***The IC Design, Processes & Methodology (ICDPM) research programme creates value for Philips by turning ideas into microelectronics*, says programme manager Gerard Beenker. Here you can read more about the purpose of this programme, his role, the people involved and the important projects.**

Gerard Beenker

Programme manager IC Design, Processes & Methodology

What is the main purpose of the programme?
Our ambition is to create value for Philips, and in particular for Philips Semiconductors, by developing new IC process technologies, device modelling and characterization, and designing advanced RF, mixed-signal and digital circuits. The ICDPM programme covers the activities in the IC Process Technology sector of Carel van der Poel and my IC Design sector. The research on new IC process technologies is done in Leuven, in close cooperation with IMEC.

Who are involved?
The groups involved are those of Casper Juffermans (CMOS Module Integration) and André Montree (Silicon Process Options), both in Leuven, and those of Reinout Woltjer (Device Modelling), Neil Bird (Integrated Transceivers), Leo Warmerdam (Mixed-Signal Circuits & Systems) and Ad ten Berg (Digital Design & Test). There are contributions from other groups as well. Satyen Mukherjee (Research Briarcliff) and Francois Martin (Research Program Office) are helping us with the strategy development and the organization of the programme.

Real breakthrough innovation comes from multidisciplinary activities

How do you see your role?
It is my responsibility to ensure that there is an excellent programme in place, well aligned with the businesses of Philips and well balanced between short-term, mid-term and long-term activities. For this, I heavily rely on the contributions of the ICPDM programme management team members. Almost daily, I have discussions with Carel van der Poel, who is responsible for the IC process technology research and for the interaction with IMEC and the other process technology partners. We try to optimize the interaction between IC process technology and IC design. I think that it is also important to have a strong working relationship with the other Research programmes, since I am convinced that real breakthrough innovation comes from multidisciplinary activities.
In addition to being programme manager, I am also the Research account manager for Philips Semiconductors. This combination of roles is very beneficial for a programme that is heavily focused on Philips Semiconductors.

Which are the important projects?

CMOS technology
Research in CMOS technology is characterized by an exponential increase of the number of transistors (Moore's law). To cope with the ever-increasing process development costs, Philips Semiconductors has created a partnership with ST Microelectronics and Motorola, with a joint development and manufacturing facility in Crolles, France. The new 300-mm facility is ramping up and expects to have 90-nm ICs in production before the end of this year. The work on 65-nm ICs is finished and almost completely transferred to Crolles. The three partners have a joint research project for 45-nm technologies. Next to the 45-nm CMOS process research, new device architectures are studied for even more advanced technologies. Together with its alliance partners, Philips is again one of the leaders in CMOS technology.

Non-volatile memories
Various consumer systems, in particular battery-operated systems, require non-volatile memories. We develop process options to allow these memories to be embedded in CMOS circuits. The output has generated substantial value for Philips Semiconductors. It is difficult to scale beyond 90 nm, but several possibilities are under investigation. Alternative non-volatile options are being studied together with the Lighting, Devices & Microsystems research programme.

Philips is again one of the leaders in CMOS technology

Compact device models
To be able to predict the behaviour of circuits, IC designers need compact-model descriptions of the transistor behaviour. Due to the ever-increasing miniaturization of these devices, the models become very advanced. Many experts consider our compact models for CMOS (MOS Model 11) and bipolar devices (Mextram) as the best in the world. These models are publicly available and are implemented in almost all commercial circuit simulators.

Deep-submicron circuit design
With decreasing feature sizes and increasing clock frequencies and circuit complexity, physical effects dominate the performance, reliability and signal integrity of current and future ICs. We study these effects and develop circuit techniques and design rules to cope with these problems. These design rules are of utmost importance to ensure working silicon.

Philips Research is seen as a centre of excellence in mixed-signal IC design

A/D and D/A converters
Consumer systems are becoming more and more digital. The external world, however, remains analog in nature, and systems will always need analog-to-digital (A/D) and digital-to-analog (D/A) converters. Since systems become more and more demanding with respect to resolution and bandwidth, new converter architectures need to be invented. Philips Research is seen as a centre of excellence in mixed-signal IC design.

RF CMOS
Until recently, RF front-ends were mostly designed in bipolar processes. Thanks to the technology developments, various RF front-ends can now be designed in CMOS. We have built quite some expertise in the design of CMOS Bluetooth, ZigBee and 802.11a front-ends, and we share our expertise with the development teams of Philips Semiconductors.

What is your opinon about programme management?
Programme management has proven to be very instrumental in aligning the projects in the various groups and also in managing the interaction between the various programmes. The major challenge for programme management is to exploit the enormous amount of talent we have in Research and to turn that into profitable businesses for Philips.