Sezione di Roma Tor Vergata

Davide Badoni *brief description*

Posizione CTER

Formazione Laurea Magistrale in Fisica
molti corsi specifici di formazione (Simulazione Spice/Spectre, analog design DKs specific, SpectreHDL …)

Analog Designer – uso estensivo della suite Cadence IC – Full custom IC

Progettazione sistemi analogici discreti e mixed-signal

Studio modelli sensori per sviluppo in ambiente di simulazione Spectre (SiPM)

Referente EUROPRACTICE per la sezione dal 1996

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EUROPRACTICE in Sezione

CADENCE COMBINED IC & SYSTEM PACKAGE
LUCEDA (IPKISS)
MENTOR (FPGA AND BOARD DESIGN)
INTEL (FPGA)
XILINX (VIVADO)

Gestione file di license (server lic. floating) e supporto installazioni locali

Centralizzazione chiamate supporto Europractice

Supporto progetto full custom fonderie AMS, IHP

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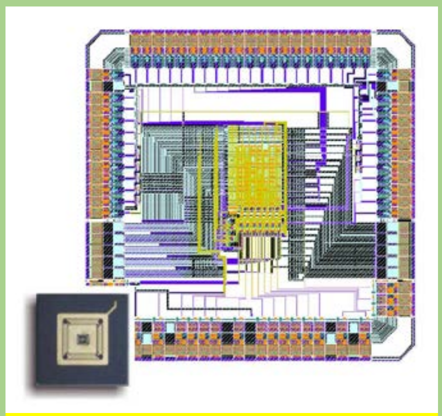
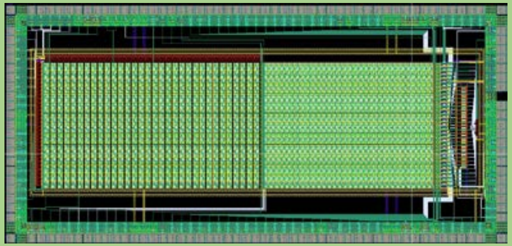
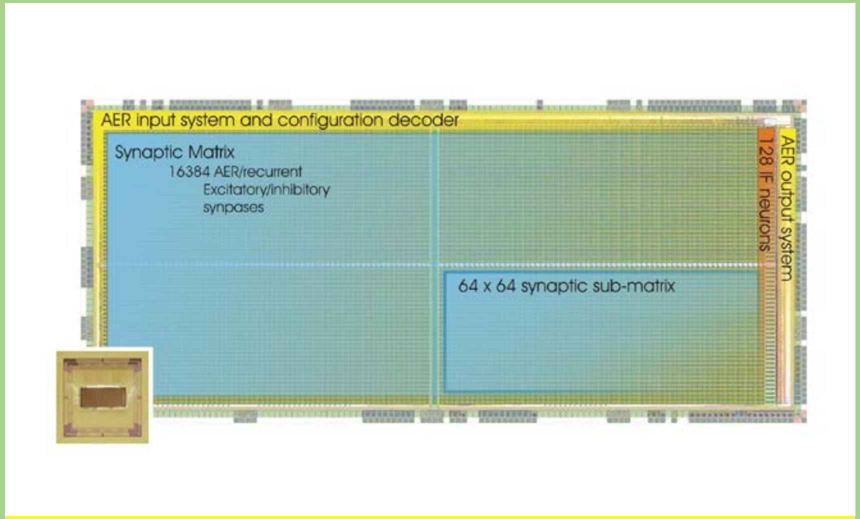
VLSI full custom: Reti Neuronali VLSI – Tecnologia AMS 0.35um



- **Technology:**
  AMS CMOS 0.6 µm CUP
  3 metallic layers
  2 poly-silicon layers
- **Size:** **3 x 3 mm^2**
- **Package:** **84 PGA**





- **Technology:** **AMS CMOS 0.35 µm**

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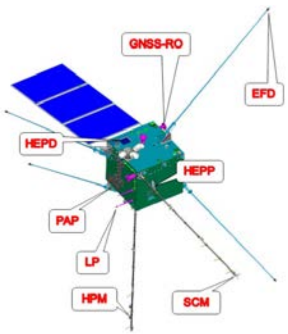
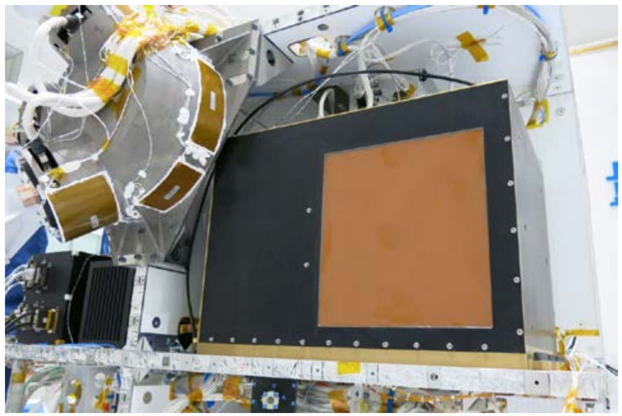
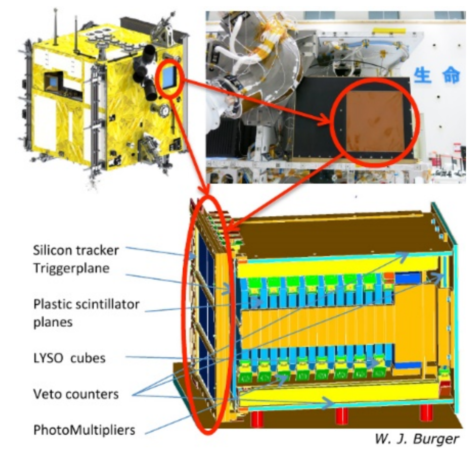
SPAZIO: Missione CSES (China Seismo Electromagnetic Satellite)

High-Energy Particle Detector (HEPD)







The instrument consists of several detectors. Two planes of double-side **silicon microstrip sensors** placed on the top of the instrument provide the direction of the incident particle. Just below, two layers of plastic scintillators, one thin segmented, give the **trigger**; they are followed by a **calorimeter**, constituted by other 16 scintillators and a layer of LYSO sensors. A **scintillator veto system** completes the instrument. The power supply and **electronics** are inserted in a box placed at one side of the detector. The HEPD is contained in an aluminum-honeycomb box.

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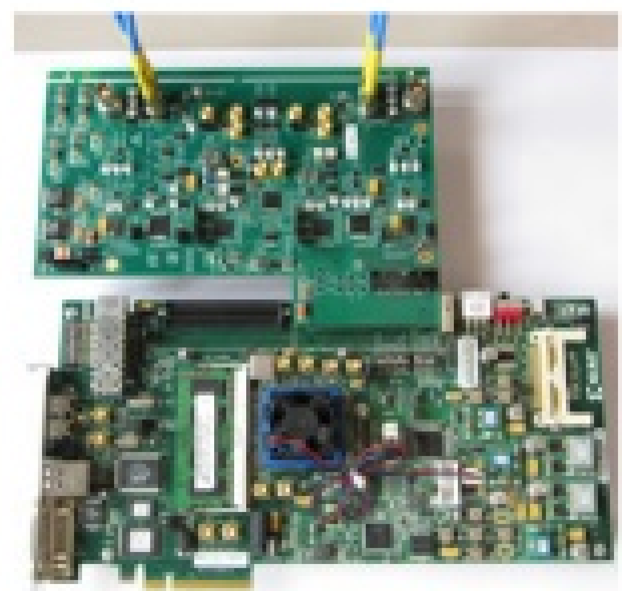
SPAZIO: Missione CSES (China Seismo Electromagnetic Satellite)

Electric Field Detector (EFD)



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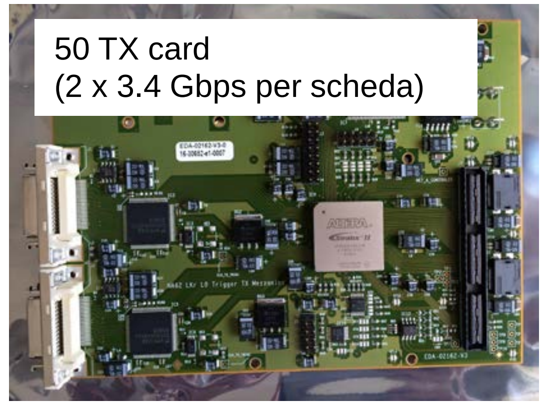
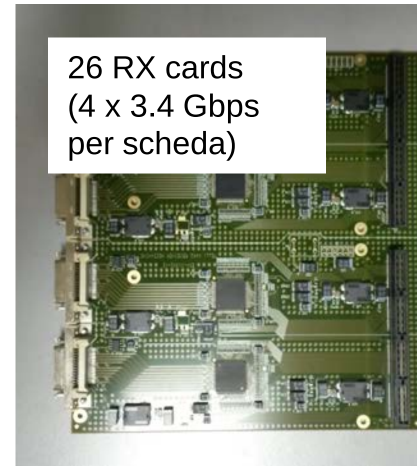
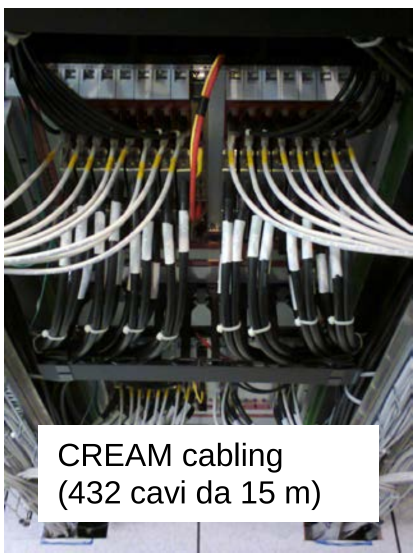
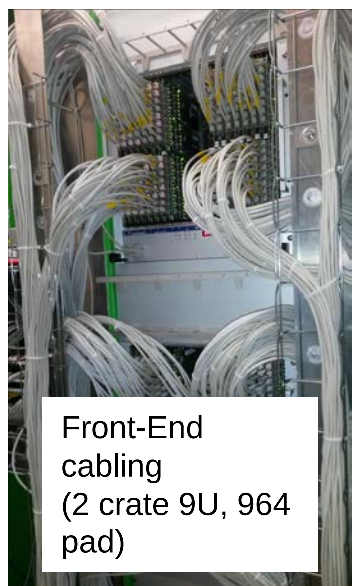
NA62 L0Calo: trigger calorimetrico dell'esperimento

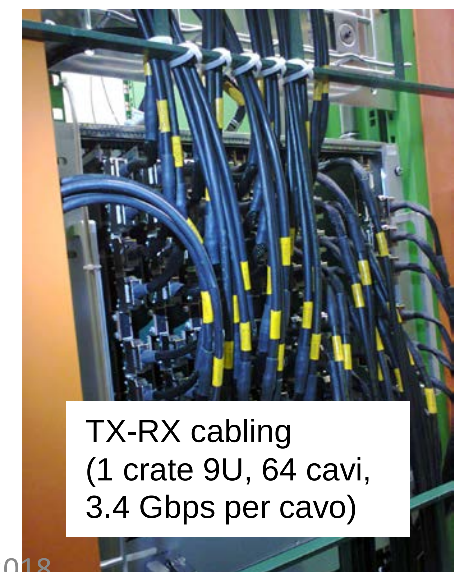

70 deserializer cards per scheda)
(collaborazione con INFN Pg)


50 TX card
(2 x 3.4 Gbps per scheda)


26 RX cards
(4 x 3.4 Gbps
per scheda)


CREAM cabling
(432 cavi da 15 m)


Front-End
cabling
(2 crate 9U, 964
pad)


TX-RX cabling
(1 crate 9U, 64 cavi,
3.4 Gbps per cavo)

Use of silicon photonics wavelength multiplexing techniques for fast parallel readout in high energy physics

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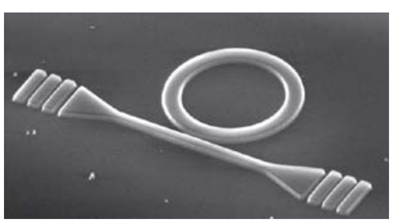
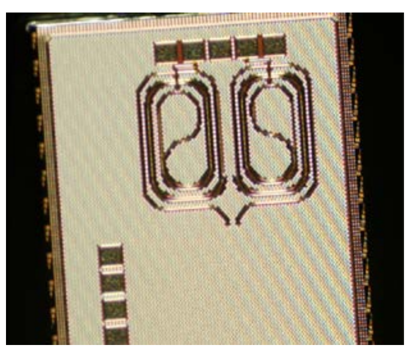
(3) INFN Structure of Turin, Turin, Italy - **(4)** University of Rome Tor Vergata, Rome, Italy
(5) University of Camerino, Camerino, Italy - **(6)** University of Milan, Milan, Italy
(7) IHP - Innovations for High Performance Microelectronics, Frankfurt (Oder), Germany
(8) Technical University of Applied Sciences, Wildau, Germany - **(9)** University of Turin, Turin, Italy

Silicon Photonics

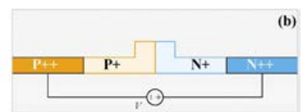
The basic structures used in integrated photonics systems are:

- ✓ **Bragg grating couplers used to feed laser light in and out of the photonics circuits;**
- ✓ **tapered or linear waveguides used to transport laser light inside the photonic integrated circuits;**
- ✓ **Mach-Zehnder Interferometers (MZI) and Ring Resonators (RR) used to implement optical signal modulation.**



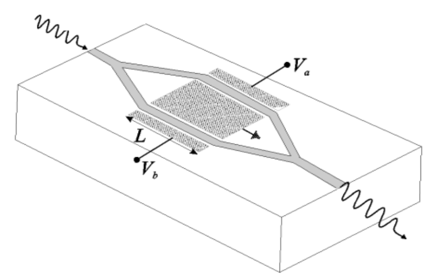


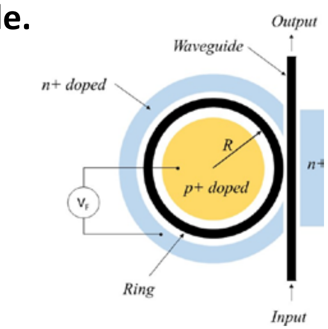
Optical modulation is obtained in silicon photonics circuits via electro-optical effect (plasma dispersion).



Modulation of the refractive index through variation of the density of the carriers.

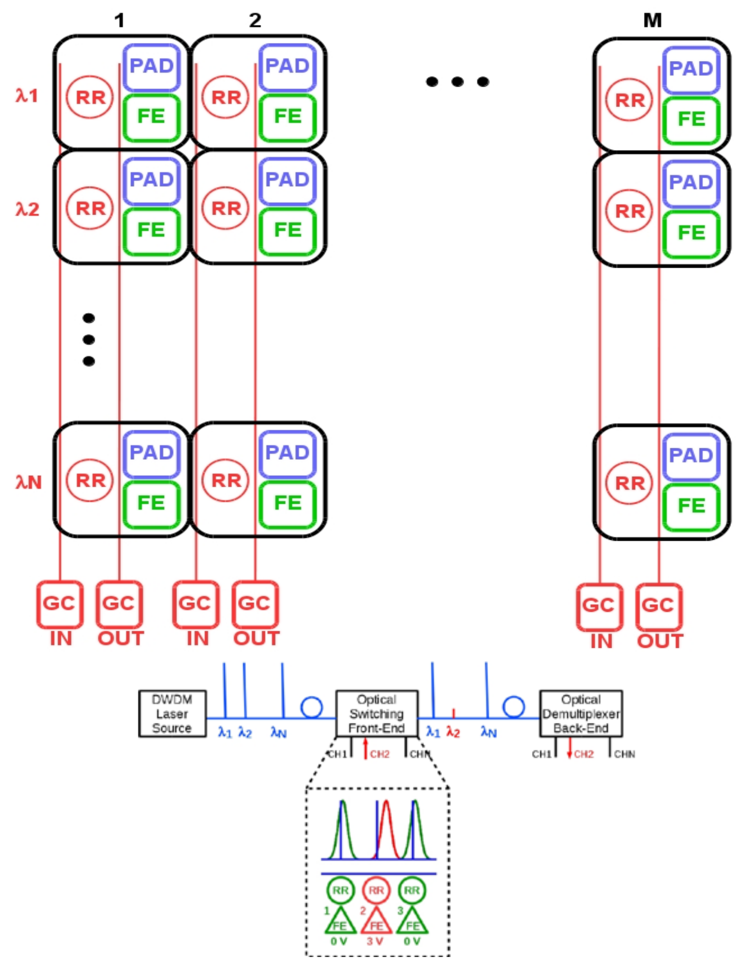
In a MZI the electro-optical effect is used to modulate the interference condition of the two branches of the interferometer, while in a RR it is used to control the resonance condition of an optical ring coupled to an optical waveguide.





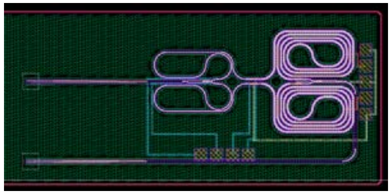
Fast parallel readout concept

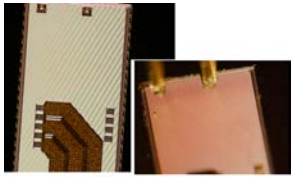
At the arrival of a particle, the pulse current produced by the detector is amplified and shaped by the front-end electronics and used to drive the corresponding ring resonator to a new resonance condition modifying the optical fingerprint of the RR array in a peculiar way specific of each channel.

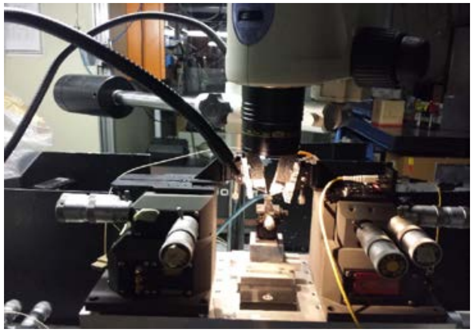


Silicon Photonics Technology

SG25H4_EPIC technology parameters:
SiGe:C (BiCMOS) technology especially suited for applications in the higher GHz bands (up to 190 GHz transit and up to 220 GHz oscillation frequencies);
0.25 µm CMOS process with Nmos, Pmos and passive components;







Applications

All the applications requiring a low noise, low power front-end with high electromagnetic interference immunity will benefit form this proposed optical multiplexing readout scheme:

- particle and nuclear physics experiments with fast -
- timing detectors (e.g. RPCs, MPGDs, silicon detectors);
- advanced medical imaging instruments (e.g. PET/MRI and SPECT/MRI);
- space instrumentation.