Hall A Simulation & Analysis

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Jefferson Lab

IT for the 12 GeV Era – Internal Review
May 20, 2011

Hall A 12 GeV Experiments Overview

Current *very* tentative schedule

Experiment	APEX	A_1^n	G_M^n	"SBS"			
				G_E^n	G_M^n	$G_E^p(5)$	Transv
PAC number 12-	10-009	06-122	07-108	09-016	09-019	07-109	09-018
Config	L+R(CI)	L+R(SA)	BB+L(SA)	BBG+ND	BBG+ND	SBS+BC	SBS+BB
PAC days	34	23	31	58	48	60	64
Schedule(?)		– 2014/2015 –			– 2016/2017 –		
Evt size (kB)	4	4	4	30	20	120	5
Trig rate (kHz)	5	10	0.1	2	2	1	5
Data rate (MB/s)	20	40	0.4	60	40	120	25

Experiment	Møller	DVCS	Hypernucl	SOLID	
				SIDIS	PVDIS
PAC number 12-	09-005	06-114	10-001	10-006	10-007
Config	toroid	L+γCal	HKS(?)	– solenoid –	
PAC days	253	88	42	90	225
Schedule(?)	2018/19	– 2020 –		– 2021/2022 –	
Evt size (kB)	15	30	2	4	1
Trig rate (kHz)	2	0.5	0.1	55	500
Data rate (MB/s)	30	15	0.2	220	500

L: L-HRS, R: R-RHS, BB: BigBite, BBG: BB(GEM), ND: neutron det, SBS: SuperBigBite, BC: BigCal, CI: coinc., SA: sing. arm

Calibration, Data Quality Checks, Prompt Analysis

- Approach
  - Done on adaq cluster in Hall A counting house
  - Raw data stored on local disks $\rightarrow$ no MSS/cache bandwidth required for calibration replay
- Resources
  - 12 dedicated CPU cores $\rightarrow$ 64 cores by FY15
  - 1.5 + 6 TB local disk $\rightarrow$ 15 + 60 TB by FY15, 30 + 120 TB by FY18 to hold $\approx$ 10% of raw/analyzed data
  - Funding out of Hall A operations
  - Might need some IT support to install/maintain (*e.g.* system backups)

Simulation

- Typically low-volume
- Done off-site or on non-farm user computers
- We anticipate this mode of operation to continue in the 12 GeV era

Analysis — Software, Workflow

- Hall A analyzer ("Podd"), in production use since 2003
  - C++/ROOT-based
  - Highly modular. Many experiments write custom modules for their special requirements
  - Supported on Linux, Solaris (deprecated), Mac OS X (in development)
  - Fully 64-bit compatible (tested)
  - Main limitation: not automatically parallel $\rightarrow$ implement full parallelization by FY13
  - Performs "Reconstruction" $\rightarrow$ farm
  - Physics "Analysis" typically done interactively on desktops using ROOT
- Custom software
  - Parity experiments
  - DVCS (partly)
  - Completely user-supported

Analysis — Computing Requirements

Anticipated SciComp resources

	2011 DVCS/SRC	2012 g2p	2013 DOWN	2014 COMISS	2015 HRS/BB	2016 SBS-I	2017 SBS-II	2018 Møller
Time per event/core (ms)	10	5	5	5	20	40	60	12
Passes through data	3	3	1	2	3	3	3	4
Output size/input size	1	1	1	2	1	1	1	4
Years to analyze	3	3	1	1	3	3	3	3
Replay duty factor	50%	50%	50%	50%	50%	75%	75%	75%
Output held on work disk	10%	10%	10%	20%	20%	20%	10%	10%
CPU time per year (s)	4.3e7	1.9e8	1.9e8	1.8e8	6.6e8	1.4e9	2.0e9	1.6e9
Dedicated farm cores	3	12	12	12	42	60	84	65
Cooked data to tape (TB)	129	245	245	174	132	510	1641	2642
Work disk storage (TB)	13	25	25	23	26	102	215	302
Avg bandwidth (MB/s)	16	31	31	20	17	43	139	187
Totals								
Farm cores (2011 vintage)	3	12	12	12	42	60	84	65
New cores each year	0	9	0	0	30	18	24	0
Raw+cooked to tape (PB)	.26	.36	.25	.19	.26	.89	2.77	2.92
Disk storage (TB)	13	25	25	23	26	102	215	302
Storage bandwidth (MB/s)	25	41	31	23	34	67	211	205

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Analysis — Computing Requirements (cont.)

- Open questions
  - Write duplicate of raw data to tape?
    - ★ Yes for smaller experiments (*e.g.* < 200 TB/yr)?
    - ★ No/selected data only for large experiments (SBS, Møller, SOLID)?
  - Can DST size be reduced for certain experiments? Factors of 3–4 seem excessive.
  - Do all replay passes need to be written to tape? Probably not $\rightarrow$ reduction of tape requirements; recycling
  - Schedule very much subject to funding (both lab-wide and experiment-specific). Presented numbers assume optimistic scenario, could be lower if large installations delayed.
- Long-term outlook
  - SOLID experiments will need a dedicated L3 trigger farm (after 2019)

Other Requirements

- Application software
  - ROOT
  - C++ development environment
  - CVS, svn, accessible from offsite
- MySQL databases
  - Few 100 GB
  - Accessible/synchronizable from offsite

Management & Manpower

- Online coordinator: Alexandre Camsonne
- Offline coordinator: OH
- Software development
  - "Podd": lead by Hall A staff (OH)
  - User contributions
  - Specialized software written & maintained by respective experiments
  - Coordinated via annual Hall A Analysis Workshop
- Adequate manpower is a challenge (both for online & offline)
  - Collaborate with other halls, DAQ group, users
  - New hires (postdoc/staff)