Data flow analysis

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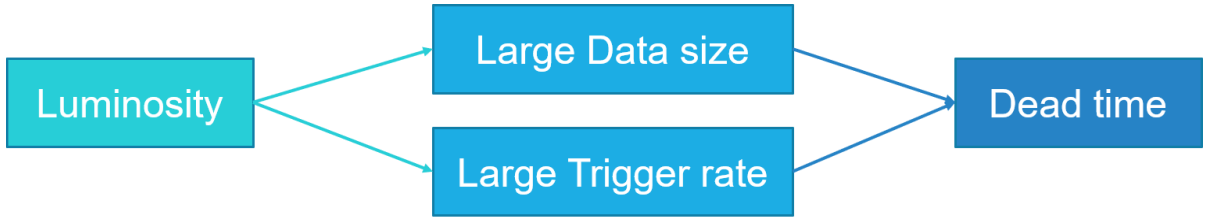
Analysis about data flow & dead time

- Dead time is expected to increase with luminosity.
  - Large trigger rate and data size

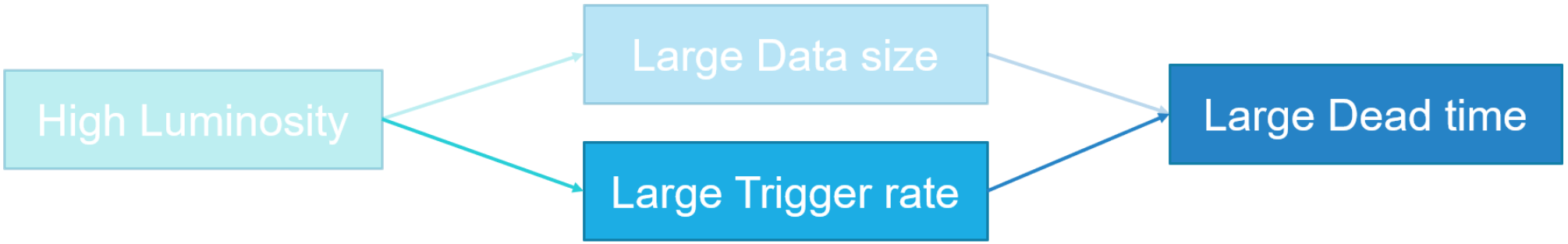


- Analysis about the relation between luminosity, data size, trigger rate and dead time is important.

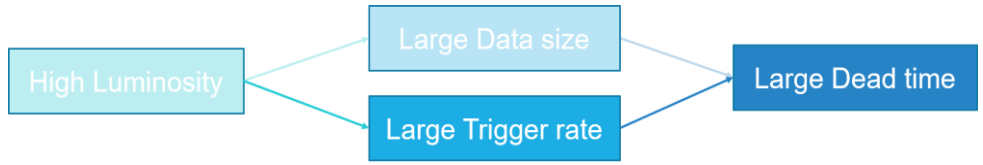
- The number of times the busy signal is issued within 1 second = 127 MHz clock is counted inside the FTSW master and stored in the register from TTD11.

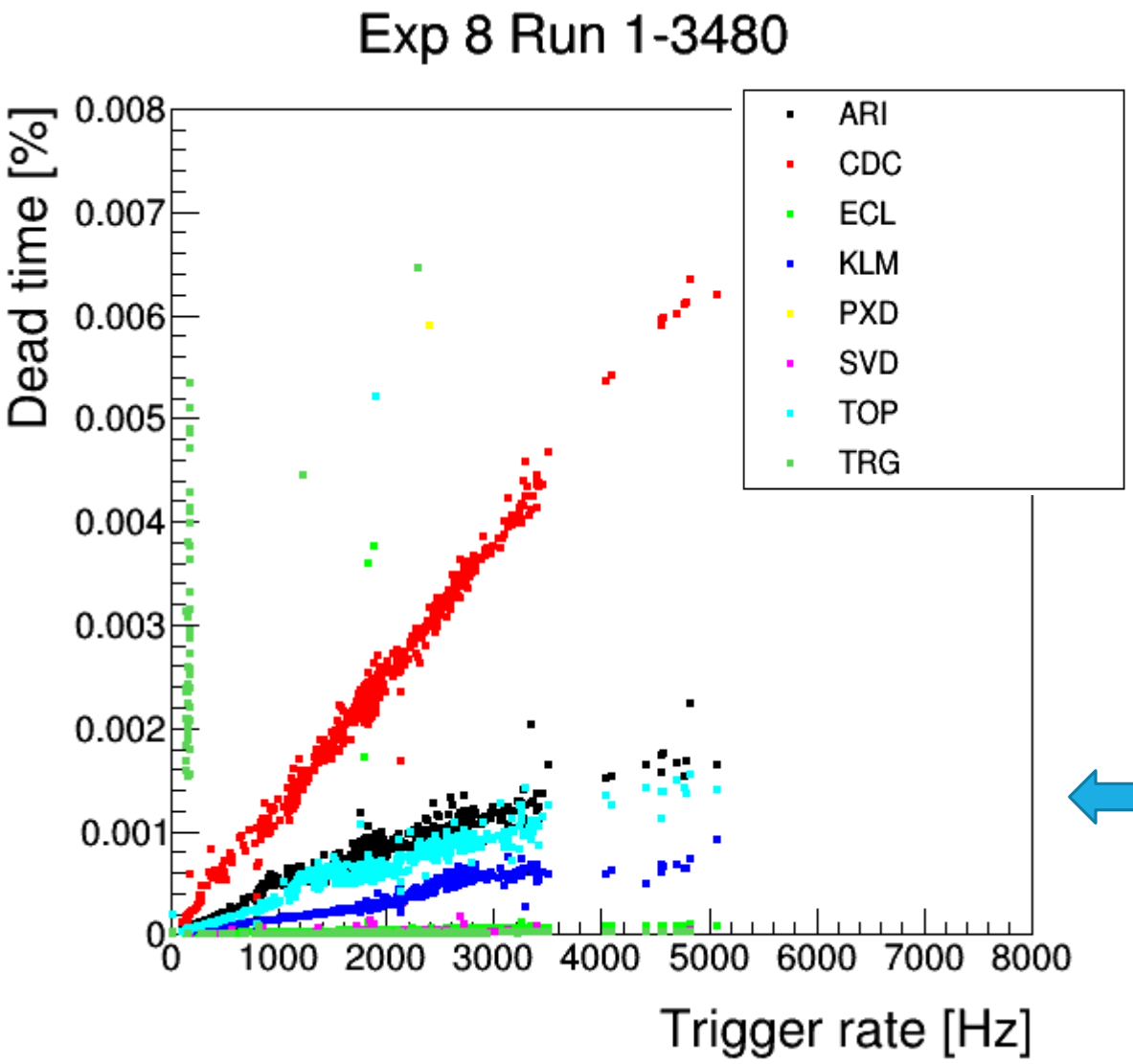
- Access registers of FTSW master from TTD11 & recorded information related to dead time.
  - Deadtime due to busy signal from each detector
  - Various type of trigger veto
    - trigger holdoff time
    - apv25 emulator
    - etc..
  - Apart from FTSW, Information related to event builder 1(eb1tx) in each readout pc
    - data size
    - number of event

Trigger rate vs dead time

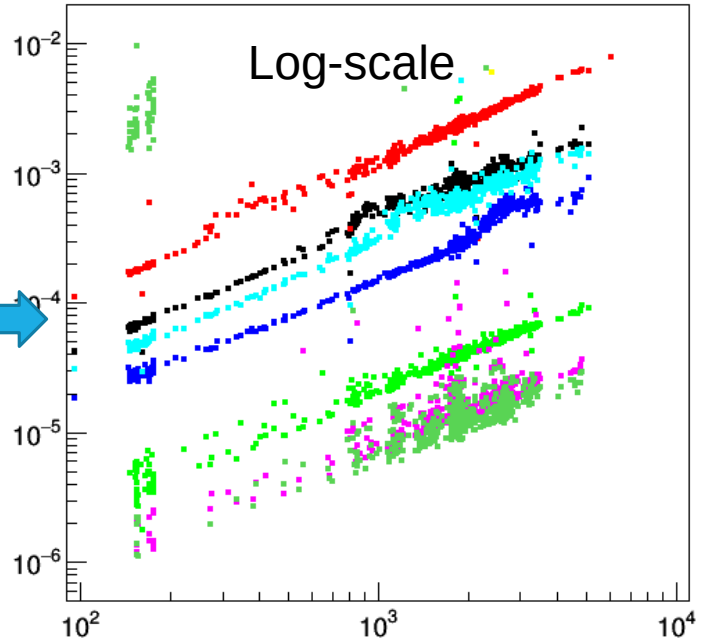


Trigger rate & dead time



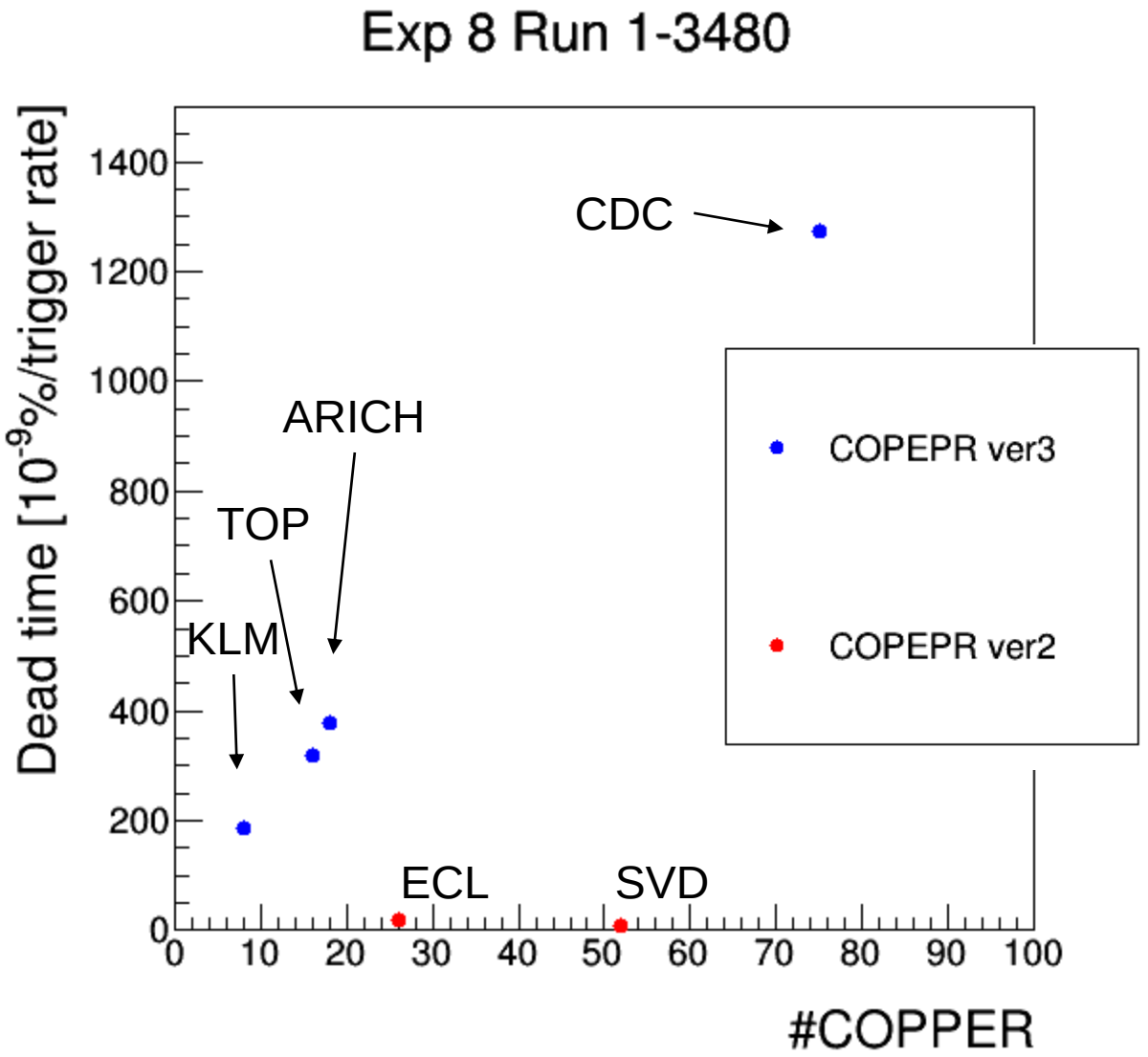


- Run by run plot of all runs in exp 8
  - Stable runs=more than 10 minutes run length
  - Trigger input from gdl
- Horizontal/vertical axis shows the average of trigger input rate/dead time during one run.
- Linear relationship between trigger rate and dead time are observed for all sub-detectors.



Cause of deadtime

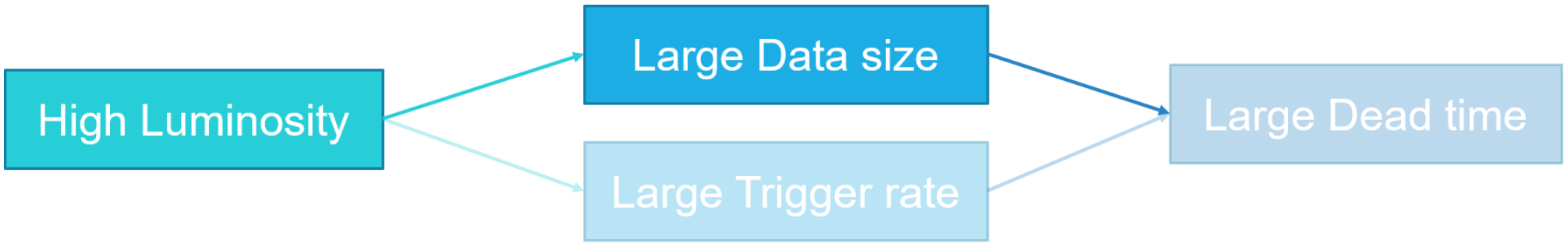
- For sub-detectors using COPPER ver.3
  - ARICH,CDC,KLM,TOP
  - The amount of dead time seems to be proportional to the number of COPPER
- For sub-detectors using COPPER ver.2
  - ECL,SVD
  - Very small dead time
  - There seems to be no correlation between the number of copper and the amount of deadtime.
- Different behavior between COPPER ver.2 and ver.3



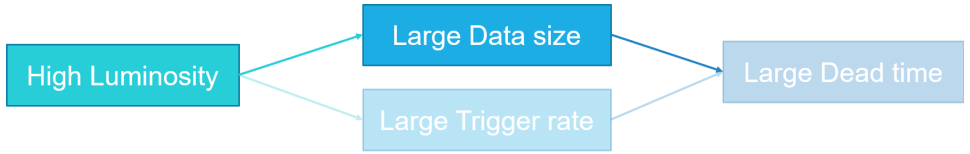
Analysis using test bench

- Different behavior between COPPER ver.2 and ver.3
- This dead time was analyzed using test bench by Nakao-san.
- With <10kHz trigger rate, a COPPER ver.3 issues certain amount of busy signal per 1 trigger, independent from trigger rate
  - 5 milliseconds/10^7 trigger
- Dead time due to this busy signal from all the sub-detectors is ~0.07% even with 30kHz trigger rate
  - Not critical, but inevitable loss unless current COPPER ver.3 is used?
- More detailed analysis
  - Test bench using COPPER ver.2
  - Data size dependency

Luminosity vs data size



Luminosity & data size

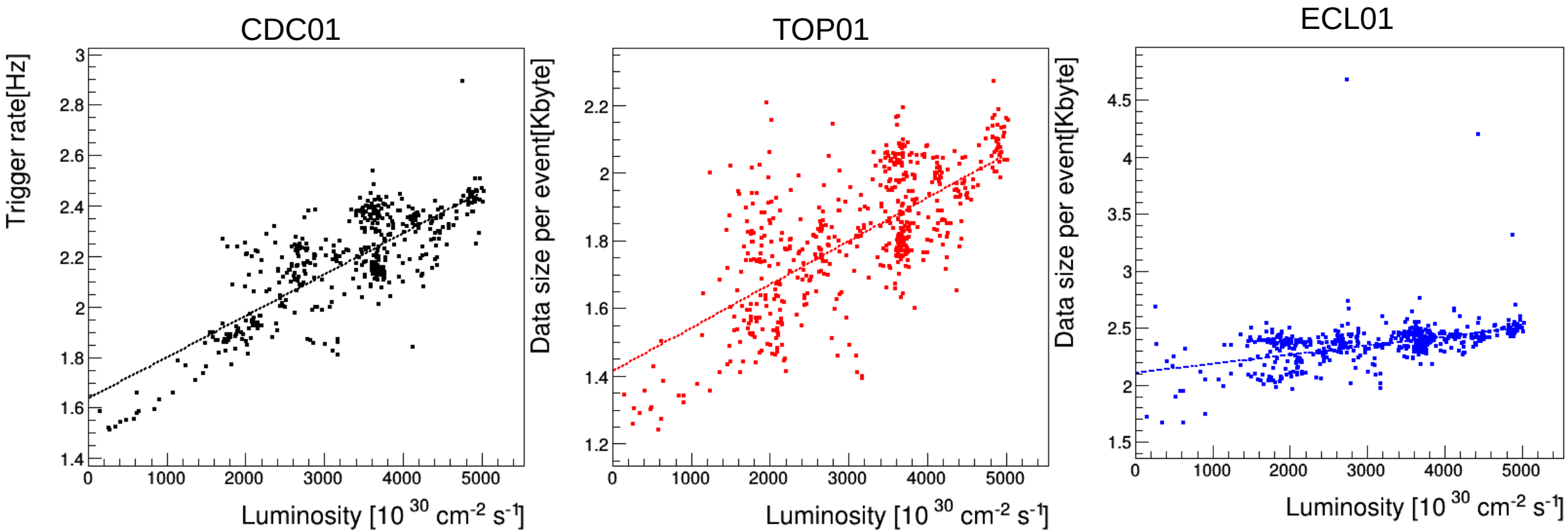


- The relation between luminosity and data size from each readout pc was analyzed.
  - Exp 8 all runs 1-3480
  - Luminosity was taken from ECL pv.
- Three kinds of the behavior of data size observed.

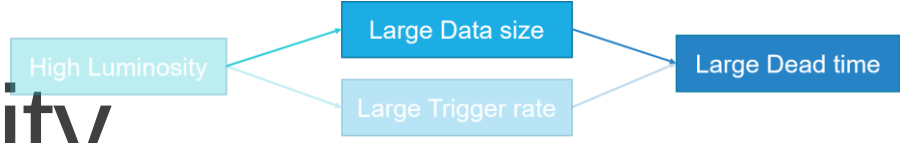
- The data size increases with luminosity:
  - CDC,ECL,TOP
- The data size doesn't change much with luminosity:
  - ARICH,SVD
- The data size decreases with luminosity:
  - KLM : neutron causes RPC in BKLM blind for 1ms.

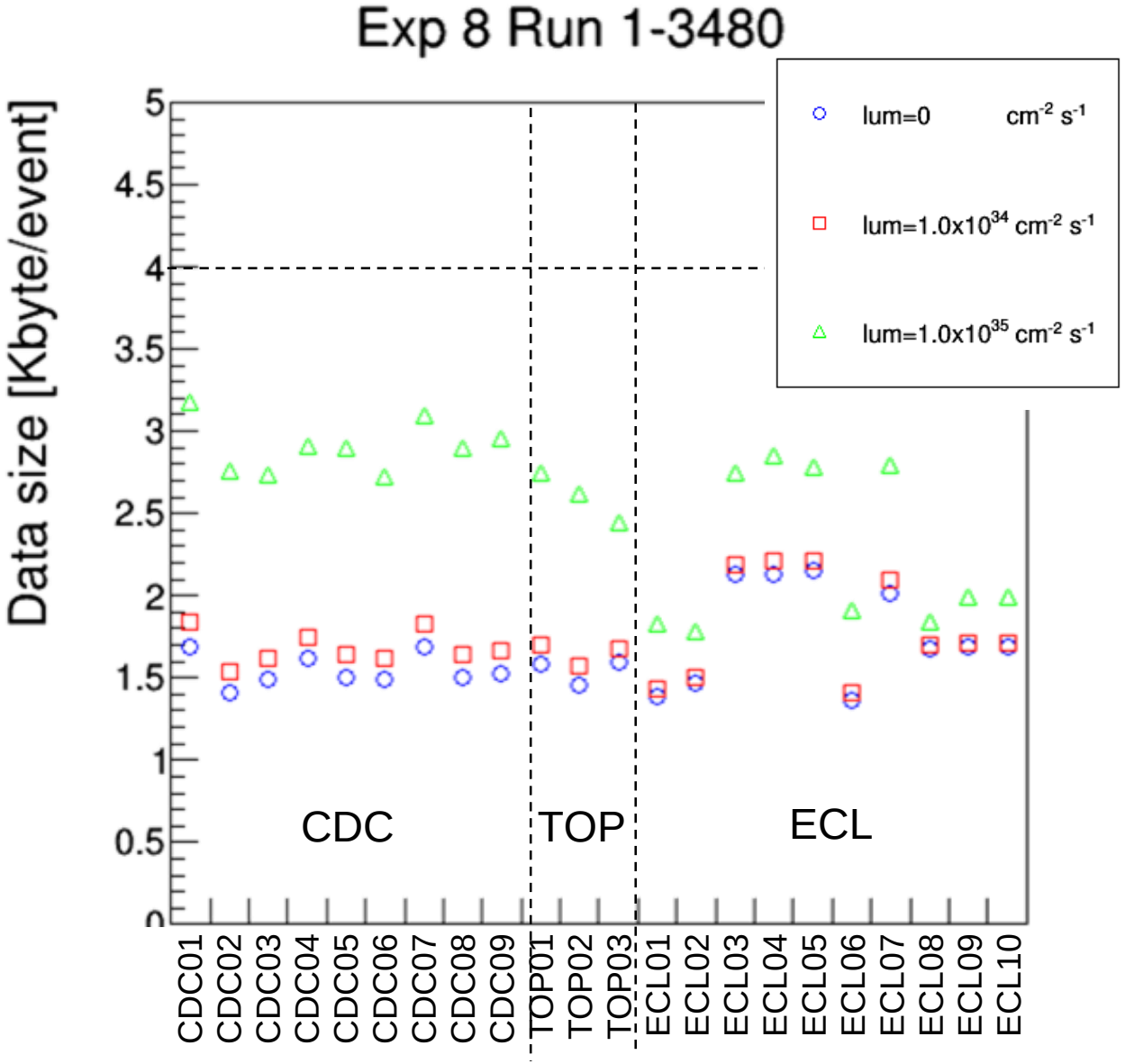
CDC,TOP and ECL

- Data size is increasing with luminosity for these subdetector.



Extrapolation to high luminosity



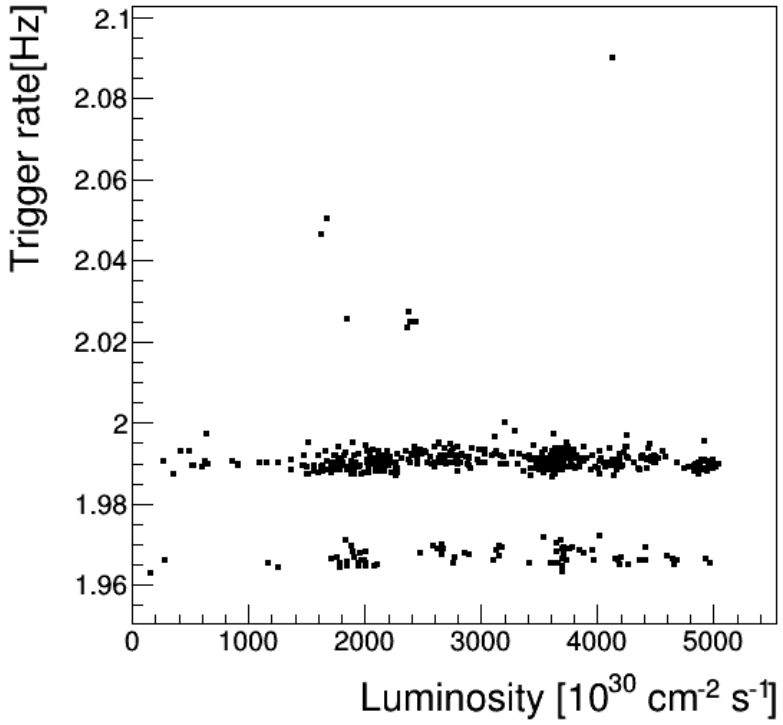


- Data size was extrapolated to 10^{34} $cm^{-2}s^{-1}$ and 10^{35} $cm^{-2}s^{-1}$
- Bottleneck due to 1GBit ethernet cable is 125MB/s
- Under high trigger rate =30kHz, bottleneck corresponds to about 4kB/event for each readout pc.
- When current data is extrapolated to luminosity= 10^{35} $cm^{-2}s^{-1}$, data size would be below 4kB/event.
  - If extrapolated to 8×10^{35} $cm^{-2}s^{-1}$, data size>4kB/event
- Luminosity is not high in experiment 8
  → Is extrapolation valid for high luminosity?

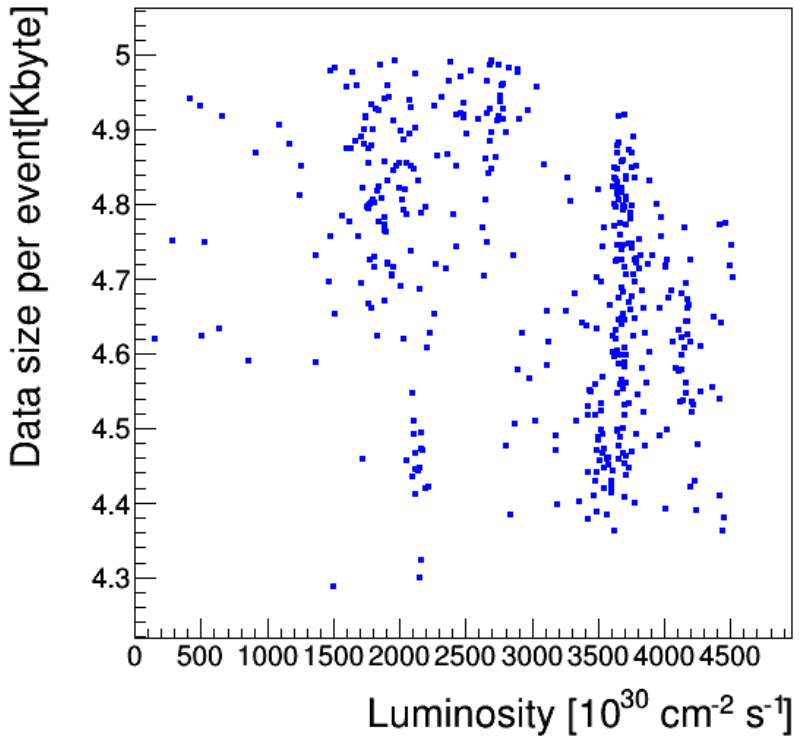
ARICH and SVD

- ARICH : data size is almost constant during exp8.
- SVD : contribution of luminosity to data size is small compared to single beam background.
  Relation between beam current and data size should be analyzed.

ARICH01

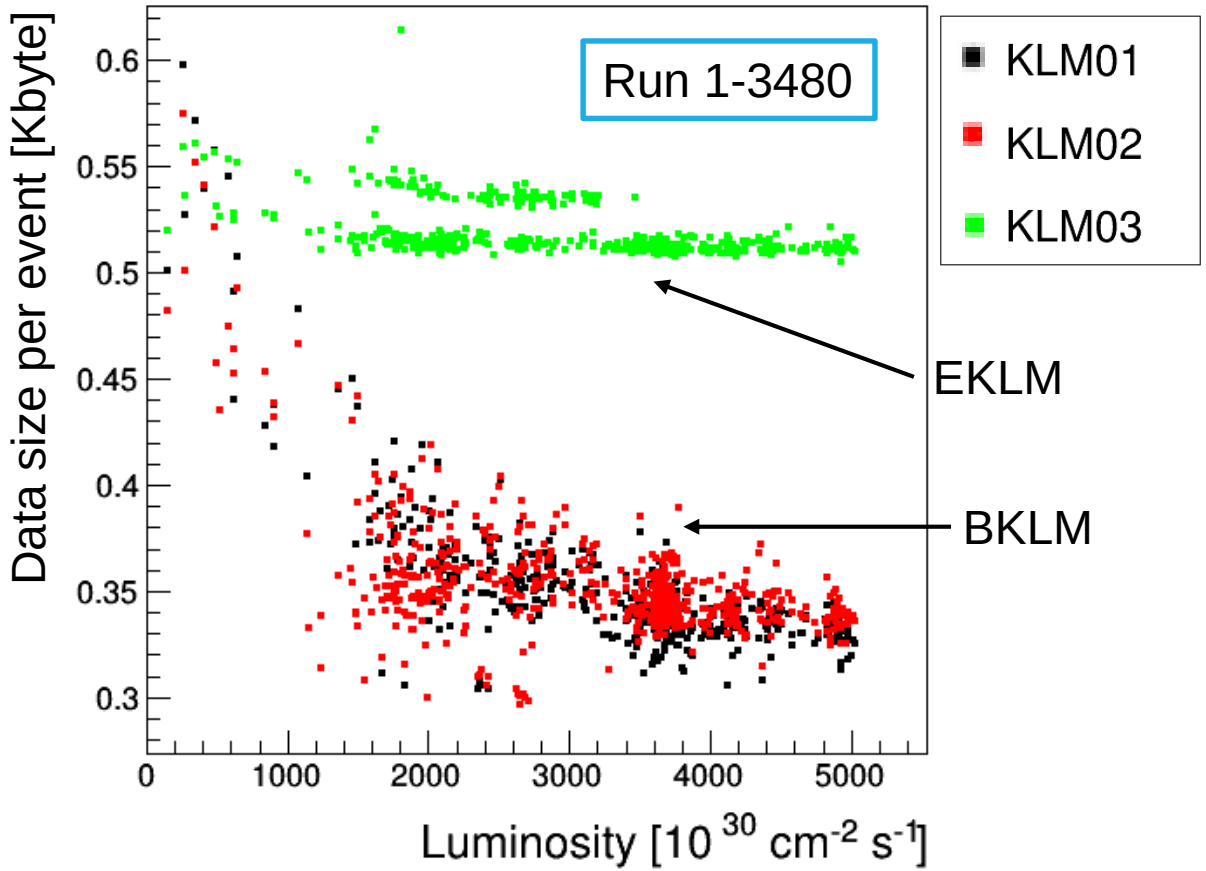


SVD01



KLM

Data size for each readout pc per event



- As the luminosity rises, so does the neutron background.

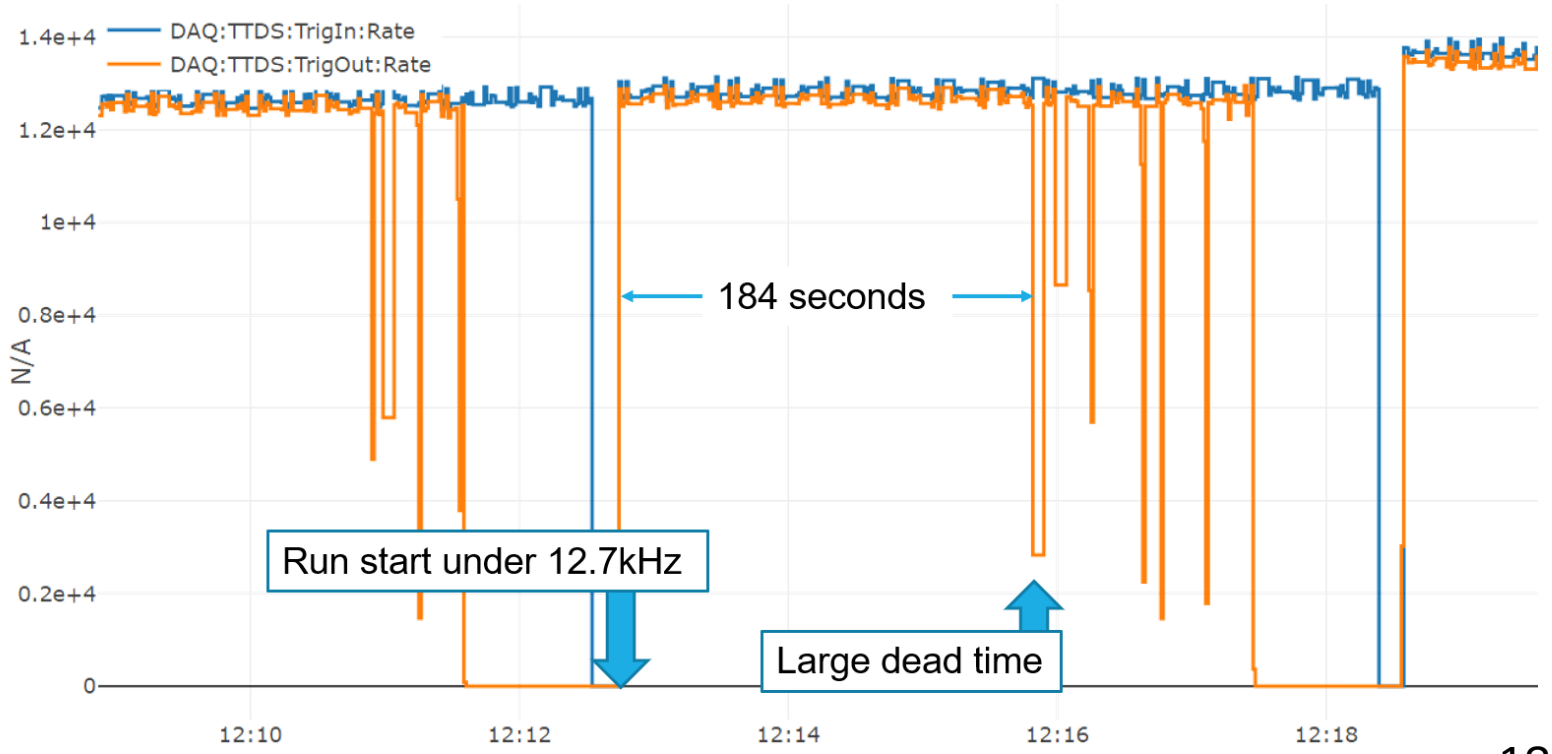
Reply from KLM expert:

- A neutron-induced discharge suppresses the electric field in the RPC gap for ~1 millisecond in the vicinity of the streamer
  → No other hits will be recorded in that vicinity until the electric field has recovered.
- the RPC is temporarily blind in this vicinity for this interval.

- Scintillators in EKLM do not exhibit this behavior.

Behaviour around bottleneck

- The 1GBit ethernet between readout pc and eb1 might be bottleneck of data flow
- Behavior of dead time around this bottleneck was observed in test run
  - Large event size = 9.9kB/event for readout pc CDC01 (low threshold)
- After 3 minutes from run start, large dead time began to be observed.
  - Easy to reproduce
- Large busy signal is issued by CDC for a few seconds, and return to normal state with small busy signal



Summary

- Analysis about the relation between luminosity, data size, trigger rate and dead time is important.
- Those relation was analyzed
  - Trigger rate & dead time
  - Luminosity & data size
- Luminosity is not high in experiment 8 , so investigation under more high luminosity is needed.

Backup