

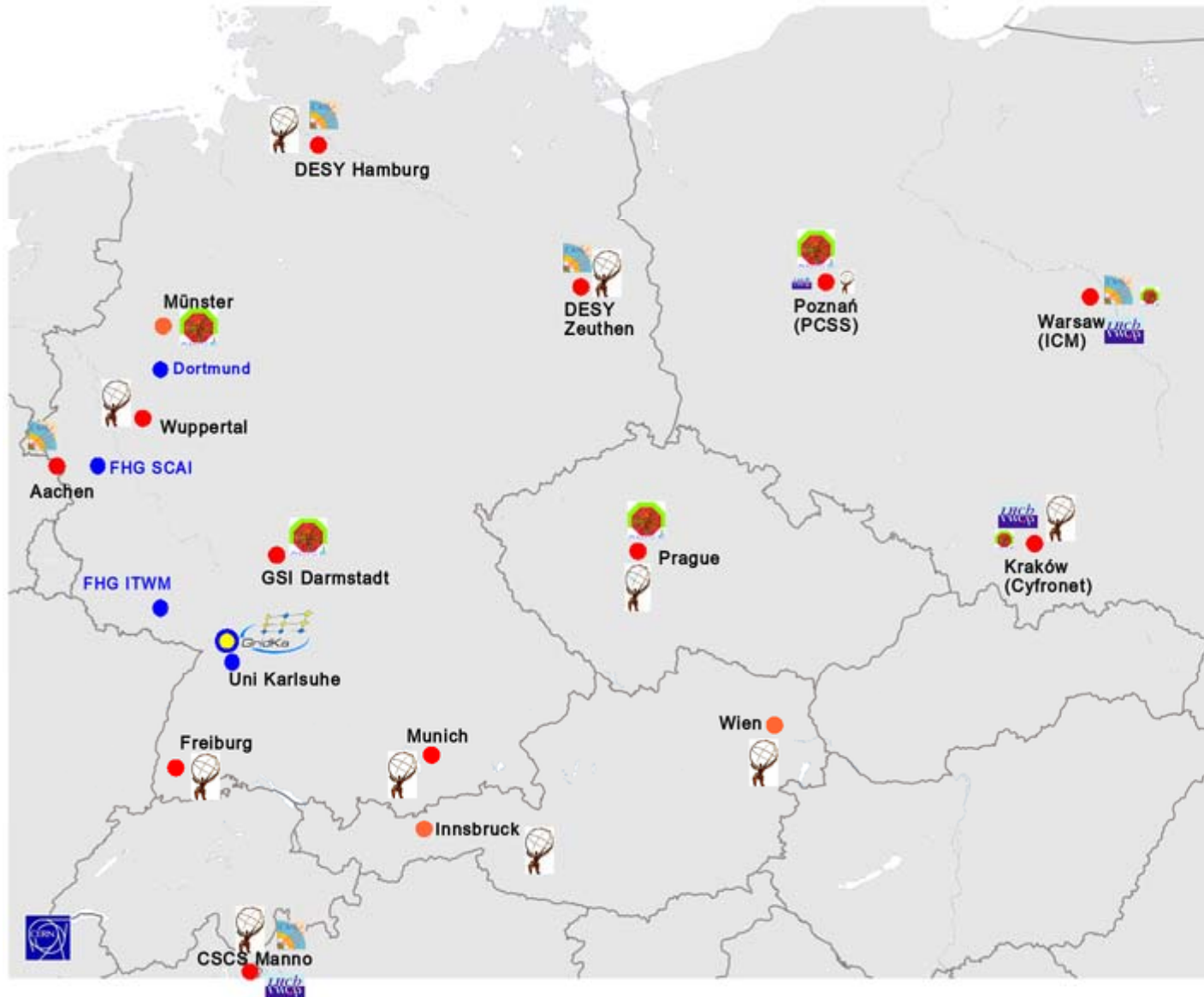
# Tier-2 cloud

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# GridKa associated Tier-2 sites spread over 3 EGEE regions.

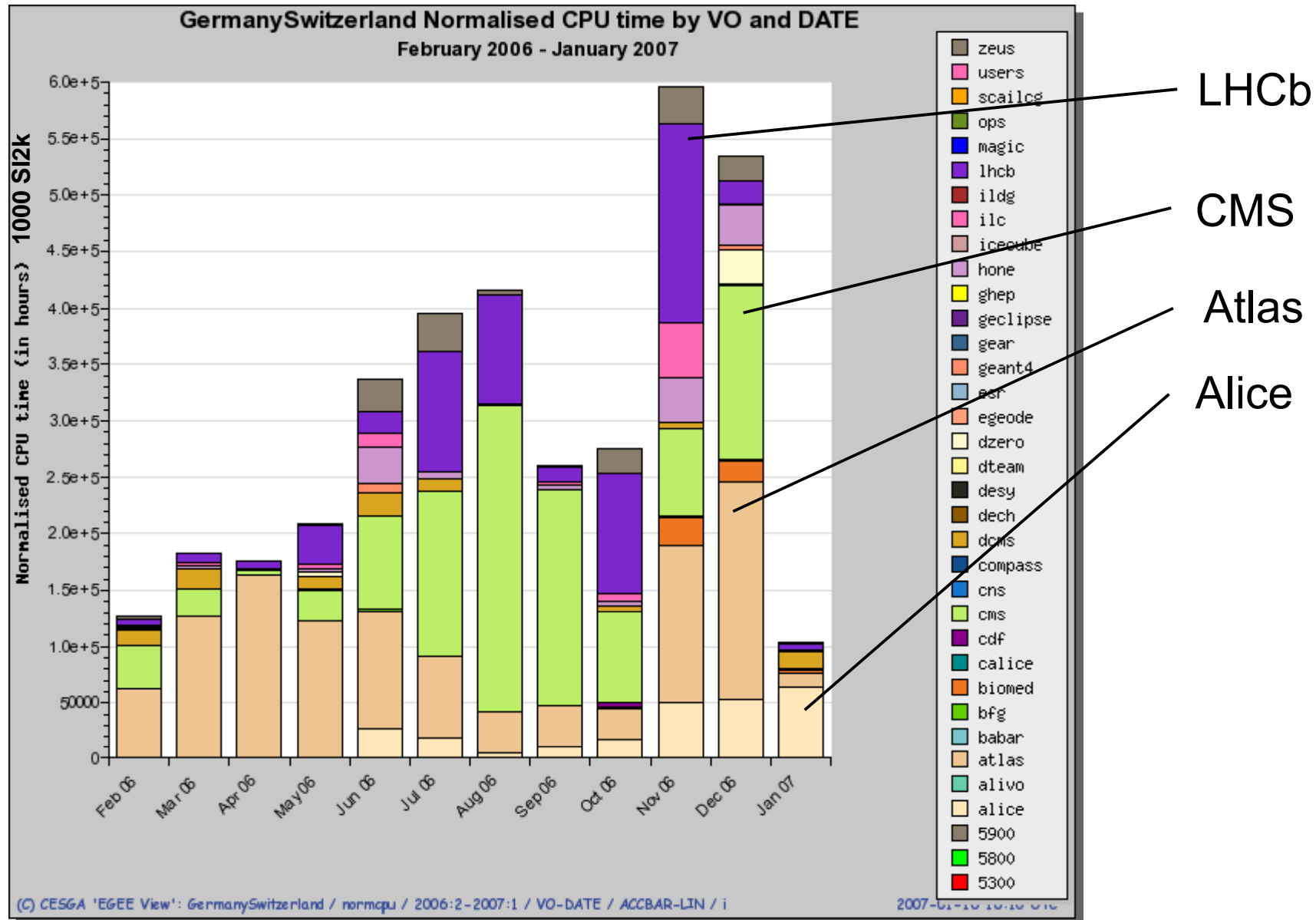
(4 LHC Experiments, 5 (soon: 6) countries, >20 T2 sites)

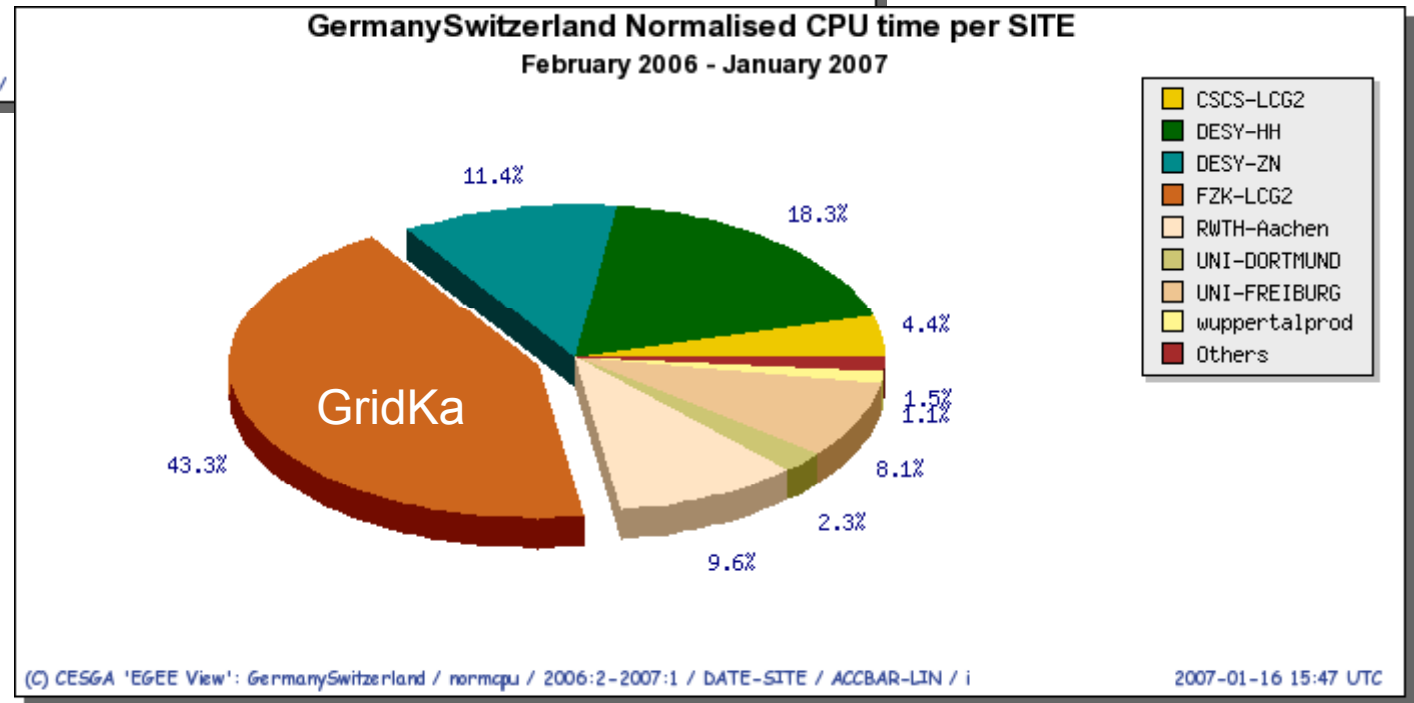
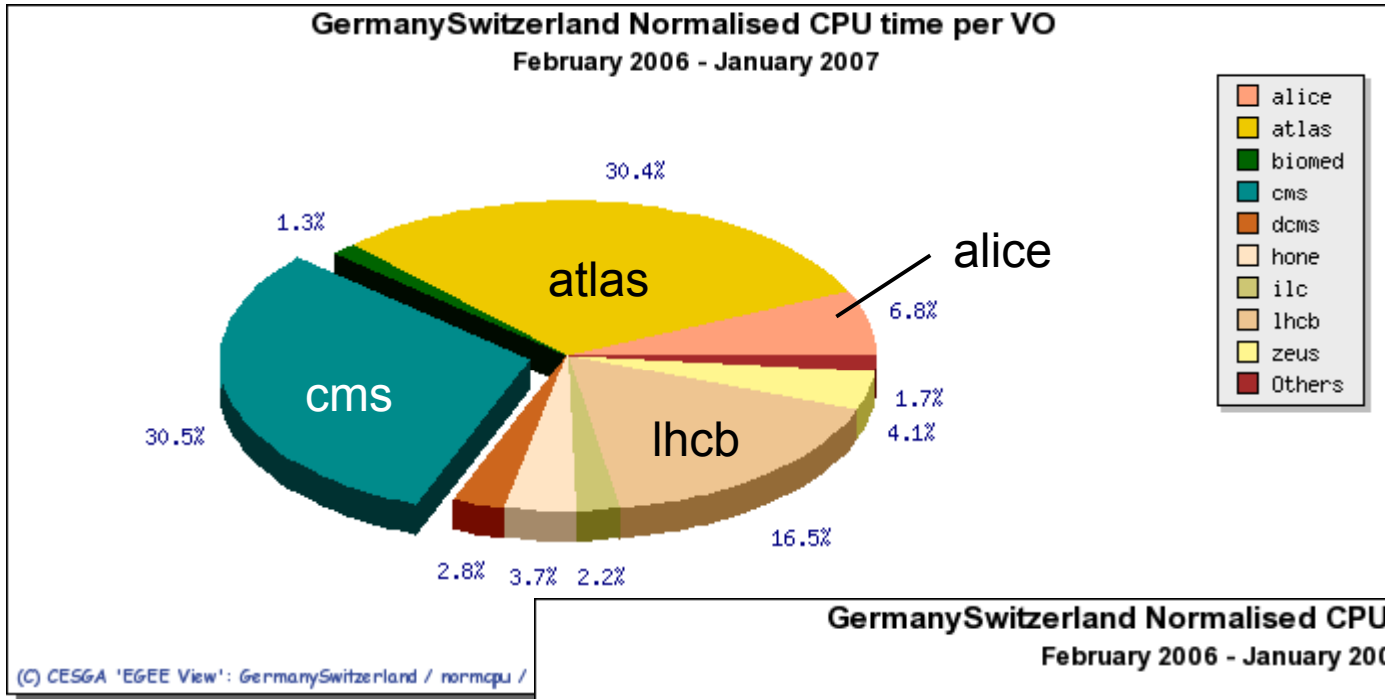


- 8 Sites
- 1 Site (SINP)

- WLCG Tier-1 site
  - WLCG Tier-2 site
  - WLCG Tier-2 candidate
  - EGEE DE/CH site, no WLCG Tier-2
- DE/CH distributed ROC:  
FZK, DESY-HH, GSI, FHG-ITWM,  
FHG-SCAI, CSCS

# eGEE region DECH





## Tier-2s associated with GridKa (The “WLCG GridKa cloud”)

Name	Location	Alice	Atlas	CMS	LHCb
CH / CSCS	Manno		X	X	X
Czech R./FZU	Prague	X	X		
D / DESY	DESY Hamburg + Zeuthen		X		
D / CMS-Fed.	DESY Hamburg + Zeuthen, RWTH Aachen			X	
D / GSI	GSI Darmstadt	X			
D / Atlas-Fed.	Munich MPG + TU		X		
Polish Tier-2 Federation	Cracow, Poznan, Warsaw	X	X	X	X
RU / RDIG	Federation (8+?)	X			
<b><u>Candidates:</u></b>					
<b>Austria</b>	<b>Innsbruck, Vienna</b>		X		
<b>D / U Münster</b>	<b>Münster</b>	X			
<b>D/ U Freiburg</b>	<b>Freiburg</b>				

## Tested FTS channels GridKa $\Leftrightarrow$ Tier-0 / 1 / 2 (not sure that this is up to date)

### Tier-0 $\Leftrightarrow$ FZK CERN - FZK

FZK  $\Leftrightarrow$  Tier-1  
IN2P3 - FZK  
PIC - FZK  
RAL - FZK  
SARA - FZK  
TAIWAN - FZK  
TRIUMF - FZK  
BNL - FZK  
FNAL - FZK  
INFNT1 - FZK  
NDGFT1 - FZK

FZK  $\Leftrightarrow$  Tier-2  
FZK - CSCS  
FZK - CYFRONET  
FZK - DESY  
FZK - DESYZN  
FZK - FZU  
FZK - GSI  
FZK - ITEP  
FZK - IHEP  
FZK - JINR  
FZK - PNPI  
FZK - POZNAN  
FZK - PRAGUE  
FZK - RRCKI  
FZK - RWTHAACHEN  
FZK - SINP  
FZK - SPBSU

FZK  $\Leftrightarrow$  Tier-2 (cont.)  
FZK - TROITSKINR  
FZK - UNIFREIBURG  
FZK - UNIWUPPERTAL  
FZK - WARSAW

## Non-associated Tier-2s accessing data at GridKa (taken from the Megatable)

- **9 European sites**
- **7 U.S. sites**
- **5 from “far East”**
- **+ 3 additional candidates**
- **all CMS (see CMS computing model)**

**They will be served through FTS STAR-channels.**

## Transfer rates for GridKa according to Megatable

T0 ⇔ T1	132.6 MB/s	}	10 Gbps dedicated GridKa – CERN +
			10 Gbps GridKa – CNAF failover
T1 ⇔ T1 in	220.1 MB/s	}	10 Gbps GridKa – CNAF
T1 ⇔ T1 out	193.6 MB/s		10 Gbps GridKa – SARA/NIKHEF
			10 Gbps GridKa – IN2P3
T2 ⇔ T1	84,4 MB/s average	}	10 Gbps GridKa “Internet”
	119.5 MB/s peak		
T1 ⇔ T2	191.2 MB/s average	}	1 Gbps GridKa – Poland
	552.6 MB/s peak		1 Gbps GridKa – Czech R.

Is that correct?  
D/CMS gives 8 MB/s average but 202 MB/s peak !

Disk and Tape requirement for GridKa acc. to Magatable is o.k.  
(balance slightly positive)



## Deployed services for Tier-2s

- usual T1 site services (CEs, SE, BDIIs, VO-Boxes ...)
- top level BDII
- RB
- FTS (see overview of tested channels)
- 3D Oracle & Squid data bases deployed (3rd machine for Atlas soon)
- LFC (yet MySQL, to be migrated to Oracle DB)

**But not always sure about usage of RB, top level BDII, ... by other sites.**

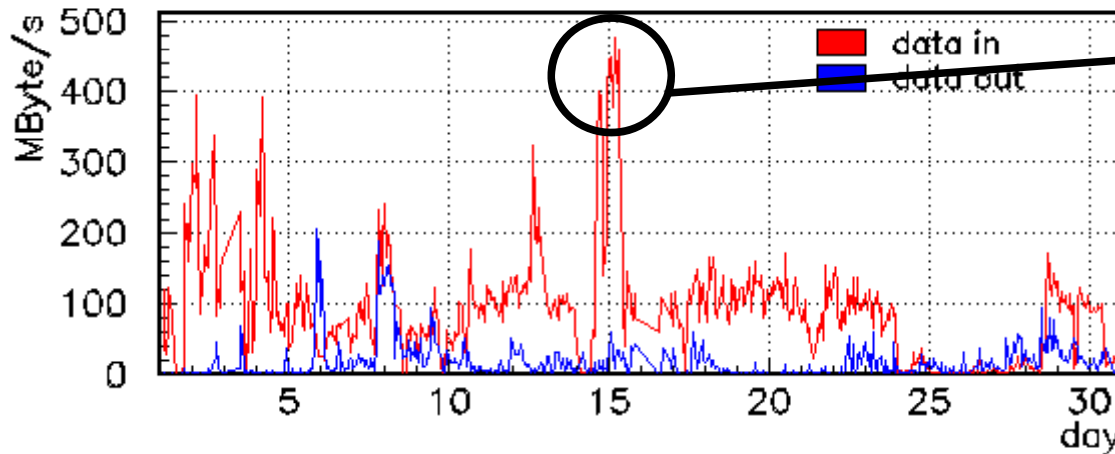
### General trends at GridKa to

- virtualize services on redundant + reliable hardware
- run DNS round-robin for load balancing

# Examples from the last Service Challenges

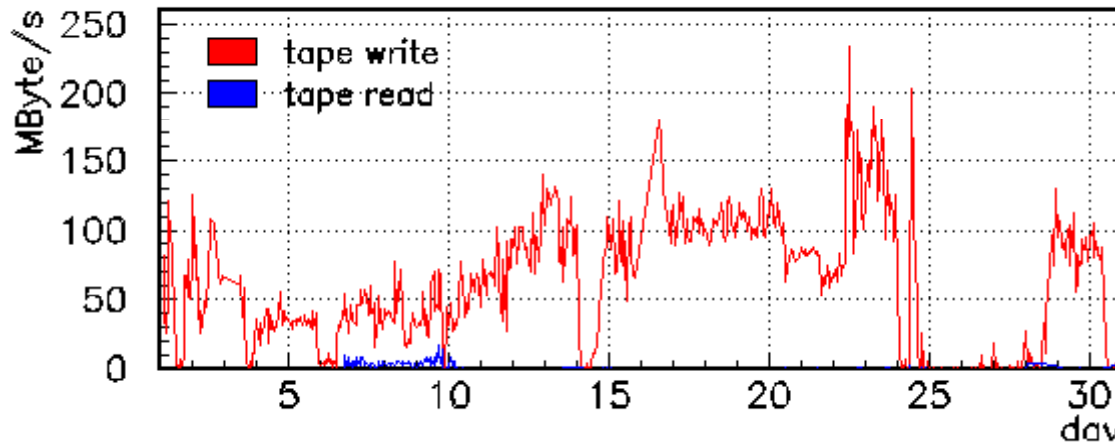
# Data transfers November 2006

Hourly averaged dCache I/O rates and tape transfer rates



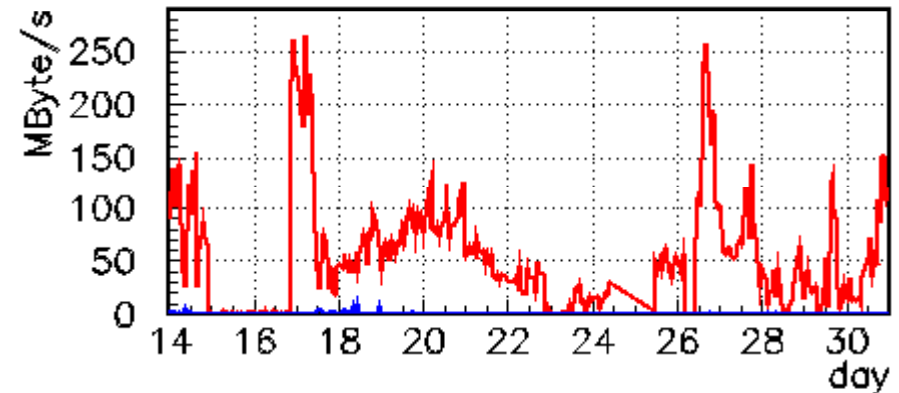
achieved 477 MB/s peak  
(1hour average) data rate.  
>440 MB/s during 8 hours

(T0→T1 + T1→T1)

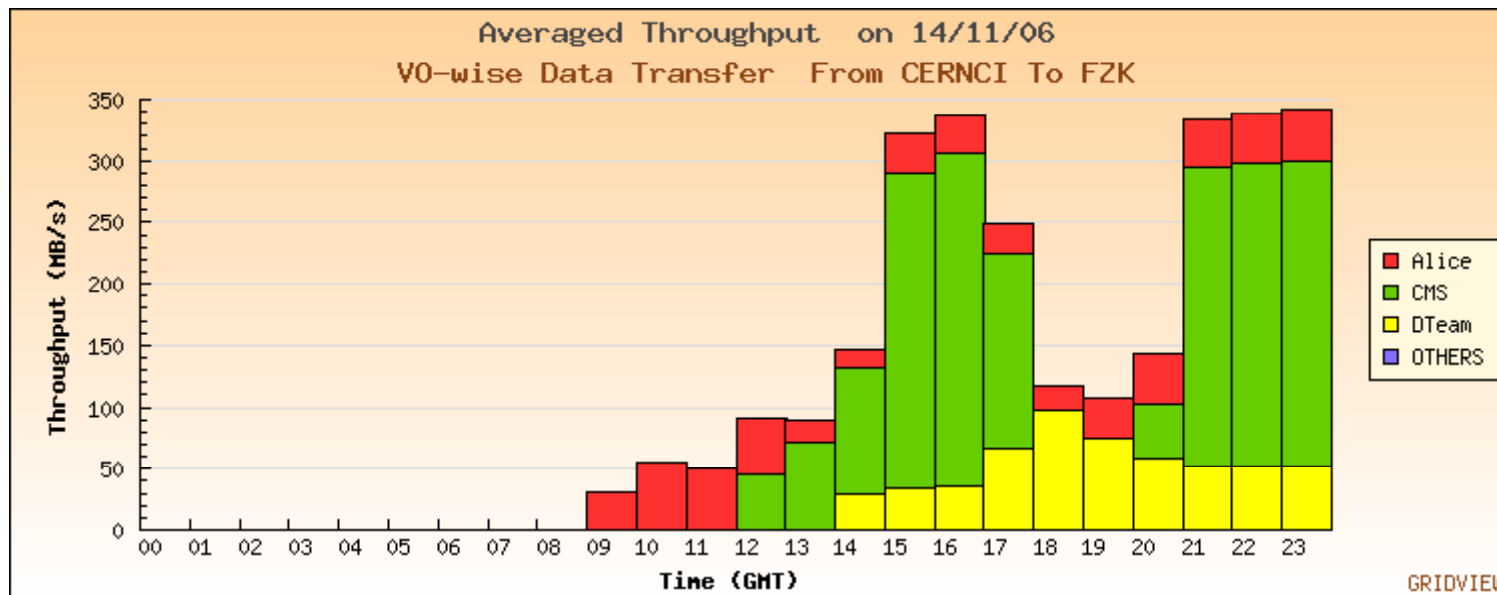


> 200 MB/s to tape  
achieved with 8 LTO3  
drives.

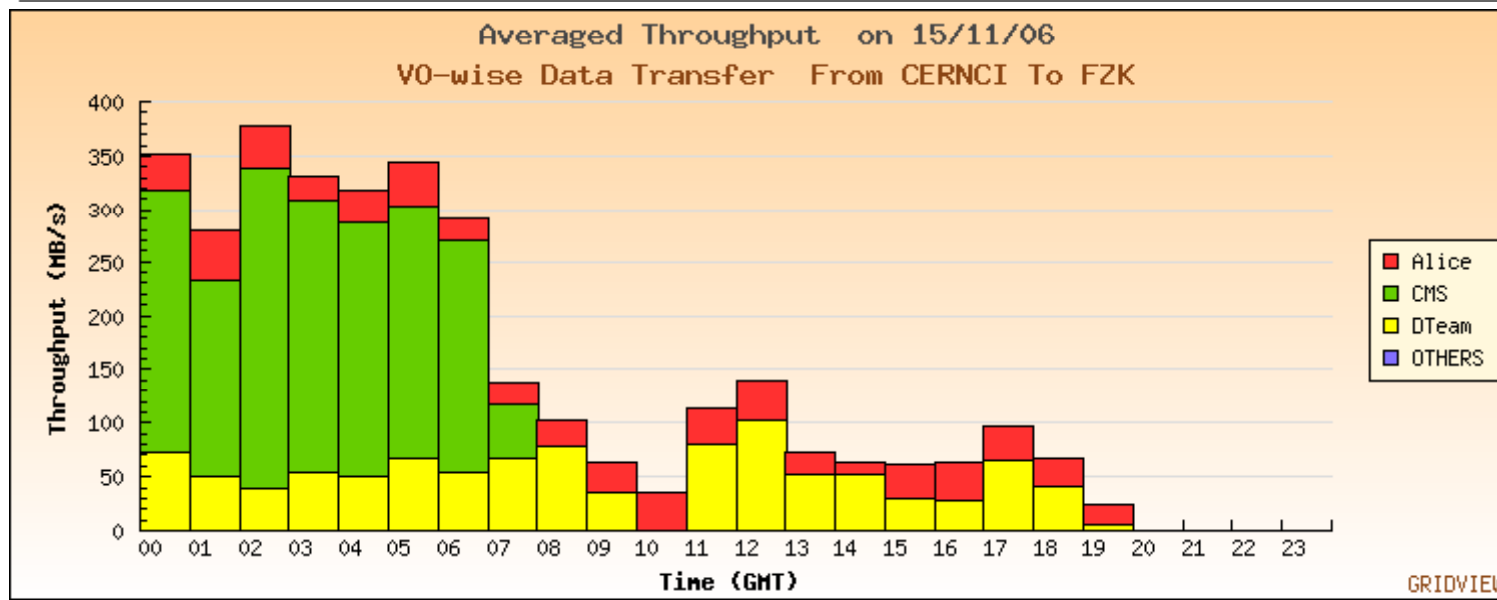
Higher tape throughput  
already in October 2006



## Gridview T0→FZK Plots for Nov. 14-15th

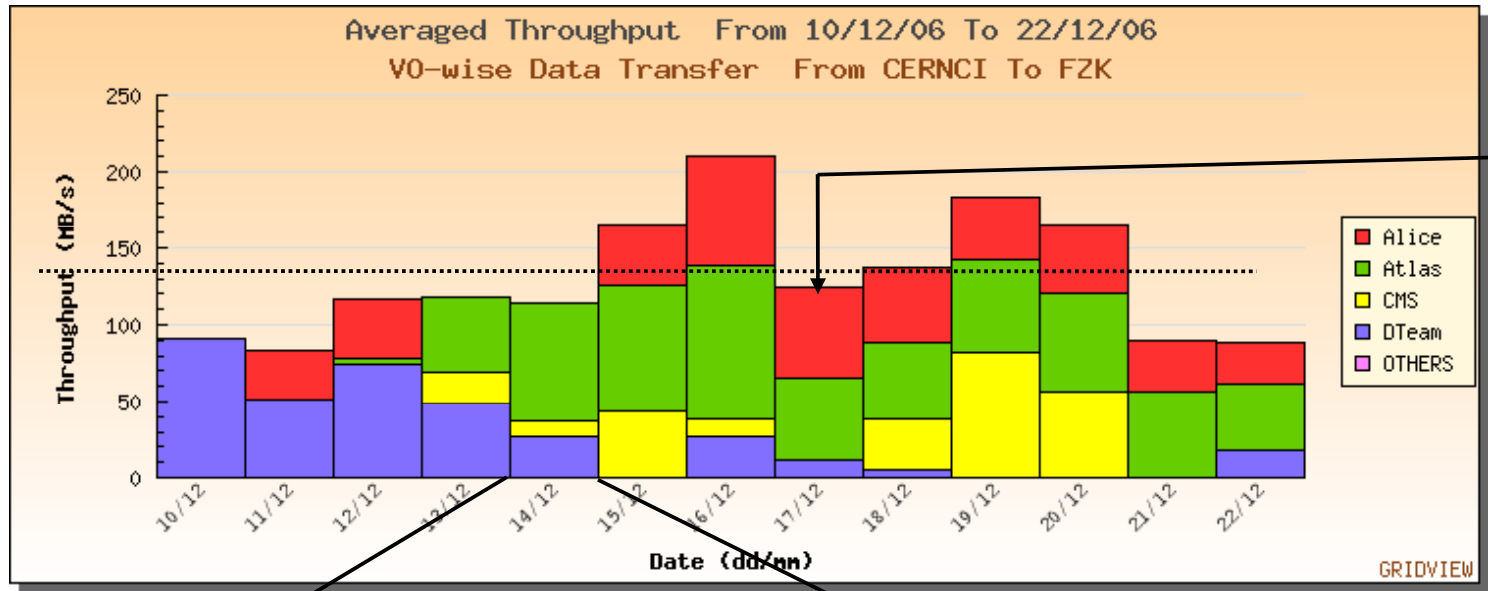


high CMS  
transfer rates  
> 200 MB/s

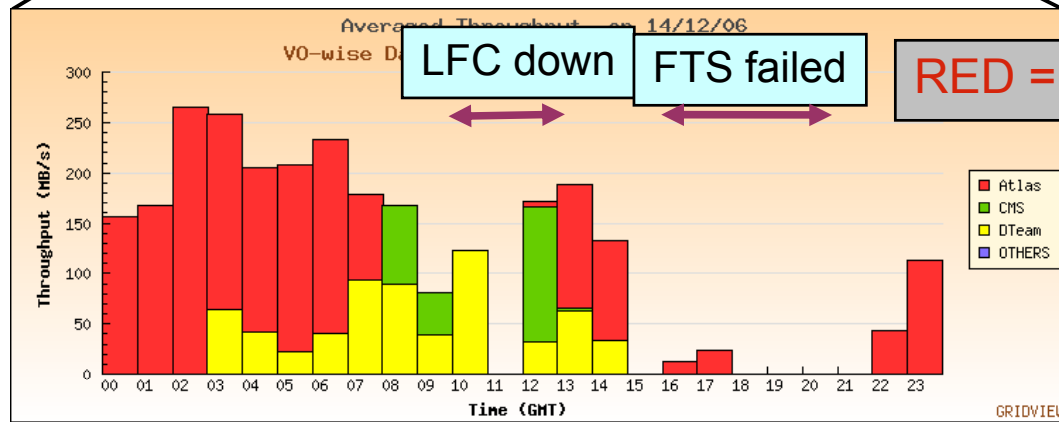


# Multi-VO transfers December 06

**Target:** Alice 24MB/s, Atlas 83.3 MB/s, CMS 26.3 MB/s → SUM: 134 MB/s



CMS disk-only pools at FZK full.



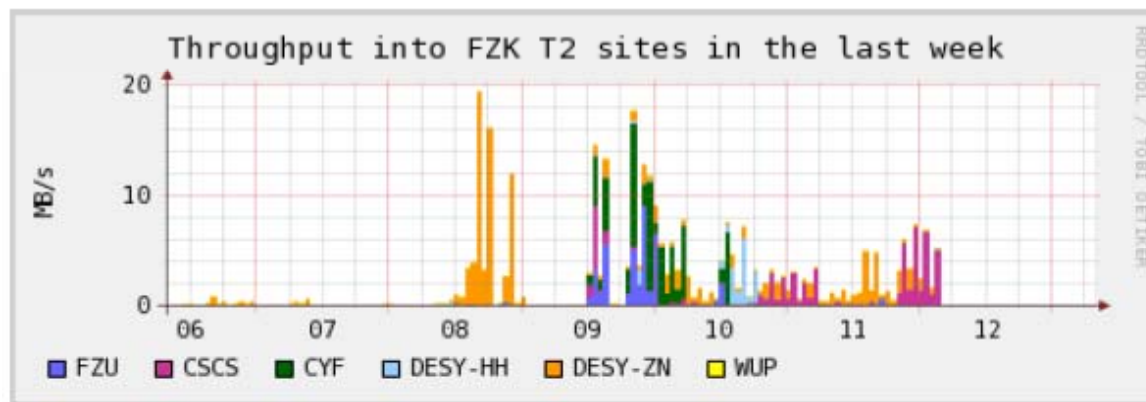
It's possible but still needs reliability as everywhere...

## Atlas DDM tests: Tier-1 + Tier-2 “cloud”

Participating Tier-2s: DESY-HH, DESY-ZN, Wuppertal, FZU, CSCS, Cyfronet

3 steps functional tests:

1. 1 dataset subscribed to each Tier-2 + one add. dataset to all Tier-2s  
→ 100% files transferred
2. 2 datasets to each Tier-2  
→ Problem w/ Atlas VO at Wuppertal, few replication failures.
3. 1 dataset in each Tier-2 subscribed to GridKa  
→ 100% files transferred.

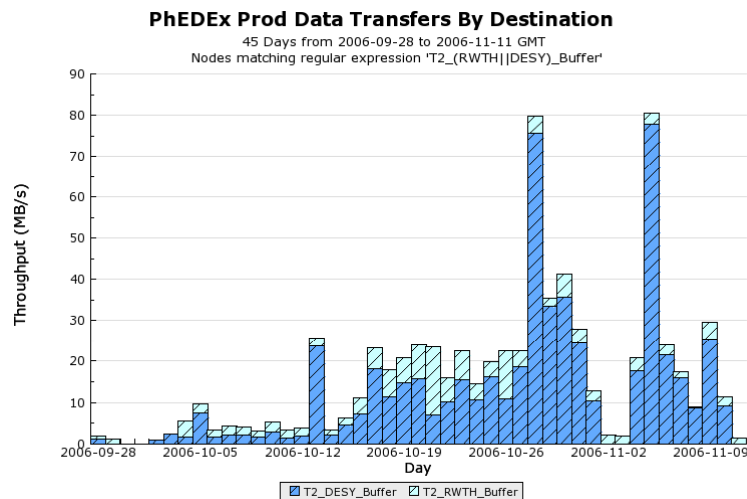
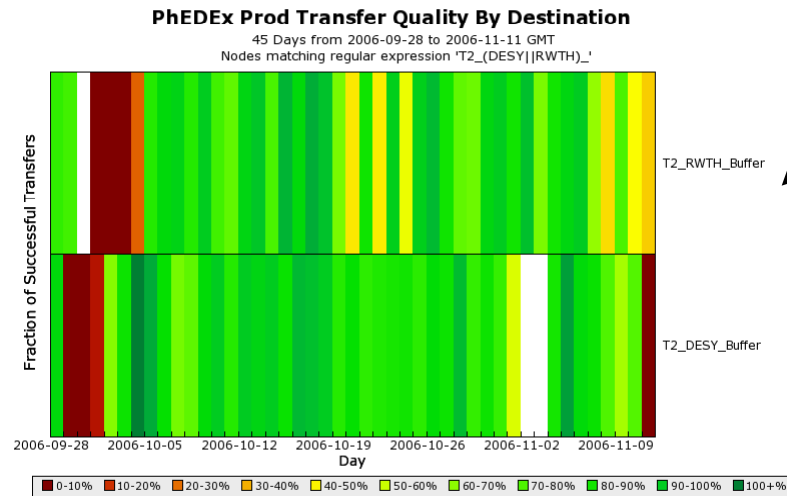


Parallel subscription  
of datasets (few 100 GBs) to  
all Tier-2s.  
(Dec. 06)

Throughput tests to be done!

# CMS T2 Desy-Aachen Federation

- significant contributions to CMS SC4 and CSA06 challenges



- stable data transfers
- transferred 55 TB to DESY/Aachen disk within 45 days, 45 TB to DESY tape
- Aachen CMS muon and computing groups successfully demonstrated full “grid-chain” from data taking at T0 to user analysis at T2 for the first time.
- 14% of total CMS grid MC production
- 2007/2008:
  - MC prod. / Calib. in Aachen, MC prod. and user analysis at Desy
  - Significant upgrade of resources
  - Further improve cooperation between German CMS centers (including Uni KA and GridKa)

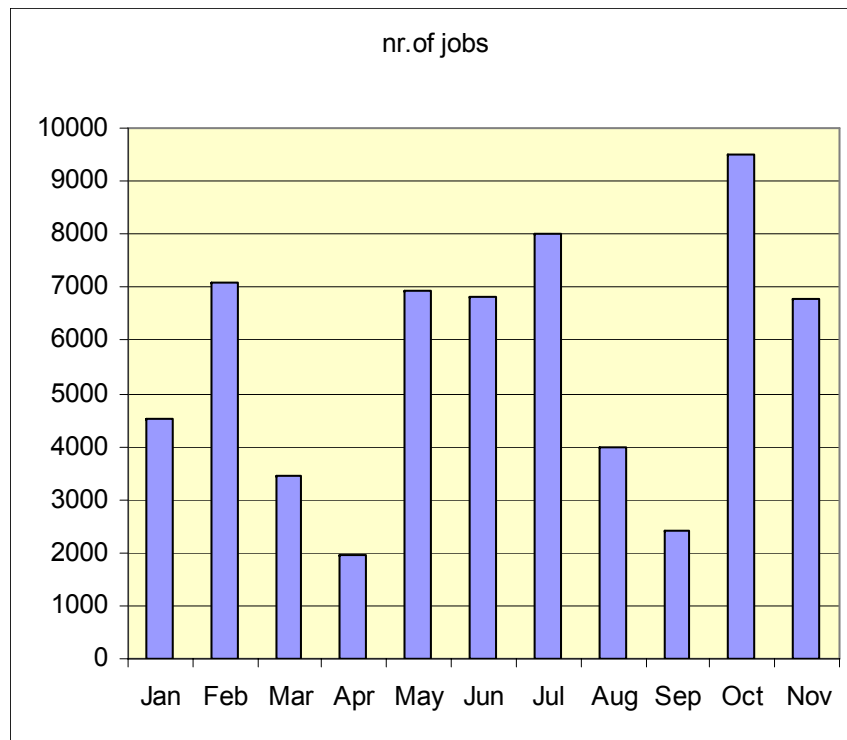
## Polish Federated Tier-2

- 3 computing centres, each supporting mainly one experiment:
    - Kraków - Atlas, LHCb
    - Warsaw - CMS, LHCb
    - Poznań - Alice
- connected via Pionier academic network
  - 1Gb/s p2p network link to GridKa in place
- 
- successful participation in Atlas SC4 T1↔T2 tests:
    - Up to 100 MB/s transfer rates from Krakow to GridKa, 50% slower in other direction.
    - 100% file transfer efficiency
  - 1000 kSI2k CPU and 250 TB disk will be provided by Polish Tier-2 Federation at LHC startup.

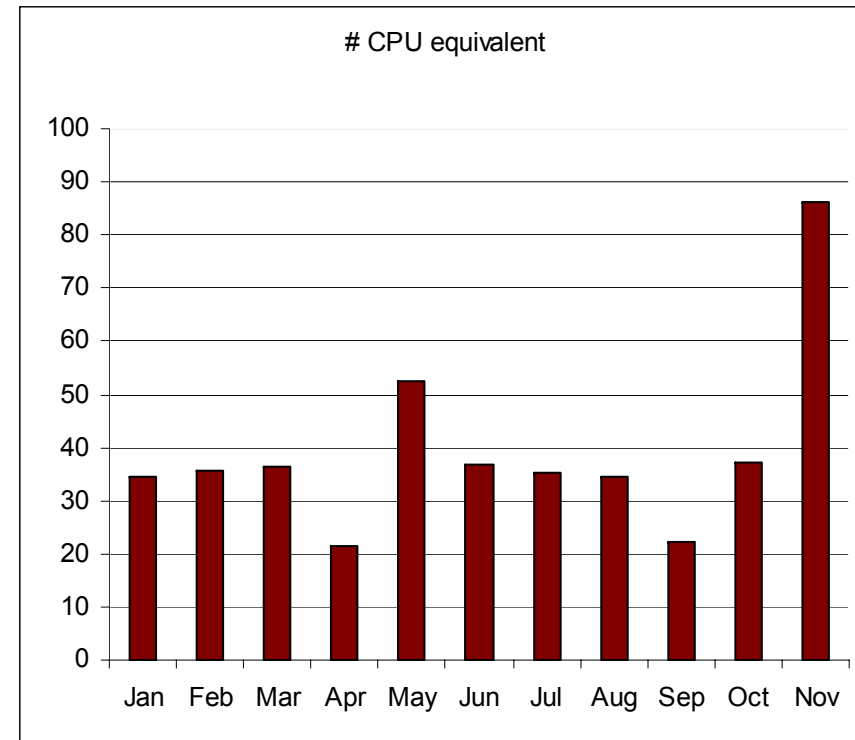


## FZU Prague

Successfull participation in Atlas DDM tests!



Nr. of ATLAS jobs submitted to Golias



CPU equivalent usage –  
average number of CPUs used continuously

## The GridKa cloud - How do we communicate (examples)

- **dedicated Tier-2 and experiment contact at GridKa (A. Heiss)**
- **GridKa – Tier-2 meeting in Munich in Oct. 2006**
- **GridKa contrib. to Polish federation meeting in Feb. 2007**
- **German Tier-2 representative in GDB**
- **Tier-2 participation in face-to-face meetings of GridKa TAB**
- **several experiment specific meetings with Tier-2 participation**
- **...**

# GridKa upgrades 2007 ...



## Upgrades in 2007

### • Install additional CPUs (April)

- LHC experiments:
- non-LHC experiments:

$$1027 \text{ kSI2k} + \mathbf{837 \text{ kSI2k}} = 1864 \text{ kSI2k}$$

$$1060 \text{ kSI2k} + \mathbf{210 \text{ kSI2k}} = 1270 \text{ kSI2k}$$

*Completed on Monday, April 2nd*

### • Add tape capacity (April)

- LHC experiments:
- non-LHC experiments:

$$393 \text{ TB} + \mathbf{614 \text{ TB}} = 1007 \text{ TB}$$

$$545 \text{ TB} + \mathbf{40 \text{ TB}} = 585 \text{ TB}$$

*Completed but needs some hardware maintenance for new drives*

### • Add disk capacity (July)

- LHC experiments:
- Non-LHC experiments

$$284 \text{ TB} + \mathbf{594 \text{ TB}} = 878 \text{ TB (usable)}$$

$$353 \text{ TB} + \mathbf{90 \text{ TB}} = 443 \text{ TB (usable)}$$

*Installation / allocation started*

**2007: LHC experiments will have biggest fraction of the GridKa resources!**