Centre de Calcul
de l'Institut National de Physique Nucléaire
et de Physique des Particules

CC IN2P3 Infrastructure et usage

EIC France

Overview

CC IN2P3 : Context

- Mission
- Organization
- How are CC-IN2P3 involved on a collaboration.

CC IN2P3 : Infrastructure and services

- Infrastructure (computing, storage, network, hosting,…)
- Services (collaboration services, users services, computing and data management services ,..)

How the experiments are using CC-IN2P3 infrastructure and services

- Kind of relationship
- Examples

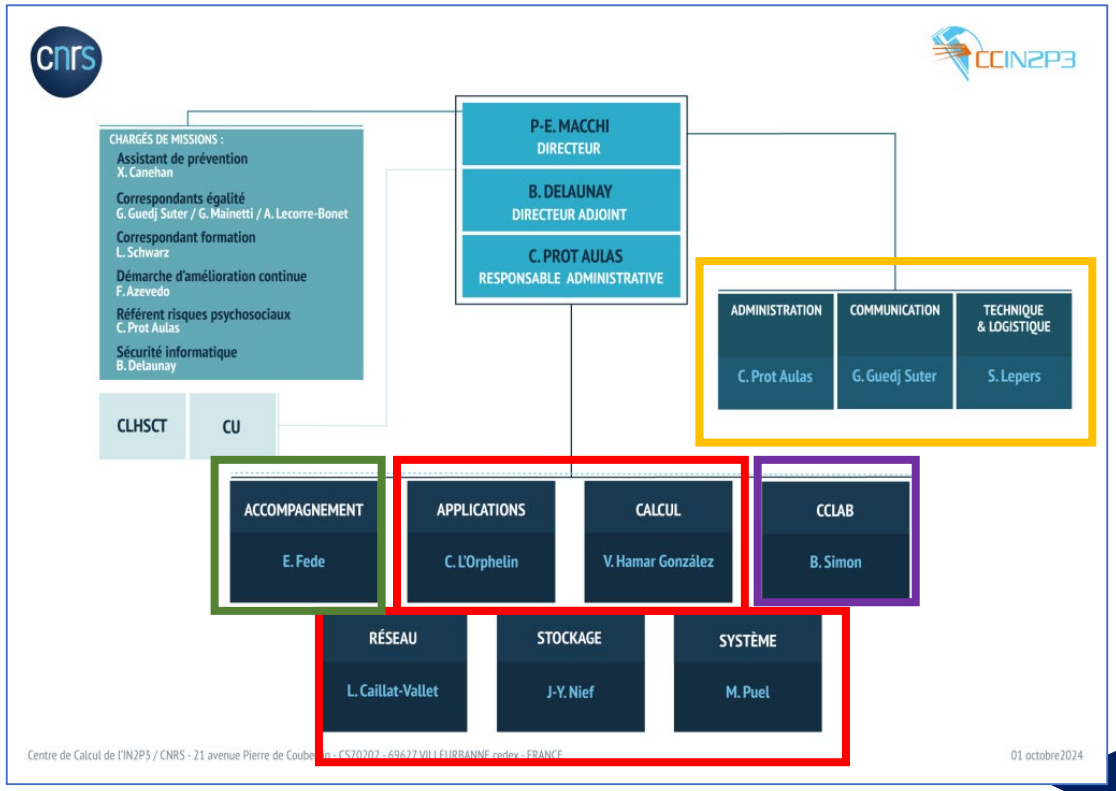
Summary

Mission : Providing data processing and services for experiments supported by IN2P3 and IRFU.

- ~85 collaborations supported at CC-IN2P3
  - HEP, Astroparticle physics, Nuclear physics, Cosmology, …
  - A small fraction < 5% of computing time open to other
  - sciences.
- 84 agents mainly engineers.

Organization :

- Administrative and building technical team
- Research team
- Computing technical and services teams
- Support and contact for collaboration team
  - Computing and data models
  - Resources allocation
  - Collaborations and users support
  - Main contact for collaboration

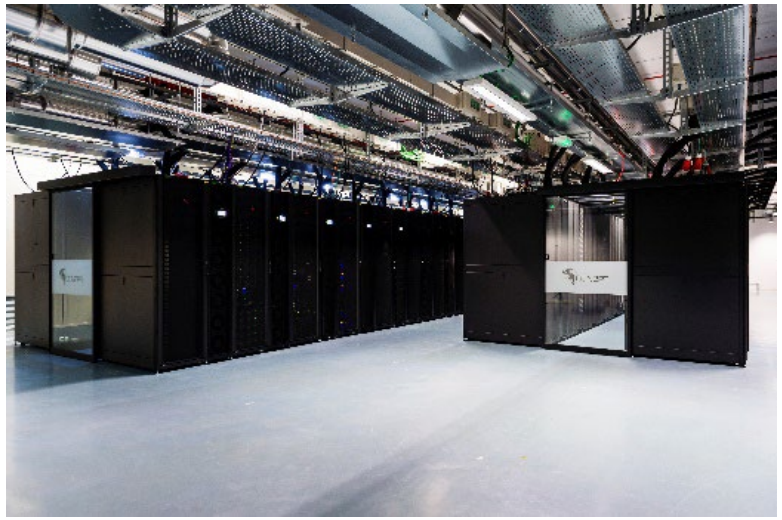


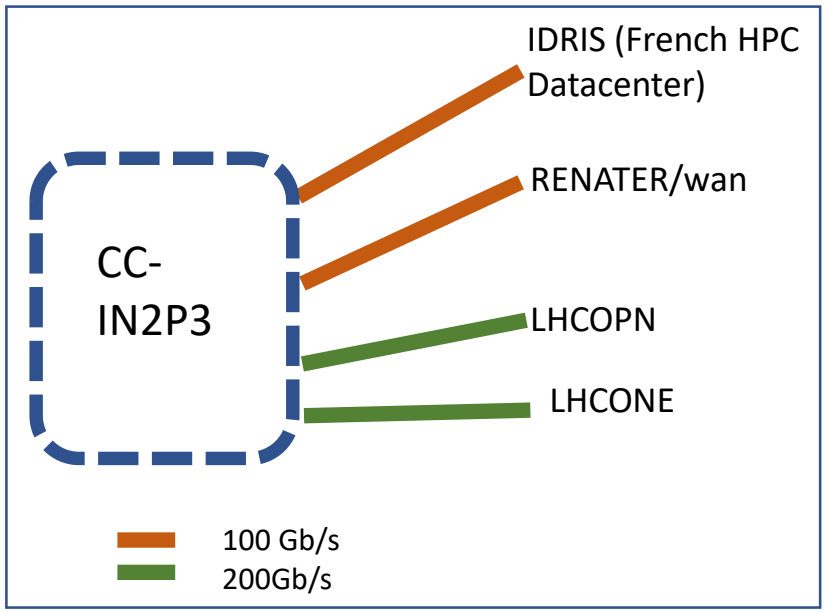
CC-IN2P3 provide resources/services for different usages

- For IN2P3 users (institutional services)
  - Mail, box, gitlab,…..
- For R&D phases. Small usage a few resources
- Because IN2P3 is involving on the computing aspect of a collaboration
  - Should be validated by DAS (scientific IN2P3 deputy)
  - Annual collect of resources requested (Computing, storage, DB, backup, virtual host,…)
  - Validated or not (mainly depending of the budget)
  - A computing coordinator have to be identified on the collaboration
  - Some collaborations have a identified budget (LHC, LSST, Euclid, …)
    - Usually a multi year planning on computing resources needs is available

CC-IN2P3 : Infrastructure

- **1500 m2 (2*750) of computing room.**
  - A new computing room will be available first months of 2026
- **Dedicated network links for a subset of collaboration**
- **~1.5 MW of electric power**
- **High availability**





CC-IN2P3 : WAN NETWORK LINK

CC-IN2P3 : Computing

Shared facilities

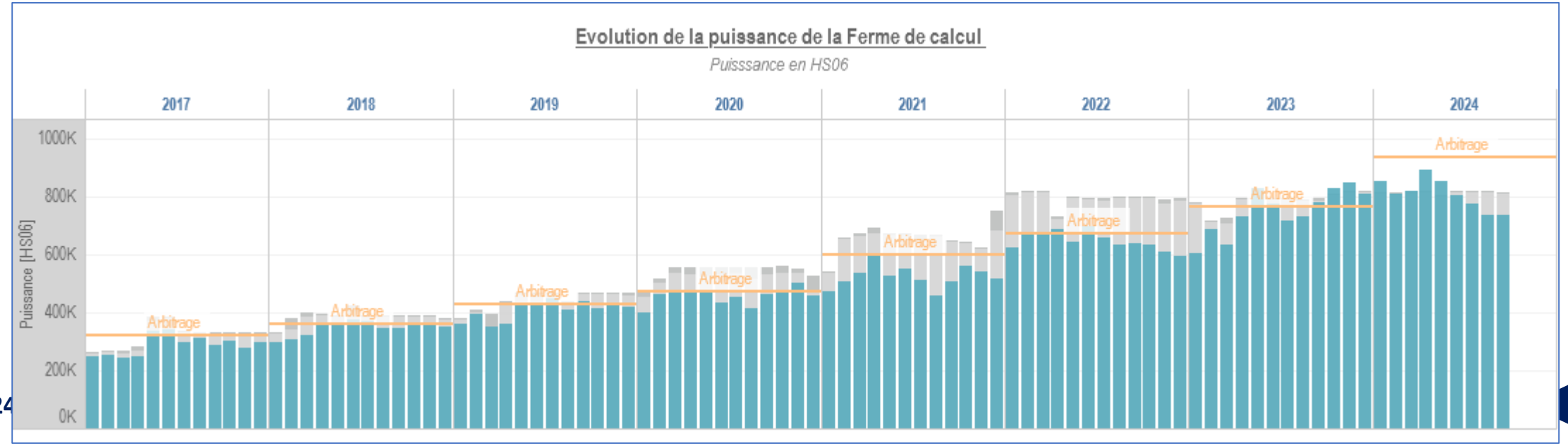
- **HTC (High Throughput Computing)**
  - Main computing resource
  - ~60 kslot : ~940 000 HS06
  - 35%/65 % Local jobs/grid jobs

- **HPC (High Performance Computing)**
  - Limited usage
  - 512 cores

- **GPU (Graphics Process Unit)**
  - 68 GPU V100

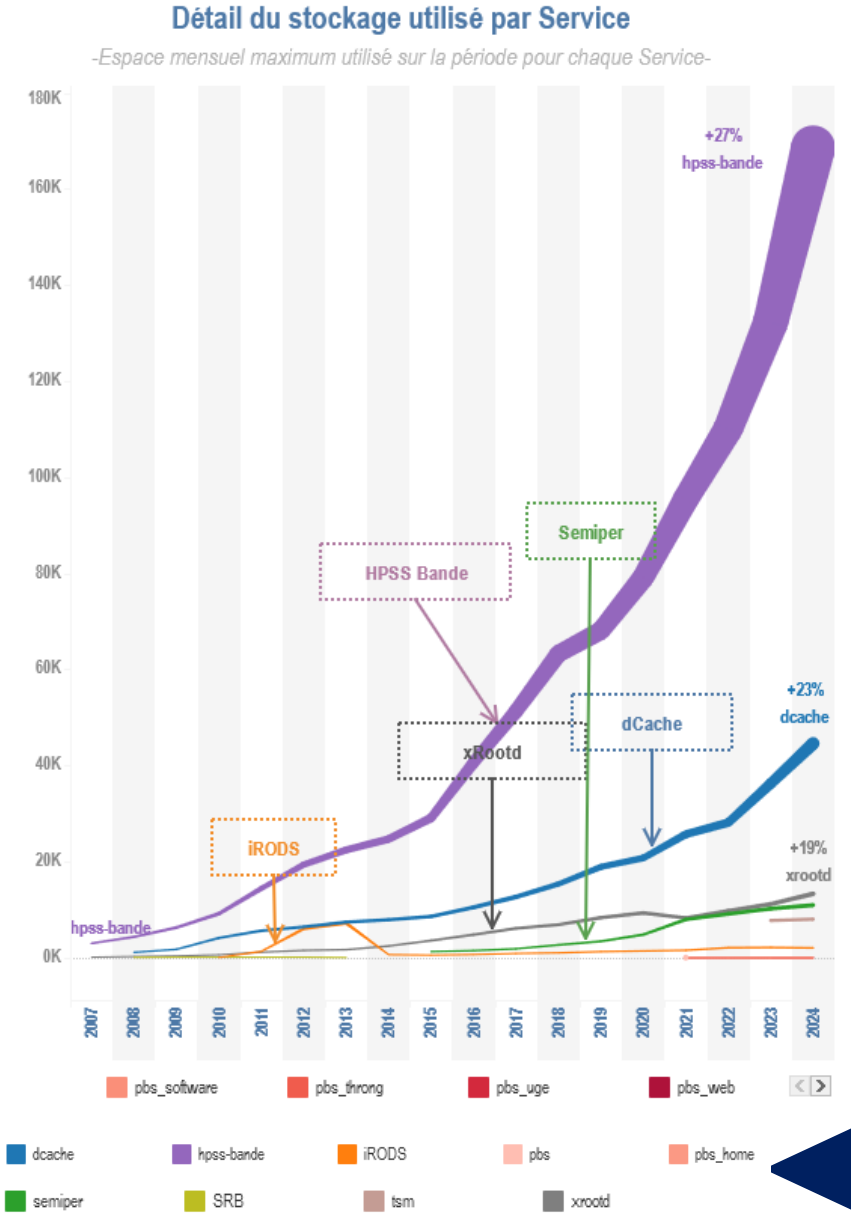
Specifics/dedicated facilities

- **Virtual hosts, dedicated GPU,…**



CC-IN2P3 : Storage

- **Disk infrastructure**
  - High capacities ~ 59 PB (dCache, Irods, Xrootd)
  - High performance ~ 15 PB (Ceph-FS, Isilon, GPFS)
  - Oriented service : Ceph
- **Tape infrastructure**
  - ~170 PB of data on tape
  - A large set of experiments
- **Backup infrastructure**
  - Double copy (~ 2*4PB)
  - Mainly to store IN2P3 laboratories backup and some experiments data.
- **Other**
  - Ceph for cloud
  - Database : Oracle, MariaDB, postgres, nosql,…



CC-IN2P3 : Services

CC-IN2P3 is providing also a large set of services to the users/collaborations.

Some of them are shared but some of them are dedicated to a collaboration and the main part of the time are a critical services for the collaboration.

Two ways to provide theses services are available :

- CC-IN2P3 provides infrastructure only, services are managed by user/collaboration
  - Mainly via internal cloud infrastructure/ kubernetes cluster.
    - Web, VObox,…
- CC-IN2P3 provide infrastructure and management of services
  - Via dedicated infrastructure or virtual machine on internal cloud
    - Job submission (Dirac), data management tool, Databases, repository (cvmfs stratum 0),….

Providing a service for a collaboration is a strong engagement because :

- Long term engagement
- Critical for collaboration
- Service level agreement (SLA) to satisfy

HAVE TO BE CLEARLY IDENTIFIED AND SUPPORTED BY IN2P3 ENGAGEMENTS AND COLLABORATION

Infrastructure growth

We have to consider whole lifetime of the collaboration (sometimes many decade).

- A multi year engagement between IN2P3 and collaborations concerning the computing (MoU) has to be established.

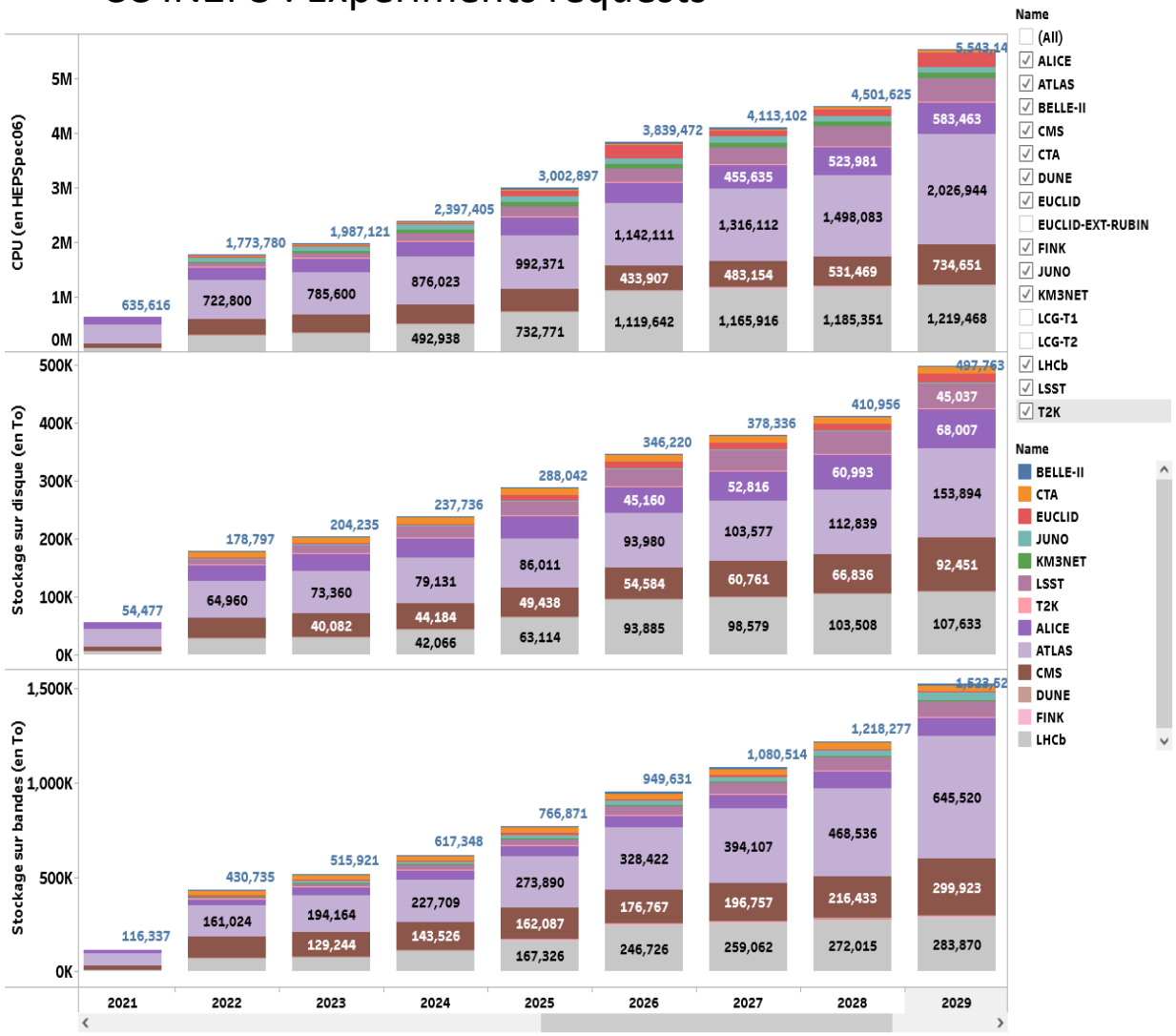
Concerning the budget many aspects have to be considered.

- Investments costs
- Running costs
- Operational costs

New technologies investigation/deployment

- More FTE

CC IN2P3 : Experiments requests



CC-IN2P3 computing infrastructure for collaborations

Three kinds of usage of our computing infrastructure can be highlighting.

First one : When the computing model of the collaboration is based on the usage of a large scale distributed infrastructure(Grid).

- LHC, JUNO, KM3net, Belle2,… ~all HEP collaborations

Second one : When the computing model is build around a small set of sites.

- LSST/VR, Virgo, Euclid…..

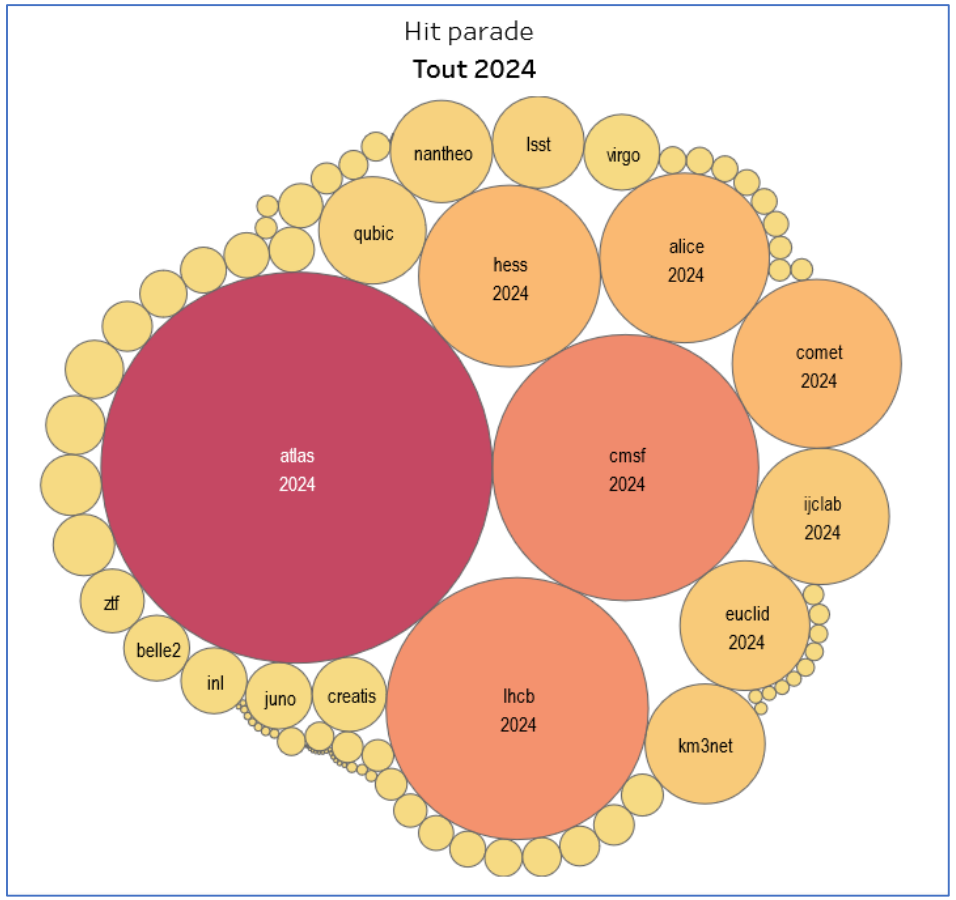
The last : When the usage of the computing is focused on only one site.

- All collaborations on which the computing resource request can be satisfied by one site.
  - Nuclear, theory,…

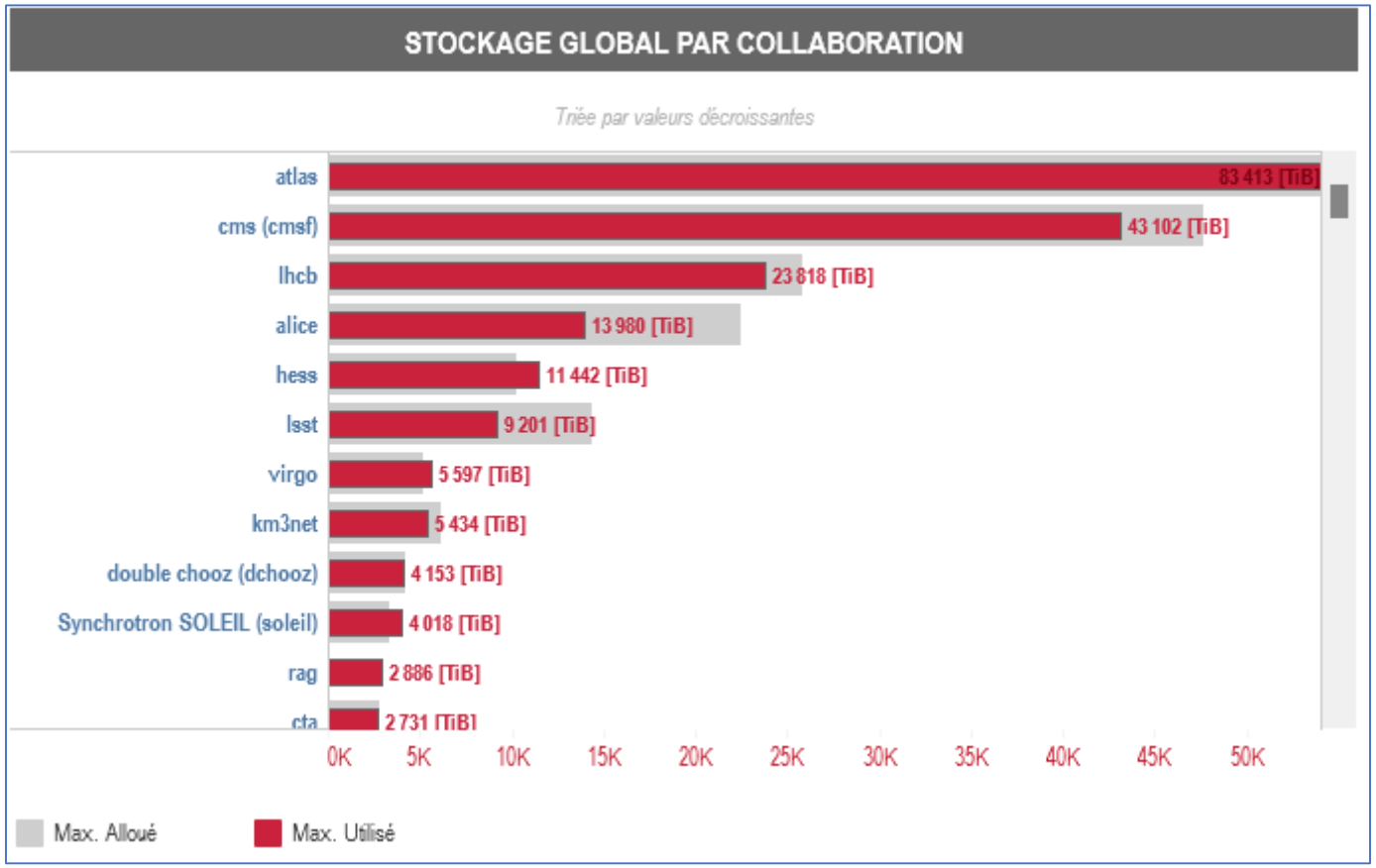
On distributed computing models (worldwide scale) : GRID

- **Commonly a MoU (IN2P3/Collaboration contract) define the computing commitments.**
- **Collaboration contact person is a team = “computing team”**
- **IN2P3 (and CC) are often asked to participate to these infrastructures.**
- **CC-IN2P3 is considered as a stable and performant site.**
  - Tier 1 for WLCG : stored a part of the raw data ~10 %
  - 15 % of the Belle2 Raw data at CC IN2P3.
  - Solicited to store a part of the JUNO, KM3NET,… raw data.
  - Involved on simulations and analyses of these collaborations.
  - Providing collaboration main services (Dirac , DB for HyperK,…).

CC-IN2P3 contribution (CC-IN2P3 view)

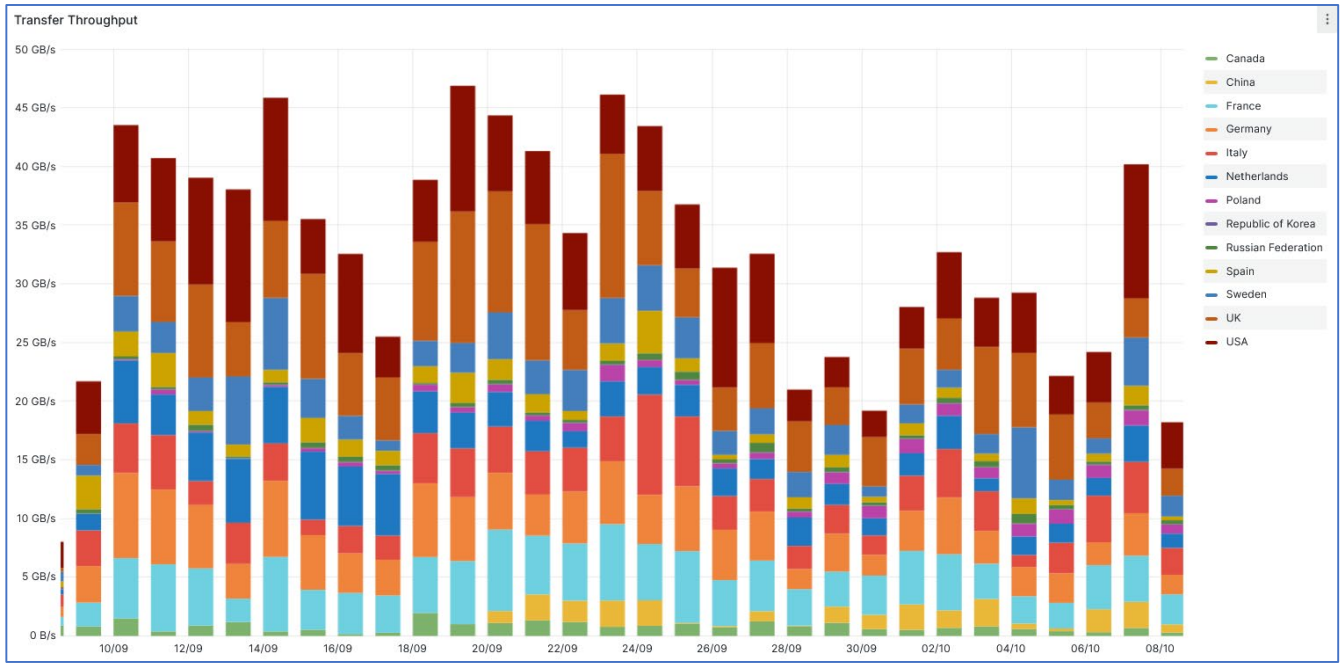


2024 : CC IN2P3 CPU

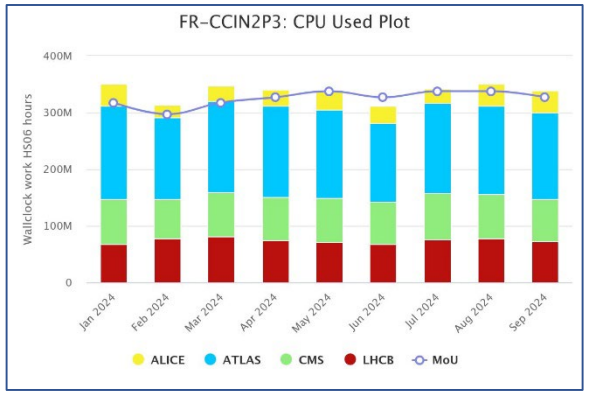


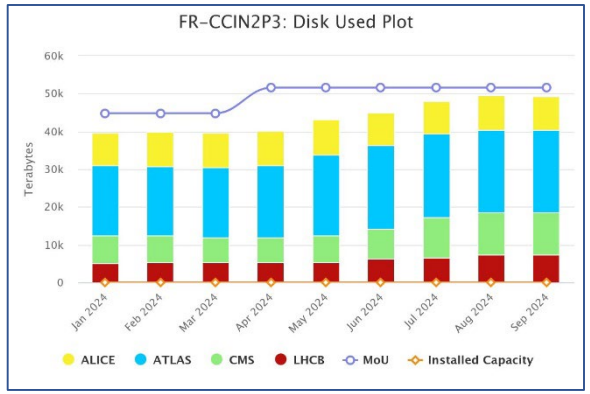
2024 : CC IN2P3 Storage

CC-IN2P3 contribution (WLCG View)

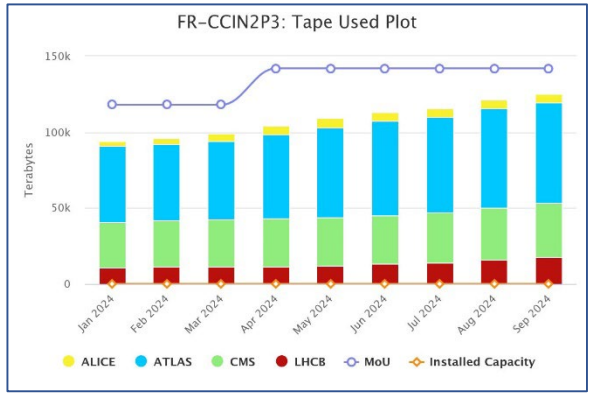


Transfert WLCG vers les Tier1



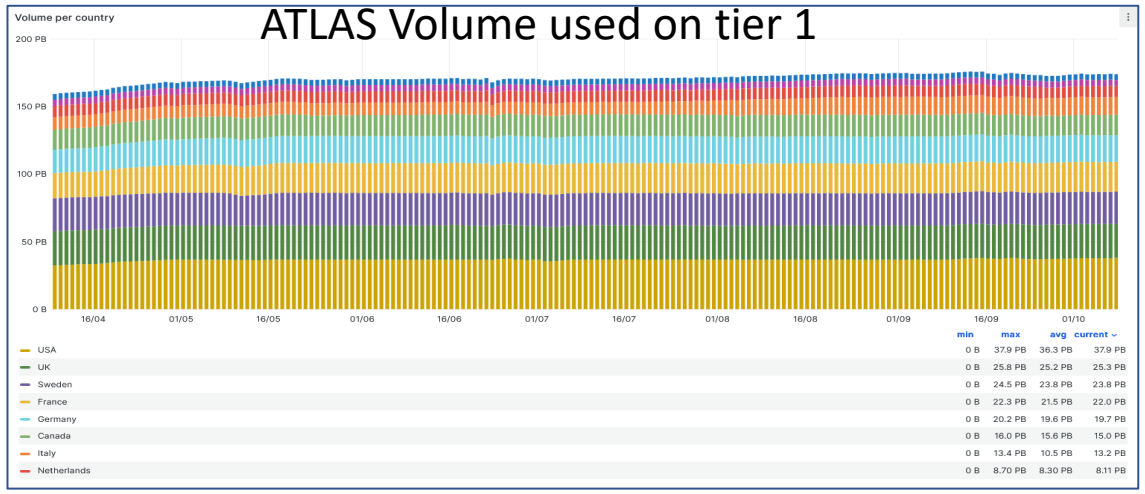


WLCG availability/reliability last 90 days from Alice/ATLAS/CMS/LHCb

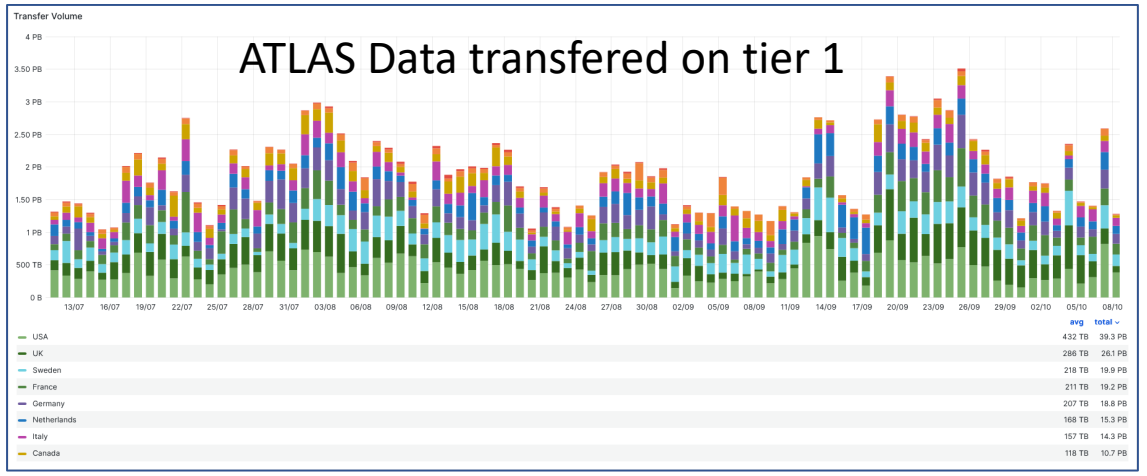


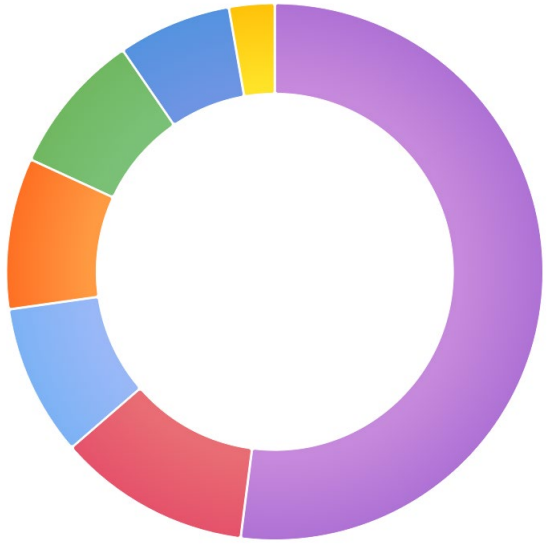
CC-IN2P3 contribution (from experiments)

ATLAS Volume used on tier 1



ATLAS Data transfered on tier 1





	Value	Percent
T1_US_FNAL	3707029	52%
T1_RU_JINR	822770	12%
T1_FR_CCIN2P3	644687	9%
T1_IT_CNAF	643988	9%
T1_DE_KIT	604999	9%
T1_UK_RAL	481553	7%
T1_ES_PIC	190321	3%

CMS : Total completed jobs : 90 days

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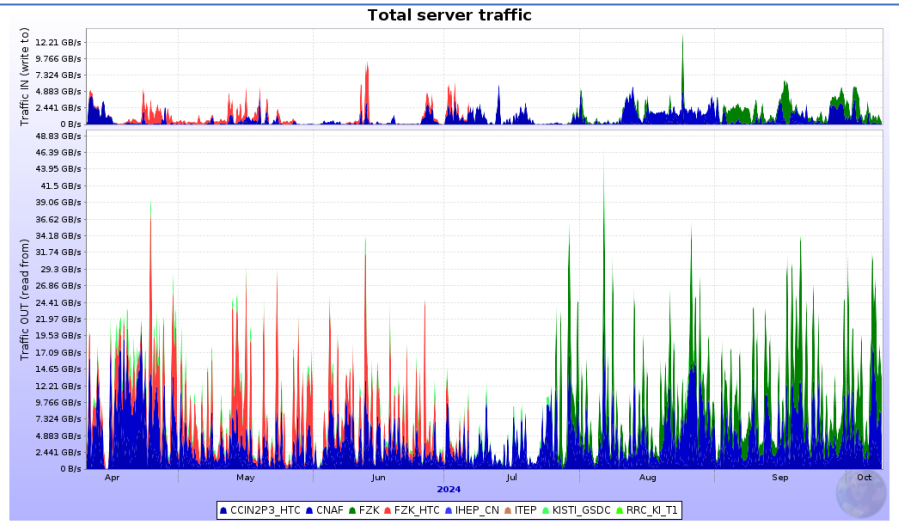


Statistics

Traffic IN

	Series	Last value	Min	Avg	Max	Total
1.	CCIN2P3_HTC	2.909 KB/s	0 B/s	479.2 MB/s	34.85 GB/s	7.023 PB
2.	CNAF	220.7 MB/s	0 B/s	444.7 MB/s	21.47 GB/s	6.516 PB
3.	FZK	211.5 MB/s	0 B/s	811.9 MB/s	45.94 GB/s	4.916 PB
4.	FZK_HTC	1.417 GB/s	0 B/s	587.4 MB/s	45.43 GB/s	4.136 PB
5.	IHEP_CN	18.39 MB/s	0 B/s	14.13 MB/s	2.52 GB/s	49.66 TB
6.	ITEP	26.62 KB/s	0 B/s	31.7 KB/s	3.012 MB/s	475.6 GB
7.	KISTI_GSDC	2.911 KB/s	0 B/s	3.167 MB/s	2.52 GB/s	47.53 TB
8.	RRC_KI_T1	0 B/s	0 B/s	4.119 KB/s	28.06 MB/s	61.8 GB
	Total	**1.857 GB/s**		**2.286 GB/s**		**22.69 PB**

Traffic OUT

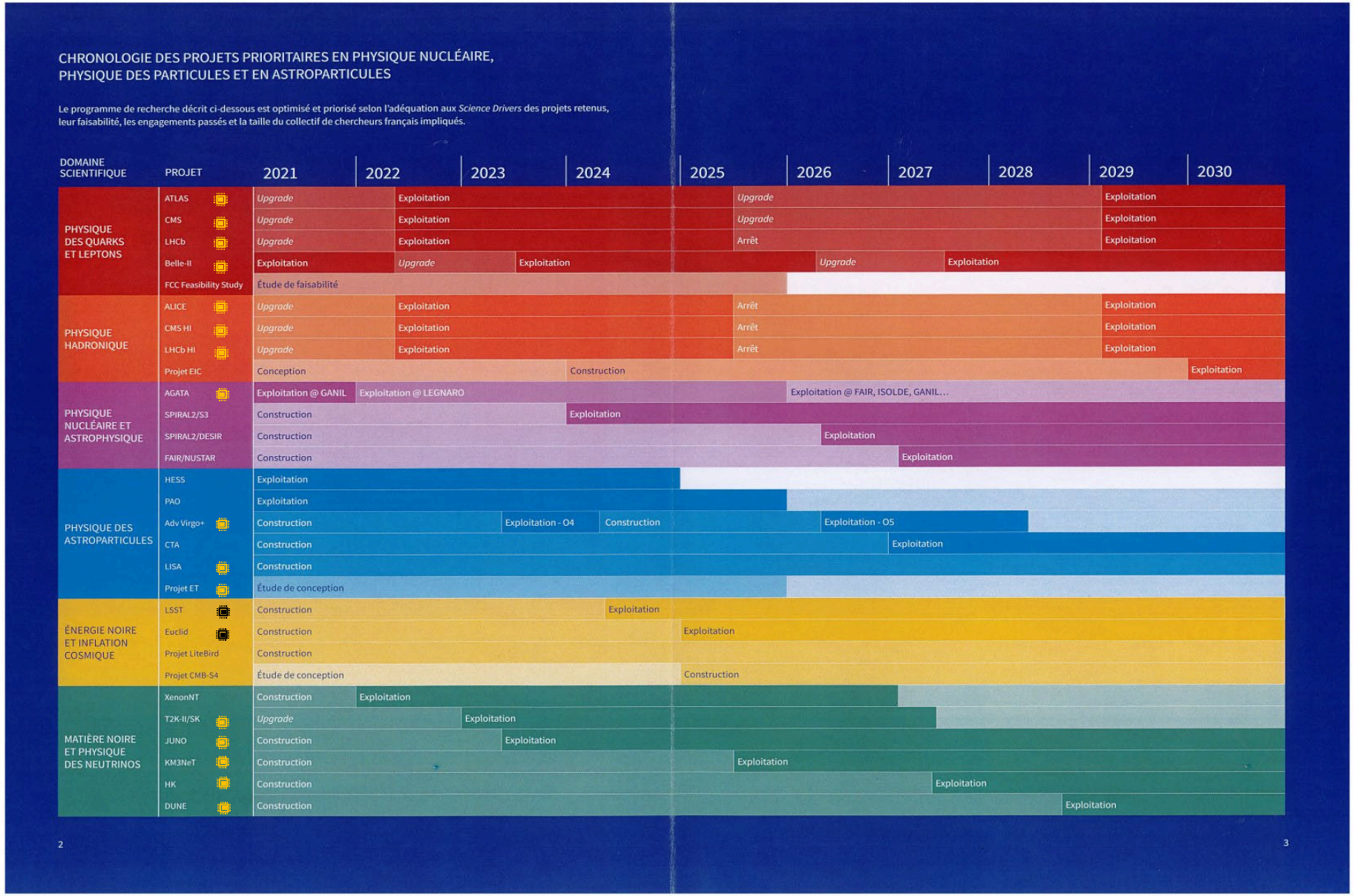
	Series	Last value	Min	Avg	Max	Total
1.	CCIN2P3_HTC	1.24 GB/s	0 B/s	1.725 GB/s	26.85 GB/s	25.88 PB
2.	CNAF	3.715 GB/s	0 B/s	3.336 GB/s	34.96 GB/s	50.05 PB
3.	FZK	8.47 GB/s	0.642 B/s	5.576 GB/s	64.95 GB/s	34.58 PB
4.	FZK_HTC	5.194 GB/s	0 B/s	4.043 GB/s	170.9 GB/s	29.15 PB
5.	IHEP_CN	35.75 MB/s	0.233 KB/s	8.421 MB/s	1.8 GB/s	29.6 TB
6.	ITEP	0.555 MB/s	0 B/s	3.846 MB/s	286.3 MB/s	57.71 TB
7.	KISTI_GSDC	14 MB/s	0 B/s	469.5 MB/s	9.14 GB/s	6.88 PB
8.	RRC_KI_T1	7.482 MB/s	0 B/s	23.02 MB/s	619.4 MB/s	345.4 TB
	Total	**18.67 GB/s**		**15.17 GB/s**		**147 PB**

IN2P3 main experiment timeline

Dull and pastel colours : prepatories/building/up grade phases.

Bright colours : Data acquisition/running phase

CC-IN2P3 is involved or will be involved or could be involved as computing resources



CHRONOLOGIE DES PROJETS PRIORITAIRES EN PHYSIQUE NUCLÉAIRE, PHYSIQUE DES PARTICULES ET EN ASTROPARTICULES

Le programme de recherche décrit ci-dessous est optimisé et priorisé selon l'adéquation aux *Science Drivers* des projets retenus, leur faisabilité, les engagements passés et la taille du collectif de chercheurs français impliqués.

DOMAINE SCIENTIFIQUE	PROJET	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
PHYSIQUE DES QUARKS ET LEPTONS	ATLAS	*Upgrade*	Exploitation			*Upgrade*				Exploitation	
	CMS	*Upgrade*	Exploitation			*Upgrade*				Exploitation	
	LHCb	*Upgrade*	Exploitation			Arrêt				Exploitation	
	Belle-II	Exploitation	*Upgrade*	Exploitation			*Upgrade*	Exploitation			
	FCC Feasibility Study	Étude de faisabilité									
PHYSIQUE HADRONIQUE	ALICE	*Upgrade*	Exploitation			Arrêt				Exploitation	
	CMS HI	*Upgrade*	Exploitation			Arrêt				Exploitation	
	LHCb HI	*Upgrade*	Exploitation			Arrêt				Exploitation	
	Projet EIC	Conception			Construction						Exploitation
PHYSIQUE NUCLÉAIRE ET ASTROPHYSIQUE	AGATA	Exploitation @ GANIL	Exploitation @ LEGNARO			Exploitation @ FAIR, ISOLDE, GANIL…					
	SPIRAL2/S3	Construction			Exploitation						
	SPIRAL2/DESIR	Construction					Exploitation				
	FAIR/NUSTAR	Construction						Exploitation			
PHYSIQUE DES ASTROPARTICULES	HESS	Exploitation									
	PAO	Exploitation									
	Adv Virgo+	Construction			Exploitation - O4	Construction			Exploitation - O5		
	CTA	Construction						Exploitation			
	LISA	Construction									
	Projet ET	Étude de conception									
ÉNERGIE NOIRE ET INFLATION COSMIQUE	LSST	Construction			Exploitation						
	Euclid	Construction				Exploitation					
	Projet LiteBird	Construction									
	Projet CMB-S4	Étude de conception				Construction					
MATIÈRE NOIRE ET PHYSIQUE DES NEUTRINOS	XenonNT	Construction	Exploitation								
	T2K-II/SK	*Upgrade*		Exploitation							
	JUNO	Construction			Exploitation						
	KM3NeT	Construction				Exploitation					
	HK	Construction					Exploitation				
	DUNE	Construction								Exploitation	

2 3

Summary

CC-IN2P3 computing infrastructure are involving on majority of computing model of our collaborations.

We are engaged with a major role on the computing an data management of collaborations.

- Productions
- R&D and infrastructure evolution

Skills and technical capability of our teams are recognized.

- Definition of computing and data management models
- Technical aspect
- Resources sizing
- ….

As early as possible a contact is establish between a collaboration and CC-IN2P3 , better it is.

BACKUP

Summary

A strong overlap of experiment on running phase:

- **Huge capacities to deploy and operate**

Commissioning or upgrade

- **Strong ramp up on resources to be delivered**

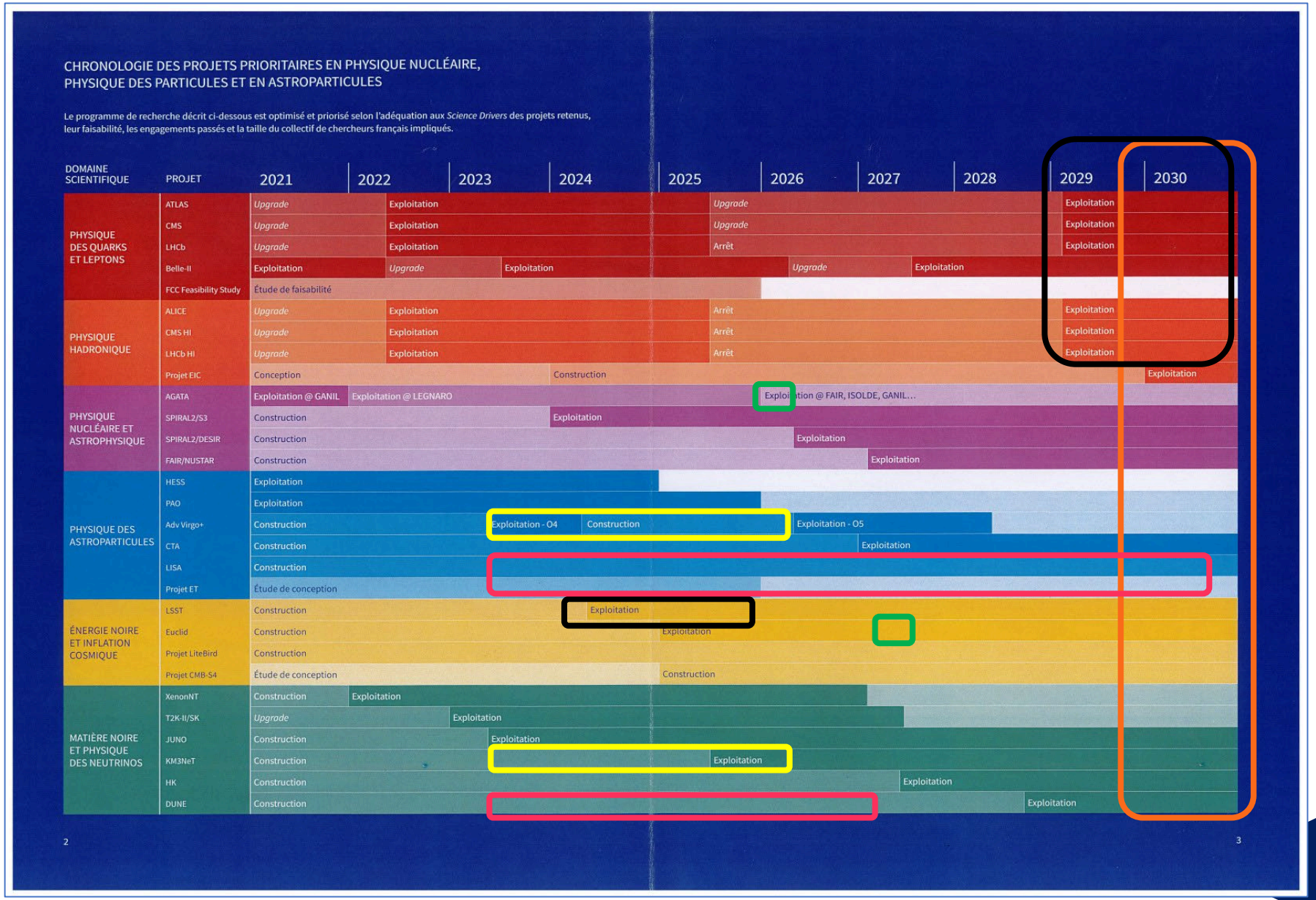
Change on computing models

- **Support and services evolution**

Potential change of technologies / new technologies to deploy

- **New computing devices, new storage technologies, new infrastructure**

Building the computing model



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