Hall D Beam Test Daily Meeting

2026/4/10

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Contents

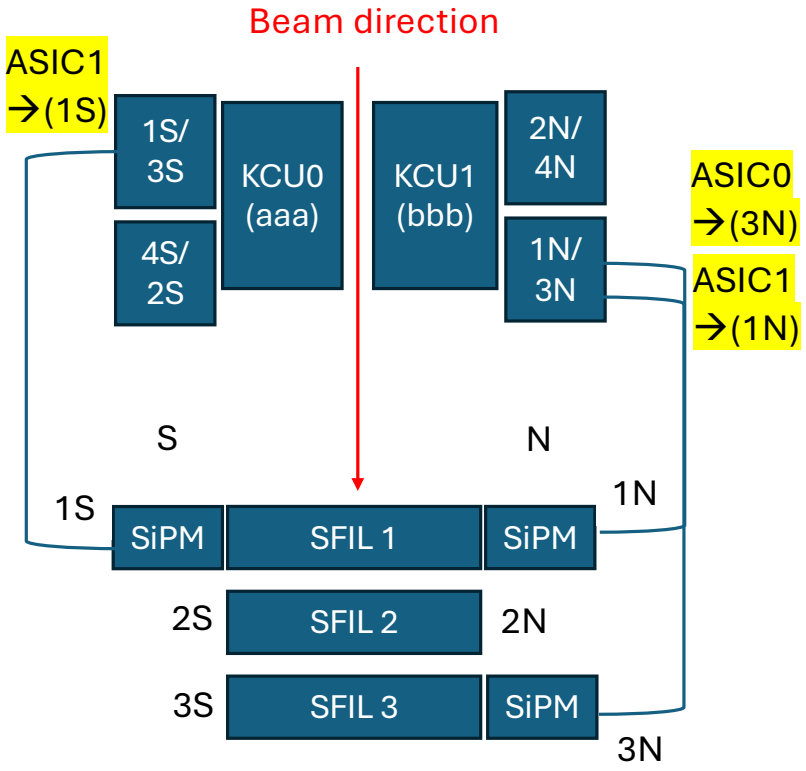
- Current Setup (Latest update)
- To match TimeStamp between AstroPix and H2GCROC
  - Check FPGA TS as a function of events using Run 323.
  - Select clear MIP signals in H2GCROC; then AstroPix track among two layers (on-going)

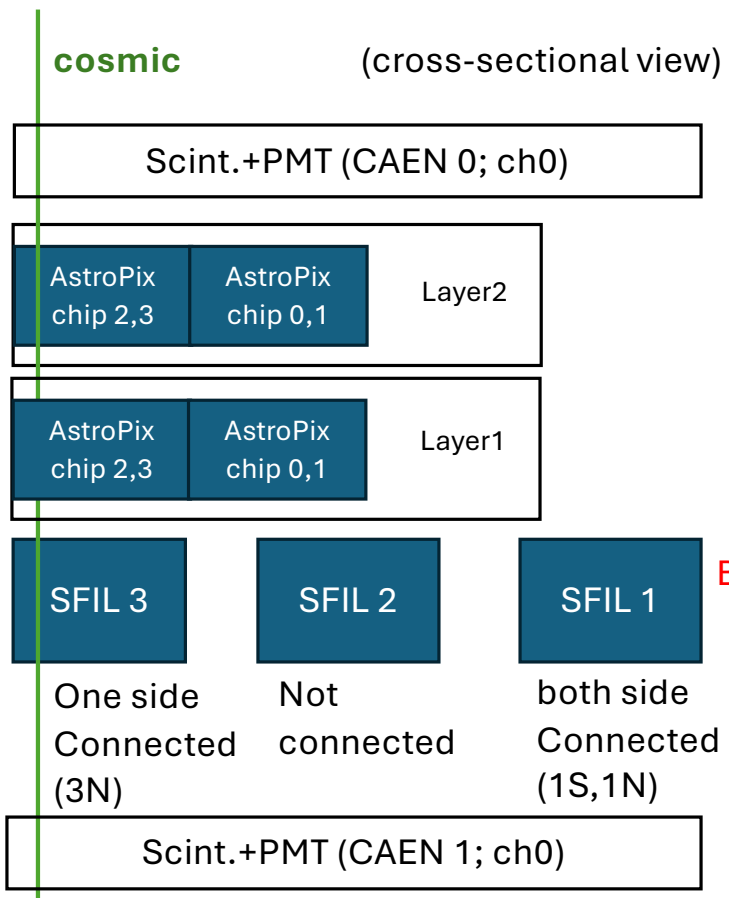
- AstroPix: Good Run 308, 309, 318, 319, 321, 322
  - Some runs may be missing set.py.
- Elog didn’t update after run315.
- (Known Issue)
  - Observed 0 SiPM HV current from Friday(4/3) 2PM to Monday (4/6) 5 PM.
    - H2GCROC data taken during this period are not meaningful (including Run 289)

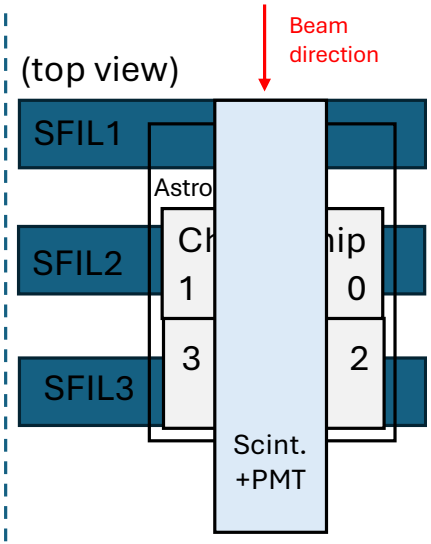
Current Setup (1)

KCU0
ASIC1→1S
(ch72-143)

KCU1
ASIC0→ 3N (ch0-71)
ASIC1→ 1N (ch72-143)







Beam direction

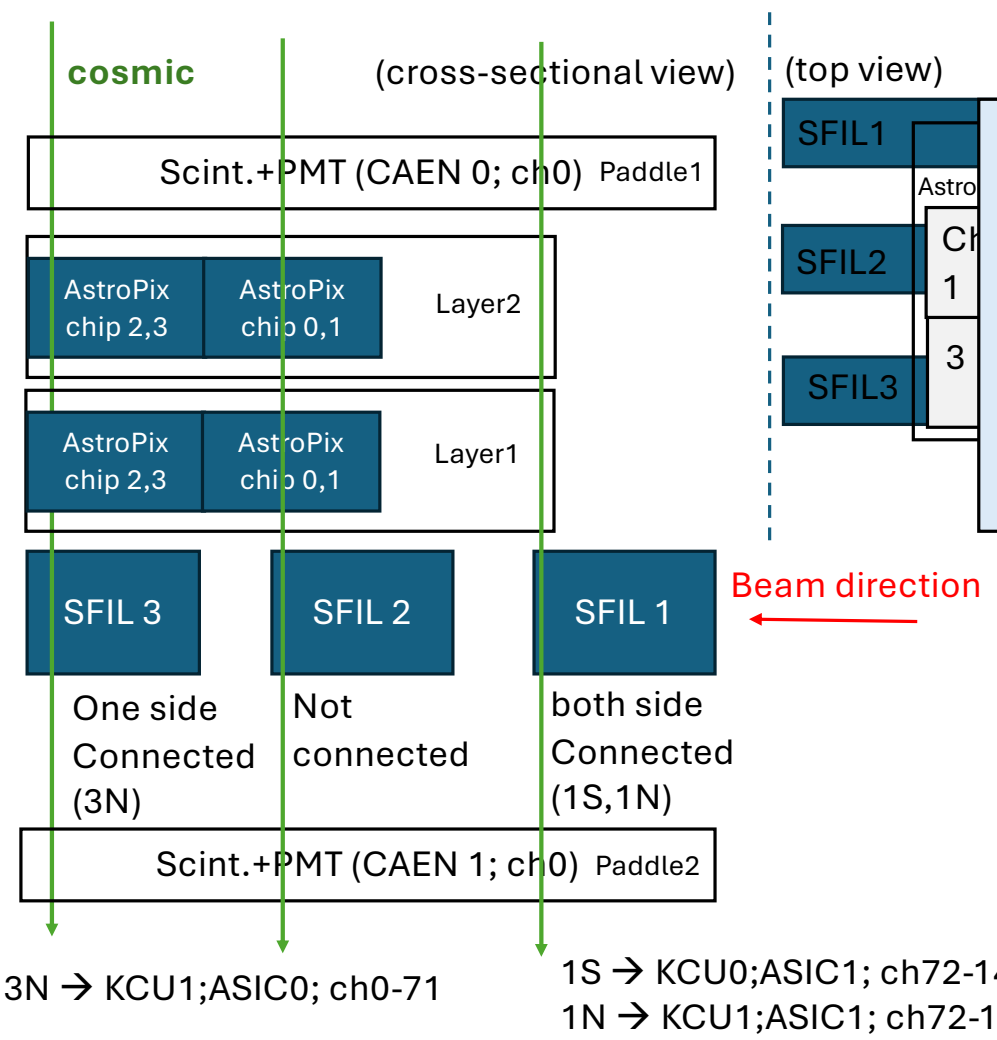
SiPM HV = 40.7 V
AstroPix HV= -150 V

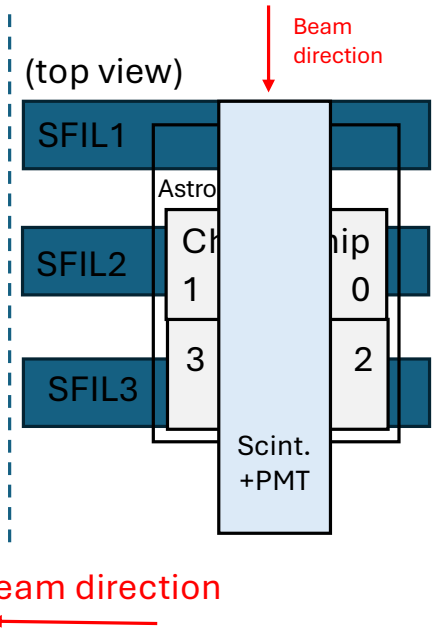
3N → KCU1;ASIC0; ch0-71

1S → KCU0;ASIC1; ch72-143
1N → KCU1;ASIC1; ch72-143

* Readout of individual channels in a 16-channel SiPM array

Current Setup (2)





Three types of cosmic events:

- All three systems
  - Paddle 1 (CAEN0,ch0)
    + two layers of AstroPix (only for chip2, 3)
    + SFIL3 (3N; KCU1,ASIC0; ch0-71)
    + Paddle2 (CAEN1,ch0)
- Except SFIL
  - Paddle 1 (CAEN0,ch0)
    + two layers of AstroPix (only for chip0,1)
    + Paddle2 (CAEN1,ch0)
- Except AstroPix
  - Paddle 1 (CAEN0,ch0)
    +SFIL 1(1S, 1N; KCU0+KCU1 ASIC1; ch72-143)
    + Paddle2 (CAEN1,ch0)

To match TimeStamp between AstroPix and H2GCROC

Event#=

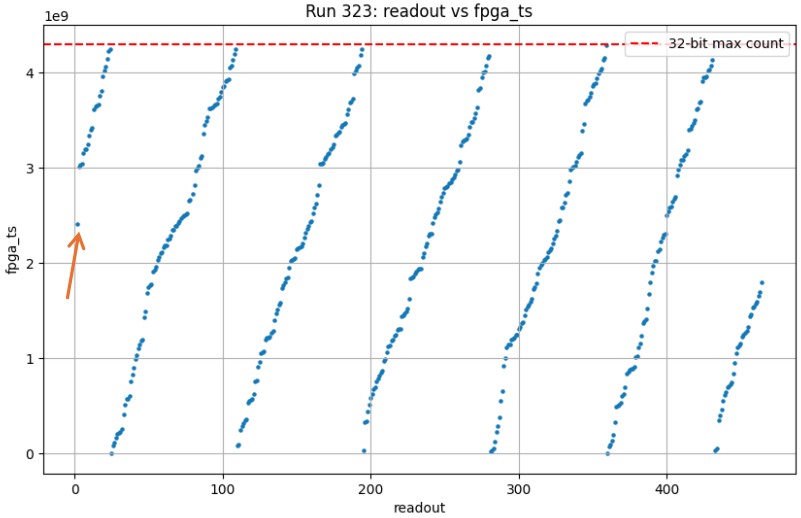
readout		layer	chipID	payload	location		isCol	timestamp	tot_us	fpga_ts
2	0	1	2	4	18	0	106	192	263196363	
2	1	1	2	4	15	1	106	170	263196803	
2	2	1	2	4	18	0	189	178	324293641	
2	3	1	2	4	15	1	189	155	324294081	
2	4	1	1	4	23	0	231	447	340927599	
2	5	1	1	4	13	1	231	428	340928039	
2	6	1	2	4	18	0	213	116	343846999	
2	7	1	2	4	15	1	213	95	343847439	
2	8	1	3	4	11	0	176	65	432942170	
2	9	1	3	4	13	1	176	41	432942610	

- AstroPix
  - AstroPix TimeStamp: 2.5 MHz (400 ns), 8-bit counter; 102 us rollover
  - FPGA TimeStamp: 40 MHz (25 ns), 32-bit counter; 107.37 s rollover
- H2GCROC
  - FPGA TimeStamp: 160 MHz (6.25 ns),64-bit counter;
    → 160 MHz (6.25 ns), 32-bit counter ?

1. Check FPGS TS as a function of events
2. Select clear cosmic signals in H2GCROC; then AstroPix track among two layers (ongoing)

Run 323; KCU1

AstroPix:
40 MHz (25 ns), 32-bit counter;
107.37 s rollover

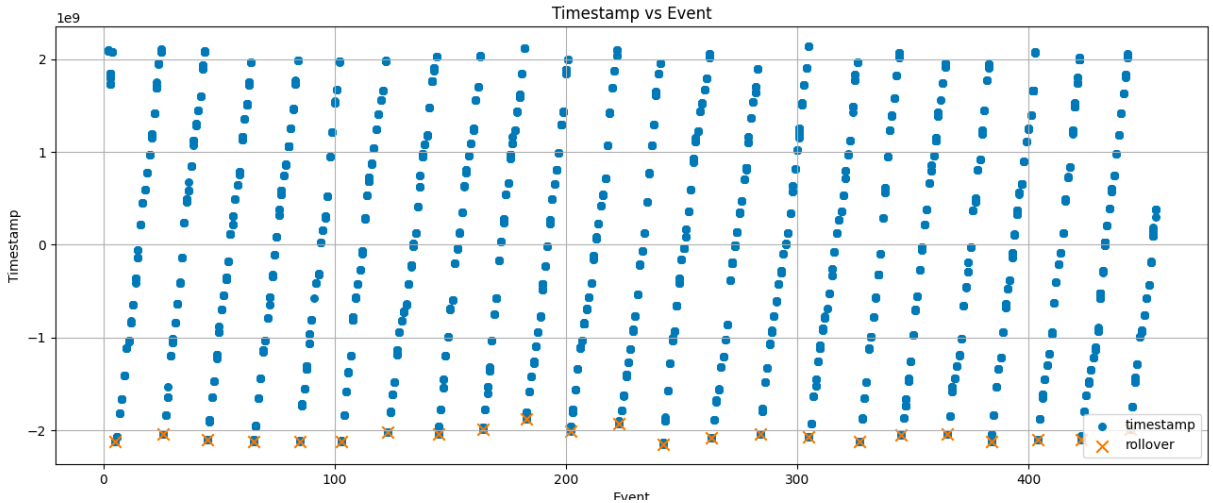



```
40 MHz clock; 32 bit counter
first_valid_idx : 0
first_ts        : 2407424691
last_ts         : 1800204482
rollover_count  : 6
duration_ticks  : 25162583567
duration_sec    : 629.064589
```

4 times lager clock;
4 times lager rollover

H2GCROC:
160 MHz (6.25 ns), 32-bit counter;
26.84 s rollover

Decoder issue? Or bit setup issue?



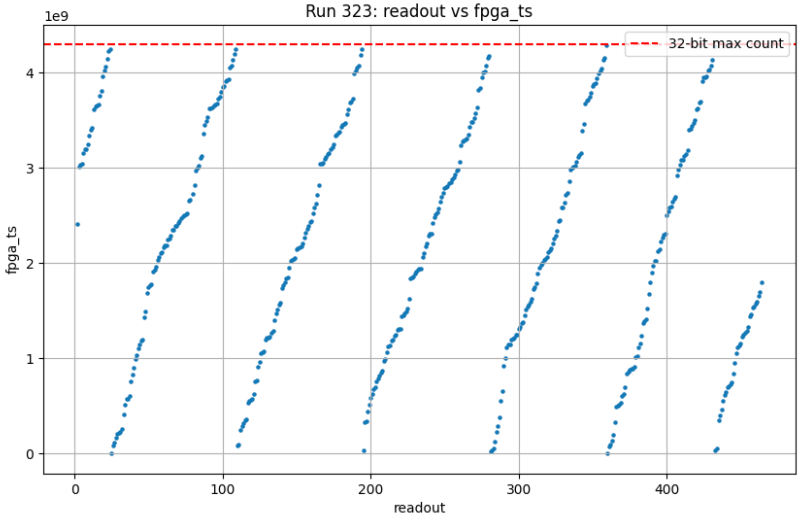
160 MHz; 32-bit counter ?

```
first_ts        : 2085068419
last_ts         : 379622435
rollover_count  : 23
duration_ticks  : 97078801824
duration_sec    : 606.742511
```

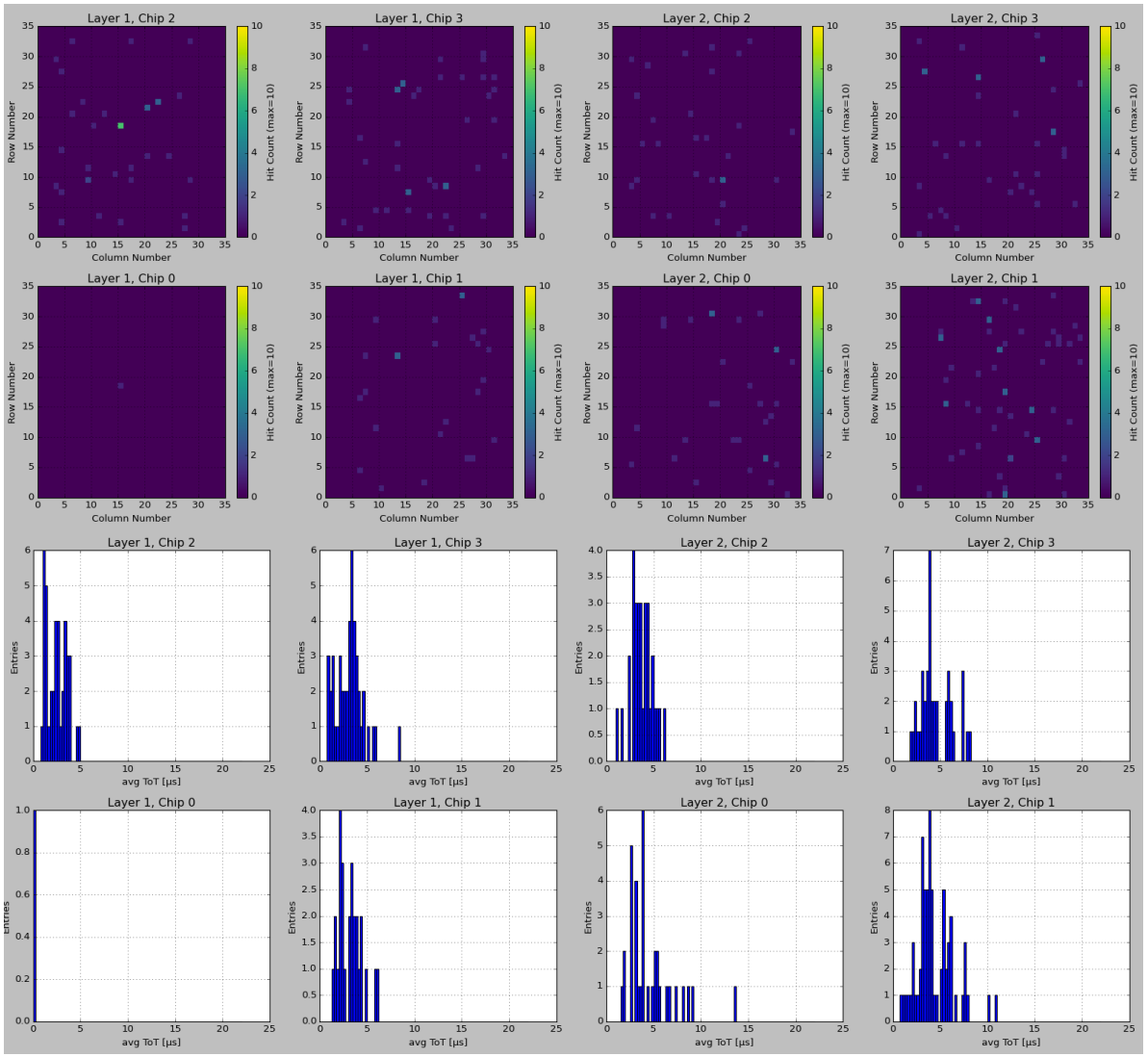
Run 323;

AstroPix;
total 286 hits/10 mins
Including noisy pixel

```
***** Matching hit: 286 *****
     layer  chipID  col  row  hits
0        1       2   15   18     7
1        1       3   15    7     3
2        2       0   28    6     3
3        2       1   25    9     3
4        2       1   24   14     3
..     ...     ...  ...  ...   ...
223      1       3   29   30     1
224      1       3   30   23     1
225      1       3   31   19     1
226      1       3   31   24     1
227      2       3   33   25     1
```



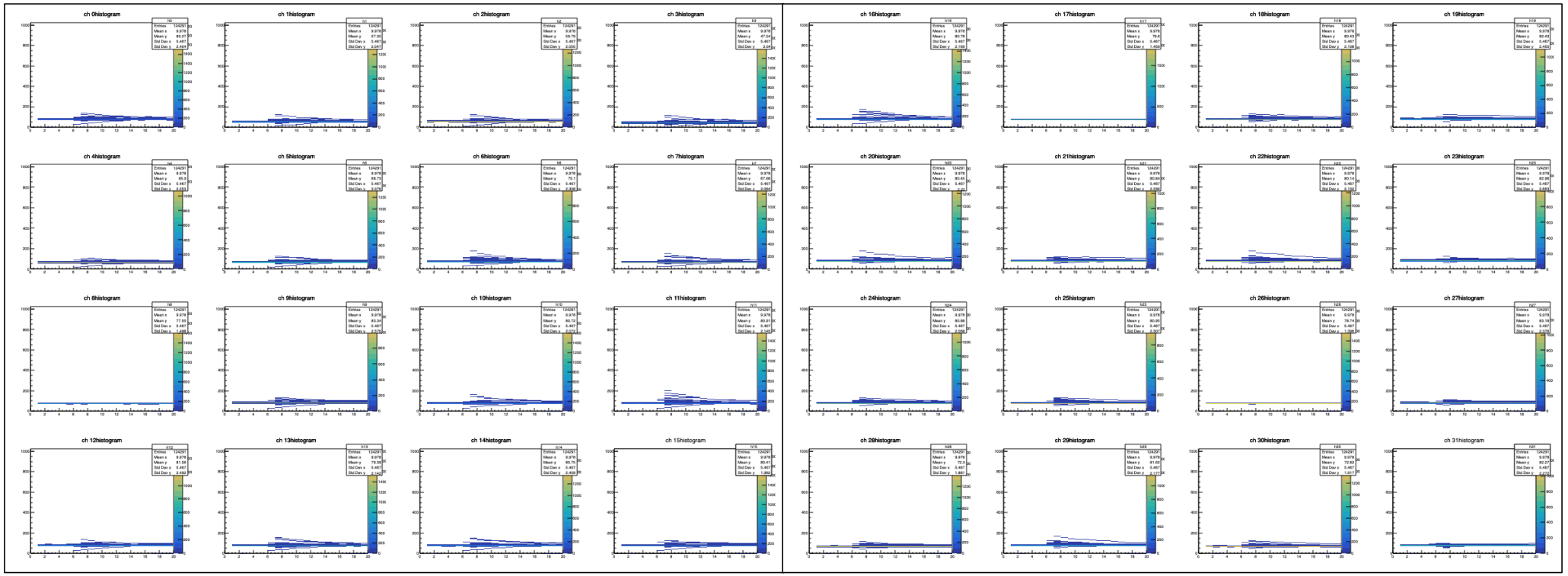

```
40 MHz clock; 32 bit counter
first_valid_idx : 0
first_ts        : 2407424691
last_ts         : 1800204482
rollover_count  : 6
duration_ticks  : 25162583567
duration_sec    : 629.064589
```



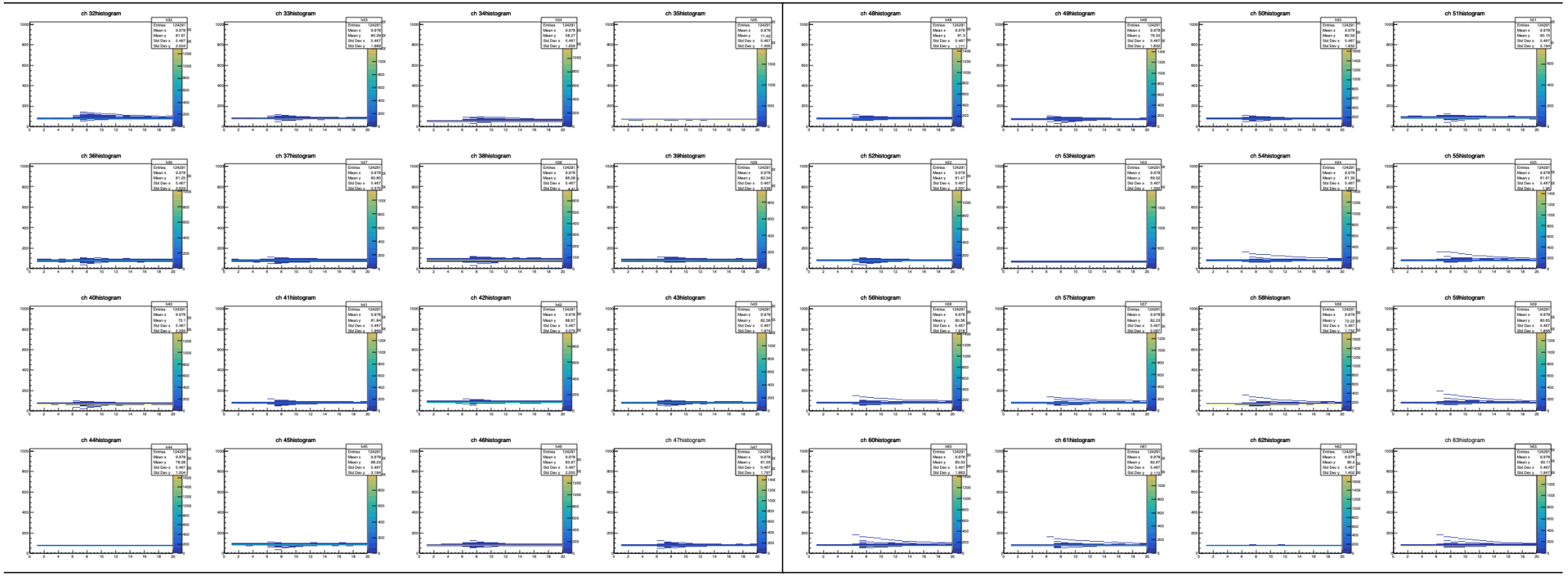
Run323; KCU1 (1) ch0-15;ch16-31;

AstroPix;
total 286 hits/10 mins
Including noisy pixel

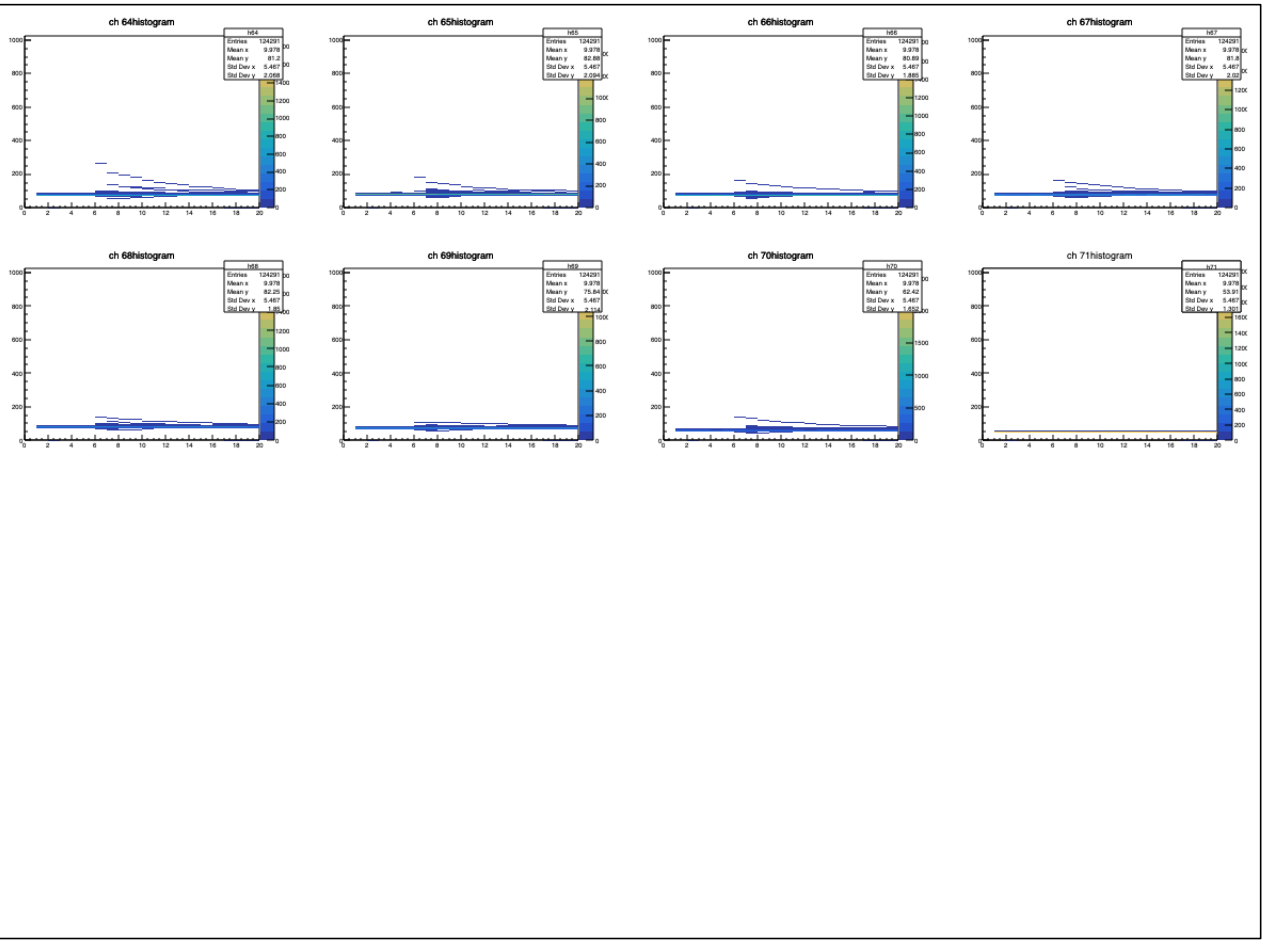
SFIL;
3~4 MIP signals / 10 mins



Run323; KCU1 (2) ch32-47;ch48-63;



Run323; KCU1 (3) ch64-71



Summary; Cosmic test

- Expected cosmic ray rate is 1/(cm^2 min)
  - AstroPix area = 4cm X 4 cm and 50% efficiency → The expected hit rate of AstroPix : ~0.13 Hz
- Increase SiPM HV more than 40.7 V to see more clear cosmic signals in H2GCROC
  - Default preamp parameter or optimized preamp parameter?
  - Check SNR with respect to HV or preamp parameters using cosmic test; if we have enough statistics

- To determine the dynamic range for individual channel readout,
  - Geant4 simulation using cosmic, then compare deposited energy with the simulation result using beam test energy → relative value
  - Consider only for ADC or TOT as well?

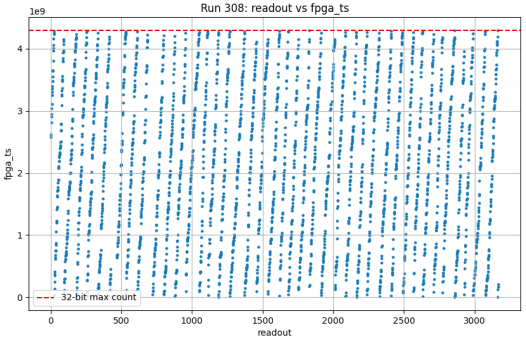
- Summing boards?

Backup; AstroPix Good Run

Run	Duration	Total hits	Total hits/time
308	4,235 s	1,625	0.38
309	3,801 s	1,440	0.38
318	1,577 s	760	0.48
319	24,342 s	9,035	0.37
321	1,801 s	695	0.39
322	1,178 s	484	0.41
323	629 s	286	0.45

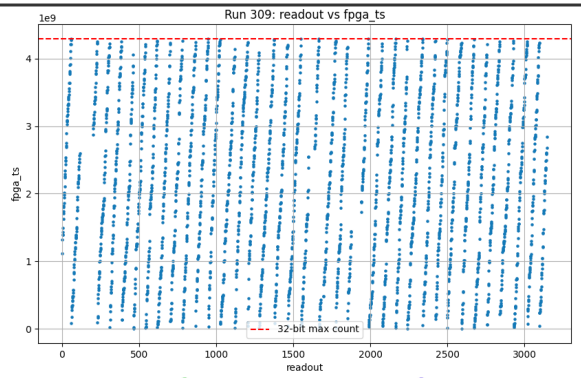
Run 308 and 309; check duration

606	Wed Apr 8 14:28:18 2026	RCDAQ - KCU 0	Run 309 ended	Run 309 ended with 2696 events, size is 695.176 MB duration 3805 s
605	Wed Apr 8 13:24:53 2026	RCDAQ - KCU 0	Run 309 started	Run 309 started with file /scratch/data/KCU0/junk/junk_ROC_0-00000309-0000.evt
604	Wed Apr 8 13:24:35 2026	RCDAQ - KCU 0	Run 308 ended	Run 308 ended with 3000 events, size is 774.024 MB duration 4243 s
603	Wed Apr 8 12:13:52 2026	RCDAQ - KCU 0	Run 308 started	Run 308 started with file /scratch/data/KCU0/junk/junk_ROC_0-00000308-0000.evt




```
40 MHz clock; 32 bit counter
first_valid_idx : 0
first_ts        : 2572893201
last_ts         : 202822602
rollover_count  : 40
duration_ticks  : 169428621241
duration_sec    : 4235.715531
```

vs 4243 s



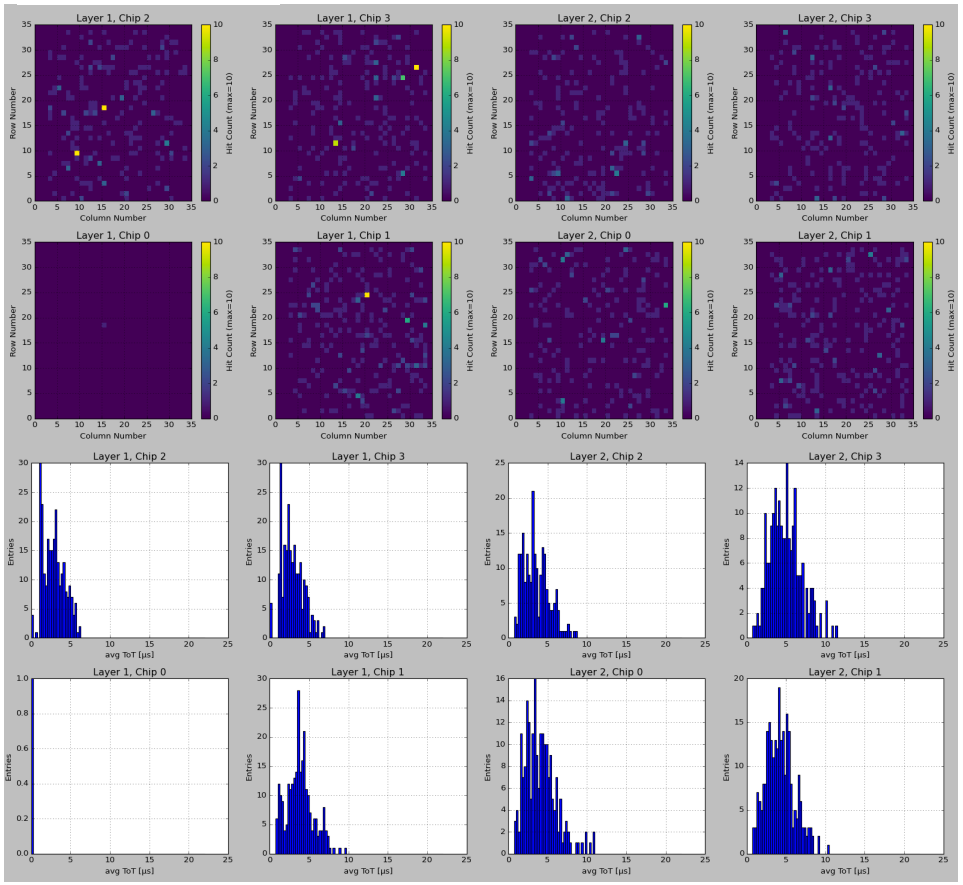

```
40 MHz clock; 32 bit counter
first_valid_idx : 0
first_ts        : 1119796264
last_ts         : 2840574568
rollover_count  : 35
duration_ticks  : 152044633664
duration_sec    : 3801.115842
```

vs 3805 s

Run 308 and 309; check

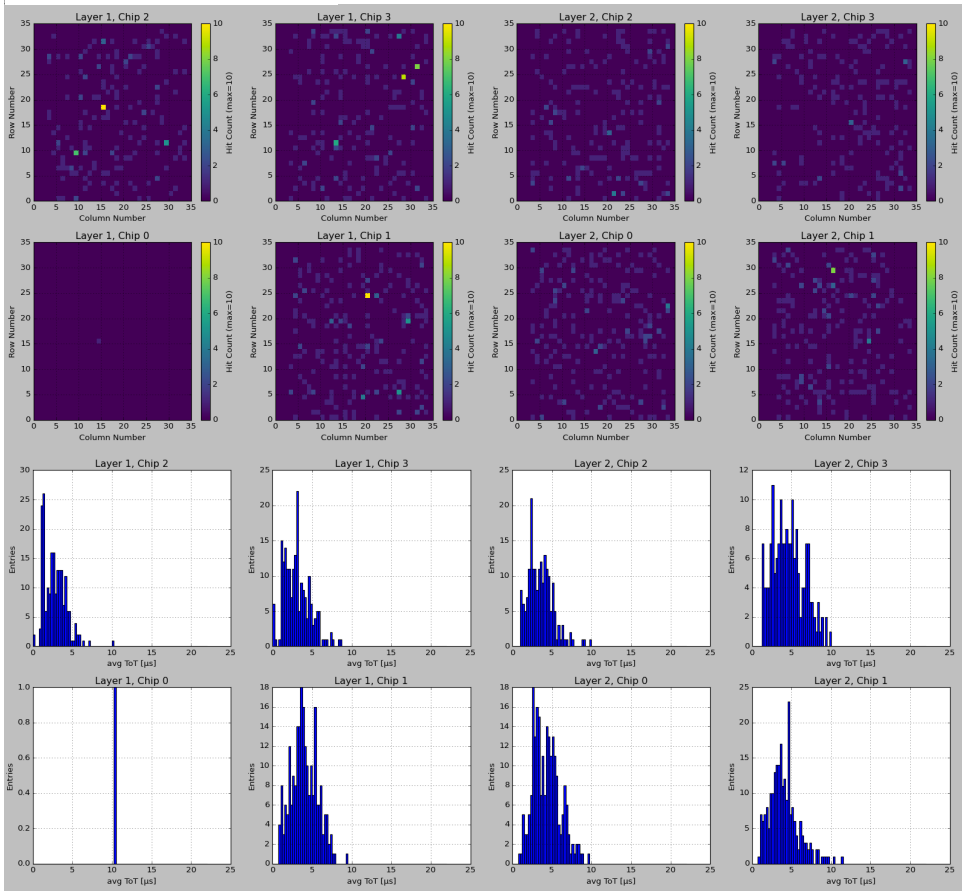
```
3083 of 3083 events were processed...
***** Matching hit: 1625 *****
      layer  chipID  col  row  hits
0         1       2   15   18    37
1         1       3   31   26    16
2         1       2    9    9    12
3         1       1   20   24    10
4         1       3   13   11     9
...     ...     ...  ...  ...   ...
1329      1       3   19   24     1
1330      1       3   19   13     1
1331      1       3   19    4     1
1332      1       3   18   16     1
1333      2       3   33   30     1
```

Run 308



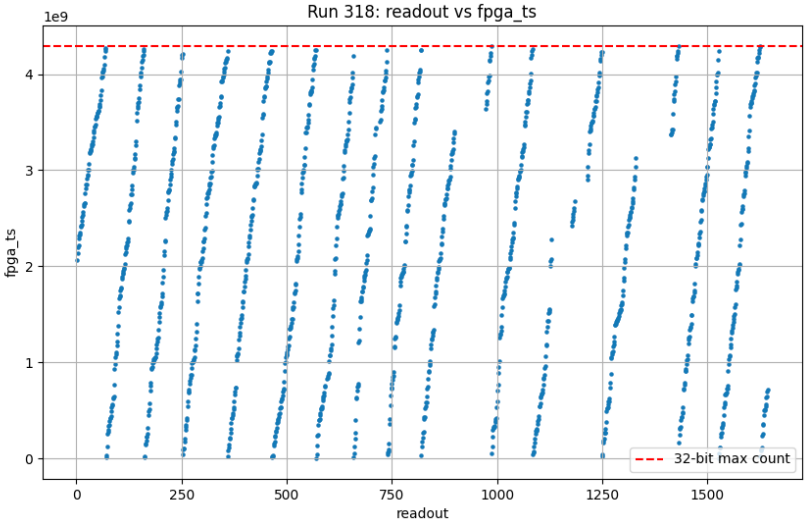

```
Summary:
2937 of 2937 events were processed...
***** Matching hit: 1440 *****
      layer  chipID  col  row  hits
0         1       2   15   18    29
1         1       1   20   24    11
2         1       3   28   24     9
3         2       1   16   29     8
4         1       3   31   26     8
...     ...     ...  ...  ...   ...
1208      1       3   22   32     1
1209      1       3   23    2     1
1210      1       3   23   16     1
1211      1       3   24    7     1
1212      2       3   33   33     1
```

Run 309

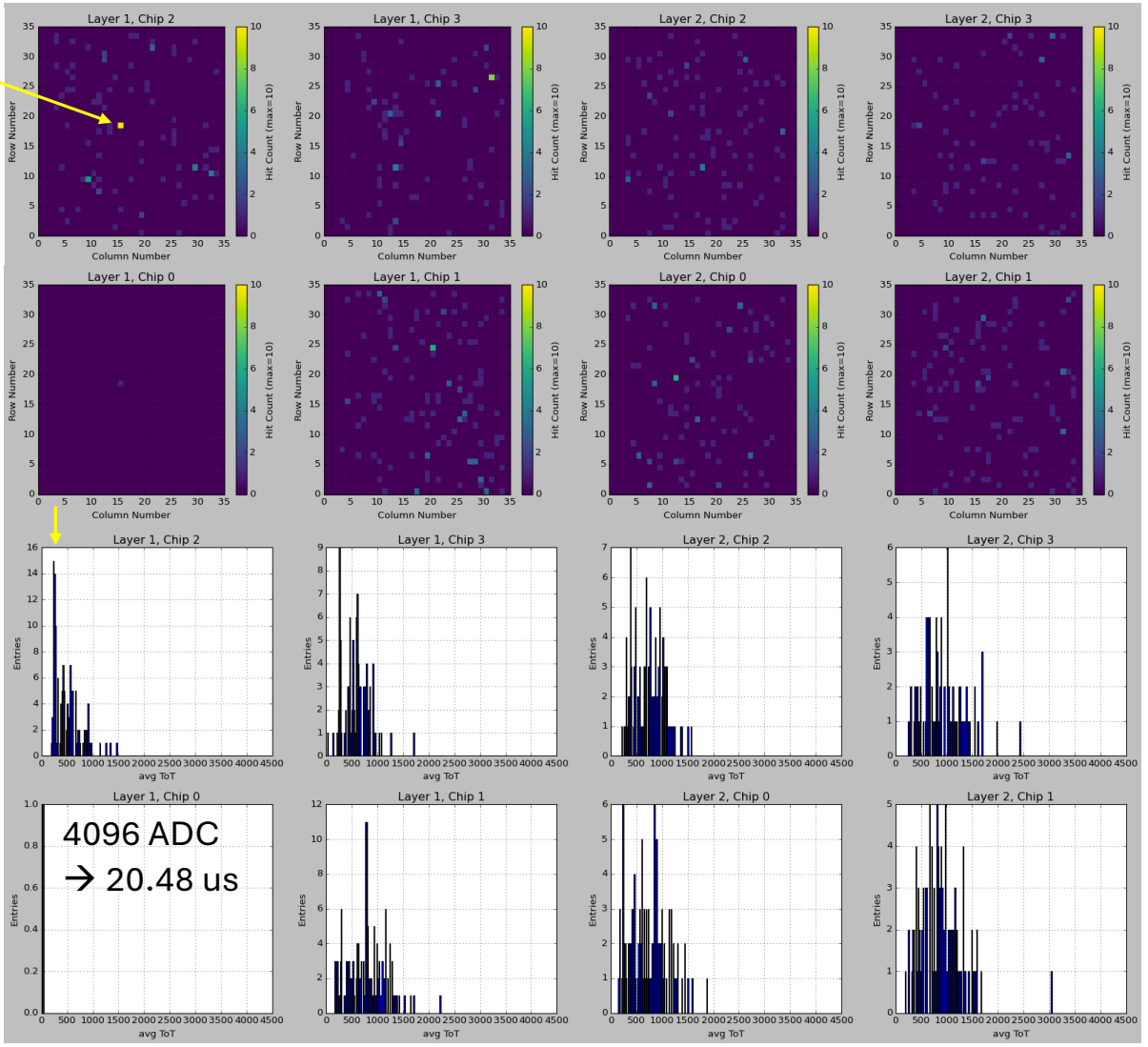


Run 318;

```
1397 of 1397 events were processed...
***** Matching hit: 760 *****
     layer  chipID  col  row  hits
0        1       2   15   18    33
1        1       3   31   26     8
2        1       1   20   24     6
3        2       0   12   19     6
4        1       2    9    9     5
..     ...     ...  ...  ...   ...
599      1       3   11   17     1
600      1       3   11   16     1
601      1       3   10   18     1
602      1       3   10   11     1
603      2       3   33   24     1
```

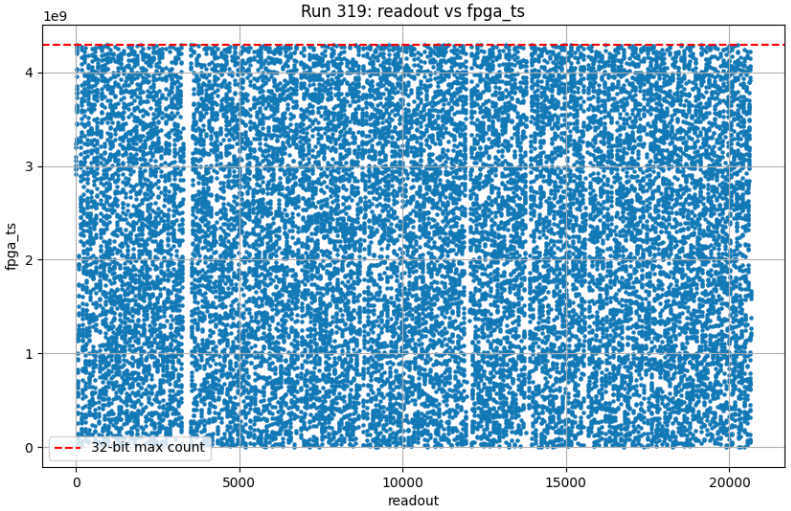



```
40 MHz clock; 32 bit counter
first_valid_idx : 0
first_ts        : 2060534811
last_ts         : 715212355
rollover_count  : 15
duration_ticks  : 63079186984
duration_sec    : 1576.979675
```



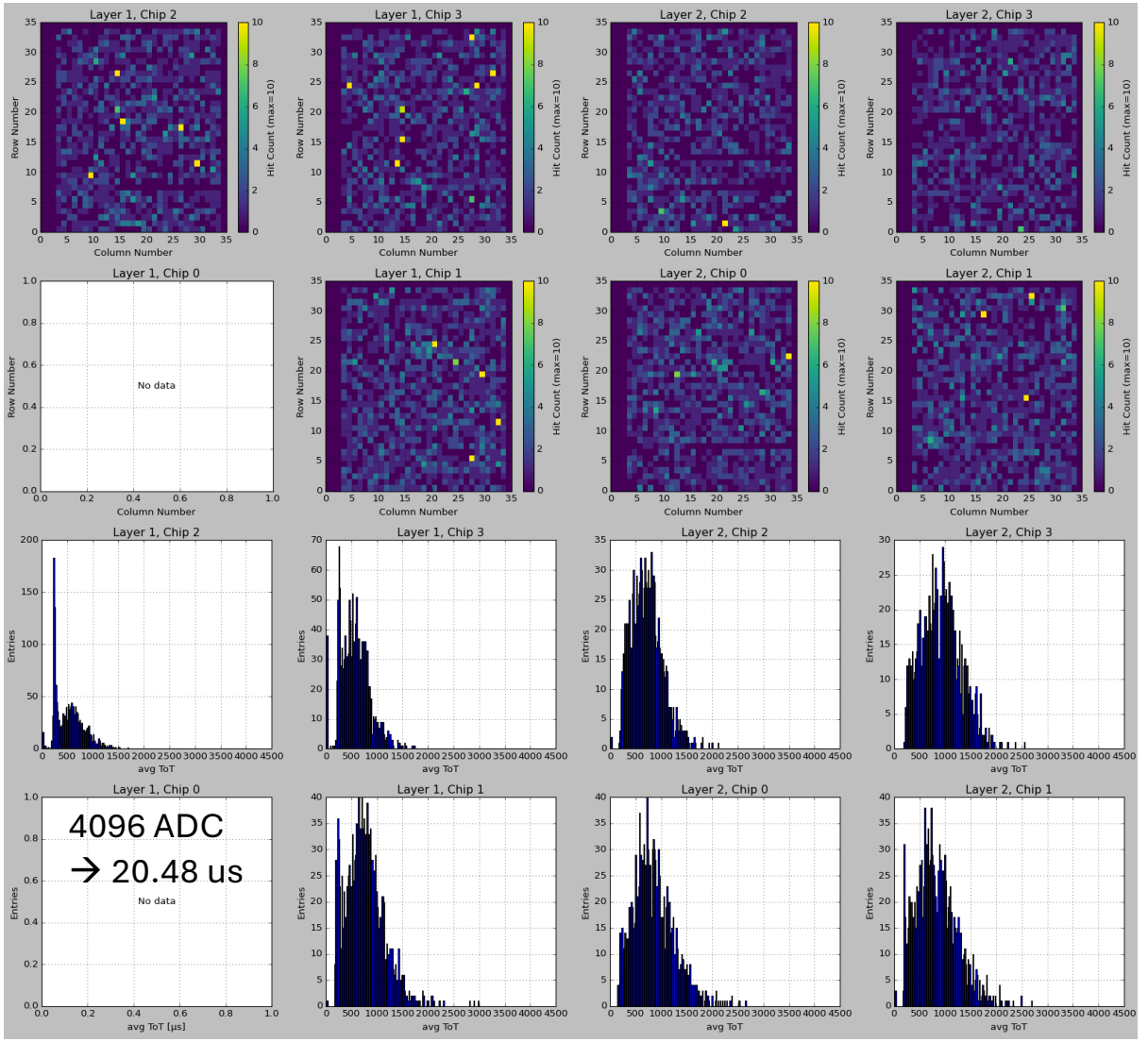
Run 319;

```
Summary:
19764 of 19764 events were processed...
***** Matching hit: 9035 *****
      layer  chipID  col  row  hits
0         1       2   15   18   331
1         1       1   20   24    95
2         1       3   13   11    74
3         1       3   31   26    66
4         2       1   16   29    36
...     ...     ...  ...  ...   ...
4811      1       2   18   30     1
4812      1       2   18   28     1
4813      2       1    4   33     1
4814      2       1    5    0     1
4815      2       0   16   31     1
```



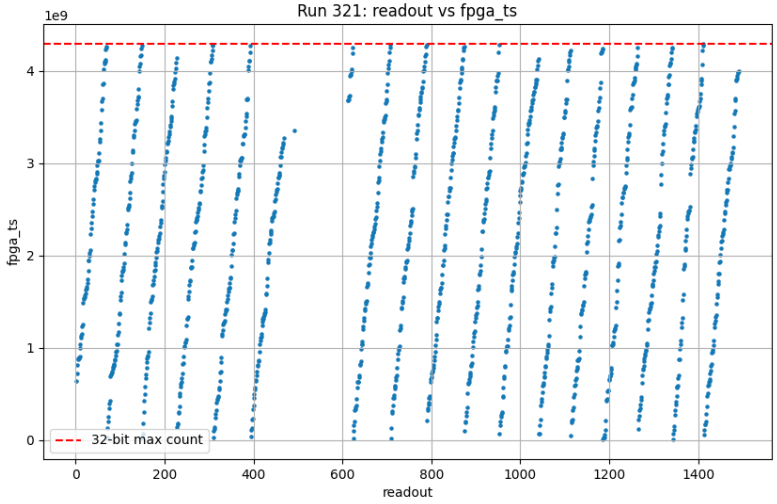

```
40 MHz clock; 32 bit counter
first_valid_idx : 0
first_ts        : 2918568125
last_ts         : 1664353289
rollover_count  : 227
duration_ticks  : 973703361356
duration_sec    : 24342.584034
```

~ 6 hours 45 mins

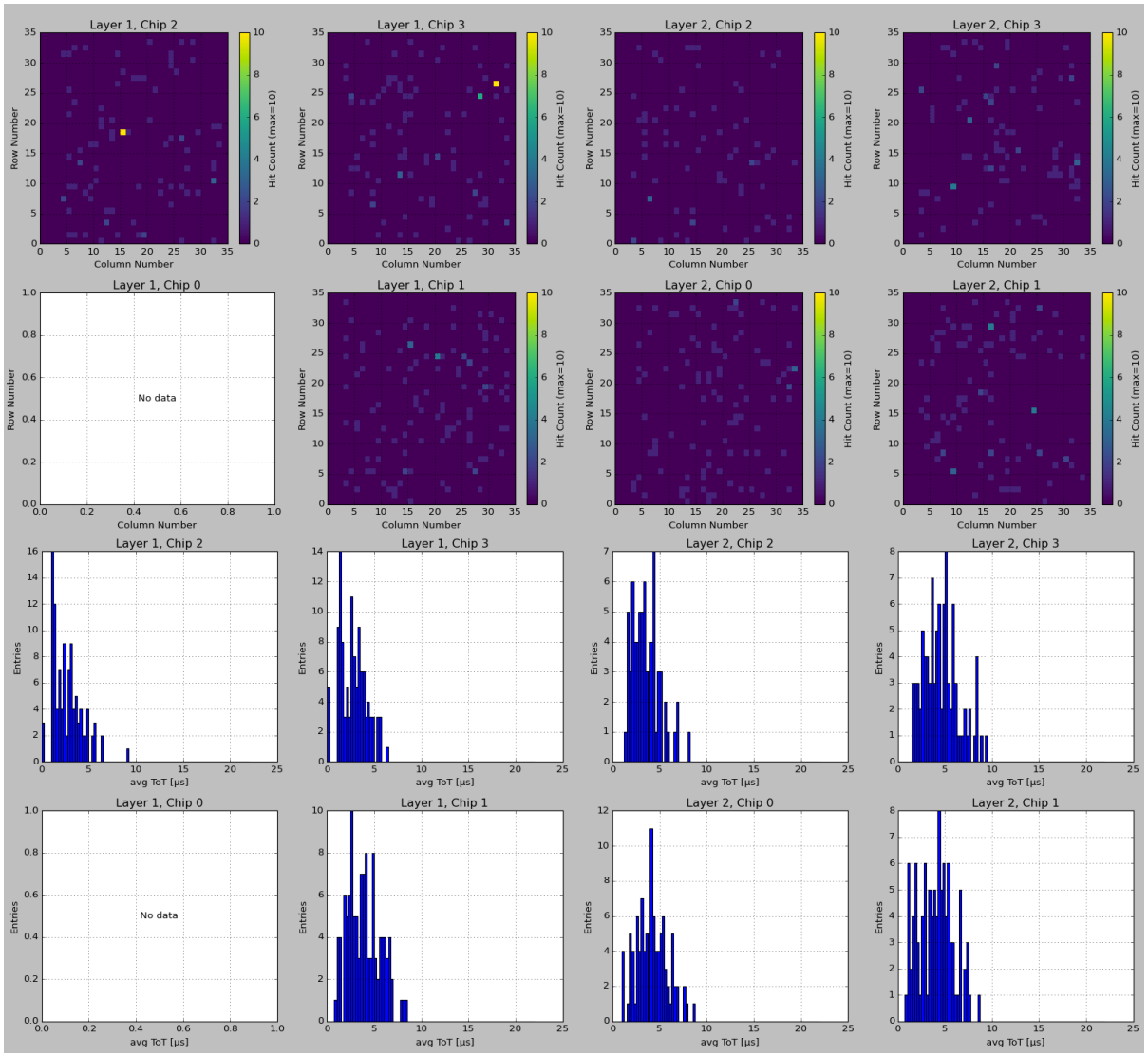


Run 321;

```
Summary:
1348 of 1348 events were processed...
***** Matching hit: 695 *****
     layer  chipID  col  row  hits
0        1       2   15   18    21
1        1       3   31   26    14
2        1       3   28   24     6
3        1       1   20   24     4
4        2       3    9    9     4
..     ...     ...  ...  ...   ...
591      1       3    9   24     1
592      1       3    9   10     1
593      1       3    9    1     1
594      1       3    8   23     1
595      2       3   32   23     1
```

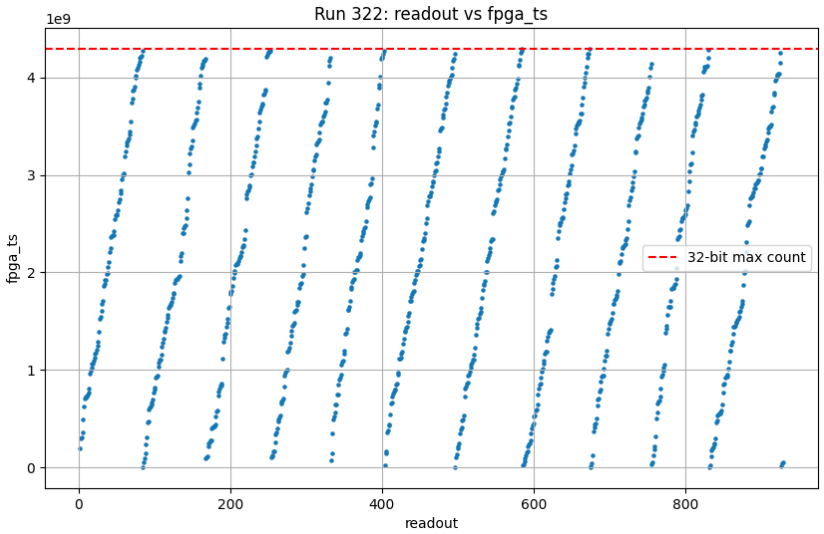



```
40 MHz clock; 32 bit counter
first_valid_idx : 0
first_ts        : 635290432
last_ts         : 3994899511
rollover_count  : 16
duration_ticks  : 72079085815
duration_sec    : 1801.977145
```



Run 322;

```
927 of 927 events were processed...
***** Matching hit: 484 *****
     layer  chipID  col  row  hits
0        1       2   15   18    19
1        1       2   29   11     6
2        2       0   33   22     4
3        1       3   31   26     4
4        1       1    5   13     3
..     ...     ...  ...  ...   ...
431      1       3   14   27     1
432      1       3   14   20     1
433      1       3   14   18     1
434      1       3   14   14     1
435      2       3   32   32     1
```




```
40 MHz clock; 32 bit counter
first_valid_idx : 0
first_ts        : 196756132
last_ts         : 55067651
rollover_count  : 11
duration_ticks  : 47102951775
duration_sec    : 1177.573794
```