Status on ecl trigger

2023/05/31
B2GM meeting
Y.Unno

Status of UT4 ETM

- (Fixed) Timing error on clustering logic
  - Improved logic which caused routing congestion
- (Fixed) Timing error in b2tt(idelayctrl)
  - Deactivated idelayctrl
- “ecl-inj” on GDL fluctuates w/ 5Gbps protocol UT4ETM-UT4GDL link
  - Likely to be due to long latency of 5Gbps protocol (~600ns)
  - 12Gbps protocol(~300ns) is being tested
    - Usage of gty_64b66b_top_GDLxxx_12g provided by YunTsung
    - Data transmission confirmed to be OK at test bench
- Strange b2link data with clustering logic
  - b2link data is OK w/o clustering logic
  - Clustering logic is same as UT3ETM

Latency of ETM-GDL link

Speed (Gbps)	connection	Latency(clk)	Latency(ns)
5	UT3 GTH → UT3 GTH	68	544
5	UT3 GTH → UT4 GTY	67	536
5	UT4 GTY → UT3 GTH	78	624
5	UT4 GTY → UT4 GTY	79	632
12	UT4 GTY → UT4 GTY	36	288
25	UT4 GTY → UT4 GTY	27	216

- “ecl-inj” problem at GDL disappeared by 12 and 25Gbps link.
- Redundancy of total latency in ecl trigger to GDL is only a few clocks in UT3ETM-UT3GDL 5Gbps link
- Latency of ETM-GDL link is reduced by 300ns with 25Gbps link and UT4ETM-UT4GDL
  - Same latency reduction between ETM-GRL
- Wrapper for 25Gbps link used at GRL side is ready
  - Will pass to Koga-san.

Status of UT4 ETM

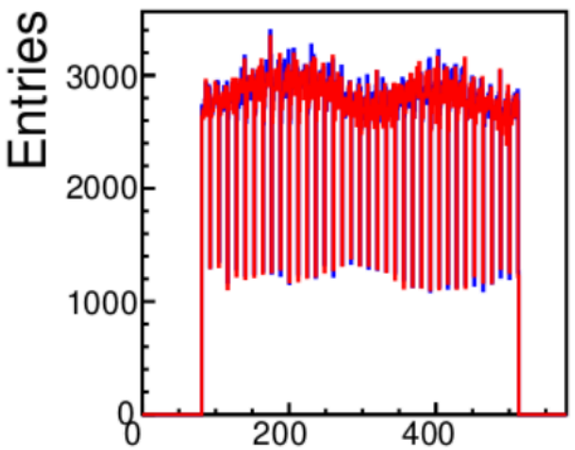
- Problem related to clustering
  - The reason of strange clustering output:
    - wrong parameters in IP cores in clustering logic
    - wrong parameters in IP cores in belle2link circular buffer
    - wrong parameters in trigger logics downloaded from servers
  - Cluster related problems are fixed.

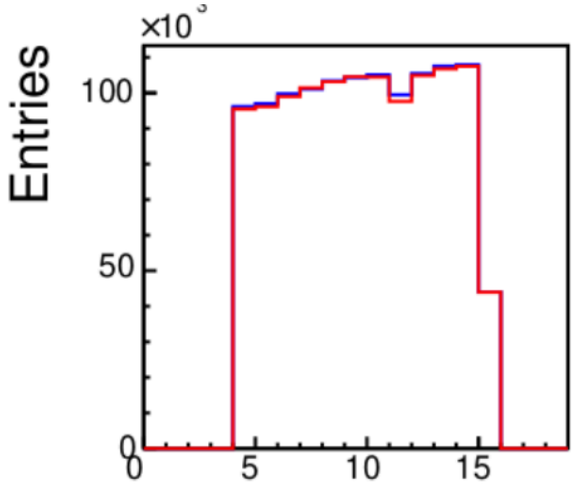
- Updated “tsim logic”
  - “tsim logic” means download tsim data to etm from trg server and read the trigger logic result from trg server.
  - All ecl trigger bits for some tsim data are found to be consistent between UT3 and UT4.

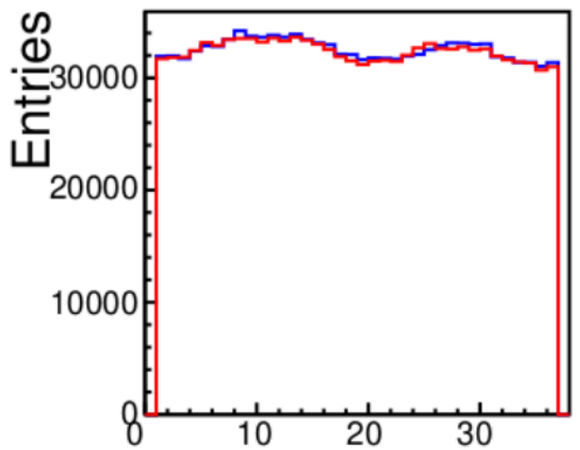
Status of UT4 ETM

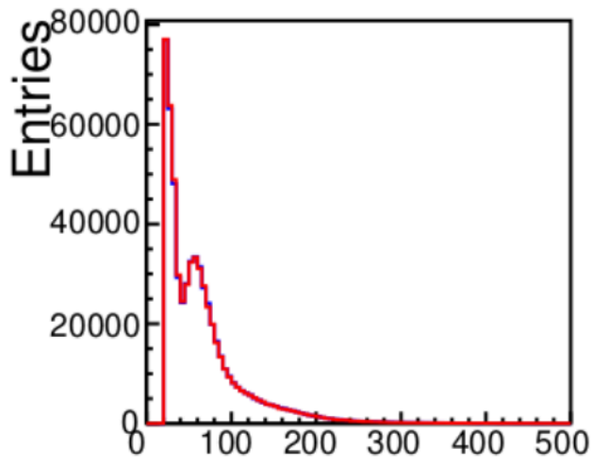
— UT3
— UT4

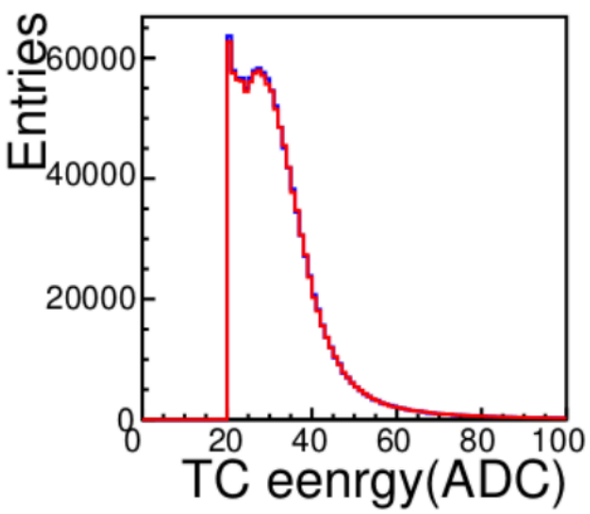
- DQM plot of 10min. local cosmic run
  - Consistent results between UT3 and UT4

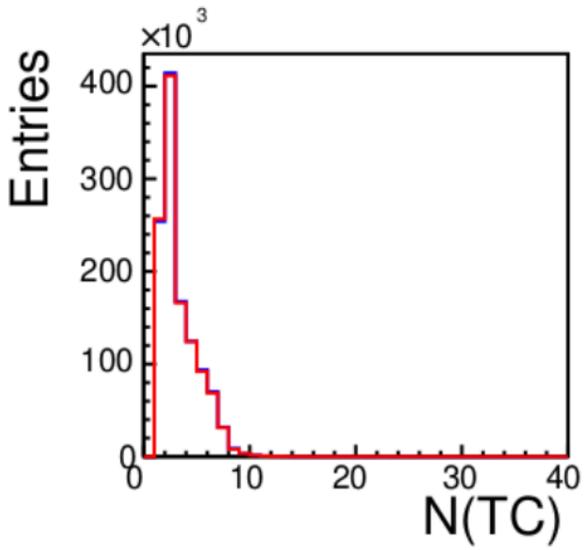


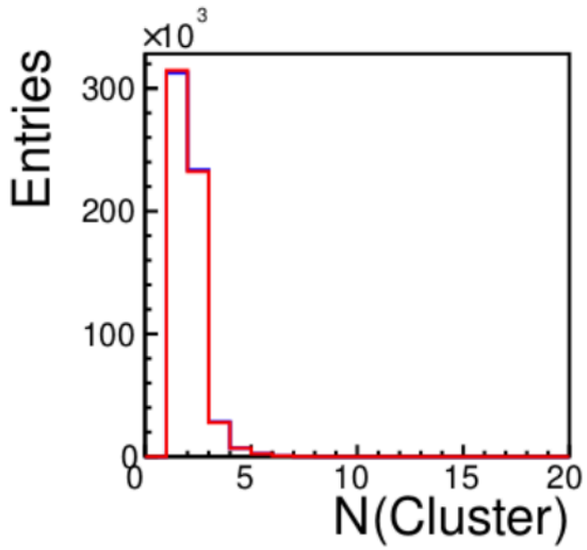


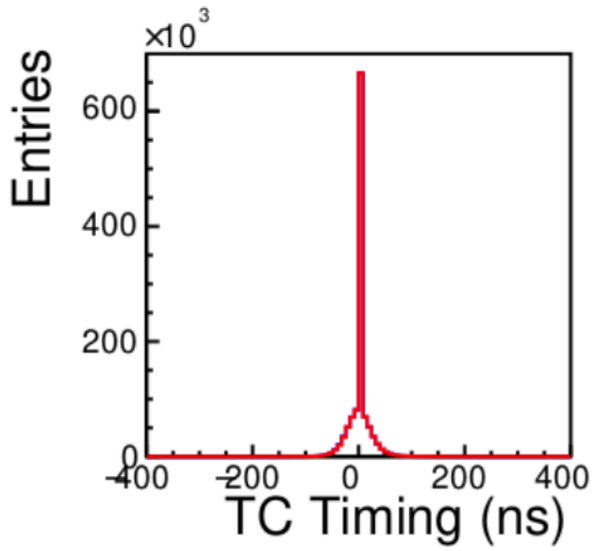












Status of UT4 ETM

— UT3
— UT4

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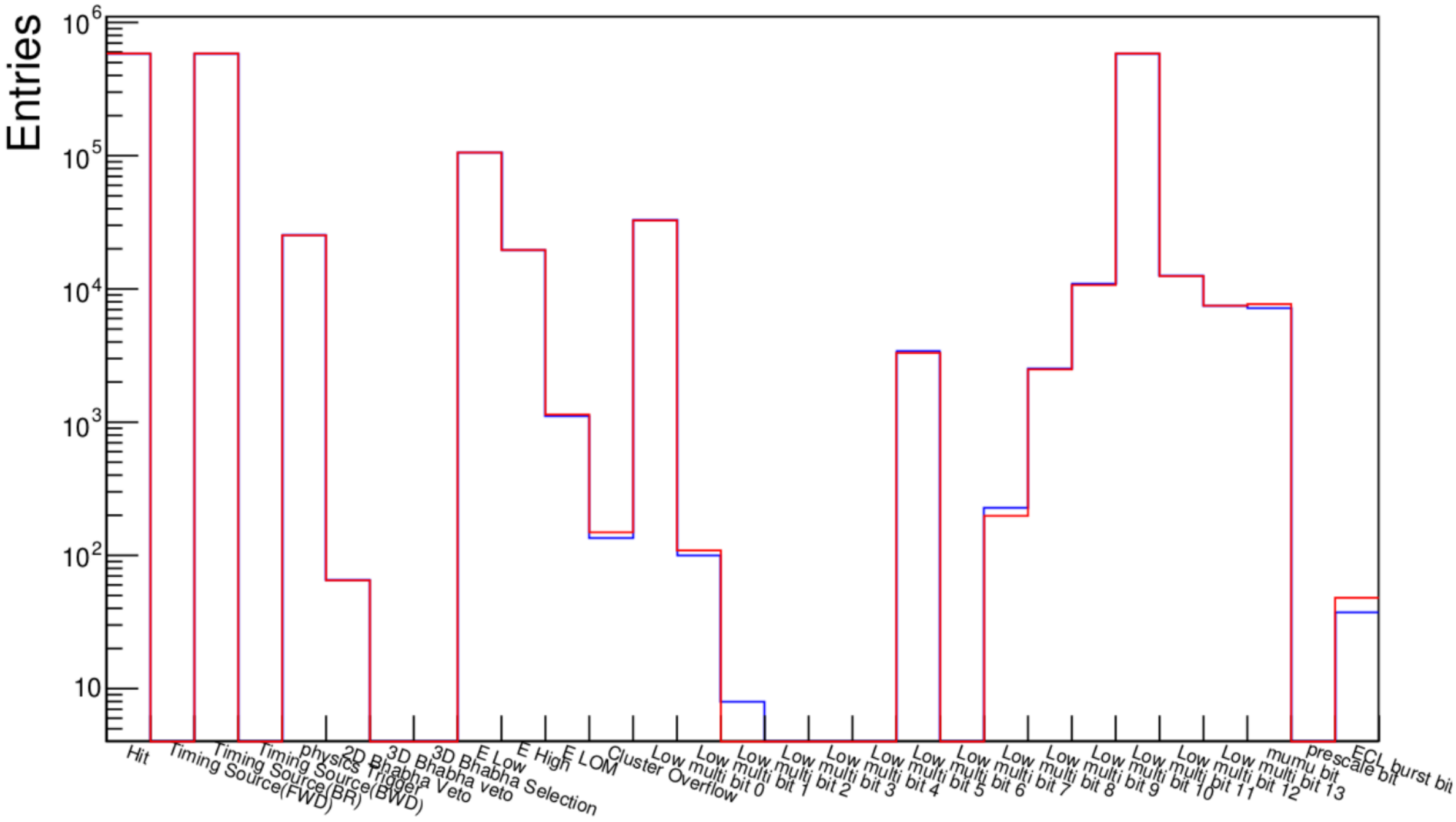
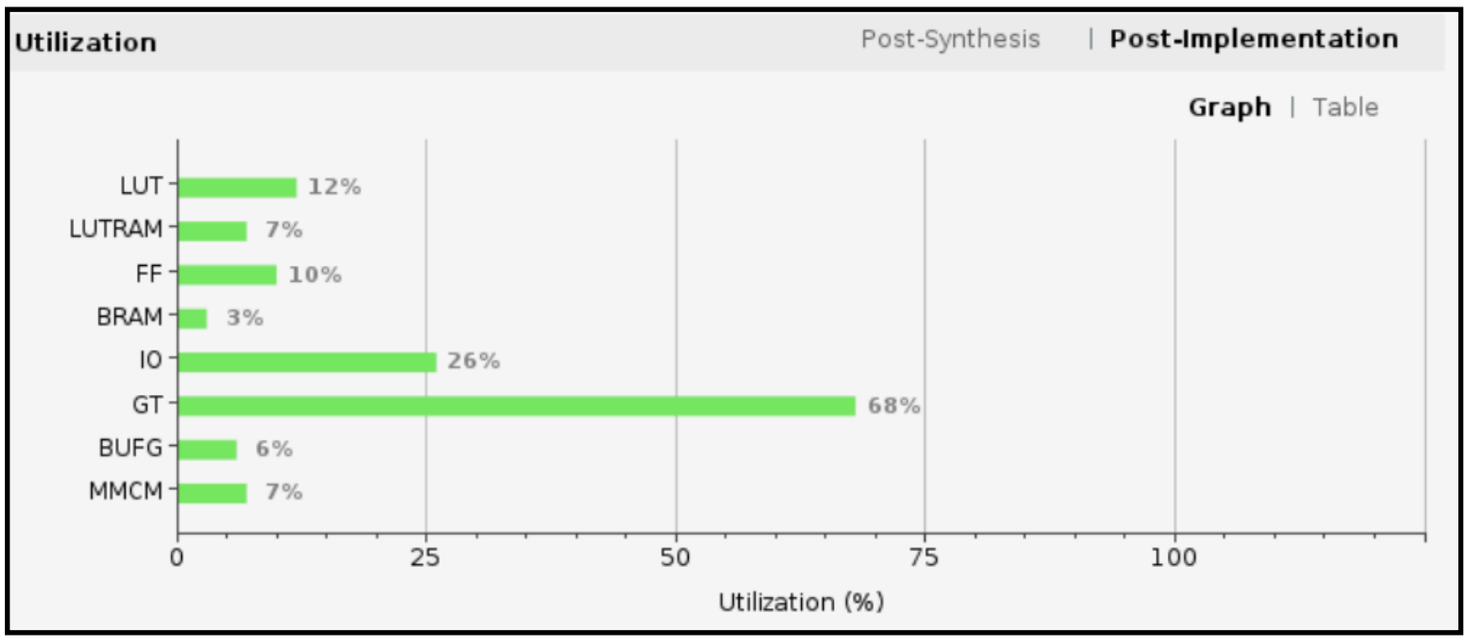


Status of UT4 ETM

- Basically first version of UT4ETM firmware is ready
  - In UT3 case, resource usage is >60% and >3h for compile.
  - In UT4 (VU160) case, resource usage is 10% and 50min for compile.



- Plan
  - Test 25Gbps link with GRL
  - Investigate the reason of instability of TMM-ETM link at link start
  - Stability test of all optical links
  - Prepare/update online software and SLC for UT4-ETM

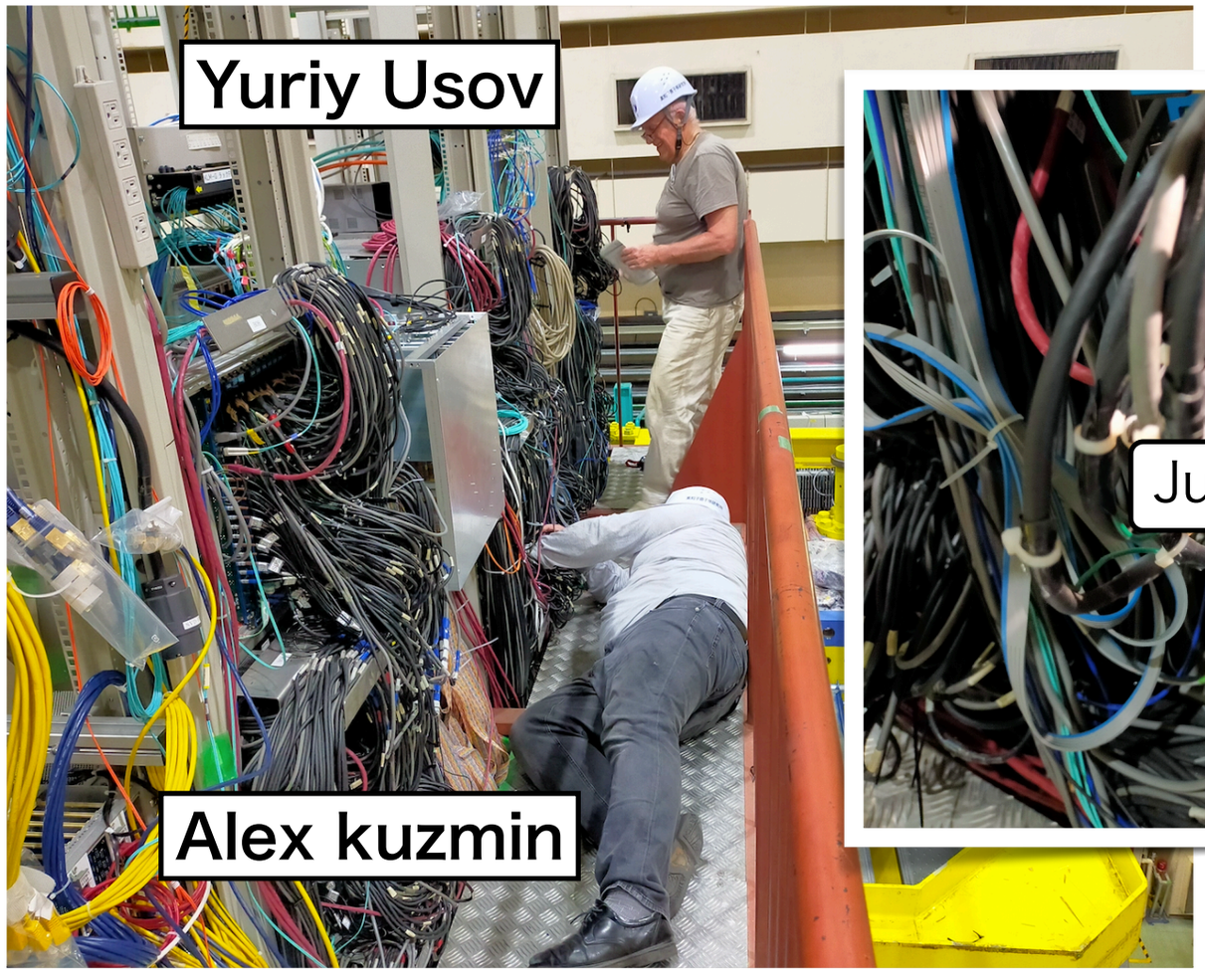
ECL trigger server

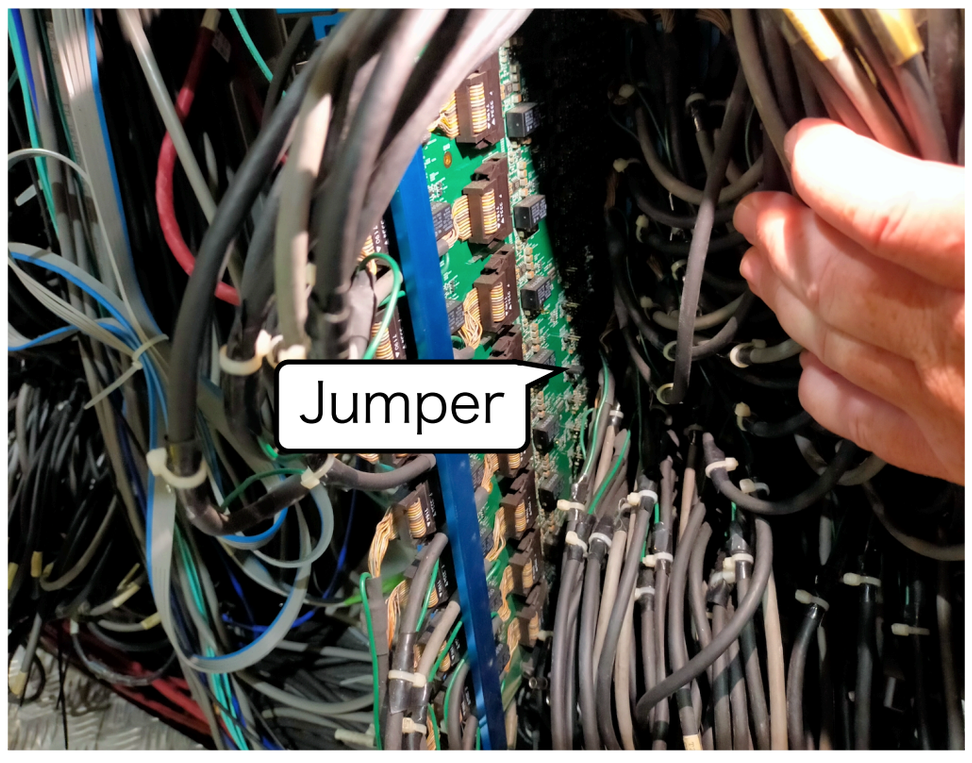
- Nakazawa-san prepared new trigger severs(btrgsrv2 and 3)
- We(ecltrg) planned to join btrgsrv2/3 from btrgctr0/1
- However, I am thinking to stay at btrgctr0/1
  - ETM will be used as beam bkg monitoring system, and additional online luminosity monitor
  - ecltrg will be required to be available during machine study (no luminosity run)
    - If ecltrg moved to btrgsrv2/3, frequent SLC reboot or update are not recommended during machine study.

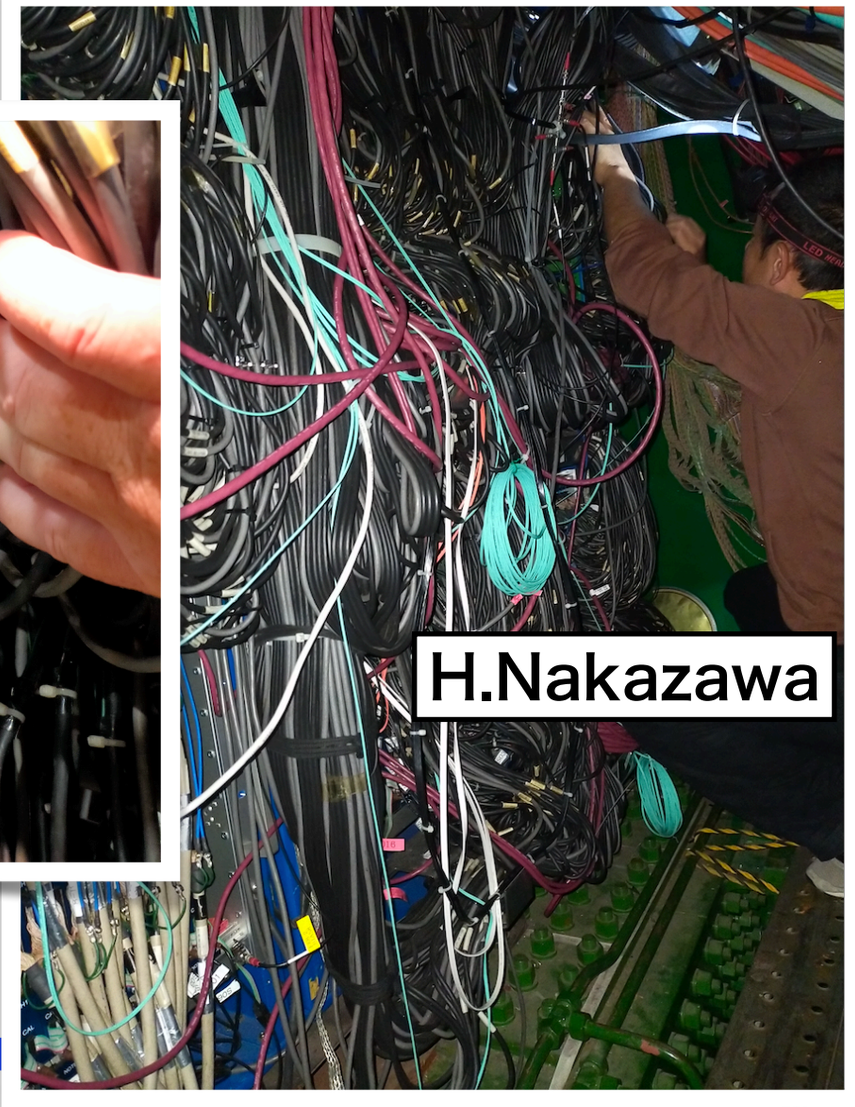
- Plan
  - Update btrgctr0/1 with new linux (Locky linux?)
  - Update ecltrg servers with new linux at Tsukuba B2 at first.

ShaperDSP jumper wok

- Change of jumper configurations on ShaperDSP was done on May/24,25,26 for ecl trigger energy calibration
  - H.Nakazawa, Alex, Yuriy Usov and Y.Unno on-site, and with remote assist by EunJi and Mikhail(data analysis and so on).
  - Changed 144 jumpers on 117 ShaperDSP boards
  - All jumpers were correctly changed (confirmed with local run by Eunji)







Summary

- Summary

  - Firmware preparation of UT4 ETM is done
    - (But, UT3-ETM will be used during June)

  - ShaperDSP jumper work is done

- Plan

  - Update of online software and SLC
  - OS update of ecl trigger servers
  - Preparation of Beam background monitoring
  - Online luminosity monitor
  - Basf2 software updates

Plan before physics run

- UT4-ETM optical link stability check
- Investigation of TMM-ETM instability at link start (1month, July)
- Update of online software and SLC (1 month, July)
- OS update of ecl trigger servers (2months, Sep-Oct)
- Beam background monitoring on ETM (2months, Aug-Sep)
- New injection veto on ETM (1month, Sep)
- Online luminosity monitor (2month, Oct-Nov)

Backup

Plan for LS1

- ETM to UT4 from UT3
  - Optical link
    - TMM, GDL, GRL, and b2link -> Stability check
  - I/O for trigger server
    - FW logic, Software update on trigger server
- Background study
  - BGOverlay logic for both MC and random data
  - Performance study for MC and data
  - Consistency study between MC and data
  - Based on the results, make a strategy for high luminosity and bkg conditions (for both after LS1 and LS2)
- ETM logic study for hie, Bhabha, and other bits
  - Detail studies with MC and data rejected by HLT filter ?
- Update/modify local run scripts ?
  - Update of script of single channel test run for PCIe40 => prepared by Mikahil
  - (Hope to) fix default large timing resolution
  - Prepare linearity local run script

Plan for LS1

- Calibration
  - TC Energy (in progress by Eunji)
  - TC timing
  - Automation system for TC E and T calibration (CAF can be utilized ?)
    - Or consider or prepare system(DQM) to monitor them with beam data
- TC and event timing study
  - TC energy weighted event timing
  - Xtal by xtal timing bias into tsim
- Software update
  - conditionDB
  - Integer tsim version
  - MC truth information
- Trigger server related work for ecl trigger
- Online luminosity by ecl trigger as redundancy requested by Alex

Plan after LS1 and in LS2

- Try to separate two energy deposition in one TC (if necessary) ?
  - If two signal peak positions are >500ns, it would be possible

- New ShaperDSP ?
  - Currently 576 ShaperDSPs in 52 9-VMEs around Belle2 detector
  - Alex is planning to upgrade ShaperDSP
    - Some studies are in progress in BINP (the status not shown anywhere)
  - For ecl trigger, any requests and the meaningful improvement ?
    - “TC” timing can be improved if cell-by-cell timing adjustment in each TC is possible, but bad resolution is mainly from low energy TC
  - Any merit if logic of FAM can be implemented in new ShaperDSP ?
    - TC with from 4x4=16xtail to 2x2 if it improves some performance ?

- PureCsI ?
  - Would be not realistic…

ECL bkg monitor

- bkg group is planning to add ECL as one of beam bkg monitor(pdf)
  - Machine parameter tuning, understanding of bkg components, future bkg prospect
  - Utilize TC hit rate as bkg parameter
- FAM node provides hit rate PV of all 576 TC (w/o injection veto)
- Requested to prepare the PV w/ and w/o injection veto
  - more looser injection veto
    - Prepare on GDL and pass it to ETM or just on ETM
    - Study of the “loose” injection veto condition, and timing adjustment on ETM is necessary

Plan of tsim bugfix and update

- (1) definition of cluster position variable “getPostionX(),Y(),Z()” in TRGECLCluster dataobject is wrong.
  - (Correct) most energetic TC position in cluster on firmware
  - (Wrong) TC energy weighted position in cluster in current tsim
  - “getPostionX(),Y(),Z()” is not used anywhere in ecltrg, but used in track-cluster matching on GRL
  - Simple simulation showed no large discrepancy in efficiency of cluster-matching on GRL

- (2) strange energy cut on TRGECLDigitization
  - TC is rejected if TC energy < 30 MeV in T=0-1us
  - This would affect ecltrg outputs when signal MC starts from negative timing (from release7 ?)

Plan of tsim bugfix and update

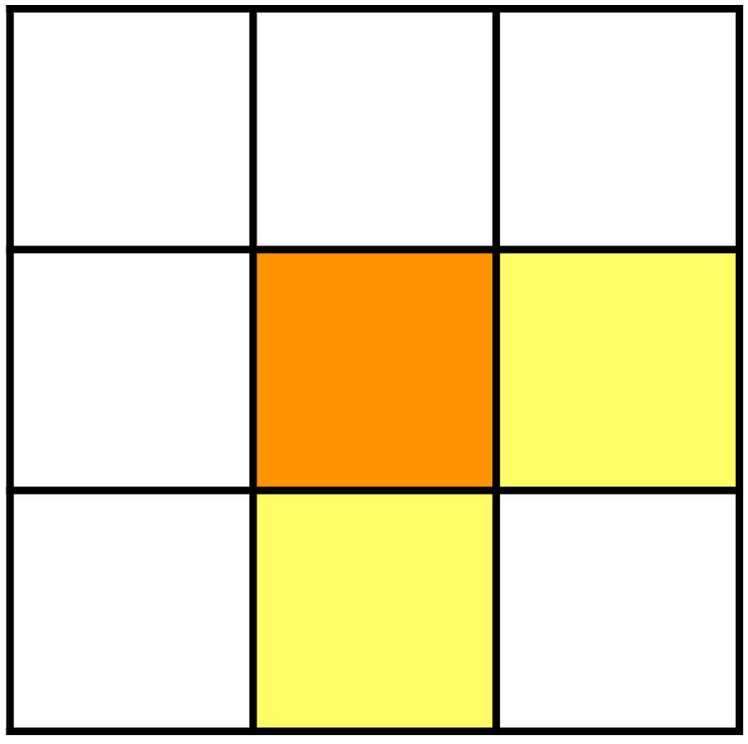
- (3) wrong dead time after fitter detects TC E > 100MeV
  - (Correct) 12 clock on firmware
  - (Wrong) 2 clock in current tsim
  - Probably effect is negligible, but better to check

- (4) update TRGECLMapping
  - Conversion of TCID, TCThetaID, TCPhiID, cellID, etc.
  - Currently this class cannot be used from python script, etc
  - Plan to add more useful conversion functions

- (5) update/modification of TRGECLBGTCHit module for background study
  - 1st version of samples were passed to nkzw-san
  - Discuss detail todo lists and strategy, and provide script, etc

Bug in cluster postion in tsim

- Communication with Isabel Haide triggered to find wrong definition of cluster position(“getPostionX(),Y(),Z()”) in TRGECLCluster dataobject.
  - Cluster consists of energy in 3x3 TCs



  - (A) Cluster position in FW is center of most energetic TC in the cluster
  - (B) “getPostion” returns TC energy weighted position in the cluster
  - In ecl trigger logic, “getPosition” is not used anywhere
    - Logic is based on TCID of most energetic TC in a cluster
  - In grl tsim, “getPosition” is used for track-cluster matching
- This bug will be fixed.