THE INTEGRATED PHOTONICS REVOLUTION

April 11th 2017

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OUTLINE

- Introduction to SMART Photonics
- Photonic integration
  - Generic platform
  - Applications and examples
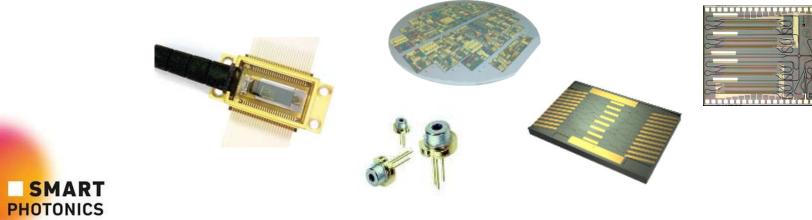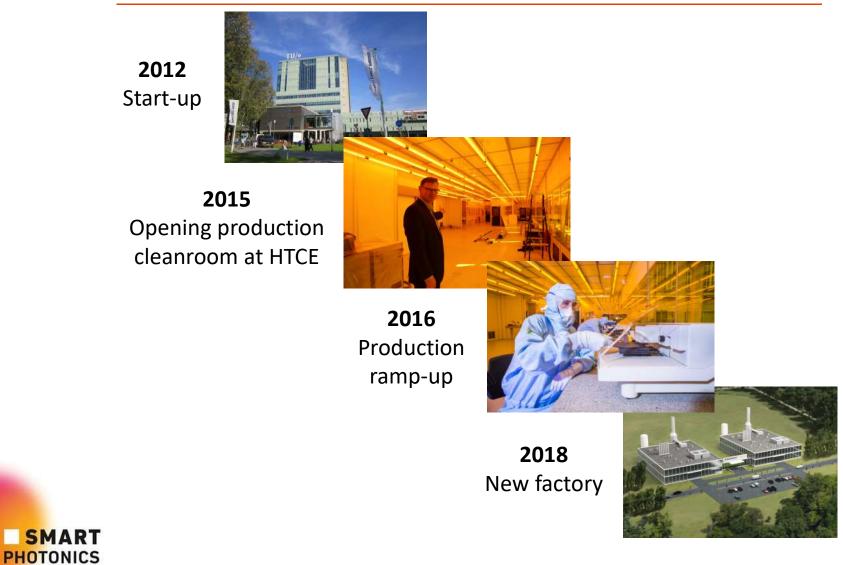 - MPW service
- Application examples
- Summary

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WHO ARE WE?

SMART Photonics B.V. founded in 2012

Independent Foundry for InP based Photonic components

1998	2003	2009	2012

| Philips Optoelectronic Center | JDS Uniphase | Cedova | Philips Research - Photonics Lab | SMART Photonics |

| Generic Integration Technology by TU/e |

WE ARE MOVING FAST!

2012
Start-up

2015
Opening production
cleanroom at HTCE

2016
Production
ramp-up

2018
New factory

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OUR FACILITIES

- SMART Photonics

  @High Tech Campus
  - 570m^2 3" Production cleanroom (Class 1000)
    - Processing and epitaxy

- SMART Photonics

  @NanoLab cleanroom Eindhoven
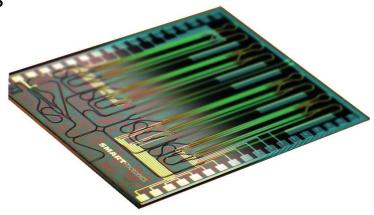 - 850m^2 Fully equipped R&D facility

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OUR CAPABILITIES

|	
Epitaxy	Multi-wafer MOVPE reactors for base wafer growth, regrowth and overgrowth
Lithography	High throughput, high resolution (>100 nm) - **DUV scanner** 0.7 µm projection litho – I-Line stepper High resolution (<100 nm) – E-beam 0.6 µm contact litho – contact aligner
Etching	Cassette-based wet etching ICP for single and multi-wafer etching RIE dedicated tools for photoresist, dielectric and polymer etching
Dielectrics	PECVD for SiO_x and SiN_x
Metallization	E-beam evaporation Sputtering Plating
Back-end	Grinding and polishing Scribe and break Optical coatings

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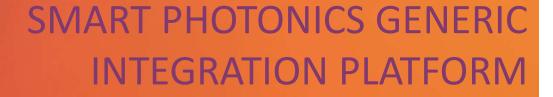
WHAT MAKES US SPECIAL

- People
  - Knowledge and experience in photonics and semiconductor processing
- Capabilities
  - Full process from Epi to coating of facets
  - Unique tools (3" ASML scanner for high resolution litho)
- Proposition
  - Unique PIC technology
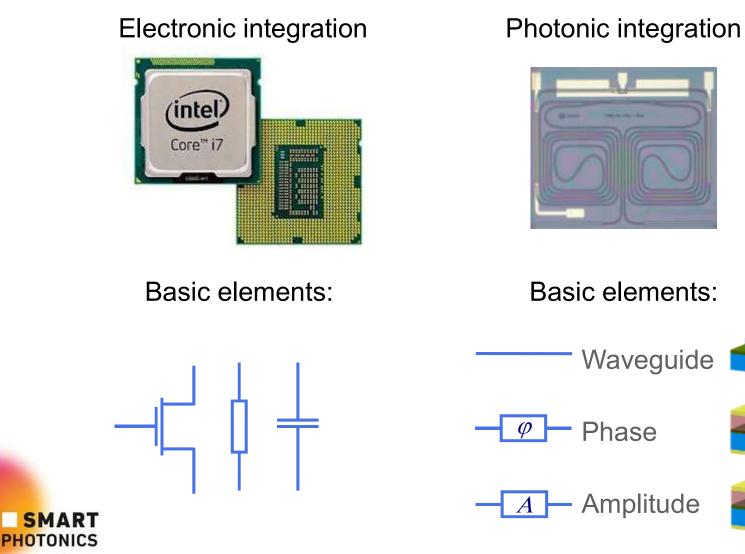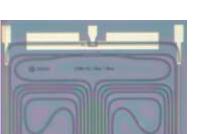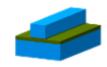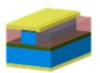 - Buried Hetero DFB process

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SMART PHOTONICS GENERIC
INTEGRATION PLATFORM

GENERIC INTEGRATION PHILOSOPHY

Electronic integration

Photonic integration

Basic elements:

Basic elements:

Waveguide

φ Phase

A Amplitude

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SEMICONDUCTORS

		Existing	New
Products	**New**	**Extended functionalities** High tech equipment Games Medical equipment Mobile Phones	**New functionalities create new applications** Computers/Notebooks Tablets Smart phones Google/Facebook
	Existing	**Same functionality on smaller footprint** High tech applications Radio Calculator TV	**Same functionality in new applications** Aviation/Space applications Car and mobile radio Flat screens

Markets

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		Markets	
		Existing	**New**
Products	**New**	**Extended functionalities** FBG for Medical sensing and positioning 5G Antenna systems LIDAR	**New functionalities create new applications** ?
	Existing	**Same functionality on smaller footprint** Sensing for high tech applications (FBG/Analyzing) Telecom/Datacom	**Same functionality in new applications** Fiber to the chip FBG in aviation/ pace Point of care medical analysis

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PHOTONIC INTEGRATION
MAKES THE DIFFERENCE!

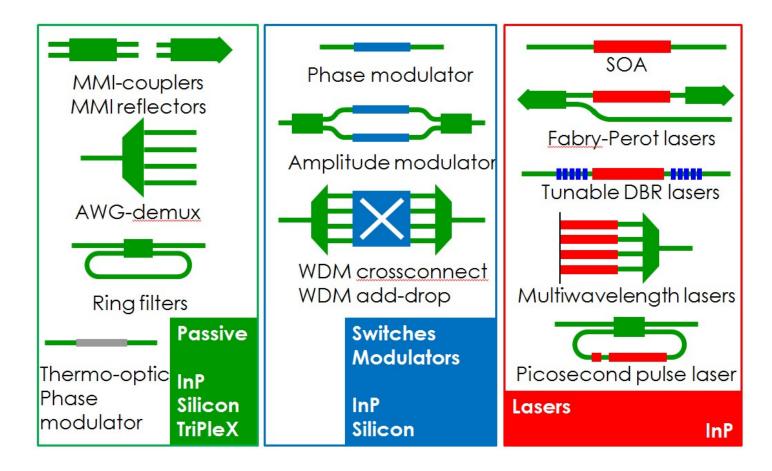- The SMART Photonics Generic Integration Technology makes the difference enabling a wealth of new applications

OUR GENERIC INTEGRATION PLATFORM

- *Standardized industrial* integration process
- Design on *functional level* by using *building block* approach
- Software design kits for fast and accurate design
- Multi-project wafer (MPW) runs for *fast* and *cost efficient* prototyping
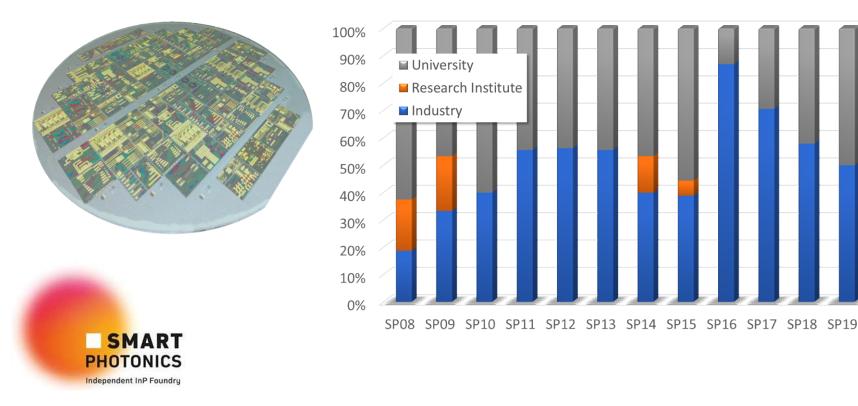- Enables *fast up-scaling* to high volume manufacturing

Generic building blocks

Collaboration

Allow basic construction

Increase complexity

Requiring custom building block development

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INP PLATFORM CAPABILITIES

OUR MPW SERVICE

- World's first commercial MPW run on InP in July 2013
- MPW run starts every quarter
- Low threshold access to a new technology
- Over 200 designs fabricated!

■ University
■ Research Institute
■ Industry

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PDK: BUILDING BLOCK LIBRARY

- Process Design Kit is available
  - For **circuit simulation** and **mask design**
  - **Design manual** and **Functional** building block description
  - Full **layout-aware** design flow
  - Access via **state of the art software** tools

APPLY NOW FOR THE PHOTONDELTA MPW INNOVATION GRANT

- PhotonDelta, in partnership with JePPix and Brainport Development, is now launching a photonics chip incentive scheme. They are reaching out to help global high-tech companies, large and small, design and build next-generation photonics chips specific to their business.

- If you're planning to fabricate your photonics chip with companies in Brabant, you may qualify for a PIC Innovation voucher, worth up to € 4,250.00. This is half the cost of an MPW run

- For more information check www.photondelta.eu
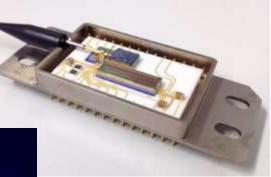
APPLICATION EXAMPLES

YOUR DESIGN
OUR SERVICE
YOUR FUTURE

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EXAMPLE: FBG INTERROGATOR

Distributed temperature and
strain measurement with embedded
fibers + PIC readouts

Wider possibilities for
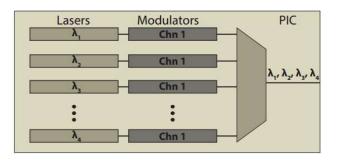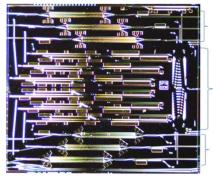structural
health monitoring

PHOTONIC CHIP BASED REAL-TIME
INTERROGATOR SYSTEMS

EXAMPLE: 100 GB/S TRANSMITTER

>100 Gb/s transmitter on single chip, fabricated in our powerful MPW platform

Wavelength tuning

20 Gb/s per channel
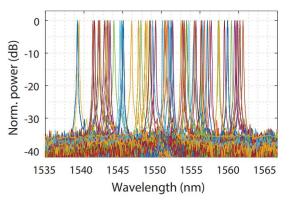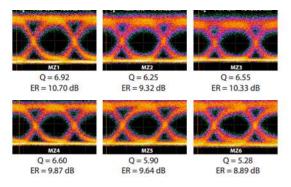

W. Yao, COBRA

SUMMARY

- Generic Integration Process available
  - Transmit and receive platform
- Large range of applications demonstrated
- Commercial, low threshold access to technology via quarterly MPW runs for proof of concept
- Industrial scale, production ready process
- Ready for medium and large volumes

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