TPC Enplate upgrade

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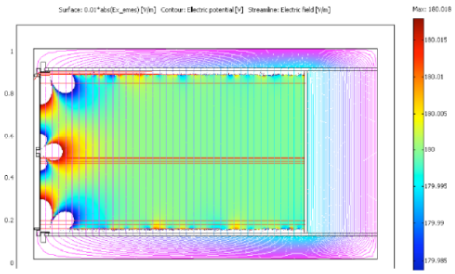
CEA Saclay Irfu/DPhP

A New endplate for the horizontal TPCs

- New design – motivations and caveats
- Charge spreading, DLC, results from LCTPC
- Preliminary test for T2K ND280 upgrade

New design

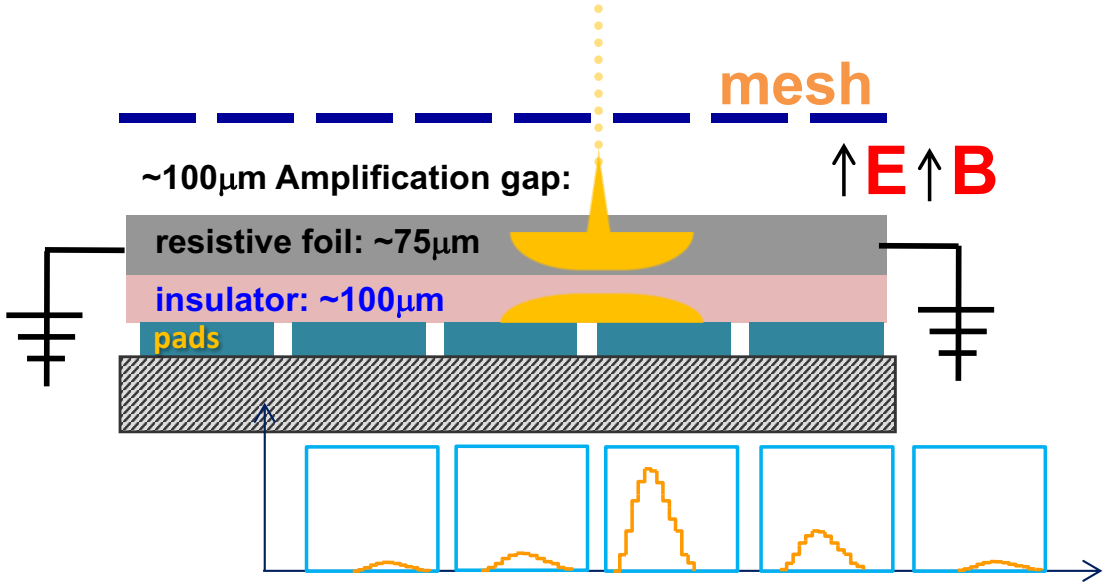
- The vertical TPCs are fine after 10 years : keep them operational.
- Add 2 horizontal TPCs
- Try a new configuration: ‘encapsulated resistive anode with grounded mesh’
  - Charge spreading allows space point resolution improvement with less electronics channels
  - The protection provided by the resistive foil allows lighter Font End Cards
  - Less track distortions due to field homogeneity
  - Less sensitive to noise

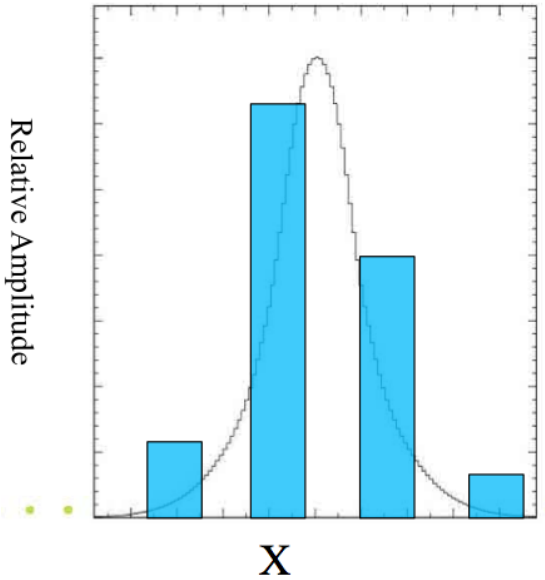


- Caveats: dE/dx to be studied ; few mm dead area on edges might be necessary.

Charge spreading technique

Continuous RC network shares evenly the charge among several pads





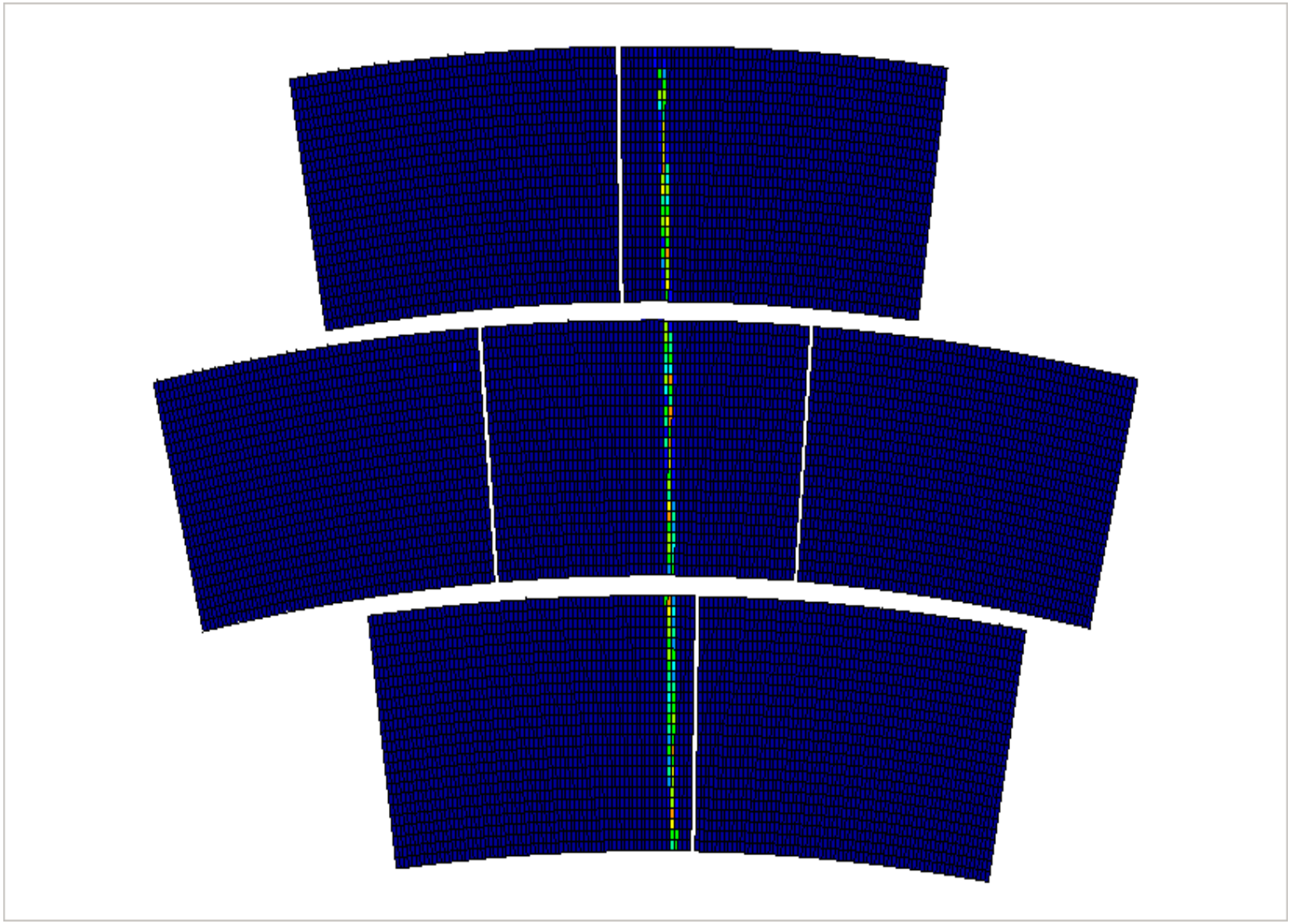
$$\rho(r,t) = \frac{RC}{2t}\exp[-\frac{-r^2RC}{4t}]$$

Gaussian spreading as a function of time with σ_r = sqrt(2t/RC)

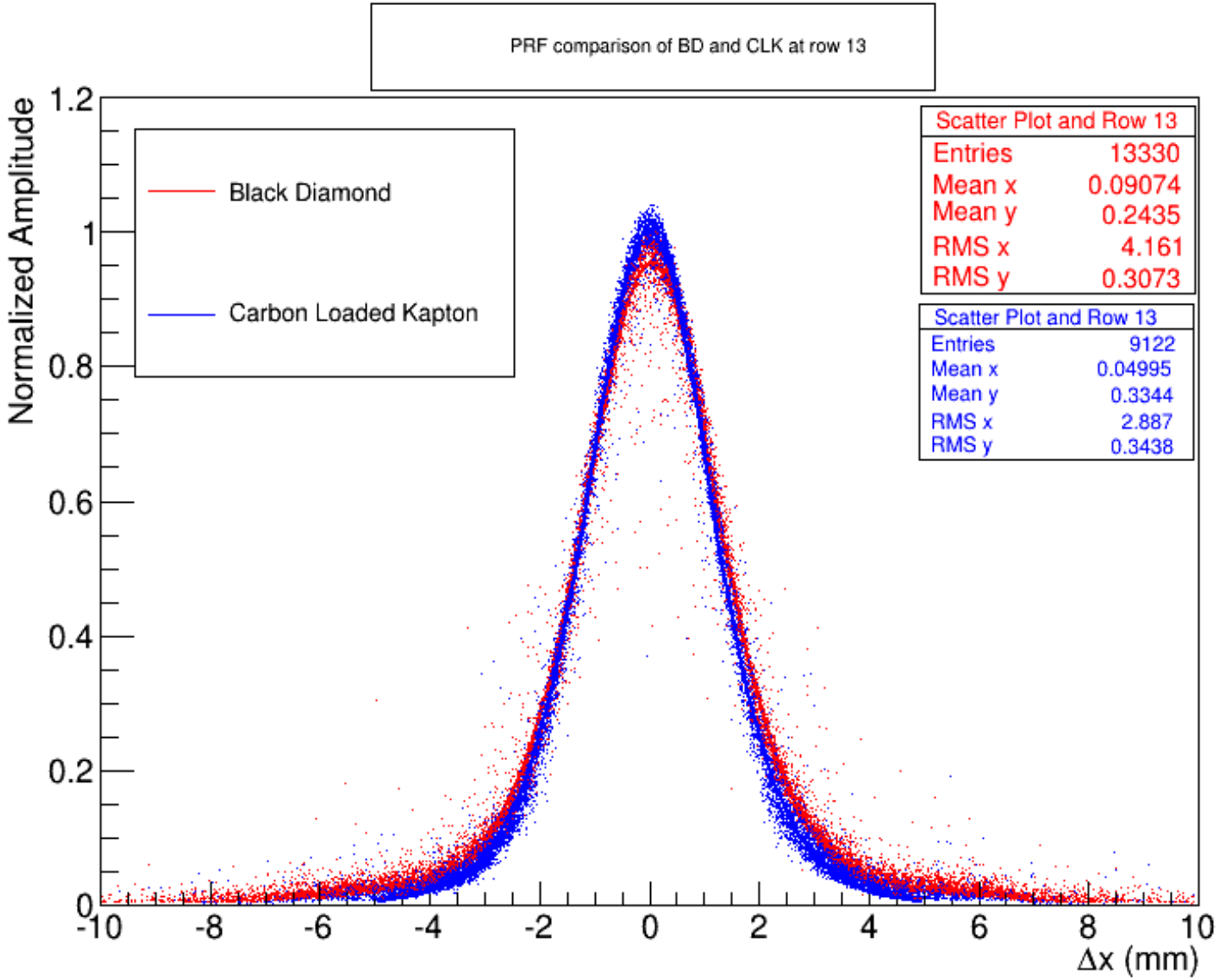
R- surface resistivity
C- capacitance/unit area

t~shaping~few 100 ns
RC = 180 R(MΩ) /(d/175μ) ns/mm²

Real events from beam test at DESY (LC TPC R&D)



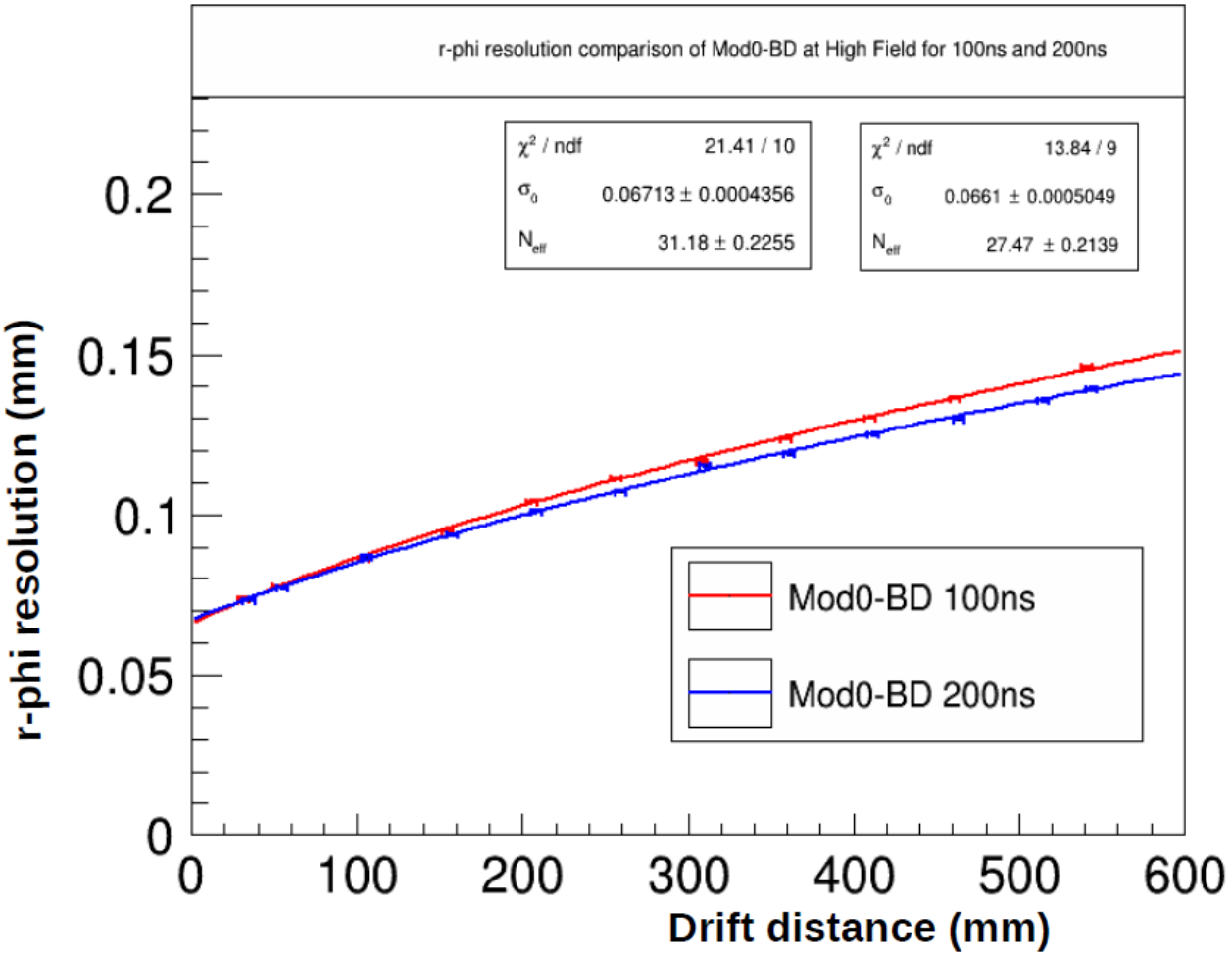
Pad Response function



Diamond-like Carbon

Carbon-loaded kapton

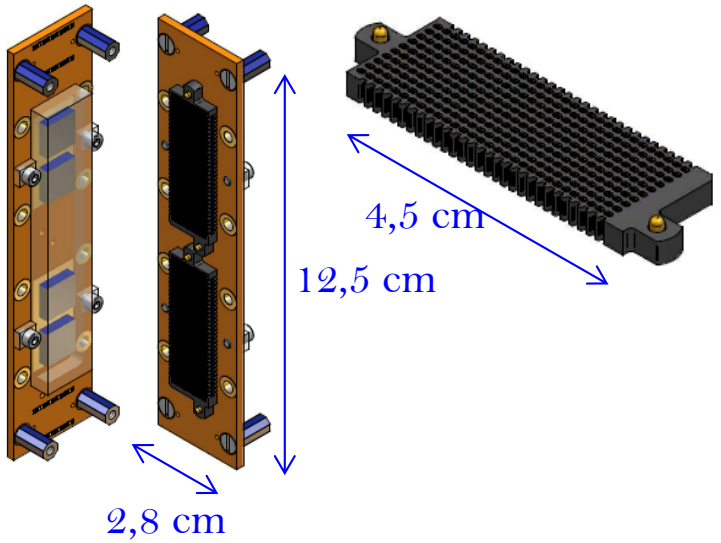
DLC : ‘Diamond-Like Carbon’

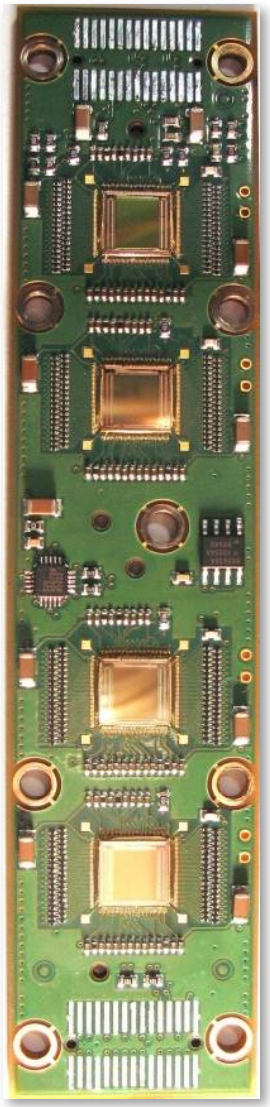


Integrated electronics for LC TPC prototype

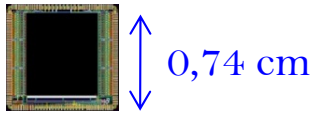
- Remove packaging and protection diodes
- Wire –bond AFTER chips
- Use 2 × 300 pins connector

FEC





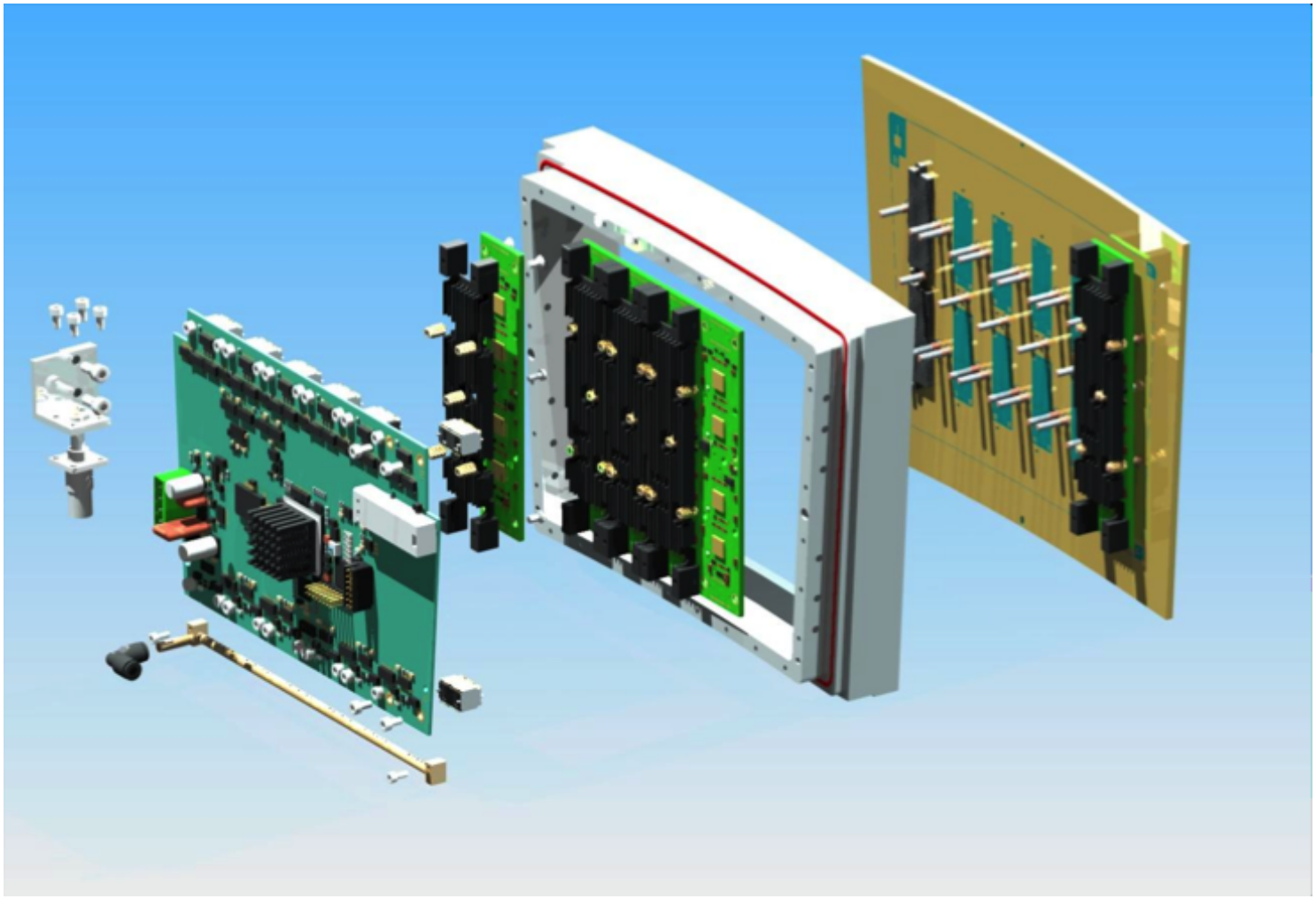
Chip



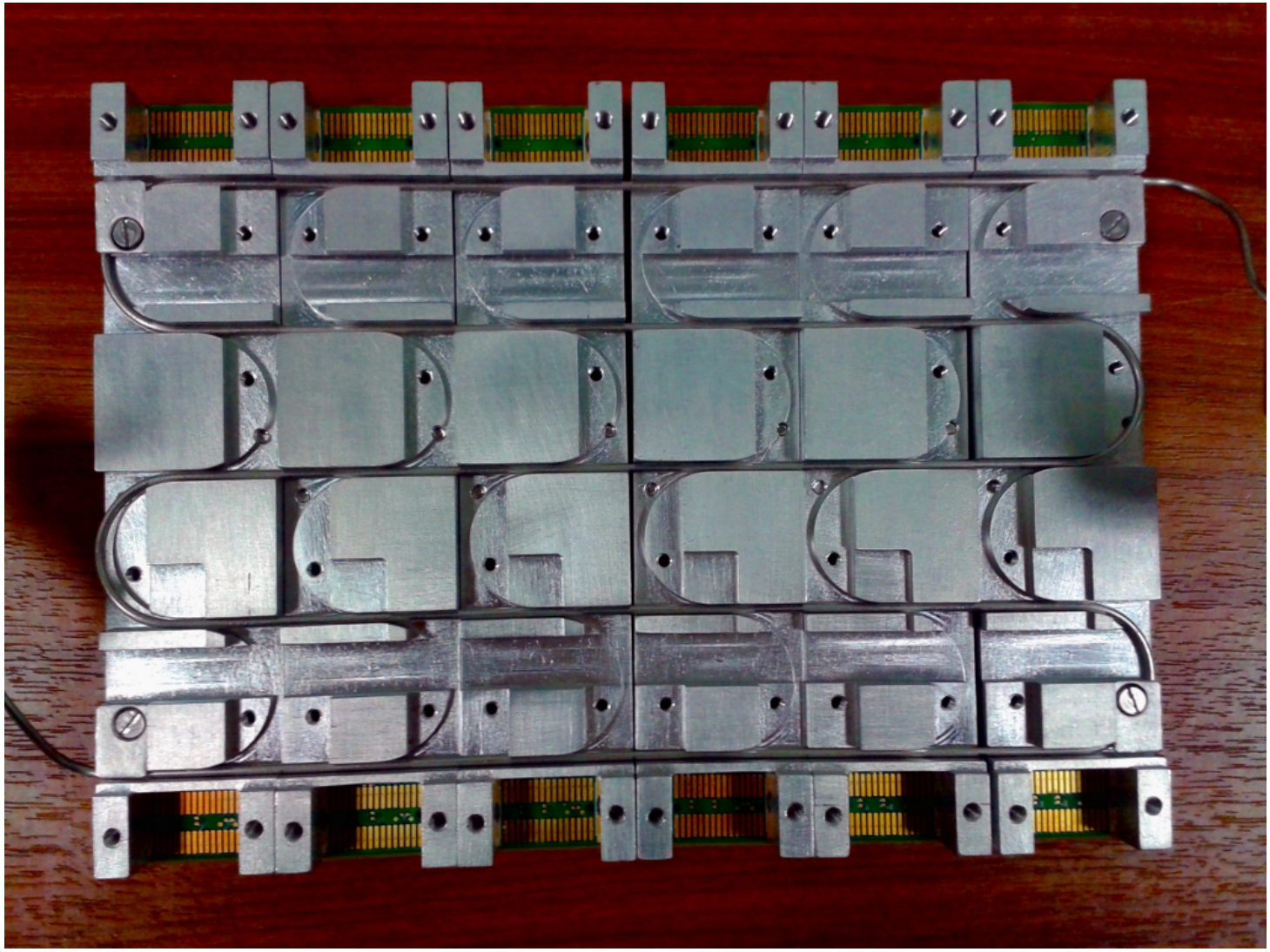
The resistive foil protects against sparks

Experience from LC-TPC studies

17x21 cm² modules

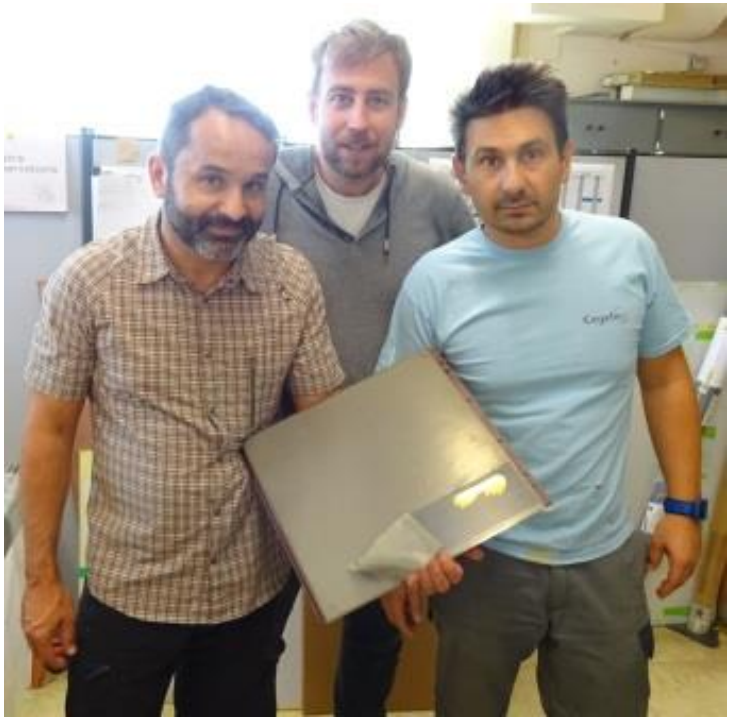


Cooling by 2-phase CO_2



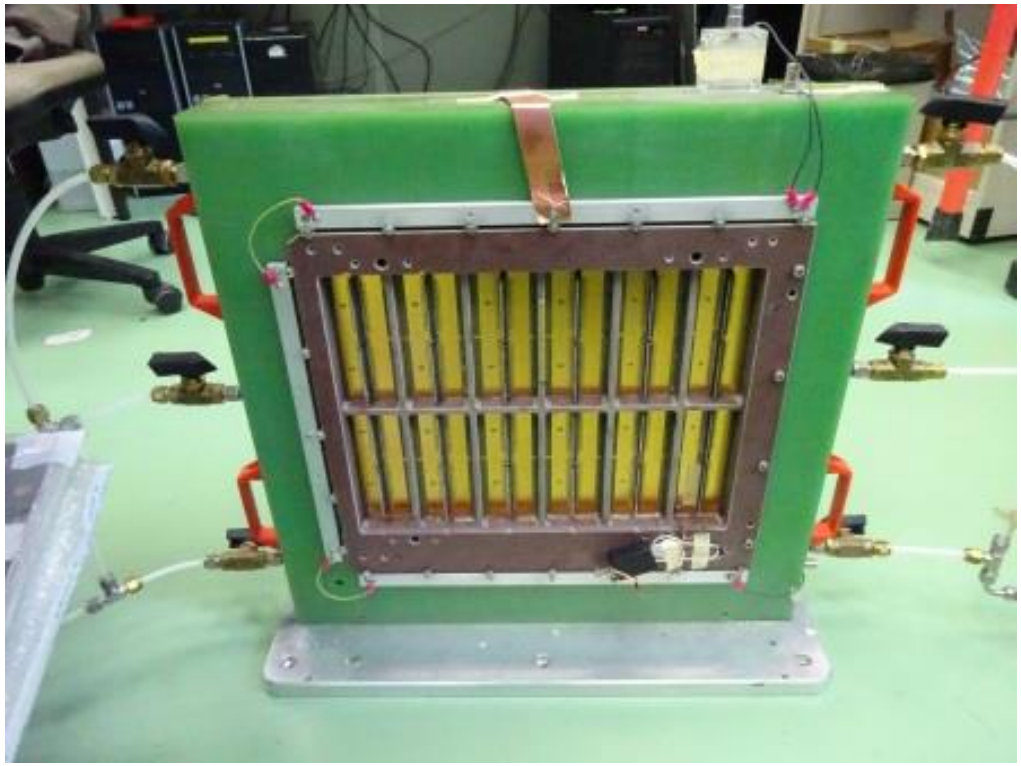
Test bench

- For a proof-of-principle of charge spreading, use the T2K test bench.
- Resistive anode never tested on a T2K module-size area (attempt in 2008)

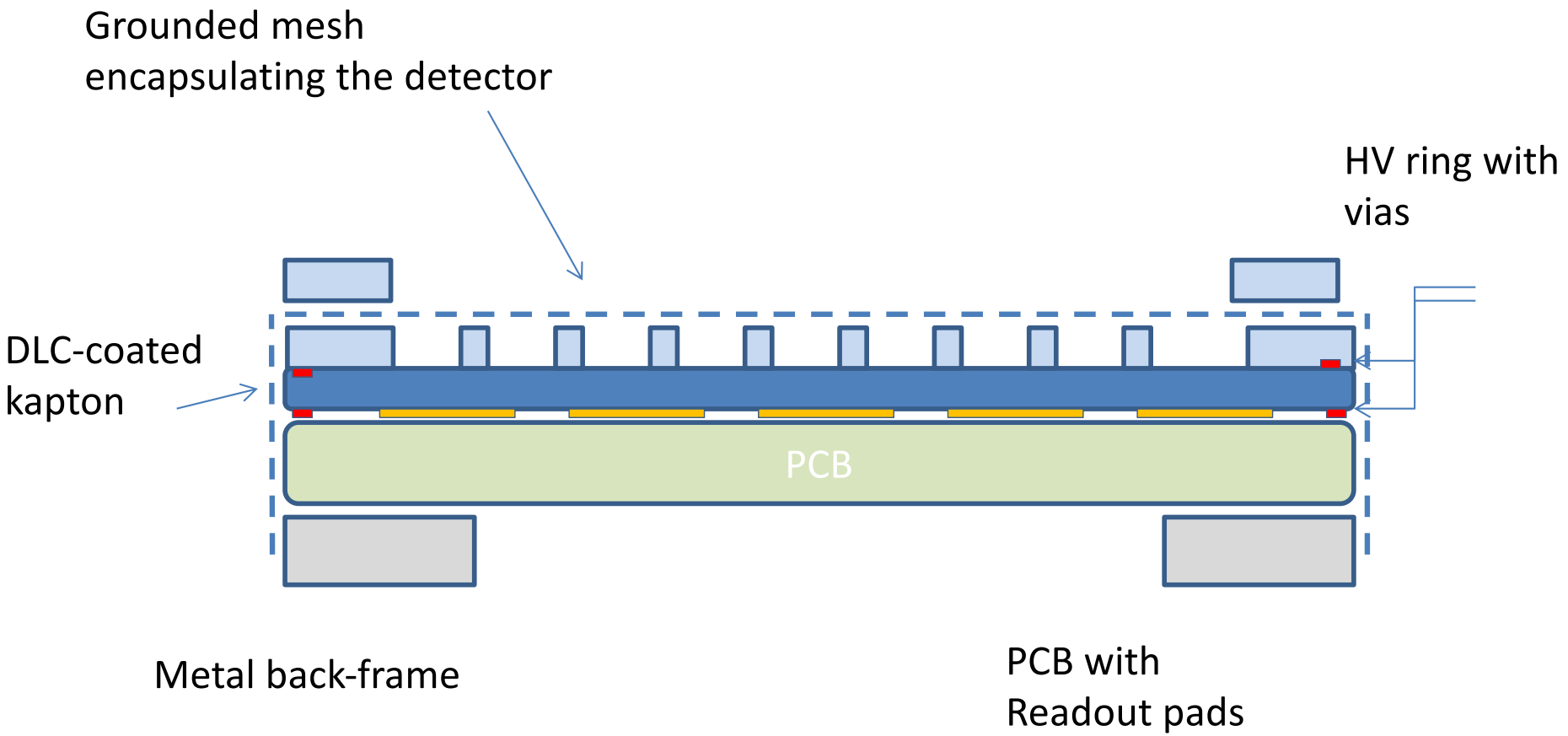


Test bench

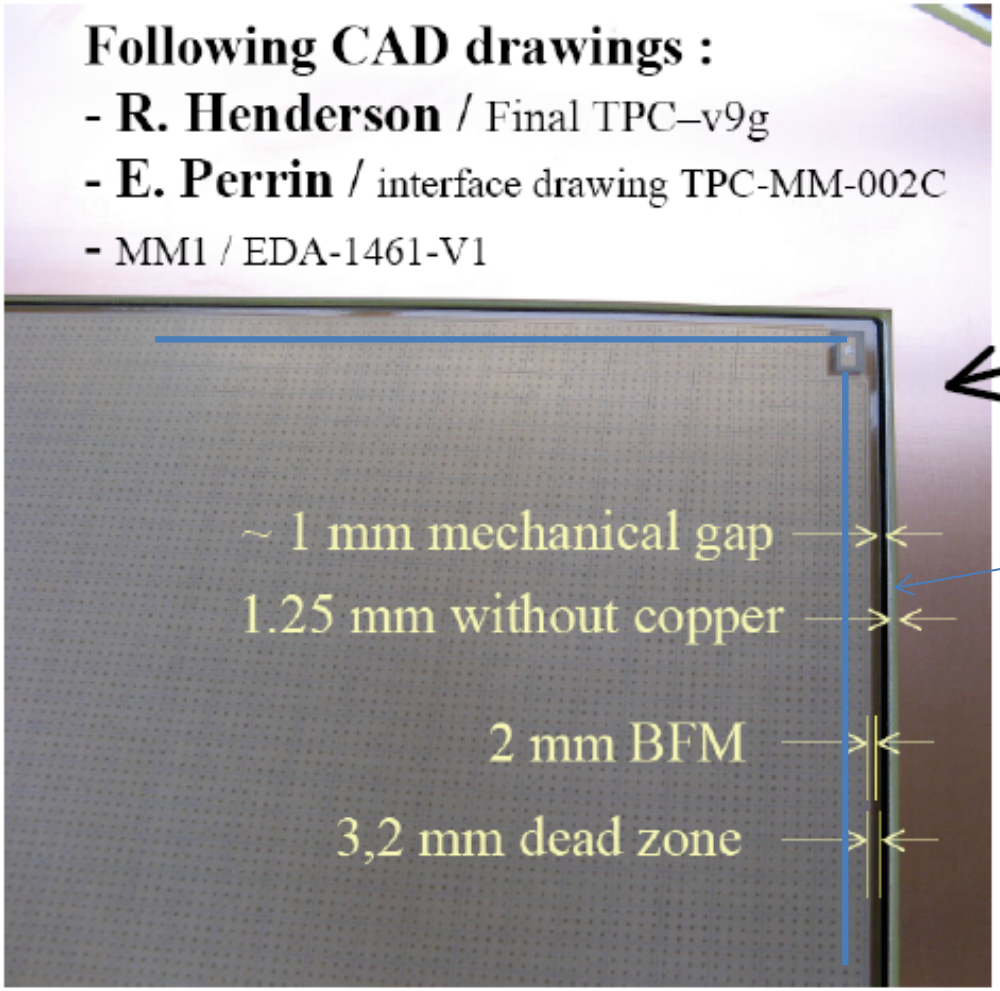
Geneva U. testbox, moved to Saclay in July.
To be adapted to a sufficiently long drift to contain cosmics.



New detector



New detector – dead area

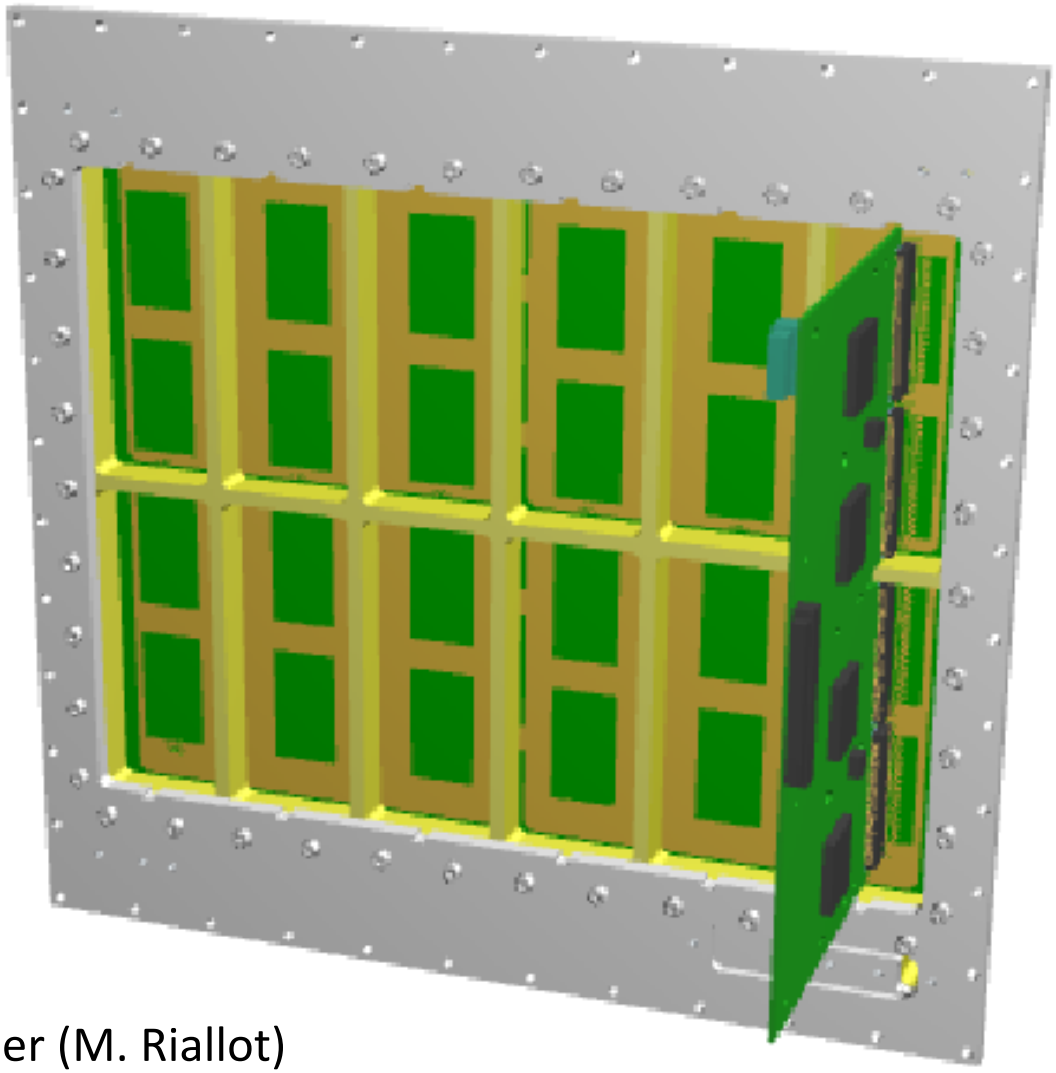


Guard frame
@ mesh voltage

5 additional mm
covered by
insulator

Status of the Saclay cosmic-ray prototype

- Drawings for the gasbox in progress (about 15 cm drift)
- 4 PCBs ordered (delivery planned Oct. 19)
- 2 will be bulked with DLC (mesh to ground, encapsulated DLC 2 MOhm/Sq on 50 µ Apical)
- DLC sputtered on Apical end of August. Should be delivered second half of October
- Selection of a readout electronics chain and of a cosmic trigger in progress
- Hope to take the first cosmics this fall



New Stiffener (M. Riallot)