Gminus2 computing funds requests

Alberto Lusiani

Scuola Normale Superiore and INFN, sezione di Pisa

Gminus2 referee meeting, Pisa, 11 September 2019

Outline

- E989 datasets: past and present estimates
- CPU, disk and tape required to process a data statistics of $1 \times$BNL
- CPU and disk required for the Italy+UK ω_a analysis, per $1 \times$BNL
- former computing funds requests
- updated computing funds requests

Note

- w.r.t. the circulated document, small revisions of E989 computing numbers (improved understanding of 2019 SCPMT review and August DOE review material)
- added more details on how computing requirements are computed
- negligible changes on numbers related to analysys requirements for funding

E989 schedule

INFN referee meeting March 2018

2018	3× BNL
2019	15× BNL
2020	5× BNL

Fermilab 2019 SCPMT review, February 25-26, 2019

2018	2× BNL
2019	6× BNL
2020	12× BNL

Now

Year			
2018	1.9× BNL	Run1	
2019	5.6× BNL	Run2 2.2× BNL	Run3(3 months) 3.4× BNL
2020	9× BNL	Run3(5 months) 5.6× BNL	Run4(3 months) 3.4× BNL
2021	3.4× BNL	Run4(3 months) 3.4× BNL	

CPU requirements to process 1×BNL of statistics

## CPU usage (Fermilab 2019 SCPMT review, February 25-26, 2019)

		core hours	
2018	15.1M	total	
	13.0M	CPU used on FermiGrid	
	2.1M	CPU used off-site	
2019	24.4M	total	
	21.0M	CPU request on FermiGrid	
	20.0M	- to process 6×BNL	
	1.0M	- to finish processing 2018 data	
	23.2M	Fermilab + off-site CPU for 6×BNL	

▶ ⇒ 3.9M core hours per 1×BNL of data
(relevant SCPMT review material in backup slides)

CPU usage for analysis

▶ analysis CPU expected 50% of total (approximately confirmed by 2018 experience)
▶ CPU primarily used by 6 ω_a analyses ⇒ 0.32M core hours per analysis per 1×BNL

Contribution of Pisa grid to E989 off-site processing

off-site jobs 2018
(Pisa is red)

off-site jobs 2019
(Pisa is red)
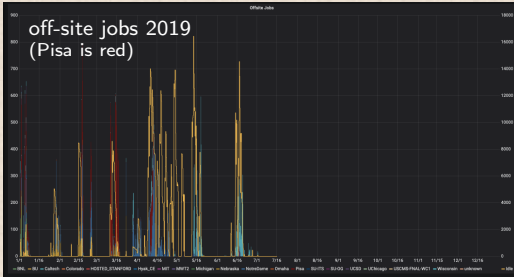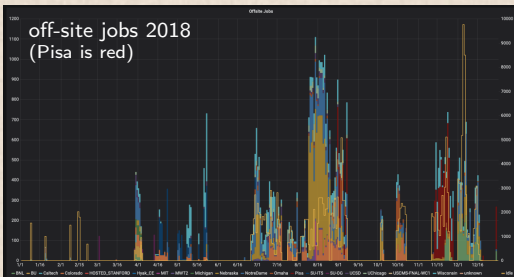
2018	
Nebraska	23.25%
NotreDame	19.78%
Wisconsin	14.16%
Pisa	12.52%
Colorado	9.36%
BNL	4.84%
SU-ITS	4.39%
UChicago	2.93%
Omaha	2.73%
UCSD	2.51%
MWT2	1.25%

2019	
Pisa	34.81%
NotreDame	33.95%
Wisconsin	19.48%
Nebraska	5.68%
BNL	2.77%
UCSD	1.87%
Omaha	1.43%

Storage requirements to process 1×BNL of statistics

disk (Fermilab 2019 SCPMT review, February 25-26, 2019)

▶ total disk space request for 2019:
dCache + NAS: $1300 + 500 + 150 + 10 + 30 = 1990\,\mathrm{TB}$ per 6×BNL
$\Rightarrow 0.33\,\mathrm{PB}$ / BNL

tape (Fermilab 2019 SCPMT review, February 25-26, 2019)

▶ in 2018 raw data for 2×BNL used $1.9\,\mathrm{PB}$, but need another $1.0\,\mathrm{PB}$ in 2019

▶ expect 2019 raw data use 66% of space used in 2018

▶ 2019 raw data $= 6/2 \cdot 1.9 \cdot 66\% = 3.8\,\mathrm{PB}$

▶ space estimate A: reco+analysis = raw;   estimate B: reco+analysis = 50% raw

▶ 2019 total tape request for 6× BNL (average of A & B): $1.75 \cdot 3.8 = 6.7\,\mathrm{PB}$
$\Rightarrow 1.1\,\mathrm{PB}$ / BNL

disk for Italy+UK ω_a analysis based on experience so far

▶ requirements are 30 TB / BNL (2.7% of tape storage, 9.1% of disk storage)
  ▶ 20 TB for 2 versions of 1×BNL data in analysis format
  ▶ 10 TB of working space

Computing requirements for simulation

▶ so far, very limited simulation data production, just for 3 dedicated studies
▶ no significant E989 CPU and storage requests for simulation

CPU and storage summary, comparison with March 2018 estimates

Computing resources per $1 \times$ BNL

estimates	activity	CPU [core hours]	disk	tape
now	raw + reco + analysis	3.90 M	330.0 TB	1100 TB
	Italian-UK ω_a analysis	0.32 M	30.0 TB	
March 2018	raw + reco (disk+tape)		470.0 TB	
	Italian analysis activities		20.0 TB	
	Italian simulation		6.7 TB	
	detector studies		6.7 TB	

Past computing funding requests

year	estimated datasets	disk per 1×BNL	disk	cost per TB	cost	note
2018	3×BNL	33.3 TB	100 TB	0.17 k€	17 k€	(used)
2019	15×BNL	16.7 TB	250 TB	0.17 k€	43 k€	(s.j.)

usage of disk space

▶ disks installed in common disk pool of Pisa grid (can be shared with other users)
▶ used about 6 TB out of 100 TB so far
  ▶ E989 collected 1×BNL of good data rather than the expected 3×BNL;
  ▶ E989 did not produce significant amount of simulation;
  ▶ we collaborated to Italy-UK ω_a analysis and used UK computing resources at FNAL
▶ since we contributed to the grid, we got good support to use Pisa idle grid CPU time

Dedicated computing resources at FNAL for analysis

▶ since 2018 Italy-UK collaboration in "Europe" ω_a analysis
▶ we used as guests the UK computing facilities at FNAL
▶ this arrangement proved effective and convenient
▶ UK workstation to be used for detector studies starting with Run 3
▶ we ask for funds to buy workstation and disks appropriate to continue the analysis
  ▶ will be probably used in association with a separate new UK workstation

advantages

▶ fast access to reconstructed data stored at FNAL
▶ good support for system and experiment software frameworks administration
▶ smaller disk cost (0.08 k€/TB vs. 0.17 k€ for Pisa grid)

administration responsibilities

▶ we already maintain with small effort an online workstation administered by FNAL
▶ our English colleagues have experience in managing their system and they will assist us

Dedicated computing resources at FNAL for analysis

UK computing facilities at FNAL

► a workstation Dell Precision T7810 with
  ► 2× Xeon E5-2630 v4, 10 cores / CPU, 2 threads / core, 1 core 10.3 HS06
  ► 64 GB RAM
  ► 1 year of operation delivers ∼1.8M core hours ≃ 1.8 kHS06.years
► a RAID disk storage server composed of:
  ► Synology RackStation RS2818RP+ 16-Bay NAS Server with 4×1Gb-ethernet
  ► 16×6 TB disks (96 TB)

Computing funds requests

year	requests	notes
2019	16 k€	from the release of part of the 43 k€ s.j. funds
		- 8 k€ for ∼250 HS06 workstation at FNAL
		- 8 k€ for 100 TB RAID disk space at FNAL, to analyze 3×BNL
2020	36 k€	
		- 24 k€ for 300 TB RAID disk space at FNAL, to analyze 9×BNL
		- 12 k€ s.j. for 150 TB RAID disk space at FNAL, for simulation

Notes

▶ s.j. disk space request for simulation to be revised according to future plans

Backup Slides

Warning!

backup slides from protected access FNAL / DOE reviews removed as this page is public