AIDA
Infrastructure for very forward calorimeters

30/04/2013

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Overview

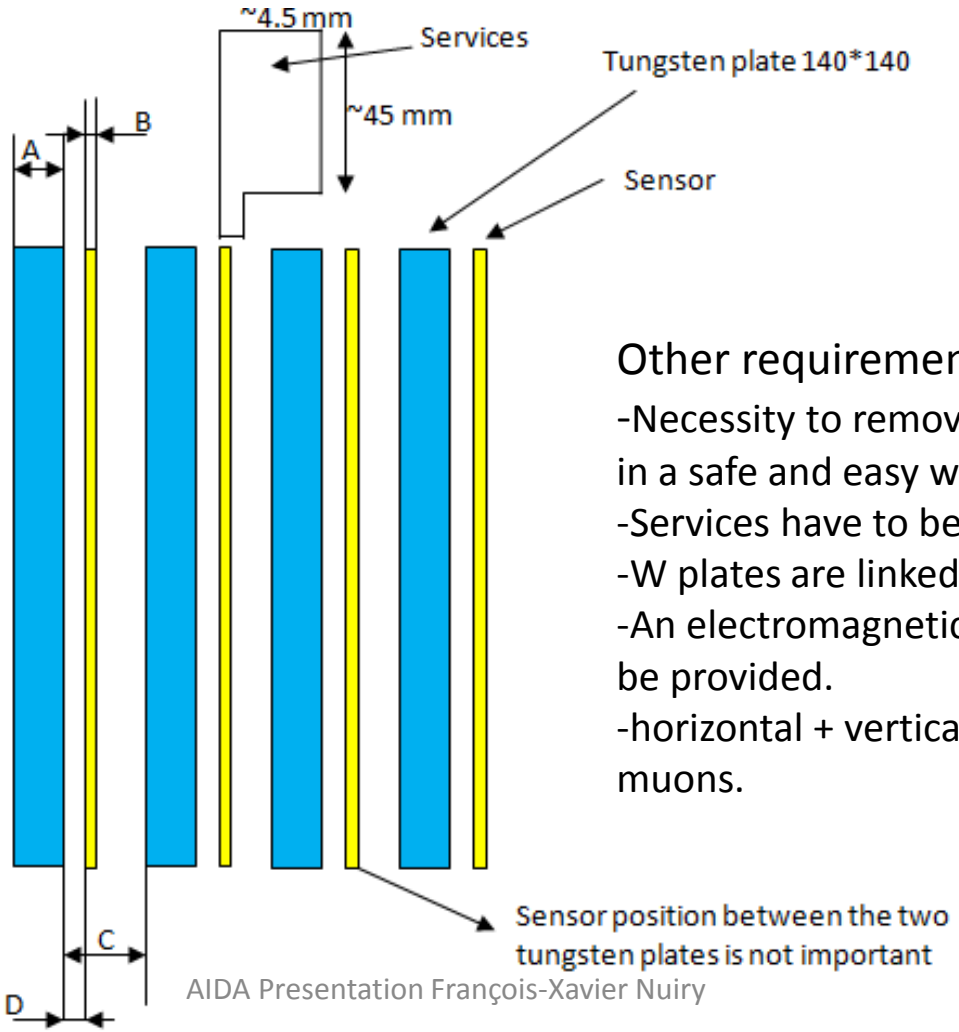
- Requirements
- AIDA very forward calorimeter design – reminder –
- Tungsten plates status
- Tungsten assemblies in permaglass frames
- Metrology with tungsten plates – Design validation –

→Measurements with 2 tungsten plates (Horizontal beam)
→Measurements with 5 tungsten plates (Horizontal beam)
→Measurements with 5 tungsten plates (Vertical beam)

- Further integration tests (services, cooling)
- Summary
- Appendix

Requirements

- Design and manufacturing of a mechanical structure for tungsten plates and silicon sensors.
- A=3.5±0.5mm B=0.32±0.015mm **C=2, 1, or 0.5 ±0.05mm** D=not really important

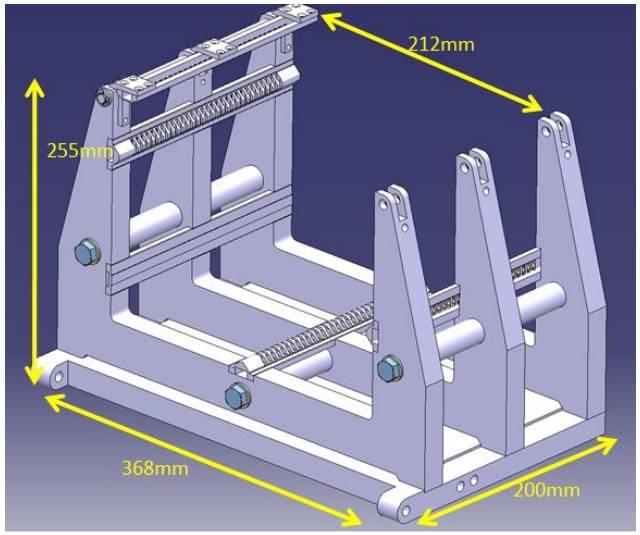


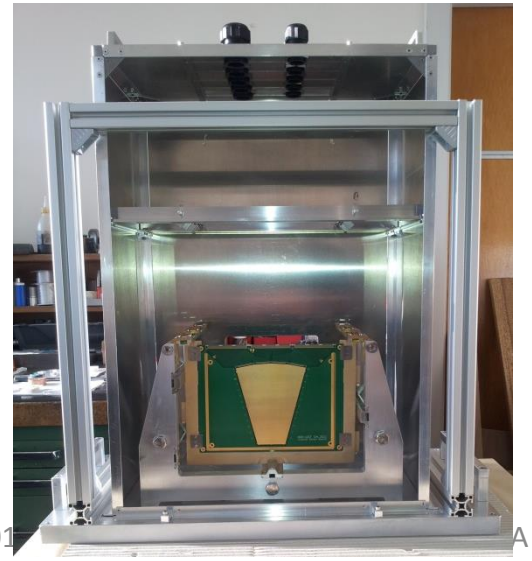
Other requirements:

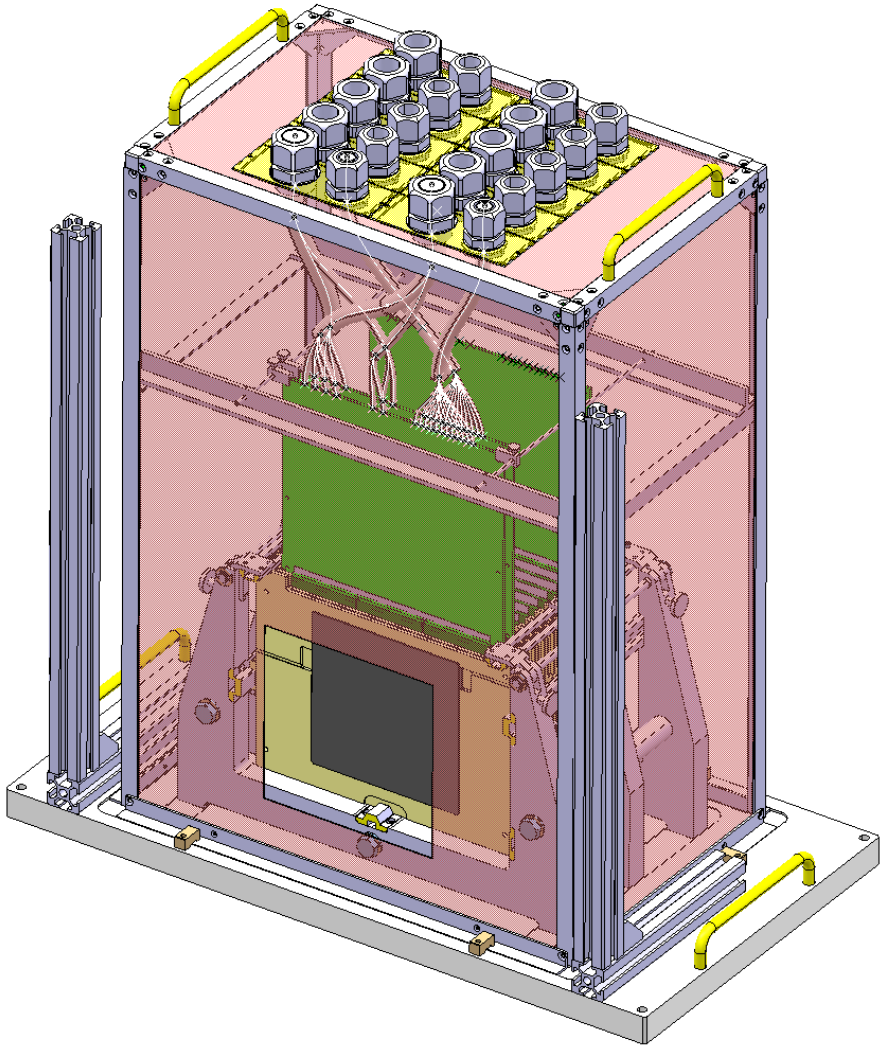
-Necessity to remove sensors and tungsten in a safe and easy way.
-Services have to be held.
-W plates are linked to the ground.
-An electromagnetic + light shielding has to be provided.
-horizontal + vertical position for cosmic muons.

Global design – reminder –

- Cradle, combs, permaglass frames + W plates, hood, services supports
- Able to work with 2mm and 1mm gap between tungsten plates







Tungsten plates status

	PLATES	TOLERANCE ASKED	PLANSEE PLATE 1	PLANSEE PLATE 2	PLANSEE PLATE 3	PLANSEE PLATE 4	PLANSEE PLATE 5
PLANSEE	Flatness plan A	10µm	90	10	9	3	7
	Position opposite plan	40µm	40	68	48	56	24

	PLATES	TOLERANCE ASKED	MG SANDERS PLATE 1	MG SANDERS PLATE 2	MG SANDERS PLATE 3	MG SANDERS PLATE 4	MG SANDERS PLATE 5	MG SANDERS PLATE 6
MG SANDERS	Flatness plan A	10µm	36	70	108	138	137	37
	Position opposite plan	40µm	214	90	132	288	294	88

	PLATES	TOLERANCE ASKED	Steel plate 1*	Steel plate 2*
STEEL PLATES	Flatness plan A	10µm	13	14
	Position opposite plan	40µm	48	46

*Steel plates machined in Belgium in the *Britte Mustad* company

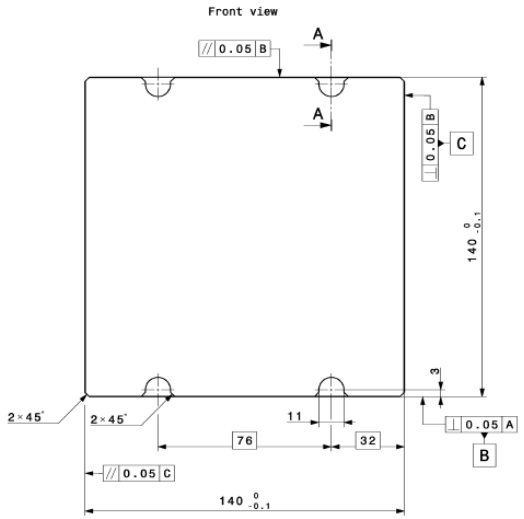
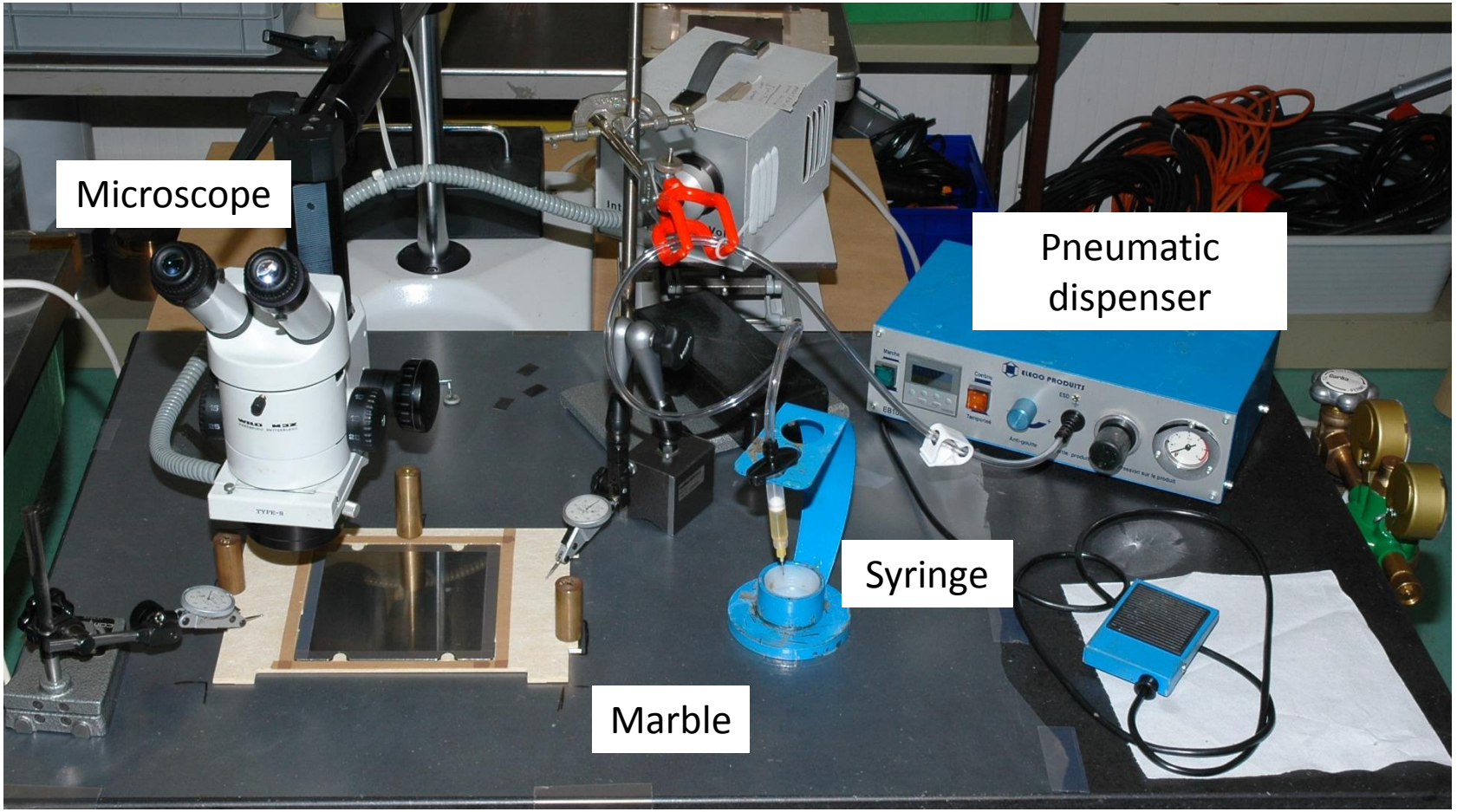
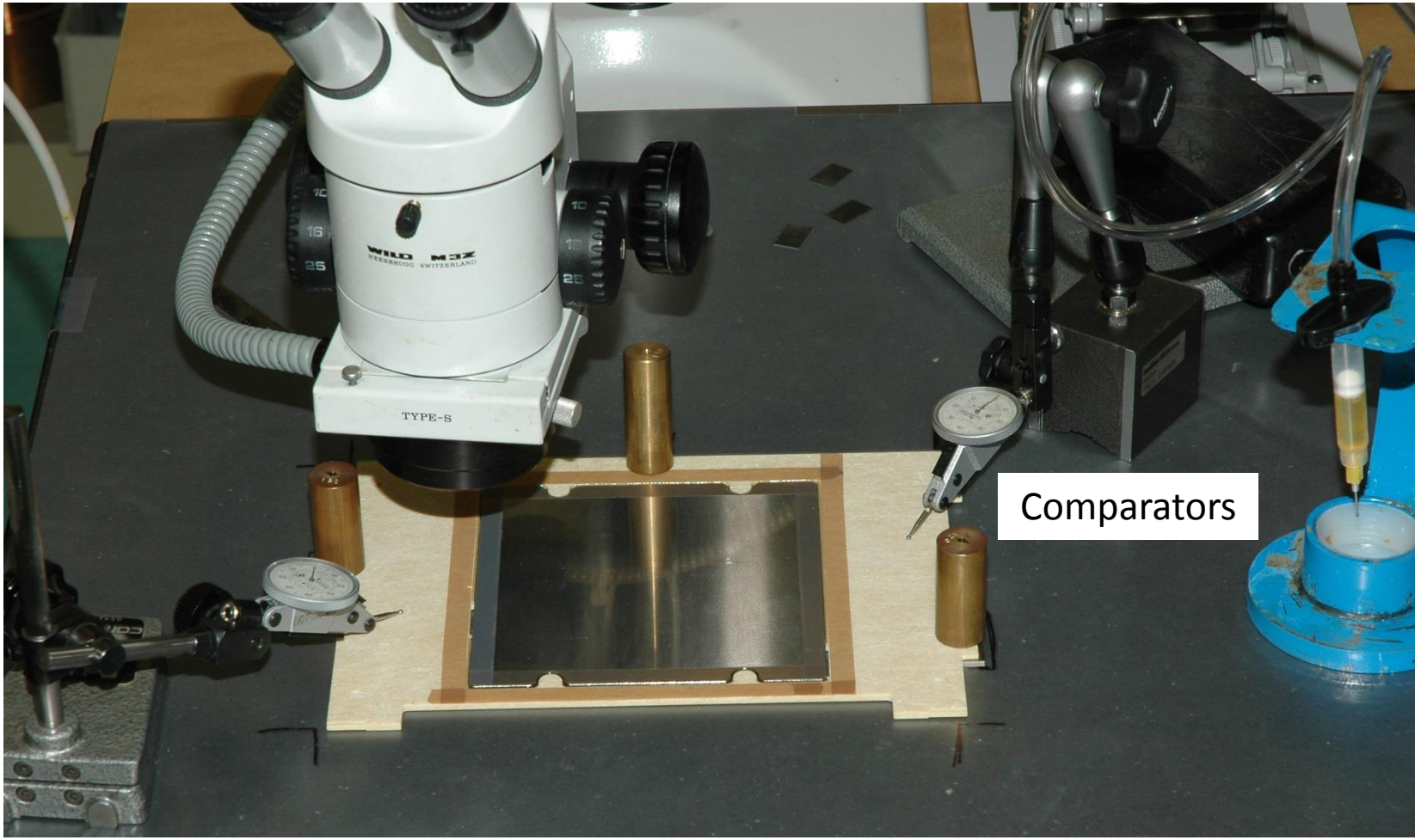


Plate arrived beginning of April at CERN

Tungsten assemblies in permaglass frames



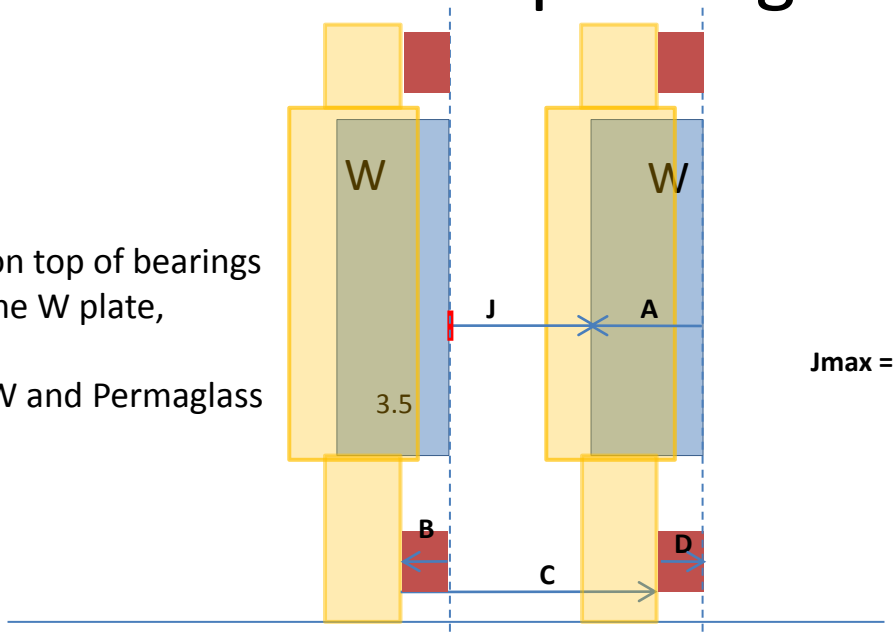
Tungsten assemblies in permaglass frames



Tungsten assemblies in permaglass frames

On the marble

1. W plate put on the marble
2. Three red spacer are installed on top of bearings
3. Perm. frame installed around the W plate, supported only on 3 red spacers
4. Glue (Araldite 2011) between W and Permaglass

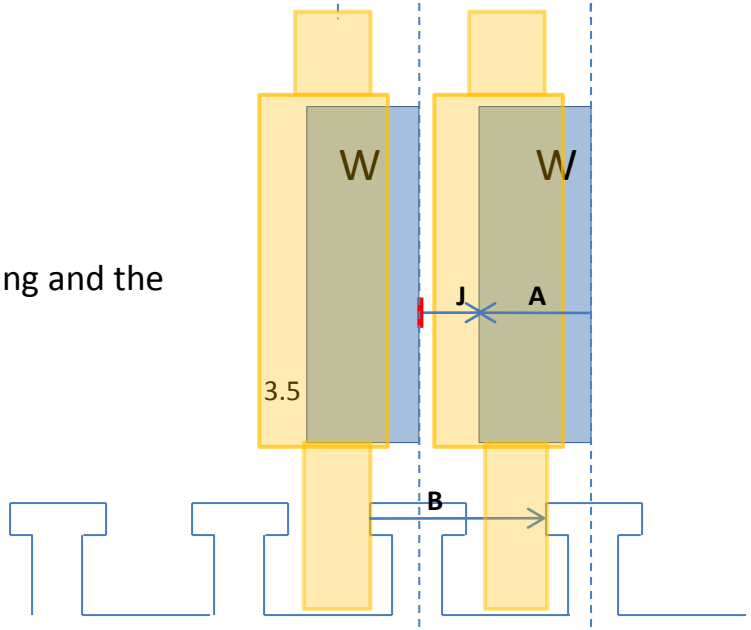


J=C+D-(A+B)
A=3.5 +/-25µm
B=2 +/-2µm
C=5.5 +/-20µm
D=2 +/-2µm

Jmax = 5.520+2.002-3.475-1.998=2.049mm

In the calorimeter

1. W + Permaglass insertion in combs
2. Accuracy given only by the W machining and the comb machining.



J=B-A

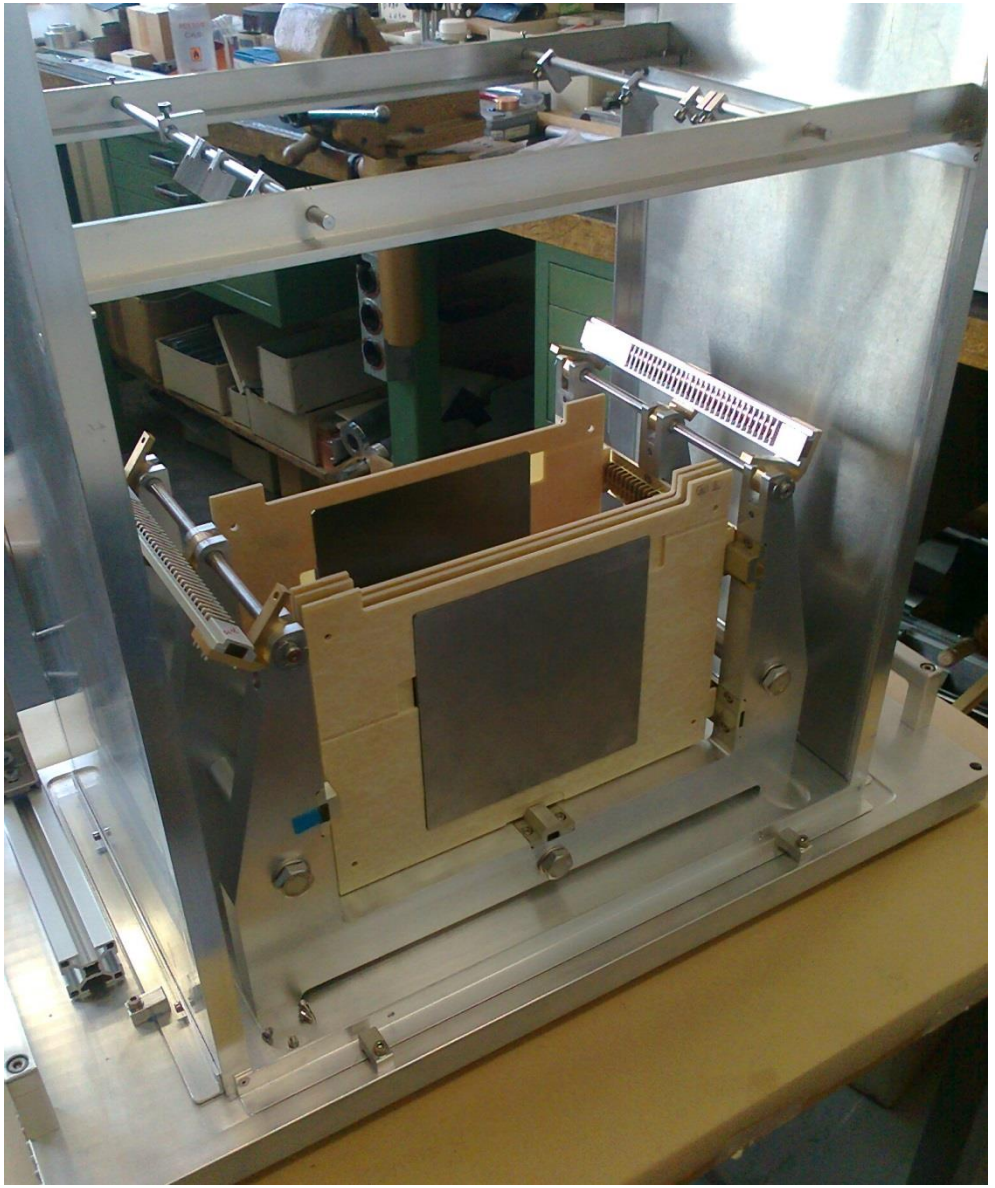
A min=3.475mm
A max=3.525mm

B min=5.480mm
B max= 5.520mm

J max= 5.520-3.470= 2.05mm
J min= 5.480-3.530= 1.95mm

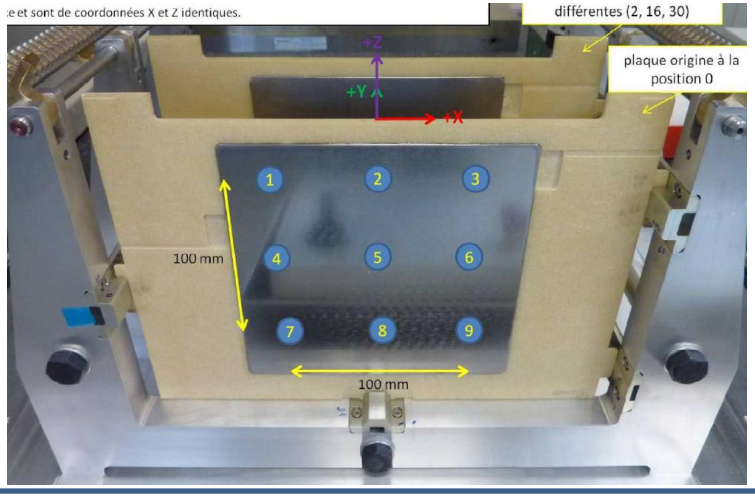
Tungsten assemblies in permaglass frames

- 5 assemblies have been realized with the 5 Plansee plates.
- The gluing operation went well and requires some preparations.
- The assemblies are able to be mounted vertically and horizontally (W weight~1.25kg).



Metrology with tungsten plates Design validation

- 9 points are probed on each plate, with the MMT machine.
- The distance point-point is measured by the machine.
- Only the **1mm gap configuration** (1mm gap combs) has been measured.



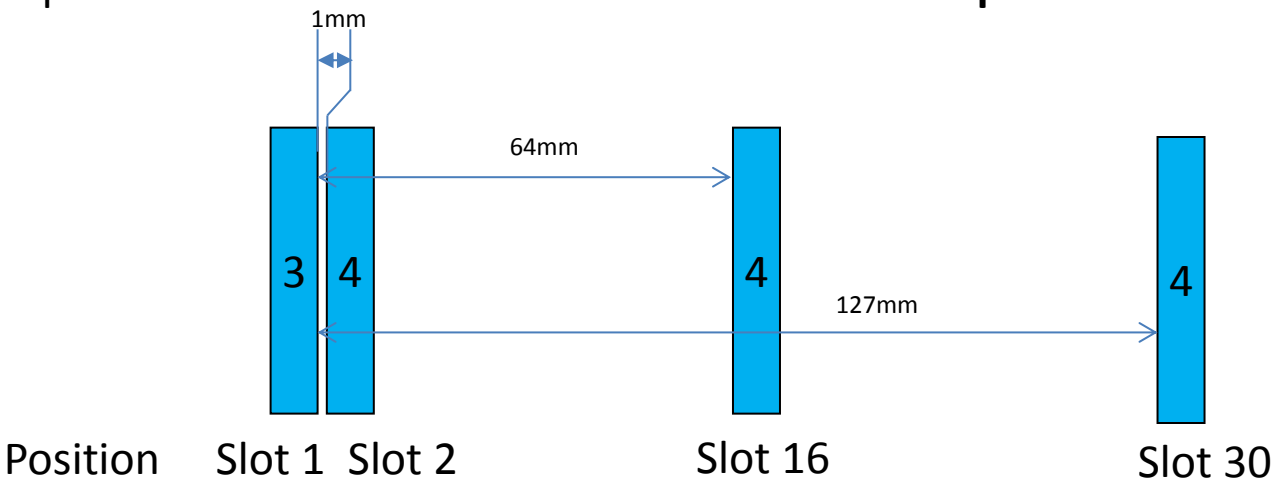
- 9 configurations have been tested with 2 plates (each time with 3 different positions)
- 4 configurations have been tested with 5 plates (each time with 2*2 different positions)
- Both orientations were tested (horizontal and vertical beam)

More than 50 measures where done which corresponds to a bit more than 900 probes!

- All results are available in the following EDMS document: 1276587

Metrology with tungsten plates

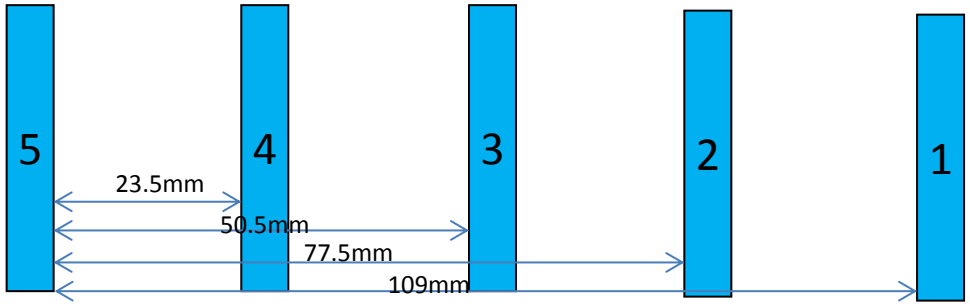
- First example: Measure of the distance between PLANSEE **plates 3 and 4**



Slot	Plate number	Plate average thickness	Theoretical distance – Distance measured
1	3	3.520	
			1.000 – 0.988
2	4	3.475	1.000 – 0.994
			64.000 – 63.981
16			64.000 – 63.993
			127.000 – 126.973
30			127.000 – 126.983

Metrology with tungsten plates

- Second example: Measure of the distance between 5 PLANSEE plates

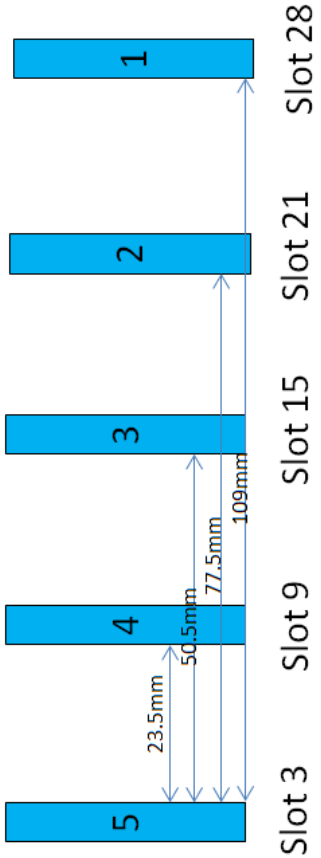


Position	Slot 3	Slot 9	Slot 15	Slot 21	Slot 28

Slot	Plate number	Plate average thickness	Theoretical distance – Distance measured	Distance N / N+1
3	5	3.490		
				23.526
9	4	3.475	23.500 - 23.526	23.508
			23.500 - 23.508	23.523
15	3	3.520	50.500 - 50.519	23.53
			50.500 - 50.508	23.494
21	2	3.470	77.500 - 77.533	23.477
			77.500 - 77.505	28.049
28	1	3.505	109.000 - 109.052	28.023
			109.000 - 108.999	

Metrology with tungsten plates

- Third example: **Vertical** measure of the distance between 5 PLANSEE plates



Slot	Plate number	Plate average thickness	Theoretical distance – Distance measured	Distance N / N+1
3	5	3.490		
				23.522
9	4	3.475	23.500 – 23.522	23.514
			23.500 – 23.514	23.507
15	3	3.520	50.500 – 50.507	23.499
			50.500 – 50.499	23.515
21	2	3.470	77.500 – 77.515	23.495
			77.500 – 77.495	28.043
28	1	3.505	109.000 – 109.043	27.991
			109.000 – 108.991	

Metrology with tungsten plates Conclusions

- In most of the configurations the +/-50 microns precision has been respected.

- The global shape of each plate is cross check with this 3D measurement

→A thin plate will give distances higher than a large plate.

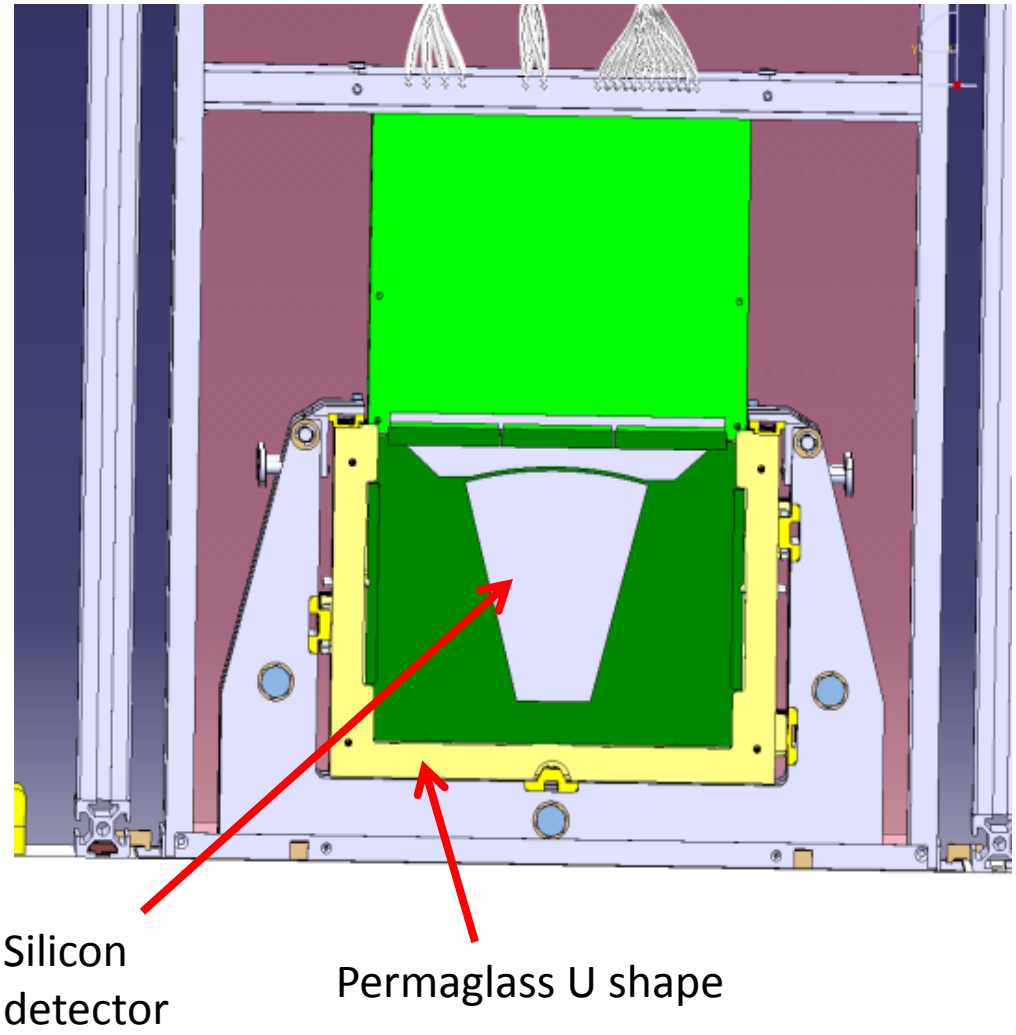
→the flatness default can be cross-checked.

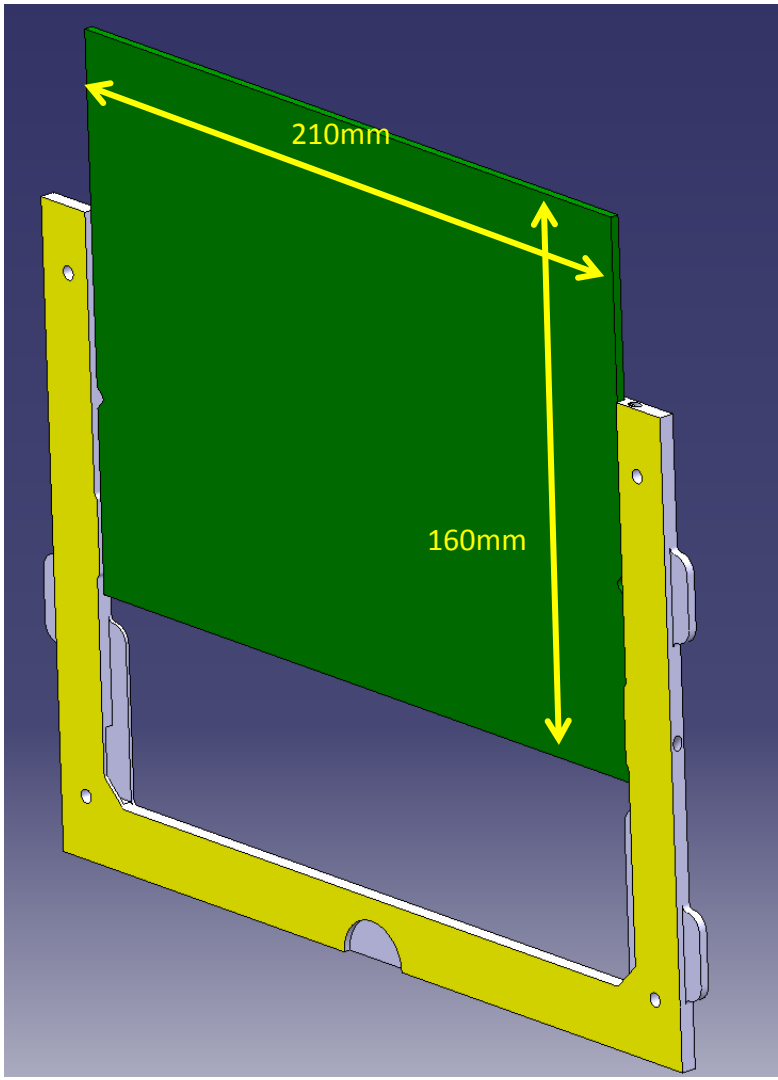
- Selecting Plansee plates 5, 4, 3, 2, (and 1), in this order, should always give good precision.

- An short training of the way to use the calorimeter is necessary.

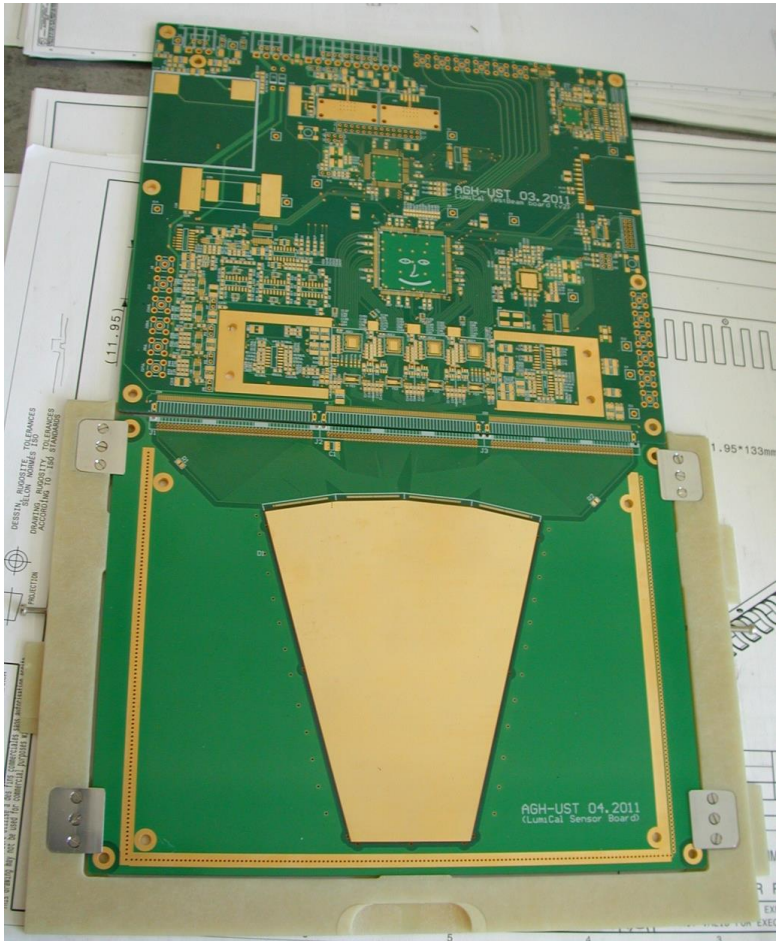
- No measurements were done with MG sanders plates but we should be in nearly all cases out of the +/-50microns asked.

Further integration tests





Further integration tests



Cooling tests?

Summary

- The tungsten and permaglass assembly has been fully validated.
- Measurements show that the precision in between 2 plate is good as well as the presicion in between several slots.
- Some preferred configurations are advised to be followed and tungsten plate 1 has to be placed with caution.

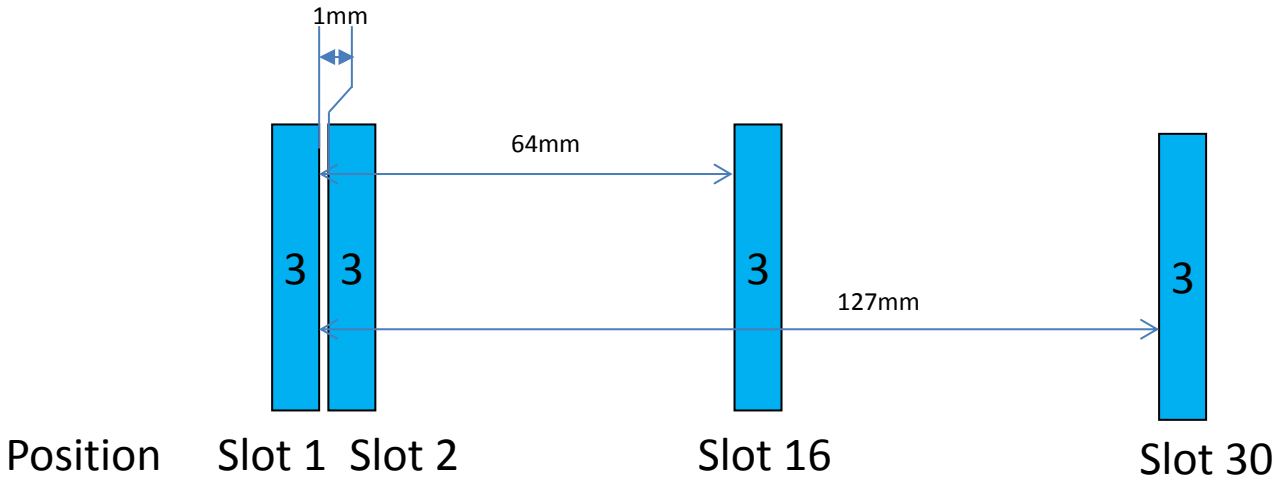
- More integration tests with services are still proposed to be done before the beam test with:

→Services

→Grounding connection

Metrology with tungsten plates

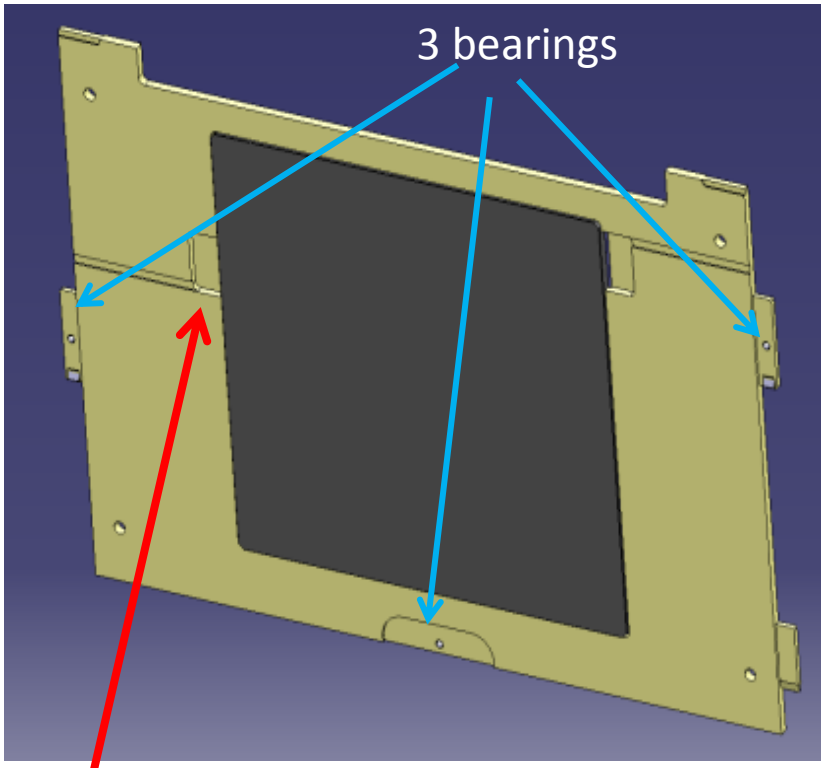
- Example: Measure of the distance between PLANSEE **plates 3 and 3**



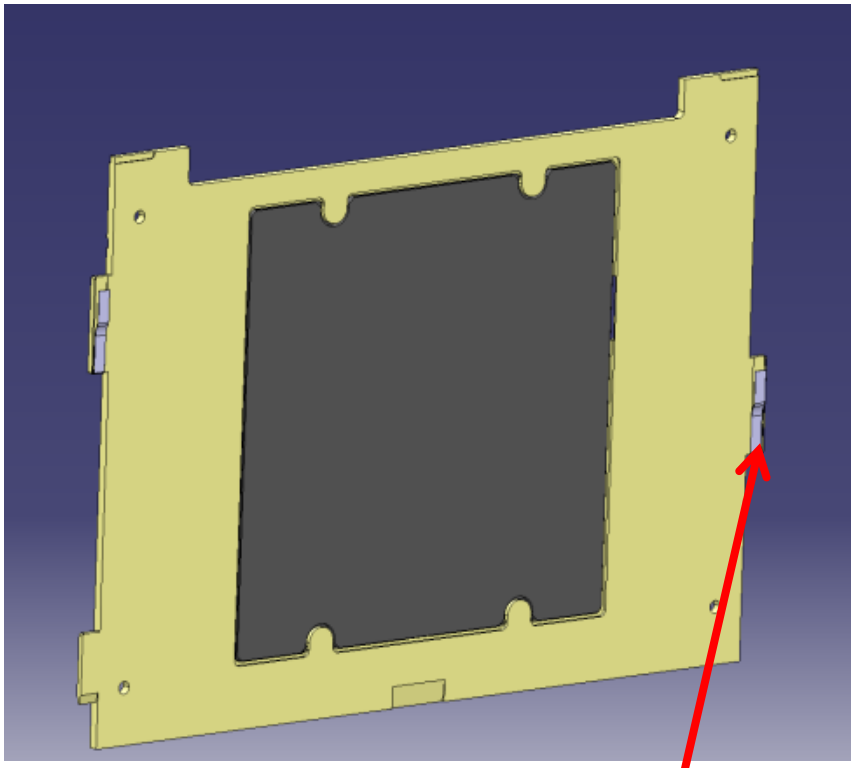
Slot	Plate number	Plate average thickness	Theoretical distance – Distance measured
1	3	3.520	
			1.000 – 0.983
2			1.000 – 0.994
			64.000 – 63.973
16			64.000 – 63.994
			127.000 – 126.970
30			127.000 – 126.990

AIDA very forward calorimeter design

Tungsten support



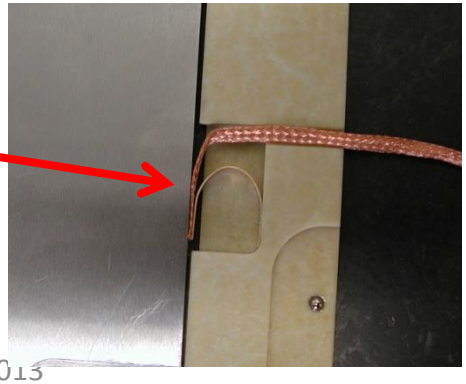
Front view

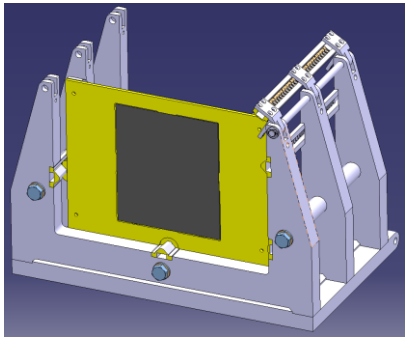


Back view

Spring

Ground

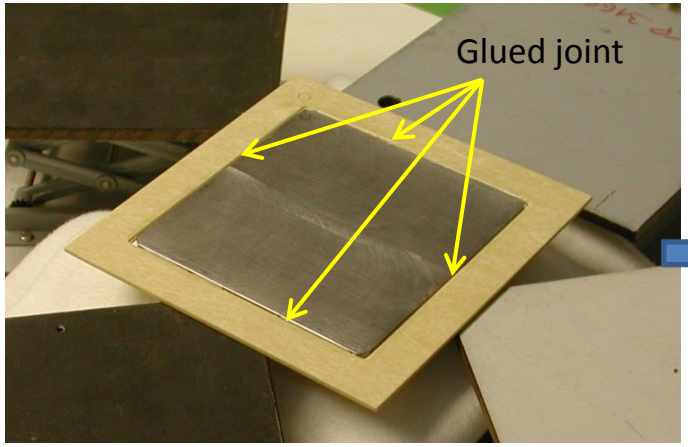


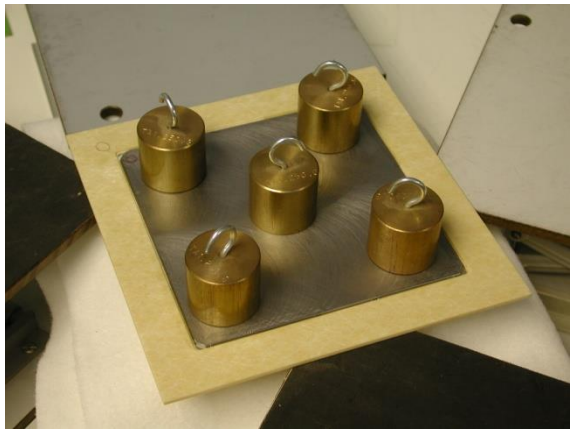


Material: Epoxy + glass fibres = PERMAGLAS

Tungsten plate is glued inside this frame

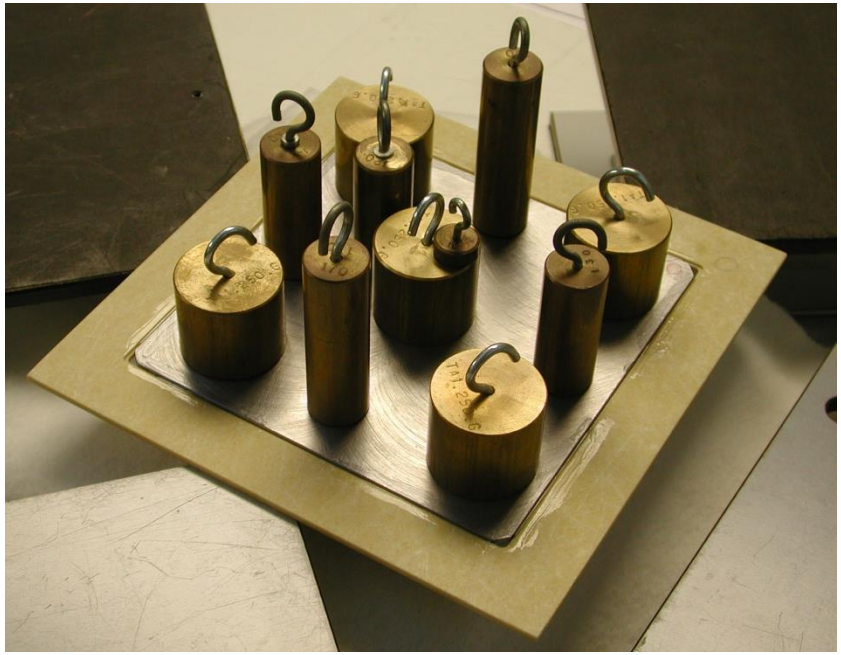
Calorimeter design validation
Tests on glued joints





1Kg

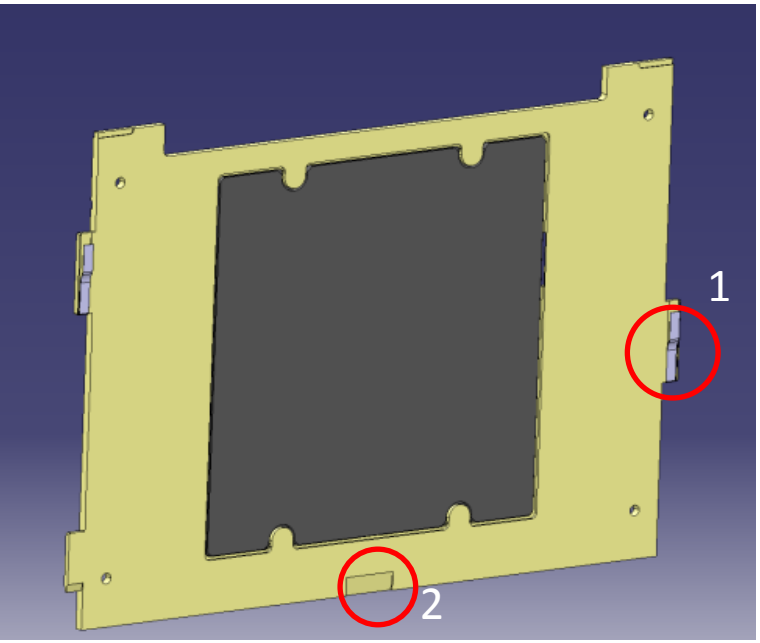
W plate + Permaglas assembly held on 3 points

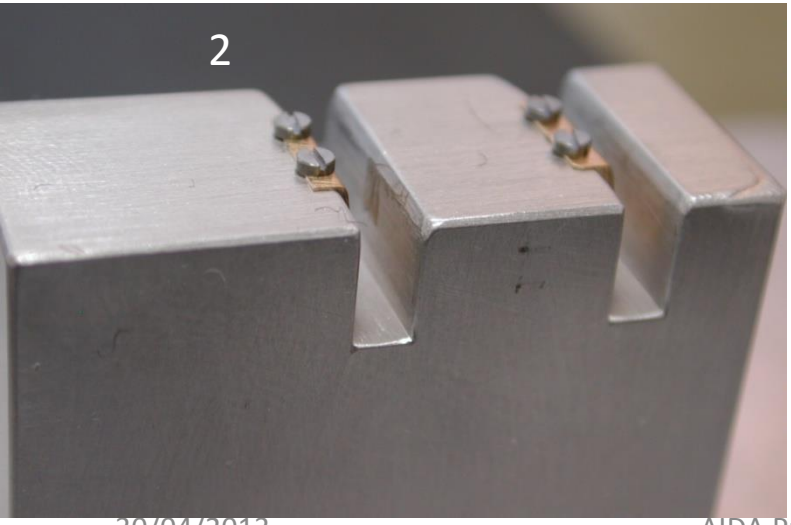


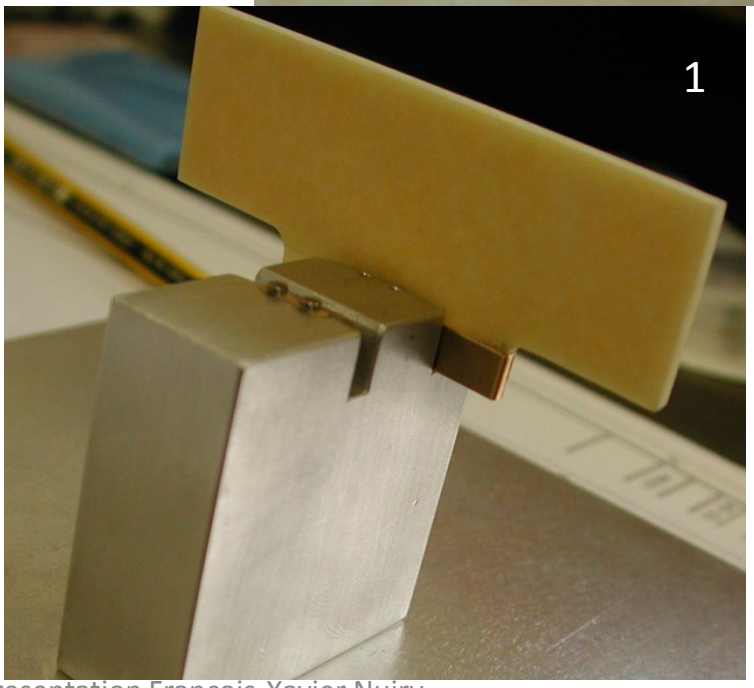
2Kg
During
24 hours

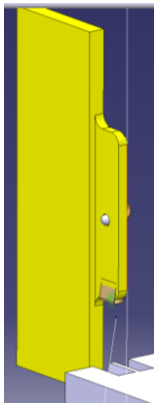
The tungsten plate can be easely removed from the frame while putting it in a methyl chloride bath (the test has been done).

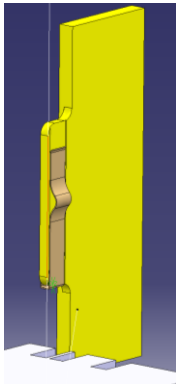
Calorimeter design validation
Tests on springs and bearings





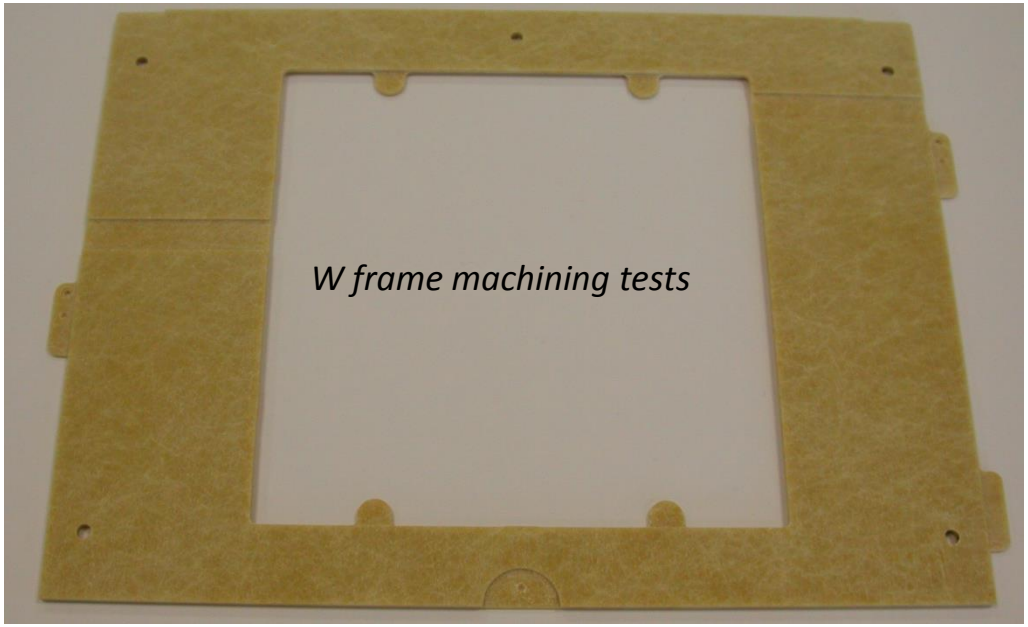






Calorimeter design validation
Manufacturing tests

W machining tests



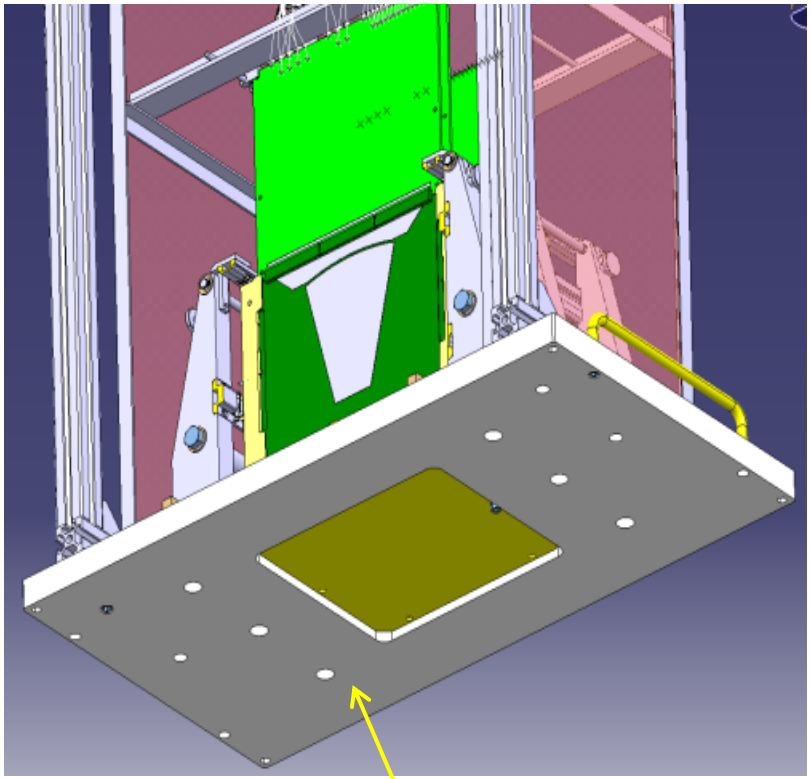
Detail of an ear

Groove for the glue

Groove for the grounding

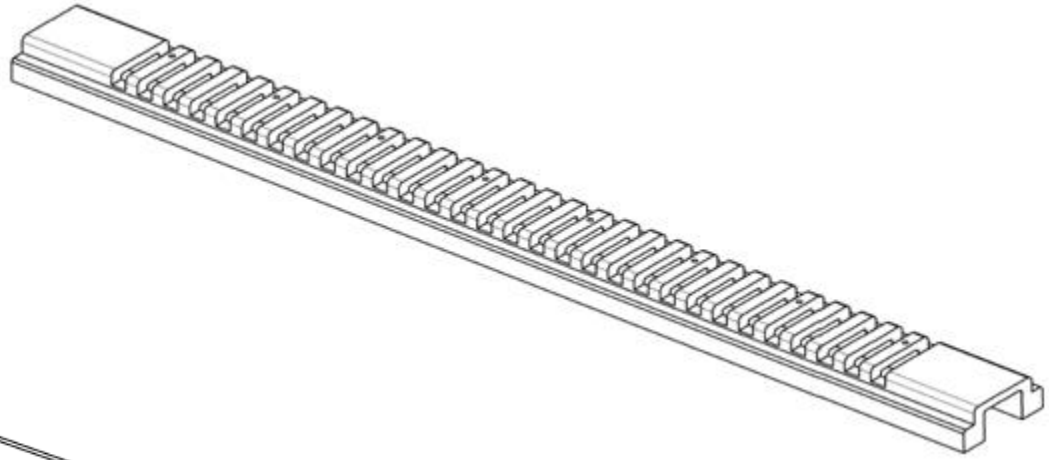
Manufacturing status
Mechanical frame

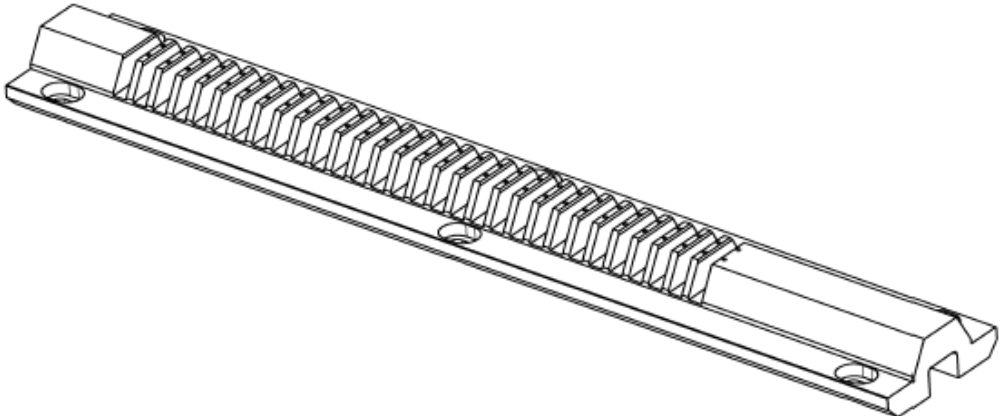
The frame is done

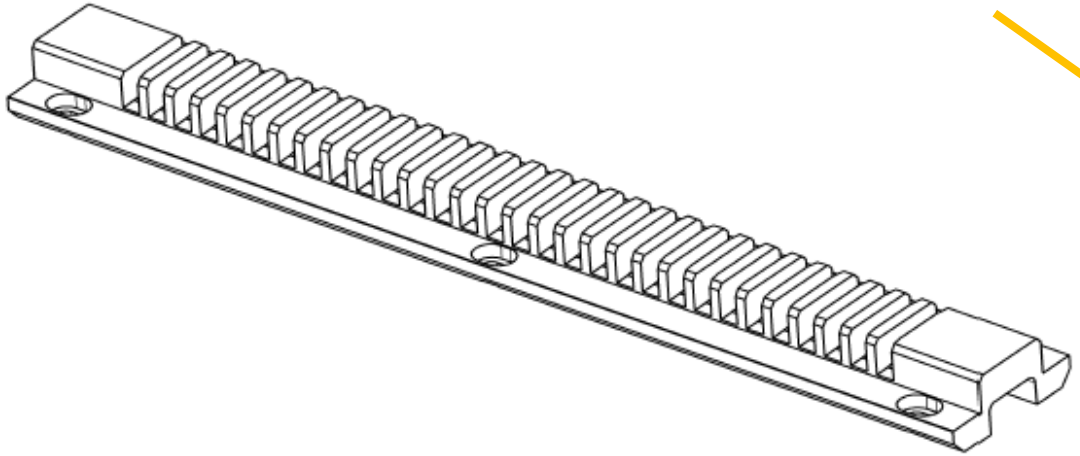


The support plate is under manufacturing @ CERN
End: ~30/04/2012

Manufacturing status
Combs

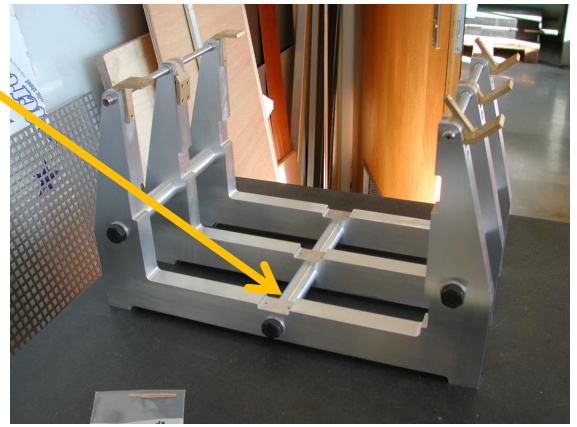






→3 combs types, and 2 sets
Subcontracted to a Belgium firm *BRITTE*

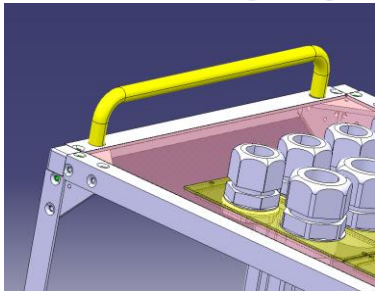
Delivery date: 15 Mai 2012

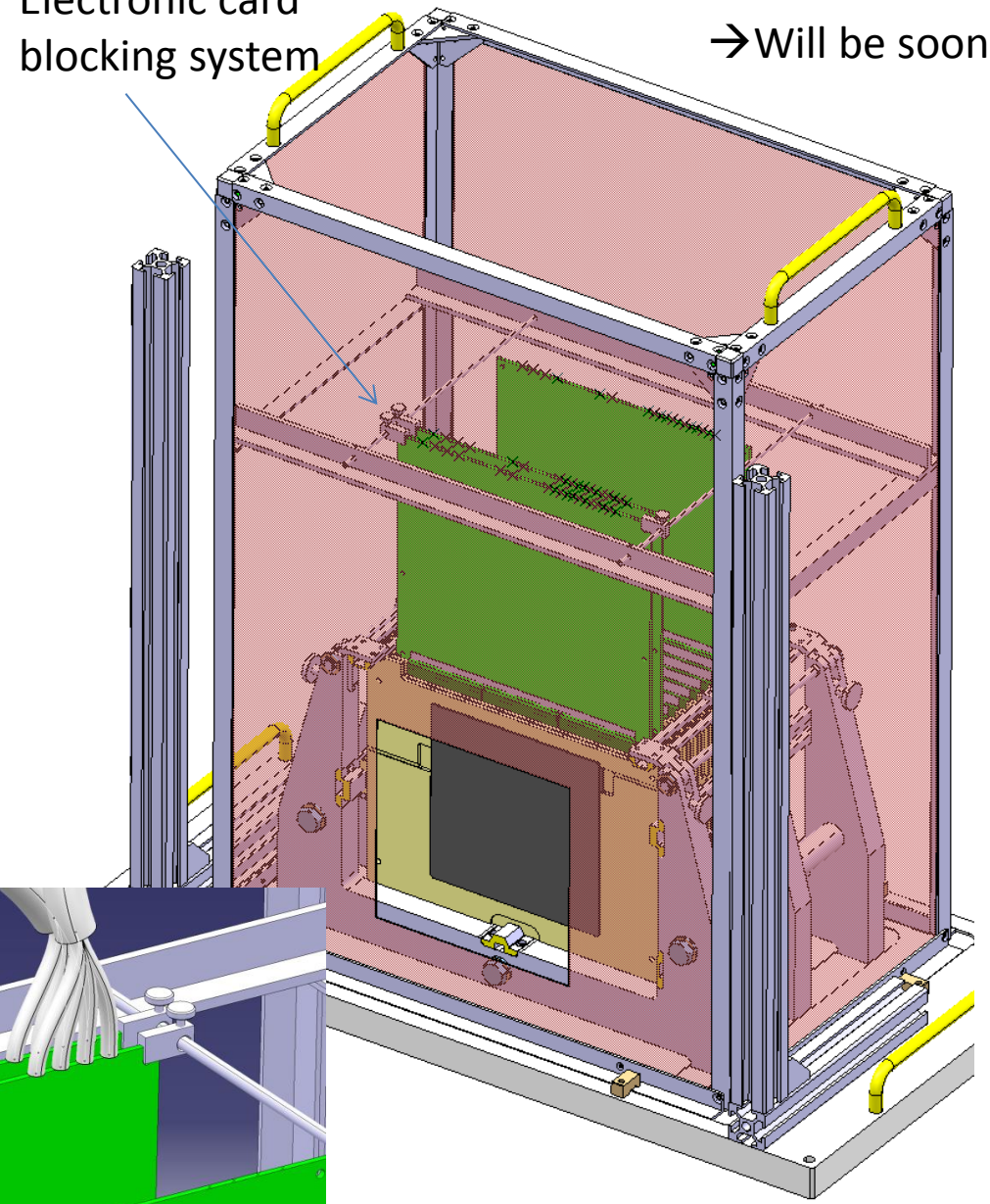


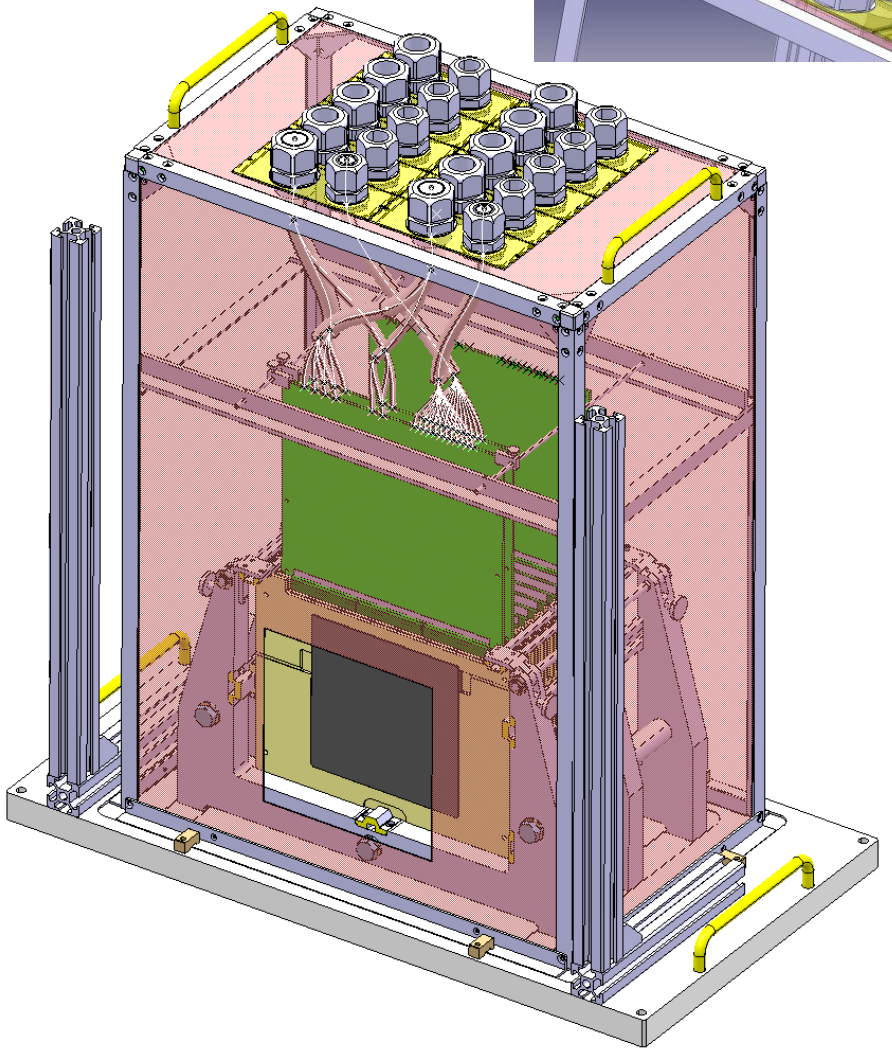
Manufacturing status
Hood & Services supports

Electronic card blocking system

→Will be soon manufactured (May/June)

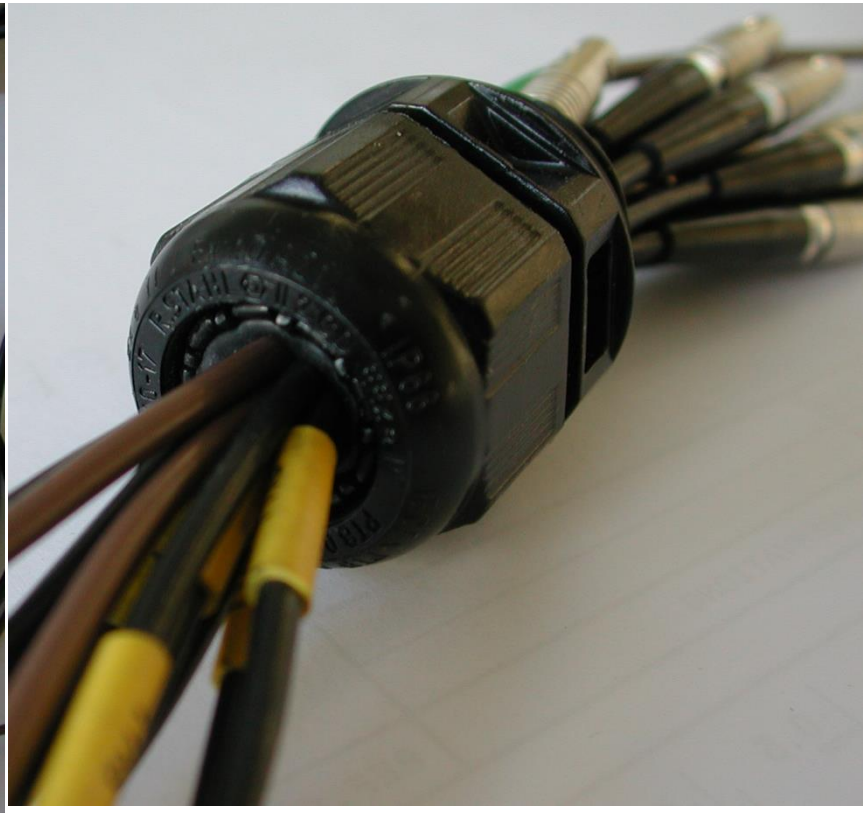






Manufacturing status
Hood & Services supports

Standard Compression Gland

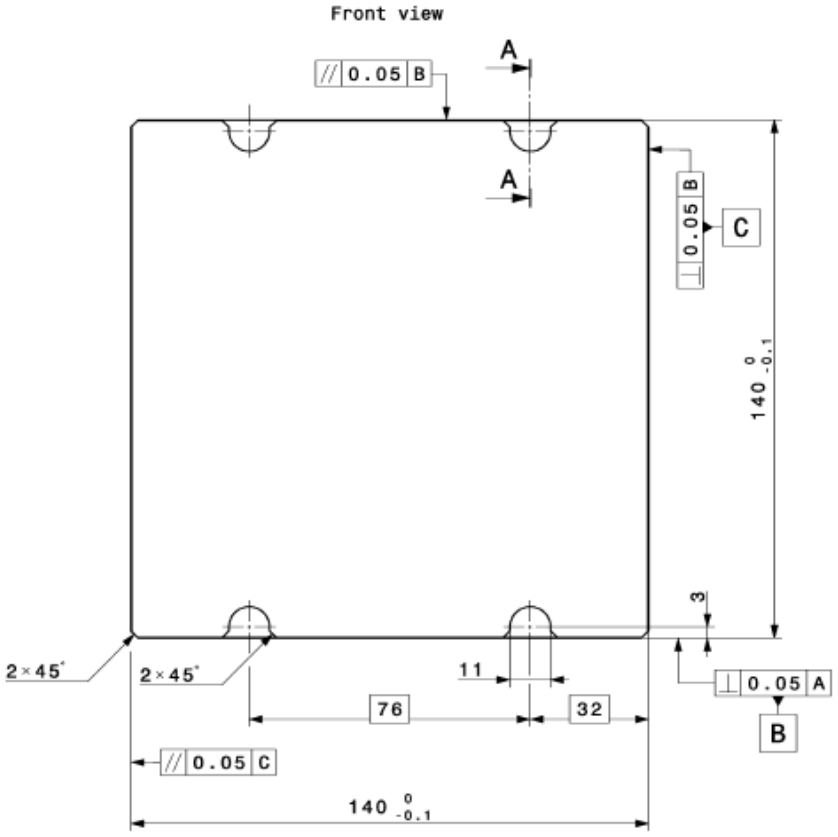


Manufacturing status
Tungsten plates

5 tungsten alloy plates ordered to each companies:

MG SANDERS
DENSAMET® TUNGSTEN

PLANSEE

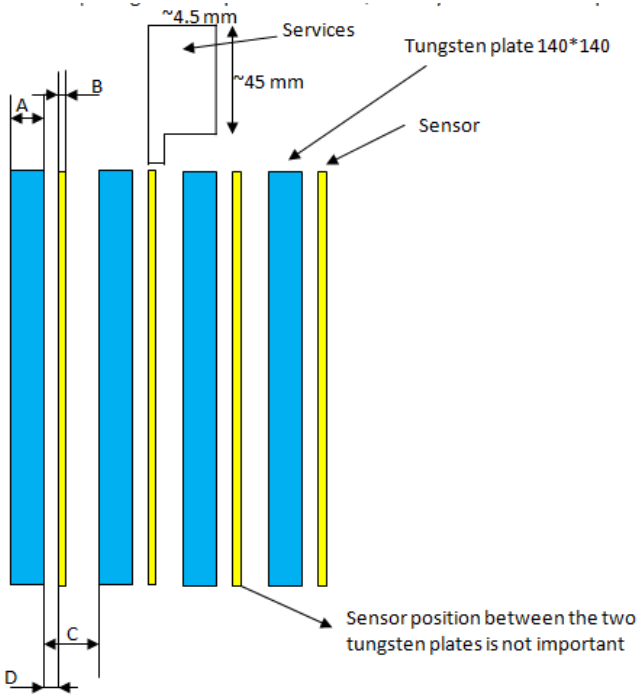


Summary

Group	Tasks / Parts	Manufacturer	Status	Delivery Dates
Manufacturing	Mechanical frame	Subcontractor + CERN	100% by beginning of May	-
	Combs	Subcontractor *BRITTE*	100% Manufactured by 15/05	15th May
	Springs	CERN	Top and bottom springs have to be done	5/05/2012
	Tungsten frame	Subcontractor *Resarm* + CERN	2 are ready, 3 more could be done at CERN Rest: subcontracted	*~ 1/07/2012*
	Silicon sensor frame	CERN	1 is ready, 4 have to be manufactured	~End of June
	Hood and services support	CERN	Drawings are done Parts have to be manufactured	*~ 1/07/2012*
Assembly & tests	Integration tests with dummy W plates	CERN	Could be done end of May	*~ 1/06/2012*
	W plates delivery	Plansee + MG sanders	Under manufacturing	*~ 15/06/2012*
	Hood assembly	CERN		*30/07/2012*
	W & Si frames assemblies	CERN		*30/07/2012*

The calorimeter should be ready, with 10 W plates by end of August.

Next Step...C=0.5mm



The idea:

-We use the same tungsten plates

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

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

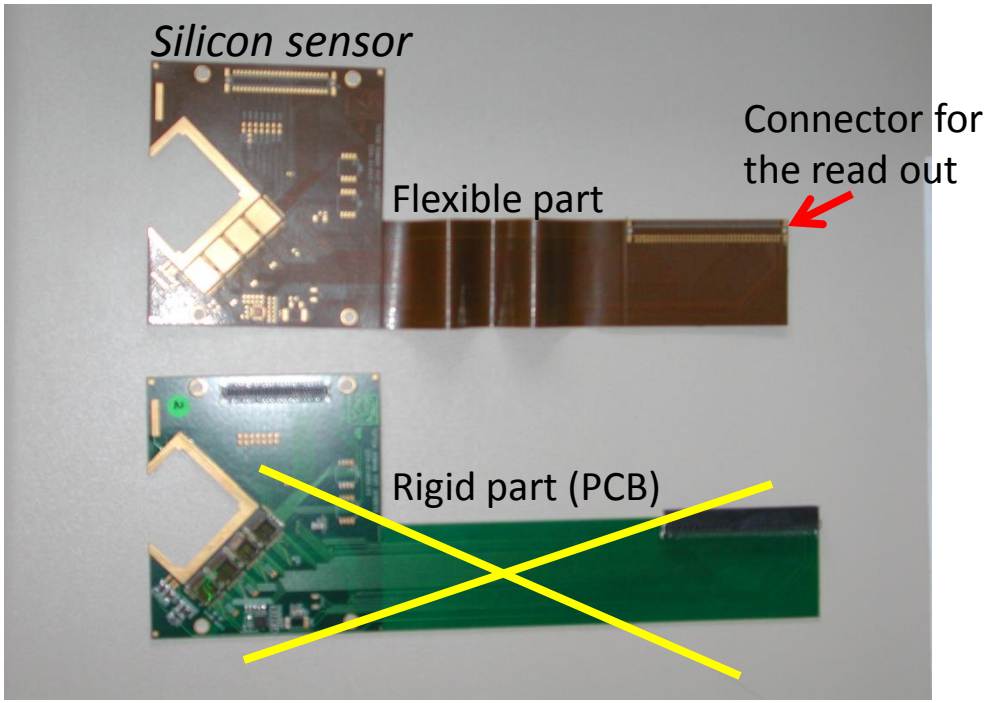
-We could realise a sliding kinematic between each tungsten plate, in order to reach the 0.5mm gap between each W plate.

-A new mechanical frame is mandatory

Next Step...C=0.5 mm

The most important for us:
Realising a flexible link between the sensor and the read out.

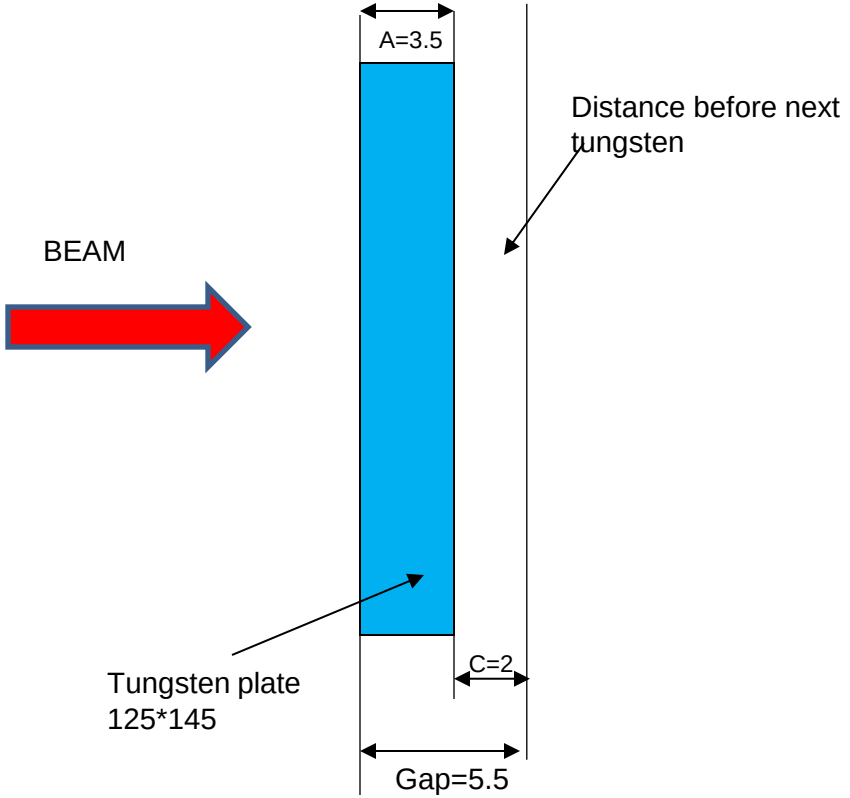
Something similar to this example:



Appendix 1:
Additional information about the frame

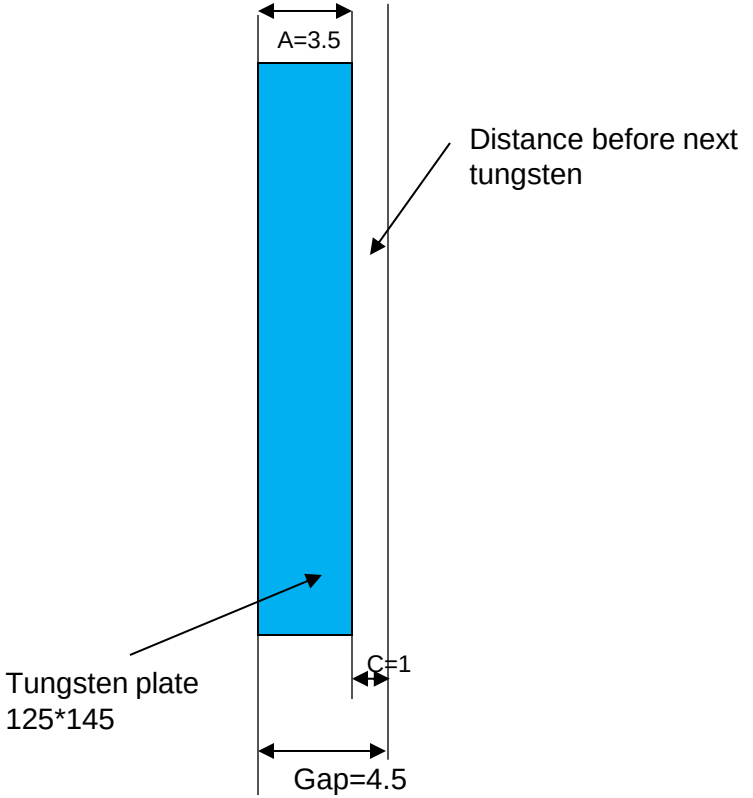
C=2mm

→ We work with an offset of 5.5mm



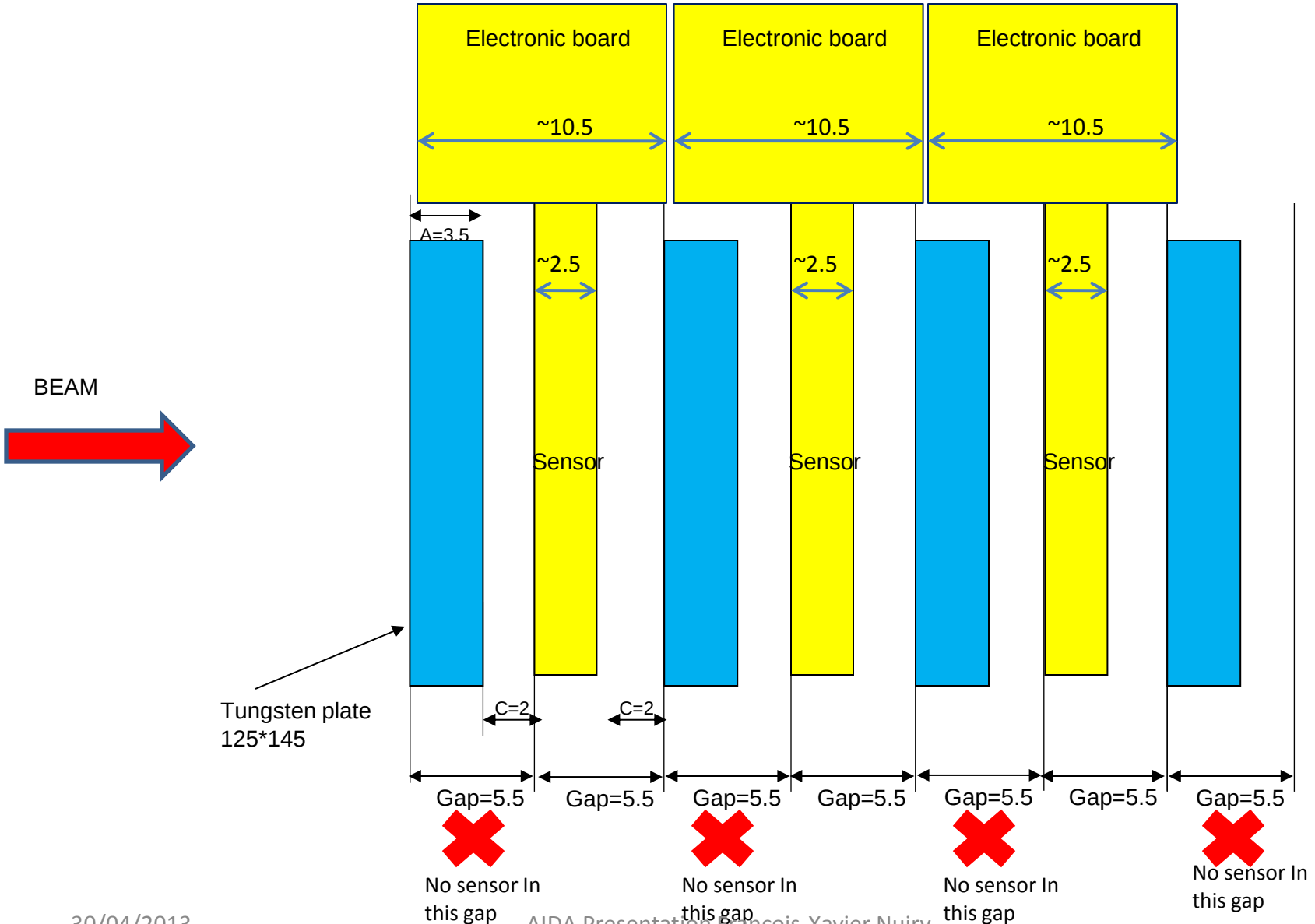
C=1mm

→ We work with an offset of 4.5mm



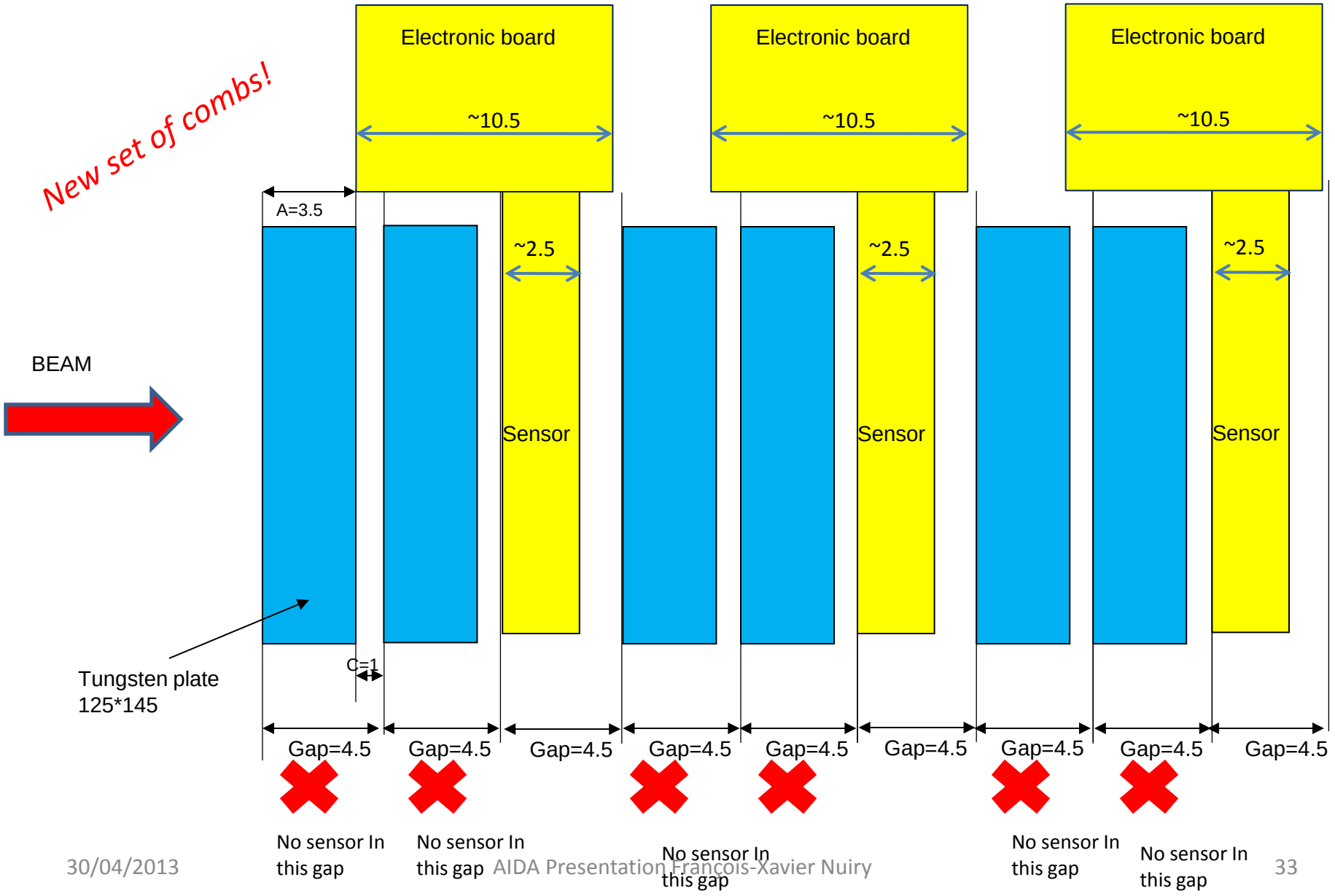
C=2mm between each tungsten

→ We work with an offset of 5.5mm



C=1mm between each tungsten

→ We work with an offset of 4.5mm



Appendix 2: Additional information about the frame

What we can do with C=2mm:

→ We work with an offset of 5.5mm