INTT Run 24 Calibration

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Calibration list/status

- **Total # of runs : 2,576 trigger mode (including AuAu) / 1,402 streaming mode (Frist run 40874 ~ Last run 54974)**
  - Physics run
  - Data taken in BigPartition(run existed in daq database)
  - Excepted for condor failure runs (49 runs due to INTT data corrupted)
- **Trigger mode BCO Offset Status**-> Offset btw INTT internal clock & GL1; Necessary to tag tracks associated with crossing
- Calibration module available in coresoftware/calibration/intt
- BCO offset CDB files produced for all runs
  Scanning whole files before putting in CDB database
  -> will produce BAD run list based on BCO alignment / will plan to put in psql database

- **Hot/Bad map Status** -> One general bad channel map in CDB database but has to be revisited run by run base
- Calibration module available in coresoftware/calibration/intt
- 1st version of Hot/Bad channel CDB files produced for all trigger runs and ~~90%~~ all(update) streaming runs
  Criteria for cold channel is under discussion

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Timing offset Calibration
BCO peak Finder

Review ; BCO (Timing offset) calibration procedure
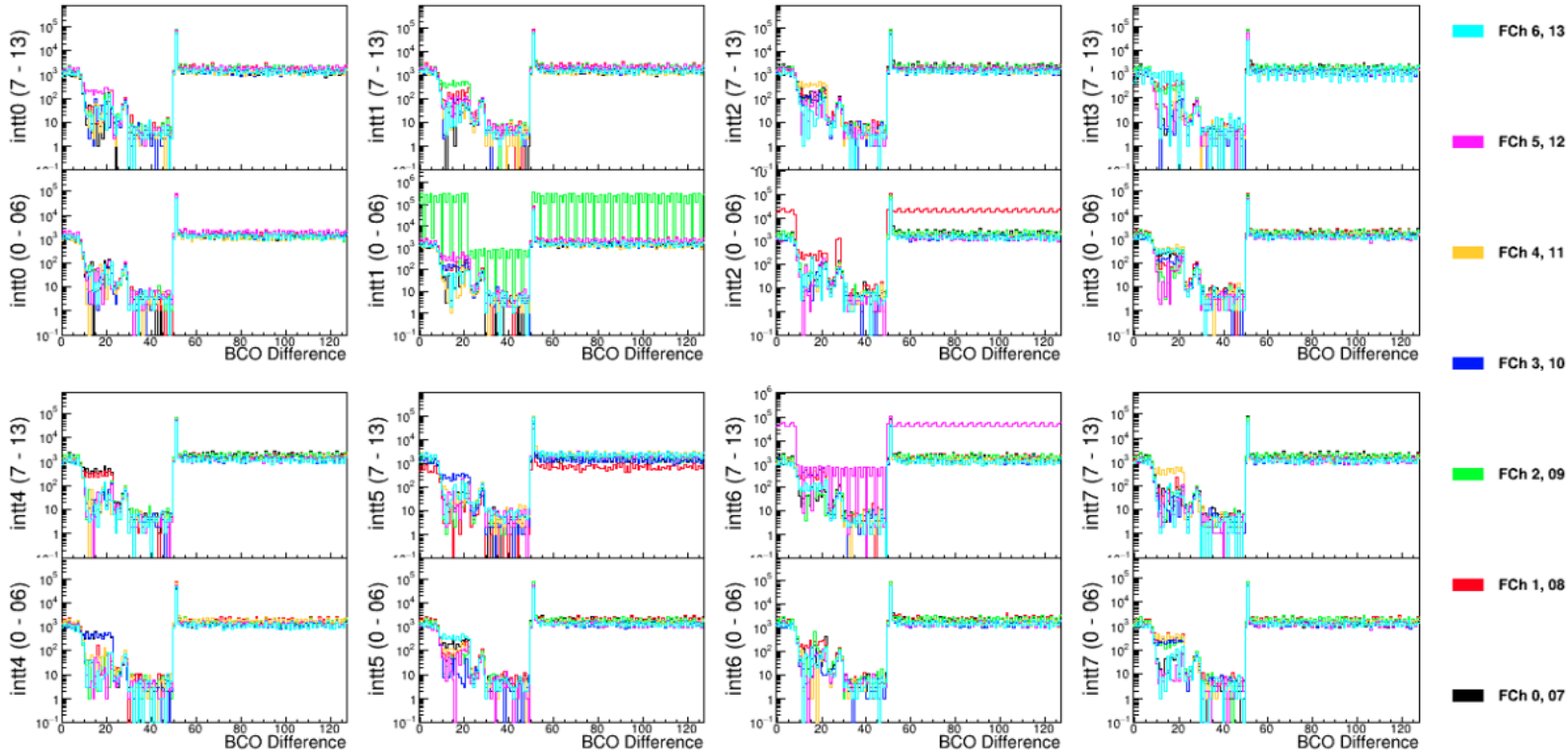
Run: 00043796 Events: 100000 BCO StdDev: 0.00 BCO Offset: 51.00

GOOD

Masked Ladders:

1. Making BCO distribution Fee(half-ladder) by Fee
   (in total 14x8 = 112 Fees)

2. Find peak position of each FC

3. Calculate Standard deviation
   (BCO StdDev -> should be 0)

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Criteria for BCO QA(cont.)

Result of BCO calibration should be one of most fundamental QA to judge if run is GOOD/BAD -> Criteria needed

OnlMon also has provided BCO plot with criteria for shift crews from the middle of Run24.
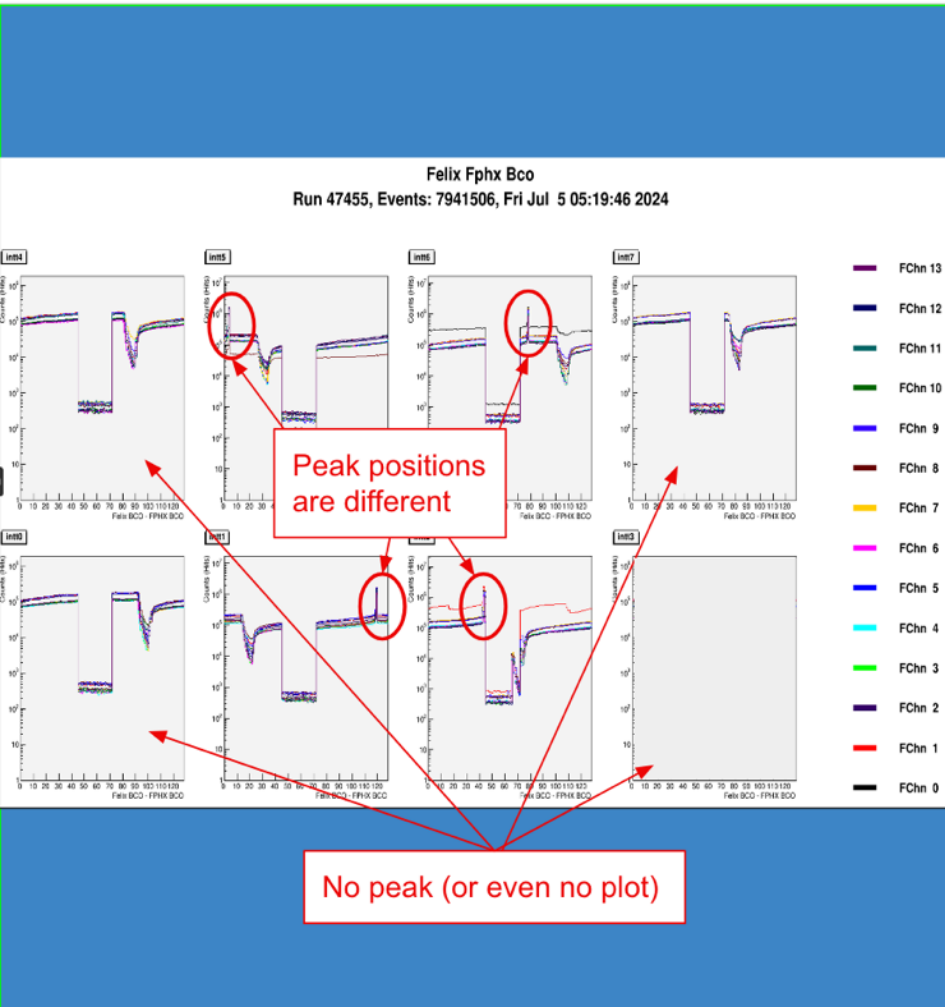
"BCO Diff" (Triggered mode only)
(Troubleshooting)

All peaks in the Felix Fphx Bco monitor should be clearly seen at the same x position (Felix BCO - FPHX BCO).

If some of the peaks are misaligned or missing (or even plot itself is missing),

- 1: may be it's rcdaq issue
  - **Remove INTT from the Big Partition**
  - **Add INTT into big partition**
  - Restart the run
- 2: (if 1 doesn't work)
  - **Remove INTT from Big partition**
  - HV -> OFF
  - LV -> OFF
  - Wait ~1 minute
    LV -> ON
  - HV -> ON
  - **Add INTT to the Big Partition INTT**
  - Restart the run
- If (1) consistently fails, you can jump to (2) for repeat issues

- Call expert if problem persists

1. All Felix are aligned in same position

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Criteria for BCO QA(cont.)

Result of BCO calibration should be one of most fundamental QA to judge if run is GOOD/BAD -> Criteria needed

OnlMon also has provided BCO difference plot for shift crews from the middle of Run24.
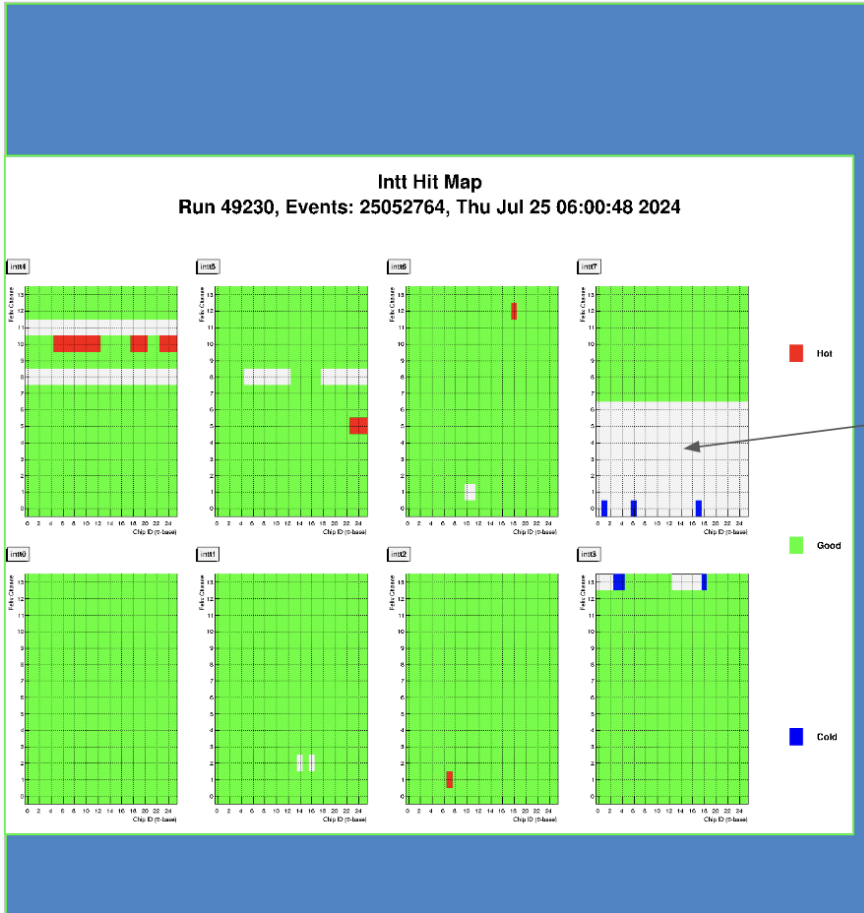
"Chip Hitmap" Troubleshooting

- **Empty Servers**

Action:
- **Restart run**

Note:
- If the problem persists (after trying several times), call the expert.

1. All Felix are aligned in same position

2. Less than 7 half-ladders missing -> Problem mostly on signal communication through one of ROCs in FELIX

3. Enough statistics GL1 events > 10,000

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Criteria for BCO QA(cont.)

Result of BCO calibration should be one of most fundamental QA to judge if run is GOOD/BAD -> Criteria needed

1. Enough statistics
    GL1 events > 10,000 & INTT events > 10,000
    TAG : LOWSTAT runs

2. Less than 7 half-ladders missing
    -> Problem mostly on signal communication through
    one of ROCs(or more than) in FELIX
    TAG : FC Missing run

3. All Felix are aligned in same position
    TAG : bad alignment run
    **-> bad alignment classification rely on algorithms ->
    need more careful check(cont.)**
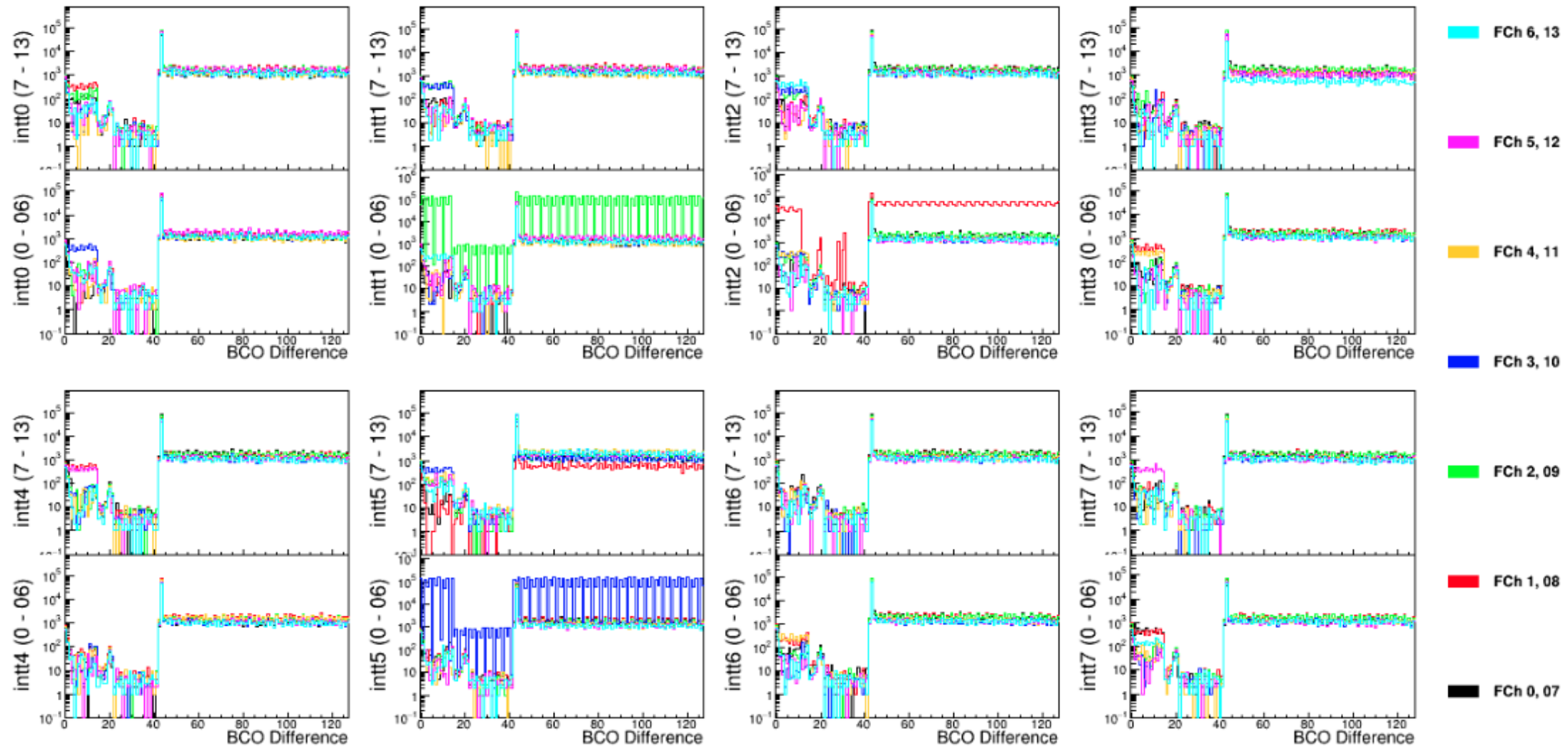
Run: 00043801 Events: 100000 BCO StdDev: 3.29 BCO Offset: 42.69
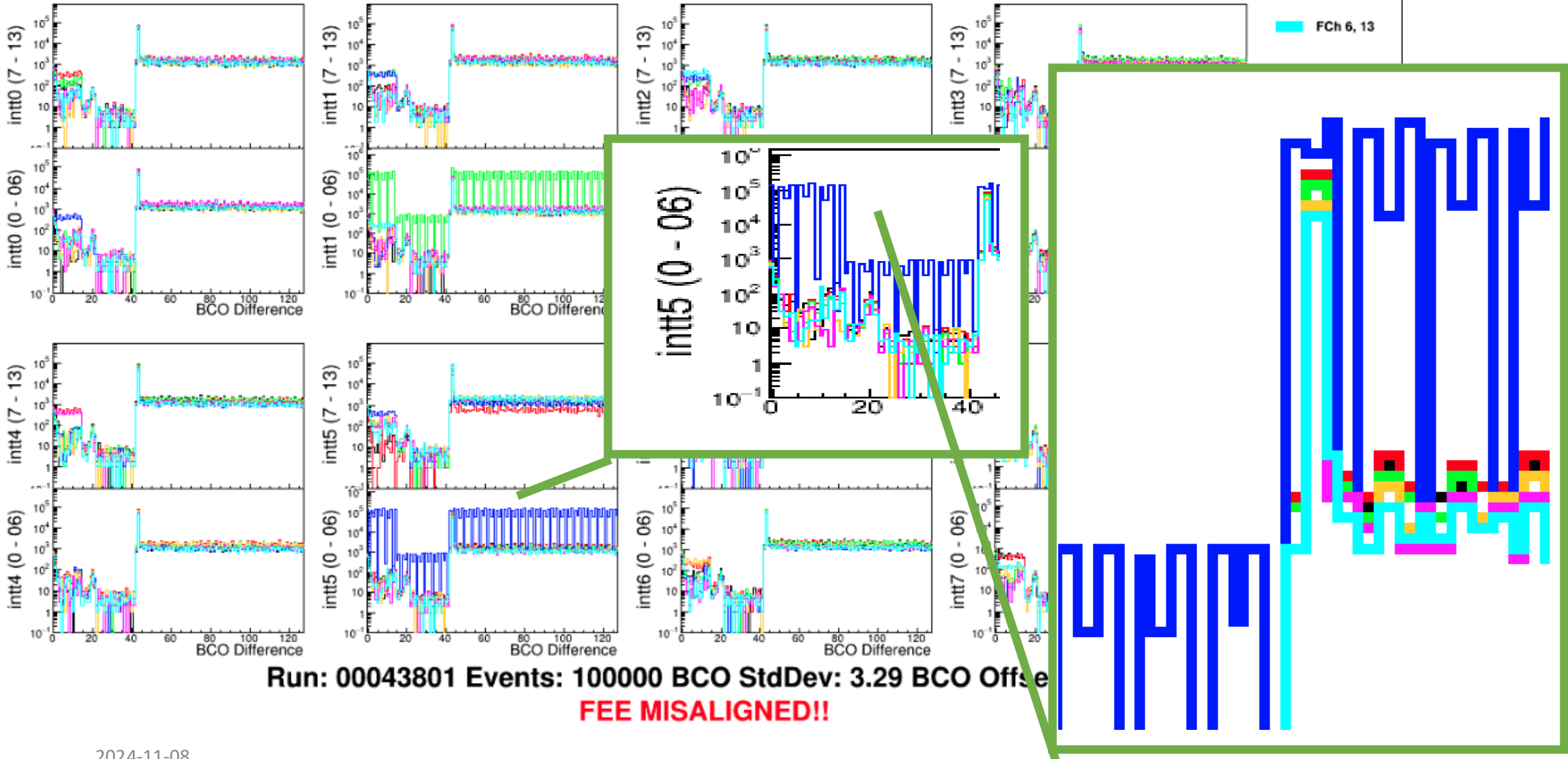
FEE MISALIGNED!!

Masked Ladders:

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Run: 00043801 Events: 100000 BCO StdDev: 3.29 BCO Offse

FEE MISALIGNED!!

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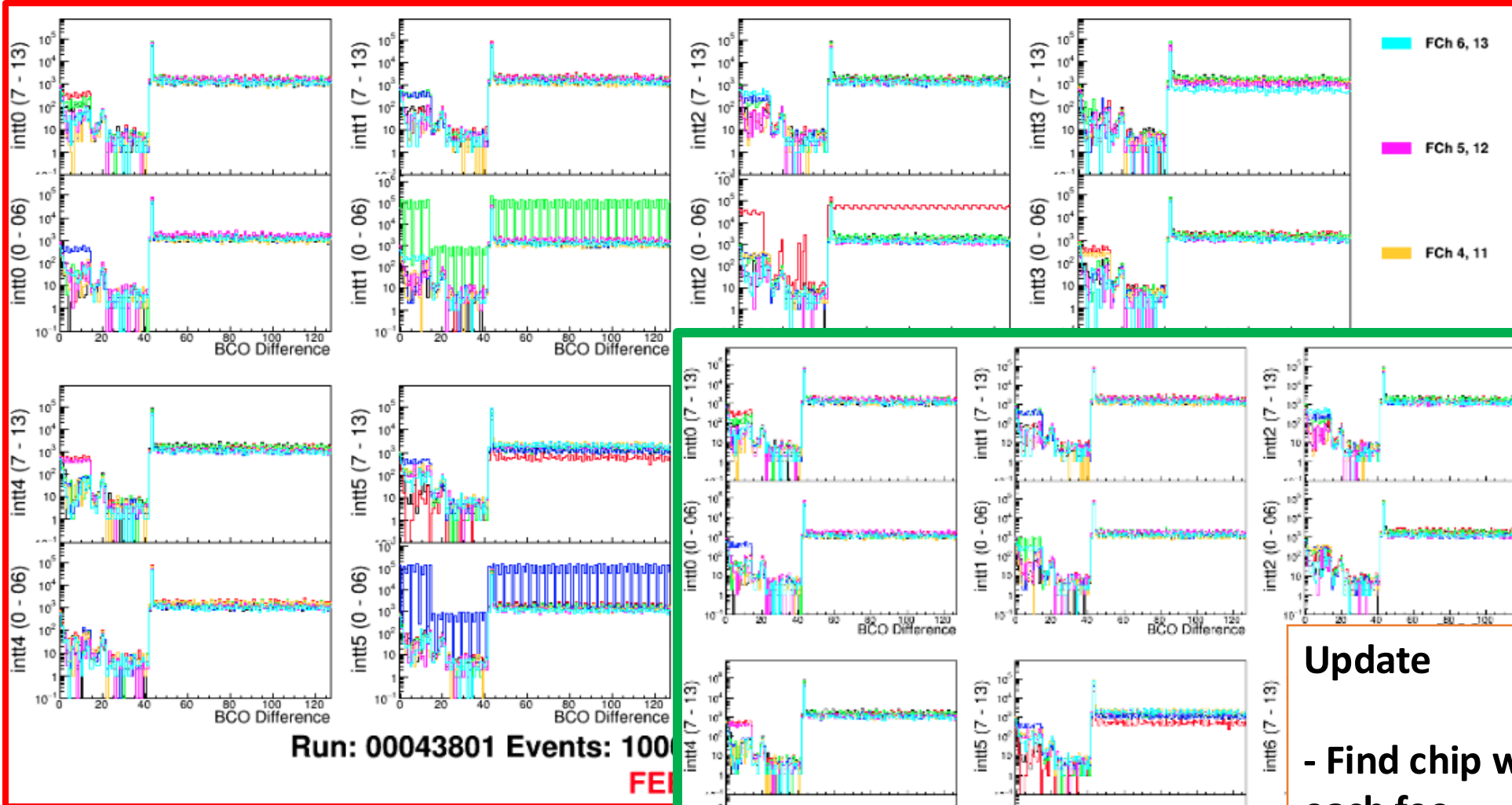
Run43801; example of FAKE bad-align run(cont.)
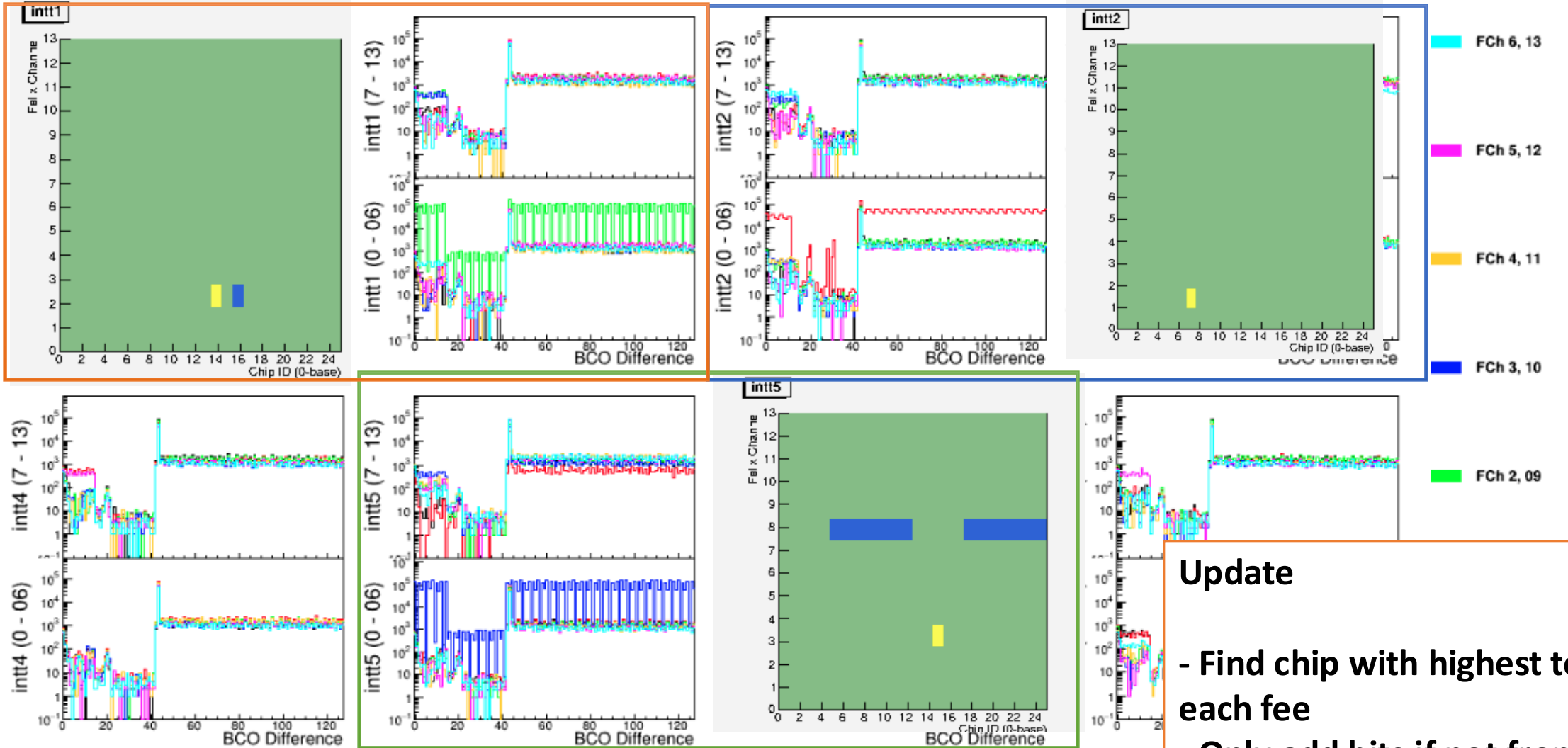
Run: 00043801 Events: 100000 BCO StdDev: 3.29 BCO Offs

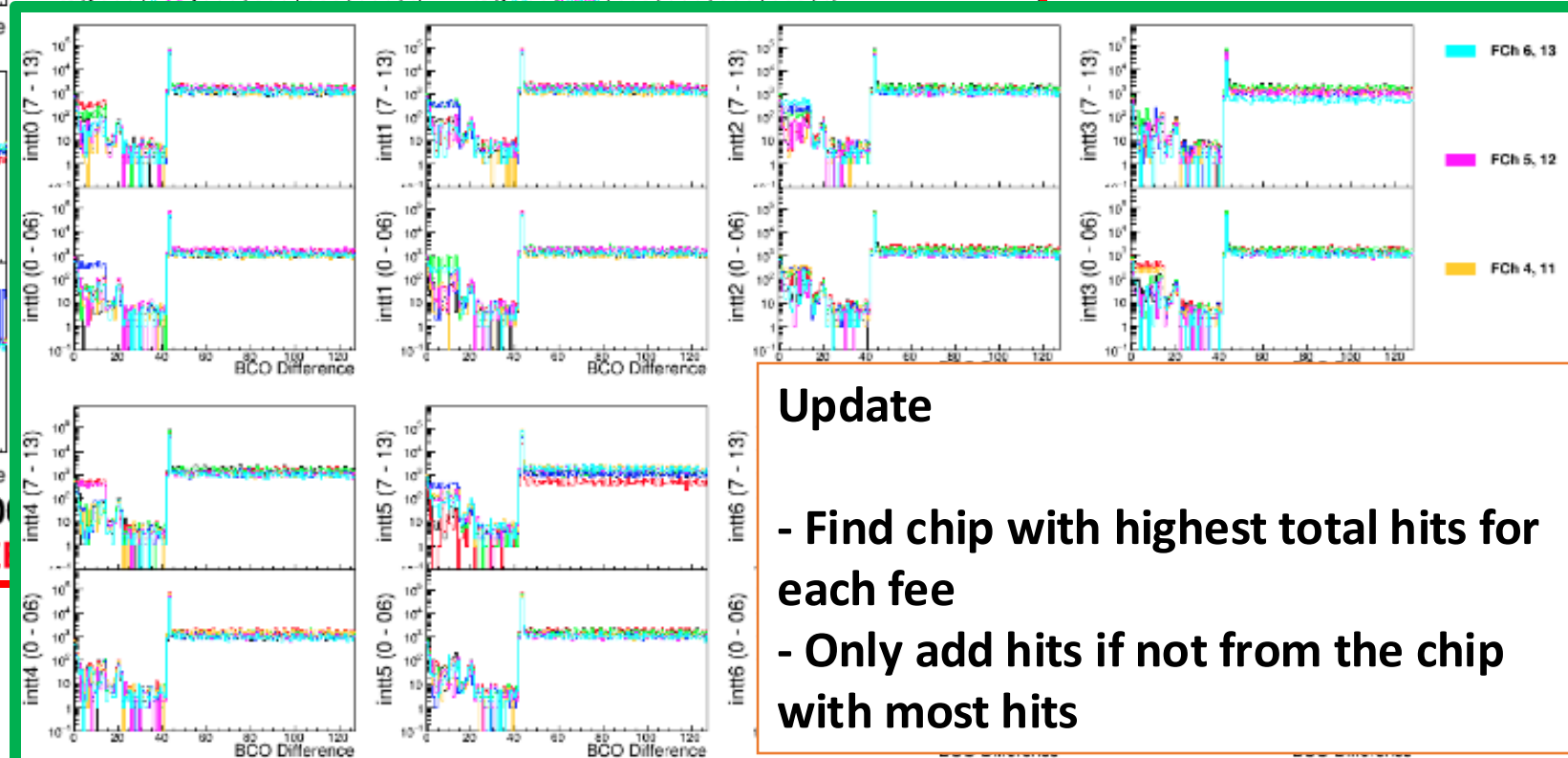**FEE MISALIGNED!!**

Update

- Find chip with highest total hits for each fee
- Only add hits if not from the chip with most hits

Run43801; example of FAKE bad-align run

BEFORE

AFTER

Update

- Find chip with highest total hits for each fee
- Only add hits if not from the chip with most hits

Run: 00043801 Events: 100000 BCO StdDev: 0.00 BCO Offset: 43.00

GOOD

Result of Trigger run BCO offset scan

Total # of runs : 2,576 trigger mode (including AuAu)

Frist run 40874 ~ Last run 54974

- Physics run and data taken in BigPartition(run existed in daq database)

Trigger mode runs: 2,576

Trigger mode GOOD runs: **1,585 (61.5%)**

Trigger mode LOW stat runs: 379 (14.7%)

Trigger mode FC missing runs: 334 (13.0%)

Trigger mode bad alignment runs: 278 (10.8%)

Trigger mode total events: 15,863,506,998

Trigger mode GOOD runs events: **12,010,358,213 (75.7%)**

Trigger mode LOW stat runs events: 517,453,615 (3.3%)

Trigger mode FC missing runs events: 1,640,597,553 (10.3%)

Trigger mode bad alignment runs events: 1,695,097,617 (10.7%)

Bad map calibration
Gaussian classifier

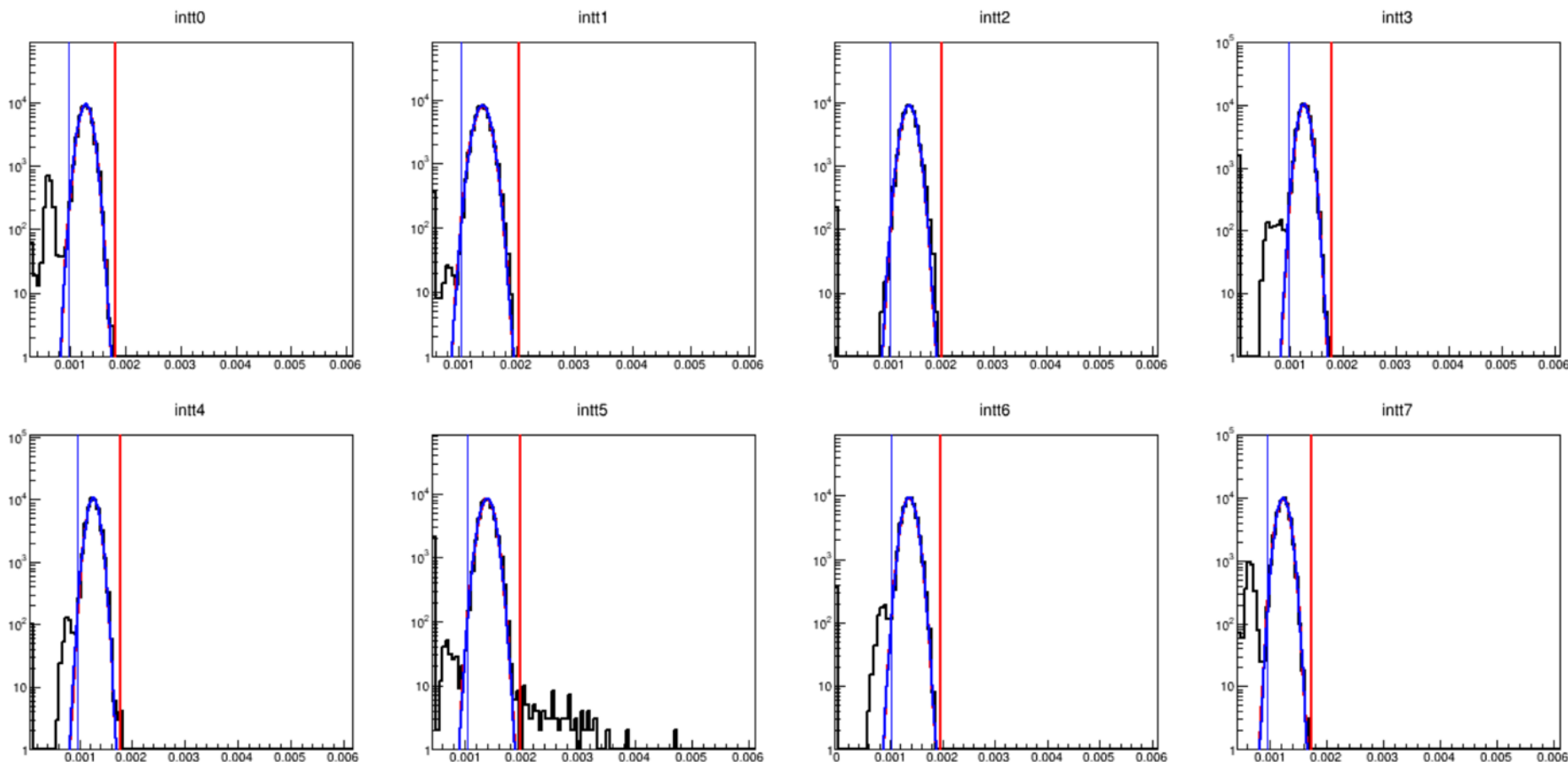# Gaussian Classifier(pp trigger)

Review : Normalized hit rate = # of hits / (events)(strip length)(barrel radius)

100k events used for all runs if run has enough events

Run2024 pp

Current cut
Dead = 0 hit
Cold < mean-3sigma
Hot > mean+4sigma

Run: 00047634 Events: 100000
Fraction Cold: 3.210% Fraction Dead: 1.303%
Fraction Hot: 0.034%

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Gaussian Classifier(pp streaming)

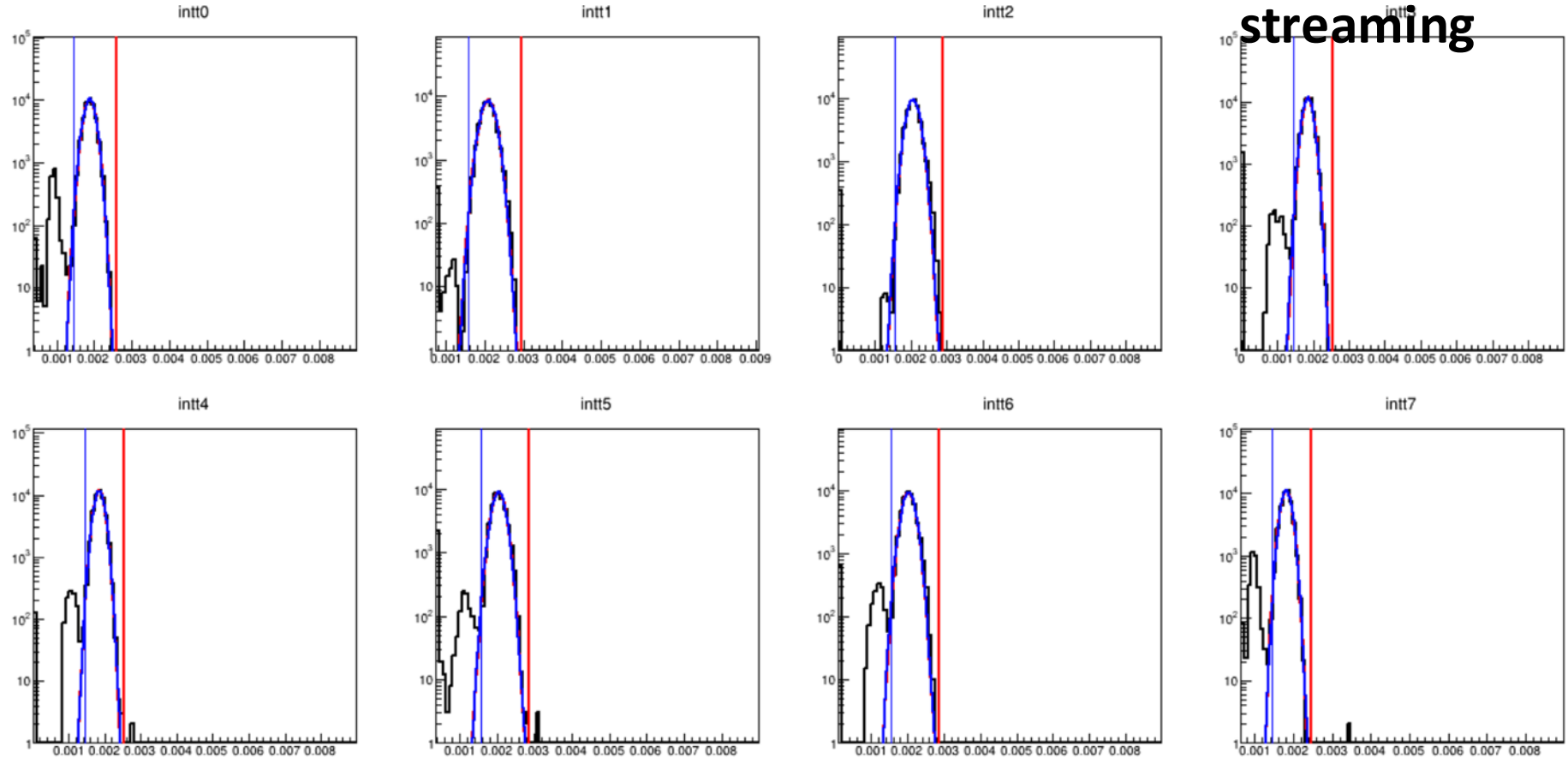Review : Normalized hit rate = # of hits / (events)(strip length)(barrel radius)

100k events used for all runs if run has enough events

Run2024 pp streaming

Current cut

Dead = 0 hit

Cold < mean-3sigma

Hot > mean+4sigma

Run: 00051173 Events: 100000
Fraction Cold: 3.928% Fraction Dead: 1.428%
Fraction Hot: 0.007%

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Gaussian Classifier(pp streaming with Hot ladders)

Review : Normalized hit rate = # of hits / (events)(strip length)(barrel radius)
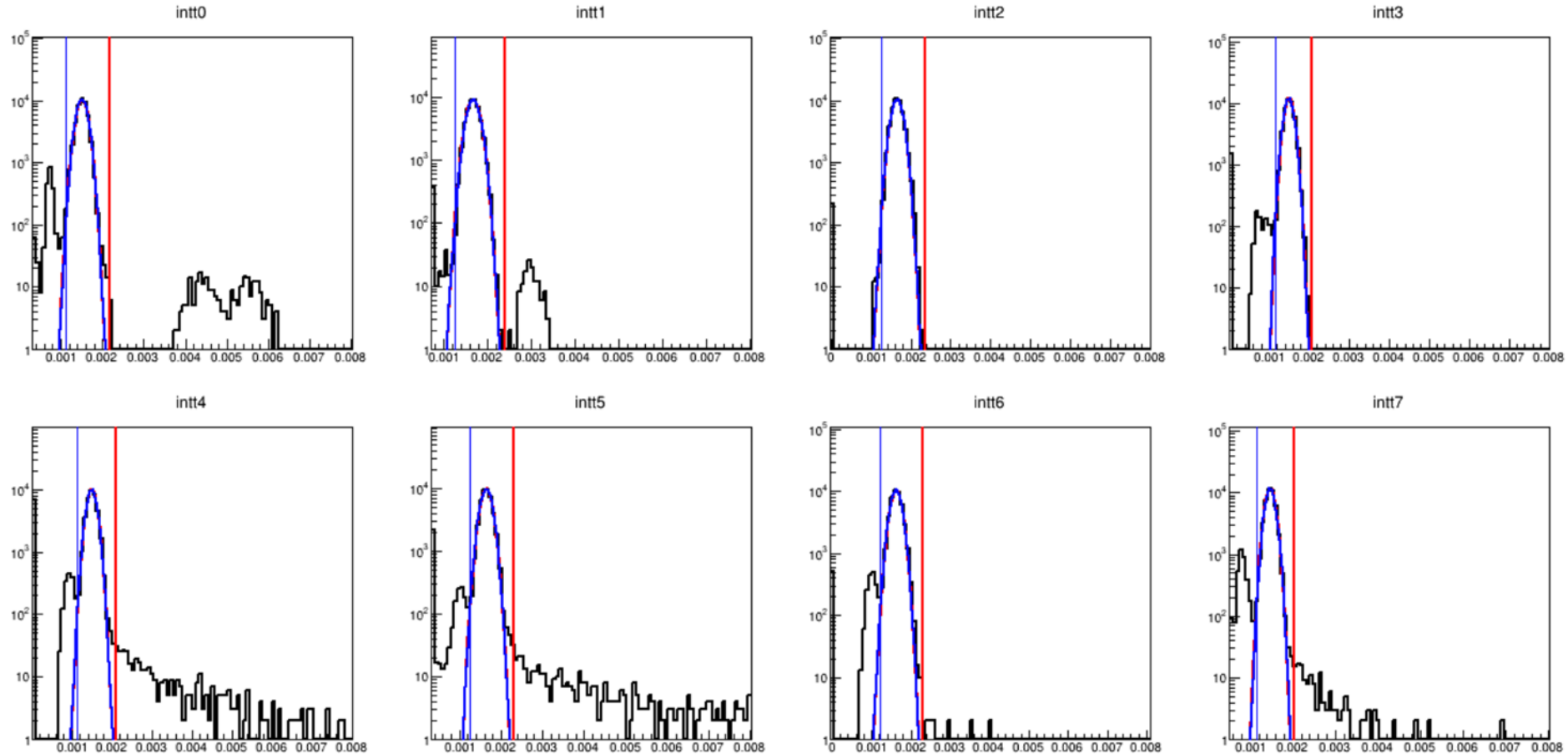
100k events used for all runs if run has enough events

Current cut

Run2024 pp streaming

Dead = 0 hit

Cold < mean-3sigma

Hot > mean+4sigma

Run: 00049134 Events: 100000
Fraction Cold: 6.028% Fraction Dead: 3.151%
Fraction Hot: 0.515%

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Gaussian Classifier(AuAu)

Review : Normalized hit rate = # of hits / (events)(strip length)(barrel radius)

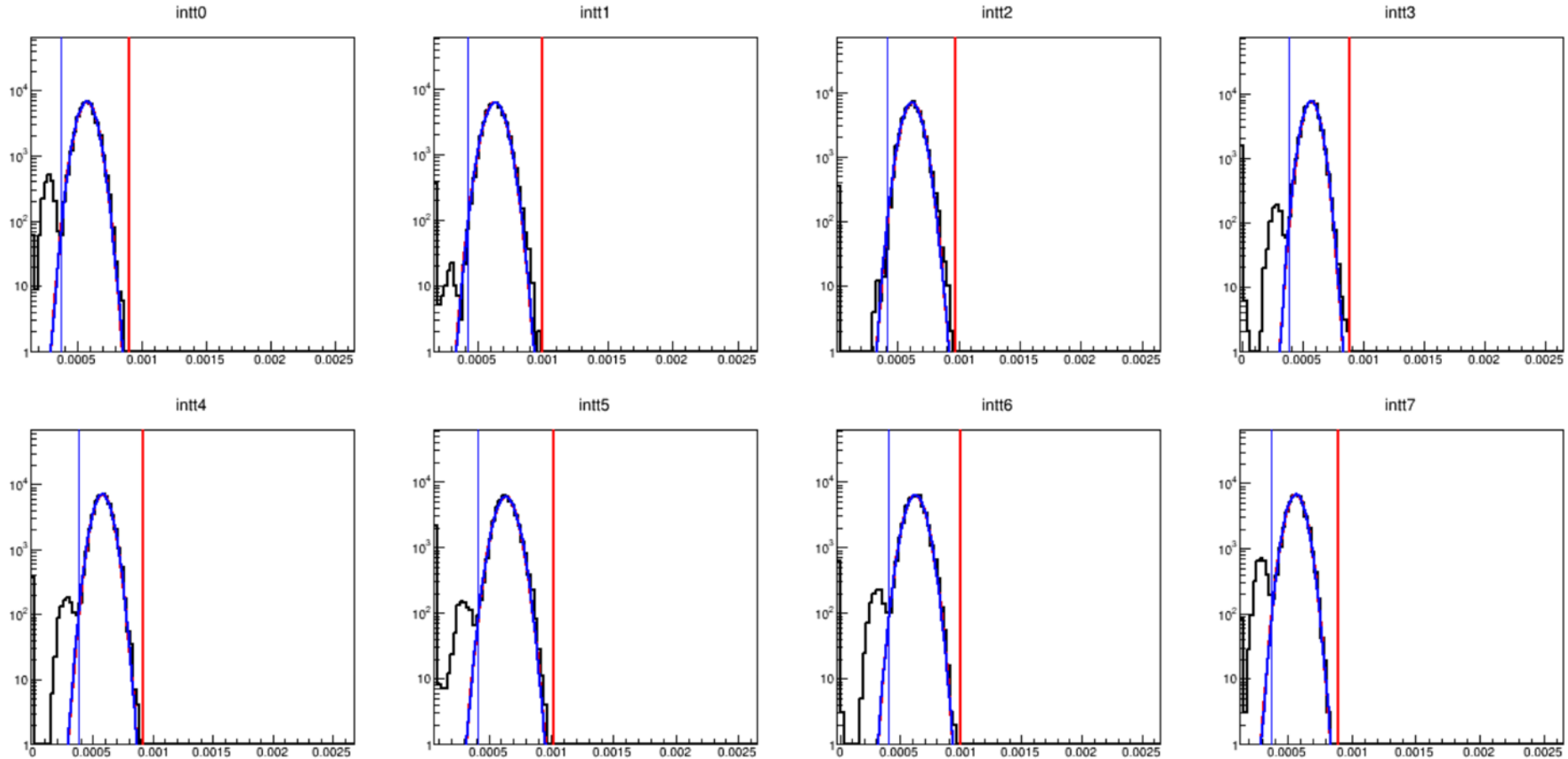**100k events used for all runs if run has enough events**　　　　　　**Run2024 AuAu**

Current cut

Dead = 0 hit

Cold < mean-3sigma

Hot > mean+4sigma

Run: 00052651 Events: 100000
Fraction Cold: 3.841% Fraction Dead: 1.490%
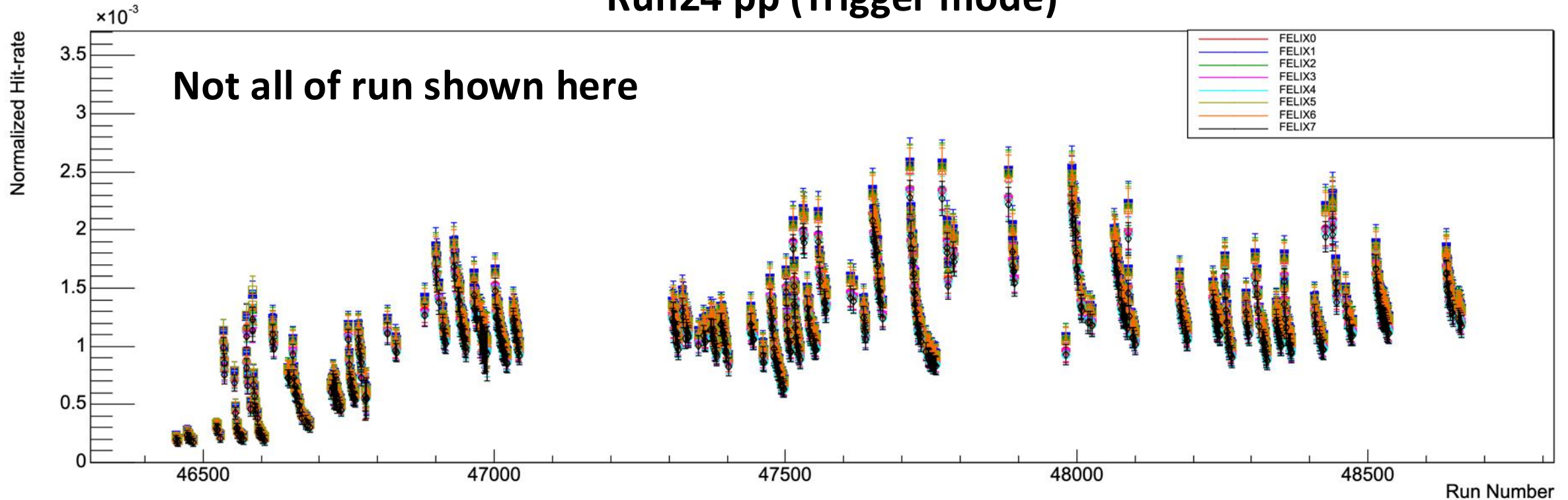Fraction Hot: 0.007%

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hitrate distribution; GOOD BCO RUNS(pp Trigger)

Review : Normalized hit rate = # of hits / (events)(strip length)(barrel radius)

Luminosity decreasing as a function of time(run number) is clearly visible.
Most of cases(~99%), algorithm can do fitting well for GOOD BCO RUNS

Run24 pp (Trigger mode)

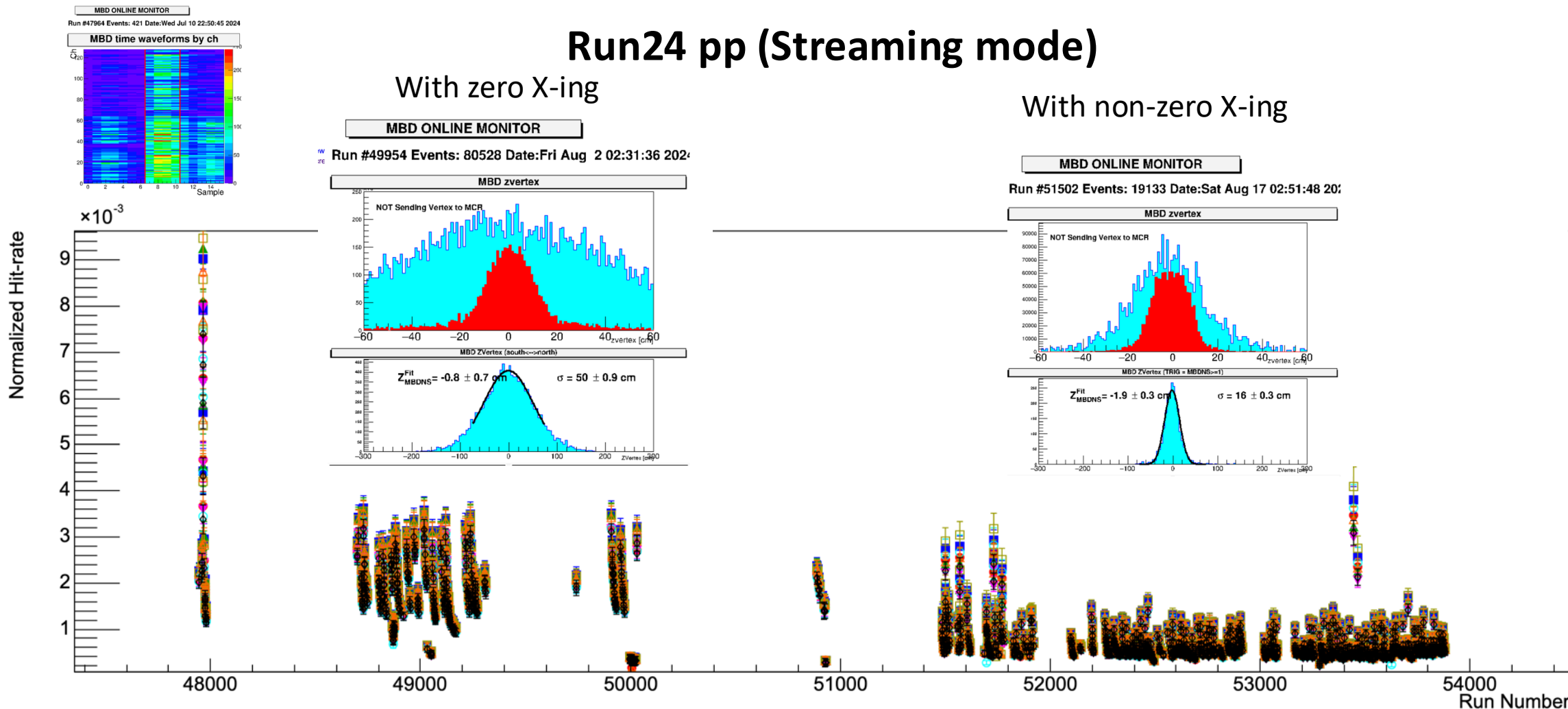# hitrate distribution; GOOD BCO RUNS(pp streaming)

Review : Normalized hit rate = # of hits / (events)(strip length)(barrel radius)

Hitrate strongly depends on X-ing; NOTE : Fun4All event frame > 1 crossing

Run24 pp (Streaming mode)
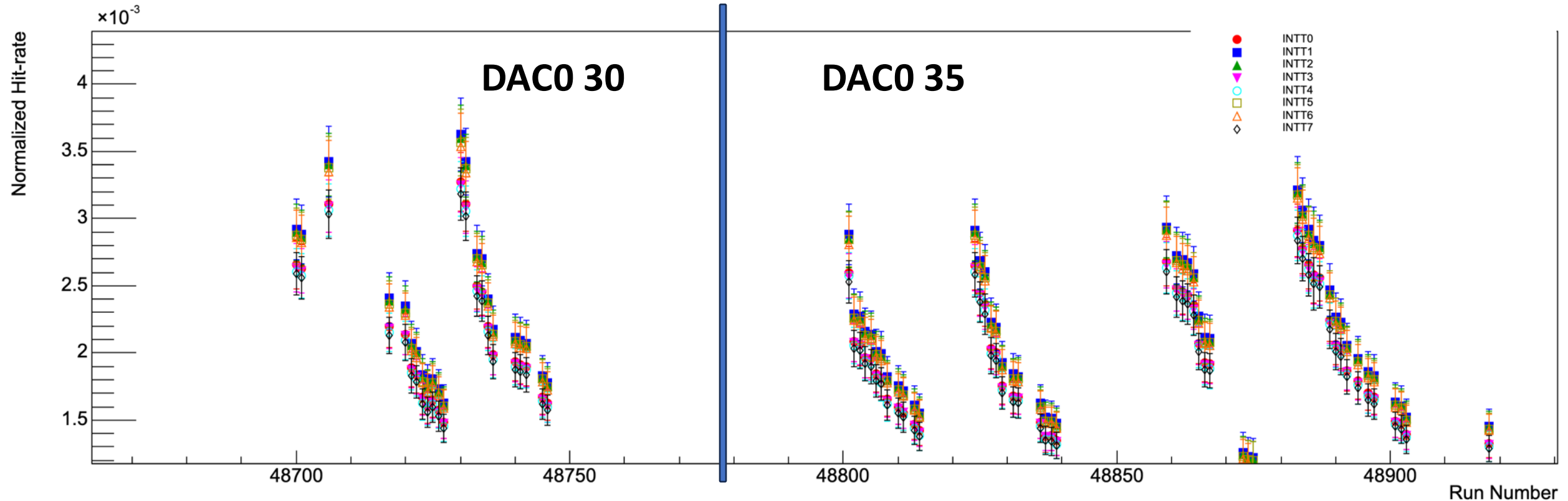
With zero X-ing

With non-zero X-ing

hitrate distribution; GOOD BCO RUNS(pp streaming)

Review : Normalized hit rate = # of hits / (events)(strip length)(barrel radius)

Hitrate was slightly decreased with higher DAC0. Not big effect as X-ing

Run24 pp (Streaming mode)

DAC0 30

DAC0 35

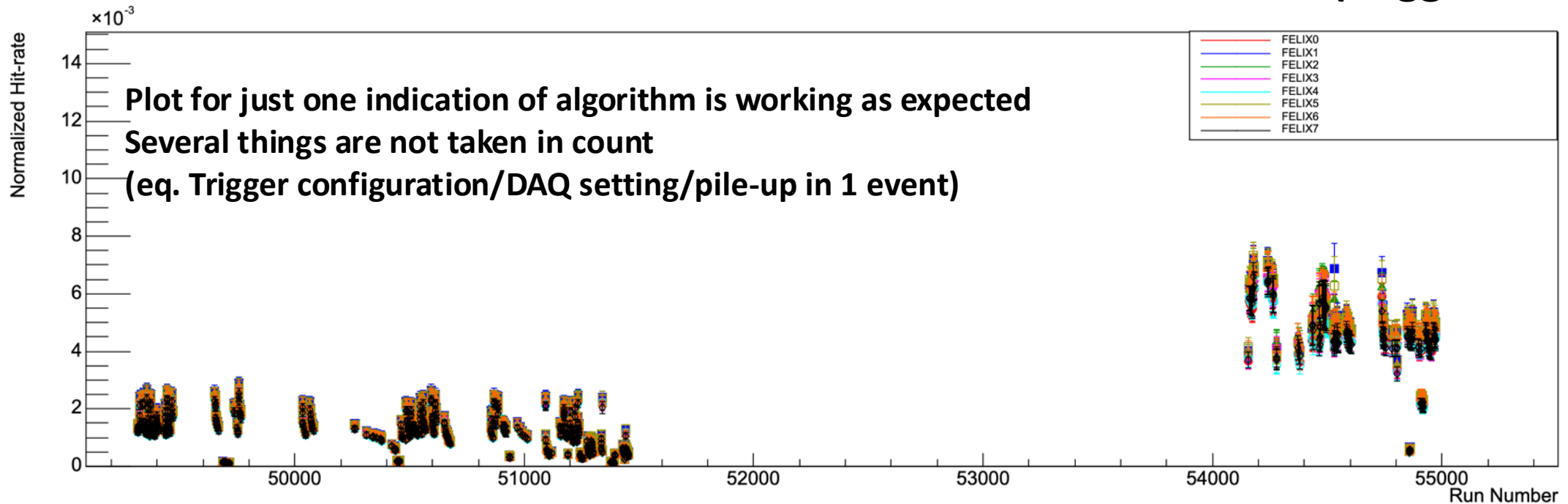# hitrate distribution; GOOD BCO RUNS(AuAu Trigger)

Review : Normalized hit rate = # of hits / (events)(strip length)(barrel radius)

Hitrate was increased due to higher multiplicity in AuAu

Run24 pp (Streaming mode)

Run24 AuAu (Trigger mode)

Plot for just one indication of algorithm is working as expected
Several things are not taken in count
(eq. Trigger configuration/DAQ setting/pile-up in 1 event)

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Calibration Plan

Short term plan

1. Checking All BAD Alignment tag run (Is it really BAD?)
2. Put All BAD Alignment run in official database : TAG as BAD
https://sphenix-intra.sdcc.bnl.gov/WWW/scripts/triage/home.py
3. Revisit LOW statistics runs / FC runs
(until next week)
4. Put LOW statistics and FC runs as questionable in official database
5. Put BCO CDB in CDB Database
6. Put BadMap CDB in CDB Database (ONLY for GOOD BCO Runs)

Relatively long term plan (until end of workshop;this month)

7. Check more detail in BadMap masking files with current cuts for GOOD RUNS
8. Check if we can use BadMap from LOW statistics runs / FC runs

Long-term plan

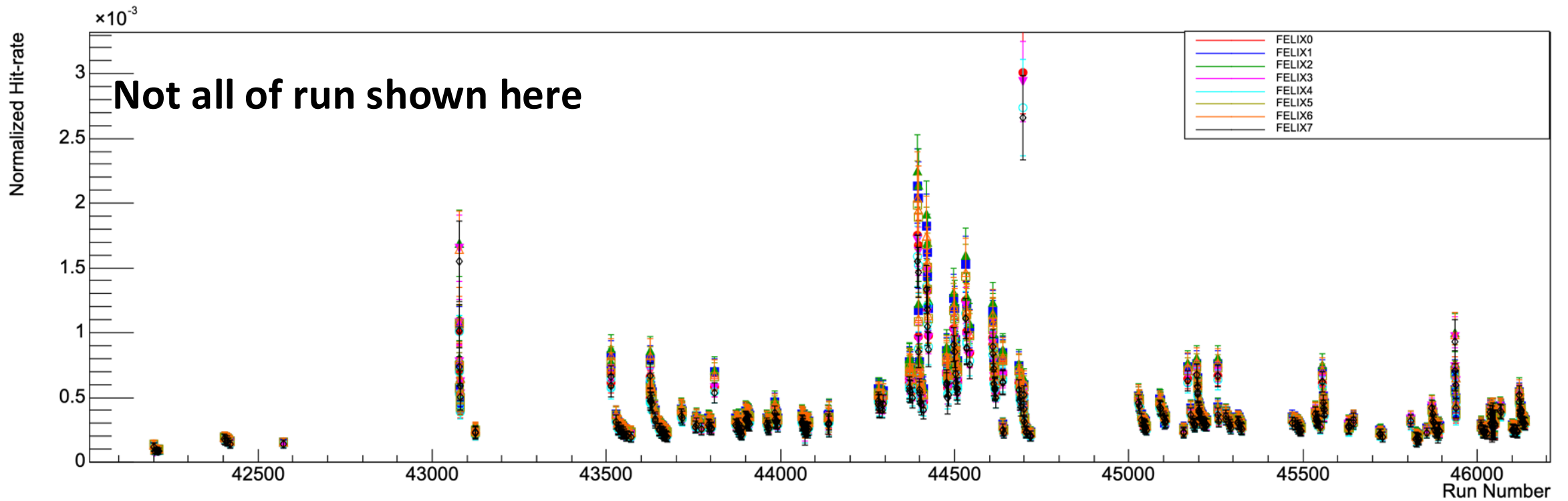9. If needed, revisit Cold channel study and will provide new BadMap CDB

Back-up

hitrate distribution; GOOD BCO RUNS(pp Trigger)

Luminosity decreasing as a function of time(run number) is clearly visible.
~ Run 46500

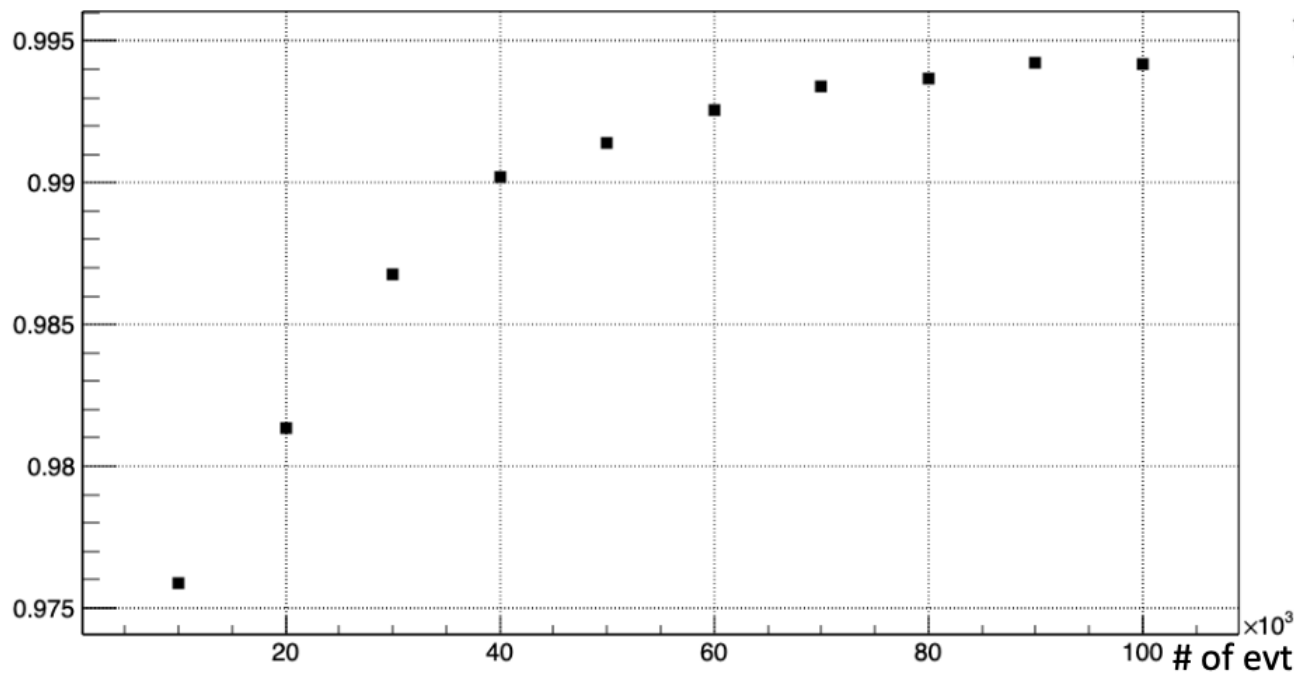**Run24 pp (Trigger mode)**


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Effect of # of events (3sigma cut)

$$\text{Agreement} = \frac{\text{\# of good channels in both 'All events used' and 'N events used'}}{\text{\# of good channels in either 'All events used' or 'N events used'}}$$
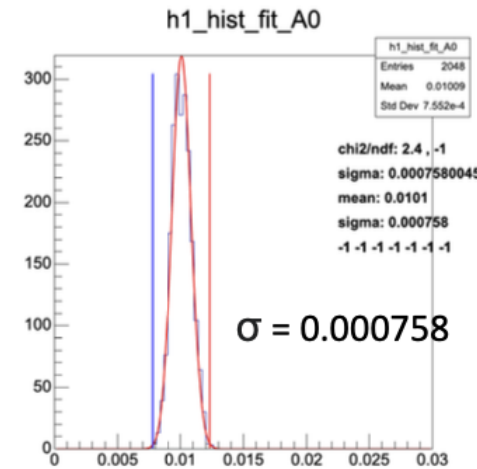
Channel matching agreement / Run 20869

# of events used	10000	20000	30000	40000	50000	60000	70000	80000	90000	100000
Agreement	0.975889	0.981348	0.986747	0.990204	0.991387	0.99254	0.993404	0.993666	0.994215	0.994198

10k events used

σ = 0.001347

50k events used

σ = 0.000758

All events used

σ = 0.000517
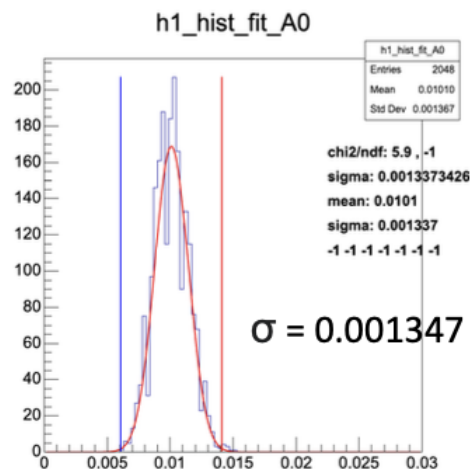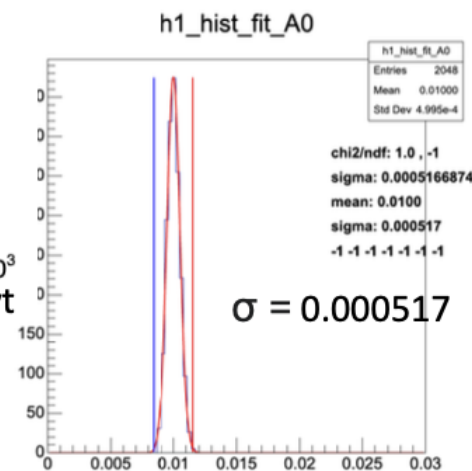
Gaussian Classifier depends on statistics due to Central Limit Theorem.

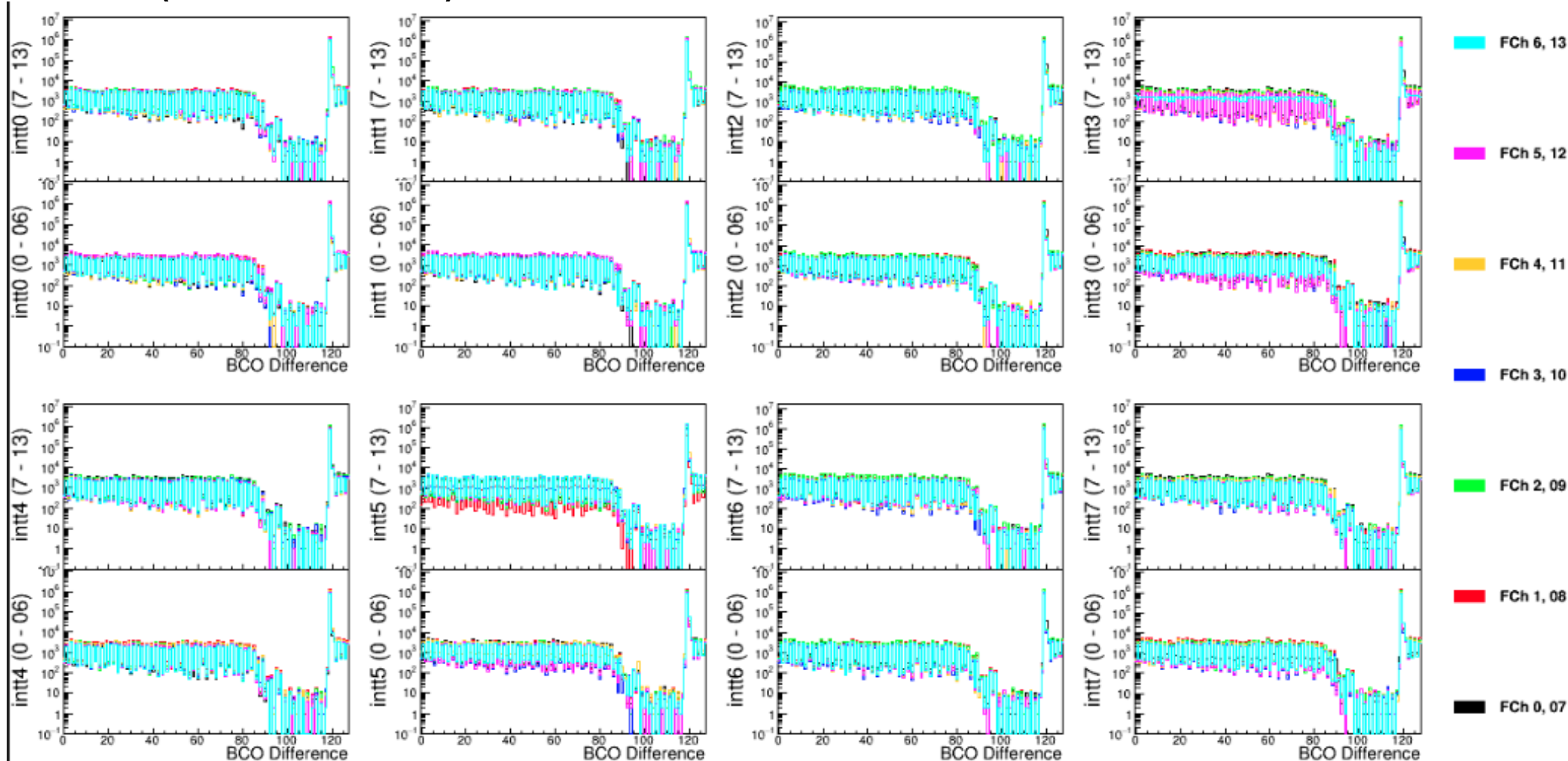**Enough statistics needed to get clear Gaussian**

More events lead to more accurate classification

Let's use 50k events to do stability check.
It's already on 99% agreement.

Example QA plot (BCO DIFF)

Run 54281 (Zero field run)

Run: 00054281 Events: 50000 BCO StdDev: 0.00 BCO Offset: 119.00

GOOD

Masked Ladders:

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