

ARCO

Accelerator Research Center in Orsay *by IJCLab*

IN2P3 Scientific Council

9th February 2021

ARCO is an initiative to coordinate accelerator science and technology activities and competences of the *Laboratoire de Physique des 2 Infinis Irène Joliot-Curie or IJCLab*.

- It is a **non-hierarchical structure** of IJCLab
- **Transverse** to all poles, services and platforms of IJCLab
- In IJCLab wording reference, ARCO could be considered as a **research group** (\neq research team)

One of the **specificities of IJCLab** is linked to the **concentration** of activities and skilled people related to **accelerator science and technology**

- In CNRS, **IJCLab** represent close to **80% of human resources** dedicated to accelerator research and development (*not counting HR operating accelerator-based research facilities*)
- At a **national level**, in terms of HR concentration and accelerator topics covered, IJCLab can only be compared with **CEA/Irfu**
- Taking into account the fact that it has no large scale accelerator to operate, at an international level, IJCLab could be compared to the **largest accelerator laboratories** worldwide, such as FermiLab, JLab, Daresbury, DESY, KEK...

 **Necessity to coordinate, at the lab level, the accelerator activities and make very visible from outside IJCLab's potential in accelerator science and technology**

The screenshot shows the Fermilab website. At the top, there is a navigation bar with 'Home', 'Newsroom', and a search bar. A yellow highlight is placed over the 'Fermilab' logo. Below the navigation bar, a 'Science' tab is selected. The main content area is titled 'Particle Accelerators'. It contains a paragraph about Fermilab's role as America's particle physics laboratory, followed by a photograph of a scientist working in a laboratory. Below the photo, there is a paragraph about the PIP-II project. To the left of the main content, there is a sidebar with a 'Science' menu and 'Related Links'.

This section contains three informational cards:

- LEADING ACCELERATOR TECHNOLOGY:** An aerial photograph of the Fermilab circular accelerator complex.
- FERMILAB'S ACCELERATOR COMPLEX AND PIP-II:** A diagram showing the layout of the Fermilab accelerator complex with various rings and components labeled.
- ILLINOIS ACCELERATOR RESEARCH CENTER:** A photograph of the modern, multi-story building of the Illinois Accelerator Research Center.

ASTEC @ Daresbury

The screenshot shows the UK Science and Technology Facilities Council website. It features a blue header with the UKRT logo and navigation tabs for 'Funding', 'Research', 'Innovation', 'Skills', 'Public engagement', 'News, events and publications', and 'About us'. A search bar is located on the right side of the header.

The banner for the Accelerator Science and Technology Centre (ASTeC) features a large satellite dish against a cloudy sky with a bright sun. The text 'About Us' is prominently displayed on the left. On the right, the text reads: 'Our mission: To maximise the impact of our knowledge, skills, facilities and resources for the benefit of the United Kingdom and its people.' Below the banner is a navigation bar with links: 'Home / About us / Where we Work / Daresbury Laboratory / Accelerator Science and Technology Centre'.

Accelerator Science and Technology Centre

ASTeC studies all aspects of the science and technology of charged particle accelerators, ranging from large scale international and national research facilities through to specialised industrial and medical applications.

ASTeC staff pursue world class research and development programmes on behalf of STFC and ASTeC is a partner in the [Cockcroft Institute](#). More details available on the [ASTeC website](#).

Programmes

Some major ASTeC programmes are listed here and more detailed information about our work can be found in our Science Highlights reports.

- [ALICE](#)
- [VELA](#)
- [CLARA](#)
- [Colliders](#)
- [EMMA and FFAGS](#)
- [Technology Research and Development](#)

Science Highlights

- [2015/16 ASTeC Science Highlights](#)
- [2014/15 ASTeC Science Highlights](#)
- [2013/14 ASTeC Science Highlights](#)

Latest News

June 17, 2020
 UK space sector gets a boost with the installation of a giant new satellite test chamber

June 11, 2020
 UK Research and Innovation seeks further council members

June 11, 2020
 Designing new radiotherapy technologies to treat cancer in low and middle-income countries

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ACCELERATOR SCIENCE

Advancing Accelerator Science, Technology and Operations

Jefferson Lab is a world leader in accelerator science. This expertise comes from the planning, building, maintaining and operating of the Continuous Electron Beam Accelerator Facility (CEBAF), the lab's primary particle accelerator, and the Low Energy Recirculator Facility, a test bed for a variety of technologies.

CEBAF is based on superconducting radiofrequency (SRF) technology. It produces a stream of charged electrons that scientists use to probe the nucleus of the atom. CEBAF was the first large-scale application of SRF technology in the world, and it is the world's most advanced particle accelerator for investigating the quark structure of the atom's nucleus. The CEBAF energy was recently upgraded from 6 GeV to 12 GeV, and an additional experimental area was added to support the highest-energy experiments.

The Jefferson Lab Low Energy Recirculator Facility is powered by a smaller SRF accelerator. Formerly known as the Free-Electron Laser (FEL), the facility holds power records in the production of infrared, ultraviolet and terahertz laser light. The FEL was used in a variety of scientific studies, such as developing processes for producing high-quality carbon and boron-nitride nanotubes, identifying laser light wavelengths for use in medical treatments and in micromachining studies.

The Jefferson Lab Accelerator Division is responsible for delivering high-quality electron beams for experiments, using a sophisticated computer system to control hundreds of thousands of hardware components, including complex cryogenic, microwave, vacuum and magnet systems that comprise the accelerator. The division also pursues a broad program of theoretical and experimental research in accelerator and beam physics.



ACCELERATOR OPERATIONS

The Jefferson Lab Accelerator Operations group is responsible for delivering high-quality electron beams to the four experimental halls for experimental physics studies in the Continuous Electron Beam Accelerator Facility (CEBAF) and operations and maintenance of the Low Energy Recirculator Facility.



SRF INSTITUTE

The SRF Institute is a world leader in the advancement of superconducting radiofrequency (SRF) science and technology, the technology that acts as the "accelerator" in all large modern particle accelerators. Advances in this technology enable the next generation of particle accelerators. This technology benefits researchers, engineers and technologists in fields ranging from particle physics and the life sciences to materials science and industry.



CASA

The Center for Advanced Studies of Accelerators (CASA) pursues a broad program of theoretical and experimental research in accelerator and beam physics. The organization's primary mission is to generate, to investigate deeply, and to distribute forefront knowledge about advanced accelerator and beam physics, especially that knowledge generated as a result of work with Jefferson Lab accelerators.



LCLS-II

Jefferson Lab is a key contributor on a new project, LCLS-II, which will increase the capabilities of the Linac Coherent Light Source (LCLS) to meet the need for a high-repetition-rate/high-average-intensity source of coherent X-rays. The project entails an upgrade of the LCLS accelerator at the SLAC National Accelerator Laboratory in Menlo Park, California.

JLab



ACCELERATORS

DESY develops, constructs and operates accelerators to boost particles up to top speed

ARD >>

EUROPEAN XFEL >>

FLASH >>

PETRA III >>

PITZ >>

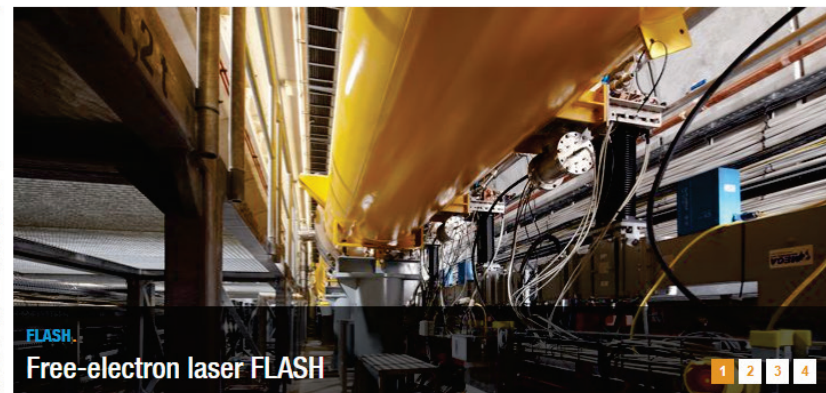
QUICK LINKS

- >> DESY JOB OFFERS
- >> DESY FELLOWSHIPS IN ACCELERATOR PHYSICS
- >> DIPLOMA AND DOCTORAL THESES
- >> DESY LIBRARY

DESY

Deutsches Elektronen-Synchrotron DESY
 A Research Centre of the Helmholtz Association

[ABOUT US](#) | [PUBLICATIONS & NEWS](#) | [ACCELERATOR STATUS](#) | [ACCELERATORS & PROJECTS](#)



FLASH
 Free-electron laser FLASH

NEWS



2020/06/15
High-school teams from Switzerland and Germany win CERN Beamline for Schools competition
 Two teams of high-school students, one from the International School of Geneva, Campus des Nations, Switzerland, and one from the Werner-von-Siemens-Gymnasium in Berlin, Germany,...



2020/06/08
Topping out ceremony for the Start-up Labs Bahrenfeld
 A milestone for the innovation centre "Start-up Labs Bahrenfeld" has been achieved! This Monday, the

SEMINARS

- >> ACCELERATOR PHYSICS SEMINAR
- >> ARD LUNCH SEMINAR
- >> TECHNISCHES SEMINAR M
- >> BESCHLEUNIGER IDEENMARKT
- >> BESCHLEUNIGER BETRIEBSEMINAR
- >> NEW PARTICLE PHYSICS FACILITIES

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 (potentiality for scientific and technological breakthrough) and our capacity to have an important and visible impact.
- **Increase our capacity to build accelerators** : a clear strategy to have important contributions to international projects, allowing us to take part in the definition of large equipment roadmaps and thus 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

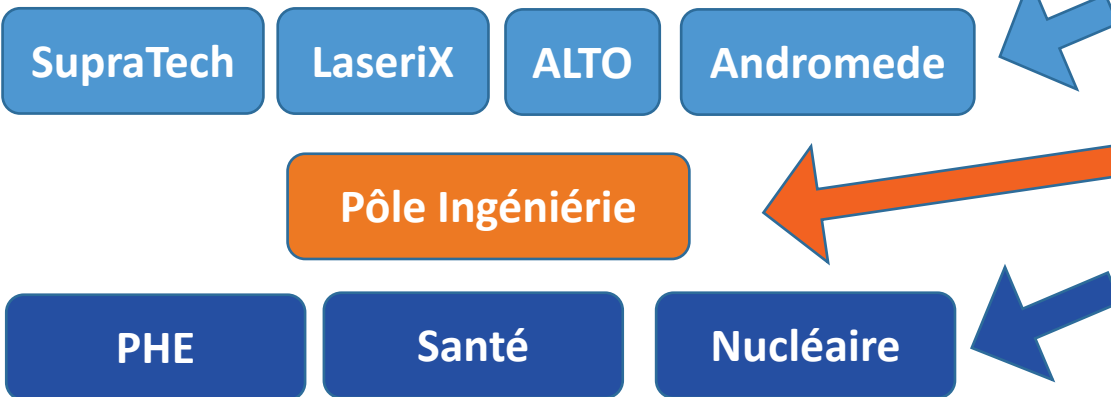
IELS

Innovative Electron &
Light Sources

ARCO Asset #1: the accelerator physics pole

Accelerator Physics Pole as of January 2020:

- 88 persons
- 20 researchers (½ CNRS, ½ University)
- 52 IT (among which 31 research engineers)
- **15 Ph-D students**
- 8 HDR



Pôle Physique des Accélérateurs

Effectifs totaux: 88 Ens.chercheurs: 10	Permanents: 60 Chercheurs: 8	CDD: 10 IR: 31 IE: 7	Doctorants: 15 AI: 10	Apprentis: 1 Emérite: 2
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Equipe Physique, Instrumentation et Manipulation des Faisceaux

Effectifs totaux: 24	Ens. chercheurs: 0
	Chercheurs: 3
Permanents: 12	IR: 10
CDD: 2	IE: 1
Doctorants: 9	AI: 0
Apprentis: 0	T: 0

Service RF

Effectifs totaux: 20	Ens. chercheurs: 0
	Chercheurs: 0
Permanents: 15	IR: 9
CDD: 4	IE: 2
Doctorants: 0	AI: 6
Apprentis: 1	T: 2

Equipe Accélération Laser et Applications

Effectifs totaux: 21	Ens. chercheurs: 9
	Chercheurs: 2
Permanents: 14	IR: 4
CDD: 2	IE: 1
Doctorants: 4	AI: 0
Apprentis: 0	T: 0
Emérites: 1	

Service Cryogénie

Effectifs totaux: 9	Ens. chercheurs: 0
	Chercheurs: 0
Permanents: 7	IR: 4
CDD: 2	IE: 3
Doctorants: 0	AI: 2
Apprentis: 0	T: 0

Equipe Matériaux, Vide et Surfaces

Effectifs totaux: 7	Ens. chercheurs: 1
	Chercheurs: 2
Permanents: 5	IR: 2
CDD: 0	IE: 0
Doctorants: 2	AI: 0
Apprentis: 0	T: 0

Plateforme Panama/vide/surface

Effectifs: 4	AI: 2
Permanents: 4	T: 2
CDD: 0	

Technological platforms dedicated to accelerator R&D:

- **SupraTech**: dedicated to superconducting accelerator R&D and construction

ARCO Asset #2: IJCLab Platforms

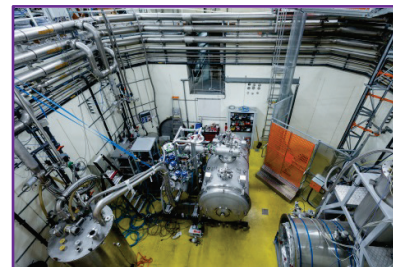
Salle blanche ISO4



Nouvelle zone d'intégration



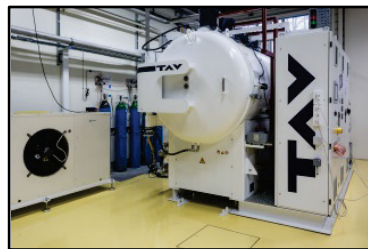
Hall d'expériences



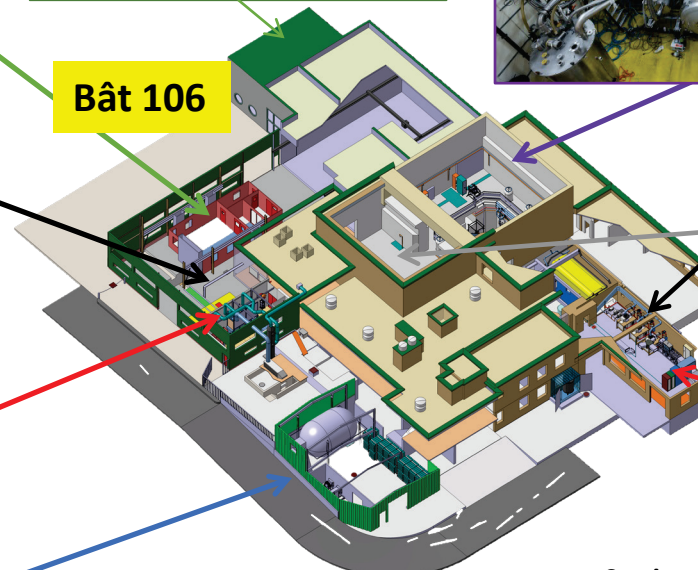
Groupes de pompage d'hélium



Four sous vide



Bât 106



Hall d'intégration



Salle de traitement de surface



Sources de puissance RF



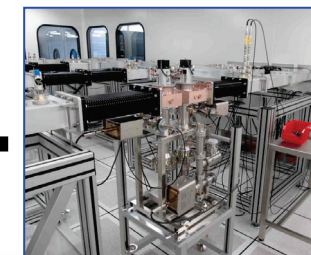
Hall d'expériences « Cryodrome »



Station d'étalonnage



Salles blanches coupleurs RF et banc de conditionnement



Bât 102

Bât 208

Hall de récupération et de compression du gaz hélium associé à un liquéfacteur d'hélium

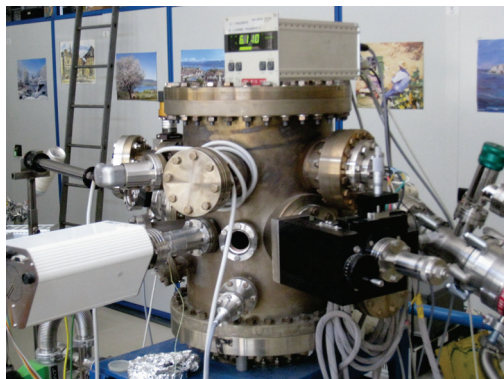


Technological platforms dedicated to accelerator R&D:

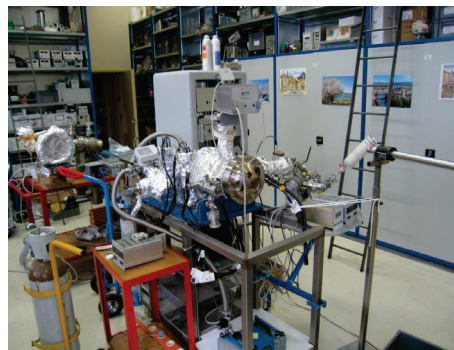
- **SupraTech**: dedicated to superconducting accelerator R&D and construction
- **Vacuum & Surface / PANAMA** : dedicated to characterization and surface analysis of materials used in accelerator technology

ARCO Asset #2: IJCLab Platforms

Bâti de mesure de l'énergie de désorption moléculaire sur différents matériaux



Bâti de mesure de faible taux de dégazage thermique

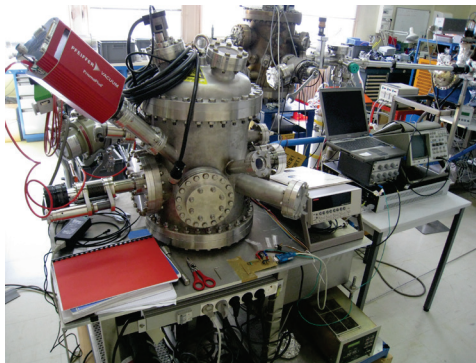


SIMS



Diffractomètre RX

Bâti de mesure de la désorption par impact électronique et mesure du taux d'émission secondaire (SEY)



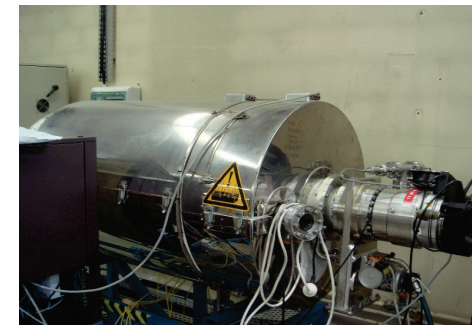
Microscope Confocal



Four de brasage



Etuve pour le traitement H₂



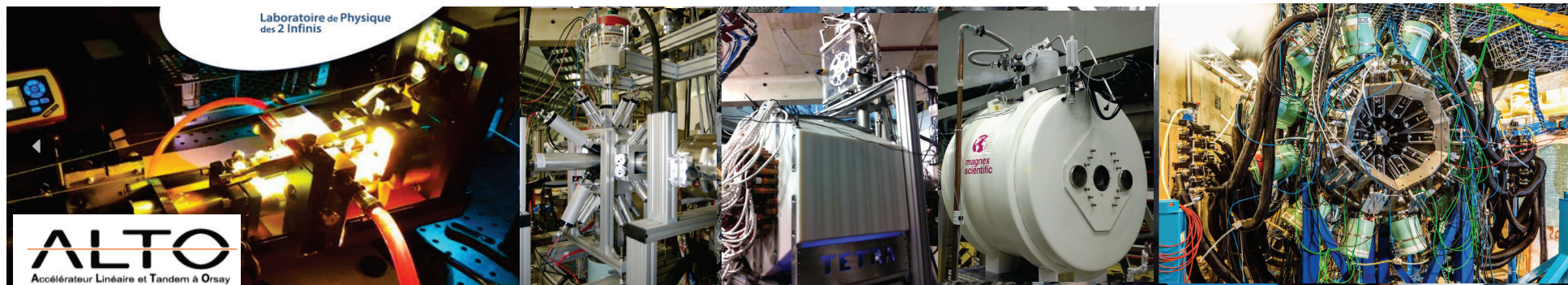
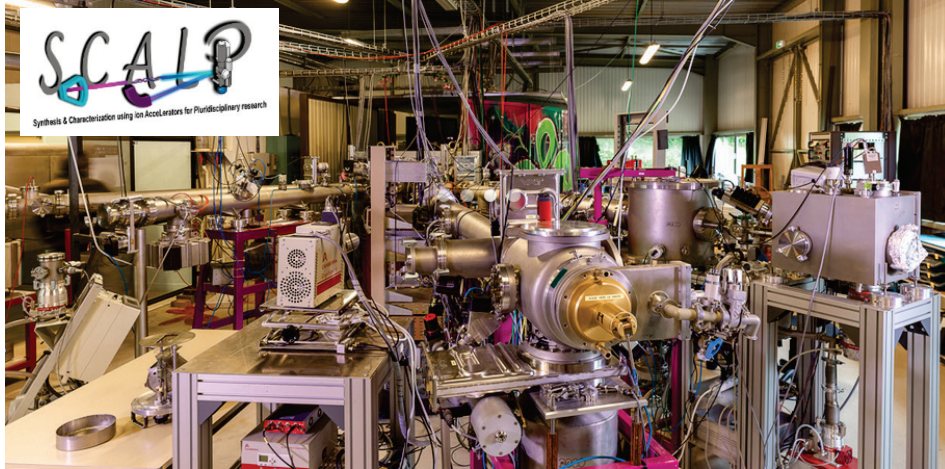
Technological platforms dedicated to accelerator R&D:

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Research platforms based on accelerator:

- **ALTO**: 15 MV tandem accelerator, 50 MeV electron linac, RIB facility
- **ANDROMEDE**: 4 MeV accelerator, innovative ion sources, surface analysis with clusters
- **SCALP**: Aramis, Irma, Sidonie accelerator/source; double beam MET

ARCO Asset #2: IJCLab Platforms



Technological platforms dedicated to accelerator R&D:

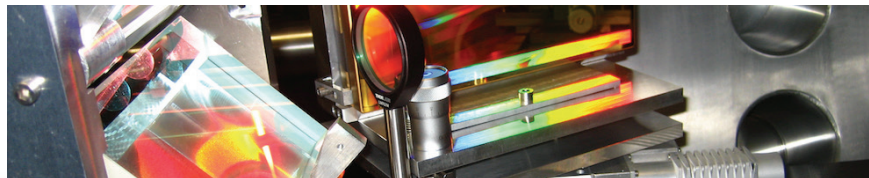
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Research platforms used for accelerator R&D:

- **LaseriX**: Ultra high power laser 40 TW, 10Hz;
XUV source; coupled with Phil



The Engineering Pole of IJCLab

- **4 engineering departments (170 engineers and technicians) gathering specialized competences required for accelerators developments**
- **An important fraction of the pole (~30%) is working on accelerator-related activities (projects or platforms)**
- **In particular, it gives IJCLab the possibility to take significant part to large scale accelerator construction.**

Pôle Ingénierie

ELECTRONIQUE

- Systèmes numériques et acquisition
- Développements analogiques et microélectronique
- CAO prototypage et réalisation

INFORMATIQUE

- Développement
- Exploitation
- On-Line

DÉTECTEURS ET INSTRUMENTATION

- Détecteurs de particules & instrumentation associée
- Détecteurs cryogéniques de particules & instrumentation associée

MÉCANIQUE

- Bureau d'études
- Réalisations et montages mécaniques

The local Ecosystem is very favorable to develop accelerators science and technology

- **Important partners** for accelerator science within a 5 km radius : CEA/Irfu and Soleil
- **Part of Paris-Saclay University:**
 - **Involvement in teaching, potentialities given by the local high concentration of students**
 - **University lab: mutualization of some equipments/skills (surface analysis)**
 - **Other local accelerators**
- **Also benefit from a French industry network (not only local...)** which is very relevant in some key technologies for accelerators

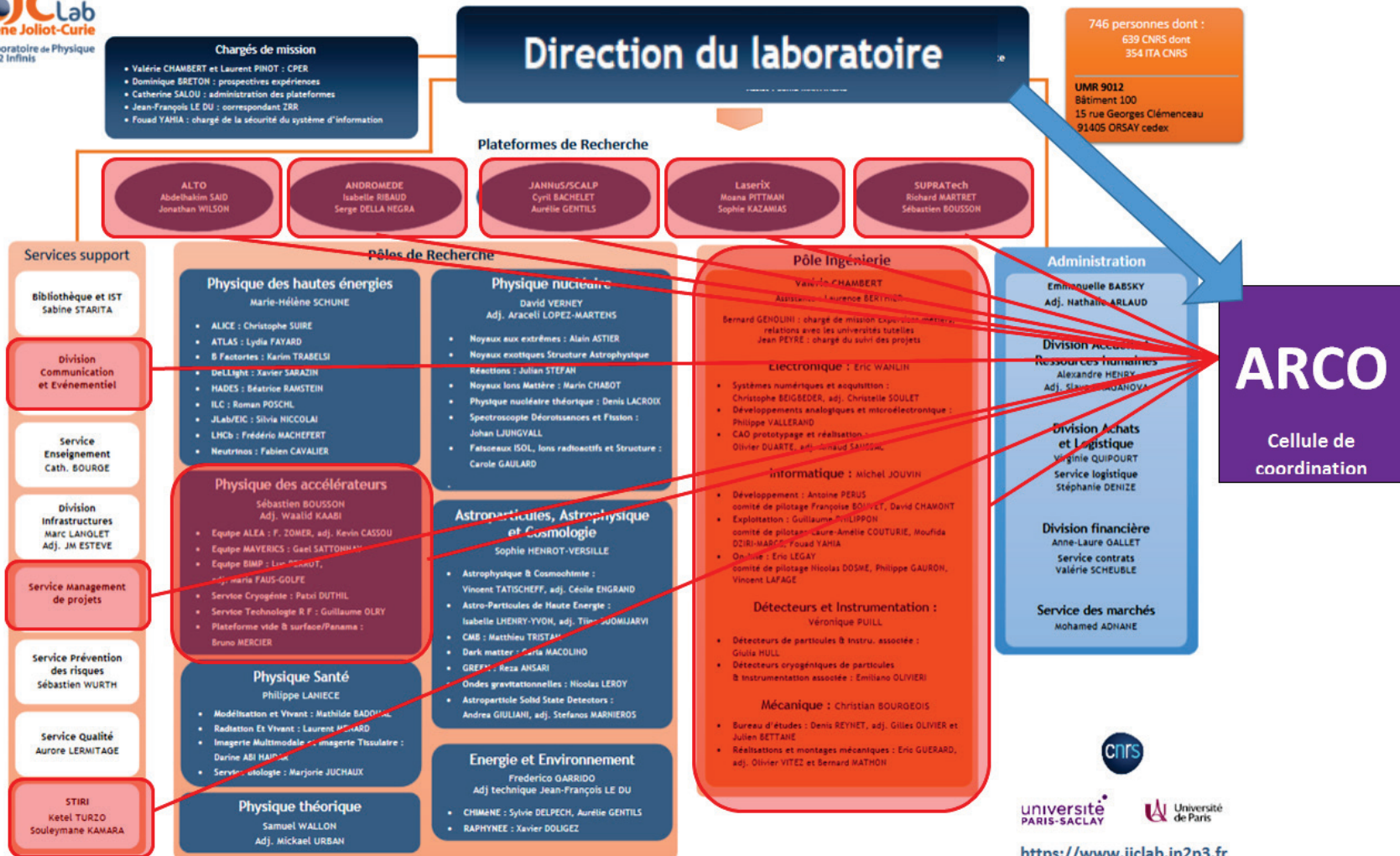
ARCO is personified thru a **coordination committee:**

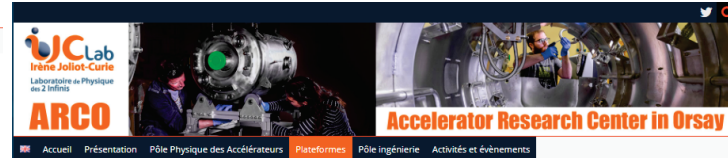
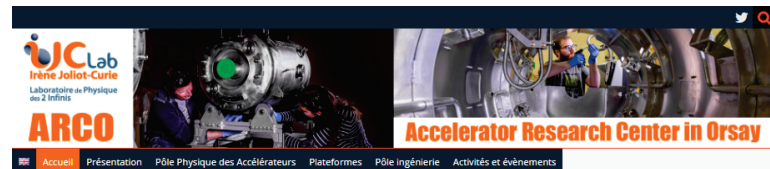
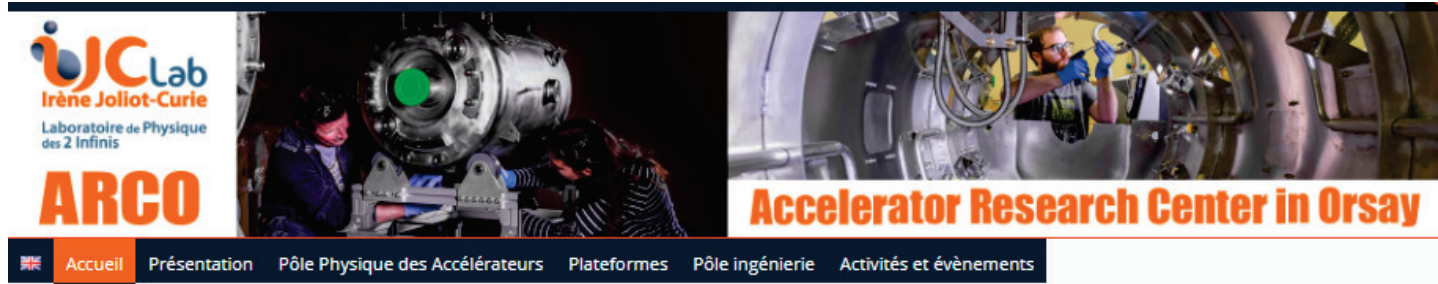
- **A non-hierarchical structure**
- **In charge of the scientific and technical animation**
- **Meant to be the visible and single-point contact for external solicitations**
- **Composition under completion – First meeting in the coming weeks**

First missions :

- **Make ARCO visible from outside**
- **Develop a scientific animation on accelerator topics (seminar, workshops,...)**
- **Proposed transverse actions such as initiate working group (and thus research groups)**
- **Strengthen the relationship with local actors on accelerators**

ARCO Organization





Accueil

ARCO (Accelerator Research Center in Orsay) est un groupement de recherche rassemblant l'ensemble des projets et des activités autour de la physique des accélérateurs et ses applications au sein du **Laboratoire de Physique des 2 Infinis Irène Joliot-Curie** IJCLab. ARCO a pour but d'incarner l'ensemble du potentiel accélérateur du laboratoire. Il anime d'un point de vue scientifique et technologique des activités accélérateur transverses aux différentes structures du laboratoire, et il constitue un point d'entrée pour ces activités auprès des collaborateurs et partenaires extérieurs d'IJCLab.

Carte d'identité

- 48 chercheurs/IT publiant en recherche en physique des accélérateurs
- 15 doctorant.e.s en physique des accélérateurs
- 2 services spécifiques à la physique des accélérateurs : service RF (20 collaborateurs) et service cryogénie (9 collaborateurs)
- 2 plateformes technologiques : Supratech + Vide et Surfaces
- 4 plateformes de recherche liées aux accélérateurs : ALTO, JANNU-SCALP, Laserix, ANDROMEDE

Projets en cours

- MYRRHA
- ESS
- THOMX
- PERLE@Orsay
- PALLAS
- FCC/ILC
- GANIL (Spiral-2, S3, DESIR)
- PIP IVDUNE

Portail IJCLab



ARCHIVES

Présentation

IJCLab constitue la plus importante force de frappe du CNRS sur la thématique de la physique des accélérateurs et se positionne parmi les plus grands laboratoires mondiaux sur cette thématique. L'ambition d'IJCLab dans ce domaine est à la fois de mener une recherche ambitieuse en physique des accélérateurs sur des concepts nouveaux d'accélération et sur des innovations technologiques, mais aussi de jouer un rôle majeur dans la conception et la construction des futurs accélérateurs en contribuant fortement aux machines mondiales.

Pour servir cette ambition, la physique des accélérateurs à IJCLab s'appuie sur trois atouts majeurs : un **pôle scientifique et technique** dédié à cette thématique, des **plateformes technologiques et de recherche** servant ou se basant sur des accélérateurs, et un **pôle ingénierie** pouvant apporter toutes les ressources nécessaires pour le déploiement des projets et programmes accélérateurs. ARCO x IJCLab bénéficie aussi du soutien des **services support** d'IJCLab, en particulier la Cellule de Management de Projets (CeMaP) et le Service Transfert Innovation et Relations Internationales (STIRI).

ARCO (et plus largement IJCLab) bénéficie également d'un éco-système particulièrement favorable. Il est au cœur de l'environnement de l'Université Paris-Saclay (proximité du CEA/IRFU, formations au niveau Master et Doctorat de l'Université Paris-Saclay). Il s'inscrit dans un tissu industriel français (PME et grands groupes) souvent très pertinent en matière d'accélérateur et avec lequel IJCLab a noué, pour certains partenaires, des relations collaboratives fortes sur la R&D amont. Enfin, les projets concernés au sein d'IJCLab font l'objet de nombreuses collaborations internationales (accords internationaux avec des laboratoires étrangers. Memorandums of Understanding).

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Portail IJCLab



ARCHIVES

Plateformes

Un atout majeur d'IJCLab en matière de science et technologie des accélérateurs est la richesse de ses plateformes de recherche et de ses plateformes technologiques en grande partie consacrées aux activités accélérateurs. Elles constituent un socle essentiel à la conduite de recherche et de développement en matière d'accélérateur. Les capacités qu'elles apportent, couplées aux ressources humaines spécialisées rendent possibles à la fois les développements expérimentaux sur les nouveaux concepts d'accélérateur, mais aussi l'environnement technologique nécessaire à la préparation et la production des systèmes accélérateurs pour les grands projets internationaux.

- Les plateformes technologiques accélérateurs du laboratoire permettent de structurer, d'organiser et de piloter un ensemble d'équipements de haute technologie au service des accélérateurs et même au-delà. Il s'agit de la plateforme **SupraTech** qui intègre les salles blanches coupleurs XFEL de la plateforme Panama/Vide et surface dont les équipements seront coordonnés et rationalisés au sein de nouveaux espaces dédiés en aménagement (bât D3 et D4)
- Les plateformes de recherche **Laserix** et **Phil**, qui permettent d'avoir l'ensemble des technologies (source d'électrons et laser de puissance) pour les développements expérimentaux de l'accélération laser/plasma
- Les plateformes de recherche locales basées sur des accélérateurs (**ALTO**, **ANDROMEDE** et **JANNU-SCALP**), dont les domaines de recherches sont variés (Physique Santé, Énergie, Physique Nucléaire, Astrophysique...), qui constituent un outil formidable de formation interne aux technologies accélérateur et dont les équipes alimentent également le socle des expertises globales du laboratoire en matière d'accélérateur.

ARCO: Accelerator Research Center in Orsay

- is an initiative to **coordinate accelerator science and technology activities and competences of IJCLab.**
- is meant to make visible **the overall potential of IJCLab** in particle accelerators
- is **embodied by a coordination committee** to be set in the coming weeks
- should be effective in the coming months with the **first actions** initiated by the coordination committee