CAEN SY4527 SYSTEM – EPICS Test Station Results Report

***Date**: October 17, 2019*
***Tested by**: Pablo Campero*

Tested CAEN A7030TN HV board using GECO2020 Script and Data Log Advanced Features

Procedure:

1. Wrote script in GECO 2020 to automate voltage ramp test for CAEN-A7030TN boards.
   1.1. System Advanced Features in GECO 2020 allows enhancement functionalities to create scripts.
   1.2. Script sets initial conditions/parameters, and ramps up/down 36 channels simultaneously to the set voltage. Script cycles ramp up/down 100 times holding voltage at set value and at zero per 10 seconds each cycle.
2. Installed one A7030TN HV, S/N: 297 at slot 0 (only one board at the time for the test).
3. Enabled EPICS server to monitor automated test via EPICS client.
4. Verified proper communications between CAEN EPICS Server Built-in and EPICS client
5. Table I below shows the specs/conditions for the mainframe and board tested.

Voltage Ramp Up/Down Test – System Specs	
Mainframe Model/ S/N	SY4527 /400
Board Model / S/Ns	A7030TN/297
Board Firmware Ver.	1.05
CPU model / S/N	Basic A4528/760
CPU Firmware Ver.	2.0.2
HiVoCS Ver.	1.0.5
Channel load	0 Ω
Total channels tested per board	36
Total # ramp up/down per channel and trial	100/100
Approx. time per trial	3200 s

Table I: CAEN SY4527 System specifications

6. Table II below shows the set values for the parameters by GECO 2020 script.

Parameter Name	**Description**	**Set value**
Pw	Power on/off	0/1
SVMax	Maximum voltage set	1800 V
V0Set	Set voltage	1500 V
RUp	Ramp up rate	250 V/s
RDWn	Ramp down rate	250 V/s
I0Set	Maximum current set	1000 µA
Trip	Trip time	3 s

Table II: Voltage test set parameters

7. Configured GECO 2020 data logger with desired parameters to be archived, for this test, selected parameters shown in table II (x7), *VMon, IMon* and also added ***Status*** parameter as requested.
8. Created log file by using GECO 2020 data logger advanced features.
9. Started GECO 2020 data logger recording (Click "On" button).
10. Ran *HV CAEN Voltage Ramp Test CSS-BOY* screen **only to monitor** voltage readouts during the 100 cycles.
11. Took screenshots for initial conditions displayed in GECO 2020 and EPICS/CSS-BOY screen. See attached screenshots.
12. Ran developed script in GECO 2020 to start automated test.
13. Verify that GECO script is completed successfully after the last cycle and all channels are off.
14. Saved data log files (Turn off GECO 2020 data logger).
15. Documented issues and screenshots with the results. See attached files and screenshots.

A7030TN Board [S/N: 297] Results

Note: Results for previous trials 1 to 4 were presented on 09/24/2019 report, for this trial 5, it was used the same board (S/N: 297), connected to the same mainframe at slot 0, the only difference is the *Status* parameter, which was taken into consideration for the monitoring and data analysis.

Trial #5

During the tests of the A7030TN board (S/N: 297) observed same issues and behavior as previous test mentioned in 09/04/2019 and 09/24/2019 reports.

1. All channels monitored and controlled by GECO2020 and ssh appears to be ok, while monitored EPICS PVs presented issues (100 ramps up/down completed per trial).
2. PVs associated with turn on/off status parameter ("Pw") for all 36 channels did not update while monitoring automated test with EPICS *Voltage Ramp Test –CSS-BOY screen*
3. Found discrepancy between GECO 2020/ssh and EPICS PVs for *Pw* parameter disappear after CSS-BOY screen is refreshed or "*camonitor"* EPICS commands is re-executed.
   3.1. Noticed that only this *Pw* PV has this issue. The rest of the monitored PVs (Vmon, Vmax, IMon, etc) during the test did not fail when "*camonitor"* EPICS command was executed once in the Host PC (EPICS client). The EPICS command "*camonitor"* is used to show/print continuously value updates for PVs at any change.
   3.2. Able to see correct *Pw* PV updated values when EPICS "*caget" command* is executed once.

4. None of the set channel's parameters changed randomly, as occurred during the previous test when more than one board was connected in the mainframe.

Latency Issues:

1. After GECO 2020 data logged analysis for channel 11 within a period between 14:02:34 and 14:03:08 (one ramp up/down cycle), found the following issues/findings:
   1.1. *HV CAEN – Voltage Ramp Test CSS BOY screen* and GECO 2020 data log plotted matched. See fig.1 and fig.2.
   1.2. Fig.1 shows how channel 11 was recovered by itself in the next cycle and ramped up with no issues along with the other channels.
   1.3. Plotting all channels from the data log file generated by GECO 2020 in the mentioned period found that, the rest 35 channels ramped up with no issues after *Pw* parameter was set 1, within the 1 s. Fig.3 show a zoom-in view for all 36 channels right at ramp up time.
   1.4. Channel 11 ramped up to set voltage ~ 9 s later with respect to the other 35 channels.
   1.5. *Pw* parameter was set to 1 (turn on channel) but ch_11 did not ramp to the set voltage. *Status* parameter confirmed same behavior. table III, Fig.4 and Fig.5.
   1.6. Comparison table IV and plot between Ch_11(Faulty channel) and Ch_12 (randomly correct channel selected) in Fig. 5 shows the relation between VMon, and Status/Pw parameters.
   1.7. Comparing the *Status* with the *Pw* parameters, noticed that for all channel that ramped up in time (all except 11), the *Status* parameter changed from on (1) to ramp up (3) within the 2 s.
   1.8. Attached table, pictures and data log file (297-*Trial 5/AllChannels-Plot.pdf* located at https://userweb.jlab.org/~campero/) shows more details of found issues.
   1.9. Behavior mentioned in all-above points seems to happen for all failed channels during test.

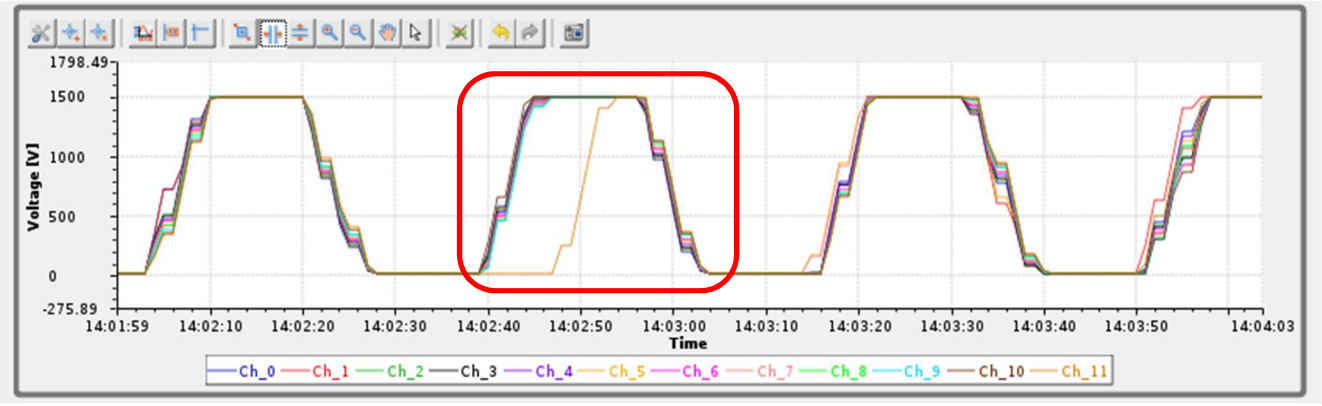

Fig.1. – *HV CAEN – Voltage Ramp Test CSS BOY* screen shows channel 11 latency to ramp up

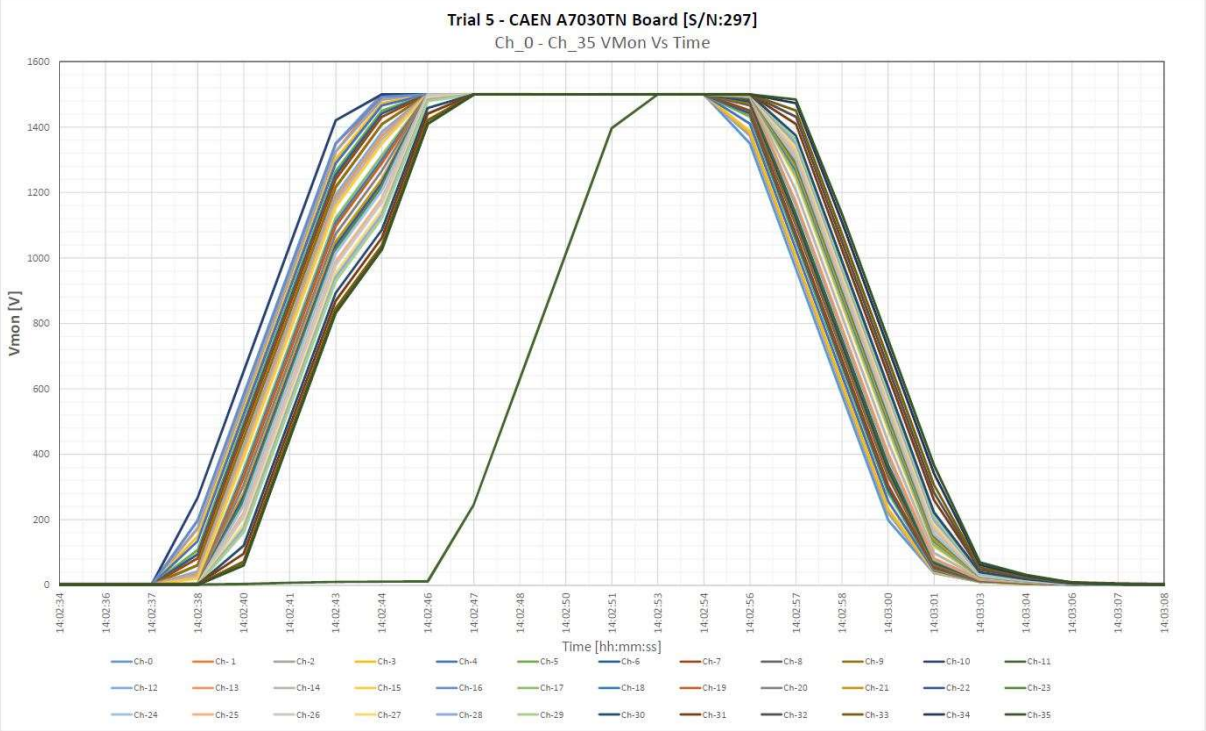

Fig.2. – Plot from GECO 2020 data logged shows the same latency to ramp up for channel 11 shown by *HV CAEN – Voltage Ramp Test CSS BOY* screen

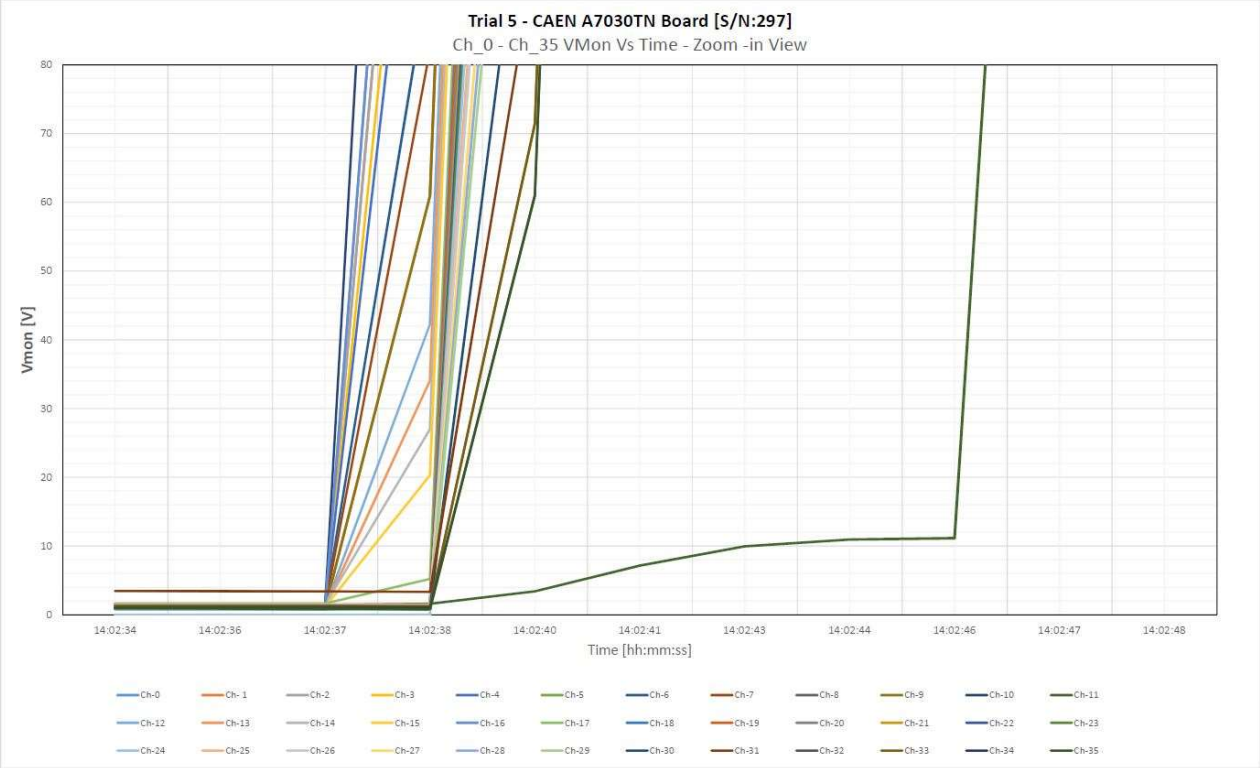

Fig.3. – GECO 2020 data logged plot shows all 36 channel zoom in view at the ramp up time. Notice that ch_11 ramped only to from 0 to 12 V after of *Pw* was set to 1, this is not a proper behavior for ch_11 since voltage ramp up value was set to 250 V/s. Ch_11 started ramping with correct set value after 9 s.

Ch_11 - *VMon, Pw* and *Status* Parameters			
Time	**Vmon**	**Pw**	**Status**
hh:mm:ss	**[V]**	**[On/Off]**	
14:02:34	1.44	0	0
14:02:36	1.42	0	0
14:02:37	1.4	1	1
14:02:38	1.6	1	1
14:02:40	3.4	1	1
14:02:41	7.16	1	1
14:02:43	9.92	1	1
14:02:44	10.92	1	1
14:02:46	11.14	1	3
14:02:47	245.79	1	3
14:02:48	629.58	1	3
14:02:50	1013.26	1	3
14:02:51	1396.68	1	3
14:02:53	1499.86	1	3
14:02:54	1499.84	1	3
14:02:55	1499.84	0	3
14:02:56	1484.12	0	5
14:02:57	1134.48	0	5
14:02:58	750.89	0	5
14:03:00	367.12	0	5
14:03:01	71.52	0	5
14:03:03	16.59	0	5
14:03:04	8.85	0	5
14:03:06	3.27	0	5
14:03:07	1.78	0	5
14:03:08	1.44	0	0
Status :	0 = Off 1 = On 3 = Ramp Up 5 = Ramp Down		
Orange Fill :	Value did not change		

Table III— Channel 11 *VMon*, *Pw* and *Status* Parameters from GECO 2020 data logged analysis

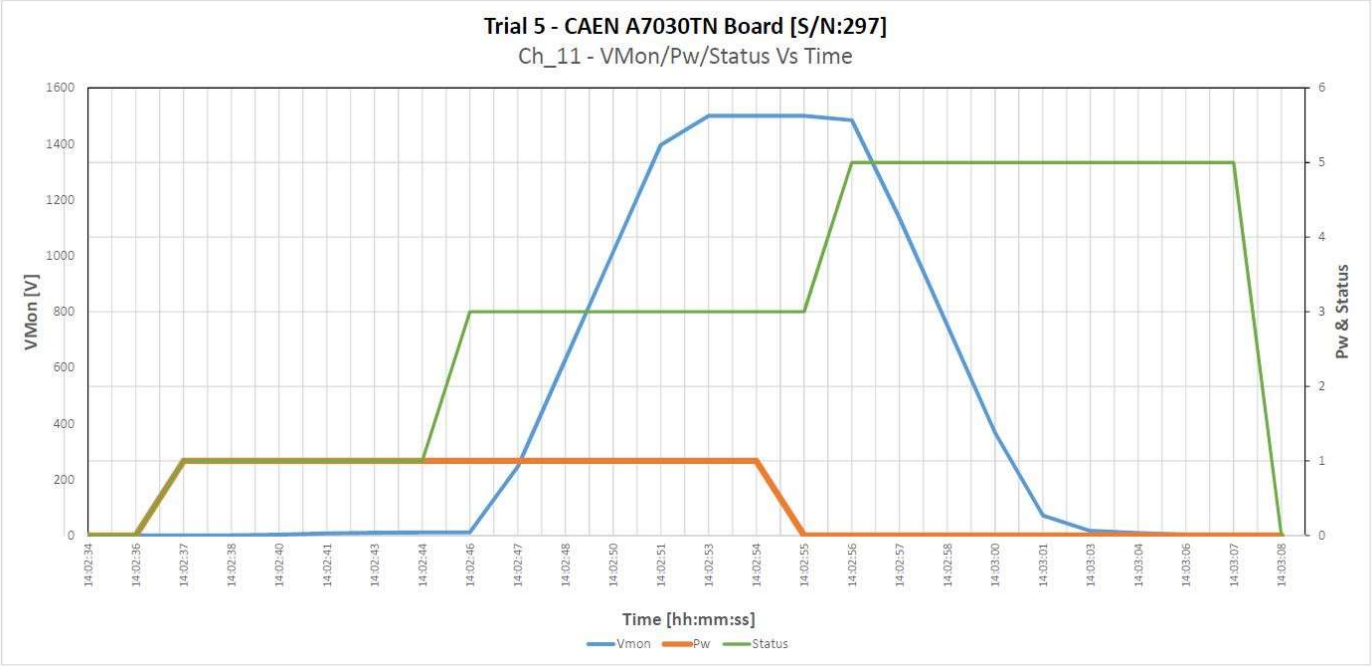

Fig.4. – GECO 2020 data logged plot show the relation between *VMon, Pw* and *Status* parameter during a ramp up/down cycle when latency incident was present

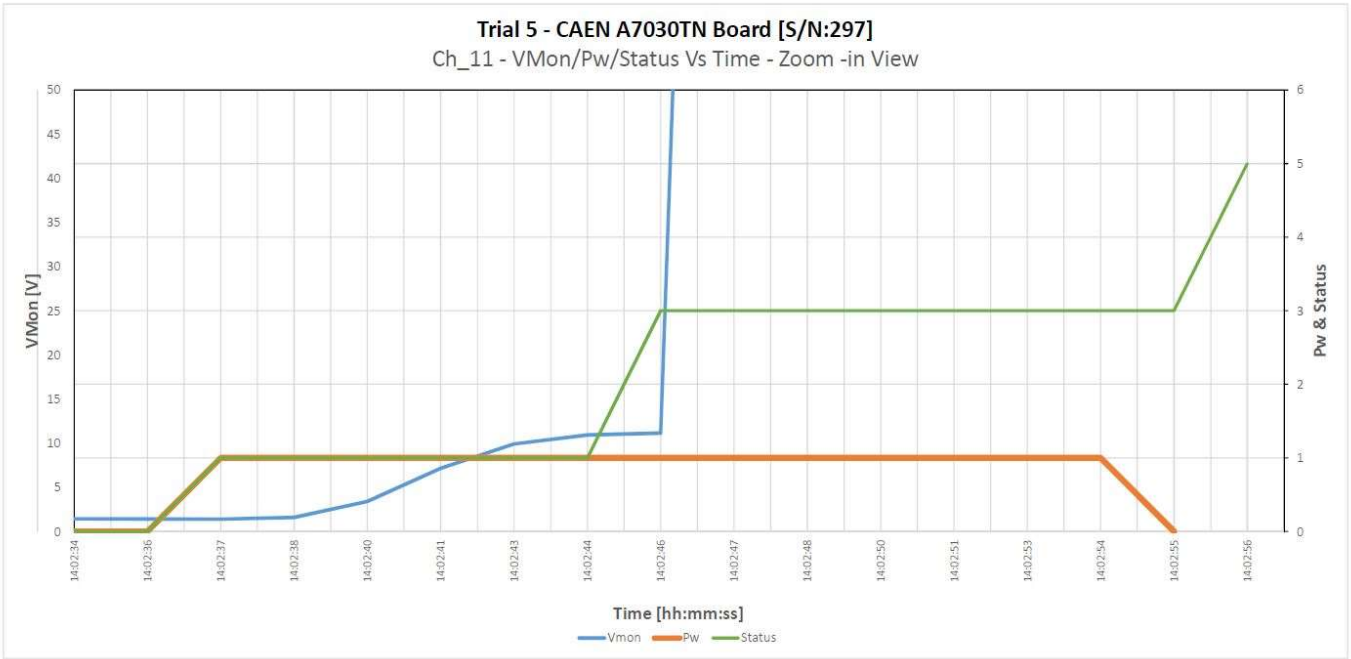

Fig.5. – GECO 2020 data logged plot show a zoom-in view of Fig4.

VMon/Status/Pw Comparison Between Ch_11 (Faulty) and Ch_12						
Time	Ch_11 Vmon	Ch_12 Vmon	Ch_11 Pw	Ch_11 Status	Ch_12 Pw	Ch_12 Status
hh:mm:ss	[V]	[V]	[On/Off]		[On/Off]	
14:02:34	1.44	1.03	0	0	0	0
14:02:36	1.42	1.01	0	0	0	0
14:02:37	1.4	1	1	1	1	1
14:02:38	1.6	42.26	1	1	1	3
14:02:40	3.4	425.65	1	1	1	3
14:02:41	7.16	809.57	1	1	1	3
14:02:43	9.92	1193.18	1	1	1	3
14:02:44	10.92	1384.95	1	1	1	3
14:02:46	11.14	1499.84	1	3	1	3
14:02:47	245.79	1499.85	1	3	1	3
14:02:48	629.58	1499.84	1	3	1	3
14:02:50	1013.26	1499.84	1	3	1	3
14:02:51	1396.68	1499.84	1	3	1	1
14:02:53	1499.86	1499.84	1	3	1	1
14:02:54	1499.84	1499.84	1	3	1	1
14:02:55	1499.84	1499.84	0	3	0	1
14:02:56	1484.12	1492.34	0	5	0	5
14:02:57	1134.48	1158.27	0	5	0	5
14:02:58	750.89	774.58	0	5	0	5
14:03:00	367.12	390.58	0	5	0	5
14:03:01	71.52	77.37	0	5	0	5
14:03:03	16.59	16.91	0	5	0	5
14:03:04	8.85	8.69	0	5	0	5
14:03:06	3.27	2.86	0	5	0	5
14:03:07	1.78	1.33	0	5	0	5
14:03:08	1.44	1.04	0	0	0	5
Status :	0 = Off 1 = On 3 = Ramp Up 5 = Ramp Down					
Orange Fill :	Value did not change					

Table IV – Comparison between channel 11 and channel 12 *VMon*, *Pw* and *Status* parameters

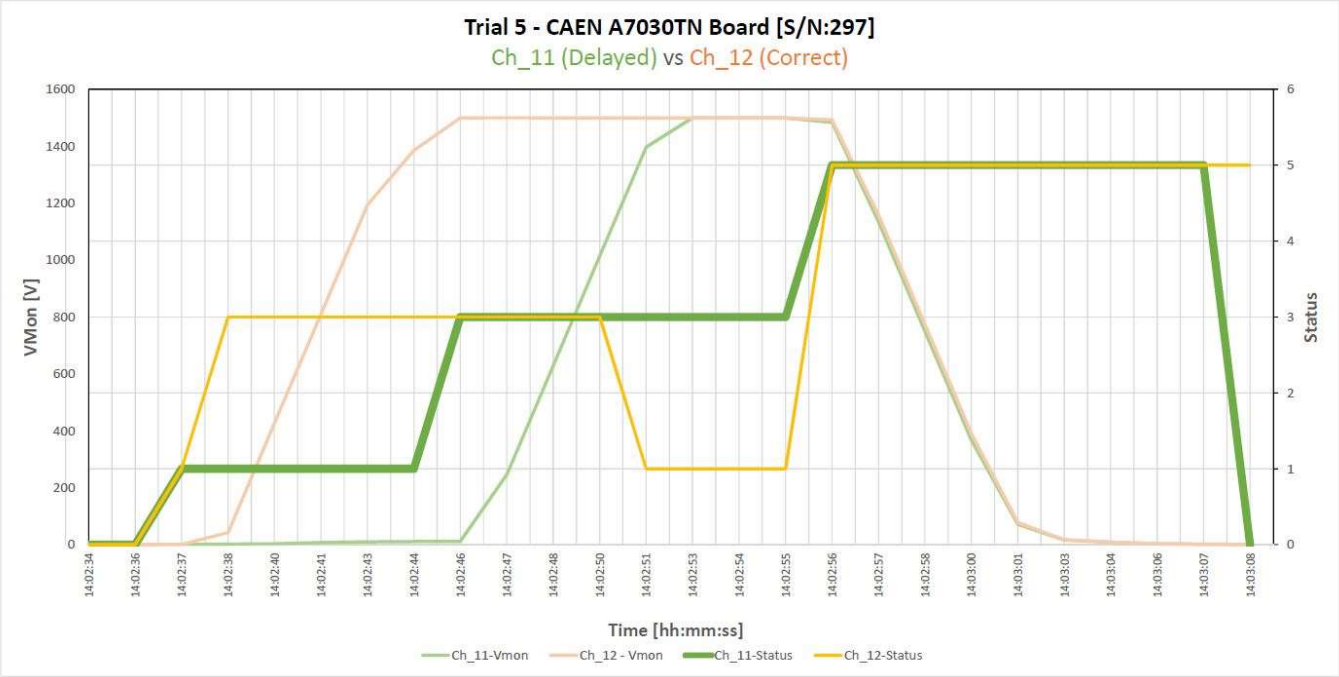

Fig.6. – Comparison between Ch_11 (Faulty) and Ch_12 (Good random channel selected) for *Status* and *Vmon* parameters

2. Channel 11 repeated latency incident in the same trial 5, ramping up ~ 10 sec later with respect to the other 35 channels. See fig.7. Analyzed data shown same behavior as the previous one mentioned in point 1.

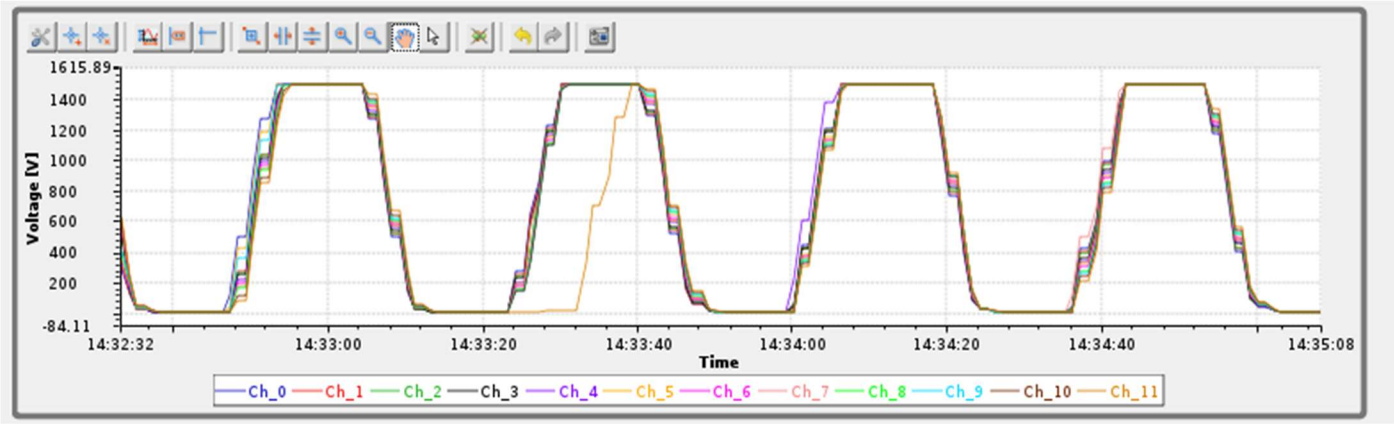

Fig.7. – *HV CAEN – Voltage Ramp Test CSS BOY* screen shows second channel 11 latency incident

3. Channel 25 presented one incident latency, ramping up ~ 10 sec later with respect to the other 35 channels. See fig.8. Analyzed data shown same behavior as the previous one mentioned in point 1.

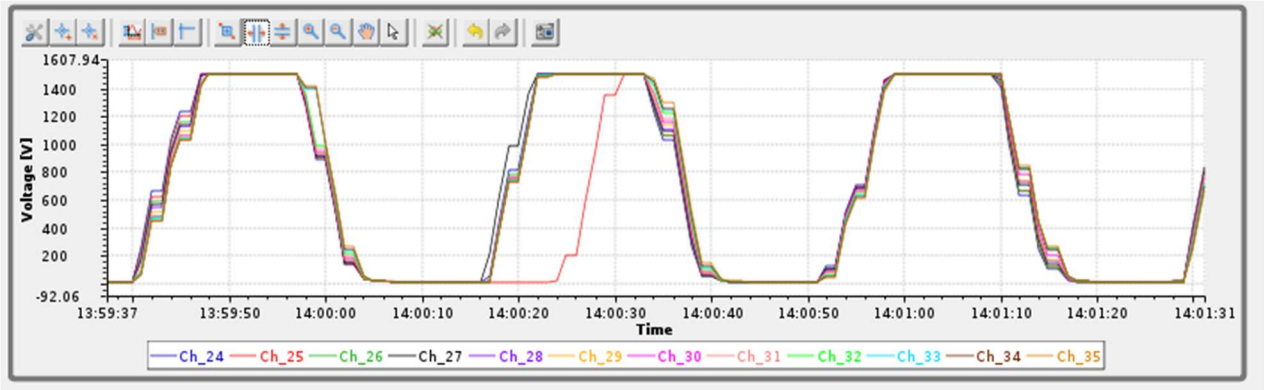

Fig.8. – *HV CAEN – Voltage Ramp Test CSS BOY* screen shows the second channel 25 latency to ramp up

Summary

CAEN A7030TN Board [S/N:297] - GECO 2020 Data						
Trial #	**Total Ramp Up/Down per Trial**	**Channel #**	**Incident # during Trial**	***Pw* (On=1) Time**	**Ch Ramping Up Time**	**Latency Time**
1	100	11	1	16:19:48	16:19:58	0:00:10
			2	16:48:47	16:48:57	0:00:10
		25	1	16:15:01	16:15:10	0:00:09
			2	16:33:04	16:33:15	0:00:11
			3	16:40:19	16:40:29	0:00:10
			4	16:43:21	16:43:31	0:00:10
2	100	25	1	9:35:33	9:35:43	0:00:10
			2	10:18:59	10:19:09	0:00:10
		35	1	9:30:45	9:30:55	0:00:10
3	100	2	1	12:33:27	12:33:36	0:00:09
		25	1	12:27:26	12:27:36	0:00:10
4	100	11	1	10:01:36	10:01:46	0:00:10
		25	1	10:01:37	10:01:47	0:00:10
			2	10:04:37	10:04:47	0:00:10
			3	10:51:07	10:51:17	0:00:10
		35	1	10:05:14	10:05:23	0:00:09
5	100	11	1	14:02:37	14:02:46	0:00:09
			2	14:33:22	14:33:31	0:00:09
		25	1	14:00:14	14:00:24	0:00:10
Total Cycles	**500**	**Total Incidents**	**19**			