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STATUS OF LEM PRODUCTION AND QA/QC + TEST OF LEM+ANODE+CRP ASSEMBLY

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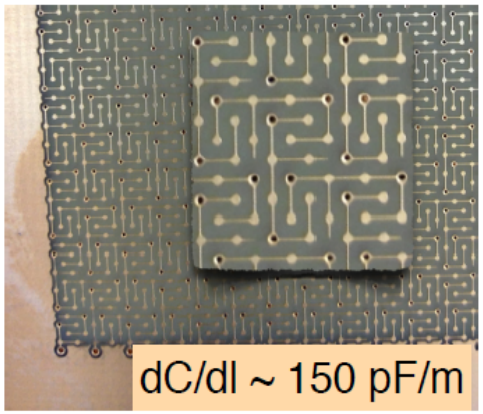
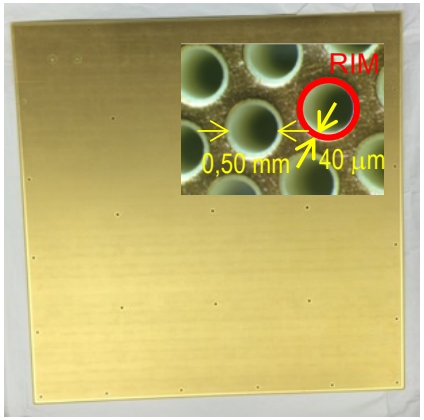
Y. Pénichot, Y. Piret, M. Zito (Irfu), S. Murphy (ETHZ)

Anode



LEM



WA105 integration vidyo meeting, june 30th 2017

LEM PRODUCTION +QA/QC STATUS

- ELTOS requested from PANASONIC to increase by 0,02 mm the mean thickness of the 0,98 mm thick current “standard” material used up to now by ELTOS. Thickness measurements by ELTOS on a batch of samples were not satisfactory in terms of mean thickness (close to 1,01 mm) and thickness uniformity. We decided to go on and launch the production with the 0,98 mm thick PANASONIC material.

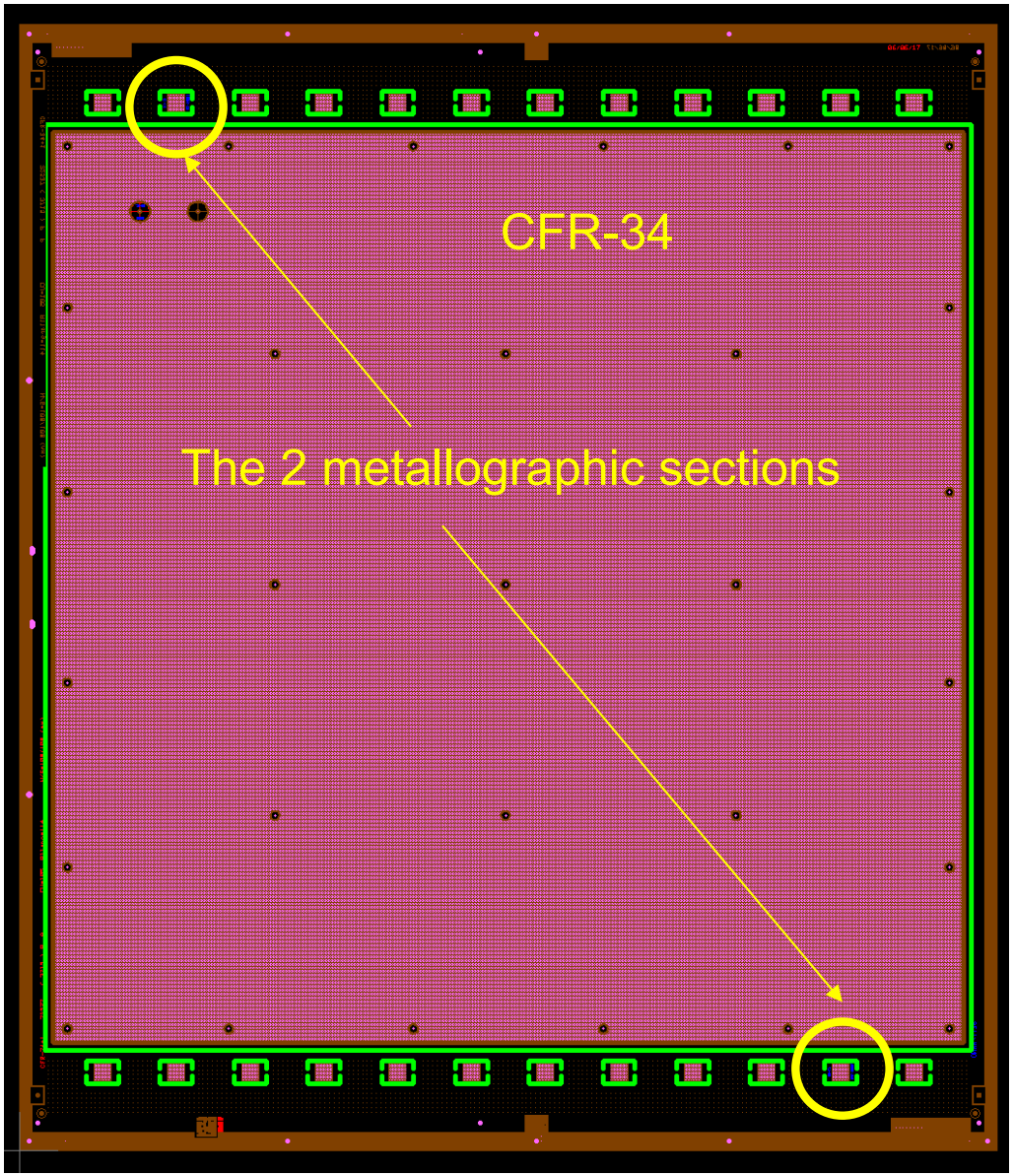
- Meanwhile, we finalized with ELTOS the Gerber for production. 2 LEMs (S/N A001 & A002) were produced from the current 0,98 mm thick material in order to qualify the production by ELTOS and the QA/QC at Saclay. These 2 LEMs were just delivered wednesday june 28th, and QA/QC is on-going.

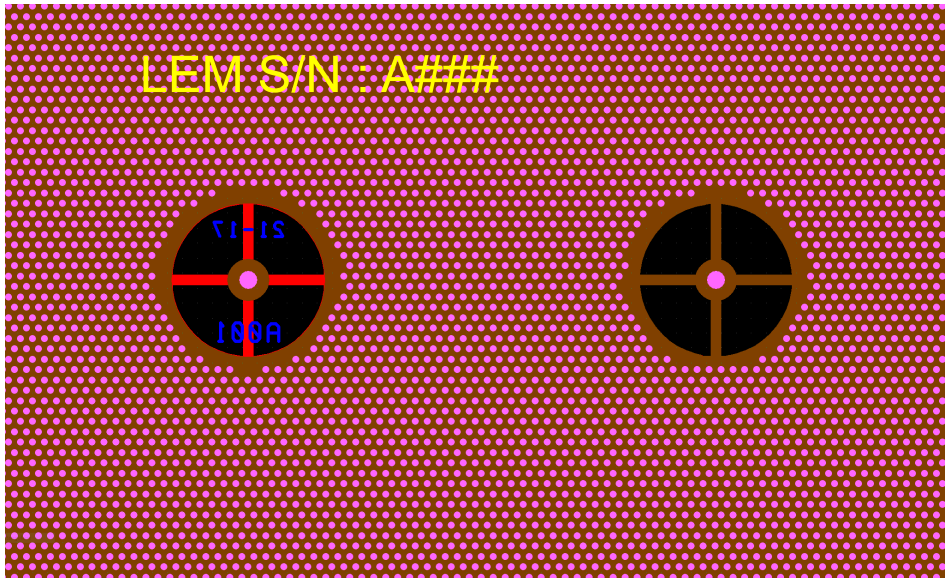
- The production review will be held july 6th at ELTOS in order to discuss the ELTOS QA/QC, the QA/QC done at Saclay, and launch the production. The production rate is not yet known and will be discussed and fixed at this meeting.

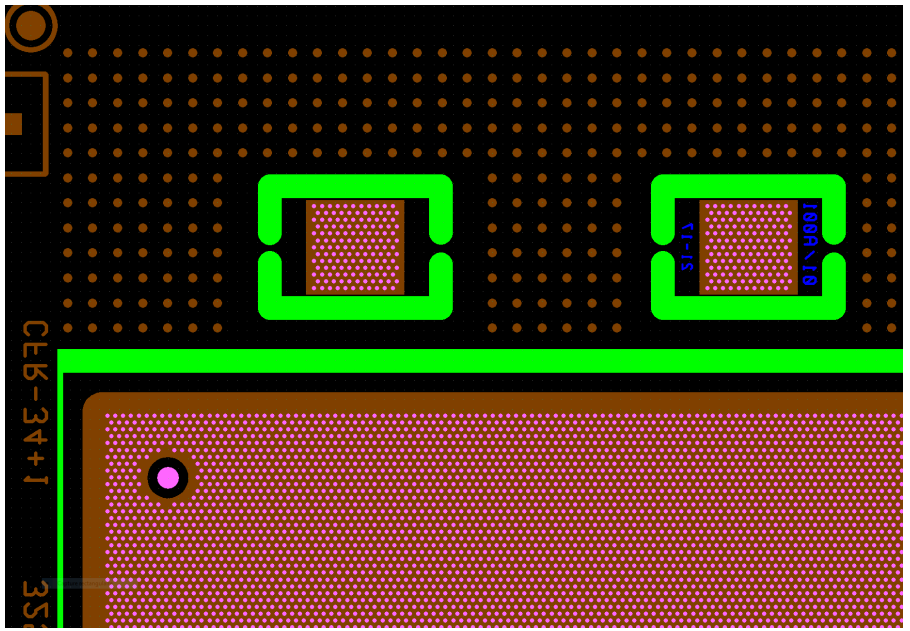
- ELTOS should be able to produce more than 6 LEMs per week by dedicating one of their drilling machine to LEM production during july-august. ELTOS is closed 11th – 21th august. Saclay is closed 14th – 20th august.

- Our goal is to get at least 36 LEMs from ELTOS by septembre.

LEM GERBER FILES FOR PRODUCTION ON WA105 INTEGRATION CERN DROPBOX







QA/QC OF LEM A001 & A002 BY ELTOS
RIM,HOLES, THICKNESS MEASUREMENTS

The QA/QC datas delivered by ELTOS are under analysis and will be discussed face to face next week, especially thickness measurements. A thickness measurement by metrology division at CERN should be done to compare with previous measurements of the 3x1x1 m^3 LEMs.

Hole Φ

SN	POINT 1	POINT 2	POINT 3	POINT 4	POINT 5	POINT 6	POINT 7	POINT 8	POINT 9	POINT 10	POINT 11	POINT 12	POINT 13
1	0,4981	0,4964	0,4950	0,4995	0,4987	0,4952	0,4965	0,4998	0,4979	0,4979	0,4963	0,4918	0,4980
2	0,4924	0,4970	0,5000	0,4986	0,4995	0,4986	0,5000	0,4999	0,4961	0,4941	0,4983	0,4990	0,4999
3													
4													
5													
6													

RIM

TOP

SN	POINT 1	POINT 2	POINT 3	POINT 4	POINT 5	POINT 6	POINT 7	POINT 8	POINT 9	POINT 10	POINT 11	POINT 12	POINT 13
1	37	37	40	39	37	38	40	37	39	38	37	37	37
2	40	39	39	42	37	37	37	37	39	41	37	41	42
3													
4													
5													
6													

BOT

SN	POINT 1	POINT 2	POINT 3	POINT 4	POINT 5	POINT 6	POINT 7	POINT 8	POINT 9	POINT 10	POINT 11	POINT 12	POINT 13
1	41	38	37	37	37	38	39	37	37	37	37	37	37
2	37	37	37	37	38	39	41	39	37	37	38	42	42
3													
4													
5													
6													

Total thickness

SN	POINT 1	POINT 2	POINT 3	POINT 4	POINT 5	POINT 6	POINT 7	POINT 8	POINT 9	POINT 10	POINT 11	POINT 12	POINT 13
1	1,11		1,11								1,11		1,11
2	1,11		1,11								1,11		1,11
3													
4													
5													
6													

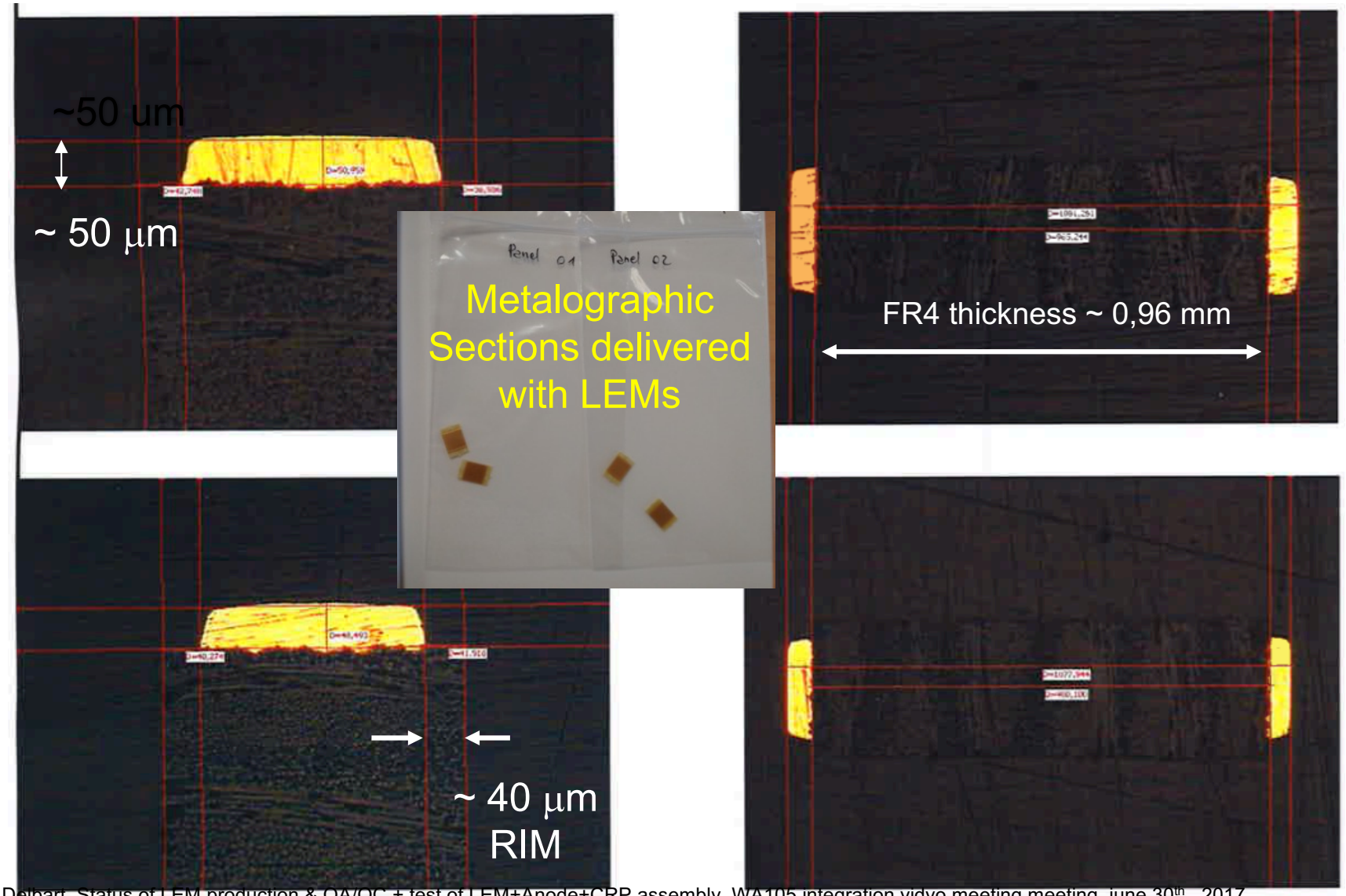
3X1X1 m³ LEMS
THICKNESS MEASUREMENTS @ CERN

LEM #	Mean th. with copper (mm)	FR4 th. (1 point)	min th. (mm)	max th. (mm)
1	1,136	0,976	1,111	1,162
2	1,133	0,965	1,105	1,171
3	1,134	0,953	1,112	1,156
4	1,126	0,981	1,091	1,145
5	1,115	0,985	1,074	1,155
6	1,126	0,993	1,103	1,153
8	1,117	0,996	1,086	1,143
9	1,118	0,994	1,071	1,151
10	1,125	0,976	1,062	1,158
11	1,118	0,980	1,072	1,144
12	1,122	0,974	1,082	1,147
13	1,117	0,954	1,087	1,149
14	1,114	0,937	1,040	1,152

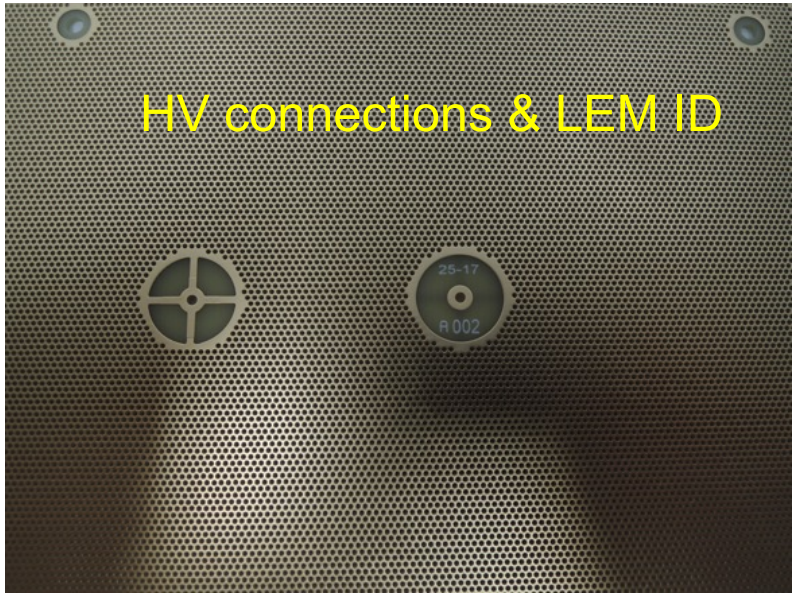
The same batch of raw material was used by ELTOS for these 3x1x1 LEMs and for the A001 & A002 LEMs.

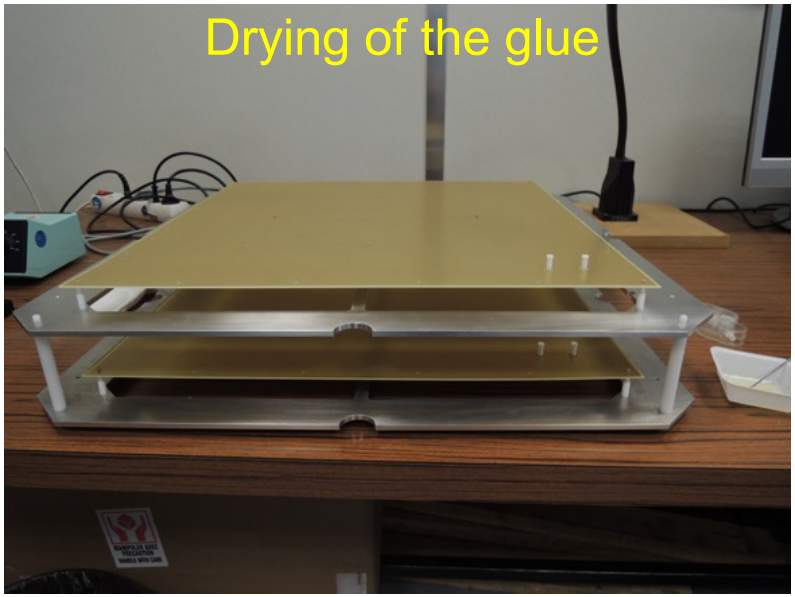
QA/QC OF LEM A001 & A002 BY ELTOS METALLOGRAPHIC SECTIONS

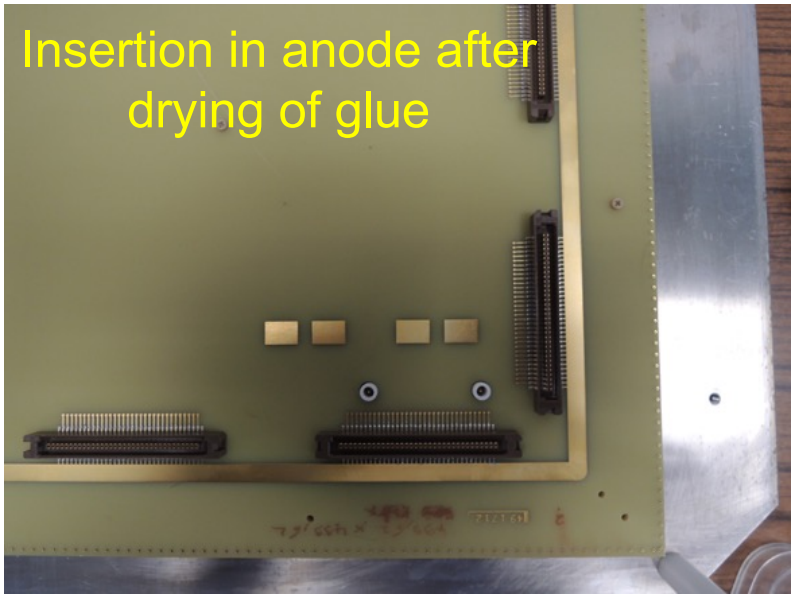
metallographic sections : 1.07 mm total thikness (~0,97 FR4 + 0,1 copper+Ni/Au)



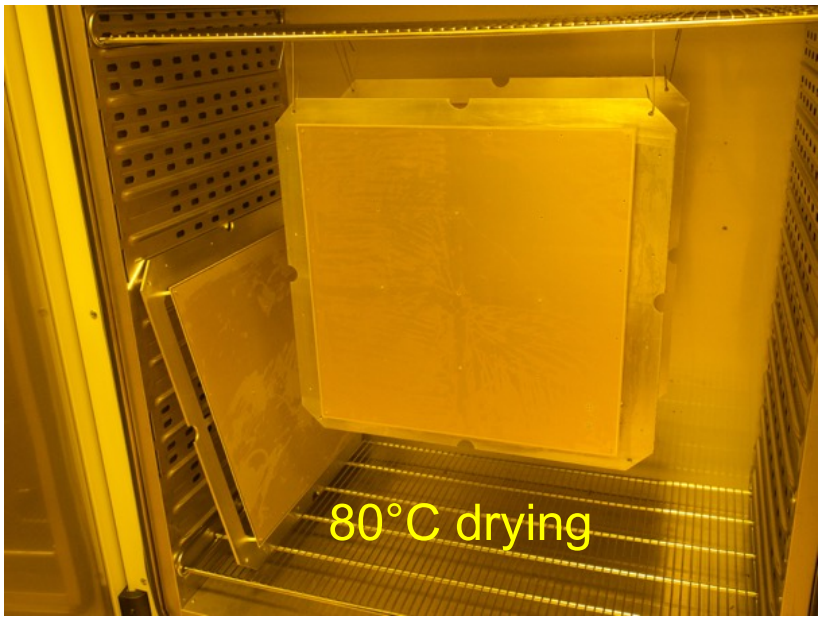
LEM # A001 & # A002 : ASSEMBLY





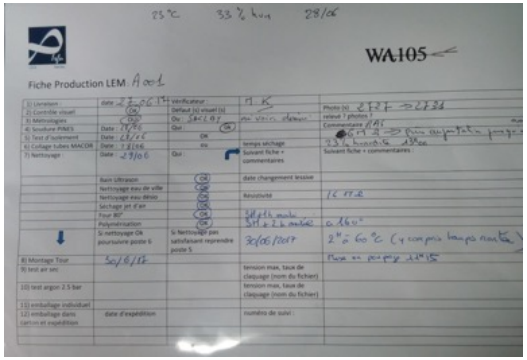


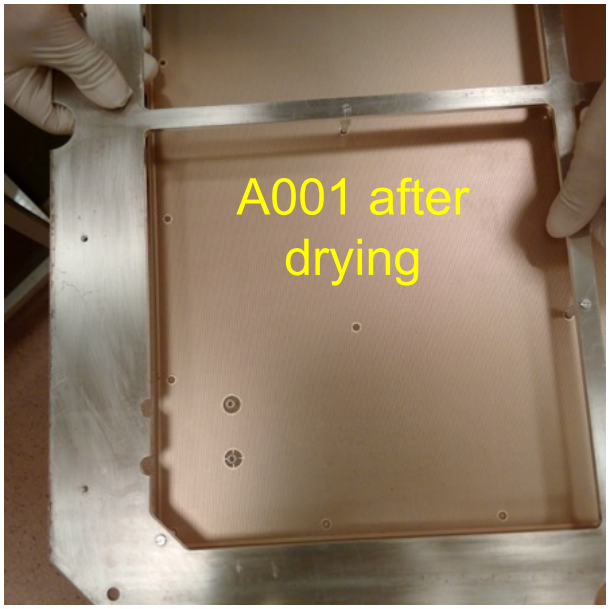
LEM # A001 & # A002 : CLEANING & DRYING

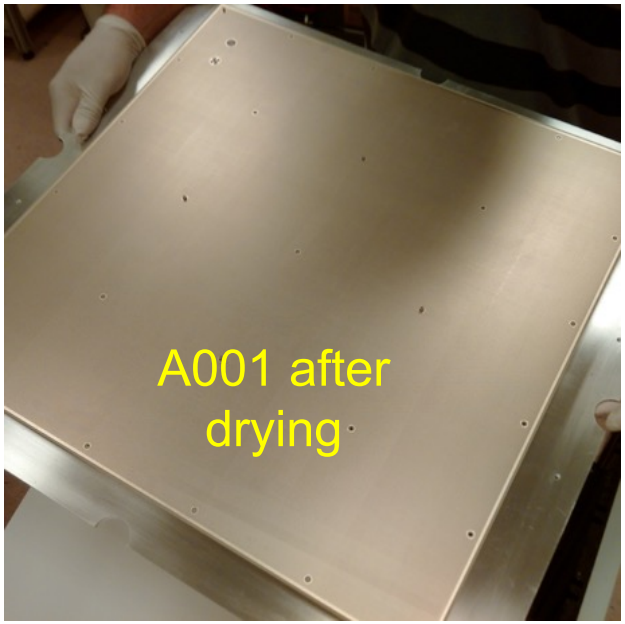


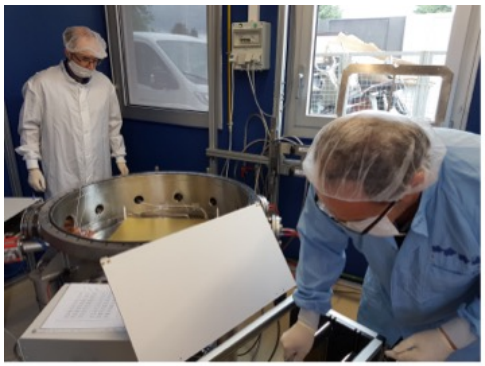
HV increase in synthetic air @ NPT is on-going and HV breakdown voltage in 5.7 argon @ ~2.3 bar will be done next week.

LEM # A001 & # A002 : MOUNTING IN VESSEL

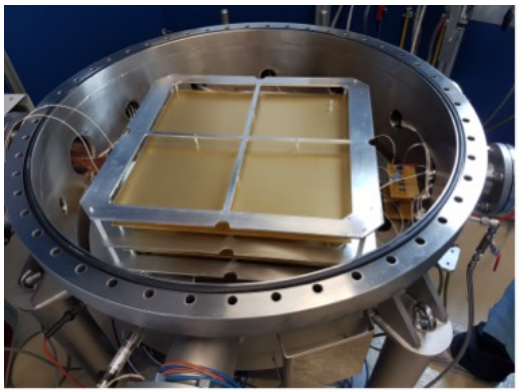








A001, A002
& Eltos 2016 proto 01



HIGH PRESSURE VESSEL TEST BENCH FOR LEM FINAL QUALIFICATION @ P≈2.3 BAR/AP

- The High Pressure Vessel was « downgraded » for use at P_S=4 bar max and type 2 gas (non-flammable nor toxic) by the APAVE certifying agency. **The CEA safety division gave its green light for use last tuesday !**

- The vessel was used at atmospheric pressure in synthetic air and 5.7 argon to test the QA/QC procedures and measure 50x50 cm^2 LEM gains

- Pumping down to ~4.10^{-4} mbar (in about 12 hours) the air in the vessel containing a tour of 6 x LEMs before to fill and pressurize with Argon 5.7 enables to have the following gas composition in the vessel :

Measures done by
Ph. Dauvois
DEN/DANS/DPC/SECR/LRMO
Gas analysis lab

Component	Volumic proportion
H2	< 20 ppm
H2O	< 10 ppm
N2	13 ppm
O2	< 5 ppm
Ar	99,994%
CO	10 ppm
CO2	6 ppm

We should be able to report on LEM A001 & A002 QA/QC and gain measurements @ NTP & 2.3 bar/Atm pressure at next meeting

LEM + ANODE ASSEMBLY ON CRP
TEST OF THE 2 SOLUTIONS

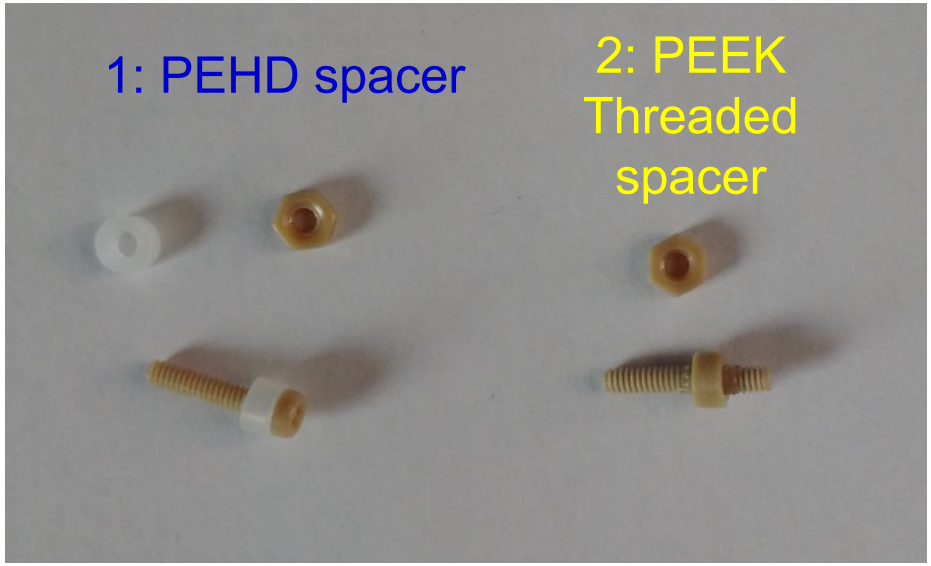
We tested the 2 assembly solutions for the mounting of the LEM + Anode on CRP.
We used a G10 frame as a mokup of CRP and maintained it ~80 cm above the floor between 2 tables to actually make the assembly as it will actually be in bdg 185.

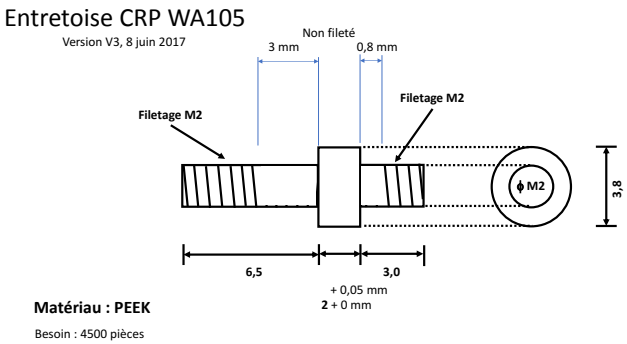
solution 1: PEHD spacers + MISUMI PEEK M2 screws

Use PEHD spacers with an inner hole diameter slightly smaller than the one of the M2 screws to get the screw tightened when inserted.

Solution 2 : Custom PEEK threaded spacer + nuts

First mount & align anode on CRP with threaded spacers , then mount LEM with nuts.





PEHD SPACERS + MISUMI M2 SCREWS
M2 SCREWS SELECTION & COST COMPARISON

For the M2 PEEK screws to be maintained in the ϕ1,88 mm inner diameter PEHD spacer the M2 srew diameter ϕ should be

$1{,}85 < \Phi < 1{,}90$

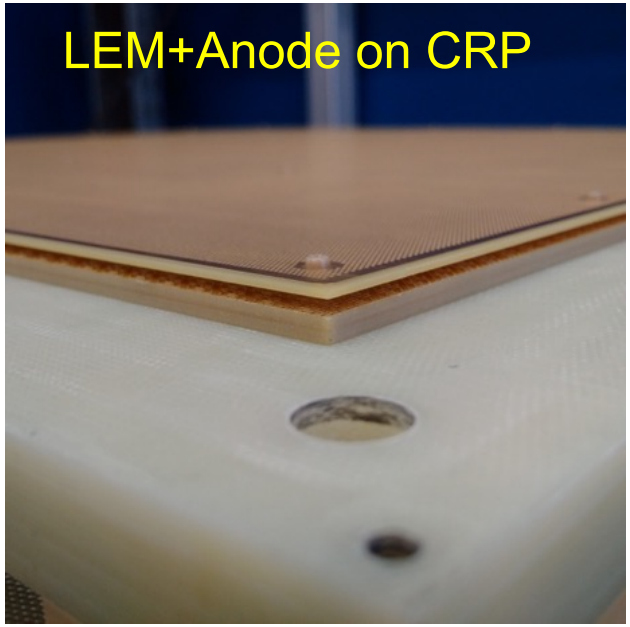
Φ1,88 mm PEHD spacer inner diameter

~5 % M2x10 screws rejected
~ 30% M2x12 screws rejected

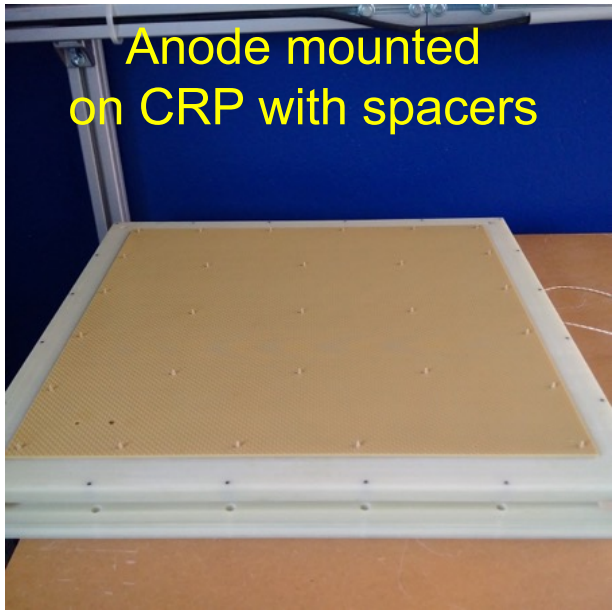
MISUMI PEEK M2 screws diameter measurement		
Screw diameter	Nbre of M2x10	Nbre of M2x12
1,94		3
1,93		
1,92		5
1,91		5
1,9		3
1,89	4	4
1,88	4	2
1,87	3	3
1,86	22	12
1,85	5	
1,84	2	
1,83		
1,82		2
	40	39
Mean	1,864	1,886

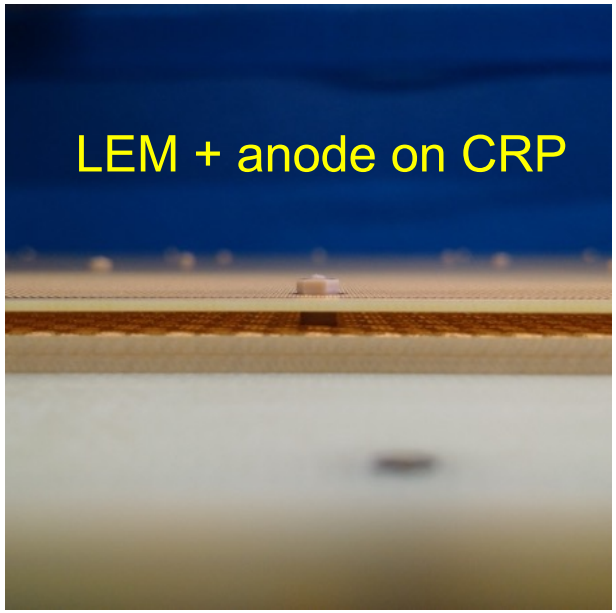
Solution 1 : PEHD spacers + MISUMI M2 screws					Solution 2 : Custom PEEK threadedspacers + nuts				Supplier
Item	needed qty	qty to order	unit cost	Total	needed qty	qty to order	unit cost	Total	
PEHD spacers	4 176	4 500	1,35 €	6 075 €					SMIDE (Fr)
M2x10 screws	4 176	4 500	0,49 €	2 205 €					MISUMI (jp)
M2 Nuts	1 296	1 500	0,24 €	360 €	5 472	6 000	0,24 €	1 440 €	MISUMI (jp)
PEEK spacers					4 176	4 500	1,25 €	5 625 €	SMIDE (Fr)
TOTAL				8 640 €				7 065 €	

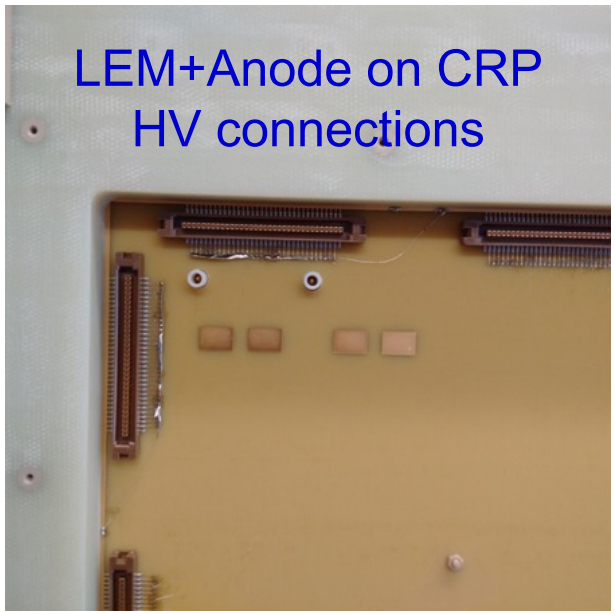
PEHD SPACERS + MISUMI M2 SCREWS
TEST OF ASSEMBLY : ~1H



CUSTOM PEEK SPACERS + NUTS
TEST OF ASSEMBLY : ~40 MN







CONCLUSION

Status of the LEM production by ELTOS and QA/QC at Saclay :

- A preseries of 2 LEMs was just delivered
- QA/QC is on-going. LEM thickness lower than expected (?)
- Production should be launched after the Production Launch Review Meeting at ELTOS next thursday july 6th.
- Actual production rate will be discussed and fixed next week

LEM + Anode + CRP assembly tests :

- The 2 assembly solutions were tested and are feasible
- We have a slight preference for custom PEEK threaded spacers
- Choice between the 2 solutions will be made after 1-2 days thinking (Adamo, Alain, Benjamin, Dominique, Sébastien)
- Ready to order the needed components for 160 assemblies