First results from tests of gaseous detectors assembled from resistive meshes

P. Martinengo¹, E. Nappi², R. Oliveira¹, V. Peskov¹, F. Pietropaola³, P. Picchi⁴

> ¹CERN, Geneva, Switzerland ²INFN Bari, Bari, Italy ³INFN Padova, Padova, Italy ⁴NFN Frascati, Frascati, Italy

Why not combining RPC and Micromegas

For large Micromegas (not segmented) discharge can be a problem for electronics. This can be avoided by adopting the RPC principle

1- Resistive anode

2- Resistive mesh : few M Ω.cm Kapton holes made with LASER (collaboration with Rui)

cathode

<u>Resistive mesh</u>

Anode



I.Laktineh, IPN-Lyon, Rpeort at the November 2009 RD51 meeting



Signal obtained from the mesh: Pream ORTEC142B+AMPLIFIER(gain=20)

We have ordered from Rui resistive meshes much before the Laktineh talk, however received it after the Laktineh talk

.. so certainly we give him and his group all credits

Resistive Mesh Detectors

This approach could be an <u>alternative/or</u> <u>complimentary</u> to the ongoing efforts in developing MICROMEGAS and GEMs with resistive anode readout plates and can be especially beneficial in the case of micropattern detectors combined with a micropixel-type integrated front end electronics. <u>Mesh #1</u> had a thickness t= 20µm, hole's diameter d=70 µm and hole spacing a=140 µm, resistivity –a few M Ω / \Box



it was made from resistive Kapton by a laser drilling technique

From these stretched meshes different detectors could be assembled:



3 mm gap RPC: mesh #2 had t=25 μ m, d=0.7 mm and a=1.7 mm; mesh #3 had t=25 μ m, d=0.8 mm, a=2.8mm;



Meshed # 2 and #3 were manufactured by usual mechanical drilling techniques.

View from the bottom



Some results obtained with large gap resistive mesh RPC



Resistive RPC Cathode-mesh: t=25 µm, d=0.7 mm and a=1.7 mm Anode –resistive Kapton Cathode –anode gap 3mm

Large-gap mesh RPCs were used in early experiments just to demonstrate the operational principle Spark's energy was suppresses on orders of magnitude (For the details of measurement see : *A. Di Mauro et al., arXiv:0706.0102, 2007*)

In fact it is an RPC with a drift region!

Some results obtained with the resistive mesh#1





Resistive MICROMEGAS

Cathode-mesh (t= 20µm, d=70 µm, a=140 µm) Anode –metallic or resistive Kapton Cathode –anode gap 0.1mm Fishing line and Kapton spacers

Triangles-alphas, squares-55Fe

The same tendency as with a 1mm gap detectors: the Raether limit is reached with alphas, but not with ⁵⁵Fe (due to even <u>stronger</u> contribution of imperfections at this very small gap)



Triangles-alphas, squares-55Fe



The maximum achievable gain for the resistive GEM was low, probably due to the mesh and design defect



Triangles-alphas, no signals were observed with ⁵⁵Fe

Cascaded resistive mesh detectors



Triangles-alphas, squares-55Fe

Preliminary conclusion: resistive meshes are ideal for multistep designs:

Higher gains

No discharge propagation (the main enemy in cascaded metallic GEMs)

Potentially good position resolution



Position resolution:

It is already <u>2-3 times</u> better that was obtained with a RETGEM. We are quite confident that a much better position resolution can be achieved with a finer mesh and with more accurate measurements and work in this direction is now in progress.



Conclusions.

• Resistive meshes developed and tested in this work are <u>convenient</u> <u>construction blocks</u> for various spark-protective detectors including the GEM-like and MICROMEGAS-like.

• Due to the small diameter of their holes and the fine pitch, a <u>better</u> <u>position resolution can be achieved</u> with resistive mesh –based detectors than with the RETGEMs.

• <u>No discharge propagation</u> was observed in our experiment when RMDs operated in cascade mode. One of the advantages of the cascade mode is the possibility to reduce an ion back flow to the cathode which can be an attractive features for some applications such as photodectors or TPC.

• Our nearest efforts will be focused on developments and tests of <u>fine</u> <u>pitch meshes manufactured by various techniques and on optimization its</u> <u>geometry and resistivity.</u> This will allow for the building of high position resolution spark protected micropattern detectors. One of the possibilities is to use the fine resistive mesh for MICROMGAS combined with a micropixel readout plate; this approach can be an alternative to current efforts from various groups to develop micropixel anode plate with resistive spark protective coating