Report on the visit to the ELTOS company for Micromegas industrialization

2 days visit (7-8 november)

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Goal of the visit

Technology transfer of MPGD production in the industry is on-going within RD51 to prepare large scale production, especially for HL-LHC upgrade

For Micromegas, this concerns both PCB and bulk-micromegas production :

- Initiate and maintain partenerships with the PCB industry to get it capable of producing cheap (high-yield) and high-quality large size anode PCBs (1-2 m^2)
- Transfer the current know-how on resistive anode PCBs and maintain partnership to help selected companies to develop their manufacturing procedures

- Transfer the know-how of woven-micromesh integration on top of « standard size » active area anode PCBs (< 100 cm^2) for bulk-micromegas production,
- Maintain partenership with selected companies to develop manufacturing procedures for large size bulk-micromegas production (at least 600 x 1000 mm^2)

Triangle Labs (USA, Nevada), Somasis (Italy, Castelfidarco) and Cirea (France, Cholet) are already involved in this process, the goal of the visit was to initiate a partnership with ELTOS and first make with them 2 standard bulk-micromegas

The ELTOS Company : key figures

A 30 years old company of around 90 employees, based at Arezzo (Italy) on 2 sites with a total of 5000 m^2 surface, for a ~ 10 M€ turnover, 50% export (30% Germany), with management (ISO 9001) and environmental (ISO 14001) certifications

ELTOS Specialties

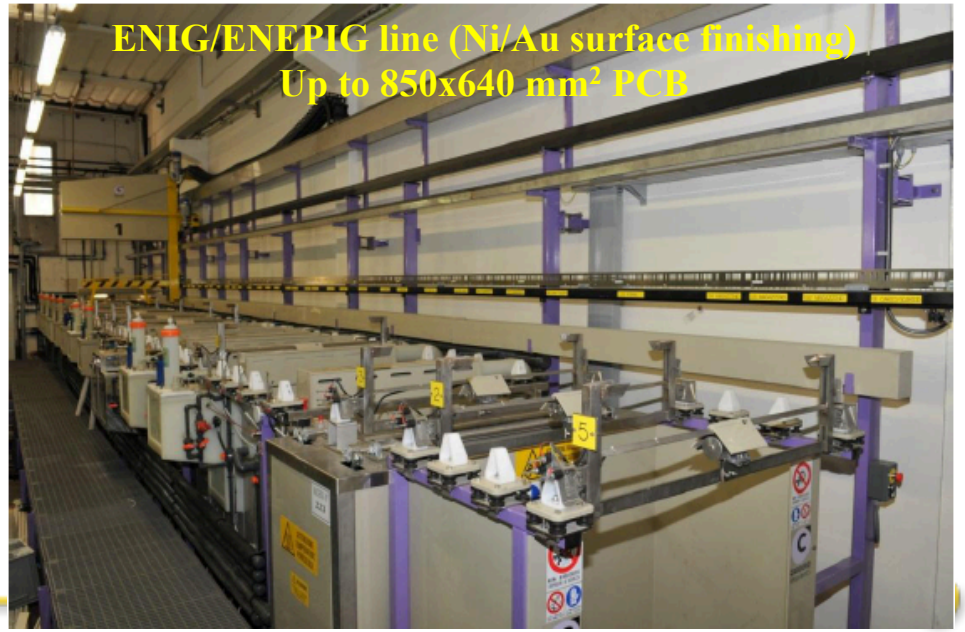
Type	Rigid PCBs
Layers	up to 32 layers
Materials	FR4, Mid-, High-Tg and Halogen Free, special materials (Isola FR-408, Arlon, Panasonic, Rogers)
PCB thickness	up to 6 mm
Big sized boards	> 600 mm long
Cu thickness	> 140 micron (external layers)
Aspect ratio	1:12 (TH), 1:1 for blind holes

Microvias, Via in pad, Blind vias, Buried vias / HDI boards
(through Sequential-Build-Up, SBU)

Surface finish Ni/Au, Ag, Tin/Indium, …

Ref: P. Lequerré (sales agent, ELTOS)

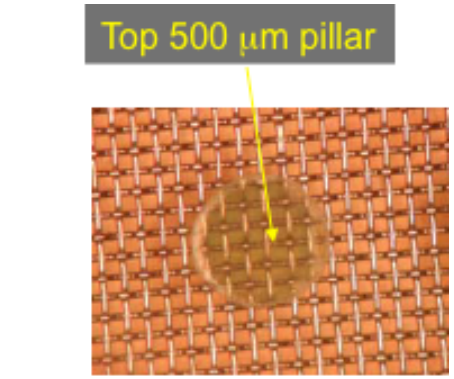
Some equipments



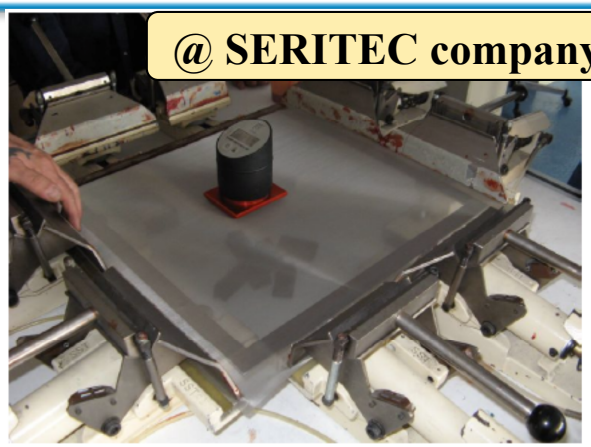
Mesh encapsulation for bulk-micromegas @ CERN

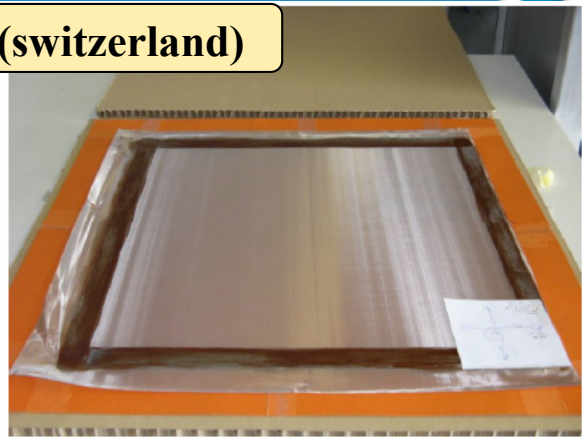
Visual inspection

- ✓ 12 N tension
- ✓ Sub-contractor



@ SERITEC company (switzerland)

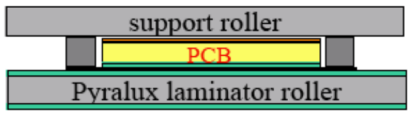




Visual inspection

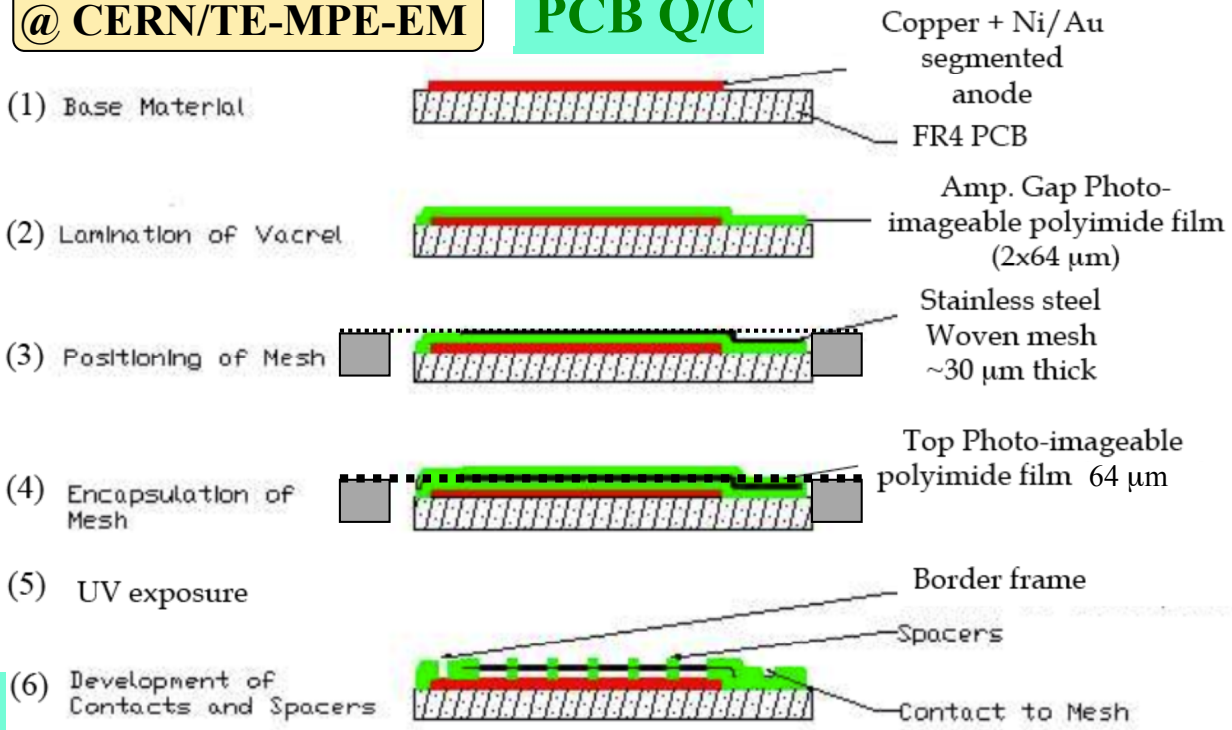
1/ Mesh is stretched on an external frame

2/ and laminated with the PCB



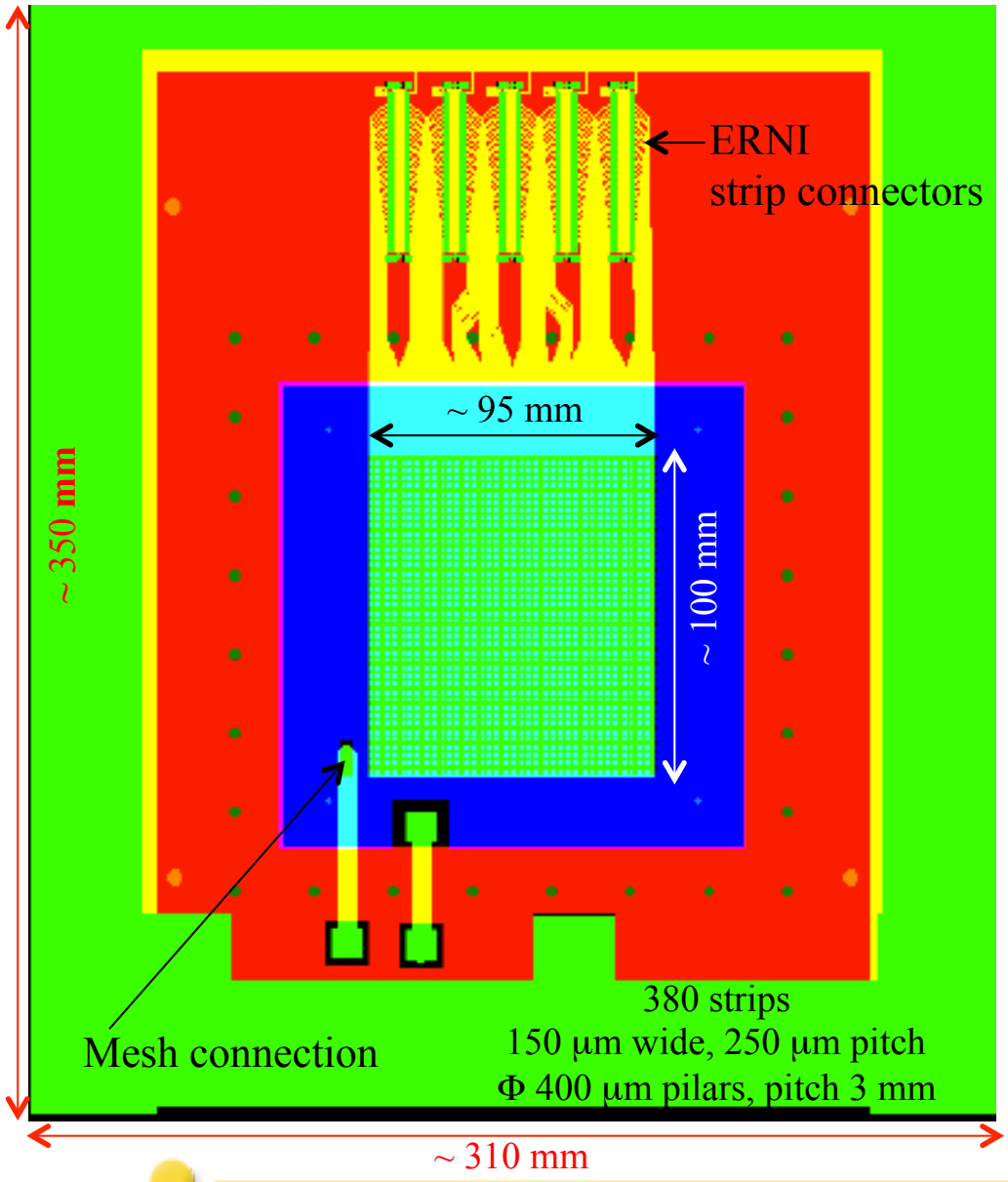
@ CERN/TE-MPE-EM

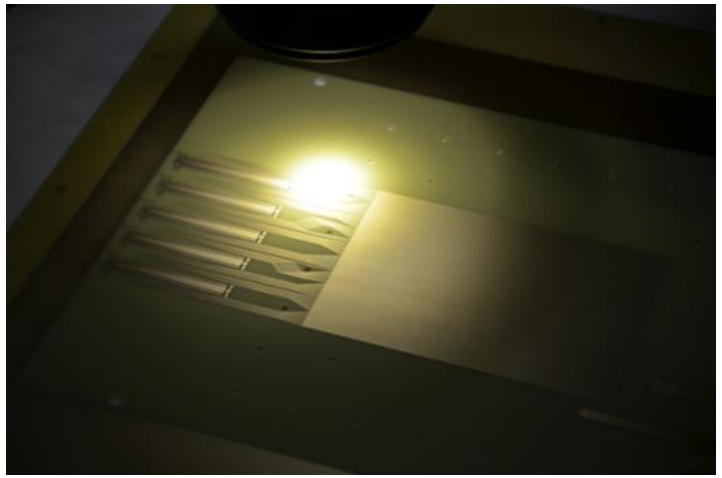
PCB Q/C



(7) Global current Q/C

The 128 μm gap bulk-micromegas to make



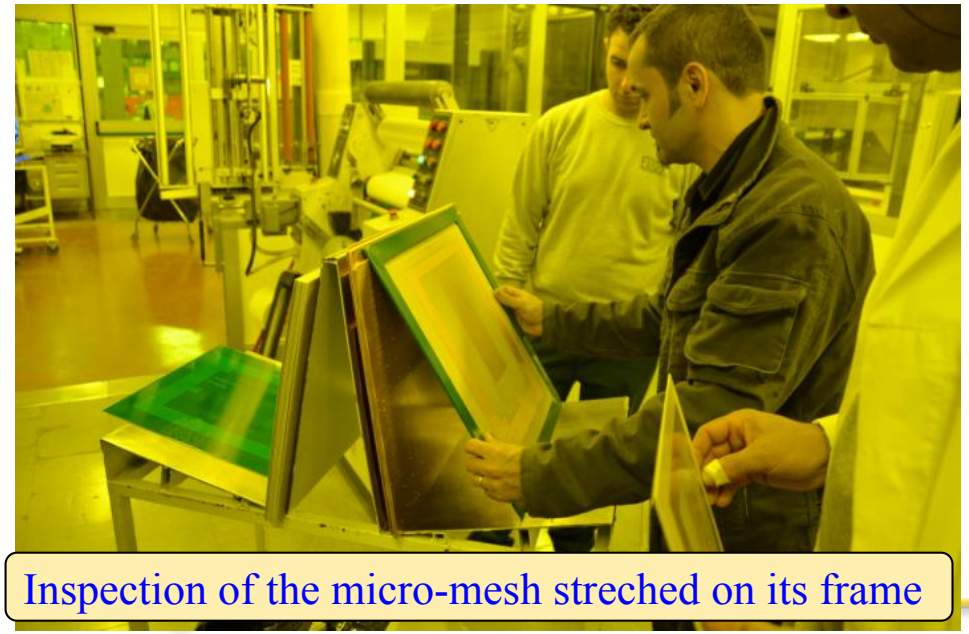


- CERN provided mesh, □ 470 mm mesh frames, PCB and UV masks gerber files
- ELTOS made the PCBs, masks, and streched the mesh on the frames (Italian sub-contractor)

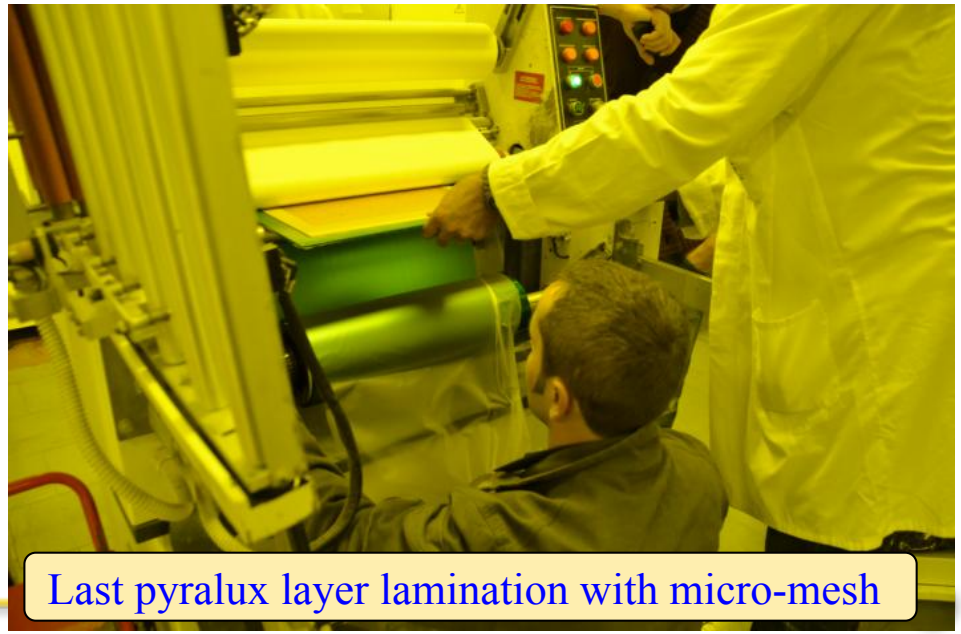
Pyralux lamination & mesh integration

Dynachem 360 semi-automatic laminator

First pyralux layer lamination

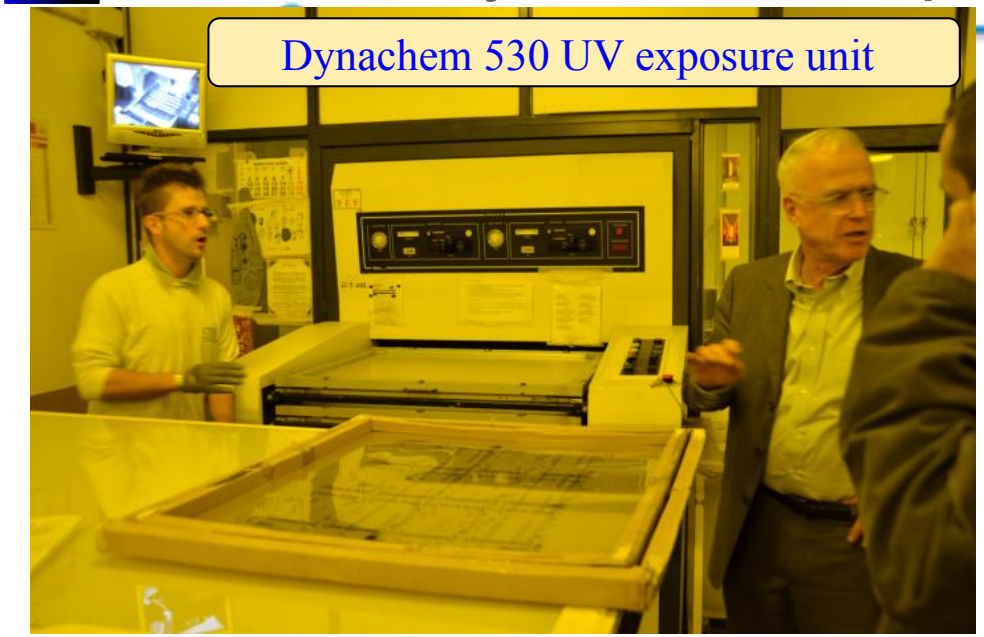


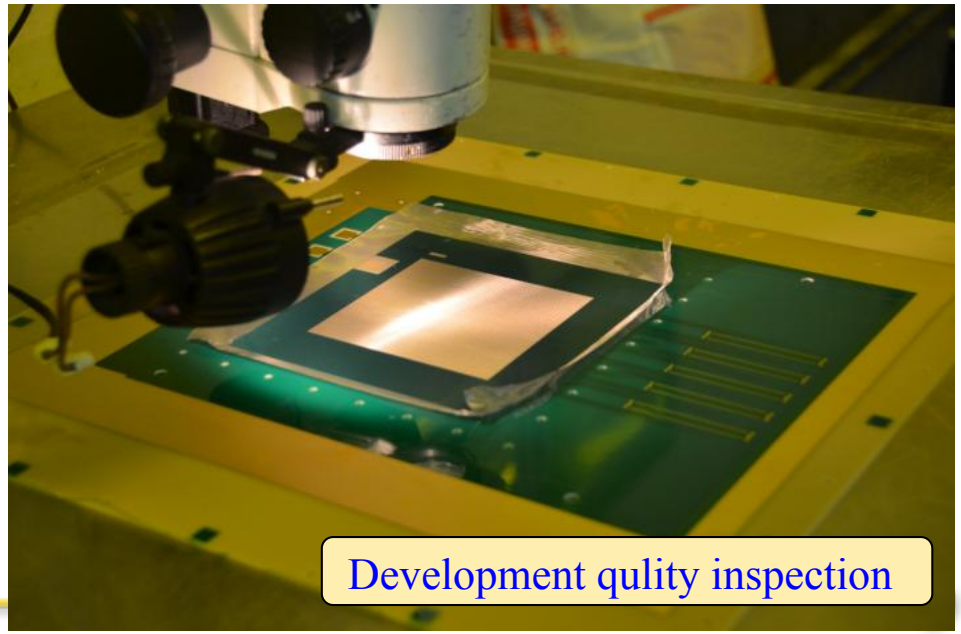
Inspection of the micro-mesh streched on its frame



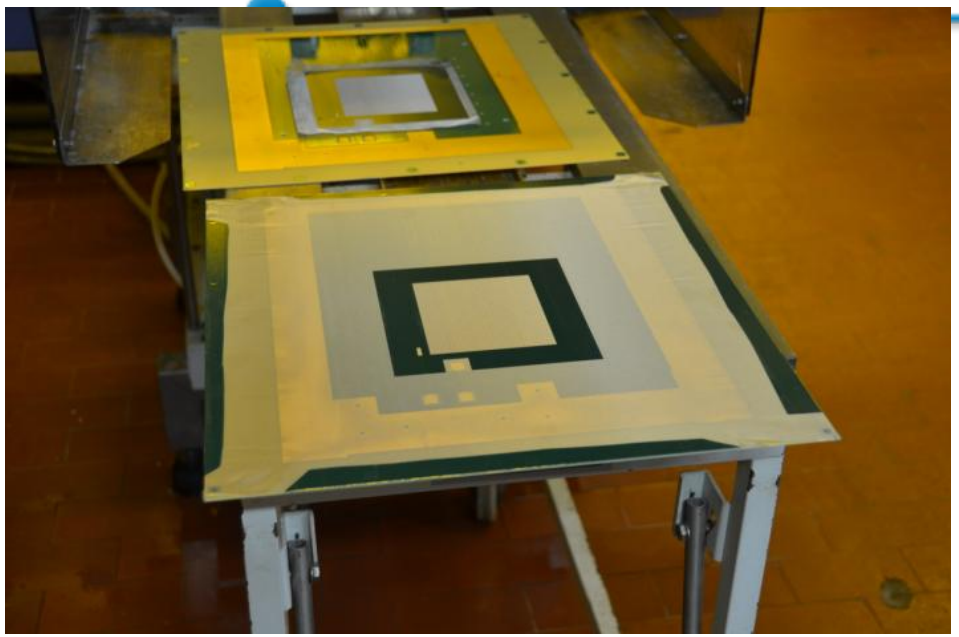
Last pyralux layer lamination with micro-mesh

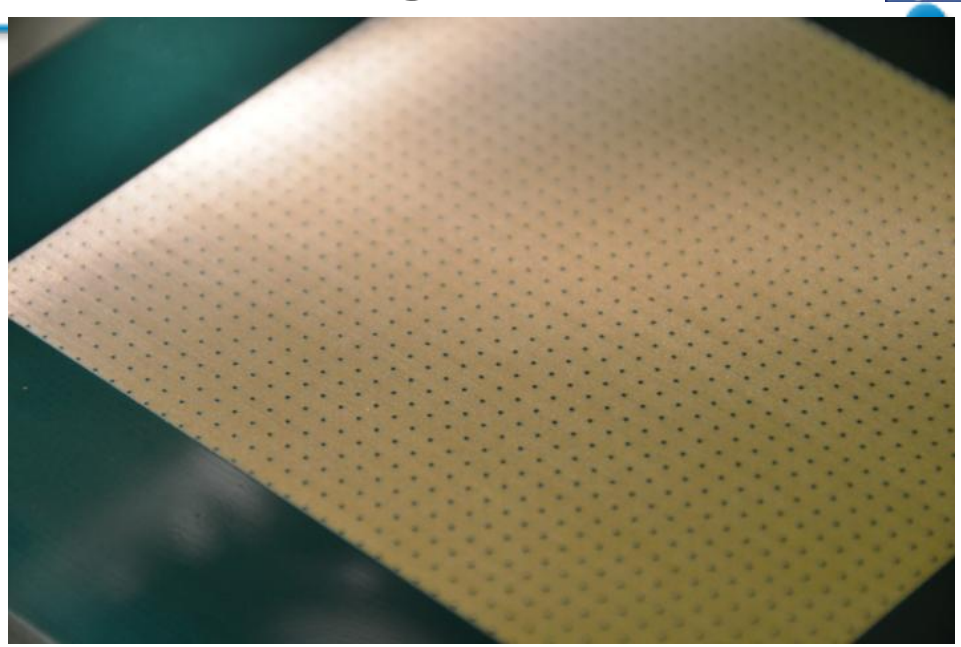
Pyralux UV exposure & development

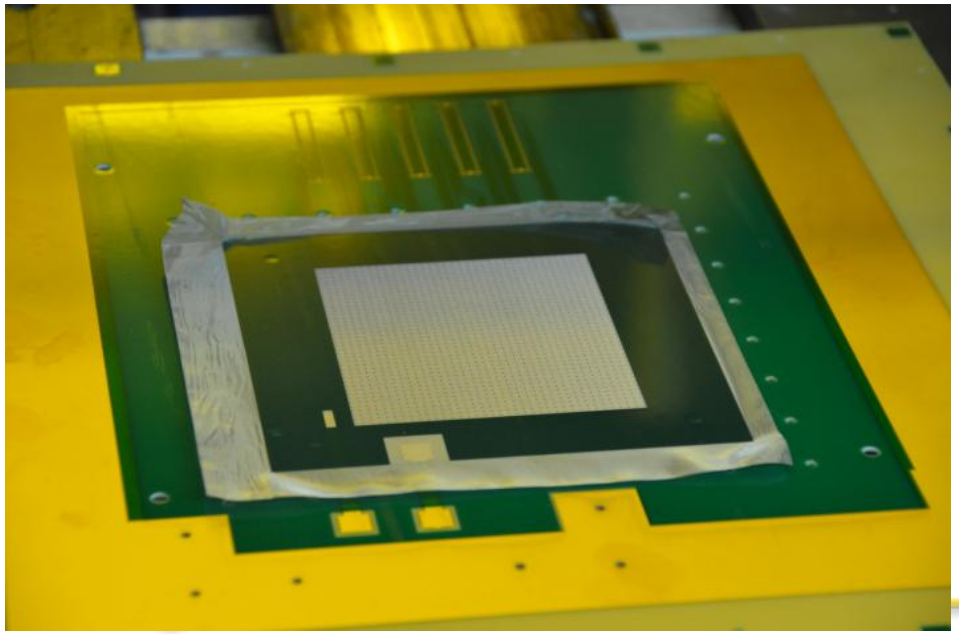




The final bulk-micromegas







To be done at CERN

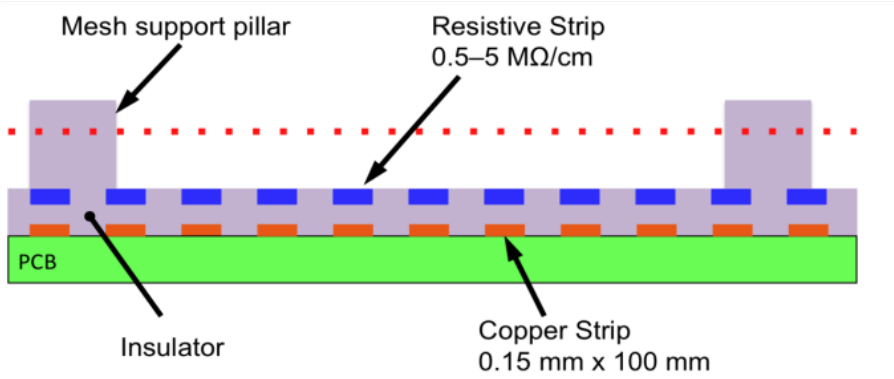
- Mesh cutting
- Mesh connection (silver paste)
- Strips grounding

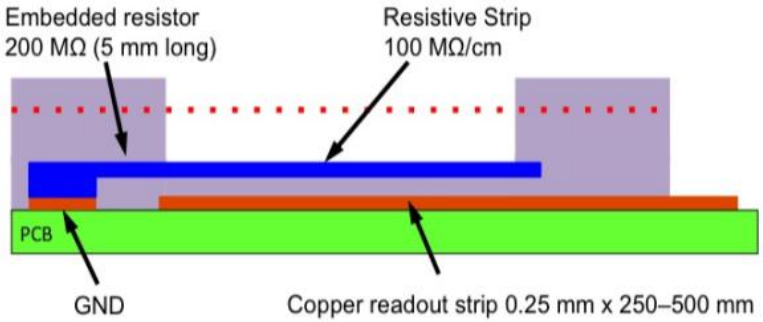
Quality tests to confirm mesh integration :
HV test in air by HV increase up to ~800 V with mesh current lower than few nA

Resistive anode bulk-micromegas

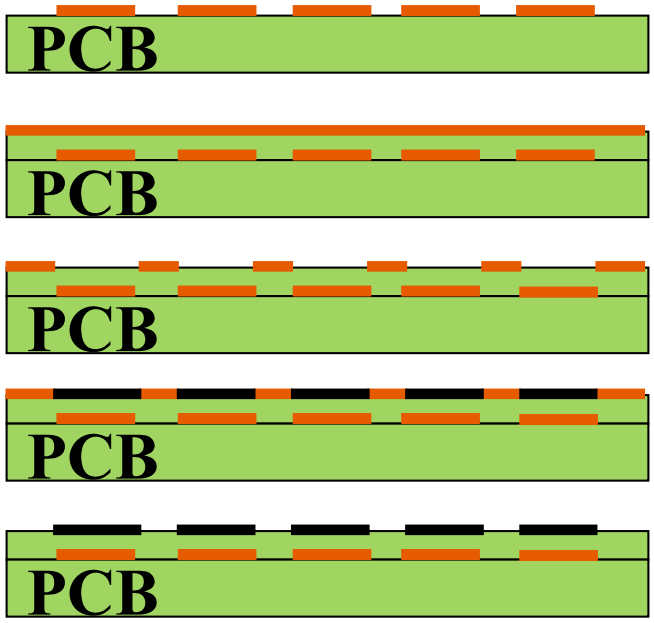
R11 model (HL-LHC MAMA)

Also used for 2D readout in R16 prototypes





The full PCB manufacturing technique was presented and discussed :



→ ELTOS has the will and the capabilities to be involved in resistive anode PCBs manufacturing

→ Know-how transfer from CERN is first needed

Ref: Rui de Oliveira (CERN/TE-MPE-EM)

Specific interesting equipments

Automatic laminator (Morton 1600-D)

Could be used for production BUT its operation with Pyralux PC1025 for mesh integration requires some development and tuning

Screen printers

Could be used for resistive paste direct deposit on anode strips

Conclusion and future plans

Conclusion

➢ ELTOS S.p.A has the will and capability (equipements and qualified staff) to produce bulk-micromegas (today for up to ~ 600 x 750 mm^2).
➢ 2 standard size bulk-micromegas were smoothly and successfully made in one shot at ELTOS with the help of Rui de Oliveira. The quality of the micromegas amplification gap is still to be confirmed by HV tests.
➢ First discussions on resistive anode PCBs manufacturing did not show a sticking point for ELTOS.

Future plans

➢ ELTOS will make 5 new bulk-micromegas by themselves, and these bulk-micromegas will be fully qualified at CERN and CEA/IRFU (with ^{55}Fe source)
→ Once this milestone achieved, the size of the bulk-micromegas will be increased

➢ Technicians form ELTOS are invited to follow a few days training at CERN on resitive anode PCBs manufacturing techniques (to be organized)
→ Next step will be a 1D - R11 PCB manufacturing by ELTOS