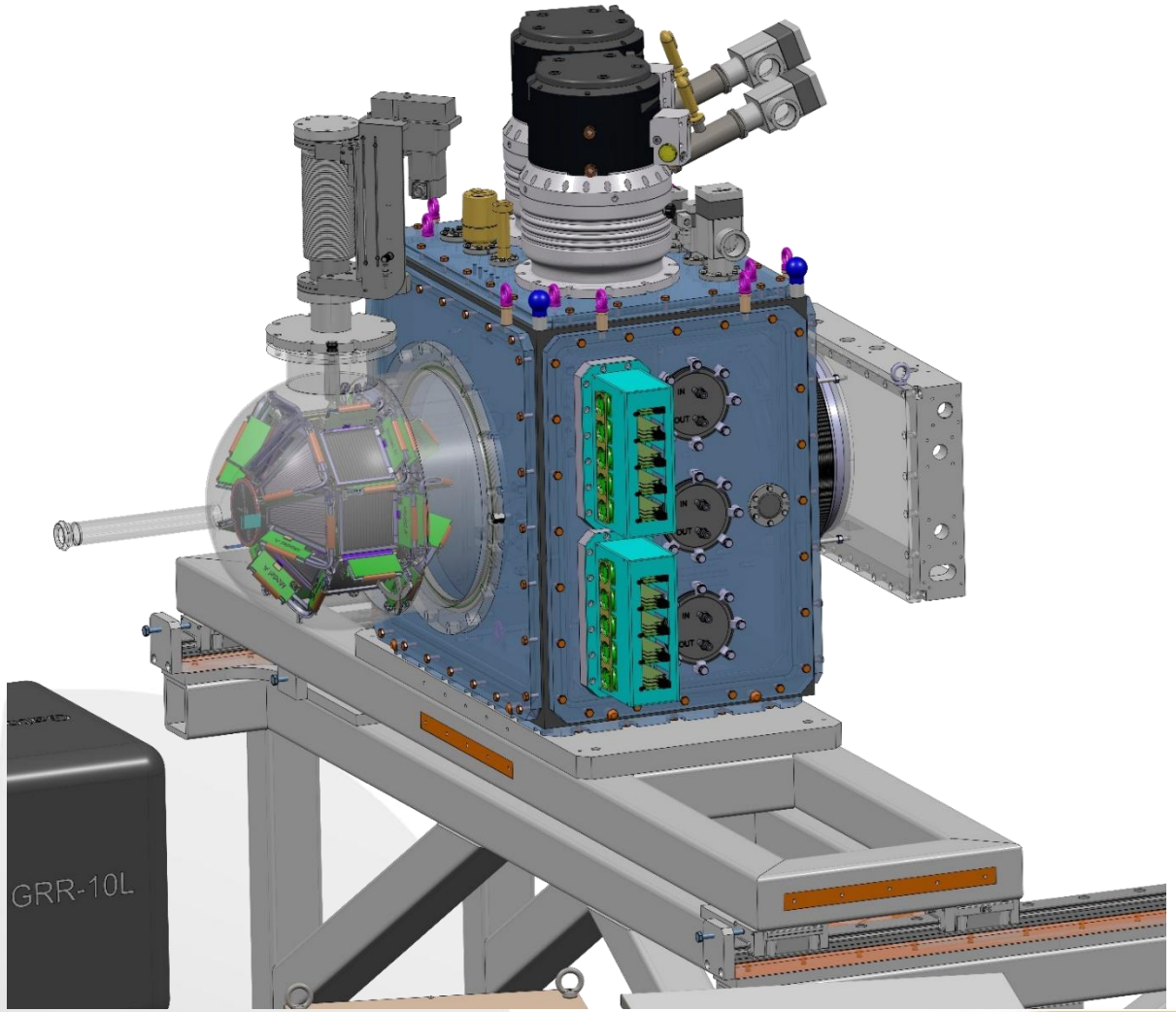
GRIT :

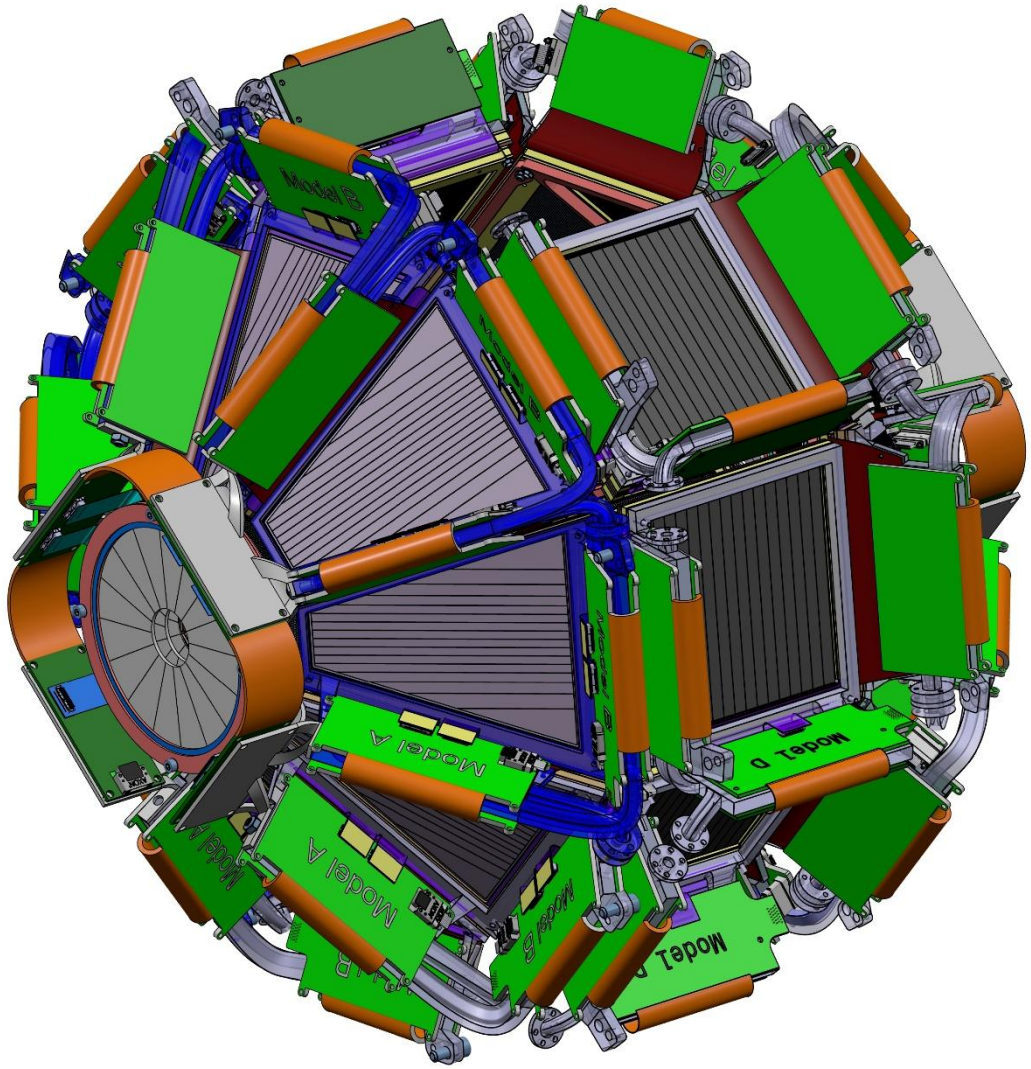
Granularity, Resolution, Identification, Transparency

https://indico.in2p3.fr/event/37746/



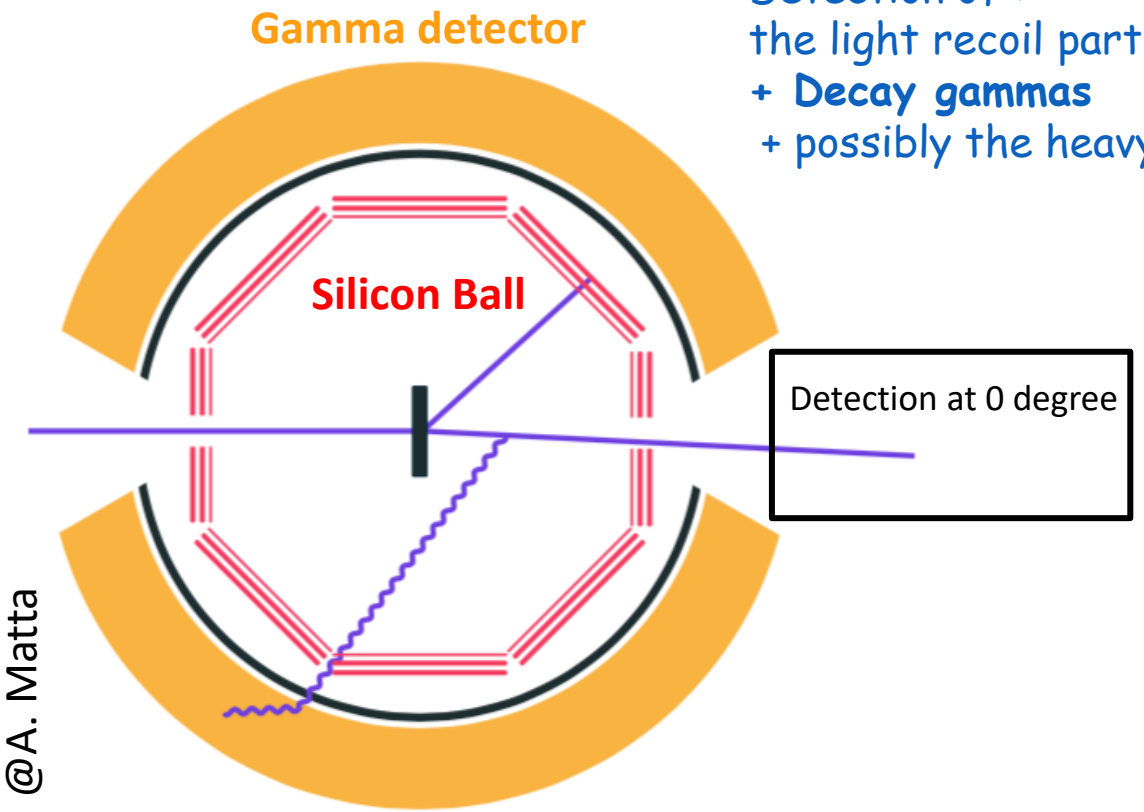
Summary

1. What is GRIT?
2. The environment around us : AGATA
3. FEBs in vacuum!
4. Cooling blocks
5. Cryogenic target
6. Outgassing: vacuum level
7. Service chamber
8. Measurements and alignment: GANIL frame
9. Conclusion

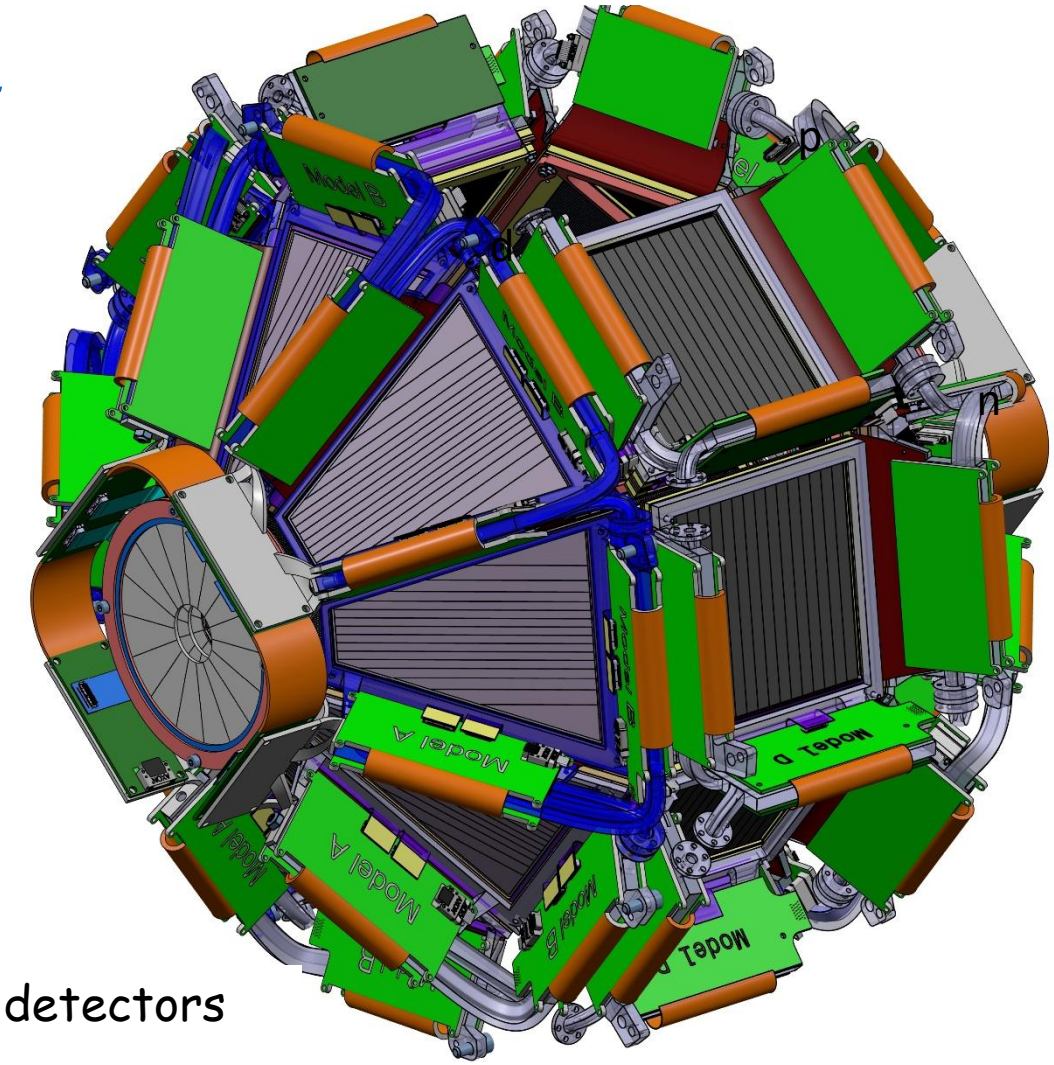


Radioactive ion beam on light-ion target (H, He, Li)

Detection of :
the light recoil particle over **4π**
+ **Decay gammas**
+ possibly the heavy residue

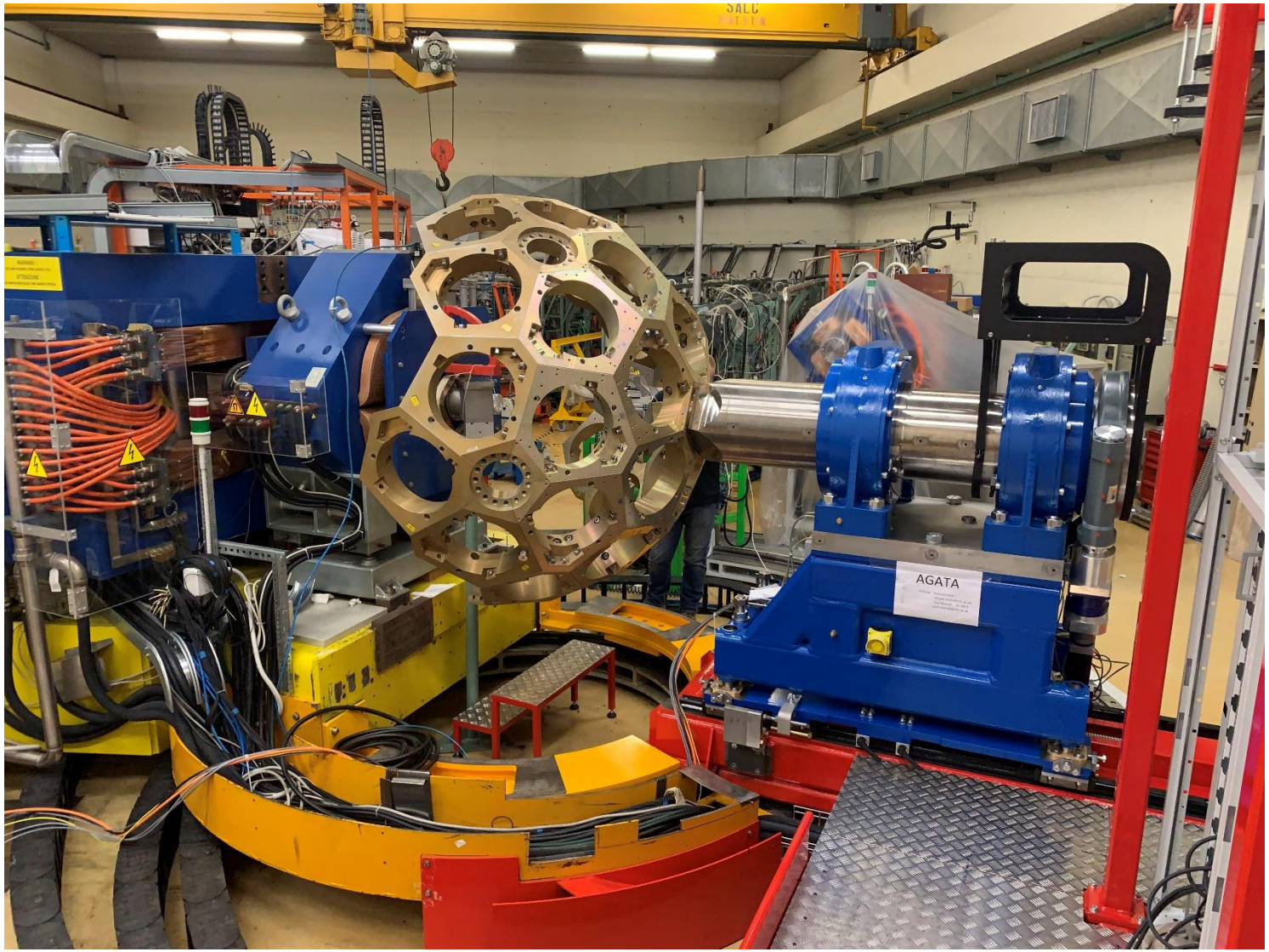


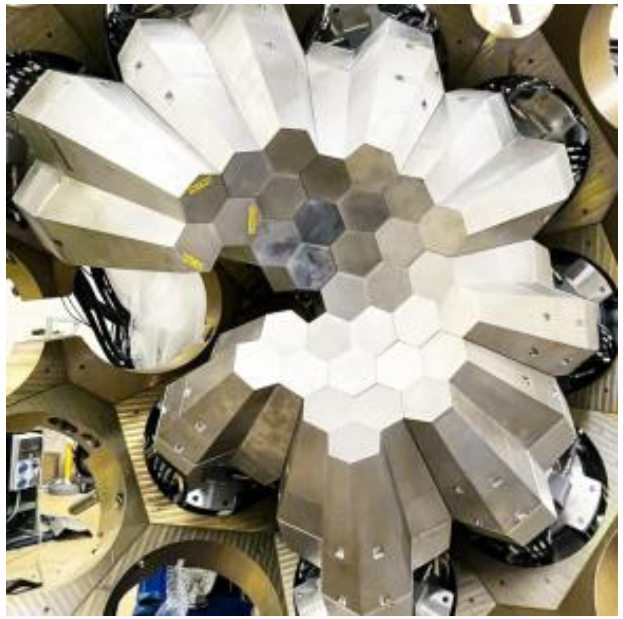
@A. Matta



→ Technology based on silicon detectors coupled with other detectors

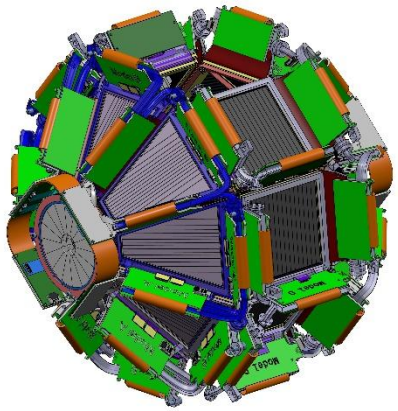
Environment : AGATA





Agata : gamma detector
Diameter 460 mm

Vacuum chamber GRIT :
External diameter 450 mm
Internal diameter 444 mm



Front End Boards in vacuum !

Detectors: 3 shapes : trapezoids, squares and annulars.

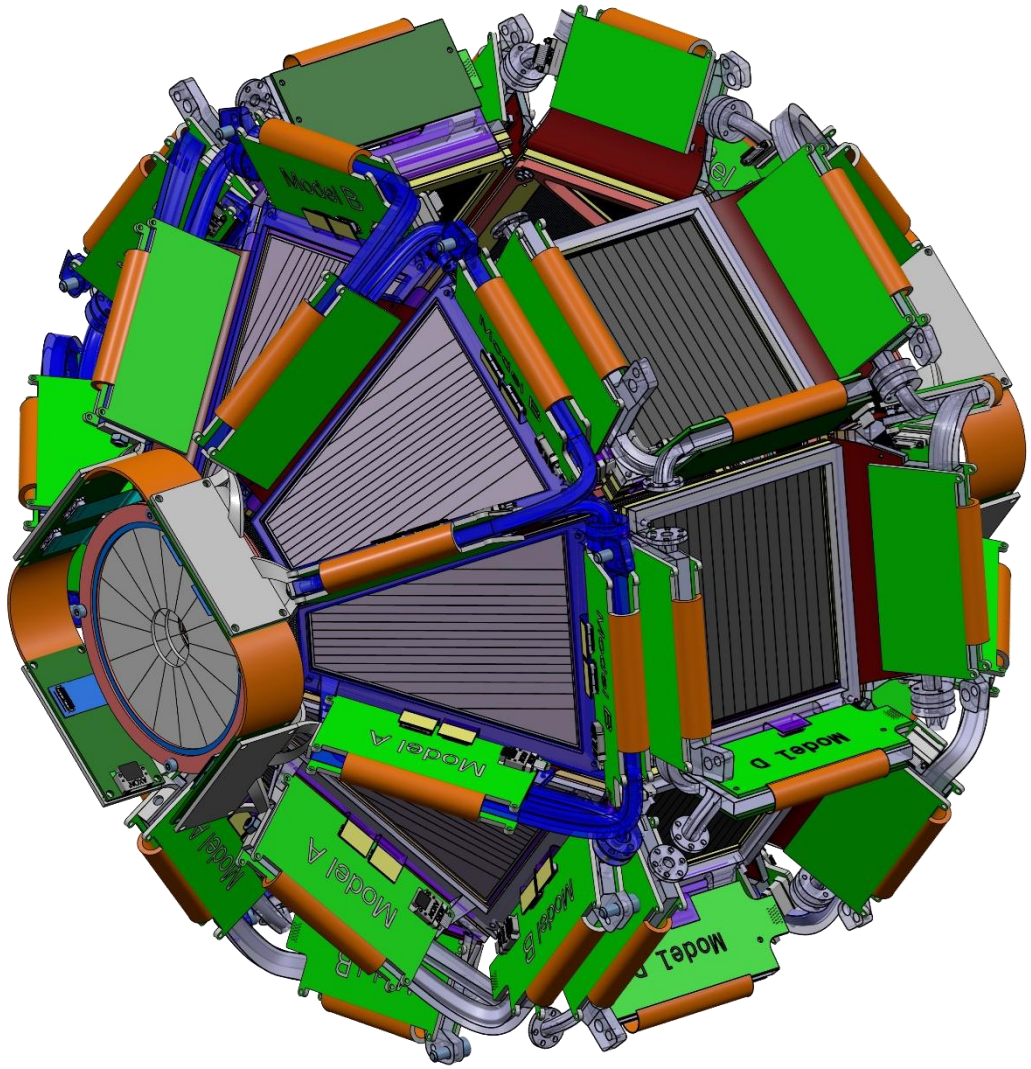
Each detectors includes two-stages:
First stage: (128X+128Y) strips
Second stage: (32X+32Y) strips

The whole detector ball is composed:
16 x trapezoids
6 x squares
2 x annulars

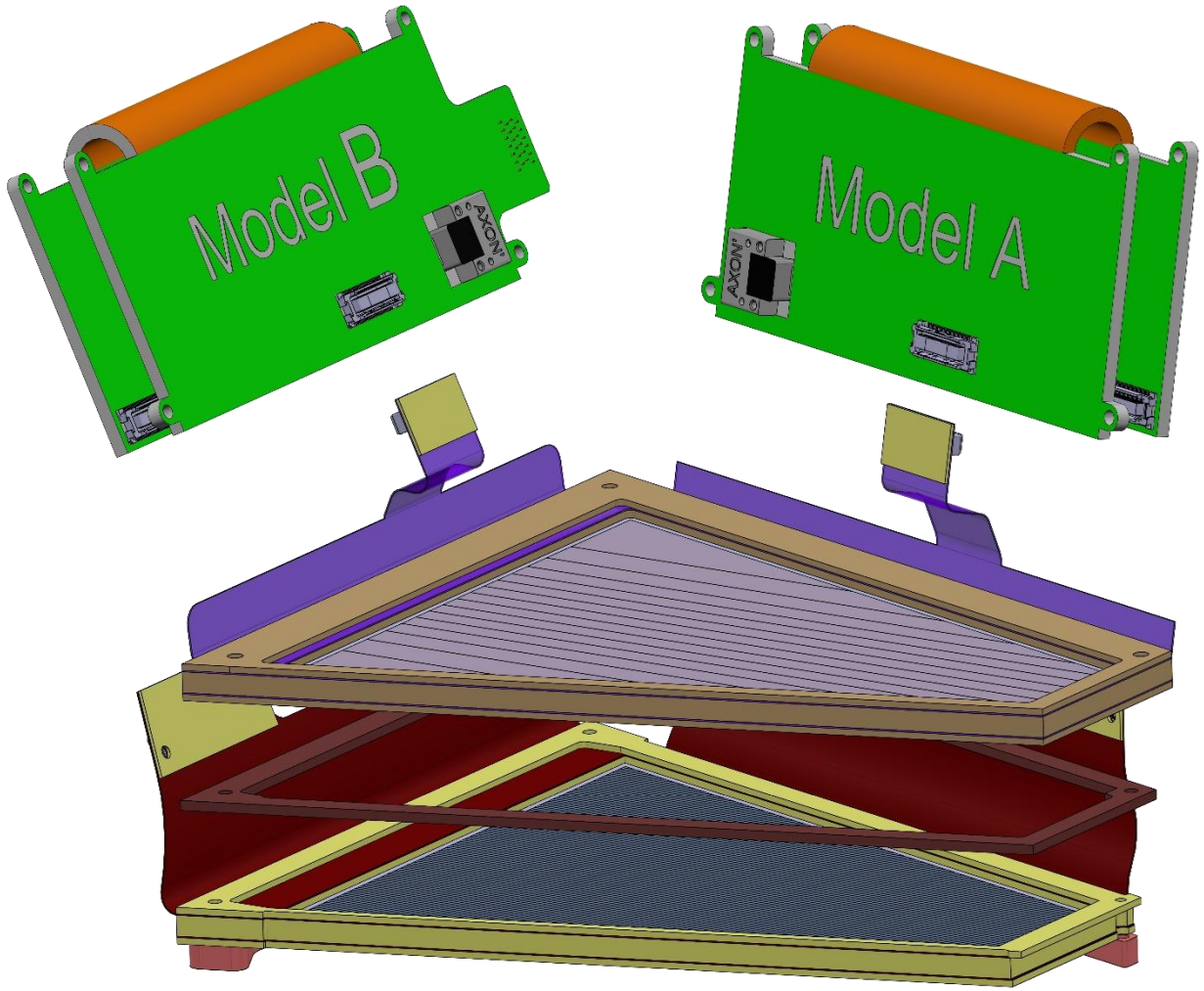
=> Total : 7680 channels !!

It's impossible to get all these cables out :

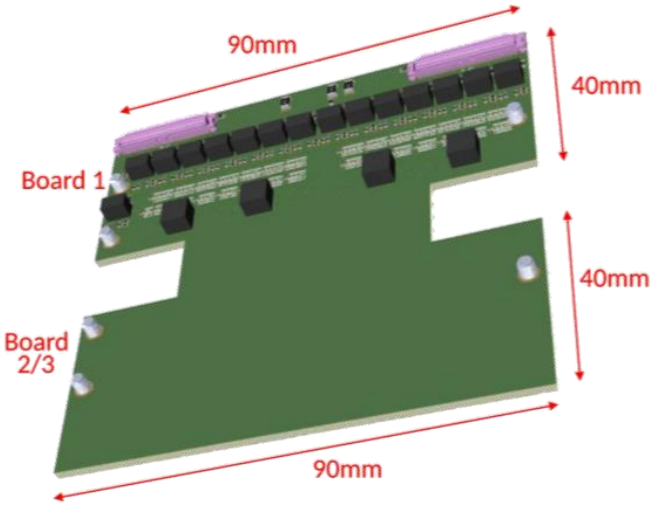
We will put the front end electronics in vacuum



Trapezoidal detector



Front-end boards (FEBs):
Two rigid parts with components on both sides linked with a flexible part

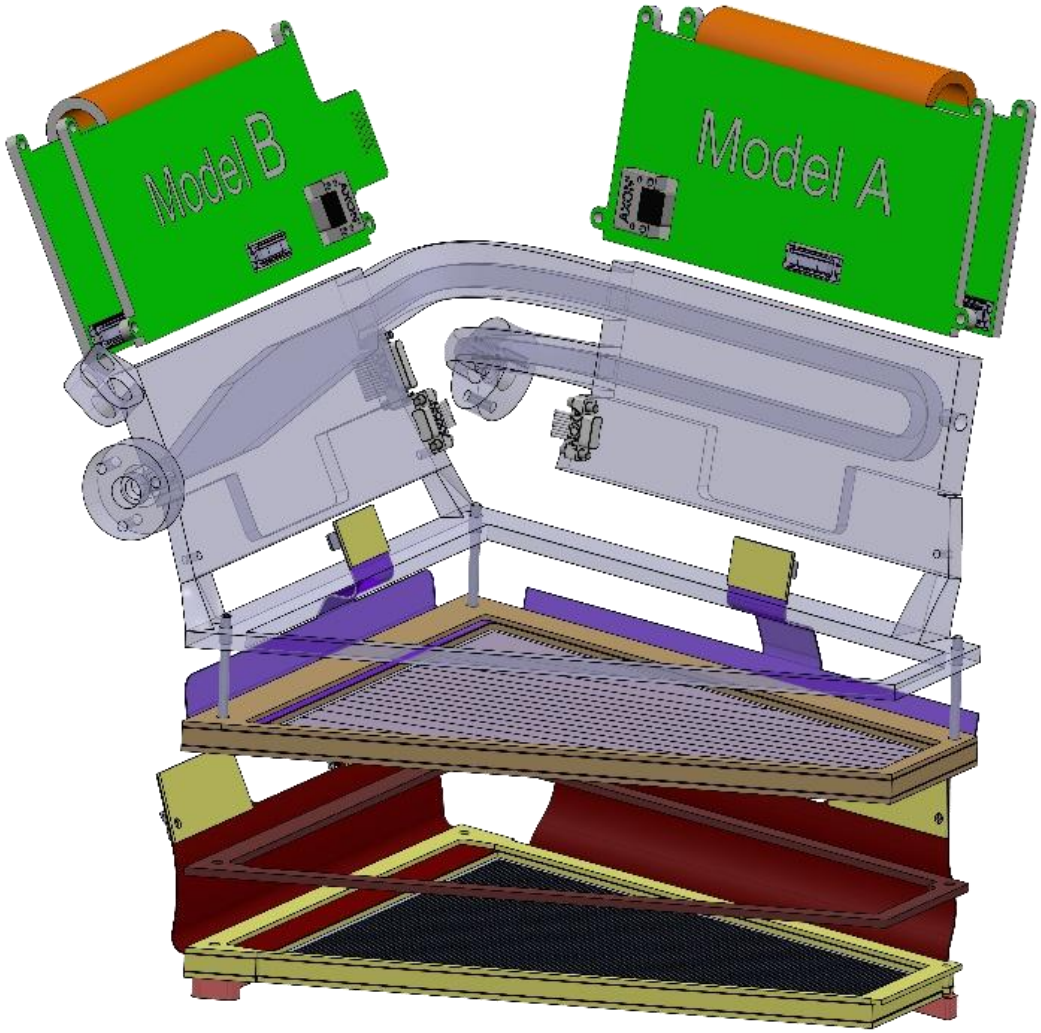


Second stage 32X + 32Y channels
Thickness 1,5 mm
Kapton + 2 40-pin Molex connectors

Spacer

First stage: 128X + 128Y channels
Thickness: 0,5 mm
Kapton + 4 80-pin Molex connectors

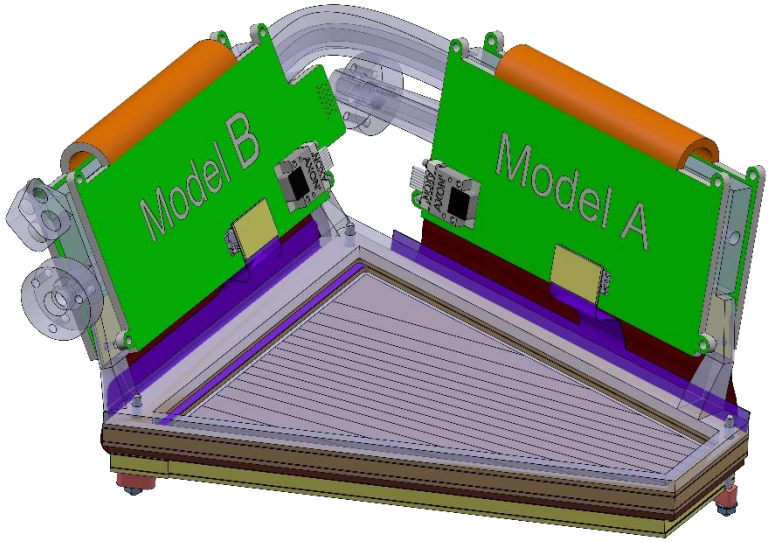
Cooling blocks/supports



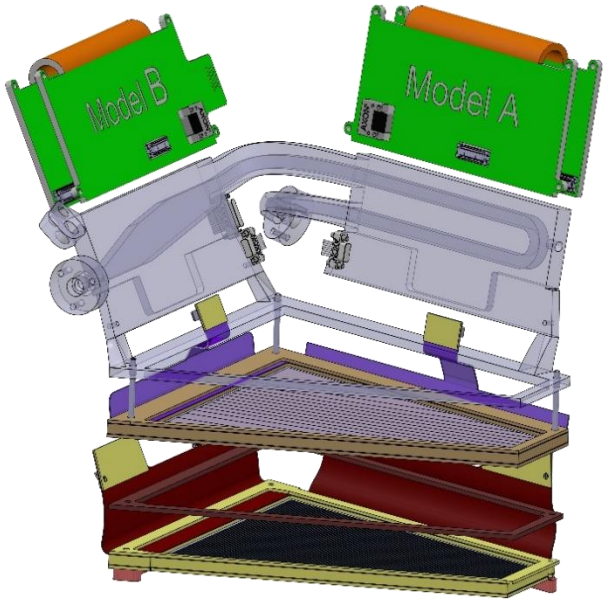
We need to create a component that will serve both purposes:
- As a mechanical support for the detector and the FEBs
- As a FEB cooler.

=> Additive Fabrication to optimize the space

FEBs water cooling done by thermal conduction

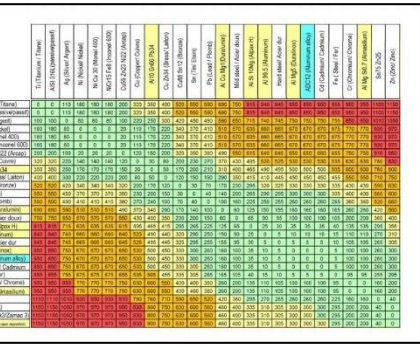


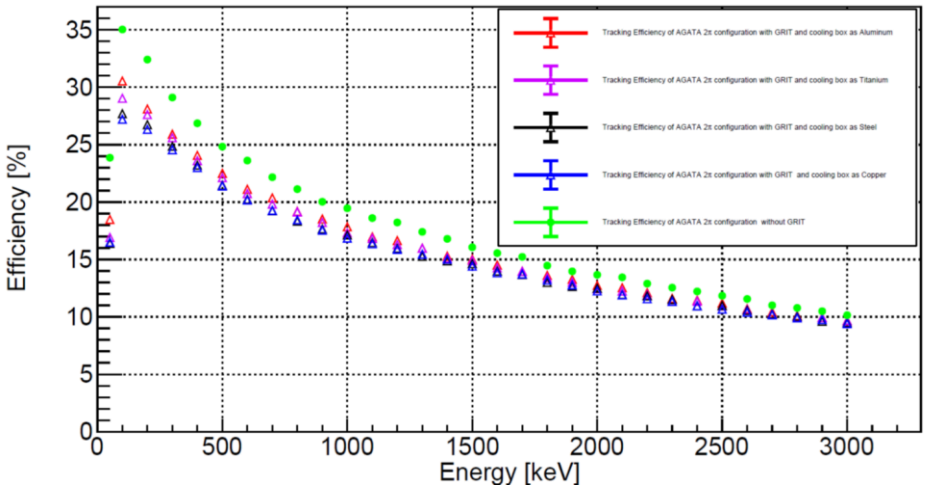
Cooling blocks/supports



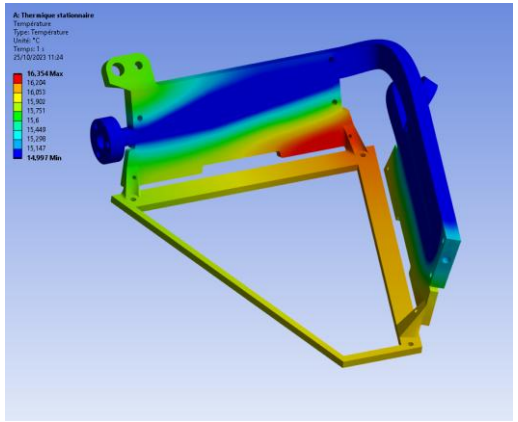
Choice of material : Titanium

Constraints	Validation	Parameters	Units	Titanium TiCp	Copper Cu	Aluminium AlSi10Mg	Stainless Steel 316L
Agata transparency	Geant4 simulation	Density	kg/m3	4500	8900	2700	7900
FEB cooling efficiency	Ansys thermal simulation and test	Thermal coef	W/m.k	16	400	200	15
Cooling block corrosion	Test with water @ ijclab	Galvanic couple vs Stainless Steel (pipes, chiller)	mV	0	320	840	0
Price	quotations	Material powder, treatment, post treatment	k€	1,4	1,5	1	1,4
Electrical contuctivity	Test @ LPC	conductivity	10e6 S.m-1	2,6	59,6	37,7	1,33

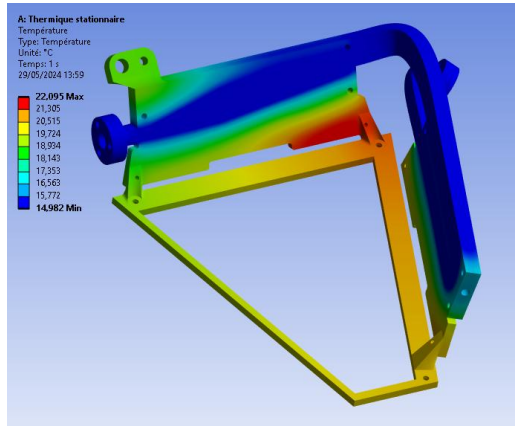




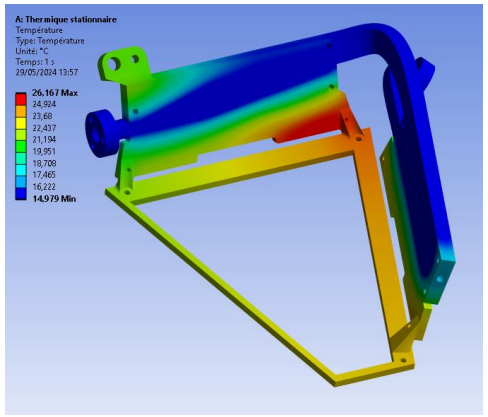
Aluminium AlSi10Mg : 16,3°C max



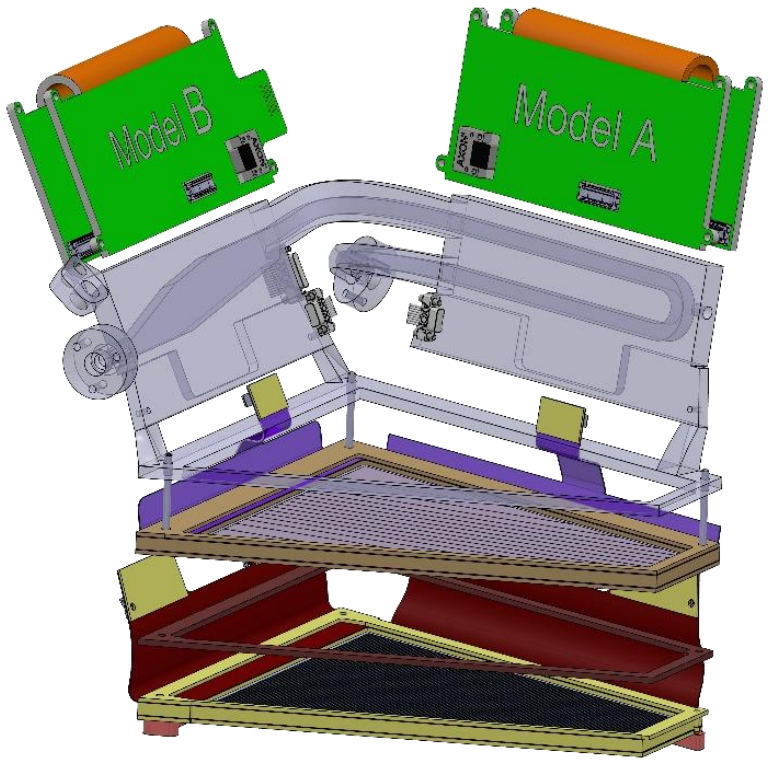
Titanium : 22°C max



Stainless Steel 316L : 26,1°C max

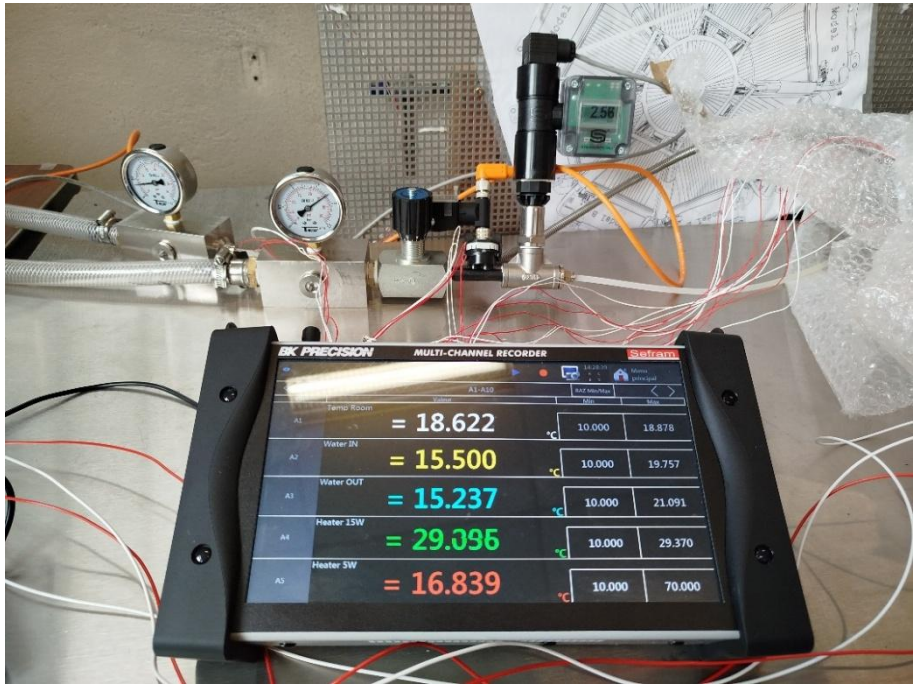


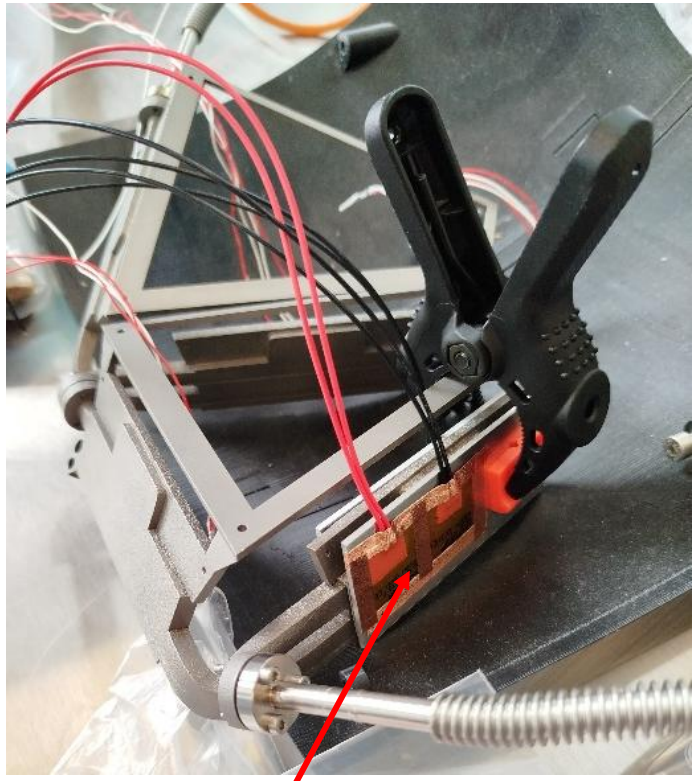
Cooling blocks/supports



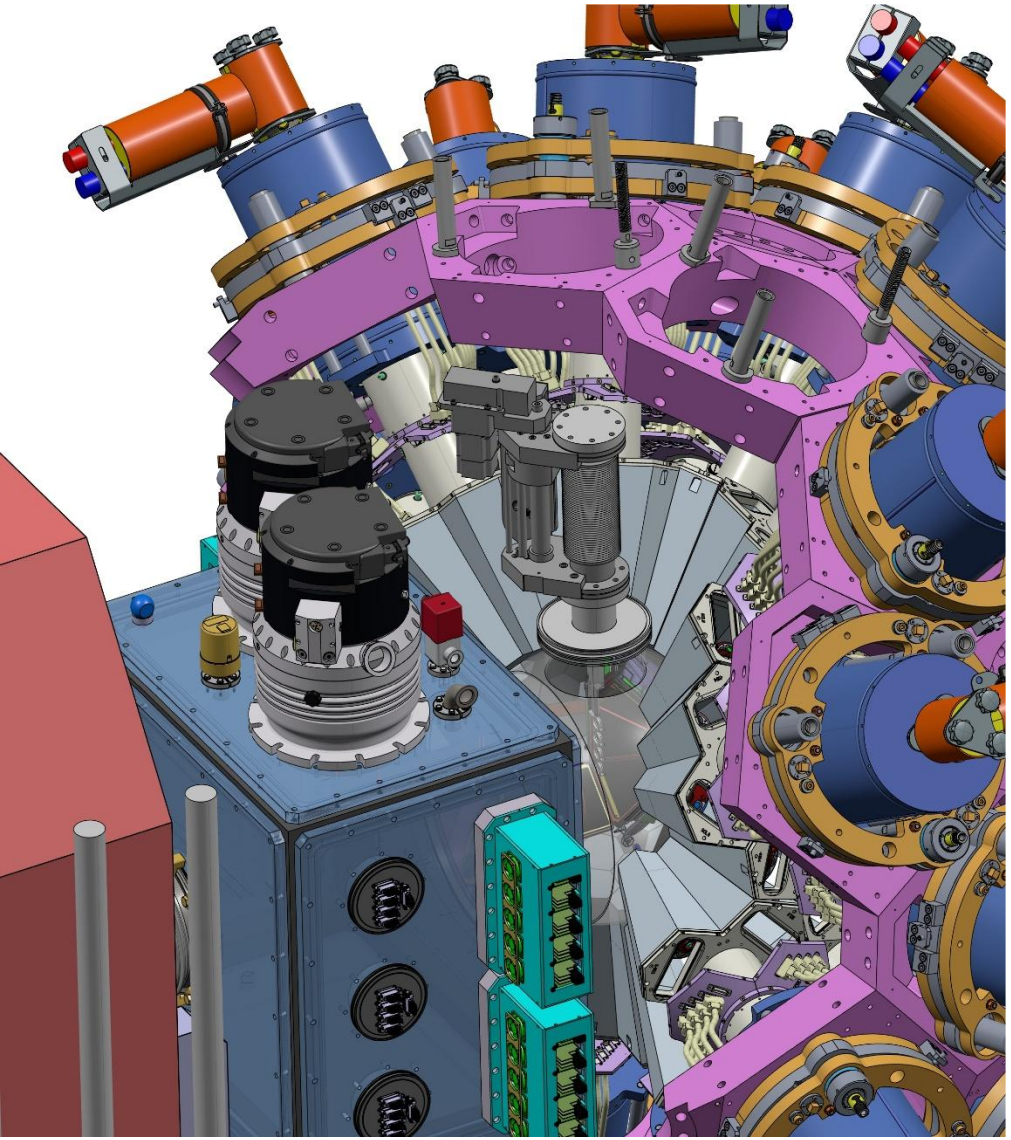
FEBs specifications:
Power consumption: 40 Watts
Maximal temperature : 60 °C

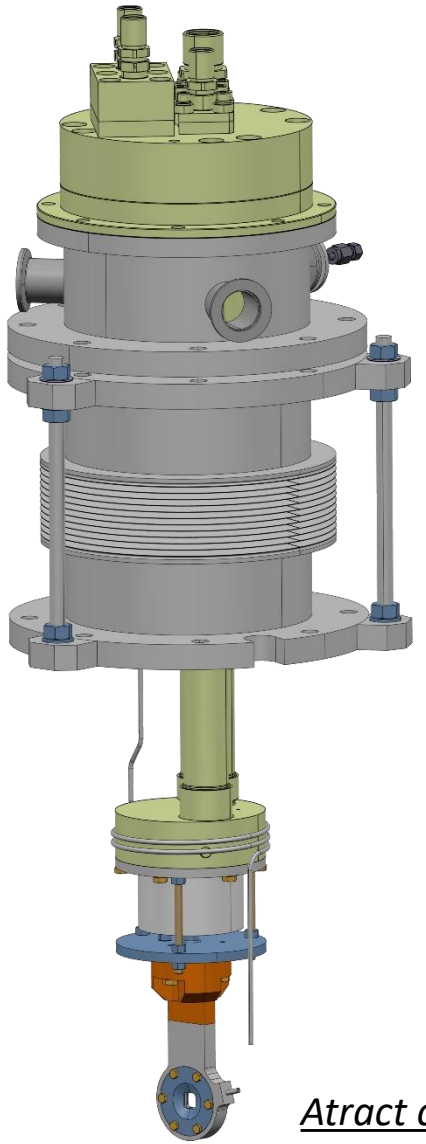
Solution:
Water at 15 °C with a 2 liters/min flow (maximal pressure 2,5 bars)
Add Gap Pad on faces to ensure the contact





Cryogenic target





Atract cryo target

Cryogenic target constraints:

22 micron/day of ice at 10-6 mbar

The need for a better vacuum to minimize 'de-icing' times

Goal: 10-7 mbar to divide by 4 the number of « cycle of de-icing »

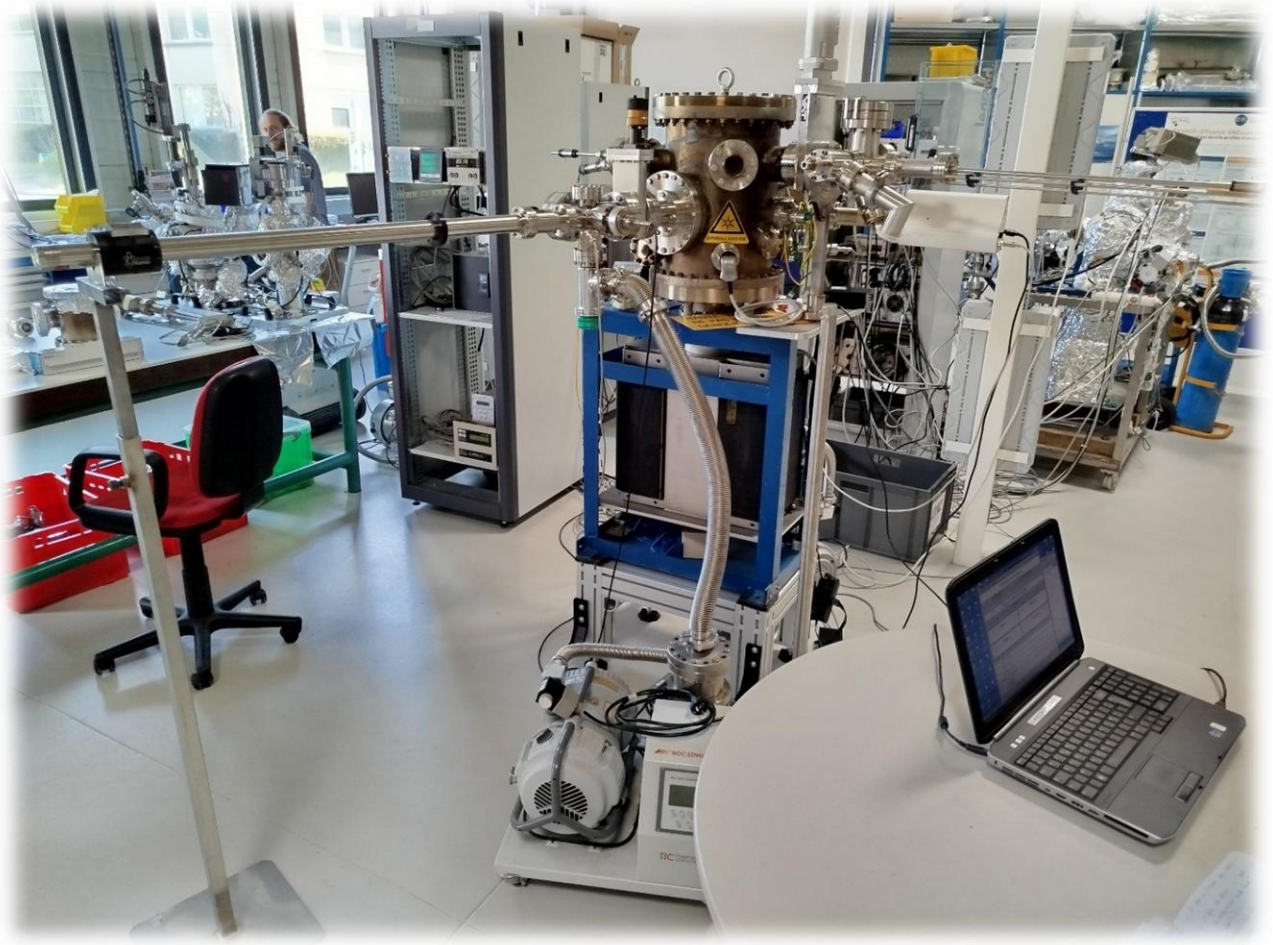
Outgassing tests and pumping sizing

Test bench installation

- UHV chamber with ionic pump and RGA
- Transfer sample system

We tested :

1. 30 cm of Axon cable
2. FEB from MUST2 project
3. Trapezoidal detector packaging from MICRON
4. Gap pad BERGQUIST® TGP HC5000



What level of vacuum can be expected with 2 DN200 turbo pumps (2500 L/s) ?

$$\text{Vacuum level} = \frac{Q(\text{cable}) + Q(\text{FEB}) + Q(\text{packaging}) + Q(\text{gappad})}{\text{Pumping speed (L/s)}}$$

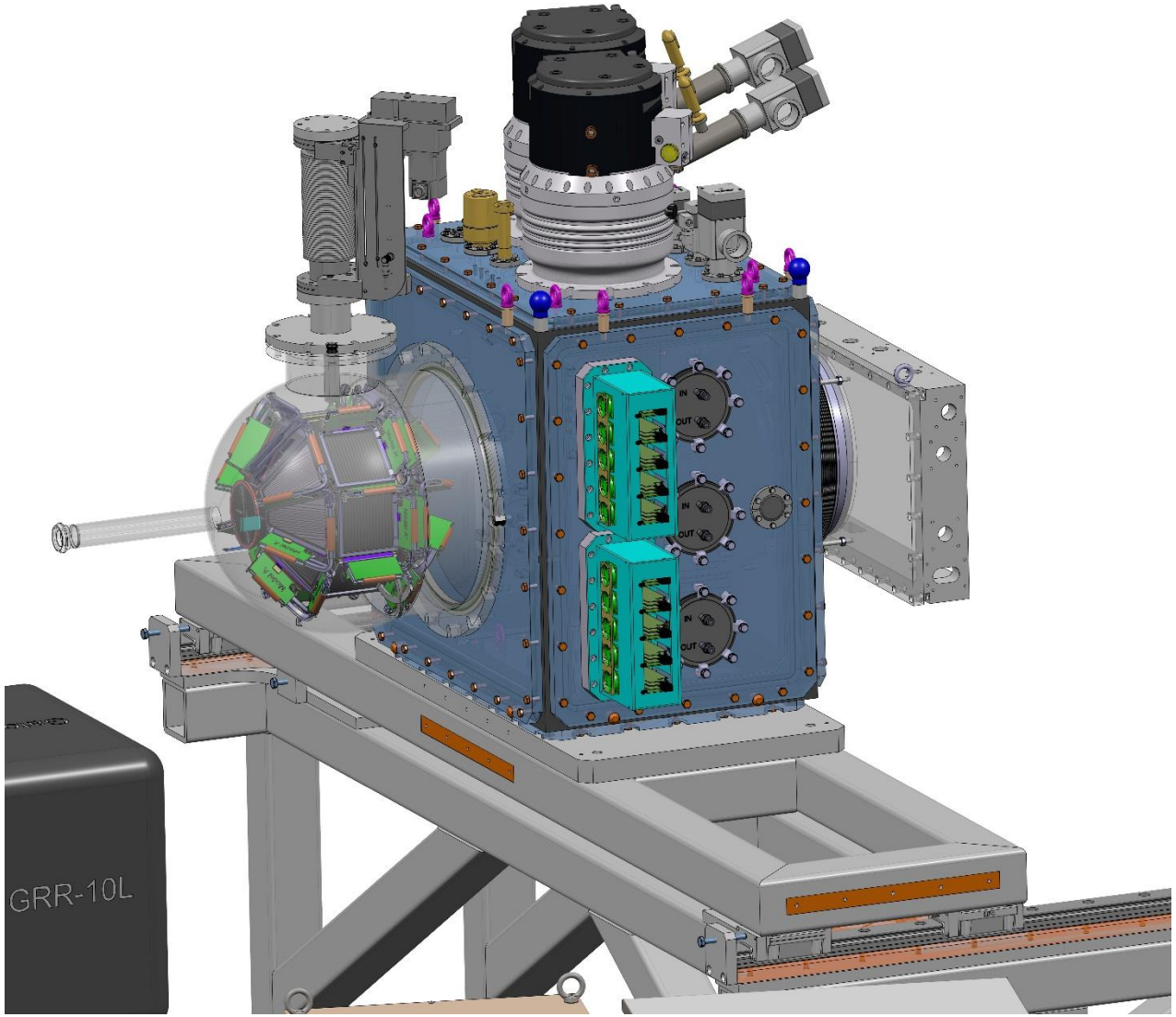
$$\text{Vacuum level} = \frac{1.10^{-6}\ \text{mbar.l.s}^{-1} + 1{,}5.10^{-4}\ \text{mbar.l.s}^{-1} + 3{,}2.10^{-4}\ \text{mbar.l.s}^{-1} + 4{,}2.10^{-6}\ \text{mbar.l.s}^{-1}}{2500\ \text{L/s}}$$

Vacuum level = **2.10-7 mbar**

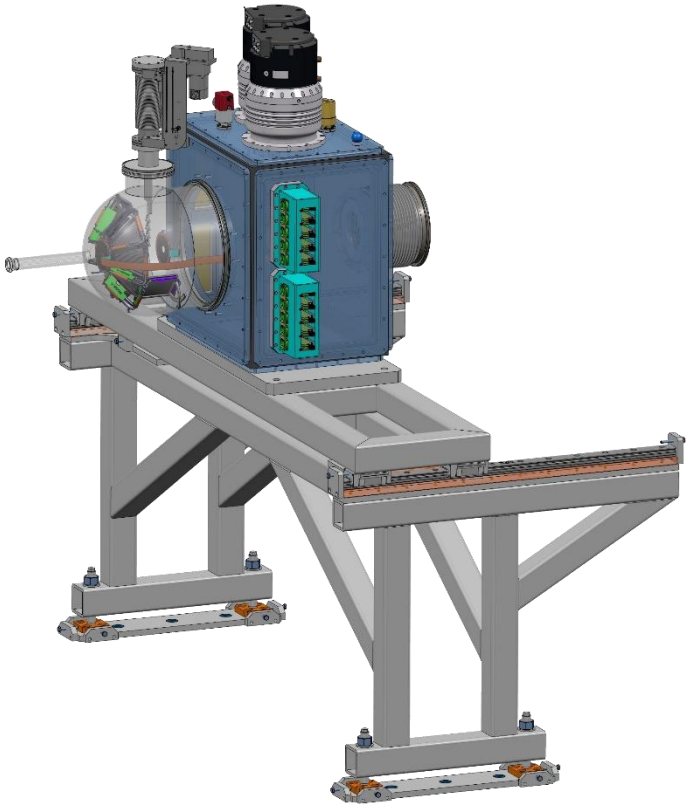
Services Vacuum Chamber

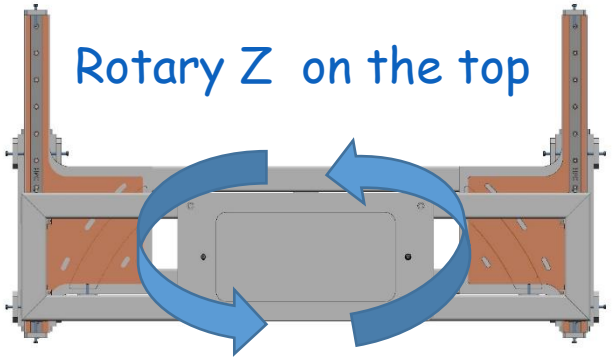
It includes:

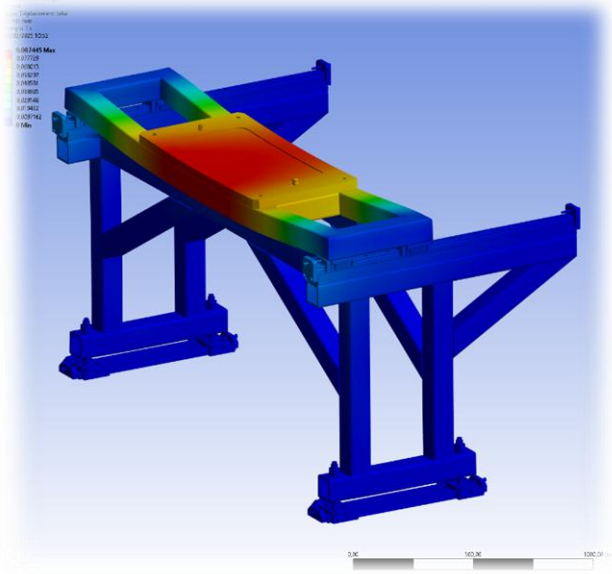
- Turbo pumps, gauges and valves
- Axon feedthrough for Grit FEB
- Water pipes feedthrough for cooling



Steel frame with XYZ positionning





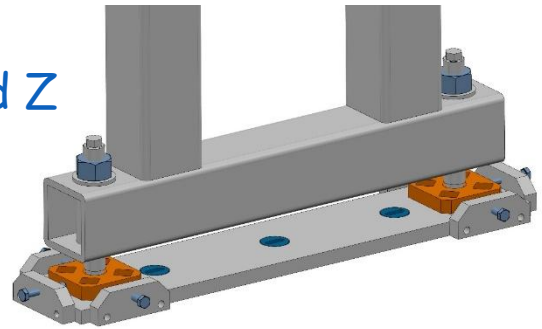


Deformation 0,1 mm
load 400 kg (300 chamber + 100 pumps)
Steel profil 100x100x10

Tilt: Rotary X and Y

Translation: X, Y and Z

on the ground



GRIT inside AGATA @GANIL

-> Beam in 2029

Merci de votre attention !!