

# SOLID TCD Cherenkov MAPMT readout assembly

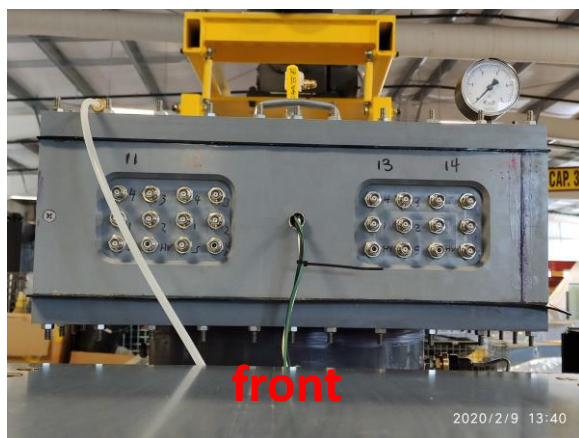
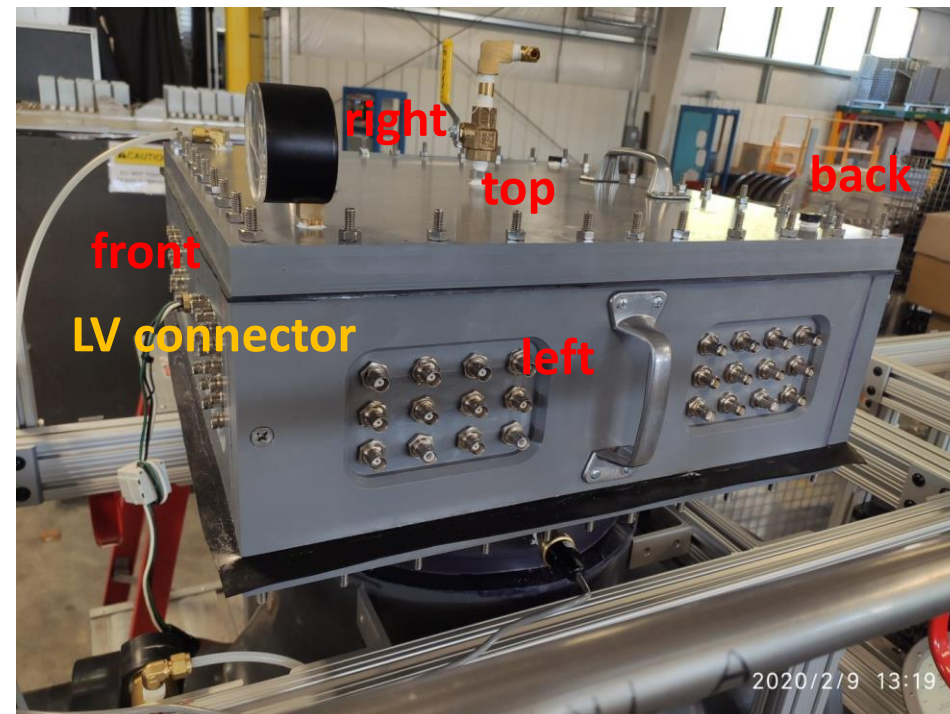
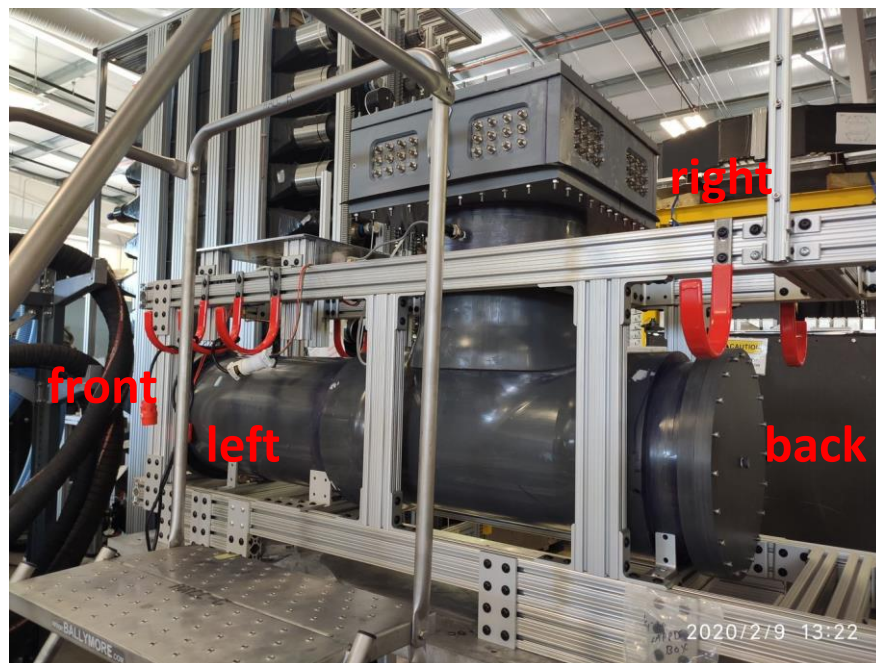
Zhiwen Zhao

2020

# MaPMT simple sum readout

# MaPMT simple sum readout position

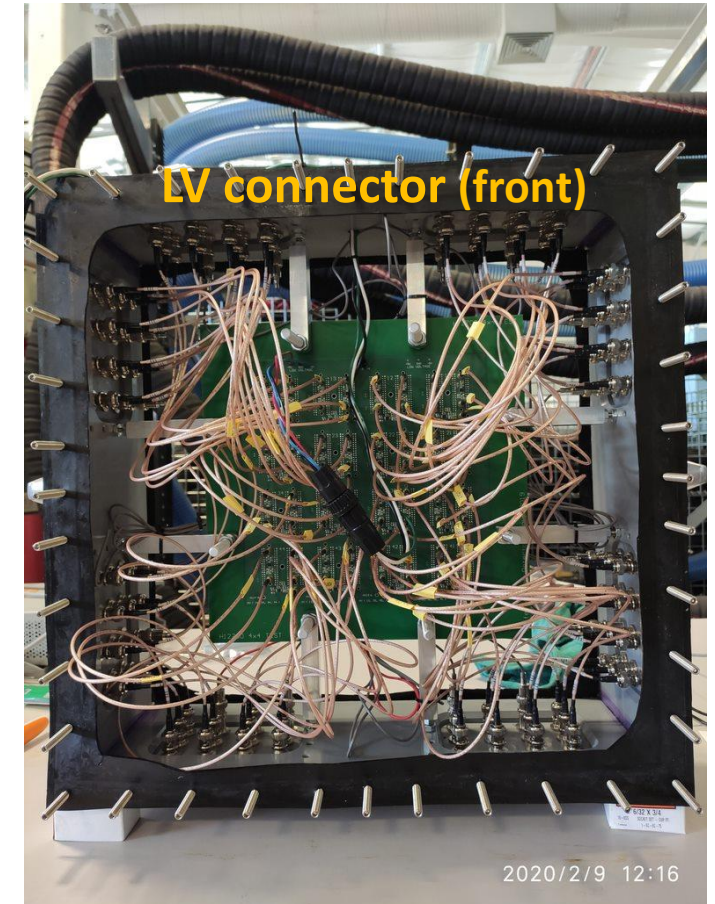
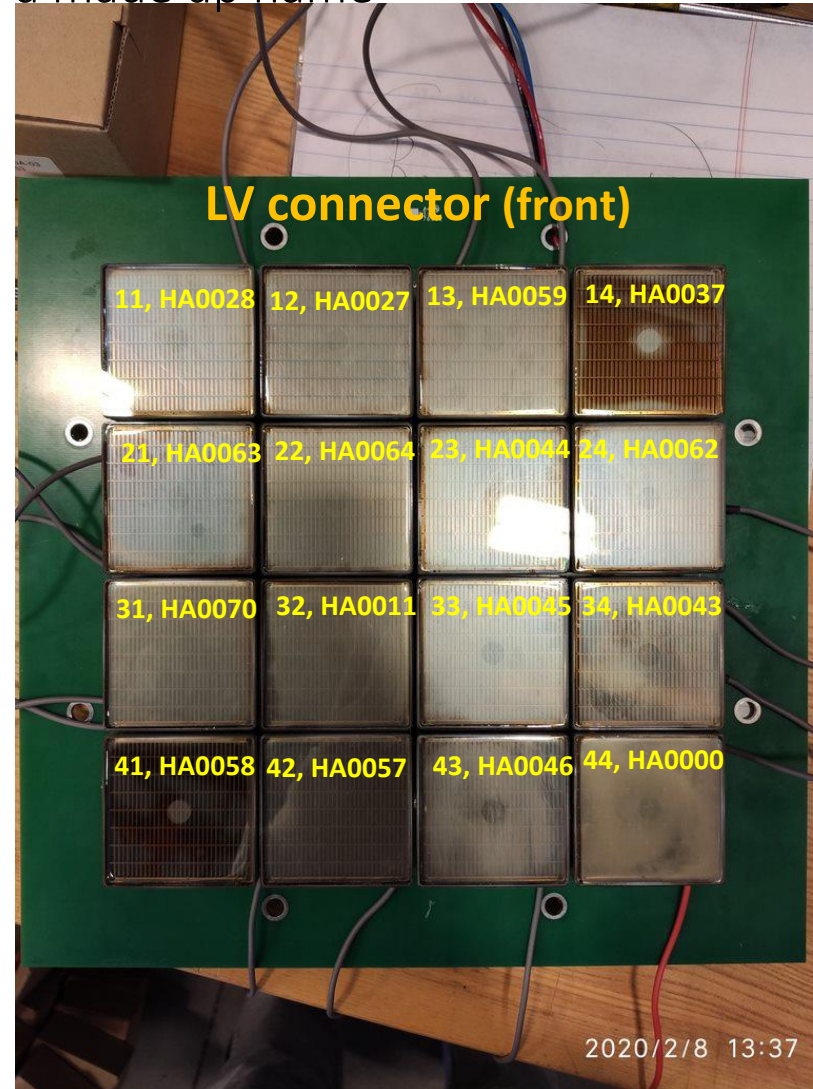
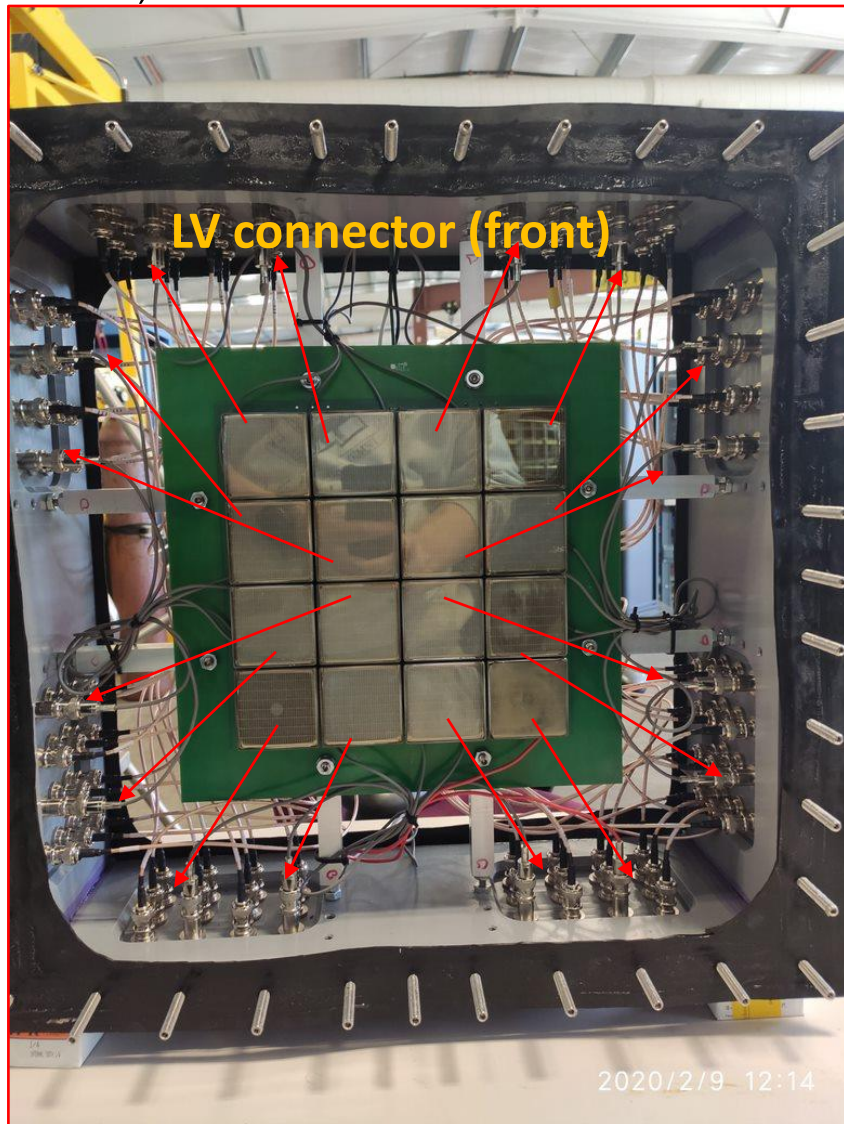
- Readout box mounting is perfect square, it's important to know the direction
- The side with **LV connector is at front**, aligned with the Cherenkov tank thin window



## MaPMT imple sum readout layout

- ID by Row and Column in position with matching MaPMT SN
- 14, HA0037 and 41, HA0058 WLS coating seem not good
- 44, HA0000 has no SN number and is a made up name

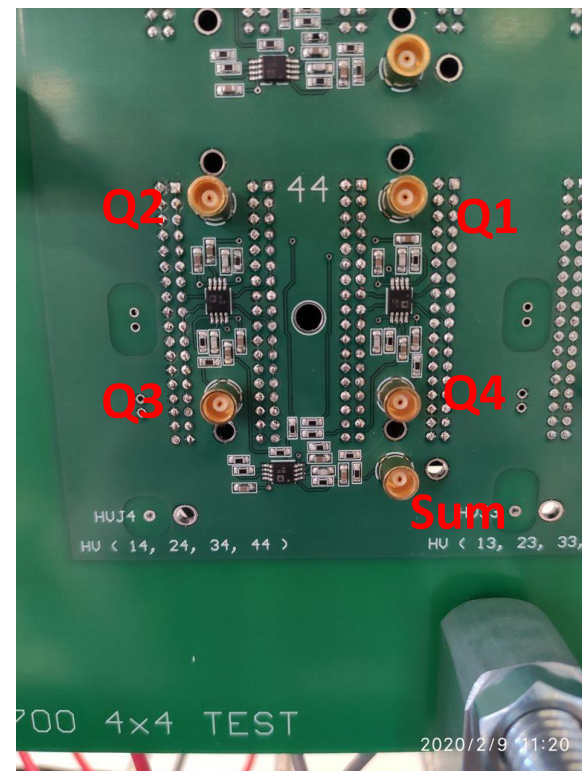
mapmt simple sum box depth 6"  
mapmt surface to box bottom 3cm





## MaPMT simple sum readout cabling

- ID by Row and Column in position, then follow by signal channel
- BNC name "11Q1,11Q2,11Q3,11Q4,11Sum,....., 44Q1,44Q2,44Q3,44Sum"
- HV name "11HV,12HV,.....,44HV"



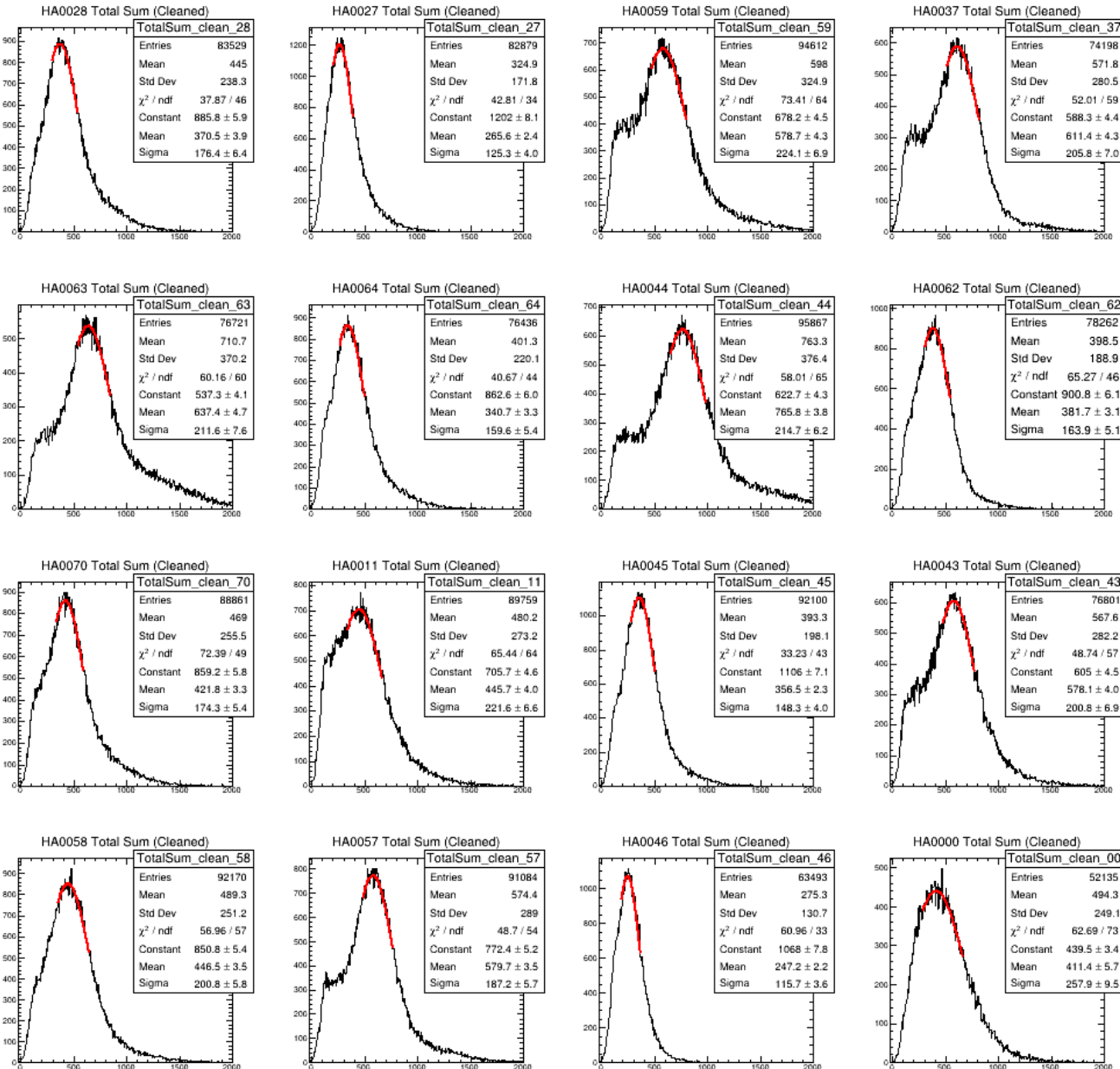
How it's done inside box

- On readout board, 4 quads defined counterclockwise
- On readout box
  - Sum is always next to HV, but their position can switch
  - Using row of Sum and HV as "top", 4 quads pattern matches pattern on readout board counterclockwise

# MaPMT simple sum readout calibration and HV

- Calibration is done with laser at low light intensity so pedestal peak is visible and at 1000V
- Events are selected when at most only 1 quad signal above pedestal to approximate SPE
- FADC integral of sum signal are fitted to find SPE peak
- HV setting is obtained by  $(1000 * 370 / \text{peak})$  to make most of them aligned at 370 for SPE.

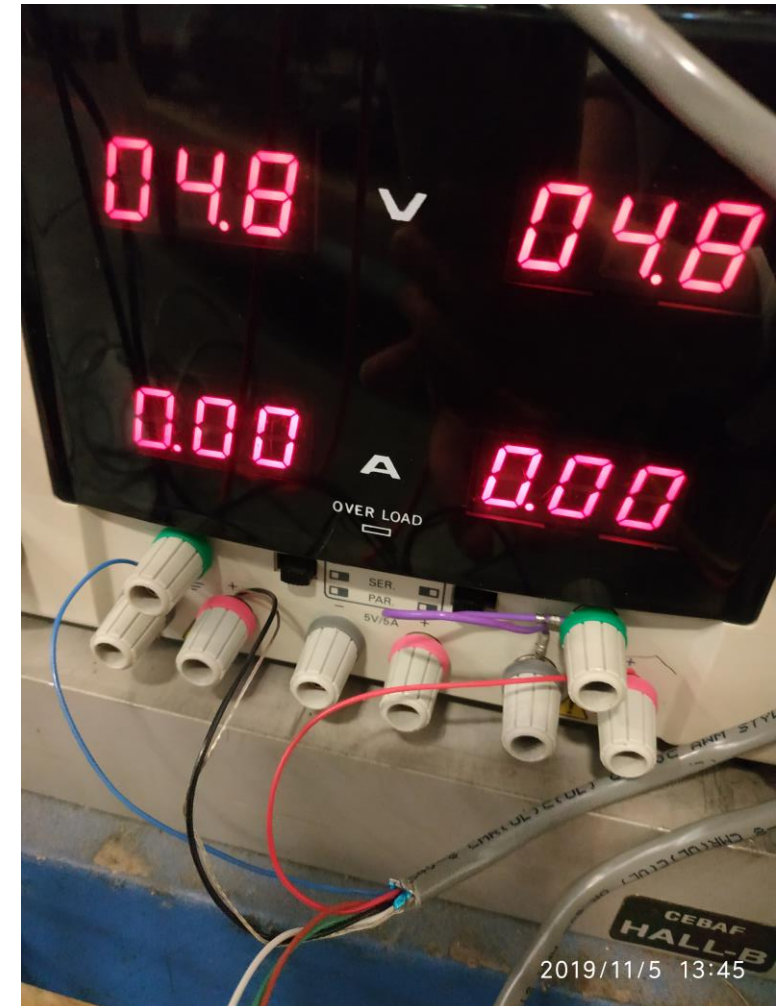
- PMT spec sheet suggest negative 600-1100V
- This result is not accurate. It would be better to have tests at two HV setting to fit gain VS HV relation to find the best HV



11 HA0028 peak 370 HV 999	12 HA0027 peak 266 HV 1100 (1393)	13 HA0059 peak 579 HV 639	14 HA0037 peak 611 HV 605
21 HA0063 peak 637 HV 581	22 HA0064 peak 341 HV 1086	23 HA0044 peak 766 HV 483	24 HA0062 peak 382 HV 969
31 HA0070 peak 422 HV 877	32 HA0011 peak 446 HV 830	33 HA0045 peak 357 HV 1038	34 HA0043 peak 578 HV 640
41 HA0058 peak 446 HV 829	42 HA0057 peak 580 HV 638	43 HA0046 peak 247 HV 1100 (1497)	44 HA0000 peak 411 HV 899

# MaPMT simple sum readout LV

- Check voltage at the end of long cable going into detector
- +5V,0,-5V with the right connectors labeled on the cables
- For old power supply (topward 6306d) with big board, set 0.35A current limit for both left and right by shorting + and –
  - Small readout for 1 pmt will draw  $\sim 0.012\text{A}$  without PMT
  - Big readout board for 16 pmt draws  $\sim 0.2\text{A}$  without PMT

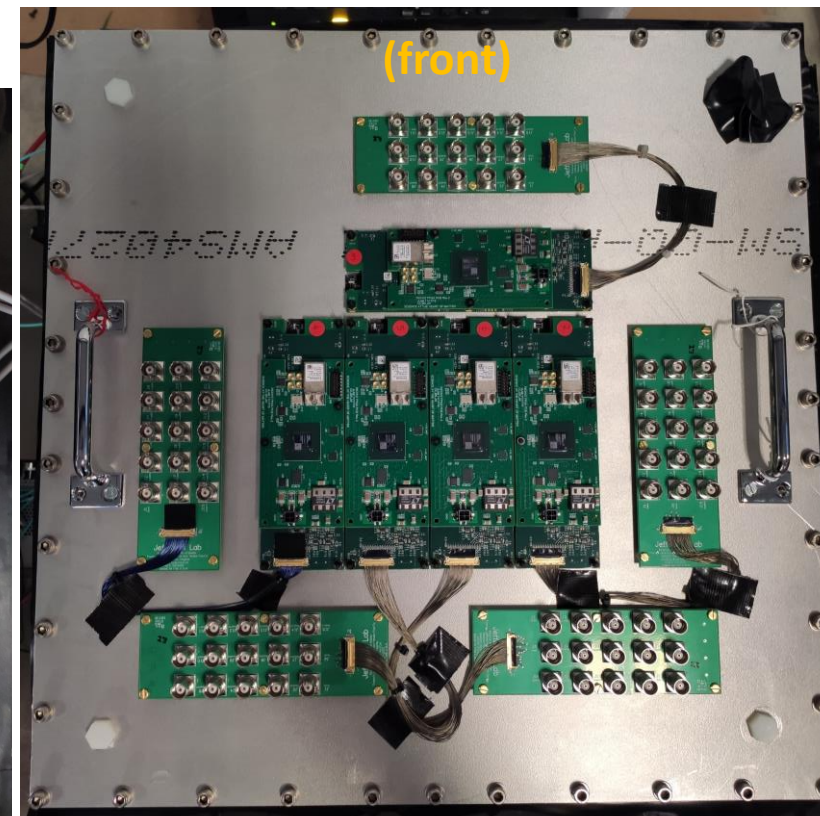
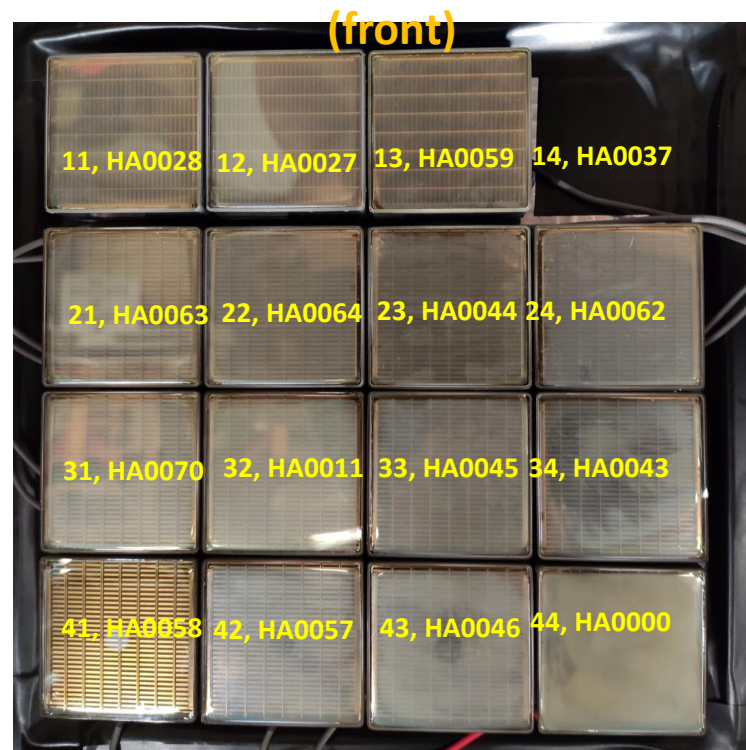
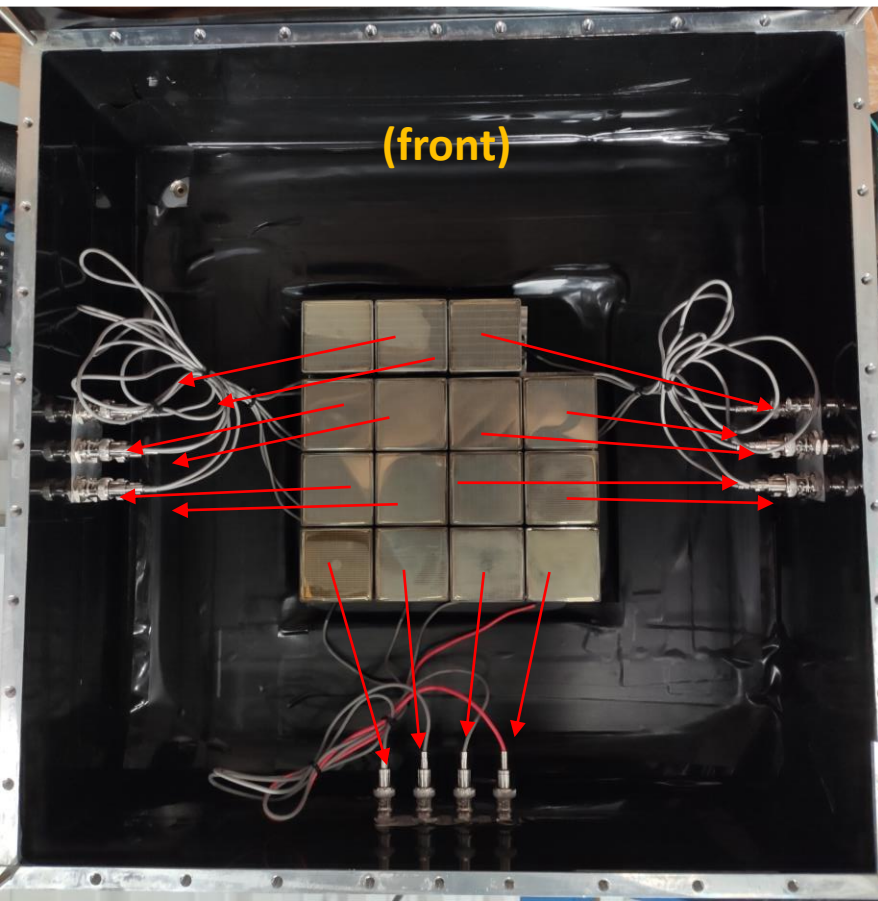


# MaPMT MAROC sum readout



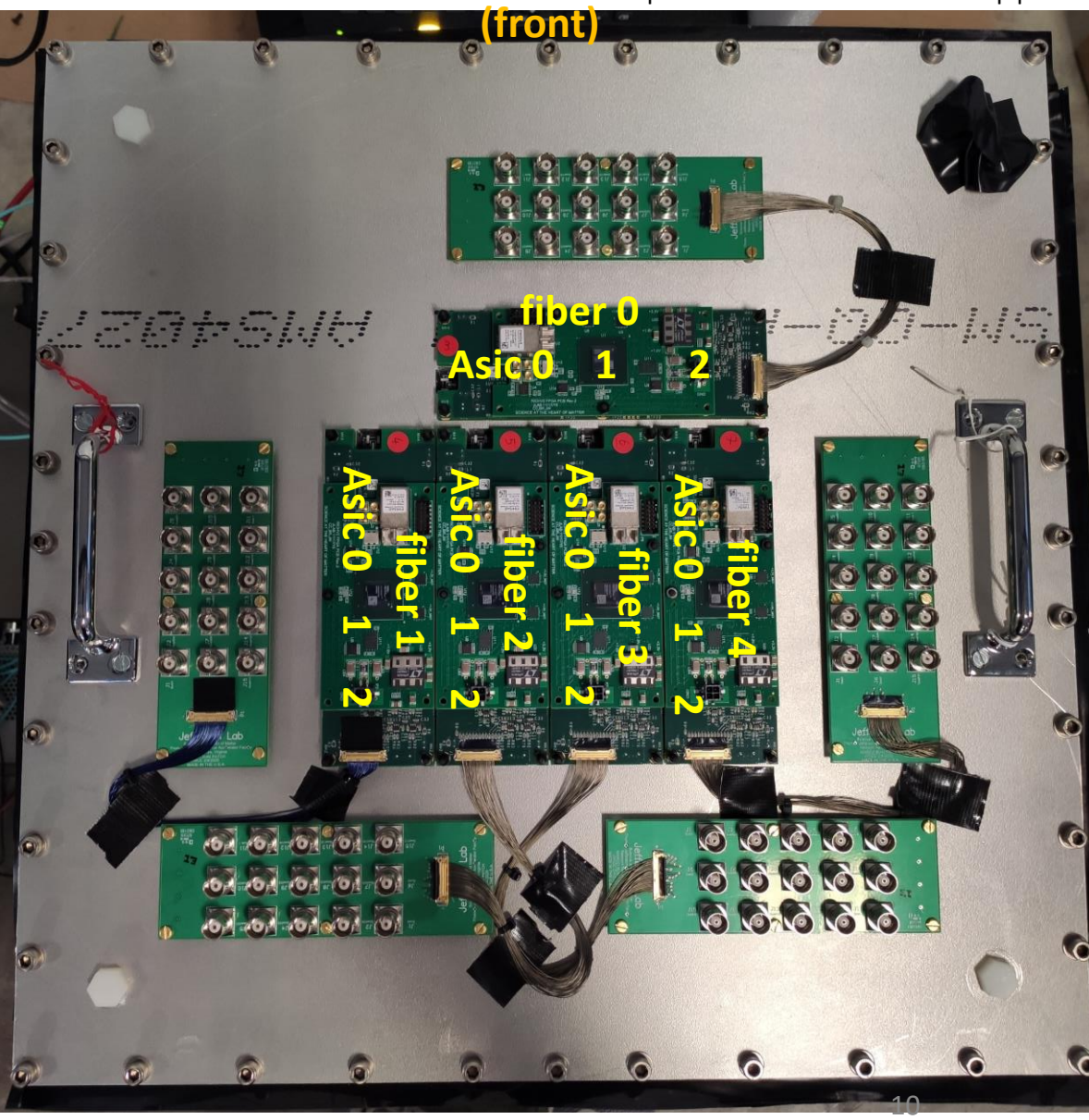
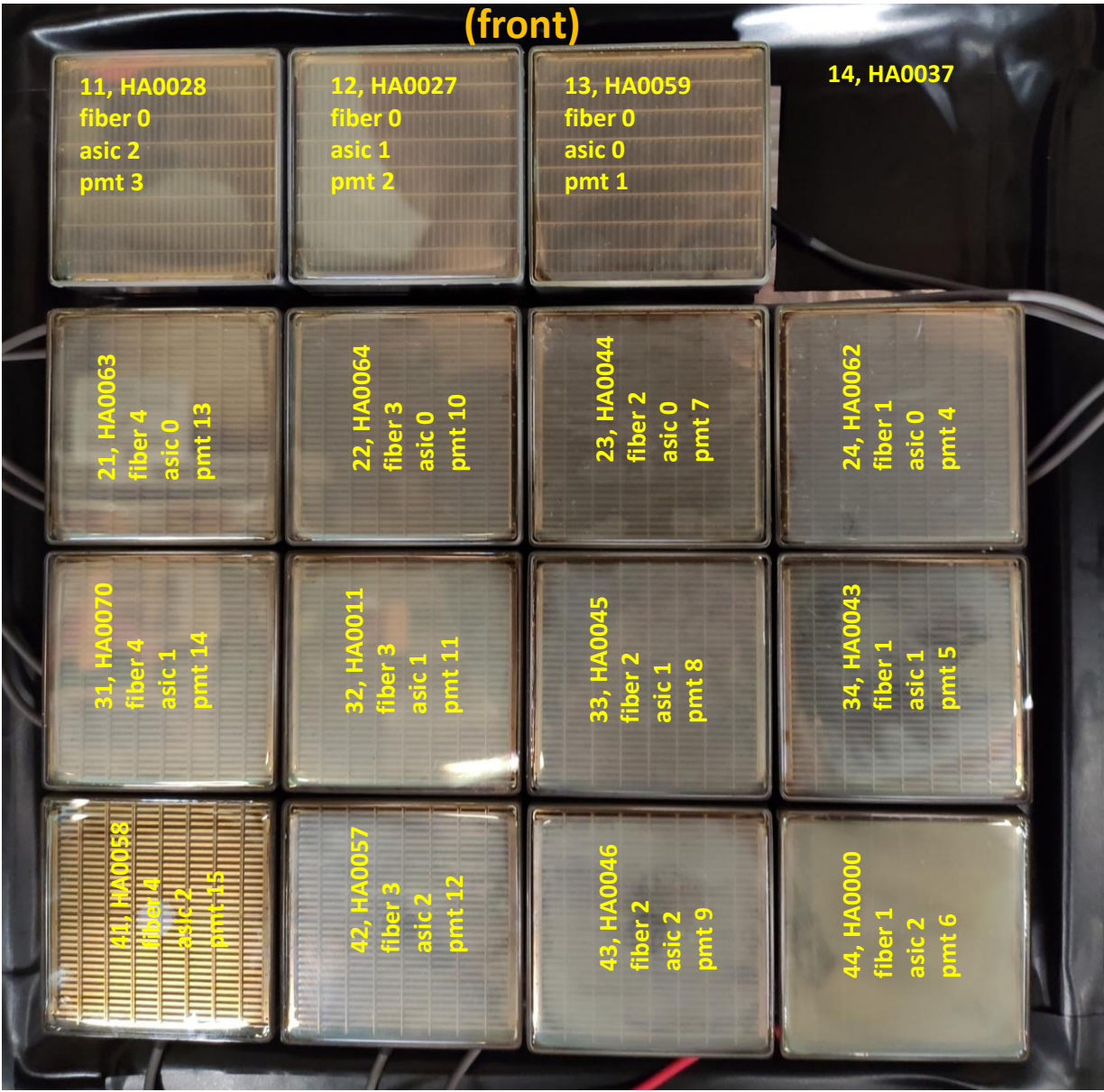
# MaPMT MAROC sum readout position

- Readout box mounting is perfect square, it's important to know the direction
- The side with **only 3 PMT at front**, aligned with the Cherenkov tank thin window



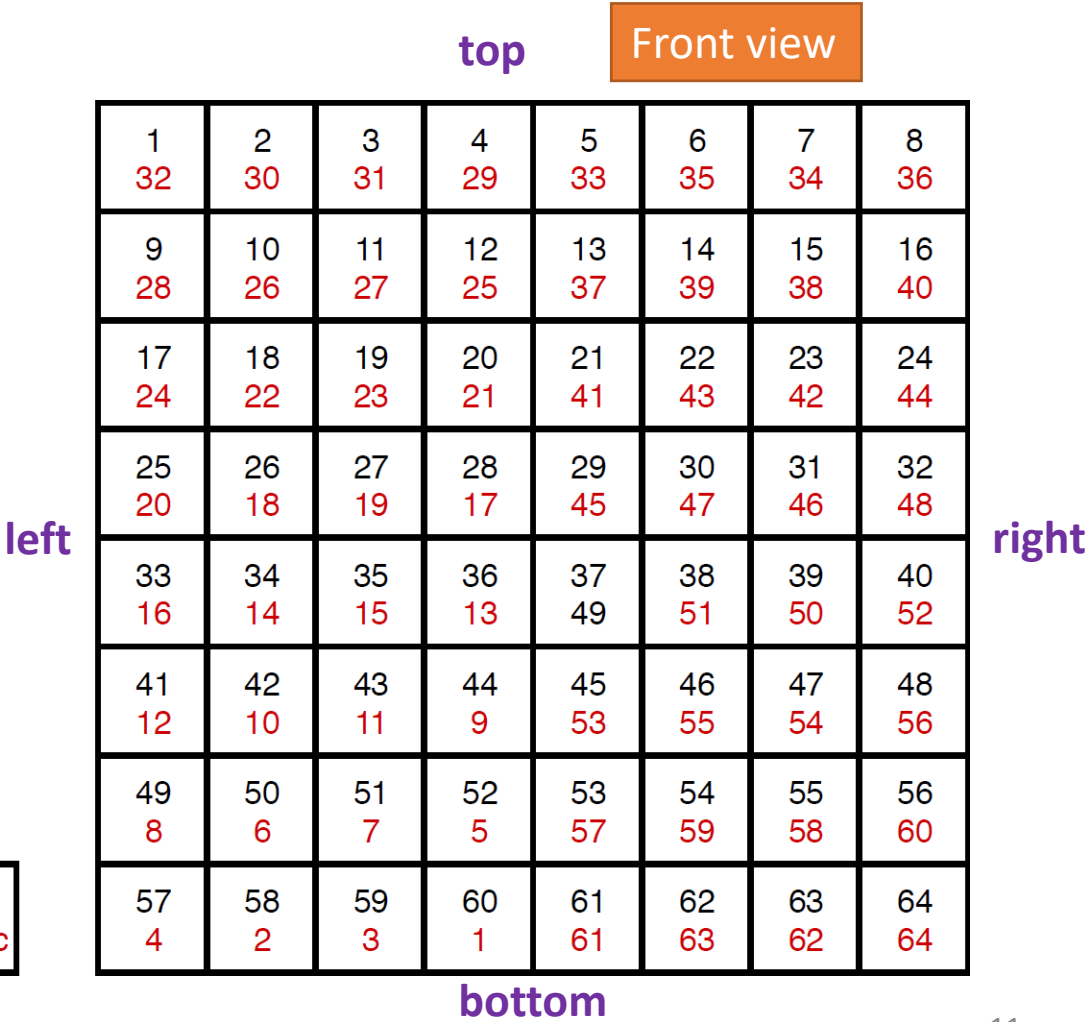
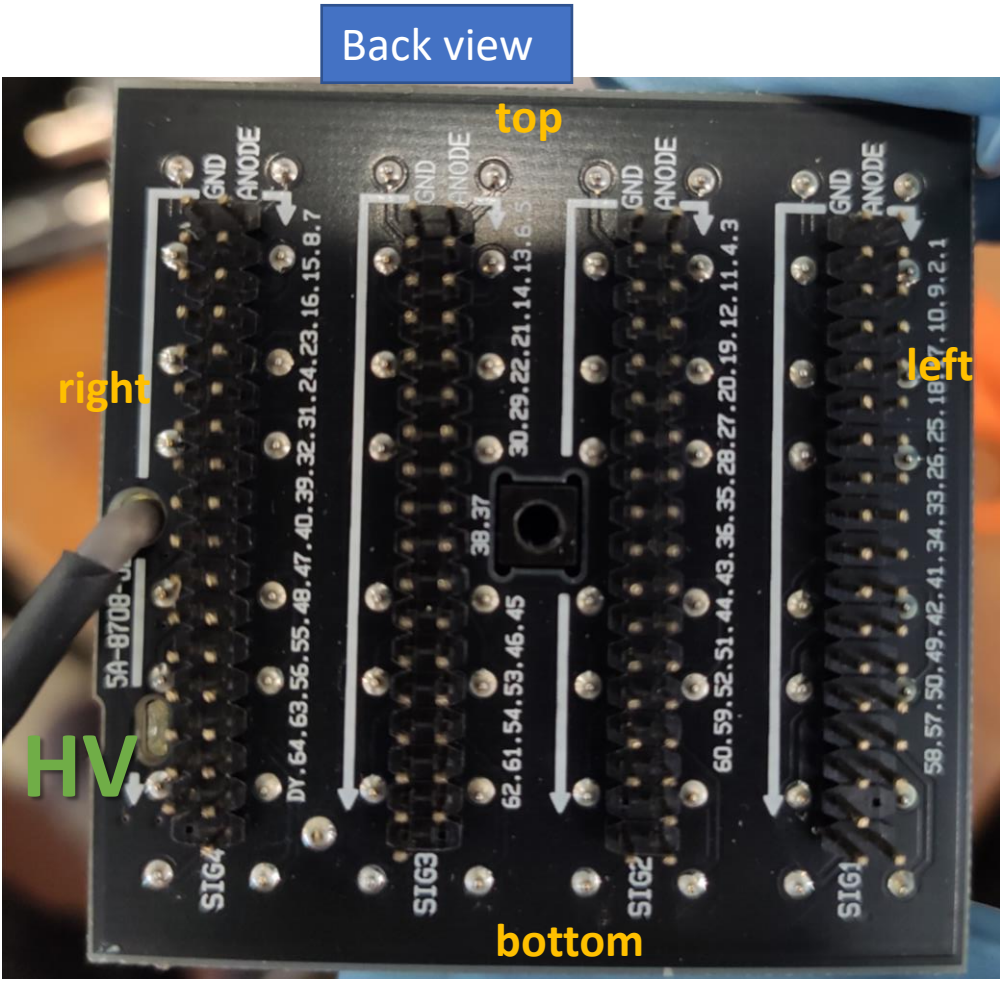
Asic 0 is near HV dent where HV connector is, asic 1 is in middle, asic 2 is at the other end  
 Fiber connector is aligned with PMT top

Fiber 0 use optical line 1&12 of fiber0 into ssp port 0  
 Fiber 1 use optical line 2&11 of fiber0 into ssp port 0  
 Fiber 2 use optical line 3&10 of fiber0 into ssp port 0  
 Fiber 3 use optical line 4&9 of fiber0 into ssp port 0  
 Fiber 4 use optical line 1&12 of fiber1 into ssp port 1



# MAPMT direction

## HV connector is at bottom right



# MPPMT gain matching table and HV

PMT4 not used for maroc sum readout

label	3	2	1	4	13	10	7	4	14	11	8	5	15	12	9	6
pos label	11	12	13	14	21	22	23	24	31	32	33	34	41	42	43	44
SN	HA0028	HA0027	HA0059	HA0037	HA0063	HA0064	HA0044	HA0062	HA0070	HA0011	HA0045	HA0043	HA0058	HA0057	HA0046	HA0000
HV ch	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.10	0.11	1.0	1.1	1.2	1.3
HV 66fC_800V	830	870	775	770	760	840	800	820	815	810	825	770	735	775	880	785
HV 98fC_850V	880	920	825	820	810	890	850	870	865	860	875	820	785	825	930	835
HV 147fC_900V	930	970	875	870	860	940	900	920	915	910	925	870	835	875	980	885
HV 220fC_950V	980	1020	925	920	910	990	950	970	965	960	975	920	885	925	1030	935
HV 329fC_1000V	1030	1070	975	970	960	1040	1000	1020	1015	1010	1025	970	935	975	1080	985
HV 334fC_1050V	1080	1120	1025	1020	1010	1090	1050	1070	1065	1060	1075	1020	985	1025	1130	1035



# LV Power supply (keysight E36313A)

need 4.5-5.5V at the LV output at FPGA end, need to measure it when connected if cable is long.

0.9A per board need, set limit 5A for 5 boards

Specs <https://www.keysight.com/us/en/assets/7018-05629/data-sheets/5992-2124.pdf>

Manual [https://hallaweb.jlab.org/12GeV/SoLID/download/cc\\_pro/lasertest/doc/E36311-90001.pdf](https://hallaweb.jlab.org/12GeV/SoLID/download/cc_pro/lasertest/doc/E36311-90001.pdf)

