LHCb Computing
Resource usage in 2015 (I)

LHCb Public Note

Issue: First version
Revision: 0

Reference: LHCb-PUB-2015-019
Created: 25th August 2015
Last modified: 4 September 2015

Prepared By: LHCb Computing Project
C. Bozzi/Editor
Abstract

This document reports the usage of computing resources by the LHCb collaboration during the period January 1st – August 25th 2015.

The data in the following sections has been compiled from the EGI Accounting portal: https://accounting.egi.eu. For LHCb specific information, the data is taken from the DIRAC Accounting at the LHCb DIRAC Web portal: http://lhcb-portal-dirac.cern.ch.
Table of Contents

1. INTRODUCTION ........................................................................................................................................... 1
2. COMPUTING ACTIVITIES DURING 2015 ................................................................................................. 2
3. USAGE OF CPU RESOURCES ....................................................................................................................... 3
   3.1. WLCG ACCOUNTING ................................................................................................................................. 4
   3.2. LHCb DIRAC CPU ACCOUNTING ........................................................................................................... 6
4. USAGE OF STORAGE RESOURCES .............................................................................................................. 12
   4.1. TAPE STORAGE ....................................................................................................................................... 12
   4.2. DISK STORAGE ..................................................................................................................................... 12
   4.3. DISK AT TIER2S .................................................................................................................................... 16
5. DATA POPULARITY ....................................................................................................................................... 18
6. SUMMARY ..................................................................................................................................................... 21
List of Figures

Figure 3-1: Summary of LHCb computing activities (concurrently running jobs) from Jan 1st to Aug 25th 2015. The line represents the approximate number of running jobs that the 2015 pledge should provide. .................................................. 3

Figure 3-2: Summary of LHCb site usage (concurrently running jobs) from Jan 1st until Aug 25th 2015. ................................................................................. 4

Figure 3-3: Monthly CPU work provided by the Tier1s (and Tier0) to LHCb from Jan 1st until July 31st 2015. ............................................................................ 5

Figure 3-4: Monthly CPU work provided by the Tier2s to LHCb from Jan 1st until Aug 25th 2015 .......................................................... 6

Figure 3-5: CPU time consumed by LHCb during Jan 1st—Aug 25th 2015 (in days), for WLCG sites, excluding the HLT farm (top, per country), and non-WLCG sites, including the HLT farm (bottom, per site). ................................................ 7

Figure 3-6: Usage of LHCb Tier0/1s during Jan 1st — Aug 25th 2015. The top plot shows the usage of resources as a function of the different activities, while the bottom plot shows the contributions from the different sites. ...................................................... 8

Figure 3-7: Usage of LHCb resources outside Tier0 and Tier1s during Jan 1st— Aug 25th 2015. The top plot shows the usage of resources as a function of the different activities, while the bottom plot shows the contributions from the different sites. User jobs (shown in magenta in the top plot) are further detailed in Figure 3-8 ................. 9

Figure 3-8: Running user jobs on sites other than Tier1s (left) and Tier-2D sites (right). 10

Figure 3-9: CPU time as a function of the job final status for all jobs (top), and as a function of activity for stalled jobs (bottom) ........................................ 11

Figure 4-1: Usage of Disk resources at CERN and Tier1s from Jan 1st to Aug 25th 2015. Real data per SE and simulated data are shown in the top and bottom figures, respectively. ................................................................. 13

Figure 4-2: Usage of Disk resources from January 1st to August 25th 2015. Usage of scratch and failover buffers per SE are shown in the top and bottom figures, respectively. ...................................................... 14

Figure 4-3: Usage of disk resources reserved for Users from January 1st to August 25th 2015. .......................................................... 15

Figure 4-4: Usage of disk space at Tier-2D sites from Jan 1st to August 25th 2015, for real data (top) and simulated data (bottom) ........................................ 17

Figure 5-1: Volume of accessed datasets as a function of the number of accesses in the last 13 weeks. ................................................................. 19

Figure 5-2: Volume of accessed datasets as a function of the number of accesses in the last 26 weeks. ................................................................. 19

Figure 5-3: Volume of accessed datasets as a function of the number of accesses in the last 52 weeks. ................................................................. 20
List of Tables

Table 1-1: LHCb estimated resource needs for 2015 (September 2014) ......................... 1
Table 1-2: Site 2015 pledges for LHCb. ........................................................................ 1
Table 3-1: Average CPU power provided to LHCb during Jan-Jul 2015 (Tier0 + Tier1s). 5
Table 3-2: Average CPU power provided to LHCb from Jan 1st until July 31st 2015, in WLCG sites other than the Tier0 and Tier1s ........................................................................ 6
Table 4-1: Situation of Disk Storage resource usage as of August 25th 2015, available and installed capacity as reported by SLS, and 2015 pledge. The contribution of each Tier1 site is also reported ........................................................................................................ 15
Table 4-2: available and used disk resources at Tier-2D sites on August 25th 2015........ 16
1. Introduction

As part of the WLCG resource review process, experiments are periodically asked to justify the usage of computing resources that have been allocated to them. The requests for the 2015 period were presented for the first time in LHCb-PUB-2014-014, and confirmed in LHCb-PUB-2014-041. Table 1-1 shows the requests to WLCG. For CPU, an additional power of 10kHS06 and 10kHS06 were deemed to be available from the HLT and Yandex farms, respectively.

<table>
<thead>
<tr>
<th></th>
<th>CPU (kHS06)</th>
<th>Disk (PB)</th>
<th>Tape (PB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 0</td>
<td>36</td>
<td>5.5</td>
<td>11.2</td>
</tr>
<tr>
<td>Tier 1</td>
<td>118</td>
<td>11.7</td>
<td>23.7</td>
</tr>
<tr>
<td>Tier 2</td>
<td>66</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Total WLCG</td>
<td>220</td>
<td>19.1</td>
<td>34.9</td>
</tr>
<tr>
<td>Non WLCG</td>
<td>20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 1-1: LHCb estimated resource needs for 2015 (September 2014).*

The last update to the pledge of computing resources for LHC from the different sites can be found in: [http://wlcg-rebus.cern.ch/apps/pledges/resources/](http://wlcg-rebus.cern.ch/apps/pledges/resources/). The LHCb numbers for 2015 are summarized in Table 1-2.

<table>
<thead>
<tr>
<th></th>
<th>CPU (kHS06)</th>
<th>Disk (PB)</th>
<th>Tape (PB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 0</td>
<td>36</td>
<td>5.5</td>
<td>11.2</td>
</tr>
<tr>
<td>Tier 1</td>
<td>139</td>
<td>14.0</td>
<td>28.1</td>
</tr>
<tr>
<td>Tier 2</td>
<td>61</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Total WLCG</td>
<td>236</td>
<td>21.5</td>
<td>39.3</td>
</tr>
</tbody>
</table>

*Table 1-2: Site 2015 pledges for LHCb.*

The present document covers the resource usage by LHCb in the period January 1st – August 25th 2015. It is organized as follows: section 2 presents the computing activities; section 3 shows the usage of CPU resources; section 4 reports on the usage of storage resources. Section 5 shows the results of a study on data popularity. Finally everything is summarized on section 6.
2. Computing activities during 2015

The usage of offline computing resources involved mostly:

- The production of simulated events, which runs continuously
- The legacy stripping of Run1 data, which was deployed and tested in autumn 2014, started in December and finished in January 2015. The regeneration of micro-DST from the MDST.DST\(^1\) related to this legacy stripping was run very recently.
- A “swimming”\(^2\) cycle of the Run 1 dataset, required by the charm group.
- Running user jobs

Activities related to data-taking were tested at the end of May, and started at the beginning of the LHC physics run at the end of June.

As in previous years, LHCb used successfully resources at Tier 2 sites with disk (T2D), and continued to make use of parasitic resources, which are not pledged to WLCG, which significantly contributed to the overall usage.

---

\(^1\) The MDST.DST is a DST stream out of the stripping, containing all events selected by micro-DST streams. It can be used to regenerate micro-DSTs without rerunning the stripping in case analysts miss some important information.

\(^2\) The swimming procedure allows to determine and correct for acceptance biases due to the LHCb trigger when performing time-dependent analyses.
3. Usage of CPU Resources

The number of running jobs is generally consistent with the 2015 pledges. We expect an increase in the CPU usage for activities related to data taking in the second half of 2015, when the LHC should provide more stable running conditions.

Computing activities (see Figure 3-1) were dominated by Monte Carlo production. Figure 3-1 also shows a continuous contribution due to user jobs and periods where Stripping and Swimming were performed. Reconstruction of collision data was performed in July and the second half of August. Data stripping will start when the LHC will restart providing collisions after Technical Stop 2 the first week of September.

The production of simulated events has been somewhat decreasing in the last months. A new simulation cycle will start right after the imminent release of a major update of the simulation package, with a corresponding increase in the usage of CPU resources.

---

Figure 3-1: Summary of LHCb computing activities (concurrently running jobs) from Jan 1st to Aug 25th 2015. The line represents the approximate number of running jobs that the 2015 pledge should provide.

The jobs were split in the various centers, according to the computing resources offered to LHCb (Figure 3-2). The Tier0 and seven Tier1s contribute about 60%, the rest is due to Tier2s, with significant amounts from Tier-2D with disk, and unpledged resources (the Yandex farm among them).

The LHCb Online HLT farm was the site running the fifth largest number of jobs. Due to the preparation for the 2015 data taking, it was no longer available after May.
3.1. WLCG Accounting

The usage of WLCG CPU resources by LHCb is obtained from the different views provided by the EGI Accounting portal. The CPU usage is presented in Figure 3-3 for the Tier1s and in Figure 3-4 for Tier2s\(^3\). The same data is presented in tabular form in Table 3-1 and Table 3-2.

The average power used at Tier0+Tier1 sites is about 15\% lower than the pledges. The average power used at Tier2s is about 30\% higher than the pledges.

The average CPU power accounted for by WLCG (including Tier0/1 + Tier2) amounts to \((150+80) = 230\) kHS06, to be compared to 240 kHS06 estimated needs quoted in Table 1-1. Additional computing power was used at the LHCb HLT farm and non-WLCG sites, for an estimated contribution of about 27 kHS06 on average (see Figure 3-5). Therefore the used CPU resources were slightly higher with respect to initial estimations.

\(^3\) Including WLCG Tier2 sites that are not pledging resources to LHCb but are accepting LHCb jobs.
Less CPU power than anticipated was used at the Tier0. The Tier1s usage is general in line with the pledges. The discrepancy for the RAL Tier1 is overcompensated by the CPU used at the UK Tier2s, the largest one being located also at RAL. In general, the LHCb computing model is flexible enough to use computing resources wherever available.

![LHCb EGI Tier0/1 Accounting 2015](image)

*Figure 3-3: Monthly CPU work provided by the Tier1s (and Tier0) to LHCb from Jan 1st until July 31st 2015.*

<table>
<thead>
<tr>
<th>&lt;Power&gt;</th>
<th>Used (kHS06)</th>
<th>Pledge (kHS06)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH-CERN</td>
<td>16.7</td>
<td>36</td>
</tr>
<tr>
<td>DE-KIT</td>
<td>16.8</td>
<td>19.6</td>
</tr>
<tr>
<td>ES-PIC</td>
<td>9.0</td>
<td>7.7</td>
</tr>
<tr>
<td>FR-CCIN2P3</td>
<td>27.8</td>
<td>23</td>
</tr>
<tr>
<td>IT-INFN-CNAF</td>
<td>28.1</td>
<td>23.6</td>
</tr>
<tr>
<td>NL-T1</td>
<td>18.2</td>
<td>15.7</td>
</tr>
<tr>
<td>RRC-KI-T1</td>
<td>11.6</td>
<td>14.2</td>
</tr>
<tr>
<td>UK-T1-RAL</td>
<td>21.4</td>
<td>35.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>149.5</strong></td>
<td><strong>175.2</strong></td>
</tr>
</tbody>
</table>

*Table 3-1: Average CPU power provided to LHCb during Jan-Jul 2015 (Tier0 + Tier1s).*
Usage of CPU Resources

3.2. LHCb DIRAC CPU Accounting

The sharing of CPU time (in days) is shown in Figure 3-5. The top chart reports the CPU time per country provided by WLCG sites, including the ones not providing a pledge for LHCb, and excluding the HLT farm. The bottom chart shows the CPU time per site provided by non-WLCG sites. The HLT farm at CERN and the Yandex farm in Russia
are dominant contributors as usual. Sizeable computing time is provided also by other farms (Ohio Supercomputing Center and Zuerich).

**Figure 3-5:** CPU time consumed by LHCB during Jan 1st—Aug 25th 2015 (in days), for WLCG sites, excluding the HLT farm (top, per country), and non-WLCG sites, including the HLT farm (bottom, per site).
The number of running jobs at Tier0/1s is detailed in Figure 3-6. As seen in the top figure, simulation jobs are dominant, with user jobs contributing about 20% to the total and data stripping contributing significantly in January.

**Running jobs by JobType**

**34 Weeks from Week 52 of 2014 to Week 34 of 2015**

**Running jobs by Country**

**34 Weeks from Week 52 of 2014 to Week 34 of 2015**

---

*Figure 3-6: Usage of LHCb Tier0/1s during Jan 1st – Aug 25th 2015. The top plot shows the usage of resources as a function of the different activities, while the bottom plot shows the contributions from the different sites.*
The contributions from the Tier2s and other non-WLCG sites are shown in Figure 3-7. It shows that their contribution is mostly dedicated to simulation (93%) and user jobs (7%).

**Running jobs by JobType**

34 Weeks from Week 52 of 2014 to Week 34 of 2015

**Running jobs by Site**

34 Weeks from Week 52 of 2014 to Week 34 of 2015

Figure 3-7: Usage of LHCb resources outside Tier0 and Tier1s during Jan 1st—Aug 25th 2015. The top plot shows the usage of resources as a function of the different activities, while the bottom plot shows the contributions from the different sites. User jobs (shown in magenta in the top plot) are further detailed in Figure 3-8.
Figure 3-8 shows the number of user jobs per site for sites other than Tier1s (left) and at Tier-2D sites (right). They typically consist of fast parameterized simulations or final selections/fits, which do not need input data, but there are also user jobs running on stripped (micro)DSTs placed on Tier-2D disks.

Figure 3-9 shows pie charts of the CPU days used at all sites as a function of the final status of the job (top) and as a function of the activity when jobs are stalled (bottom plot). About 90% of all jobs complete successfully. The major contributors to unsuccessful jobs are “stalled” jobs, which are mostly killed by the site where the jobs are executed. By looking at the bottom plot of Figure 3-9, one can see that stalled jobs are due to user jobs in 70% of the cases. This was generally due to a handful of individual users.
Figure 3-9: CPU time as a function of the job final status for all jobs (top), and as a function of activity for stalled jobs (bottom)
4. Usage of Storage resources

4.1. Tape storage

A tape storage growth of about 1PB was due to the archival of Monte Carlo productions, the legacy stripping of Run 1 data, and new Run2 data. The total tape occupancy as of August 25th 2015 is 16.9 PB, 6.5 PB of which are used for RAW data, 4.9 PB for FULL.DST, 5.5 PB for archived data. It should be noted that the tape efficiency factor of 0.85, included when determining the requests, is dropped in the reported tape occupancy.

4.2. Disk storage

The evolution of Disk usage during 2015 is presented in Figure 4-1, separately for real data DST and MC DST, Figure 4-2 for scratch buffer and failover space, and Figure 4-3 for user disk. The scratch buffer space is used for storing temporary files such as FULL.DST until they are stripped or DST files before they are merged into large (5 GB) files. The failover space allows production jobs to upload their output to any other Tier1 in case the associated Tier1 is not available. The data written to this storage class are automatically moved to the destination storage (DST, MC DST, BUFFER) when the associated Tier1 comes back online.

The real data DST space increased due to the legacy stripping (1 PB) at the beginning of the year. The recent removal of datasets unused since a long time allowed us to recover 1.2 PB of disk space. A slight increase due to the 2015 data taking is visible in July.

Space used for simulation has increased at a regular pace of about 140 TB per month.
Figure 4-1: Usage of Disk resources at CERN and Tier1s from Jan 1st to Aug 25th 2015. Real data per SE and simulated data are shown in the top and bottom figures, respectively.
Figure 4-2: Usage of Disk resources from January 1st to August 25th 2015. Usage of scratch and failover buffers per SE are shown in the top and bottom figures, respectively.
Figure 4-3: Usage of disk resources reserved for Users from January 1st to August 25th 2015.

Table 4-1 shows the situation of disk storage resources at CERN and Tier1s, as well as at each Tier1 site, as of August 25th 2015. The used space includes derived data, i.e. DST and micro-DST of both real and simulated data, and space reserved for users. The latter accounts for 624TB in total.

<table>
<thead>
<tr>
<th>Disk (PB)</th>
<th>CERN</th>
<th>Tier1s</th>
<th>CNAF</th>
<th>GRIDKA</th>
<th>IN2P3</th>
<th>PIC</th>
<th>RAL</th>
<th>RRCKI</th>
<th>SARA</th>
</tr>
</thead>
<tbody>
<tr>
<td>LHCb accounting</td>
<td>3.32</td>
<td>8.36</td>
<td>1.76</td>
<td>1.54</td>
<td>1.14</td>
<td>0.57</td>
<td>2.30</td>
<td>0.17</td>
<td>0.87</td>
</tr>
<tr>
<td>SLS T0D1 used</td>
<td>3.51</td>
<td>8.43</td>
<td>1.79</td>
<td>1.54</td>
<td>1.14</td>
<td>0.57</td>
<td>2.34</td>
<td>0.18</td>
<td>0.87</td>
</tr>
<tr>
<td>SLS T0D1 free</td>
<td>1.57</td>
<td>5.31</td>
<td>0.81</td>
<td>0.59</td>
<td>0.65</td>
<td>0.22</td>
<td>1.28</td>
<td>1.08</td>
<td>0.68</td>
</tr>
<tr>
<td>SLS T1D0 (used+free)</td>
<td>0.53</td>
<td>1.36</td>
<td>0.94</td>
<td>0.14</td>
<td>0.03</td>
<td>0.01</td>
<td>0.20</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>SLS T0D1+T1D0 total</td>
<td>5.61</td>
<td>15.10</td>
<td>3.54</td>
<td>2.27</td>
<td>1.82</td>
<td>0.80</td>
<td>3.82</td>
<td>1.28</td>
<td>1.58</td>
</tr>
<tr>
<td>Pledge '15</td>
<td>5.50</td>
<td>14.04</td>
<td>2.72</td>
<td>2.34</td>
<td>1.88</td>
<td>0.76</td>
<td>3.51</td>
<td>1.26</td>
<td>1.57</td>
</tr>
</tbody>
</table>

Table 4-1: Situation of Disk Storage resource usage as of August 25th 2015, available and installed capacity as reported by SLS, and 2015 pledge. The contribution of each Tier1 site is also reported.

The SLS used and SLS free information concerns only permanent disk storage (T0D1). The first two lines show a good agreement between what the site reports and what the LHCb accounting (first line) reports, except for small discrepancies at CERN, CNAF and RAL.

\[^4\] This total includes disk visible in SRM for tape cache. It does not include invisible disk pools for dCache (stage and read pools).
The total allocated space is 1.1PB above the 2015 pledges, the available disk space (about 6.88PB) is sufficient to cover the various activities foreseen until the end of the 2015 WLCG year. We anticipate that, due to the reduction in the LHC live time with respect to the one used to calculate the requests, the available disk space will not be completely used.

4.3. Disk at Tier2s

The available disk at Tier-2D is now 2.56 PB, 1.20 of which is used. Table 4-2 shows the situation of the disk space at the Tier-2D sites.

Table 4-2: available and used disk resources at Tier-2D sites on August 25th 2015.

<table>
<thead>
<tr>
<th>Site</th>
<th>SLS free disk (TB)</th>
<th>SLS used disk (TB)</th>
<th>SLS total disk (TB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBPF (Brasil)</td>
<td>66</td>
<td>55</td>
<td>121</td>
</tr>
<tr>
<td>CPPM (France)</td>
<td>65</td>
<td>45</td>
<td>110</td>
</tr>
<tr>
<td>CSCS (Switzerland)</td>
<td>120</td>
<td>170</td>
<td>290</td>
</tr>
<tr>
<td>IHEP (Russia)</td>
<td>9</td>
<td>56</td>
<td>65</td>
</tr>
<tr>
<td>LAL (France)</td>
<td>62</td>
<td>48</td>
<td>110</td>
</tr>
<tr>
<td>LPNHE (France)</td>
<td>76</td>
<td>54</td>
<td>130</td>
</tr>
<tr>
<td>Manchester (UK)</td>
<td>133</td>
<td>169</td>
<td>302</td>
</tr>
<tr>
<td>NCBJ (Poland)</td>
<td>142</td>
<td>168</td>
<td>310</td>
</tr>
<tr>
<td>NIPNE (Romania)</td>
<td>258</td>
<td>110</td>
<td>368</td>
</tr>
<tr>
<td>RAL-HEP (UK)</td>
<td>198</td>
<td>257</td>
<td>455</td>
</tr>
<tr>
<td>UKI (UK)</td>
<td>230</td>
<td>70</td>
<td>300</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1358</strong></td>
<td><strong>1203</strong></td>
<td><strong>2561</strong></td>
</tr>
</tbody>
</table>

Figure 4-4 shows the disk usage at Tier-2D sites.
Figure 4-4: Usage of disk space at Tier-2D sites from Jan 1st to August 25th, 2015, for real data (top) and simulated data (bottom).
5. Data popularity

Dataset usage patterns are now routinely monitored in LHCb. A first report was given in LHCb-PUB-2014-042. The obtained results were used to purge a significant amount of disk space. In LHCb-PUB-2015-002, we observed that rather old datasets were still used in the first half of 2014, mostly for completing the analysis based on 2011 data. These older datasets were no longer accessed since a few months, and have therefore been archived in August (Figure 4-1, top plot).

For each user job, DIRAC records the dataset(s) used by the job and how many files are accessed from this/these dataset(s); the storage element from which the dataset is accessed; the timestamp of the job. This information is used to infer the usage for each dataset over any period of time. In the following, we integrate the usage in time slots of one week and analyze the usage in the last 13, 26, and 52 weeks. The number of usages of a dataset over a period of time is defined as the ratio of the number of files used in that dataset to the total number of files in the dataset.

Figure 5-1, Figure 5-2, and Figure 5-3 show the physical volume of disk of the accessed datasets as a function of the number of accesses in the last 13, 26, and 52 weeks. The first bin indicates the volume of data that were generated before and were not accessed during that period (e.g. 2.8 PB in the last 52 weeks). The last bin shows the total volume of data that was accessed (e.g. 8.2 PB in the last 52 weeks). The total amount of disk space used by the derived LHCb data is 11.5 PB. The datasets accessed at least once in 13, 26 and 52 weeks, occupy respectively 52%, 63% and 72% of the total disk space in use, respectively.

The dataset classifier mentioned in our previous report has been further developed and improved. The next step will be to use the estimators provided, and additional information for each storage site (space used by each dataset, total space, free space) and upcoming space needs in order to provide hints for the best placement strategy.

---

5 The volume in each bin is not weighted by the number of accesses.

6 Since this number is computed by explicitly excluding files that are not usable for physics analysis, e.g. RDST or temporary unmerged files, it is not directly comparable to the used resources mentioned in Section 4.
Figure 5-1: Volume of accessed datasets as a function of the number of accesses in the last 13 weeks.

Figure 5-2: Volume of accessed datasets as a function of the number of accesses in the last 26 weeks.
Figure 5-3: Volume of accessed datasets as a function of the number of accesses in the last 52 weeks.
6. Summary

The usage of computing resources in the first eight months of 2015 has been quite smooth for LHCb.

The legacy stripping of the Run1 dataset was completed at the end of January. A “swimming” activity was run shortly afterwards. The workflow for the Run2 data taking was exercised in the spring, and successfully put to work as soon as LHC started providing collisions.

Simulation has been running at almost full speed using all available resources, being the dominant activity in terms of CPU work. Additional unpledged resources, as well as clouds, on-demand and volunteer computing resources, were also successfully used.

The average CPU power achieved in 2015 is in line with the expectation. We foresee an increase of CPU usage, as the LHC will provide more data in the remaining months of 2015, and a new simulation cycle will start.

Storage resources are not a concern. It is likely that the storage resources provided to LHCb will not be saturated by the end of the WLCG year in March 2016, due to the reduced LHC live time with respect to the initial expectations.

The usage of datasets produced for physics analysis is constantly monitored, the subsequent analysis of data popularity having allowed LHCb to free a significant amount of disk space.