

Discussion on the upgrade roadmap before PXD2020 installation (DAQ side)

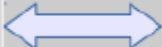







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Upgrade plan in DAQ

- The major upgrade is the replacement of COPPER readout with new readout card.
- The decision of new readout card is supposed to be made by the end of October B2GM.
- After the decision, the production of cards will be started and they will be ready to be installed hopefully in the summer 2020.
- A pre-defined upgrade schedule is there proposed by the upgrade committee.
- Does it match with the Belle II global schedule?

Replacement timescale

- In the course of discussion and evaluation it became vital to clarify the timescale that is being considered

Year	2018	2018	2018-2020	2020	2020	2021	2021	2022	2022	2023
Month	Jul.16	Oct.31	Apr/18 Mar/20	Apr.	July-Sep.	Jan.	July-Sep.	Jan.	July-Sep.	Jan.
	Proposal deadline	Decision								
Proto typing				<div>Could be shortened depending on budgetary situation and integration results</div>						
Mass Produc- tion										
COPPER- replacem ent					repl. 1	spare	repl. 2	spare	repl. 3	spare
										
Comment		Multiple candi- dates may be chosen?	test with pocket DAQ	<div>- COPPERs are replaced detector by detector during summer shutdown period in 2020, 2021, and 2022. - Short winter shutdown might be utilized for additional work.</div>						

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- Current Belle II schedule in coming years is mostly determined by the installation schedule of PXD2020.
- The original plan was to have a long shutdown in 2020 summer, but because of the delay in the PXD production, it has been deferred to 2021 summer.
 - > We have a long shutdown in 2021 summer.
- How do we utilize 2020 and 2021 summer shutdown?
- In the proposed plan, the upgrade is supposed to be done subsystem by subsystem in consecutive 3 years.
- But the card production could be better to be done at one time to reduce the production cost.
 - > Possibility of one-time upgrade. Too dangerous?

Upgrade possibility of other subsystems

- The data flow and slow control software have to be updated to handle new readout card.
where the number of optical links/card is increased from 4 to 48 (or so).
- Readout driver is now being designed to be compatible with that used for COPPERs, however, the slow control software may requires a drastic change to manage the increased number of links (as suggested by Oskar).
- Backend:
 - * Event builder 1 upgrade to handle new readout PCs.
 - * **HLT framework will be upgraded to ZMQ from fall run.**
 - * ERECO may follow by looking at the performance of ZMQHLT.
 - * Other upgrades? (Like ZMQ-based data flow / DQM histogram transfer / everywhere replacing Linux socket?)
- Slow control
 - * Config. DB, ELK, MESOS/AURORA,

- It is nice to adopt up-to-date technology in our DAQ and young people (like Oskar) tend to run for such technology as fast as possible! The readout upgrade could be a good chance for such a drastic upgrade.
- But elder people (like me) think, it is dangerous to replace/upgrade all these components at one time. Gradual upgrade/improvement is more realistic.
 - * From management side, we need to worry for the long term system maintenance, which includes the technology transfer, man power allocation, etc.
- The basics of DAQ management is “to leave untouched for well working components” (My opinion after 30 years experience).
 - > The Belle II DAQ has a modular structure and working elements should be kept untouched unless there is a strong reason to replace/upgrade (**necessity-basis upgrade**).
 - > Module based upgrade by keeping outside interface the same as before.

* Evaluation of “upgrade necessity” is essential before we go for the new technology.

Example of Evaluation : HLT upgrade

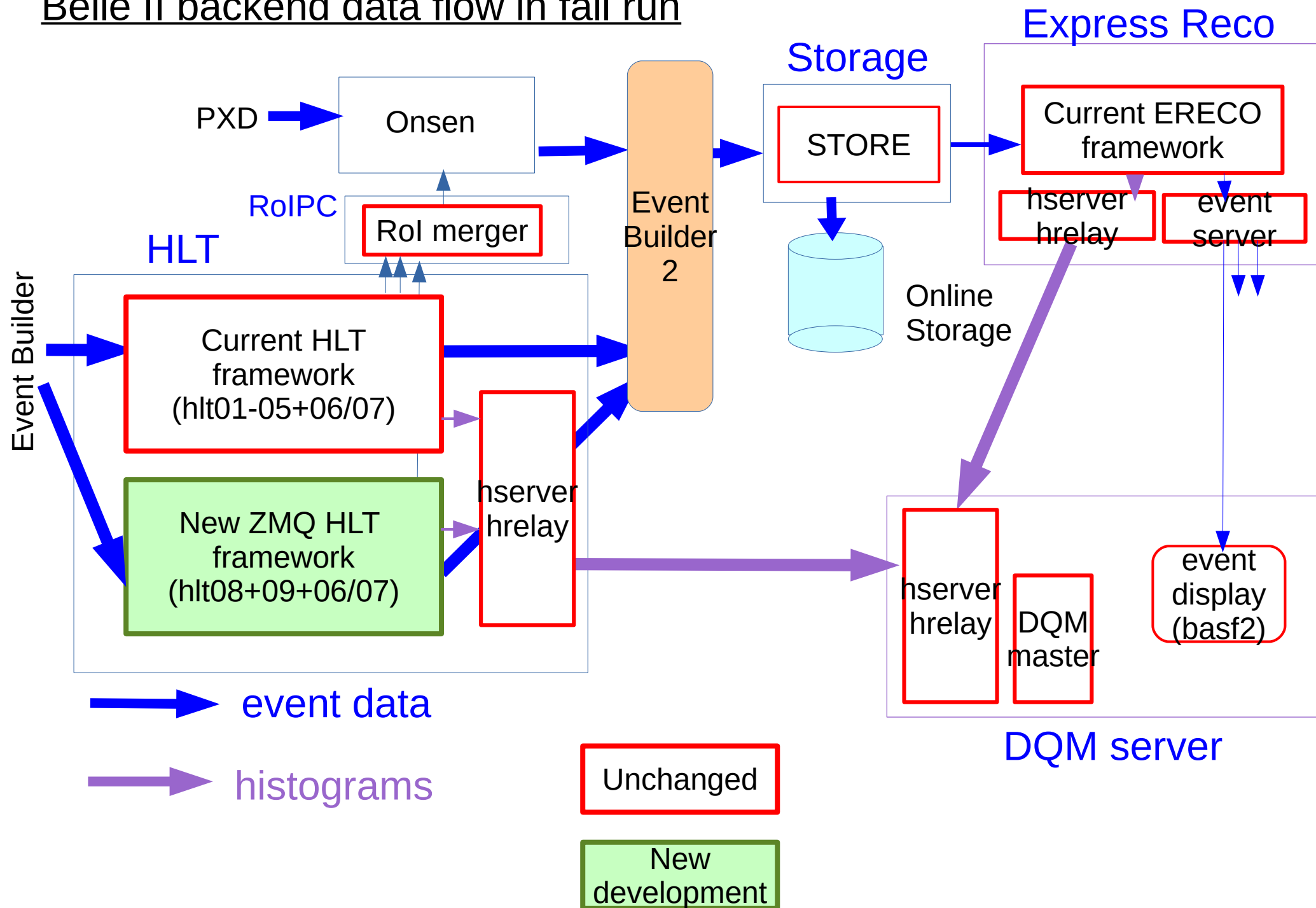
Grading of components inside previous HLT framework (RFARM)

Component	Current HLT (RFARM)	Grading in Phase 3	Remark
Data transport	RingBuffer+ socket	△	dead lock at ABORT
Processing basf2	the same offline basf2	△	Long initialization
Message logging	pipe + socket	○	working stably
System control	Own scheme + native NSM	○	working stably worry for long term maintenance
Configuration management	Own config file	○	working stably worry for long term maintenance
DQM	DQMHistomanager +hserver/hrelay	○	working stably
RoI transport	Object embedded in data stream	△	missing events Trouble in RingBuffer

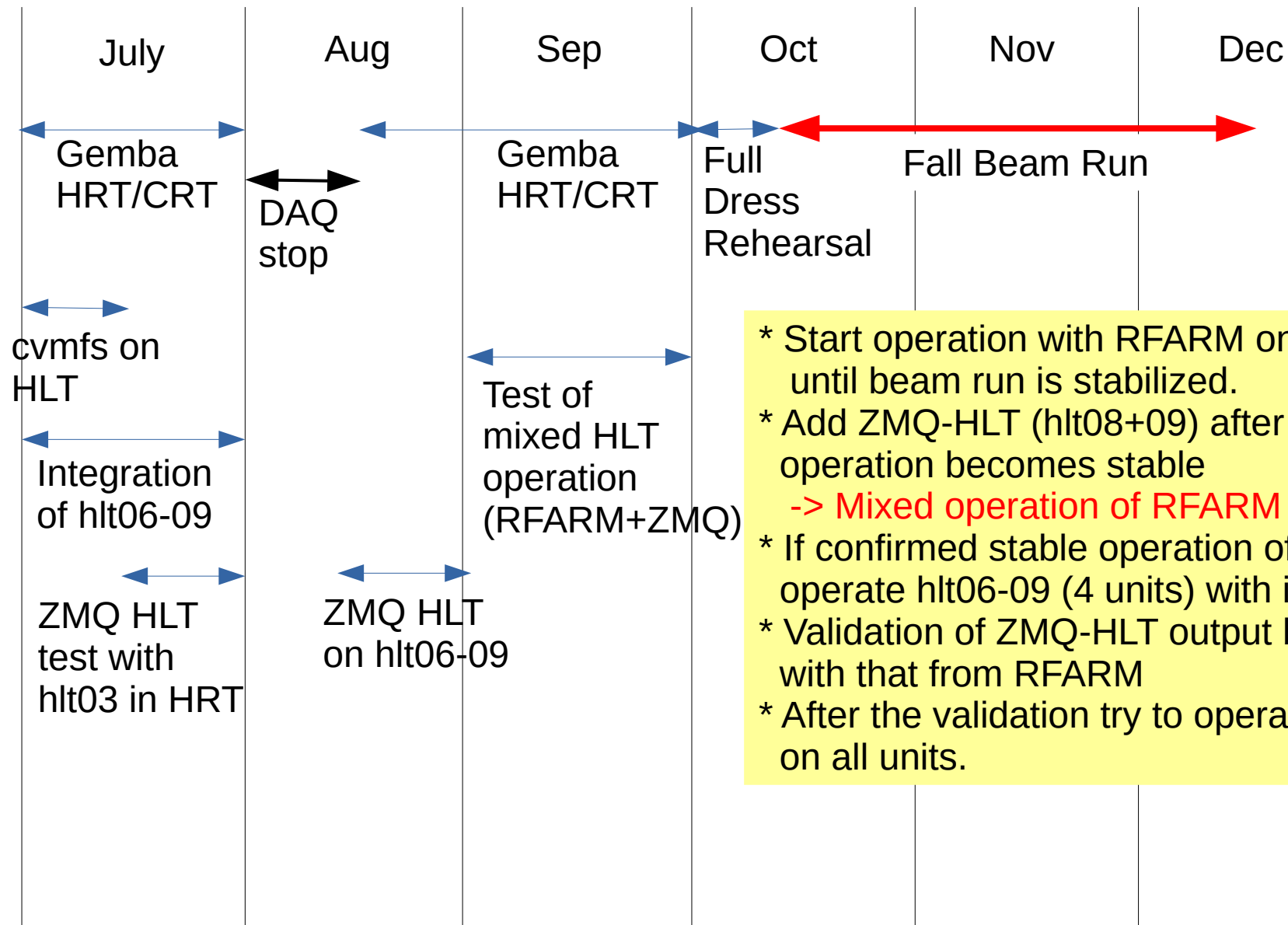
Actual deployment of ZMQ HLT

Component	Current HLT	Original ZMQ HLT	Deployment in B2 HLT	Remark
Data transport	RingBuffer+socket	ZeroMQ	Yes	Should be stable Maintenance free Load Balancing?
Processing basf2	the same offline basf2	variant of basf2 specialized for HLT	Yes	Fast startup Compatibility with offline basf2 is kept at module level only?
Message logging	pipe + socket	pipe+socket	Yes	Compatible with daq_slc
System control	Own scheme + native NSM	daq_slc	Yes	Consistent maintenance
Configuration management	Own config file	daq_slc	Yes	Consistent maintenance
DQM	DQMHistomanager +hserver/hrelay	ZeroMQ+ TMemFile	internally yes externally with hrelay/hserver	Compatibiltiy with external I/F is kept
RoI transport	Object embedded in data stream	RoI binary embedded in ZMQ message	Yes	proven to work stably no event lost

Belle II backend data flow in fall run



Timeline of ZMQ-HLT deployment



- * Start operation with RFARM only (hlt01-05) until beam run is stabilized.
- * Add ZMQ-HLT (hlt08+09) after the operation becomes stable
-> **Mixed operation of RFARM and ZMQ**
- * If confirmed stable operation of ZMQ-HLT, operate hlt06-09 (4 units) with it.
- * Validation of ZMQ-HLT output by comparing with that from RFARM
- * After the validation try to operate ZMQ-HLT on all units.

Slow control upgrade (longer term) : Example

- ELK and MESOS/AURORA
 - * Elastic logging system could be useful for the fast debugging of troubles.
 - * MESOS/AURORA could be useful for the system recovery after power outage, for example.
- Can we allocate enough man power skilled in such advanced technology? (Nils is leaving now.....)
- Need to revisit the evaluation of necessity and maintenance resource before we decide.