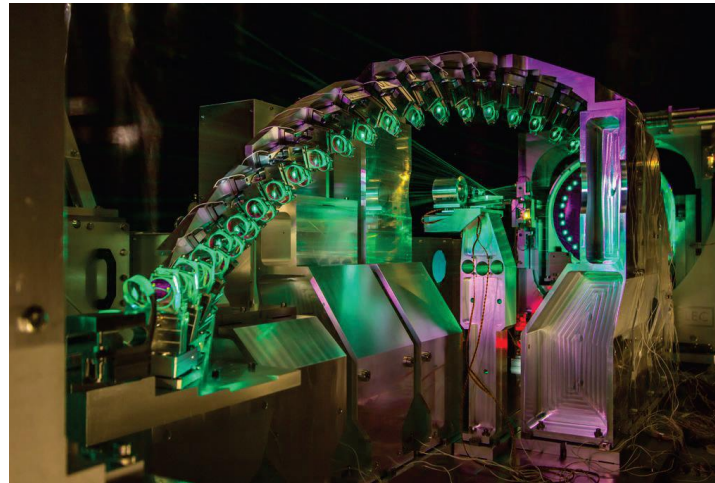
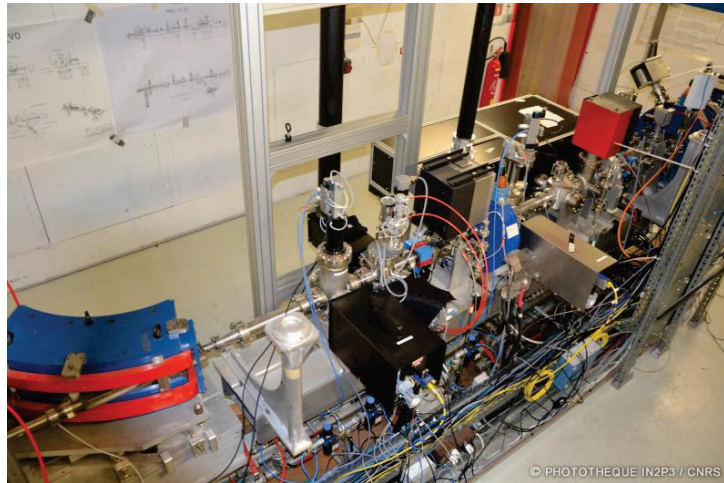


# Accelerator Physics Pole



**Fresher's day 2021 – 3<sup>rd</sup> November 2021, IJCLab, Orsay**

Speaker: Carmelo Barbagallo, PhD Student, on behalf of the Accelerator Physics Pole of IJCLab

**Accelerator Physics @IJCLab:** deals with research themes concerned with designing, building and operating accelerators.

## The main objectives of the Accelerator Physics Pole:

- **Be a major actor on accelerator physics research** in several key areas, selected for their strategic importance and impact.
- **Increase our capacity to build accelerators:** a clear strategy to have important contributions to international projects, in order to facilitate the positioning of our research teams.
- **Contribute to an efficient use and development of our local accelerators and technological platforms:** a key to keep accelerators expertise, training capabilities, and insure visibility and attractiveness.

**All Accelerator Research Activities are fully integrated in the IN2P3 accelerator R&D landscape:**

### LPAC

Laser Plasma Acceleration &  
high-energy Colliders

### SCPL

Superconducting RF Cavities &  
high-power Proton Linac

### SRHI

Stable & Radioactive Heavy-Ions  
production & acceleration

### IELS

Innovative Electron &  
Light Sources

## 3 scientific teams, 2 specialized groups and one technological platform:

- **BIMP Team: Beam Instrumentation, Manipulation and Physics:**

Team leader: Luc PERROT, Assist: Angeles FAUS-GOLFE

- **MAVERICS Team: Materials for Accelerators, dynamic Vacuum and Innovative Research on Superconducting Cavities**

Team leader: Gaël SATTONNAY

- **ALEA Team: Laser Acceleration and Applied science**

Team leader: Daniele NUTARELLI, Assist: Kevin CASSOU

- **RF Service: Specialized service for RF science and technology**

Team leader : Guillaume OLRÉ

- **Cryogenic Service: Specialized service for cryogenic science and technology**

Team leader : Patxi DUTHIL

- **Vacuum and Surfaces Technological Platform**

Team leader : Bruno MERCIER

**Director:**  
Sébastien BOUSSON  
**Deputy Director:**  
Walid KAABI

### Accelerator Physics Pole

- 88 persons
- 20 researchers (50% CNRS, 50% University)
- 52 IT (among which 31 research engineer)
- 15 PhD students
- 8 HDR

## BIMP: Beam Instrumentation, Manipulation and Physics

ThomX @ IJCLab

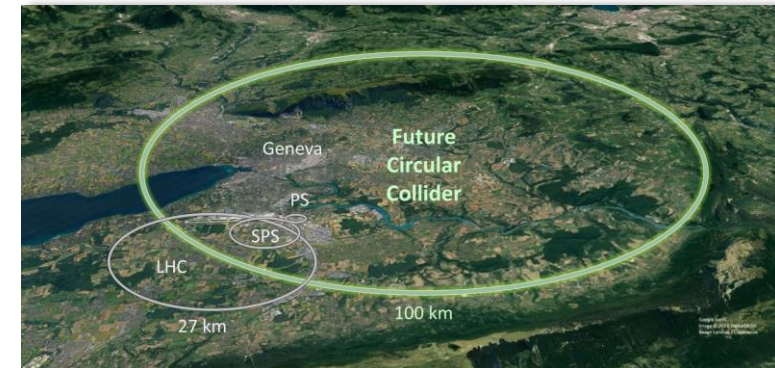
### Main research themes:

- Design of accelerators for nuclear physics (ALTO, GANIL) and high energy physics (ILC, CLIC, FCC) and their application (ThomX, MYRRHA)
- Beam dynamics simulations, beam control and monitoring
- Beam instrumentation
- Specific expertise (high intensity positron sources, nanobeams, collimation, machine learning for accelerator control)



### Main projects:

- |                                                |                                                 |
|------------------------------------------------|-------------------------------------------------|
| • ThomX (Compton X-ray source)                 | • GANIL: Spiral-2, DESIR                        |
| • Next Particle Collider (NPC), FCC, ILC, ATF2 | • PERLE: ERL demonstrator                       |
| • ALTO (RIB)                                   | • ARIES and I-FAST (accelerator R&D EU program) |
| • MYRRHA (nuclear waste transmutation)         |                                                 |



FCC @ CERN



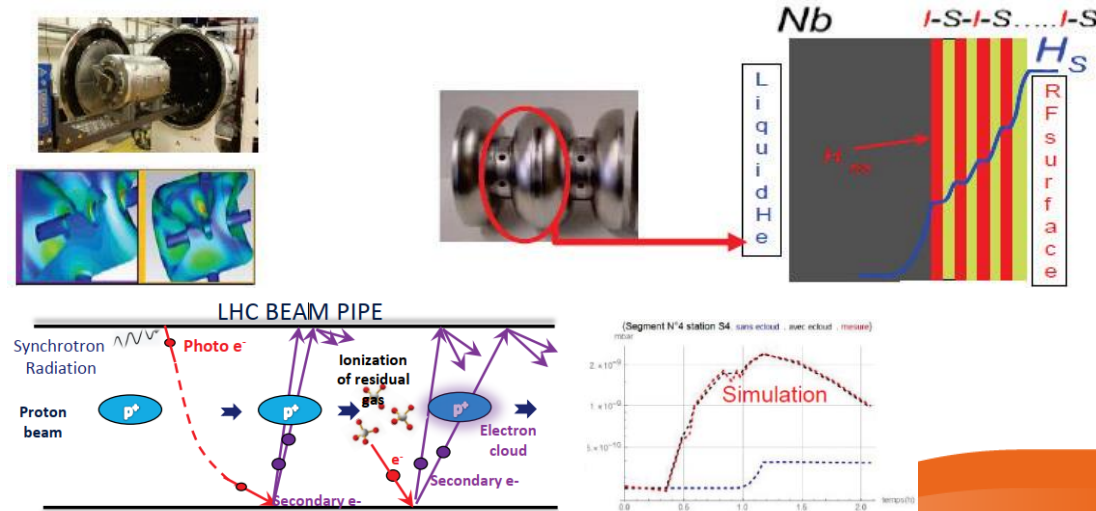
## MAVERICS: Materials for Accelerators, dynamic Vacuum and Innovative Research on Superconducting Cavities

### Main research themes:

- New materials and surface treatments for SCRF cavities
  - Doping, infusion, thermal treatment
  - Alternative material to Niobium
  - Multilayers
- Dynamic vacuum
  - Stimulated desorption
  - Electron emission (SEY) from surfaces
  - Simulation: DYVACS code
- Multipacting analysis
- Surface analysis

### Main projects:

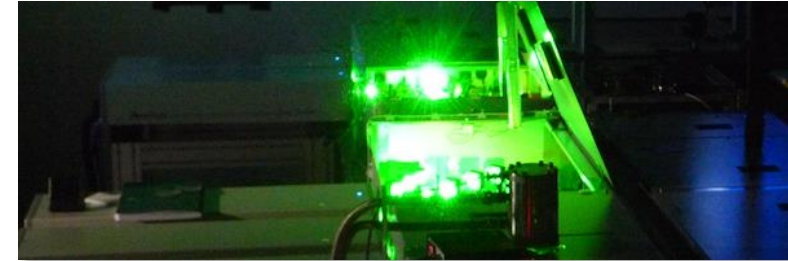
- ESS
- MYRRHA
- PIP-II
- PERLE
- NPC: FCC-hh/ee
- Master project SRF



## ALEA: Acceleration Laser and Applications

### Main research themes:

- Gamma and X-ray source based on Compton scattering
- Polarimetry (Beam diagnostic) based on Compton interaction
- Laser plasma amplification and interaction
- Laser plasma acceleration
- High power optical cavities
- Non linear optics



### Main projects:

- ThomX (Compton X-ray source)
- Laser plasma acceleration (PALLAS)
- Minicav (High Power Cavity, industrial collaboration)
- LaseriX
- Polarimetry BELLE-II, SuperKEKb and ILC
- Gamma factory

## RF Service: Specialized service for RF science and technology

### Main research themes:

- Design, preparation and operation of RF accelerating structures (conventional or superconducting) as well as their related systems
  - Normal and Superconducting RF cavities
  - RF power sources
  - Low level RF systems
- Support for operations and maintenance of SupraTech RF systems
- Additional specialized expertise:
  - RF Photo-injector
  - RF systems for beam diagnostics (BPMs,...)
  - High voltage systems

### Main projects:

- |          |            |
|----------|------------|
| • ThomX  | • PIP-2    |
| • ESS    | • PERLE    |
| • MYRRHA | • SPIRAL-2 |



- **Cryogenic Service: Specialized service for cryogenic science and technology**

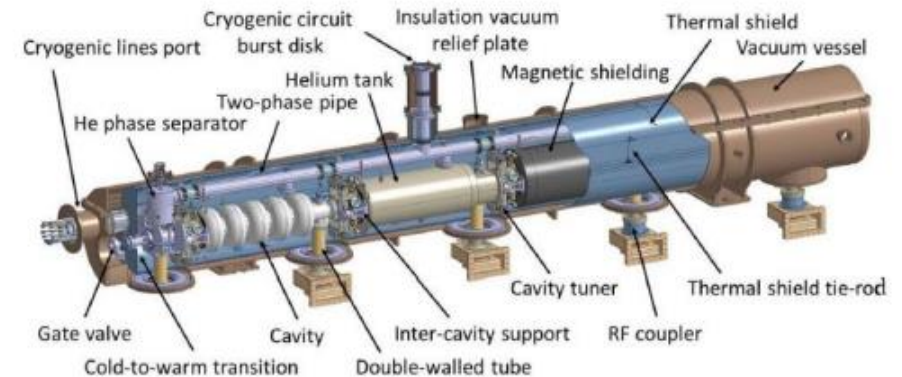
## Main research themes:

Design and operation of cryogenic systems for accelerators and beyond:

- Research axis
  - Cryogenic instrumentation
  - Compact refrigeration without cryofluids
  - Heat transfer at cryogenic temperature
- Operational missions (within SupraTech)
  - Liquid Helium production
  - Operation and maintenance and development of cryogenic infrascrutures
  - Cryogenic experiments
  - Cryogenic temperature sensors calibration
- Expertise
  - Design of cryogenic systems (cryostat, cryomodules, cold box, cryo lines)
  - Numerical simulations of cryogenic systems

## Main projects:

- ESS
- MYRRHA
- PIP-2
- MUGAST
- PERLE
- SPIRAL-2
- NGCryo





## • Vacuum and Surfaces Technological Platform

### Main research themes:

- Operate and develop surface analysis equipment related to MAVERICS activity (material and vacuum)
- Develop our expertise
  - Material for accelerators
  - Surface analysis
  - UHV
  - Simulation

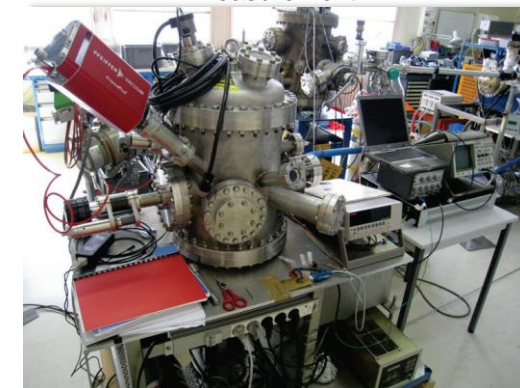
### Main projects:

- ThomX
- NPC - FCC
- SFR Master Project
- I3D Metal
- ...

Setup for degazing rate measurement



Setup for desorption and SEY measurement



SIMS



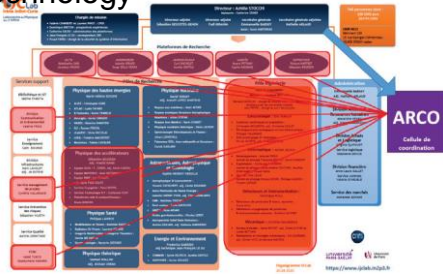
Confocal microscope



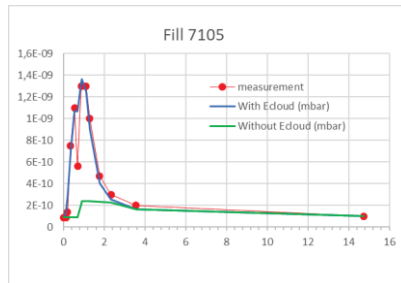
RX Diffractometer



- Creation of ARCO (Accelerator Research Center @ Orsay):** highlight and add visibility of the fantastic potentiality of IJCLab in accelerator science and technology



- DYVACS:** Simulation code for dynamic beam vacuum: simulation results and experiment on the LHC (S. Bilgen thesis)



- ThomX:** Completion of the Linac installation and first dry-run

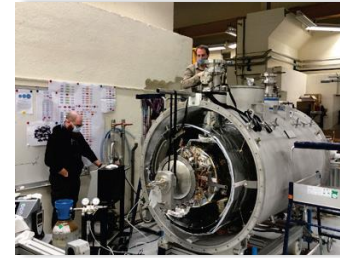


- PIP-II:** Prototype couplers and cavities started; contribution to construction defined and approved.

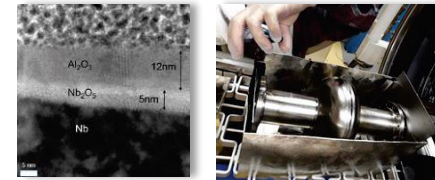
- Optical cavity:** Valorization of IJCLab competences with the start of collaboration with Amplitude for the Minicav project (US Darpa grant)

- PALLAS:** launch of the civil works for the construction of the laser plasma acceleration platform.

- Contribution to ESS:** Assembly of the first series Cryomodule and shipment to Uppsala

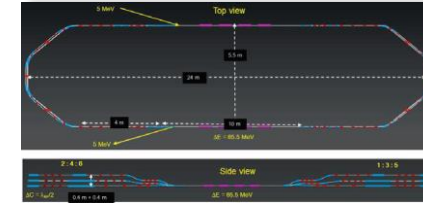


- SRF:** Thin films ( $\text{Al}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$ ,  $\text{MgO}$ ): SEY measurement and MET analysis (S. Birra Thesis)

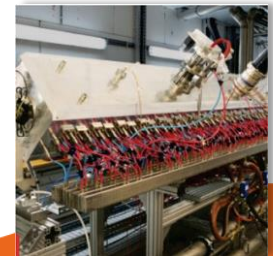


- Approval of I-FAST:** EU project aiming at fostering the innovation in Accelerator Science and Technology in Europe, starting in April 2021 of the Linac installation and first dry-run.

- PERLE:** Success of the PERLE collaboration meeting in June 2020 (55 attendees) and 1<sup>st</sup> international management board of the collaboration



- MYRRHA:** First beam with the RFQ @ Louvain-la-neuve: major contribution of IJCLab with the RFQ low level RF



- **Complete ThomX Installation** and start commissioning as soon as ASN authorization is delivered
- Achieve **ESS cryomodule production** in early 2022 and the **spoke cryogenic distribution** in 2021
- Start scientific production on **laser plasma acceleration** with the completion of PALLAS phase 1
- Perform the **first experiments on the MYRRHA prototype cryomodule** and discuss with SCK-CEN on the **future contribution to MINERVA** construction
- Build and install **the new vacuum and surface / PANAMA platform** within D3/D4 building
- Pursue the **contribution to GANIL** (S3, DESIR, SPIRAL-2 commissioning, MLLTRap) and build new research collaborations with the GANIL teams
- **Prepare and test the PIP-2 prototypes** (cavity, coupler, tuning system) in 2021/2022 and prepare for the production phase
- Pursue the on-going activities on our main **research projects** (NPC, Minicav, SRF, I3DMetal...)
- Conduct the **PERLE TDR Phase to its end** and shape the scientific/technological/financial opportunity to build PERLE @ Orsay

Thank you for your attention!



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