



***Large area detectors
Aida WP 9.2
RD51 WG6***

Rui De Oliveira

outline

- **AIDA project**
- **Largest GEM**
 - **NS2 description and projects**
 - **Industry status**
- **Largest Micromegas**
 - **industry status**
- **conclusion**

CERN workshop upgrade for MPGD

- **CERN have invested in 9 machines for large MPGD production.**
 - The 9 machines are at CERN
 - 5 machines are installed and commissioned
 - 4 are still not installed , the installation is postponed .
 - The machines will be installed directly into the new building 107 (no space in existing premises)
 - This decision does not affect the running R&Ds
 - The processes involved in these 4 machines are standard only the size of the machine have been increased. No commissioning is needed
- **Deliverables:**
 - redefine all the process parameter related to the new equipment's
 - Build prototypes with these equipment
- **Man power:**
 - 4 CERN staff during 4 years up to 15% of their time
 - 1 technician during 2 years (AIDA contribution)
 - Juliens Burnens 1/07/2011 → 31/12/2011
 - Michal Zientec 1/01/2012 → 31/12/2012
 - Kacper Kapusniak 1/04/2014 → 31/12/2014

Equipment status

	installation	Commissioning
• GEM		
– 1/ continuous polyimide etcher	06/2012	OK
– 2/ Cu electro-etch line	06/2012	OK
• Micromegas		
– 3/ large laminator	06/2011	OK
– 4/ large Cu etcher	postponed	no need
– 5/ large UV exposure unit	06/2011	OK
– 6/ large resist developer	postponed	no need
– 7/ large resist stripper	postponed	no need
– 8/ large oven	06/2011	OK
– 9/ large dryer	postponed	no need

•Juliens Burnens 1/07/2011 → 31/12/2011

Machines: 3,8

•Michal Zientec 1/01/2012 → 31/12/2012

Machines: 2,5

•Kacper Kapusniak 1/04/2014 → 31/12/2014

Machine: 1



•UV exposure unit limited to 2m x 0.6m → 2.2m x 1.4m



•Resist developer limited to 0.6m width → 1.2m

•Resist stripper “

•Copper etcher “

•Dryer “



•GEM electro etch limited to 1m → 2m



•GEM polyimide etch limited to 1m → 2m



•Ovens limited to 1.5m x 0.6m → 2.2m x 1.4m



•Laminator limited to 0.6m width → 1.2m



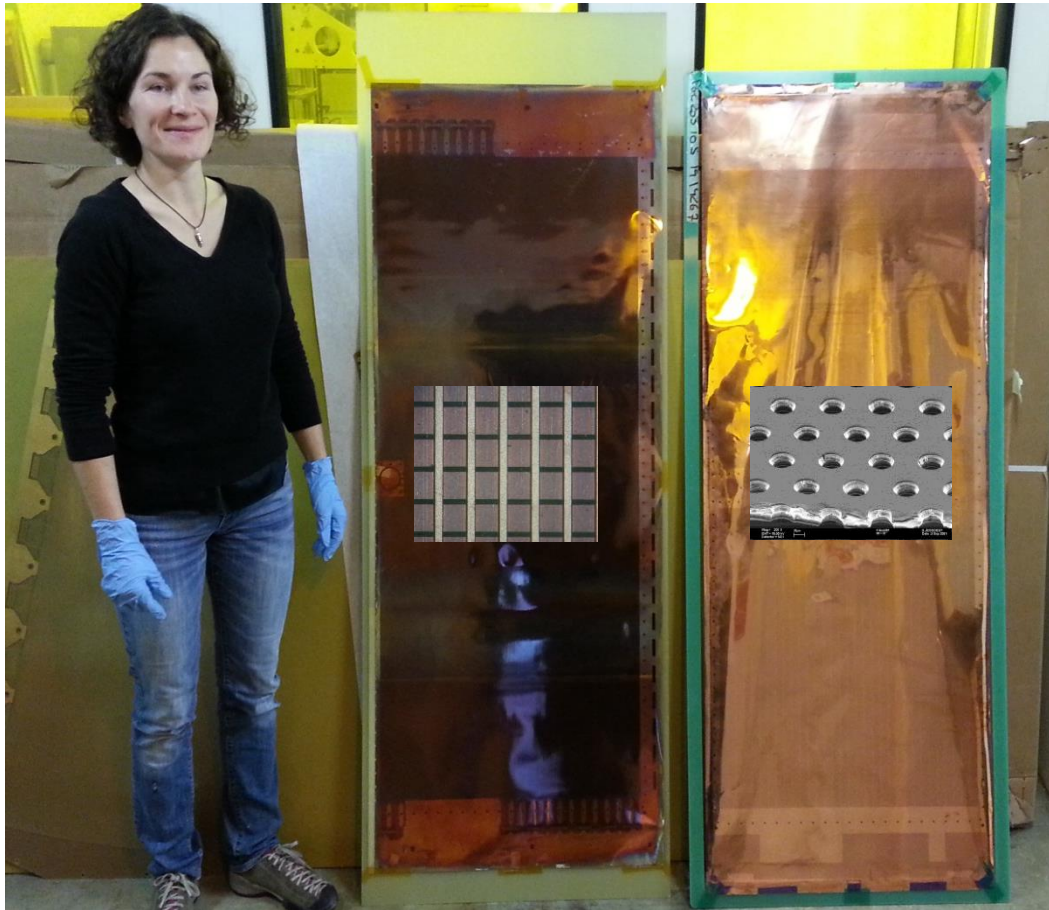
R&D Projects made with these equipment

•SBS tracker	GEM 600mm x 500mm
•ALICE TPC upgrade	GEM 600mm x 400mm
•CMS muon	GEM 1.2m x 450mm
•ATLAS NSW muon	Micromegas 2m x 1m
•COMPASS pixel Micromegas	GEM & Micromegas 500mm x 500mm
•BESIII	GEM 600mm x 400mm
•KLOE	GEM 700mm x 400mm
•SOLID	GEM 1.1m x 400mm
•CLAS 12	Micromegas 500mm x 500mm
•LSBB (geoscience)	Micromegas 1m x 500mm
•Prad	GEM 1.5m x 55cm
•CBM	GEM 1m x 450mm
•ASACUSA	Micromegas

•Most of them are still at the R&D phase but some are already in production:

•ATLAS NSW	1300 m ²
•SBS Tracker	100 GEMs
•ALICE TPC upgrade	350 GEMs
•COMPASS pixel Micromegas	20 GEM + Micromegas
•BESIII	15 GEM
•CLAS 12	30 Micromegas
•CMS	450 GEM

Largest GEM ever produced for Prad prototype



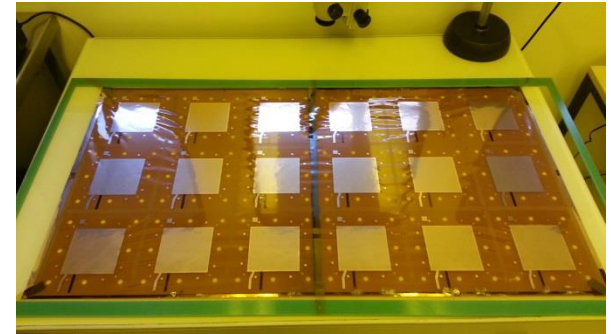
GEM

- Size 1.5m x 0.55m
- 140um pitch
- 70um hole

Read-out

- 2D
- Compass type
- 400um pitch

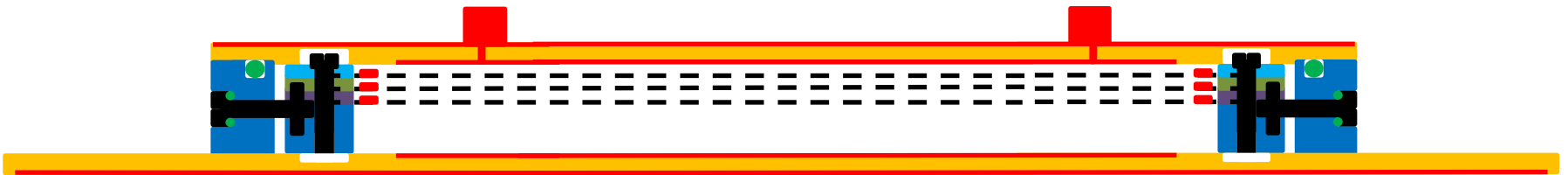
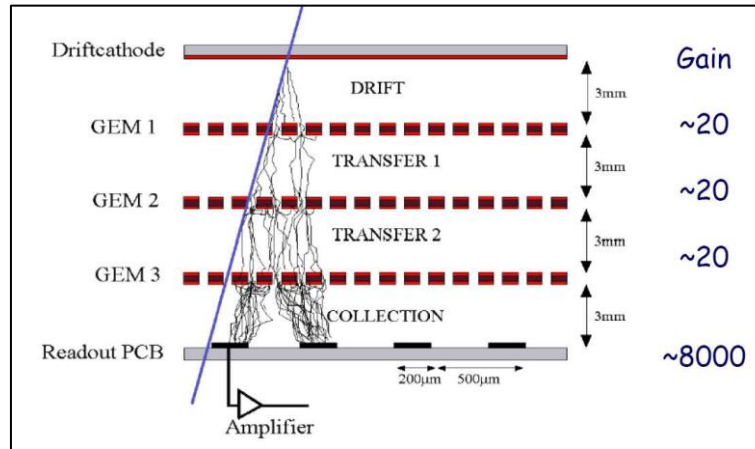
Large GEM introduces cost reduction
10cm x 10cm GEM example



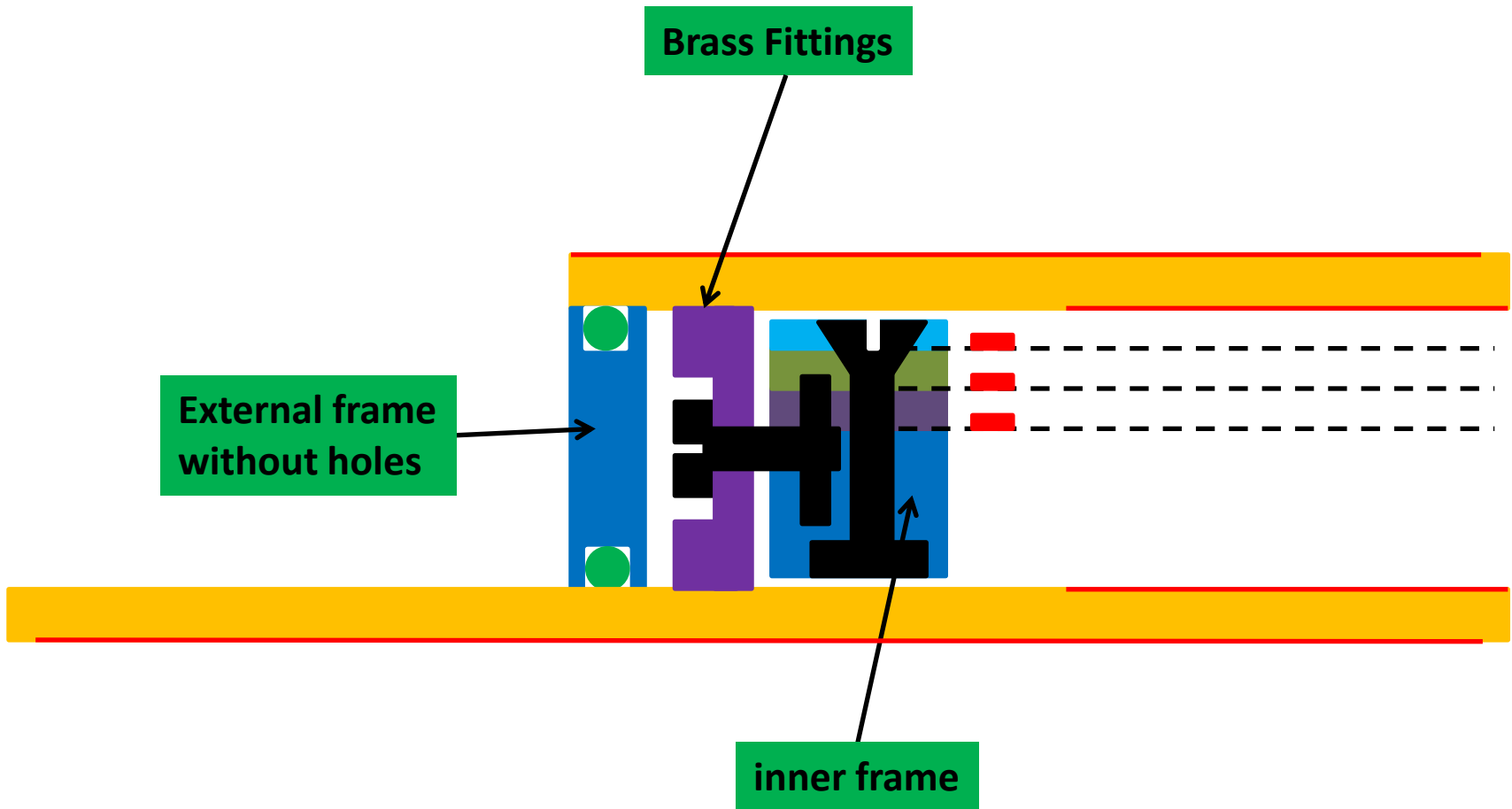
**10cm x 10cm GEM low volume
- 300 CHF/piece**

**10cm x 10cm GEM high volume
- 80 CHF/piece**

NS2 assembly of 3 GEMs



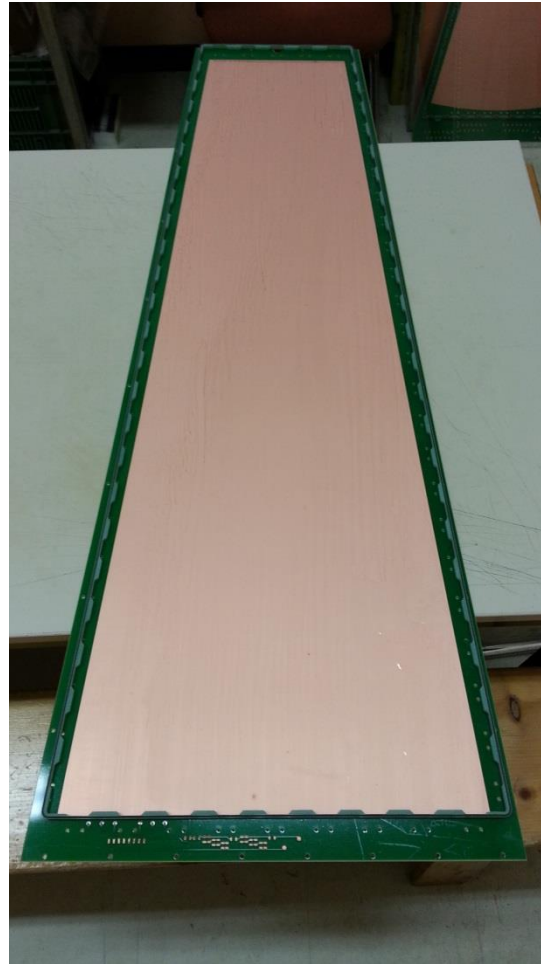
NS2 3.0



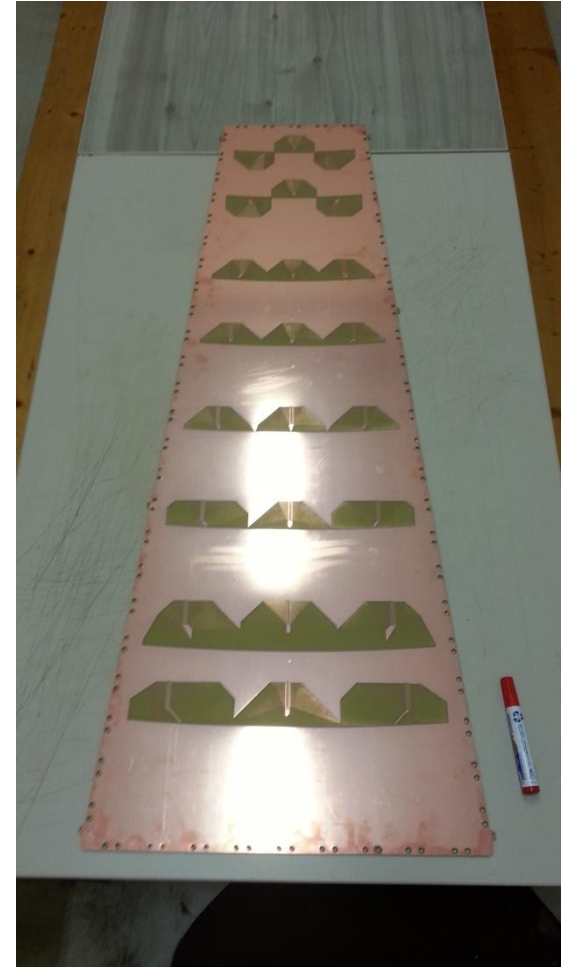
Largest NS2 detector : CMS GE1/1 long
First trial of PU-less detector



**1.3m x 0.5m
GEM**

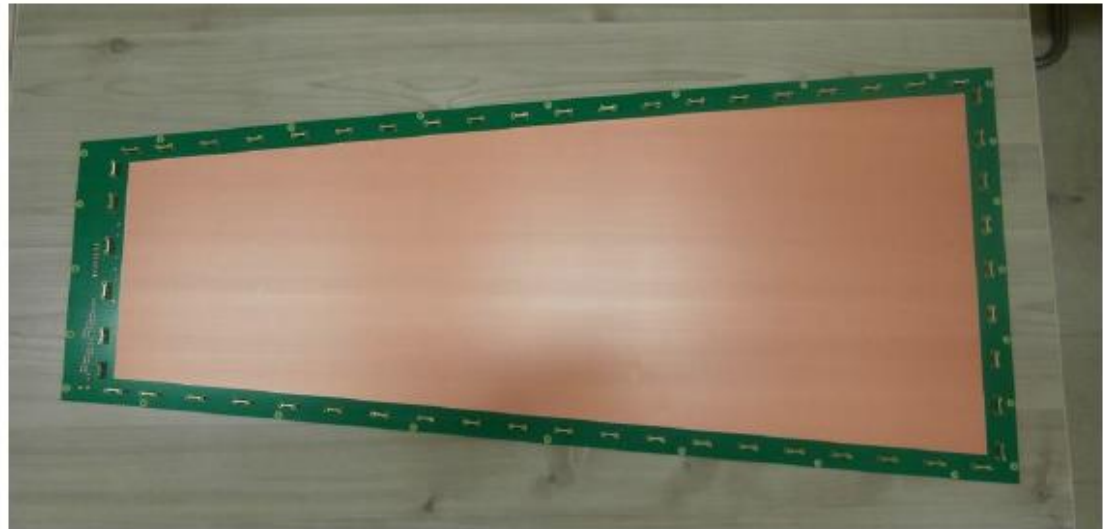
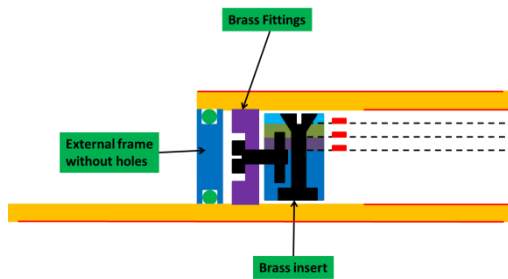


**1.3m x 0.5m
Double sided board
3.2mm thick**

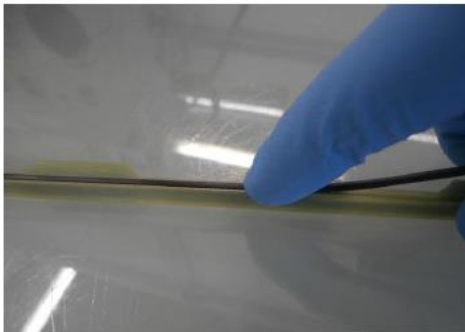
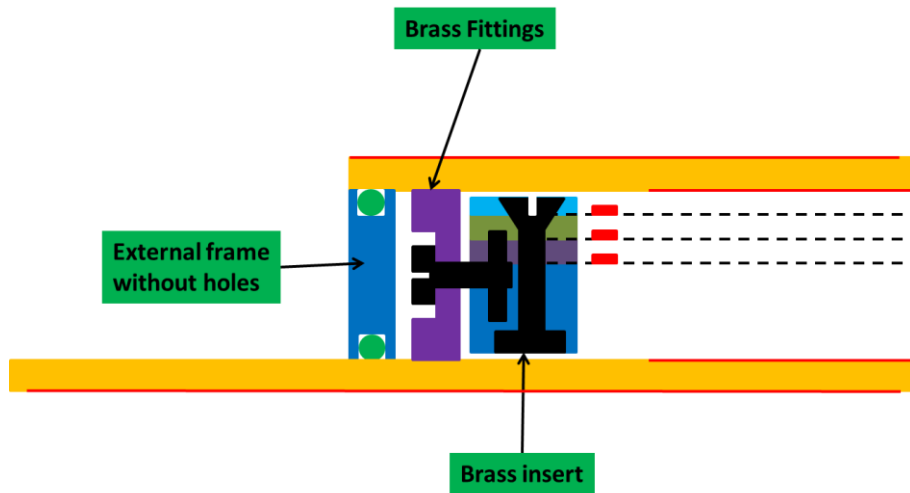


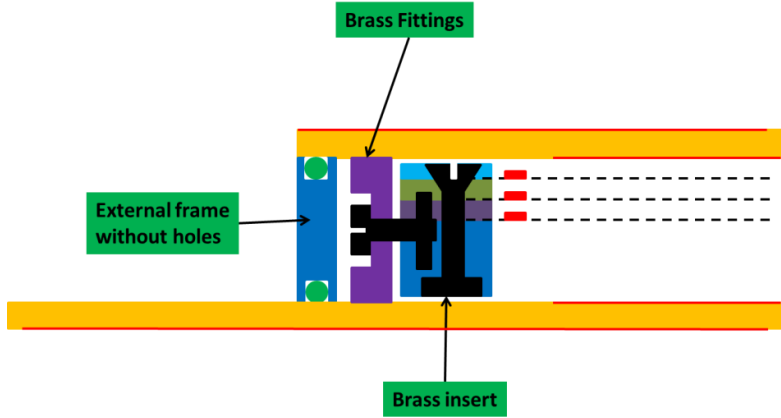
**1.3m x 0.5m
Double sided board
3.2mm thick**

Brass fittings assembly

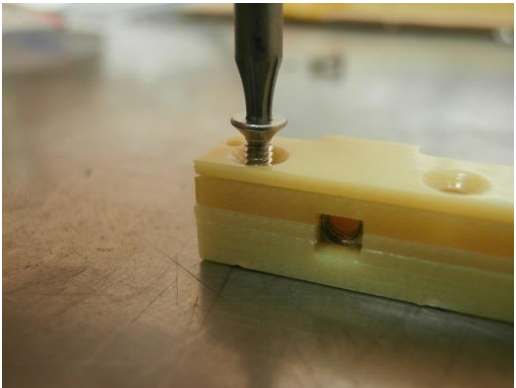
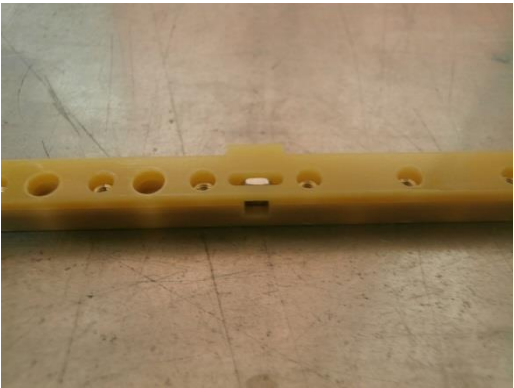
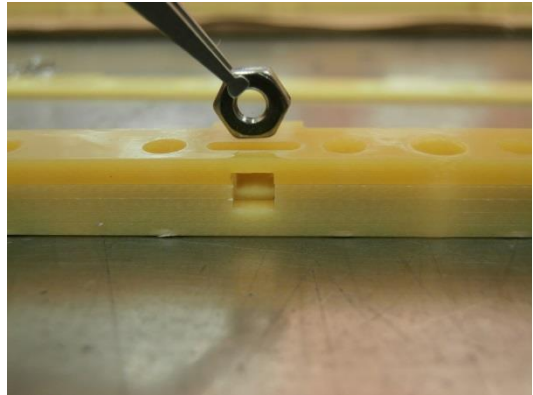
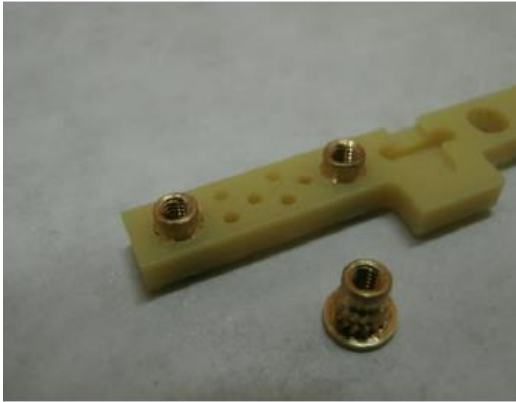
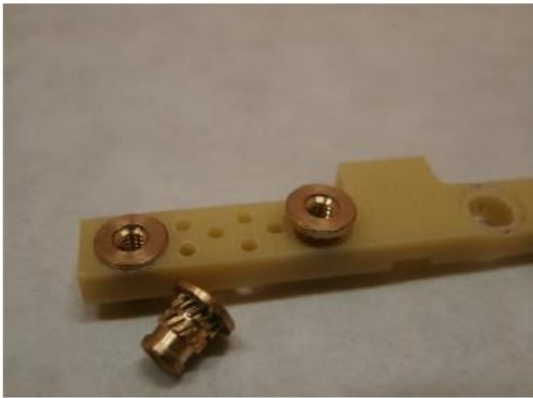


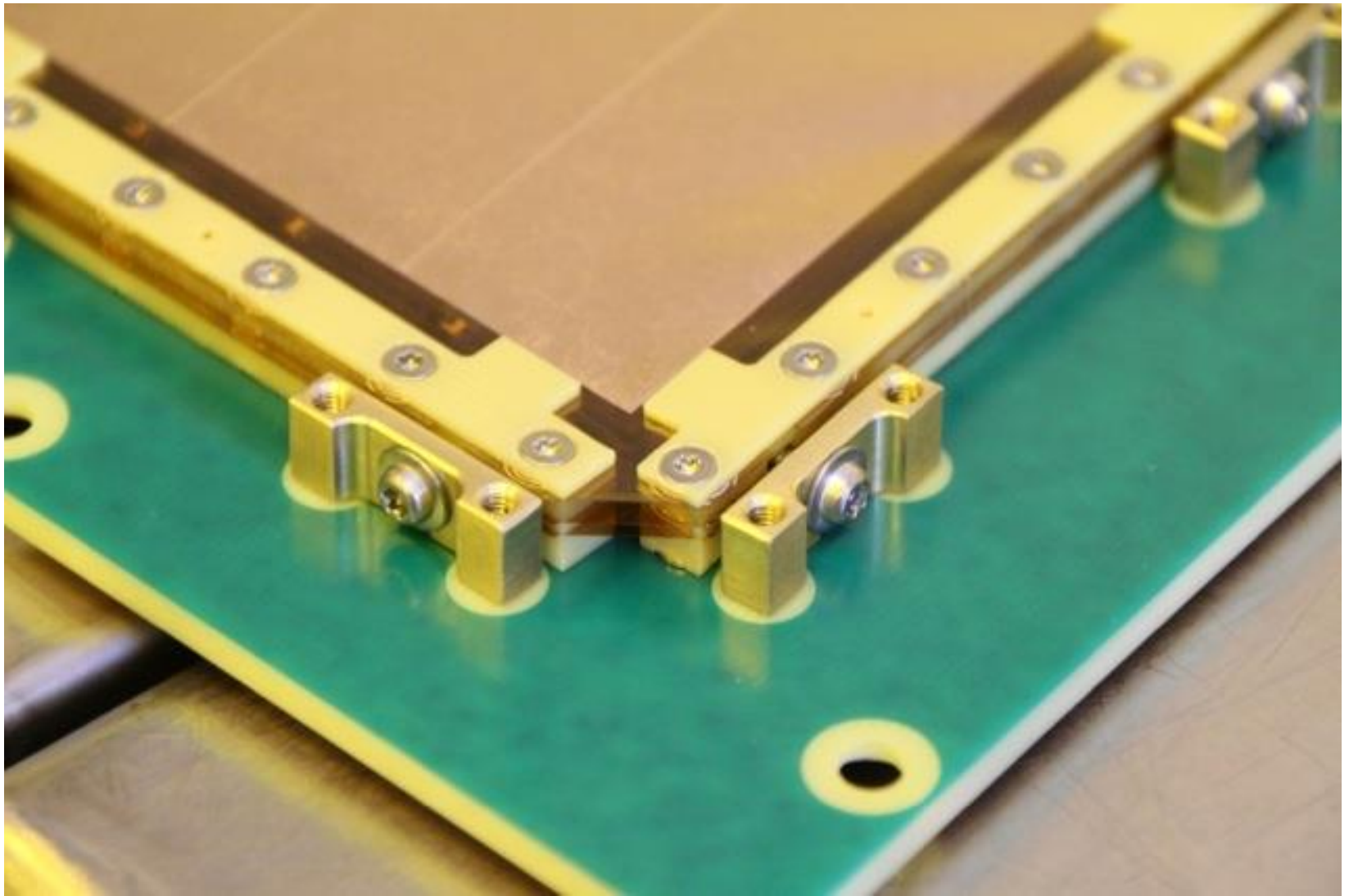
External frame



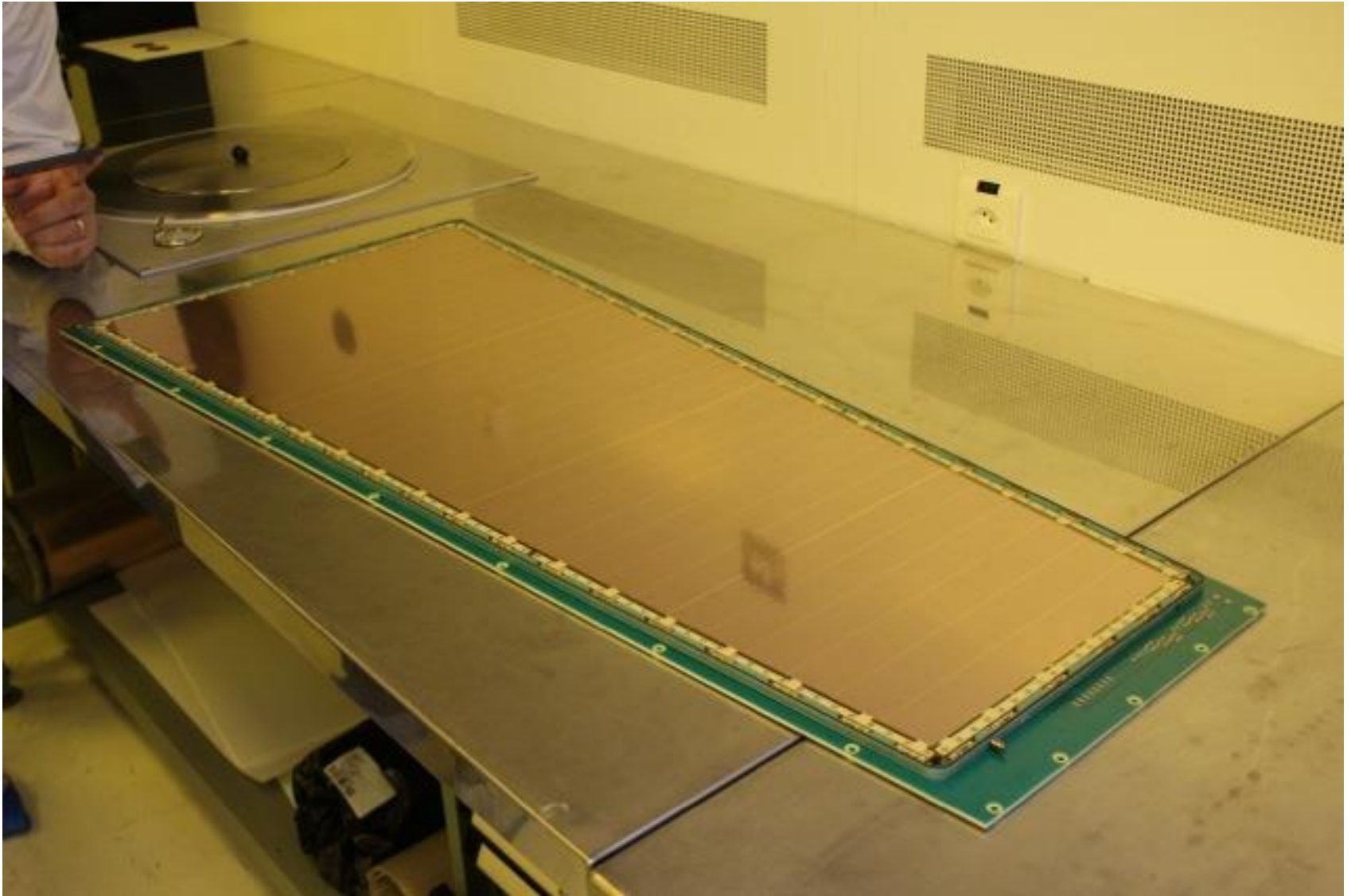


inner frame

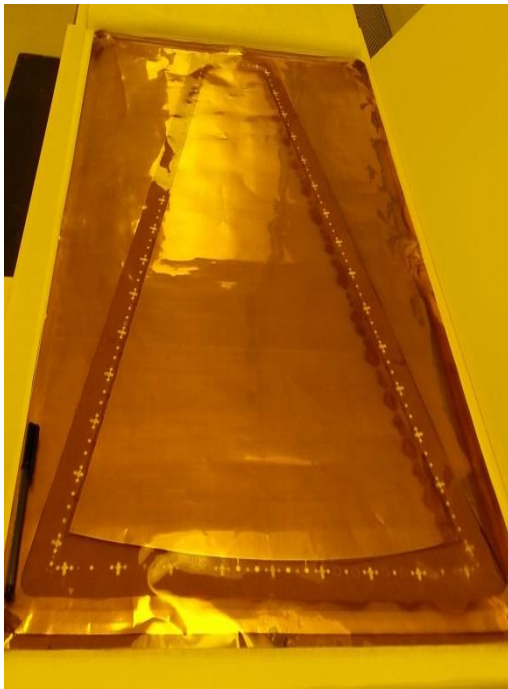
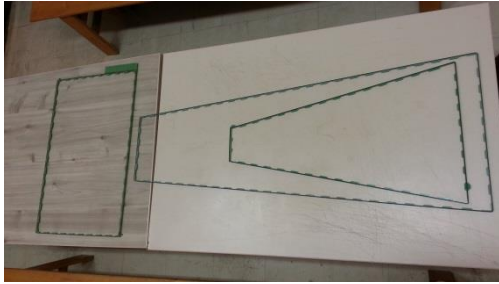




CMS GE1/1 NS2 detector assembled



NS2 projects



CBM
Under characterization
2 detectors built



Dubna
Prototype production



CMS
2 long version in production
5 STD KITS to be delivered

Industry status

• GEMs

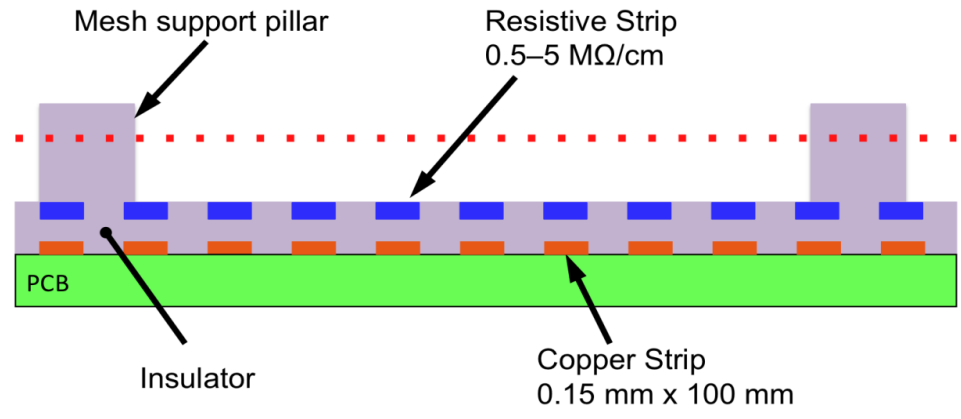
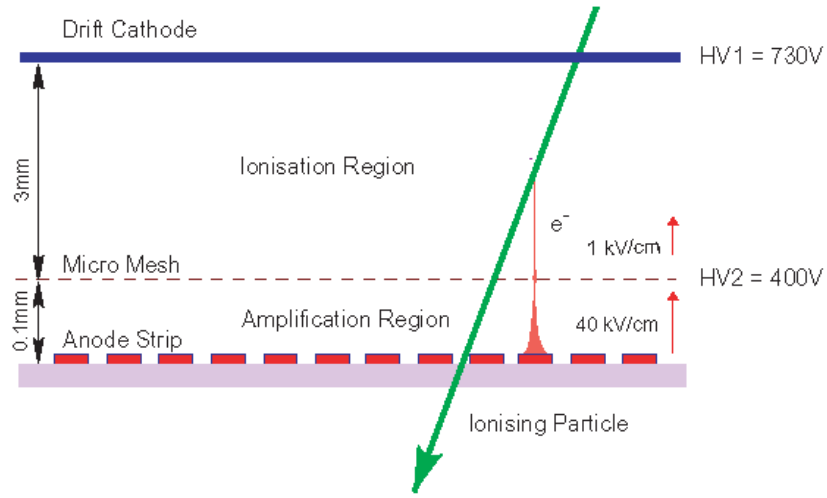
- Tech-etch (US) → single mask 1m x 0.5m OK
- Techtra (PL) → single mask 30cm x 30cm OK
- Mecharonics (KR) → single mask 1m x 0.5m in progress
- Micro Pack (India) → single mask 10cm x 10cm in progress



***ALICE IROC
Made at Tech-etch***

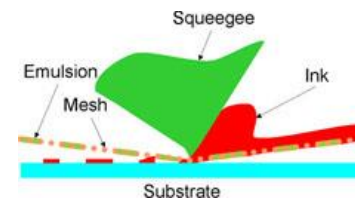
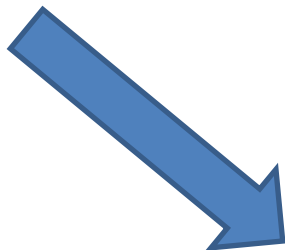
***For detector smaller than 1m x 0.5m
100% of the GEM detectors parts are
now available in industry***

Micromegas detector



PCB + readout strips

50um Kapton + resistive strips + glue + hole



25um solid Glue



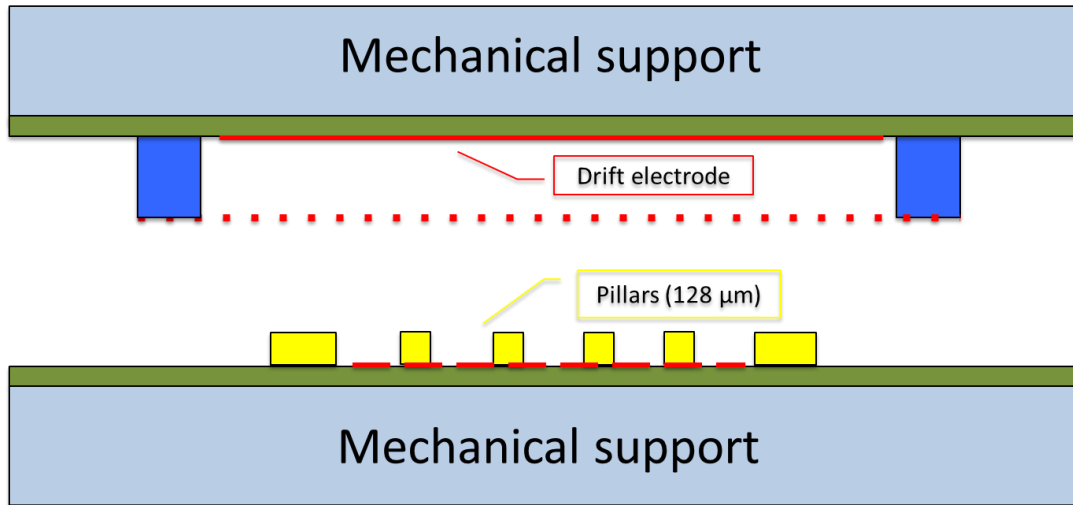
High temp Gluing



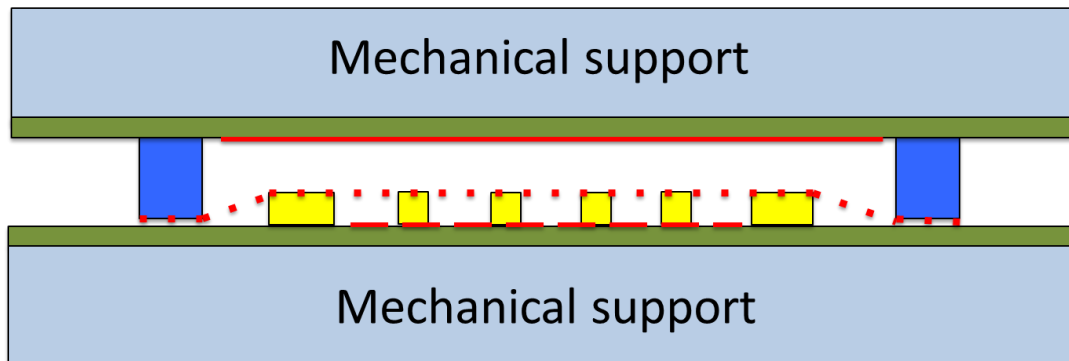
Pillars creation

STD Micromegas structure

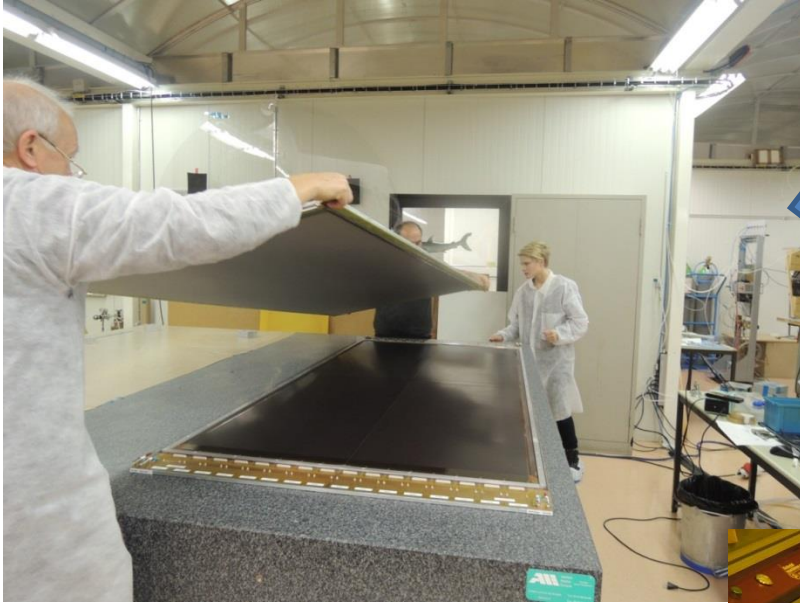
Open



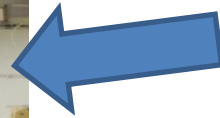
Closed



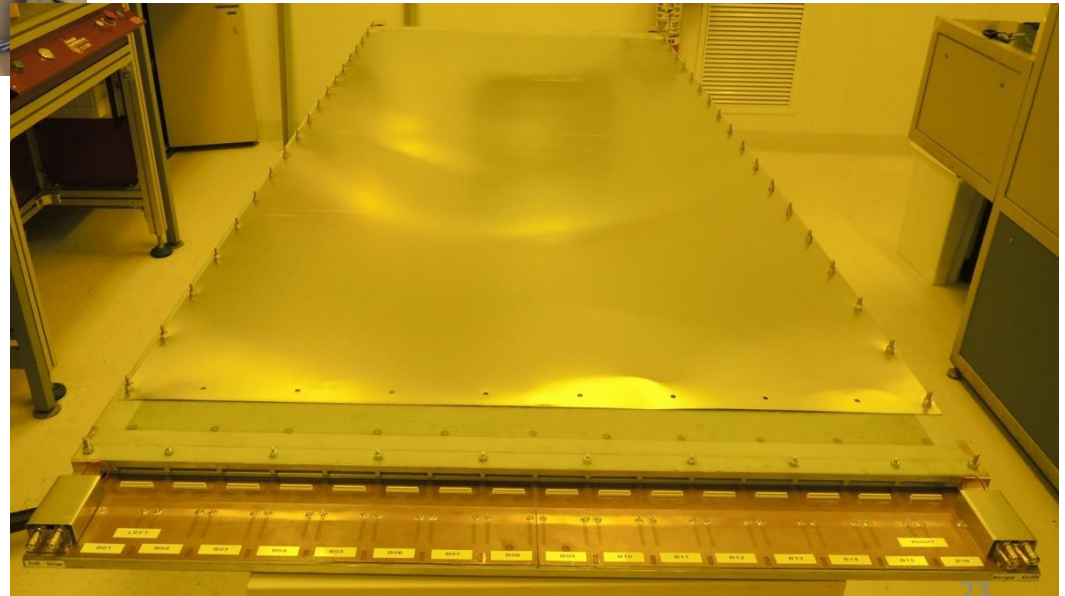
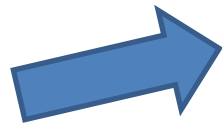
Largest Micromegas produced for NSW prototype



ATLAS NSW upgrade
detector 2m x 1m opened



Detector closed



Industry status

- **Micromegas**

- **ELTOS , ELVIA , Triangle Labs:**

- **BULK ok up to 50cm x 50cm**

- **STD Micromegas up to 2.2m x 0.5m**

- **Other companies showing interest:**

- **Trackwise (UK)**

- **PCB electronics (Israel)**

Conclusion

- **Out of the Building 107 the project is on time**
- **We are ready for 2m x 0.5m GEM**
- **Micromegas are already available in 2m x 0.5m**
 - **2m x 1m in 4 pieces already produced**
 - **Futur goal 2m x 1m in one piece**