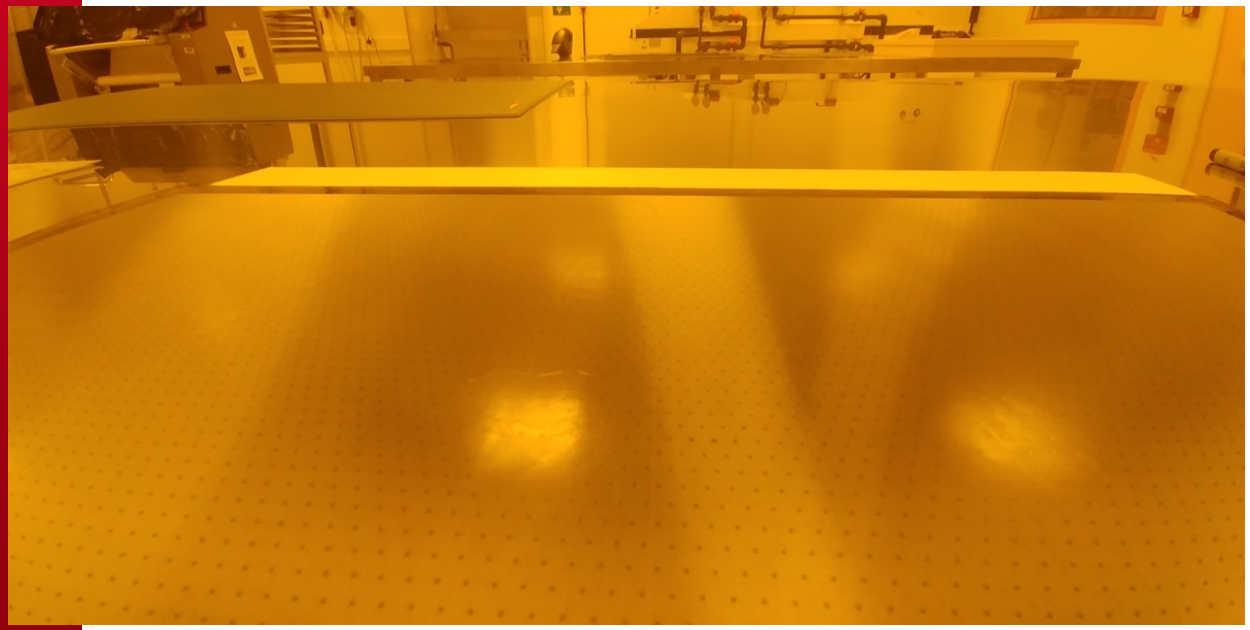
DE LA RECHERCHE À L'INDUSTRIE

ALD review of sPHENIX TPOT Production status

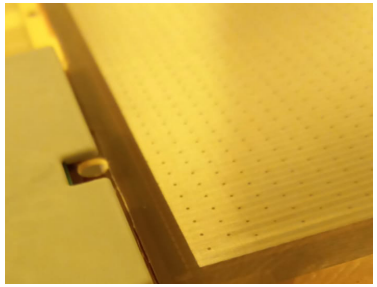


A. Francisco & M. Vandenbroucke

20/07/2022

COVERED TOPICS IN THIS TALK

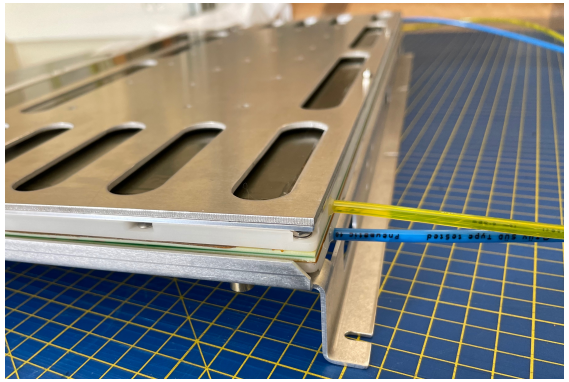
- Detector production



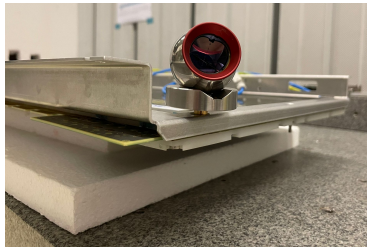
- Module assembly and testing



- Mechanics assembly of module

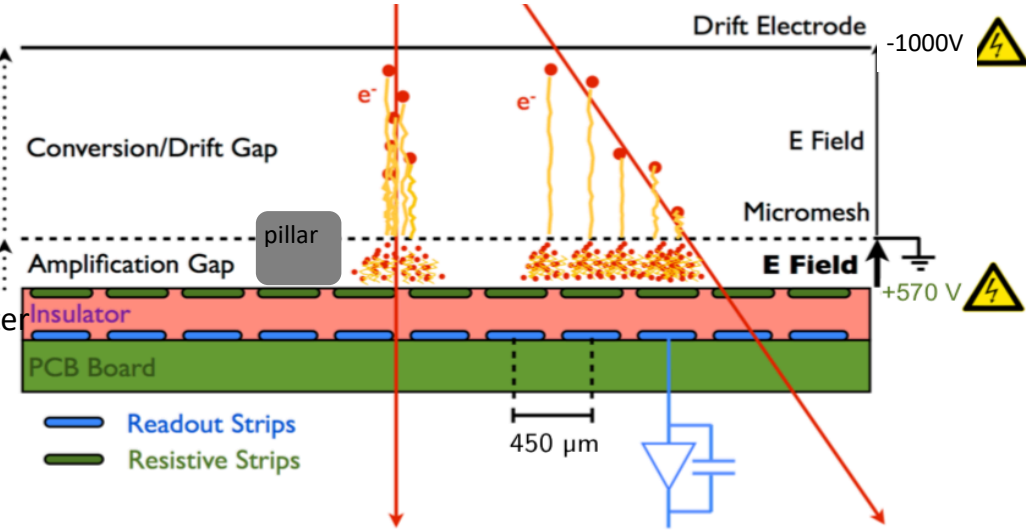


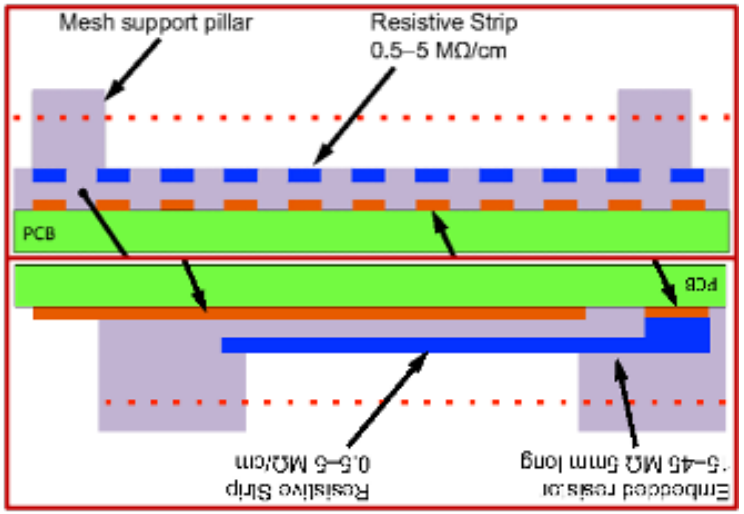
- Metrology



DETECTOR TECHNOLOGY

- **1 TPOT module is two 1D Micromegas layers (rΦ and Z)**
  - Design is simple
  - 3mm drift
  - No R&D on 2D resistive necessary
- **Resistive layer with strips**
  - Necessary with heavy ions environment
  - Occupancy is high, strips limit cluster size
  - Division in 4 HV sectors for reliability (no access after installation)
- **Z Pitch is 2mm (Zigzag), rΦ pitch is 1mm (straight)**
  - Each layer is read by 1 FEE
  - Straight strips for simplicity and low capacitance
- **Resistive layer of 0.5mm**
- **No soldering design**
  - Mec8 connectors on side of PCB (1.6mm thickness)
  - HV card with FSI connectors

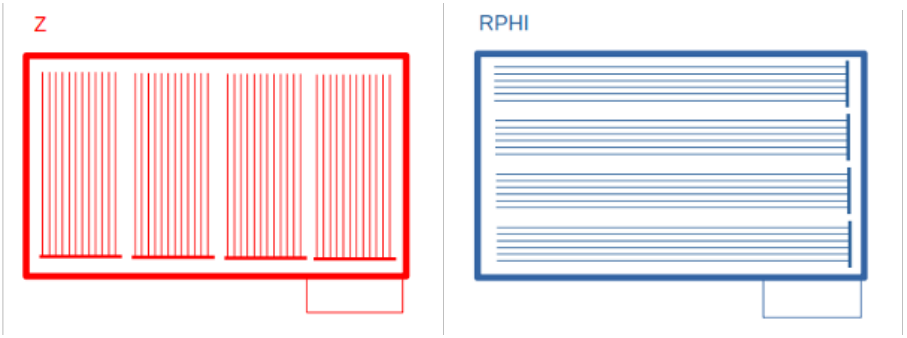




2 1DMicromegas back to back

Contract covers 10 Modules (production + testing)

- Resistive layers
- Bulk
- HV cards
- Drift with carbon layer
- Assembly with drift
- Testing

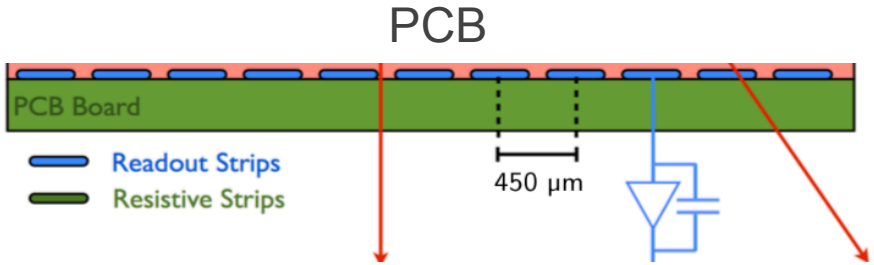


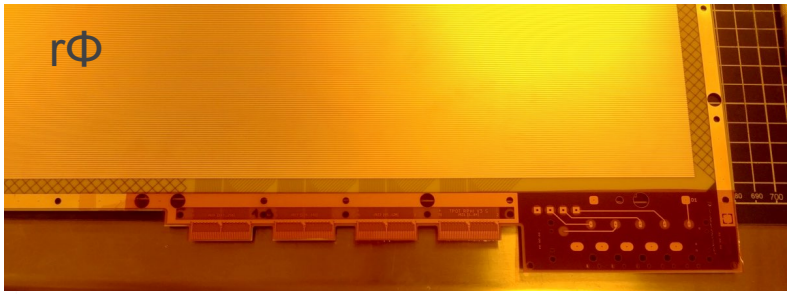
1 module = 1 rΦ + 1 Z detector

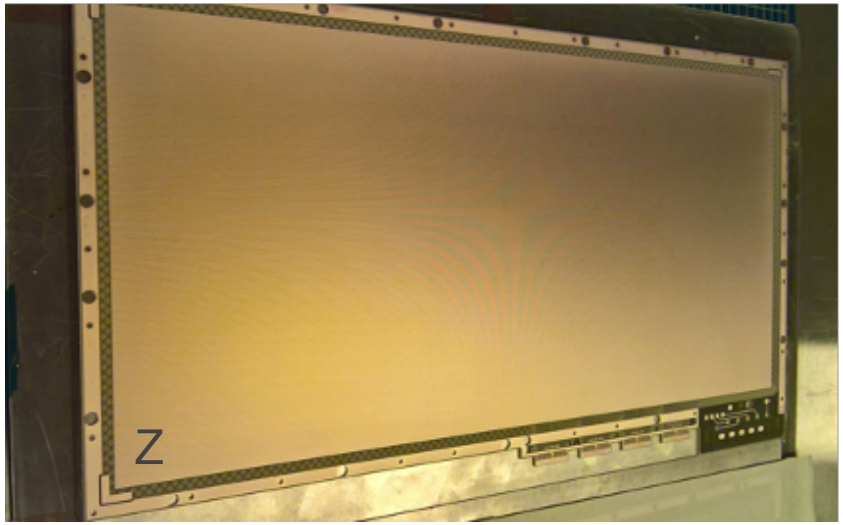


Tray assembly/Metrology

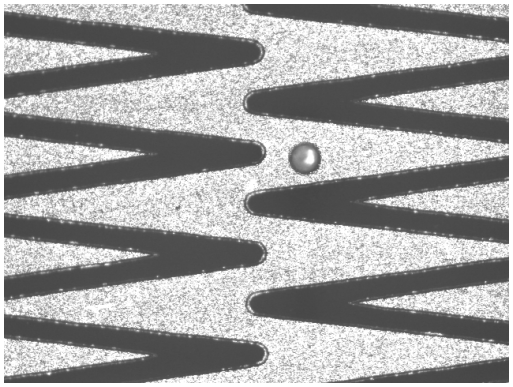
DETECTOR TECHNOLOGY





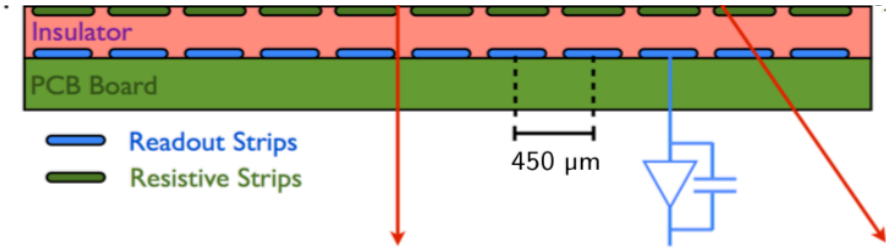


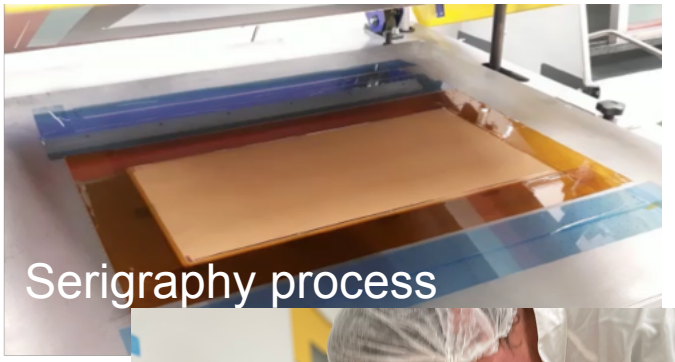
Zigzag strips (naked PCB)



DETECTOR TECHNOLOGY

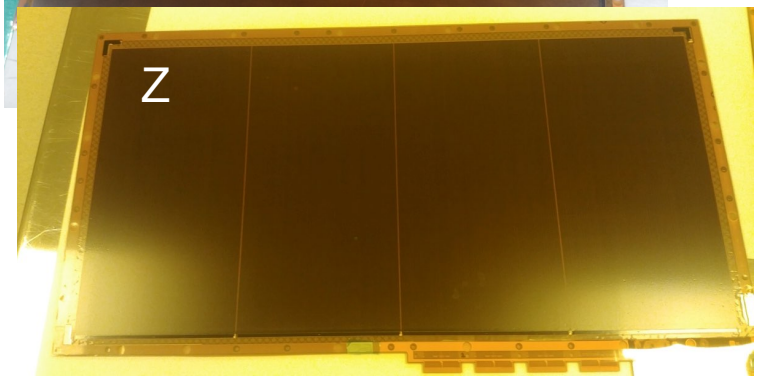
Resistive layer



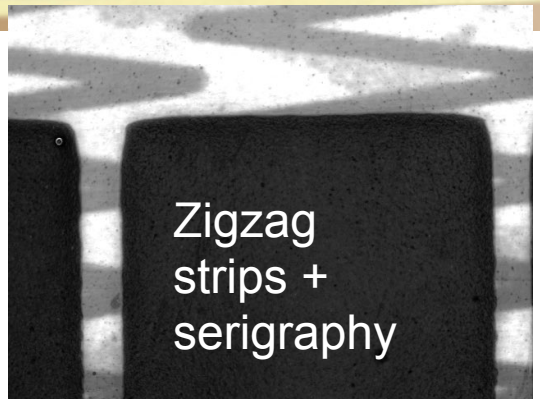




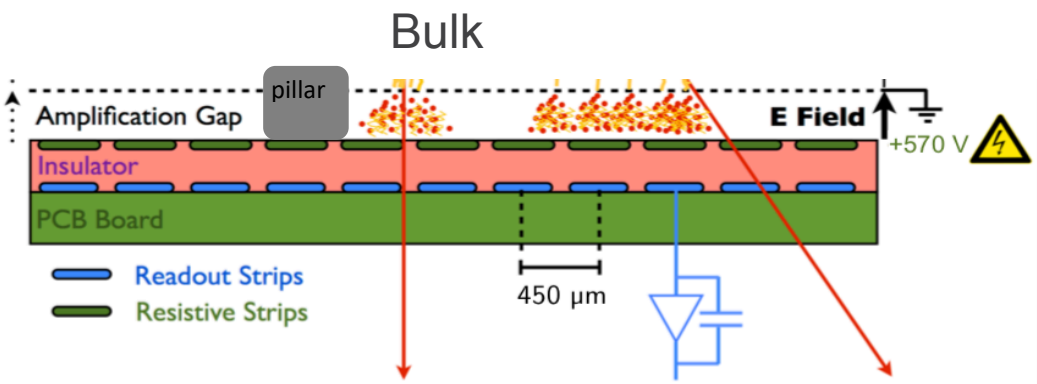


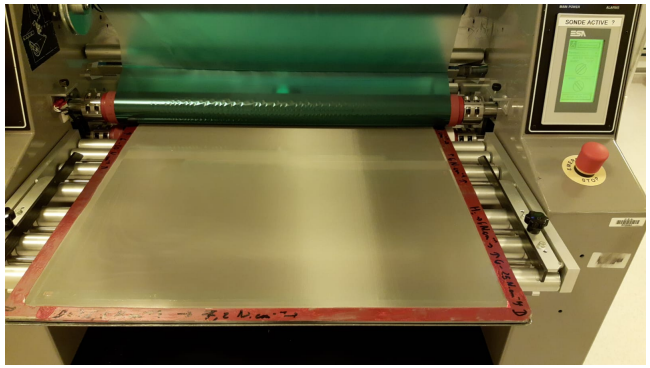


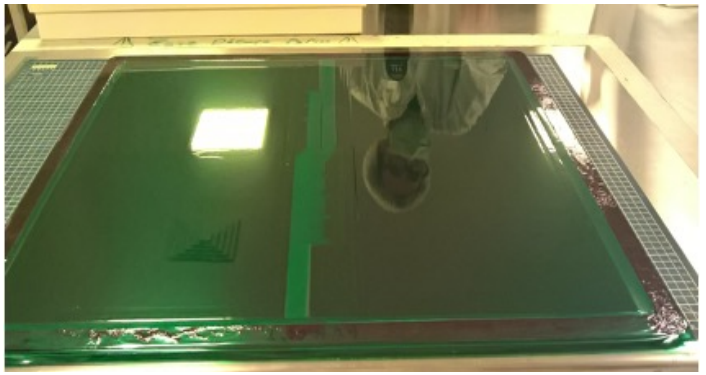
Resistive layers pressed on the PCB



DETECTOR TECHNOLOGY

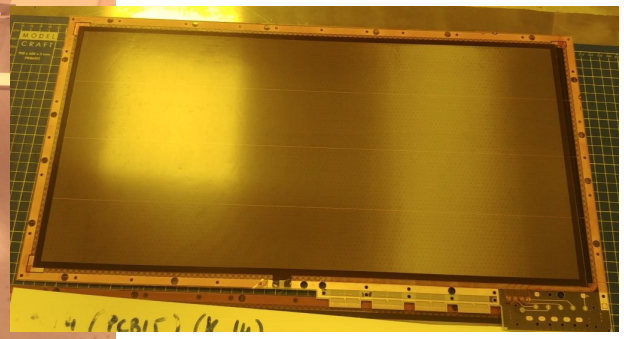




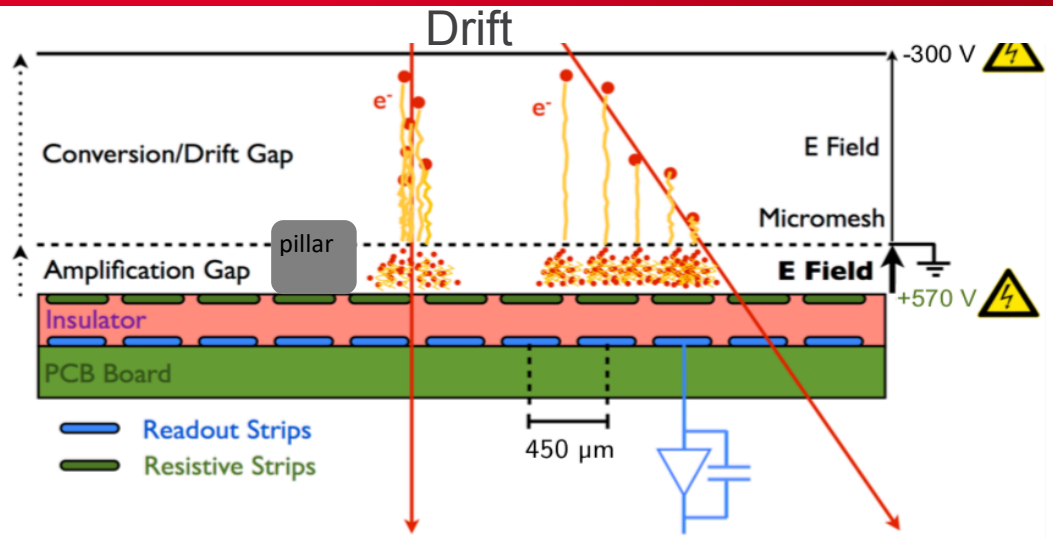


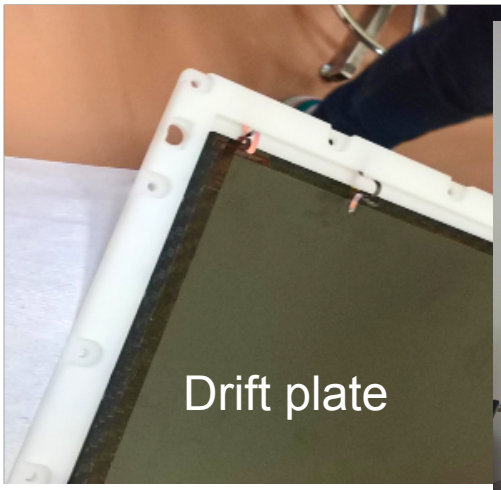




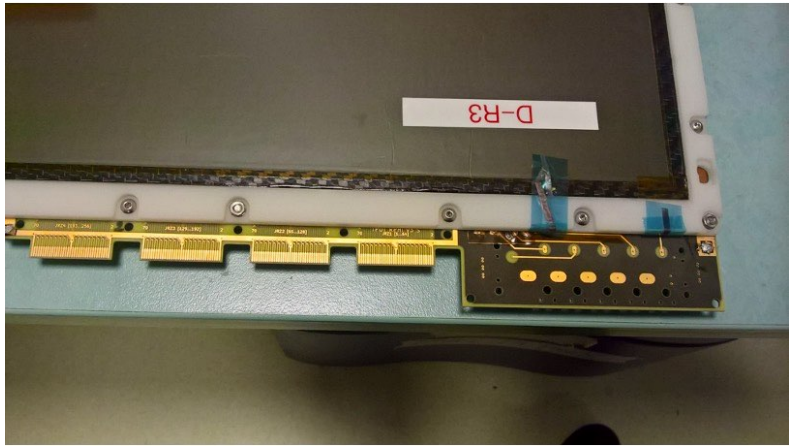


DETECTOR TECHNOLOGY



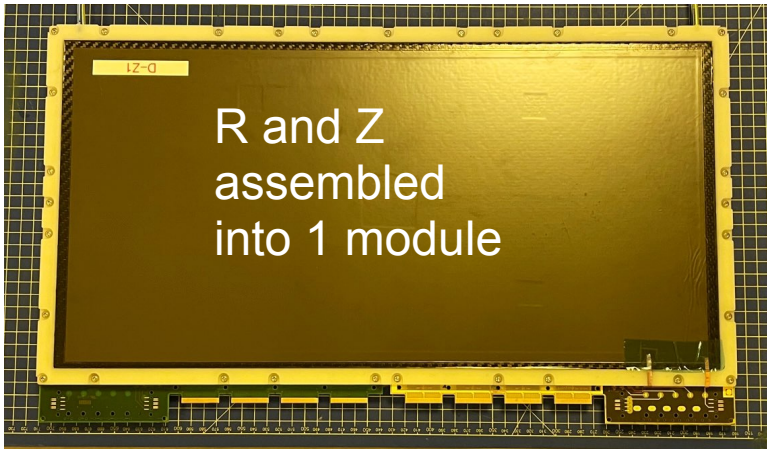


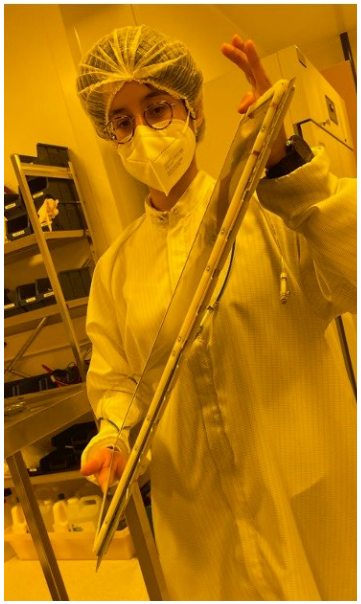




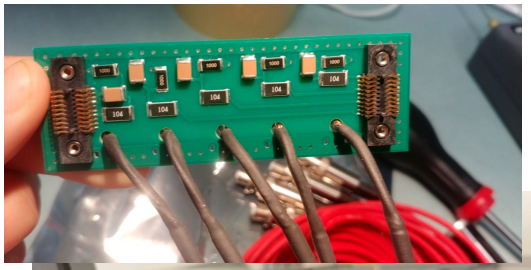


DETECTOR PRODUCTION





HV card







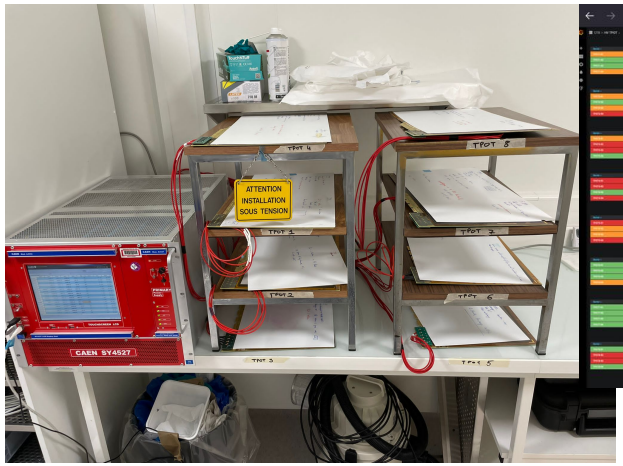


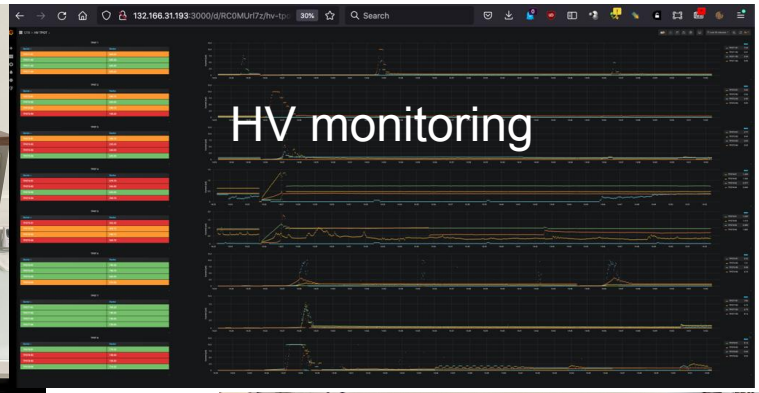
TESTING (NOT EXHAUSTIVE)

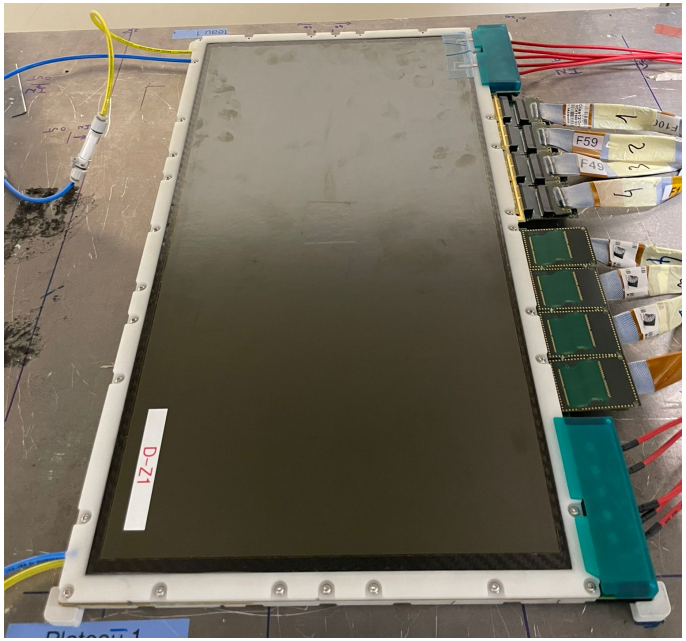
- Each detector tested individually for
  - PCB QA
  - In the clean room
    - Resistive layer QA
    - Mesh and pillars QA
    - HV behaviour (without the drift)
  - In the cosmic test bench
    - Efficiency with cosmic rays (DREAM electronics)
    - Gas tightness
    - Drift HV test

- Each module is tested for
  - Gas tightness
  - Reconstruction of cosmic rays in the test bench (DREAM electronics)

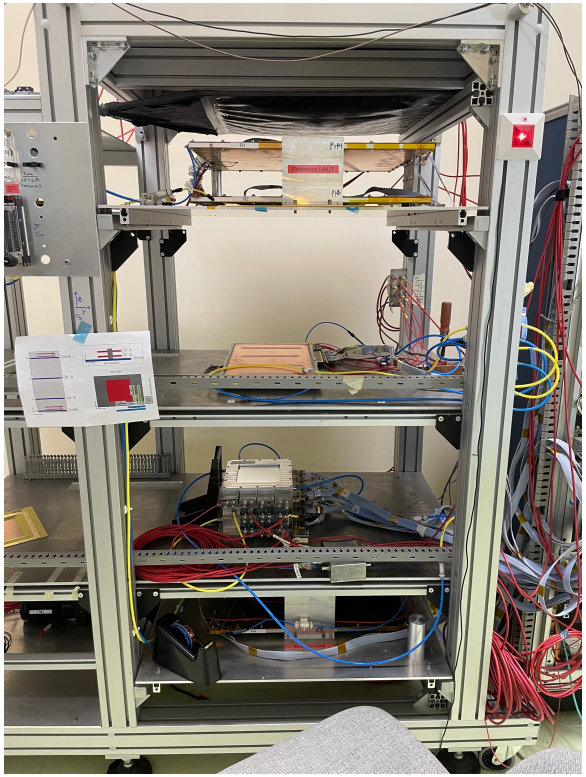
TESTING - FEW PICTURES







Cosmic test bench
With Multigen-V2 detectors



STATUS OF DETECTOR PRODUCTION

10 Z detectors produced and tested
9 rΦ detectors produced and tested

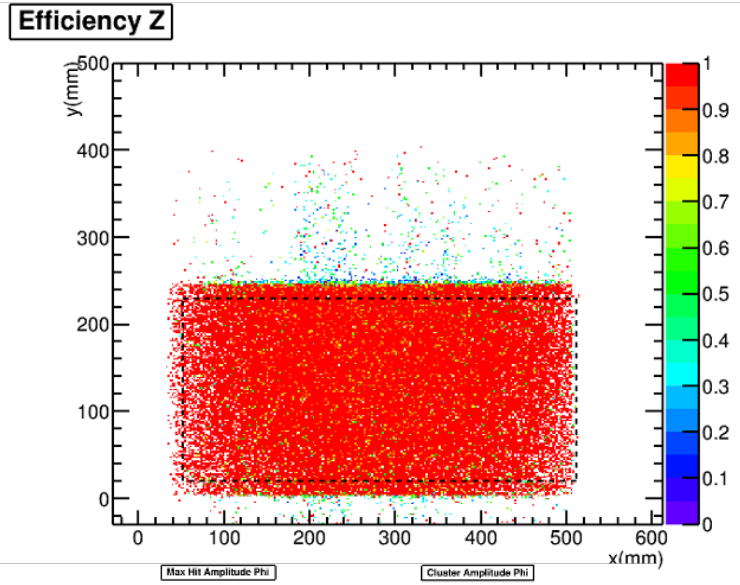
- 8 modules are validated
- Module 2 was tested with the assembly mechanics (no added noise)
- Module 10 is missing the rΦ detector (ongoing)

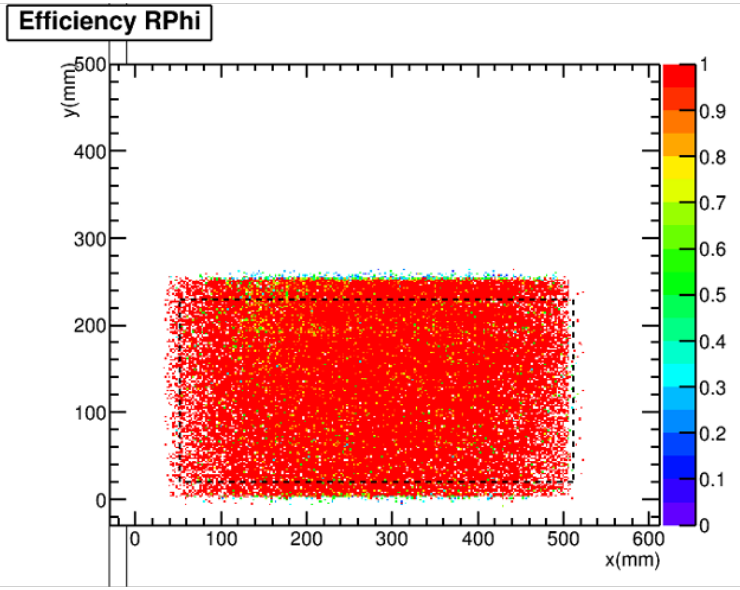
Factors for delayed production:

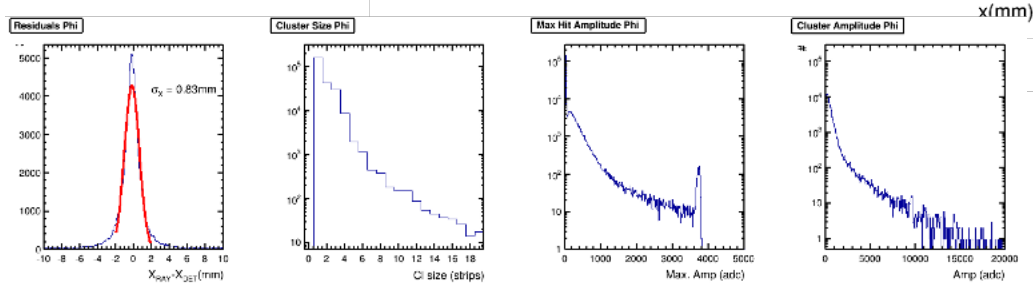
- several COVID cases
- the lab manager on long-term medical leave (not anticipated)
- leave of production engineer early in the production (not anticipated)
- late contract with BNL
- initial schedule very tight
- massive delay for PCB supply

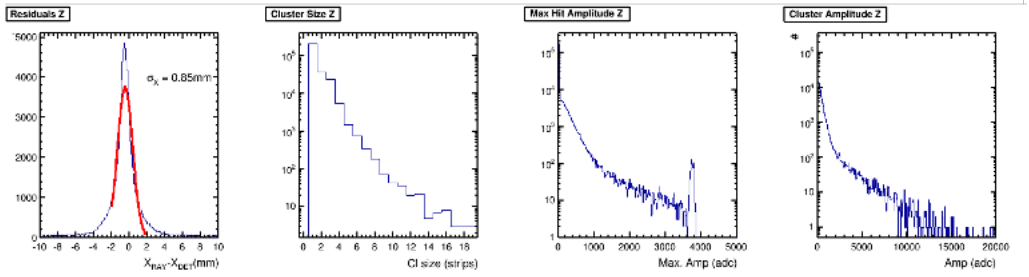
EXEMPLE OF MODULE TESTING

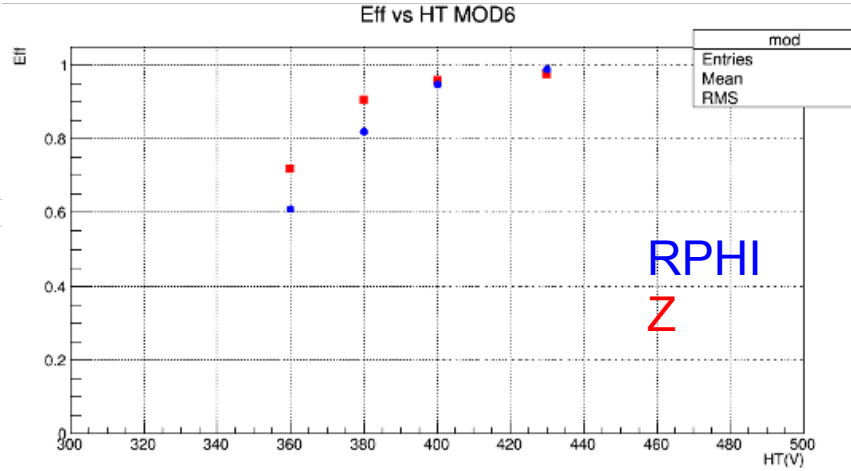
Gas leak: 0.03L/h
Efficiency:
RPHI 98%
Z 98%
MODULE 96%











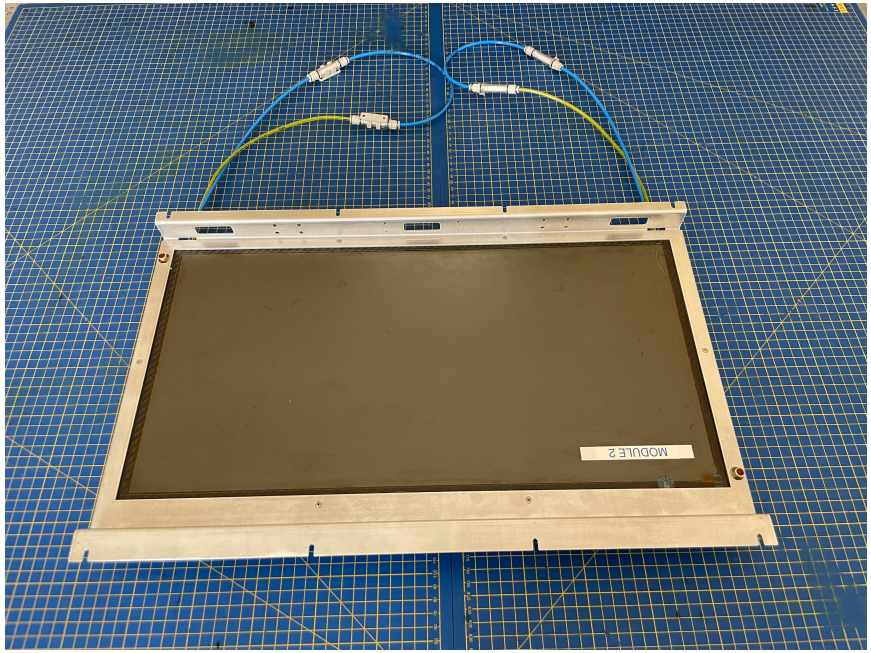
Summary of Testing results

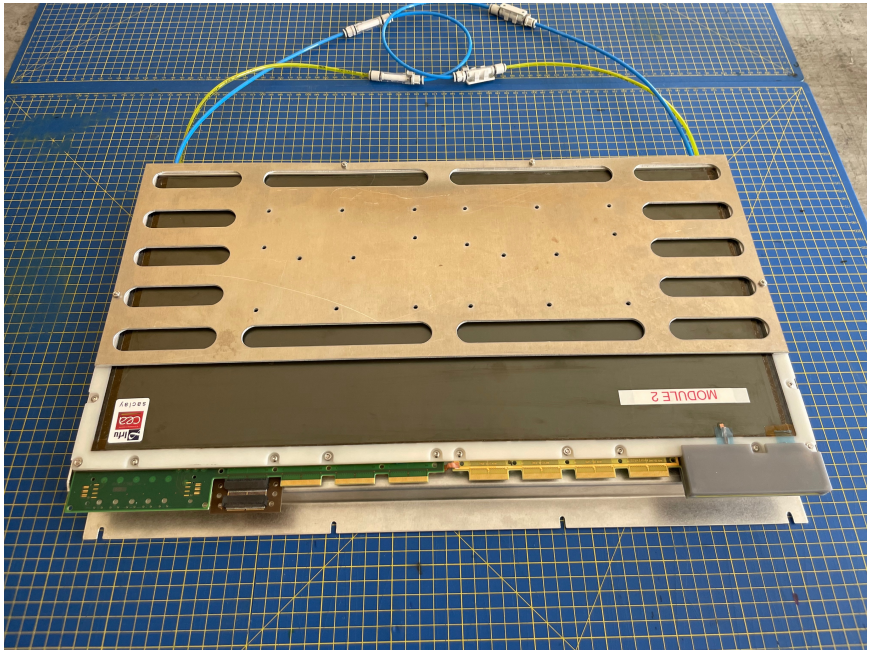
Module	2	3	4	5	6	7	8	9
RPHI eff	Under analysis	98 %	99 %	99 %	98 %	99 %	99 %	99 %
Z eff	Under analysis	98 %	98 %	99 %	98 %	98 %	98 %	98 %
Module eff	Under analysis	97 %	97 %	97 %	96 %	97 %	97 %	97 %
Gas leak	0.03L/h (detection limit of the setup)							

Operating points for testing:
Ar/iC4H10 95/5
Drift HV: -200V
Amplification HV: +420V

TRAY ASSEMBLY

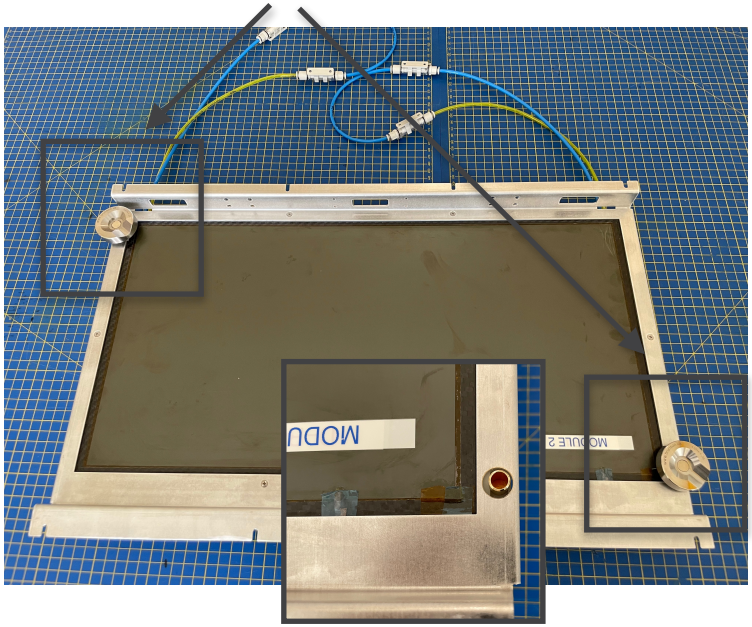
- Received 9 trays on 28/06/2022 @ Saclay
- Drill bush and targets work great
- Everything fits (had to enlarge drill bush holes in tray)
- Assembly is ongoing (in parallel with the metrology)

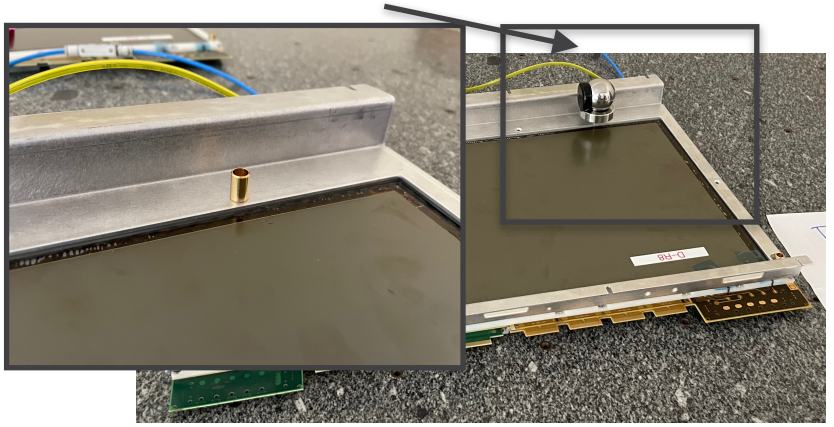




Strategy:

- 3 space points on the detector frame
  2 drill-bush holes on the detector + 1 glued pin

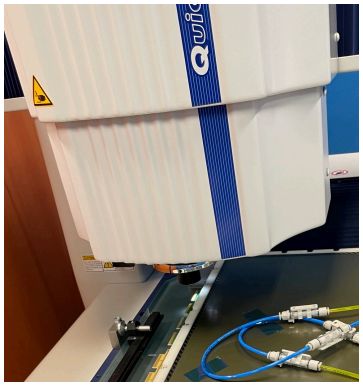


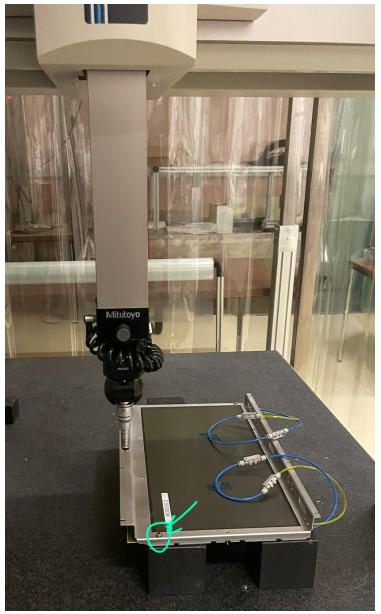


METROLOGY

Strategy:

- 3 space points on the detector frame
  2 drill-bush holes on the detector + 1 glued pin
- **Measurements of relative positions** of strips to the pins
  - Local **optical measurement**
    for each pin
    → strip positions wrt to target and PCB side

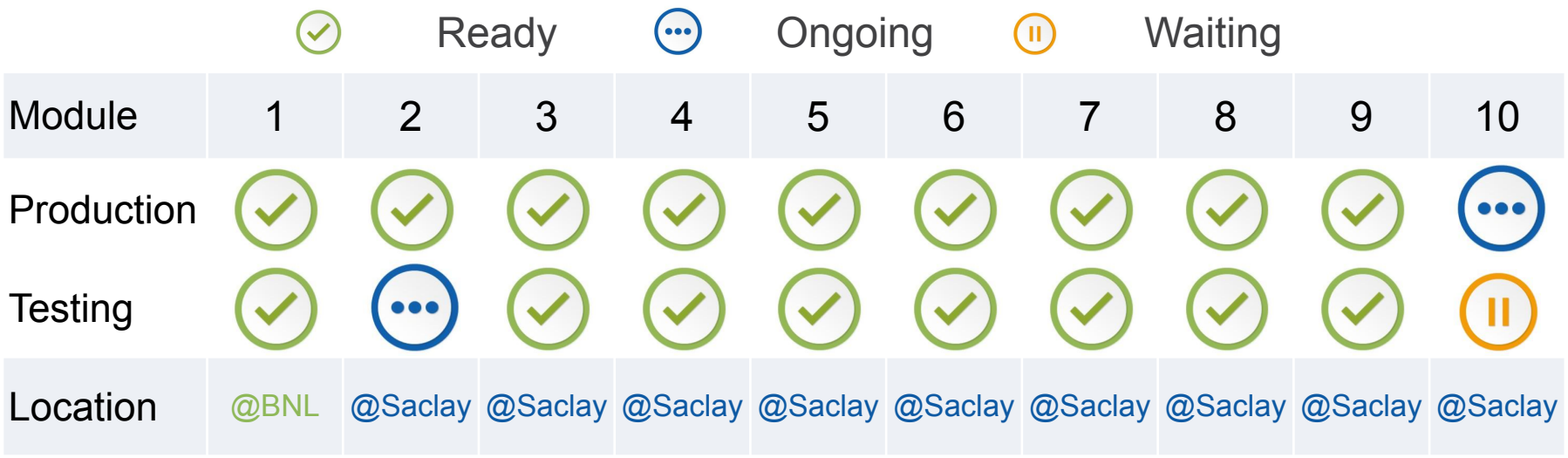




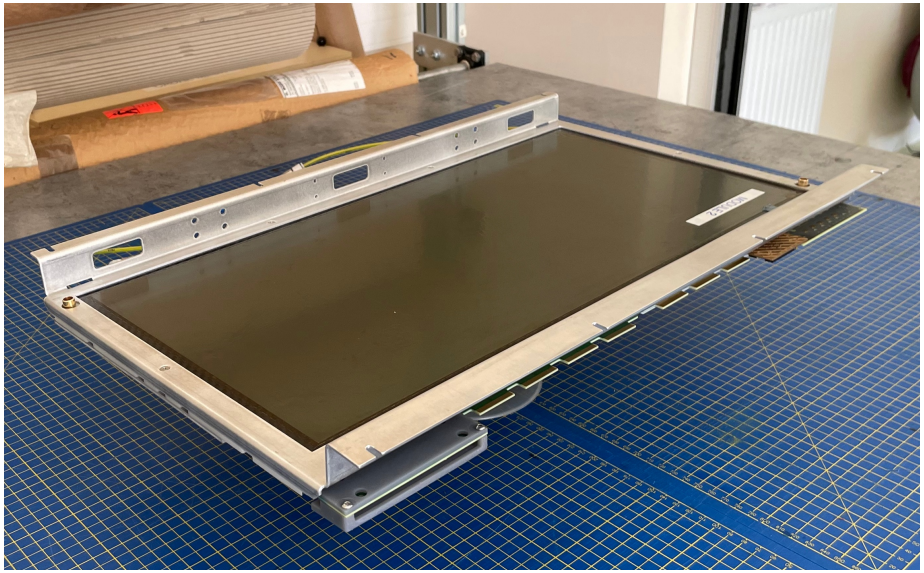
  - Global **mechanical measurement**
    for all targets
    → get target positions wrt to PCB side

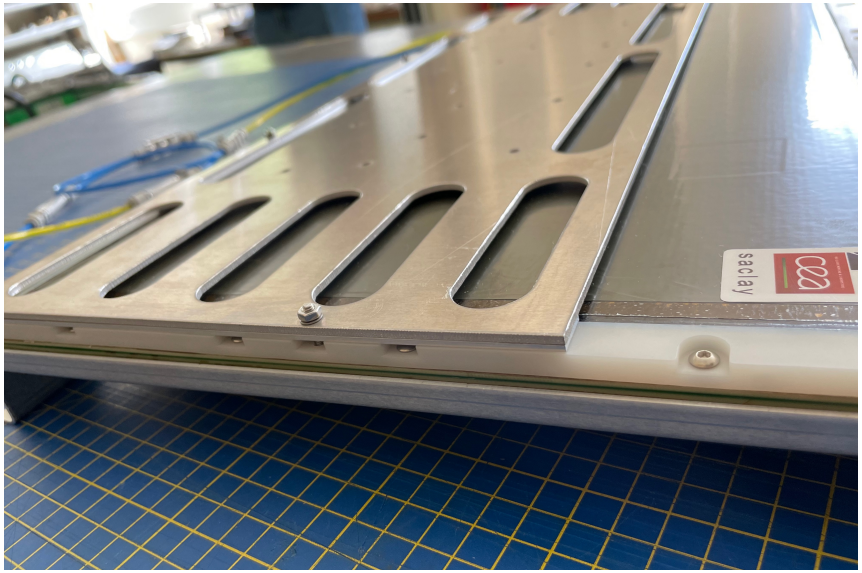
CONCLUSION

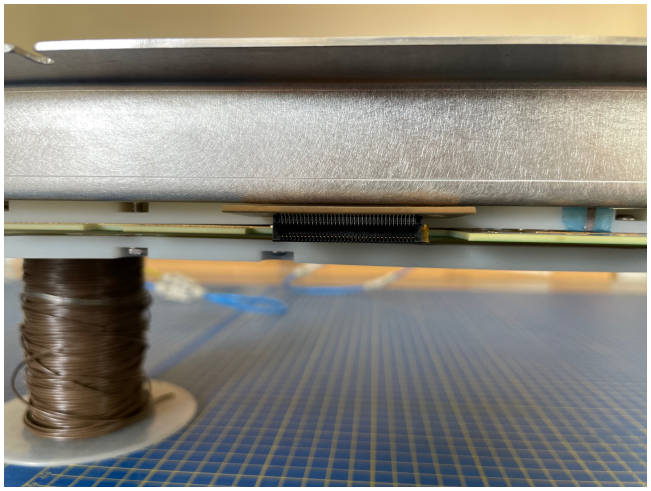
- Shipment is scheduled for next week
  (All material + information ready)
  - 1 module already at BNL since May 2022
  - 1st batch on Monday 7/25 (5 detectors) and 2nd batch on Monday 8/1 (4 detectors)
- Trays + HV cards are ready
- Assembly on trays is ongoing + metrology (2/9 modules ready)
- One module is missing (only rΦ detector) + 1 under test



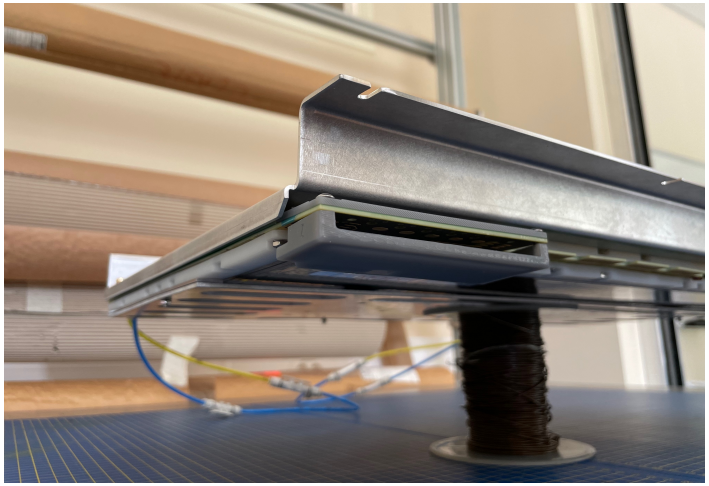
BLANK ASSEMBLY ON MODULE 2











Commissariat à l'énergie atomique et aux énergies alternatives
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Etablissement public à caractère industriel et commercial | R.C.S Paris B 775 685 019



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