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Pascal RUSQUART
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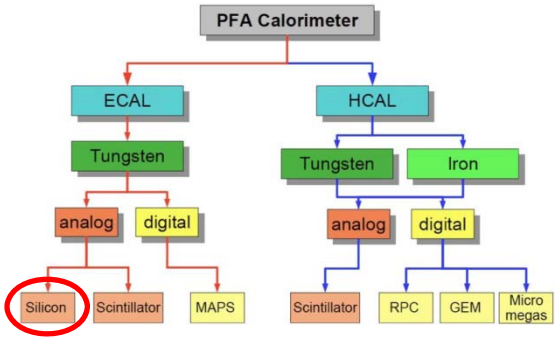
Jean-Luc SOCHA
Michel GASPARD
Stéphane TROCHET
Marc FERNANDEZ

CALICE Calorimeter for ILC

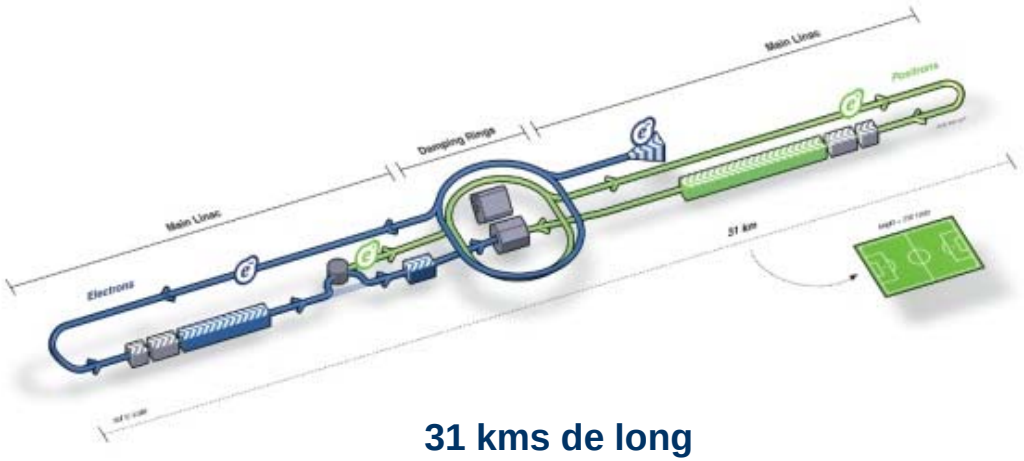


LAL Laboratoire de l'Accélérateur Linéaire

LPSC Grenoble Laboratoire de Physique Subatomique et de Cosmologie

LPNHE Paris

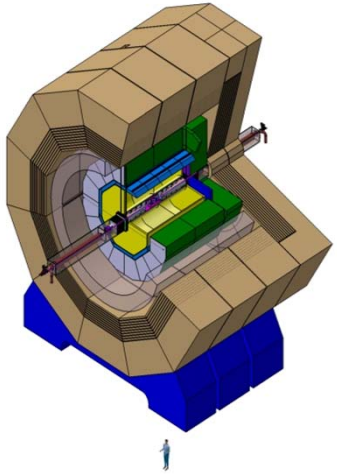
ILC (International Linear Collider)
Etudes de la physique et du développement d'un détecteur à opérer au sein du futur collisionneur linéaire d'électrons et positrons .
Cette machine permettra d'explorer la physique aux énergies d'environ 1 TeV .



31 kms de long
2 détecteurs: SID et ILD positionnés alternativement sur la ligne ILC

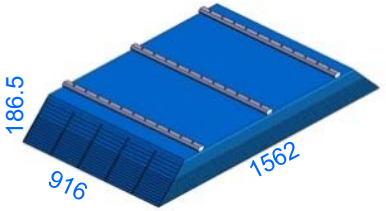
ILD

Poids: 12 kton
Hauteur: 15,50 mètres
Longueur: 13,40 mètres

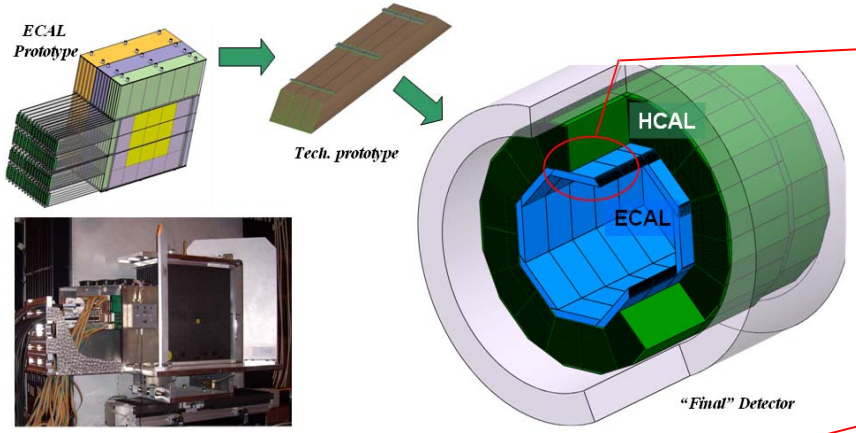


VTX Vertex
SIT Silicium Inner Tracking
FTD Forward Tracking Disk
SET Silicium External Tracking
TPC Time Projection Chamber
HCal Hadronique Calorimeter
ECal
Electromagnetique Calorimeter
5 roues de 8 modules
150 alvéoles/module

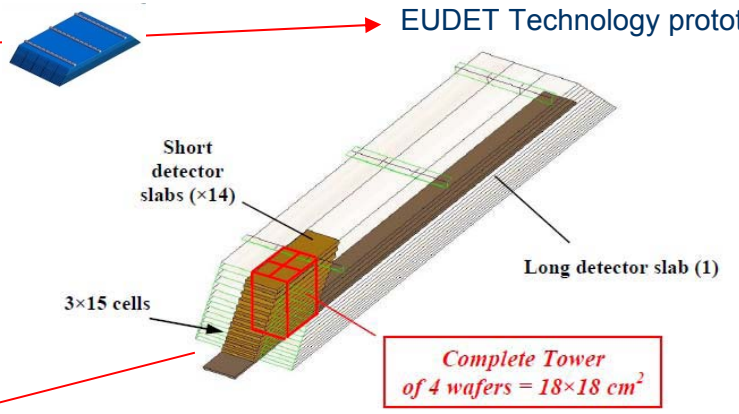
1 Module ECal Barrel



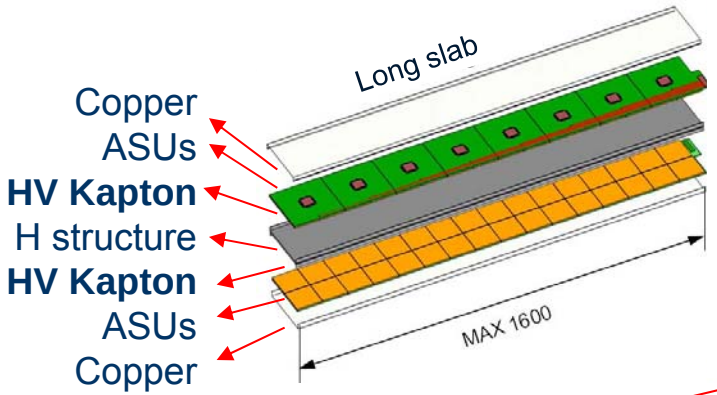
The goal is realize interconnection of ASUs for EUDET Technology prototype



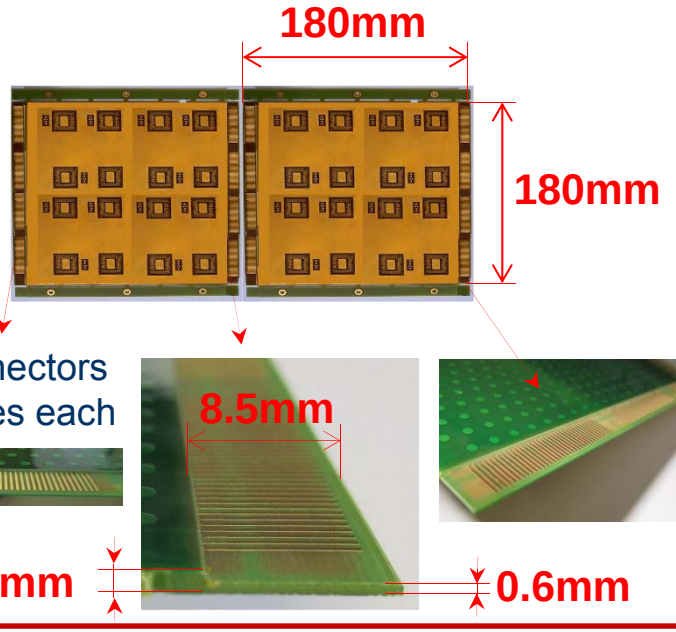
EUDET Technology prototype



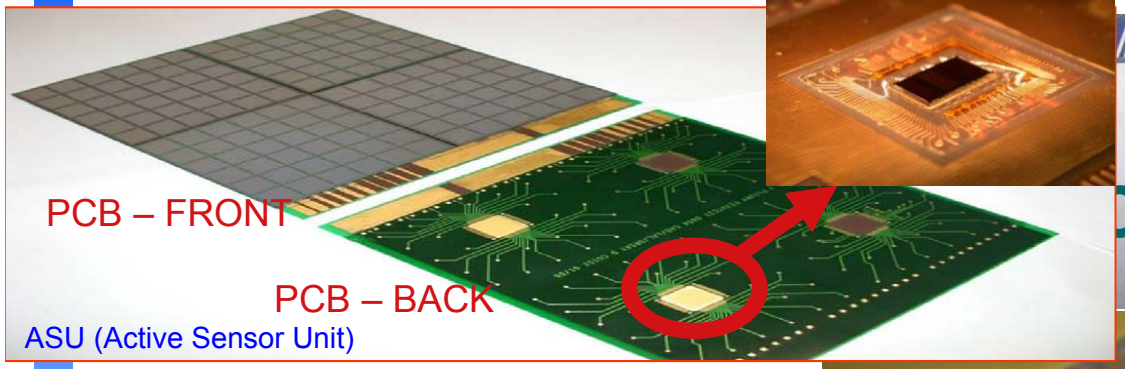
1x Long slab with:
7 ASUs+1Adapter-card+1Dif each side
14x Short slab with:
1ASU+1Adapter-card+1Dif each side
Will be interconnected

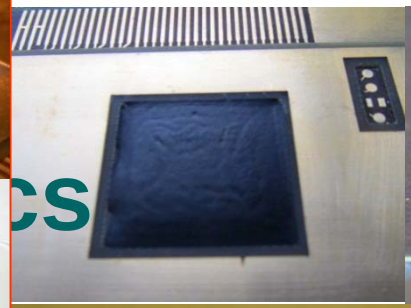


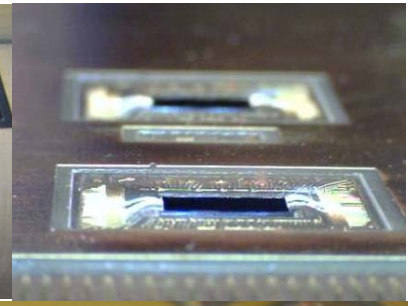
This presentation focuses on the ASUs interconnections study

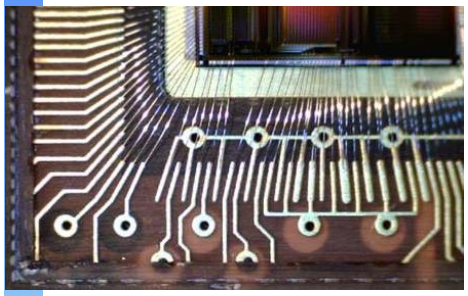


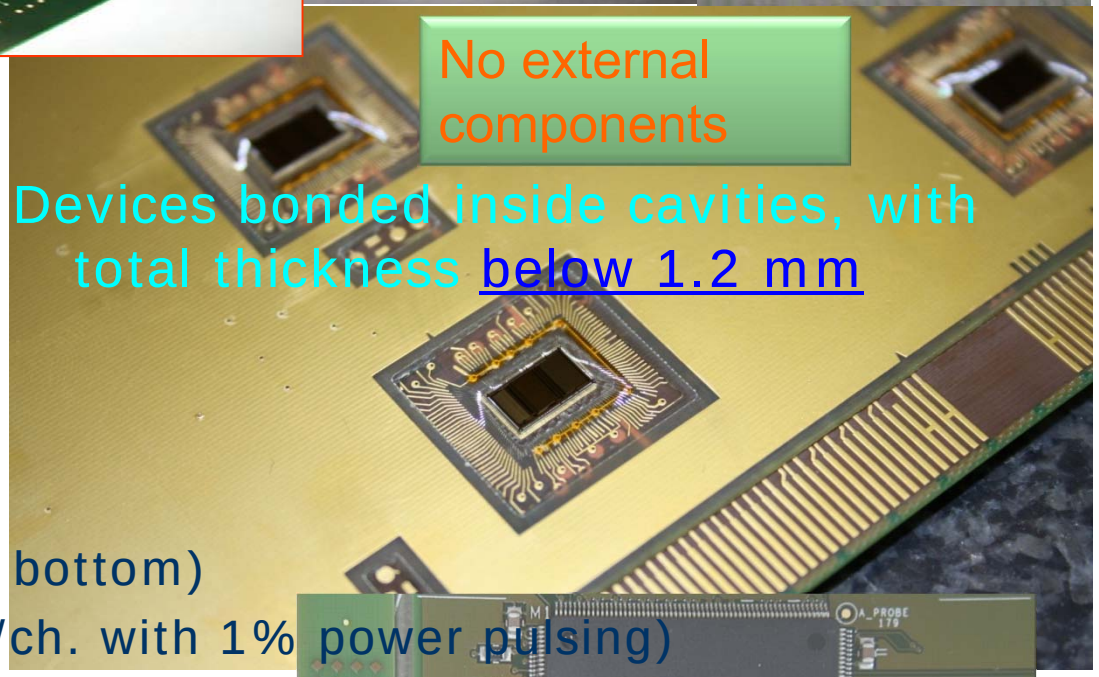
Total ILD: Barrel 336 000 connecteurs 36 voies





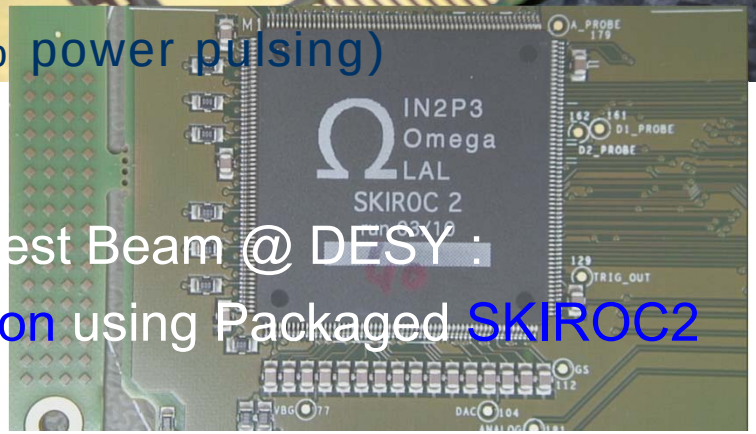






E-CAL Constraints for FE:

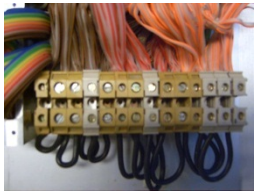
- Thickness (>1.2mm)
- Flatness (325µm Si wafer on bottom)
- Power consumption (>25µW/ch. with 1% power pulsing)
- Low noise (1MIP = 4fC)
- Auto Trigger
- ADC Embedding
- Zero suppress

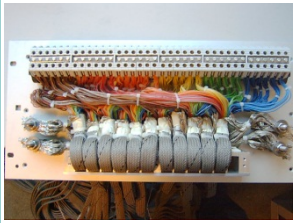


Currently in est Beam @ DESY :

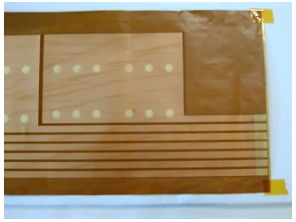
Backup solution using Packaged SKIROC2

Patch pannel





HV kapton



J.L Socha

Interconnection By solder paste

Interconnection By ACF

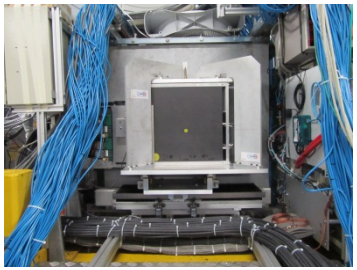
Interconnection By Kapton

P.Rusquart,C.Hernandez,S.Trochet

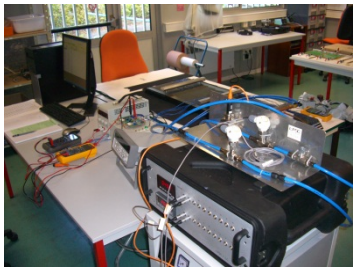
Manipulator 3 axis

Test réseau Bragg (fibres opt) sur la nouvelle structure alvéolaire à l'institut sup optique Palaiseau

2008 2009 2010 2011 2012

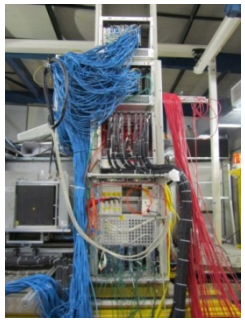


ECAL prototype physique
Fermilab test beam



Thermal slab LAL Test

M.Gaspard

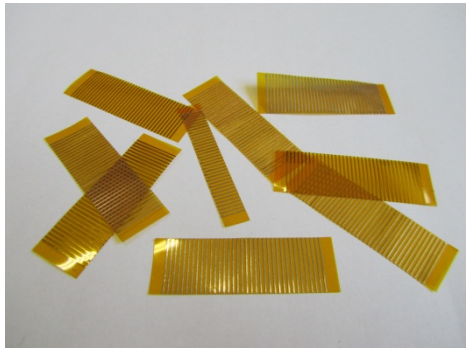


Ecal with DHCAL
Fermilab test beam

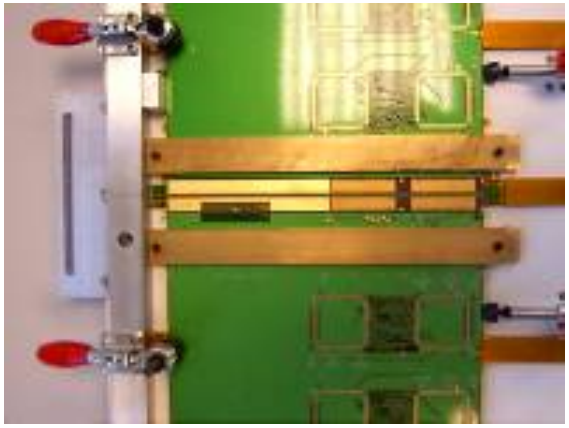
F.Wicek,M.Gaspard,S.Trochet

FEV8 Desy
test beam

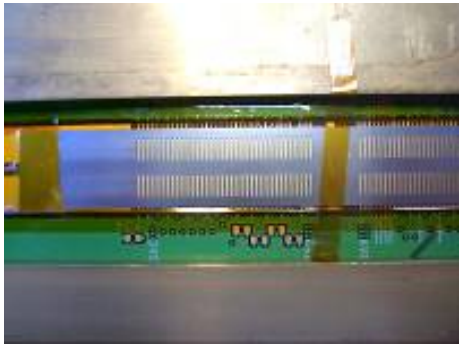
ASU interconnection by soldering



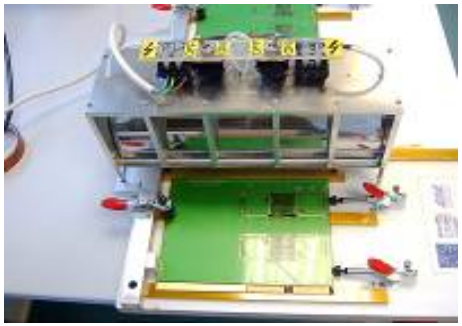
Kapton comb 1 connector
with 36 wires



Solder bench



Silk screen for
manual solder paste laying
(very delicate operation)



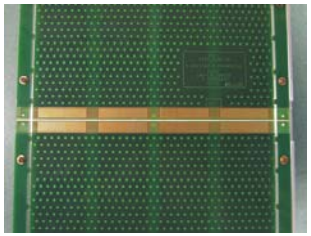
Halogen lamp for the solder
200°C for 2min 30sec

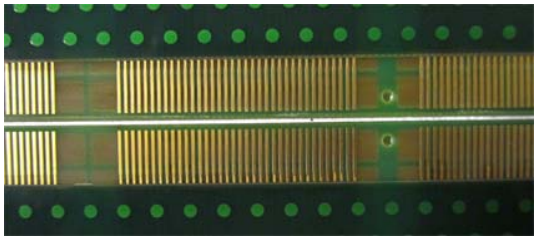
We developed this method with the
and used it to interconnect 8 FEV-temps

UNIVERSITY OF CAMBRIDGE

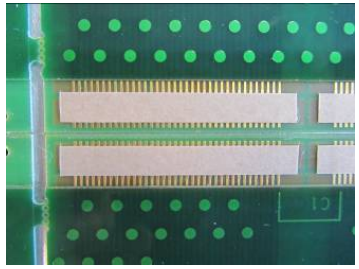
ASU interconnection with ACF 3M Anisotropic Conductive Film adhesives

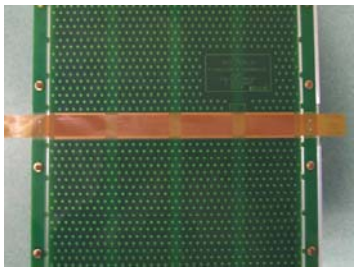
3x FEV8 3C
4x4 connectors each with 36 channels



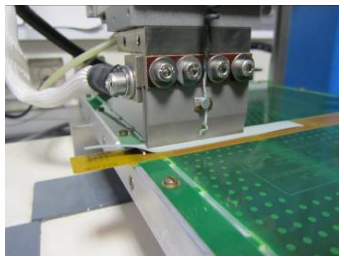


Positioning ACF on boards and positioning kapton combs



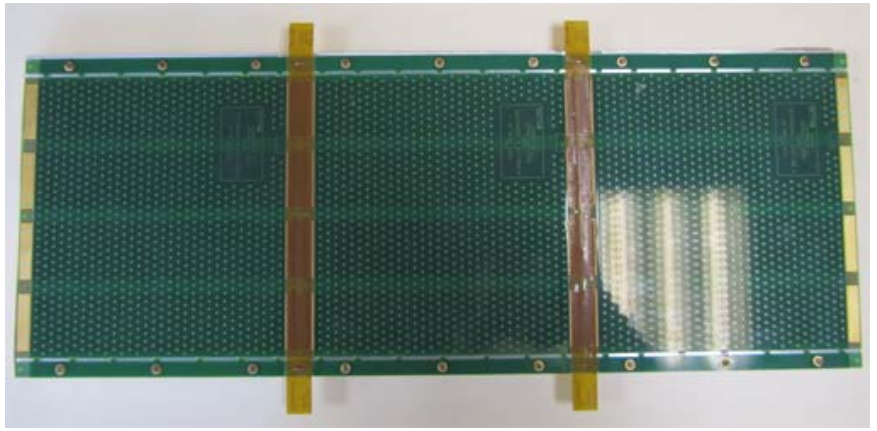


Using Myachi Thermode



Temperature 150°C
Time 25 seconds
Pressure 18 Bar

3x FEV8 3C are ready to the electrical test

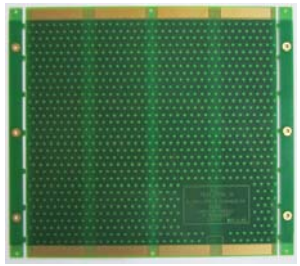


ASU interconnection with special kapton

FEV8-3C

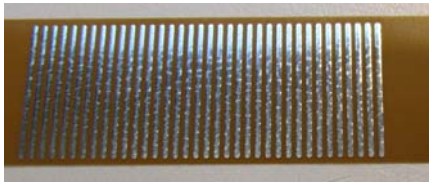
4 connectors each with 36 channels

Wire by wire



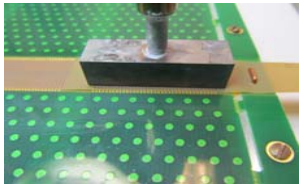
Kapton combs

4 connectors with 36 copper pads
with tin and lead
length=14mm width=0.5mm
Thickness of copper = 35µm
Thickness of kapton = 50µm
Thickness of tin and lead = 65µm

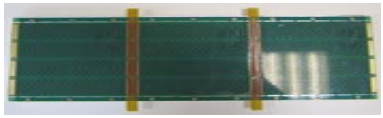


Using Weller Solder tool

300°C for 5 seconds

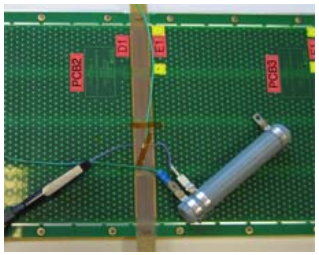


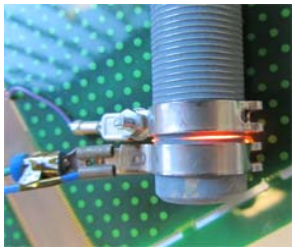
Continuity test



Resistance between wires in PCB = 0.21ohms
Isolation between wires in PCB = ∞

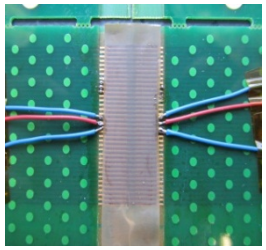
Power test

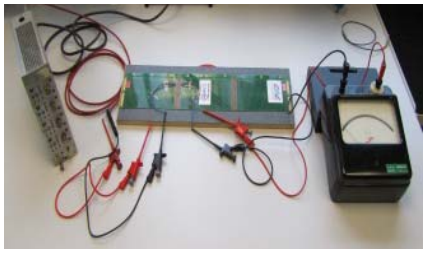




Sfernice adjustable resistance
R = 2.5 ohms, U = 12.8V, I = 5A

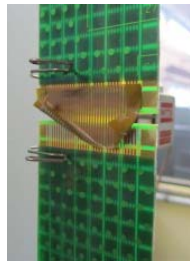
HV tests



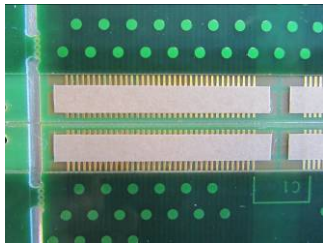


1 wire with Max 1350V
between 2 ground wires

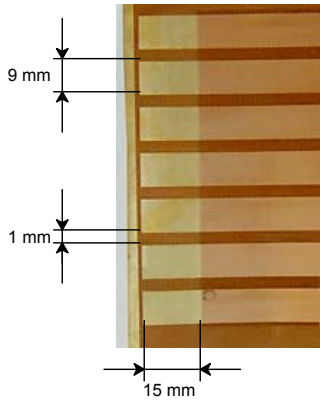
Tensile tests

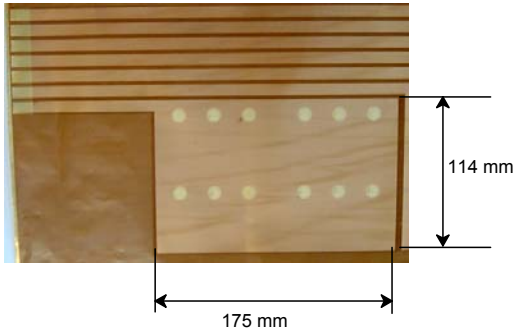


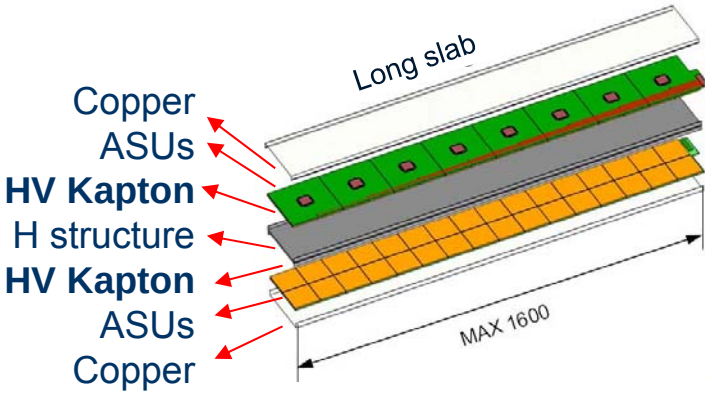
Max 600N before destruction

Technology	Advantages	Disadvantages
N°1 Solder 	-Proven technology -Possible to repair -~3 euros/connector	-Difficult procedure -Too much heat for the glue of wafers -Cannot be industrialized
N°2 ACF 	-Easy to install -Easy to remove -Easy to industrialize	-Needs to have a perfect planarity -Needs to have a thermode ~15Keuros -10mA maximum per wire -~30 euros/connector -Too much pressure =mechanical stress for the wafers
N°3 Spécial Kapton 	-Easy to install -Good reliability -Possible to repair -Easy to industrialize -Good strength -~4 euros/connector	-I don't know yet

HV Kapton V1

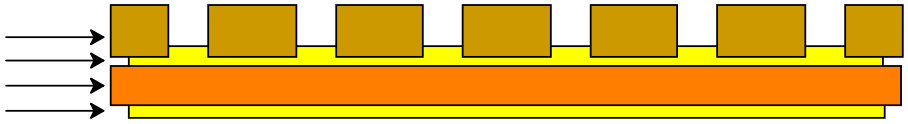




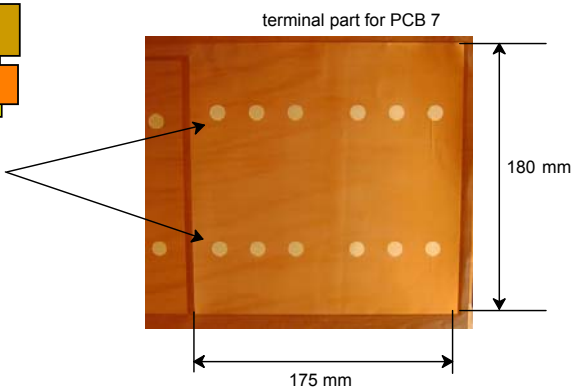


Thickness

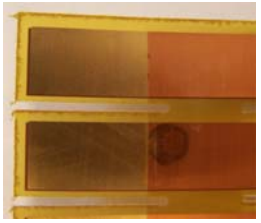
coverlay + glue = 50 µ
CU + ARG chimical = 17.5 µ
kapton = 25 µ
CU + ARG chimical = 17.5 µ
= 110µ



2 x 6 holes diameter = 10 mm for gluing and connecting waffer



HV Kapton V2



Prochaines étapes

EUDET

- Régler puis tester le manipulateur 3 axes en réalisant l'interconnexion d'une ligne de 7 FEV8 3C.
- Etudier les nouveaux kapton HV pour l'alimentation des wafers.
- Etudier un patch pannel HV avec filtres.
- Réaliser pour les tests beam à Désy en juillet les interconnexions de :
  -8 slabs courts avec chacun 1 FEV8 avec wafers + 1 ADAPT + 1 kapton HV.
- Réaliser pour la fin de l'automne les interconnexions de :
  -1 slab long avec 7 FEV8 avec wafers + 1 ADAPT + kapton HV
  -8 slabs courts avec chacun 1 FEV8 et wafers + 1 ADAPT+ kapton HV.

ILD

- Etudier l'impact des câbles de tous les sous détecteurs (VTX.FTD.TPC.Hcal.Ecal…) pour l'intégration sur ILD.

SERDI
Service d'Electronique, Recherche en Détecteurs et Instrumentation

Merci pour votre attention