Hall C CAEN SY4527 High Voltage System Test Results

Pablo Campero
Detector Support Group
November 6th, 2019

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- List of Tests Performed
- Test Results
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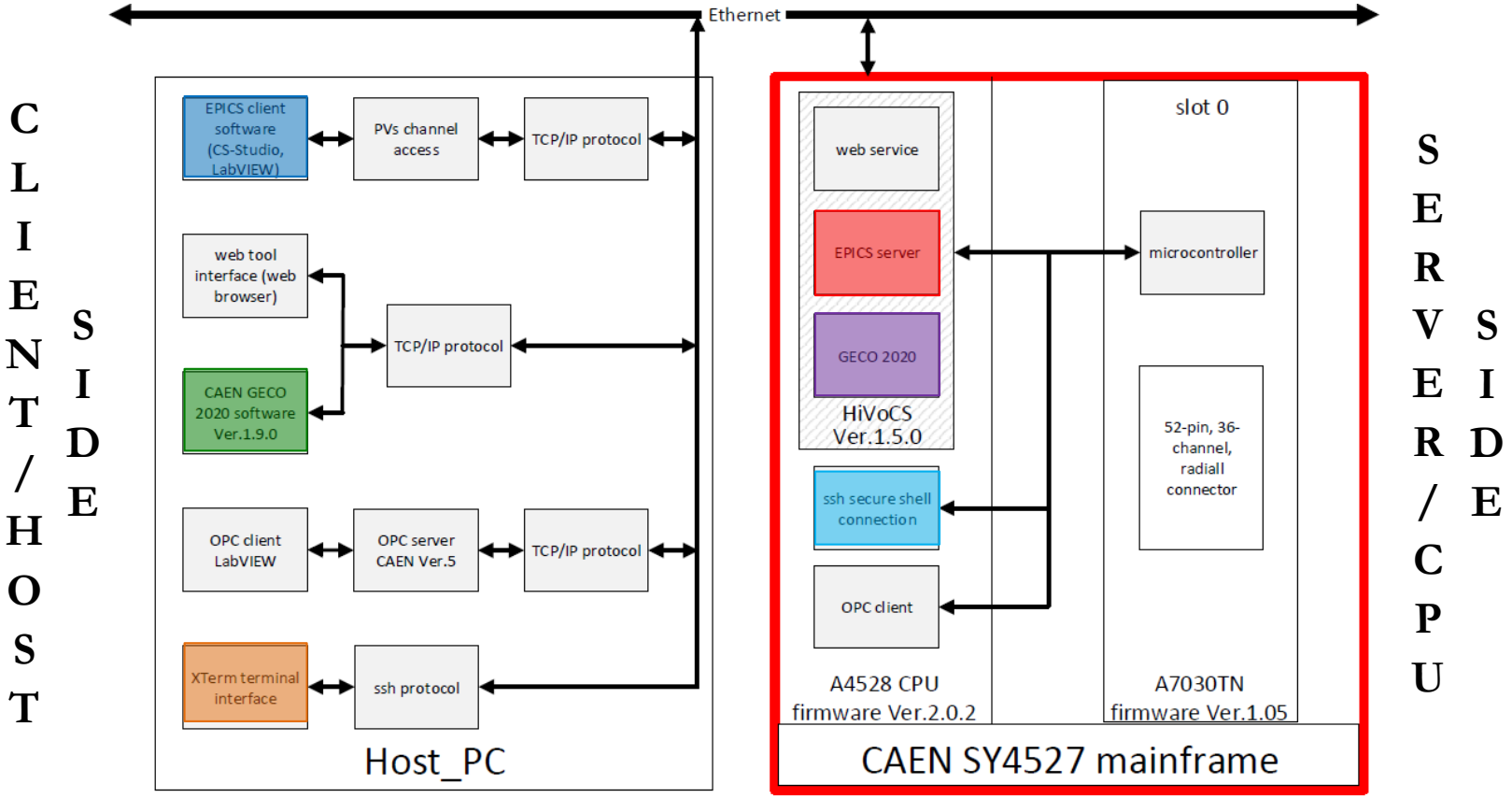
Overview - SY4527 Communication Modes

EPICS client → EPICS server
LabVIEW client → EPICS server
GECO 2000 host → GECO CPU
Xterm → SSH secure shell-CPU



Communication modes to control and monitor CAEN SY4527 System
Highlighted squares show components tested

Tests Performed

1. Overall communication test
2. Manual voltage ramp up/down test via EPICS client
   - Tested A1535 and A7030TN boards
3. Manual voltage ramp up/down test via SSH
4. Automated voltage ramp test with GECO 2020
5. Stability test with GECO 2020 and EPICS Client

Test 1. Communication Test

- Developed EPICS-CSS BOY screens and EPICS Client to test communication status for each HV board and mainframe
- Results
  - Able to read/write all PVs one by one
  - EPICS commands verified connection status that each PV works
  - Generated screens for each board and mainframe shows all PVs connected
  - **Found discrepancies between EPICS PVs and CAEN GECO/ssh**

Primary Power Supply Status

Description	Set	Readback
Power Supply Current	1.44A:1.72A:0.	1.44A:1.72A:0.
Power Supply Voltage	0	0

Network Status

Description	Set	Readback
IP ADDRESS	129.57.86.124	129.57.86.124
IP NET MASK	255.255.255.0	255.255.255.0
IP GATEWAY	129.57.86.1	129.57.86.1

Network setting controls available from CSS-EPICS screen developed

TEST HV CAEN - Expert Controls - Slot 2

Novice | Board Model: A7030TN - [S/N: 324] | ALL ON/OFF

Ch#	Location	Click to Turn	Status	VMon [V]	Imon [uA]	Vset [V] Readback	Vset [V] Set	Iset [uA] Readback	Iset [uA] Set	Vmax [V] Readback	Vmax [V] Set	RUp [V/s] Readback	RUp [V/s] Set	RDwn [V/s] Readback	RDwn [V/s] Set	Trip [s] Readback	Trip [s] Set
00	DSG-Lab	OFF	ON	1499.90	-0.020	1500.00	1500	1000.00	1000.00	1800	1800	25	25	25	25	3.0	3.0
01	DSG-Lab	OFF	ON	1499.85	-0.004	1500.00	1500	1000.00	1000.00	1800	1800	25	25	25	25	3.0	3.0
02	DSG-Lab	OFF	ON	1499.80	-0.082	1500.00	1500	1000.00	1000.00	1800	1800	25	25	25	25	3.0	3.0
03	DSG-Lab	OFF	ON	1499.76	0.944	1500.00	1500	1000.00	1000.00	1800	1800	25	25	25	25	3.0	3.0
04	DSG-Lab	OFF	ON	1499.68	-0.082	1500.00	1500	1000.00	1000.00	1800	1800	25	25	25	25	3.0	3.0
05	DSG-Lab	OFF	ON	1499.92	-0.008	1500.00	1500	1000.00	1000.00	1800	1800	25	25	25	25	3.0	3.0
06	DSG-Lab	OFF	ON	1499.90	-0.052	1500.00	1500	1000.00	1000.00	1800	1800	25	25	25	25	3.0	3.0
07	DSG-Lab	OFF	ON	1499.77	-0.078	1500.00	1500	1000.00	1000.00	1800	1800	25	25	25	25	3.0	3.0

CSS-BOY expert control screen used to test HV boards

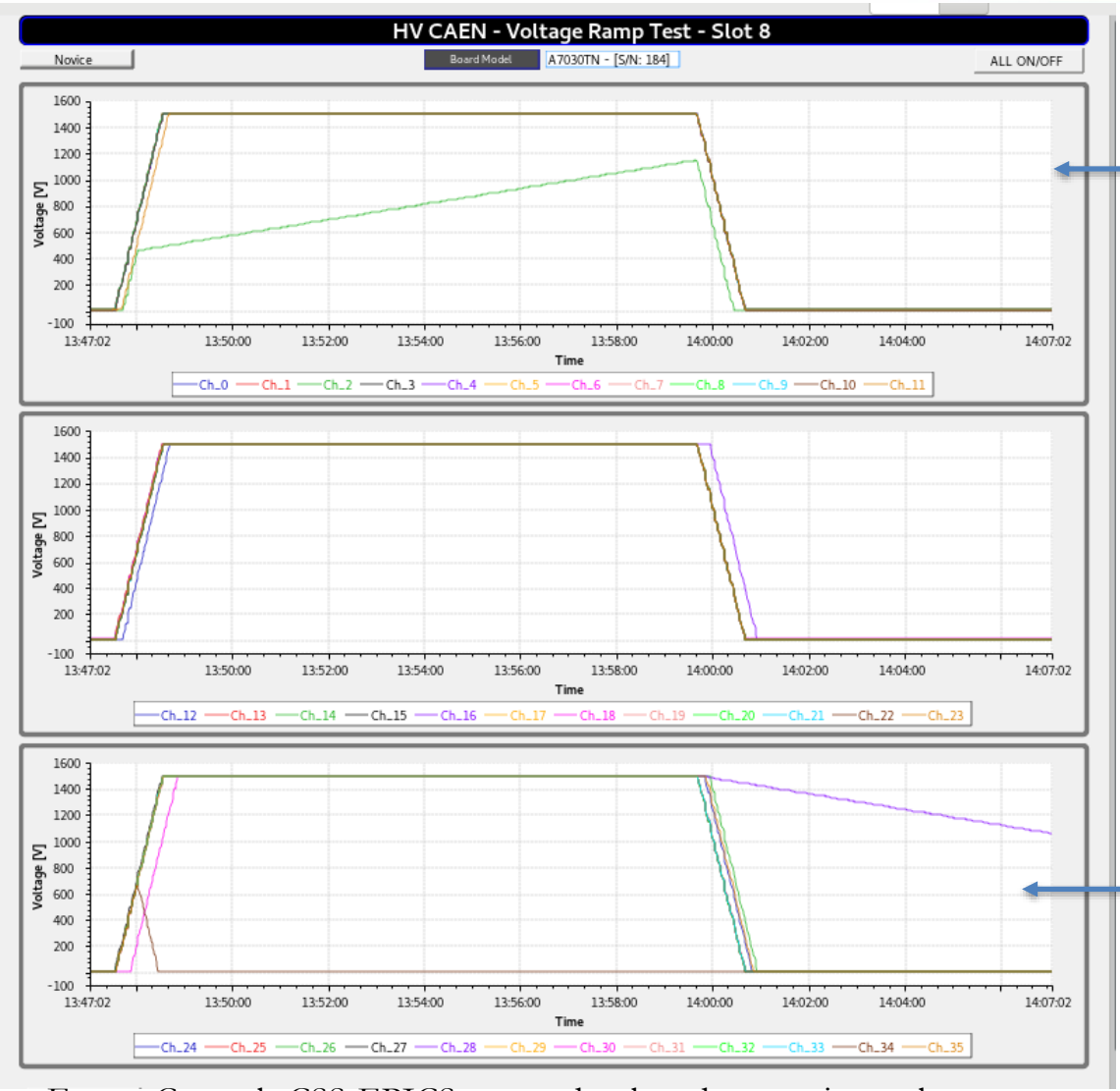
```
[campero@dsg-b-linux1 ~]$ cainfo hvcaentest2:00:000:Pw
hvcaentest2:00:000:Pw
    State:              connected
    Host:               129.57.86.124:5064
    Access:             read, write
    Native data type:   DBF_ENUM
    Request type:       DBR_ENUM
    Element count:      1
[campero@dsg-b-linux1 ~]$
```

Linux Host PC with EPICS base showing connection status for PVs

Test 2. EPICS Client Voltage Test

- Used EPICS Client (CSS-BOY screens) to control and monitor parameters (*VMon*, *IMon*, *V0Set*, *I0Set*, *VRUp*, *VRDWn*, *Trip*, *SVMax*, and *Pw*)
  - Used GECO 2020 interface to verify CSS-BOY screen's PVs
- Results
  - **Random channels did not turn on**
  - **Pre-set values for some parameters changed randomly during test**
  - **Discrepancies between values shown in GECO 2020 and PVs read from CAEN EPICS Server**

Test 2. EPICS Client Voltage Test



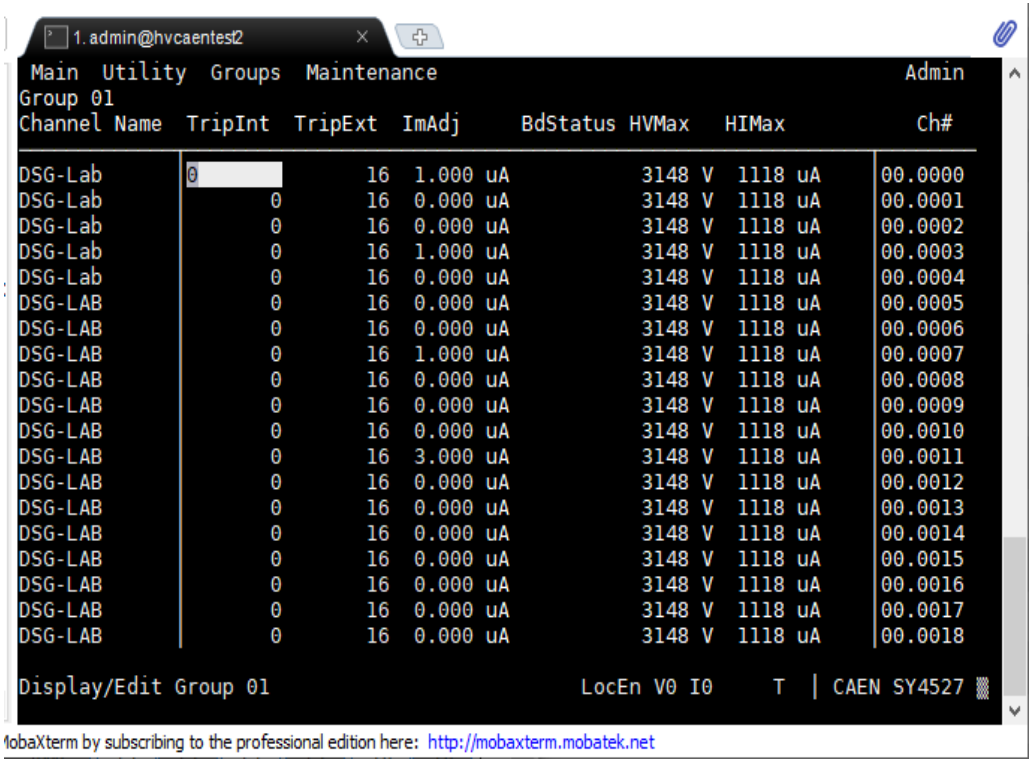
Expert Controls CSS-EPICS screen developed to monitor voltage ramps for all 36 channels of A7030TN module

Channel 2 changed *VRUp* value from 25 V/s to 1 V/s

Initial set *SVMax* parameter changed from 1800 V to 1 V and channel 31 tripped
Channel 28 changed *VRDWn* value from 25 V/s to 1 V/s

Test 3. Voltage Test via Secure Shell Connection

- Used ssh xterm interface to control and monitor HV board parameters
  - For verification used GECO 2020 and EPICS Client interfaces
- Results
  - Pre-set values for some parameters did not change randomly during the test
  - Parameters between GECO 2020 and ssh interface matched
  - **Discrepancy with PV values read from CAEN EPICS Server via EPICS client (CSS-BOY screens)**

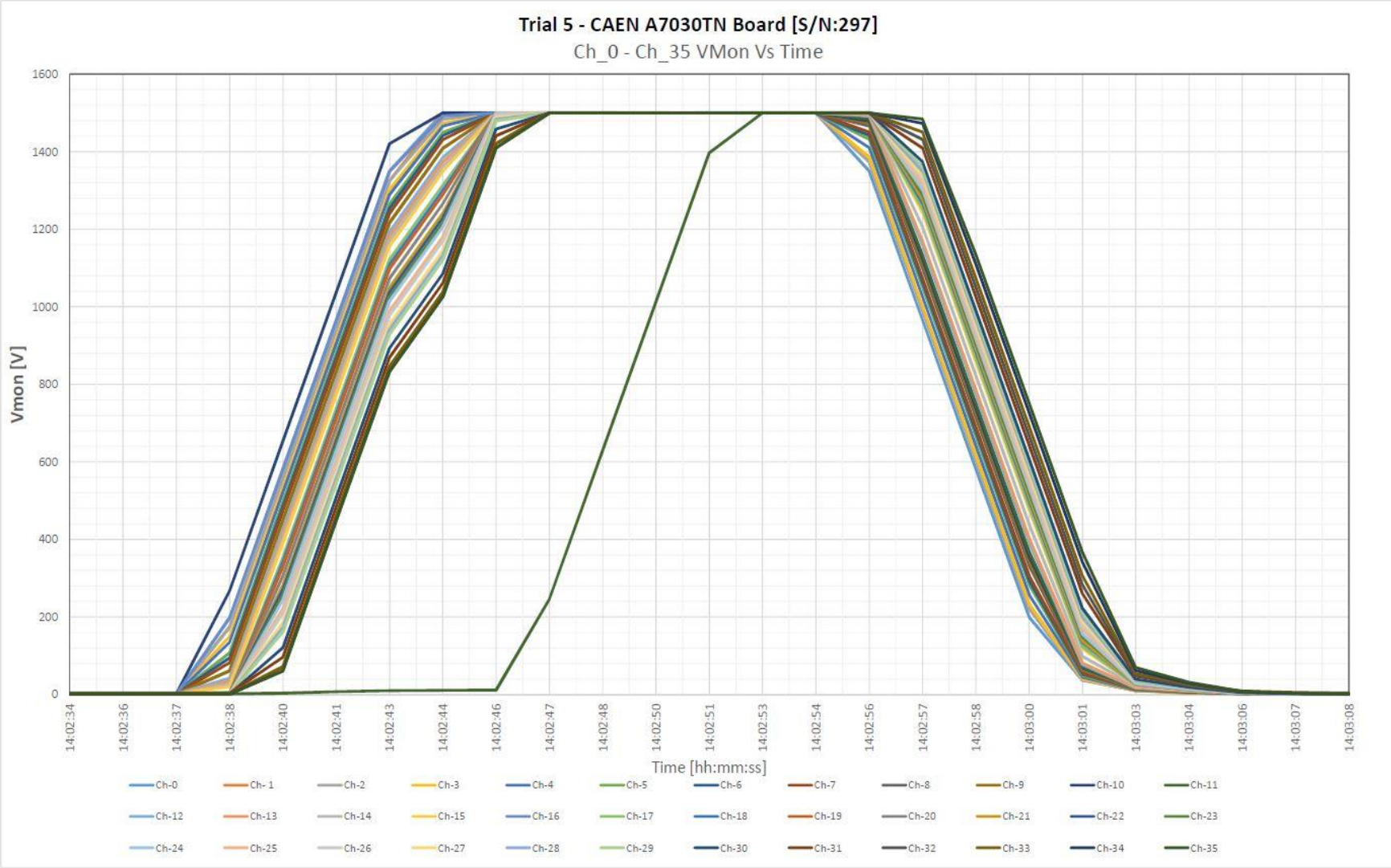


MobaXterm ssh interface terminal shows board's parameters that are controlled

Test 4. Automated Test

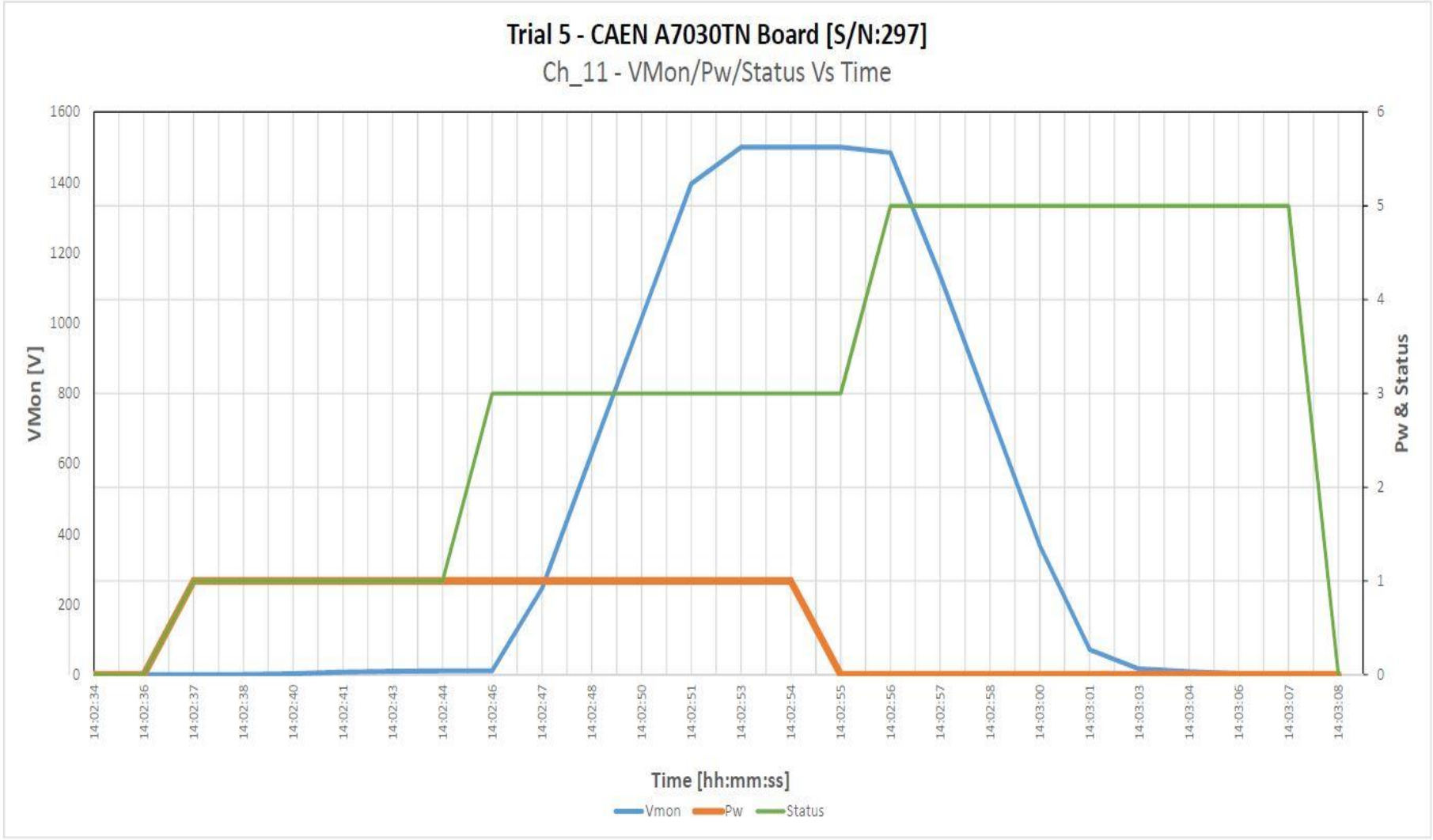
- Test performed with single A7030TN board connected
  - Tested all 36 channels 100 times at 1500 V
  - Used GECO 2020 to run script for auto voltage ramp up/down cycles, to control and monitor and log parameters
    - Included status parameter to previous list (slide 6)
  - Used EPICS client to only monitor test
- Results
  - None of 36 channels' parameters for each tested board changed
    - CSS-BOY screens matched with GECO 2020 in the latency issues found
  - **EPICS commands and PV updates for *Pw* parameter did not update**
  - **Random 8 s — 10 s latency to ramp up some channels during some cycles in the test**

Test 4. Automated Test



GECO 2020 data shows latency to ramp up channel 11

Test 4. Automated Test

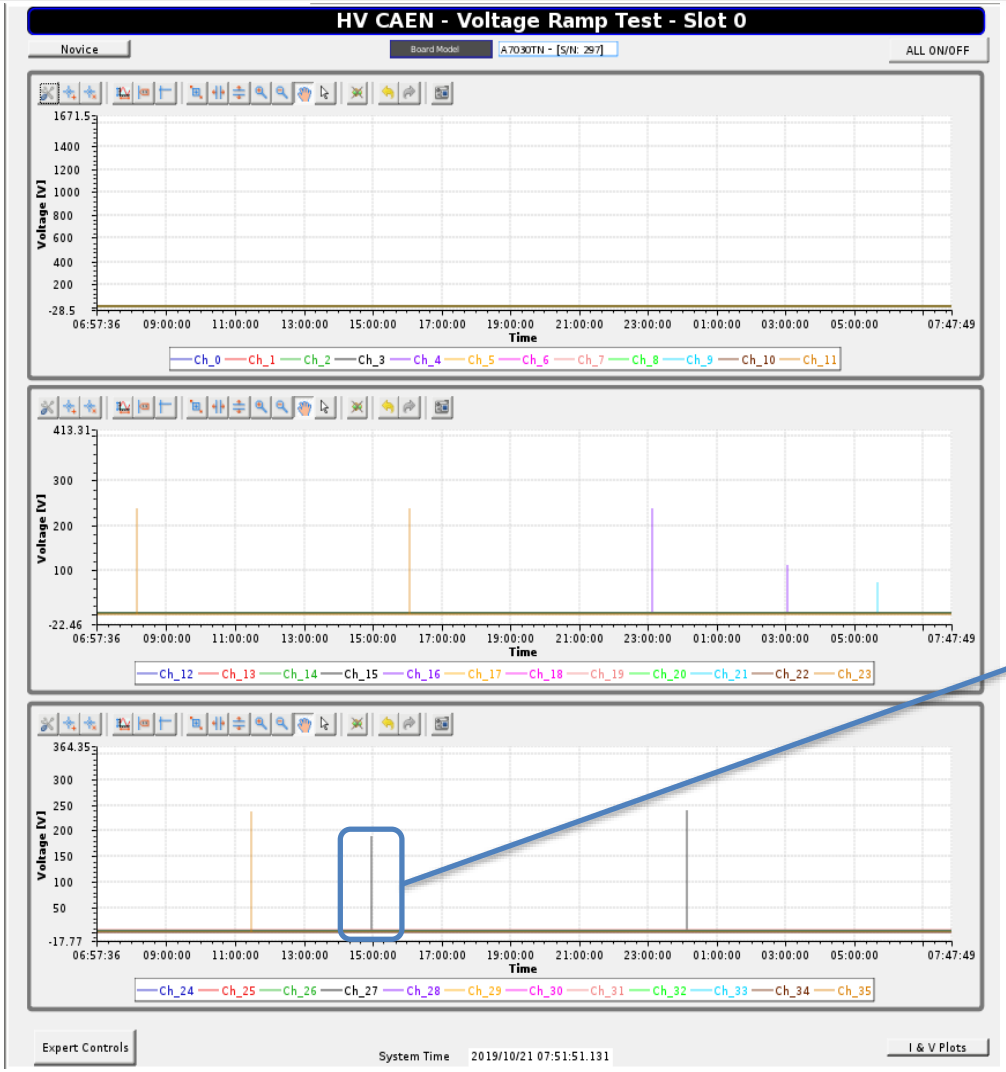


GECO 2020 data logged plot shows relation between *VMon*, *Pw* and *Status* parameters during a ramp up/down cycle when latency incident was present

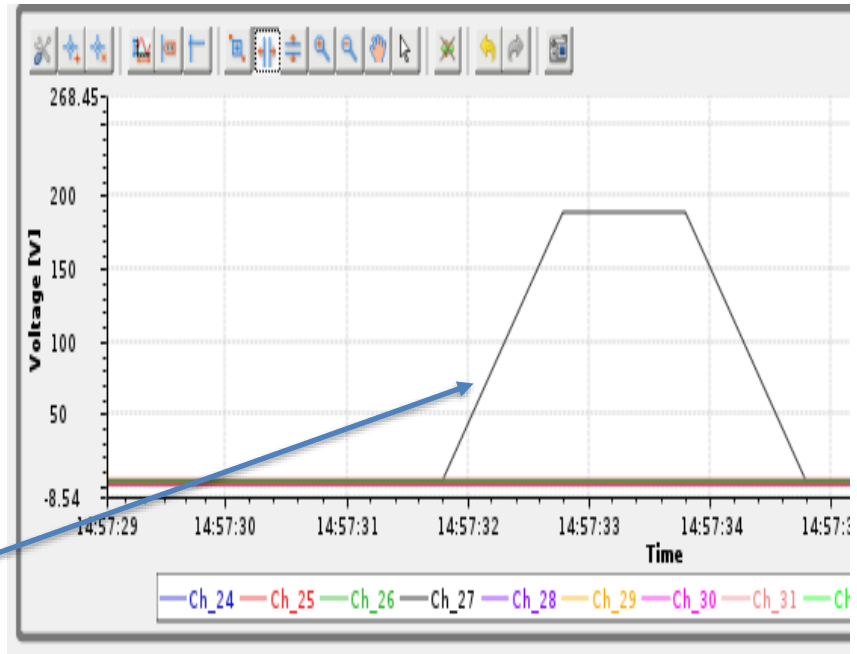
Test 5. Stability Test

- Test ran for > 24 hours to check for random changes of pre-set values
  - Tests performed with a single or 16 A7030TN boards connected
  - Tested with all 36 channels at 0 V and 1500 V
  - Only used GECO 2020 to control, monitor, and log all 16 boards' parameters
- Results
  - None of 36 channels' parameters for each tested board were changed
  - **Random voltage spikes of ~ 236 V, even when *V0Set* was set at 0 V**
    - **Possibly a readout voltage spike at software level (not real)**
  - **Issues with changing all channel's (x576) parameters**
    - ***SVMax, VSet,* and *IMax* at the same time with GECO 2020**

Test 3. Stability Test



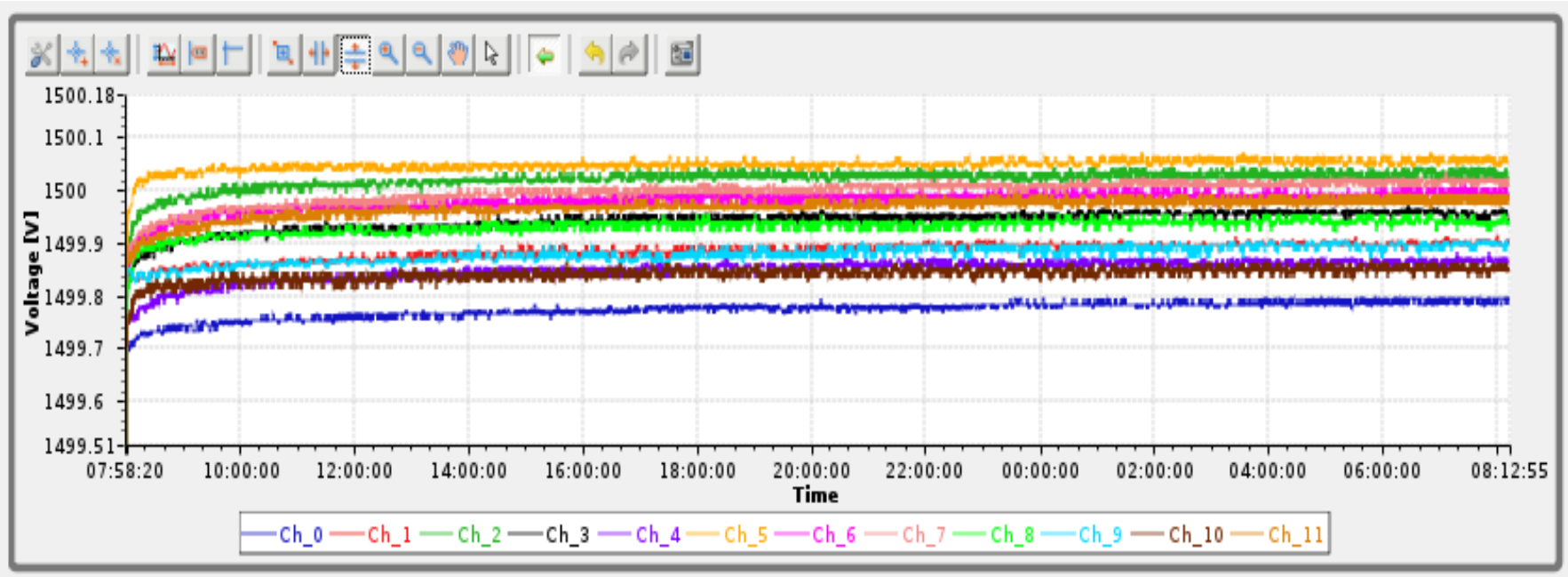
Voltage Ramp Test CSS-BOY screen shows voltage spikes during stability test run with a single board



Zoomed-in view of Voltage Ramp Test CSS-BOY screen shows a 2 s voltage spike for channel 27

Test 5. Stability Test

- Results
  - GECO 2020 data matched PV values shown by Voltage Ramp Test CSS-BOY screen
  - No changes in set values for all monitored/set parameters
  - Voltage monitored was set point 1500 V ± 0.3 V, and current monitored ~ 0 μA as expected (no load connected for test)
    - Both monitored parameters within CAEN specifications



Plot shows zoomed-in view of channels 0 to channel 11; voltage set at 1500 V

Conclusions

- Discrepancies and random changes are present when EPICS client is used to control and monitor **(Page 7)**
- Latency issues in random channels was seen even when only GECO 2020 is used to control and monitor **(Page 10)**
- During stability test noticed, random voltage spikes ~ 230 V **(Page 13)**
- Completed software test for one mainframe and 17 A7030TN boards
  - Detailed reports sent to CAEN support
  - Test will continue on remaining 19 boards and 1 mainframe to be delivered to JLab on December, 2019.

THANK YOU