Micromegas Bulk

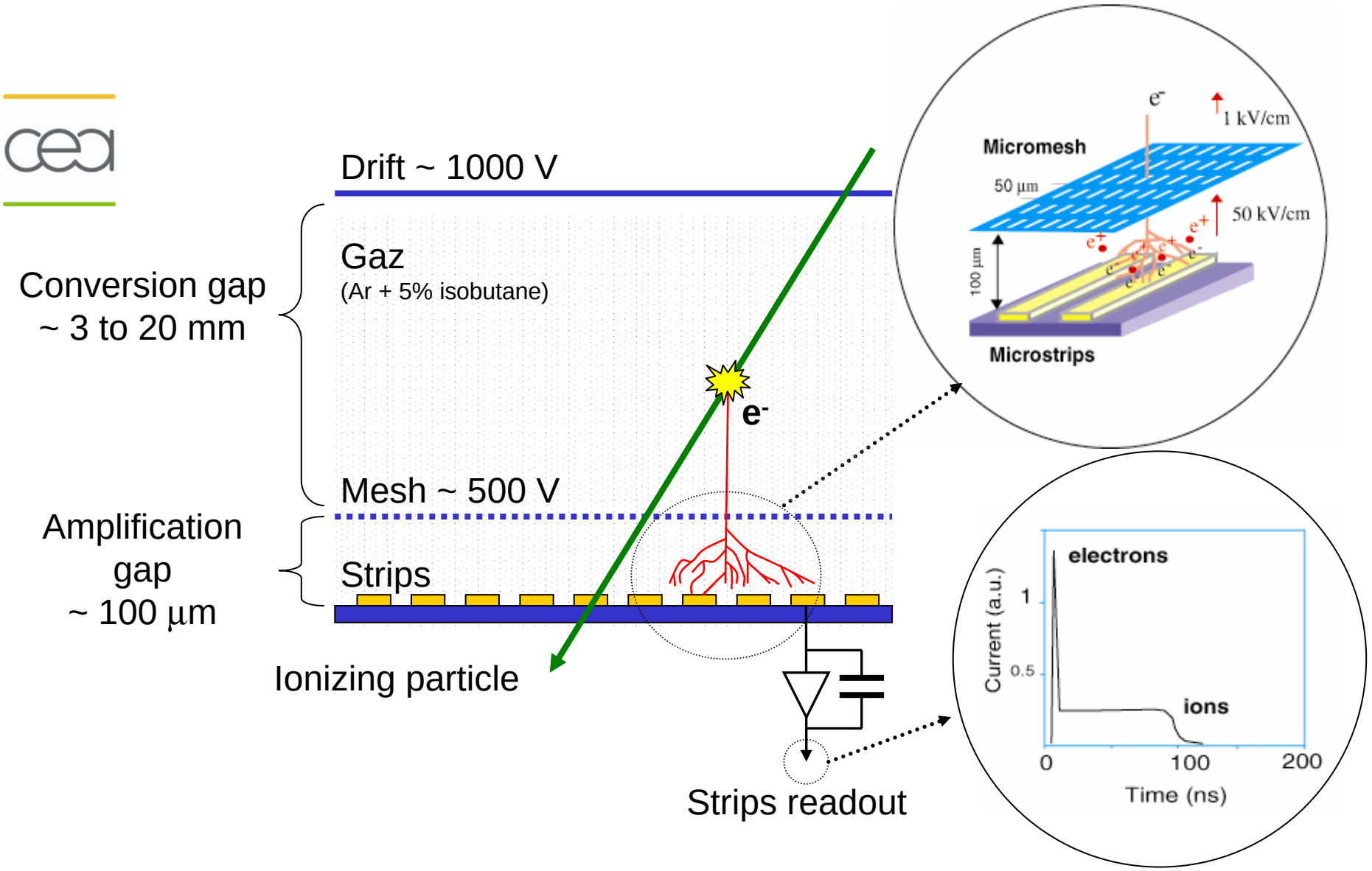
Results of a R&D

S. Aune[a], M. Boyer[a] , A. Delbart[a], R. De Oliveira[b], A. Giganon[a], Y. Giomataris[a]

[A] *CEA / DAPNIA, Centre d' Études de Saclay, Gif sur Yvette Cedex 91191, France*
[B] *CERN, CH-1211 Geneva 23, Switzerland*

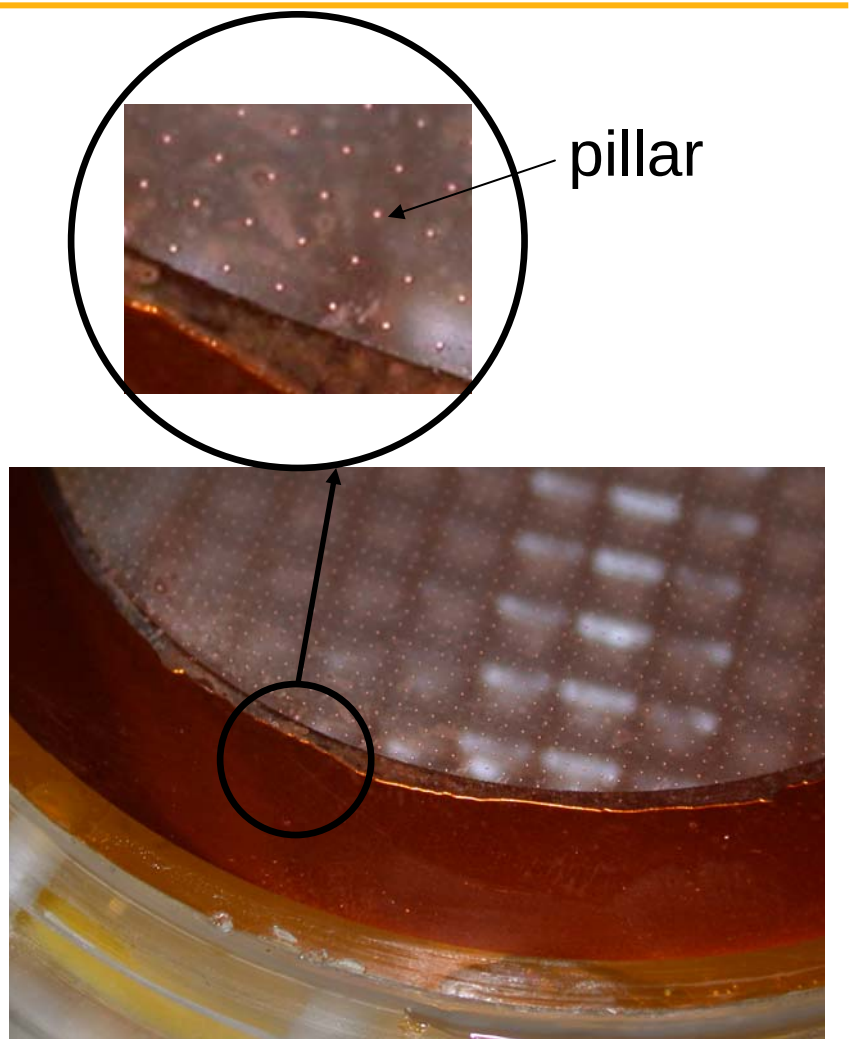
- Introduction
- Bulk fabrication
- Results
- Conclusion

Micromegas principle



Micromegas mesh assembly

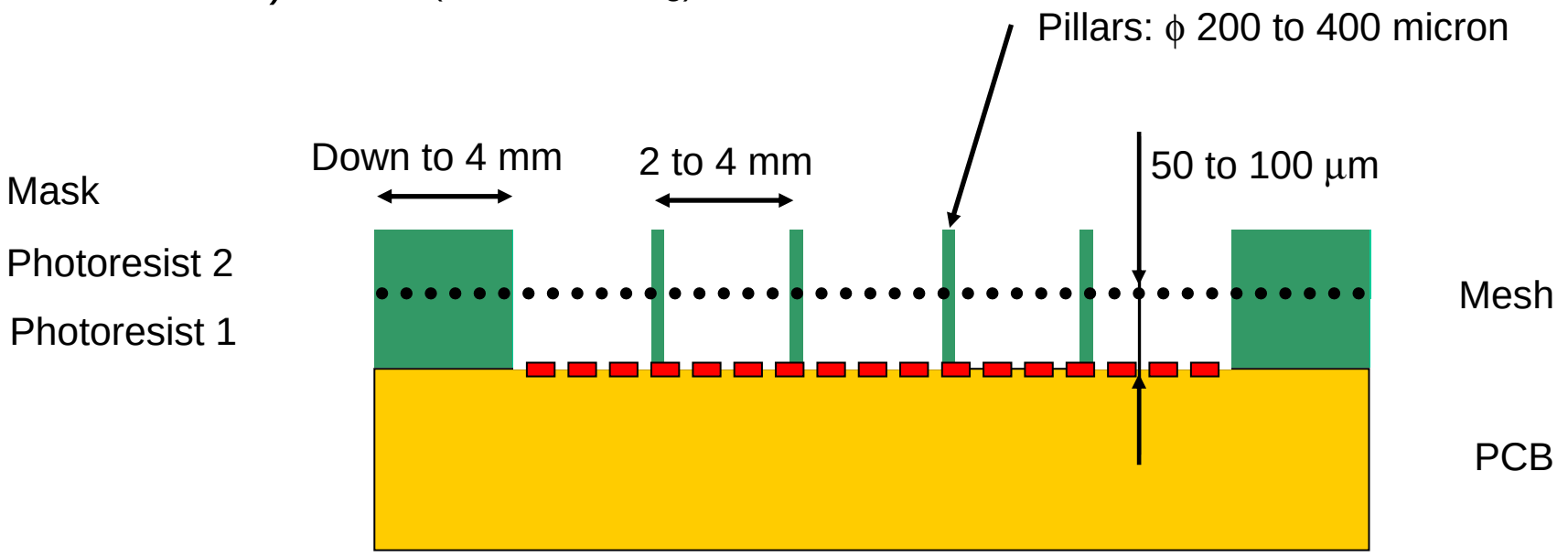
- Micromegas is used in several detectors (COMPASS, CAST, KABES, …) with a mesh mounted on a **frame**.
- To obtain the amplification gap **pillars** are mounted either on the PCB or the mesh.
- The pillars are generally made of Kapton or photoresist (Solder Mask).
- The **tricky** thing is to mount correctly the mesh frame on the PCB.



CAST mesh frame: “ploté”

Bulk fabrication concept

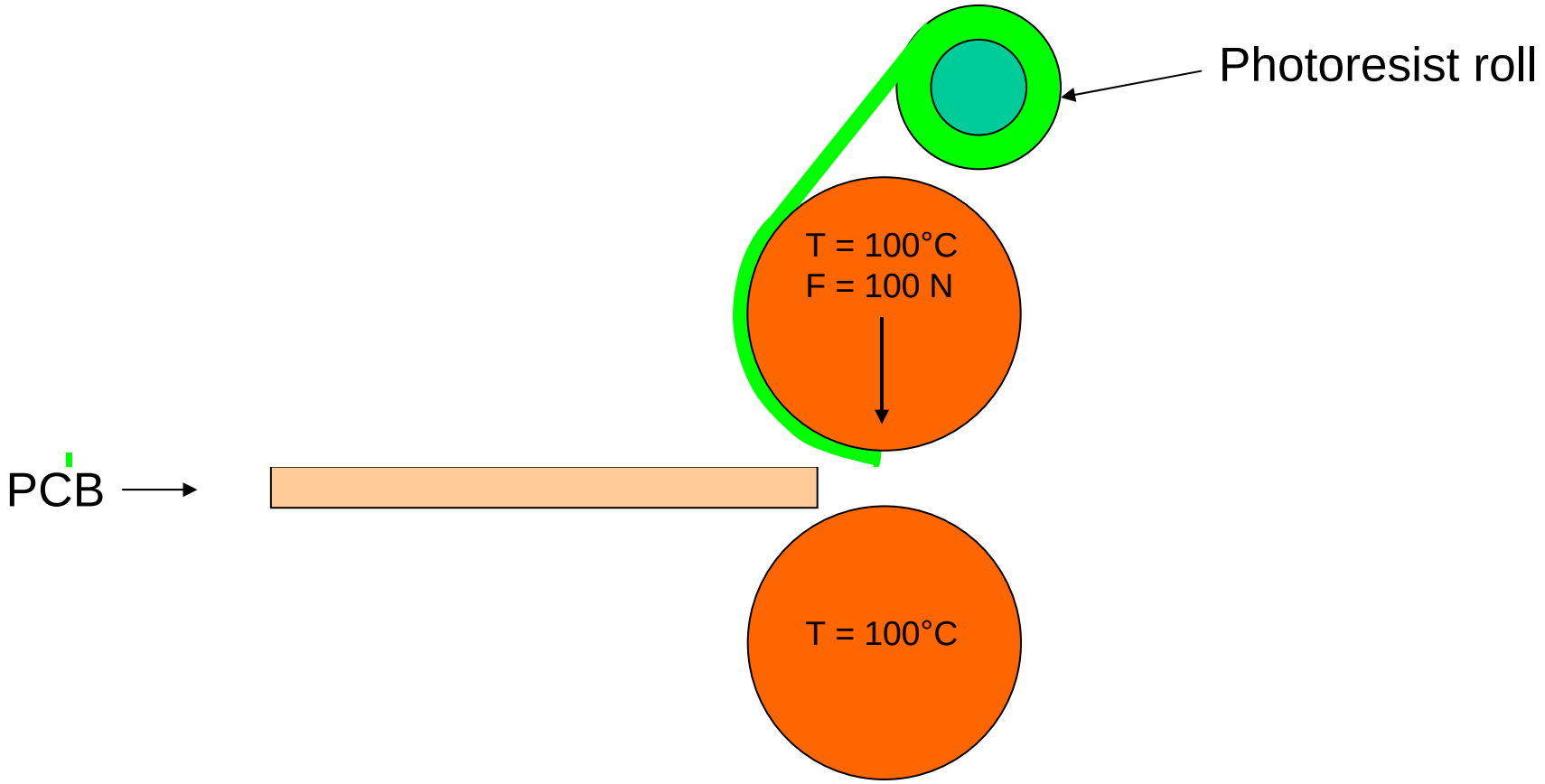
1) PCB cleaned (strips, pixels,…)
2) Photoresist lamination (50 to 100 micron)
3) Mesh laid down (19 micron weave stainless steel, 500 LPI)
4) Photoresist lamination (50 to 100 micron)
5) UV insulation trough a mask
6) Development (Sodium carbonate solution)
7) Cure (UV and backing)



Lamination, first layer

Goal: a **sandwich** with a **mesh** between **photoresist** on a **PCB**

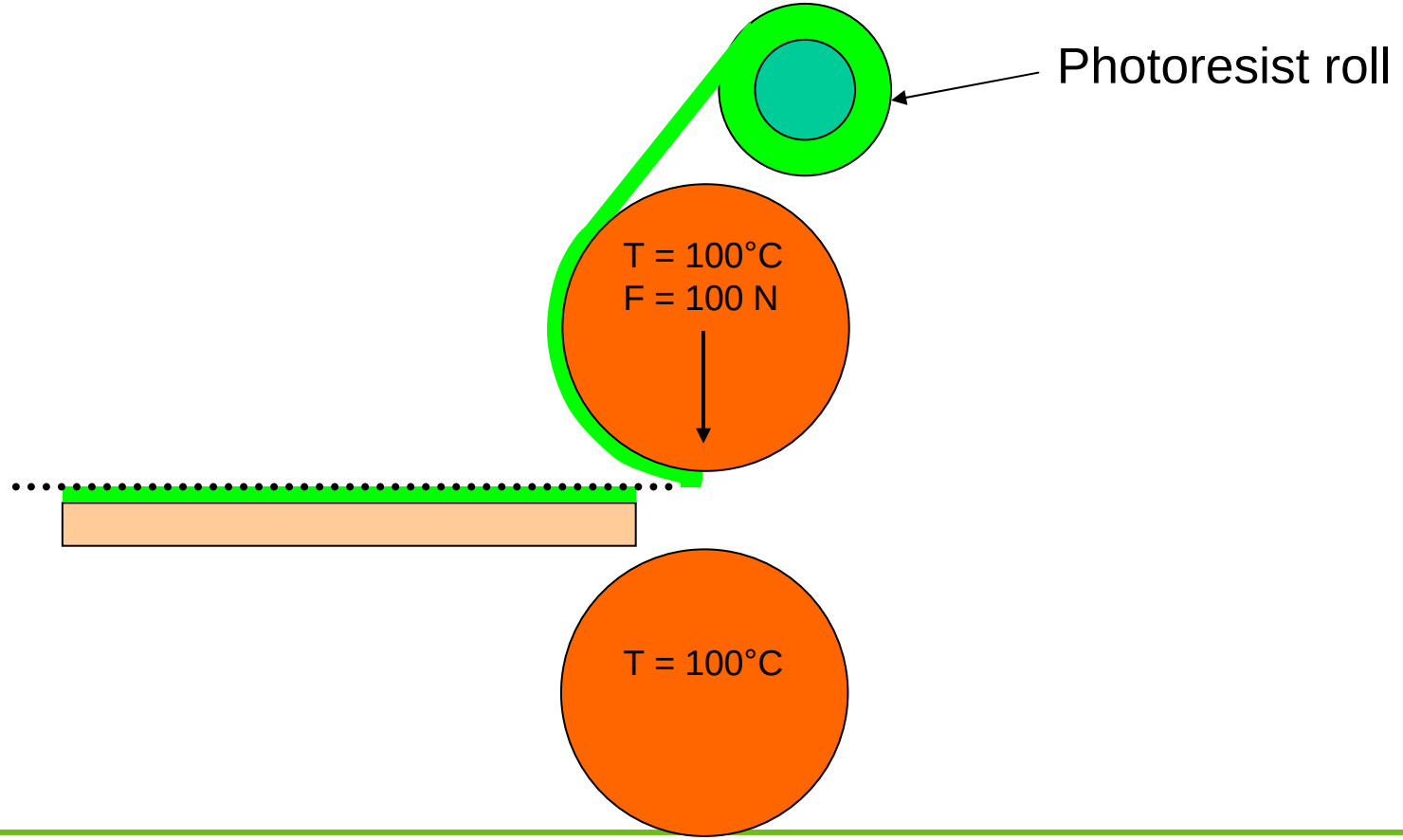
1. Laminate the 1st layer of photoresist on the PCB.



Lamination, second layer

Goal: a **sandwich** with a **mesh** between **photoresist** on a **PCB**

1. Laminate the 1st layer of photoresist on the PCB.
2. deposit of the mesh. (with a transfer frame)
3. Laminate the 2nd layer of photoresist the mesh

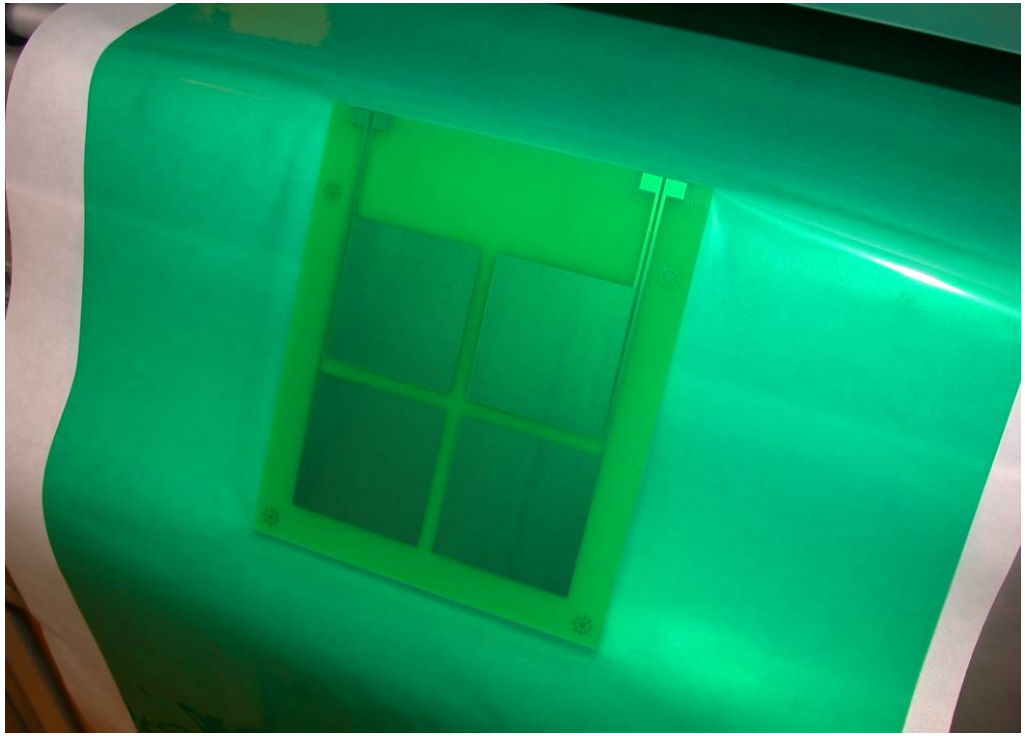


Lamination, pictures

Goal: a **sandwich** with a **mesh** between **photoresist** on a **PCB**

1. Laminate the 1st layer of photoresist on the PCB.
2. deposit of the mesh. (with a transfer frame)
3. Laminate the 2nd layer of photoresist the mesh

laminator

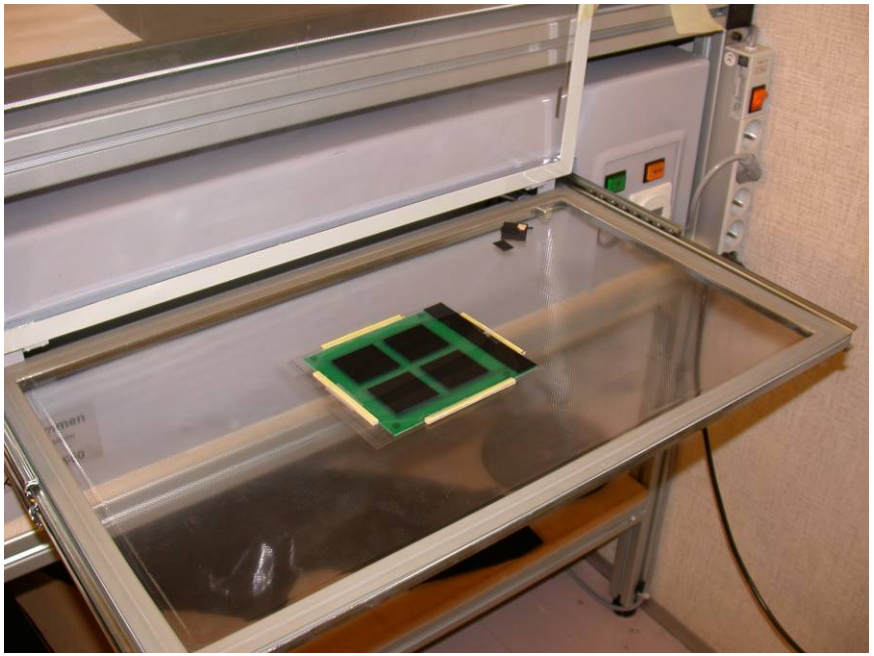


1st layer output

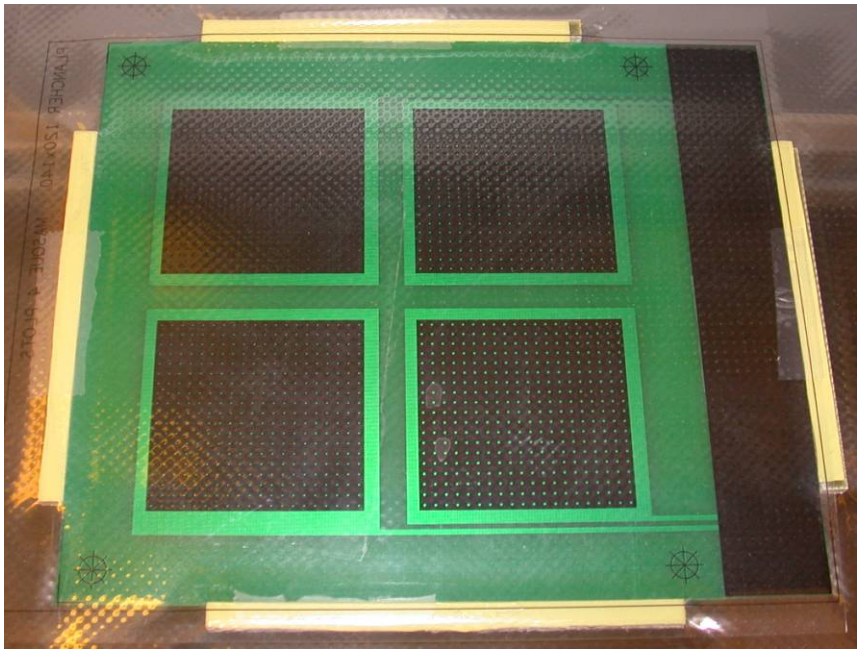
Insulation

Goal: **polymerization** of the photoresist with the **pattern**

- done in a insulator with UV through a mask (border, pillars, …)
  (Vacrel data: λ = 350 to 450 nm, 0.2 J/cm^2 on 30 s)
- lack of power: Insulation between lamination: good idea !



Insulator unit

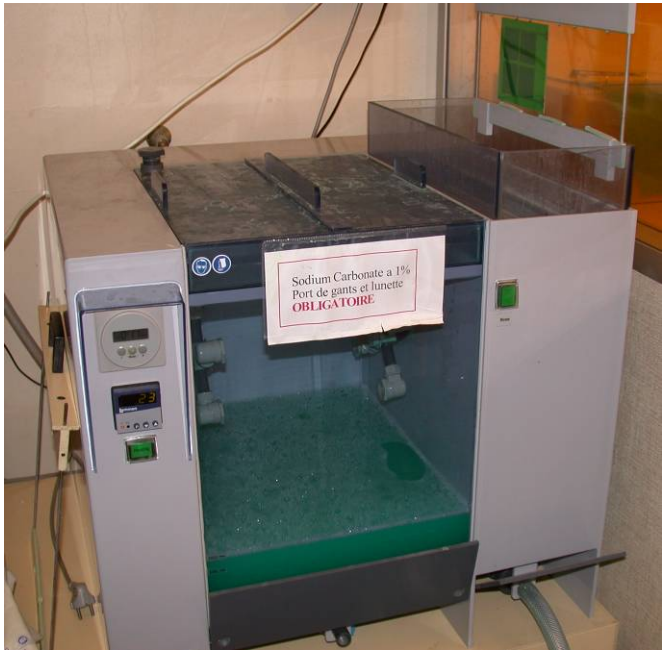


Photoresist sandwich with mask

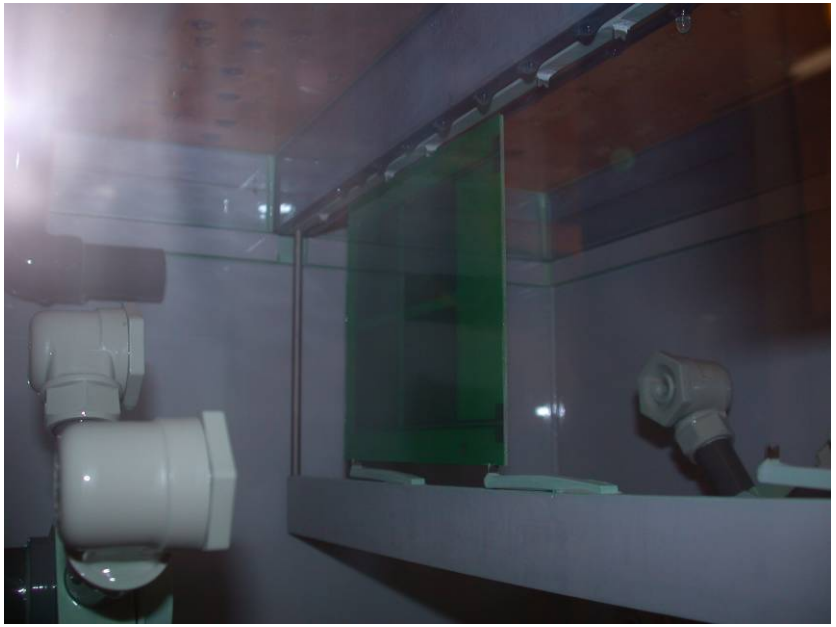
Development and cure

Goal: **remove** the none-polymerized photoresist

- done in a developer filled with 1 % Sodium carbonate
  (T = 40 °C, solution applied by jet)
- Cure: complete the polymerization
  (Oven baking: 1 hour at 150 °C, UV cure: 5 J/cm2)



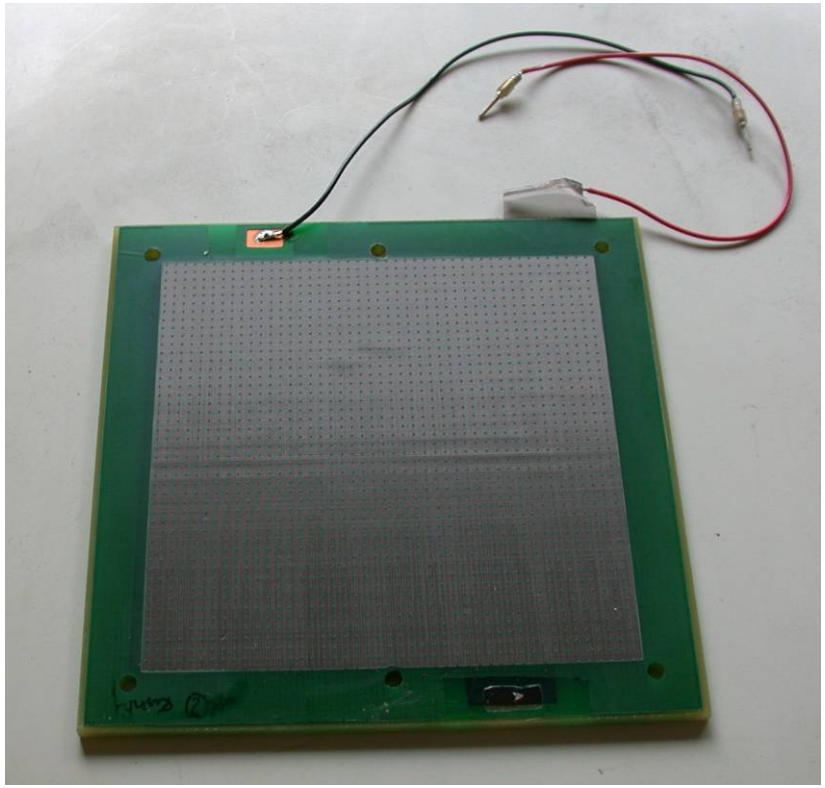
Developer unit

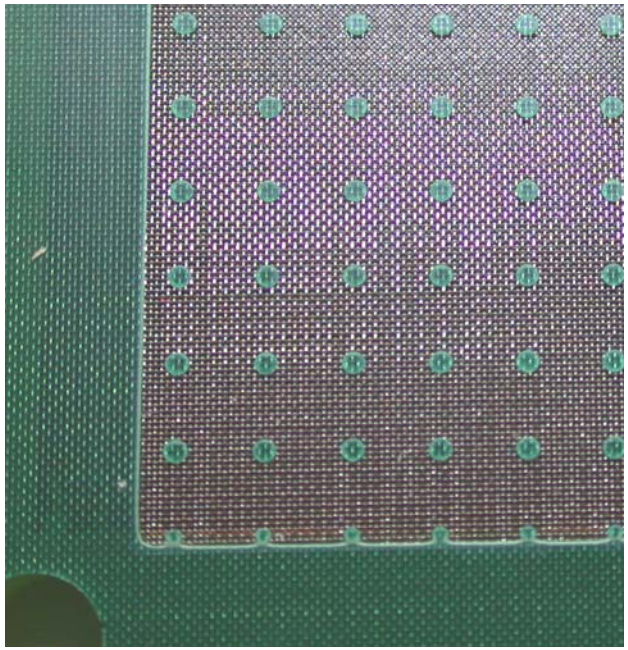


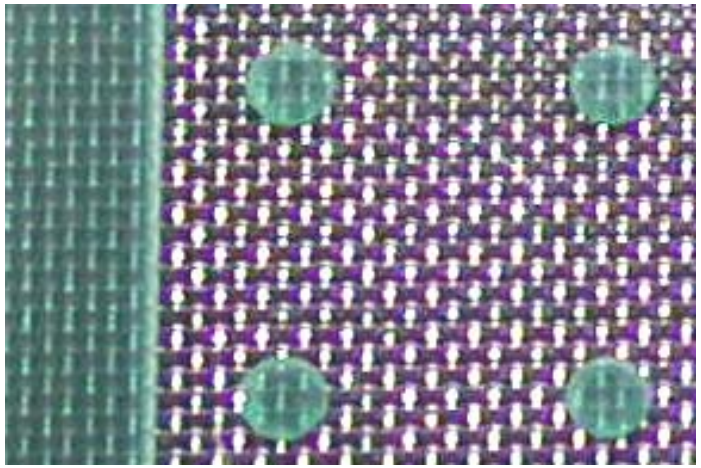
PCB sandwich inside

Results, picture

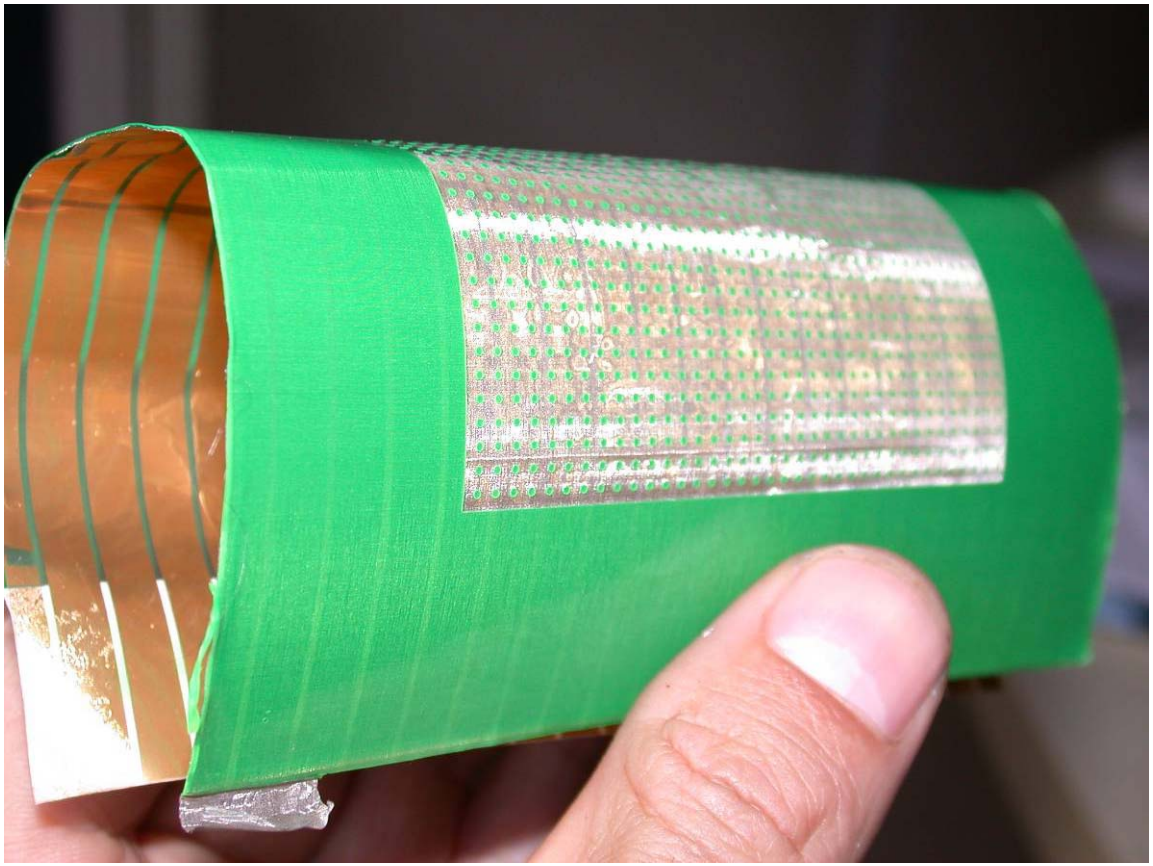
Bulk with central anode, equipped with a resistive layer







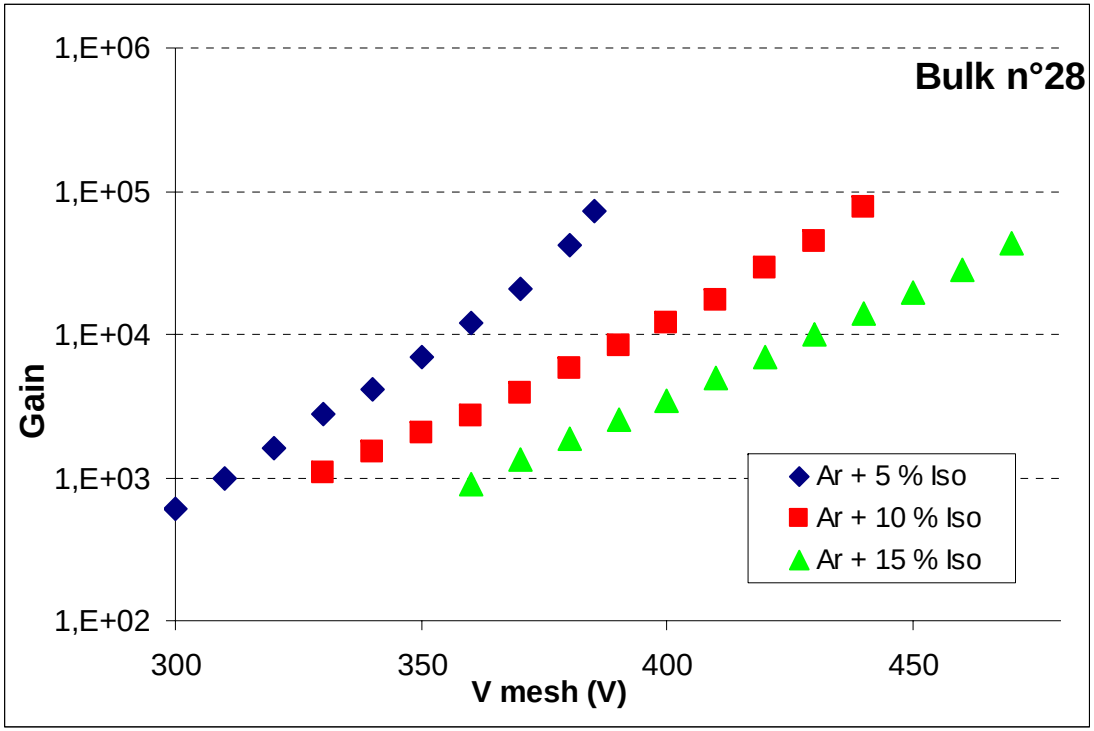
Results, bulk on striped Mylar



10 x 10 cm^2 flexible bulk with steel mesh on 30 micron thick Mylar. Not tested under gas, but infinite resistance between strips and mesh even when bended.

Results, detector gain

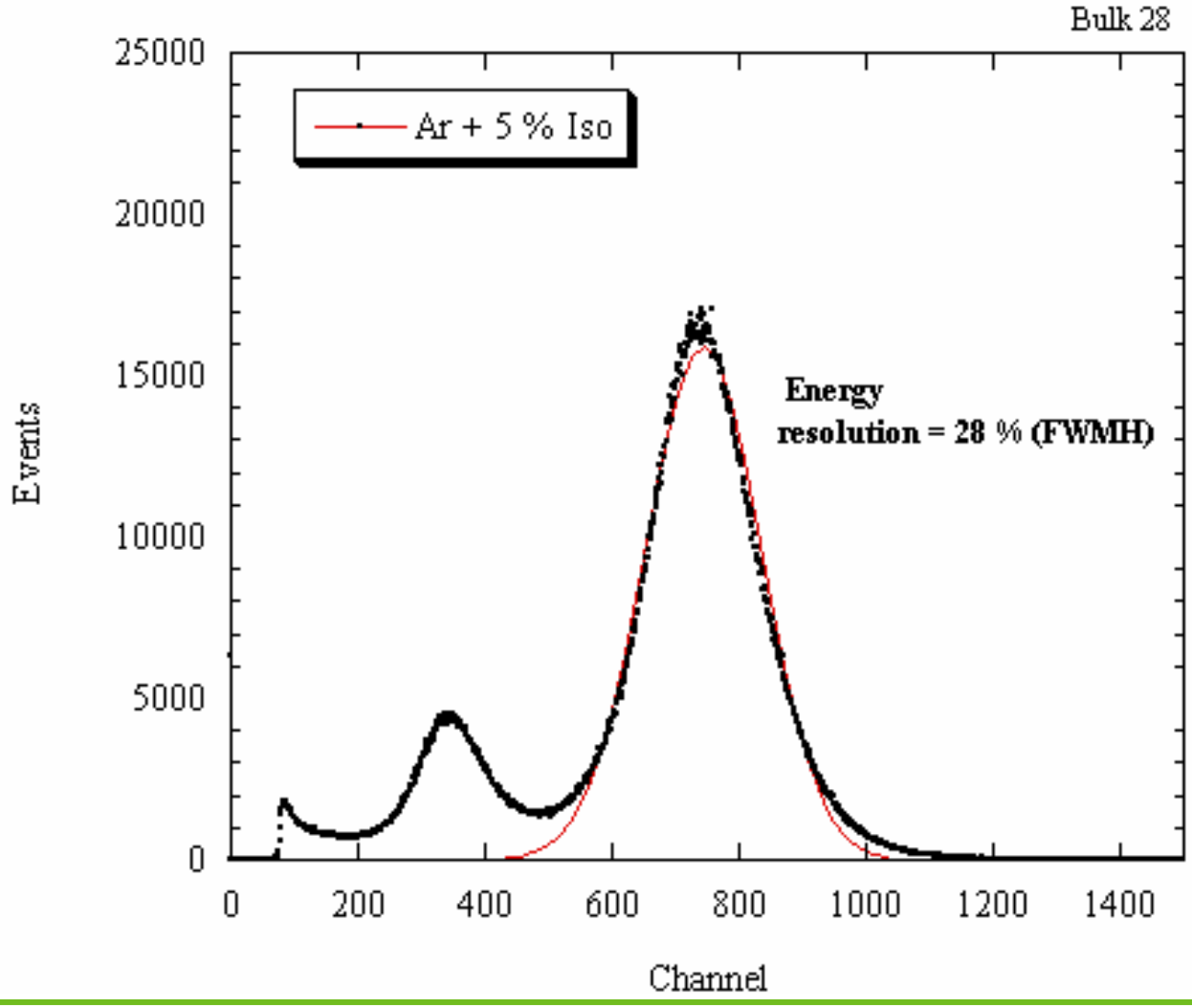
Bulk n°28. 10 x 10 cm2, unique central anode equipped with 19 micron woven steel mesh.



le 07/04/05
bulk S28 mesh inox ép: 19 microns (tissée)
V drift:500V
gap mesh anode:100 microns
gap drift mesh: 7mm
pre-ampli: ORTEC 142B(blindé n°460)
Ampli ORTEC 472A
Coarse gain: mini (5)
Fine gain: mini (0,5)
Shaping time: 1 microns secondes
B de F:10mV
input: positive
output:bipolar
source: 55 Fe **20276**
gaz: Ar+15% C4H10
mesh sans plots sup. (bordure Vacrel)
diamètre plots 100 microns

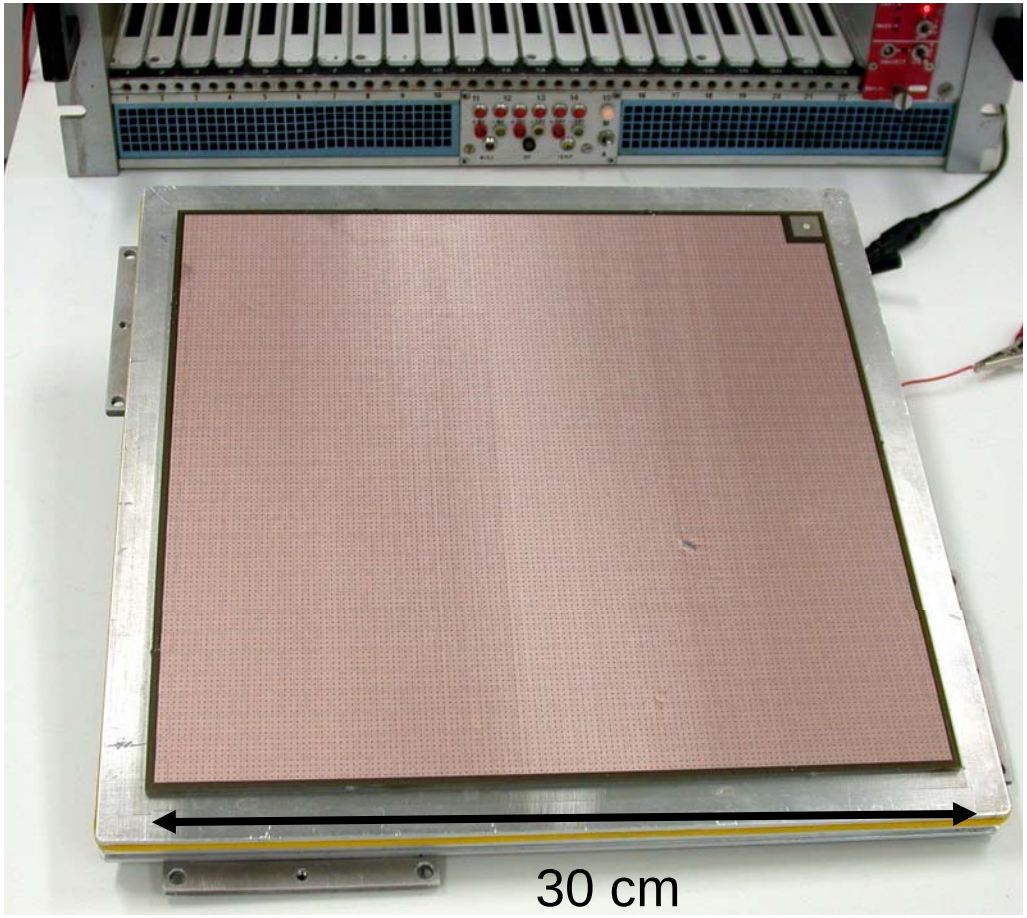
Result energy resolution

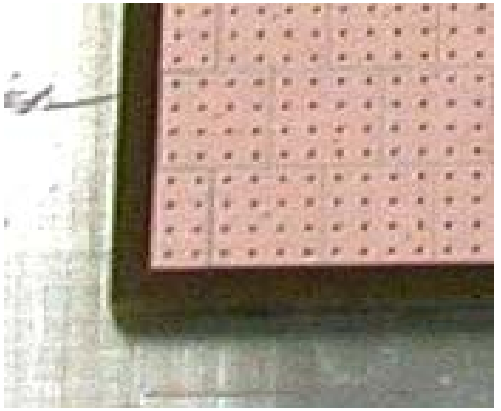
Bulk n°28. 10 x 10 cm2, unique central anode equipped with 19 micron woven steel mesh. (same parameter than for gain curve)

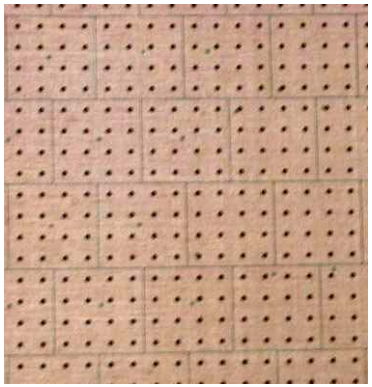


Result T2K

T2K: competition between GEM and micromegas

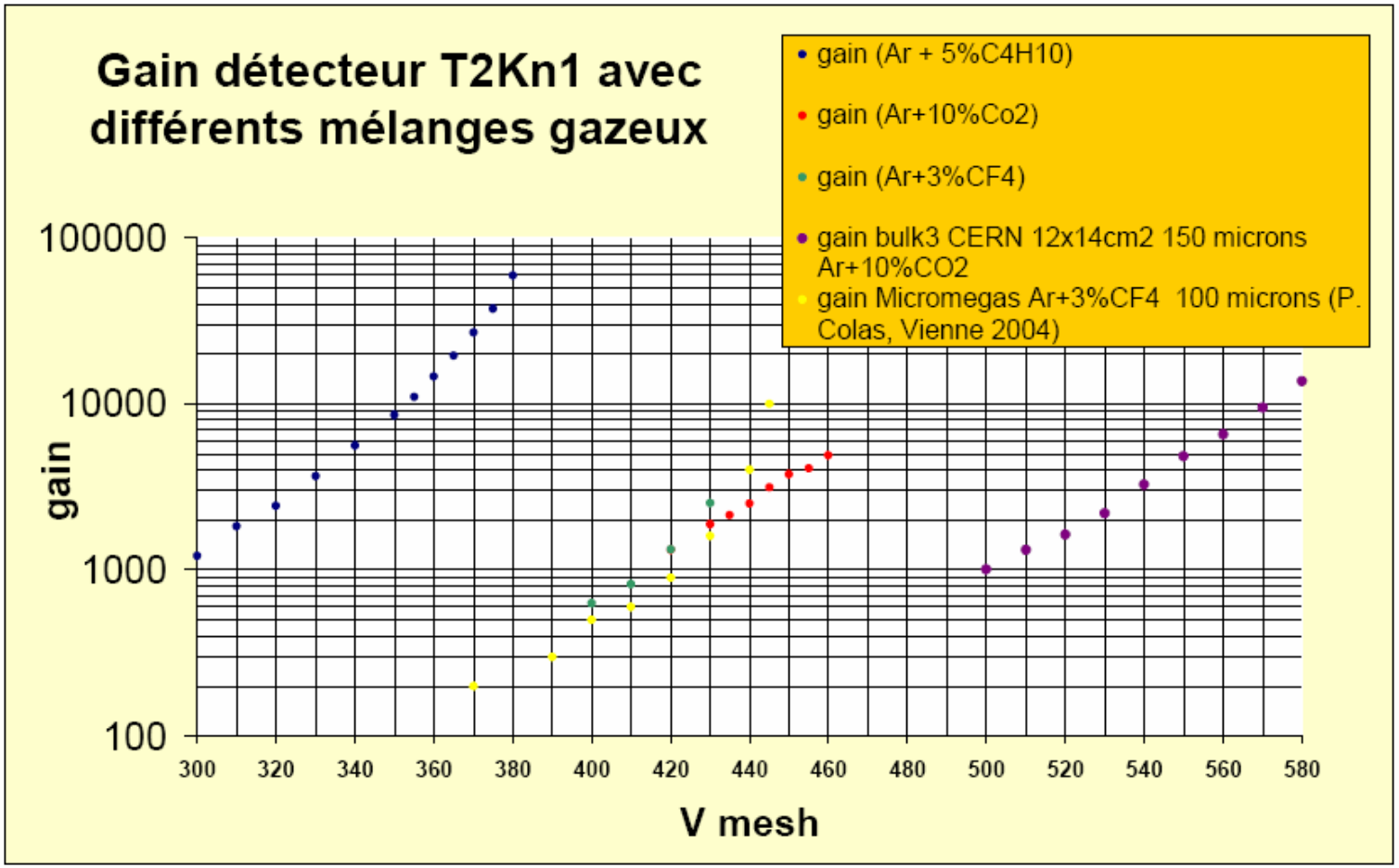




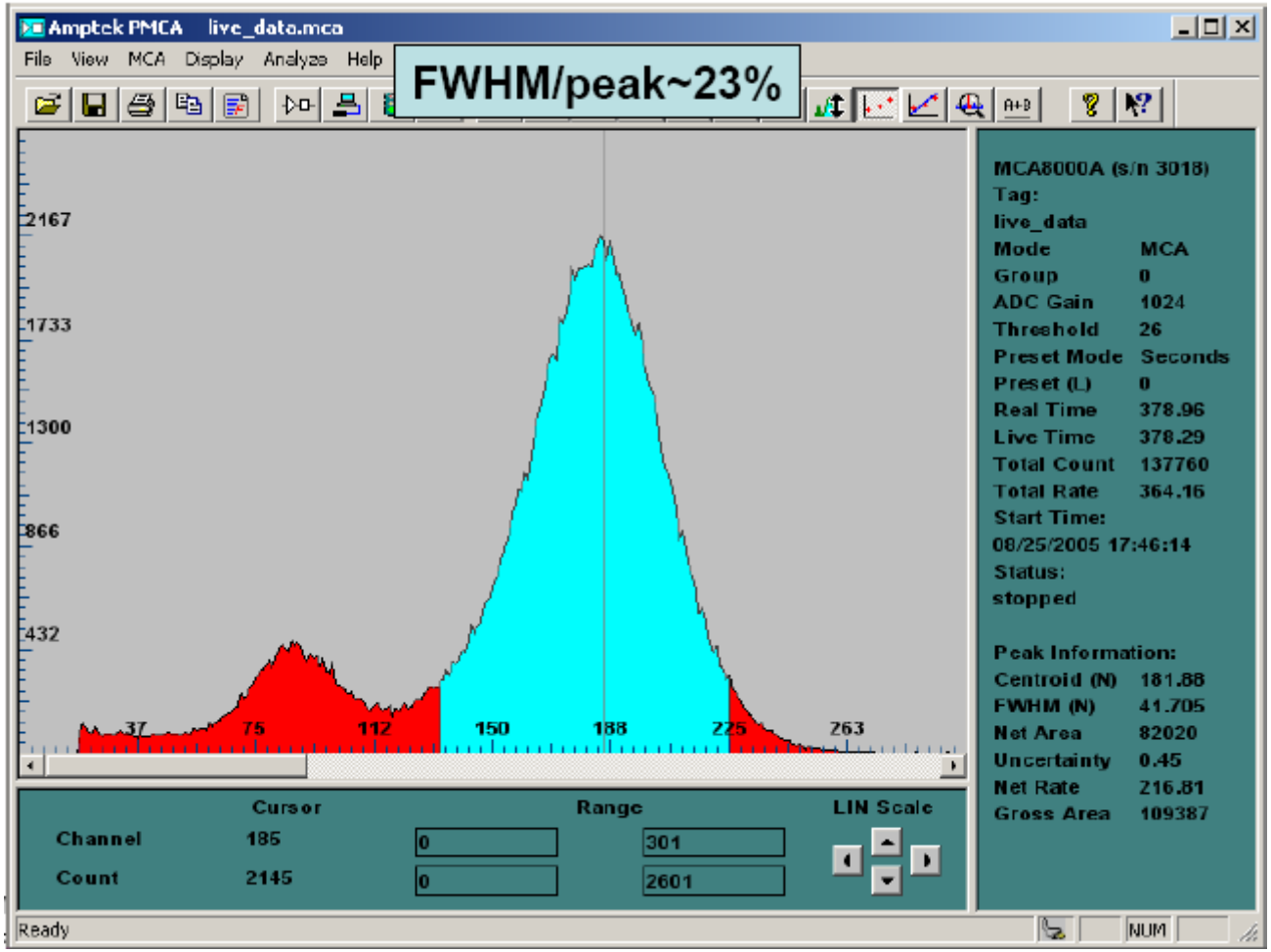


Prototype T2k#1 (made at CERN)

Result T2K, gain



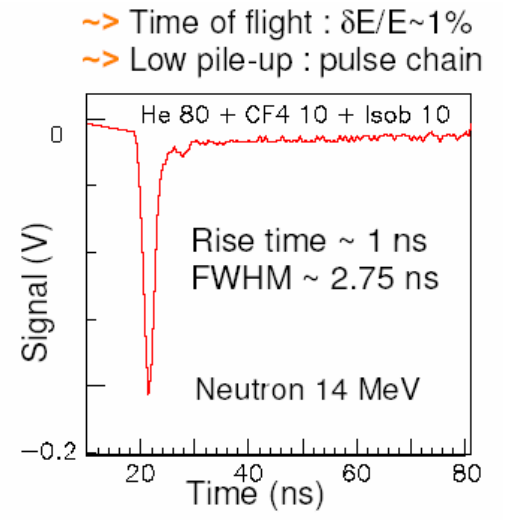
Result T2K, energy resolution



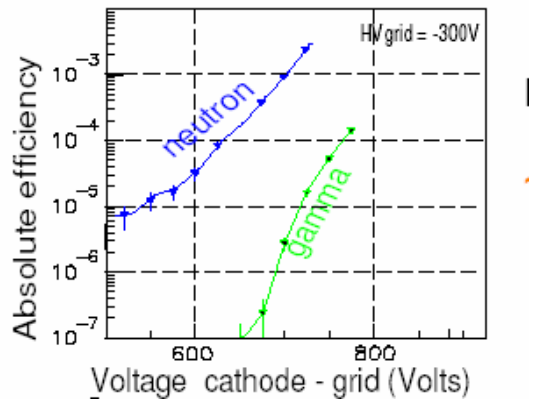
Result, DEMIN

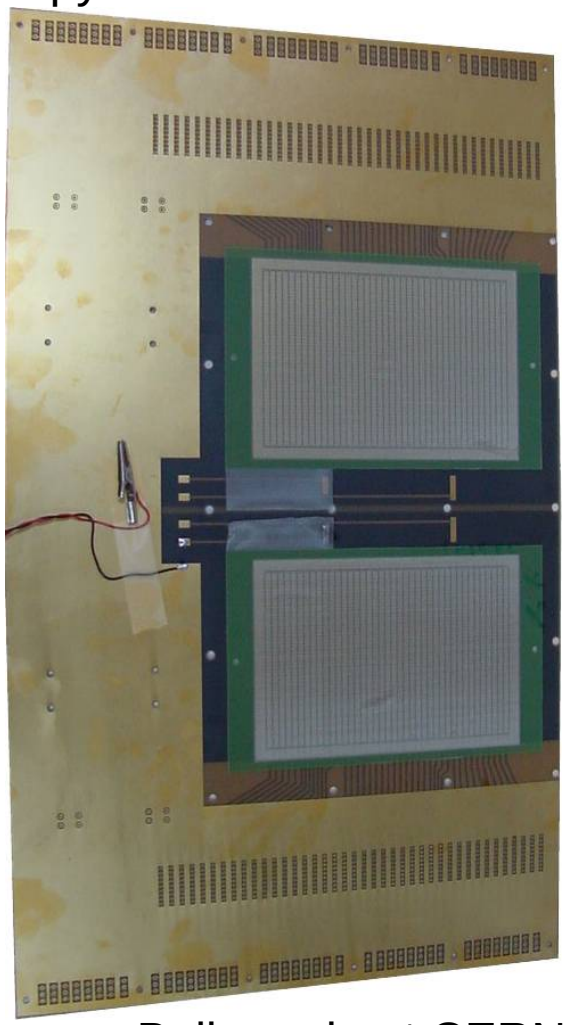
Micromegas neutron detector with 2 mm polypropylene converter

Pulse shape



n / γ discrimination

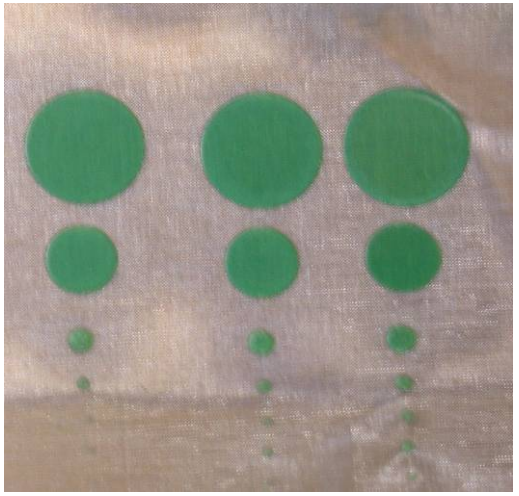




Bulk made at CERN

Bulk Upgrade application

- Mesh
  - Use of thinner mesh (5 mm Cu) not woven
- Photoresist
  - Try other photoresist (liquid ?)
- Insulation
  - Use of a laser for polymerization
- Integrate resistive layer on top of the anode
- Mesh splitting (mechanical : 50 μm, laser: 10 μm)
  - Less spark energy
  - Mesh readout
- I have a Dream…
  - Bulk with drift integrated
  - Flexible bulk with drift and gas



Laser shoot