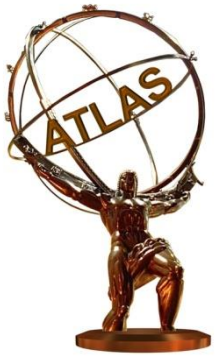


M. Bianco

On behalf of the MAMMA Collaboration

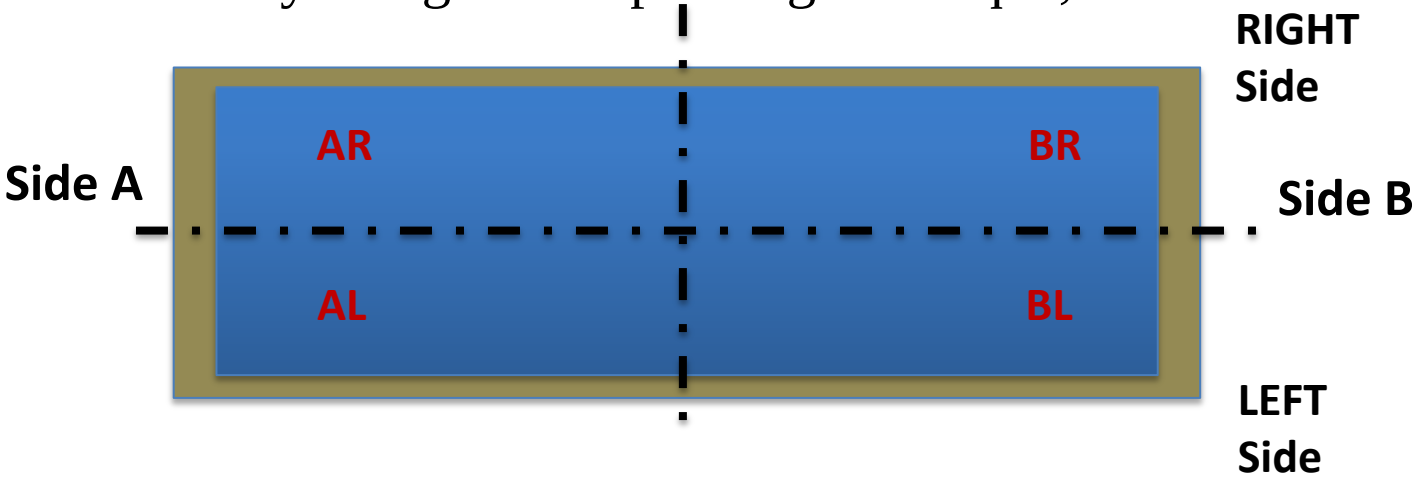
Experience with the first 1 X 2 m^2 micromegas chamber for the ATLAS upgrade

Outline

- Large MM (L2) construction
- Mechanical Issues
- Test stand setup for L2 characterization
- First test on L2 chamber
- Summary

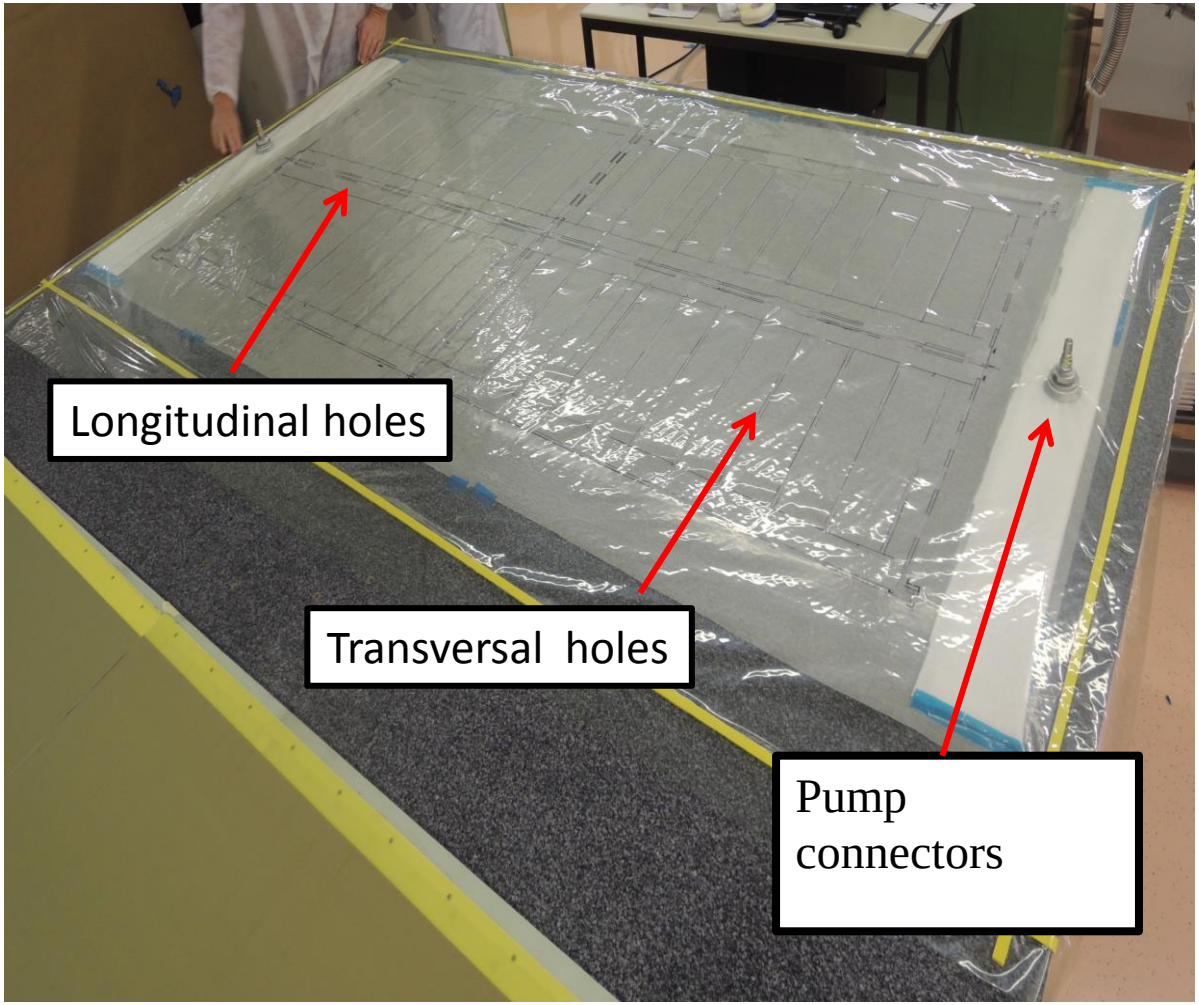
The L2 chamber

- Parameters:
  - Chamber dimensions: 1 x 2.4 m^2 (0.92 x 2.12 m^2 active area)
  - 2 x 2048 strips (0.45 mm pitch), separated in the middle
  - Four PCBs (0.5 x 1.2 m^2, thickness 0.5 mm) glued to a 10 mm thick stiffening panel
  - Floating mesh, integrated into drift-electrode panel (15 mm thick)
  - PCBs were made at CERN, resistive strips have been printed in industry using screen printing technique, with interconnects



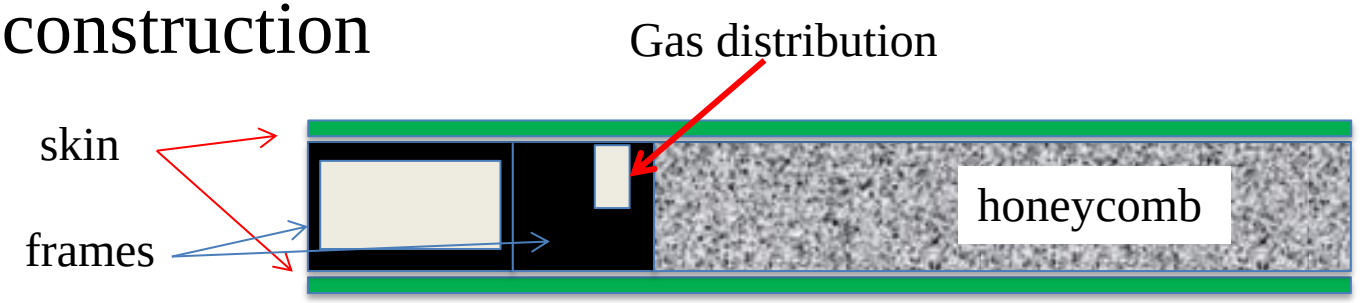
L2 construction, the vacuum system

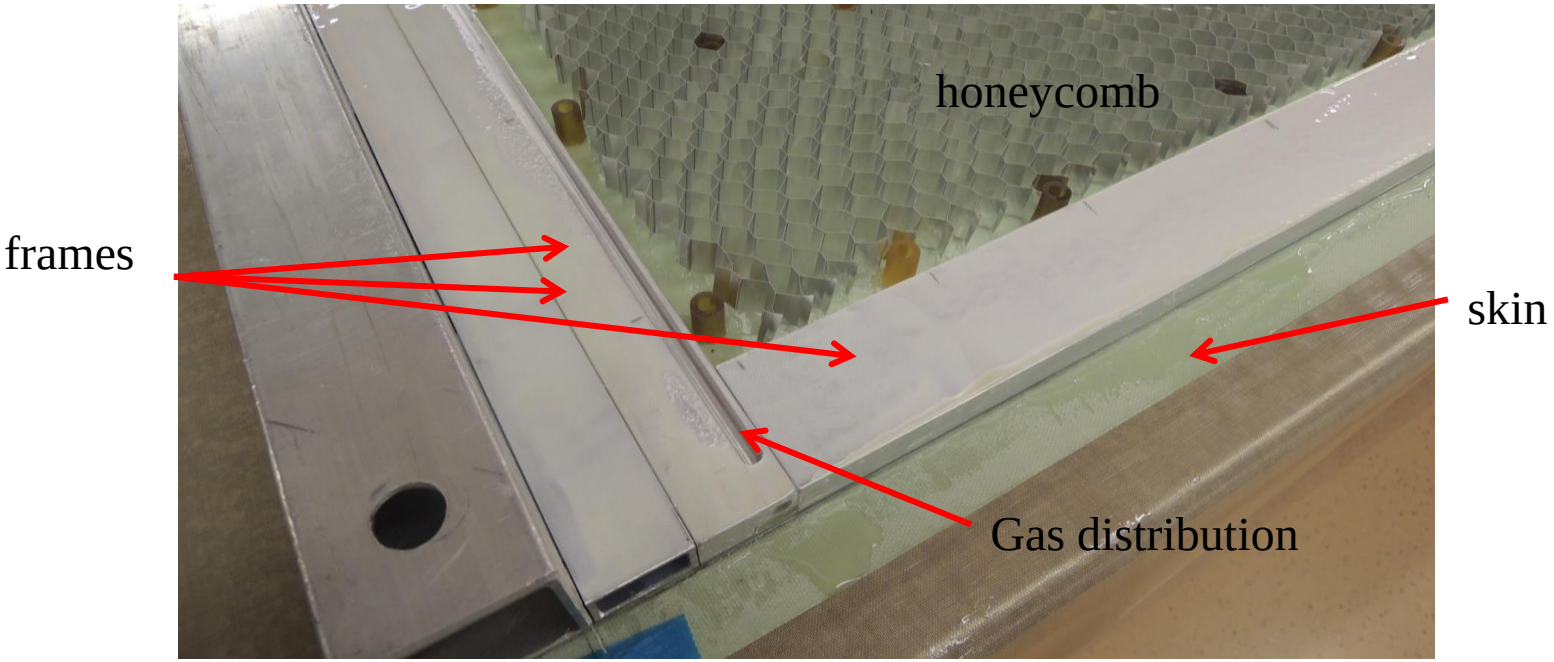
- On the granite table a thin plastic mesh to make a vacuum, covered with thin foil used for the vacuum bag was positioned
- On the thin foil about 130 hole were made to suck the PCB
  - Longitudinal holes: ~ 10 x 0.5 cm
  - Transversal holes: ~ 40 x 0.5 cm
  - Transversal holes on the edge of the PCB: ~ 10 x 0.5 cm
- For the L3 panels construction the thin foil of vacuum bag has been replaced with maylar foil (175 μm thick) and the holes with a uniform grid of circular holes:
  - More than 800 holes
  - 4 mm ∅
  - Distance from holes 5 cm



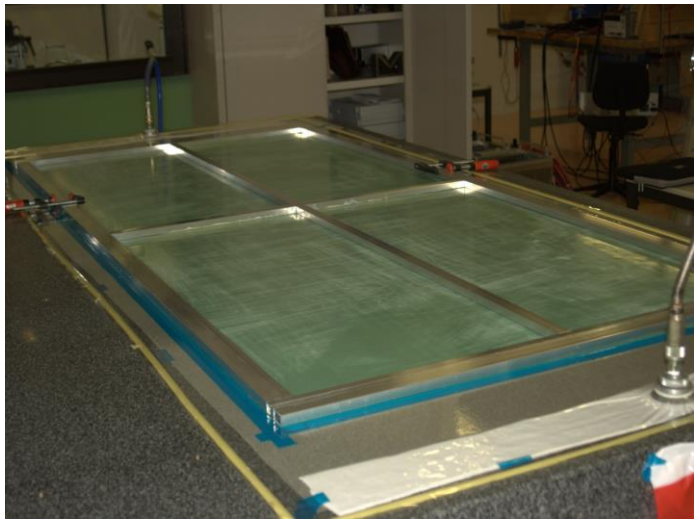
L2 construction

L2 Drift panel construction

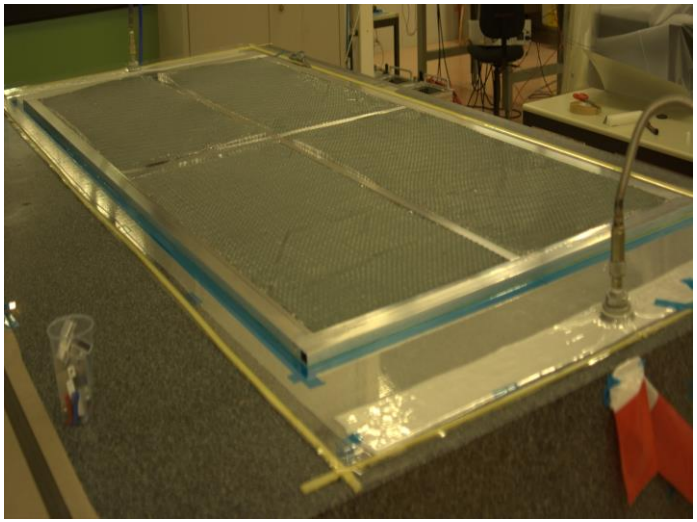




L2 construction, the drift panel

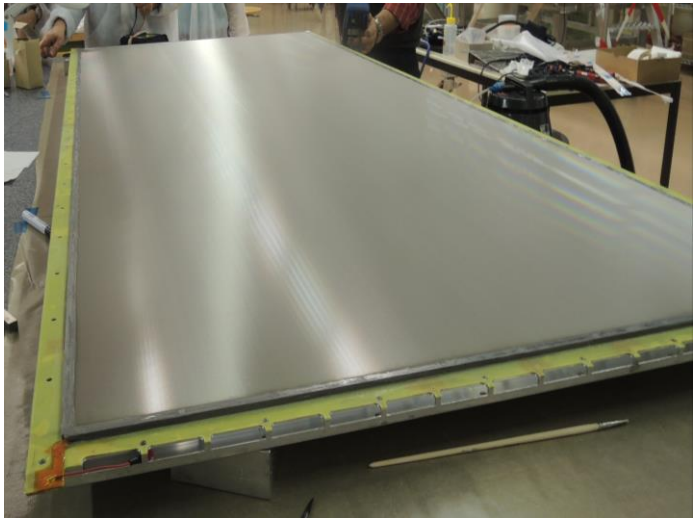


1) Frame positioning



2) Honeycomb gluing

3) Drift electrode panel completed

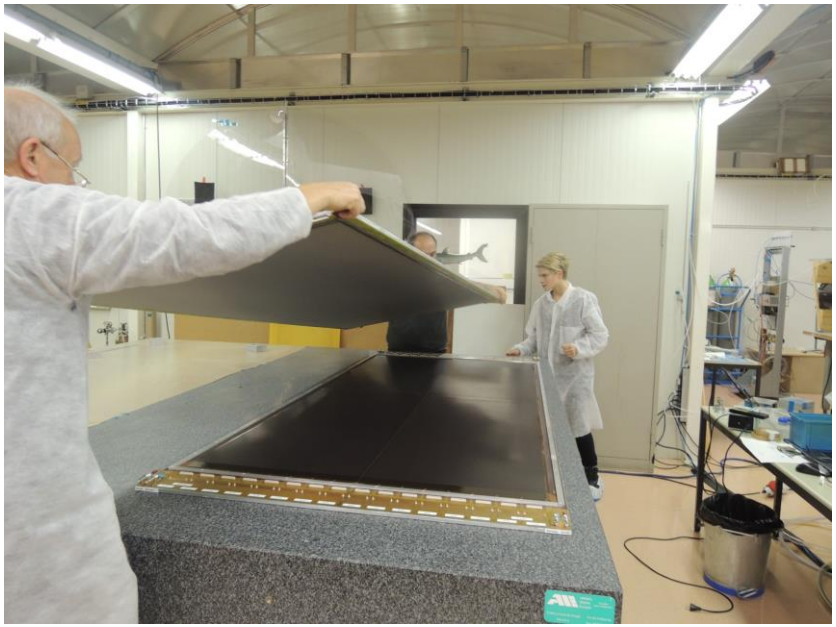


4) Drift electrode panel with mesh glued to it

L2 construction ,readout panel

Readout boards glued on readout panel

L2 construction



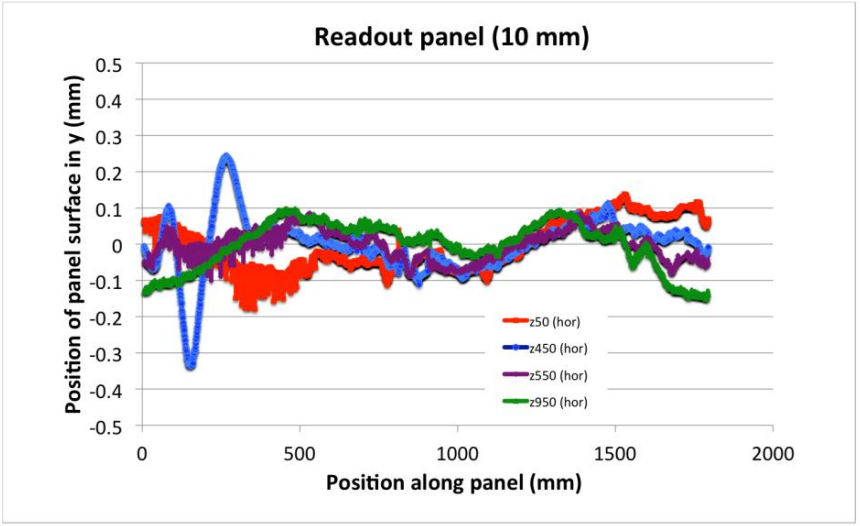
Chamber assembling

Chamber completed

Problems with L2 chamber

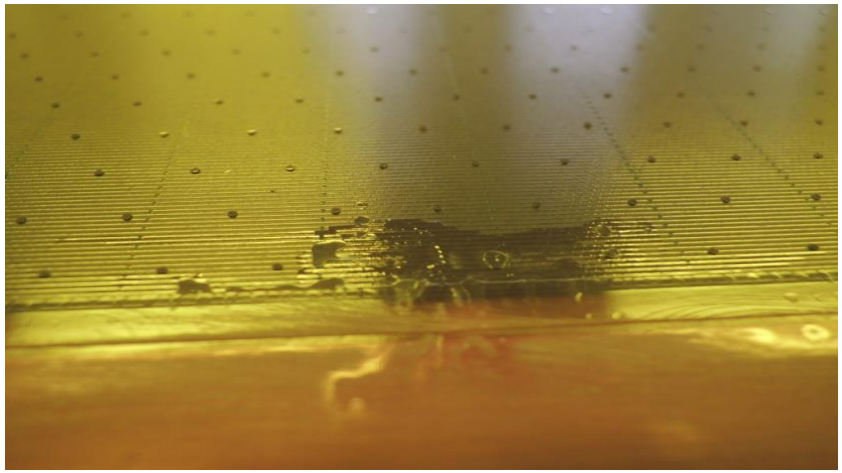
- Non planarity of readout board

Planarity measurements of the readout board after the gluing on the readout support panel shown that same area are not perfectly flat



- Glue creeping under readout board

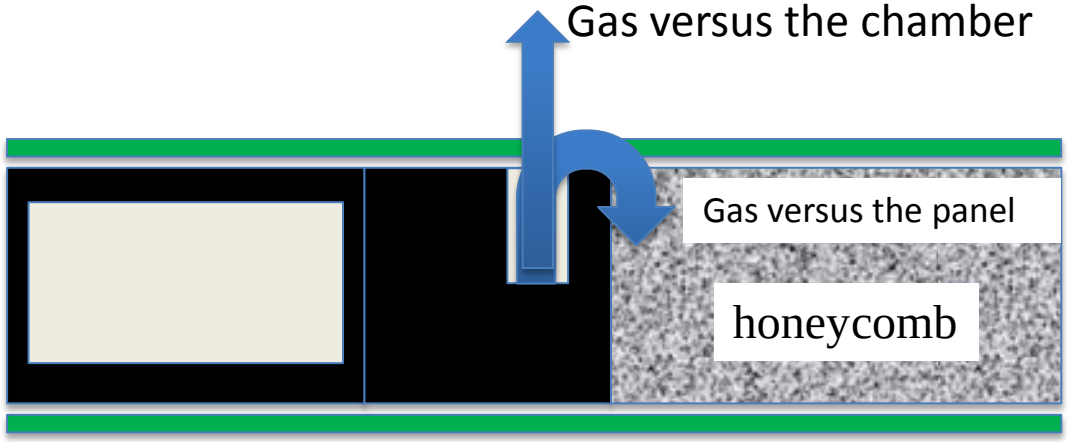
During the gluing of the readout board on the support panel, some glue spill over and reached the readout strips, maybe the glue was to fluid.
For the L3 panel production a thin tape has been applied between the edge of PCB and the Mylar foil to avoid spill of glue.



Problems with L2 chamber

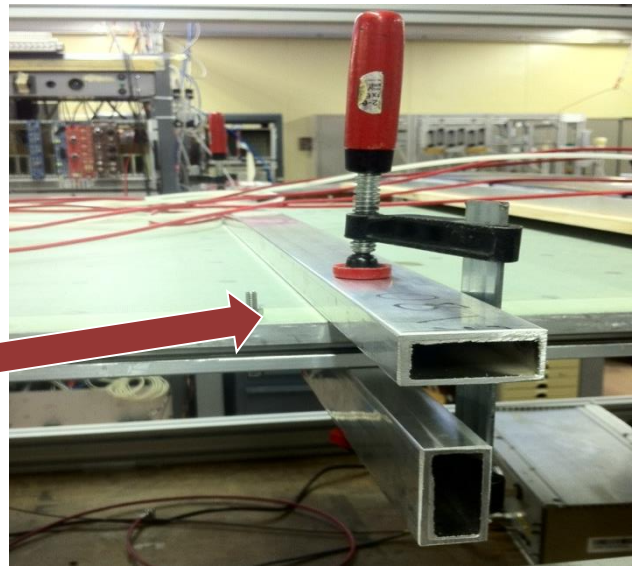
❑Gas Leak

Gas Leak in to Drift Panel (Gas inside the honeycomb structure)
To avoid the gas leak a new profile for the gas distribution in L3 chamber has been adopted (See backup slides)



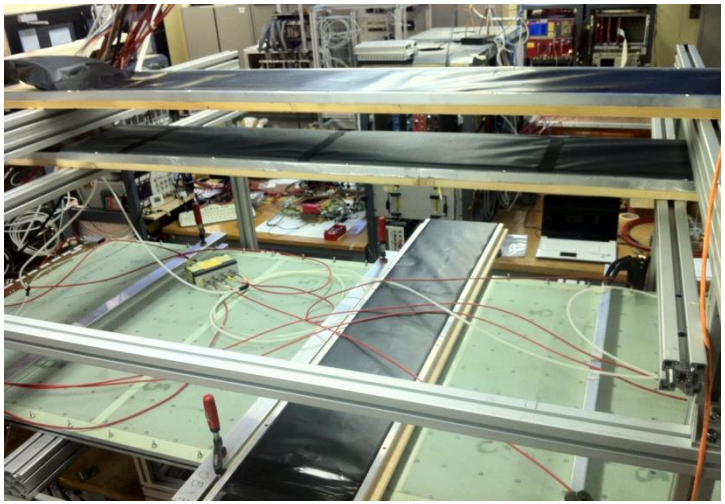
❑Panel deformation for gas pressure

- Due to the large area, under the gas pressure the chamber was deformed, as a consequence low efficiency was observed (mesh not touching pillars)
- To operate correctly the L2 bars were tightened to the chamber surface to maintain planarity
- For L3 Chamber new mechanical constrain in the meddle of the chamber have been added

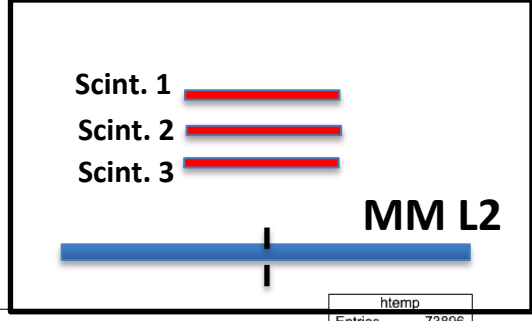


Cosmic Stand

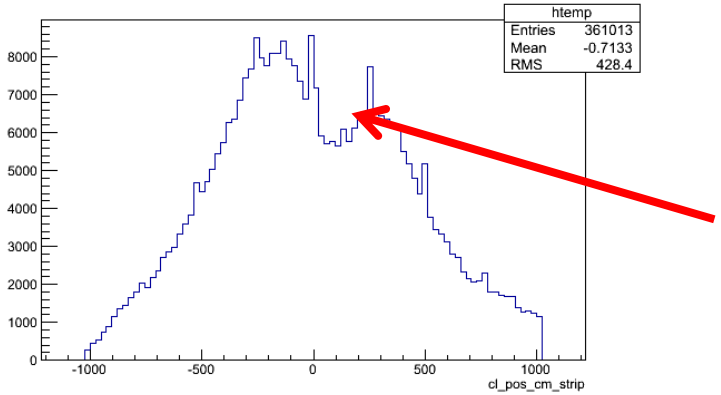
- Cosmic trigger provided by three fold scintillator coincidence
  - One scintillator used to scan the surface
- Data acquired by 16 APVs connected to SRS readout system (single FEC card), able to readout half chamber.
- Power supplied by five HV channels. Four used for the resistive strips, one for the drift electrode.
- Gas flow monitored manually by gas flow-meter



L2 Cluster profile with cosmics



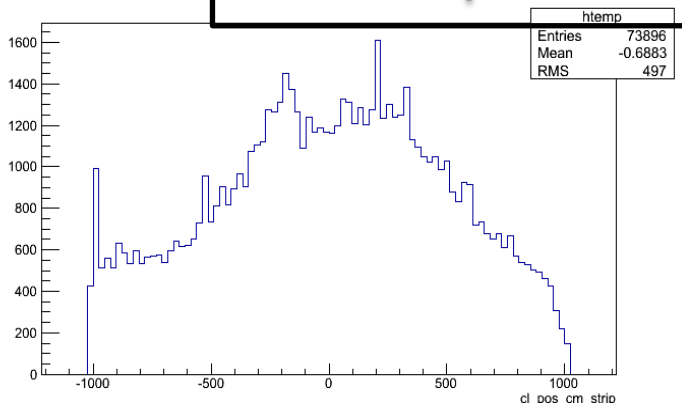
SIDE A

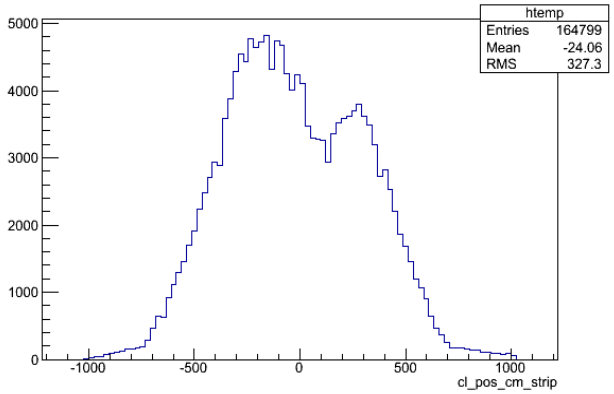


All events

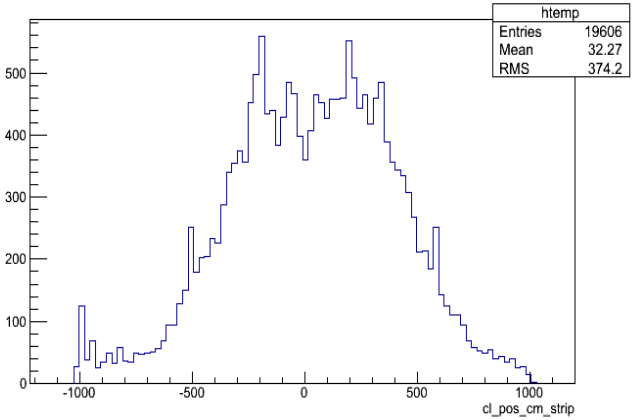
Discussed in detail later

SIDE B





Event with one cluster



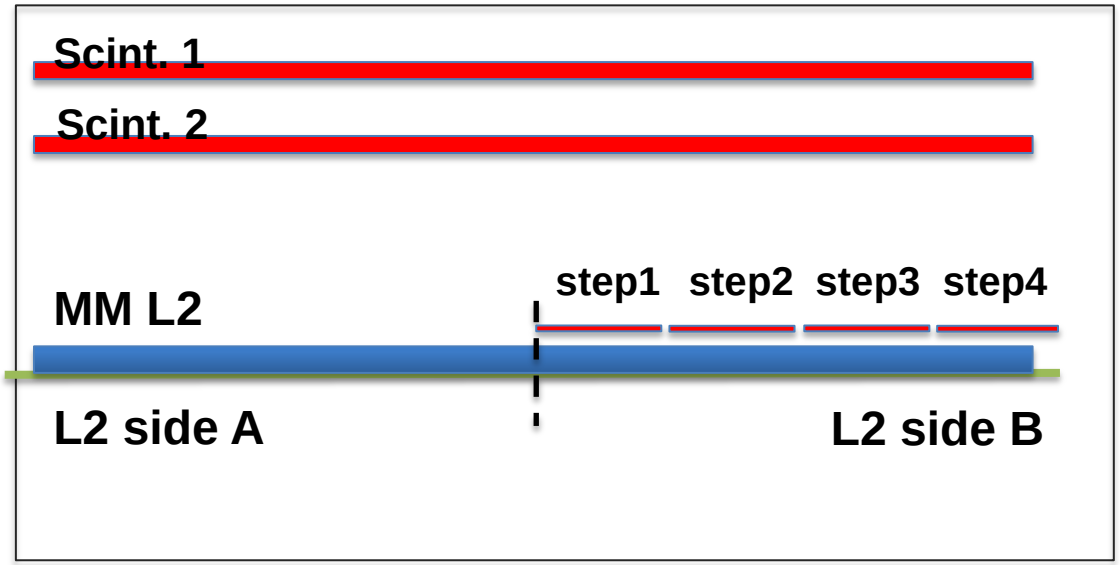
- HV on resistive strips scanned in the range 500 V – 580 V in steps of 10 Volts. Aims to increase the HV to 590V or more during next tests

Surface Scan

- The electrostatic force keep the mesh in touch with the pillars, we want to investigate the effect produced on half chamber while HV on the second part is turned off.

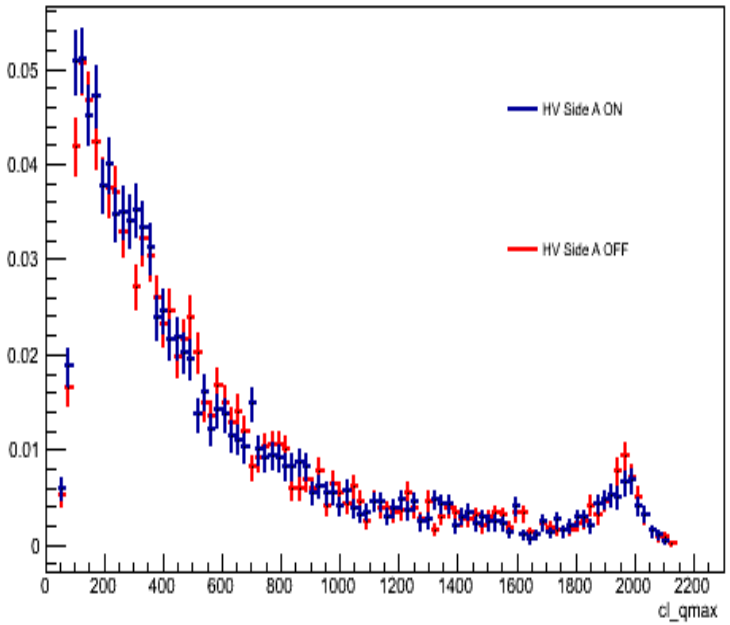
- Use the surface scan to investigate the double peak on cluster profile on Side A.

Trigger scheme

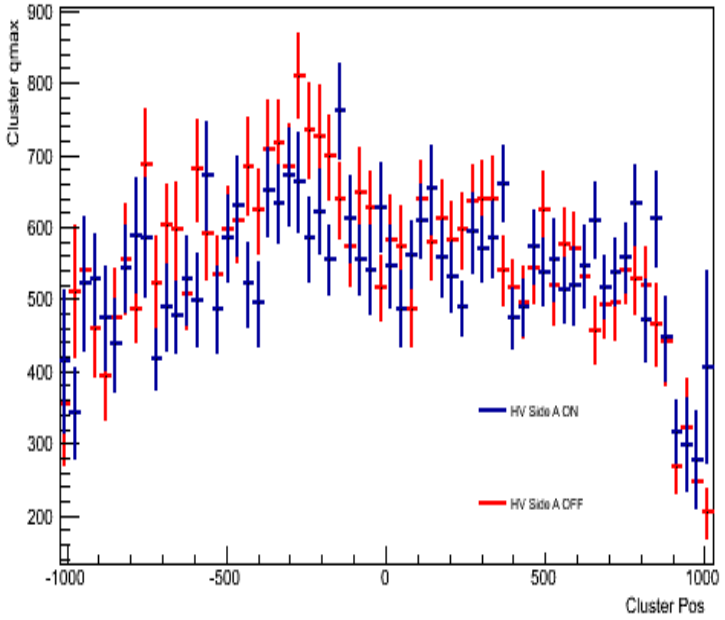


Surface Scan

- Switching off half of the detector (side A) does not impose any effect on the Side B



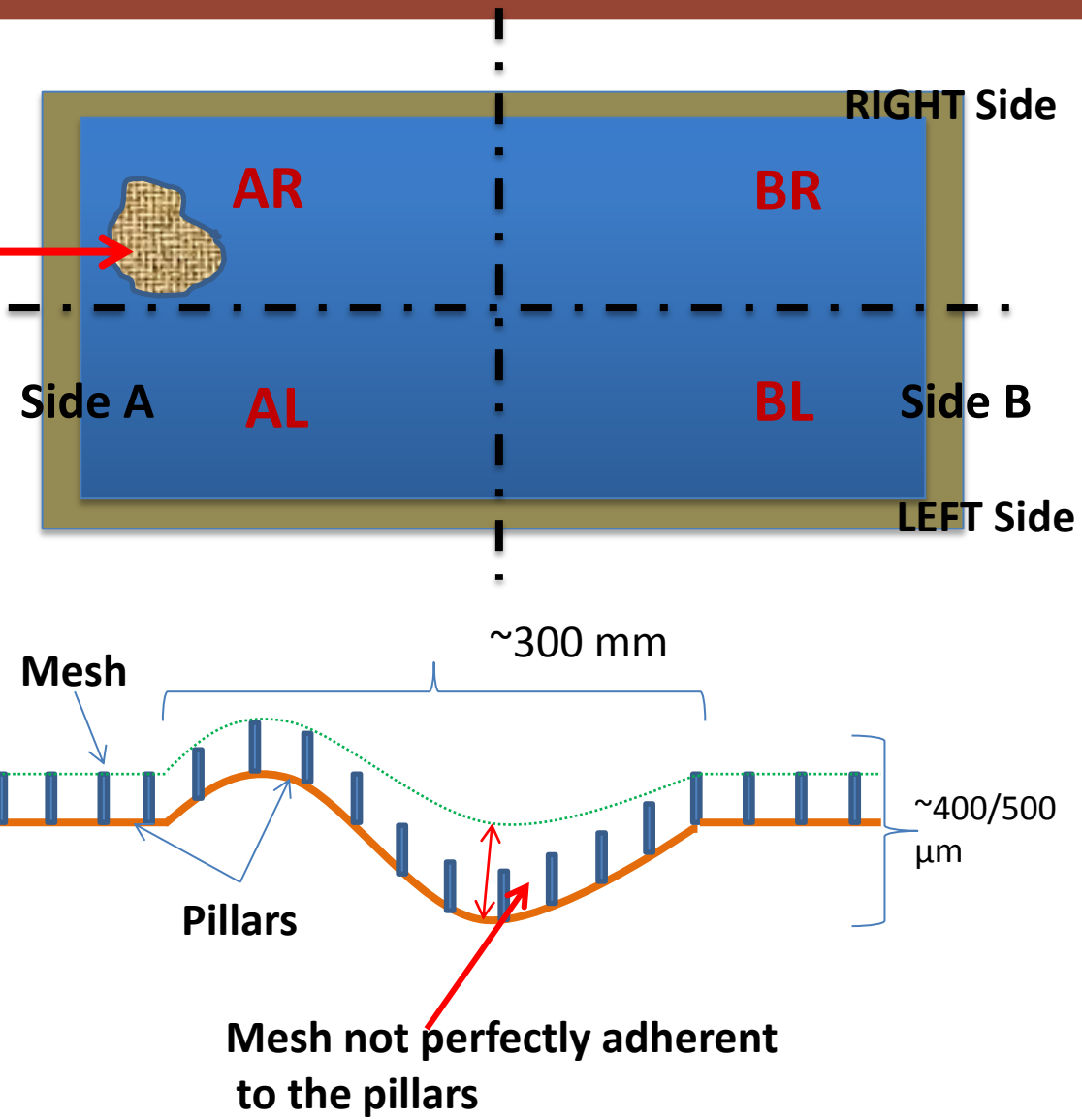
- Cluster charge distribution



- Cluster charge as a function of cluster position

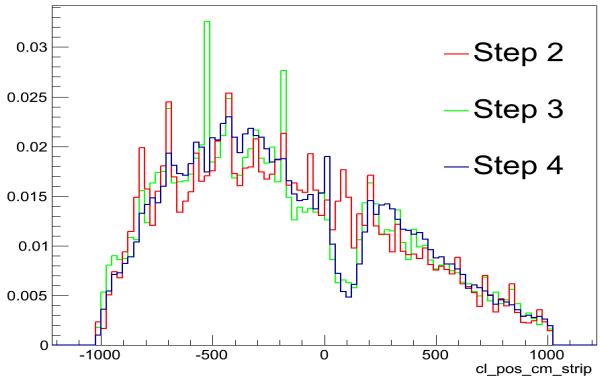
Surface Scan

- Read out board not flat in some area (AL/AR)
- The mesh is stretched on the frame mounted over the drift plane
- The non-flatness over short distances of the readout boards prevents the mesh to following the shape of the board; leading to a smaller amplification field in some regions.



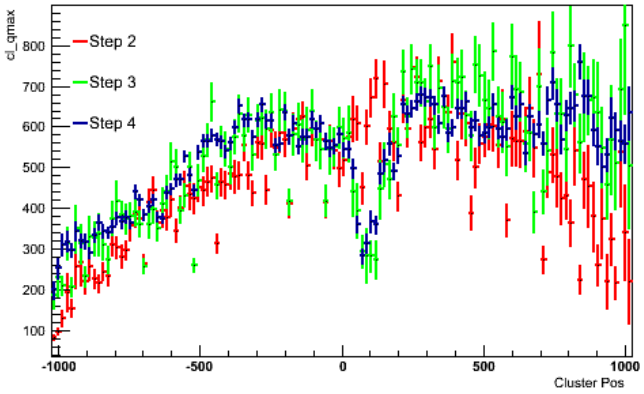
Surface Scan

Moving the orthogonal scintillator from step 1 to step 4, a clear dip appear in the cluster profile, similarly the same effect appear in the charge profile.

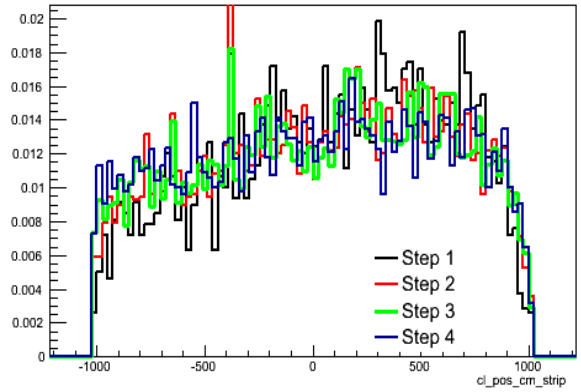


(SideA)

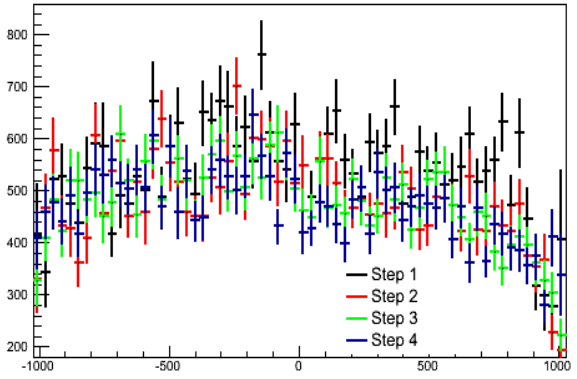
Step 1 is not added to make the plots more clear



On side B, moving the orthogonal scintillator from step 1 to step 4 the cluster profile and "cluster charge" profile appears regular and uniform.

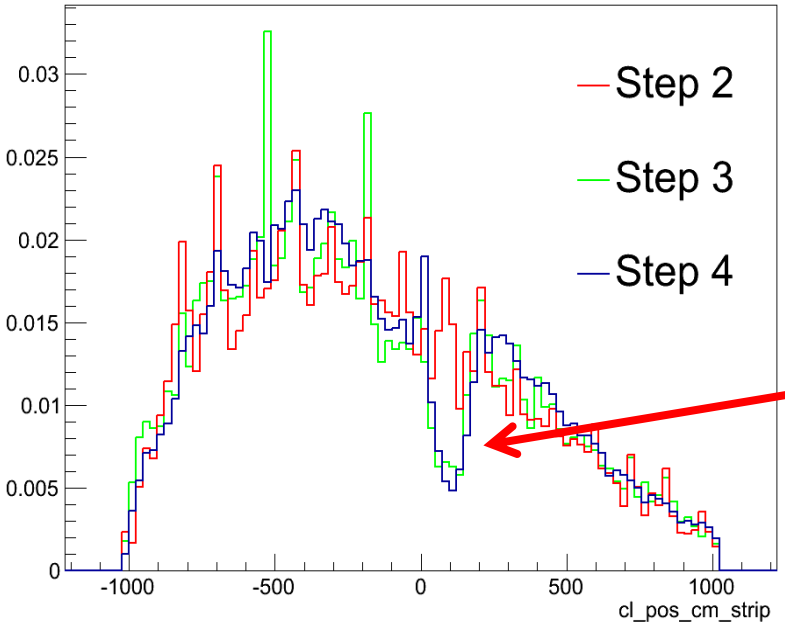


(SideB)



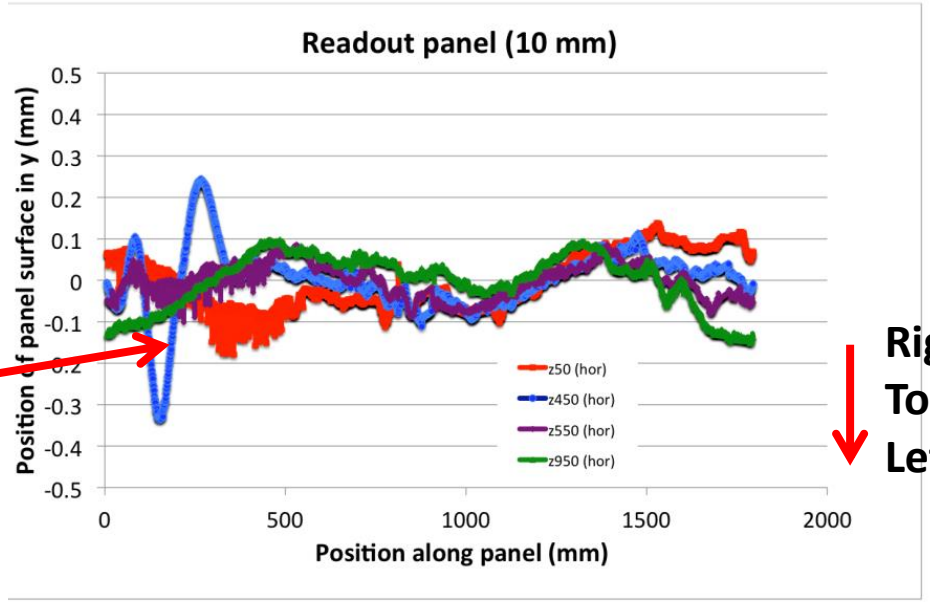
Surface Scan

The position of the dip on cluster profile seems to be in agreement with what measured by the laser interferometer



LEFT Side **RIGHT Side**

Side A cluster profile



Right To Left

Side A → **Side B**

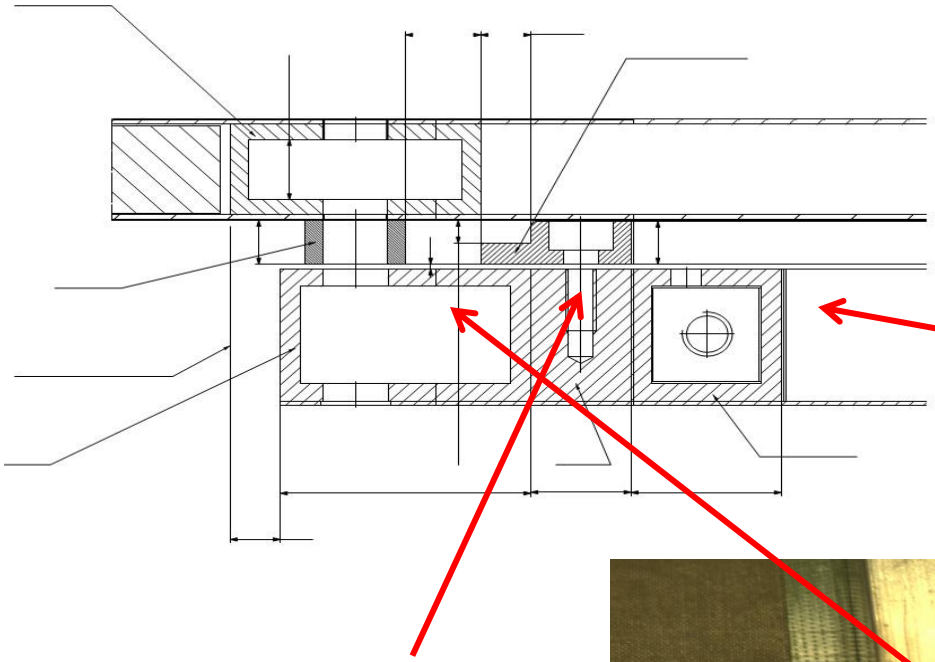
Summary

- A 2 x 1 m^2 Micromegas chamber has been successfully built and is working smoothly.
- The chamber response is quite uniform.
- HV of up to +580 V in Ar:CO_2 (93:7) has been applied to the readout strips without observing HV instabilities because of sparks
- A dip in the detector response has been identified at the areas of imperfect planarity of the readout boards

Backup

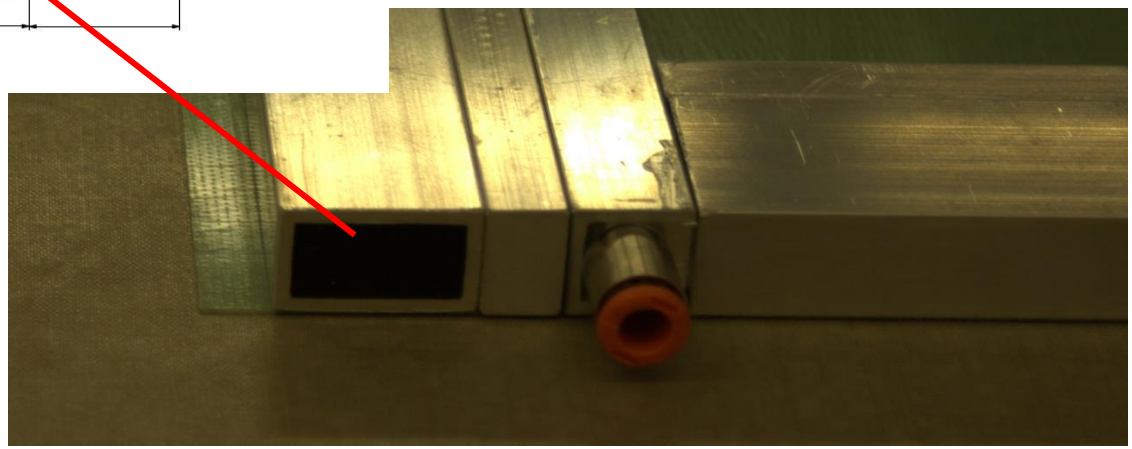
L3 drift panel construction

L3 transversal section



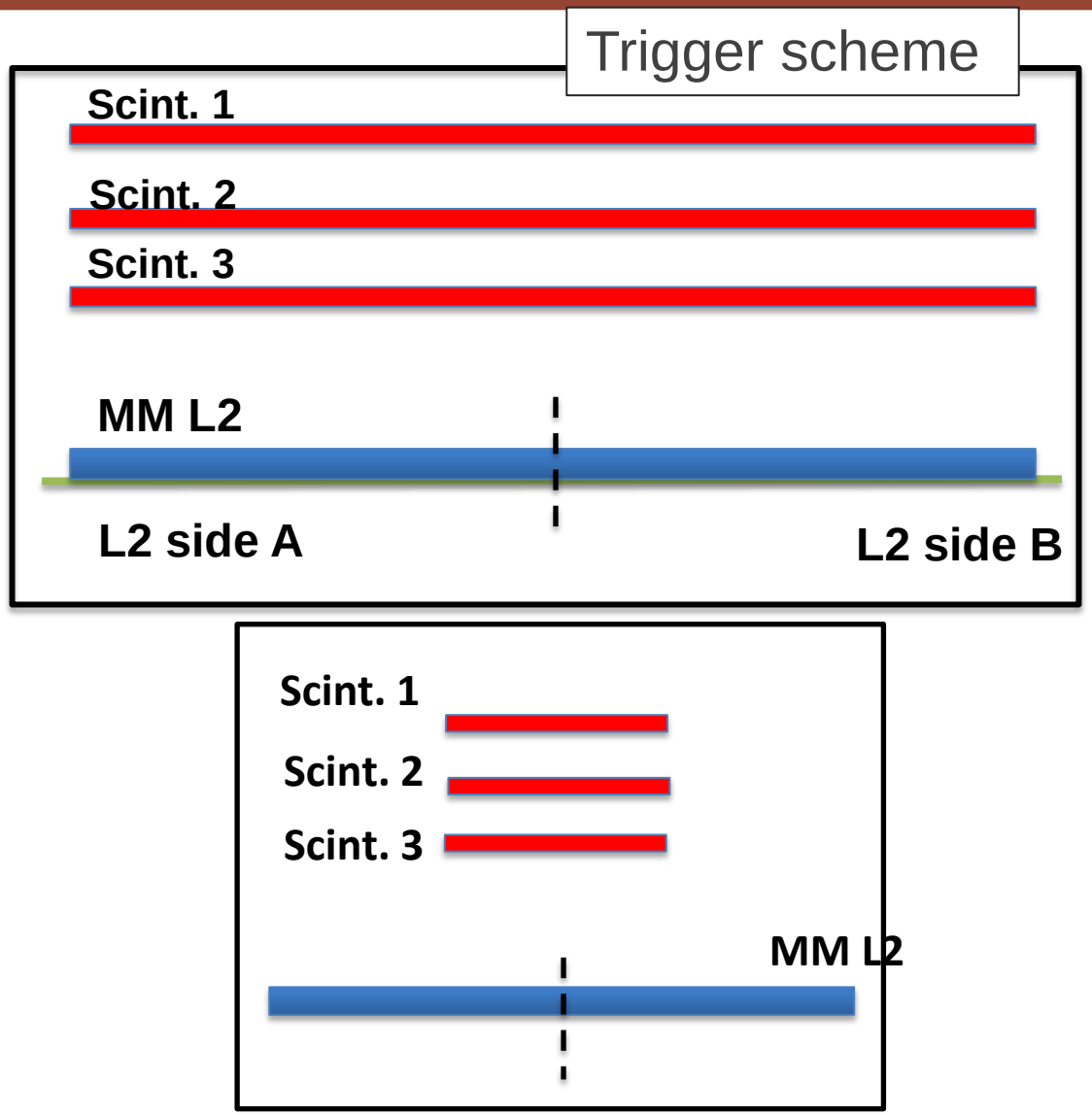
Gas distribution

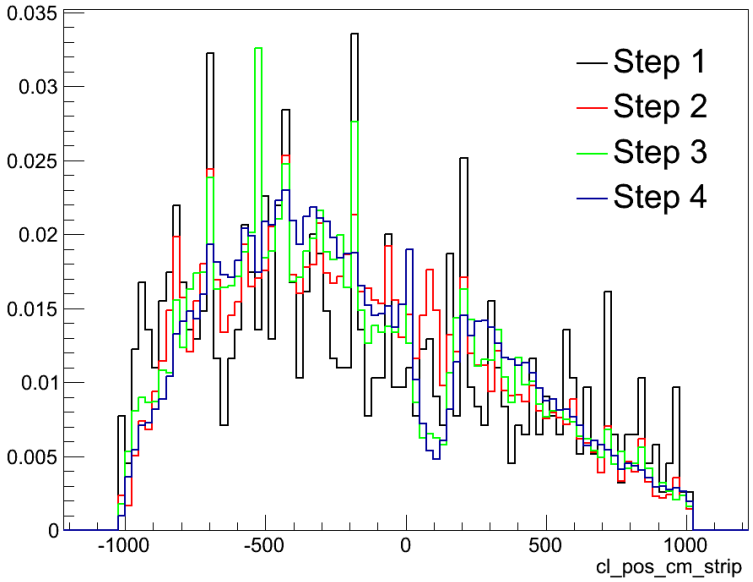
Mesh frame support

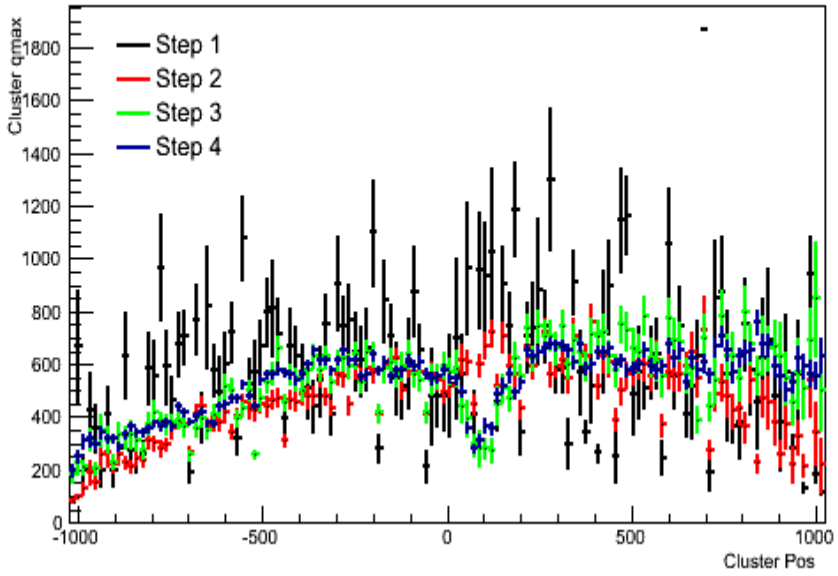


L2 Strip profile with cosmics

- **Three-fold coincidence**
- **Scheme 1: all three scintillators aligned along the strips**




Step 1
Step 2
Step 3
Step 4
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
-1000
-500
0
500
1000
cl_pos_cm_strip


Step 1
Step 2
Step 3
Step 4
Cluster qmax
1800
1600
1400
1200
1000
800
600
400
200
0
-1000
-500
0
500
1000
Cluster Pos

Surface Scan (Side B)

On side B, moving the orthogonal scintillator from step 1 to step 4 the cluster profile and “cluster charge” profile appears regular and uniform.