

Status & Plan of high-voltage power supply and flex tails

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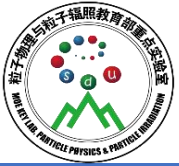


山东大学

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中国科学院高能物理研究所
Institute of High Energy Physics
Chinese Academy of Sciences



Outline

□ Flex tail

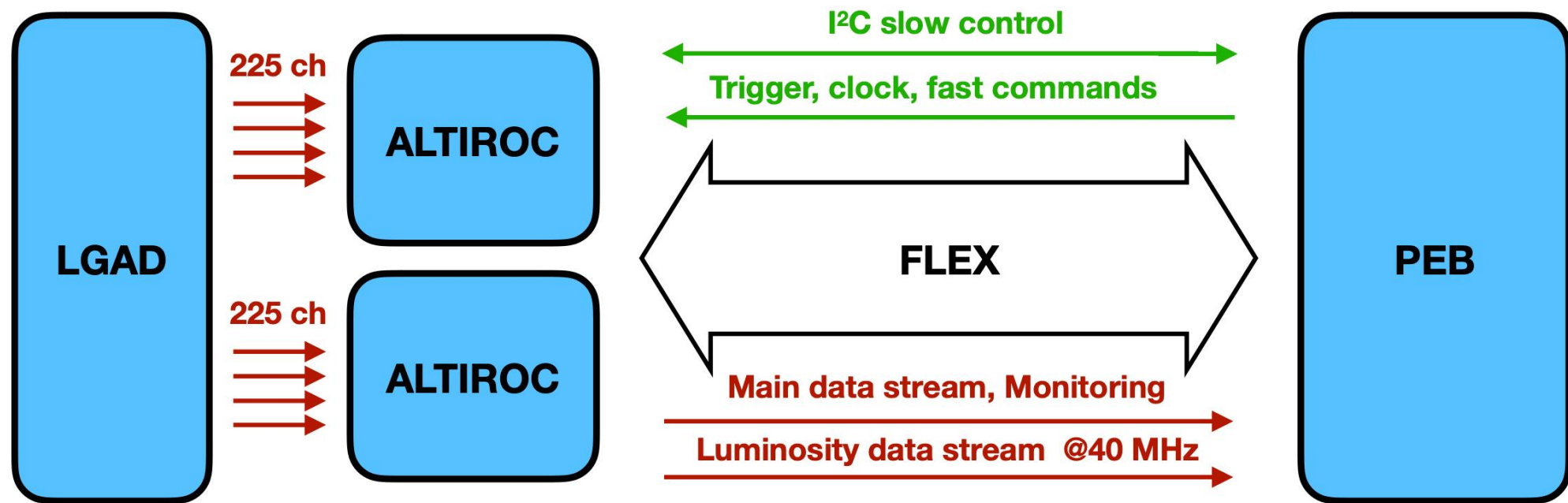
- ✓ PCB Structure
- ✓ Testing: width & thickness, voltage drop, etc

□ High voltage

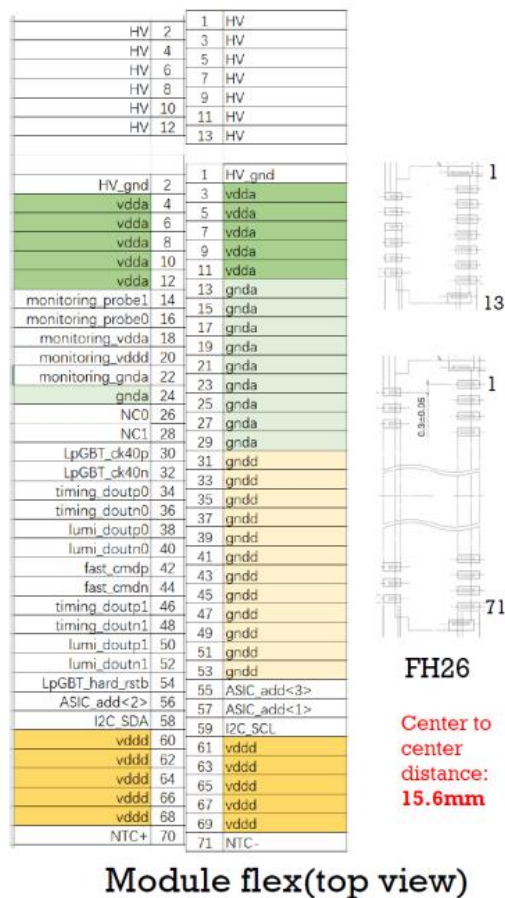
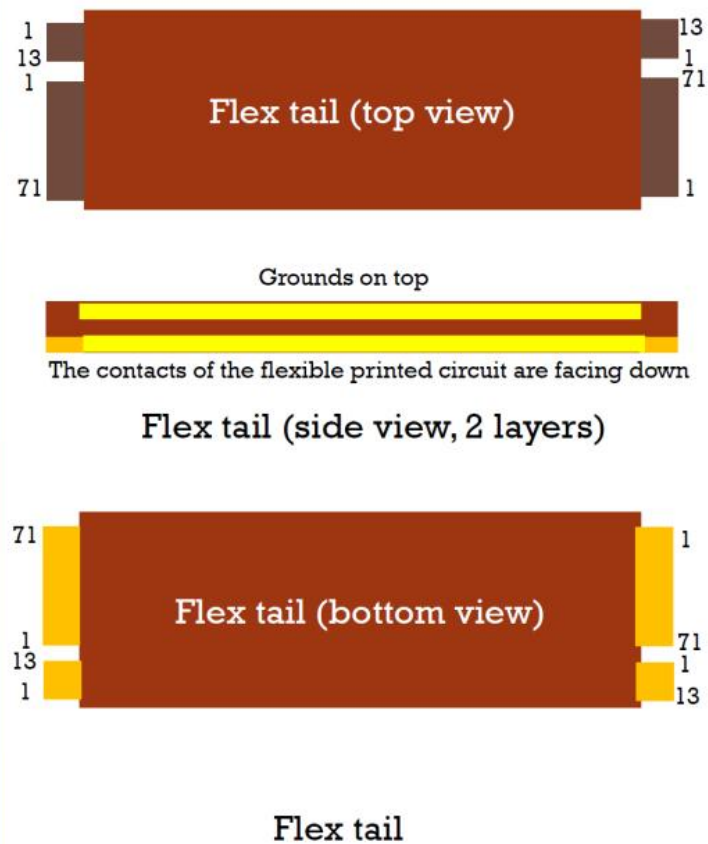
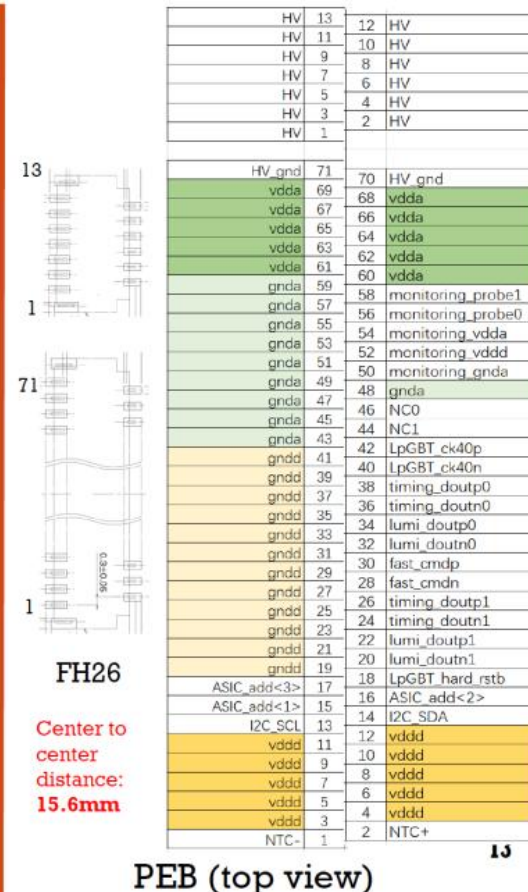
- ✓ Test in China
- ✓ Test at CERN

High granularity timing detector (HGTD):

- ✓ Flexible PCB between low-gain avalanche detector (LGAD) and peripheral electronics board (PEB) : 1/3 mass production;
- ✓ High Voltage (HV) module: $\sim 18\%$;



Pin layout in flex tail



FT Parameters:

Width : 36 mm

thickness at two ends: ~200 μ m (<220 μ m)

Impedance:

Single-ended 50 Ohm +/-10%

Diff 100 Ohm +/-10%

Ends		Flex					
13 um		Coverlay Yellow					
25 um		Coverlay Adhesive					
28 um	Base Copper	18	um +	Plated	Plated	10	um min
50 um	Polyimide						
28 um	Base Copper	18	um +	Plated	Plated	10	um min
25 um	Coverlay Adhesive						
13 um	Coverlay Yellow						
25 um	Adhesive						
50 um	PI						

Last time

Two ends: flex+ stiffener=219 um ;
Flex =182 um

Line Parameters:

Differential pairs: 90 um line - 335 um gap
Single lines: 90 um

Impedance:

Single-ended 50 Ohm +/-10%
Diff 100 Ohm +/-10%

Ends		Flex					
13 um							
25 um							
28 um	Base Copper	18	um +	Plated	Plated	10	um min
50 um	Polyimide						
28 um	Base Copper	18	um +	Plated	Plated	10	um min
25 um	Coverlay Adhesive						
13 um	Coverlay Yellow						
25 um	Adhesive						
25 um	PI						

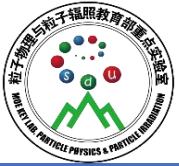
This time

Two ends: flex+ stiffener=194 um ;
Flex =182 um

Stiffener layer on the bottom was
decreased by 25 um.

Meet FT specification requirements



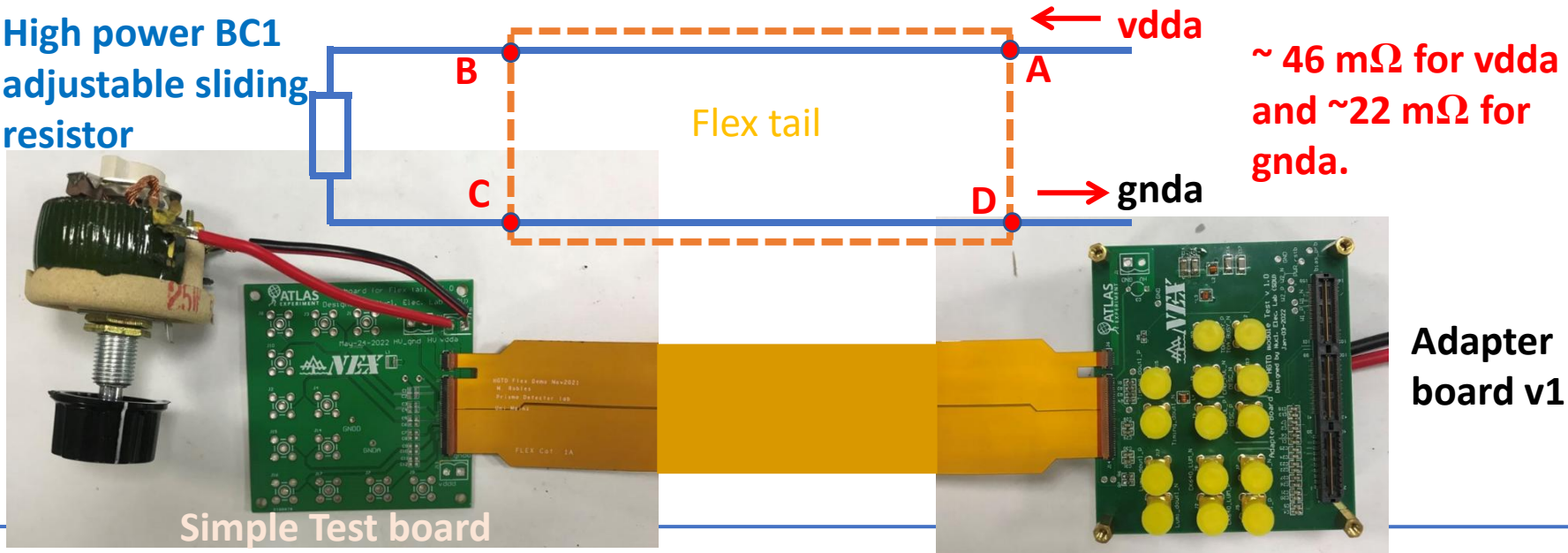


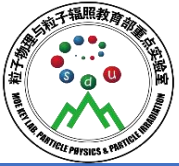
Impedance of Power & Gnd Plane



	Current (A)	Applied Voltage(V)	Voltage between A and B	Voltage between C and D	R value for vdda (m Ω)	R value for gnda (m Ω)
Current version	1.053	1.4	0.048	0.024	45.6	22.3
	0.977	1.3	0.045	0.022	46.1	22.4
	0.904	1.2	0.041	0.020	45.4	22.1
Previous version	1.034	1.4	0.071	0.033	68.6	31.9
	0.961	1.3	0.066	0.031	68.7	32.2
	0.888	1.2	0.061	0.029	68.7	32.6

High power BC1 adjustable sliding resistor





Impedance test results



New stackup: 45 um Cu

Flex tail Cat. 12L: 32.3 cm

Specifications

Power planes: <2.7 mΩ/cm

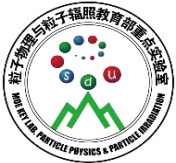
Ground planes: <0.7 mΩ/cm

	R_{plane} [mΩ]	R_{plane} [mΩ/cm]
vdda	45.6	1.41
	46.1	1.43
	45.4	1.40
gnda	22.3	0.69
	22.4	0.69
	22.1	0.68

	R_{plane} [mΩ]	R_{plane} [mΩ/cm]
vddd	42	1.30
	41.8	1.29
	41.8	1.29
gndd	19.5	0.60
	19.3	0.60
	19.7	0.61



The test results meets the requirement of the PDR specifications.



54 FT production for demonstrator

L[mm]	Category
646,6	1
640,5	2
637,6	3
614,5	4
608,4	5
605,5	6
582,2	7
576,1	8
573,2	9
550,1	10
544,0	11
541,1	12
518,0	13
511,9	14
509,0	15
483,0	16

L[mm]	Category	Serial Number	Nr or pieces to be produced	Company	Funding
646,6	1	20WFTC11F01	2	China	China
640,5	2	20WFTC11F02	2	China	China
637,6	3	20WFTC11F03	2	China	China
614,5	4	20WFTC11F04	2	China	China
608,4	5	20WFTC11F05	2	China	China
605,5	6	20WFTC11F06	2	China	China
582,2	7	20WFTC11F07	2	China	China
576,1	8	20WFTC11F08	2	China	China
573,2	9	20WFTC11F09	2	China	China
550,1	10	20WFTC11F10	2	China	China
544,0	11	20WFTC11F11	2	China	China
541,1	12	20WFTC11F12	2	China	China
518,0	13	20WFTC11F13	2	China	China
511,9	14	20WFTC11F14	2	China	China
509,0	15	20WFTC11F15	2	China	China
483,0	16	20WFTC11F16	2	China	China

**Totally, the demonstrator has 54 flex tails with different lengths.
The first 16 flex tails are relatively longer.
Germany and Slovenia cover the others costs.**

Status & Plan:

- ✓ After 54 Flex Tail (FT) production for module demonstrator, they are still under test.
- ✓ Currently, we are in the pre-production stage. China (others: Germany, Morocco, Slovenia) will be responsible for the 19 FTs (right table) in pre-production and final production.



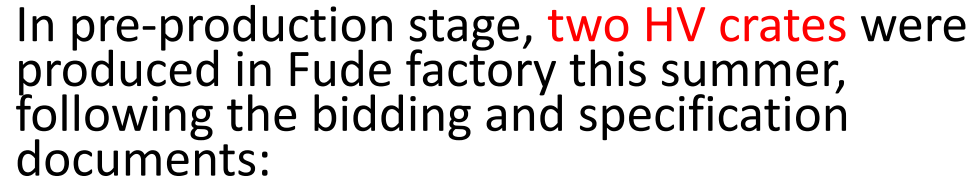
caliper



micrometer



	Length (mm)	Category	Serial Number Pre-production batch 1, first 11 digits only, add counter 000-999	Serial Number Production batch 1, first 11 digits only, add counter 000-999 at the end	Total number	Pre-production	Production
2							
3	475.8	29	20WFTCP1F29	20WFTCM1F29	158	15	143
4	495.4	27	20WFTCP1F27	20WFTCM1F27	99	10	89
5	507.9	26	20WFTCP1F26	20WFTCM1F26	80	8	72
6	516.9	24	20WFTCP1F24	20WFTCM1F24	138	13	125
7	530.4	23	20WFTCP1F23	20WFTCM1F23	80	8	72
8	540.1	22	20WFTCP1F22	20WFTCM1F22	80	8	72
9	545.4	20	20WFTCP1F20	20WFTCM1F20	41	5	36
10	549.1	19	20WFTCP1F19	20WFTCM1F19	88	16	72
11	572.2	16	20WFTCP1F16	20WFTCM1F16	80	8	72
12	581.2	13	20WFTCP1F13	20WFTCM1F13	89	17	72
13	584.1	12	20WFTCP1F12	20WFTCM1F12	21	3	18
14	604.3	10	20WFTCP1F10	20WFTCM1F10	80	8	72
15	613.3	8	20WFTCP1F08	20WFTCM1F08	80	8	72
16	614.5	7	20WFTCP1F07	20WFTCM1F07	41	5	36
17	632.7	6	20WFTCP1F06	20WFTCM1F06	22	4	18
18	636.5	5	20WFTCP1F05	20WFTCM1F05	80	8	72
19	639.4	4	20WFTCP1F04	20WFTCM1F04	21	3	18
20	645.5	3	20WFTCP1F03	20WFTCM1F03	80	8	72
21	683.5	1	20WFTCP1F01	20WFTCM1F01	30	12	18
22	Totals						



1. Temperature cycling and aging test
2. Control and monitoring communication tests
3. Output voltage and current tests
4. Protection tests
5. Interlock functionality test
6. LED indicators test
7. Quality inspection of inside of Supply components
8. Efficiency test.





Test environment

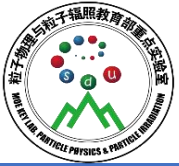


Temperature cycling

Main equipment:

- Temperature machine
For temperature cycling
- Digital multimeter: KEYSIGHT 34461A
For voltage measurement
- Picoammeter: Tonghui TH2691A
For current measurement
- Oscilloscope: Keysight DSOX3014A
For voltage ripple & up/down speed
- Loading :300K and 10M resistors

- Temperature cycling test was done from July 10th to July 11th
- Aging tests was done at room temperature from July 12th to August 17th
- FAT was done from August 18th to August 23rd



Test summary in China

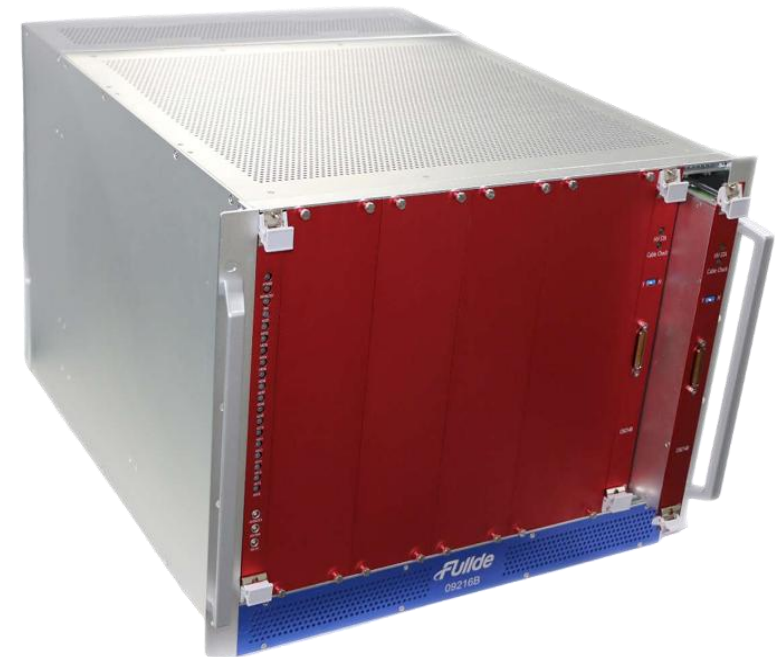


- All parameters of the high-voltage power supply have been tested.
- Except for efficiency, all other parameters meet the requirements.
- The test data has been uploaded to the database.

	Results
Voltage	√
Current	√
Aging	√
Interlock	√
Protection	√
Safe loop	√
LED	√
Ramp up/down	√
DCS	√
Size	√
Components check	√
Efficiency	×

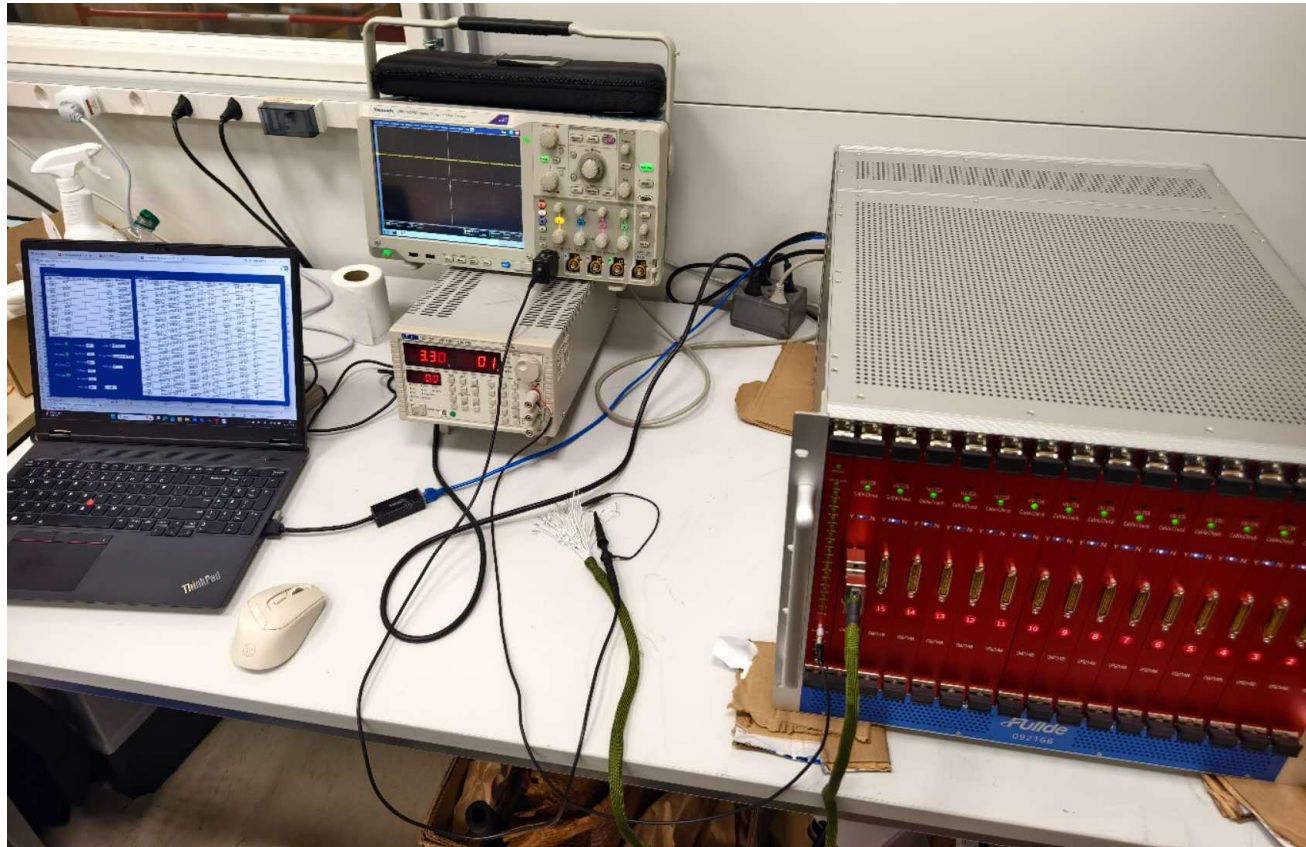
Tests carried out at CERN follows the specification documents:

1. Voltage and current control and monitoring tests;
2. Protection test;
3. Interlock test;
4. LED indicators test;
5. OPC-UA control and monitoring communication tests.(Filipe)



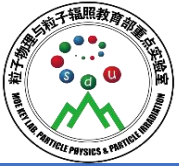
20WCSP02511001

20WCSP02511002



Main equipment:

- Digital multimeter: KEYSIGHT U1252B
For voltage measurement
- Picoammeter
For current measurement
- Oscilloscope: Tektronix DPO 5104B
For voltage ripple & up/down speed
- Loading :291.6K resistor(300k in China)



Control & monitoring



FULLDE HVI Power Supply Tool

File(F) Edit(E)

Modules Info >>

MD	Temperature	OverTemp	HV Output	Cable Status	Module ID
MD1	26.3°C			PASS	MD2505001
MD2	25.4°C			PASS	MD2505002
MD3	26.2°C			PASS	MD2505003
MD4	25.8°C			PASS	MD2505004
MD5	25.4°C			PASS	MD2505005
MD6	24.9°C			PASS	MD2505006
MD7	26.5°C			PASS	MD2505007
MD8	25.4°C			PASS	MD2505008
MD9	26.1°C			PASS	MD2505009
MD10	25.2°C			PASS	MD2505010
MD11	25.6°C			PASS	MD2505011
MD12	25.7°C			PASS	MD2505012
MD13	25.3°C			PASS	MD2505013
MD14	25.1°C			PASS	MD2505014
MD15	25.4°C			PASS	MD2505015
MD16	25.0°C			PASS	MD2405016

Channels Info >>

MD	Name	IOSet	VOSet	RUUp	RDn	VMon	IMon	SW	Status
MD1	MD1.CH1	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD1	MD1.CH2	3100.00 uA	100.00 V	20 V/s	50 V/s	0.00 V	0.00 uA	Off	
MD1	MD1.CH3	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD1	MD1.CH4	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD1	MD1.CH5	3100.00 uA	100.00 V	20 V/s	50 V/s	0.00 V	0.00 uA	Off	
MD1	MD1.CH6	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD1	MD1.CH7	3100.00 uA	100.00 V	20 V/s	50 V/s	0.00 V	0.00 uA	Off	
MD1	MD1.CH8	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD1	MD1.CH9	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD1	MD1.CH10	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD1	MD1.CH11	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD1	MD1.CH12	3100.00 uA	100.00 V	20 V/s	50 V/s	0.00 V	0.00 uA	Off	
MD1	MD1.CH13	3100.00 uA	100.00 V	20 V/s	50 V/s	0.00 V	0.00 uA	Off	
MD1	MD1.CH14	3100.00 uA	100.00 V	20 V/s	50 V/s	0.02 V	0.00 uA	Off	
MD2	MD2.CH1	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD2	MD2.CH2	3100.00 uA	100.00 V	20 V/s	50 V/s	0.00 V	0.00 uA	Off	
MD2	MD2.CH3	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD2	MD2.CH4	3100.00 uA	100.00 V	20 V/s	50 V/s	0.02 V	0.00 uA	Off	
MD2	MD2.CH5	3100.00 uA	100.00 V	20 V/s	50 V/s	0.02 V	0.00 uA	Off	
MD2	MD2.CH6	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD2	MD2.CH7	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD2	MD2.CH8	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD2	MD2.CH9	3100.00 uA	100.00 V	20 V/s	50 V/s	0.00 V	0.00 uA	Off	
MD2	MD2.CH10	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD2	MD2.CH11	3100.00 uA	100.00 V	20 V/s	50 V/s	0.00 V	0.00 uA	Off	
MD2	MD2.CH12	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD2	MD2.CH13	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD2	MD2.CH14	3100.00 uA	100.00 V	20 V/s	50 V/s	0.02 V	0.00 uA	Off	
MD3	MD3.CH1	3100.00 uA	100.00 V	20 V/s	50 V/s	0.00 V	0.00 uA	Off	
MD3	MD3.CH2	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD3	MD3.CH3	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	
MD3	MD3.CH4	3100.00 uA	100.00 V	20 V/s	50 V/s	0.01 V	0.00 uA	Off	

Interlock ☒ Fan1Speed 2134 Crate ID CS2505001

Crate Status ☒ Fan2Speed 2155 System Time 2025-10-26 13:59:23

HV Output ☐ Fan3Speed 2177 Duty Cycle 50

Fans Status ☒ Fan4Speed 2100

Fan5Speed 2143

Fan6Speed 2173 记录

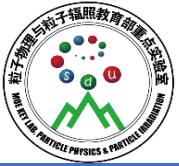
Param

Param List >>

MD	Name	IOSet	VOSet	RUUp	RDn
MD1	MD1.CH1	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH2	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH3	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH4	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH5	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH6	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH7	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH8	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH9	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH10	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH11	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH12	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH13	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH14	3100.00 uA	100.00 V	20 V/s	50 V/s

IOSet 3100.00 VOSet 100.00 RUUp 20 RDn 50 Edit All

- HV crates can be controlled and communicated.
- Status, temperature, fans speed and crate id can be monitored
- Output ,protection threshold value and ramp up/down speed can be set.



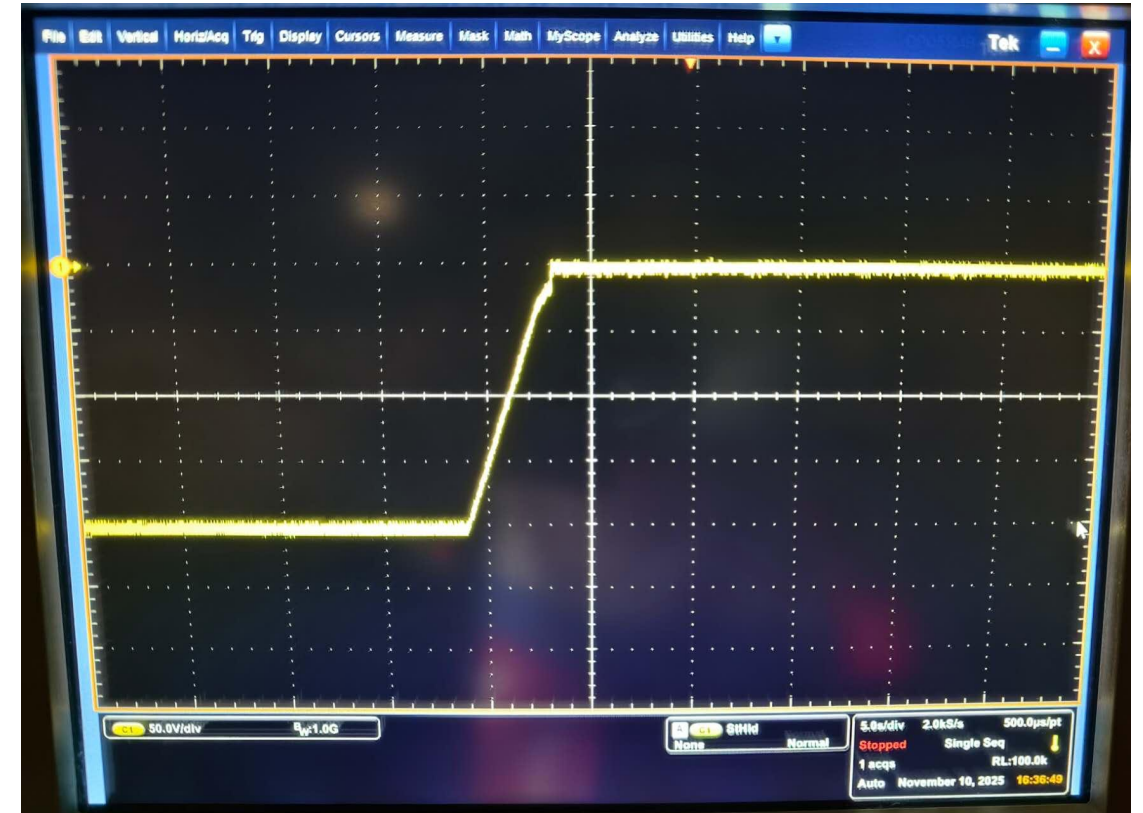
Voltage & current tests

Serial_number_module	channel	voltage_setup_value_V	voltage_test_value_V	current_test_value_uA	voltage_monitor_value_V	current_monitor_value_uA	voltage_precision_V	current_accuracy_percentage	current_resolution_nA
20WMDP025110016	1	50	49.86	170.99	50.06	171.53	0.14	0.32	100
20WMDP025110016	1	100	99.87	342.49	100.03	342.85	0.13	0.11	100
20WMDP025110016	1	200	199.89	685.49	200.04	687.56	0.11	0.30	100
20WMDP025110016	1	300	299.93	1028.57	300.05	1031.59	0.07	0.29	100
20WMDP025110016	1	400	399.86	1371.26	400.02	1374.35	0.14	0.23	100
20WMDP025110016	1	500	499.97	1714.57	500.06	1716.26	0.03	0.10	100
20WMDP025110016	1	600	599.87	2057.17	600.01	2060.38	0.13	0.16	100
20WMDP025110016	1	700	699.4	2398.49	700.03	2398.89	0.6	0.02	100
20WMDP025110016	1	800	799.50	2741.77	800.03	2739.96	0.5	0.07	100
20WMDP025110016	1	900	899.92	3086.15	900.04	3090.56	0.08	0.14	100

- The accuracy of the output voltage is better than 0.7V.
- The accuracy percentage of current monitoring is better than 5%.
- The resolution of current monitoring is 100nA.
- No abnormal output channels.

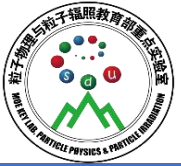


20V/s Ramp up

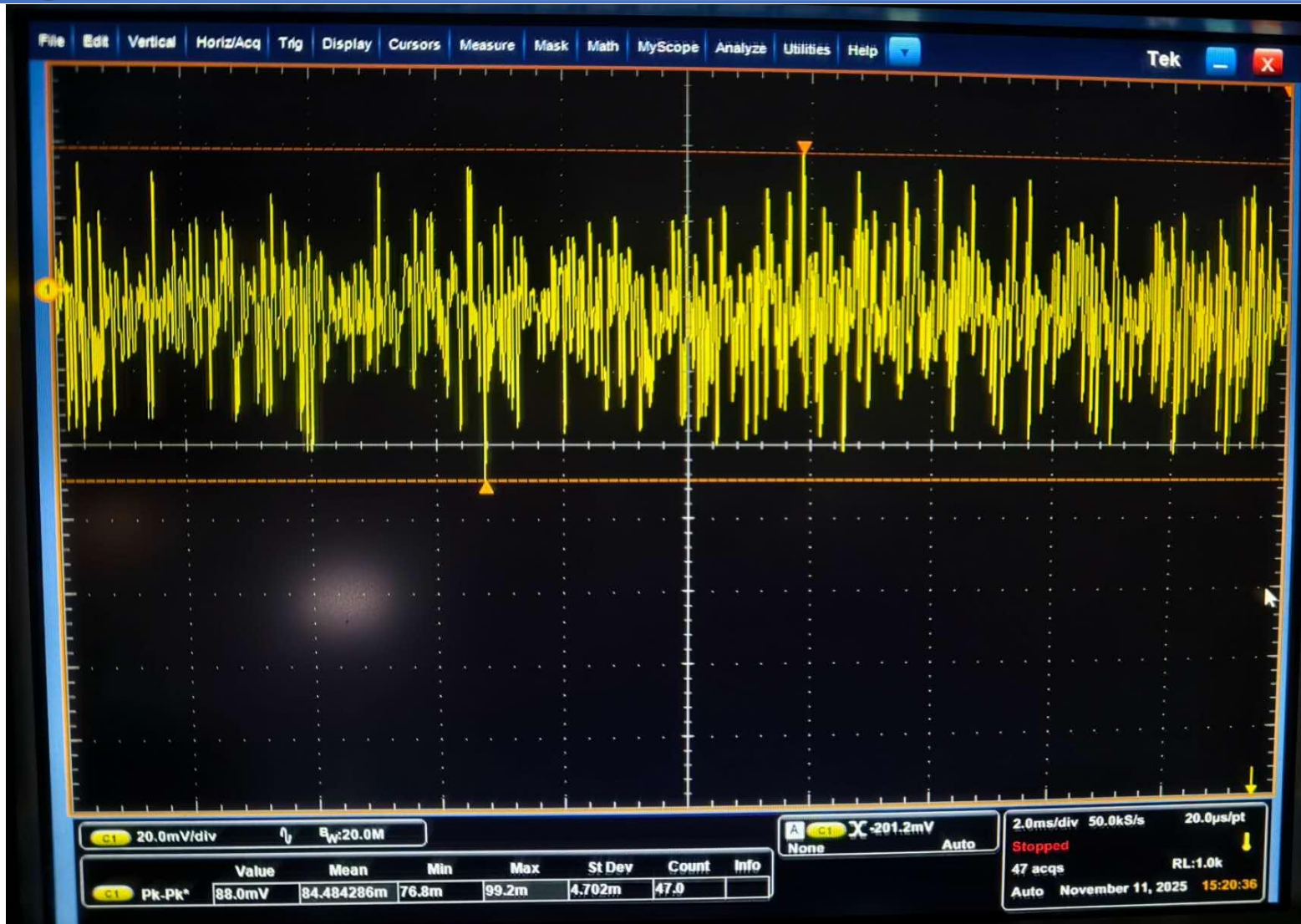


50V/s Ramp down

- Ramp up/down speed is correct.



Voltage & current tests



Voltage Ripple

70mv-90mv

load an equivalent resistor

Protection tests

Modules Info>>

MD	Temperature	OverTemp	HV Output	Cable Status	Module ID
MD1	42.0°C			PASS	MD2505001
MD2	43.6°C			PASS	MD2505002
MD3	44.9°C			PASS	MD2505003
MD4	45.5°C	OverTemp		PASS	MD2505004
MD5	44.1°C			PASS	MD2505005
MD6	44.3°C			PASS	MD2505006
MD7	48.3°C	OverTemp		PASS	MD2505007
MD8	46.1°C	OverTemp		PASS	MD2505008
MD9	47.5°C	OverTemp		PASS	MD2505009
MD10	45.5°C	OverTemp		PASS	MD2505010
MD11	45.8°C	OverTemp		PASS	MD2505011
MD12	45.7°C	OverTemp		PASS	MD2505012
MD13	45.0°C			PASS	MD2505013
MD14	43.0°C			PASS	MD2505014
MD15	43.1°C			PASS	MD2505015
MD16	41.1°C			PASS	MD2405016

Protection

Interlock ☒

Crate Status ☒

HV Output ☒

Fans Status ☒

Overvoltage V

Over-temperature °C

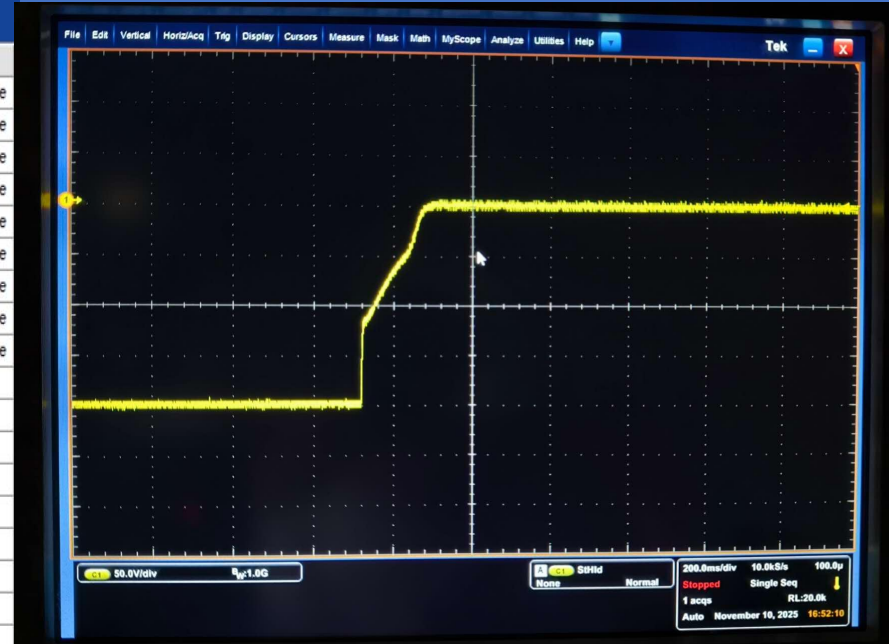
OK Cancel

Fan6Speed 2198

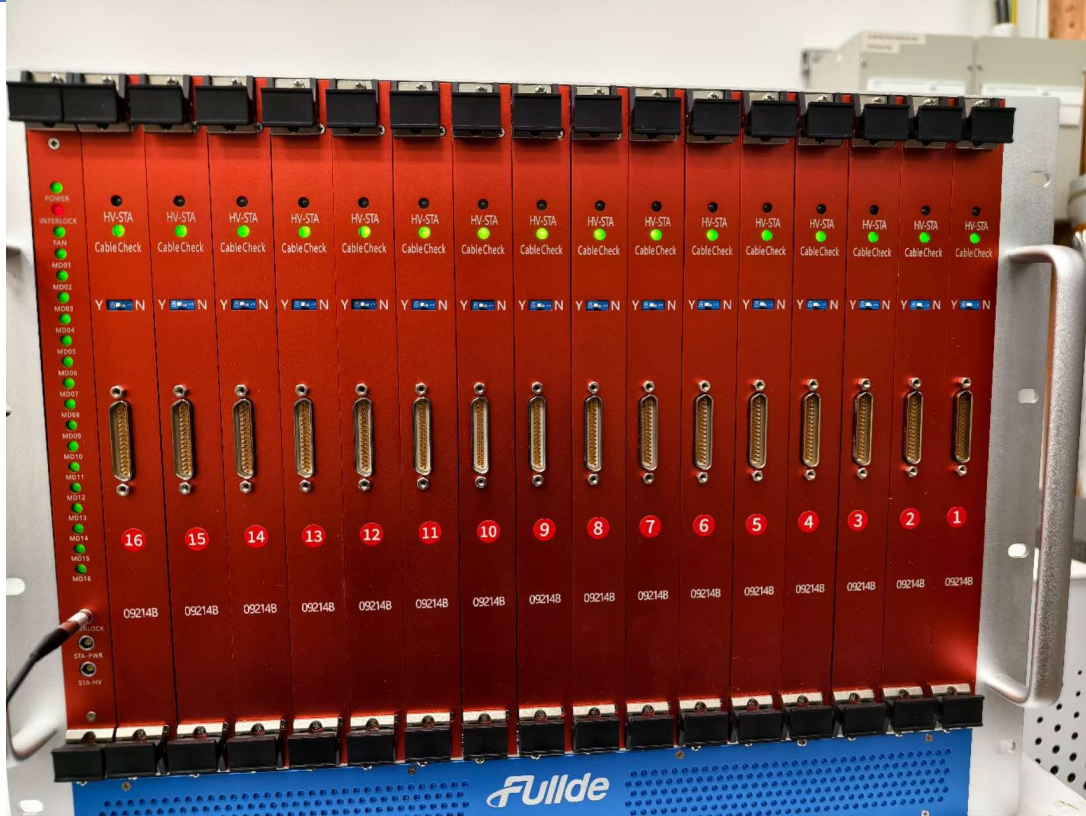
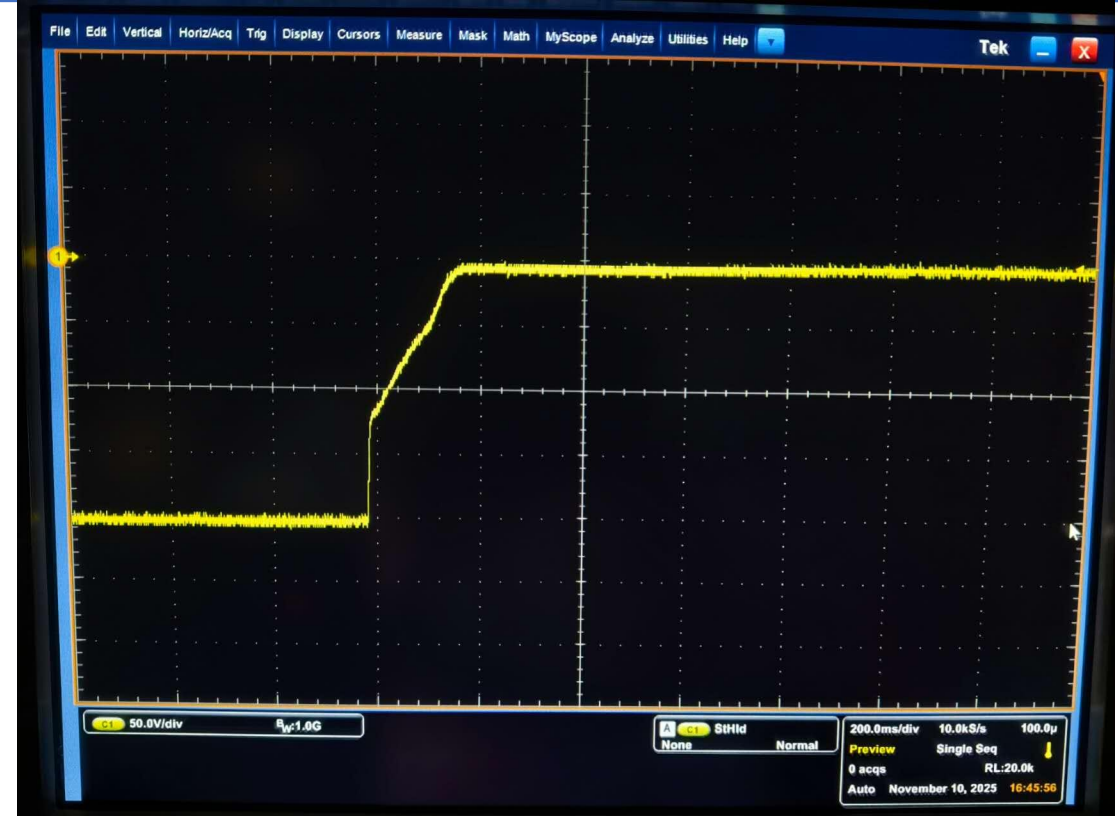
记录

Channels Info>>

MD	Name	IOSet	VOSet	RUup	RDn	VMon	IMon	SW	Status
MD1	MD1.CH1	3100.00 uA	60.00 V	20 V/s	50 V/s	0.20 V	0.00 uA	Off	OverVoltage
MD1	MD1.CH2	3100.00 uA	60.00 V	20 V/s	50 V/s	0.16 V	0.00 uA	Off	OverVoltage
MD1	MD1.CH3	3100.00 uA	60.00 V	20 V/s	50 V/s	0.17 V	0.00 uA	Off	OverVoltage
MD1	MD1.CH4	3100.00 uA	60.00 V	20 V/s	50 V/s	0.18 V	0.00 uA	Off	OverVoltage
MD1	MD1.CH5	3100.00 uA	60.00 V	20 V/s	50 V/s	0.16 V	0.00 uA	Off	OverVoltage
MD1	MD1.CH6	3100.00 uA	60.00 V	20 V/s	50 V/s	0.19 V	0.00 uA	Off	OverVoltage
MD1	MD1.CH7	3100.00 uA	60.00 V	20 V/s	50 V/s	0.17 V	0.00 uA	Off	OverVoltage
MD1	MD1.CH8	3100.00 uA	60.00 V	20 V/s	50 V/s	0.17 V	0.00 uA	Off	OverVoltage
MD1	MD1.CH9	3100.00 uA	60.00 V	20 V/s	50 V/s	0.19 V	0.00 uA	Off	OverVoltage
MD1	MD1.CH10	3100.00 uA	30.00 V	20 V/s	50 V/s	30.07 V	0.00 uA	On	
MD1	MD1.CH11	3100.00 uA	30.00 V	20 V/s	50 V/s	30.07 V	0.00 uA	On	
MD1	MD1.CH12	3100.00 uA	30.00 V	20 V/s	50 V/s	30.07 V	0.00 uA	On	
MD1	MD1.CH13	3100.00 uA	30.00 V	20 V/s	50 V/s	30.08 V	0.00 uA	On	
MD1	MD1.CH14	3100.00 uA	30.00 V	20 V/s	50 V/s	30.07 V	0.00 uA	On	
MD2	MD2.CH1	3100.00 uA	30.00 V	20 V/s	50 V/s	30.07 V	0.00 uA	On	
MD2	MD2.CH2	3100.00 uA	30.00 V	20 V/s	50 V/s	30.07 V	0.00 uA	On	
MD2	MD2.CH3	3100.00 uA	30.00 V	20 V/s	50 V/s	30.07 V	0.00 uA	On	
MD2	MD2.CH4	3100.00 uA	30.00 V	20 V/s	50 V/s	30.07 V	0.00 uA	On	
MD2	MD2.CH5	3100.00 uA	30.00 V	20 V/s	50 V/s	30.08 V	0.00 uA	On	
MD2	MD2.CH6	3100.00 uA	30.00 V	20 V/s	50 V/s	30.08 V	0.00 uA	On	
MD2	MD2.CH7	3100.00 uA	30.00 V	20 V/s	50 V/s	30.07 V	0.00 uA	On	
MD2	MD2.CH8	3100.00 uA	30.00 V	20 V/s	50 V/s	30.07 V	0.00 uA	On	



- The thresholds for voltage, current, and temperature can be set correctly by software.
- The protection function is normal. When protection occurs, the output voltage will be 0V.
- The protected information can be monitored by software.



- Interlock function is normal. Interlock output can show the HV PS status correctly.
- When interlock occurs, the output voltage will be 0V.

Param

Param List>>

MD	Name	IOSet	VOSet	RU _p	RD _n
MD1	MD1.CH1	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH2	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH3	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH4	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH5	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH6	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH7	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH8	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH9	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH10	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH11	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH12	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH13	3100.00 uA	100.00 V	20 V/s	50 V/s
MD1	MD1.CH14	3100.00 uA	100.00 V	20 V/s	50 V/s

IOSet: 3100.00 VOSet: 100.00 RU_p: 20 RD_n: 50 Edit All

Vision_1: webPanel.xml HighVoltage/hgtd_highVoltageCrate.xml

user: hgtddemo
pass: ●●●●●● enter

mypanel

Crate 1
Crate 2

on_air

Crate SN: CS2505002

Settings
Actual Over-Voltage limit: 920
Actual Temperature Limit: 60
Set Protections

INTERLOCK Recover

Fan Status
Fan1: 2000 rpm
Fan2: 2000 rpm
Fan3: 2000 rpm
Fan4: 2000 rpm
Fan5: 2000 rpm
Fan6: 2000 rpm

Channel Configuration
voltage
Current Limit
Ramping Up Step
Ramping Down Step

Switch ON ALL Switch OFF ALL

Module 1 Module 2 Module 3 Module 4 Mod...

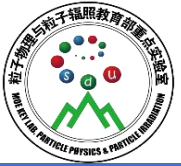
Module3
is HW CONNECTED Temperature: 60 C
Over Temperature Fault
High Voltage Status
Cable Status

Channels
Switch ON ALL Switch OFF ALL

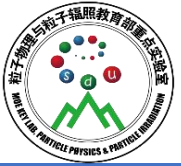
Voltage	0.0 V	Channel 1
Current	0.000 uA	
Voltage	0.0 V	Channel 2
Current	0.000 uA	
Voltage	0.0 V	Channel 3
Current	0.000 uA	
Voltage	0.0 V	Channel 4
Current	0.000 uA	
Voltage	0.0 V	Channel 5
Current	0.000 uA	
Voltage	0.0 V	Channel 6
Current	0.000 uA	
Voltage	0.0 V	Channel 7
Current	0.000 uA	
Voltage	0.0 V	Channel 8
Current	0.000 uA	
Voltage	0.0 V	Channel 9
Current	0.000 uA	
Voltage	0.0 V	Channel 10
Current	0.000 uA	
Voltage	0.0 V	Channel 11
Current	0.000 uA	
Voltage	0.0 V	Channel 12
Current	0.000 uA	
Voltage	0.0 V	Channel 13
Current	0.000 uA	
Voltage	0.0 V	Channel 14
Current	0.000 uA	

with Filipe

- HV crates can be controlled and communicated.
- Status, temperature, fans speed and crate id can be monitored
- Output ,protection threshold value and ramp up/down speed can be set.



- At the end of this month, 15 crates were produced. HV Tests in factory will start.
- Manpower:
 - ✓ @China, two graduate students will be assigned to Fude for HV testings;
 - ✓ @CERN, one graduate student will finish the reception test.



Summary



- After two versions of R&D for FTs, they are currently qualified for HGTD project. FTs in preproduction stage will be sent to all module production sites in one month;
- The HVPS in preproduction work very well. We will be busy with testing of new 15 crates soon.