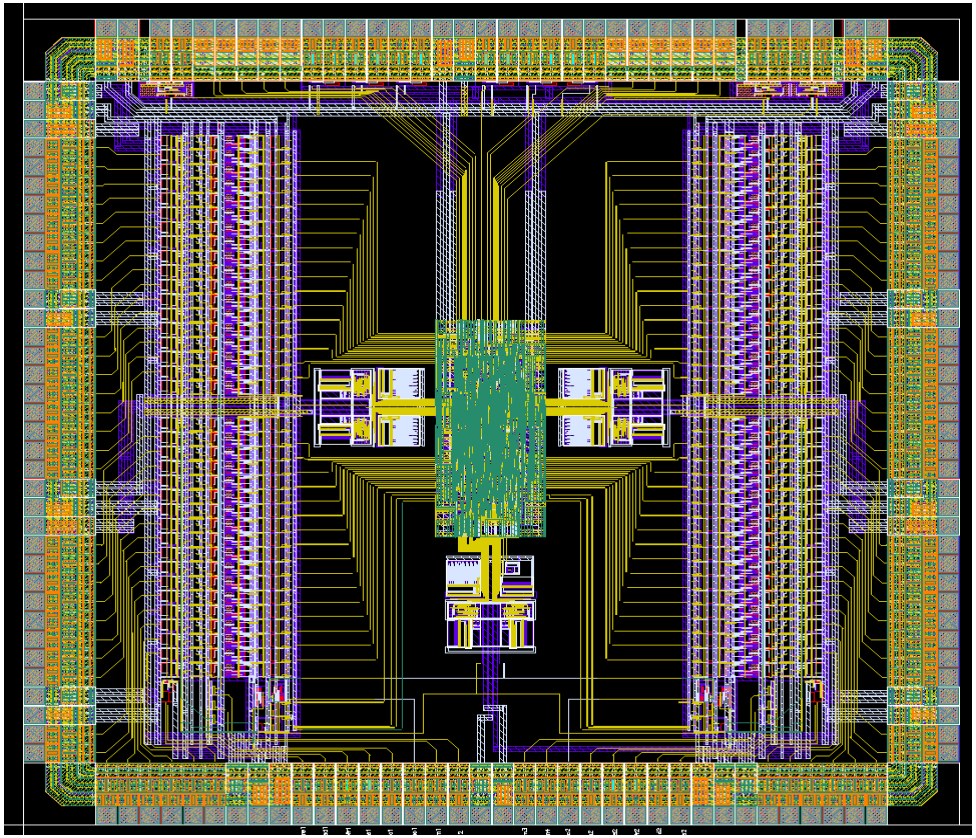
GASTONE64

The KLOE IT Front-End Electronics

F. Loddo
INFN Bari

On behalf of KLOE2 IT Sub-group

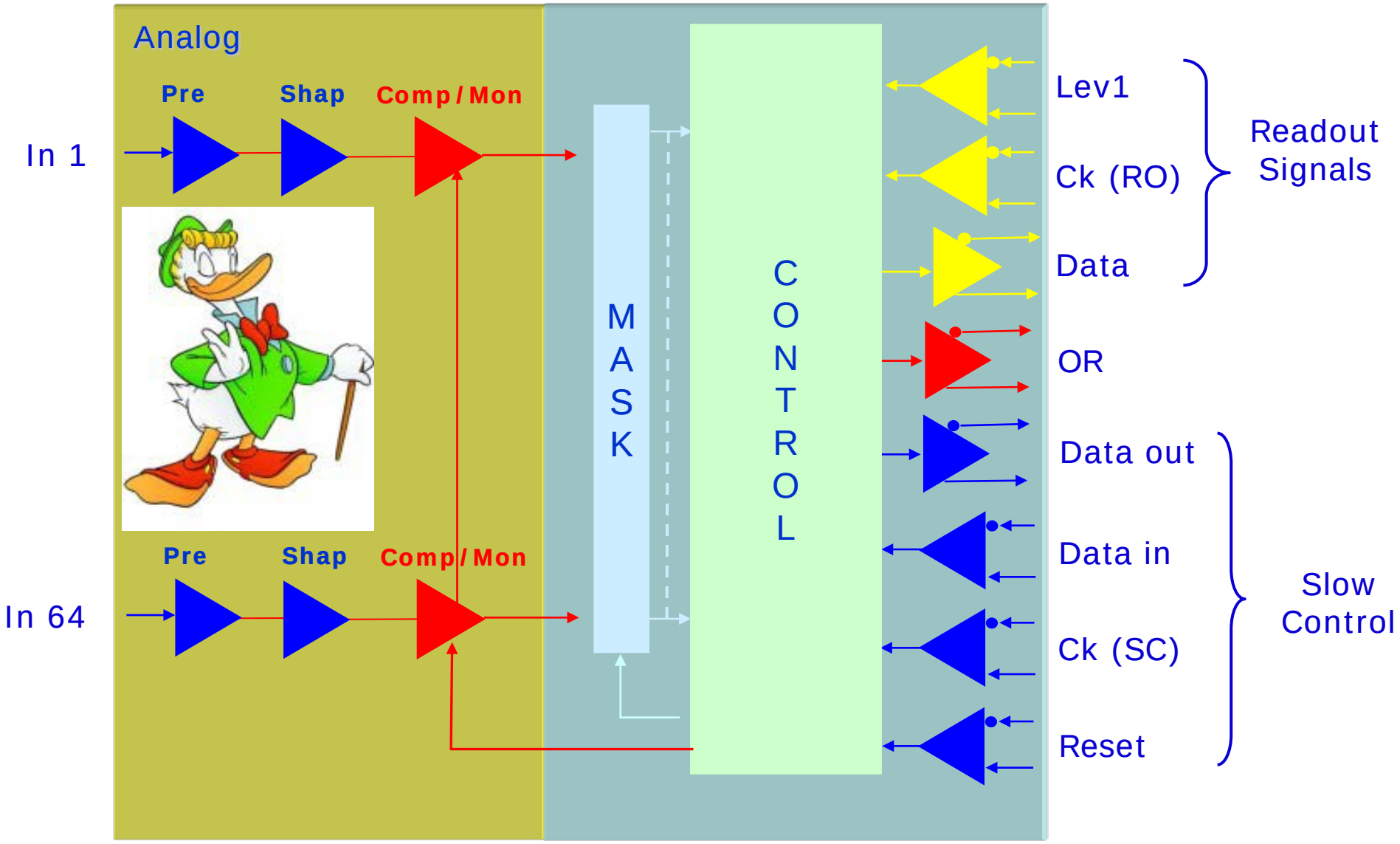
GASTONE64 layout



- Technology: CMOS 0.35 µm
- #Channels: 64
- Die area: ~ 4.5 x 4.5 mm^2
- Power: ~ 6 mW/channel
- Package: plastic QFP144
  - 20x20 mm^2
  - pitch: 0.5 mm
  - thickness: 1.4 mm

GASTONE (Gem Amplifier Shaper Tracking ON Events)

Block diagram



Analog Section

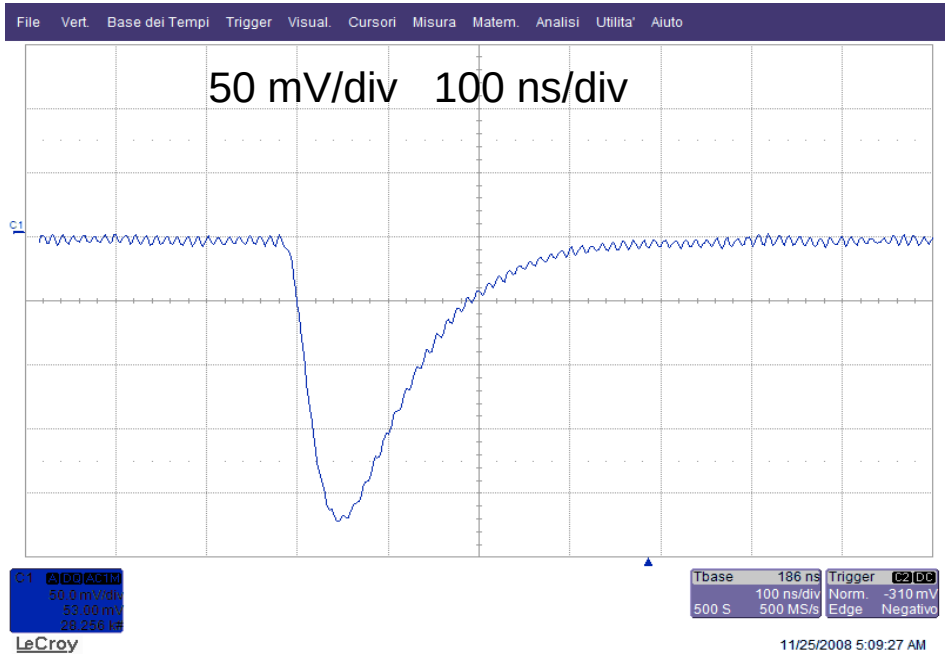
1. a charge preamplifier to integrate the input strip current into a voltage
2. a shaper circuit providing noise filtering and semi-gaussian shaping
3. A leading-edge discriminator

Preamp gain	4 mV/fC @ C_{det} = 100 pF
Input impedance	120 Ω
Preamp supply current	~ 280 μA
Shaper gain	4
Shaper supply current	~ 150 μA
Peaking time	90 ns
ENC	800 e^- + 40 e^-/pF
Overall charge sensitivity	16 mV/fC @ C_{det} = 100 pF
Crosstalk	< 3%

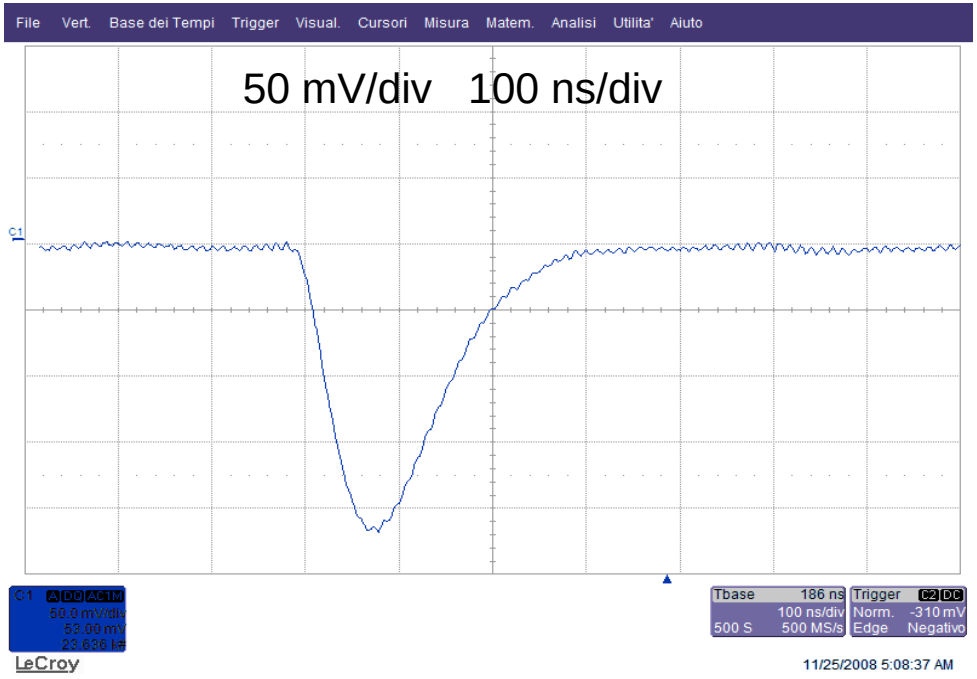
DISCRIMINATOR MAIN SPECS	
Threshold	0 - 30 fC
Offset (rms)	~ 2.2 mV
Supply current	~ 180 μA

Analog Section

Shaper output (Q_{in} = 10 fC)



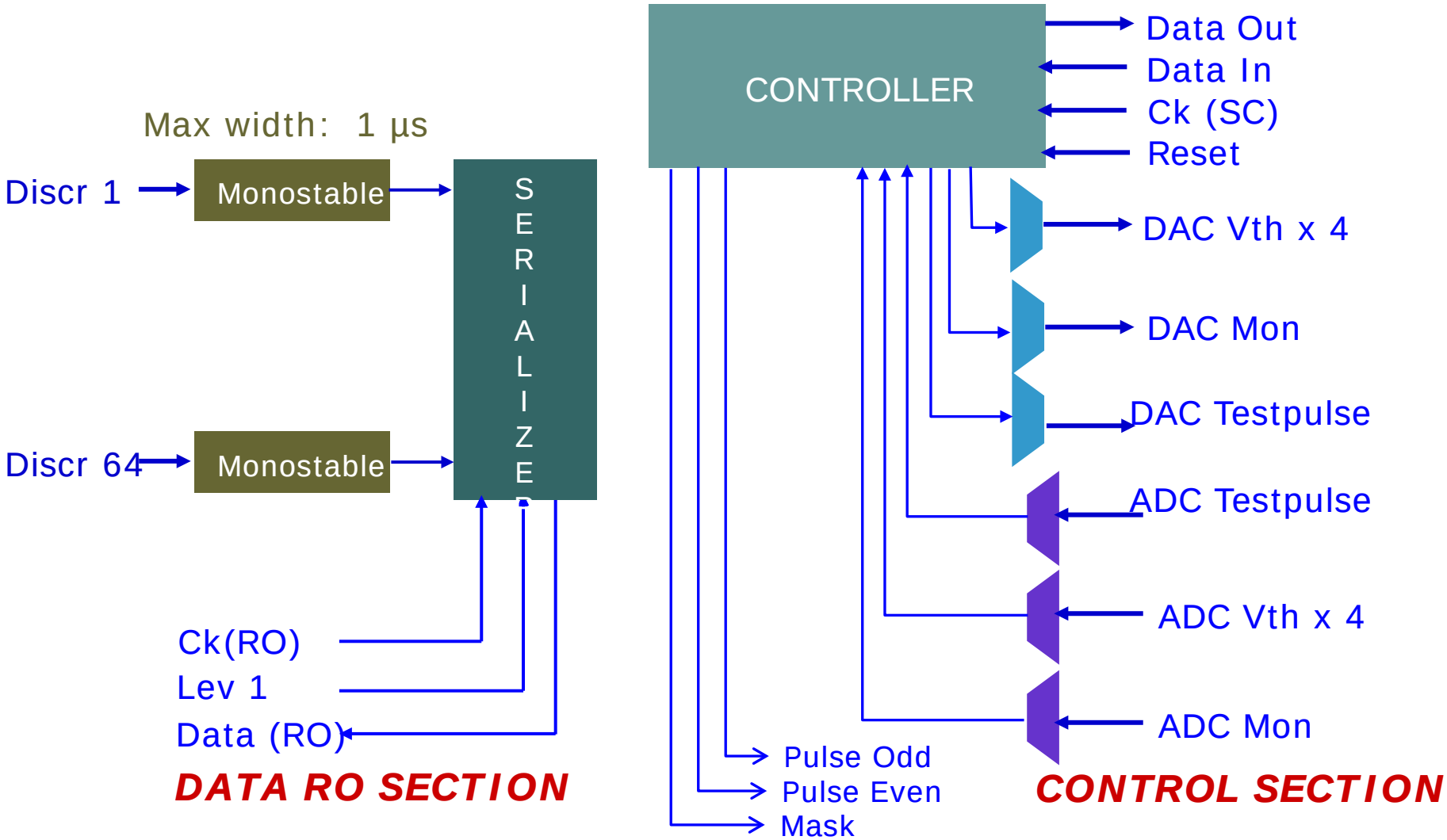
C_{in} = 10 pF



C_{in} = 50 pF

Digital Section

The digital section contains a slow-control logic and a data readout logic



Digital Section (Readout)

- Upon the arrival of the trigger signal, the signals coming from the analog section are stored into a 96-bit register
- Each event word contains:
  - 10 bits header
  - 5 bits identifying the trigger number
  - 9 bits for ID chip
  - 64 bits for data
  - 8 bits at '0' ending the data-frame

- The readout clock (50 MHz) is active only during the readout
- Using both clock edges → Serial readout 100 Mbit/s on LVDS

- The chip also produces a global OR signal to be used for self-triggering applications

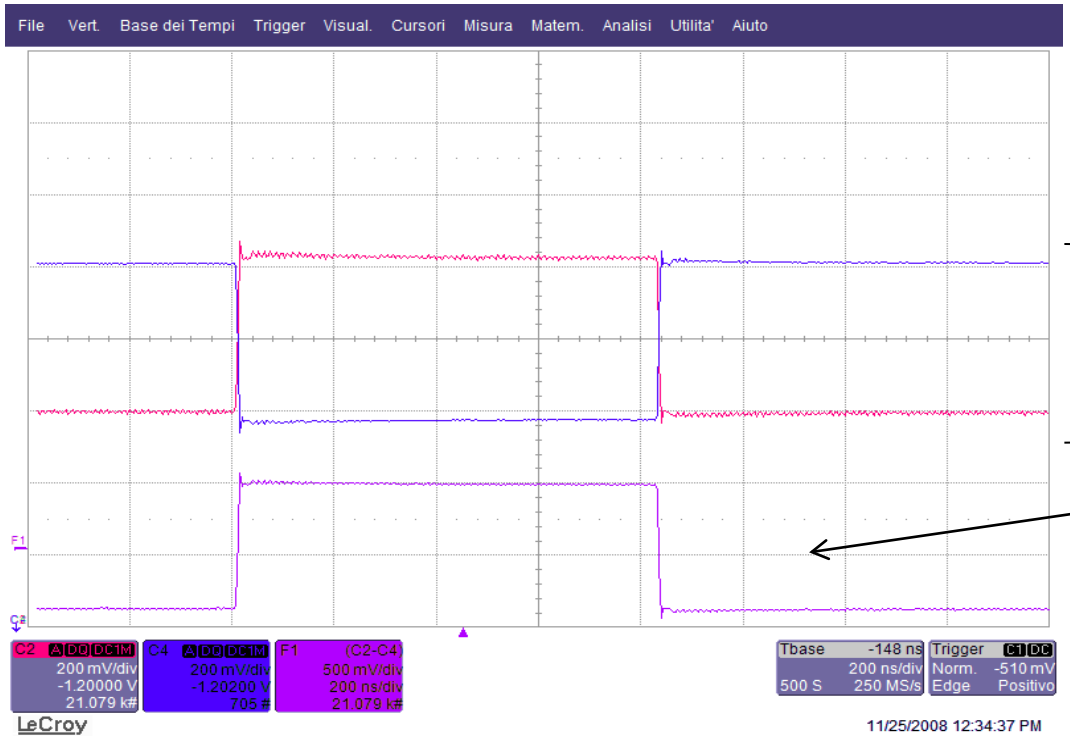
Digital Section (Slow-control)

- 28 8-bit registers for configuring the chip functionalities

  - ❑ 4 10-bit DACs (1 DAC/16 channels)
  - ❑ 1 8-bit DAC for Pulse Width setting
  - ❑ 1 10-bit DAC for Test Pulse setting
  - ❑ 6 8-bit ADCs for monitoring

- Controlled by a SPI interface port running at 1 MHz.

LVDS driver



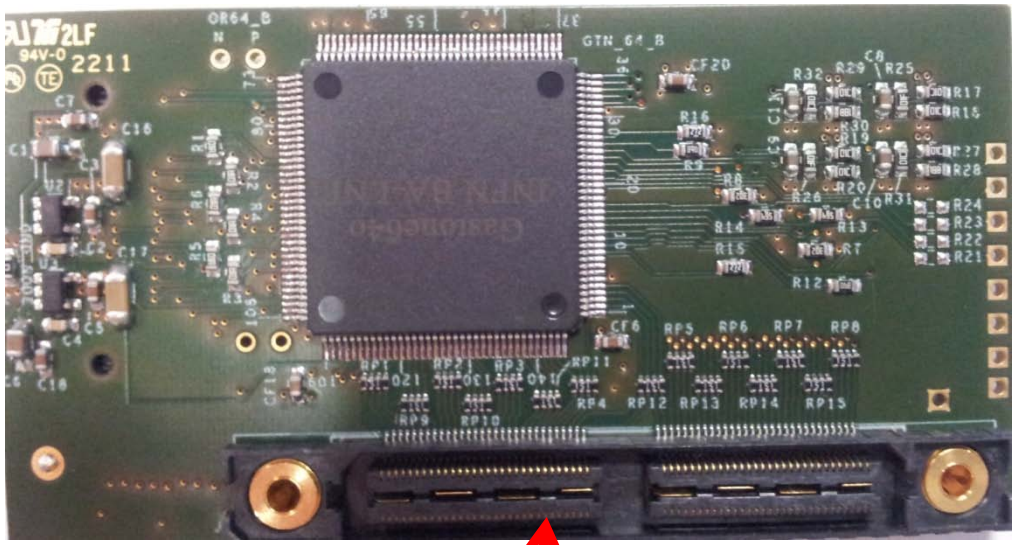
LVDS signals

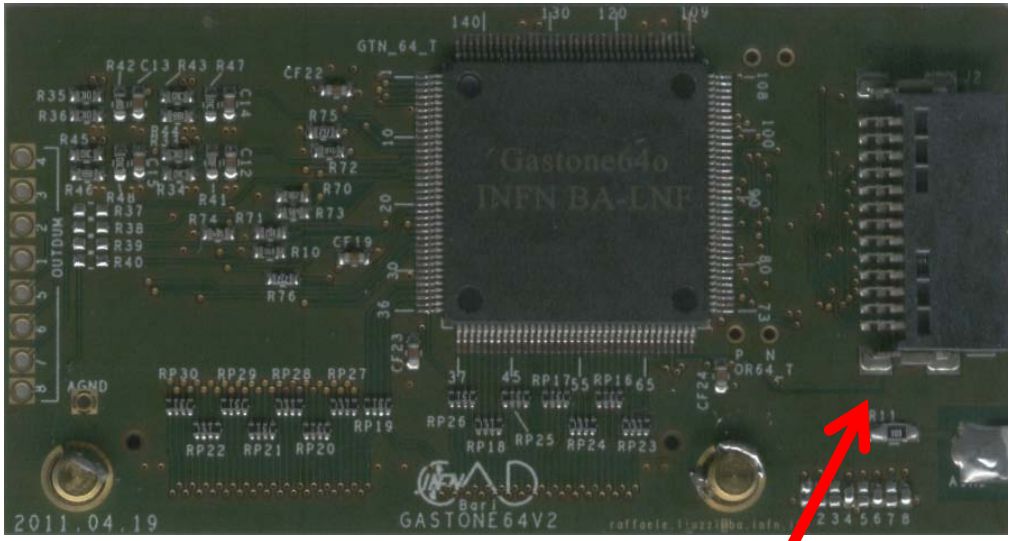
Differential signal

- Common mode: 1.2 V
- Voltage swing: 400 mV
- Differential signal voltage swing: 800 mV
- Capable to drive long lines (20 m)
- Power consumption: 12 mW

Front-end board (120 channels)

Dimensions: 75x40 mm²





Input connector (GEM)

- 120 strips
- GND

I/O connector

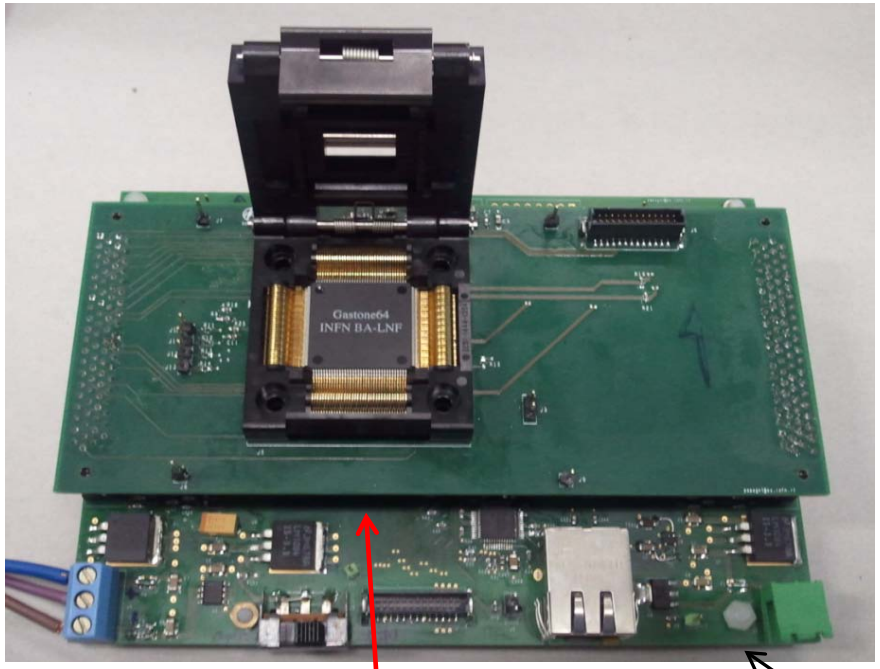
- Power supplies
- SPI slow control bus
- Readout bus

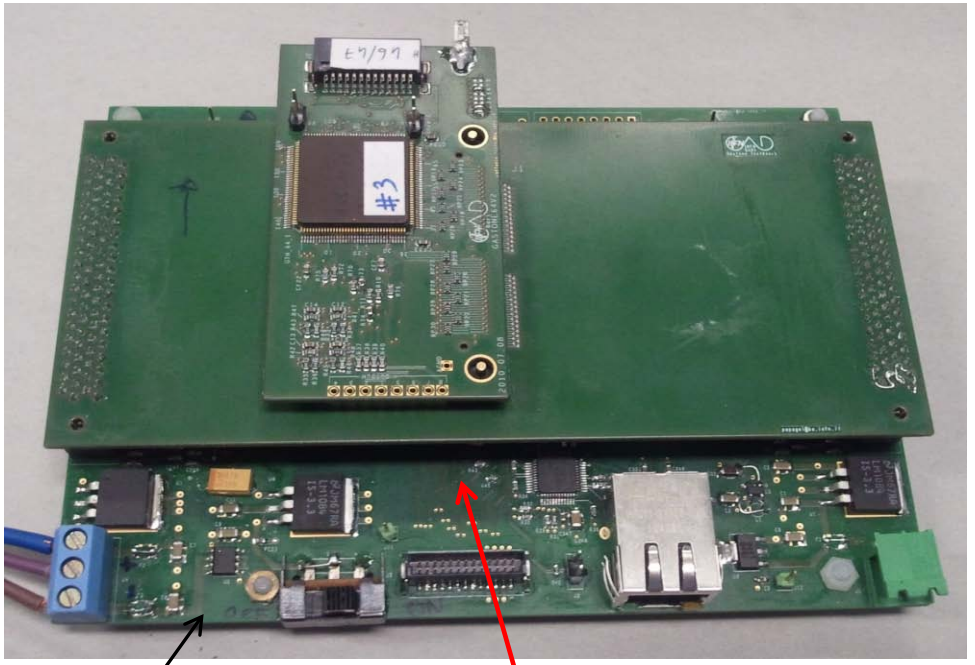
GASTONE64 quality control

Test bench:

Single mother board Ethernet controlled

- **Piggy-back board housing socket for chip testing (64 channels)**
- **Piggy-back board for FEB testing (120 channels)**



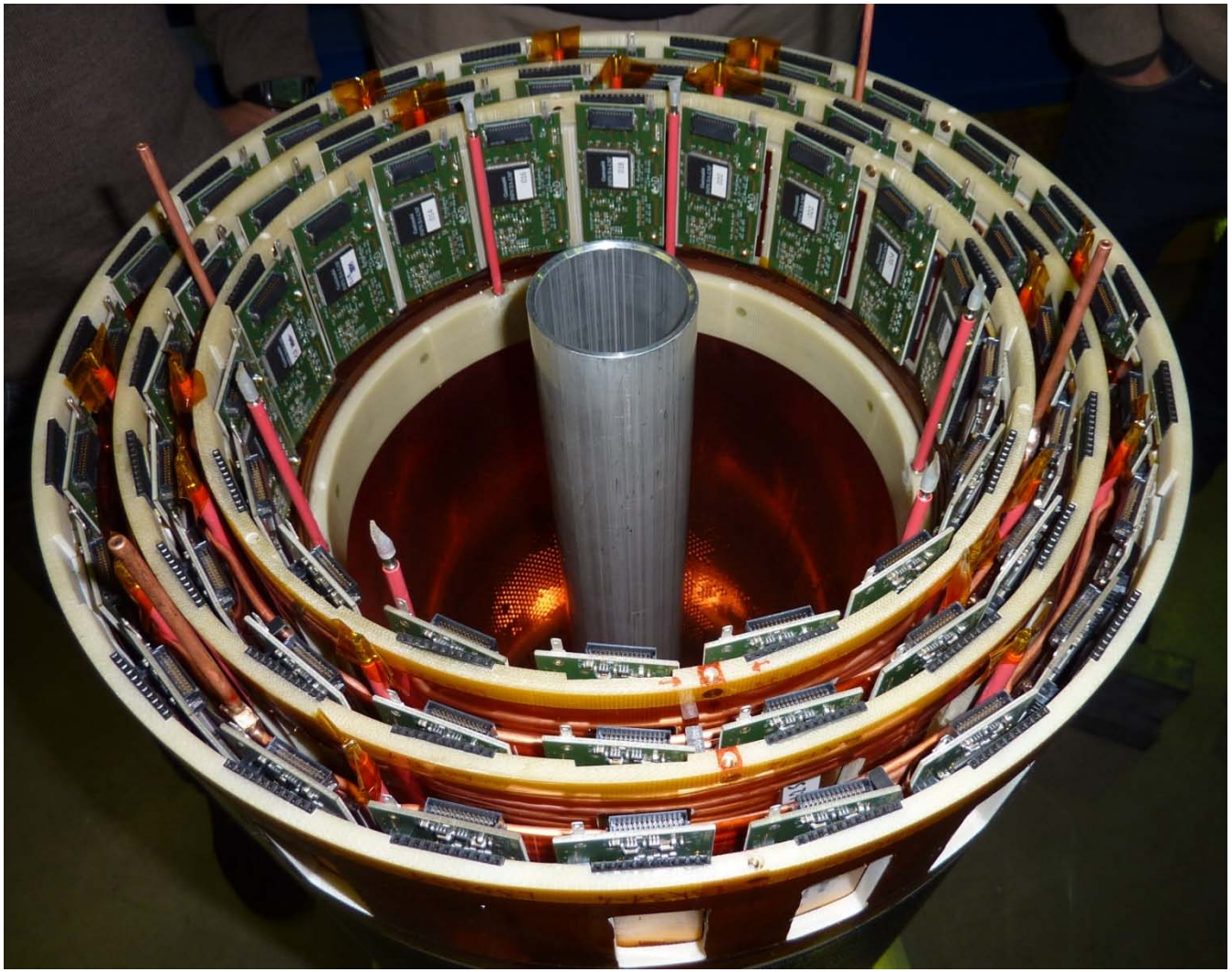


Piggy-socket board

Mother board

Piggy-FEB board

Front-end board installation



Conclusions

- Gastone64 fulfils all the design specifications
- The chips as well the front-end boards have been fully produced and installed in KLOE2 IT
- We are ready to install KLOE2 IT in KLOE apparatus