# LHCb Computing

# 2015Q3 status report

### New in Run 2: Split HLT

- Online calibration
- Same reconstruction online-offline
- TURBO stream

2015 Resource Usage 2016-2017 Updated resources request 2016 pledges





### Split HLT in Run 2



### **Real time calibration**



#### OT to calibration:

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- Is running/updating automatically at the pit
- Update quite often (small variations)

#### **RICH refractive index calibration:**

- Is running/updating automatically at the pit
- Update each run

#### **Calorimeter calibrations:**

- Pio calibration (absolute):
  - Issue of the DB for all data collected before 2<sup>nd</sup> TS
  - New calibration available. It will run as <u>monitoring</u> from now on (every month(s))
  - (Cs scan during TS)
- Calorimeter Occupancy method (relative):
  - Running on monitoring farm, commissioning on going
  - Waiting for stable LHC conditions
- LED (relative):
  - OK for HCAL and inner part of ECAL, LED to be replaced in the outer part. 8

# Applied automatically

Still in commissioning: human eye to validate





### Example: Automatic Outer Tracker TO calibration







### Online alignment status

### VELO and tracker alignment:

- Running automatically in the pit. Update of constants (independently decision for the tracker and VELO) still manually (commissioning)
- The system is quite stable

### Muon alignment:

 Run <u>as monitoring</u>. For the moment, its automatic behavior still in commissioning

### **RICH mirror alignment:**

- Possible to run it online.
- Negligible effect between magnet up and down sample: only one calibration needed
- It will be run only as <u>monitoring</u>. For the moment, its automatic behavior still in commissioning





### Validation of online / offline reconstruction differences

Algorithm **TeslaBrunelMonitor** builds histograms with the difference between the online and offline;







### Example: track momentum

Lucio Anderlini - Online-Offline - 77th LHCb Week - Bologna



Pi\_P/100

### Status - Tracking - Momentum

Level of agreement: Excellent.

The main source of disagreement is the packing-unpacking procedure which happens when writing DST files. A relative error of 10<sup>-6</sup> (consistent with floating point precision), translates into a few MeV disagreement.



Track momentum is input for most of the other variables (PID, IP,  $\ldots$ )

=> You cannot expect there better agreement than here.



# Run 2 Data Validation & Production



16 Sep '15 - LHCb Week



## First publication with Turbo stream

# Turbo stream

- Online has offline quality
   → use it for physics analyses
- Turbo stream:
  - Write out full information of trigger candidates
  - Throw away raw event data
  - $\rightarrow$  Saves a lot of space
- Ideal for analyses with very high signal yields (millions)
- Extremely quick turn around









### • Main activities:

- Simulation
- Legacy stripping of Run1 data
- Swimming of Run1 data
- User jobs
- Test of 2015 data-taking workflows
- Processing of 2015 data
- Pledged resources generally ~10% above requested

	Requested			Pledged		
2015	CPU	Disk	Tape	CPU	Disk	Tape
2013	(kHS06)	(PB)	(PB)	(kHS06)	(PB)	(PB)
Tier 0	36	5.5	11.2	36	5.5	11.2
Tier 1	118	11.7	23.7	139	14.0	28.1
Tier 2	66	1.9		61	2.0	
Total WLCG	220	19.1	34.9	236	21.5	39.3
Non WLCG	20					





# Running jobs



- Usage consistent with pledges
- Somewhat below in Q3 due to reduced data-taking and preparation of new simulation cycle
- LHCb continues to use efficienctly the HLT farm and opportunistic resources (Yandex, OSC, Zurich and others)
- Expect usage in line with pledges until the end of 2015
   WLCG year







- Currently using less disk than anticipated
  - LHC live time ~half of that initially foreseen
  - LHCb implemented changes in the computing model parameters (see later) which moderate the tape requirements
  - Also ~1.1PB disk space cleaned up following data popularity analysis
- Expect ~15% less disk usage and ~35% less tape usage with respect to pledge by the end of 2015 WLCG year

Disk (PB)	CERN	Tier1s	Tier2Ds	Tane (PB)	CERN + Tier1s
LHCb accounting	3.32	8.36	1.20		6.5
SLS T0D1 used	3.51	8.43	1.20	KAW	0.3
SLS T0D1 free	1.57	5.31	1.36	FULL.DST	4.9
SLS T1D0 (used+free)	0.53	1.36		ARCHIVE	5.5
SLS T0D1+T1D0 total1	5.61	15.10	2.56	TOTAL	16.9
Pledge '15	5.50	14.04	1.95	Pledge '15	39.3





### Data popularity: accesses in time X







- Follow the recommendation of the CRSG: cancel second copy of ARCHIVE.
  - In case of tape losses, derived data would have to be regenerated.
  - Decrease of tape requests for 2016 and 2017.
- Do not store the content of RAW banks in FULL.DST.
  - ~2x saving on FULL.DST size
  - Decrease of tape requests.
- Re-balance generation of MC events in 2016 and 2017, in order not to impact physics analysis
  - Image: small) increase in CPU and storage
- Postpone parking of RAW data to 2018 (if really needed)





## Summary of 2016-2017 requests

$\mathbf{P}$	

Power (kHS06)	Request 2016	Request 2017	Request 2016	Request 2017
Tier 0	48	59	51	<b>8</b> 8 62
Tier 1	146	184	156	<b>0 9</b> 191
Tier 2	81	102	88	<b>0</b> 107
Total WLCG	275	345	2950	360
HLT farm	10	10	010	10
Yandex	10	10	5 10	10
Total non-WLCG	20	20	v 220	20
Grand total	295	365	315	380

## Disk

Disk (PB)	2016 Request	2017 Request
Tier0	5.8	8.5
Tier1	14.9	17.4
Tier2	2.8	3.8
Total	23.5	29.7







	Tape (PB)	20 Req	)16 uest	2 Red	017 quest	2 Re	016 quest	2 Re	017 quest
	Tier0		15.0		21.6		20.6		30.9
	Tier1		25.8		38.0		472 13		62.2
	Total		40.8		59.6		62.3	00	93.1
pp Running							Ö	0	
Tape storage usage foreca	<mark>ast (PB</mark>	<b>)</b>	201	L <mark>6</mark>	201	7	201	6, 9	2017
Raw Data			1	8.3	27	7.6	21	4	34.5
RDST				8.0	11	L.O	15	5.2	20.7
MDST.DST				3.8	e	5.7	5	5.2	<b>2</b> 3 7.9
Archive – Operations				9.6	13	3.2	11	.6	° 16.0
Archive – Data preservation				0.0	(	0.0	6	5.0	9.2
Total			3	9.7	58	<mark>8.5</mark>	59	).7	87.3
HI Running Tape (PB)				1.1	1	.1		3.0	5.7

Please note:

WLCG estimates of tape costs include a 10% cache disk. This is probably too large for our purposes.





## Comparison with "flat budget"



# TierO + Tier1 pledged resources in 2016 (REBUS)



#### T0+T1 Tape 2016





		_
CPU	Disk	Таре
HS06	Tbytes	Tbytes
51000	7600	20600
23000	1880	5050
19600	2340	3960
28080	3150	7578
17082	1743	3019
14200	1260	1480
10140	878	2737
46800	4050	12630
209902	22901	57054
194000	20700	40800
8.2%	10.6%	39.8%
	CPU HS06 51000 23000 19600 28080 17082 14200 10140 46800 209902 194000 8.2%	CPU         Disk           HS06         Tbytes           51000         7600           23000         1880           19600         2340           28080         3150           17082         1743           14200         1260           10140         878           46800         4050           194000         20700           8.2%         10.6%



C. Bozzi - NCB - 14/09/2015



## Tier2 pledged resources in 2016 (REBUS)



Significant contribution from other sites not pledging resources to WLCG, e.g. Yandex & OSG

2016	CPU	Disk
Tier2	HS06	Tbytes
France	17952	604
Germany	4500	8
Italy	15800	0
Latin America	5350	240
Poland	3900	0
Romania	6300	360
<b>Russian Federation</b>	1393	165
Spain	5265	1
Switzerland	10000	540
UK	18480	901
Total	88940	2819
Requested	81000	2800
Difference	9.8%	0.7%





# Software workshop @LPNHE16-20 Nov.



# Visit <a href="https://indico.cern.ch/event/337568/">https://indico.cern.ch/event/337568/</a> for practical and registration information!



16 Sep '15 - LHCb Week