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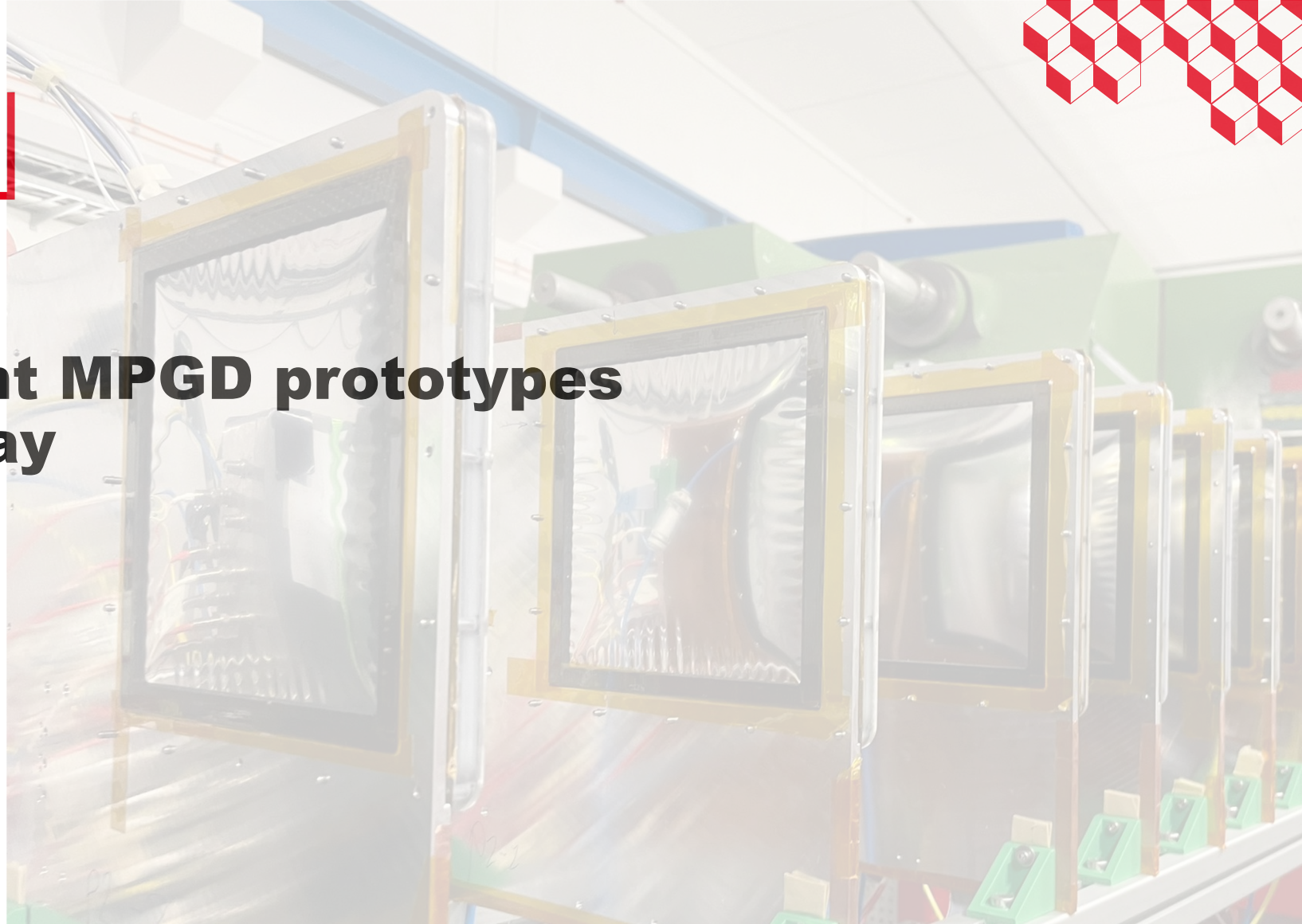
Sail Trackers : Light MPGD prototypes production at Saclay

CERN, December 2023

Maxence Vandenbroucke for the Saclay MPGD lab

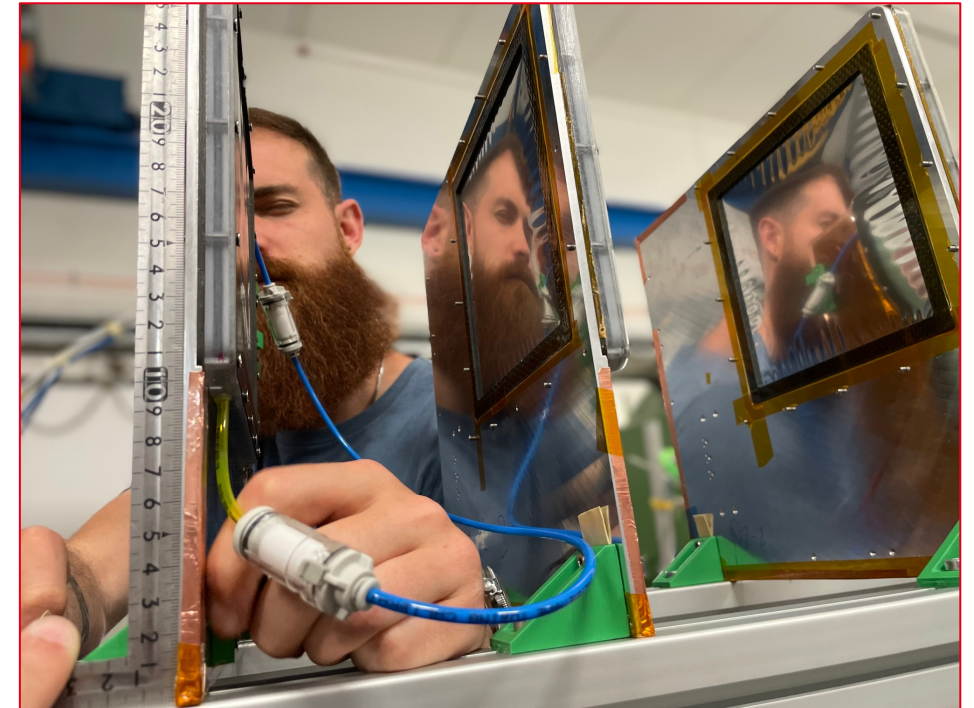
CEA Saclay

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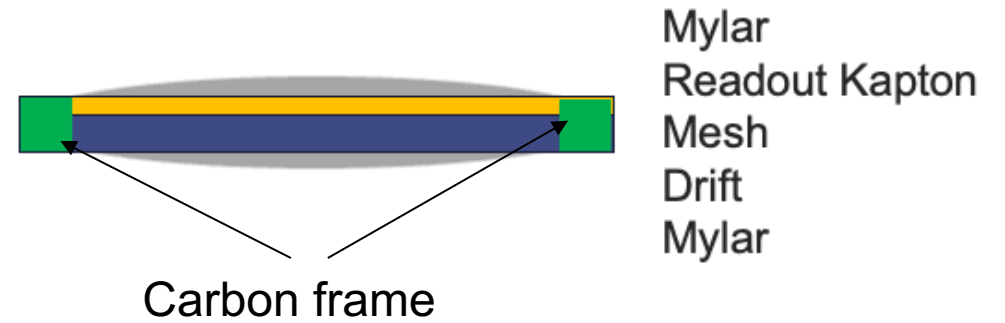
News from Saclay's Labo MPGD

- 1. sPhenix TPOT detector production 2022 finished**
- 2. EIC and P2 experiment interested in low budget material**
 - 1. Low energy electron (MeV) easily scatter**
 - 2. High X-Ray background : need to avoid photon conversion**
- 3. Goal = make micromegas on Kapton at Saclay for P2 => "RD4" detectors**
- 4. Test beam with electrons at Mainz in 2023**



Sail Tracker

1. Bulk Micromegas on Kapton
2. Mylar for Drift electrodes
3. Mylar windows for gas volume to avoid “balloon” deformations



	Material	Thickness	Fraction area X/X0				Material	Thickness	Fraction area X/X0	
		cm	%	%				cm	%	%
P2 active area						P2 Side				
	Cu	5.00E-04	0	0.00E+00		Frame	C	3.00E-01	100	1.59E+00
Drift	Kapton	5.00E-03	100	1.75E-02		3D	Ny	1.00E+00	80	2.18E+00
	Cu	5.00E-04	100	3.48E-02		Detector				2.37E-01
Readout	Fe	1.80E-03	40	4.19E-02						
	Cu	1.50E-03	100	1.04E-01						
	Kapton	5.00E-03	100	1.75E-02						
	Cu	1.50E-03	20	2.09E-02						
		Material budget =	0.24 % of X0					Material budget =	4.00 % of X0	

=> ~0.20% of X0 in active area with light drift (half of CLAS12)

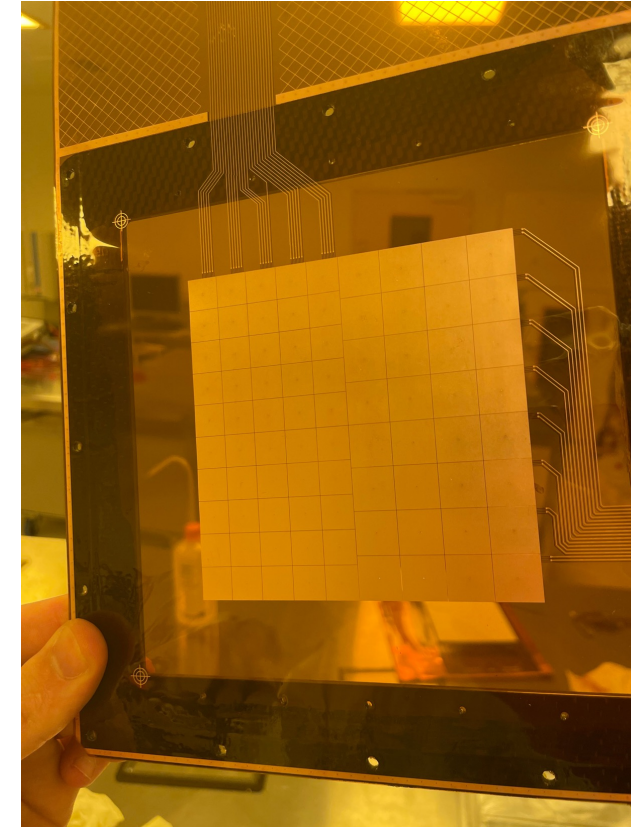
Sail Tracker Process

1. Bulk Micromegas on Kapton

- 1. If resistive : serigraphy on amplification Kapton**
- 2. Gluing (pressing) of readout Kapton and amplification Kapton (at CERN)**
- 3. Stretching of Kaptons on carbon frame**
- 4. Lamination using back plate to avoid deformation**
- 5. Standard process (insolation + development + cooking)**



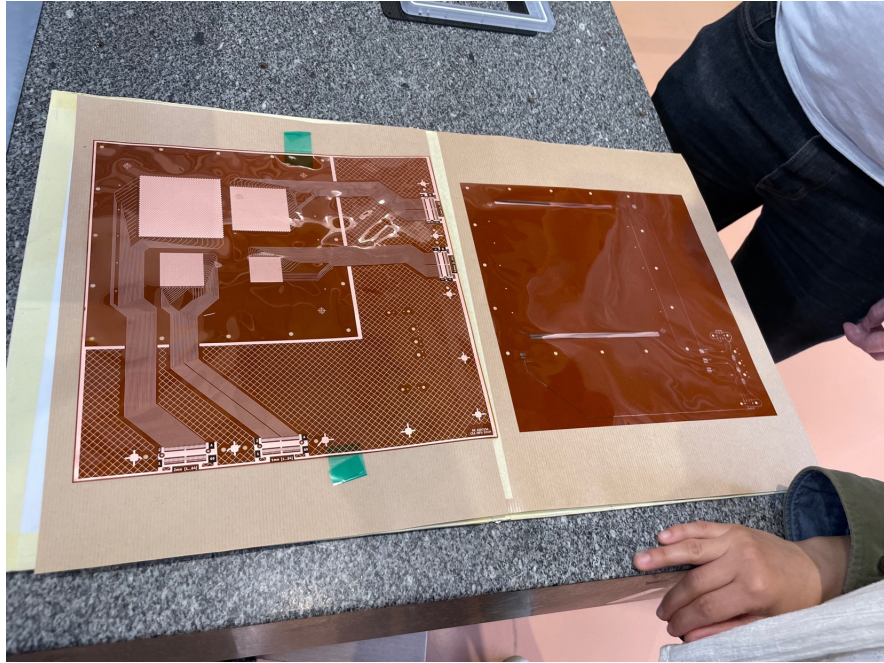
Mylar
Readout Kapton
Mesh
Drift
Mylar



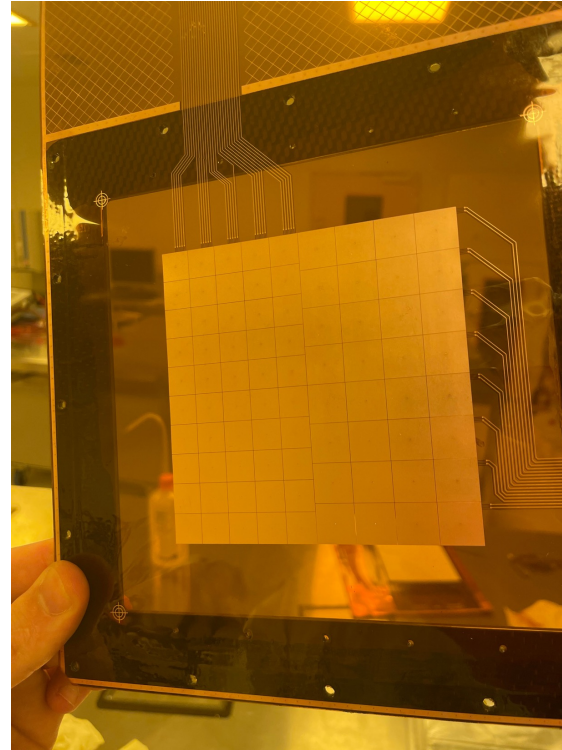
At CERN :

- Kapton production (readout and amplification)
- Pressing of kaptons

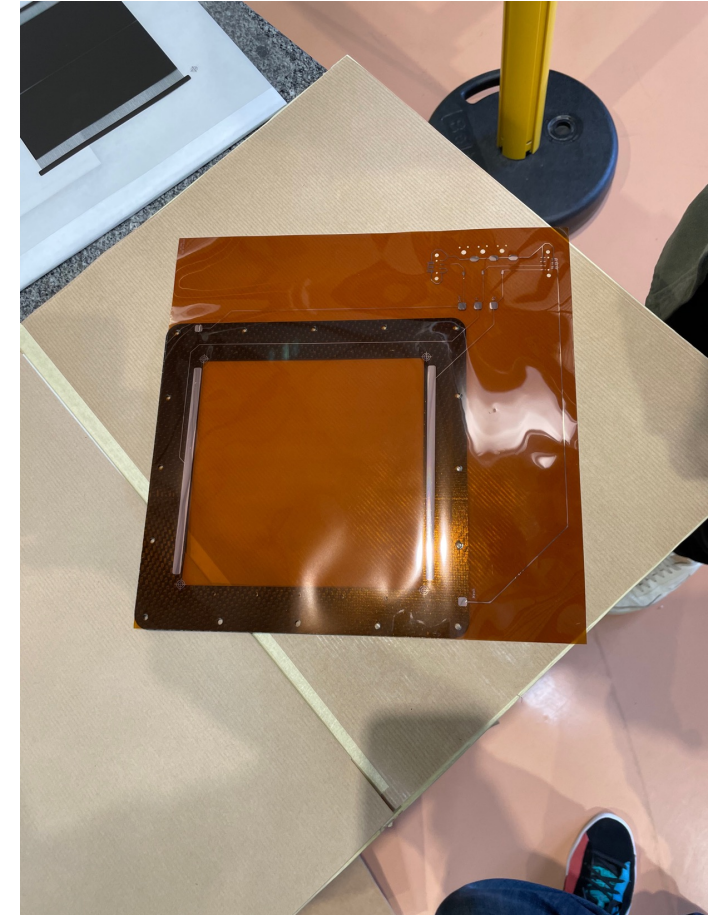
Sail tracker Micromegas : RD4



Readout Kapton Amplification Kapton



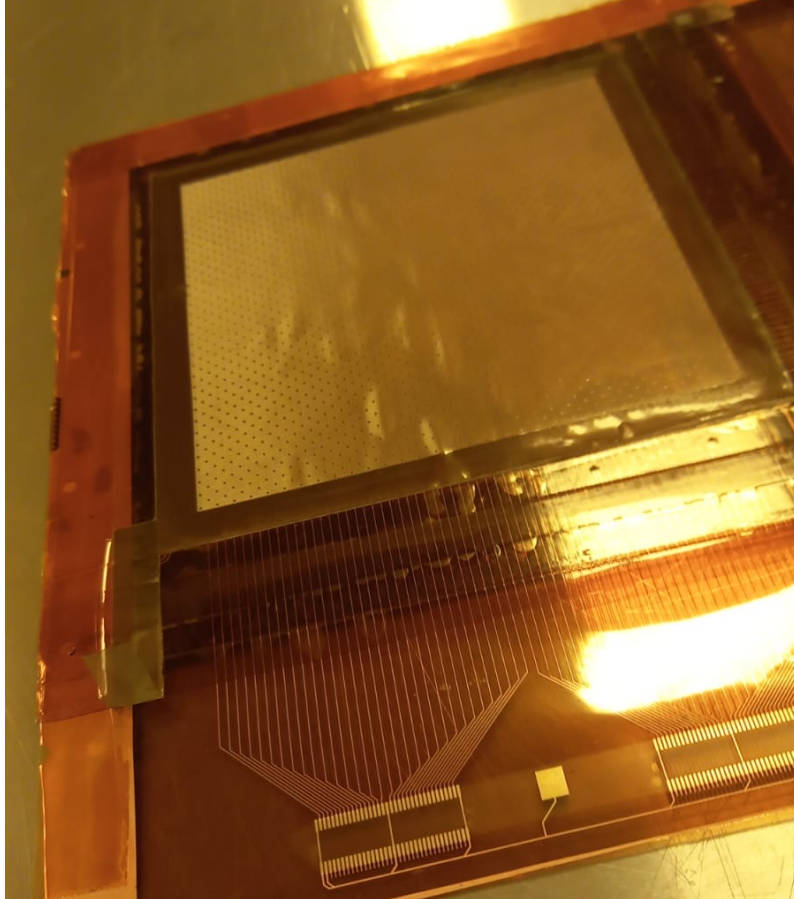
On carbon frame



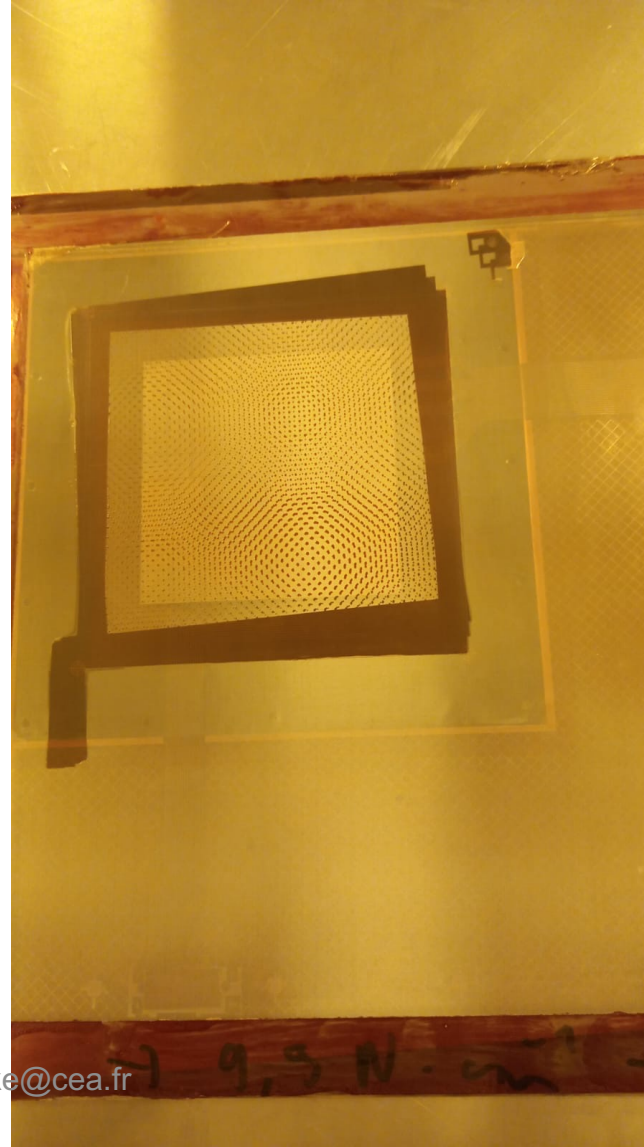
On carbon frame

Sail tracker Micromegas : RD4 First tries

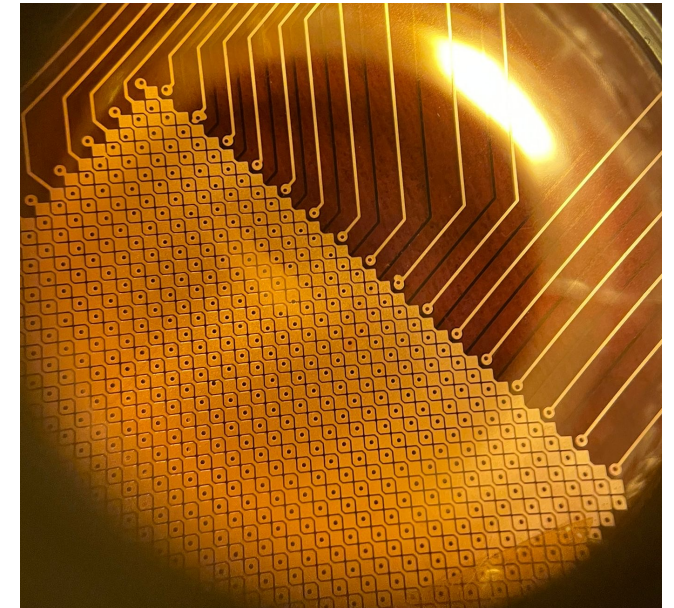
First Bulk tests :



Mask misalignments



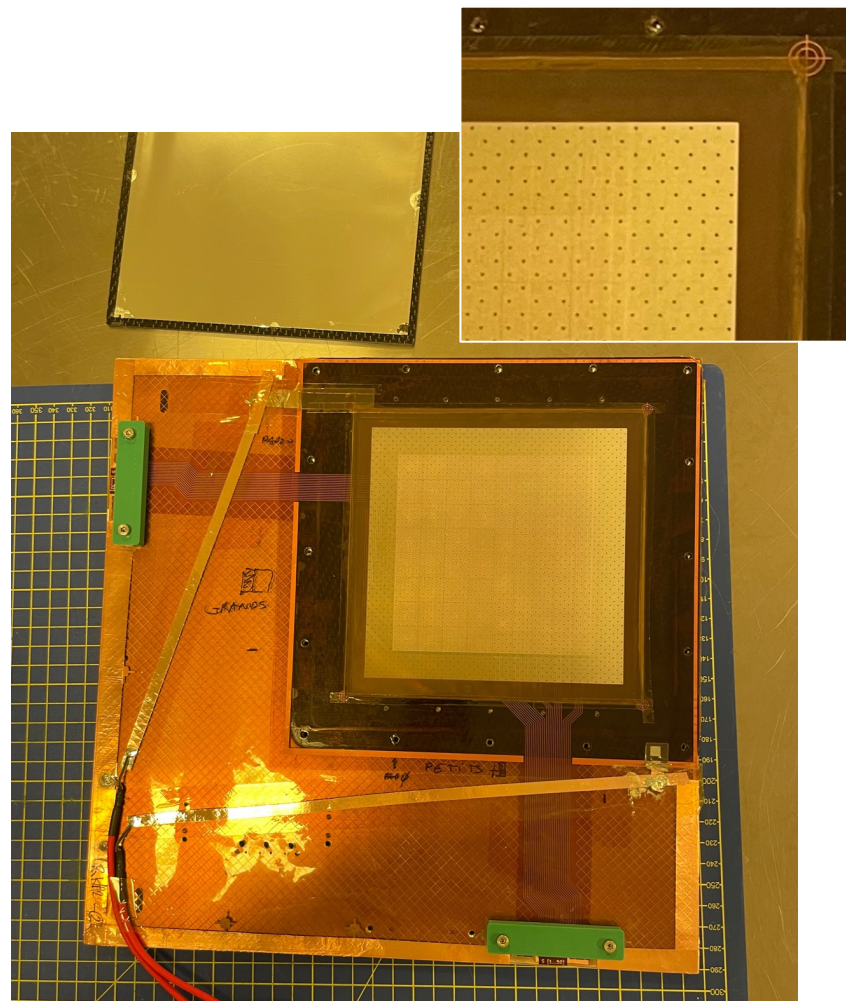
Broken vias



Sail tracker Micromegas : RD4



3D printed transparent frame



RD4 HV test



RD4 closed with HV card

Production for Mainz test beam 2023

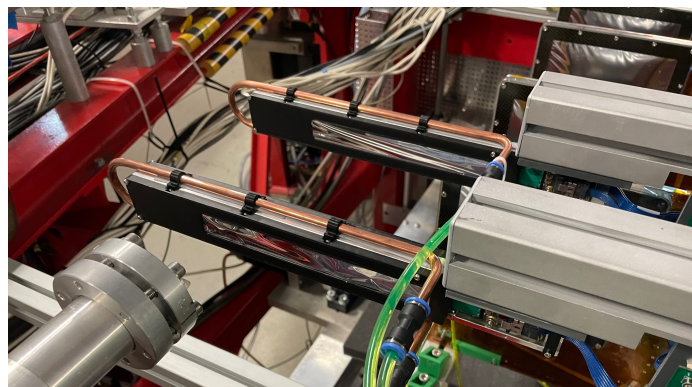
1. MPGD : 2 weeks of production

1. 3/3 P2 metallic
2. 3/3 Urwell (really easy)
3. 3/5 Resistive mm (plain resistive still tricky) => 9 working MM detectors for the TB

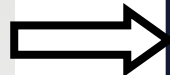
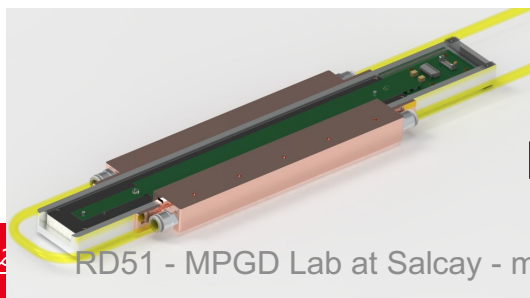
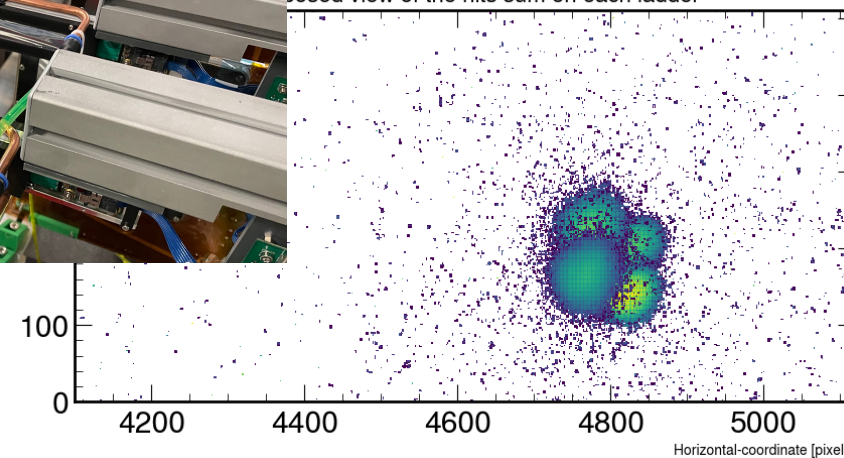


2. MAPS tracker

1. 4 layers from Alice MFT
2. Gluing + mechanics + cooling

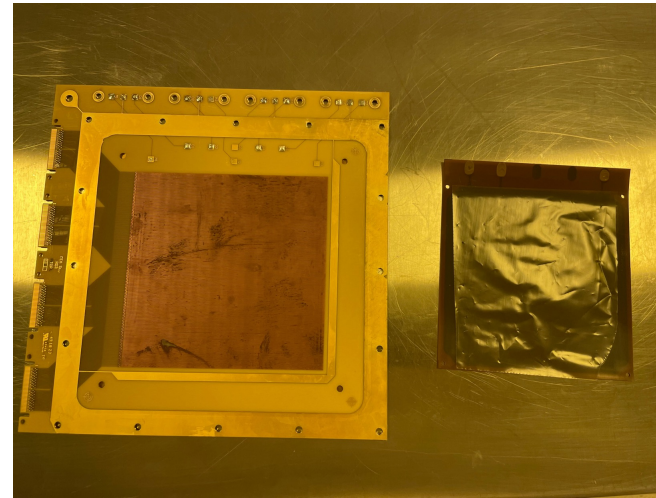
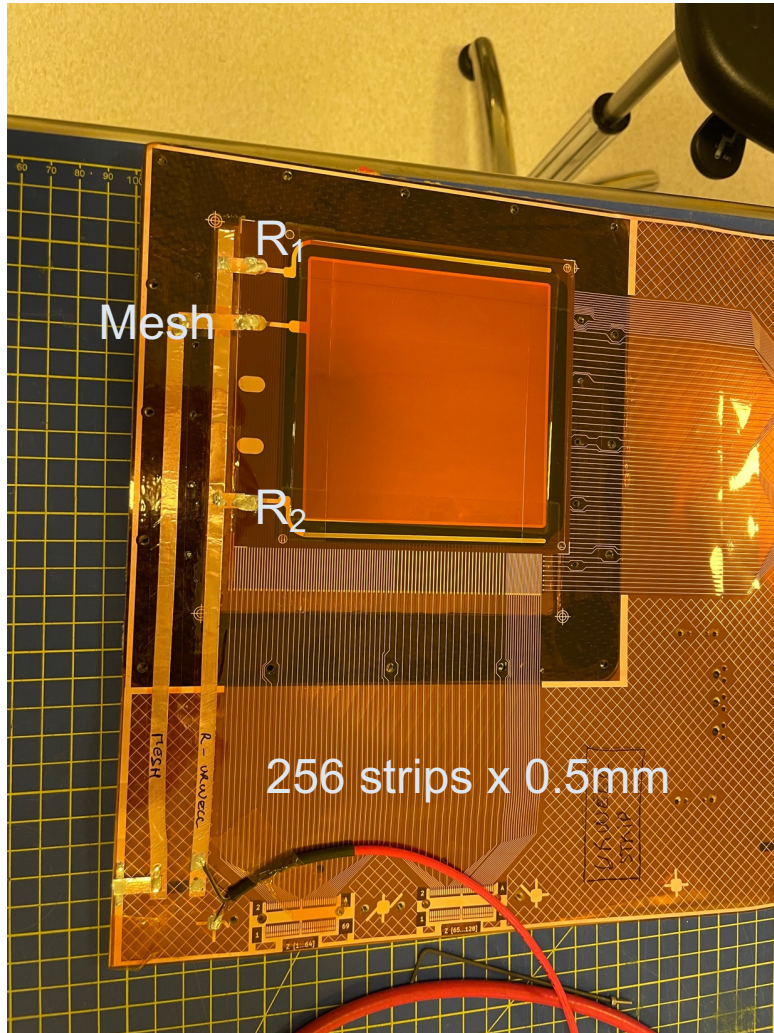


Proposed view of the hits sum on each ladder

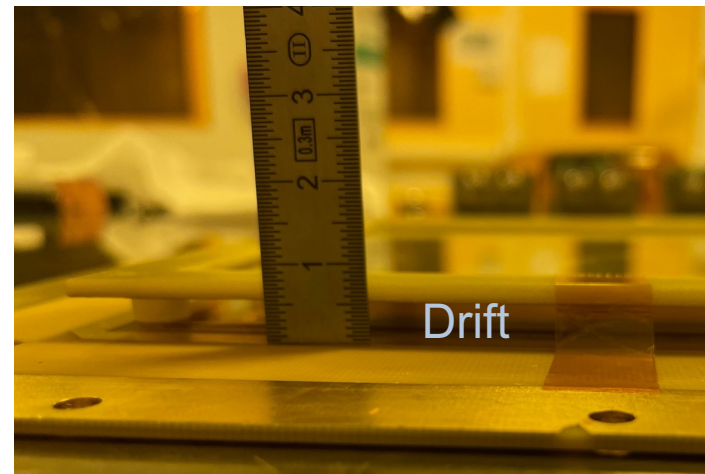


4x beam profiles before alignment⁸

μ Rwell + RD4 and RD3



Glued using a vacuum press with glue film



Conditions :

Gaz :

5% isobutane (0.2 ln/h)
95% Argon (3.8 ln/h)

HV typical :

Drift 400V

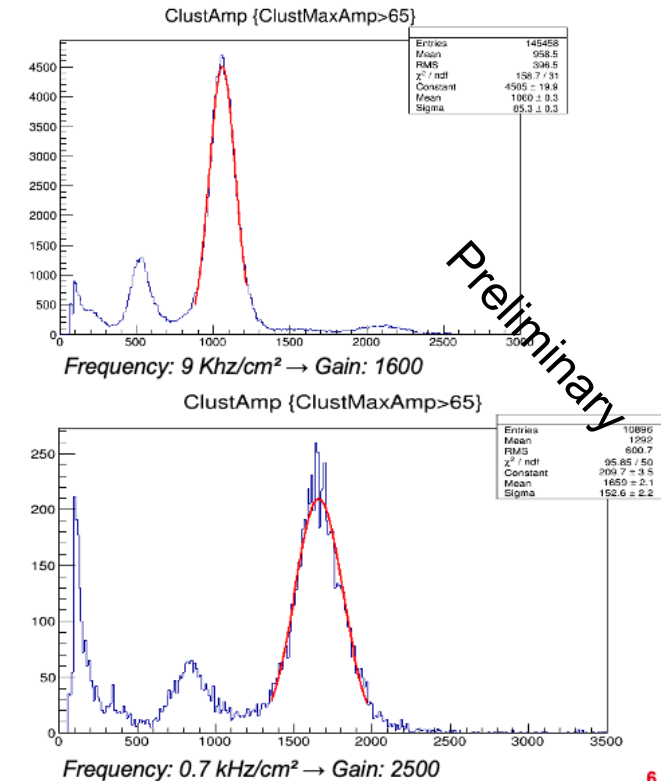
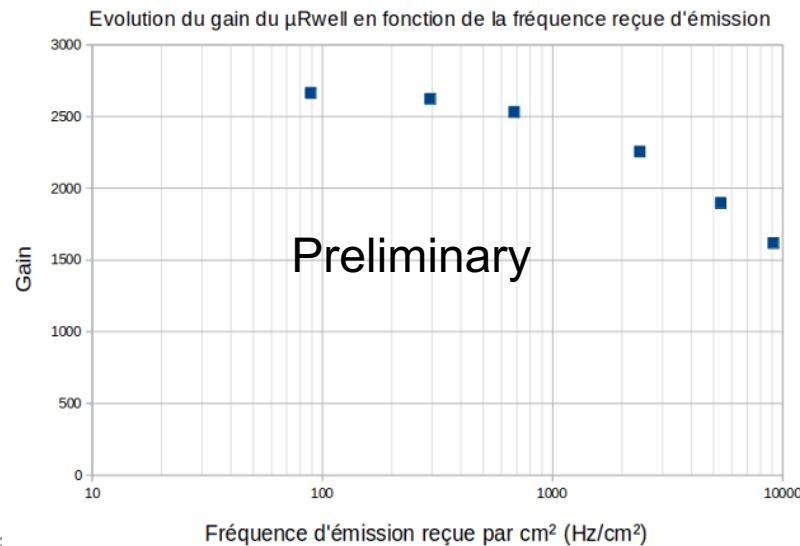
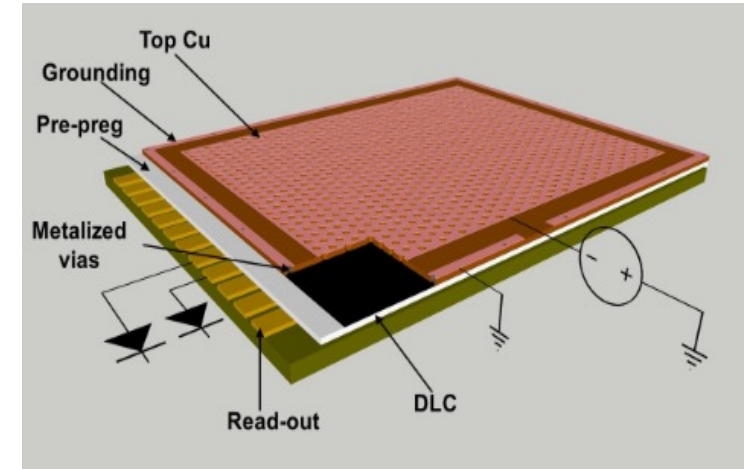
Resistif -320V

Mesh 40V

μ Rwell or Micromegas for P2

Urwell :

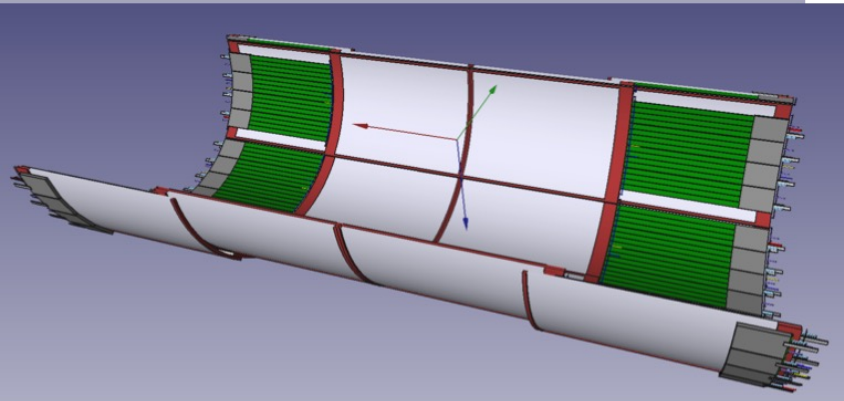
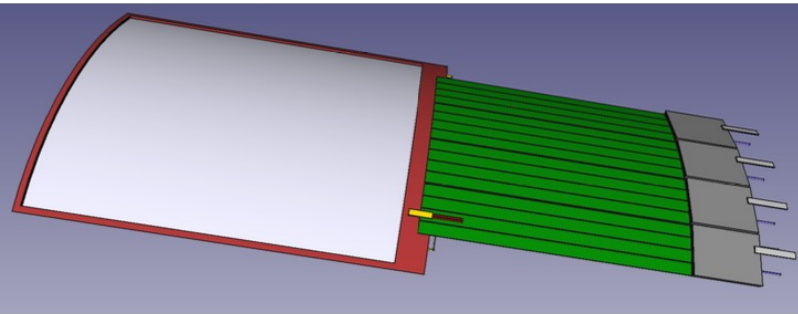
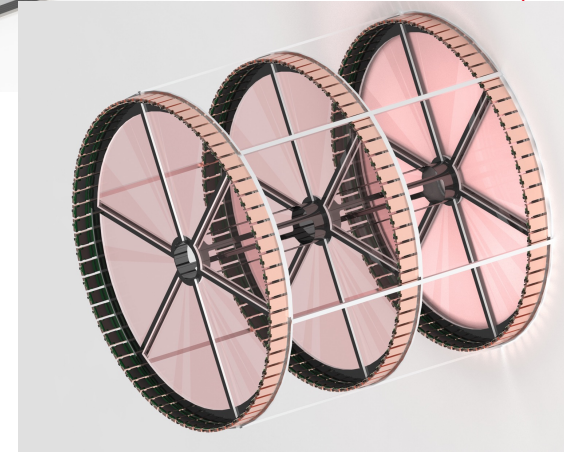
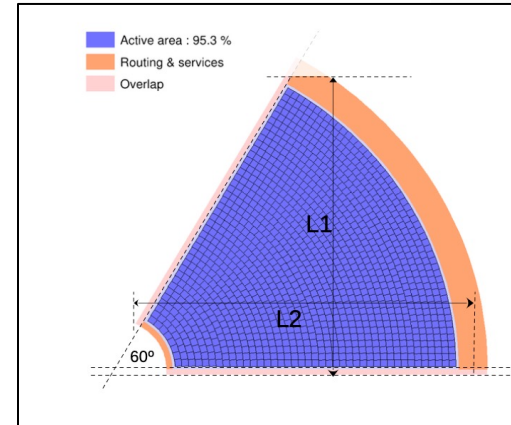
- +
 - Great energy and spatial resolution
 - Easy to integrate
 - Similar X0
- - urwell production not possible at Saclay
 - Large cluster size not compatible with P2
 - Large size to be proven to be workable
 - Gain decreases from 1kHz/cm on our prototype (20kHz/cm expected at P2)



Next at Saclay's MPGD lab

1. P2 : BASket

1. Full P2 design + prototyping (2024)
2. 6x3 60x60cm sail tracker detectors (2025)



EIC : Electron Ion Collider, EPIC at BNL

1. Full scale cylindrical prototype for 2024
2. 40 XY Barrel detectors for EPIC 2025-2027

Others :

1. CLAS12 barrel spare production ?
2. Picosec, R&D, Tomography, Glass ...

Thanks Ioanis !

