

Software & computing report 2023

Frédéric Derue, LPNHE Paris

ATLAS France CAF-user meeting

21st november 2023

- **CAF and other S&C involvement in France**
- **ATLAS S&C this year**
- **Other news**

ATLAS France web site
<https://atlas-fr.pages.in2p3.fr>

- **CAF mandate** [link](#)

- ensure French S&C activities & resources provided to ATLAS meet expectation
- ensure French physicists get adequate computing infrastructures & resources for analysis

- **CAF makes the link between**

- French physicists
- French T1 & T2s sites
- other T2s in the FR-cloud :
China, Hong Kong, Japan,
Morocco, Romania
- ATLAS S&C
- other projects LCG-FR

- **CAF members**

- 1 representative/lab
APC (G. Marchiori),
CPPM (A. Duperrin),
IJCLab (L. Duflot),
IRFU (E. Chapon, A. Formica),
L2IT (J. Stark),
LAPP (S. Jézéquel),
LPC (D. Calvet),
LPNHE (F. Derue, chair),
LPSC (P-A. Delsart)
- CC-IN2P3 representatives
E. Fédé : Technical responsible for T1
A. Vedaee : ATLAS support at T1
- LCG-FR representatives (de facto)
L. Duflot, D. Bouvet
- ATLAS-IN2P3 & IRFU resp. ex-officio
L. Serin & F. Déliot

● ATLAS S&C responsibilities

- International Computing Board (ICB): F. Derue (IN2P3), A. Formica (CEA)
- most of members of CAF in sites with T2 are also scientist in charge of the grid site
- ongoing appointments as appearing in [*glance*](#)

Appointment	OTP	Member	Affiliation	Start date	End date	Status
Conditions Evolution Coordinator // Activities and Detector Projects // Software and Computing // ATLAS Database and Metadata (ADAM)		ANDREA, Formica	Saclay CEA (France)	2021-01-01	2024-09-30	active
LAr Phase-II Online Software // Activities and Detector Projects // Liquid-Argon Calorimeter (LAr) // Upgrade Phase-II Electronics		OLIVIER, Arnaez	Annecy LAPP (France)	2023-03-01	2024-03-31	active
LAr Phase-II Online Software // Activities and Detector Projects // Liquid-Argon Calorimeter (LAr) // Upgrade Phase-II Electronics		FATIH, Bellachia	Annecy LAPP (France)	2023-03-01	2024-03-31	active
Physics Metadata Coordinator // Activities and Detector Projects // Software and Computing // ATLAS Database and Metadata (ADAM)		PIERRE ANTOINE, Delsart	Grenoble LPSC (France)	2021-05-01	2024-09-30	active
Muon Database Coordinator // Activities and Detector Projects // Muon Spectrometer // Database		ANDREA, Formica	Saclay CEA (France)	2014-01-01	2024-02-29	active

● Other S&C responsibilities

- DS IN2P3 Calcul Intensif : S. Crépé-Renaudin (LPSC)
- WLCG/LCG-FR: member of CoDir / scientific director L. Duflot (IJCLab)

Information taken from [OTP report](#)

→ either Activity= «Computing & Software »

Same as in 2022

ATLAS OTP - OTP ATLAS
- Commitment Report - 2023 - Class 2, Class 3 and Class 4

System	Activity	Task Id	Task	Requirement Id	Requirement	Funding Agency	Institution Id	Institution	Description	Committed [FTEs]	Allocated [FTEs]	Task Requirement [FTEs]	Committed Fraction of Requirement [%]
General Tasks	Computing/ Software	534123	Dataset-level Metadata Catalogues and Infrastructure (AMI)	558077		France IN2P3	52	Grenoble LPSC	Support and developmnt for AMI.	2.70	0.94	0.87	311
PIXEL	Computing/ Software	531773	Software Development/ Maintenance and Physics Performance	555533		France IN2P3	40	Marseille CPPM	Performance studies and software development	0.80	0.08	6.00	13
PIXEL	Computing/ Software	531773	Software Development/ Maintenance and Physics Performance	555533		France IN2P3	107	Paris LPNHE	Offline software, rad damage, performance studies.	0.15	0.01	6.00	3
PIXEL	Computing/ Software	531773	Software Development/ Maintenance and Physics Performance	555533		France IN2P3	353	APC Paris		0.15	0.00	6.00	3
General Tasks	Computing/ Software	12347	TAG/El and Conditions/ Metadata Database Development	12350	Conditions Database	France CEA	127	Saclay CEA	Develop and maintain the conditions database infrastructure	0.65	0.20	1.49	44
General Tasks	Computing/ Software	64	Reconstruction	552677	Jet/ETmiss combined reco.	France IN2P3	52	Grenoble LPSC	JET-Athena-Reconstruction	0.20	0.07	1.74	12
PIXEL	Computing/ Software	531773	Software Development/ Maintenance and Physics Performance	556392	Rad Damage Coordinator	France IN2P3	353	APC Paris		0.50	0.18	1.40	36
General Tasks	Computing/ Software	12347	TAG/El and Conditions/ Metadata Database Development	552547	TAG, EventIndex and Conditions Metadata	France IN2P3	104	IJCLab	Develop and operate the EventIndex (Hadoop)	1.00	0.20	2.48	40
Total Commitments:		8							FTEs:	6.15	1.68	25.97	24

Some of these commitments (e.g part of AMI) are also in-kind contributions

→ either appears the key-word « software »

System	Activity	Task Id	Task	Requirement Id	Requirement	Funding Agency	Institution Id	Institution	Description	Committed [FTEs]	Allocated [FTEs]	Task Requirement [FTEs]	Committed Fraction of Requirement [%]
Muon	Data Preparation	528951	Barrel optical alignment	551723	Alignment experts	France CEA	127	Saclay CEA	M&O, software, DQ	2.00	0.50	0.55	367
LAr	Detector Operation	22547	Home stations	22550	Back end test station (Annecy)	France IN2P3	9	Annecy LAPP	online software test station	0.10	0.00	0.00	Infinity
LAr	Detector Operation	22512	LAr online software	22513	LAr Online SW development	France IN2P3	9	Annecy LAPP	LAr online SW maintenance and development, TDAQ version migration	1.00	0.24	0.72	139
TILE	Detector Operation	20569	Tile calibration systems maintenance	554143	Laser	France IN2P3	36	Clermont-Ferrand	Maintenance of Laser 2 non-optical hardware and TileLasII software package	0.10	0.00	0.00	Infinity
LAr	Data Preparation	22747	Reconstruction,EDM,Validation	291594	Validation / RTT tests	France IN2P3	40	Marseille CPPM	Software validation (J. Toth)	0.20	0.00	0.00	Infinity

	Software					ADAM	Computing				
	Core	Upgrade	Data/ Detector	Reco/ Ana	Total [S&C+AS]	Total	C2	C3	C4	Other	Total
APC		0.28	0.36	0.50	1.14 [1.14]		0.10				0.10
CC- IN2P3									3.30		3.30
CPPM	0.39	0.04	1.06	0.39	1.78 [1.08]			0.05	0.65		0.70
IJCLab		0.90		0.42	1.32 [0.42]	0.40	0.23	0.05	0.30	0.40	0.98
IRFU			0.10		0.10 [0.10]	0.54		0.05	0.50		0.55
L2IT		1.52		0.24	1.76 [0.36]						
LAPP			0.24	0.05	0.29 [0.05]		0.02	0.05	1.00		1.07
LPC			0.15	0.42	0.57 [0.22]				0.70		0.70
LPNHE		0.20	0.84	0.40	1.24 [0.22]		0.17	0.45	0.90		1.52
LPSC				0.58	0.58 [0.58]	1.90		0.05	0.08		0.13
Total	0.39	2.94	2.75	3.00	8.78 [4.17]	2.84	0.52	0.70	7.43	0.40	9.05

See also dedicated set of slides on the agenda for the details for each laboratory

• Computing (9.1 FTE)

- 7.4 FTE for FR-T1/2 (Class 4)
 - 8.2 in 2022 (LPSC decommissioned)
- 0.70 FTE for FR-cloud support & management (Class 3)
- 0.5 FTE for shifts (Class 2)
 - 0.4 in 2022
- 0.4 FTE for other (WLCG)

• Software (8.7 FTE)

- 4.2 FTE are labelled as S&C or Analysis Support for ATLAS OTPs
 - 4.3 in 2022
- 0.2 FTE SW core (0.2 in 2022)
- 2.9 FTE Upgrade (3.4 in 2022)
- 2.8 FTE data/detector (4.4 in 2022)
- 3.0 FTE reco/analysis (2.9 in 2022)

• ADAM (2.8 FTE)

- WG management 0.3 FTE (0.3 in 2022)
- AMI, EventIndex 2.5 FTE (3.3 in 2022)

⇒ slow erosion of our involvement, due to decommissioning/retirement and switchover to other responsibilities ; **no/not enough new blood**

⇒ several new positions (CR + Univ.) with ML flavour, do not specially reflect in OTPs

These numbers include (in general) contributions to other projects on computing to LCG-FR, DOMA-FR, ESCAPE 2

● Version

- build static sites based on gitlab/Mkdocs, deployed at CC
- gitlab : <https://gitlab.in2p3.fr/atlas-fr/atlas-fr.pages.in2p3.fr/>
 - need an account at gitlab@CC
 - then i give access rights to the project
- static page : <https://atlas-fr.pages.in2p3.fr/>
- simple link : <http://atlas-france.in2p3.fr/>

● Link to S&C papers and presentation

- <https://atlas-fr.pages.in2p3.fr/fr/Ressources/Publications/>

Publications

Les membres d'ATLAS France participent aux publications de la collaboration.

Physique et détecteurs

Les publications sont accessibles sur le site suivant [géré par la collaboration ATLAS](#).

Software & Computing

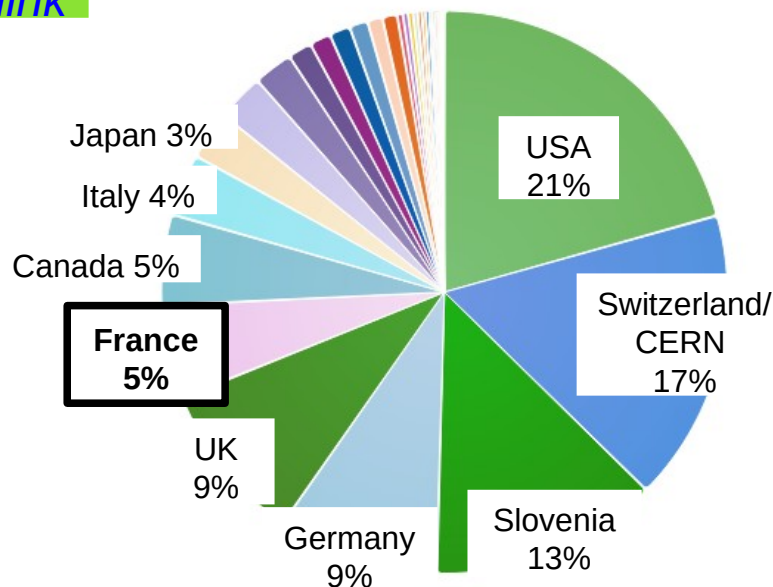
Les résultats publics de la collaboration sur les aspects software et computing sont disponibles sur la page [suivante](#).

2023

- Software performance of the ATLAS Track reconstruction, ATLAS Coll., <https://arxiv.org/abs/2308.09471>
- Experimental Particle Physics and Artificial Intelligence, D. Rousseau (IJCLab), Part of Artificial Intelligence for Science: A Deep Learning Revolution, 447-464, <https://inspirehep.net/literature/2673116>
- Jet Diffusion versus JetGPT – Modern Networks for the LHC, A. Butter (LPNHE) et al., <https://inspirehep.net/literature/2660878>
- pyBumpHunter: A model independent bump hunting tool in Python for high energy physics analyses, L. Vaslin, S. Calvet, V. Barra, J. Donini (LPC), [doi: 10.21468/SciPostPhysCodeb.15](https://doi.org/10.21468/SciPostPhysCodeb.15)

● Computing usage by country

[link](#)

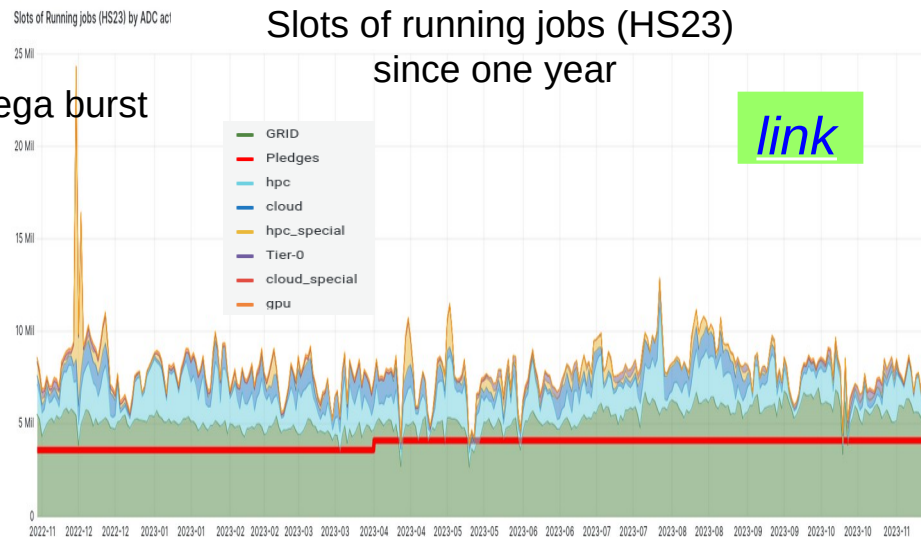


● Smooth computing operation

- 6-800k jobs/d on grid
- HLT farm, HPC, cloud, gpu
- Wallclock successfull jobs : 93%
- ~70% MC simu, reco, evgen
- 10% group production
- 12% user/group analysis

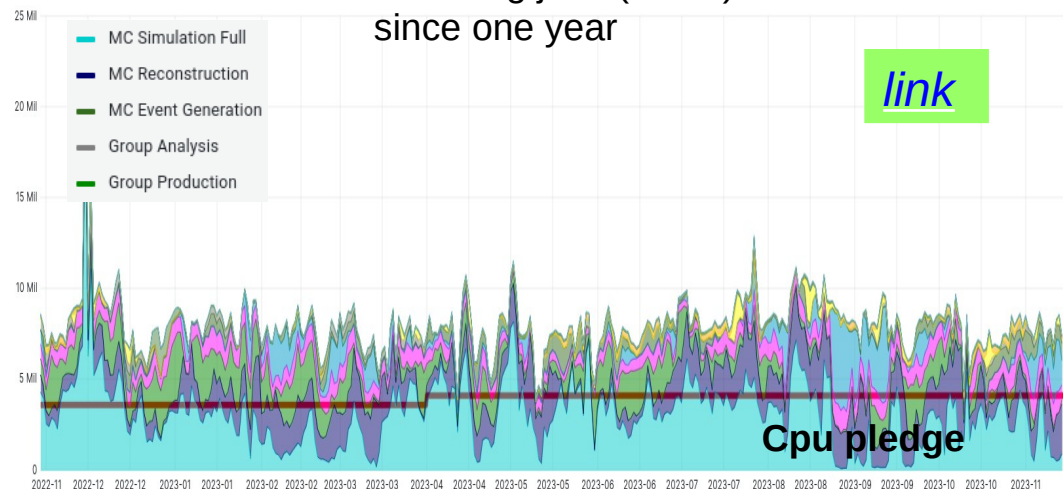
fake Vega burst

Slots of running jobs (HS23) since one year



Slots of Running jobs (HS23) by ADC ar

Slots of running jobs (HS23) since one year

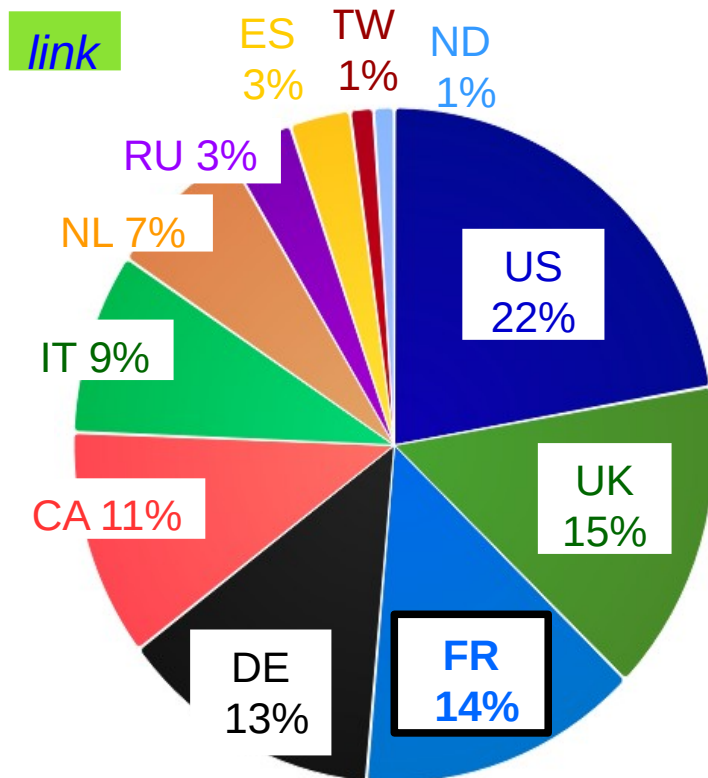


- **Pledge of CC-IN2P3 (see [cric](#))**

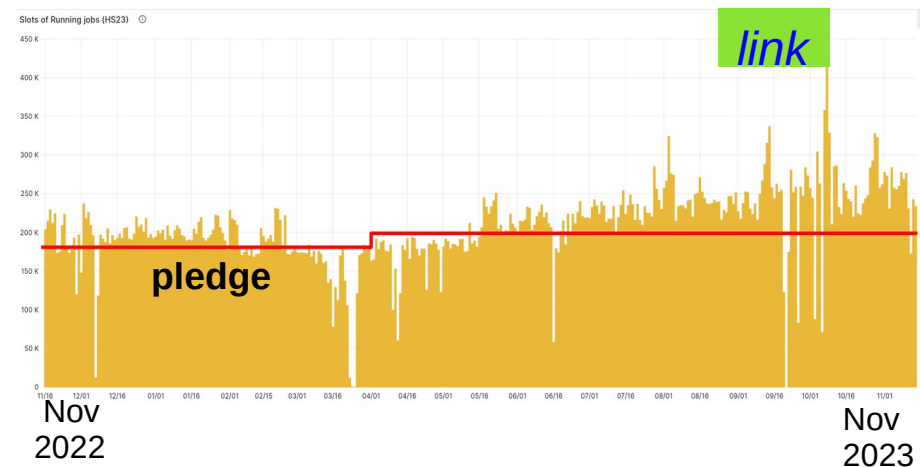
- 13.1% of T1s pledges
- in 2024 : +3% $\Rightarrow$ 13.5% of all T1s pledge requests

Pledge 2023 (HS23)	Pledge 2024 (HS23)
198770	204660

- **CPU realized on grid by each T1 since one year**



Slots of running jobs (HS23) at CC-IN2P3



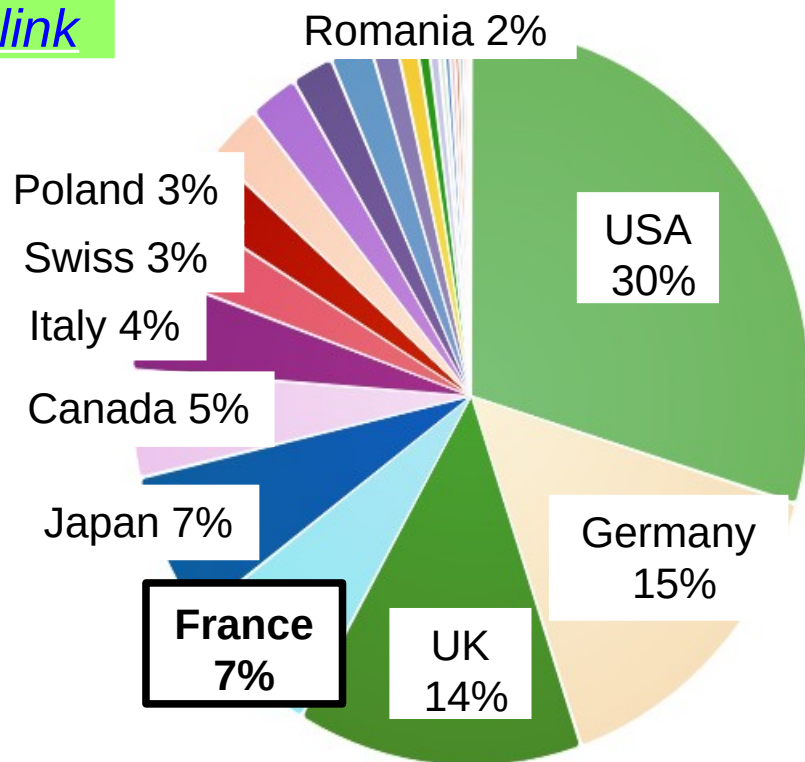
108% of its pledge since a year

France has realized 14% of T1 ATLAS usage of computing resources this year

- **Pledge for France (see [cric](#))**
 - 8.6% of T2s pledges
 - in 2024 : +9% $\Rightarrow$ 8.3% (9.3%) of all T2s pledges (ATLAS pledges request)

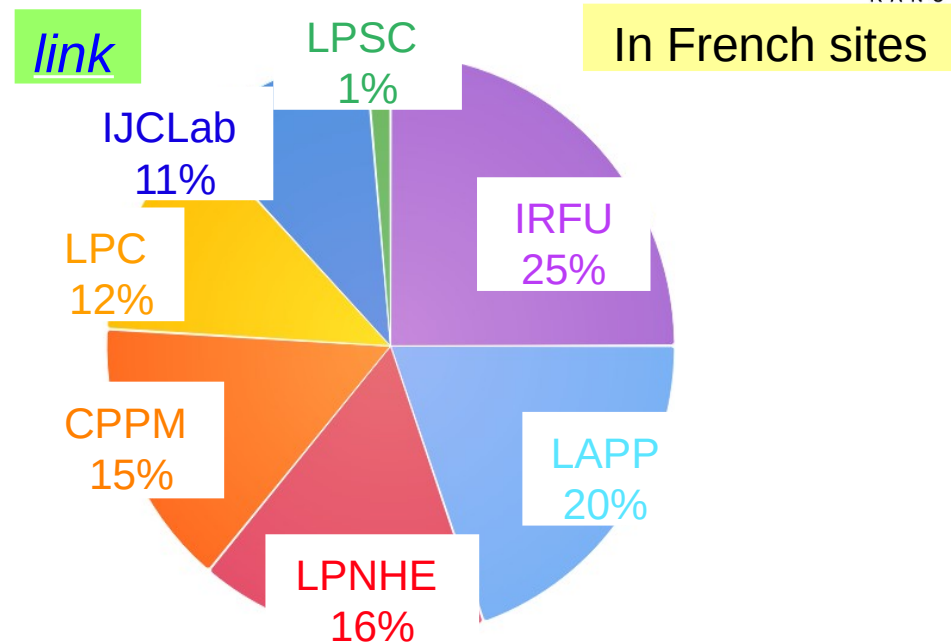
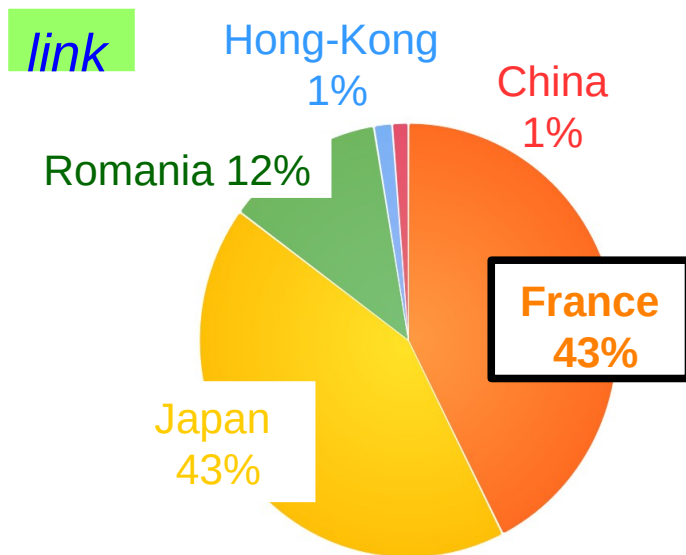
● realized by each country this year

[link](#)

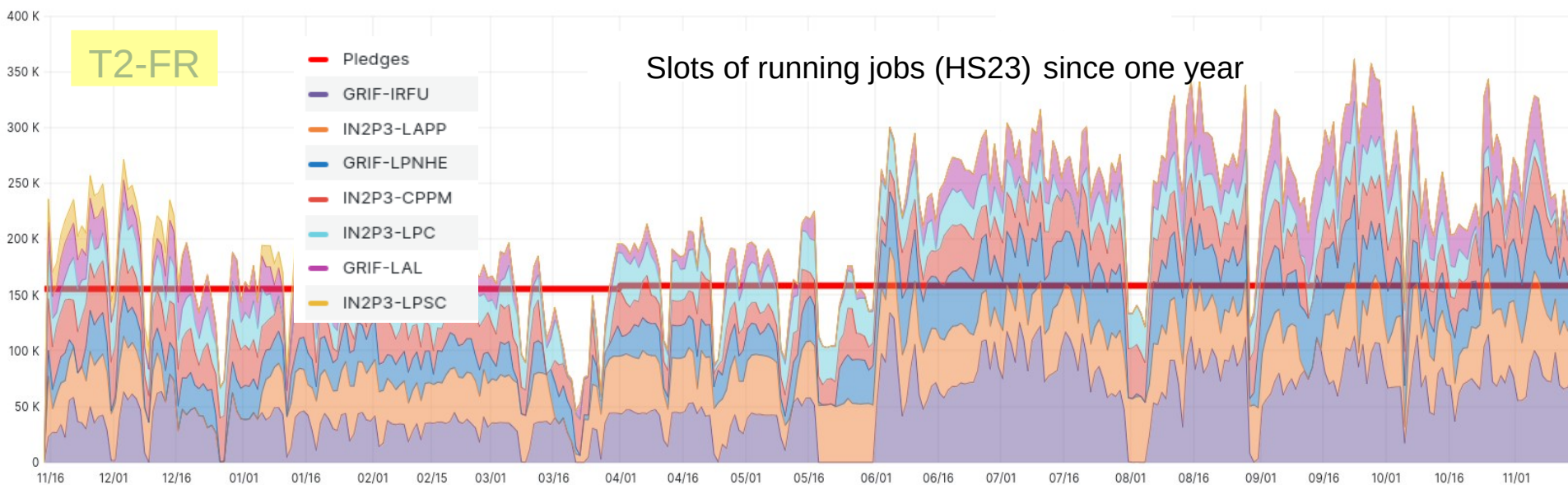


Site	Pledge 2023 HS23	Pledge 2024 HS23
Tokyo	100000	100000
GRIF	65200	69527
LAPP	45000	55000
CPPM	24000	24000
RO-LCG	24000	24000
LPC	24000	24000
Beijing	8000	8000
Hong-Kong	1000	1000

France has realized 7% of T2 ATLAS usage of computing resources this year



Slots of Running jobs (HS23) by ADC activity ⓘ



France has realized 133% of its ATLAS T2 pledge of computing resources this year

The analysis model of ATLAS is to send jobs on grid
Thanks to CC-IN2P3 we can use our own resources on local batch system

● local batch system

- batch system based on Slurm
- typical pledge ~500 jobs but up to 3500 jobs
- no priorities within ATLAS jobs first arrived first served

<https://portail.cc.in2p3.fr/>

Each user should log here
and check its own infos !

Informations about slurm batch system partitions

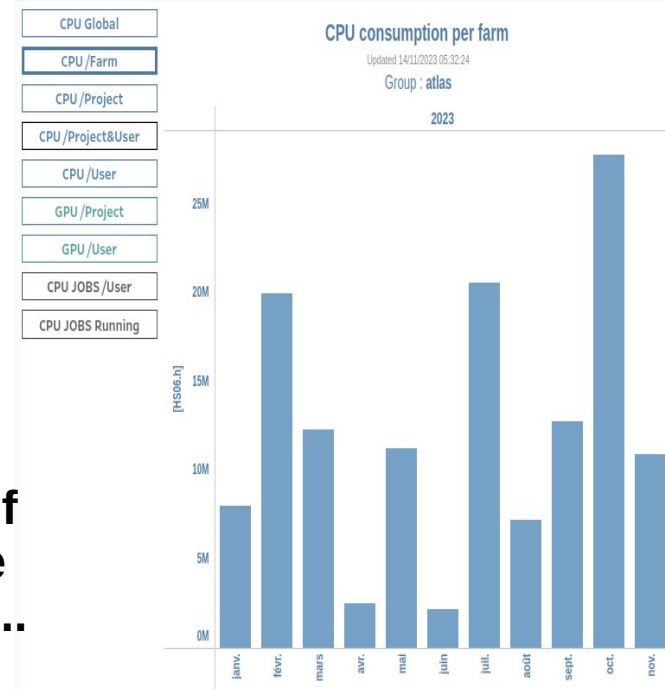
https://cctools.in2p3.fr/mrtguser/info_slurm_parcsV2.php

● cpu consumption

- 9.2% of ATLAS CPU at CC-IN2P3
rest is grid production (was ~4% last year)
- ~50 ATLAS users
- but large fluctuations from month to month

**There is no priority in between ATLAS users
First arrived first served !**

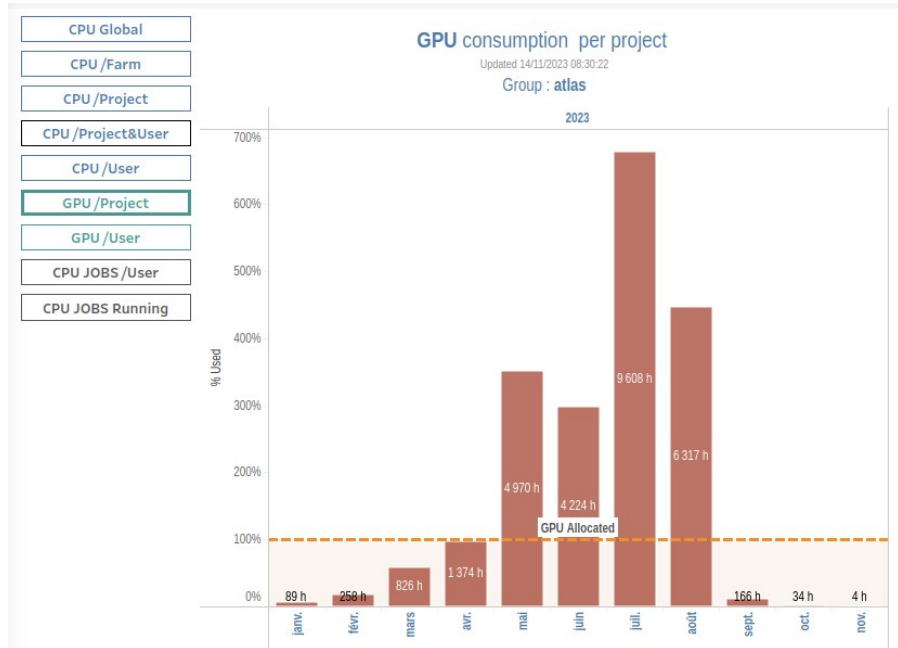
**It's considered as impolite to send xillions of
jobs in once, to use enormous RAM, to have
cpu inefficient jobs, to take all disk space**



Request to CC-IN2P3 for cpu on batch for 2024 is the same as in 2023

Informations about slurm batch system partitions

https://cctools.in2p3.fr/mrtguser/info_slurm_parceV2.php



https://portail.cc.in2p3.fr/graph/conso_group

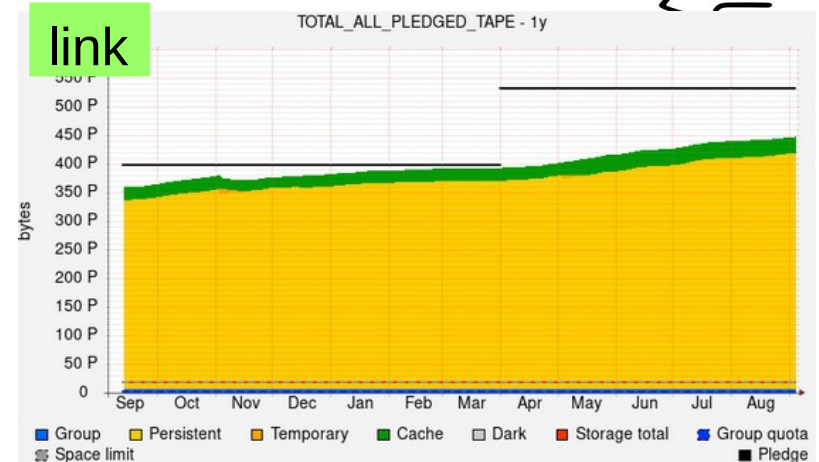
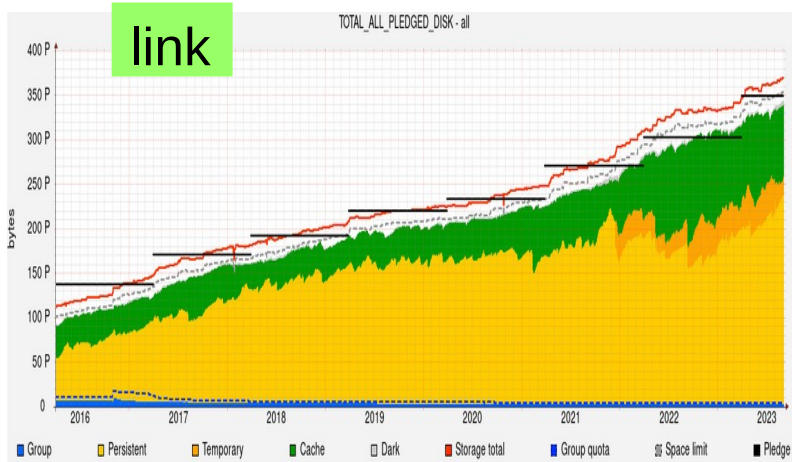
• Request 2023

- 2 GPU-year, ~0.25 per lab
- 17kh or ~200h per lab, or 1400h/month

• Realized 2023

- 27870 h used, ~220 % of our request
We are finally doing more than our request !
- 11 users ... but large peaks relied on one student at LPNHE
⇒ see presentation this afternoon
- comes back to almost 0 since september ...

For 2024 increase pledge to 4 GPU-year (34 kh)



Storage evolution

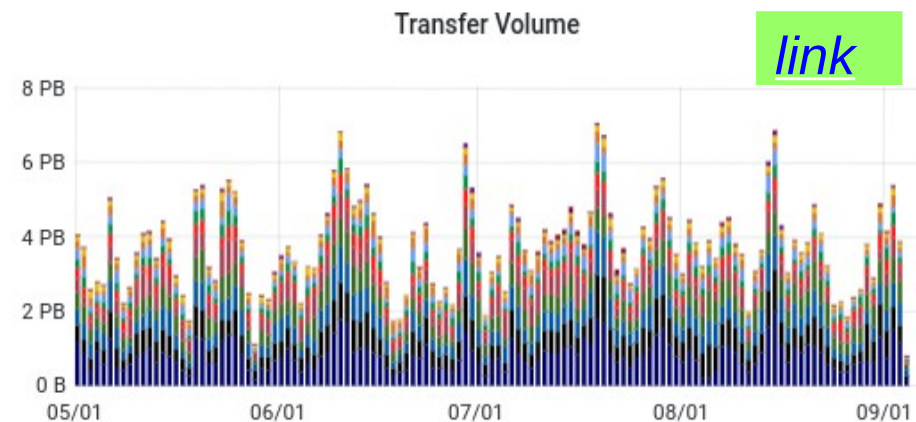
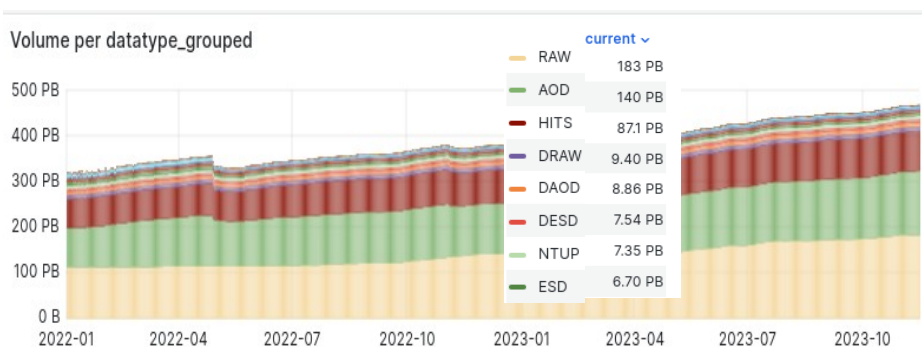
- disk pledge of 370 PB – 337 TB filled
- tape pledge of 530 PB – 440 TB filled

Tape usage since start of Run 3

- we take data
- some Tier 2s now offer tapes

Data movement (per day)

- moving 3-4 PB/d (1.5M files)
@30-40 GB/s with peaks >50 GB/s
- deleting ~3-4 PB/d

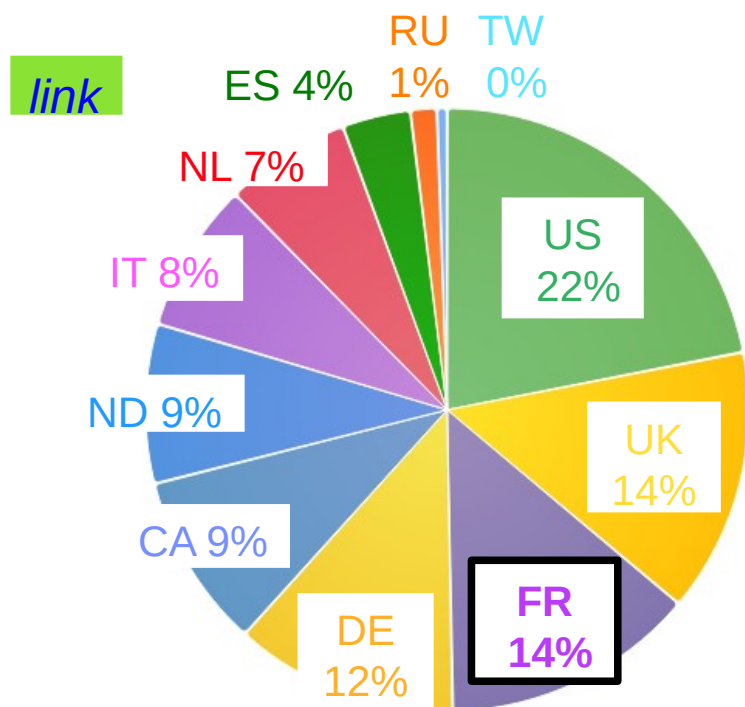


- Pledge of CC-IN2P3 as a Tier-1 (see [cric](#))
 - disk=12.4%, tape=14.5% of T1s pledge request
 - in 2024 : +16 % for disk, +25% for tapes
⇒ disk=13.5%, tape=14.5% of T1s pledge requests

	Pledge 2023 (TB)	Pledge 2024 (TB)
Disk	19040	22005
Tape	52244	65540

- Storage for each cloud

DATA+SCRATCHDISK+ DATATAPE+MCTAPE



- LOCALGROUP [\[link\]](#)

- non pledged, accessed from grid/batch
 - 9 users=400 TB on LGD
- **pledge will not increase in 2024**

	Total (TB)	Free (TB)
DISK	520	199
TAPE	250	

France has realized 14% of T1 ATLAS usage of storage resources this year

- **Pledge for France (see cric)**

- 9.7% (9.3%) of T2s pledges (pledge requests)
- in 2024 : +23%
⇒ 9.9% (9.6%) of T2s pledges (pledge requests)

live-storage

- **LOCALGROUP**

- non pledged resources

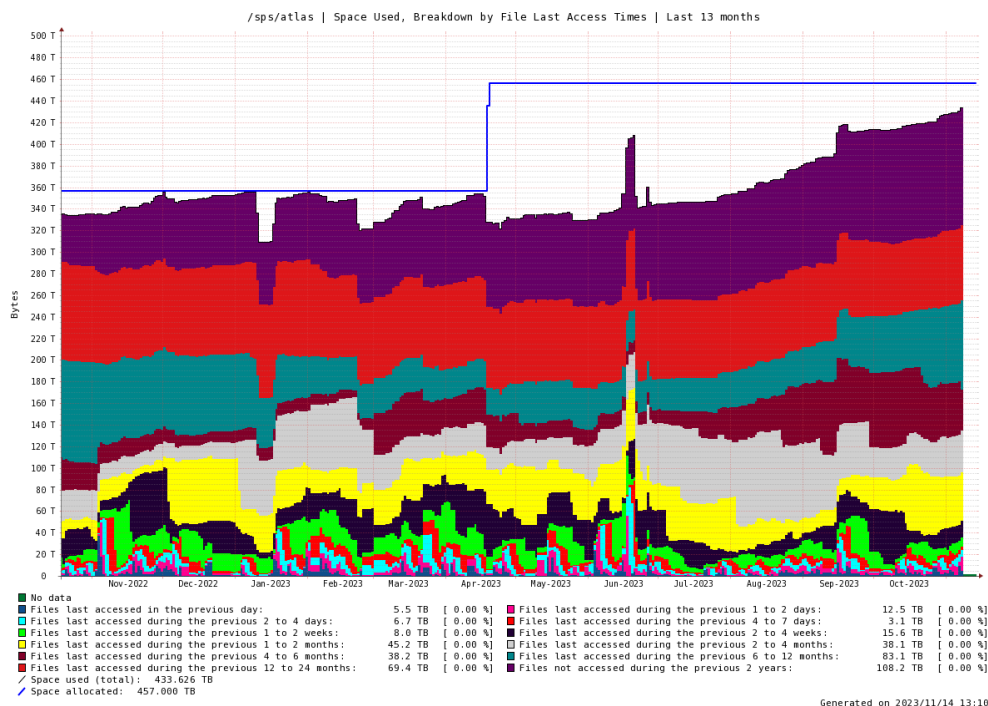
	Total (TB)	Free (TB)
CPPM	245	190
GRIF	700	204
LAPP	59	18
LPC	28	10
Beijing	10	10
Tokyo	2000	845
RO-07	11	3

	Pledge 2023 (TB)	Pledge 2024 (TB)	Installed (TB)
CPPM	2200	2200	2264
GRIF	6099	7221	6150
LAPP	4500	7000	7100
LPC	2825	2825	2197
Beijing	400	400	376
Hong Kong	1050	1050	1056
Tokyo	8800	8800	11000
RO-07	3500	3500	4510

Migration of DPM to EOS or dCache is now finalized !

⇒ that was a huge effort done by the syst admins of our Tier 2 sites !

● semi-permanent sps (see [link](#))



	Total (TB)	Free (TB)
sps	457	20

Many new users (~15) since a year who need place ...

- data not accessed since 1-2 year 69 TB, since >2 years 108 TB
- could be moved to ATLASLOCALGROUPTAPE but cleaning would be better
- list of main users ([link](#)) + check with your CAF contact

For 2023 pledge we asked for 100 TB more
In September there was no foreseen increase
no increase of request was done for 2024

⇒ since then sps was filled with 110 TB, while 34 TB was deleted,
so +80TB in a few weeks ⇒ we will be again in crisis

• LHCOPN/GEANT @100 Gbps

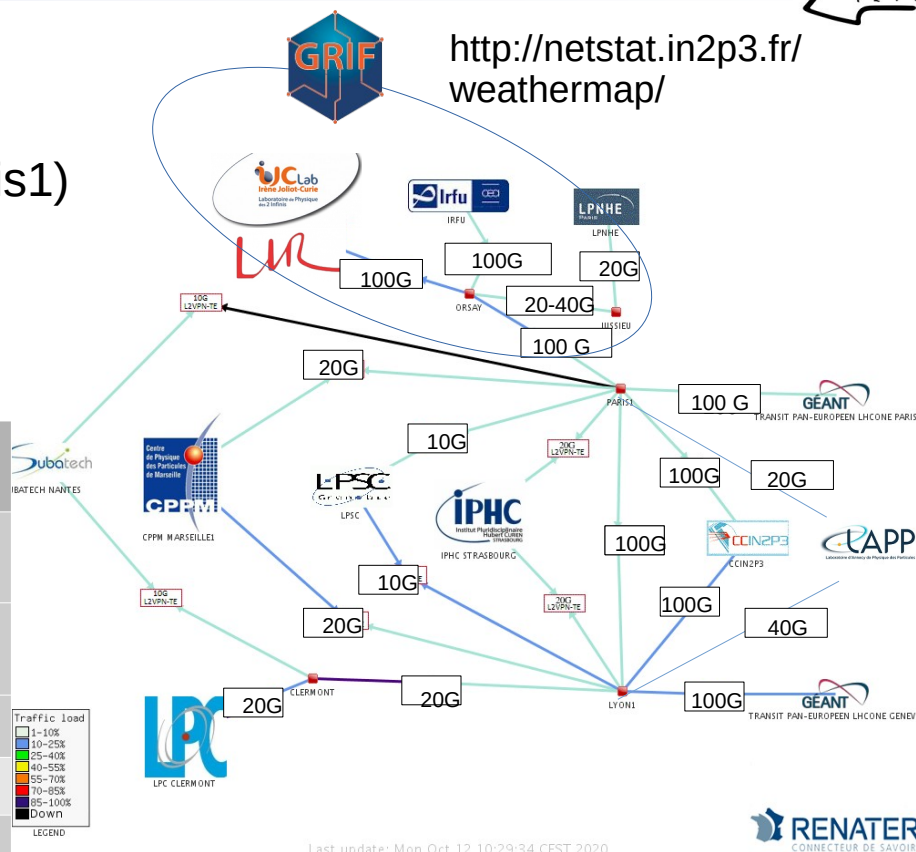
• LHCONE

- links to Tier 1 100 Gbps (Orsay ↔ Paris1)
(Paris1 ↔ CCIN2P3 ↔ Lyon1)
- links in between sites 10-100 Gbps

foreseen upgrades [link](#)

Site	2022	2023 (pred)	2023 (real)	2028
CC (LHCOPN)	100	200	200	400
CC (LHCONE)	100	100	100	400
CPPM	20	40	10	100
IRFU	100	100 (+10)	100 (+10)	200
IJCLab	100	100 (+20)	100 (+20)	200
LAPP	40	40	20	100
LPC	20	20	10	100
LPNHE	20 (+10)	40	2*10 (+10)	100
LPSC	10	10	10	10

Expect upgrade to 40 or 100 Gbps by RENATER to CPPM, LAPP, LPC « soon » (since ~summer)



• Data Challenge 24

- cf. [agenda](#) at LCG-FR CoDir
- WLCG DOMA group is organizing DC24
- targeting 25% of HL-LHC scale and includes T1/T2
- ~end of February 2024

See Friday plenary at last S&C week : [slides](#)

Few people available for subsystem software, most are busy with upgrade construction and Run 3 operation. Important to keep a small team of software experts, which will hopefully grow after the end of Run 3

● Core software

- RNTuple being on very good track for being our (analysis) file format for Run-4
 - ROOT's new I/O subsystem for Run 4 <https://inspirehep.net/literature/2065284>
 - superseeding TTree
- the 2 main GPU demonstrator projects show good results by now
 - the [traccc project](#) is nearing feature completion using the “toy detector” geometry
Discussions already started on the code's re-integration into Acts, and then into Athena
 - GPU-based TopoClustering : clustering and almost all moment calculations now fully implemented using CUDA

● Simulation

- Run 3 version of AtlFast3 has been successfully validated and is ready to be used by the collaboration.
Implements two distinct approaches of shower generation:
 - FastCaloSimV2: parametrised modelling
 - FastCaloGAN: Generative Adversarial Networks
- pileup Digitization is the one piece of MC workflow which is not MT yet

See Friday plenary at last S&C week : [slides](#)

● Reconstruction

- redoubling efforts to strengthen coordination, communication, & personpower
 - ACTS roadmap & R2R4 (Road To Run 4) in rough agreement, revisit synchronization
 - muons: work with new upgrade-focused coordinators to develop muon roadmap
 - planning more CP-focused upgrade sessions (~6 months)
- can be difficult to track ongoing FTE across projects
 - consider using JIRA to track project progress (even for CP groups)
 - request OTP for all Reconstruction & Upgrade related activities with clear list of tasks

● AMG / Analysis

- Analysis projects focusing on the deployment of the Run 4 model; tests in Run 3
 - focusing on PHYSLITE, and
 - enabling the use of python and columnar data operations
- Existing Milestones
 - AN-1: Baseline DAOD_PHYSLITE with Run 3 s/w (event loop based) and TTree (Q3/23)
Full example exercising all CP algorithms available in AnalysisAlgorithmsConfig
PHYSLITE being exercised by multiple analyses, active feedback loop created
First result using PHYSLITE
 - AN-2: PHYSLITE working with RNTuple (Q2/24)
 - AN-3: Prototyping & review of columnar data operations for end-to-end analysis (Q3/24)
 - AN-4: Development of columnar analysis infrastructure (Q2/26)
Efforts to adapt analysis performance algorithms (calibration, uncertainties, scale factors,...)
to columnar analyses. ⇒ "triple-use" algorithms (Athena, AnalysisBase, columnar)
 - AN-5: Accommodate all analyses in the Run 4 analysis model (Q2/28)

See Review at last S&C week : [slides](#)

● Database & conditions

- Oracle consolidation (done)
 - deployment of new Frontier launchpads using ATONR_ADG done and used by some sites since April (T0, CERN, LRZ-LMU fully, BNL using as backup)
- CREST (on schedule)
 - developments of server side and client side tools ongoing (standalone+Athena)
 - deployment of CREST service
 - data migration from COOL to CREST and Athena job testing successfully done for Lar, Tile subsystems
 - started to work on HLT demonstrator

● Metadata

- AMI deployment only @CERN (done, since May 2023)
 - CC-IN2P3 dismissed (thanks to experts in CC!)
- AMI Tags (on schedule)
 - progress on new DB implementation using JSON LOBs
- AMI DB (delayed)
 - ongoing DB scheme re-design for optimization and better maintainability
- tasks inside AMI
 - some tasks to collect metadata are considered heavy to maintain and AMI team is looking for some external help interested in taking over the development
 - other collaborations are using/develop AMI, e.g deployment of AMI using Kubernetes
 - ATLAS Dataset classification : <https://cds.cern.ch/record/1070318>

- **Réorganisation direction IN2P3**

- plus de DAS Calcul, devient déléguée scientifique (DS)
Calcul Intensif, attachée à la direction
- LCG-France rapasse sous le giron du DAS Particule
- France-Grilles ne passe pas sous un DAS → sous le directeur
- les plateformes restent sous le DS CI
- l'activité AI/ML sera sous un autre DS
- budget LCG-FR sanctuarisé

● LAPP

- decease of Cécile Barbier in early August who took the responsibility of LAPP contact for LCG
- forced renewall of the MUST platform team after the departure of key members (Philippe Seraphin, Ludovic Duflot) and retirement (Nadine Neyroud)
- after almost a year of operation and dcache migration with very restricted, new IT engineers arrived with permanent (CNRS) or temporary (University) arrived under the coordination of Frederique Chollet

● LPSC

- decommissioning finalized in January 2023
- huge work of Christine Gondrand ! and all people who created and maintained (Sabine, Pierre-Antoine, Catherine ...) this Tier 2 during so many years

● CC-IN2P3

- Adriano Di Florio got a Chair Professeur Junior (CPJ) IN2P3 (calcul hétérogène et HPC pour le LHC)
- Sabine organized a 1st contact meeting end of September with ATLAS France LHC computing contacts, LCG-FR dir.

- **CAF group and activities**

- business as usual
- also involved in support for FR-cloud !

- **LCG-France**

- ensure the scientific and technical coordination of Tier sites in France
- important contribution for grid sites funding
(but there are also other sources ...)

- **S&C in ATLAS France**

- smooth operation of CC-IN2P3 as a Tier-1 and our Tier-2s
- level of resources for ATLAS-FR users reviewed by CAF in september
 - adequate level of resources of CC-IN2P3 as Analysis Facility in 2023
(batch, sps, LGD), keep same level in 2024,
but sps disk crisis, absence of cleaning and good planification
 - CC-IN2P3 offers GPU farm, request of 4 GPU-year done for 2024
 - many other resources also available in laboratories (Tier-2s, local batch/disk)

**A BIG thanks to CC-IN2P3, all our Tier-2s colleagues,
& LCG-FR management for the operation, maintenance
and development of our computing infrastructure**

More to come this afternoon !

- **S&C in ATLAS, Run 3 and preparation of Run 4**
 - egamma-ML studies (Edmar Purcino de Souza)
 - HL-LHC tracking demonstrator (Jan Stark)
- **Better & more efficient tools**
 - CC-IN2P3 as an Analysis Facility (Bernard Chambon)
 - Carbon & sustainability (Emilien Chapon)

**R&D for storage/analysis evolution requires person power
– syst admins and physicists –
in order to use solutions which fit our needs !**