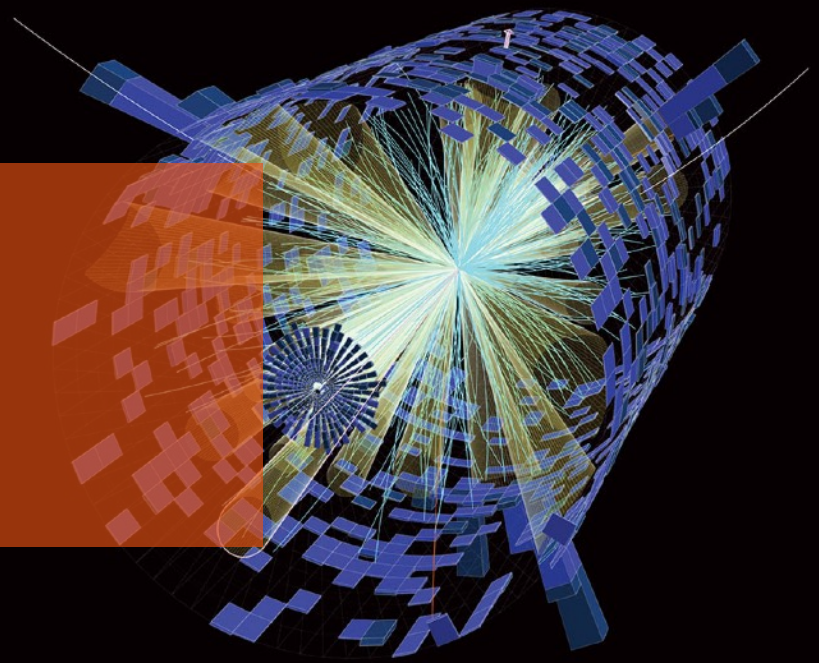
Institut national de physique nucléaire et de physique des particules

Mardi 13 juin 2023

Sabine Crépé-Renaudin



French landscape

Federated computing model round table

The French Stakeholders

IN2P3

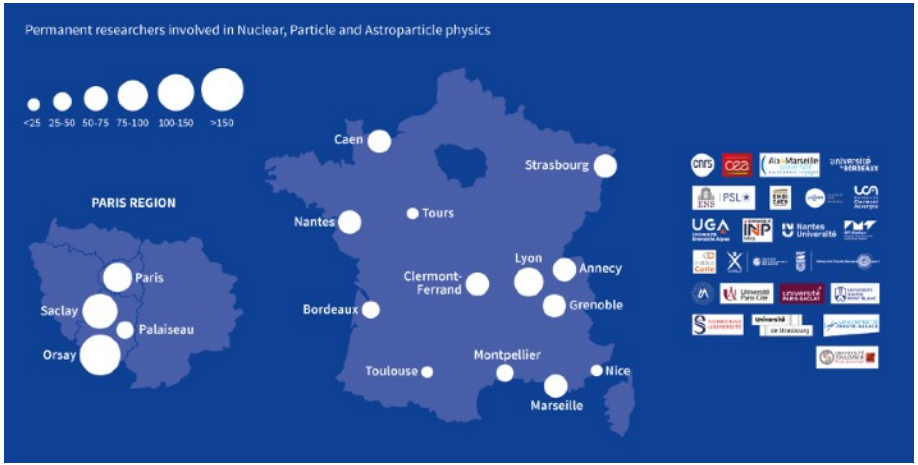
- is the National Institute for particle, astroparticle and nuclear physics
- is one of the 10 CNRS institutes
  - CNRS is the French National Centre for Scientific Research, it spans over almost all research fields
- coordinates in France the research in particle, astro-article and nuclear physics
- explores the physics from elementary particles to cosmology
- 25 labs or technical units

Universities

- Most of the IN2P3 labs are Unité mixte de Recherche meaning they are joined CNRS-University labs with staff from both organisations

CEA

- is the French Alternative Energies and Atomic Energy Commission
- researchers in our fields are mostly in the IRFU laboratory operated by the Fundamental Research Department (DRF) of CEA, as well as in GANIL in Caen.



Staffs

- IN2P3
  - 3 200 staff : 1000 permanent researchers, including 600 from CNRS and 400 from universities, 1,500 permanent engineers, technicians and administrators including 600 research engineers mostly from CNRS, and around 750 doctoral students and post-docs.
- also ~100 researchers in INP (physics) and INSU (univers sciences) at CNRS
- CEA
  - 850 employees (among which 400 staff working on accelerators technologies and superconducting magnets) including 130 permanent researchers engaged in Nuclear, Particle and Astroparticle physics.

Covered Fields

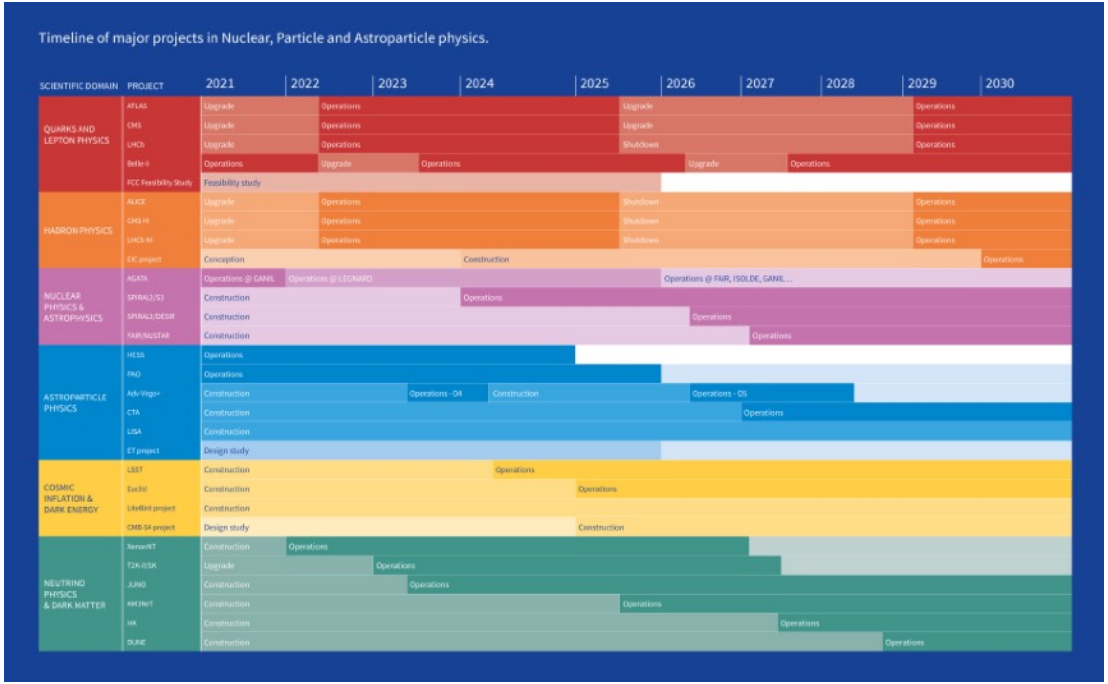
Scientific fields

- Particle and hadronic physics
- Nuclear physics and applications
- Astroparticle physics and cosmology

Also

- Particle detectors and accelerators and associated instrumentation
- Computing and data science

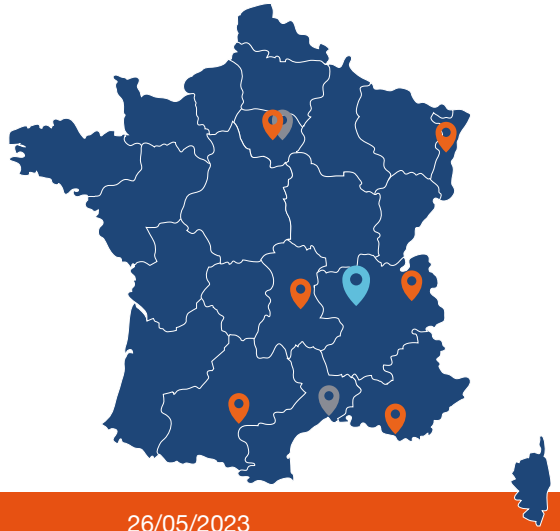
Timeline of major projects as defined in our prospective exercise



Computing Infrastructures

Main IN2P3 data and computing centres

- National centre: CC-IN2P3, our WLCG Tier1
- WLCG Tier2s, often also regional centres in general linked to universities providing grid and cloud ressources and storage
  - 8 Tier2s (7 IN2P3 1 CEA)
- Local small HPC ressources for developments



Related infrastructures

- France-Grilles/Cloud
  - issued from French WLCG community, grid/cloud sites (mainly IN2P3) providing ressources to all scientific researchers - long tail of science -
  - scientific consortium of several organisms, represents France to EGI
- HPC centres:
  - national: IDRIS (CNRS), TGCC (CEA), CINES (Universities) all coordinated through GENCI national initiative
  - expecting EuroHPC decision about Exascale supercomputer application soon, to be hosted at TGCC
  - regional HPC center: « mesocentre » also providing some cloud and storage now
- Renater: national network provider
  - 10 to 400 Gb/s

CC-IN2P3

Description and missions

- National research infrastructure for IT resources dedicated to our research fields (main experiments LHC/HL-LHC T1, LSST, Belle II, CTA, KM3NET, DUNE,…)
- Provides storage (disk+tape) and computing resources with the more appropriate architecture
  - Mainly HTC but increasing part of GPU and small HPC resources included
- Provides IT related services
  - IN2P3 sites connexion in relation with Renater
  - Tools for software developments, set of collaborative toolsTexte niveau 1

CC-IN2P3 Datacenter

- 2 computer rooms: 1700 m2
  - > 300 racks
- 790 kHS06
- 80 PB disks + 170 PB tapes
  - 340 PB capacity
- Bandwidth 380 Gb/s
- 85 staffs
- Users
  - 150 teams
  - ~ 4000 active users

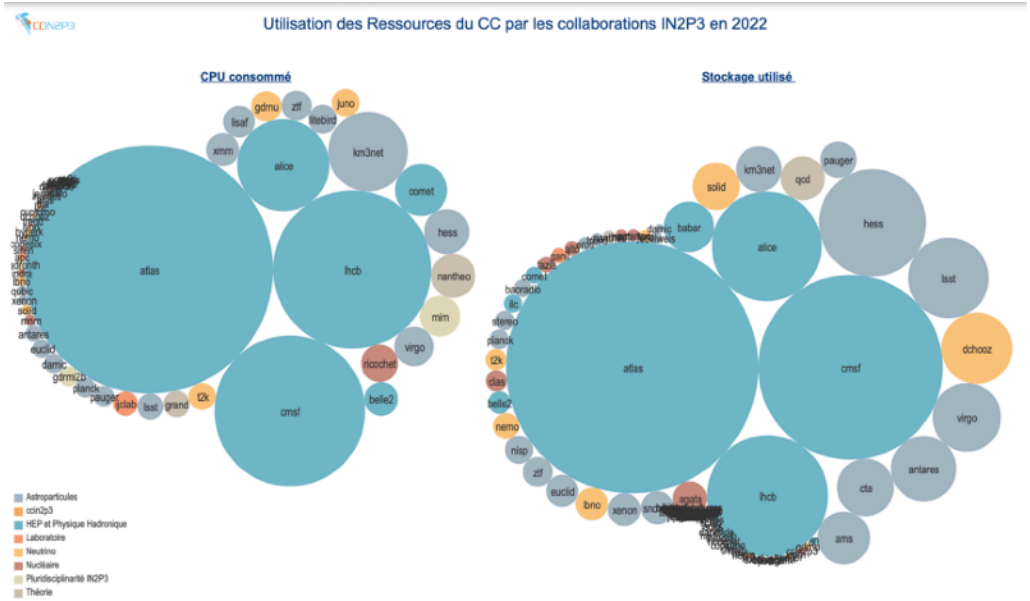
CC-IN2P3 and experiments

CC-IN2P3 supports 80 experiments

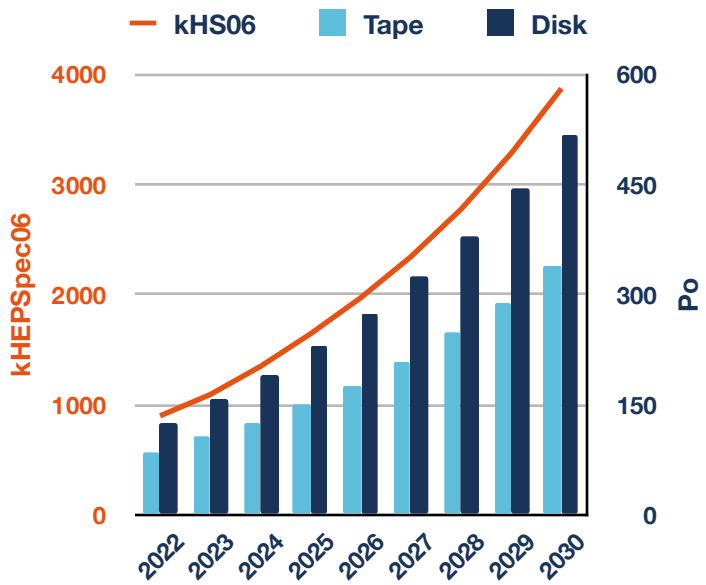
- each collaboration is asked by IN2P3 to provide plan for ressource needs for their lifespan and DMP
  - updated regularly
- resource requests reviewed each year
- computing needs discussed and evaluated for all new experiments before approval

Experiment resource usage at CC-IN2P3

- LHC is still the biggest user and will stay but others are growing => important to prepare and organize
  - ex CC-IN2P3 will process 40% of Rubin observatory/LSST raw images: requests higher CPU memory than LHC



Projection of ressource evolution



Challenges

Successful work to fulfill current experiment needs

Computing needs increasing considerably for the next decade: exascale area

- LHC Run3 + HL-LHC, Belle II, KM3NET, T2K…
- LSST, Euclid, CTA…
- great diversity of experiments with smaller computing needs
- Open data

➜Technical challenges

➜ Impact on computing, storage, network resources… and the computing models

➜ manpower

Needs to take into account

- the diversification of ressource types
  - Increased use of AI
  - HTC, HPC, GPU, FPGA, …
- the cost and the impact on environment

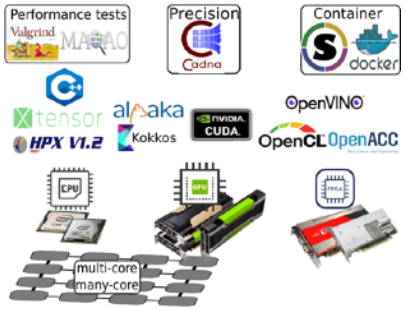
Some questions

- how distributed the ressources should be ?
- how to share expertise between fields
- how to share ressources (network) and deals with heterogenous needs ?
- how to organize: interplay between national European international landscape in our fields and with other research fields

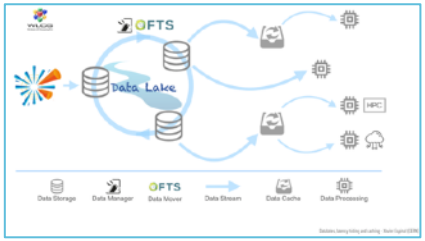
Transverse R&D and activities to prepare our answer to the next challenges

Artificial Intelligence

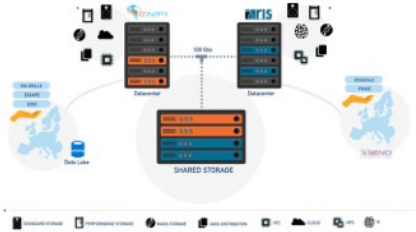
Software performance, heterogenous computing, orchestration…



Distributed computing models, DOMA

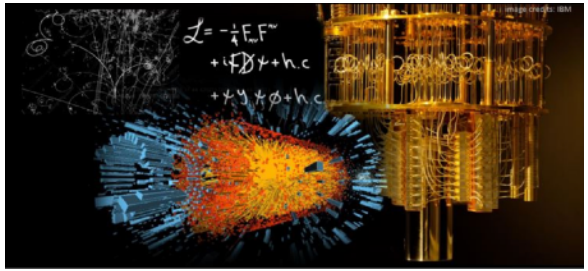


Getting closer to HPC ressources



- *CC-IN2P3-IDRIS project*
- *Exascale project*

Quantum computing



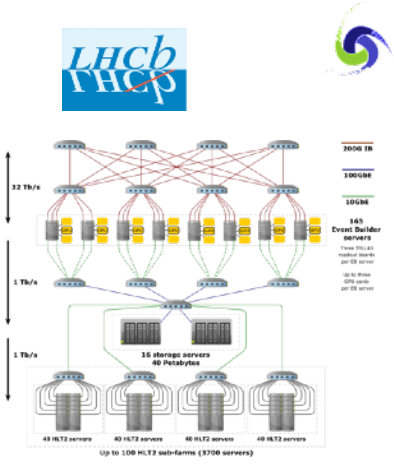
Open Science

Further information

French contributions to LHC Computing

WLCG participation coordinated through LCG-France project

- Tier 1: CC-IN2P3
- 8 Tier 2: 7 IN2P3/CNRS 1 CEA, 4 federated
- ~14 FTE
- LHCONE and LHCOPN connections thanks to Renater and CC-IN2P3
- ➜ provide between 10% to 13% of WLCG T2 and T1 resources
  - 2022:100 Po bandes (CC-IN2P3), 65 Po disque, 700 kHS06 CPU



Contribution to LHC experiments

- software online and offline
- data and computing

Contribution to common tools

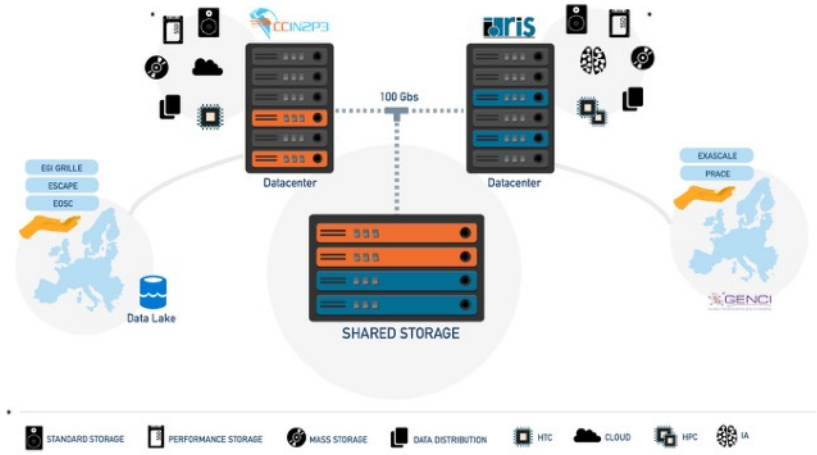
- Geant 4, DIRAC…

Strenghtening collaborations with HPC

FITS project: CNRS Federated IT Services for research infrastructures

- Collaboration between CC-IN2P3, IDRIS CNRS HPC center and GENCI (French organisation for HPC)
  - to bring the hosting capacities of the two sites up to the state-of-the-art
  - to develop solutions to allow transparent access to HTC and HPC ressources for CNRS RI (HL-LHC, LSST, SOLEIL synchrotron…)

  ➜ deployment of shared storage capacity and common Access Portal



Participation to the Exascale project

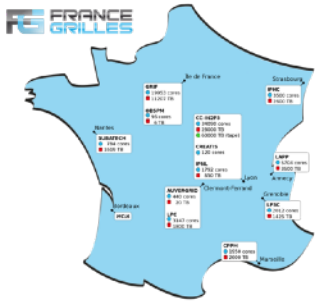
- Preparing French answer to EuroHPC call to host an exascale HPC calculator
- Inventory of softwares that could benefit from such calculator and definition of their constraints to better define the design of the exascale machine

France-Grilles/Cloud and EGI

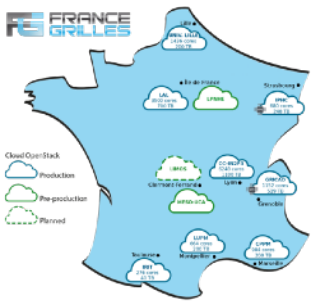
France-Grilles/France-Cloud

- GIS (scientific consortium) of several organisations (CEA, CNRS, CPU, INRA, INRIA, INSERM, MESRI, RENATER) built originally upon the French LHC grid, open to all scientific fields
- France-Grilles is member of EGI (European Grid Infrastructure) and represents France in EGI
- Provides services on a distributed e-infrastructure: storage (IRODS), grid and cloud for all scientific fields, long tail of science
- Allows to share our expertise, provides support for different scientific communities, organises exchanges
- more than a thousand users

Grid



Cloud



Irods storage