

Micromegas Detectors and their Large Scale Construction

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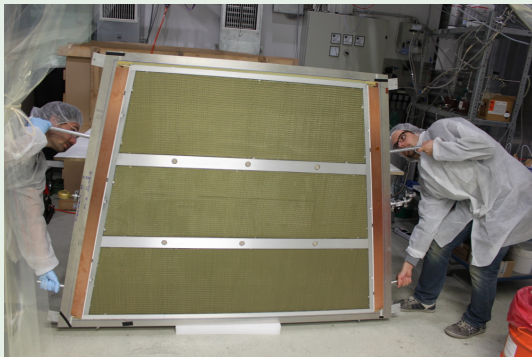


Origin and Structure of the Universe
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Micromegas Production in Munich

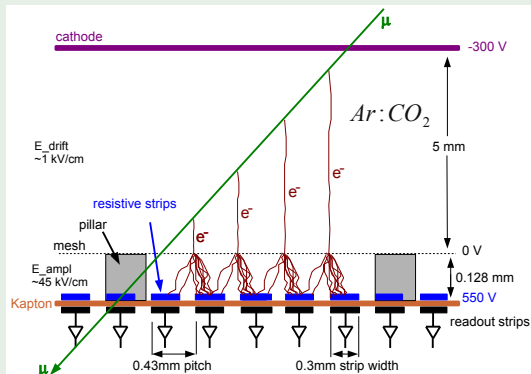
Half Panel of a 2 m^2 Micromegas Detector



- **MICRO MESH**
GAseous Structure
Detector
- Planar Detectors with high spatial resolution
- Construction of a quadruplet of Micromegas with 2 m^2 active area in Munich

Working Principle and Requirements

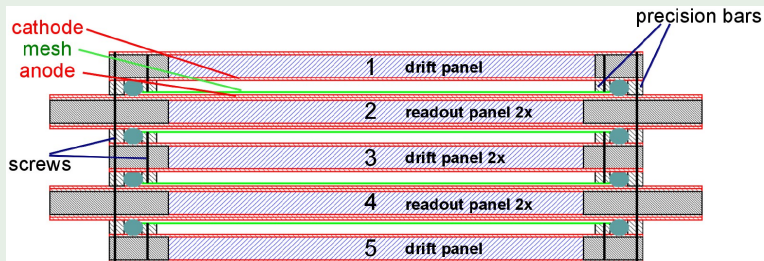
Sketch of a MM Detector



- Single strip readout
- Required spatial resolution $\sigma < 100\ \mu\text{m}$
- Need of a precise readout plane
 - Strip pitch
 - Planarity
 - Drift gap
 - Amplification gap
- RMS of planarity below $30\ \mu\text{m}/2\text{ m}^2$ required
 - \Rightarrow Need of a precise quality control

MM Construction as quadruplets

Sketch of a MM Quadruplet

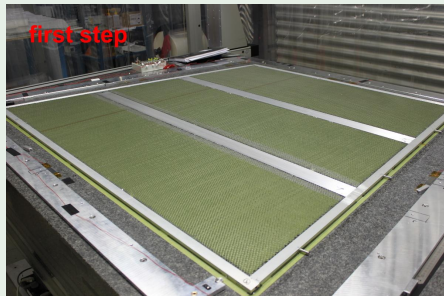


- 1 quadruplet = five panels
- Planarity requirement RMS below $30 \mu\text{m}$ over 2 m^2
- Measurement technique & duration / panel:
 - Tactile: $\approx 8 \text{ h}$
 - Laser: $\approx 2 \text{ h}$

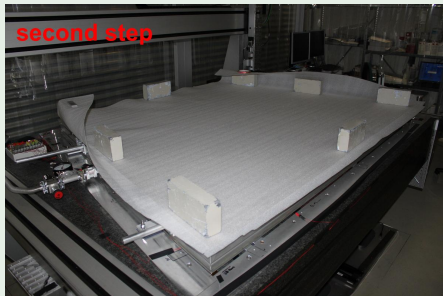
Gluing Process of a Prototype

Example for drift panel

Gluing the first side

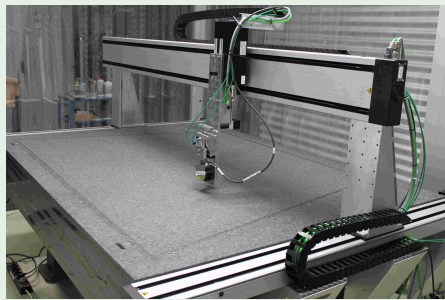


Gluing the second side



Laser Distance Sensor

Coordinate Measurement Machine



- Spot size $20 \times 20 \mu\text{m}^2$
- Specular reflection measurement mode (for semitransparent surfaces)

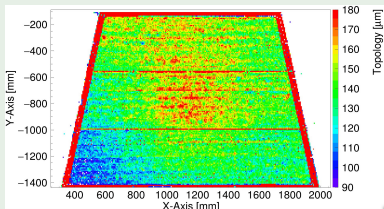
microEpsilon ILD2300-2BL



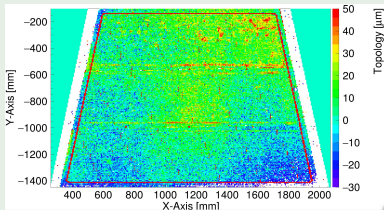
- 25 mm working distance ± 1 mm range
- Resolution of sensor $0.03 \mu\text{m}$
- Resolution of setup $7 \mu\text{m}$

Results of a Readout Panel Panel with vacuum

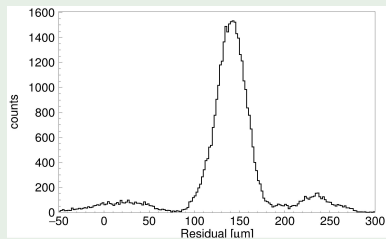
Topology of 1. Side



Topology of 2. Side



Height Distribution of 1. Side



- Panel sucked to granite table
 - $RMS_{required} = 30 \mu m$
 - $RMS_{1.Side} = 16 \mu m$
 - $RMS_{2.Side} = 14 \mu m$
- ⇒ Fulfilling requirements!

Summary

- Upgrade of the ATLAS muon spectrometer
- Construction, ..., validation of 2 m^2 modules in Munich
- Quality control of the MM panel surface mandatory
- Non tactile, laser based measurements
- Achieved $\text{RMS} < 30 \mu\text{m} = \text{RMS}_{\text{required}}$

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Thank you