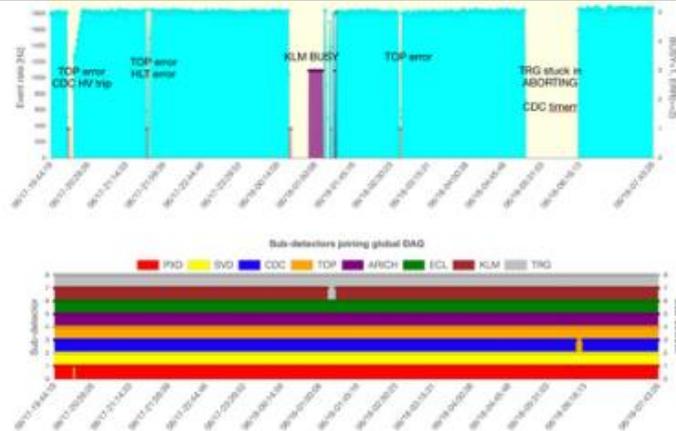


DAQ TROUBLES IN THE PHASE III

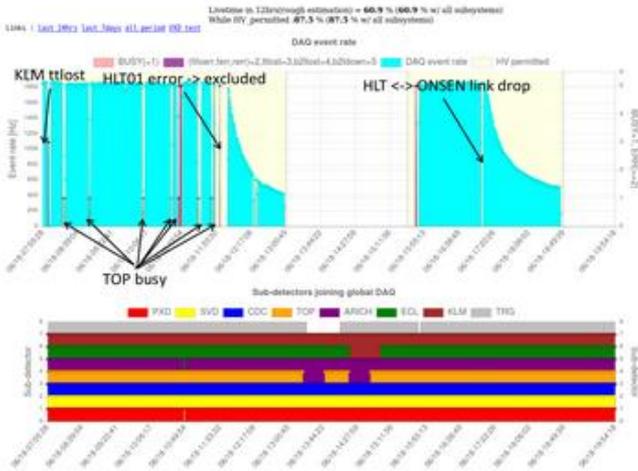
S. Yamada (KEK)

Monitoring livetime ratio in every shift during phase III



seokhee.park 8:15 PM

Screenshot from 2019-06-18 20-15-15.png



- DAQ expert shifters report downtime and its causes in every shift to make people keep in their mind about what are the current main causes of downtime.

DAQ troubles of each subsystem

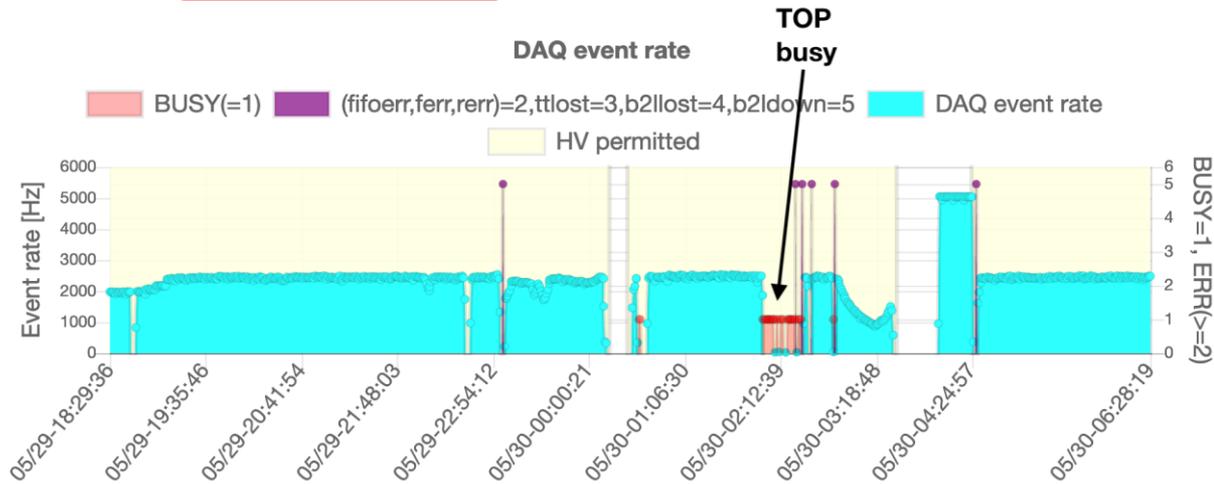
Sub-systems	
PXD	<ul style="list-style-type: none">➤ Testing new firmware -> Seems to be stable after May 28➤ No data comes from some module (ASIC state machine stuck?) -> workaround : increase the injection veto length
SVD	<ul style="list-style-type: none">➤ Basically stable.
CDC	<ul style="list-style-type: none">➤ Belle2link in some links are unstable. (Data corruption in idle patter, b2llost)➤ Strange data which caused unpacker error in HLT➤ Sometimes, FEE reprogramming is needed. 7 FEEs out of 299 are masked due to frequent errors.
TOP	<ul style="list-style-type: none">➤ Event # jump sometimes happens related with b.g. burst.➤ TOP firmware experts are working to fix the problem.
ARICH	<ul style="list-style-type: none">➤ Basically stable.
ECL	<ul style="list-style-type: none">➤ FEE sometimes stop sending data. It happens when waveform is attached in data. It needs experts' help to restart data-taking. FW experts are investigating.
KLM	<ul style="list-style-type: none">➤ Basically stable.
TRG	<ul style="list-style-type: none">➤ Firmware/software update is going on.➤ Situation changes time-to-time, but seems not stable sometimes.
Backend DAQ	<ul style="list-style-type: none">➤ COPPER(CDC, TOP, KLM) CPU freezes sometimes.➤ HLT/STORAGE states remains ABORTING/LOADING <p>-> improved a lot by HLT experts.</p>
Slow control system	<ul style="list-style-type: none">➤ SLC/NSM daemon died sometimes.➤ PCs for CR shifters becomes heavy.

A typical day in phase III

- **When DAQ stops,**
 - Control room shifters tries restart. (Downtime : a few min.)
 - If DAQ stops again, they call on-call sub-system experts. (Downtime : a few tens of minutes.)

Livetime in 12hrs(rough estimation) = 87.0% (83.1% w/ all subsystems)

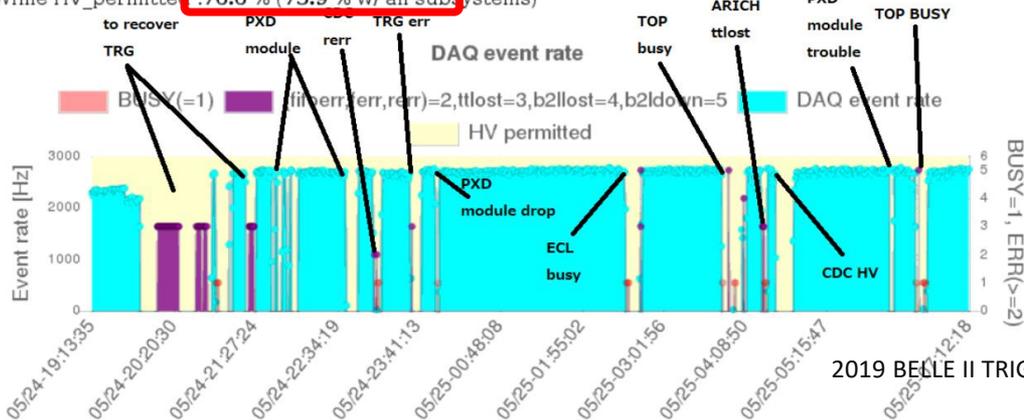
While HV_permitted : 92.0% (91.2% w/ all subsystems)



One trouble which needs expert's help. (find a problem and mask an FEE in this case)
Livetime : 92%

Livetime in 12hrs(rough estimation) = 76.6% (75.9% w/ all subsystems)

While HV_permitted : 76.6% (75.9% w/ all subsystems)



Several troubles which needs experts' help
Livetime : 77%

Breakdown of DAQ downtime in a week near the end of phase III (1)

Minor troubles : downtime < 10min.

(backend)DAQ related

date	Downtime (min.)	Error(Sometimes, occurred due to other sub-system's trouble)
06/18-01:24:13	55.7	Cpr7001 froze
06/21-04:26:37	45.9	SLC daemon died on SVD ROPC
06/21-08:25:52	18.8	SLC daemon died on TOP COPPER
06/18-11:47:04	15.0	HLT error
06/21-19:08:25	13.5	HLT stuck
	12.8	Other minor troubles x3
	161.7	

TRG readout related

date	Downtime (min.)	Error(Sometimes, occurred due to other sub-system's trouble)
06/18-06:13:13	62.5	SLC on TRG control server stuck
06/19-01:05:38	59.4	Trouble/preparation
06/21-09:25:16	40.6	Trouble/preparation
06/21-00:10:57	31.6	Trouble/preparation
06/21-06:37:36	21.8	Trouble/preparation
	11.2	Other minor troubles x4
Total	227.2	

TOP related

date	Downtime (min.)	Error(Sometimes, occurred due to other sub-system's trouble)
06/20-02:44:56	26.3	busy
06/23-08:14:25	21.0	busy
06/20-12:35:20	17.3	busy
06/20-11:38:56	14.3	busy
06/22-03:50:58	12.8	busy
	58.6	Other minor troubles x19
total	150.3	

CDC related

date	Downtime (min.)	Error(Sometimes, occurred due to other sub-system's trouble)
06/21-05:37:25	39.9	CDC strange data (unpacker error)
	48.9	Other minor troubles x10
total	88.8	

Breakdown of DAQ downtime in a week near the end of phase III (2)

ARICH DAQ related

date	Downtime(min.)	Error(Sometimes, occurred due to other sub-system's trouble)
06/18-12:24:40	23.3	Error signal from FEE(Fifoerr)
	7.5	Other minor troubles x3
total	30.8	

PXD related

date	Downtime(min.)	Error(Sometimes, occurred due to other sub-system's trouble)
06/20-09:34:08	11.3	Busy (PXD expert fixed)
06/20-08:18:56	9.0	Busy (PXD expert fixed)
total	20.3	

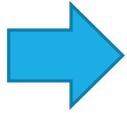
ECL/KLM related

	date	Downtime(min.)	Error(Sometimes, occurred due to other sub-system's trouble)
KLM	06/18-08:04:29	3.0	Error signal from FEE(ttlost)
KLM	06/23-02:21:35	1.5	Error signal from FEE(ttlost)
ECL	06/22-21:57:43	15.1	ECLTRG's tag was strange

- Beam related (beam abort, large b.g.) while HV is permitted : 45.1min.
- Shifters operation (ramp up down HV , include exclude subsystems etc..) : 150.3min. (34events)

Miner/major trouble

- Troubles which can be reset by run-restart (reset signal in firmware)
 - ttlost (link error between FEE/COPPER and FTSW)
 - B2lllost (b2link lost between FEE and COPPER)etc.



- Whenever DAQ stops, CR shifters first try this.

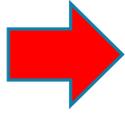
- Troubles which needs experts' help
 - No data arrives at FEE
 - Strange data but cannot be fixed by reset
 - COPPER CPU freezes.
 - Slow control daemon is down.etc.



- On-call experts try to find the source of the problem first.
- Then, usually they perform
 - Restarting some processes
 - Downloading firmware
 - Reboot a system etc.

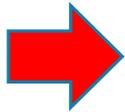
To reduce downtime for recovery...

- Troubles which can be reset by run-restart (reset signal in firmware)
 - ttlost (link error between FEE/COPPER and FTSW)
 - B2llost (b2link lost between FEE and COPPER)
- etc.



- Automatically restarting could reduce downtime
 - At least, pushing STOP-ABORT-LOAD-START button automatically
- Not yet implemented

- Troubles which needs experts' help
 - No data arrives at FEE
 - Strange data but cannot be fixed by reset
 - COPPER CPU freezes.
 - Slow control daemon is down.
- etc.



- Automatic error diagnosis to reduce downtime
 - Currently, we are preparing the system, which will collect information from DAQ nodes and give simple message to CR shifters about what to do or who should be called.
- Automatic recovery
 - E.g. COPPER crate power-cycle, initialize FEE firmware etc.
 - Not yet done. Currently rely on manual operation by experts.

Recovery time in a bit serious trouble

Example : recent trouble when one COPPER CPU froze midnight.

		Time Elapsed (min)	
12:28AM	CR shifters noticed something wrong	4	➤ Call experts, Error diagnosis, ➤ Prepare for recovery procedure
12:32-35 AM	A KLM expert shifter found out that he could not login to one KLM COPPER.	3	
12:41 AM	A DAQ expert shifter became online and investigated the situation.	10	
12:51 AM	Power-cycle a COPPER VME crate to restart the COPPER CPU.	6	Power-cycle the crate
12:57 AM	FPGA firmware on some COPPERs was not downloaded properly by /etc/init.d/ scripts.	3	
1:00 AM	A KLM expert downloaded firmware	1	Restart SLC
1:01	DAQ experts restarted SLC daemon processes	14	
1:15	Restarting takes much longer than usual since multiple people tried and confliction occurred.		
1:19AM	After checking if the KLM DAQ is working, a new run with KLM started !	4	Final check

- We need to think about reducing each part of the recovery time.
- First step : Automated error diagnosis -> a talk in this session

Summary

- Near the end of the phase III run, DAQ efficiency (while HV was permitted) is around 80% .
- The breakdown of down time in a week tells, DAQ, TRG, CDC and TOP are the main source of the downtime.
- While there is an ongoing effort by each sub-group to fix those troubles, another way to reduce the downtime is to shorten recovery time
 - Error diagnosis system
 - Automatic recovery