cnrs NUCLÉAIRE & PARTICULES

2024 FJPPN & FKPPN Workshop

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Introduction

Welcome to this new edition of the workshop at KISTI !

Building on the success of previous years : 2023 Tokyo @ Ochanomizu University :

Looking forward to very interesting talks and lively discussions !

The new FJPPN and FKPPN International Research Networks

FJPPL & FKPPN : success stories since 2006 and 2008

Very fruitful collaborations, seeding larger cross-participations in several projects

Structures adapted last year to follow evolution of CNRS international tools :

- 2 structures replaced TYL/FJPPL
  - a network : **FJPPN International Research Network**
    - *network with many partners/institutions*
    - *funding of collaborative research projects*
  - a lab : TYL International Research Laboratory
    - *see later*

- FKPPL became :
  - a network : **FKPPN International Research Network**
    - *network with many partners/institutions*
    - *funding of collaborative research projects*

IN2P3 : a national institute of CNRS

Mission : to coordinate research in nuclear physics, particle physics, and 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

A new Director for IN2P3 :

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Reynald PAIN

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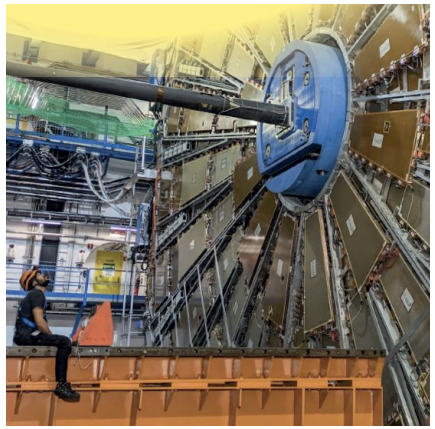
Christelle ROY

IN2P3
Institut national de physique nucléaire
et de physique des particules

Areas of research

- Particle & Hadronic Physics
- Nuclear Physics
- Astroparticle Physics & Cosmology

- Nuclear Science for Society
- Accelerators, Detectors, Technology
- Computing & Data

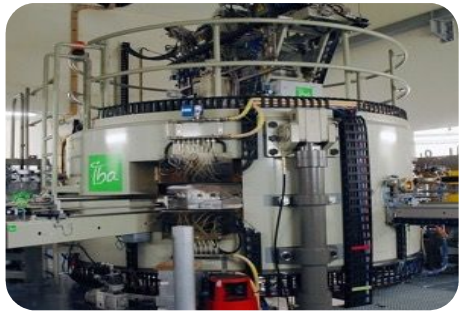





Highlight : nuclear science for society (health, energy, environment)

Health

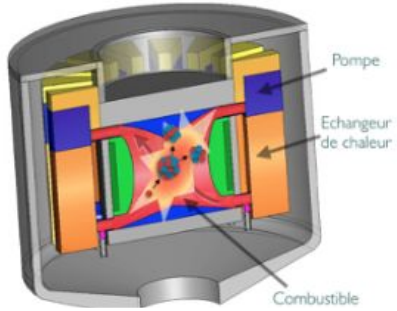
- New radiation modalities for internal and external radiotherapy: + efficacy, - toxicity
- Innovative (bio)medical imaging: + sensitive, + fast, - patient dose
- Biological effects of ionizing radiation (experimental radiobiology, simulation): towards a mechanistic understanding of effects
- Production of new radioisotopes: towards personalized medicine (diagnosis & therapy)



ARRONAX / Subatech

Energy

- Future nuclear energy and its impact on resources, waste and costs: from nuclear data & new reactor systems to electronuclear scenarios
- Nuclear materials and fuel cycle: understanding the behavior of current and future nuclear materials, including long-term waste storage
- Interactions of ionizing radiation in the cosmic environment: understanding the formation of the solar system and the emergence of life



« Molten Salt Fast Reactor » concept. / LPSC

Environment

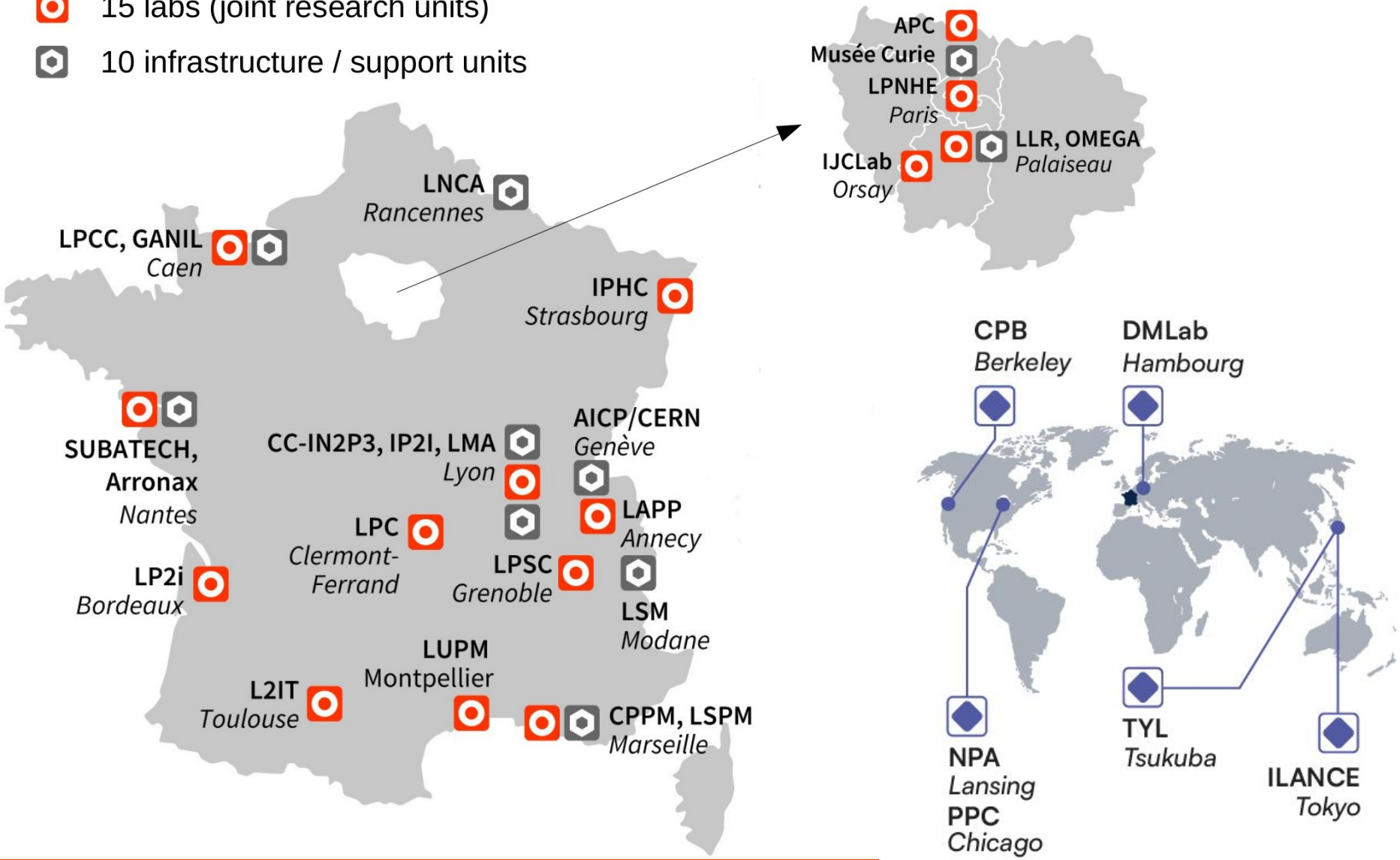
- The Earth system: multi-scale (Ocean - Earth - Atmosphere) and multi-disciplinary (geology, archaeology, etc.) exploration and monitoring
- Radioactivity in the environment: behavior and impact on ecosystems, from fundamental chemistry to remediation

Muography of « la Soufrière » volcano / IP2i

IN2P3 2024 : a distributed institute

15 labs (joint research units)

10 infrastructure / support units



Highlight : Toshiko Yuasa Lab, a new Int'l Research Lab

An actual laboratory with offices ! Launched last year at the workshop

Joint lab from KEK and CNRS, in KEK (Tsukuba) premises

To foster scientific exchanges on all our research topics

(with a focus on particle & accelerator physics, Belle-II)

- Hosts IN2P3 scientists for long stays at KEK
- Liaison with IN2P3 there
- Currently between 2-5 people, plus guests
- Soon (oct): *physics school/workshop on tau physics & dark sector w/ Belle-II*
- Directors : Karim Trabelsi, Shoji Hashimoto
- *(see Karim's talk)*

IN2P3 2024 : key figures

25
laboratories and technical support units, jointly operated with universities*, CEA**, and INFN*** in Italy

*incl UCBerkeley et UTokyo, **GANIL, ***EGO

10
interdisciplinary research platforms (accel.)

30
national research programs

50
international research agreements

90 M€
annual budget (w/o salaries)

20 M€
yearly for very large research infrastructures

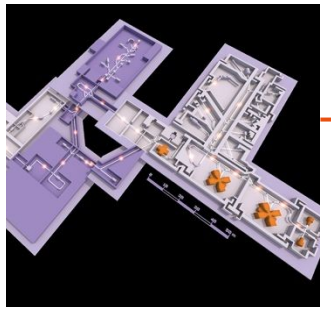
1 000
staff scientists & faculties

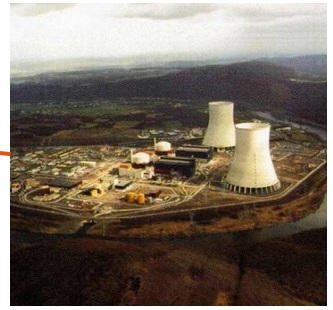
1 500
engineers, techs and admins

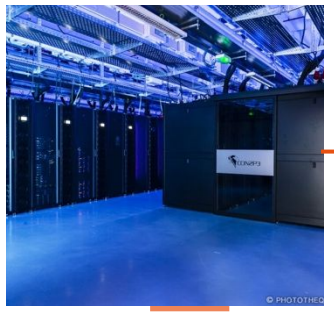
300
post-docs

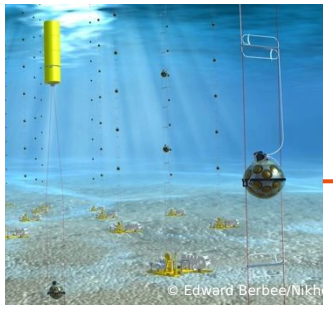
450
PhD students

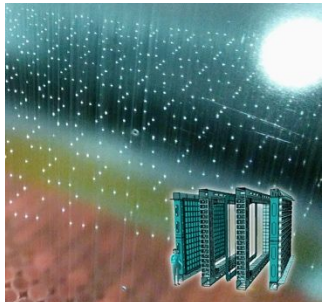
IN2P3 2024 : research infrastructures in France











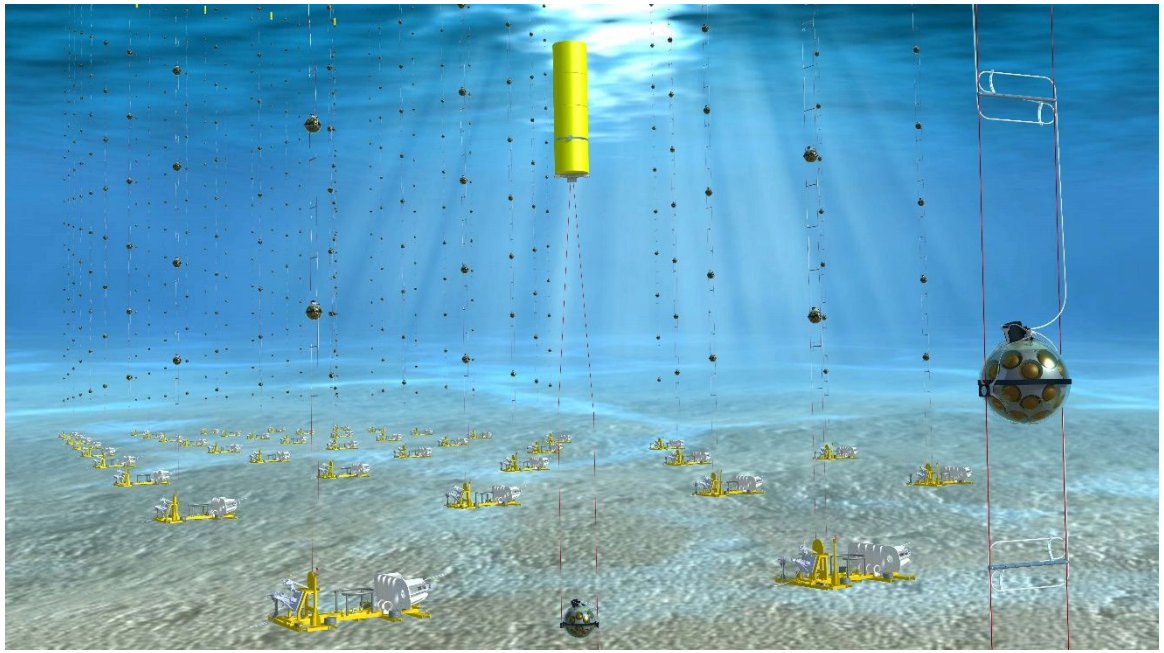
Highlight : research infrastructures in France : **GANIL**

- From past :
  - 40 years from first beam
  - in March 2023

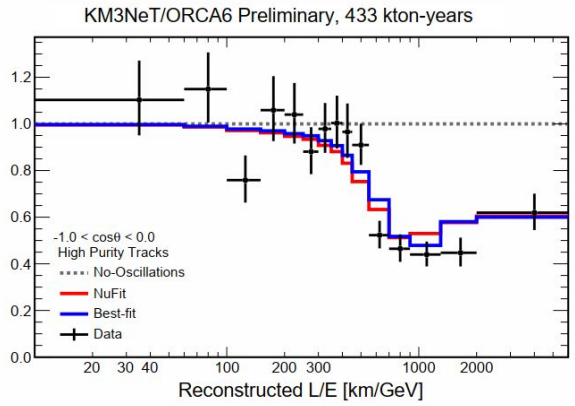
- To future :
  - ceremony for the « 1st stone » for DESIR at GANIL-SPIRAL2
  - in November 2023
  - DESIR (Decay, Excitation and Storage of Radioactive Ions) is a "low-energy" facility that will work with beam energies down to a few tens of keV and will use the SPIRAL1 and SPIRAL2 beams as well as the exotic nuclei produced by the S3 separator.

Highlight : research infrastructures in France : **KM3NeT**

- KM3NeT/**ORCA** (Toulon, FR) :
  - Depth of 2500 m
  - 115 detection lines to be deployed by 2028
  - 19 lines aleady taking data
  - *Study of mixing and masses of neutrinos*



- KM3NeT/**ARCA** (Sicilia, IT) :
  - Depth of 3500 m
  - 230 detection lines to be deployed by 2030
  - 28 lines already taking data
  - *Search for neutrinos from distant astrophysical sources such as supernovae, gamma ray bursts, or colliding stars*



International research infrastructures

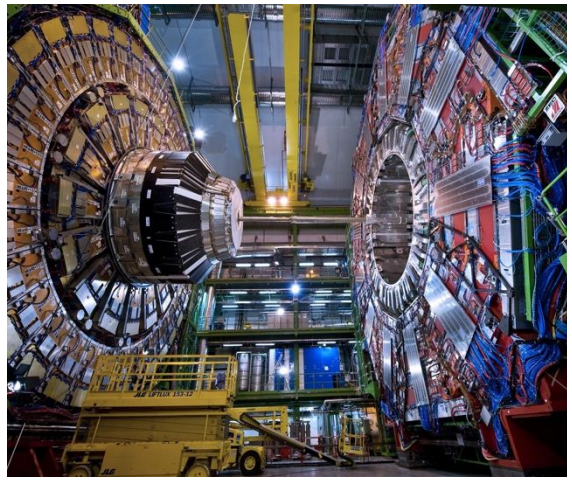
Particle physics and hadronic physics

Elementary constituants and fundamental interactions

- Searches for new physics beyond the Standard Model
- Higgs boson & EWSB
- Matter/antimatter asymetry & CP violation
- Quark/gluon interactions
- Neutrinos from accelerators or reactors
- Precision measurements
- Tests of fundamental interactions

Priorities :

- LHC experiments and upgrades for HL-LHC
- Belle-II
- Neutrino LBL experiments (DUNE, T2K/HK)
- JUNO



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Standard Model of PP & Beyond (SMPP):

- ATLAS & CMS @ LHC

Strongly Interacting Matter (SIMP):

- ALICE, CMS, LHCb




Mixing & CP Violation in Quark sector (CPVQ):

- BELLE-II @ SuperKEKB
- LHCb @ LHC

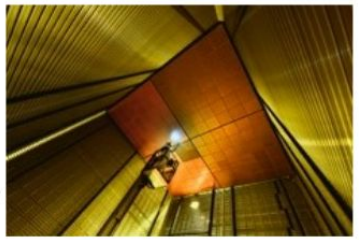
Neutrino nature, Masses & Mixing (NUMM):

Accelerator-based:
- DUNE
- T2K and HyperK
- (ancillary: NA61)

Reactor-based:
- Double Chooz
- JUNO
- Stereo, Solid

Astro:
- KM3Net
- SuperNEMO
- SK

[Vincent Poireau]




Innovative Detectors (INDE): + preparation for DRDs @ CERN

- CALICE: SiW, SDHCAL ultragranular calorimetry (e^+e^-)
- CMOS/GRAM: thin&granular CMOS pixels (e^+e^-, hh)
- DICE/DEPHY: monolithic MAPS & hybrid pixels (e^+e^-, hh)
- PCIe400, LHCbCalo2: towards HL-LHCb

Precision Tests of Fundamental Interactions (PTFI):

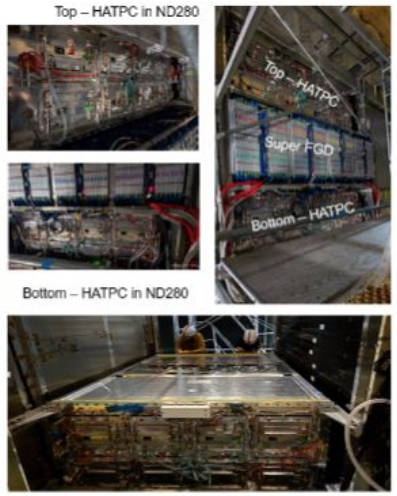
- nEDM/n2EDM (PSI)
- COMET (J-Parc)
- AEgIS & GBar (CERN)

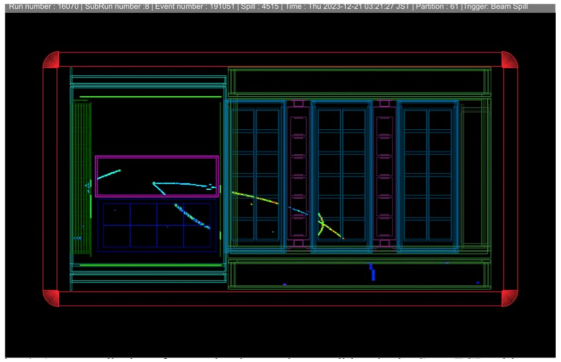
Theory:

- very broad spectrum
- formal th, susy, strings
- SM, BSM , EFT
- lattice QCD

Highlight : neutrino physics at T2K (and HyperK)

- Completion of the **ND280 upgrades for T2K-II** :
  - IN2P3 contributed to HA-TPC and SuperFGD
  - investment of 0.7MCHF M&S
  - everything installed now
  - beam power now 750kW
  - new data taking June 2024-2027





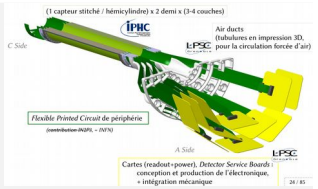
- Preparation for the **IN2P3 contribution to HK** :
  - time generation & distribution
  - test benches of electronics at CERN
  - common items & installation
  - substantial investment : 1.5M€ M&S
  - MoU to be signed soon
  - financial meeting HKFOP tomorrow

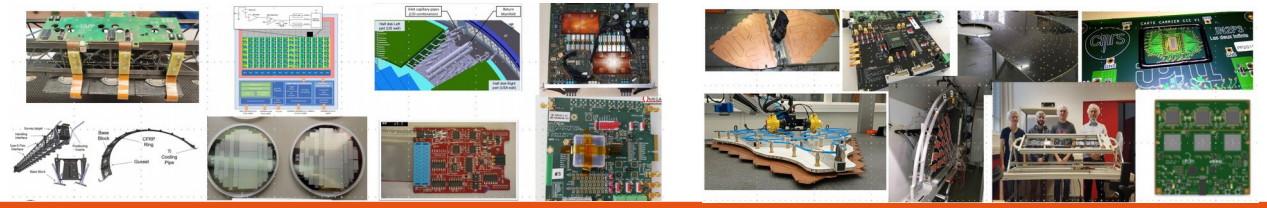
NB : a lot of progress also on JUNO & DUNE

Highlight : physics at the LHC (and beyond...)

- **Run 3** of LHC :
  - on-going, very good machine performance 2024
  - our contributions to Phase 1 (ALICE ITS2 + MFT + MUON + DAQ, ATLAS LAr, LHCb SciFi + DAQ + RTA) working well
  - analyses in full swing

- Next upgrades for **HL-LHC** :
  - for LS3 : on-going for ALICE ITS3
  - major work on Phase 2 ATLAS & CMS for HL-LHC
    - 250 FTE engineers & techs
    - investment of 53M€ CORE, special IR* credits
    - mostly at pre-prod/early prod stage now ! schedule..
  - decision process for LHCb & ALICE Phase 2





- **FCC** feasibility study :
  - FS mi-term report out since Feb 2024
  - FR has set up an inter-ministery committee
  - aim : follow & prepare FR position/decision
  - excellent & thorough work, strong dedication
- **ESPPU** process : getting ready (new schedule)
- On-going reorganization & strengthening for **FCC**
  - new R&D Master-Projects at institute
  - mapping into ECFA DRD
  - **ECFA Higgs Factory workshop in Paris : 9-11 oct**

Presidents of CH and FR at CERN 16/11/2023

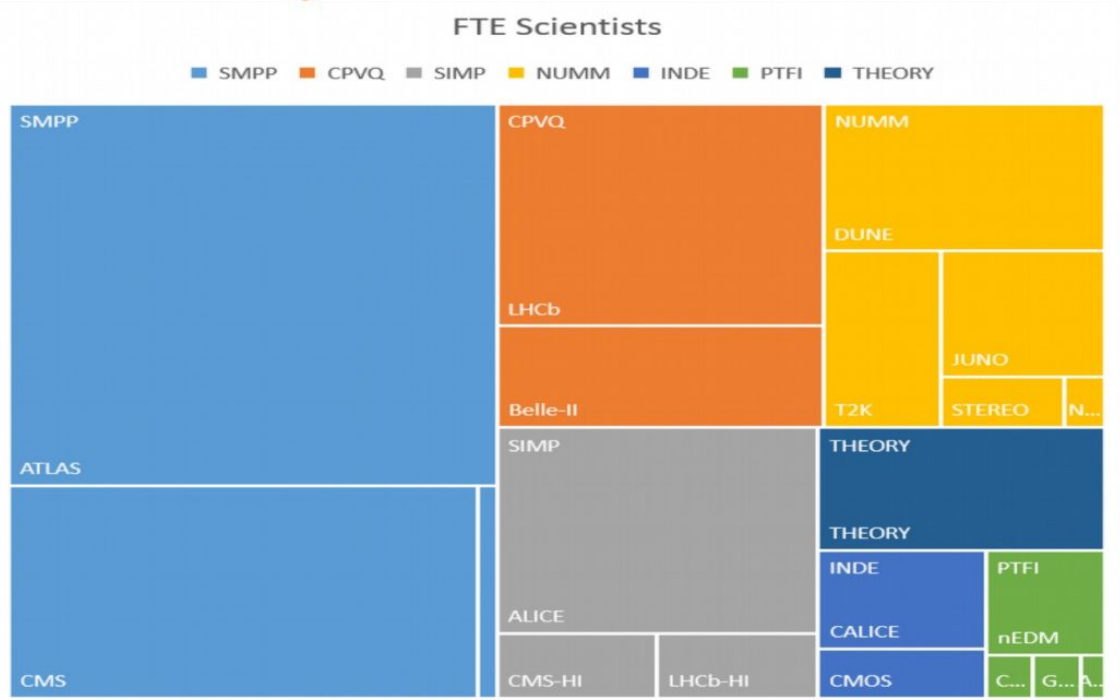
EM : « will & ambition to keep the leadership in the domain »

Particle physics projects portfolio

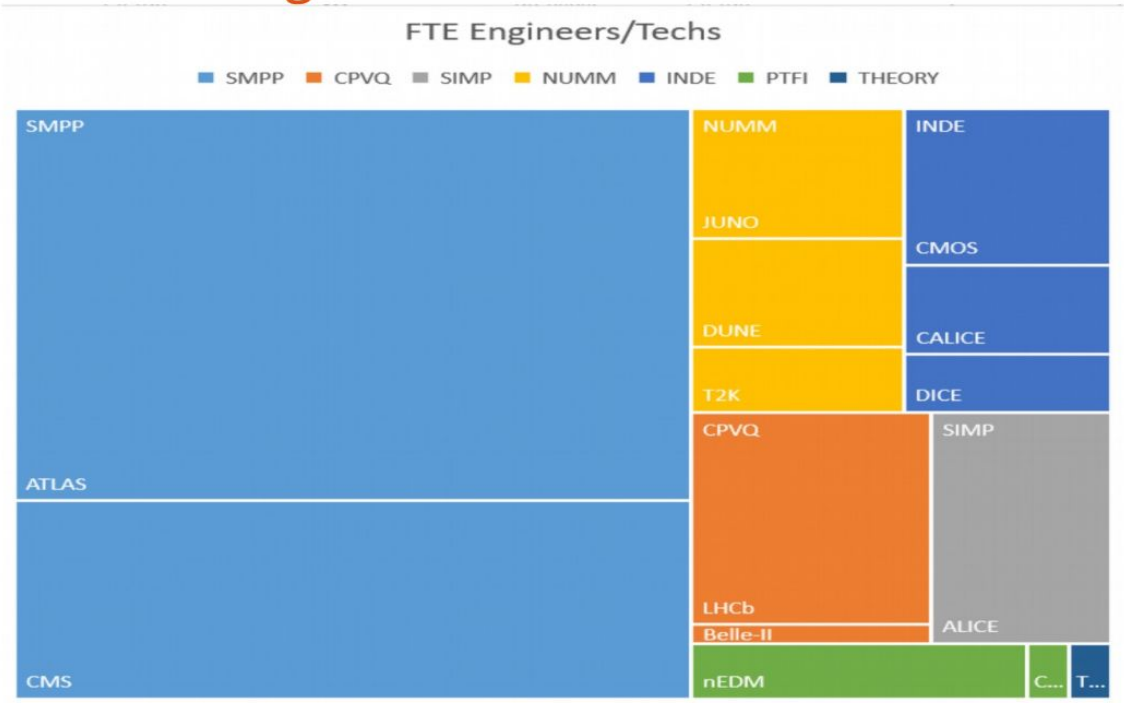
6 scientific programs 35 master-projects 70 teams, 17 labs

~450 PHY: 300 ch (200 cnrs+100 uni) + 100 doc+ 50 pdoc + ~450 E/T

Physicists:



Engineers/techs:



Conclusion

Strong commitment of IN2P3 to support the two networks

Will continue to accompany their evolution and growth

Best wishes for a fruitful workshop !

Many thanks to :

Directors & Steeering Committees
International Organizing Committee
Local Organizing Committee
KISTI