

Debugging SY4527 Mainframe and A7030TN High Voltage Boards with EPICS CSS-BOY

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Hall C plans to use the CAEN SY4527 with A7030TN high voltage boards for the photo multiplier tubes of the calorimeter of the Neutral Particle Spectrometer. Initial tests [1, 2] indicated issues with the high voltage system. This note presents the results of a single board retested using CSS-BOY for controls and monitoring; CSS-BOY monitored values were verified by data logging the results independently with CAEN's proprietary software, GECO 2020.

Results of tests to set process variable (PV) values simultaneously on sixteen A7030TN high voltage boards (576 channels) installed in the SY4527 mainframe showed the same issues observed for the A1535 high voltage boards [2].

To debug the problem, a *single* board was retested with CSS-BOY, which was used for controls and monitoring. To verify the obtained results monitored by CSS-BOY, GECO 2020 was used for data logging. The steps performed to set up and run the tests is given in Appendix A. Board specifications are given in Table I; targeted PV set points for the tests are given in Table II.

Mainframe model	SY4527
Mainframe S/N	400
Board model/S/N	A7030TN/304
CPU model/S/N	A4528/760
Total channels tested	36
Channel load	0 Ω

Table I. SY4527 and board specifications.

PV Name	Description	Set point
<i>Pw</i>	power on/off	0/1
<i>SVM</i> <i>Max</i>	set voltage maximum	1800 V
<i>V0Set</i>	set voltage	1500 V
<i>RUp</i>	ramp up rate	25 V/s
<i>RDWn</i>	ramp down rate	25 V/s
<i>I0Set</i>	maximum current set	1000 μ A
<i>Trip</i>	trip time	3 s

Table II. Targeted set points for test.

To set PV values at the targeted set points, six JavaScript programs were written to send the commands simultaneously to the 36 channels of the board. These JavaScript programs were executed via the CSS-BOY screen, *HV CAEN Expert Controls*. Results of the tests for 15 ramp ups and ramp downs are summarized below.

1. Issue setting *RUp*

Channels 11, 12, 17 and 18 did not go to the targeted set point of 25 V/s after the JavaScript program to set *RUp* values was executed. Data log by GECO confirmed the results. See Appendix B, Figs. 1 and 2.

2. Issue with *Pw*

Channel 2 did not ramp down because its *Pw* value did not change from 1 to 0 after the JavaScript program was executed. GECO data logs confirmed CSS-BOY results. See Appendix B, Figs. 3 and 4.

After the JavaScript program was executed to set *Pw* of all 36 channels to 1 simultaneously, *Pw* did not change from 0 to 1 for channels 14, 16, and 19; hence, these channels did not ramp up. GECO data logs confirmed CSS-Boy readings. See Appendix B, Figs. 5–10.

Voltage ramp up/down graphs for all 36 channels are shown in Appendix B, Figs. 11–13.

To conclude, after execution of the JavaScript programs to turn on/off 36 channels simultaneously, using the *HV CAEN Expert Controls* CSS-BOY screen, random channels did not turn on/off. Some channels' parameters did not get to the set value. Preset PV values did not arbitrarily change. There were no discrepancies between GECO 2020 and CSS-BOY monitored PVs.

[1] P. Campero, et. al. [Screens to test the CAEN SY4527 High Voltage Power Supply System's Built-in EPICS Server](#), DSG Note 2019-22, 2019.

[2] P. Campero, et. al. [Test Results of CAEN SY4527 System Installed with A1535 High Voltage Boards for Hall C](#), DGS Note 2019-30, 2019.

APPENDIX A: TEST STEPS

1. Installed an A7030TN HV board into CAEN SY4527 mainframe's slot 0 (remaining 15 slots were empty).
2. Enabled System Advanced Features in GECO 2020.
3. Enabled GECO logging options for *V0Set*, *SVMax*, *I0Set*, *RUp*, *RDWn*, *Pw*, *VMon*, *IMon*, and *Trip* parameters of all 36 channels.
4. Enabled CAEN EPICS server built-in to allow controls and monitoring from EPICS CSS-BOY screens (EPICS Client).
5. Verified communication between CAEN EPICS server and EPICS client.
6. Used *HV CAEN Expert Controls* CSS-BOY screen to set and read above-mentioned parameters.
7. Took screenshots for initial conditions displayed in GECO 2020 and EPICS/CSS-BOY screens.
8. Started ramp up for all 36 channels by clicking "*All Turn On/Off*" button on *HV CAEN Expert Controls* CSS-BOY screen.
9. Ran *HV CAEN Voltage Ramp Test* CSS-BOY screen to monitor voltage readouts.
10. Saved datalog files and screenshots with the results.

APPENDIX B: SCREENSHOTS

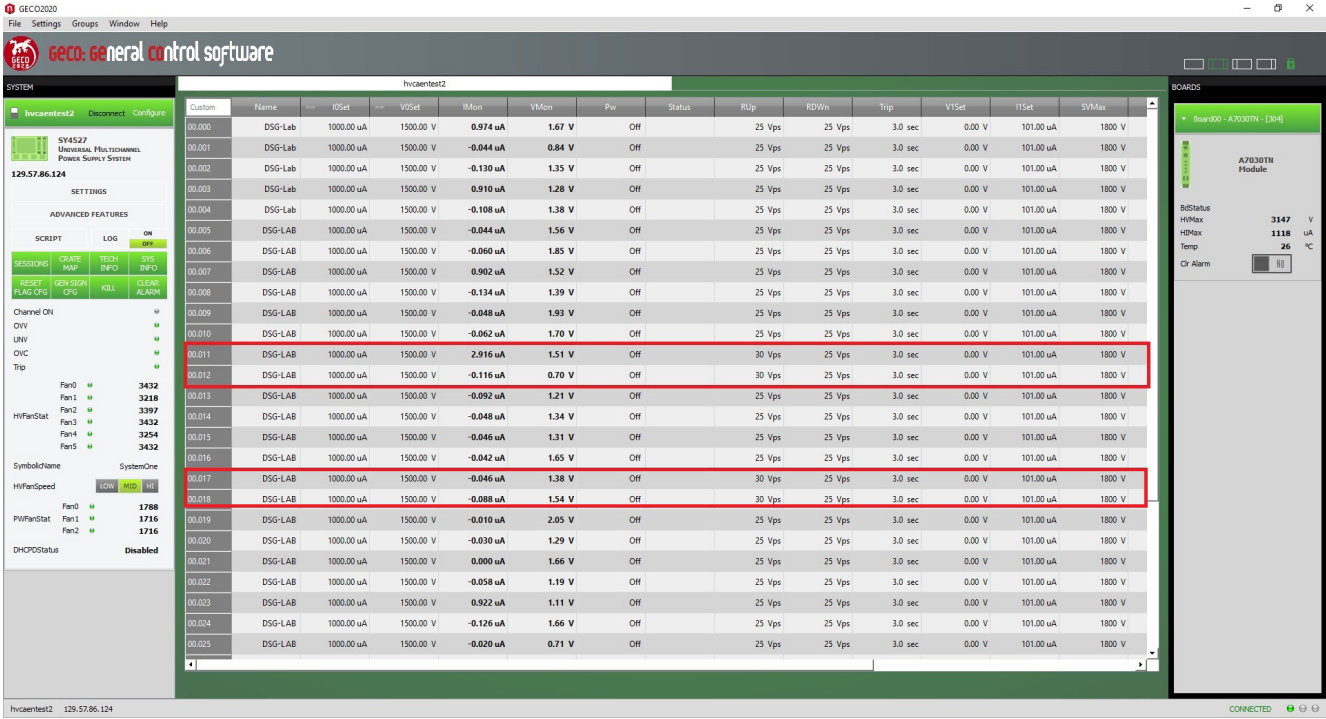


FIG. 1. GECO 2020 screenshot shows channels 11, 12, 17 and 18 with incorrect R_{Up} values (30 V/s).

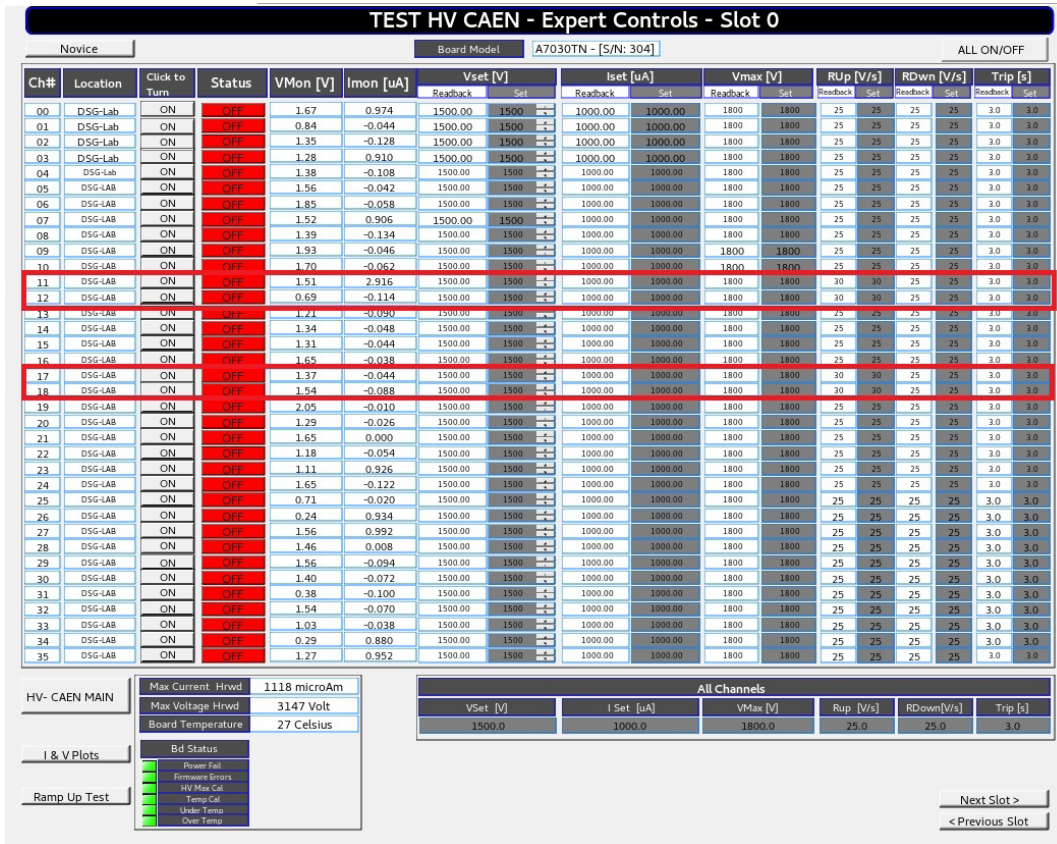


FIG. 2. *Expert Controls* CSS-BOY screen shows channel 11, 12, 17 and 18 with incorrect R_{Up} values (30 V/s).

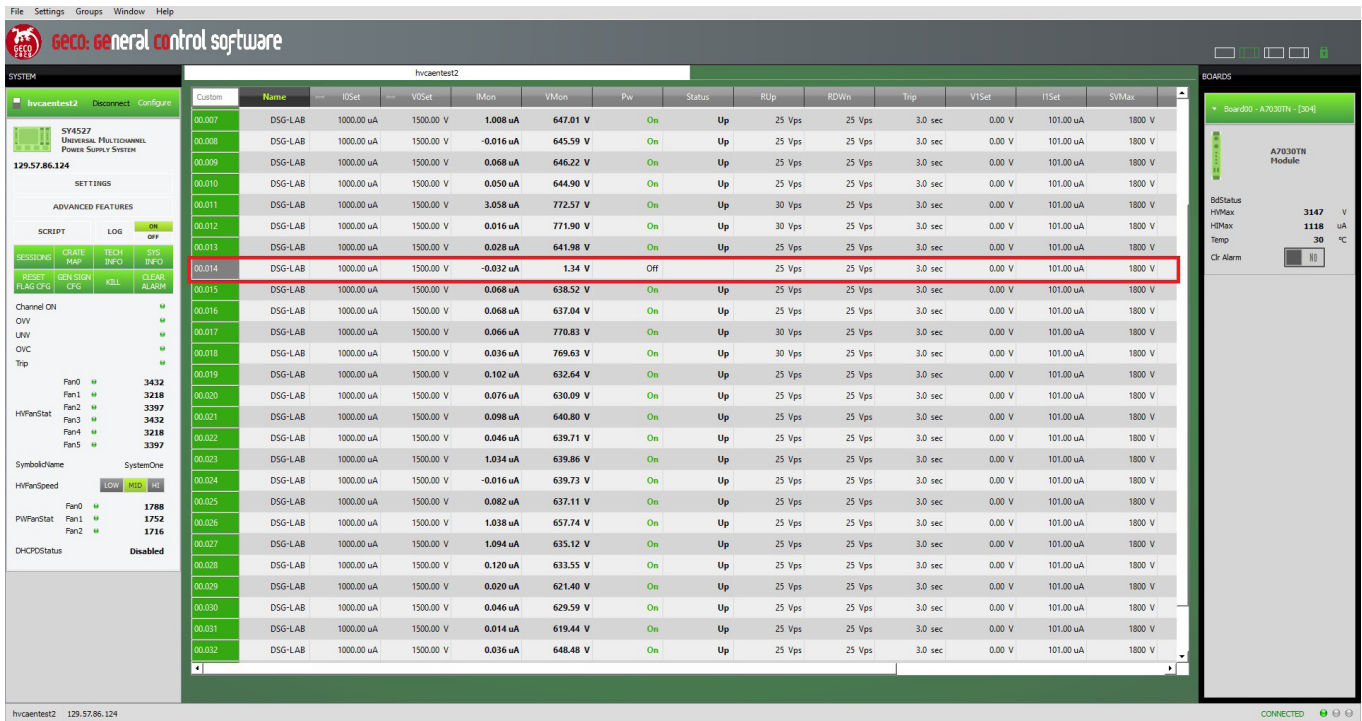


FIG. 5. GECO 2020 screenshot shows channel 14 is off after P_w for all channels was set to 1 (turn on) simultaneously.

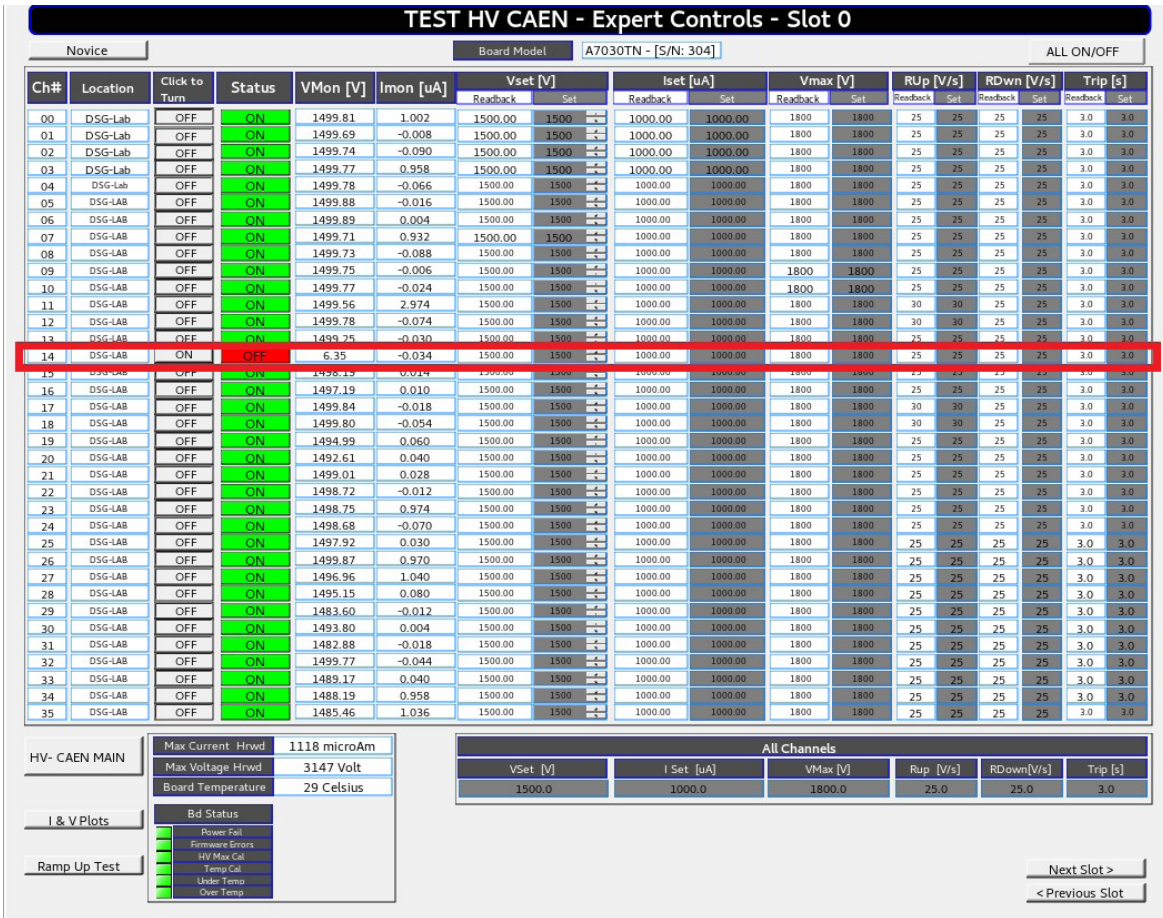


FIG. 6. Expert Controls CSS-BOY screen shows status of channel 14 is off after P_w for all channels was set to 1 (turn on) simultaneously.

The screenshot displays the GECO 2020 software interface. The main window shows a list of channels for 'hvcaentest2'. Channel 19 is highlighted in red and has a status of 'Off', with a power reading of 3.15 V. Other channels are mostly 'On' with power readings around 1499.75 V to 1499.82 V. The interface includes a left sidebar with 'SYSTEM' settings, a top menu bar, and a right sidebar showing board status for 'A7030TN Module' with voltage at 3147 V and temperature at 28 °C.

FIG. 9. GECO 2020 screenshot shows channel 19 is off after P_w for all channels was set to 1 (turn on) simultaneously.

The screenshot shows the Expert Controls CSS-BOY interface. The main window is a table titled 'TEST HV CAEN - Expert Controls - Slot 0'. The table lists 35 channels (Ch# 00-35) with columns for Location, Status, VMon [V], Imon [uA], Vset [V], Iset [uA], Vmax [V], RUp [V/s], RDwn [V/s], and Trip [s]. Channel 19 is highlighted in red and has a status of 'OFF'. The interface also includes a 'Novice' toolbar, a 'Board Model' dropdown, and several monitoring widgets at the bottom, such as 'HV-CAEN MAIN' showing a max voltage of 3147 Volt and 'I & V Plots' showing Bd Status with Power Fail and HV Max Cal indicators.

FIG. 10. Expert Controls CSS-BOY screen shows status of channel 19 is off after P_w for all channels was set to 1 (turn on) simultaneously.

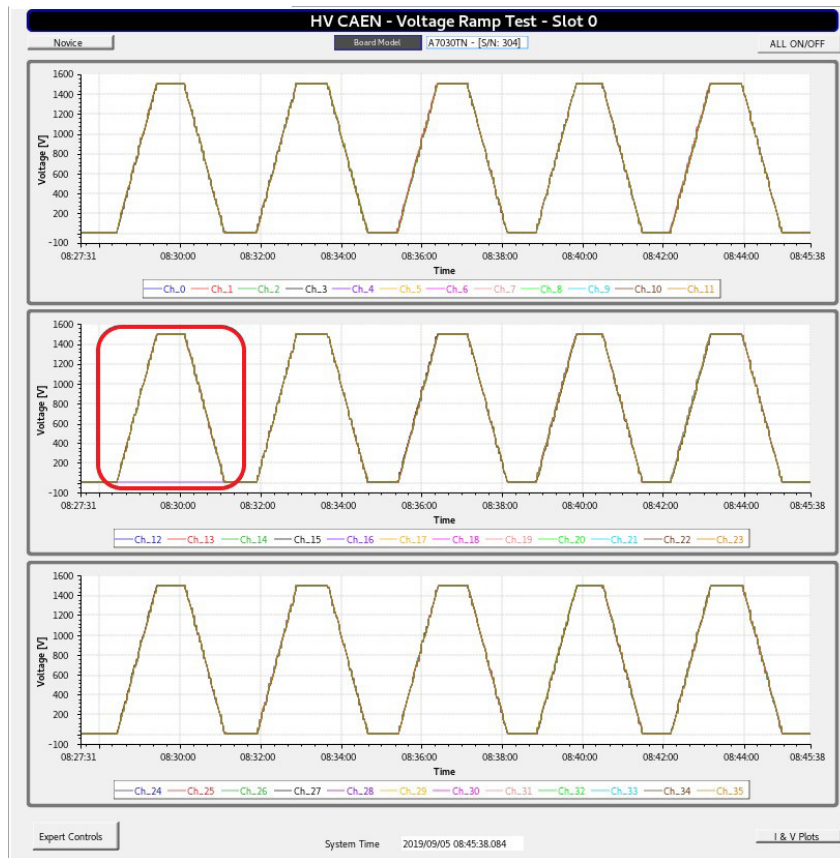


FIG. 11. Voltage Ramp Test CSS-BOY screen. Red rounded rectangle indicates channel 16 failed to ramp up .

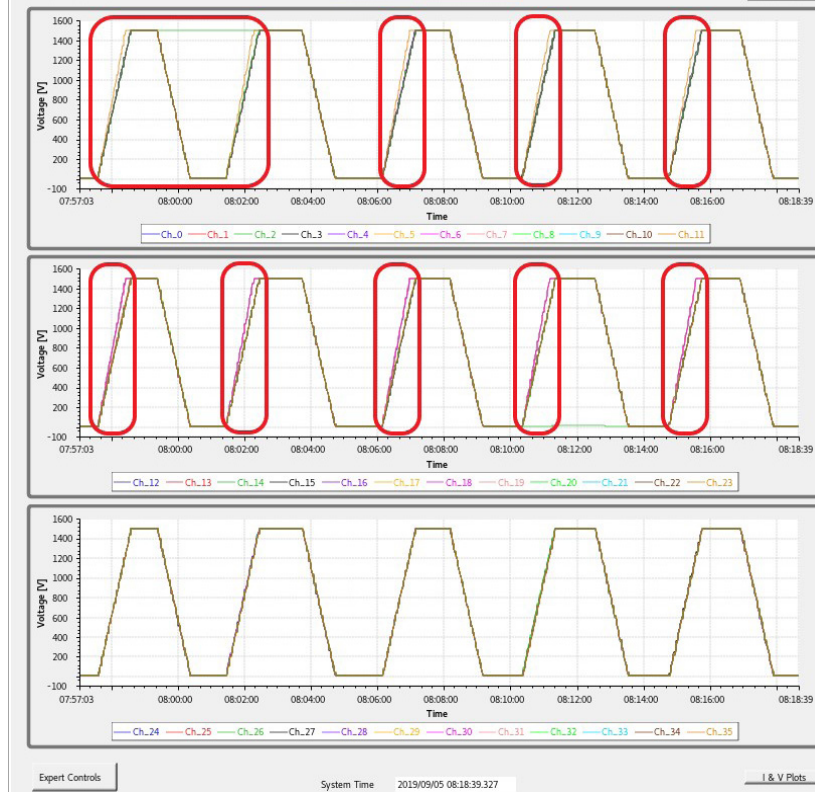


FIG. 12. Voltage Ramp Test with CSS-BOY. Red rounded rectangles show that R_{up} does not go to the set point, 25 V/s, but stays at 30 V/s.

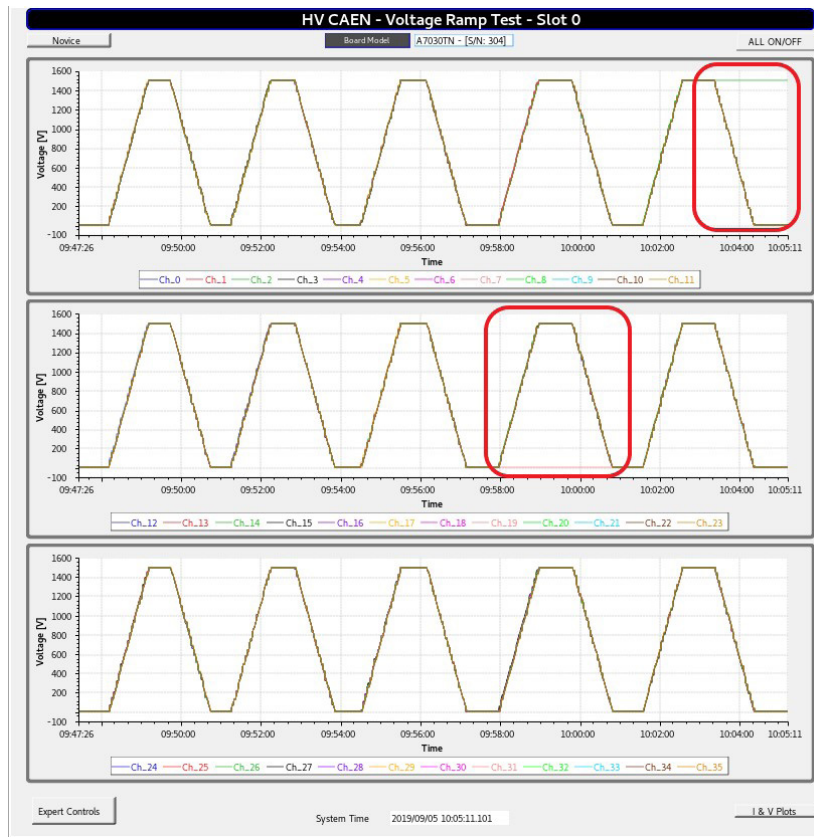


FIG. 13. *Voltage Ramp Test* CSS-BOY screen. Red rounded rectangles show that channel 19 failed to ramp up.