



AIDA Infrastructure for very forward calorimeters

Mechanical design adapted to the existing electronics

6/09/2011

Designers:

Eric David

Adrien Varlez

Christophe Bault

In collaboration with:

François-Xavier Nuiry

AIDA Infrastructure for very forward calorimeters

Introducing Permaglas frames
for higher flexibility

6/09/2011

Slides were re-arranged and slightly
modified by K. Elsener

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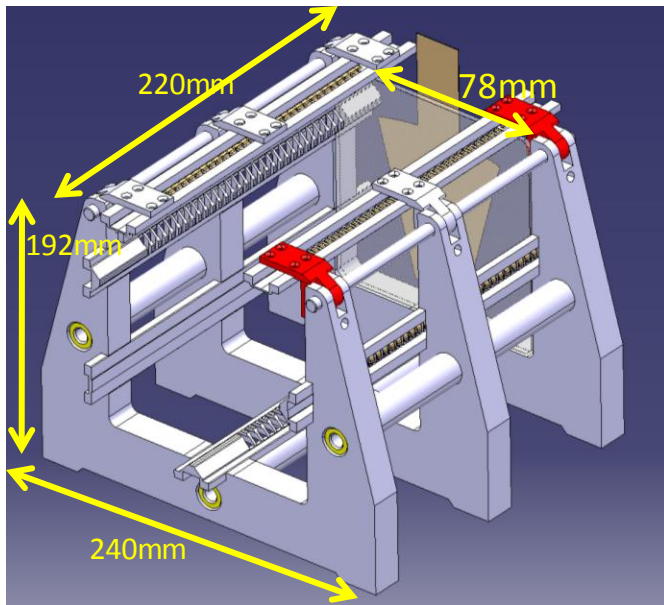
In collaboration with:

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Reminder – last FCAL meeting

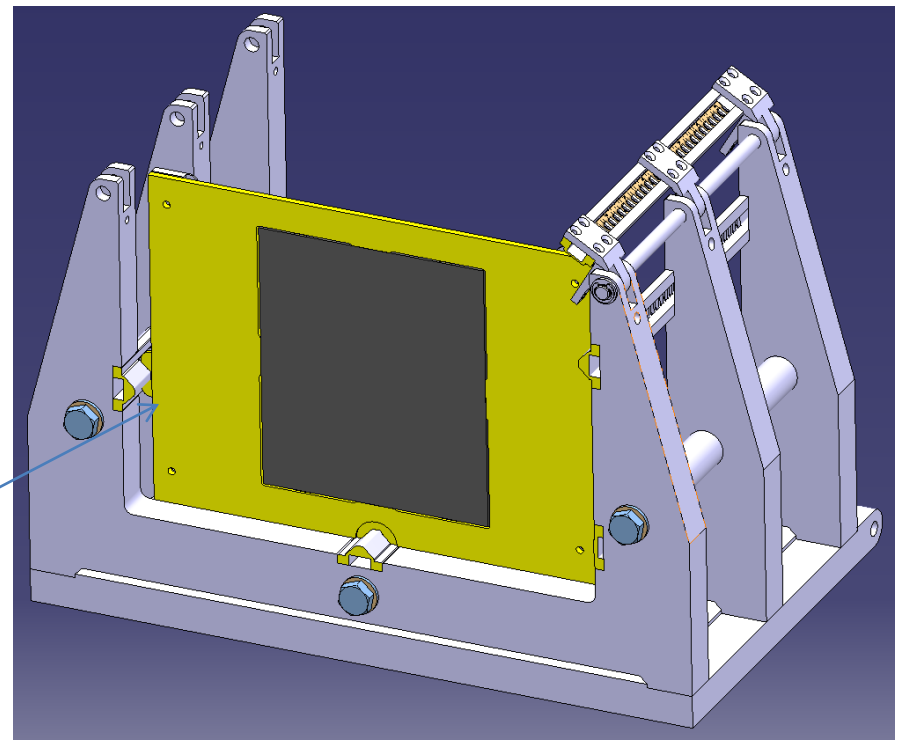
Proposed mechanical infrastructure to allow

- > tungsten plates separated by **2 mm** or by **1 mm (challenge: $\pm 50 \mu\text{m}$)**
- > option of 0.5 mm separation is still kept (different design, very preliminary)



NB1. sensor position between tungsten plates deemed less critical

NB2. structure must accept present LumiCal sensor board and electronics



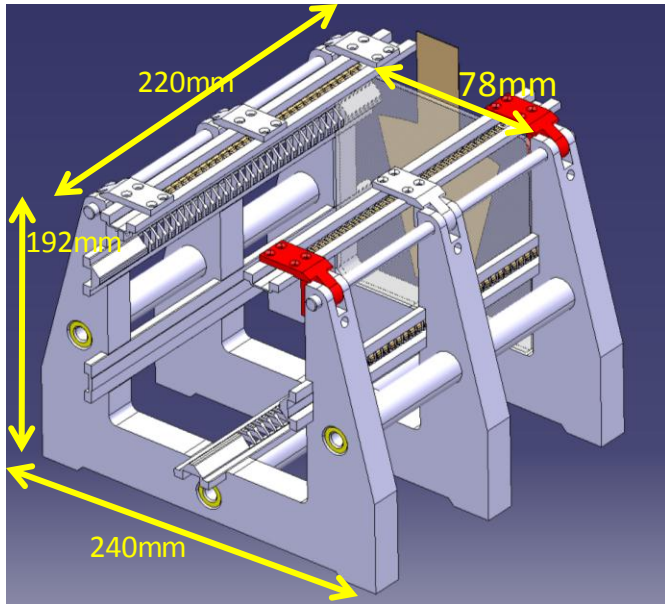
Need lateral space

Don't want to buy larger tungsten plates

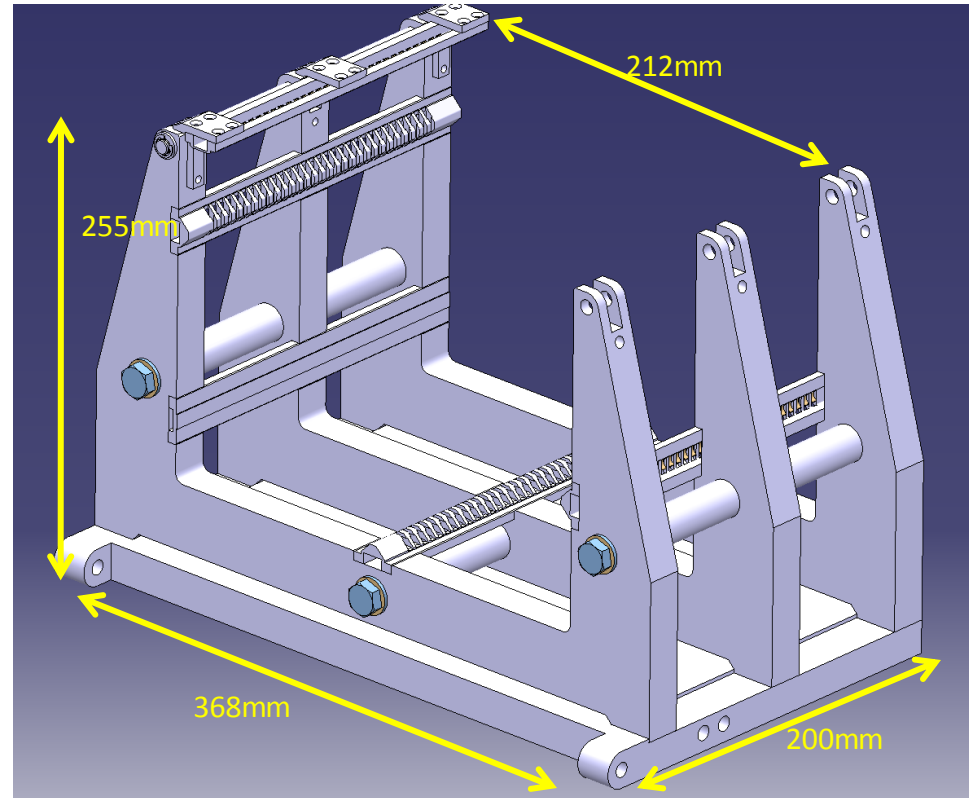
→ Permaglass frames

(sometimes known as Stesalit)

result: new mechanical design



Former design
(May 2011, Predeal)



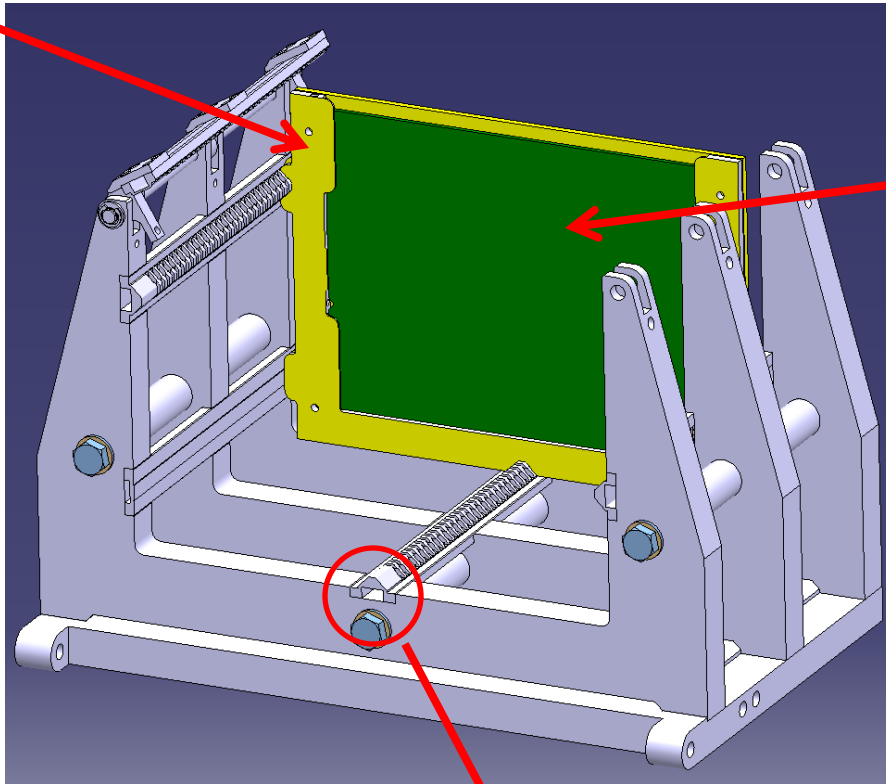
New design new dimensions,
adapted to the existing electronics

The existing electronics board, in the Permaglas frame [RESARM company]

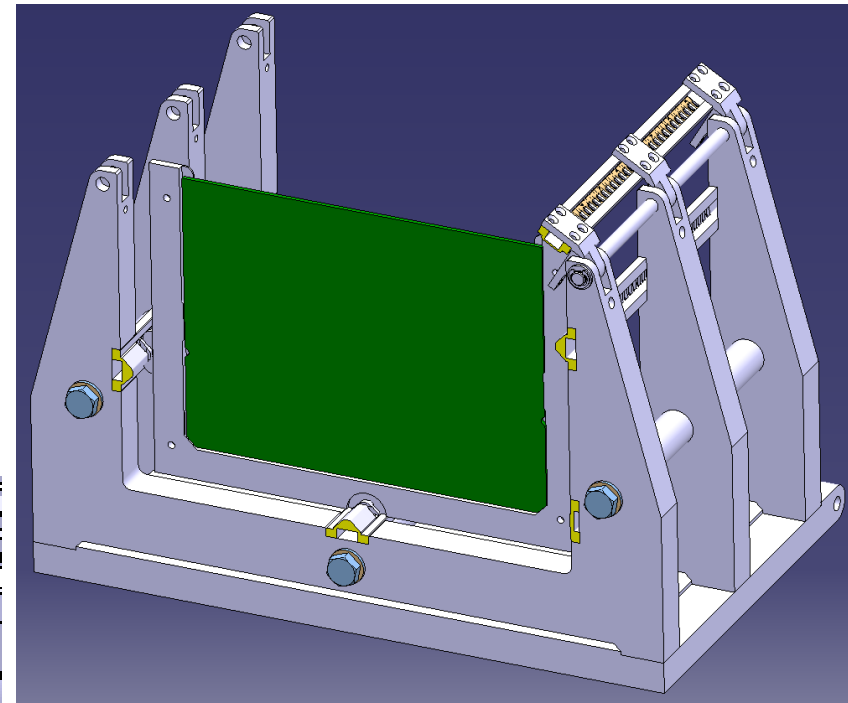
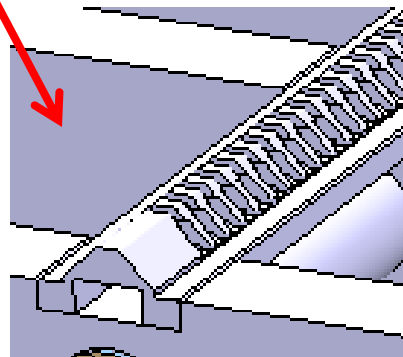
↳ Glass fibres in epoxy resin

Permaglas
frame

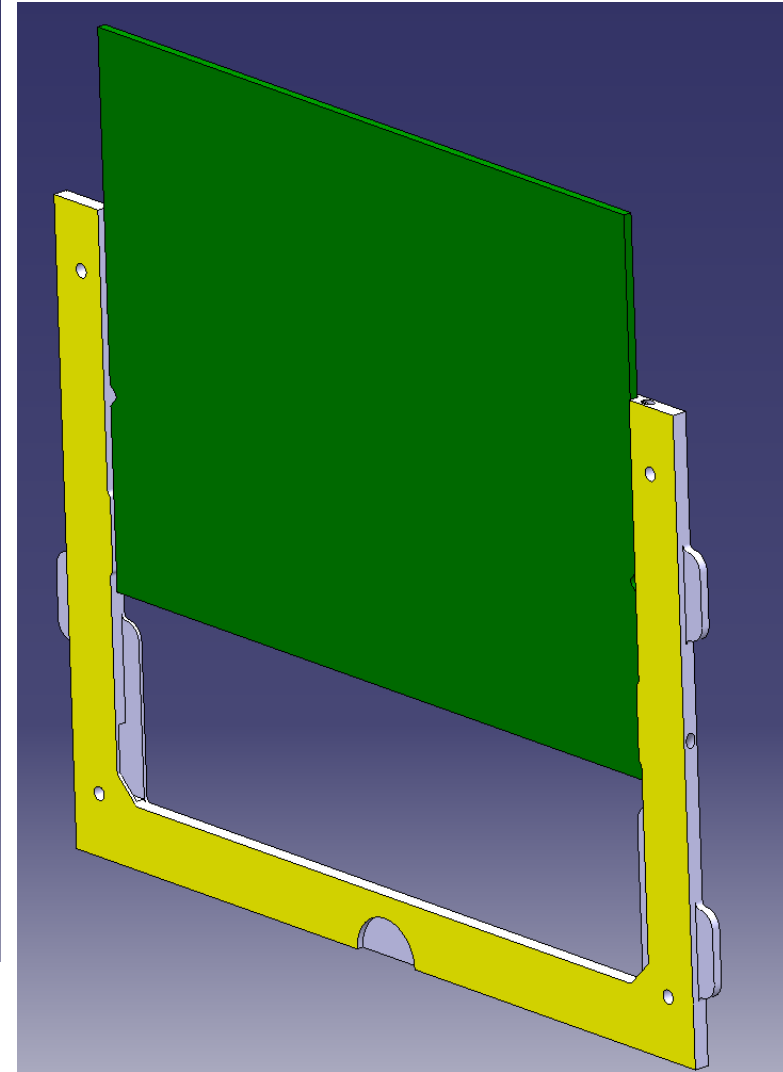
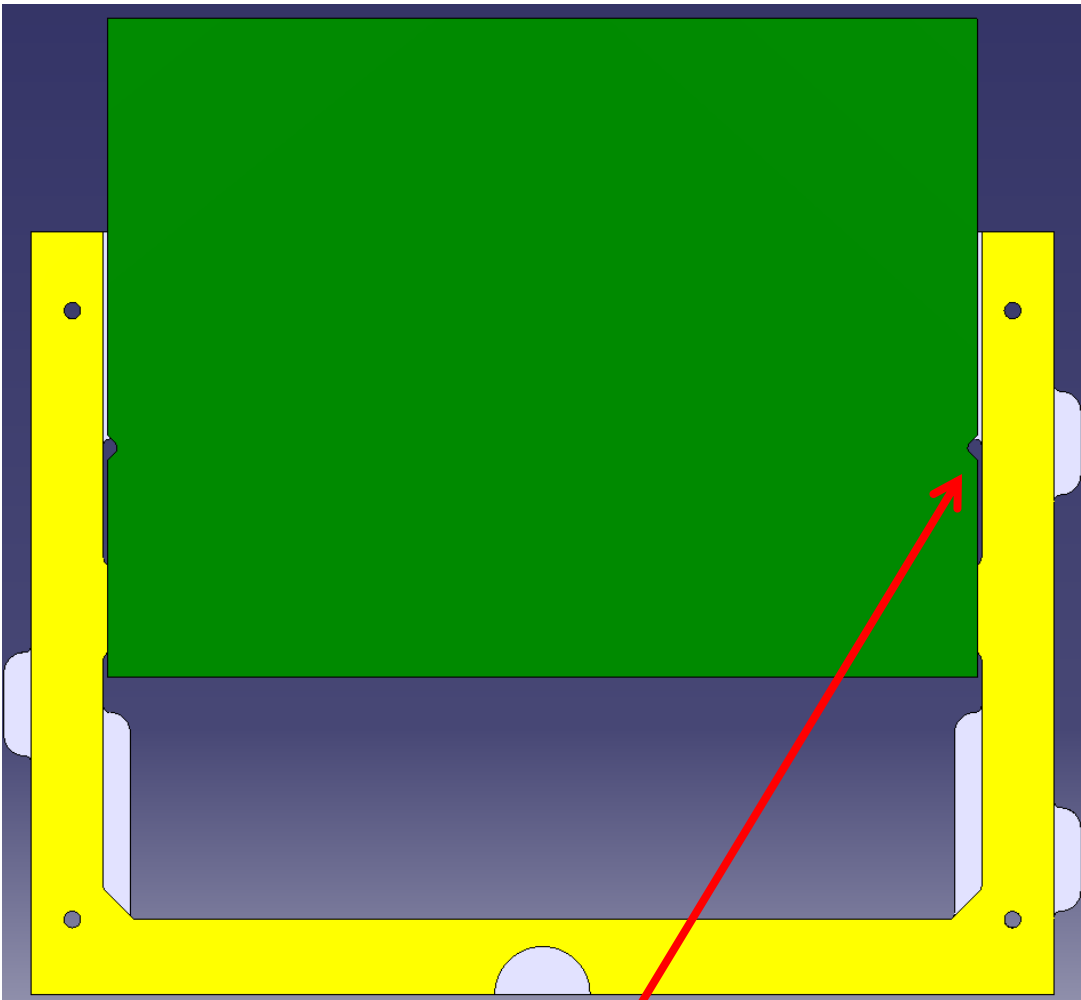
PCB Board



Comb

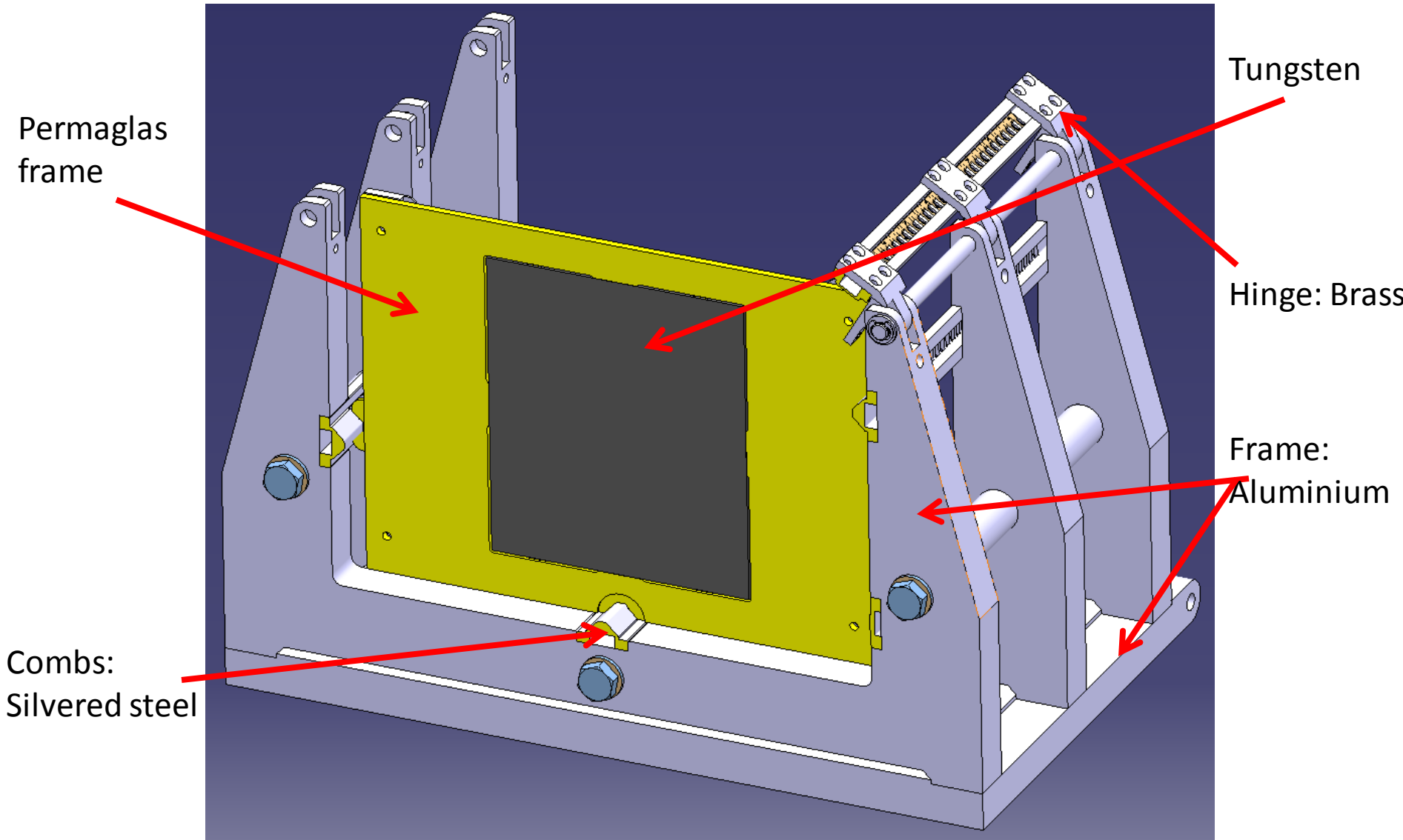


The existing electronics board, in the Permaglas frame



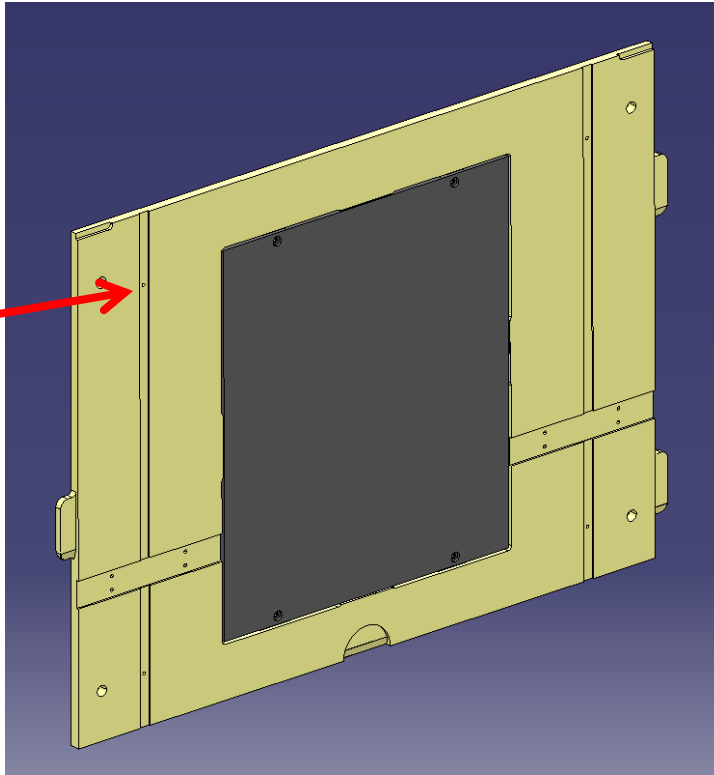
Proposal – to be discussed:
the PCB should be machined before
mounting the Si detector

The tungsten plate, in the Permaglas frame

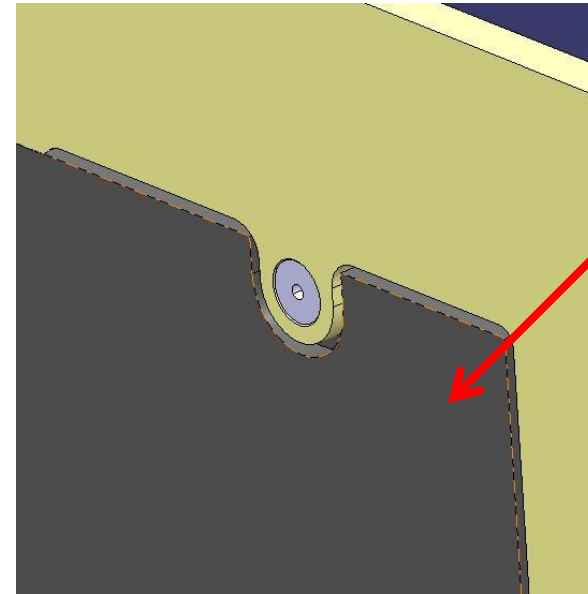


Tungsten holder: → Some details

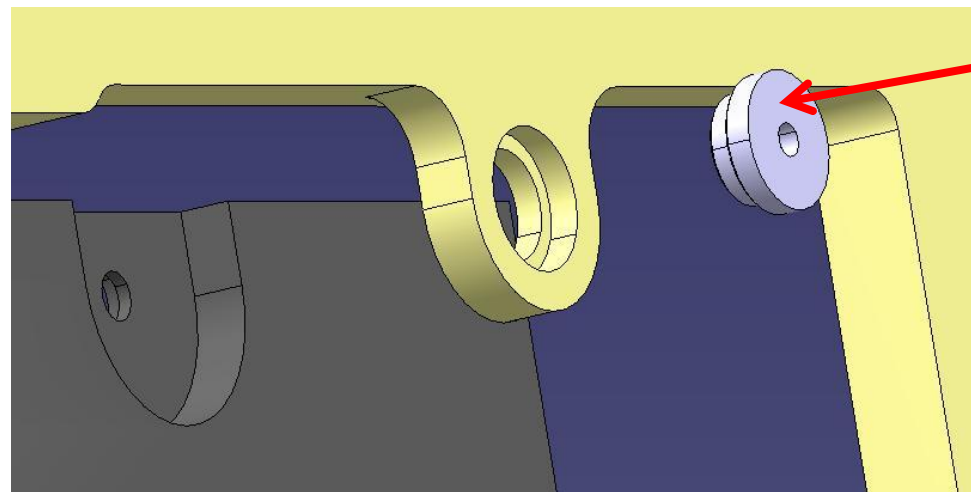
Permaglas
frame



Tungsten

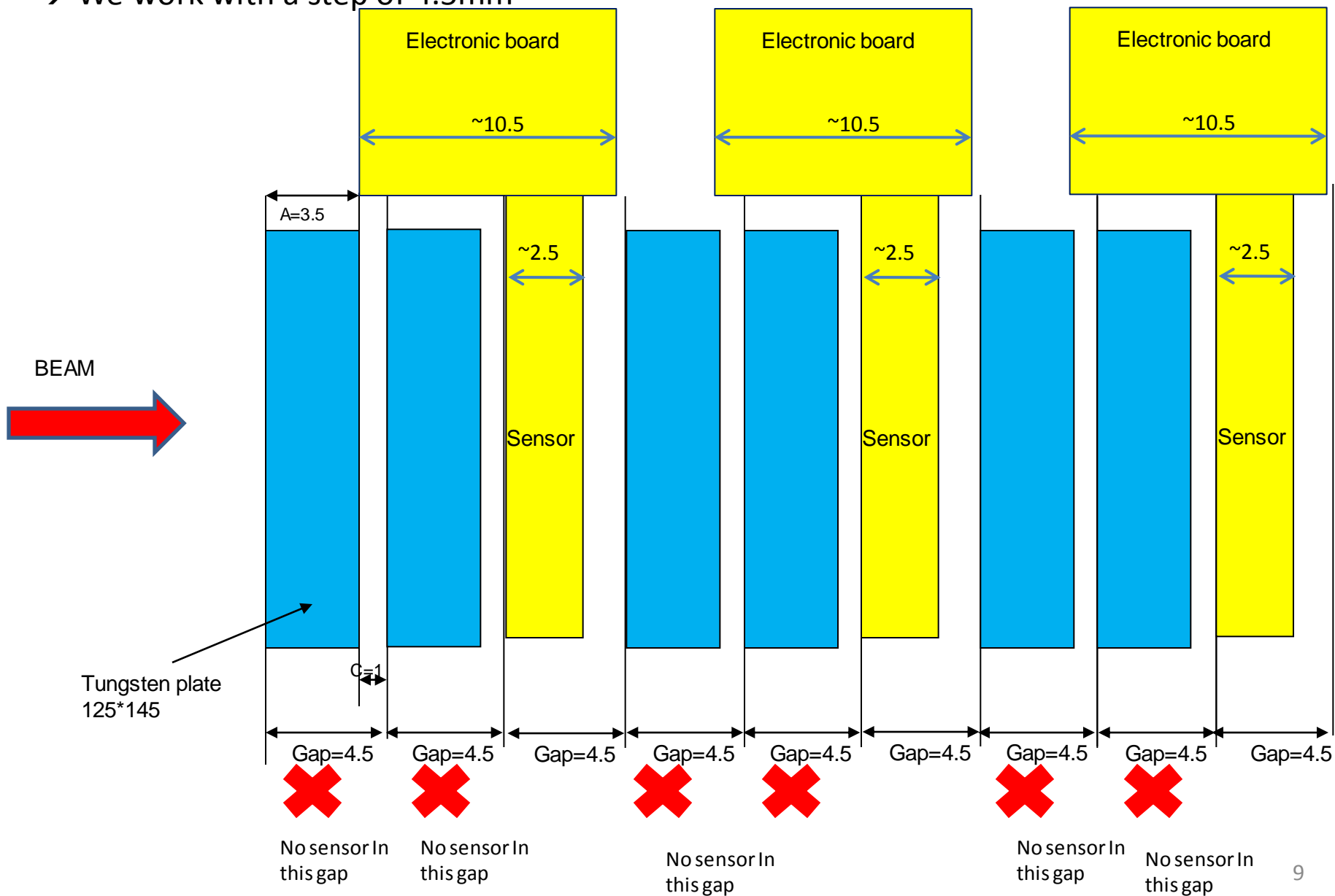


Glued insert

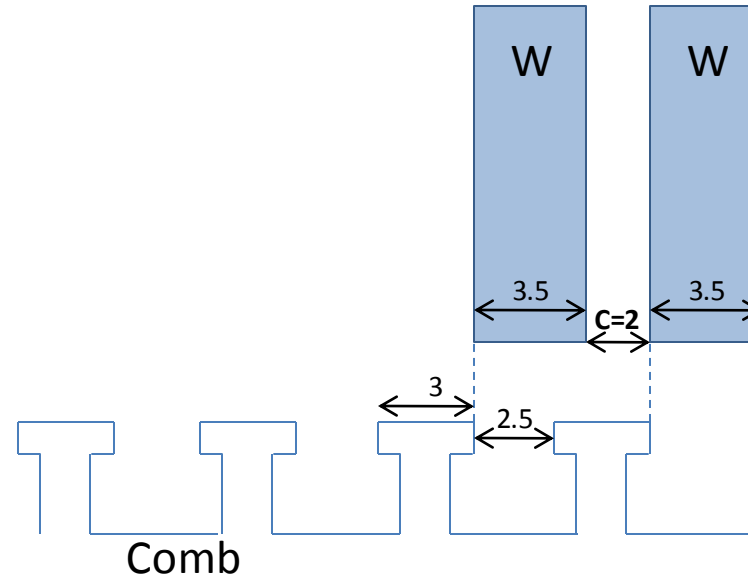


Example: what we can do with C=1mm (present electronics)

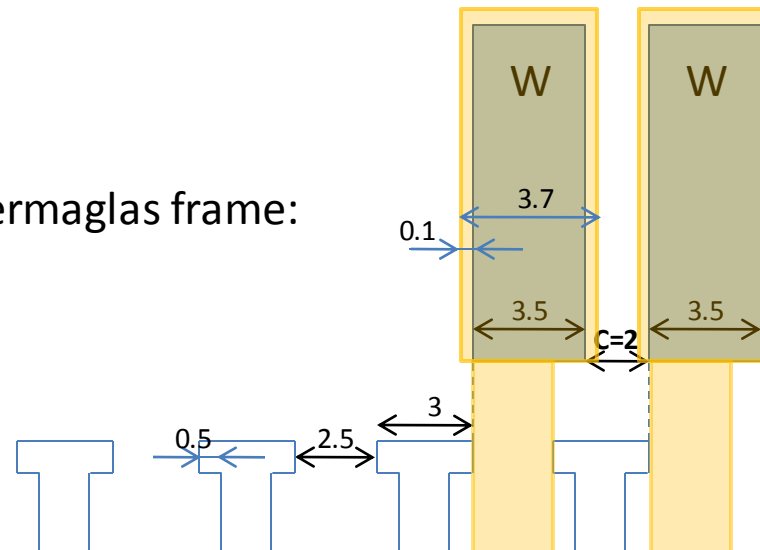
→ We work with a step of 4.5mm



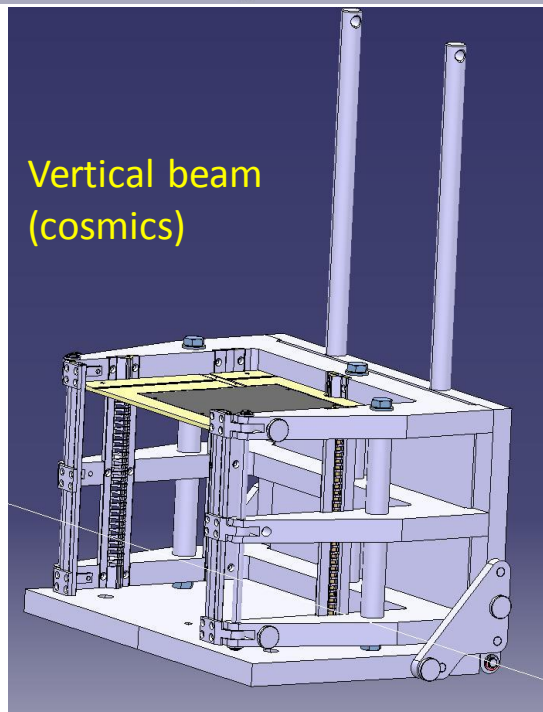
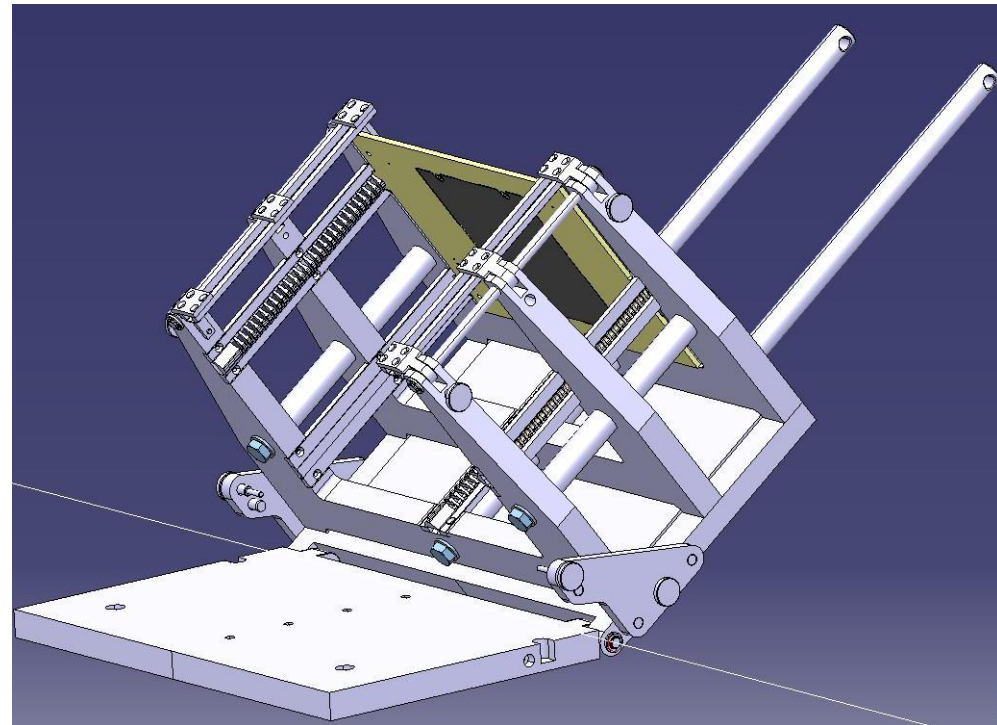
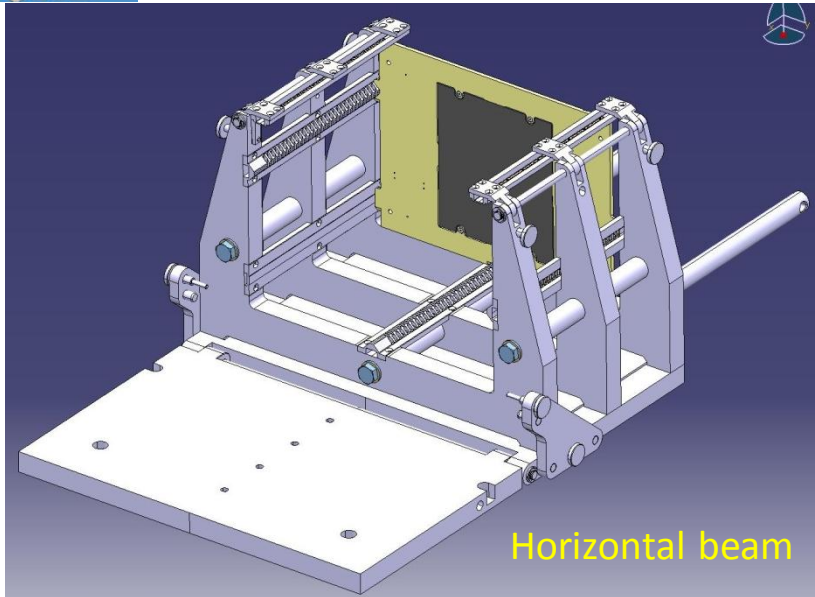
Example: detail of arrangement for C=2mm



With Permaglas frame:



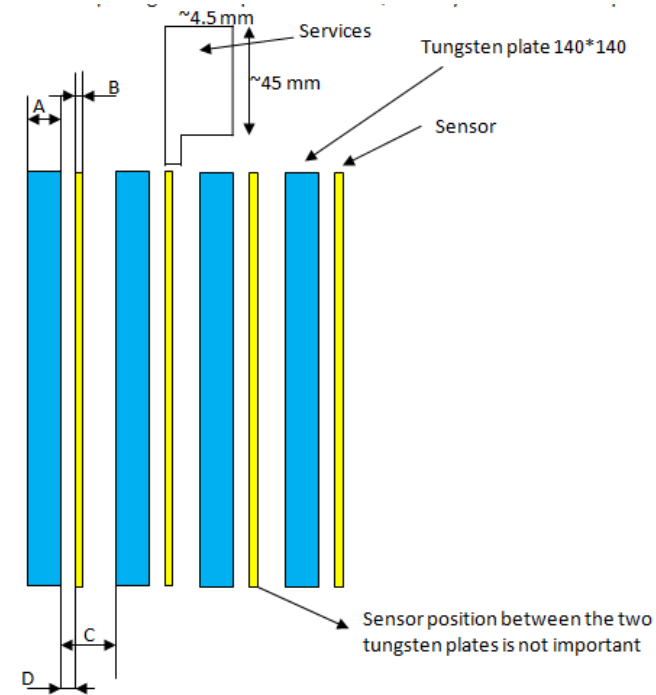
Mechanical infrastructure – general view



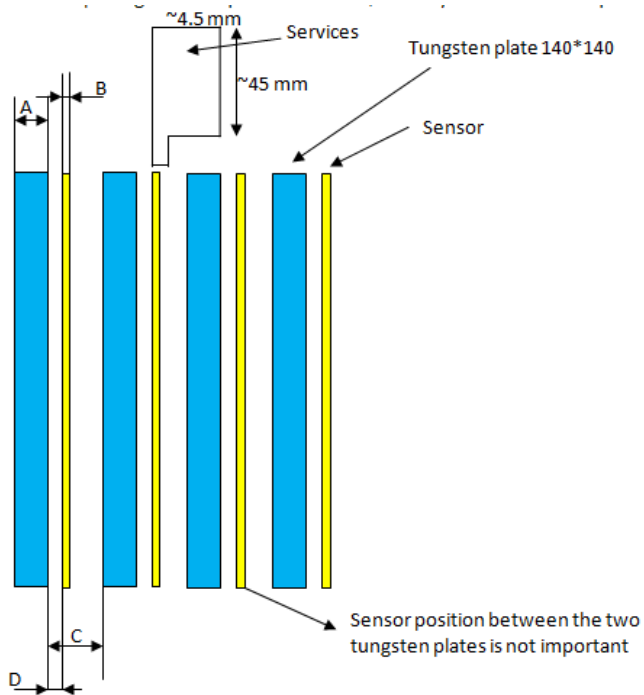
The “black box” around this assembly, as specified “light tight”, will be designed soon. This box will also provide means to hold cables and pipes firmly in place (avoid strain on electronics board).

Mechanical frame: Summary

- The C=2 solution is designed in full detail
- The C=1 solution needs adapted combs, with the same frame (should be designed soon)
- The “black box” needs to be designed
- We will soon determine the total price of this detector (W + frame) [Approximation]
- We will soon meet a subcontractor for all the parts of the mechanical infrastructure



The Future... C=0.5mm



The idea:

-We use the same tungsten plates

-We could use the same Permaganas frame (in white in this picture)

-We glue the Si detector + the read-out on the Permaganas frame

-We could realise a sliding kinematic between each tungsten plate, in order to reach the 0.5mm gap between each W plate.

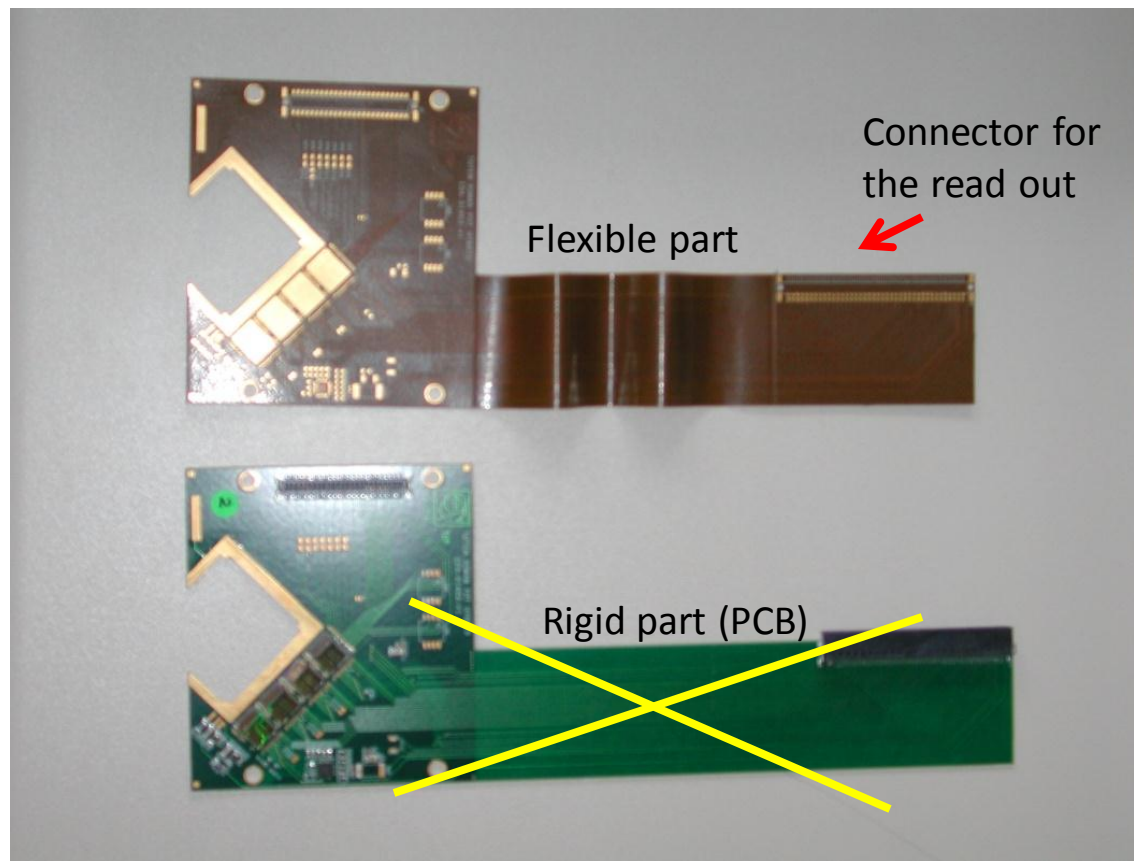
-A new mechanical frame is mandatory

The Future... C=0.5mm

The most important for us:

Realising a flexible link between the sensor and the read out.

Something similar to this example (taken from TOTEM):



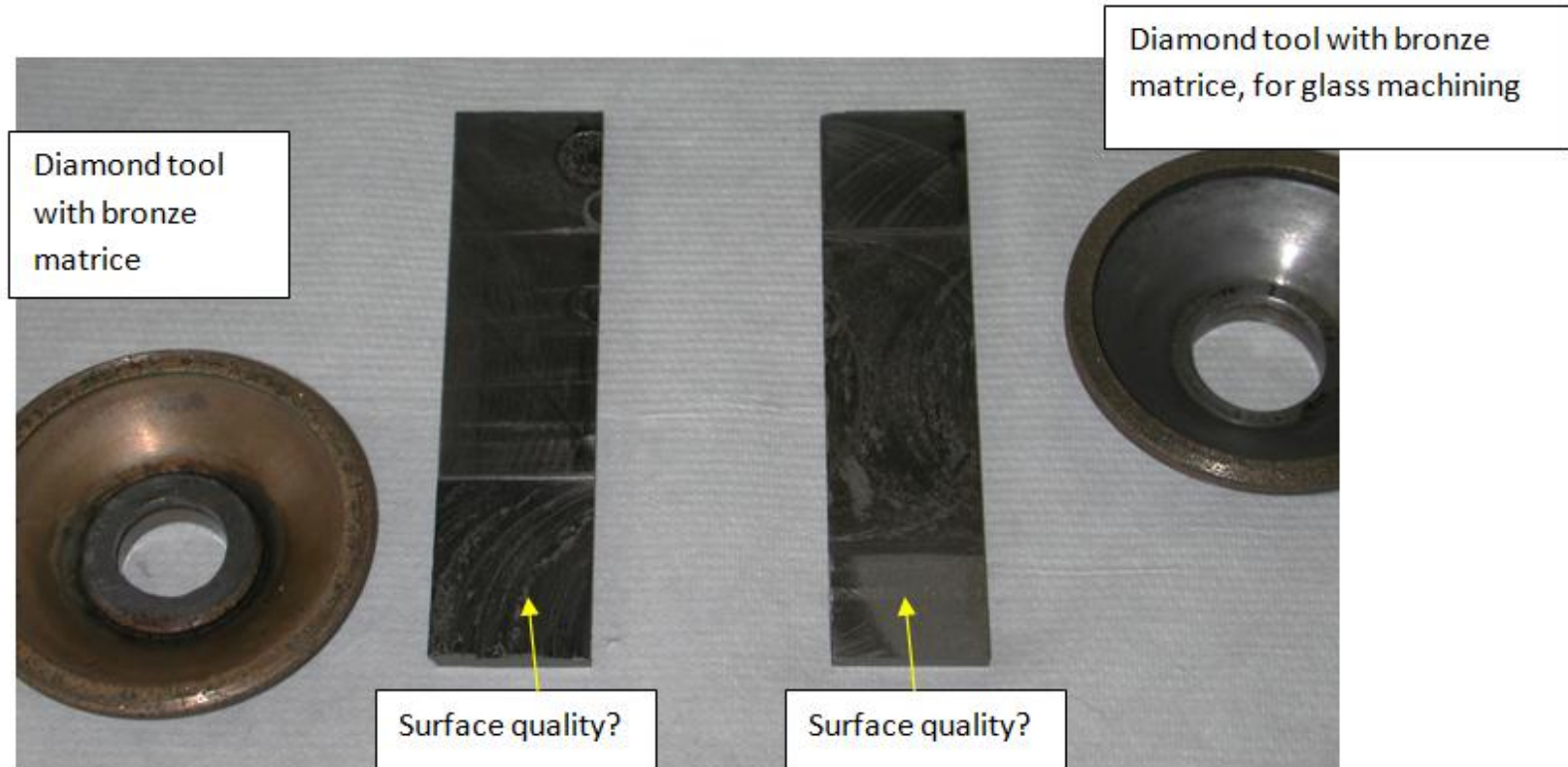
Part 2 - Tungsten plates

- Main supplier: *Cime Bocuse (Plansee)*

	Tungsten min W 99.97%	Densimet W min 90%	Inermet W min 90%	Sparkal X W 75% - Cu 25%
Magnetism	Paramagnetic	Ferromagnetic	Paramagnetic	<i>Should be Paramagnetic</i>
Other components		Ni + Fe	Ni + Cu (0%Fe)	Cu 25%
ρ	19.3	from 17 to 18.8	from 17 to 18.0	~16.5
Ability to machine	Hard	Nearly like steel	Good machinability	
Cost / Kg	~770€(standard plate) ~15510 € for 30 plates	~220 € <i>Only rod shapes, no plates</i>	Not available	~165€
Cost after machining At CERN				
Cost after machining At Cime Bocuse	3500€ for 1 machined plate 45000€ for 30 machined plates	3492€ for 4 machined plates	3507€ for 4 machined plates	

Tungsten alloys are 4 time cheaper than pure tungsten

Tungsten machining tests: surfacing

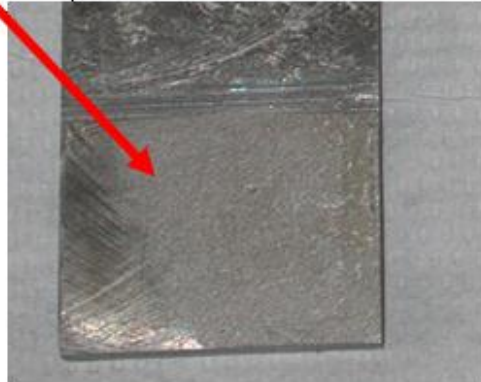
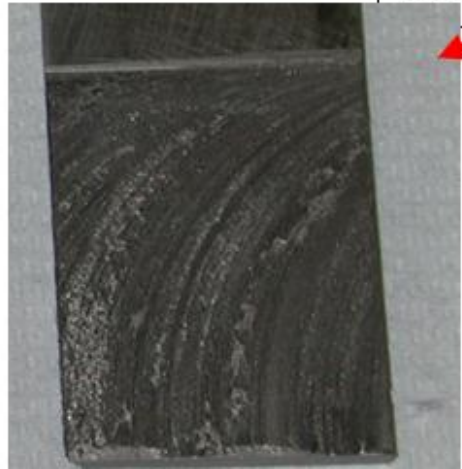


Diamond tool with bronze matrice

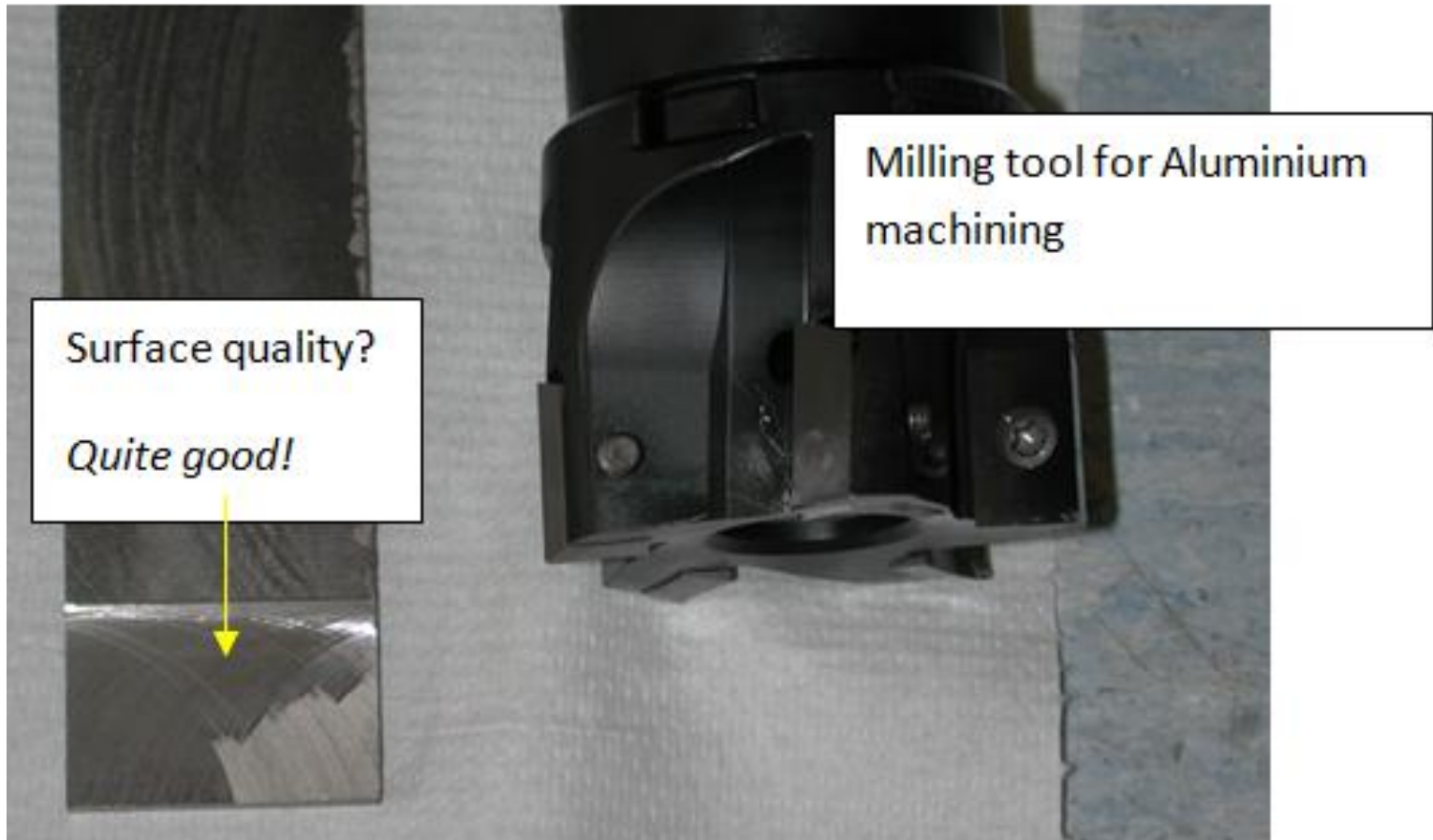
Diamond tool with bronze matrice, for glass machining

Surface quality?
Not Acceptable

Surface quality?
Not Acceptable



Tungsten machining tests: surfacing

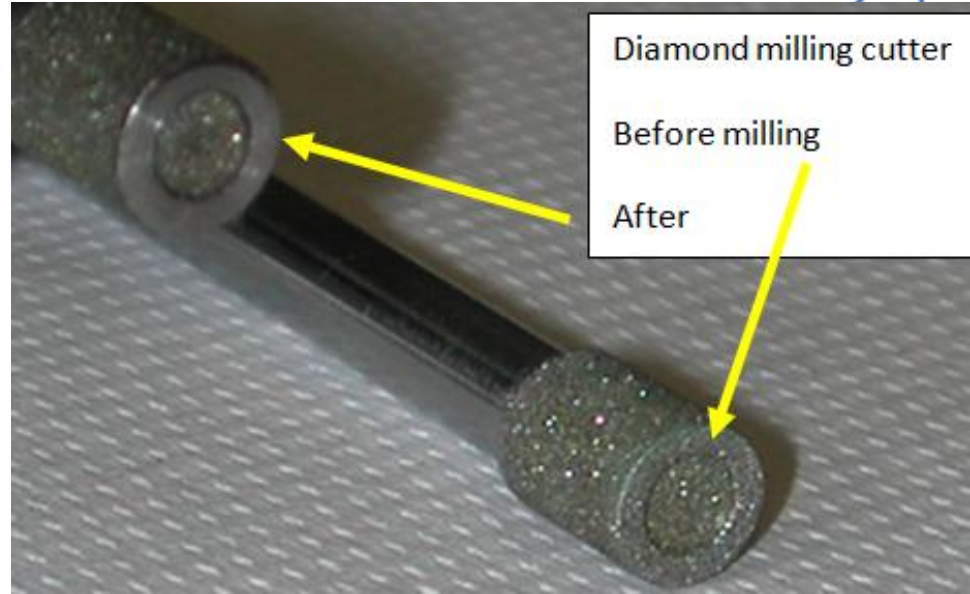
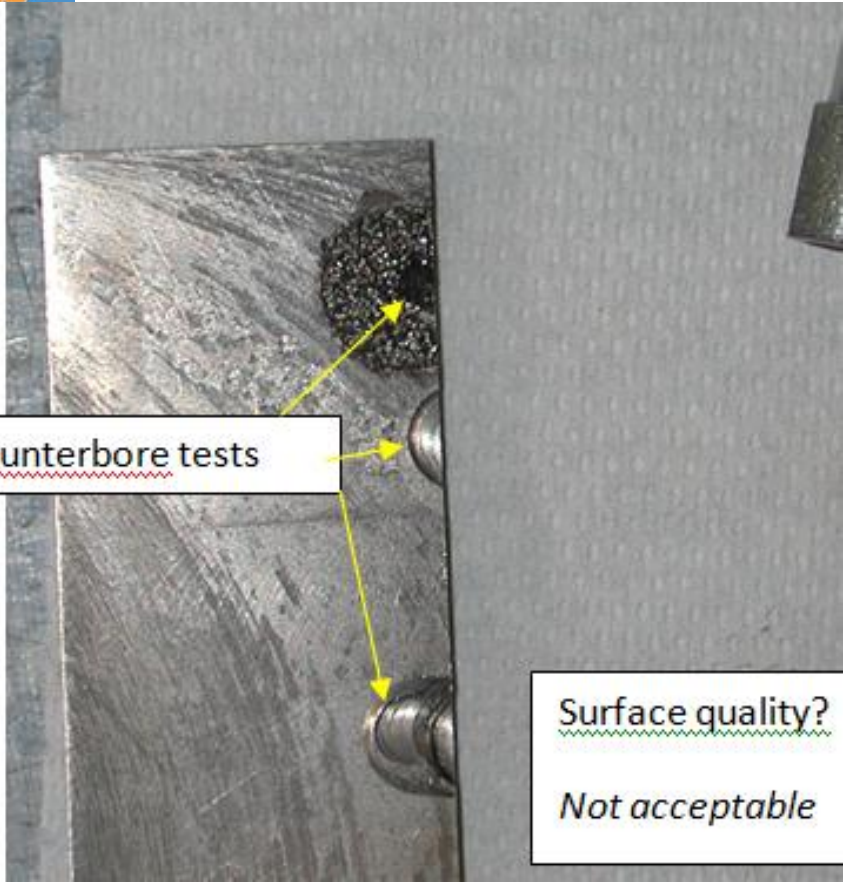


Is it reproducible? → not so sure!

An other test is currently done, with a more suitable tool.

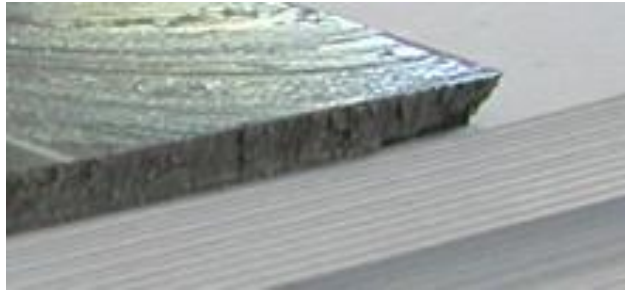
→ Diamond + Vitreous matrice instead of Diamond + Bronze matrice

Tungsten machining tests: spot facing



Very good result with a standard carbide tool

Tungsten machining tests: Spark machining



Very bad results with standard milling tool



Very good results with Spark machining

Tungsten machining tests: Summary

Technology	Tested	Results	Conclusion
Conventional milling tool	yes	Not acceptable	<p>The standard tungsten (100% W) is not easy to machine. Hopefully some methods / tools work well, but it will be expansive and risky (we could break a plate).</p> <p><u>We will try to test the tungsten alloy machinability. If results are acceptable, we will definitively choose the best tungsten alloy.</u></p>
Spark Machining	yes	Good for contouring	
Surfacing	yes	Not acceptable, excepted with one tool	
Finish grinding	No, technician broke his leg	-	

Tungsten procurement

News

- A new supplier has been identified: ATI Firth Sterling, USA
- It proposes tungsten alloys

	Tungsten min W 99.97%	SD180 95% W	SD185 97% W	DENS25 95% W
Magnetic perm	Paramagnetic	n/a	n/a	<1.05
Other components		3.6%Ni + 1.4%Fe	2.1%Ni + 0.9%Fe	4.4%Ni + 0.6%Fe
ρ	19.3	17.75	18.25	17.75
Ability to machine	Hard			Like steel, according to ATI
Cost / Kg				

Will be tested soon!

- Other potential suppliers:
 - STEINEMANN CARBON AG
 - EWG Wagener www.ewagener.de
 - www.mgsanders.co.uk

- The C=2mm and C=1mm design are nearly ready for us
- We will launch a call for tenders for the machining of parts ASAP

The shortest schedule we can propose:

[if subcontractors are available]

- We should get the parts for the first mechanical frame with combs for C = 2 mm machined by end of November
- We should be able to assemble the frame by mid of January

Summary (II) – tungsten

- Machining pure tungsten is too difficult
- Machining tungsten alloys is now a priority
- In first approximation, a tungsten alloy machined solution is 4 times cheaper than a pure W machined solution

The shortest schedule we can propose:

[if subcontractors are available]

- We should get the first machined W alloy plates by end of October (test plates!)

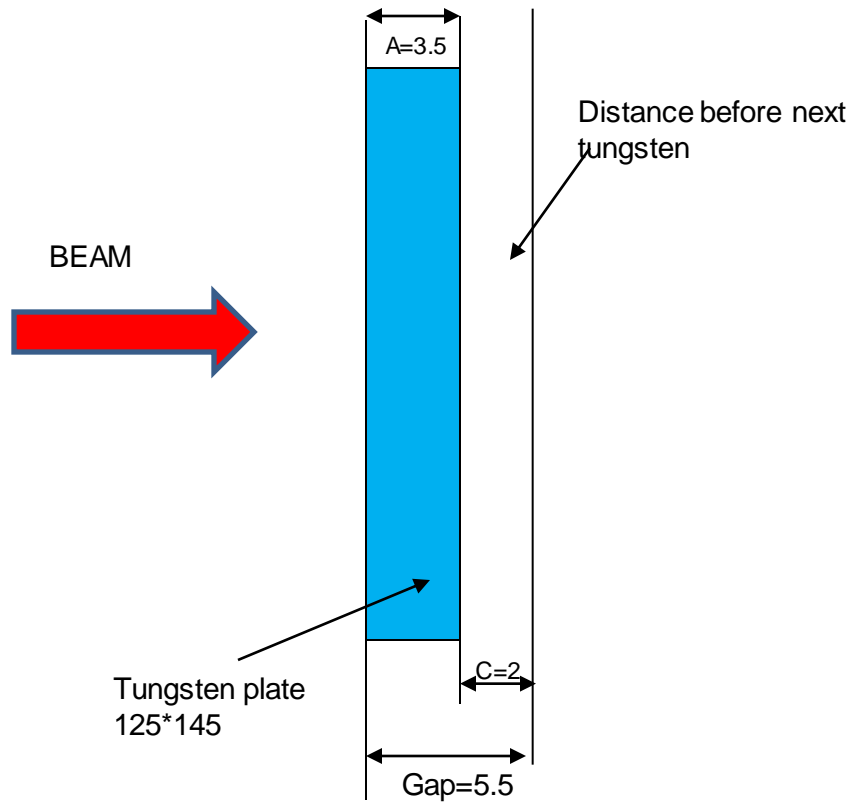
Collaborators will soon be sent a drawing with tungsten plate specifications – you are then encouraged to contact “your” tungsten suppliers to receive offers (details to be discussed)

Spare slides

Additional information about the frame

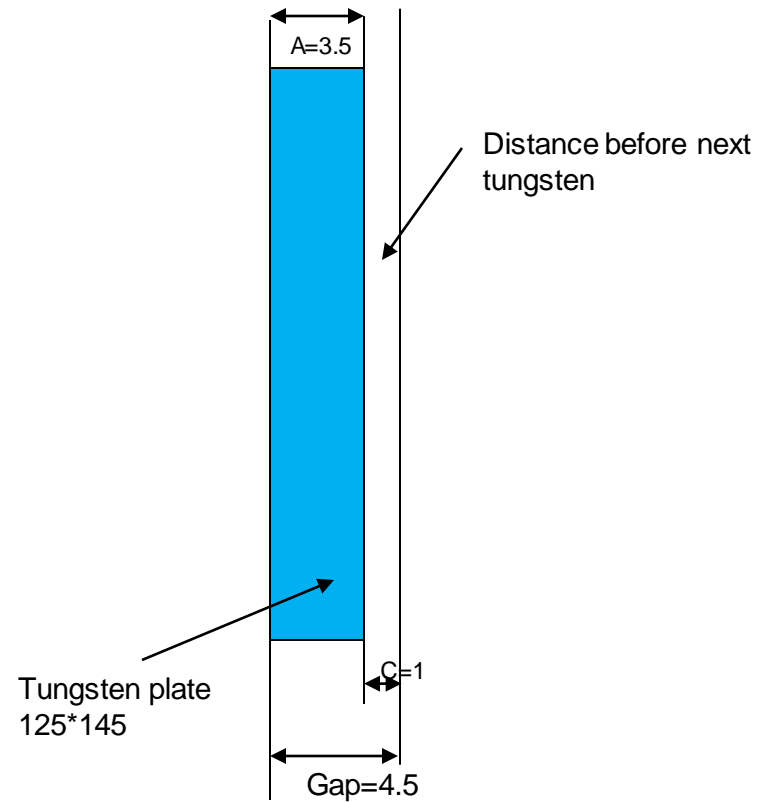
$C=2\text{mm}$

→ We work with an offset of 5.5mm



$C=1\text{mm}$

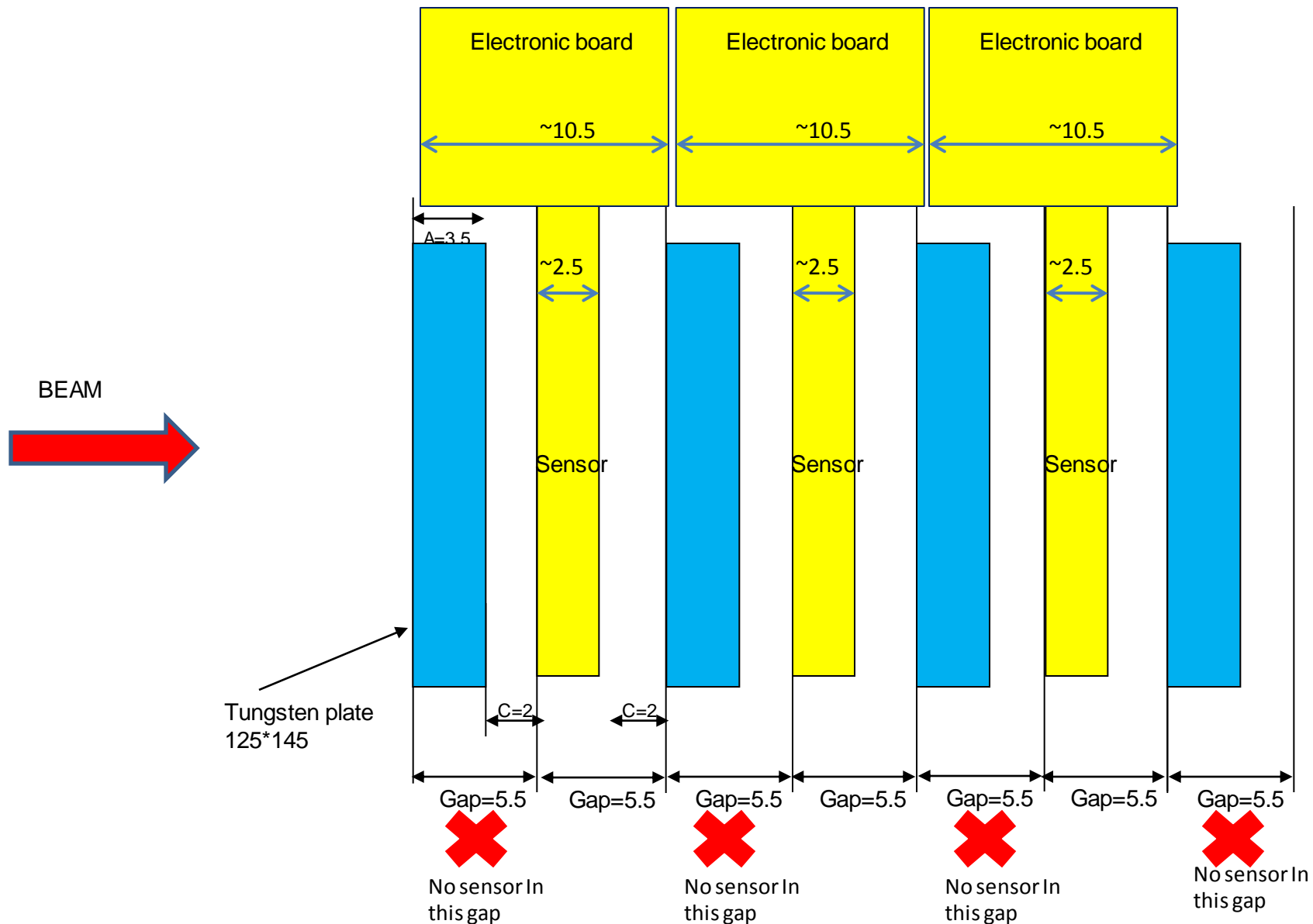
→ We work with an offset of 4.5mm



Additional information about the frame

What we can do with C=2mm:

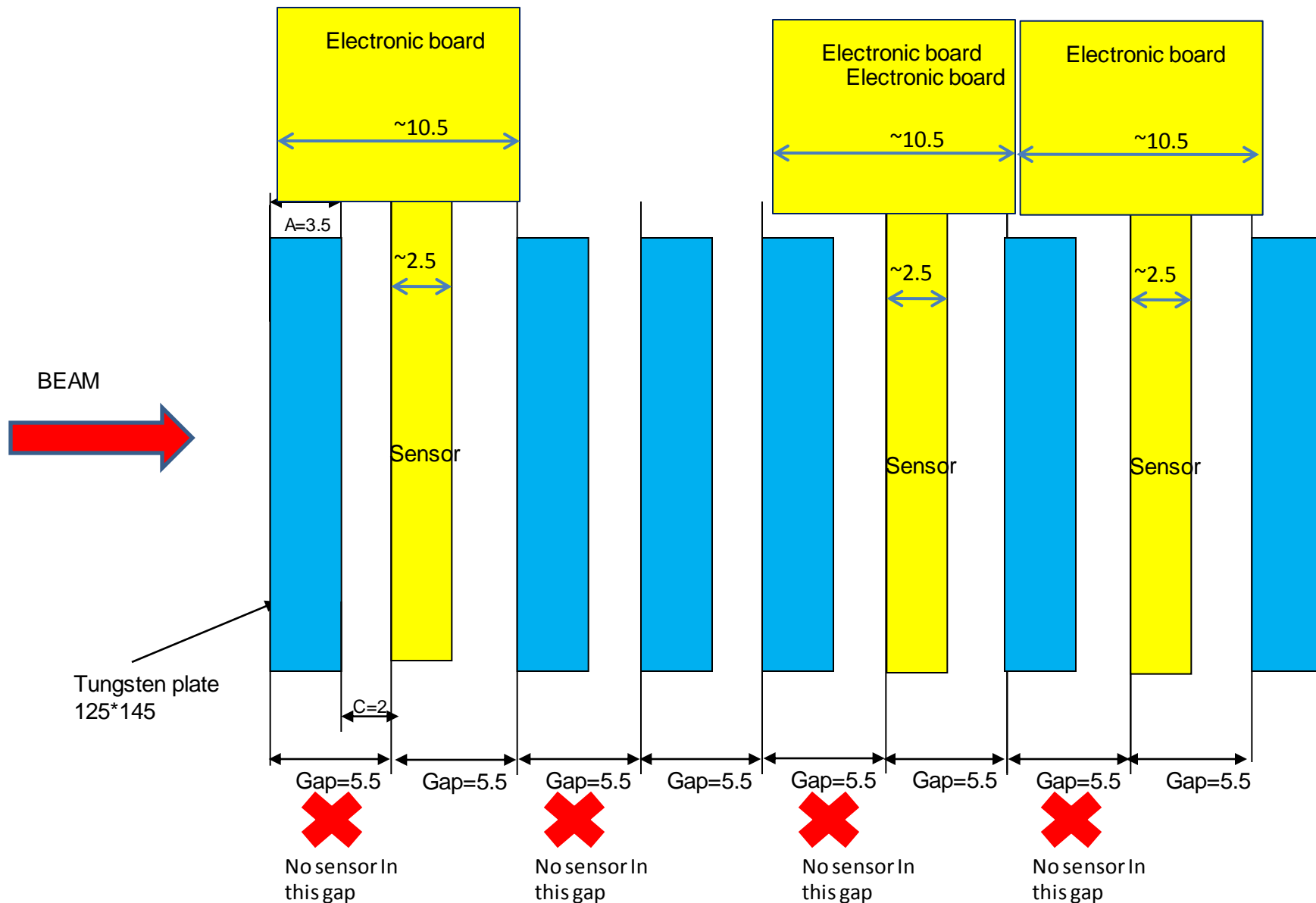
→ We work with an offset of 5.5mm



Additional information about the frame

What we can do with C=2mm:

→ We work with an offset of 5.5mm

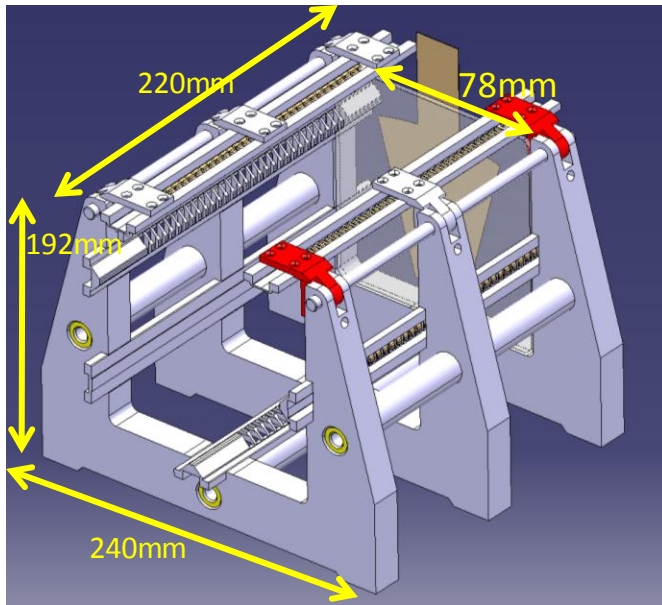


Comments:

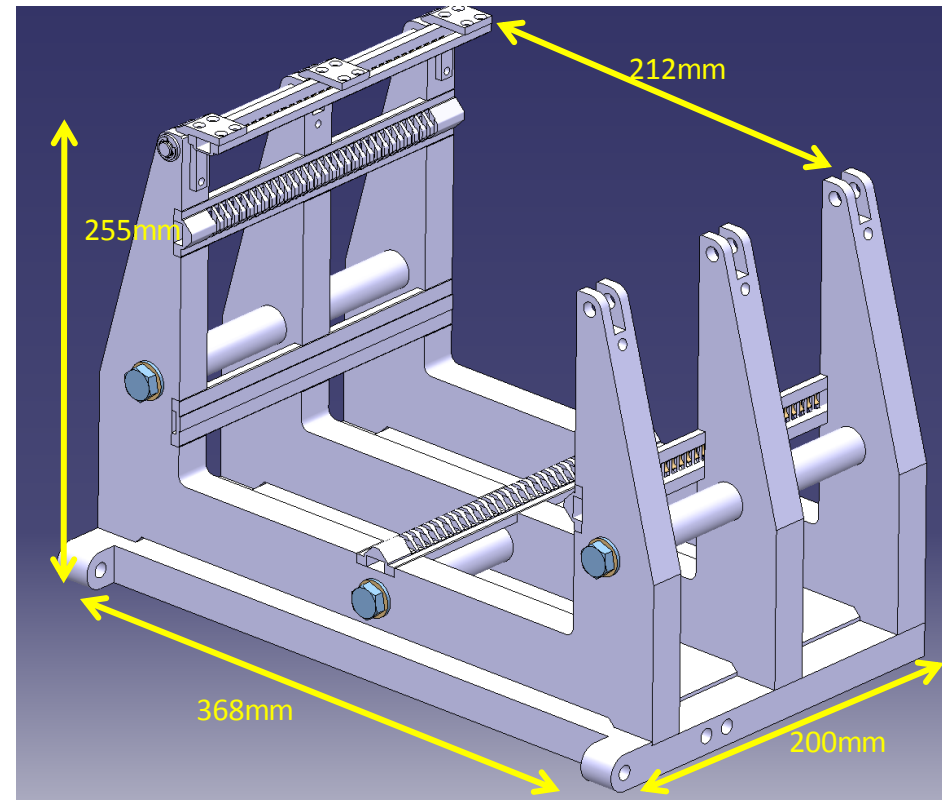
(Multi-parts structure (internally called ST0362847))

→ Able to work with distance between tungsten plates $C=2\text{ mm}$ and 1 mm

→ This is **not viable** for the $C=0.5\text{ mm}$ version: manufacturing combs is impossible in this case.



Former design
(May 2011, Predeal)



New design new dimensions,
adapted to the existing electronics