

MICROME GAS Development for the European DHCAL

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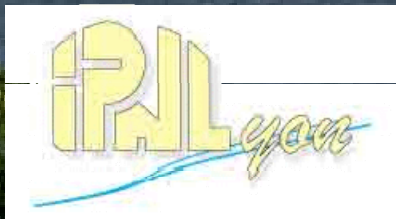
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Inocencio Monteiro

Fabrice Peltier

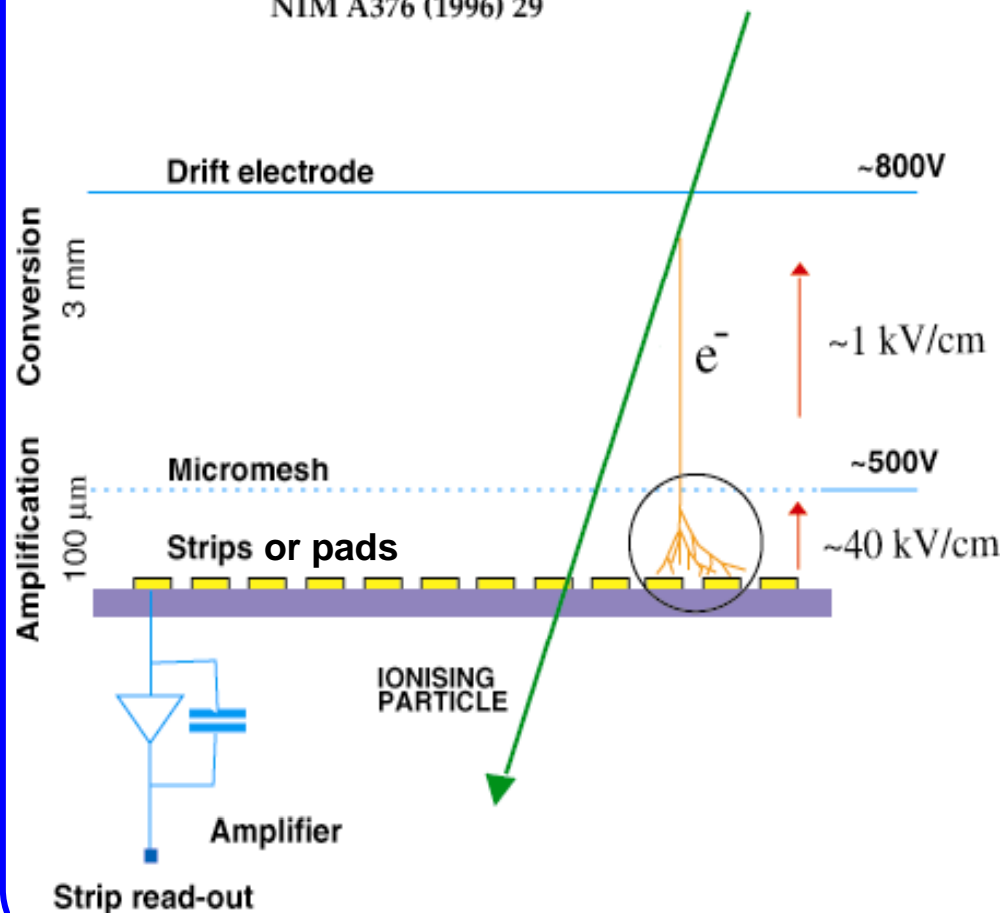
Julie Prast

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Micro mesh gaseous structure

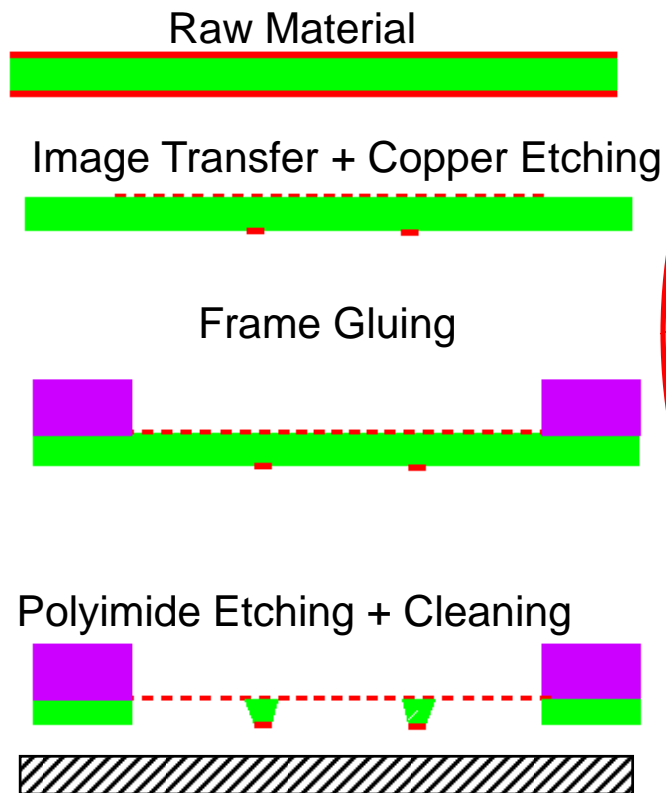
Y.Giomataris, Ph. Rebourgeard, J.P Robert and G. Charpak
NIM A376 (1996) 29



➤ Already heavily used

- COMPASS
- NA48 charged kaon upstream spectrometer
- high rate neutron beam profiler of the n-TOF facility at CERN
- CAST
- MEDICAL APPLICATIONS
- Neutron imaging
- T2K TPC
- ...

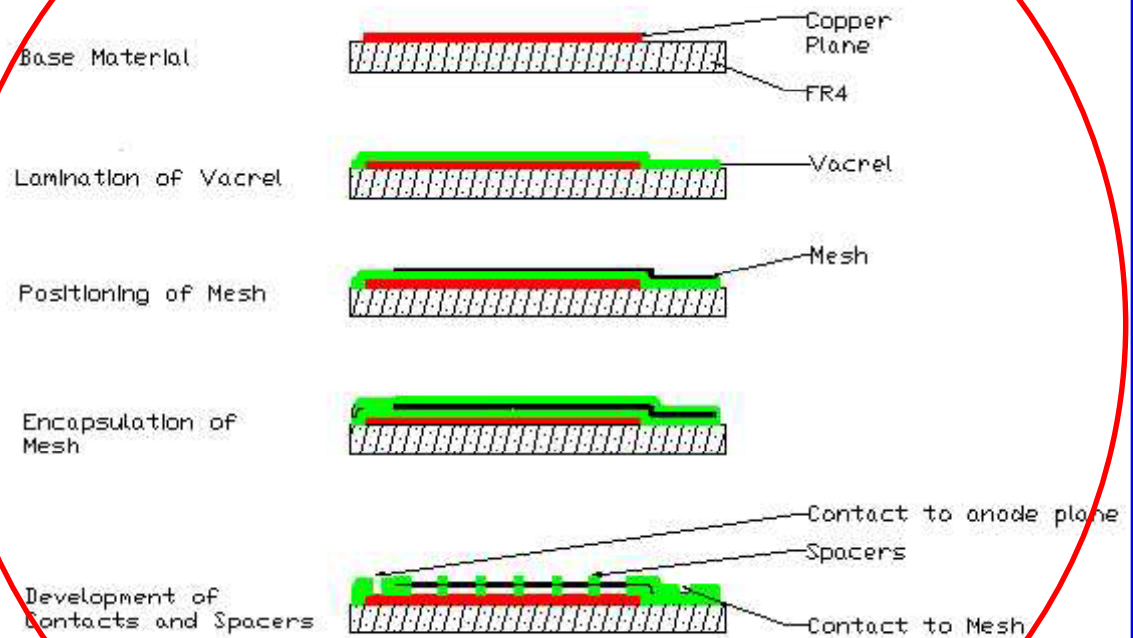
➤ Standard mesh



EST-DEM
R. De Oliveira

➤ Bulk

robustness, large area, uniformity, industrial process...

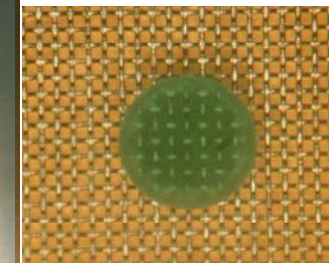


mesh+PCB interdependent

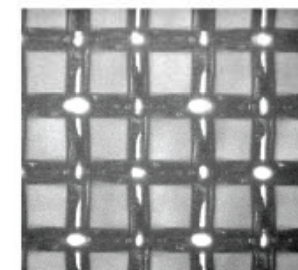
our choice

The First Prototypes

- 96 pads : $0.98 \times 0.98 \text{ cm}^2$, $200 \mu\text{m}$ between pads
- PCB and bulk from CERN *Rui de Oliveira*
 - 325 LPI mesh
 - spacers : $120 \mu\text{m}$ height
 $300 \mu\text{m}$ diameter

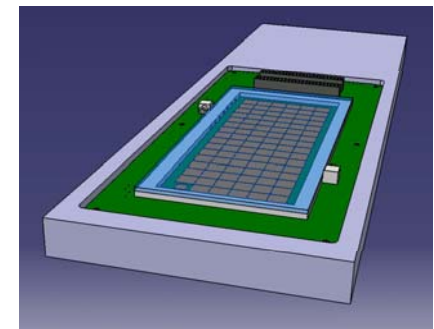
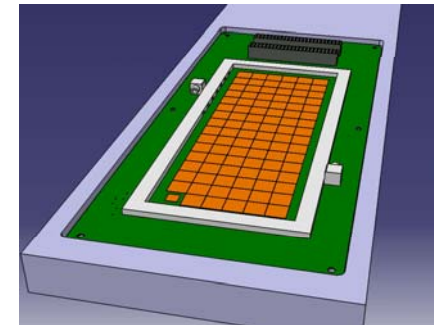
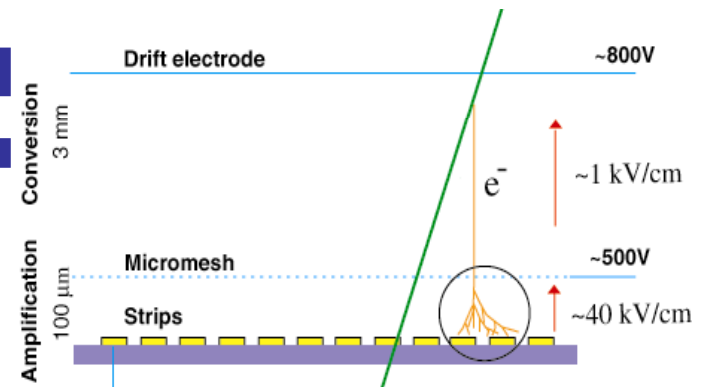
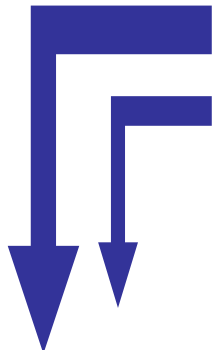


80 μm



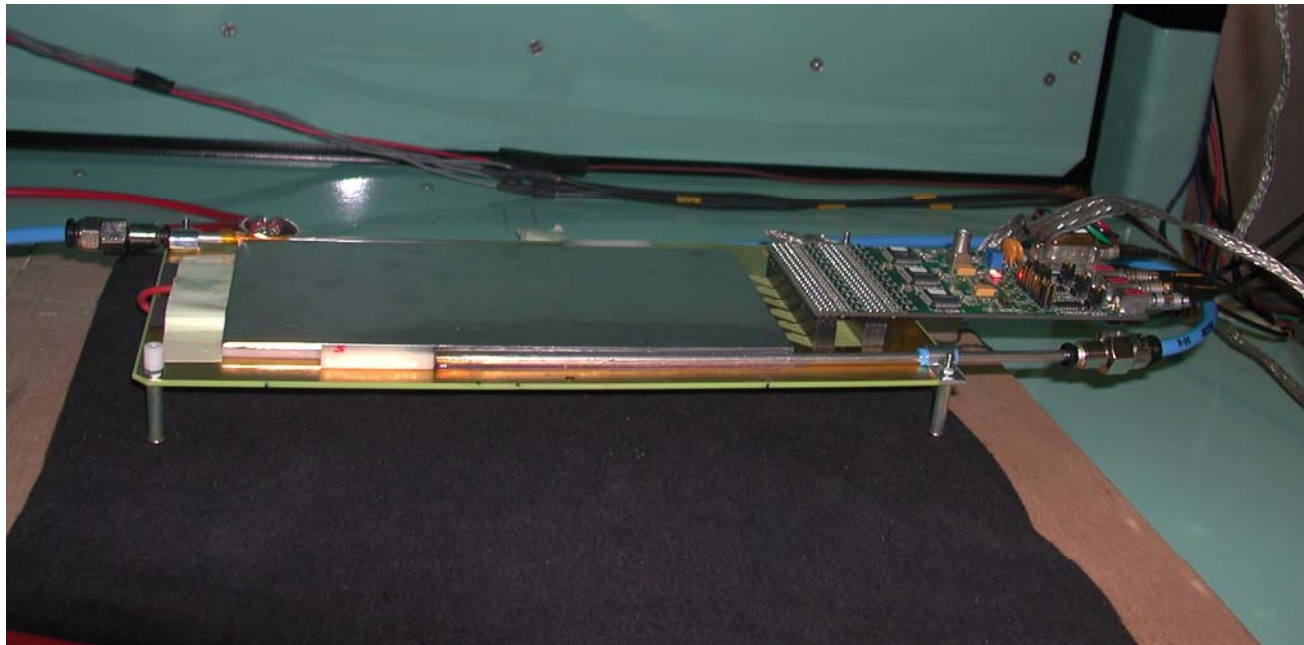
The First Prototypes

- a frame for
 - the conversion volume (3mm)
 - the gas supply
- a top in Stainless Steel
 - with the cathode drift electrode
17μm copper + 25μm Kapton
+ 25μm epoxy glue (Rui de Oliveira)

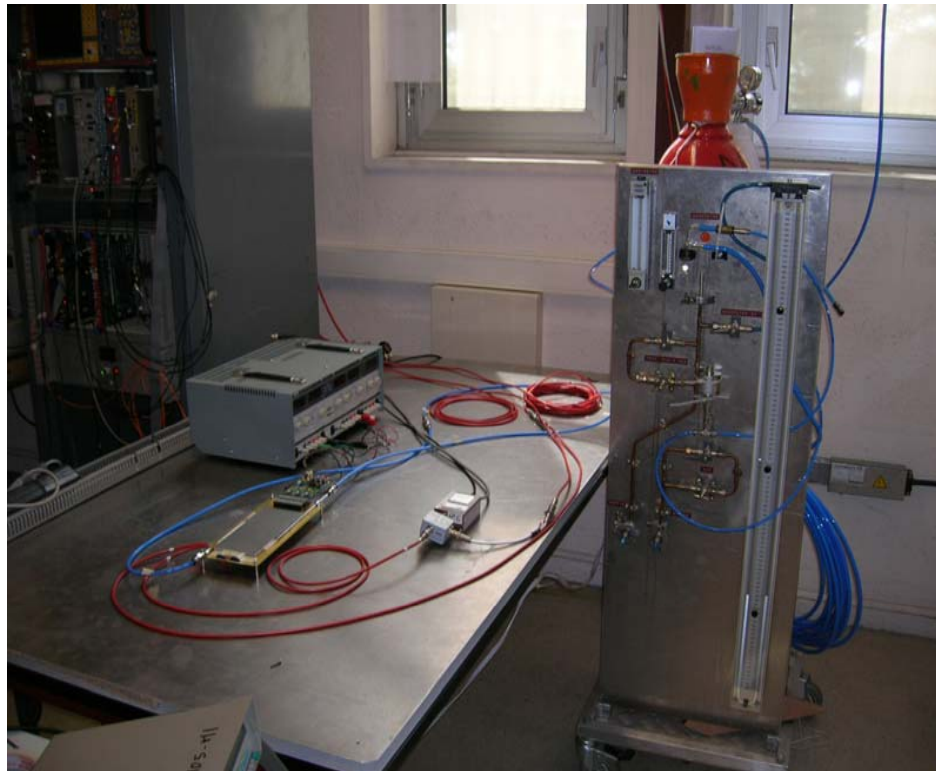


The Chamber readout

- Gassiplex card : 6 gassiplex chips -96 channels
Electronics card built for CAST by DAPNIA
(P. Colas, Philippe Abbon)
- VME sequencer and ADC from CAEN
- CENTAURE acquisition
(SUBATECH, Nantes, D.Roy)

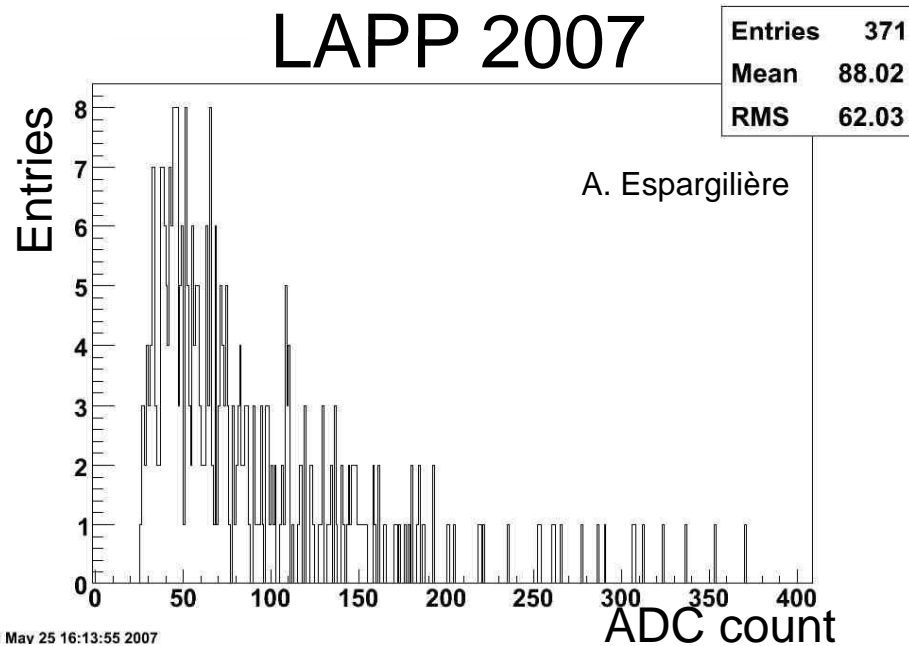


- Gas system based on salvaged materials premixed 95% Argon 5% Isobutane

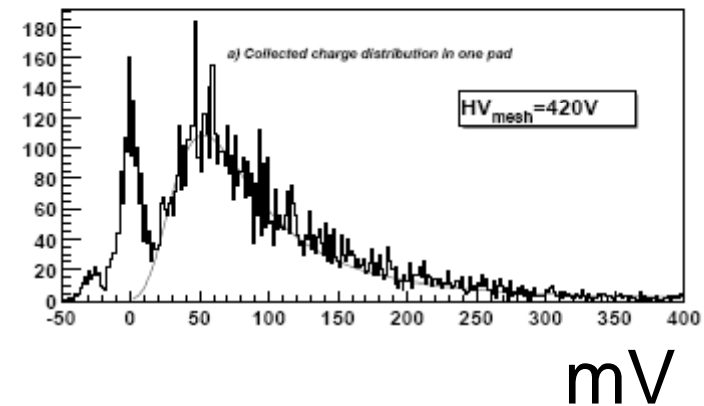


➤ With trigger on scintillators coincidence : **MIPs**

LAPP 2007



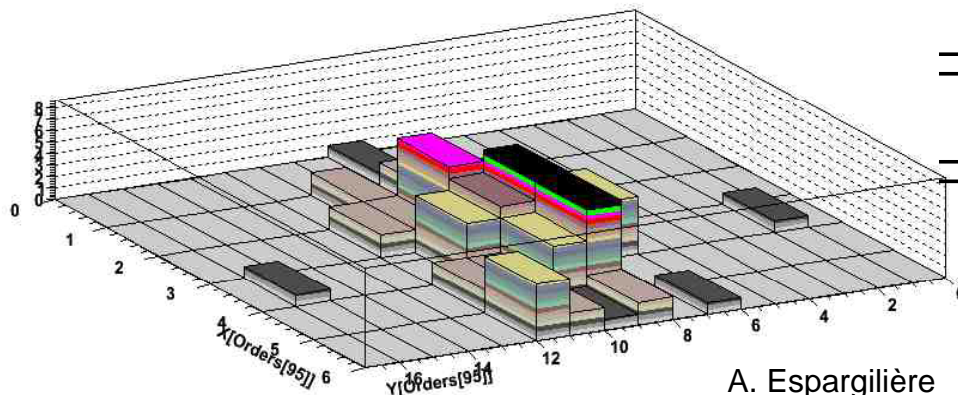
Subatech 2000



Non optimised prototype

⇒ X-talk

⇒ Dirty mesh



The Second Prototypes

- PCB routing with great care (4 layers)
- Stainless Steel top with wholes for X-rays
- 5 μ m thick copper Cathode
- Chamber assembly in clean environment



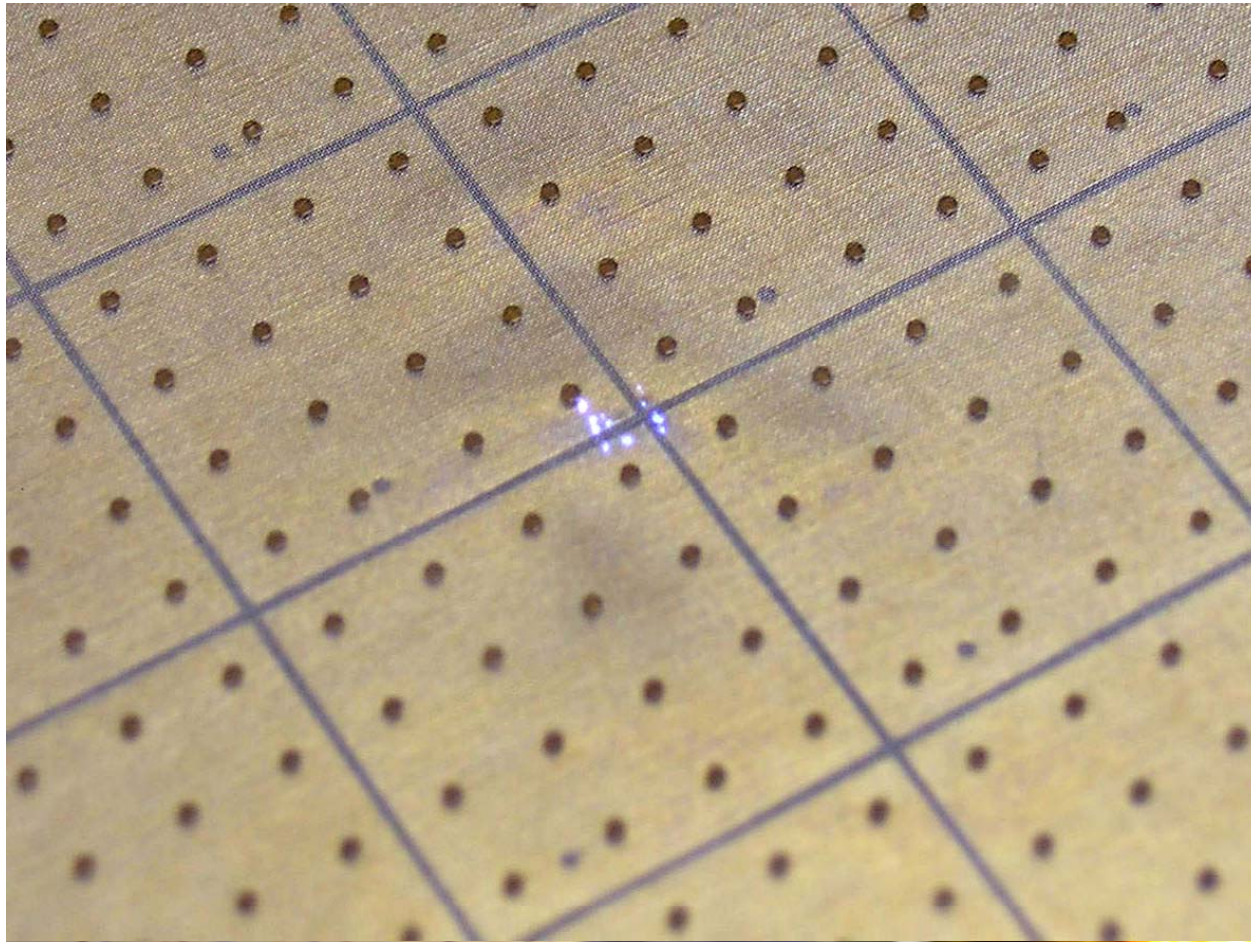
dust burning time reduced!
less sparks during functioning



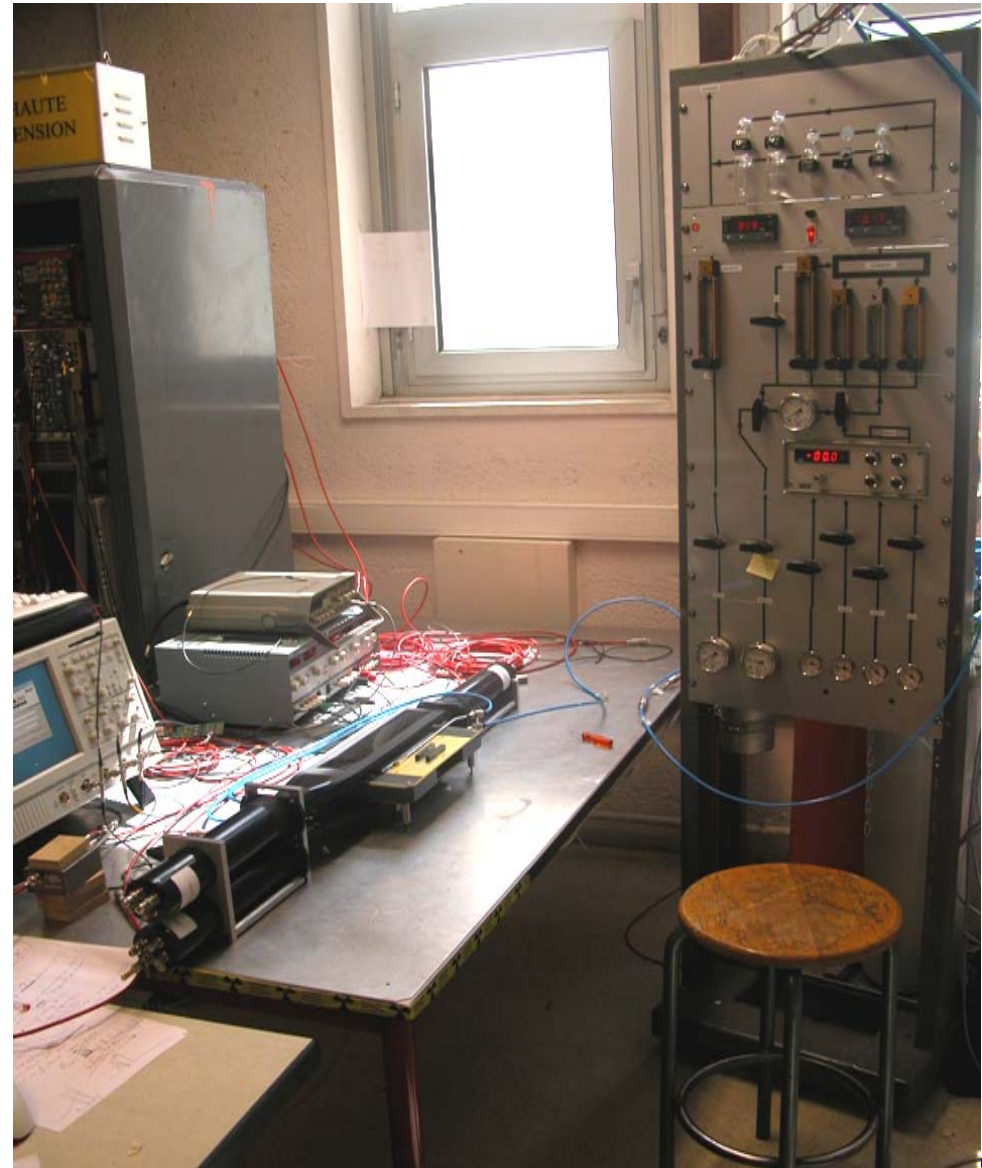
F. Peltier

➤ mesh localized fault

$V_{\text{mesh}} = 800\text{V}$ in air



- More sophisticated gas system
 - premixed
 - 95% Argon + 5% Isobutane
 - home made mixtures
 - Argon + Isobutane
 - Argon + CO₂
- HV supply with nA monitoring
- Dedicated cosmic scintillator trigger setup for 2 chambers

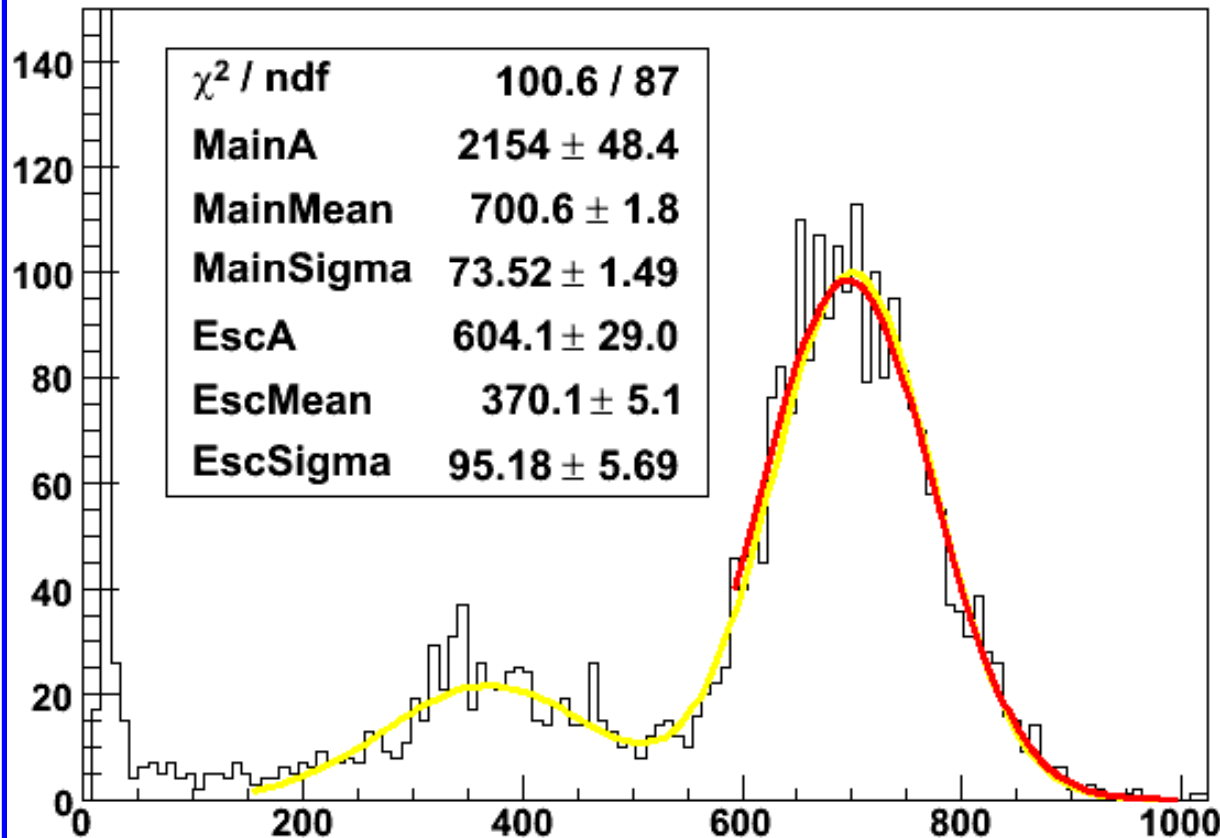


The Second Prototypes

- X-ray source: ^{55}Fe
- Trigger on mesh (preamp+discr)



- $V_{\text{mesh}} = 420\text{V}$
- $V_{\text{cathode}} = 470\text{V}$
- $E_{\text{drift}} = 167\text{V/cm}$

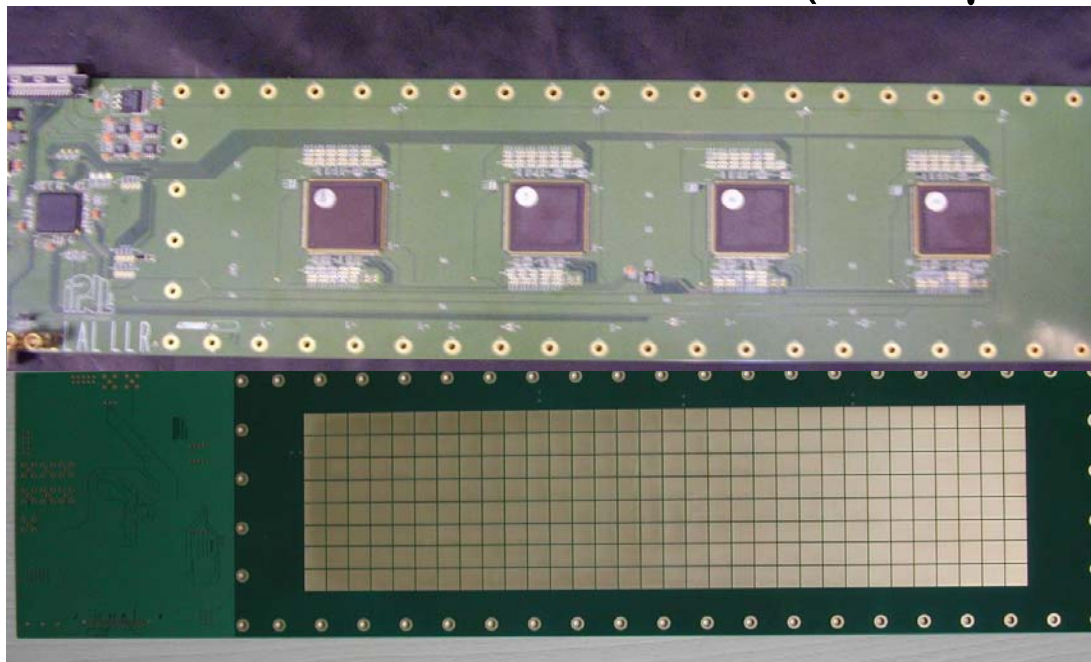


- Peak = 700 ADC cnts
= 996 mV
= 277 fC
⇒ **Gain = ~7700**

- Sigma = 73.5
⇒ 10.8%
- FWHM=25.5%

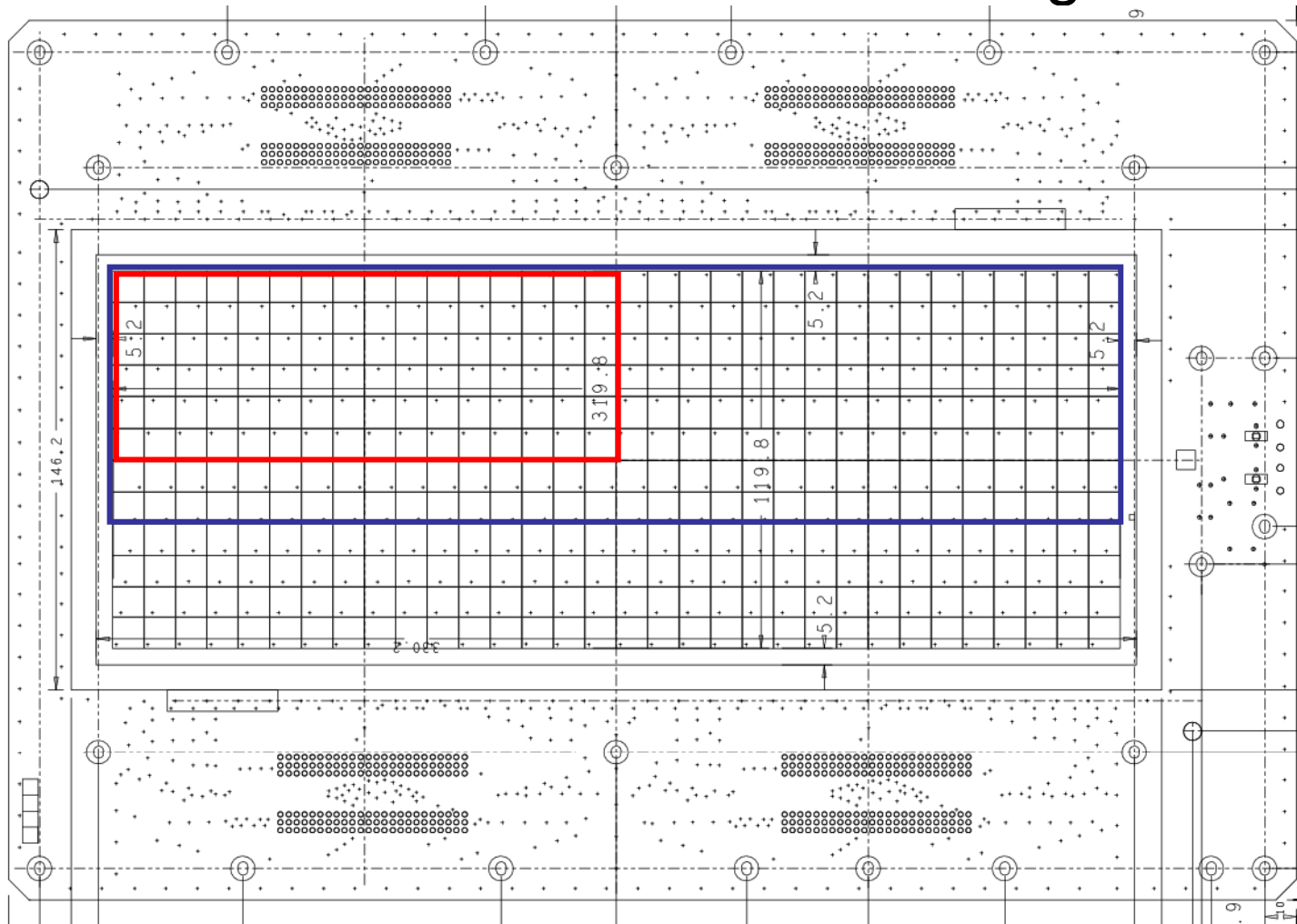
T2K(same techno) FWHM = 26%

- With the actual prototypes 6x16:
 - homogeneity, stability wrt pressure, temperature...
 - different gas mixture
 - efficiency
- One Micromegas chamber 8x32 with the 4 Hardrocs IPNL-LLR PCB (500 μm interpad)



⇒ test beam

➤ ... for further detector understanding



⇒ towards a 1m² Micromegas with embedded ASICs