Experience with resistive coatings at Saclay

and Carleton, Nikhef, Neuchatel

P. Colas

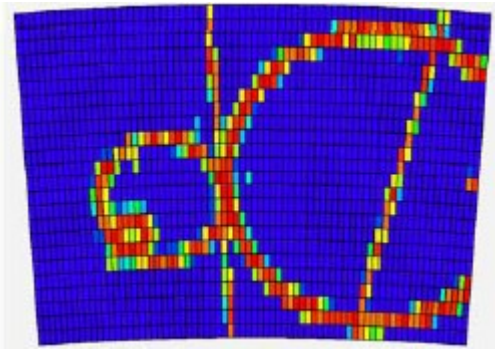
Use of resistive coatings for:
-Spreading the charge to improve resolution while limiting the number of electronic readout channels
-Stabilizing Micromegas detectors (spark suppression)
-Protecting integrated circuits

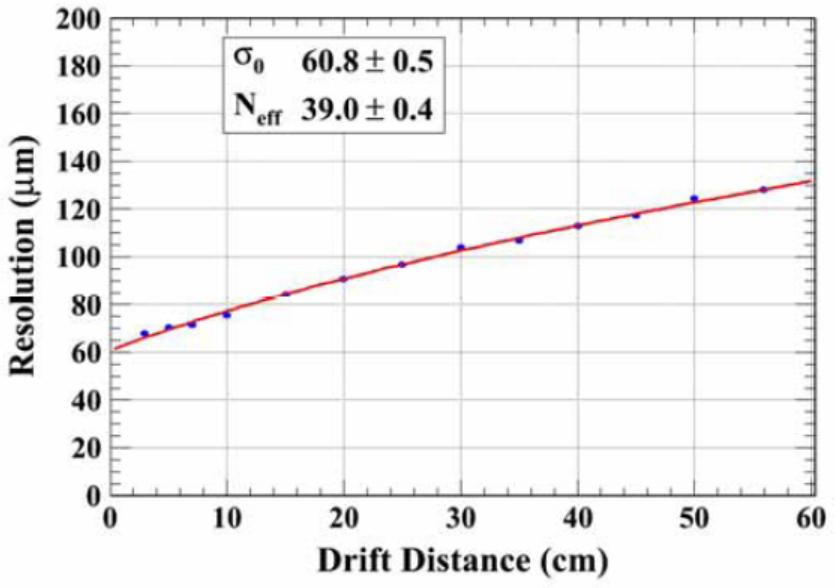
Numerous techniques tried since a decade

Characterization of coverlays : measurement of surface resistivity, bulk resistivity and thru-resistivity

ILC-TPC : charge spreading

Resistive bulk
Micromegas

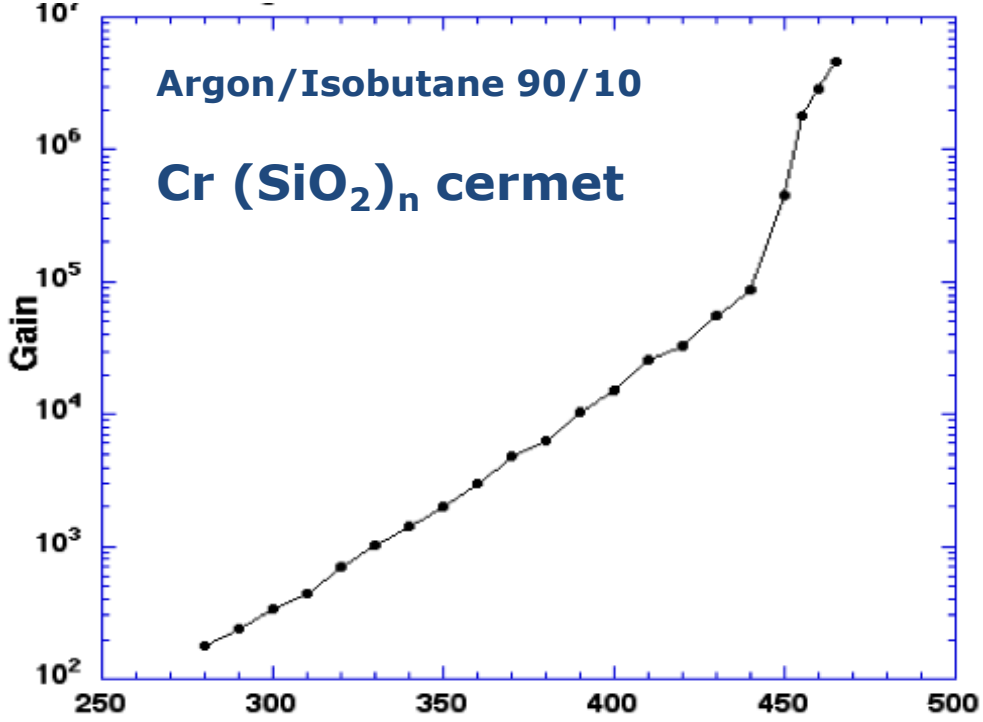




Continuous RC circuit spreads the charge -> resolution improvement

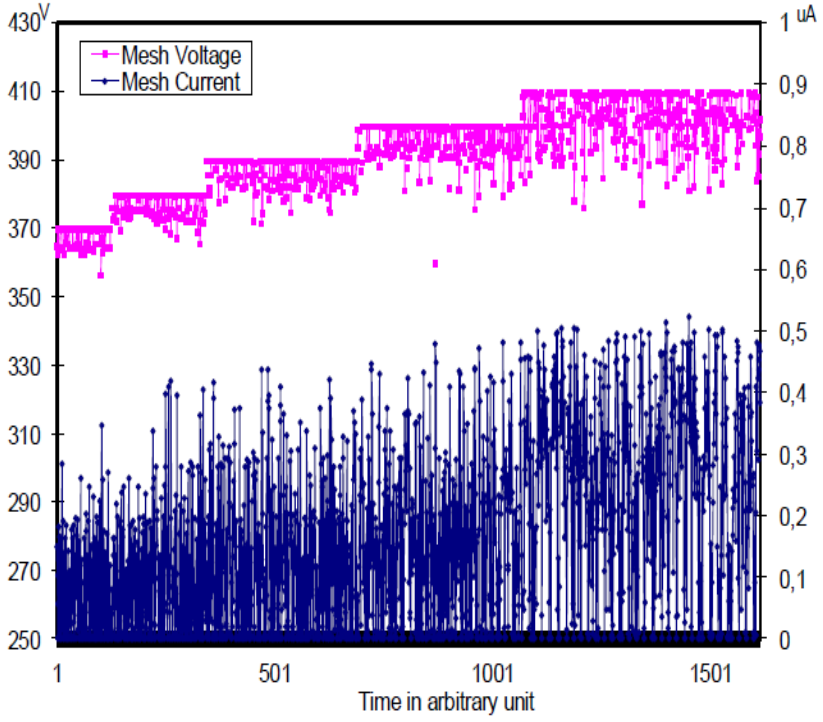
60 μ resolution at 0 drift with 3 mm pads !

Also the resistive foil stabilizes Micromegas: no more breakdown, stable current

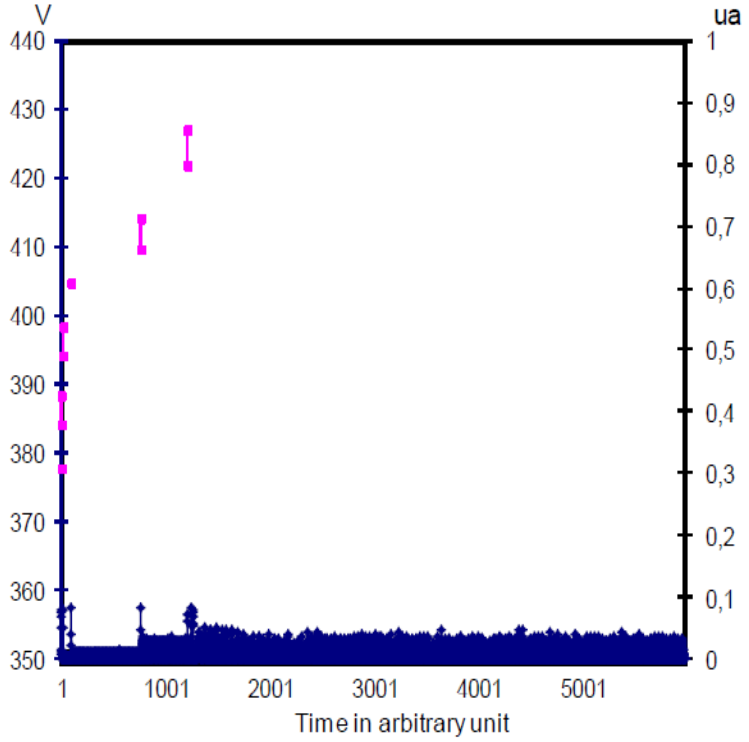


P.C., M. Dixit, I. Giomataris
2005 LC workshop, Stanford

Standard Micromegas

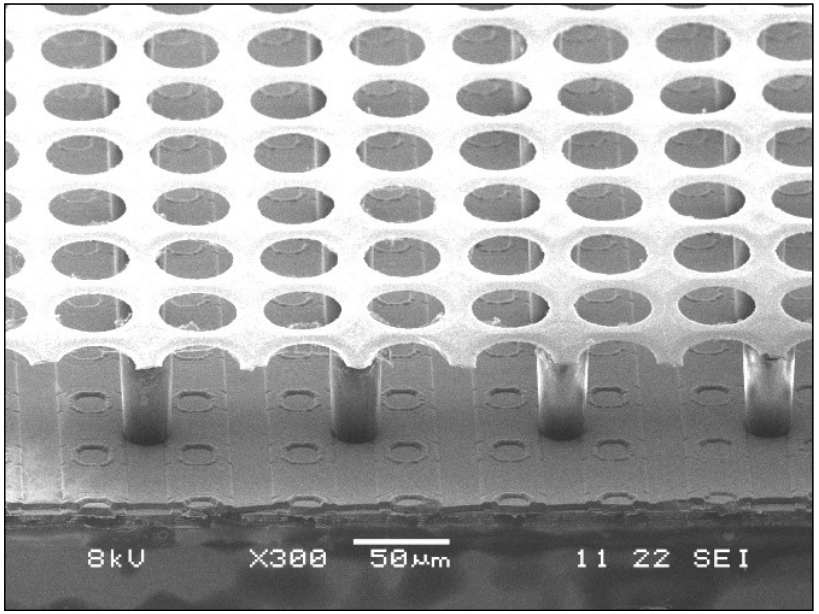


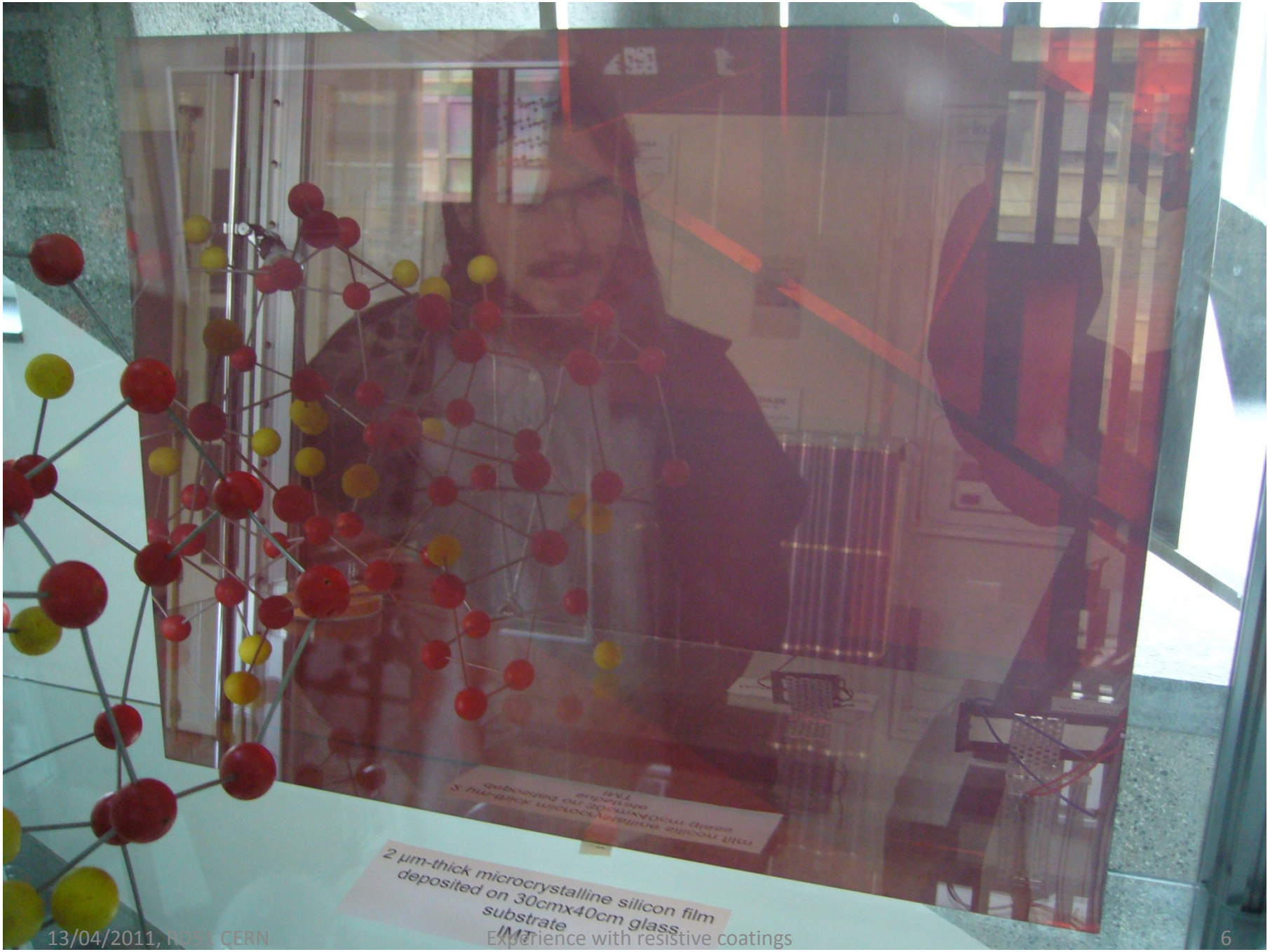
Resistive Micromegas



MAMMA beam test, 15 kHz hadron beam, October 2009

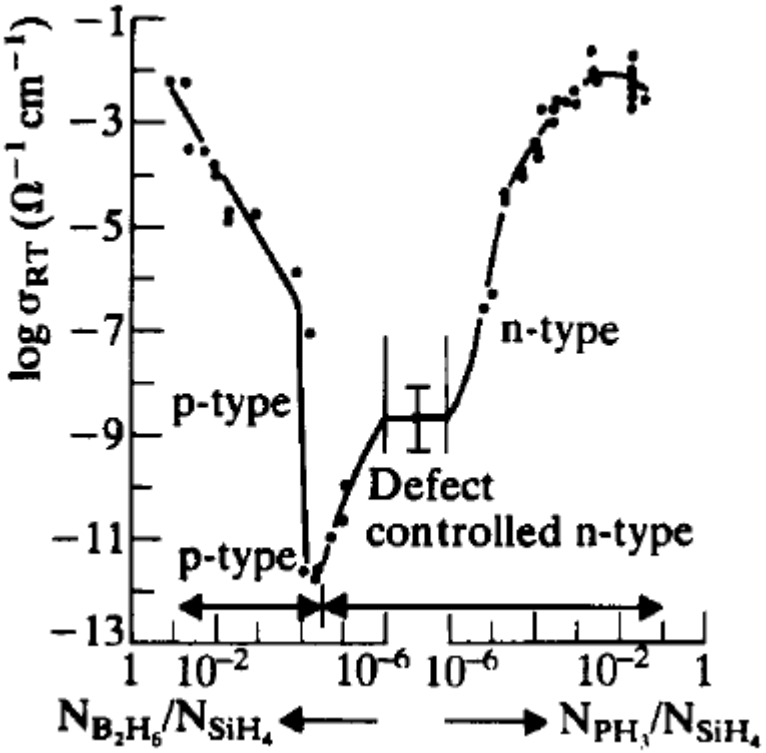
Resistive deposits also protect TimePix Chips from sparks
(10 microns of aSi:H, 4-7 microns of Si_xN_y (H. VdGraaf, N. Wyrsch)

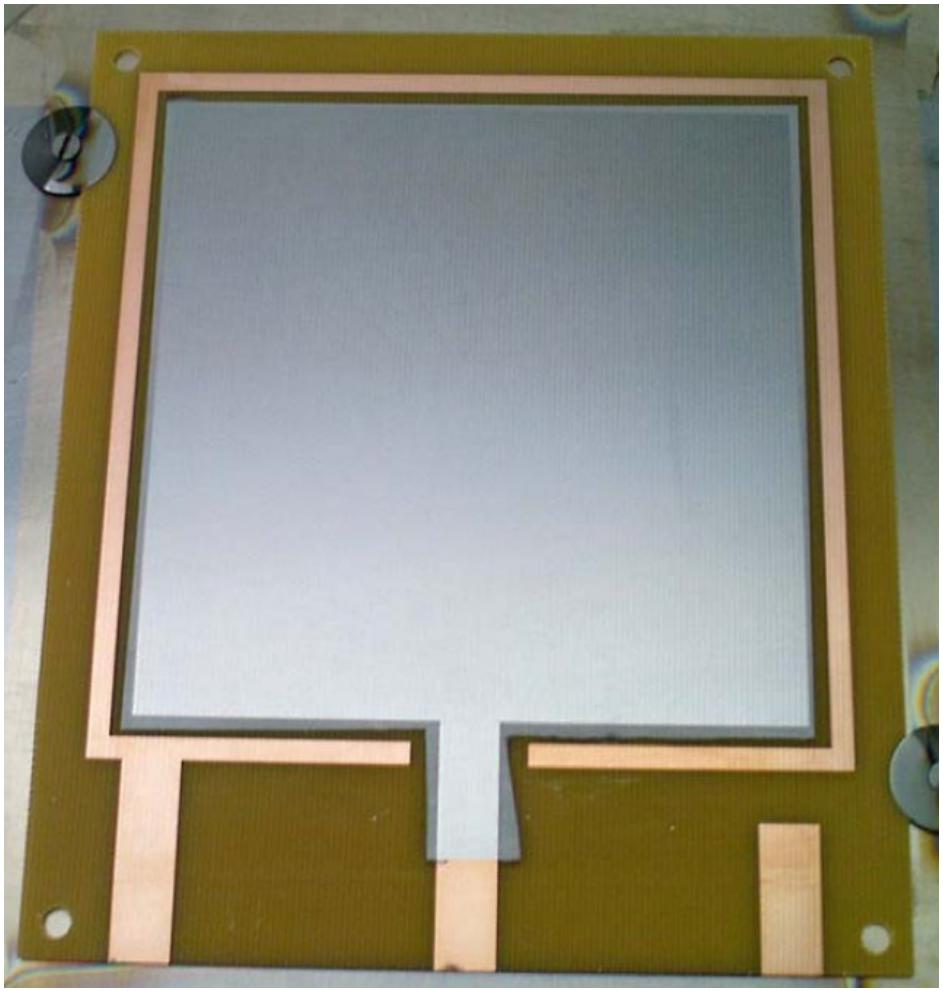



2 µm-thick microcrystalline silicon film
deposited on 30cmx40cm glass
substrate
IMT

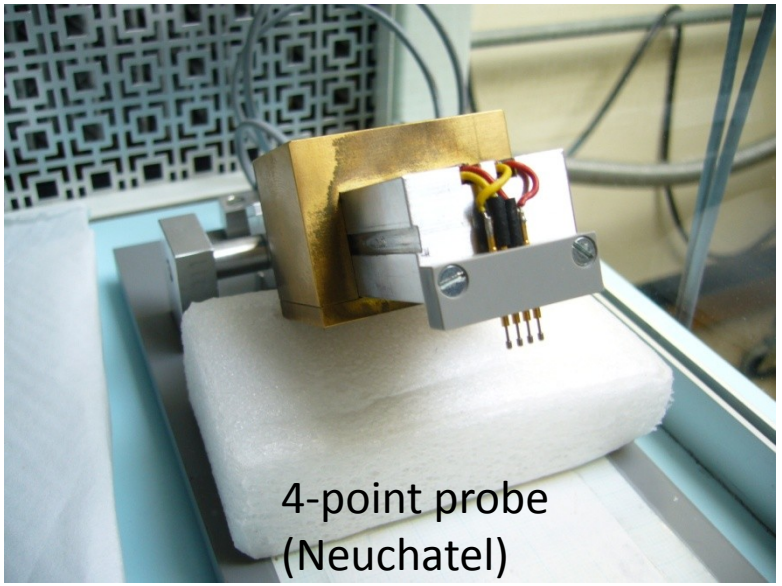
Deposition of thin layers (10 µ thick) of a-SiH (10^{13} Ω.cm)
Neuchatel, N. Wyrsch

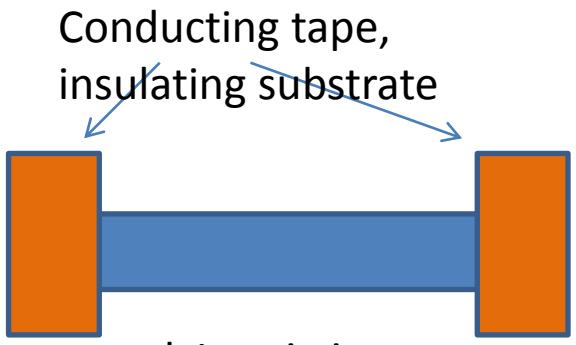
Possibility to add a doped layer on top





We used several techniques to measure resistivities.
-May depend on voltage, pressure of the contact,…
-Often see discrepancies, inhomogeneities, unstabilities
-Thru-resistivity sometimes inconsistent with surface resistivity





lxL resistive sample = L/l 'squares'

Measure resistance, divide by number of squares

Diagnostic tools : thermal image of the prototype with a high-resistivity layer and a lower-resistivity layer on top (N. Wyrsch, EPFL, Neuchatel)

Hot spots due to leakage current

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Type of coating	PROs	CONs
Cermet (Sheldal; M. Dixit et al.)	Tunable resistivity, homogeneous Stable once laminated	Fragile / scratchable
Carbon-Loaded polyimide (Dupont; M. Dixit et al.)	Accurate thickness (25 µ) Large surfaces easy	
Thin layer deposition (H. VdGraaf, N. Wyrsch, EPFL)	Limited to few micron thickness	Limited to small surfaces (10x10cm2). Very clean substrate needed.
Sprays (G. Mikenberg, Tel Aviv, J. Répond, I.Laktineh)	Large surfaces. Needs tuning	10-20% homogeneity
paints	Can be patterned. Large surfaces.	inhomogeneous