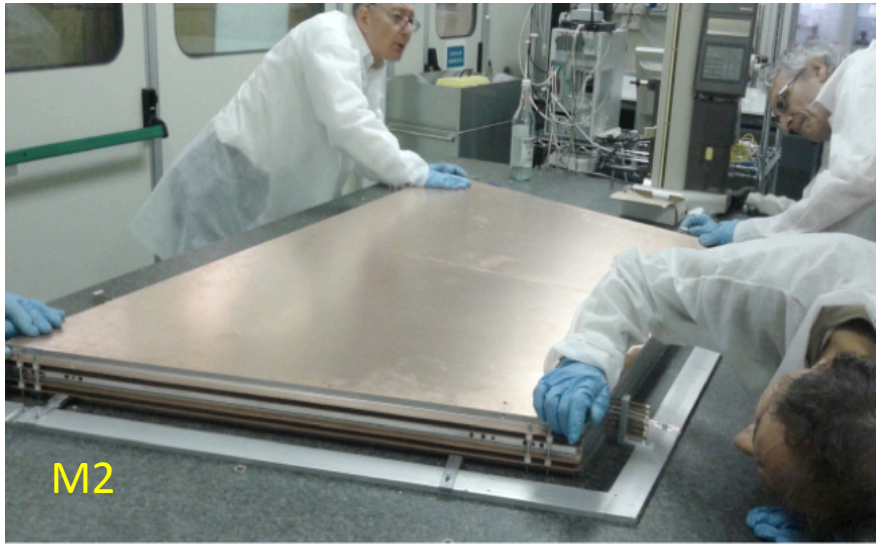
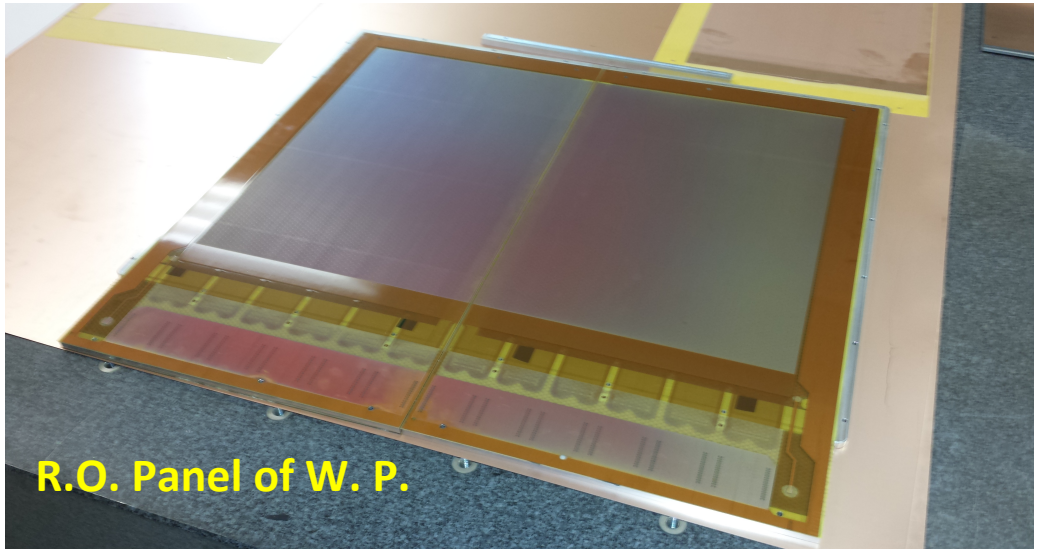
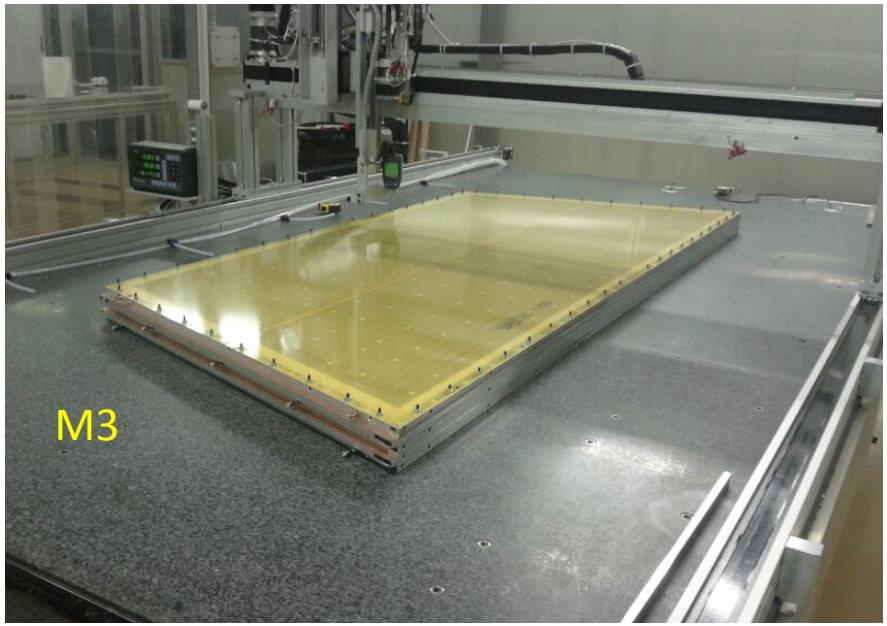
Report on INFN recent activities

Giovanni Maccarrone (INFN-LNF)
On behalf of the Italian NSW Community

Outline



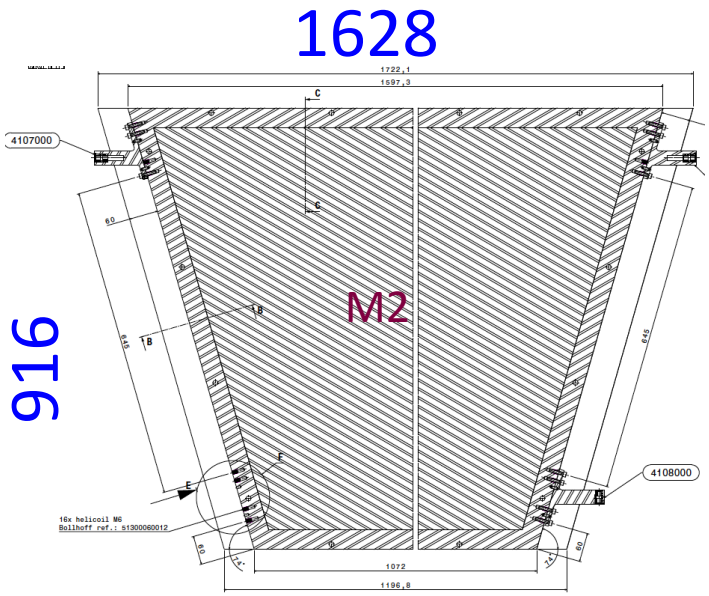




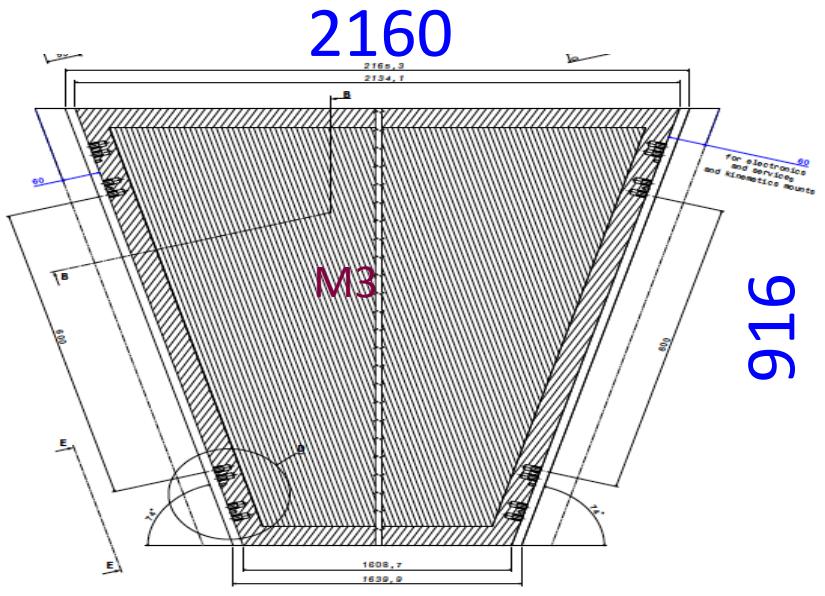
- Mechanical Prototypes
  - Deformation Simulation
    - M3
    - SM1
  - Deformation Test M3
- Working Prototype

N.B. M3 simulation results are very preliminary because the prototype description is not so accurate.

Mechanical Prototypes (technique)



Made in Rome 1



Made in Pavia

with the support of the others INFN groups

	M2	M3
Construction technique	vacuum bag	reference plates + stiffback
Inner structure	none	gas system + mesh frame
Module assembly	glued	screwed
Best panel planarity (rms)	28 μm	36 μm

Rome1 activity: follow-up from last meeting

→ Test of vacuum bag technique with Al honeycomb (5052 – 3/16' cell -0.001')

→ New frame scheme to better control absolute thickness.

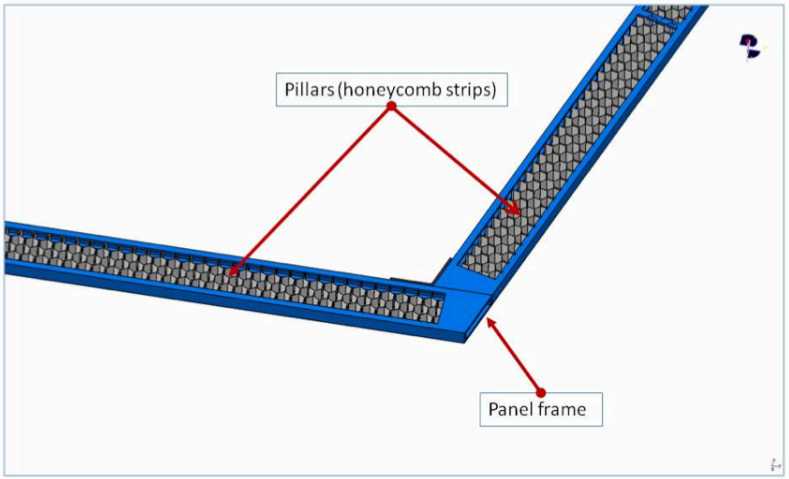
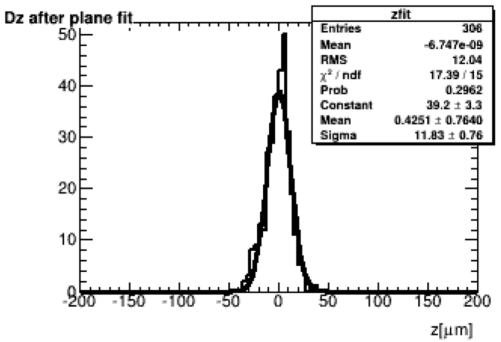
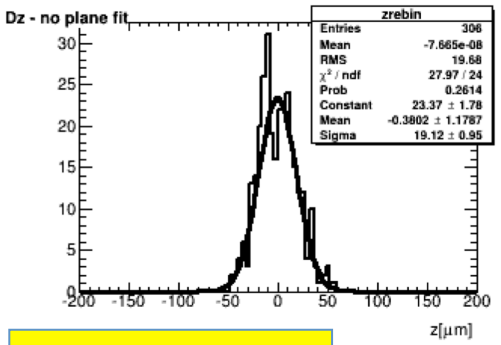


Figure 11: Honeycomb pillars inserted in slits carved in the panel frame

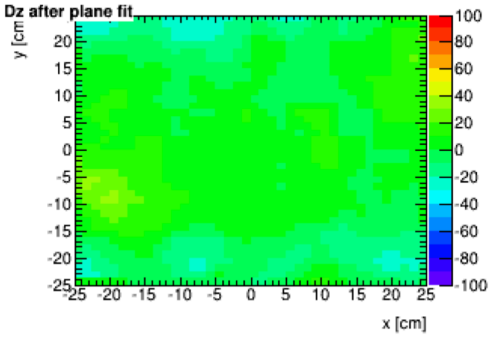
Test done on a 68x60 cm^2 panel with the Two-step assembly method (Δt = 24 h):

Planarity RMS (σ_{RAW}) below 20 μm both faces



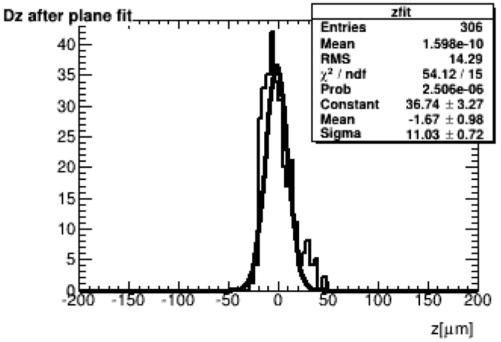


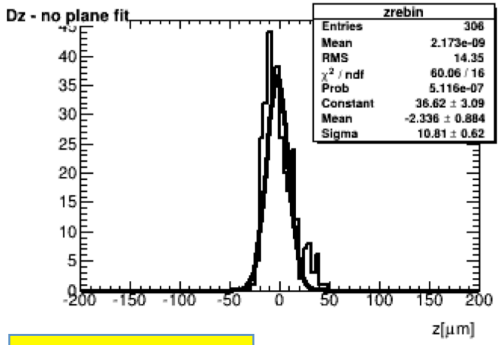
"bottom" face



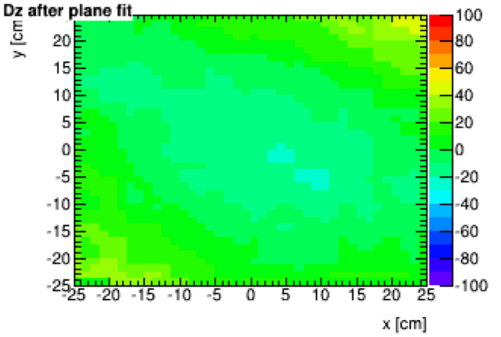
σ_{RAW} (RMS) = 19.12 (19.68) μm

σ_{FIT} (RMS) = 11.83 (12.04) μm





"top" face

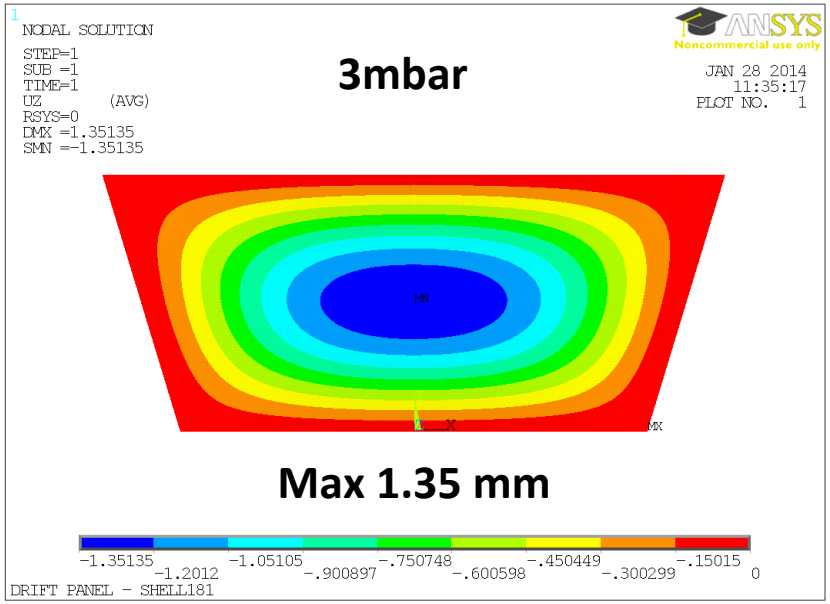


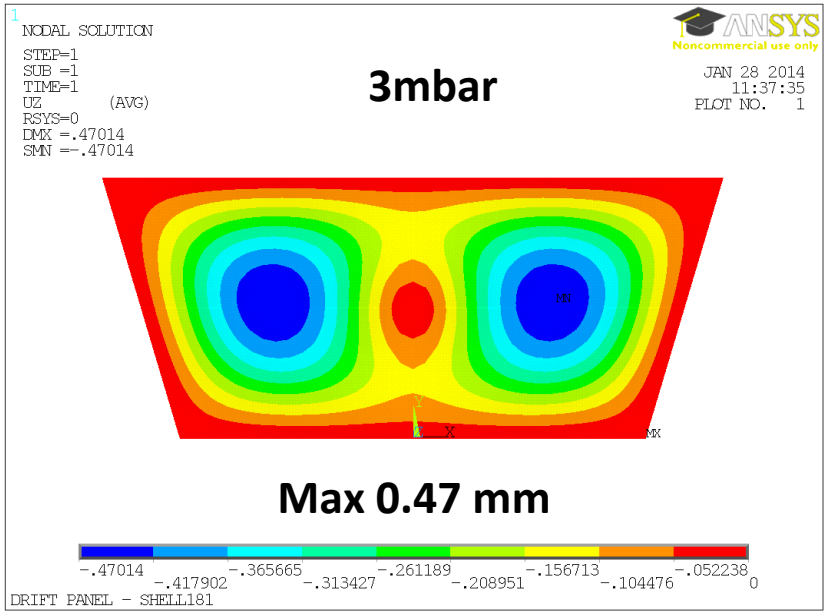
σ_{RAW} (RMS) = 10.81 (14.35) μm

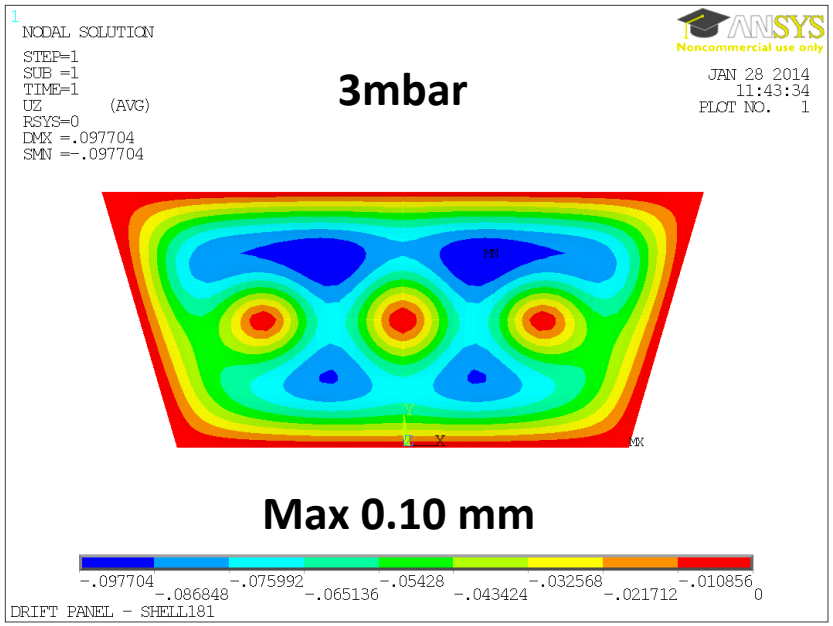
σ_{FIT} (RMS) = 11.03 (14.29) μm

Test/Simulation on Mechanical Prototype (M3)

Simulation of Mechanical deformation due to gas overpressure





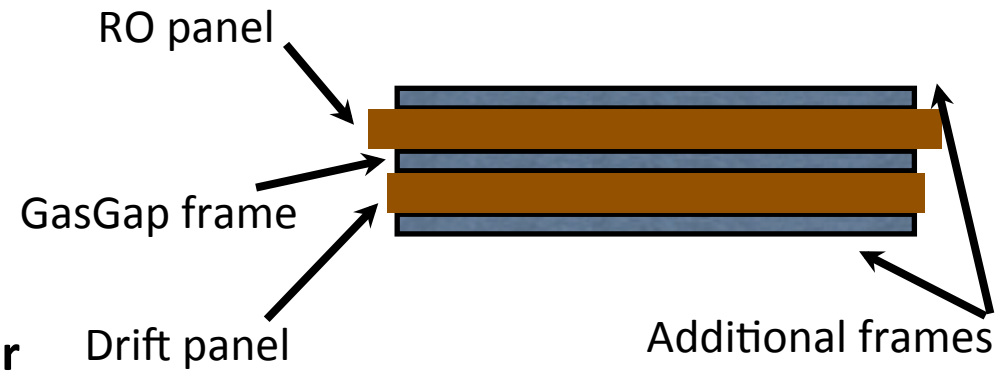


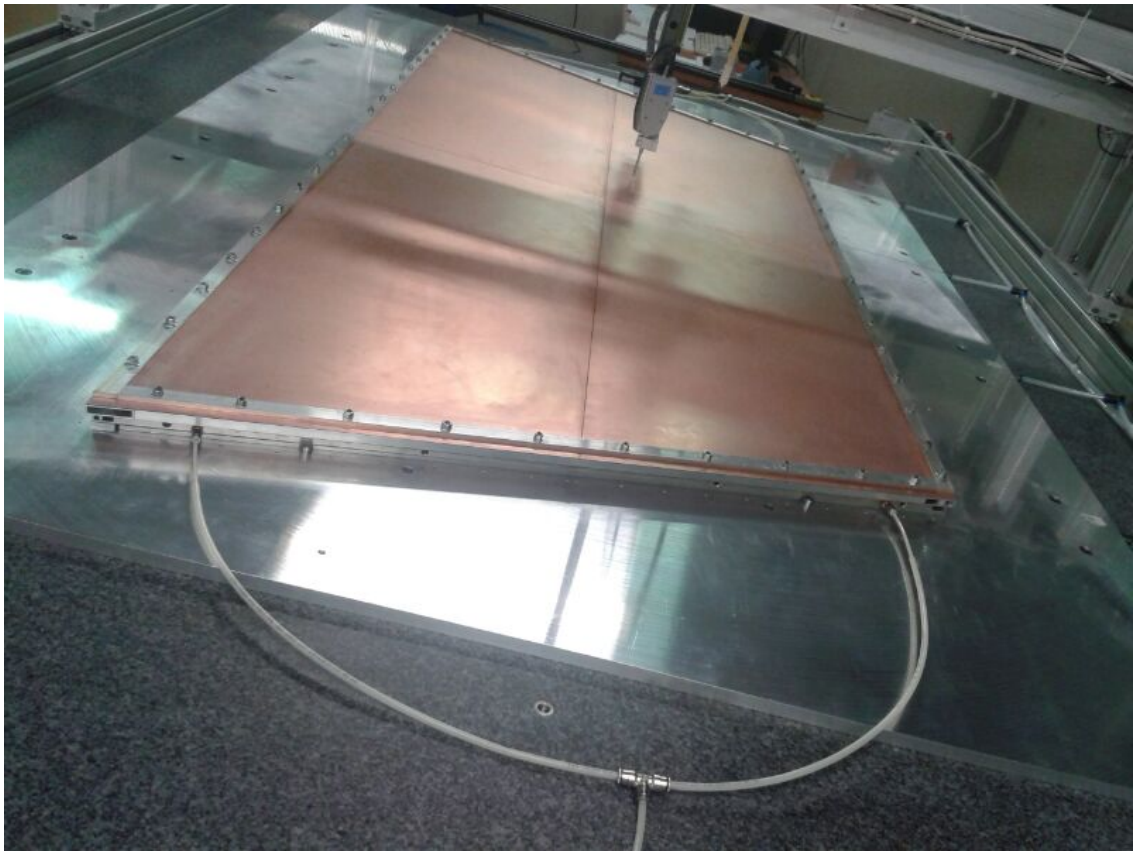
We have simulation for different values of overpressure running from 1 to 3 mbar with 0,1,3 interconnections.
Maps are shown for 3 mbar only, being the same (as behavior) for any overpressure.

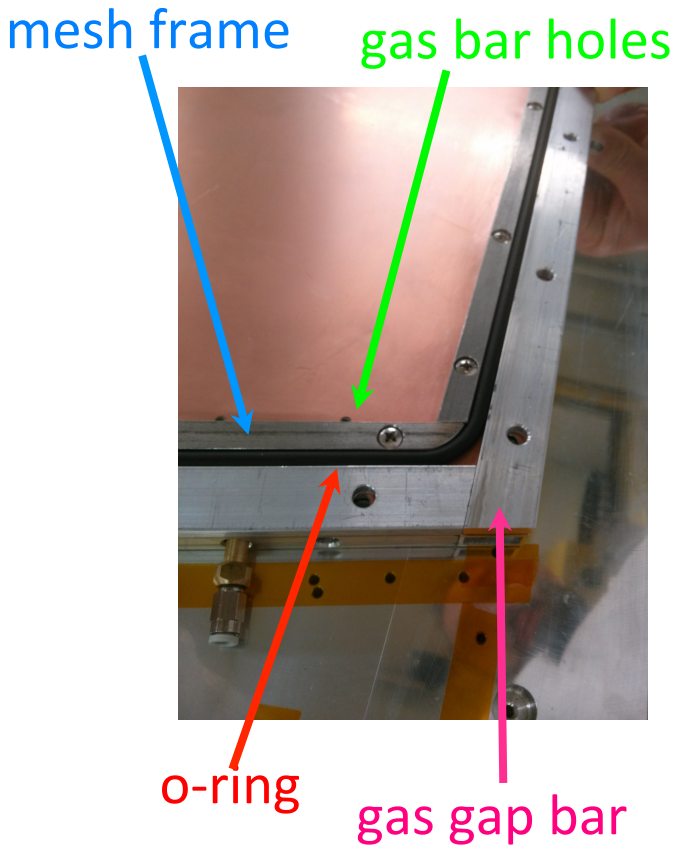
Test/Simulation on Mechanical Prototype (M3)

Measurement Mechanical deformation due to gas overpressure

- **Surface ~ 1.7 m² (SM1 ~ 1.9 m²)**
  1 gas gap (about 8.5 l)
- **Measured leak rate 1,5 mbar overpressure lost in 40 min**
- **Measure with: 0 (reference), 1, 1.5, 2, 3 mbar**

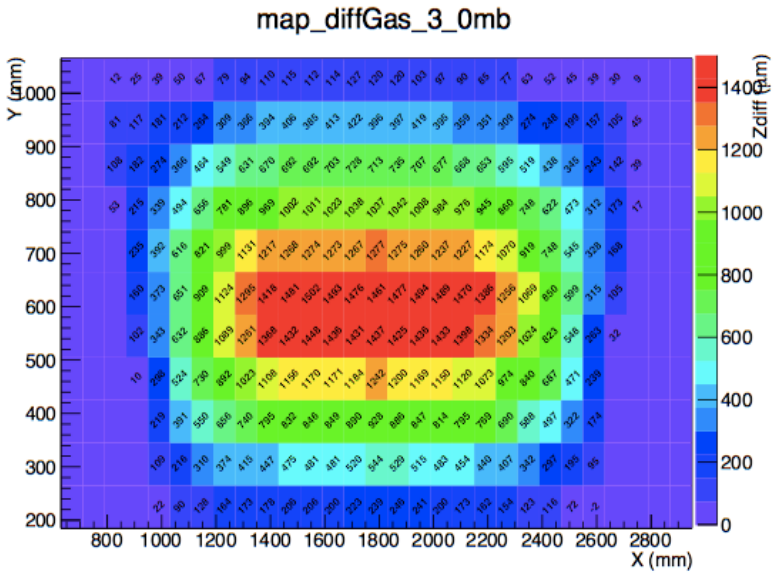






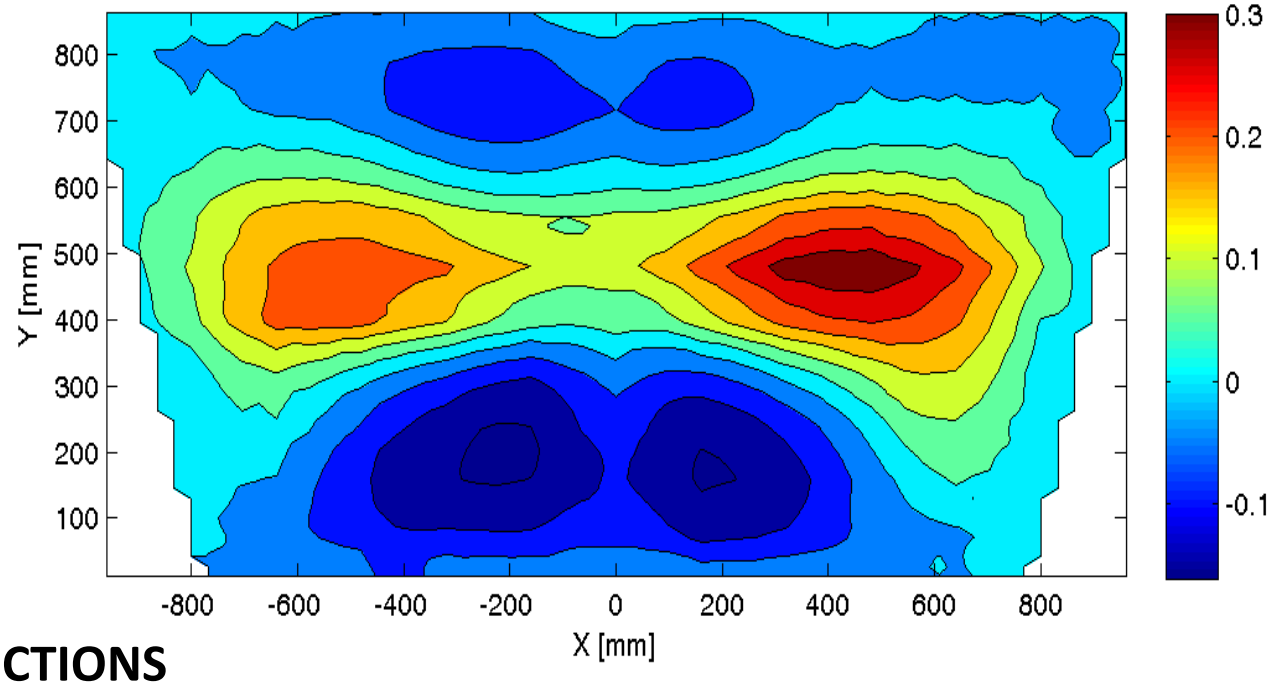
Test/Simulation on Mechanical Prototype (M3)

Test Results on Mechanical deformation due to gas overpressure



Measured deformation map 3 mbar

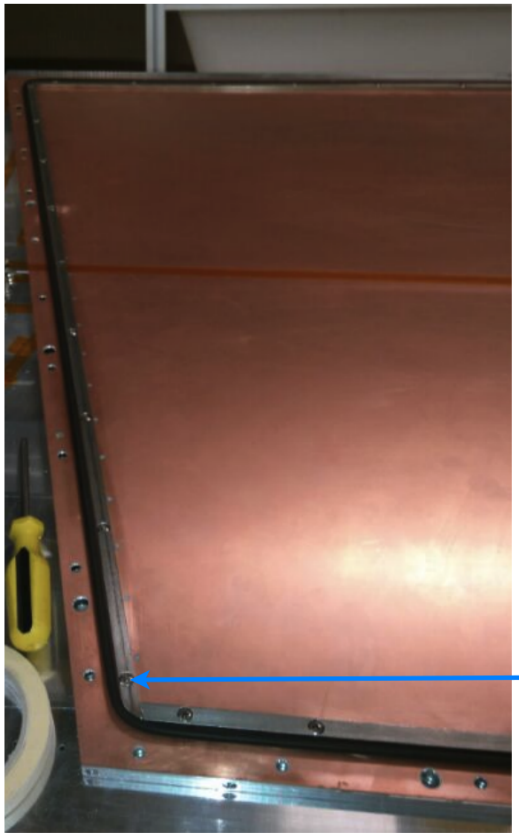
Measures – Simulation ; 3 mbar

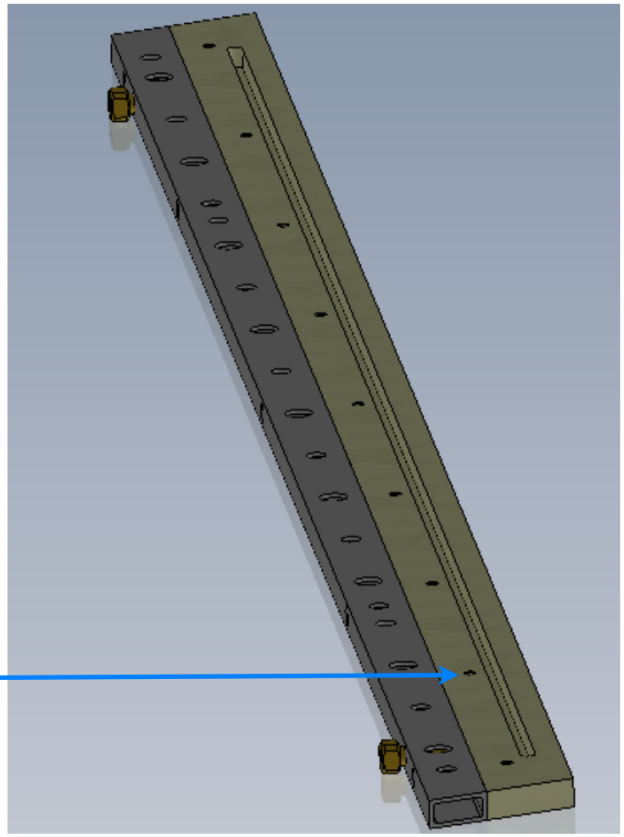


NO INTERCONNECTIONS

The max mismatch between data and simulation is not in the peak.
In general the panel deforms much more then the simulation and with a slightly different shape.
Not bad as fist result, but need to be better understood.

Test/Simulation on Mechanical Prototype (M3) Mesh





The mesh frame used for full scale test is the one originally designed for the M3 mechanical prototype.

The mesh frame is screwed on the arnite frame (inner structure of the drift panel)

The mesh frame will be modified with a groove, to allow gluing disposal.

We'll do test both on external panel (one mesh) and central one (two meshes)

Evaluating FBG sensor system for deformation measurement

Time scale:

Mesh frames arrived in Pavia last Friday, test will start soon, expected results for the end of February.

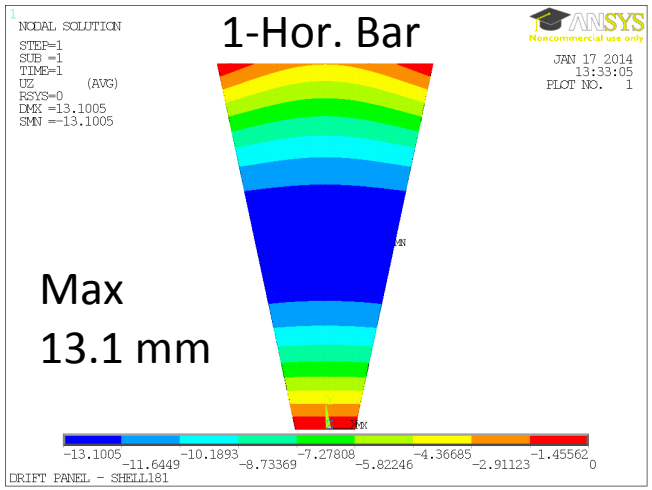
Test/Simulation on Mechanical Prototype (M3)

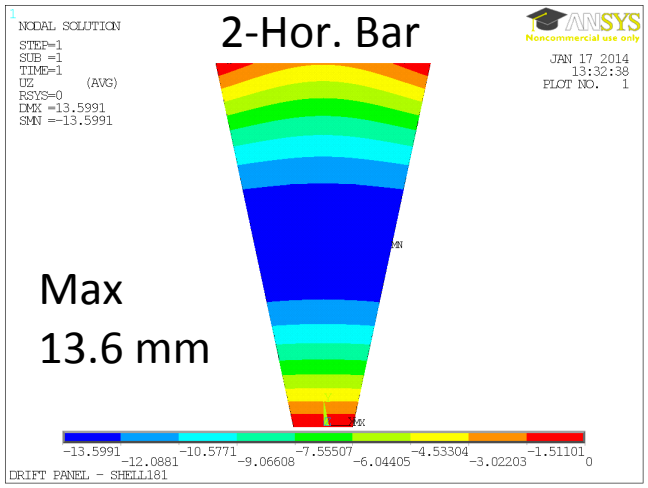
Plans

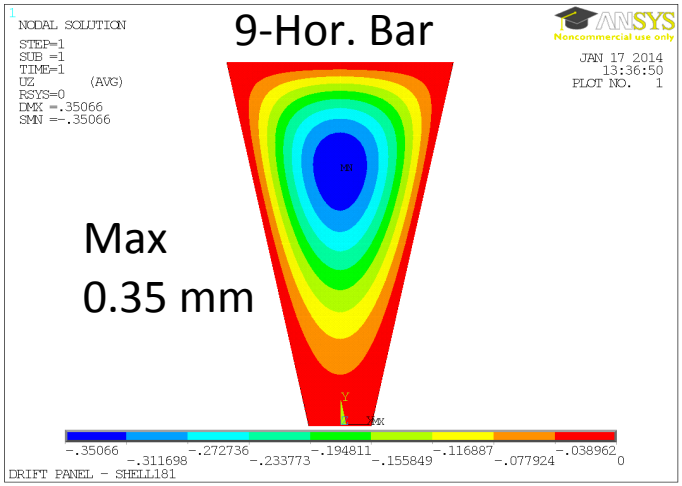
- Improve the accuracy of the M3 description in simulation
- Feedback from gas induced deformation measurement
- Perform simulation of mesh in single panel and on quadruplet
- Compare data and simulation with mesh
- 4 mesh frames are now in Pavia, mechanical test can start soon

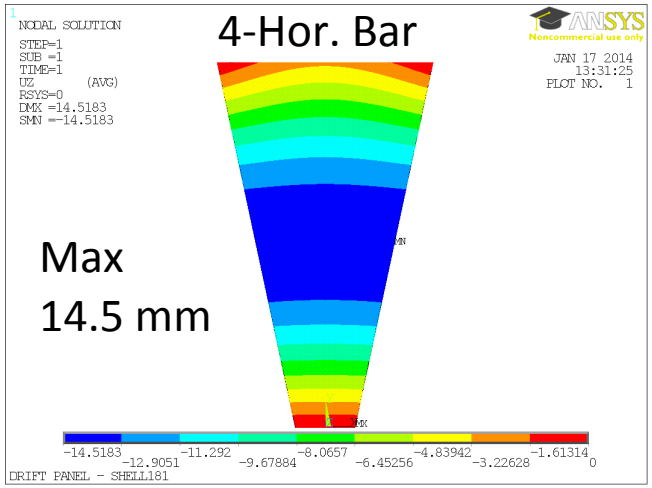
Simulation on SM1

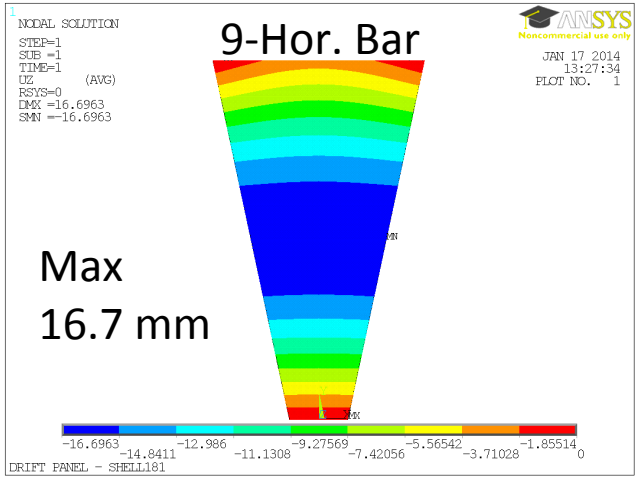
Simulation of Panel Mechanical deformation due to its own weight









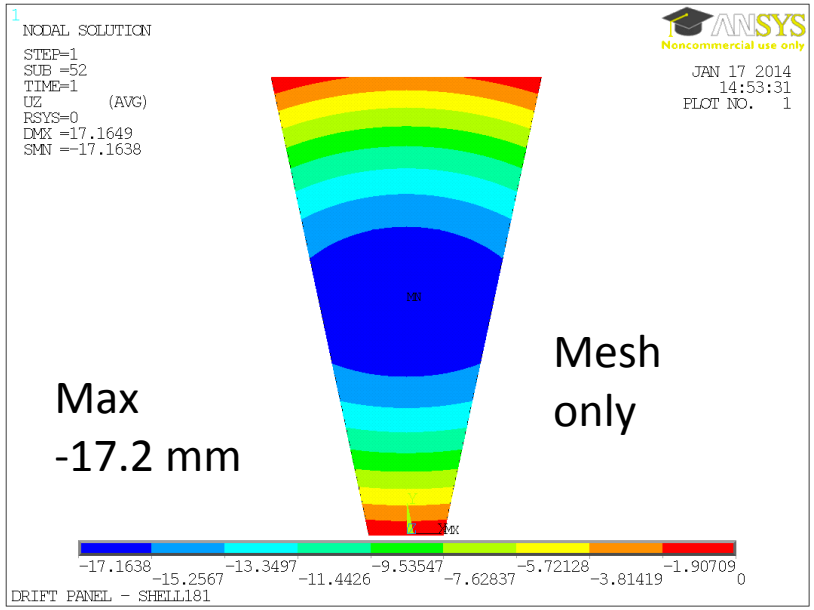


Large differences are visible for panels taken from the 4 corners and from the entire perimeter, important indication for panel handling during construction.

Hor. Bars do not improve the panel stiffness.

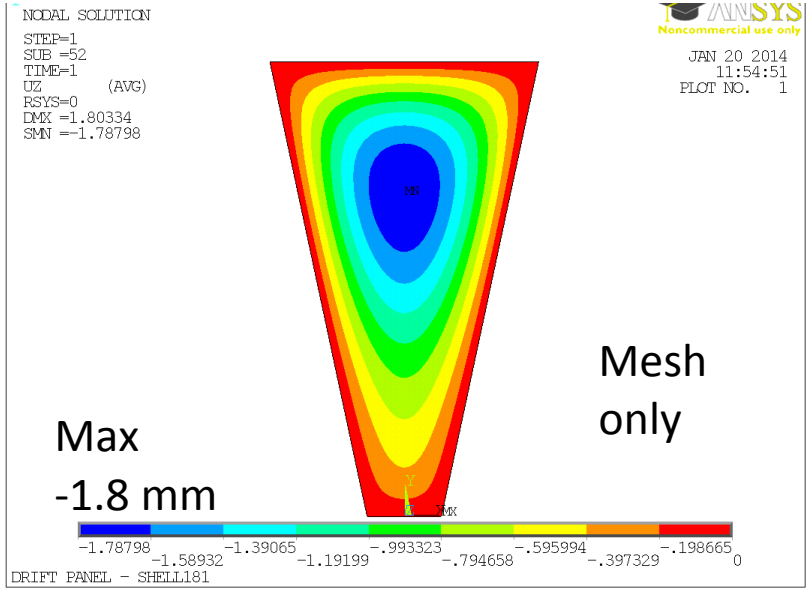
Simulation on SM1

Simulation of Mechanical deformation due to the mesh



Max
-17.2 mm

Mesh
only



Max
-1.8 mm

Mesh
only

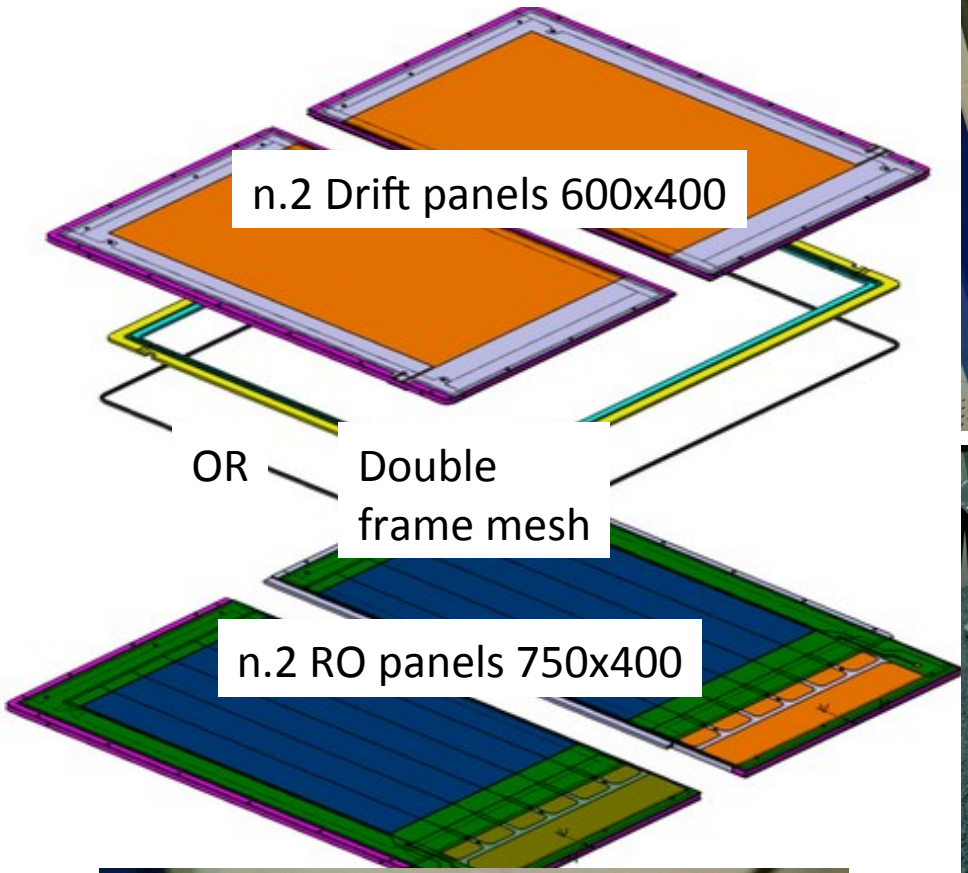
Max Def (mm)	4 Corners	All Around
Weight Only	-13.1	-0.35
Mesh Only	-17.2	-1.8
Weight + Mesh	-52.6	-1.9
Weight - Mesh	19.0	-1.1

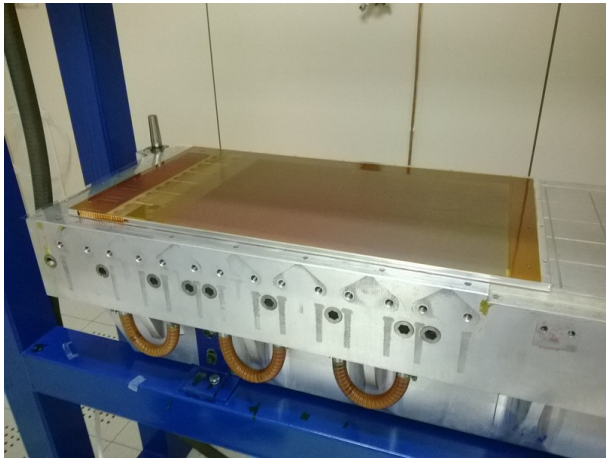
- **Improve the accuracy of the SM1 simulation using feedback from M3**
- **A stiff frame all around a panel can be useful in the handing during the construction**
- **A study on weight effect is needed to understand unbalance on panels with mesh in the two sides**

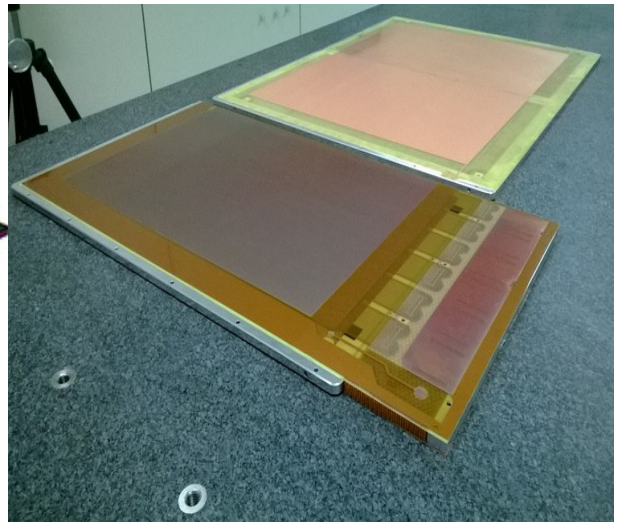
Mesh tension loss due to deformation is not considered

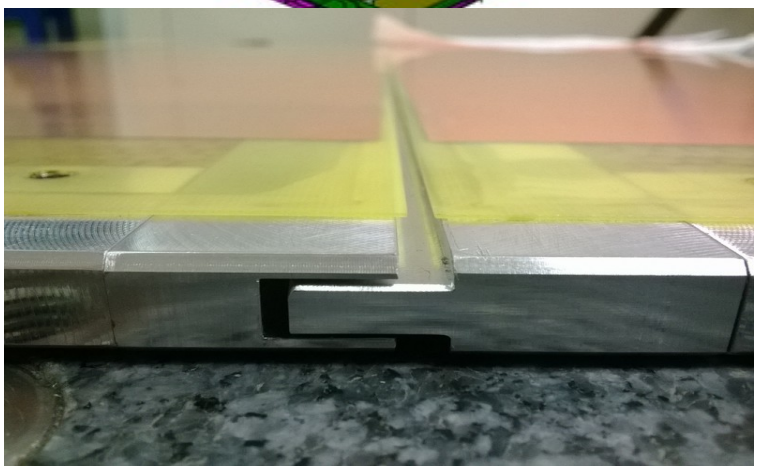
Details on the simulation data and more results are in S. Lauciani talk in the last L&D W.G.

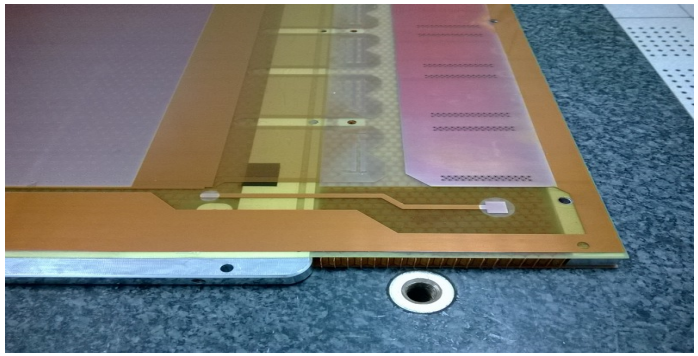
Working Prototype





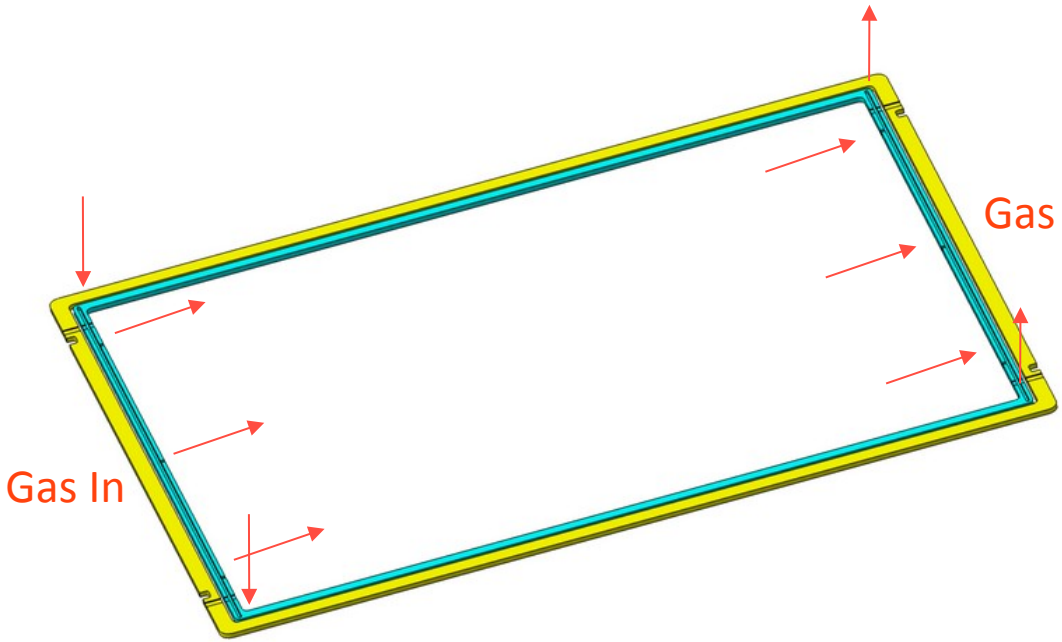


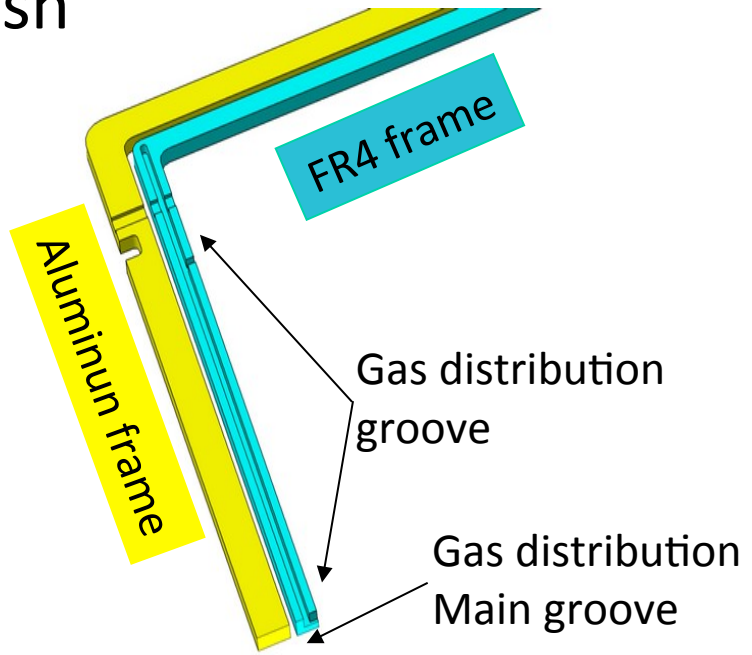


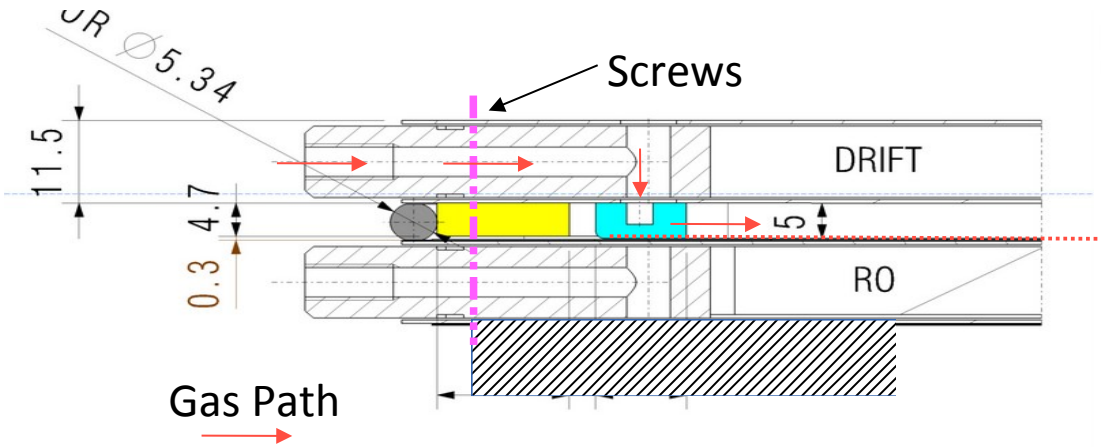


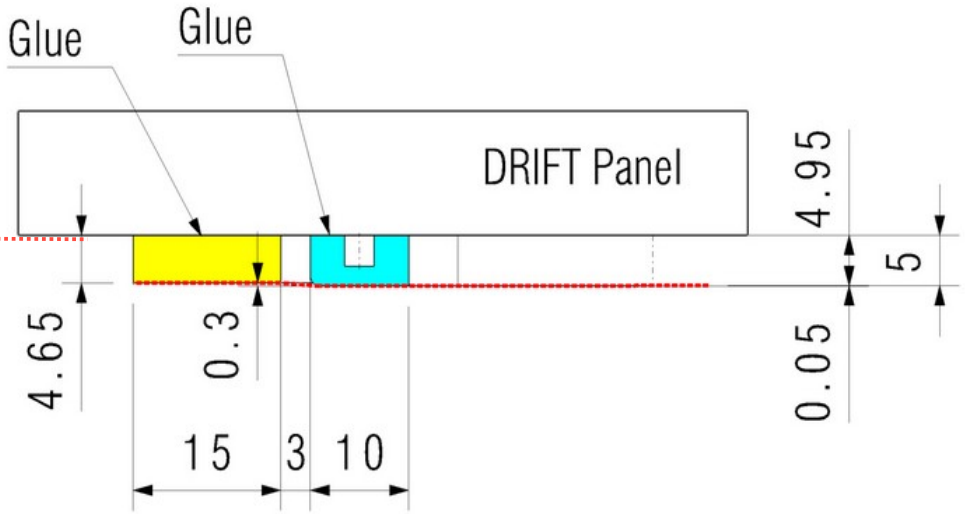
Working Prototype

Double Frame Mesh



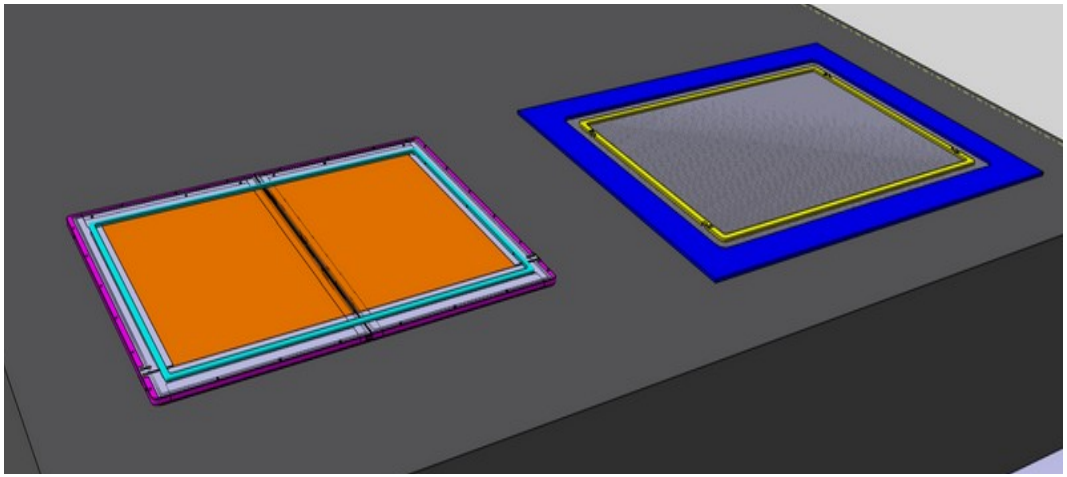


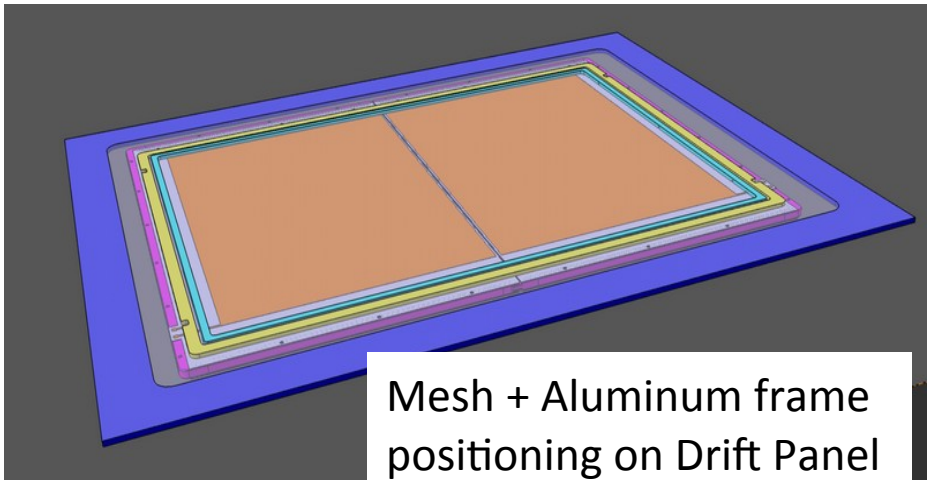


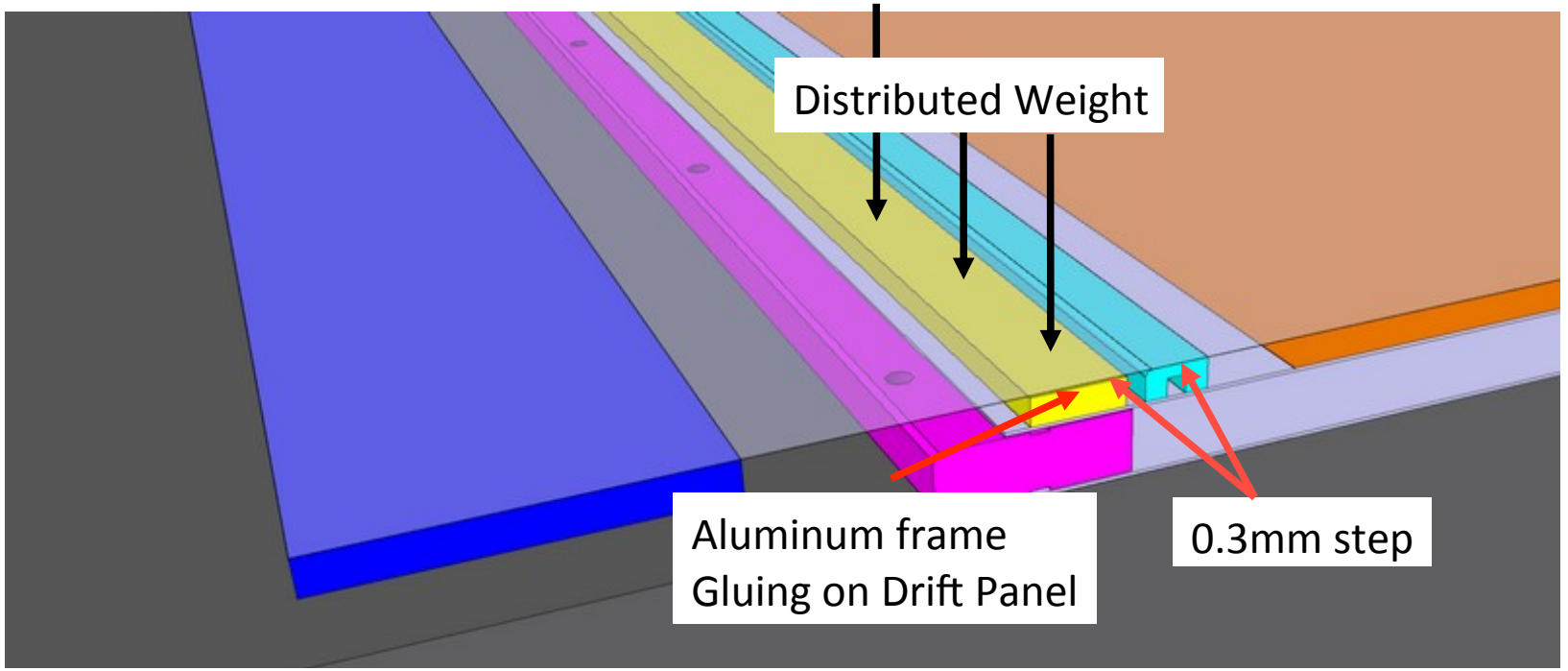


Working Prototype

Gluing mesh procedure







Working Prototype

PCB (and one gas gap prototype)

- **Drift PCB already at LNF few panels already glued.**
- **Few RO PCB avalable in Frascati but without resistive strips. Only copper and pillars. Decided to build the one gas gap prototype with these, keeping the final PCB ordered to Eltos for the quadruplet.**
- **Screen printing (Dimensione Circuiti in Turin, contact person Ing. Massimo de Lollis) technique for resistive strips looks reasonable on both PCB and Kapton, average surface resistivity measured about 2 MOhm/square.**
- **PCB with resistive strips back in Eltos end next week, and ready in LNF (with pillars) in the second half of February.**
- **One (only) mesh frame is available at LNF for the one gas gap prototype, we decided to stretch the mesh for the quadruplet by ourselves (Roma Tre + CS)**
- **One gas gap prototype ready for end of February**

Working Prototype

Quadruplet

- **Baseline idea for the Quadruplet assembly is the standard one (unless some new indication from this meeting occur):**
  - **3 Drift Panels (one central with mesh on both sides; two external with asymmetric mesh)**
  - **2 RO panels B2B.**
  - **Screwing**
  - **NO Interconnection (at least in the beginning)**

- **Starting now to make drawing about the assembly tools.**

- **Since we have 2+2 more RO PCB we may have the possibility to produce 2 single side RO panels to try alternative configuration.**

- **Quadruplet ready for end of May.**

Conclusions

- **M3 Mechanical Prototype is now under study to evaluate deformation induced by weight, gas overpressure and mesh**
- **First results already available more will arrive soon**
- **Simulation is in progress and get feedback from data**
- **Simulation for SM1 also started**

- **One gas gap prototype (with no resistive strips in the RO PCB) will be ready for the end of February.**
- **The working quadruplet is foreseen for the end of May.**

- **The experience from M3 test and simulation and from the assembly of the working prototype can give us all the information to finalize the design of the final assembly tool**