Narodowe Centrum Badań Jądrowych
National Centre for Nuclear Research
ŚWIERK

UPDATED MANUAL

DESCRIPTION of FilterBox@NCBJ, MTCD2@NCBJ and CAPSULE CABLES

September 2019

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New software features including:

- *Automatic power off and power on of FilterBox@NCBJ when program starts or any time a failure in communication between MTCD2@NCBJ and FilterBox@NCBJ is detected.*
- *Detailed reports on connection failures. Necessary data are written in log files and dedicated scripts are prepared for graphical presentation of temperature and voltage information.*

***New hardware features including**:*

- *One module for vertical and horizontal camera (20 high voltage power supplies in single box).*
- *FilterBox@NCBJ power supply is included in MTCD2@NCBJ (no separate module is needed now) and is controlled by control software.*

Before measurements:

1. Check date and time on each computer in use.
2. Connect all cables from the equipment to power, e.g., MTCD2@NCBJ, power module for both FilterBox@NCBJ, laptops.

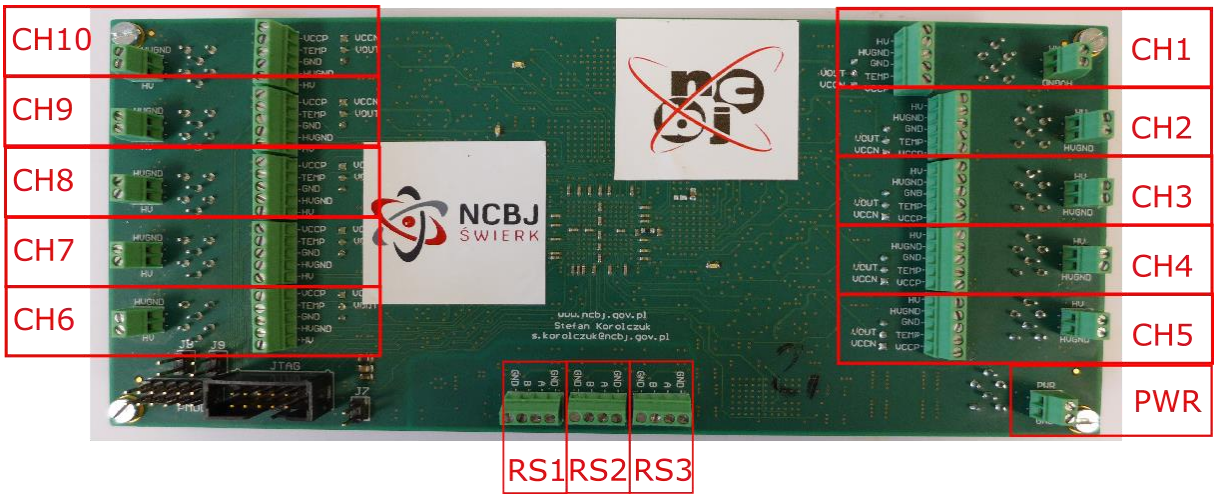


Fig. 1 FilterBox@NCBJ PCB board.

Fig. 2. Power supplies for FilterBoxes@NCBJ and MTCD2@NCBJ units in J1D.

3. In the MTCD2@NCBJ unit serving for Vertical and Horizontal parts of the Gamma Camera:
   3.1. plug Ethernet cable (ETH) to MTCD2@NCBJ. MTCD2@NCBJ has a static IP address.
   3.2. switch on power on MTCD2@NCBJ.
   3.3. for tests connect microUSB cable to MTCD2 (serial port configuration: 115200, 8-n-1). This is an alternative way to the option in point 3.1.
4. With an active network connect to MTCD2@NCBJ from any computer using ssh protocol.

PC computer:

-	IP	192.168.1.1
-	NFS folder for horizontal camera	/var/nfs/mtcd2/horizontal
-	NFS folder for vertical camera	/var/nfs/mtcd2/vertical

MTCD2:

-	IP	192.168.1.22
-	User	root
-	Password	root

- From PC connect to MTCD2 (please open separate terminal for each camera control program):
  ssh root@192.168.1.22

On MTCD2 mount a NFS folder:
mount -o port=2049,nolock,proto=tcp -t nfs 192.168.1.1:/var/nfs/mtcd2 /mnt/

Now start a program for HORIZONTAL and VERTICAL
we have two options to start a control program

1. type:
   - for horizontal:
     cd /mnt/horizontal/
     ./start_MTCD2_HOR.sh
   - for vertical:
     cd /mnt/vertical/
     ./start_MTCD2_VER.sh

a. with default values:
temperature = 20 deg

b. initial optimal values of voltage for each detector determined from FWHM measurements:

Channel No.	Voltage at 20 °C [V]
01	55.79
02	56.16
03	56.48
04	55.71
05	56.87
06	56.07
07	55.76
08	55.56
09	55.80
10	55.40
11	55.74
12	55.53
13	55.75
14	55.59
15	55.67
16	55.46
17	55.92
18	55.36
19	55.44

c. Number of lines in a log file: 10 800 lines for each detector →108 000 for 10 detectors, corresponding to 3 hours of measurements. After reaching a preset limit, a new log file will start.

2. use a following command if you want to set your own temperature and voltage values as well as a number of lines in log files:
./mtcd2_hor --temp 20 --c1 55.79 --c2 56.16 --c3 56.48 --c4 55.71 --c5 56.87 --c6 56.07 --c7 55.76 --c8 55.56 --c9 55.8 --c10 55.4 --log_size 10800

./mtcd2_ver --temp 20 --c1 55.74 --c2 55.53 --c3 55.75 --c4 55.59 --c5 55.67 --c6 55.46 --c7 55.92 --c8 55.36 --c9 55.44 --c10 50.0 --log_size 10800

Remark: values given above are as examples how to type them in input.

WARNING: *Please keep in mind that we have determined optimal voltage values for each detector at the same temperature equal to 20 deg. So, if you change initial*

voltage values and keep the same temperature of 20 deg, results could be incorrect because of FWHM values.

3. to end the control program at any time type Ctrl-C
4. to disable HV power supplies for detectors type a command:
   - horizontal

     ./mtcd2_hor --c1 0

   - vertical

     ./mtcd2_ver --c1 0

5. All log files will be written on NFS folders in /var/nfs/mtcd2/horizontal and /var/nfs/mtcd2/vertical
   A title of each log file includes a GC part (hor or ver), date (2019_05_20 for 20 May 2019) and time (08_00_00).
   Two output files are available for a further analysis:
   - hor2_2019_05_20_09_02_55.txt with a following structure:

     XXX_01 20.05.2019 13:07:08 volt_meas temp_meas volt_ini test

   XXX_01: HOR_01 or VER_01 etc.
   volt_meas and temp_meas: measured values
   volt_ini: voltage given as input to the all_channel_set_fbox program
   test: value not important for users
   Initial voltage values are from the Table above or typed by user. Measured initial values were obtained with an accuracy of 10 mV (2 digits). In log files we decided to use a format with 3 digits corresponding to 1 mV. Nevertheless, this is an artificial accuracy !
   - hor2_2019_05_20_09_02_55.msg contains information about fault in communication, see explanation below
6. On each screen (for HOR2 and VER2 GC parts) please look only to data appearing after a line:

   *** START MTCD2 at 20-05 08:01:02

   All lines before this line are for initialization of a system, not important for a user.

7. Any fault in communication between MTCD2 and FilterBox will be noticed both on a screen and in the log file with an extension msg, e.g.,

   20-05-2019 11:55:29 FAILURE! HOR2_UART Read timeout from channel 1

We observed in last days that such problems in communication can be correlated with JET operation. For this, please look to a web page: meta.jet.efda.org:8081/pulses and compare with screen information.

Communication problems do not stop detectors – data are collected as long as a voltage on detectors is on.

To look to log files (with an extension txt) a script is prepared which allows to draw figures, e.g., presenting a dependence of voltage/temperature as a function of time for each of detectors. A user has to change a name of a file. A file name has to be typed below a line:

// below type a file name:

This name is shown on figures. The script is in C language to run under ROOT, see end of this report.

This script is for interactive checking of log files. It depends on a user what and how to plot !

DETAILS of WIRING/CABLING

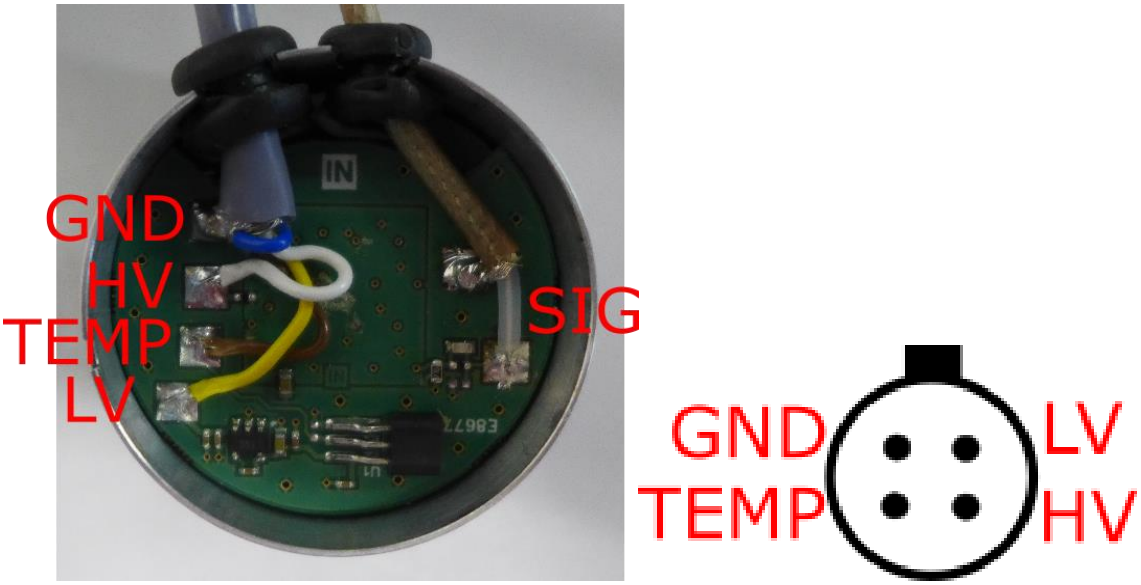


Fig. 3. Passive base PCB board and LEMO connector (front view).

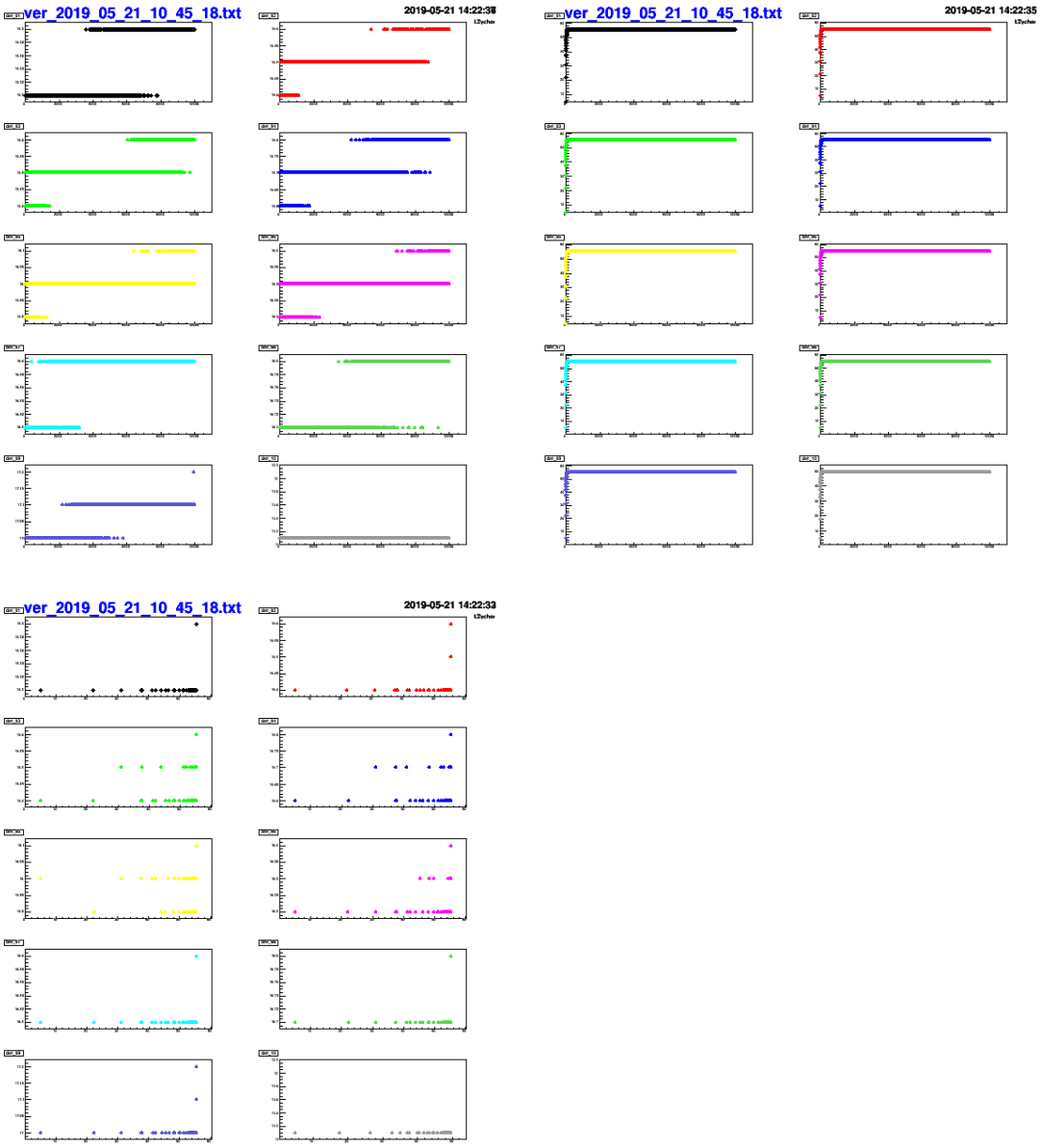
Fig. 4. MTCD2@NCBJ rear panelsof the Gamma Camera. Most left connectors (label: 12V - +) are power suppliers for Filterboxes

Vertical camera								
Channel	**Detector**	**color**	**FilterBOX**	**color**	**lemo W00172**	**terminal block K2159**	**cable label**	**Vertical MTCD**
1	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	3	3	HV11	HV1+
	GND	blue	GND	red	1	1		HV1-
2	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	36	7	HV12	HV1+
	GND	blue	GND	red	22	6		HV1-
3	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	37	9	HV13	HV1+
	GND	blue	GND	red	20	8		HV1-
4	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	26	12	HV14	HV1+
	GND	blue	GND	red	4	11		HV1-
5	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	25	14	HV15	HV1+
	GND	blue	GND	red	6	13		HV1-
6	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	46	19	HV16	HV1+
	GND	blue	GND	red	39	18		HV1-
7	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	34	22	HV17	HV1+
	GND	blue	GND	red	19	21		HV1-
8	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	17	23	HV18	HV1+

	GND	blue	GND	red	35	24		HV1-
9	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	7	26	HV19	HV1+
	GND	blue	GND	red	28	27		HV1-
Channel			**FilterBOX**		**lemo W00173**	**terminal block K2160**	**cable label**	**Vertical MTCD**
RS01			GND		6	13	VRS01	RS485 1 *
			A		4	11		RS485 1 A
			B		26	12		RS485 1 B
RS02			GND		39	18	VRS01	RS485 1 *
			A		38	16		RS485 1 A
			B		47	17		RS485 1 B
RS03			GND		17	23	VRS01	RS485 1 *
			A		19	21		RS485 1 A
			B		34	22		RS485 1 B
PWR			PWR		36	7	VFBOX	
			GND		22	6		

Horizontal camera								
Channel	**Detector**	**color**	**FilterBOX**	**color**	**lemo W00170**	**terminal block K21596**	**cable label**	**Horizontal MTCD**
1	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	3	3	HV01	HV1+
	GND	blue	GND	red	1	1		HV1-
2	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	36	7	HV02	HV1+
	GND	blue	GND	red	22	6		HV1-
3	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	37	9	HV03	HV1+
	GND	blue	GND	red	20	8		HV1-
4	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	26	12	HV04	HV1+
	GND	blue	GND	red	4	11		HV1-
5	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	25	14	HV05	HV1+
	GND	blue	GND	red	6	13		HV1-
6	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	46	19	HV06	HV1+
	GND	blue	GND	red	39	18		HV1-
7	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	34	22	HV07	HV1+
	GND	blue	GND	red	19	21		HV1-
8	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	17	23	HV08	HV1+
	GND	blue	GND	red	35	24		HV1-
9	LV	yellow	VCCP	white				
	TEMP	brown	TEMP	green				
	HV	white	HV	blue	7	26	HV09	HV1+

	GND	blue	GND	red	28	27		HV1-
Channel			**FilterBOX**		**lemo W00171**	**terminal block K2157**	**cable label**	**Horizontal MTCD**
RS01			GND		6	13	VRS01	RS485 1 *
			A		4	11		RS485 1 A
			B		26	12		RS485 1 B
RS02			GND		39	18	VRS01	RS485 1 *
			A		38	16		RS485 1 A
			B		47	17		RS485 1 B
RS03			GND		17	23	VRS01	RS485 1 *
			A		19	21		RS485 1 A
			B		34	22		RS485 1 B
PWR			PWR		36	7	HFBOX	
			GND		22	6		



Some output plots from log files.

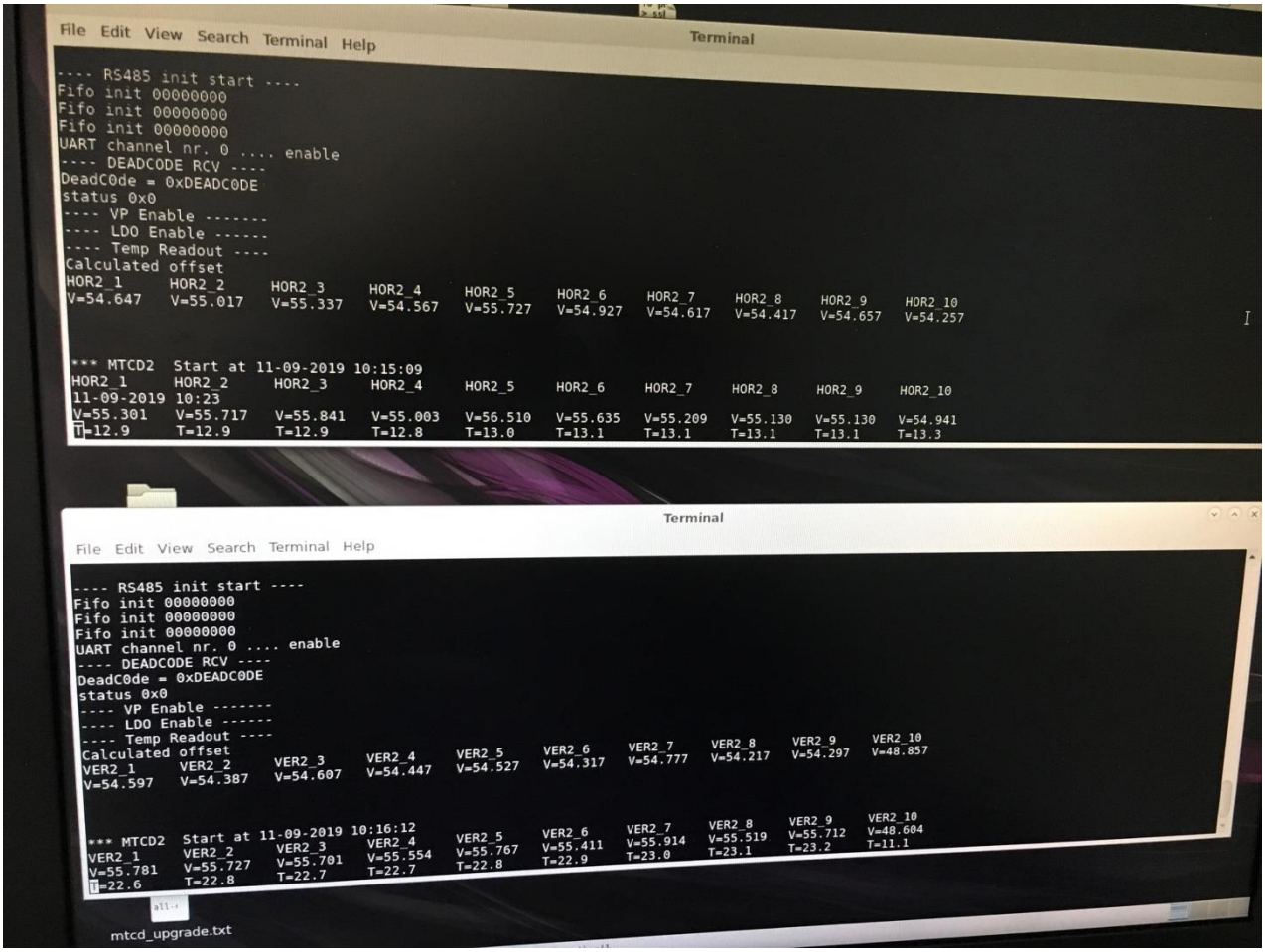


Photo 1. If "– 11.1" is seen only for non-existing VER_10, than the device is working correctly.

If "– 11.1" is seen not only for VERT_10, the following procedure should be applied (similar to restart):

a. first press CTRL-C
b. type:

- for horizontal if "-11.1" seen for HOR:

  cd /mnt/horizontal/
  ./start_MTCD2_HOR.sh

- for vertical if "-11.1" seen for VERT:

  cd /mnt/vertical/
  ./start_MTCD2_VER.sh

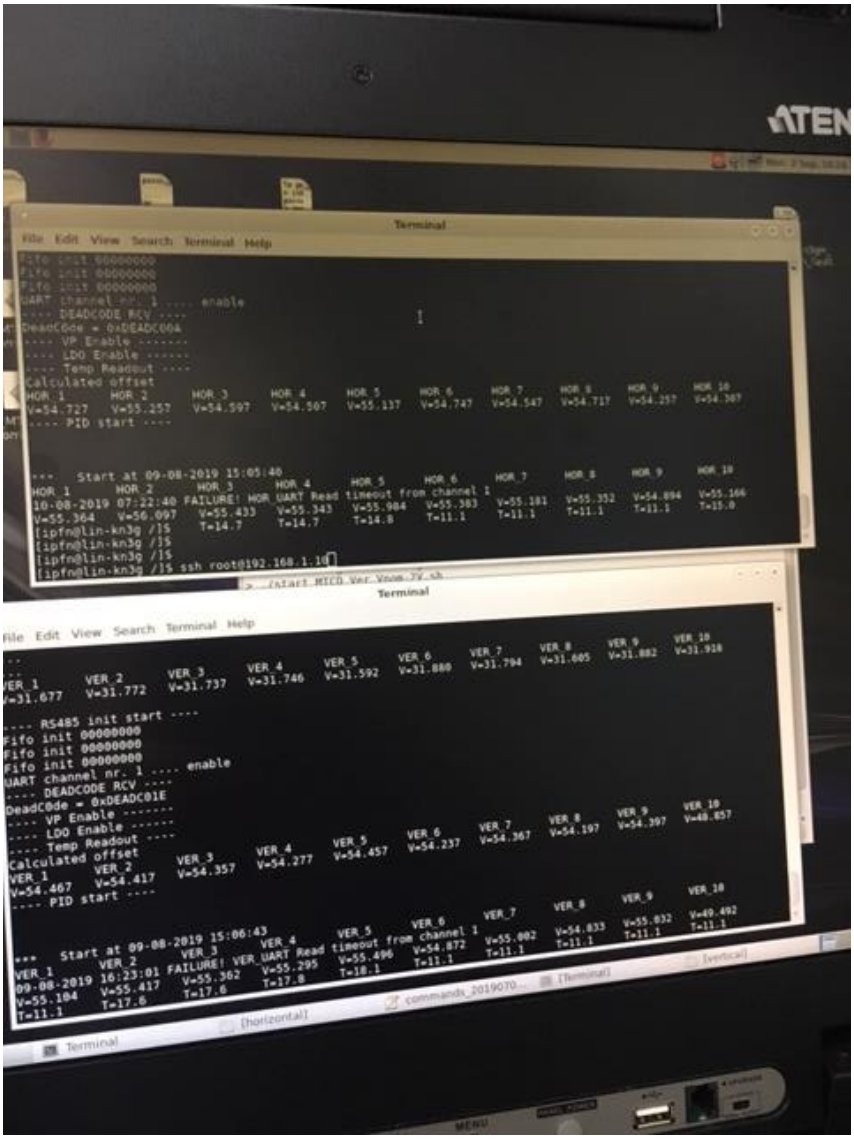


Photo 2. Necessary to restart FilterBox – 11.1 seen for some detectors in HOR or VER.