



NUCLÉAIRE
& PARTICULES

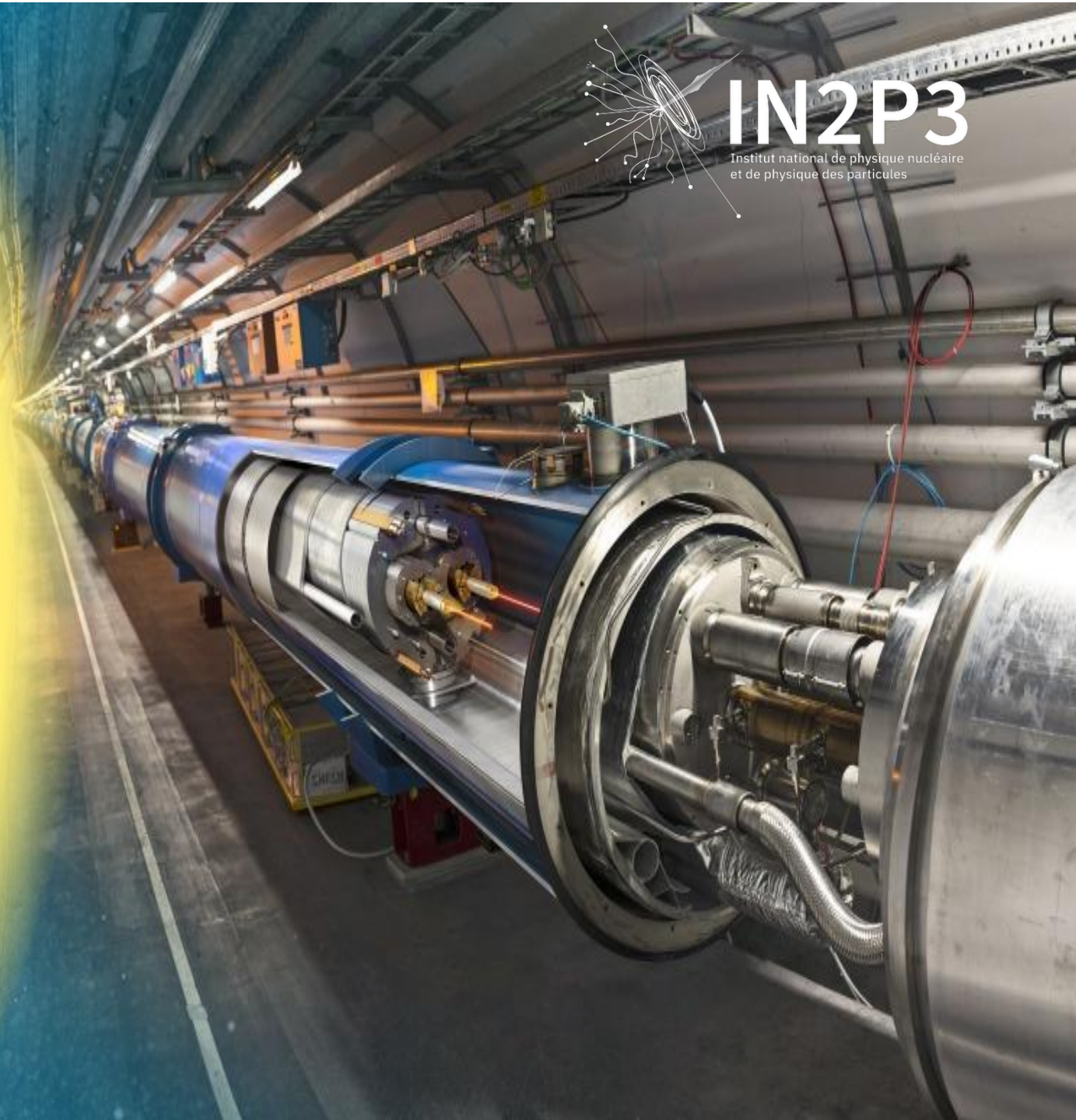


IN2P3
Institut national de physique nucléaire
et de physique des particules

IN2P3 and FJPPN-FKPPN

FJPPN-FKPPN Workshop
MAY-2026

Amaud Lucotte
Scientific Director for Accelerators and Technology



IN2P3 : organization &
our collaboration with Japan

IN2P3 : a national Mission within CNRS

Mission : nationally coordinate research in
nuclear physics, particle physics & astroparticle physics

COORDINATES
national research
programs and French
participations in major
infrastructures

OPERATES
research units, mostly in
partnership with universities
and/or research
organizations

EXPLORES
the physics of the two
infinities : from elementary
particles to cosmology

Links with society :

DEVELOPS
associated technologies,
applications and interdisciplinary
research

PROVIDES
expertise, teaching, training

IN2P3

National Mission w/i CNRS
Ministerial Decree / 1971



IN2P3 : Research Fields

Particle Physics

Standard Model and beyond
Flavour and CP violation in quark sector
Precision tests of fundamental interactions

Hadronic & Nuclear Physics

Properties of matter in strong interaction
Nucleon structure
Atomic nuclei at the stability limit
Nuclear astrophysics

Astroparticle & Cosmology

Properties of dark energy
Inflation and CMB
Origin of high energy gamma & cosmics
Gravitational Waves

Neutrinos and Dark Matter

Origin, nature, mass and neutrino mixing
Direct detection of dark matter

Accelerators and Technologie

Proton and electron high-power LINAC
Heavy ion production & acceleration
Lepton Collider
Laser plasma acceleration & light sources
Innovative detectors & technologies

Nuclear for society

Upstream science for nuclear fission
Health and environment

Computing & Data

Data Science & computing
Infrastructures & Architecture for computing

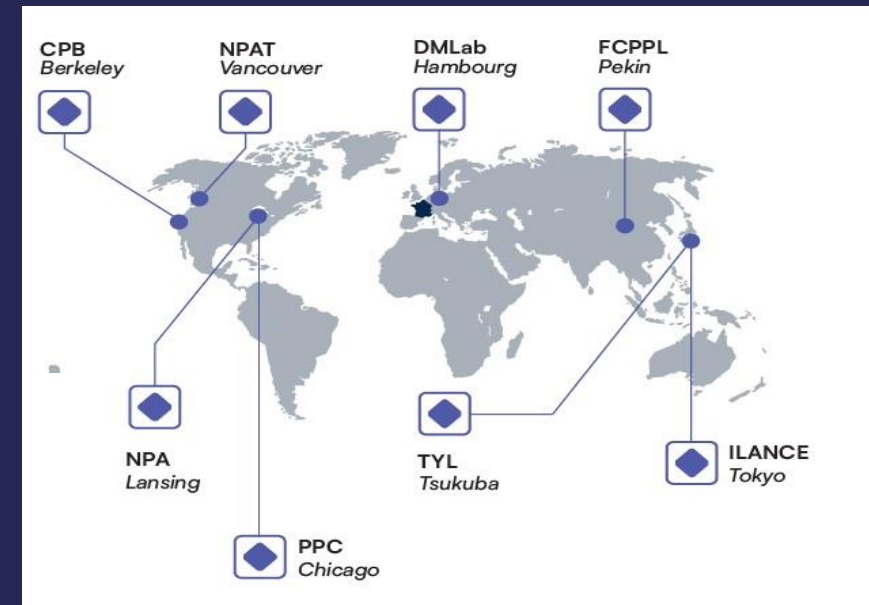
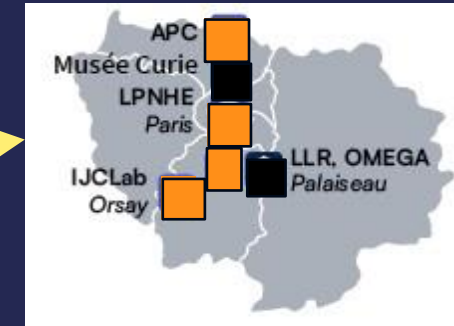
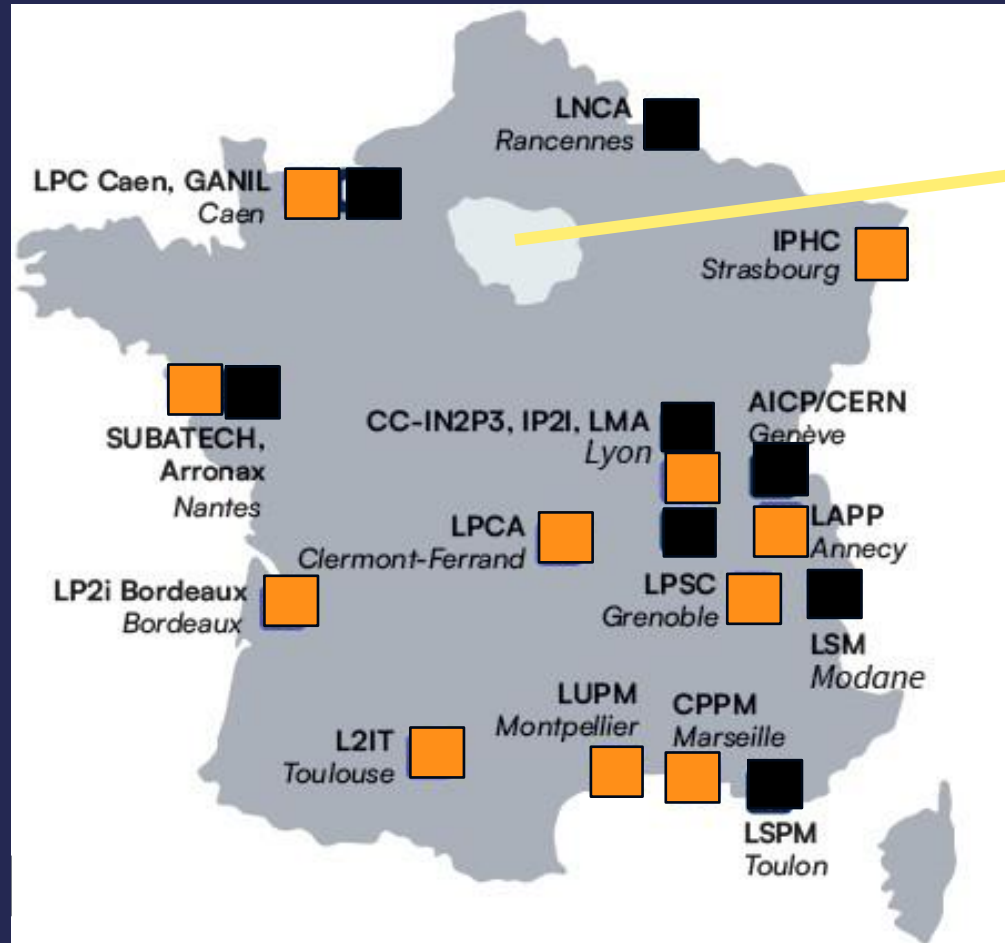
IN2P3

Research Fields

Personnels per Fields

| | |
|-----------------|---------|
| Particle | 370 FTE |
| Nuclear | 260 FTE |
| Astro-Cosmo | 400 FTE |
| Neutrino & DM | 250 FTE |
| Accelerator & T | 150 FTE |
| Computing | 110 FTE |
| Society | 50 FTE |

IN2P3 : Laboratories in France and abroad



- CNRS-University Joint Research Unit
- Infrastructure & national platform

IN2P3 Laboratories & infrastructures

Infrastructures :
 15 Laboratories
 9 national infrastructures
 8 International Laboratories

Annual Budget :
 210 M€ (salaries)
 90 M€ (projects)
 Incl 20 M€ large infras.

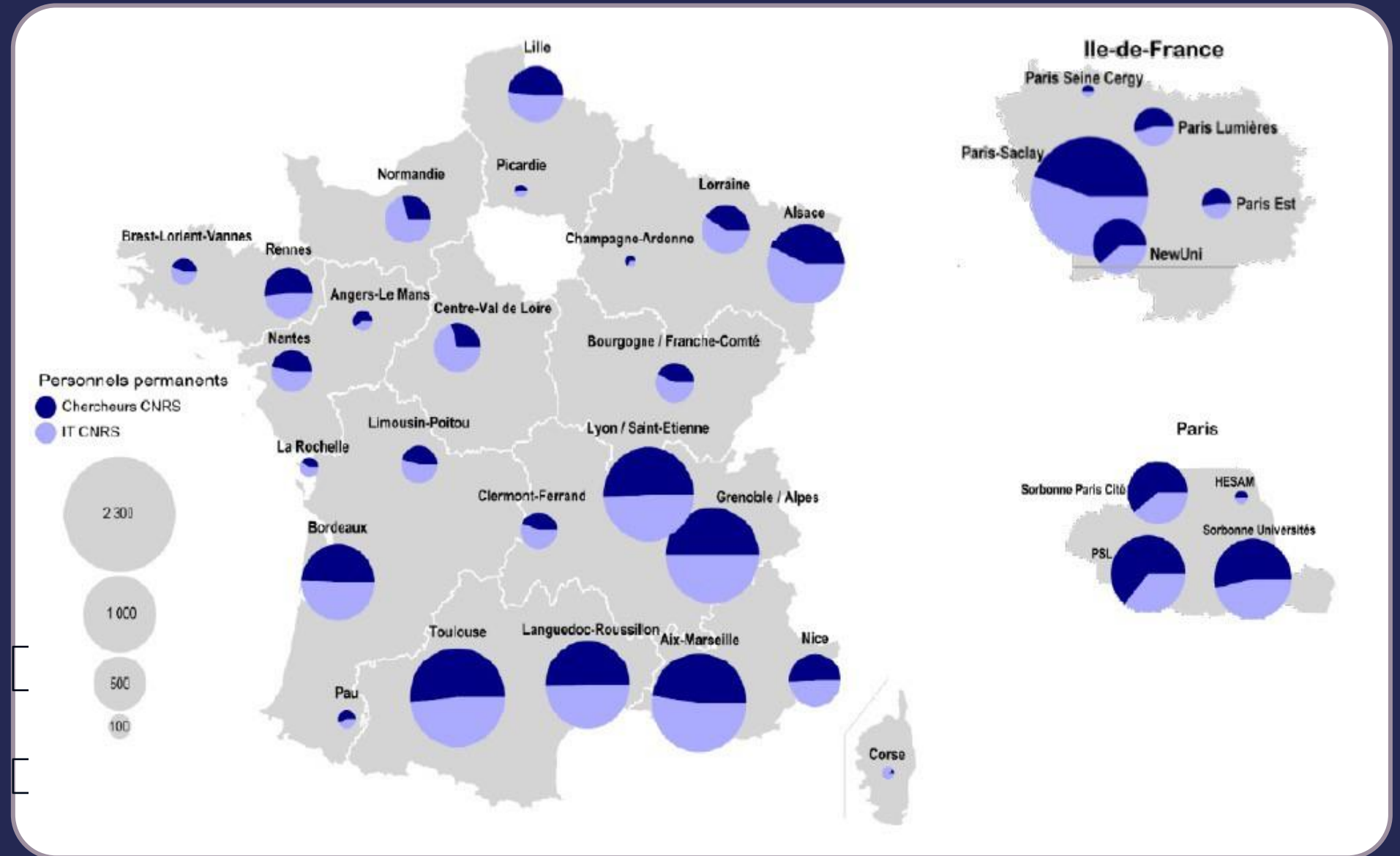
IN2P3 : Laboratories in France and abroad

IN2P3

Laboratories & infrastructures

2900 permanent staff :
1200 researchers/faculty
1700 engineers/technicians

Fixed-Term contracts :
300 postdocs
550 PhD's

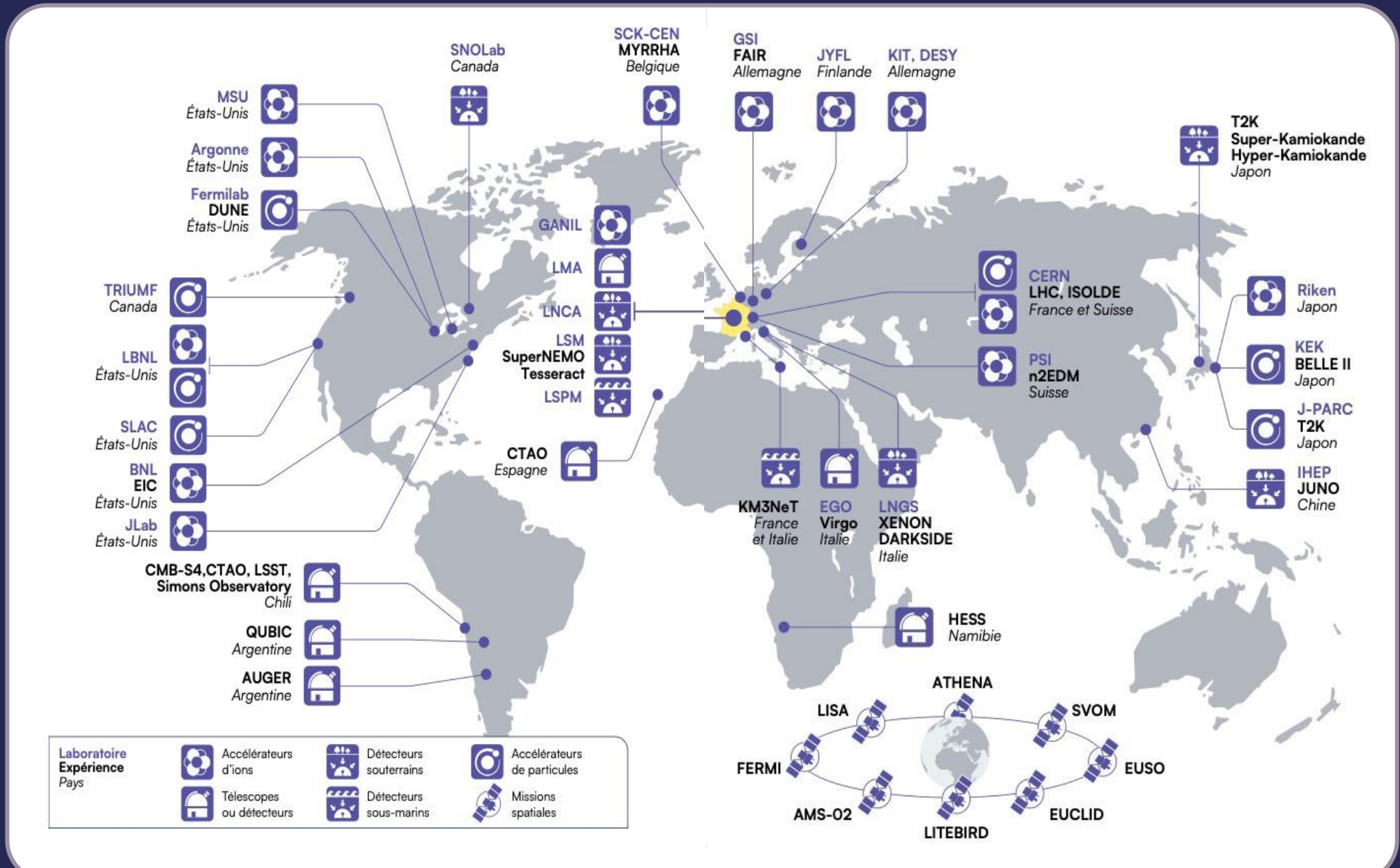
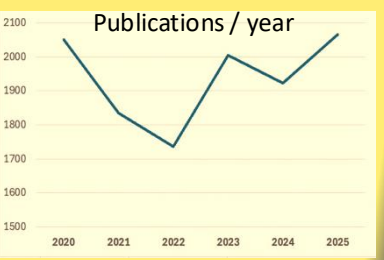


IN2P3 : International Research Programs

IN2P3 Research Programs

40 International Large Projects
all continents
earth – space

Publications
2 000 publications yearly
85% of co-publications
top-5 : USA, Ger, Italy, UK



Toshiko Yuasa Lab – International Research Laboratory

TYL Laboratory (since 2023)

- ❖ Located in KEK (Tsukuba) premises
- ❖ Directors : K. Trabelsi (-> Cristina Carloganu), S. Hashimoto
- ❖ Joint Lab between IN2P3 (CNRS) and KEK

TYL Mission

- ❖ Structuring collaboration in large international projects
- ❖ Promoting new projects between KEK and IN2P3 labs
- ❖ Hosting visiting scientists for long stays at KEK and favor exchanges
- ❖ Liaison with IN2P3 & CNRS Office for NE Asia (Bruno LePioufle)

Research Program Fields

- ❖ Intensity Frontier
- ❖ Energy Frontier
- ❖ Cosmic Frontier
- ❖ Detector R&D
- ❖ Accelerator R&D, Etc...

*Being re-structured
with new direction*



ILANCE – International Research Laboratory

ILANCE Laboratory (*since 2021*)

- ❖ Located in Kashiwa Campus (Tsukuba) premises
- ❖ Directors : Michel GONIN, Takaaki Kajita
- ❖ Joint lab between IN2P3 (CNRS) and U. Tokyo (ICRR, Kavli IPMU, ICEPP)



ILANCE Mission

- ❖ Structuring collaboration in large international projects
- ❖ Promoting new projects between Univ Tokyo and IN2P3 laboratories
- ❖ Hosting visiting scientists for long stays at Tokyo and favor exchanges
- ❖ Liaison with IN2P3 & CNRS Office for NE Asia (Bruno LePioufle)



Research Program Fields

- ❖ Primordial Universe
- ❖ Dark Universe
- ❖ Neutrinos
- ❖ Gravitational Waves
- ❖ High Energy Astrophysics
- ❖ Particle Physics and Detectors



ILANCE

International Research Lab

FJPPN and FKPPN – International Research Networks

FJ/KPPN
International Research Networks

FJPP and FKPP Networks Mission

- ❖ Succeed the FJ/KPPL established in 2006(8), later transformed into IRN to expand collaborations
- ❖ Strengthen scientific exchanges, and facilitate mobility and training for early-career researchers
e.g. Young Researcher Prizes & Toshiko Yuasa Medal, masterclasses like the Rikejo Camp, ...
- ❖ Foster a collaborative scientific community between France and Japan with TYL and ILANCE
while preparing joint applications for European and international calls for projects.

FJPP and FKPP Networks : a central role for the IRL's

- ❖ Foster and structure collaboration by promoting and supporting *new projects and initiatives*
- ❖ Prepare the *integration of mature activities* into both partner's project organizations in a multi-year framework
- ❖ Structure the *research program developed by IRL's*, allowing access to calls eg. ANR, KAKENHI, ERC...

Major Scientific Projects in both Networks (among others...)

- ❖ Belle II, ATLAS, COMET
- ❖ T2K, HK,...
- ❖ Accelerator R&D's at ATF2 and SuperKEKB
- ❖ LiteBird cosmology with CMB
- ❖ Instrumentation R&D: Development of detectors (calorimetry) and sensors
- ❖ Etc....

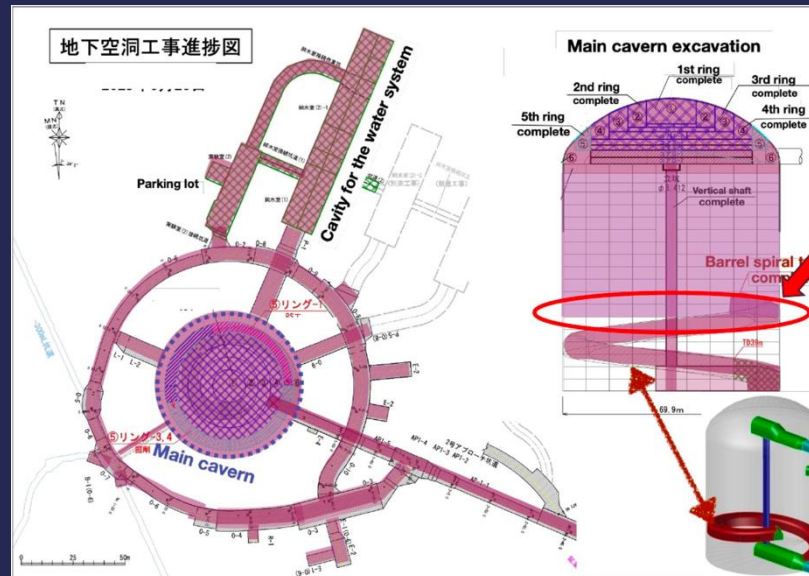
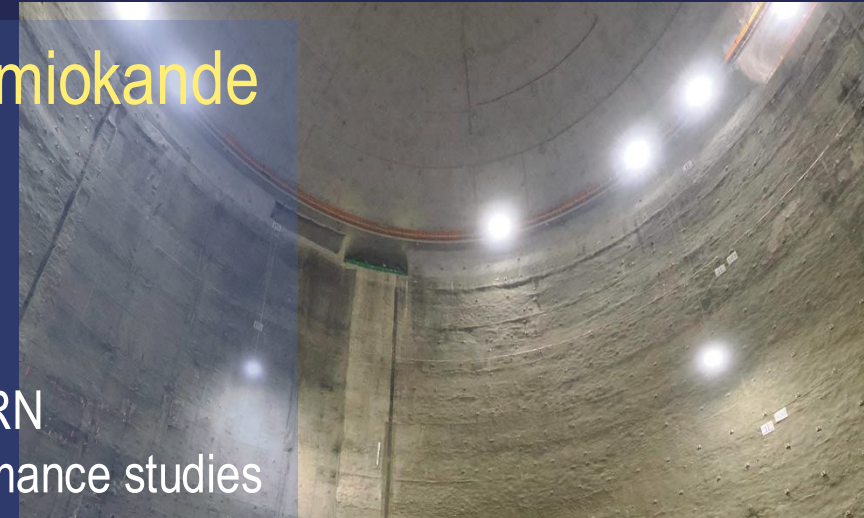
IN2P3 : some Highlights in
the past year...

Hyper-Kamiokande

HyperK
Neutrinos Physics

2025 : Excavation completed in Hyper-Kamiokande

- ❖ Site excavation completed, installation underway
→ Data-taking expected to start in 2028
- IN2P3 contributions to HK well advanced:
 - ❖ Clock generation/distribution system
 - ❖ PMT electronic characterization benches set up at CERN
 - ❖ Development of algorithms, reconstruction, and performance studies

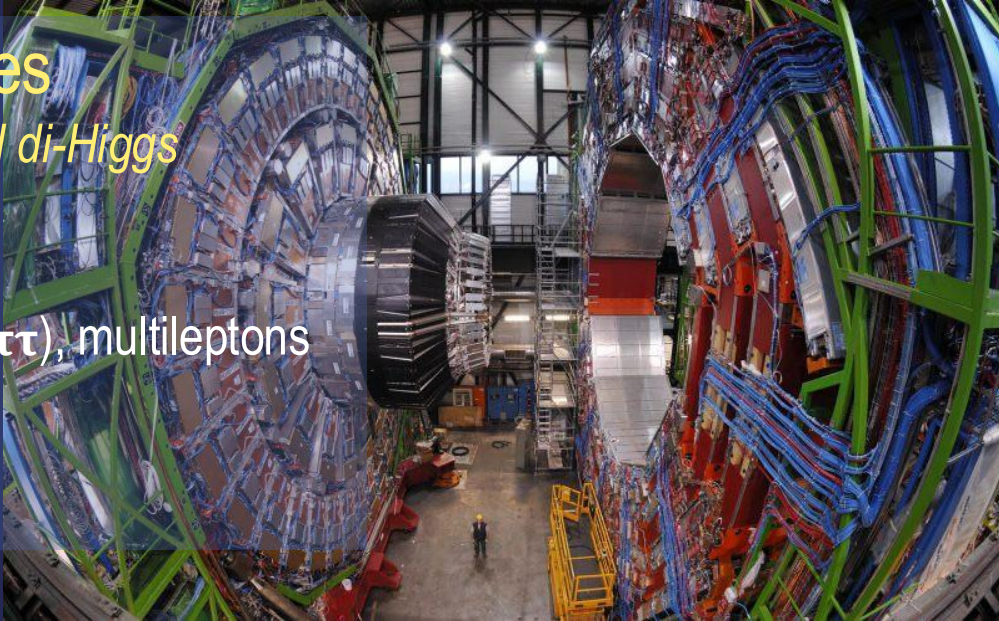


LHC and ATLAS & CMS

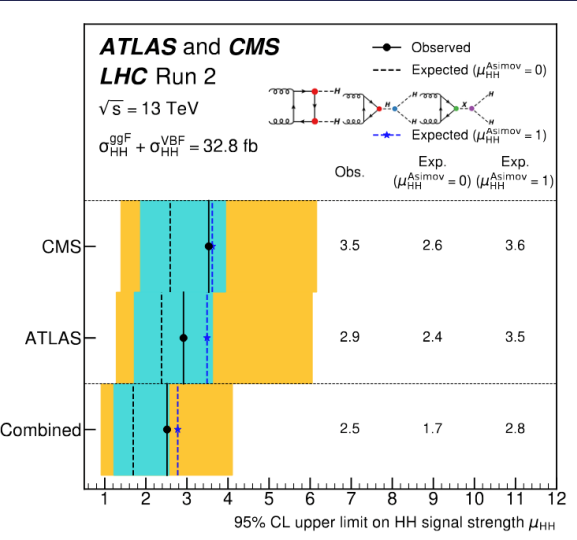
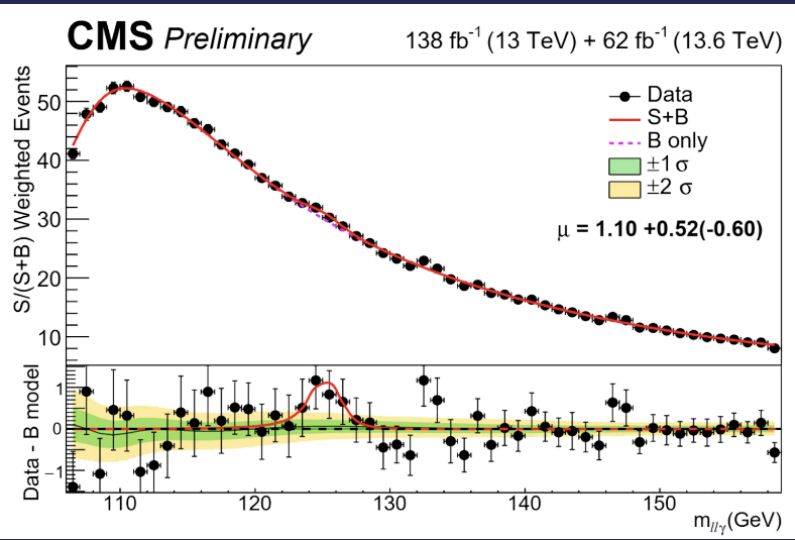
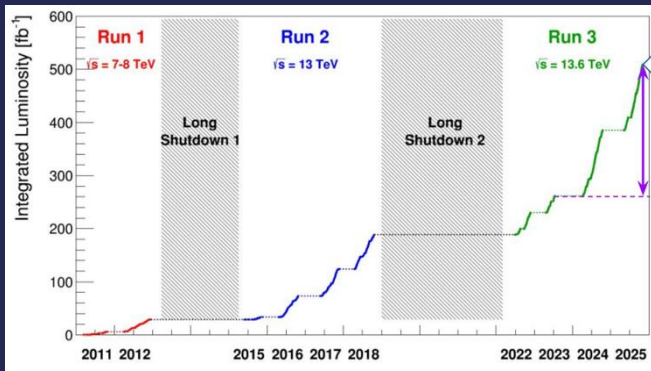
2025: Sensitivity in rare Higgs processes

Improve sensitivity in rare desintegration in $H \rightarrow Z\gamma$ and di-Higgs

- ❖ First sensitivity to rare decay $H \rightarrow Z\gamma$ at $1,9\sigma$
Progress on $H \rightarrow cc$ and $H \rightarrow \mu\mu$
- ❖ Sensitivity to Di-Higgs : combinaison of $bb+(bb, \chi\chi, \tau\tau)$, multileptons
 $\rightarrow 2,5 \times SM$ expectations
- ❖ Observation expected at the end HL-LHC !



LHC
Neutrinos Physics



February 2025: detection of highest energy neutrino @ KM3NeT

announces the detection of the highest-energy neutrino ever observed

- ❖ A neutrino 30 times more energetic than any previously detected worldwide
- ❖ Energy of 220 PeV ($\times 36$)
- ❖ Detected by KM3NeT/ARCA off the coast of Sicily
- ❖ Towards identifying the most likely source

KM3Net

Neutrinos Physics



European Spallation Source ESS

May 2025: First beam accelerated in ESS

In the superconducting linac of the European Spallation Source @ Lund

- ❖ Design, fabrication, validation, and installation of 13 Spoke accelerator cryomodules
- ❖ Design, fabrication and implementation of the Cryogenic Distribution System
- ❖ First proton beam accelerated on May 16, 2025, across the entire ESS accelerator, up to 800 MeV
- ❖ Global recognition of our accelerator expertise @ IJCLab



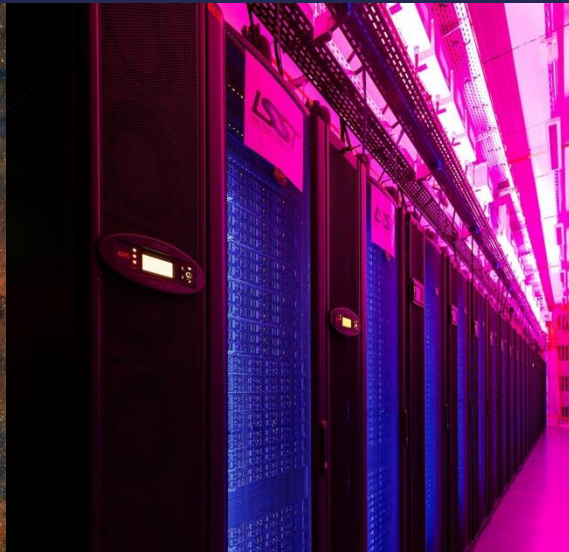
ESS-Spoke
Accelerator Physics



Vera Rubin Observatory / LSST

June 2025: First images at the LSST camera

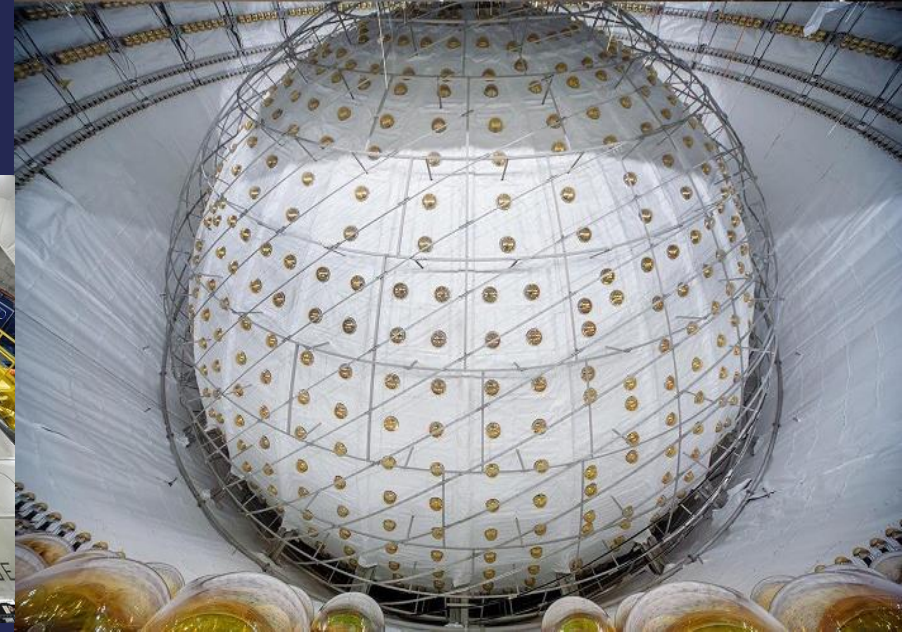
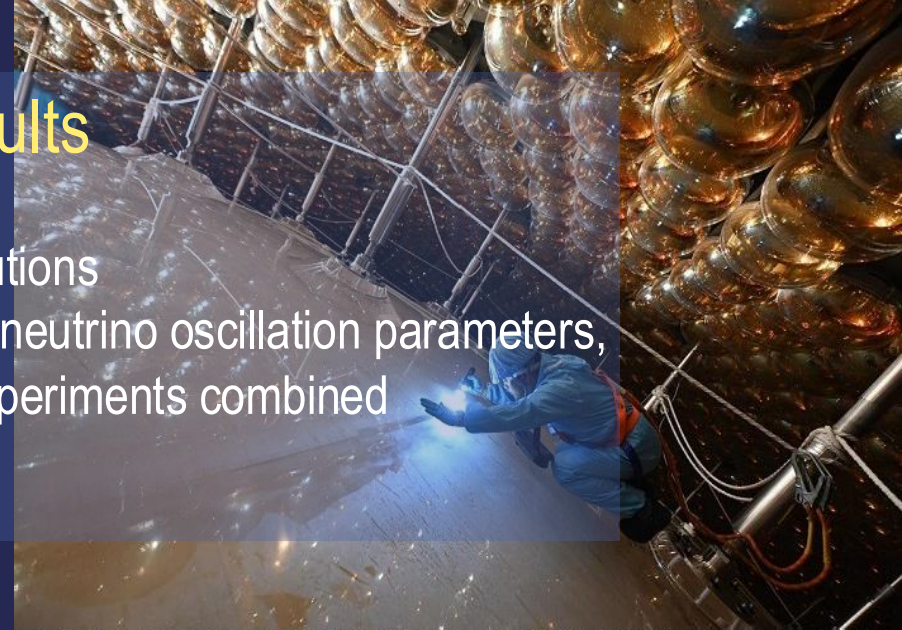
- ❖ Vera C. Rubin Observatory (Chile): start of a 10-year survey of the southern sky with unprecedented depth and detail
- ❖ Dark matter, dark energy, distant objects in the Universe
- ❖ LSST: the world's largest wide-field optical camera, installed at the telescope's focus
- ❖ From instrumentation to data processing (FINK) and management



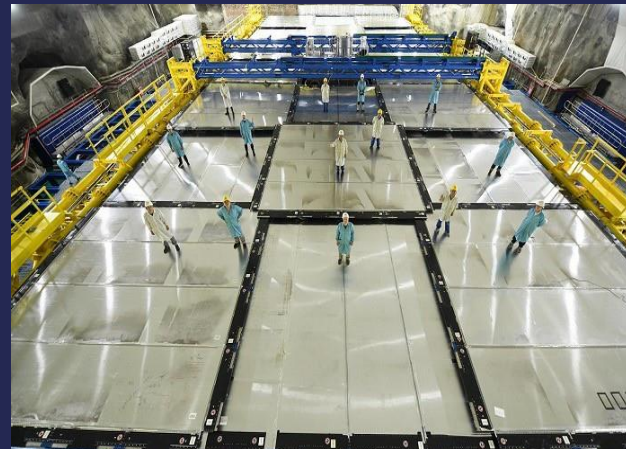
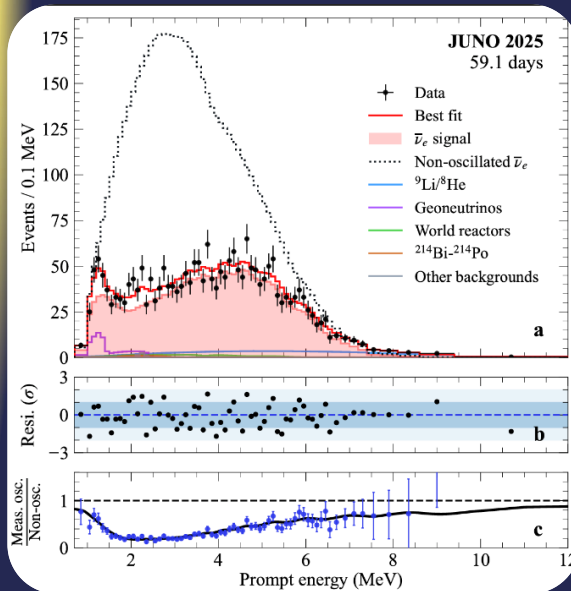
VRO-LSST
Cosmology – large survey

November 2025: JUNO delivers its first results

- ❖ Instrumental, algorithmic, software, and analysis contributions
- ❖ After 2 months of data collection, JUNO measured solar neutrino oscillation parameters, θ_{12} and Δm^2_{21} , with $1.6\times$ the precision of all previous experiments combined
- ❖ Neutrino 2026 Conference (June, Irvine, CA)



JUNO
Neutrinos Physics



Nov-2025 : Demonstrator of a high intensity Inverse Compton X-source for a compact X-source (IJCLab)

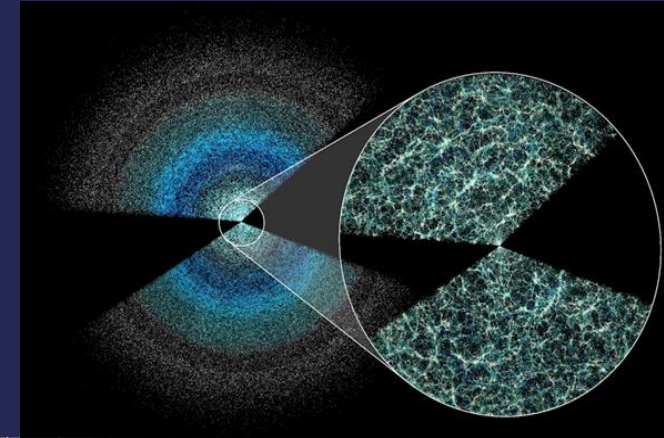
- ❖ Compact equipments area : 100 m²
e-accelerated and stored in a 18-m ring
laser pulse accumulated in Fabry-Perrot cavity
- ❖ Electron bunch : 50-70 MeV, 1 nC
- ❖ Laser pulse : 1030 nm, 21 mJ,
- ❖ Cavity amplification : 70 W → 700 kW (x10,000)
- ❖ Beam crossing : every 60 ns with 2° angle

Achieved flux
of 10^{10} X-ray/s



March 2026: DESI's five-year galaxy survey *with unmatched precision*

- ❖ Influence of dark energy on the expansion of the Universe
- ❖ Could dark energy vary over time ?
- ❖ Observation of over 47 million galaxies and quasars, as well as over 20 million nearby stars
- ❖ Largest ever high-resolution 3D map of the Universe spanning 11 billion years



DESI

Cosmology – large survey

