



*European Photonics
Industry Consortium*

7-8 November 2019

Neuchatel, Switzerland

EPIC Meeting on Wafer Level Optics

Hosted by





SUSS MicroOptics Sets Up Excellence Center for Wafer-Level Optics

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SUSS MicroOptics is setting up an excellence center for the manufacturing of wafer-level optics (WLO) in order to meet the increase in demand for precision optics applications. Among the various structures that can be manufactured at wafer-level, freeform micro-optic arrays are

one of the most challenging, as they have no rotational symmetry. Thanks to this property, they can generate new light distribution patterns, correct for aberrations, as well as improve miniaturization of the optical systems. This will be key for driving the volume production of new optics for volume markets, such as automotive, transportation, lighting, augmented reality, medical, datacom, consumer electronics etc. The excellence center will be part of 800 m2 of new cleanroom space currently build in Neuchâtel and certified for the main markets targeted by SUSS MicroOptics.



Participants

Name		Job Title	Company	Country
Ana	Gonzalez	R&D Manager	EPIC	Spain
Andrea	Lovera	Chief Science Officer	FEMTOprint	Switzerland
Andrea	Kneidinger	Specialist	DELO	Germany
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Andreas	Gaab	Product Line Manager	Corning Laser Technologies	Germany
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Jens Ulrich	Thomas	Research Scientist	SCHOTT	Germany
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Manon	Vidal	Regional Sales & Application Engineer	OptoSigma	France
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Marc	Verschuuren	CTO	SCIL Nanoimprint Solutions	The Netherlands
Marc	Schillgalies	VP Development	First Sensor	Germany

Name		Job Title	Company	Country
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Michael	Hornung	Managing Director	AMO	Germany
Michel	Antolovic	CEO	Pi Imaging Technology	Switzerland
Mirco	Altana	Manager of Mastering Engineering	ams	Switzerland
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Tobias	Senn	VP Engineering	NIL Technology	Switzerland
Uwe	Zeitner	Head of Department	Fraunhofer IOF	Germany
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Wilfried	Noell	Director of Research & Development	SUSS MicroOptics	Switzerland
Zoltán	Balogh-Michels	Project Leader	RhySearch	Switzerland

Manufacturers



Process Development Tools



End User



Instrument /System Integrator



Design



Equipment Supplier



Market analyst



Process Development Services



Metrology



Materials



30-31 Oct 2019	EPIC Meeting on LIDAR for Automotive at Anteryon, Eindhoven, NL
7-8 Nov 2019	EPIC Meeting on Wafer Level Optics at SUSS Microoptics, Neuchatel, CH
19 Nov 2019	EPIC TechWatch on Medical Lasers at MEDICA, Dusseldorf, Germany
11-12 Dec 2019	EPIC Meeting on Cancer Diagnostics and Treatment at NKI, Amsterdam, NL
30 January 2020	EPIC Roundtable on Quantum Optronics at OPTRO, Paris , France
3 February 2020	EPIC World Photonics Technology Summit , San Francisco, USA
4 February 2020	EPIC CEO Networking Lunch & Dinner, San Francisco, USA
5 February 2020	EPIC 5miles CEO Run at Photonics West, San Francisco, USA
26 February 2020	EPIC TechWatch at W3+Fair, Wetzlar, Germany
11 March 2020	EPIC VIP Networking Reception at OFC, San Diego, USA
18 March 2020	EPIC VIP Networking Reception at LASER World of PHOTONICS, Shanghai, China
19–20 March 2020	EPIC Meeting on Freeform Optics at Optimax , Rochester, NY, USA
15–17 April 2020	EPIC Annual General Meeting , Vilnius, Lithuania
21 April 2020	EPIC TechWatch on Polymer Optics at Polymer Optics Days 2020, Aachen, Germany
7–8 May 2020	EPIC Meeting on Nanophotonics for Comms, Sensing and Data Processing at Nanoscribe , Germany
21–22 May 2020	EPIC Executive Meeting on Industrial Lasers at Convergent Photonics , Torino, Italy
4–5 June 2020	EPIC Meeting on Hyperspectral and Multispectral Imaging and Spectroscopy at NORCE, Bergen, Norway
14 July 2020	EPIC 6km Photonics Run B2Run, Munich, Germany
9-10 Sep 2020	EPIC Tech Watch at CIOE, Shenzhen, China
10 Sep 2020	EPIC VIP Networking Reception at CIOE, Shenzhen, China
21 Sep 2020	EPIC VIP Networking Reception at ECOC, Brussels, Belgium
29–30 Oct 2020	EPIC Meeting on Automation for Manufacturing, Packaging and Testing at PI, Karlsruhe, Germany
5–6 Nov 2020	EPIC Meeting on Micro-Optics for Display, Imaging, Sensing and Metrology at IMT, Zurich, Switzerland



NEXT EVENTS

Jose Pozo Calendar 2019



1. Amsterdam 10-11 Jan
2. Brussels 15-18 Jan
3. Dresden 21-22 Jan
4. Eindhoven 23-25 Jan
5. Dresden 27-29 Jan
6. San Francisco 1 - 9 Feb
7. Neuchatel 13-14 Feb
8. Karlsruhe 17-18 Feb
9. Torino 19-20 Feb
10. Limoges 20-22 Feb
11. Wetzlar 24-27 Feb
12. San Diego 1-8 Mar
13. New York 9 Mar
14. Toulouse 11-13 Mar
15. Liege 20 Mar
16. Mainz 20-22 Mar
17. Brussels 25-27 Mar
18. Aachen 27-29 Mar
19. Glasgow 7-13 Apr
20. Eindhoven 16-17 Apr
21. Ghent 24 Apr
22. Gottingen 1-3 May
23. Nuremberg 6-7 May
24. Munich 7-8 May
25. Jena 13-15 May
26. Nice 20-22 May
27. Regensburg 22-24 May
28. Glasgow 28-29 May
29. Barcelona 4-6 Jun
30. Berlin 12-14 Jun
31. Silicon Valley 16-21 Jun
32. Munich 23-27 Jun
33. Berlin 1-2 Jul
34. Pisa 2-3 Jul
35. Munich 15-16 Jul
36. Warsaw 16-18 Jul
37. Berlin 27-30 Aug

EPIC Staff Meeting
 EU Commission (ACTPHAST and PILOT Lines Meeting and P21 Info day)
 LAMPAS Kick-off Meeting
 InPULSE Kick Off Meeting
 SEMI 3D & Systems Summit
 Photonics West
 Outreach
 Outreach
 EPIC Board of Directors Meeting
 EPIC Meeting on Specialty Fiber
 W3+ Fair + Visit Gottingen
 OFC
 Outreach Chiral Photonics
 Quantum Optronics and Captech Meeting
 Outreach visit UPMT Wielandts and LASEA
 EPIC Meeting at Huber+Suhner
 PIC International
 NILIndustry Days
 EPIC AGM
 PIXAPP Consortium meeting
 ECIO 2019
 EPIC Meeting on Industrial Lasers
 SMT Connect
 Dinner in Munich with CEO AMS Technologies
 Optecnet + Outreach
 DCI & NGON
 EPIC Meeting on Automation for Manufacturing
 Visit to University of Glasgow
 EPIC Quantum Summit
 WTMF
 ISUPT/SSPhF Napa + Outreach
 Laser World of Photonics
 Autonomous Machines World
 ePIXfab Summer School
 EPIC Munich B2Run
 Outreach
 EPIC World Photonics Technology Summit

38. Shenzhen 1-6 Sep
39. Noordwijk 11-13 Sep
40. Rheintal 17-19 Sep
41. Dublin 22-25 Sep
42. Antwerp 2-4 Oct
43. Zurich 7-8 Oct
44. Coventry 8-9 Oct
45. Almelo 10-11 Oct
46. Stuttgart 17-18 Oct
47. Christchurch 23-25 Oct
48. Auckland 23-35 Oct
49. Den Haag 29 Oct
50. Eindhoven 30-31 Oct
51. Boxmeer 4 Nov
52. Neuchatel 7-8 Nov
53. Abu Dhabi 12 Nov
54. Tokyo 13-15 Nov
55. Dusseldorf 19 Nov
56. Barcelona 21 Nov
57. Eindhoven 25 Nov
58. Brussels 3 Dec
59. Gent 6 Dec
60. Amsterdam 11-12 Dec
61. London 13 Dec

CIOE 2019 Conference
 EPIC Meeting on New Space
 W3+ Fair
 ECOC 2019
 EPIC Staff Meeting
 EPIC BoD Meeting
 Photonex UK
 EPIC Meeting on High Power Laser Systems
 EPIC Meeting on VCSELs Technology and Applications
 Outreach New Zealand (Quantum Presentations)
 Outreach New Zealand (Quantum Presentations)
 Inside Quantum Technology
 EPIC Meeting on LIDAR Technology and Applications
 Visit Marel Poultry
 EPIC Meeting on Wafer Level Optics
 EPIC Meeting on Fiber Sensing for Oil and Gas at ADIPEC
 Outreach Hitachi
 EPIC Techwatch at MEDICA
 EPIC Meeting on Fiber Sensing at Smart Cities Expo
 Visit TEGEMA and outreach Eindhoven area
 Round Table at European Parliament
 Invited Lecture on PIC Manufacturing
 EPIC Meeting on Cancer Diagnostic and Treatment
 IEEE BICOP Conference



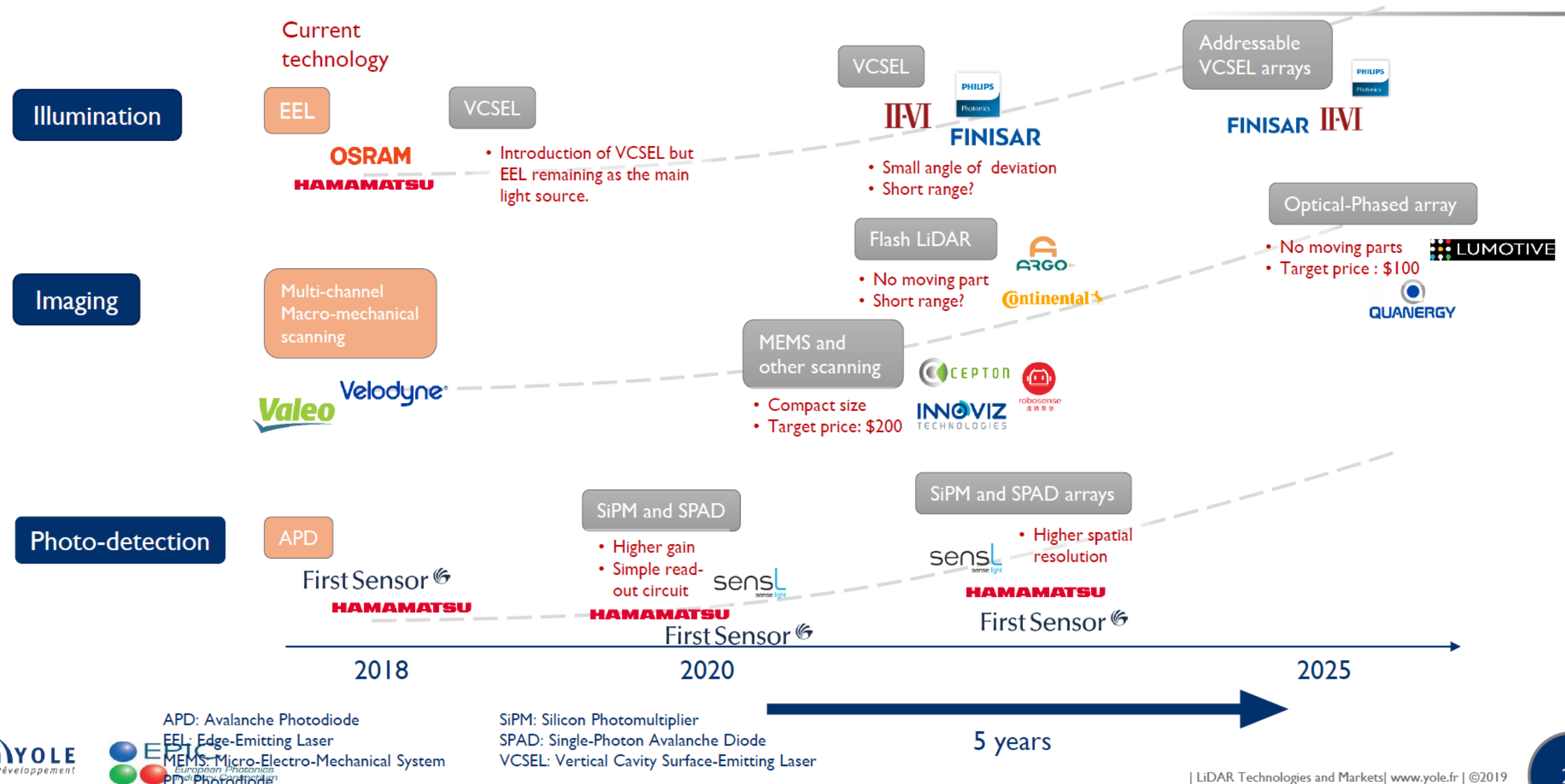
Special report on
**LiDAR for
Automotive and
Industrial
Applications**

*Technology, Industry
and Market Trends
for EPIC*



TIME-TO-MARKET ANALYSIS

Introduction of new automotive LiDAR technologies










**Special report on
Status of the
Camera Module
Industry - Focus on
Wafer Level Optics**

*Technology, Industry and
Market Trends
for EPIC*



MARKET SEGMENTATION

Known WLO application
Potential WLO application
Unknown WLO application

	Segment	Sensor application (light Rx)	Lighting application (light Tx)
	Industry/space/defense	Machine vision, barcode readers , professional & broadcast, defense, night vision camera	Datacom , 3D printing , AOC, Laser printer
	Security	Security & surveillance cameras	Security & surveillance cameras
	Medical	PET scan, x-ray, endoscopy	OCT systems, pulse oximeter , dermatology laser
	Automotive	In-cabin, infotainment, front ADAS cameras, lidar	POF, lidar , eye tracking , Gesture recognition, automotive lighting
	Computing	Laptop PC, tablets, computer mice	computer mice
	Consumer	DSLR, DSC, video cam, action cam, consumer drones, personal robotics, game stations, AR-VR headsets , smart home devices, smart watch	Laser printer, proximity sensors, autofocus systems, facial recognition, gas sensor, driver monitoring , gesture recognition
	Mobile	Smartphones , feature phones	Smartphones , feature phones

**Special report on
Medical Wearables**
*Technology, Industry and
Market Trends
for EPIC*



AN INCREASING NUMBER OF PRODUCTS ARE REACHING THE MARKET*



**Special report on
InP Wafer and
Epiwafer -
Photonics & RF**
*Technology, Industry and
Market Trends
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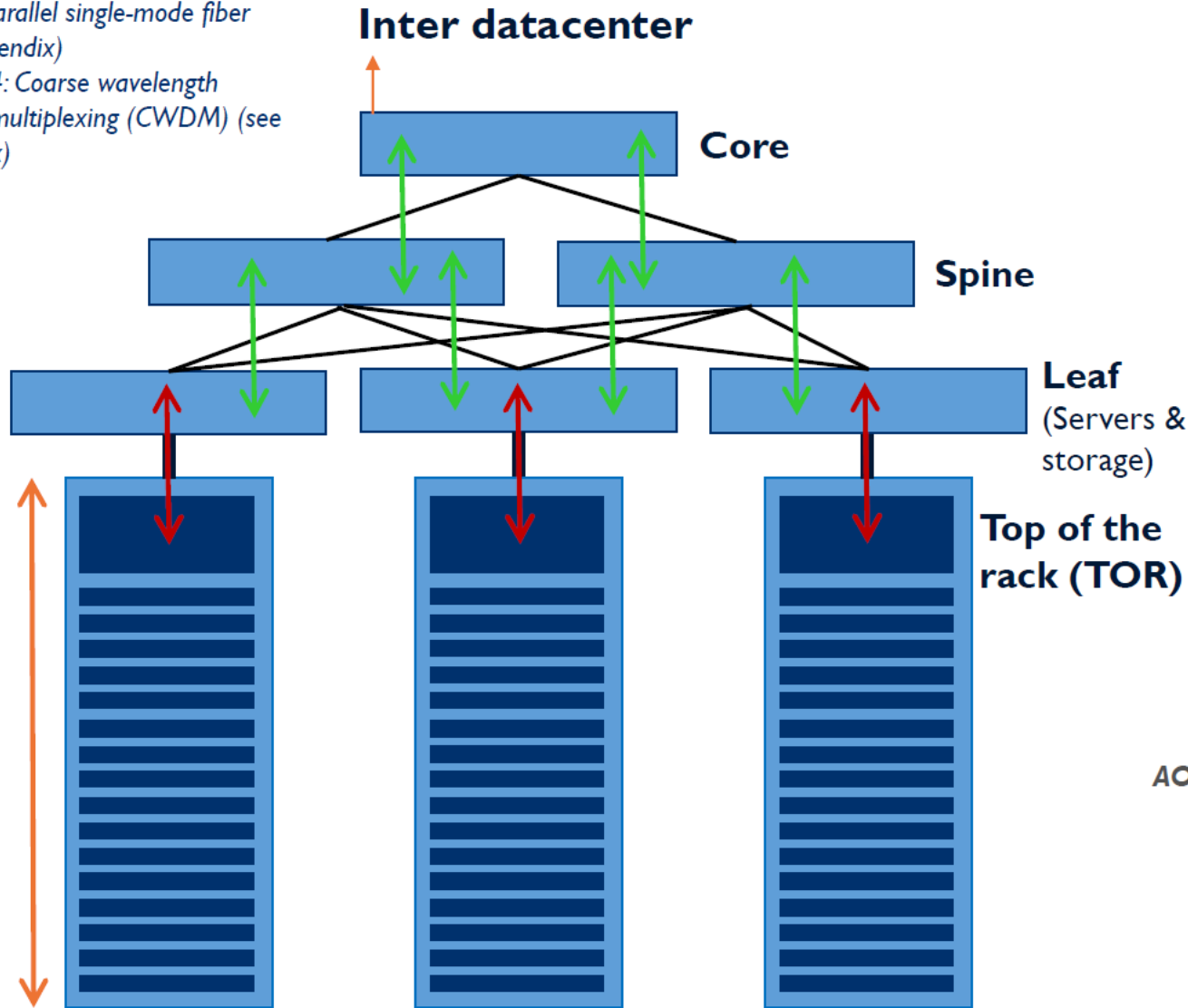
DATA CENTERS - ARCHITECTURE AND DATA RATE

DC: Data Center

DCI: Data Center Interconnect

PSM4: parallel single-mode fiber
(see appendix)

CWDM4: Coarse wavelength
division multiplexing (CWDM) (see
appendix)



Inter DC: 100G & beyond (200G, 400G)

DWDM

DCI Long Haul >600km

DCI Metro 100km-600km

DCI Edge 2km-100km

Spine-Core: 40G - 100G & beyond (200G, 400G)

Single-mode fiber

PSM4 or CWDM4

500m - 2 km

Optical transceivers (transmitter-receiver) with detachable connectors

InP/GaAs

INTER-RACK: 40G, moving to 100G

Multimode/singlemode fiber

< 100m: active optical cable (AOC) with VCSELs

100 - 500m: InP

Lowest-priced optical link

AOC: transceivers with integrated fibers

INTRA-RACK: 10G Direct attach cable (DAC)

moving to 25G AOC

1 - 30 m

Lowest-priced link

DAC: copper cables

Special report on Silicon Photonics and Photonic Integrated Circuits (PICs)

*Technology, Industry and
Market Trends
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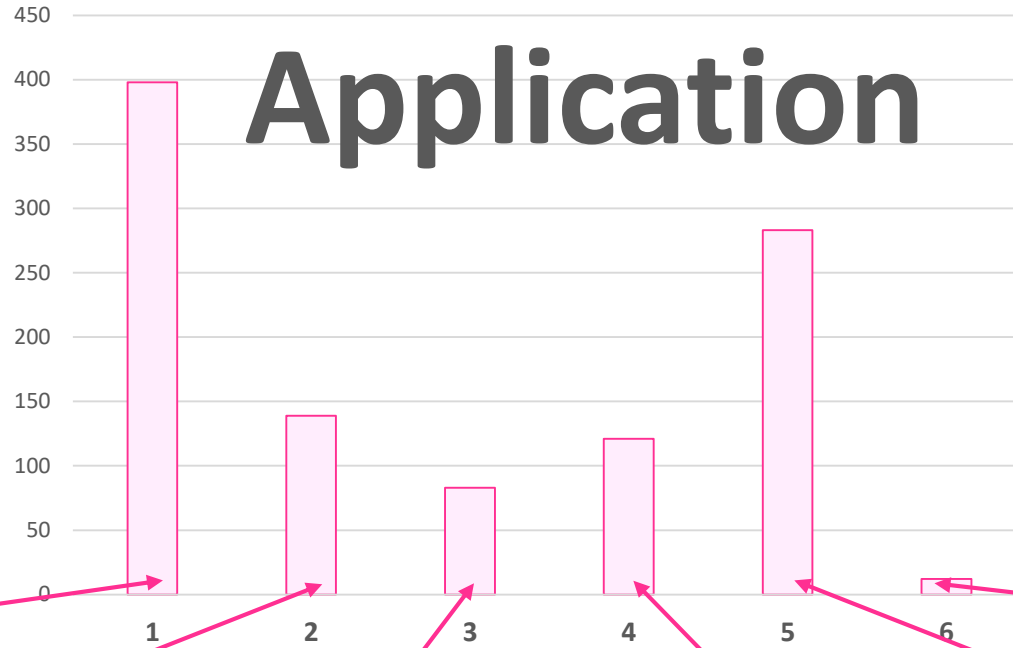


THE DIFFERENT PIC PLATFORMS AND POSSIBLE FUNCTIONS

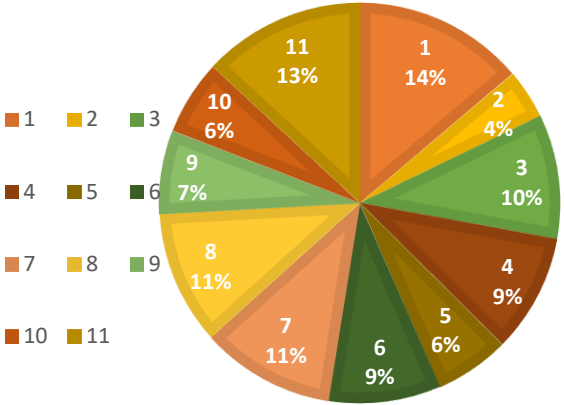
Table below shows which optical functions can be integrated into a PIC die (green).

		SIGNAL MODULATION	EMISSION	AMPLIFIER	GUIDING	GUIDING	ELECTRONICS CONTROL	FILTERING	DETECTION	CONVERSION	ELECTRONICS CONTROL	COUPLING
PIC	Si photonics	SiPh die			SiPh die (SOI)	SiPh die (SOI)		SiPh die (SOI)	SiPh die (PN photodiode or PIN diode: Si or Ge)		SiPh die	
PIC	InP	EML: EAM + DFB/DBR	EML: EAM + DFB/DBR	PIN diode	WG							
PIC	InP	EML: EAM + DFB/DBR	EML: EAM + DFB/DBR	PIN diode	WG					EML w/ SOA		
PIC	InP		Laser			DWDM			APD			
PIC	SiN				Low loss WG							Coupler
PIC	Polymer	Modulator			WG	Mux/Demux						Spot converter
PIC	GaAs		VCSEL						PIN			
PIC	Silica				Splitters	AWG						
PIC	LiNbO3											
PIC	Glass				WG	splitters, taps, Mux/Demux, polarizers						Coupler

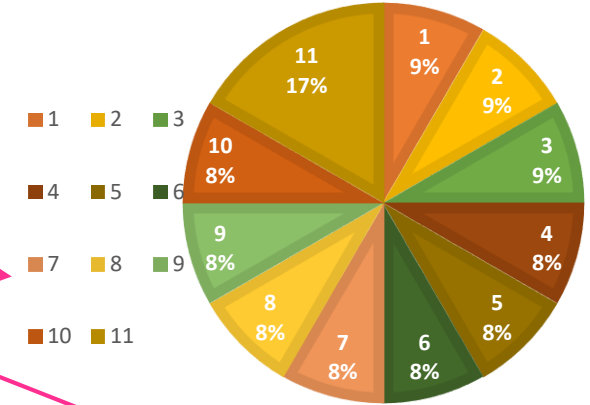
Application



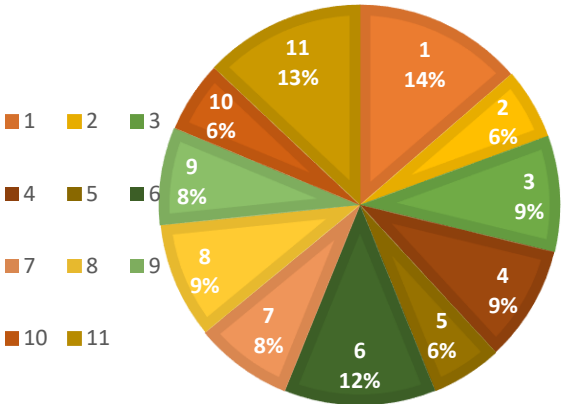
COMPONENTS



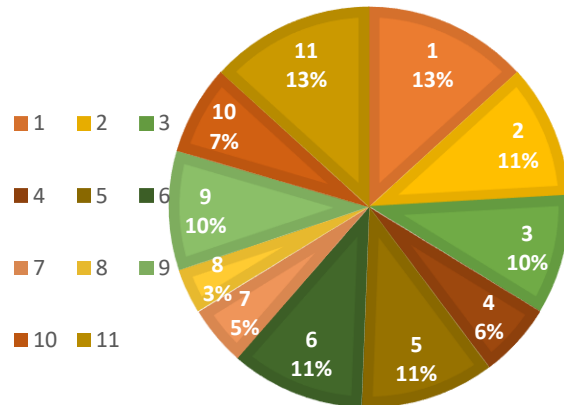
USER



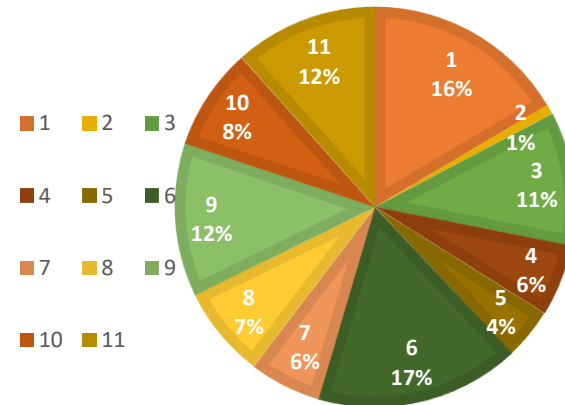
MODULE



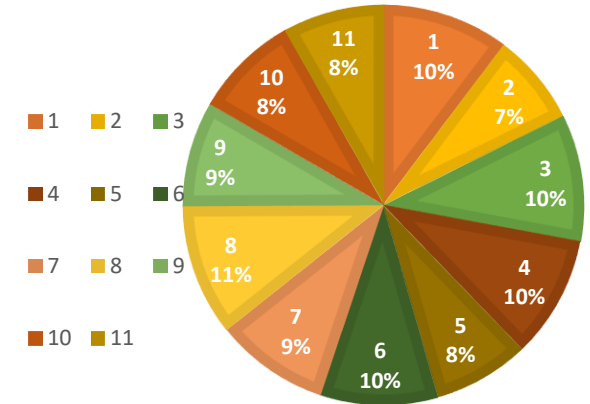
INSTRUMENT



SYSTEM



SERVICE



Manufacturers



Process Development Tools



End User



Instrument /System Integrator



Design



Equipment Supplier



Market analyst



Process Development Services



Metrology



Materials



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