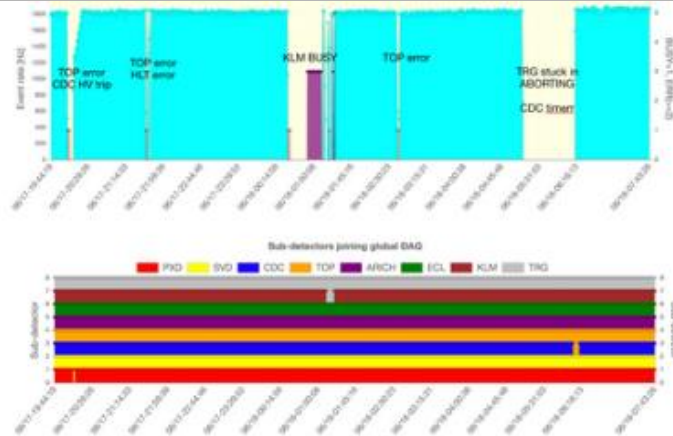




# DAQ TROUBLES IN THE PHASE III

S. Yamada (KEK)

# Monitoring livetime ratio in every shift during phase III

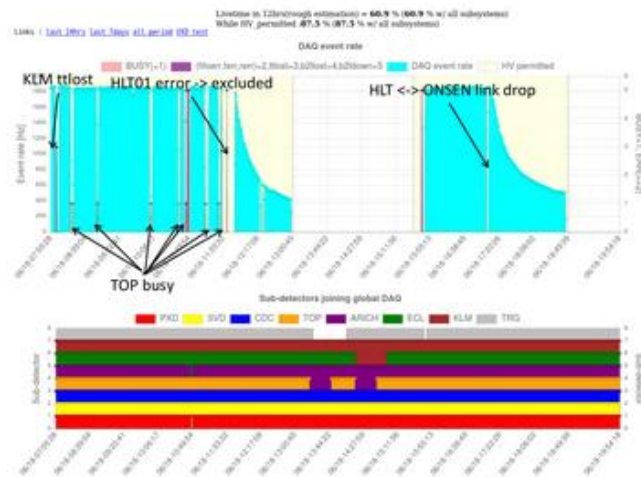


- DAQ expert shifters report downtime and its causes in every shift to make people keep in their mind about what are the current main causes of downtime.



seokhee.park 8:15 PM

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



# DAQ troubles of each subsystem

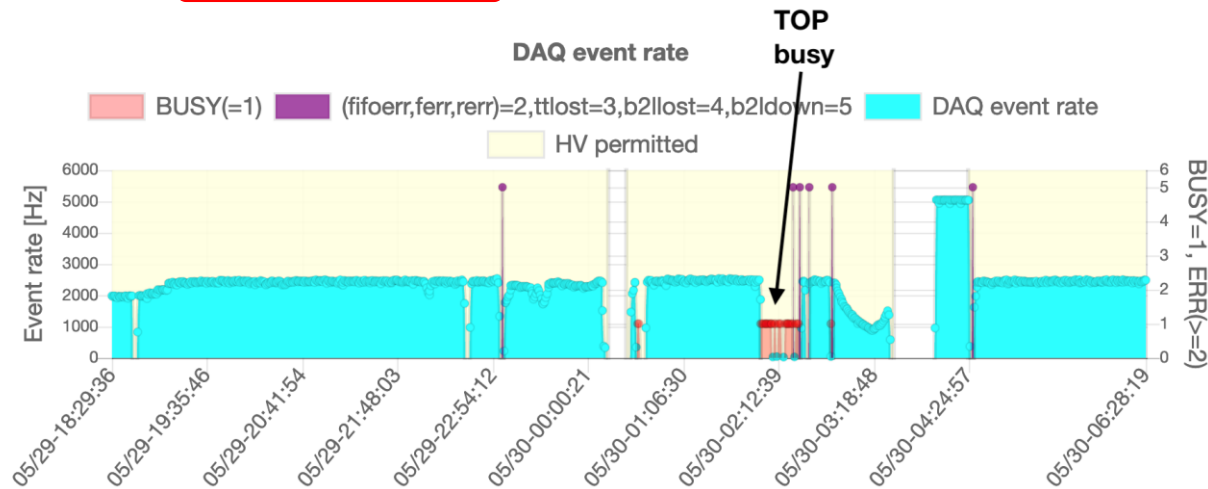
Sub-systems	
PXD	<ul style="list-style-type: none"><li>➤ Testing new firmware -&gt; Seems to be stable after May 28</li><li>➤ No data comes from some module (ASIC state machine stuck?) -&gt; workaround : increase the injection veto length</li></ul>
SVD	<ul style="list-style-type: none"><li>➤ Basically stable.</li></ul>
CDC	<ul style="list-style-type: none"><li>➤ Belle2link in some links are unstable. (Data corruption in idle patter, b2lllost )</li><li>➤ Strange data which caused unpacker error in HLT</li><li>➤ Sometimes, FEE reprogramming is needed. 7 FEEs out of 299 are masked due to frequent errors.</li></ul>
TOP	<ul style="list-style-type: none"><li>➤ Event # jump sometimes happens related with b.g. burst.</li><li>➤ TOP firmware experts are working to fix the problem.</li></ul>
ARICH	<ul style="list-style-type: none"><li>➤ Basically stable.</li></ul>
ECL	<ul style="list-style-type: none"><li>➤ 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.</li></ul>
KLM	<ul style="list-style-type: none"><li>➤ Basically stable.</li></ul>
TRG	<ul style="list-style-type: none"><li>➤ Firmware/software update is going on.</li><li>➤ Situation changes time-to-time, but seems not stable sometimes.</li></ul>
Backend DAQ	<ul style="list-style-type: none"><li>➤ COPPER(CDC, TOP, KLM ) CPU freezes sometimes.</li><li>➤ HLT/STORAGE states remains ABORTING/LOADING</li></ul> <p>-&gt; improved a lot by HLT experts.</p>
Slow control system	<ul style="list-style-type: none"><li>➤ SLC/NSM daemon died sometimes.</li><li>➤ PCs for CR shifters becomes heavy.</li></ul>

# 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)**

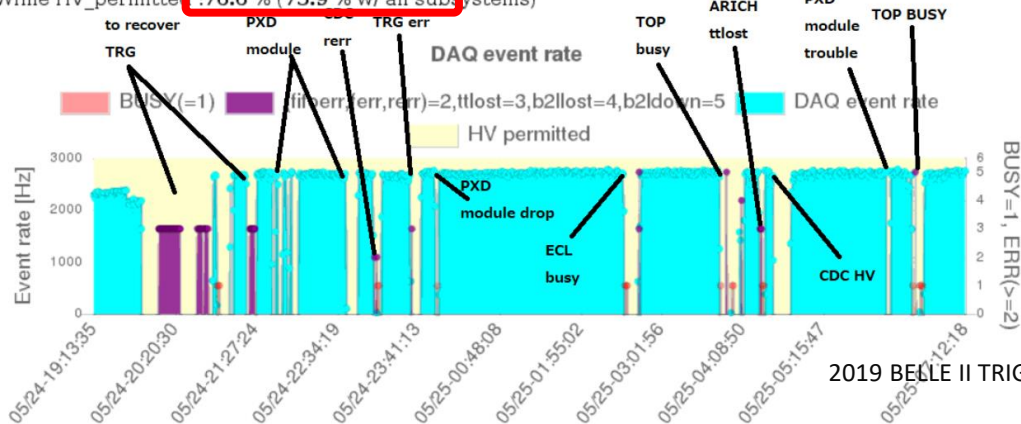
While HV\_permitted : **92.0 % (91.2 % w/ all subsystems)**



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
	<b>161.7</b>	

## 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	<b>227.2</b>	

## 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	<b>150.3</b>	

## 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	<b>88.8</b>	

# 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	<b>30.8</b>	

## **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	<b>20.3</b>	

## **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	<b>15.1</b>	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)
    - B2llost ( 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.

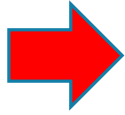
etc.



- 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.

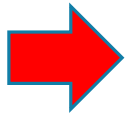
# To reduce downtime for recovery...

- 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