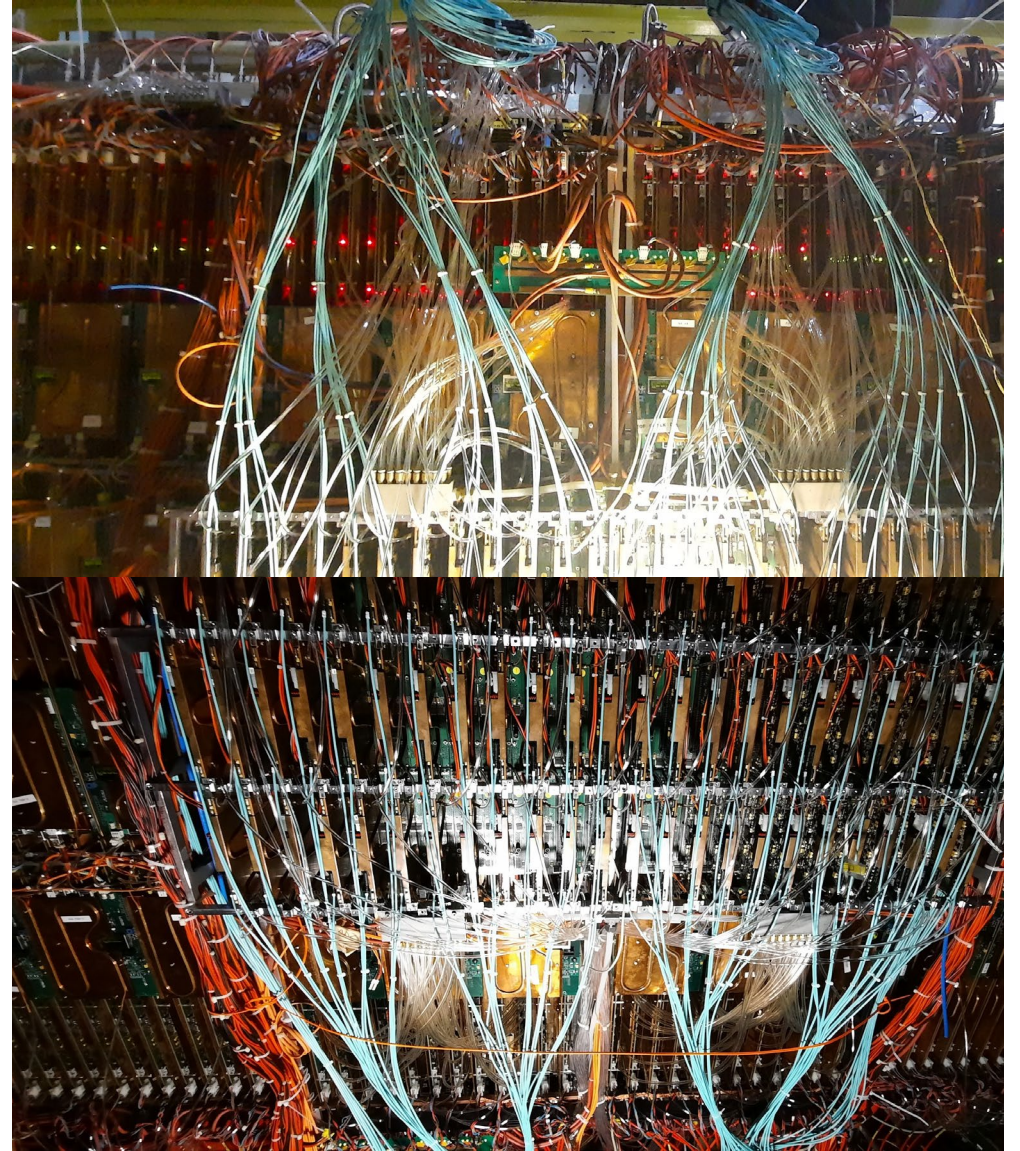


REPORT ON RICH1 ACTIVITY OCT - DEC 2020

Shuddha

INFN Trieste

*With all other without whose support
was essential for the work: Special thanks
to → Christophe, Moritz, Martin, Igor,
Stefano*



OUTLOOK

- Basics for not RICH people.
- Preparation for Dry RUN 2020
- Cooling and High Voltage
- Front End Electronics
- Conclusion

RICH 1 HV AND FEE: BRIEFLY

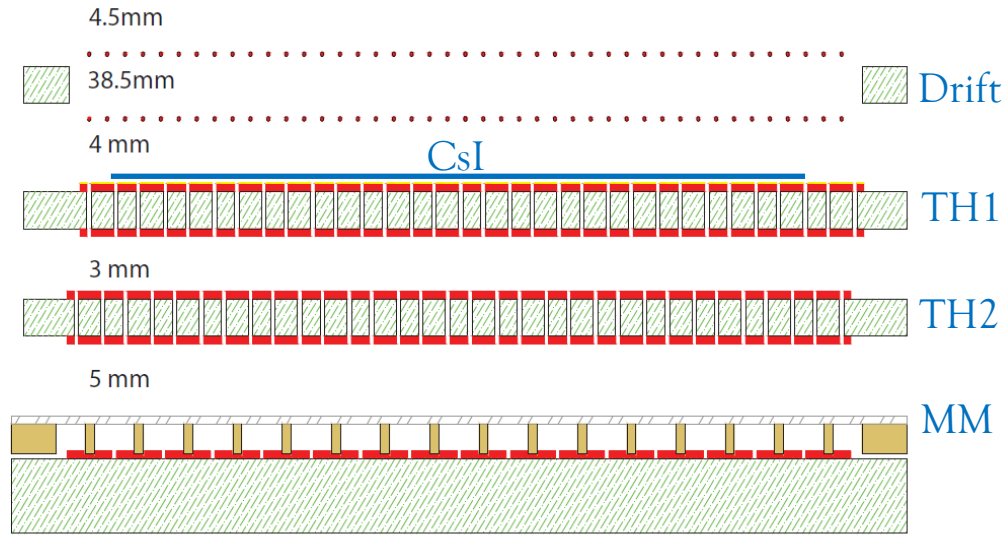


- RICH - 1 has 3 types of detector technology installed to date →
 - MWPCs
 - Hybrids [THGEMs + MMs]
 - MAPMTs
- Different HVs and FEE locations are shown from BEAM view
- Water based cooling for FEE are provided by two separate systems for top and bottom detectors.
- We have 8 MWPCs, 4 Hybrids and 576 MAPMTs with ~ 1100 HV channels and 82,944 FEE readout channels within which 71,424 are physical channels and rest are extra channels of APVs.

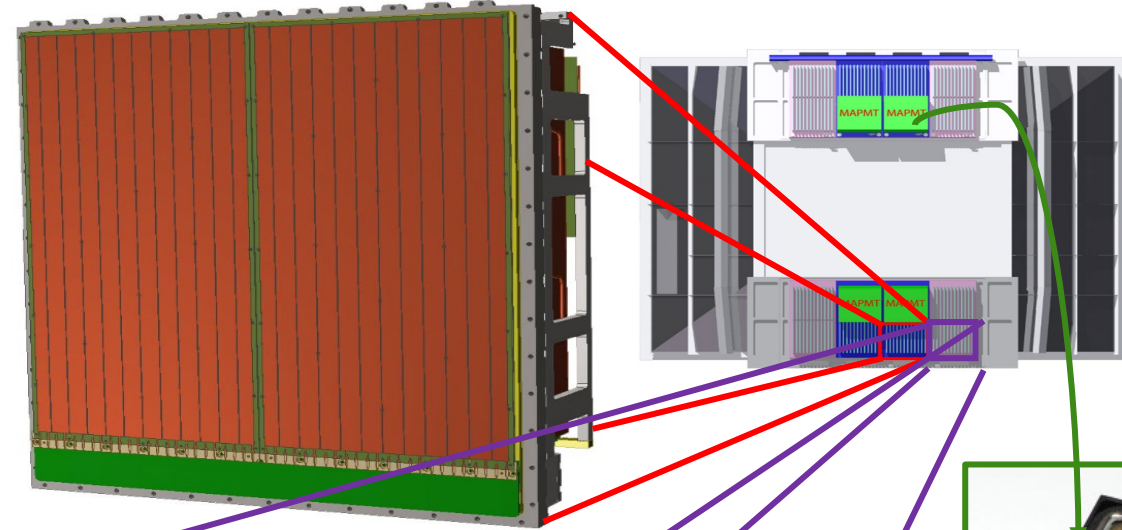
DETECTORS OF RICH - 1

Hybrid PD scheme

quartz

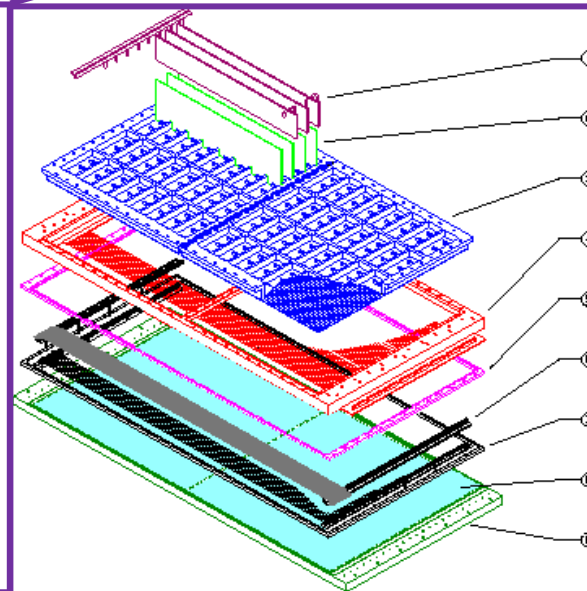


modular structure: one module = 600x300 mm²



8mm X 8mm pads
at positive HV

- Sides of the photon detection plane of RICH - 1 are equipped with MWPCs with CsI photocathodes.
- MWPCs are 600 × 600 mm² modules with 8 × 8 mm² readout pads.
- R/O pads are read with APV - 25 based FEE.



- MAPMTs are having 4 × 4 = 16 readout channels
- Each MAPMTs are powered by 1 HV channel.
- A total of 576 MAPMTs are used for the central zone of the Photodetection plane.

SOME BASIC IDEAS ABOUT DETECTORS

MAPMT			
01	02	03	04
05	06	07	08
09	10	11	12
13	14	15	16

- Each Gaseous PD has $72 \times 72 = 5184$ readout PADs \rightarrow 48 APV chips with 108 channels are connected to 12 APV Motherboards \Rightarrow 3 ADC Cards.
- 9216 Channels of 576 MAPMTs are read by 288 CMADs \Rightarrow 192 ROOFs \Rightarrow 192 Dreisam F1 TDCs.

M A P M T 1	CMAD 1 8 ch	CMAD 2 8 ch	ROOF BOARD \rightarrow 8 CMADs \rightarrow Dreisam DREISAM 1 \rightarrow 8 CMADs \rightarrow 64 chs
M A P M T 2	CMAD 1 8 ch	CMAD 2 8 ch	
M A P M T 3	CMAD 1 8 ch	CMAD 2 8 ch	
M A P M T 4	CMAD 1 8 ch	CMAD 2 8 ch	

Hybrid DETECTOR [Photon Detector (PD)]			
Saleve		Jura	
HYBRID 0		HYBRID 1	
S E C T O R	S E C T O R	S E C T O R	S E C T O R
0	1	2	3
3HV \rightarrow 1 SHV/LEMO	3HV \rightarrow 1 SHV/LEMO	3HV \rightarrow 1 SHV/LEMO	3HV \rightarrow 1 SHV/LEMO

DRY RUN 2020 PREPARATION

TASKs & TOOLS

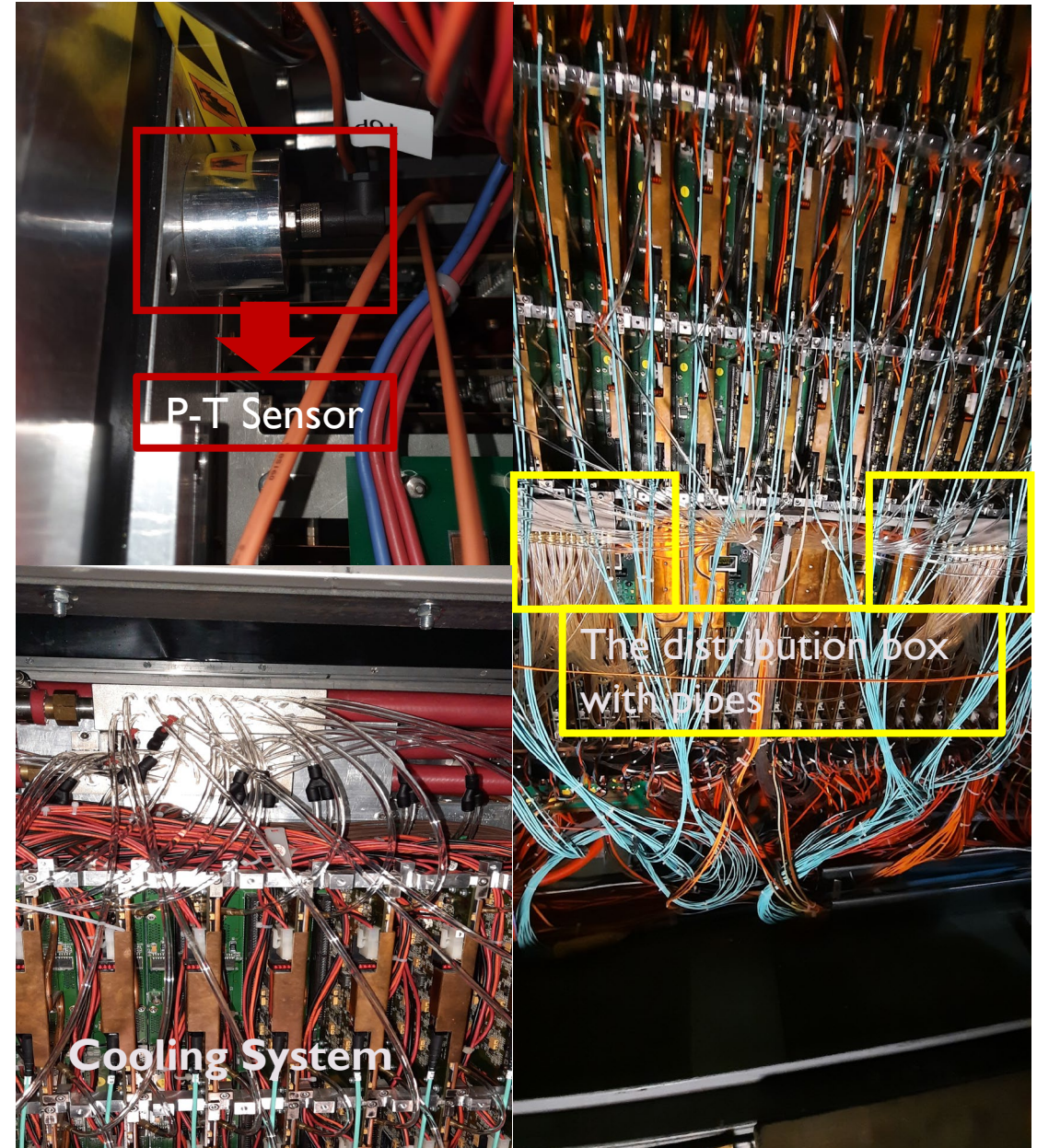
- To check the Cooling of the FEEs → Turning on the cooling and checks for water flow, leaks and the temperatures.
- HV of the detectors → Turning on the HV and looks for dark currents/shorts → Finding out the problem is in detector side or in HV PS Side.
- Check the HVCS software for Hybrids and MWPCs
- Turning on the LV for the FEE and check for the desired currents/voltages in PS side and in the DCS.
- Take pedestals [for analogue] and threshold scans [for digital part] to identify not working FEE chips/cards.
- Turning on two LEDs mounted inside RICH and to check for any faulty MAPMTs.
- Check the radiator gas transparency → if found dirty → cleaning the gas with filters and check for the transparency again and again until it is cleaned.



- Cooling → Prepared by Livio, Triloki and others before 15th of October.
- High Voltage (HV) → Prepared by Shuddha and Livio for the bottom detectors and Shuddha and Christophe for the top detectors. → HV test by Gergo. HV for MAPMTs → Reorganized the lemos by Triloki → HV test by Christophe and Shuddha. HV for MWPCs are tested only the HV crate part... few cables needed to be deployed.
- Pressure - Temperature (pT) sensors [both for Hybrids and MWPCs] are mounted by Stefano and Livio and tested by Gergo from remote.
- New HVCS programme has been tested by Gergo from remote → my personal apologies to him for very limited availabilities from my side.
- Fibres are put in place for MAPMTs → Shuddha and Triloki for the lower chambers and Livio and Shuddha for upper chambers → has been connected by shuddha.
- The FEE has been turned on and tested for operation by means of taking pedestals or by threshold scans by Shuddha. → Special thanks to Igor and Michela for their availabilities and specially for Igor's remote help in diagnosis in observed anomalies.
- Pulsed LED board has been checked and reincarnated by Stefano, Moritz and a bit by Shuddha (Shuddha find out the ppgControl software in compass directory) → After long work it has been found out that the both LEDs are shorted in both directions. → New Pulsed LED system in progress.
- F₂ chemicals C₄F₁₀ gas has been transported to and transparency has been measured by Stefano and a bit by Shuddha.

COOLING AND HIGH VOLTAGE

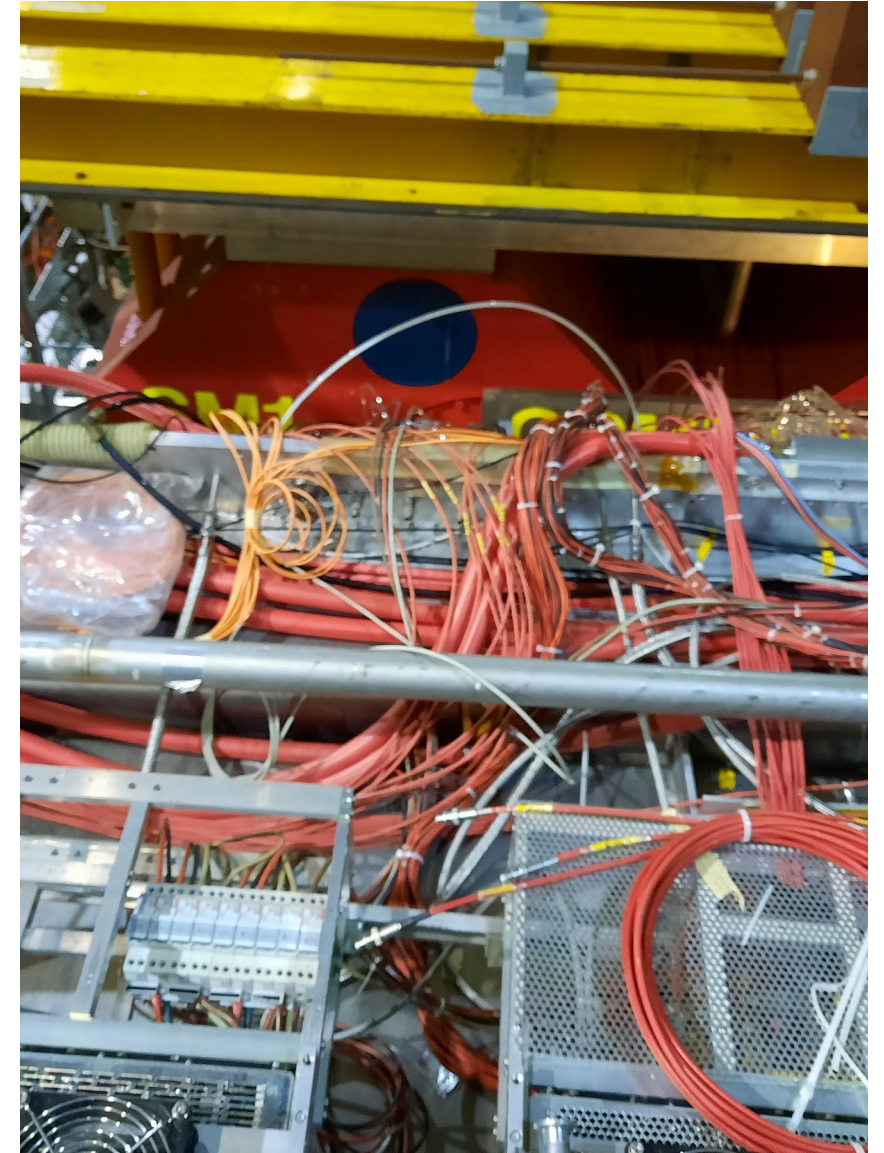
- **Cooling** → Prepared by Livio, Triloki and others before 15th of October.
- pT sensors in MWPCs gas input and output are put in place → Livio and Stefano.
- **High Voltage (HV) for Hybrids:**
 - → Prepared by Shuddha and Livio for the bottom detectors and Shuddha and Christophe for the top detectors.
 - → HV test by Gergo.
- **HV for MAPMTs:**
 - → Reorganized the lemos by Triloki
 - → HV test by Christophe and Shuddha.
- **HV for MWPCs are tested only the HV crate part:**
 - → few cables still need to be deployed.



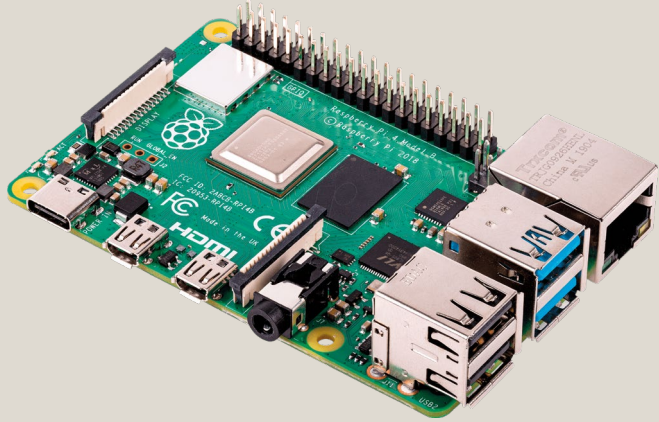
HV MAPPING AND HV FAULTS

- While re - cabling shuddha updated the existing HV mapping files. **(Special Thanks to Christophe for the great help)**
- There is only one broken channel [`Crate00:Slot07:Channel000`].
- There is a partially broken SHV connector for the Hybrids → **Will be fixed.**
- **The HV module with faulty channel will be repaired before RUN 2021**

TOP DETECTORS



RASPBERRY - PI INSTALLATION



- Raspberry - PIs (R - Pis) are standard micro computers.
- We use R - PIs to control our pT sensors installed in the gas input and output lines for our gaseous detectors [both MWPCs and Hybrids]
- New R - PI box for MWPC pT sensors has been installed after the successful use of them for Hybrids during 2016 - 2017 RUNs for stabilizing the gas gain.
- Both boxes have been fixed in the yellow support beam.
- Both Boxes have been configured by Gergo from remote and with help of Christophe from local support.

Raspberry Pi

3D printed box to hold the R - PI and the connectors connected to it and to the pT sensors.



NEW HVCS

- In HVCS MWPCs have been included with Hybrids.
- pT sensors was checked.
- Software Ready -> Fine tuning of the parameters for detectors are on going.
- Effective gain stabilization with environmental pT changes are working for gaseous detectors.

It is possible to implement the HV for MWPCs because of new HV upgrade by COMPASS common fund. MAPMTs are not present!

18/1/2021

HV Info (on pccohvhybrid.cern.ch)

HV Status

PD4										PD5				PD6				PD7			
Qf(R,F,D): 0, 0, 0										Qf(R,F,D): 0, 0, 0				Qf(R,F,D): 0, 0, 0				Qf(R,F,D): 0, 0, 0			
On: 0 Set: 100										On: 0 Set: 100				On: 0 Set: 100				On: 0 Set: 100			

A	B	C	D	E	F	G	H	I	PD5S0	PD5S1	PD5S2	PD5S3	PD6S0	PD6S1	PD6S2	PD6S3	A	B	C	D	E	F	G	H	I
0	0	0	0	0	0	0	0	0	QfR: 0	QfR: 0	QfR: 0	QfR: 0	QfR: 0	QfR: 0	QfR: 0	QfR: 0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	QfF: 0	QfF: 0	QfF: 0	QfF: 0	QfF: 0	QfF: 0	QfF: 0	QfF: 0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	QfD: 0	QfD: 0	QfD: 0	QfD: 0	QfD: 0	QfD: 0	QfD: 0	QfD: 0	0	0	0	0	0	0	0	0	0
100	100	100	100	100	100	100	100	100	Set: 100	Set: 100	Set: 100	Set: 100	Set: 100	Set: 100	Set: 100	Set: 100	100	100	100	100	100	100	100	100	100
0	0	0	0	0	0	0	0	0	On: 0	On: 0	On: 0	On: 0	On: 0	On: 0	On: 0	On: 0	0	0	0	0	0	0	0	0	0

A	B	C	D	E	F	G	H	I	PD1S0	PD1S1	PD1S2	PD1S3	PD2S0	PD2S1	PD2S2	PD2S3	A	B	C	D	E	F	G	H	I
0	0	0	0	0	0	0	0	0	QfR: 0	QfR: 0	QfR: 0	QfR: 0	QfR: 0	QfR: 0	QfR: 0	QfR: 0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	QfF: 0	QfF: 0	QfF: 0	QfF: 0	QfF: 0	QfF: 0	QfF: 0	QfF: 0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	QfD: 0	QfD: 0	QfD: 0	QfD: 0	QfD: 0	QfD: 0	QfD: 0	QfD: 0	0	0	0	0	0	0	0	0	0
30	30	30	30	30	30	30	30	30	Set: 50	Set: 100	Set: 100	Set: 100	Set: 60	Set: 60	Set: 60	Set: 60	40	50	40	40	40	40	40	40	40
0	0	0	0	0	0	0	0	0	On: 0	On: 0	On: 0	On: 0	On: 0	On: 0	On: 0	On: 0	0	0	0	0	0	0	0	0	0

PD0										PD1				PD2				PD3			
Qf(R,F,D): 0, 0, 0										Qf(R,F,D): 0, 0, 0				Qf(R,F,D): 0, 0, 0				Qf(R,F,D): 0, 0, 0			
On: 0 Set: 30										On: 0 Set: 100				On: 0 Set: 60				On: 0 Set: 40			

Sector Info

RichHvInfo-PD1S1

Name	Nom	OwnSc	SetSc	PTSc	Voltage	Electrode	VSet	VMon	IMon	NspR
EDrift	4	1.000	1.000	1.000	1.80	UDrift	30.34	29.33	0.000	0
UTrgem	12	1.030	1.000	1.000	12.88	UT1Top	32.99	31.56	0.000	0
ETrans1	10	1.000	1.000	1.000	3.00	UT1Bot	20.12	18.34	0.000	0
UTrgem:	12	1.010	1.000	1.000	12.12	UT2Top	17.12	15.83	0.000	0
ETrans2	10	1.000	1.000	1.000	5.00	UT2Bot	5.00	3.79	0.000	0
UMesh	6	0.973	1.000	1.000	6.23	UMesh	6.23	5.51	0.050	0

CageDrift : 29 V, 0.000 uA, 0 CageTop : 27 V, 0.003 uA, 0 FieldWires : 0 V, 0.000 uA, Status: OnState : 0, ScaleSet: 100%, QualityFactors:: Recent: 0, Former: 0, Daily: 0

Regular updates [s] : 10 Update

Wiregroup Info

RichHvInfo-PD3

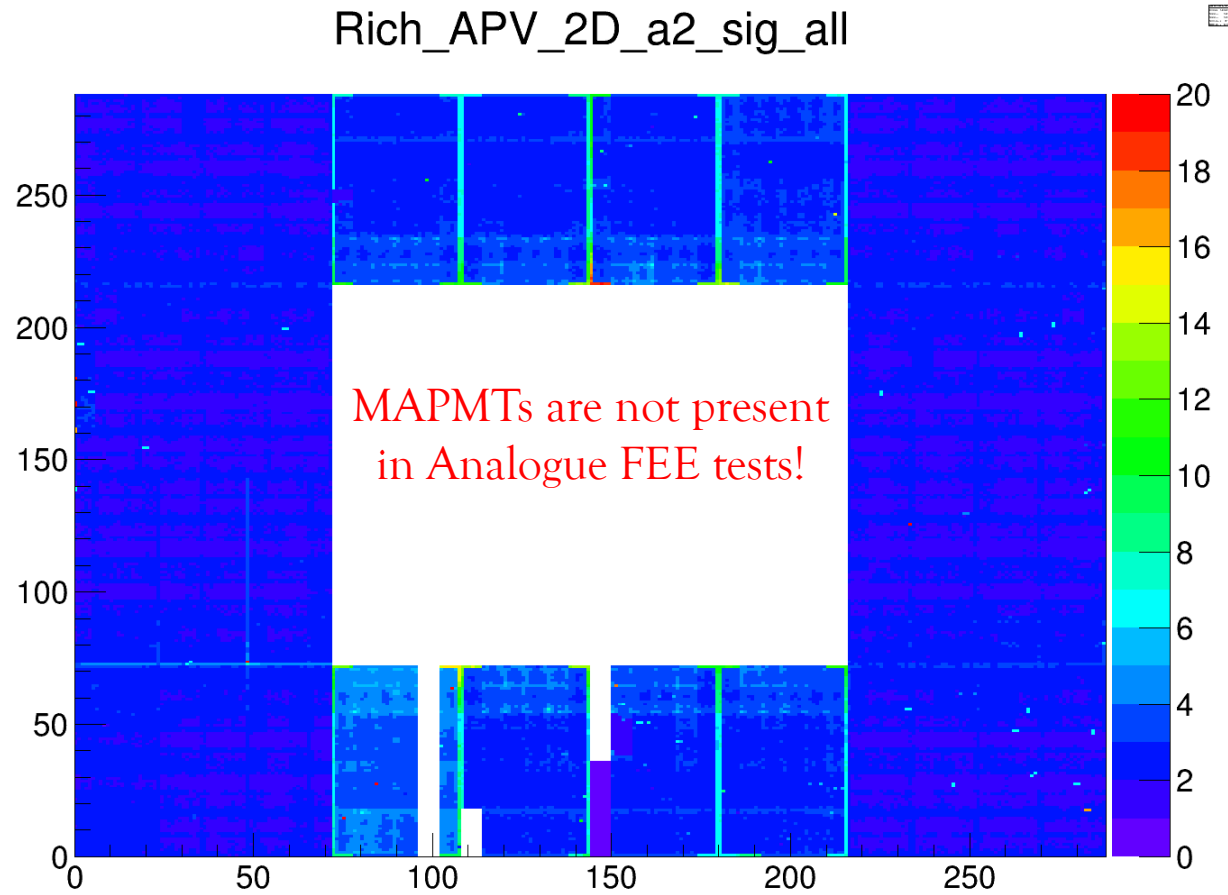
Name	Nom	OwnSc	SetSc	PTSc	VMon	IMon
A	10	1.000	0.400	1.000	3.62	0.007
B	10	1.000	0.500	1.000	4.36	0.001
C	10	1.000	0.400	1.000	3.37	0.009
D	10	1.000	0.400	1.000	2.95	0.001
E	10	1.000	0.400	1.000	3.55	0.008
F	10	1.000	0.400	1.000	3.24	0.009
G	10	1.000	0.400	1.000	3.60	0.010
H	10	1.000	0.400	1.000	3.25	0.006
I	10	1.000	0.400	1.000	3.31	0.004
FW	1	1.000	0.400	1.000	0.00	0.002

HV FOR MAPMT

- 6 within 576 HV channels have faults
- Jura Bottom part has no broken HV channels
- Channel SB_083 comes back to voltage as soon as the lemo is disconnected
- Modules with faults will be sent for repair.

Channel	Faults	Where	When
ST_040	Undervoltage	Module	after ~ 5h
JT_004	Undervoltage	Module	from start
JT_013	Undervoltage	Module	from start
SB_029	Undervoltage	Module	after ~ 8h
SB_045	Undervoltage	Module	from start
SB_083	Undervoltage	MAPMT	from start

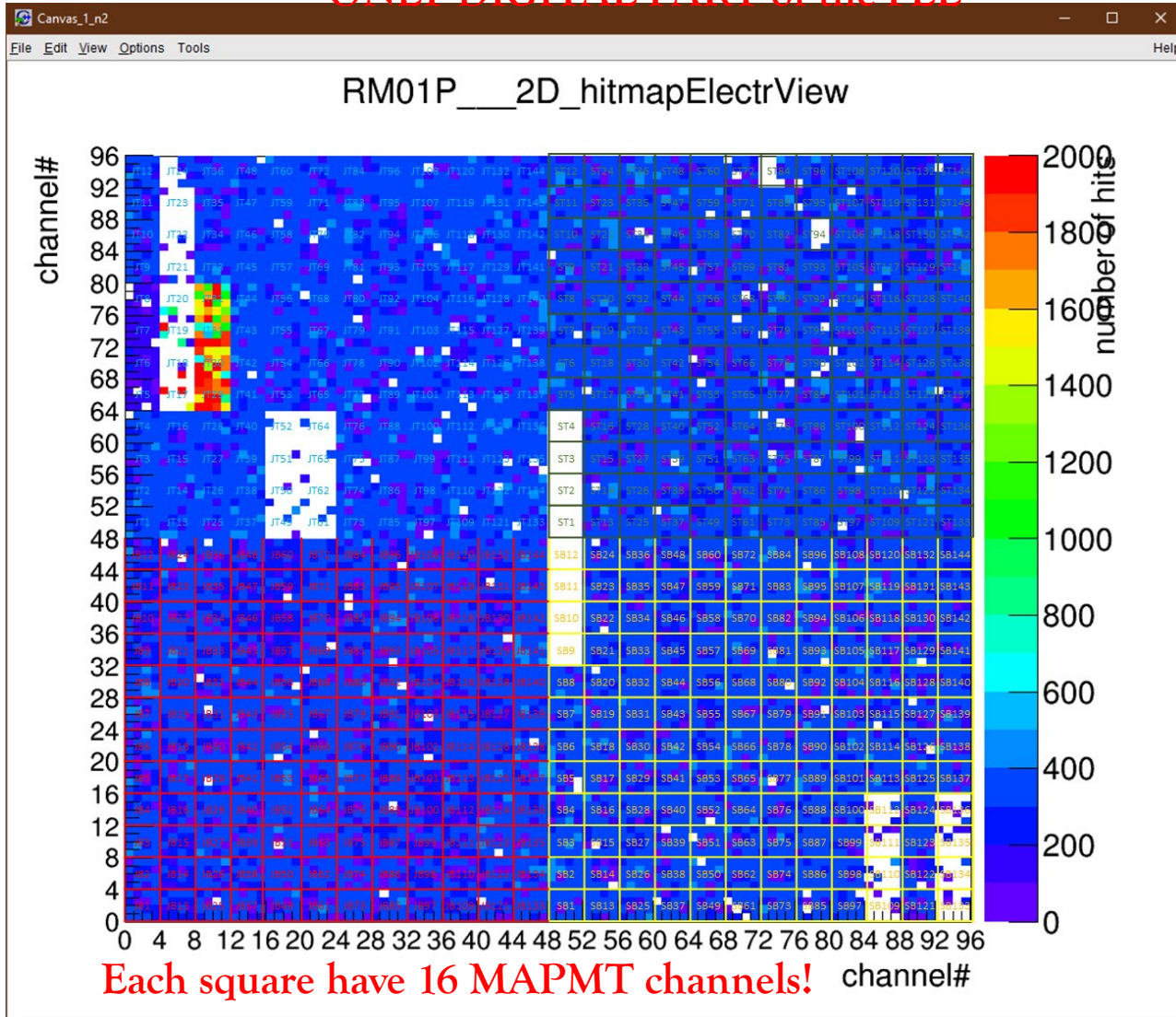
JURA												SALE VE												
TOP												BOT												
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
96	JT12	JT24	JT36	JT48	JT60	JT72	JT84	JT96	JT108	JT120	JT132	JT144	ST12	ST24	ST36	ST48	ST60	ST72	ST84	ST96	ST108	ST120	ST132	ST144
92	JT11	JT23	JT35	JT47	JT59	JT71	JT83	JT95	JT107	JT119	JT131	JT143	ST11	ST23	ST35	ST47	ST59	ST71	ST83	ST95	ST107	ST119	ST131	ST143
88	JT10	JT22	JT34	JT46	JT58	JT70	JT82	JT94	JT106	JT118	JT130	JT142	ST10	ST22	ST34	ST46	ST58	ST70	ST82	ST94	ST106	ST118	ST130	ST142
84	JT9	JT21	JT33	JT45	JT57	JT69	JT81	JT93	JT105	JT117	JT129	JT141	ST9	ST21	ST33	ST45	ST57	ST69	ST81	ST93	ST105	ST117	ST129	ST141
80	JT8	JT20	JT32	JT44	JT56	JT68	JT80	JT92	JT104	JT116	JT128	JT140	ST8	ST20	ST32	ST44	ST56	ST68	ST80	ST92	ST104	ST116	ST128	ST140
76	JT7	JT19	JT31	JT43	JT55	JT67	JT79	JT91	JT103	JT115	JT127	JT139	ST7	ST19	ST31	ST43	ST55	ST67	ST79	ST91	ST103	ST115	ST127	ST139
72	JT6	JT18	JT30	JT42	JT54	JT66	JT78	JT90	JT102	JT114	JT126	JT138	ST6	ST18	ST30	ST42	ST54	ST66	ST78	ST90	ST102	ST114	ST126	ST138
68	JT5	JT17	JT29	JT41	JT53	JT65	JT77	JT89	JT101	JT113	JT125	JT137	ST5	ST17	ST29	ST41	ST53	ST65	ST77	ST89	ST101	ST113	ST125	ST137
64	JT4	JT16	JT28	JT40	JT52	JT64	JT76	JT88	JT100	JT112	JT124	JT136	ST4	ST16	ST28	ST40	ST52	ST64	ST76	ST88	ST100	ST112	ST124	ST136
60	JT3	JT15	JT27	JT39	JT51	JT63	JT75	JT87	JT99	JT111	JT123	JT135	ST3	ST15	ST27	ST39	ST51	ST63	ST75	ST87	ST99	ST111	ST123	ST135
56	JT2	JT14	JT26	JT38	JT50	JT62	JT74	JT86	JT98	JT110	JT122	JT134	ST2	ST14	ST26	ST38	ST50	ST62	ST74	ST86	ST98	ST110	ST122	ST134
52	JT1	JT13	JT25	JT37	JT49	JT61	JT73	JT85	JT97	JT109	JT121	JT133	ST1	ST13	ST25	ST37	ST49	ST61	ST73	ST85	ST97	ST109	ST121	ST133
48	JB12	JB24	JB36	JB48	JB60	JB72	JB84	JB96	JB108	JB120	JB132	JB144	SB12	SB24	SB36	SB48	SB60	SB72	SB84	SB96	SB108	SB120	SB132	SB144
44	JB11	JB23	JB35	JB47	JB59	JB71	JB83	JB95	JB107	JB119	JB131	JB143	SB11	SB23	SB35	SB47	SB59	SB71	SB83	SB95	SB107	SB119	SB131	SB143
40	JB10	JB22	JB34	JB46	JB58	JB70	JB82	JB94	JB106	JB118	JB130	JB142	SB10	SB22	SB34	SB46	SB58	SB70	SB82	SB94	SB106	SB118	SB130	SB142
36	JB9	JB21	JB33	JB45	JB57	JB69	JB81	JB93	JB105	JB117	JB129	JB141	SB9	SB21	SB33	SB45	SB57	SB69	SB81	SB93	SB105	SB117	SB129	SB141
32	JB8	JB20	JB32	JB44	JB56	JB68	JB80	JB92	JB104	JB116	JB128	JB140	SB8	SB20	SB32	SB44	SB56	SB68	SB80	SB92	SB104	SB116	SB128	SB140
28	JB7	JB19	JB31	JB43	JB55	JB67	JB79	JB91	JB103	JB115	JB127	JB139	SB7	SB19	SB31	SB43	SB55	SB67	SB79	SB91	SB103	SB115	SB127	SB139
24	JB6	JB18	JB30	JB42	JB54	JB66	JB78	JB90	JB102	JB114	JB126	JB138	SB6	SB18	SB30	SB42	SB54	SB66	SB78	SB90	SB102	SB114	SB126	SB138
20	JB5	JB17	JB29	JB41	JB53	JB65	JB77	JB89	JB101	JB113	JB125	JB137	SB5	SB17	SB29	SB41	SB53	SB65	SB77	SB89	SB101	SB113	SB125	SB137
16	JB4	JB16	JB28	JB40	JB52	JB64	JB76	JB88	JB100	JB112	JB124	JB136	SB4	SB16	SB28	SB40	SB52	SB64	SB76	SB88	SB100	SB112	SB124	SB136
12	JB3	JB15	JB27	JB39	JB51	JB63	JB75	JB87	JB99	JB111	JB123	JB135	SB3	SB15	SB27	SB39	SB51	SB63	SB75	SB87	SB99	SB111	SB123	SB135
8	JB2	JB14	JB26	JB38	JB50	JB62	JB74	JB86	JB98	JB110	JB122	JB134	SB2	SB14	SB26	SB38	SB50	SB62	SB74	SB86	SB98	SB110	SB122	SB134
4	JB1	JB13	JB25	JB37	JB49	JB61	JB73	JB85	JB97	JB109	JB121	JB133	SB1	SB13	SB25	SB37	SB49	SB61	SB73	SB85	SB97	SB109	SB121	SB133



FRONT END ELECTRONICS ANALOGUE → APV

- APVs were turned on both for up and down detectors.
- A check of the working electronics has been done by checking the pedestal map.
- Pedestals here itself doesn't make that much sense as still a lot of interventions has been planned before final commissioning → e.g. The cover for CH₄ yet to be installed for both upper and down detectors.
- With Igor I have been succeeded to learn a bit in depth how to dragonize with gemMonitor the faults.
- The existing mapping has been checked and changes/anomalies have been updated accordingly.

ONLY DIGITAL PART of the FEE

FRONT END
ELECTRONICS DIGITAL

CMAD + DRIESAM

- Threshold scans has been taken.
- Around Threshold = 650 [the peak value of the pedestal] the threshold map has been created.
- Thanks to Michela for remote help on the last days for understanding the analysis programs and diagnosis.
- There are few wrongly calibrated ROOF boards and one not working Driesam card?
- Also, there are few not working CMADs.

CONCLUSION

- Colling and other services are commissioned and tested successfully.
- HV services including cables are rearranged, new pT sensors are installed and been tested → faulty components will be repaired before 2021 data taking.
- FEE has been turned on and tested → faults will be taken care in next weeks before start of the data taking.

**THANK YOU AND HAPPY
NEW YEAR 2021**

