IFIC
25/05/2017

News from CM and calibration status

A. Cervera

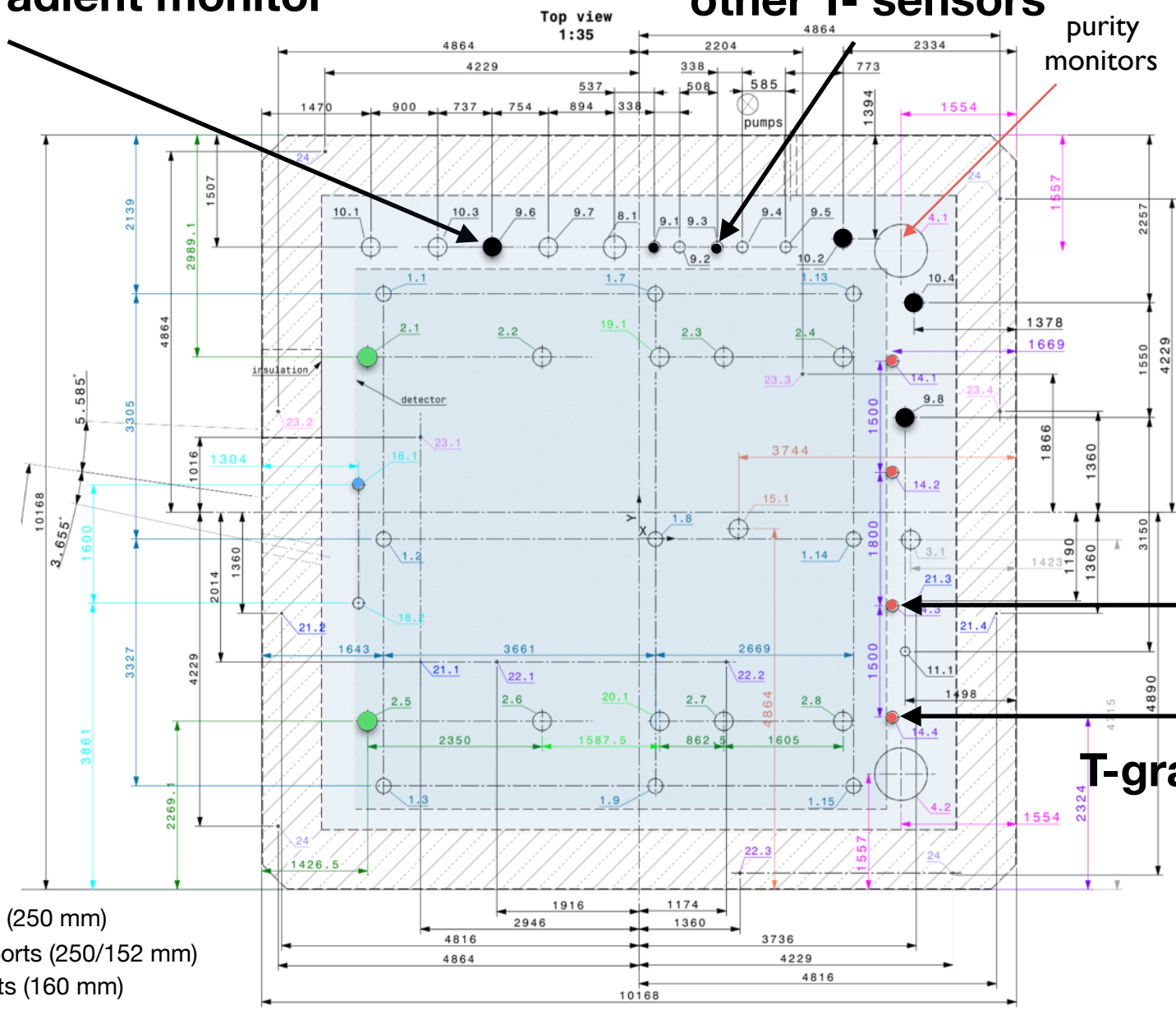
IFIC - (CSIC & Univ. Valencia)

Cryostat ports

Hawaii T-gradient monitor

other T- sensors

purity monitors



other T- sensors

Valencia T-gradient monitor

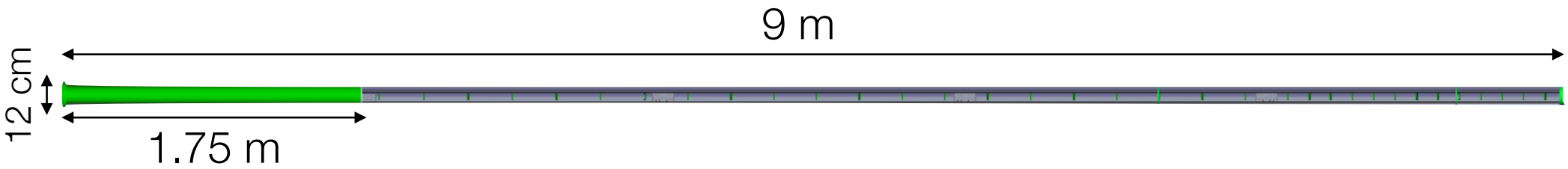
9.1 to be shared

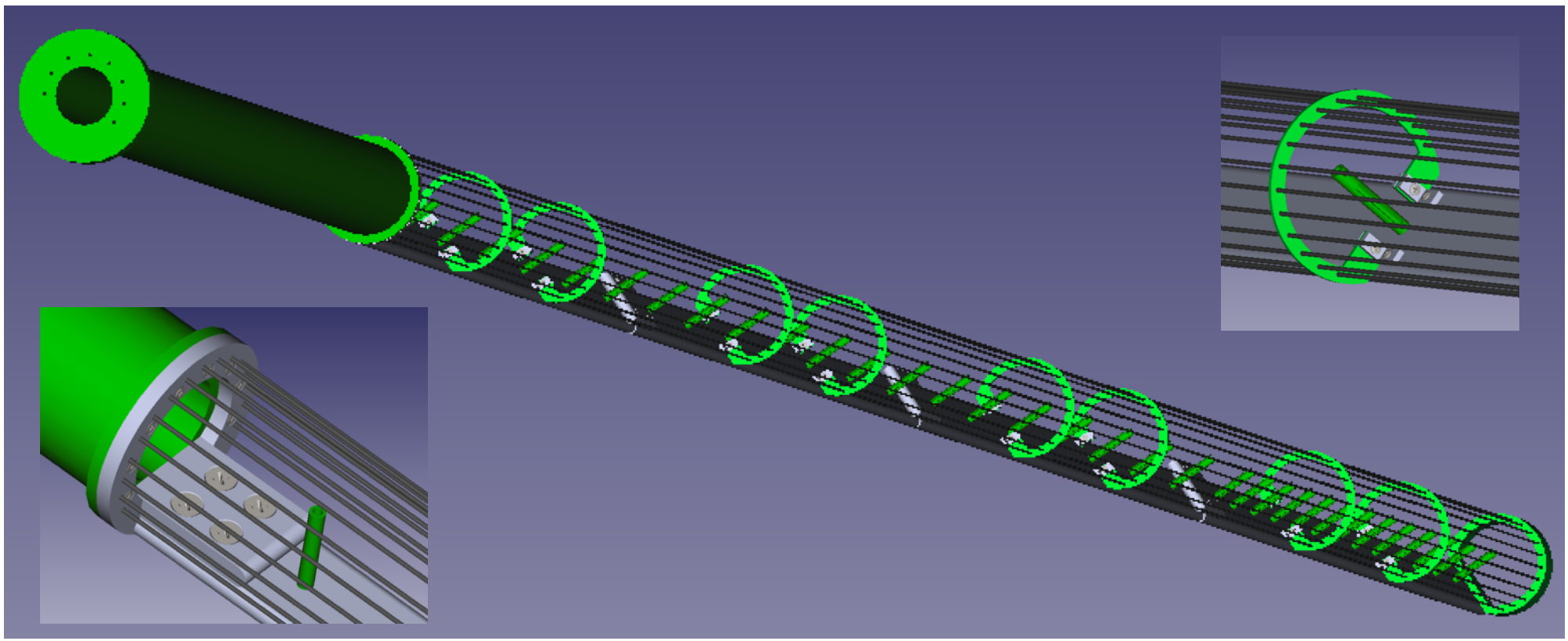
- Spare signal ports (250 mm)
- Spare cryogenic ports (250/152 mm)
- Unused Laser ports (160 mm)
- Spare (150 mm)

T-gradient monitor

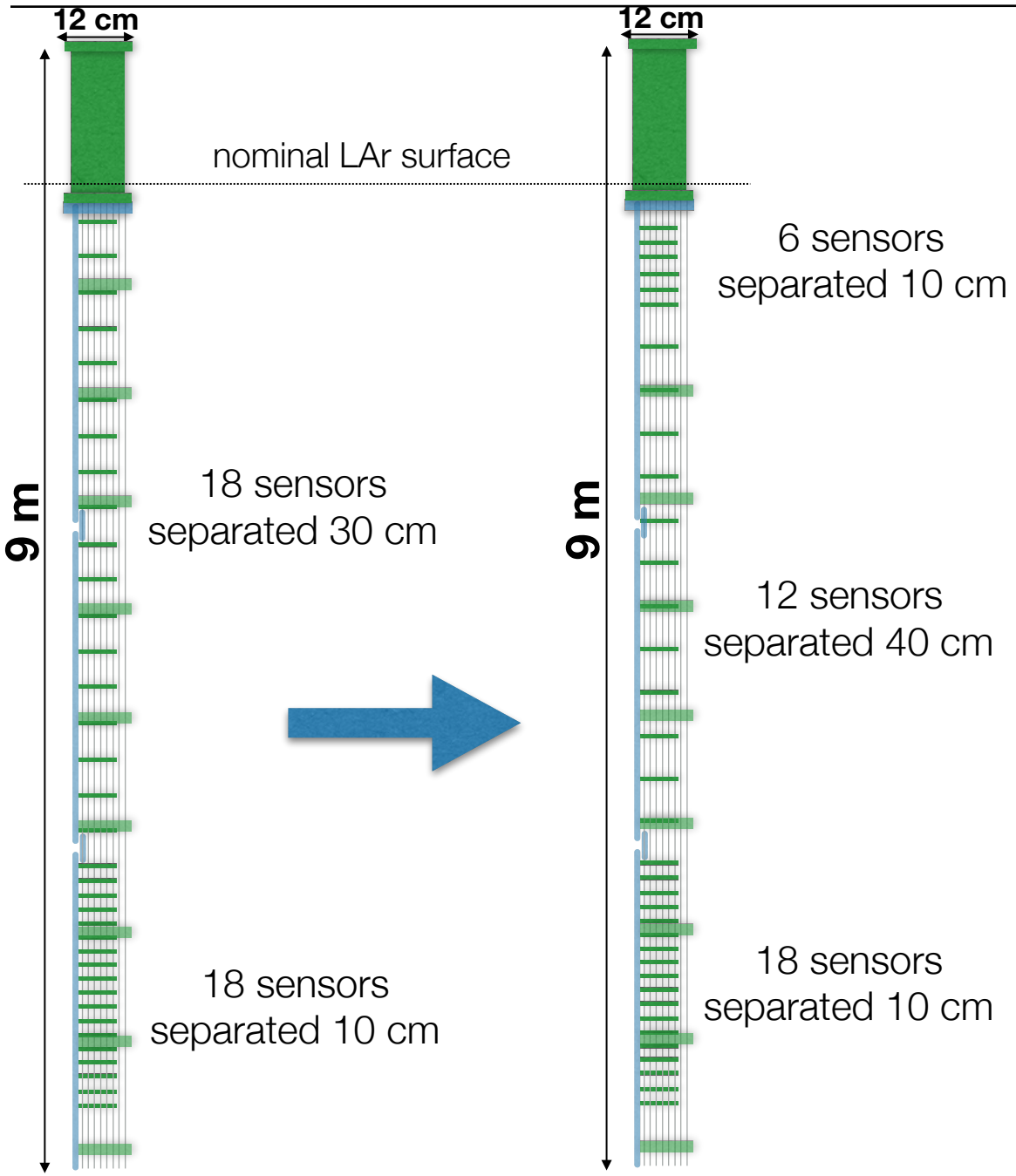
preliminary 3D cad model

- 9 meters long and 12 cm diameter cylinder hanging from port 14.4 (14 cm diameter)

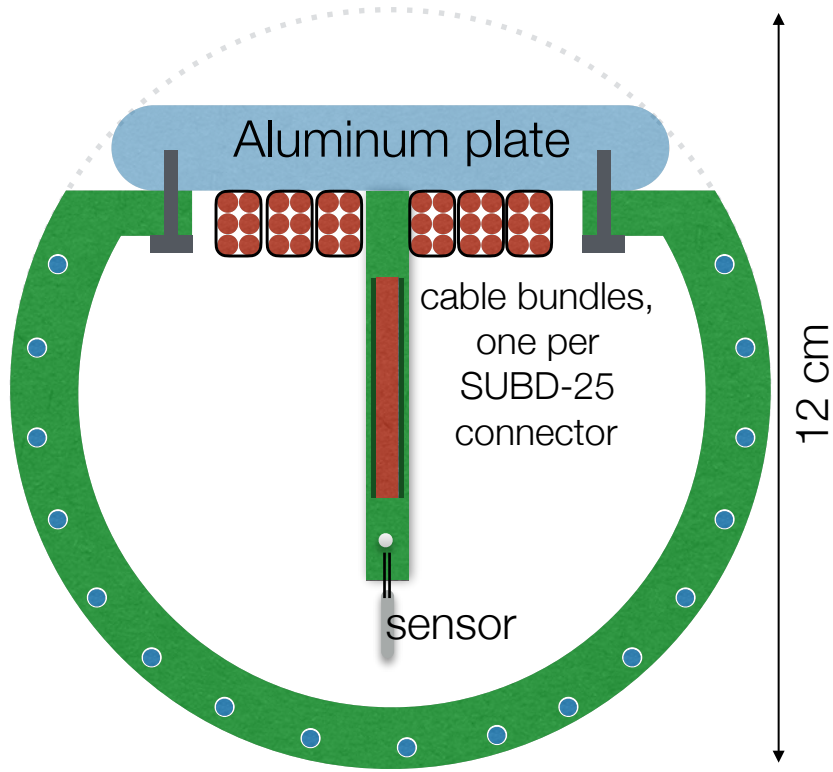




Sensor distribution



- In the review there was a suggestion to **increase the density at the top**
- We can either redistribute the 36 sensors foreseen so far or add 6 more sensors and another connector



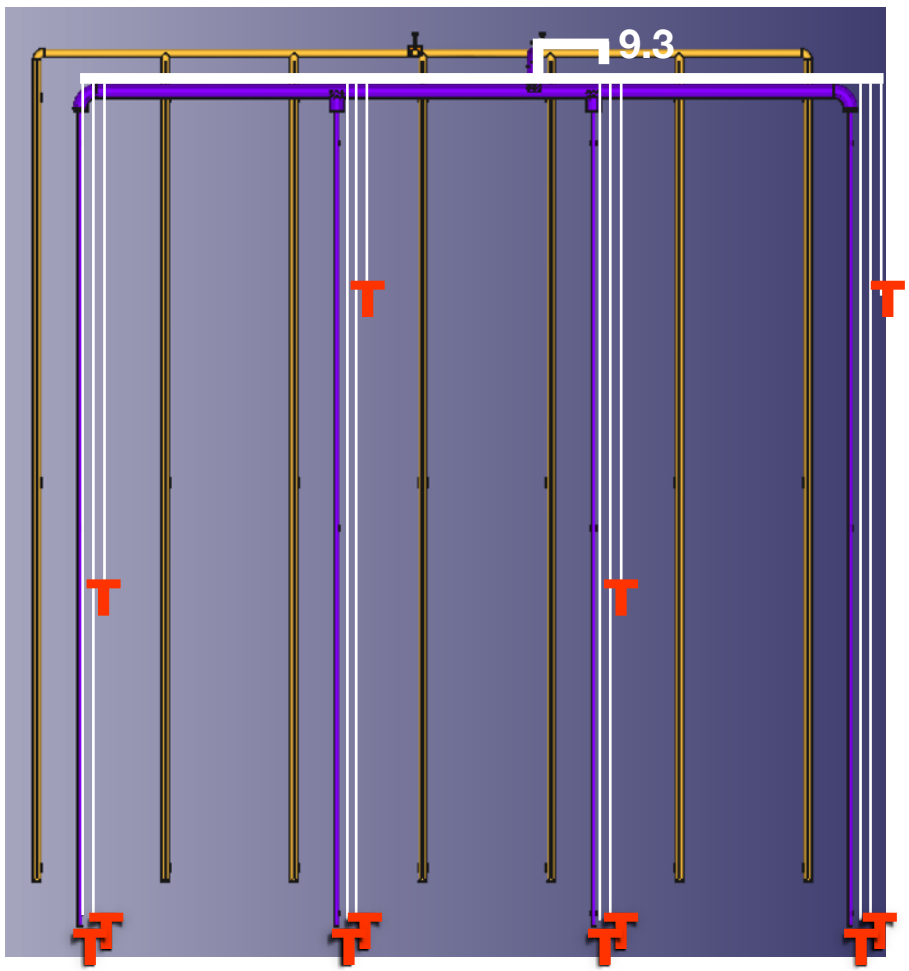
- They suggested to make the upper tube of SS since it has much lower outgassing in gas. FR4 is not good in the gas phase
- The also suggest to make the structural plates of SS since it has almost an order of magnitude less thermal conductivity

bottom pipes

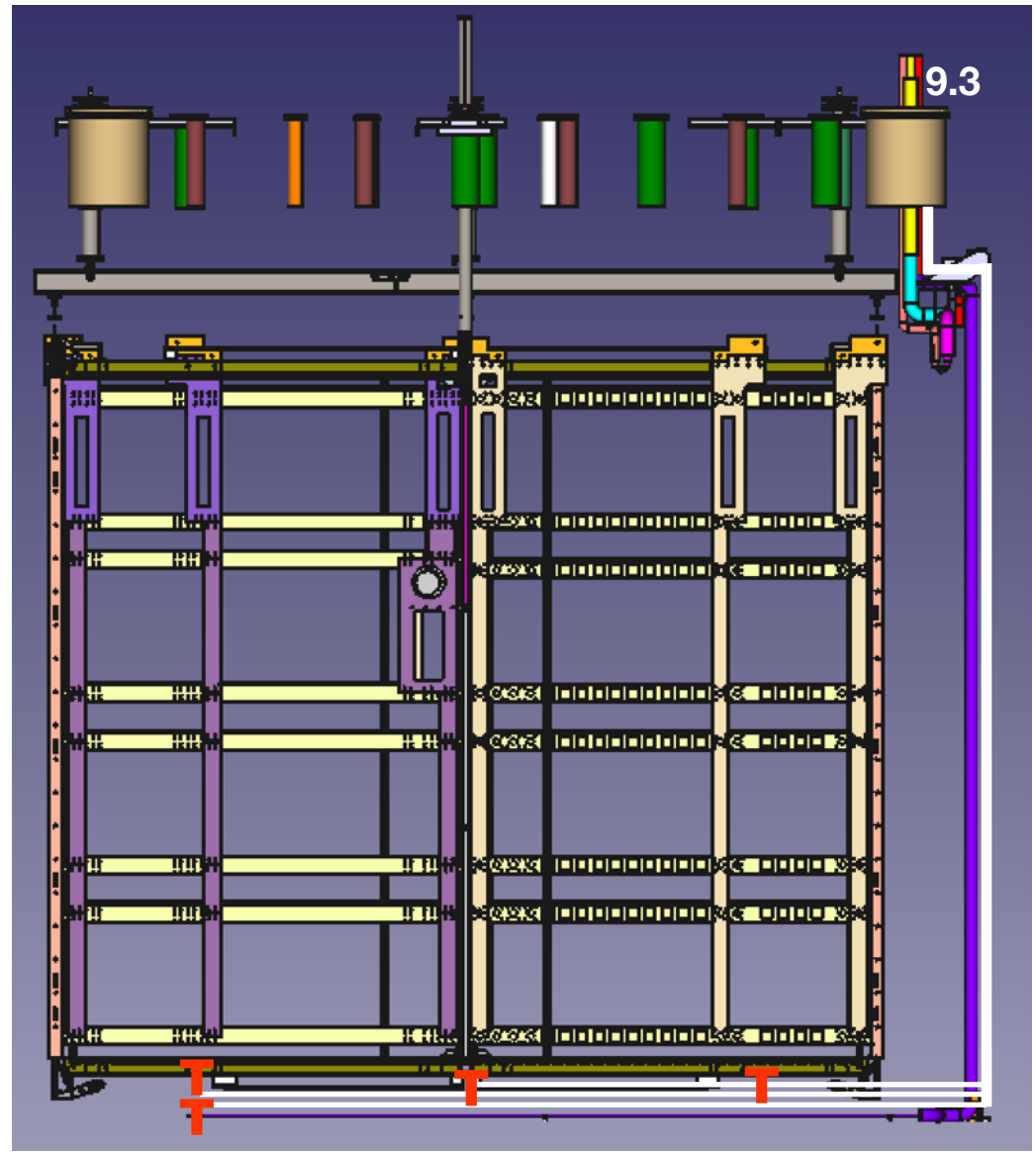
Sensor map and cabling

- Cables can run attached to the pipes all the way to port 9.3
- Pipes in purple, cables in white

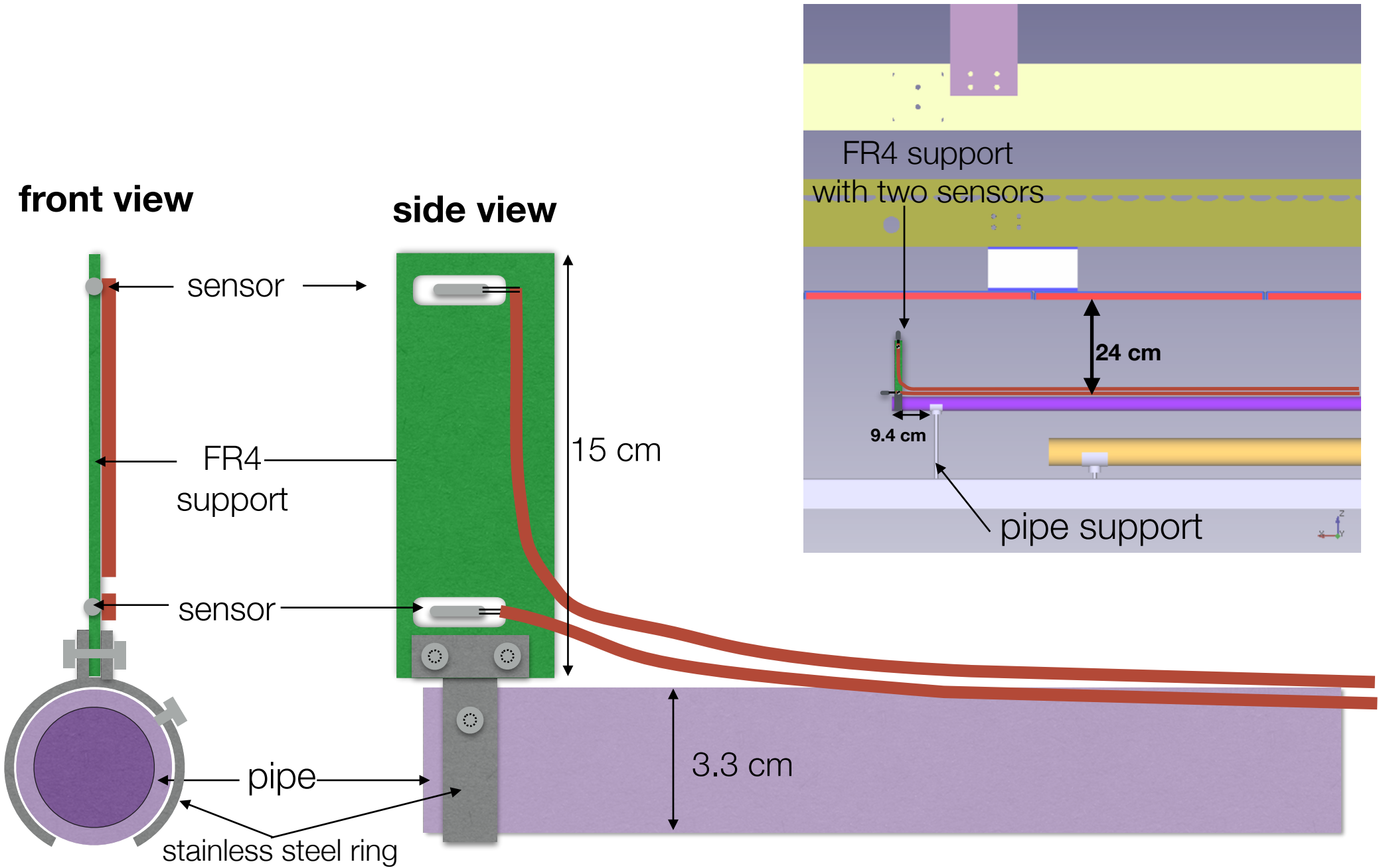
TOP view



SIDE view

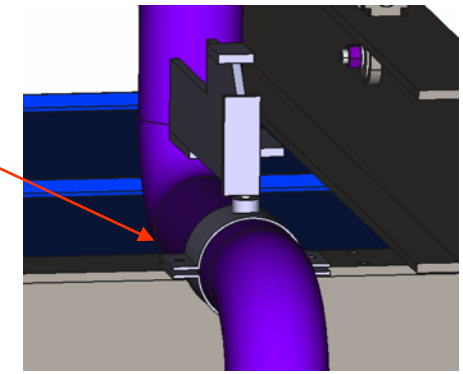


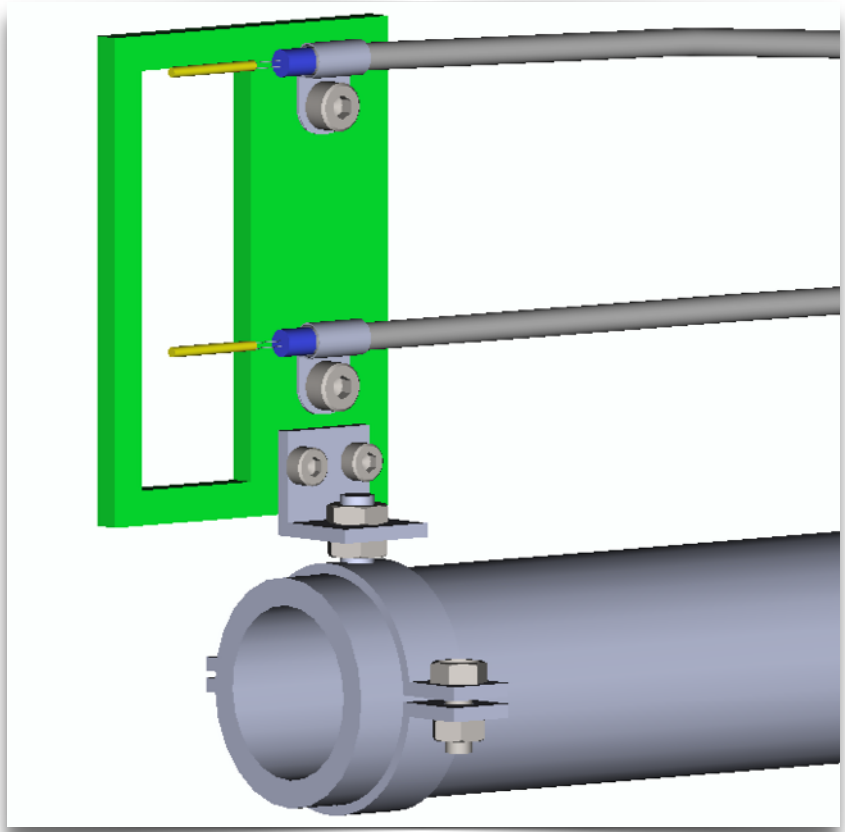
Conceptual design

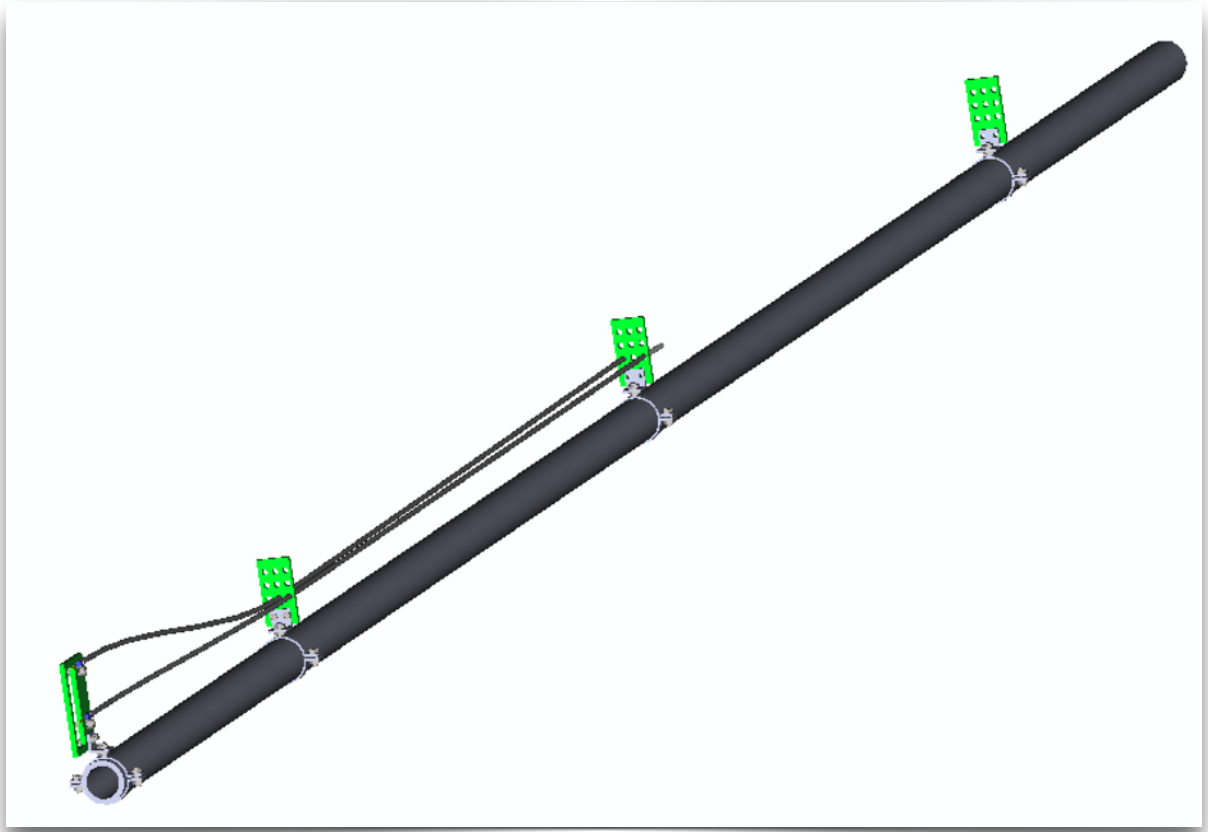


Preliminary 3D model

- We could use a similar system to the one used to hold the pipes
- All those elements must be ready by August
- Installation will happen in september



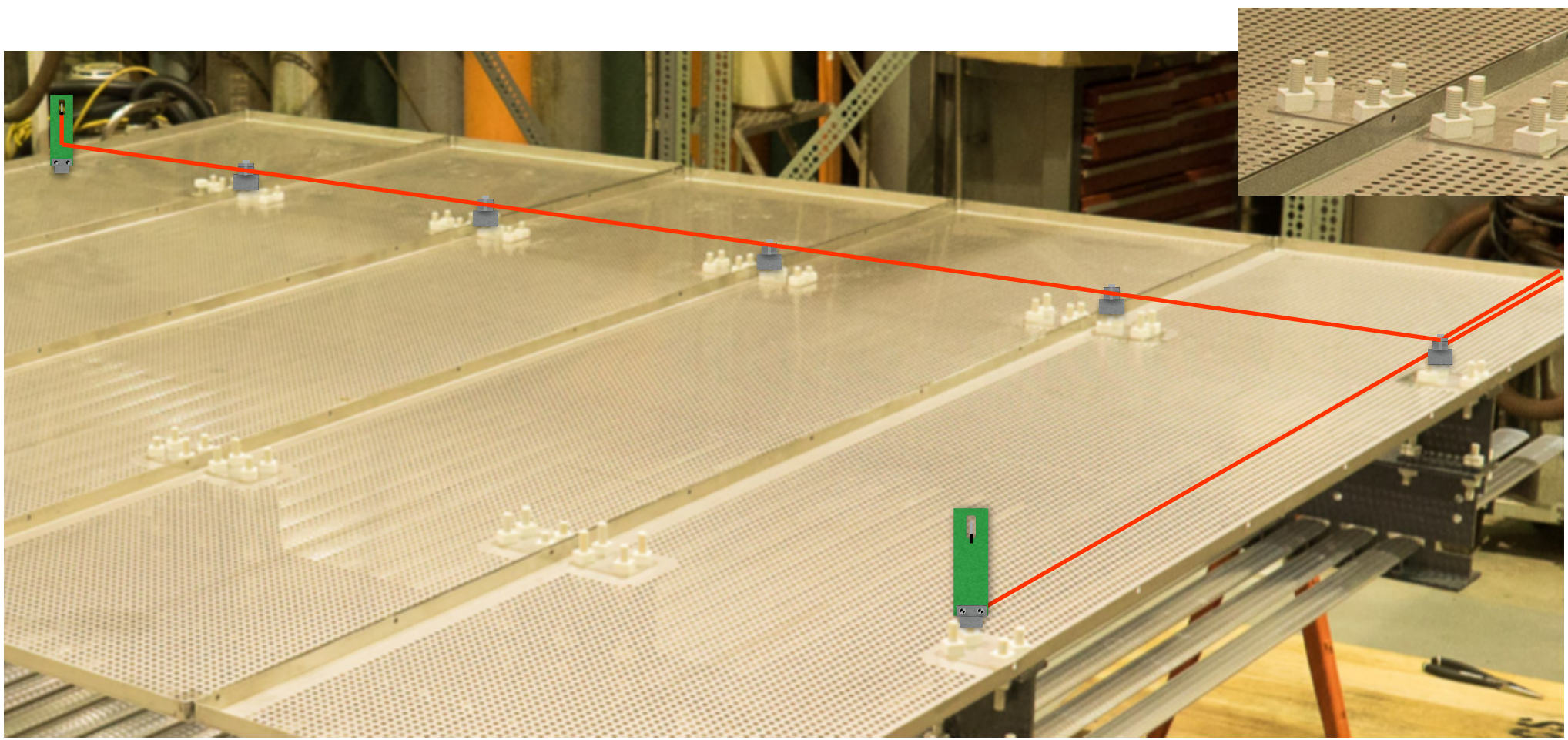




top ground planes

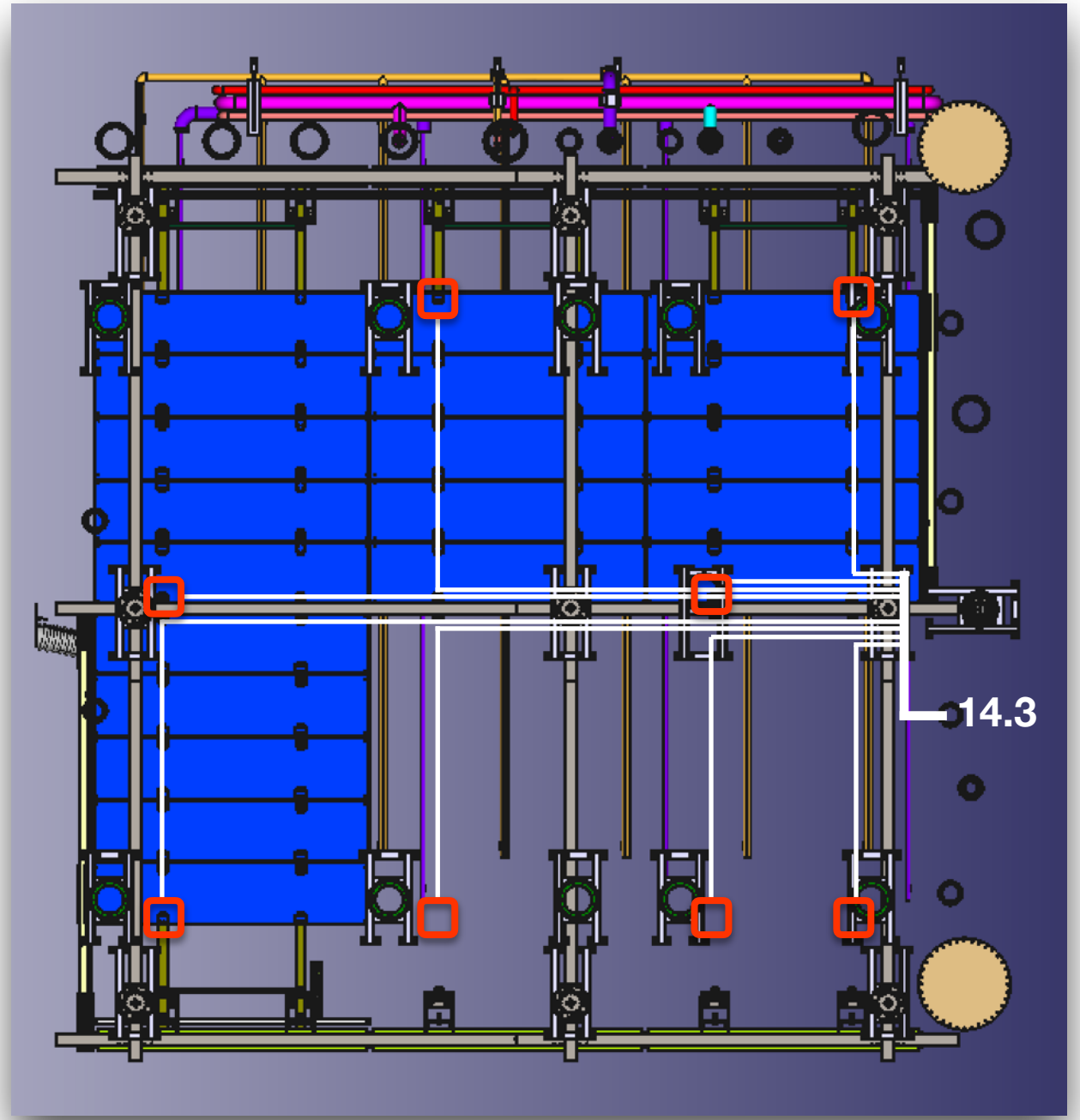
Anchoring points

- Suggestion from FC/GP responsibles to **use the existing FR4 screws**
- The edge of each plate is quite sharp. There is risk of damaging the cable. It is recommended to **install supports for cables in each transition between modules**



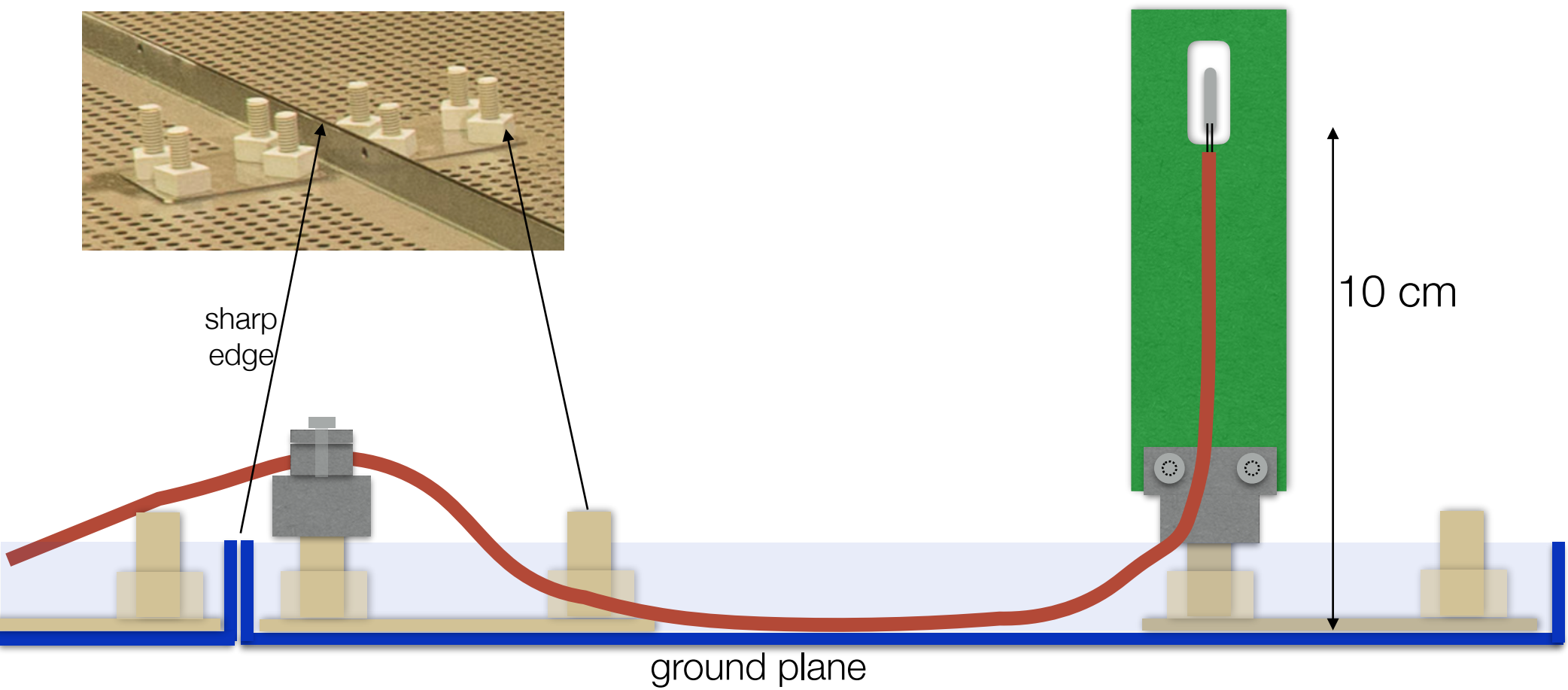
New configuration

- The sensors had to be moved slightly to coincide with FR4 screws



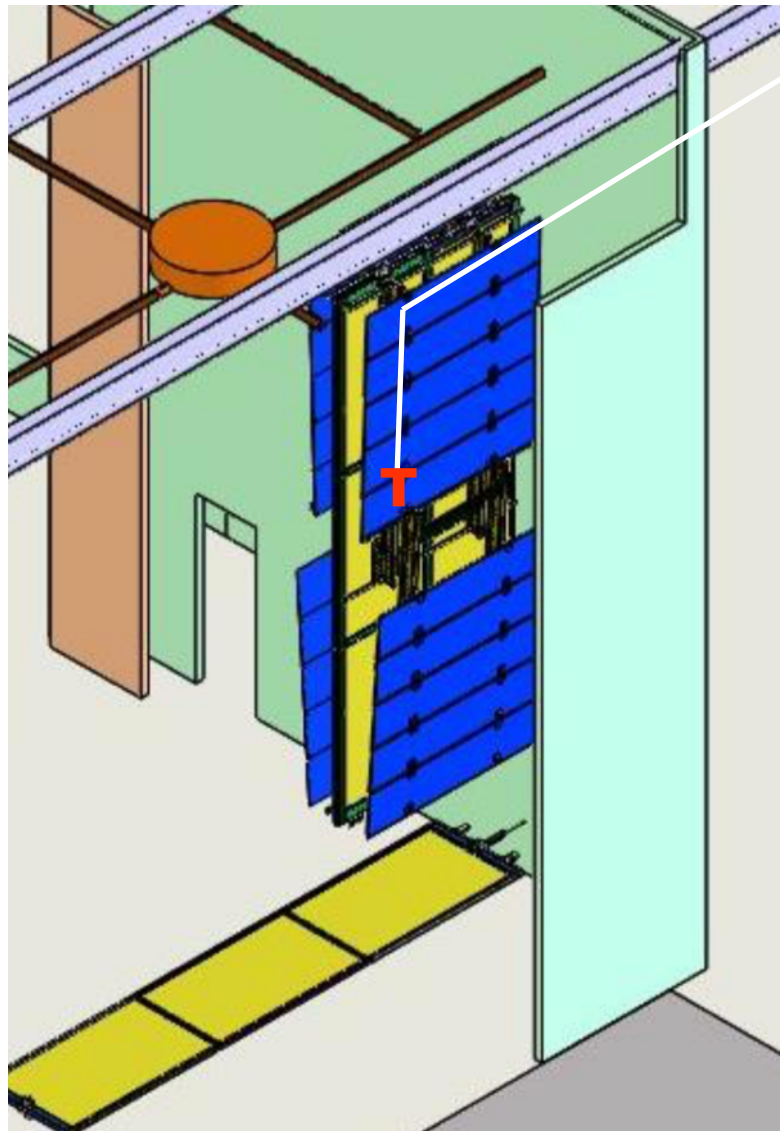
Sensor support

- To minimise the temperature bias produced by ground planes keep sensors at some distance from them (~10 cm)
- Must be careful with sharp edge between GP modules



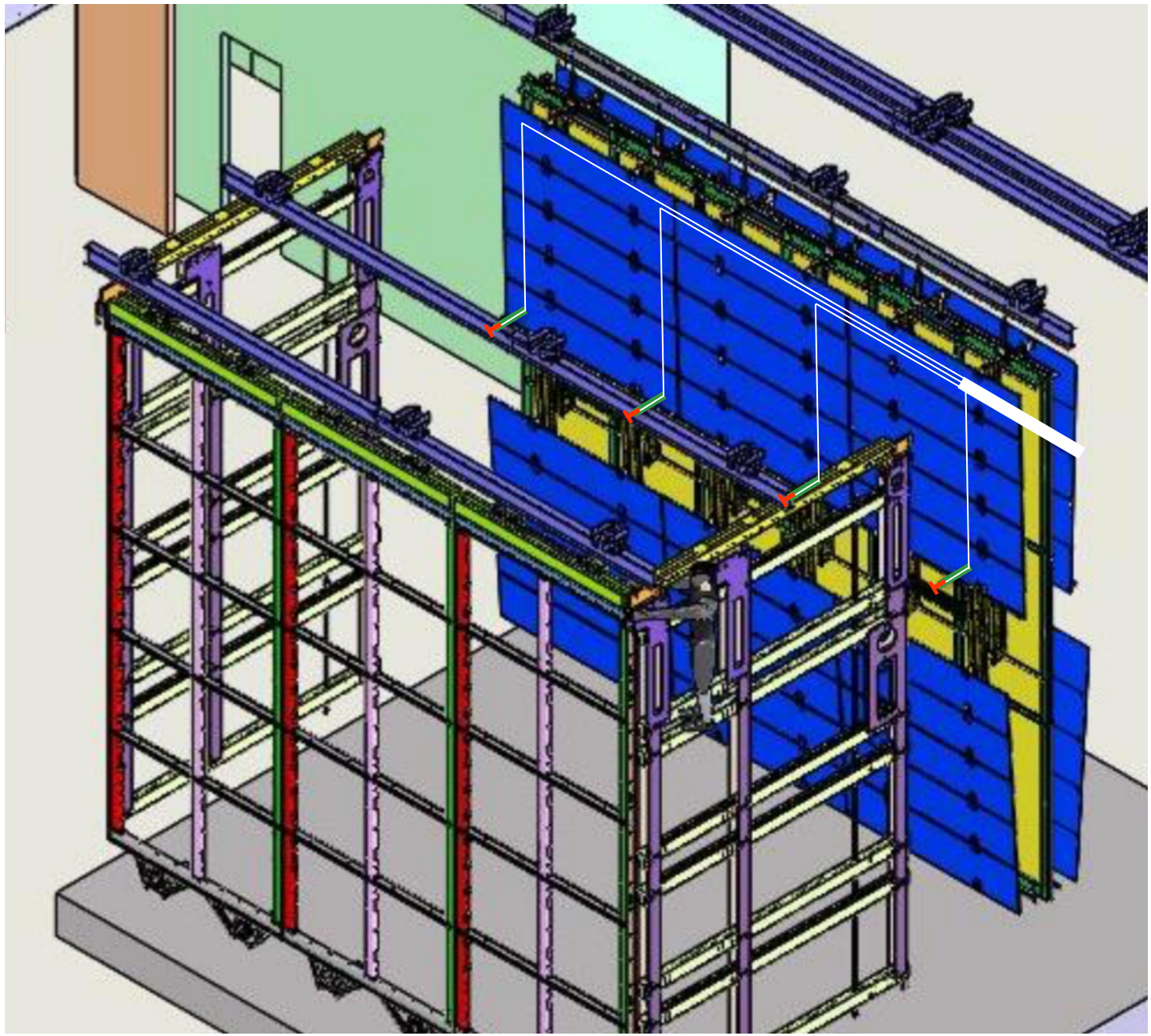
Installation in clean room

- **Nov 7, 2017 - Jan 5, 2018**
- For each CPA module, sensors/cables in the 2 associated top GP modules are installed in the clean room
- The cable exceeding the GP dimensions is attached to the modules beside, once they are put together (in the cryostat, see next slide)



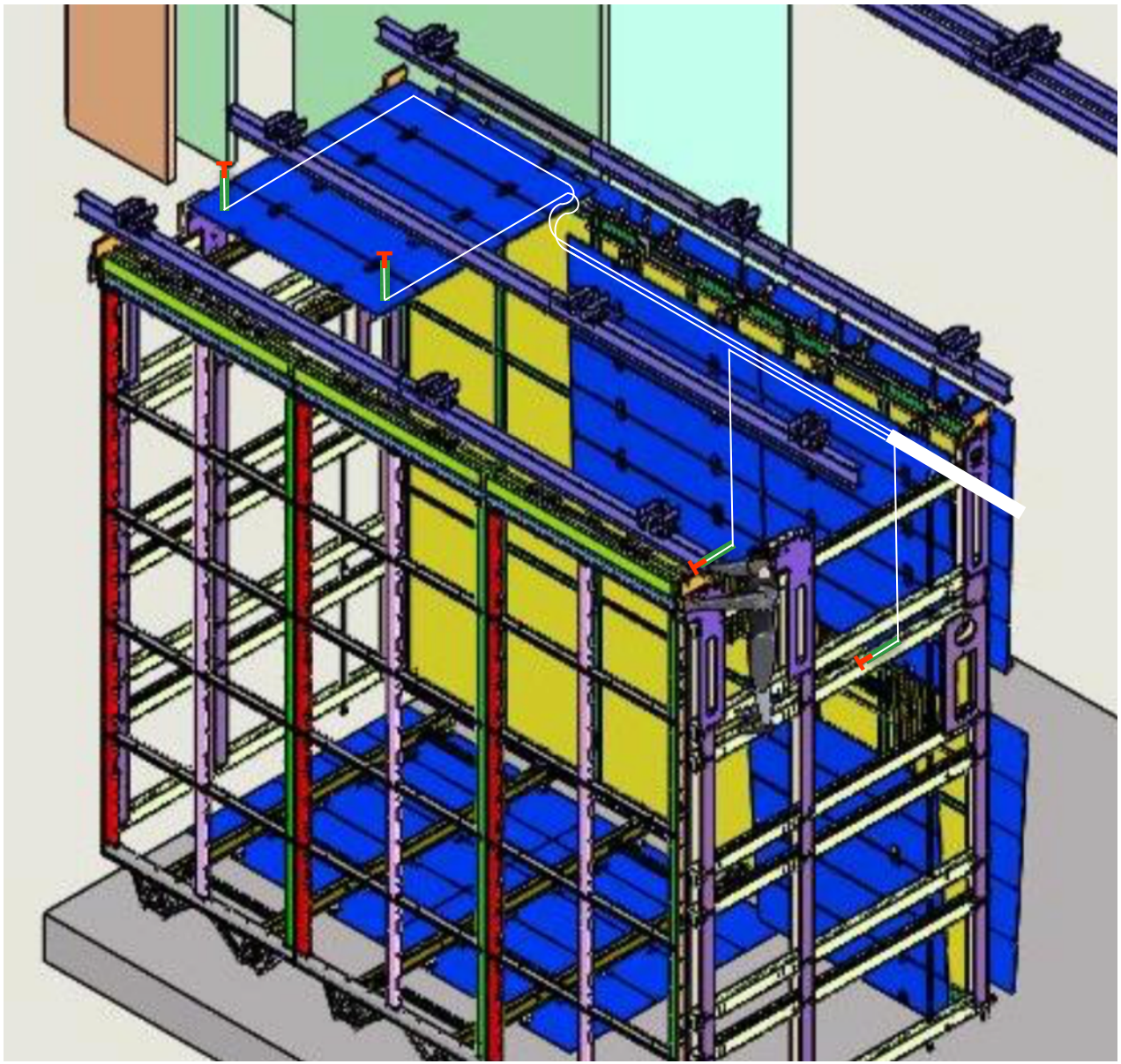
Moving GP into cryostat

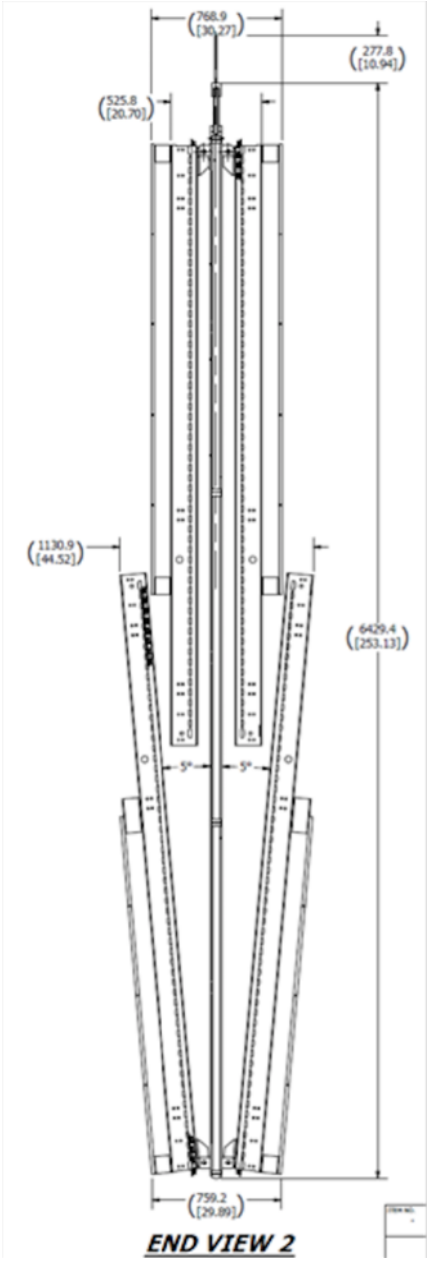
- **Nov 7, 2017 - Jan 5, 2018**
- The three CPA modules and corresponding FCs and GPs are put together once in the cryostat
- So cables in each GP module should be attached to nearby GP modules at that point

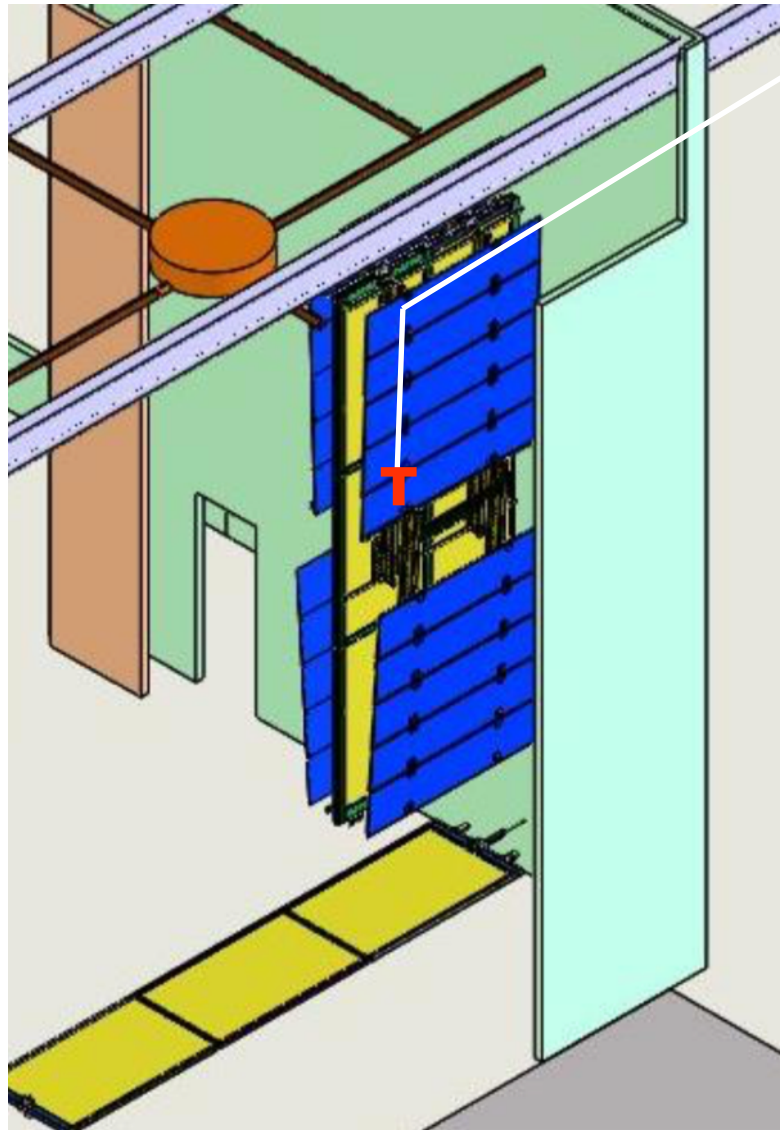


Rotating FC/GP

- **Jan 5, 2018 - Jan 10, 2018**
- Cables should be loose between GP modules to allow rotation of one with respect to the other
- They will be tighten once the three modules are in their final positions



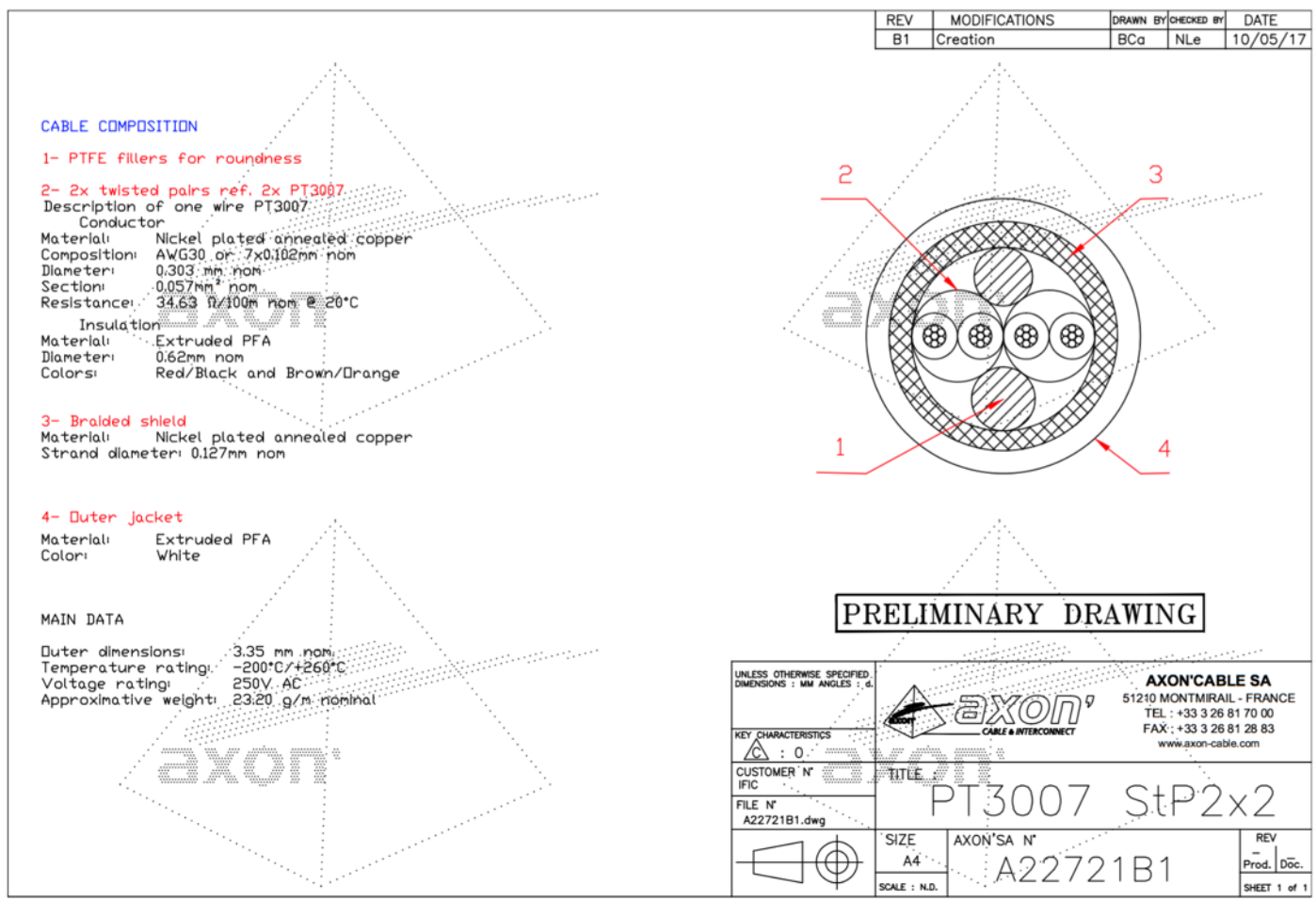

768.9
[30.27]
277.8
[10.94]
525.8
[20.70]
1130.9
[44.52]
6429.4
[253.13]
5°
5°
759.2
[29.89]
END VIEW 2


T

cable

- Customized cable by Axon
- 10 weeks to deliver. Will arrive at the end of July
- A sample of a similar cable sent to Fermilab for testing

- 4 wires per sensor
- Teflon jacketed (PFA) cables
- 2 twisted pair wires
- EMC shielding



REV	MODIFICATIONS	DRAWN BY	CHECKED BY	DATE
B1	Creation	BCa	NLe	10/05/17

CABLE COMPOSITION

1- PTFE fillers for roundness

2- 2x twisted pairs ref. 2x PT3007
Description of one wire PT3007
Conductor
Material: Nickel plated annealed copper
Composition: AWG30 or 7x0.102mm nom
Diameter: 0.303 mm nom
Section: 0.057mm² nom
Resistance: 34.63 Ω/100m nom @ 20°C
Insulation
Material: Extruded PFA
Diameter: 0.62mm nom
Colors: Red/Black and Brown/Orange

3- Braided shield
Material: Nickel plated annealed copper
Strand diameter: 0.127mm nom

4- Outer jacket
Material: Extruded PFA
Color: White

MAIN DATA

Outer dimensions: 3.35 mm nom
Temperature rating: -200°C/+260°C
Voltage rating: 250V AC
Approximative weight: 23.20 g/m nominal

PRELIMINARY DRAWING

UNLESS OTHERWISE SPECIFIED DIMENSIONS : MM ANGLES : d.

KEY CHARACTERISTICS
C : 0

CUSTOMER N° IFIC

FILE N° A22721B1.dwg

TITLE : PT3007 StP2x2

SIZE A4

SCALE : N.D.

AXON'SA N° A22721B1

REV – Prod. Doc.

SHEET 1 of 1

AXON'CABLE SA
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FAX : +33 3 26 81 28 83
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offer and leadtime

FOLLOWED BY: Alice BLASSON
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E-Mail : a.blasson@axon-cable.fr

Cust No: 000841 INSTITUTE OF CORPUSCULAR PHYSICS

Tel : +34 963 544 758
E-Mail : acervera@cern.ch
Your ref : RFQ dated May 16th 2017

Montmirail, May 18th 2017

QUOTATION 17179/ESP/AB1

Dear Sirs,

Further to your request, we are pleased to quote as follows:

No	Reference	Designation	Qty	Leadtime	Unit price	Line total	Comments
1	A22721B1	PT3007 STP2X2	1 KM		9 770.68 € / KM	9 770.68 €	3 options for T-gradient monitor
2	A22721B3	Flat cable (6x (PT3007 S2x2)) P	0.05 KM		126 617.74 € / KM	6 330.89 €	3 options for T-gradient monitor
3	PRESTATION30-03	SET-UP FOR AXP TOOLING COSTS	1 P		350.00 € / P	350.00 €	special tooling is requested for punching in A22721B3

GLOBAL QUOTATION VALUE: 16 451.57 €

SALES CONDITIONS

This offer is subject to enclosed sales conditions.
Firm prices, except increase of raw materials or labour cost of more than / equal to 2%.
For a standard packaging. Tolerance on quantity +/- 10%.
Standard manufacturing lengths of mini 10 meters. If you need minimum or continuous lengths, please mention it on the order and we will come back to you if additionnal costs are involved.
Leadtimes are given for information and are subjected to confirmation in case of an order.

MINIMUM OF INVOICING OF 200€ per item / shipment

INSURANCE 0.23% OF NET AMOUNT PACKAGING EXCLUDED FREIGHT: FCA MONTMIRAIL ACCORDING TO INCOTERMS® 2010

PAYMENT: CASH IN ADVANCE

VALIDITY OF THE OFFER 30 Days

We stay at your disposal for any further information you may need.

Alice BLASSON
Sales Coordinator

A propósito del plazo, te paso los detalles de la mejor opción que tenemos al día de hoy :
Es posible hacer un envío parcial de 500m del estudio A22721B1 a mediados de Julio, si tenemos el pedido antes el final de la semena qui viene (semana 21), y los 500m restantes después.
y enviar los 50m del estudio A22721B3 mediados de Julio, si tenemos el pedido antes el final de la semena qui viene (semana 21).

Questions to Axon

Let's focus on the single cable with two twisted pairs.
The shrinkage of cables elements from room to Liquid argon temperature (88 K) would be:
- 28.9 mm/m for PFA
- 3.4 mm/m for the conductor

But what will happen when the cable assembly is put at 88 K during months ? Most likely it will be OK for short cables.
However I have doubts for a 18 m cable, which would be our longest cable.
I can see several possibilities:
1. there are tensions between the different elements in the cable assembly. As a result the PFA is finally broken at several points, even the internal PFA covering each of the conductors such that there are short-circuits
2. the PFA is elastic such that it will shrink less than when isolated, but does not break and finally it stays together with the conductor
3. the PFA in the 18 m cable shrinks 52 cm while the conductors and probably the shield shrinks by 6.1 cm. As a result there are 46 cm (52-6.1) of conductor (the last 46 cm of the 18 m cable) uncovered by PFA.

For short cables, probably 3 is the right answer, but I don't think this will happen for long cables.
I hope 2 is the right answer in that case. But I would need the opinion of experts.

On the other hand it is written in the cable specifications that the temperature rating is from -200º to 260º. What does this means ?

Answer from Axon

1-Shrinkage

Unfortunately, the right answer is “46 cm will be uncovered ”

I spoke with R&D department and the colleagues of the cell harness.
The idea is to use a sleeve is not possible because the sleeve will swell under negative temperature and it will not stick the materials (insulation and conductor)

The best solution to limit the shrinkage is to change the raw material of insulation
We suggest the following modifications

- Insulation of core : extruded PFA -> wrapped and sintered polyimide tape (coefficient of linear thermal 4.1mm /m instead of 28.9mm/m)
- Jacket : no change
- Addition of tape under the jacket to facilitate the sliding between the shielding and the jacket

2-Temperature rating -200°C to 260°C

The cable can be used until these 2 limits of temperature

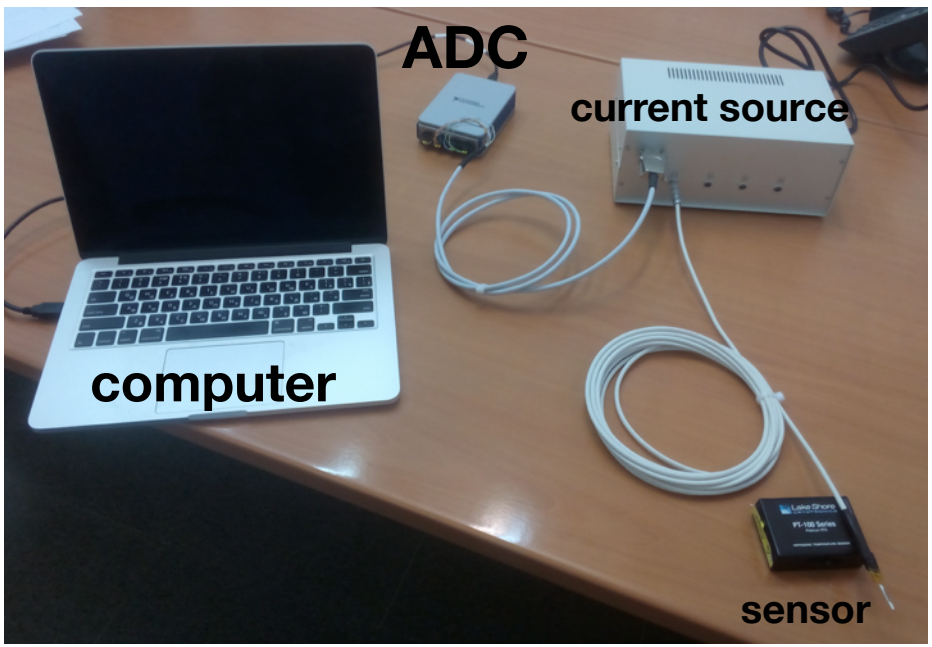
Other point

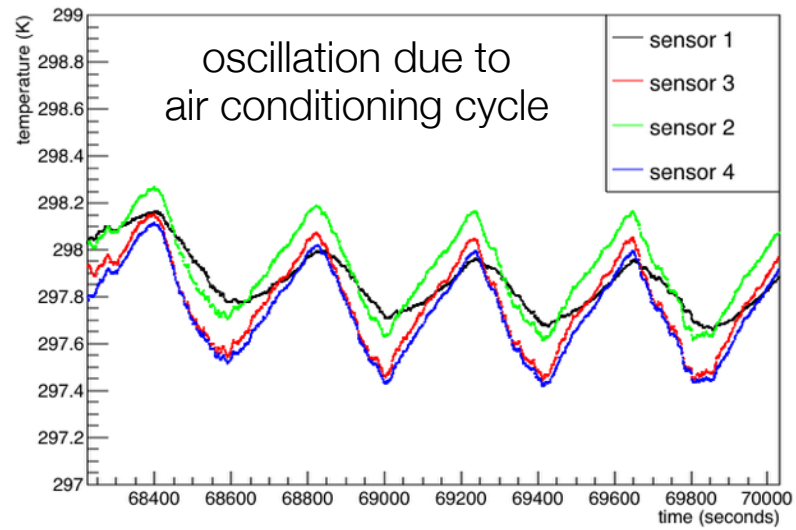
Technical department have a doubt concerning the conductor for the twisted pair
It seems that the customer’s application is similar at a thermocouple cable
In this case, we usually use to 2 raw material different for the conductor
For example: A thermocouple type E, will be constituted with one Chromel° conductor and one Constantan° conductor

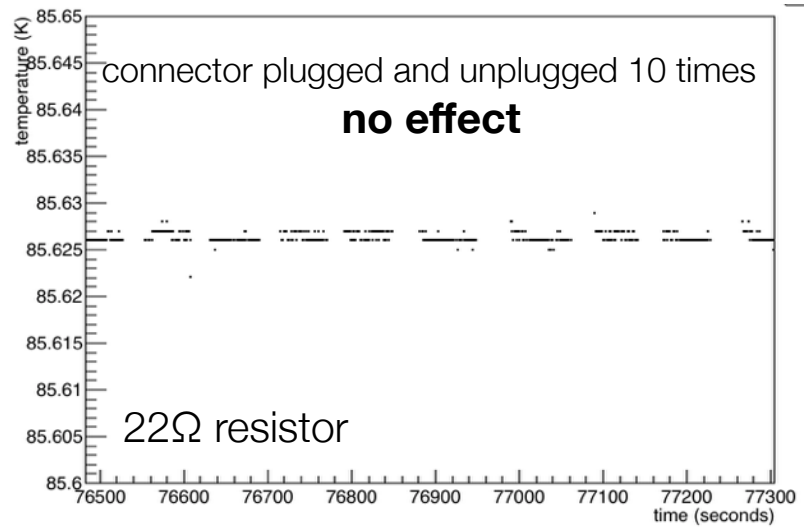
calibration

First tests at IFIC

- We recently got the readout system from Xavier Pons (CERN-DT)
- First tests done at room temperature by Maria Antonova & Alexander Izmaylov

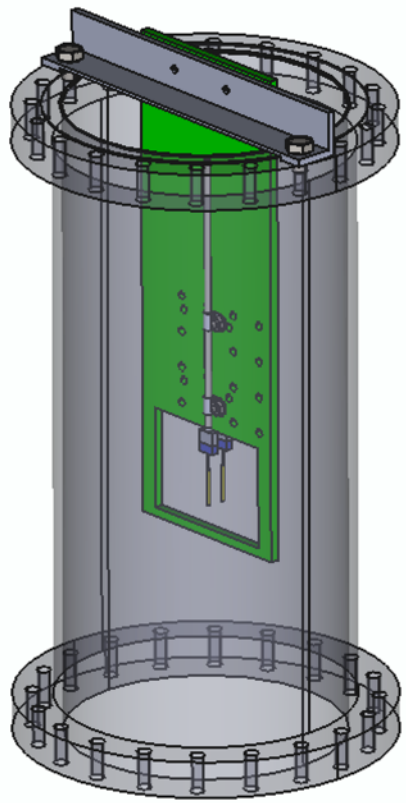






Actual calibration

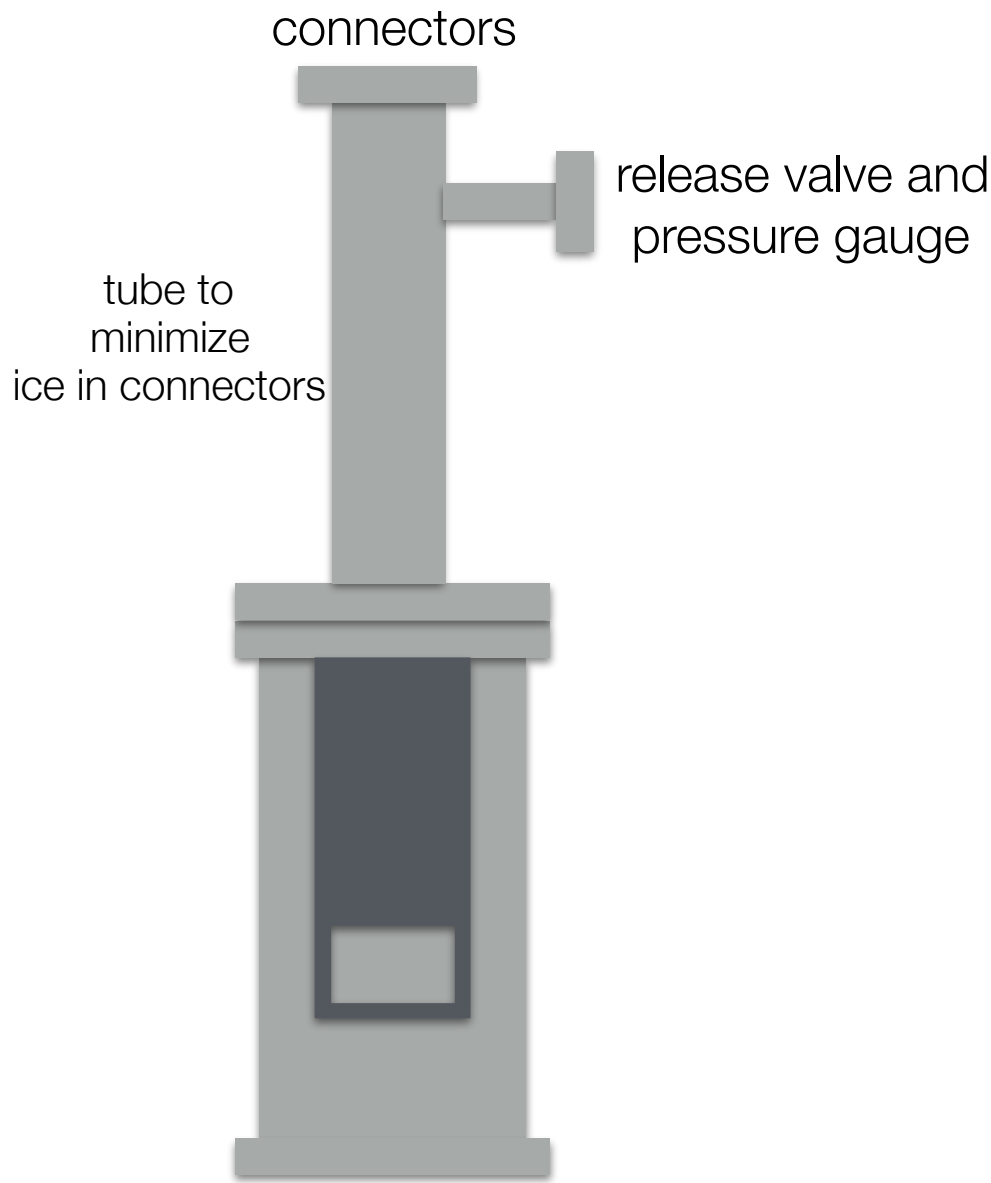
- The temporary support for open vessel available
- Tests with liquid nitrogen (77 K) will start tomorrow
- Calibration with LAr and flange (88± 5 K) in July
- Calibration with final cables from mid July because the installation of sensors on the pipes should happen in September



Next steps

- We need to start calibrating with closed vessel in July
- Critical point is the flange
- Options:
  - Order the whole thing to a company (Linde, Air Liquide ?)
  - Fabricate it at IFIC

Conceptual design



backup