

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 <u>FilterBox@NCBJ</u> when program starts or any time a failure in communication between <u>MTCD2@NCBJ</u> 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 <u>MTCD2@NCBJ</u> (no separate module is needed now) and is controlled by control software.

Before measurements:

- 1. Check <u>date and time</u> 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.

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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. <u>for tests</u> connect microUSB cable to MTCD2 (serial port configuration: 115200, 8-n-1). This is an alternative way to the option in point 3.1.

192.168.1.1

/var/nfs/mtcd2/horizontal

/var/nfs/mtcd2/vertical

4. With an active network connect to MTCD2@NCBJ from any computer using ssh protocol.

PC computer:

- IP
- NFS folder for horizontal camera
- NFS folder for vertical camera

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:

<mark>cd /mnt/vertical/</mark> ./start_MTCD2_VER.sh

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a. with default values:

temperature = 20 deg

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

Channel	Voltage at
No.	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.

<u>WARNING</u>: 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

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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.

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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 !

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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

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Vertical camera								
Channel	Detector	color	FilterBOX	color	lemo W00172	terminal block K2159	cable label	Vertical MTCD
	LV	yellow	VCCP	white				
1	1 TEMP		TEMP	green				
Ŧ	HV	white	HV	blue	3	3	LI\/11	HV1+
	GND	blue	GND	red	1	1		HV1-
	LV	yellow	VCCP	white				
2	TEMP	brown	TEMP	green				
2	HV	white	HV	blue	36	7	н\/12	HV1+
	GND	blue	GND	red	22	6	11012	HV1-
	LV	yellow	VCCP	white				
3	TEMP	brown	TEMP	green				
5	HV	white	HV	blue	37	9	HV/13	HV1+
	GND	blue	GND	red	20	8	11015	HV1-
	LV	yellow	VCCP	white				
Д	TEMP	brown	TEMP	green				
-	HV	white	HV	blue	26	12	H\/1 <i>1</i>	HV1+
	GND	blue	GND	red	4	11	11014	HV1-
	LV	yellow	VCCP	white				
5	TEMP	brown	TEMP	green				
5	HV	white	HV	blue	25	14	HV/15	HV1+
	GND	blue	GND	red	6	13	11015	HV1-
	LV	yellow	VCCP	white				
6	TEMP	brown	TEMP	green				
0	HV	white	HV	blue	46	19	HV16	HV1+
	GND	blue	GND	red	39	18	11010	HV1-
	LV	yellow	VCCP	white				
7	TEMP	brown	TEMP	green				
,	HV	white	HV	blue	34	22	HV/17	HV1+
	GND	blue	GND	red	19	21	11017	HV1-
	LV	yellow	VCCP	white				
8	TEMP	brown	TEMP	green				
	HV	white	HV	blue	17	23	HV18	HV1+

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	GND	blue	GND	red	35	24		HV1-
	LV	yellow	VCCP	white				
0	TEMP	brown	TEMP	green				
9	HV	white	HV	blue	7	26	111/10	HV1+
	GND	blue	GND	red	28	27	пу19	HV1-
Channel			FilterBOX		lemo W00173	terminal block K2160	cable label	Vertical MTCD
RS01			GND		6	13		RS485 1 *
			А		4	11	VRS01	RS485 1 A
			В		26	12		RS485 1 B
RS02			GND		39	18		RS485 1 *
			А		38	16	VRS01	RS485 1 A
			В		47	17		RS485 1 B
RS03			GND		17	23		RS485 1 *
			А		19	21	VRS01	RS485 1 A
			В		34	22		RS485 1 B
PWR			PWR		36	7		
			GND		22	6	VEDUX	

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Horizontal camera									
Channel	Detector	color	FilterBOX	color	lemo W00170	terminal block K21596	cable label	Horizontal MTCD	
	LV	yellow	VCCP	white					
4	TEMP	brown	TEMP	green					
1	HV	white	HV	blue	3	3	111/04	HV1+	
	GND	blue	GND	red	1	1	HVU1	HV1-	
	LV	yellow	VCCP	white					
	TEMP	brown	TEMP	green					
2	HV	white	HV	blue	36	7		HV1+	
	GND	blue	GND	red	22	6	HV02	HV1-	
	LV	yellow	VCCP	white					
_	TEMP	brown	TEMP	green					
3	HV	white	HV	blue	37	9		HV1+	
	GND	blue	GND	red	20	8	HV03	HV1-	
	LV	yellow	VCCP	white					
	TEMP	brown	TEMP	green					
4	HV	white	HV	blue	26	12		HV1+	
	GND	blue	GND	red	4	11	HV04	HV1-	
	LV	vellow	VCCP	white					
	TEMP	brown	TEMP	green					
5	HV	white	HV	blue	25	14		HV1+	
	GND	blue	GND	red	6	13	HV05	HV1-	
	LV	vellow	VCCP	white					
	TEMP	brown	TEMP	green					
6	HV	white	HV	blue	46	19		HV1+	
	GND	blue	GND	red	39	18	HV06	HV1-	
	LV	vellow	VCCP	white					
	TEMP	brown	TEMP	green					
7	HV	white	HV	blue	.34	22		HV1+	
	GND	blue	GND	red	19	21	HV07	HV1-	
	LV	vellow	VCCP	white					
	TEMP	brown	TEMP	green	+				
8	HV	white	HV	blue	17	23		HV1+	
	GND	blue	GND	red	35	23	HV08	HV1-	
		vellow	VCCP	white					
9		hrown	TEMP	green					
2		white	HV/	hlue	7	26	HV/00	H\/1+	
	117	winte	110	שועכ	,	20	11003		
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	GND	blue	GND	red	28	27		HV1-
Channel			FilterBOX		lemo W00171	terminal block K2157	cable label	Horizontal MTCD
RS01			GND		6	13		RS485 1 *
			А		4	11	VRS01	RS485 1 A
			В		26	12		RS485 1 B
RS02			GND		39	18		RS485 1 *
			А		38	16	VRS01	RS485 1 A
			В		47	17		RS485 1 B
RS03			GND		17	23		RS485 1 *
			А		19	21	VRS01	RS485 1 A
			В		34	22		RS485 1 B
PWR			PWR		36	7		
			GND		22	6	пгвОх	

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Some output plots from log files.

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le Edit Vie	ew Search	Terminal u	ala			Tei	rminal				
RS485	init start	reminal He	ыр								
ifo init of	0000000										
ifo init O	0000000										
DEADCO	L nr. 0 DE RCV	enable									
DeadCOde =	0xDEADC0DE										
VP Ena	ble										
Temp P	Readout										
HOR2_1	HOR2_2	HOR2_3	HOR2_4	HOR2 5	HOR2 6	H082 7	HORD A	11000 0			
V=34.047	V=55.017	V=55.337	V=54.567	V=55.727	V=54.927	V=54.617	V=54.41	17 V=54.65	HOR2_10 7 V=54.257		
*** MTCD2 HOR2_1	Start at HOR2_2	11-09-2019 HOR2_3	10:15:09 HOR2 4	HOR2 5	HOR2 6	H0R2 7	HOR2 8	H082 9	HOR2 10		
11-09-2019 V=55.301	10:23 V=55.717	V=55.841	V=55.003	V=56.510	V=55.635	V=55.209	V=55.13	0V=55.130	V=54.941		
T=12.9	T=12.9	T=12.9	T=12.8	T=13.0	T=13.1	T=13.1	T=13.1	T=13.1	T=13.3		
						Termin	al				
File Edit V	liow Search	Terminal H	elp			Tertim	iai				
Hie cuit •	Tew Search	1Circlina	cip					annande de more re-ance-			
RS485 Fifo init	init start 00000000	:									
Fifo init Fifo init	00000000										
UART chann	el nr. 0 . ODE RCV	enable									
DeadC0de = status 0x0	0xDEADCOD	3									
VP Er	nable Enable										
Calculated	d offset	VER2 3	VER2_4	VER2_5	VER2_6	VER2_7 V=54.777	VER2_8 V=54.217	VER2_9 V V=54.297 V	/ER2_10 /=48.857		
VER2_1 V=54.597	V=54.387	V=54.607	V=54.447	V=54.527	V=SHIDT						
			16:12			raa 7	VER2 8	VER2_9 V	ER2_10		
*** MTCD2	Start at VER2_2	11-09-2019 VER2_3	VER2_4	VER2_5 V=55.767	VER2_6 V=55.411	/=55.914	V=55.519 T=23.1	V=55.712 V T=23.2 T	=11.1		
V=55.781	V=55.727 T=22.8	V=55.701 T=22.7	T=22.7	T=22.8	1=22.9			Carlo and			
al	1-1										-
a best of	narade.txt							Contraction of the second	and the second second	and the second second	COLUMN STREET,

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

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	1
	ATE
	Color Management
Tensital	000
Tate and bodocoo Tate and bodocoo Tate and bodocoo Tate and bodocoo SUBAT chargel and i enable DEADCOUE RTY DeadCoose and Enable VP Enable Tenp Readput Tenp Readput 	100
HOR 1 HOR 2 HOR 3 HOR 4 HOR 5 HOR 6 HOR 7 HOR 8 HOR 9 HO V-54,727 V-53,257 V-54,597 V-54,597 V-55,137 V-54,747 V-54,547 V-54,717 V-54,257 V- V-54,727 V-54,547 V-54,547 V-54,597 V-54,747 V-54,547 V-54,547 V-54,717 V-54,257 V- 7	6 10 54 397
*** Start at 09-08-2019 15:05/48 HOR 5 HOR 6 HOR 7 HOR 8 HOR 9 HOR 1 HOR 2 HOR 3 HOR 4 HOR 5 HOR 6 HOR 7 HOR 8 HOR 9 HOR 1 HOR 2 HOR 9 HOR 9 HOR 10:08-2019 07:22:48 PATLIRE: HOR WART Bead timeout from channel 1 v=55.181 v=55.352 v=54.484 v v=55.948 v=56.948 v=5	96, 18 -15, 164 -15, 0
Ule Edit View Search Terminal Help 	528
=31.677 V=31.72 ************************************	10
Teep Readout VER.4 VER.3 V=54.277 V=54.237 V=54.	10
<pre>v== Start at 09-08-2010 15:00:43 VER.5 VER.5 VER.6 VER.7 VER.5 v== VER.3 VER.4 VER.5 VER.6 VER.1 v=>5.002 v=>4.833 v=>5.022 v= v== VER.1 VER.2 v=>6.000 V=>5.496 V=>5.496 V=>6.872 v=>5.496 V=>6.872 v=>1.1.1 v=>1.1.1</pre>	(vertical)
09-88-2019 10:27:27 y=55:384 y=55:184 T=11:1 T=17:6 T=17:6 (horizontal) 28 commands_2019070	
Termical	
	E
uter terms	

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

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