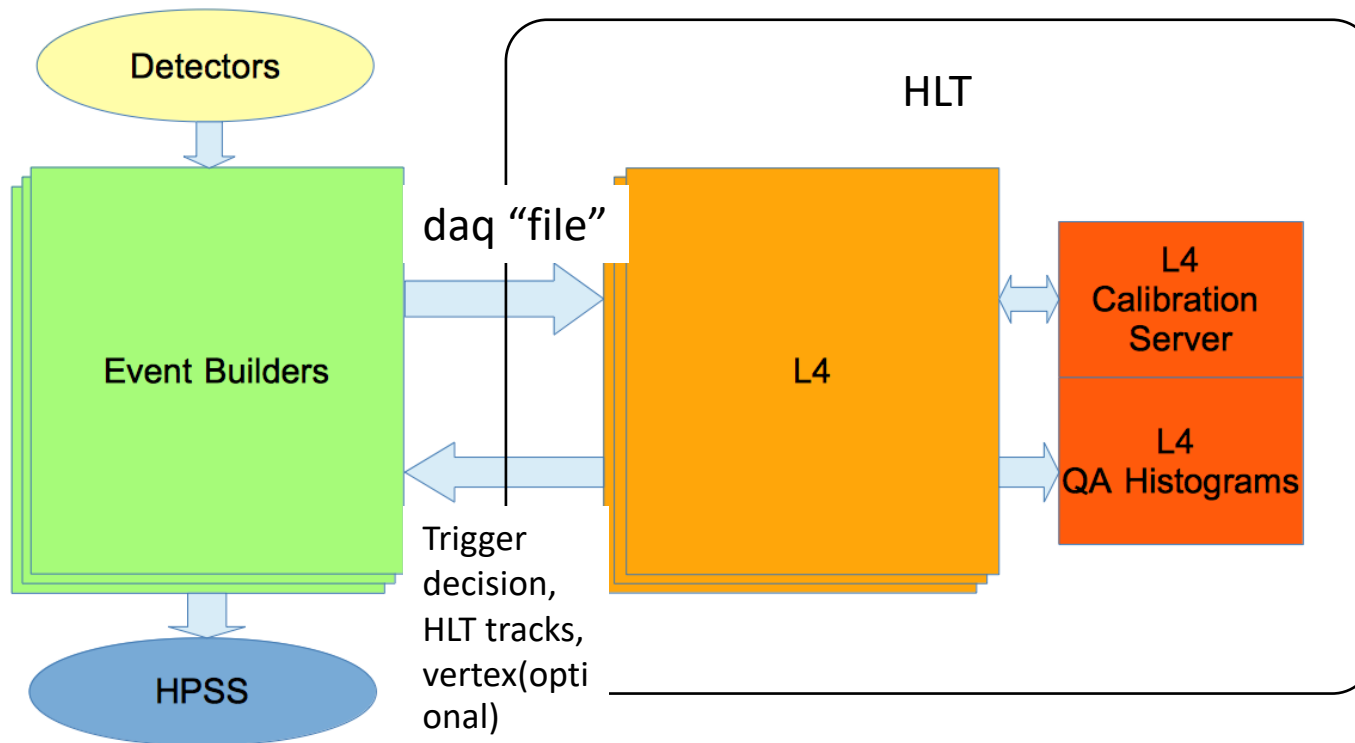


HLT for the Forward Upgrade

Hongwei Ke

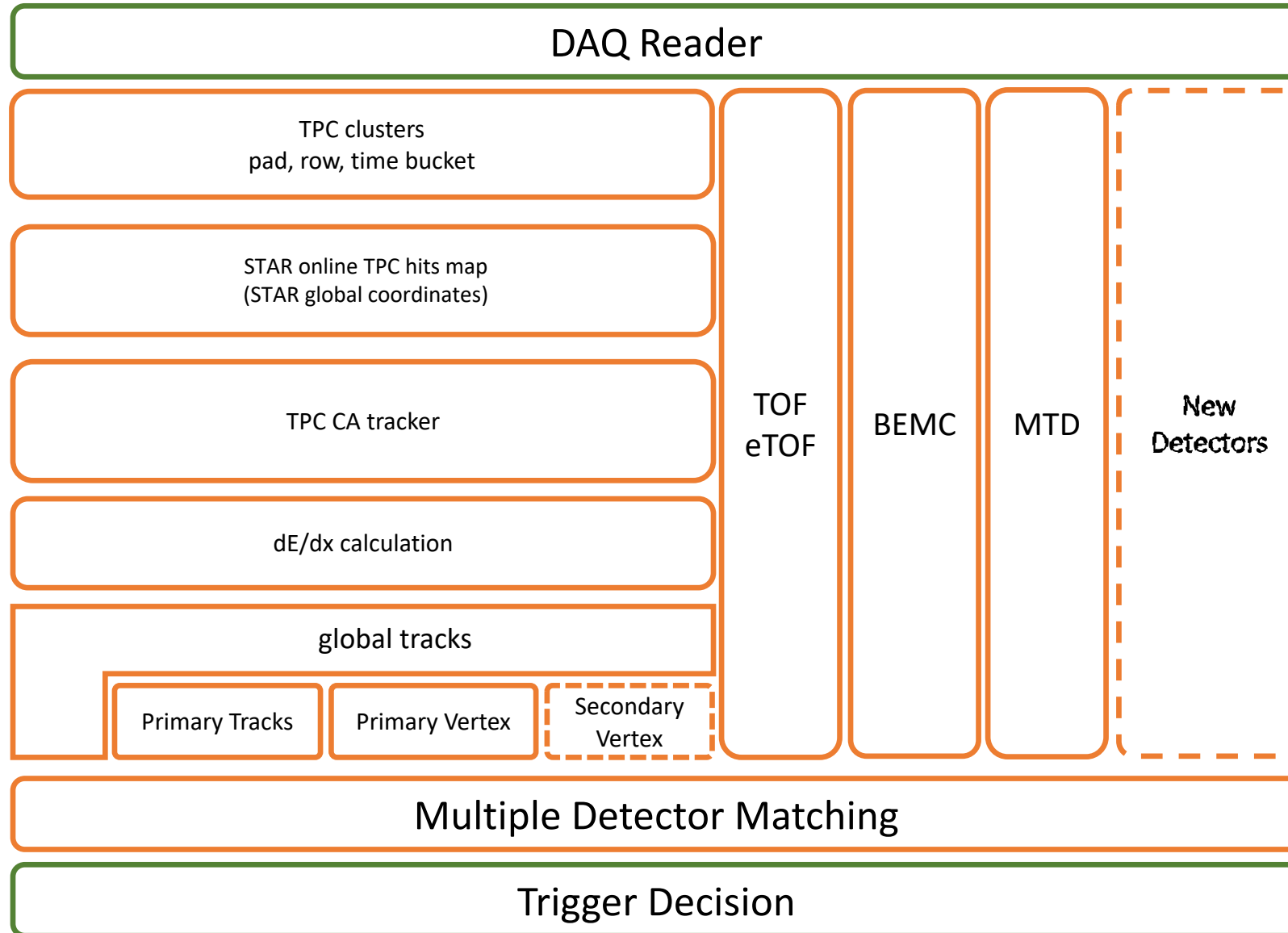
BNL

STAR HLT Integration with DAQ



- HLT is a software layer between trigger system and HPSS
 - Event tagging
 - Event selection
- Real-time event Reconstruction
 - TPC tracks, vertex
 - TOF, eTOF, BEMC matching
 - Physics algorithms:
 - Heavy fregments, He
 - J/psi
 - ...
- Process all mini-bias events in all heavy ion collisions and a few pp collision experiments

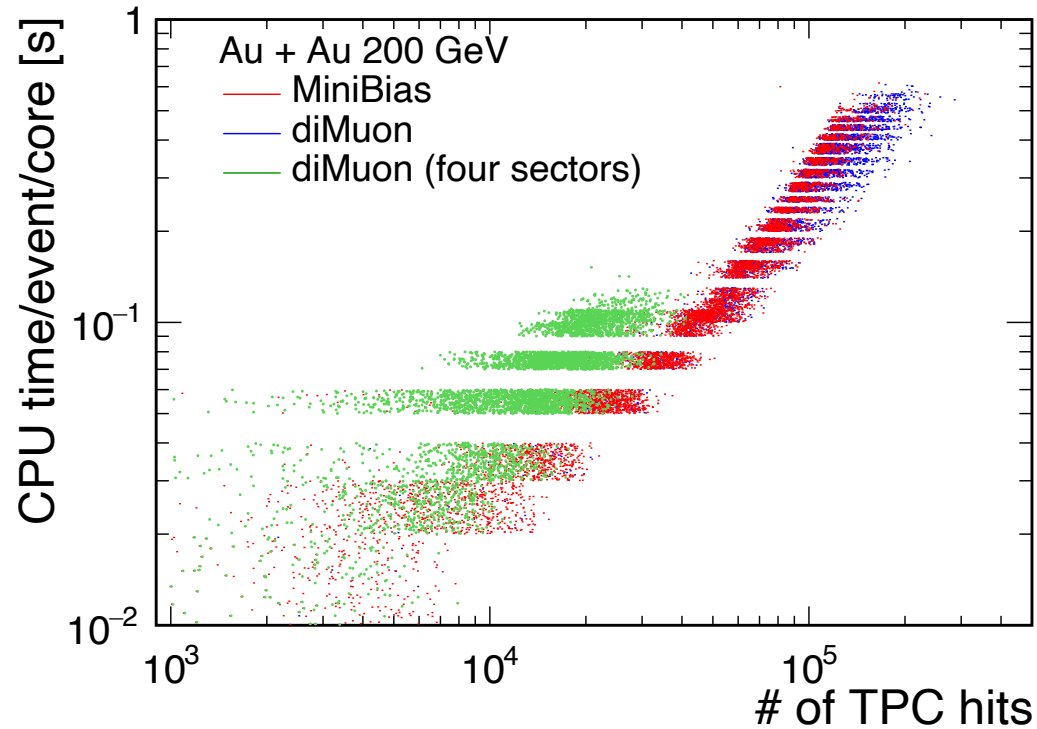
Conceptual Software Components



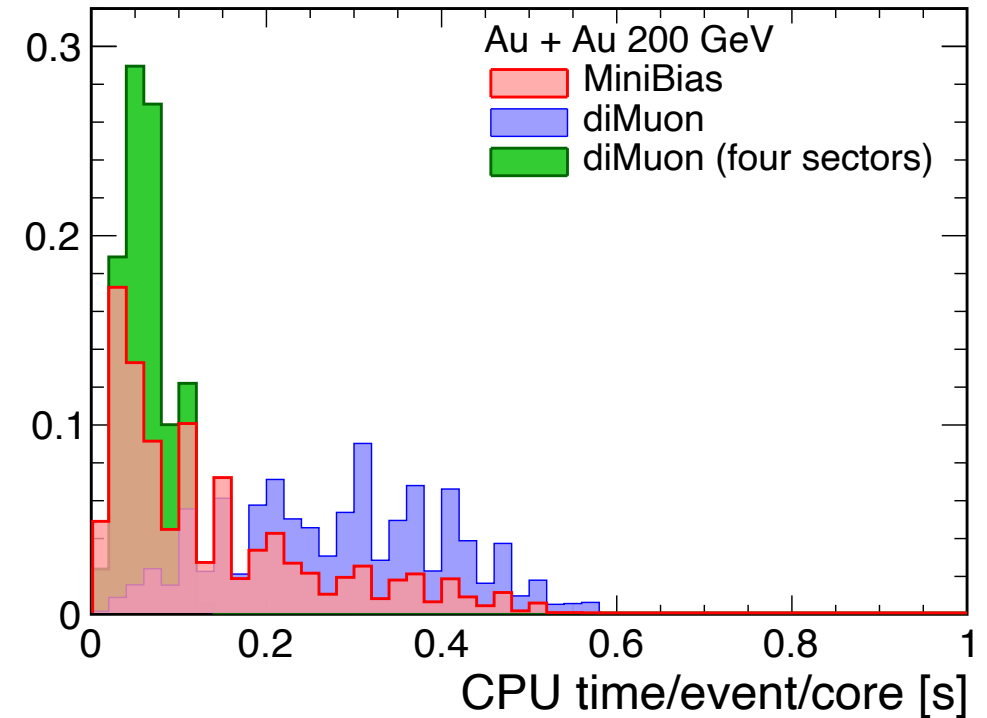
Features and Limitations

- Full access to daq events
- Full TPC, TOF, eTOF, MTD and BEMC reconstruction
- Can do multiple detector matching
- Do not use StRoot
- Use tables/files instead of DB
- Need be thread safe
 - Multithreading environment
- Prefer minimal external dependency
- Xeon Phi co-processors available for CPU intensive tasks

HLT Software Performance



Run 14 Au+Au 200GeV



MB: $\langle \text{time/event/core} \rangle = 0.140910 \text{ s}$
dimuon: $\langle \text{time/event/core} \rangle = 0.280611 \text{ s}$
diMuon partial: $\langle \text{time/event/core} \rangle = 0.065963 \text{ s}$

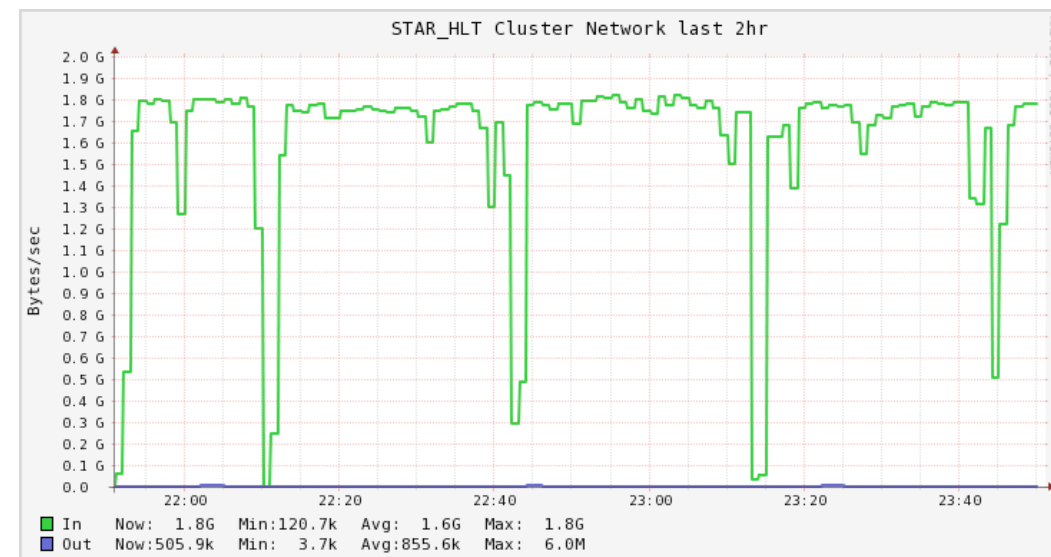
iTPC increases the processing time, within 2x?

HLT Computing resources

- 22 Nodes available for event reconstruction
 - 512 physical cores
 - 1024 hyper threading
- 120TB distributed storage as local buffer

HLT in year 2016 (almost the highest data volume)

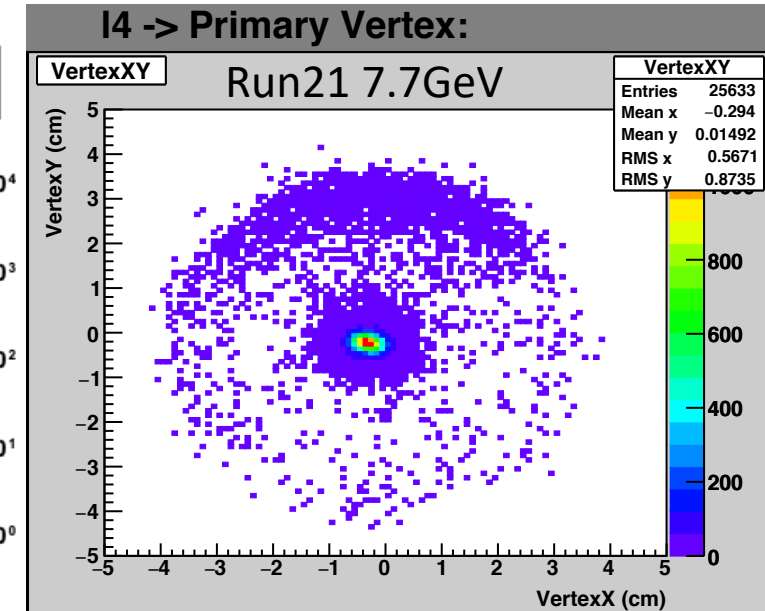
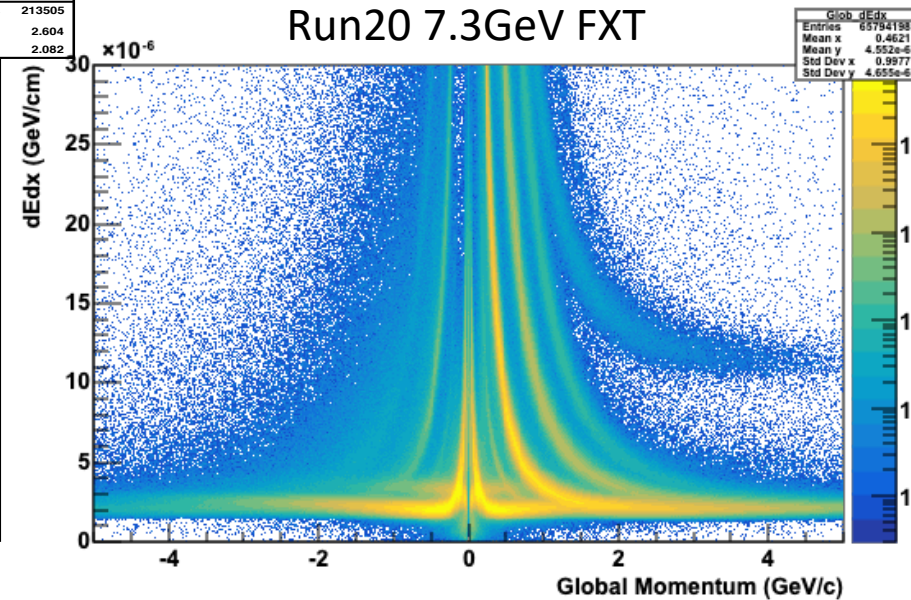
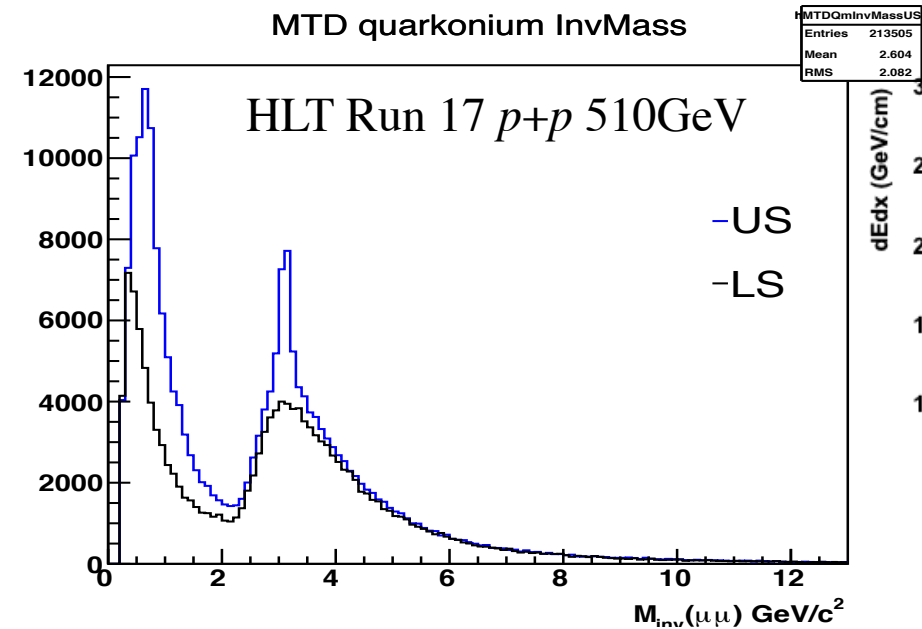
- HLT process almost all of the data taking by DAQ at 1700+Hz, 1.7+GB/s input data
- ~1000Hz Mini-Bias
- ~700Hz MTD (tracking 6-8 sectors)
- ~40% CPU load



Det	State	Dead	CPU	Evts	Evts In	Hz	MB/s EVB	Err	MB/s RDO
TOF	RUNNING	10 %	15 %	459762	1	1777	21.6	1	21
BTOW	RUNNING	4 %	14 %	459634	0	1784	17.5	2	17
Trigger	RUNNING	0 %	-1 %	601598	-16787624	2277	16.9	0	0
ETOW	READY	0 %	0 %	171381	0	0	0.0	0	0
BSMD	RUNNING	5 %	18 %	33505	0	150	1.0	0	11
ESMD	READY	0 %	0 %	0	0	0	0.0	0	0
TPX	RUNNING	21 %	77 %	460336	22	1795	1346.5	5	15115
PXL	RUNNING	5 %	17 %	318562	0	1285	215.7	1	215
MTD	RUNNING	4 %	14 %	459288	0	1777	1.7	2	2
IST	RUNNING	6 %	77 %	318082	0	1245	25.9	0	930
SST	RUNNING	35 %	14 %	279764	0	1136	17.3	1	17
GMT	RUNNING	7 %	15 %	217682	0	851	20.6	1	20
L4	RUNNING	0 %	41 %	-1/418755	302	1685	1725.5	0	2067

Examples of Physical Quantities

- Real-time QA (L4 QA)
- Event selection



Summary

- STAR HLT can reconstruct all events at real-time
- Produce physical quantities for event selection and QA
- STAR HLT can be extended to include new detectors