LCTPC collaboration meeting, Nov. 29,2017

Micromegas modules

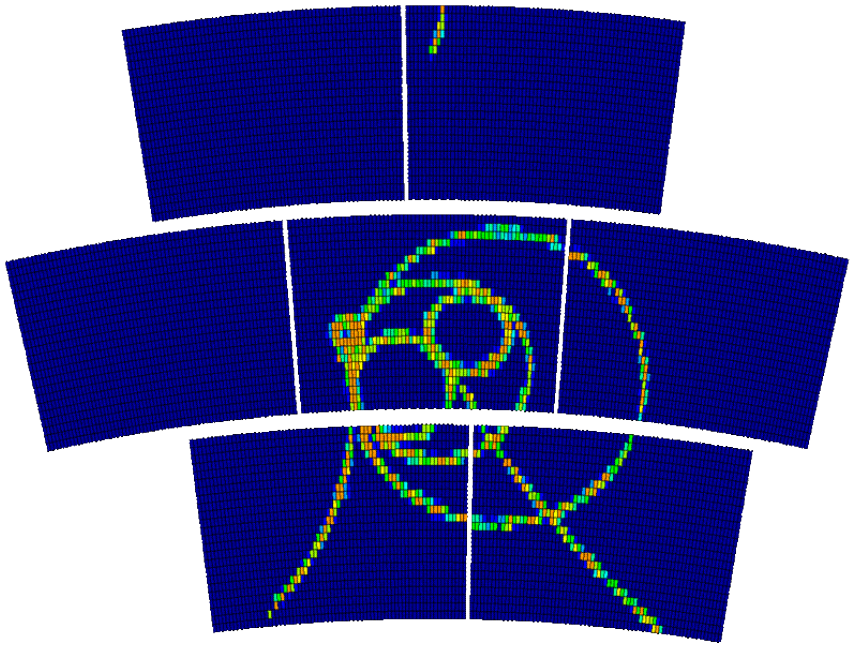
P. Colas, D. Attié, S. Ganjour
(contribution from M. Zito and S. Suvorov

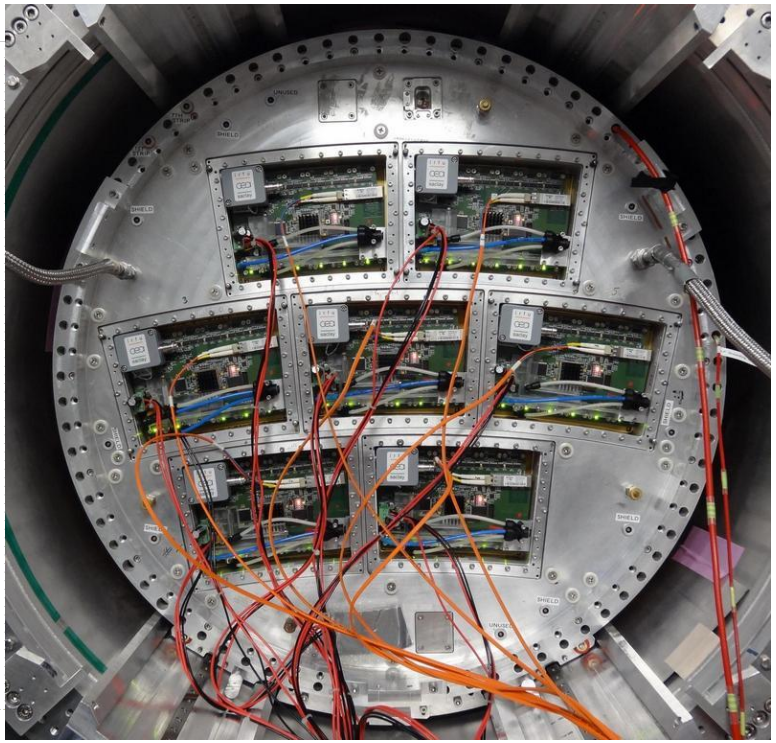
dE/dx analysis

- With MM test beam data from 2015 by S. Suvorov a Russian student (from T2K)

Micromegas Large Prototype overview

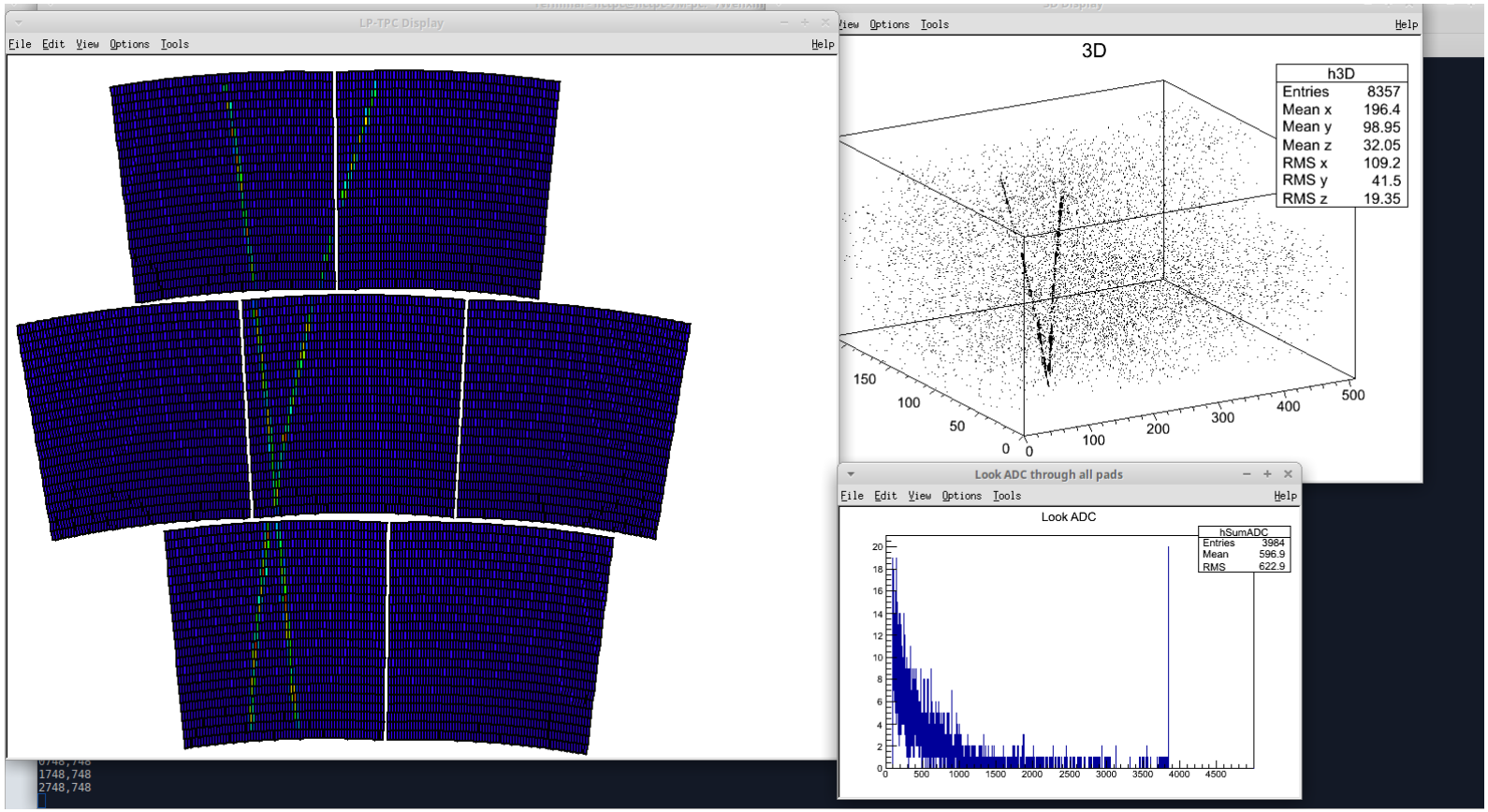
- Endplate with 7 modules
- each module has 24 rows x 72 columns





ILC-TPC raw data

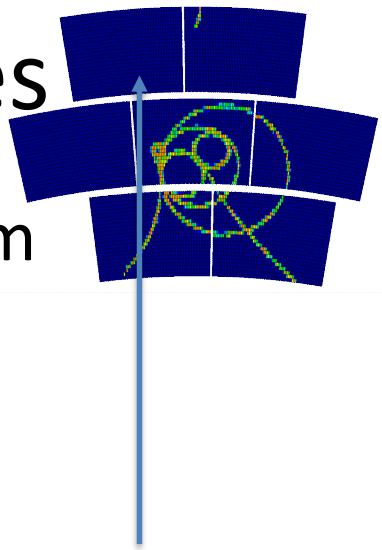
- Event display



dE/dx study

- Perform the study similar to the one for the T2K TPCs (Claudio TN-001)
- Method:
  1. For each pad take maximum charge from ADC (C_{pad})
  2. Sum up pads in a row to make a cluster ($C_{cluster}$)
  3. For each track sort $C_{cluster}$ in increasing order
     (N clusters per track)
  4. Take αN first clusters.
     $0.4 < \alpha < 1$
  5. Truncated mean energy per cluster
     $$C_T = \frac{1}{\alpha N} \sum_{i}^{\alpha N} C_{cluster,i}$$
  6. First look at the resolution.
  7. Vary α to understand the influence on the results
  8. Calculate C_T independent from the N
     some calibrations needed

2015 LP TPC Micromegas samples



Lots of different configuration tested with beam

For the 1st look use a scan over drift length

plots in this talk are mainly for module 0

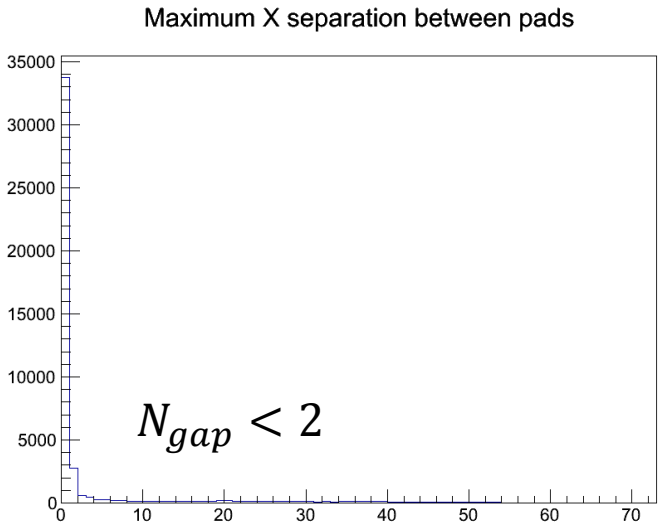
E_{Field} *V/cm*	Drift z *cm*	Table z *mm*	Table Vertical 3 *mm*	Sampling *MHz*	Zero Suppression	Peaking time *ns*	Request N_{events}	V_{mesh} *volts*	DATA	
									RUN	Evts
					B=1T					
230	**0**	-199	-40	25	1	200	1000	380	**5148**	1,000
	3	-169					1000		**5149**	1,000
	3	-169					4000		**5150**	4,000
	5	-149					4000		**5151**	4,000
	10	-99					4000		**5152**	4,000
	15	-49					4000		**5153**	4,000
	20	1					4000		**5154**	4,000
	25	51					4000		**5155**	4,000
	30	101					4000		**5156**	4,000
	35	151					4000		**5157**	4,000
	40	201					4000		**5158**	4,000
	45	251					4000		**5159**	4,000
	50	301					4000		**5160**	4,000
	52.9	330					4000		**5161**	on

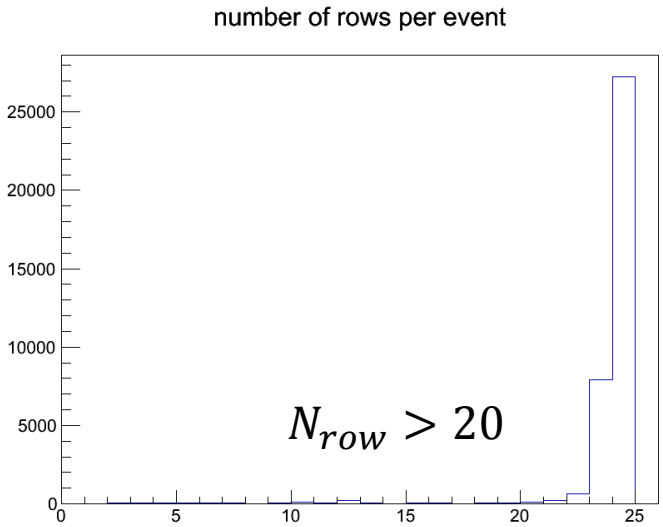
ILC-TPC event selection

- For first look PID study need:
  1. one track per event (per FEM)
  2. long enough track
- Selection:
  1. Look at maximum gap between pads hit in a row
  2. Look at track length (number of rows)

FEM 0 selection results:

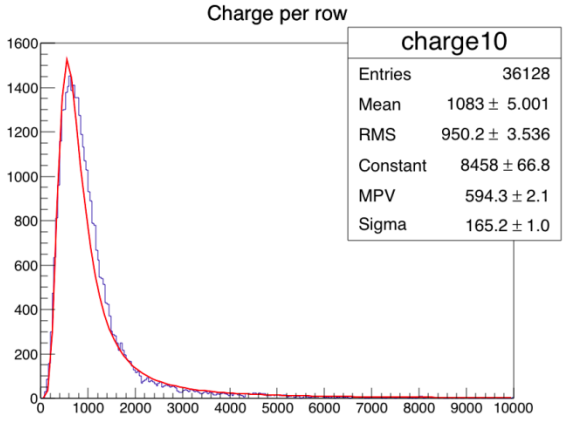
Events in sample:	46000
Not empty fem0:	44224
< 2 tracks :	37151
> 20 rows:	36146



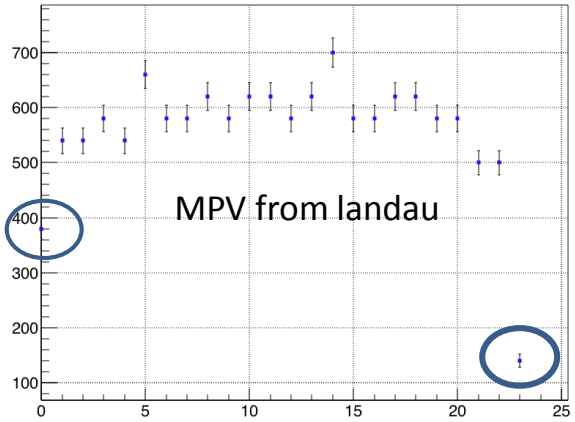


Charge per row (cluster)

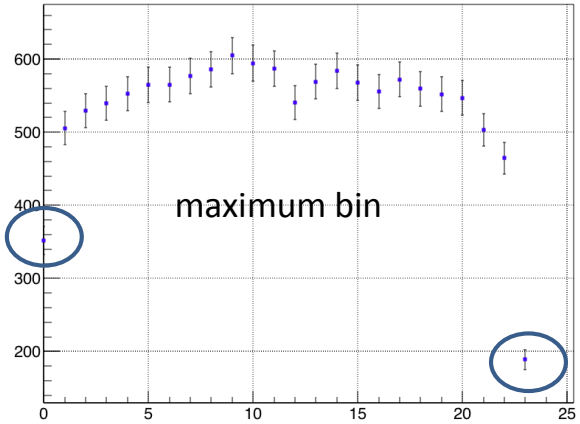
- Look at the most probable charge per cluster in a row



charge per cluster (row 10)

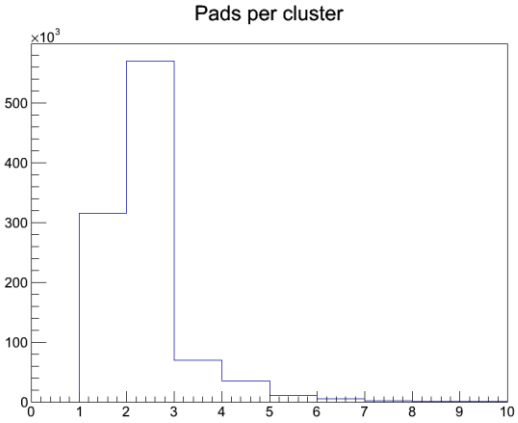


row number



row number

- Edges of module demonstrate lack of charge (Electric field inhomogeneity)
- pads at edges collect ~half of charge compared to center
- Exclude 1st and last row for dE/dx estimations



Typically 1-4 pad per cluster

Charge cut

- Reminder about dE/dx study plan:

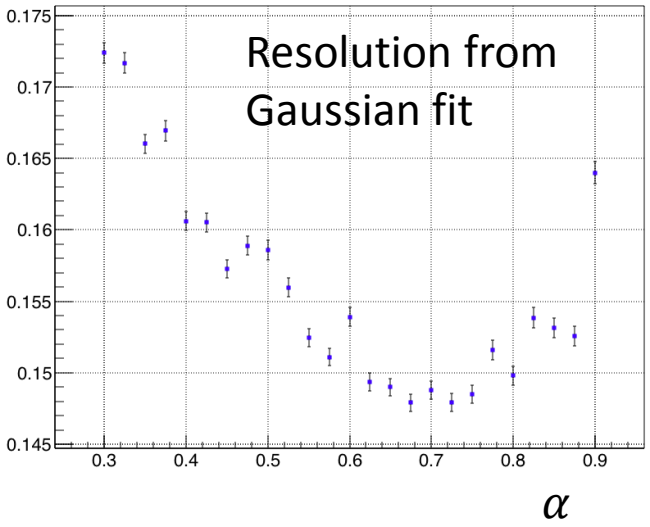
4. Take αN first clusters.

$$0.4 < \alpha < 1$$

5. Truncated mean energy per cluster

$$C_T = \frac{1}{\alpha N} \sum_{i}^{\alpha N} C_{cluster,i}$$

Need to define α

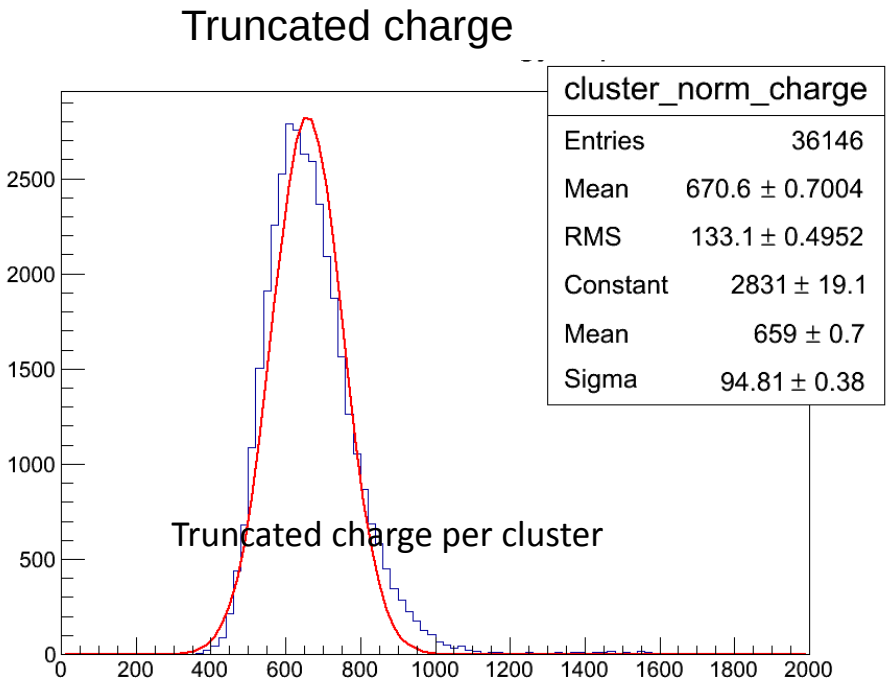


T2K value is 0.7

Still make sense!

First results

- Applying C_T calculation method to the selected events
- $\alpha = 0.7$ gives the best resolution



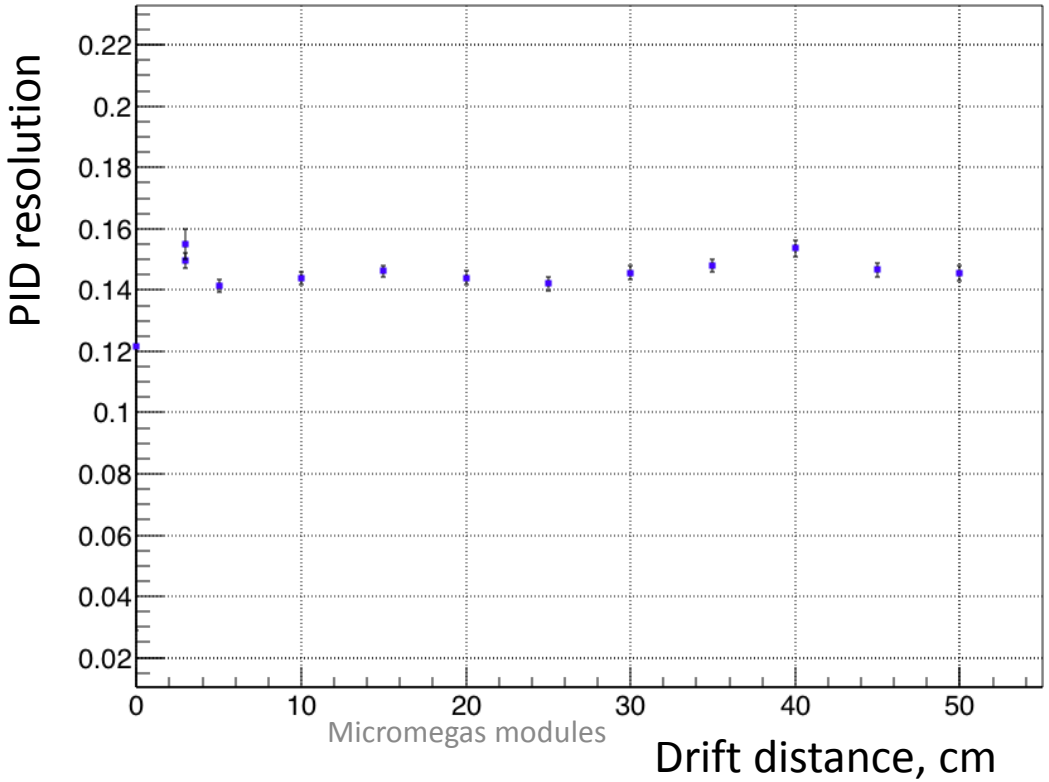
Gaussian and FWHM calculations give ~same results
~14% for 24 rows FEM (~17 cm)

for T2K TPCs 72 pads (~80 cm) have ~6.5%

For ILD TPC track length ~120 cm : ~5.0%

First results

- Charge per pad is calculated as maximum ADC
- Maximum ADC can depend on drift distance → can effect PID resolution
- No dependence observed → $C_{pad} = \max(ADC)$ is good enough



Summary

- LC-TPC 5 GeV/c e^- samples are used for dE/dx resolution estimation
- the first estimation of the dE/dx resolution was done : 5.0 %

- TODO:
  - We still have:
    - other module → work started some *very* preliminary results obtained
    - other data samples (voltage, beam position, peaking time)
    - other technical details → understand the possible dependence
  - Calibration is necessary

Encapsulated resistive foil Micromegas with reverse polarization

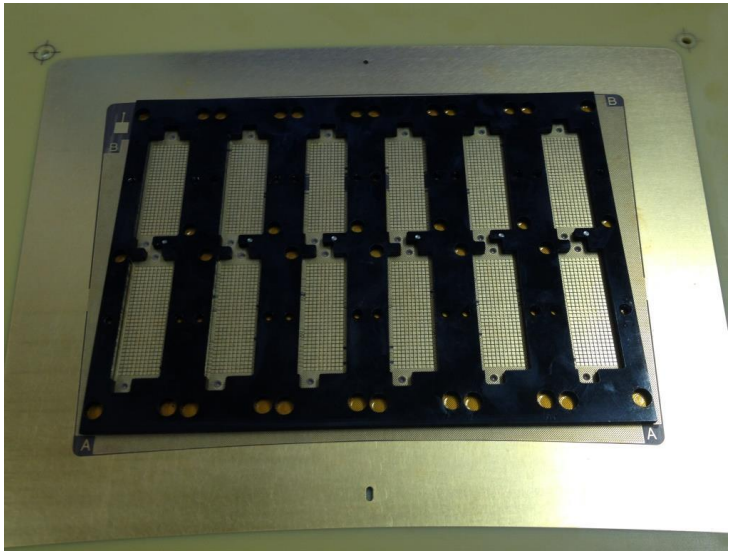
Reserved a test beam period at DESY to test 3 to 4 modules with several improvements:

- Better pad connections (threaded stiffener glued on PCB, under mechanical test, electronic test in 1 or 2 weeks)
- Grounded mesh, anode at +400 V

(should give less noise and less distortions)

-- DLC delivered (2.5 Mohm/sq)

-- same test going on for T2K upgrade with cosmic rays (2 modules ordered, one with annealing at 210 °C to reach 500 KOhm



Cosmic-ray setup (Boris Tuchming)

- There is a cosmic test permanently going on in Saclay (so-called FCC test)
- We hope to be able to test 4 new modules there before going to the test beam.