

i r f u

cea

saclay

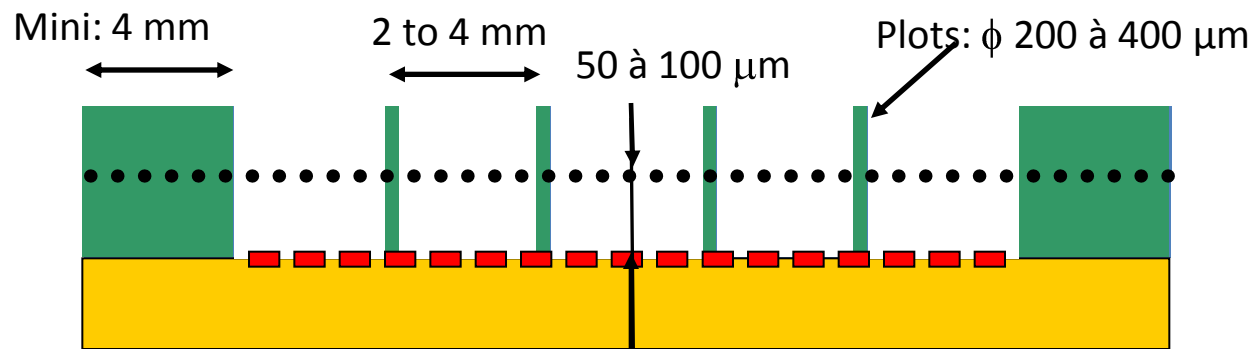
Saclay MPGD workshop

- Bulk description
- Saclay MPGD workshop in 2010
 - Description
- Operation
 - R&D
 - Prototype realization
- Operation
 - Team
 - Goal (RD, prototypes, series)
 - First realization
- Summary and realization pictures

Realization process

The bulk process use PCB industry machines. Photoresist film are polymerize on a PCB with the mesh between them . The mesh is then definitely embedded on the redaout board.

- 1) PCB cleaned (strips, pixels,...)
- 2) Lamination of the photoresist film (50 to 150 μm)
- 3) Integration of a mesh on a frame (woven SS mesh 19 μm , 500 LPI)
- 4) Lamination of the photoresist film (50 μm)
- 5) UV insulation trough a mask
- 6) Development
- 7) Curing (UV et four)



Saclay MPGD workshop

irfu

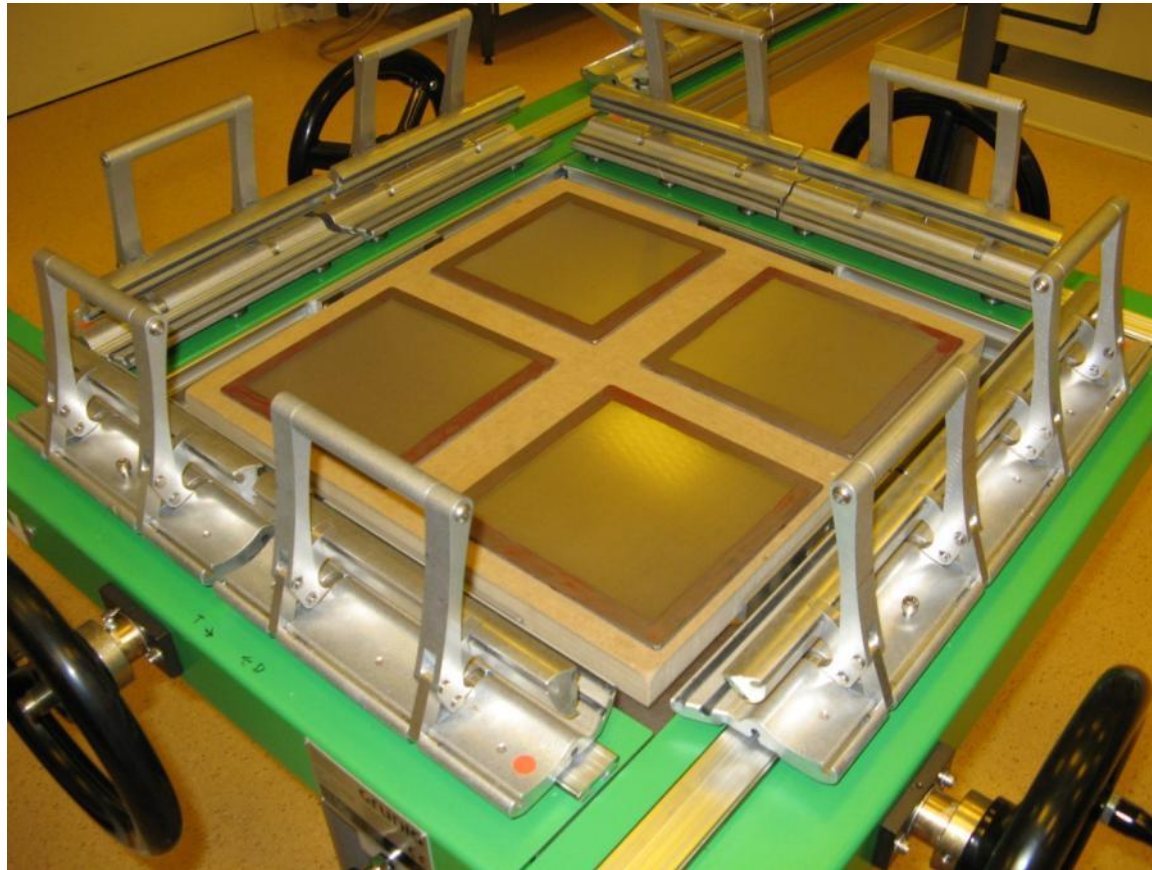


saclay

- Between 2008 and 2010 four machines were bought:
 - Mesh stretcher
 - Laminator
 - UV Insulator
 - Development unit
- The workshop is installed in a clean room (64 m² of class 100.000)
- The first 4 month were dedicated to the qualification of the machines (abacus for each machine) on simple test PCBs. Validation detectors were tested under gas with Fe55 for validation.

Mesh stretching

- The standard bulk are made with a woven SS mesh (Bopp SDC 45/18).
- The goal of the stretching machine is to obtain a mesh glued on a frame with some 8 N/cm tension.
- The frames are made on purpose by the mechanical workshop



Tension and gluing of 4 mesh for 20x 20 cm PCB each

irfu

cea

saclay

Laminator

The photoresist film (Pyrалux PC) are laminated on the PCB. The maximum width is 600 mm. Two thickness can be used, 50 and 64 μm , with several layer to obtain the amplification gap (typically 128 μm). The mesh stretched on a frame is laminated with (under) the last layer. The 128 μm amplification gap is theoretical : depending of the pressure of lamination this gap varies between 110 and 120 μm .

irfu
cea
saclay

Oven
lamineur



Laminator

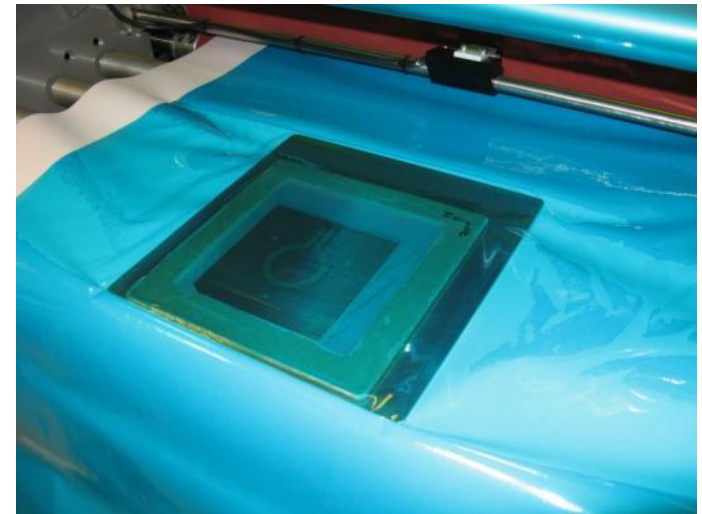
irfu

cea

saclay



Lamination 1st layer



After laminating the last layer

UV insulator

- The goal of the laminator is to polymerize the layers of photoresist that encapsulate the mesh.
- A insulating mask allows to polymerize pillars ,on the active area and , borders and zone for HV contact. The important parameter is the insulation energy (mJ/cm^2)



rinsing

Developing
unit

insolator

Atelier côté insolateur

UV insulator

irfu

cea

saclay



insolateur



Insolateur ouvert avec
PCB et masque

Development unit

- The developing unit dissolves the photoresist part that were not insulated. The liquid bath is made of water with 1% of carbonate sodium. Several pass are necessary to develop the layer through the mesh with rinsing between each development.



rinsing

development

PCB in

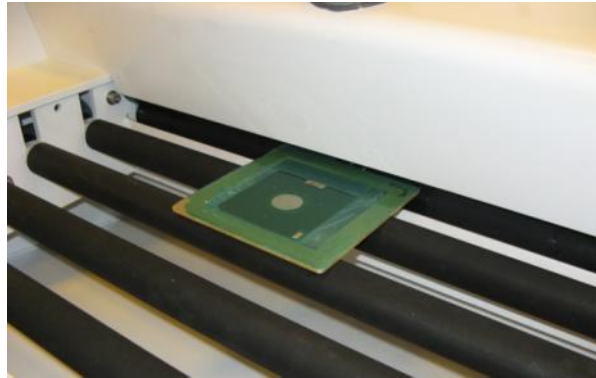
irfu

cea

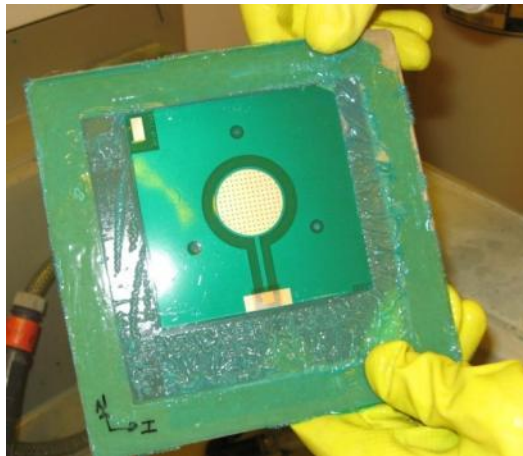
saclay

PCB rinsing

- Between development of the photoresist several rinsing are done to remove the photoresist under the mesh .



rinsing



Develop bulk with mesh frame

PCB machining

In 2009 we bought a PCB machine device (originally made to create PCB: 600 x 400 x 120 mm). Goals:

- cut of the bulk after realization
- Segmentation of the mesh
- Realization of small PCB interface card

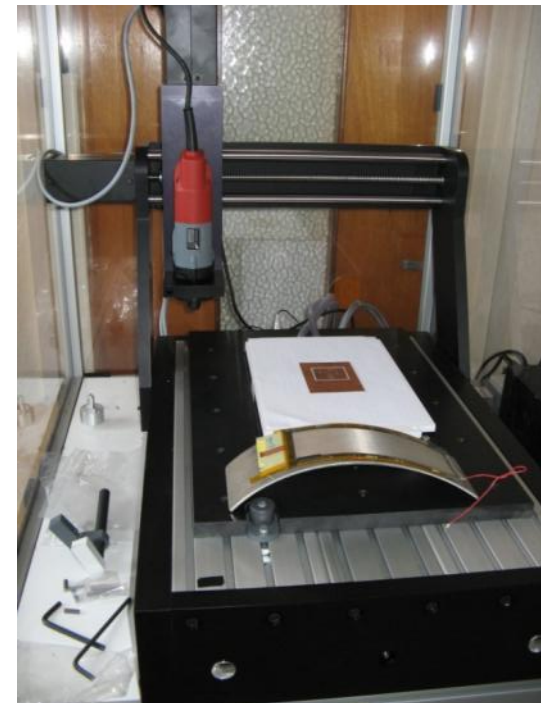
irfu

cea

saclay



Machine and PC



Machine clas12 prototype

Upgrade of the workshop

- The goal of the workshop been R&D the tool will upgrade with new idea arriving.
 - bulk qualification test bench(2010)
 - The goal is to have a HV cooking test bench with dry air to deliver bulk with few nA at 900 V
 - Mesh stretching machine modification (2011)
 - More uniform tension with pneumatic jack.
 - New tool with new idea....

Goal of the workshop

- Realization and test in 48 hours !!!
- Realization of simplified bulk with innovation **(R&D)**
 - Thin Mesh
 - Segmented mesh
 - Multi stage mesh
- Upgrade of existing techniques **(R&T)**
 - Pillar seize
 - Mesh tension
 - Double sided bulk
- Upgrade of the process in term of quality **(R&Q)**.
 - Realization process
 - Data base of component
 - Feedback after test of bulk

irfu



saclay

Workshop team

- The team is composed of 5 persons each at 20% to 50 %. Other personal of experience will come in the lab to participate to the realization. .



Marc



Stephan



Julien



Arnaud



Robert



X

- **Marc ANFREVILLE** : coordinator of the activity

- **Stephan AUNE** : Workshop creation, contact person, detector R&D

- **Julien GIRAUD** : management of the quality

- **Arnaud GIGANON** : realize et qualifies bulks for R&D and validation of processes

- **Robert DURAND** : prepare tool and bulk realization

- **X.X** detector CAO

First realization

- Use of the machine: 80 %
 - Amelioration of the laminator.
- Abacus of machine: 60 %
 - More than 30 bulk test to reach a standard optimized bulk procedure
 - Variation of the amplification gap with the lamination pressure
- Reference bulk : 18 % energy resolution @ 5.9 KeV, nominal gain .
- R&D: Thin and thick mesh, SS/nylon mesh, segmented mesh, multi-stage mesh, double face detector
- Bulk for beam test (SLHC, CLAS12-COMPASS)
- Bulk for prototype (ForFire, MIMAC, AT-TPC, ACTAR)

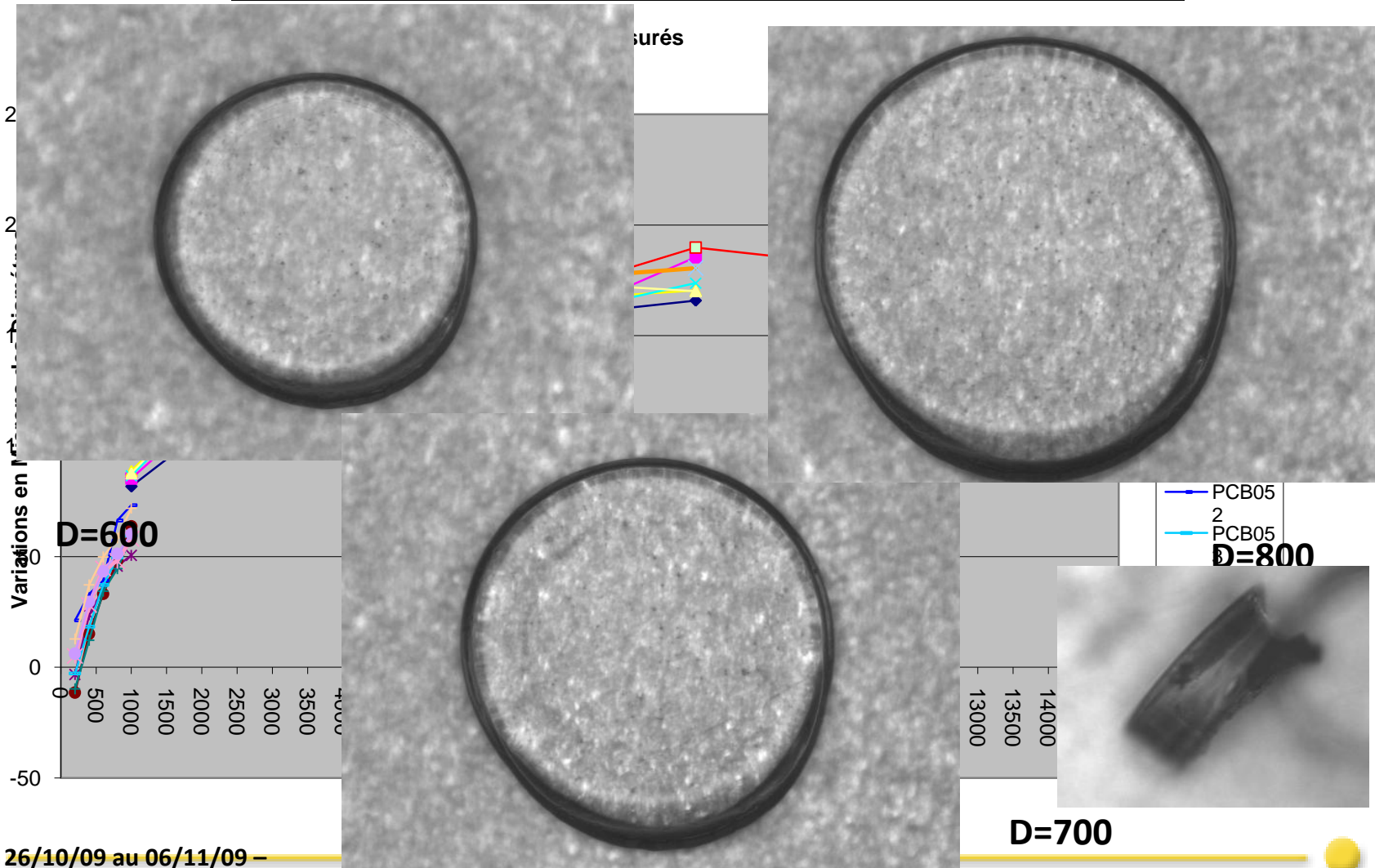
Abacus & pillars pictures

PCB 051 – 700mJ – 70° L Comparatif des différences de diamètres entre 100 et 500 Microns

irfu

cea

saclay



26/10/09 au 06/11/09 –
AG/RD/MA

Bulk done (04/2010 to 10/2010)

	Goal	Dimension PCB	Active area (cm)	number
Lab TESTS				
	PCB Test Equipements	250/280	200/200	12
	PCB RD1	120/140	95/95	18
	PCB Test Mèche Fine	120/140	95/95	5
EXPERIENCES				
	SLHC	200/280	100/100	4
	MIMAC	180/180	110/110	7
	CLAS 12 (TF10)	250/360	57/100	11
	DETFROST	D=110	D= 90	3
	FORFIRE	D=70	41/41	3
	COSMULTI (2 faces)	340/410	260/260	1
	AT- TPC	290/320	D= 270	4
	Vrai/ Faux 2D	115/130	60/60	2
	Total			70

irfu



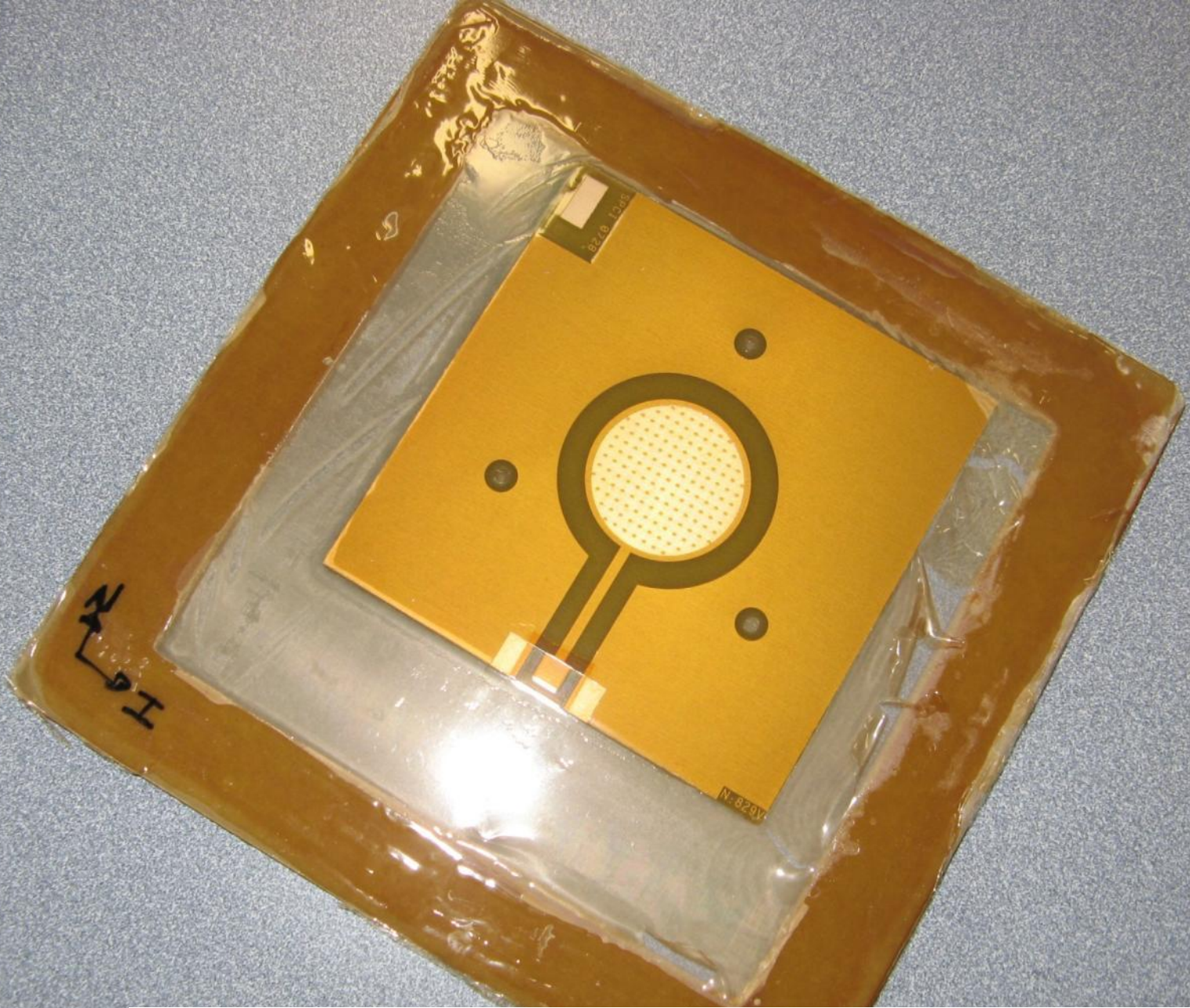
saclay

Summary

- Inauguration of the Workshop in Mai 2010
- Process for standard bulk OK
- Workshop open to IRFU team for detector R&D and prototype.
- Open to other institute for bulk prototype.

i r f u

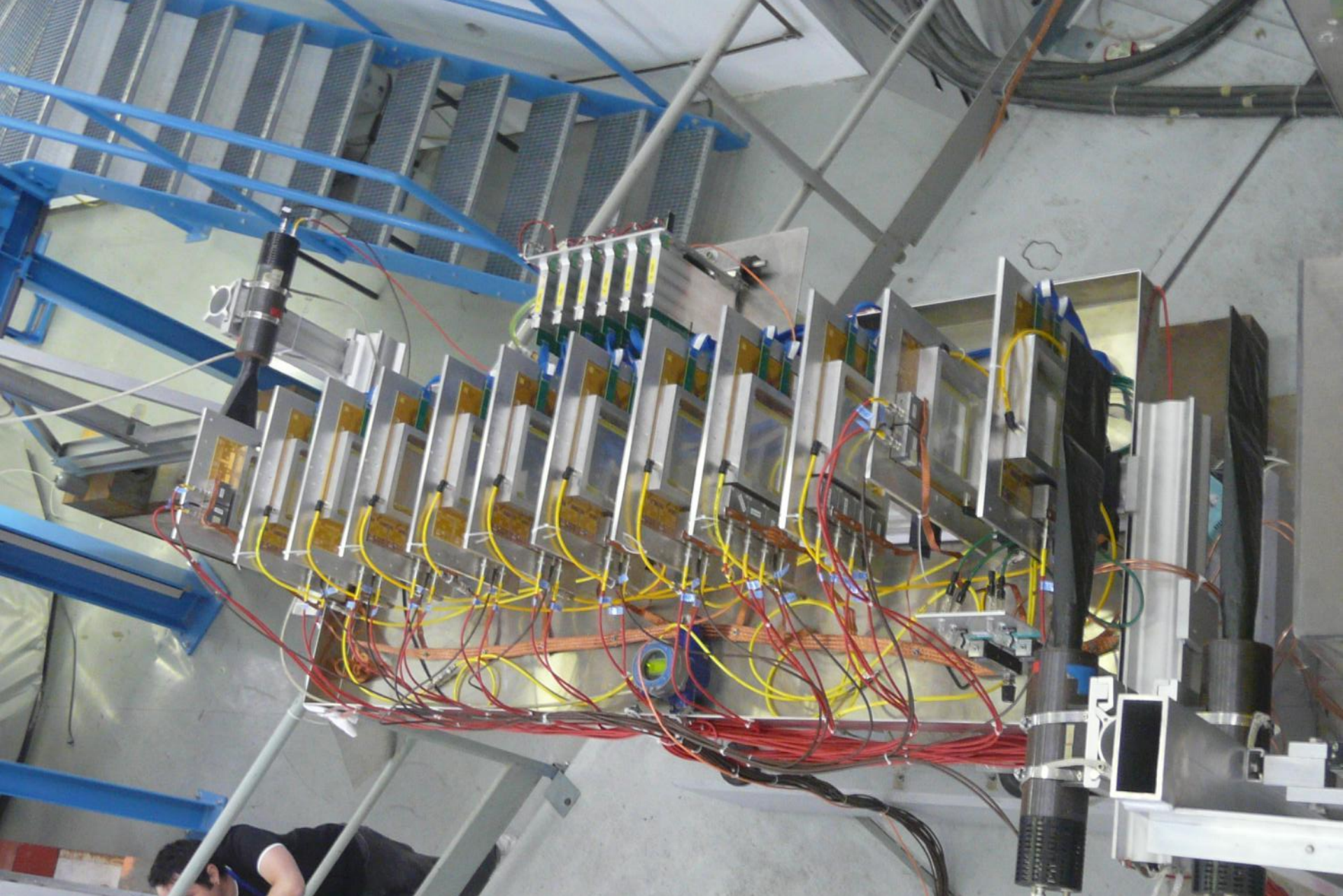
cea
saclay



R&D bulk with exotic mesh (SS/Nylon)



Clas12 double sided bulk for cosmic bench



Clas12/COMPASS CERN test beam 08/2010