NOISE ANALYSIS

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OVERVIEW

- From Beam data without time in, I investigated the amount of noise.
- From Pedestal data in the magnet ON/OFF, I investigated the amount of noise.
- I found hot channel problem from Pedestal Run.

CONTENTS

- Study about the amount of Noise
  - Beam (no time in)
  - Pedestal (Magnet on/off)
- Hot channel problem

NOISE OF BEAM(NO TIME IN)

BEAM WITHOUT TIME IN

Beam data without time in ・・・・ Data don't include collision data.
→ Only background

2023/07/23 Modebit Scan　　This data I surveyed.

1 min run

0:13 run22933 /1 min /modebite delay=76// result is (BCOFULL-BCO: not yet) ,(proces data=ok(ok means "there is data")/(other statas=) n_collision =0/L1_delay=21 / open_time=35/ DAC setting =default

0:20 run22934/1 min modebite delay=75/ result is (BCOFULL-BCO: not yet) ,(proces data=ok)/(other statas=) n_collision =0/L1_delay=21 / open_time=35/ DAC setting =default

0:31 run22935/1 min modebite delay=77/Event= 144942/result is (BCOFULL-BCO: decresed) ,(proces data=ok) /(other statas) n_collision =0/L1_delay=21 / open_time=35/ DAC setting =default

0:38 run22936/1 min modebite delay=74/Event=51284 / result is (BCOFULL-BCO: increse) ,(proces data=ok) /(other statas) n_collision =0/L1_delay=21 / open_time=35/ DAC setting =default

044: run22937 /1 min modebite delay=73/Event=61599 / result is (BCOFULL-BCO: decrese) ,(proces data=ok) /(other statas) n_collision =0/L1_delay=21 / open_time=35/ DAC setting =default

047: run22938 /1 min modebite delay=72/Event=58611 / result is (BCOFULL-BCO: both) ,(proces data=ok) /(other statas) n_collision =0/L1_delay=21 / open_time=35/ DAC setting =default

0: 51 run 22939 /1 min modebite delay=71/Event=48543 / result is (BCOFULL-BCO: both) ,(proces data=ok) /(other statas) n_collision =0/L1_delay=21 / open_time=35/ DAC setting =default

0: 54 run22940 /1 min modebite delay=78/Event= 49768/ result is (BCOFULL-BCO: increce) ,(proces data=ok) /(other statas) n_collision =0/L1_delay=21 / open_time=35/ DAC setting =default

1: 03 run22941 /1 min modebite delay=79/Event= 51269/ result is (BCOFULL-BCO:decrese) ,(proces data=ok) /(other statas) n_collision =0/L1_delay=21 / open_time=35/ DAC setting =default

1:09 run22943 /1 min modebite delay=80/Event=50075 / result is (BCOFULL-BCO:maby increce) ,(proces data=ok) /(other statas) n_collision =0/L1_delay=21 / open_time=35/ DAC setting =default

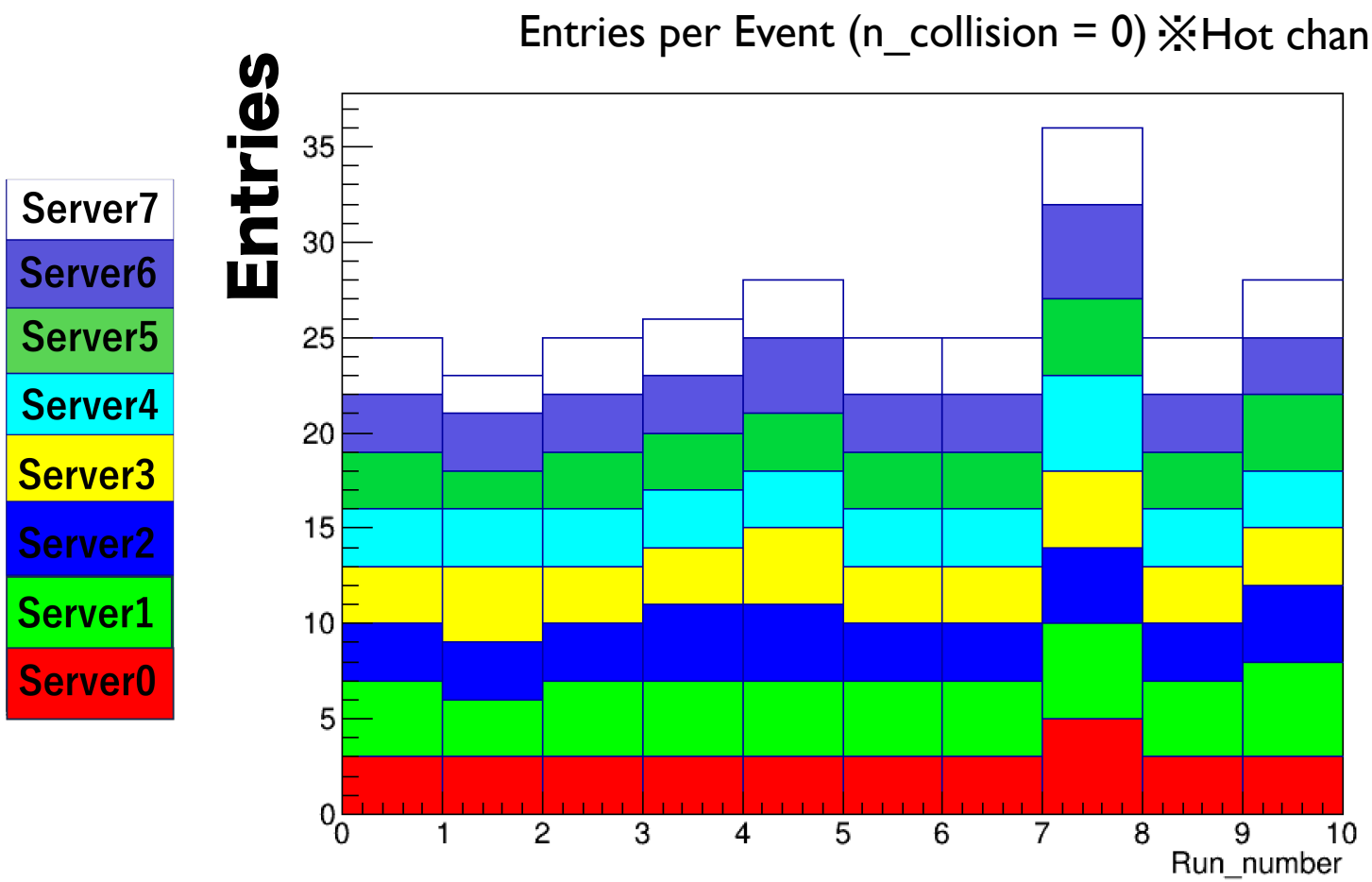
1:15 run22944 /1 min modebite delay=76/Event=78860 / result is (BCOFULL-BCO: lowest) ,(proces data=ok) /(other statas) n_collision =0/L1_delay=21 / open_time=35/ DAC setting =default

The scan was terminated by the INTT LAD1 cooling interlock >_<.

We couldn't observe time-in peak within the range we spanned tonight [71 - 80].

E-log (https://sphenix-intra.sdcc.bnl.gov/WWW/elog/INTT/399)

RUN # 22934 ~ 22944 BEAM_DATA NO TIME IN



- The plot shows amount of noise per Event.
- Color difference is Felix difference.
- About 5 Entries/Felix per Event
- This means Beam data include this amount of noise.

26.6 (± 3.63) ※ / BCLK

※ Dispersion by Run

NOISE OF NO BEAM (PEDESTAL RUN)

PEDESTAL RUN

Pedestal Run : Taking data with clock/random trigger (50~5000Hz)

Magnet ON E-Log (https://sphenix-intra.sdcc.bnl.gov/WWW/elog/INTT/428)

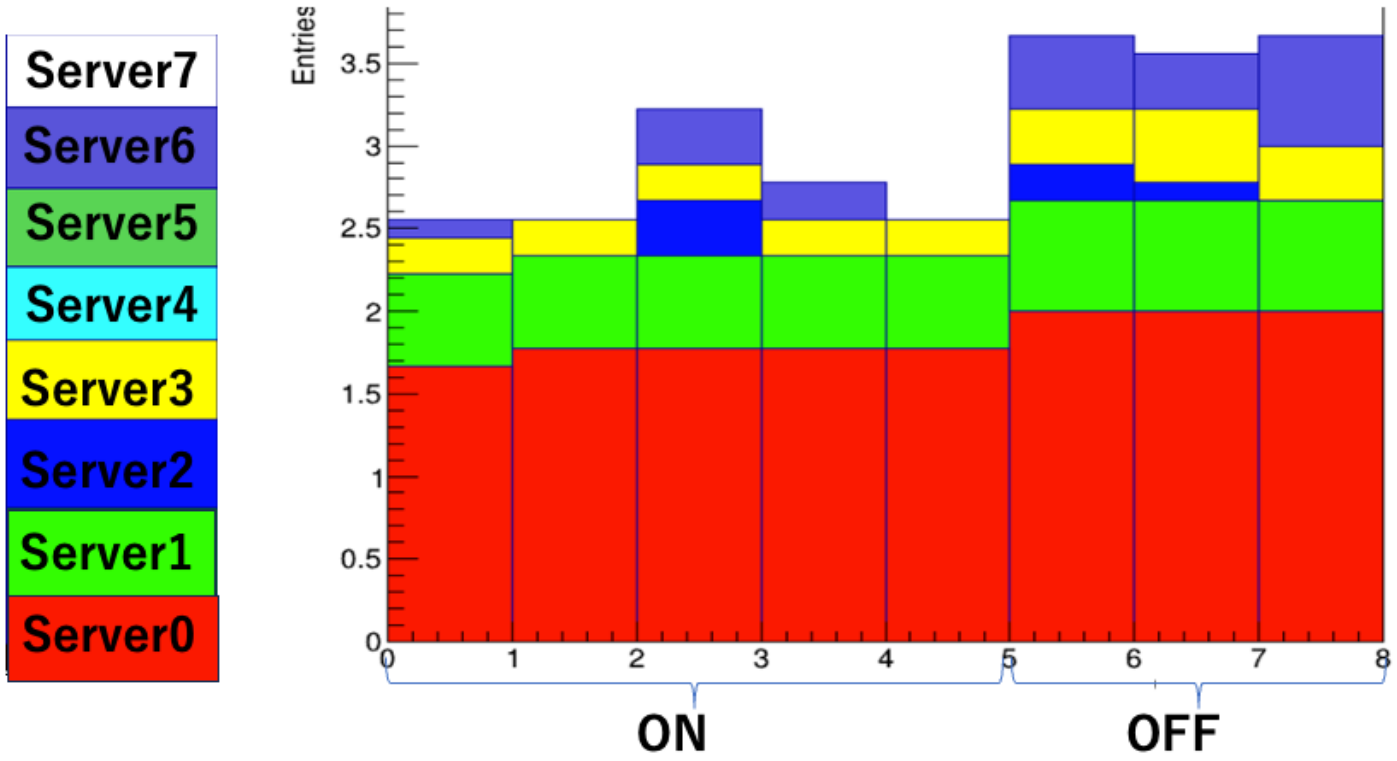
Time	Run	Run Length (min)	Event(intt0s packet)	setting	trigger	porpose
17:10	10479	6min		def		test
17:18	25477	4			trigger0(clocktrigger)=9999 ,trigger rate =around 510Hz	
17:23	25478	3			clocktrigger=999 rate =5140Hz	
17:27trigger	25479	3			trigger1(randam),trigger rate=62Hz	
17:34	25480	3			trigger1(randam),trigger rate=620Hz	
17:37	25481	10			trigger0,trigger rate=51Hz	

Magnet OFF E-Log(https://sphenix-intra.sdcc.bnl.gov/WWW/elog/INTT/440)

Time	Run	Run Length (min)	Event(intt0s packet)	setting	n_coll	trigger	purpose	comment
5:27 PM	25920	3			8	random trigger, 370Hz		run type:calib
5:31 PM	25921	3			8	random trigger, 370Hz		run type:calib
5:35 PM	25922	3			8	random trigger, 370Hz		run type:calib

NOISE OF NO BEAM (MAGNET ON/OFF)

Entries per Event vs Run number (n_collision = 8)



※Hotchannel not removed

- The plot shows amount of noise not related to beam. (Noise include cosmic and others)
- The n_collision is different and is standardized.
- About 10% of amount of beam background
- Slightly more Magnet OFF than ON
- The n_collision is different and is standardized.
- Intt0 has more noise than others (I'll mention it later.)

Magnet on, no beam	Magnet off, no beam
2.73 (± 0.289)※	3.63(±0.064)※

※ Dispersion by Run

AVERAGE HIT RATE

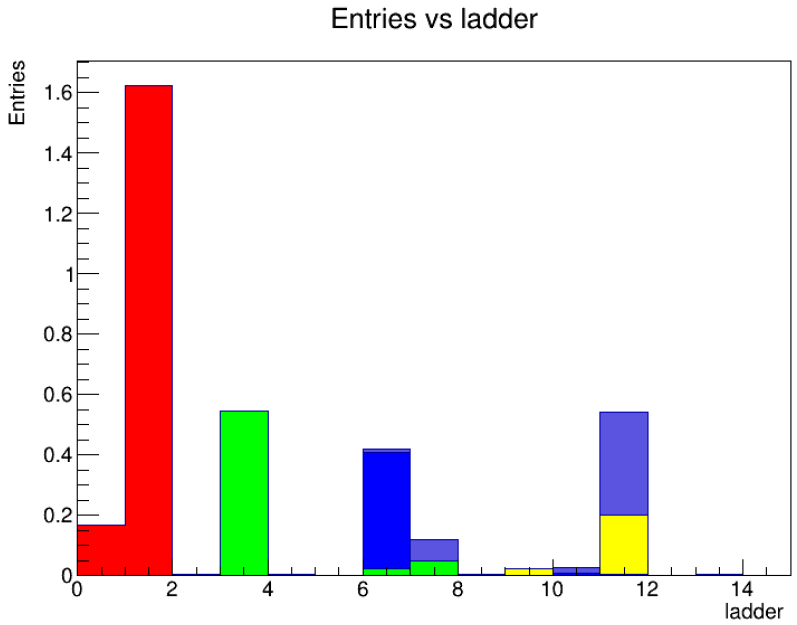
	Magnet off, no beam	Magnet on, no beam	Magnet on, w/ beam
Average hit rate / BCLK	3.63(±0.064)※	2.73 (± 0.289)※	26.6 (± 3.63)※

※ Dispersion by Run

HOT CHANNEL PROBLEM

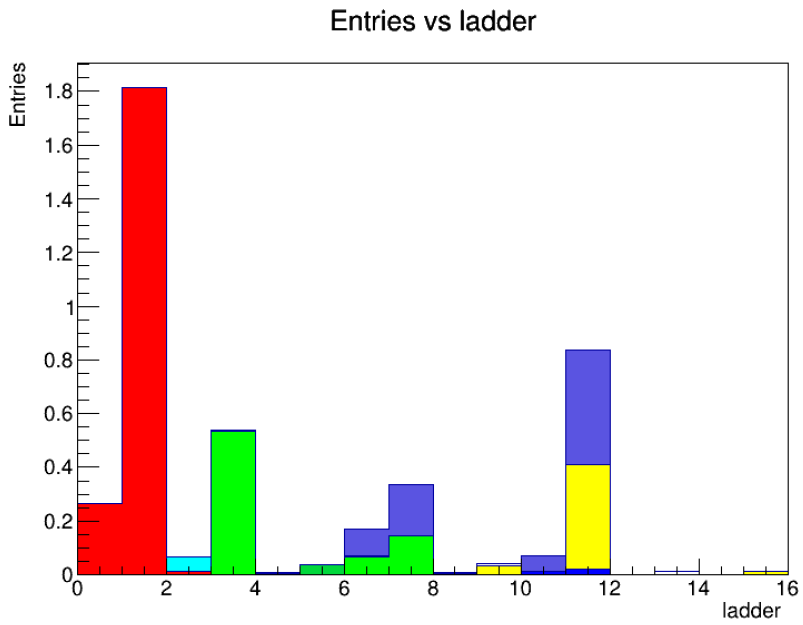
LADDER DEPENDENCE

Magnet On



RUN#25478

Magnet Off

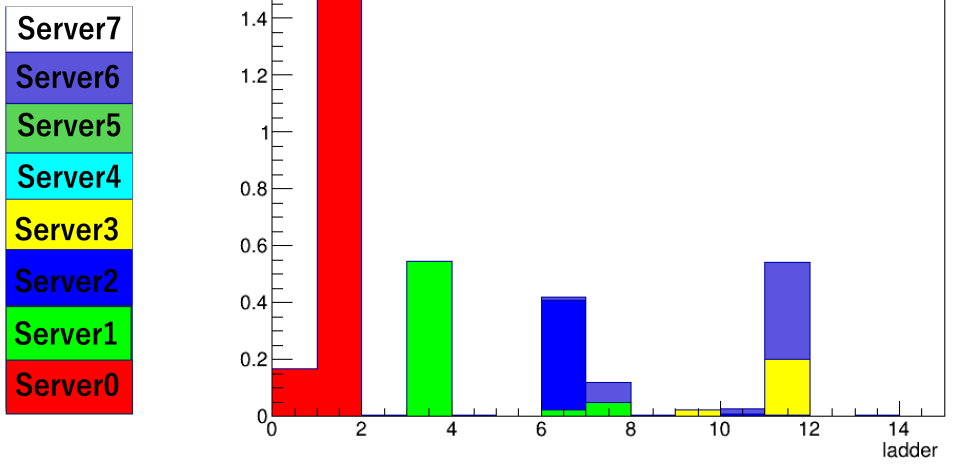


RUN#25922

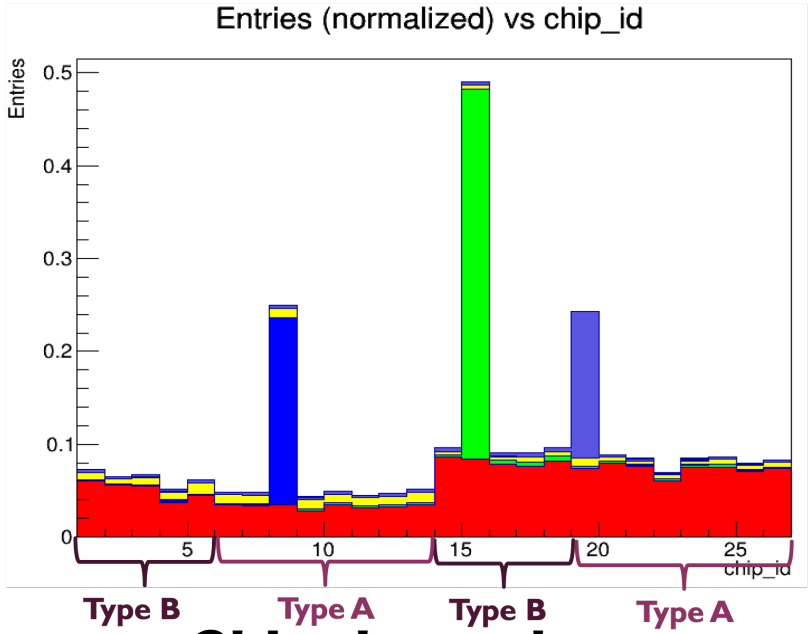
- This plot shows ladder dependence of noise without beam.
- Previous plot shows that intt0 receive noise more than others, so I tried to find the hot channel.
- You can see Ladder1of intt0 has hot channel and don't change the location in Magnet ON or OFF plot.

CHIP DISTRIBUTION

RUN#25478



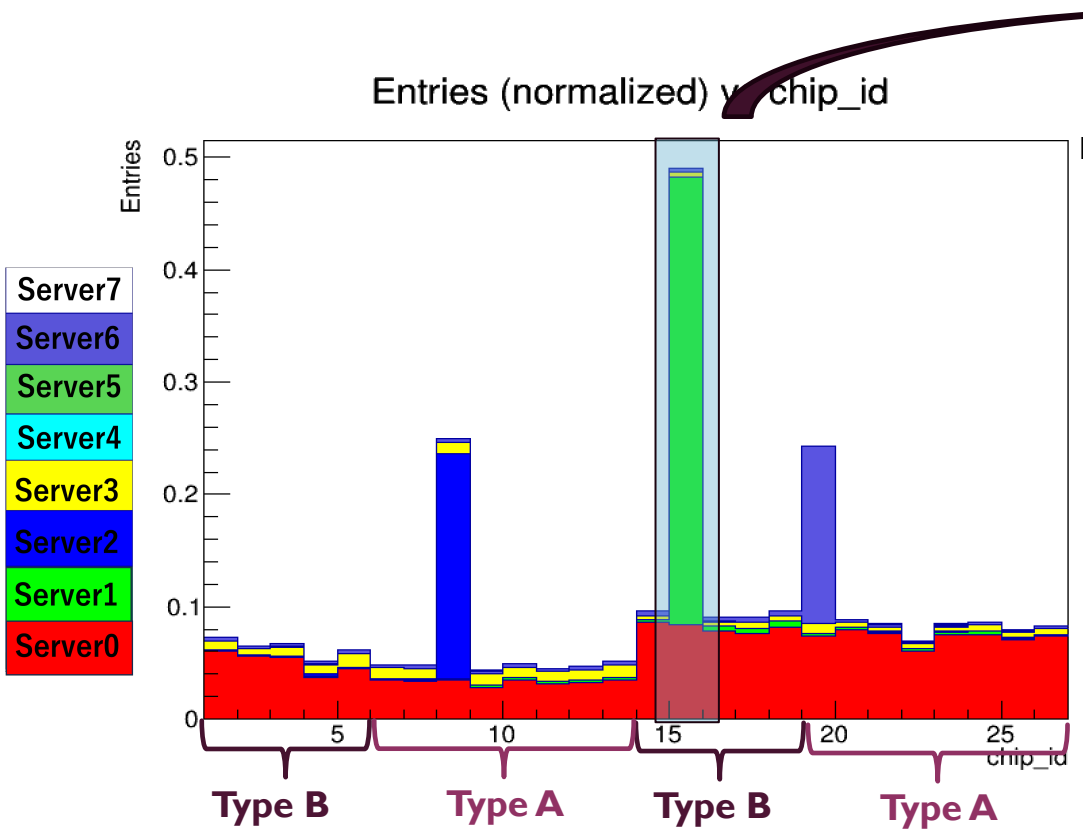
Ladder dependence



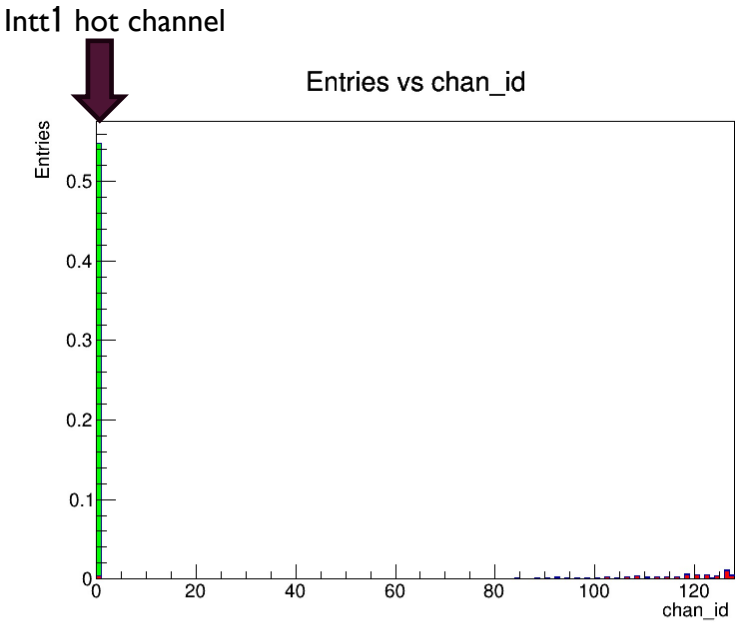
Chip dependence

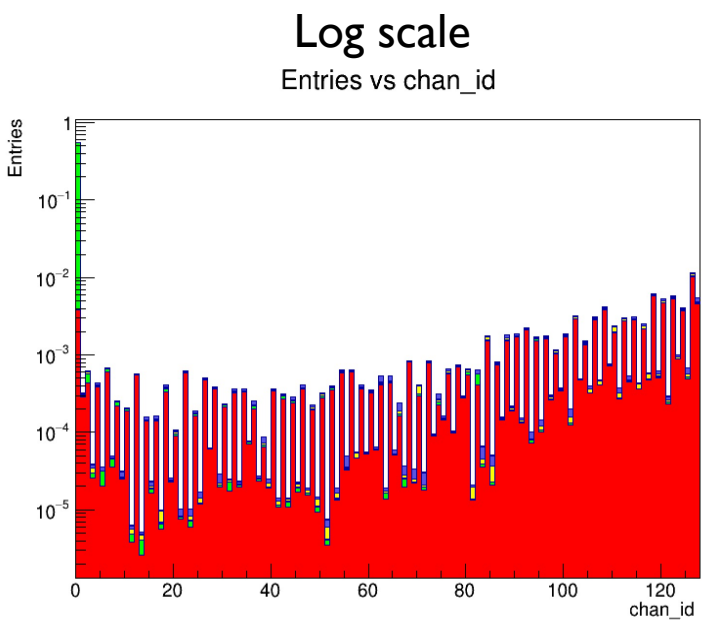
- The right plot shows chip dependence of noise without beam.
- If you pay attention to intt0, we can see that it is distributed throughout the CHIP, not a specific CHIP.

CHANNEL DISTRIBUTION



RUN#25478





- If you pay attention to one chip, we also can see that it is distributed throughout the channel, not a specific channel.
- I think it is difficult to remove the hot channel.

SUMMARY

- the amount of Noise per Event (with hot channel)
  - Beam 26.6 (± 3.63)※/BCLK
  - No beam(Magnet on) 2.73 (± 0.289)※/BCLK
  - No beam(Magnet off) 3.63 (± 0.064)※/BCLK ※ Dispersion by Run

Next step

I would like to try to study about the amount of Noise without hot channel.

- Ladder 1 of intt0 has all channel as hot channel, which would be difficult to remove.

  Further investigation is needed.