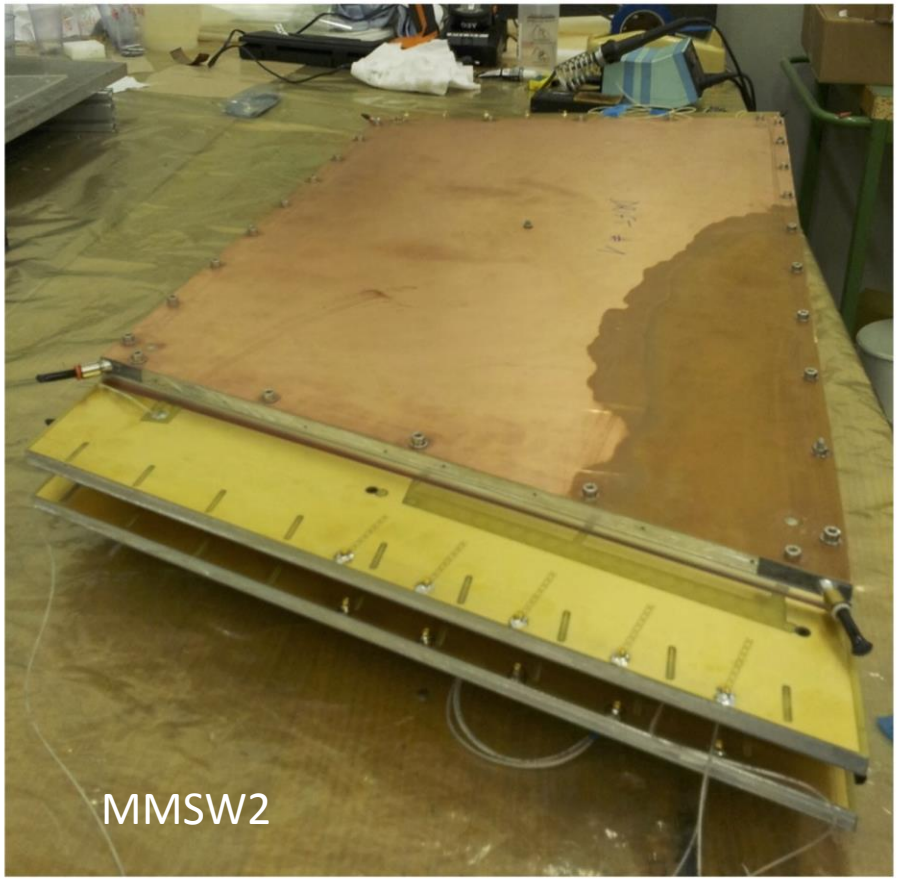
# ATLAS Micromegas

## from MMSW1 to MMSW2

# Introduction

- The MMSW chambers are pre-series prototypes for the ATLAS NSW micromegas detectors
  - Very similar main design features
  - Test objects for Module-0s
- They correspond to a 50 cm slice of the large-sector NSW MMs at r≈1.5–2 m.
- One of the two MMSWs will be installed in the ATLAS cavern next year to be integrated into the ATLAS data stream.
  - It will later be installed on one of the existing Small Wheels

# The MMSW chambers

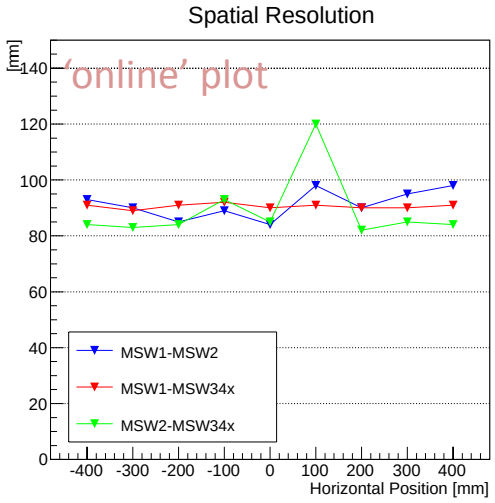


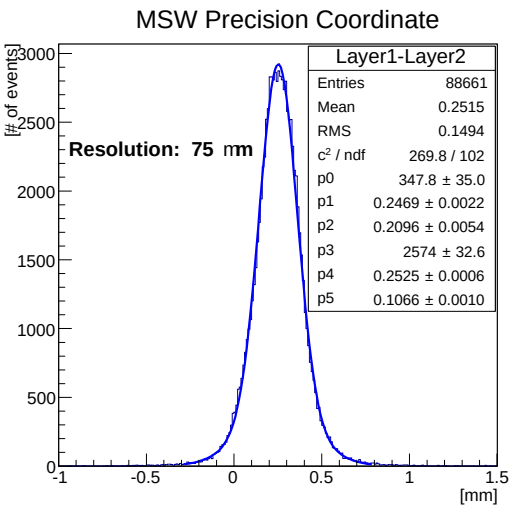

- 1.2 x 0.5 $m^2$ x 80 mm
- 4 detection planes
  - 2 back-to-back planes for precision coordinate
  - 2 planes with strips under ±1.5°
  - 1024 strips/plane
- Strip pitch: 415 µm
- Drift gap: 5 mm
- Mesh: integrated into drift panel & electr. connected to ground
- Resistive strips
  - split in the centre, 2 HV per plane
  - interconnected every 2 cm
  - R(strip) ≈ 20 MOhm/cm
  - $R_{eff}$≈2–20 MOhm

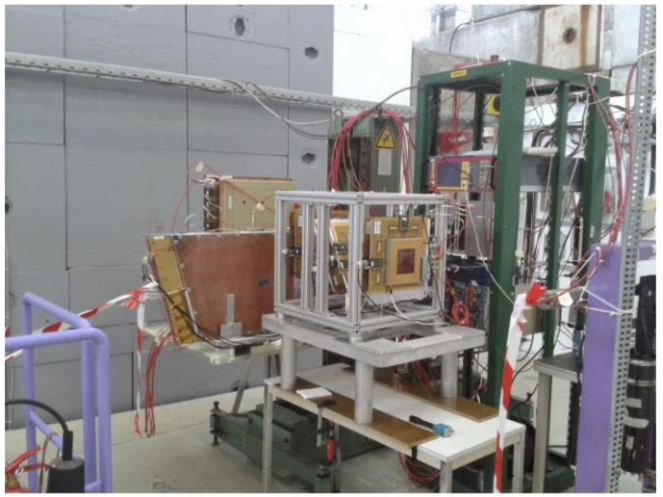
# MMSW1

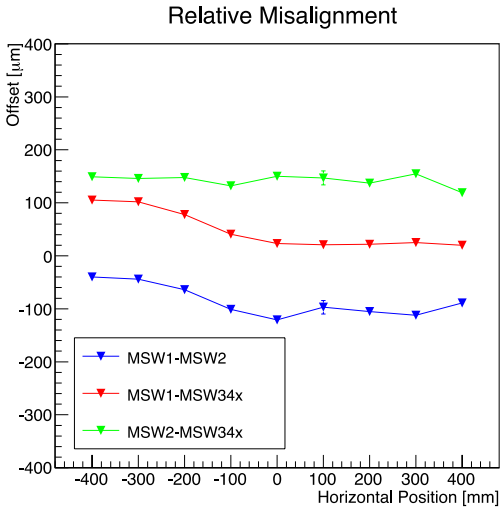
- In the June RD51 mini week Paolo Iengo reported about the construction of the MMSW1 which, at this, time, was just being completed, see http://indico.cern.ch/event/323839/other-view?view=standard
- He described the preparation of the parts, the tools, the panel and detector assembly, and showed first tracks with two out of the four detection planes in operation.
- In July the MMSW1 chamber was completed with all four detector planes
- In August and October MMSW1 was tested in the T9 and T10 test beams at the PS with 10 GeV hadrons and in the Lab with cosmics

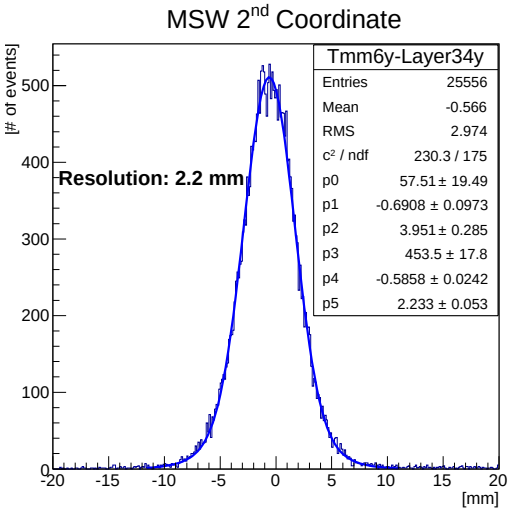
# MMSW1: T9 & T10 test beam results

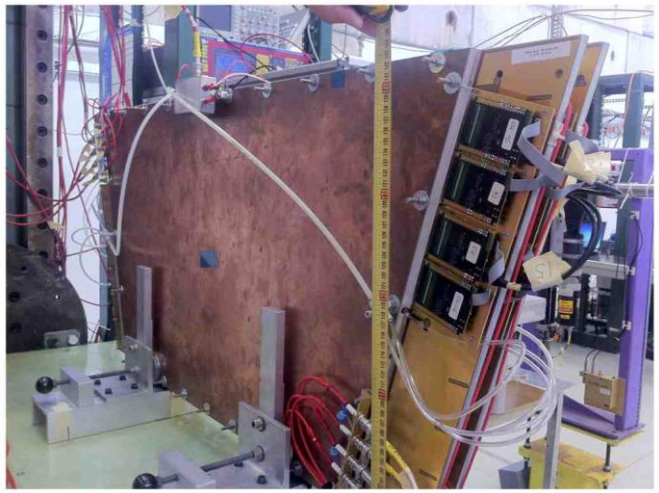


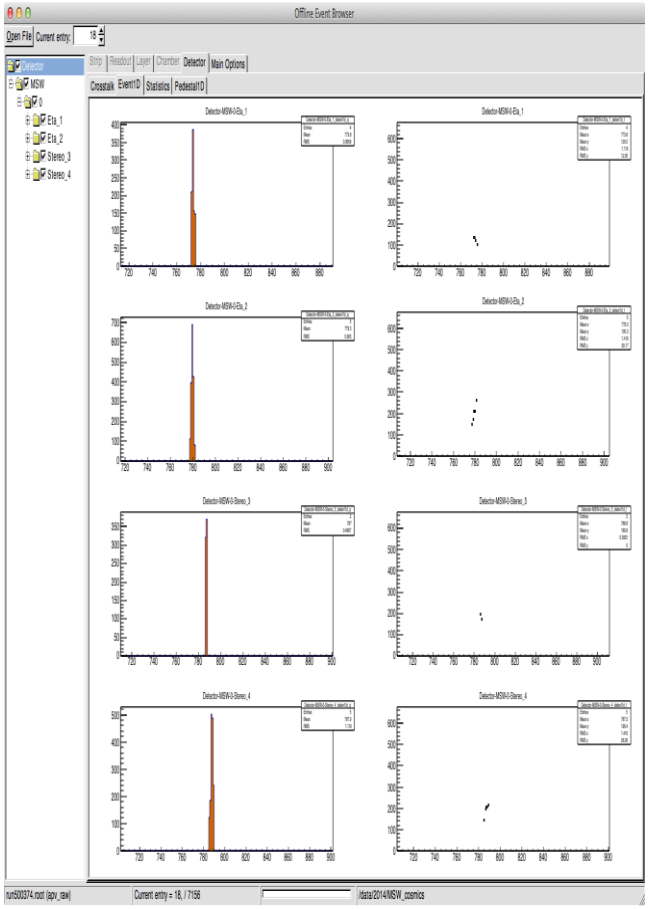



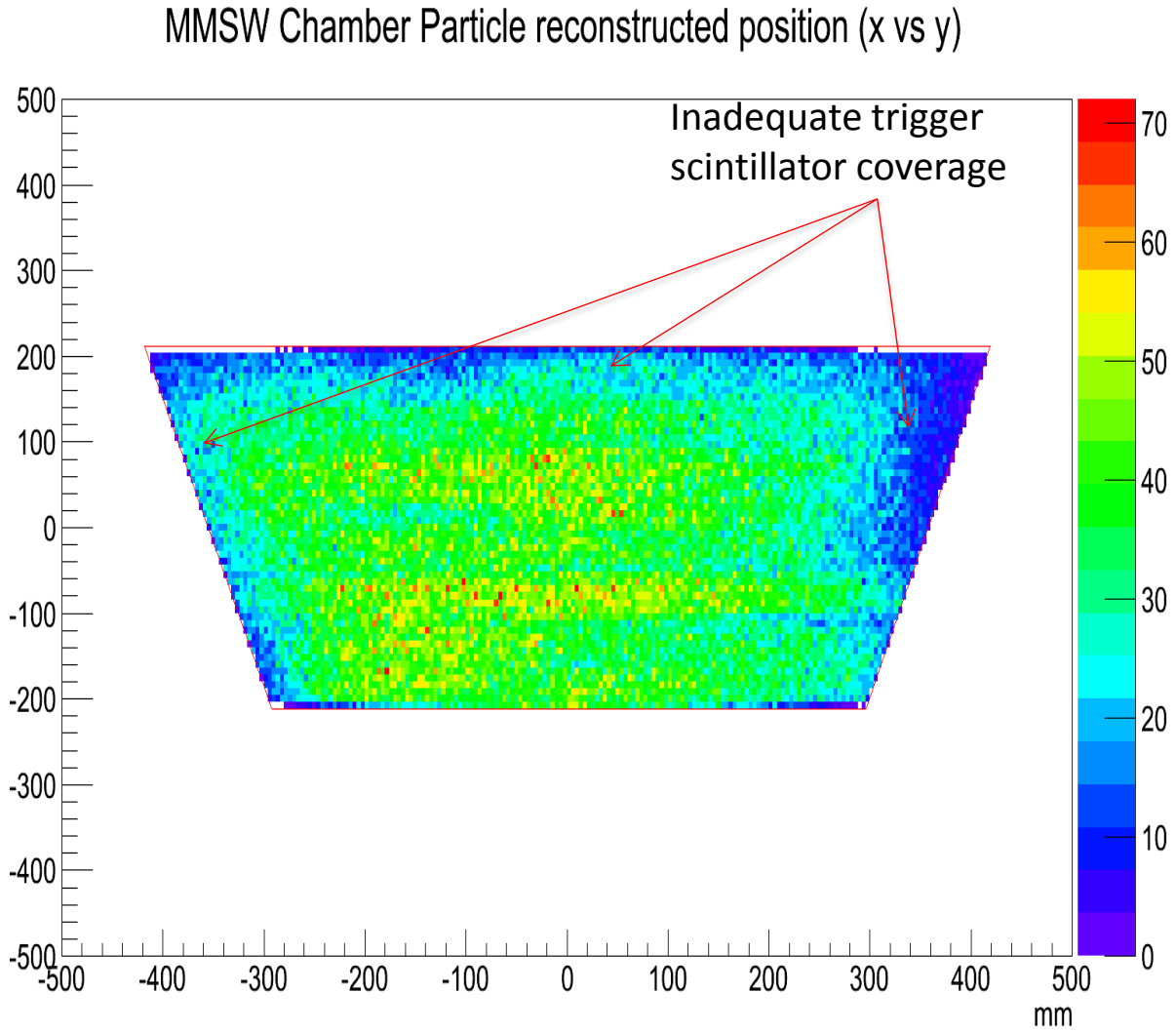


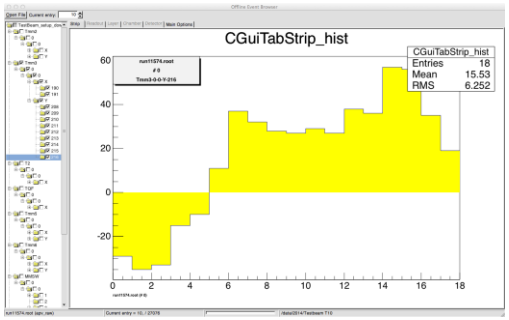
# MMSW1: Cosmics

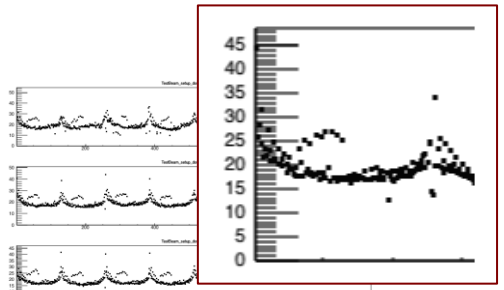


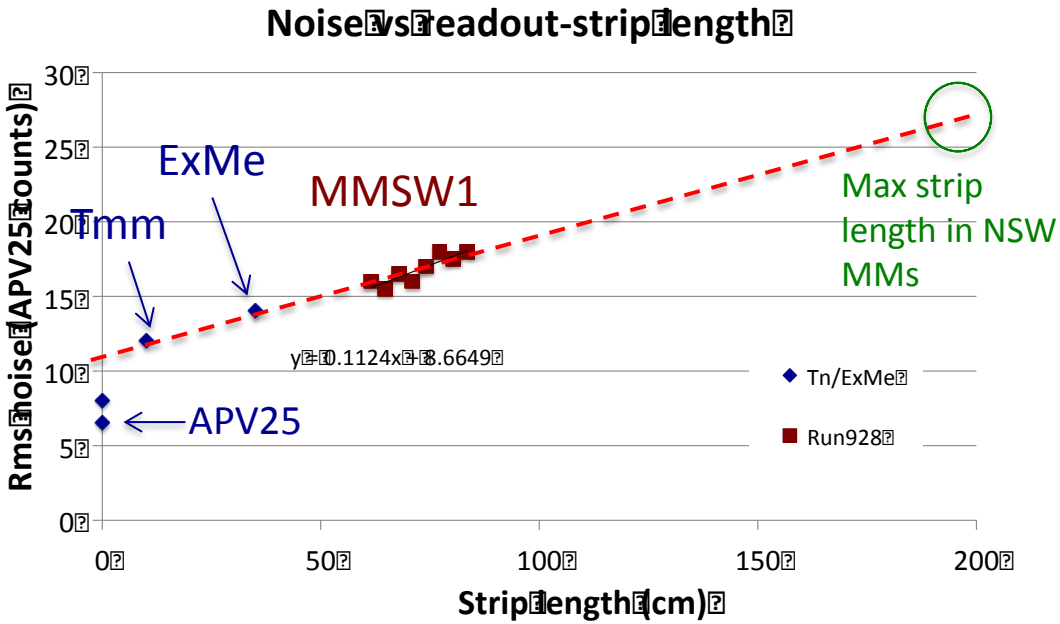



# Electrical properties of MMSW1

- Strip lengths in MMSW 60–80 cm
- Measuring the APV pedestal sample fluctuations gives a good idea about the detector noise
- Linear increase of noise between 0.1 and 0.8 m strip length above a base of 11 counts
- Fits nicely with results from 10 and 35 cm strips
- Extrapolation to 2 m strip length yields a noise ≤30 counts, perfectly acceptable





# From MMSW1 to MMSW2

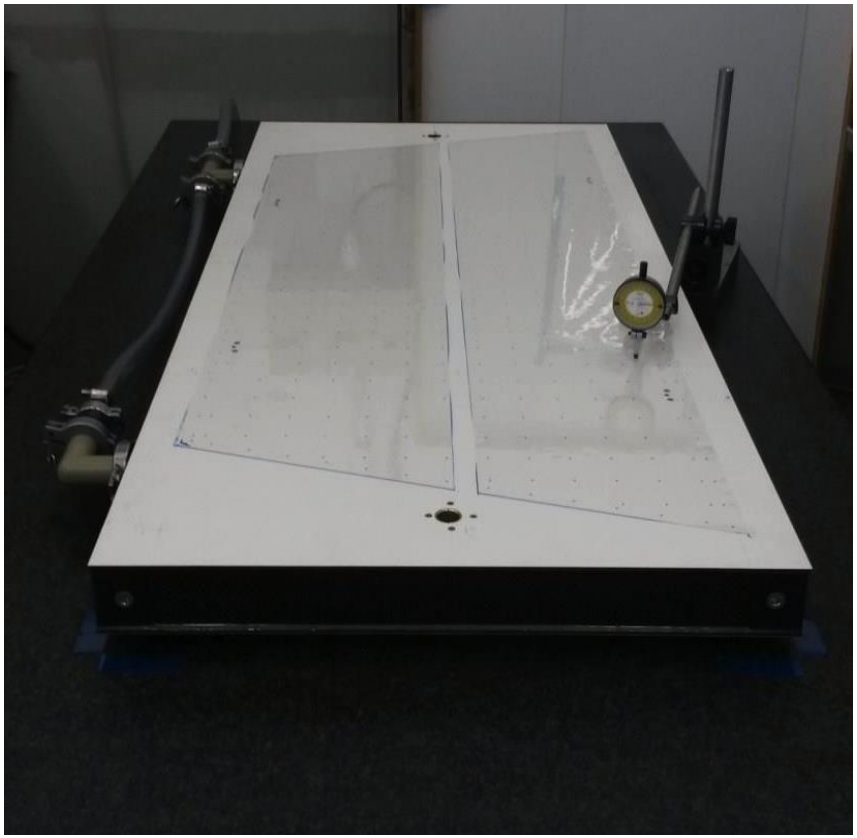
Although MMSW1 performes nicely there are a number of points that we consider(ed) as not optimal

1. Construction issues
   - Vacuum table flatness varied with temperature => panel flatness sufficient but not good enough for full-size panels
   - Mesh frame and glueing procedure to complicated and work-intensive, also the result was not perfect (glue into mesh)
   - Gas distribution through mesh frame too tight in space and complicated to make; gas tightness not perfect
2. Assembly and operation
   - Relative alignment (pins) of the two readout panels not used
   - Relatively high dark currents (although not affecting the detector operation) suggest some pollution (mesh?) - occasionally shorts

Some of those issues are addressed in the following slides

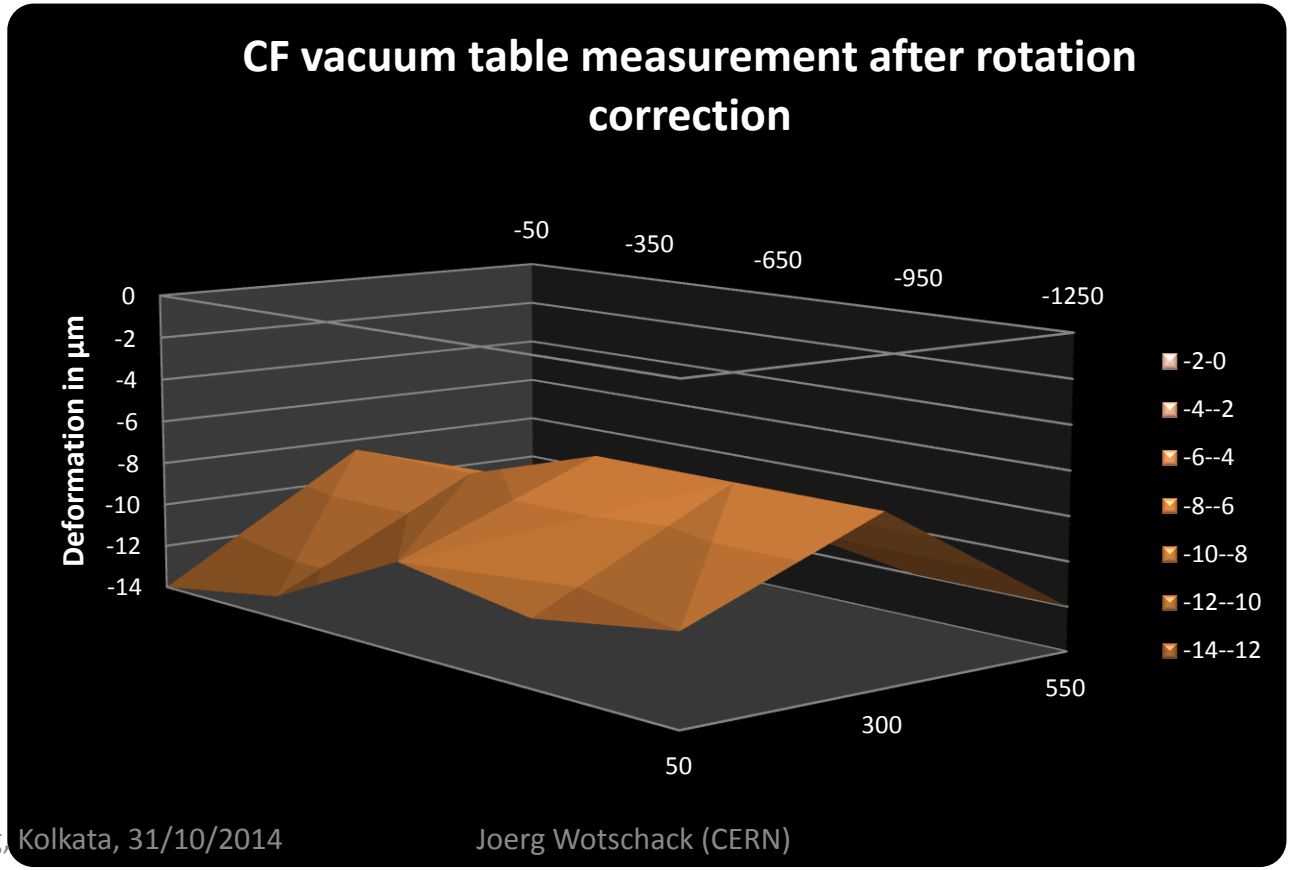
# Carbon Fibre vacuum table manufactured at CERN

**Vacuum table QC**



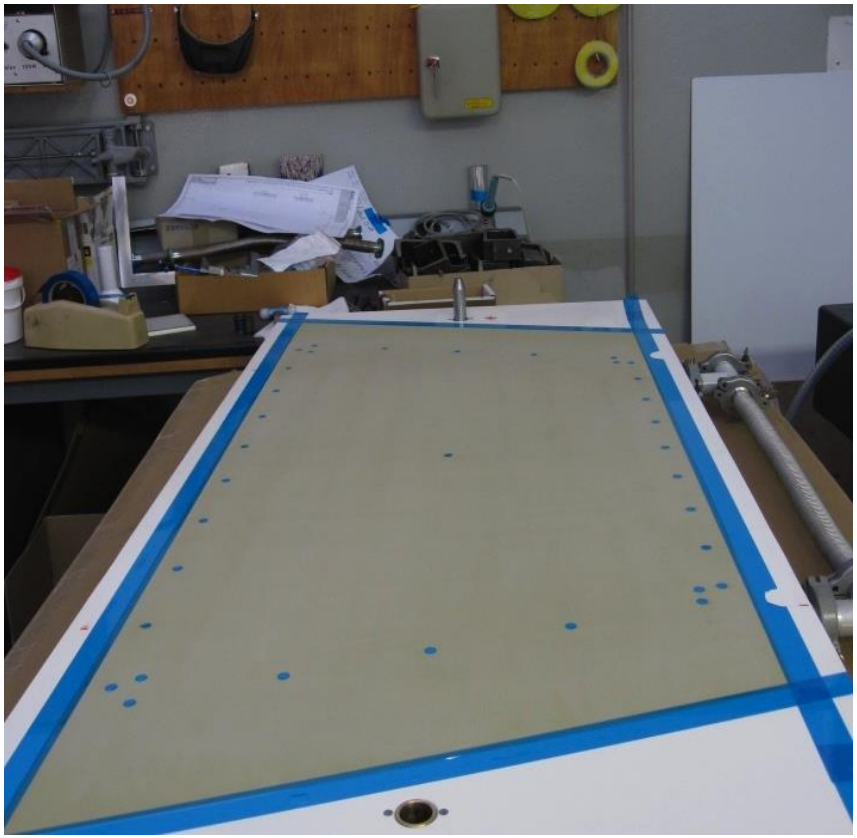
**Structure under construction**

- CF vacuum table supported on 3 points (15 points measured) **Flatness <10µm**

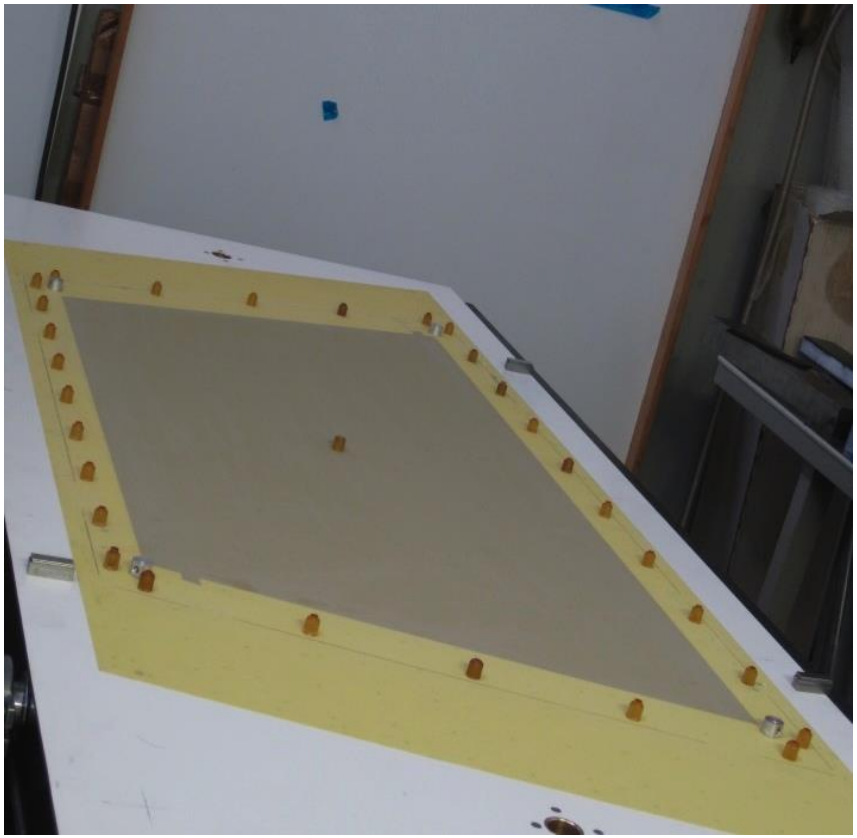


# Panel construction

**Top skin (Table #1)**

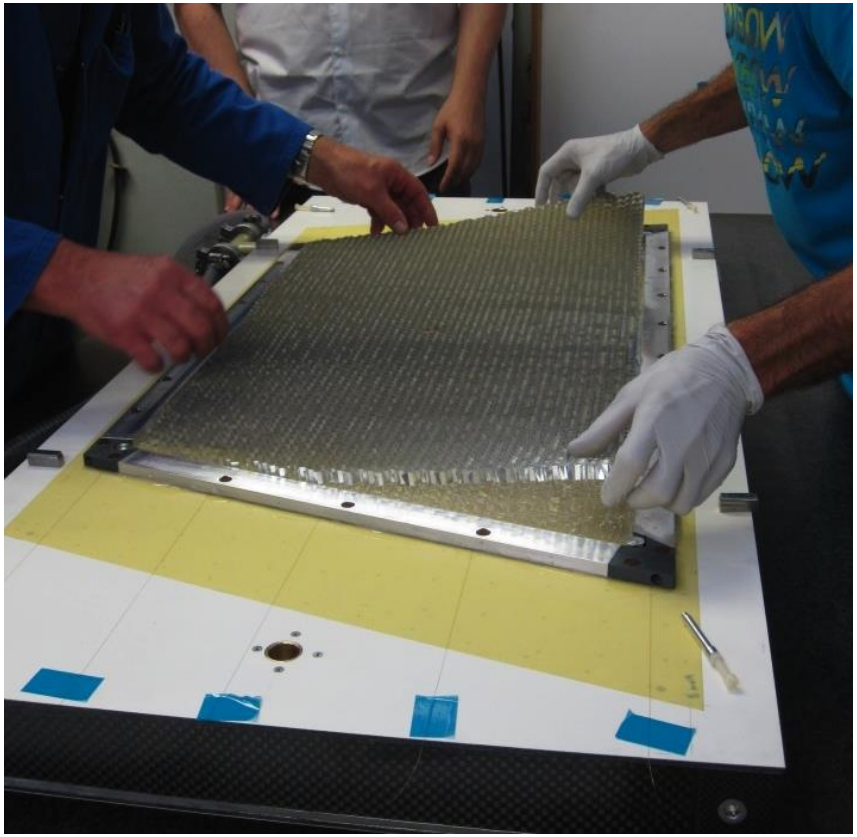


**Bottom skin (Table #2)**



# Panel construction

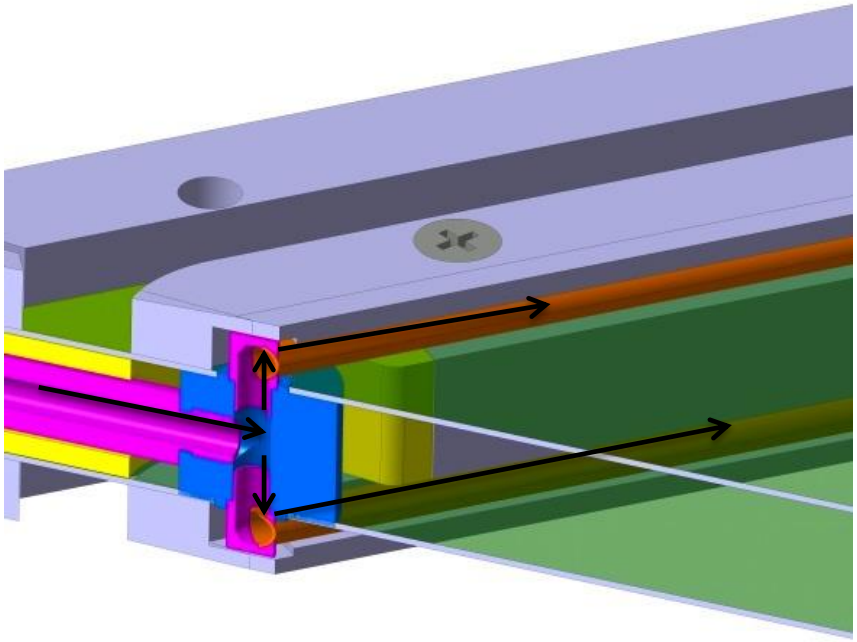
**Frame and honeycomb assembly**



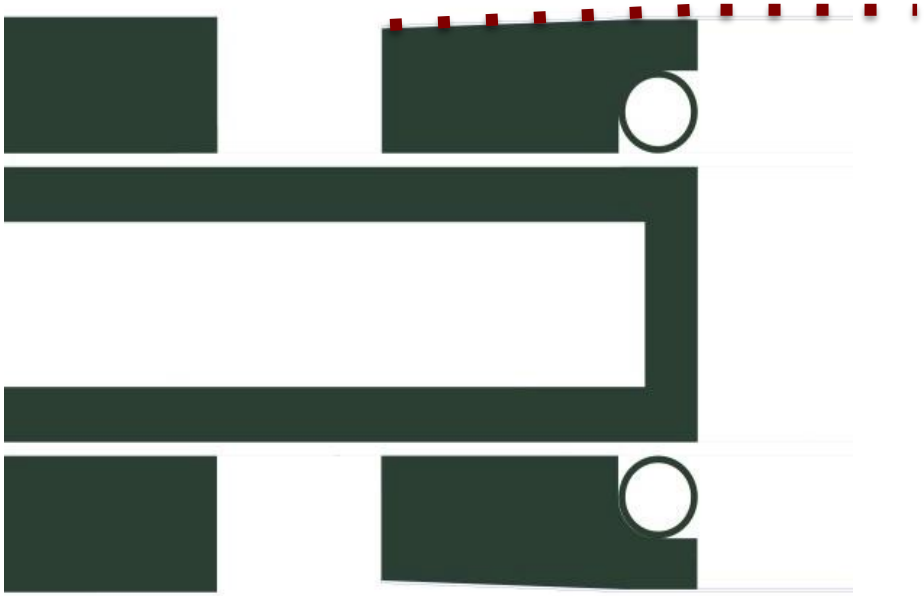
**Final assembly**

# Active gas distribution

**Active gas injection**

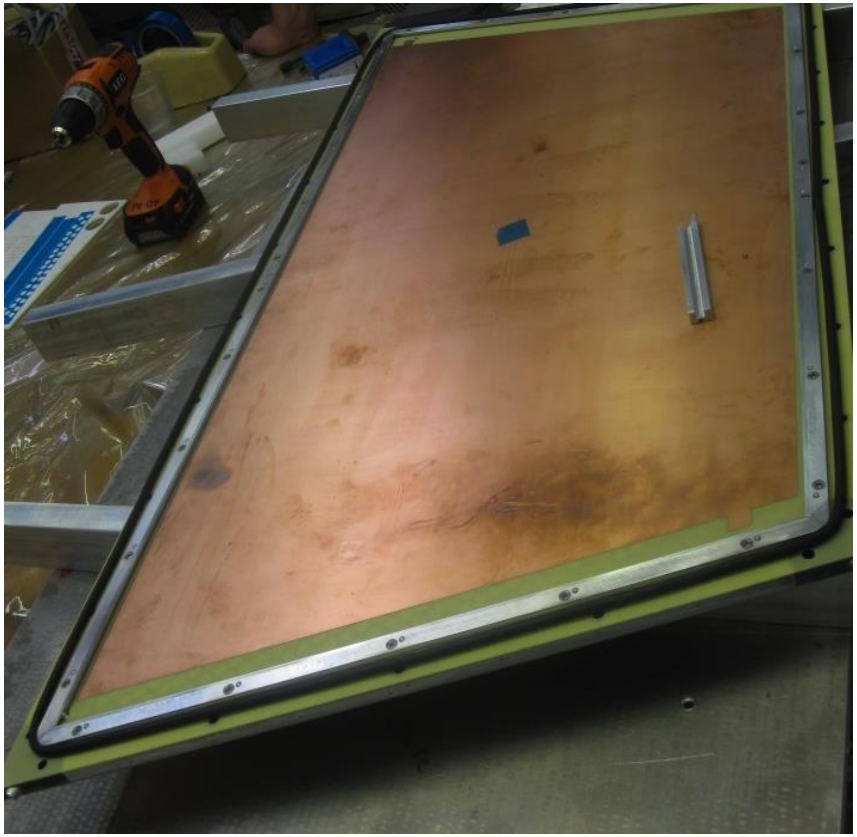


**SS tube Ø3 under mesh support**

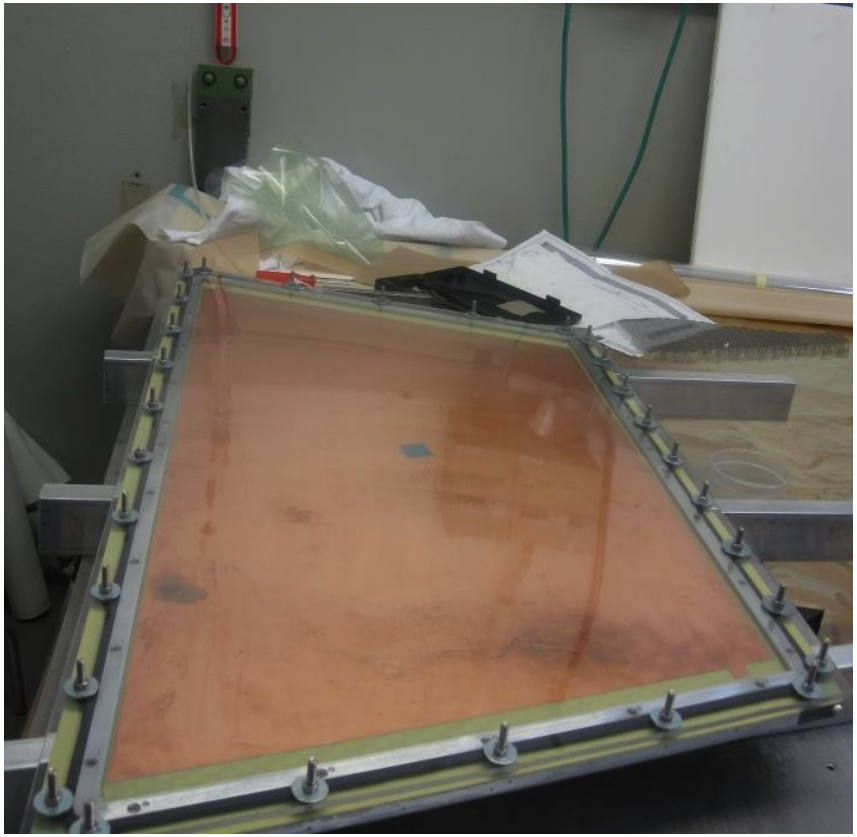


# Panel leak test

**Drift panel + EPDM joint**

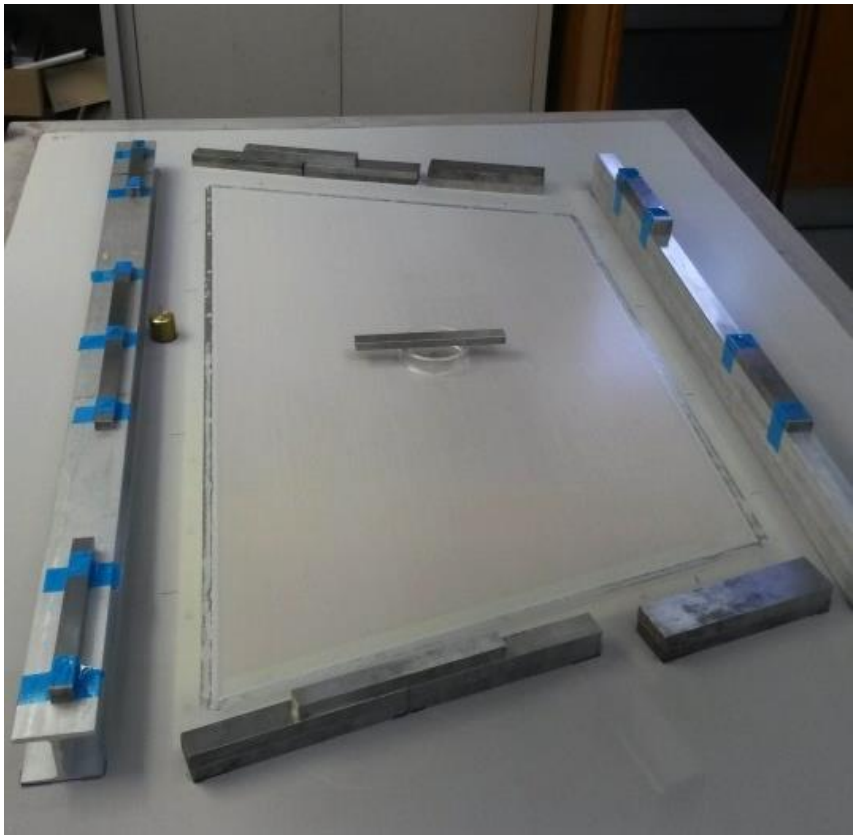


**Drift panel under pressure test**



# Mesh gluing

**Mesh during polymerisation**



- Procedure simplified
- 1 day before / 2 hours now!
- Cleaning improved

# MMSW2

- MMSW2 has been fully assembled and connected to gas and HV 10 days ago
  - Under HV for one week, no trip
  - Lower currents than MSW1 at higher HV
- It has been installed in the H6 test beam Tuesday this week
- First data expected last night after the SPS MD

# Summary and outlook

- The MMSW1 & MMSW2 construction exercises were extremely useful in view of the forthcoming construction of the NSW MM Module-0 construction
- The detector performs as expected
- For the first time stereo strips were used (by us) giving us a $2^{nd}$-coordinate spatial resolution of 2.2 mm, as designed for and perfectly adequate for the NSW
- A number of issues that appeared in MMSW1 were successfully cured in MMSW2
- A big step in the direction of ATLAS micromegas chamber construction has been done

# Acknowledgements

The construction of the MMSW chambers is a collaborative effort between CERN-PH, CERN-DT, and Mainz University

- The PCB layout and art work was done by CERN-PH (G. Sekhniaidze)
- The PCBs were produced by industry (Eltos, Italy) and completed by CERN-DT (Rui de Oliveira et al.)
- The resistive strips were deposited by sputtering in industry in Japan (A. Ochi et al.)
- The engineering, tooling, mechanics, and glueing are done by PH-DT (H. Danielsson et al.)
- Module assembly and commissioning by CERN-PH
- Tests in the beam and data analysis by the full ATLAS MM community (special thanks)