04/09-05/09 Light off test:
trigger chain(CTU-RMU-BEC-GCU) check

Outline

- BEC status
    - how many bec used for this light off test
- light off test introduction
    - trigger mode
    - test area
    - data structucture

analysis

    - analysis and suggestion

BEC status

- 1613 CD GCUs connected to **45 BECs**
- 155 VETO GCUs connected to **10 BECs**
- 56 sPMT UWB connected to **2 BECs**

#1

	1柜	2柜	3柜	4柜	5柜	6柜	7柜	8柜	9柜	10柜
1排	61	33	41	46	144	51	142	95	78	58
	169	112	65	34	159	59	87	2	129	107
	12	86	82	44	72	120	125	40	103	83
2排	117	42	91	152	50	115	84	13	5	3
	122	128	168	155	127	64	23	38	4	35
	111	167	148	70	92	173	73		16	15
3排	31	135	174	176	123	137	24	53	85	
	132	179	170	43	71	146	172	164	141	
	10	163	109	80	57	14	62	49	79	

#2

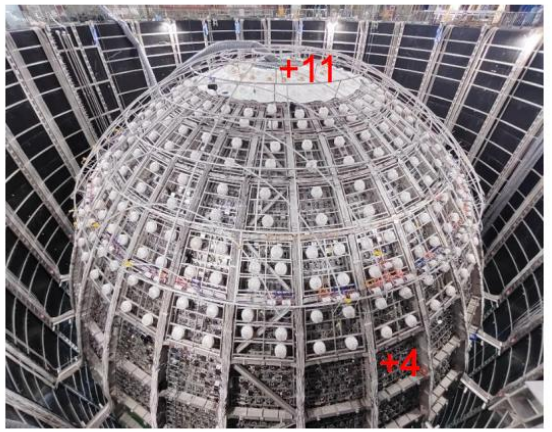
	1柜	2柜	3柜	4柜	5柜	6柜	7柜	8柜	9柜	10柜
1排	9	175	67	88	75	162	36	178	133	
	27	131	157	20	158	48	47	77	105	
	19	8	100	101	166	165	45	69	94	
2排	145	160	39	32	11	74	76	56	124	
	29	108	102	177	114	147	153			
	119		81	154	93	156	121			
3排	52	143	149	126	104	25	68	136	134	
	37	63	90	60	110	161	30	106		
	54	151	130	98	28	139	99	17		

Note	orange = CD 134	purple =VETO 21	blue = sPMT 5

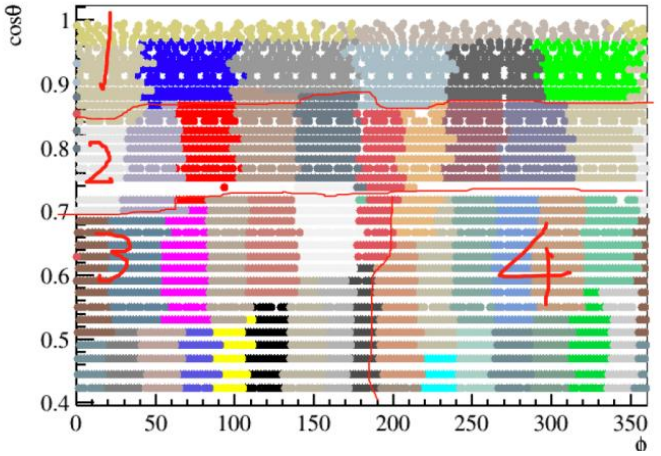
light off test introduction

Light off test from Sept.4 to Sept.5

- trigger mode: global trigger: period/nhits/external
- test area: see right figure and table



batch

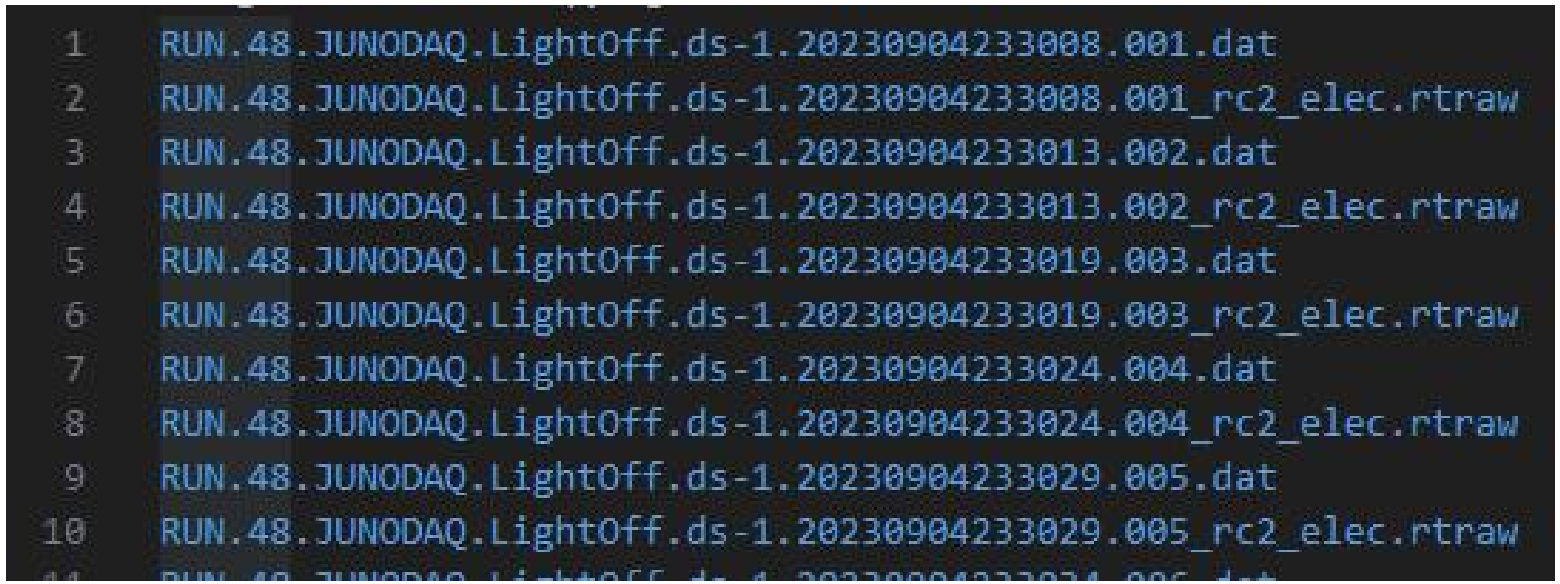


Run No	Number of GCUs	CTU trigger mode		
48	155	periodic	Veto GCUs	
49	155	nHit	Veto GCUs	
50	155	external	Veto GCUs	LED on
51	342	periodic	CD batch 1	
52	342	nHit	CD batch 1	
53	342	external/nhit	CD batch 1	LED on
57	446	nHit	CD batch 2	
58	446	nHit	CD batch 2	LED on
60	449	nHit	CD batch 3	
61	376	nHit	CD batch 4	

light off test introduction

Light off test from Sept.4 to Sept.5

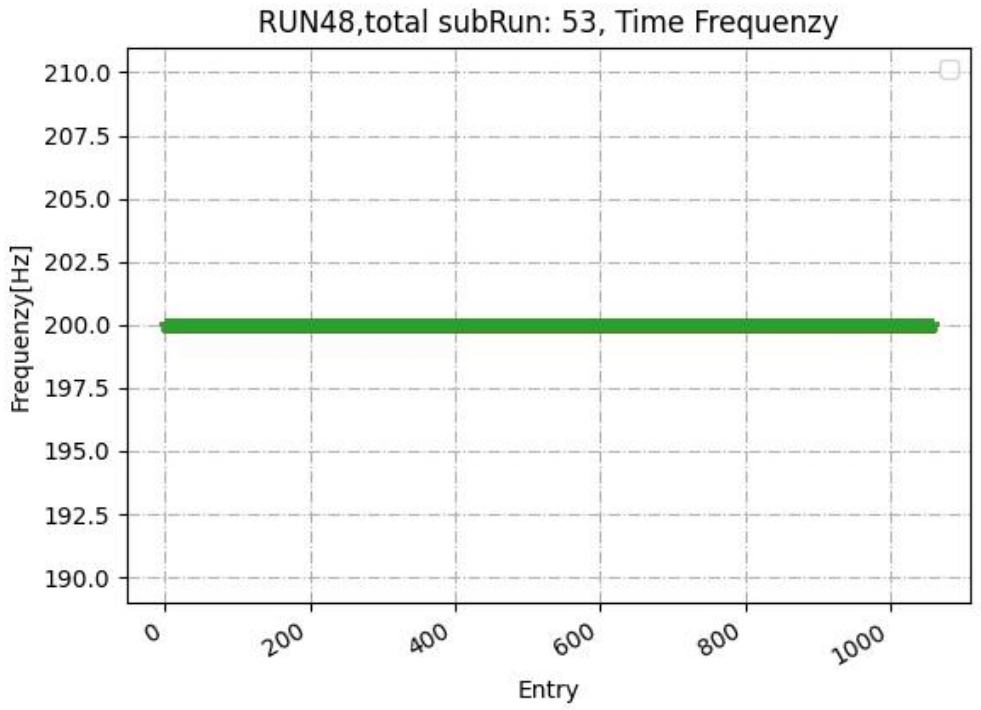
- data structucture: for one run, like RUN48, there is few files(sub-run)
  - each takes ~5s data.
  - each include all GCUs output



Analysis

purpose: check if there is trgger lost from CTU-RMU-BEC-GCU

- Start from **period trigger**(configuration: 200Hz)
- Check if CTU send the trigger



plot shows 53 files data togther.
Y: 1/triggerTimeGap
X: ith trigger of the sub-run

No trigger lost from CTU sender

Analysis

purpose: check if there is trgger lost from

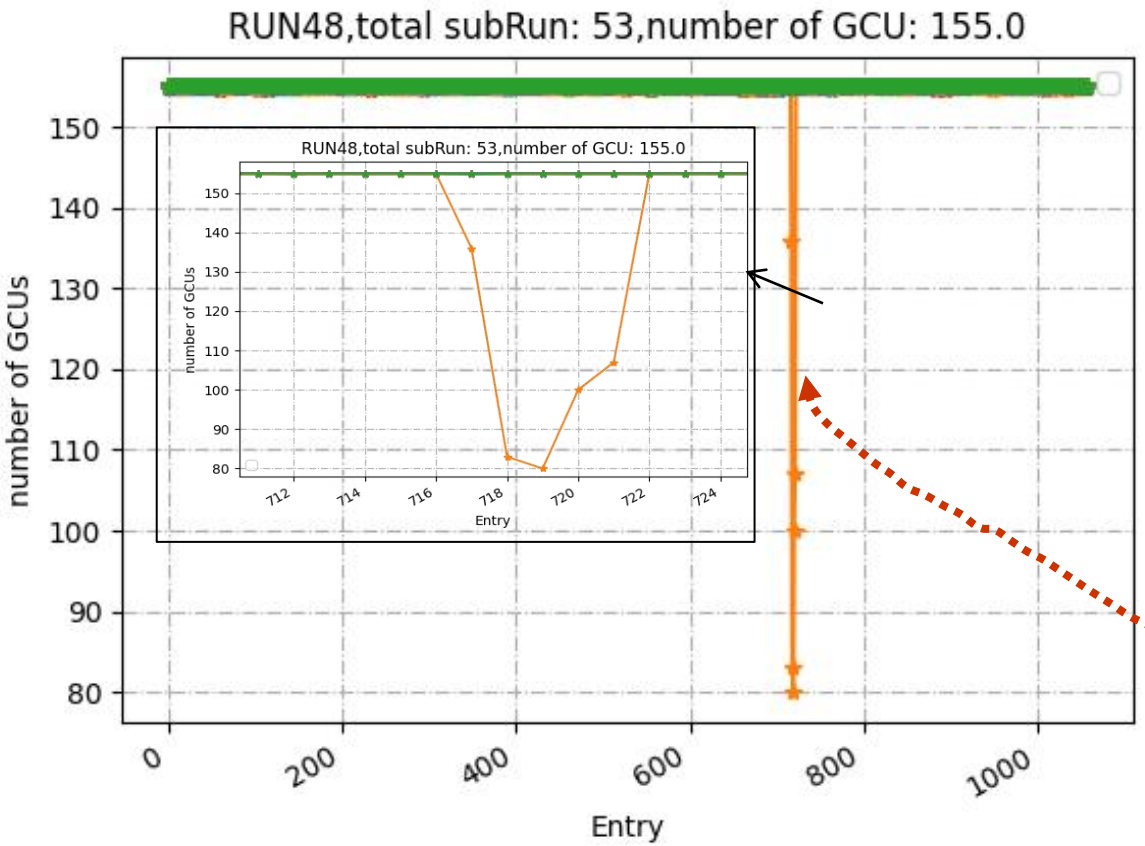
CTU-RMU-BEC-GCU

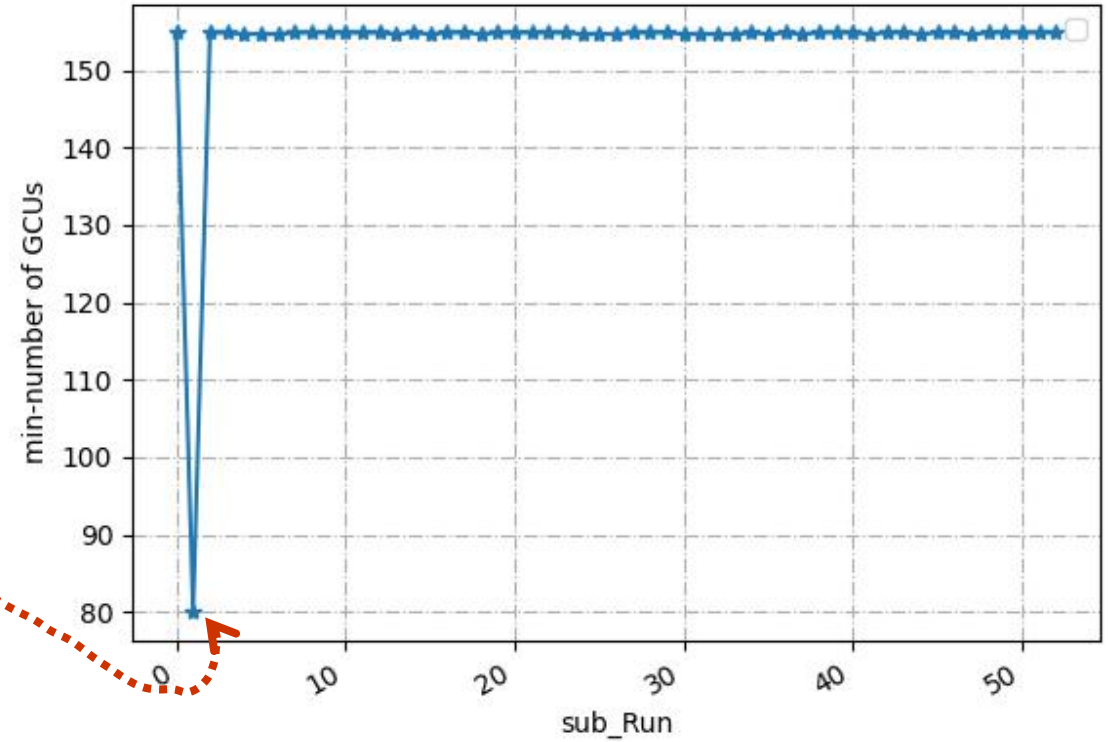
- check the trigger chain

plot shows 53 sub-run data togther.
Y: total number of triggered GCU
X: ith trigger of the sub-run

N_triggered GCU < N_total GCU:

- **data lost: trigger or DAQ?**



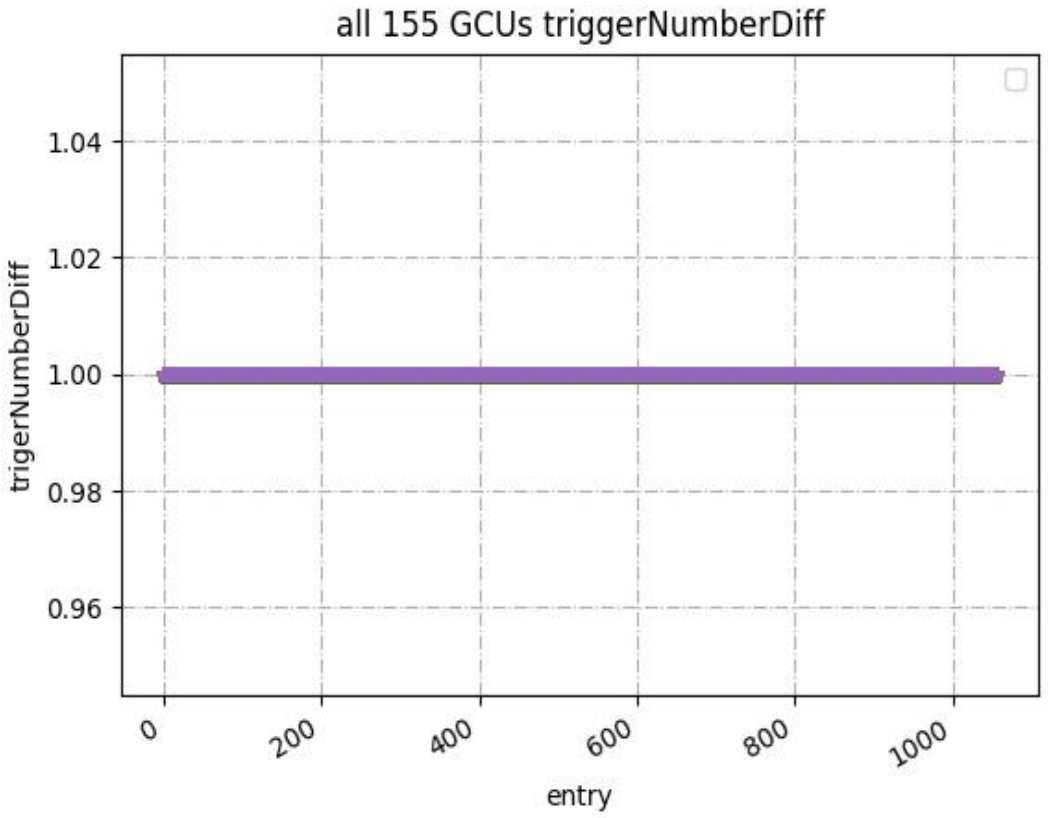


Analysis

purpose: check if there is trgger lost from

CTU-RMU-BEC-GCU

- check the trigger chain



plot shows 53 sub-run data togther.
Y: triggerNr gap
X: ith trigger of the sub-run

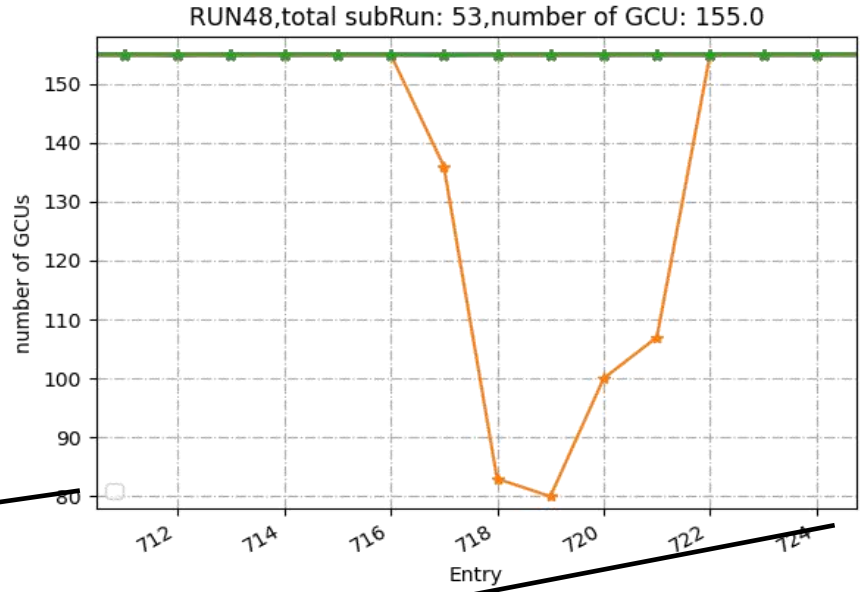
triggerNr=1:

- **data lost: trigger!**

Analysis

purpose: check if there is trgger lost from CTU-RMU-BEC-GCU

- check the trigger chain



BEC ID	N_GCU_all	lost: 0th	lost: 1th	lost: 2th	lost: 3th	lost: 4th	lost: 5th
76	17	-	-	-	Full	Full	-
121	10	-	-	Full	-	-	-
73	18	-	-	-	-	Full	-
23	13	-	Full	-	-	-	-
147	22	-	Full	Full	-	-	-
74	11	-	-	Full	Full	-	-
56	13	-	-	-	Full	Full	1
64	14	-	-	Full	Full	-	-
38	18	-	Full	Full	-	-	-
84	19	Full	Full	-	-	-	-

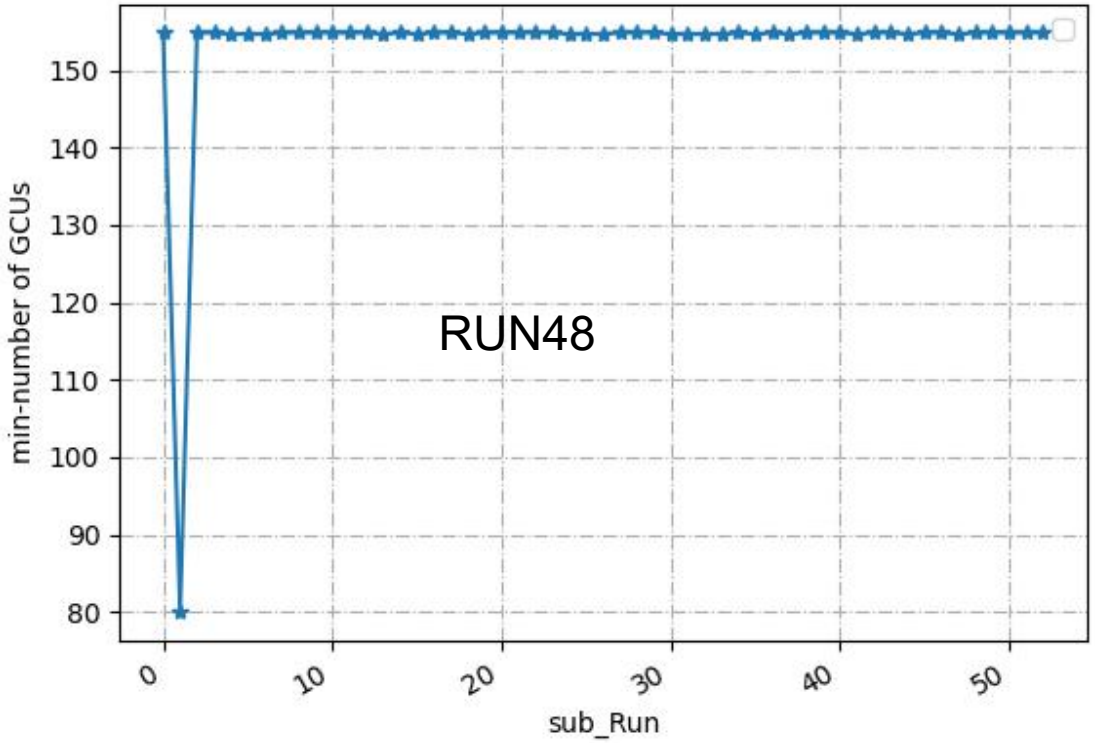
Table shows total GCU numbers and lost GCU numbers of one connected BEC .

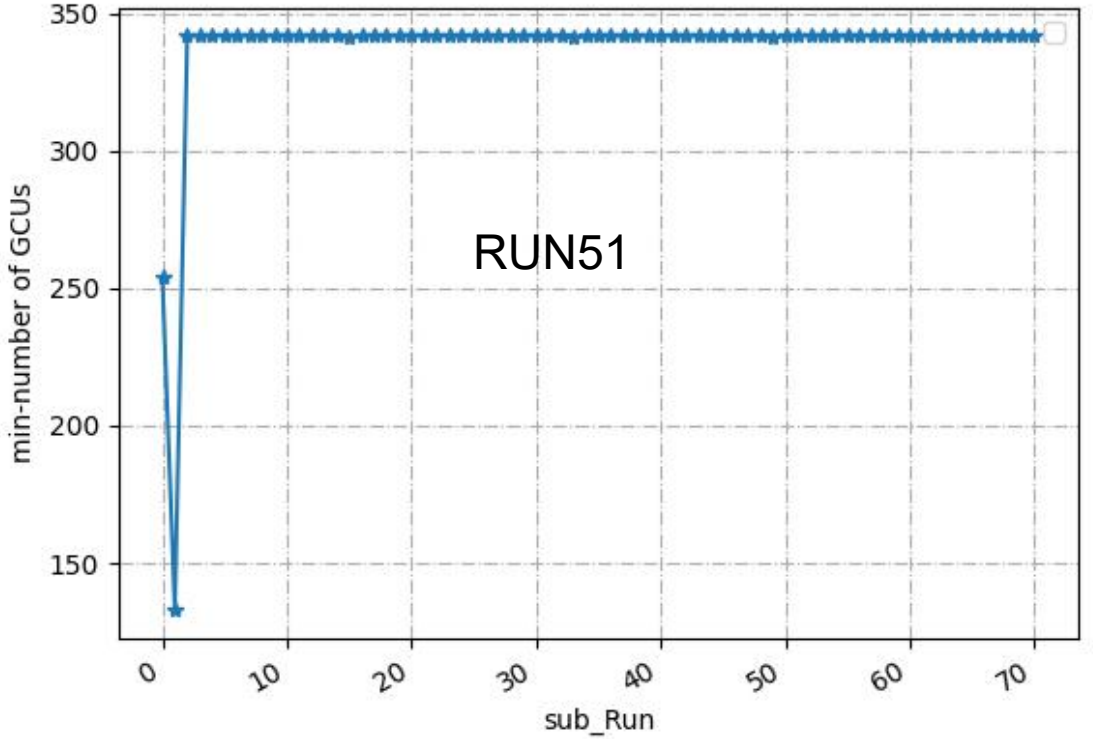
- Full means: at this triggertime, all GCU of this connected BEC are lost.

Analysis-period trigger result

- **trigger lost in the begining of run**
- **trigger lost between CTU and BEC**
- **trigger lost between BEC and GCU**

- only two period trigger this time, both happen in the begining, it might be the trigger chain is not stable in the begining.
- Next light off test, can repeat the period trigger to get more information.



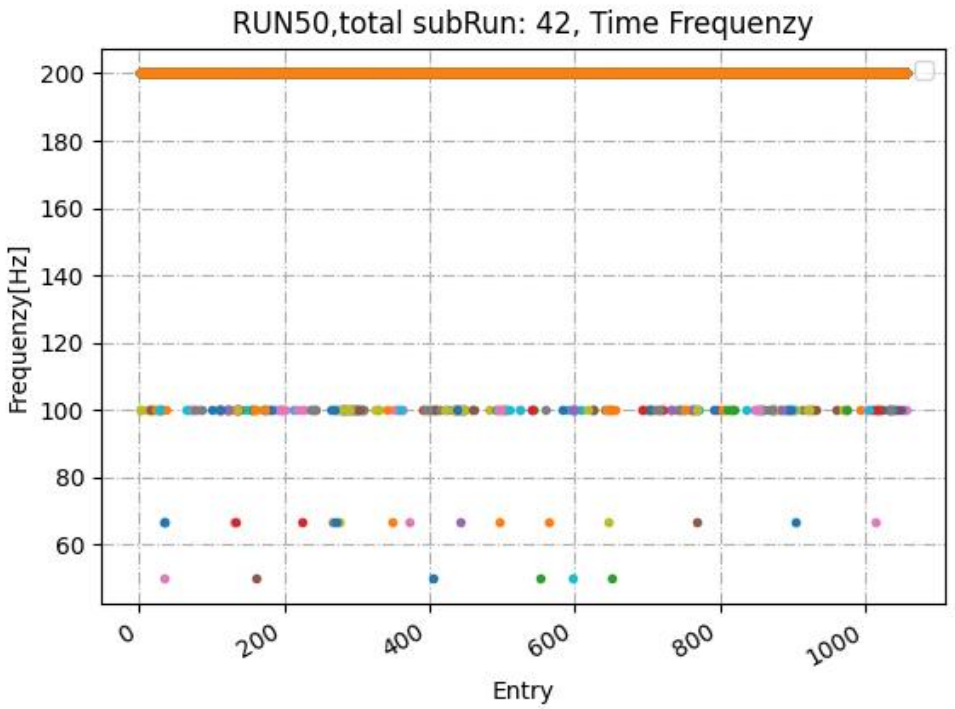


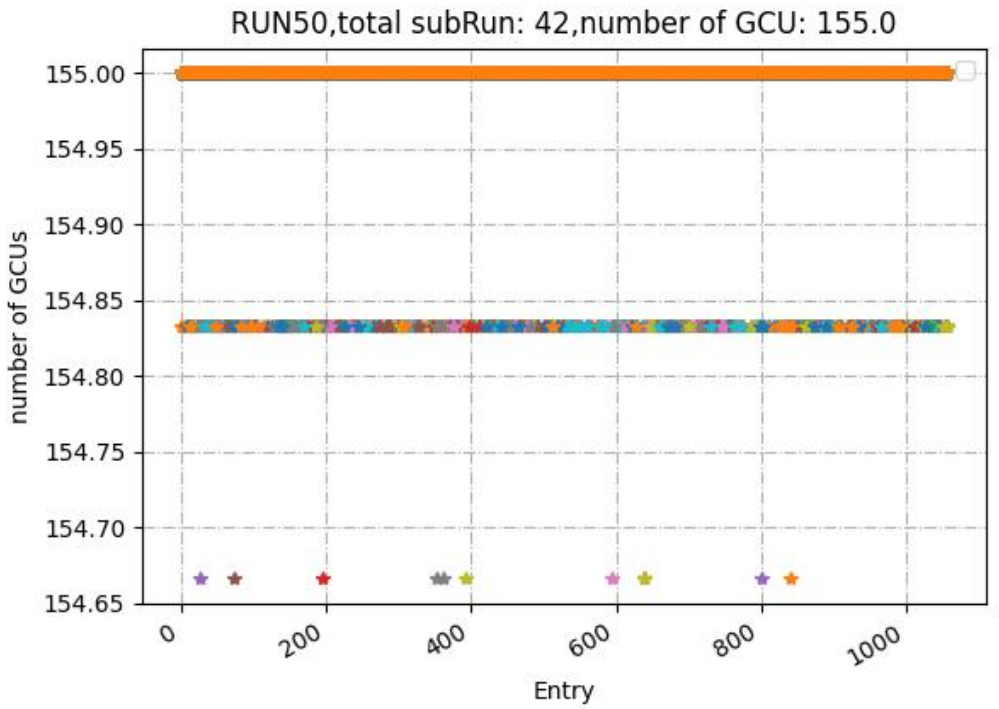
Analysis

purpose: check if there is trgger lost from CTU-RMU-BEC-GCU

- check external trigger

Result：No trigger lost



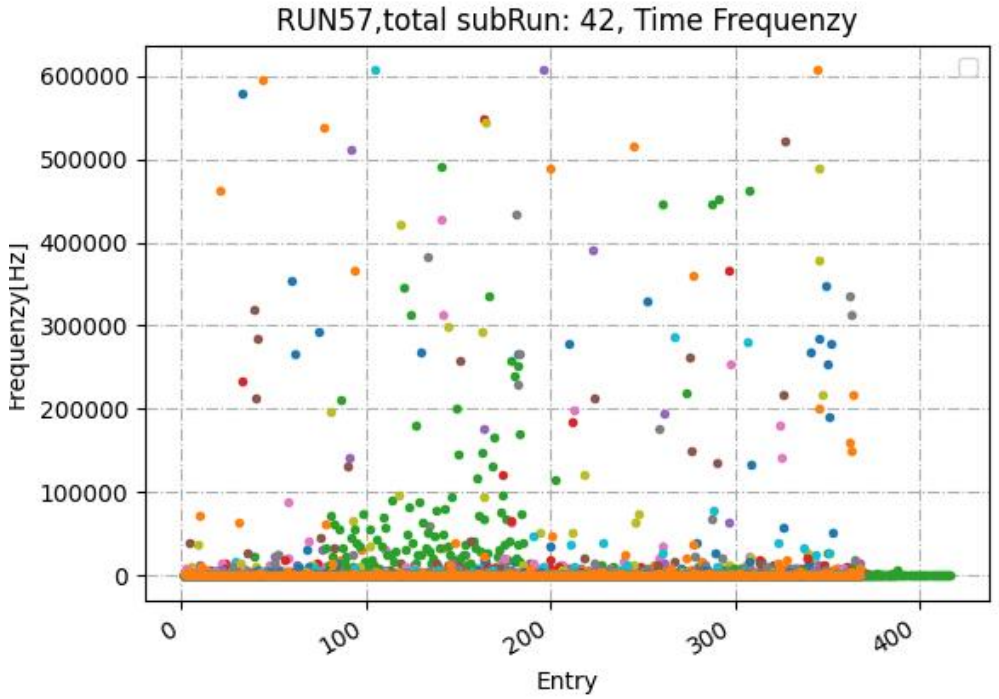


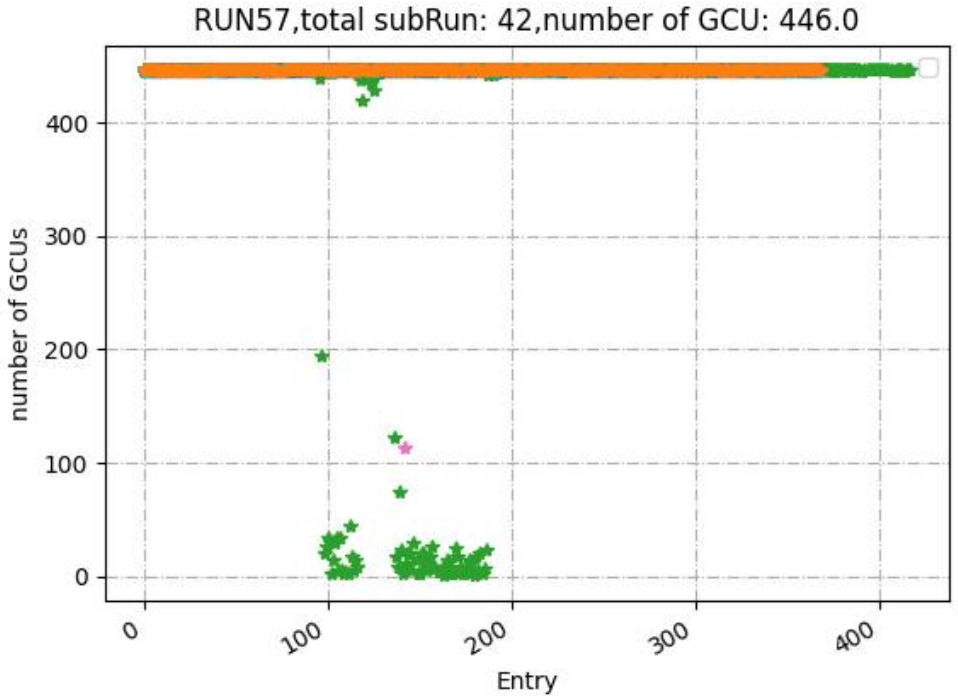
Analysis

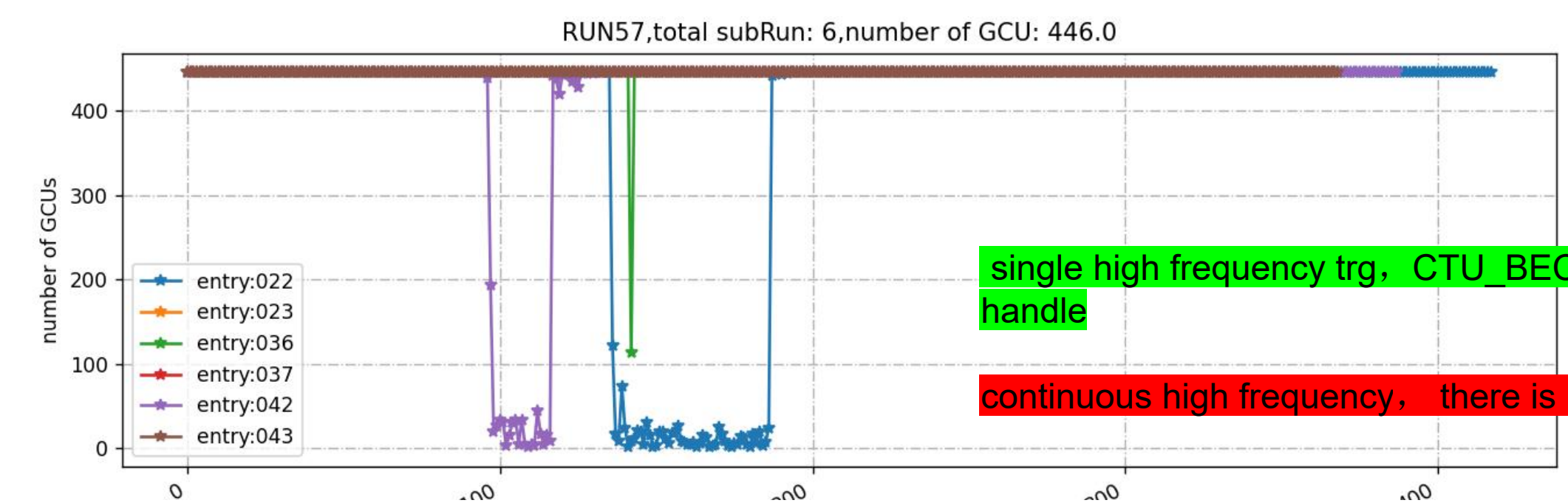
purpose: check if there is trgger lost from CTU-RMU-BEC-GCU

- check nhits trigger : RUN 57

Result：data lost

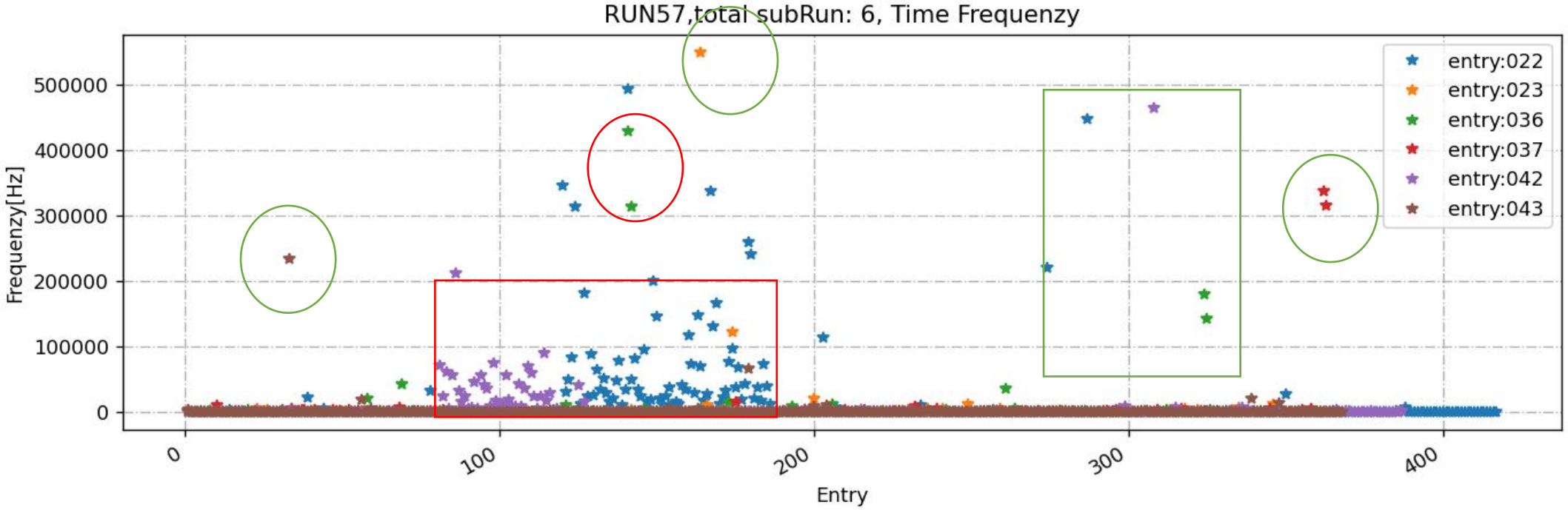


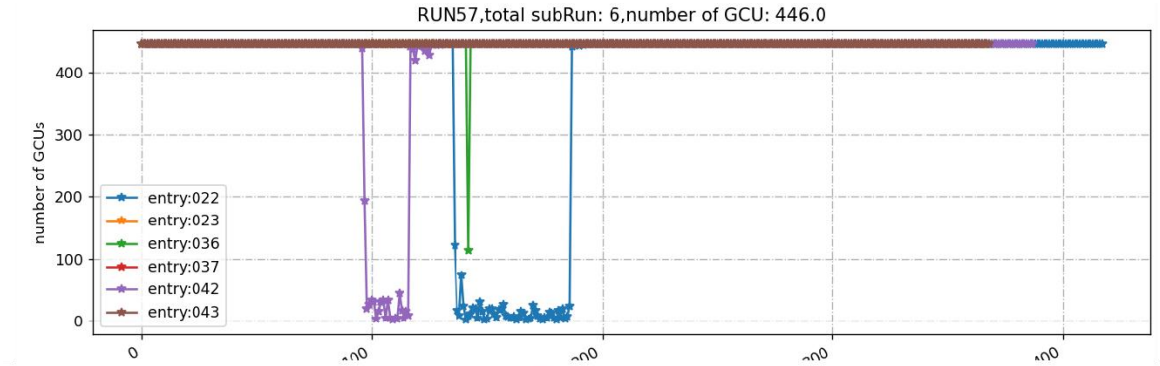


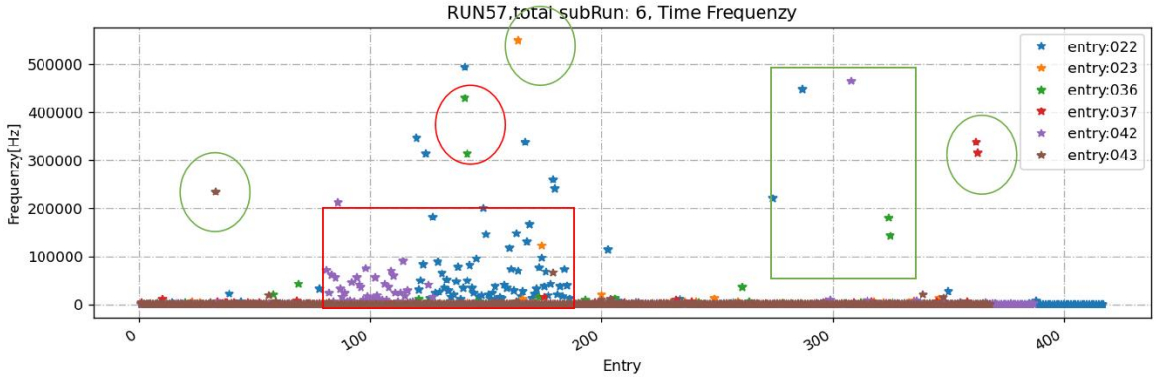


single high frequency trg，CTU_BEC_GCU can handle

continuous high frequency， there is lost on trg/data







exist ‘problem’:

- dead time of device:
  BEC: 2us
  CTU:1us
  GCU:1.xxus
- RMU: need carefully check

- the threshold for RUN57 nhit=37,total 446*3=1338
- mean frequency of this RUN is about 100Hz
  - f= Total trgN/Time

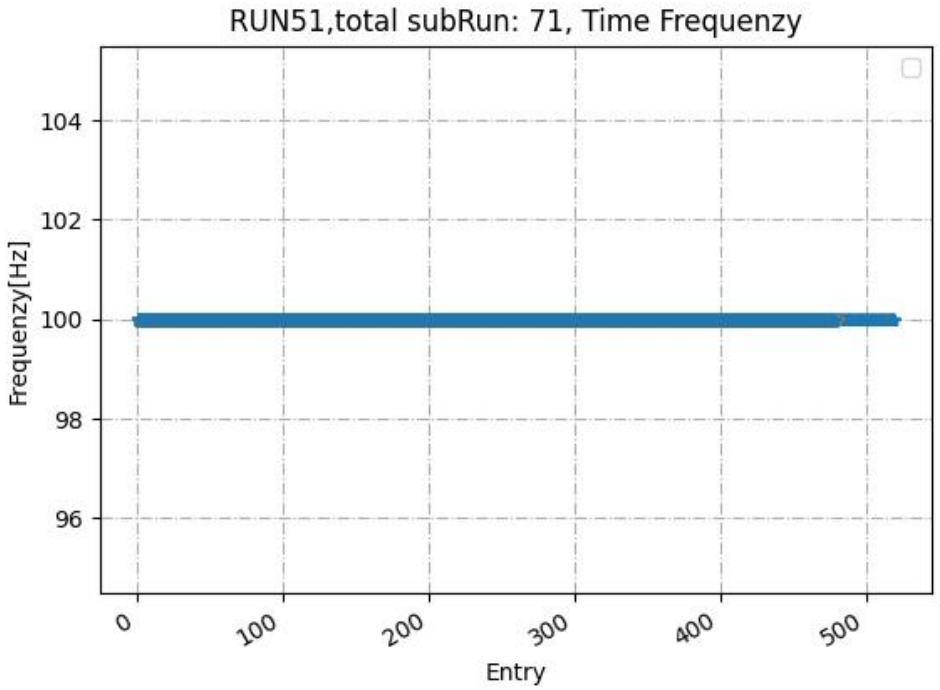
- It brings question:
- nhit trigger time difference min-limit(fre)
- the short time difference trg come from nhits or transmission error
  - can we monitor the transmission error on GCU for next test?

period trigger-CD

period trigger

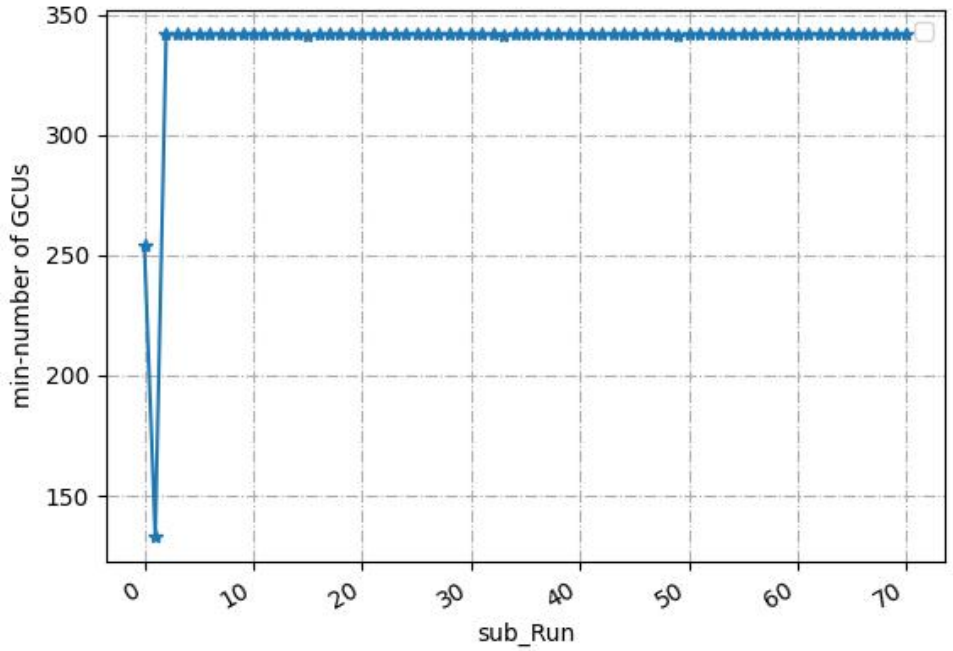
检查整体从CTU是否发送里trigger

- constant frequency， good



检查从CTU_BEC_GCU是否有trigger丢失

- 每次sub_RUN：trigger下的GCU最小个数
  - 有2次有数据丢失。具体看看。也发生在最开始的run



period trigger

检查trigger丢失的sub-run1具体信息

- 丢失的**triggerNumber**变化情况
- 这个丢失的**GCU**连接的**BEC:table**

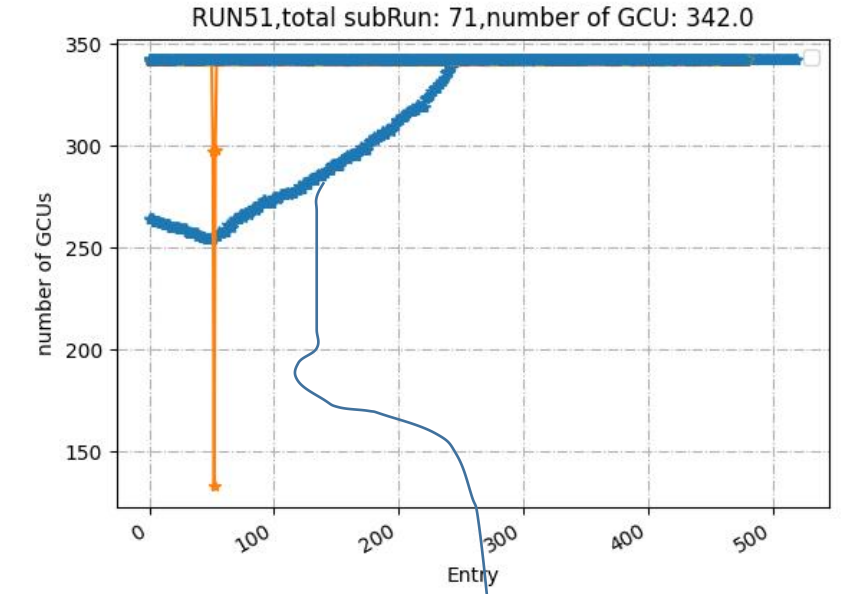
result：总共丢了200多次

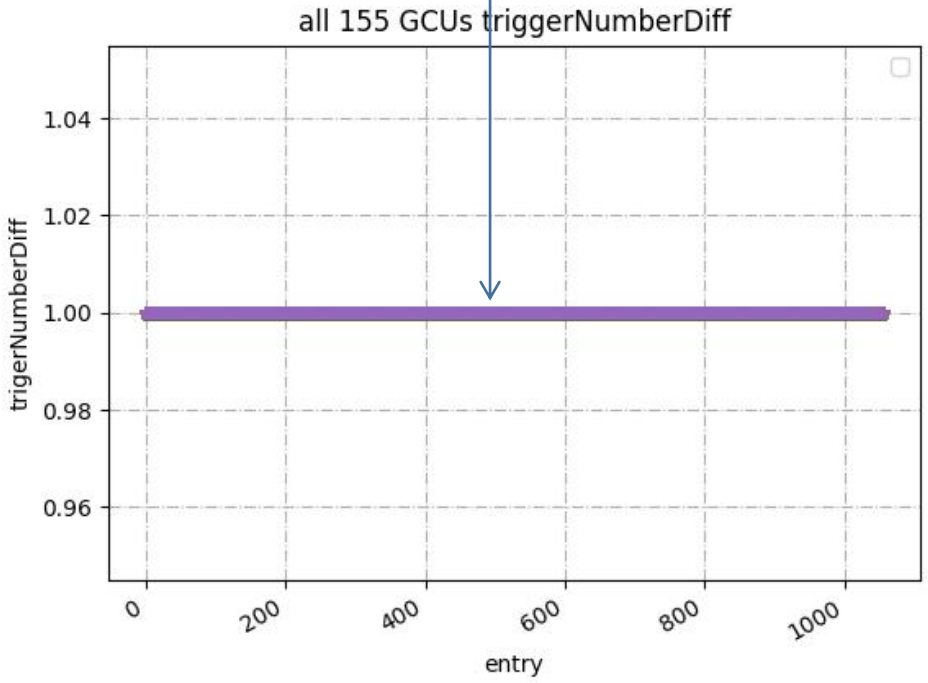
trigger lost between CTU and BEC： NO 因为没有

trigger lost between BEC and GCU：YES

table只显示了一部分

BEC ID	N_GCU_al	lost: 0th	lost: 1th	lost: 2th	lost: 3th	lost: 4th	lost: 5th	lost: 6th	lost: 7th
45.0	40	-	-	-	-	-	-	-	-
146.0	41	20	20	20	20	20	20	20	20
47.0	40	-	-	-	-	-	-	-	-
11.0	44	-	-	-	-	-	-	-	-
14.0	44	13	13	13	13	14	14	14	14
50.0	44	22	22	22	22	22	22	22	22
114.0	44	-	-	-	-	-	-	-	-
72.0	45	23	23	23	23	23	23	23	23





period trigger

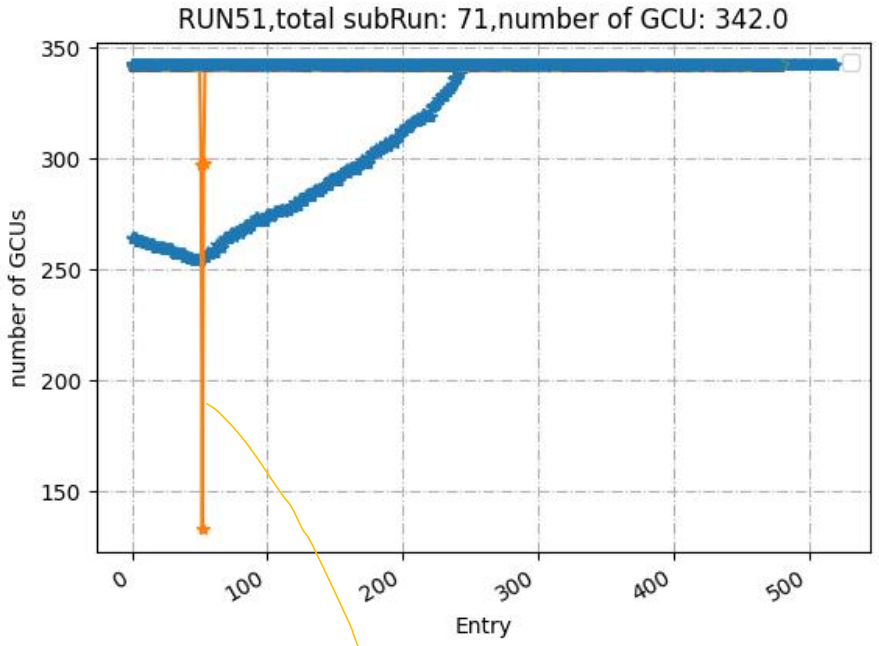
检查trigger丢失的sub-run2具体信息

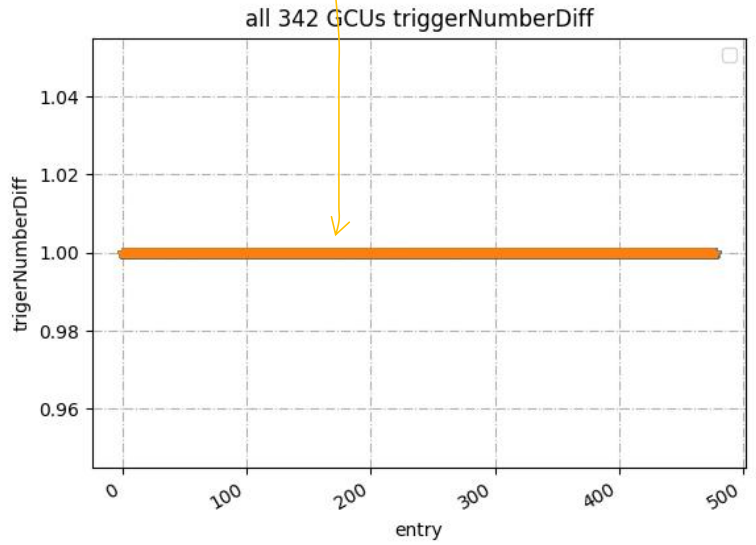
- 丢失的**triggerNumber**变化情况
- 这个丢失的**GCU**连接的**BEC:table**

result：

trigger lost between CTU and BEC

trigger lost between BEC and GCU





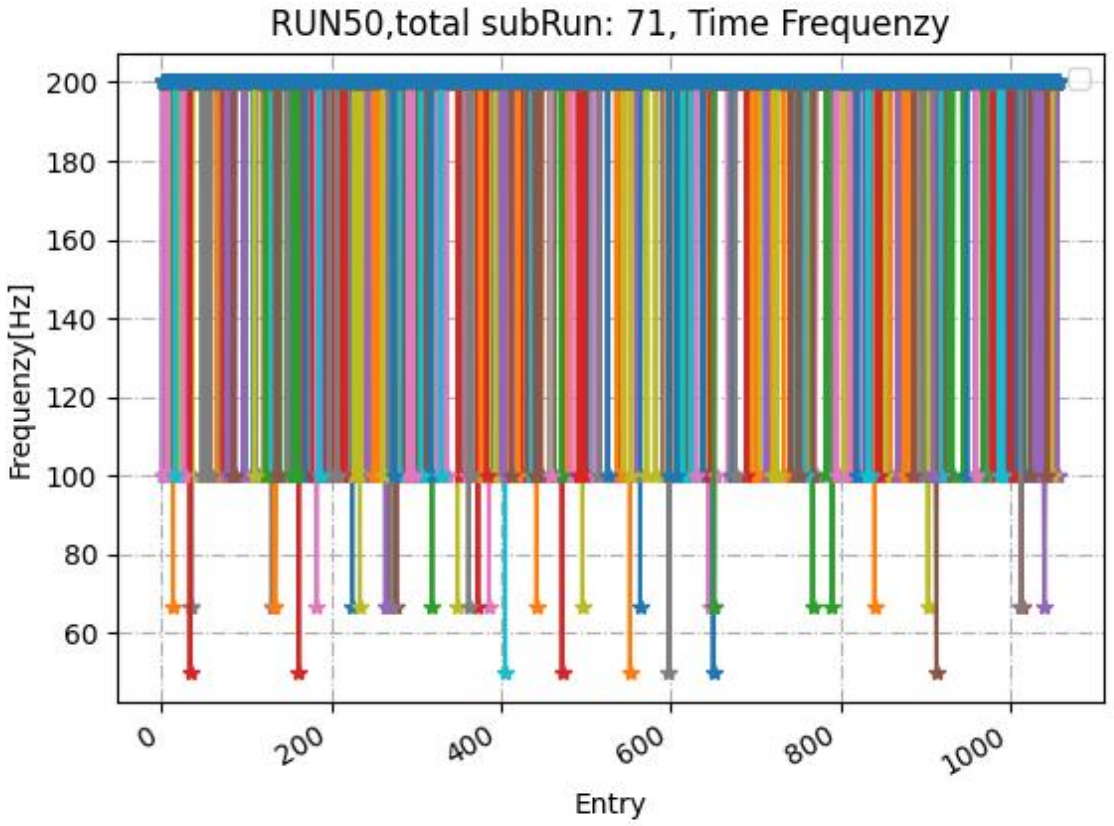
BEC ID	N_GCU_all	lost: 0th	lost: 1th	lost: 2th	lost: 3th
45.0	40	-	Full	-	-
146.0	41	-	Full	-	-
47.0	40	-	Full	-	-
11.0	44	-	Full	-	-
14.0	44	-	-	-	-
50.0	44	-	Full	-	-
114.0	44	-	-	Full	1
72.0	45	Full	-	-	-

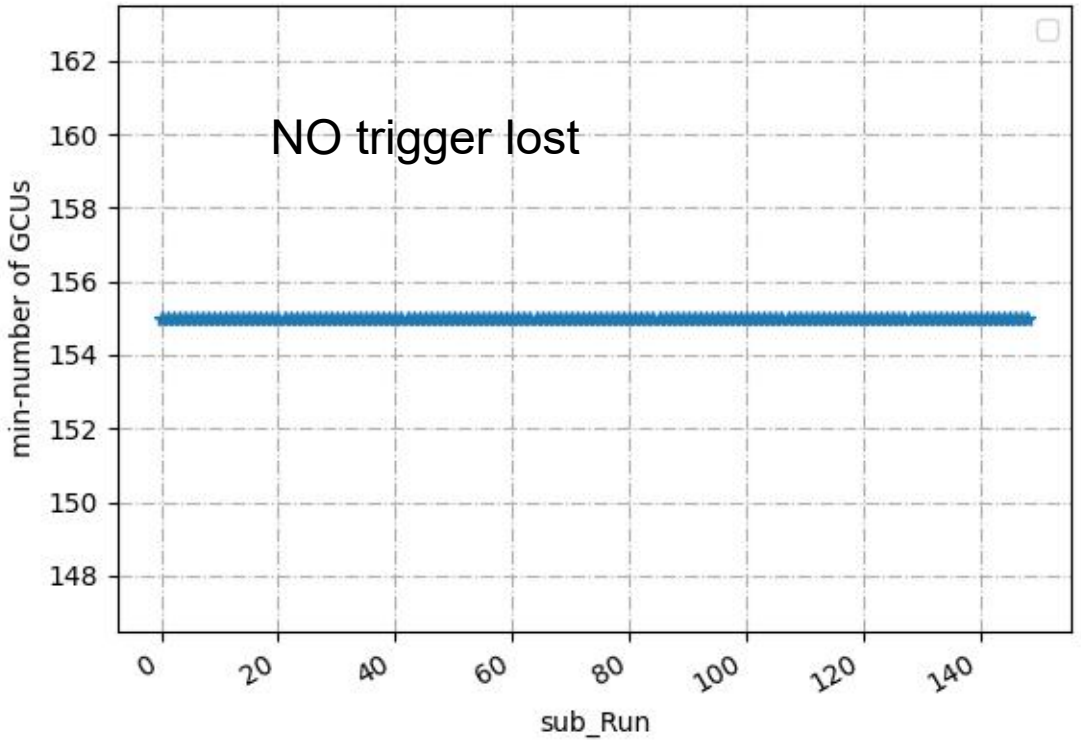
nhit/exteral trigger

external没有发现问题
nhit总有某些奇怪的超高的频率

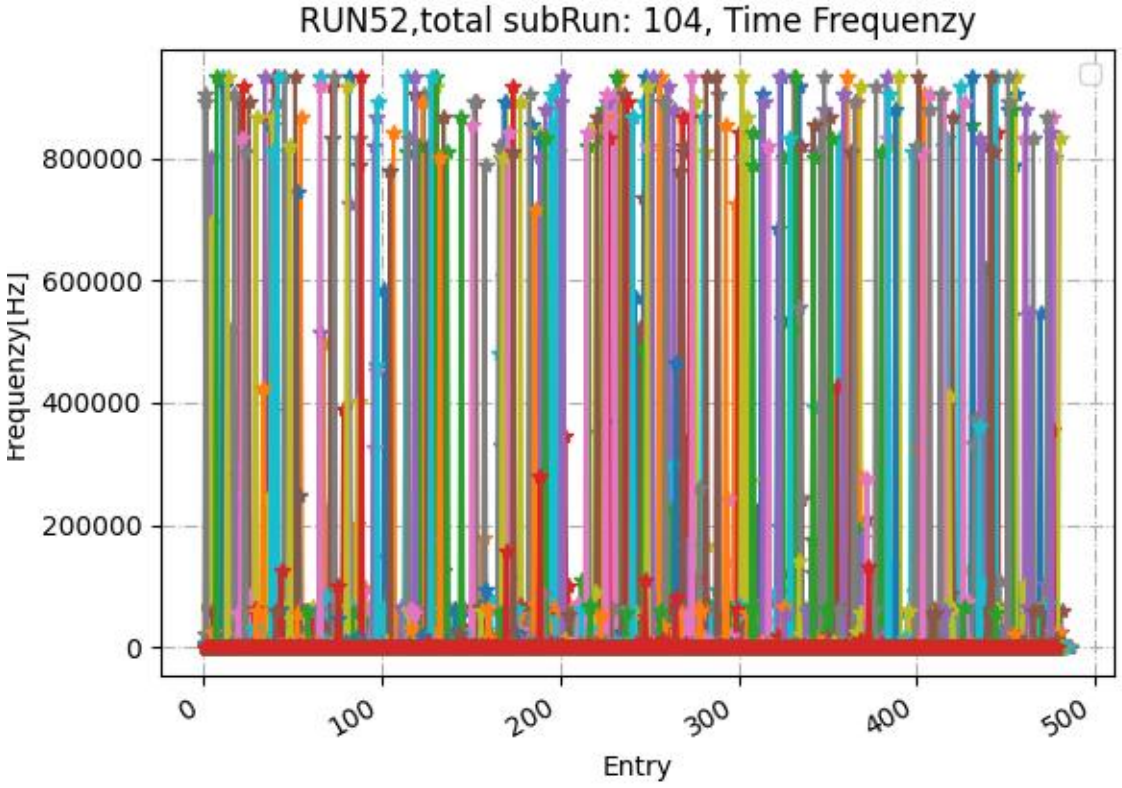
- 这次的thr多少呢？
- 真实情况下对于f>50kHz的有什么处理吗？DAQ可能丢数
- nhit模式下CTU有可以处理的频率上限吗？

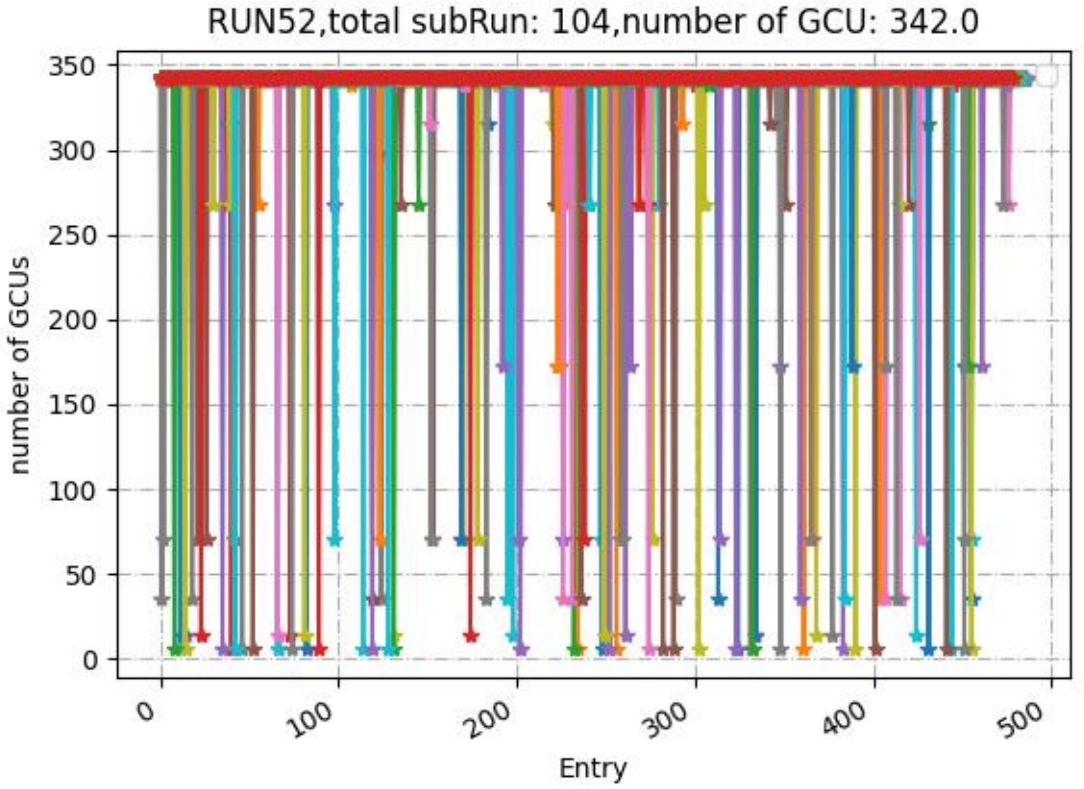
Run No	Start time	End time	Number of GCUs	GCU trigger mode	BEC trigger mode	CTU trigger mode	RTRaw files		
50	20230904-235129	20230905-000437	155	0x0000	N/A	external	Veto GCUs	LED on	



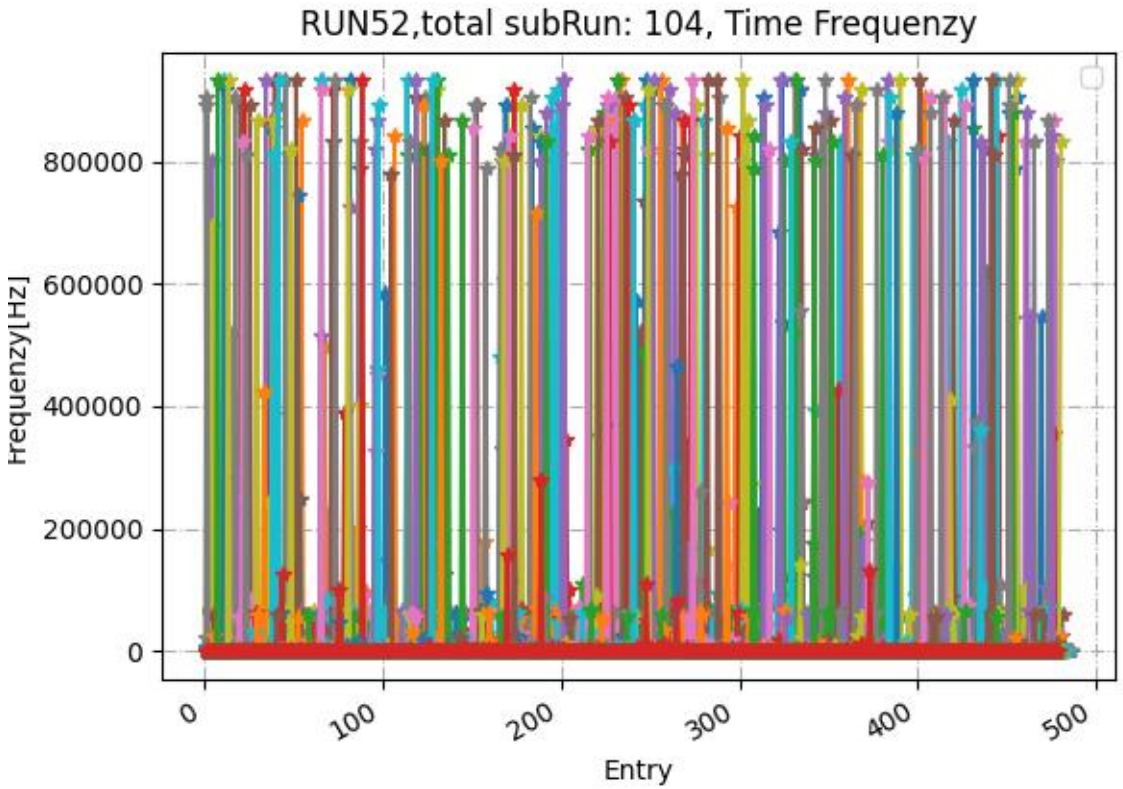


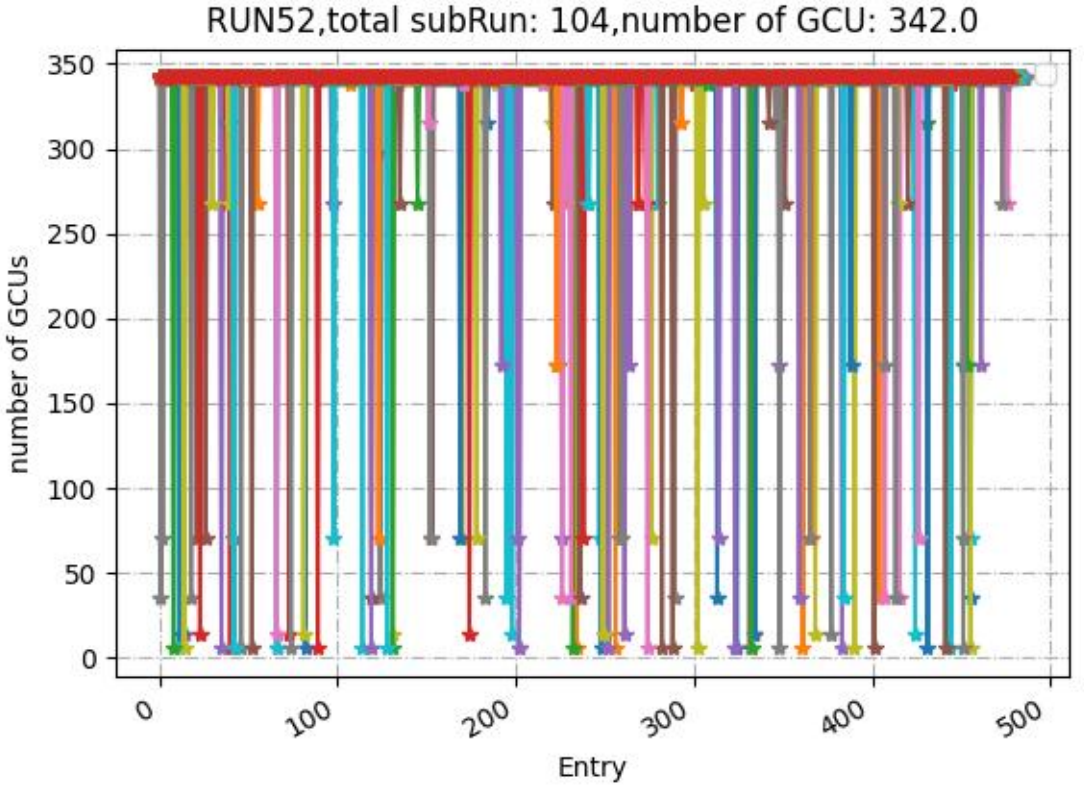
Run No	Start time	End time	Number of GCUs	GCU trigger mode	BEC trigger mode	CTU trigger mode	RTRaw files		
52	20230905-011227	20230905-012033	342	0x0000	N/A	nHit	CD batch 1		





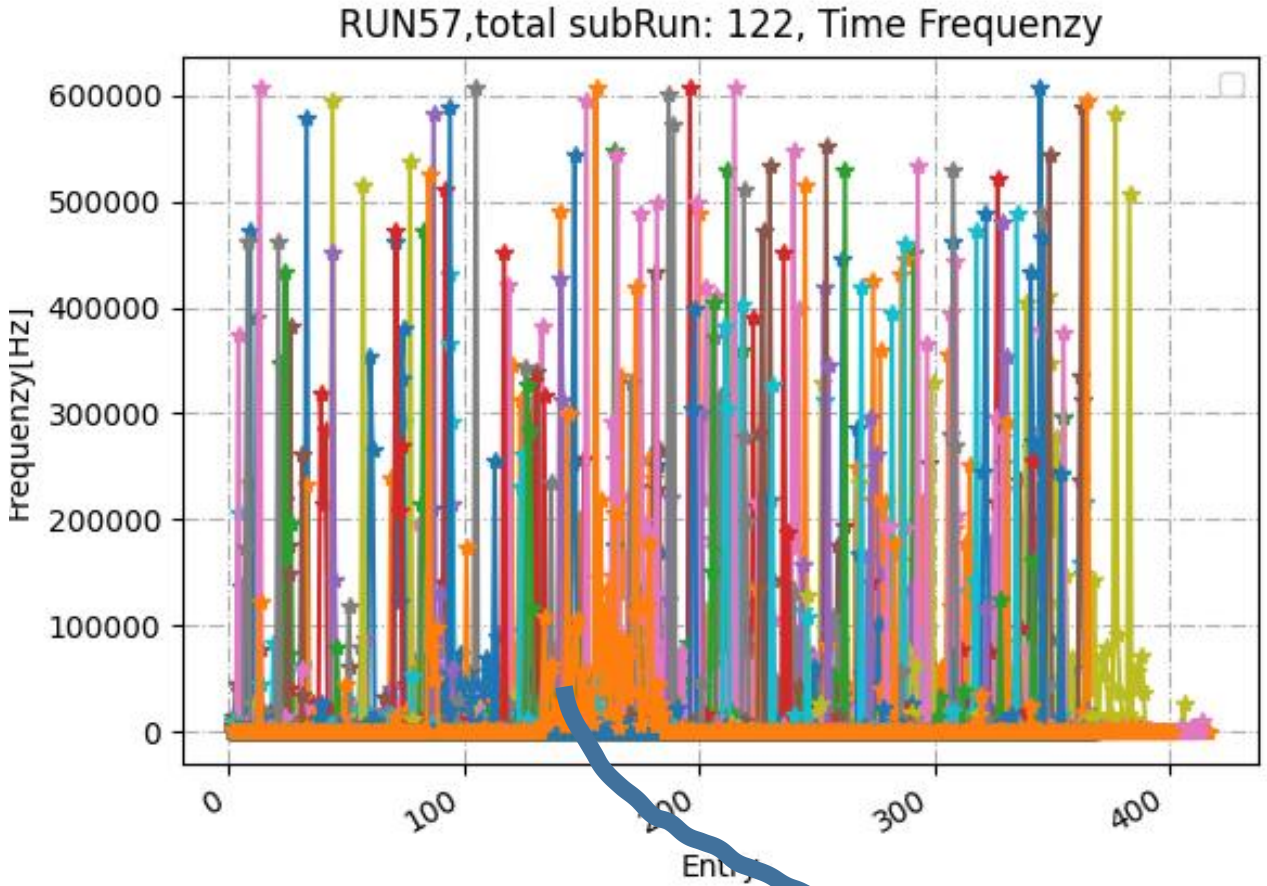
Run No	Start time	End time	Number of GCUs	GCU trigger mode	BEC trigger mode	CTU trigger mode	RTRaw files		
53	20230905-012318	20230905-013314	342	0x0000	N/A	external/nhit	CD batch 1	LED on	changed from external to nhit at about 01:27

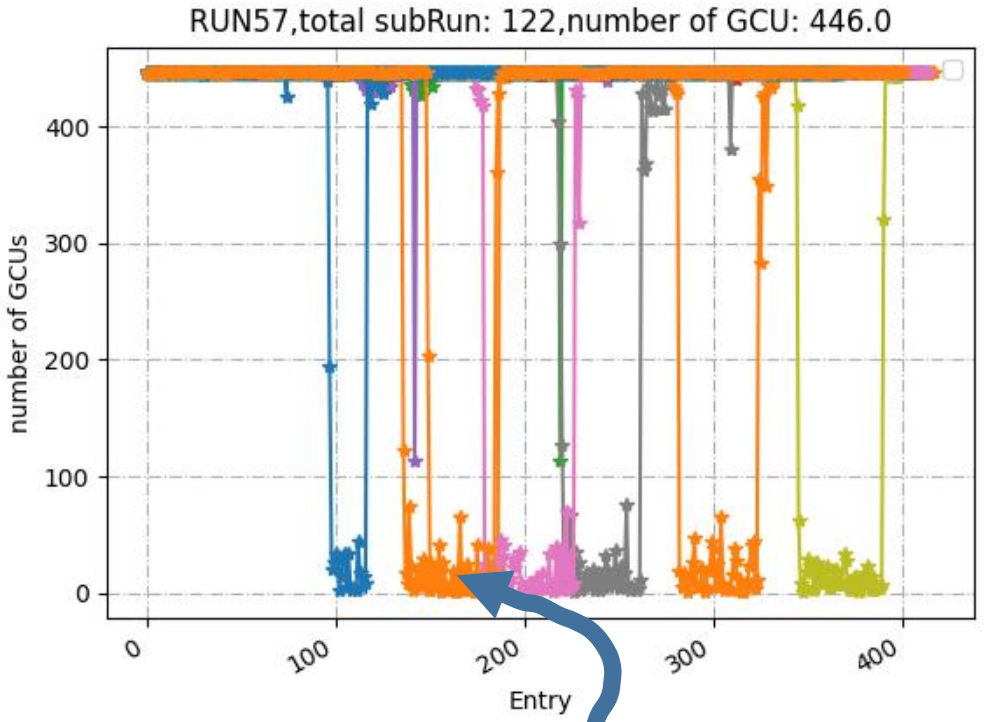


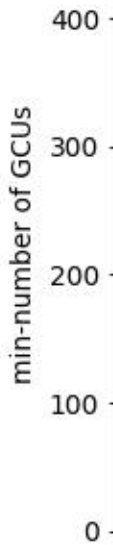


So many lost because frequency? why frequency is so high?
let's check ith sub run

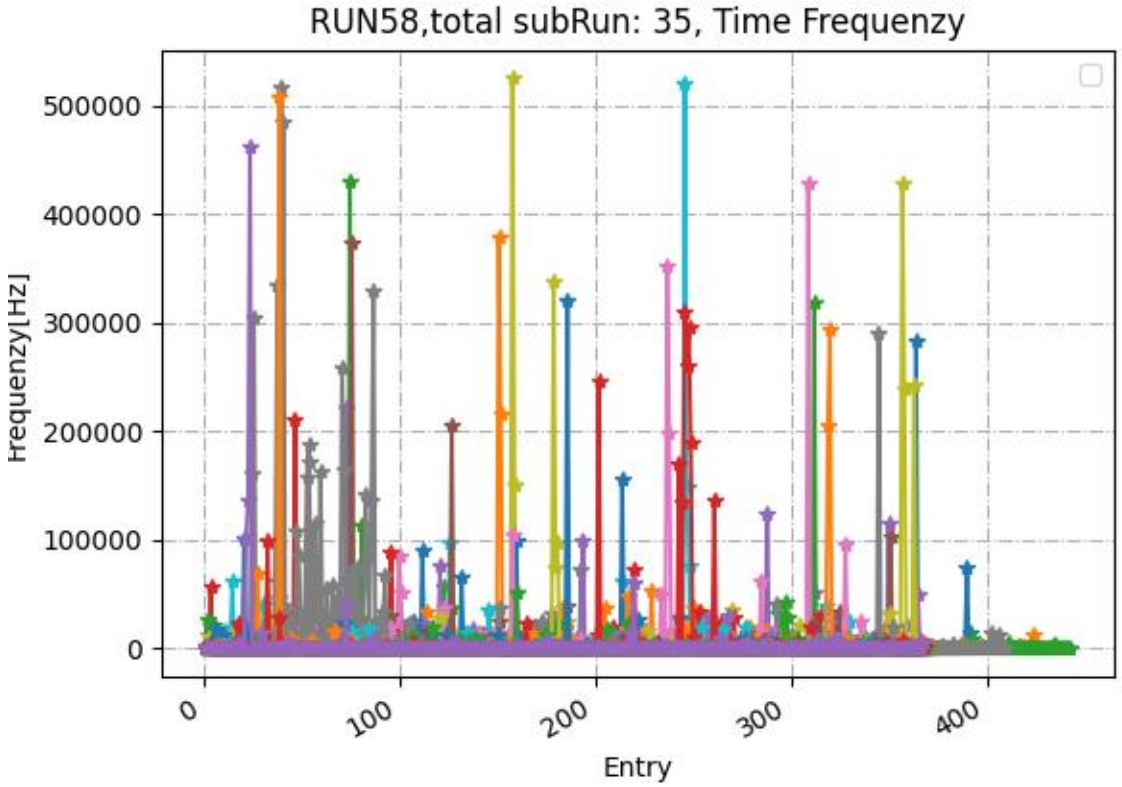
Run No	Start time	End time	Number of GCUs	GCU trigger mode	BEC trigger mode	CTU trigger mode	RTRaw files		
57	20230905-023206	20230905-023808	446	0x0000	N/A	nHit	CD batch 2		

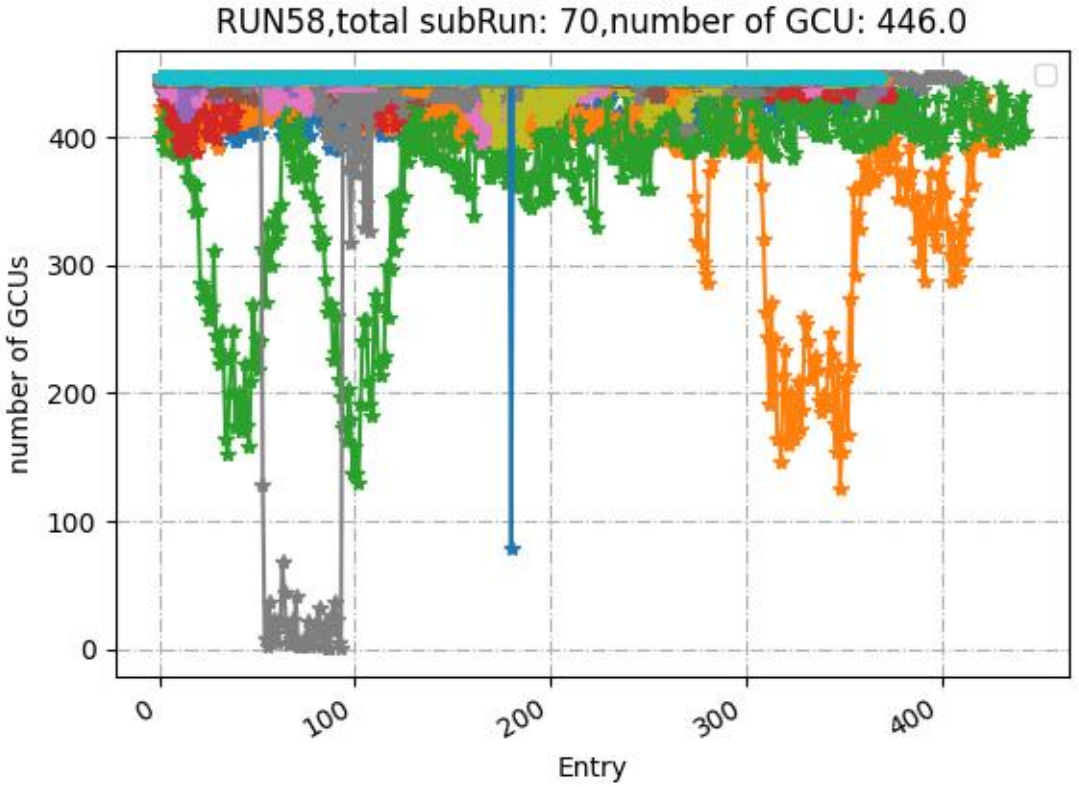


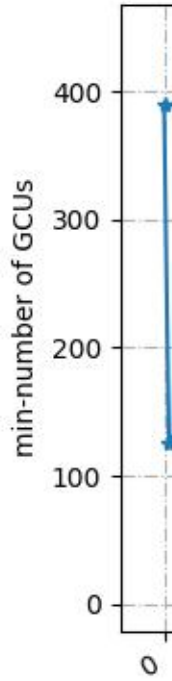




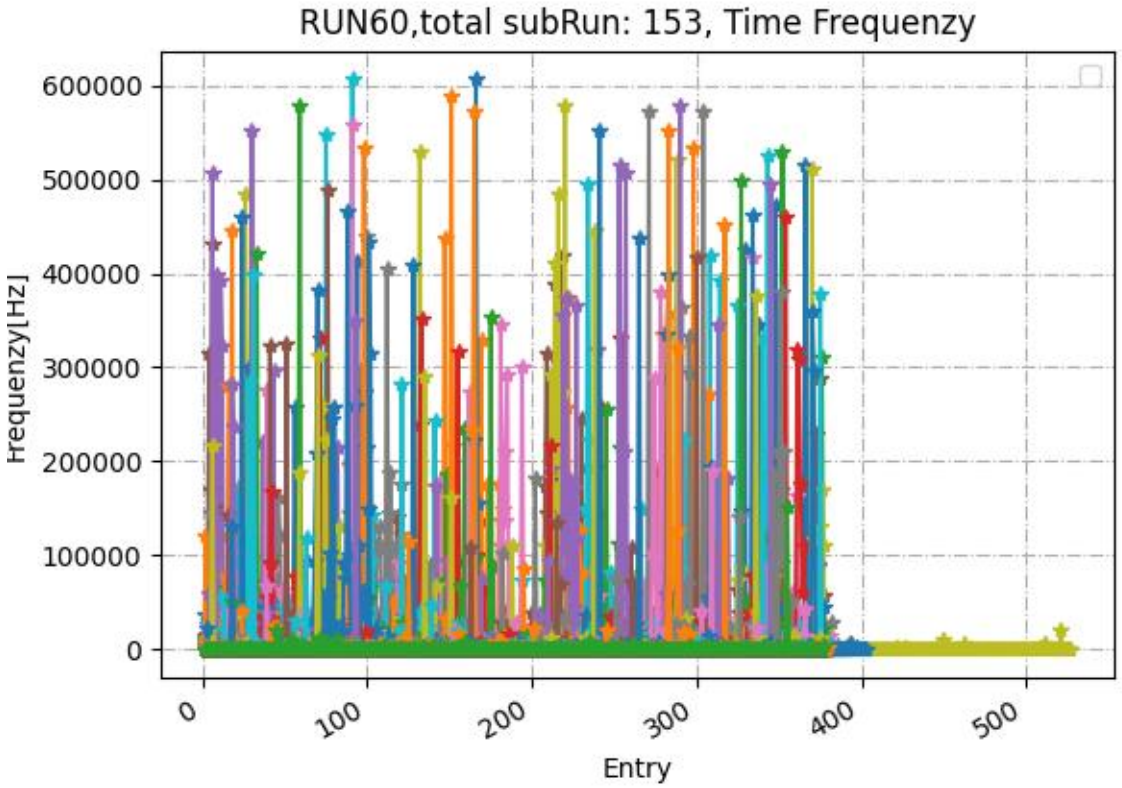
Run No	Start time	End time	Number of GCUs	GCU trigger mode	BEC trigger mode	CTU trigger mode	RTRaw files		
58	20230905-024121	20230905-024826	446	0x0000	N/A	nHit	CD batch 2	LED on	

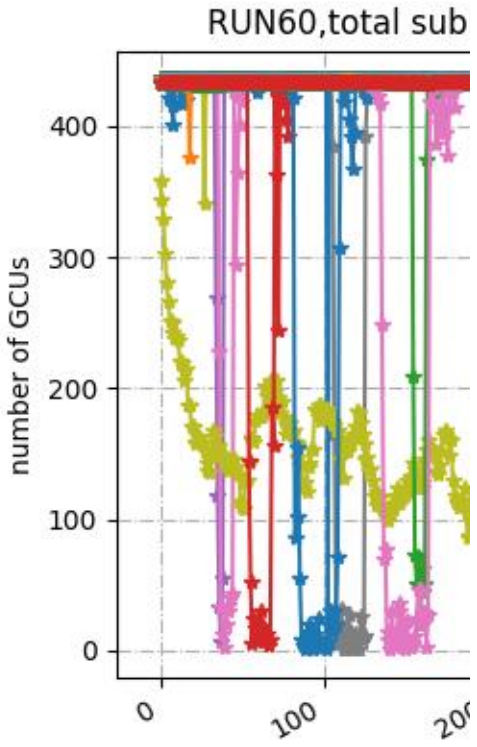


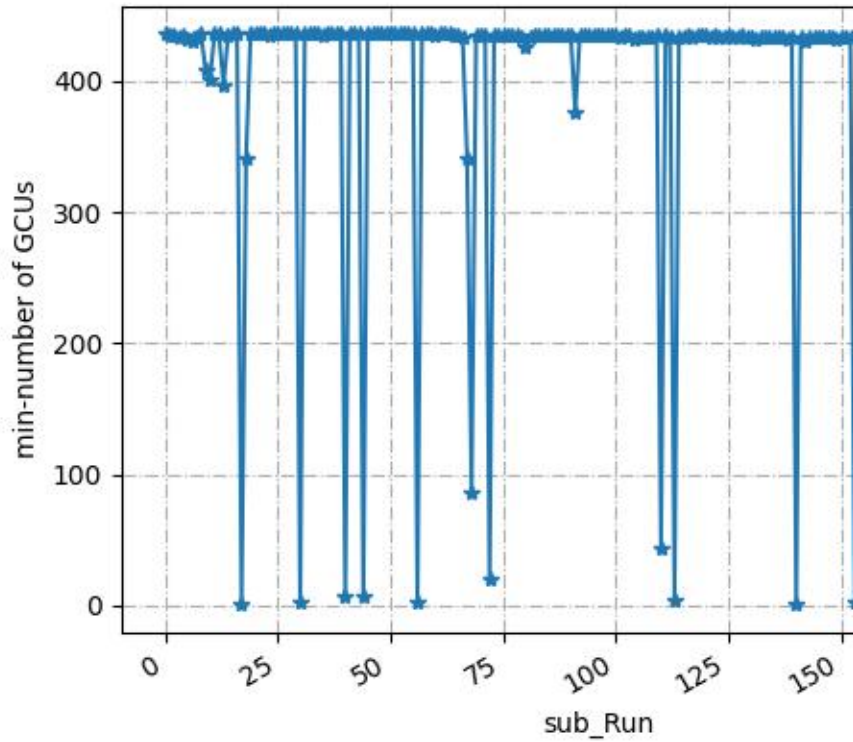




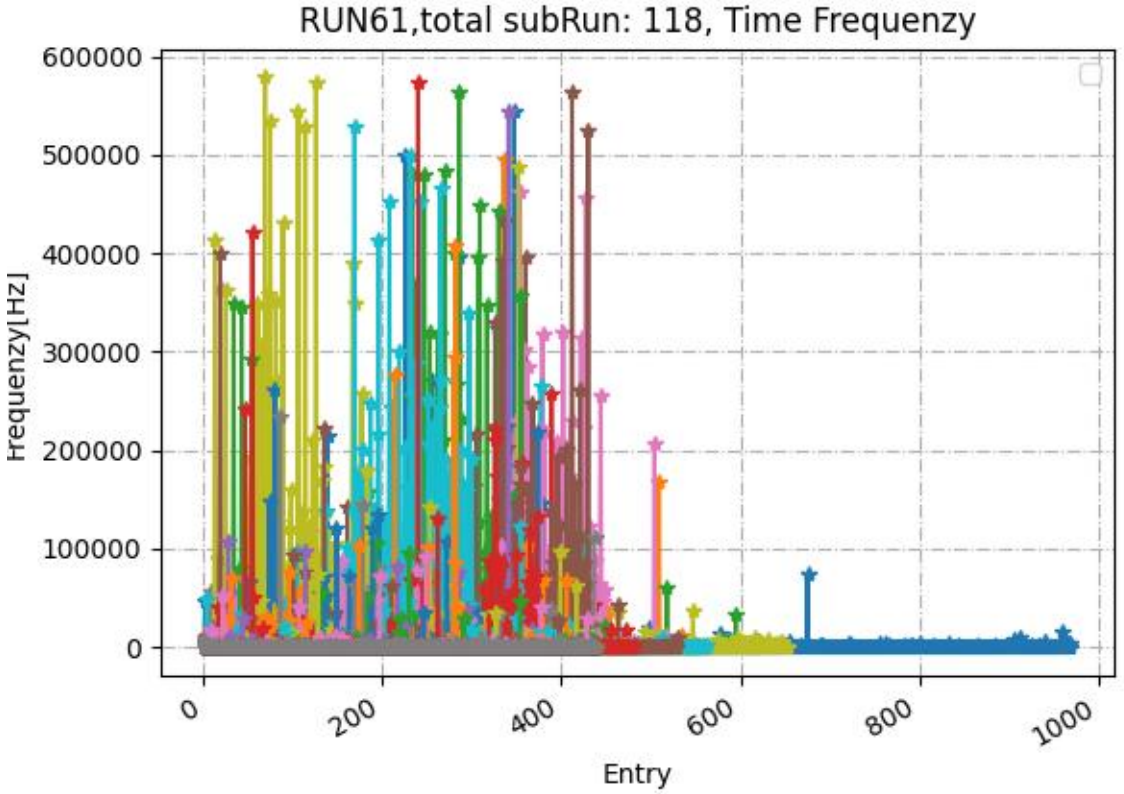
Run No	Start time	End time	Number of GCUs	GCU trigger mode	BEC trigger mode	CTU trigger mode	RTRaw files		
60	20230905-035036	20230905-040002	449	0x0000	N/A	nHit	CD batch 3	LED was turned on at 03:54:54	

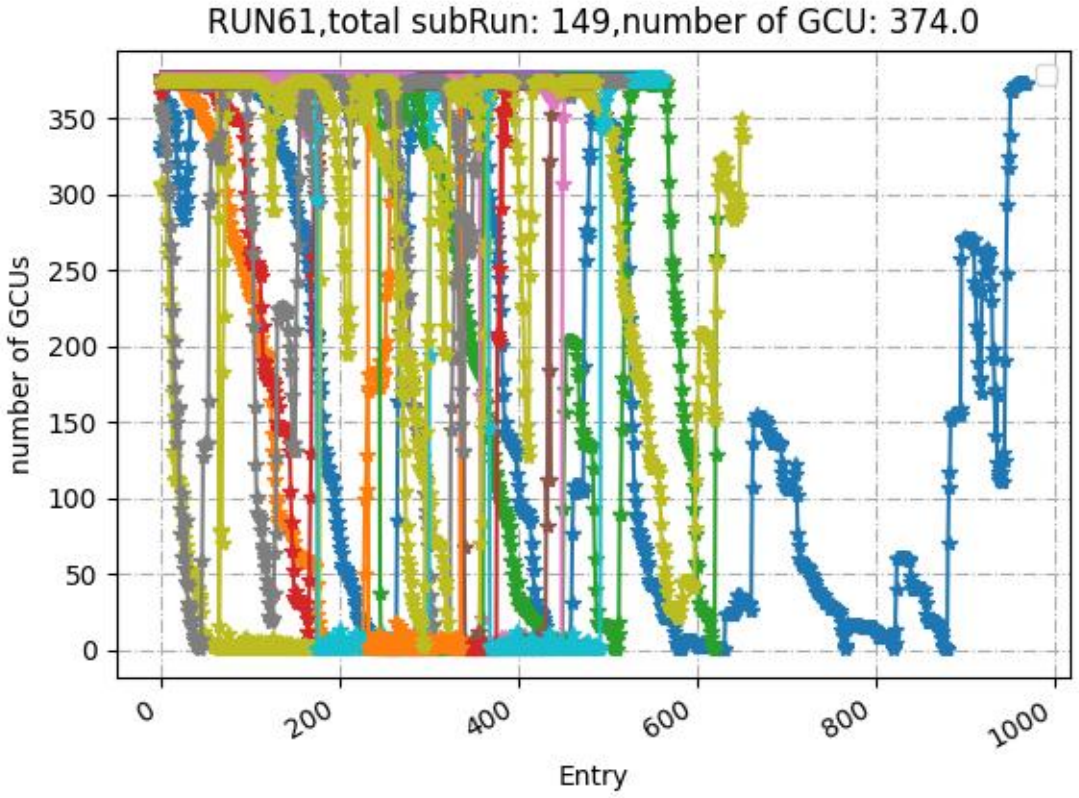






Run No	Start time	End time	Number of GCUs	GCU trigger mode	BEC trigger mode	CTU trigger mode	RTRaw files		
61	20230905-045216	20230905-051052	376	0x0000	N/A	nHit	CD batch 4	LED was turned on at 04:59:46	



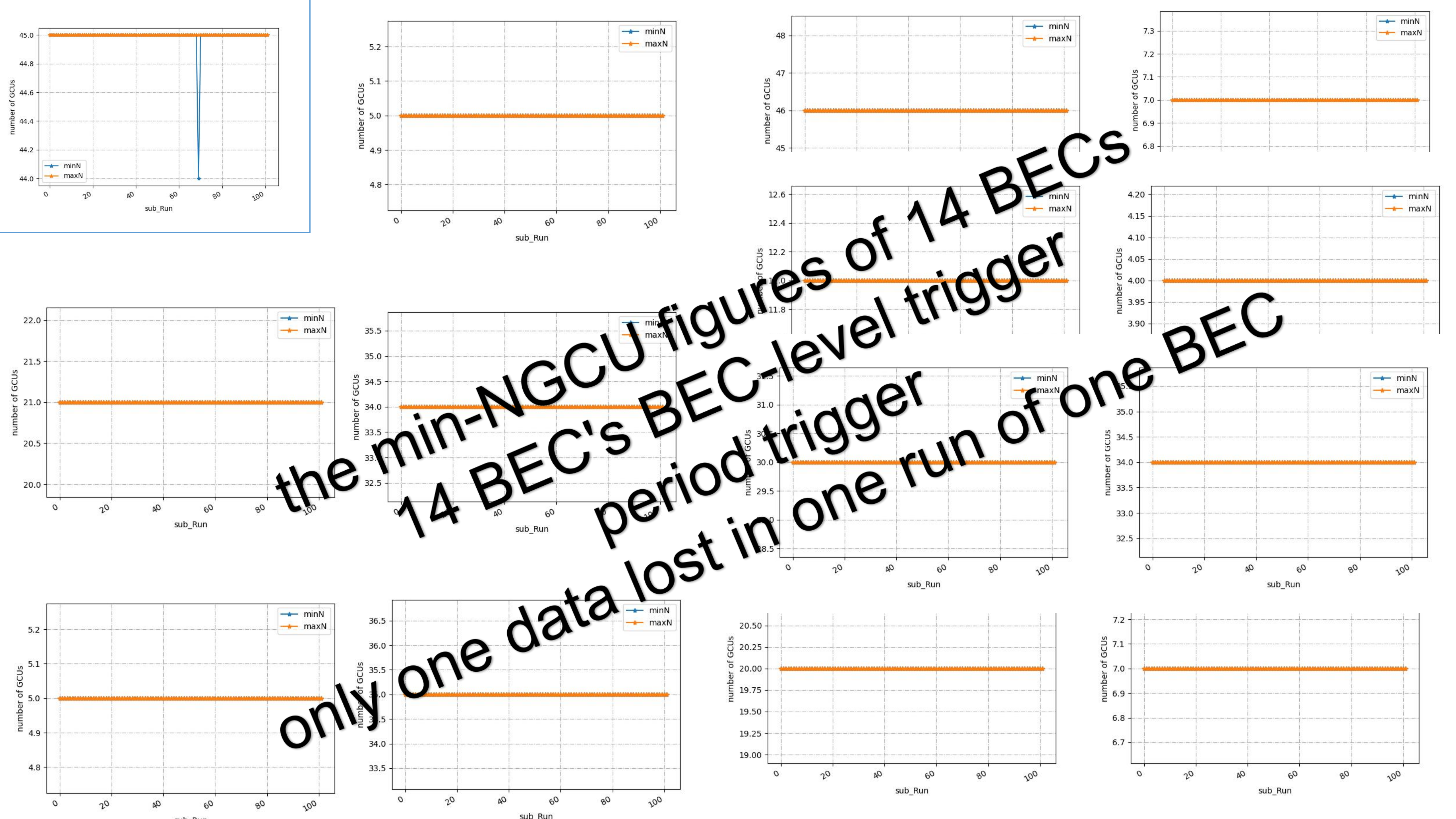


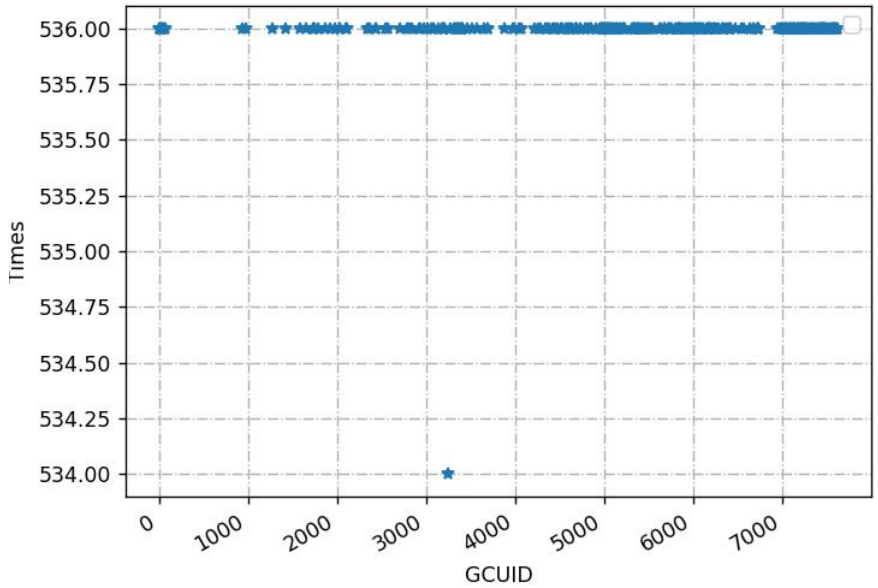
the min-NGCU figures of 14 BECs

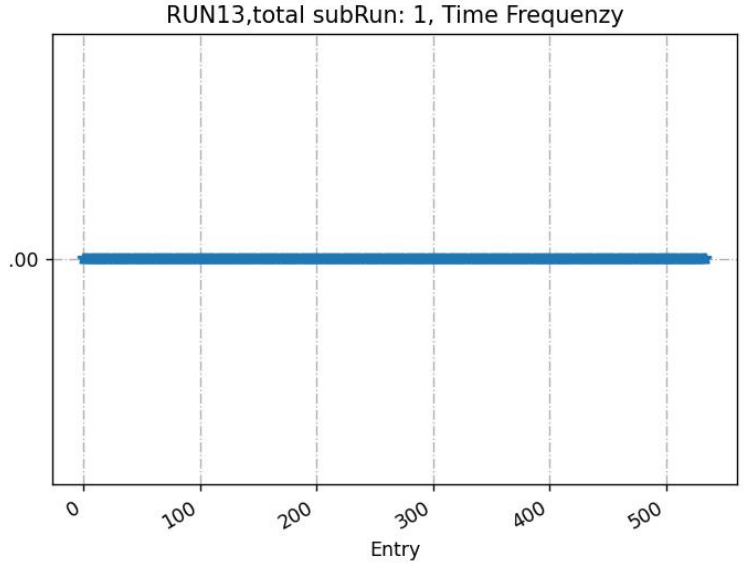
14 BEC's BEC-level trigger

period trigger

only one data lost in one run of one BEC







相邻的triggerN差值都是1，BEC-GCU之间trg丢了