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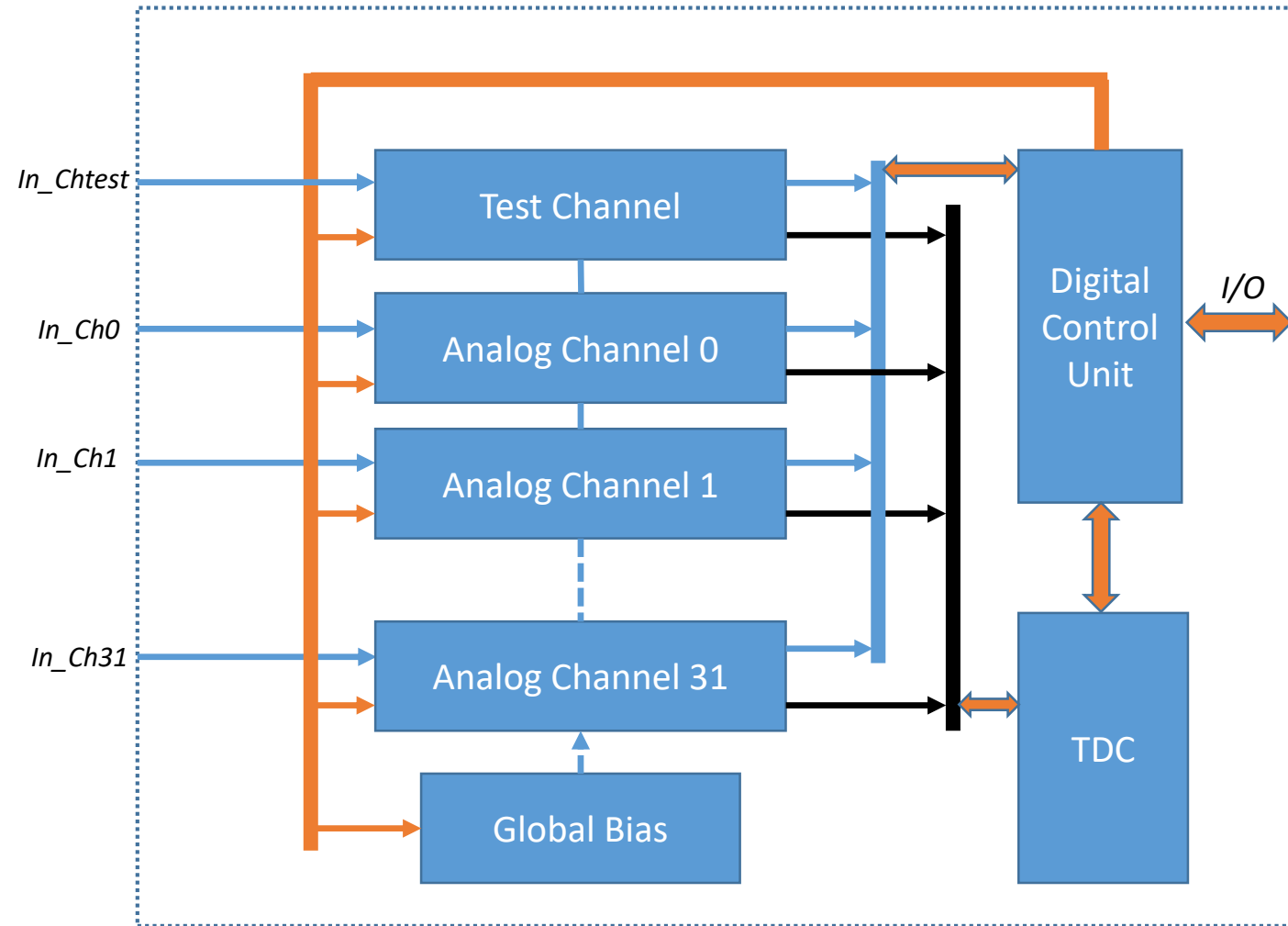
# **Micro-RWELL Frontend Electronic**

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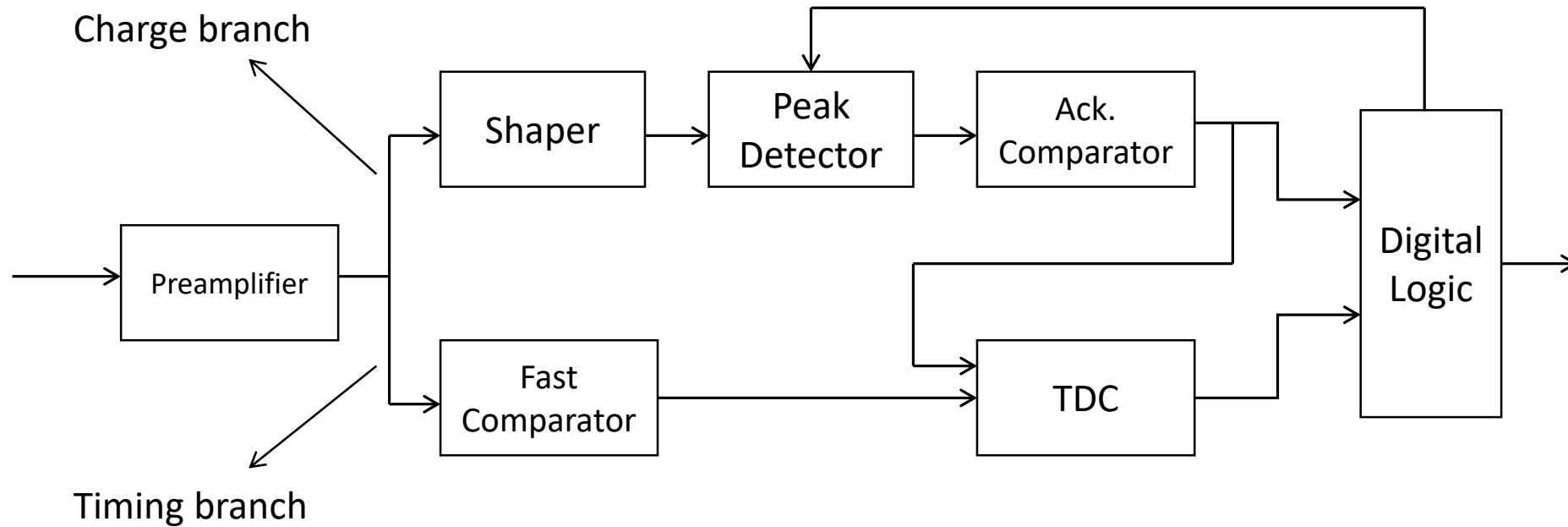
# FATIC2 architecture

## Features:

- Technology: TSMC 130 nm
- 32 channels
  - Programmable polarity, gain and peaking time
  - Charge and time measurement
  - Time measurement using 100 ps TDC
- Calibration, Bias and Monitoring
  - Charge injection calibration
  - Programmable biases (currents and voltages)
  - Monitoring ADC (12 bit SAR)
- 320 Mbps serial link, LpGBT compatible
- Power supply 1.2 V
- Radiation hardness: up to 100 Mrad



# Channel block diagram



## Preamplifier features:

- CSA operation mode
- Input signal polarity: positive & negative
- Recovery time: adjustable

## CSA mode:

- Programmable Gain: 10 mV/fC ÷ 50 mV/fC
- Peaking time: 25 ns, 50 ns, 75 ns, 100 ns

## Timing branch:

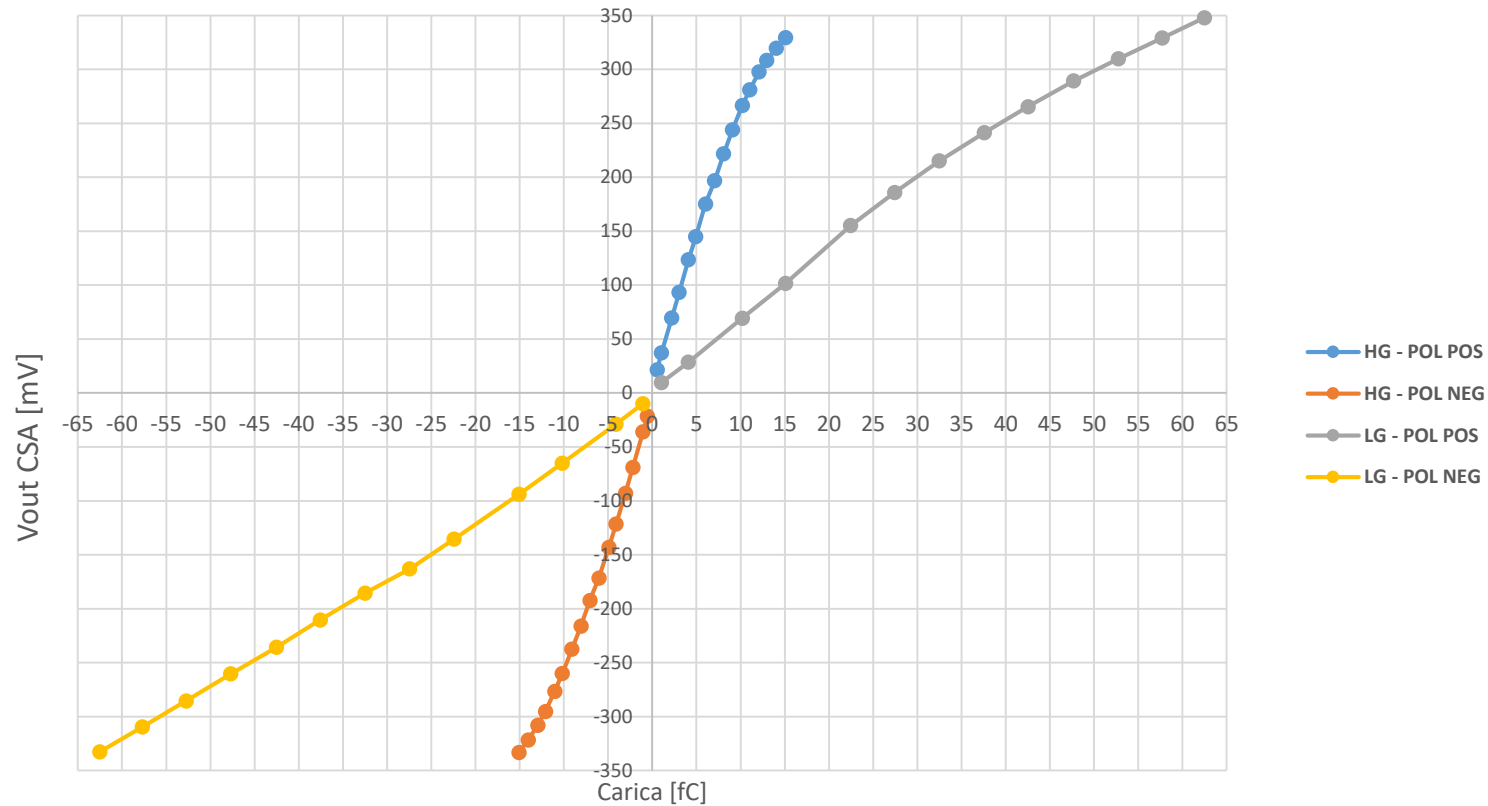
- ✓ Measures the arrival time of the input signal
- ✓ Time jitter: 400 ps @ 1 fC & 15 pF (Fast Timing MPGD)

## Charge branch:

- ✓ Acknowledgment of the input signal
- ✓ Charge measurement: dynamic range > 50 fC, programmable charge resolution

# CSA output dynamic measurement

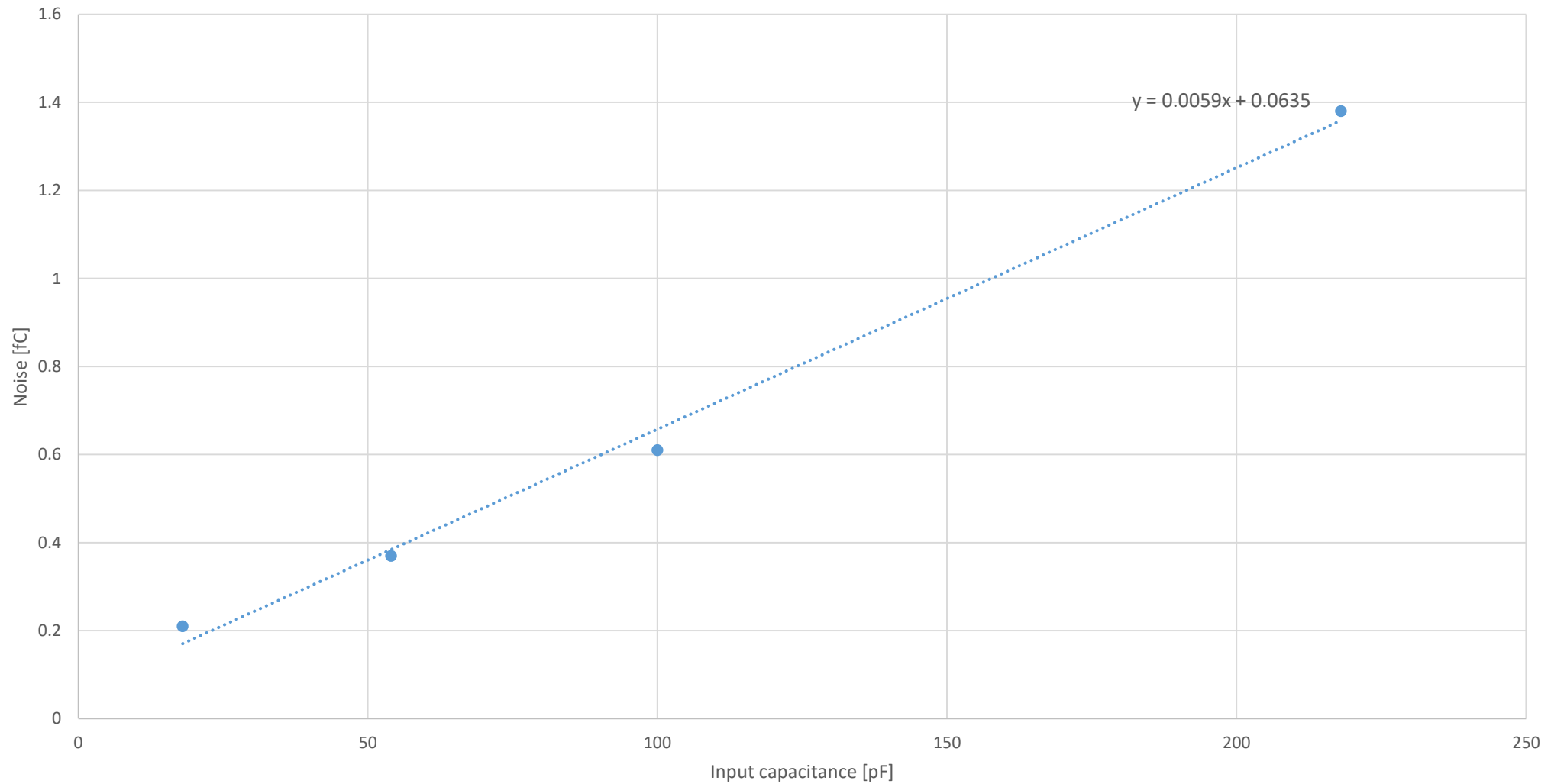
CSA output dynamic



## Measured gains:

- HG: 37 mV/fC
- LG: 9.66 mV/fC

# CSA noise vs input cap

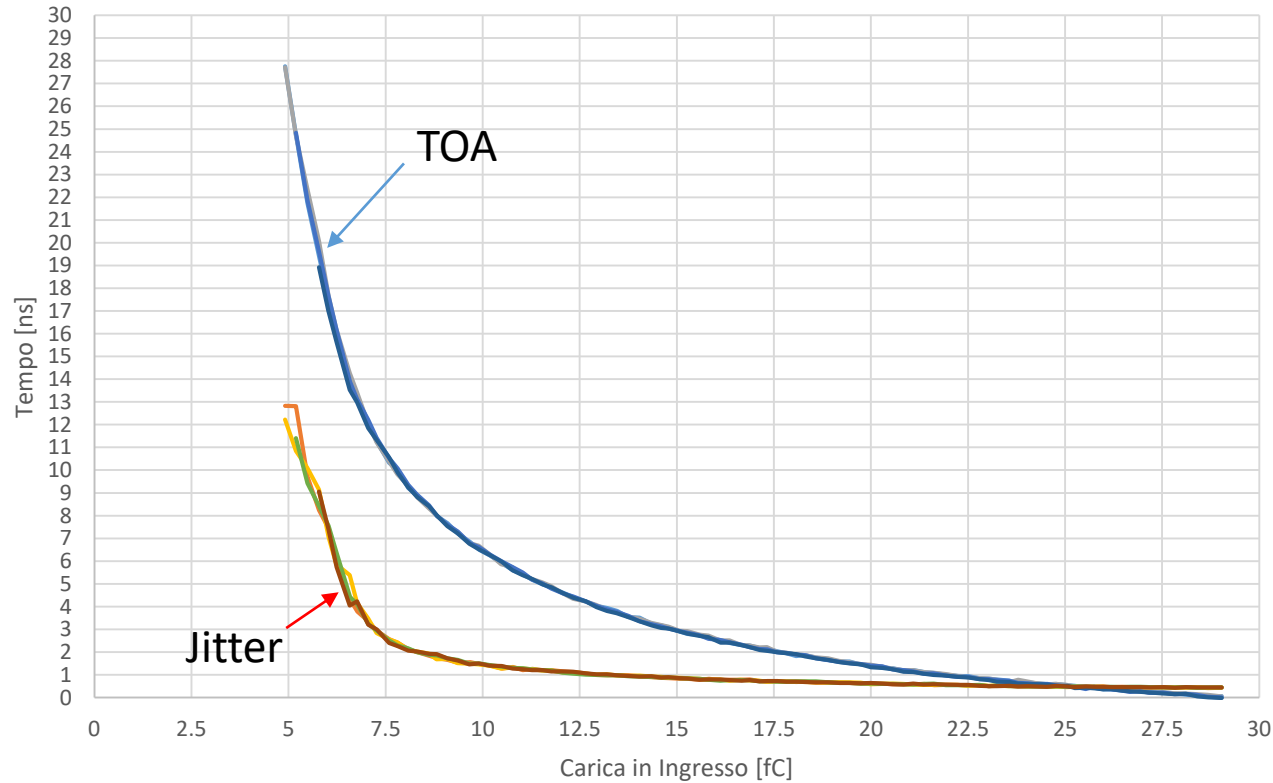


Measurement conditions: fast-branch, LG, positive polarity

G. De Robertis - INFN Bari

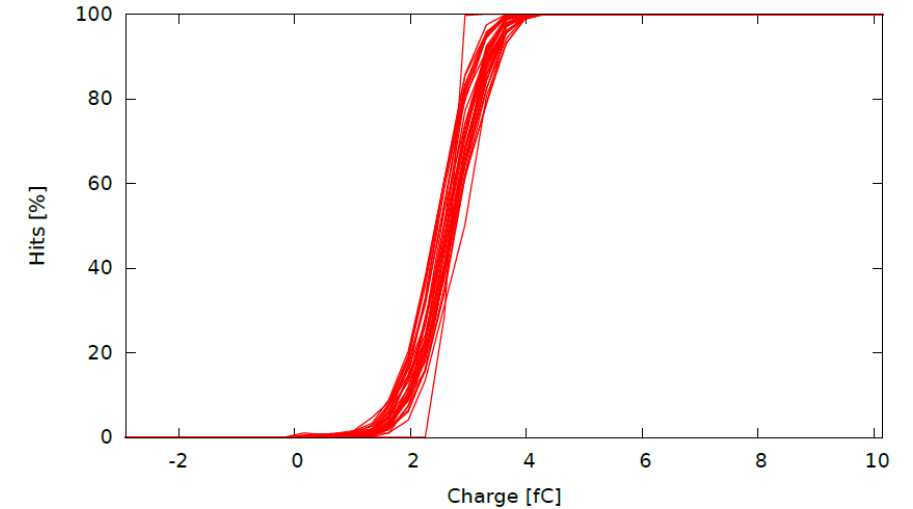
# Fast-branch: timing measurements

FATIC2: toa e jitter vs peaking time

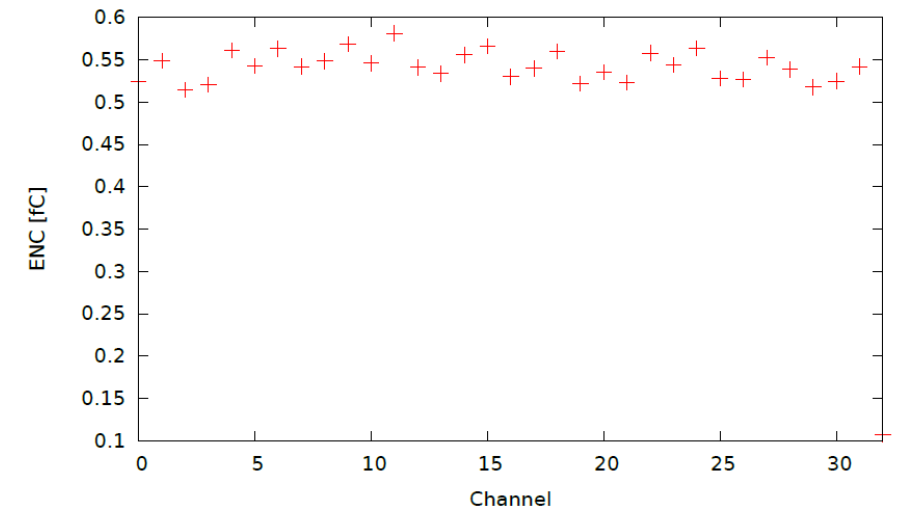


Measurement conditions: fast-branch, LG,  
positive polarity, 100 pF input capacitance,  
threshold 4.5 fC

S-Curves

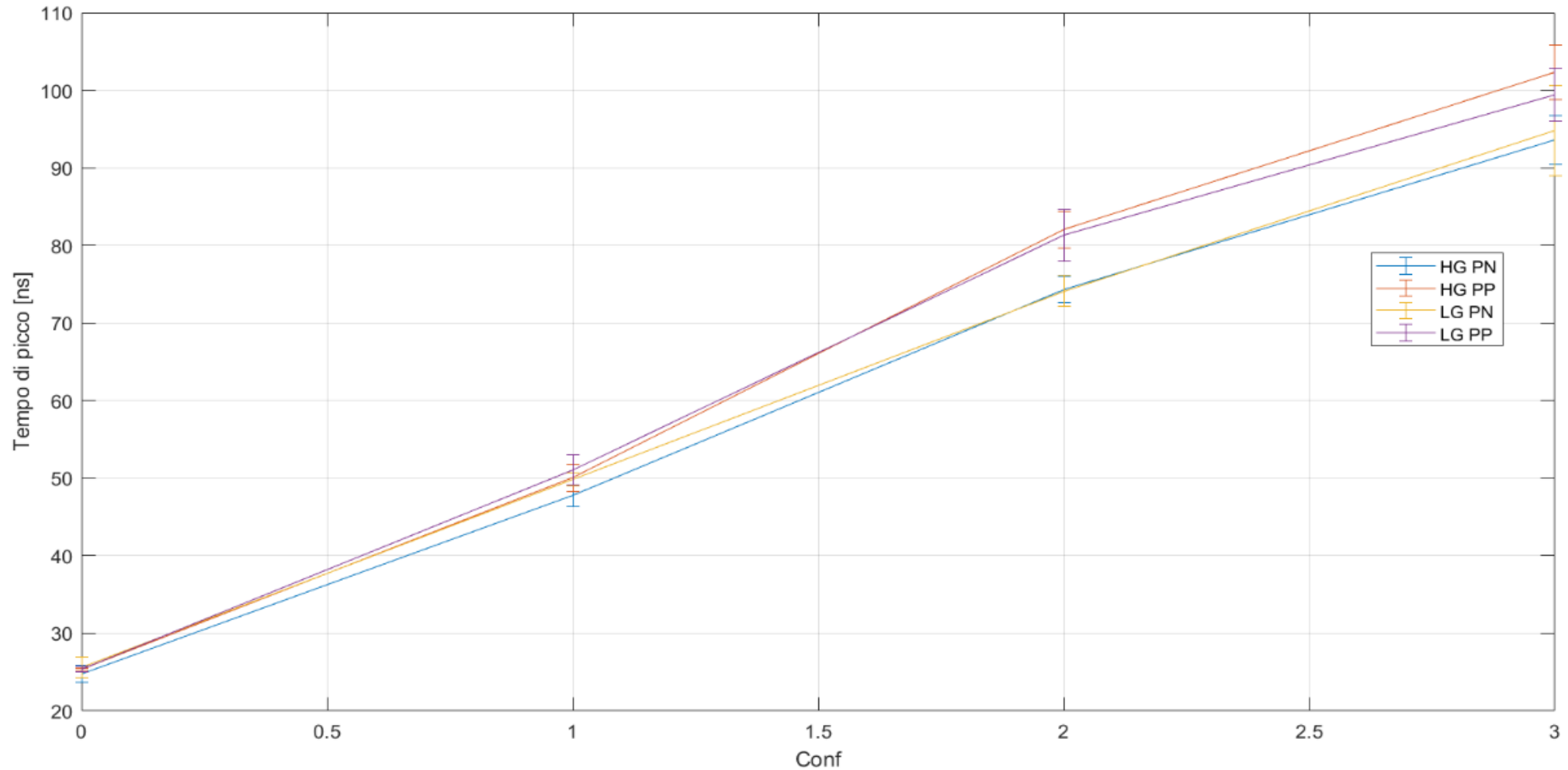


Noise

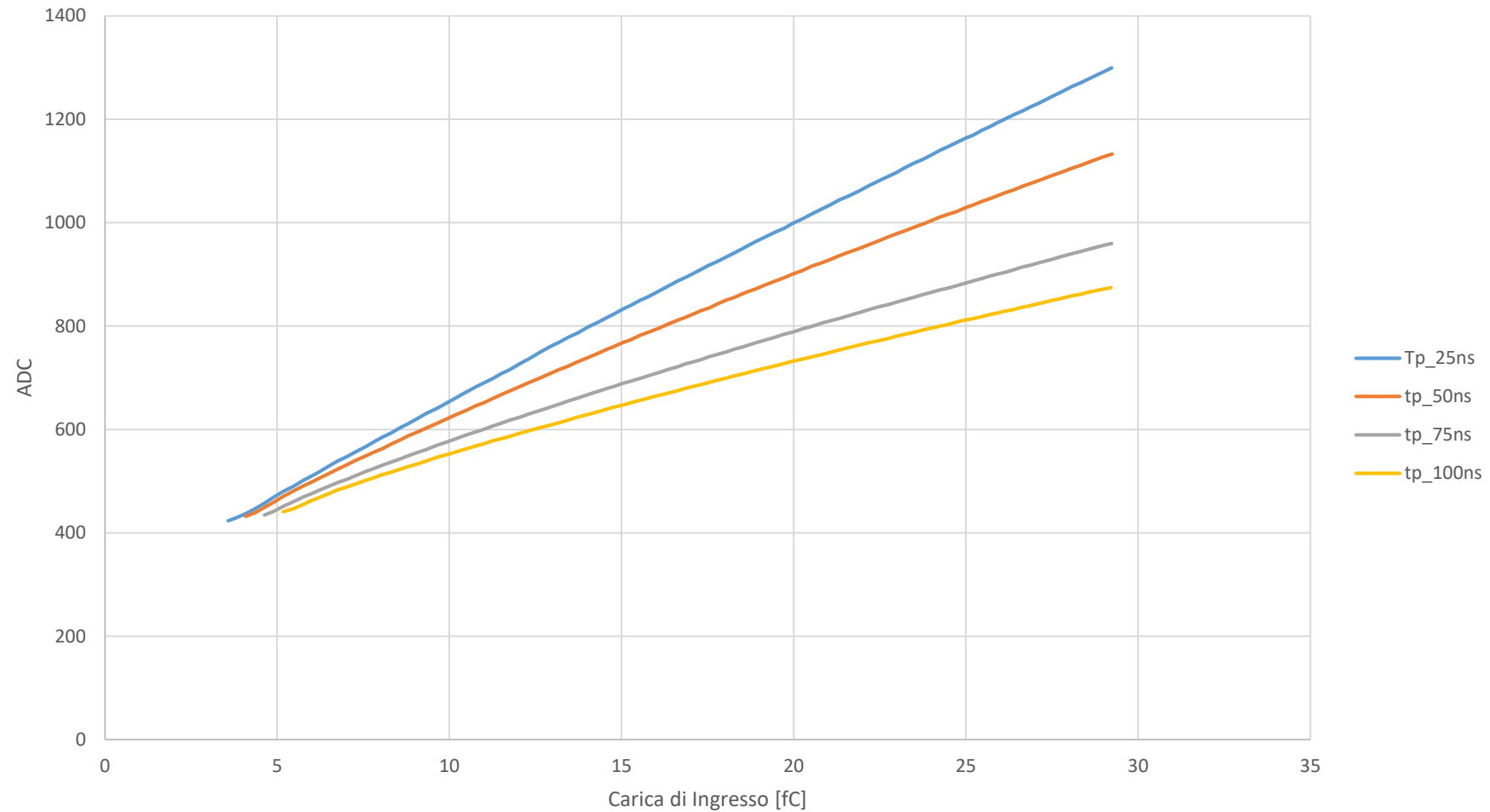


Threshold can be reduced

# Charge branch: peaking time measurement

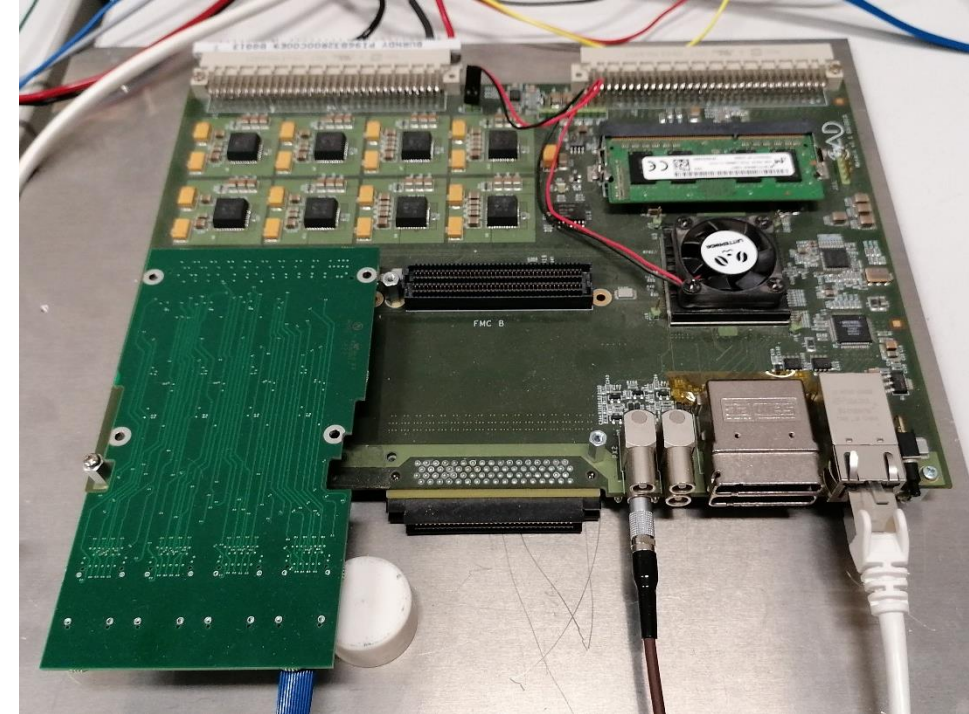
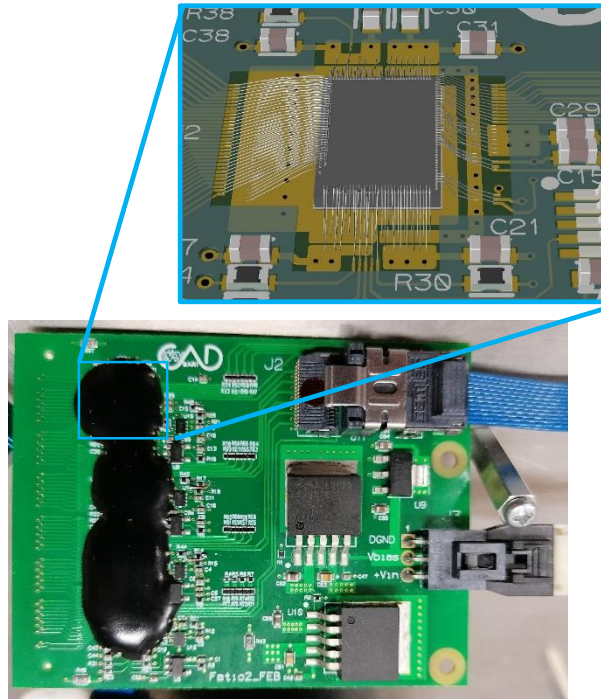
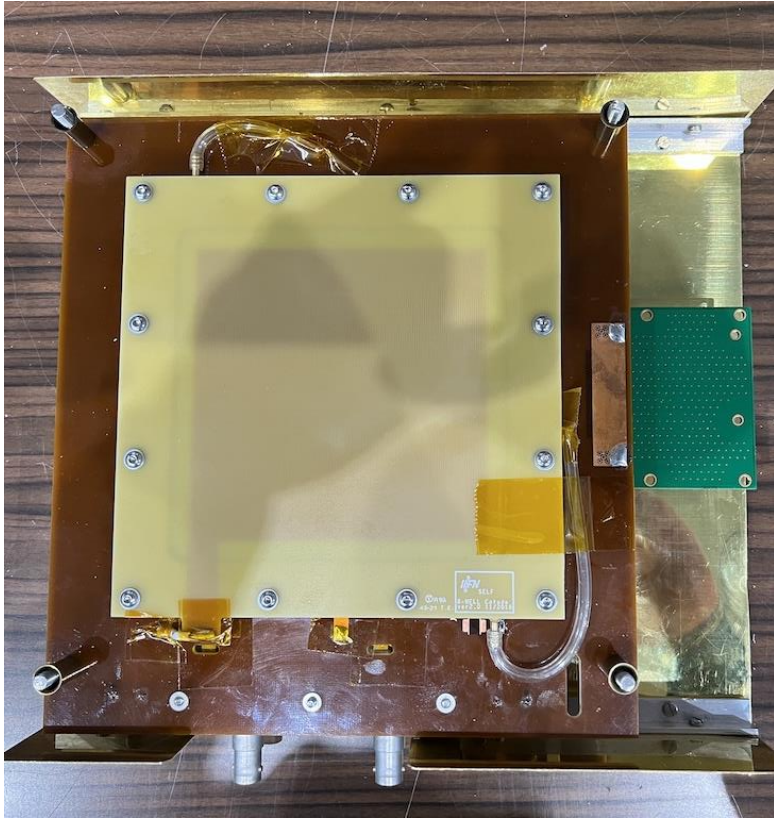


# Charge branch: charge measurement





# Test setup



Test system ready to perform noise measurement and data acquisition from up to 4 Front-End boards (4 x 128 channels)  
Trigger system will be implemented in firmware

# To do

- Test @ INFN-Bari:
  - 10 x 10 cm<sup>2</sup> u-rwell is arriving @ INFN BARI,
  - FATIC2\_FEB to read-out the chamber,
  - Test target:
    - Noise measurements: understand the pad capacitance effect on the current front-end
- Test @ INFN-Frascati:
  - 10 x 10 cm<sup>2</sup> u-rwell + FATIC2\_FEB, FATIC2 test board
  - Measurement with cosmic muons
  - Test target:
    - Timing measurements (with FATIC2\_FEB)
    - Charge measurements (with FATIC2\_FEB): statistic on the u-rwell charge
    - u-rwell output waveform acquisition (with FATIC2 test board): understand the signal shape, time duration

## Purpose of tests:

- Collect data about the u-rwell: capacitance, signal shape (charge and time duration)

From preliminary discussions, **the FATIC2 front-end is not suitable for LHCb application**: architecture not suitable for the expected rate.

Combining the test results and the LHCb specifications we should study:

- **Feasibility of the design**
- Choose the most appropriate front-end architecture