



U.S. DEPARTMENT OF  
**ENERGY**



# Hall C – CAEN SY4527 High Voltage System Test Results

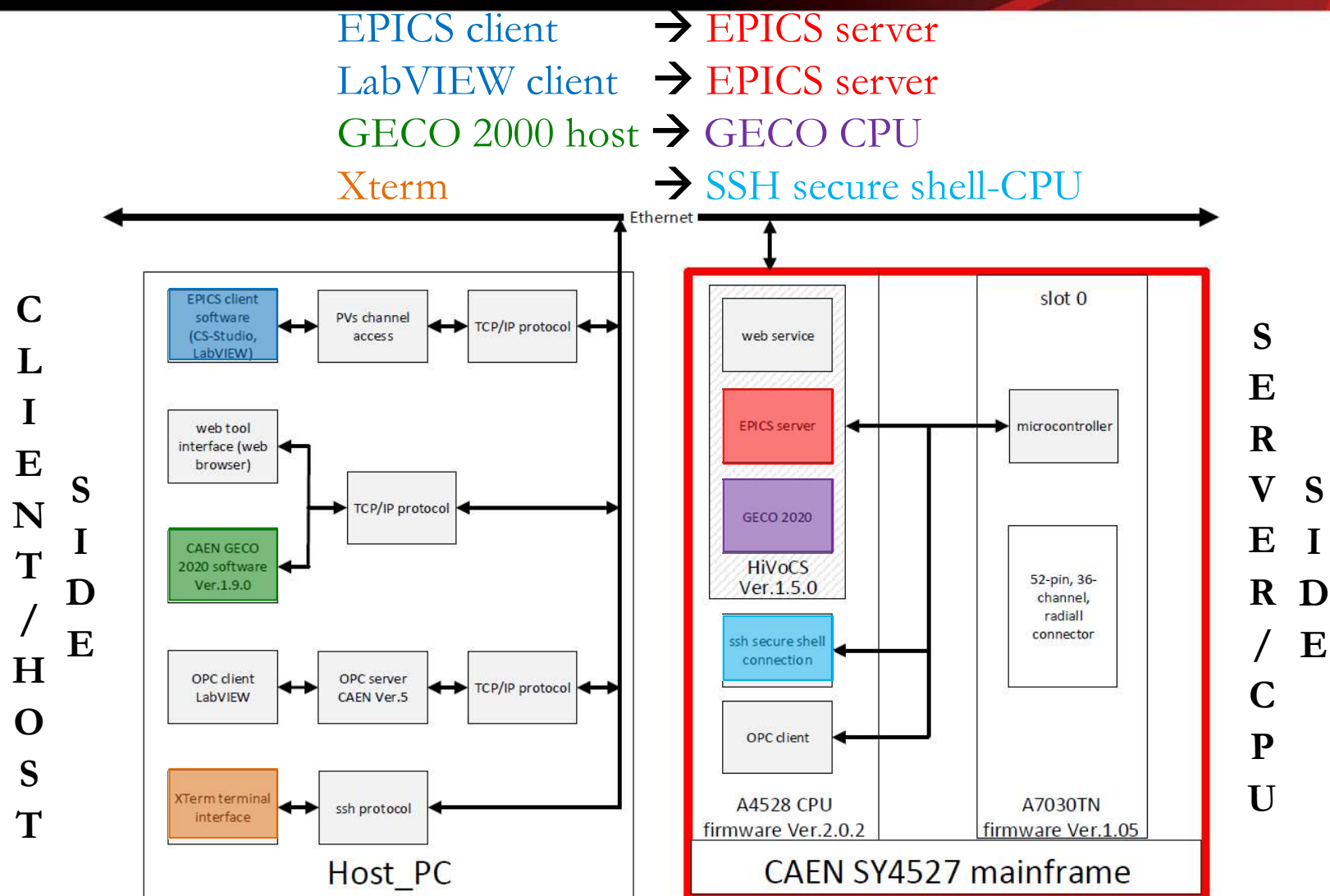
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Detector Support Group  
November 6<sup>th</sup>, 2019

# Content

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

# Overview - SY4527 Communication Modes



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      |
| P ADDRESS      | 129.57.86.124 | 129.57.86.124 |
| P NET MASK     | 255.255.255.0 | 255.255.255.0 |
| P 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] |      | Iset [uA] |         | Vmax [V] |      | RUp [V/s] |     | RDwn [V/s] |     | Trip [s] |     |
|-----|----------|---------------|--------|----------|-----------|----------|------|-----------|---------|----------|------|-----------|-----|------------|-----|----------|-----|
|     |          |               |        |          |           | Readback | Set  | Readback  | Set     | Readback | Set  | Readback  | Set | Readback   | Set | Readback | 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

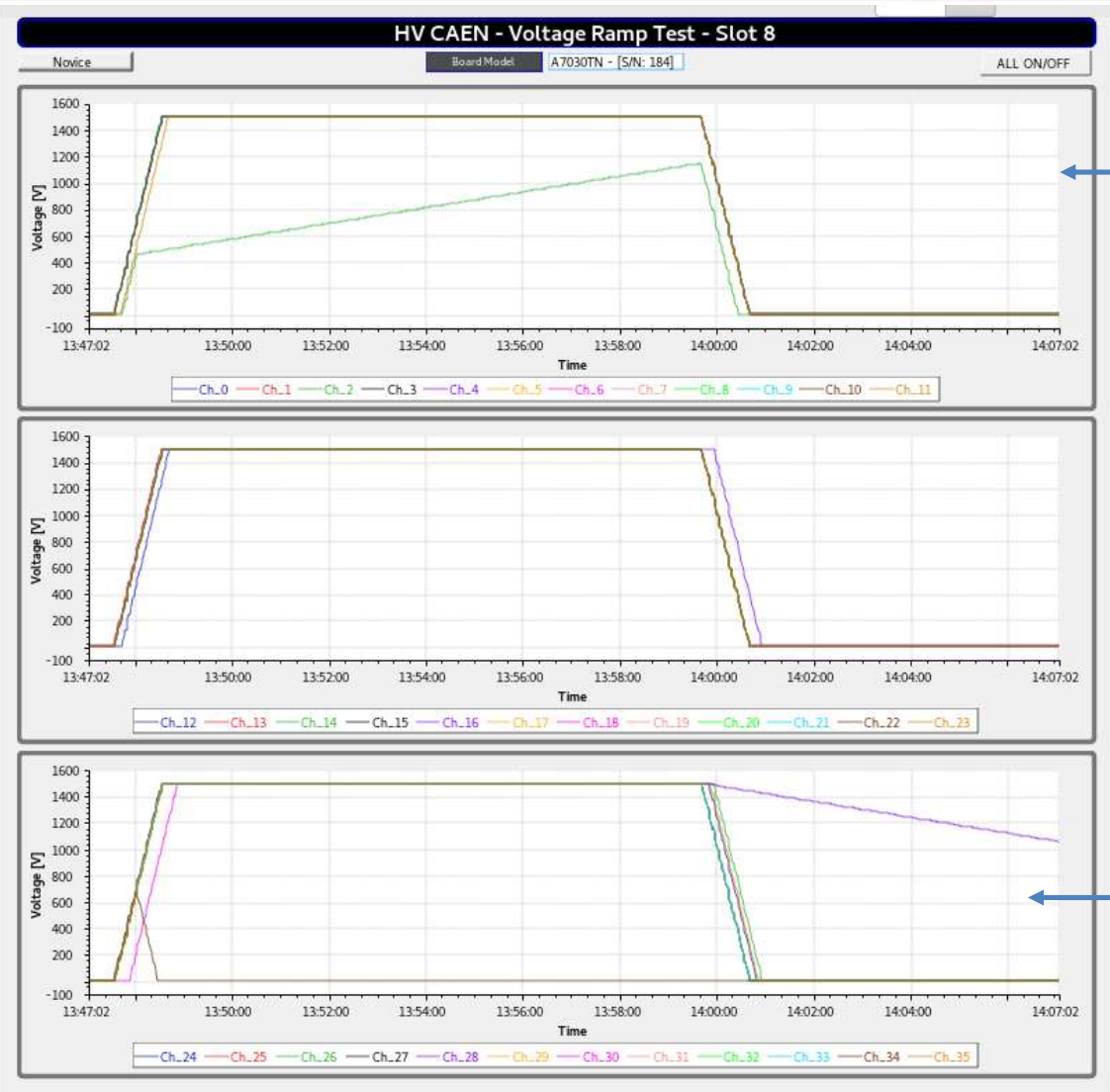
```
[campero@dsg-b-linux1 ~]$ cainfo hvcaentest2:00:000:Pw
hvcaentest2:00:000:Pw
State: connected
Host: 129.57.86.124:5064
Access: read, write
Native data type: DBF_ENUM
Request type: DBR_ENUM
Element count: 1
[campero@dsg-b-linux1 ~]$
```

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, SVMMax, and Pw)
  - Used GECO 2020 interface to verify CSS-BOY screen's PVs.
- Results
  - **Channels (random) did not turn on**
  - **Pre-set values for some parameters changed randomly during the test.**
  - **Discrepancies between values shown in GECO 2020 and PVs read from CAEN EPICS Server.**

## Test 2. EPICS Client Voltage Test



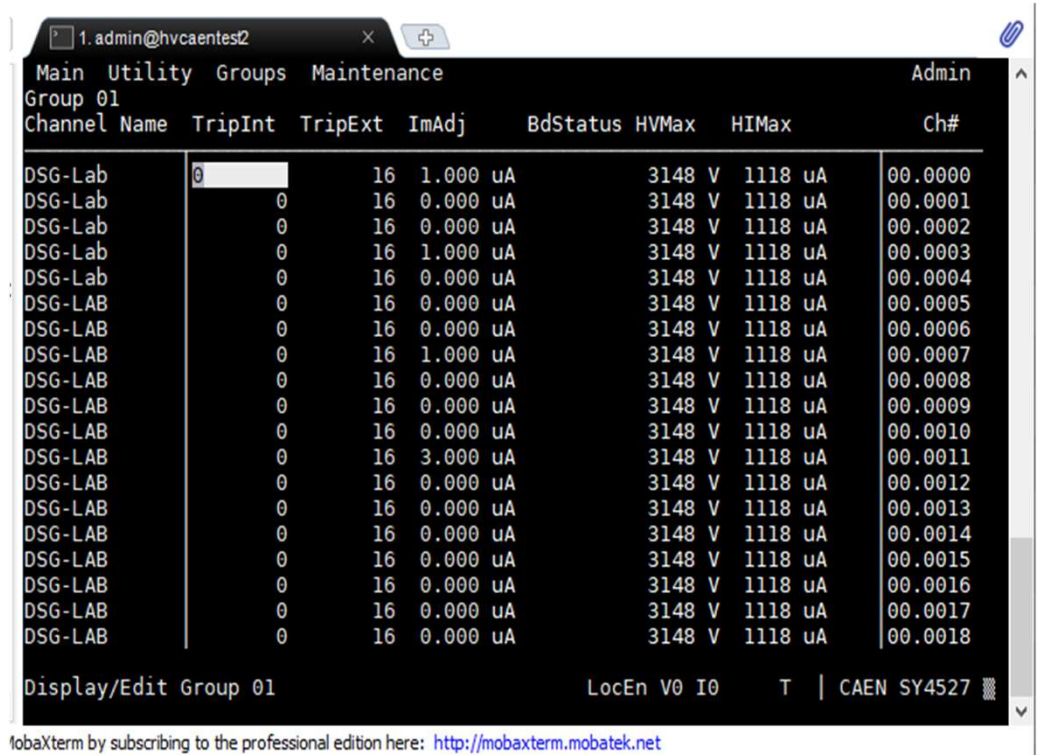
Channel 2 changed  $VRUp$  value from 25 V/s to 1 V/s

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

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

# Test 3. Voltage Test via Secure Shell Connection

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



The screenshot shows a MobaXterm window with a terminal session. The terminal displays a table of parameters for 'Group 01'. The table has columns: Channel Name, TripInt, TripExt, ImAdj, BdStatus, HVMax, HIMax, and Ch#. The data rows show parameters for 'DSG-Lab' channels, with values for TripInt, TripExt, ImAdj, BdStatus, HVMax, HIMax, and Ch#.

| Channel Name | TripInt | TripExt | ImAdj    | BdStatus | HVMax   | HIMax   | Ch# |
|--------------|---------|---------|----------|----------|---------|---------|-----|
| DSG-Lab      | 0       | 16      | 1.000 uA | 3148 V   | 1118 uA | 00.0000 |     |
| DSG-Lab      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0001 |     |
| DSG-Lab      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0002 |     |
| DSG-Lab      | 0       | 16      | 1.000 uA | 3148 V   | 1118 uA | 00.0003 |     |
| DSG-Lab      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0004 |     |
| DSG-LAB      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0005 |     |
| DSG-LAB      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0006 |     |
| DSG-LAB      | 0       | 16      | 1.000 uA | 3148 V   | 1118 uA | 00.0007 |     |
| DSG-LAB      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0008 |     |
| DSG-LAB      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0009 |     |
| DSG-LAB      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0010 |     |
| DSG-LAB      | 0       | 16      | 3.000 uA | 3148 V   | 1118 uA | 00.0011 |     |
| DSG-LAB      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0012 |     |
| DSG-LAB      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0013 |     |
| DSG-LAB      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0014 |     |
| DSG-LAB      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0015 |     |
| DSG-LAB      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0016 |     |
| DSG-LAB      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0017 |     |
| DSG-LAB      | 0       | 16      | 0.000 uA | 3148 V   | 1118 uA | 00.0018 |     |

Display/Edit Group 01 LocEn V0 I0 T | CAEN SY4527

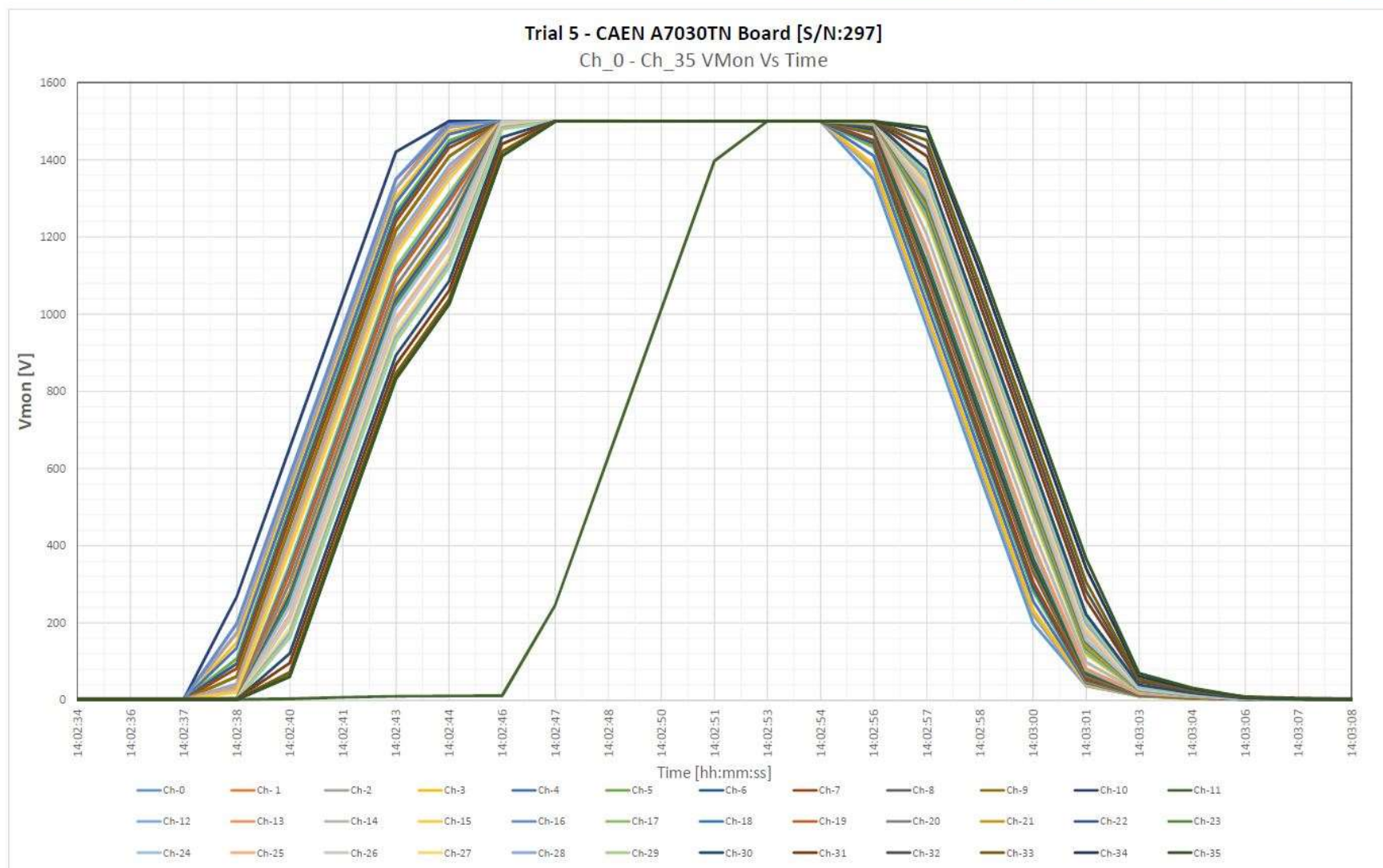
MobaXterm by subscribing to the professional edition here: <http://mobaxterm.mobatek.net>

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

## Test 4. Automated Test

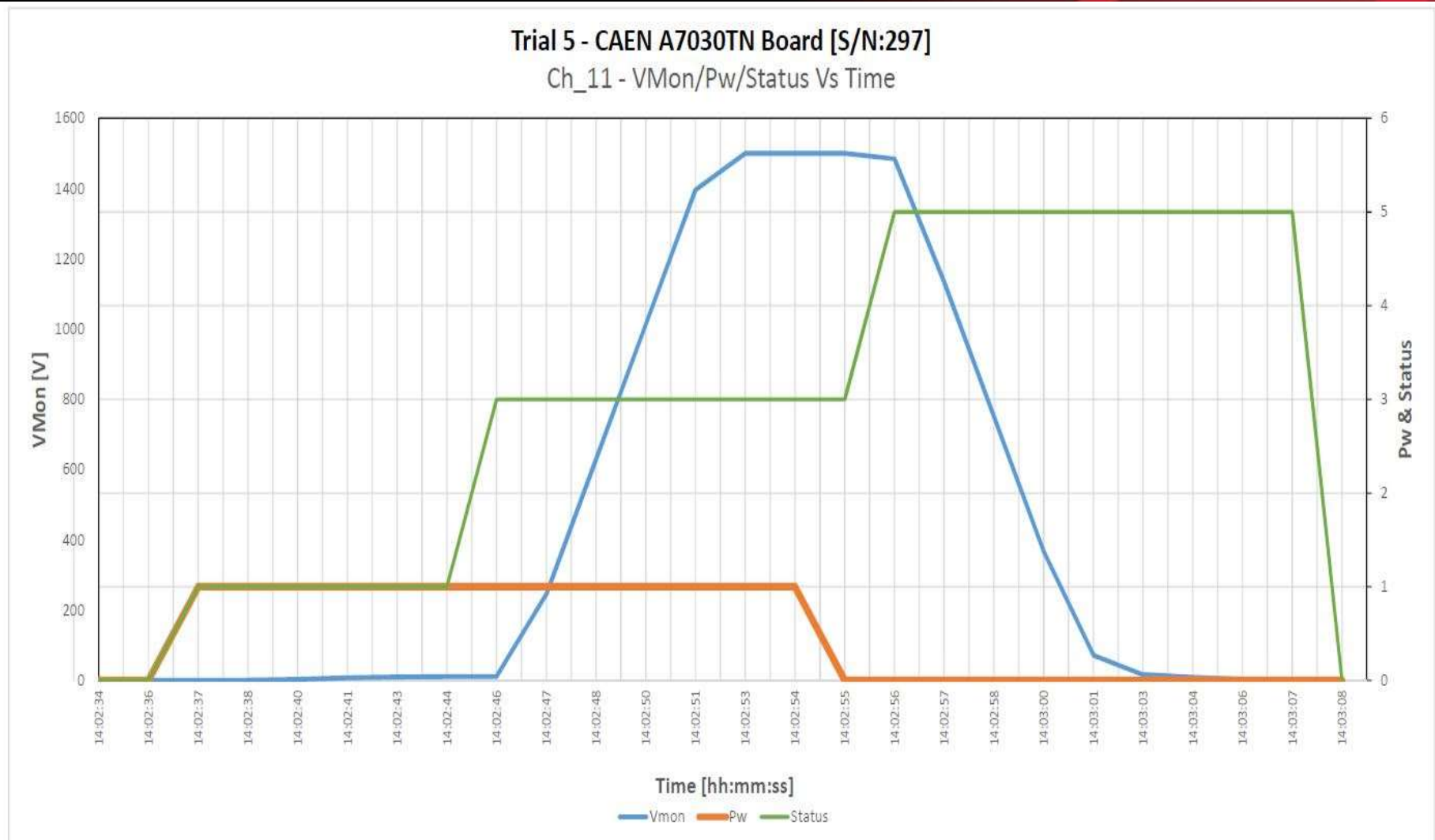
- Test performed with a single A7030TN board connected
  - Tested all 36 channels 100 times at 1500 V
  - Used GECO 2020 to run script for auto voltage ramp up/down cycles, to control and monitor and log parameters
    - Included status parameter to previous list (slide 6)
  - Additional used EPICS client 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

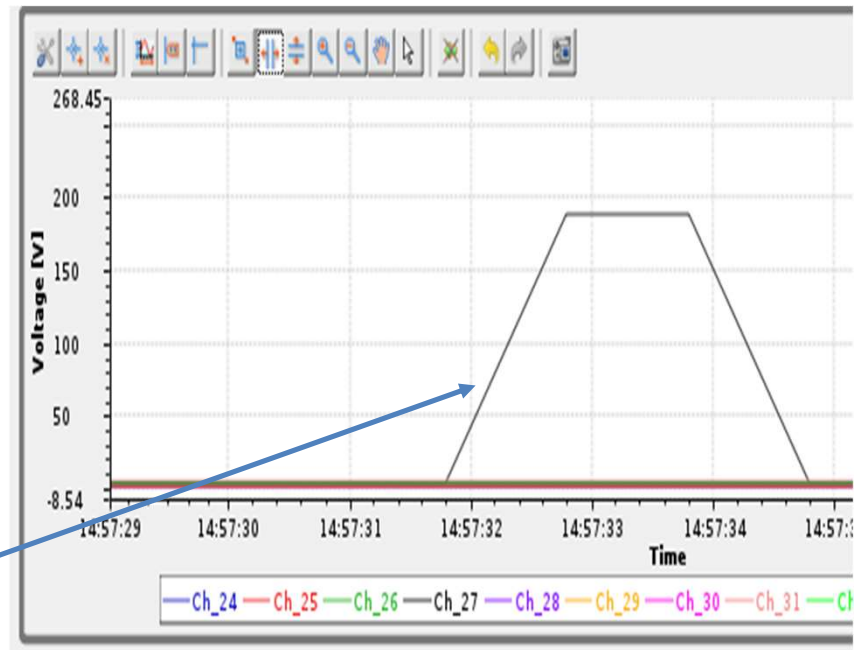
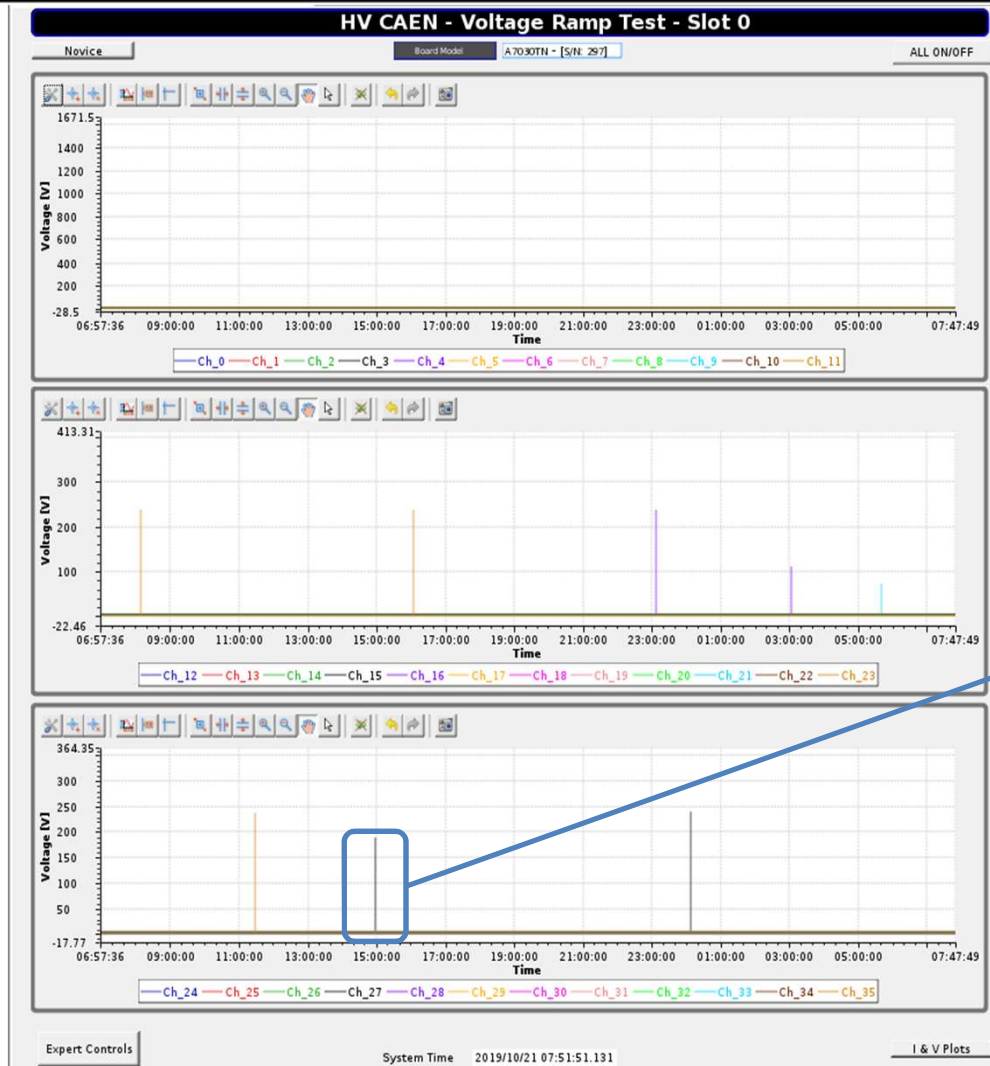


GECO 2020 data logged plot show the relation between *VMon*, *Pw* and *Status* parameter during a ramp up/down cycle when latency incident was present

# Test 5. Stability Test

- Test ran for a period  $> 24$  hours to verify to check for random changes of pre-set values.
  - Test performed with a single and 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 board's parameters
- Results
  - None of 36 channels' parameters for each tested board were changed
  - Random voltage spikes  $\sim 230$  V, even when *V0Set* was set at 0 V.
    - Could be only a readout voltage spike at software level (Not real).
  - Issues to change all channel's (x576) parameters
    - *SVMax*, *VSet*, and *IMax* at the same time with GECO 2020.

# Test 5. Stability Test

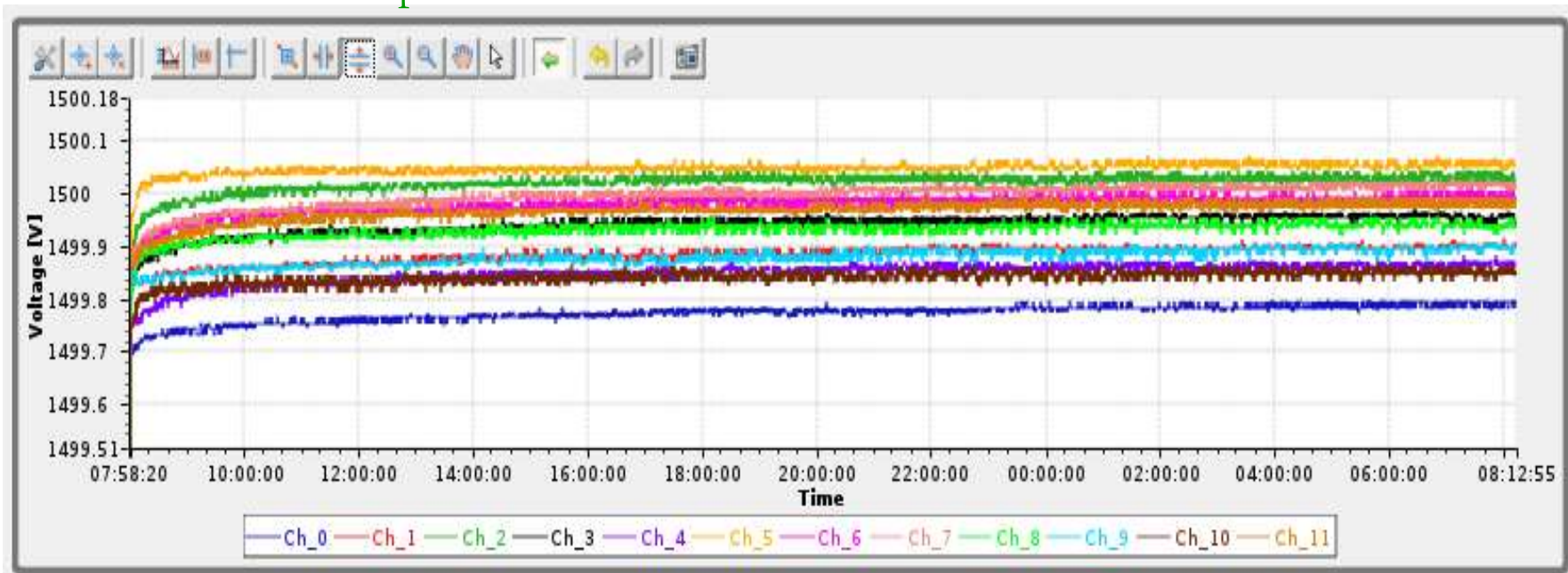


Zoom-in view of *Voltage Ramp Test* CSS-BOY screen shows a 2 s voltage spike for channel 27

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

# 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 kept at set point  $1500 \pm 0.3$  V, and current monitored  $\sim 0$   $\mu$ A as expected (No load connected for test), both monitored parameters within CAEN specs.



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

# Conclusions

- Discrepancies and random changes are present when EPICS client 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  $\sim 230$  V (Page 13)
- Completed software test for one mainframe and 17 A7030TN boards.
  - Detailed reports sent to CAEN support
  - Test will continue on remain 19 boards and 1 mainframe to be delivered at Jlab on December, 2019.

THANK YOU



11/8/2019

Detector Support Group

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Jefferson Lab