

High involvement of technical departments



**I wish you a pleasant stay in Bordeaux
and fruitful scientific discussions...**