

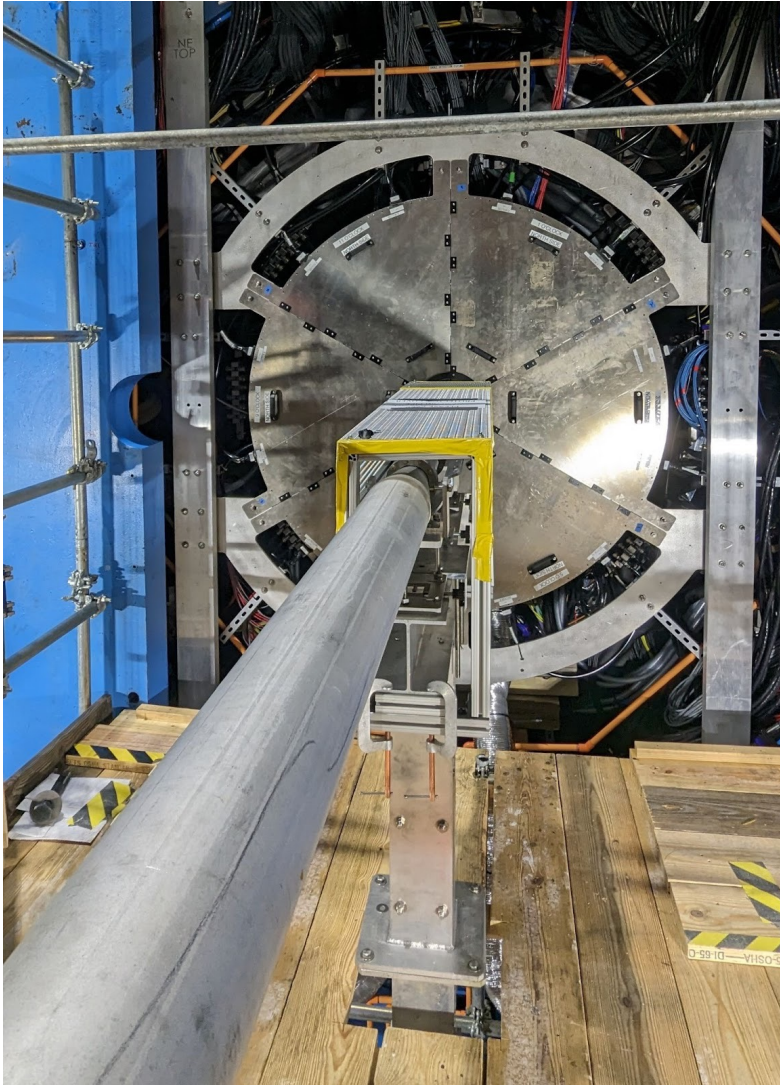
sPHENIX and INTT Commissioning Status

RIKEN/RBRC

Itaru Nakagawa

On behalf of Genki & INTT team

sPHENIX Status



sEPD

- sEPD North panels installed July 21st

Commissioning Schedule

- May 17/18 Collisions begin in sPHENIX
- May 18 BHSO approves sPHENIX operation
- May 25 Magnet reaches 4K
- May 31 Magnet operation passed to sPHENIX

So today we are nominally 7 weeks through commissioning out of 12 weeks

From Beam Use Proposal 2022

Weeks	Details
2.0	low rate, 6-28 bunches
2.0	low rate, 111 bunches, MBD L1 timing
1.0	low rate, crossing angle checks
1.0	low rate, calorimeter timing
4.0	medium rate, TPC timing, optimization
2.0	full rate, system test, DAQ throughput
12.0	total



May 18
June 1
June 15
June 22
June 29
July 27

Aug. 10

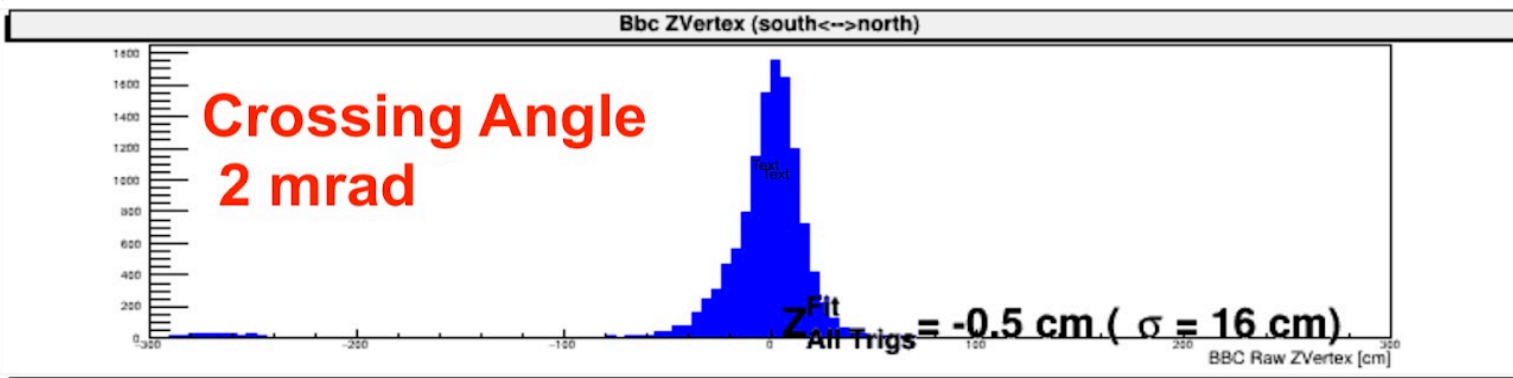
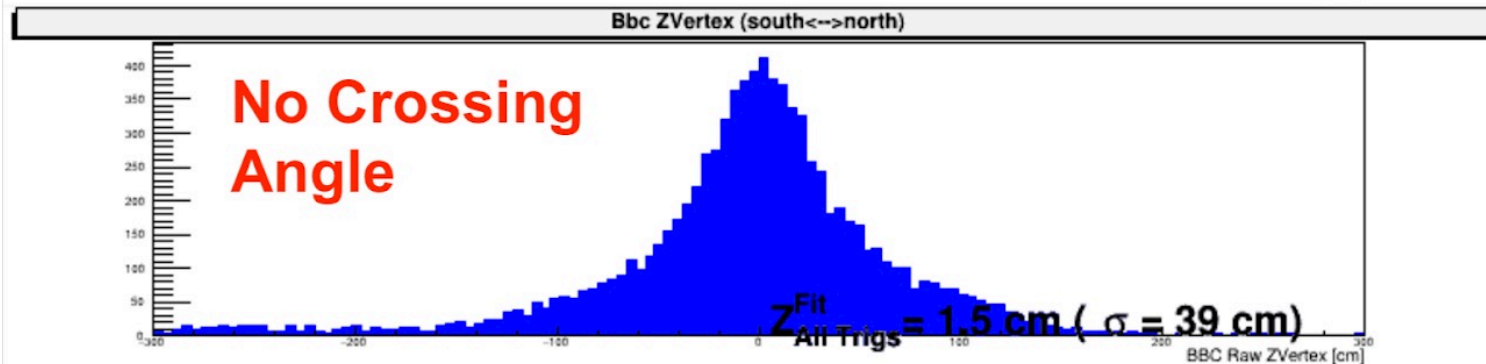
Weeks 7-10

The next phase will consist of four weeks of stores with 111 bunches, non-zero crossing angle, and a collision rate of 1--5 kHz. These stores will be used for initial operation of the tracking detectors, beginning with the TPC. The minimum bias trigger, developed in the previous weeks, will be used to trigger the detector readout. It may be useful during this phase to operate with **zero magnetic field and/or very low luminosity for periods of time in order to collect data which can be used to align the tracking detectors and characterize track distortions.** Some additional time may be necessary for data taking at zero field in order to change the MBD high voltage for zero field.

Weeks 11-12

The next two weeks will involve stores with 111 bunches, non-zero crossing angle, and an increasing rate of minimum bias collisions, culminating in fills that provide 15-20 kHz of collisions in order to stress test the data acquisition system under target running conditions.

Friday's crossing angle studies, 6x6 bunches



- Observed expected relative reduction in vertex width
- Absolute width is factor 2 too large
- But MBD not fully calibrated yet

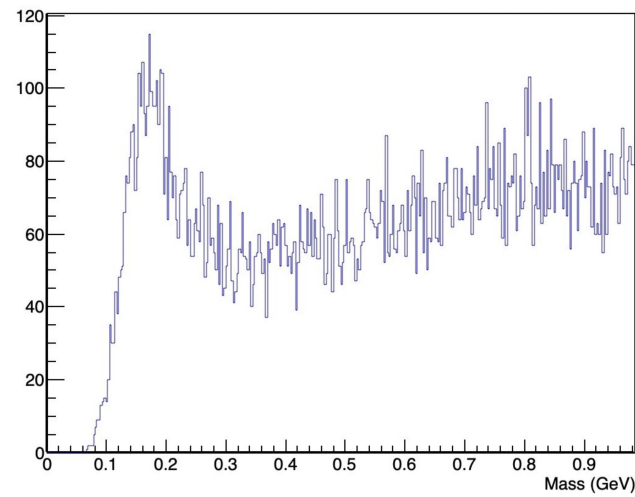
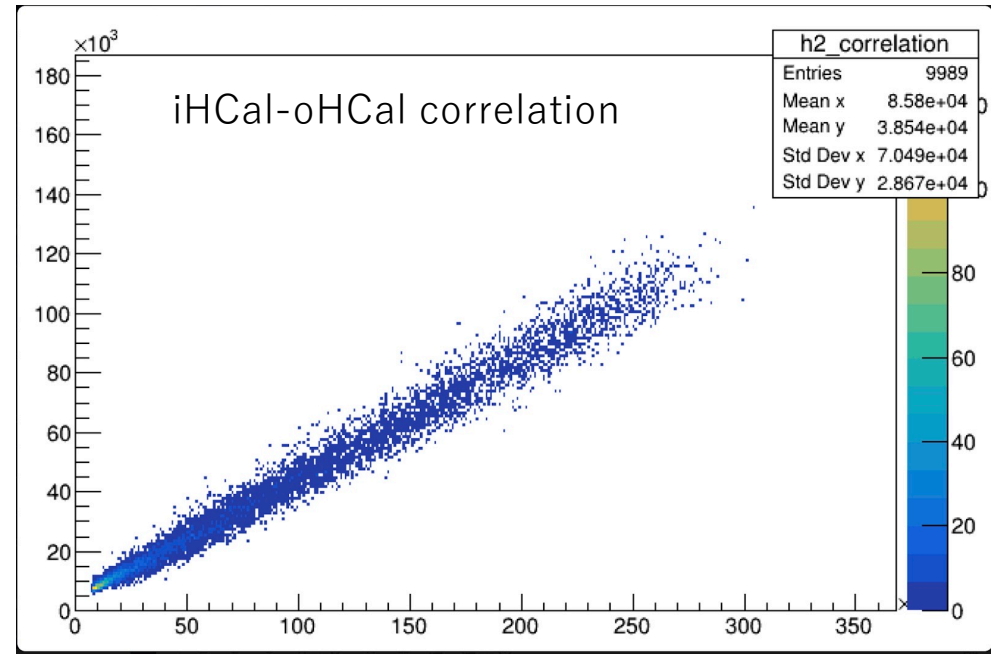
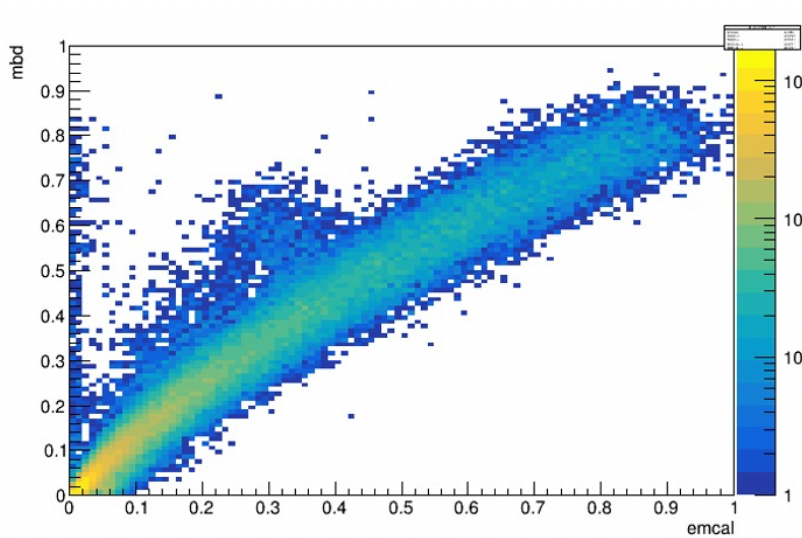
Good news and bad news

- Beam
 - RHIC availability has been excellent and has not impacted our work very much
- Magnet
 - Operated at full current for several days
- MBD
 - Works in magnetic field!
 - Trigger operational for other detectors since day 3 of commissioning
- MVTX
 - First attempts to stream data from collisions
- INTT
 - Calibration procedure far along (in fact disabled in order to prevent felix servers to process data w/o trigger), Timed in with collisions once, but lost synchronization between 8 felix servers.
- TPC
 - GEM conditioning appears to be converging
 - FELIX/FEE readout working quite well
 - Diffuse laser works!
- EMCAL
 - 99% live channels
 - Radiation damage slower than I feared
 - Convincing π^0
- HCAL
 - 99% live channels
- sEPD
 - Preparing for installation in July
- ZDC
 - Unplanned add-on that is fully functional
- Magnet
 - Has been stable since quench protection repair
- MBD
 - Need to systematize calibration and make vertex cuts in trigger
- MVTX
 - Investigating readout lockup with beam
- INTT
 - Demonstrated Internal/external detector hits correlation
- TPC
 - Working to operate with collisions at high voltage
- EMCAL, HCAL
 - Readout now reasonably stable, need to plug acceptance holes in EMCAL
- sEPD
 - Building the electronics box; schedule for July 19
- ZDC
 - Gain balancing may still be needed
 - Once we terminate the SMD cables we can add that easily

What we need now

- We're approaching stable running with
GL1+MBD+ZDC+EMCAL+HCAL+INTT+TPOT
 - Still rough spots and acceptance holes to address
- TPC+MVTX have to join up
- Zero suppression needed for TPC and calorimeters
 - Necessary but not sufficient to approach 15 kHz
- Record keeping

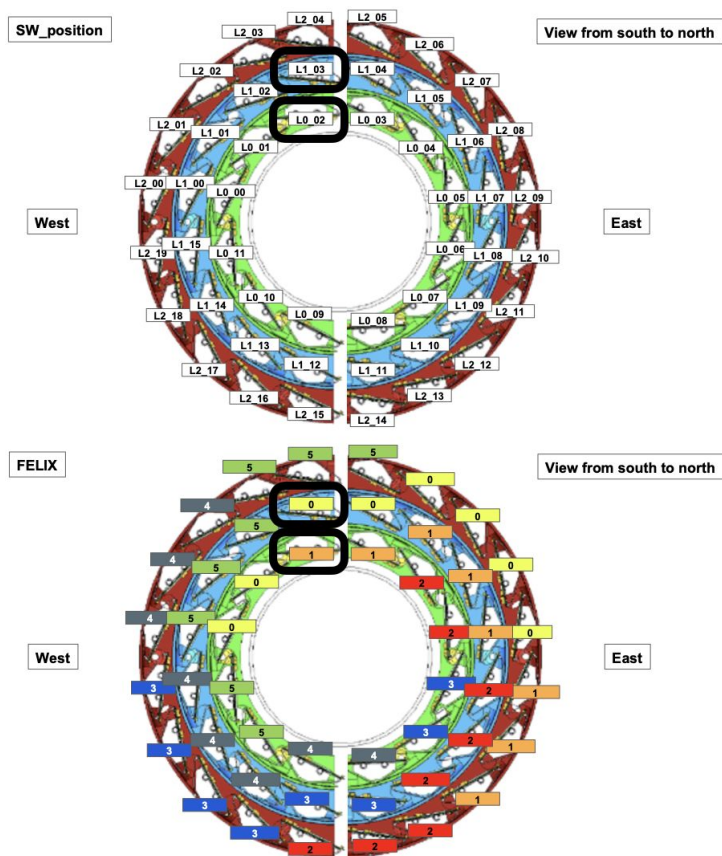
Calorimeter Status



Low Collision Rate (ZDC ~ 100Hz) Run: Stave Hit Correlation

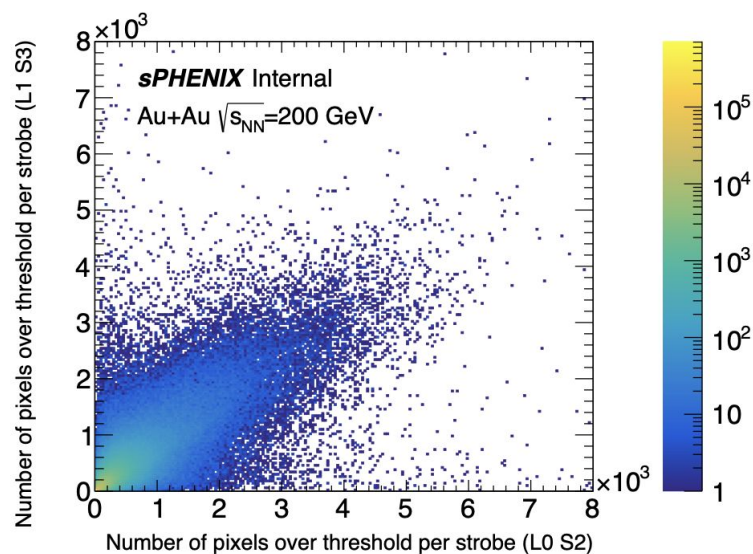
- from 6/27/2023, 2 staves from two **different** FELIX readout

positive correlation observed from beam collision data



Plot made by Hao-Ren Jheng (MIT)

Different FELIX, different layers L0_02 v.s L1_03



- Date: 2023/06/27
- Beam: Au+Au, $\sqrt{s_{NN}}=200\text{GeV}$, 111x111 bunches, 2 mrad crossing angle
- ZDC rate: 100Hz
- sPHENIX magnet ON
- Continuous readout, strobe window 89 μs
- Threshold for a pixel to be fired = 100 e-

* Without coincidence with other detectors (MBD trigger, or INTT)

TPC Status

HV GEM Conditioning on weekends (06/03, 06/04 & 06/10, 06/11)

- Understanding HV system
- GEM burn in

Cooling Investigation (06/07)

- Leak found and fixed

First Collisions in TPC ! (06/13)

- 12x12 AuAu, 100 Hz ZDC, 20 Hz trigger

Diffuse Laser test (06/15)

- 85 % intensity, 5 kHz, timed in

Collisions in TPC with full magnetic field (06/23)

- 111x111 AuAu, 100 Hz ZDC coincidence, 20 Hz trigger

Spark tests 06/26,27

- Took waveforms for the spark protection system



Road map to physics operation of INTT

RIKEN/RBRC

Itaru Nakagawa

2023/6/26

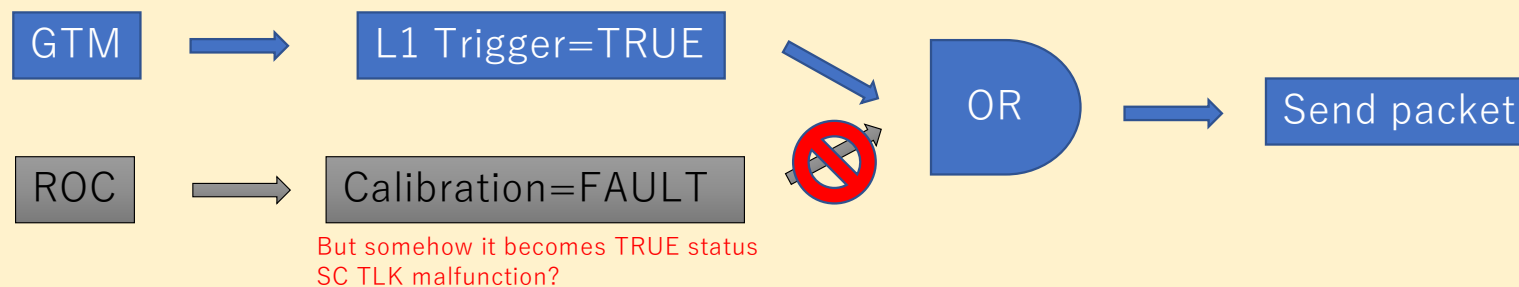
To declare physics mode operation of INTT

- A) 8 Felix servers in operational condition
 - Intt0 and intt1 are under triggerless mode.
 - Fallback solution: Disable calibration flag in Felix. No calibration possible for intt0 and intt1.
- B) Fix timing and online parameters
 - Inconsistent time-in condition between 8 felix servers .has to be resolved in order to finalize the timing parameters
 - All felix servers are to be timed-in within 2 BCLKs (1BCLK by the end of Run23)
- C) Proof of correlation with other detectors
 - Attempt to synchronize w/ MBD by event counter after Martin's new decoder was unsuccessful.
 - If feasible, MIP observation in conjunction with MBD's z-vertex cut.
- D) Online Monitor
 - Need to prove the it displays known dead/hot spots (no-bias silicon region, hot chips, etc)

A) Triggerless Symptom Issue

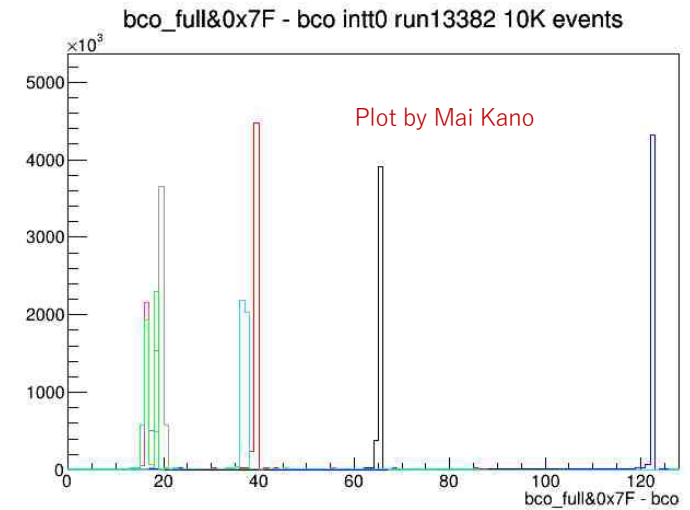
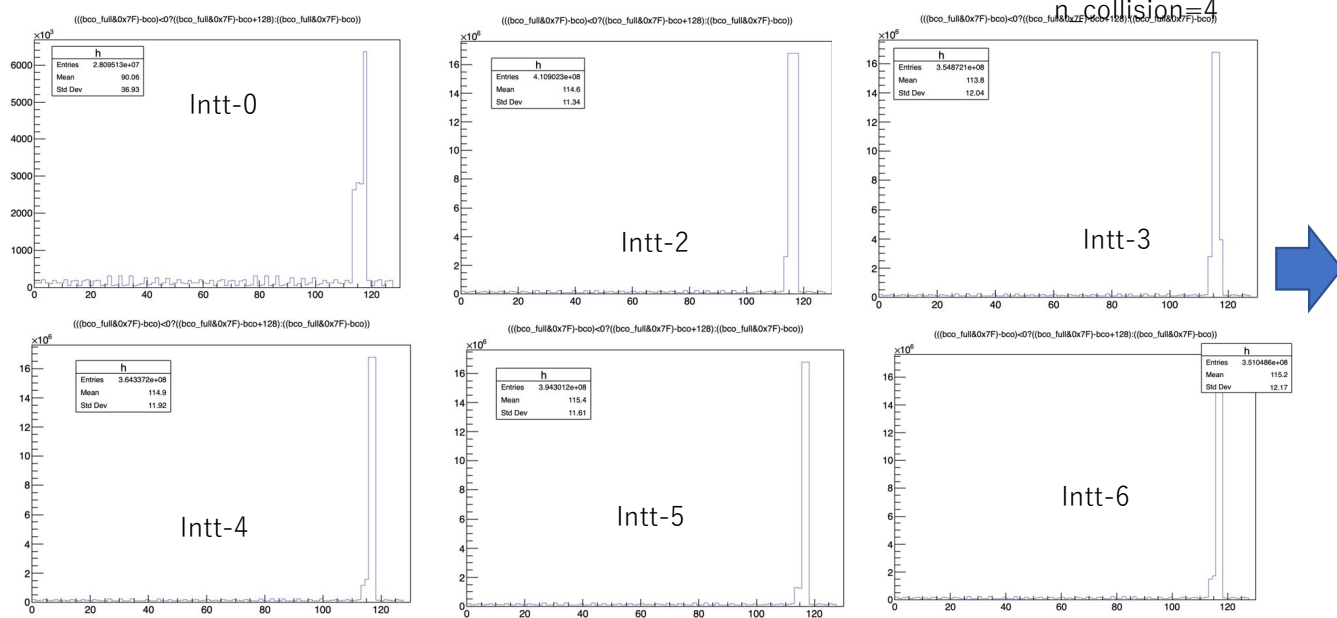
- Intt1 has been barely operational since it tends to become triggerless (see below flow chart). Noisy condition of intt1 server has been a suspect, but no obvious abnormal grounding was found by Rachid within 6/21 access.
- The same symptom appeared to intt0 on 6/22 and all ROCs in 6/29 owl shift.
- Raul implemented new firmware which disables the trigger thru SC link from ROC in all felix servers on June 29th around 23o'clock. So far so good.
- We should watch if intt1 won't gets exploded with the new firmware.
- The trade off is no calibration capability for these servers.

"Triggerless Mechanism" in the present felix firmware



B) Inconsistent time-in between 8 felix servers

bco_full – bco distribution on other felixs (Run#9328)



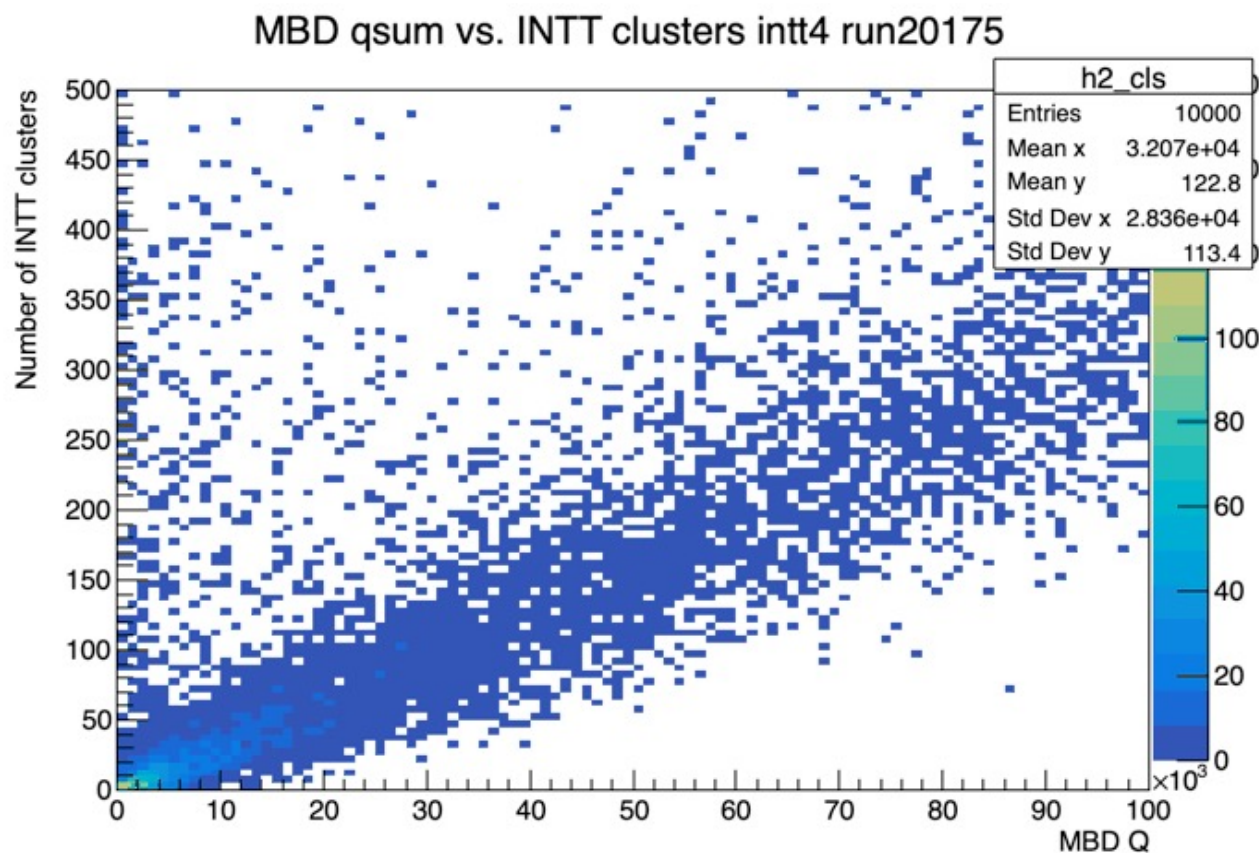
https://indico2.riken.jp/event/4499/contributions/21219/attachments/12028/17431/230606_BCO_Issues_maya_日本語ミーティング.pdf

Above plots **made by Maya** demonstrate peaks in the same location i.e. horizontal axis around ~116 implies all 6 servers were timed-in with the same modebit delay setting

Time-in Scan results of 6/19 (data taking by Mai). This implies we lost timing control of each servers. The question is when and how come?

C) Correlation Study w/ Other Subsystem

Maya Shimomura



- After resolving synchronization issues of event counters between MBD and INTT, a clear correlation between them were finally observed on July 2nd.