Grid resources use

ALICE Offline week

30 March 2017
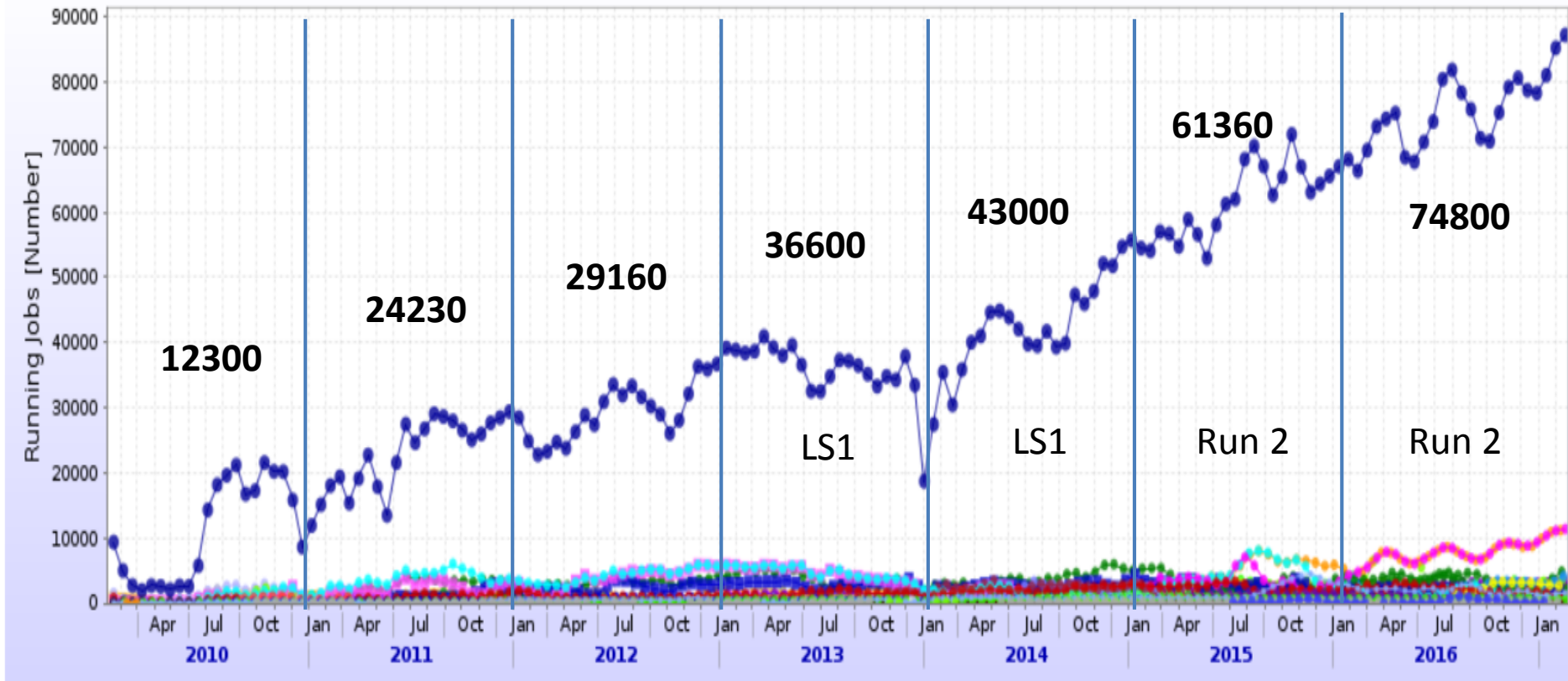Latchezar Betev

Job records are boring

CPU resources evolution is exciting

Running Jobs

12300, 24230, 29160, 36600, 43000, 61360, 74800

LS1, LS1, Run 2, Run 2

Year on year increase

+97%   +20%   +26%   +17%   **+43%**   +21%

The canonical 20% year-on-year increase is still there for CPU

3

Disk resources evolution

- Pledged

Sites	2015 [PB]	2016 [PB]	Delta
T0	14.5	16.8	+16%
T1s	15.8	18.9	+19%
T2s	16.8	18.5	+10%

- Pledged and Installed in 2016

Sites	Pledged [PB]	Installed [PB]	Delta
T0	16.8	16.6	0%
T1s	18.9	18.7	0%
T2s	18.5	14.5	-22%

Resources evolution 2015-2016

- Real 20% CPU increase
  - Standard increase per year
  - Matches the site pledges
- Pledged 15% per year storage increase
  - Standard increase per year
  - However, the real increase is just 6%
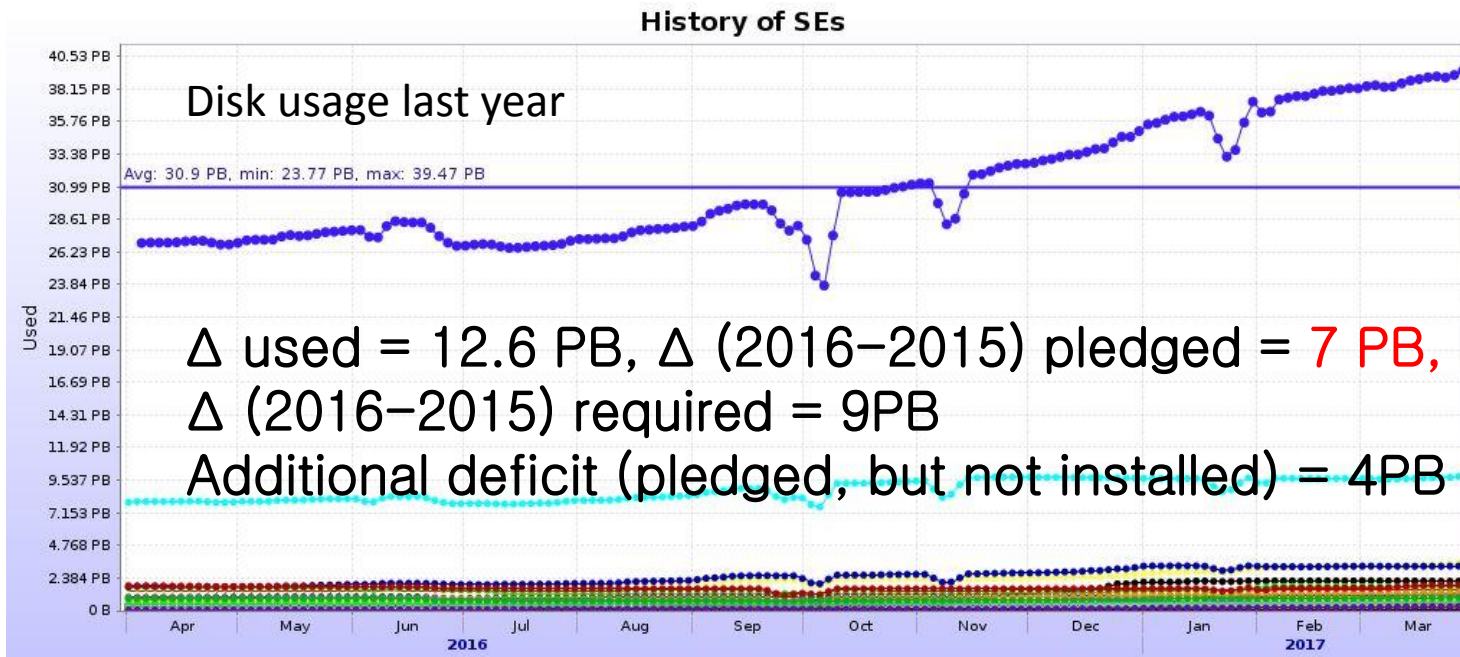   - Number of T2s are not fulfilling their pledges

Things become worse…

- … If we consider the requirements

ALICE Pledged/Required/Used DISK

■ Pledged ■ Required ■ Used

Required is 15% more

Does not show 6PB disk buffer for tape

6
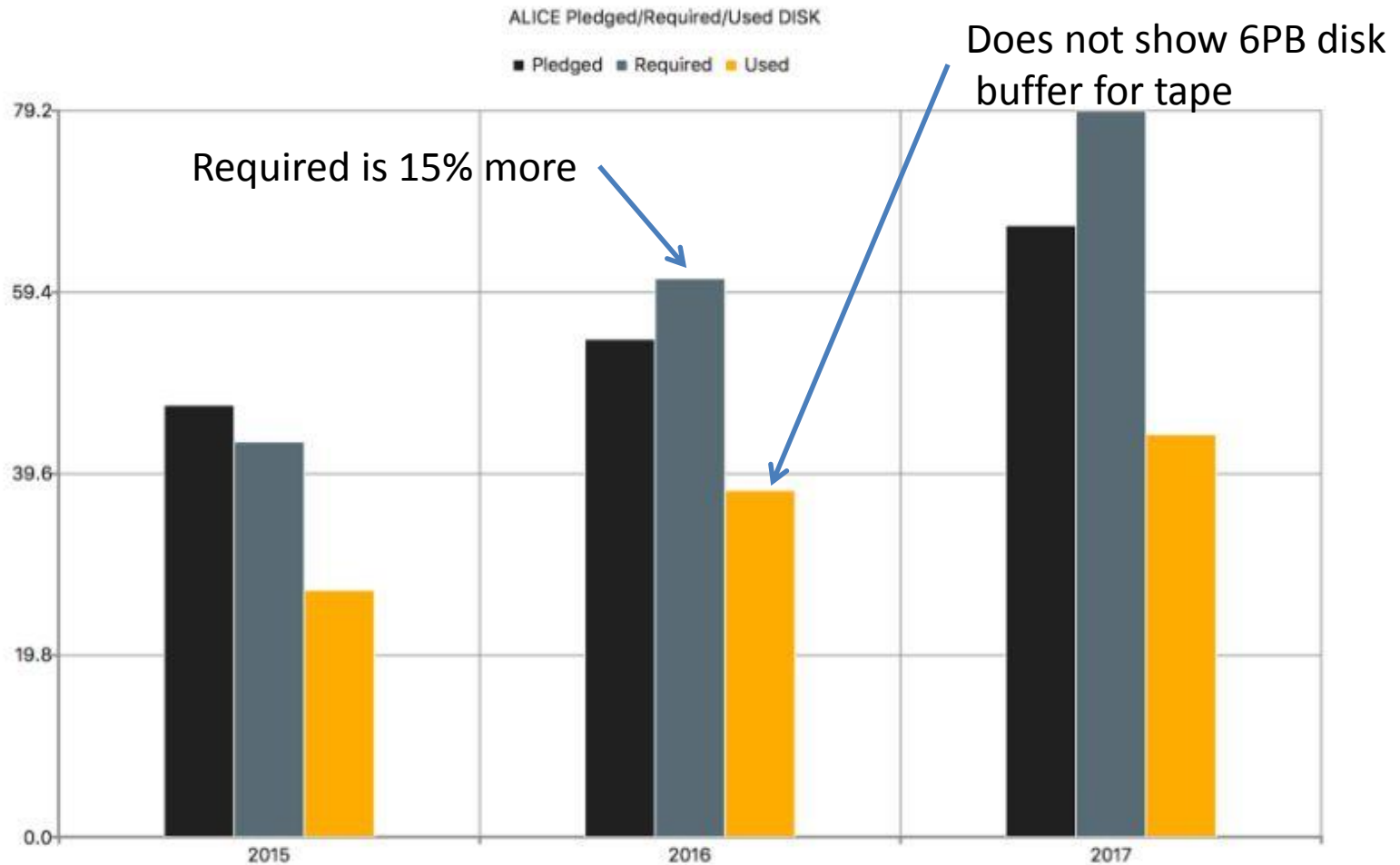
Real situation with storage today

- Installed disk, excluding buffer – 48 PB (should be 56 PB if requirements fulfilled)
- Used disk, excluding buffer – 40PB (83%)

History of SEs

Disk usage last year

Avg: 30.9 PB, min: 23.77 PB, max: 39.47 PB

Δ used = 12.6 PB, Δ (2016−2015) pledged = 7 PB,
Δ (2016−2015) required = 9PB
Additional deficit (pledged, but not installed) = 4PB

A lot of red

SE Name	AliEn name	Size	Used	Free	Usage ▲
44. RRC-KI - SE	ALICE::RRC-KI::SE	243 TB	241.7 TB	1.346 TB	99.45%
25. ITEP - SE	ALICE::ITEP::SE	20.01 TB	19.82 TB	187.7 GB	99.08%
45. RRC_KI_T1 - EOS	ALICE::RRC_KI_T1::EOS	2.267 PB	2.239 PB	28 TB	98.79%
6. CCIN2P3 - SE	ALICE::CCIN2P3::SE	1.972 PB	1.939 PB	33.11 TB	98.36%
14. FZK - SE	ALICE::FZK::SE	4.5 PB	4.409 PB	92.77 TB	97.99%
11. CNAF - SE	ALICE::CNAF::SE	3.405 PB	3.329 PB	77.64 TB	97.77%
42. Prague - SE	ALICE::Prague::SE	1.591 PB	1.555 PB	36.74 TB	97.74%
38. NIPNE - EOS	ALICE::NIPNE::EOS	185.2 TB	180.8 TB	4.409 TB	97.62%
34. Legnaro - SE	ALICE::Legnaro::SE	1.128 PB	1.095 PB	33.78 TB	97.08%
37. NIHAM - FILE	ALICE::NIHAM::FILE	829.2 TB	798 TB	31.27 TB	96.23%
16. GRIF_IPNO - SE	ALICE::GRIF_IPNO::SE	669.3 TB	641 TB	28.27 TB	95.78%
39. ORNL - EOS	ALICE::ORNL::EOS	956.4 TB	912.7 TB	43.76 TB	95.43%
46. SaoPaulo - SE	ALICE::SaoPaulo::SE	203.9 TB	194 TB	9.932 TB	95.13%
12. CyberSar_Cagliari - SE	ALICE::CyberSar_Cagliari::SE	70.87 TB	66.63 TB	4.24 TB	94.02%
29. KISTI_GSDC - SE2	ALICE::KISTI_GSDC::SE2	1.446 PB	1.355 PB	93.91 TB	93.66%
2. Birmingham - SE	ALICE::Birmingham::SE	418.4 TB	389.2 TB	29.2 TB	93.02%
15. Grenoble - SE	ALICE::Grenoble::SE	319.8 TB	291.2 TB	28.56 TB	91.07%
24. ISS - FILE	ALICE::ISS::FILE	421.5 TB	383.8 TB	37.7 TB	91.05%
5. Catania - SE	ALICE::Catania::SE	1.1 PB	1.001 PB	101.6 TB	90.98%
22. IPNL - SE	ALICE::IPNL::SE	37.3 TB	33.8 TB	3.5 TB	90.61%
10. Clermont - SE	ALICE::Clermont::SE	298.3 TB	270.1 TB	28.19 TB	90.55%
52. Subatech - EOS	ALICE::Subatech::EOS	1.339 PB	1.21 PB	131.8 TB	90.39%
21. IHEP - SE	ALICE::IHEP::SE	270.7 TB	242.2 TB	28.52 TB	89.47%
27. JINR - SE	ALICE::JINR::SE	289 TB	255.2 TB	33.72 TB	88.33%
51. Strasbourg_IRES - SE	ALICE::Strasbourg_IRES::SE	65.86 TB	57.66 TB	8.203 TB	87.55%
8. CERN - EOS	ALICE::CERN::EOS	11.55 PB	9.918 PB	1.632 PB	85.87%

8

What happened

- Furious pace of reconstruction of 2015 + 2016 RAW data (especially heavy) and MC
  - This will continue
- No more quiet and "easy" cleanup possible
  - Dark data (in SE, but not catalogue) < 1%, checked few weeks ago
  - Some CPass0/CPass1 to be cleaned, but little to be gained, mostly catalogue space
  - Users occupy ~10% of the SEs, some a lot over (300GB) soft quota – introduce strict quotas and recuperate the space

What more can be done

- Next round of production cleanups
  - Between 5-10 PB on disk not accessed in last year
  - Can this be released for replica reduction?
- Urgency of this task is becoming high!
- Some respite will come when the 2017 resources are installed (April and beyond)
  - This will be temporary, as the pledges are below the requirements

Reduction of reco output

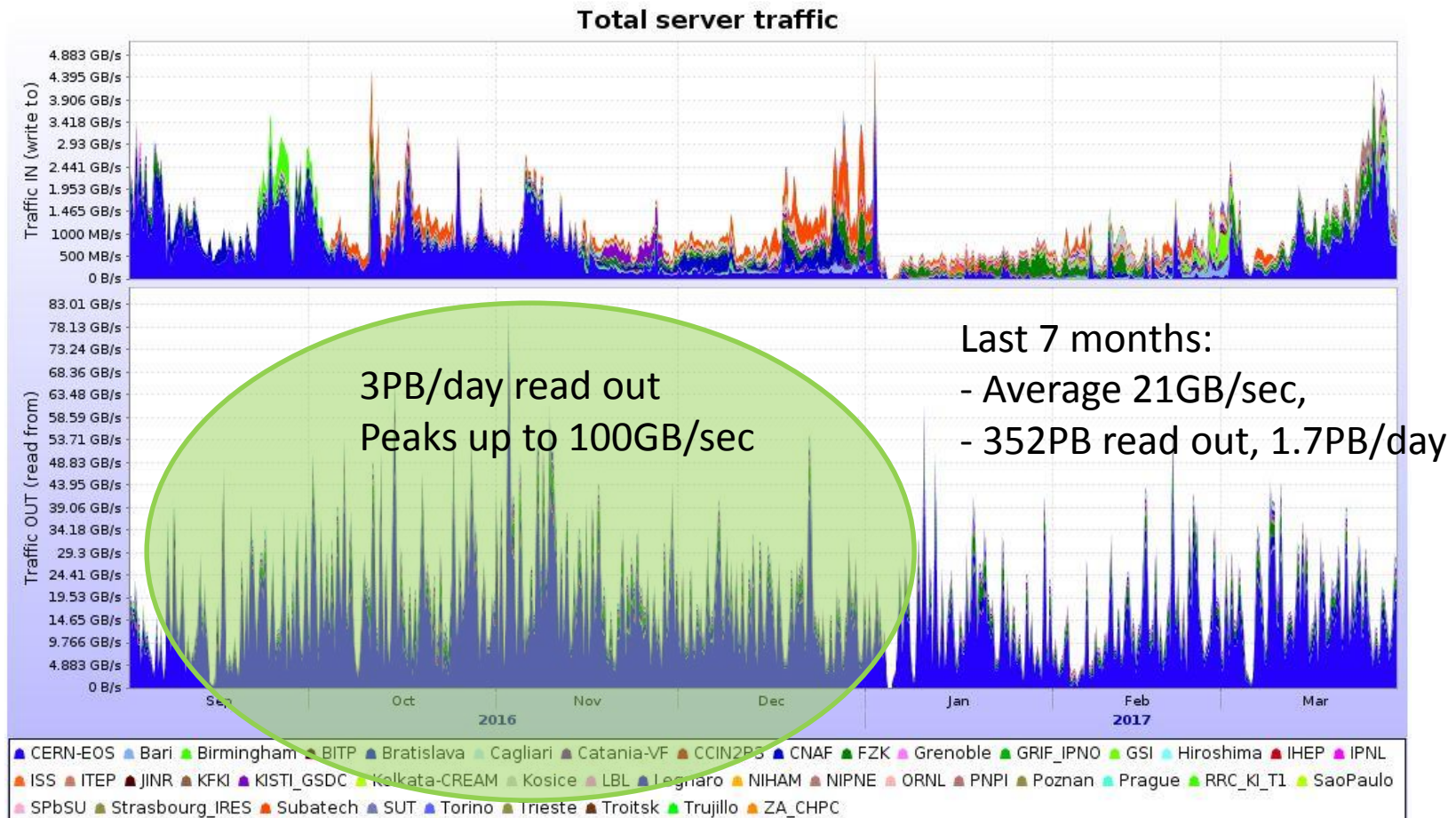| Production	Description	Status	Run Range	Runs	Chunks	Size	Chunks		Size	
LHC16i_pass1	LHC period LHC16i - Full production pass 1	Running	255515 - 255618	21	168,070	282.5 TB	167,676	99%	45.46 TB	16%
LHC period LHC16f - Full production pass 1	LHC period LHC16f - Full production pass 1	Completed	253659 - 253978	24	265,854	449.8 TB	263,184	98%	14.25 TB	3%
LHC16t_pass1_CENT_wSDD	LHC period LHC16t - Full production pass 1, CENT trigger selection, with SDD, ALIROOT-7068	Completed	267161 - 267166	5	48,397	80.83 TB	48,379	99%	12.31 TB	15%
LHC16s_pass1_CENT_wSDD	LHC period LHC16s - Full production pass 1, CENT trigger selection, with SDD, ALIROOT-7068	Completed	266405 - 267110	25	58,950	93.87 TB	58,647	99%	36.13 TB	38%
LHC16t_pass1_CENT_woSDD	LHC period LHC16t - Full production pass 1, CENT trigger selection, without SDD, ALIROOT-7068	Completed	267161 - 267166	5	48,397	80.83 TB	48,379	99%	12.13 TB	15%
LHC16t_pass1_FAST	LHC period LHC16t - Full production pass 1, FAST trigger selection, without SDD, ALIROOT-7068	Completed	267161 - 267166	5	48,397	80.83 TB	48,378	99%	12.41 TB	15%
LHC16s_pass1_CENT_woSDD	LHC period LHC16s - Full production pass 1, CENT trigger selection, without SDD, ALIROOT-7068	Completed	266405 - 267110	25	58,950	93.87 TB	58,629	99%	35.97 TB	38%
LHC16s_pass1_FAST	LHC period LHC16s - Full production pass 1, FAST trigger selection, without SDD, ALIROOT-7068	Completed	266405 - 266998	2	3,551	5.431 TB	3,551	100%	849 GB	15%
LHC16r_pass1_CENT_woSDD	LHC period LHC16r - Full production pass 1, CENT trigger selection, without SDD, ALIROOT-7068	Completed	265589 - 266318	53	130,043	208.9 TB	128,710	98%	72.97 TB	35%
LHC16r_pass1_CENT_wSDD	LHC period LHC16r - Full production pass 1, CENT trigger selection, with SDD, ALIROOT-7068	Completed	265589 - 266318	53	130,043	208.9 TB	128,429	98%	73.15 TB	35%
LHC16r_pass1_FAST	LHC period LHC16r - Full production pass 1, FAST trigger selection, without SDD, ALIROOT-7068	Completed	265630 - 266318	9	17,048	26.67 TB	17,039	99%	4.17 TB	15%
LHC16q_pass1_CENT_woSDD	LHC period LHC16q - Full production pass 1, CENT trigger selection, without SDD, ALIROOT-7068	Completed	265305 - 265525	35	305,861	512.3 TB	304,725	99%	75.89 TB	14%
LHC16q_pass1_CENT_wSDD	LHC period LHC16q - Full production pass 1, CENT trigger selection, with SDD, ALIROOT-7068	Completed	265305 - 265525	35	305,861	512.3 TB	304,769	99%	77.11 TB	15%
LHC16q_pass1_FAST	LHC period LHC16q - Full production pass 1, FAST trigger selection, without SDD, ALIROOT-7068	Completed	265305 - 265525	35	305,861	512.3 TB	304,967	99%	77.83 TB	15%
LHC16k_pass1	LHC period LHC16k - Full production pass 1, ALIROOT-6947	Completed	256504 - 258537	213	696,219	1.134 PB	691,464	99%	250.8 TB	21%
LHC16l_pass1	LHC period LHC16l - Full production pass 1, ALIROOT-6853	Completed	258883 - 260014	89	199,244	329.2 TB	198,454	99%	105.3 TB	32%
16 productions					2,790,746	4.531 PB	1,775,380		907.3 TB	

Reconstruction output size is ~20% of RAW
Is more aggressive pileup removal possible?
Relevant for upgrade, perhaps worth starting now

11

Back to some positive news

- Analysis for QM'2016

Total server traffic

3PB/day read out
Peaks up to 100GB/sec

Last 7 months:
- Average 21GB/sec,
- 352PB read out, 1.7PB/day

Performance

- The reconstruction/simulation/analysis drive for QM'2016 was by all accounts a success
- The infrastructure performed well throughout the year
- To be acknowledged
  - Costin and Miguel for the tireless central services support and improvements
  - Maarten for keeping a tab on all events on the Grid and not letting anything go wrong
  - Steady work of all T0/T1/T2experts which keep the infrastructure running

Summary

- 2016 was another good year for the Grid computing
- Through the dedicated efforts of all experts, the infrastructure grew and delivered what was expected of it
- Keeping up with the demand for resources is still a struggle, ***especially storage***
  - This will be an issue for the observable future and we must find a way to avoid crisis situations