Fermilab: CMS Tier 1

SCD Projects Meeting

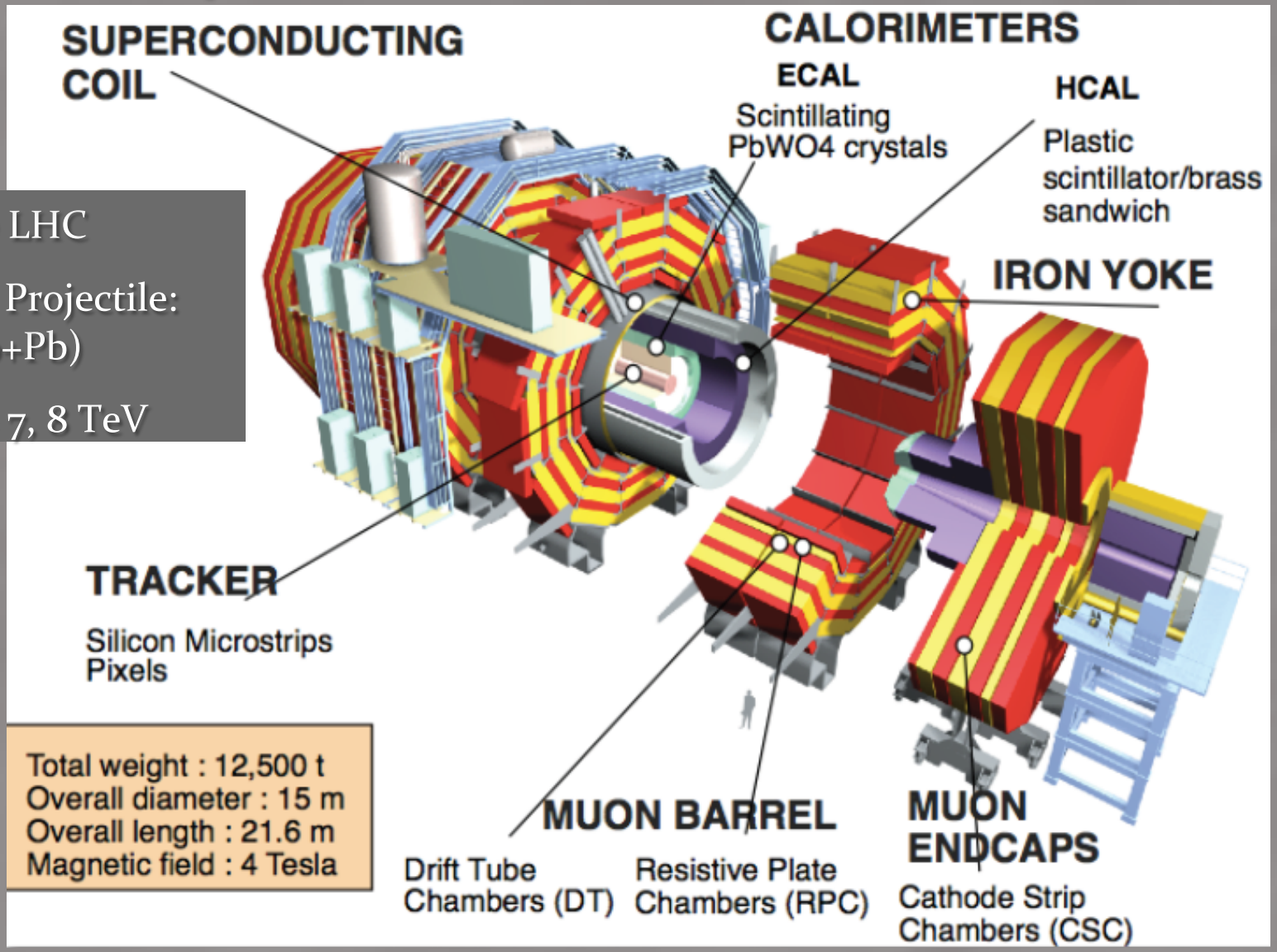
Burt Holzman

CMS Experiment

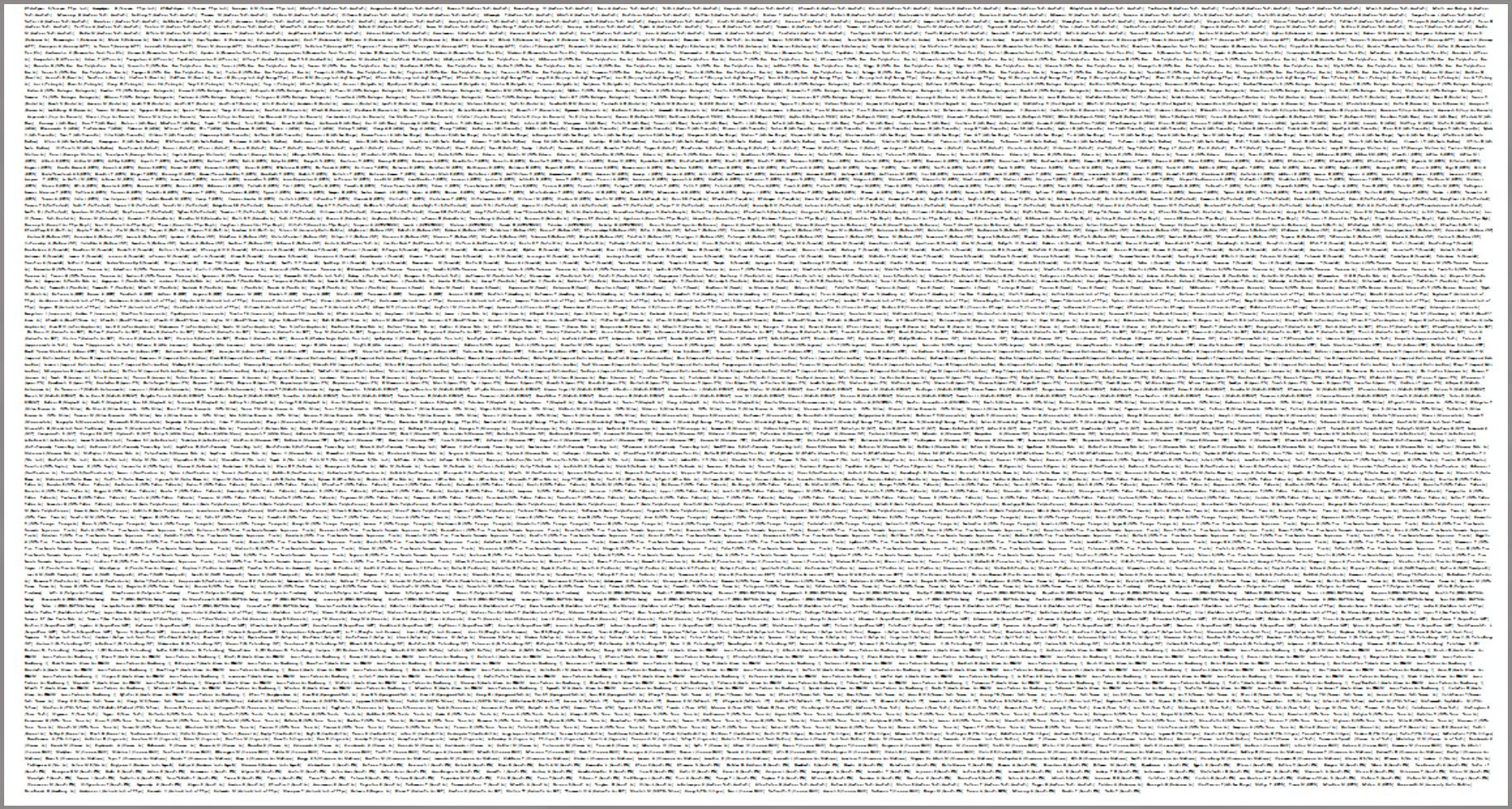
CMS @ LHC

Target, Projectile:
p, p (Pb+Pb)

E_{BEAM} = 7, 8 TeV



CMS Collaboration



CMS Physics

- Could discover:
  - **Higgs (like?) Boson**
  - Supersymmetry
  - Extra Dimensions
  - Dark Matter
  - Dark Energy
  - and much, much more…

Total number of citable papers analyzed:	460
Total number of citations:	9922
Average citations per paper:	21.6
Renowned papers (500+)	2
Famous papers (250-499)	2
Very well-known papers (100-249)	13
Well-known papers (50-99)	26
Known papers (10-49)	112
Less known papers (1-9)	151
Unknown papers (0)	154
h-index	48

Citation data from INSPIRE

CMS Computing

E917
My thesis
experiment
5 TB/run

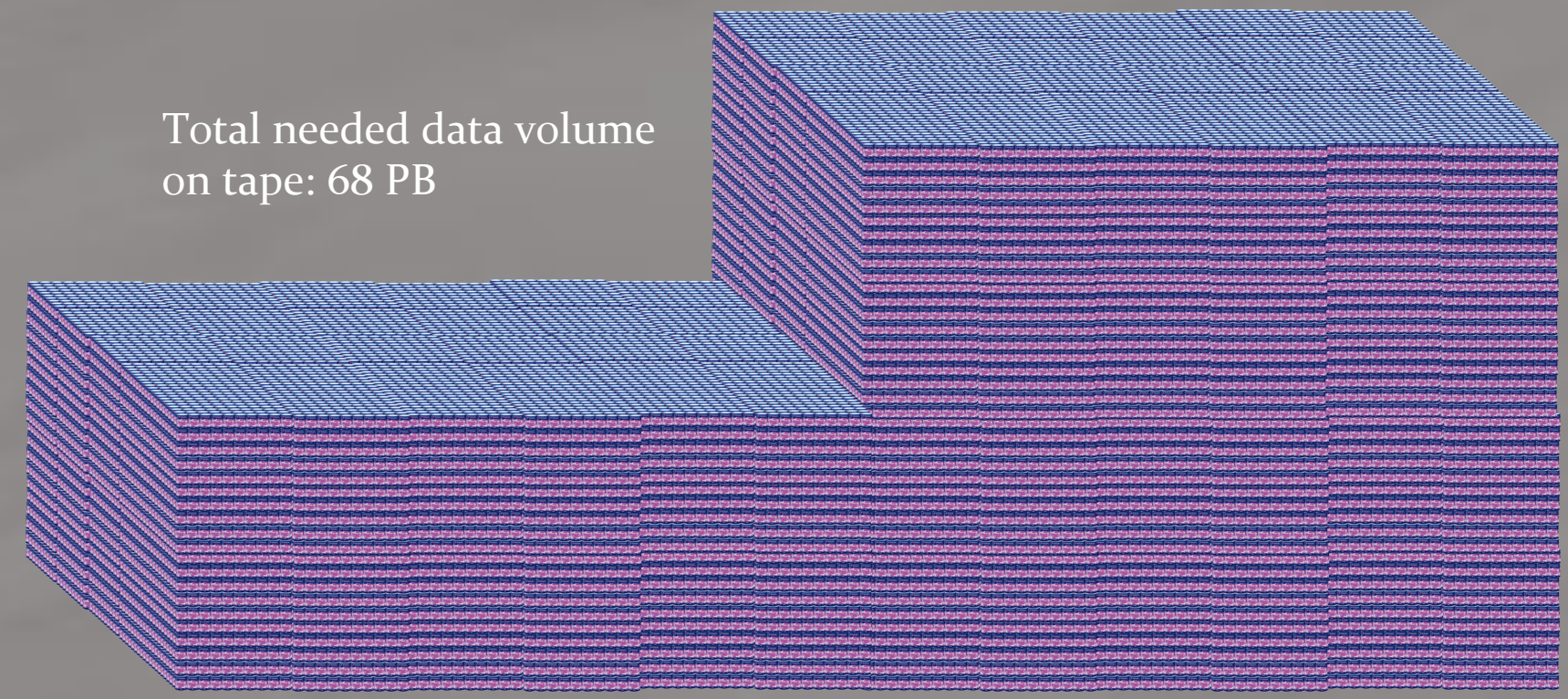
Phobos
My postdoc
experiment
50 TB/run

CMS

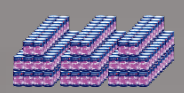
6 PB raw/run

CMS Computing

Total needed data volume on tape: 68 PB

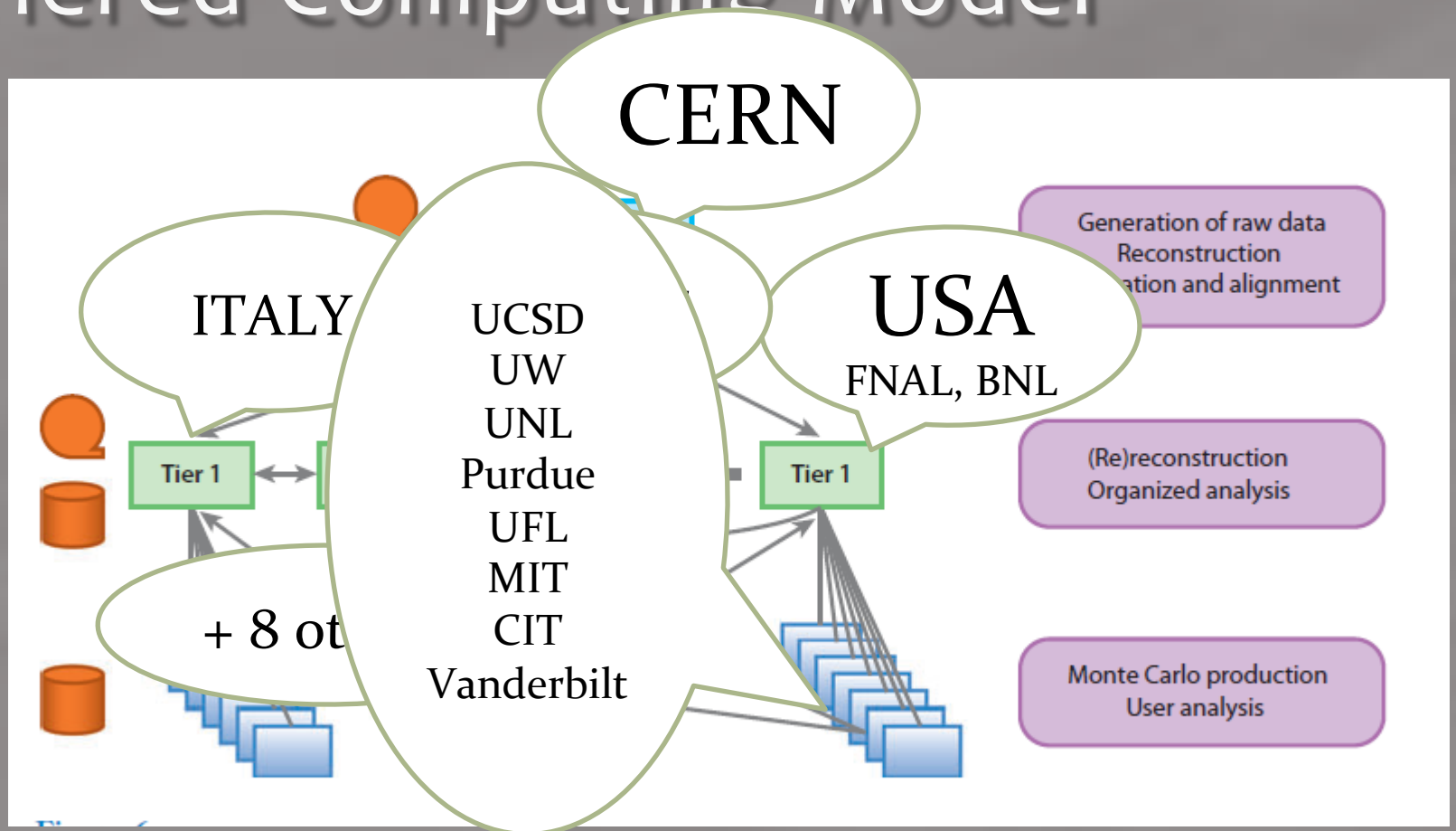


E917

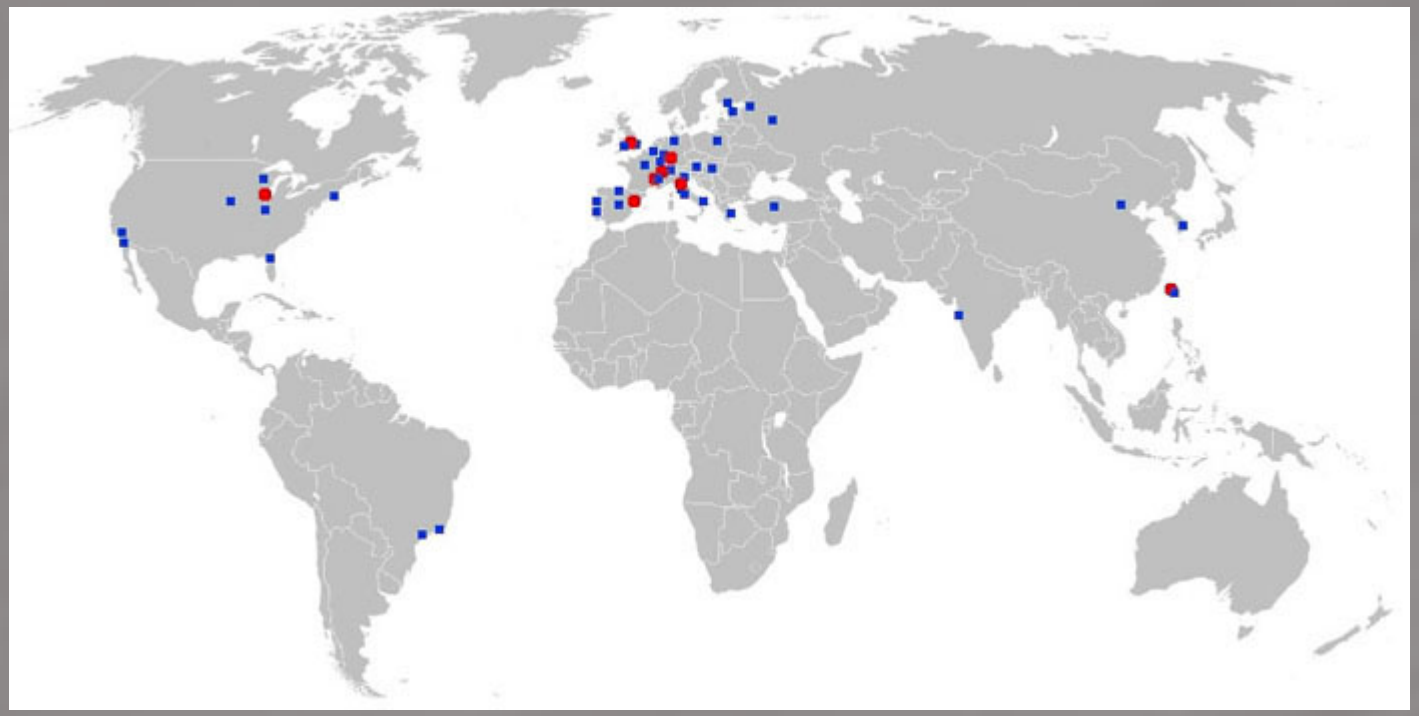


Phobos

"MONARC" Tiered Computing Model



CMS Computing Hierarchy

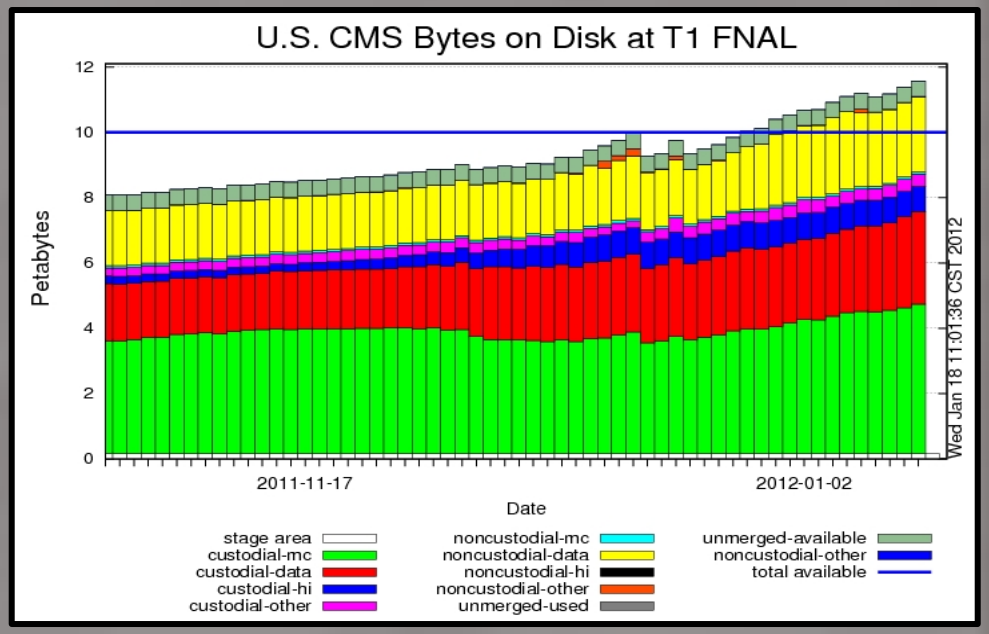


RED: Tier 1: Fermilab (US), ASGC (Taiwan), INFN (Italy), KIT (Germany), RAL (UK), PIC (Spain), IN2P3 (France)
BLUE: Tier 2: (roughly 50)

Fermilab is the only Tier 1 dedicated to CMS at 100%;
Consequently we are pledged to **40%** of the T1 computing share

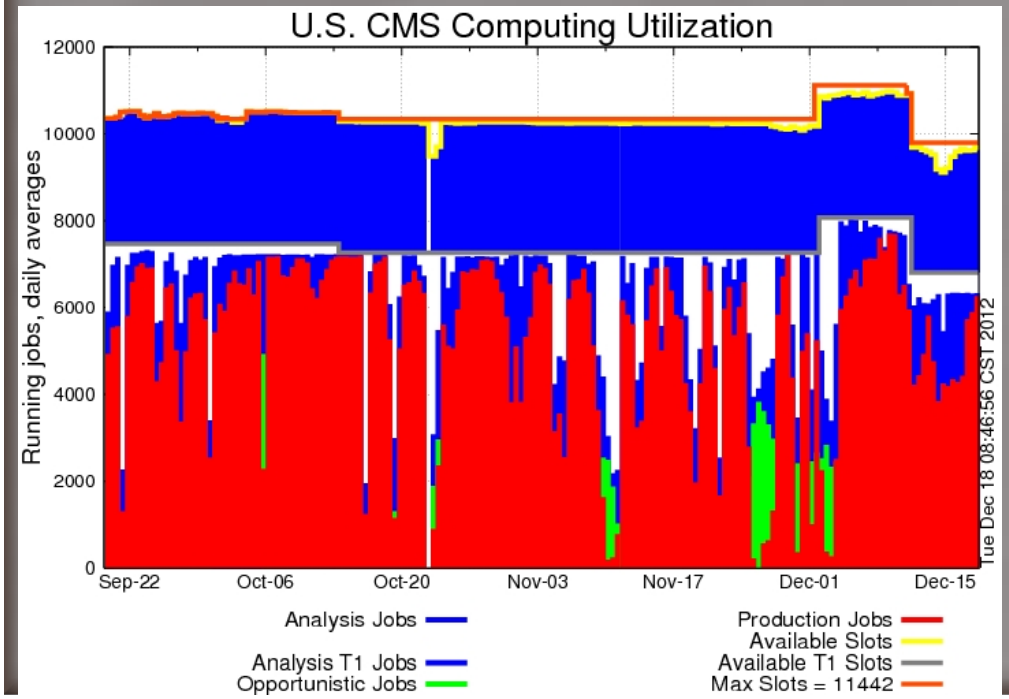
Fermilab Tier 1 for CMS

- Nearline Storage:
  - 15 Petabytes
  - Nexsan E60s (60 disks, 2-3 TB each)



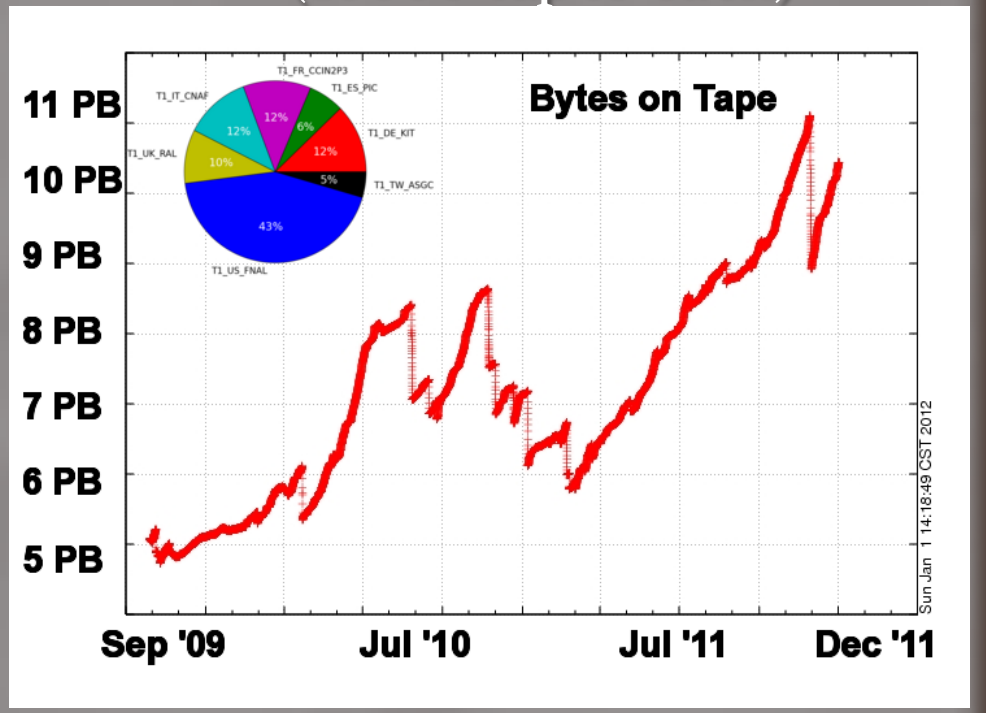
Fermilab Tier 1 for CMS

- Computing:
  - 3300 cores locally available
  - 6400 cores globally available
  - Provisioned with NPACI Rocks

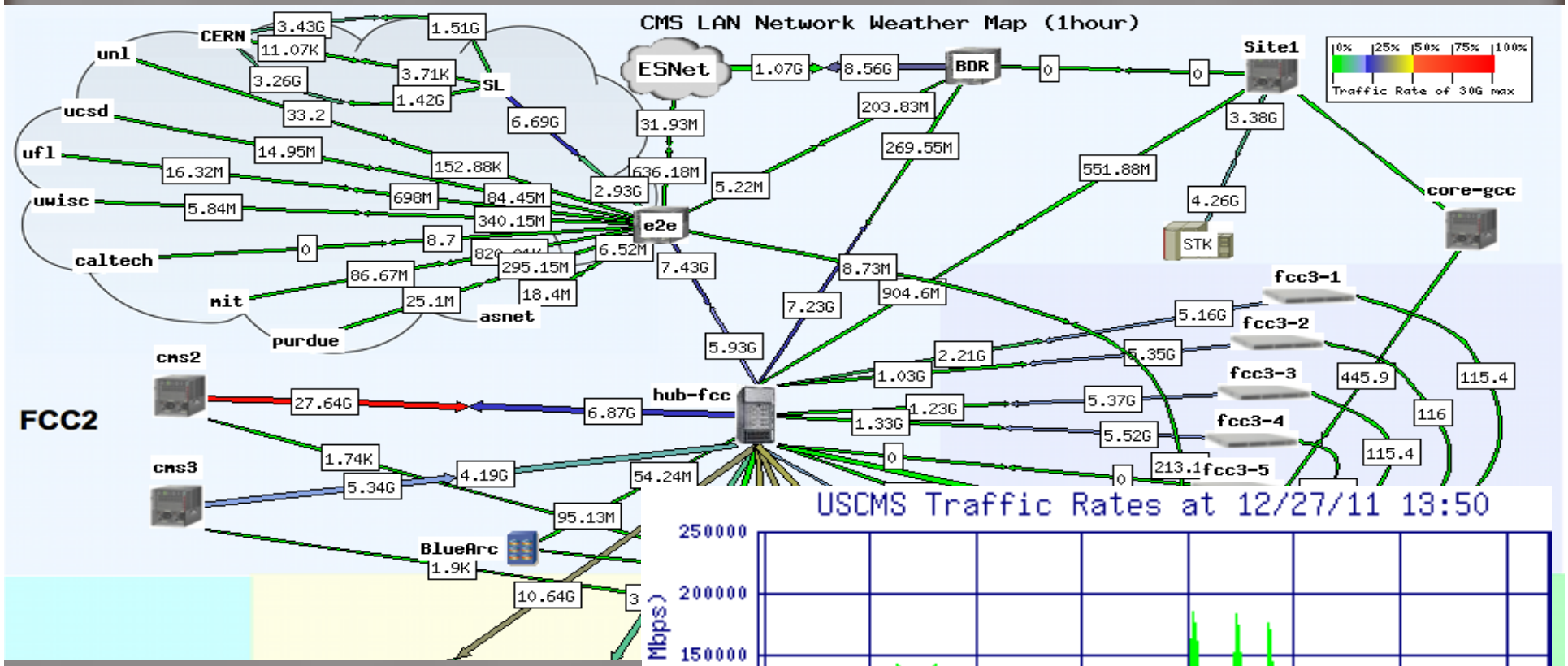


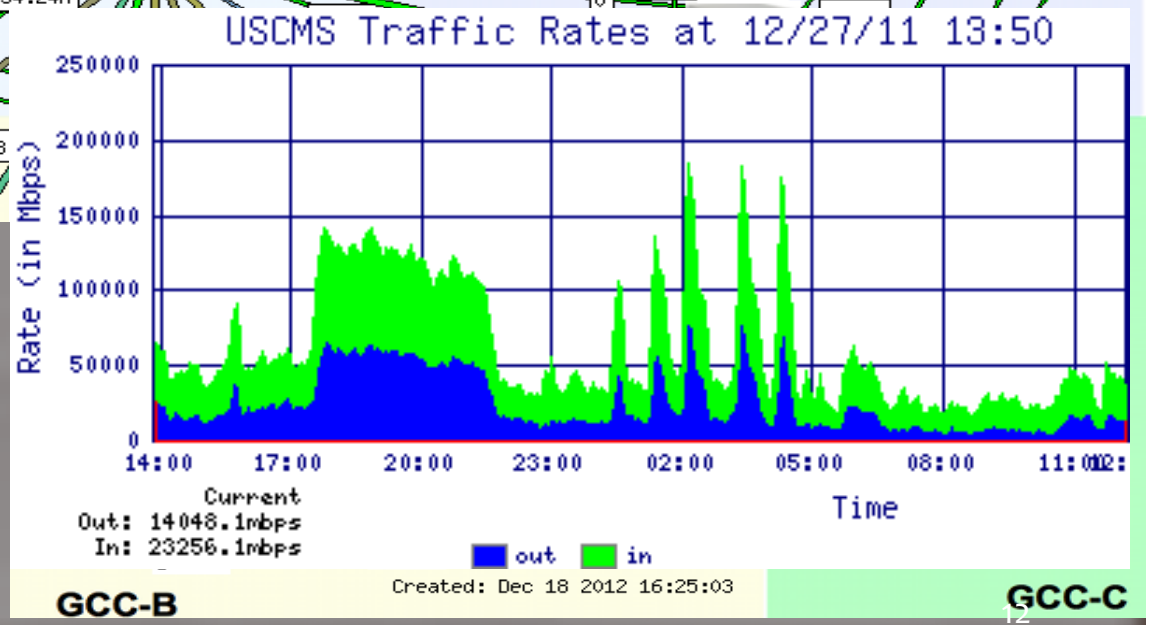
Fermilab Tier 1 for CMS

- Tape (managed by DMS):
  - 22 Petabytes
  - STK SL8500 bots (10000 tapes each)



Fermilab Tier 1 for CMS





- Network (managed by NVS)
  - 60 Gbit WAN
  - Including 20 Gbit trans-atlantic link (shared with ATLAS)

Fermilab Tier 1 Staff

- Merina Albert
- *Catalin Dumitrescu*
- *David Fagan*
- Lisa Giacchetti
- *Burt Holzman*
- Chih-Hao Huang
- Krista Majewski
- Natalia Ratnikova
- (Tim Skirvin)
- Rob Snihur*
- Rich Thompson
- Anthony Tiradani
- John Weigand*

Fermilab Tier 1 Staff Contributes back to US CMS and FNAL

- Merina Albert
- *Catalin Dumitrescu*
- *David Fagan*
- Lisa Giacchetti
- *Burt Holzman*
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- Anthony Tiradani
- John Weigand*

- glideinWMS global operations
- X509 transition support for US CMS
- glideinWMS development for the cloud
- PhEDEx development
- dCache and EOS development and testing
- OSG Information Provider
- glideinWMS project management
- Tier 3 leadership and support
- Scientific hardware acquisition
- OSG accounting
- Online storage evaluation

Internal Monitoring

- Zabbix – more than 120k monitored elements

Dashboard | Overview | Web | Latest data | Triggers | Events | Graphs | Screens | Maps | Discovery | IT services |

History: Hosts » Latest data » History » Latest data » Status of triggers

PERSONAL DASHBOARD

Favourite graphs

- cmsosgce:Number of processes
- cmsosgce2:Number of processes
- cmsosgce4:Number of processes
- cmssrv28:DCAP Movers Queued
- cmscode04:Outgoing traffic on interface eth0
- cmscode01:codeservers - aggregate
- cmscode01:codeservers - aggregate 2
- cmscode01:codeservers - aggregate bond
- cms-xen43:CPU system time (avg1)
- cms-xen43:Processor load

Graphs »

Favourite screens

Favourite maps

Status of Zabbix

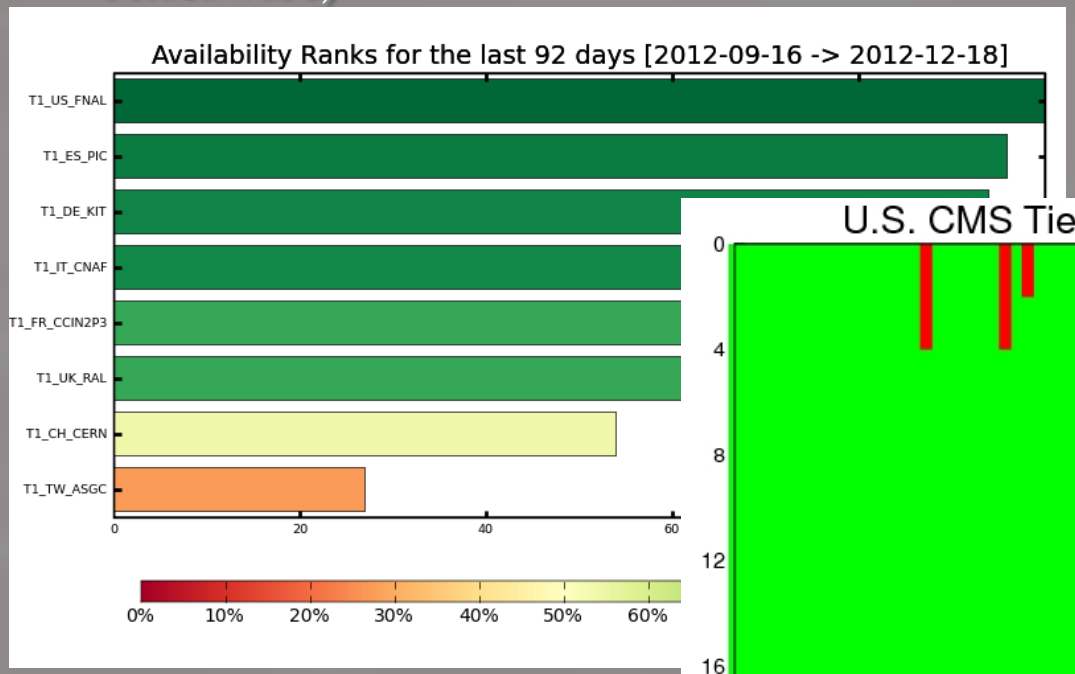
System status

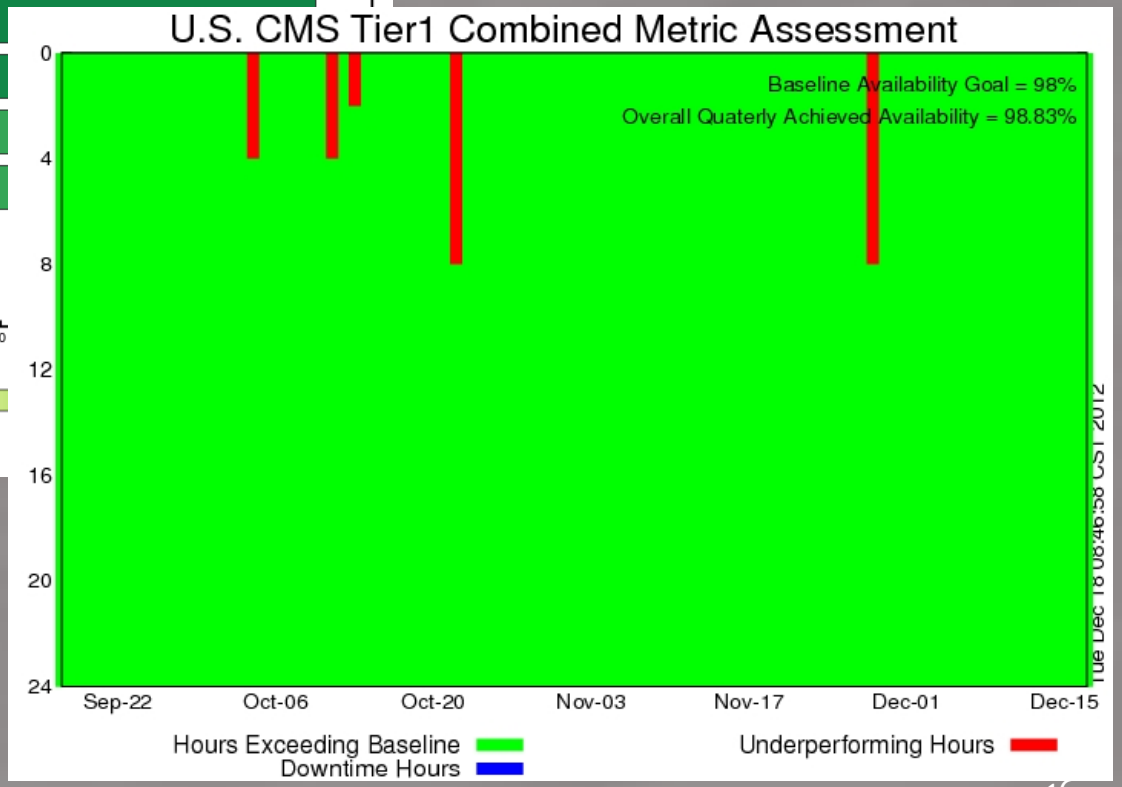
Host group	Disaster	High	Average	Warning	Information	Not classified
Condor Head Nodes	0	0	0	0	0	0
Consoles	0	0	0	0	0	0
dcache_all	0	7	0	0	0	0
Disk arrays	0	0	0	0	0	0
EOS servers	0	0	0	0	0	0
EOS storage	0	0	0	0	0	0
external	0	0	0	0	0	0
glideinWMS	0	0	0	0	0	0
Linux servers	0	7	0	6	0	0
LPC interactive	0	0	0	0	0	0
Misc	0	0	0	0	0	0
sl6 servers	0	0	0	1	0	0
Templates	0	0	0	0	0	0
Virtual Machines	0	0	0	0	0	0
ZABBIX Servers	0	0	0	0	8	0

Updated: 09:46:25

External Monitoring

- We are constantly probed by CMS and the WLCG for site availability and readiness: need to meet 98% uptime when LHC has beam (97% otherwise)





Some upcoming facility challenges (in no particular order)

- Pushing the (cost-effective) scale for computing, storage, networking
- Any data Any time Anywhere: evolving beyond MONARC to read files from anywhere
- Evolving provisioning tools beyond Rocks
- Consolidating user storage
- Reducing tape overhead
- CMS computing operations explicit control over which files are resident on disk