

**CURRICULUM VITAE of GIAN-FRANCO DALLA BETTA**

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Trento, September 22, 2015

I authorize the use of my personal data in compliance with Legislative Decree 196/03.

In witness whereof

Gian-Franco Dalla Betta



## 1. PERSONAL INFORMATION

First Name : Gian-Franco  
Family Name : Dalla Betta  
Date of Birth : May 7<sup>th</sup>, 1967  
Place of Birth : Venice, Italy  
Sex : Male  
Nationality : Italian  
Marital Status : Married  
Permanent Address : Via Ciocche, 16 - 31044 Montebelluna (Treviso), Italy  
Phone +39-0423-302207, Mobile +39-3485928003  
Office Address : Department of Industrial Engineering, University of Trento  
Via Sommarive, 9 - 38123 Trento, Italy  
Office Ph. Number. : +39-0461283904  
Office Fax Number. : +39-0461281977  
Office Email : [gianfranco.dallabetta@unitn.it](mailto:gianfranco.dallabetta@unitn.it)  
Skype : dallabe  
Web Page : <https://webapps.unitn.it/People/it/Web/Persona/PER0003161#INFO>

Military service : Alternative Civil Service fulfilled at the “Patronato ACLI”,  
Padua, Italy (from November 1992 to November 1993).

## 2. EDUCATION

September 1997: received the “Dottore di Ricerca” degree (i.e., the Italian PhD) in Microelectronics from the University of Trento, Trento, Italy. Thesis title: “Design, fabrication and characterization of silicon radiation detectors”; Supervisor: Professor Giovanni Soncini.

December 1992: enabled to operate as a professional electronic engineer by passing the public examination for engineers at the University of Bologna, Italy.

July 1992: received the “Laurea” degree (equivalent to a MSc degree) in Electronic Engineering from the University of Bologna, Bologna, Italy, summa cum laude. Thesis title: “Design of CMOS programmable Cellular Neural Networks”; Supervisor: Professor Guido Masetti.

July 1985: received High School Diploma of Scientific Liceum from “Pio X” Institute in Treviso, Italy with grade 60/60.

### 3. EMPLOYMENT HISTORY

November 2002-today: **Associate Professor of Electronics** at the University of Trento, Trento, Italy. First with the Department of Information Engineering and Computer Science (November 2002- October 2012), then with the Department of Industrial Engineering (October 2012-today).

Currently, at the same University:

- Responsible for the Trento Unit of the Italian Electronics Group (2004-today);
- Responsible for the Laboratory of Electronics and Embedded Systems (2006-today);
- Member of the Steering Committee (2013-today) for the International Doctorate School in "Materials, Mechatronics, and Systems Engineering" (MMSE).

May 2005 – October 2005: **Visiting Scientist at the Santa Cruz Institute for Particle Physics**, University of California Santa Cruz, USA.

January 1997-October 2002: **Researcher at the Centre for Scientific and Technological Research (ITC-irst)**, Trento, Italy. Main project: Silicon Radiation Detectors. Responsible for sensor design and simulation, responsible for Lithography in the Microfabrication Facility. Responsible for the development of detectors with integrated electronics.

July 1992 - November 1992: **Research Fellow** at the Department of Information Technology, University of Bologna, Bologna, Italy. Main project: Cellular Neural Networks.

### 4. DESCRIPTION OF THE RESEARCH ACTIVITY

The research activity of Gian-Franco Dalla Betta is concerned with the design, simulation, fabrication and experimental characterization of silicon integrated devices and circuits, with emphasis on radiation sensors over a broad range of radiation types and energies.

#### A. RADIATION DETECTORS

This is the main research activity. It started in 1994 with the PhD activity and it has continued for more than 20 years, involving many different detector types and applications, as briefly summarized in the following.

##### A.1. PIN diode and drift detectors for X-ray spectroscopy and imaging

This activity initiated the development of radiation detection processes on high-resistivity silicon at ITC-IRST of Trento in 1994. As such, it was crucial in establishing a production capability for radiation detectors that is unique in Italy. Achievements included: (i) the

development of a state-of-the-art, low leakage process for the fabrication of PIN diode detectors, making use of extrinsic gettering techniques; (ii) the design, modeling, and experimental characterization of PIN diode detectors with good electro-optical and spectroscopic properties; (iii) the study of the accuracy of generation lifetime measurements in high-resistivity silicon using gate-controlled diodes and the design and characterization of optimized test structures; (iv) the development of PIN diode arrays coupled to CsI scintillators to be used in an X-ray imaging system for the on-line inspection of materials and structures; (v) the development of a fabrication process for drift detectors, and the fabrication of the first prototypes of these detectors ever made in Italy.

**Publications:**

International journals: [IJ.5], [IJ.14], [IJ.28]

International conference proceedings: [IC.2], [IC.5], [IC.14], [IC.20]

Italian journals: [NJ.1], [NJ.2]

Italian conference proceedings: [NC.1], [NC.4]

**A.2.Strip and pixel detectors for tracking of charged particles**

This activity, strongly fostered by INFN, allowed to fully accomplish the goal to establish at ITC-IRST, within a relatively short period of time, a production capability of medium volumes of advanced detectors for tracking of charged particles in High Energy Physics and space experiments. Achievements included: (i) the development of the critical process steps (e.g., integrated coupling capacitors, bias resistors, etc.) for microstrip detectors; (ii) the design, fabrication and electrical characterization of several prototype batches of double-sided microstrip detectors with excellent electrical properties and very low defect density; (iii) the development of an analytical model for the interstrip resistance on the ohmic-side of double-sided microstrip detectors; (iv) the development of an automatic test method for the electrical characterization of double-sided microstrip detectors and of a computerized analysis tool for process defect identification; (v) the development of a state-of-the-art process for double-sided pixel sensors of the n-on-n type, oriented to the ATLAS Pixel Detector.

Results were so good that ITC-IRST was included among the few silicon foundries at world level entitled to bid for the tenders relevant for the production of radiation detectors for CERN experiments, and it soon obtained important achievements: the production of 600 double-sided microstrip detectors for the silicon tracker of the AMS2 experiment (installed on board of the International Space Station), and 800 double-sided microstrip detectors for the silicon tracker of the ALICE experiment (one of the main experiments at CERN-LHC). Both productions were completed in due time and with very good results, both in terms of detector quality and of fabrication yield.

More recently, double-sided triplet detectors and pixel detectors were designed, fabricated on thin silicon substrates (200  $\mu\text{m}$ ), and fully characterized with good results. These detectors represented the baseline option for the Layer 0 of the foreseen SuperB Silicon Vertex Tracker, but the project was cancelled at the end of 2012 and these developments had to stop.

**Publications:**

International journals: [IJ.11], [IJ.15], [IJ.20], [IJ.22], [IJ.23],[IJ.25], [IJ.26], [IJ.27], [IJ.42], [IJ.77], [IJ.114], [IJ.117], [IJ.120], [IJ.126], [IJ.132], [IJ.139], [IJ.154], [IJ.157]

International conference proceedings: [IC.8], [IC.11], [IC.17], [IC.81], [IC.92], [IC.105], [IC.112]

Italian conference proceedings: [NC.8]

**A.3. Radiation damage effects and radiation tolerant detectors**

Theoretical and experimental studies have been carried out to investigate radiation damage effects on radiation detectors, and to develop new technological/design solutions for radiation-hard detectors to be used at future experiments at the High-Luminosity LHC Upgrades.

Achievements included: (i) the TCAD analysis and experimental characterization of irradiated FOXFET transistors to be used as bias structures in microstrip detectors; (ii) the TCAD analysis of the edge-generated leakage current in single-sided microstrip detectors irradiated beyond the type-inversion fluence; (iii) the development of special fabrication technologies by means of substrate engineering (e.g., oxygen enrichment of Float Zone substrates, pre-irradiation of Float Zone substrates by high fluences of fast neutrons, use of oxygen-rich substrates such as epitaxial, Czochralsky or Magnetic Czochralsky wafers); (iv) the design, fabrication and characterization of radiation-hard detectors featuring the above mentioned substrate engineering options; (v) the design, fabrication and characterization of thin radiation detectors obtained by local thinning of the substrate by TMAH etching; (vi) the measurement of the impact ionization coefficient of electrons in highly irradiated silicon.

For their importance and impact on the recent research activity, 3D and active edge detectors are described separately.

**Publications:**

International journals: [IJ.3], [IJ.17], [IJ.34], [IJ.38], [IJ.48], [IJ.51], [IJ.57], [IJ.59], [IJ.62], [IJ.68], [IJ.72], [IJ.83], [IJ.85], [IJ.91], [IJ.96], [IJ.101], [IJ.137]

International conference proceedings: [IC.3], [IC.13], [IC.16], [IC.29], [IC.33], [IC.35], [IC.38], [IC.40], [IC.53], [IC.54], [IC.56]

Papers of the CERN-RD60 Collaboration: [RD50.1], [RD50.2], [RD50.3], [RD50.4]

**A.4. Multiple guard-ring edge terminations for radiation detectors**

The edge termination is one of the most important problems in the design of radiation detectors. Dedicated efforts were devoted to this purpose with very good results. Achievements included: (i) the design, TCAD optimization and characterization of termination structures with multiple guard rings enabling the high voltage (>1000V) behavior of silicon radiation detectors both before irradiation and after heavy particle irradiation; (ii) the introduction of a new termination principle (namely the “all-p-type” multiple guard ring termination) aimed at improving the long term stability of radiation detectors subject to varying environmental

conditions while using a simplified fabrication technology; (iii) the design, TCAD simulation and experimental characterization of several variants of the “all-p-type” termination (e.g., by using different combinations of inward and outward field plates) under different environmental conditions and irradiation scenarios.

**Publications:**

International journals: [IJ.4], [IJ.10],[IJ.16], [IJ.32], [IJ.36], [IJ.44], [IJ.49]

International conference proceedings: [IC.6], [IC.9], [IC.22], [IC.30], [IC.34]

Italian journals: [NJ.3]

**A.5. Radiation detectors with integrated electronics**

The integration of the radiation detector and at least part of the front-end electronics on the same high-resistivity substrate can significantly improve the noise performance, owing to the reduction of the stray capacitances associated with the connections from the charge collecting electrode and the preamplifier. For this reason, and also as a demonstration of the advanced processing capabilities achievable at ITC-IRST, an important R&D effort was started in the mid 90’s and continued for about 10 years, leading to interesting results.

Achievements included: (i) the development of a fabrication process (the so called JSD technology) for detector-compatible n-channel JFETs; (ii) the design, fabrication and characterization of a test chip, demonstrating the feasibility of JFETs with good electrical properties while maintaining a very low detector leakage current; (iii) the design and characterization of PIN diode detectors with integrated JFETs, showing good performance; (iv) the modification of the JSD technology to allow for other active and passive devices to be fabricated (e.g., MOS transistors, BJT transistors, poly-Si resistors, coupling capacitors); (v) the design and fabrication of JFET-based charge sensitive amplifiers monolithically integrated on the detectors substrate and their extensive characterization, including radiation damage effects; (vi) the TCAD study and explanation of some anomalies in the JFET characteristics, causing excess noise, and the optimization of the fabrication process by implementing a high-energy p-well implant to fix these issues; (vii) the successful demonstration of the low noise features of modified JFET transistors and of JFET-based detectors and integrated amplifiers; (viii) the design, fabrication and characterization of microstrip detectors with embedded, JFET-based source-follower amplifier; (ix) the design, fabrication and characterization of arrays of active pixels featuring JFET and MOSFET transistors embedded within the charge collection element.

**Publications:**

International journals: [IJ.2], [IJ.9], [IJ.12], [IJ.19], [IJ.21], [IJ.29], [IJ.30], [IJ.31], [IJ.35], [IJ.39], [IJ.41], [IJ.43], [IJ.50], [IJ.52], [IJ.64], [IJ.66], [IJ.69], [IJ.80], [IJ.90], [IJ.106], [TBP.4]

International conference proceedings: [IC.4], [IC.21], [IC.23], [IC.27], [IC.28], [IC.31], [IC.32], [IC.36], [IC.49], [IC.72]

### **A.6. Radiation detectors based on bipolar junction transistor**

Initially obtained as a side-product of the JSD process, radiation detectors based on bipolar junction transistors (BJT) were extensively characterized and optimized, finally leading to their use in a commercial product. Achievements included: (i) the TCAD analysis and experimental characterization of BJT-based radiation sensors featuring different design and technological options; (ii) the design, implementation and experimental validation of different bias methods for BJT detectors; (iii) the design, implementation and characterization of an original detector concept featuring monolithic arrays of BJT detectors with shared collector (substrate) and emitters shorted by a metal grid; (iv) the development of an alpha particle detector system based on BJT detectors and suited for Radon concentration measurements.

**Patents:** [P.3], [P.4], [P.5]

**Publications:**

International journals: [IJ.40], [IJ.45], [IJ.47], [IJ.53], [IJ.60], [IJ.63], [IJ.65], [IJ.67], [IJ.109], [IJ.118], [IJ.128], [IJ.156]

International conference proceedings: [IC.39], [IC.61], [IC.67], [IC.85], [IC.90], [IC.103], [IC.107]

Italian conference proceedings: [NC.11], [NC.15], [NC.16]

Magazines: [M.1]

### **A.7. Radiation detectors for medical imaging**

The detector technologies developed for High Energy Physics experiments were adapted to fabricate other types of detectors aimed medical imaging applications. Achievements included: (i) the optimization of the technological processes for very thick substrates (up to 1mm), as required for increased detection efficiency for X-rays; (ii) the design, fabrication and experimental characterization of several batches of pixel detectors for digital mammography, compatible with the read-out chips of the MEDIPIX family; (iii) the design, fabrication and experimental characterization of arrays of PIN diodes coupled to scintillators for  $\gamma$ -ray detection, to be used in a functional imaging instrument for scintigraphy.

**Publications:**

International journals: [IJ.37], [IJ.46], [IJ.56], [IJ.61], [IJ.70], [IJ.74]

International conference proceedings: [IC.41], [IC.46], [IC.50], [IC.71]

Italian conference proceedings: [NC.6]

### **A.8. Silicon photomultipliers**

Silicon photomultipliers (SiPM) are the hottest topic in photodetection and candidate themselves to replace photomultiplier tubes in most applications. Achievements included: (i) the development of the first prototypes of silicon photomultipliers at ITC-IRST by contributing to the design, the definition of the fabrication process, and the experimental characterization, in

particular of the timing properties; (ii) the development of a compact model for the circuit simulation of SiPM; (iii) the development of a SiPM-based detection system for Positron Emission Tomography; (iv) the feasibility study of a novel SiPM-based detection system for Positron Time-of-Flight measurements, to be used for defect analysis in material science.

**Publications:**

International journals: [IJ.76], [IJ.81],[IJ.82], [IJ.93], [IJ.98], [IJ.112], [IJ.113], [IJ.115], [IJ.116], [IJ.141], [IJ.144]

International conference proceedings: [IC.55], [IC.57], [IC.58], [IC.64], [IC.65], [IJ.114]

Italian journals: [NJ.4], [NJ.5], [NJ.6]

Italian conference proceedings: [NC.13]

**A.9. Radiation detectors with three-dimensional electrodes (3D detectors)**

This research activity has been the most important one for Gian-Franco Dalla Betta in the past few years. His contribution was fundamental in bringing 3D detectors from their infancy to their maturity, allowing for their first application in a High Energy Physics experiment at CERN-LHC, and paving the way for their use in other experiments. Moreover, other activities later started based on 3D detector technology, as reported in the following.

Achievements included: (i) the introduction of modified 3D detector concepts, alternative to the original one proposed by S. Parker (e.g., single-type column 3D detectors; double-sided double-type column 3D detectors with partially-through and full-through electrodes), and the development of the related technologies; (ii) the design, fabrication and experimental characterization of several batches of 3D detectors in different configurations (e.g., pad, strip, pixels) and featuring different design and technological options; (iii) the study and TCAD analysis of non idealities in non irradiated and irradiated 3D detectors; (iv) the first observation of charge multiplication effects in irradiated 3D detectors; (v) the development and industrialization of 3D pixel detectors for the ATLAS Insertable B-Layer; (vi) the optimization of 3D detector design and technology for higher breakdown voltage; (vii) the introduction of original design and technological solutions for a new generation of downscaled (smaller and thinner) 3D pixel detectors for future applications at the High-Luminosity LHC.

**Publications:**

International journals: [IJ.55], [IJ.71], [IJ.79], [IJ.84], [IJ.87], [IJ.88], [IJ.89], [IJ.92], [IJ.94], [IJ.95], [IJ.99], [IJ.100], [IJ.102], [IJ.103], [IJ.104], [IJ.108], [IJ.110], [IJ.111], [IJ.121], [IJ.123], [IJ.125], [IJ.127], [IJ.129], [IJ.131], [IJ.133], [IJ.135], [IJ.136], [IJ.138], [IJ.143], [IJ.145], [IJ.146], [IJ.147], [IJ.149], [IJ.150], [IJ.151], [IJ.152], [IJ.153], [IJ.158], [IJ.160], [IJ.161], [IJ.162], [IJ.164], [IJ.166], [IJ.172], [IJ.173], [IJ.176],[IJ.178], [IJ.179],[TBP.2]

International conference proceedings: [IC.60], [IC.62], [IC.63], [IC.66], [IC.68], [IC.69], [IC.78], [IC.79], [IC.80], [IC.88], [IC.89], [IC.91], [IC.99], [IC.100], [IC.101], [IC.104], [IC.108], [IC.109], [IC.111], [IC.118], [IC.129]

Italian conference proceedings: [NC.17], [NC.18], [NC.19]



Book Chapters: [BC.1]

#### **A.10. Active-edge and slim-edge terminations for radiation detectors**

Based on the experience with 3D technology, active-edge and slim-edge detectors have been developed allowing for the minimization of the dead-area at the edge and for the realization of large area seamlessly tiled detector matrices. Achievements included: (i) the development of a fabrication technology for planar active-edge detectors; (ii) the design, TCAD simulation, fabrication, and experimental characterization of planar active-edge diode and strip detectors; (iii) the introduction of original slim-edge concepts in double-sided 3D detectors, also suitable for planar detectors, and their implementation in the ATLAS IBL design; (iv) the design, TCAD simulation, fabrication, and experimental characterization of different slim-edge structures in double-sided 3D detectors, with minimum dead area at the edge; (v) the contribution to the validation of the scribe-cleave-passivate (SCP) post-processing technique for slim edge in 3D detectors; (vi) the development of high-efficiency, active edge planar pixel sensors for experiments at next generation Free Electron Lasers (FELs).

#### **Publications:**

International journals: [IJ.140], [IJ.142], [IJ.152], [IJ.159], [IJ.165], [IJ.168], [IJ.175], [IJ.177], [IJ.180],[TBP.1]

International conference proceedings: [IC.102], [IC.120], [IC.126], [IC.127], [IC.128], [IC.131]

Italian conference proceedings: [NC.17], [NC.18]

Book Chapters: [BC.1]

#### **A.11. Hybrid neutron detectors**

Also based on the experience with 3D technology, hybrid detectors of neutrons have been developed. Achievements included: (i) the design of novel 3D sensors for neutron detection, also compatible with pixelated read-out chips for neutron imaging; (ii) the fabrication and experimental characterization of prototype hybrid detectors based on 3D sensors and different converter materials for the detection of both thermal and fast neutrons; (iii) the optimization of the 3D sensors by GEANT4 simulations and the design of a new batch with enhanced efficiency.

#### **Publications:**

International journals: [IJ.169], [IJ.181]

International conference proceedings: [IC.116], [IC.119], [IC.133]

Italian conference proceedings: [NC.17], [NC.18]

#### **A.12. Low Gain Avalanche Detectors**

Low Gain Avalanche Detectors (LGADs) are radiation sensors with intrinsic signal amplification based on the avalanche effect. LGADs are a recent, hot topic in the field of radiation detectors, since they promise to open several new application opportunities, in

particular owing to the possibility to provide an excellent timing resolution ( $\sim 10$ s of ps) besides the usual high spatial resolution. Achievements included: (i) the contribution to the optimization of design parameters of LGADs; (ii) the proposal of a new, double-sided LGAD concept to allow for segmented detectors with uniform gain; (iii) the definition of a fabrication process and the design of a first batch of double-sided LGADs, currently being fabricated at FBK.

**Publications:**

International journals: [IJ.182], [IJ.183]

**A.13. Monolithic Active Pixel Sensors**

Within a large collaboration project funded by INFN, Monolithic Active Pixel Sensors (MAPS) have been developed for particle tracking in high-energy physics experiments (in particular for the Layer 0 of SuperB project). The specific role of Gian-Franco Dalla Betta has been the design and numerical simulation of CMOS radiation sensors embedded in the MAPS pixels. Achievements included the design and experimental characterization of several chips of the so-called APSEL family in 0.13  $\mu$ m CMOS technology, featuring pixels with full signal processing capabilities and on-chip data sparsification, also suited to vertical integration. The experimental characterization in the laboratory and at beam tests confirmed the high tracking efficiency of these devices.

**Publications:**

International journals: [IJ.78], [IJ.105], [IJ.107], [IJ.114], [IJ.119], [IJ.124], [IJ.126], [IJ.130], [IJ.132], [IJ.139], [IJ.154], [IJ.155], [IJ.163], [IJ.167]

International conference proceedings: [IC.59], [IC.70], [IC.81], [IC.105], [IC.112]

**B. CMOS PHOTODETECTORS AND IMAGE SENSORS**

This activity includes both a device-related part aimed at the realization of non-standard photodetectors in commercial CMOS technologies and a circuit/system part devoted to the realization of pixel arrays for different imaging applications.

Achievements included: (i) the design, modeling and experimental characterization of photon mixing devices based on different structures (e.g., MSM, interdigitated photodiodes, pinned photodiodes) suitable for the implementation of the Indirect Time-of-Flight technique at the pixel level for distance measurements; (ii) the development of versatile models for the simulation of optical sensors at the circuit level; (iii) the design, modeling and experimental characterization of avalanche based photodetectors, operated either in the linear mode (APD) or in the Geiger mode (SPAD) in different sub-micron CMOS technology nodes; (iv) the porting of a Current-Assisted Photonic Demodulator (CAPD) to a 0.18 $\mu$ m CMOS process; (v) the design and characterization of smart pixels based on the previously mentioned sensors and their implementation in functional 3D image sensors with good performance; (vi) the design,

modeling and characterization of CMOS SPAD-based pixel arrays with time-resolved readout channels, which enable single photon imaging with sub-ns resolution, for time resolved fluorescence measurements; (vii) the design and implementation of image sensors featuring novel active pixel concepts enabling outstanding performance in terms of dynamic range (higher than 130 dB); (viii) the design and characterization of a prototype hybrid camera based on a CMOS chip coupled to an array of organic photodiodes, aimed at the development of an image sensor with chemically-tunable spectral response also extending to the infrared; (ix) the design of dual-tier SPAD sensor arrays for coincidence charged particle detection.

**Patent:** [P.2]

**Publications:**

International journals: [IJ.18], [IJ.33], [IJ.54], [IJ.73], [IJ.75], [IJ.97], [IJ.134], [IJ.148], [IJ.170], [IJ.171], [IJ.174],[TBP.3]

International conference proceedings: [IC.18], [IC.24], [IC.43], [IC.44], [IC.45], [IC.47], [IC.51], [IC.52], [IC.73], [IC.74], [IC.75], [IC.76], [IC.77], [IC.82], [IC.83], [IC.84], [IC.86], [IC.87], [IC.93], [IC.94], [IC.95], [IC.96], [IC.97], [IC.98], [IC.106], [IC.110], [IC.113], [IC.115], [IC.117], [IC.121], [IC.122], [IC.123], [IC.124], [IC.125]

Italian conference proceedings: [NC.2], [NC.9], [NC.10], [NC.14]

Book Chapters: [BC.2], [BC.3]

Magazines: [M.2]

### C. DEVICES AND CIRCUITS FOR SENSING APPLICATIONS

Achievements included: (i) the design, fabrication and experimental characterization of high performance optical sensors (photodiodes, phototransistors, photoASICs) for position encoders to be used in industrial control applications; (ii) the development and successful demonstration of technological modules (p-channel JFET, filterless color sensor based on multiple overlapped junctions, LED structures based on MOS diodes biased in the Fowler-Nordheim regime) fully compatible with the CMOS process available at ITC-IRST, and aimed at enhancing the design flexibility; (iii) the design and implementation of novel blue-sensitive optical transducers (finger shaped photodiodes and BJT phototransistors) for gas sensing (electro-optical noses), showing good response down to 300 ppm concentration of ethanol; (iv) the design and implementation of CMOS circuits (main building blocks and full interfaces) for optical sensors and chemical sensors; (v) the development of silicon nanowires featuring palladium gate contacts for hydrogen detection; (vi) the TCAD and experimental validation of an active method to improve the reliability of RF-MEMS switches.

**Patent:** [P.1]

**Publications:**

International journals: [IJ.6], [IJ.7], [IJ.8], [IJ.13], [IJ.58], [IJ.86], [IJ.122].

International conference proceedings: [IC.12], [IC.15], [IC.19], [IC.25], [IC.26], [IC.37], [IC.42], [IC.48]

Italian conference proceedings: [NC.3], [NC.5], [NC.7], [NC.12]

#### **D. CMOS ANALOG CELLULAR NEURAL NETWORKS**

This activity was started at the University of Bologna for the MSc thesis, and then was reprised for some time while at ITC-IRST. Achievements included: (i) the design and simulation of novel CMOS implementations of analog programmable Cellular Neural Networks (CNNs), considering small area occupation and low power consumption as main constraints; (ii) the design, fabrication, and test of an original CMOS test structure for the mismatch characterization of MOS transistors, based on a circuit topology typical of neural circuits; (iii) the design and test of prototype CNN circuits showing good electrical figures and correct performance in some basic image processing applications (noise removal, hole filling, edge detection, shadow detection, etc).

#### **Publications:**

International journals: [IJ.1], [IJ.24]

International conference proceedings: [IC.1], [IC.7], [IC.10]

### **5. PUBLICATIONS AND BIBLIOMETRIC INDICATORS**

On the above topics, he has authored or co-authored more than 350 scientific papers, among them ~180 papers published in refereed international journals (including 40 papers in IEEE journals), ~130 papers published in proceedings of international conferences, and 3 book chapters. The full list of publications is reported in Section 19.

His **bibliometric indicators** are:

- Google Scholar: entries 338, H index 28, citations 3213
- Scopus: entries 291, H index 19, citations 1766
- Web of Science: entries 261, H index 19, citations 1499

### **6. INVITED TALKS AND SEMINARS**

He gave the following **invited talks**:

1. “Tecnologie per la fabbricazione di rivelatori di radiazioni in silicio”, Giornata di Studio AEI sul Tema “Prospettive per i sistemi di imaging radiografico a bassa dose in applicazioni medicali”, Bari (Italy), June 6, 2000.
2. “Silicon radiation detectors: Review of production and R&D activities at ITC-IRST”, 8th Italian Conference on Sensors and Microsystems, Trento, Italy, February 11-14, 2003.
3. “Advanced photodetectors based on single photon avalanche diodes for 3D vision and medical imaging”, Electronics and Communications PhD Summer School of the University of Padova, Bressanone (Italy), July 6, 2007.

4. “Development of 3D detectors”, 16th Workshop on Vertex Detectors (Vertex 2007), Lake Placid (U.S.A.), September 23 – 28, 2007.
5. “High-Sensitivity Photodetectors in CMOS Technology for 3-D Imaging”, 21st IEEE LEOS Annual Meeting, Newport Beach (U.S.A.), November 9-13, 2008.
6. “Development of modified 3D sensor technologies for HEP experiments”, 2010 CMOS Emerging Technologies Workshop, Whistler (Canada), May 19-21, 2010.
7. “Surface effects and breakdown voltage”, MC-PAD Training Event, Lubiana (Slovenia), September 26-30, 2010.
8. “3D pixel sensors for the ATLAS IBL”, Symposium Honoring Sherwood Parker, SLAC National Accelerator Laboratory (USA), March 31, 2012.
9. “3D Irradiation Results”, 21st Workshop on Vertex Detectors (Vertex 2012), Jeju (Republic of Korea), September 16 – 21, 2012.
10. “Edgeless and slim-edge solutions for silicon pixel sensors”, 22nd Workshop on Vertex Detectors (Vertex 2013), Lake Starnberg (Germany), September 15 – 20, 2013.
11. “Characterization of New FBK Double-Sided 3D Sensors with Improved Breakdown Voltage”, IEEE Nuclear Science Symposium, Seoul (Republic of Korea), October 27 – November 2, 2013.
12. “3D Silicon Detectors”, INFN Workshop on Future Detectors for HL-LHC, Trento (Italy), March 11-13, 2014.
13. “State of the art of 3D sensors”, 2014 CMOS Emerging Technologies Workshop, Grenoble (France), July 6-8, 2014.
14. “Why and How Pixels are becoming more and more intelligent”, Second international Summer School on "Intelligent Signal Processing for Frontier Research and Industry", Paris (France), July 14 – 25, 2014.
15. “Pixelated low gain avalanche detectors”, Symposium on Advanced Semiconductor Detector for Medical Applications, Munich (Germany), February 13, 2015.

Moreover, he gave **seminars** dealing with silicon optical sensors and radiation detectors at: CERN (Geneve, Switzerland), SCIPP (Santa Cruz, USA), DESY (Hamburg, Germany), Albert Ludwig University of Freiburg (Freiburg, Germany), Manchester University (Manchester, United Kingdom), University of Ljubljana (Ljubljana, Slovenia), ENEA (Frascati, Italy), as well as at several Italian Universities and INFN Chapters.

## 7. RESEARCH CONTRACTS

He has participated in numerous funded research programs, including:

- European Project H2020-INFRAIA-1-2014-2015 Excellent Science “Advanced Infrastructure for Detectors at Accelerators (AIDA-2020)”, years 2015-2019 (**research-unit leader and manager of Task 7.2 "TCAD Simulations" within WorkPackage 7 "Advanced hybrid pixel detectors"**).

- CERN Large Hadron Collider, ATLAS Experiment; Spokeperson Prof. David Charlton, University of Birmingham; years 2015-... **(research-unit leader)**.
- INFN Project (National Scientific Committee I), RD\_FASE2 experiment, National Coordinator Dr. Giovanni Darbo, INFN Genova, years 2015-2017 **(research-unit leader)**.
- INFN Project (National Scientific Committee V), APIX2 experiment “Development of an avalanche pixel sensor for tracking applications”, National Coordinator Prof. Pier Simone Marrocchesi, INFN Pavia, Research-Unit Leader Dr. Lucio Pancheri, INFN TIFPA, years 2014-2016.
- INFN Project (National Scientific Committee V), PIXFEL experiment “Enabling technologies, building blocks and architectures for advanced X-ray Pixel cameras at FELs”, National Coordinator Prof. Lodovico Ratti, INFN Pavia, Research-Unit Leader Dr. Lucio Pancheri, INFN TIFPA, years 2014-2016 **(task manager)**.
- INFN Project (National Scientific Committee V), HYDE experiment “HYbrid DETectors for Neutrons”, National Coordinator Prof. Alberto Quaranta, INFN Legnaro, years 2012-2014 **(research-unit leader)**.
- INFN Project (National Scientific Committee I), P-SuperB experiment, National Coordinator Dr. Roberto Calabrese, INFN Ferrara, years 2012-2013 **(research-unit leader)**.
- INFN Project (National Scientific Committee I), ATLAS experiment, National Coordinator Prof. Marina Cobal, University and INFN Udine, years 2011-2015 **(research-unit leader)**
- European Project FP7-INFRASTRUCTURES-2010-1, title “Advanced European Infrastructures for Detectors at Accelerators (AIDA)”, years 2011-2014.
- European project, FP7 ICT-2009.3.7, STREP “Fully Networked, Digital Components for Photon-starved Biomedical Imaging Systems (SPADNET)”, years 2010-2013, Coordinator Prof. E. Charbon (TU Delft, NL), Responsible for FBK: Ing. D. Stoppa **(responsible for a sub-contract from FBK: "Characterization of CMOS SPAD based devices for gamma ray detection")**.
- INFN Project (National Scientific Committee V), TRIDEAS experiment "Development and optimization of silicon detectors with 3-D Electrodes and Active edges", years 2009-2012 **(national coordinator and research-unit leader)**.
- INFN Project (National Scientific Committee V), VIPIX experiment “Vertical Integrated PIXels”, National Coordinator Prof. Valerio Re, INFN Pavia, years 2009-2011 **(research-unit leader)**.
- Project VIGONI 2008, Title “CMOS image sensors based on Organic Photodetectors (CIOP)”, Partner Technical University of Munich, Germany (Prof. Paolo Lugli), years 2009-2010 **(research-unit leader)**.
- Call “Grandi progetti 2006”, funded by Provincia Autonoma of Trento, title: “A NANO on MICRO approach to a multispectral analytical system for protein assays (NAoMI)”, scientific coordinator: Dr. Cecilia Pederzoli, FBK, years 2008-2012 **(research-unit leader)**.

- CERN ATLAS 3D Sensor Collaboration, Title: “Development, testing and industrialization of Full-3D active-edge and Modified-3D silicon radiation pixel sensors with extreme radiation hardness. Results, Plans”; Spokeperson: Prof. Cinzia Da Via, University of Manchester, years: 2007-2012 (**research-unit leader and responsible for the design of 3D pixel sensors installed in the ATLAS Insertable B-Layer**).
- MIUR (Italian Ministry for Instruction, University and Research), 2007 PRIN project, Title: "Time-of-Flight Range Image Sensor", years 2008-2010 (**national coordinator and research-unit leader**).
- INFN Project (National Scientific Committee V), DASIPM2 experiments “Development and Applications of SiPM to Medical Physics and Space Physics”, National Coordinator Prof. Alberto Del Guerra, INFN Pisa, years 2007-2010 (**research-unit leader**).
- INFN Project (National Scientific Committee V), SLIM5 experiment “Silicon detector with Low Interaction with Material”, National Coordinator Prof. Francesco Forti, INFN Pisa, Research-Unit Leader Prof. Giovanni Soncini, INFN Trento, years 2006-2008 (**task manager**).
- MIUR (Italian Ministry for Instruction, University and Research), 2005 PRIN project, Title: "Development of monolithic active pixel and thin strips detectors for charged particle trackers"; National Coordinator: Prof. Marcello Giorgi, University of Pisa; Title of the specific program of the research unit “Design, simulation and characterization of thin silicon microstrip detectors”, years 2006-2007 (**research-unit leader**).
- INFN Project (National Scientific Committee V), DASIPM experiments “Development and Applications of SiPM to Medical Physics and Space Physics”, National Coordinator Prof. Alberto Del Guerra, INFN Pisa, year 2006 (**research-unit leader**).
- INFN Project (National Scientific Committee V), TREDI experiment “Development of fabrication technologies and design solutions for the realization of silicon radiation detectors with three-dimensional electrodes and active edge”, National Coordinator Prof. Luciano Bosisio, INFN Trieste, years 2005-2008 (**research-unit leader**).
- MIUR (Italian Ministry for Instruction, University and Research), 2003 PRIN project, Title: "Development of monolithic pixel detectors with integrated electronics", National Coordinator: Prof. Marcello Giorgi, University of Pisa; Title of the specific program of the research unit: “Design and characterization of pixel detectors with integrated electronics on high resistivity silicon”; years 2004-2005 (**research-unit leader**).
- CERN Project LHCC-2002-003-P6-RD50, “Development of Radiation Hard Semiconductor Devices for Very High Luminosity Colliders”; Spokeperson Prof. Mara Bruzzi, University of Florence; Research-Unit Leader Dr. M. Boscardin, ITC-IRST, Trento, years 2002-2007.
- Call “Fondo Unico per la Ricerca 2001”, funded by Provincia Autonoma of Trento, title: “Development of pixel detectors on high resistivity silicon for X-ray medical imaging (PDX)”, scientific coordinator: Dr. Nicola Zorzi, ITC-IRST, Responsible for the Research Unit: Prof. Giovanni Soncini, University of Trento, years 2002-2004 (**task manager**).

- INFN Project (National Scientific Committee V), SISPEX experiment “Development of  $n^+/n$  pixel detectors on thick silicon substrates”, National Coordinator Prof. Valeria Rosso, INFN Pisa, years 2002-2003 (**task manager at aggregate partner ITC-IRST**).
- MIUR (Italian Ministry for Instruction, University and Research), 2001 PRIN project, Title: “Silicon detectors of different thickness and with integrated electronics”, National Coordinator: Prof. Marcello Giorgi, University of Pisa; Research-Unit Leader: Prof. Luciano Bosio, University of Trieste, years 2001-2003 (**task manager at aggregate partner ITC-IRST**).
- MIUR (Italian Ministry for Instruction, University and Research), 2001 PRIN project, Title: “Electro-optical nose”, National Coordinator: Prof. A. D'Amico, University of Rome Tor Vergata; Research-Unit Leader: Prof. G. Soncini, University of Trento, years 2001-2003.
- MIUR (Italian Ministry for Instruction, University and Research), Law 297 Project, Title: “Three-dimensional vision system for a scene detection (OPTO-3D)”, Coordinator Dr. G. Alessandretti, Centro Ricerche FIAT, Trento; Research-Unit Leader Dr. L. Gonzo, ITC-IRST, Trento, years 2000-2003.
- MIUR (Italian Ministry for Instruction, University and Research), 1999 PRIN project, Title: “Feasibility study of microelectrode detectors on high resistivity silicon with integrated electronics”, National Coordinator: Prof. Marcello Giorgi, University of Pisa; Responsible for the Research Unit: Prof. Giorgio Pignatel, University of Trento, years 1999-2001 (**task manager at aggregate partner ITC-IRST**).
- National Research Council (CNR) “Materials and Devices for Solid-State Electronics MADESS”, Title: “Development of an imaging system for baggage control security based on an array of X-ray sensors”, Research-Unit Leader Prof. G. U. Pignatel, University of Trento, years 1998-2000 (**task manager at aggregate partner ITC-IRST**).
- National Research Council (CNR) “Materials and Devices for Solid-State Electronics MADESS”, Title: “Integrated electronics for sensors”, Research-Unit Leader Prof. G. Soncini, University of Trento, years 1998-2000 (**task manager at aggregate partner ITC-IRST**).
- MURST (Italian Ministry for University and Scientific and Technological Research), 60% Project, Title: “Microelectronic and nanoelectronic technologies”, Title of the specific program of the research unit: “Silicon integrated X-ray microsensors and detectors”, Research-Unit Leader Prof. G. Soncini, University of Trento, years 1997-1999 (**task manager at aggregate partner ITC-IRST**).
- European Project ESPRIT-FUSE 24575, Title: “Optoelectronic Microsystem for Encoders (OPE)”, Prime Industrial Contractor ELTRA s.r.l., Sarego (Vicenza), Italy; Research-Unit Leader Dr. M. Zen, ITC-IRST, Trento, Italy; year 1997.
- Framework Agreement between Istituto Trentino di Cultura (ITC) and Istituto Nazionale di Fisica Nucleare (INFN), Title: “Protocollo di intesa per una collaborazione al fine di sviluppare e fabbricare rivelatori in silicio a microstriscia per esperimenti di fisica delle alte



- energie”, Research-Unit Leader Dr. M. Zen, ITC-IRST, Trento; years 1996-1999 (**task manager**).
- European Project ESPRIT 1500, MEPI-T-DIM 157, Title: “X-ray Spectrometer for Environmental Chemical Analysis (XSECA)”, Prime Industrial Contractor Silena s.p.a., Milan, Research-Unit Leader Dr. M. Boscardin, ITC-IRST, Trento, Italy; years 1996-1997
  - INFN Project (National Scientific Committee V), LAST experiment “Development of fabrication processes for detectors of radiation and charged particles with integrated front-end electronics”, National Coordinator Prof. Marcello Giorgi, INFN Pisa, Research-Unit Leader Prof. Giovanni Soncini, INFN Trento, years 1995-1997 (**task manager at aggregate partner ITC-IRST**).
  - MURST (Italian Ministry for University and Scientific and Technological Research), 60% Project, Title: “Microelectronic and nanoelectronic technologies”, Title of the specific program of the research unit: “Development of JFET-CMOS technological modules on Czochralsky and Float Zone silicon”, National Coordinator and Research-Unit Leader Prof. G. Soncini, University of Trento, year 1996.

## 8. SCHOLARSHIPS AND AWARDS:

October 2004: received a “Certificate for outstanding contributions in the field of nuclear radiation measurements” from the Radiation Instrumentation Steering Committee of the IEEE Nuclear & Plasma Science Society.

May 2004: received the 2004-2005 grant for the International Mobility Program between the University of Trento and the University of California.

July 1996: received a scholarship to attend the “Advanced Summer School on New Detectors for Radiation Measurements and Related Applications”, CNR/TESRE, Bologna (Italy), July 1-12, 1996.

July 1995: received a scholarship to attend the “International School on Materials Science and Technology: Silicon-Germanium high-speed electronics”, NATO Advanced Study Institute, Erice (Italy), July 13-25, 1995.

## 9. SCIENTIFIC AND INDUSTRIAL COLLABORATIONS

During his research activity, he has collaborated with several universities in Italy and with:

- Fondazione Bruno Kessler (formerly ITC-IRST, Trento, Italy)
- Optoelettronica Italia s.r.l. (Trento, Italy)
- CERN (Geneve, Switzerland)
- CSEM (Neuchatel, Switzerland)

- Italian National Institute of Nuclear Physics (INFN)
- Jozef Stefan Institute (Ljubljana, Slovenia)
- ST Microelectronics (Catania, Italy)
- Santa Cruz Institute for Particle Physics (Santa Cruz, USA)
- Stanford Linear Accelerator Center (SLAC, Stanford, USA)
- FERMILAB (Batavia, USA)
- Purdue University (West Lafayette, USA)
- University of New Mexico (Albuquerque, USA)
- Technical University of Munich (Munich, Germany)
- Technical University of Prague (Prague, Czech Republic)
- Albert Ludwig University of Freiburg (Freiburg, Germany)
- Manchester University (UK)
- University of Edinburgh (UK)
- CNM (Barcelona, Spain)
- IFAE (Barcelona, Spain)
- SINTEF (Oslo, Norway)

## 10. PROFESSIONAL SOCIETIES

- Member of the Institute of Electrical and Electronics Engineers (IEEE) from 1994 to 2006, **Senior Member of IEEE** since 2006 (Electron Devices, Solid-State Circuits, Photonics and Nuclear and Plasma Sciences Societies)
- Member of the International Society for Optics and Photonics (SPIE) since 2011
- Member of the Optical Society of America (OSA) since 2011
- Member of the International Association of Engineers (IAENG) since 2014

## 11. BOOK, JOURNAL AND CONFERENCE ROLES

He has been the editor of the book “Advances in photodiodes”, ISBN 978-953-7619-X-X, INTECH, Rijeka, Croatia, March 2011.

He has been an **Associate Editor of the “IEEE Transactions on Nuclear Science”** (ISSN 0018-9499) since May 2008.

He has been a member of the Editorial Board of “Informacije MIDEM – Journal of Microelectronics, Electronic Components and Materials” (ISSN 0352-9045) since May 2012.

He has been a member of the Editorial Board of “Sensors and Materials” (ISSN 0914-4935) since November 2012.

He has been a member of the Technical Committee and a reviewer for the International Conference “IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS-MIC)” since 2005.

He has been a member of the Technical Program Committee for the Conference on “Ph.D. Research in Microelectronics and Electronics (PRIME)” since 2011.

He has been a member of the Scientific Committee for the International Conference on “Radiation Effects on Semiconductor Materials, Detectors and Devices (RESMDD)” since 2012.

He has been session Chair at the: 2005, 2006, 2009, 2010, 2012, 2014 IEEE Nuclear Science Symposium; the 6<sup>th</sup> (2006), 7<sup>th</sup> (2009) and 9<sup>th</sup> (2013) International "Hiroshima" Symposium on the Development and Application of Semiconductor Tracking Detectors; the 7<sup>th</sup> Conference on Ph.D. Research in Microelectronics and Electronics (PRIME 2011), the 9<sup>th</sup> (2012) and 10<sup>th</sup> (2014) International Conference on Radiation Effects on Semiconductor Materials, Detectors and Devices.

He has been a reviewer for several other international conferences, e.g., Vertex, ICECS, MIDEM, EESMS.

He has been a reviewer of scientific books for CRC Press (Taylor and Francis group),

He has been a **reviewer for the following international journals** (in alphabetical order):

- Applied Optics
- Applied Physics B
- Applied Radiation and Isotopes
- Chinese Optical Letters
- IEEE Electron Device Letters
- IEEE Journal of Selected Topics in Quantum Electronics
- IEEE Sensors Journal
- IEEE Transactions on Circuits and Systems – II
- IEEE Transactions on Electron Devices
- IEEE Transactions on Nuclear Science
- International Journal of Numerical Modelling: Electronic Networks, Devices and Fields.
- Journal of Applied Physics
- Journal of Instrumentation
- Journal of Physics D: Applied Physics

- Material Science in Semiconductor Processing
- Measurement Science and Technology
- Microelectronics Engineering
- Microelectronics Journal
- Nuclear Instruments and Methods in Physics Research A
- Optical Engineering
- Optics Express
- Sensors
- Sensors, Sensors and Actuators A: Physical
- Sensors and Actuators B: Chemical
- Solid-State Electronics

## 12. PROJECT REVIEW

He has been a **reviewer of scientific projects** for the following funding agencies:

1. Provincia Autonoma di Trento (PAT), Progetti Legge 6
2. Italian Ministry for Education, University and Research (MIUR) Progetti FIRB
3. Agence Nationale de la Recherche (ANR, France)
4. Czech Science Foundation (Czech Republic)
5. Austrian Science Fund (FWF, Austria)
6. Qatar National Research Fund (QNR, Qatar)
7. Dutch Technology Foundation (STW, The Netherlands)

He has also been a reviewer for the Sensor Engineering Design Review of CERN LHCb VELO Upgrade project.

## 13. PhD THESIS REVIEW

He was an **external reviewer of PhD Theses** for:

- the University of Edinburgh (UK) in 2012
- the Polytechnic of Milan (Italy) in 2012
- the University of Padua (Italy) in 2013

## 14. EVENT ORGANIZATION

In 2005, he was among the initiators, and since he has been a member of the organization committee for the “Trento Workshop on Advanced Silicon Radiation Detectors”, which celebrated its 10<sup>th</sup> anniversary edition on Feb. 17-19, 2015.

He was the General Co-Chair of the "XVIII AISEM Annual Conference", Trento (Italy), February 3-5, 2015.

He was the Co-Organizer of the 2014 Summer School on "Neutron Detectors and Related Applications (NDRA2014)", Riva del Garda (Italy), June 30 - July 4, 2014.

He was the local organizer of the "1<sup>st</sup> INFN Workshop on Future Detectors for HL-LHC (IFD2014)", Trento, March 11-13, 2014.

He was the General co-chair for the "7<sup>th</sup> Conference on Ph.D. Research in Microelectronics and Electronics (PRIME 2011)", Madonna di Campiglio (Italy), July 4-8, 2011.

He was the local organizer of the "41<sup>st</sup> Annual Meeting of the Italian Group of Electronics (GE2009)" and of the related Doctorate School, Trento, June 15-19, 2009.

He was a member of the organizing committee for the Workshop honoring Prof. Giovanni Soncini "Trentino as a lab: the role of Electronics", Trento, March 17, 2009.

He was the local organizer for the course "CMOS Analog Integrated Circuit Design", given by Prof. Phillip E. Allen, Georgia Institute of Technology (Atlanta, USA), Trento, October 13-17, 2003 that was attended by more than 70 people from all over Italy.

## 15. TECHNOLOGY TRANSFER

He has been **co-inventor of 5 patents**:

- P.1. European Patent nr. 0907208 of 18/12/2002, title: "A process for manufacturing JFET devices and related device"
- P.2. Italian Patent n. TO2004A000543 of 02/08/2004, title: "Dispositivo per la rivelazione di radiazione elettromagnetica, pixel e matrice di pixel comprendenti siffatti dispositivi, e sensori ottici comprendenti una matrice di pixel"
- P.3. Italian Patent n. TO2004A000901 of 23/12/2004, title: "Procedimento per la realizzazione di un rivelatore di radiazioni ionizzanti a stato solido"
- P.4. European Patent n. WO/2012/172490 (PCT/IB2012/052975) of 20/12/2012, title: "A containment apparatus for a sensor"
- P.5. US Patent n. US 20140151556 A1 of 05/06/2014, title: "Device and method for estimating the concentration of gas radon"

In 2011, he **co-founded RSens** ([www.rsens.it](http://www.rsens.it)), a joint **spin-off company** of the University of Trento and the University of Modena e Reggio Emilia, that operates in the field of Radon gas monitoring systems.

## 16. TEACHING AND STUDENT SUPERVISION

February 2000 – today: He has been the **official instructor of 50 courses in Electronics** (SSD ING-INF/01) at the University of Trento, at both the undergraduate (24) and graduate (25) level, covering the following fields: semiconductor devices, microelectronic technologies, basic analog and digital circuits, solid-state sensors and detectors, numerical simulations.

April-May 1997 & January 1998: **Teaching Assistant** of “Materials, Technologies and Components for Electronics” (Lecturer: Prof. Giovanni Soncini) at the Materials Engineering School of the University of Trento, Trento, Italy.

February 1994-June 1996: **Electronics Laboratory Assistant** at the Materials Engineering School of the University of Trento, guiding students during laboratory experience for the courses of “Circuit Theory” and “Materials, Technologies and Components for Electronics”.

He was thesis **advisor or co-advisor of 14 PhD students** at the University of Trento:

- Ekaterina Panina, "Design and characterization of SPAD based CMOS analog pixels for photon-counting applications", PhD Thesis in ICT, Advisor Prof. Gian-Franco Dalla Betta, Co-Advisor Dr. Lucio Pancheri, a.y. 2012-2013
- Elisabetta Mazzuca, "A novel high-efficiency SiPM-based system for Ps-TOF", PhD Thesis in ICT, Advisor Dr. Claudio Piemonte, Co-Advisors Prof. Gian-Franco Dalla Betta, Dr. Alberto Gola, a.y. 2012-2013
- Marco Povoli, "Development of enhanced double-sided 3D radiation sensors for pixel detector upgrades at HL-LHC", PhD Thesis in ICT, Advisor Prof. Gian-Franco Dalla Betta, a.y. 2011-2012
- Olga Shcherbakova, "3D camera based on gain-modulated CMOS avalanche photodiodes", PhD Thesis in ICT, Advisor Prof. Gian-Franco Dalla Betta, Co-Advisor Dr. Lucio Pancheri, a.y. 2011-2012
- Vladyslav Tyzhnevyyi, "BJT Detector for Alpha Particle and Radon Detection and Monitoring", PhD Thesis in ICT, Advisor Prof. Gian-Franco Dalla Betta, a.y. 2010-2011
- Michele Benetti, "Simulation and Characterization of Single Photon Detectors for Fluorescence Lifetime Spectroscopy and Gamma-ray Applications", PhD Thesis in ICT, Advisors Prof. Gian-Franco Dalla Betta and Dr. David Stoppa, a.y. 2010-2011

- Quazi Delwar Hossain, "Design and characterization of a Current Assisted Photo Mixing Demodulator for TOF based 3D CMOS Image Sensor", PhD Thesis in ICT, Advisor Prof. Gian-Franco Dalla Betta, a.y. 2009-2010
- Marina Repich, "Development of a simulation environment for the analysis and the optimal design of fluorescence detectors based on single photon avalanche diodes", PhD Thesis in ICT, Advisors Prof. Gian-Franco Dalla Betta and Dr. David Stoppa, a.y. 2008-2009
- Alena Repchankova, "Anti-Stiction And Self-Recovery Active Mechanisms For High Reliability RF-MEMS Switches", PhD Thesis in ICT, Advisors Prof. Gian-Franco Dalla Betta and Dr. Jacopo Iannacci, a.y. 2008-2009
- Andrea Zoboli, "Development of radiation detectors with three-dimensional electrodes for future high energy physics experiments", PhD Thesis in ICT, Advisor Prof. Gian-Franco Dalla Betta, a.y. 2007-2008 (Best Doctorate Student Award, University of Trento)
- Francesco Ficorella, "3DJAM: A Linear CMOS Sensor for 3D Vision with Merged i-TOF and OT Techniques", PhD Thesis in ICT, Advisor Prof. Gian-Franco Dalla Betta, a.y. 2005-2006
- Lucio Pancheri, "Design and characterization of novel silicon photodetectors for 3D imaging applications", PhD Thesis in ICT, Advisor Prof. Gian-Franco Dalla Betta, a.y. 2004-2005 (Best Doctorate Student Award, University of Trento)
- Arianna Tibuzzi, "An Innovative Electro-Optical Nose for Artificial Olfaction Applications", PhD Thesis in ICT, Advisor Prof. Giovanni Soncini, Co-Advisors Prof. Arnaldo D'Amico, Prof. Gian-Franco Dalla Betta, a.y. 2003-2004 (Best Doctorate Student Award, University of Trento)
- David Stoppa, "Integrated CMOS optical sensors for advanced applications", PhD thesis in "Electronic Devices", Advisor Dr. Gian-Franco Dalla Betta, a.y. 2001-2002.

He is currently **advisor or co-advisor of 5 PhD students** at the University of Trento:

- Mostafa Ahmed Soliman Khatib, PhD Student in Materials, Mechatronics and Systems Engineering, XXX cycle
- DMS Sultan and Olufemi Akindele Olomudeji, PhD Students in Materials, Mechatronics and Systems Engineering, XXIX cycle
- Roberto Mendicino and Hesong Xu, PhD Students in Information and Communication Technology, XXVIII cycle

At the University of Trento he was **advisor or co-advisor of:**

- 6 graduate students for their 2<sup>nd</sup> Level Professional Master thesis in Nano- and Micro-Electro-Mechanical-Systems
- 9 students for their MSc theses in Materials Engineering
- 2 students for their MSc theses in Physics

- 37 students for their MSc theses in Telecommunication Engineering
- 74 undergraduate students for their theses in Telecommunication Engineering
- 47 undergraduate students for their theses in Electronics and Telecommunication Engineering
- 1 undergraduate student for his thesis in Industrial Engineering
- 1 undergraduate student for his thesis in Civil Engineering

He was **co-advisor of MSc theses at other Universities:**

- 1 student for his MSc thesis in Electronics Engineering at the University of Padua, Italy
- 2 students for their MSc theses in Physics at the University of Turin, Italy

He was **supervisor of the final year internships at the University of Trento for:**

- 3 MSc students from the Birla Institute of Technology and Science (BITS), Pilani (India)
- 1 MSc student from the Universitat Politecnica de Catalunya, Barcelona (Spain)

He was also **supervisor for the internships at the University of Trento** for students from the US within **the INFN-DOE exchange program:**

- 2 MSc students from the University of California Santa Cruz
- 1 MSc student from the University of Hawaii

He was also **supervisor for the internships at the University of Trento** for PhD students within **the Erasmus-Averroes mobility program:**

- 1 PhD student from the University of Constantine, Algeria
- 1 PhD student from the University of Batna, Algeria

## 17. FACULTY AND DEPARTMENT SERVICE

Since the appointment as Associate Professor (01/11/2002), Gian-Franco Dalla Betta has carried out several organizational and service activities at the University of Trento.

### a. Faculty of Engineering (2002-2012)

- Member of the Library Commission (from 2002 to 2012)
- Member of the Commission for the “Study Regulations of the Master of Science in Telecommunication Engineering” (from 2002 to 2003)
- Member of the Commission for the "Study of the minimum criteria for access to the Faculty of Engineering” (from 2003 to 2004)
- Member of the Commission for the “Equipment for teaching” (from 2005 to 2011), President of the same Commission (from 2009 to 2012)
- Member of the Commission for Construction (2009-2012)



- Member of the Commission for the evaluation of curricular requirements and the assessment of personal preparation for the Admission to Graduate Studies in Information Engineering (from 2010 to 2012)
- Member of final graduation exams in Telecommunication Engineering and Materials Engineering (2002-2012)
- Effective Member of the Commission for the public examination for the license to practice as a professional engineer in 2004 and 2012.
- Aggregate member of the Commission for the public examination for the license to practice as a professional engineer in 2006.
- Initial proponent and Member of the Executive Committee of the 2nd Level Professional Master in "Nano- and Micro-Electro-Mechanical-Systems (NEMS-MEMS), co-managed by the University of Trento and Fondazione Bruno Kessler (FBK) of Trento (from 2006 to 2010)
- Vice-President of the Board for Undergraduate and Graduate Programs in Information Engineering (from 2005 to 2007)
- b. Department of Information Engineering and Computer Science (2002-2012)
  - Member of the commission for the evaluation of scientific publications (from 2005 to 2012)
  - Responsible of the "Nano and Microsystems" Research Program (from 2006 to 2012)
  - Member of the commission for the evaluation of proposals for the Application Labs. in 2008
  - Member of the interdepartmental commission for the research laboratory network (from 2009 to 2012)
- c. International Doctorate School in Information and Communication Technology (2003-2012)
  - Member of the committee for graduate studies and of the steering committee of the School (from 2003 to 2012)
  - Member of the commission for the Manifesto of Studies (from 2003 to 2004)
  - Member of the commission for the Comprehensive Exam (from 2002 to 2004)
  - Member of the commission for the Qualifying Exam from 2004 to 2005
  - President of the commission for the Qualifying Exam from 2005 to 2008
  - President of the Admissions Committee in 2006, 2009, and 2010
  - Member of theses defense Committees in 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014.
  - Deputy-Dean of the School (from 2008 to 2012)
  - Temporary Dean of the School from July 2012 to October 2012
- d. Department of Industrial Engineering (2012-today)
  - Member of final graduation exams in Industrial Engineering and Mechatronics Engineering (from 2012)
  - Member of the interdepartmental working group for the University libraries (from 2013)

- Member of the Joint Faculty-Student Committee (from 2013)
- e. International Doctorate School in Materials, Mechatronics and Systems Engineering (2013-today)
  - Member of the committee for graduate studies and of the executive committee of the School (from 2013)
  - Member of the Admissions Committee in 2013 and 2015.

## **18. SERVICE AT OTHER UNIVERSITIES**

- Member of the theses defense Committee for the PhD in Electronic Engineering at the University of Padua (Padua, Italy) in 2007.
- Member of the Selection Committee for a position of Research Assistant in Electronics at the Polytechnic University of Marche (Ancona, Italy) in 2008.
- Member of the theses defense Committee for the PhD in Electronic Engineering at the Mediterranean University of Reggio Calabria (Reggio Calabria, Italy) in 2010.
- Member of the Admissions Committee for the PhD School of Microelectronics at the University of Pavia (Pavia, Italy) in 2010.
- Member of the Examination Committee for the degree of PhD by Research at the University of Edinburgh (Edinburgh, UK) in 2012.
- Member of the theses defense Committee for the PhD in Physics and Astrophysics at the University of Turin (Turin, Italy) in 2013, 2014, and 2015.
- Member of the Selection Committee for Grants for Senior Researchers in Information Engineering at the University of Padua (Padua, Italy) in 2014.

**19. LIST OF PUBLICATIONS****[IJ] Papers published in international journals**

- [IJ.1] **G. F. Dalla Betta**, S. Graffi, Zs. M. Kovacs, G. Masetti, “CMOS implementation of an analogically programmable cellular neural network”, **IEEE Trans. on Circuits Systems-II**, vol. 40(3), pp. 206-215, 1993
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## Curriculum Vitae di **Cristiana Peroni**

Laureata in Fisica presso l'Università di Torino nel 1974, ha iniziato la sua attività scientifica come ricercatore dell'Istituto Nazionale di Fisica Nucleare nel campo della fisica sperimentale delle particelle elementari.

E' stata Research Fellow al CERN, Associee de Recherche al Laboratoire de Annecy de Physique des Particules, Research Associate all'Università di Rochester (N.Y.) ed alla University of Indiana, Bloomington.

Nel 1988 e' divenuta Professore Associato di Fisica presso la Facolta' di Farmacia dell'Università di Torino e dal 2001 e' Professore Ordinario presso la Facolta' di Scienze MFN della stessa Università'.

Dal 2007 e' Socio corrispondente dell'Accademia delle Scienze di Torino.

Ha insegnato nei corsi di Fisica per Farmacia e per Scienze Motorie. E' attualmente titolare del corso di Fisica Medica e di quello di Laboratorio di Fisica Sanitaria per la Laurea Magistrale in Fisica Ambientale e Biomedica, di cui coordina l'indirizzo biomedico; del corso di Fisica I per la scuola di Specializzazione in Fisica Sanitaria; e' inoltre co-titolare del corso di Fisica della Materia Vivente per la laurea triennale in Fisica e del corso Fisica per la Laurea in Chimica e Tecnologie Farmaceutiche.

E' Direttore della Scuola di Specializzazione in Fisica Medica e membro del Collegio dei Docenti della Scuola di Dottorato di Scienza ed Alta Tecnologia dell'Università di Torino.

La sua attività di ricerca si e' svolta nel campo della fisica sperimentale delle particelle elementari contribuendo principalmente allo studio della struttura dei nucleoni a basso ed alto momento trasferito, con misure del fattore di forma del protone e delle sue funzioni di struttura con fasci di antiprotoni, muoni ed elettroni. Ha inoltre studiato la produzione di mesoni vettori nelle interazioni leptone protone e leptone nucleo ad alte energie.

Attualmente svolge attività di ricerca prevalentemente nel campo della fisica medica con particolare interesse allo sviluppo di rivelatori per il controllo e la dosimetria di fasci terapeutici di fotoni, elettroni e adroni in collaborazione con istituzioni di ricerca italiane ed estere e con l'industria. L'attività nel campo della fisica medica ha portato, tra gli altri risultati, alla realizzazione di camere a ionizzazione di nuova concezione per la misura delle distribuzioni di dose da fasci terapeutici di fotoni, protoni e ioni. Tali strumenti, oggetto di tre brevetti, sono stati ingegnerizzati e commercializzati dalla Scanditronix-Wellhofer (gruppo IBA), azienda leader nel campo delle apparecchiature di uso medico.

Ha presentato i risultati delle sue ricerche in fisica sperimentale delle alte energie ed in fisica medica in numerose conferenze internazionali ed ha pubblicato piu' di 250 lavori in riviste internazionali.

## **Curriculum Vitae di Angelo Rivetti**

Angelo Rivetti è attualmente primo tecnologo presso la Sezione di Torino, dove si è occupato e si occupa della progettazione di circuiti integrati VLSI analogici e mixed-signal.

Si è laureato in fisica nel 1995 presso l'Università degli Studi di Torino ed ha ottenuto il Dottorato di Ricerca in Ingegneria Elettronica e Telecomunicazioni dal Politecnico di Torino. Dal 1998 al 2000 è stato *Doctoral Fellow* presso il gruppo di microelettronica del CERN di Ginevra, dove ha svolto ricerche sull'utilizzo di tecnologie CMOS deep submicron per il disegno di circuiti integrati tolleranti alle radiazioni.

Dal 2001 è di ruolo presso la Sezione di Torino dell'INFN, dove ha sviluppato elettronica integrata di front-end per gli esperimenti ALICE e COMPASS al CERN e svolto ricerche su sistemi avanzati per la lettura di rivelatori a pixel ibridi. Presso l'INFN è stato responsabile nazionale del progetto LePix ed è attualmente responsabile nazionale del progetto SEED, entrambi finalizzati allo sviluppo di sensori monolitici innovativi. Si occupa inoltre del disegno di sistemi VLSI di timing ad alta risoluzione per applicazioni in fisica medica ed in ambito industriale.

Angelo Rivetti è membro dell'IEEE ed ha partecipato al program committee della conferenza IEEE Nuclear Science Symposium and Medical Imaging conference, in qualità di revisore di articoli, chairman di Sessioni e organizzatori ed insegnante di corsi specialistici. E' inoltre reviewer per riviste internazionali quali IEEE Transactions on Nuclear Science, Nuclear Instruments and Methods in Physics research e Journal of Instrumentations. Ha ottenuto il 28/11/2014 l'abilitazione a Professore Ordinario in Fisica Sperimentale delle Interazioni Fondamentali (Settore concorsuale 02/A1) e nel 2015 è risultato idoneo al concorso per Dirigente Tecnolgo presso l'INFN (bando 16619/2014).

E' titolare dei corsi di Elettronica Applicata e Microelettronica presso la laurea magistrale in fisica dell'Università di Torino e di Microelettronica per Rivelatori di Radiazione presso la Scuola di Dottorato del Politecnico di Torino. Autore e coautore di più di cento lavori scientifici pubblicati in ambito internazionale, ha pubblicato nel 2015 il libro "CMOS Front-End Electronics for Radiation Sensors", edito da CRC-Pess, (Taylor & Francis group, Stati Uniti d'America).