ECL trigger for Super Belle
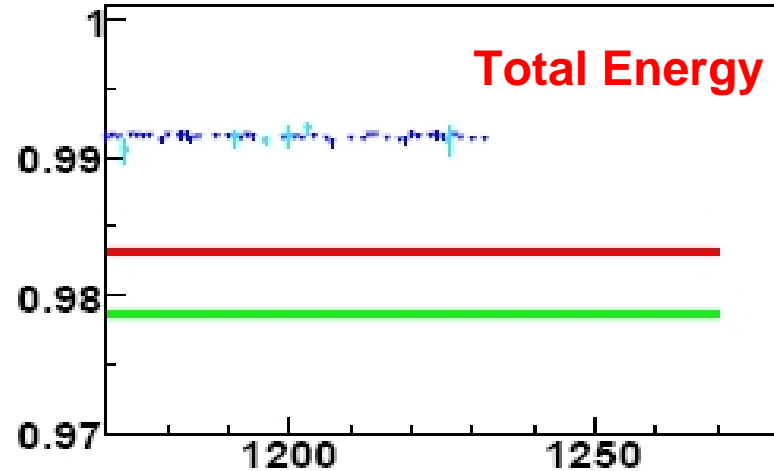
B.G. Cheon (Hanyang U)

Dec.10-12 @ KEK
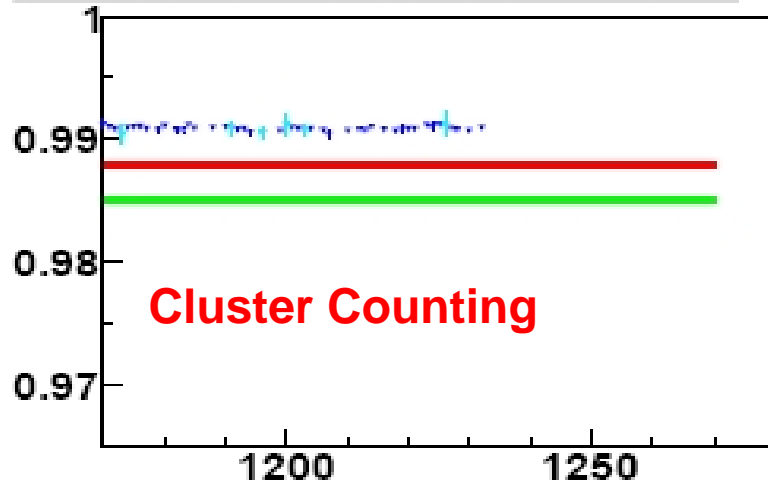1st open meeting of the Super KEKB Collaboration

Belle ECL physics triggers
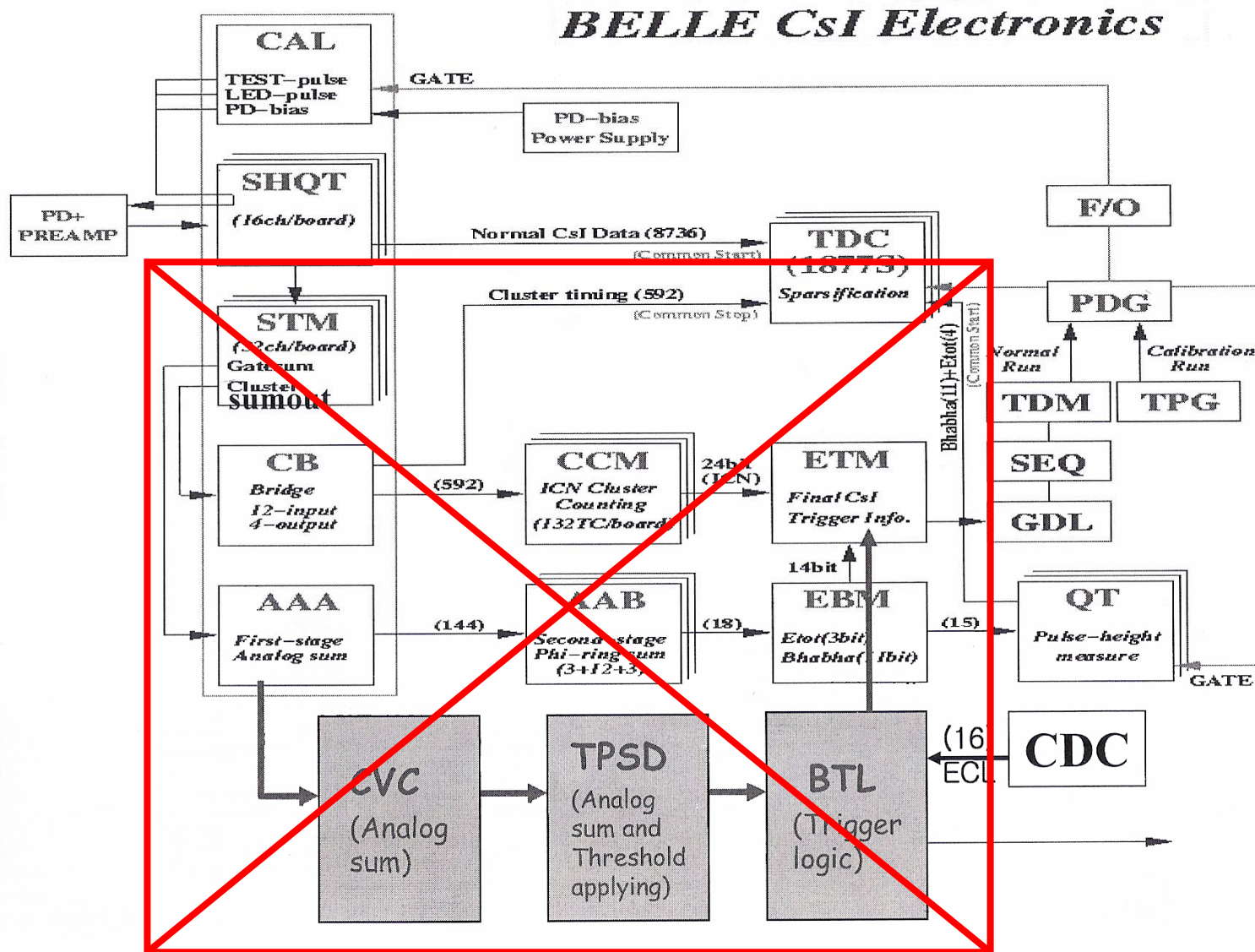
Belle ECL Electronics

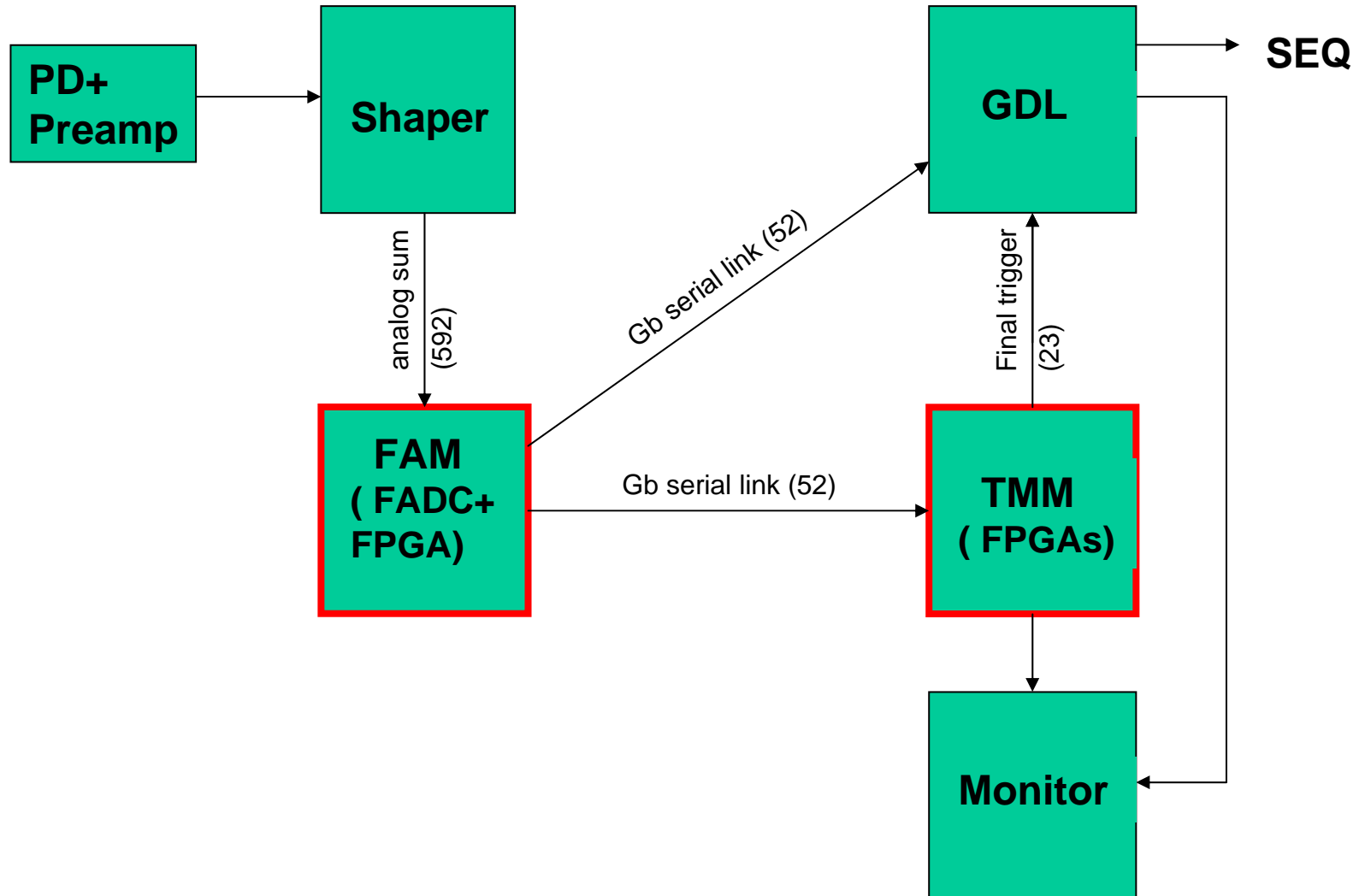# Super Belle ECL trigger electronics

PD+ Preamp → **Shaper**

analog sum (592) ↓

FAM (FADC+ FPGA)

Gb serial link (52) → **GDL** → SEQ

Gb serial link (52) → **TMM (FPGAs)**

Final trigger (23) ↑

TMM (FPGAs) ↓ **Monitor**
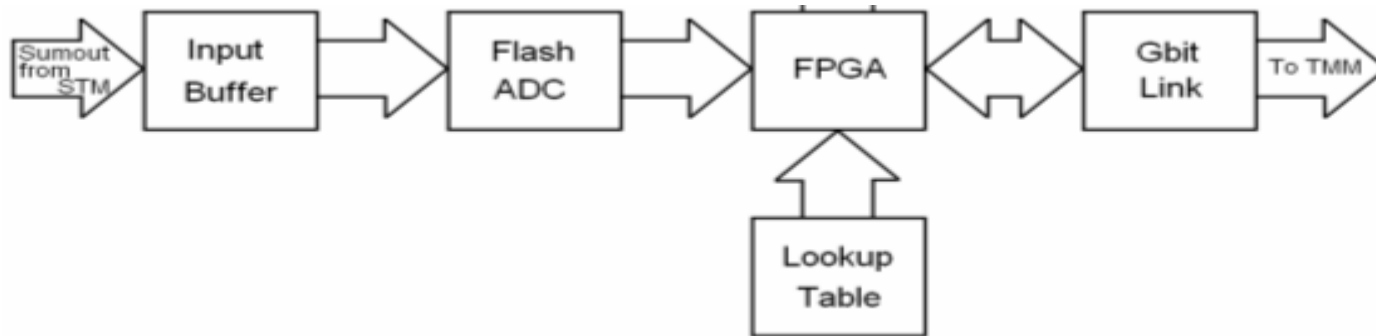
Advantage of FAM + TMM scheme

- Electronics chain will be very simple.

- More flexible trigger algorithm design than Belle trigger.

- Reduction of cable; lots of bulky copper cables → 52 optical fibers

- Simple monitoring scheme (extra QT & TDCs are not necessary)

- Easy handling of CsI(Tl) and pure-CsI signals simultaneously

Flash ADC Trigger Module (FAM)

- 52 FAMs to cover all the TC(4x4 crystals) signals.
- Input : 12 TC analog sum signals from each shaper
- Continuous Input signal digitization @ 100MS/s 12bit
- Output : 12 TC <pulse height + discriminator bit> via Gbit link
- TC output gain variation adjustment using look-up-table
- One board(12 TC channels) / VME crate
- Crystal gain adjustment will be done at shaper board.
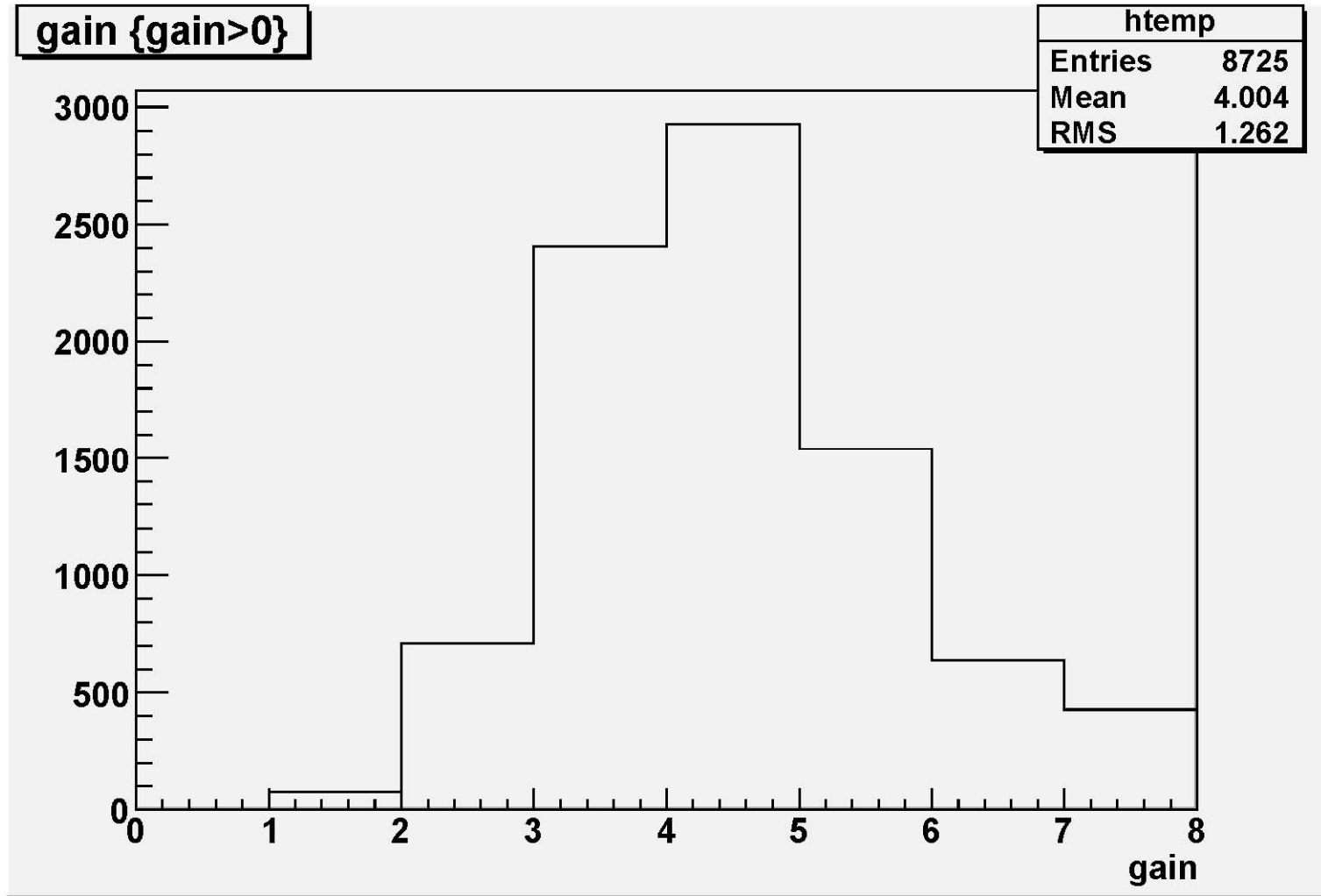
Each step : ~10% pulse height difference

New VME shaper-digitizer board
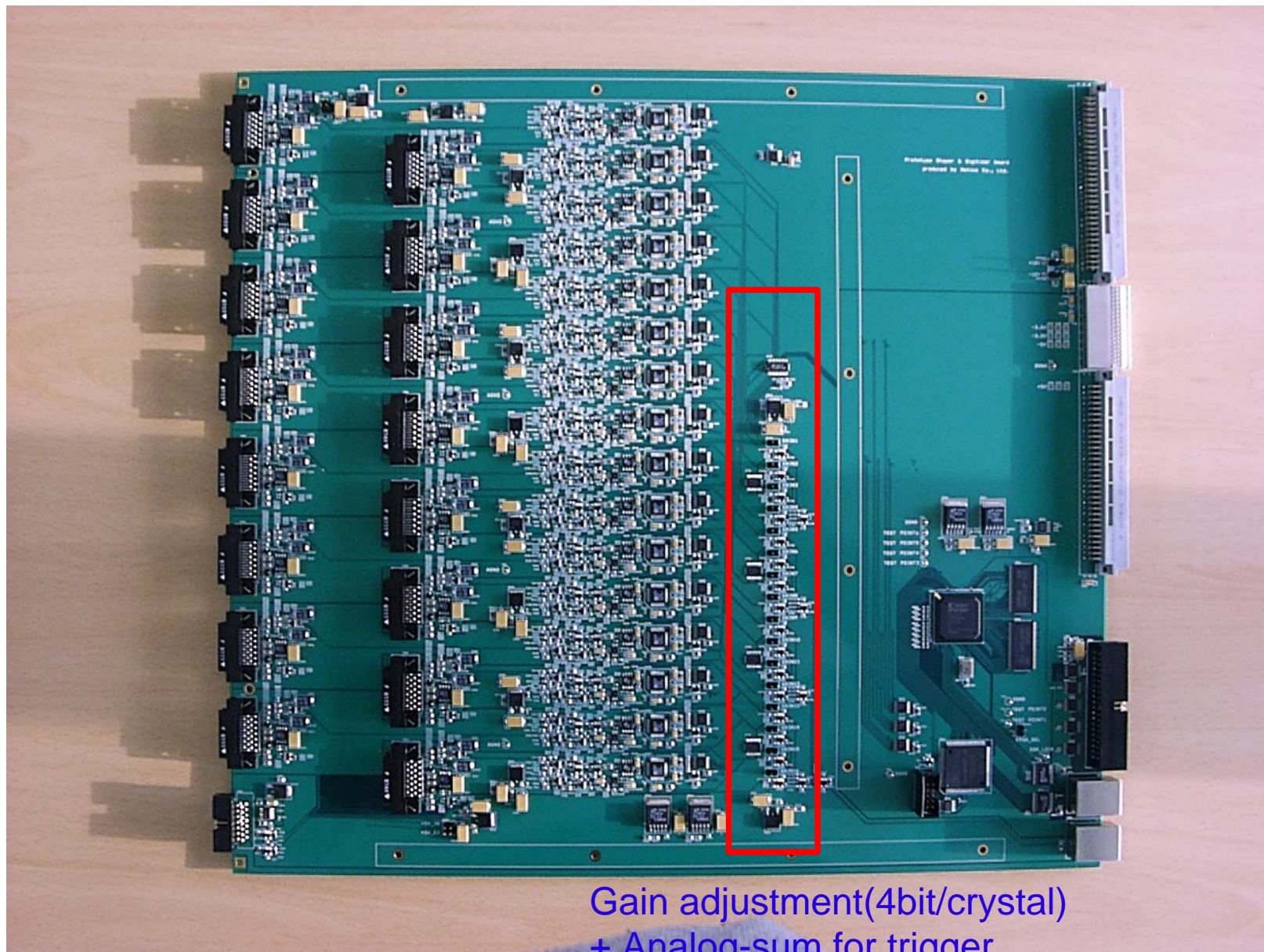
Gain adjustment(4bit/crystal)
+ Analog-sum for trigger

Trigger & Monitoring Module (TMM)

- Input : 52 x 12 TC signals from FAM modules
- 7 FPGAs + VME interface
- If all parts are not fitted into one board, partitioning & cascading design will be taken into account.
- Output : 23 ECL final trigger signals to GDL

    4   ECL trigger timings (Final, Fwd, Barrel, Bwd)

    3   Total Energy (>0.5, 1.0, 3.0 GeV)

    4   Isolated Cluster Number (3 bits + 1 carry-bit)

    11   types of Bhabha triggers

    1   Cosmic Veto

    ** Any more useful trigger algorithm will be studied.

Timing Latency

- Crystal to FAM = ~100ns

- Peaking time=700ns @ peak position of analog sum signal

- ADC pipeline latency @ FAM = ~100ns

- Peak finding process @FAM = 100 ~ 200ns

- Programmable delay @ FAM = ~300ns

- Gbit transfer(~200bit) = ~200ns

- Optical cable length(40~60m) = 200 ~ 300ns

- 52 Trigger input alignment @ TMM = ~100ns

- Trigger decision @ TMM = 100 ~ 200ns

Total latency = 1.9 ~ 2.2 μs

Summary

- FAM core firmware algorithm has been studied using new EBM.

- Trigger algorithm will be studied with gsim4superb (Unno san's talk).

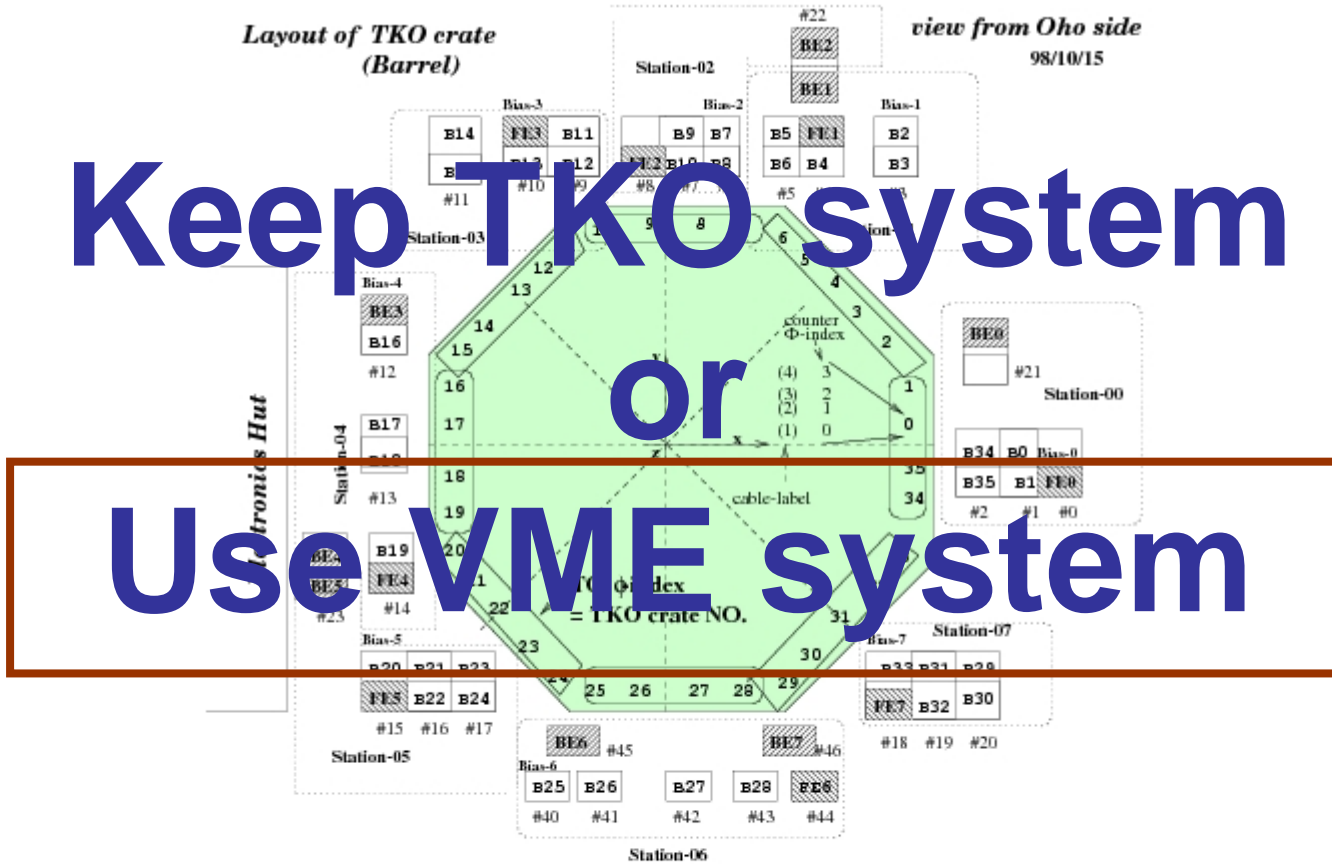- We will start designing FAM after new VME shaper is tested.
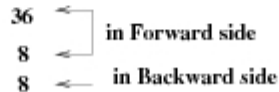
Backup Slide

52 TKO crates

Keep TKO system
or
Use VME system

How FAM works
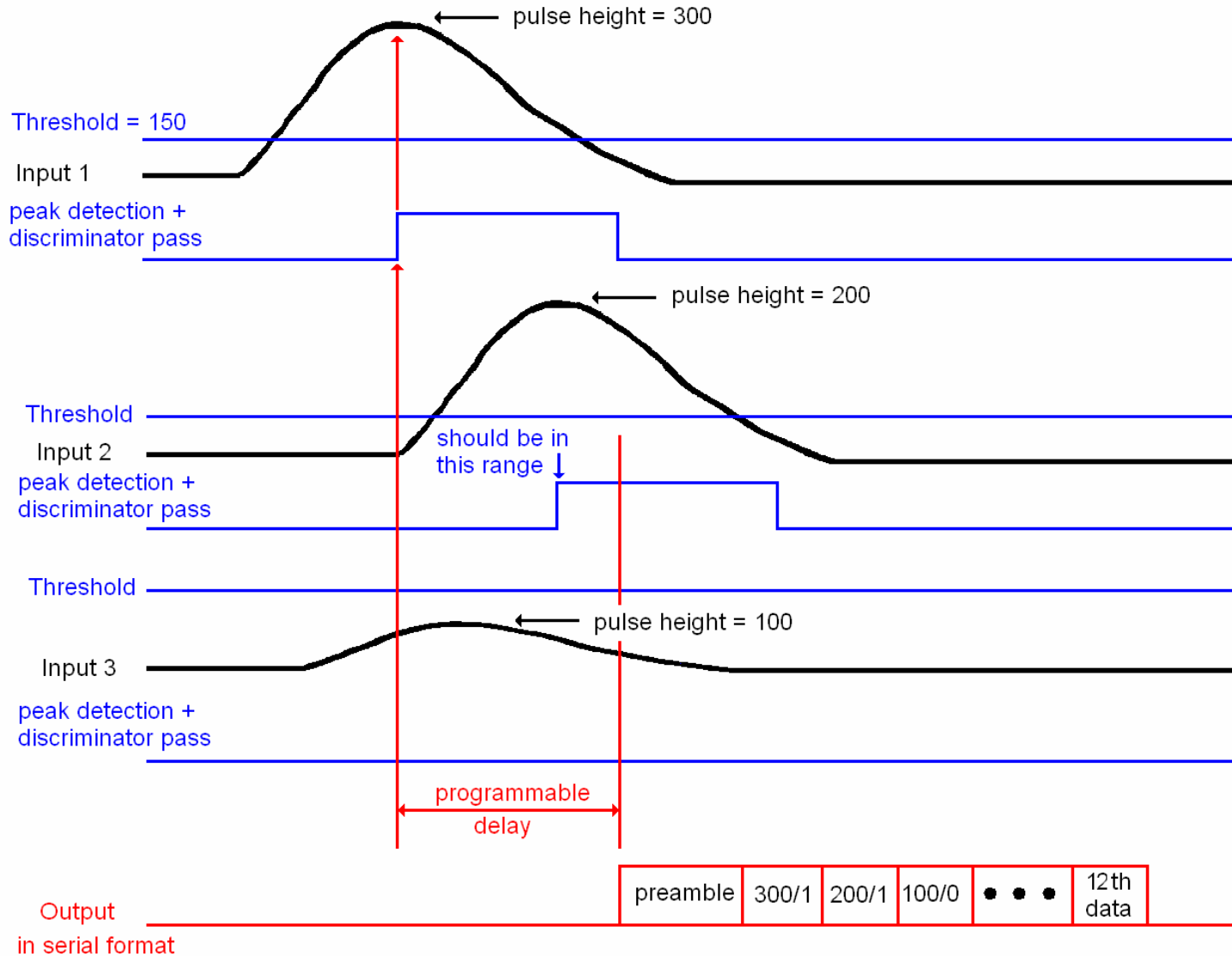
New EBM

M.J.Lee

- New EBM is not just a replacement of old EBM
  - It uses digitization of incoming signal and FPGA processing for discrimination & peak searching
- We installed new EBM test bench
  - This test bench is also aiming possible test for sBelle