

Temperature Sensors Update

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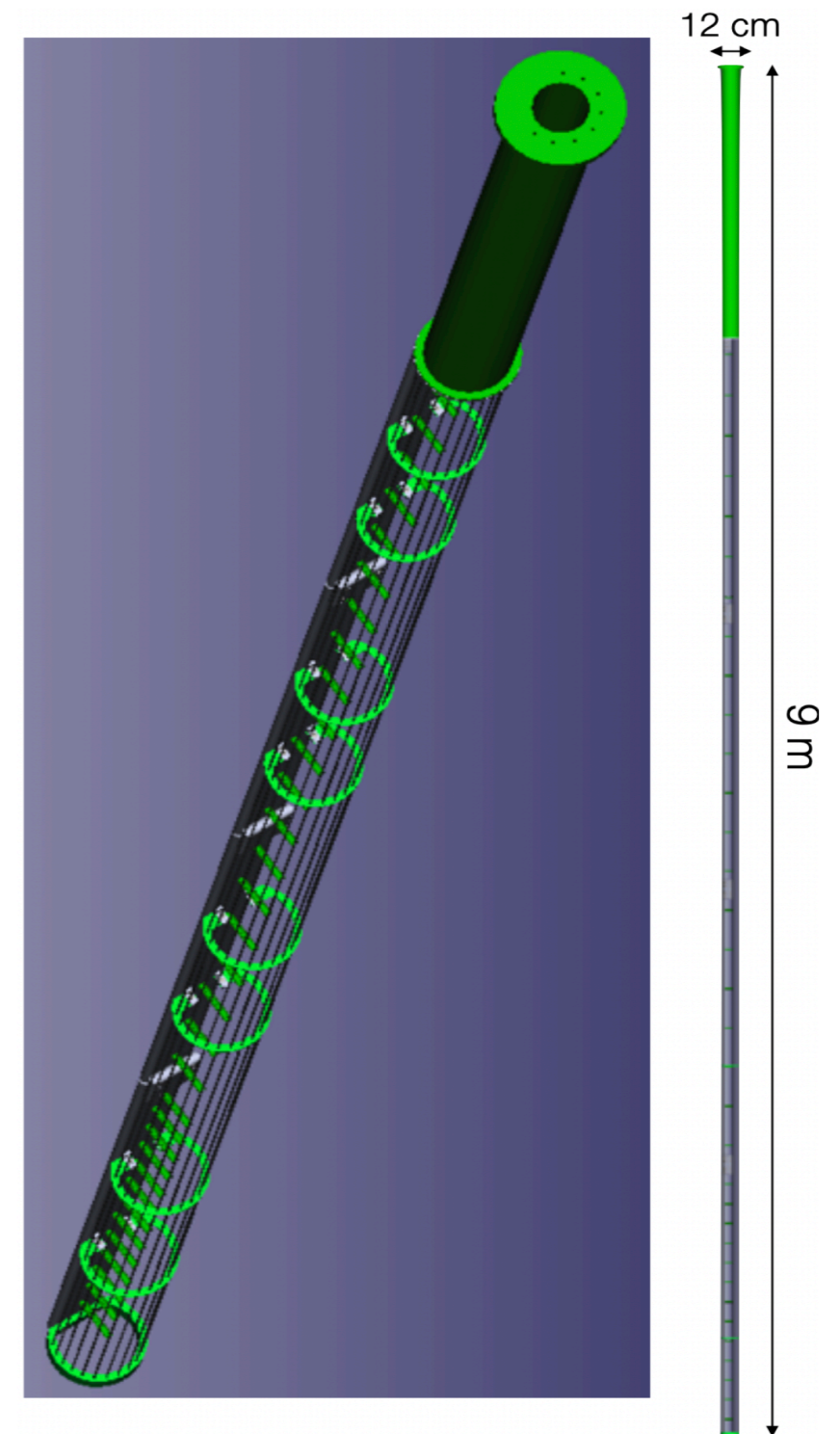
ProtoDUNE-HD

Week #	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	6	13	20	27	6	13	20	27	3	10	17	24
	Oct	Oct	Oct	Oct	Nov	Nov	Nov	Nov	Dec	Dec	Dec	Dec	Jan	Jan	Jan	Jan	Jan	Feb	Feb	Feb	Feb	Mar	Mar	Mar	Mar	Apr	Apr	Apr	Apr
DAQ test APAs 1&2																													
Test Beam Plug																													
Move upstream EW into position																													
Align APAs fix them into final position																													
Fix CPA beam into position																													
Mount TOP GP																													
Mount beam plug and fix upstream EW																													
Deploy TOP_FCs Saleve side																													
Remove floor, clean																													
Install pin diodes and T sensors on pipes and inlets																													
install BOT_GP																													
Deploy BOT_FC, fix downstream EW																													
Mount HV donut and check FC electrical connections																													
Close Saleve-side Drift Volume																													
Cold Box test APA #3																													
Install/Cable APAs 3&4 and DAQ test																													
Insert EWs																													
Align APAs and CPA and fix them in final position																													
Mount B&C Diffusors fibers																													
Mount gas arrays on TOP GP beams																													
Mount TOP GP																													
Fix downstream EW, Deploy TOP FCs																													
Remove floor, clean																													
Install T sensors on pump and pipes																													
Install BOT GP																													
Deploy BOT FC, fix upstream EW																													
Close Jura-side Drift Volume																													
Laser system preparation																													
Purity Monitors assembly and test																													
Install laser Periscopes																													
Install Purity Monitors																													
Reposition Valencia monitor																													
Install instrumentation																													
Close TCO																													
Reposition CRT																													
Install beam line																													
Clean and last connections																													
Seal & Purge																													
Fill																													

LAR procurement

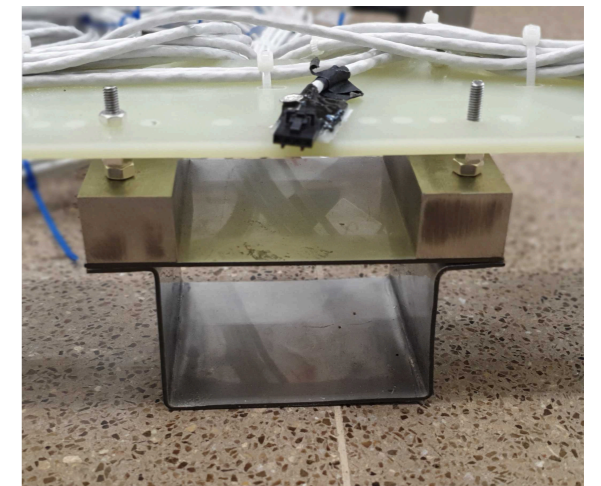
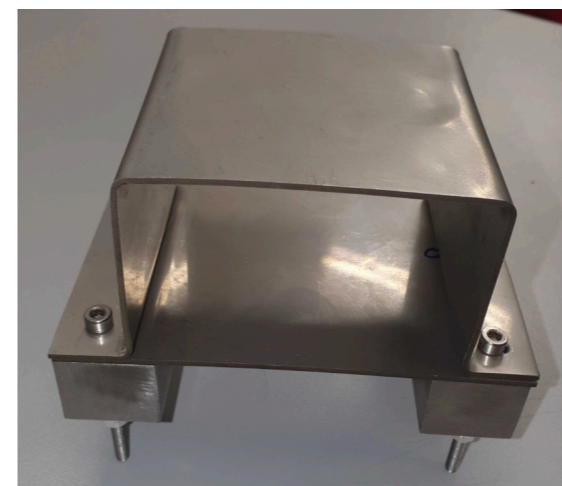
T-Gradient Monitor (Valencia): Status & Installation Plan

- **48 sensors in total**
- 46/48 were correctly unplugged from the profiler.
- 2/48 were damaged and therefore replaced.
- **All 48 sensors have been re-calibrated** and assigned to their specific locations on the TGM.
- They can be plugged in again at any moment with a scissor lift or when inserting the device in the final port (**28th November week**).



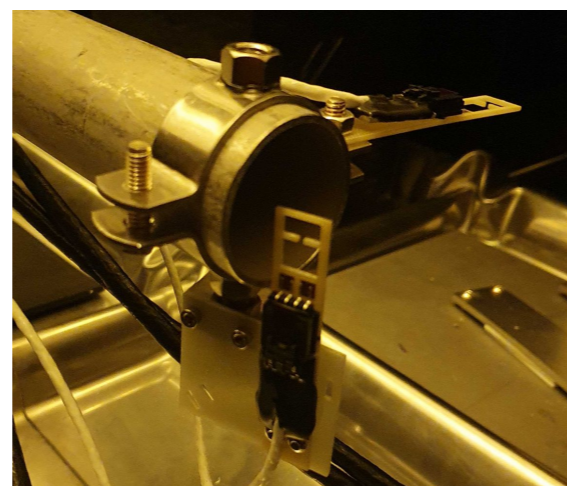
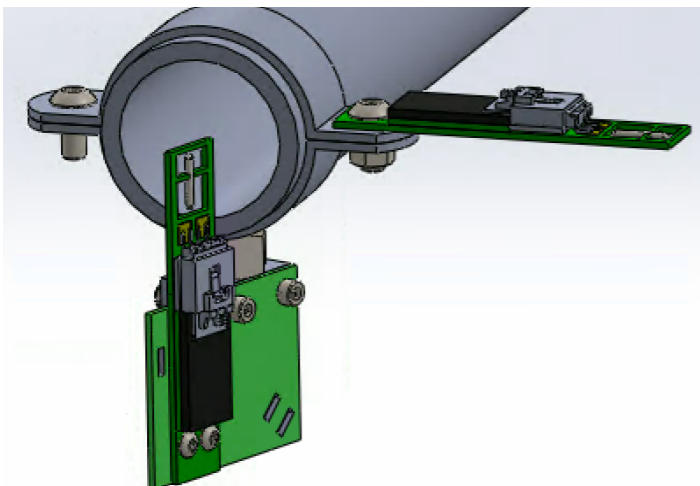
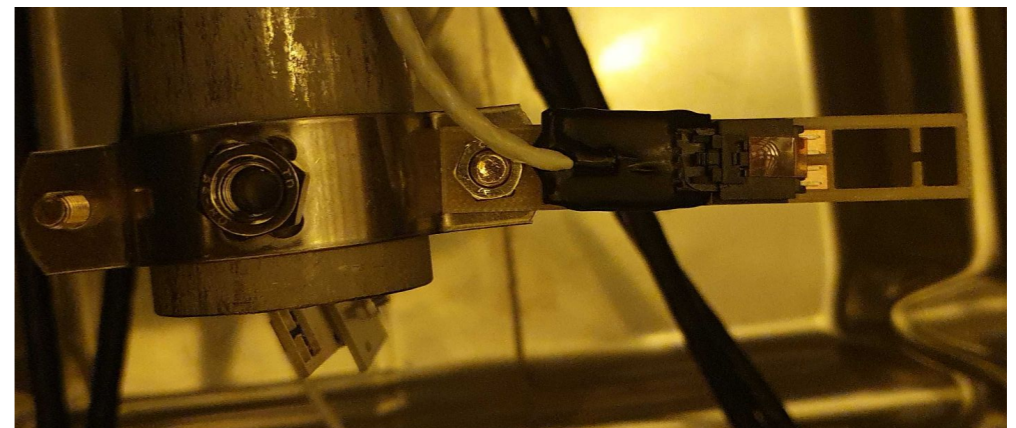
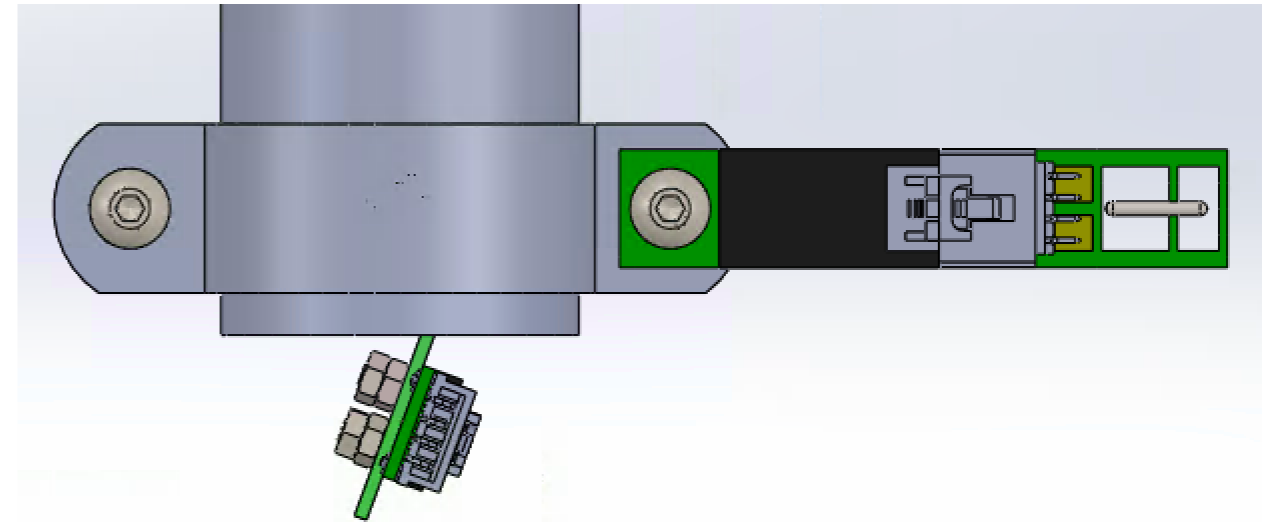
Gas Arrays: Status & Installation Plan

- 4 high precision sensors will be inside the liquid and **14 standard** will measure the gas temperature above.
- All 36 sensors have been **calibrated and cross-referenced** with those of the TGM.
- They will be installed on the GP beam before the installation of the GP on each of the sides (**14th November week**).



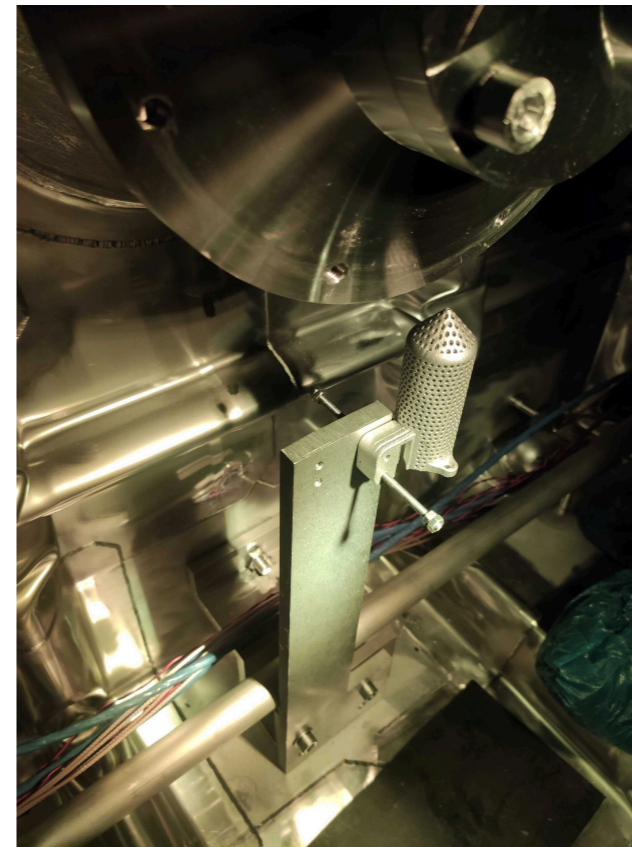
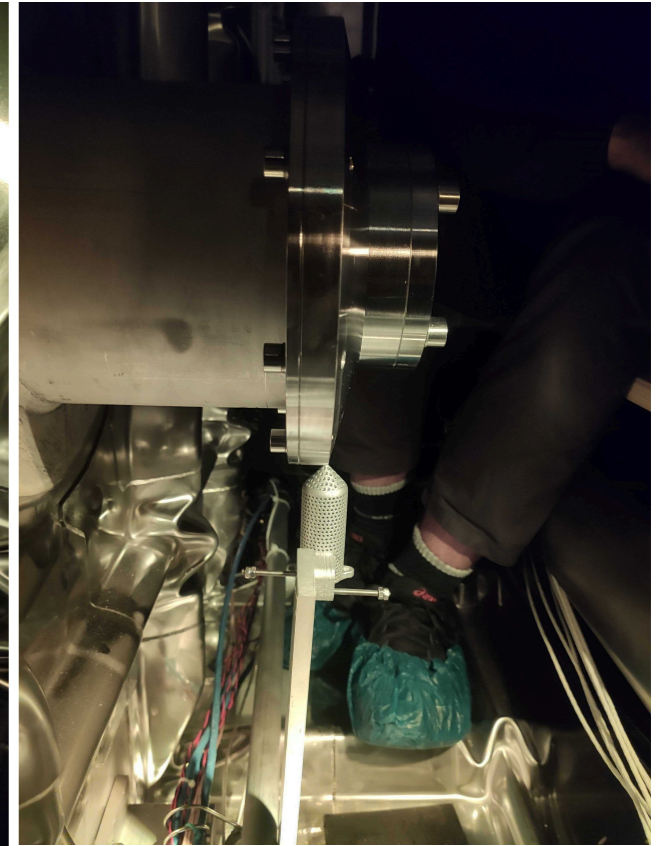
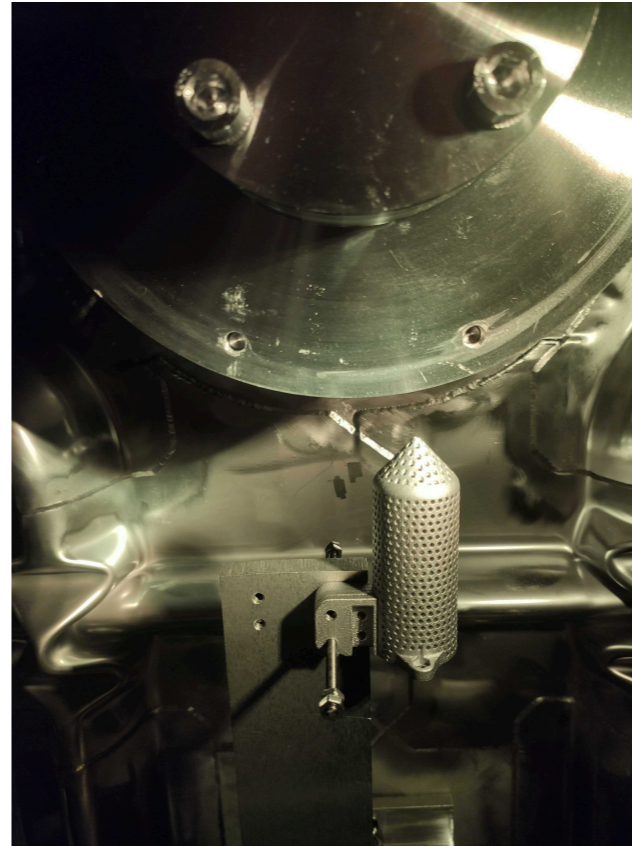
Pipes and Inlets: Status & Installation Plan

- Back in March we were at CERN to **test the installation**.
- Cables and calibrated sensors are already there, routed to their locations on the pipes.
- Sensors are cross-referenced with respect to those of the TGM.
- Installation after false floor removal on each of the sides of the detector (**31st October week, by Migue**).



Pump Sensors: Status

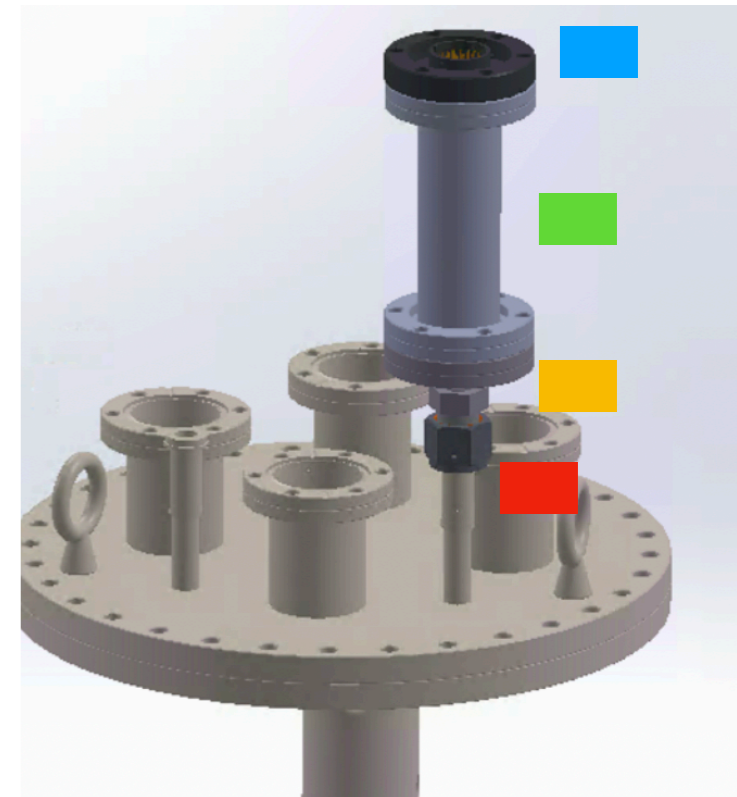
- During the stay at CERN in **March** we also took time to **route the cables** and to check the installation of the pump sensors.
- The installation of the supports is being tested by Anselmo and Migue this week at CERN.
- It has been noticed that the capsule lays 2 cm away from the design position, so the holes will be adjusted in order to have the capsules well placed.
- Final installation will be carried on by the **21st November week**.



Purity Monitors: Status

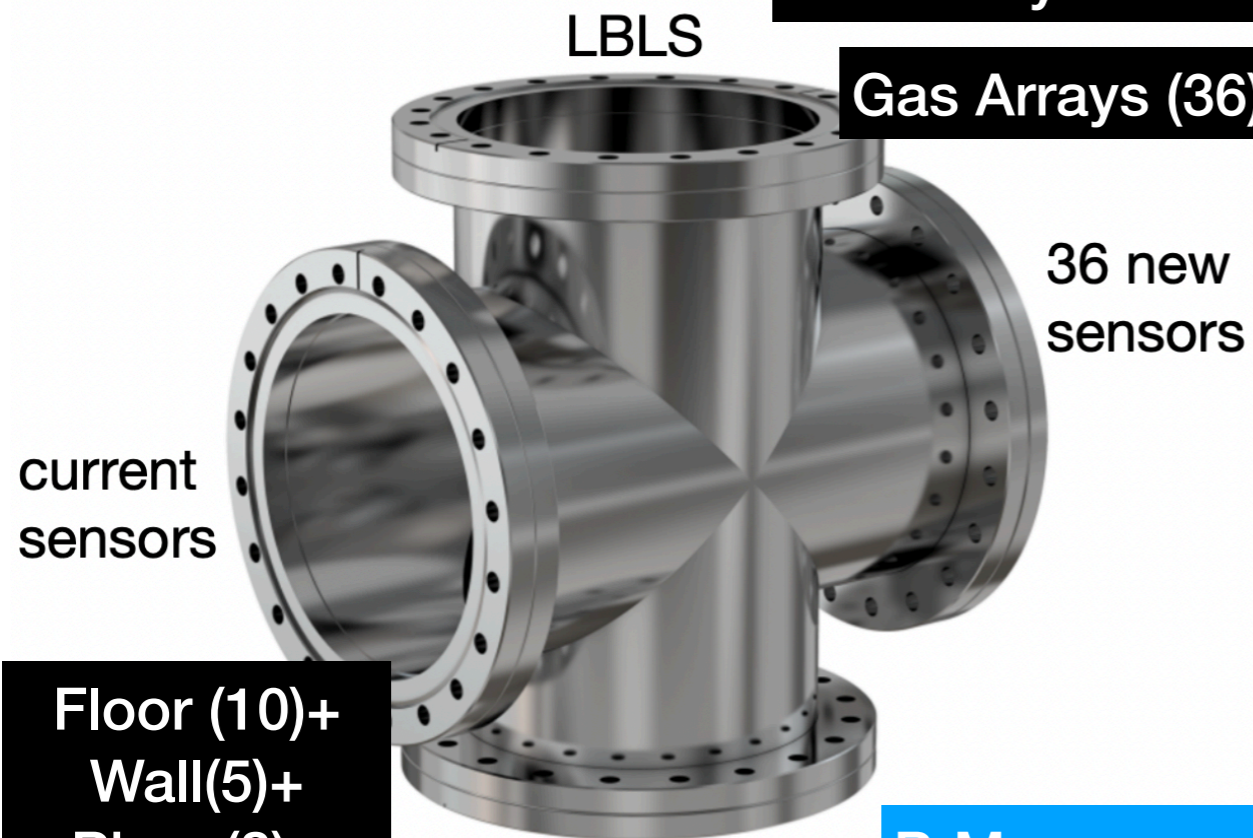
- **Cables** were fabricated and tested at IFIC lab last week and **delivered to CERN.**
- The flange to connect the readout was also delivered together with the cables.
- Sensors are calibrated together with those of the Gas Arrays and Pumps, and cross-referenced with respect to TGM's.
- Installation of the sensors before the PrM assembly and tests (**28th November week**)

- (1) VCR 1/2" -> CF40 (ordered)
- (2) CF40 -> CF63 (already at IFIC)
- (3) CF63 straight connector (already at IFIC)
- (4) CF63 with 1 SUBD25 (ordered)



Systems Cables Routing

Port 9.1



The new 6 DSUB-25 CF160 flange is already at IFIC

Gas Arrays (36)

36 new sensors

Floor (10)+
Wall(5)+
Pipes(8)+
Inlets(4)+
Pump(2)+
7 empty slots

PrM sensors use the PrM flange

APA sensors use the PD flange



Systems Calibrations & Cross-references

CalibSetNumber	Ref13	Ref14	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
TGrad1	44123	44124	39655	39654	39653	39652	39651	39650	40526	40525	40524	39659	39658	39657
TGrad2	44123	44124	39649	39648	39647	39646	39644	39630	39629	39628	39627	39626	39625	39624
TGrad3	44123	44124	39623	39622	39621	39620	39619	40533	40531	39615	39614	39613	39612	39611
TGrad4	44123	44124	39610	39609	39608	39607	39666	39665	39664	39667	39661	39660	40529	40530

TGrad2.1	44123	44124	39610	39666	39661	39622	40533	39613	39647	39629	39625	39652	40525	39657
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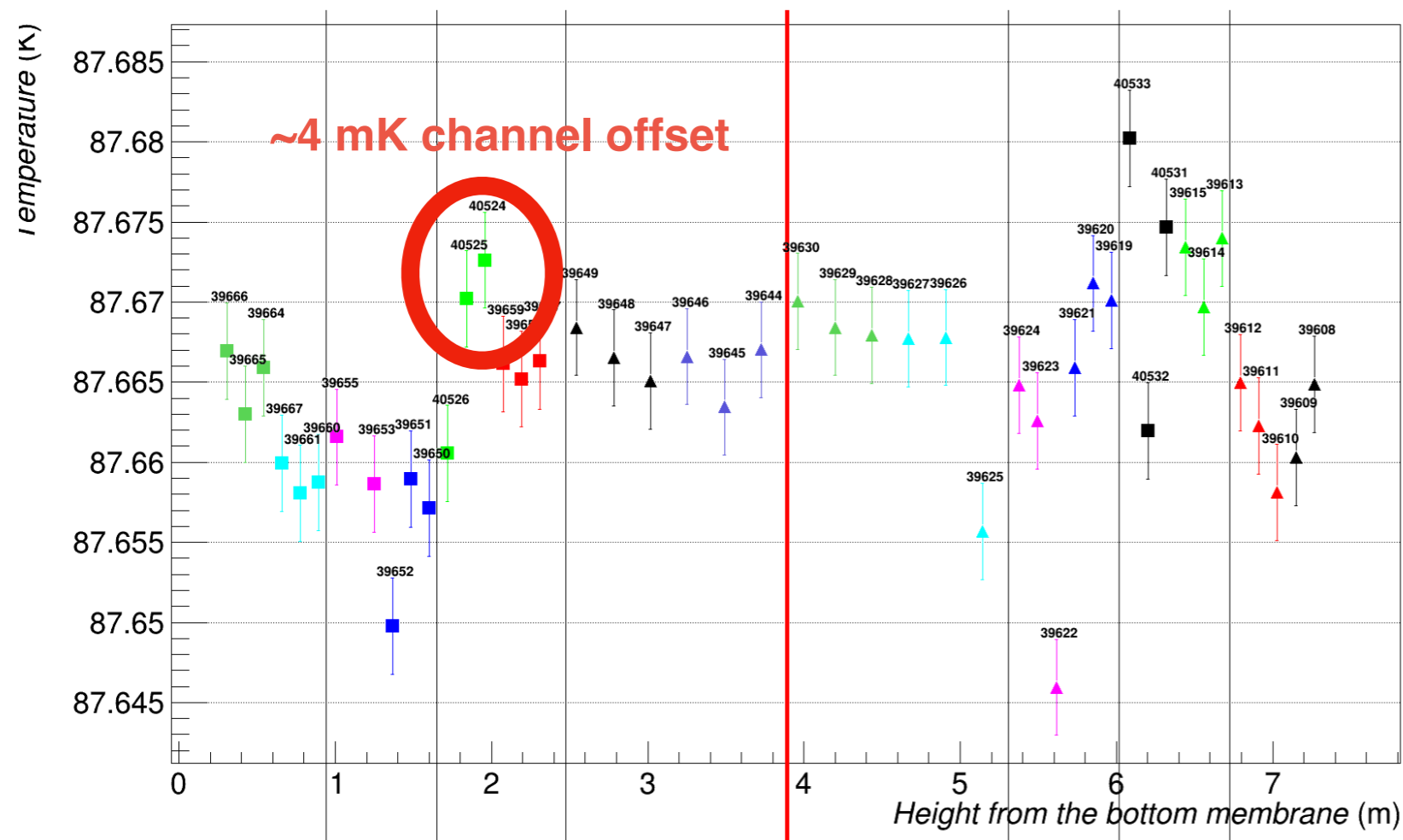
CalibSetNumber	Ref13	Ref14	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
Pipe1	44123	44124	39671	37131	37136	37135	39669	39631	36463	37134	39670	37130	36467	37133
Pipe1 (NAMES)	TGrad1	TGrad2	1-U	2-U	3-U	4-U	1-M	2-M	3-M	4-M	1-D	2-D	3-D	4-D
Pipe-TGrad1 (NAMES)	44123	44124	39671	37131	39666	37136	39669	39665	39631	39670	39664	37130	37133	39667
Pipe-TGrad1 (NAMES)	TGrad1	TGrad2	1-U.2	2-U.2	TGrad4-s5	3-U.2	4-U.2	TGrad4-s6	1-M.2	2-M.2	TGrad4-s7	3-M.2	4-M.2	TGrad4-s8
Pipe2	44123	44124	39671	37131	49319	37136	39669	49320	39631	39670	49321	37130	37133	49322
Pipe2 (NAMES)	TGrad1	TGrad2	1-U.2	2-U.2	1-I	3-U.2	4-U.2	2-I	1-M.2	2-M.2	3-I	3-M.2	4-M.2	4-I

CalibSetNumber	Ref13	Ref14	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
GA-PM-PP-1	44123	44124	48751	48746	48797	48490	48848	48485	48478	48205	39666	40529	39622	39625
GA-PM-PP-1 (names)	TGrad1	TGrad2	GA1.1	GA1.2	GA1.3	GA1.4	GA2.1	GA2.2	GA2.3	GA2.4	TG4-s5	TG4-s11	TG3-s2	TG2-s11
GA-PM-PP-2	44123	44124	48733	49323	49324	48754	48841	48836	37142	37127	39610	40530	39652	39647
GA-PM-PP-2 (names)	TGrad1	TGrad2	PM1	PM2	PM3	PM4	PM5	PM6	PP1	PP2	TG4-s1	TG4-s12	TG1-s4	TG2-s3

CalibSetNumber	Ref13	Ref14	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
GA-STD-1	1G13	1G14	1G1	1G2	1G3	1G4	1G5	1G6	1G7	1G8	1G9	1G10	1G11	1G12
GA-STD-2	2G13	2G14	2G1	2G2	2G3	2G4	2G5	2G6	2G7	2G8	2G9	2G10	2G11	2G12
GA-STD-HP	1G13	2G14	GA1.1	GA1.2	1G3	2G4	GA2.1	GA2.2	1G7	2G8	TG4-s5	1G10	TG3-s2	2G12

Protodune-HD: Readout Calibration

- During this week, Anselmo and Migue are performing some tests on the TMS readout.
- We noticed that even the precautions taken, in the calibration readout that we have at IFIC each channel is introducing a small offset of the order ~ 2.5 mK.
- It is possible that the CERN readout shows the same behaviour, and this could be the source of some of the inhomogeneities seen in the T-Gradient profile.
- Anselmo found that the CERN readout is also adding an offset in some of the channels, so it is something to be studied and characterised in the future before the operation of the detector.



Readout Calibration at IFIC

Chan	CalConst	Error
s2	1.535538333	0.3012312328
s3	1.797743333	0.2930521079
s4	1.358913704	0.3058432483
s5	1.788341667	0.3754375023
s6	2.6413125	0.3592468528
s7	1.808271667	0.4313178404
s8	2.155388684	0.3995224131
s9	2.325402982	0.4719136837
s10	2.646883421	0.4742488659
s11	2.311088421	0.3239406996
s12	2.468876667	0.2607058385
s13	2.297977281	0.3766297225
s14	2.284646111	0.352488642
s1	0	0

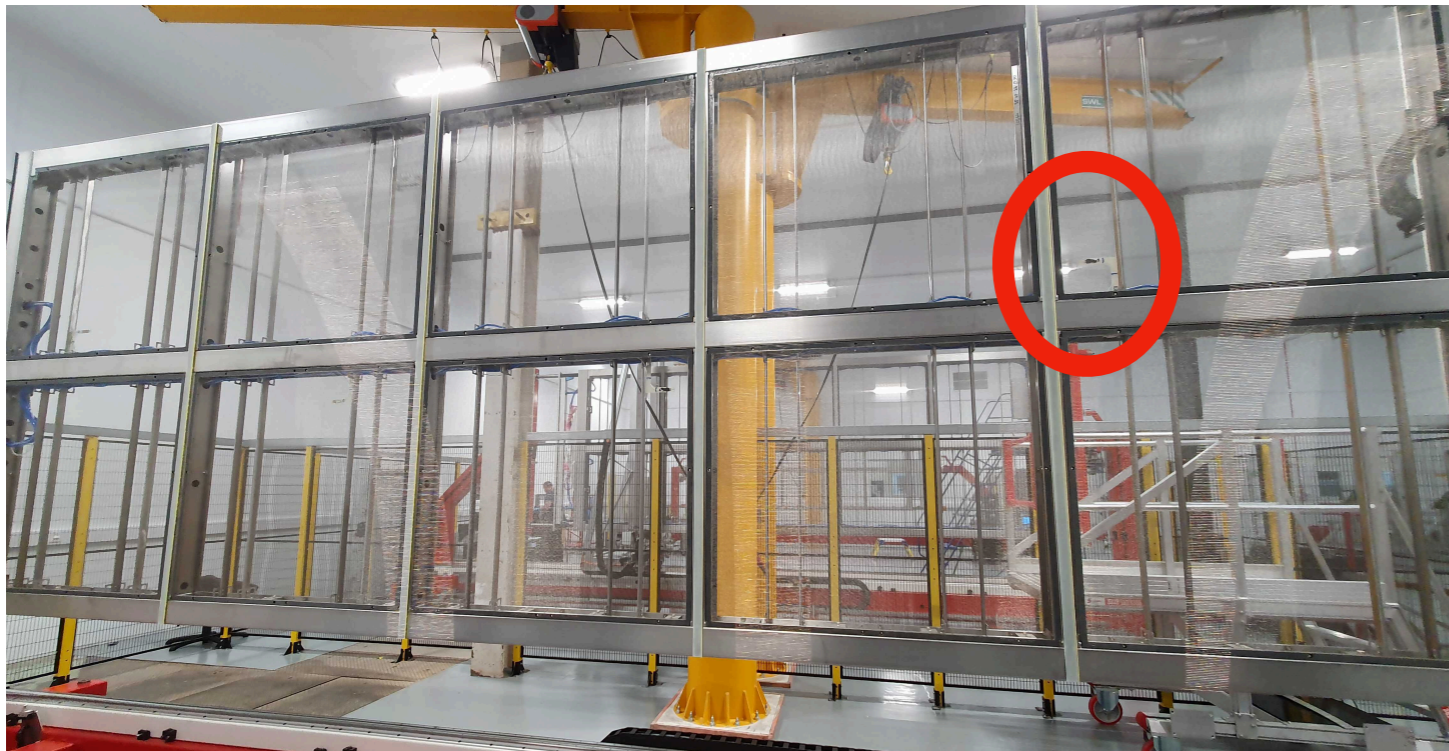
DUNE T-Sensors: Status

APA ID	UPPER/ LOWER	TYPE	CALCI config	APA Configuration	Sensor 1			Sensor 2			Sensor 3			Sensor 4		Cable bundle B		Cable bundle C		PT cable bundle	Production date	Shipping date	Delivery date	
					cable length	sensor type	sensor ID	cable length	sensor type	sensor ID	cable length	sensor type	sensor ID	cable length	sensor type	sensor ID	Pin 1	Pin 9	Pin 1					Pin 9
1	UPPER	A	UA-2	U-F-3-12-F	1017	F1	STS 001	1705	LAr3	48178	4762	LAr12	48179	6429	F2	STS 002	F1	LAr3	LAr12	F2	2	2022/02/11	2022/02/12	2022/02/14
2	LOWER	A	LA-2	L-F-7-16-F	5968	F1	STS 004	4485	LAr7	48181	1629	LAr16	48180	977	F2	STS 003	LAr7	F1	F2	LAr16		2022/03/09	2022/03/11	2022/03/17
3	UPPER	B	UB-2	U-1-6-11-16	1101	LAr1	48182	2803	LAr6	48183	4269	LAr11	48184	6044	LAr16	48185	LAr6	LAr11	LAr1	LAr16	2	2022/03/10	2022/03/11	2022/03/17
4	LOWER	B	LB-2	L-3-8-13-18	5701	LAr3	48189	4061	LAr8	48188	2705	LAr13	48187	977	LAr18	48186	LAr18	LAr3	LAr13	LAr8		2022/03/10	2022/03/11	2022/03/17
5	UPPER	B	UB-1	U-1-5-10-15	1101	LAr1	48190	2383	LAr5	48191	4084	LAr10	48192	5551	LAr15	48193	LAr10	LAr15	LAr1	LAr5	2	2022/05/03	2022/05/03	2022/06/03
6	LOWER	B	LB-1	L-4-9-14-18	5277	LAr4	48197	3921	LAr9	48196	2193	LAr14	48195	977	LAr18	48194	LAr18	LAr14	LAr9	LAr4		2022/05/03	2022/05/03	2022/06/03
7	UPPER	A	UA-1	U-F-1-10-F	1017	F1	STS 005	1101	LAr1	48198	4084	LAr10	48199	6429	F2	STS 006	F1	LAr10	LAr1	F2	2	2022/05/03	2022/05/03	2022/06/03
8	LOWER	A	LA-1	L-F-9-18-F	5968	F1	STS 008	3921	LAr9	48201	977	LAr18	48200	977	F2	STS 007	LAr18	F1	F2	LAr9		2022/05/03	2022/05/03	2022/06/03
9	UPPER	B	UB-3	U-2-7-12-17	1520	LAr2	48060	2987	LAr7	48061	4762	LAr12	48062	6229	LAr17	48063	LAr2	LAr7	LAr12	LAr17	2	2022/06/10	2022/06/13	2022/06/03
10	LOWER	B	LB-3	L-2-7-12-17	5841	LAr2	48477	4485	LAr7	48476	2845	LAr12	48204	1489	LAr17	48202	LAr7	LAr2	LAr17	LAr12		2022/06/10	2022/06/13	2022/06/03
11	UPPER	A	UA-3	U-F-5-14-F	1017	F1	STS 009	2383	LAr5	48480	5366	LAr14	48481	6429	F2	STS 010	F1	LAr14	LAr5	F2	2	2022/06/10	2022/06/13	2022/06/03
12	LOWER	A	LA-3	L-F-5-14-F	5968	F1	STS 012	5137	LAr5	48483	2193	LAr14	48482	977	F2	STS 011	LAr14	F1	F2	LAr5		2022/06/10	2022/06/13	2022/06/03
13	UPPER	B	UB-4	U-3-8-13-18	1705	LAr3	48484	3480	LAr8	48486	4946	LAr13	48487	6648	LAr18	48488	LAr3	LAr18	LAr8	LAr13	2	2022/10/11		
14	LOWER	B	LB-4	L-1-6-11-16	6353	LAr1	48493	4625	LAr6	48492	3296	LAr11	48490	1629	LAr16	48489	LAr11	LAr6	LAr16	LAr1		2022/10/11		
15	UPPER	A	UA-4	U-F-7-16-F	1017	F1	STS 013	2987	LAr7	48494	6044	LAr16	48495	6429	F2	STS 014	F1	LAr7	LAr16	F2	2	2022/10/11		
16	LOWER	A	LA-4	L-F-3-12-F	5968	F1	STS 016	5701	LAr3	48674	2845	LAr12	48672	977	F2	STS 015	LAr3	F1	F2	LAr12		2022/10/11		
17	UPPER	B	UB-5	U-4-9-14-18	2198	LAr4	48675	3665	LAr9	48797	5366	LAr14	48798	6648	LAr18	48799	LAr14	LAr18	LAr4	LAr9	2	2022/10/11		
18	LOWER	B	LB-5	L-1-5-10-15	6353	LAr1		5137	LAr5		3409	LAr10		2053	LAr15		LAr15	LAr10	LAr5	LAr1		2022/10/11		
19	UPPER	A	UA-5	U-F-9-18-F	1017	F1	STS 017	3665	LAr9		6648	LAr18		6429	F2	STS 018	F1	LAr18	LAr9	F2	2	2022/10/11		
20	LOWER	A	LA-5	L-F-1-10-F	5968	F1	STS 020	6353	LAr1		3409	LAr10		977	F2	STS 019	LAr10	F1	F2	LAr1		2022/10/11		
21	UPPER	B	UB-1	U-1-5-10-15	1101	LAr1		2383	LAr5		4084	LAr10		5551	LAr15		LAr10	LAr15	LAr1	LAr5	2			
22	LOWER	B	LB-1	L-4-9-14-18	5277	LAr4		3921	LAr9		2193	LAr14		977	LAr18		LAr18	LAr14	LAr9	LAr4				
23	UPPER	A	UA-1	U-F-1-10-F	1017	F1	STS 021	1101	LAr1		4084	LAr10		6429	F2	STS 022	F1	LAr10	LAr1	F2	2			
24	LOWER	A	LA-1	L-F-9-18-F	5968	F1	STS 024	3921	LAr9		977	LAr18		977	F2	STS 023	LAr18	F1	F2	LAr9				

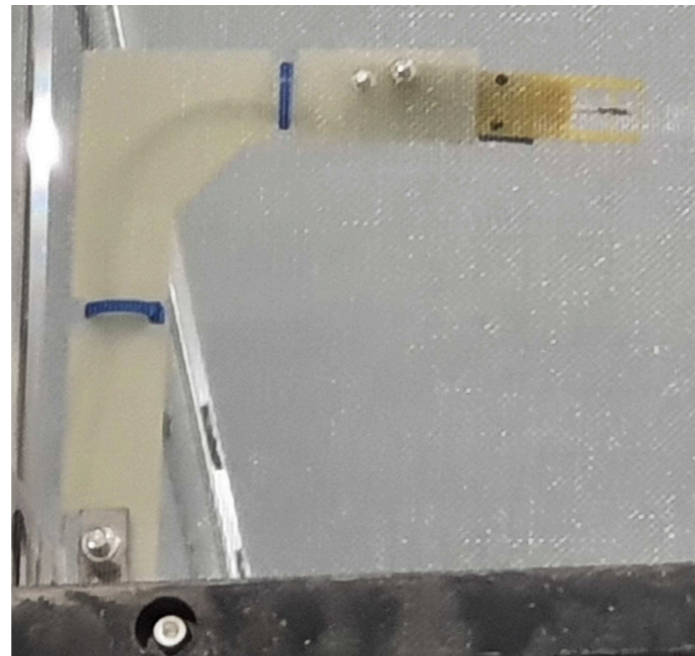
- The status of the fabrication of the whole system for the APAs is **tracked at IFIC**.
- Fabricated up to APA24. Delivery scheduled for next week.
- All sensors are catalogued in their corresponding set and calibrated accordingly.



DUNE T-Sensors: Installation at Daresbury

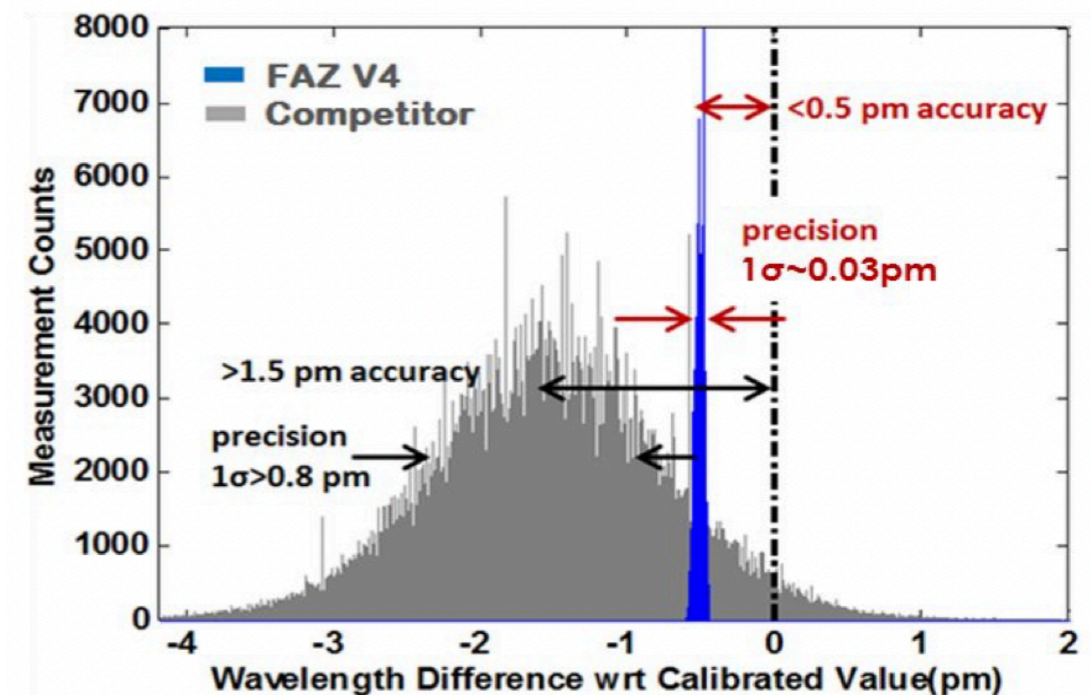
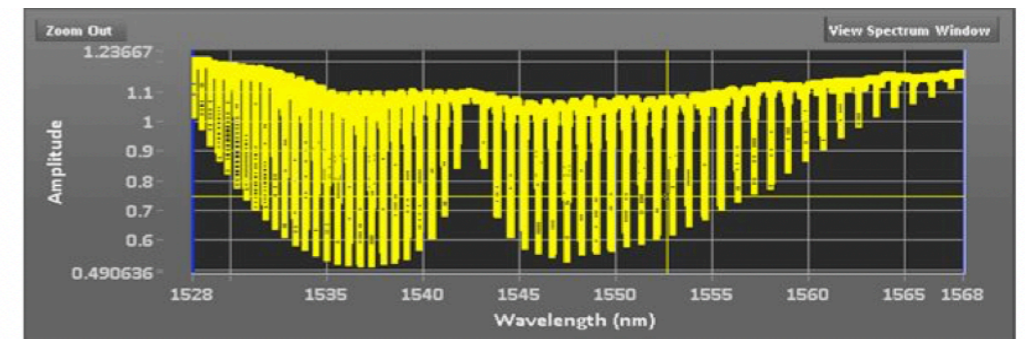


- During the CM in Manchester we visited the APA factory in Daresbury.
- The installation of the T-Sensors on the APA does not show any issue in terms of logistics and we are on time with the deliveries.



ProtoDUNE-VD: Interrogator

- We have **converged** in an agreement of purchase with **Optics11** (Technica SA, USA).
- This week we have purchased the **I4G-16chan** interrogator, with a wavelength **repeatability <0.1 pm** and operation range 1529.0 to 1568.2 nm.
- It will take 2 weeks to get to IFIC since Tuesday 25th October. Some test fibres com along with the interrogator from Optics11.



ProtoDUNE-VD: Fiber Bragg Grating Sensors

- We have **converged with FBGS, S.A.** to develop the FBG sensors with the needed sensitivity over temperature to reach the needed resolution ~ 3 mK.
- There are some commercial products that offer sensitivities around ~ 1 pm/K at 87 K, which is 1 order of magnitude away from the requirements. An iterative R&D has been agreed with the company in order to improve the sensitivity an order of magnitude while reducing other sources of noise (vibrations, strain, etc...)
- We are planning to place a purchase order this week for the ~ 240 m of fibres that we need for the installation in PD-VD.
- The installation will consist on a mechanical installation as we don't have still the needed sensitivity on the fibres, but it will be useful to gain experience and learn mechanical-related properties of the installation.

ProtoDUNE-VD: Installation Plan

- The idea is to install 16 15-meters long fibres produced by FBGS to occupy the 16 channels of the interrogator.
- They will be guided and subjected on the rods that hold the cathode (red vertical lines).
- Other fibres can be also installed along the horizontal axis if needed.
- This needs to be agreed within the collaboration and tested as soon as fibres arrive at IFIC.

