LHCb
Computing review and plans

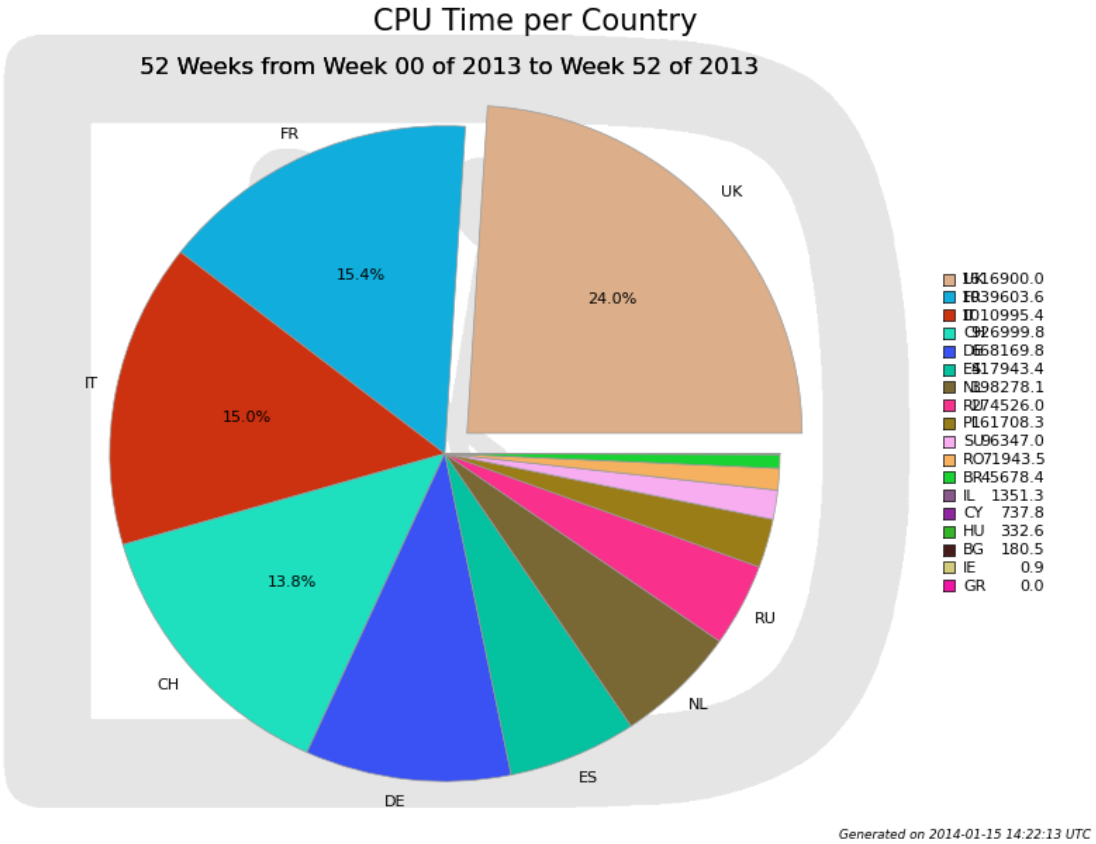
GridPP 32

25-March 2014

Pete Clarke

Flat Cash

GridPP performance for LHCb



CPU time per site

- CPU usage in 2013

LHCb likes GridPP

GridPP performance for LHCb

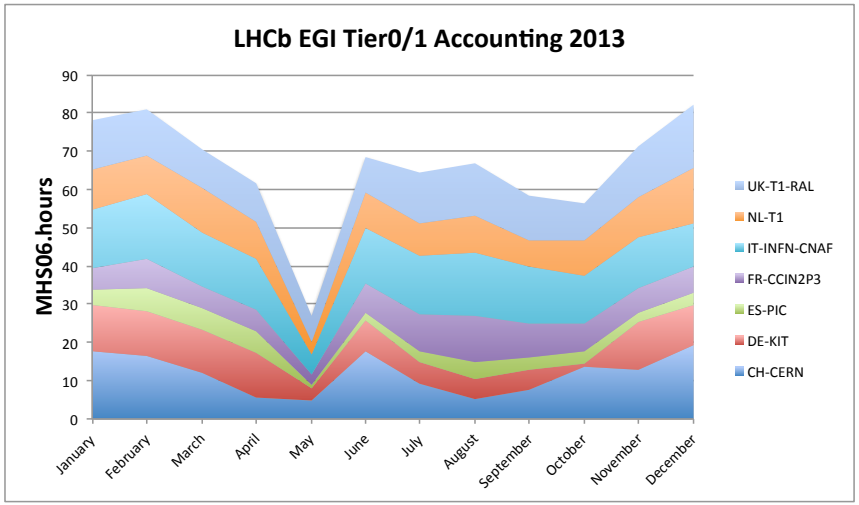


Figure 3-4: Monthly CPU work provided by the Tier1s (and Tier0) to LHCb.

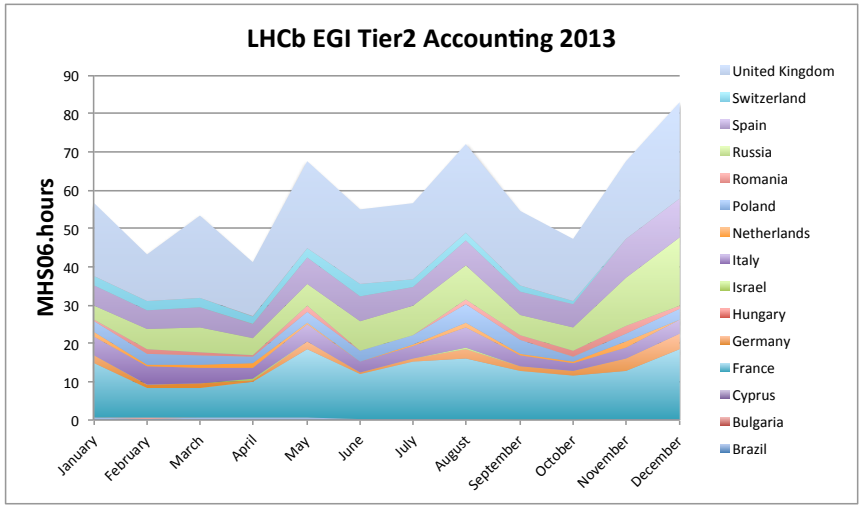


Figure 3-5: Monthly CPU work provided by the Tier2s to LHCb.

- CPU used at T1s in 2013
- CPU used at T2s in 2013
- LHCb used much more than pledged

LHCb computing model - start of Run-1

	Tier-0	Tier-1	Tier-2
RAW data (tape)	✔	✔	
DST data (disk)	✔	✔	
Reconstruction	✔	✔	
Reprocessing	✔	✔	
Analysis with data	✔	✔	
Analysis (no data)	✔	✔	✔
MC	✓	✓	✔

- Tier-0 and Tier-1 essentially identical (all reconstruction at all)
- LHCb uses six Tier-1 sites (RAL, INFN, NIKHEF, GRIDKA, IN2P3, PIC)
- Tier-2 mainly used for MC

LHCb computing model - by end of Run-I

	Tier-0	Tier-1	Tier-2
RAW data (tape)	✔	✔	
DST data (disk)	✔	✔	
Reconstruction	✔	✔	
Reprocessing	✔	✔	✔
Analysis with data	✔	✔	
Analysis (no data)	✔	✔	✔
MC	✓	✓	✔

- Tier-2s were added as “co-processors” for re-processing
  - Attached to a nearby Tier-1
  - Data downloaded and uploaded after processing
- UK sites were particularly good and so were used a lot

LHCb computing model - For Run-II

	Tier-0	Tier-1	Tier-2
RAW data (tape)	✔	✔	
DST data (disk)	✔	✔	✔
Reconstruction	✔	✔	
Reprocessing	✔	✔	✔
Analysis with data	✔	✔	✔
Analysis (no data)	✔	✔	✔
MC	✓	✓	✔

- Introduced Tier-2s with data (T2-D)
  - DST data distributed to T2D
  - Analysis carried out at T2-D
- T2-D coordinator is Andrew McNab

LHCb computing model - For Run-II

- A T2-D must
  - Promise >= 300 TB of disk by 2014
  - Have an LHCb contact point
  - Satisfy published performance criteria
  - We use them like tape-less T1s
  - We need xrootd for analysis including working SRM for DPM
- T2-Ds were primarily introduced to allow non-T1 countries to contribute disk. Currently:
  - Switzerland
  - Brazil
  - Poland
  - Russia
- T2-Ds also introduced to allow T1 countries who were NOT providing enough disk at T1 to contribute more disk overall
  - Currently talking to France
- T2-Ds at other T1 countries
  - UK
  - Currently talking to Germany

T2-Ds in the UK

- UK provides 2 x T2-Ds because it can
  - But this was not extra disk – it was removed from T1
  - Initially a bootstrapping issue:
    → GridPP formula : 20% of 2.5 PB request = 600 TB = 2 x 300 TB
    → Only possible to set up 2 x T2-D to start with
  - Currently
    - RAL
    - Manchester
- More UK T2-Ds would be welcome
  - They would need to "bootstrap" themselves (i.e. invest in 300 TB disk for LHCb)
    (this is up to Institute physics management support policy)
  - LHCb would NOT want the T1 disk to be reduced any further
- If any site is interested speak to Andrew, Raja and myself

LHCb – Data movement and networking

- LHCb is NOT planning to ship data round at anywhere near the levels of the GPDs. I.e. no “AAA” policy.
  - Data will by and large be processed where it is
  - We will run a federation by giving jobs a list of alternative locations, in case data is not available locally
- LHCb networking needs are small compared to GPDs and it has no formal requirements apart from “if it works for the GPDs it will work for us”

LHCb - Trigger rate - Run-I → Run-II

- LHCb trigger rate in Run-1 was ~ 5 kHz @ 70 kB/event
- LHCb trigger rate in Run-II will (to first order) be ~10 kHz @ 70 kB/event
- Bottom line: Everything doubles

(note: LHCb rate does not increase with LHC performance - we are rate limited and adjust beams to keep luminosity down)

LHCb Requirements for 2015 and first look to 2016

Table 7-1: Summary of resources requested in 2015, estimates for 2016

	CPU (kHS06)		Disk (PB)		Tape (PB)	
	2015	**2016**	**2015**	**2016**	**2015**	**2016**
Tier 0	41	54	6.7	8.7	12.3	19.9
Tier 1	132	174	11.7	15.5	27.1	49.9
Tier2	75	98	2.5	4.2	-	-
Total WLCG	**248**	**326**	**20.9**	**28.4**	**39.4**	**69.8**
Non-WLCG	**20**	**20**	**-**	**-**	**-**	**-**
Grand total	**268**	**346**	**20.9**	**28.4**	**39.4**	**69.8**

LHCb Requirements for 2015 and first look to 2016

Table 7-1: Summary of resources requested in 2015, estimates for 2016

	CPU (kHS06)		Disk (PB)		Tape (PB)	
	2015	**2016**	**2015**	**2016**	**2015**	**2016**
Tier 0	41	54	6.7	8.7	12.3	19.9
Tier 1	132	174	11.7	15.5	27.1	49.9
Tier2	75	98	2.5	4.2	-	-
Total WLCG	**248**	**326**	**20.9**	**28.4**	**39.4**	**69.8**
Non-WLCG	**20**	**20**	**-**	**-**	**-**	**-**
Grand total	**268**	**346**	**20.9**	**28.4**	**39.4**	**69.8**

Disk (PB)	2014 Pledge	2015 Request	2016 Request
Tier0	4.0	6.7	8.7
Tier1	11.7	11.7	15.5
Tier2	1.1	2.5	4.2
Total	**16.8**	**20.9**	**28.4**

Table 5-5: LHCb Disk request for each Tier level and comparison with 2014 pledge and request. Note that for countries hosting a Tier1, the Tier2 contribution could also be provided at the Tier1.

Tape (PB)	2014 Pledge	2015 Request	2016 Request
Tier0	8.5	12.3	19.9
Tier1	11.0	27.1	49.9
Total	**19.5**	**39.4**	**69.8**

Disk storage usage forecast (PB)	2015	2016
Stripped Real Data	8.2	13.8
Simulated Data	8.8	9.9
User Data	0.9	1.0
MDST.DST	1.8	2.3
FULL.DST	0.0	0.0
RAW buffer	1.0	1.2
Other	0.2	0.2
Total	**20.9**	**28.4**

Table 5-3: Break down of estimated Disk Storage usage for the different categories of LHCb data.

Tape storage usage forecast (PB)	2015	2016
Raw Data	14.5	25.5
FULL.DST	10.0	17.8
MDST.DST	2.1	6.5
Archive	12.8	20.0
Total	**39.4**	**69.8**

Table 5-4: Break down of estimated Tape Storage usage for the different categories of LHCb data.