

DRD1 Workshop

Production at MPT workshop



Adam Drozd, Warsaw 09/10/2025

Outline

Micro pattern technologies workshop

activities

staffing and infrastructure

Recent large size productions

HCAL Resistive Micromegas high-rate detector

HCAL μ Rwell high-rate detector

μ Rwell for EIC ePIC BOT (barrel outer tracker)

CLAS 12 μ Rwell 1 D

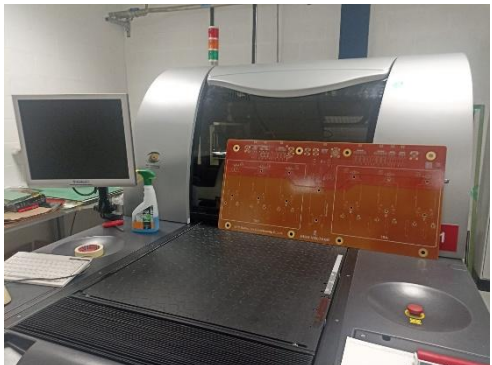
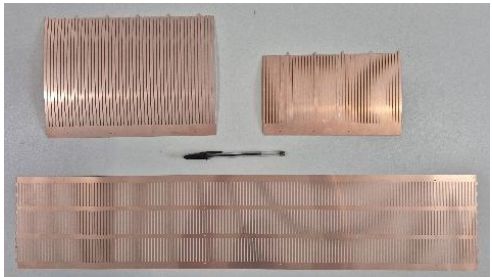
Future

Polyamide etching machine

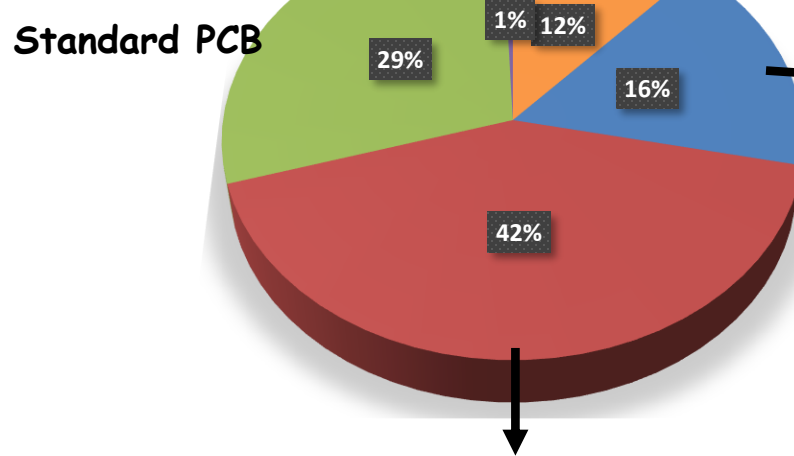
MPT activities

Components for the LHC machine

Flexible quench heater (up to 14m long)
Magnetic sensors for calibration
RF fingers
Many chemical milling



Standard PCB



Inner trackers components

ATLAS ITK inner tracker long buses (1.4 x 0.15m)
~1000 pieces
ATLAS ITK forward power tapes
ATLAS ITK pig tails and PPO flex rigid boards



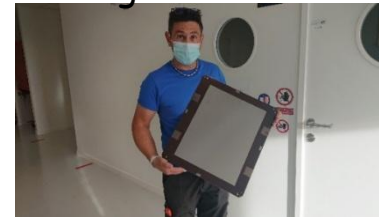
GEM

Compas
CMS: GE2.1, ME0; GE1.1
PRAD II (1.5x0.5m)
TOTEM
LHCb
Phoenix TPC (Brookhaven)
SBS tracker and EIC (Jefferson Lab)



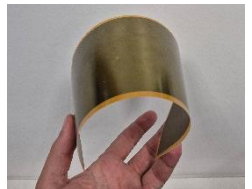
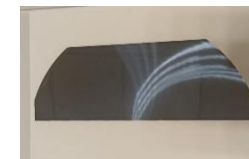
Production

Resistive BULK Micromegas
uRwell
uRgroove
Pico Sec



Heavy R&D program

uRwell large size detectors
Capacitive sharing detectors
High-rate detectors (MM & uRwell)
Resistive GEMs
Fast timing detectors
Low mass
uGroove
embedded silicon chips -> 27x10 cm



MPT staffing and infrastructure

MPT Human resources

Rui de Oliveira -> Adam Drozd

- 23 persons:

15 persons from

a contracting company

8 CERN staff

Wet processing Area

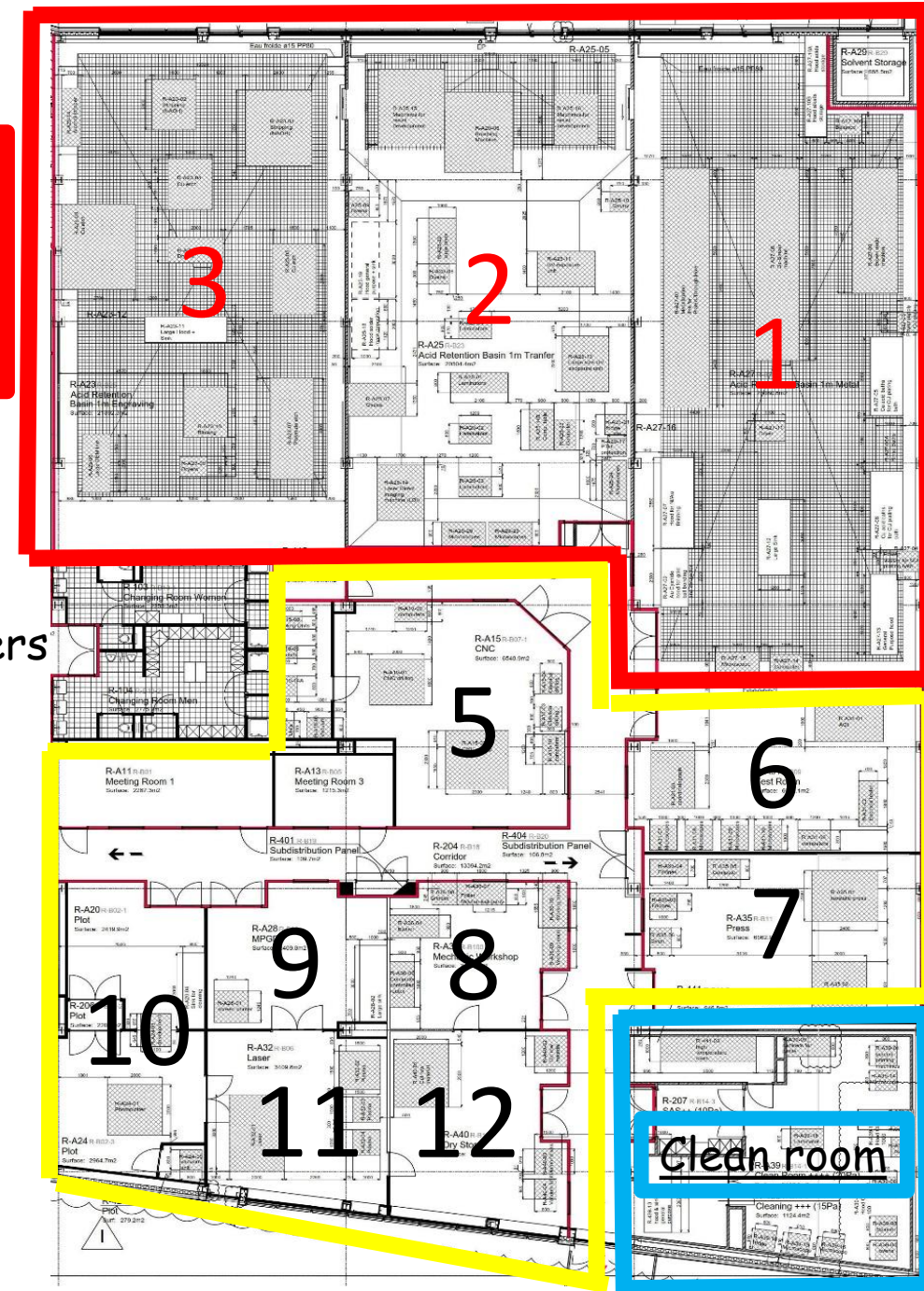
- 1 Plating facility
- 2 Photo processes
- 3 Chemical Etching

Building 107

- Meyrin site
- 1400 square meters
- moved in 2018

Dry processing Area

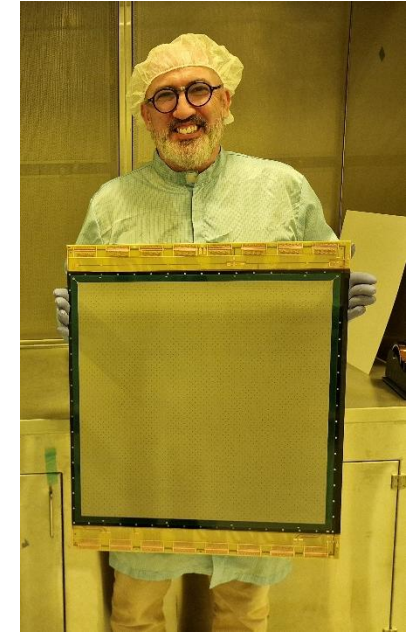
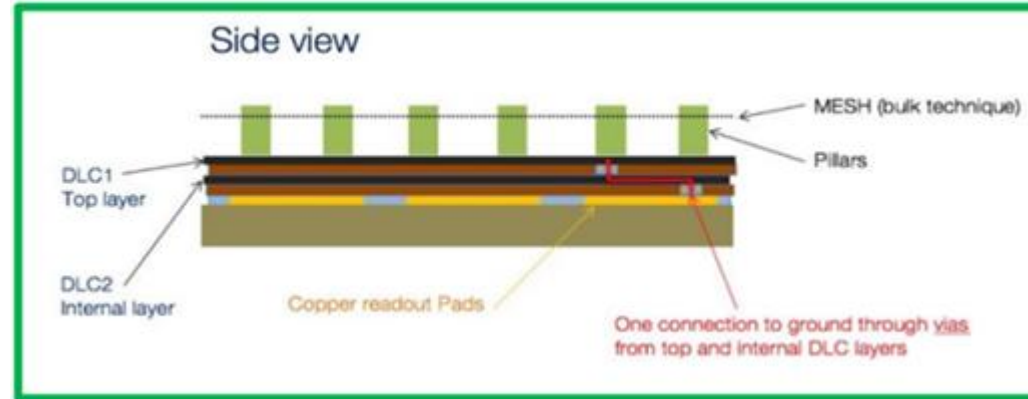
- 5 Drilling/milling
- 6 Test
- 7 Pressing
- 8 GEMs
- 9 Chemical analysis
- 10 Photo mask lab
- 11 Vacuum deposition
- 12 Dry store



HCAL - Resistive Micromegas high-rate detector

Double SBU DOT structure

- DLC 20 to 40M
- outer size : 70cm x 54cm
- active area : 50cm x 50cm
- pads 11.1mm x 11.1mm pitch
- 2025 Pads



copper top
resistive DLC
polyimide bottom

After vacuum gluing



Prepreg

PCB from ELTOS

plating



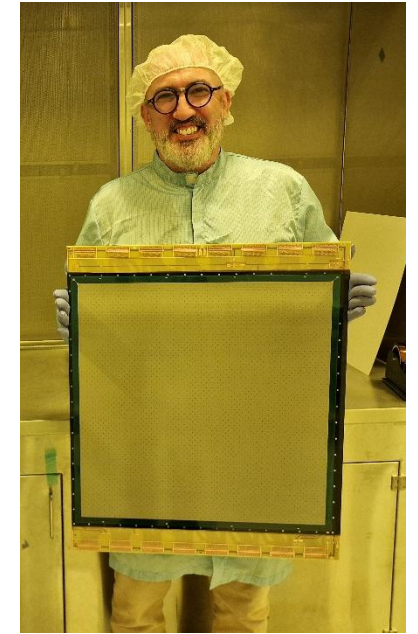
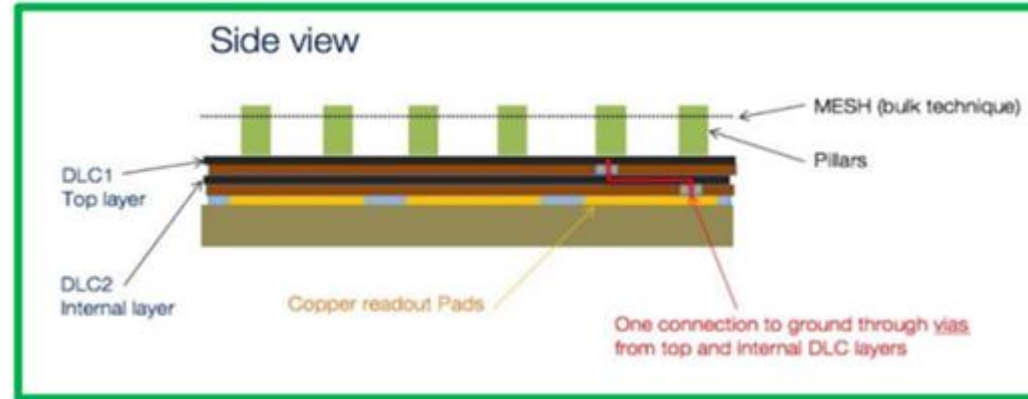
Drilling



HCAL - Resistive Micromegas high-rate detector

Double SBU DOT structure

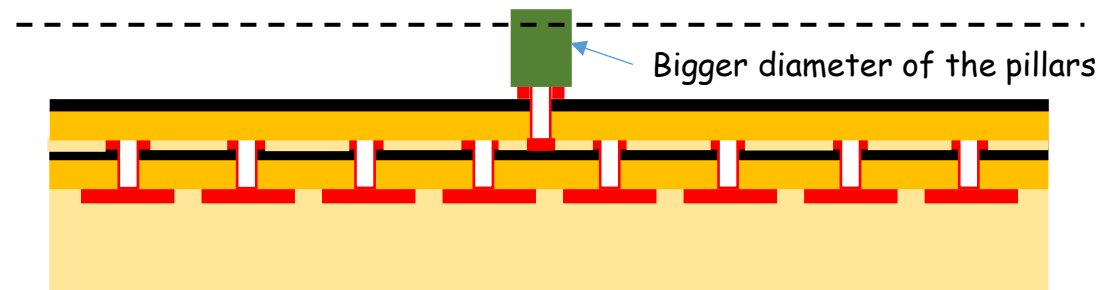
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After vacuum gluing

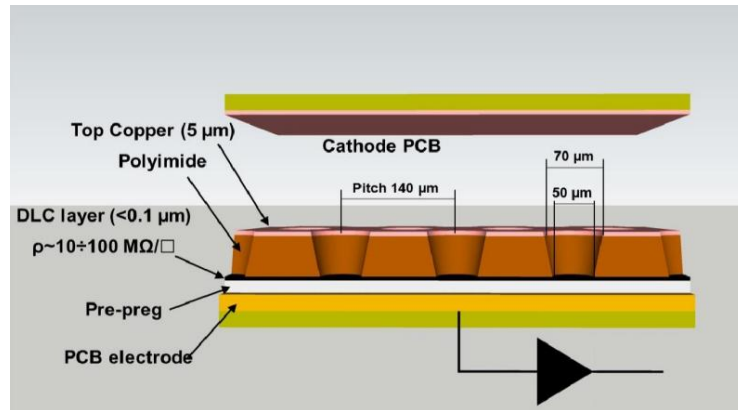
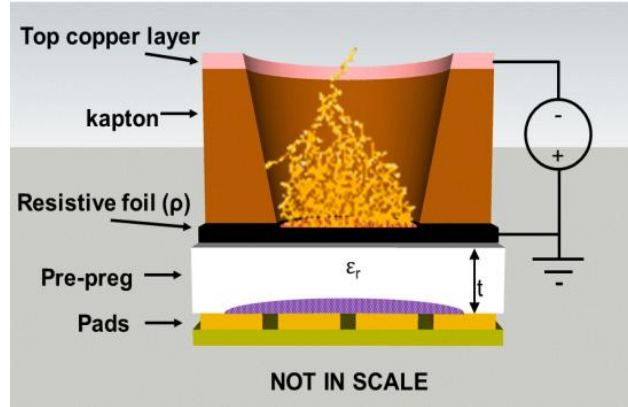


After copper etching,
Palting, "bulkage"



Micro Resistive Well

Principles



Production steps

Polyimide coated foil: copper top ,
resistive DLC layer bottom



Any PCB or flex with any kind of R/O structure
X/Y , UVW , Pads, Capacitive sharing etc..



After vacuum gluing



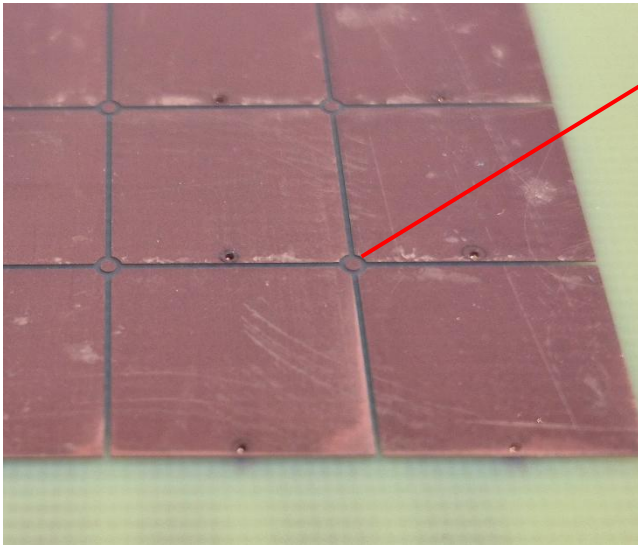
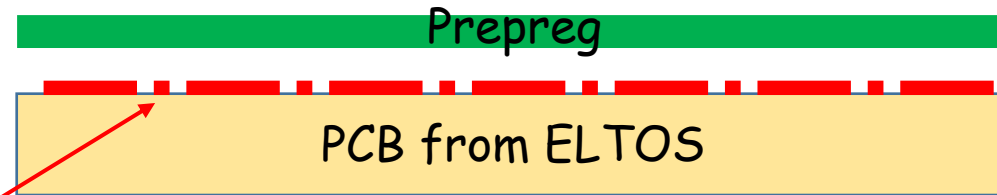
'Wellized' with GEM process



HCAL μ Rwell high-rate detector

DOT evacuation structure

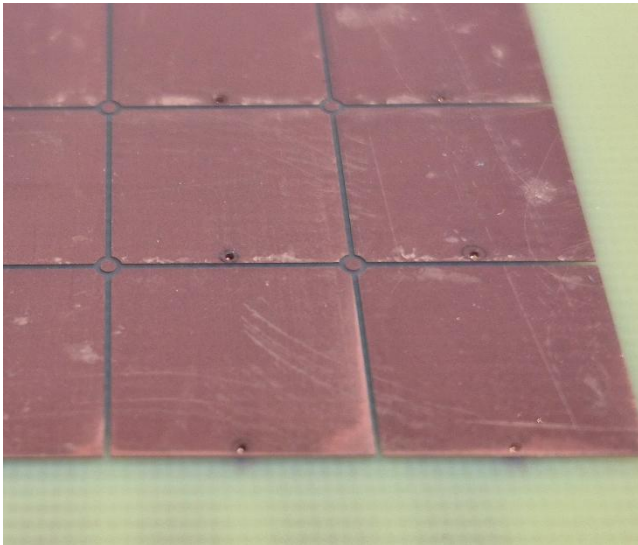
- DLC 40 to 80M
- outer size : 70cm x 54cm
- active area : 50cm x 50cm
- pads 11.1mm x 11.1mm
- 2025 Pads



HCAL μ Rwell high-rate detector

DOT evacuation structure,
connected to back shielding

- DLC 40 to 80M
- outer size : 70cm x 54cm
- active area : 50cm x 50cm
- pads 11.1mm x 11.1mm
- 2025 Pads

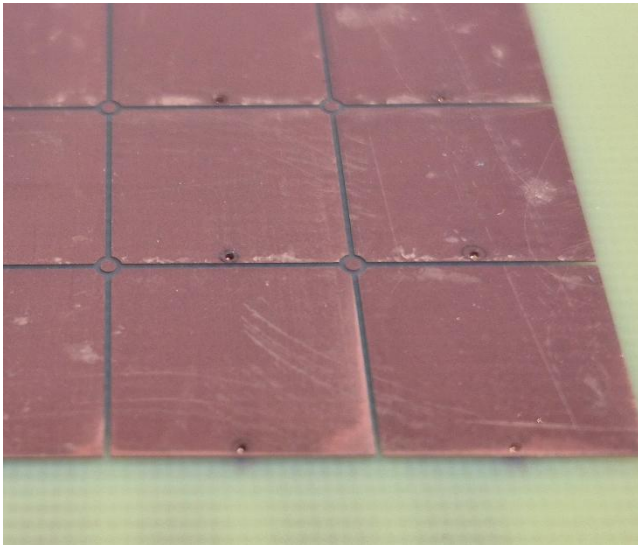


HCAL μ Rwell high-rate detector

DOT evacuation structure,
connected to back shielding

- DLC 40 to 80M
- outer size : 70cm x 54cm
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- 2025 Pads

After vacuum gluing

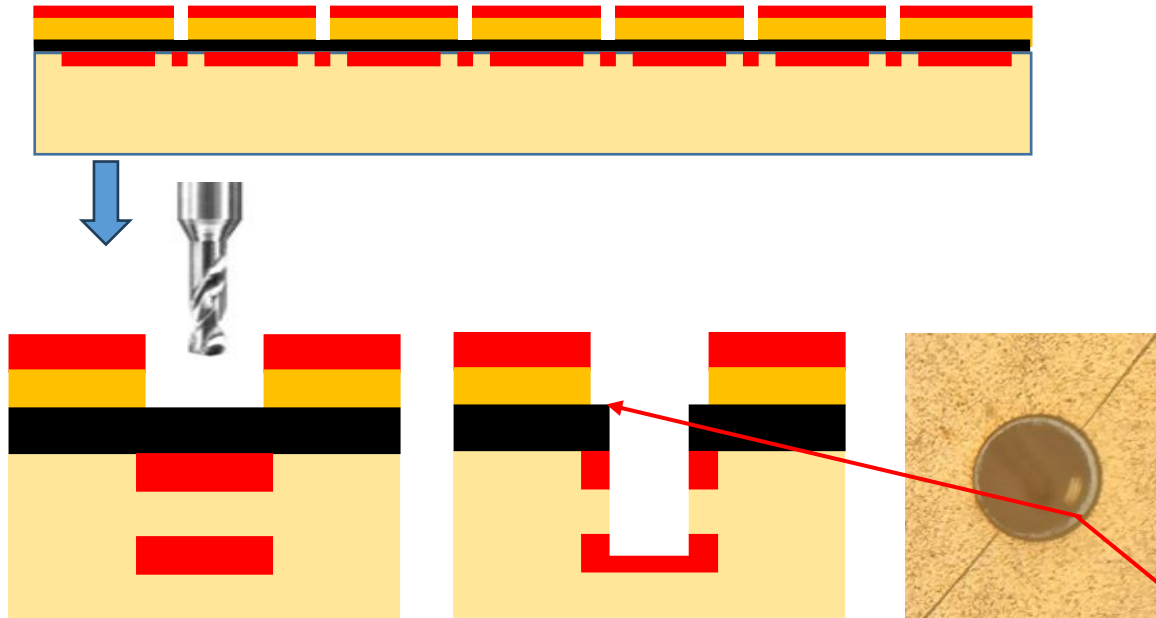


HCAL μ Rwell high-rate detector

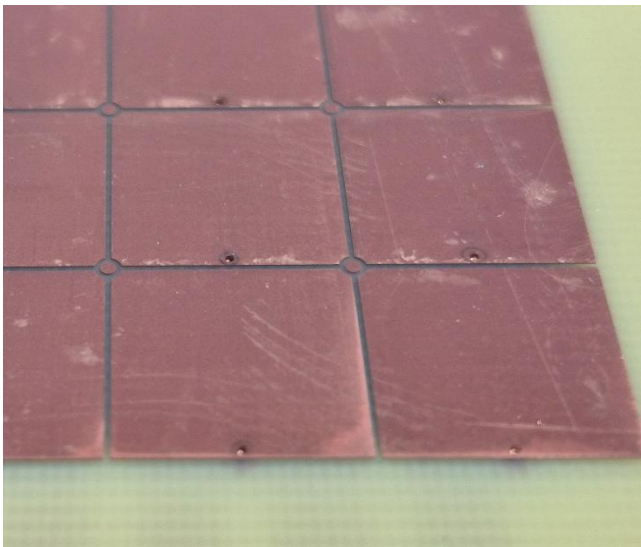
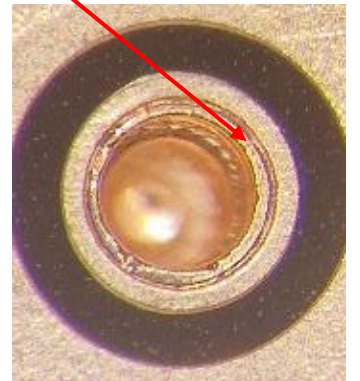
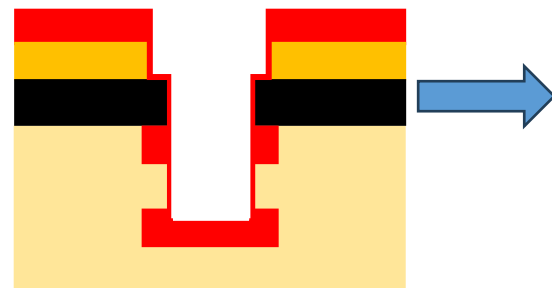
DOT evacuation structure,
connected to back shielding

- DLC 40 to 80M
- outer size : 70cm x 54cm
- active area : 50cm x 50cm
- pads 11.1mm x 11.1mm
- 2025 Pads

After copper and Kapton etching



After plating

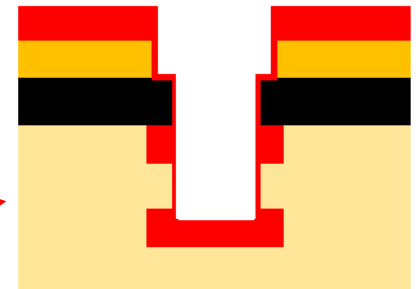
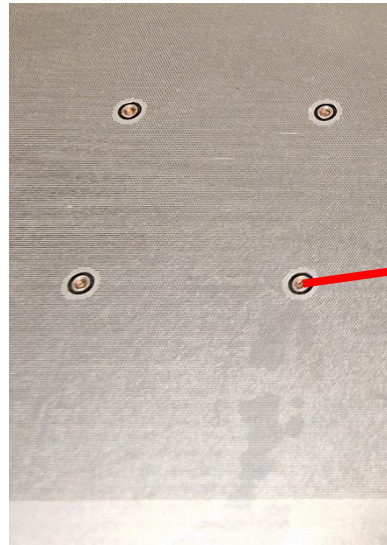
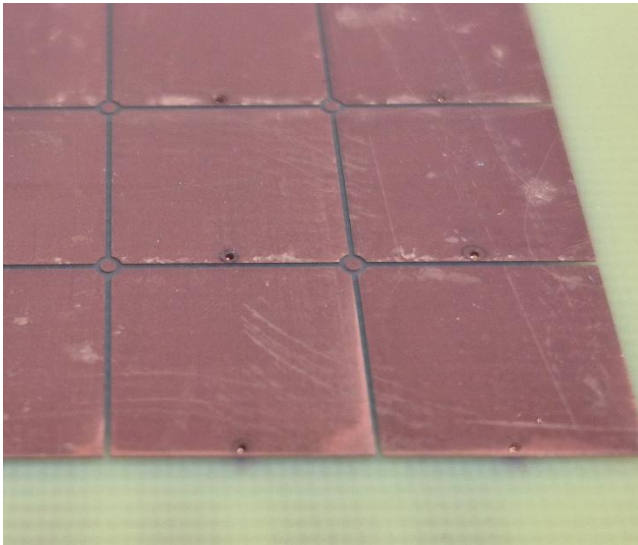
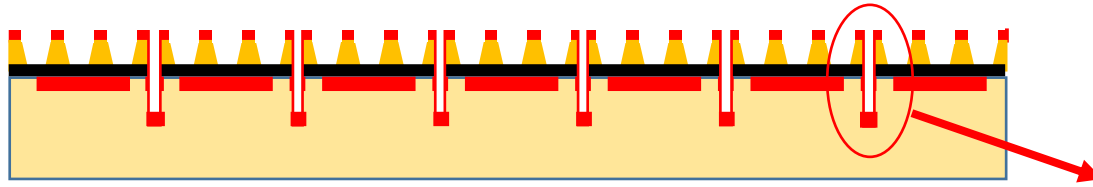


HCAL μ Rwell high-rate detector

DOT evacuation structure, connected to back shielding

- DLC 40 to 80M
- outer size : 70cm x 54cm
- active area : 50cm x50cm
- pads 11.1mm x 11.1mm
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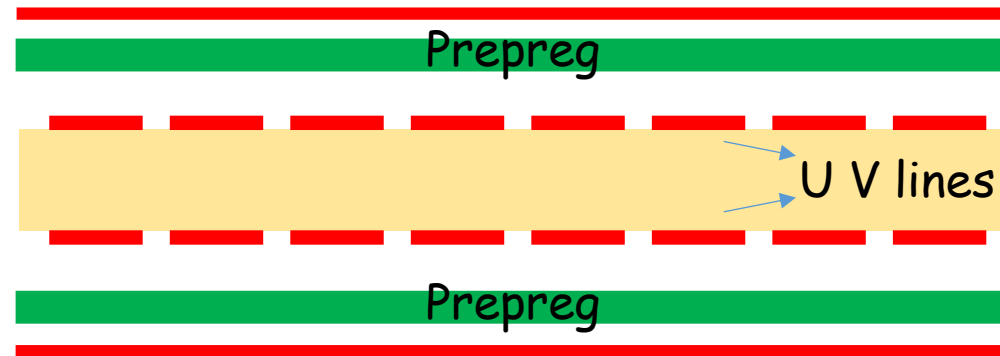
'Wellized' with GEM process



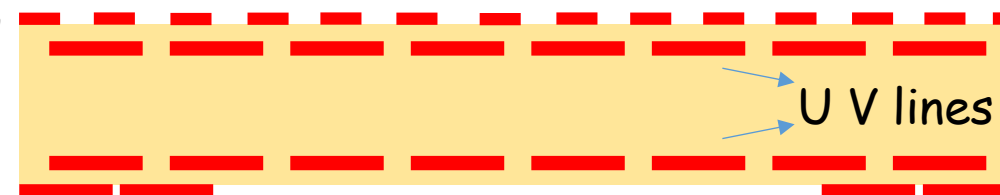
μ Rwell for EIC ePIC

μ Rwell active area 1700mm x 340mm

- 40-80 M Ω /square DLC resistive layer
- 2 capacitive sharing layers
- UV RO strips pitch 0,8



After Autoclave gluing
and copper patterning



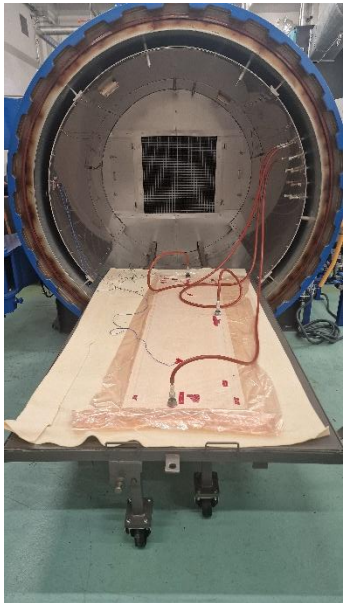
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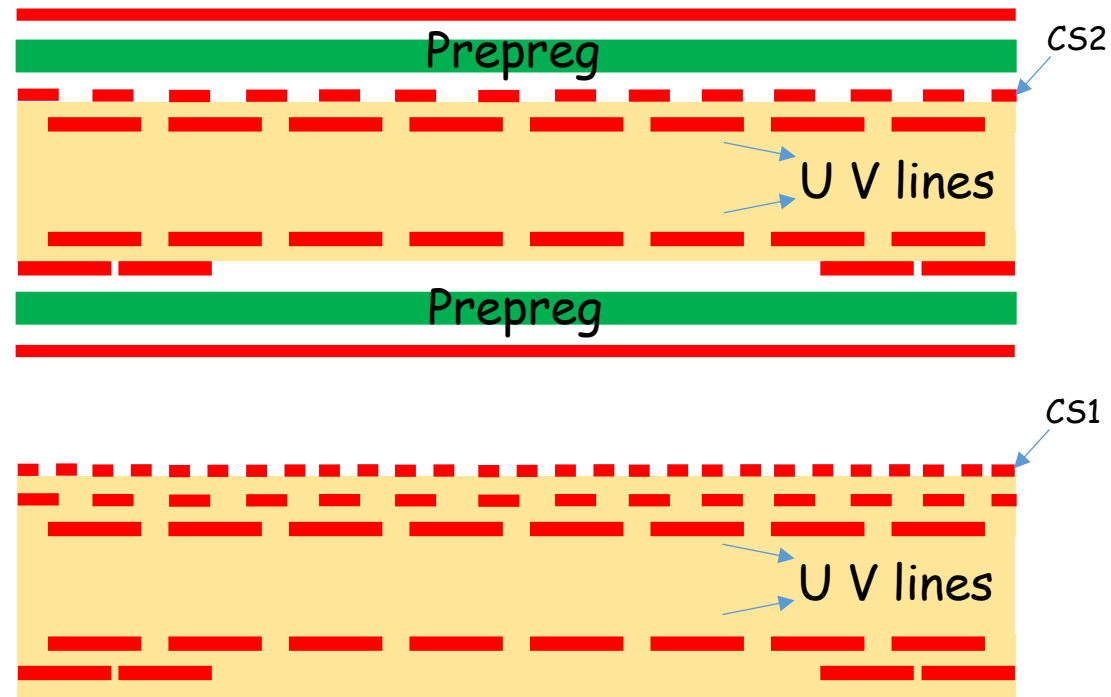
μ Rwell for EIC ePIC

μ Rwell active area 1700mm x 340mm

- 40-80 M Ω /square DLC resistive layer
- 2 capacitive sharing layers
- UV RO strips pitch 0,8



After 2nd Autoclave
gluing and copper
patterning



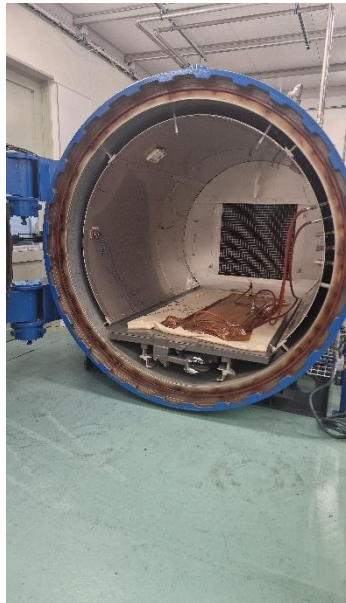
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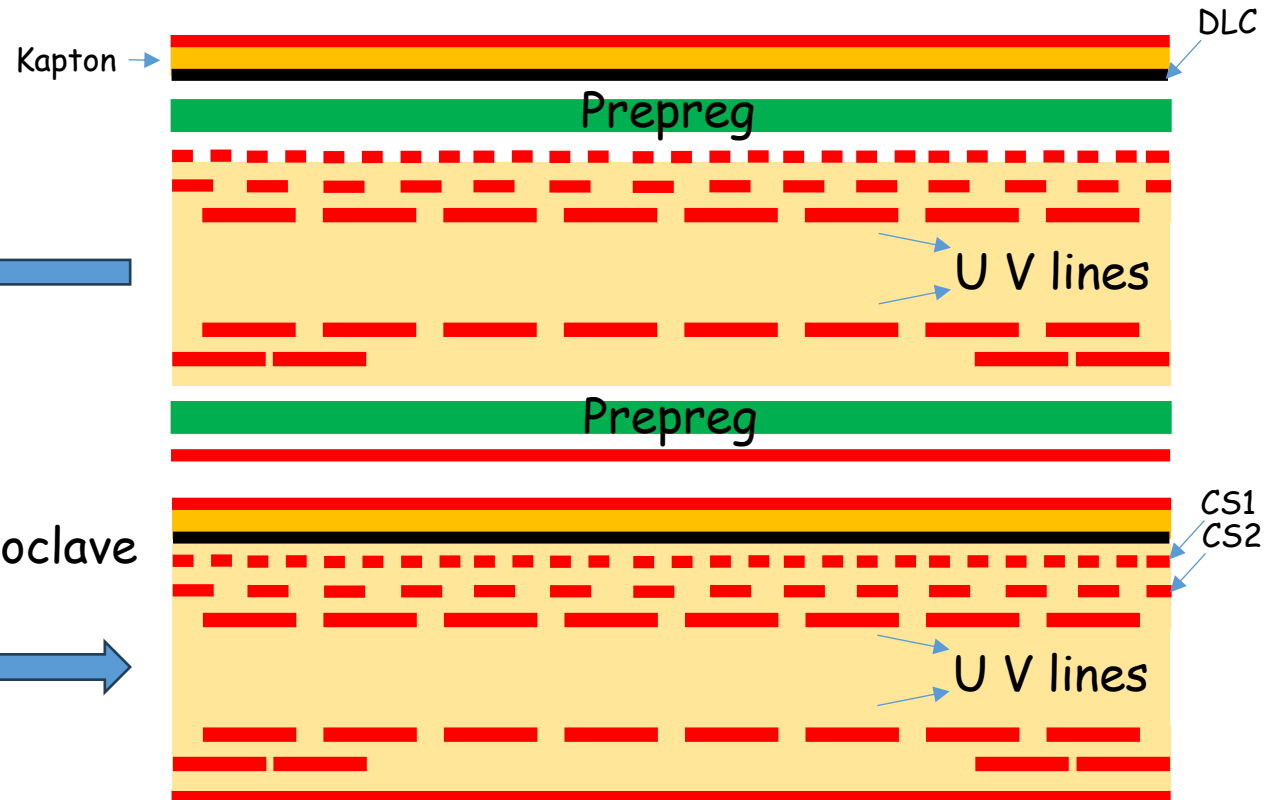
μ Rwell for EIC ePIC

μ Rwell active area 1700mm x 340mm

- 40-80 M Ω /square DLC resistive layer
- 2 capacitive sharing layers
- UV RO strips pitch 0,8



After 3rd Autoclave
gluing



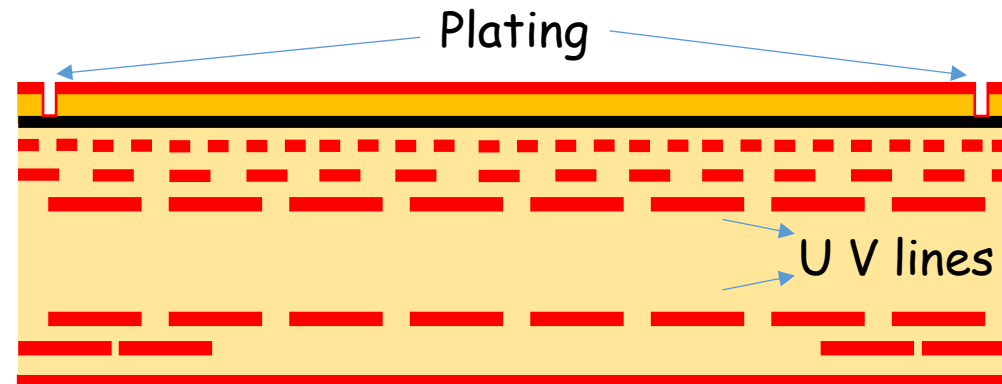
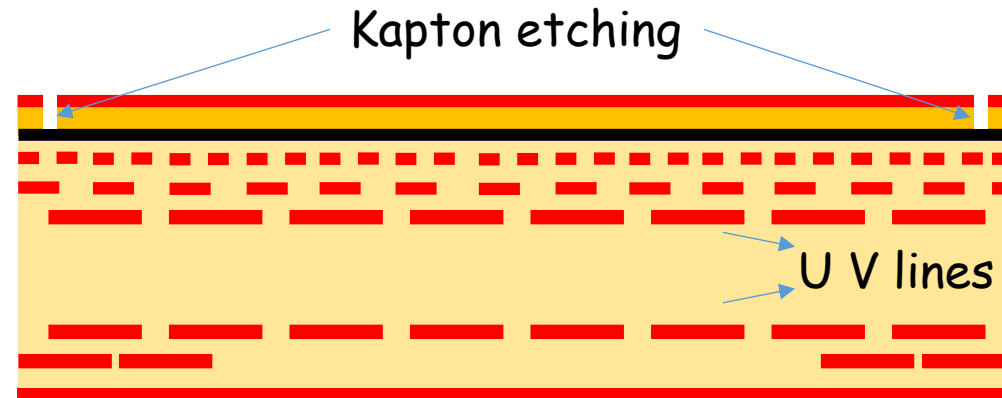
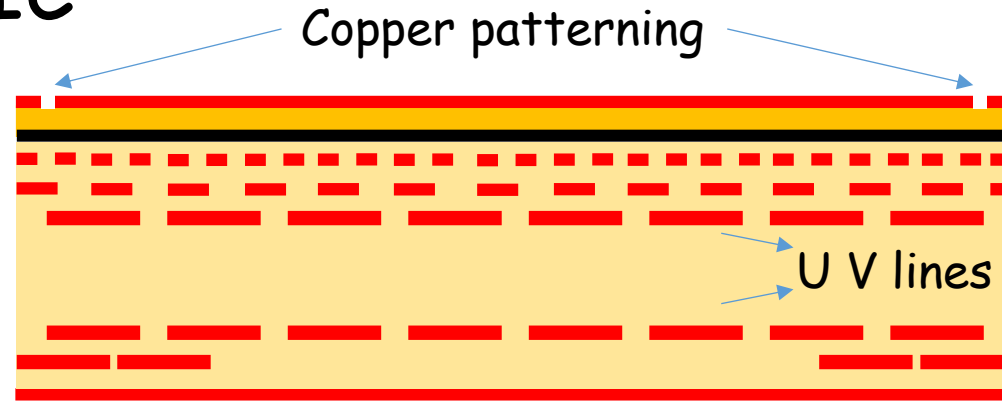
Not in scale



μ Rwell for EIC ePIC

μ Rwell active area 1700mm x 340mm

- 40-80 M Ω /square DLC resistive layer
- 2 capacitive sharing layers
- UV RO strips pitch 0,8



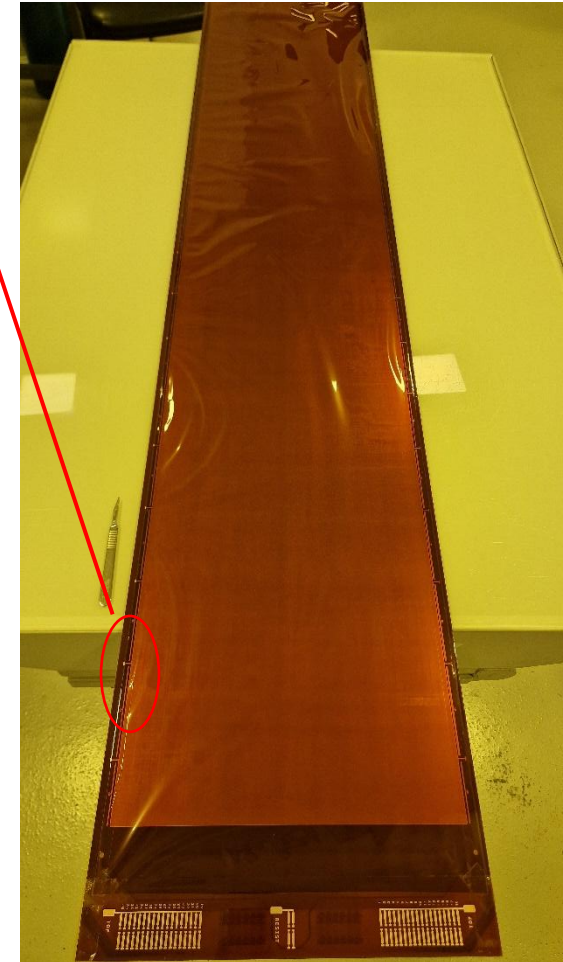
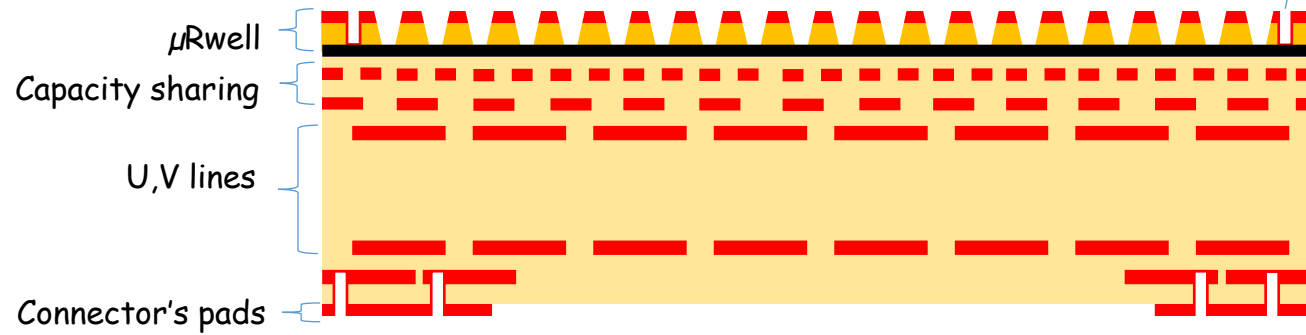
Not in scale



μ Rwell for EIC ePIC

μ Rwell active area 1700mm x 340mm

- 40-80 M Ω /square DLC resistive layer
- 2 capacitive sharing layers
- UV RO strips pitch 0,8

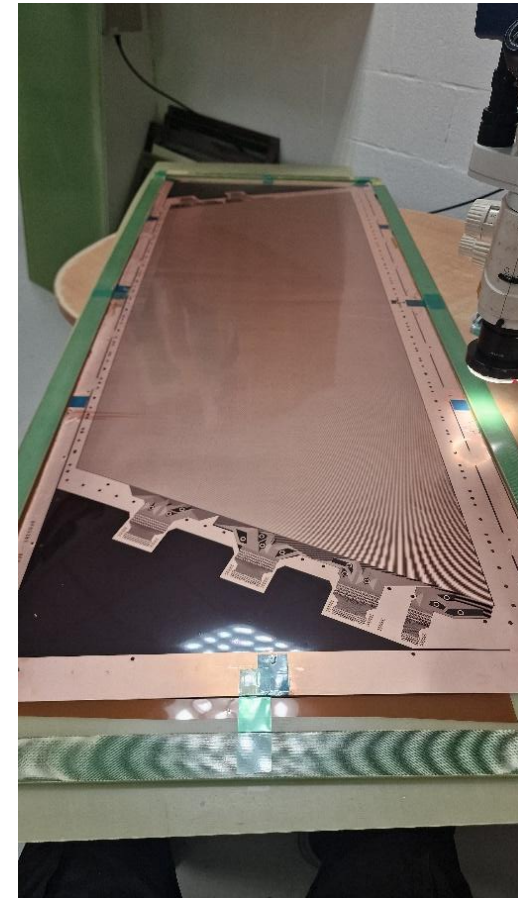
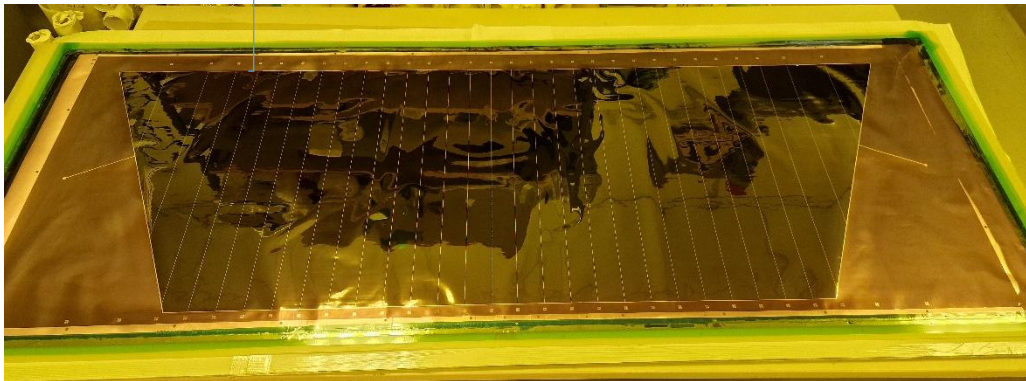
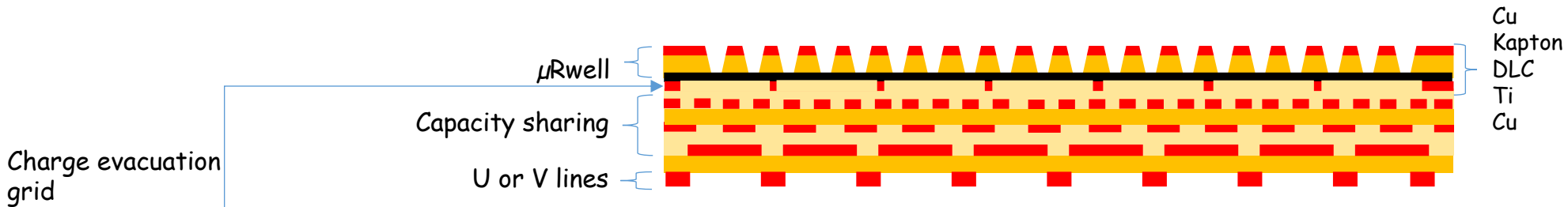


Not in scale

CLAS 12 μ RWell 1 D

1,56 x 0,55m total size μ Rwell detector

- 20 to 70 Mohms/square DLC resistive layer
- Charge evacuation with strips
- 3 capacitive sharing layers
- V or U readout 1 mm pitch
- Total detector thickness lower than 300um



Future - Polyimide etching machine

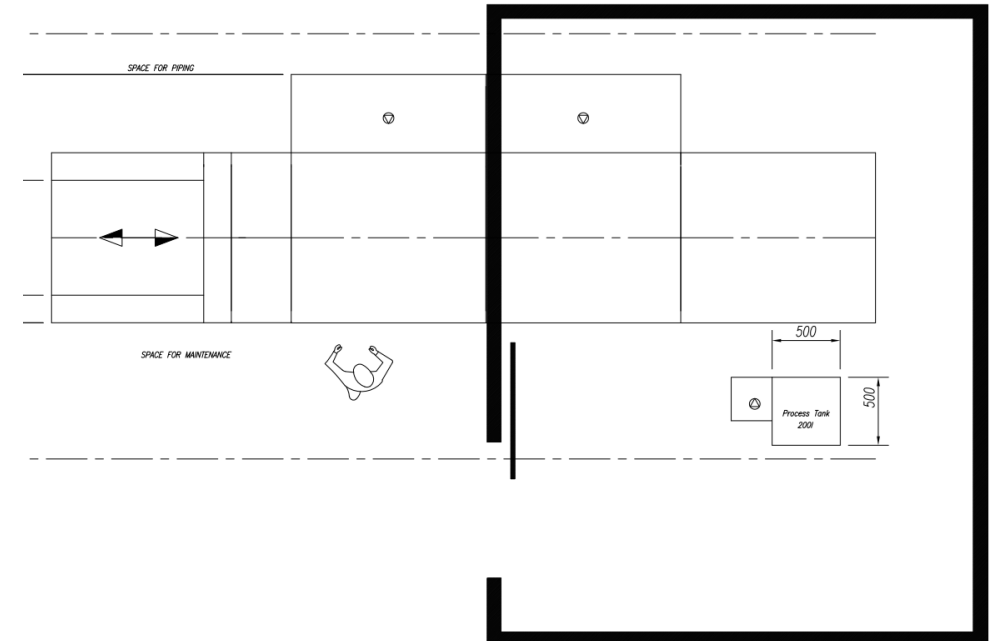
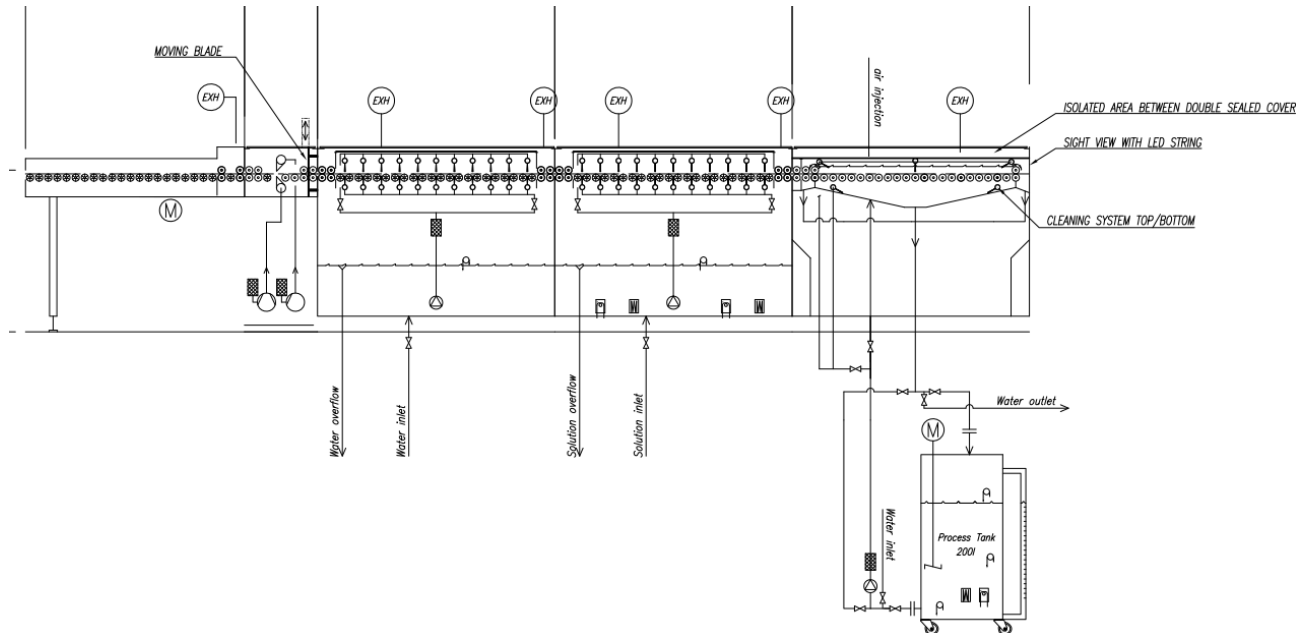
safe and easy process

accessible by every technician in the workshop

Reducing time -> cost

size $\leq 1\text{m}$ long

Not to replace dead bath but to industrialize the process

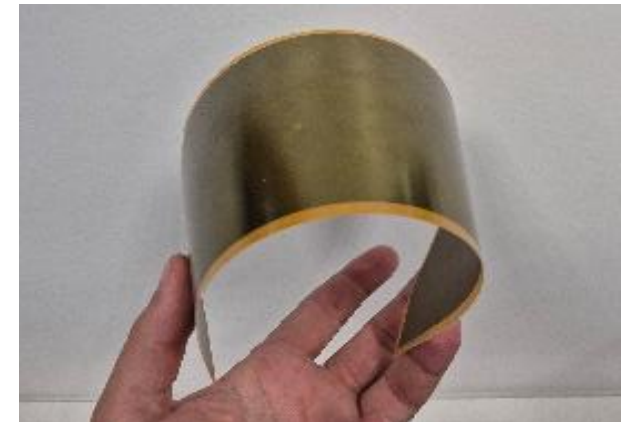
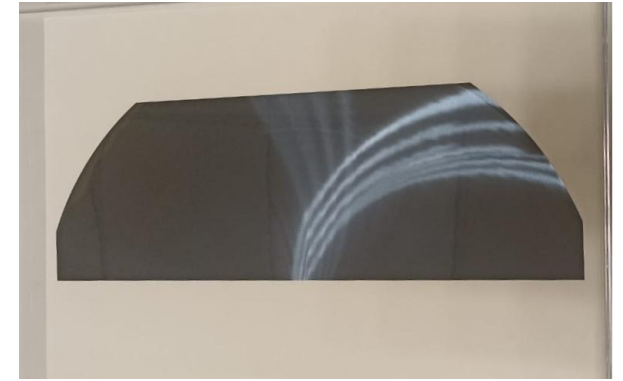
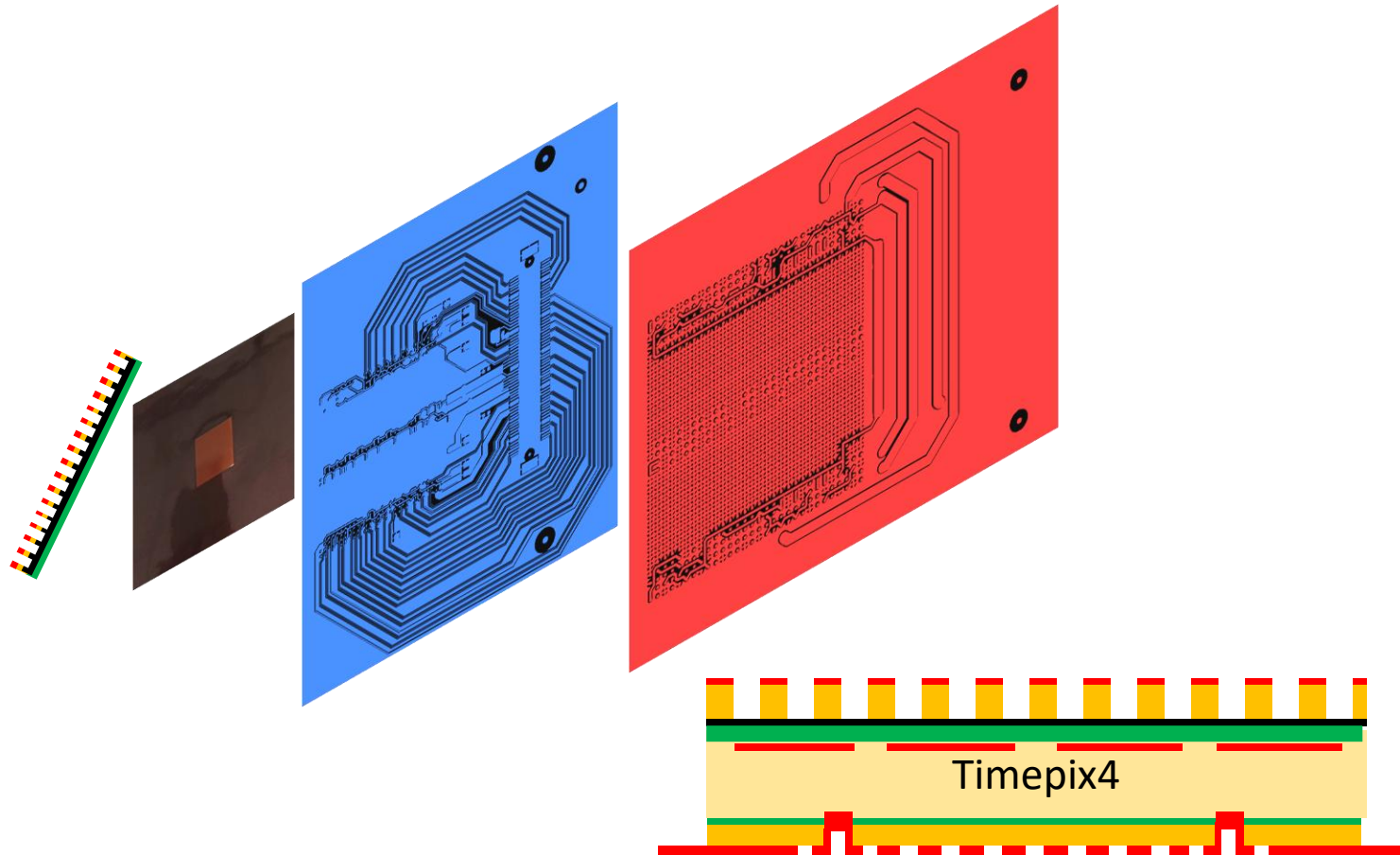


Dziękuję

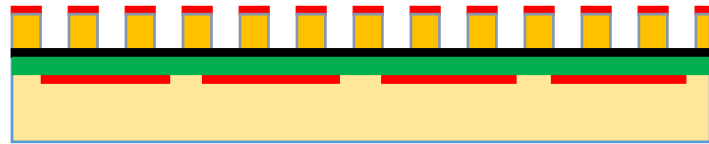
Large silicon chips 27 x 10 cm

Embedded silicon chip

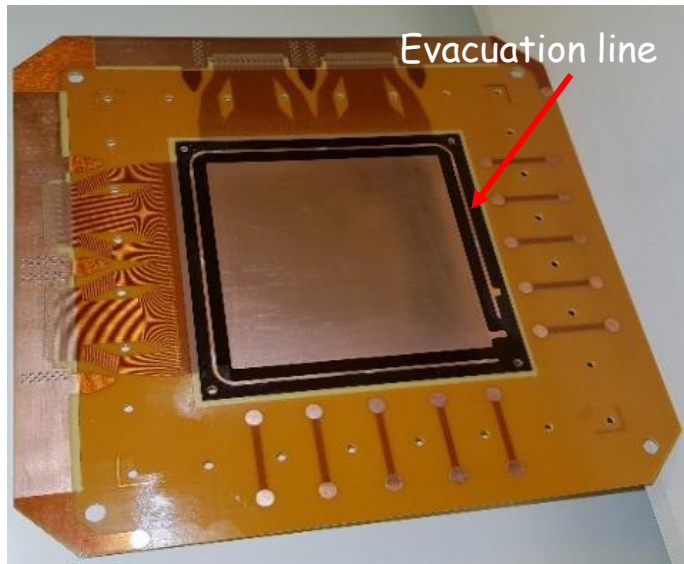
- Timepix4 (25 x 28 mm) with uRwell



Medium rate μ Rwell
Lateral evacuation of charges



- 1 DLC layer



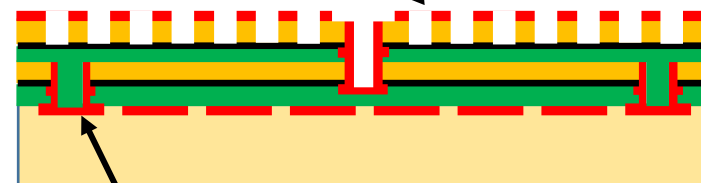
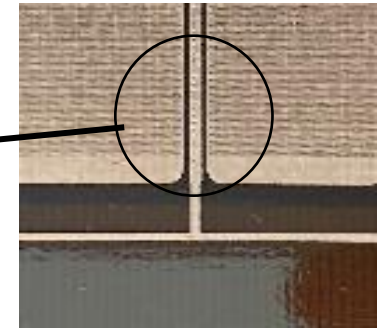
10cm x 10cm μ Rwell detector
"STD kit"

High rate μ Rwell

Charge evacuation in the active area



- DLC connected by plated grooves or holes



- 2 DLC layers connected by plated holes

