

# Characterization of the AFTER-T2K Front-End electronics

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Analysis of the test bench data shows noise/crosstalk

=> AFTER-T2K “final” characterization

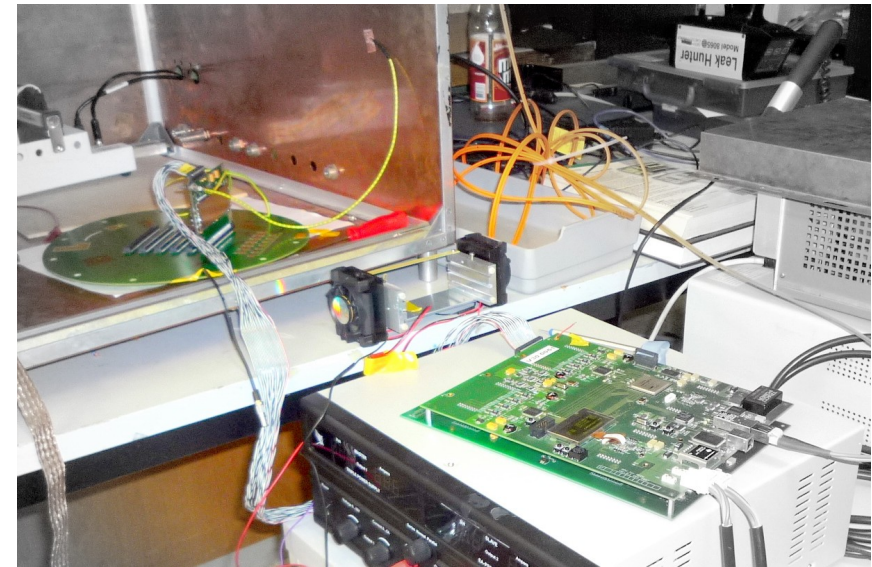
**AFTER-T2K** Front-End electronics measurements :

- Noise
- Gain
- Crosstalk

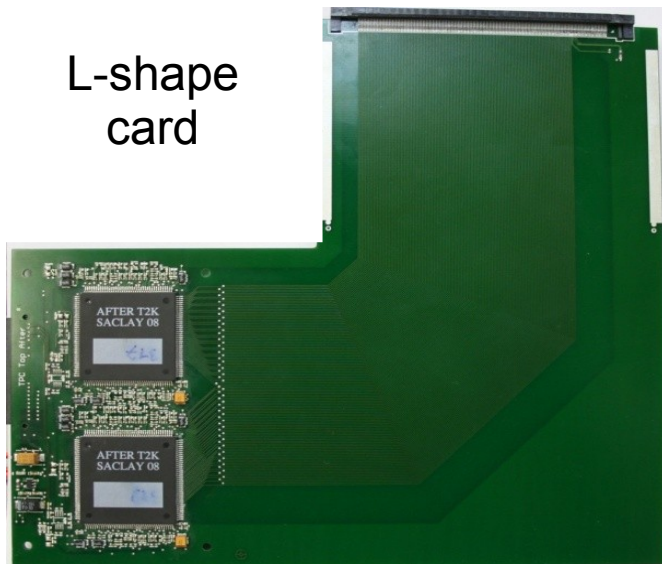
Test bench **off-line** data check

## Test setup :

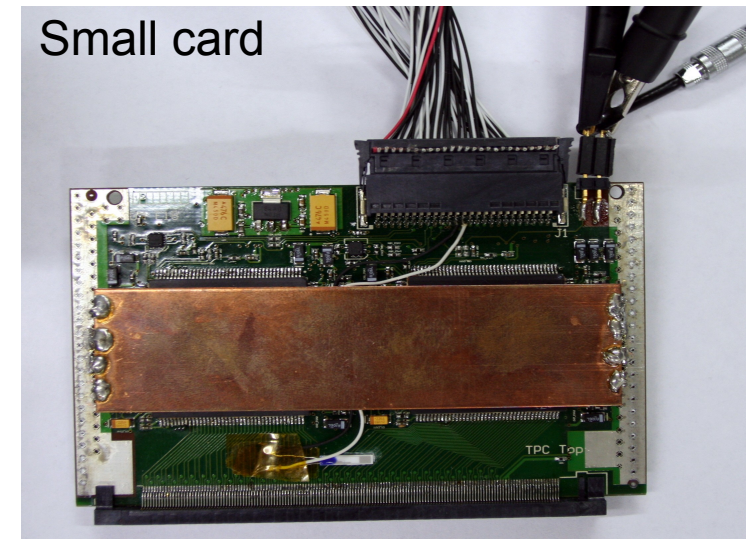
- 2 different AFTER-T2K front end card
- Faraday cage
- Dedicated cooling system
- Card mounted on the spare hexagonal padplane of the test chamber



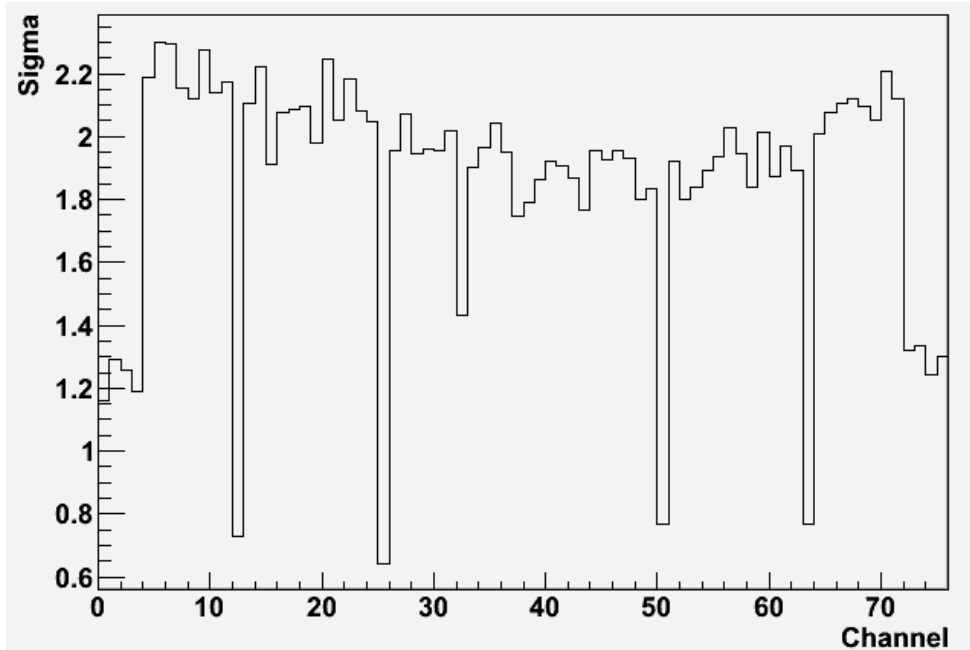
L-shape card



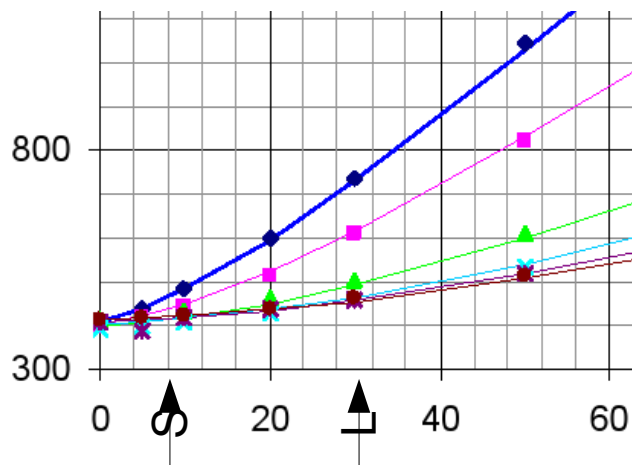
Small card



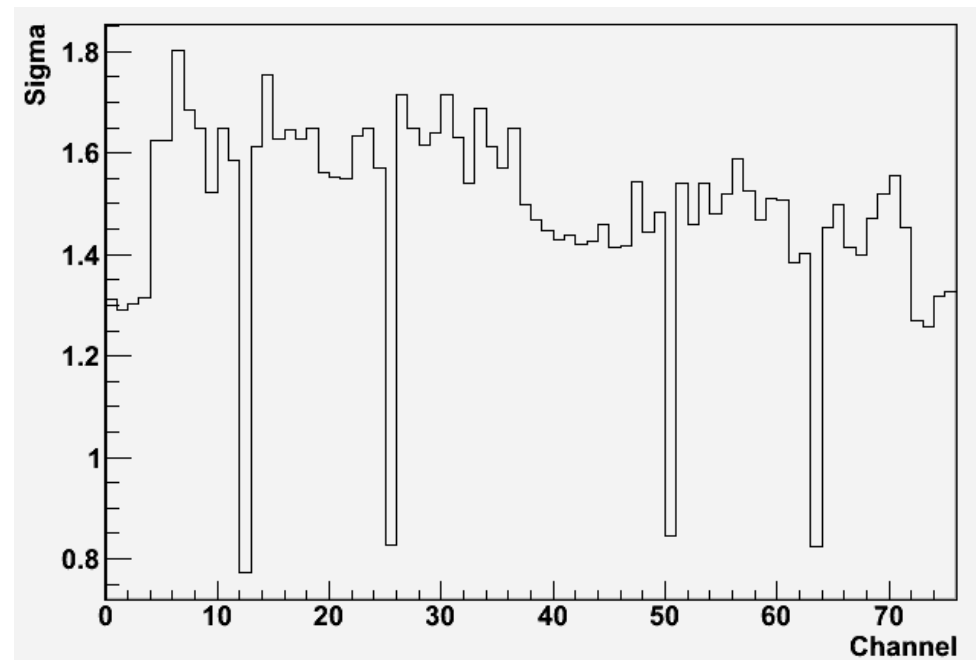
## L-Shape Card



Average noise (RMS) on connected channel : **2.3 ADC/ch ~790e-**



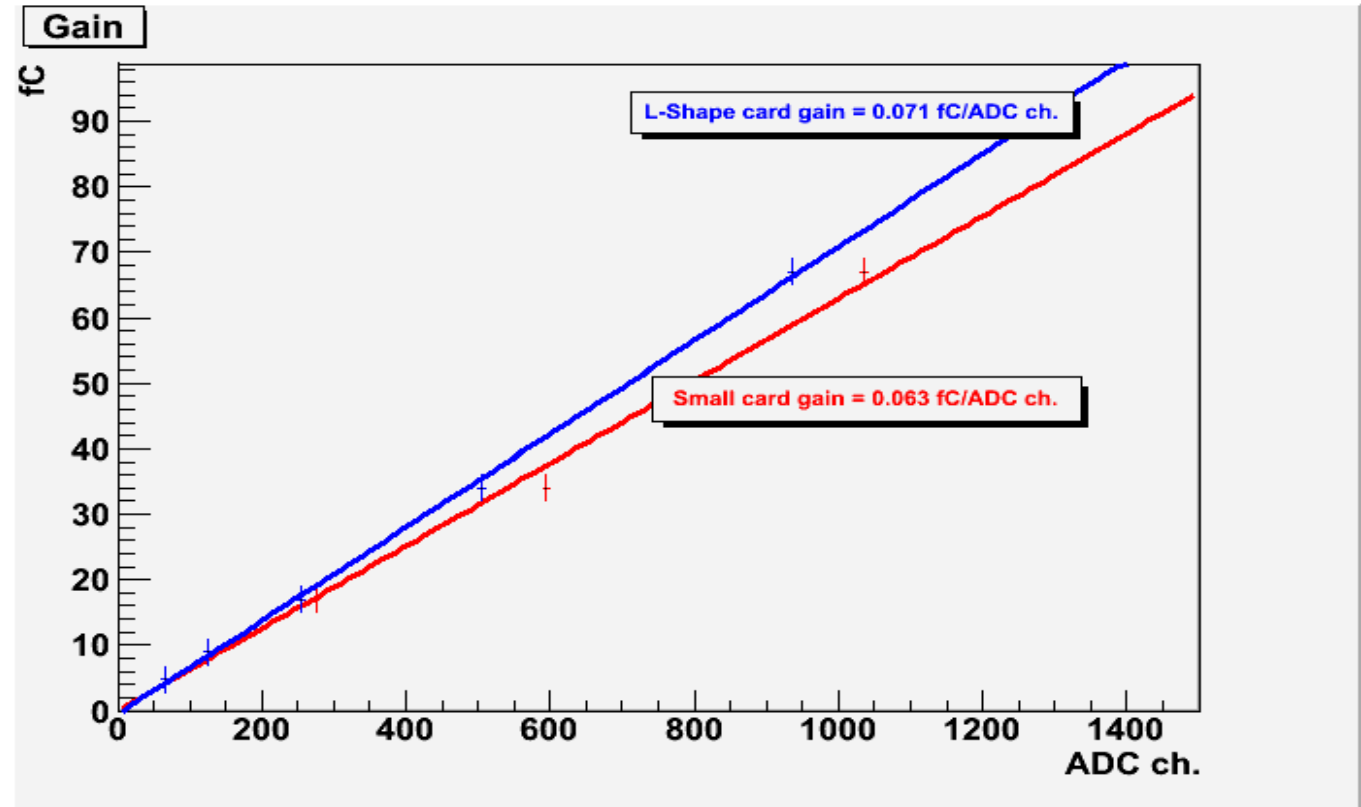
## Small card



Average noise (RMS) on connected channel : **1.55 ADC/ch ~530e-**

Difference entirely explained by the strips capacitance

- Using the maximal amplitude of a pulse directly injected on the padplane through a 1pF capacitance



***L-Shape Card***

Fitted gain :

0.071 fC/ADC ch. ~ 437 e-/ADC ch.

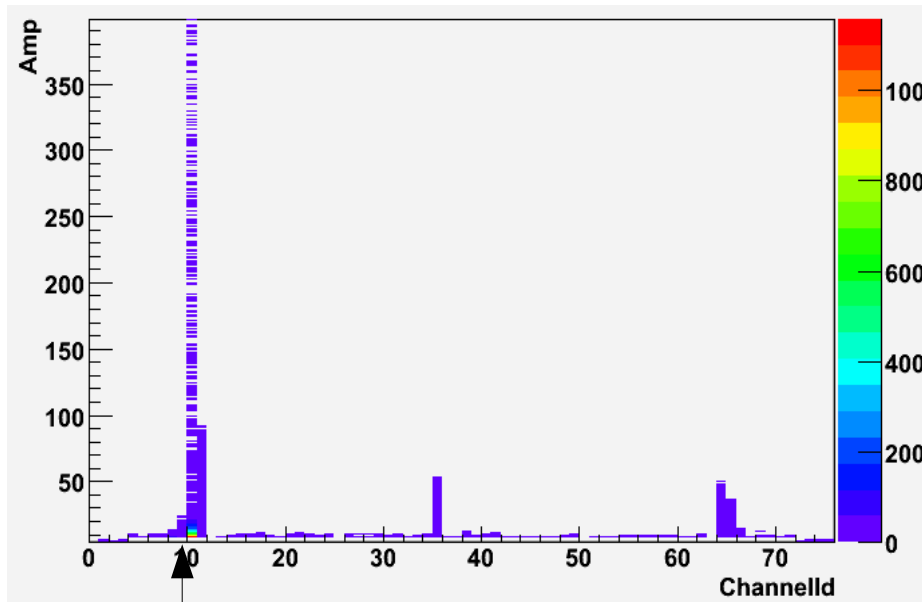
***Small card***

Fitted gain :

0.63 fC/ADC ch. ~ 393 e-/ADC ch.

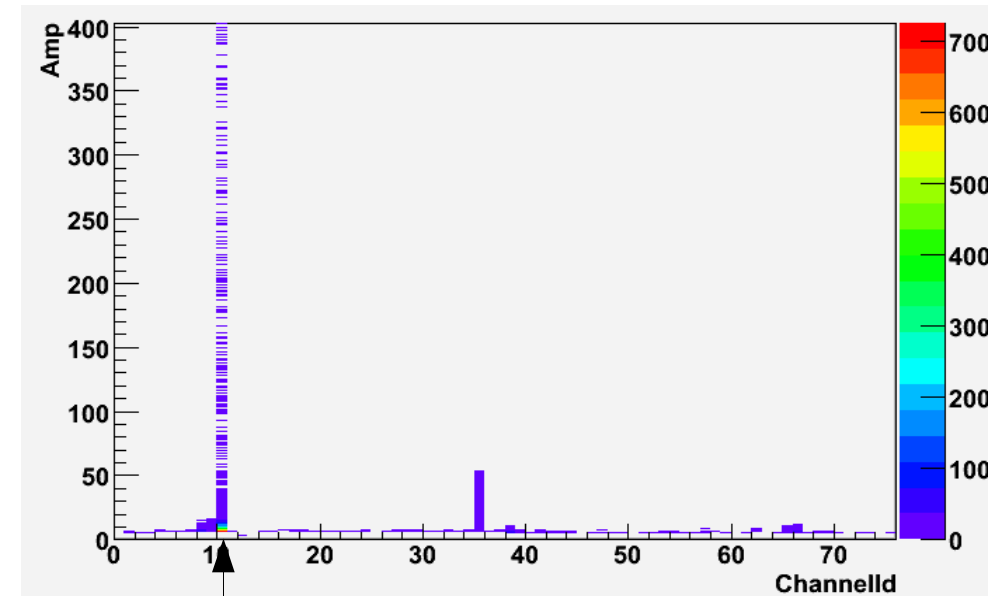
**=> Results compatible with the 0.055fC/ ADC ch. of the first tests**

## L-Shape Card



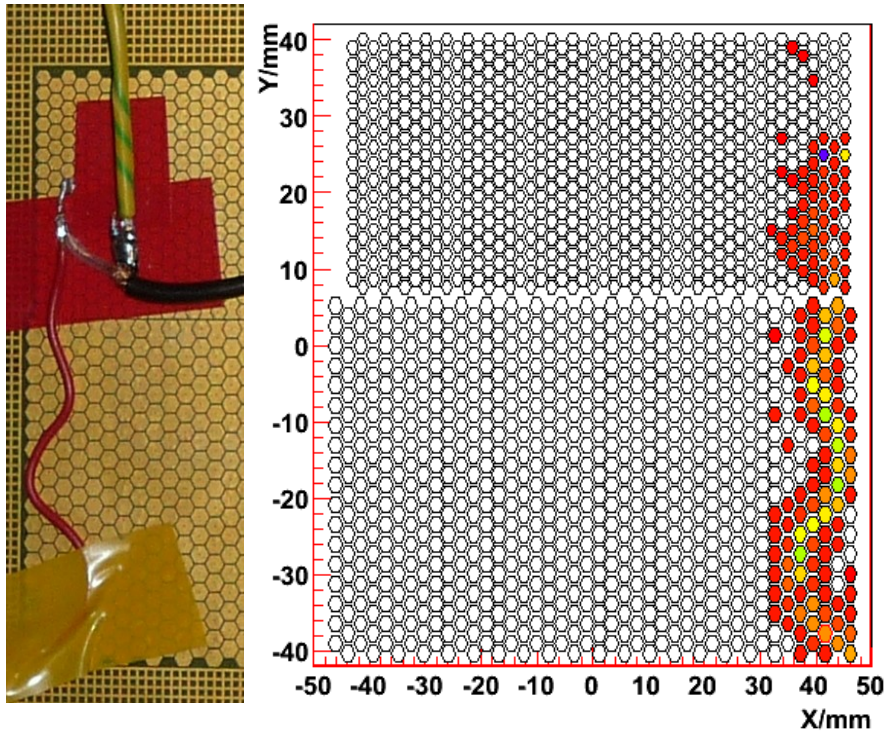
Ch.	Distance to pin	Amp. in ADC ch.	In % of the pulse
10	0	965	100
64,65	1	50, 37	5.2, 3.8
11, 9	2	90, 24	9.3, 2.5
8,66	3	14, 15	1.4, 1.5

## Small card

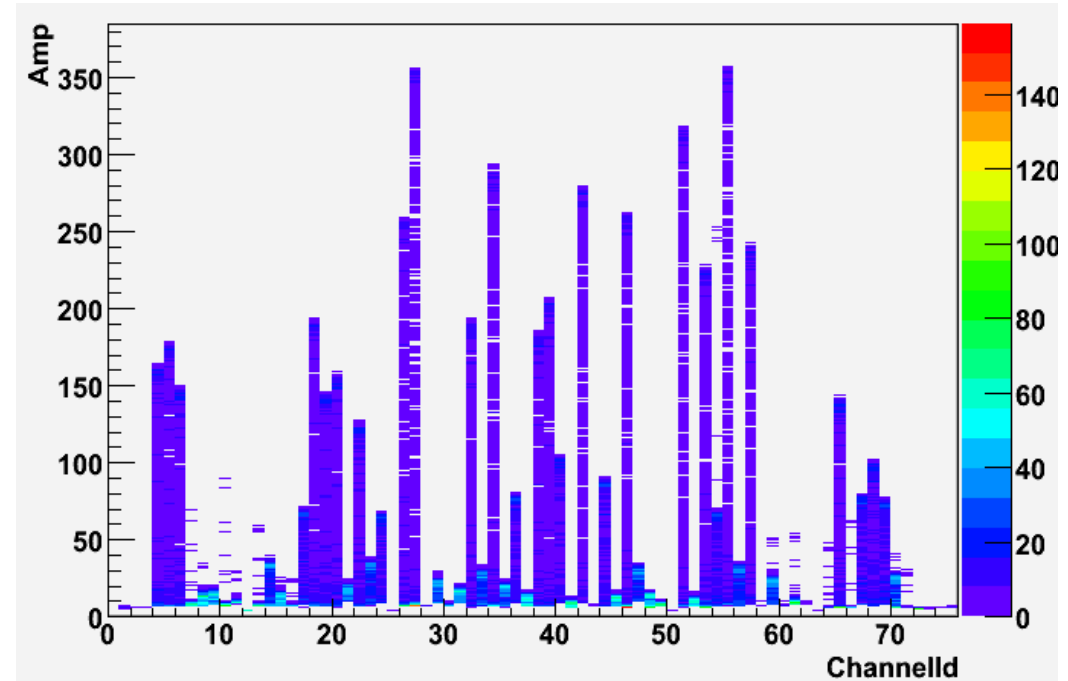


Ch.	Distance to pin	Amplitude in ADC ch.	In % of the pulse
10	0	1060	100
65,64	1	6,12	0.6, 1.3
11,9	2	6, 16	0.6, 1.5
8, 66	3	13, 13	1.2, 1.2

=> Up to 10% crosstalk on the L-Shape Card



Bringing signals overall channels.



Amplitudes on the T2K chip

- No signals on unconnected / FPN channels  
 => Crosstalk can only appear on the FE cards

- **Temperature dependence :**

=> No real influence on the noise both card. Without cooling the temperature of the cards stabilizes around 42°C

- **Power Consumption:**

=> Approx. 2.5 W per card so 8.2mW/ch. (from 5.7 to 8.3mW expected).

- **Shortcut between 2 pads detection for the test of padplane:**

=> Noise of the connected pads goes to 20 ADC/ch.

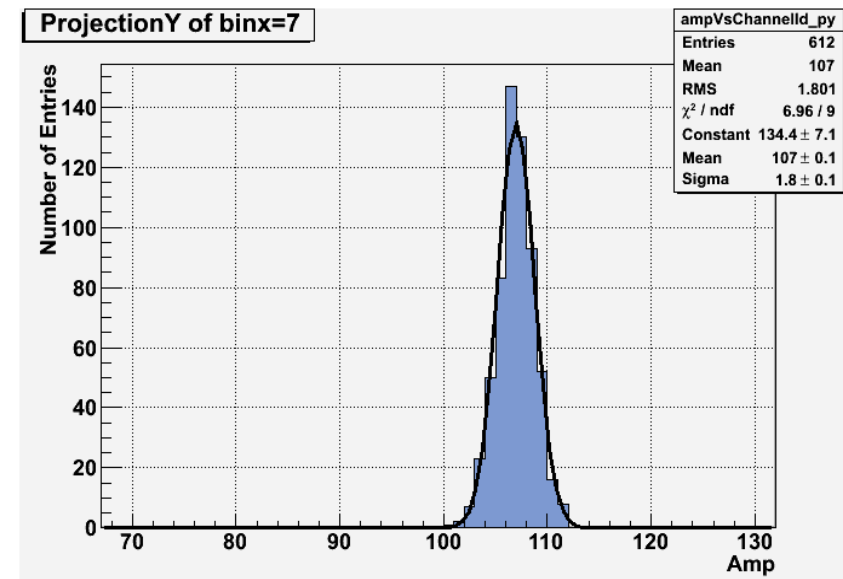
- **Occupancy:**

2 sigma cut => 0.5% (of 510 samples x 76 Channels)

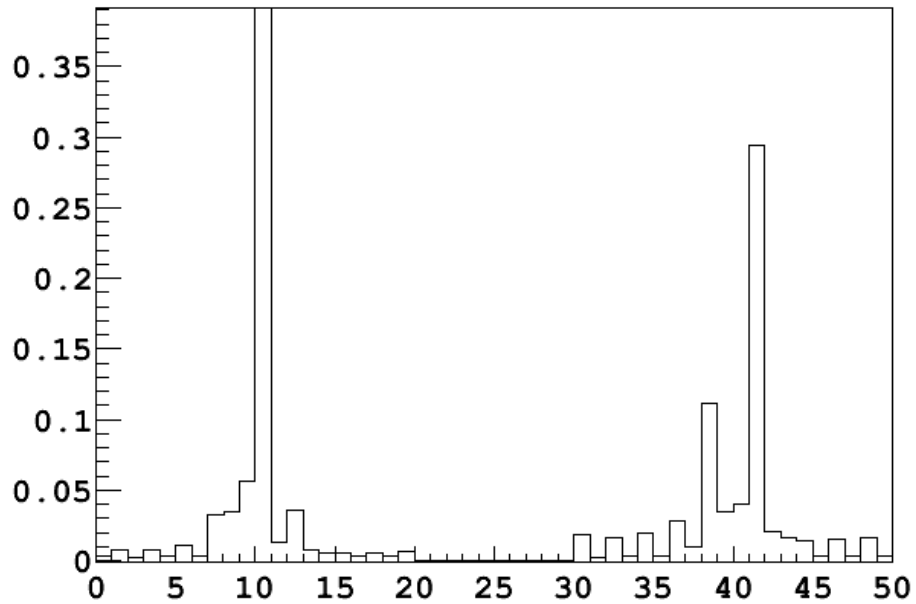
3 sigma cut => 0.04%

- **Noise Shape:**

=> RMS and Sigma of a fitted Gaussian approx. equals



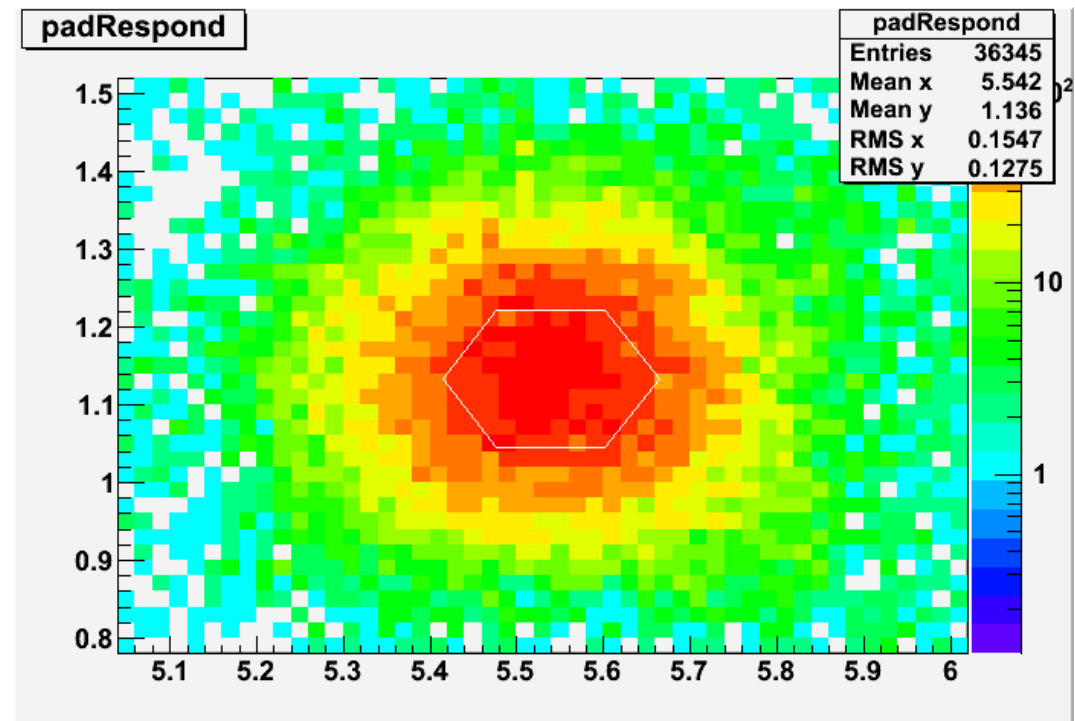




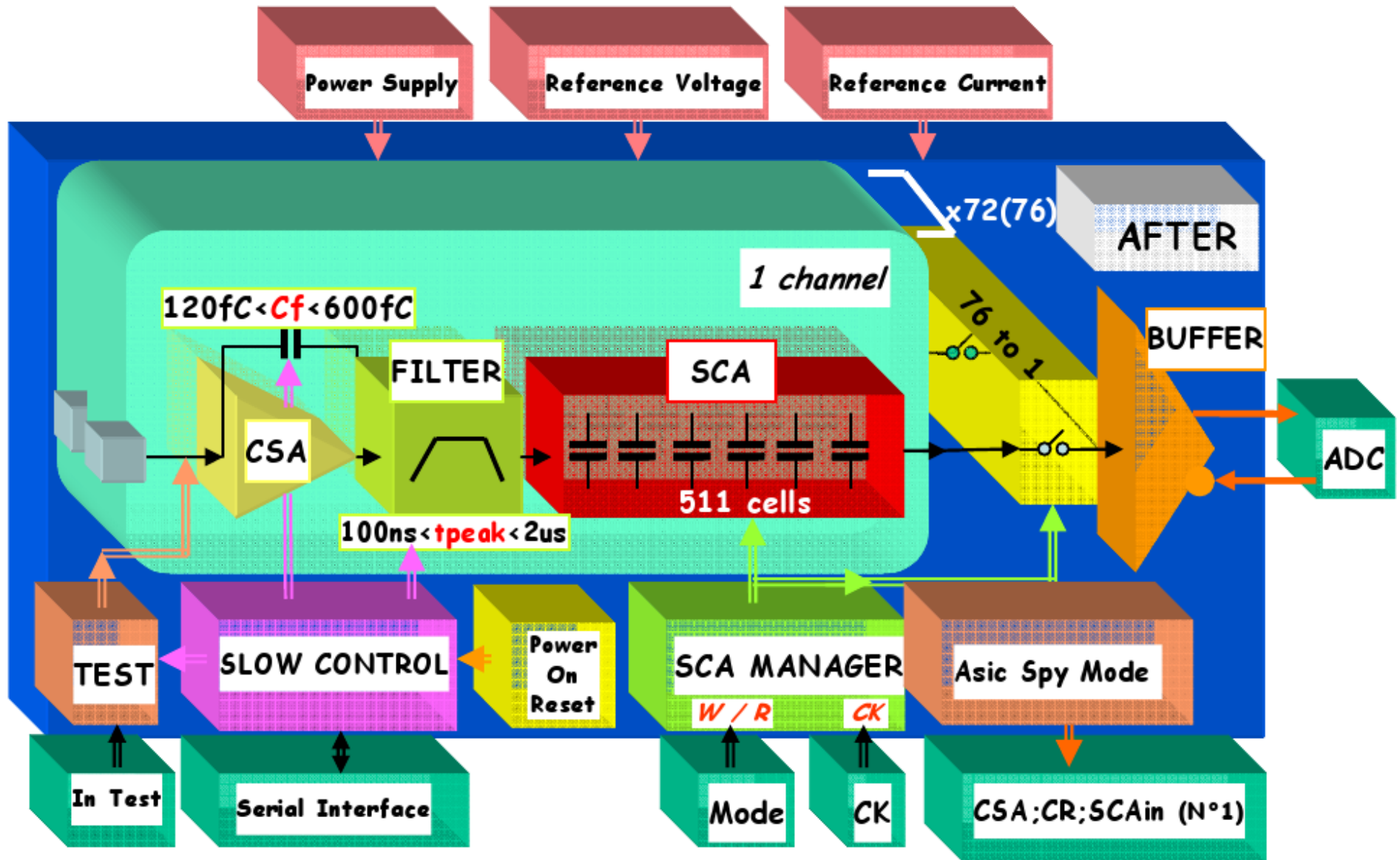
Maximal amplitude and neighboring channels/strip

=> 30% crosstalk ? Signals?

- Pad respond (2D residuals) with only the maximal amplitude per chip for each sample (no crosstalk).  
=> In the range of the expected hexagonal pad size (1.25mm radius)



- AFTER-T2K FEE characterized
- No major problem for the small card : green light for production
- L card has crosstalk:
  - Off-line correction with the new analysis framework?
  - Small cards on the test-chamber?
- Test bench at ELSA for this year:
  - Noise correction
  - Replacement of card 8



SCA : Switched Capacitor Array