Chronos Quality Control Report

Item	Value
Product Mode	Venus Lite 16
Product SN	0x0132026090100009
Hardware Version	Rev 1.5
Firmware Version	V10
Software Version	V1.5.0
Test Time	2026-11-13 11:41:42
Operator	Yue Hou
Location	Hangzhou China

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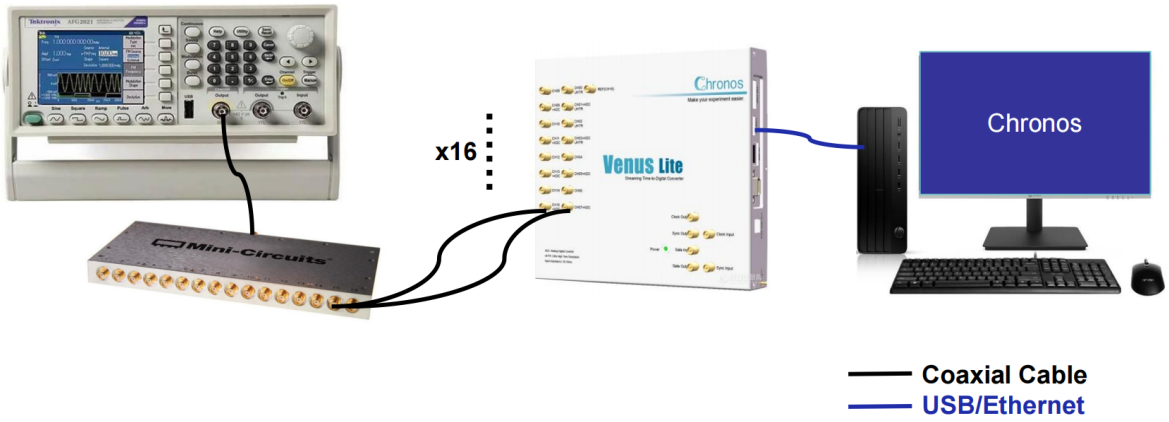
1. Test Platform Description

- The signal generator outputs a periodic positive pulse signal with an amplitude of 5 V, a rise time of 3 ns, a pulse width of approximately 100 ns, and a repetition frequency of 500 KHz. This signal is split into 16 channels via a 1:16 passive power divider and fed into the 16 measurement channels of the Venus Lite.
- The Venus Lite is connected to the test computer via USB, Gigabit Ethernet, or 10 Gigabit Ethernet, configured with a 200 mV trigger level, and dedicated host software is used for data acquisition and analysis.



2. Device Self-check Test

Channel number: 16 + 1 Ref Channel
Test Result: **PASS**

Detected devices

Type	Name	Bandwidth(Mtags/s)
Gigabit Ethernet	Network - 以太网 (10.0.0.5)	25.1
10 Gigabit Ethernet	Network - 以太网 5 (10.0.0.6)	187.9
USB 3.0	USB 3.0 - SN:132026090100009	70.0

2.1 Channel Default Configuration

Configuration range

Configuration Item	Range
DAC(mV)	-1500mV ~ +1500mv, LSB = 0.6mV
Hysteresis(mV)	1mV/30mV/40mV/70mV
Inter Delay(ps)	0ps ~ 1000000ps
Dead Time(ns)	2ns ~ 130000ns
A/D Integration Points	0 ~ 65535
Edge Type	Rising Edge/Falling Edge/Positive Midpoint/Negative Midpoint

Channel	DAC(mV)	Termination(Ohm)	Hysteresis(mV)	Inter Delay(ps)	Dead Time(ns)	A/D Integration Points	Edge Type
0	200	50	30	0	2	N/A	Rising Edge
1	200	50	30	0	2	20	Rising Edge
2	200	50	30	0	2	N/A	Rising Edge
3	200	50	30	0	2	20	Rising Edge
4	200	50	30	0	2	N/A	Rising Edge
5	200	50	30	0	2	20	Rising Edge
6	200	50	30	0	2	N/A	Rising Edge
7	200	50	30	0	2	20	Rising Edge
8	200	50	30	0	2	N/A	Rising Edge
9	200	50	30	0	2	20	Rising Edge
10	200	50	30	0	2	N/A	Rising Edge
11	200	50	30	0	2	20	Rising Edge
12	200	50	30	0	2	N/A	Rising Edge
13	200	50	30	0	2	20	Rising Edge
14	200	50	30	0	2	N/A	Rising Edge
15	200	50	30	0	2	20	Rising Edge
16	N/A	N/A	N/A	0	2	N/A	Rising Edge

2.2 Global Default Configuration

Item	Value
TDC Clock Source	Internal Clock
Test Mode	RAW
Data Mode	Global Coins
Coins Time Window	10000*LSB (Range: 0~16000, LSB = 0.976ps)

3. Channel CPS(Counts Per Second) Test

3.1 General Channel CPS(Counts Per Second) Test

Single CPS(Counts Per Second) Test Result: **PASS**
Input a 240 MHz clock, the singles OCR of each channel is around 240 Mcps.

Coins CPS(Counts Per Second) Test Result: **PASS**

Channel Single CPS(Counts Per Second) Test Results

Channel	1s	2s	3s	4s	5s	Test Result
0	500000	500000	500000	500000	500000	PASS
1	500000	500000	500000	500000	500000	PASS
2	500000	500000	500000	500000	500000	PASS
3	500000	500000	500000	500000	500000	PASS
4	500000	500000	500000	500000	500000	PASS
5	500000	500000	500000	500000	500000	PASS
6	500000	500000	500000	500000	500000	PASS
7	500000	500000	500000	500000	500000	PASS
8	500000	500000	500000	500000	500000	PASS
9	500000	500000	500000	500000	500000	PASS
10	500000	500000	500000	500000	500000	PASS
11	500000	500000	500000	500000	500000	PASS
12	500000	500000	500000	500000	500000	PASS
13	500000	500000	500000	500000	500000	PASS
14	500000	500000	500000	500000	500000	PASS
15	500000	500000	500000	500000	500000	PASS

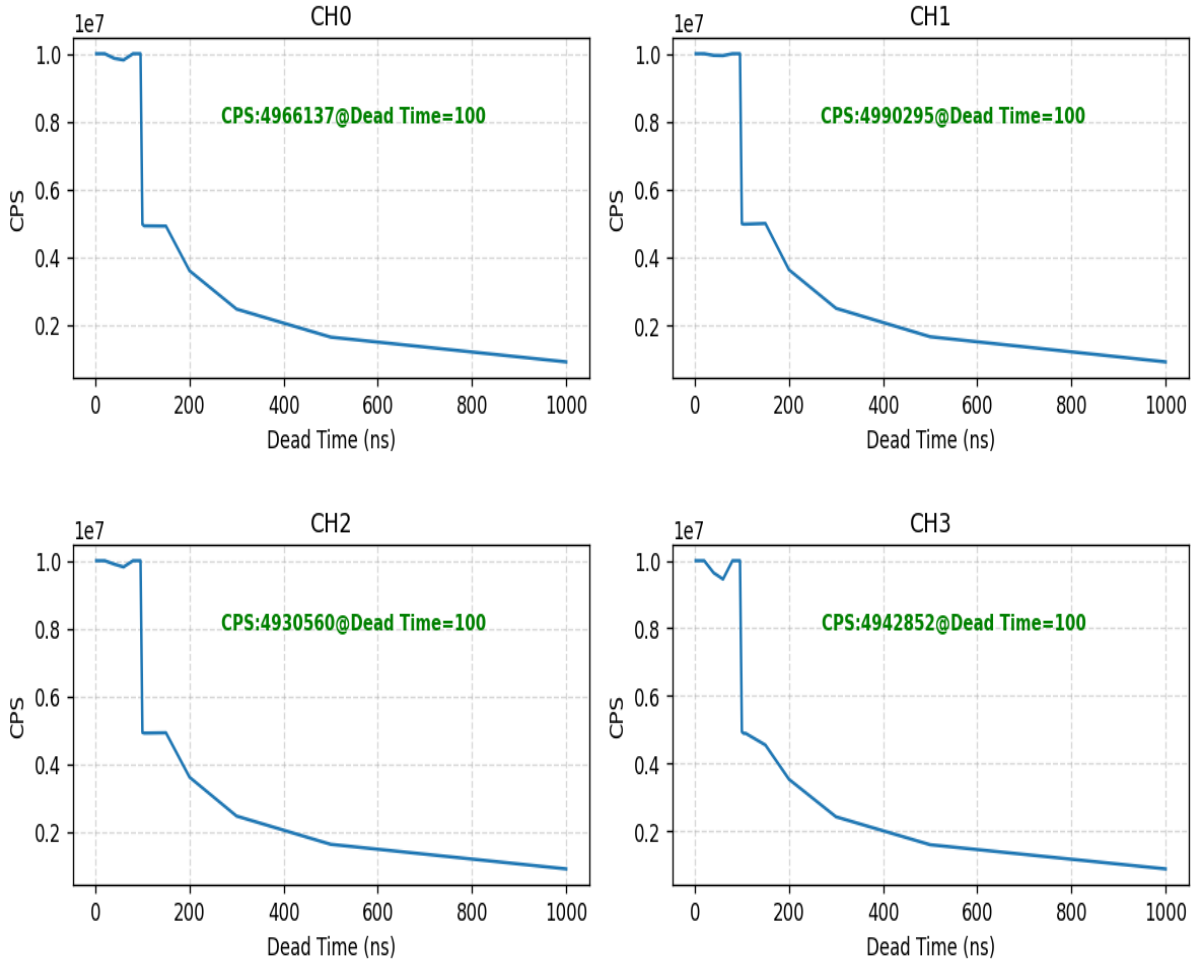
Channel Coins CPS(Counts Per Second) Test Results

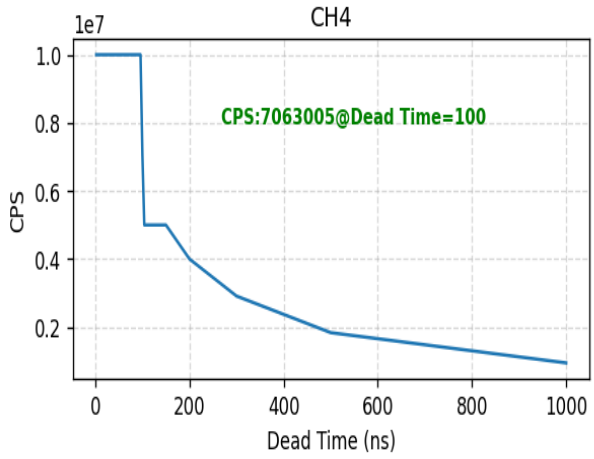
Channel	1s	2s	3s	4s	5s	Test Result
0	7499985	7500000	7499986	7499999	7499990	PASS
1	7499985	7500000	7499994	7499989	7500000	PASS
2	7499995	7499994	7499992	7499999	7499989	PASS
3	7499995	7499993	7499991	7499999	7499988	PASS
4	7499995	7500000	7499986	7499999	7499989	PASS
5	7499995	7500000	7499986	7499999	7499988	PASS
6	7499995	7499994	7499992	7499999	7499989	PASS
7	7499995	7499993	7499991	7499999	7499988	PASS
8	7499996	7499993	7499992	7499999	7499988	PASS

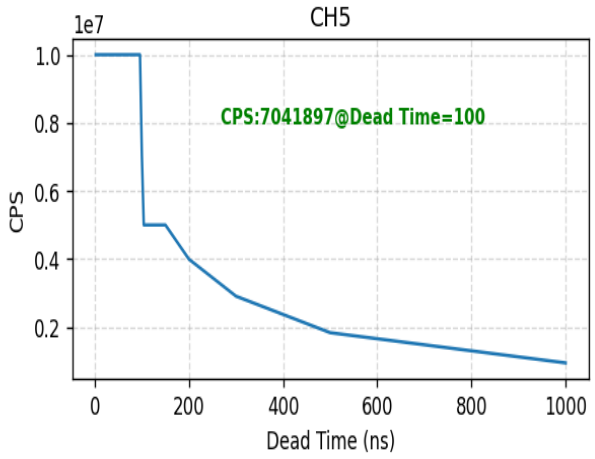
Channel	1s	2s	3s	4s	5s	Test Result
9	7499996	7499993	7499992	7500000	7499988	PASS
10	7499996	7499993	7499992	7500000	7499988	PASS
11	7499996	7499993	7499992	7499999	7499988	PASS
12	7499991	7500000	7499986	7499999	7499989	PASS
13	7499985	7500000	7499986	7499999	7500000	PASS
14	7499995	7500000	7499986	7499999	7499988	PASS
15	7499985	7500000	7499986	7499999	7500000	PASS

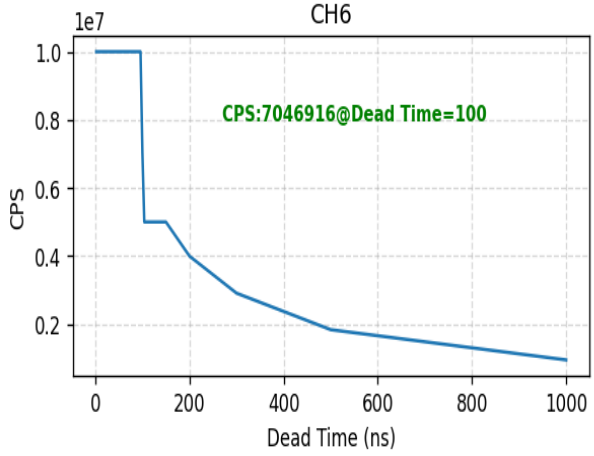
3.2 Channel Single CPS(Counts Per Second) Test with Dead Time

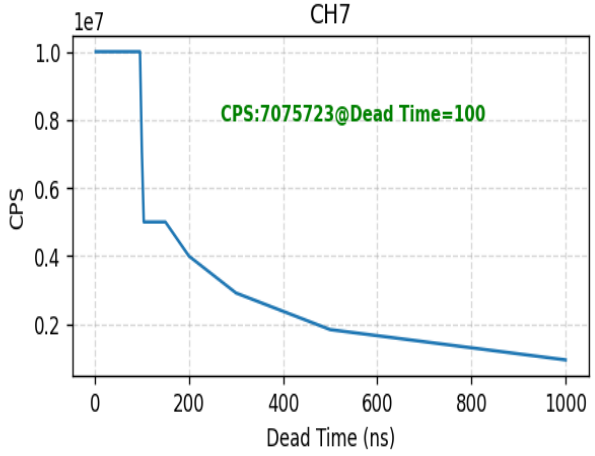
Input a 450 MHz clock, the TDC can acquire almost all of the rising edge timestamp data.
The minimum dead time is around 2 ns.

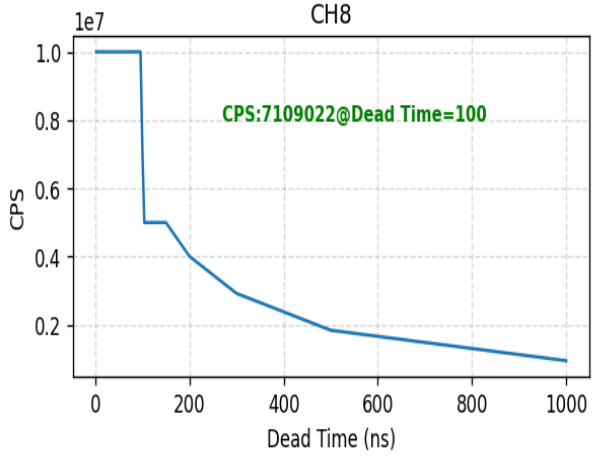


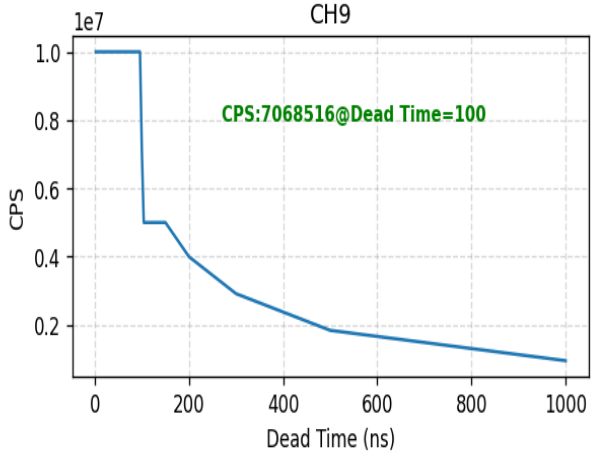

CH4
1e7
CPS:7063005@Dead Time=100
CPS
Dead Time (ns)

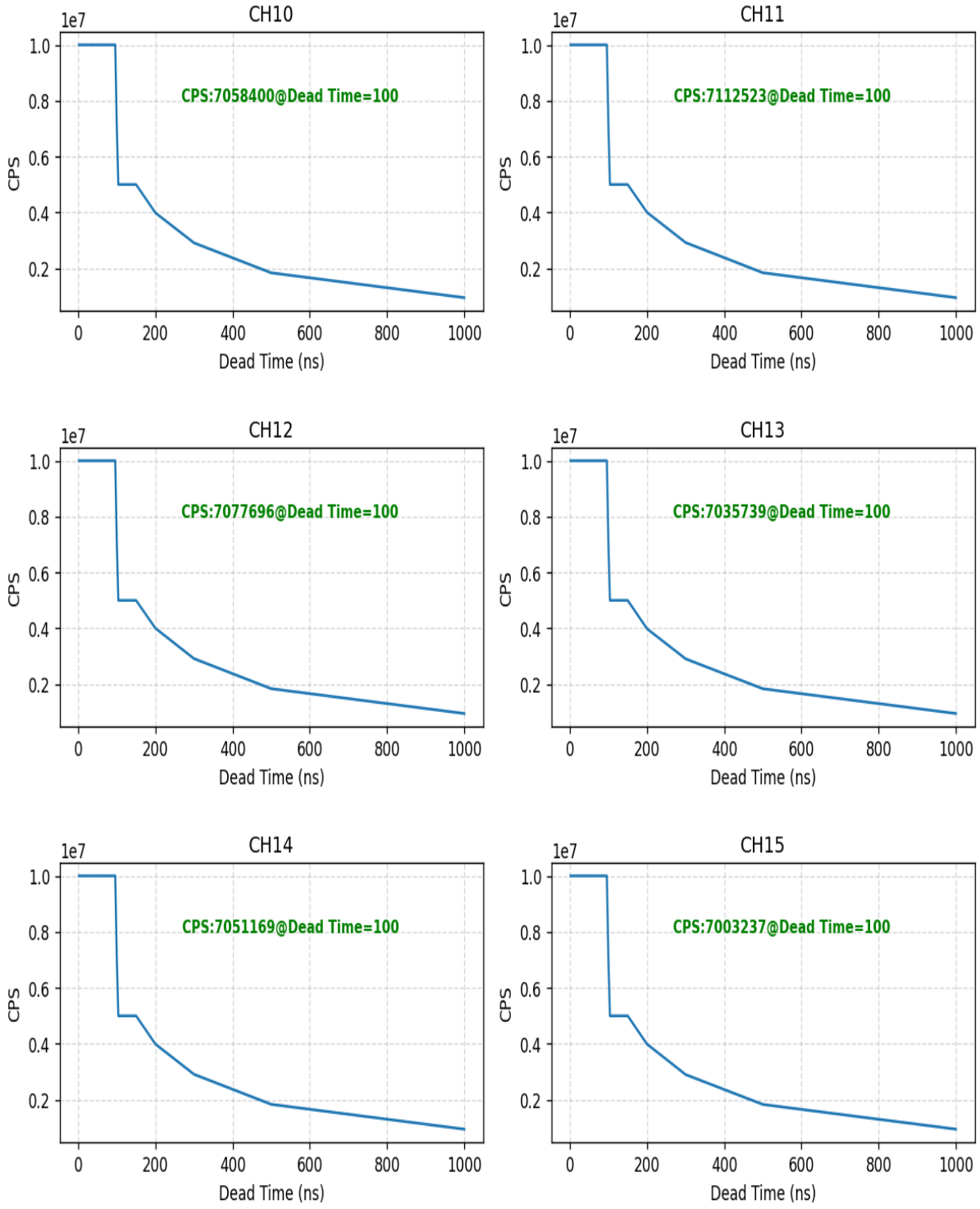

CH5
1e7
CPS:7041897@Dead Time=100
CPS
Dead Time (ns)


CH6
1e7
CPS:7046916@Dead Time=100
CPS
Dead Time (ns)


CH7
1e7
CPS:7075723@Dead Time=100
CPS
Dead Time (ns)


CH8
1e7
CPS:7109022@Dead Time=100
CPS
Dead Time (ns)


CH9
1e7
CPS:7068516@Dead Time=100
CPS
Dead Time (ns)


CH10
1e7
CPS:7058400@Dead Time=100
CPS
Dead Time (ns)
CH11
CPS:7112523@Dead Time=100
CH12
CPS:7077696@Dead Time=100
CH13
CPS:7035739@Dead Time=100
CH14
CPS:7051169@Dead Time=100
CH15
CPS:7003237@Dead Time=100

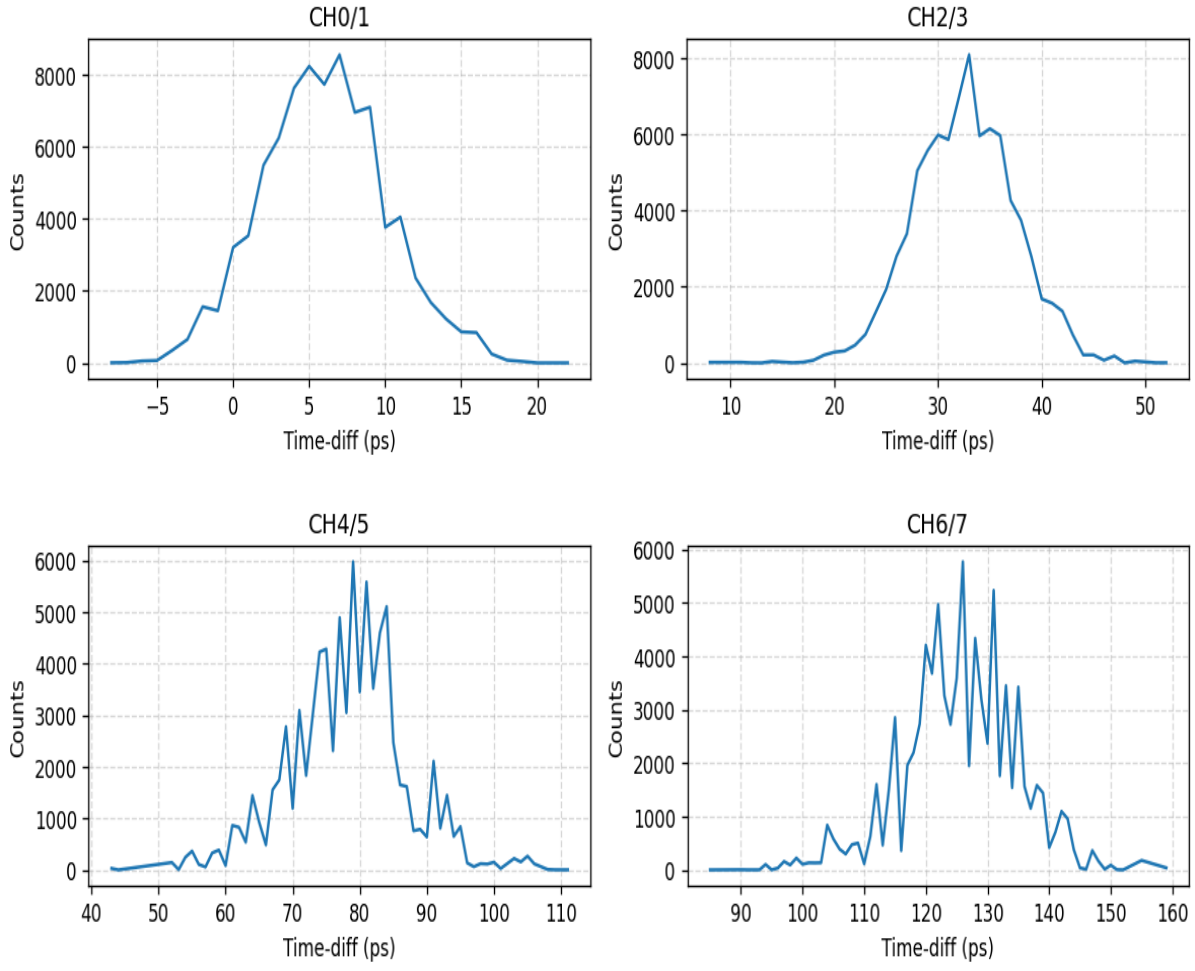
4. Channel Performance Test

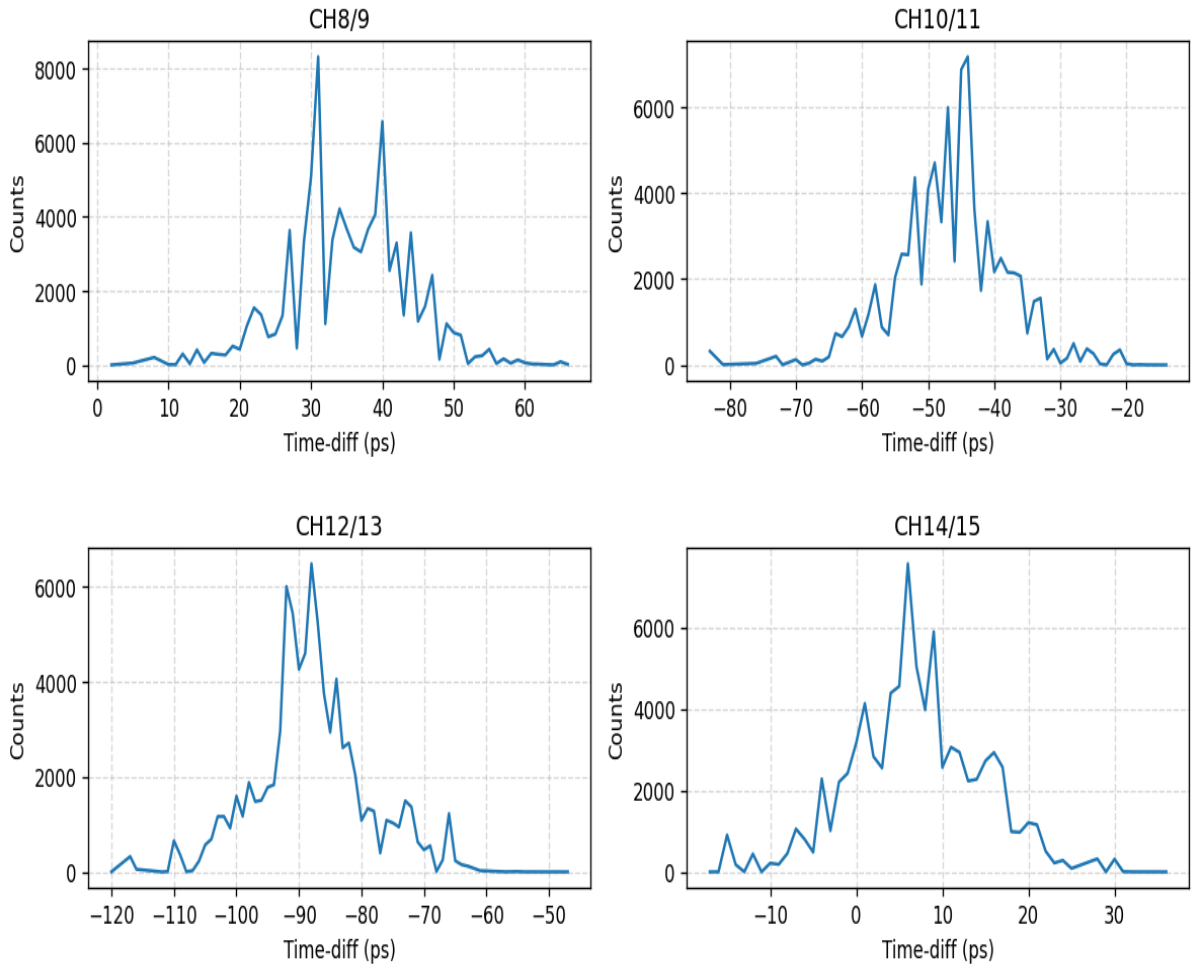
4.1 CRT Performance Test(Internal Trigger)

4.1.1 CRT Performance Test(Internal Trigger, Rising Edge)

Test Result: **PASS**

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH0/1	4.00	5.89	PASS
CH2/3	4.76	32.55	PASS
CH4/5	7.34	78.56	PASS
CH6/7	8.44	125.82	PASS
CH8/9	7.91	35.40	PASS
CH10/11	6.94	-46.26	PASS
CH12/13	6.09	-88.60	PASS
CH14/15	7.02	6.74	PASS





4.1.2 CRT Performance Test(Internal Trigger, Rising Edge, Inter Delay)

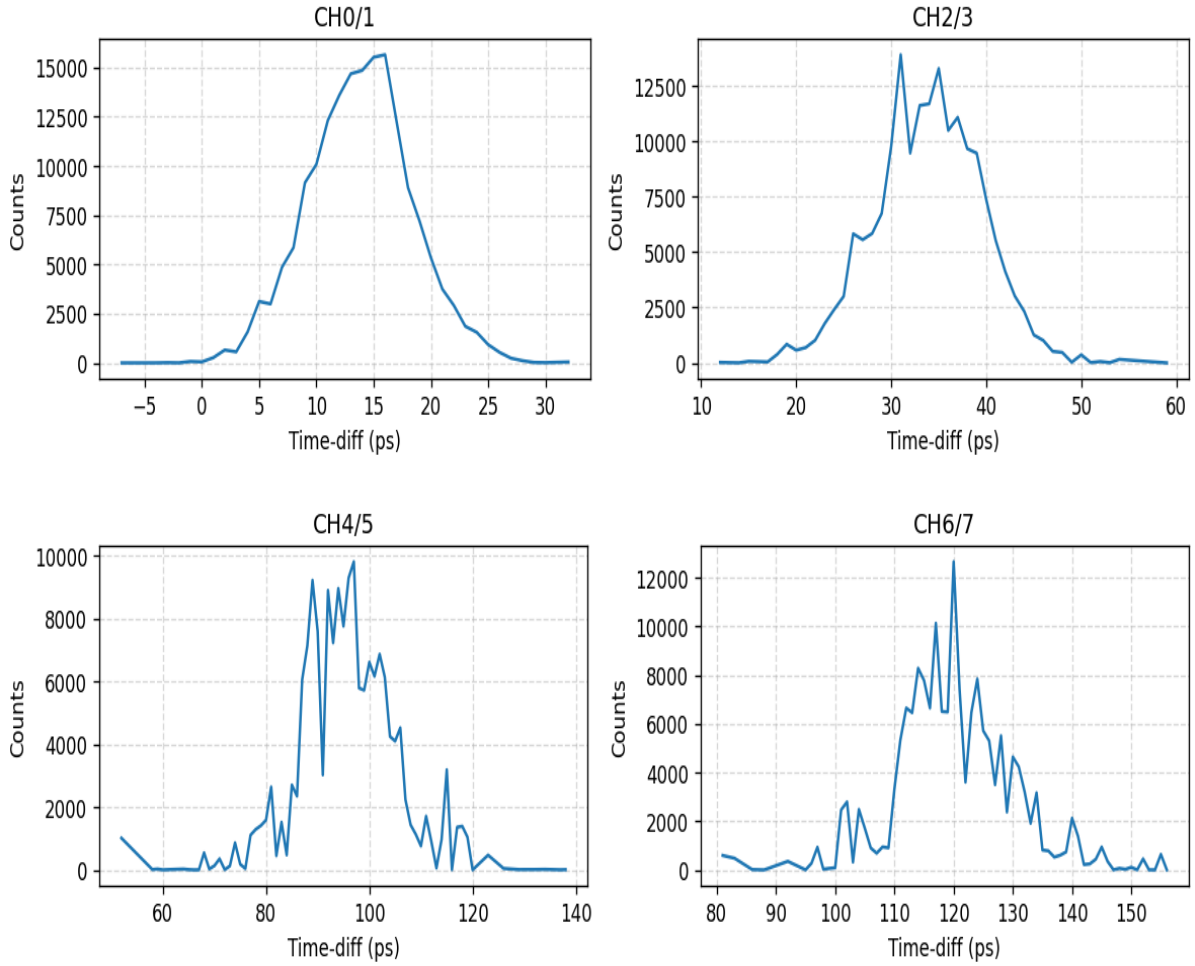
Test Result: **PASS**

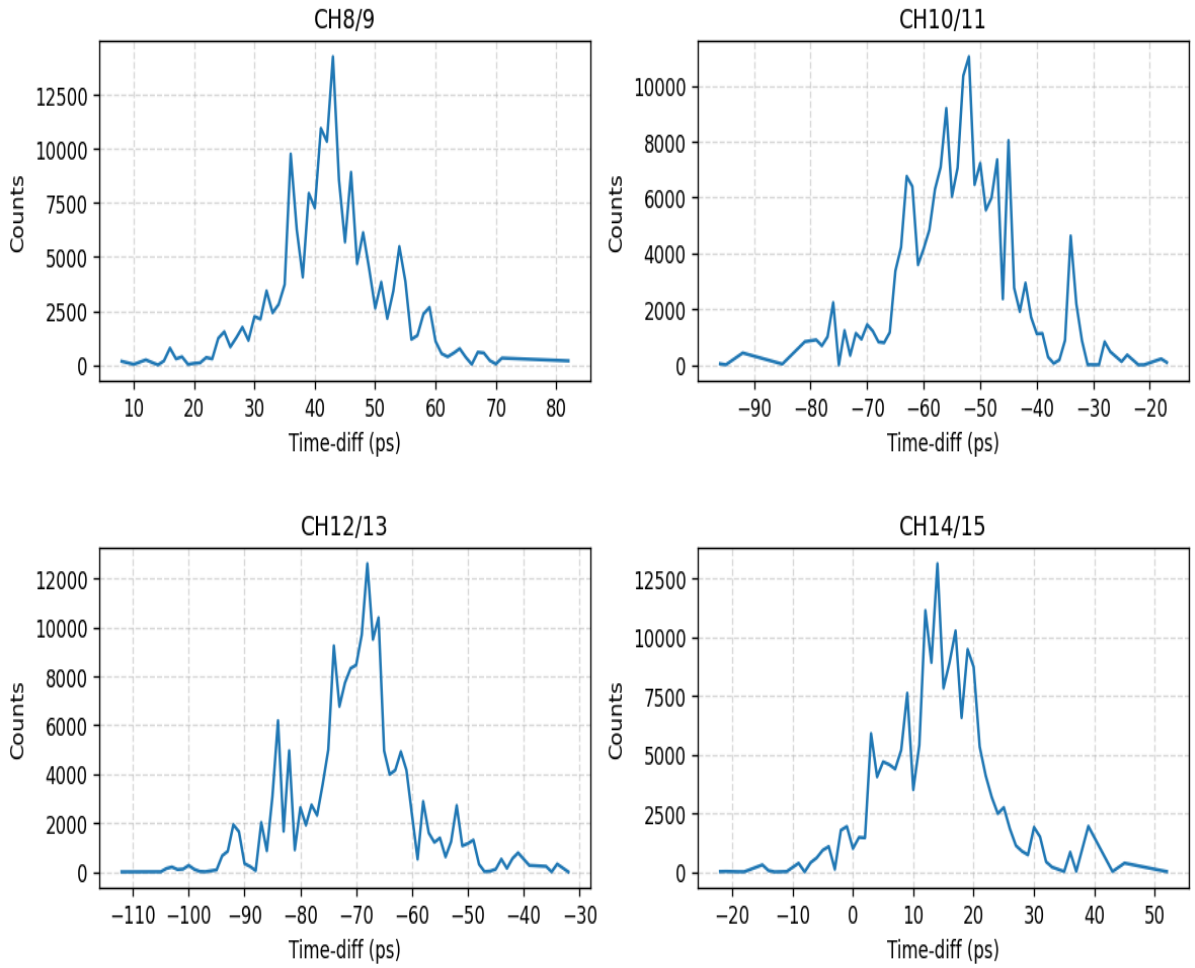
Channel Group	CRT(RMS, ps)	Inter Delay(ps)	Mean(ps)	Result
CH0/1	3.99	5	0.80	PASS
CH2/3	4.90	32	0.86	PASS
CH4/5	7.22	78	0.99	PASS
CH6/7	8.39	125	0.86	PASS
CH8/9	7.97	35	0.44	PASS
CH10/11	6.93	-46	-0.19	PASS
CH12/13	6.10	-88	-0.56	PASS
CH14/15	7.15	6	1.39	PASS

4.1.3 CRT Performance Test(Internal Trigger, Falling Edge)

Test Result: **PASS**

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH0/1	4.40	13.86	PASS
CH2/3	5.56	34.06	PASS
CH4/5	7.86	95.37	PASS
CH6/7	8.11	119.40	PASS
CH8/9	7.08	42.36	PASS
CH10/11	7.94	-53.62	PASS
CH12/13	6.46	-69.38	PASS
CH14/15	7.03	14.34	PASS

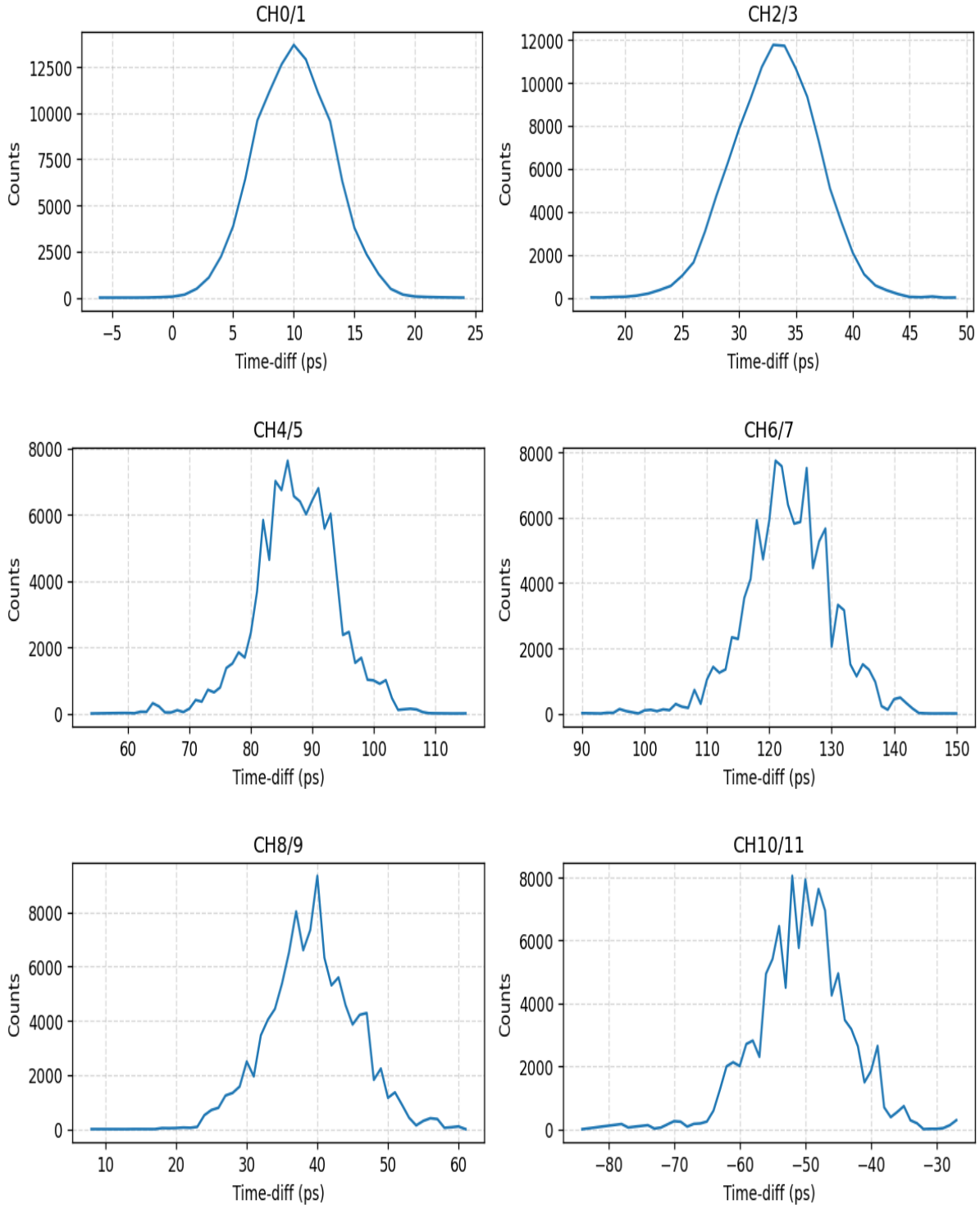


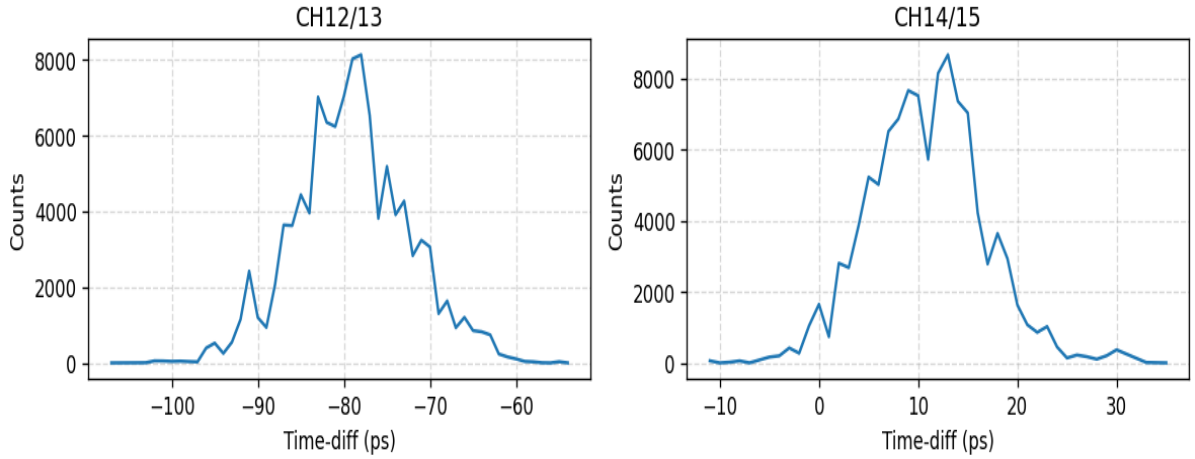


4.1.4 CRT Performance Test(Internal Trigger, Positive-Middle Edge)

Test Result: **PASS**

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH0/1	3.22	10.00	PASS
CH2/3	3.73	33.28	PASS
CH4/5	5.97	87.60	PASS
CH6/7	6.24	123.09	PASS
CH8/9	5.89	39.16	PASS
CH10/11	6.12	-50.30	PASS
CH12/13	6.14	-79.34	PASS
CH14/15	5.52	10.77	PASS

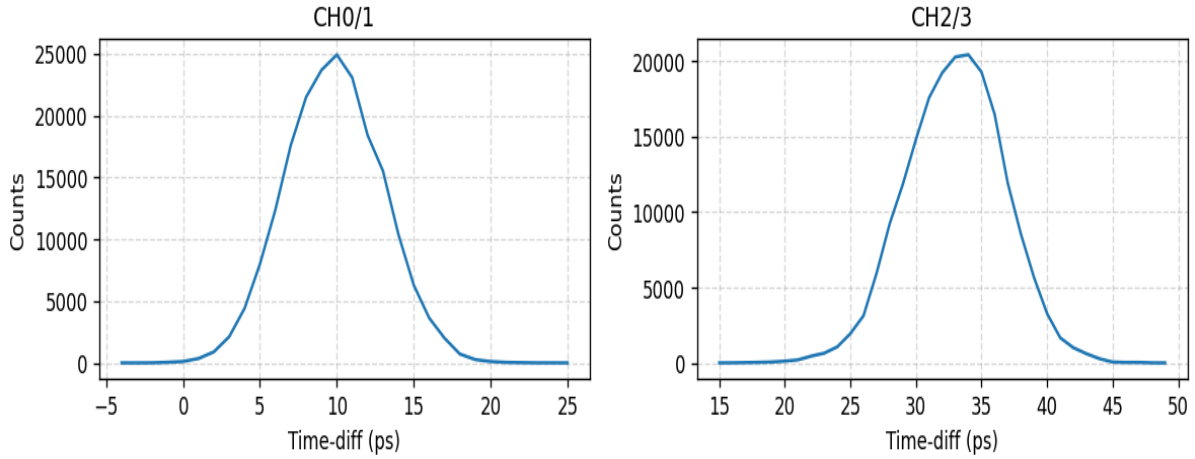

CH0/1
Counts
Time-diff (ps)
CH2/3
Counts
Time-diff (ps)
CH4/5
Counts
Time-diff (ps)
CH6/7
Counts
Time-diff (ps)
CH8/9
Counts
Time-diff (ps)
CH10/11
Counts
Time-diff (ps)

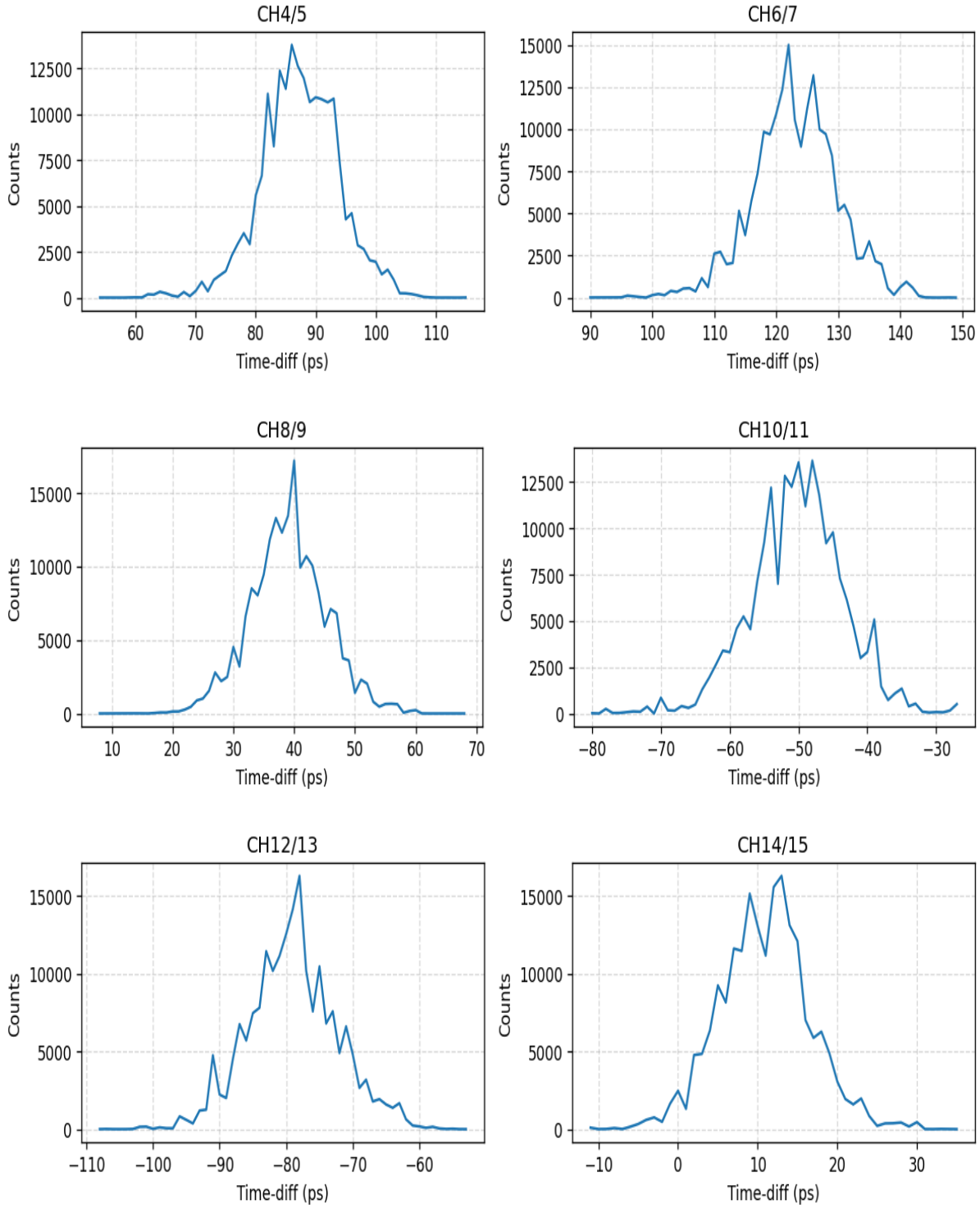


4.1.5 CRT Performance Test(Internal Trigger, Negative-Middle Edge)

Test Result: **PASS**

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH0/1	3.18	9.76	PASS
CH2/3	3.75	33.09	PASS
CH4/5	6.04	87.48	PASS
CH6/7	6.27	123.12	PASS
CH8/9	5.84	39.01	PASS
CH10/11	6.15	-49.92	PASS
CH12/13	6.23	-79.19	PASS
CH14/15	5.34	10.89	PASS



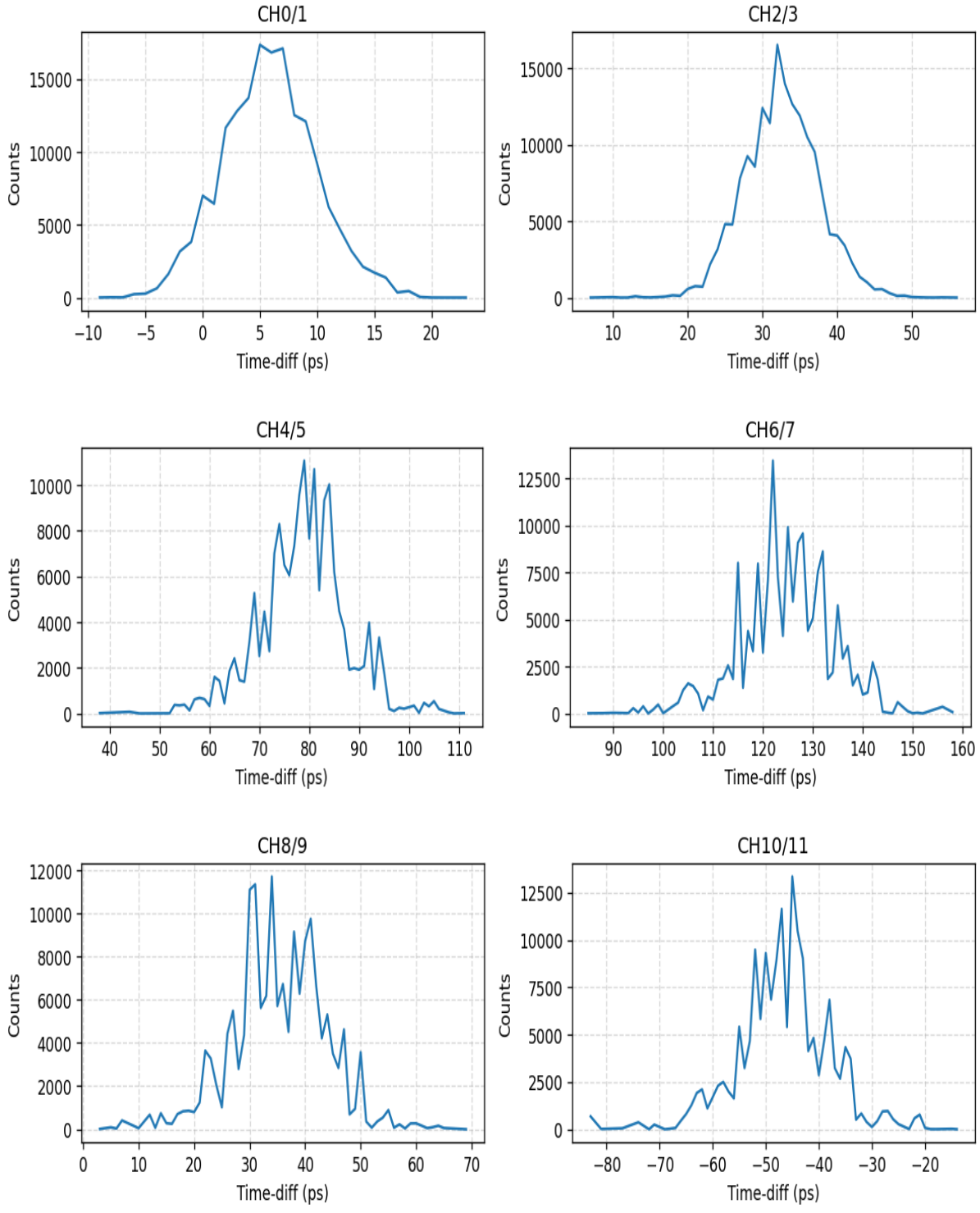


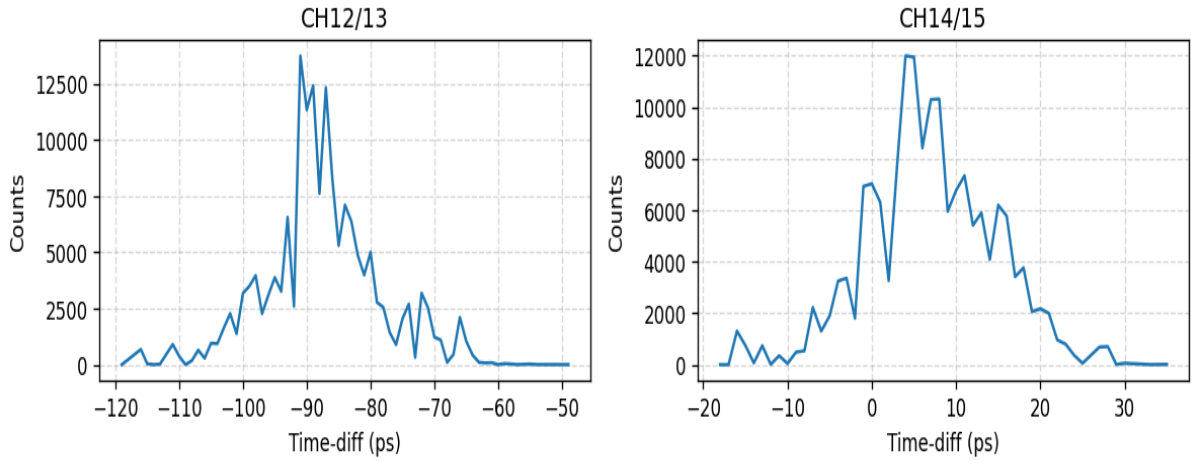
4.1.6 CRT Performance Test(Internal Trigger, Switch to 10MHz external clock source)

Test Result: **PASS**

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH0/1	3.97	5.72	PASS
CH2/3	4.77	32.51	PASS
CH4/5	7.17	79.15	PASS

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH6/7	8.16	125.15	PASS
CH8/9	7.98	35.48	PASS
CH10/11	6.94	-46.49	PASS
CH12/13	6.20	-88.19	PASS
CH14/15	7.16	6.78	PASS



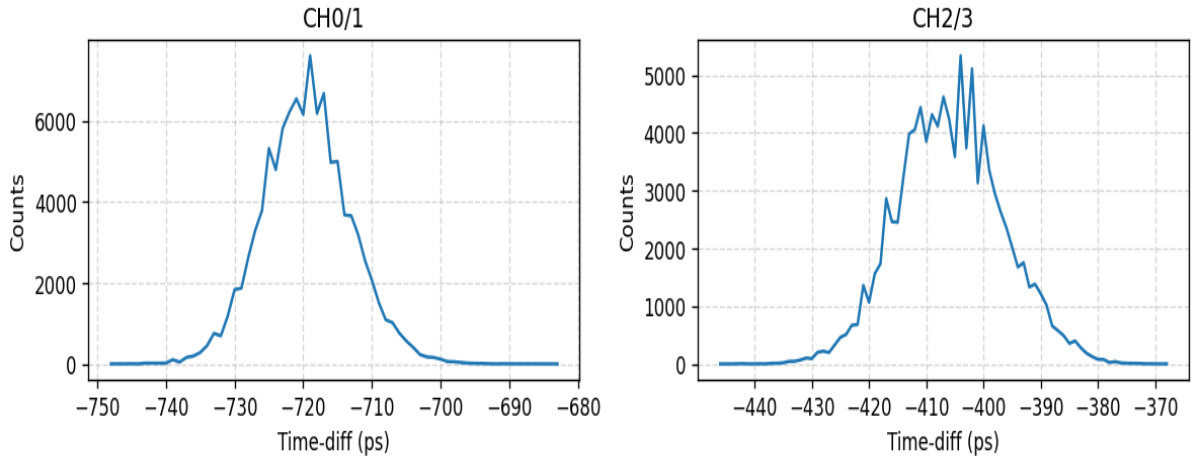


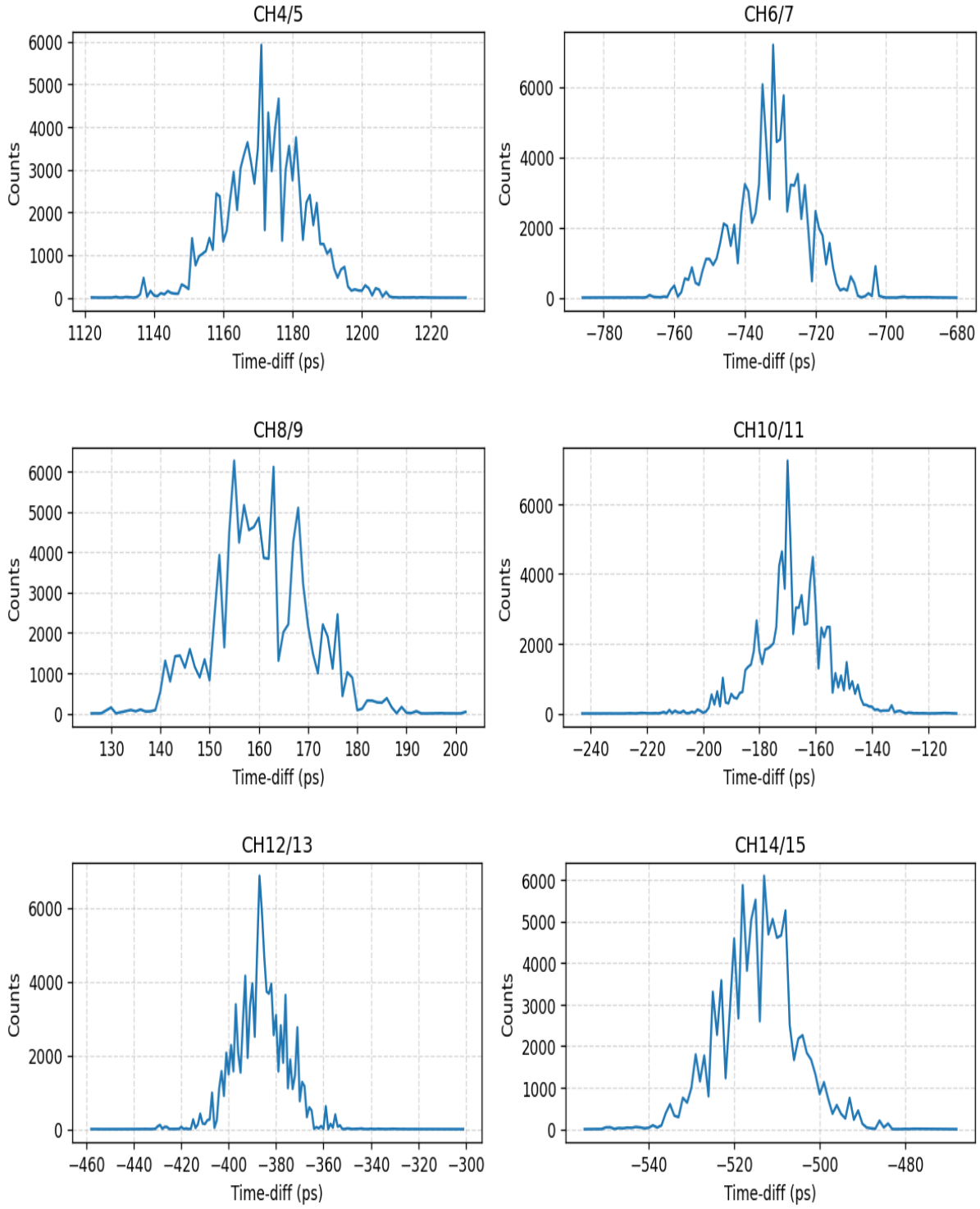
4.2 CRT Performance Test(External Trigger)

4.2.1 CRT Performance Test(External Trigger, Rising Edge)

Test Result: **PASS**

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH0/1	6.16	-719.70	PASS
CH2/3	9.15	-406.10	PASS
CH4/5	11.49	1172.46	PASS
CH6/7	9.20	-731.98	PASS
CH8/9	9.19	160.01	PASS
CH10/11	10.53	-167.91	PASS
CH12/13	9.60	-386.52	PASS
CH14/15	8.28	-514.15	PASS



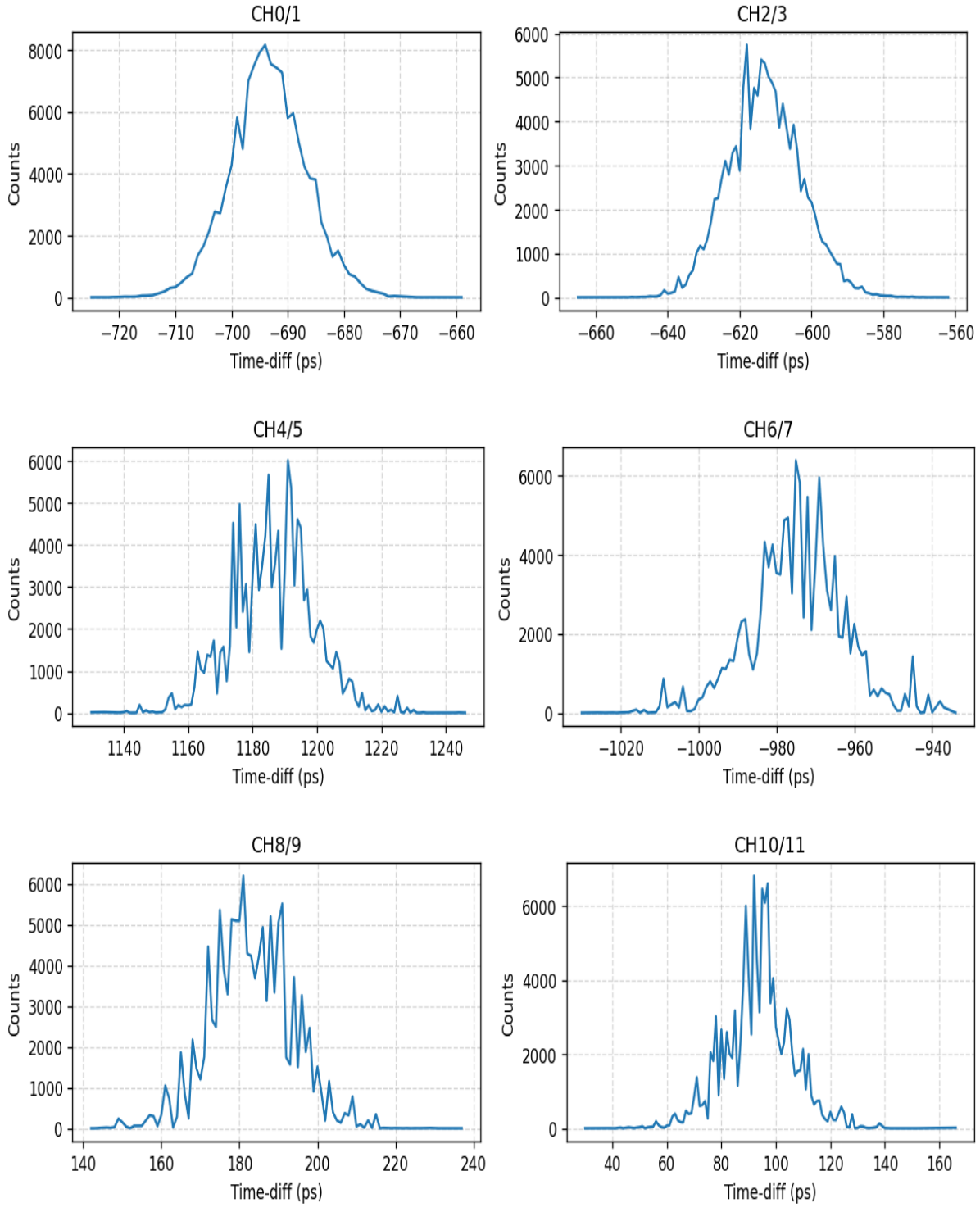


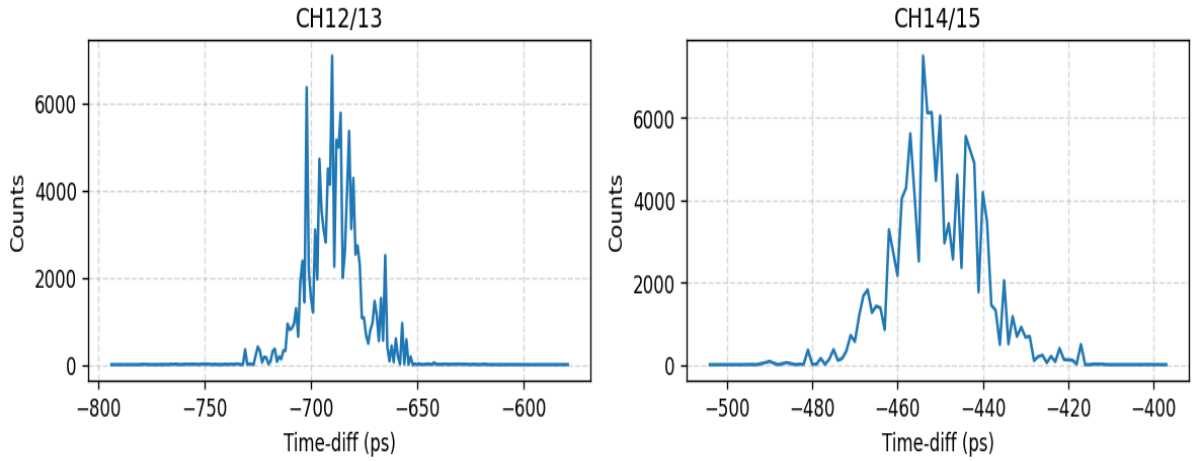
4.2.2 CRT Performance Test(External Trigger, Falling Edge)

Test Result: **PASS**

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH0/1	6.41	-693.52	PASS
CH2/3	10.06	-613.32	PASS
CH4/5	12.13	1186.73	PASS

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH6/7	10.64	-974.43	PASS
CH8/9	10.08	182.92	PASS
CH10/11	10.44	93.88	PASS
CH12/13	11.13	-689.19	PASS
CH14/15	9.77	-450.83	PASS

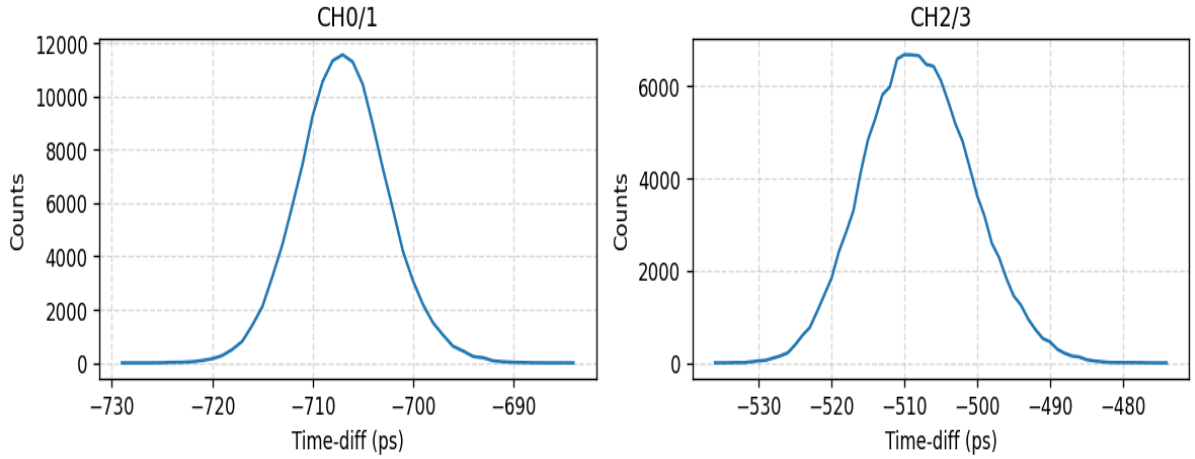


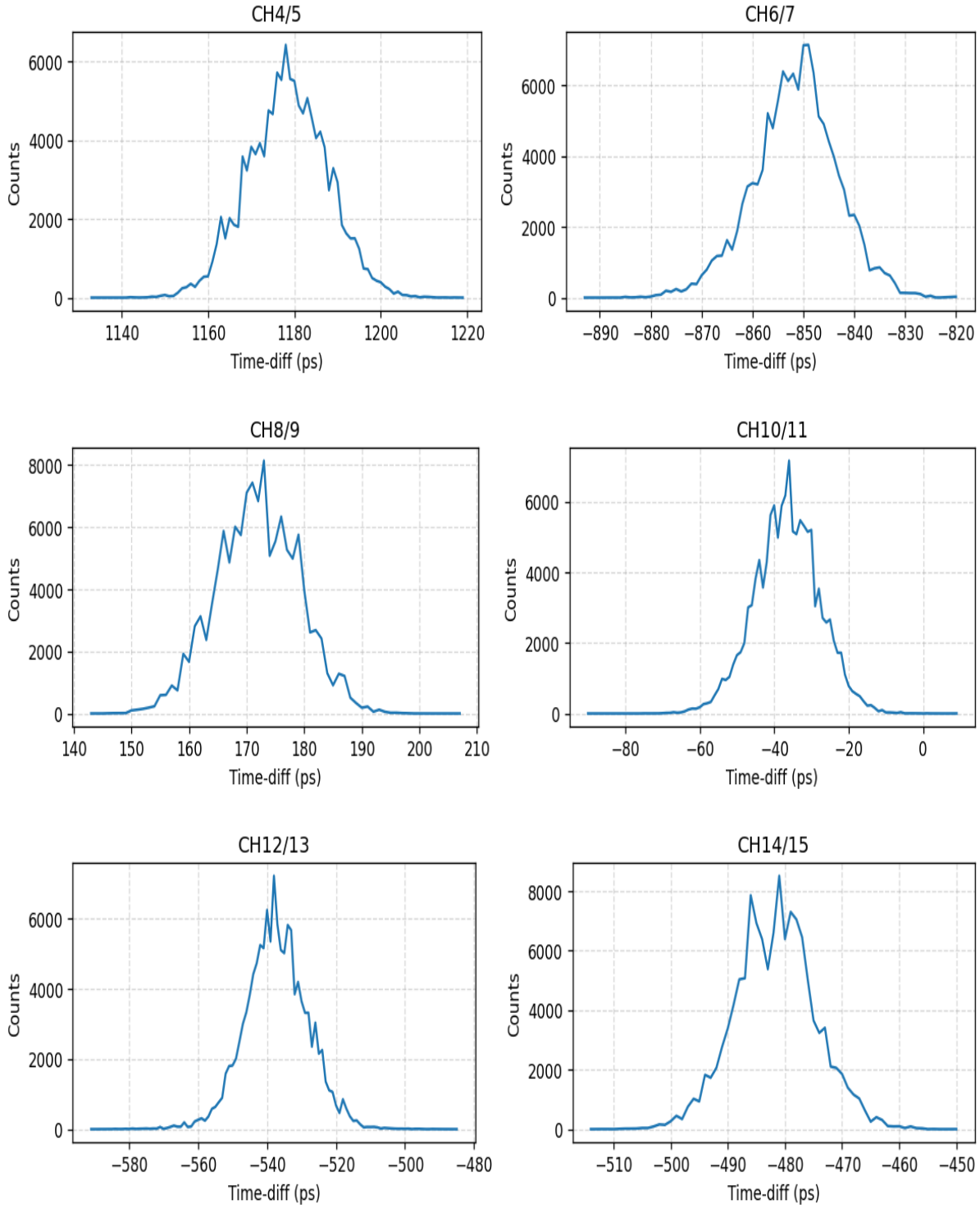


4.2.3 CRT Performance Test(External Trigger, Positive-Middle Edge)

Test Result: **PASS**

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH0/1	4.33	-707.05	PASS
CH2/3	7.46	-508.30	PASS
CH4/5	9.22	1178.59	PASS
CH6/7	7.69	-851.20	PASS
CH8/9	7.31	171.94	PASS
CH10/11	8.45	-36.47	PASS
CH12/13	8.51	-537.41	PASS
CH14/15	6.85	-481.79	PASS



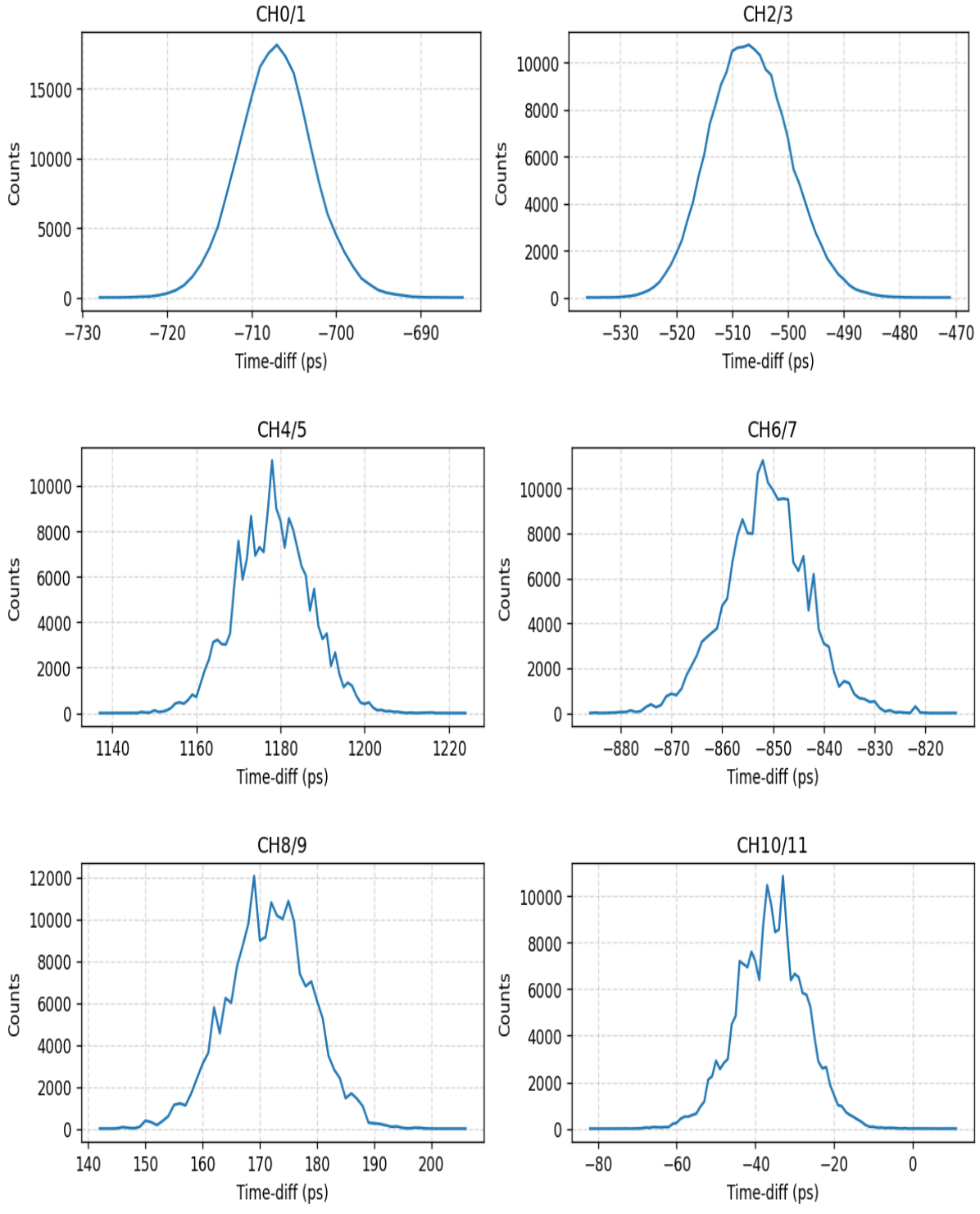


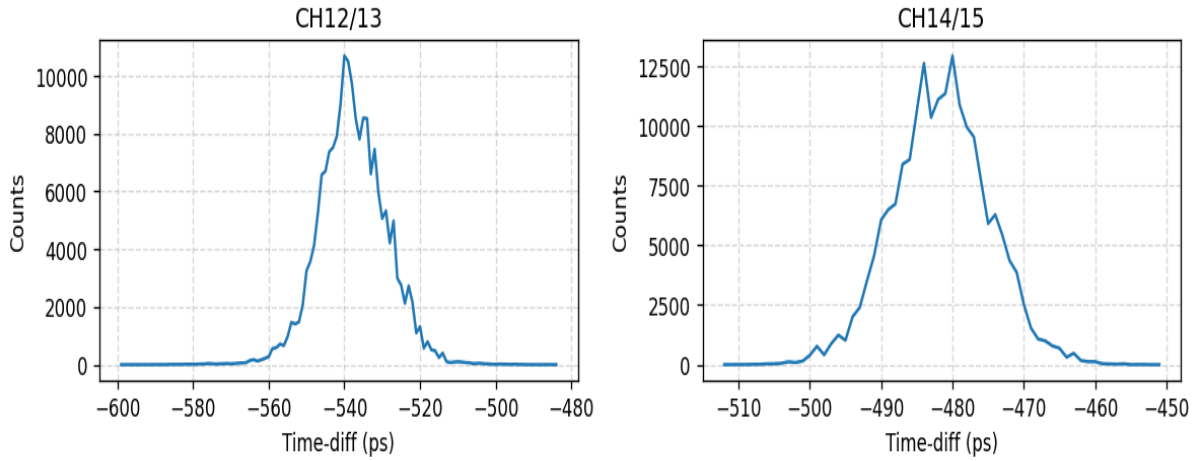
4.2.4 CRT Performance Test(External Trigger, Negative-Middle Edge)

Test Result: **PASS**

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH0/1	4.31	-707.21	PASS
CH2/3	7.15	-507.13	PASS
CH4/5	8.84	1178.19	PASS

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH6/7	7.65	-851.26	PASS
CH8/9	7.32	171.71	PASS
CH10/11	8.50	-35.89	PASS
CH12/13	8.23	-538.05	PASS
CH14/15	6.63	-481.62	PASS





4.3 NCoins Performance Test(Internal Trigger, Hardware analysis mode)

Test Result: **PASS**

Strategy Index	Strategy Name	CPS
0	ST0	499999
1	ST1	499999
2	ST2	499999
3	ST3	499999
4	ST4	499999
5	ST5	499999
6	ST6	499999
7	ST7	499999
8	ST8	499999
9	ST9	499999
10	ST10	499999
11	ST11	499999
12	ST12	499999
13	ST13	499999
14	ST14	499999
15	ST15	499999
16	ST16	499999
17	ST17	499999
18	ST18	499999
19	ST19	499999
20	ST20	499999
21	ST21	499999
22	ST22	499999

Strategy Index	Strategy Name	CPS
23	ST23	499999
24	ST24	499999
25	ST25	499999
26	ST26	499999
27	ST27	499999
28	ST28	499999
29	ST29	499999
30	ST30	499999
31	ST31	499999
32	ST32	499999
33	ST33	499999
34	ST34	499999
35	ST35	499999
36	ST36	499999
37	ST37	499999
38	ST38	499999
39	ST39	499999

4.4 TOT Performance Test(External Trigger)

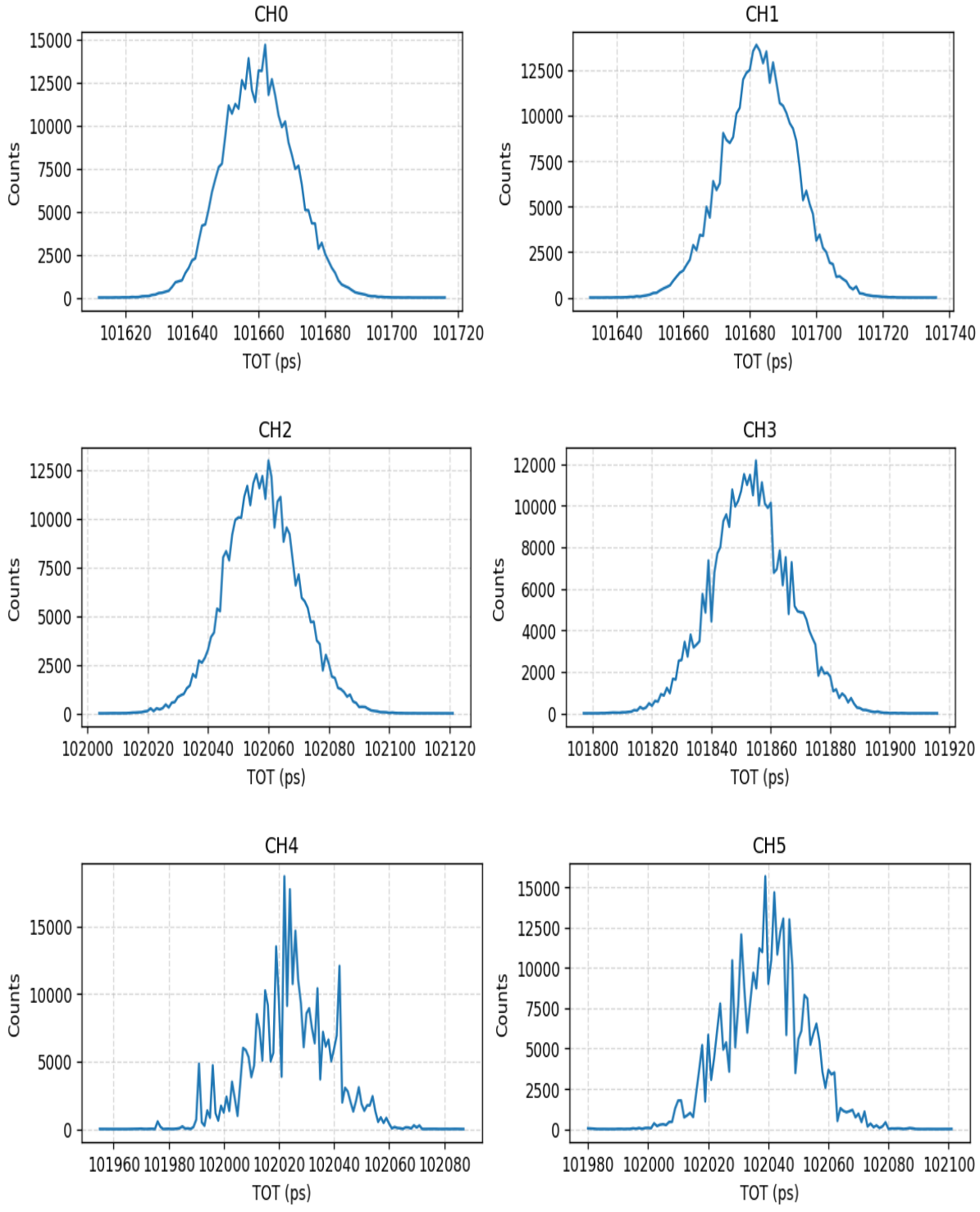
Test Result: **PASS**

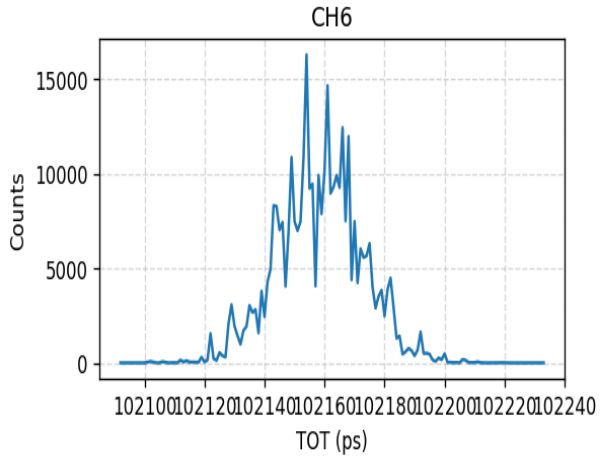
Channel	TOT(RMS, ps)	Mean(ns)	Result
CH0	10.84	101.66	PASS
CH1	10.81	101.68	PASS
CH2	11.82	102.06	PASS
CH3	13.06	101.85	PASS
CH4	13.27	102.02	PASS
CH5	13.01	102.04	PASS
CH6	13.94	102.16	PASS
CH7	14.28	101.92	PASS
CH8	13.43	101.83	PASS
CH9	13.81	101.85	PASS
CH10	13.62	101.73	PASS
CH11	13.82	102.00	PASS
CH12	14.57	101.93	PASS
CH13	14.15	101.62	PASS
CH14	13.01	101.83	PASS

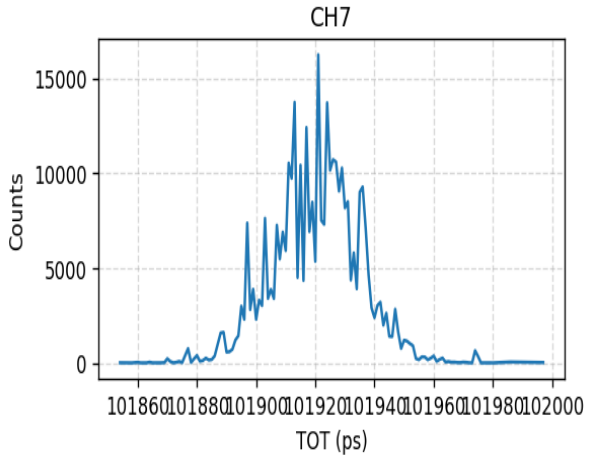
Channel	TOT(RMS, ps)	Mean(ns)	Result
CH15	13.28	101.89	PASS

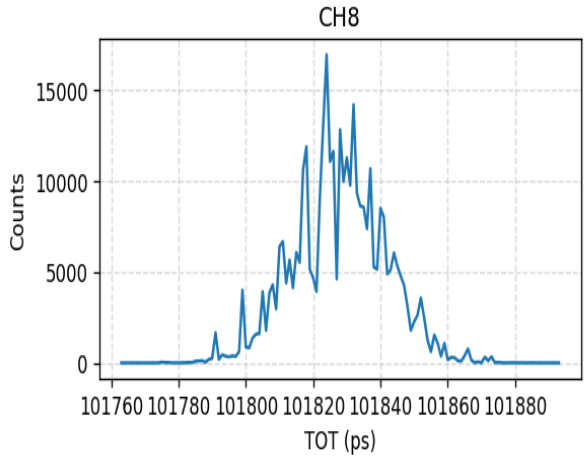
Minimum trigger pulse width: ~0.5 ns

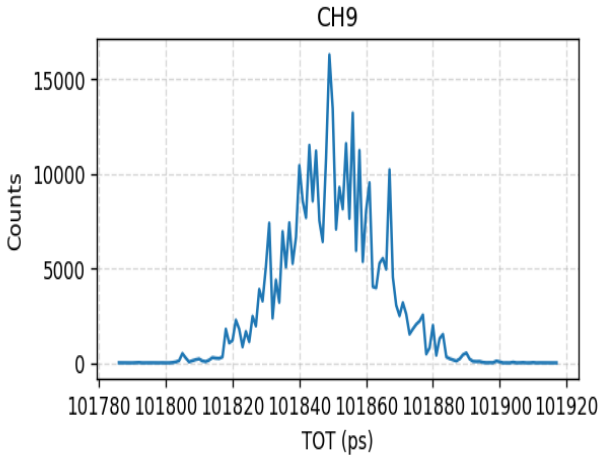
Maximum measurement pulse width: ~16 us

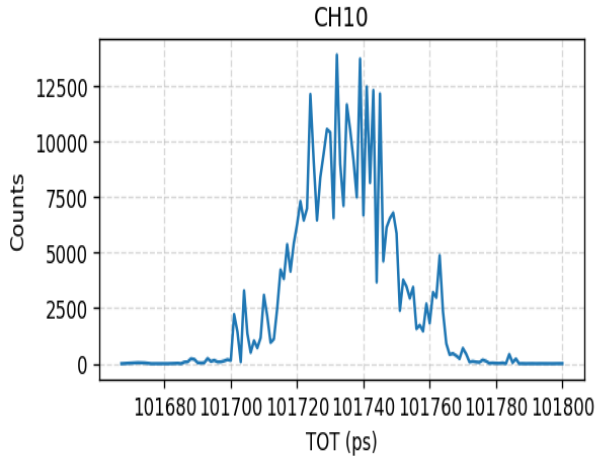


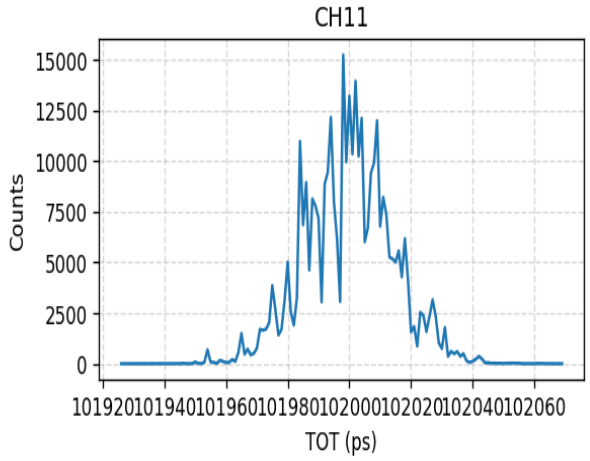

CH6
Counts
15000
10000
5000
0
102100 102120 102140 102160 102180 102200 102220 102240
TOT (ps)

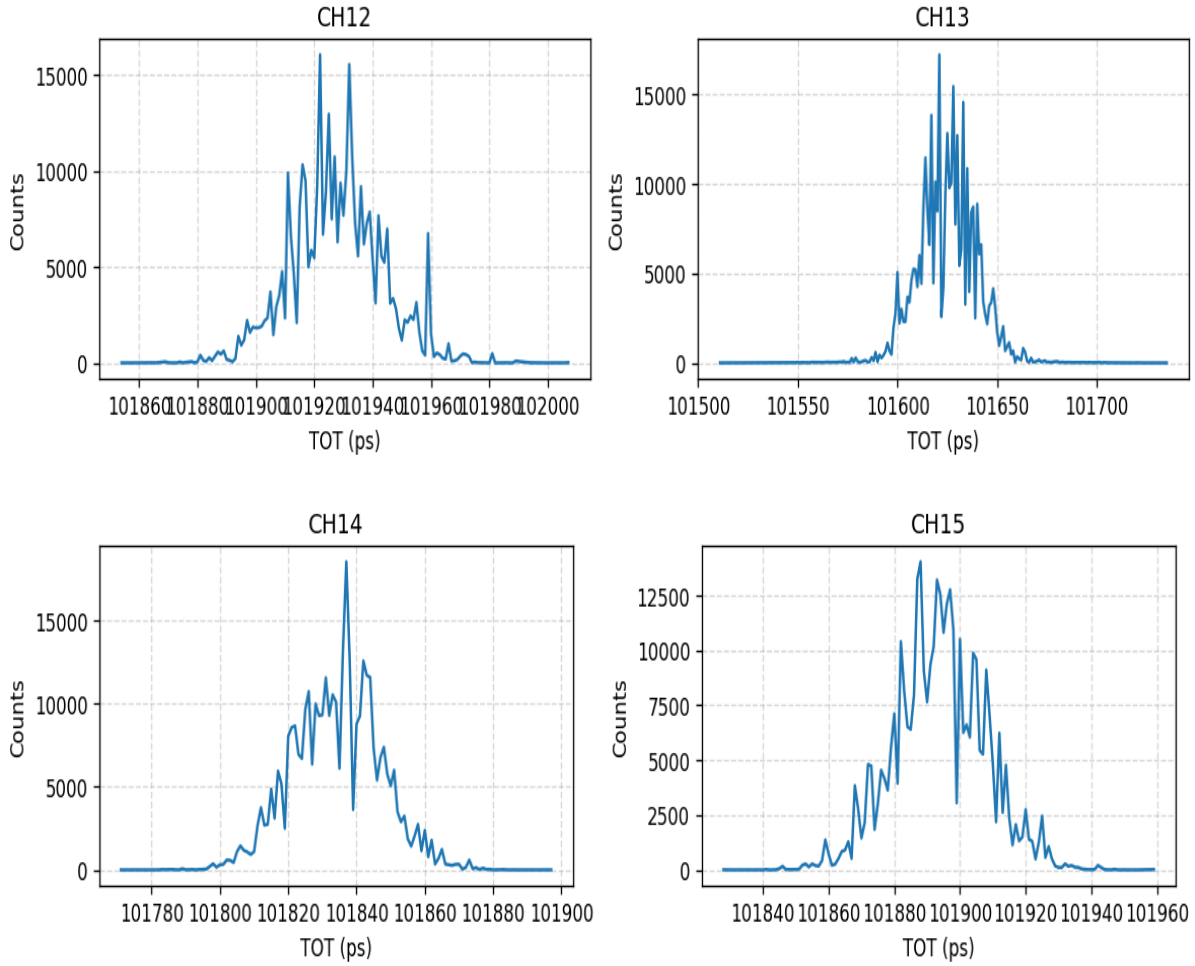

CH7
Counts
15000
10000
5000
0
101860 101880 101900 101920 101940 101960 101980 102000
TOT (ps)


CH8
Counts
15000
10000
5000
0
101760 101780 101800 101820 101840 101860 101880
TOT (ps)


CH9
Counts
15000
10000
5000
0
101780 101800 101820 101840 101860 101880 101900 101920
TOT (ps)


CH10
Counts
12500
10000
7500
5000
2500
0
101680 101700 101720 101740 101760 101780 101800
TOT (ps)

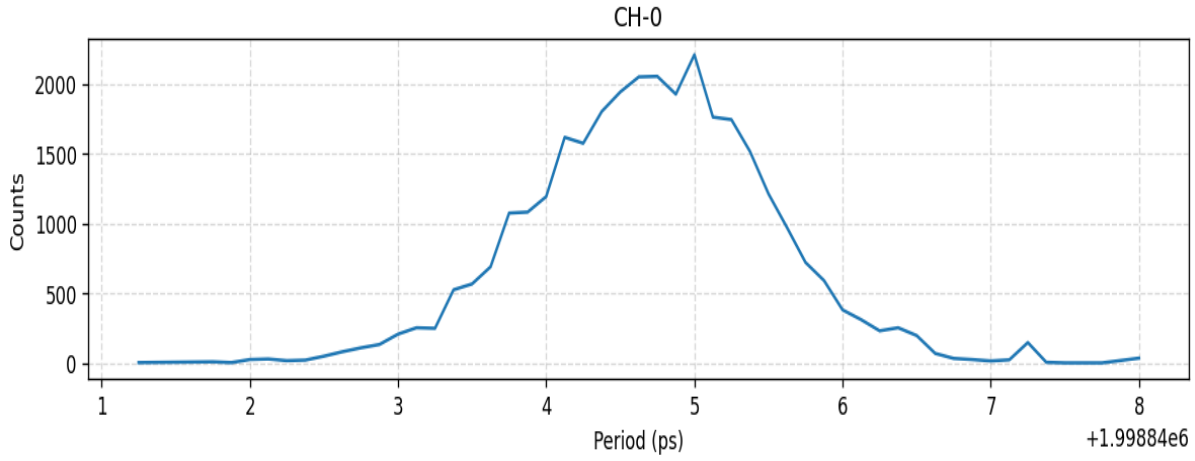

CH11
Counts
15000
12500
10000
7500
5000
2500
0
101920 101940 101960 101980 102000 102020 102040 102060
TOT (ps)



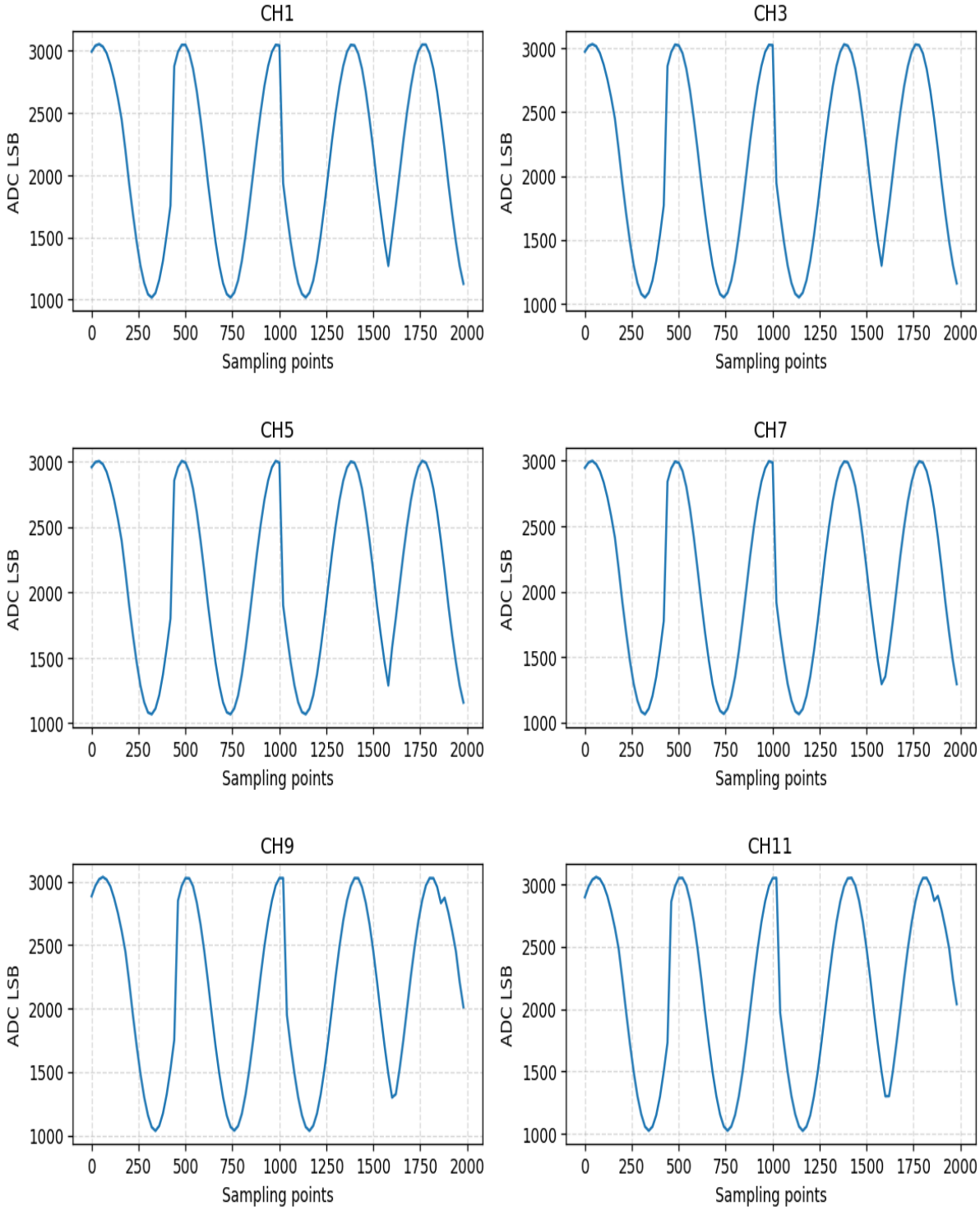
4.5 Period Performance Test(External Trigger)

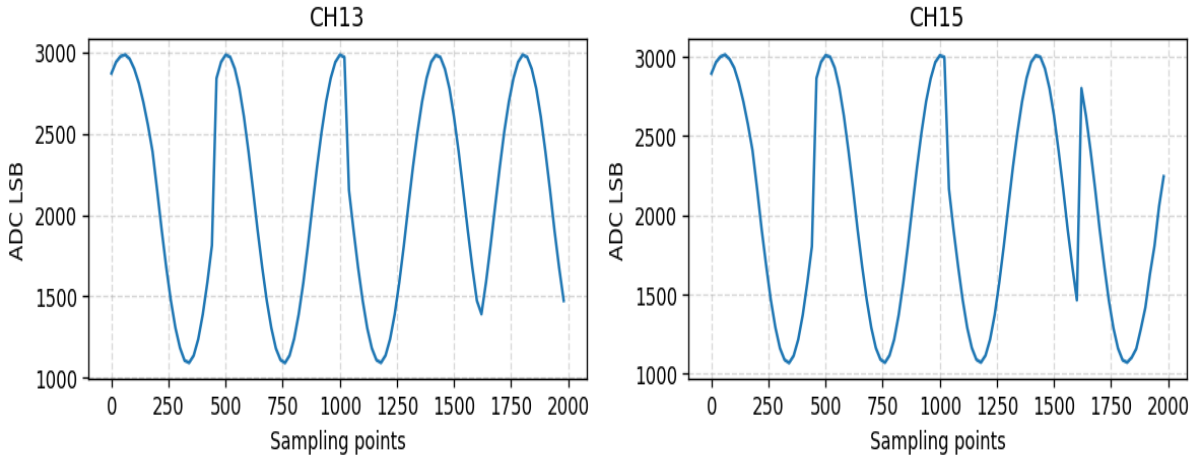
Test Result: **PASS**

Channel	Period(RMS, ps)	Mean(ns)	Result
0	6.03	1998.84	PASS

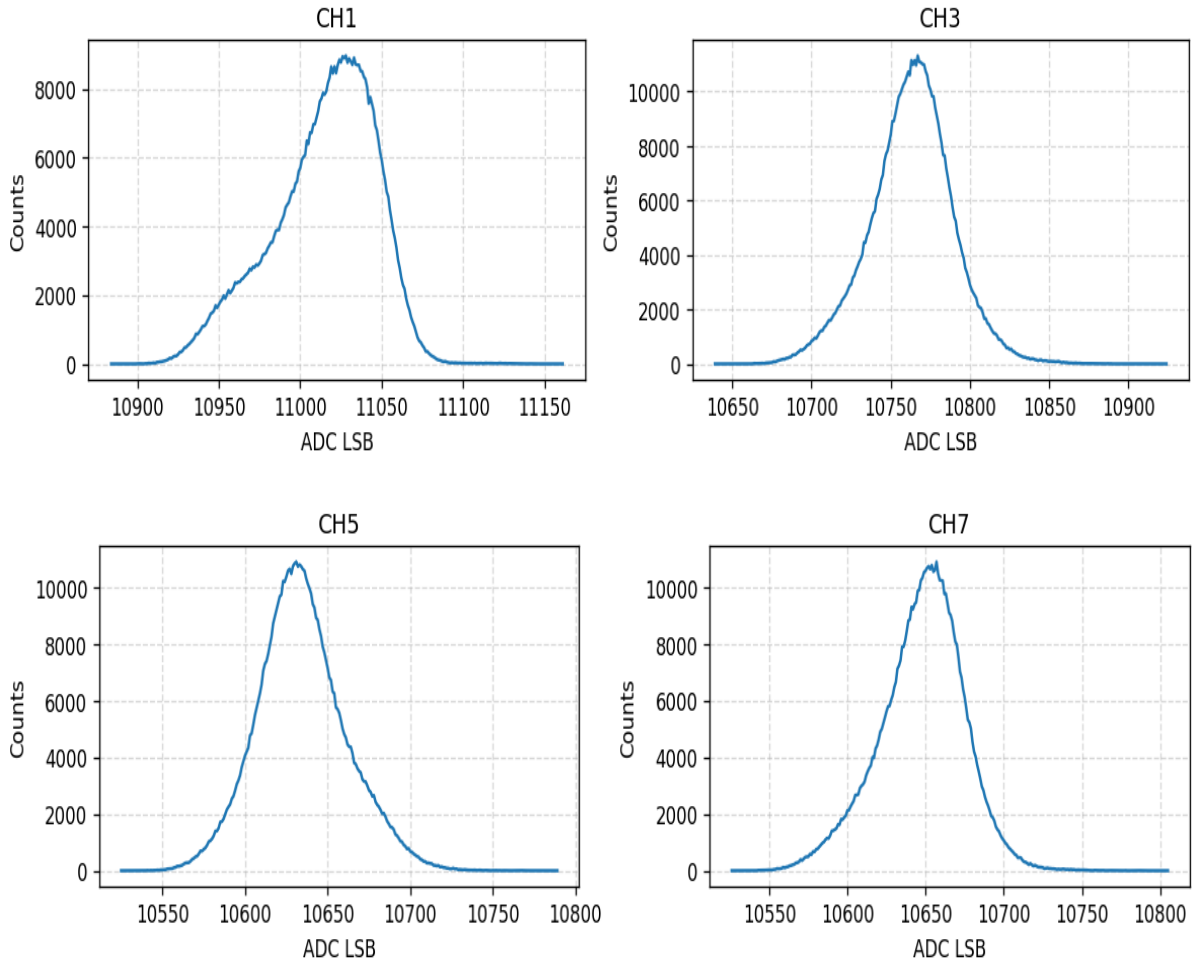


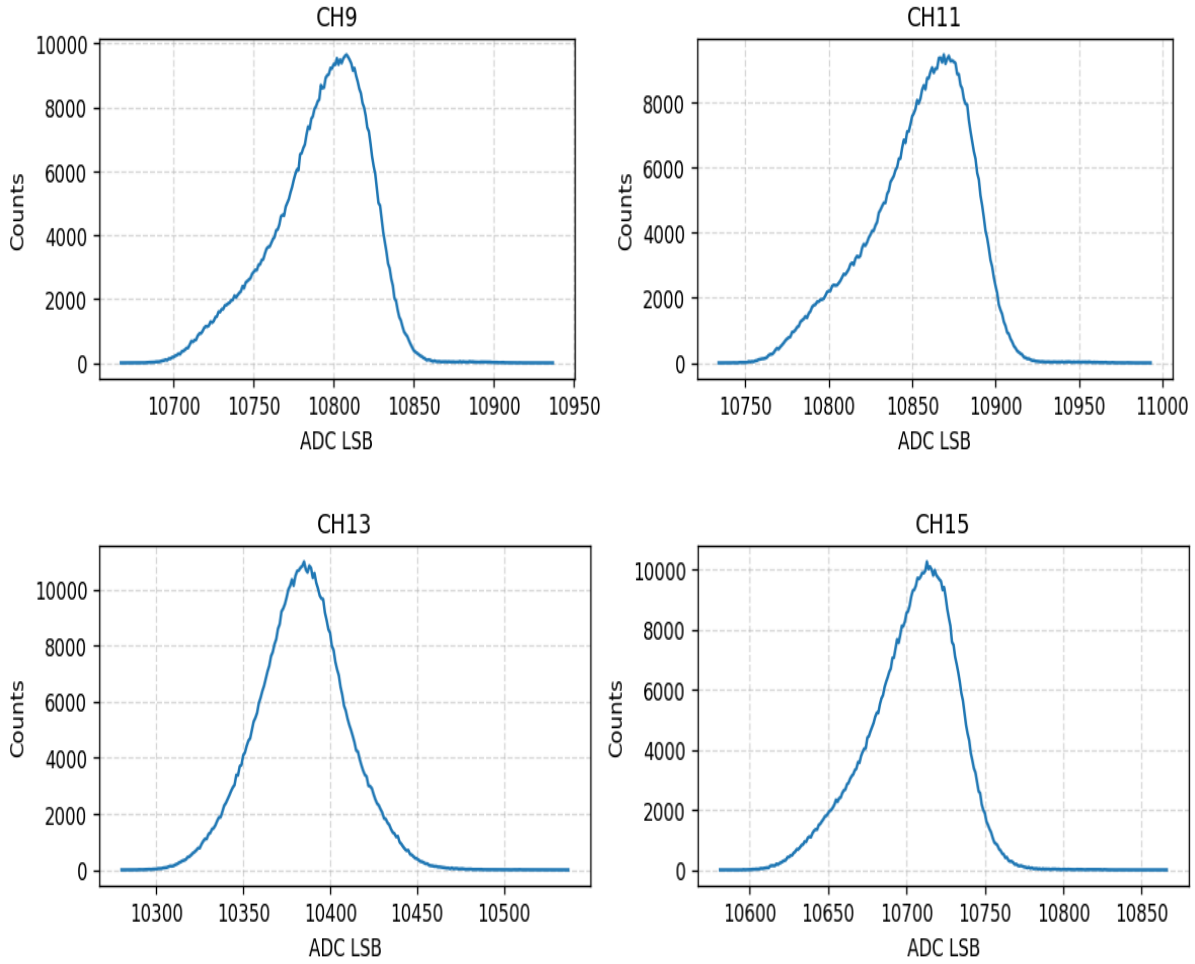
4.6 A/D Test(External Trigger)





4.7 Energy Spectrum Test(External Trigger)

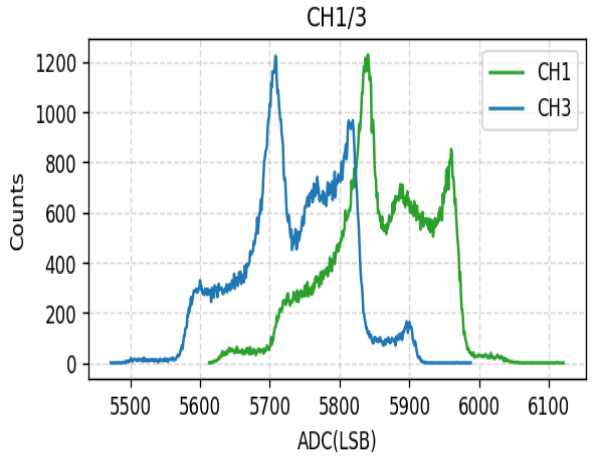


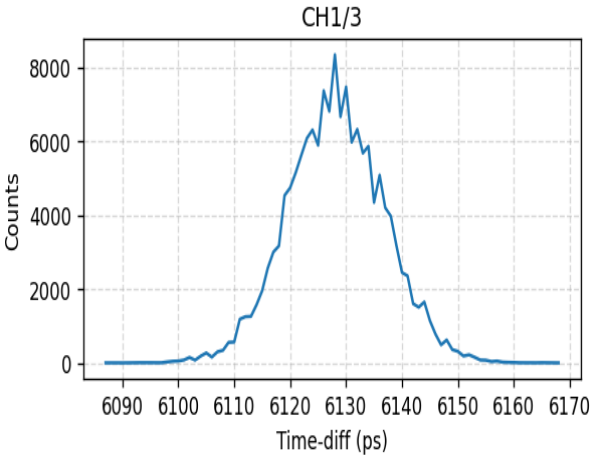


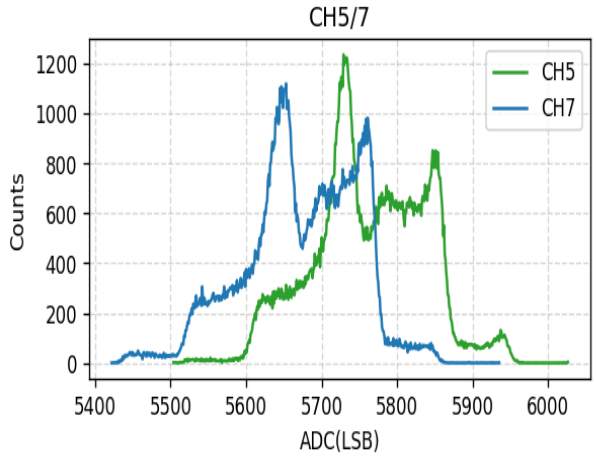
4.8 Coincidence Energy Spectrum Performance Test(External Trigger)

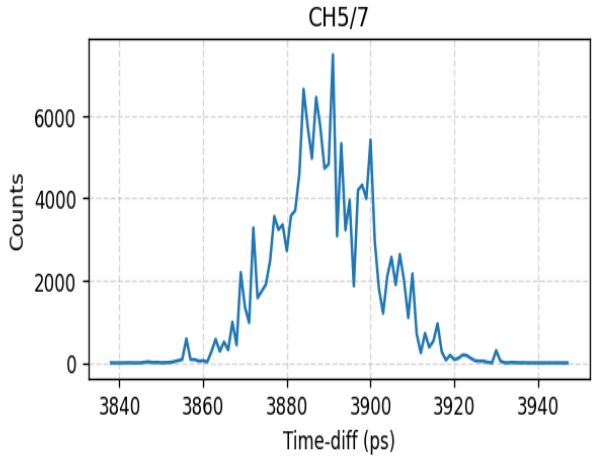
Test Result: **PASS**

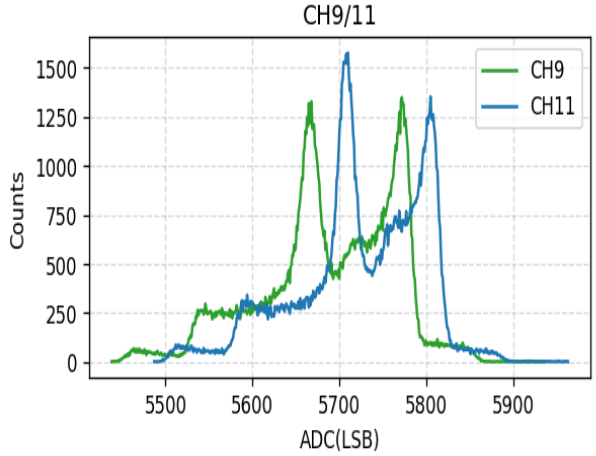
Channel Group	CRT(RMS, ps)	Result
CH1/3	8.50	PASS
CH5/7	11.64	PASS
CH9/11	9.57	PASS
CH13/15	8.03	PASS

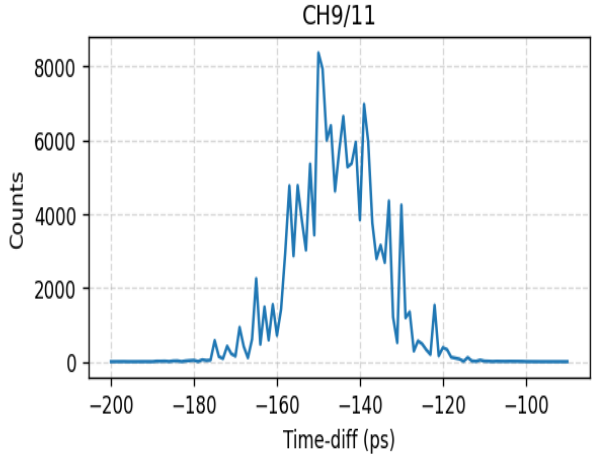

CH1/3
CH1
CH3
Counts
ADC(LSB)

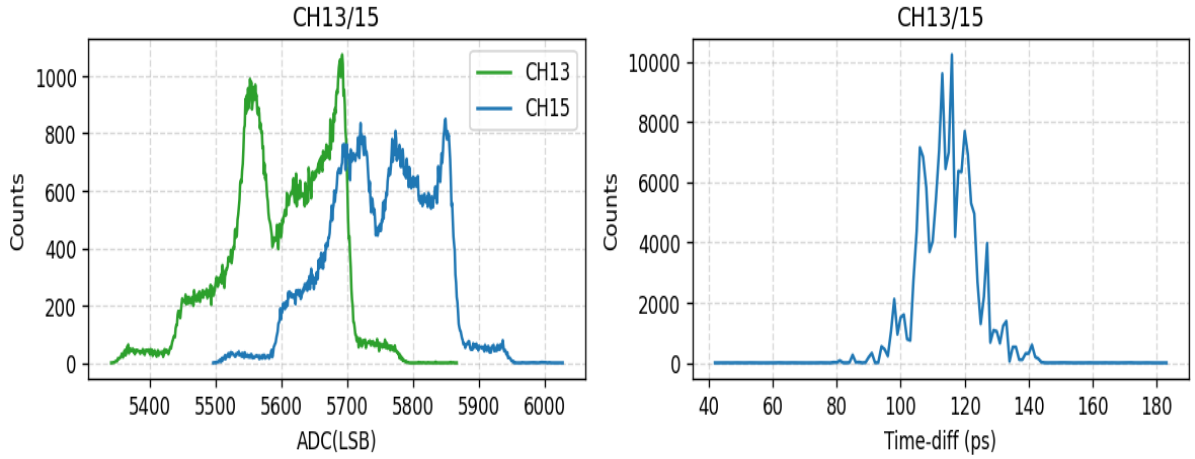

CH1/3
Counts
Time-diff (ps)


CH5/7
CH5
CH7
Counts
ADC(LSB)


CH5/7
Counts
Time-diff (ps)


CH9/11
CH9
CH11
Counts
ADC(LSB)

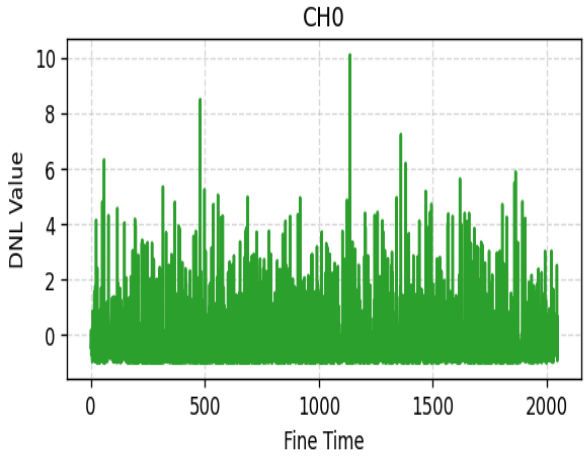

CH9/11
Counts
Time-diff (ps)

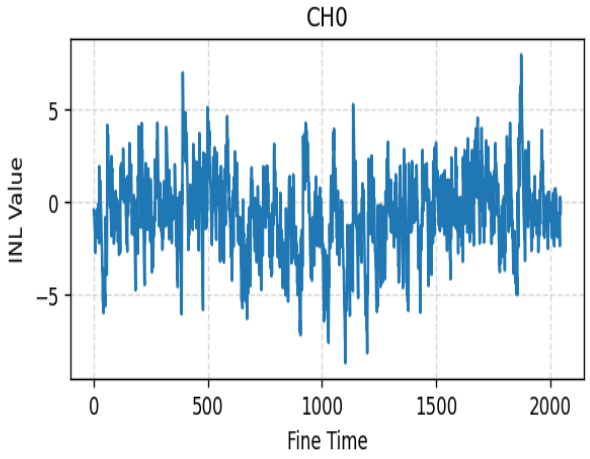


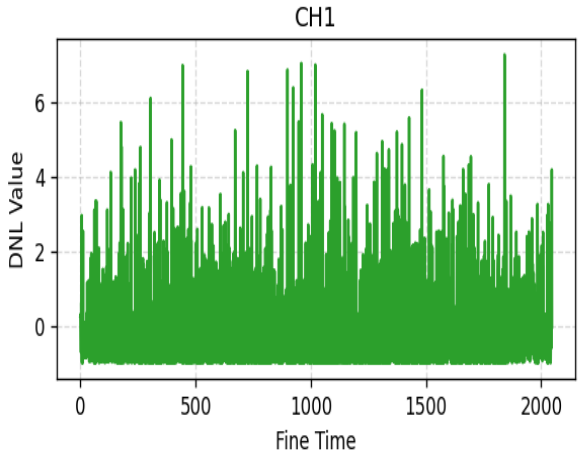
4.9 TDC Nonlinearity Performance Test(External Trigger)

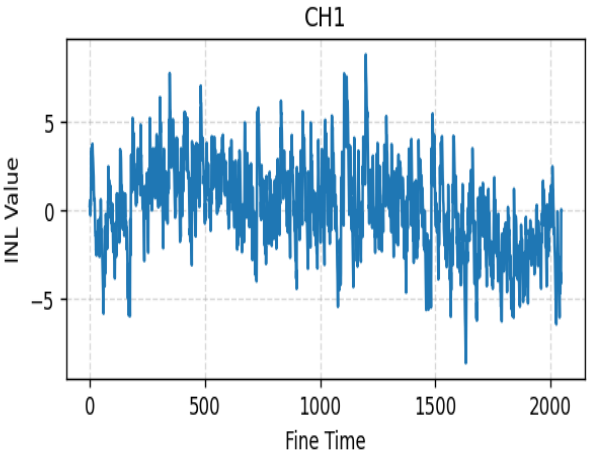
Test Result: **PASS**

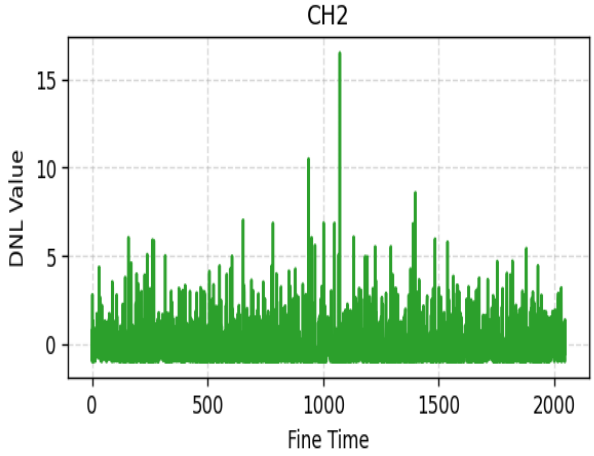
Channel	DNL(LSB)	INL(LSB)	Result
CH0	-1.00~10.10	-8.70~7.97	PASS
CH1	-1.00~7.26	-8.63~8.79	PASS
CH2	-1.00~16.51	-7.46~13.41	PASS
CH3	-1.00~11.36	-5.46~17.39	PASS
CH4	-1.00~34.45	-29.41~21.37	PASS
CH5	-1.00~22.21	-13.92~16.57	PASS
CH6	-1.00~31.75	-20.60~15.98	PASS
CH7	-1.00~30.65	-22.96~11.50	PASS
CH8	-1.00~28.23	-23.02~14.66	PASS
CH9	-1.00~27.78	-18.86~13.59	PASS
CH10	-1.00~35.14	-21.43~17.53	PASS
CH11	-1.00~25.18	-22.02~10.36	PASS
CH12	-1.00~30.82	-23.79~18.83	PASS
CH13	-1.00~26.34	-15.74~18.26	PASS
CH14	-1.00~21.73	-14.09~16.25	PASS
CH15	-1.00~31.59	-22.31~17.02	PASS

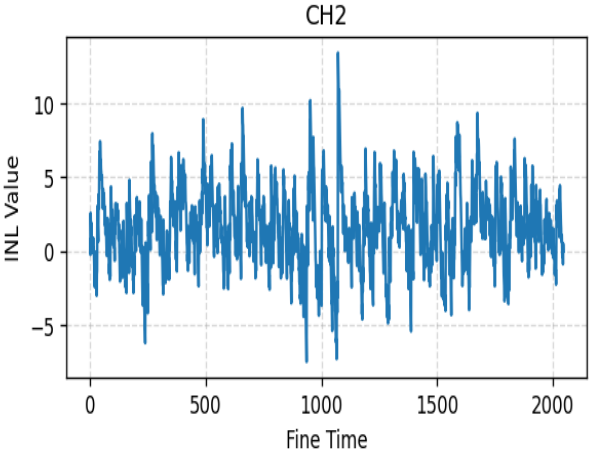

CH0
DNL Value
Fine Time

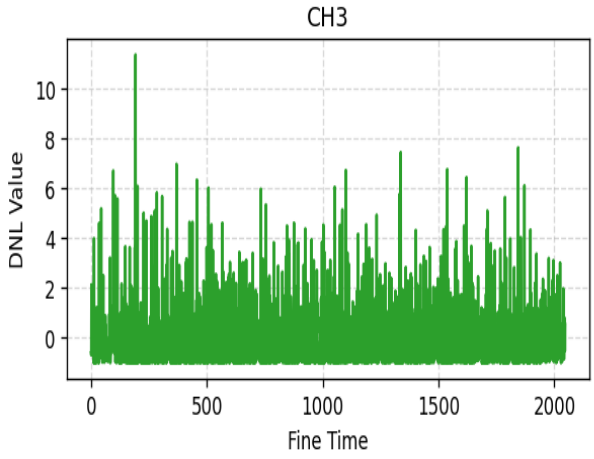

CH0
INL Value
Fine Time

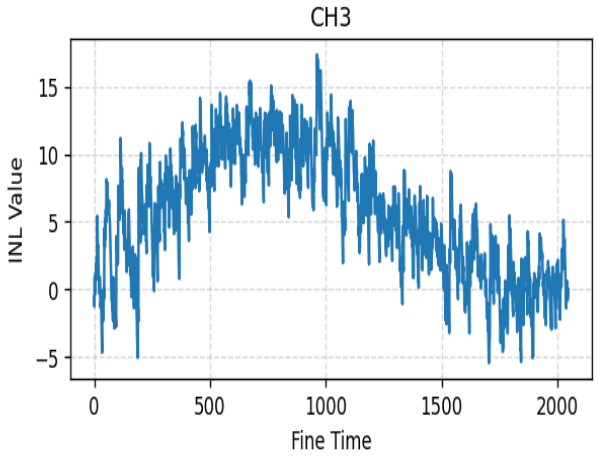

CH1
DNL Value
Fine Time

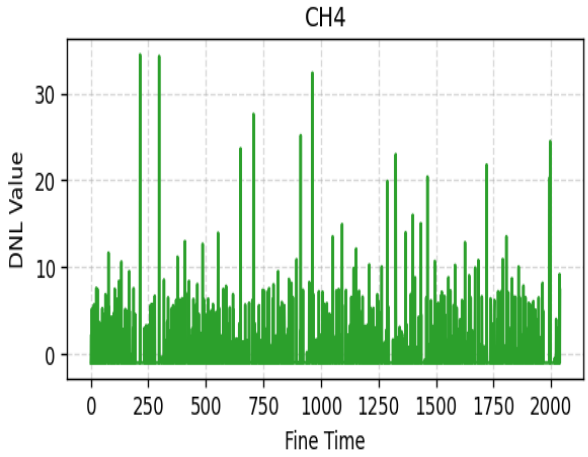

CH1
INL Value
Fine Time

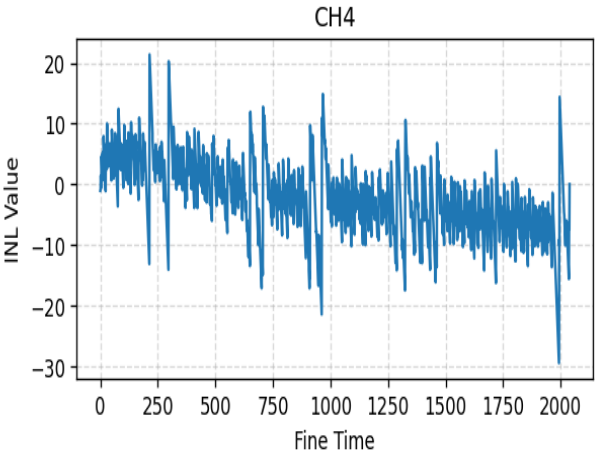

CH2
DNL Value
Fine Time

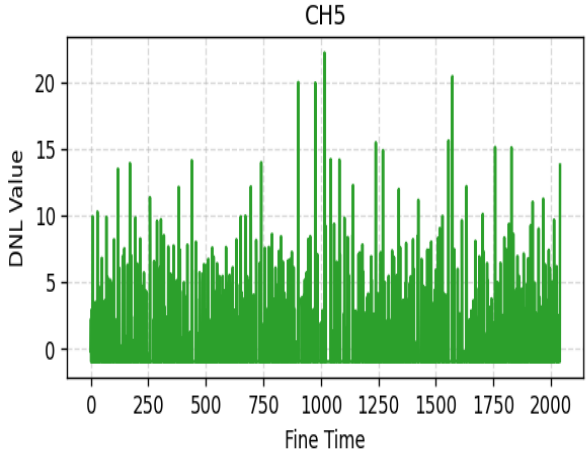

CH2
INL Value
Fine Time

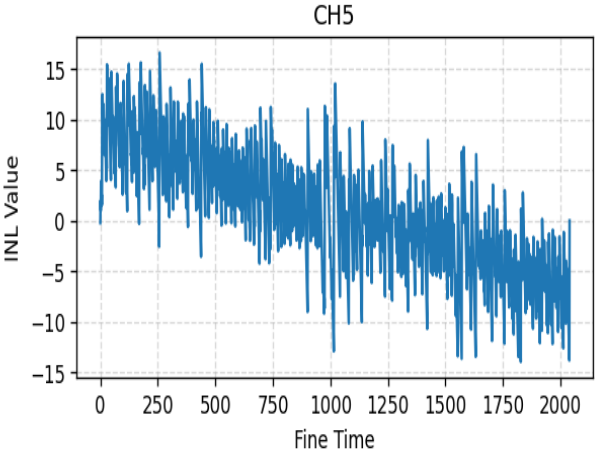

CH3
DNL Value
Fine Time

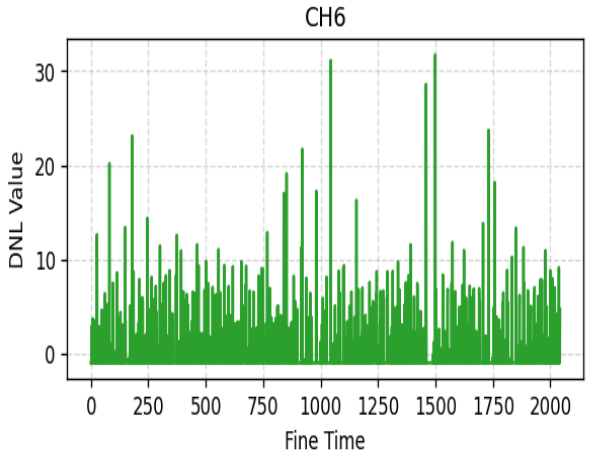

CH3
INL Value
Fine Time

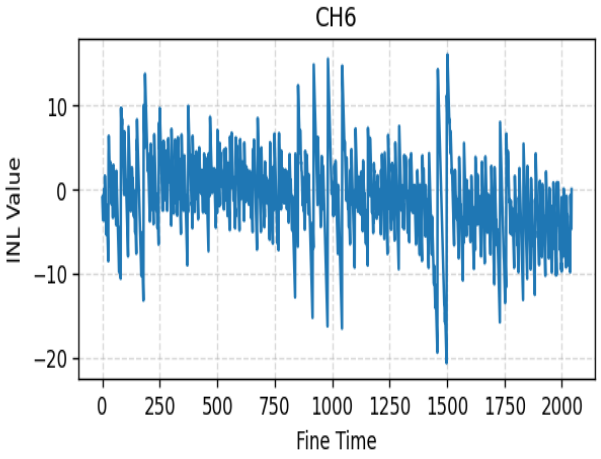

CH4
DNL Value
Fine Time

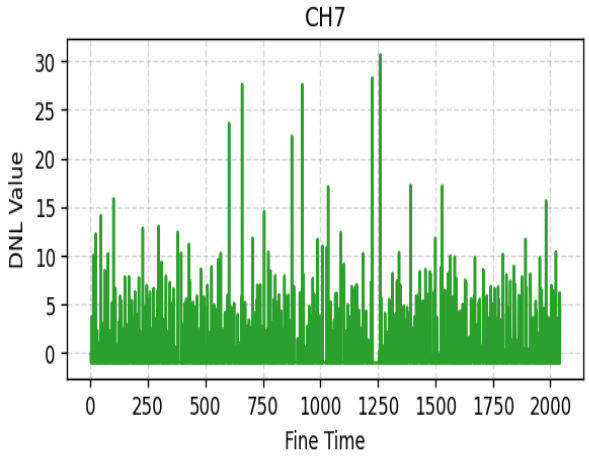

CH4
INL Value
Fine Time

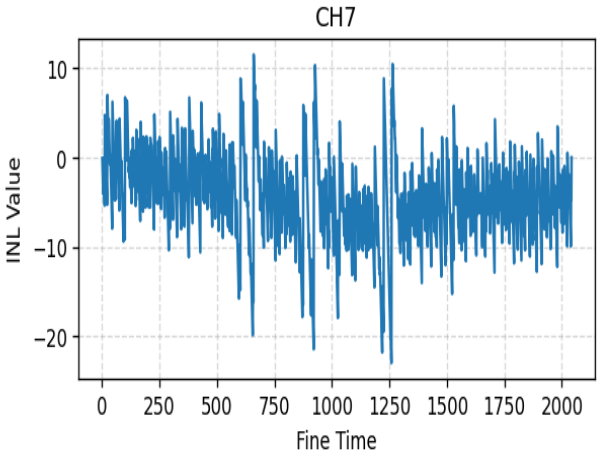

CH5
DNL Value
Fine Time

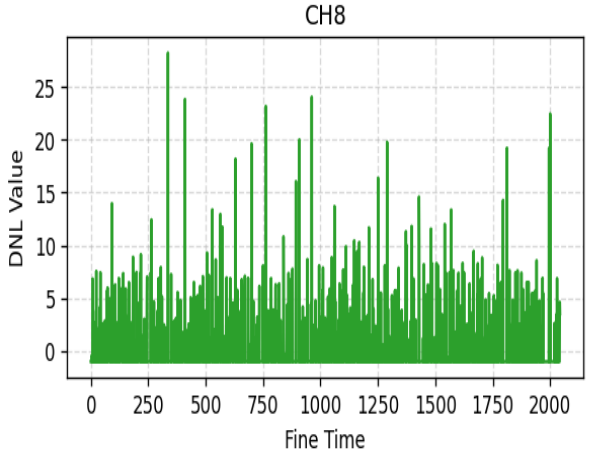

CH5
INL Value
Fine Time

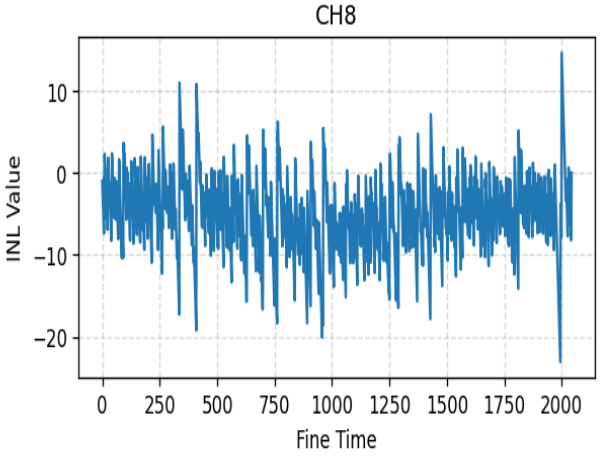

CH6
DNL Value
Fine Time

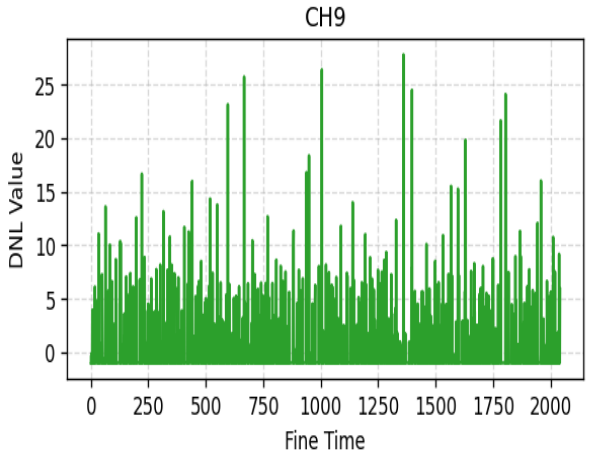

CH6
INL Value
Fine Time

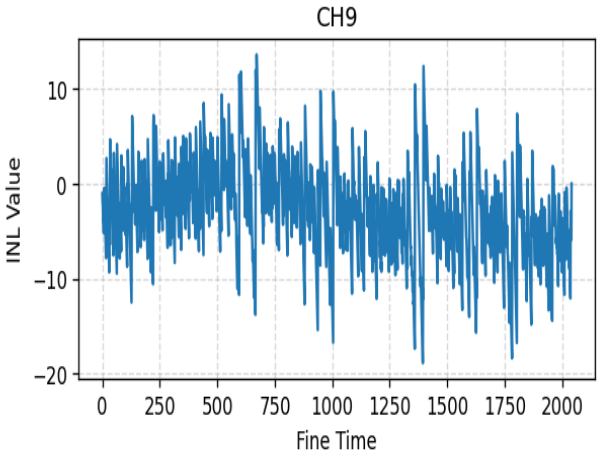

CH7
DNL Value
Fine Time

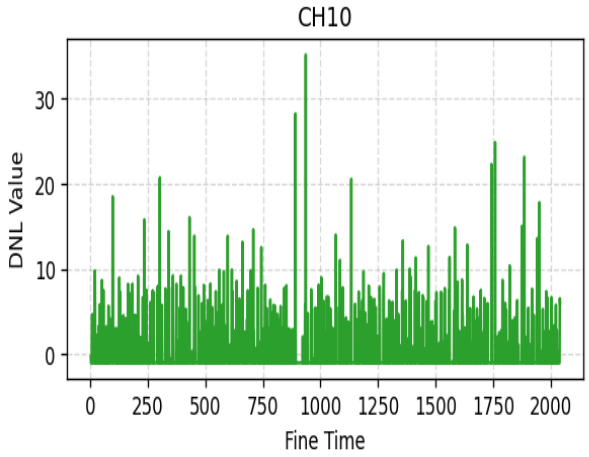

CH7
INL Value
Fine Time

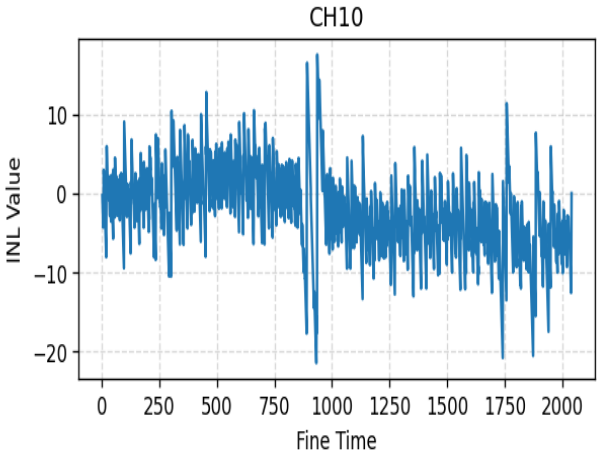

CH8
DNL Value
Fine Time

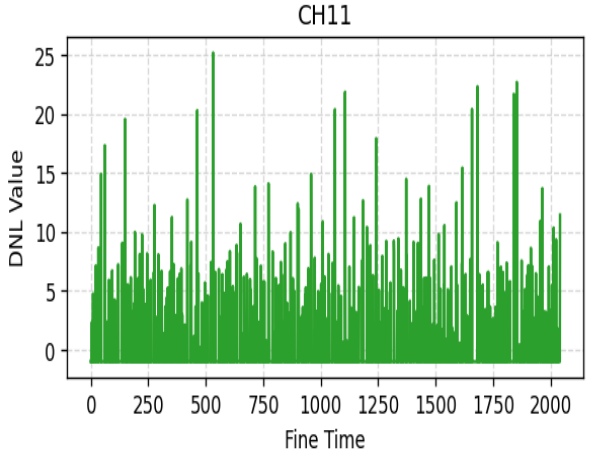

CH8
INL Value
Fine Time

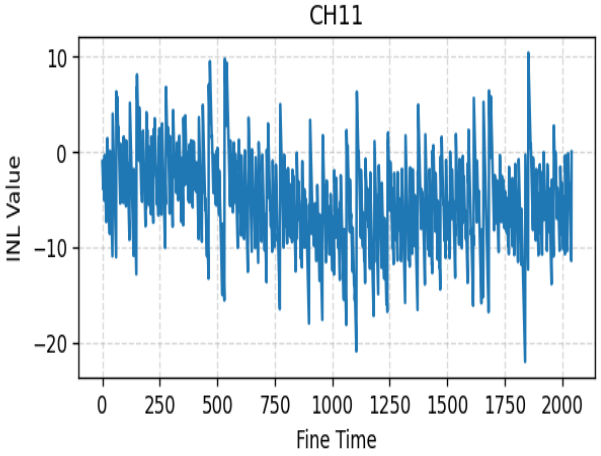

CH9
DNL Value
Fine Time

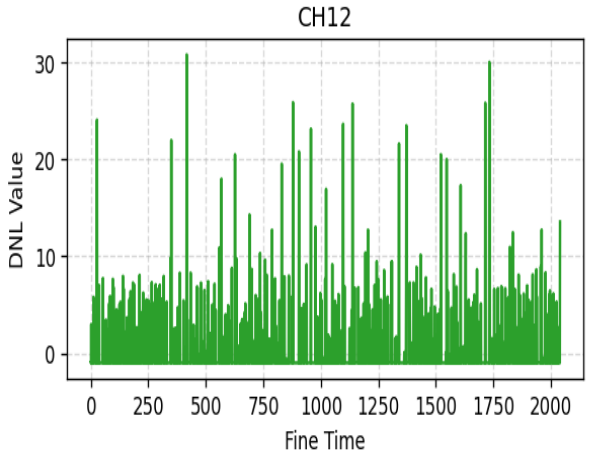

CH9
INL Value
Fine Time

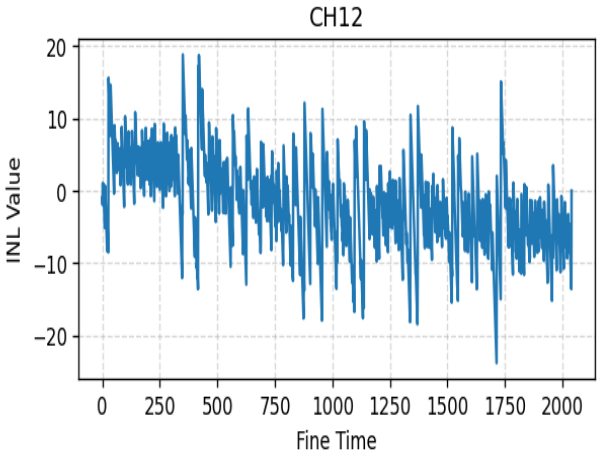

CH10
DNL Value
Fine Time

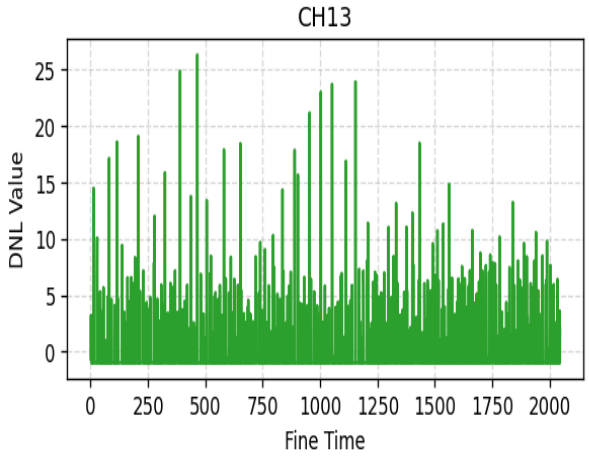

CH10
INL Value
Fine Time

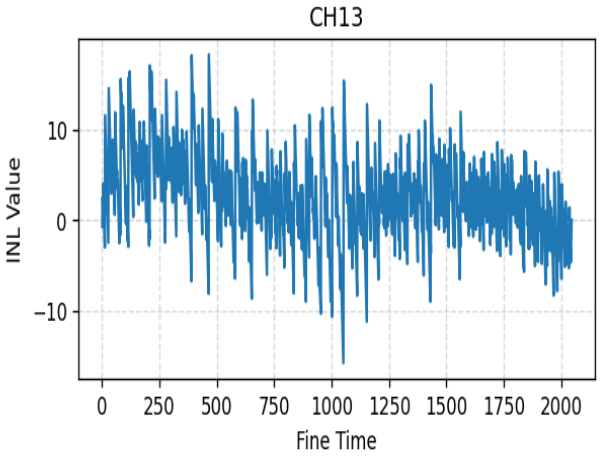

CH11
DNL Value
Fine Time

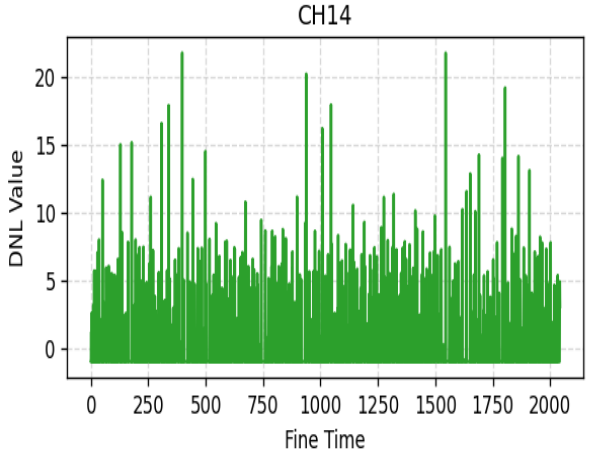

CH11
INL Value
Fine Time

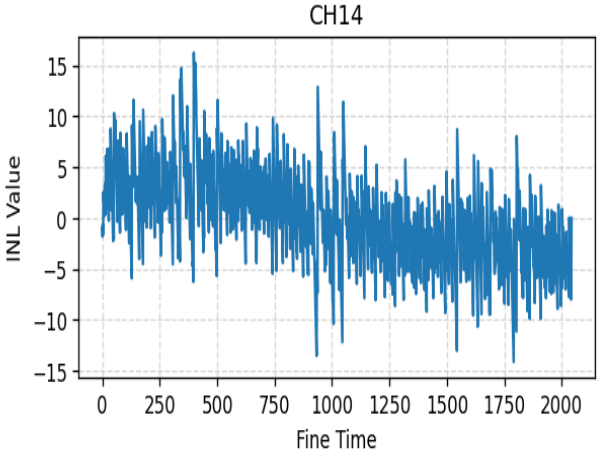

CH12
DNL Value
Fine Time

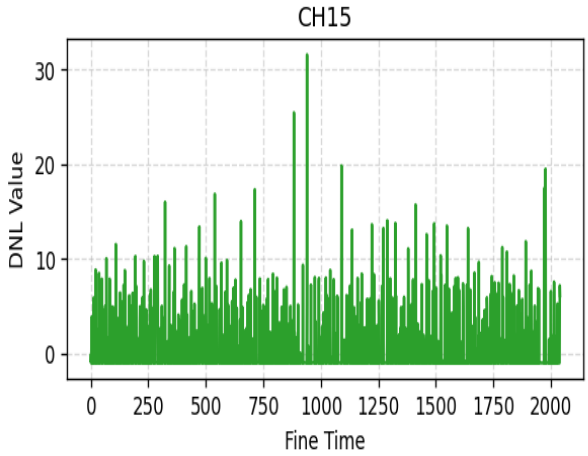

CH12
INL Value
Fine Time

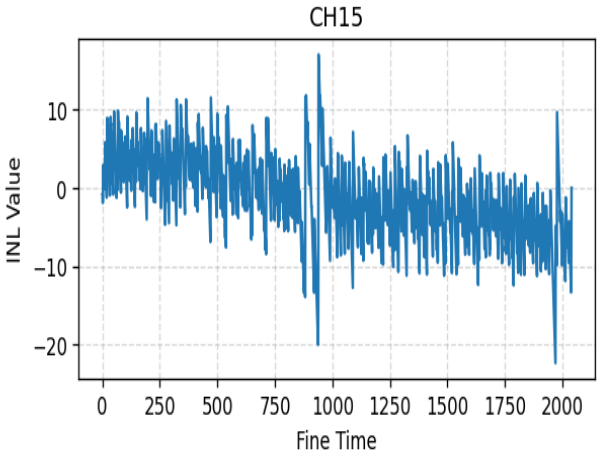

CH13
DNL Value
Fine Time


CH13
INL Value
Fine Time


CH14
DNL Value
Fine Time


CH14
INL Value
Fine Time


CH15
DNL Value
30
20
10
0
0
250
500
750
1000
1250
1500
1750
2000
Fine Time


CH15
INL Value
10
0
−10
−20
0
250
500
750
1000
1250
1500
1750
2000
Fine Time

5. 1G Network Interface Test

Connect Status: **SUCCESS**

5.1 1G Network Self-check Test

Test Result: **PASS**

5.2 1G Network Basic Test

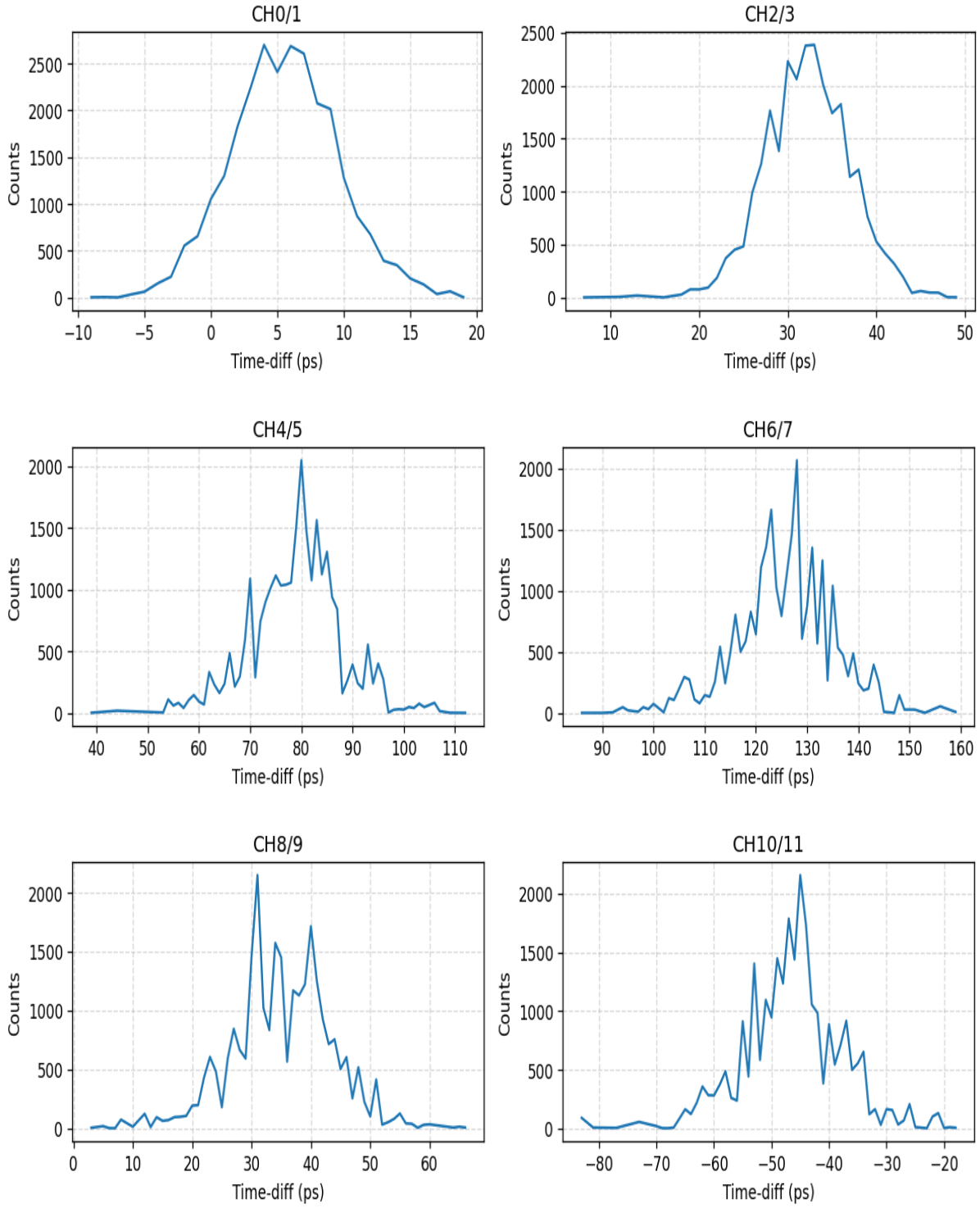
Test Result: **PASS**

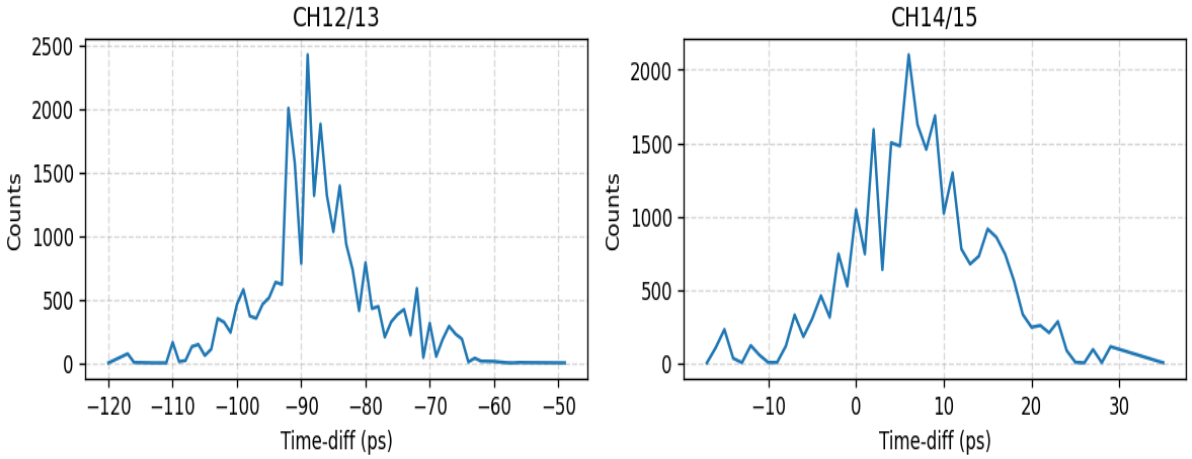
Test Item	Result
Change Board Id	PASS
Change 1G IP	PASS
Change 1G Netport	PASS
Change 10G IP	PASS
Change 10G Netport	PASS
TDC Resetn	PASS
System Resetn	PASS

5.3 1G Network CRT Performance Test(Internal Trigger)

Test Result: **PASS**

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH0/1	3.92	5.46	PASS
CH2/3	4.65	32.23	PASS
CH4/5	7.19	79.48	PASS
CH6/7	8.18	126.04	PASS
CH8/9	7.91	35.35	PASS
CH10/11	6.96	-46.31	PASS
CH12/13	6.11	-88.10	PASS
CH14/15	6.81	7.02	PASS


CH0/1
Counts
Time-diff (ps)
CH2/3
Counts
Time-diff (ps)
CH4/5
Counts
Time-diff (ps)
CH6/7
Counts
Time-diff (ps)
CH8/9
Counts
Time-diff (ps)
CH10/11
Counts
Time-diff (ps)


CH12/13
Counts
Time-diff (ps)
CH14/15
Counts
Time-diff (ps)

6. 10G Network Interface Test

Connect Status: **SUCCESS**

6.1 10G Network Self-check Test

Test Result: **PASS**

6.2 10G Network Basic Test

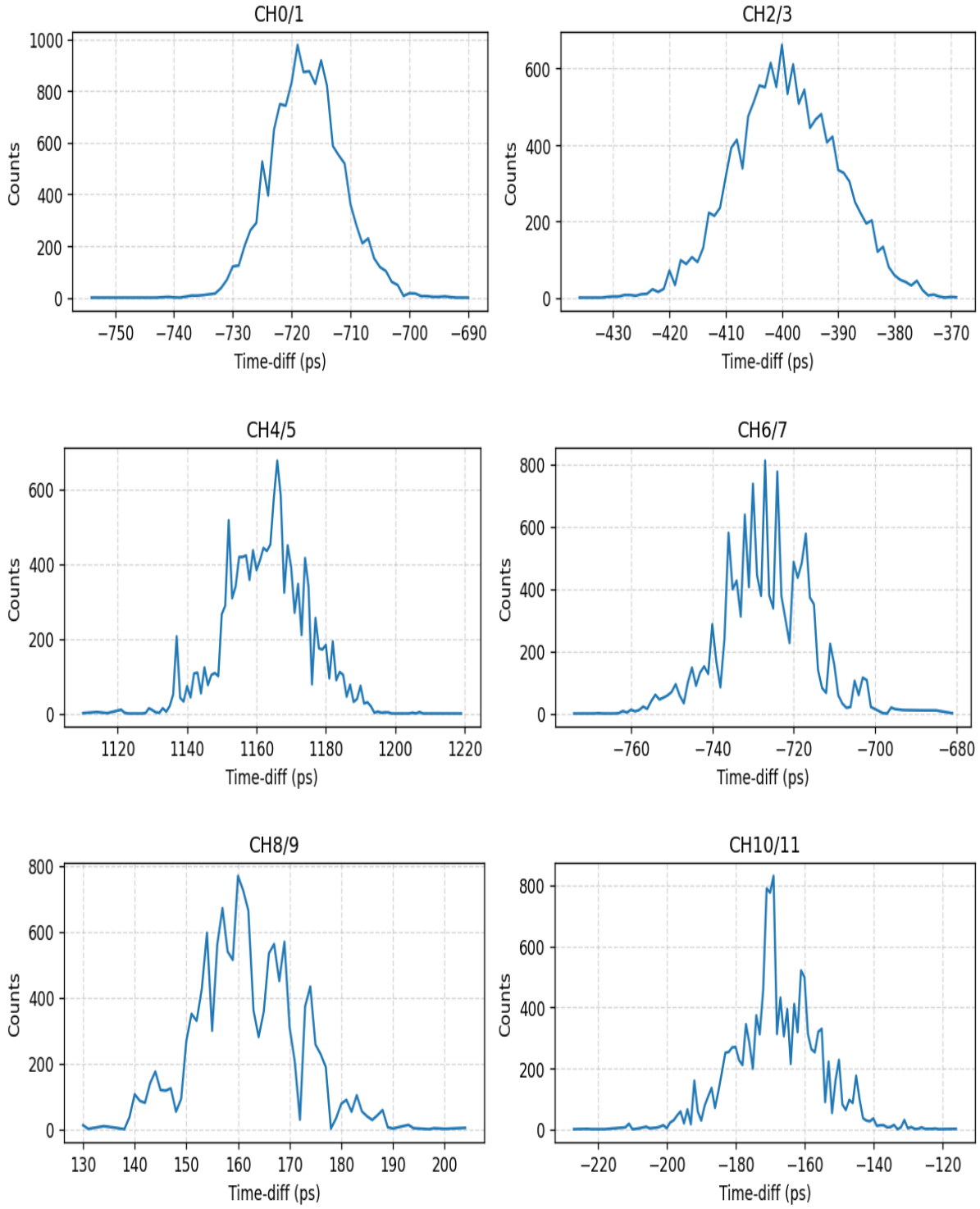
Test Result: **PASS**

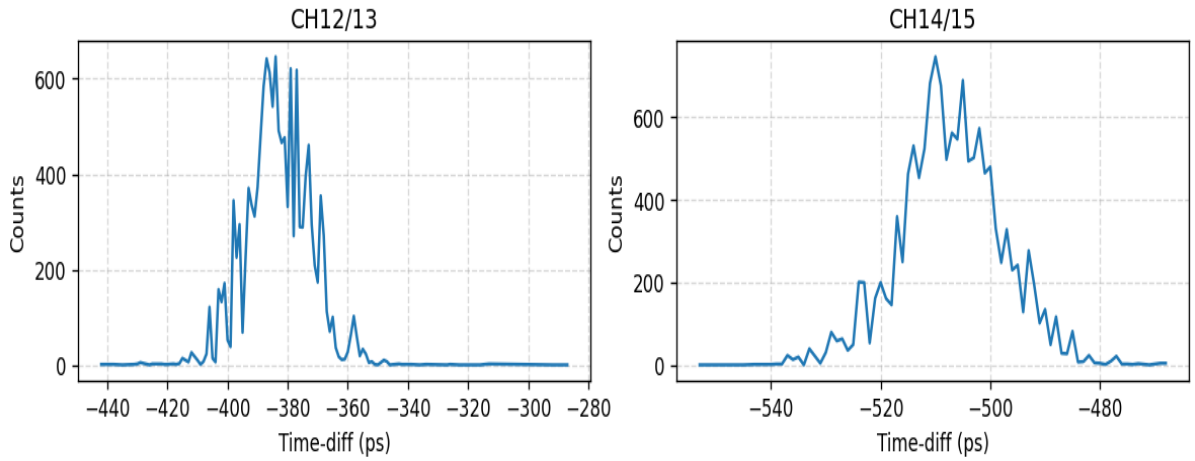
Test Item	Result
Change Board Id	PASS
Change 1G IP	PASS
Change 1G Netport	PASS
Change 10G IP	PASS
Change 10G Netport	PASS
TDC Resetn	PASS
System Resetn	PASS

6.3 10G Network CRT Performance Test(External Trigger)

Test Result: **PASS**

Channel Group	CRT(RMS, ps)	Mean(ps)	Result
CH0/1	5.91	-717.67	PASS
CH2/3	9.34	-399.35	PASS
CH4/5	11.12	1163.25	PASS
CH6/7	10.05	-726.72	PASS
CH8/9	9.30	161.12	PASS
CH10/11	11.15	-168.02	PASS
CH12/13	9.99	-383.24	PASS
CH14/15	8.62	-507.25	PASS

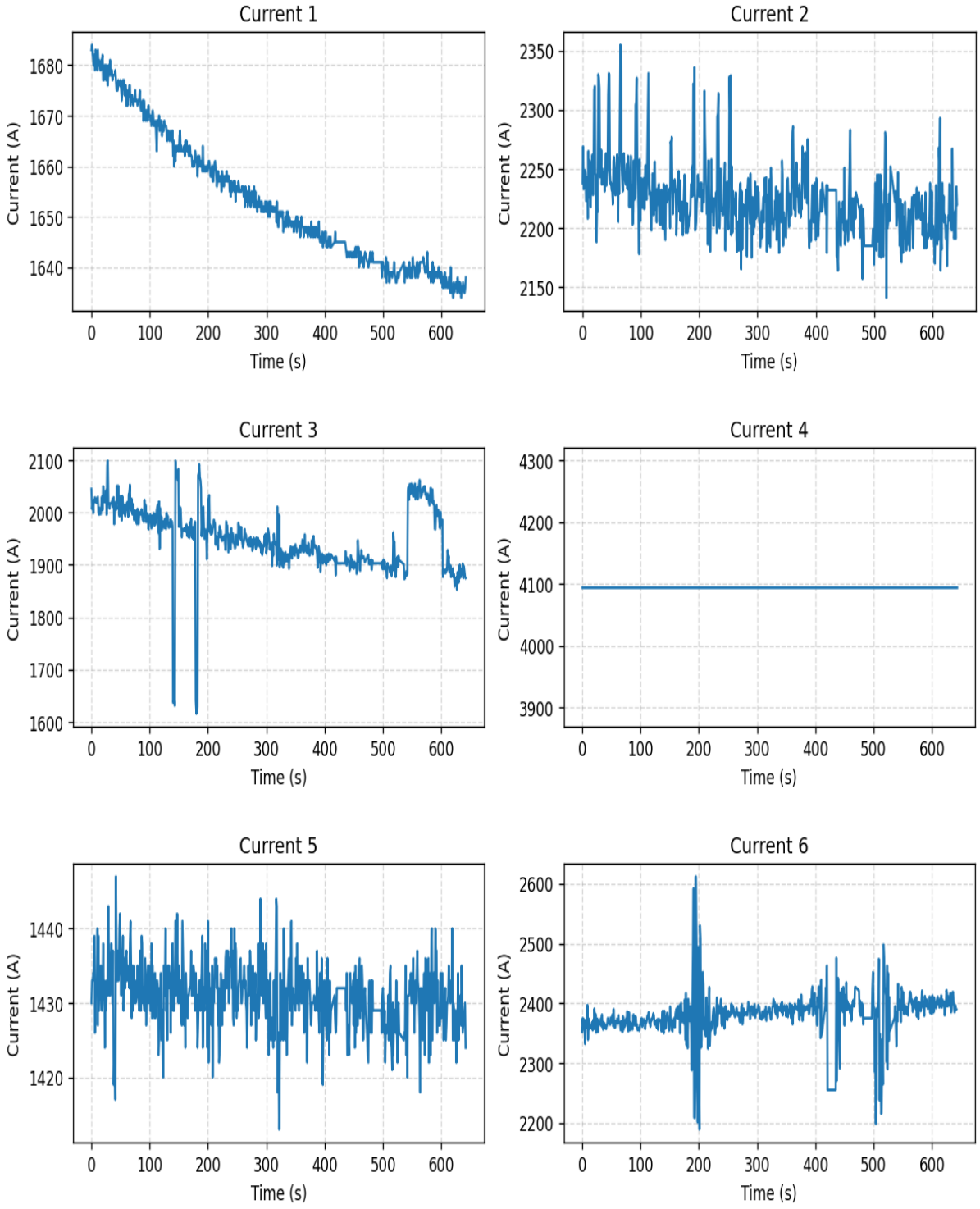

CH0/1
Counts
Time-diff (ps)
CH2/3
Counts
Time-diff (ps)
CH4/5
Counts
Time-diff (ps)
CH6/7
Counts
Time-diff (ps)
CH8/9
Counts
Time-diff (ps)
CH10/11
Counts
Time-diff (ps)

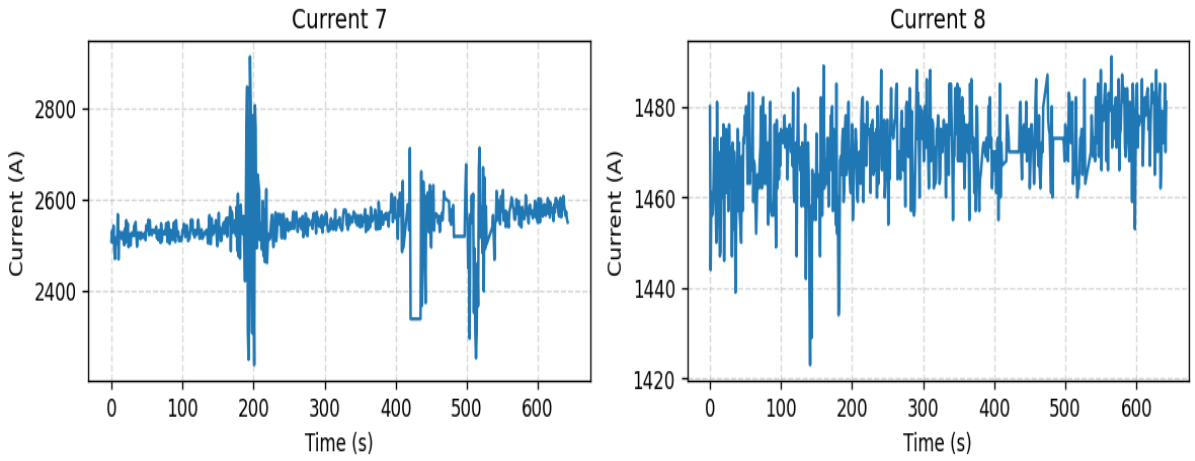

CH12/13
Counts
600
400
200
0
−440 −420 −400 −380 −360 −340 −320 −300 −280
Time-diff (ps)
CH14/15
Counts
600
400
200
0
−540 −520 −500 −480
Time-diff (ps)

7. Device Status Monitoring Result

Power Consumption: 22.8 W

7.1 Channel Current Monitoring (A)





7.2 FPGA Temperature Monitoring (°C)

Fan Speed: **1434**(RPM)

