LCG-France : Bilan préliminaire 2011

Fairouz Malek (LPSC)
Frédérique Chollet (LAPP)
Pierre Girard (CC-IN2P3)
Yannick Patois (IPHC)

LCG-France meeting, CC-IN2P3, Villeurbanne
30 nov. 1rst dec. 2011

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- LCG-France within WLCG
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LCG-France
http://lcg.in2p3.fr

La composante française de l'infrastructure de calcul des expériences LHC (Coll. internationale W-LCG),

Un projet de l'IN2P3/CNRS et de l'Irfu/CEA initié en 2004,

Une grille thématique au sein de l'infrastructure de production pérenne France Grilles (NGI),

Une communauté d'experts français des laboratoires et des expériences

LCG-France

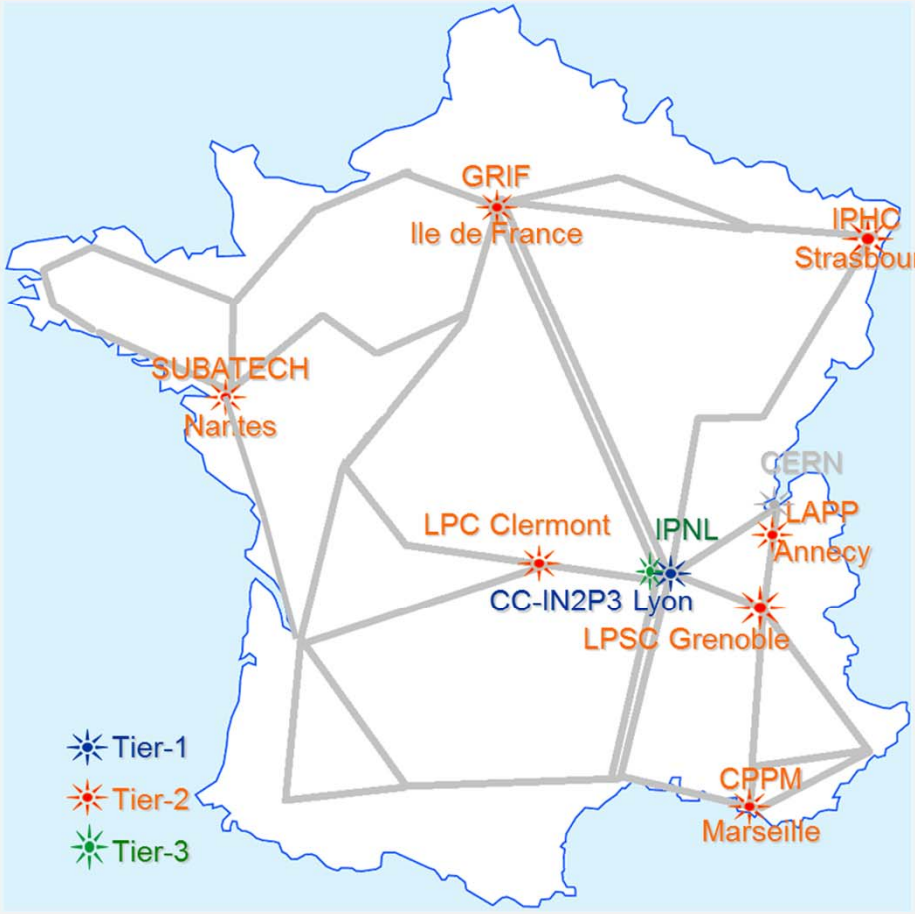
Projet de l'IN2P3/CNRS et de l'Irfu/CEA

- **Projet initié en 2004**
  - Mettre en place un Tier-1 au Centre de Calcul de l'IN2P3 (CC-IN2P3) à Lyon
  - Promouvoir et soutenir l'émergence de sites Tier-2 et Tier-3 en France
- Contribution française significative au calcul des quatre expériences LHC, de l'ordre de 10 %
- Financement annuel au titre des TGIR du CNRS avec soutien aux sites Tier-2 et Tier-2 hors CC-IN2P3 depuis 2009
- **Organisation projet**
  - **Responsables scientifique** (F.Malek) **et technique** (F.Chollet), **Calcul LHC au Tier-1** (P.Girard), **Responsable sites Tier-2 Tier-3** (Y.Patois**)**
  - Comité de pilotage annuel (représentants instituts, projet, expériences, CC-IN2P3)
  - Comité de direction mensuel (représentants sites, calcul des expériences)
  - Groupe technique T2-T3

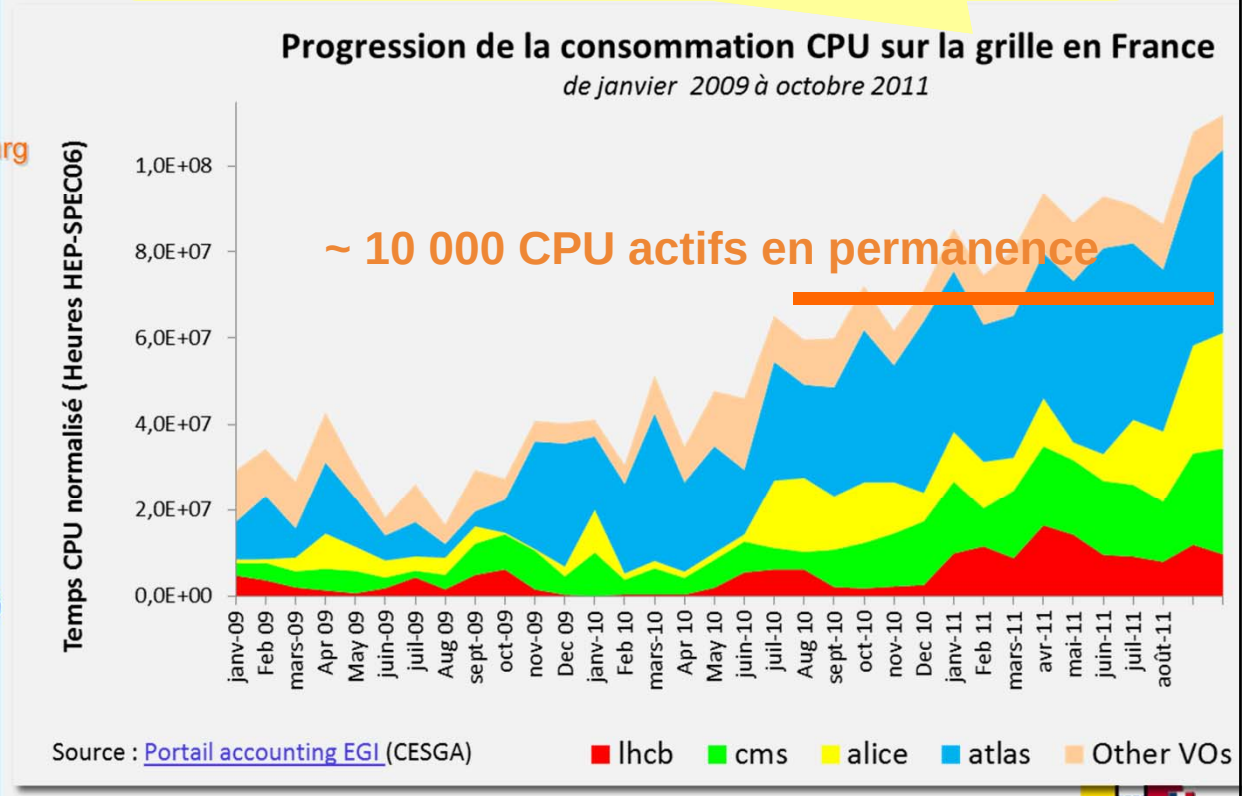
LCG-France

Les sites Tier-1 /2 /3 français

Également nœuds de France-Grilles ouverts à d'autres communautés scientifiques
Financements via des coll. locales ou régionales (universités, régions…)



En 2011, le computing LHC représente plus de 85 % de la consommation CPU en France



LCG-France

La collaboration, les partenaires

Strong collobaboration site between s and national experiment representatives

CC-IN2P3, AF Lyon : Fairouz Malek, Pierre Girard
CPPM Marseille : François Touchard, Edith Knoops
GRIF Paris Region : Jean-Pierre Meyer, Michel Jouvin
IPHC Strasbourg : Daniel Bloch,Yannick Patois
IPNL Lyon : Stéphane Perries, Denis Pugnère
LAPP Annecy : Stéphane Jézéquel, Eric Fede
LPC Clermont : Dominique Pallin, Jean-Claude Chevaleyre
LPSC Grenoble : Sabine Crepe, Christine Gondrand
Subatech Nantes : Laurent Aphecetche, Jean-Michel Barbet

Alice : Laurent Aphecetche
ATLAS : Eric Lançon
CMS : Claude Charlot
LHCb : Andrei Tsaregorodtsev

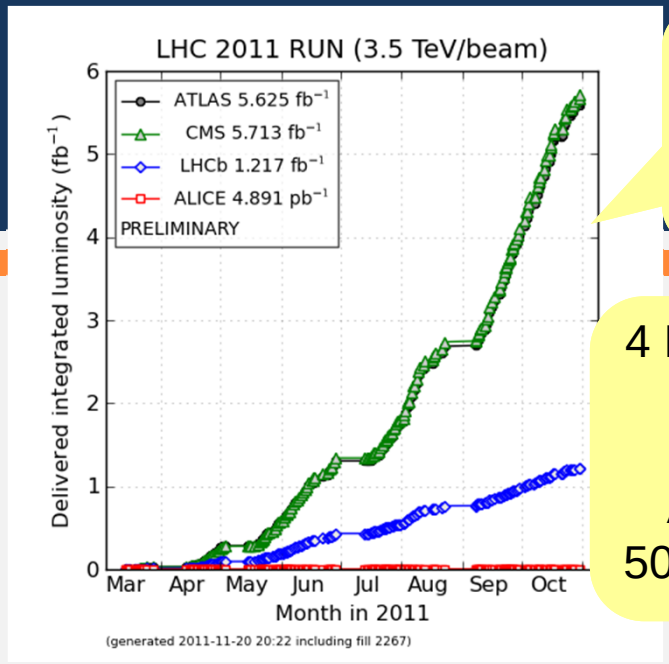
Technical team (LCG-FR-TECH) gathering more than 50 persons

LCG-France also relies on

- network connectivity provided by french NREN (Renater) and support from CC-IN2P3
- grid operations managed by France Grilles (french NGI)

LCG-France within WLCG

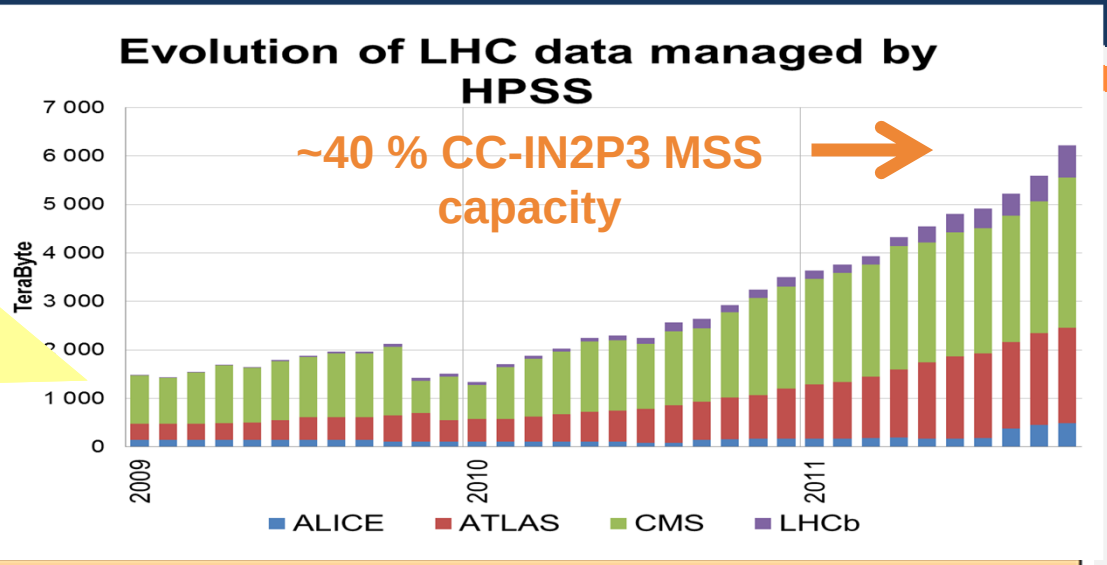
LHC data in 2011



~ 2 billions of CMS events (pp running)

4 PB written to HPSS in 2011

ATLAS estimate : 50 % Raw - 50 % MC

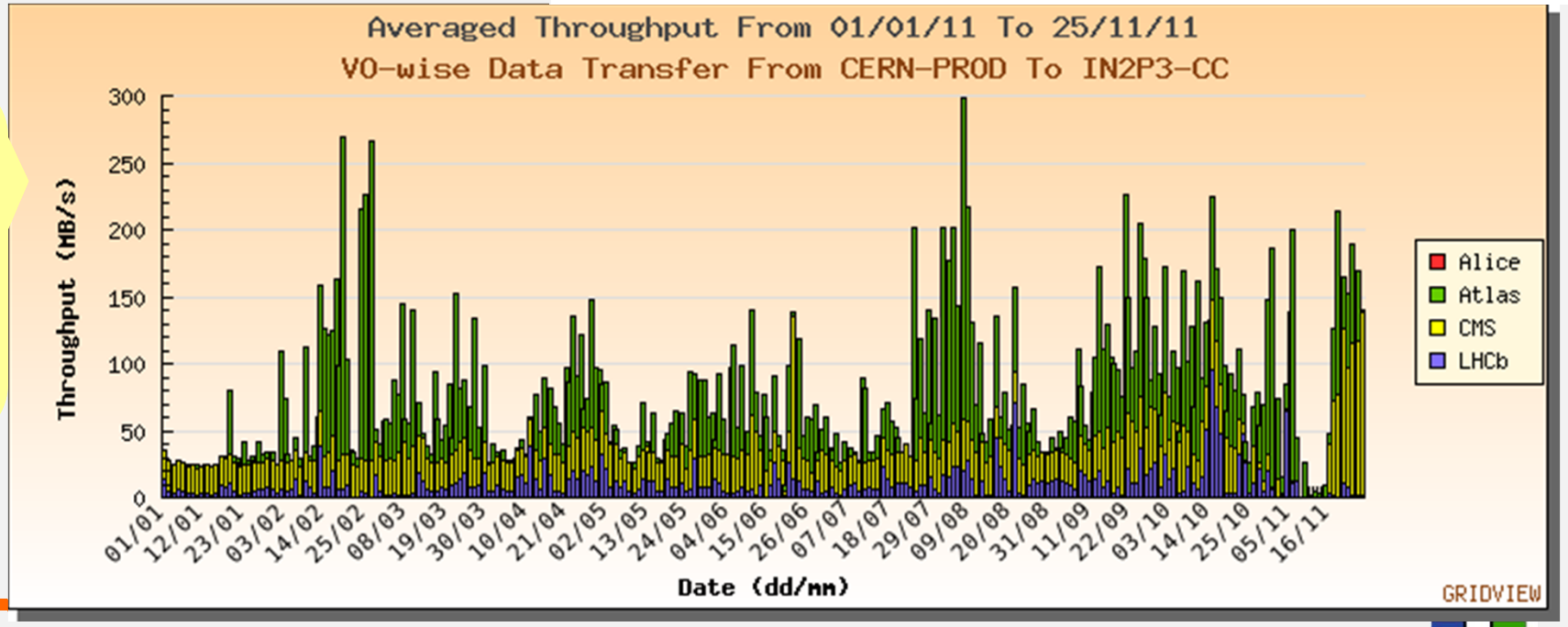


LHC Luminosity plots for 2011 proton runs

Source : CERN-LPC

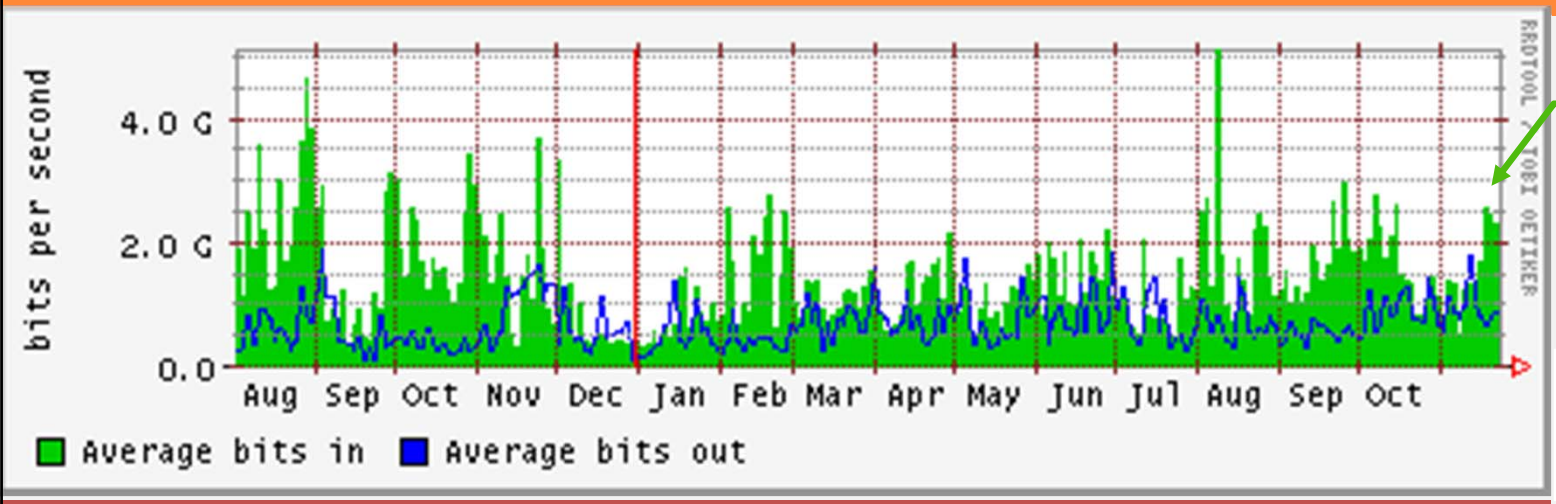
Data transfer rate from CERN to CC-IN2P3 176 MB/s (average)

not only raw data! MC data replication



Source: GridVIew http://gridview.cern.ch

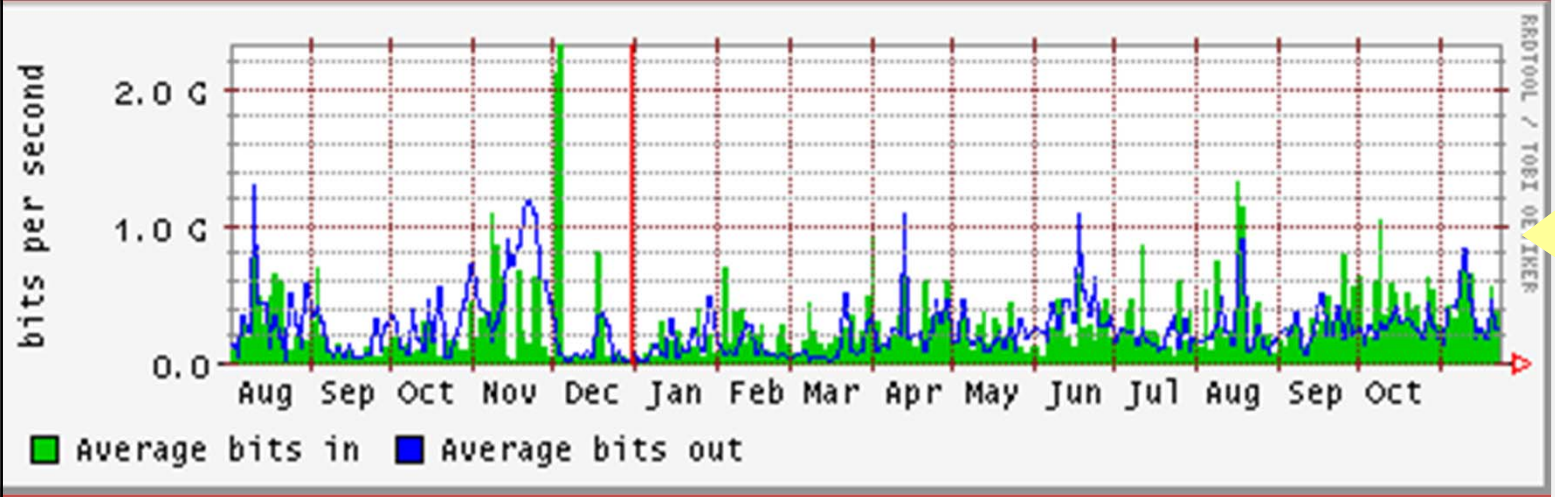
Connectivity Tier-0 ⇌ Tier-1 via LHCOPN



LHCOPN Link: CCIN2P3 ⇄ CERN, 10 Gbps

Network bandwidth for traffic CERN ⇔ CC-IN2P3 (LHCOPN T0 path)

	Avg	Max
IN2P3 to CERN	758.68M	2.13G
CERN to IN2P3	1.41G	5.63G



LHCOPN Link: CCIN2P3 ⇄ KIT ⇄ CERN, 10 Gbps

CC-IN2P3 ⇔ KIT ⇔ CERN (LHCOPN T1 path)

Used also for data exchange with other tier-1s

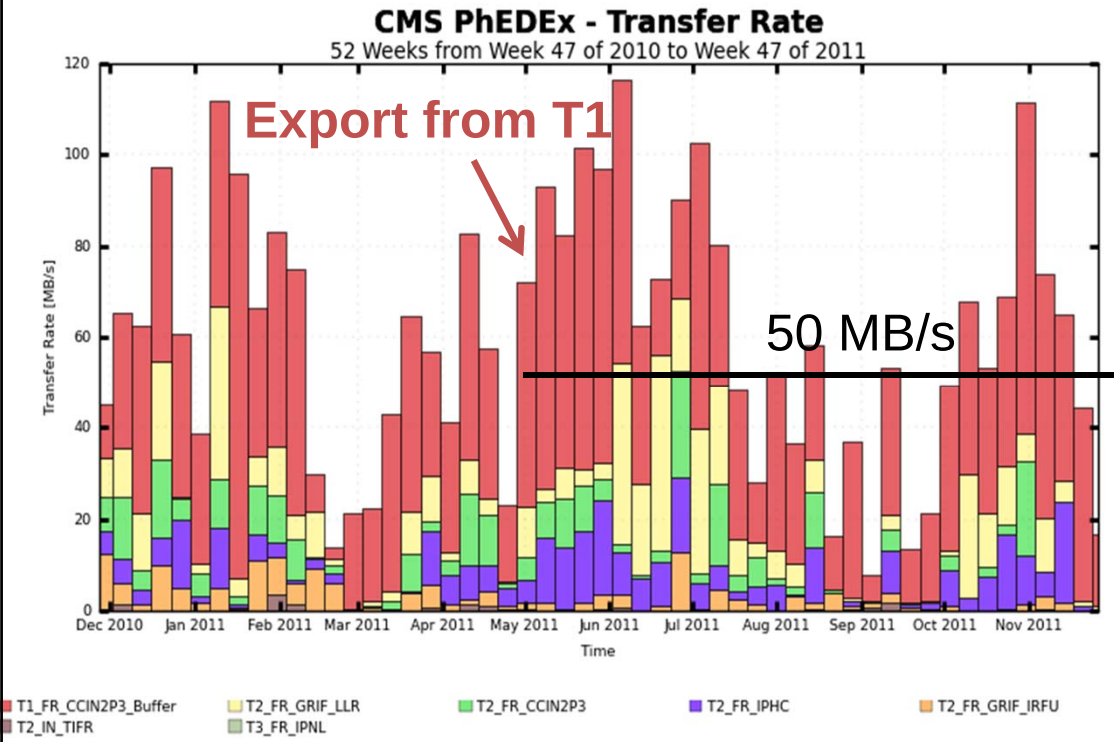
Source: http://netstat.in2p3.fr

CMS Data Transfers

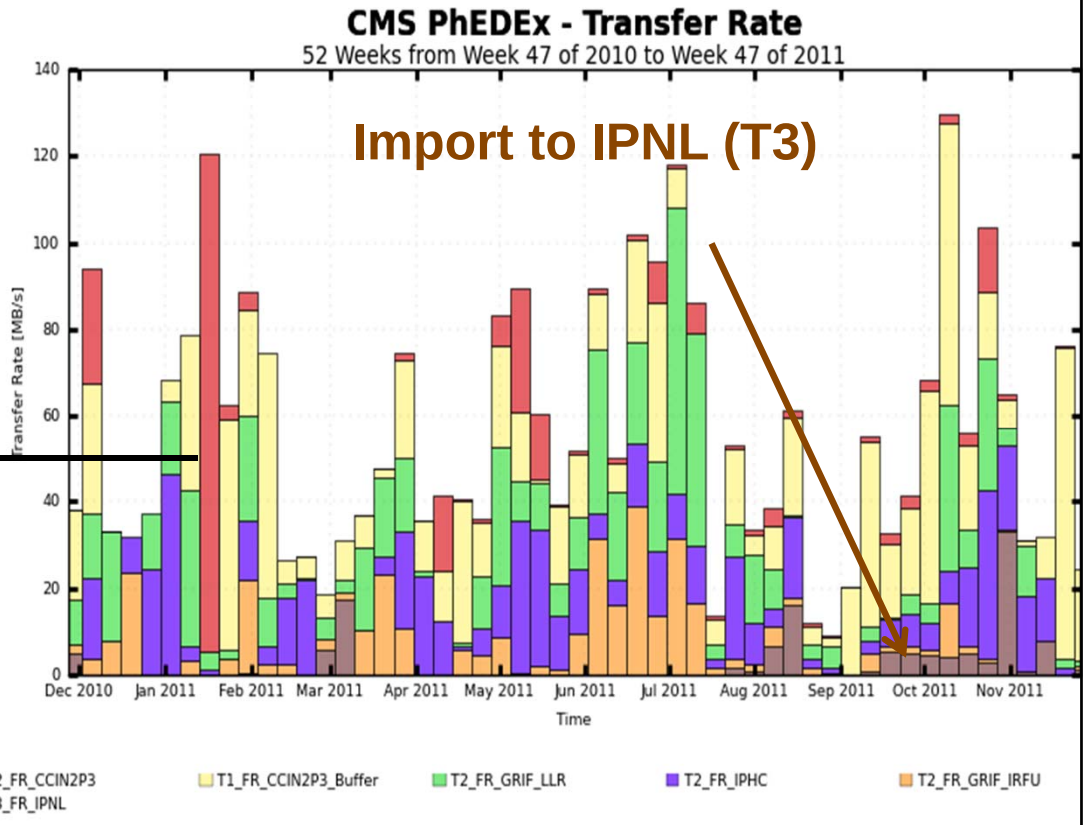
- Full mesh (T1-T2) strategy from the beginning
- Present CMS Analysis Model : association between T2s supporting a given physics group

T2-T2 transfers allowed => larger mesh

T2_FR_CCIN2P3 :Tracker+EWK+ PFlow/tau+QCD
T2_FR_GRIF :Higgs+e/g+Exotica+ Heavy ions
T2_FR_IPHC : Top+Btag



50 MB/s



Export from FR sites

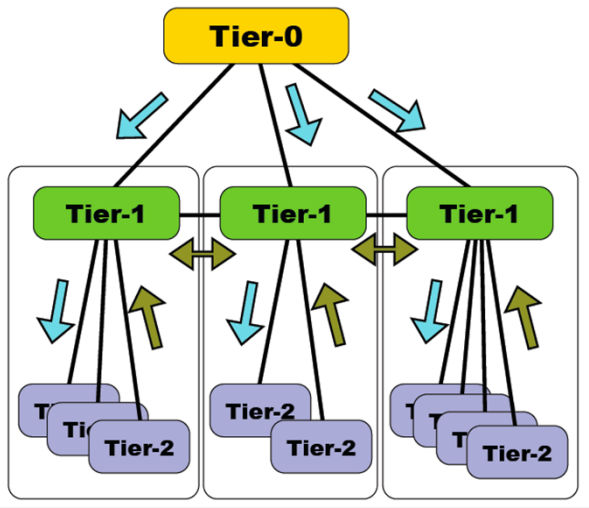
Import to FR sites

Source : https://cmsweb.cern.ch/phedex/

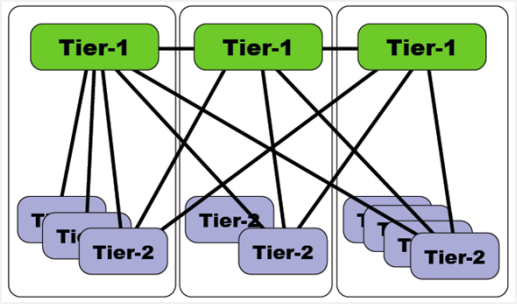
Evolution of ATLAS computing model

Introduction of T2Ds (May 2011)

- Benefit from network performances and fit with user needs (better data handling)



- Hierarchical model
- Pre-placement of data distributed from Lyon Tier-1 within FR Cloud
- Predefined network channels

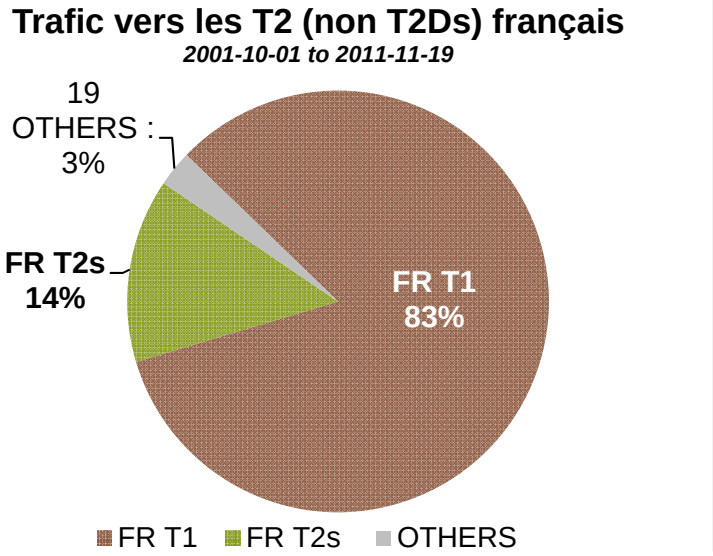


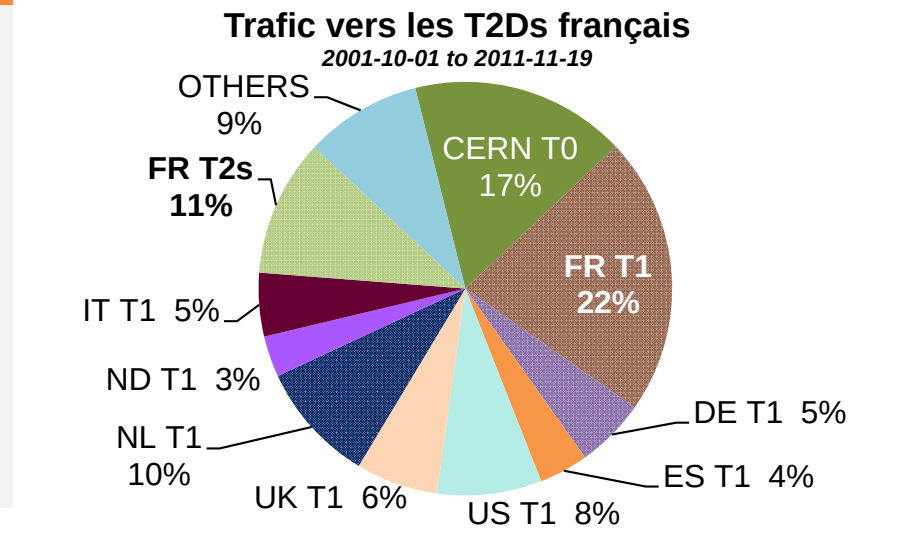
New communications channels between T2Ds sites

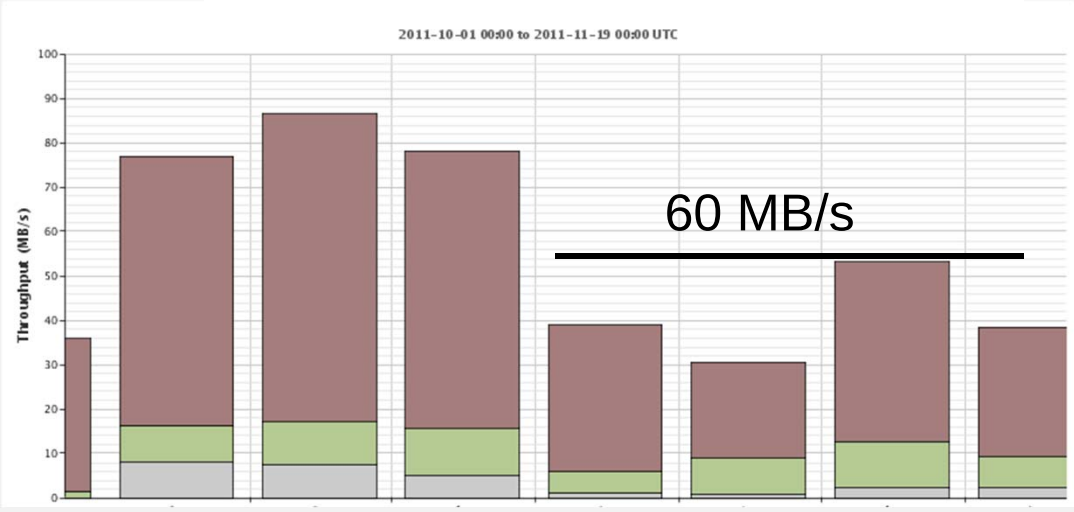
Sites FR : GRIF-LPNHE, GRIF-LAL, IN2P3-LAPP, IN2P3-LPC, IN2P3-LPSC

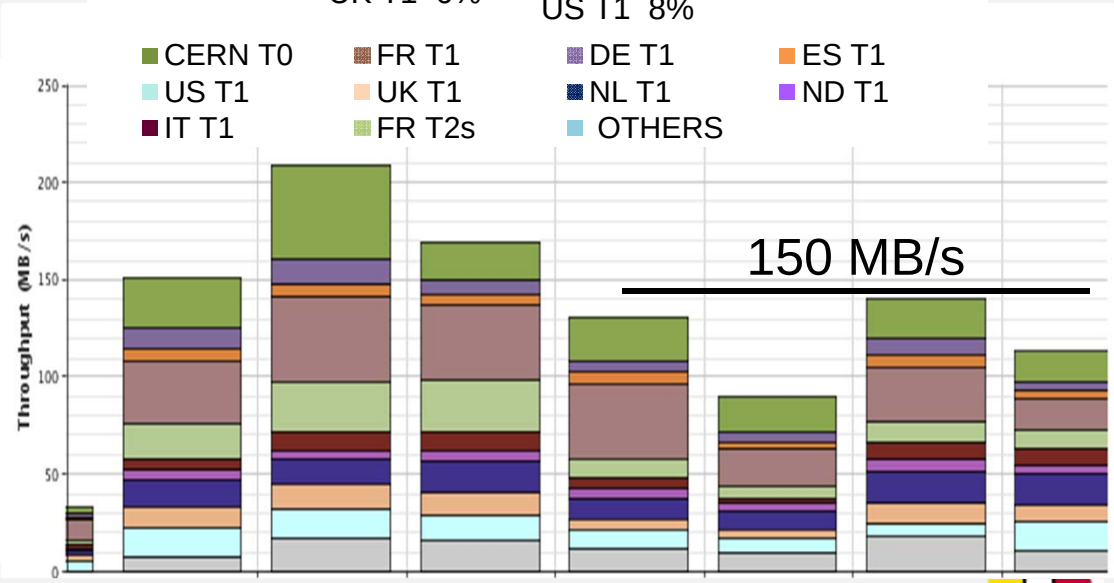
- Flatter hierarchy
- Flexibility in data managemnt
  - Dynamic data caching and selection based on data popularity
  - Remote data acces
- New paths between T2s

Evolution of ATLAS T2 Traffic





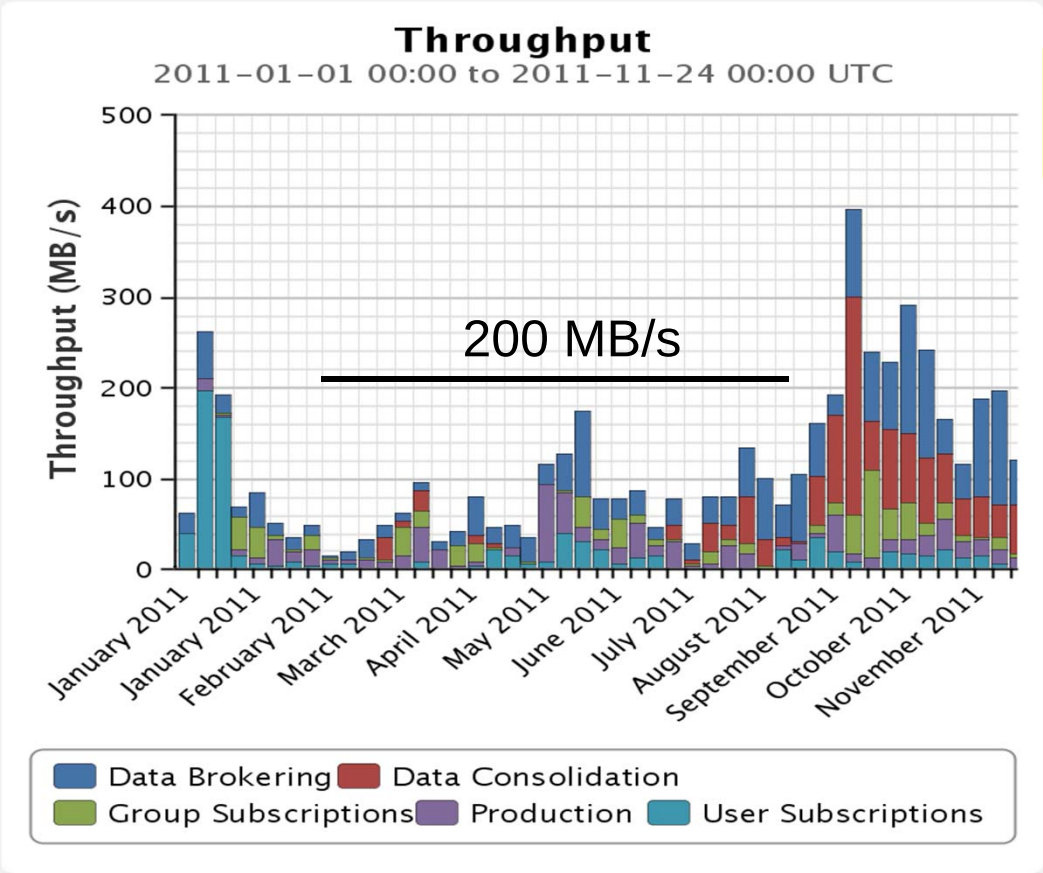




Source: http://dashb-atlas-data.cern.ch/dashboard/ddm2/

ATLAS Data Movement

- ATLAS DDM Transfer rates to FR Tier-2 sites



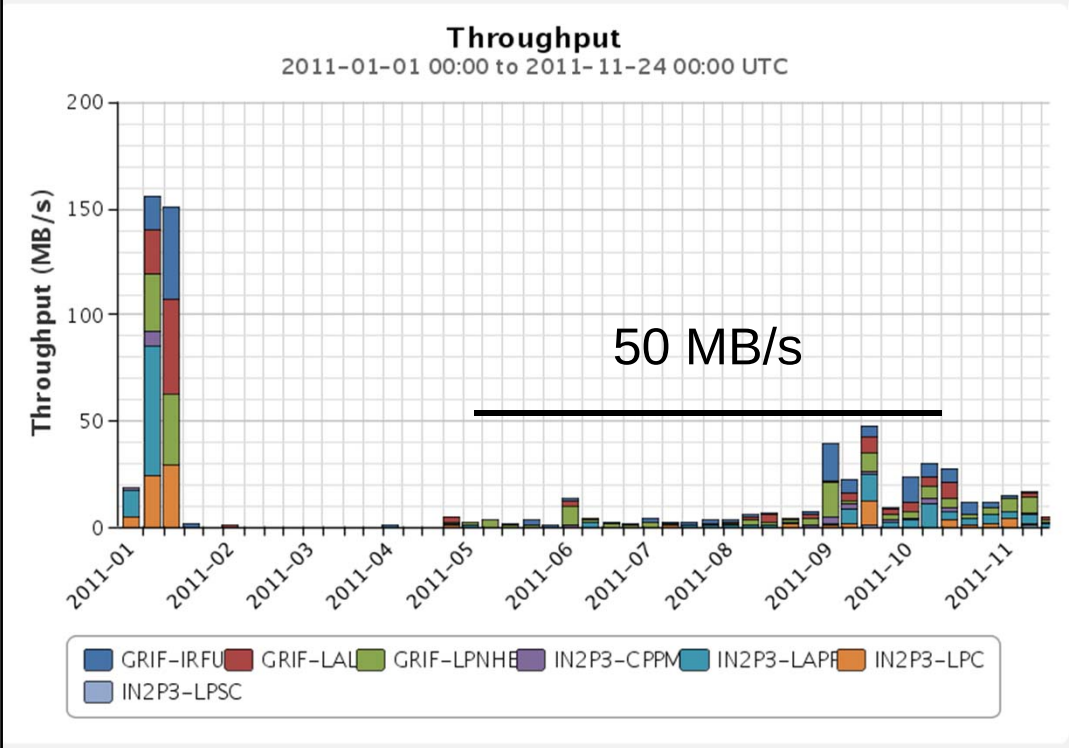
Production : 14 %,
Data distribution : 58 %
user&group subscriptions : 28 %

Import to FR Tier-2 sites

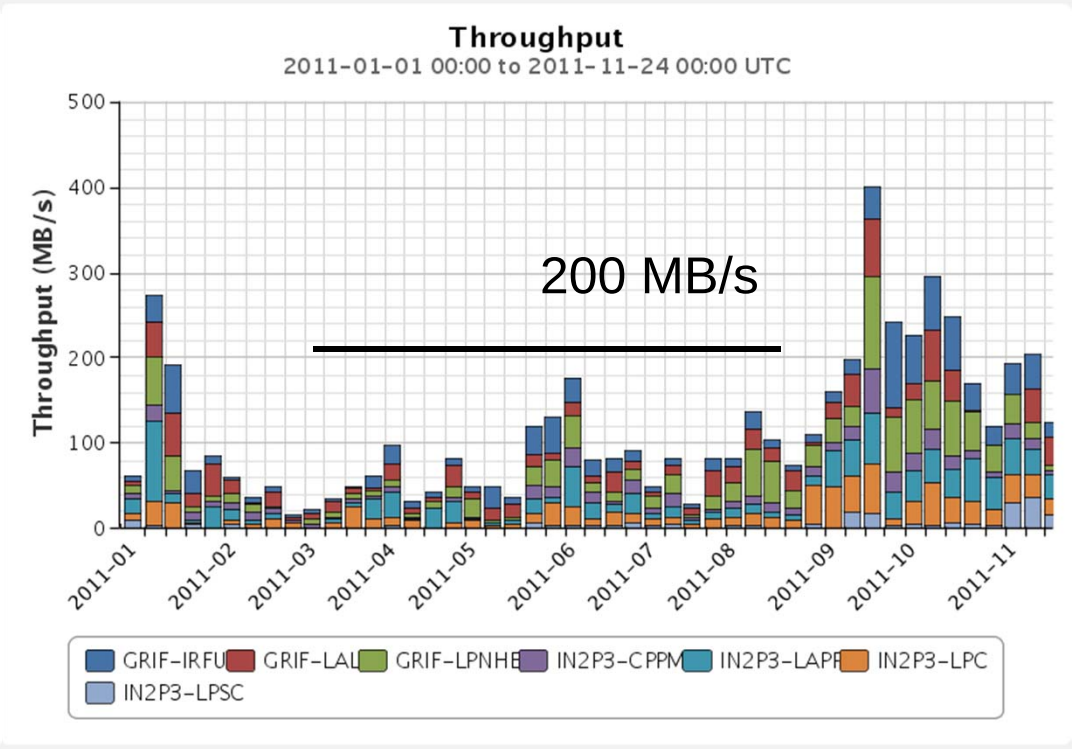
Source: http://dashb-atlas-data.cern.ch/dashboard/ddm2/

ATLAS Data Movement

- ATLAS DDM Transfer rates to FR Tier-2 sites



Export from FR Tier-2 sites

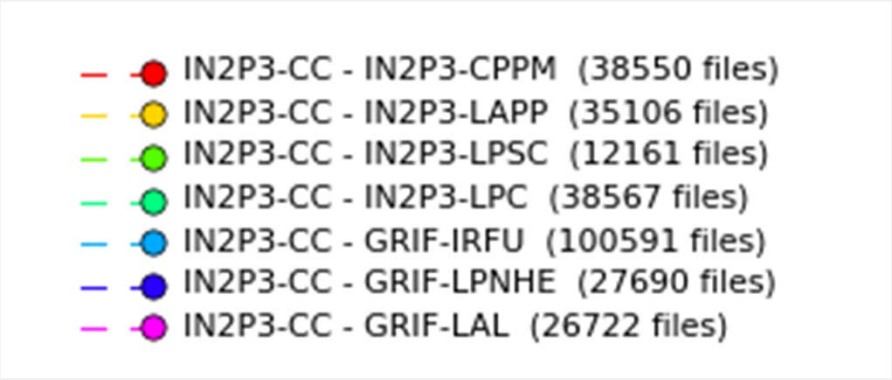


Import to FR Tier-2 sites

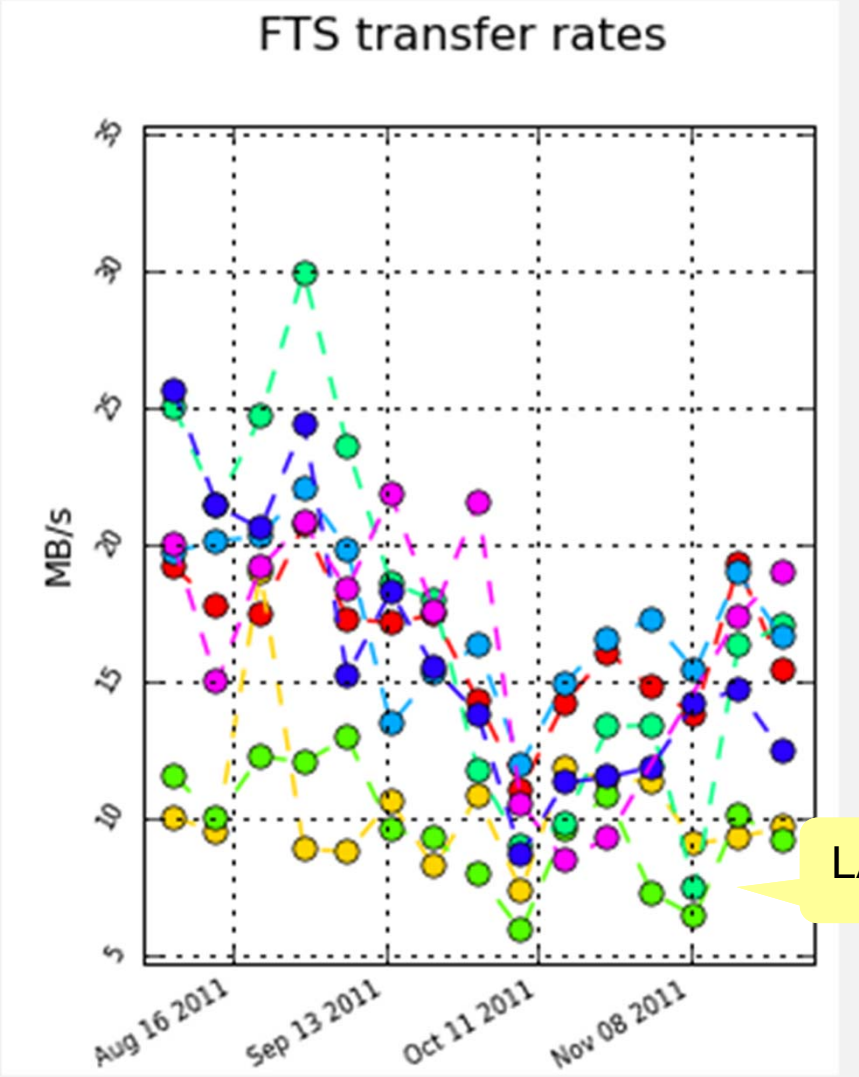
Source: http://dashb-atlas-data.cern.ch/dashboard/ddm2/

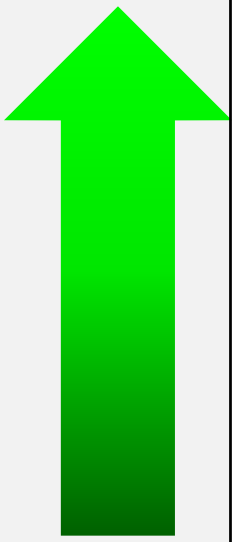
ATLAS link commissioning

- Observed connectivity between CC-IN2P3 and FR Tier-2 sites
- FTS transfer statistics from CC-IN2P3 to FR T2 sites for large files (> 1 GB)
- Expected rate> 15 MB/s (av.)



Source : http://bourricot.cern.ch/dq2/ftsmon/





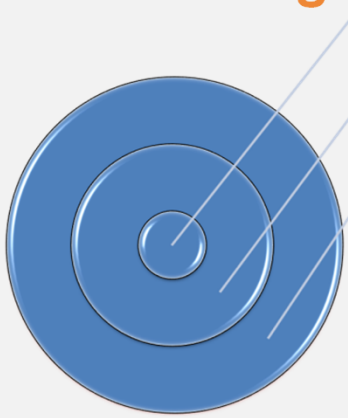
LAPP, LPSC

LHCONE

LHCONE ➔ LHC Open Network Environment

- Aim of LHCONE project is
  - better trans-regional networking for data analysis,
  - complementary to LHCOPN network connecting LHC T0 - T1s
  - move traffic off general purpose IP network (not so urgent)
- LHCONE still in the prototyping phase.
  - currently deploying and evaluating a private layer 2 shared network
  - Futher discussion for long term solution and roadmap

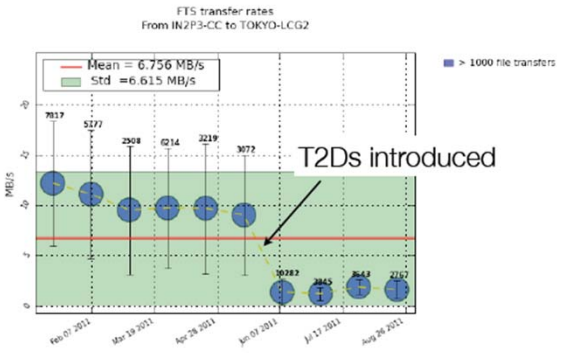
Experiments want to benchmark todays performance and show improvements => monitoring



Courtesy : E.Lancon

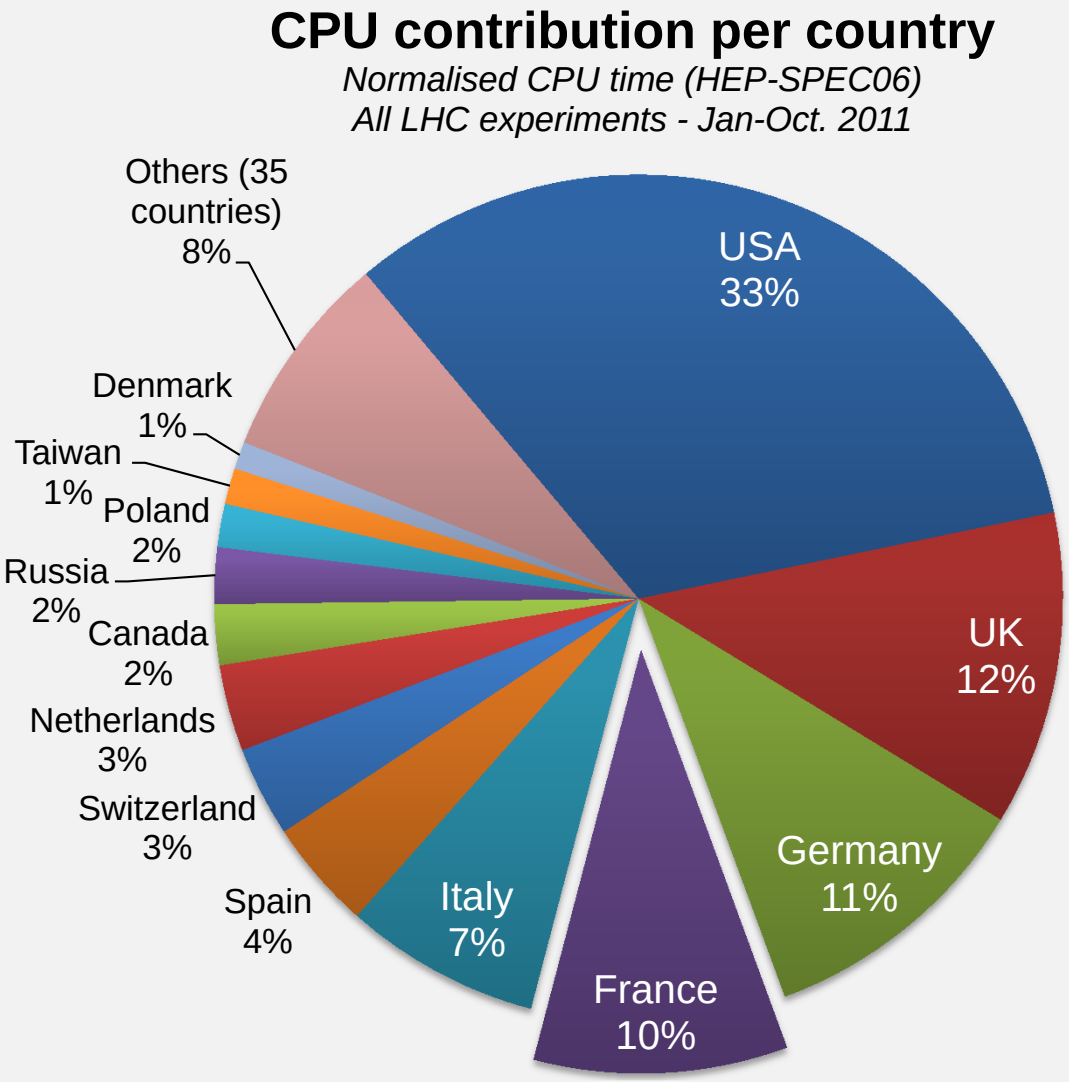
Drop of throughput since may 2011 observed by ATLAS (not clear if is related to LHCONE deployment or not)

The symptom : Transfers to Tokyo



https://ggus.eu/ws/ticket_info.php?ticket=74268

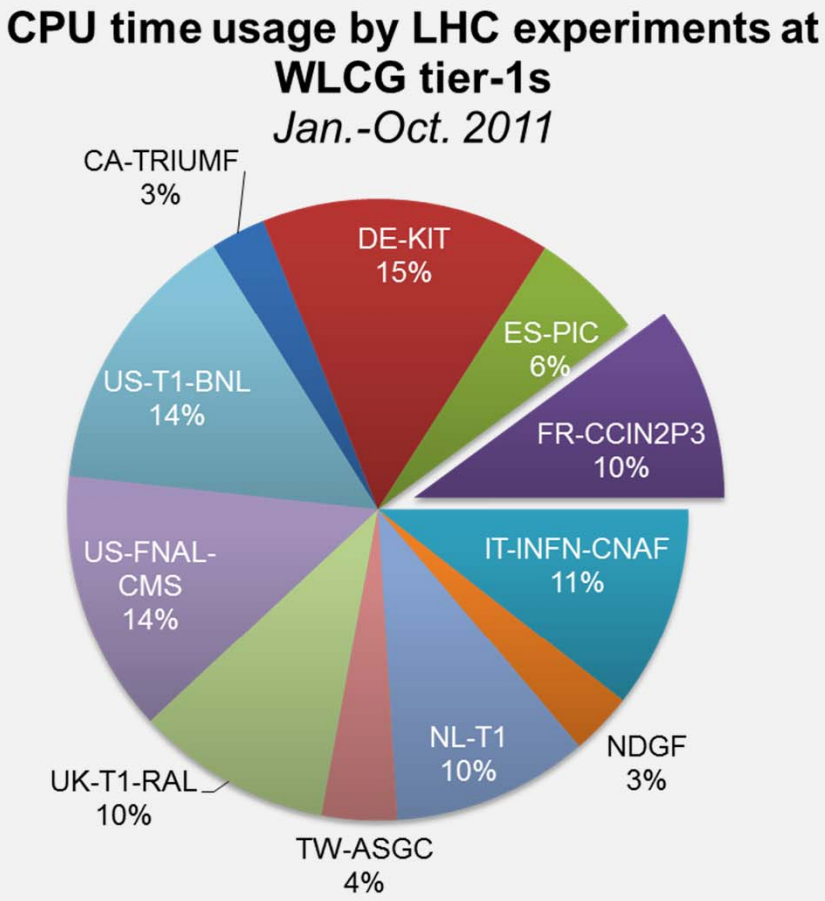
LCG-France Contribution to WLCG

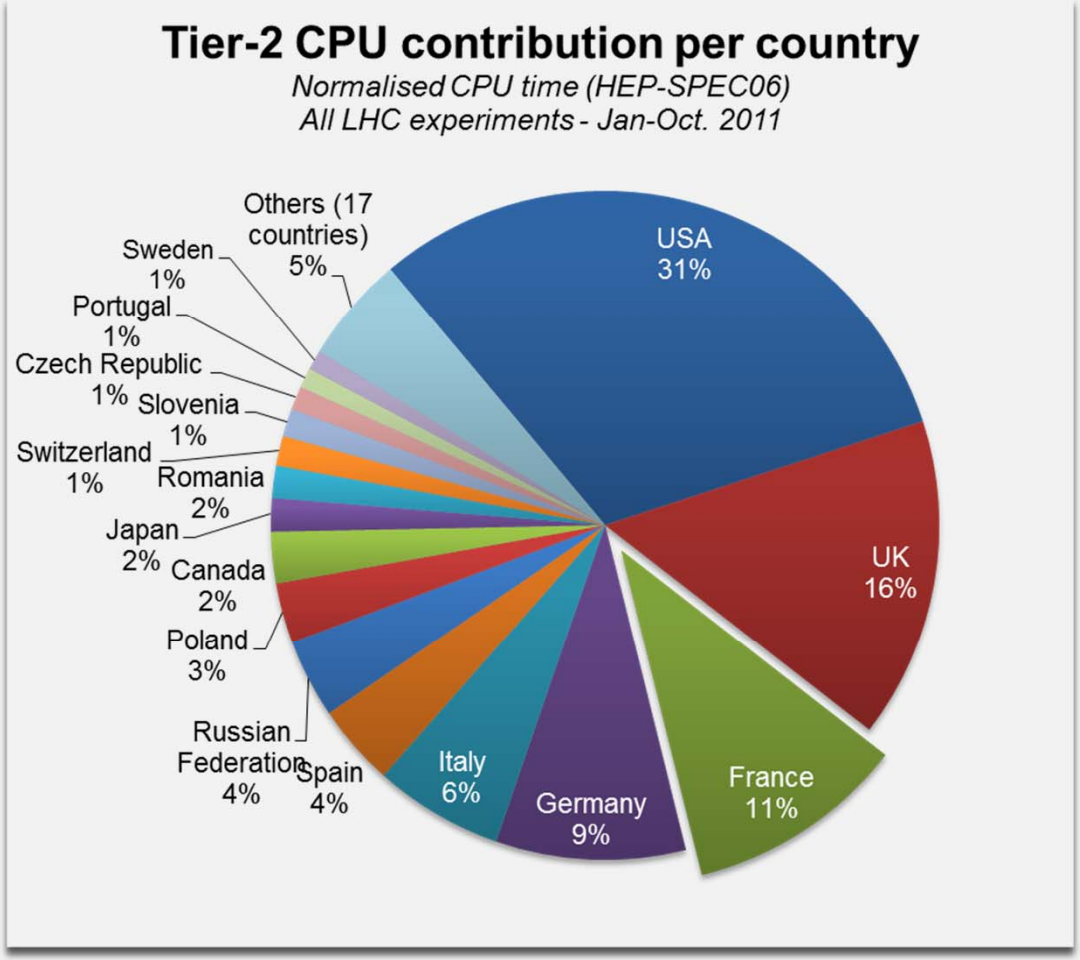


Contribution to the WLCG collaboration remains well in line with LCG-France's target.

48 countries

LCG-France Contribution to WLCG





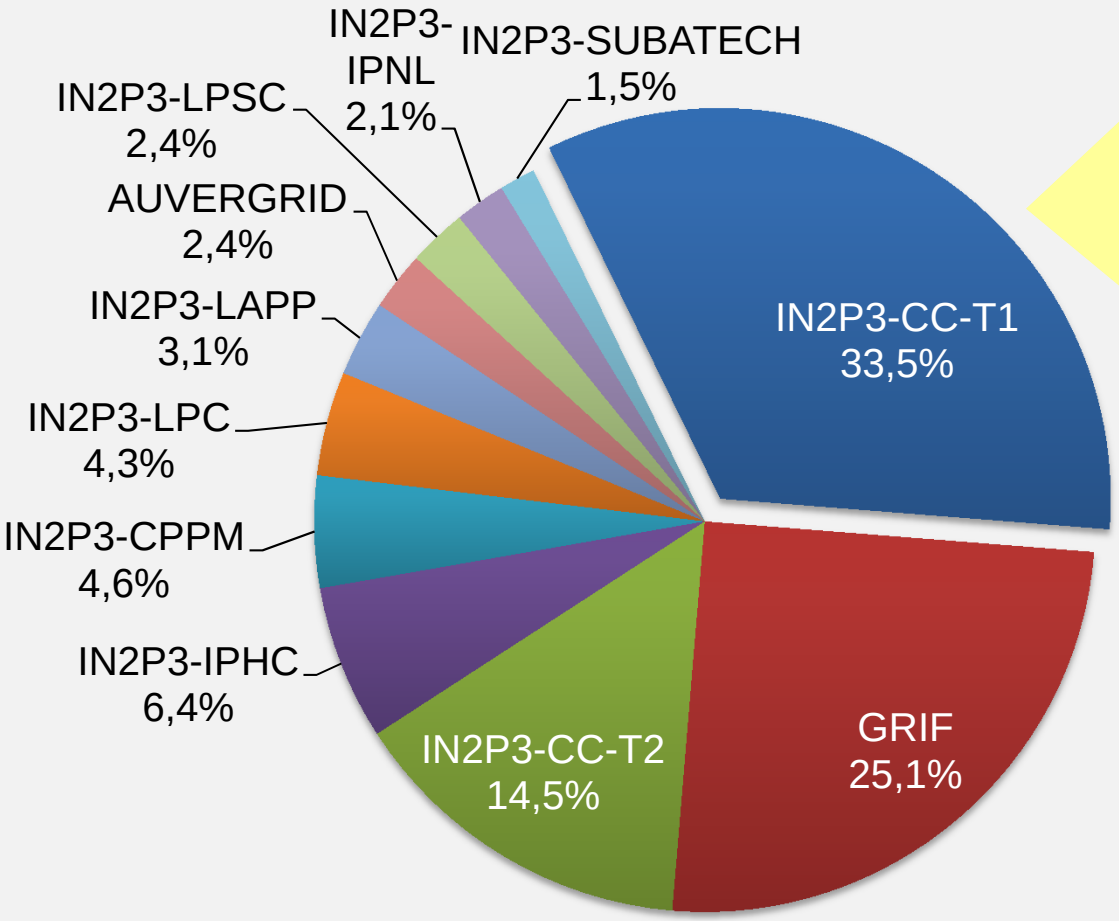
Source: EGI Accounting Portal

F. Hernandez, F.Malek, F. Chollet

Usage of french sites

CPU contribution to LHC VOs per site (France)

Normalised CPU time (HEP-SPEC06) - Jan. - Oct. 2011



Relative Tier-1 / Tier-2 contribution :
35 % / 65 %

50 % of CPU time used outside CC-IN2P3

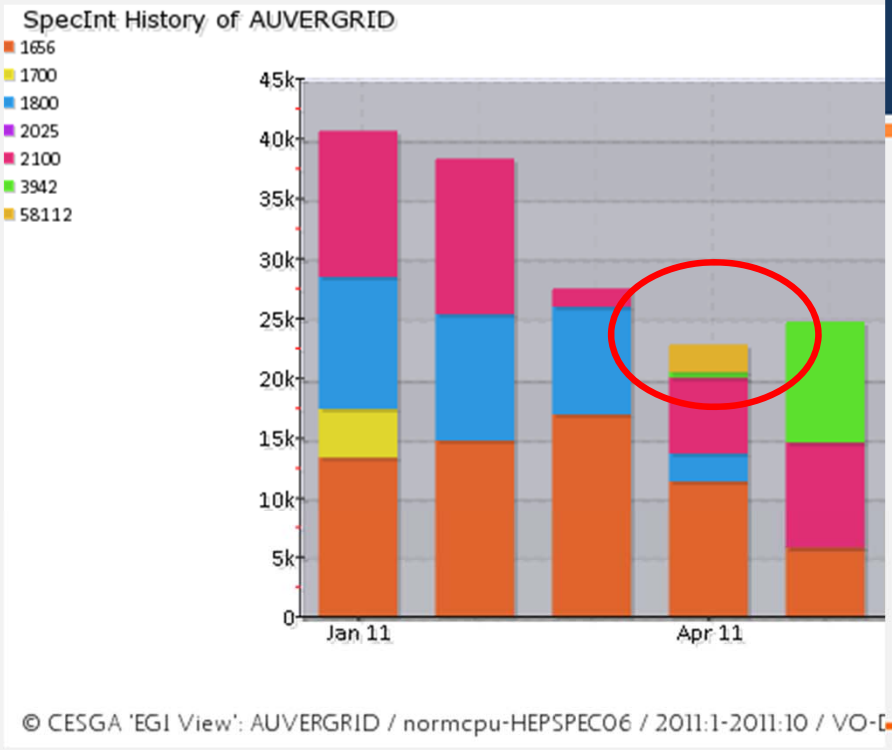
~same level as in 2010
in line with expectations.

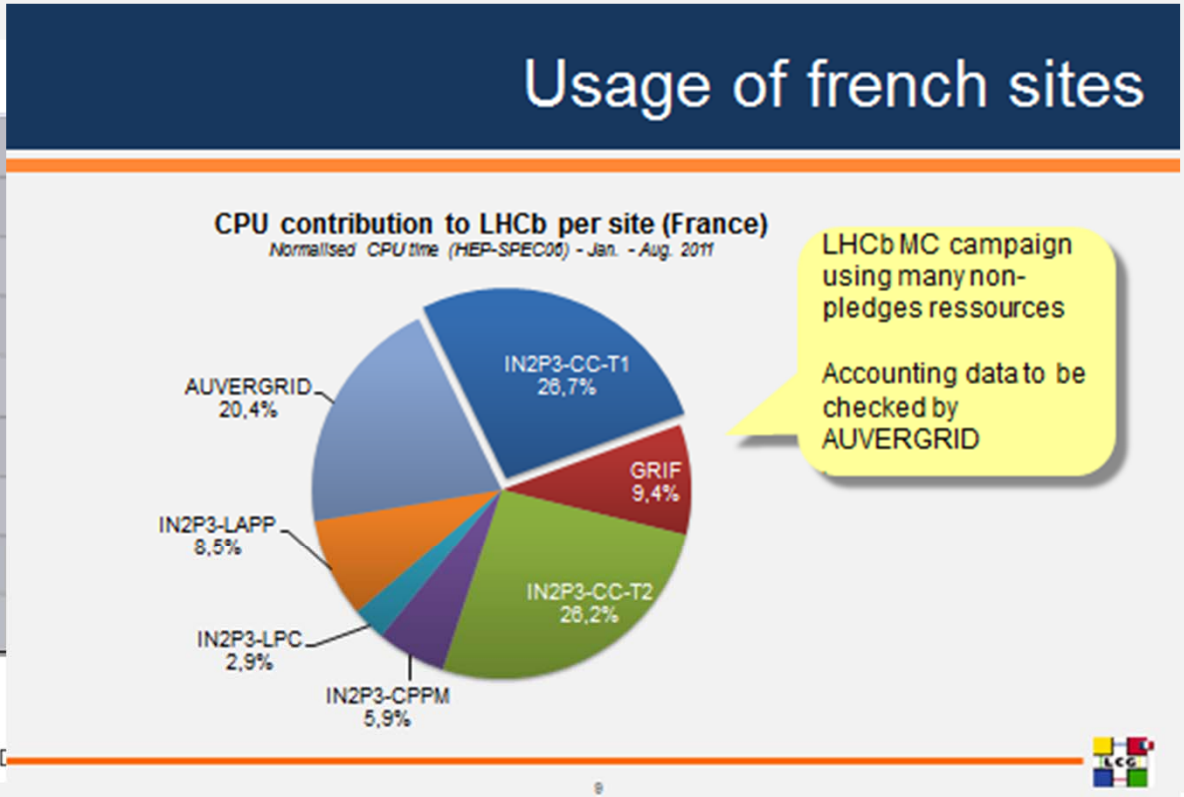
AUVERGRID (non LCG-France site) : opportunistic usage by LHCb

Usage of french sites

Follow-up on AUVERGRID contribution

- discussion at LCG-France MB (oct. Meeting)
- Over-estimated CPU contribution due to wrong publication of CPU normalized capacity in april 2011

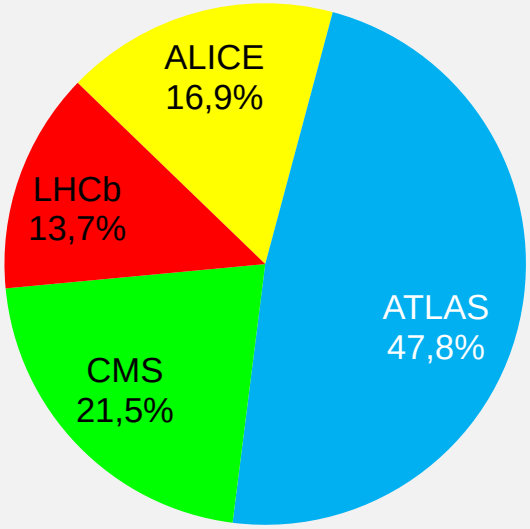




Usage of french sites

CPU Time Used by the LHC experiments in LCG-France sites *

Jan-Oct. 2011



Utilisation by LHC experiments of the aggregated CPU capacity provided by LCG-France tier-1, tier-2s and tier-3s
To be compared with the utilisation in the same period in all WLCG sites :
ALICE : 9 %
ATLAS : 54 %
CMS : 27 %
LHCb : 10 %

Utilisation Ressources T1
Jan.- Oct. 2011

Rapports mensuels W-LCG

- http://lcg.web.cern.ch/LCG/accounts.htm
- Taux d'utilisation en % des ressources pledges mises à disposition en tenant compte d'un coef. d'efficacité std

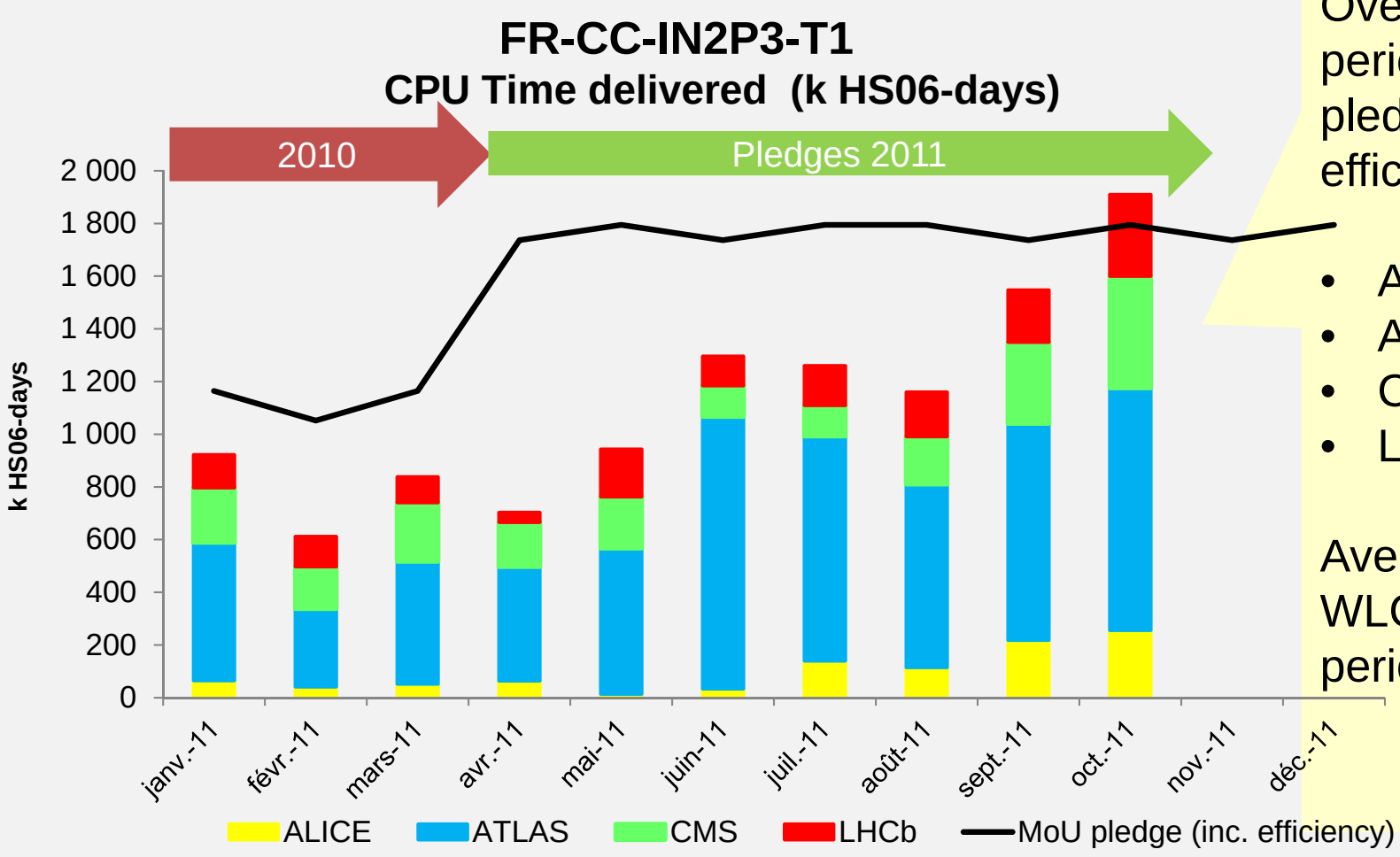
Standard efficiency factors	
Scheduled cpu used (Tier-0,-1)	85%
Chaotic cpu used (Tier-2)	67%
Disk utilisation	70%
Mass storage utilisation	100%

since may 2011

- Use Tier-1 (Tier-2) CPU as % of pledge

$$\frac{\text{Used CPU Time normalized in HEP-SPEC06-days (-hours)}}{\text{Pledge CPU value x Nb days (-Nb hours) in month x standard efficiency}}$$

CC-IN2P3 Tier-1 CPU usage
(inc. 85 % of efficiency)



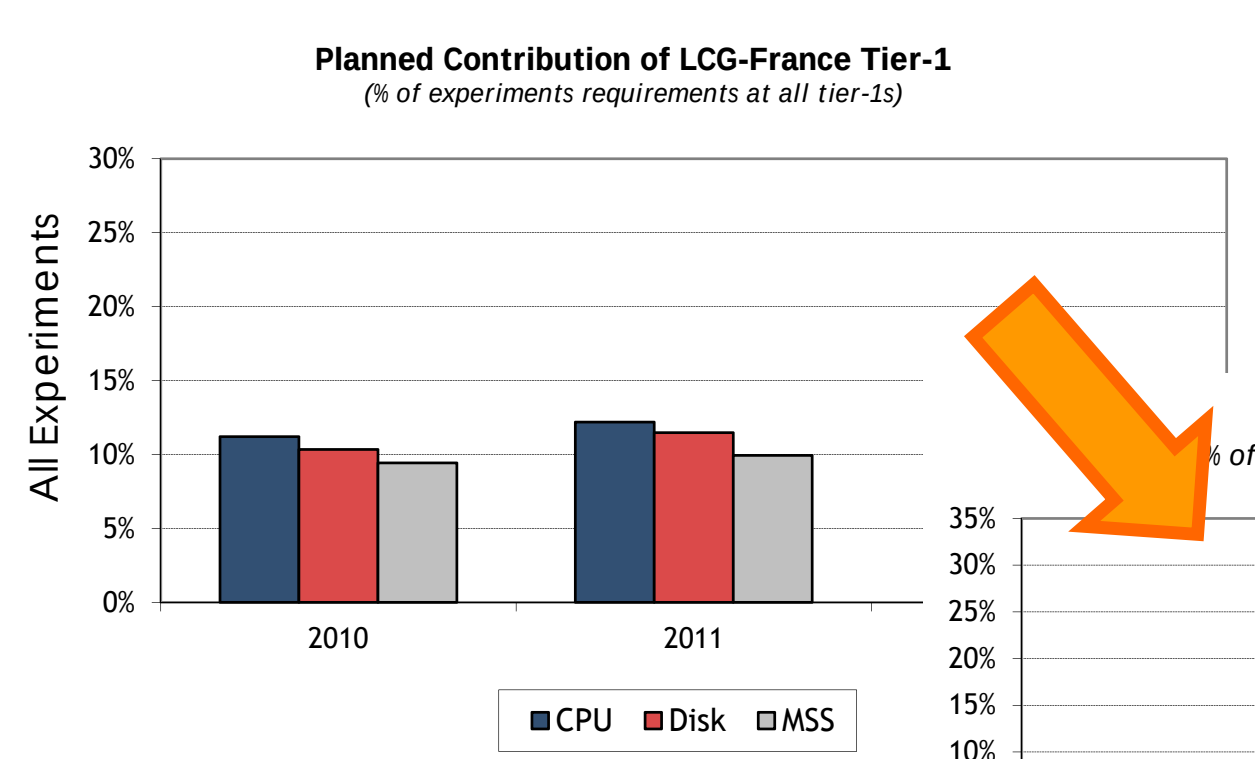
Overall CPU usage over the period : ~71 % of MoU pledges (inc. 85 % of efficiency)

- ALICE : 59 %
- ATLAS : 89 %
- CMS : 81 %
- LHCb : 35 %

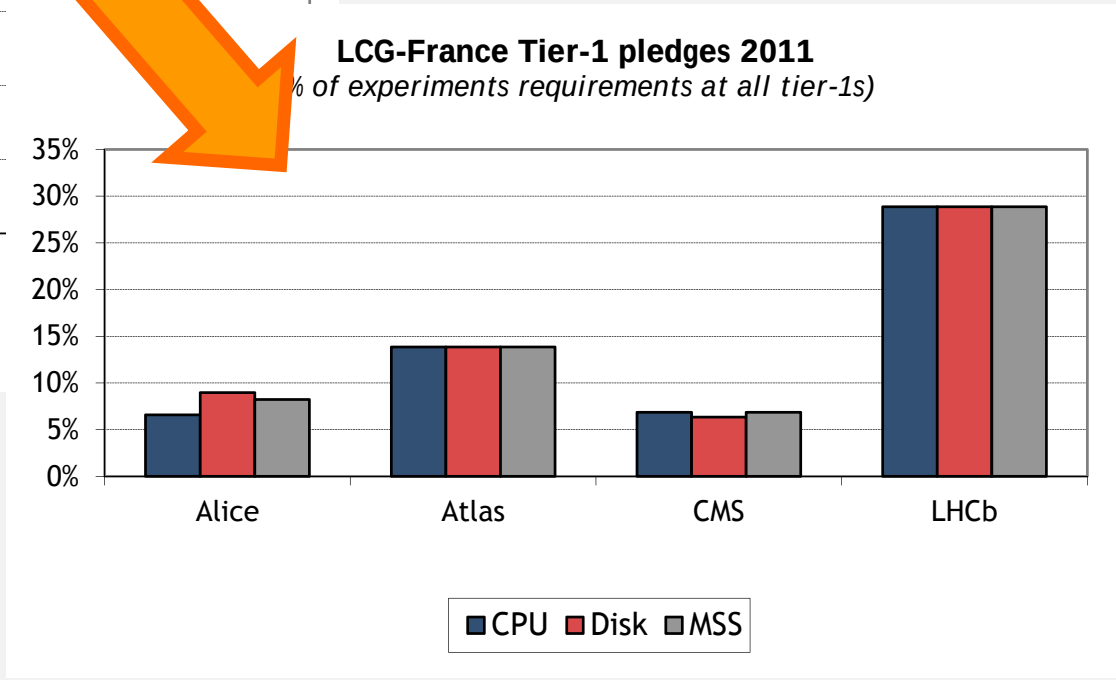
Average CPU usage in WLCG T1s over the same period: 89 %

Sources : Portail accounting EGI (CESGA), WLCG T1 montly reports

LCG-France T1 planned contribution

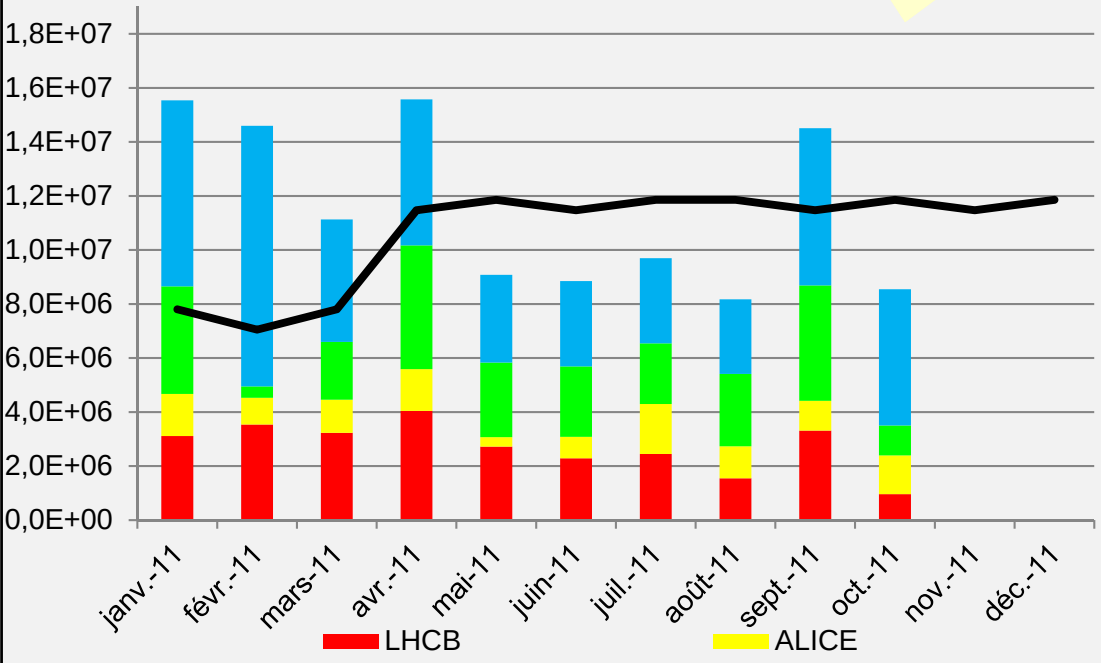


Budget share
ATLAS: 45 %
ALICE 15 %
CMS 25 %
LHCb 15 %

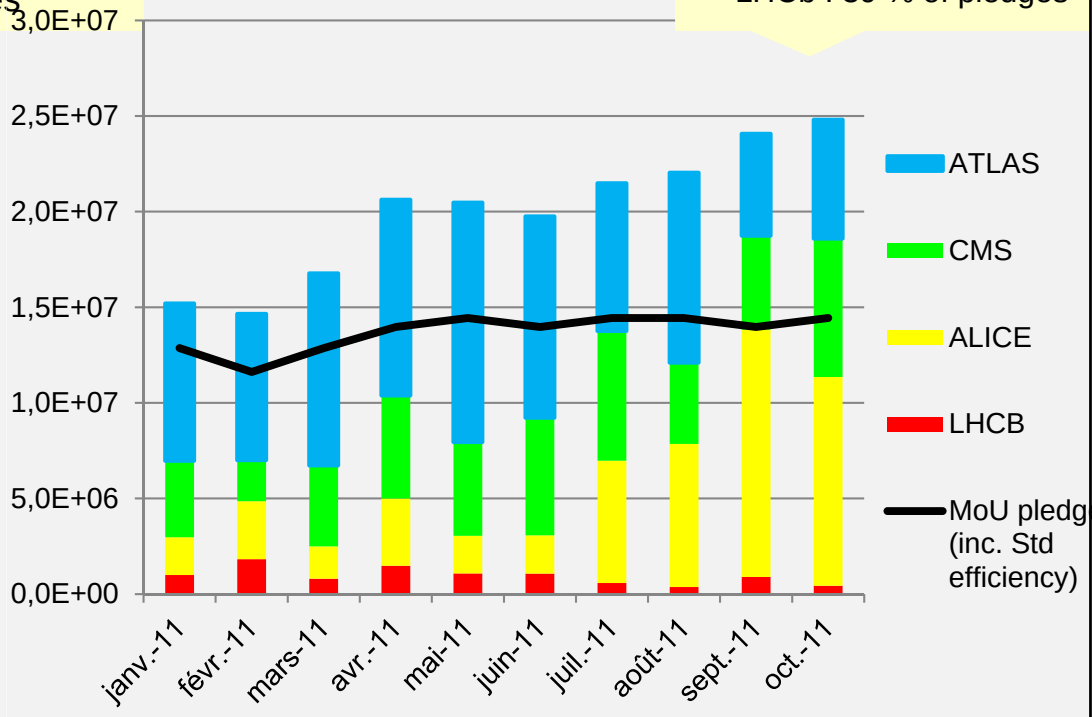


Tier-2 CPU usage

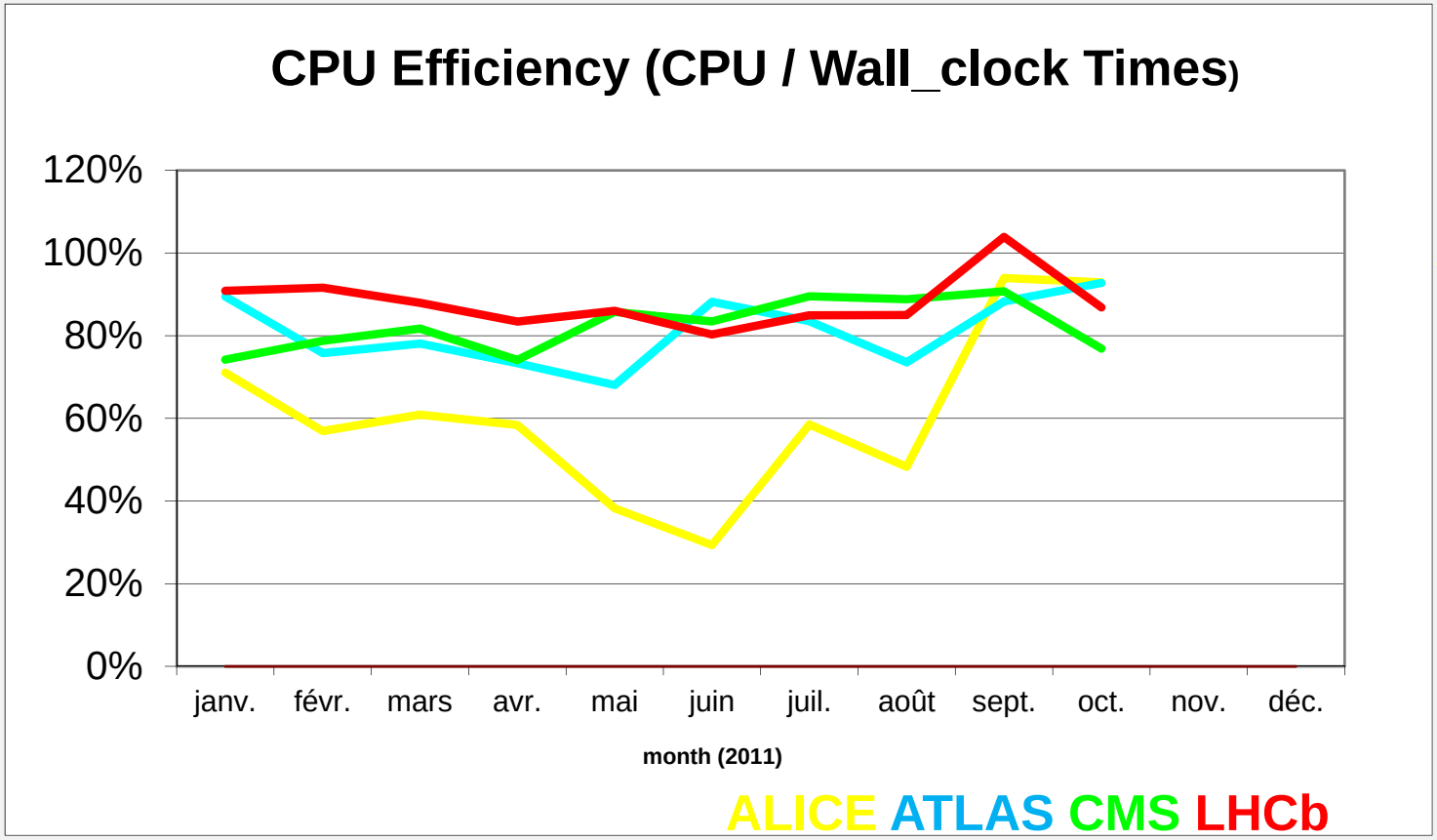
Overall CPU usage 2011: ~111 % of MoU
ATLAS : 123 % of pledges
CMS : 91 % of pledges
ALICE : 121 % of pledges
LHCb : 111 % of pledges



Overall CPU usage 2010 ~146 %
ATLAS : 192 % of pledges
CMS : 118 % of pledges
ALICE : 218 % of pledges
LHCb : 39 % of pledges



CPU efficiency at CC-IN2P3 Tier-1



Overall CPU efficiency in 2011 : 77 %

- ALICE : 53 %
- ATLAS : 79 %
- CMS : 81 %
- LHCb : 86 %

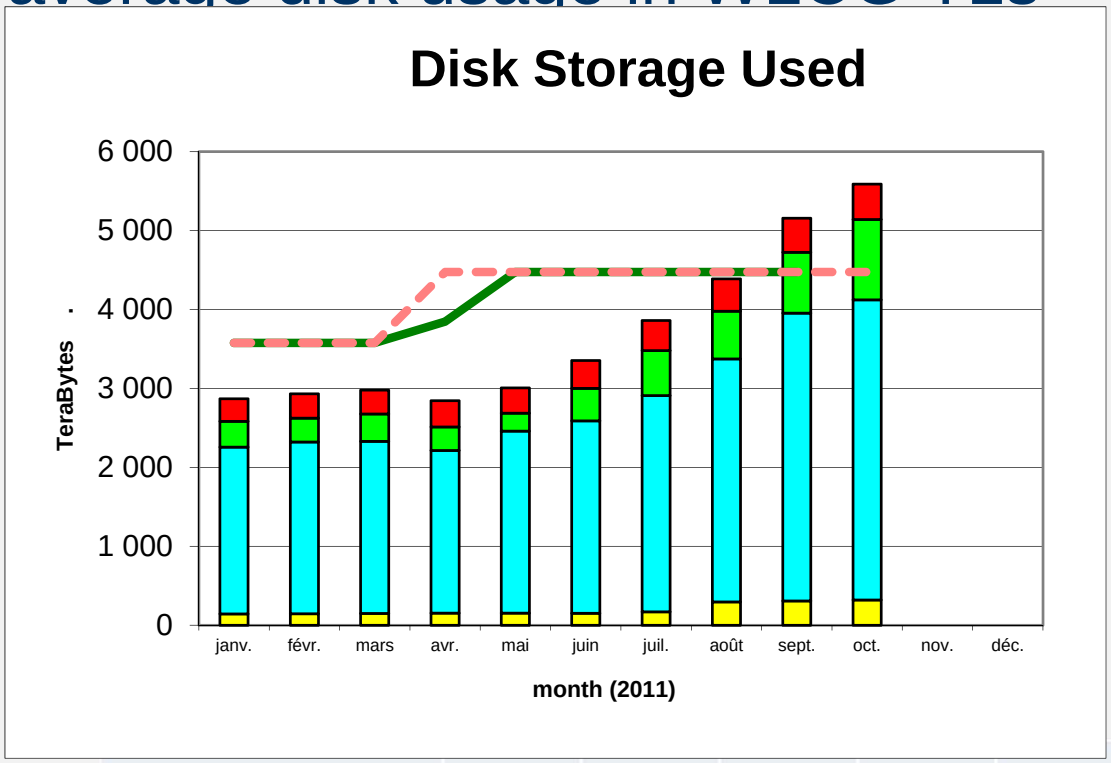
Std CPU efficiency : 85 %

Low Efficiency for ALICE jobs

Main cause identified : extensive ad-hoc use of RAW OCDB (Offline Cond DB)
Consolidation on- going

CC-IN2P3 Tier-1 Disk usage
(inc. 70 % of std. efficiency)

- Aggregate Disk usage (Jan-Oct. 2011): Total TB-months has reached 109 % 2011 pledges inc. 70 % efficiency)
- Same average disk usage in WLCG T1s

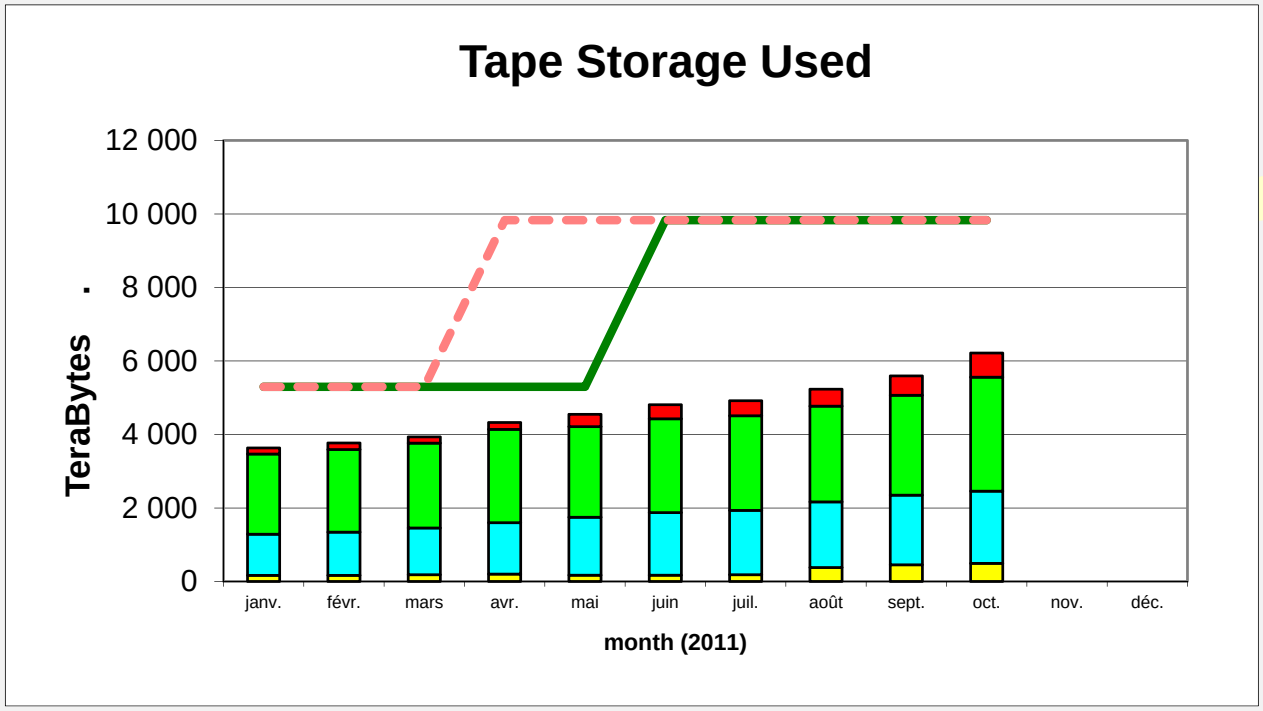


70 % of the installed disk capacity is used

Source : WLCG T1 montly reports

CC-IN2P3 Tier-1 MSS usage
(inc. 100 % of std. efficiency)

- Aggregate MSS usage (Jan-Oct. 2011): Total TB-months 55 % 2011 pledges



63 % of the installed disk capacity is used

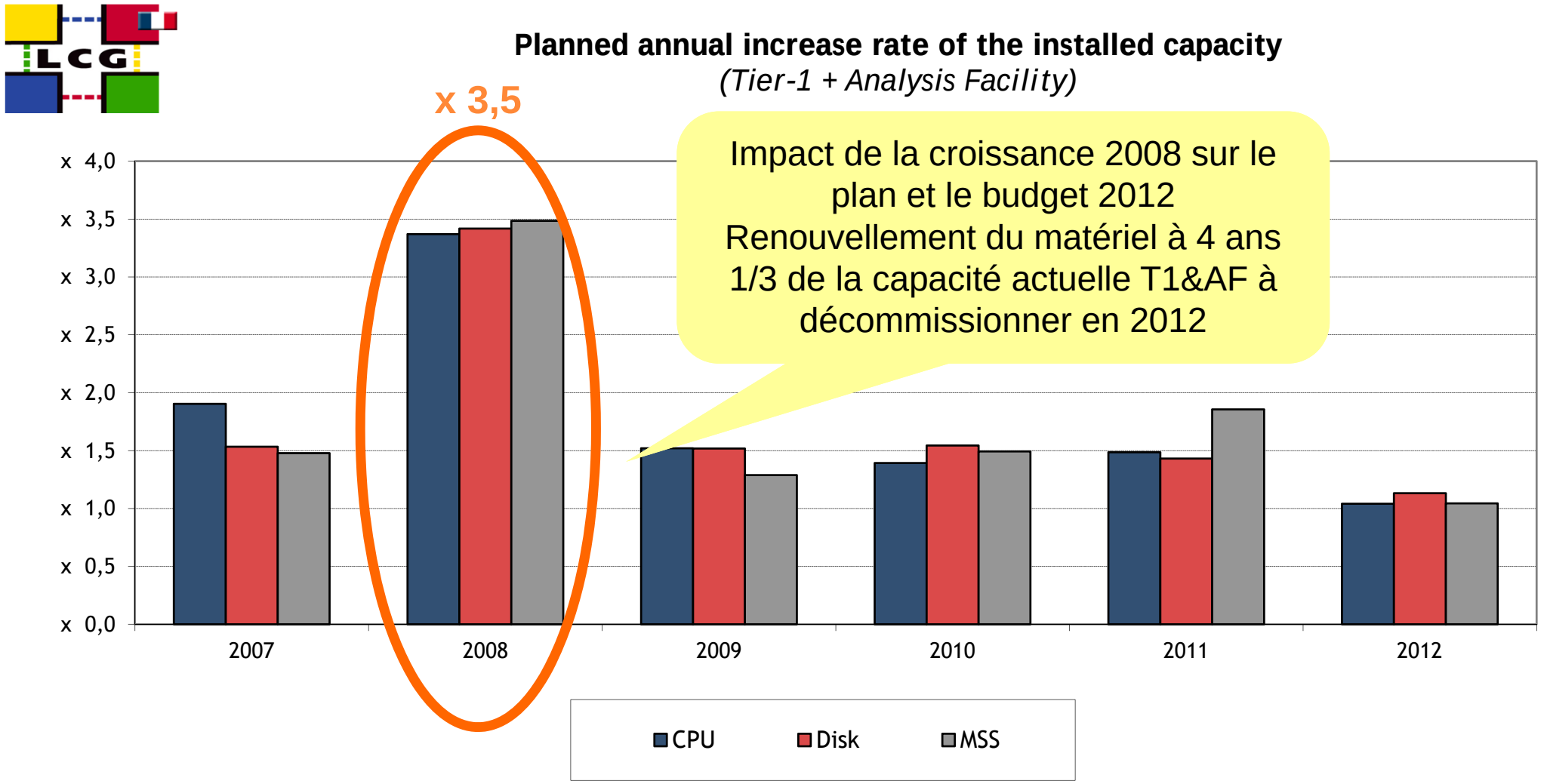
Source : WLCG T1 montly reports

ALICE CMS installed capacity (inc. efficiency factor)
ATLAS LHCb MoU commitment (inc. efficiency factor)

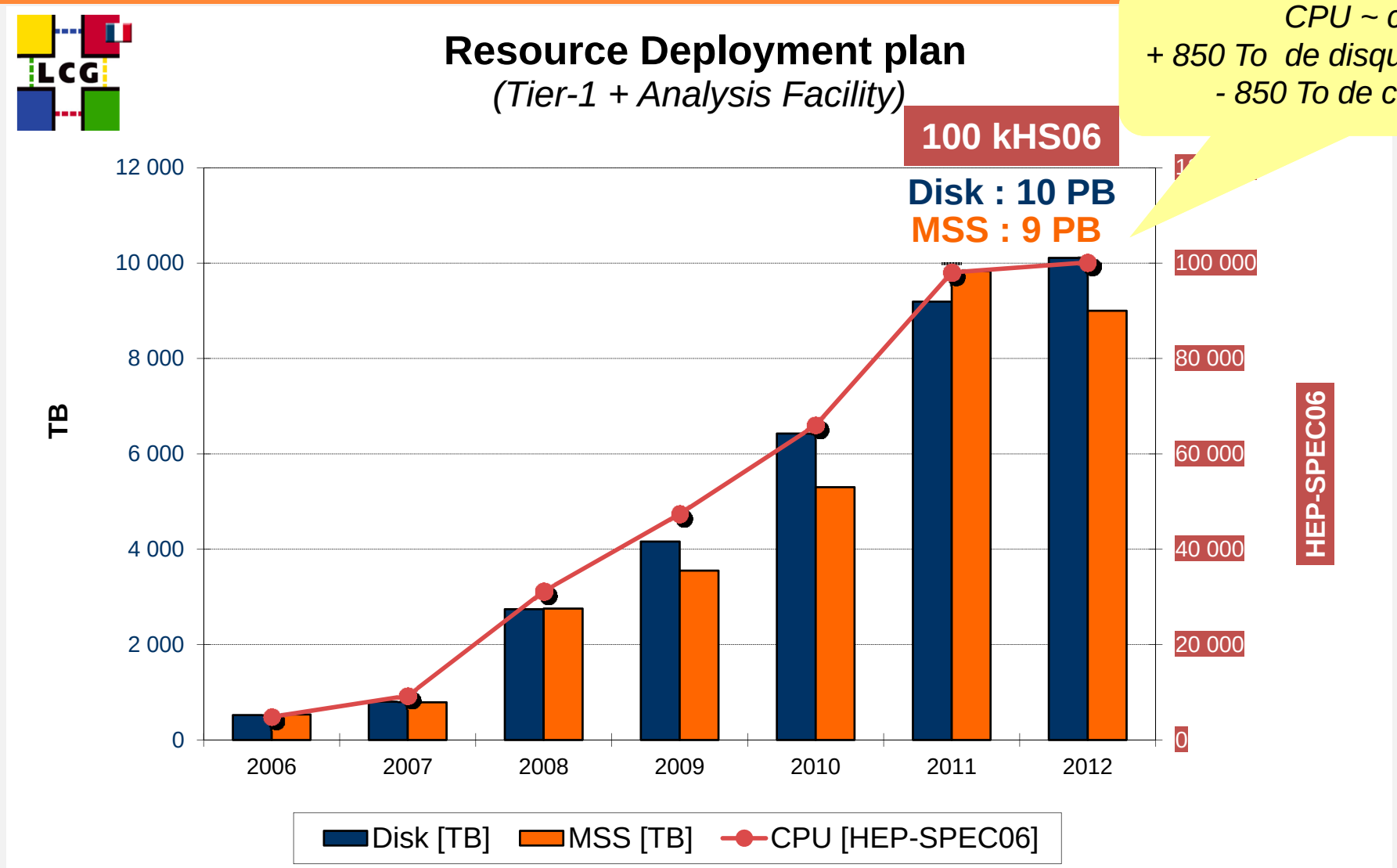
Plans for 2012

Plan T1-AF pour 2012

Capacité déployée en 2008 à renouveler



Plan T1-AF pour 2012

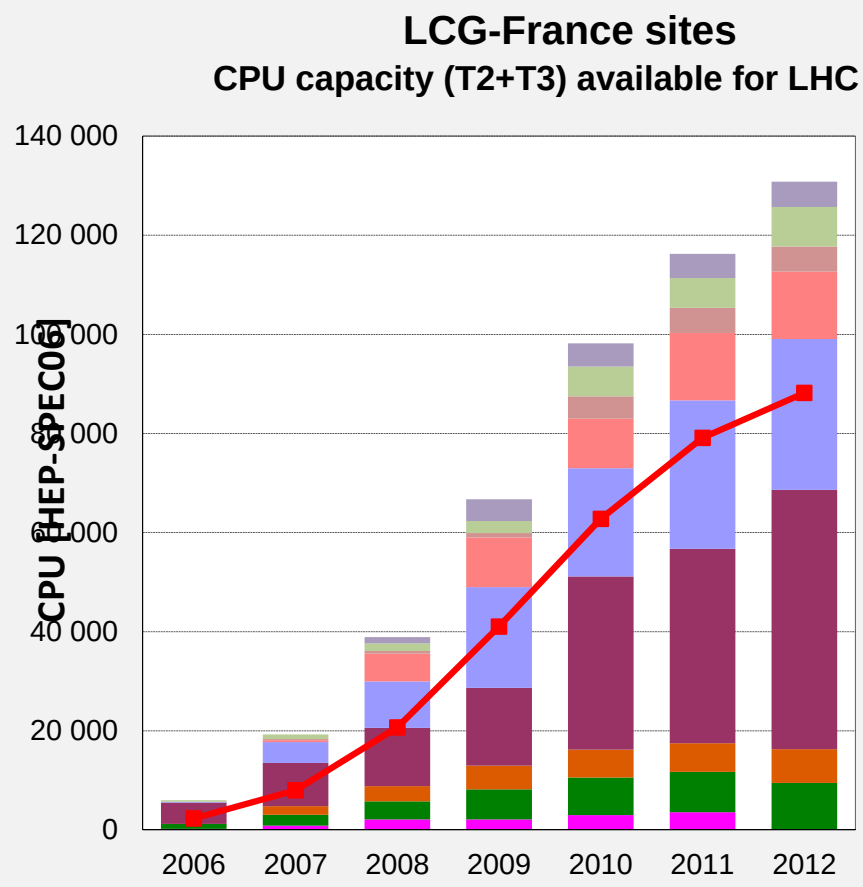


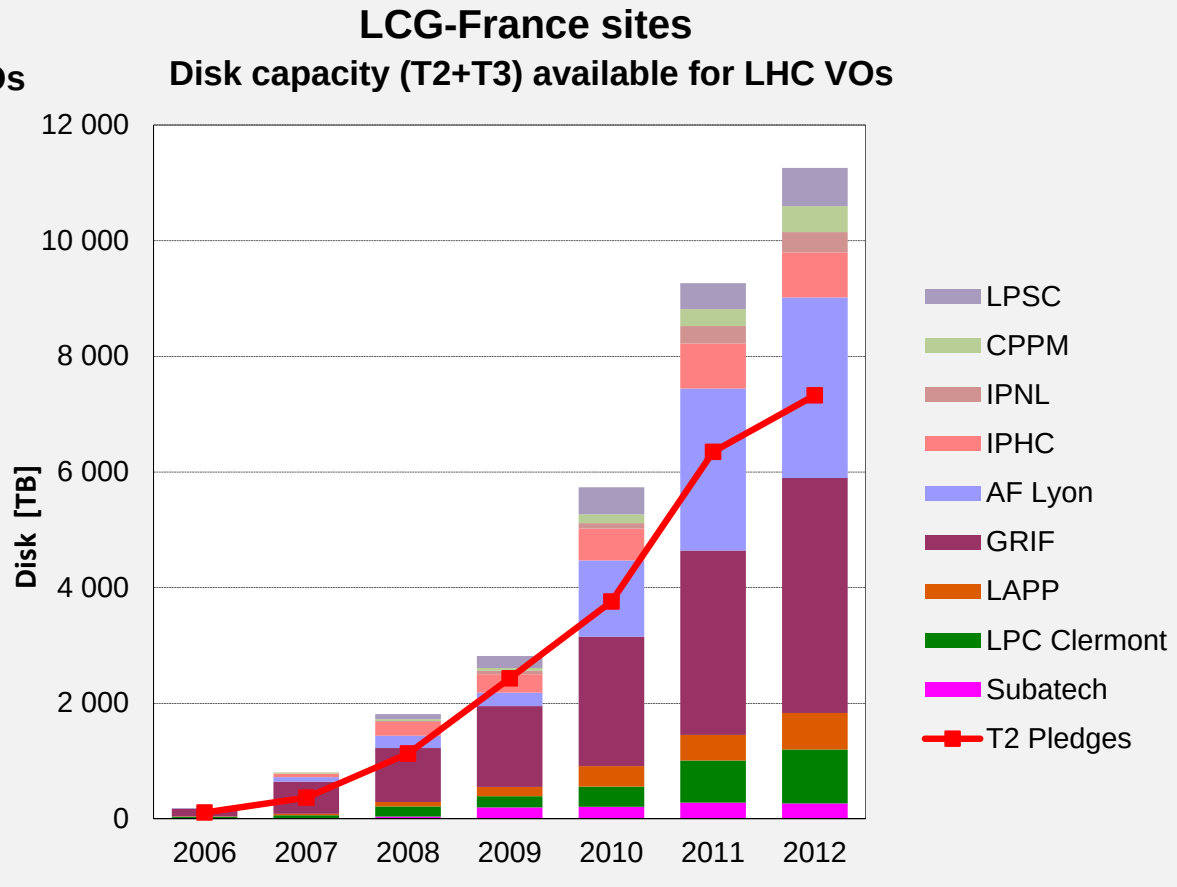
Plan T1-AF pour 2012

cf. http://wlcg-rebus.cern.ch/apps/pledges/resources/

		T1			AF (T2)			AF (T3)		
		2010	2011	2012	2010	2011	2012	2010	2011	2012
Alice	CPU [HS06]	3 779	7 699	**7700**	1 469	2267	**2300**			
	Disk [TB]	708	708	**900**	207	207	**210**			
	MSS [TB]	1 069	1 069	**800**	0	0	**0**			
Atlas	CPU [HS06]	21 600	31 324	**33 050**	4 807	9747	**9750**	4 145	4 145	**4 140**
	Disk [TB]	2 464	3 437	**3 620**	418	1318	**1310**	188	561	**640**
	MSS [TB]	1 598	4 172	**3400**	0	0	**0**	0	0	**0**
CMS	CPU [HS06]	9 065	10 331	**10700**	4 704	6579	**6600**	2 016	2 016	**2 000**
	Disk [TB]	1 209	1 237	**1 630**	296	508	**570**	127	127	**140**
	MSS [TB]	2 102	3 592	**3 800**	0	0	**0**	0	0	**0**
LHCb	CPU [HS06]	9 742	18 759	**18 700**	4 674	5188	**5200**	0	0	**0**
	Disk [TB]	728	1 010	**1 090**	80	0	**0**	0	80	**0**
	MSS [TB]	531	1 001	**1 000**	0	0	**0**	0	0	**0**
Σ All Experim.	CPU [HS06]	44 185	68 113	**70150**	15 655	23781	**23850**	6 161	6 161	**6 140**
	Disk [TB]	5 109	6 392	**7 240**	1 001	2033	**2090**	315	768	**780**
	MSS [TB]	5 300	9 834	**9 000**	0	0	**0**	0	0	**0**

Composante T2-T3 (hors CC-IN2P3)





Conclusion

- L'infrastructure de calcul LHC joue aujourd'hui pleinement son rôle et fait face à la montée en puissance du LHC
- LCG-France a su créer une communauté d'ingénieurs et de physiciens au service du calcul LHC
- 2012 …une année charnière ?
  - Coût de maintenance et coût humain demeurent importants
  - Essentiels à préserver :
    - pérennité des opérations de l'infrastructure de grille de production FR
    - Importance de la connectivité réseau (10Gbps pour tous !, utilisation plus intensive en perspective)
  - WLCG Technology Evolution Groups : roadmap stratégique LCG à court / moyen terme à suivre….