SBS A_{LL} Data Volume & Computing Resources

Ole Hansen

Jefferson Lab

SBS A_{LL} Experimental Readiness Review
May 18, 2022

Event Size Estimate

SBS A_LL: Event size details

Detector	Type	# modules	chan/module u/x	chan/module v/y	Occupancy u/x (%)	Occupancy v/y (%)	Samples per chan	Total active chan/event	Data size (kB)
			From Eric's latest "with addt'l shielding" simulations 5/17/22						
BB GEM 1	UVA uv	1	3840	3840	17%	22%	6	1498	18
BB GEM 2	UVA uv	1	3840	3840	30%	36%	6	2534	30
BB GEM 3	UVA uv	1	3840	3840	24%	28%	6	1997	24
BB GEM 5	UVA uv	1	3840	3840	34%	40%	6	2842	34
BB GEM 5	UVA xy	4	1280	1536	18%	15%	6	1843	22
SBS GEM 1	INFN xy	3	1280	1024	26%	22%	6	1674	20
SBS GEM 2	INFN xy	3	1280	1024	31%	26%	6	1989	24
SBS GEM 3	UVA xy	4	1280	1536	34%	28%	6	3461	42
SBS GEM 4	UVA xy	4	1280	1536	37%	31%	6	3799	46
SBS GEM 5	UVA xy	4	1280	1536	39%	32%	6	3963	48
SBS GEM 6	UVA xy	4	1280	1536	40%	34%	6	4137	50
SBS GEM 7	UVA xy	4	1280	1536	42%	35%	6	4301	52
SBS GEM 8	UVA xy	4	1280	1536	43%	36%	6	4413	53
SBS HCAL		1	288		16%		40	46	4
BB Shower & Preshower		1	243		22%		25	53	3
GRINCH/other		1	750		10%		1	75	1
							Total event size estimate		469

NB: Not all SBS GEM layers may be needed (under discussion) → event size may be smaller

Computing Resources Estimate

Estimated data taking time (wall time)	hours	196
Accelerator uptime		50%
Event rate	kHz	4.5
Event size	kB	469
Raw events	10^6	1588
Beam-on raw data rate	MB/s	2111
Average raw data rate to tape	MB/s	1056
Raw data to tape	**TB**	**745**
Raw data skimming reduction factor		5
Simulated events per raw event		10%
Simulation time per event per core	ms	500
Time to analyze one event per core	ms	150
Number of passes though data		3
Production data reduction factor		20
Simulation CPU requirement	k-core-hours	22
Production CPU requirement	k-core-hours	198
Total CPU for current experiment	**k-core-hours**	**221**
Simulation percentage		10%
Skimmed raw data to tape	TB	149
Simulated data to tape	TB	74
Production data to tape	TB	112
Total data to tape (raw+sim+production)	**TB**	**1080**

Notes
Core = AMD EPYC 7502 2.5 GHz
Raw data does not include duplicates (backups)

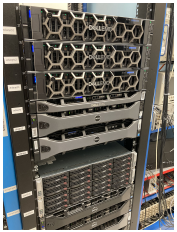
- Trigger rate (4.5 kHz) is limited by DAQ frontend readout speed. Will adjust beam current and/or trigger thresholds to set.
- Considering first-pass event skimming to reduce raw data volume for subsequent analyses.
- Simulation requirements are rough estimates. Simulations will be run as needed and are not expected to be crucial for analysis.
- "Time to analyze one event per core" derived from experience with last fall's SBS-GMn run.

SBS DAQ & Online Computing

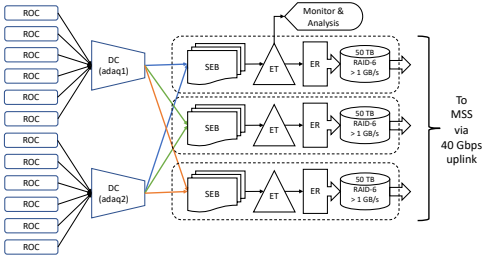
- New high-performance event builder hosts, demonstrated $\approx$ **1 GB/s** to disk per node.
- Planning to use CODA3's scalable event stream parallelization to achieve up to $\approx$ **3 GB/s.**

- Online replay on aonlX systems (128 threads). Planning to procure additional nodes this summer for 2–3$\times$ higher throughput
- GMn has developed scripts for launching massive parallel online analysis ($\mathcal{O}(100)$ jobs).
- GMn was typically able to keep up with incoming data.

New CODA Event Builder Machines



Full SBS DAQ Configuration



Summary

- Main challenges: high raw data rate & volume.
  - Expect $\approx$ 2.1 GB/s to disk. Existing infrastructure supports up to 3 GB/s based on experience with GMn.
  - Average rate to MSS/tape expected slightly above 1.0 GB/s.
  - Total tape volume requirement $\approx$ 1.1 PB (without raw data duplicates).
- Farm CPU requirements are modest. Entire data set can be processed in a single day, using only a fraction of the farm ($\approx$ 2800 cores).
  - Bottleneck will be restoring raw data from tape.
- Disk requirements (1st pass): 60 TB `/cache` + 50 TB `/volatile`.
  - Considering first-pass event skimming to reduce input data set size and speed up subsequent analysis passes.