

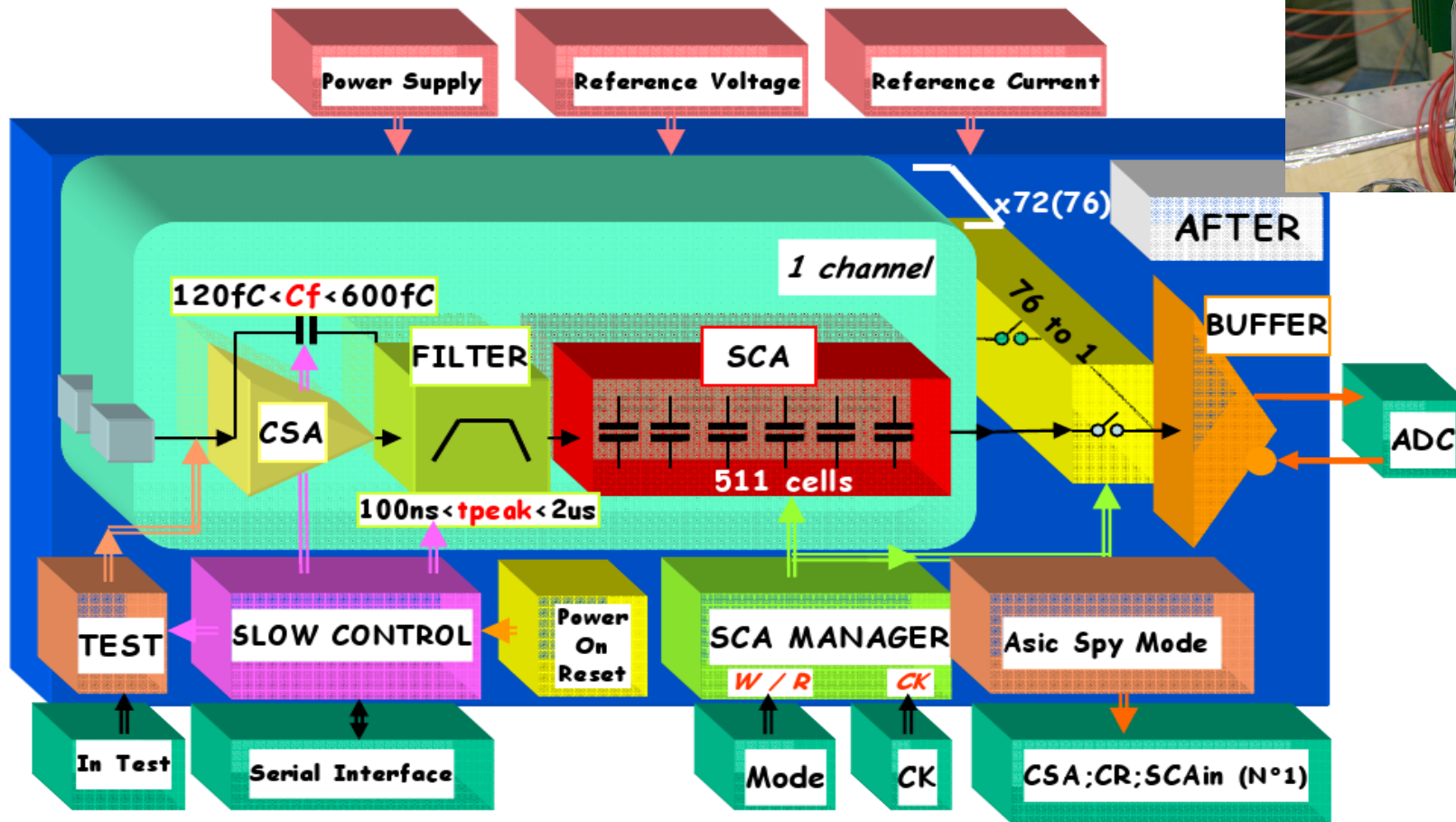
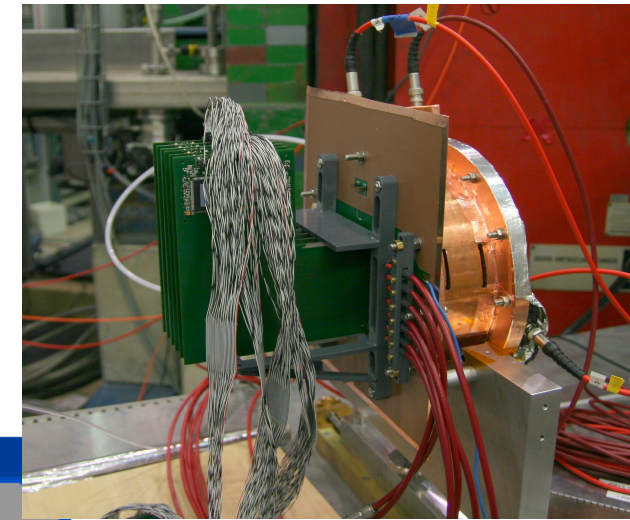
Development around the GEM-TPC Test Chamber

Maxence Vandembroucke, TUM E18

GSI- 09-03-10



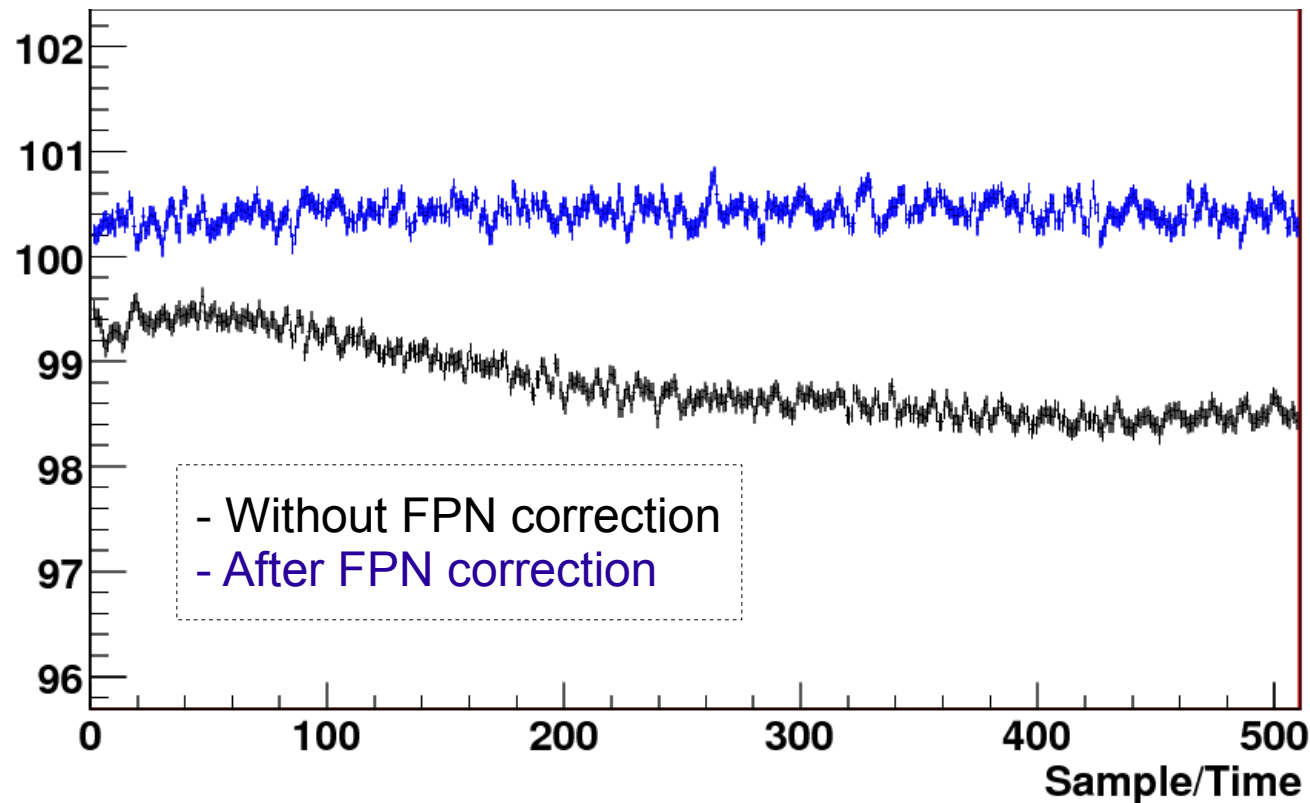
- New development of AFTER-T2K front end electronics
- New cosmic setup
- Analysis of the ELSA test beam data and cosmic
 - Integration in Pandaroot
 - About Pulse Shape Analysis
 - Crosstalk suppression



SCA : Switched Capacitor Array

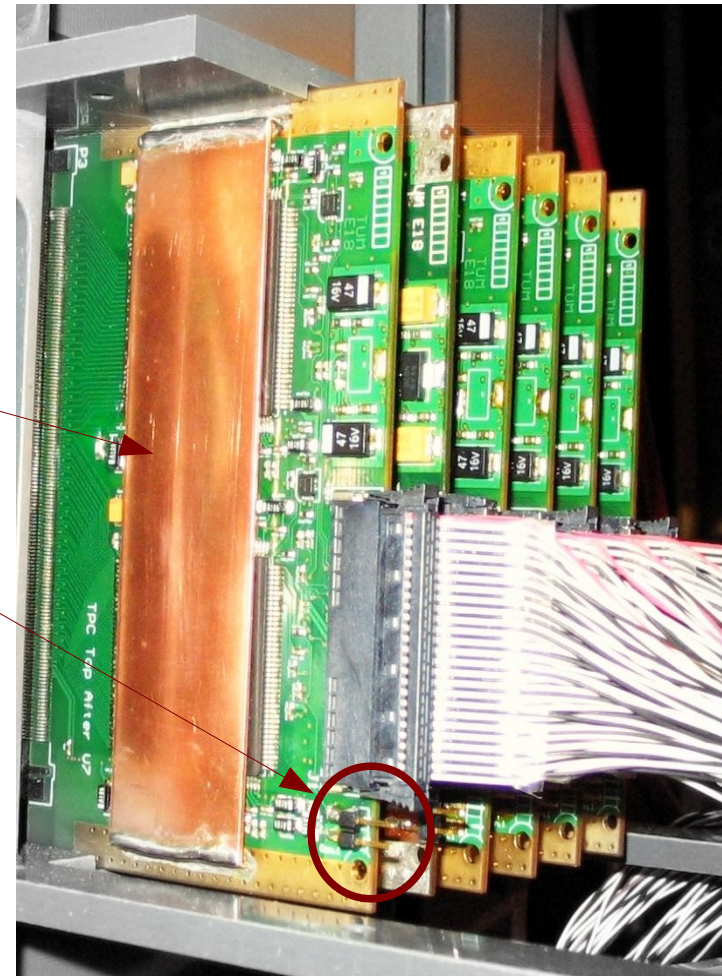
- Fix Pattern Noise correction :

- Particular shape of the pedestals along the analog memory of the AFTER-T2K chip (due to capacitance fluctuation inside the chip)
- Corrected using internally unconnected channels:

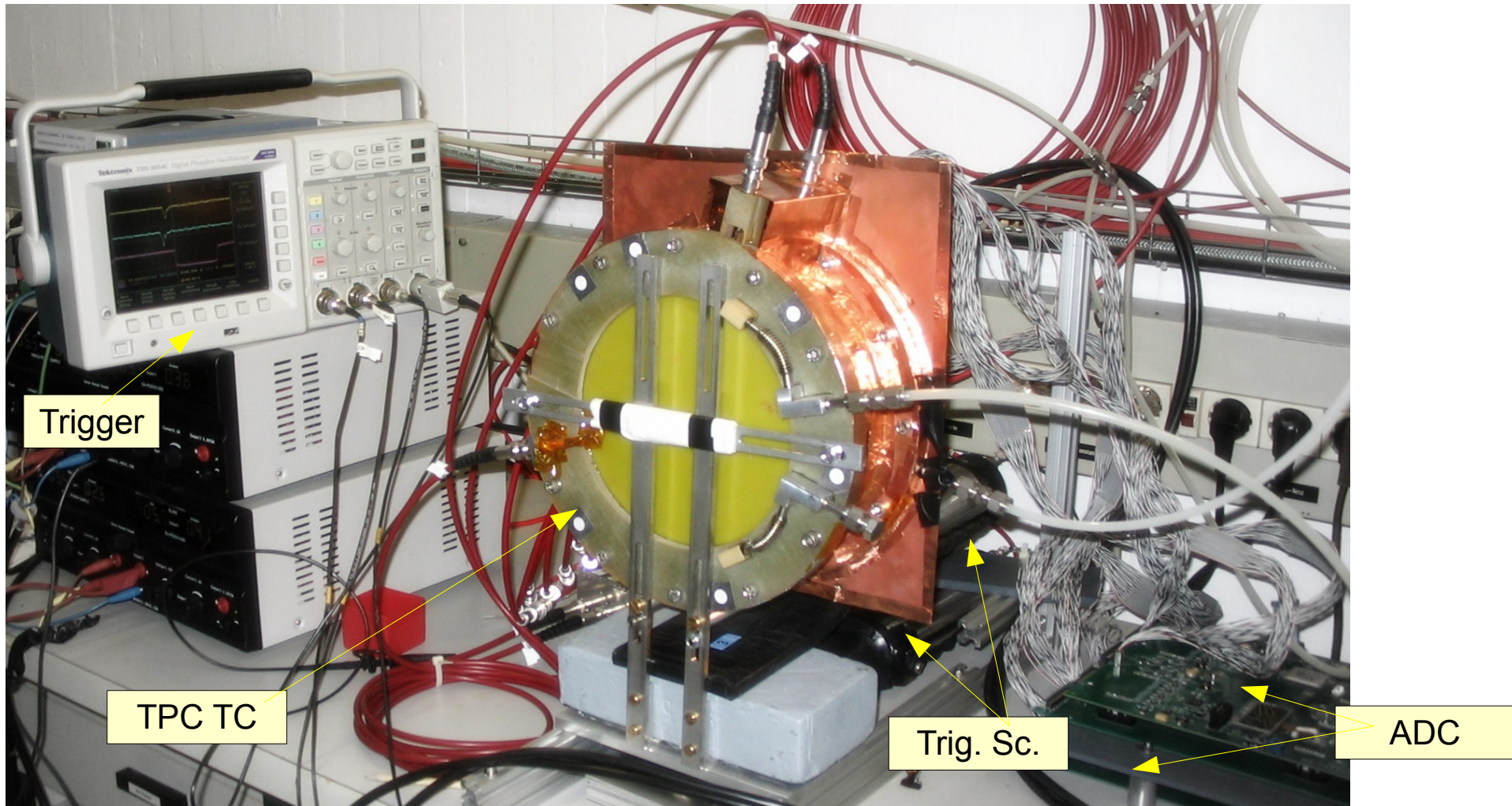


- Tunable sampling frequency (not tested yet) : 20, 23, 27, 32, 40 and 53MHz

- Front-end AFTER-T2K cards for FOPI/CB in production
 - 4 chip per card – 256 channels
 - Small dimensions : 10.2 x 7 x 0.8 cm
 - 2.5 W per card
 - Copper plate for cooling/shielding
 - Pin for pulse/trigger injection
 - Noise of $\sim 600 e^-$
 - 50 cards in production
 - Pcb and components will be delivered in 2 weeks

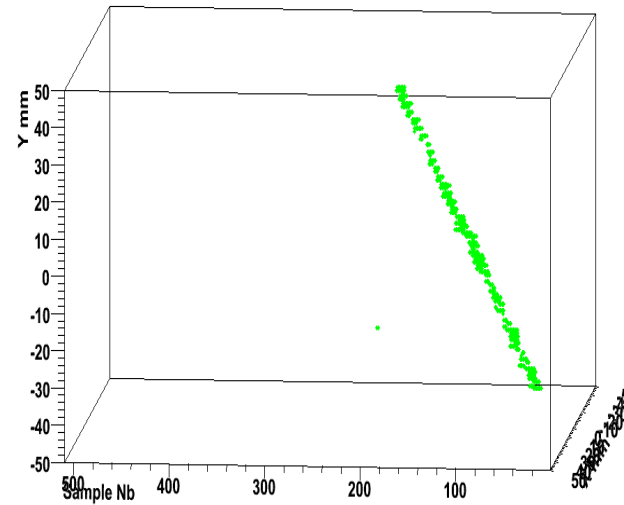
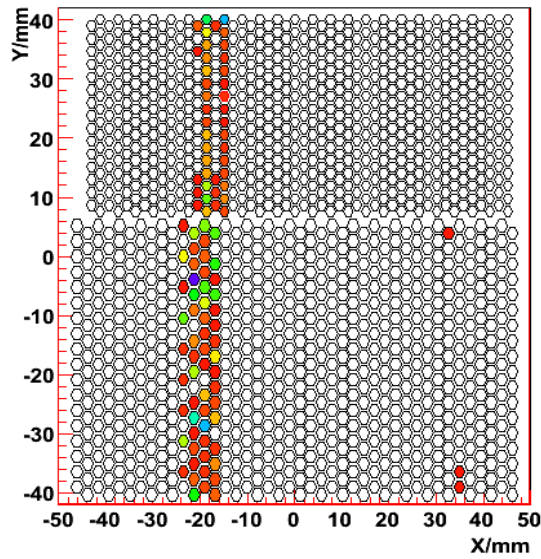


➤ Setup :

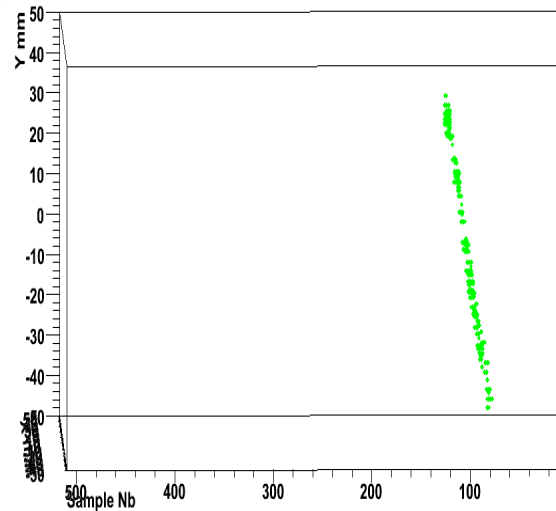
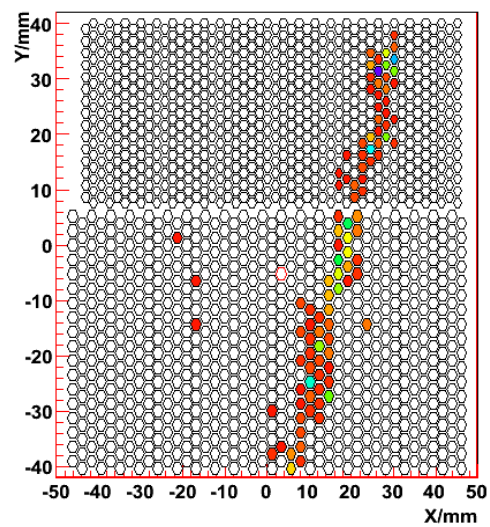


- 8cm drift GEM-TPC TC
- 2 ADC
- Noise $\sim 800 e^-$
- 2 trigger scintillator
- 24 T2K chip / 1500 ch.
- Rate $\sim 0.7 \text{ Hz}$

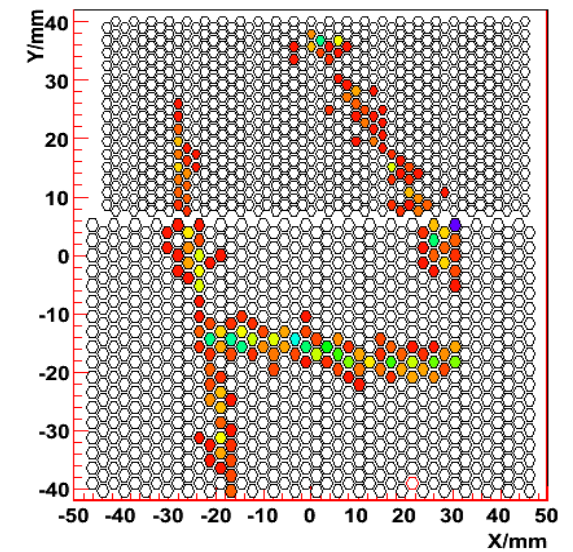
➤ AR/C02 70/30 :



➤ Ne/C02 90/10 :

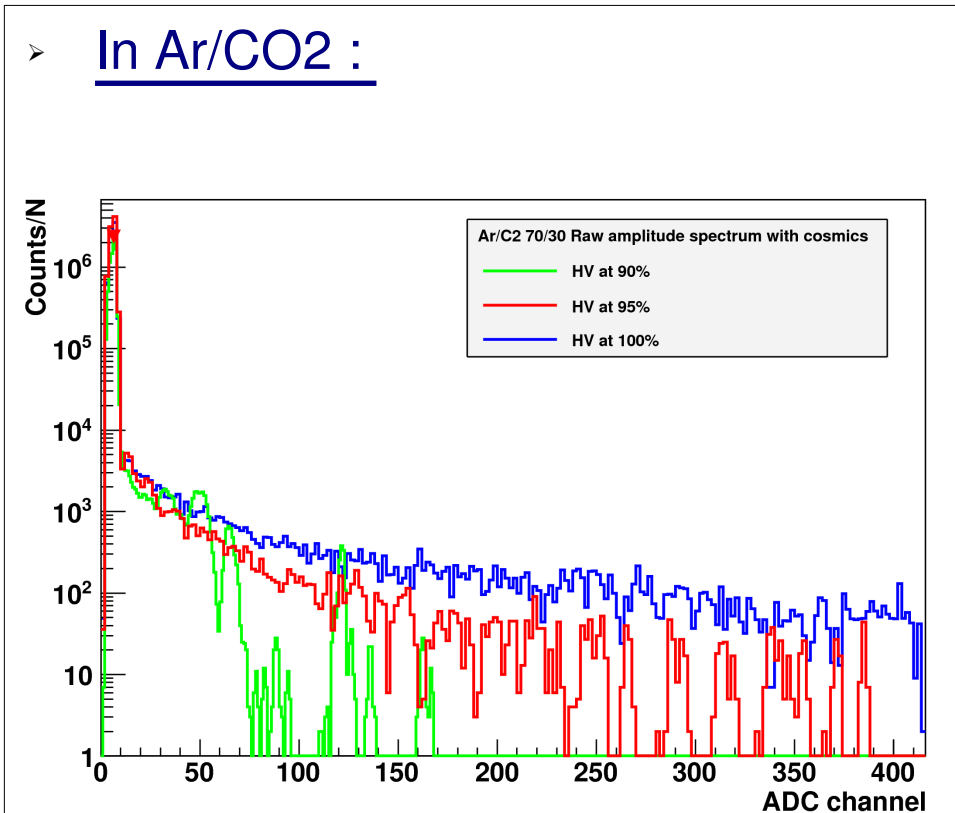


δe^- in Ne/CO2

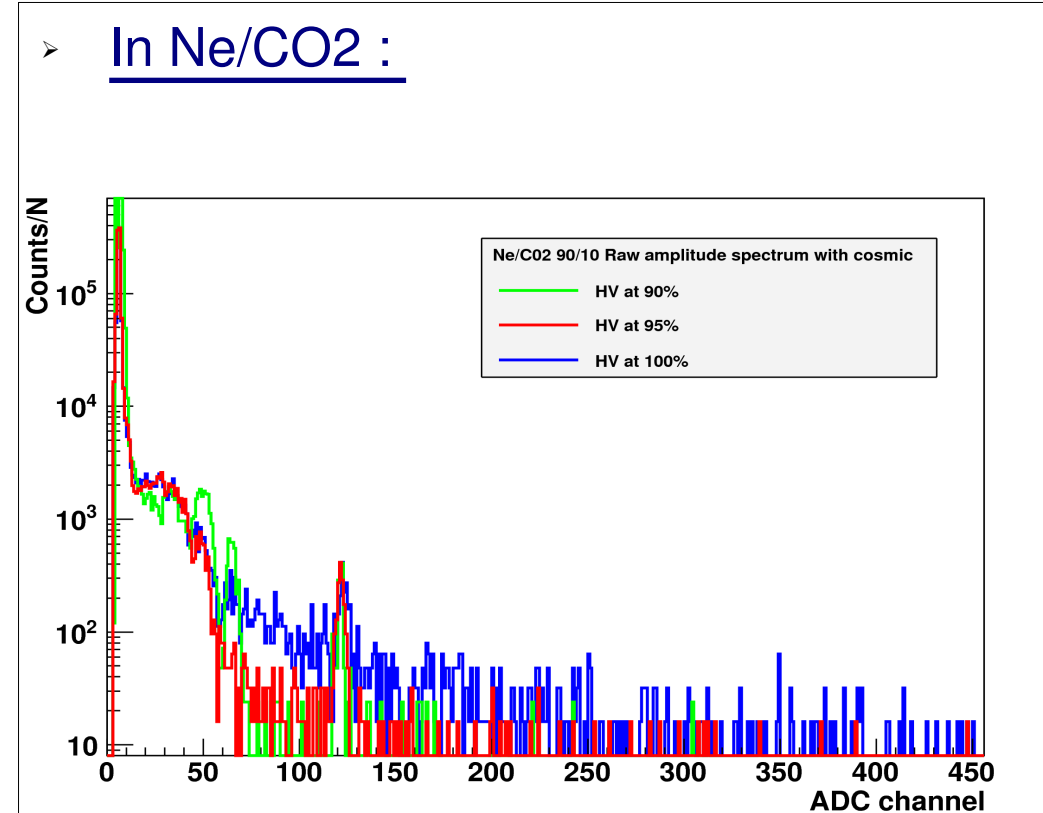


➤ Raw sample amplitude :

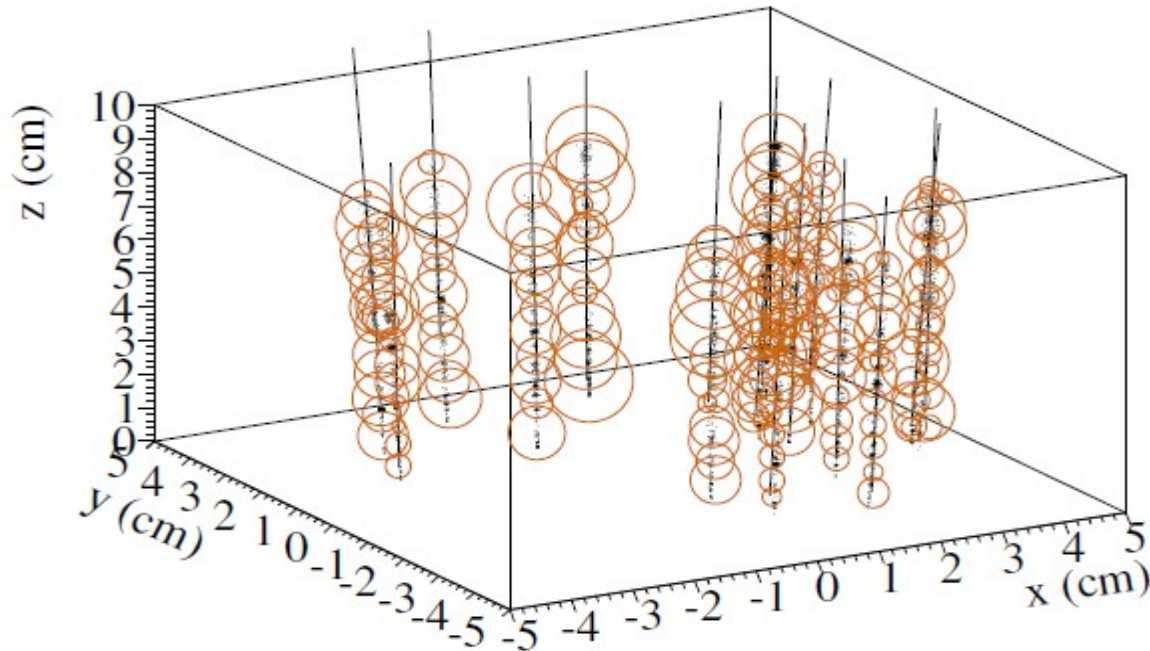
➤ In Ar/CO₂ :



➤ In Ne/CO₂ :

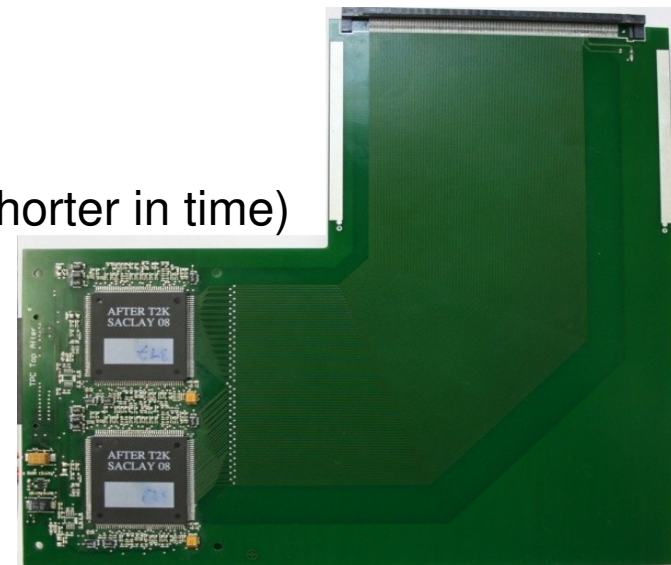


- Integration to pandaRoot :
 - Same classes and geometry for MC and real data
 - Task from the TPC framework :
 - PSA / Clusterisation / Pattern Reco / Track Fitting
 - Modular 2D Fast hough transform pattern recognition
 - Implementation of RKTrackRep (Runge Kutta) => cf. Felix Böhmer Talk

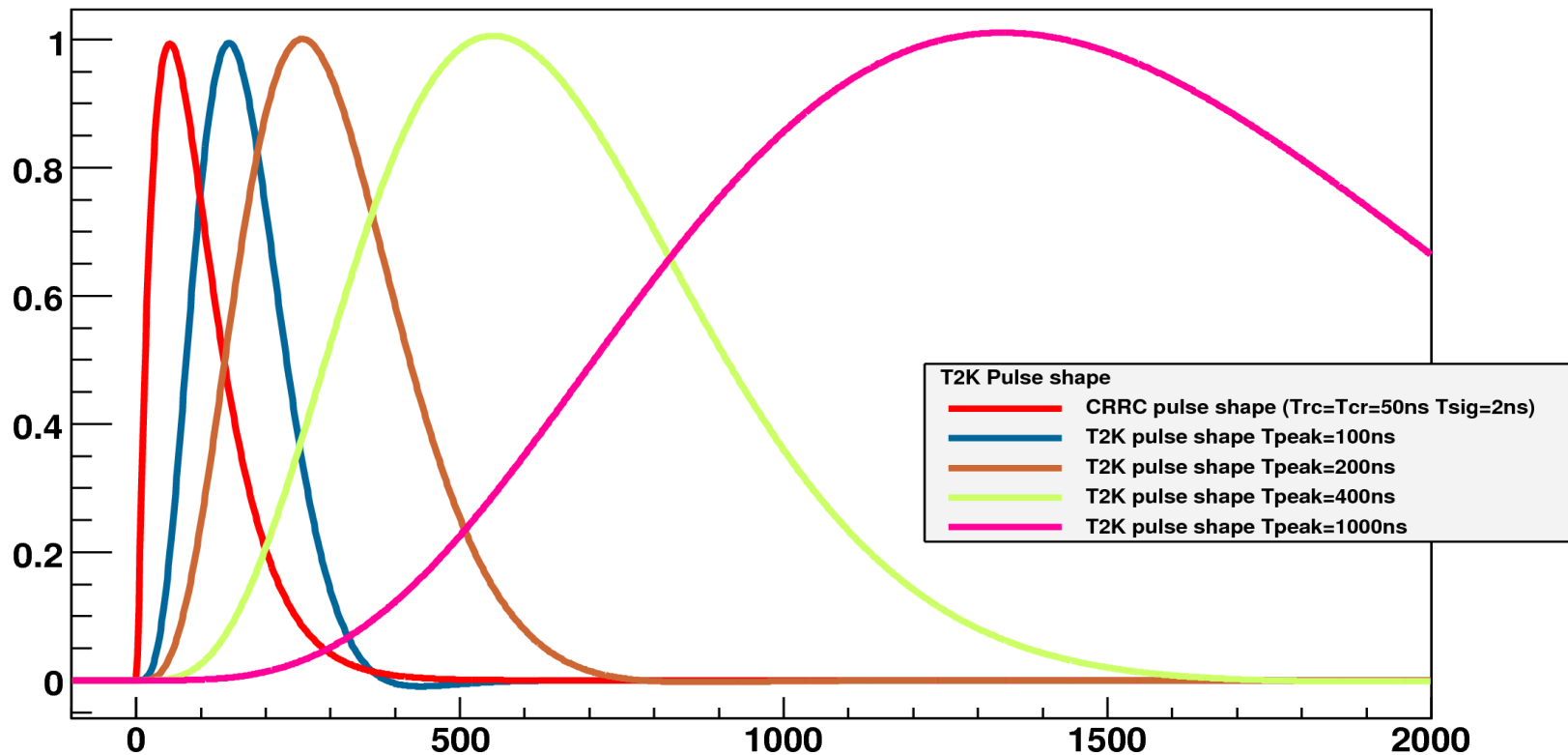


(Cluster amplitude not to scale)

- Long strips of the L-shape card introduced important crosstalk (>10%)
- Tagging algorithm :
 - 1) Tagging the samples using topology, amplitude and time
 - 2) Propagating the weighted tag through the PSA and clusterisation
 - 3) Cutting the cluster which have more than 60% of their amplitude tagged as crosstalk
- => Improve of the (bias) residuals by 25%
- Other algorithms :
 - Cut on time length (xtalk mostly derivative => much shorter in time)
 - Cut too important
 - Systematic subtraction of xtalk on neighboring strips
 - Need a better xtalk description



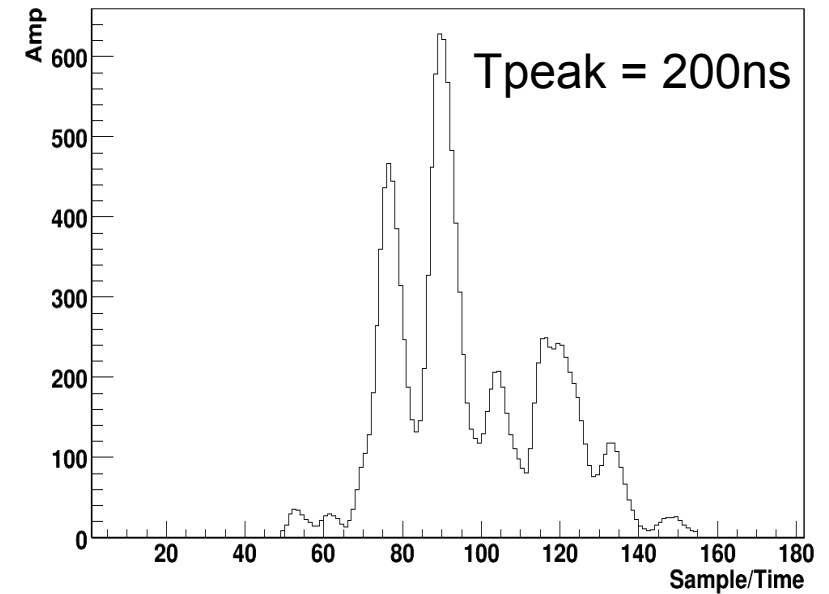
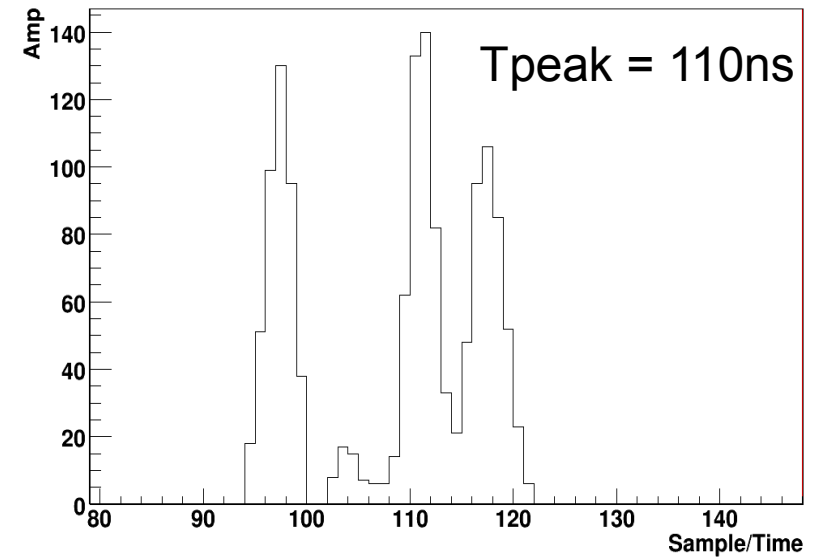
- Integration of the “real” pulse shape of the AFTER-T2K FEE in the analysis framework:



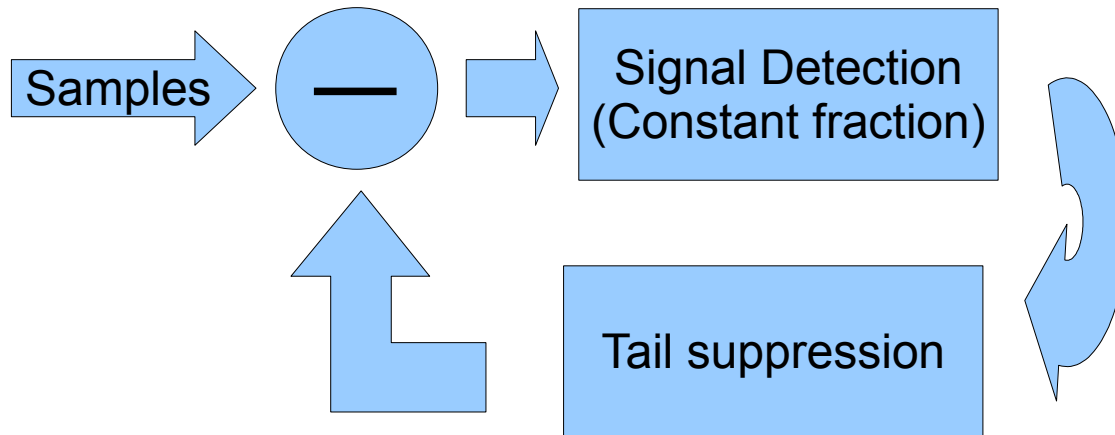
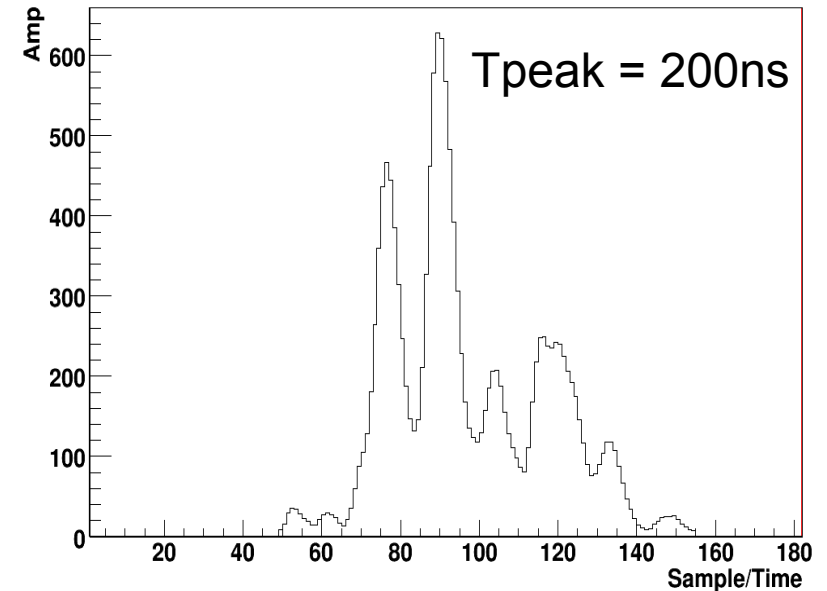
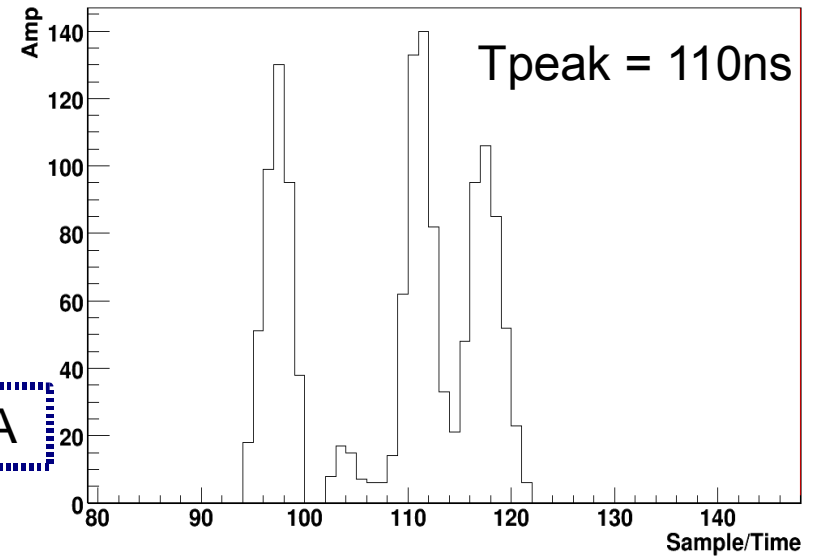
CRRC filter + complex pole:

$$H(T) = A_0 \times (t/\tau)^3 \times \sin(t/(3\tau)) \times \exp(-t/\tau) \quad (\text{at } T_p=100\text{ns})$$

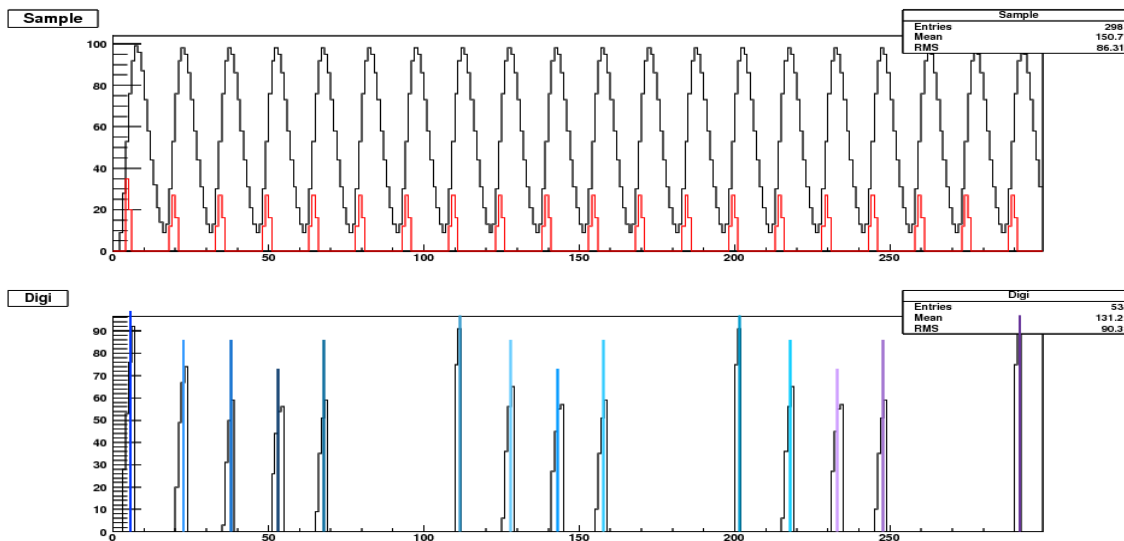
- The memory size and the drift time constrain the FEE freq.
- Increasing the peaking time of the FEE is needing to provide good amplitude and time definition
- That implied a tail suppression algorithm to correct pile-up
- Tail analytical description



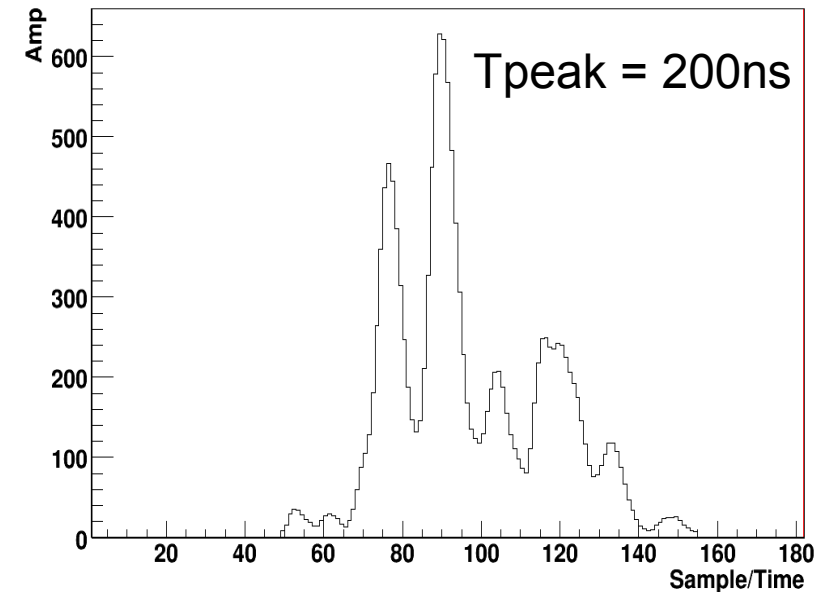
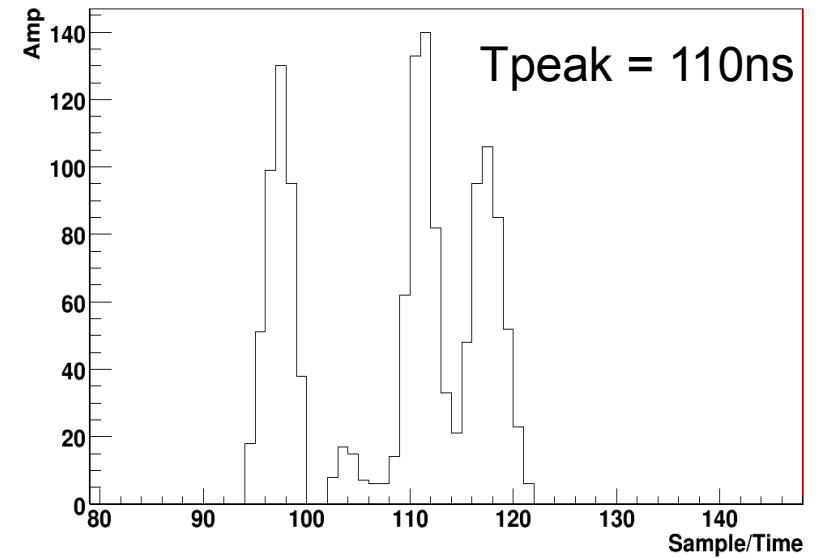
- The memory size and the drift time constrain the FEE freq.
- Increasing the peaking time of the FEE is needing to provide good amplitude and time definition
- That implied a tail suppression algorithm to correct pile-up
- Tail analytical description



- The memory size and the drift time constrain the FEE freq.
- Increasing the peaking time of the FEE is needing to provide good amplitude and time definition
- That implied a tail suppression algorithm to correct pile-up
- Tail analytical description

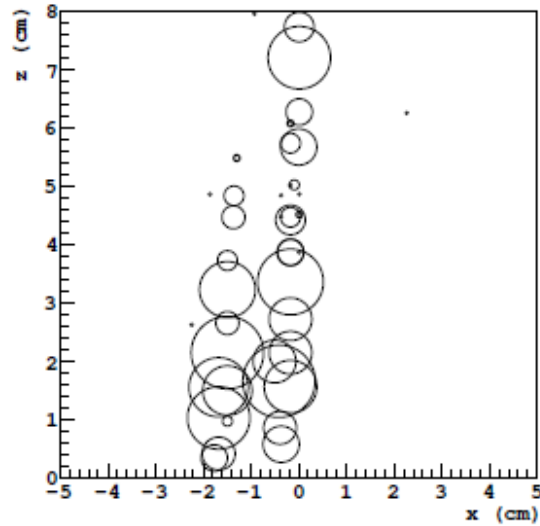


Implemented but not stable when too much pile-up => tuning ongoing

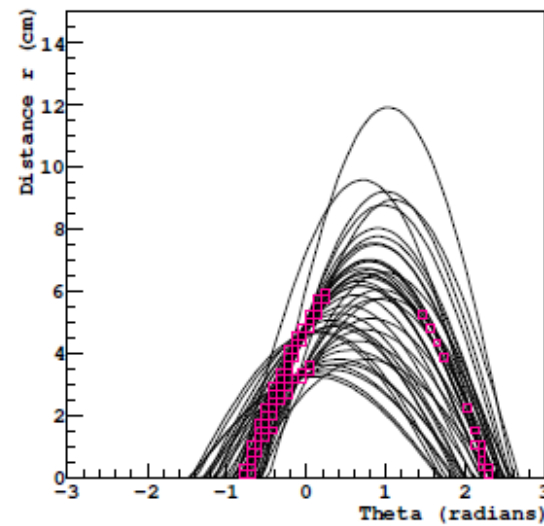


- From the Test Bench at ELSA :

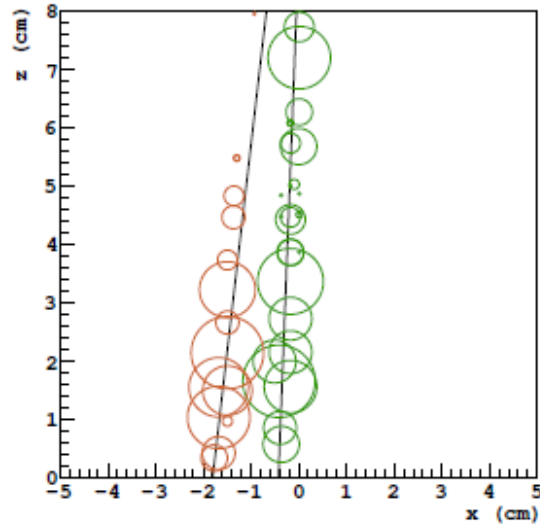
Real Space



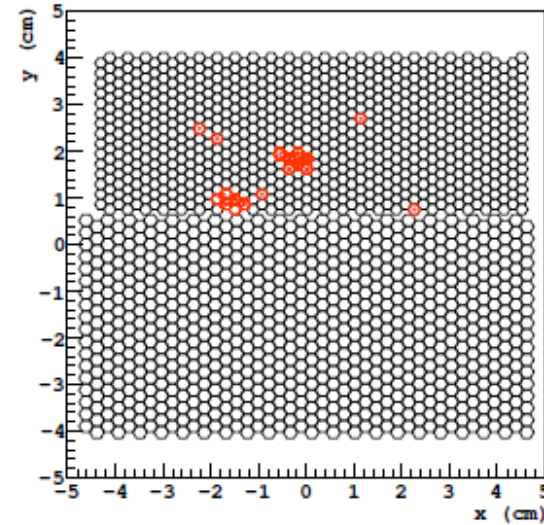
Hough Space



Real Space

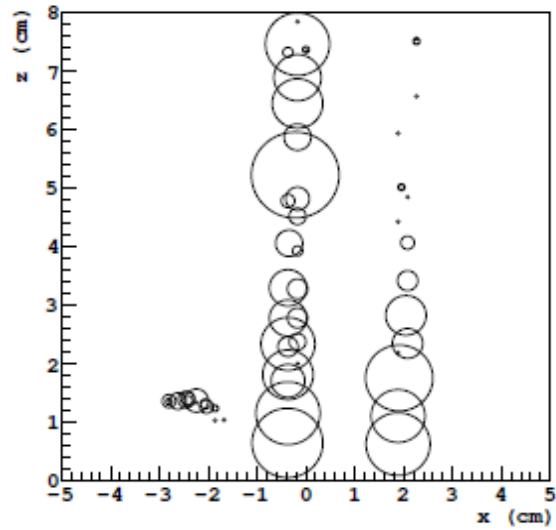


Real Space x-y

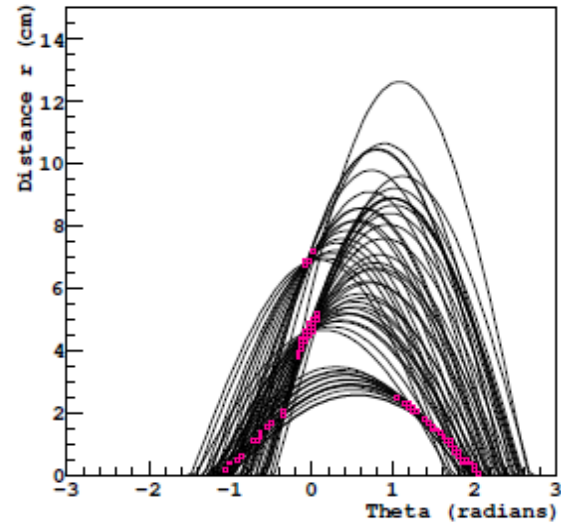


- From the Test Bench at ELSA :

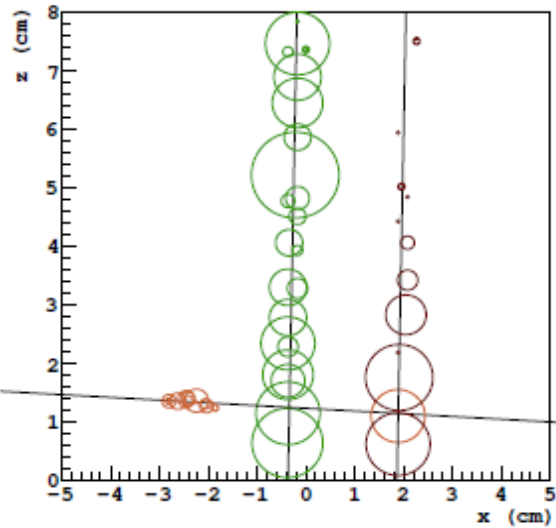
Real Space



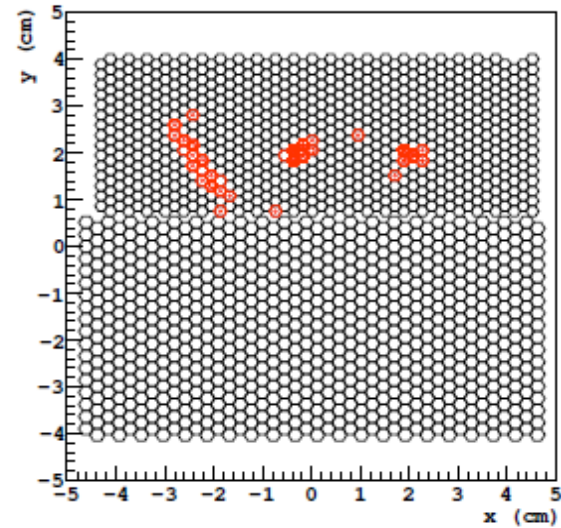
Hough Space



Real Space

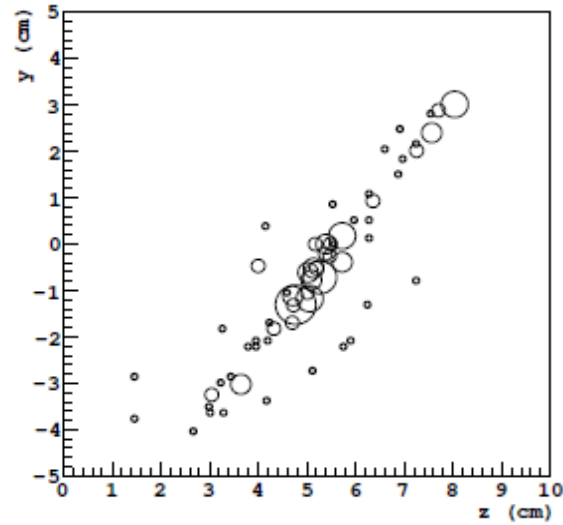


Real Space x-y

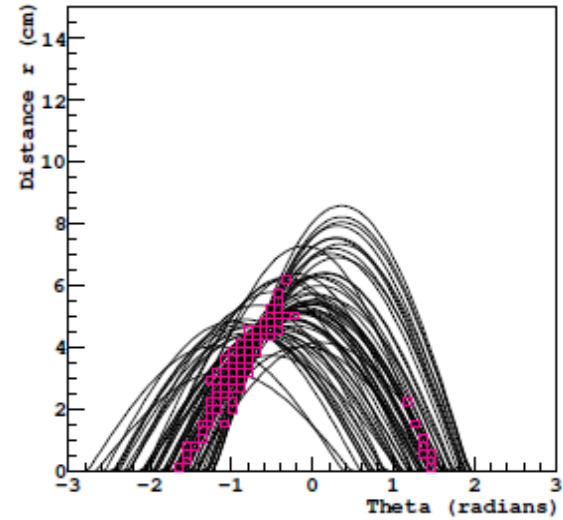


- Cosmic taken at Munich :

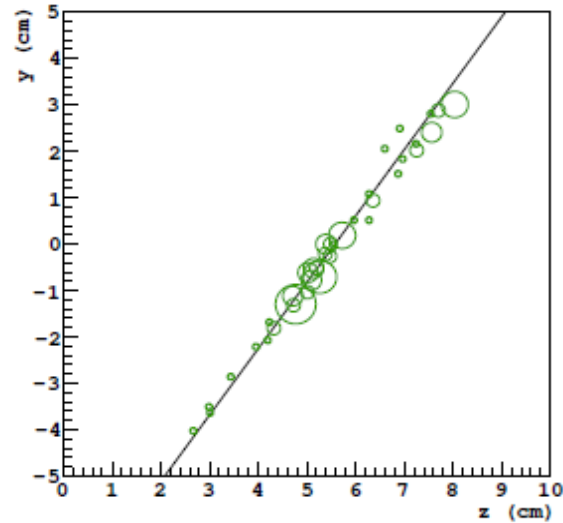
Real Space z-y



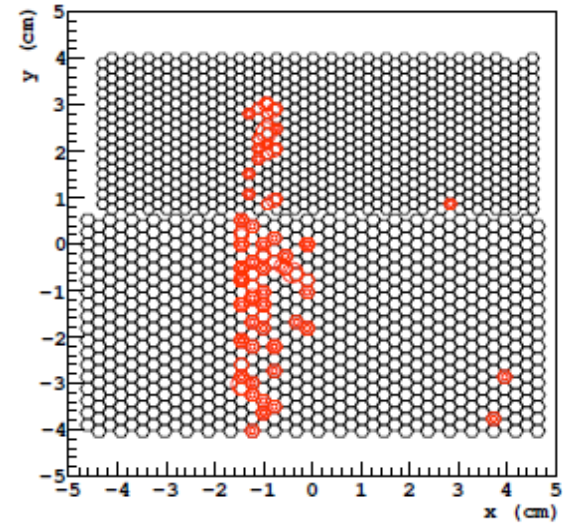
Hough Space



Real Space z-y

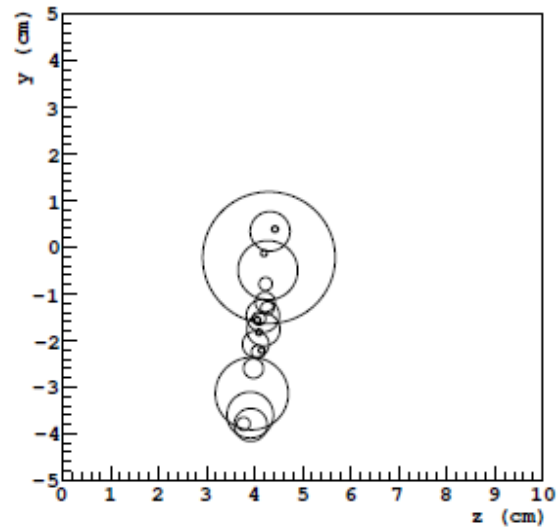


Real Space x-y

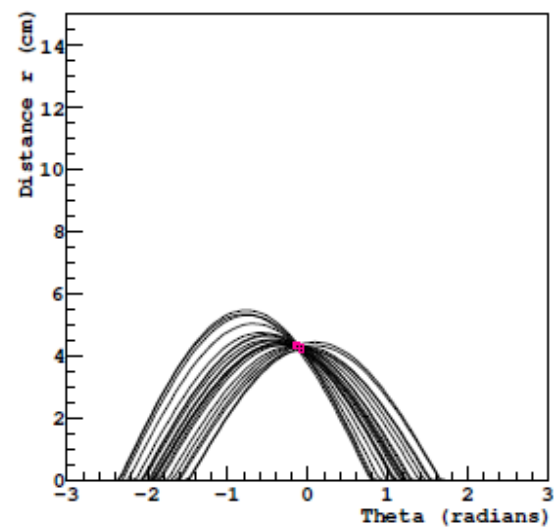


- Cosmic taken at Munich :

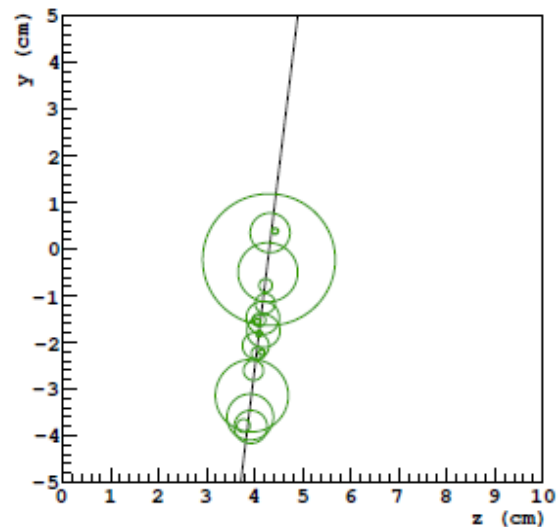
Real Space z-y



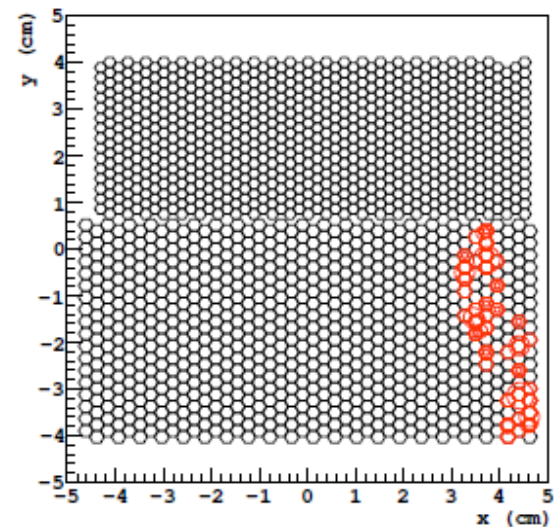
Hough Space



Real Space z-y



Real Space x-y



- Hardware :

- Replacement of the drift end plate of the TC ongoing for ELSA test beam
 - OLD PCB: 2 mm + 3.5 μm Cu (+Ni/Au) $\sim 1.334\%$ X/X0
 - NEW PCB: 0.5 mm + 1.2 μm Cu $\sim 0.34\%$ X/X0
- Cosmic with small FE cards for xtalk reduction
- Systematics studies (gain, gas, angle, frequency ...)

- Analysis :

- PSA algorithm
- Crosstalk suppression
- Tracking telescope of the test beam in PandaRoot
- Semi-bias analysis (using a part of the chamber to test another part)