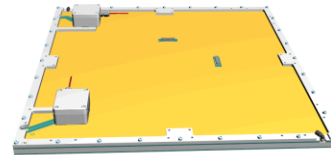


DE LA RECHERCHE À L'INDUSTRIE



Status on the industrialization of (multiplexed) Micromegas with the ELVIA company



IRFU/SPhN: S. Procureur, S. Bouteille (PhD)

IRFU/Sédi: D. Attié, P. Magnier, I. Mandjavidze, M. Riallot

RD51, 14/09/2016

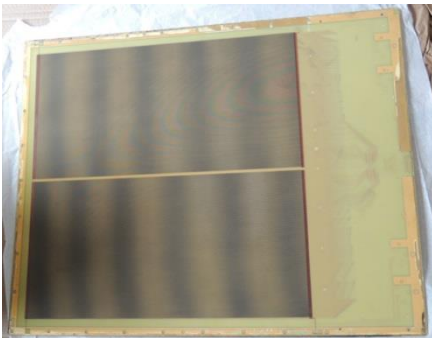
→ M-Cube project initiated in 2014 to build a « small » container scanner (4 x 1m²)

- *Multiplexed Micromegas*
- *Bulk process*
- *Resistive strip technology*
- *2D strip readout*

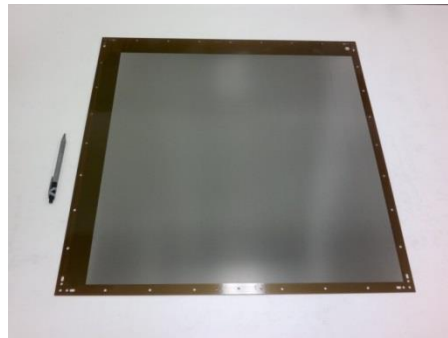
⇒ **16 detectors of 50x50 cm² to build**

→ started (continued...) a know-how transfer with ELVIA for manufacturing

2013



End 2015



March 2016



⇒ **First operational prototype in November 2015**



→ the needs increased in 2016 with 2 additional projects:

- *TomoMu setup: interactive muon imager for science exhibitions* ⇒ **16 more detectors to build!**
- *ScanPyramids mission: 3 muon telescopes to scan Egyptian pyramids*

→ strong interests of many companies for such muon telescopes/scanners

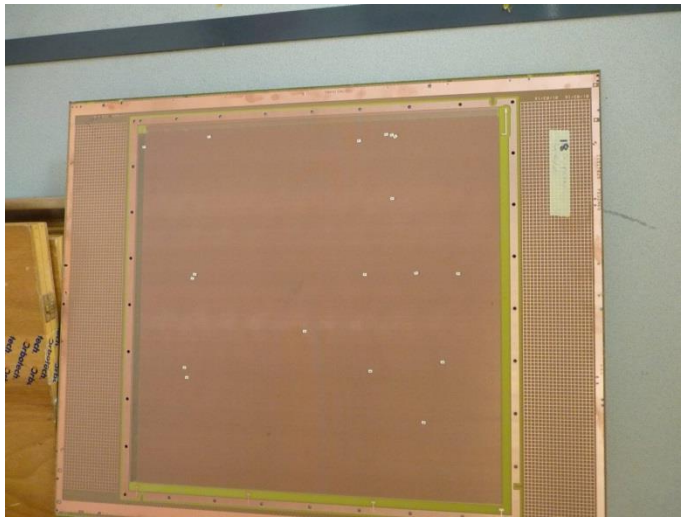
⇒ **Ongoing discussions, industrialization is a key ingredient**

→ Processes needed to master for detectors construction

- *PCB manufacturing (multi layer, 2D readout)*
- *Screen printing of the resistive strip film*
- *Gluing of the resistive film*
- *Silver paste deposit (x2)*
- *Bulk (multi-process: lamination, grid, UV, development, cooking)*

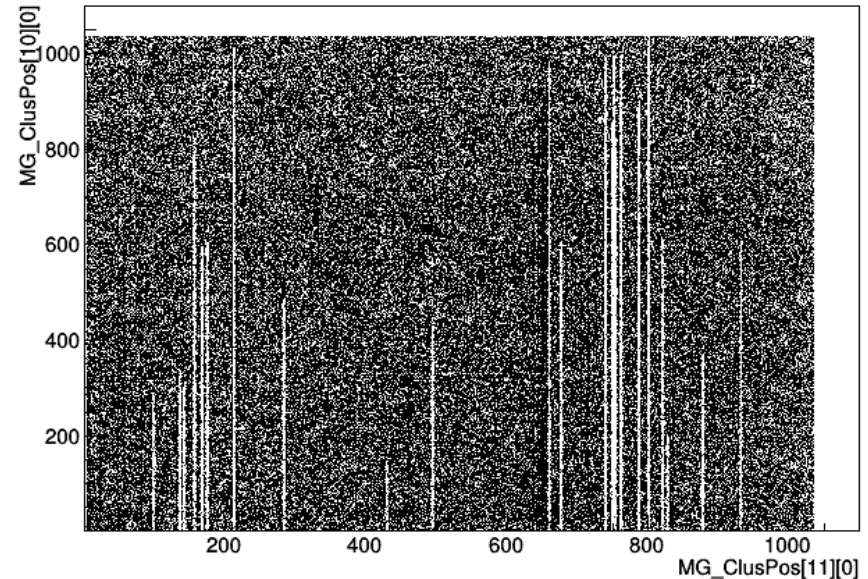
→ main difficulty: top Copper (Y) strips, 100 micron thick (to allow for signal on inner X strips)

- *First production lot had from 10 to 20 strip cuts on the top layer*



Example with 18 cuts (detected during manufacturing)

MG_ClusPos[10][0]:MG_ClusPos[11][0] [MG_ClusSize[10][0]>-1 && evn>150000 && MG_ClusSize[11][0]>-1)



Muon reconstructed positions in cosmic test bench

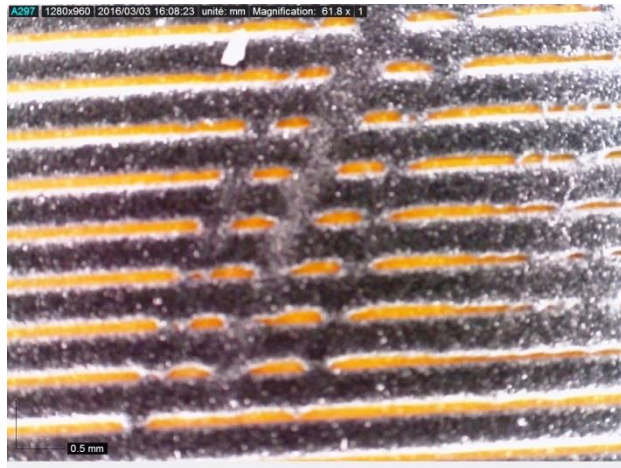
→ better and better quality in the latest lots (cleaner environment)

- *N-1th production lot had around 10 cuts (0.1%, required value)*
- *Nth production had around 5*



→ ELVIA does not have (yet) skills for this part

- *Films manufactured by Rui's team so far*
- *Now manufactured without interconnection between strips*



Some small defects were observed in some films, but not an issue

→ If larger production is needed (>100), films can be produced in industry (Rui)

→ R&D started at Saclay workshop to produce these films

- *First fillms should be soon ready*



→ manufacturing requires silver paste line to connect resistive strips to HV contact

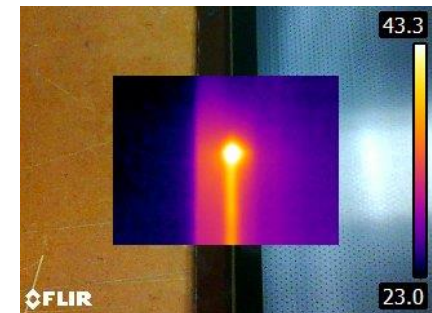
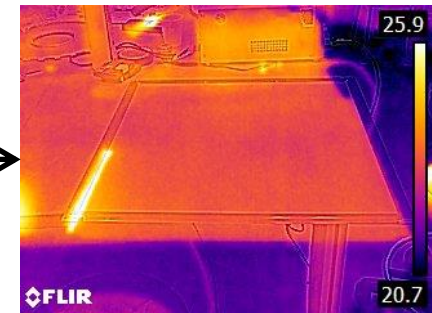
- Several defects in the first production lot
- Induced very localized shortcuts with the micromesh, visible with UV camera



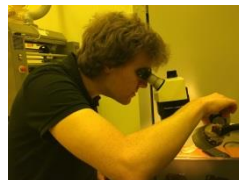
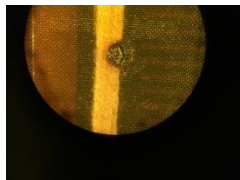
Example n°1, visible defect



Example n°2, shortcut detected with UV camera



→ Repaired by hand at Saclay a posteriori (painful & long)

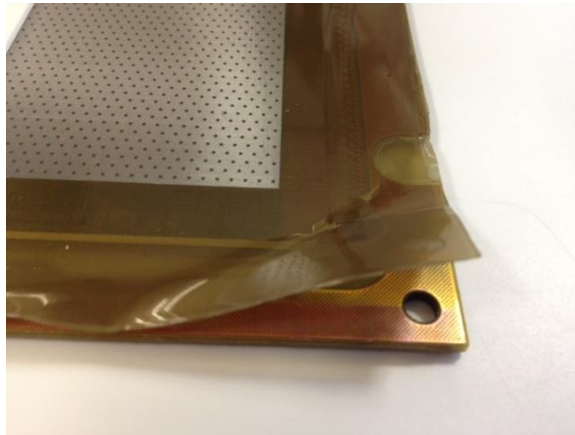


→ Identified as badly cooked photo-imageable film (thanks Rui!)

- Fixed now, better cooking and additional thin Kapton tape on top (ELVIA)



→ all the processes are now well controlled, after early adherence problems on corners

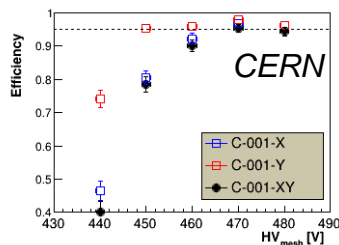
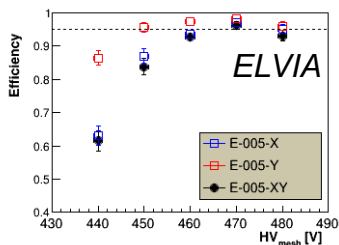
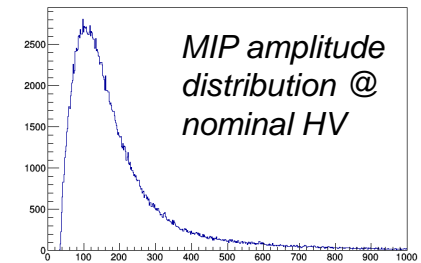
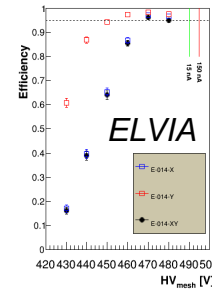
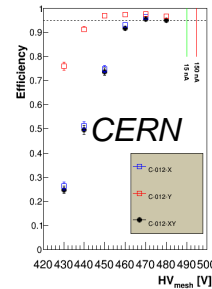
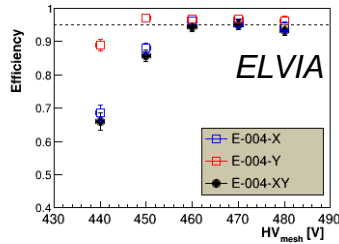
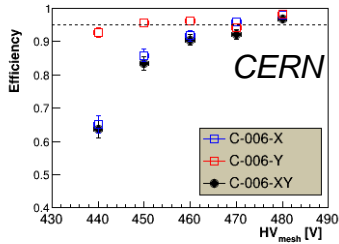
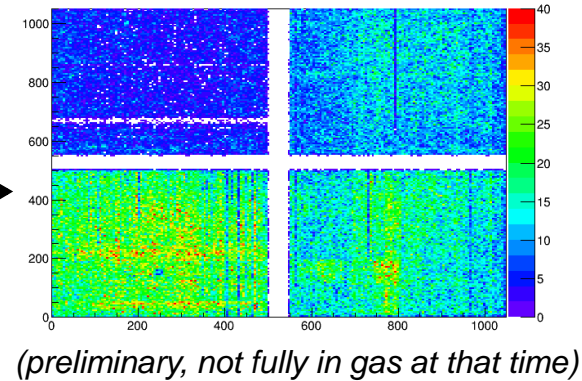
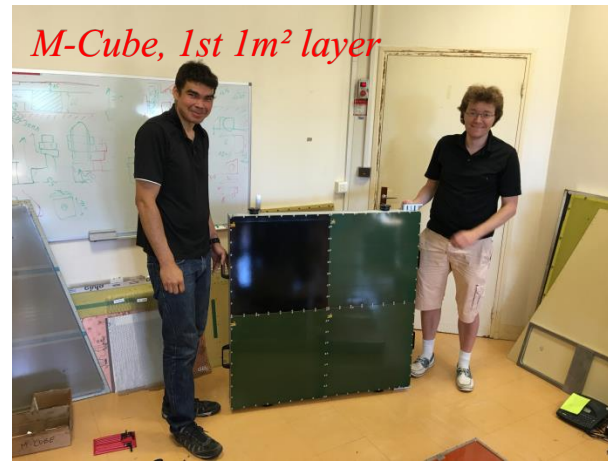


→ Since this year, all the bulk manufacturing is performed on the same site (Coutances)

→ No Karcher washing at the end, but last lots were operational without washing at Saclay



→ 16 working detectors have been delivered so far by ELVIA (8 in Egypt & 8 at Saclay)



⇒ Same performance as CERN detectors

→ Completion of the M-Cube setup very soon (15 detectors out of 16)



→ Further productions will depend on funding request, but also on discussions with industrials

