Characterization of the ATLAS Micromegas quadruplet prototype

O. Sidiropoulou, M. Bianco, H. Danielsson, J. Degrange, E.M. Farina, F. P. Gomez, P. Iengo, F. Kuger, T.H. Lin, M. Schott, G. Sekhniaidze, C. Valderanis, M. Vergain, J. Wotchack

Micromegas princliple

- Parallel plate avalanche chambers (Giomataris et. al. 1996).

- Several mm wide drift region and ~0.1 mm wide amplification region, separated by thin conductive micro-mesh.

- Charged particles/photons traversing drift space ionize the gas releasing electron-ion pairs.

- Electrons drift within 100 ns into the high-field amplification region multiplied   in avalanche, while ions drift towards to cathode.
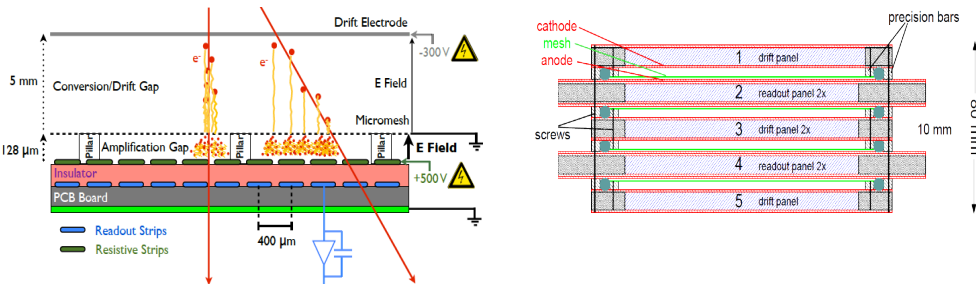
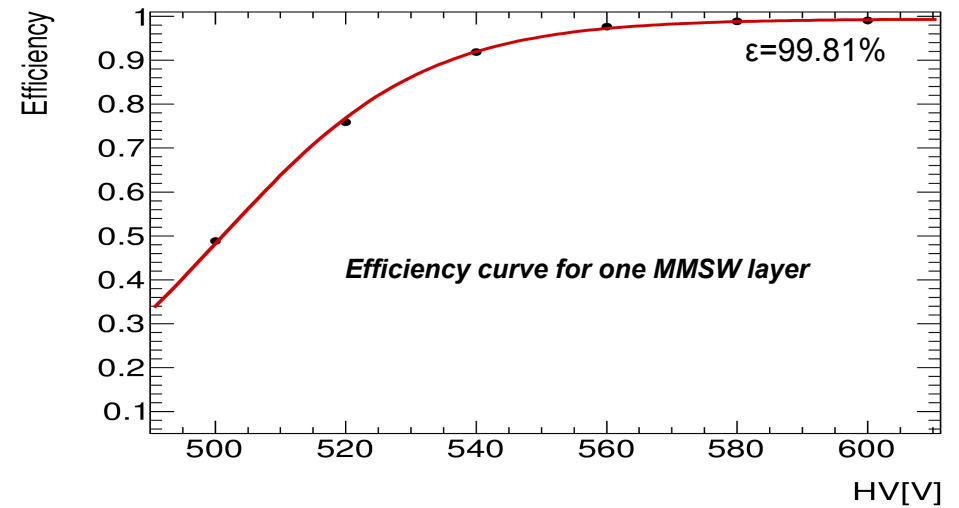## Micromegas Small Wheel (MMSW) prototype

Towards the upgrade of the innermost end-cap stations of the ATLAS muon system a 0.5 m^2 quadruplet prototype has been built.

- Two double sided readout panels, 1 with horizontal strips – 1 with inclined strips (±1.5°). 1024 strips per plane with 415 μm strip pitch.

  - Readout planes are covered by thin Kapton® Foil layer for spark tolerance. Pillars of 128 μm height are built on top to define mesh position

- 3 drift panels with space bars hold the mesh and define the drift region.
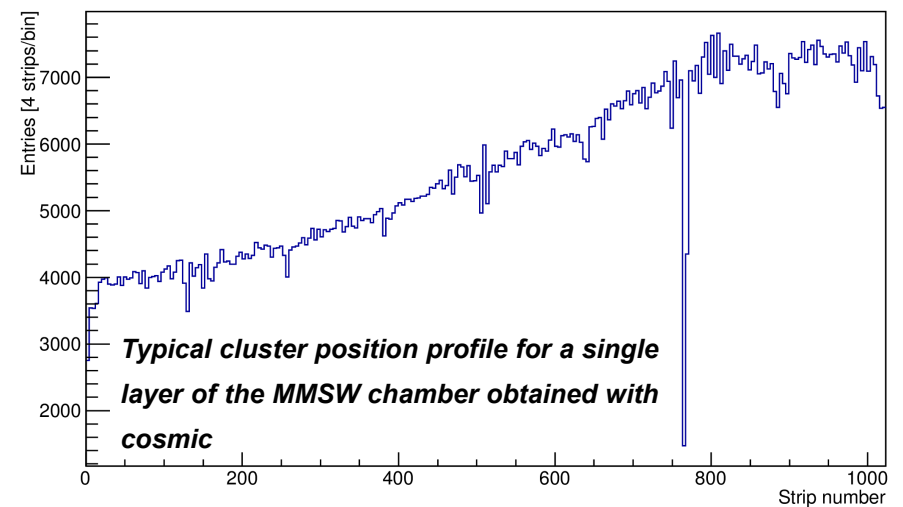
Cosmic Tests

Dedicated cosmic stand in RD51 DGG laboratory at CERN used for cosmic tests.

- Readout chamber with front-end electronics based on APV-25 ASIC, Scalable Read-out System (SRS) and dedicated DAQ software
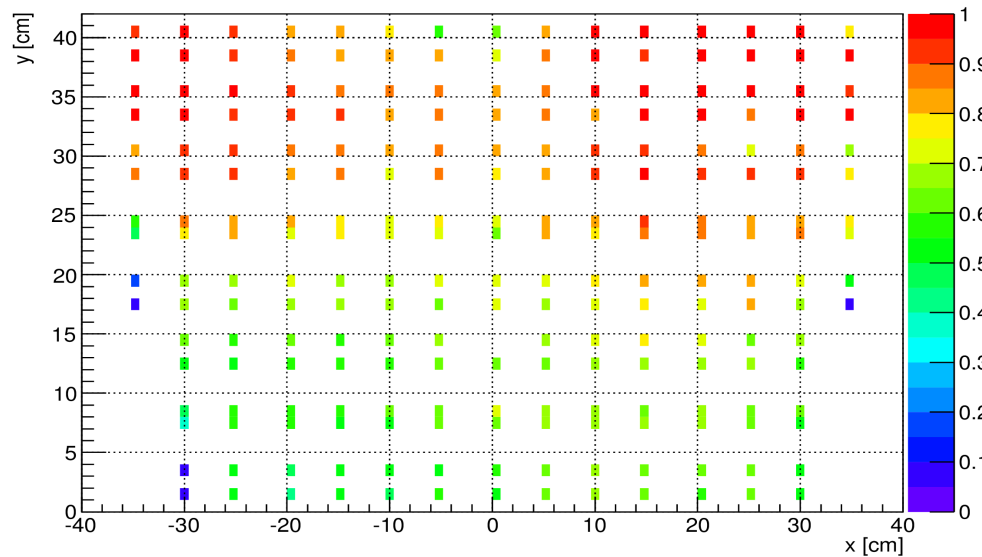

ε=99.81%

Efficiency curve for one MMSW layer

Cluster distribution along the readout strips

Typical cluster position profile for a single layer of the MMSW chamber obtained with cosmic

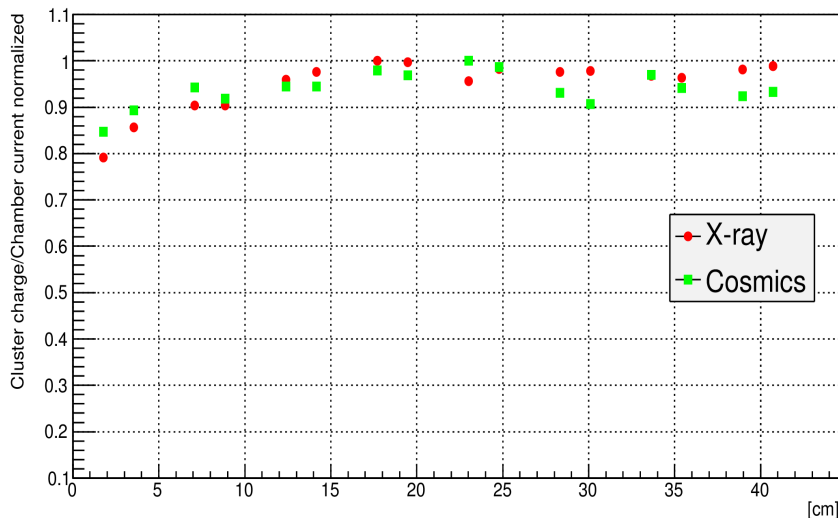# X-Ray tests: Mini-X Ag (energy up to 50keV, max.flux 50 nA)

Map of amplification current by X-ray

Amplification current (normalized) induced by X-Ray gun in one MMSW layer using a small collimator.

To check uniformity of chambers X-Ray and Cosmic rays can be compared

Amplification current compared with the cluster charge

Comparison between amplification current, with X-Ray irradiation, and average cluster charge, with cosmic events, for one MMSW layer.

X-Ray

Pros

✔ No front-end electronics

✔ No DAQ system

✔ Only HV monitoring

Cons

✗ No info of the readout

✗ channels (dead/missing channels)

✗ Dedicated instrument and setup

Cosmic

Pros

✔ Fully chamber characterization

✔ Complete channel map

Cons

✗ DAQ system with large amount of readout channels

✗ Time consuming