

BULK lab at Saclay

Bulk Saclay lab historic

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2004

- **Idea** of the bulk by par Ioannis et Rui
- delivery of the first bulk by CERN, **test à Saclay**
- decision to invest in a bulk lab at Saclay (30 K€)

2005

- first machine arrive at Saclay
- **first realization at Saclay**: lack of UV power, exotic and classical realisation

2006

- Tests de bulks du CERN pour T2K

2007

- New machine search, no decision yet
- T2K and prototype for several other experiences

2008

- New lab decided with professional machine

2009

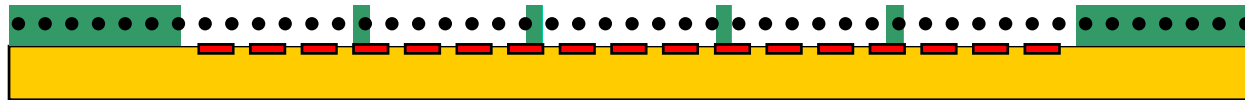
- New lab with professional machine

Old Saclay Bulk lab

- Created in 2005, it used machine design for technological university for PCB manufacturing.

- Allowed bulk realization on 30 cm x 30 cm but with:
 - Low reproduction process
 - Poor UV illumination = large pillars
 - Laminator “sometime” made bubble on photoresist film

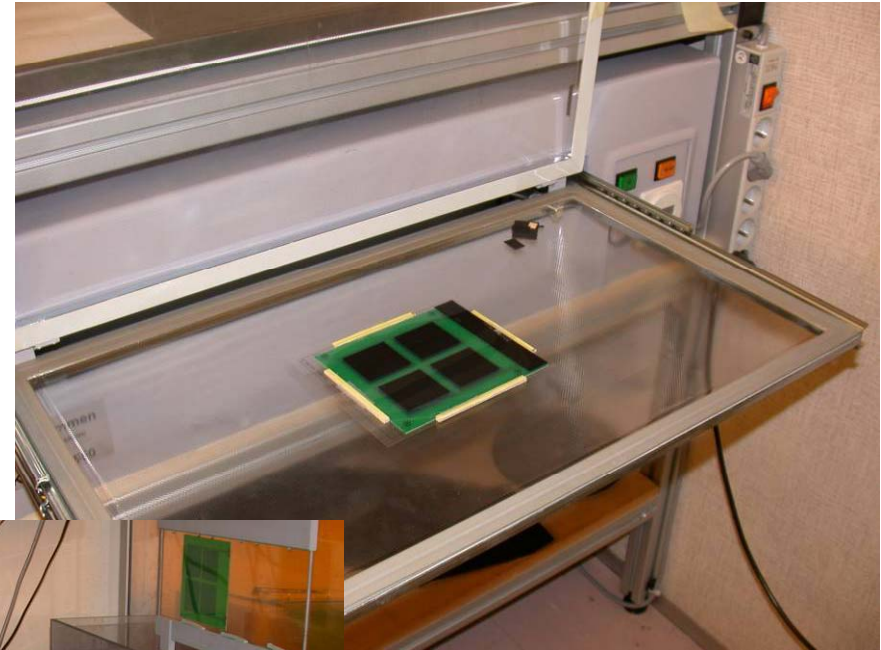
- This lab allowed us to familiarize with the bulk technique, to made R&D and prototype for “beginning” experience
 - Classical gain
 - Energy resolution around 28 %
 - Frame on mesh: $DE/E = 22\%$



Old Saclay bulk lab machines



Laminator



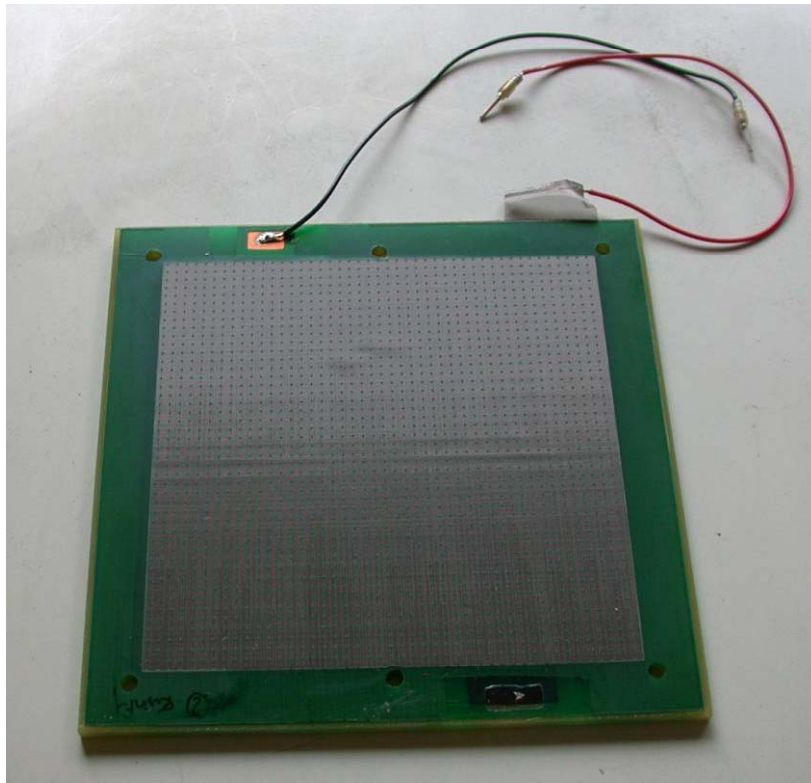
insulator



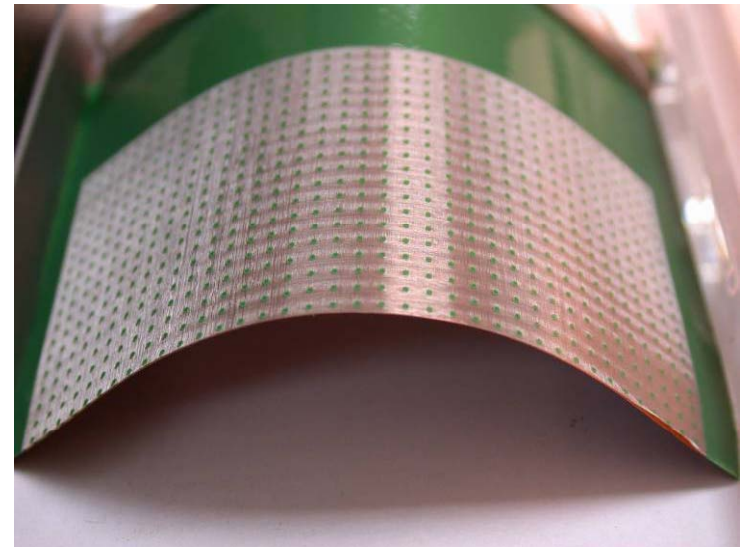
Development unit

Bulk at Saclay in 2005

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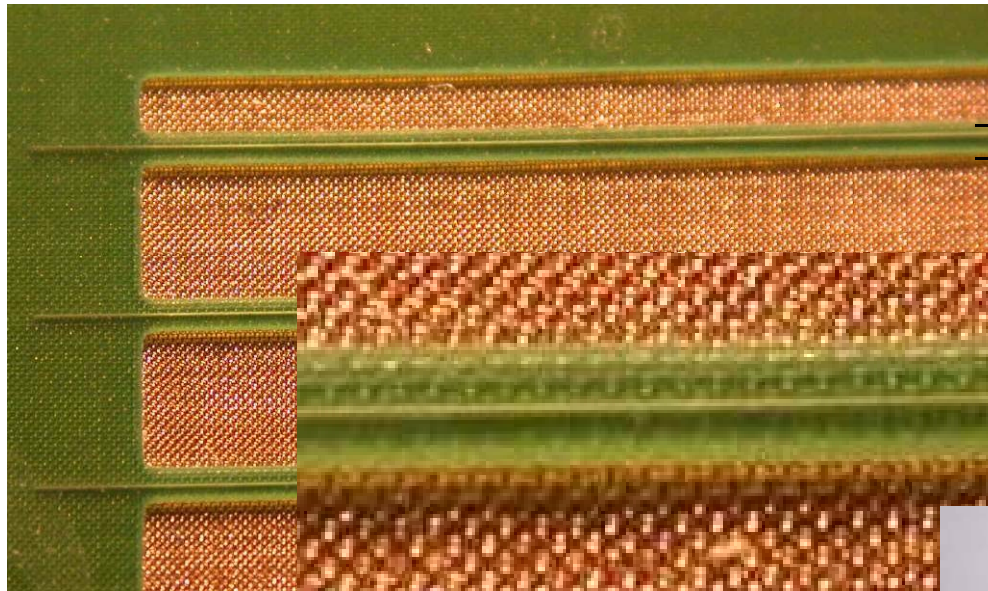
Typical bulk prototype



Bulk on Kapton (200 μm)
test curved at 650 V (air)

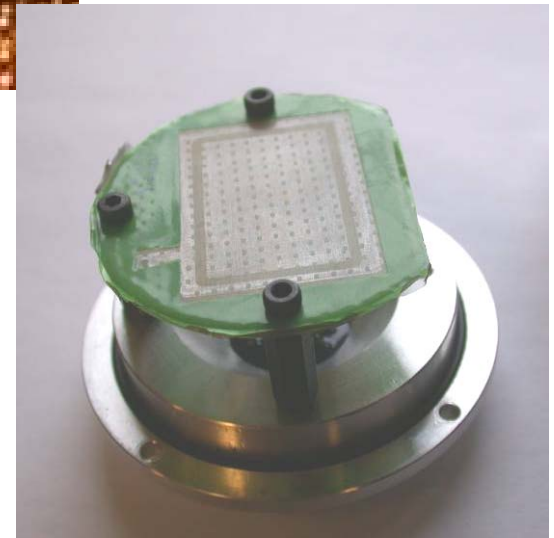
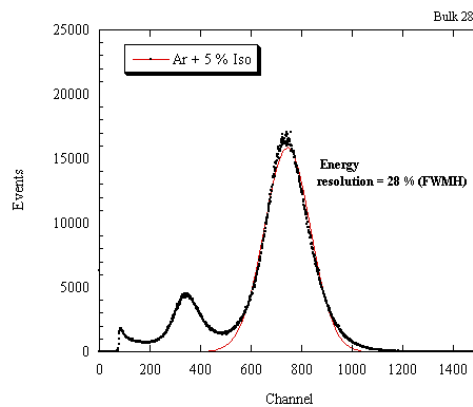
Bulk at Saclay in 2005 (2)

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100 μm

Cutting the mesh in a resist wall



Small bulk for industry

Laboratory equipped with professional machine designed for industry:

- Stretching machine for lithography (2008)
- Laminator unit (2008)
- Large oven (2008)
- Insulator unit (2009)
- Development unit (2009 ?)

Building 546 in Saclay, 64 m² of clean room (class 100.000)
maximum seize of the bulk: 600 mm x 800 mm.
bulk lab will be ready in 2010.

Cost:

Budget R&D bulk 2008 et 2009 : 60 k€ + 20 k€ of safety
consumable: 10 k€/year

Mesh stretching machine at Saclay

- Starting stretching woven mesh allowed us to “see with our hands” the difficulties of uniformity
- Difficult to obtain better than 4 N/cm uniformity on 30 cm x 30 cm with nominal 12 N/cm.
- Tools to measure tension on the mesh
- Understanding of the process
- Training in stretching to be done in fall 2009



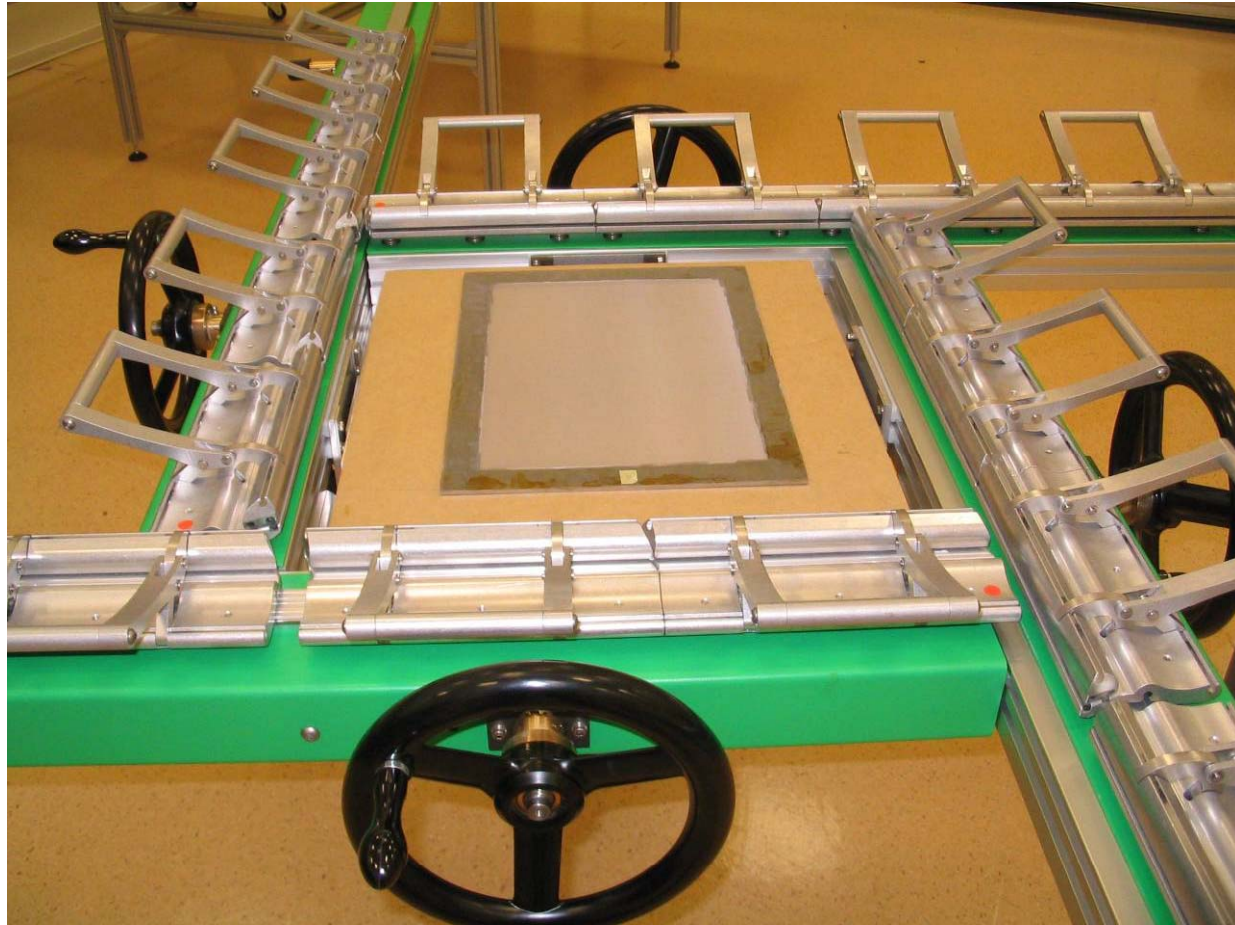
Stretching machine: max size of 1 m x 1m.

First mesh stretched in Saclay (2008)

- Seize of 30 x 30 cm
- Optimization of the machine for our needs under way.

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Laminator unit

- Manual laminator ML 3024 from Rohm and Haas (20 k€)

Operation Features	
Panel Size	
Width (max.)	635 mm (25 in.)
Thickness (min.–max.)	0.05–5 mm (0.002–0.197 in.)
Dry Film Photoresist Size	
Width	635 mm (25 in.)
Rolls Diameter	300m (1,000 ft.)
Conveyor (Adjustment)	
Conveyor Height (min.–max.)	1,025–1,110 mm (40.4–43.7 in.)
Conveyor Speed	
Adjustable up to 3 m/min. (10 ft./min.)	
Standard conveyor idler roller	
Lamination Roll	
Temperature (max.)	130°C (266°F)
Material	Silicone rubber 65 SH
Options	
Thicker panel device up to 12,7 mm (0.500 in.)	

12,7 mm !



The first test showed a perfect lamination with no bubble on photoresist layer. Automatic mode used without problems. Used for SLHC prototype.

Exposure unit

- Exposure unit EU 530 from Rohm and Haas (20 k€)

ADVANTAGES

- High-resolution and good repeatability
- U.V. energy-operated integrators
- High productivity for primary imaging, DFSM and liquid photoimaging soldermask
- Light uniformity on all the exposure areas
- Lamp power switchable from 2 to 5 Kw
- High-efficiency, closed-loop air cooling system
- Drawer's temperature controlled by a temperature regulator (optional)
- Refrigerator with water intercooler (optional)
- Friendly operator approach
- Easy control by numeric display for diagnostic and instructions to the operator
- Compatible with yellow room environment



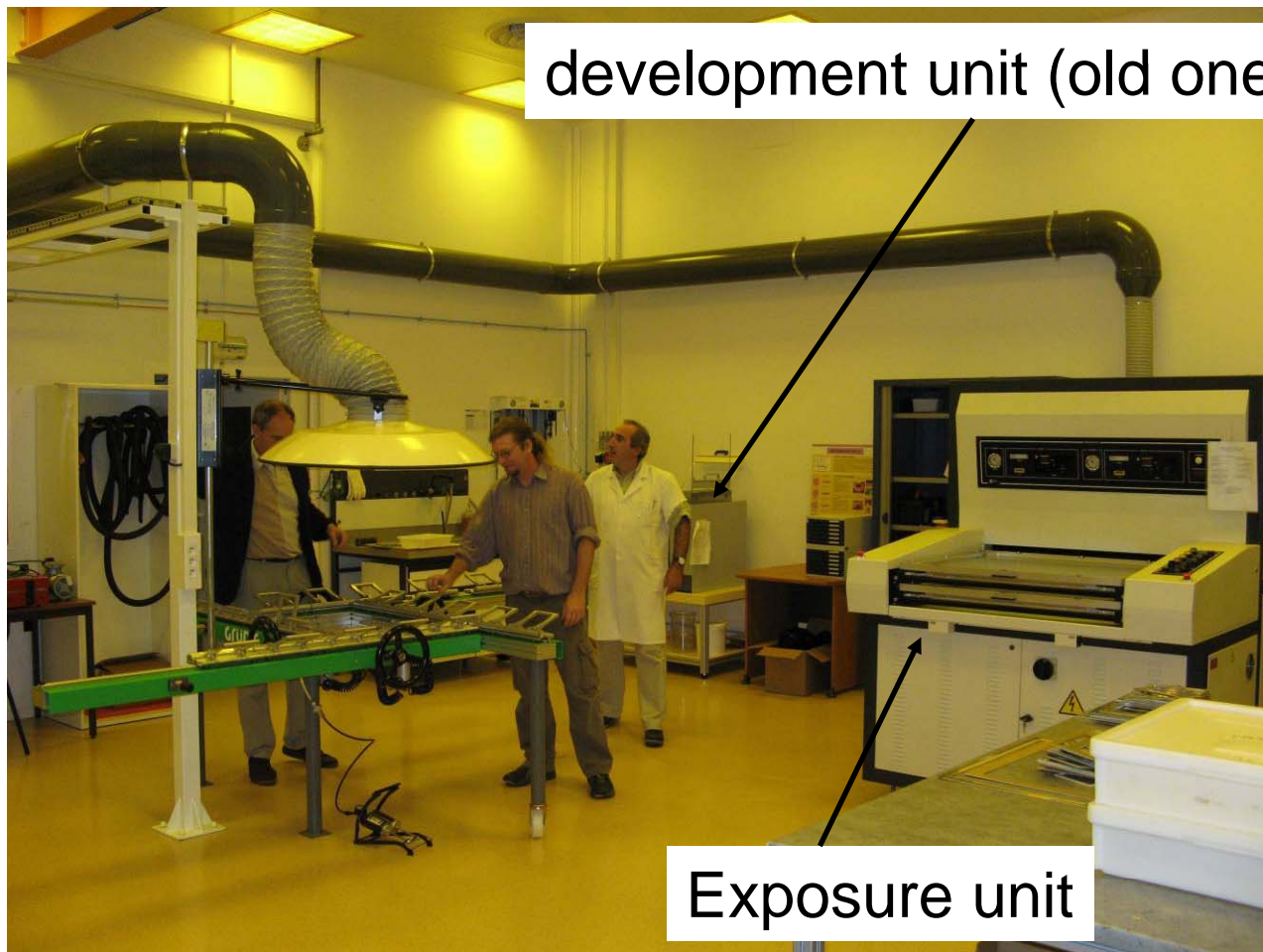
The first test showed a perfect exposure for 400 micron pillar.
Used for SLHC prototype.

Bulk Lab picture (1)

- Renovation of the lab was done in spring 2009: electricity, photoresist and gluing exhausts, liquid exhaust, de-ionized water to rinse, clean room filter change. Cost of 20 k€

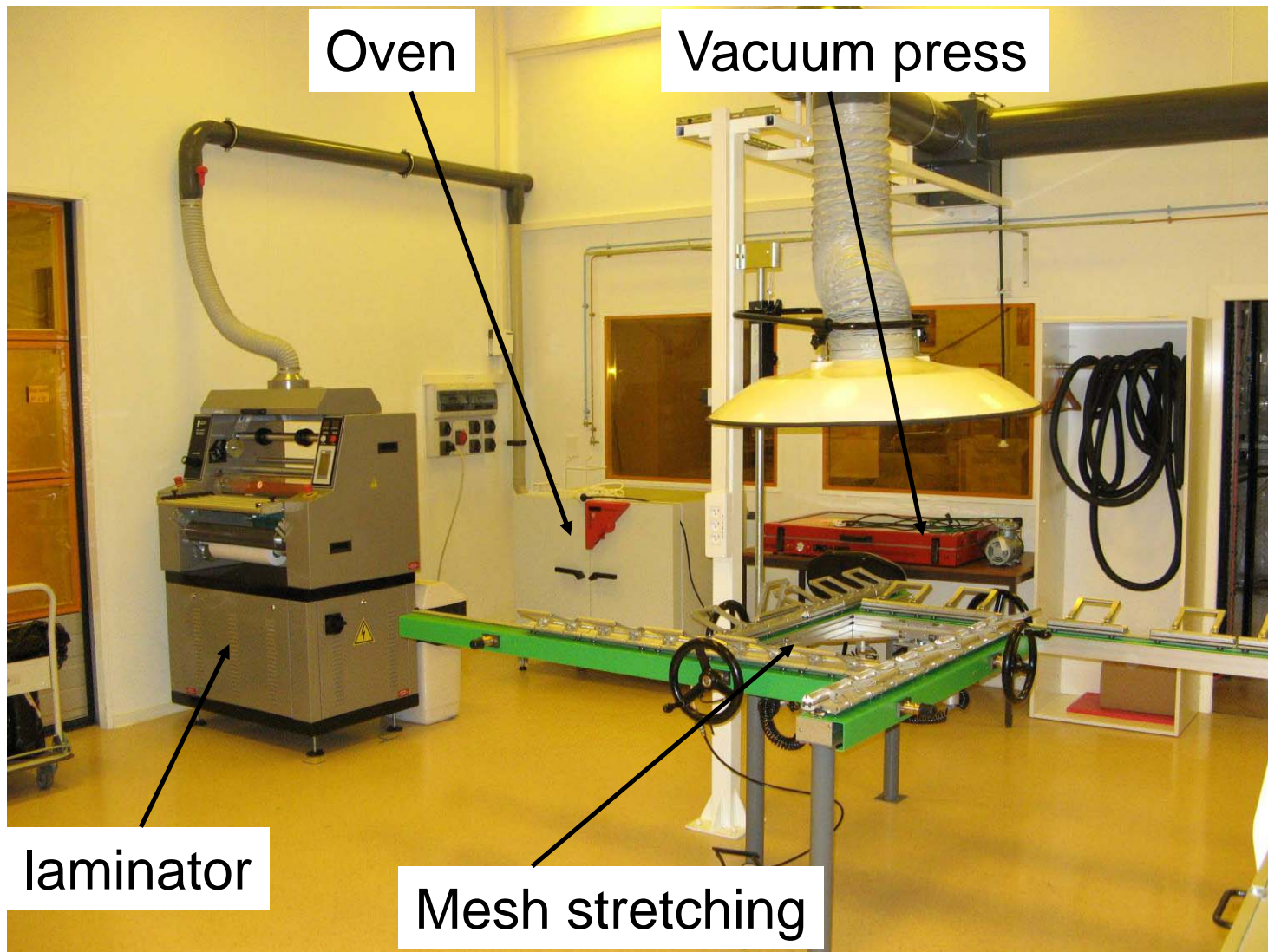
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Bulk Lab picture (2)

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Saclay lab organization

- Permanent human resource:
 - 5 persons at more or less 30% each: 1.5 man/year
 - Engineer for lab upgrade and administration
 - Engineer for R&D and external contact (CERN and other lab)
 - Quality Engineer for written procedure
 - Superior technician for R&D and prototype
 - Technician for standard realization and lab upgrade (full time person)
- IRFU Project resource:
 - The lab will be an “**open lab**” for IRFU personal to make their bulk with the help of the permanent team. The goal is to have project personal to make prototype before buying them at CERN.
- External project resource:
 - Allow external collaboration to access the lab for prototypes and tests (bulk training): micromegas bulk diffusion

Goal of the Saclay bulk lab



1. **Control and understand the realization process of a bulk for each phases**
 - Abacus of several parameters on each machine
 - Written procedure for standard realization
2. **Realization of prototypes for the IRFU project**
 - Prototypes
 - R&D on project (mesh segmentation, thin bulk,...)
 - Small serial (several days of occupation)
3. **R&D engineering “for fun” with no direct application**
4. **Synergy with Rui’s lab**
 - Exchange of process
 - **Prototype at Saclay = serial at CERN**

R&D and prototype
from design to test

R&D and prototype and
serial from design too sell