In Silicon micro-electronics a broad range of functionalities is realised from a rather small set of basic building blocks, like transistors, diodes, resistors, capacitors and interconnection tracks. By connecting these building blocks in different numbers and topologies we can realize a huge variety of circuits and systems, with complexities ranging from a few hundred up to over a billion transistors. In photonics we can actually do something similar. On inspection of the functionality of a variety of optical circuits we see that most of them consist of a rather small set of components: lasers, optical amplifiers, modulators, detectors and passive components like couplers, filters and (de)multiplexers. By proper design these components can be reduced to an even smaller set of basic building blocks. In a generic integration technology that supports integration of the basic building blocks we can realize a variety of functionalities.

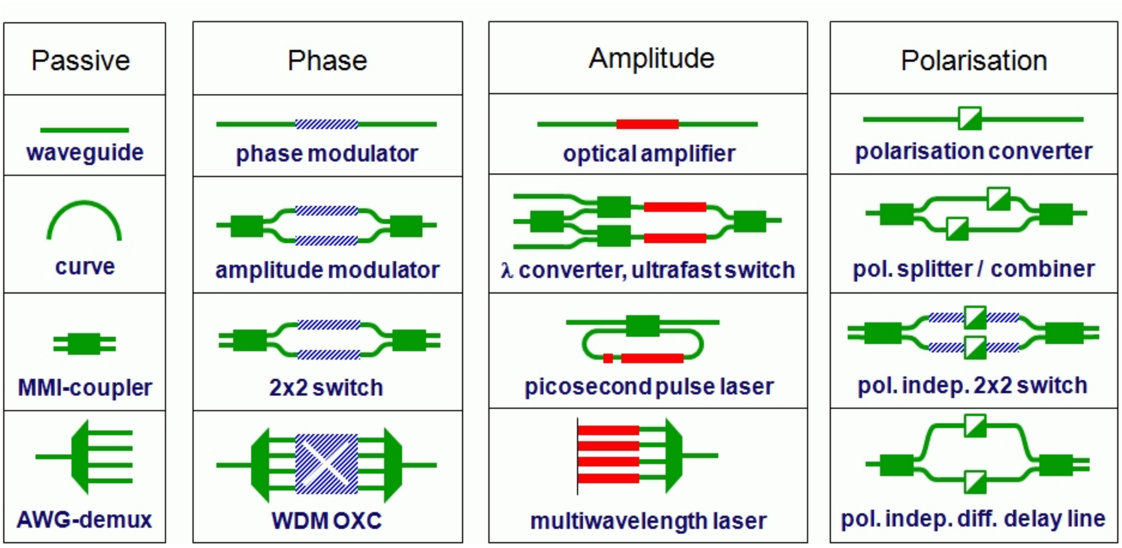

Figure 3 Example of the functionalities that can be realised in a generic integration technology that supports four basic building blocks: Passive Waveguide Devices (PWD), (Optical) Phase Modulators (PHM), Semiconductor Optical Amplifiers (SOA) and Polarisation Convertors.

Figure 3 illustrates which functionalities can be realised in a generic Indium Phosphide technology that supports integration of three basic building blocks: passive waveguide devices (PWD), phase modulators (PHM) and Semiconductor Optical Amplifiers (SOA). With these building blocks a variety of modulators, switches and lasers can be realised. Most of the examples in figure 3 have been reported in the scientific literature and additionally presented as the experimental generic technology that has been developed within the JePPIX platform. They illustrate the fact that a generic foundry approach similar to that applied in CMOS is indeed also feasible in photonics. Figure 4, for example, shows a photograph of an integrated discretely tuneable laser with nanosecond switching speed, useful for packet switching applications, which has recently been developed in a generic technology by the COBRA institute of the TU Eindhoven. The schematic on the left shows how the laser is composed of only two basic building blocks: passive waveguides in the MMI-coupler, the AWG demultiplexer and the interconnections, and Semiconductor Optical Amplifiers for amplification and switching. Chip dimensions are 1.5 x 3.5mm^2.

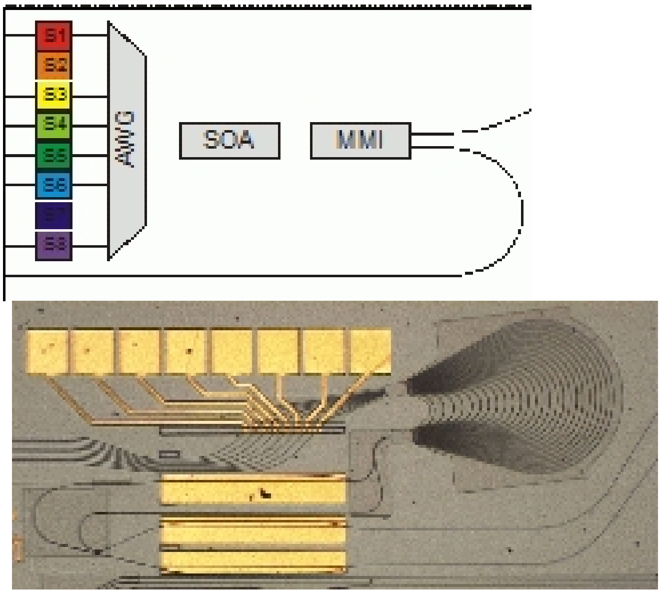

Figure 4 Circuit scheme and microscope photograph of a fast discretely tuneable laser with 100GHz channel spacing which has recently been realised in the COBRA InP-based generic integration process. Chip dimensions are 1.5 x 3.5mm2 [4].

The JePPIX platform has been already used by researchers of the University of Cambridge, Technical University of Denmark, University of Tokyo, University of Gent, Politecnico di Torino, Universidad Politécnica de Valencia and ENST Paris, and a number of highly innovative devices have resulted. Interest in using the platform is increasing rapidly and presently exceeds the available capacity. The reliability and the performance of the experimental research platform, although excellent for proof-of-concept, are not adequate for highly reproducible manufacturing as required in commercial applications.

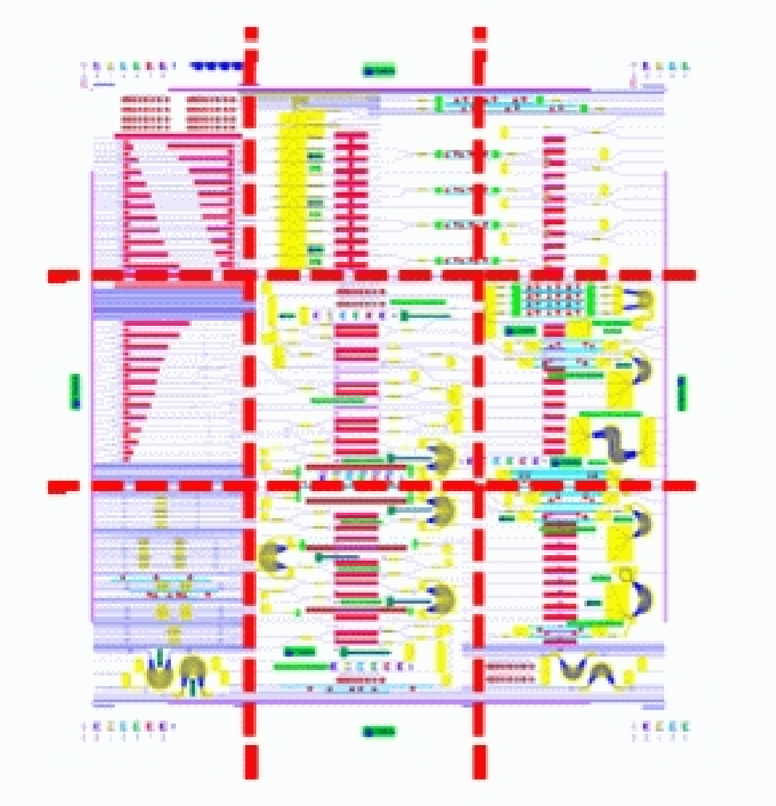

Figure 5 Multi-project mask carrying seven user designs, and test structures, developed in the JePPIX Platform.

An advantage of generic integration technologies is that, because they can serve a large market, they justify the investments in developing the technology for a very high performance at the level of the basic building blocks, which will make circuits realised in this technology highly competitive. This performance will not apply for every application, of course. Just like in CMOS different classes of applications need different processes, e.g. for high-voltage, high power or low power, high speed etc. In a similar way generic photonic processes will need a few different generic technologies, optimized for different kinds of applications, to cover a major part of all applications. In a fully-fledged generic integration technology we will need a few additional building blocks, like polarisation converters for on-chip handling and control of polarisation, DBR gratings as on-chip reflectors, and Fibre Mode Adapters for low-loss coupling to fibres. And we might also want a process with compact Electro-Absorption Modulators instead of the longer phase modulators. But the number of basic building blocks will remain pretty small, and the number of generic technologies required is far smaller than the number of technologies which are presently in use.

Today several companies in Europe have integration processes that are suitable as a starting point for development of a truly generic integration process. What is missing still is the organizational and software infrastructure essential for providing easy and low-cost access.

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