

Prototype Micromegas et connectique Zebra pour l'électronique MIMAC

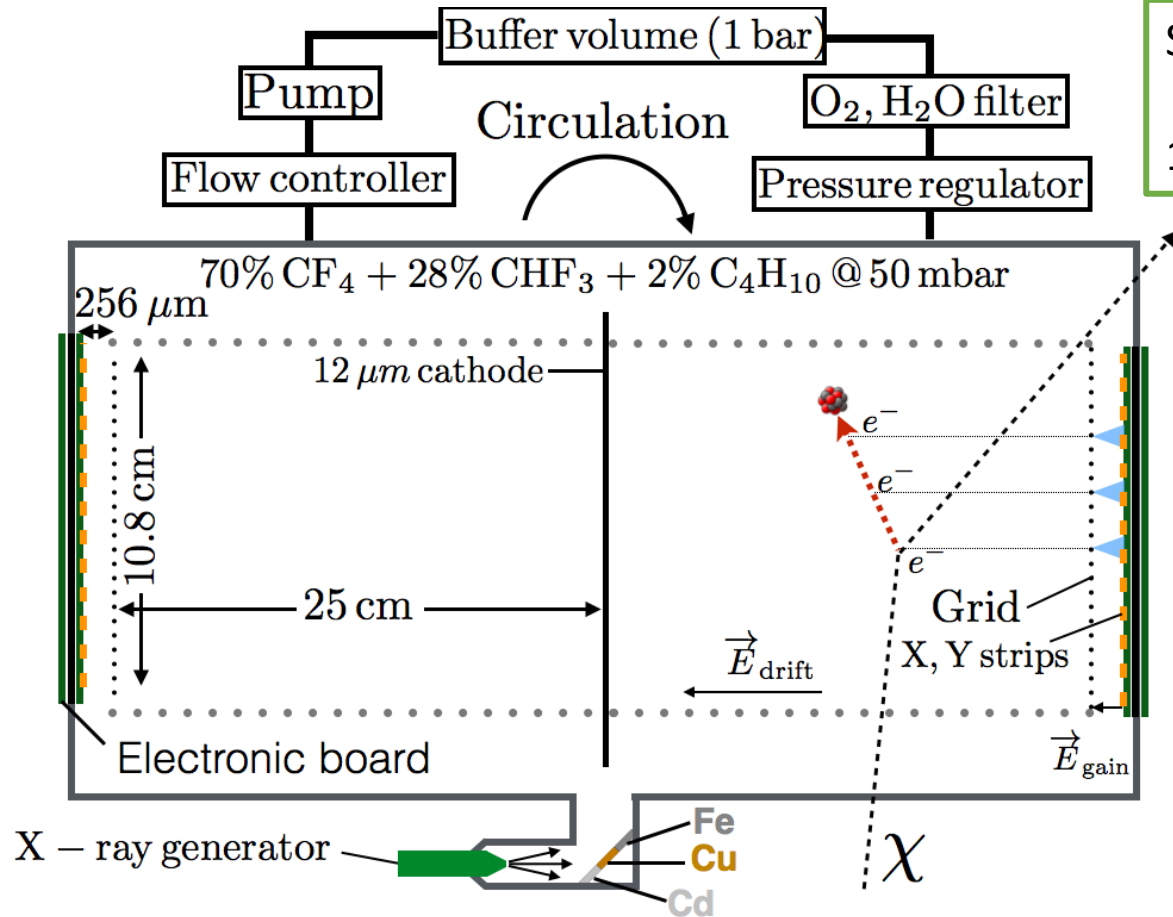
LPSC (Grenoble) : D. Santos,

- SDI : **O. Guillaudin, M. Marton, N. Sauzet**
- Electronique : **(G. Bosson, J. Bouvier), N. Ponchant, (J.L Bouilly). O. Bourrion, C. Caplan**
- Informatique : **T. Descombes**

Détection directionnelle de matière noire
+
Spectrométrie des neutrons

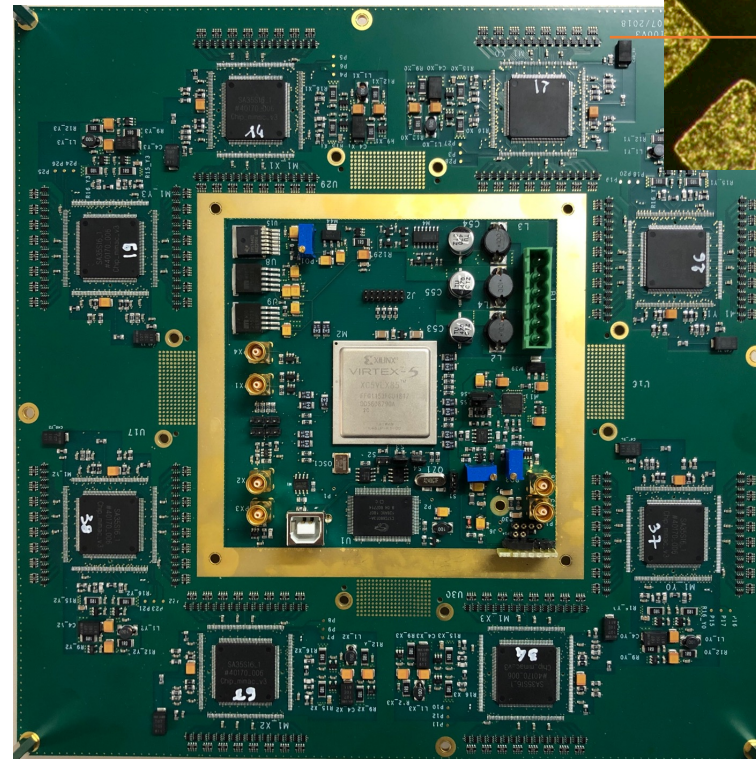
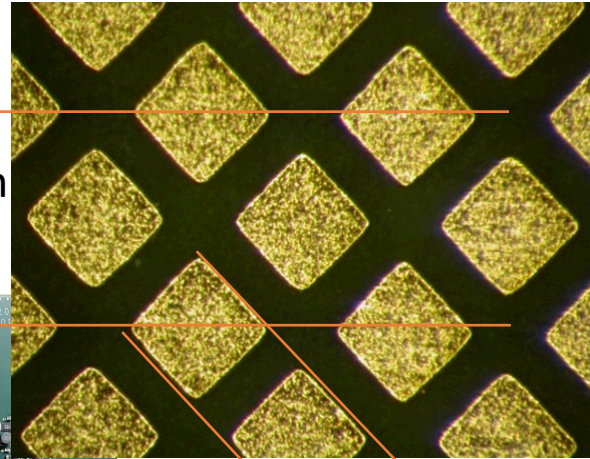


R&D : Prototype bi-chambre



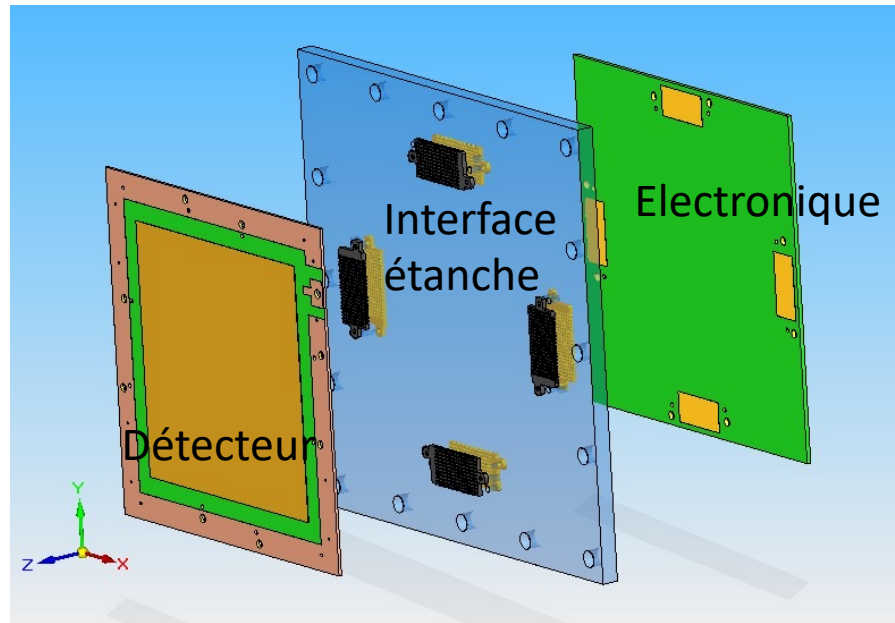
Gap 256 à 512 μm

Seuil en énergie : < 1keV
seuil / voie \sim 3000 à 10000 e^- (\sim fC)

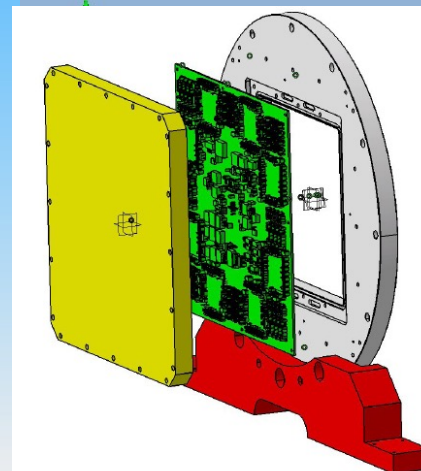
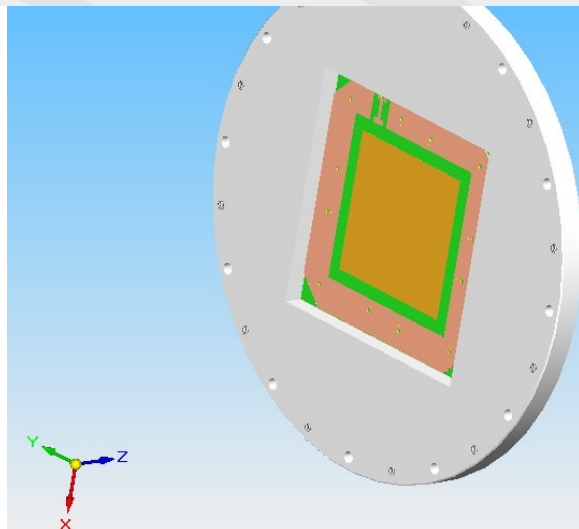
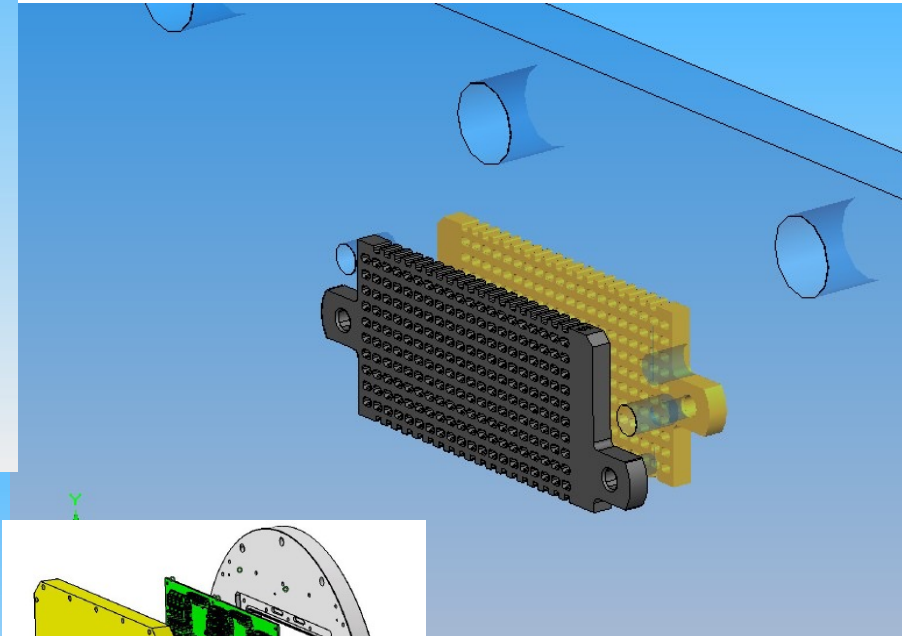


- 512 voies \rightarrow 65000 pixels
- Lecture pixels : 20 ns (50 MHz)
- Energie : ADC (50 MHz)
- Horloge externe

Assemblage



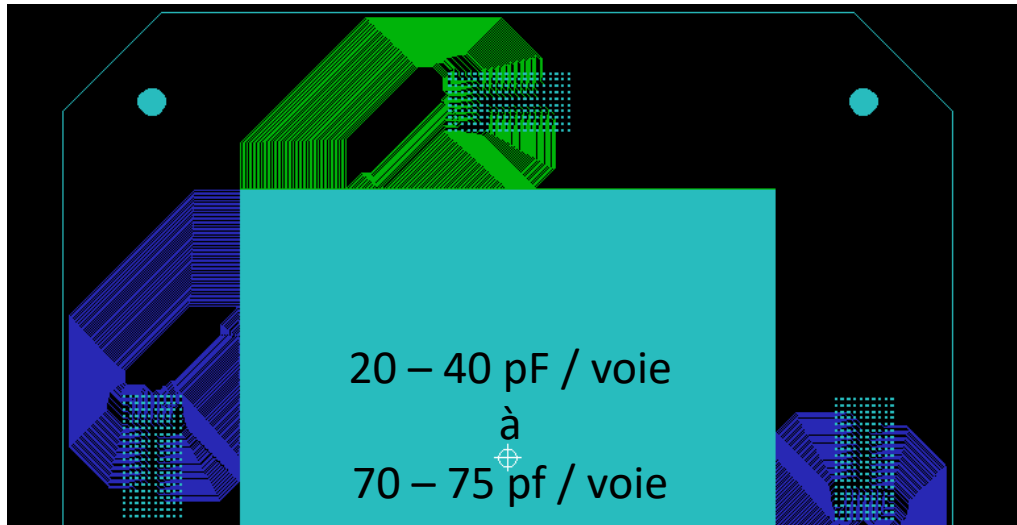
Pas de flexible



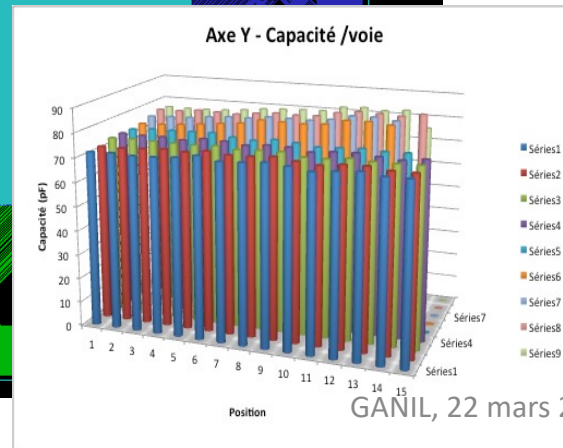
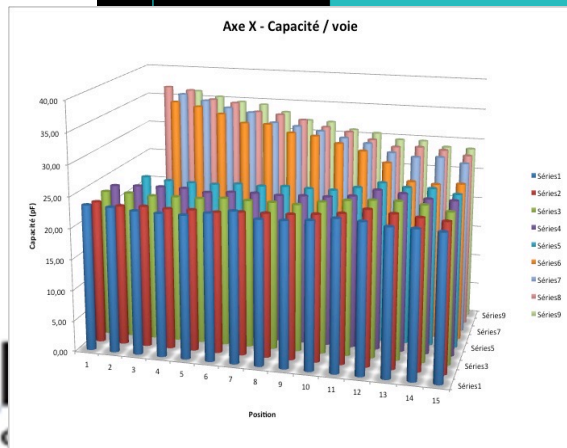
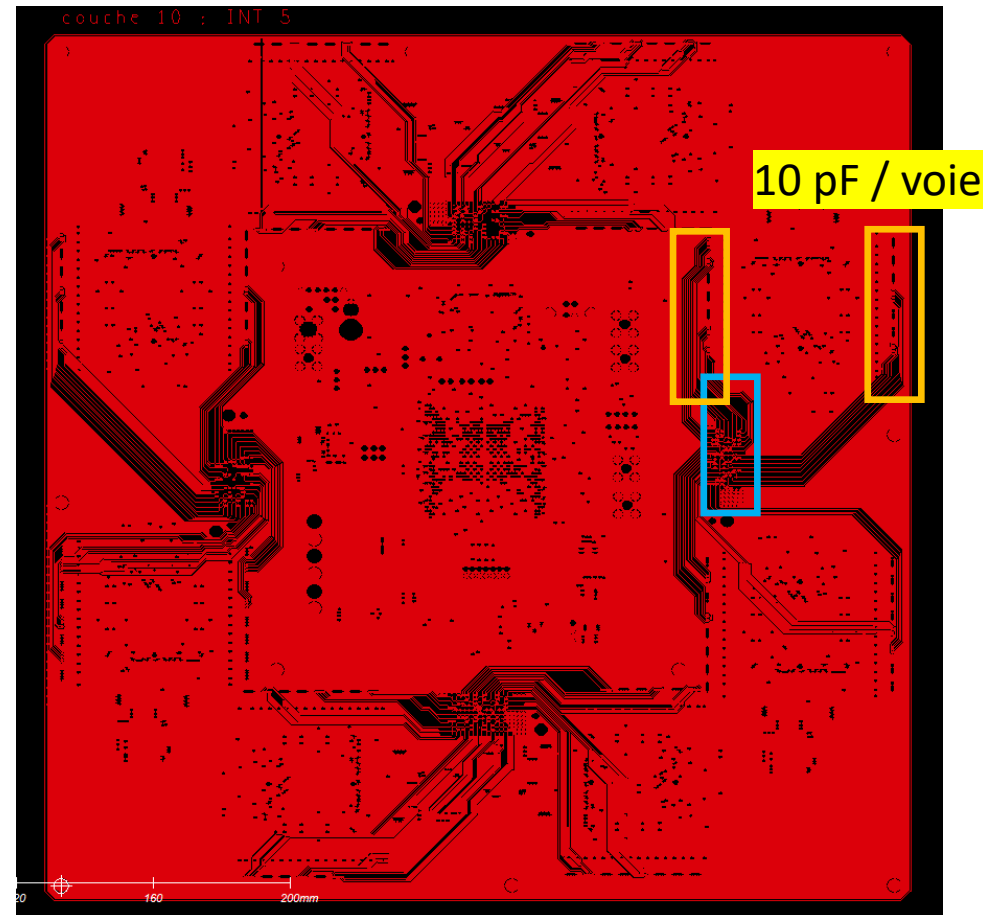
- SAMTEC 200 contacts
- 5,12 voies/cm²

Routage PCBs Détecteur / Electronique (Capacité parasite)

Détecteur 10 x 10 cm



Carte 512 voies



Micromegas (connectique)

3 x 3cm²
64 x 64 voies

10 x 10 cm²
256 x 256 voies
Bulk
65 536 pixels/via

10 x 10 cm²
256 x 256 voies
Piggy Back Bulk

10 x 10 cm²
256 x 256 voies
Piggy Back DLC
Grille Cu

5,4 x 5,4cm²
96x96 voies

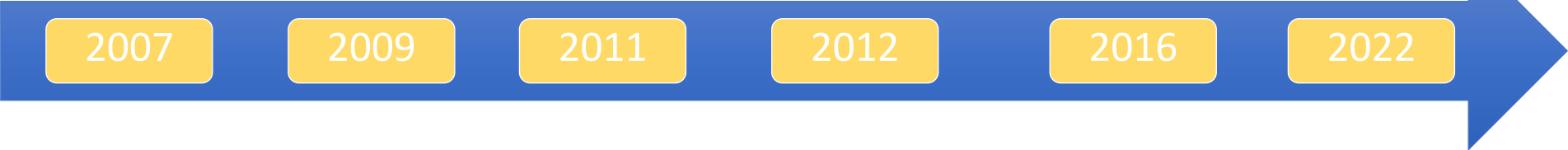
200 x 200 cm²
512 x 512 voies
Bulk
262 144 pixels/via

10 x 10 cm²
256 x 256 voies
Piggy Back
Grille Cu

Matériaux

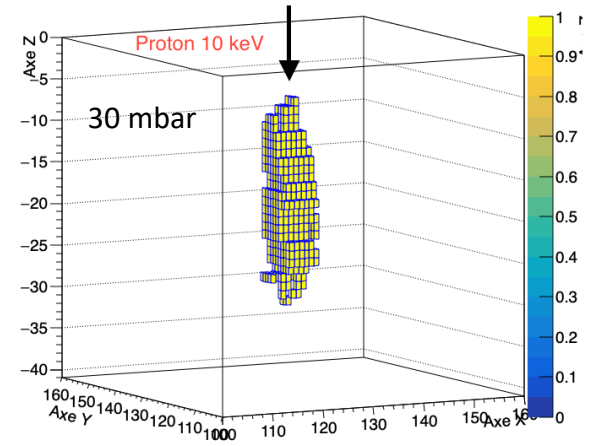
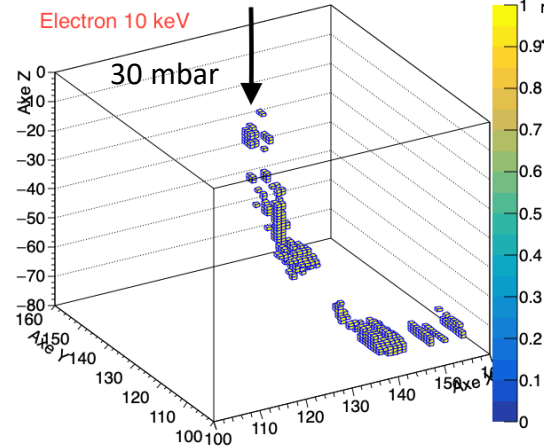
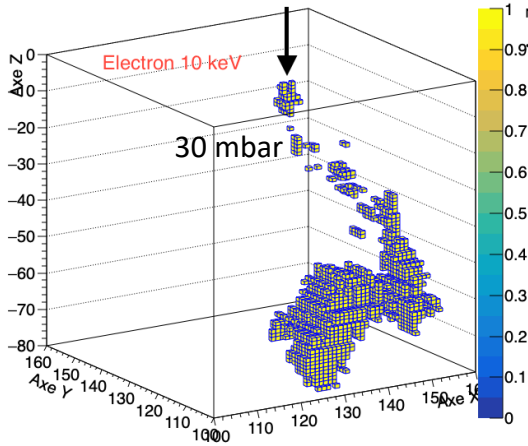
- Kapton / Cu
- DLC
- PMMA

Diagram labels: Conversion volume, Drift plane, Mesh, Amplification gap, Resistive layer, Anode plane, d, t_i

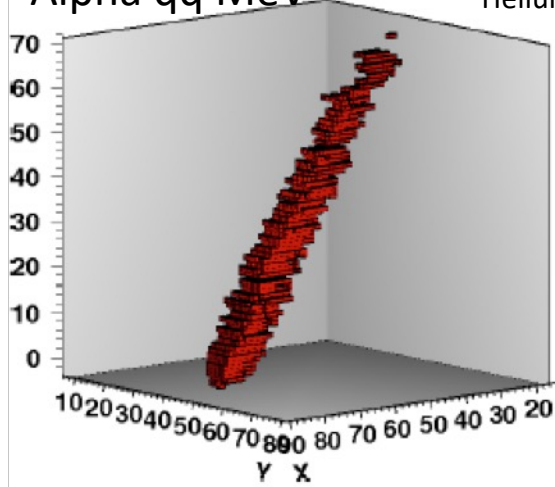


Traces 3D

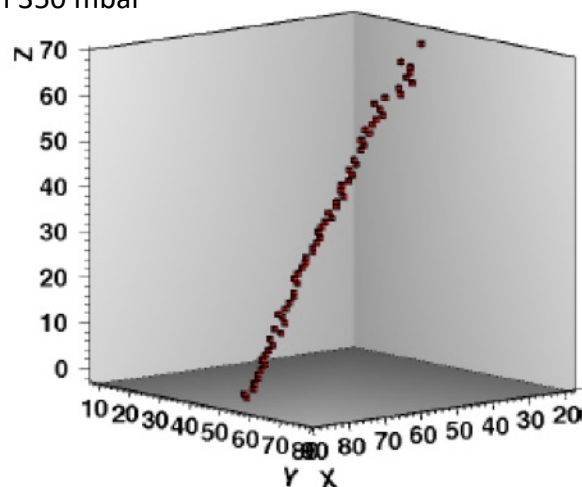
Isobutane/ CHF3 30 mbar



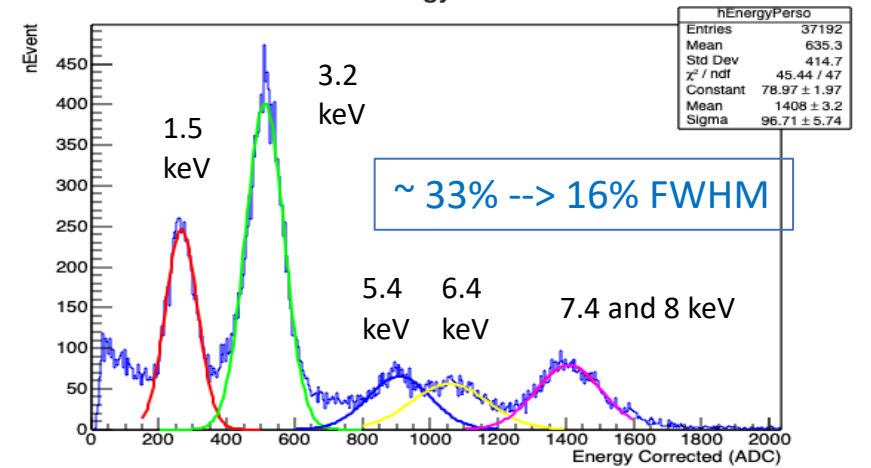
Alpha qq MeV



Hélium 350 mbar



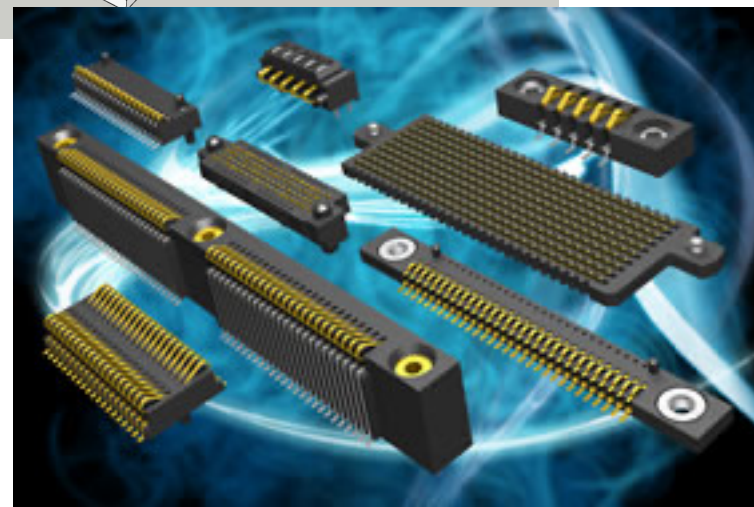
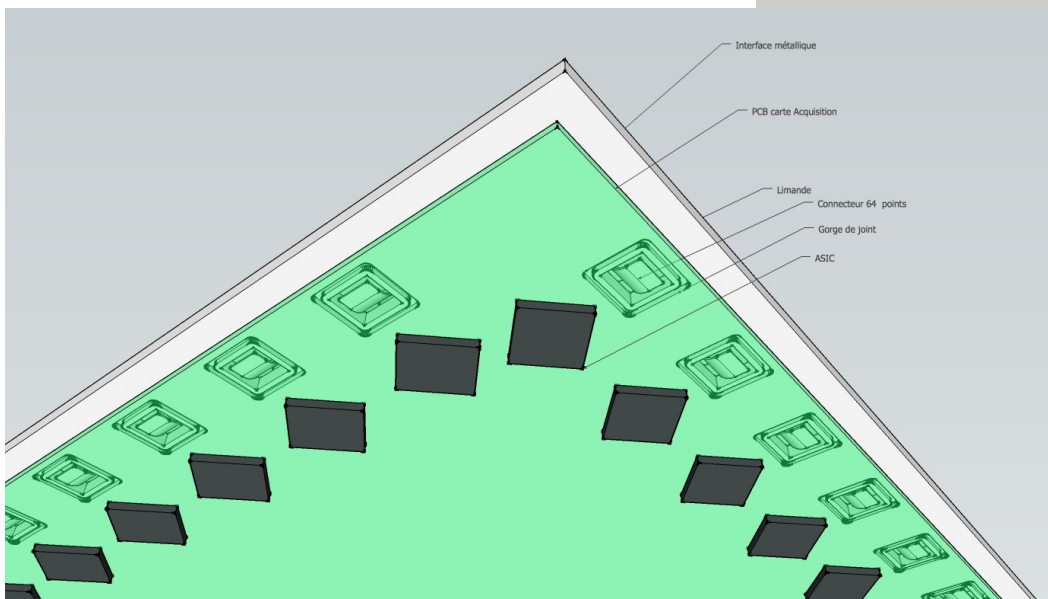
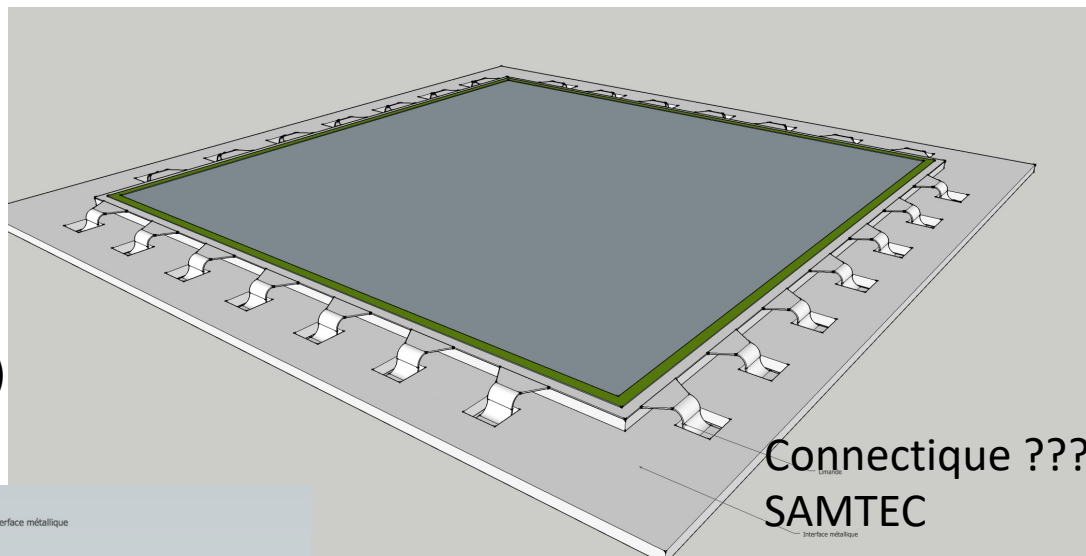
hEnergyPerso



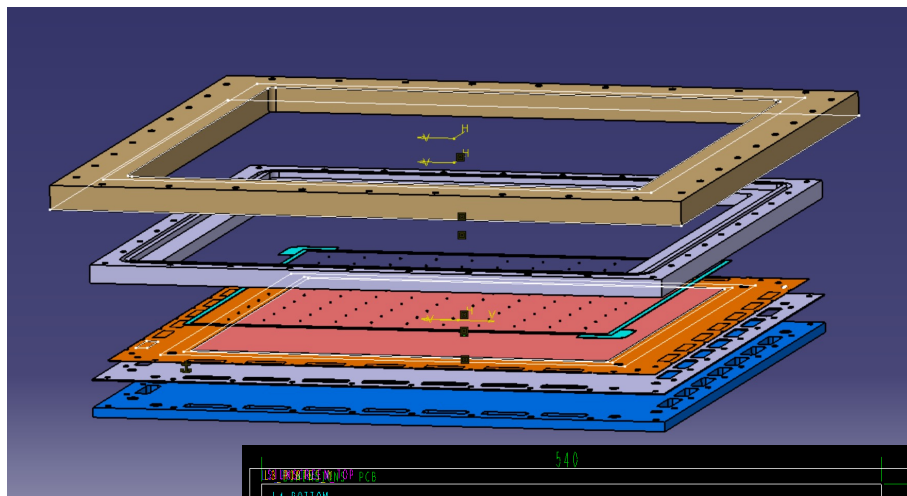
Détecteur 35x35 cm

Projet :

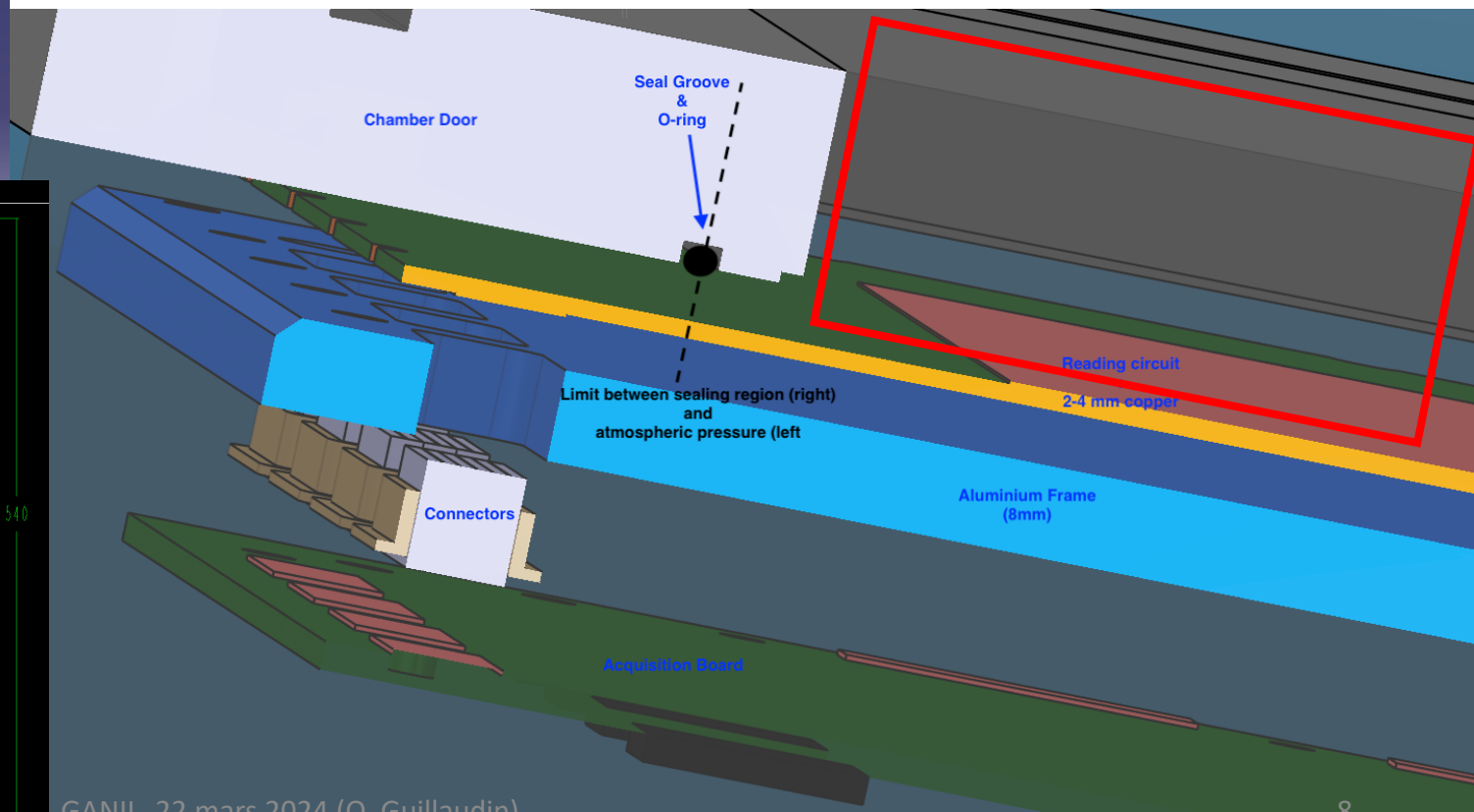
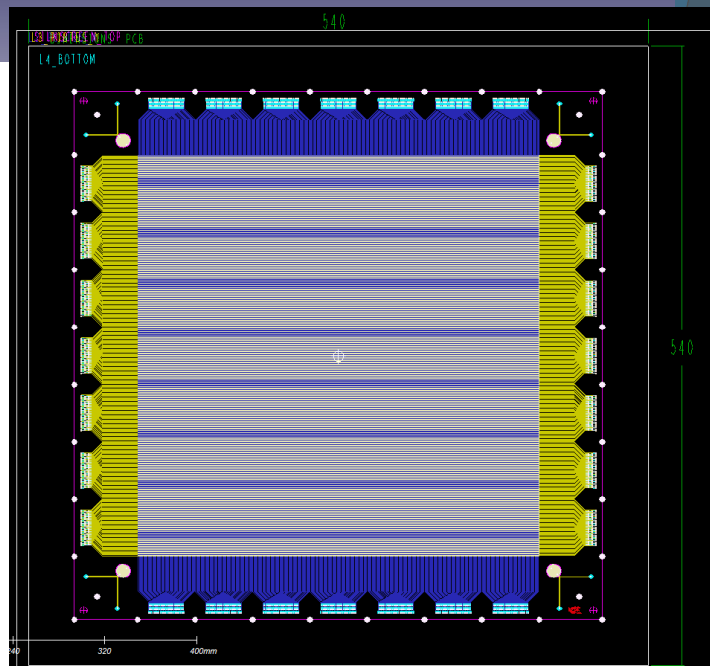
- Zone utile 35 x 35 cm
- Résistif (DLC)
- Pitch <math>< 400 \mu\text{m}</math> $\rightarrow 390 \mu\text{m}</math>$
- Nombre de voies 1792 (multiple de 64)
- Pression 50 mbar (\rightarrow gap $512 \mu\text{m}</math>)$
- 1,46 voies/cm² (3,5 fois moins/ 10x10 cm²)
- 50 pF / piste



Maquette 3D



Aligner 1792 voies en une fois !!!
Tenue au vide : 50 mbar



Connecteur ZEBRA[®]

Elastomeric Electronic Connectors (Fujipoly)

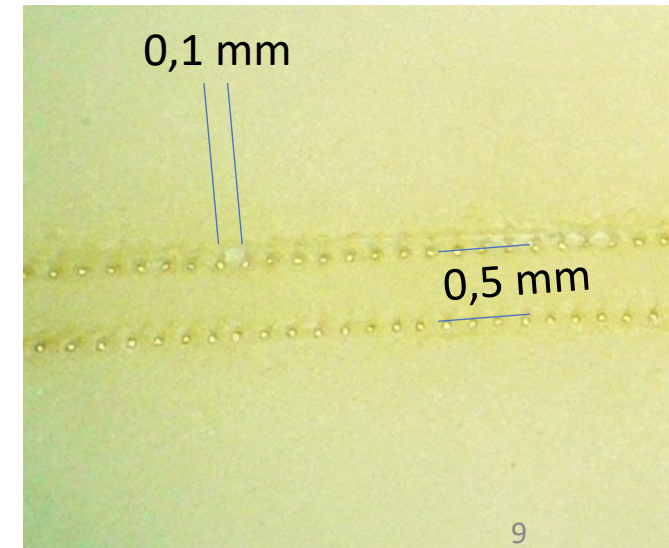
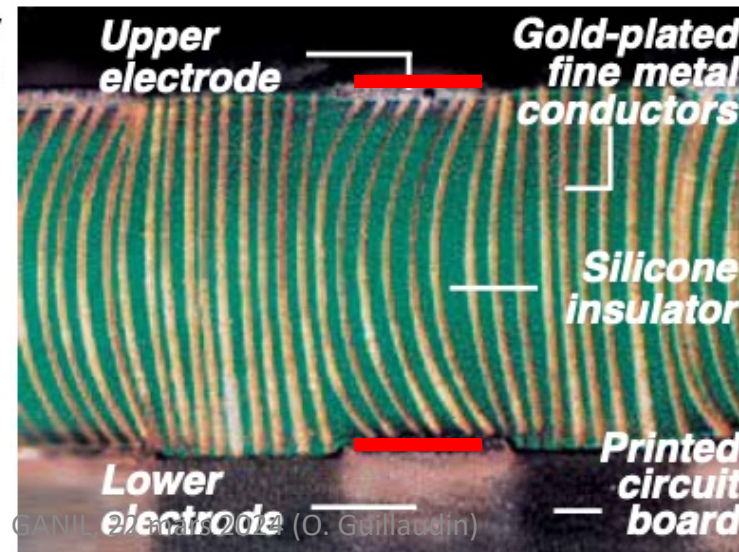
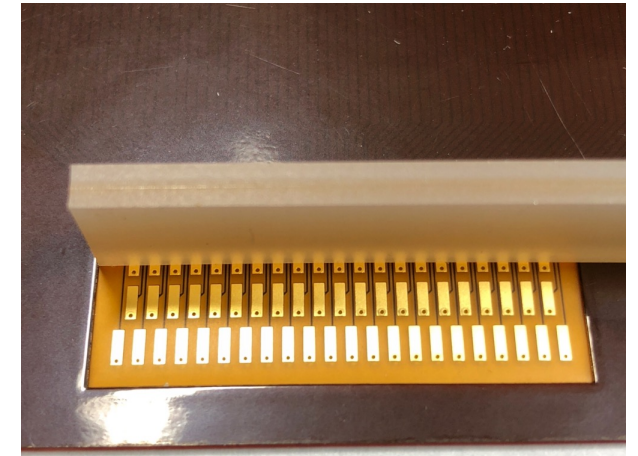
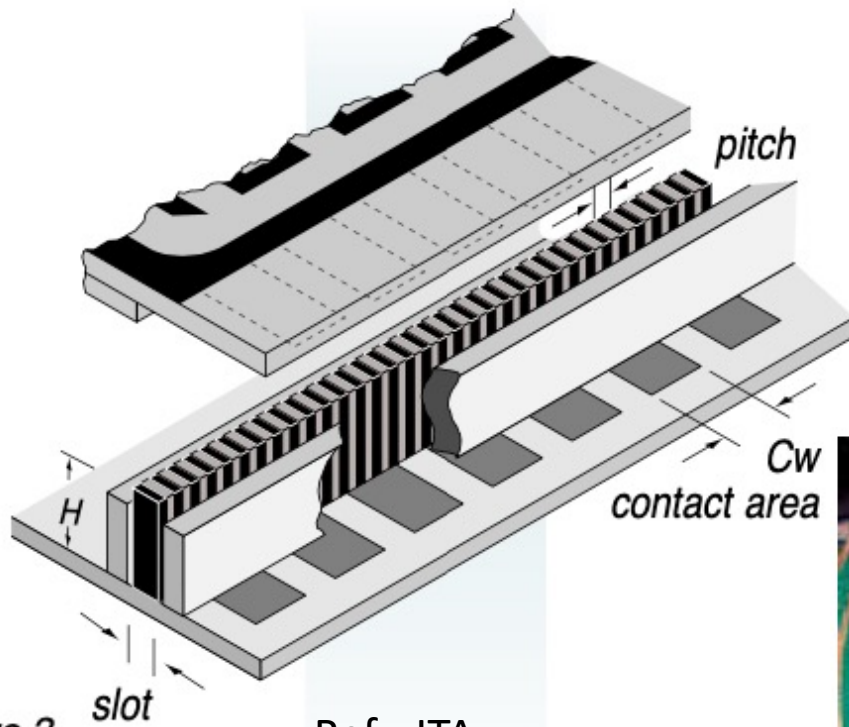
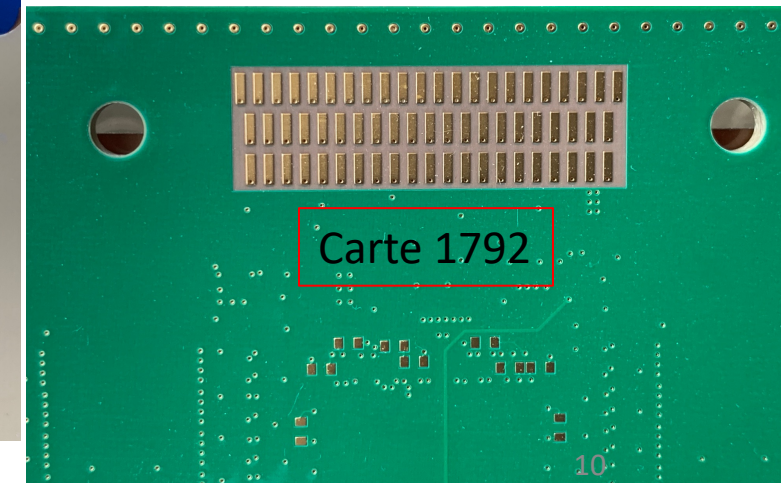
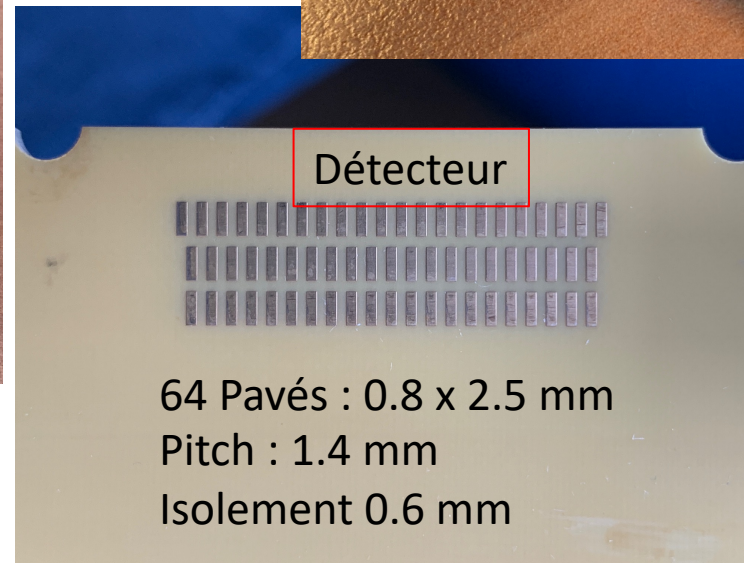
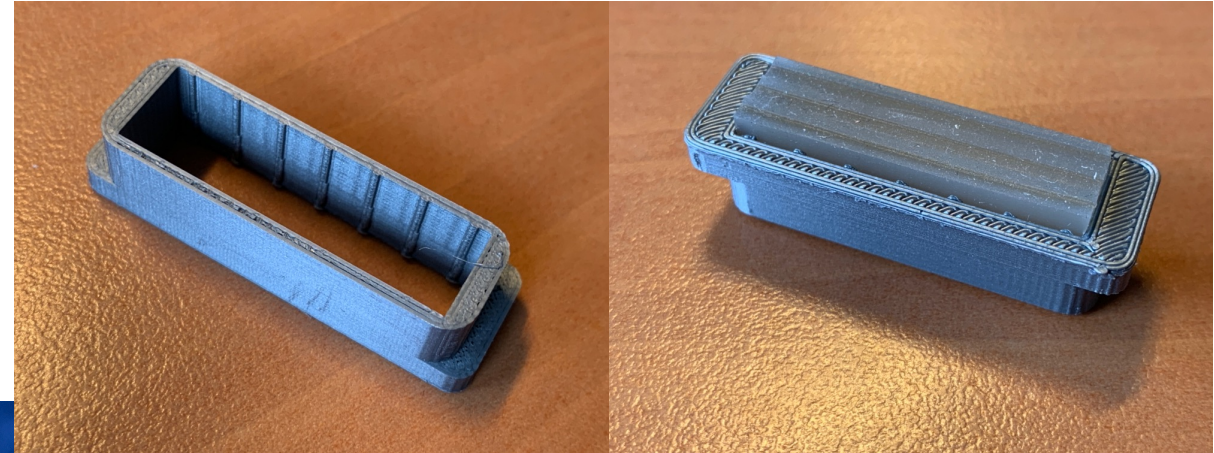


Figure 3

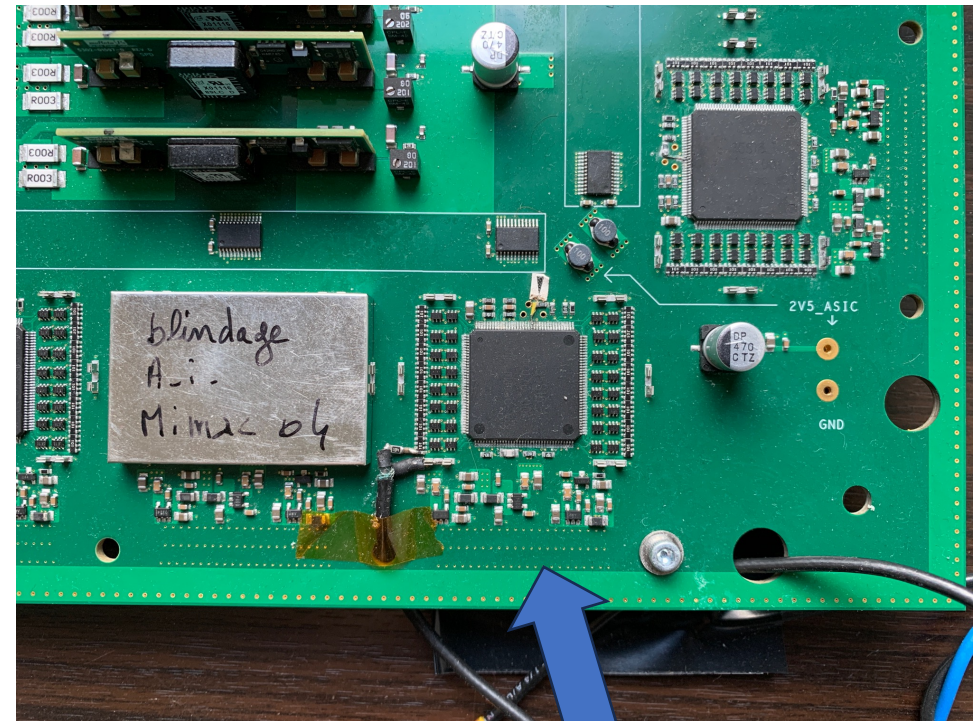
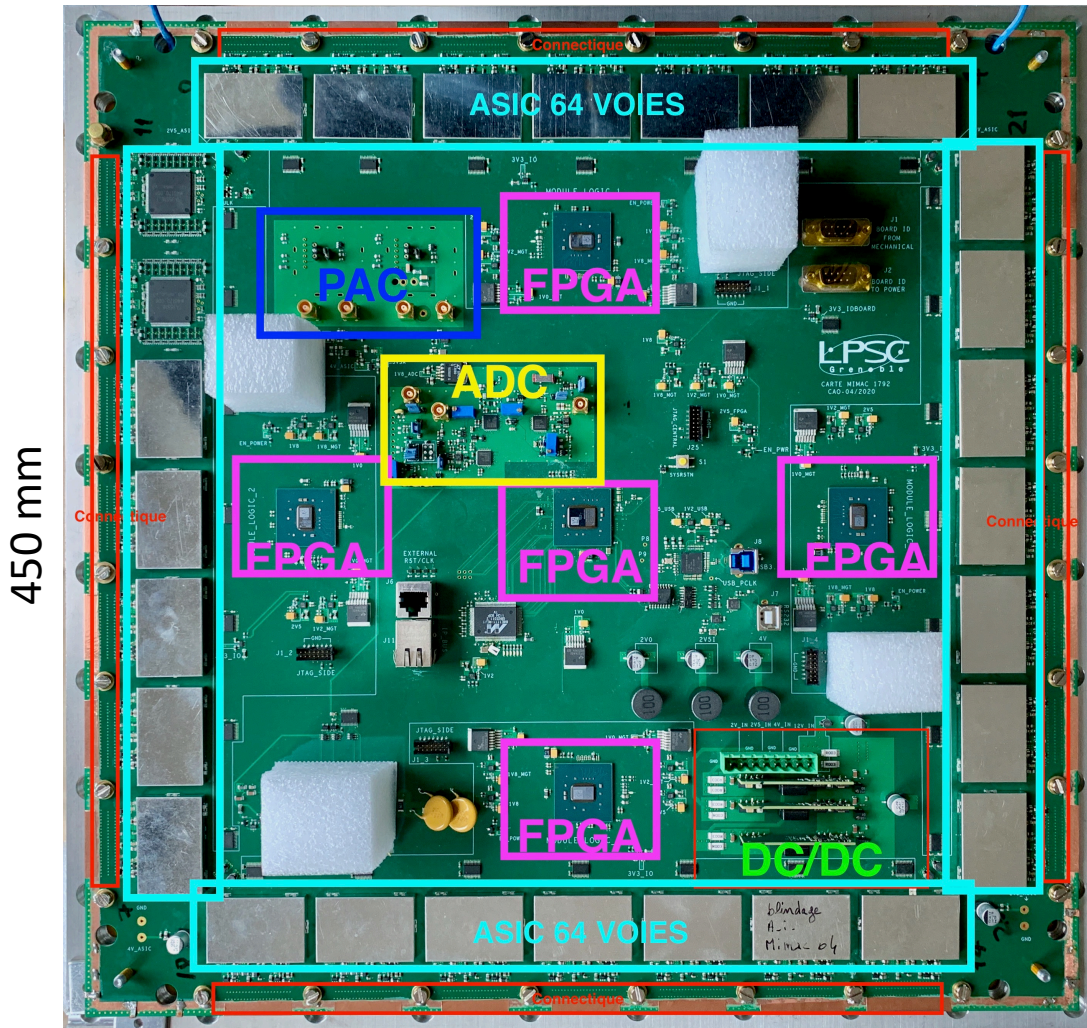
Ref : JTA
2 rangées de fils (0,5 mm)
Pitch : 0,1 mm
100 x 3 x 13 mm

Holder

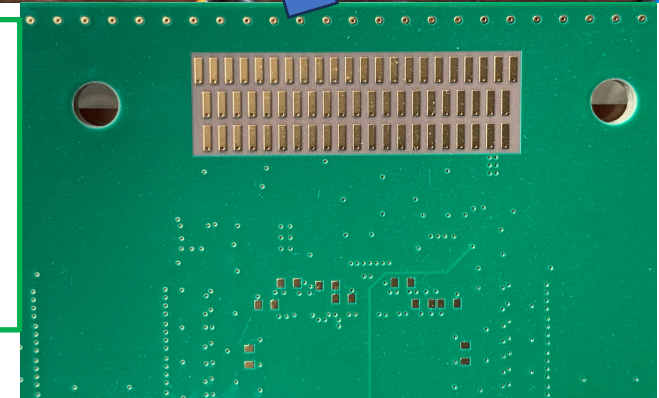
- Positionne le Zebra sur l'empreinte
- Définit l'écrasement (~10%)
- Absorbe le gonflement



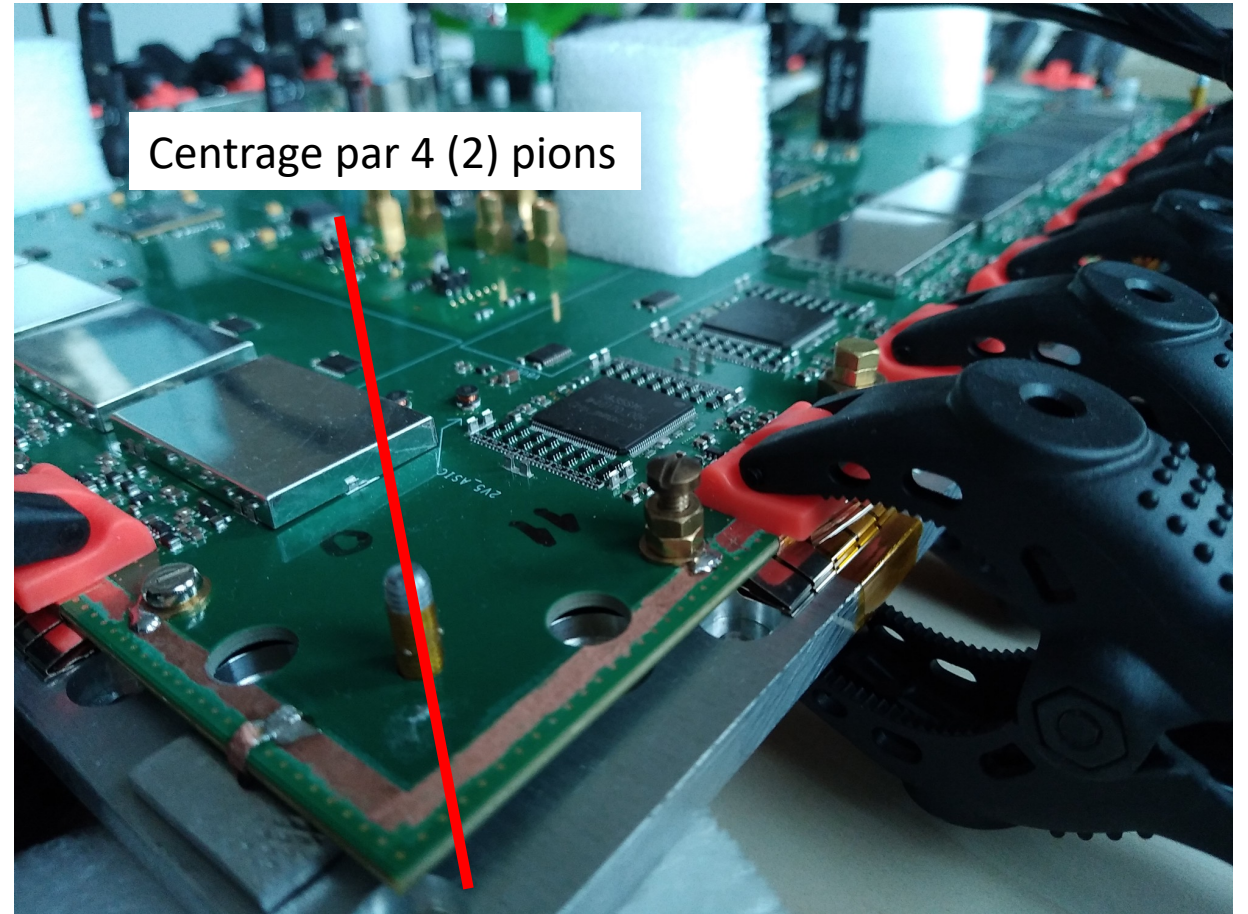
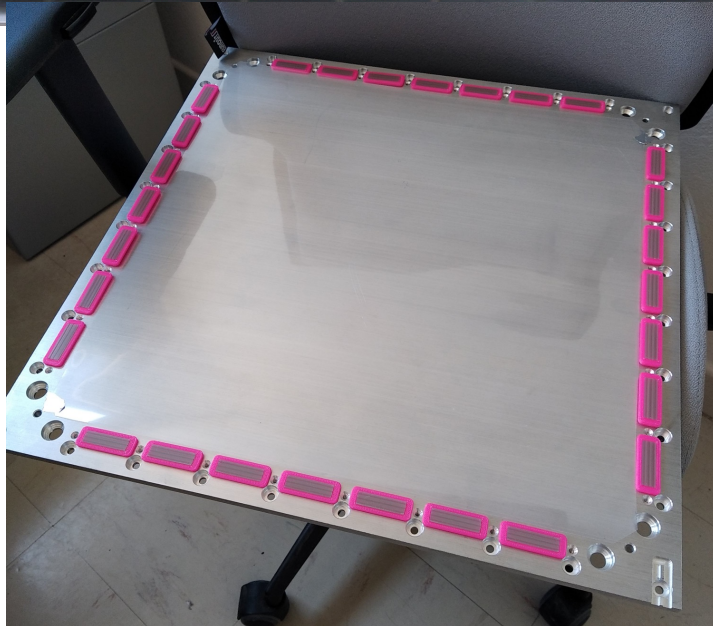
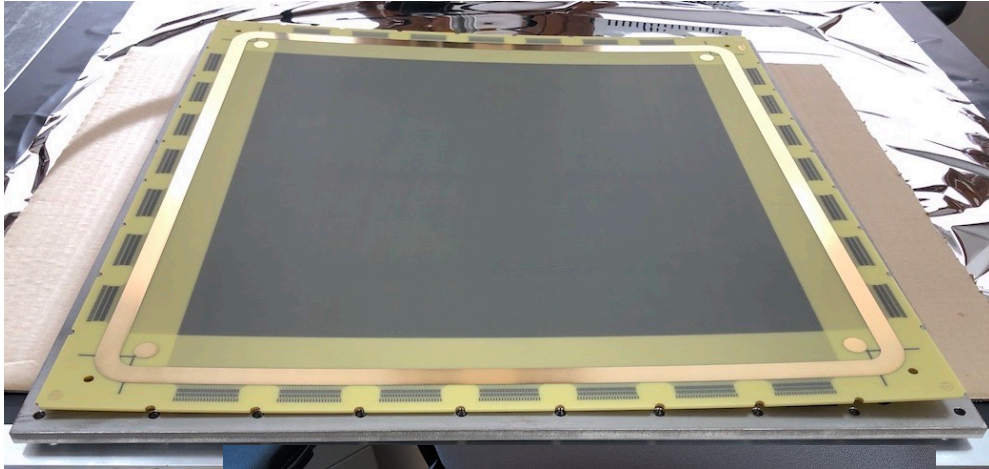
Carte 1792 voies



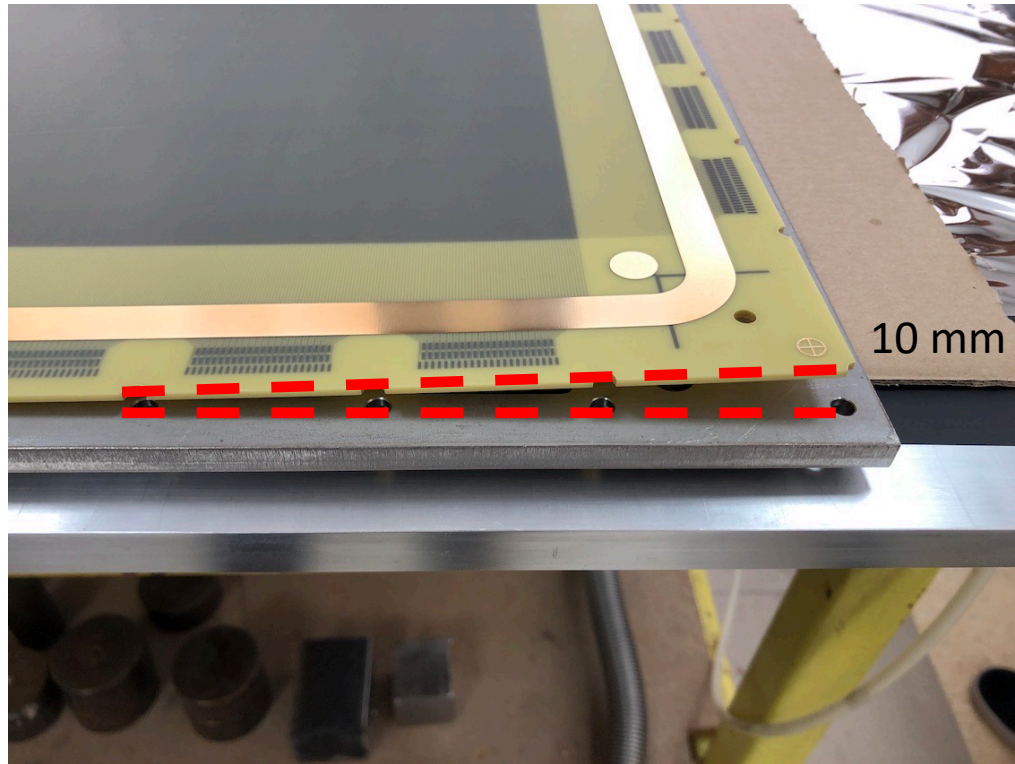
- 28 ASIC s(64 chs)
- 5 FPGAs
- 2 ADCs
- 3 DC/DCs
- 2 PACs



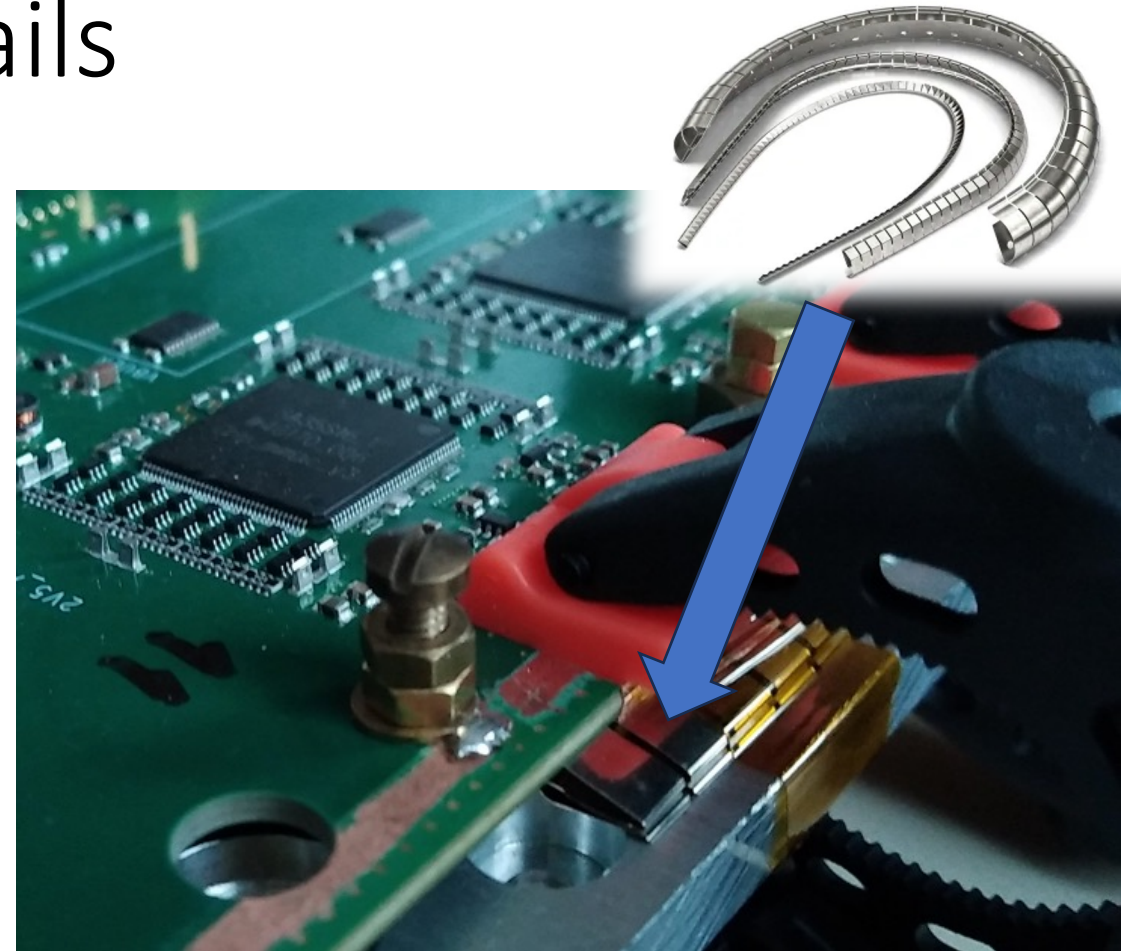
Assemblage



Détails

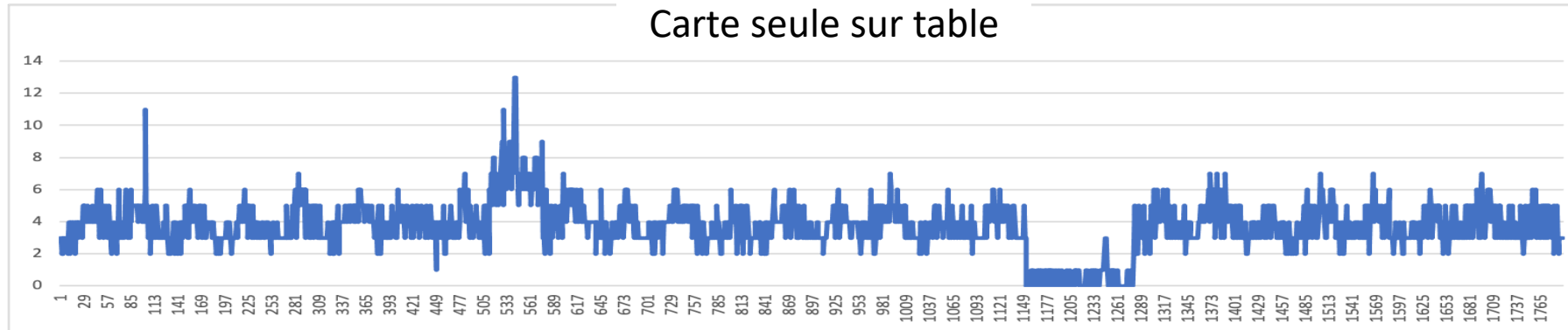


Planéité des PCBs
→ Modifications du routage des détecteurs



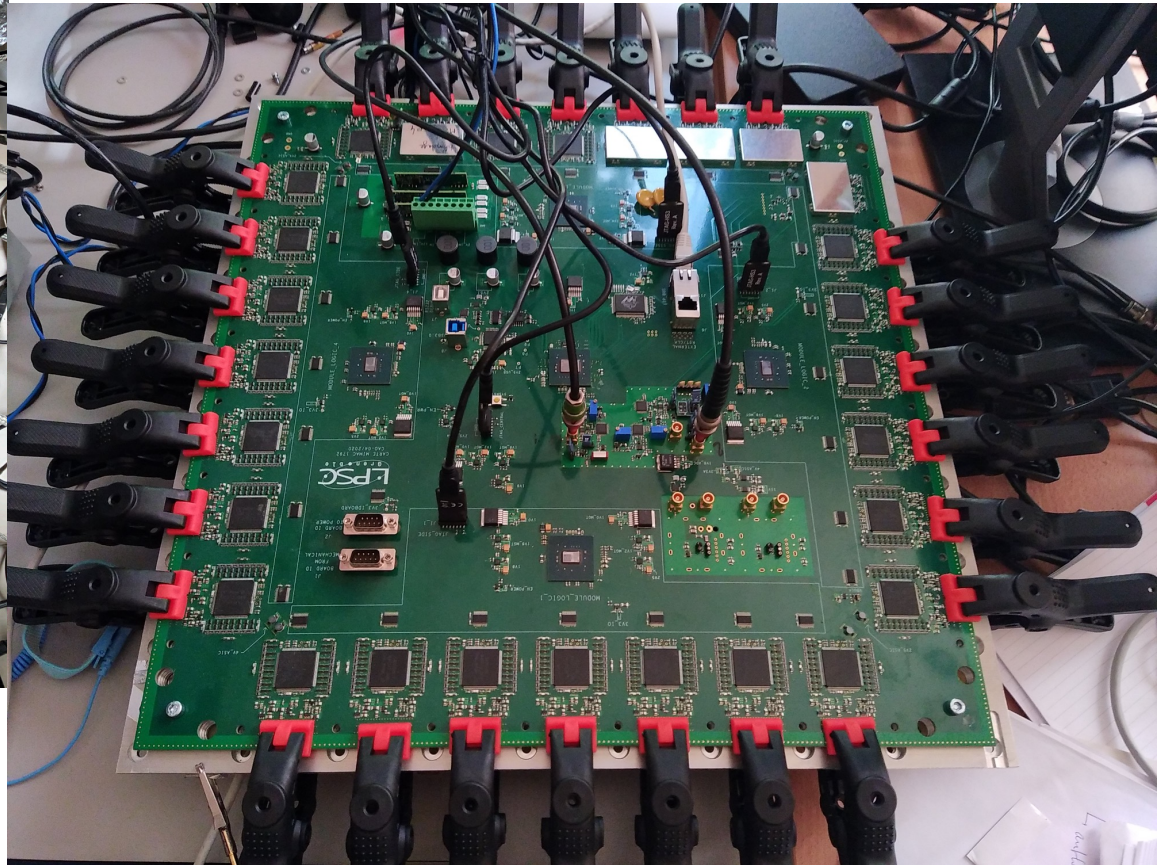
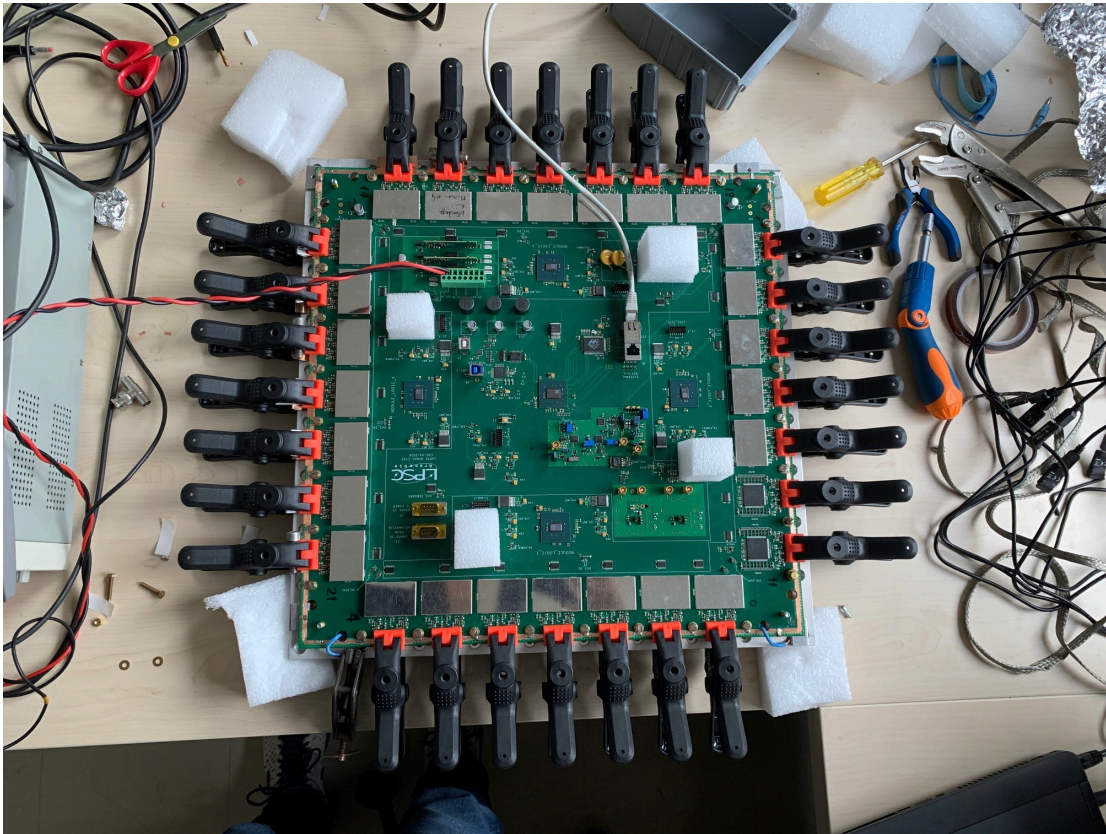
Mise à la masse :
Plan de masse : interface rigide (8mm)
64 Bandes de blindage (↓ inductance)

Résultats : Autocalibration des 1792 voies

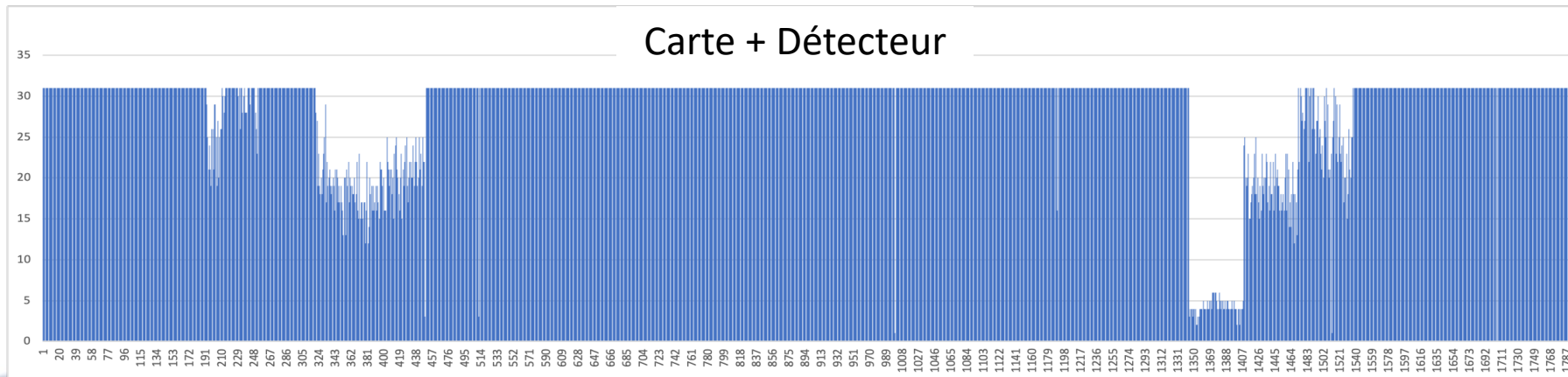
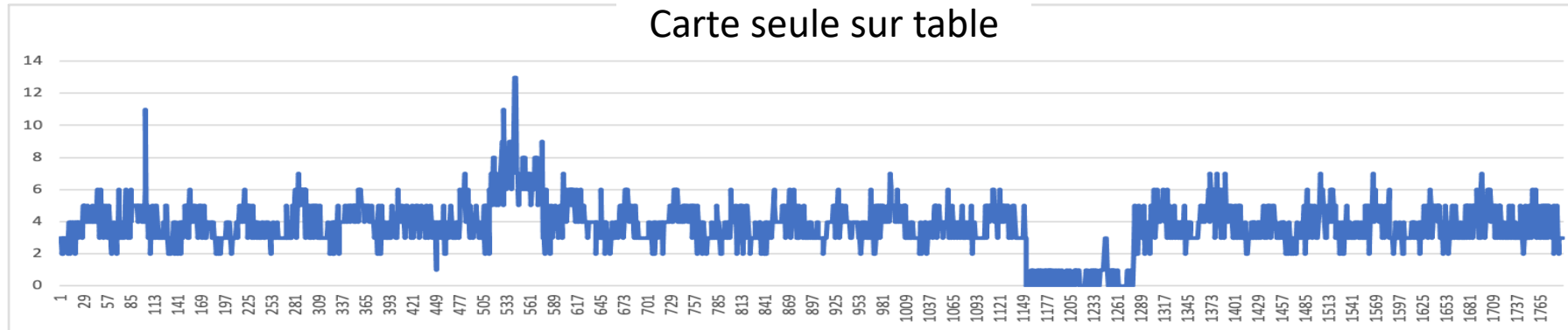


Moyenne : 4 (ADC)
1 ASIC muet (64 voies)

Premier montage

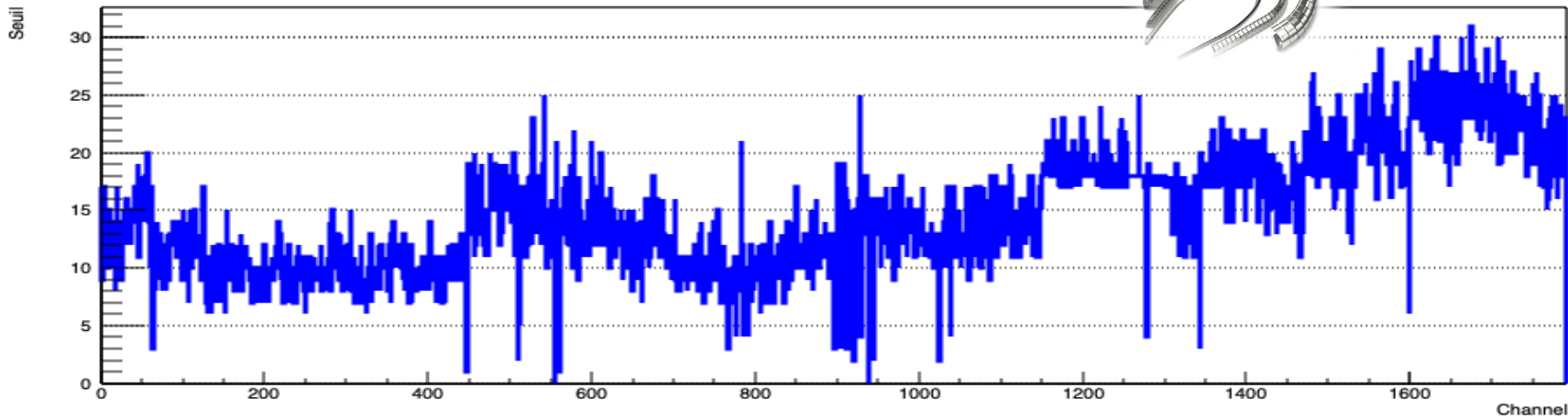


Résultats : Autocalibration des 1792 voies

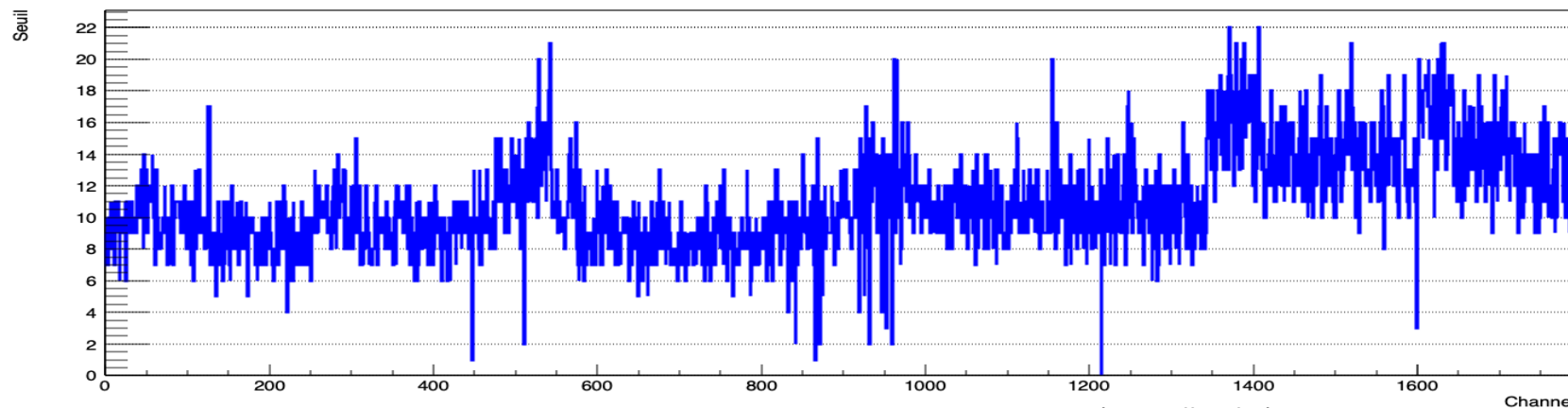


Résultats : Autocalibration des 1792 voies

Avec bande de blindage



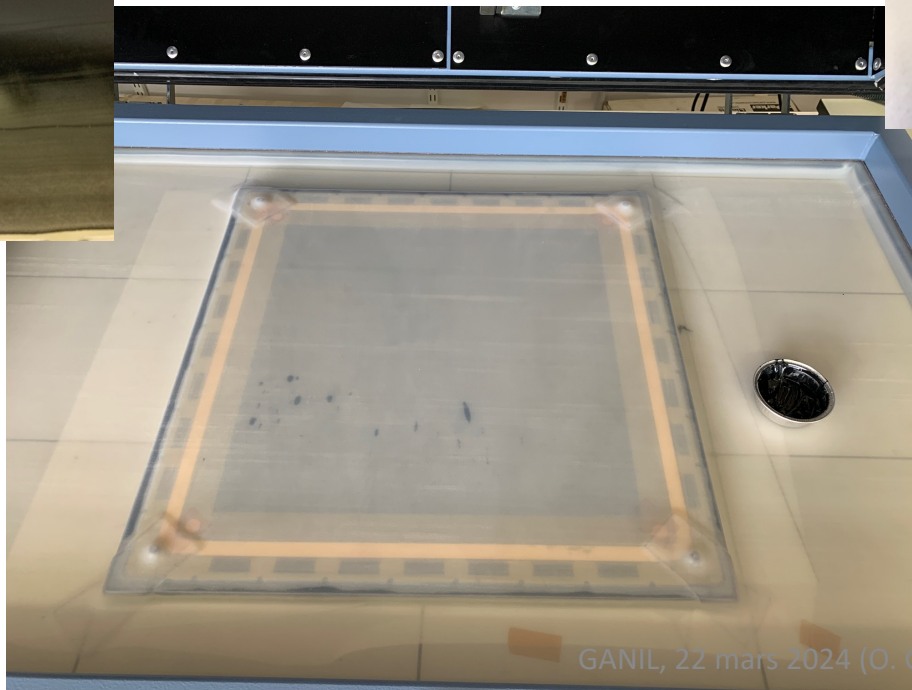
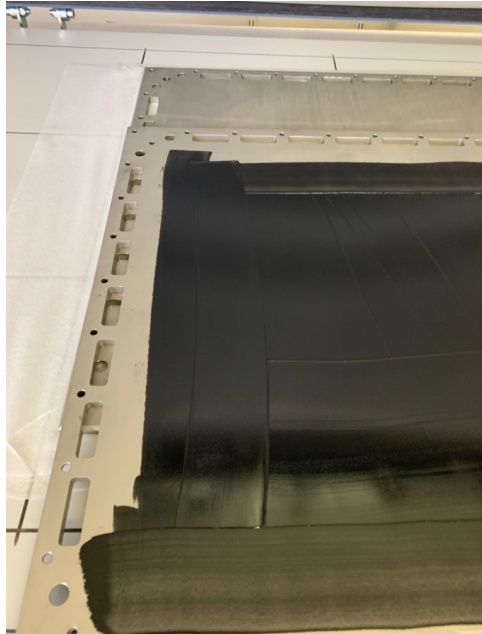
Reprise de masses, blindage partie numériques, capots



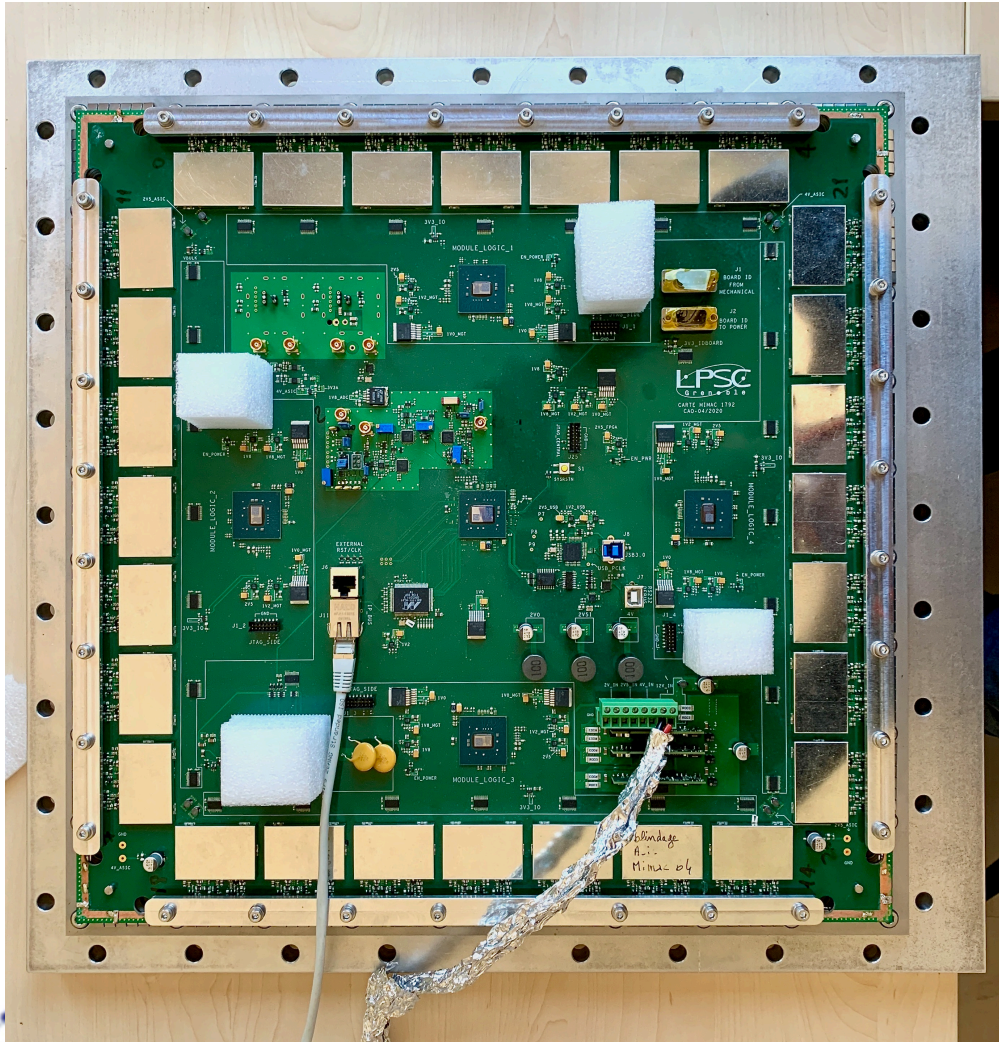
Moyenne : 12-14 (ADC)
15 voies non connectées

Collage détecteur – Interface Inox

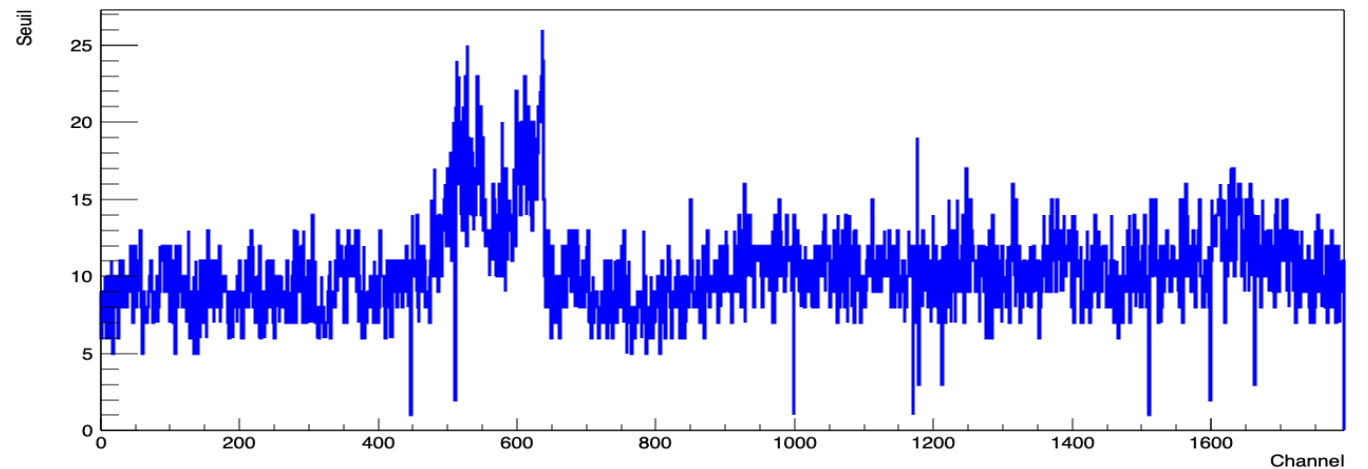
- Colle Thixotropie 3M DP 490
- Presse à vide
- Température 55°
- Durée : 2h



Résultats : Autocalibration des 1792 voies



Mécanique de serrage définitive
Pions de centrage ajustés ($\pm 0.02\text{mm}$, g6...)



Moyenne des seuils : ~ 10 (ADC)
2 ASICs Bavards
9 voies muettes... (poussières, PCB, ...)



Prochaines étapes

- Collage d'un vrai détecteur Micromegas résistif (8 k€ / pièce)
- Test des ADC
- Test de connectique : f(pression)
- Tests d'étanchéité
- Test de fonctionnement sous gaz.....

