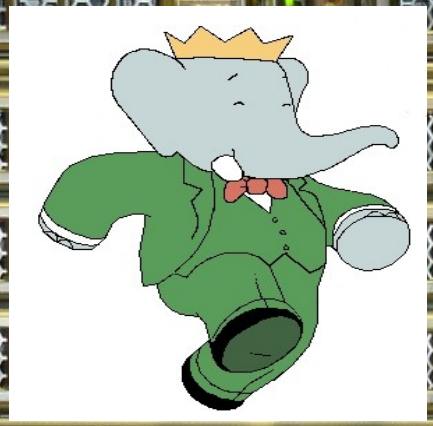
BaBar Computing Needs going into the future



by Homer Neal
SLAC NATIONAL ACCELERATOR LABORATORY

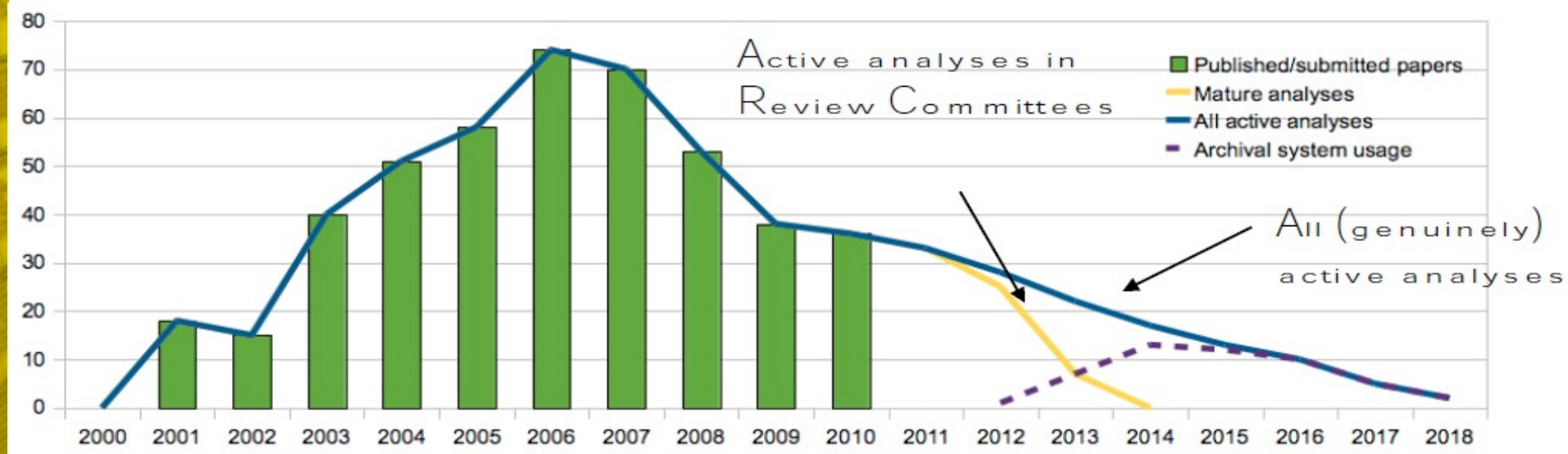
for the
SLAC Scientific Computing Workshop
20 June 2011

on behalf of all of the BaBar LTDA contributors

(BaBar LTDA/BaBar management/SLAC Computing Division/LTDA Advisory Committee)

Current and Projected Analysis Activity

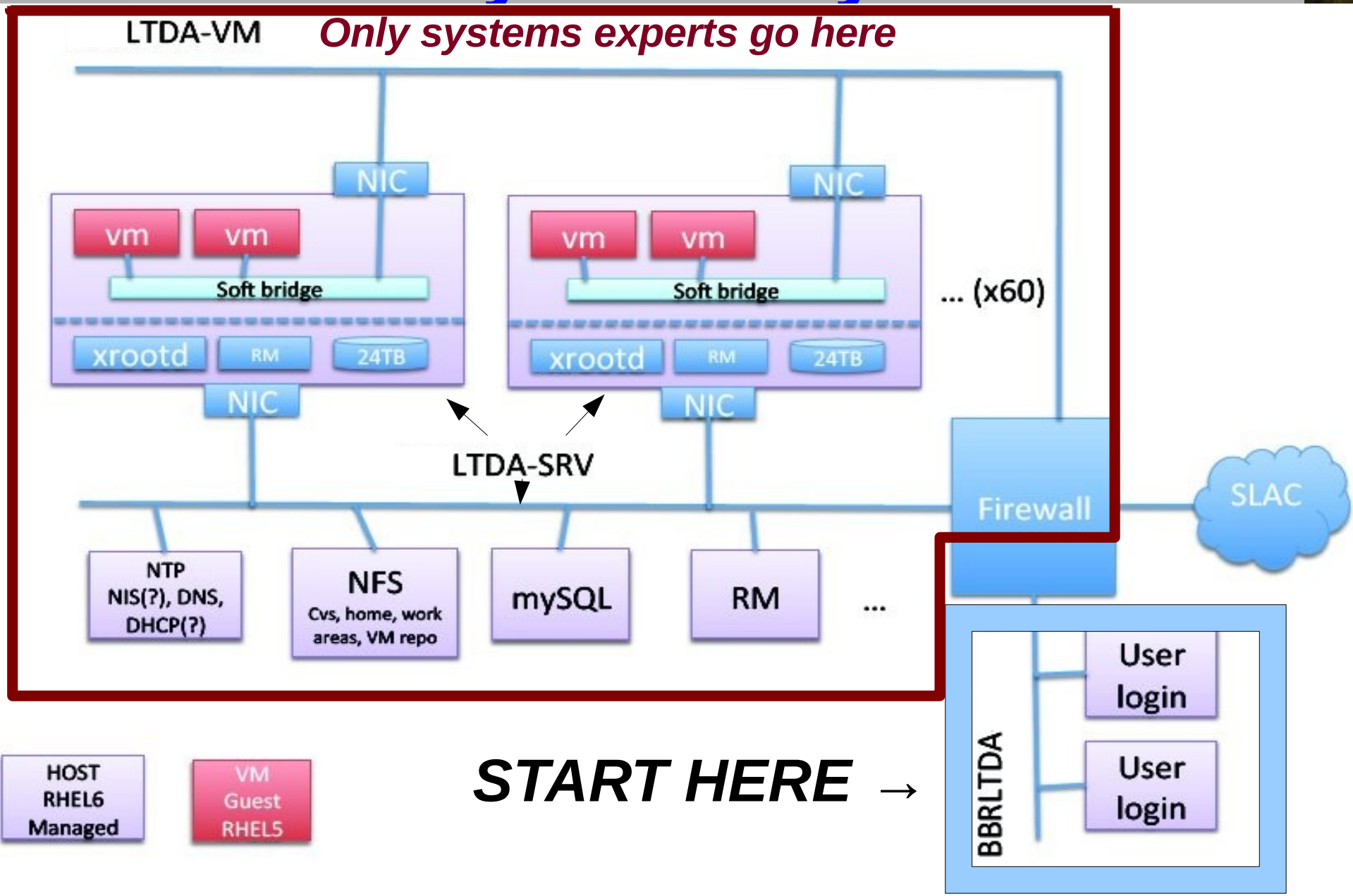
- BaBar has collected good data from Oct 22nd 1999 to Apr 7th 2008
  - 800TB of raw data, 1.2 PB from the last data reprocessing
  - 453 published papers to date
  - ~120 active analyses
- Physics Analysis profile
  - Provide support for >50 publications foreseen beyond 2012



Providing for the future needs

- Must maintain stable, trusted validated platform for future analyses
- SLAC must roll-out new secure platforms
- Ability to keep-up with no platforms is almost lost; a significant problem with running BaBar code on a new platform could kill the ability to analyse the data or produce new signals OR the results would simply be questionnable
- Large infrastructure currently used by BaBar will change and share is dwindling
- Hence … the creation of the BaBar Archival System

The System Layout

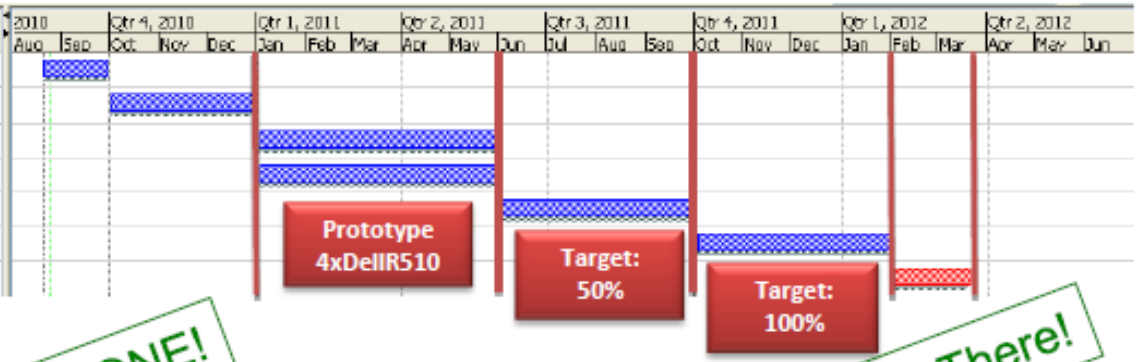


Hardware

- 60 servers Intel dual 6-core,3GHz, 48GB RAM, 24TB disk
  - 4 existing systems in prototype
  - Purchase remaining systems in 2 stages
- Cisco 6506 network switch
- NFS server
- A few dedicated infrastructure & login servers
- Distributed storage and computing ressources
  - Each node provides both CPU and storage

Main Milestones 2010 → 2012

	Name	Start	Finish
1	CEP+PO LTDA Prototype	8/20/10 8:00 AM	9/30/10 5:00 PM
2	Installation/configuration complete	10/1/10 8:00 AM	12/31/10 5:00 PM
3	Run7 available for test users	1/1/11 9:00 AM	6/1/11 5:00 PM
4	Fix, test, tune. PO for final design	1/1/11 9:00 AM	6/1/11 5:00 PM
5	Extended system ready (25% to50%)	6/2/11 8:00 AM	9/30/11 5:00 PM
6	100% system acquired	10/1/11 8:00 AM	1/31/12 5:00 PM
7	Deploy LTDA	2/1/12 9:00 AM	3/22/12 9:00 AM



- Sep 2010 — DONE!
  - PO for the prototype
  - Prototype on site by October — DONE!
- Dec 2010 — DONE!
  - Installation/configuration complete
- Jan 1st 2011 — DONE!
  - System available for test users
- Jun 1st 2011 — Getting There!
  - Test phase ends, LTDA final design ready
  - PO for first 50%
- Jul 1st 2011
  - First 50% of LTDA available
- Oct 1st 2011
  - PO for 100% of LTDA
- March, 21st, 2012
  - Deployment of the LTDA
  - All new analyses will use LTDA

The LTDA archival system – the fruit of many contributions

–Computing Management: Tina Cartaro
–Software expert and beta tester: Homer Neal
–Network design: Steffen Luitz
–Virtualization expert: Kyle Fransham
–System performance expert: Igor Gaponenko
–Databases, tools and production: Douglas Smith
–Tools and environment: Tim Adye

–Computing Division experts
•System setup and adminstration: Booker Benseand Lance Nakata
•XrootD experts: Wilko Kroeger and Andy Hanuchevsky
•Network setup: Antonio Ceseracciu
•BaBar-SLAC liason: Len Moss

–PPA and BaBar Management

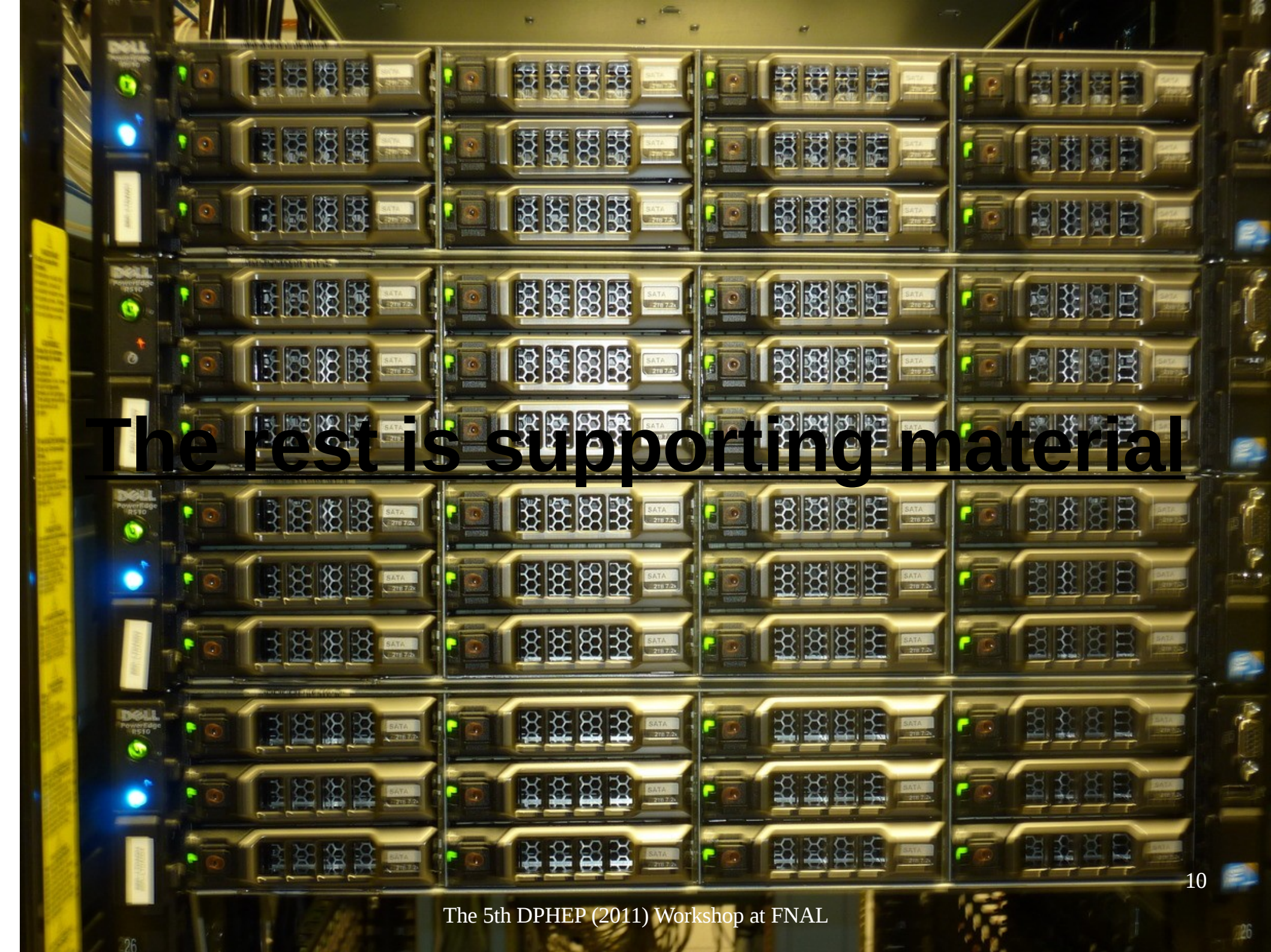
plus strong backing from the BaBar management (Mike, Tina and Steve) and the SLAC PPA management (David and Bill), wiki documentation managers Matt and Adam, the advisory committee (special thanks to Fabrizio) and others,

Support of the Archival System

- **BaBar experts**:
  - Releases, databases, data management and documentation
  - The Collaboration will have to provide such expertise
- **Computing experts:**
  - Network architects, security, system and networks administration, virtualization, …
  - 0.5 FTE/year foreseen after 2012

Status

- Functional prototype system being thoroughly tested:
  - Validated: **simulation, reconstruction and skimming** on the system
  - Currently finishing work on setting up **simulation production**
  - Currently testing the system by doing **analyses** from start to finish on it.
  - Working on SL6 migration



The rest is supporting material

The starting point

- One connects to a login server « bbrltda » (this is your gateway to the archival system)
  - « bbrltda » is a pool of up-to-date machines from which all LTDA operations can be submitted.

- User access is controlled through an NIS netgroup (u-ltda). User's must have a kerberos ticket.
  - LDAP is used to manage the authentications

The Workers

- We currently have
  4 – DELL R510 dual six core servers.
  One serves special functions such as ldap, xrootd redirector, and PBS/torque.

- Three of the R510s are **worker nodes** on which the virtual machines run. We currently have 2 of the three configured with hyperthreading on.

The worker nodes

```
[homer@bbrltda01 ~]$ qnodes | & egrep "srv|np|prop|jobs" | grep -v status
ltda-srv002
     np = 12
     properties = ht
     jobs = 0/392.ltda-srv001.slac.stanford.edu, 1/393.ltda-srv001.slac.stanford.edu, 2/394.ltda-
srv001.slac.stanford.edu, 3/395.ltda-srv001.slac.stanford.edu, 4/396.ltda-
srv001.slac.stanford.edu, 5/397.ltda-srv001.slac.stanford.edu, 6/398.ltda-
srv001.slac.stanford.edu, 7/399.ltda-srv001.slac.stanford.edu, 8/400.ltda-
srv001.slac.stanford.edu, 9/401.ltda-srv001.slac.stanford.edu
ltda-srv003
     np = 12
     properties = ht
ltda-srv004
     np = 12
     properties = noht
```

VM JOBS RUNNING

- **The worker nodes also are the storage servers for the data collections**
- Data is accessed through **xrootd** and non-local collections are staged in from our **hpss** tape system by xrootd.

NFS storage

- We also have a SUN x4540 acting as our nfs server for data needing RAID protection
- Analysis working group areas
- Simulation production
- Skimming production

```
[bbrltda01] ~/rel-24.5.7/workdir $ amdmap wain062
wain062: /nfs/ltda/awg/AWGL001
wain062: /nfs/ltda/awg/AWGL002
wain062: /nfs/ltda/awg/AWGL003
wain062: /nfs/ltda/awg/AWGL004
wain062: /nfs/ltda/prod/simu001
wain062: /nfs/ltda/prod/simu002
wain062: /nfs/ltda/prod/skim001
wain062: /nfs/ltda/prod/skim002
```

Output from the vm jobs are written to one of these areas. Writing to the home areas is blocked for security reasons.

NFS storage (code, applications, repositories)

- Software releases
- Root
- User home directories
- cvs
- ...

wain062:/ltda/BFROOT/bin
wain062:/ltda/BFROOT/build
wain062:/ltda/BFROOT/dist
wain062:/ltda/BFROOT/hepix
wain062:/ltda/BFROOT/kanga
wain062:/ltda/BFROOT/package
wain062:/ltda/BFROOT/prod
wain062:/ltda/BFROOT/physicstools
wain062:/ltda/BFROOT/reco
wain062:/ltda/BFROOT/repo
wain062:/ltda/BFROOT/simu
wain062:/ltda/BFROOT/work
wain062:/ltda/home/...

+ a node for the login server

Job Management

- Explored using condor/nimbus/torrent but the system was too unstable
- Now **PBS/torque** is used as the batch system
  - Easier to maintain

1st Stress Test

```
[homer@bbrltda01 workdir]$ qstat -r

ltda-srv001.slac.stanford.edu:
                                                                  Req'd  Req'd   Elap
Job ID                  Username Queue    Jobname         SessID NDS  TSK Memory Time  S
Time
----------------------- -------- -------- ---------------- ------ ----- --- ------ ----- - -----
403.ltda-srv001.        homer    batch    STDIN            12444   1   1   16mb 48:00 R 00:53
404.ltda-srv001.        homer    batch    STDIN            12516   1   1   16mb 48:00 R 00:53
406.ltda-srv001.        homer    batch    STDIN            12689   1   1   16mb 48:00 R 00:53
407.ltda-srv001.        homer    batch    STDIN            12762   1   1   16mb 48:00 R 00:53
408.ltda-srv001.        homer    batch    STDIN            12854   1   1   16mb 48:00 R 00:53
409.ltda-srv001.        homer    batch    STDIN            12926   1   1   16mb 48:00 R 00:53
410.ltda-srv001.        homer    batch    STDIN            12998   1   1   16mb 48:00 R 00:53
411.ltda-srv001.        homer    batch    STDIN            13070   1   1   16mb 48:00 R 00:53
412.ltda-srv001.        homer    batch    STDIN            13142   1   1   16mb 48:00 R 00:53
413.ltda-srv001.        homer    batch    STDIN            13214   1   1   16mb 48:00 R 00:53
414.ltda-srv001.        homer    batch    STDIN            13286   1   1   16mb 48:00 R 00:53
415.ltda-srv001.        homer    batch    STDIN            13358   1   1   16mb 48:00 R 00:53
416.ltda-srv001.        homer    batch    STDIN            30815   1   1   16mb 48:00 R 00:53
417.ltda-srv001.        homer    batch    STDIN            30887   1   1   16mb 48:00 R 00:53
418.ltda-srv001.        homer    batch    STDIN            30959   1   1   16mb 48:00 R 00:53
419.ltda-srv001.        homer    batch    STDIN            31031   1   1   16mb 48:00 R 00:53
420.ltda-srv001.        homer    batch    STDIN            31103   1   1   16mb 48:00 R 00:53
421.ltda-srv001.        homer    batch    STDIN            31175   1   1   16mb 48:00 R 00:53
422.ltda-srv001.        homer    batch    STDIN            31247   1   1   16mb 48:00 R 00:53
423.ltda-srv001.        homer    batch    STDIN            31319   1   1   16mb 48:00 R 00:53
424.ltda-srv001.        homer    batch    STDIN            31392   1   1   16mb 48:00 R 00:53
425.ltda-srv001.        homer    batch    STDIN            31464   1   1   16mb 48:00 R 00:53
426.ltda-srv001.        homer    batch    STDIN            31536   1   1   16mb 48:00 R 00:53
427.ltda-srv001.        homer    batch    STDIN            31611   1   1   16mb 48:00 R 00:52
428.ltda-srv001.        homer    batch    STDIN              335   1   1   16mb 48:00 R 00:53
429.ltda-srv001.        homer    batch    STDIN              407   1   1   16mb 48:00 R 00:53
430.ltda-srv001.        homer    batch    STDIN              479   1   1   16mb 48:00 R 00:53
431.ltda-srv001.        homer    batch    STDIN              565   1   1   16mb 48:00 R 00:53
432.ltda-srv001.        homer    batch    STDIN              637   1   1   16mb 48:00 R 00:52
433.ltda-srv001.        homer    batch    STDIN              723   1   1   16mb 48:00 R 00:52
434.ltda-srv001.        homer    batch    STDIN              795   1   1   16mb 48:00 R 00:52
435.ltda-srv001.        homer    batch    STDIN              867   1   1   16mb 48:00 R 00:52
436.ltda-srv001.        homer    batch    STDIN              956   1   1   16mb 48:00 R 00:52
437.ltda-srv001.        homer    batch    STDIN             1037   1   1   16mb 48:00 R 00:52
591.ltda-srv001.        homer    batch    STDIN             2328   1   1   16mb 48:00 R 00:30
592.ltda-srv001.        homer    batch    STDIN             2408   1   1   16mb 48:00 R 00:30
```

A VM surface

- On the server, a vm looks like:

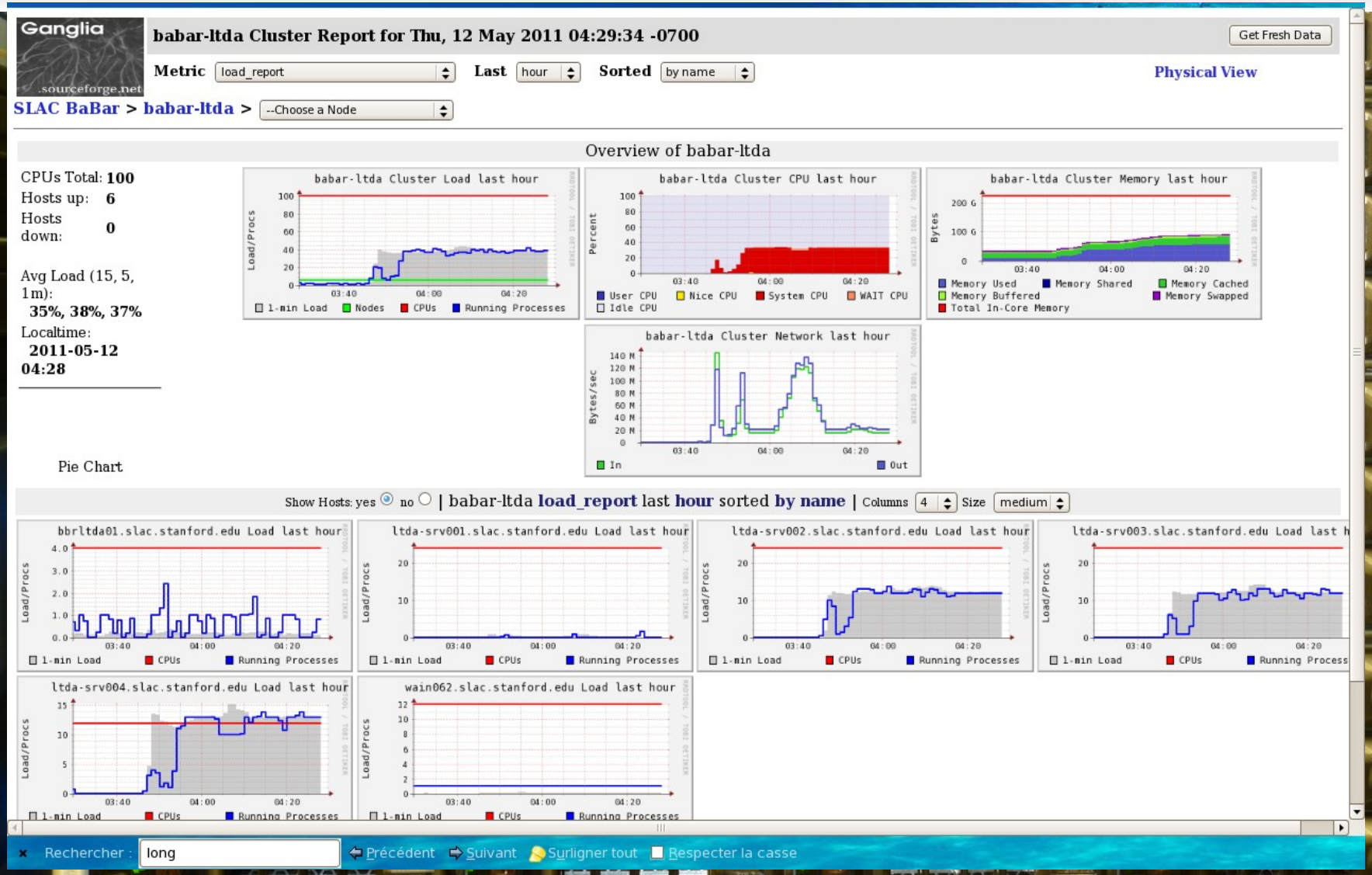
- /usr/libexec/qemu-kvm -S -M rhel5.4.0 -m 2048 -smp 1,sockets=1,cores=1,threads=1 -name vm-415 -uuid 48a47241-4a73-1a0e-3514-a4501d176a6e -nographic -monitor unix:/var/lib/libvirt/qemu/vm-415.monitor,server,nowait -no-kvm-pit-reinjection -no-acpi -boot c -drive file=/scratch/secureimages/vm-415,if=ide,bus=0,unit=0,boot=on,**format=qcow2** -net nic,macaddr=a2:aa:bb:5d:0a:16,vlan=0,model=virtio -net tap,fd=15,vlan=0 -serial none -parallel none -usb -balloon virtio

```
top - 04:45:02 up 2 days, 21:14,  1 user,  load average: 12.27, 12.28, 12.05
Tasks: 386 total,   1 running, 385 sleeping,   0 stopped,   0 zombie
Cpu(s):  0.0%us,  2.1%sy,  0.0%ni, 97.4%id,  0.5%wa,  0.0%hi,  0.0%si,  0.0%st
Mem:  49450772k total, 29657764k used, 19793008k free,   603752k buffers
Swap:  8385920k total,        0k used,  8385920k free, 11338928k cached

  PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
12456 root      16   0 2250m 1.3g 3728 S 101.8  2.9  56:19.20 qemu-kvm
12701 root      15   0 2250m 1.4g 3728 S 101.8  2.9  53:12.13 qemu-kvm
12528 root      15   0 2250m 1.3g 3728 S 99.8  2.8  54:53.50 qemu-kvm
12866 root      15   0 2250m 1.3g 3728 S 99.8  2.8  53:12.26 qemu-kvm
12938 root      16   0 2250m 1.4g 3728 S 99.8  2.9  53:09.85 qemu-kvm
13010 root      15   0 2250m 1.4g 3728 S 99.8  2.9  53:12.31 qemu-kvm
13082 root      15   0 2250m 1.4g 3728 S 99.8  2.9  53:11.57 qemu-kvm
13154 root      15   0 2250m 1.3g 3728 S 99.8  2.8  53:10.79 qemu-kvm
13226 root      16   0 2250m 1.3g 3728 S 99.8  2.9  53:04.95 qemu-kvm
12774 root      15   0 2250m 1.4g 3728 S 97.8  2.9  53:10.35 qemu-kvm
13370 root      16   0 2250m 1.4g 3728 S 95.9  2.9  52:26.63 qemu-kvm
13298 root      16   0 2250m 1.3g 3728 S 90.0  2.8  52:28.63 qemu-kvm
 1076 root      16   0 23504  10m 2732 S  3.9  0.0   0:17.09 pbs_mom
 6539 bbdatsrv  15   0 70036 4644 2004 S  2.0  0.0   2:47.37 xrootd
```

With the **qcow (qemu-copy-on-write)** images it takes less than 2 minutes to fill up the system with jobs

Monitoring



i/o, load, space, etc... is all monitored by Ganglia

Virtual Debugging

- In case of problems that are platform dependent …

- The virtual world is also the place to code releases

```
[homer@bbrltda01 workdir]$ qsub -I
qsub: waiting for job 623.ltda-srv001.slac.stanford.edu to start
qsub: job 623.ltda-srv001.slac.stanford.edu ready


------------------------------------------------------------------
TORQUE PROLOGUE:
  jobid:              623.ltda-srv001.slac.stanford.edu
  userid:              homer
  requested resources: neednodes=1,nodes=1,walltime=01:00:00
  queue:               batch
  host:               bbr-ltda-vm005
------------------------------------------------------------------


Starting virtual machine... please wait
VM is ready. Connecting...

bash-3.2$ which MooseApp
/BFROOT/dist/releases/current/bin/Linux26SL5_i386_gcc412/MooseApp
bash-3.2$ gdb MooseApp
GNU gdb (GDB) Red Hat Enterprise Linux (7.0.1-23.el5_5.1)
Copyright (C) 2009 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.  Type "show copying"
and "show warranty" for details.
This GDB was configured as "i386-redhat-linux-gnu".
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>...
Reading symbols from /BFROOT/dist/releases/24.5.7/bin/Linux26SL5_i386_gcc412/MooseApp...done.
(gdb)
```

This does everything you need. Next stop … the virtual world.

AFS

- No AFS access from the VM's:
  - It is a security concern and also given that the archival system is intended to be as modular as possible, keeping AFS access would lead to strong/irresistable dependencies on the general SLAC infrastructure
- However, in order to maintain the servers, the servers themeselves must have AFS access.

Analysis Job Performance

- SLAC's next to last generation batch workers (**fells**):
  - Intel(R) Xeon(R) CPU X5355 @ 2.66GHz
  - Total CPU usage: **7239** User: 7204 System: 35
- SLAC's latest generation batch workers (**hequs**):
  - Intel(R) Xeon(R) CPU X5570 @ 2.93GHz
  - Total CPU usage: **4756** User: 4718 System: 38
- LTDA **VM** running on an R510:
  - QEMU Virtual CPU version 0.9.1
  - w/hyperthreading
    - Total CPU usage: 6544 User: 6421 System: 123
  - w/o hyperthreading
    - Total CPU usage: **5295** User: 5207 System: 88

Study in progress to understand this

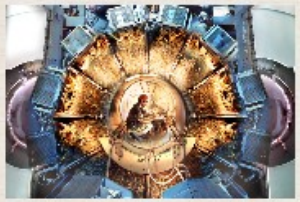
Other related data preservation news

- Migration to new media completely done
- Old tapes stored away safely
- Backing up active data to ccin2p3
- Tape library for accessing raw data copy at Padova restored
- First time central backup of AWG areas
- History of analyses being preserved in the joint BaBar/BELLE physics of B-factories book (PBF)

Also preserving the spirit of the analyses!

Webmaster

Physics of



BaBar Homepage

Belle Homepage

the B-Factories

- Home
- Hypernews
- Computing
- Organization
- Meetings & Events
- Book
- News/Outreach
- Institutions
- Pictures Gallery

Over the last decade BaBar and Belle have studied the physics of bottom and charm mesons, tau leptons, heavy quarkonium states, etc. that were produced at the PEP-II and KEKB e+e- storage rings. The two collaborations contiuously developed more and more sophisticated techniques for extracting the maximum amount of information from data.

Often these techniques have been used in many analyses. However,as most of BaBar's and Belle's 600+ publications are in Physical Review Letters, Physical Review D Rapid Communications, and Physics Letters where the page limits imposed by the journals do not allow for a full description of the analyses, many details of this work have never been published. The Physics of the B-Factories will address this problem by providing descriptions of all of the techniques developed by the experiments, and a comprehensive overview of the measurements. This will provide an essential reference for physicists working at the next generation of Super Flavour Factories.

The book will bring together all of the work done by both collaborations in a single comprehensive collection. As no such work would be complete without discussing the theoretical implications of the measurements performed, there will also be a significant review of the associated theory. Thus, the full impact that the B-Factories and the associated theoretical progress have had on the field of high energy physics will be reviewed through this work.

Rechercher : tuple Précédent Suivant Surligner tout Respecter la casse Phrase non trouvée

Documentation

- The Documentation Working Group (**DWG**) headed by Adam and Matt has been successful in getting people to get up-to-date clean documentation on the BaBar LTDA wiki.

(The wiki runs on a server outside the archival system because of the need to retain access even during outages of the archival system)

LTDA Developers Documentation

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Main Page
BaBar Links
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Computing Links
Computing page
Environment
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Online
Offline
LTDA Links
LTDA User Guide
Available Data
Simulation Production
Particle ID
Event Reconstruction
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Long Term Data Analysis

The Long Term Data Access Task Force Site

- Study Group on Data Preservation and Long Term Analysis in High Energy Physics

BaBar LTDA works with the the global DPHEP effort.

Contents [show]

Meetings [edit]

- Weekly meetings
- DPHEP workshops
  - First workshop at DESY, Jan 2009
  - Second workshop at SLAC. May 2009
  - Third workshop at CERN, Dec. 2009
  - Fourth workshop at KEK, July. 2010
  - **Upcoming!** Fifth workshop at FNAL, May 2011

Milestones [edit]

- see: http://babar-hn.slac.stanford.edu:8080/hn/aux/cartaro/LTDAMilestones-RHlifecycle.pdf
- also: Steve Robertson's presentation on the projected analysis load at:

http://www.slac.stanford.edu/BFROOT/www/Organization/Beyond2010_TF_III/meetings/100924/physics.pdf

LTDA milestones

LTDA Prototype System Setup Notes [edit]

- Notes
- Photos of the LTDA Prototype System
- IaaS and LRM installation
- Tina's 3 Dec. 2010 presentation
- Tests

Long Term Advisory Committee [edit]

- LTDA Advisory Committee Meeting (June 1st, 2010)
- LTDA Advisory Committee Meeting Minutes (September 15th, 2010)

Rechercher : eof Précédent Suivant Surligner tout Respecter la casse

LTDA Developers Documentation

Environment
Operations
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LTDA Links
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Simulation Production
Particle ID
Event Reconstruction
Publications Board
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LTDA Documentation

FAQs

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Printable version
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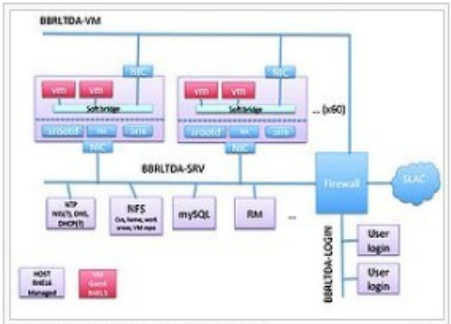

Design of the LTDA Prototype

LTDA Documentation [edit]

- File:Ltda v03.pdf - Douglas' CHEP2010 Presentation on the LTDA
- Archival Use Case Examples
- How to use the ltda prototype
- Publications:
  - In development: BAD 2237
    - also available at: version 17

Tasks [edit]

- Common Data Format
- Education and outreach efforts
- Documentation issues
- Virtualization issues

× Rechercher : eof ⇦ Précédent ⇨ Suivant Surligner tout Respecter la casse

Analysis Journaling

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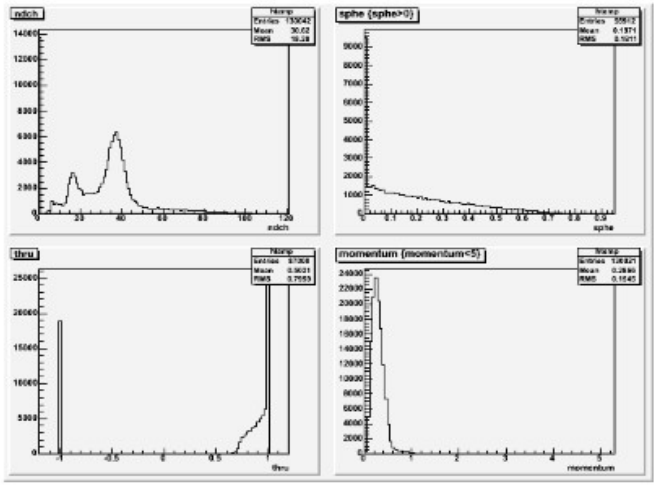
Physics analysis/Yns 1001

< Physics analysis

Search for $A^o \to \gamma\gamma$ from $\Upsilon(1S) \to \gamma A^o$ with $\Upsilon(2S) \to \pi^+\pi^-\Upsilon(1S)$



(Note: the plot above is for Y(2S)->pi+pi-Y(1S),Y(1S)->gamma A0(8.75), A0->invisible, it will soon be replace by A0->gamma gamma)

Contents [show]

Analysts [edit]

- Homer Neal
- Arafat Gabareen

Other documentation [edit]

Outstanding issues [edit]

- $A^o \to invisible$ and $A^o \to \tau\tau$ exist but no $A^o \to \gamma\gamma$
- starting with analysis-52 on the LTDA prototype and intend to migrate ti analysis-53 as soon as it is available
- plan to use viewpoints visualization to best means of isolating the signal
- working area is /home/homer/rel-24.5.7/workdir from the bbrltda login pool
- jobs are submitted using subq <collection>

```
[homer@bbrltda01 workdir]$ ssh homer@ltda-srv002 ls -l /u\?/store/SP/R24/009016/run7/24.2.1p/SP_009016_033703\*
lrwxrwxrwx 1 bbdatsrv br 41 Apr 14 07:43 /u1/store/SP/R24/009016/run7/24.2.1p/SP_009016_033703.01.root -> /u2/cache1/public/17/58E3A44D070000000086%
```

```
[homer@bbrltda01 workdir]$ subq /store/SP/R24/009016/run7/24.2.1p/SP_009016_033703
757.ltda-srv001.slac.stanford.edu
ltda-srv003
```

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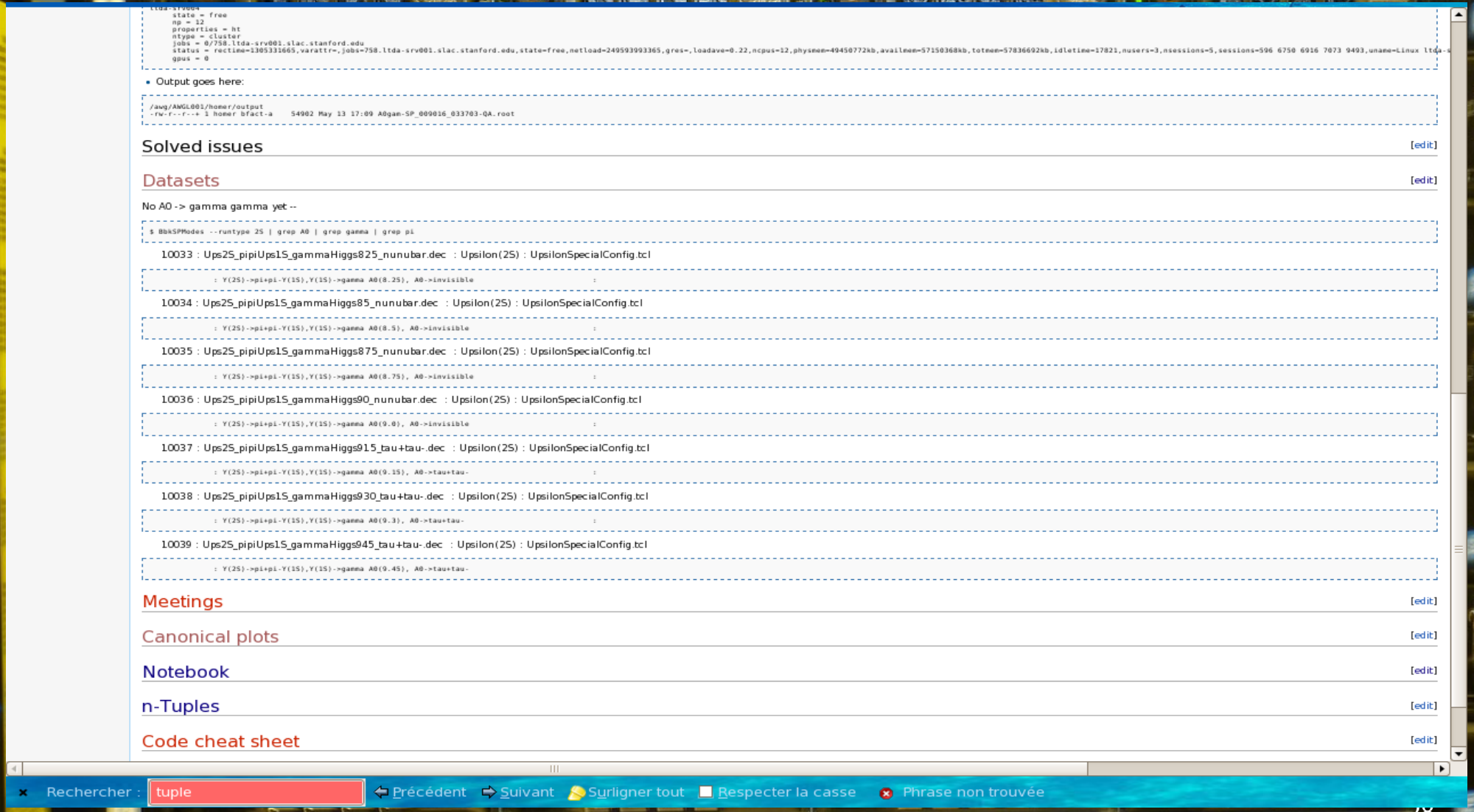
Analysis Journaling



```
     state = free
     np = 12
     properties = ht
     ntype = cluster
     jobs = 0/758.ltda-srv001.slac.stanford.edu
     status = rectime=1305331665,varattr=,jobs=758.ltda-srv001.slac.stanford.edu,state=free,netload=2495939933365,gres=,loadave=0.22,ncpus=12,physmem=49450772kb,availmem=57150368kb,totmem=57836692kb,idletime=17821,nusers=3,nsessions=5,sessions=596 6750 6916 7073 9493,uname=Linux ltda-s
     gpus = 0
```

- Output goes here:

```
/awg/ANGL001/homer/output
-rw-r--r--+ 1 homer bfact-a    54902 May 13 17:09 A0gam-SP_009016_033703-QA.root
```

Solved issues [edit]

Datasets [edit]

No A0 -> gamma gamma yet --

```
$ BbkSPModes --runtype 2S | grep A0 | grep gamma | grep pi
```

10033 : Ups2S_pipiUps1S_gammaHiggs825_nunubar.dec : Upsilon(2S) : UpsilonSpecialConfig.tcl

```
            : Y(2S)->pi+pi-Y(1S),Y(1S)->gamma A0(8.25), A0->invisible                    :
```

10034 : Ups2S_pipiUps1S_gammaHiggs85_nunubar.dec : Upsilon(2S) : UpsilonSpecialConfig.tcl

```
            : Y(2S)->pi+pi-Y(1S),Y(1S)->gamma A0(8.5), A0->invisible                     :
```

10035 : Ups2S_pipiUps1S_gammaHiggs875_nunubar.dec : Upsilon(2S) : UpsilonSpecialConfig.tcl

```
            : Y(2S)->pi+pi-Y(1S),Y(1S)->gamma A0(8.75), A0->invisible                    :
```

10036 : Ups2S_pipiUps1S_gammaHiggs90_nunubar.dec : Upsilon(2S) : UpsilonSpecialConfig.tcl

```
            : Y(2S)->pi+pi-Y(1S),Y(1S)->gamma A0(9.0), A0->invisible                     :
```

10037 : Ups2S_pipiUps1S_gammaHiggs915_tau+tau-.dec : Upsilon(2S) : UpsilonSpecialConfig.tcl

```
            : Y(2S)->pi+pi-Y(1S),Y(1S)->gamma A0(9.15), A0->tau+tau-                     :
```

10038 : Ups2S_pipiUps1S_gammaHiggs930_tau+tau-.dec : Upsilon(2S) : UpsilonSpecialConfig.tcl

```
            : Y(2S)->pi+pi-Y(1S),Y(1S)->gamma A0(9.3), A0->tau+tau-                      :
```

10039 : Ups2S_pipiUps1S_gammaHiggs945_tau+tau-.dec : Upsilon(2S) : UpsilonSpecialConfig.tcl

```
            : Y(2S)->pi+pi-Y(1S),Y(1S)->gamma A0(9.45), A0->tau+tau-
```

Meetings [edit]

Canonical plots [edit]

Notebook [edit]

n-Tuples [edit]

Code cheat sheet [edit]

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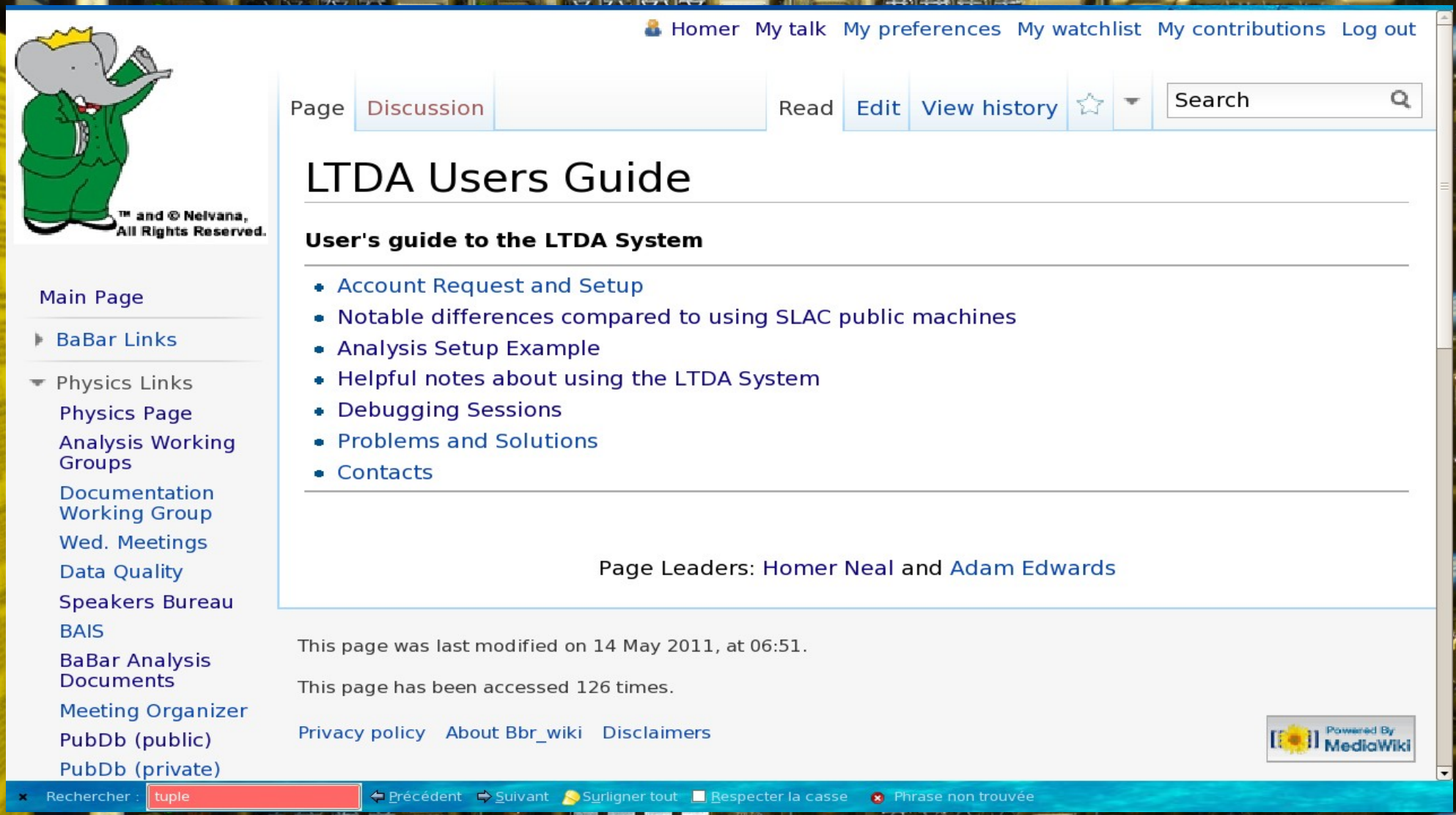
User's Guide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Lessons learned … so far ...

- Easy to get trapped in unexpected details (security!)

- Beware of unexpected costs (licenses!)
- Complete independence from the existing computing infrastructure is difficult to achieve and not necessarily desirable.
- Storage costs are not negligeable
- No twisting of arms needed to get experts to voluntarily contribute

Data storage on worker nodes

```
$ egrep "^Size|Level" ltda-srv00*/megaraid
ltda-srv001/megaraid:RAID Level        : Primary-1, Secondary-0, RAID Level Qualifier-0
ltda-srv001/megaraid:Size              : 136.125 GB
ltda-srv001/megaraid:RAID Level        : Primary-5, Secondary-0, RAID Level Qualifier-3
ltda-srv001/megaraid:Size              : 18.188 TB
ltda-srv002/megaraid:RAID Level        : Primary-1, Secondary-0, RAID Level Qualifier-0
ltda-srv002/megaraid:Size              : 136.125 GB
ltda-srv002/megaraid:RAID Level        : Primary-6, Secondary-0, RAID Level Qualifier-3
ltda-srv002/megaraid:Size              : 16.369 TB
ltda-srv003/megaraid:RAID Level        : Primary-1, Secondary-0, RAID Level Qualifier-0
ltda-srv003/megaraid:Size              : 136.125 GB
ltda-srv003/megaraid:RAID Level        : Primary-0, Secondary-0, RAID Level Qualifier-0
ltda-srv003/megaraid:Size              : 1.818 TB
ltda-srv003/megaraid:RAID Level        : Primary-0, Secondary-0, RAID Level Qualifier-0
ltda-srv003/megaraid:Size              : 1.818 TB
ltda-srv003/megaraid:RAID Level        : Primary-0, Secondary-0, RAID Level Qualifier-0
ltda-srv003/megaraid:Size              : 1.818 TB
ltda-srv003/megaraid:RAID Level        : Primary-0, Secondary-0, RAID Level Qualifier-0
ltda-srv003/megaraid:Size              : 1.818 TB
ltda-srv003/megaraid:RAID Level        : Primary-0, Secondary-0, RAID Level Qualifier-0
ltda-srv003/megaraid:Size              : 1.818 TB
ltda-srv003/megaraid:RAID Level        : Primary-0, Secondary-0, RAID Level Qualifier-0
ltda-srv003/megaraid:Size              : 1.818 TB
ltda-srv003/megaraid:RAID Level        : Primary-0, Secondary-0, RAID Level Qualifier-0
ltda-srv003/megaraid:Size              : 1.818 TB
ltda-srv003/megaraid:RAID Level        : Primary-0, Secondary-0, RAID Level Qualifier-0
ltda-srv003/megaraid:Size              : 1.818 TB
ltda-srv003/megaraid:RAID Level        : Primary-0, Secondary-0, RAID Level Qualifier-0
ltda-srv003/megaraid:Size              : 1.818 TB
ltda-srv003/megaraid:RAID Level        : Primary-0, Secondary-0, RAID Level Qualifier-0
ltda-srv003/megaraid:Size              : 1.818 TB
ltda-srv003/megaraid:RAID Level        : Primary-0, Secondary-0, RAID Level Qualifier-0
ltda-srv003/megaraid:Size              : 1.818 TB
ltda-srv004/megaraid:RAID Level: Primary-1, Secondary-0, RAID Level Qualifier-0
ltda-srv004/megaraid:Size:139392MB
```