IJCLab :
un nouveau laboratoire dans et pour l'IN2P3 au cœur de Paris-Saclay

IJCLab :
Presented in 5 slides

CSNSM, IMNC, IPNO, LAL, LPT → IJCLab ~4 years of history at a glance

Laboratories sharing the same history, the same way of working (CNRS/University).
Unique opportunity : thematic coherence and geographical proximity *(in a map: ellipse of 600m,300m).*
The ensemble of all the themes of “the physics of the two infinities” with the presence
of strong historical/existing poles, of emerging poles and of activities at the interfaces
All technical forces unified in IJClab

Apr. 2016 → Sept. 2018 Prematuration Phase

Discussions / Conseil Inter Laboratoire / working groups (science, technics, supports) / dedicated workshops / Consultation.

Sept. 2018 → Sept 2019 Project Phase

Work in project mode to propose the structure and the organization of the future laboratory.

Sept. 2019 → End 2019 Transition Phase

Coexistence of the new direction and the former laboratories

Formed on 2020 by merging CSNSM, IPN, IMNC, LAL, LPT

Direction du laboratoire

Chargés de mission

Plateformes de Recherche
- ALTO
- ANDROMEDE
- JANNuS/SCALP
- SUPRATech
- Laserix

Services support
- Documentation
- Communication & Évènementiel
- Enseignement
- Infrastructures
- Prévention des risques
- STIRI

Pôles de Recherche

PHYSIQUE DES HAUTES ÉNERGIES
- ALICE
- ATLAS
- B Factories
- DeLLight
- HADES
- ILC
- JLab/EIC
- LHCb
- Neutrinos

PHYSIQUE DES ACCÉLÉRATEURS
- ALEA
- MAVERICS
- BIMP
- Cryogénie
- Technologie RF
- Plateforme /PANAMA

PHYSIQUE SANTÉ
- Modélisation et vivant
- Radiation et vivant
- Imagerie multimodale et Imagerie tissulaire
- Service biologie

PHYSIQUE THÉORIQUE

PHYSIQUE NUCLÉAIRE
- Noyaux aux extrêmes
- Noyaux exotiques structures astrohysique réactions
- Noyaux ions matière
- Physique nucléaire théorique
- Spectroscopie décroissanse et fission
- Faisceau ISOL, ions radioactifs et structure

ASTROPARTICULES, ASTROPHYSIQUE ET COSMOLOGIE
- Astrophysique & cosmochimie
- Astro-particules de haute énergie
- CMB
- Dark matter
- GREEN
- Ondes gravitationnelles
- Astroparticles Solid State detectors

ENERGIE ET ENVIRONNEMENT
- CHIMèNE
- RAPHYNEE

Pôle Ingénierie

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

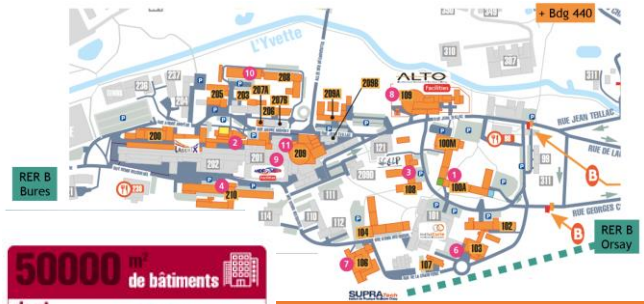
INFORMATIQUE
- Développement
- Exploitation
- On-Line

DÉTECTEURS ET INSTRUMENTATION
- Détecteurs de particules & instrumentation associée
- Détecteurs cryogéniques de particules & instrumentation associée

MÉCANIQUE
- Bureau d'études
- Réalisations et montages mécaniques

Administration
- Division accueil et ressources humaines
- Division achats et logistique Service logistique
- Division financière Service contrats
- Service des marchés

~710 membres (530 permanents)
One of the biggest laboratory in
CNRS / Paris-Saclay / Université de Paris



https://www.ijclab.in2p3.fr

7 Researches Poles
31 research teams et 2 services

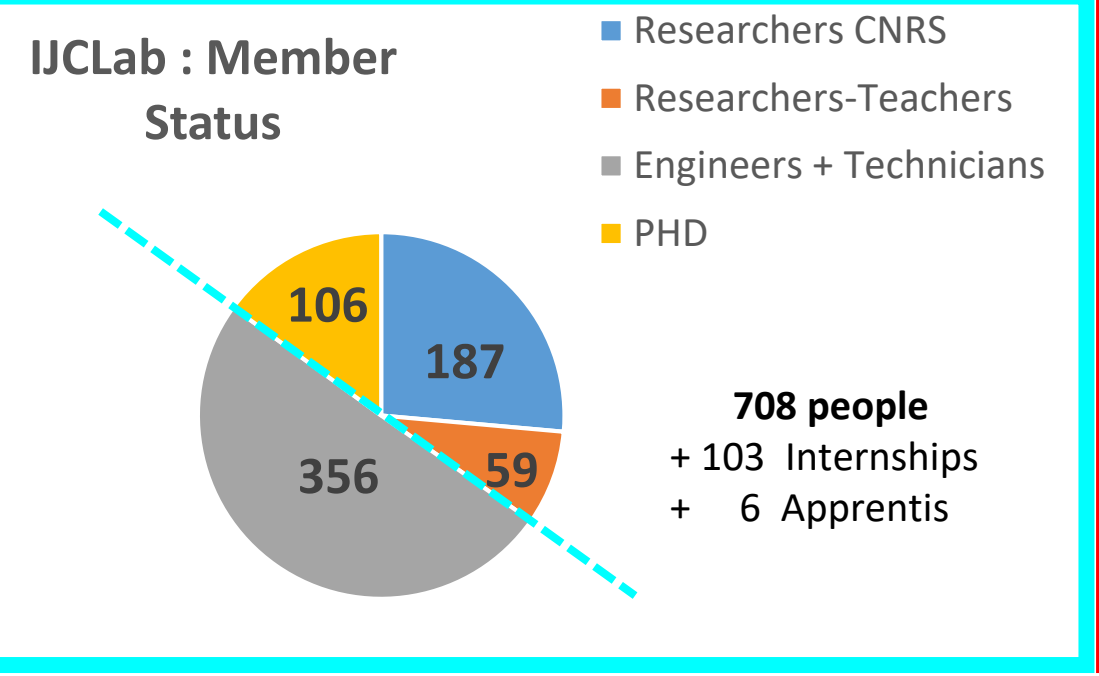
1 Engineer Pole
4 Departments with 11 Services

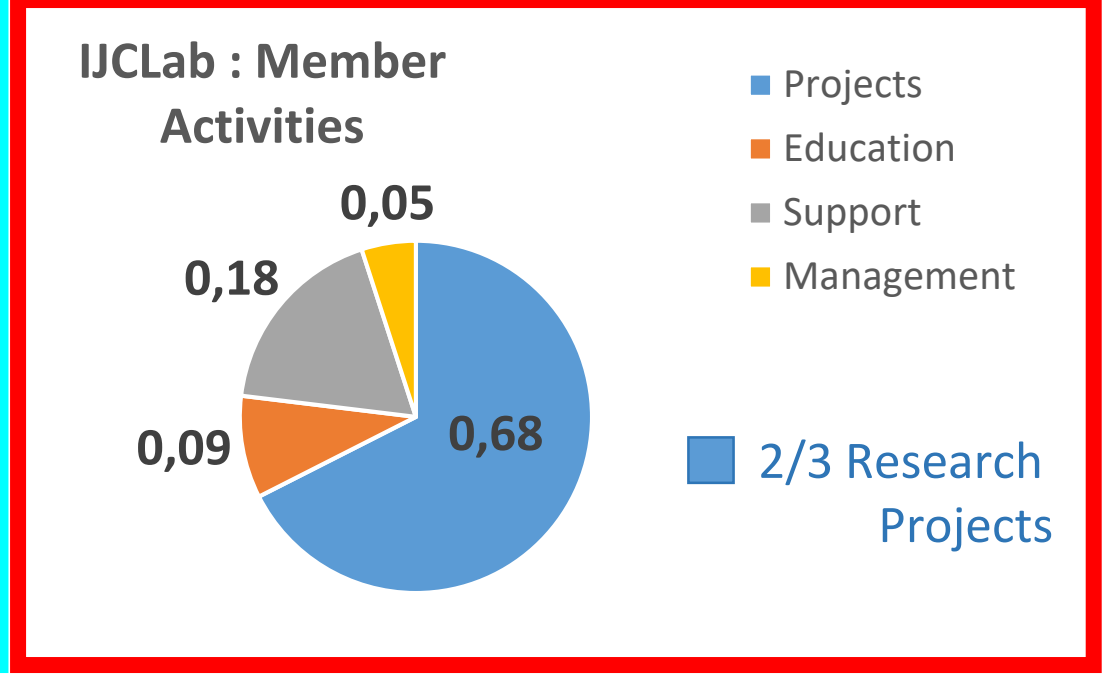
1 Administration Pole
3 Divisions + 1 Service

8 Support Services

5 Platforms (welcoming external projects)
+ several technical platforms

IJCLab in a nutshell





IJCLab is organized according to the skills and activities of the member

- Researchers from previous laboratories are mixed in the scientific poles / teams
- Technical staff from previous laboratories are mixed in the 13 services
- Support staff from previous laboratories are mixed in the support services

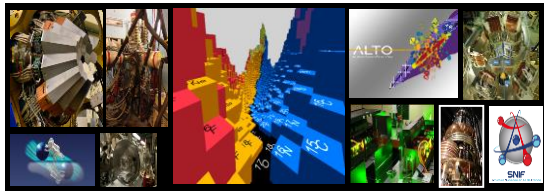
Still early days : the teams of current projects are often the same as before IJCLab - long-term evolution.

IJCLab in a nutshell

7 Pôle Scientifiques

The ensemble of all the themes of "the physics of the two infinities" with the presence of strong historical/existing poles, of emerging poles and of activities at the interfaces

PHYSIQUE NUCLÉAIRE
NUCLEAR PHYSICS
~ 67

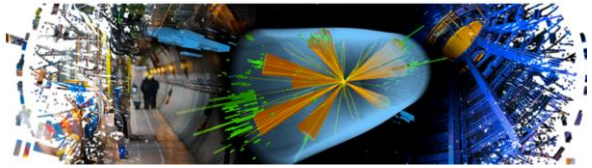


A2C Astroparticles, Astrophysics & Cosmology
~ 57

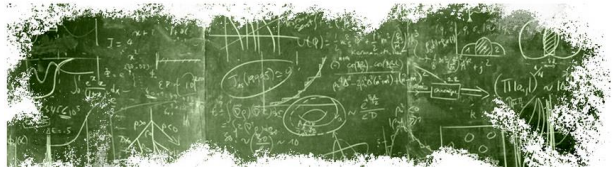
Accelerator Physics
~ 83

Including RF and cryogenic services

PHE Physique des Hautes Energies
High Energy Physics
~94



Théorie
~ 54



Santé
~ 21

~34
Energie et Environnement

~ 130 PhD

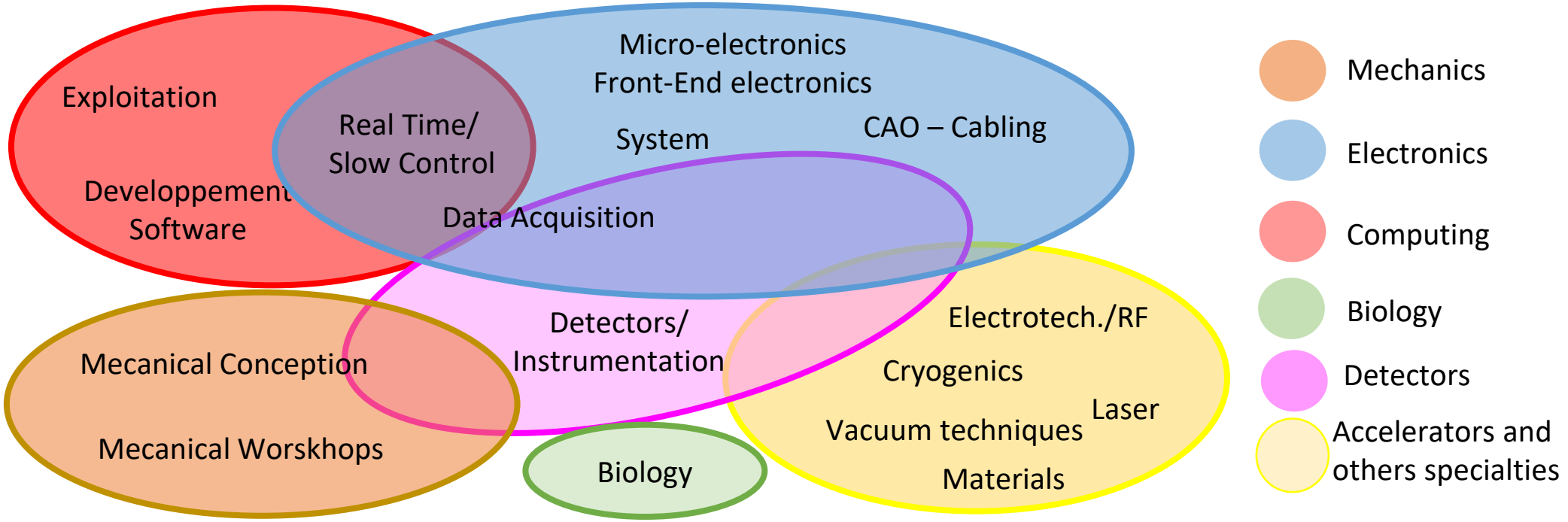
IJCLab in a nutshell

1 Pôle Ingénierie | 4 Départements | 5 Plateformes de Recherche | 3 Plateformes Techniques | RF Cryogenics

~180 staff members
4 Departments :
Electronics / Computing
Instrumentation / Mechanics
with 11 Services

Technical staff with technical skills/expertise
essential pillars for the laboratory to design, draw and build instruments.

- Technical services are fuelled by the challenges of research (R&D and projects)
- The proximity of technical and research teams (integrated teams)
- The ability to combine and make coexist versatility and specialization



IJCLab in a nutshell : the support Services

Indispensable in supporting all the scientific and technical activities of the laboratory

Administration

- Division accueil et ressources humaines
- Division achats et logistique
  Service logistique
- Division financière
  Service contrats
- Service des marchés

48 staff members

Strong and newly structured Administrative Service
3 divisions
2 Services

4 **CeMaP**

Project management unit. Accompanies and supports the project leaders, provides data and advises IJCLab management

38 staff members

Management of lab libraries, common digital library, simplified access to all documentary resources and lab productions

National/international visibility of IJCLab : external and internal communication, event organization, patrimonial activities ...).

Support to teaching activities : helping IJCLab to be a place for students

Essential for a "laboratoire constructeur". Essential for the successful new implementation of IJCLab

Key role, given the specificity of our research activities and all the facilities involved.

International Cooperation and links with enterprises : 2 pillars of IJCLab

Services support

- Documentation
- Communication & Événementiel
- Enseignement
- Infrastructures
- Prévention des risques
- STIRI

… we restart from 2010… y-10

The decade that preceding the creation of IJCLab

2010-2020 : Recent discoveries, great achievements !

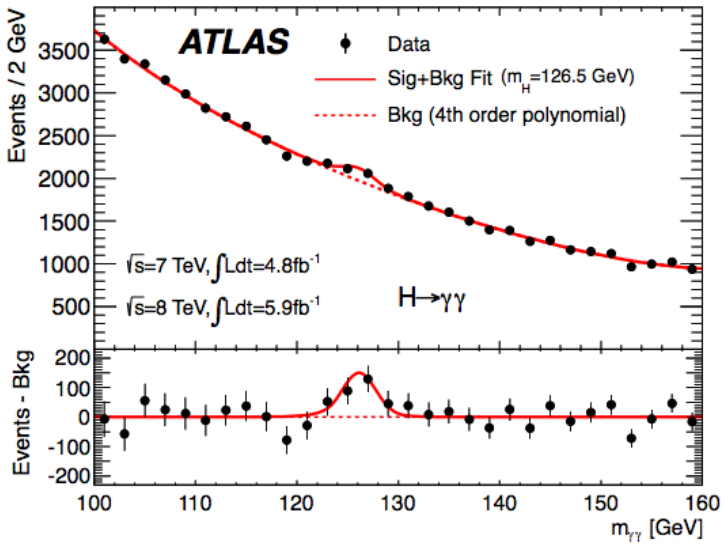
2012

The Standard Model and the Higgs boson discovery ! ATLAS

The missing piece of the Standard Model

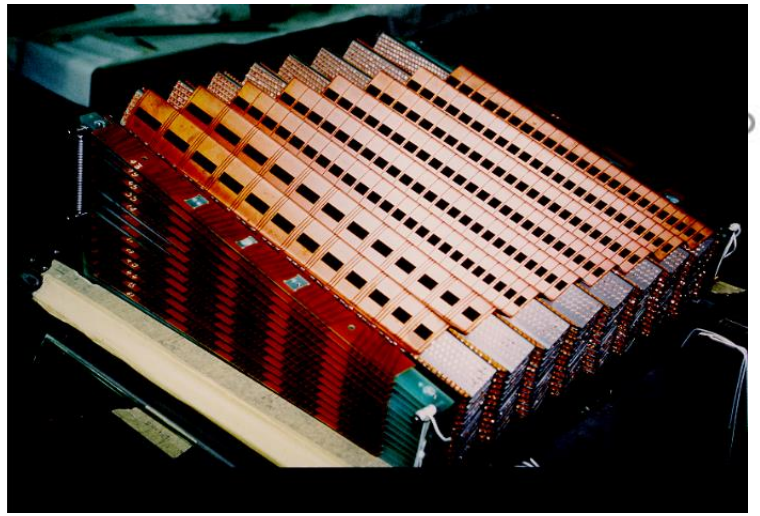
Effort started in 1985 !

H -> γγ



Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC, Phys Lett B 716 (2012), pp. 1-29

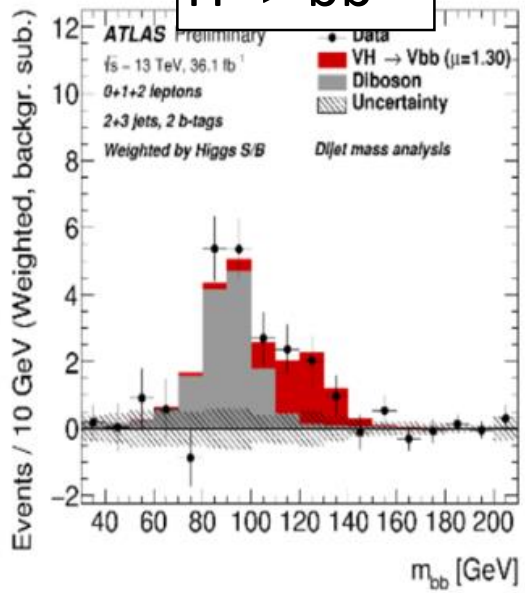
Important contributions in detector conception and construction



Electromagnetic calorimeter

2017

H -> bb



- **Contribution to ATLAS to all stages : conception, construction of the detector, preparation and data analysis**
- **Common national effort with other IN2P3 laboratories and IRFU/CEA**

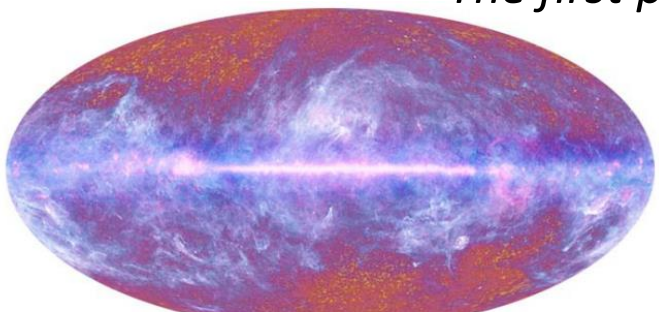
2010-2020 : Recent discoveries, great achievements !

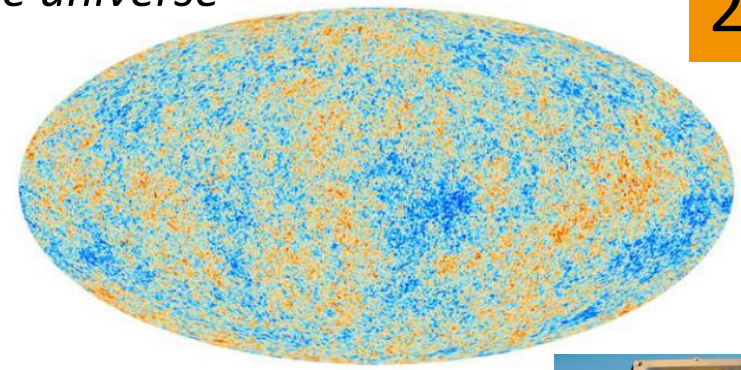
Effort started in 1990 !

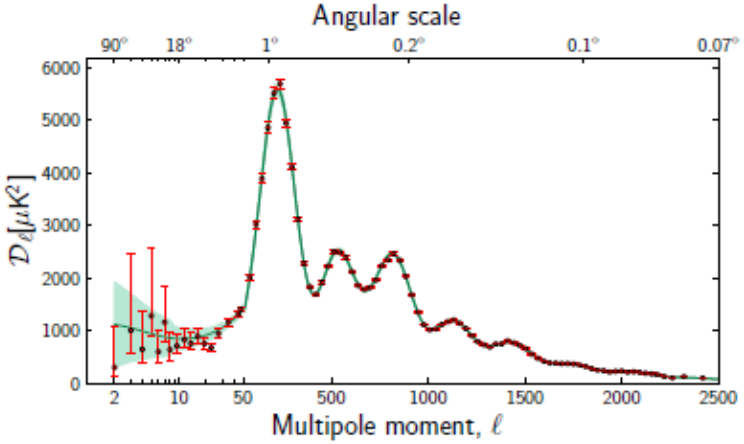
The Early Universe seen with CMB !

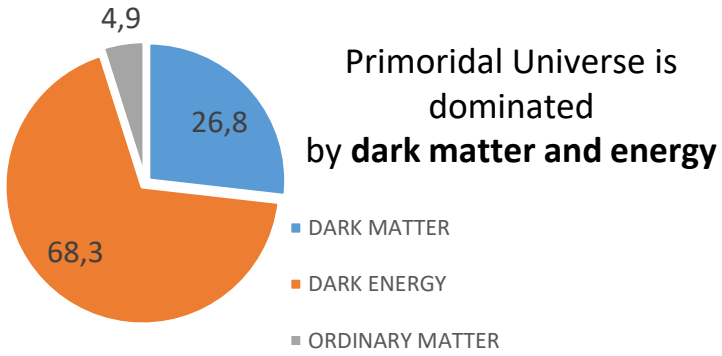
The first photo of the universe

2013/2014









Primoridal Universe is dominated by **dark matter and energy**

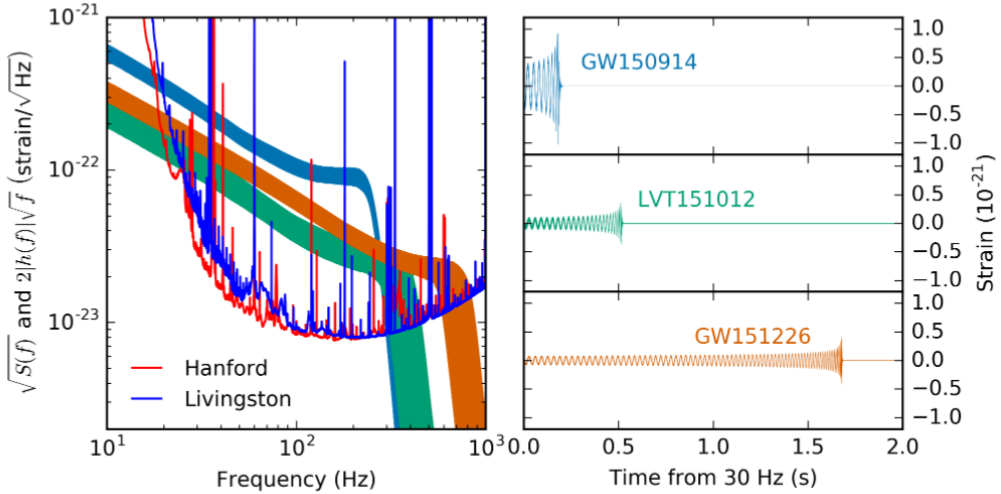
DPU : on-board computer

- **First Experiment in space. Implication in hardware and data analysis**
- **Common effort with other IN2P3 laboratories and INSU (IAS in Orsay). Joint experience with CNES**

2010-2020 : Recent discoveries, great achievements !

2015 The observation of the Gravitational Waves LIGO/VIRGO **Effort started in 1990 !**

Space-time waves, direct observation of black holes and other compact objects

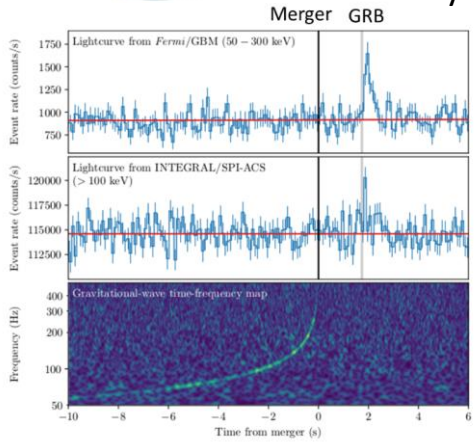


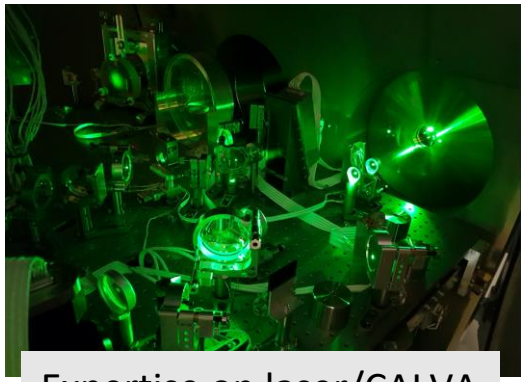
- First direct detection of gravitational waves
- First direct evidence of black holes
- No deviation / general relativity
- In particular limit on the mass of the graviton: M(G) < 10^{-22} eV.

2017

The birth of multi-messenger astronomy

- Coalescence of 2 neutron stars
- Gamma-ray burst (GRB) after 1.7 sec. (Fermi+Integral)

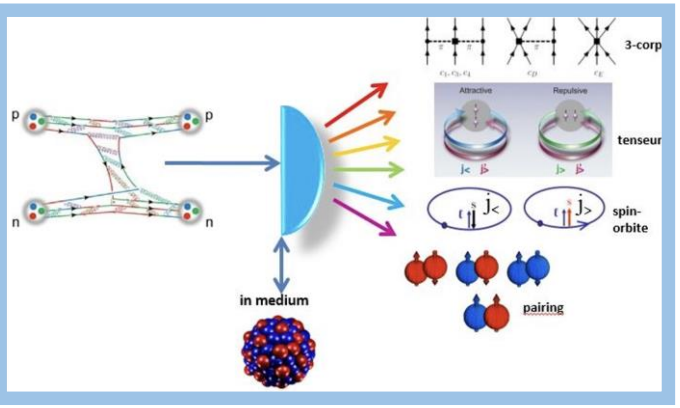




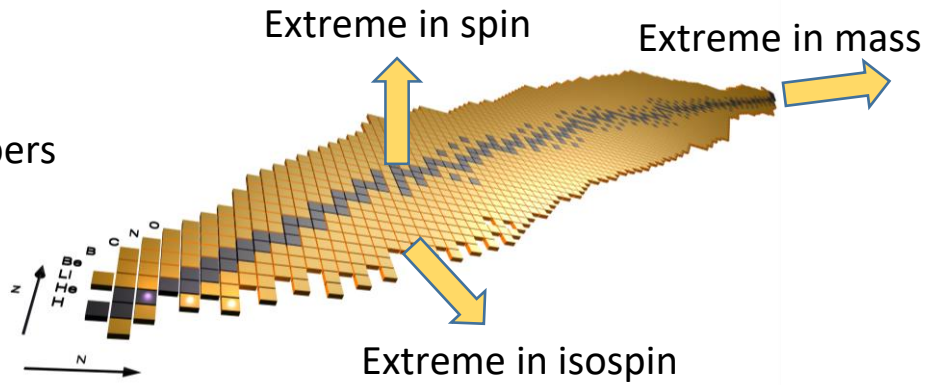
Expertise on laser/CALVA

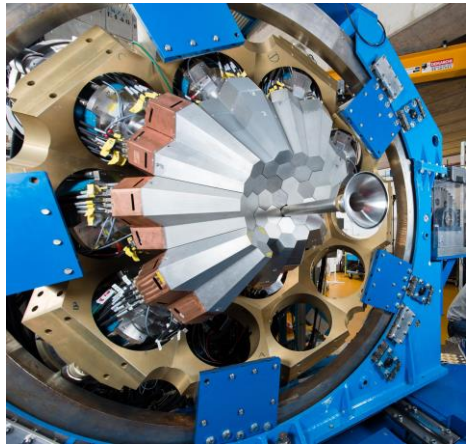
- **We played a central role since the beginning. VIRGO started in Orsay. Strong implication in hardware/data analysis**
- **Common effort with other IN2P3 laboratories**

2010-2020 : emerging properties from effective interaction



- Superdeformation
- disappearance of magic numbers
- Super heavy nuclei





Revolution of the gamma tracking **Effort started in the 90's**

We have entered the era of precision

Spectroscopy has been the field of excellence of nuclear physics at Orsay since its origins.

To understand the microscopic origins of complexity in the universe, it is necessary to break the frontier of precision

Strong contribution of Orsay in the construction of detectors and in the production of exotic beams together with other IN2P3 laboratory, GANIL and IRFU/CEA

… IJCLab present and future…

Our vision is to drive discoveries by :

MISSION 1

contributing to projects at all stages:
proposal, design, construction, operation, data analysis, theory

- At the birth – creation of the Orsay Campus (IPN, LAL and CSNSM)
- Within IN2P3 – which coordinates all this in a national coherent framework

- At present with **IJClab** stronger in/for IN2P3 at the heart of Paris-Saclay

DRIVING LABORATORY

*Reinforcing the **lead of international flagship projects***
in high energy physics, nuclear physics, astroparticles and cosmology.
+ important reinforcement in theory (with IPN and LPT -> IJCLab).

Still many questions remained opened in High Energy Physics…

1

- Structure of nucleon (and of hadrons)
- New state of matter : Quark Gluon Plasma
- New particles, symmetries beyond Standard Model
- Origin of the mass of elementary particles
- Particle-antiparticle asymmetry (CP violations)
- Masses and mass hierarchy of neutrinos
- Nature of neutrinos (Majorana or Dirac)

To answer these questions, many researches activities grouped in *research themes/projects* !

Hadronic Physics	Particle Physics	Neutrinos
QCD studies towards a better understanding of the Standard Model.	Precision measurements of the SM parameters and search for New Physics phenomena.	

First 18 months of IJCLab : many important results (many others in Backup)

Theory

Hint of New Physics from Lepton Flavour Universality Violation ?

$$R_{D^{(*)}} = \frac{\mathcal{B}(B \to D^{(*)}\tau\bar{\nu})}{\mathcal{B}(B \to D^{(*)}\ell\bar{\nu})_{\ell\in(e,\mu)}} \quad \& \quad R^{\exp}_{D^{(*)}} > R^{\mathrm{SM}}_{D^{(*)}}$$

$$R_{K^{(*)}} = \frac{\mathcal{B}(B \to K^{(*)}\mu\mu)}{\mathcal{B}(B \to K^{(*)}ee)}\Big|_{q^2\in[q^2_{\min},q^2_{\max}]} \quad \& \quad R^{\exp}_{K^{(*)}} < R^{\mathrm{SM}}_{K^{(*)}}$$

2019

Exp : $R_D = 0.340 \pm 0.030$, $R_{D^*} = 0.295 \pm 0.014$

SM : $R^{\mathrm{SM}}_D = 0.293 \pm 0.008$, $R^{\mathrm{SM}}_{D^*} = 0.257 \pm 0.003$

Moriond 2021

$R_K^{[1.1,6]} = 0.847(42)^{\mathrm{LHCb}}$ vs $R_K^{[1,6]} = 1.00(1)^{\mathrm{SM}}$

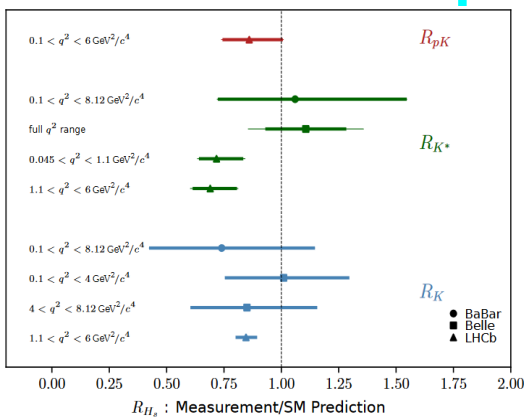
LHCb 2017

$R_{K^*}^{[1.1,6]} = 0.71(10)^{\mathrm{LHCb}}$ vs $R_{K^*}^{[1,6]} = 1.00(1)^{\mathrm{SM}}$

$R^{\exp}_{D^{(*)}} > R^{\mathrm{SM}}_{D^{(*)}} \Rightarrow \Lambda_{\mathrm{NP}} \lesssim 3$ TeV

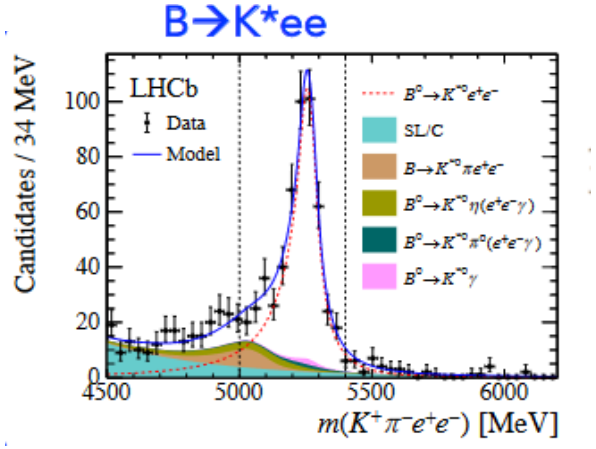
$R^{\exp}_{K^{(*)}} < R^{\mathrm{SM}}_{K^{(*)}} \Rightarrow \Lambda_{\mathrm{NP}} \lesssim 30$ TeV

naive NP scale



Physics analysis

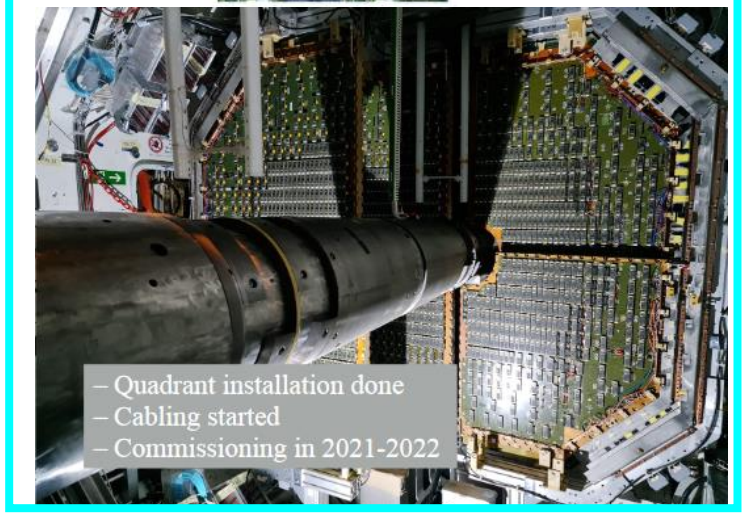
Rare decays : FCNC (LHCb)



Control of low pT electrons reconstruction in the LHC environment. World best precision on the photon polarisation in b→ s γ transitions using the B0→ K*ee

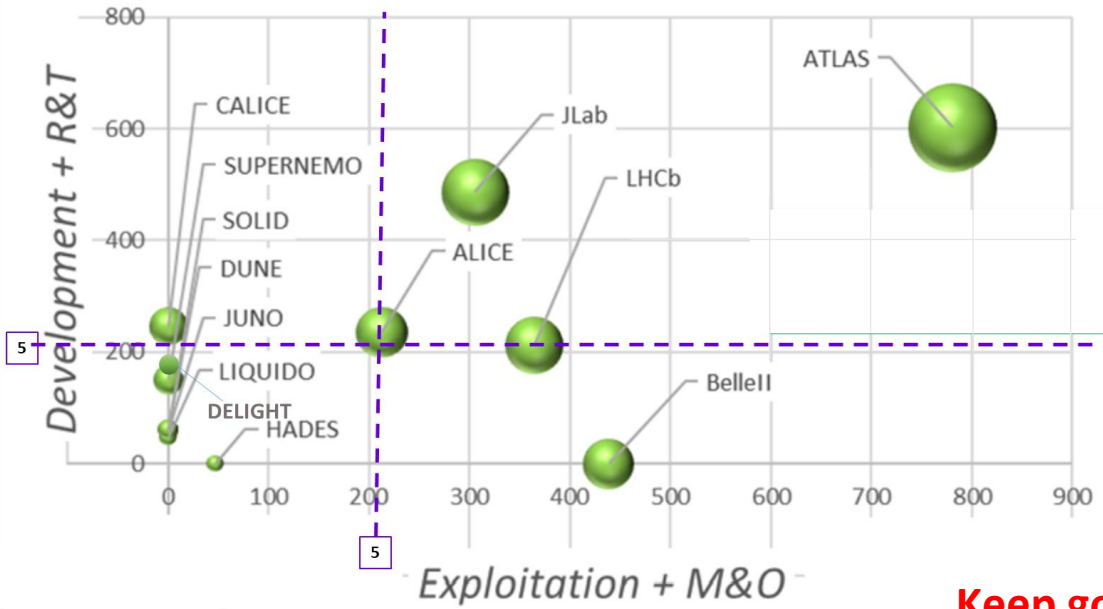
Technical realisation

Electronics for ALICE Muon spectrometer



Projects related to the research themes in HEP…

Number of weeks on the projects



~100 FTE (Full Time Equivalent) involved in these activities !

- ✓ Good balance (50%/50%) between exploitation of the ongoing experiments and programming the future.
- ✓ Strong involvement (~30 FTE) of technical personnel to conceive, build and maintain the detectors
- ✓ ~30 PhD students

Assure/Exploit the present
prepare the future

Keep going and invest for future, possible within IJCLab

- LHC upgrades (ATLAS, LHCb)
- Heavy Ions (synergy LHCb/ALICE)
- Increasing involvement in the upgrade of Belle II
- Positioning for the next colliders (Higgs factory : ILC, FCC)
- From JLab experiments -> EIC
- Strong involvement in neutrino physics, with priority for DUNE

Still many questions remained opened in Astroparticle and Cosmology …

1

- Detections of new Gravitational waves and new astronomy
- Multi-messenger astronomy : transient sky, acceleration mechanisms, dynamics of the violent Universe
- Origin of the elements / nuclear processes at work in astrophysical sites
- Fundamental tests of fundamental physics: (modified)Gravity, Lorentz Invariance.
- Model of Primordial Universe. Improving knowledge of cosmological parameters; CMB
- Search for (primordial) GW of inflation through CMB B modes
- Elucidating the Dark Energy
- Search for Dark Matter directly and indirectly : WIMPS, Dark Photons, Axions…
- Neutrino Physics : masses, sterile neutrinos, interactions
- Nature of neutrinos (Majorana or Dirac)

To answer these questions, many researches activities grouped in *research themes/projects*!

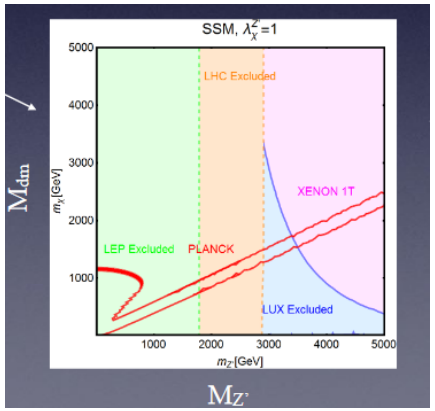
Cosmology | Astroparticles | Dark Matter | Neutrino

First 18 months of IJCLab : many important results (many others in Backup)

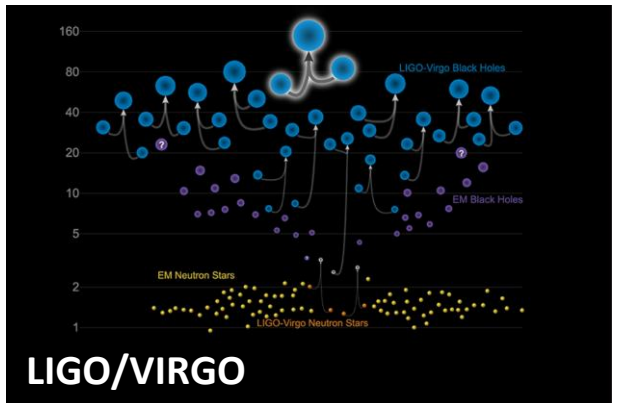
Selected examples

Theory

Dark Matter : WIMP Detection of dark matter with a multi wavelength approach



Physics analysis



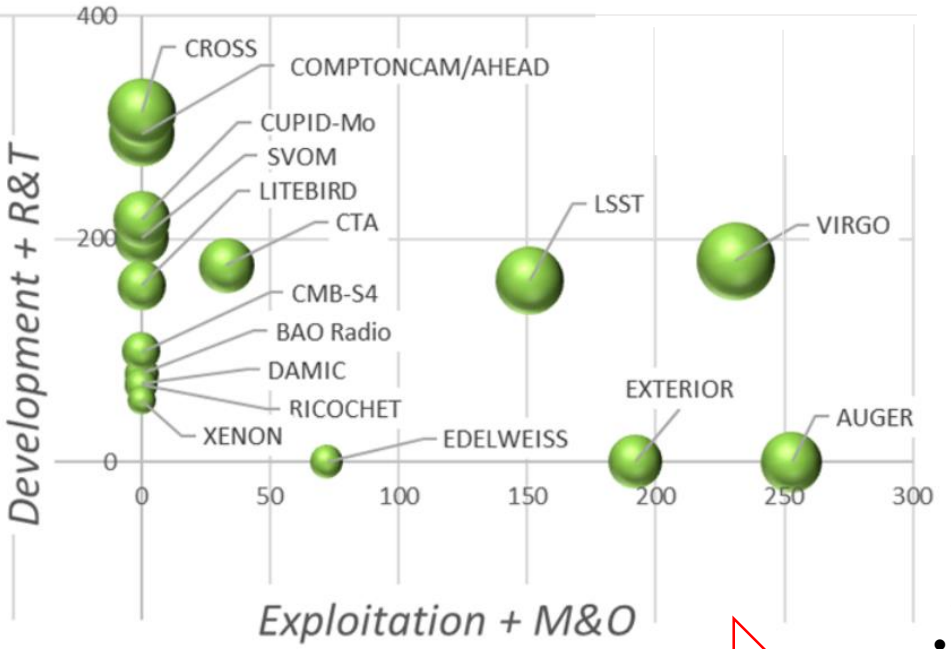
The masses of black holes detected by electromagnetic observations (purple), black holes measured by gravitational wave observations (blue), neutron stars measured by electromagnetic observations (yellow) and neutron stars detected by gravitational waves (orange).

Technical realisation

Hologram to allow the auxiliary telescope (AuxTel) of the Vera C.Rubin Observatory to measure more effectively the absorption of the atmosphere.

Projects related to the research themes in Astroparticles and Cosmo…

Number of weeks on the projects



Assure/Exploit the present

prepare the future

~70 FTE (Full Time Equivalent) involved in these activities !

- ✓ A lot of developments (30%/70%) between exploitation of the running experiments and programming the future.
- ✓ Strong involvement (~20 FTE) of technical personnel for conceiving, constructing and maintain the detectors
- ✓ ~25 PHD students

A lot of investments for future, possible within IJCLab

- From Virgo to Advanced Virgo / Einstein Telescope
- CMB: strong involvement in LiteBird
- Start of LSST
- Gamma Astronomy : COMCUBE
- Next steps in double beta decays : CUPID

Still many questions remained opened in Nuclear Physics…

- **Complexity of nuclear structure arise from the interaction among nucleons**
- **Limits on nuclear stability**
- **Heavy and Super Heavy Nuclei.**
- **Nucleosynthesis and origin of the elements in the universe.**
- **Properties of nuclei and strongly-interacting matter at high energies**

To answer these questions, many researches activities grouped in *research themes/projects* !

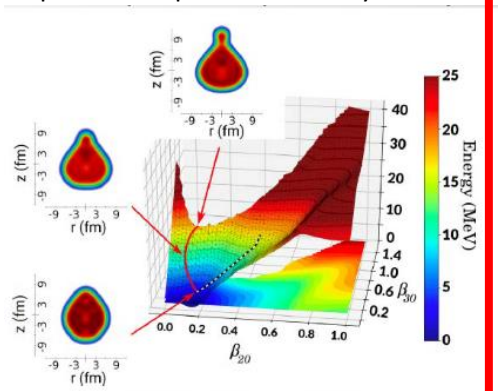
Nuclear Physics | Nuclear Astrophysics

First 18 months of IJCLab : many important results (many others in Backup)

Selected examples

Theory

Deformation energy surface for 104Te and paths for alpha radioactivity

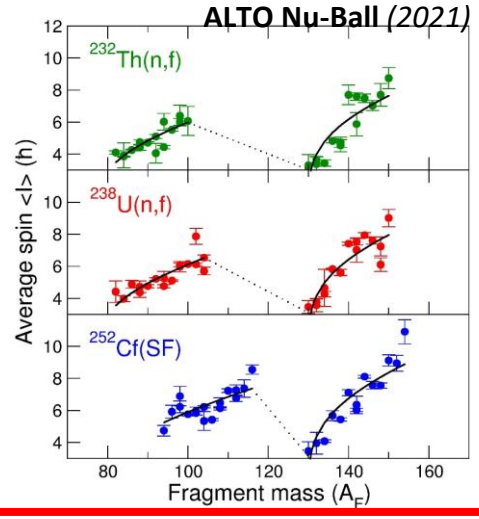


Physics analysis

Nature publication. And press release

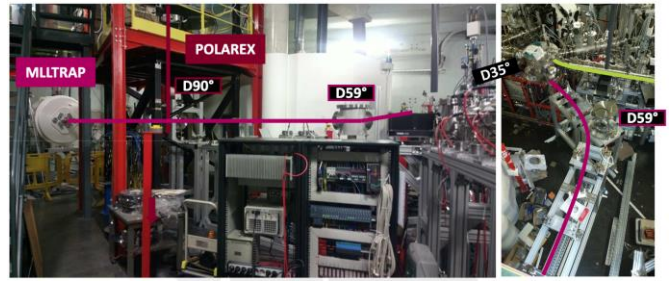
Angular momentum generation in nuclear fission. ν-Ball @ ALTO

ALTO Nu-Ball *(2021)*

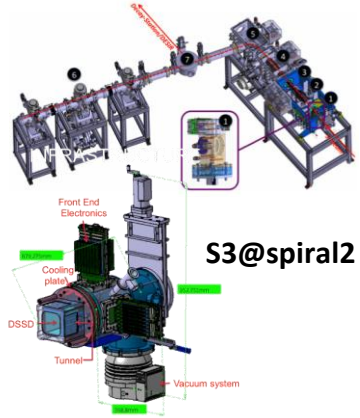


Technical realisation

ALTO-LEB facility

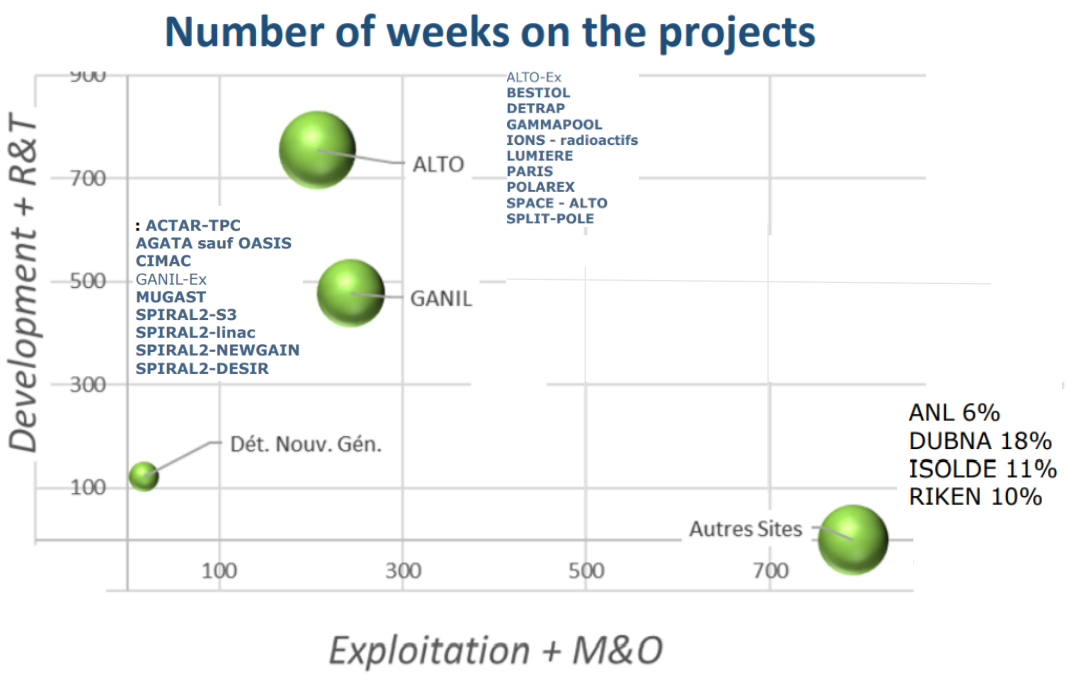


AGATA



S3@spiral2

Projects related to the research themes in Nuclear Physics…



~65 FTE (Full Time Equivalent) involved in these activities !

- ✓ Good balance (50%/50%) between exploitation of the running experiments and programming the future.
- ✓ Good balance among different sites :1/3 ALTO, 1/3 GANIL, 1/3 Other Sites
- ✓ Strong involvement (~15 FTE) of technical personnel for conceiving, constructing and maintain the detectors
- ✓ ~20 PhD students

Assure/Exploit the present
prepare the future

A lot of investments for future, possible within IJCLab

- ALTO national platform in synergy with GANIL
- Strongly participate to the GANIL/SPIRAL2 experiments and functioning
- From AGATA@GANIL -> AGATA@LNL
- Heavy/Very Heavy spectroscopy (ANL, Dubna,Jyväskylä..S3)
- First experiments electron-radioactive nuclei @ Perle@Orsay

Our vision is to drive discoveries by :

MISSION 2

playing a major role in the conception, design and construction of current and future accelerators.

- At the birth – creation of the Orsay Campus (IPN, LAL and CSNSM)
- Within IN2P3 – which coordinates all this in a national coherent framework

- At present with **IJClab** stronger in/for IN2P3 and at the heart of Paris-Saclay

Strongly contribute to ambitious, innovative, large-scale projects / worldwide accelerators

Accelerator : Researches, conception, construction

NEW@IJCLab

- Increase the **R&D activities** several **themes of research**. Some are still at the very beginning

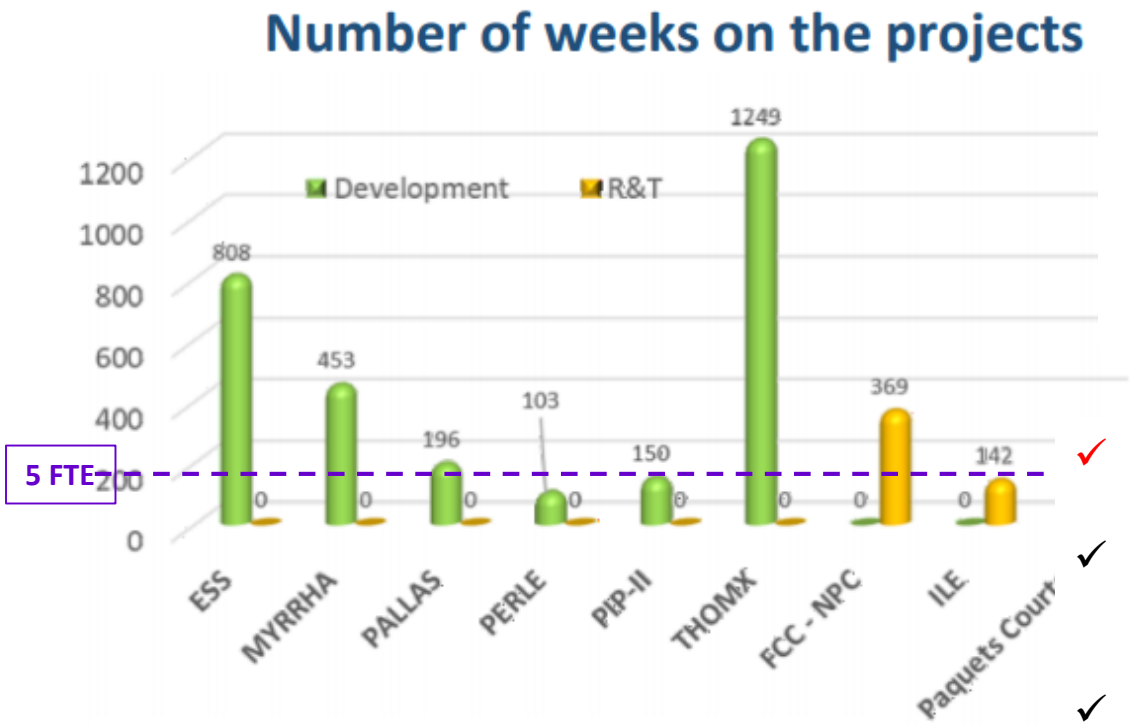
IELS (Innovative electron and light sources)	**LPAC (Laser Plasma Acceleration & high-energy Colliders)**
SCPL (Superconducting RF Cavities & High-Power Proton Linacs)	**SRHI (Stable & Radioactive Heavy-Ion production & acceleration:**

- Contribute to **worldwide machines** in one of our areas of excellence
  Now/future **: LHC** through material/vacuum, **ILC**, new implications on **FCC**, **PIPII** for DUNE, **PERLE@Orsay**
  Present/finishing **: ESS, Myrrha**

- Guarantee an efficient developing and operation of the **local accelerator facilities** of the new laboratory
  Important role in developing and supporting platforms and for some of them **to be associated to the researches**
  - **SCALP, ALTO, ANDROMEDE, Supratech**, «**Vacuum and Surfaces** »
  - demonstrators : **PALLAS/Laserix** for Laser Plasma Acceleration , **ThomX** X-ray source based on Compton effect

IRFU/CEA and IJCLab/IN2P3 are the driving forces in accelerator researches,
with possibility to go from conception to construction
Both laboratories are in Paris-Saclay
Strong links with industrials

Projects related to the research themes…



ThomX achievements: linac ready, Fabry-Perot cavity now installed, ASN authorization received !

Spoke cryomodules for **ESS:** Phase of validation and delivery @ Lund

- ✓ **~85 FTE (Full Time Equivalent) involved in these activities !**
- ✓ Strong involvement of research engineers in addition to physicists within the pole
- ✓ ~25 PHD students

- ➢ Ongoing/finishing effort (~60 FTE) for local demonstrator (ThomX) and European machines (ESS, Myrrha)
- ➢ Next year, important transition toward the new priorities : **CERN machine, PIP II, PALLAS, PERLE@Orsay**

Our vision is to drive discoveries by :

MISSION 3

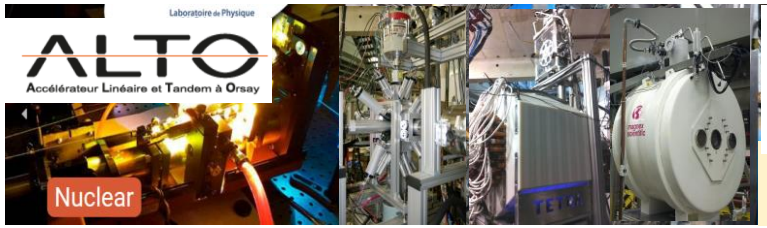
developing and operating research infrastructures and technological platforms supporting these research areas as well as original research in health physics and energy.

The ambition of our platforms is international aiming at a new equilibrium between fundamental and technological researches and opening to society.

A particular role of the platforms concerns some research themes on

- *Energy & Environment*
- *Health Physics (**IMNC -> IJCLab**).* ***Close link of this component with the Université de Paris***

The Platforms @IJCLab



- **15 MV Tandem** (from proton to aggregates)
- **electron linac** -> radioactive beams by photofission

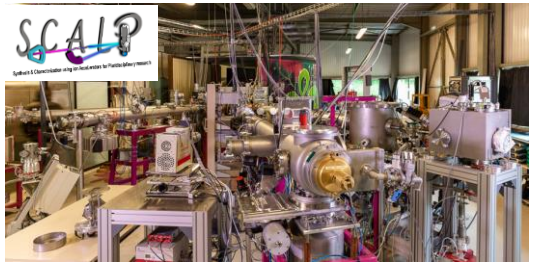
Nuclear, Health physics, Irradiation

Opened to externals

Several MeV protons, multicharged atomic ions, gold molecules and nanoparticles

Nuclear/A2C, Health physics, Irradiation

Opened to externals



Ion irradiation / implantation and *in situ* characterization techniques (TEM, IBA)

Energy, nuclear materials, Health physics, Irradiation physics and chemistry

Opened to externals

The Platforms @ IJCLab

Captinnov : Silicon Detector Caractérisation/Production

VIRTUAL DATA
Advanced computing resources infrastructure
Grid / Cloud

Health research themes

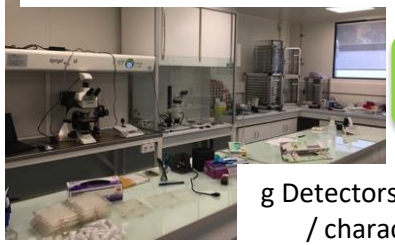
PIMPA
Plateforme d'imagerie Multiphotonique du Petit Animal

non linear optical biphotonique imaging

A2C Research themes

CALVA

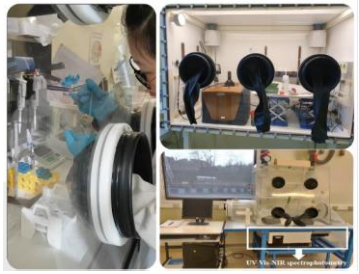
Micrometeorite Preparation/analysis



Myrtho

g Detectors development / characterization

Radiochemistry laboratory
Actinides - Bat 107

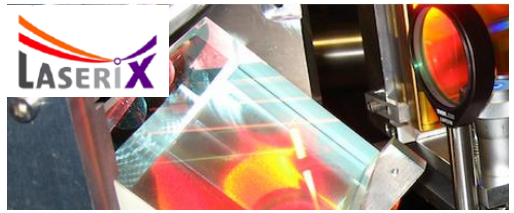


Accelerators research themes/technologies

Opening to Materials, atomic physics, detectors

SUPRATECH

R&D on the superconducting cavities (prepare, package, assemble & testof the superconducting RF cavities).



LaseriX

coherent, intense, brief (50fs to 10 ps) **sources in near-infrared** (800nm) **and EUV** (30 to 90 eV)

Vide et Surfaces

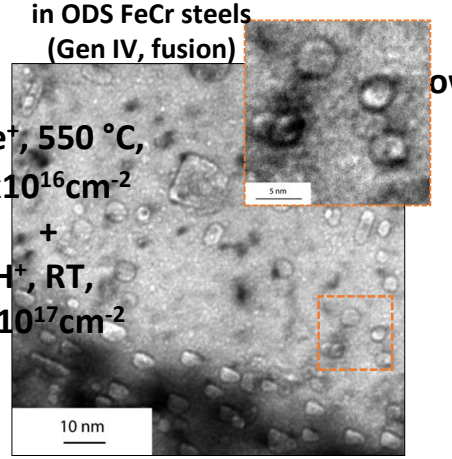
In construction

An exemple of research themes on Health Physics and Energy

SCALP

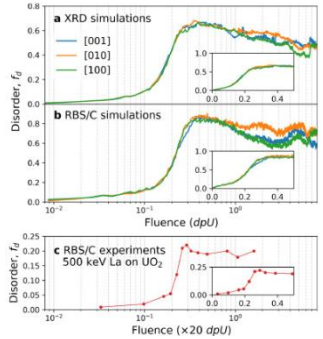
Materials and Irradiation

He + H accumulation in ODS FeCr steels (Gen IV, fusion)



He^+, 550 °C, $1x10^{16}cm^{-2}$ + H^+, RT, $1x10^{17}cm^{-2}$

Modelling the nuclear fuel towards ATF (Accident Tolerant Fuels)

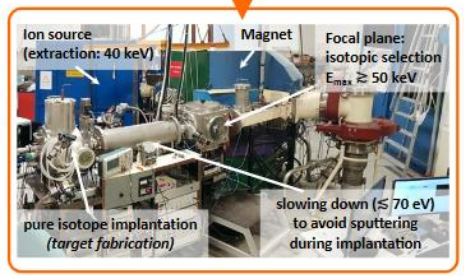


- Simulation of radiation effects: defects, impurities
- Atomic-scale modelling and comparison with data of irradiated UO_2 single crystals

These research themes are benefitting of the unique environment -platforms and wide range of technical skills- in IJCLab allowing new/ambitious instrumental and large scale projects

PRISM on SIDONIE/SCALP. Production of stable isotopes for Radioisotopes.

$^{nat}Gd \xrightarrow{\text{Sidonie}} {}^{155}Gd \xrightarrow{\text{ARRONAX}} (p,n)^{155}Tb$ ← Need for **iso** contaminants



FIRST RESULTS

Measured isotopic purity at the focal plane of SIDONIE:

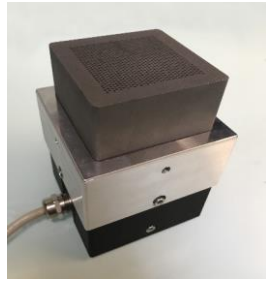
$9.6 \pm 80.10^{-5} < {}^{157}Gd/{}^{158}Gd < 4.7 \pm 0.5.10^{-4}$

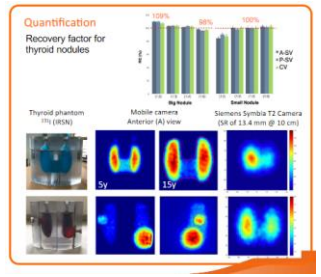
Gd isotopes at the focal plan

Target production

^{155}Gd (3.10^{18} at/cm²)

Thidos. Internal Dosimetry. Prototype of a gamma-camera dedicated to vectorized therapy (monitoring of thyroid treatment)





MISSION 4

Promoting the development of new technologies for science for the benefit of society and thus supporting national and European industrial competitiveness.

Often are a long term benefits. Difficult to calculate. Several « spectacular » example in the past.

- we are engaged to transfer quicker our knowledge and out know-out to society.
- We are engaged to involve industries in our technological developments and to transfer the know-out
- We want to have more industrials in the laboratory , using facilities and with common labs

Recent example :

- Prematuration programs (IMOP and DosiMoems) and **Start-up development (Beams)** on Health pole
- Gamma detectors (Astro gamma) used for localization/characterization of radioactive waste -**SYSTEL Eléctronique SAS, THEORIS SAS**
- **SPACE-ALTO** Project (IdF) to open ALTO to industrial irradiations (many interested users)
- Picosecond electronics developed for HEP (**Caen**)
- Interest of industry for Opaque Scintillator for Nuclear dismantling purposes (**EDF**)
- Co-development on lasers with **Amplitude,** Fastlite
- Know-how transfer on supraconductor cryomodules assembly with **CNIM** (in progress)
- Spin-off of the lab: **ACS**
- Multiple collaborations with **Thales** (Thesis, R&D couplers, co-development of modulator for klystron...)

Our vision is to drive discoveries by :

MISSION 5

Welcoming students that the laboratory trains through and for research in the heart of a world-class academic environment.

Many of IJCLab's actions are guided by the ambition to play a central role in the Paris-Saclay University under construction, with the intensification of teaching, training and knowledge diffusion activities.

IJCLab must be a "student place" in symbiosis with its university environment.

IJCLab a student place : Attractiveness based upon education / research

5

The strength and the specificity of our Masters (Bachelors) at the University are based on the close links with the associated laboratories and their excellence.

60 Researchers-Teachers and several Researches-CNRS are involved in University teaching.

We have also important responsibilities : L1/L2, L3 (Licence Fondamentale), M1 General Physics, M2 NPAC, Grand Instrument, ICFP, , M1 and M2 Nuclear Energy…)

Research Installations/ Platforms -> Educational platforms

Some Platforms are already used for educational purposes (SCALP, LaseriX, ALTO…). Other will be opened soon with lines for exclusive pedagogical purposes.

Technical teachings

We are implied in technical teaching (Computer labworks at different levels, L3, M1, M2…)

Apprentices (“apprentis”) to technical services

The present experiences are very positive and strong interest in extending the program.

IJCLab a student place : Attractiveness based upon education / research

Internships for students

Internships: the gateway for students to discover research

Internships at different level (from L1 to M2 and international.) :

133 internships in 2020 corresponding to approximatively ~600 months

important effort from the lab to welcome many students particularly affected by the Covid crisis

Thesis

PhD Training by research and for research

~130 PhD students in the ensemble of the laboratories (from 30 different nationalities)

We are also increasing the number of technical theses

International /national Schools

Participation and creation of international/national schools

Participation and creation of international/national schools participate to the dissemination of our disciplines, give an help to some countries to participate and join our disciplines, and participate to our attractiveness : School : ***WISHEPP (Palestine), TESHEP, QCD, School at*** *L3 level… IJCLab leads* ***Erasmus+ MIC Colombia / Georgia / Ukraine / Palestine and Erasmus Mundus Lascala***

In conclusions…

- Contributing to projects at all stages: proposal, design, construction, operation, data analysis, theory
- Playing a major role in the conception, design and construction of current and future accelerators.
- Developing and operating research infrastructures and technological platforms supporting these research areas as well as original research in health physics and energy
- Promoting the development of new technologies for science for the benefit of society and thus supporting national and European industrial competitiveness
- Welcoming students that the laboratory trains through and for research in the heart of a world-class academic environment.