

Testing, Analysis, and Debugging of Hall C’s Neutral Particle Spectrometer High Voltage Supply Cables

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This note presents the results of the testing, analysis, and debugging of the Neutral Particle Spectrometer’s high voltage cables.

Five high voltage cables (36 channels each) in module #309, slot 0, of CAEN crate #2 were tested because of their voltage oscillations, unstable setpoints, and tripping of at least one high voltage channel.

For the test, all channels were ramped up to their set voltage levels, their high voltage settings unchanged so that the cables would be tested as they were used in the experiment.

The readback current and readback voltage of each channel were monitored on the high voltage user interface. If the channel was stable, it was ramped down and turned off. The test data of the five cables were archived using MYA.

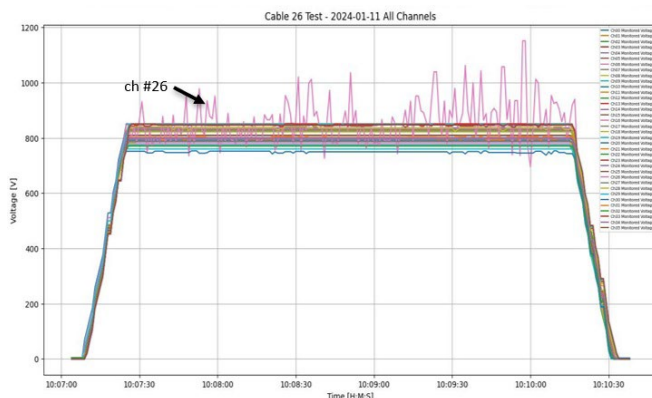
The MYA *mySampler* command was used to extract data for analysis. Given the number of data points to extract, the number of seconds between data points, and the process variable names as input arguments, the *mySampler* command extracts the test data, the date, and the start time as a .csv file. Data extraction with *mySampler* command ensures that each data point of all channels Ch#0–Ch#35 in a cable has the same timestamp, Fig. 1.

Time	Ch #0			Ch #1		
	IMon	VMon	V0Set	IMon	VMon	V0Set
10:07:04	4.606	0	841.4	0.052	0.3	792.45
10:07:05	4.606	0	841.4	0.052	0.3	792.45
10:07:06	4.606	0	841.4	0.052	0.3	792.45
10:07:07	4.606	0	841.4	0.052	0.3	792.45
10:07:08	4.606	0	841.4	0.052	0.3	792.45
10:07:09	22.058	69.35	841.4	0.052	15.86	792.45
10:07:10	34.704	107.28	841.4	20.396	63.98	792.45
10:07:11	47.49	146.67	841.4	33.228	102.9	792.45
10:07:12	60.224	183.84	841.4	46.044	140.79	792.45

FIG. 1. Snippet of data file. Only two of the 36 channels are shown. Data was extracted at 1 Hz. VMon column for Ch#0 and Ch#1 ramp up voltage at 1 s intervals.

A Python program to plot the extracted data for all channels called *cableTestplotting.py* was created to read the data from the .csv file, which is organized in labeled columns. Since each data point has the same timestamp, there is only one column with time. The program plots the data for all channels versus the timestamps on one plot, Figs. 2a and 2b.

The plots of all channels of the other tested cables (cables #11, #22, #23, and #32) had no issues. Figures 3a and 3b show the plots of all channels of cable #23.

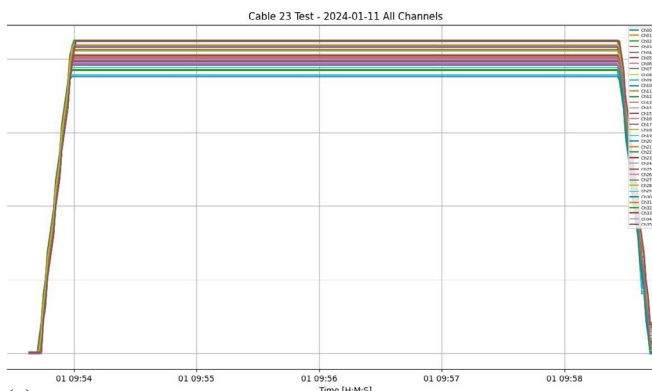


(a)

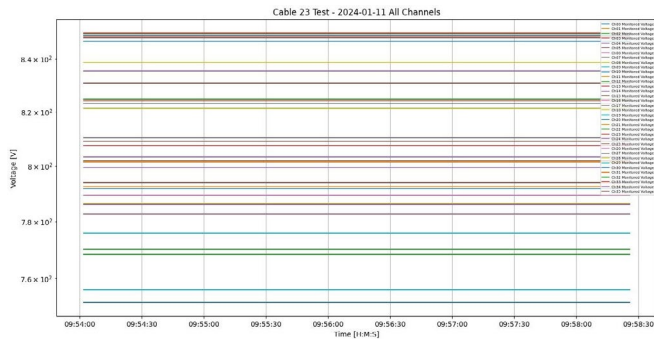


(b)

FIG. 2(a). Plot of all monitored voltage vs. time for all 36 channels of cable #26. (b). Log plot of the central portion of (a)—sans ramp up or ramp down. Channel #26 of the cable shows the largest oscillations, which might have caused the high voltage trip.



(a)



(b)

FIG. 3(a). Plot of all monitored voltage vs. time for all channels of cable #23. (b). Log plot of the central portion of (a)—sans ramp up or ramp down. No channel of the cable shows oscillations.

In conclusion, five high voltage supply cables were tested. Cable #26 showed multiple channels with multiple issues. Inspection of the CAEN Radial connector on cable #26 showed that the connector pin for channel #26 is recessed, Fig. 4, which could, due to poor contact with the Radial connector on the high voltage module, be part of the problem. A problem with the CAEN module has been ruled out because a good cable used instead of cable #26 showed no issues.

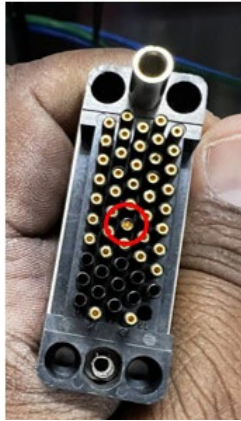


FIG. 4. Recessed pin (circled in red) of channel #26 cable #26.