

European DHCAL Meeting

13/06/08

GRPC development in Lyon

GRPCs 'Lyonnais' – technology (1)

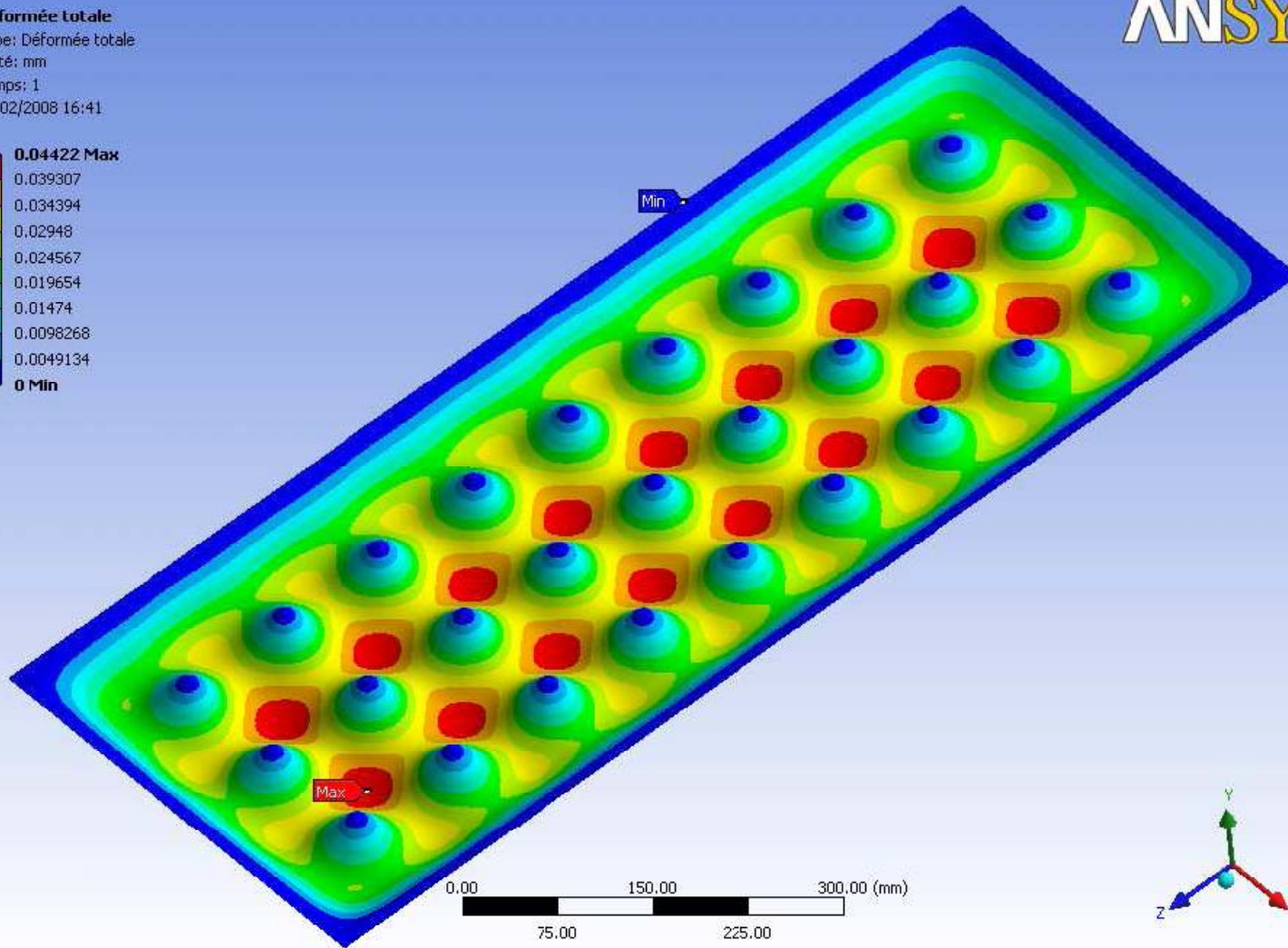
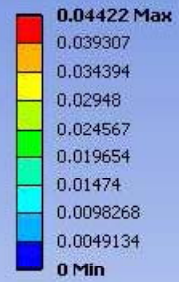
- Borosilicate glass
 - Anode: 0.7 mm
 - Cathode: 1.1 mm
 - Resistive layer ($\sim 20\mu$)
 - Graphite: $\rho_s \sim 2 \text{ k}\Omega/\square$
→ Very high multiplicity!
 - 'Licron' (polymer): $\rho_s \sim 30 \text{ M}\Omega/\square$
 - 'Statguard' (oxides of Fe, Ti): $\rho_s > 100 \text{ M}\Omega/\square$
 - Insulation layers – mylar
 - 175 μ cathode side (HV $\sim 7.5 \text{ kV}$)
 - 50 μ anode side (0 V)
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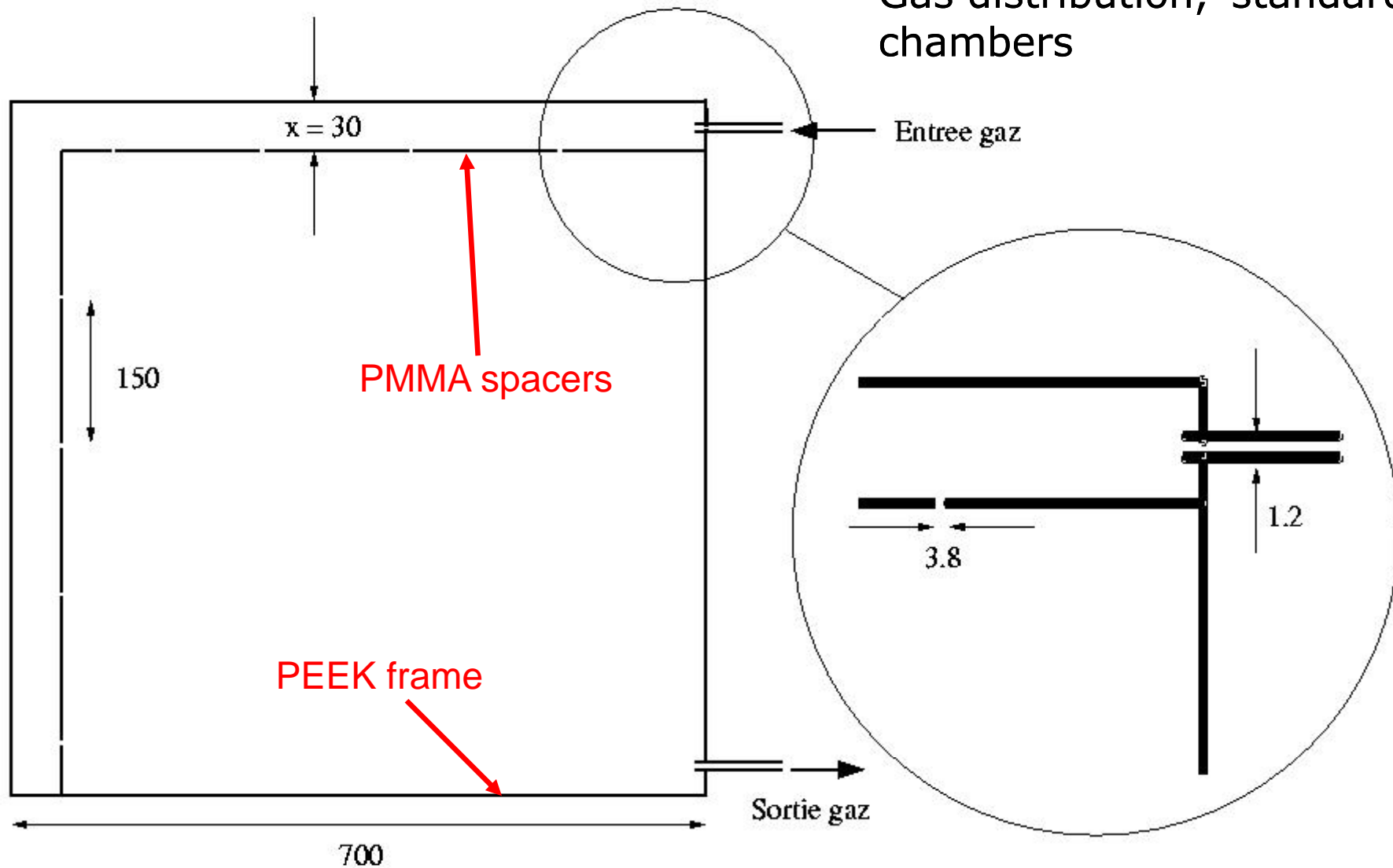
GRPCs 'Lyonnais' – technology (2)

- Two types of chamber:
 - 'Standard' chamber
 - Frame PEEK or FR4, thickness 1.2 mm, width 3 mm
 - 'Channelled' gas distribution – 'fishing line' (PMMA)
 - 'Capillary' chamber
 - Capillary tube frame 1.2 x 0.8 mm
 - Frame used to distribute gas (0.3 mm holes drilled in capillary walls)
 - Advantage: reduction of dead zones
 - Support between glass planes:
 - Ceramic balls diam. 1.2 +/- 0.02 mm
 - Distance between balls optimized (ANSYS): 100 mm (max. deformation 44 μ – 81 balls / m²)
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ANSYS

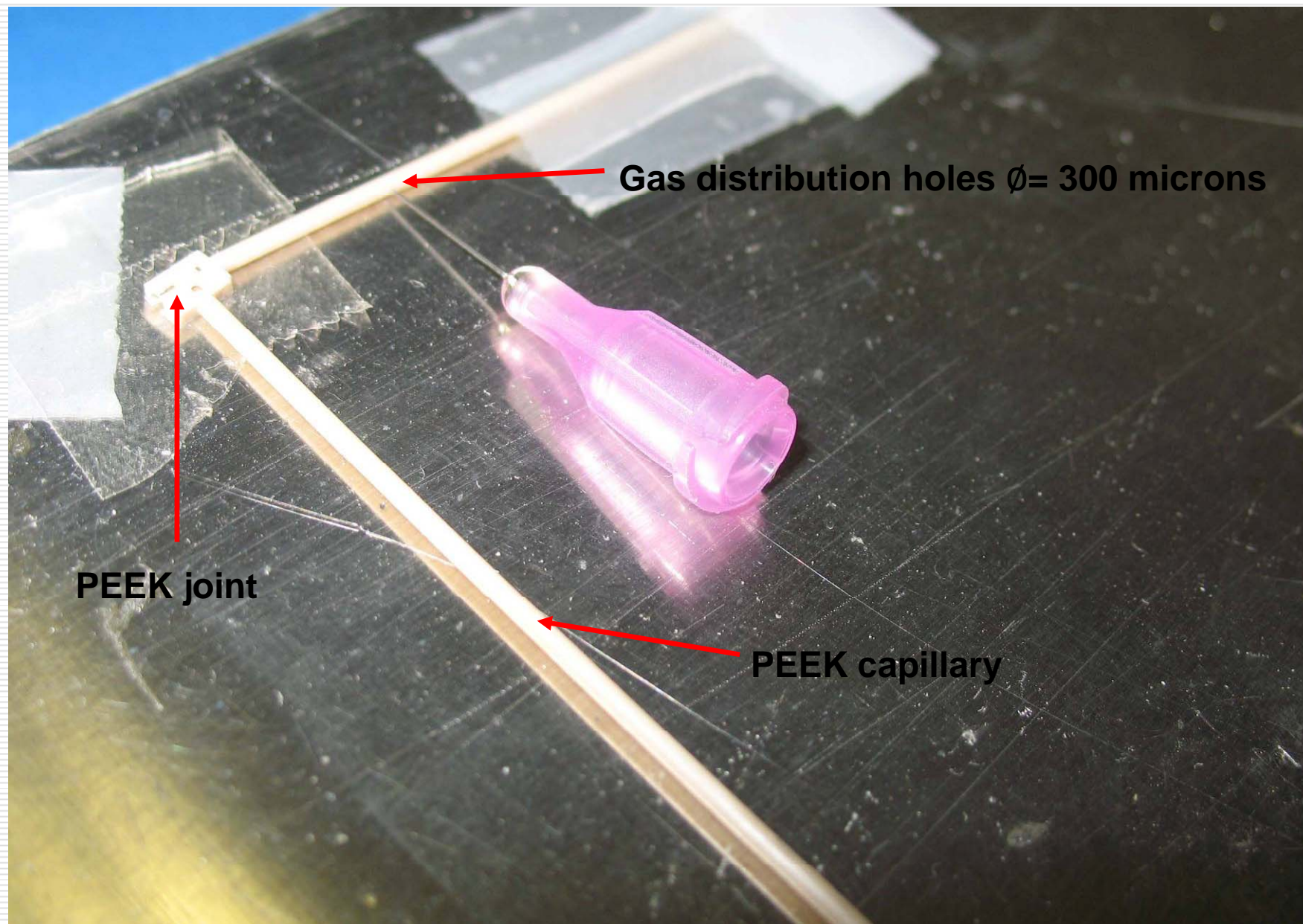
Déformée totale
Type: Déformée totale
Unité: mm
Temps: 1
07/02/2008 16:41



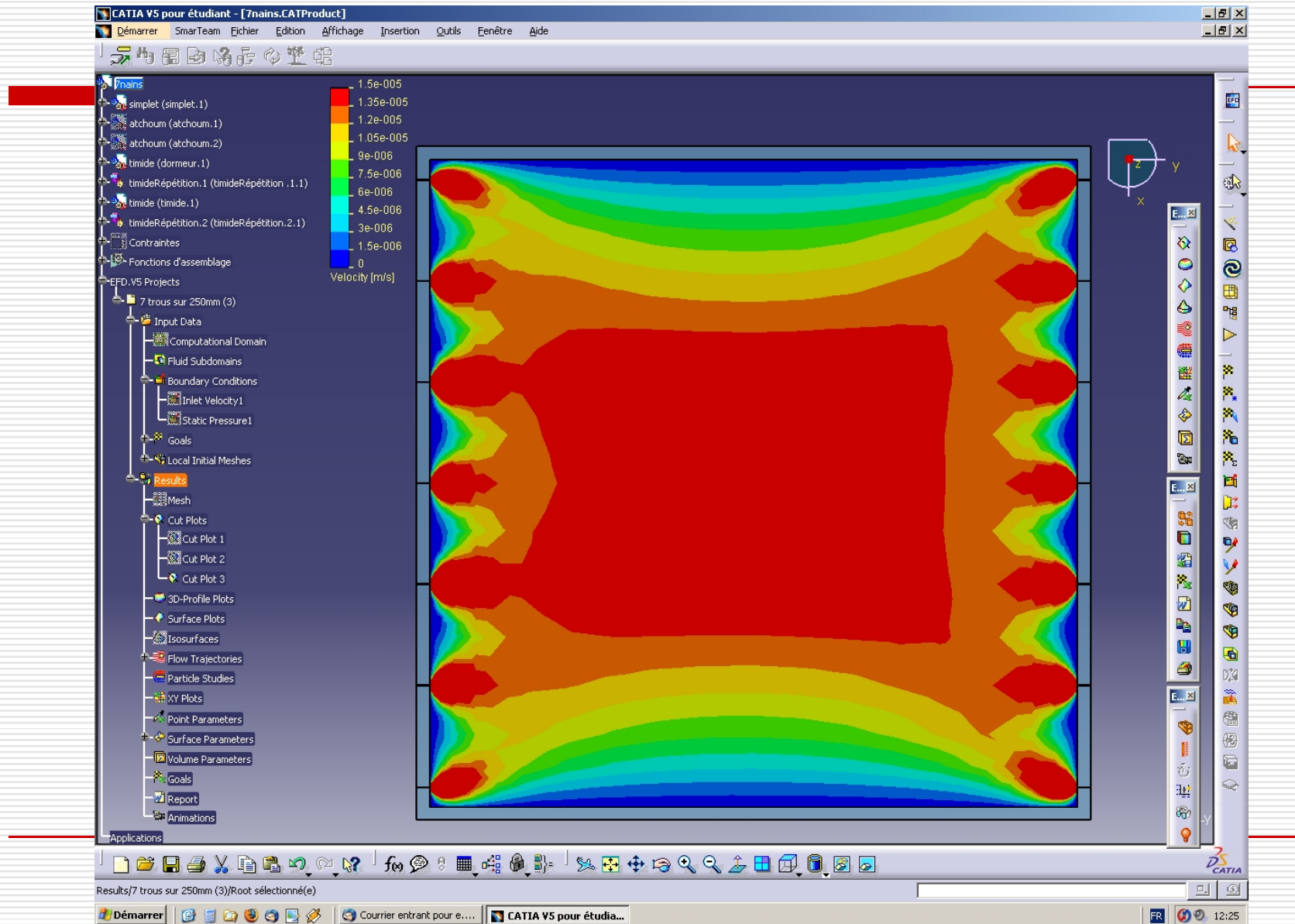


Largeur des piquages = $x / (\text{Nombre de piquages})$

Gas distribution, 'capillary' chambers



Simulation – gas circulation in capillary chamber



Resistive layer

□ Application:

- Statguard: paint roller
- Graphite / Licron: aerosol

□ Quality control:

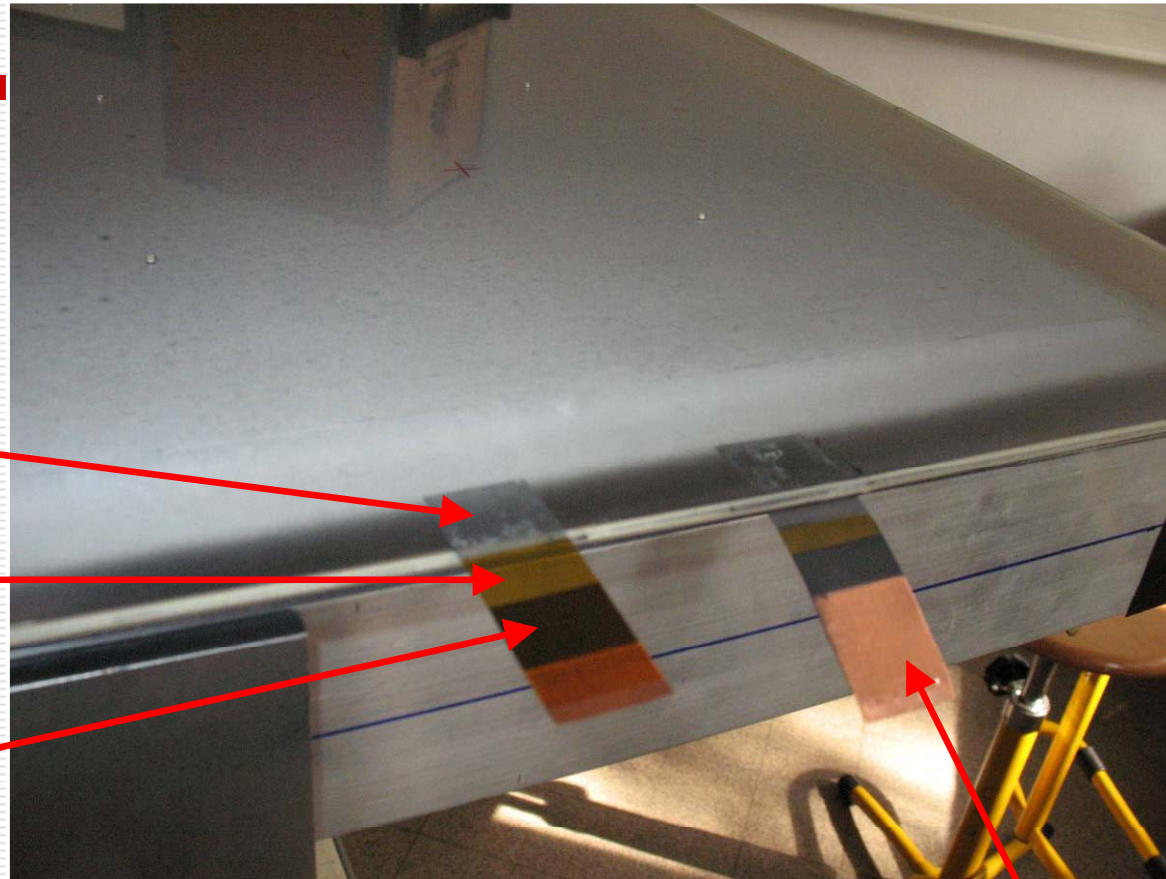
- Surface quality: visual inspection
 - Electrical continuity / voltage distribution
 - Homogeneity: measure ρ_s
-

Connections HV / ground

Standard Scotch
+ Licron

Kapton tape
(strengthenener)

Graphite layer



Try to remove copper from active area

Copper tape

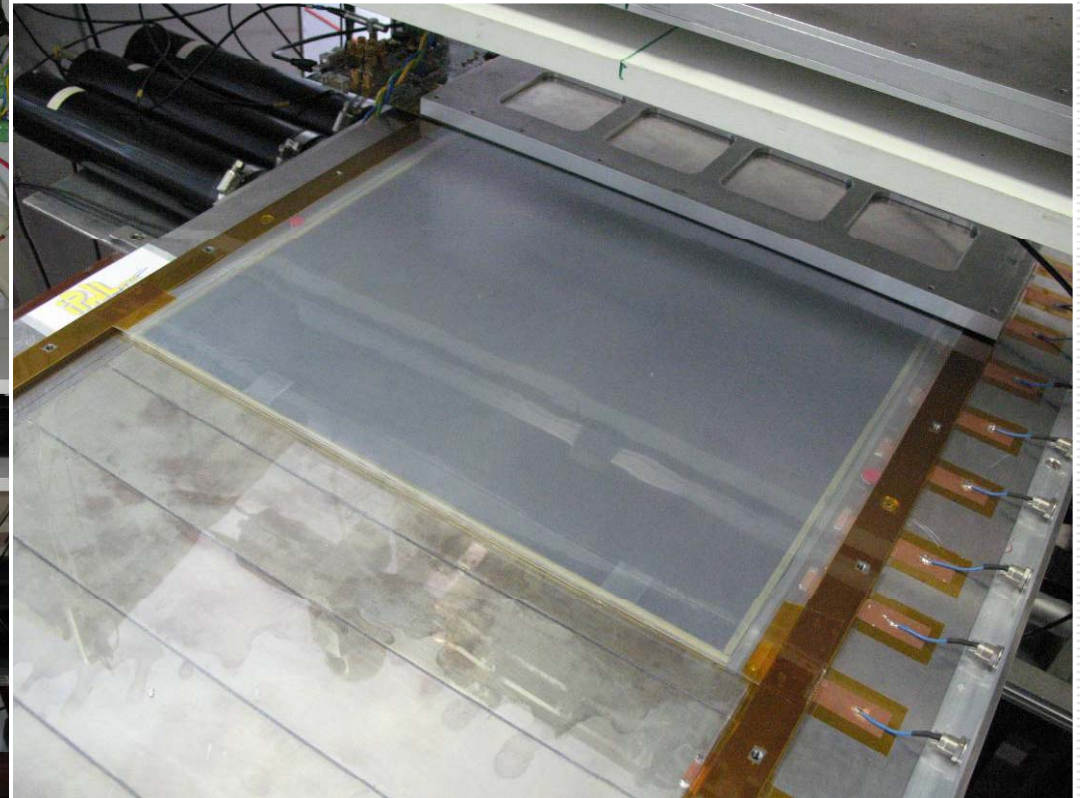
Constructed chambers

- Three chambers dimensions 345 x 85 mm
 - Sized to HARDROC PCB
 - 1 'standard' chamber + Licron
 - 1 'capillary' chamber + Licron
 - 1 'capillary' chamber + graphite
 - Later re-coated with Statguard
 - 1 chamber 345 x 500
 - 'Standard', Licron
 - 1 chamber 345 x 1000
 - 'Capillary' chamber, Licron
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Standard chamber, 345 x 85



Standard chamber 345 x 500



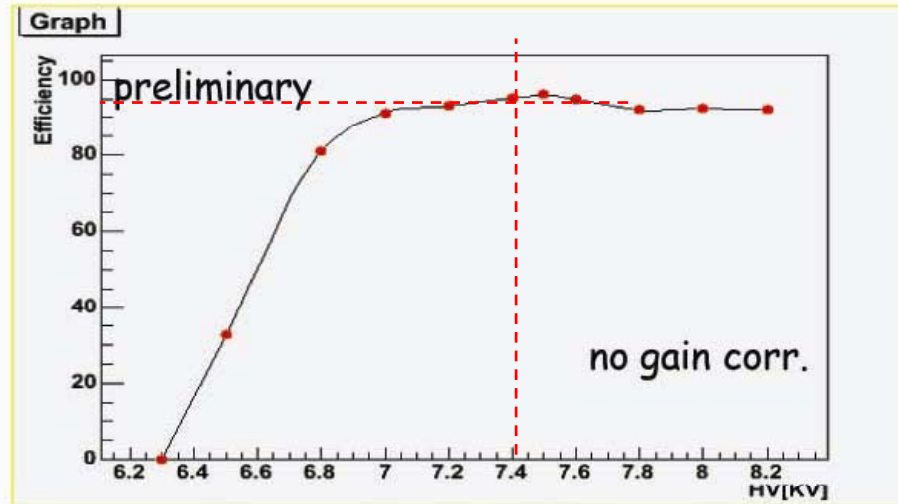
Capillary chamber 345 x 1000



345 x 85 mm
'Capillary', Licron

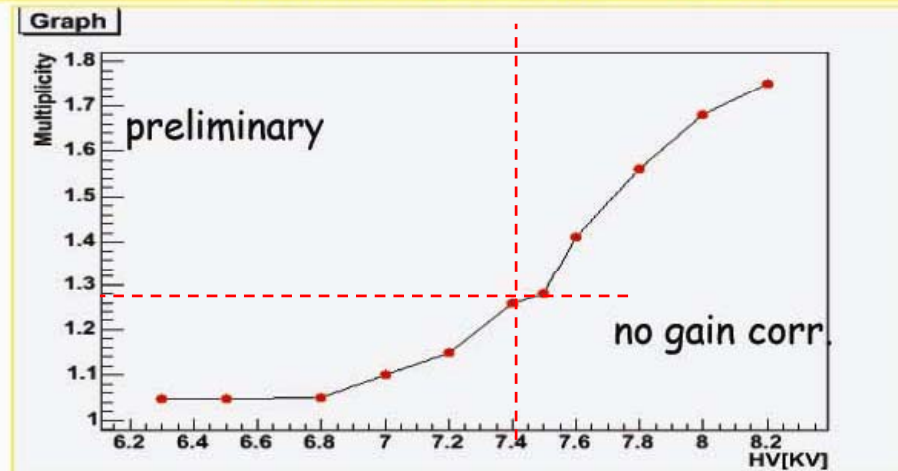
First results

GRPC-lyon
32X8 pads
licron



TFE 93%
Isobutene 5%
SF6 2%

Threshold= 190 DAQ.U \approx 100 fc



Rate performance
to be verified in
test beam

Large area chambers - difficulties

- ❑ 0.7mm glass – fragile!
 - ❑ Technique for cutting not immediately obvious
 - ❑ Gluing requires suitable assembly table
 - Horizontal rotation axis with locked positions
 - Gluing in vertical position
 - Drying in horizontal position
 - ❑ Dust accumulation on resistive layer during drying phase
 - Laminar flow cabinet
 - ❑ Thickness variations of resistive layer
-

1m2 chamber

- ❑ Glass manipulation with vacuum system
 - ❑ Same assembly table
 - ❑ Honeycomb support in design phase
 - Combine with assembly table to study angled tracks at SPS
 - ❑ No showstoppers identified for mechanical construction
 - ❑ Timescale (1m2 GRPC with partial readout): end September
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Test systems (Lyon lab.)

- Ex-CMS silicon telescope
 - 2 x XY (4 Si layers)
 - Small chambers only
 - Study efficiency / multiplicity at edges, near HV connection, etc.

 - Hodoscope
 - For 1m² with full readout
 - End 08
 - Partial readout in the meantime
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