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 (≠ 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**
Why ARCO?

Fermilab

ASTEC @ Daresbury

Particle Accelerators

As America’s particle physics laboratory, Fermilab operates and builds powerful particle accelerators for investigating the smallest things in the universe and for solving the most pressing scientific problems. Fermilab’s accelerators are used in a wide range of scientific research, from basic physics to applications in medicine, industry, and education.

The Department of Energy manages Fermilab, a national laboratory operated by Fermi National Accelerator Laboratory, Inc. The laboratory is a world-class research facility that operates several particle accelerators and colliders. Fermilab’s accelerators provide scientists with the tools they need to make discoveries in physics and other fields.

Related Links

- All Things News

LEADING ACCELERATOR TECHNOLOGY

Fermilab’s Accelerator Complex and PIP-II

ILLINOIS ACCELERATOR RESEARCH CENTER

From blueprint to construction, Fermilab scientists and engineers develop powerful particle accelerators to produce the beams needed to take particle physics to the next level. Collaborating with scientists and laboratories around the world, Fermilab has built some of the most advanced accelerators and storage rings in the world.

Fermilab’s Accelerator Complex comprises several powerful particle accelerators and storage rings that produce beams for a variety of experiments and national programs.

The Fermilab Accelerator Complex is a world-class research facility that provides scientists with the tools they need to make discoveries in physics and other fields. Fermilab scientists use the facility to conduct research and develop technologies that will advance science and improve human life.

Programmes

Some of the programmes at Fermilab include:

- ATLAS
- CMS
- Colliders
- Particle and Few-Body Physics
- Technology, Research, and Development

Science Highlights

- 2016: ASTRIC Science Milestone
- 2016: ASTRIC Science Roadmap
- 2016: ASTRIC Science Milestone
Why ARCO?

ACCELERATOR SCIENCE

Advancing Accelerator Science, Technology and Operations

JLab is a world leader in accelerator science. This expertise stems from the planning, building, maintaining and operating of the Continuous Electron Beam Accelerator Facility (CEBAF), the last primary particle accelerator and the largest Energy Resonance Facility (ERF) in the world. A large number of scientific disciplines, such as developing processes for producing high-quality carbon and boron nitride nanotubes, identifying laser light wavelengths for use in materials research and in microscopical studies, the JLab 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 electronic, vacuum, vacuum and magnet systems that comprise the accelerator. The division also produces a broad program of the scientific and experimental research in accelerator and beam physics.

ACCELERATOR OPERATIONS

The JLab 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 Joint Energy Resonance Facility (JERF). The JLab 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 Joint Energy Resonance Facility (JERF).

SIE INSTITUTE

The SIE Institute is a world leader in the advancement of superconducting radiofrequency (SRF) science and technology. The role of the "accelerator," or "accelerators," in the modern particle accelerators. Advancements in this technology enable the next generation of particle accelerators. This technology is used to detect and analyze subatomic particles and their properties. The SIE Institute also operates a world-class research center and a national user facility.

CASCA

The Center for Advanced Studies of CAASCA, CASCA, is a premier program of the theoretical and experimental research in accelerator and beam physics. The organization has a primary focus on the generation of novel ideas and the development of knowledge about advanced accelerator and beam physics, especially that knowledge generated as a result of work with JLab accelerator facilities.

LCLS-II

JLab Accelerators 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 needs for a high repetition rate high-average intensity source of X-ray FELs. The project enables an upgrade of the LCLS accelerator at the SLAC National Accelerator Laboratory in Menlo Park, California.
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
**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
Technological platforms dedicated to accelerator R&D:

• **SupraTech**: dedicated to superconducting accelerator R&D and construction
ARCO Asset #2: IJCLab Platforms

Salle blanche ISO4

Four sous vide

Salle de traitement de surface

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

Nouvelle zone d'intégration

Hall d'expériences

Bât 106

Groupes de pompage d'hélium

Hall d'intégration

Bât 102

Sources de puissance RF

Salles blanches coupleurs RF et banc de conditionnement

Bât 208

Hall d'expériences « Cryodrome »

Station d'étalonnage

Bât 208
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
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
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Research platforms based on accelerator:

- **ALTO**: 15 MV tandem accelerator, 50 MeV electron linac, RIB facility
- **ANDROMÉDE**: 4 MeV accelerator, innovative ion sources, surface analysis with clusters
- **SCALP**: Aramis, Irma, Sidonie accelerator/source; double beam MET
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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.
ARCO Asset #4: The Orsay Ecosystem

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 Organization

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
ACCELERATOR RESEARCH CENTER IN ORSAY

Présentation

ARCO 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’attended position de laboratoire et de l’Equipe d’Exploitation, un rôle de leader, et une gestion des projets et programmes d’accélérateurs. ARCO est l’un des plus grands laboratoires mondiaux en néons, en particulier en vue de transmettre le savoir-faire et des technologies à d’autres laboratoires internationaux et industriels.

Un atout majeur d’ACO en matière de science et de technologie des accélérateurs est le choix de ses plateformes de recherche et de ses plateformes technologiques en grande partie consacrées aux accélérateurs. Il constitue un ensemble équilibré et cohérent de technologies et de compétences qui permet de s’adapter rapidement à des évolutions de la technologie et de proposer des solutions innovantes pour répondre aux besoins des utilisateurs internes et externes.

- Les plateformes technologiques et les plateformes de recherche du laboratoire permettent d’organiser et de piloter un ensemble d’activités de haute technologie autant des accélérateurs et qu’en dehors. Il s’agit de la plateforme sur le logiciel de simulation du faisceau de particules. La plateforme sur le logiciel de simulation de la propagation des photons, la plateforme sur le logiciel de simulation de la propagation des neutrons.

- Les plateformes de recherche et de développement d’ACO permettent d’analyser et de proposer des solutions innovantes pour répondre aux besoins des utilisateurs internes et externes.

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- 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