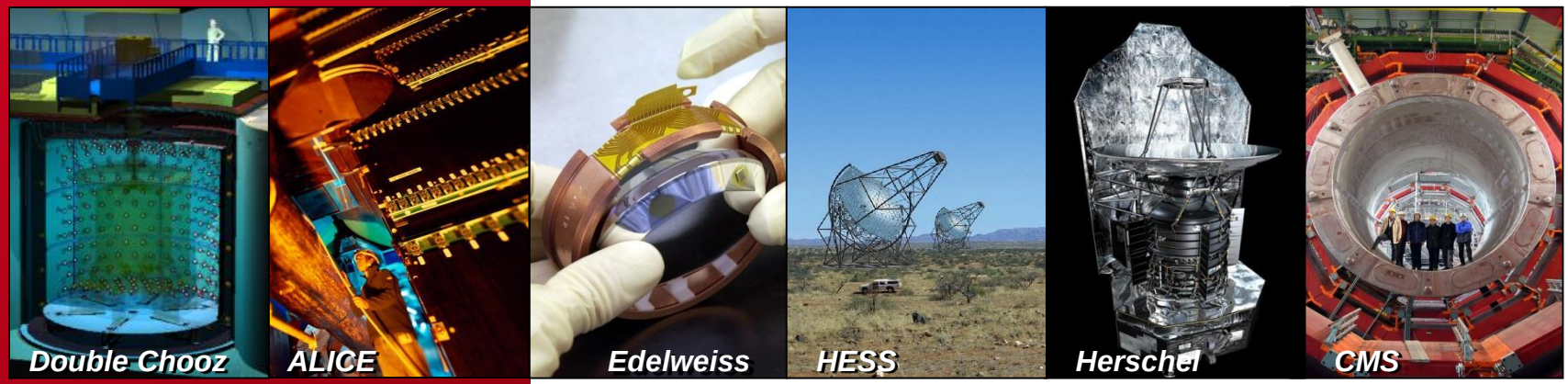
DE LA RECHERCHE À L'INDUSTRIE

CEA Saclay
MPGD Workshop



Déchiffrer les rayons de l'Univers

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18/06/2021

OUTLINE

- New lab: Big & Clean
- Resistive serigraphy
- Micromegas Bulk
- R&D

New MPDG clean room

- New laboratory since 2020.
  - Clean room 120 m² class 100.000 (ISO 5)
    - SAS of 20 m²
      - clean material / ultra sonic bath / air shower
    - Serigraphy lab of ~30m²
      - Resistive screen printing
    - Bulk and test lab of 70m²
      - Bulk process
      - Optical measurement with a Mitutoyo and cameras
      - Resitive and HV test with dry air
  - No new machine, just new lab, bigger & cleaner
    - New process for serigraphy with paste mixing.

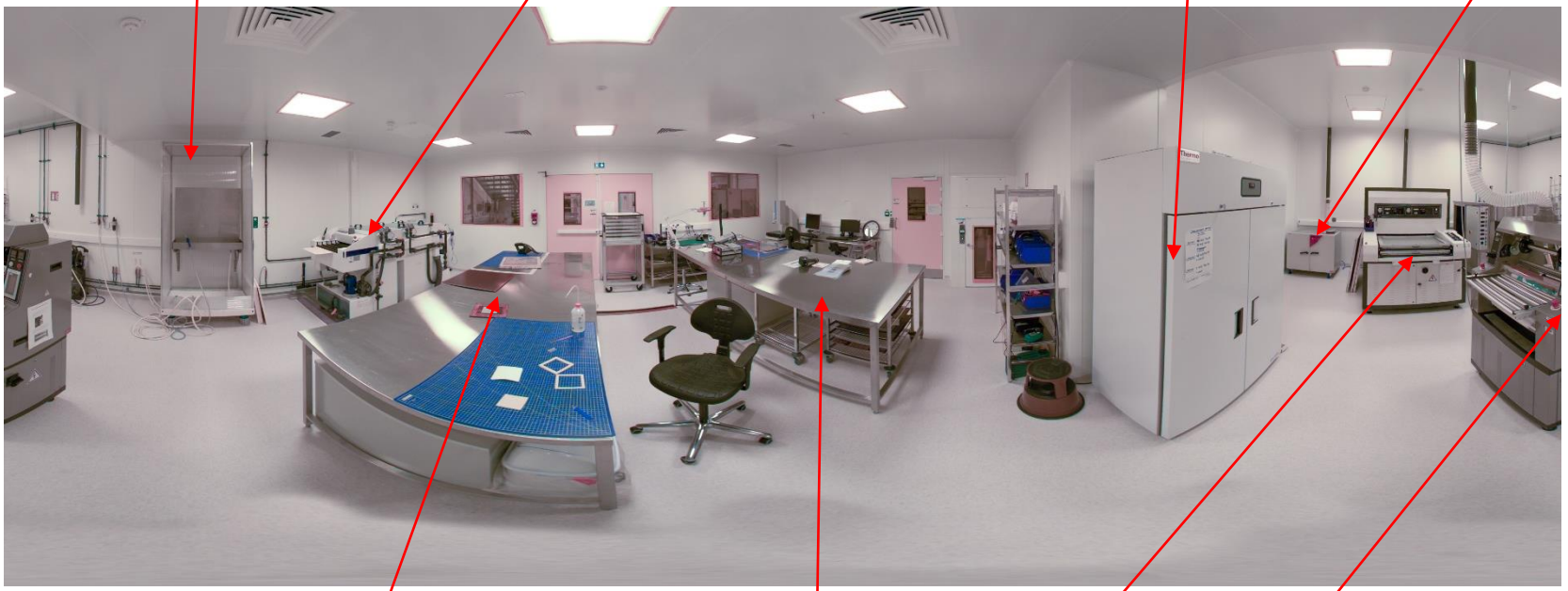
- Two new adjacent lab
  - Mesh stretching lab (preparation outside clean room)
  - Cosmic lab, cosmic bench / Fe55 bench:
    - characterization of micromegas

SERIGRAPHY LAB

- Serigraphy lab of ~30m²

BULK LAB

- Bulk lab of ~70m²

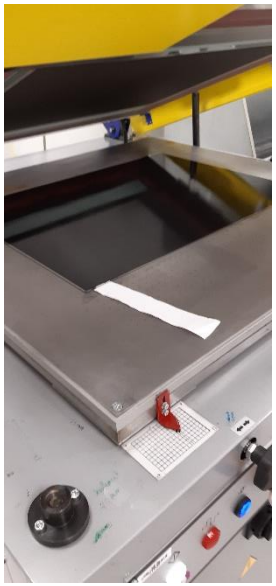


RESISTIVE SERIGRAPHY

- Serigraphy
  - ON KAPTON FOR MICROMEGAS
  - ON GLASS FOR RPC
  - POSSIBLE ON OTHER MATERIAL
- Maximum seize is ~70x70 cm² on the screen.
- Use of two brand of pastes (ESL and Loctite) with possibility to ~ adjust wanted resistivity by mixing pastes of same brand.
  - RANGE OF ~10 KOHM/□ TO 10 MOHM/□
  - USE OF BALANCE, MIXING SYSTEM, VISCOSITY MEASUREMENT
- We produce for small serial (by ~12) or prototypes.

RESISTIVE SERIGRAPHY, FAB FOR RPC

- Glass for RPC, example of production
  - SUBSTRATE OF GLASS OF 2 MM AND 0,7 MM
  - PASTE LOCTITE 80/20%, GOAL OF 3 MOHM/□
    - homogeneity +/- 0.5 Mohm/□
  - ~ 80 GLASS MADE IN ~7 DAYS



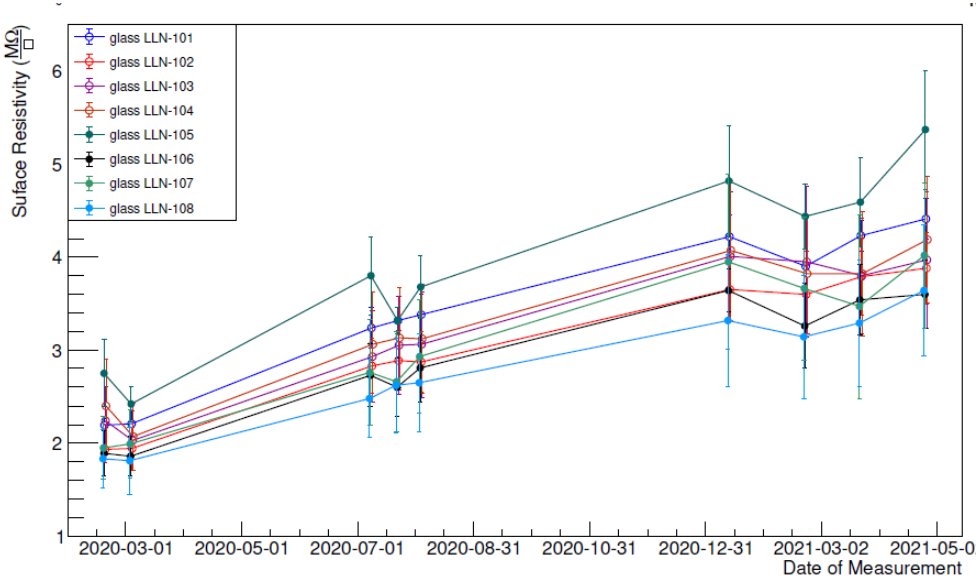
Printed !

RPC glass measurement

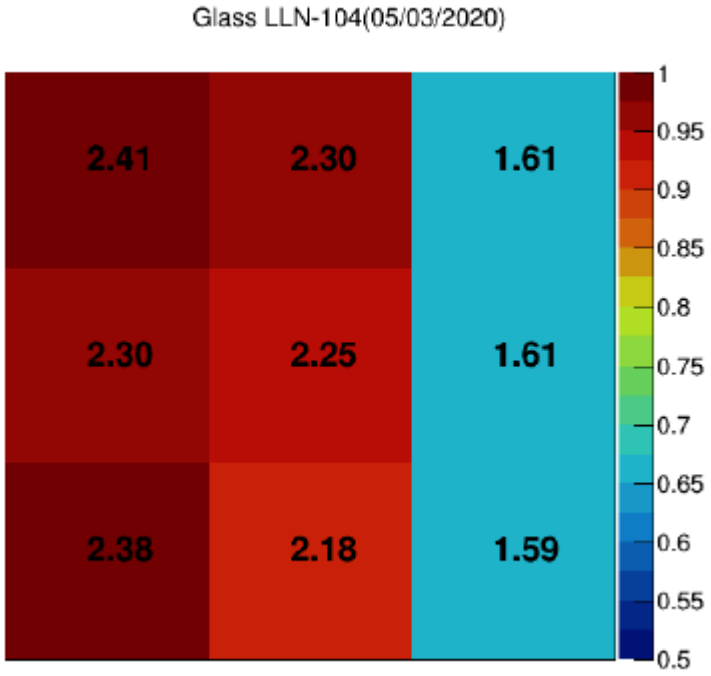
curing

RESISTIVE SERIGRAPHY, FAB FOR RPC

- Glass for RPC (E. Cortina Gil @ Louvain)
  - ~24 GLASS OF 2 MOHM/□



Aging of resistive in open lab

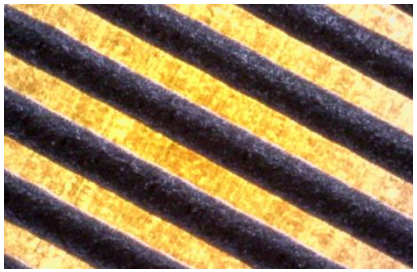


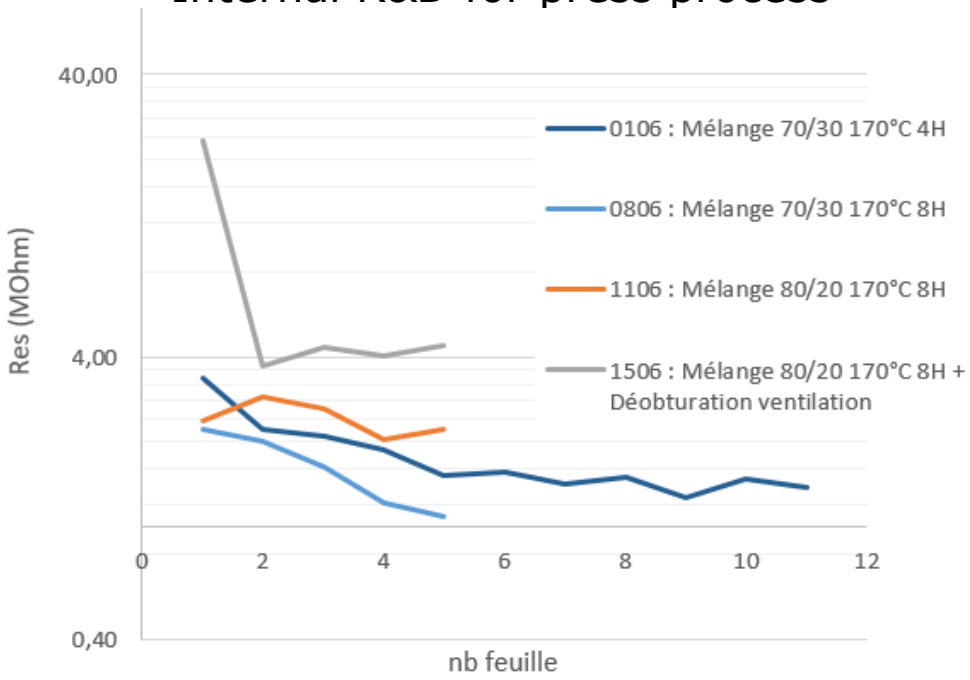
Resistive homogeneity

- Effect on humidity on RPC glass after ~18 month in lab (R goes up) !!!
  Effect removed by curing at 180°C (humidity)

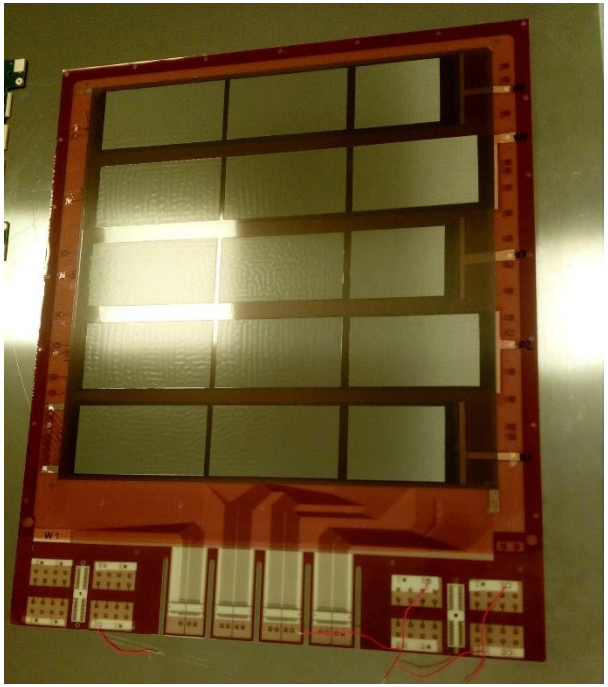
RESISTIVE SERIGRAPHY, FAB FOR MICROMEGAS

- Resistive Kapton for micromegas
  - ~ 40 GOOD FOIL MADE FOR TOMOGRAPHY & GBAR
  - SEVERAL FOIL FOR R&D PROJECT
    - Zigzag
    - Picosecond
    - Internal R&D for press process





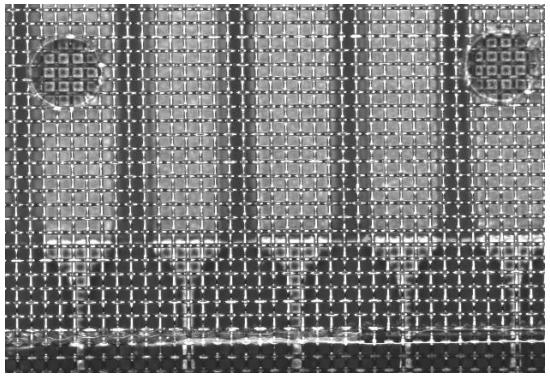
Resist measurement



BIZ detector with 5 different resistive area, 3 diif. pitch (total 40x40 cm²)

MICROMEGAS BULK

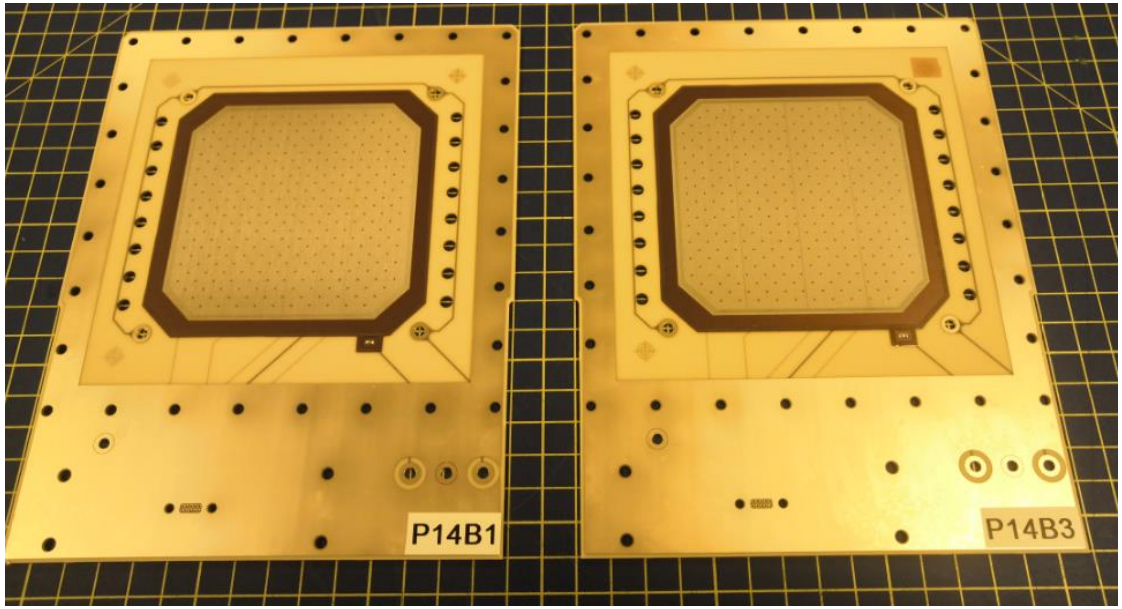
- Goal: attachment of mesh to a PCB with lamination/ lithography / development = bulk
- Maximum seize: 60x70 cm²
- Standard mesh is woven (SDC 45/18)
  - THIN MESH TESTED OK FOR SMALL SURFACE
- Capability to produce ~3 large bulk/day max.
- Possible bulk of small PCB at the same time
- PCB with connector OK (max thickness 12 mm)



Mesh area with 2 pillars of ~ 300 µm

BULK, SERIAL FOR NBLM

- For nBLM @ ESS we manufactured bulk readout for neutron detection
  - MORE THAN 50 BULK MANUFACTURED / TESTED
  - Bulk seize, 15x20 cm², bulk 9 at a the same time.
  - MORE TO COME IF OTHER EXPERIMENT FOR NEUTRON DETECTION ON ACCELERATOR

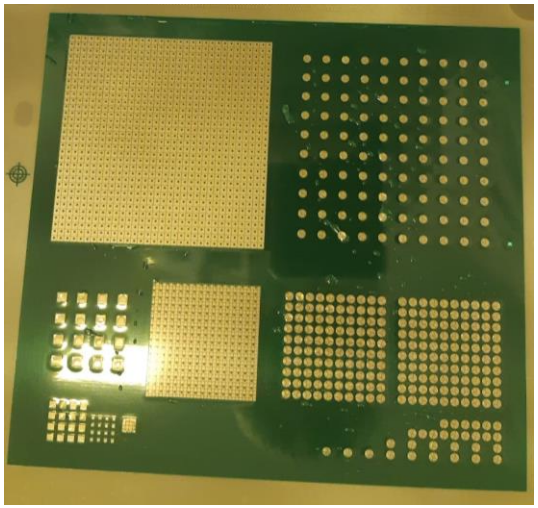


Two nBLM bulk tested.

BULK PROTOTYPE

- Various prototypes made for R&D
  - ZIGZAG PATTERN, R&D FOR EIC
  - MULTIPLEXED PATTERN, FOR MEDICAL APPLICATION
  - BULK GEM (TAKE A GEM AND BULK IT WITH A MESH), IBF TEST
  - DOUBLE MESH BULK: FOR IBF TEST
  - PICOSECOND
  - PANDA X
  - MCUBE
  - TPC READOUT FOR MSU
  - …/…

Picosecond with thin mesh



Medicaplus detector with different multiplexing area (total 10x10 cm²)

BULK FORESEEN IN 2021-2022

- Visibility on serial manufacturing < 12 month:
- TPOT (TPC outer tracker for sPhenix):12 to 52 bulk
- Mcube (tomography): 20 bulk
- Picosecond for Piment project
- Various prototypes

R&D FORESEEN IN 2021-2022

- Resistive 2D detector (for EIC tracker)
  - STACK OF 1 D KAPTON UNDER A RESISTIVE BULK KAPTON
    - Strait strips
    - Zigzag strip
    - Al metalized strip & chrome strip
- Radiation length reduction (for EIC tracker)
  - STRETCHED RESISTIVE BULK KAPTON (~50X50 CM²)
  - MESH MADE OF ALUMINUM FOIL WITH LASER HOLES
  - ALUMINIZED STRIP UNDER RESISTIVE KAPTON
- Bulk on glass (Omnis project)
  - TEST OK, BULK TO BE MADE
- Multi screen printing layer
  - PRINT RESISTIVE PASTE ON NEUTRAL PAS ON CONDUCTIVE PASTE.
- Zigzag resistive screen printing
- Multi screen printing layer
  - PRINT RESISTIVE PASTE ON NEUTRAL PAS ON CONDUCTIVE PASTE.

SUMMARY

- CEA Saclay MPGD lab operational in a clean room environment
- Small serial manufacturing
- Prototypes for starting experience
- R&D for new idea

Welcome at Saclay MPGD workshop ☺.

Commissariat à l'énergie atomique et aux énergies alternatives
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