ATLAS EXPERIMENT

http://atlas.ch

Analysis in ATLAS

Réunion des sites LCG-France, CC-IN2P3 Lyon

22-23 November 2010 *CC-IN2P3, Villeurbanne*

Europe/Paris timezone

irfu

cea

saclay

Analysis: which one?

- Grid Analysis
  - Group Analysis
    - User Analysis
- ‘local’ Analysis
  - Batch Analysis
  - Interactive Analysis

Analysis is the process of breaking a complex topic or substance into smaller parts to gain a better understanding of it.

~NOT covered

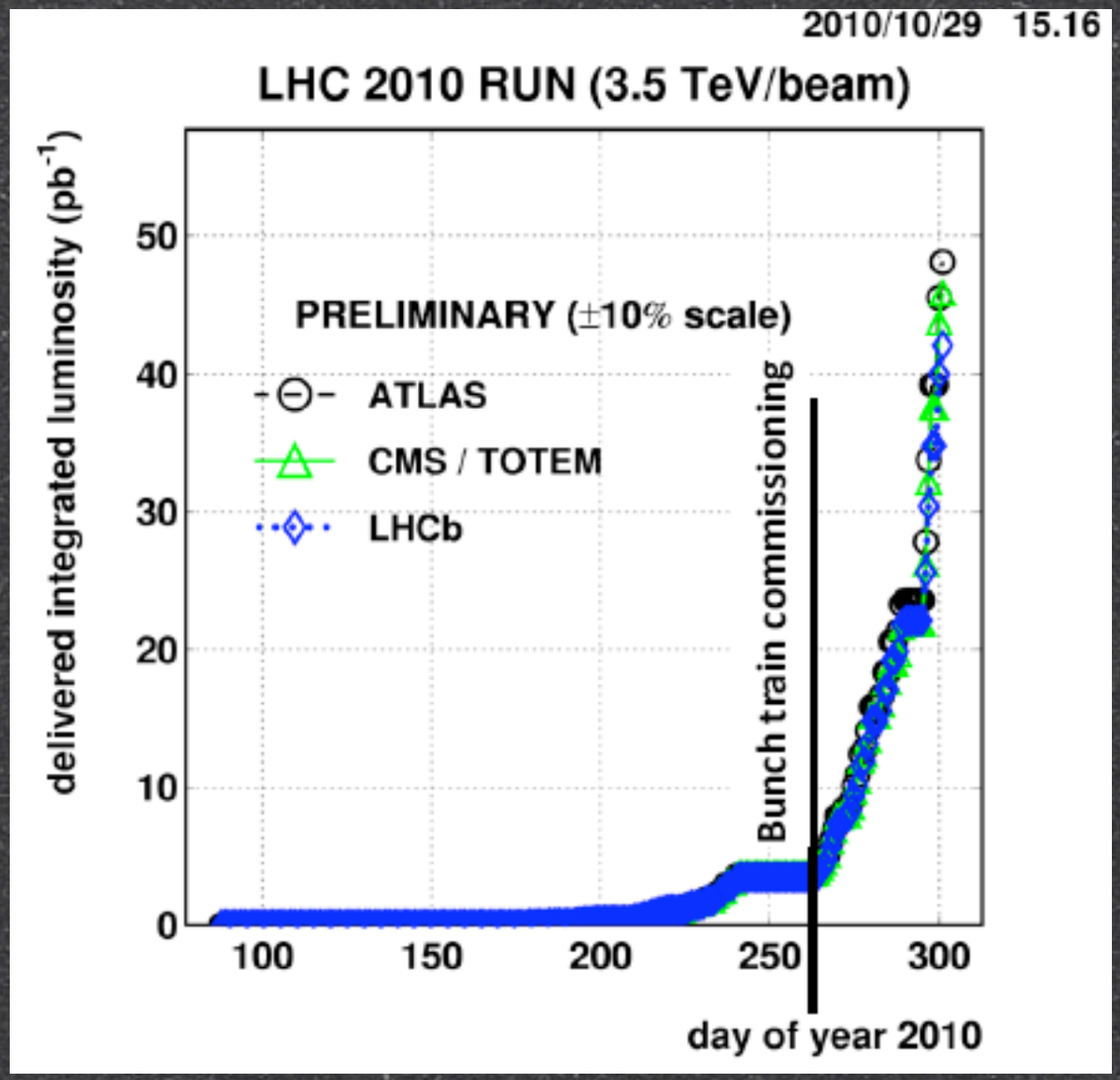
Analysis...

- Which kind of data format (dataset)
  - RAW, ESD, AOD, DPD, ...
- Which tool
  - ATHENA (ATLAS software)
  - ROOT

Warnings...

- Analysis pattern will change
- Most of data taken during last month
- Reprocessed data not yet available

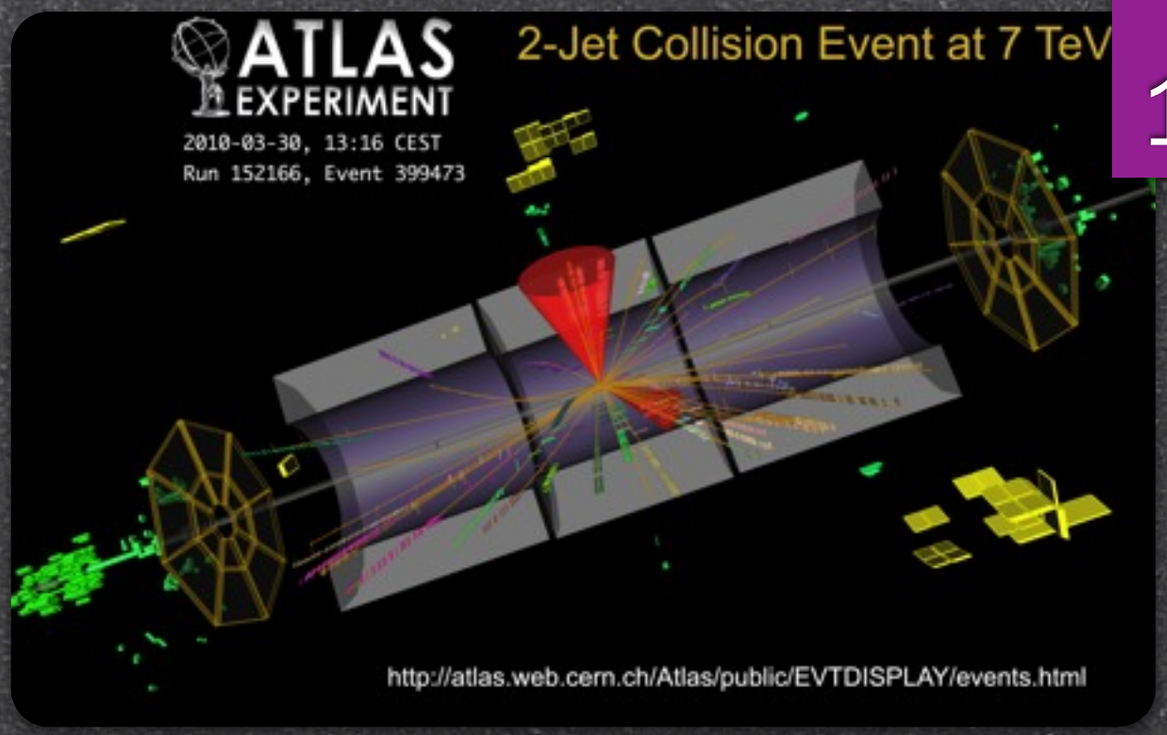
~50 pb^{-1} delivered, half of it in the last week !



Roger Bailey Nov. LHCC

ATLAS Datasets

+200Hz ~ L indep.

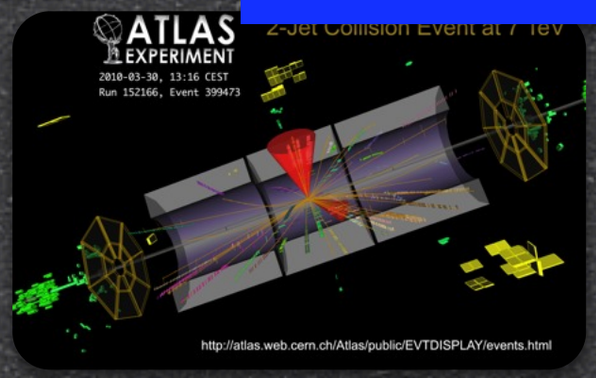


RAW
1.6 MB/evt

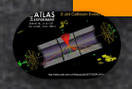
2 copies

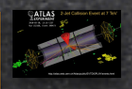
ESD
0.8 MB/evt

2 copies
guaranteed



AOD
(physic oriented)
0.15 MB/evt

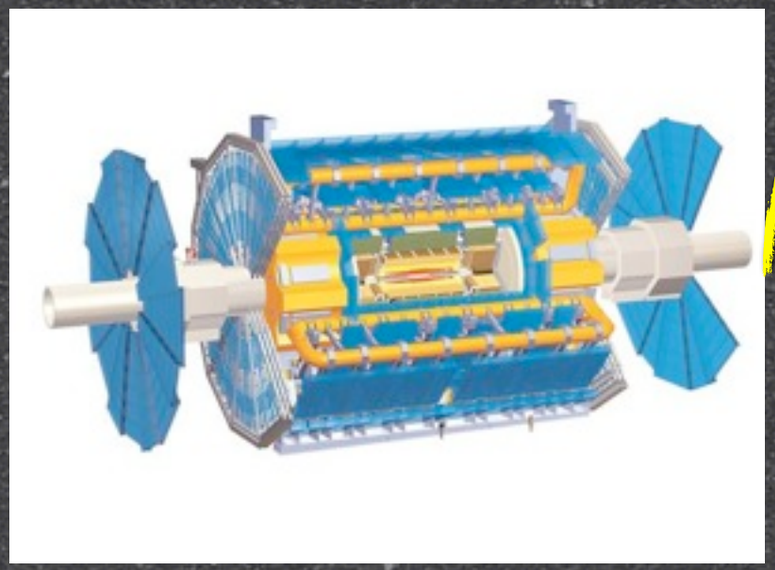




DESD
(detector performance
oriented)
0.15 MB/evt

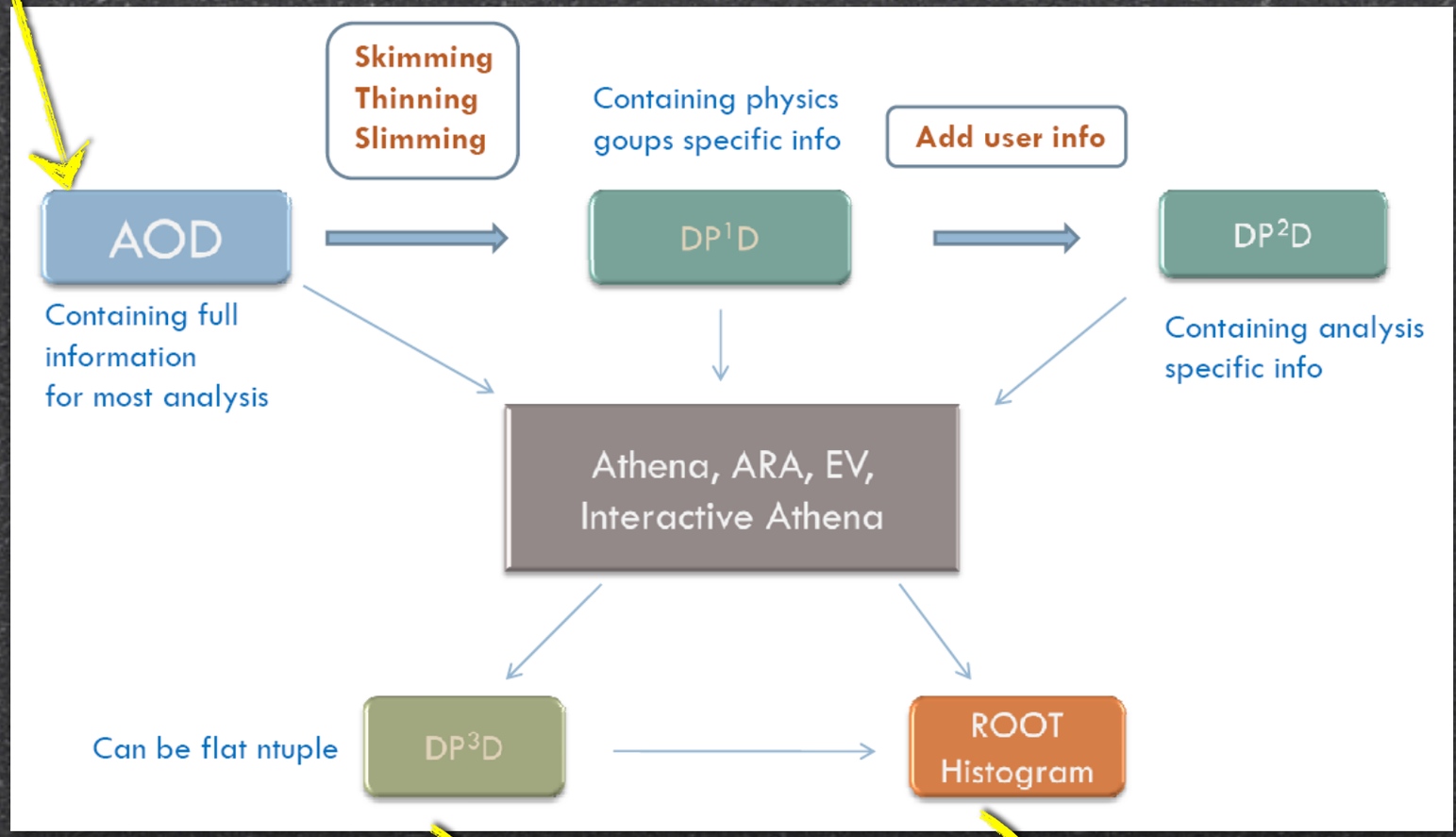
10 copies
guaranteed

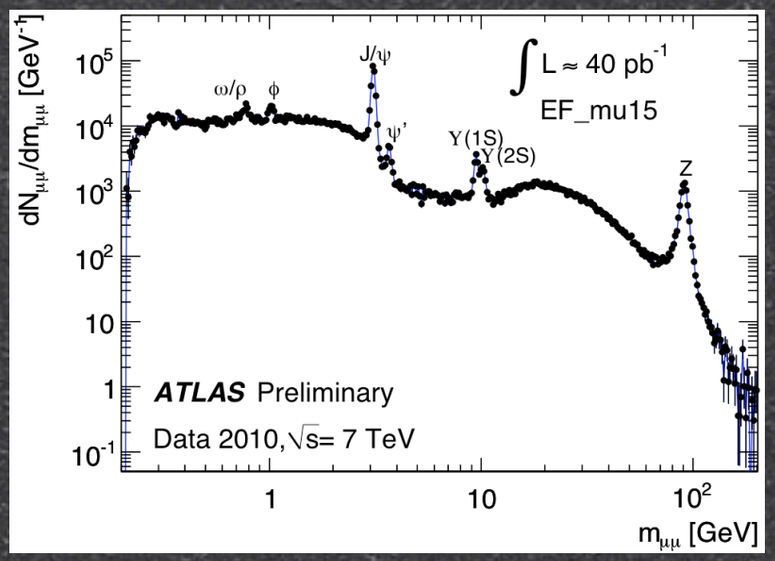
Initial Analysis Model



Group Analysis (mostly at T1)

Group Analysis (mostly at T2)





What are DPDs?

A reduced version of the full datasets (ESD, AOD):

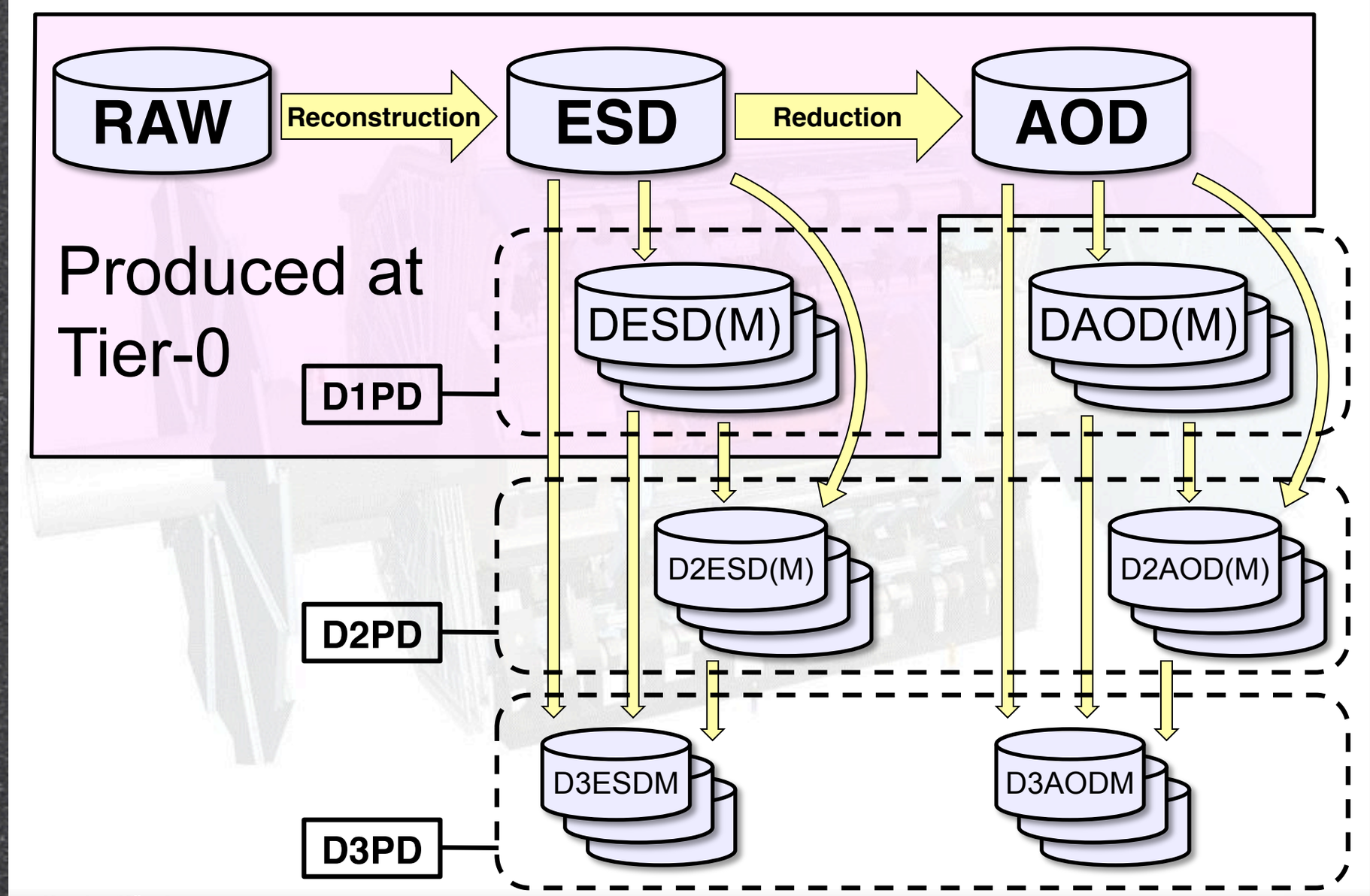
- *This reduction can be achieved in several ways:*
  - **Skimming:** *Event selection (e.g., keep events with two good electrons)*
  - **Trimming:** *Removing whole containers (e.g., remove the CaloCellContainer)*
  - **Thinning:** *Remove individual objects from a container (e.g., keep only CaloCells near an electron)*
  - **Slimming:** *Remove parts of an object (e.g., remove redundant error matrix from TrackParticles)*

2008 Analysis Model Forum Report:

- *Define the D1PDs, D2PDs, D3PDs*
- *ATL-GEN-INT-2008-001; ATL-COM-GEN-2008-001*

Zoology

Primary, Secondary, and Tertiary DPDs



Karsten Köneke
September 29th 2010

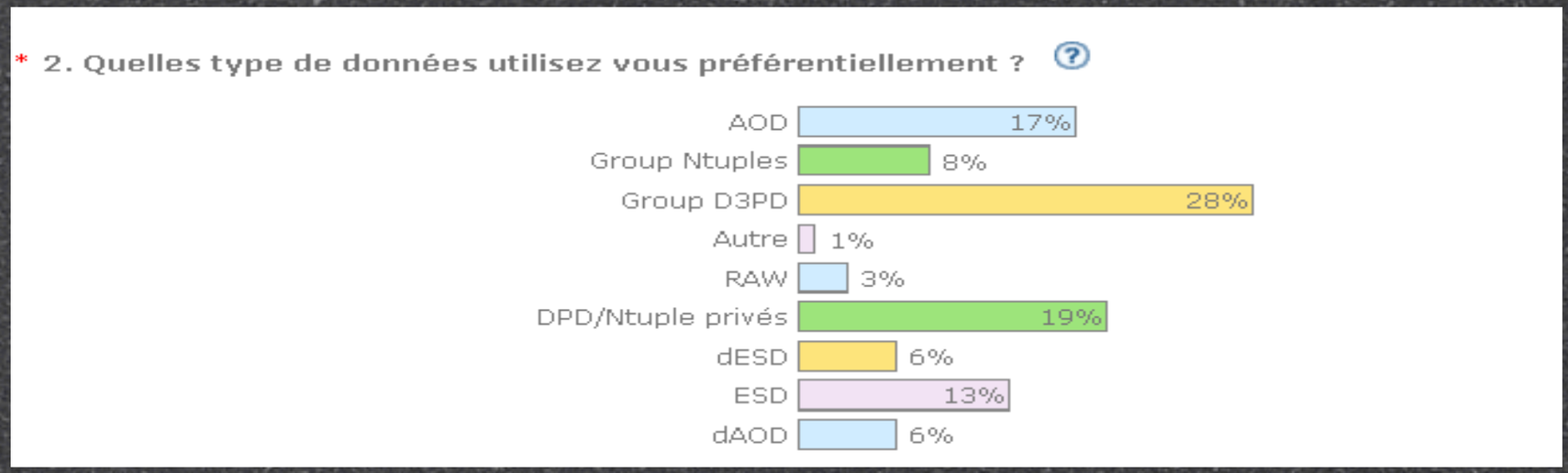
Athena based (pre-)Analysis

24/21

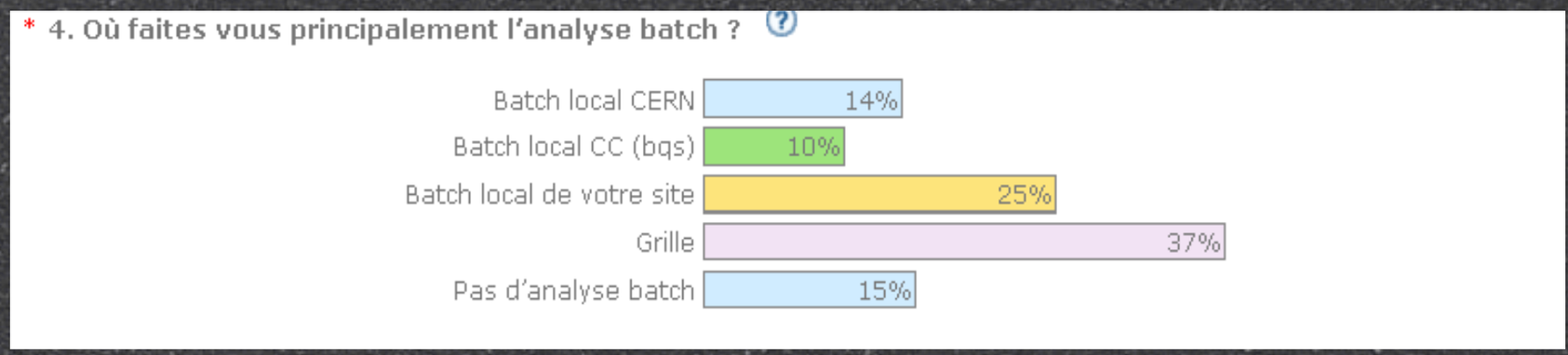
Questionnaire PAF

Questionnaire submitted
to Physics ATLAS France

55 answers



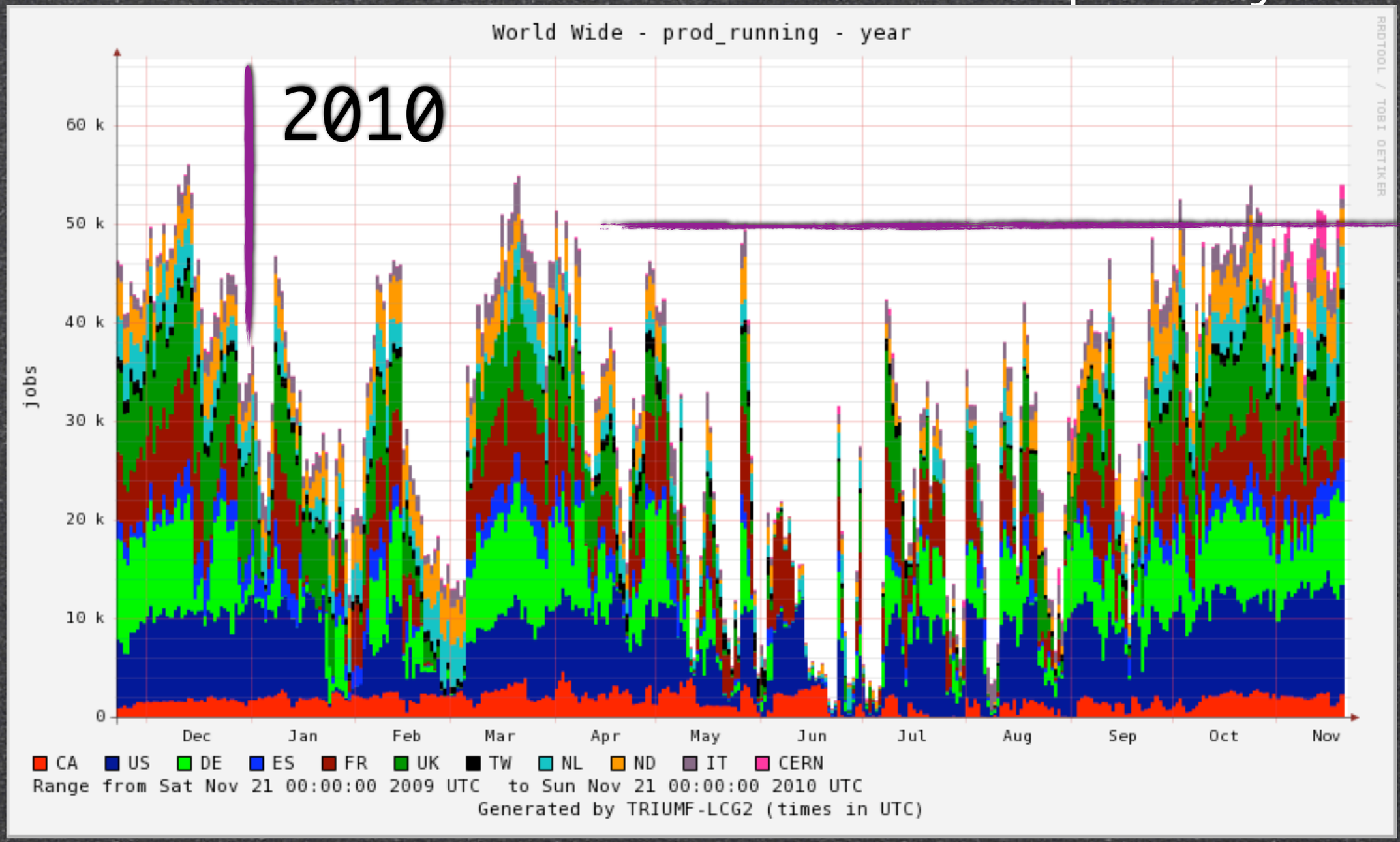
ROOT format ~55%



Grid Activity

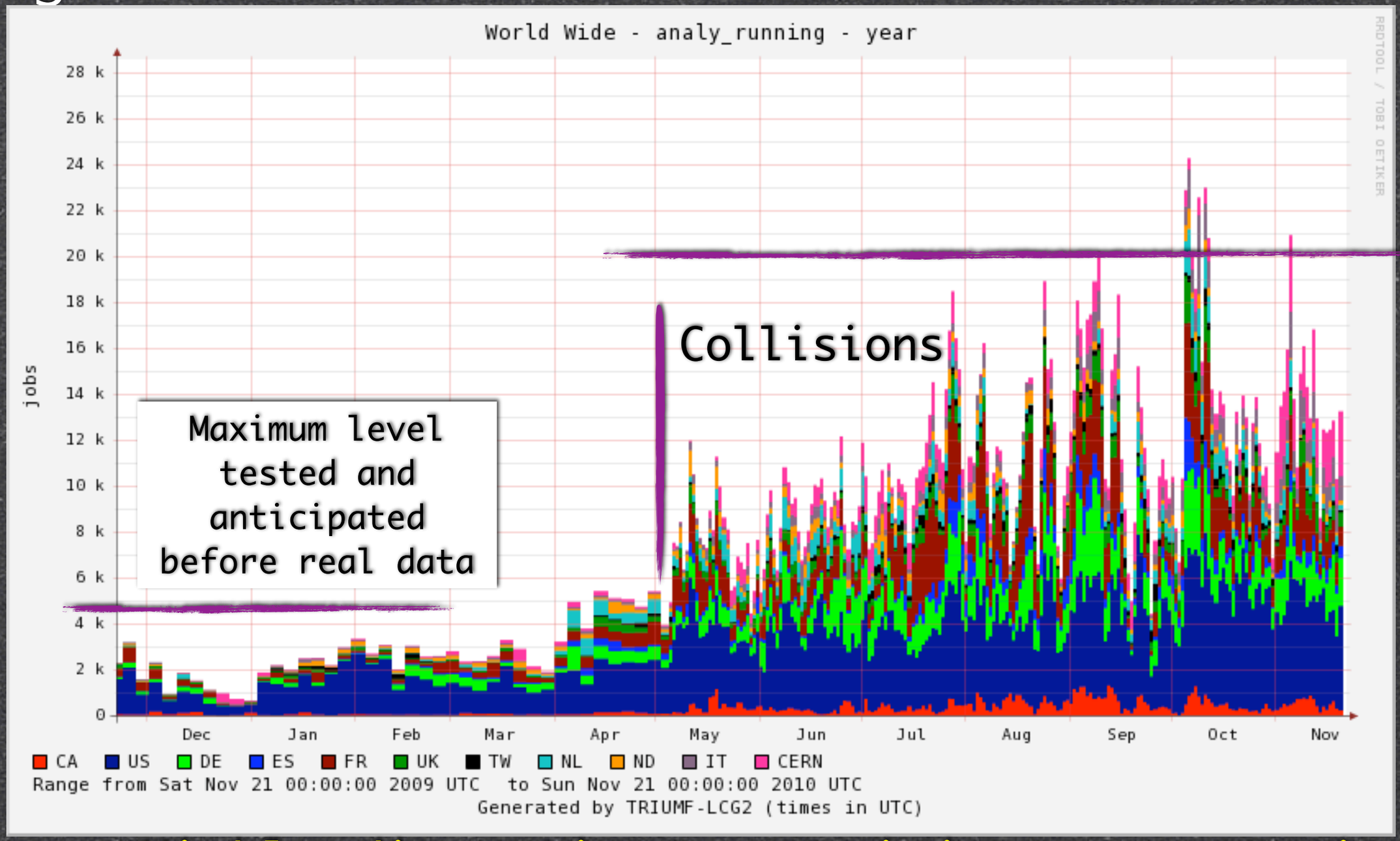
Central Production

Simulation + reconstruction + Group Analysis



Analysis

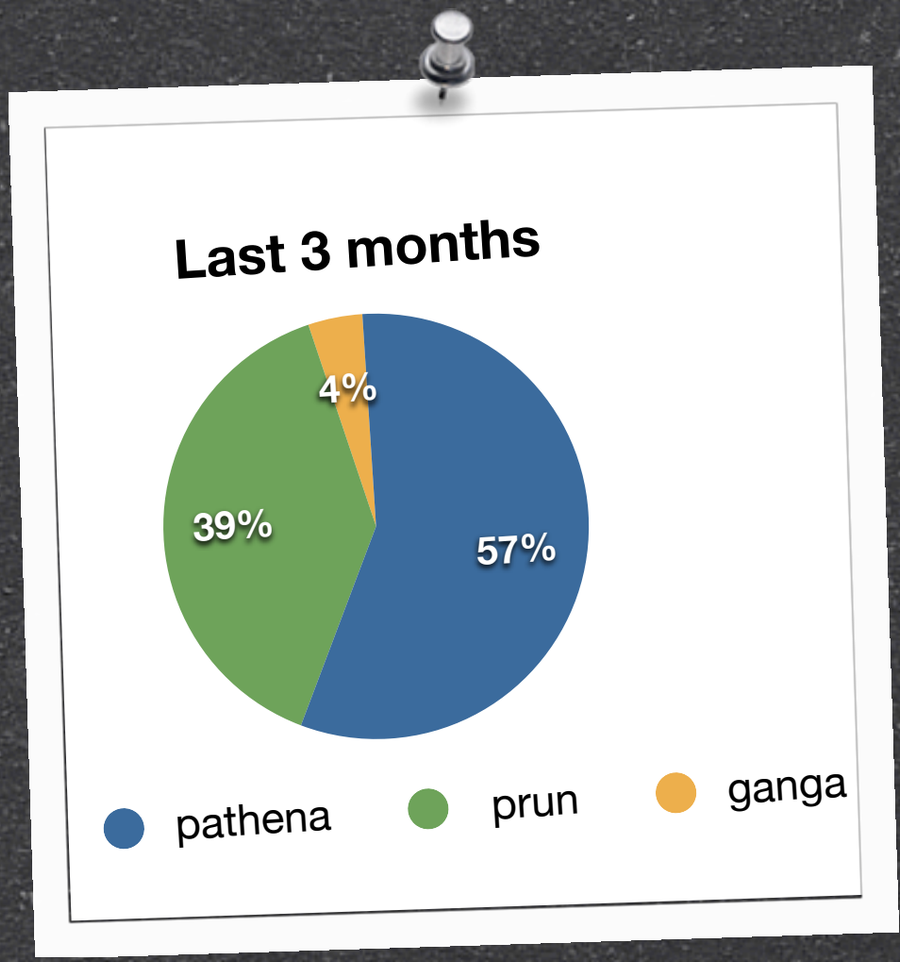
Ganga-WMS not accounted



Highly discontinuous activity on most sites..

Grid Analysis

- Pilot based the standard now
- two submission tools talking to panda pilots
- panda
  - pathena : ATHENA jobs
  - prun : ROOT
- Ganga-panda
- Ganga-WMS not supported from 2011



Users use ROOT on the Grid...

Changes in data placement...

- High demand on ESDs
  - available mostly at T1s
- ~none of some other dataset formats
- Some sites have free CPUs but not the popular data
- Less rigid data placement thanks to
  - Dataset popularity measurement
  - Efficient Central deletion service
  - Mature Data distribution tools & monitoring

Adaptability

7 TeV data on DISK

Changes

- RAW : 1 copy over 9 T1s (lyon : 15 %)
- ESD : 2 copies over 9 T1s (BNL 100%, extra. is secondary)
  - Lyon : 100% (DE, NL too...)
  - To T2s Dynamically
- AODs : 2 primary copies over T1s
  - Lyon 100%
  - GRID : 100%
    - Tokyo 100%
    - LAPP, LPC : 15%
    - RO, Beijing : 10%
    - Additional dynamic distribution
- DESDs stay at T1 (not used)

PD2P
PanDA Dynamic Data Placement

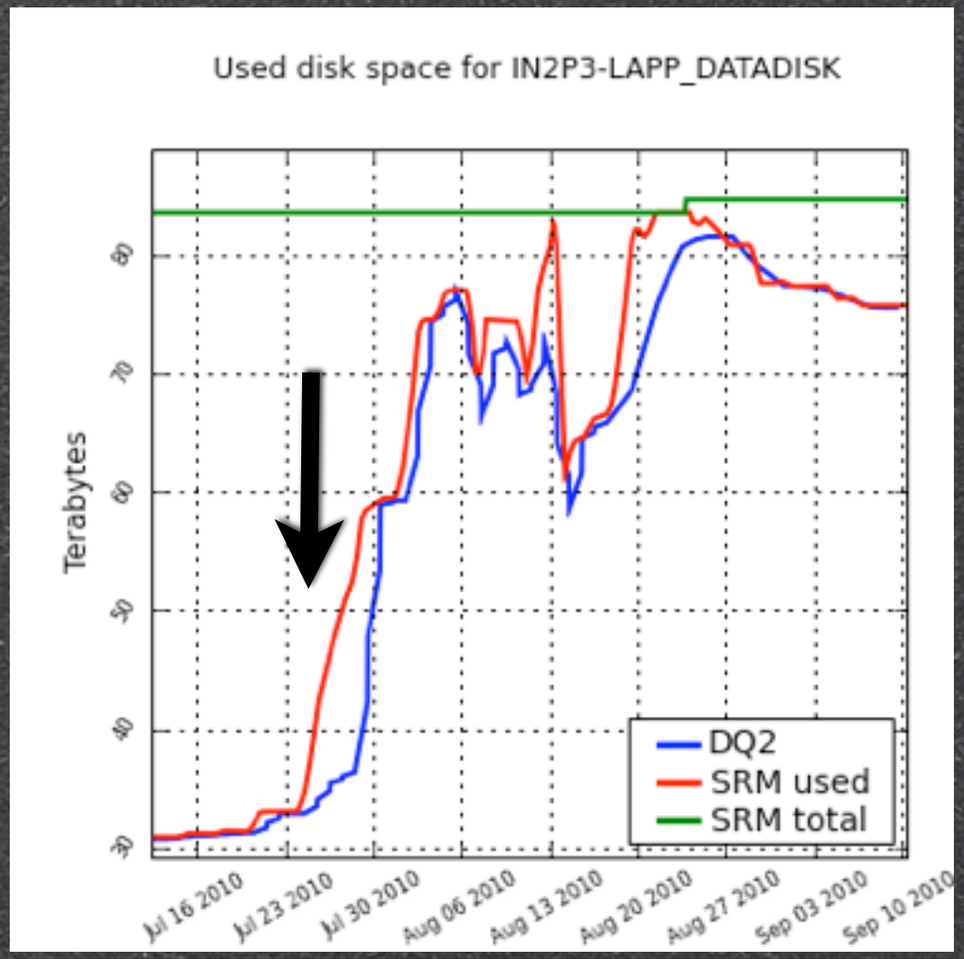
Job queue

Job queue periodically updated by panda server taking into account status of subscriptions

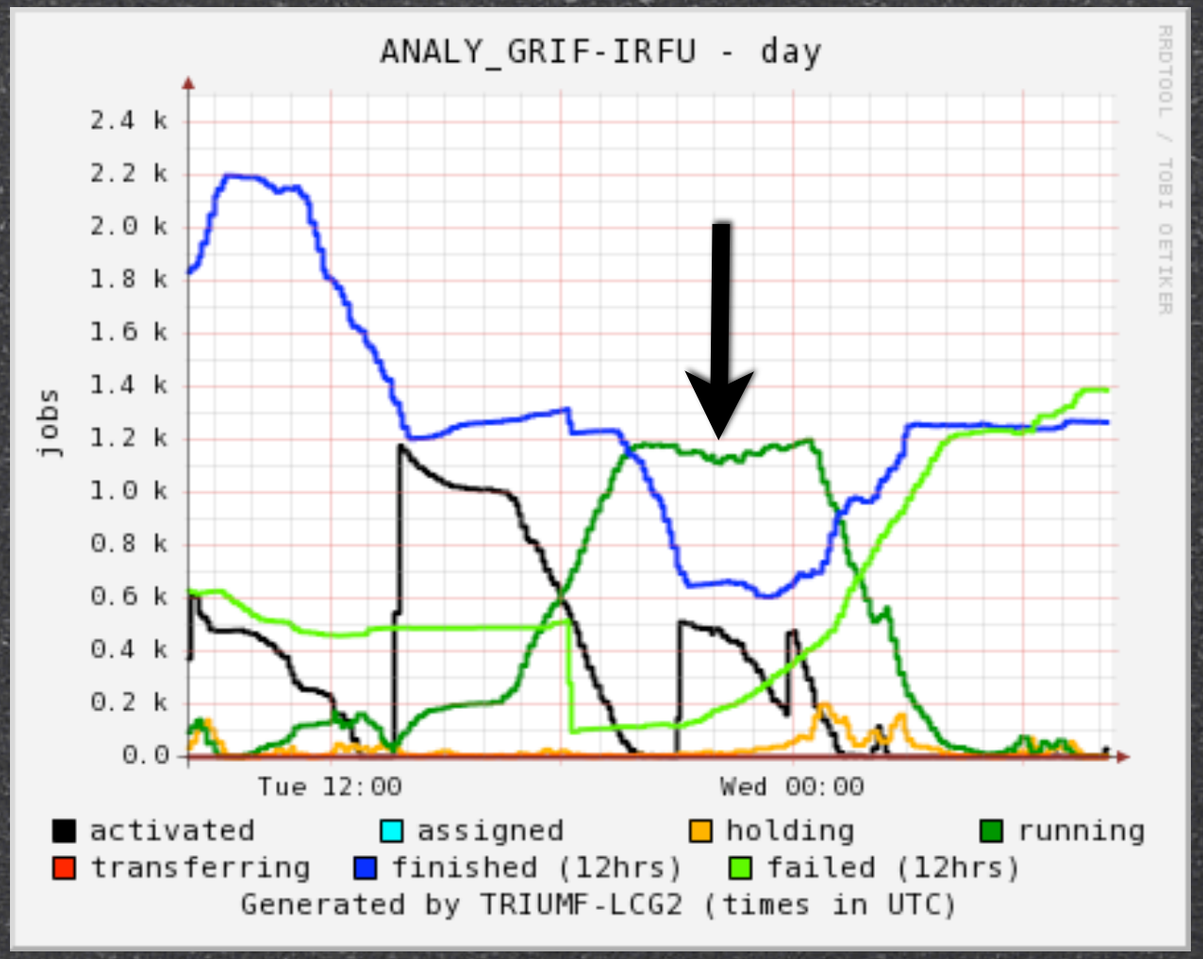
Availability & Performance of T1

- Dynamic data placement at T2s
- Reduce automatic data subscription
- Analysis should be enabled at T1
- Restrict to cloud for time being

DP2D effects



Disk space filling and clean-up activated



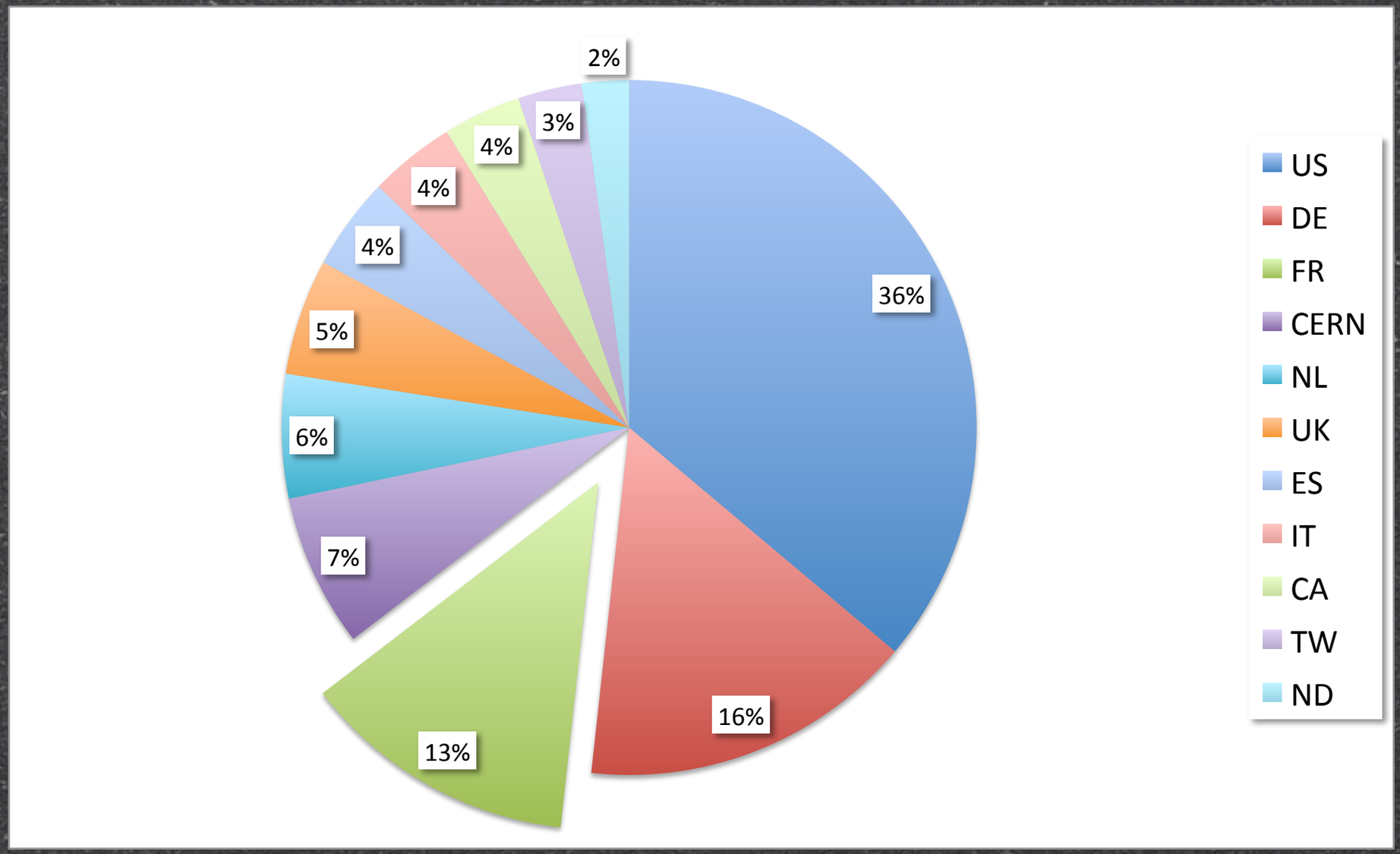
1.200 simultaneous analysis jobs at IRFU using ESDs

Some statistics

- About grid analysis jobs
- By Cloud
- By site
- for [July - October]

By Cloud

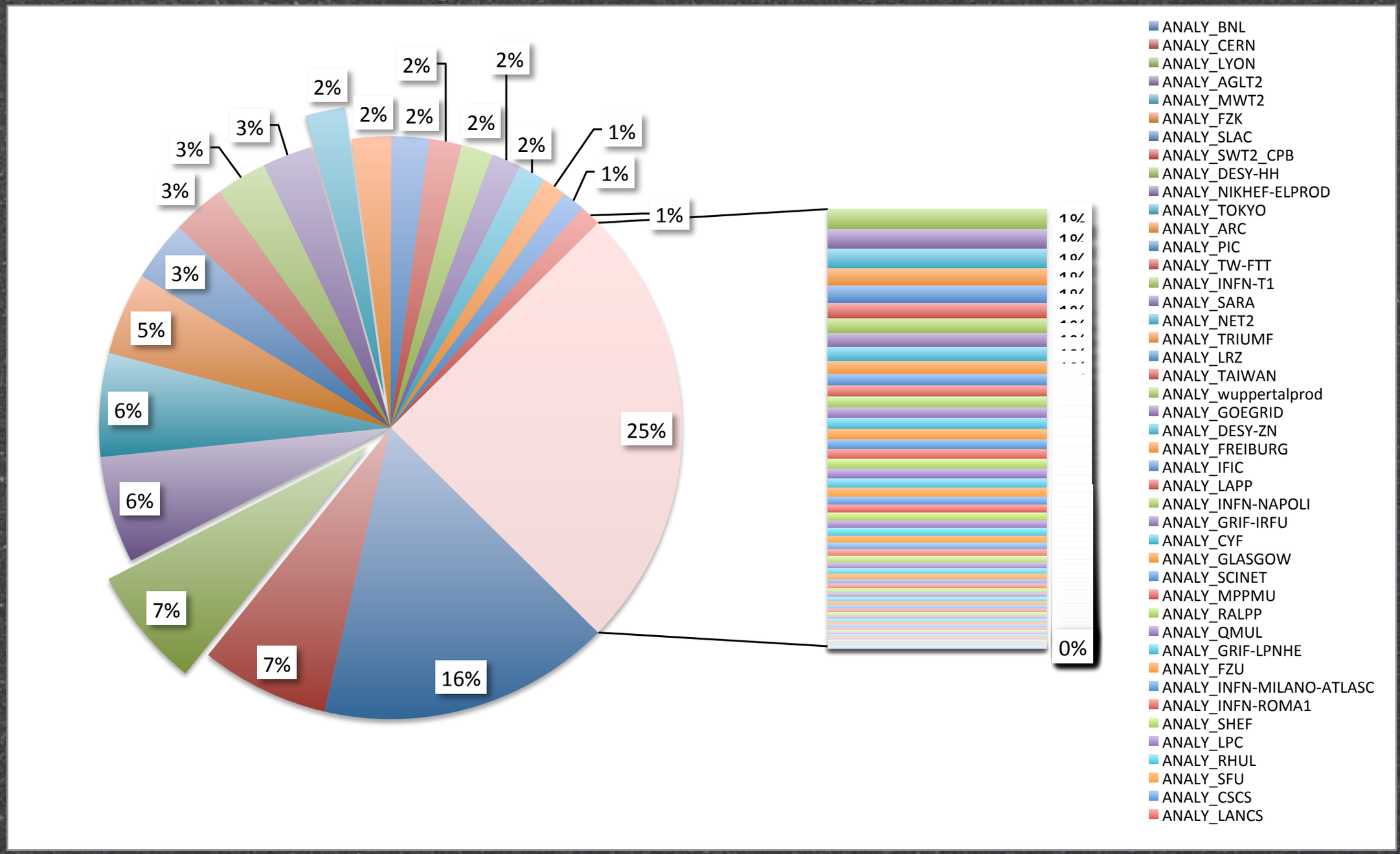
30,318,902 jobs



FR-cloud : 13%

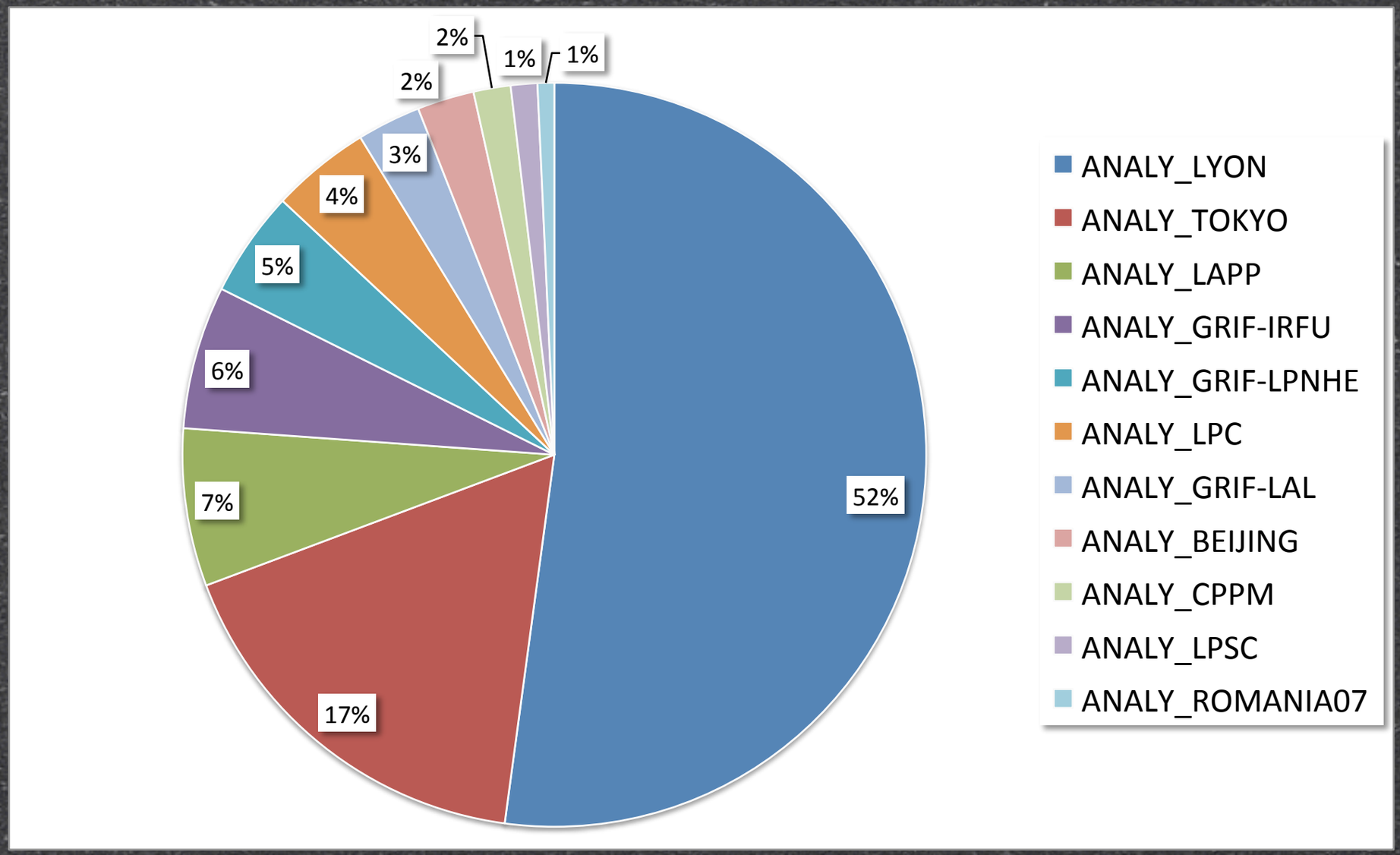
FR-sites : 10%

By Site



All T1s (except RAL) in top 20 sites

Analysis jobs on FR



3,897,724 Jobs

Production & Analysis

- For T2s
- Production & analysis shares : ~50:50
- In CPU, Not in job number!
- Rapid job turn around needed

Production

Full load on Cloud

FR sites	Pilots	Latest	defined	assigned	waiting	activated	sent	running	olding	transferring	finished	failed	cancelled	%fail
ALL			317	898	0	16374	0	8714	128	3999	24657	773	0	3%
BEIJING	123	09-09 07:40	0	0	0	1298	0	734	0	731	1699	4	0	0%
CPPM	131	09-09 07:40	0	0	0	1144	0	537	5	630	780	0	0	0%
GRIF-IRFU	242	09-09 07:40	0	898	0	1961	0	1293	79	1648	134	57	0	30%
GRIF-LAL	208	09-09 07:40	0	0	0	1010	0	730	2	85	95	0	0	0%
GRIF-LPNHE	28	09-09 07:40	0	0	0	403	0	197	0	43	120	0	0	0%
IN2P3-LPSC	48	09-09 07:40	0	0	0	485	0	219	0	4	1313	0	0	0%
LAPP	66	09-09 07:40	0	0	0	554	0	90	0	38	324	91	0	22%
LPC	182	09-09 07:40	0	0	0	545	0	482	4	309	239	15	0	6%
LYON	1458	09-09 07:40	0	0	0	6981	0	3620	30	0	17648	539	0	3%
LYON_REPRO			0	0	0	0	0	0	0	0	0	0	0	
Lyon-T2	18	09-09 07:40	0	0	0	208	0	16	0	0	39	1	0	2%
ROMANIA02 (offline)			0	0	0	0	0	0	0	0	0	0	0	
ROMANIA07	67	09-09 07:40	0	0	0	677	0	427	1	65	885	8	0	1%
ROMANIA16 (test)			0	0	0	0	0	0	0	0	0	0	0	
TOKYO	162	09-09 07:40	0	0	0	1108	0	369	7	446	1381	38	0	3%

Analysis

Analysis queued...

FR sites	Pilots	Latest	defined	assigned	waiting	activated	sent	running	holding	transferring	finished	failed	cancelled	%fail
ANALY_BEIJING	60	09-09 07:40	0	0	0	31	0	93	0	0	2042	2	0	0%
ANALY_CPPM	98	09-09 07:40	0	0	0	614	0	99	23	0	1161	0	0	0%
ANALY_GRIF-IRFU	161	09-09 07:40	0	0	0	133	0	94	2	0	2221	111	126	5%
ANALY_GRIF-LAL	29	09-09 07:40	0	0	0	1350	0	0	0	0	194	3	0	2%
ANALY_GRIF-LPNHE	47	09-09 07:40	0	0	0	3575	0	25	2	0	1750	358	0	17%
ANALY_LAPP	127	09-09 07:40	0	0	0	2914	0	386	0	0	412	17	0	4%
ANALY_LONG_LYON_DCACHE	1282	09-09 07:40	443	0	0	1936	0	1536	131	0	4805	278	5	5%
ANALY_LPC	137	09-09 07:40	391	0	0	136	0	211	0	0	91	0	0	0%
ANALY_LPSC	55	09-09 07:40	0	0	0	0	0	1	0	0	967	173	0	15%
ANALY_LYON_DCACHE	1419	09-09 07:40	2185	0	0	0	0	922	38	0	4760	636	3809	12%
ANALY_ROMANIA02			0	0	0	0	0	0	0	0	0	0	0	
ANALY_ROMANIA07	8	09-09 07:40	0	0	0	63	0	2	0	0	82	0	0	0%
ANALY_TOKYO	212	09-09 07:40	11	0	0	1431	0	514	72	0	2014	6	2606	0%

Sites to set right balance between Analysis & Production

A word about T3s

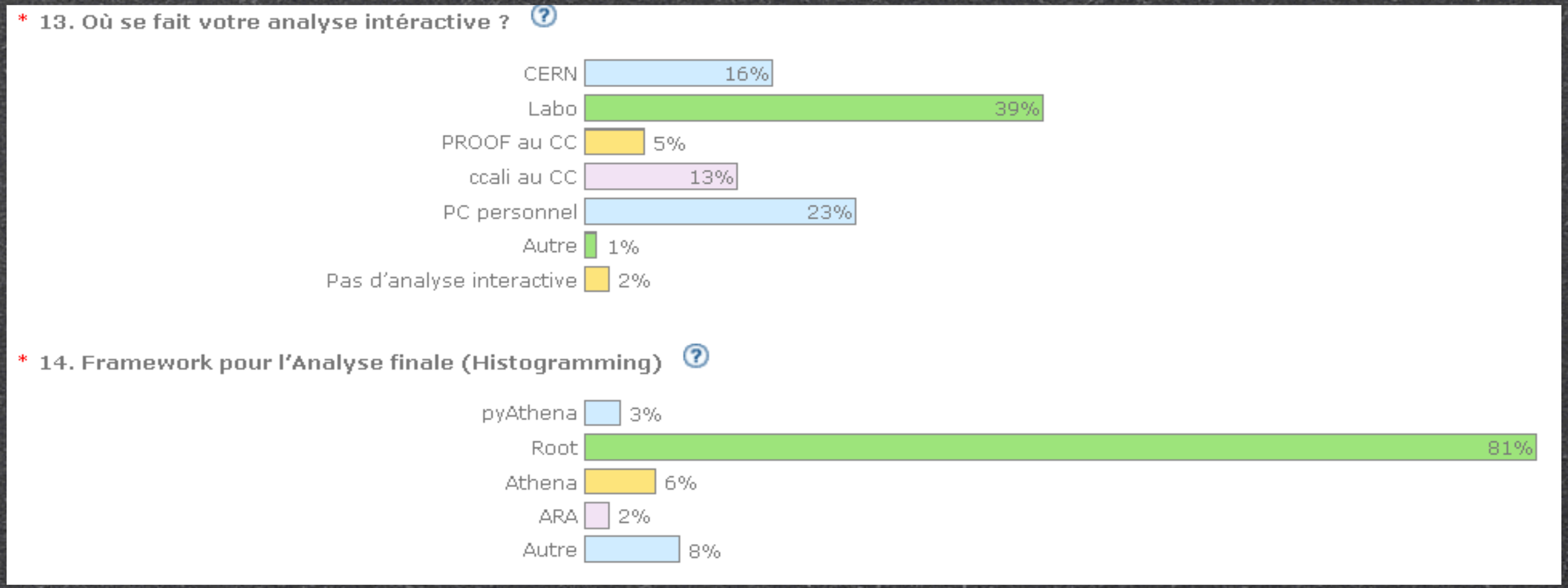
- T3 Grid resources
- All site have non-pledged resources for local users
- How to separate T2 from T3
  - Submission of pilots with /pilot/fr identity
  - In place at Lyon
  - To be deployed on all French sites

Interactive Analysis

- The ‘final touch’
- At home-lab
- User PC
- At Lyon
  - ccali
  - Experimental PROOF farm

Final stage of analysis

20% @ Lyon

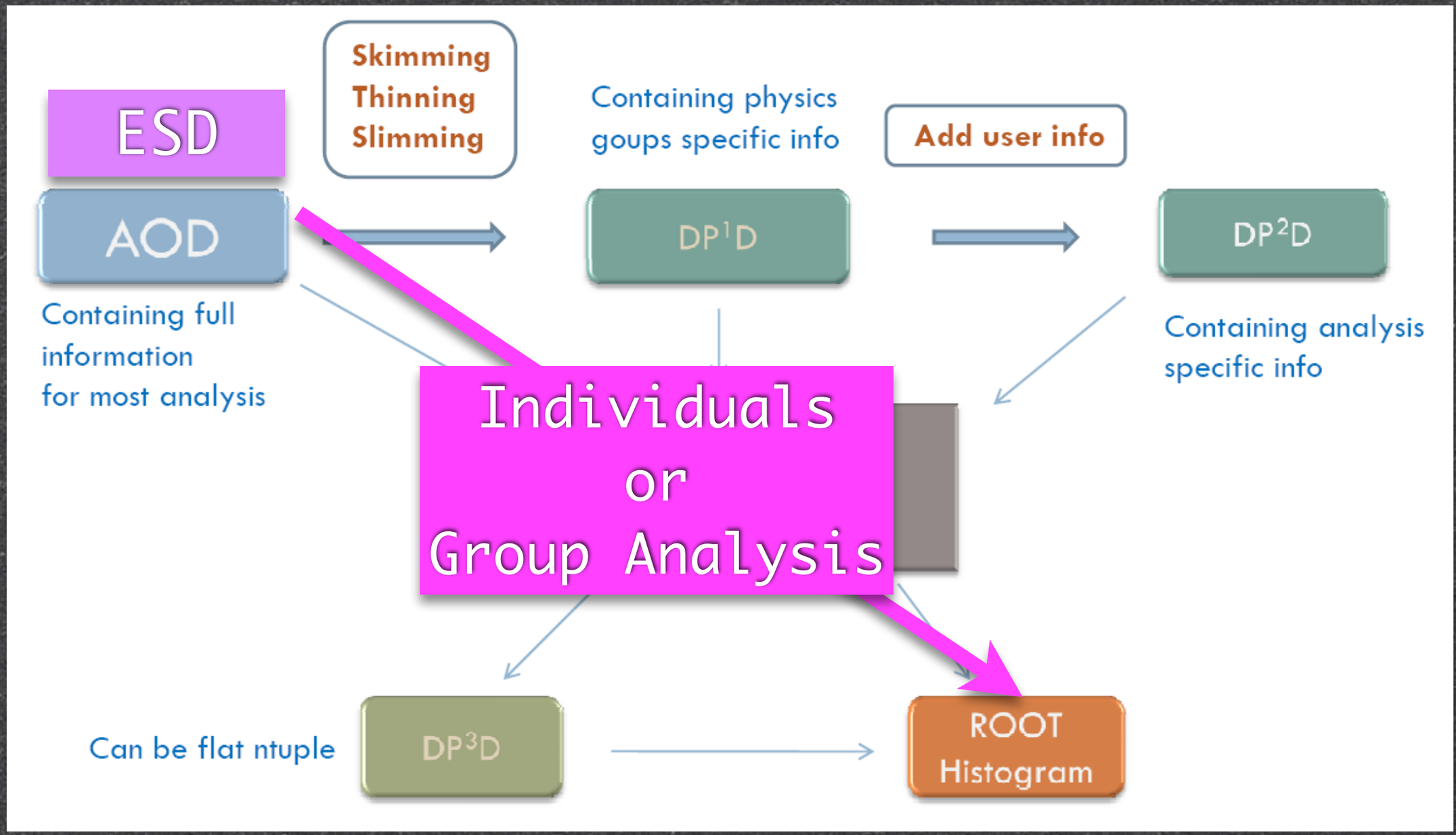


80% ROOT

PROOF @ Lyon

- Experimental farm
  - Might be useful for dedicated applications
- 100TB dedicated Xrootd storage
- Handful of users
- Future of the facility evaluated in 2011
  - Stop or Continue?

The actual analysis model

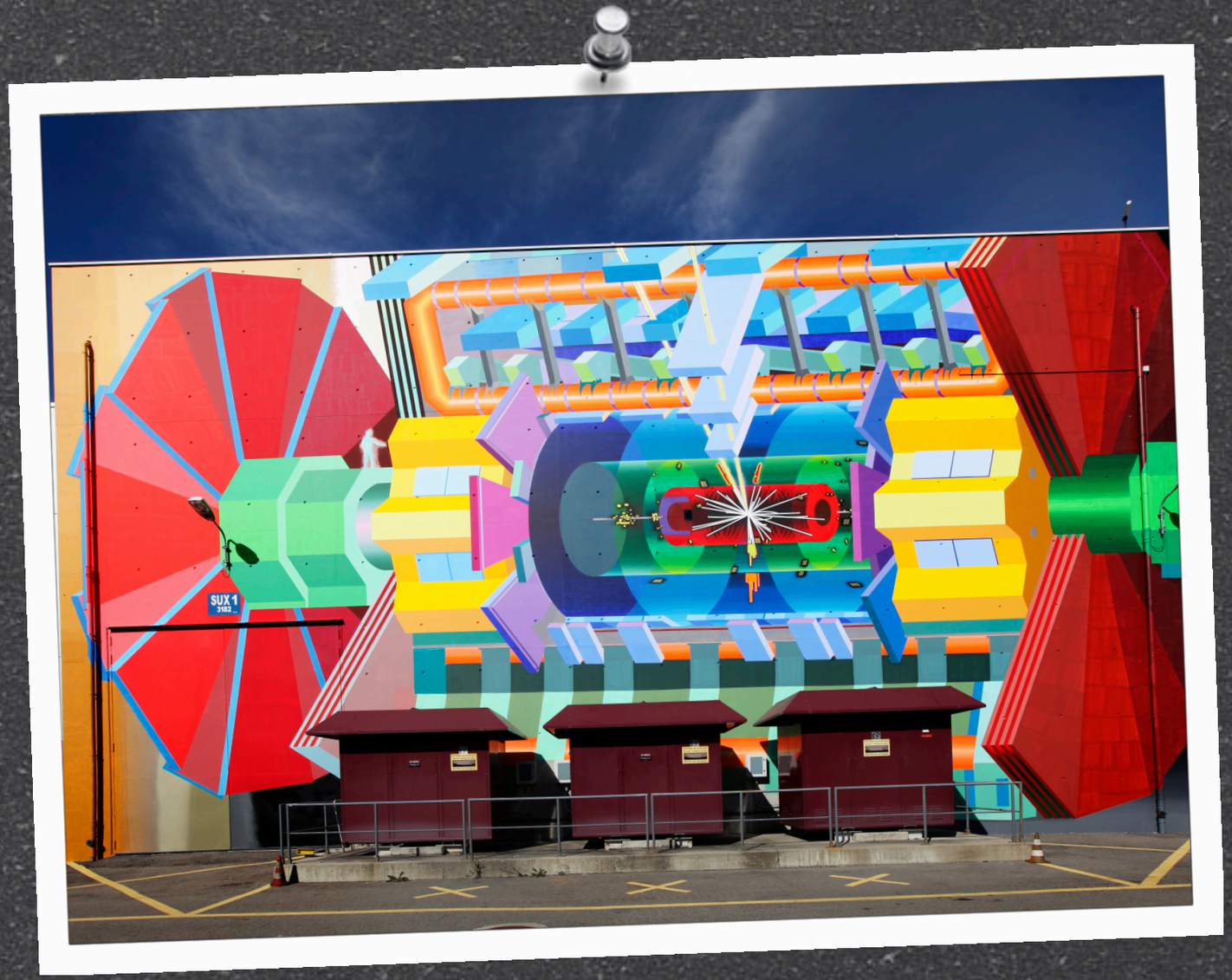


Is it Scalable?

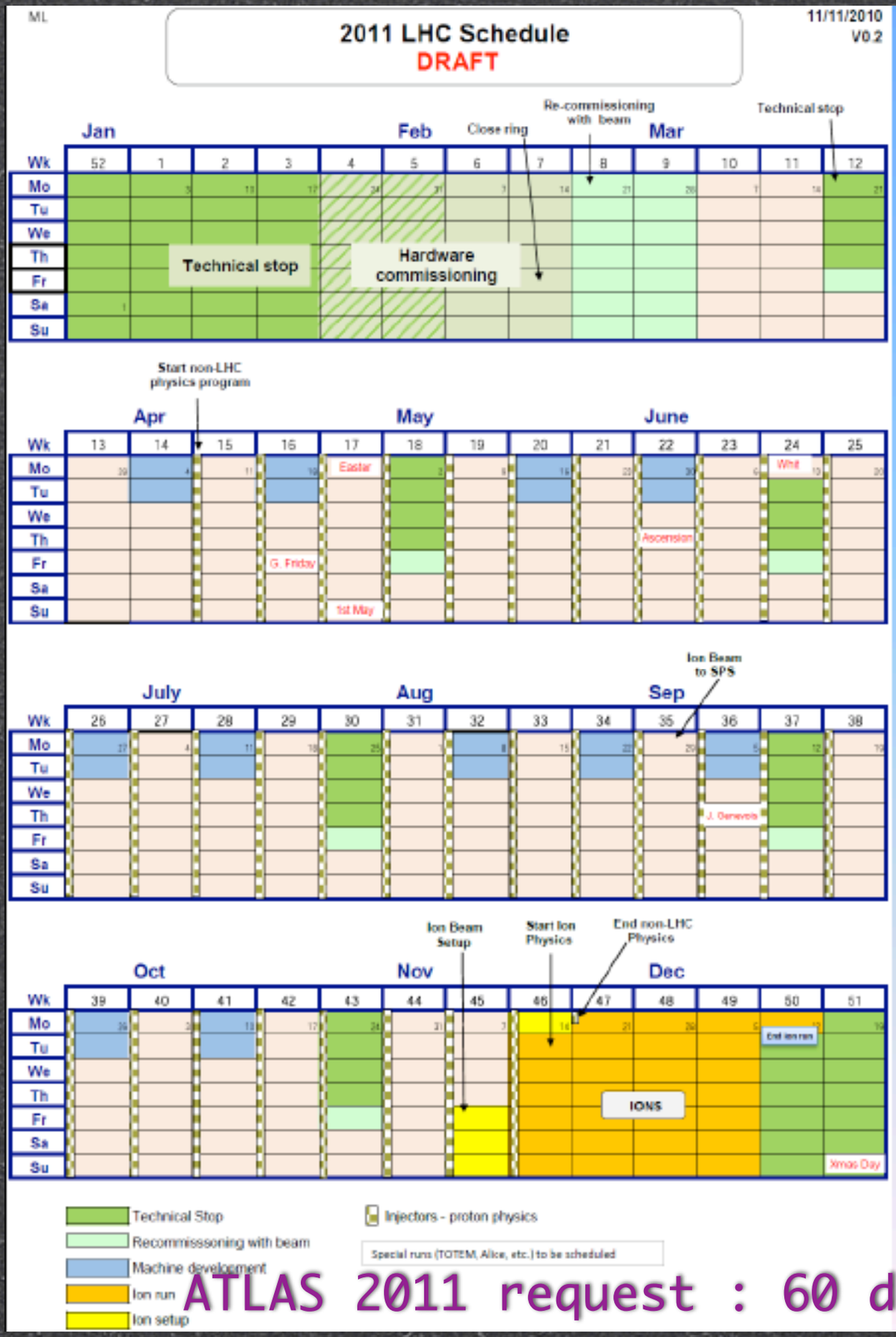
Individual User Analysis (mostly at T3)

Summary

- Much more Grid analysis jobs than anticipated
  - France has provided a bit less than its share
- Mature Grid and monitoring tools :
  - Adaptability
  - Will go away from rigid cloud model and data pre-placement
- Users go directly to ROOT
  - Scalability? Common ATLAS framework needed?



What next ?



2011

- Beam back around 21st February
- 2 weeks re-commissioning with beam (at least)
- 4 day technical stop every 6 weeks
- Count 1 day to recover from TS (optimistic)
- 2 days machine development every 2 weeks or so
- 4 days ions set-up
- 4 weeks ion run
- End of run – 12th December

~200 days proton physics

ATLAS 2011 request : 60 days, 100% efficiency (5M sec.)

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2011

2011: “reasonable” numbers

- 4 TeV (to be discussed at Chamonix)
- 936 bunches (75 ns)
- 3 micron emittance
- 1.2 x 10^{11} protons/bunch
- beta* = 2.5 m, nominal crossing angle

Peak luminosity	6.4 x 10^{32}
Integrated per day	11 pb^{-1}
200 days	2.2 fb^{-1}
Stored energy	72 MJ

Usual warnings apply – see problems, problems above

12/11/10 43 LHC status

- 50 times more data than 2010 ‘guaranteed’
- 2 times more than anticipated for resource planning

Which resources for LCG-France?

http://indico.cern.ch/conferenceDisplay.py?confId=112439

Ultimate reach

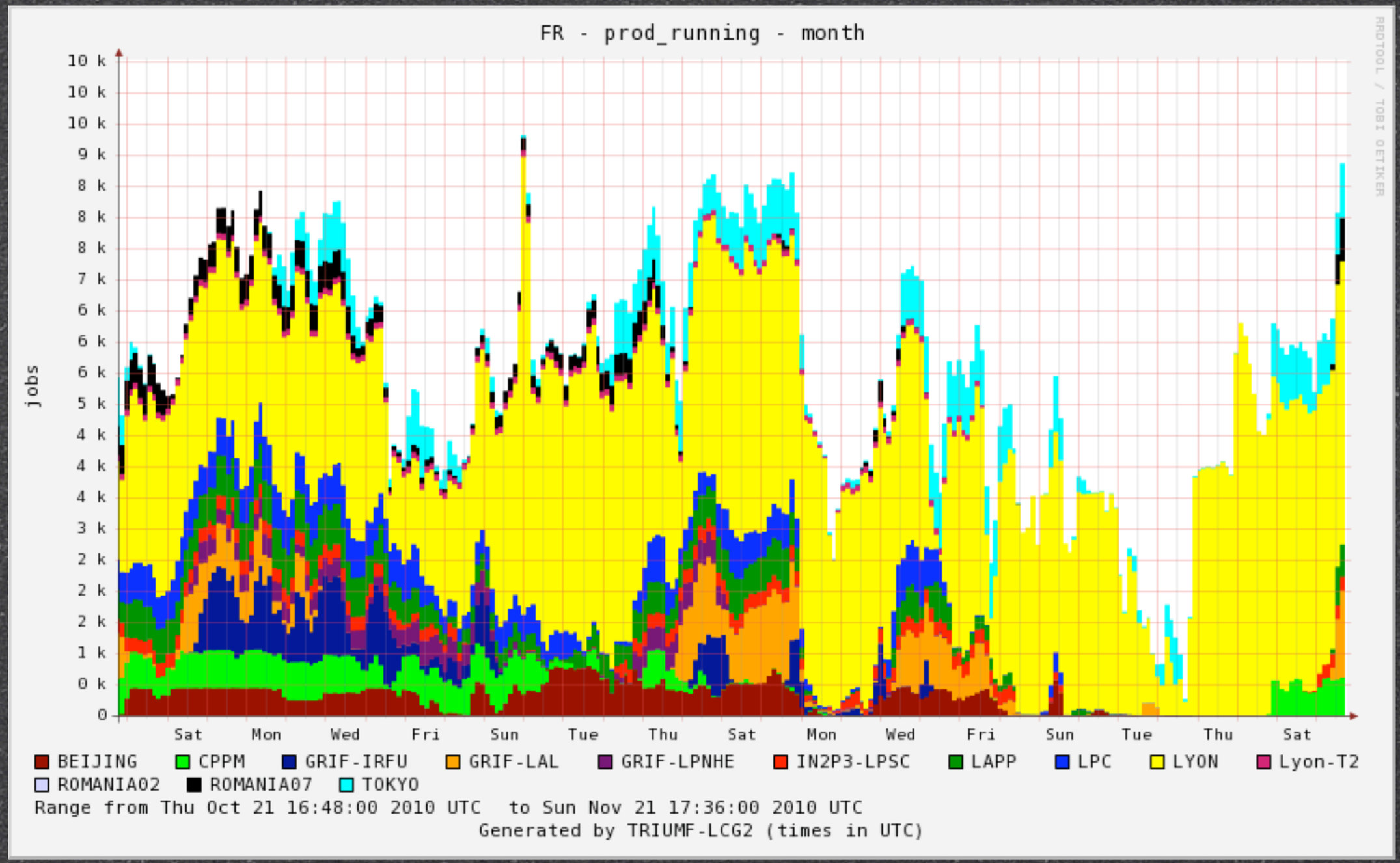
- 4 TeV
- 1400 bunches (50 ns)
- 2.5 micron emittance
- 1.5 x 10^{11} protons/bunch
- beta* = 2.0 m, nominal crossing angle

Peak luminosity	2.2 x 10^{33}
Integrated per day	38 pb^{-1}
200 days	7.6 fb^{-1}
Stored energy	134 MJ

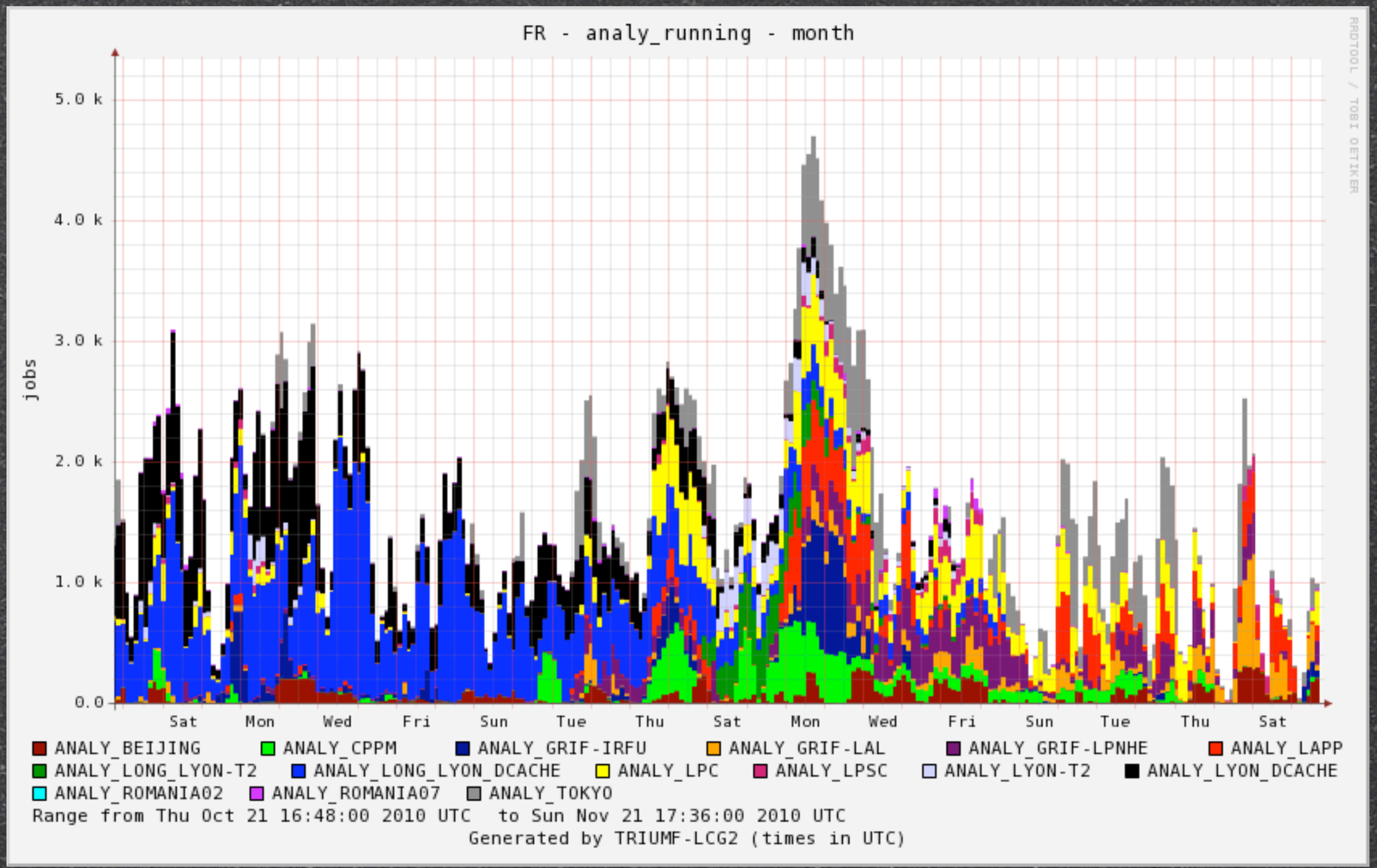
Usual warnings particularly apply – see problems, problems above

ooppps

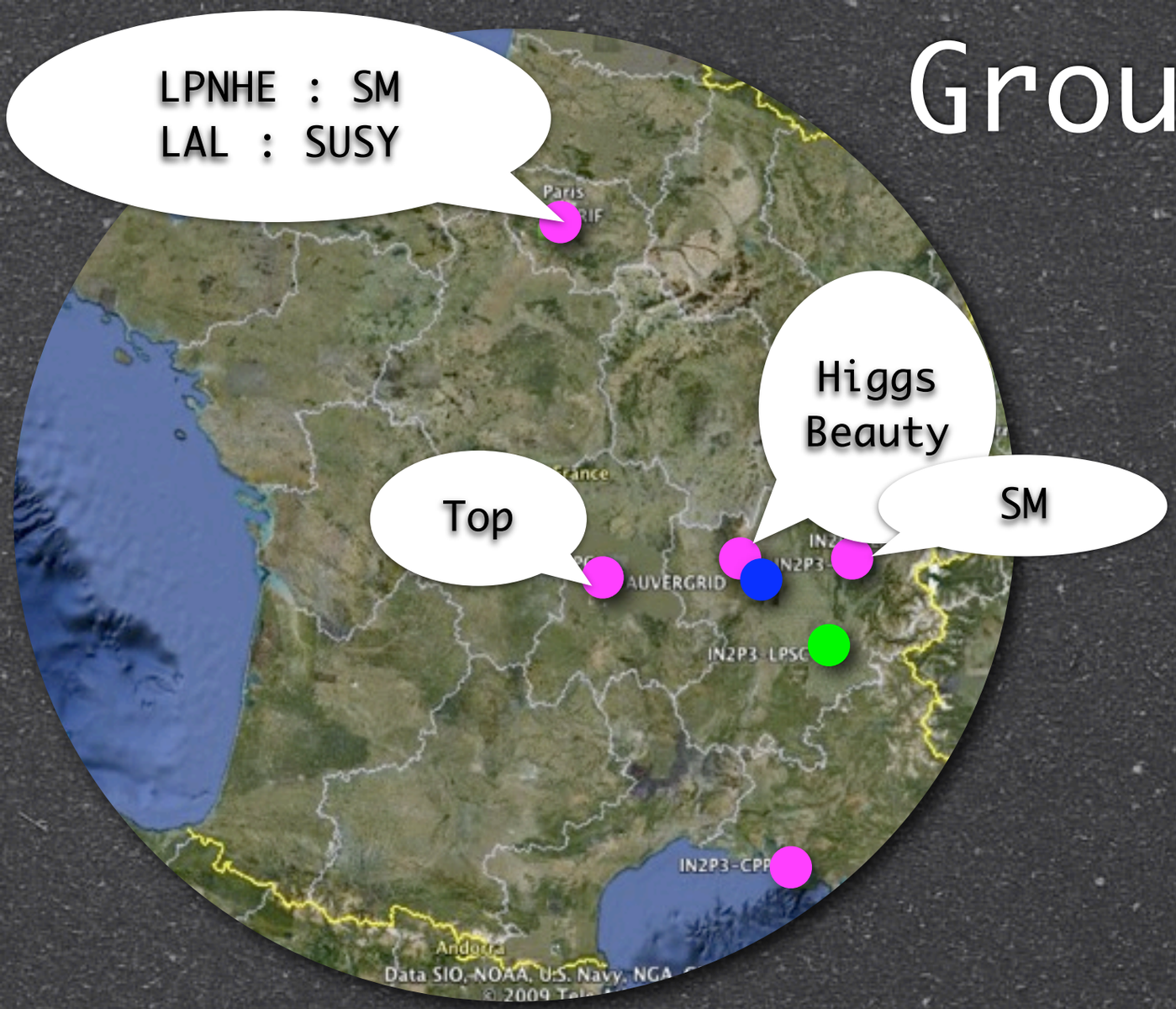
And if LHC runs in 2012 ?


FR - prod_running - month
jobs
10 k
10 k
10 k
9 k
8 k
8 k
8 k
7 k
6 k
6 k
6 k
5 k
4 k
4 k
4 k
3 k
2 k
2 k
2 k
1 k
0 k
0
Sat
Mon
Wed
Fri
Sun
Tue
Thu
Sat
Mon
Wed
Fri
Sun
Tue
Thu
Sat
BEIJING
CPPM
GRIF-IRFU
GRIF-LAL
GRIF-LPNHE
IN2P3-LPSC
LAPP
LPC
LYON
Lyon-T2
ROMANIA02
ROMANIA07
TOKYO
Range from Thu Oct 21 16:48:00 2010 UTC to Sun Nov 21 17:36:00 2010 UTC
Generated by TRIUMF-LCG2 (times in UTC)
RRDTOOL / TOBI OETIKER

Last month on FR



GroupDisk : PHYS



7 TeV data on DISK

Status before summer...Rigid Pre-placement

- RAW : 1 copy over 9 T1s (lyon : 15 %)
- ESD : 2 copies over 9 T1s (BNL 100%, extra. is secondary)
  - Lyon : 32%
  - To T2s on some clouds (where no analysis at T1)

Secondaries : deleted if space is needed

- AODs : 2 primary copies over T1s
  - Lyon 100%
  - GRID : 100%
    - Tokyo 100%
    - LAPP, LPC : 15%
    - RO, Beijing : 10%
- DESDs follow AODs but are secondaries