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Performances of the first large size bulk Micromegas produced at CIREA

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R&D on production at CIREA company

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Collaboration between Saclay and CIREA company since late 2010

CIREA: producer of large size PCB at Cholet (France), part of ELVIA group

Also knowledge on resistive layers in ELVIA group

Collaboration improved since late 2011 with financing from ANR french funding agency

Activities on bulk production

A few small prototypes (6x10cm²) produced during 2011, 1 with good gain performances

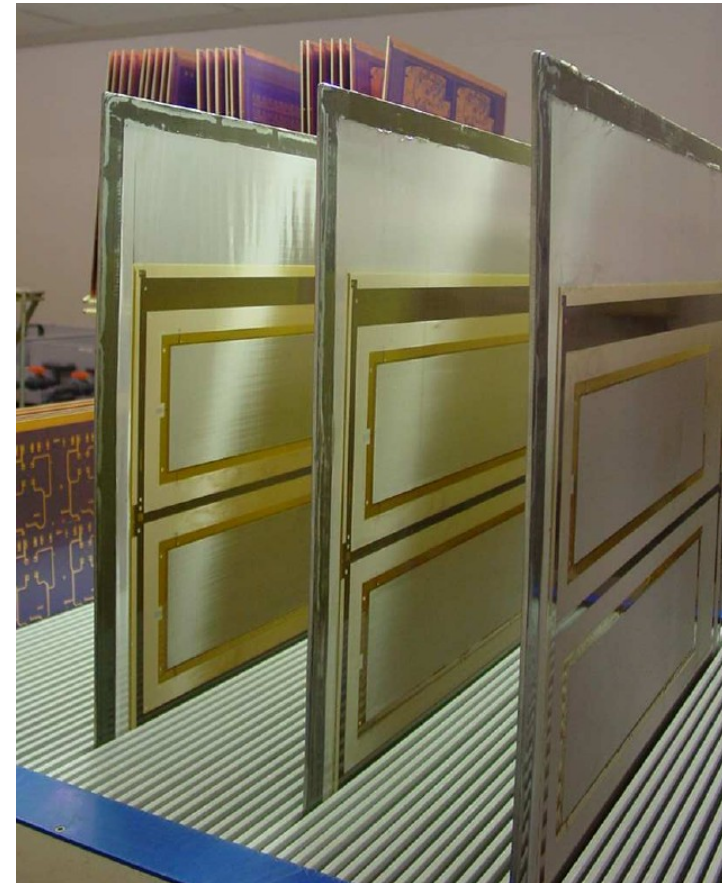
Several larger PLV3 prototypes (12x50cm²) batches produced since end of 2011 on thick boards

Also PLV3 on thin boards glued on Rohacell sandwich

Several problems at the beginning: bubbles in coverlay, pillars unstuck off board, low pillar thickness, waves on mesh

Quality has been improved with the time, almost good now

Production of resistive BXY prototypes from June 2012 for ATLAS

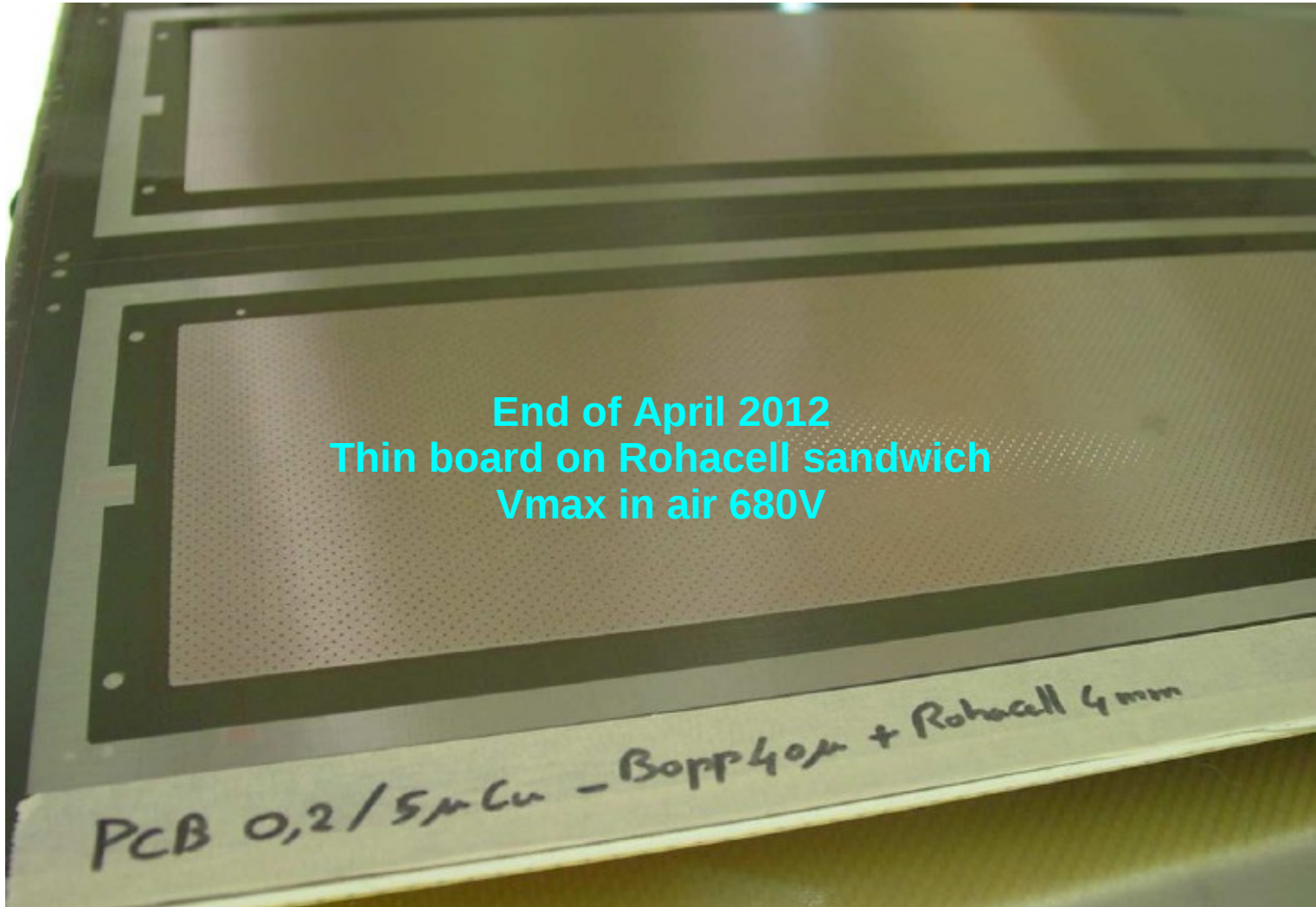


PLV3 boards from CIREA

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End of April 2012
Thin board on Rohacell sandwich
Vmax in air 680V

PCB 0,2/5µCu - Bopp 40µ + Rohacell 4mm

PLV3 boards from CIREA

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End of R&D on PLV3 prototypes

- *Last batch sparks at >750V in air*
- *Pillar thickness nominal*
- *Remaining waves on mesh solved by higher stretch*

Decision to go to COMPASS prototype in summer 2012

Large size pixelized MM detectors for COMPASS

Goal: to replace present MM

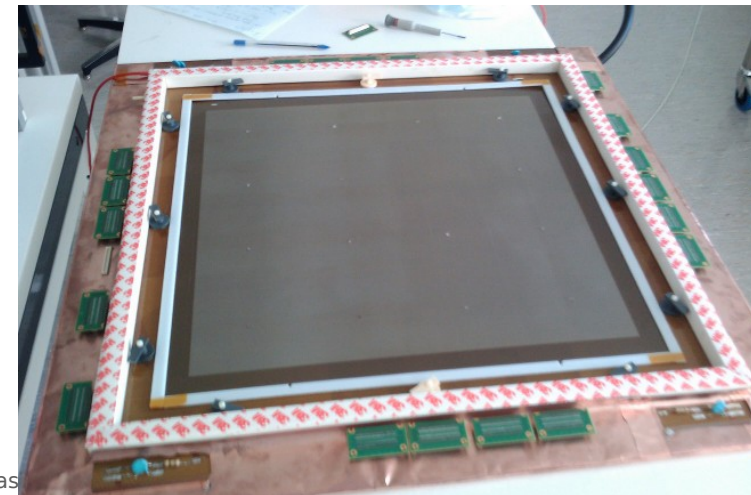
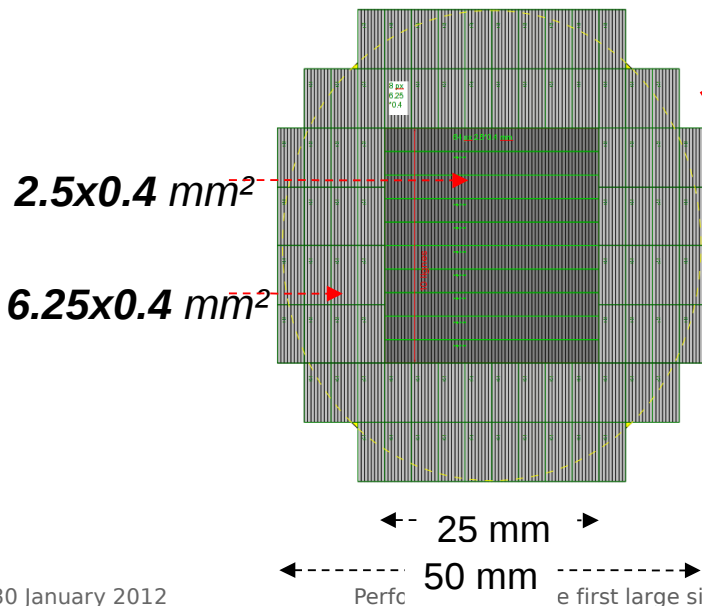
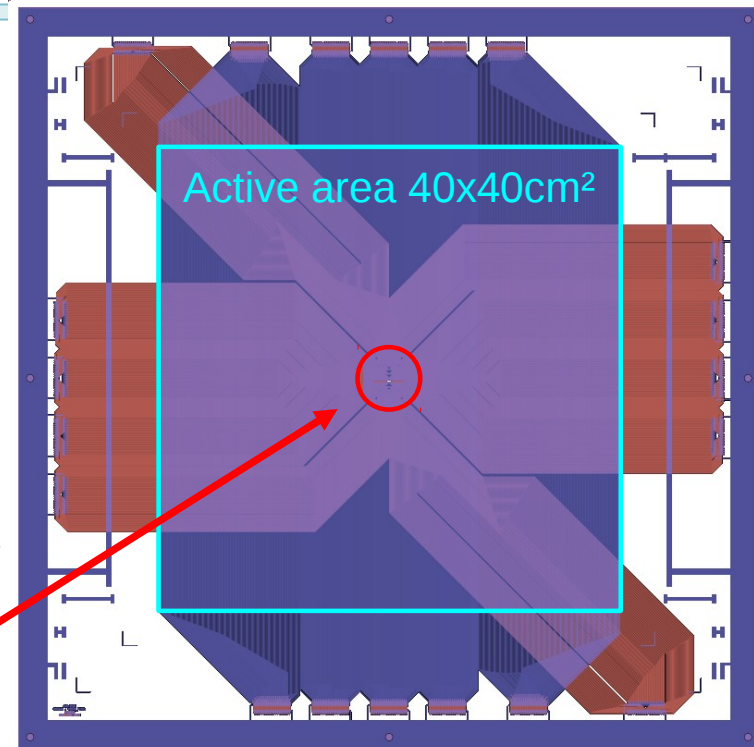
Large prototypes built at CERN

40x40cm² active area, MM bulk technology, built at CERN lab

400µm pitch strips, 5cm diameter pixel area in center

1280 + 1280 channels

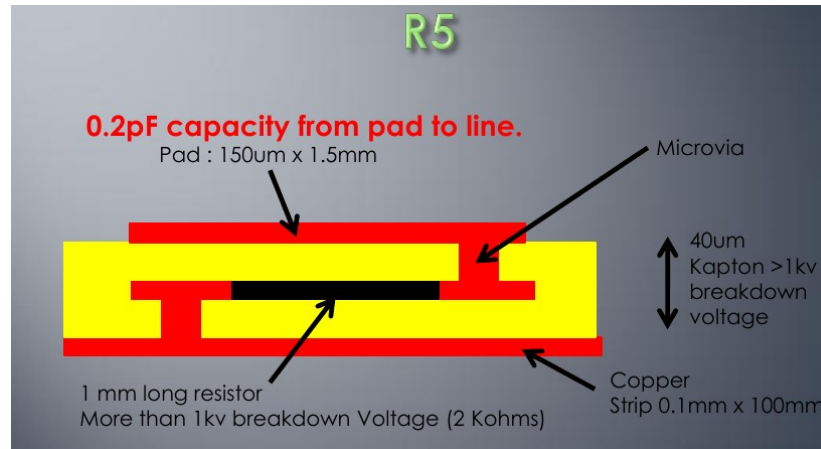
Tested in nominal conditions at COMPASS in 2010-2011



Two solutions to reduce discharge rate

Resistive Micromegas

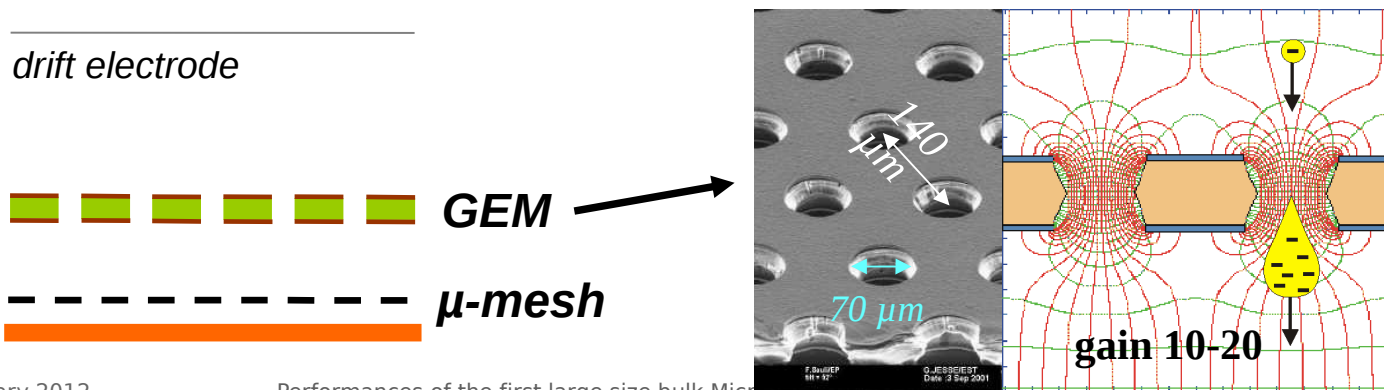
Buried resistors scheme proposed by R. de Oliveira et al.



Classic Micromegas + 1 GEM foil

Preamplification with a GEM foil (gain 10-20)

Micromegas stage at lower gain → less discharge



Production of large size prototypes at CIREA

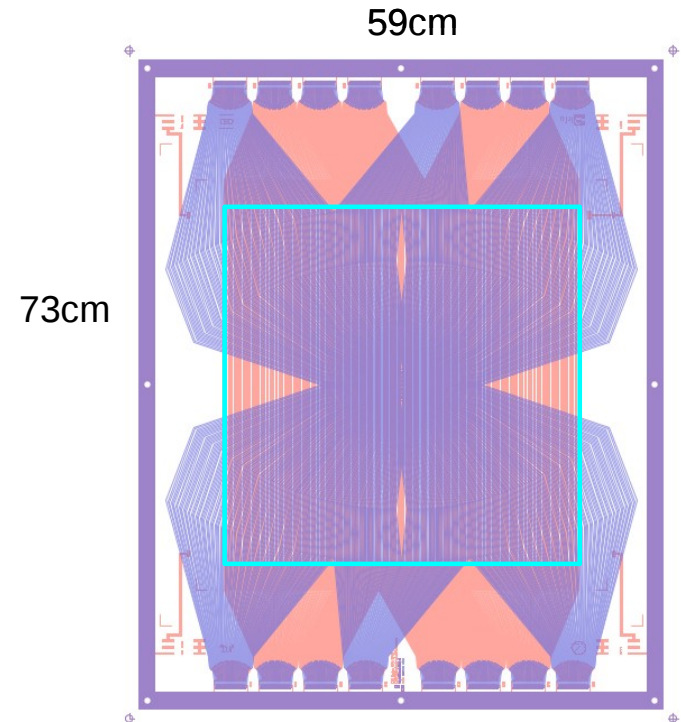
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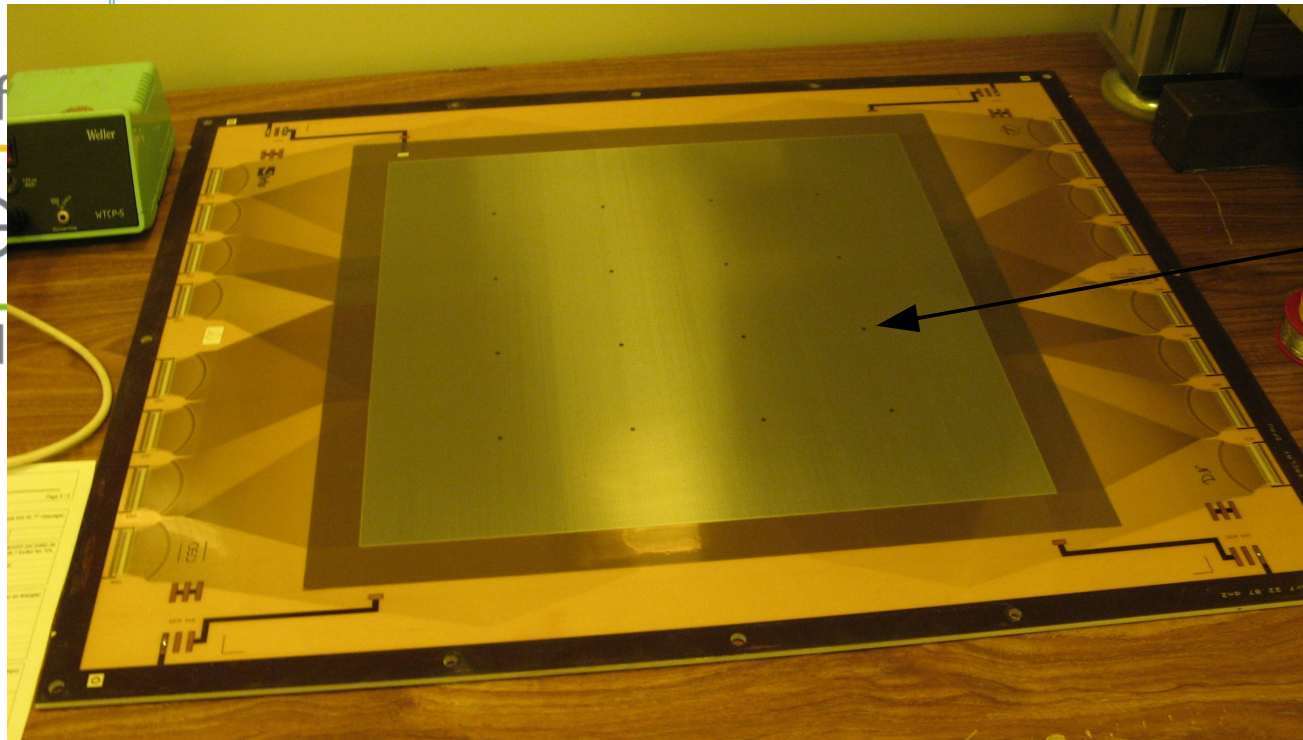
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Large size CIREA prototypes

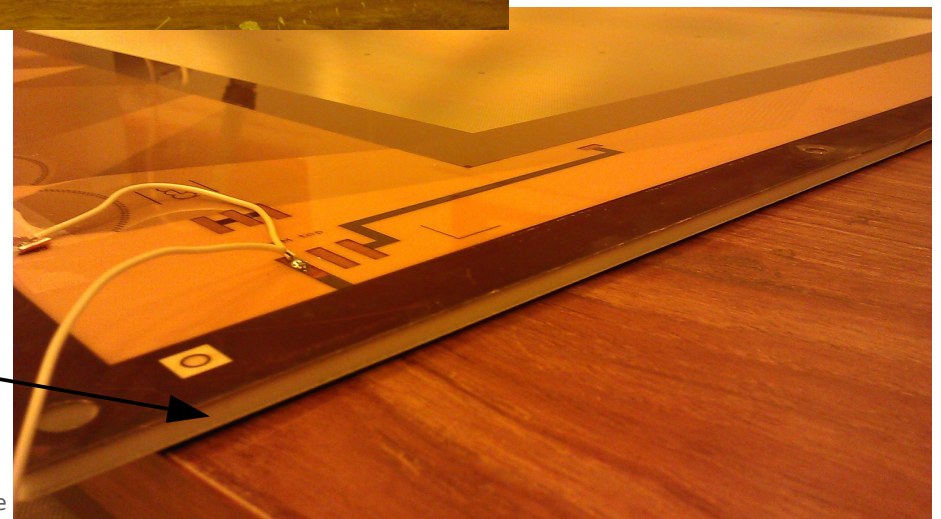
- *Rectangular design with same active area 40x40cm²*
- *Simplified design for first prototypes → less pixels*
- *Thin board on Rohacell sandwich to lower material budget*
- *2 proto produced end of October*
- *1 prototype installed in beam at COMPASS Thursday 29/11*



Compass pixelMM board built at CIREA

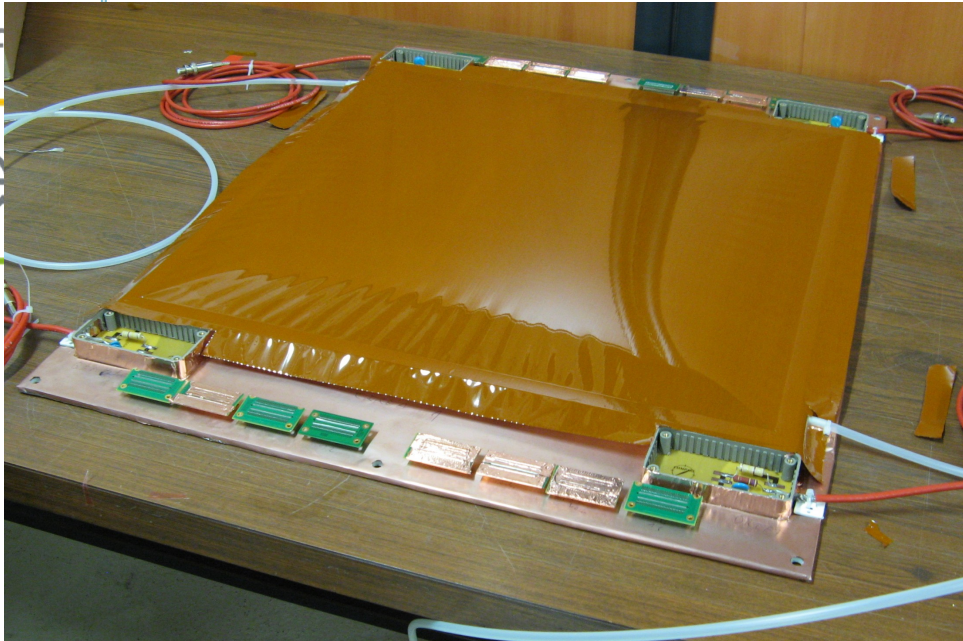


16 large pillars to support additional GEM foil

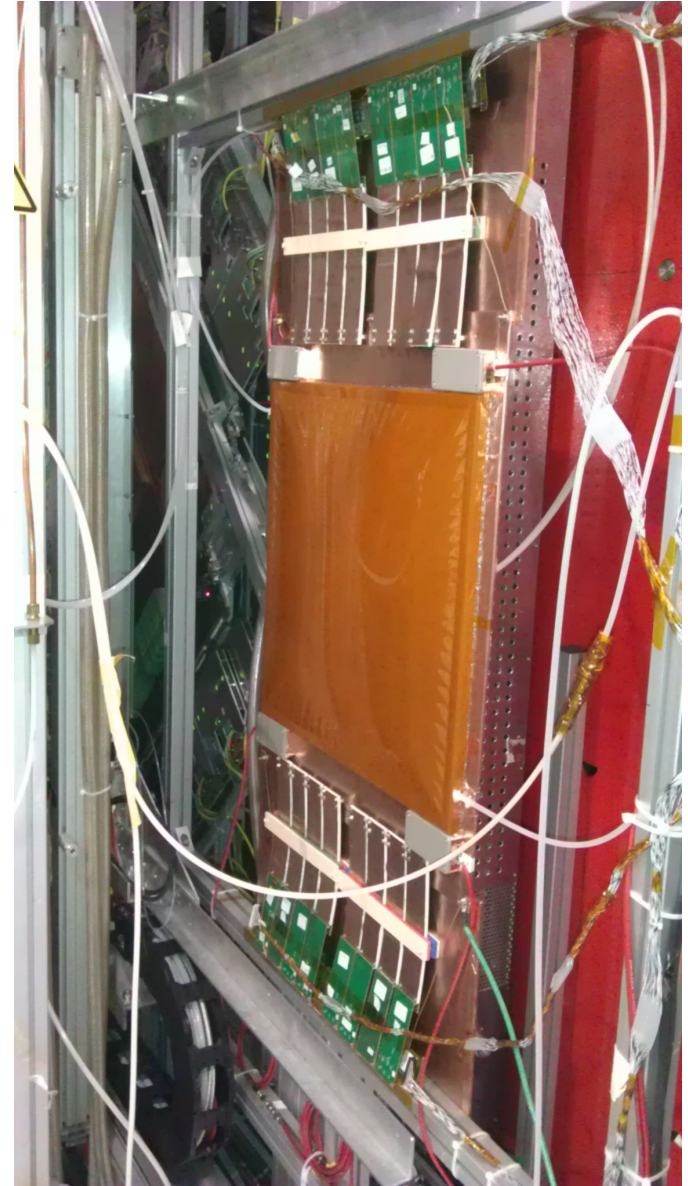


Rohacell sandwich

CIREA pixelMM installed at COMPASS



Ok in laboratory (800V in air)
Prepared with a GEM foil
Installed at COMPASS end of
November
Tested with beam during 4 days



Relative gain of CIREA prototype compared to CERN

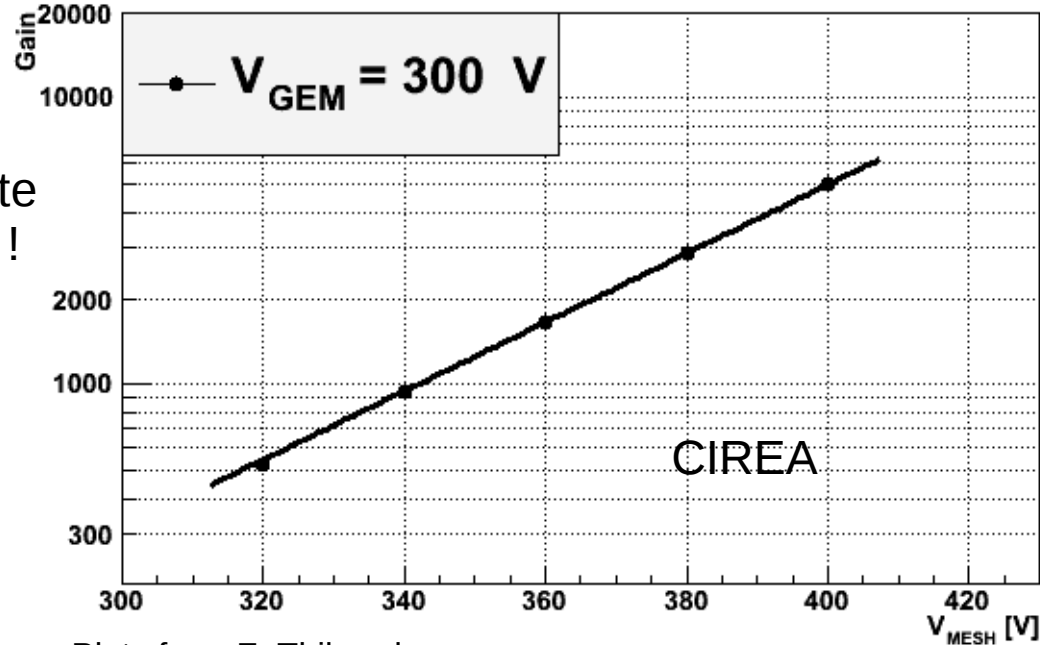
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Bad absolute calibration !

CIREA gain slightly larger than CERN

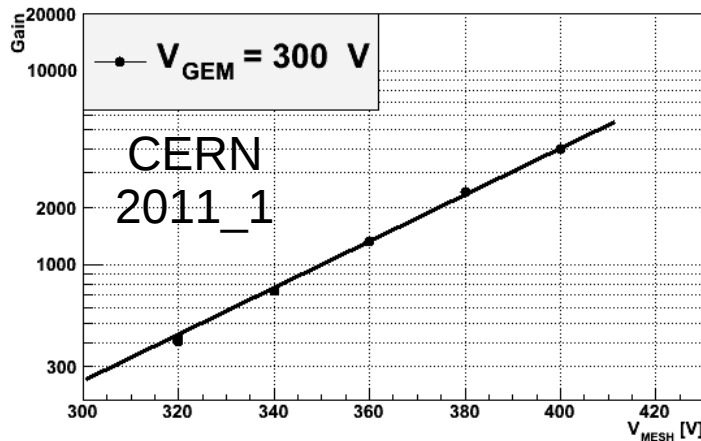
Gain vs V_{MESH}



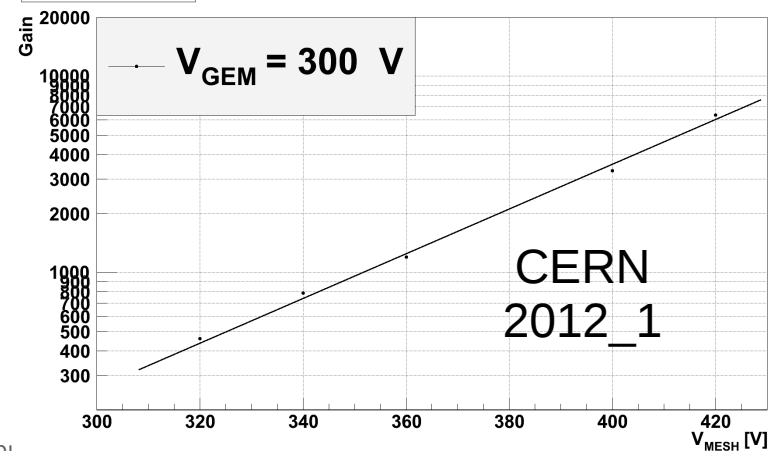
Ne-
10% C_2H_6 -
5% CF_4

Plots from F. Thibaud

Gain vs V_{MESH}



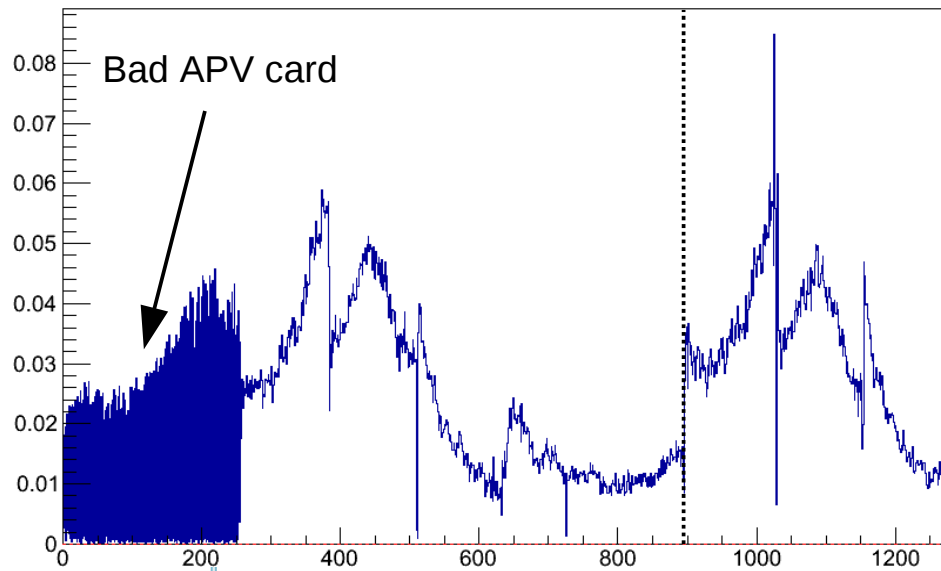
Gain vs V_{MESH}



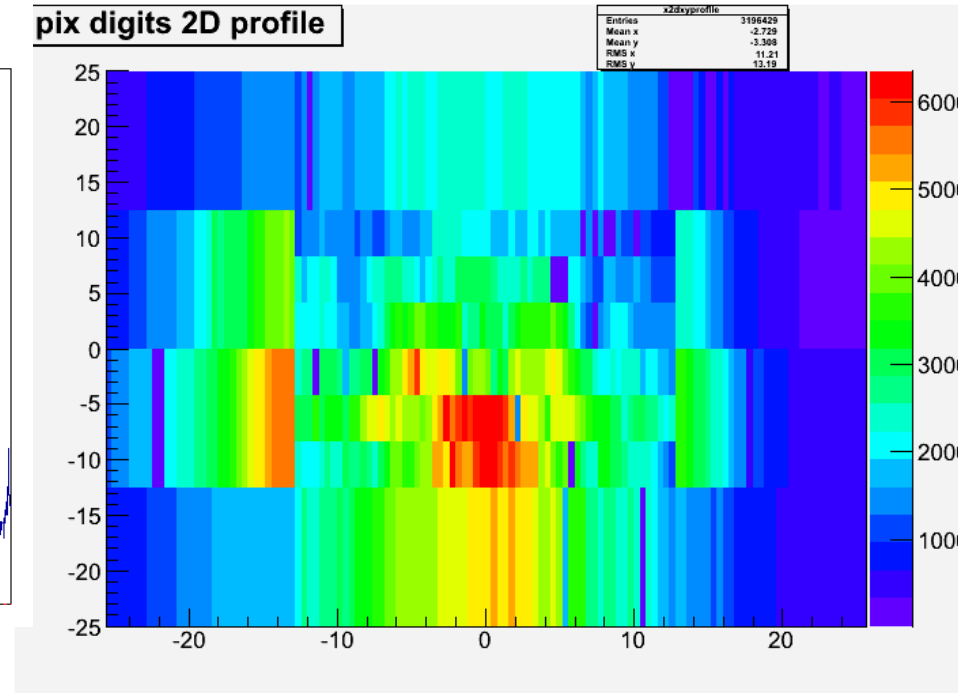
First profiles with CIREA pixelMM



MP00X1__occupancies



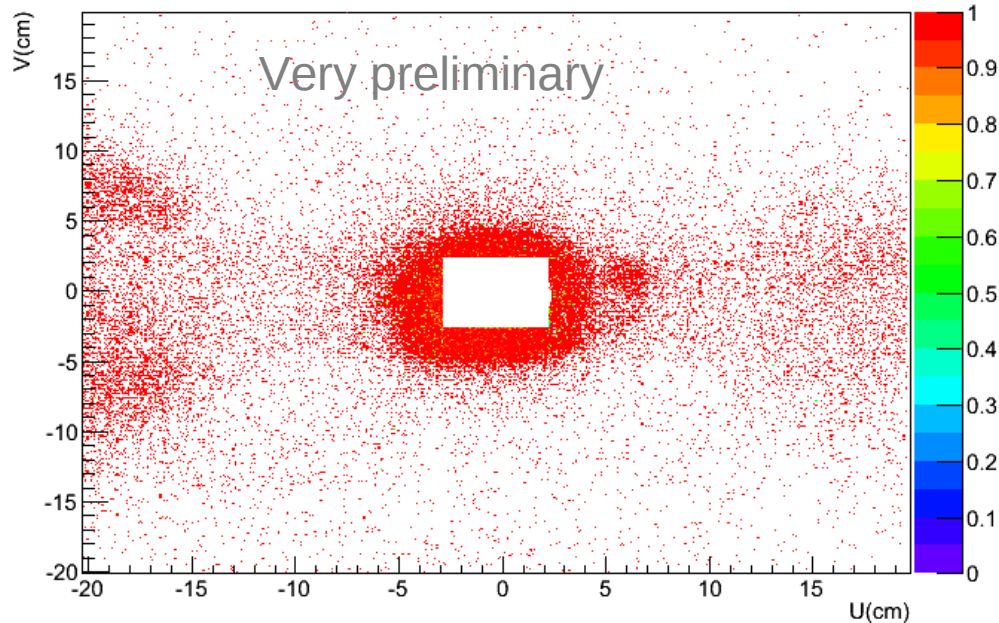
pix digits 2D profile



Very preliminary results: strip efficiencies

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Efficiency of strip part = 97 %

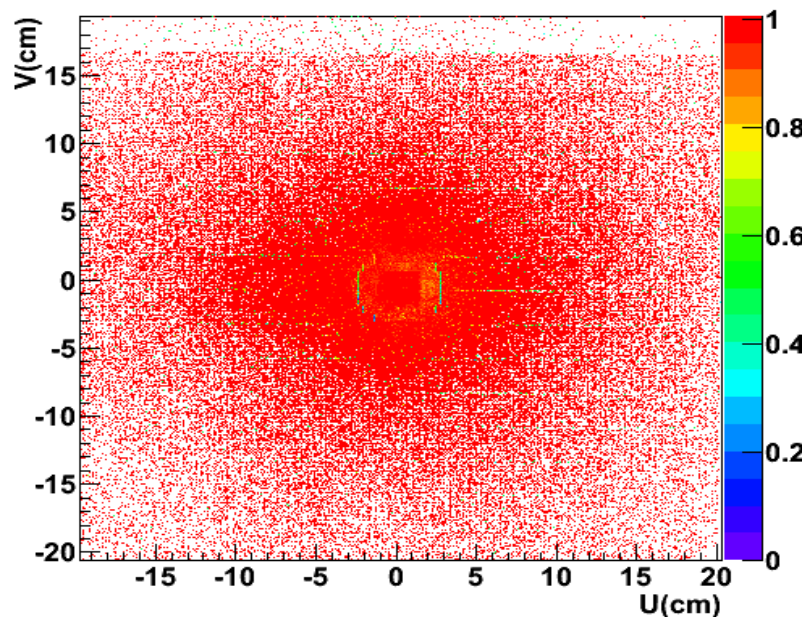


Plots from F. Thibaud

CIREA prototype in 2012
Thinner target → few tracks at large angle

High flux muon beam

V vs U of efficiency with noise correction - efficiency = 96 %



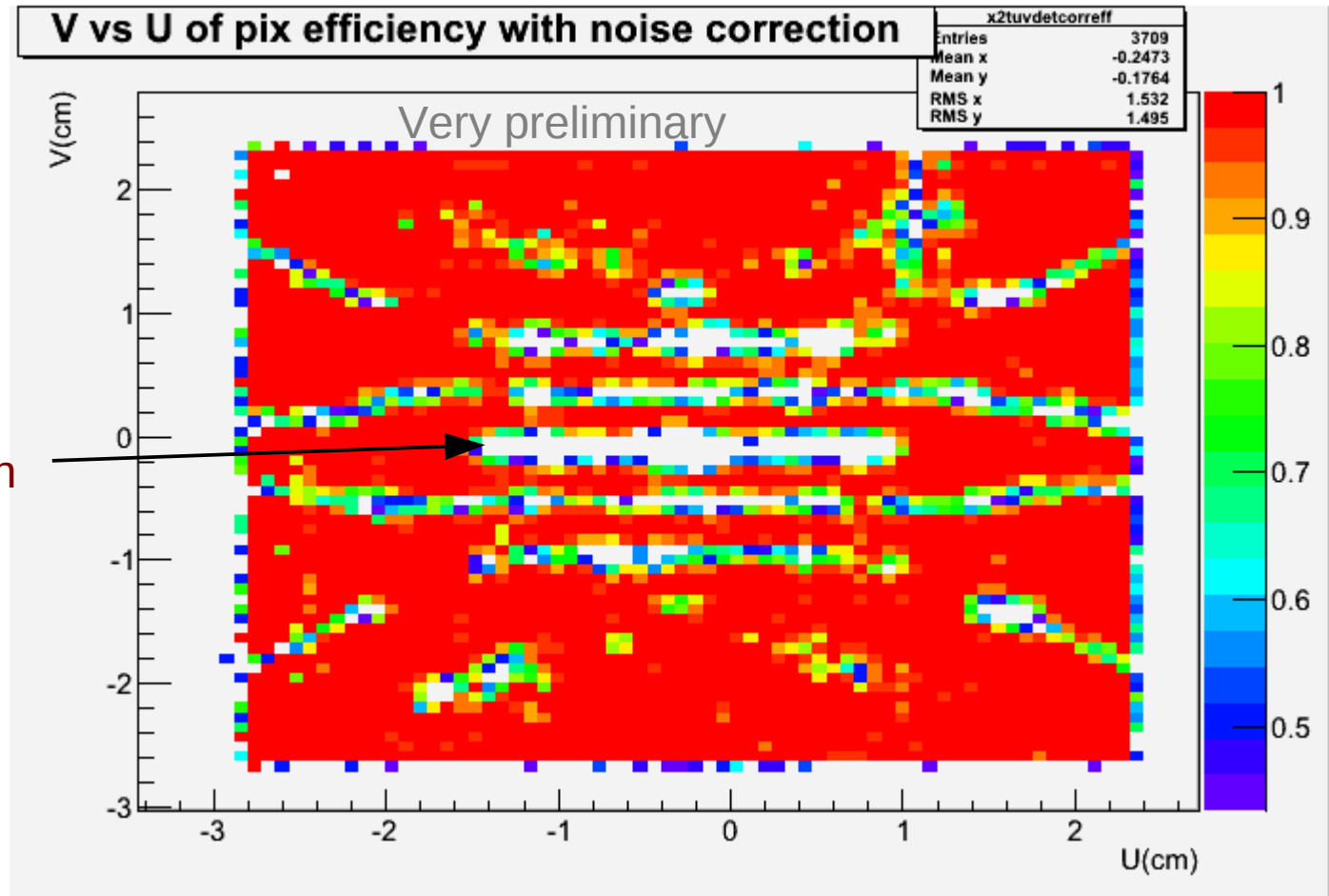
CERN prototype in 2011
(same position)
Strip efficiency ~ 96%

Very preliminary results: pixels efficiencies

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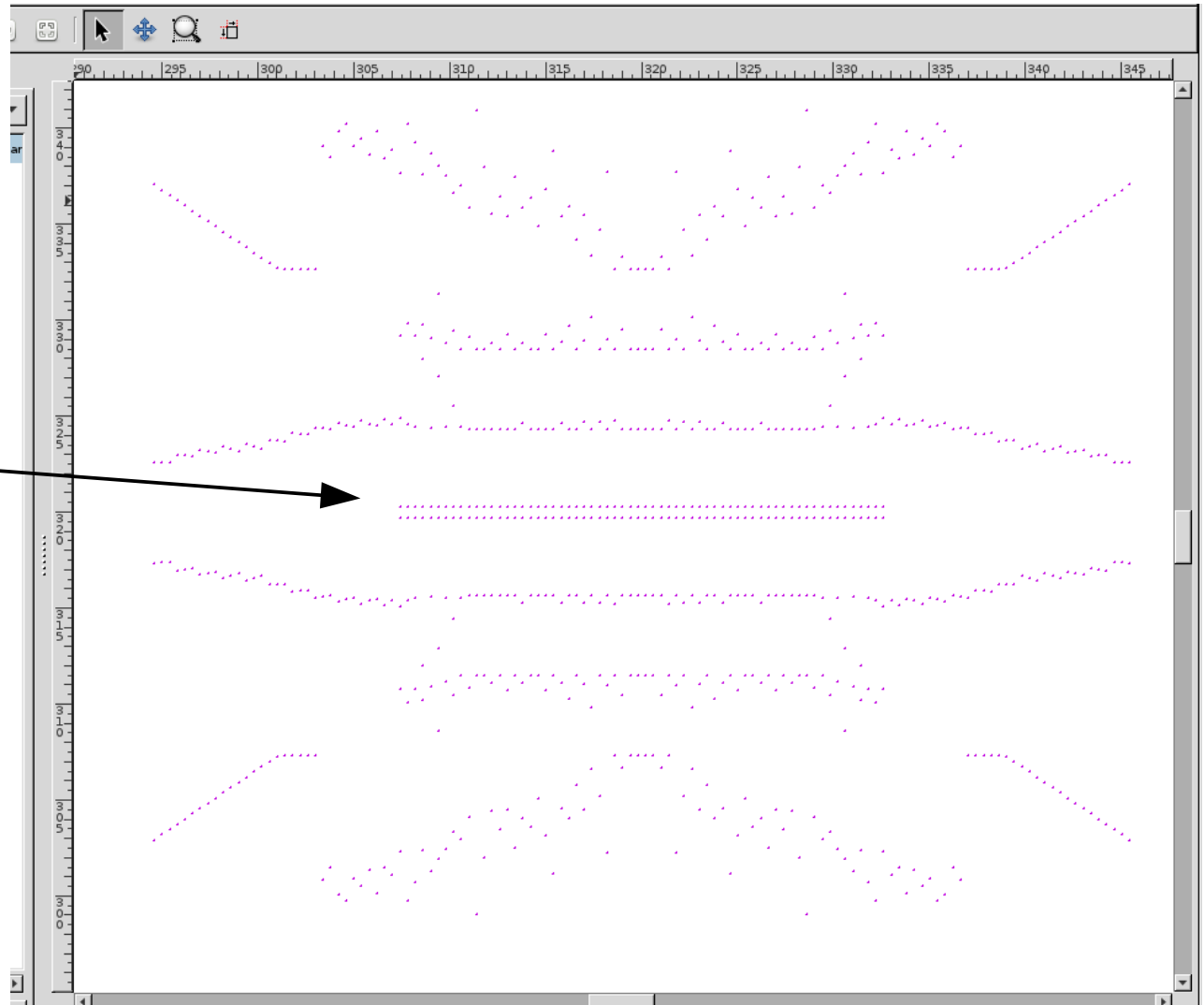


A lot of low efficiency spots in pixel area

Low flux muon beam

Bad efficiency spots in pixel area

Position of vias in
pixel area



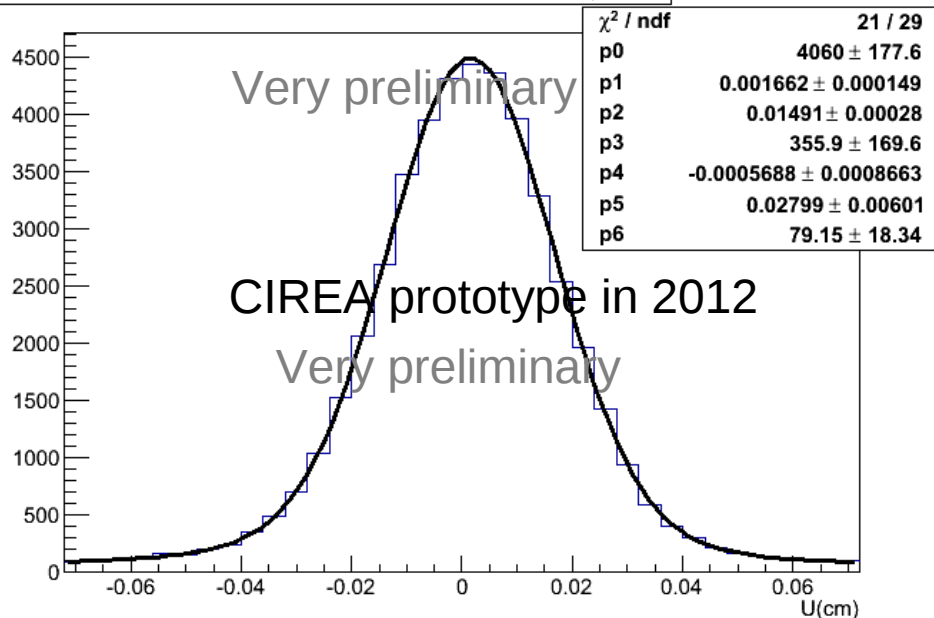
Detector inefficient on vias positions: larger thickness of vias ?

Very preliminary results: spatial residuals

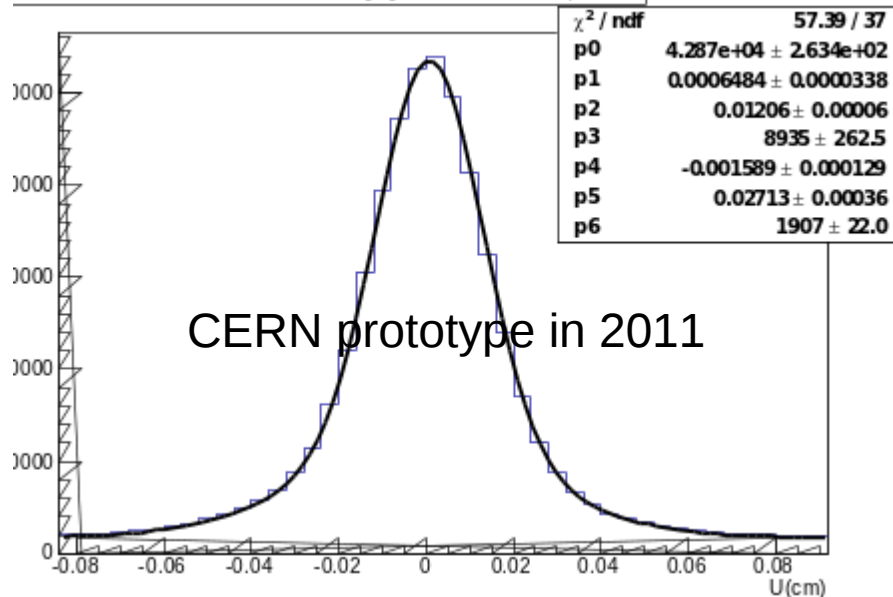
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High flux muon beam

Residual distribution of strip part - $\sigma = 168 \mu\text{m}$



Residual distribution of strip part - $\sigma = 168 \mu\text{m}$



Plots from F. Thibaud

~160-170 μm residual for both (magnetic fringe field)

Spatial resolution a priori ok for strips
Not measurable for pixels due to inefficient spots

Conclusions and perspectives

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Large size CIREA prototype

- *Production without problem*
- *2 prototypes delivered, one prepared and tested with beam*
- *Normal behavior during data taking: no leak current, no discharge*

First results on performances

- *Performances of strips look good: efficiency, residuals*
- *Important problem with pixels, very low efficiency near vias*
- *Detector to be opened soon to investigate this problem*
- *Discussion with CIREA next week to find a solution*

Next steps with CIREA

- *Complete analysis*
- *Large resistive prototype for CLAS12 (resistive strips) to be delivered next week*
- *Production of small prototypes (TF10, 6x10cm²) with buried resistors in progress, expected in February*
- *Large size non-simplified prototype to be launched in February, including solution on vias*
- *Large size resistive prototype launched afterward*

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Spares

MM protection circuit

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