INTT Status

RIKEN/RBRC

Itaru Nakagawa

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.

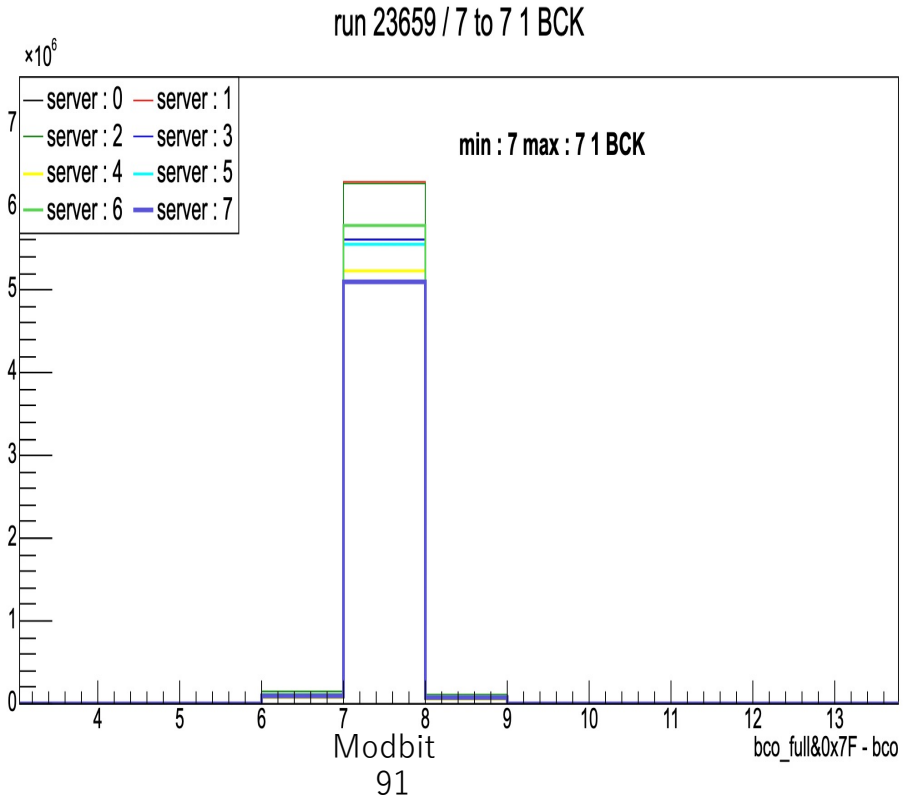
B) Fix timing and online parameters
- Inconsistent time-in condition between 8 felix servers has to be resolved in order to finalize the timing parameters
- All felix servers are to be timed-in within 2 BCLKs (1BCLK by the end of Run23)

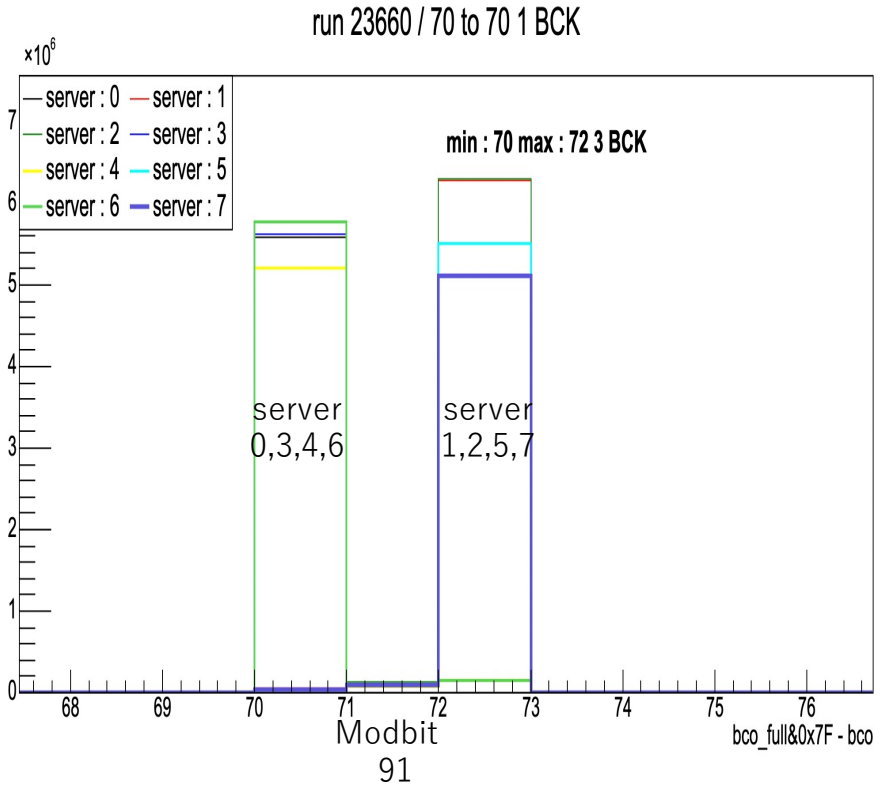
C) Proof of correlation with other detectors
- Attempt to synchronize w/ MBD by event counter after Martin's new decorder was unsuccessful. -> Established MBD & TPOT
- If feasible, MIP observation in conjunction with MBD's z-vertex cut.

D) Online Monitor
- Need to prove the it displays known dead/hot spots (no-bias silicon region, hot chips, etc) ✓?

B) Timing and Online Parameters

B) Latest Timing Issue

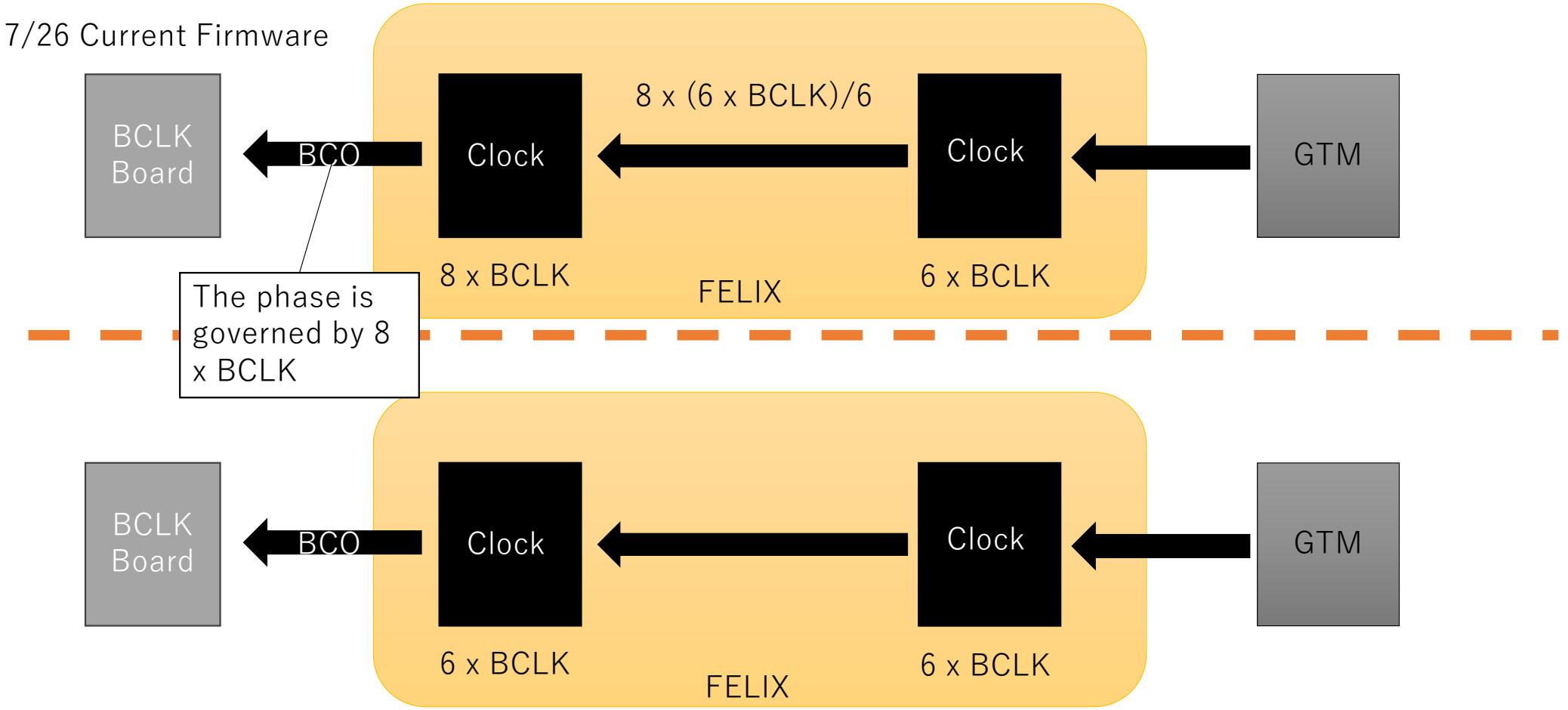




Plots from Jaein's slide

B) Possible Cause?

Raul is skeptical the glitch in the frequency conversion within clock blocks in the felix firmware. The new version avoids the conversion and was tested in intt0 on 7/26.



B) BCO Phase Scan

Latest configuration as of 7/24
Fine Delay : 88ps/tic
Maximum = 88ps x 255 = 22ns

L1 Coase Delay= L1Delay

Delay Set #	13	14	15	16	17	18	19	20	21	22	23	24
L1 Coase Delay	123	123	124	124	125	125	126	126	127	127	128	128
Fine Delay	10	121	10	121	10	121	10	121	10	121	10	121
Total Delay [BCLK]	20.51	20.59	20.67	20.76	20.84	20.92	**21.01**	21.09	21.17	21.26	21.34	21.42
Total Delay [ns]	2181.65	2190.53	2199.38	2208.26	2217.11	2225.99	2234.84	2243.72	2252.57	2261.45	2270.30	2279.18

- L1Delay=21
- n_collision=0
- Modebit 76:0x35
- 60 kEvents (1minute @ 1kHz) x 42 runs ~ 2 hours

Execution and Analysis:

- Script : Execute ~/operations/INTT//L1FineDelay.sh (need to be tested)
- Time in plots are to be made in felix-by-felix basis: Jaein / Other volunteer?

FVTX Performance

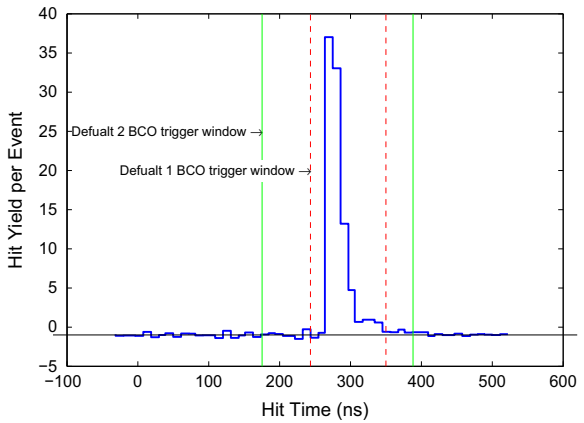
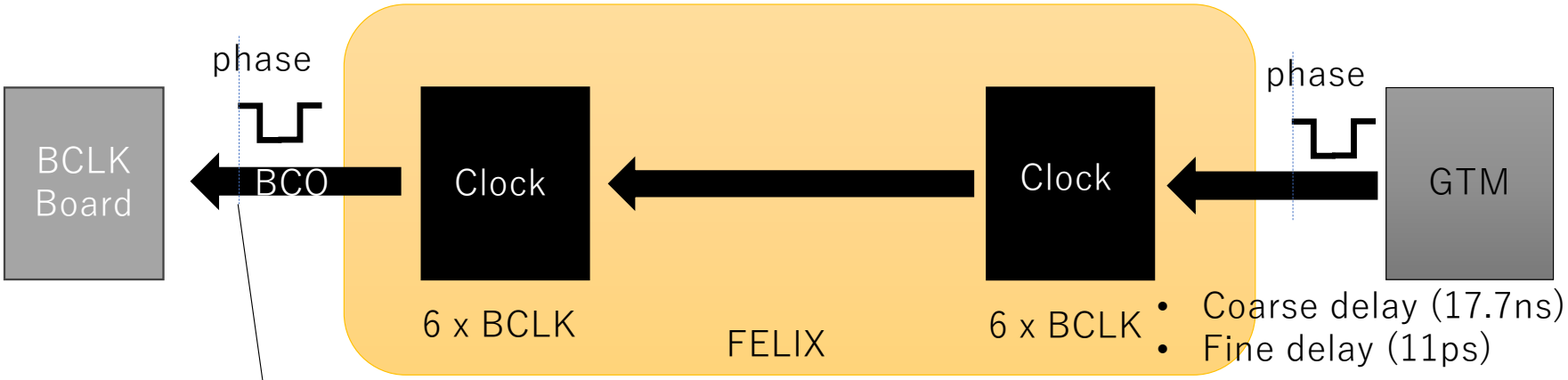


Fig. 32. Timing distribution of the FVTX hits relative to the RHIC beam clock.

BCO Phase Scan Preparation



Only coarse delay is propagated to BCLK board

The firmware will be upgrade propagate the fine delay to BCLK board as well.

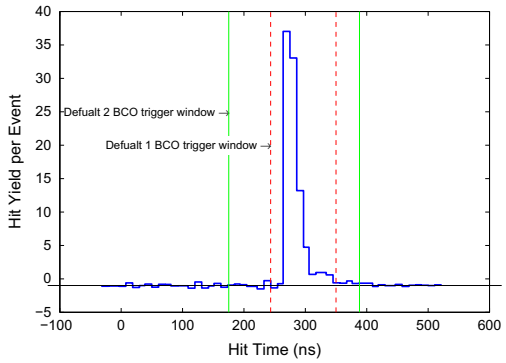
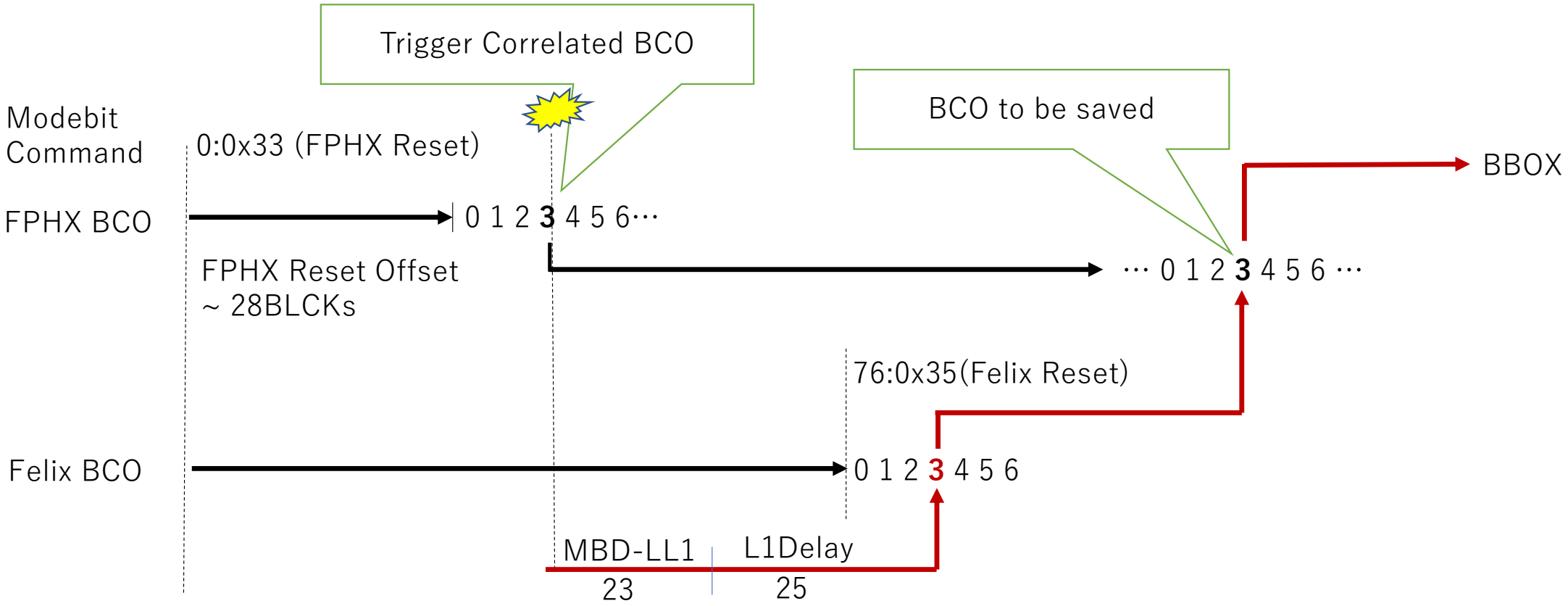


Fig. 32. Timing distribution of the FVTX hits relative to the RHIC beam clock.

History of INTT Timing Tunes

Phase	Date	Run	Comments
I	5/25	7364 ~ 8059	• LVL1 Delay Scan • n_collision Scan • Open time Scan
II	5/30	8100 ~ 8126	• Modebit delay scan • Intt2 timed in at modebit=**76**:0x35
II	6/2	9158 ~ 9231	• Modebit 78:0x35 • Open up n_collision = 4
IV	6/17	13091 ~ 13127	• Modebit delay scan 7 servers • Inter-felix timing shift observation
V	7/14	21386 ~ 21506	• MBD Trigger 28->32, L1Delay=25->21 • Inter-felix timing shift fixed
VI	7/25	23642 ~ 23667	• All felix servers timed in at modebit=**91**:0x35 • Split timing peak +/-1BCLK alternating runs

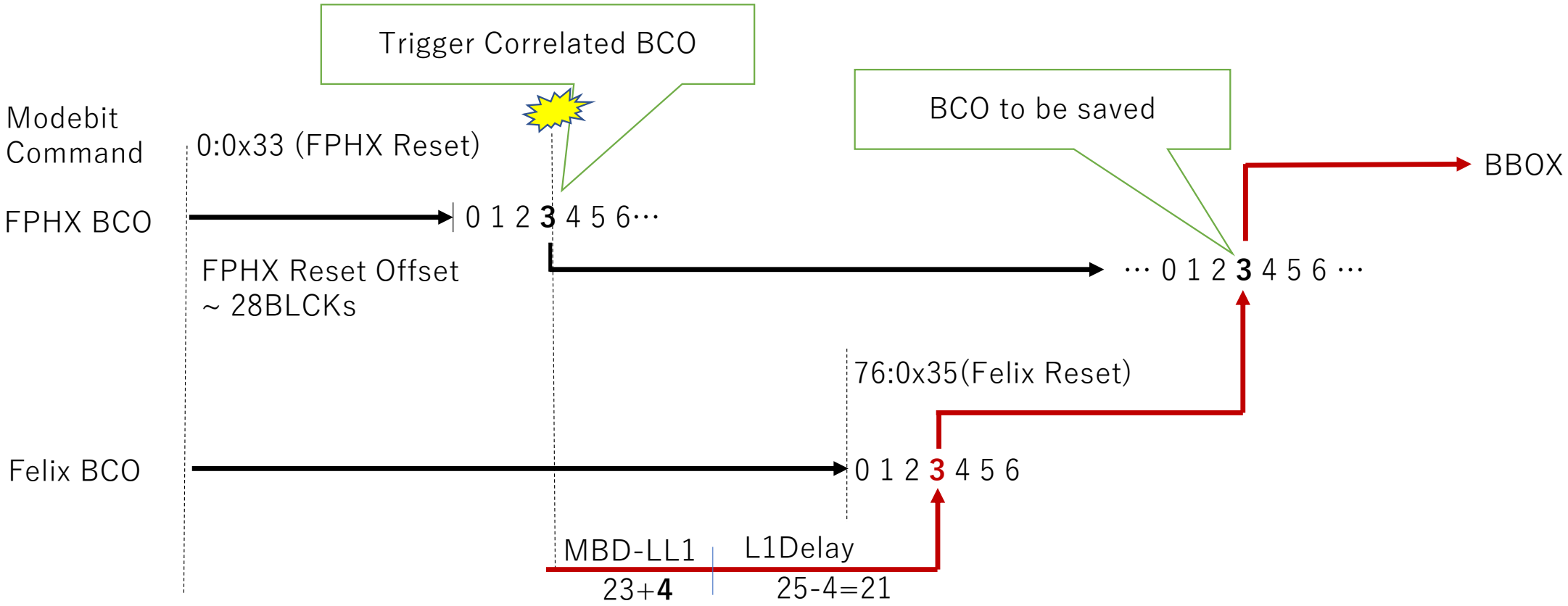
Solution : Modebit Offset



Modebit Felix Reset Delay: 28+23+25=76

Compensation of MBD Timing Tune

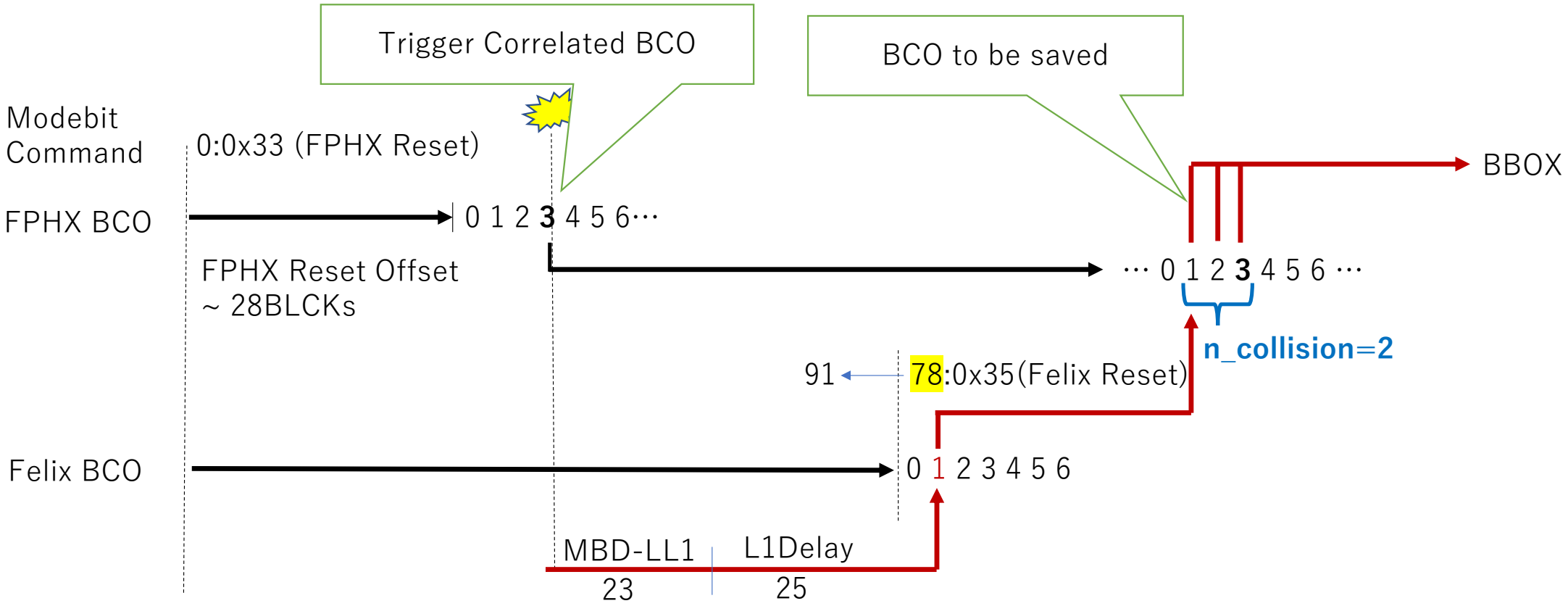
MBD timing change by 4BCLK is compensated by L1Delay setting from 25 -> 21.



Modebit Felix Reset Delay: 28+23+25=76

7/25 Time-In Result

Modebit 76:0x35 -> 91:0x35 picks up earlier hits by 15 BCLKS



Modebit Felix Reset Delay: 28+23+25=76

Remaining Steps to Satisfy Timing Goal

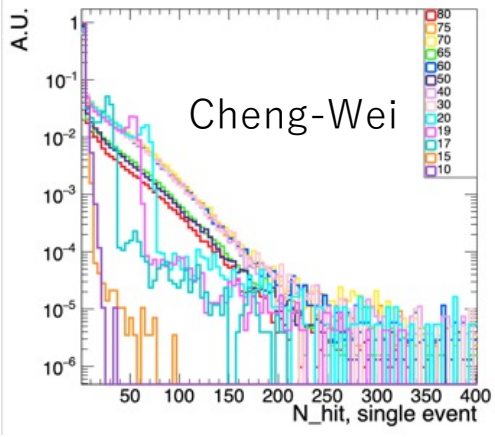
1. Fix splitting the timing peak +/-1BCLK issue in the felix firmware (Raul)
2. Upgrade firmware to propagate the fine delay to BCLK boards (Raul)
3. Execute the phase scan (Onsite crews)

B) Optimization of Timing Parameters

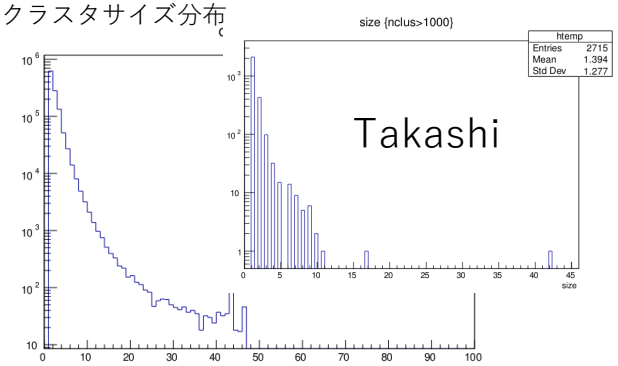
Cheng-Wei

Index	Date	Run#
I	5/25	8020 ~ 8059
II	6/9	9545 ~ 9553
III	To be done again after timing issue is resolved	

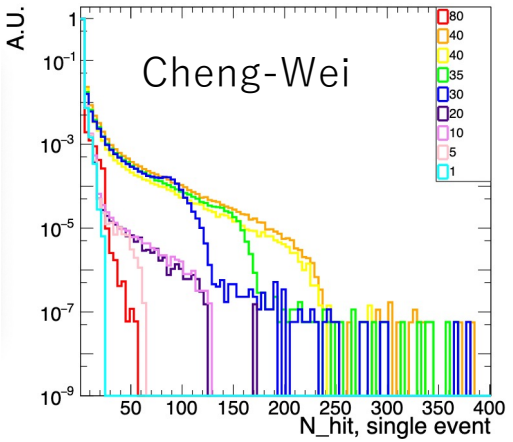
First Open Time Scan Result



クラスタサイズ分布



2nd Open Time Scan Result



/home/inttdev/data/IR_DAQ_server/INTT_study_run/BCO_window/data_analysis/8020_Time_5min_L1Delay00_Ncollision127_Opentime120

DAC0 Scan

Scan	1	2	3	4	5	6	7	8	9	10	11
minutes	**5**	**5**	**5**	**5**	**10**	**20**	**60**	**5**	**5**	**5**	**5**
DAC0	**17**	**16**	**15**	**18**	**20**	**30**	**40**	**14**	**13**	**12**	**11**
DAC1	44	44	44	44	44	44	44	44	44	44	44
DAC2	48	48	48	48	48	48	48	48	48	48	48
DAC3	52	52	52	52	52	52	52	52	52	52	52
DAC4	56	56	56	56	56	56	56	56	56	56	56
DAC5	60	60	60	60	60	60	60	60	60	60	60
DAC6	64	64	64	64	64	64	64	64	64	64	64
DAC7	68	68	68	68	68	68	68	68	68	68	68

Executed 7/26 Hot channel mask list will be updated (Jaein).

C) MIP Observation

DAC Scan

Extend to max range

Scan	1	2	3	4	5	6	7	8	9	10	11	12
DAC0	8	28	48	68	88	108	128	148	168	188	212	236
1	12	32	52	72	92	112	132	152	172	192	216	240
2	16	36	56	76	96	116	136	156	176	196	220	244
3	20	40	60	80	100	120	140	160	180	200	224	248
4	24	44	64	84	104	124	144	164	184	204	228	252
5	28	48	68	88	108	128	148	168	188	208	232	255
6	32	52	72	92	112	132	152	172	192	212	236	255
7	36	56	76	96	116	136	156	176	196	216	240	255

- BigPartition together with MBD (Must) no need to be a dedicated run
- Can be done with n_collision=127 (w/o waiting for asynchronous timing issue btwn intt servers.
- 12 settings
- ~2M events (30 minutes @ ~1kHz)
- 6 hours total
- If the series of data are interrupted by the beam dump, repeat the same setting as the last run at the last store.

Towards MIP Peak Observation

329 | Sat Jul 22 00:18:22 2023 | Ron Belmont | DAQ operation - Night shift log and summary

https://sphenix-intra.sdcc.bnl.gov/WWW/elog/DAQ/329

Summary Table

Fill Type	Time	Fill Number	Run Number	Detectors	Raw Rate (kHz)	Scaledown	Scaled Rate (Hz)	Number of Events	Log and Reason for Stopping	INTT DAC Scan Number
Beam	0000	34017	23055	LL1, MBD, ZDC+sEPD, EMCAL, HCAL, INTT	1.5	0	100-ish	273015	MCR decided to dump very early (0043hrs), seb07 seemingly stopped at 262145	3
Beam	0202	34018	23058	LL1, MBD, ZDC+sEPD, EMCAL, HCAL, INTT	3.7	7	300-ish	377622	DAQ hang on seb06 (377617 events)	2
Beam	0242	34018	23059	LL1, MBD, ZDC+sEPD, EMCAL, HCAL, INTT	2.8	10	200-ish	419185	Sufficient number of events and about 1 hour of run time	1
Beam	0346	34018	23060	LL1, MBD, ZDC+sEPD, EMCAL, HCAL, INTT	1.9	0	200-ish	270000-ish	Ended run due to minor fault on rack 3C1, also noted most EMCal bias monitoring went offline along with warnings on EMCal NE LV monitoring	
LED	0504	34018	23061	HCAL				10096	Sufficient number of events collected	

Notes

Following the example of the previous DAQ shifter, I am placing the DAQ scan number with the run that was started after the DAC scan script was executed. Two DAC scans, 5 and 4, we the previous shift. We will attempt to do 3, 2, and 1 in this shift. The beam dump is scheduled for 0342hrs, so it's unclear how many we'll actually be able to do before then.

Attempted to do an MBD laser between fills. The python gui started fine, and clicking the start run button clearly executed some code and started a run (7220114). However, no even for several minutes. MCR started injection tuning shortly after, so we decided not to bother the expert since it was very unlikely there would be enough time to edit the script and before beam was injected.

Did a little playing around with scaledowns to see if we could improve the live rate to try to get the scaled rate to something reasonable. This was largely unsuccessful.

When the EMCal went down (racks 3C2 and 3C1) around 0436hrs, we were not able to start new runs after that because rc_begin tries to initialize the DCMs even when the detectors aren't selected---it seems to be stuck trying to communicate with seb02, I'm seeing "SEB02: 1009 \n retry" over and over again in rc.log. This happened 179 times over the course of 21 minutes before there was finally a time out and a segmentation fault. I don't think it's an urgent issue but it might be nice to have this be avoided in the future.

When the beam was dumped 0631hrs we attempted to power cycle 3C2 and 3C1 remotely, which was unsuccessful. We then attempted to power cycle the racks directly in the IR during a controlled access, which was also unsuccessful. It is now 0745hrs so we will simply wait until handoff to the next shift crew before contacting the experts for the sake of continuity.

328 | Fri Jul 21 20:14:56 2023 | Uttam Acharya | DAQ operation - Evening shift log and summary

https://sphenix-intra.sdcc.bnl.gov/WWW/elog/DAQ/328

fill type	fill#	Run#	Detectors#	Raw(Khz)[MBD N&S]	ScaleDown	Scaled Rate	#Events	Log/Reason for stopping	Intt Dac Scan Number
beam		23046	LL1 MBD ZDC sEPD EMCAL HCAL INTT	2.6	0	188	55174	MCR adjusting vertex.	
beam		23049	LL1 MBD ZDC sEPD EMCAL HCAL INTT	2.7	0	470			
beam		23050	LL1 MBD ZDC sEPD EMCAL HCAL INTT	2.5	0	200	149218	INTT dac stat test begin	
beam		23051	LL1 MBD ZDC sEPD EMCAL HCAL INTT	2.4	0	220	150000	Jaeboem working on gtm_startrun /gtm_stop issue	5
beam		23052	LL1 MBD ZDC sEPD EMCAL HCAL INTT	2.08	0	not stable	279558	DAQ got hung and had to stop	5
beam		23053	LL1 MBD ZDC sEPD EMCAL HCAL INTT	1.72	0	not stable	277463	EVENT watch gui crashed, still took data by looking RCDAQ status GUi for each detector	4

New DAC Scan with MBD for Scan #1~5
DAC e-log 329, 328

- Z-vertex cut by MBD or selecting hits only associated with intt standalone tracklet to z-vtx with eta angle cut

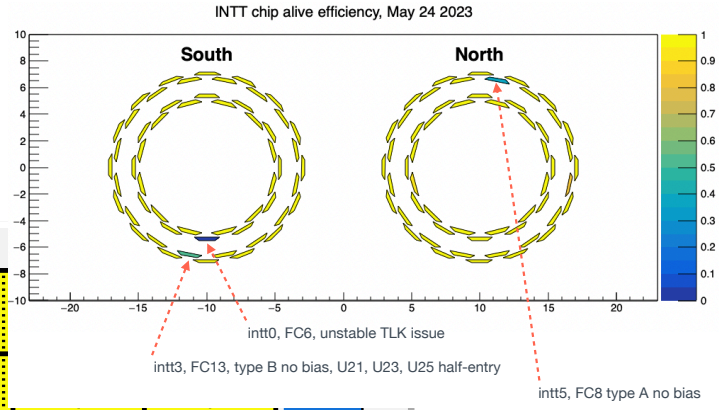
D) Online Monitor

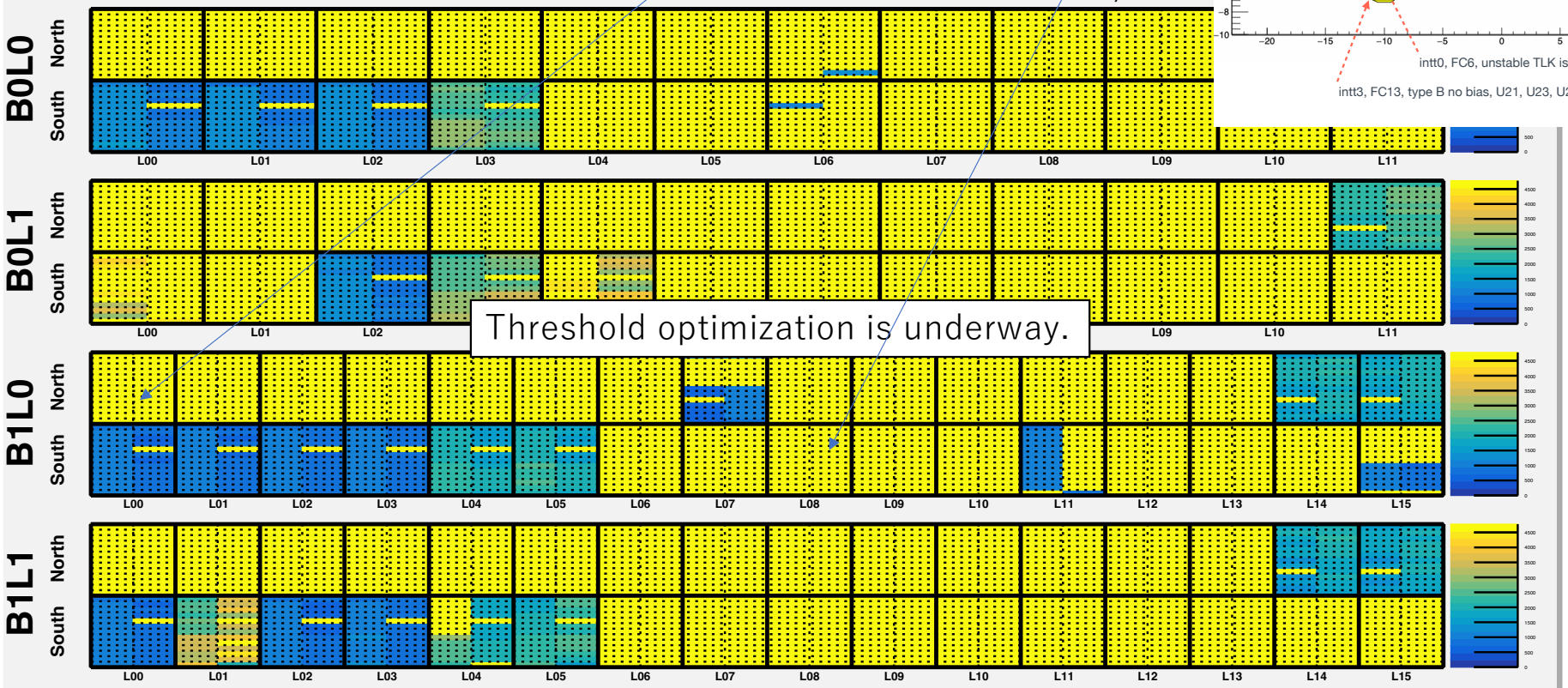
D) Online Monitor

S-B1L008 type-B no bias

N-B1L000 type-A no bias

Online Monitor for INTT has been available for shift takers since 6/14



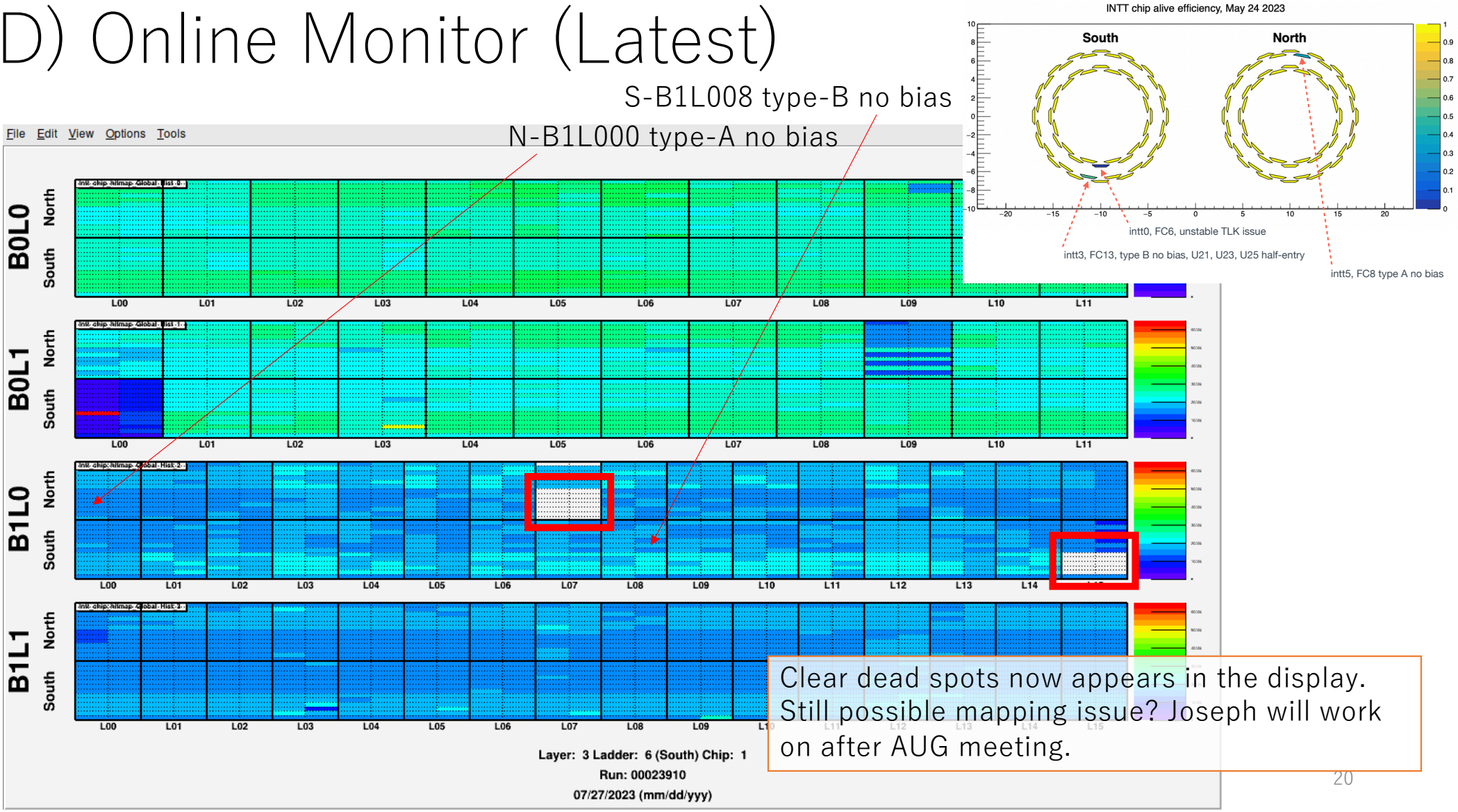


Threshold optimization is underway.

Joseph

Quality of INTT data can be monitored by shift takers run-by-run basis

D) Online Monitor (Latest)



Clear dead spots now appears in the display. Still possible mapping issue? Joseph will work on after AUG meeting.