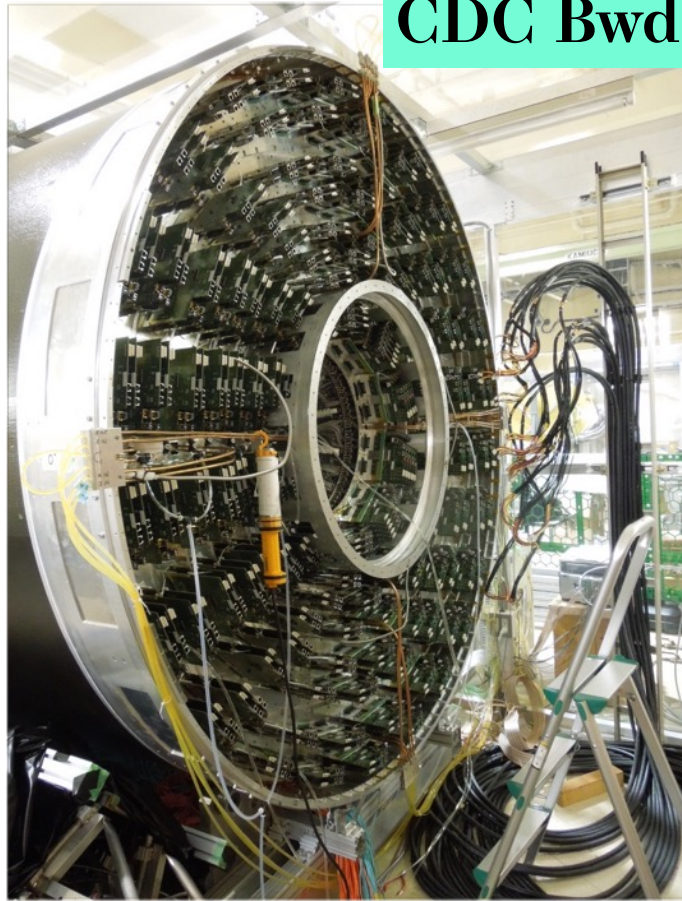# CDC

Nanae Taniguchi (KEK)

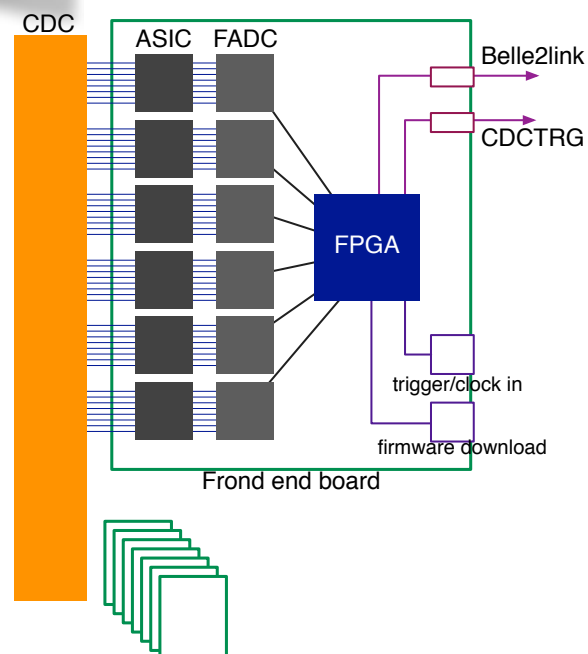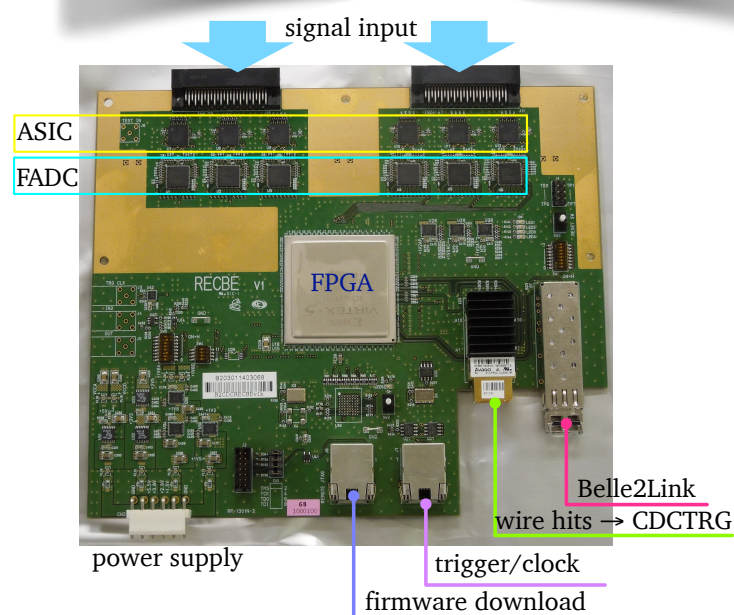Belle II Trigger and DAQ Workshop 2019

CDC readout

CDC Bwd.

- **14,336 channel**
- **299 FEs : 48ch/FE**
- **1 FE read 3-layer x 16 cells**
- **299 HSLB : 75 coppers**
- **data sent to DAQ and TRG systems**
  - cdc raw data (drift time and dE/dx) to DAQ
  - timing information to CDCTRG

signal input

ASIC
FADC

FPGA

RECBE V1

power supply

firmware download

trigger/clock

Belle2Link

wire hits → CDCTRG

CDC

ASIC FADC

FPGA

Belle2link

CDCTRG

trigger/clock in

firmware download

Frond end board

2

operation of CDC readout

- **DAQ problems of CDC FE**
  - known problems occurred before beam ON
    - specific FEs have problems
    - could not be fixed, mask these FEs during phase-3
  - problems occurred during beam ON
    - seems to occur randomly and not occur without beam

CDC front end operation

- 7 FEs are masked during phase-3 physics run

  - #247,204,218 (b2llost) : fixed once ~2 years ago, but appear again

  - #37,193 (b2llost) : new

  - #97, 115 (ttlost/crc error/b2link error) : new. it was occurred when we had resumed operation with Belle solenoid turned ON

- 1 FE can not be programed via FTSW

  - special treatment with firmware download tool provided by Xilinx (iMPACT)

  - replacement of cat.7 cable may be necessary
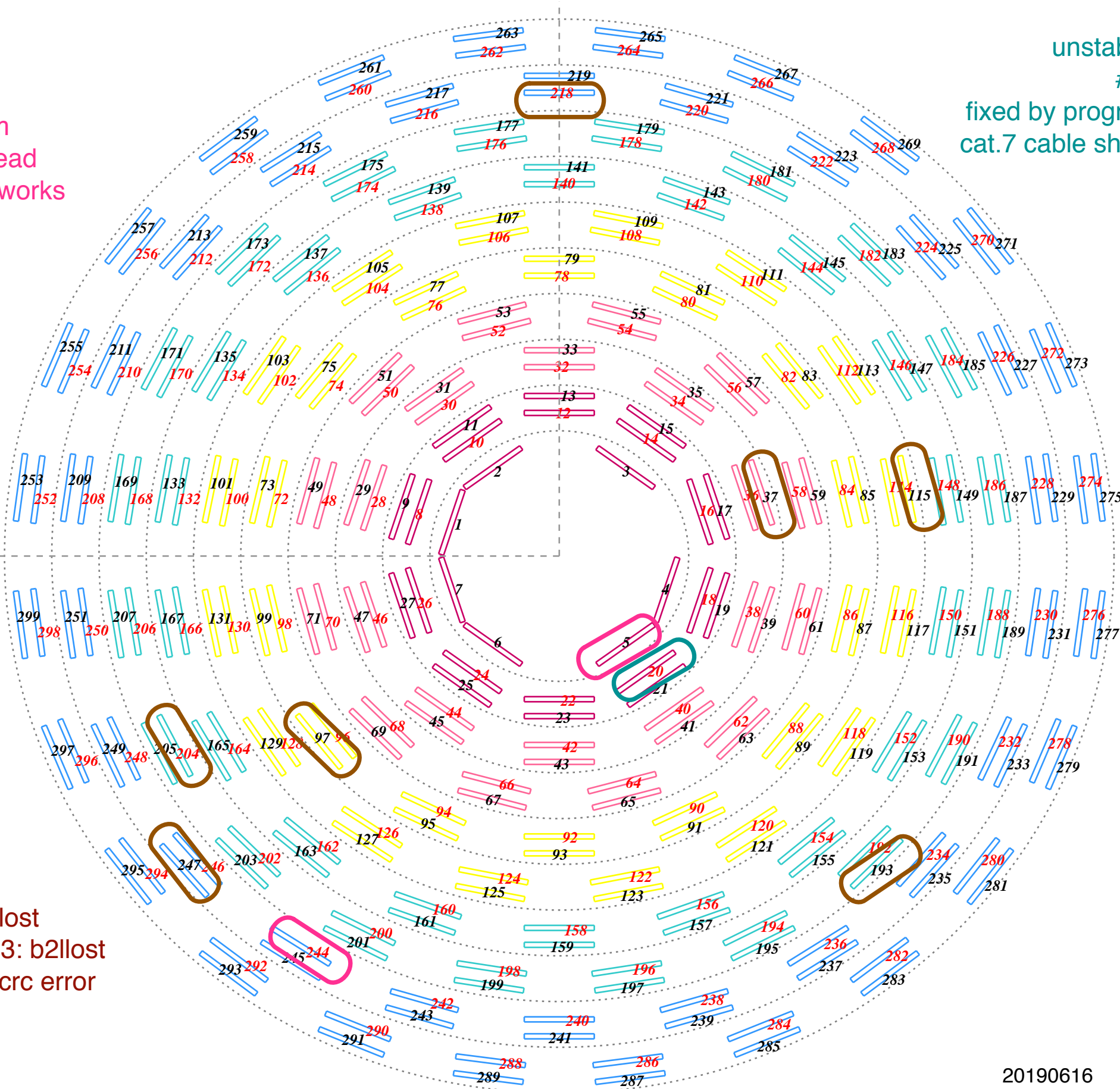
- These errors occurred before beam ON

FE   FTSW
                ttd
      cat.7   jtag

                ttd

download   PC
cable
RJ45<-jtag

4
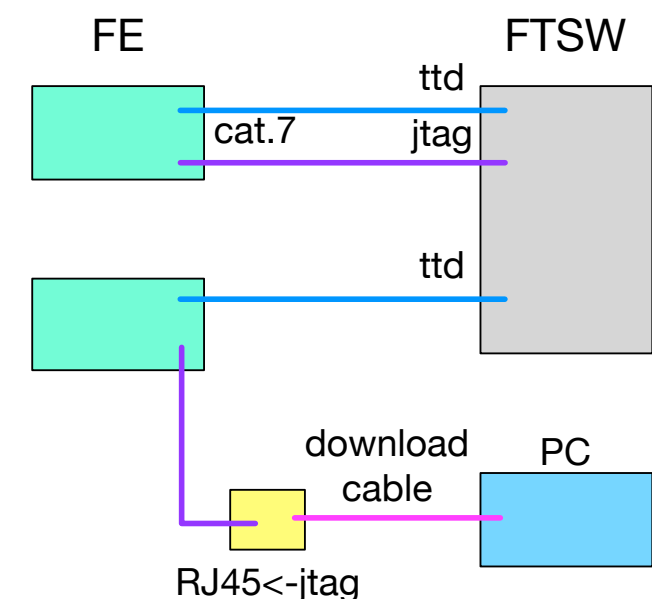
CDC backward

FADC problem
#5 : one ASIC dead
#244 : no channel works

phase-3

unstable JTAG
#20
fixed by programing using PC
cat.7 cable should be replaced

b2llost/b2lerr/ttlost
#247,204,218, 37,193: b2llost
#97,115 : ttlost and crc error

20190616
Nanae Taniguchi

maintenance of FE board

- belle2 link lost (b2llost) problem
  - board (1) : #204
    - link lost after 1-2 hours in global cosmic run
  - board (2) : #219
    - no b2llost in global cosmic run
    - link lost after ~ 24 hours with high rate test (poisson ~45kHz)
  - board (3) : #247
    - no b2llost in global cosmic and recent high rate test
    - We haven't touch this board in September maintenance

b2llost problem

	optical fiber swap	cat.7 swap	replace board	
board #204	b2llost	🟢	🔵	
board #205	🟢	🟢	—	

FTSW port is O.K.
It may be a problem of cat.7 (clock timing),
but it works after changing combination.

cat.7 cable is
not swapped

	optical fiber swap	cat.7 swap	replace board	cat.7 swap
board #219	b2llost	🟢	b2llost	🔵
board #218	🟢	🟢	—	🔵

FTSW port is not checked.
(work in high place. I'm considering to build a scaffold
for safety maintenance work. CDC/TOP)
It may be a problem of cat.7 (clock timing),
but it works after changing combination.

🟢 No b2llost in several short(~24h) runs with normal stop at high rate test

🔵 No b2llost in long run > 9 days at high rate test

investigation of b2llost/ttlost

- **To check if b2llost is fixed, we can only have test runs for several hours**

- **Zhou-san suggests a test for investigation of b2llost. We have started to check FEs one by one during summer shutdown.**

- **(I think) we see features in problematic FEs. We expect to establish a criteria to check b2llost.**

- **details will be reported by Zhou-san tomorrow**

- **Kunigo-san is working to study ttlost**
  - CDC FE will be tested soon

CDC front end operation

- DAQ errors of CDC FEs during beam ON

  - rerr / fifoerr / semmbe / semcrc

    - SALS(Stop Abort Load Start) doesn't work

    - need to re-program FPGA on FE

  - Unpacker error due to corrupted data

    - load on HLT become heavy

    - SALS doesn't work

    - need to re-program FPGA on FE

  - they seem to occur randomly, not in specific FE

FE error during phase-3 operation

- **Error map of FEs**

- **monitoring errors by statft**
  - script is running to check error every 5 sec. If catch error, execute ttaddr -200 -e/-p and make log file
  - mostly continuously running during phase-3

- **operation with included in GLOBAL (Apr. 1 - June 30)**

- **Errors**
  - rerr x13
  - fifoerr x9
  - semmbe(multi bit error) x1 (20190503, ~14:00), FE#20

FE error during phase-3 operation

rerr
fifoerr
unpacker error
semmbe

Nanae Taniguchi Apr. 25, 2016
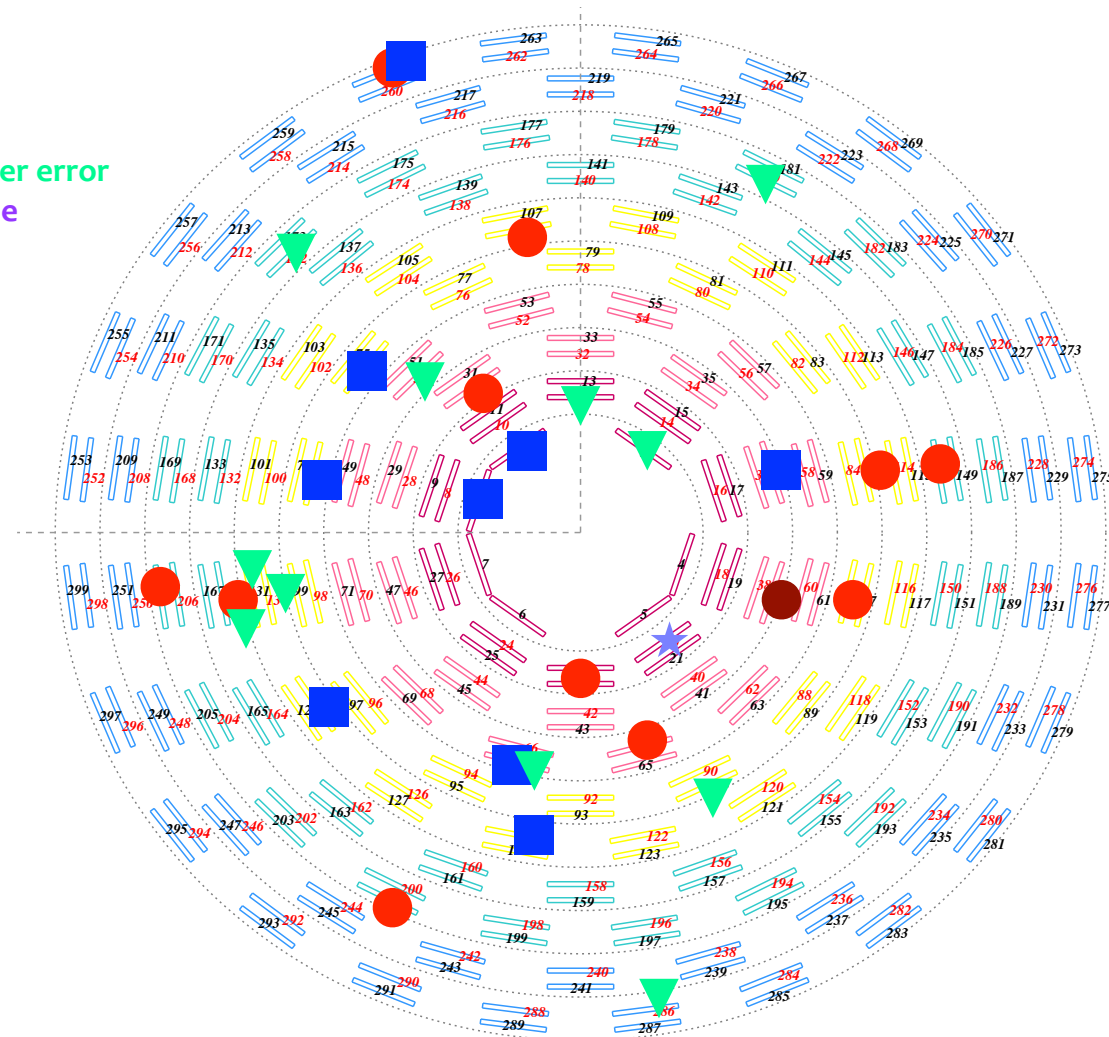
- **mostly occurred inner part ?**
- **study for relation with radiation is ongoing**
  - background level measured by diamond sensor and neutron detectors

FE error during phase-3 operation

```
nanae.taniguchi  Owner  午前8時24分

1=13700 reg=17000001 17000001 anyerr b2ldown=0
 0=11200 37000002  b2ldown=1
  1=11202 57000000  b2ldown=me [14 cpr2063a]

8=19080 reg=17101000 17101000 b2ldown=cA [cpr2063]
Mon Jul  1 08:24:43 JST 2019
```
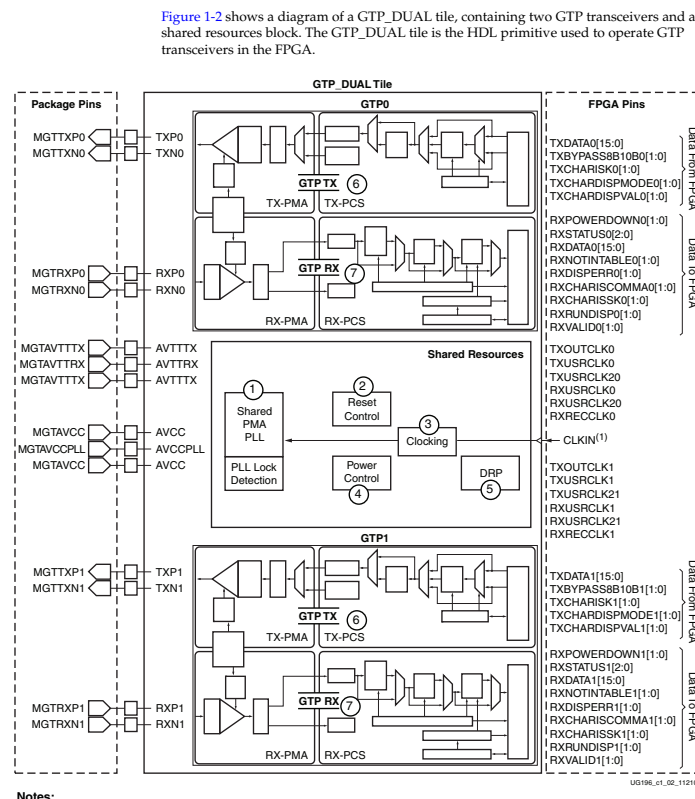
```
[nanae@ttd11 ~]$ /usr/local/bin/jtag-chain-cdc.sh fee1
11201 * DEV[0]: xc5vlx155t (02aec093)
11202 * DEV[0]: xc5vlx155t (02aec093)
11203 * DEV[0]: xc5vlx155t (02aec093)
11204 * DEV[0]: xc5vlx155t (02aec093)
11205 * DEV[0]: xc5vlx155t (02aec093)
11206 * DEV[0]: xc5vlx155t (02aec093)
11207 * DEV[0]: xc5vlx155t (02aec093)
```

optical transceiver 死んだ??

```
HSLB-a version 0.67 / b2link is down
(a)    stat=18000001 (ff=0 rx=0 pr=0 pt=0 tx=18 linkdown)
(a)    rxdata=bcbf rxlinkdown=0 rxcrcerr=0 feecrcerr=255
(a)    event=0 total=0kB
(a)    no b2link error ff00 0 datapkt 0 dataword 0
```
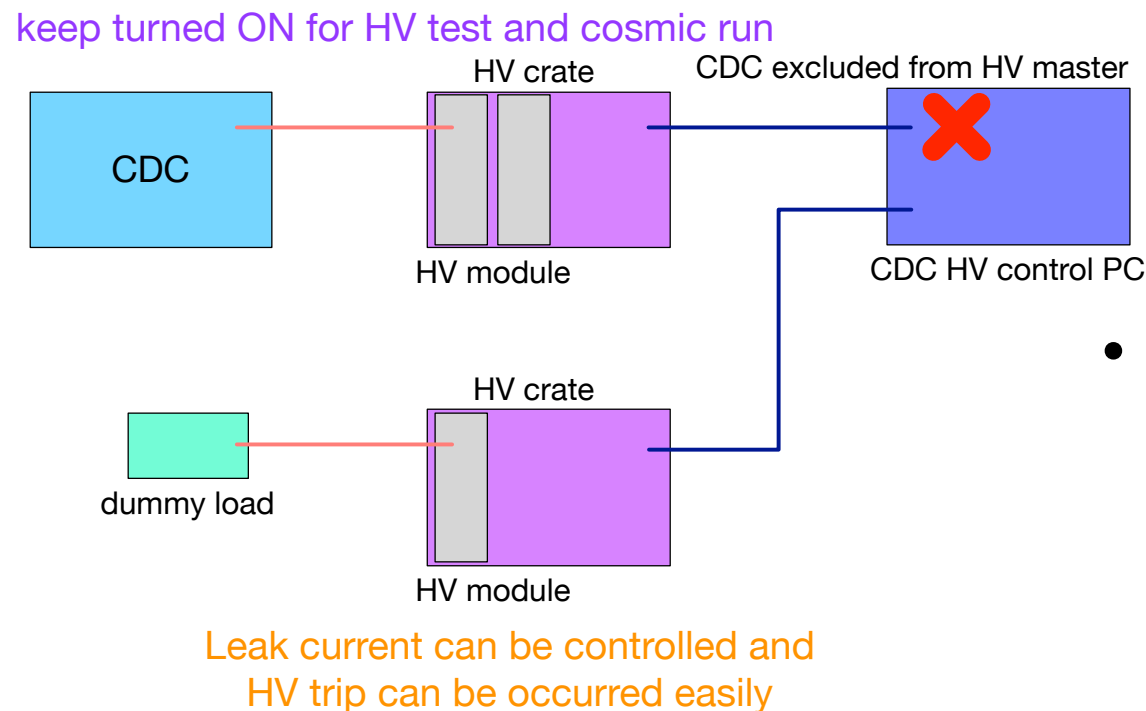

Figure 1-2 shows a diagram of a GTP_DUAL tile, containing two GTP transceivers and a shared resources block. The GTP_DUAL tile is the HDL primitive used to operate GTP transceivers in the FPGA.

Figure 1-2: GTP_DUAL Tile Block Diagram

- **Rocket I/O SEU**

  - b2ldown at ~08:20, 1st July

  - not during physics run, but high beam current study was ongoing

  - FPGA re-program didn't work

  - check optical fiber -> no light from FE

  - By power-cycle of DC PS, link is recovered

  - Nakao-san suggested it may be Rocket I/O SEU

12

preparation for autumn run

keep turned ON for HV test and cosmic run

HV crate

CDC excluded from HV master

CDC

HV module

CDC HV control PC

HV crate

dummy load

HV module

Leak current can be controlled and
HV trip can be occurred easily

- **HV auto-recovering from trip**

  - auto recovering was not implemented since we worry about persistent high current

- **prepare test setup**

  - we like to keep CDC HV ON for HV test and cosmic run and avoid affecting detector by test of auto-recovering

  - CDC is excluded from HV master and independent test setup with dummy load is included

- **will start with simple function first**

  - call 'recover' when TRIP detected

  - constrain the number of trials if necessary

preparation for autumn run

- ## DQM
  - occupancy plot with updated every a few seconds
  - requested to understand beam background
  - Yin Junhao (IHEP) is working
- ## QAM / monitoring of run dependence
  - dE/dx : Jitendra Kumar and Roy Briere (CMU)
  - Ks reconstruction, decay inside CDC to check performance CDC only : Makoto Uchida (TIT)

summary

- CDC readout work basically during phase-3
- Although 7 FEs are masked, impact on performance is not so large
- We have progress in investigation for DAQ errors of FE
- During summer shutdown, we will implement HV auto-recovering and improve DQM/run-dependent monitoring