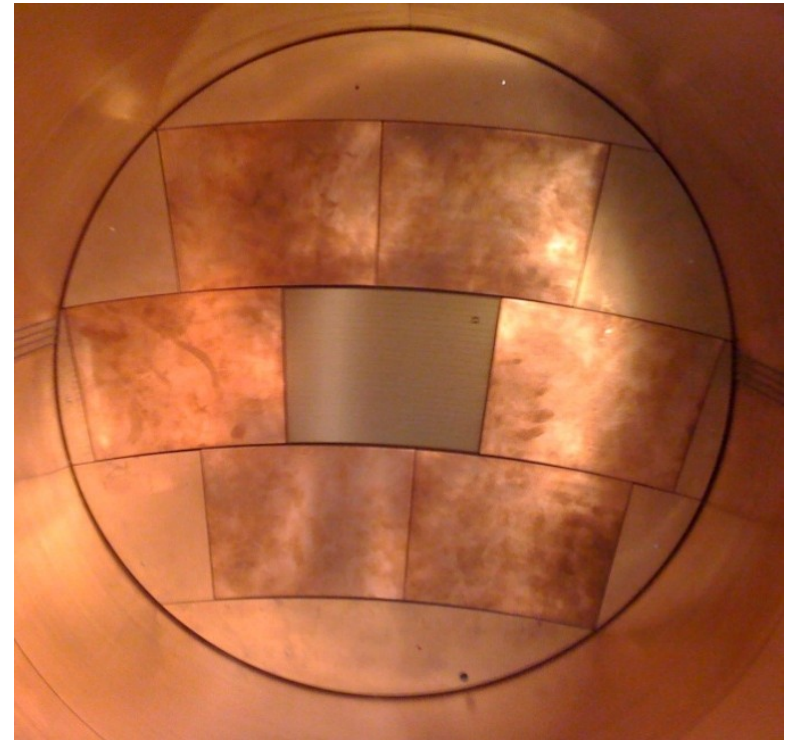
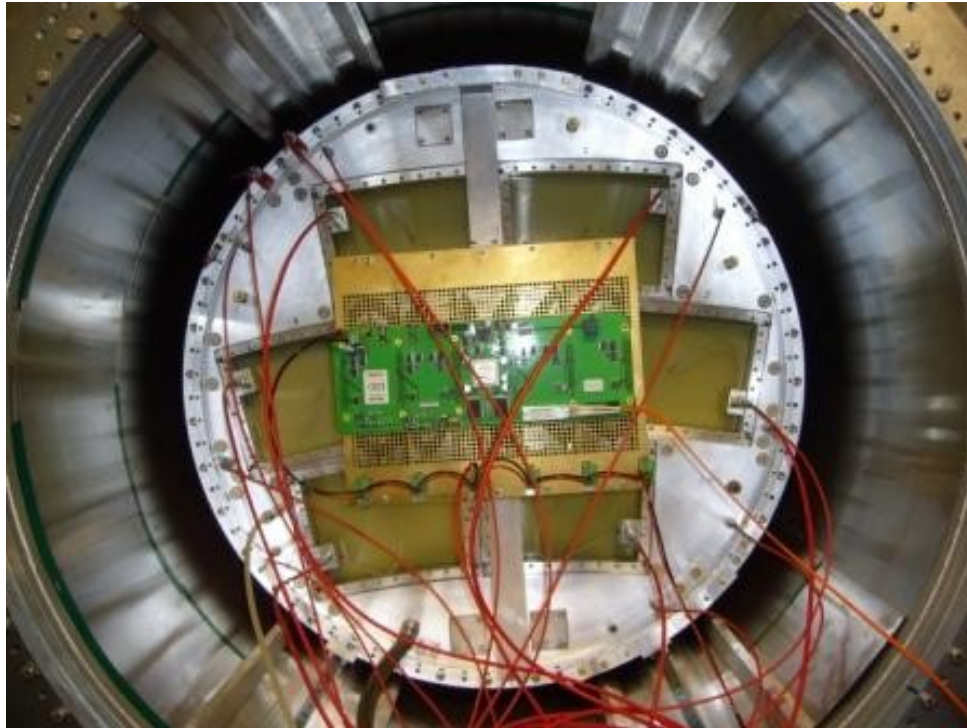


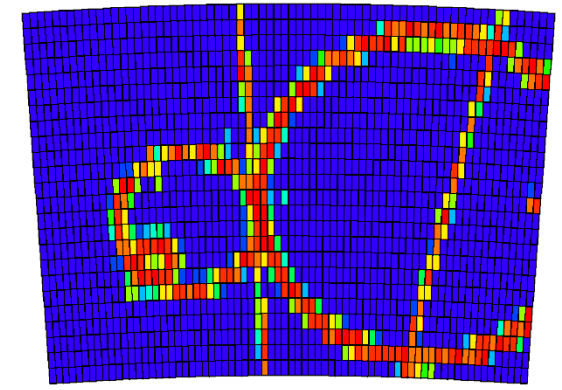
# Large Area Endplate Prototype for the LC-TPC

D. Attié, P. Baron, D. Calvet, P. Colas, C. Coquelet, E. Delagnes, M. Dixit,  
A. Le Coguie, R. Joannes, S. Lhénoret, I. Mandjavidze, M. Riallot,  
S. Turnbull, Yun-Ha Shin, W. Wang, E. Zonca

# Large Micromegas TPC Prototype



**First phase with 1 module in the centre, T2K electronics : finished.  
5 modules (of which 4 resistive) tested and worked well.  
Detailed analysis in progress**



## Phase 2: Fully integrated 7 modules

**Goal:** Fully equip 7 modules with more integrated electronics, still based on the T2K AFTER chip.

- Fit the electronics in 3 cm behind the modules
- Make a backend able to read up to 12 modules
- Go to fully ILC-compatible DAQ
- New zero-suppression scheme
- Air cooling
- Multi-module software: alignment
- quasi-industrial production and quality check of 9 modules (in clean room at CERN used by T2K)



# How to cover a large area?

## Multimodule

### Module size :

**not too large : capacitance, flatness**

**not too small : alignment, cost-effective maintenance, lower dead space, lower mechanical overhead.**

### Development is also modular

# Back End

- **Functionalities**

- Receives clock, trigger and data flow control and distributes them to FEMs (up to 12) by optical fibres
- Concentrates data from 12 FEMs and send them to DAQ

- **Interfaces**

- 12 2-Gbit/s optical links
- DAQ – Slow Control 1-Gbit/s link
- fast Trigger – Clock link

# Back End Hardware

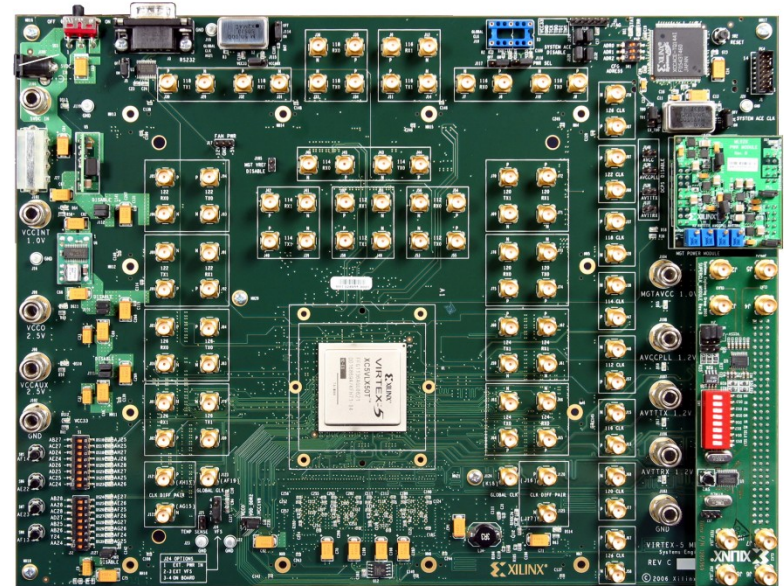
- ML523 development kit from Xilinx

- vc5vfx100t FPGA from Virtex-5 device family

- Embedded PowerPC
- 16 Multi Gigabit Transceivers
- Embedded Ethernet MAC

- 128 Mbyte DDR2 memory

- RS232 interface



- Up to 3 4-channel SMA-SFP interface cards

- 2 Gbit/s optical transceivers for FE links

- RJ45 Ethernet transceiver for the DAQ link

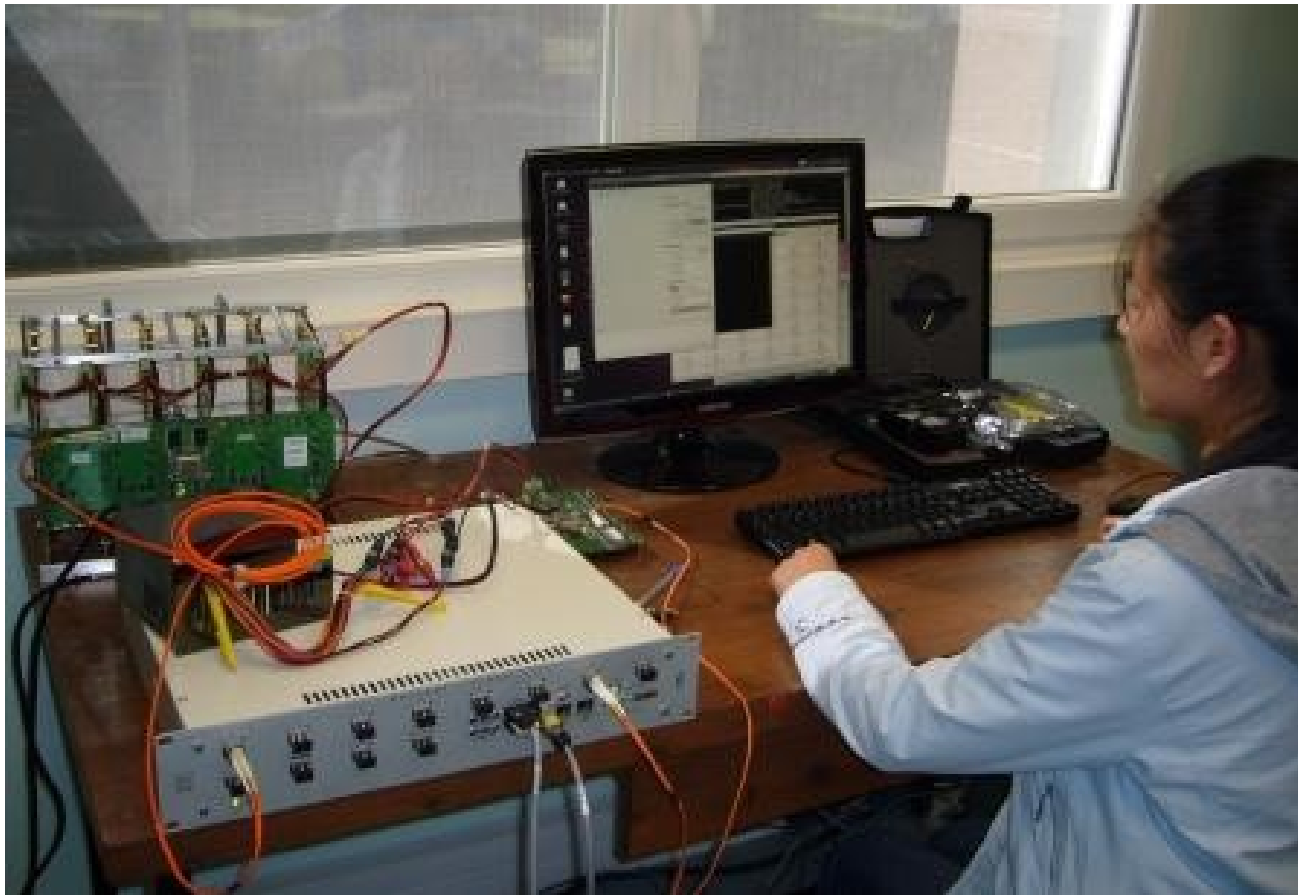
- Trigger – Clock – Fast Control link mezzanine card



# Back End status: ready and tested

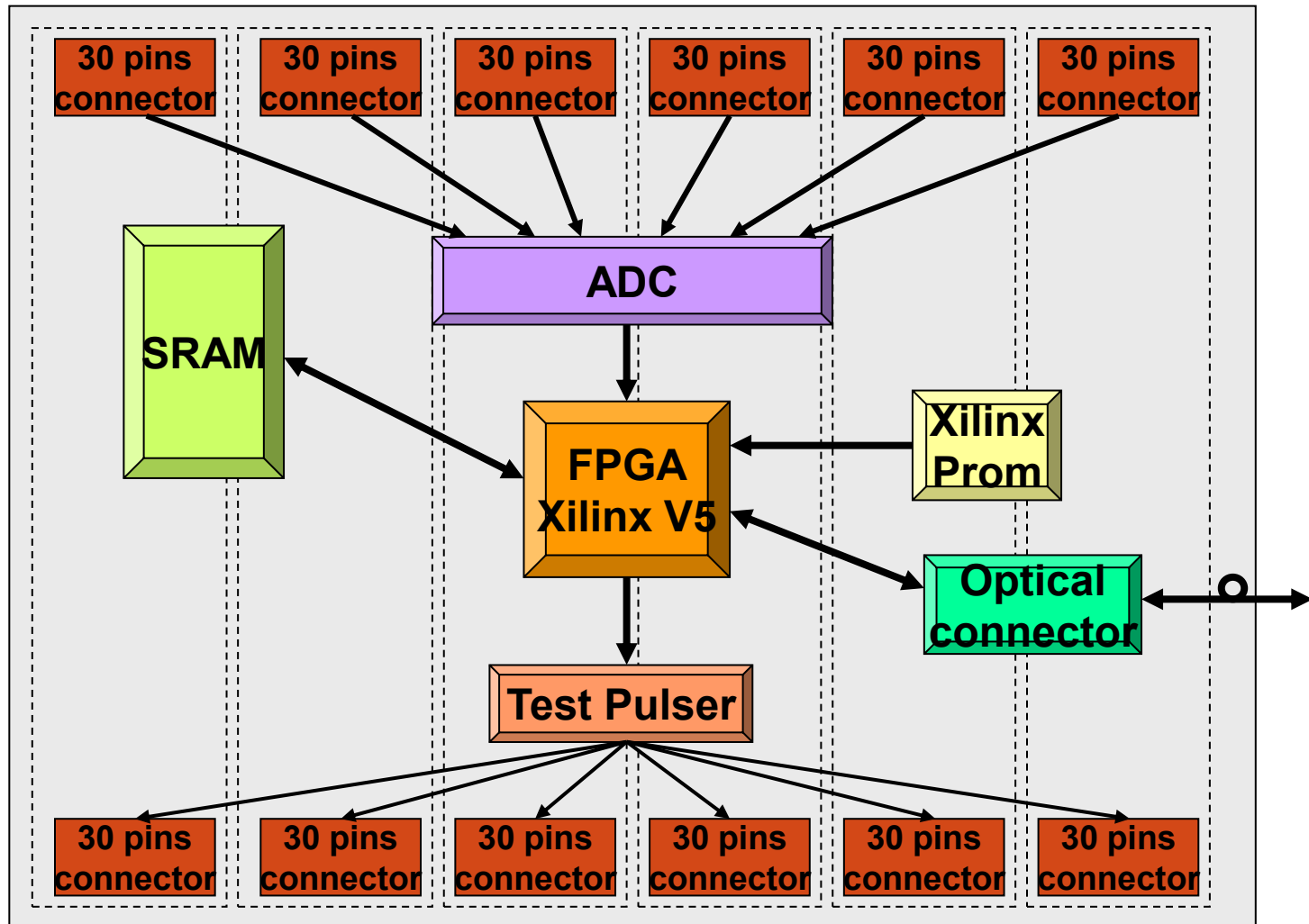
With up to 12 FEM cards (old and new)

Fully tested up to DAQ with 1 old FEM and 6 old FECs



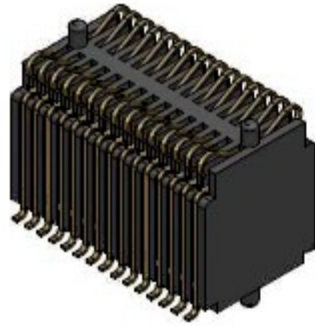
# Front End Mezzanine (module card)

One per module, 1728 channels. Gathers the signals from 6 FECs and sends them to the Back End with optical links

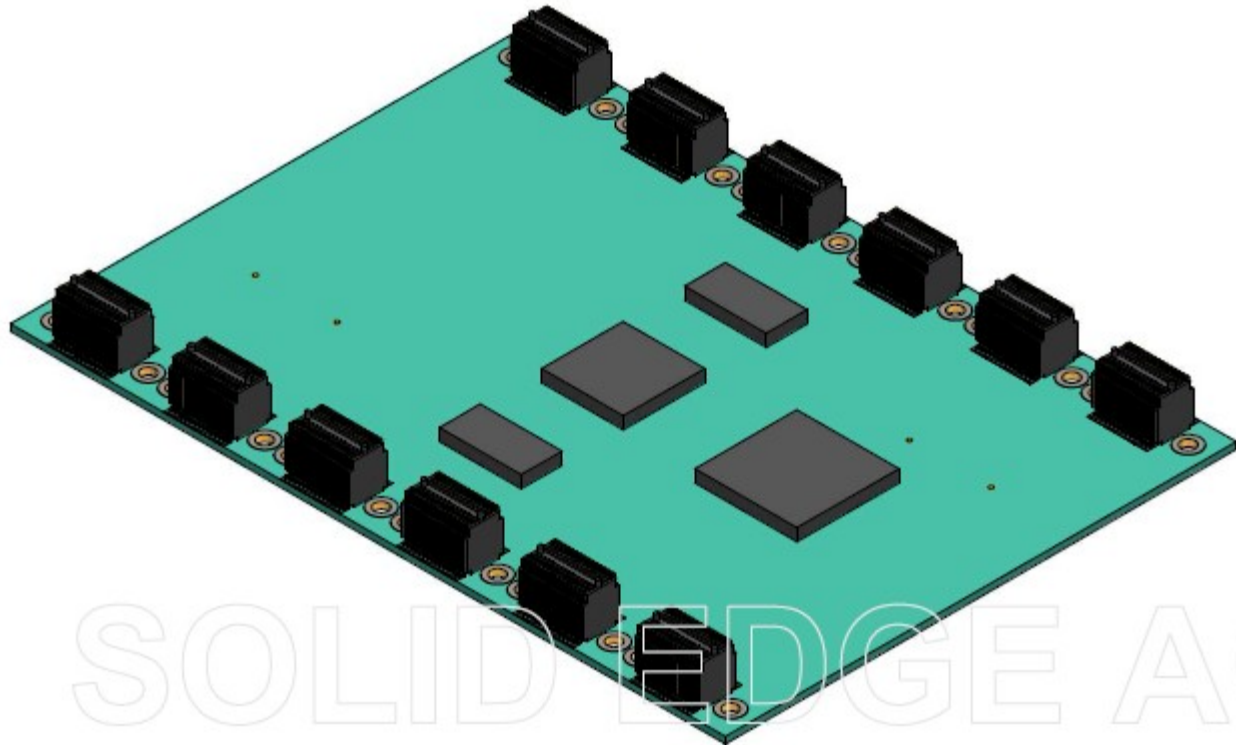




# Front End Mezzanine

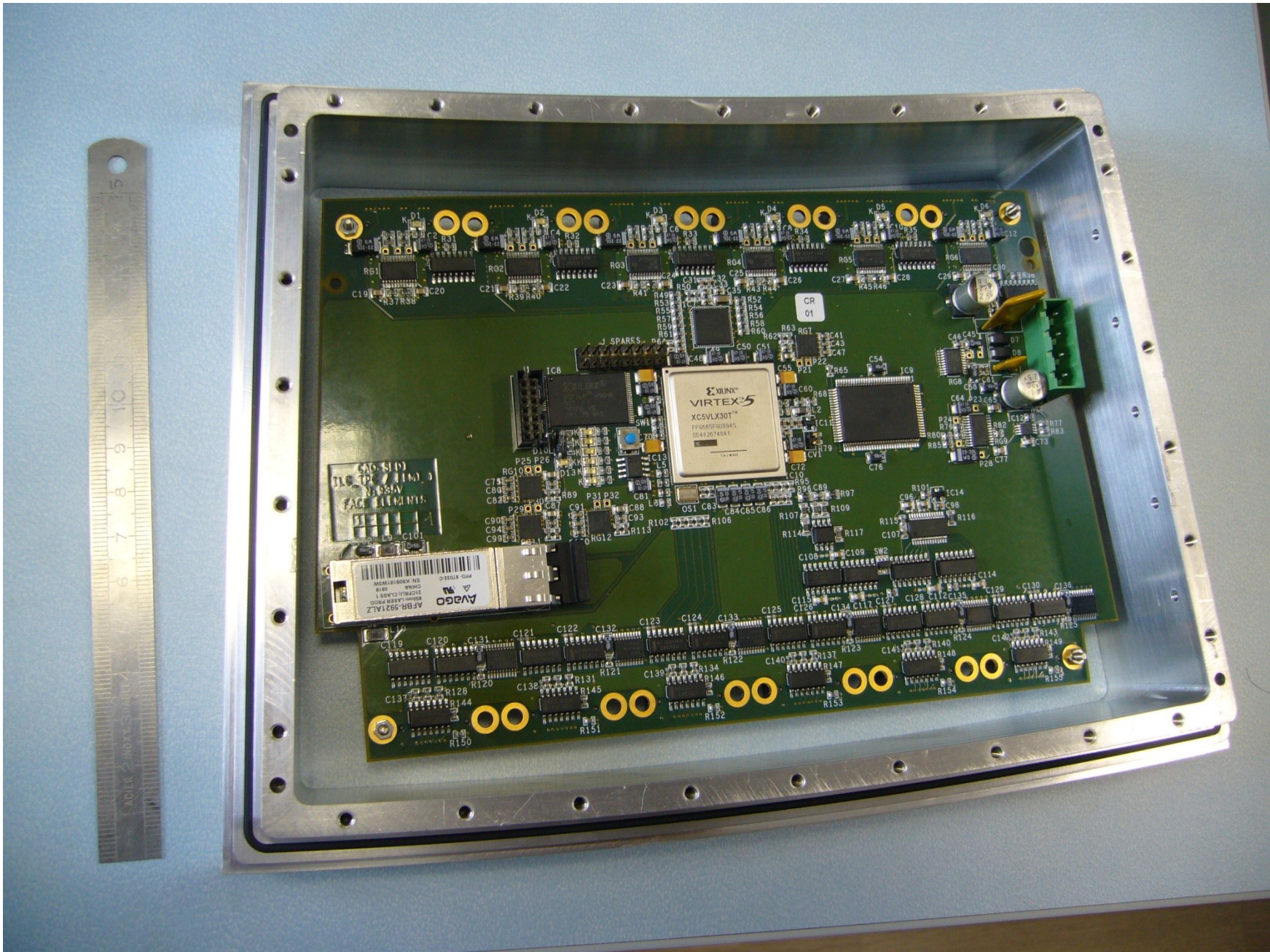


Status : 2 prototype  
cards ready and  
tested: fully  
operationnal



SOLID EDGE AC





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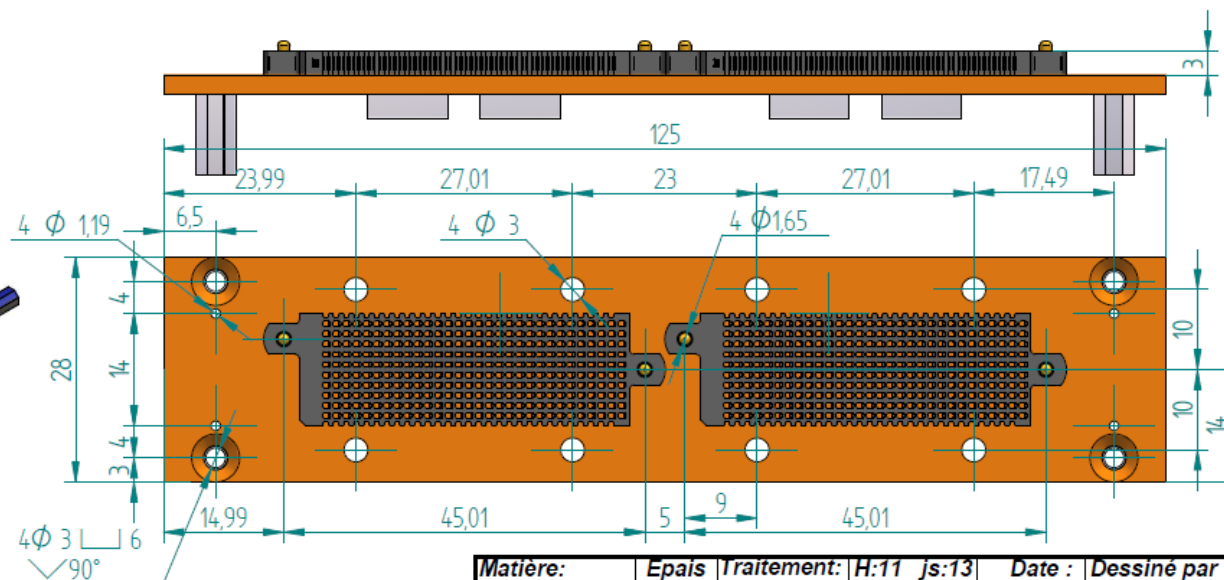
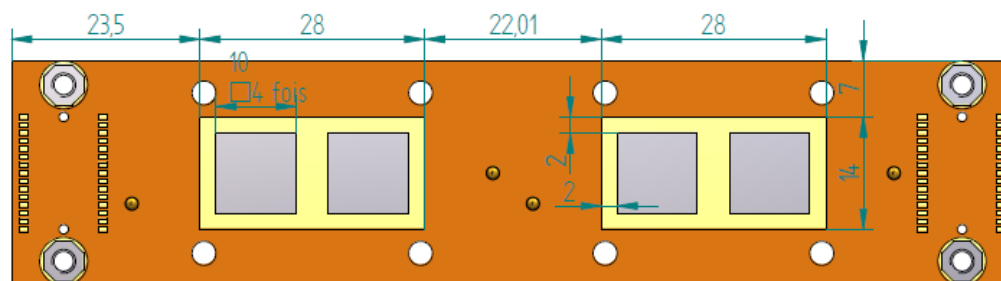
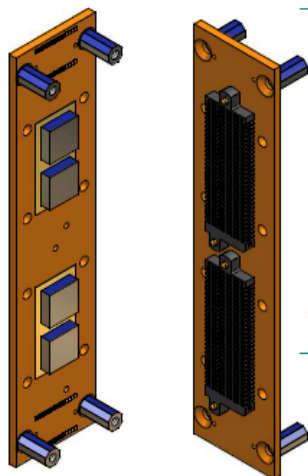
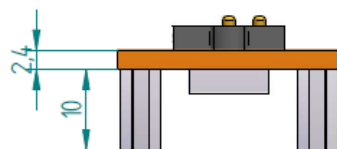
Large area Micromegas proto



# Front-End Cards

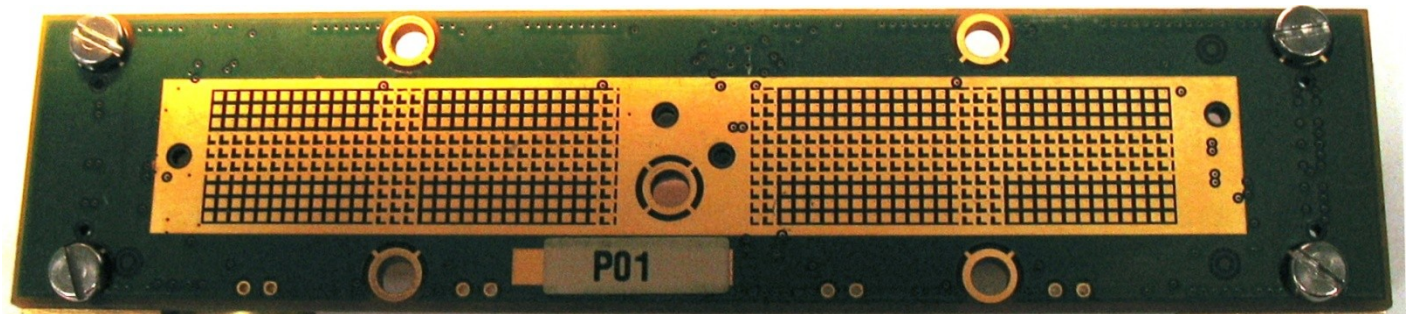
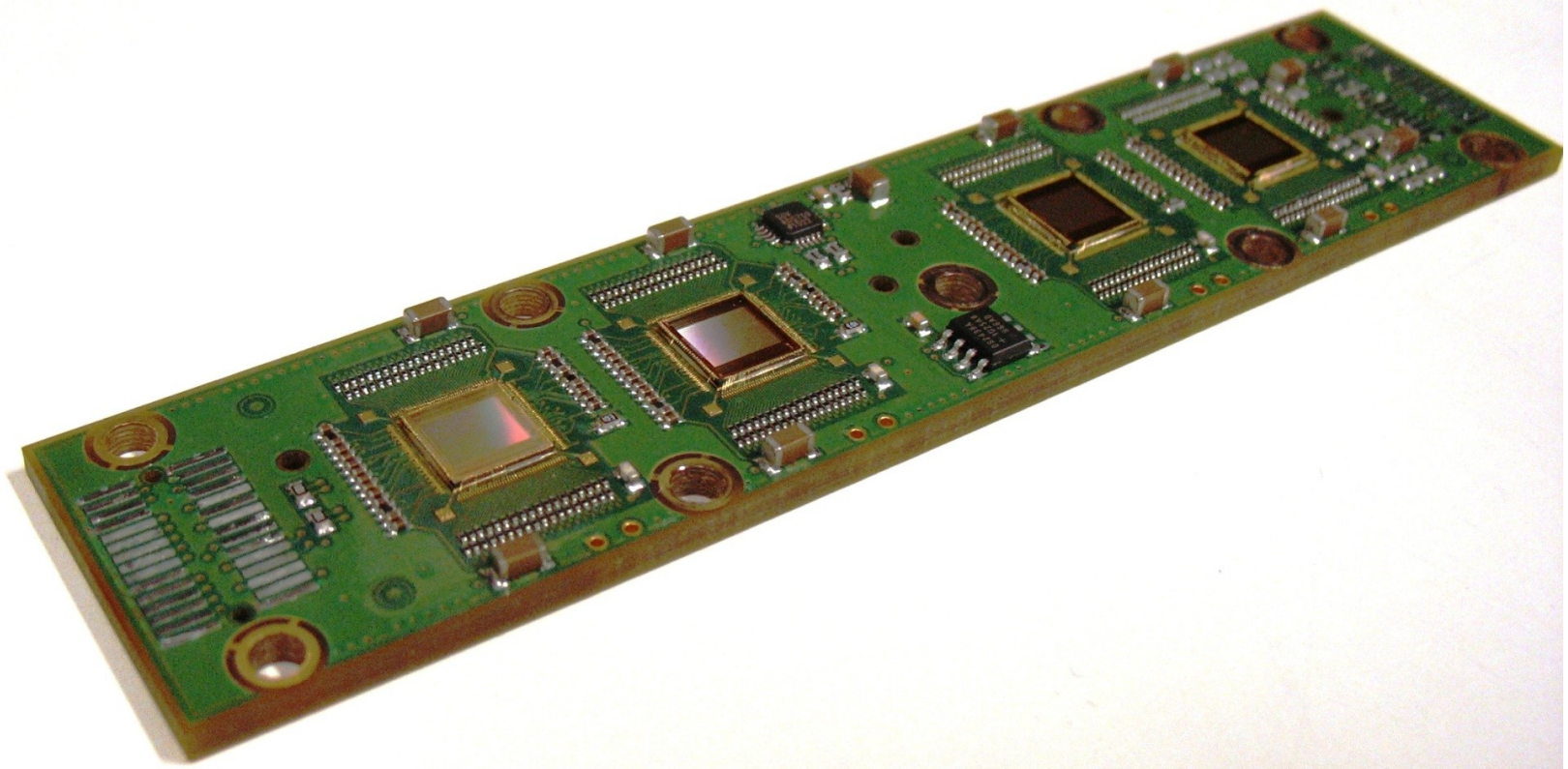
Status : 8 cards ordered, being built  
1 received

Naked chip on board  
High density connectors  
Power dissipation  
opposite to gas volume



Matière: FR4	Epais 2,4	Traitement: Aucun	H:11 js:13 h:11 Irg:3,2	Date : 29/06/2009	Dessiné par : RIALLOT
Ech : 1	Qté : 1	Cote mécanique X Face	Modifié le: / /	Etat:R	
		Cote piste X Double	Ide-A		
		Dessus (Top) X Simple			
		Dessous (bottom) X Multicou X			
Titre : <b>FEC connecteur GFZ 2x300-V5</b>					
Solid Edge		Document <b>LP/TPC</b>			Plan: 1/1
C.E.A / SACLAY / IRFU / SEDI					

SOLID EDGE ACADEMIC COPY



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Large area Micromegas proto

# New detector module

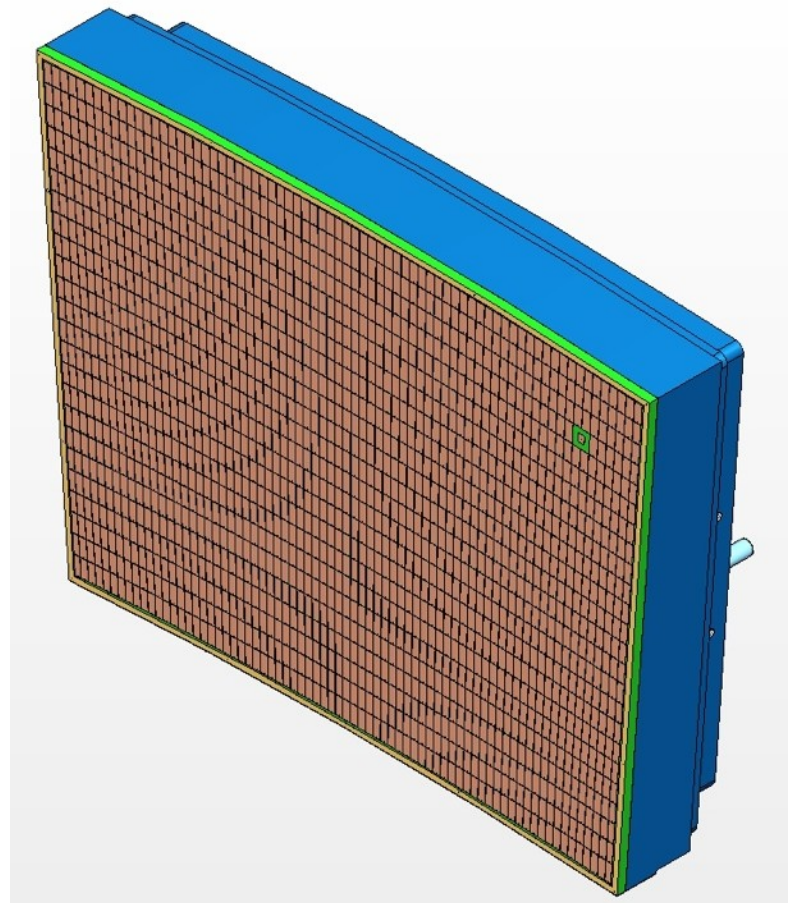
Based on experience from single-module tests:

Same pattern, but routing adapted to new flat connectors. New via filling technique.

Use CLK with 2-3 Mohm/square resistivity

New grounding of the resistive foil on the sides of the modules, by metallization: no dead space.

Back from the PCB maker these days. Being equipped with a resistive bulk at CERN workshop.

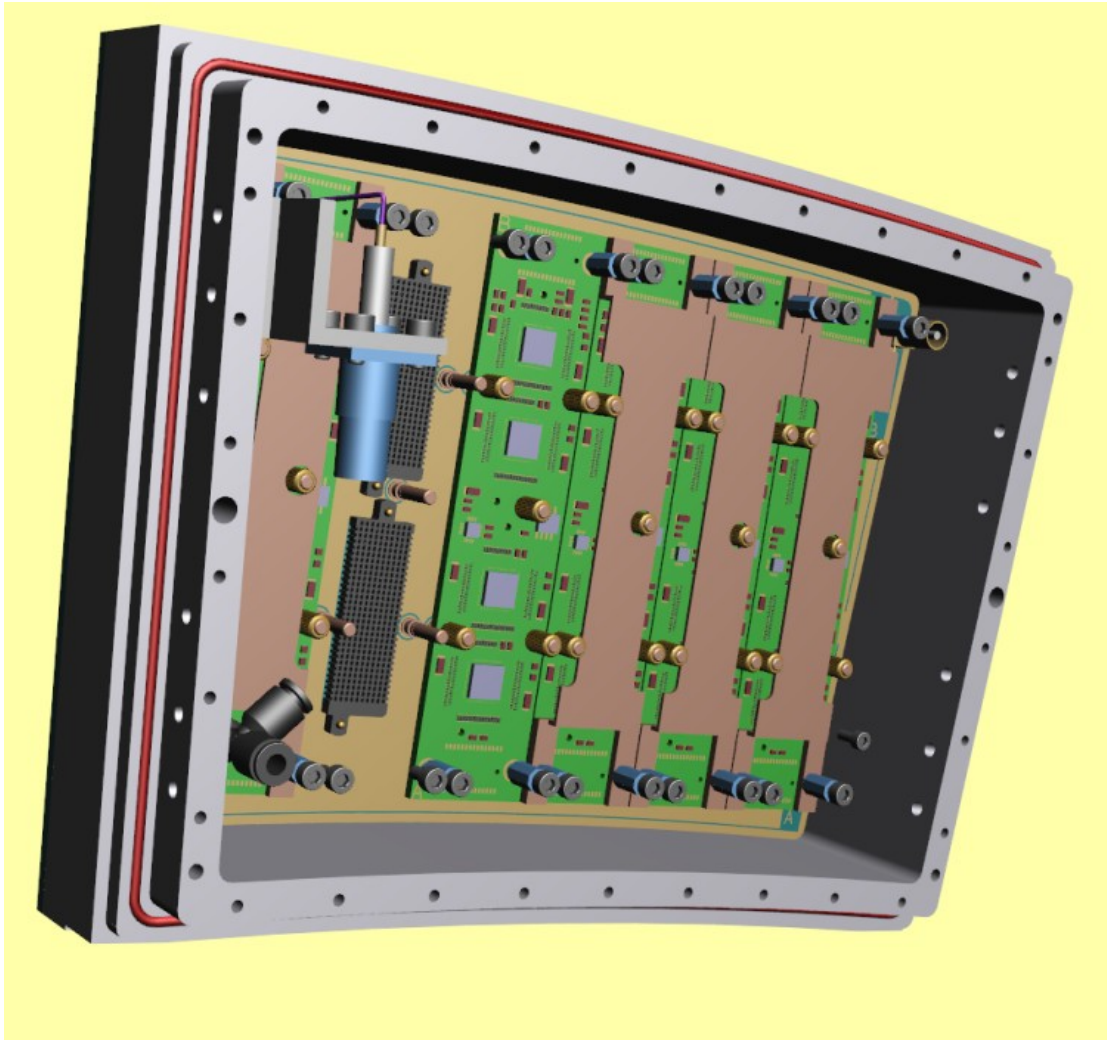


24 rows x 72 columns  
<pad size> ~ 3x7 mm<sup>2</sup>



# Summary: 7 modules & New T2K Electronics

## FLAT ON THE BACK OF THE MODULE



Test 1 module with full chain early 2011.

Build in a quasi-industrial process 9 modules in 2011, and characterize them.

Perform multi-module tests in 2012 and following years.

Use the same cards for a power-pulsing test in the DESY 5T magnet.



# Multi-module Software

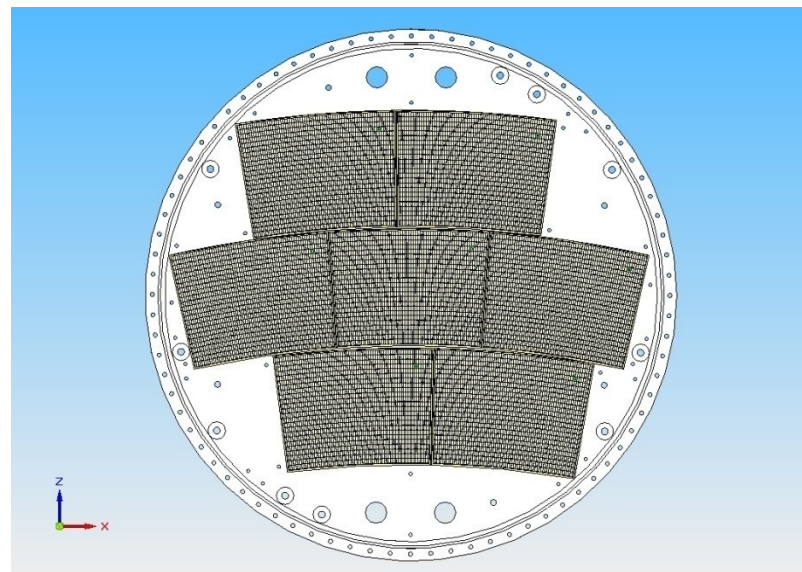
**Display program**

**GEAR-integrated geometry with free translations and rotation angles w.r.t. central module**

**Track reconstruction and fitting by Kahlman filter, integrated in Marlin TPC**

**Simulation integrated in Marlin TPC**

**Analysis (study of resolution and distortions, correction for non-uniformity) integrated in Marlin TPC**



# Power pulsing test with Saha and Carleton in the 5T magnet

Goal : check that  $^{55}\text{Fe}$  parameters are stable with power pulsing (both on mesh readout and pad readout) and study mechanical effects in high B field.

