

# Digital Silicon Photo-multipliers: Design and Applications

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Until recently, photomultiplier tubes have been the detector of choice for sensing low photon emission in many scientific applications. The rise of silicon photomultiplier technology has changed the *status quo* creating a true revolution in single-photon sensing and time-resolved imaging.

While analog silicon photomultipliers (a-SiPMs) have appeared first and are still dominating the scene, digital silicon photomultipliers (d-SiPMs) are making headways in many scientific disciplines due to their different approach to photon detection. However, doubts still exist on the real advantages of d-SiPMs.

In this talk we will address some of the most common myths and misconceptions, while exposing what we believe to be the true advantages of d-SiPMs in the context of specific applications, such as positron emission tomography (PET). We will discuss the emergence of deep-submicron CMOS single-photon avalanche diodes, and how they can enable the design of better d-SiPMs. Time-of-arrival single-photon detection can now be implemented on chip or even on-pixel, thus the dream of a completely standalone d-SiPM on a phothead is getting near.

## Biography



**Edoardo Charbon** (SM'00) received the Diploma from ETH Zurich in 1988, the M.S. degree from UCSD in 1991, and the Ph.D. degree from UC-Berkeley in 1995, all in Electrical Engineering and EECS. From 1995 to 2000, he was with Cadence Design Systems, where he was the architect of the company's initiative on information hiding for intellectual property protection purposes. In 2000, he joined Canesta Inc. as its Chief Architect, leading the development of wireless 3-D CMOS image sensors. Since November 2002, he has been a member of the Faculty of EPFL in Lausanne, Switzerland, working in the field of CMOS sensors, biophotonics, and ultra low-power wireless embedded systems. In Fall 2008 he has joined the Faculty of TU Delft, as full professor in VLSI design, succeeding Patrick Dewilde.

Dr. Charbon has consulted for numerous organizations, including Texas Instruments, Agilent, and the Carlyle Group. He has published over 200 articles in technical journals and conference proceedings and two books, and he holds 13 patents. His research interests include high-performance imaging, quantum integrated circuits, and design automation algorithms.

Dr. Charbon has served as Guest Editor of the TRANSACTIONS ON COMPUTER-AIDED DESIGN OF INTEGRATED CIRCUITS and SYSTEMS and the JOURNAL OF SOLID STATE CIRCUITS and as Chair of technical committees in ESSCIRC, ICECS, ISLPED, and VLSI-SOC.