Resistive …..

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Motivation

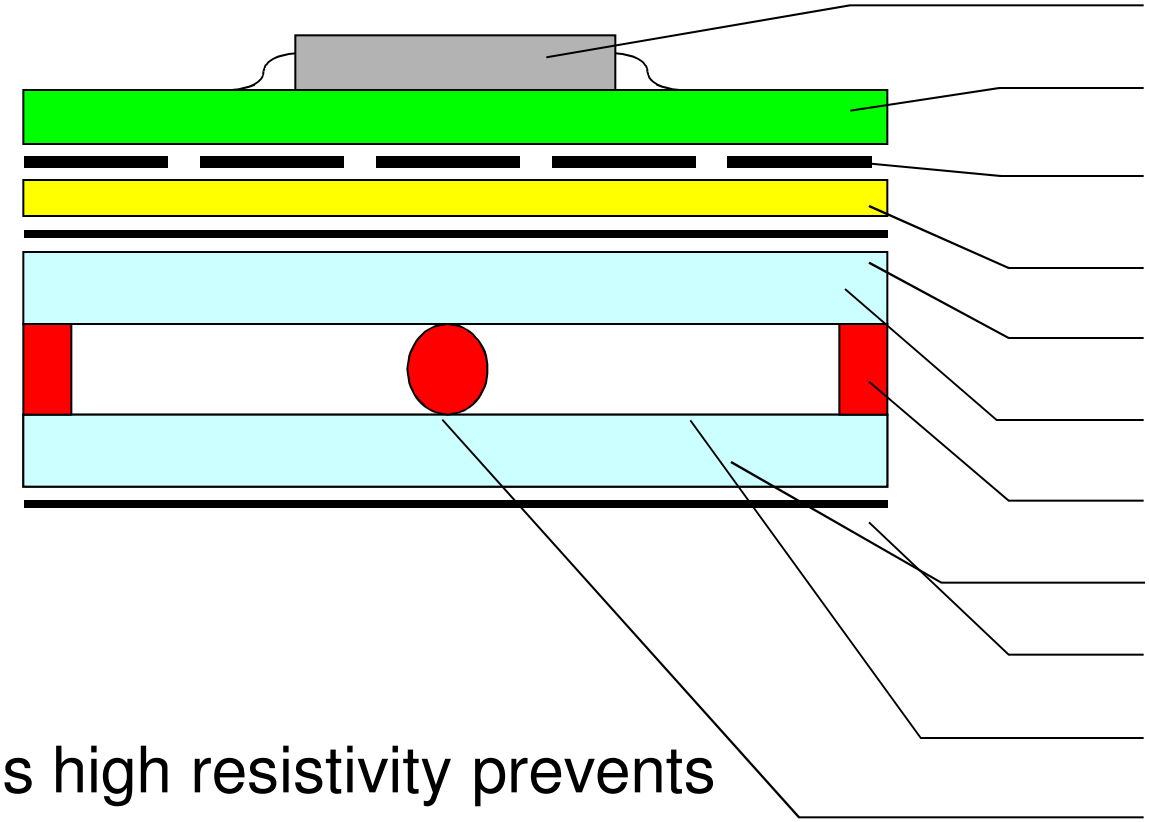
Calorimeters are expected to play an important role in future experiments (ILC, CLIC…) based on PFA concepts → high granularity is needed

→Gas detectors can provide a suitable sensitive medium :Homogeneous,
→Ganularity provided by the electronics readout

Solutions : **GRPC**, GEM, **MICROMEGAS.**

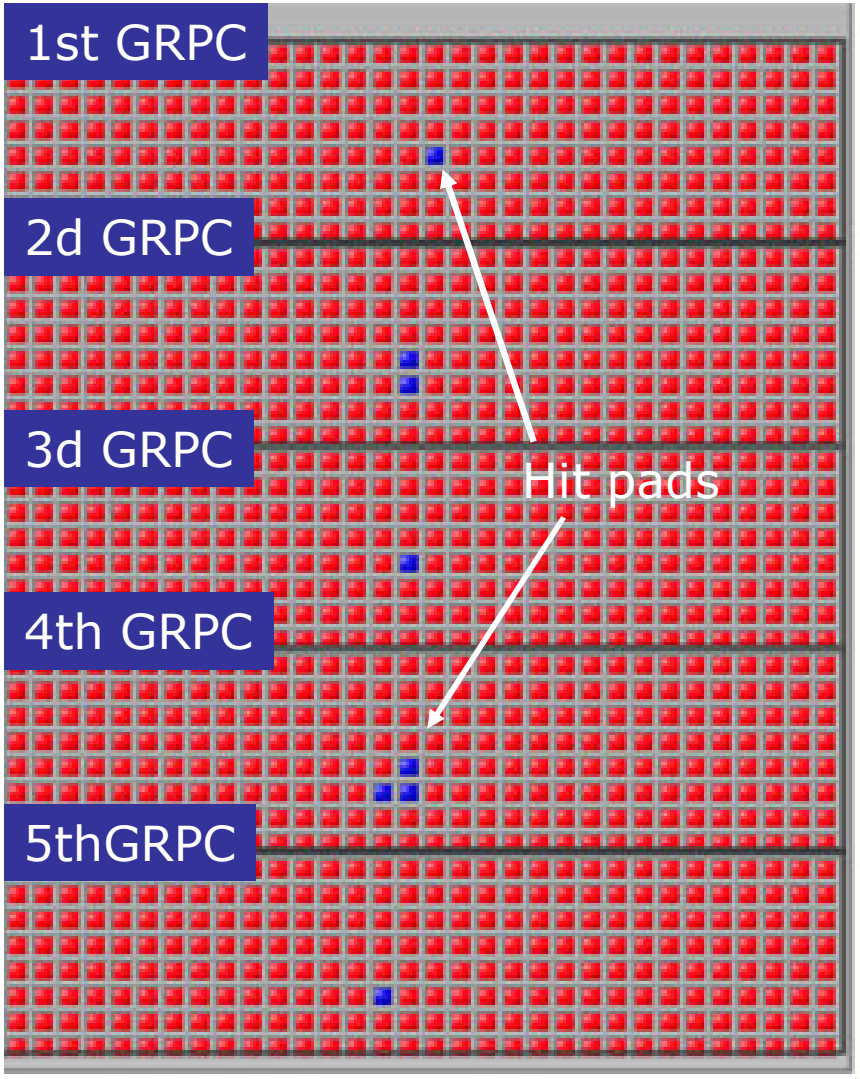
GRPC for the DHCAL

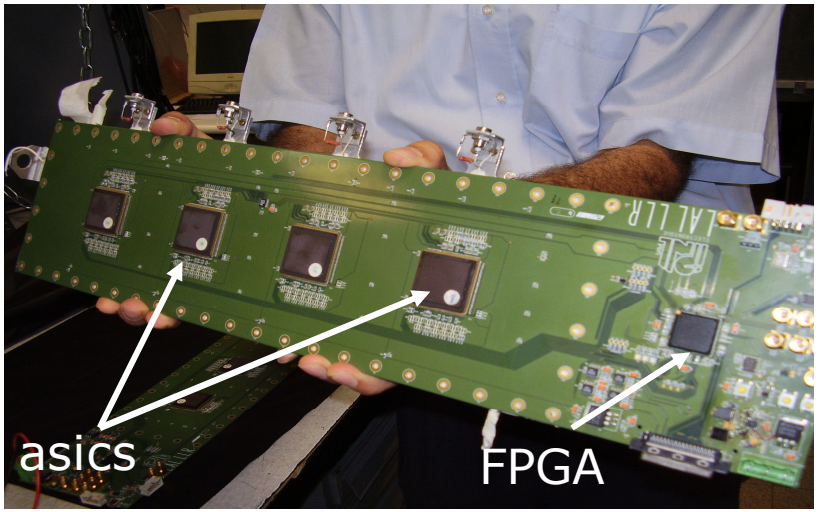
- Thickness of few millimeters
- Efficient, homogenous, cheap and easy to build

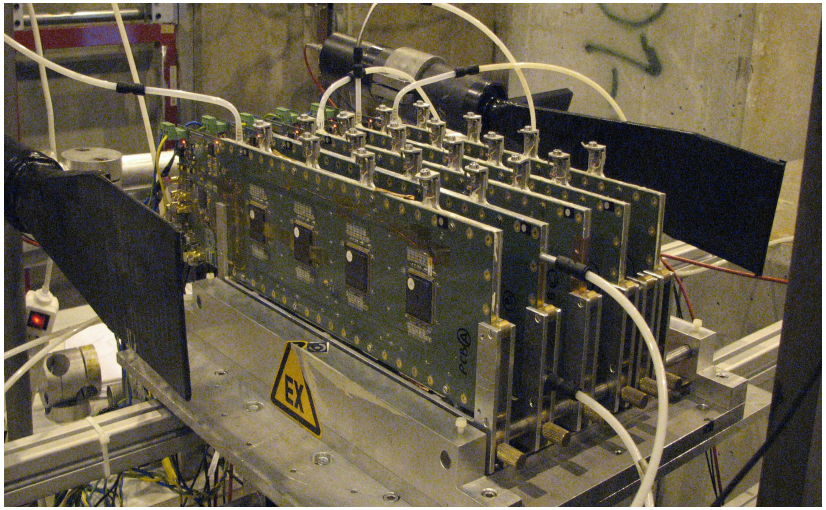


Glass high resistivity prevents sparks

Small GRPCs (32X8 pads) were built and tested with success using semi-digital electronics

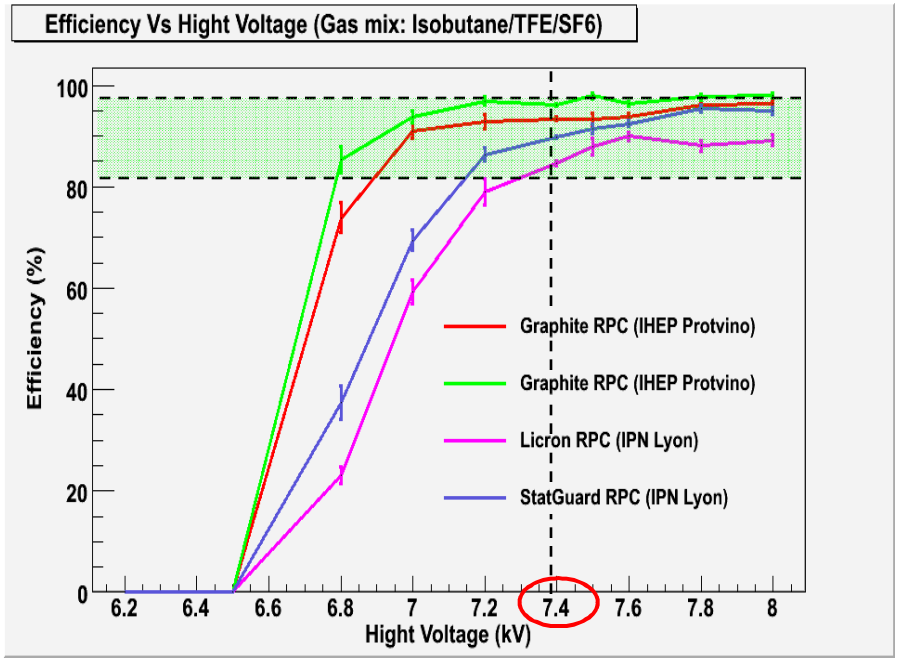


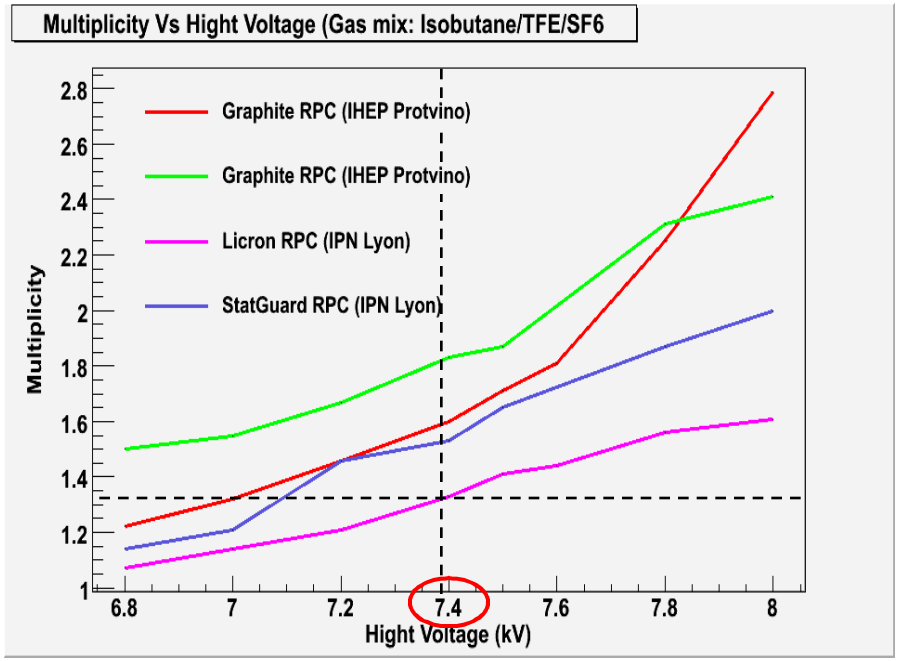




Resistive painting is used to establish HV

Graphite 400 K Ω/□
Licron : > 20 M Ω/□
Statguard few M Ω/□





The problem is to have homogenous paining for large surface:

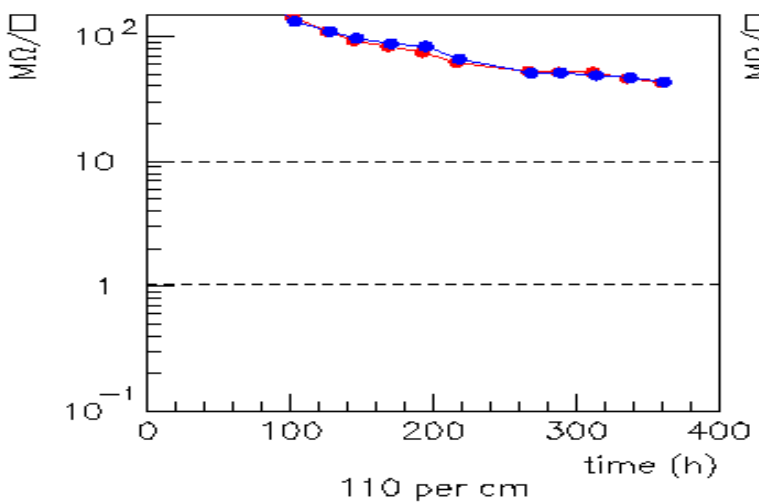
Graphite (400 K Ω/□) Standard but high multiplicity

Licron (> 20 M Ω/□) : Spray, good multiplicity, HV long-term connection problems (HV lost after few months)

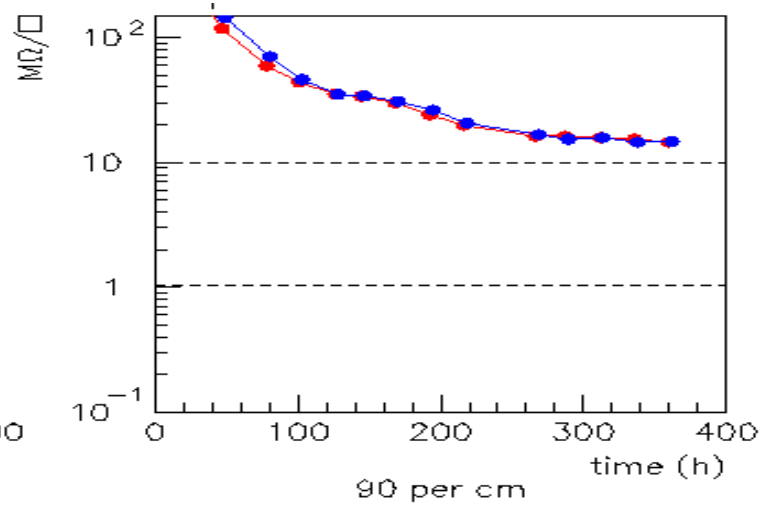
Statguard (few M Ω/ □) : Liquid painting, stable, no HV connection problem observed so far but homogeneity is not good when painted with a roll

Silk Screen Printing :

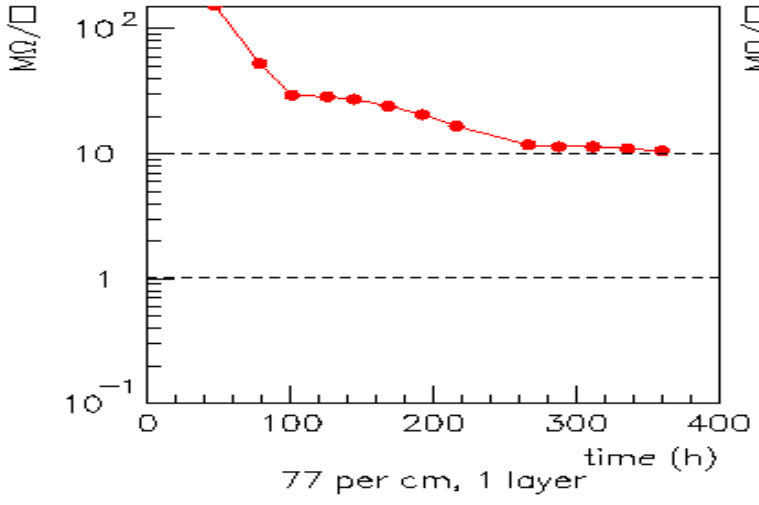
The technique is well known , it provides homogenous and well controlled coating. Simple tools are needed



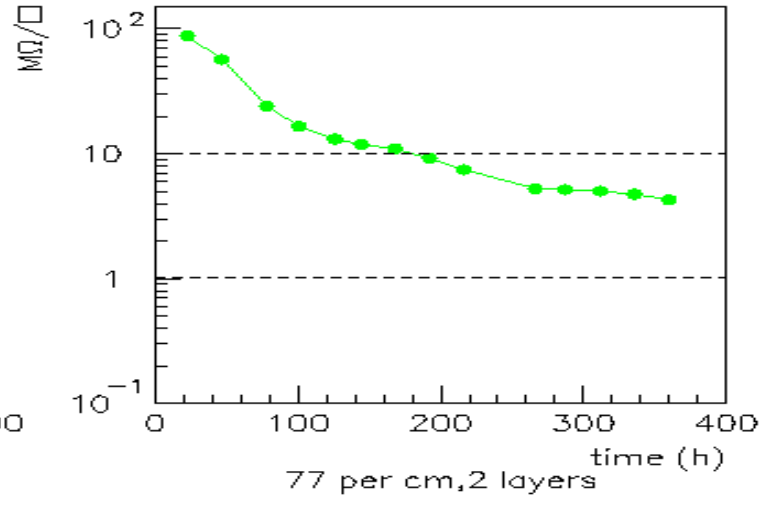
110 per cm



90 per cm



77 per cm, 1 layer

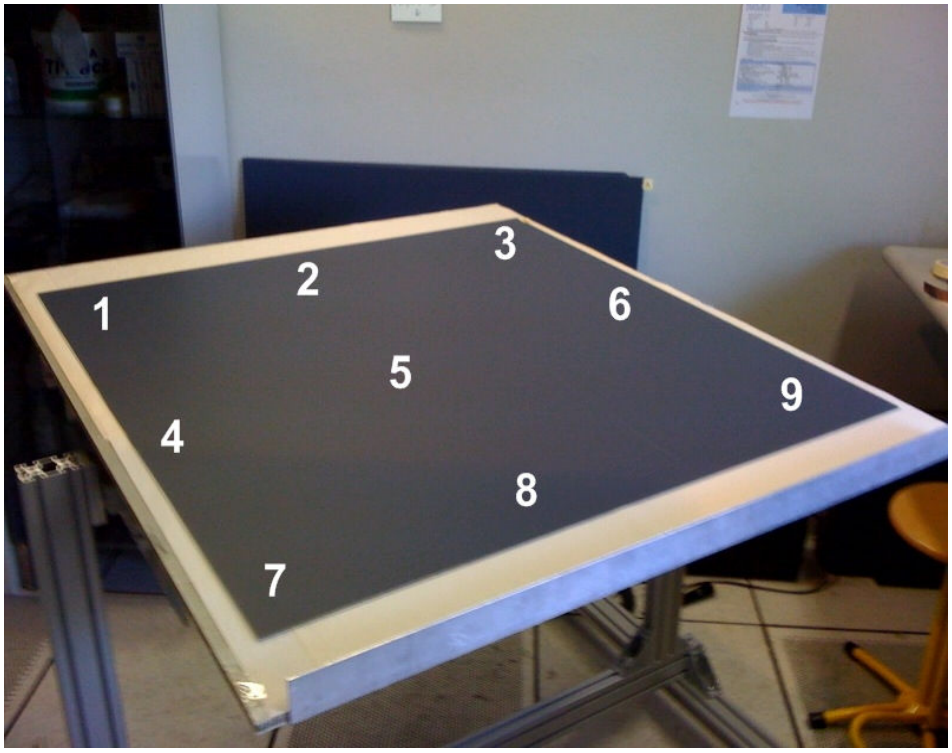


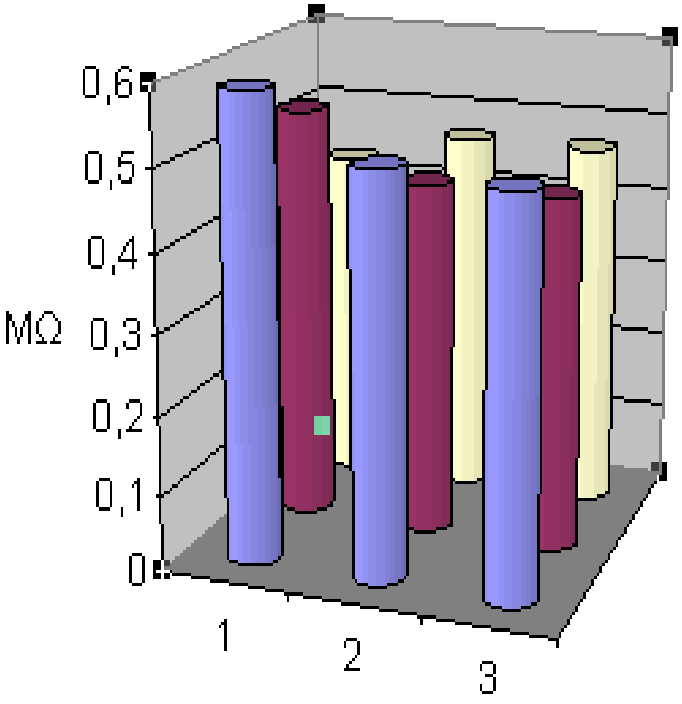
77 per cm,2 layers

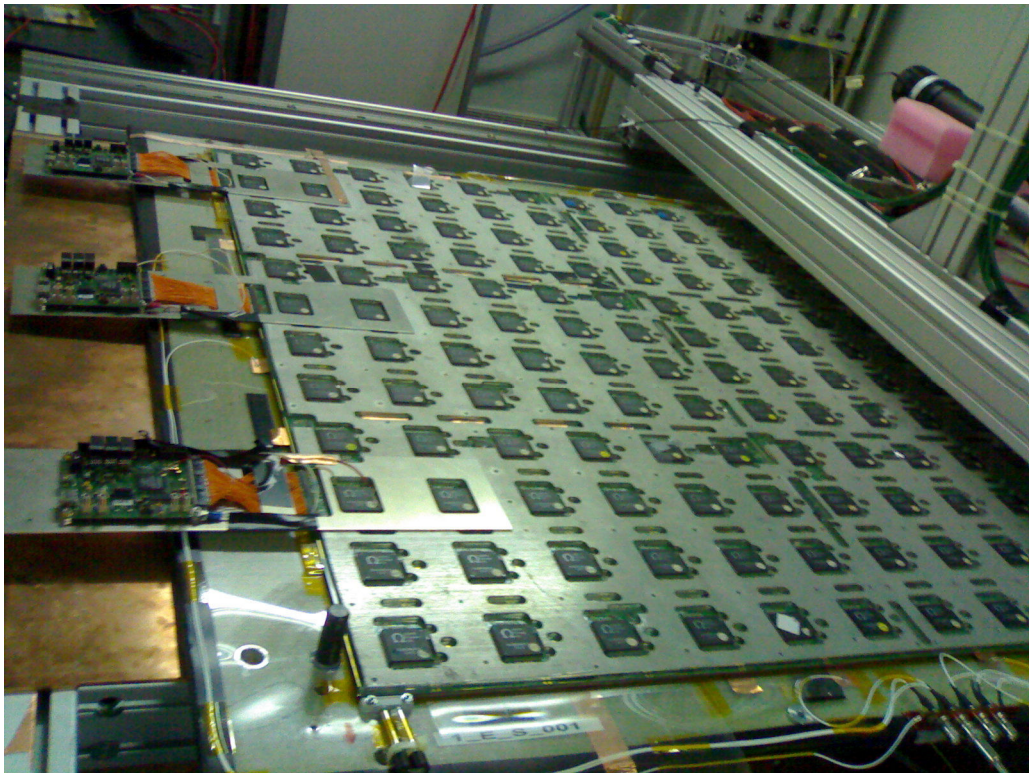
Silk Screen Printing :

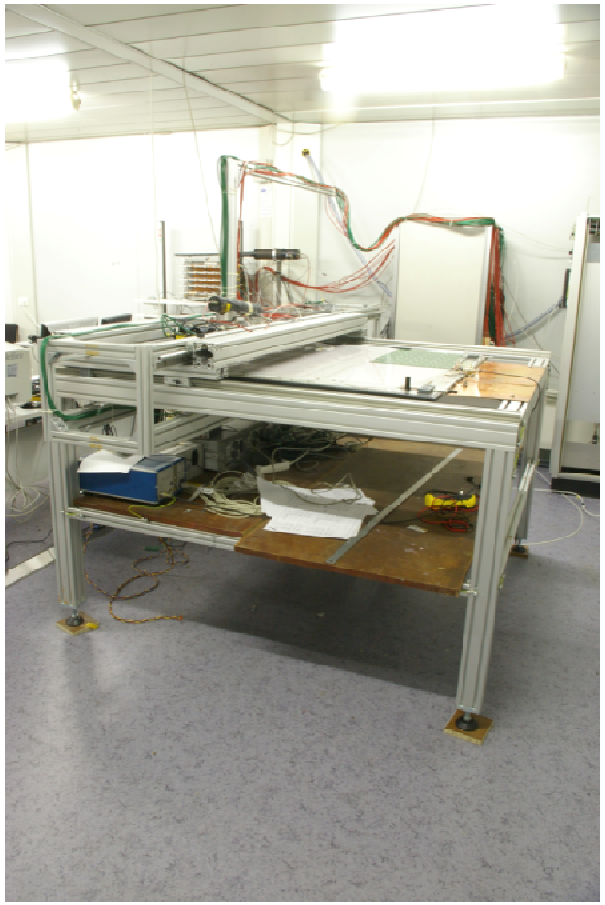
Statguard is not really adapted to Silk Screen Printing. It dries quickly

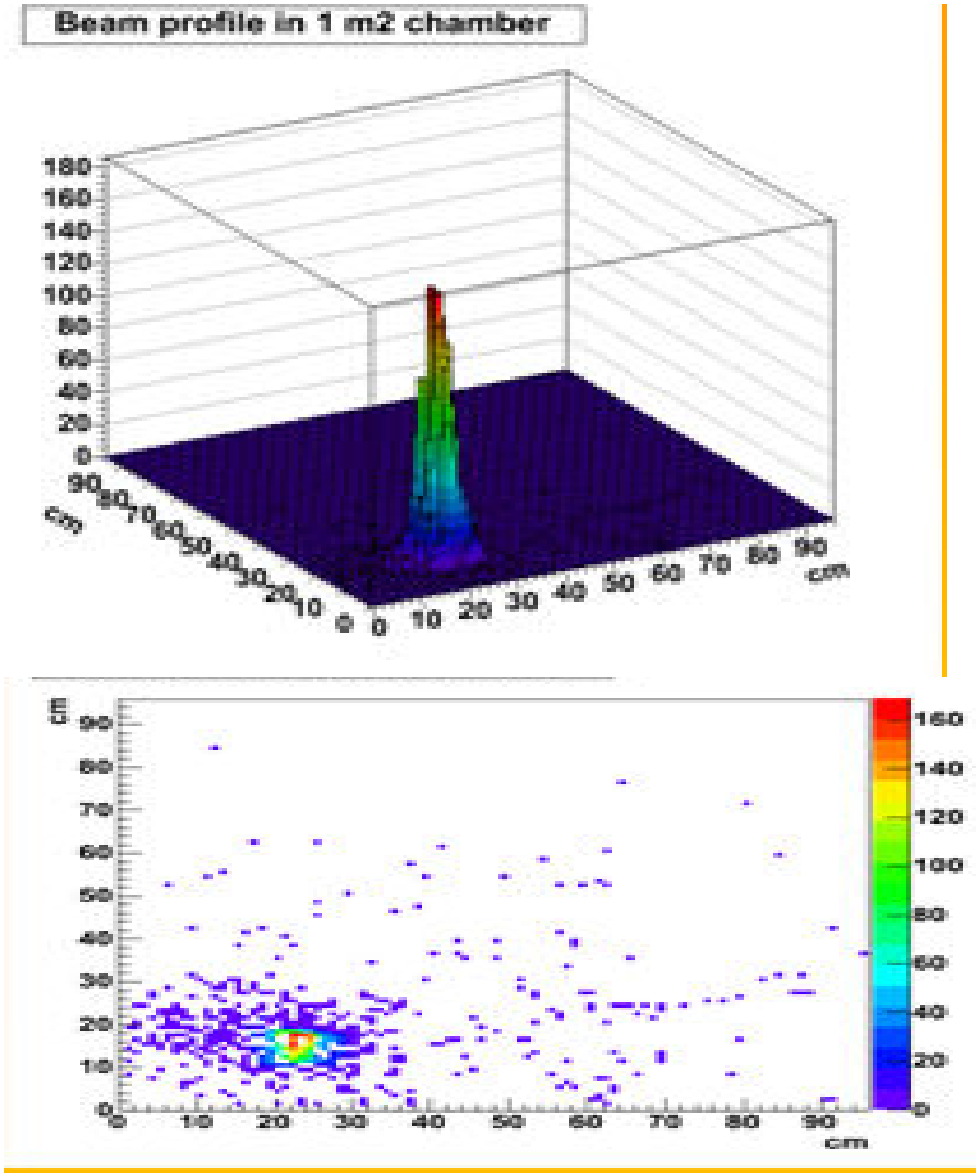
Colloidal graphite (~1 M Ω/ □) is well suited for Silk Screen Printing but drying at high temperature (180°) is needed

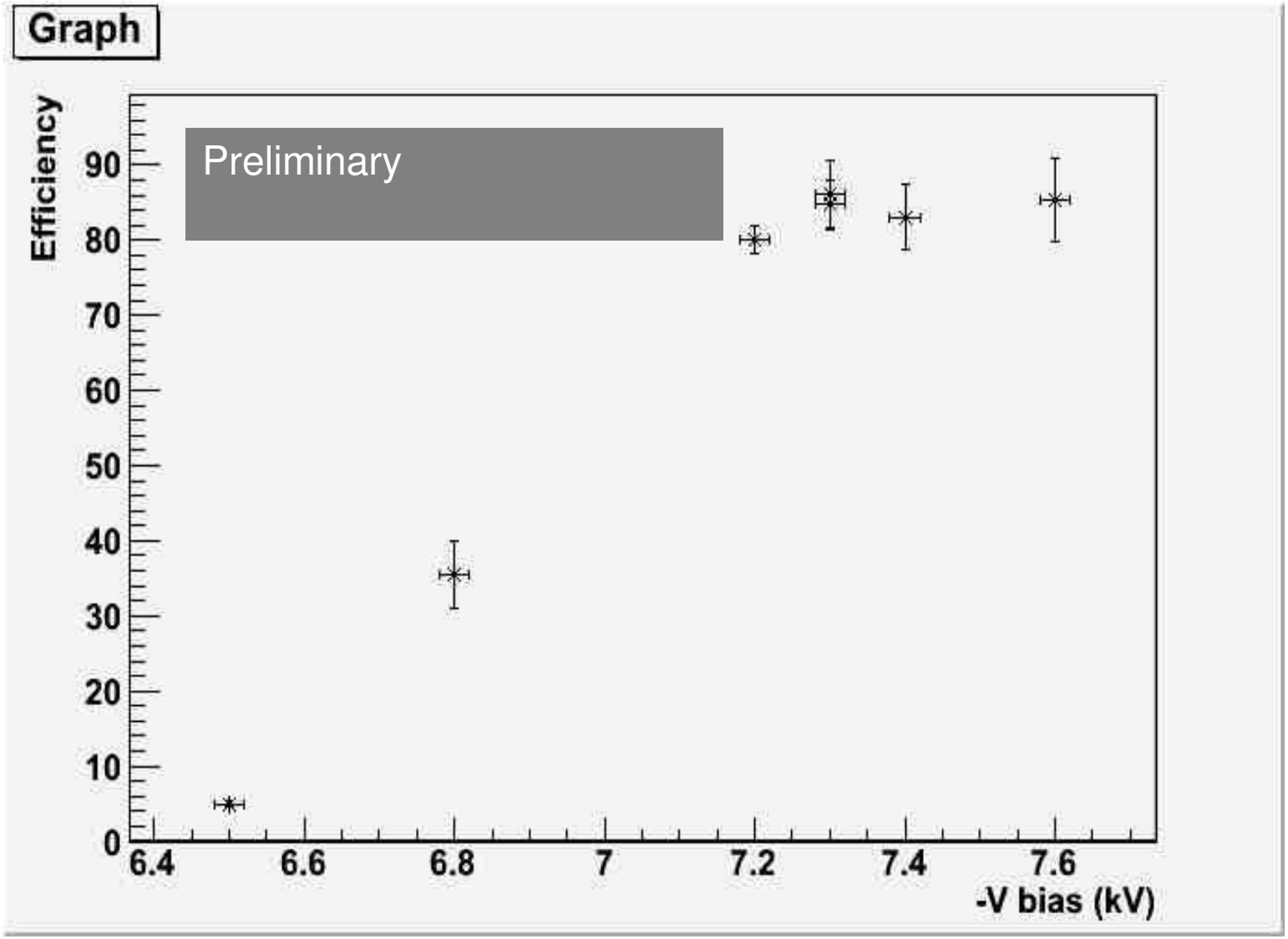









Beam profile in 1 m2 chamber
180
160
140
120
100
80
60
40
20
0
cm
0 10 20 30 40 50 60 70 80 90
cm
cm
0 10 20 30 40 50 60 70 80 90
cm
160
140
120
100
80
60
40
20
0


Graph
Preliminary
Efficiency
90
80
70
60
50
40
30
20
10
0
6.4
6.6
6.8
7
7.2
7.4
7.6
-V bias (kV)

Why not combining RPC and Micromegas

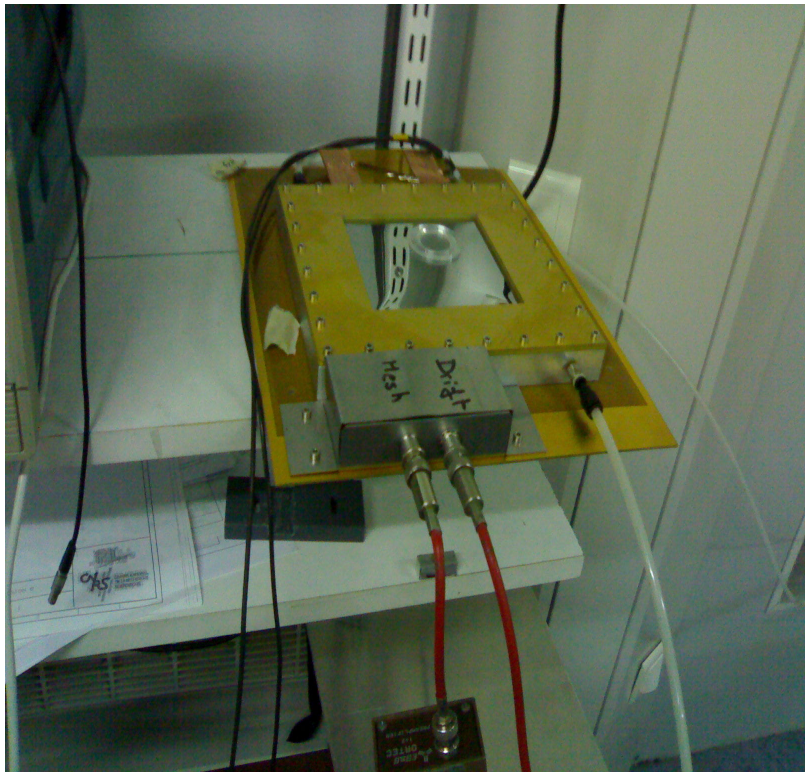
For large Micromegas (not segmented) discharge can be a problem for electronics. This can be avoided by adopting the RPC principle

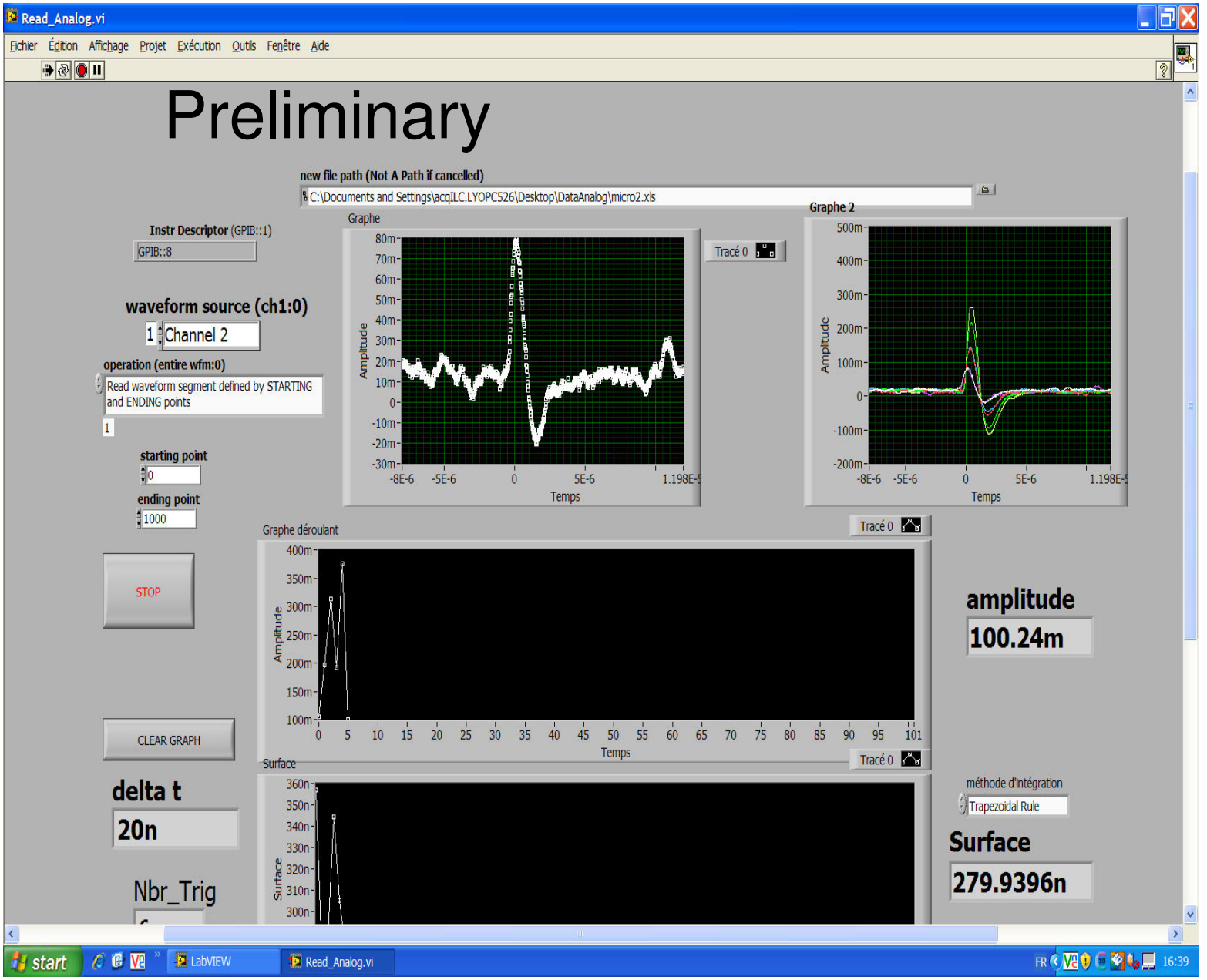
1- Resistive anode
2- Resistive mesh : few M Ω.cm Kapton
holes made with LASER
(collaboration with Rui)

cathode

Resistive mesh

Anode





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

Conclusion

- Resistive material control is of an utmost importance.
- Expertise from RPC can be helpful in Micromegas
- Resistive Mesh is an attempt to overcome discharge problems