



Components manufacturers

Optics



Light Sources



Detectors



Scanning elements



Integrated Chips



Materials, assembly and equipment



LIDAR market analyst



LIDAR manufacturers



3D sensors



Tier1 Suppliers/OEMs



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 | EPIC Staff Meeting | 38. Shenzhen | 1-6 Sep | CIOE 2019 Conference |
| 2. Brussels | 15-18 Jan | EU Commission (ACTPHAST and PILOT Lines Meeting and P21 Info day) | 39. Noordwijk | 11-13 Sep | EPIC Meeting on New Space |
| 3. Dresden | 21-22 Jan | LAMPAS Kick-off Meeting | 40. Rheintal | 17-19 Sep | W3+ Fair |
| 4. Eindhoven | 23-25 Jan | InPULSE Kick Off Meeting | 41. Dublin | 22-25 Sep | ECOC 2019 |
| 5. Dresden | 27-29 Jan | SEMI 3D & Systems Summit | 42. Antwerp | 2-4 Oct | EPIC Staff Meeting |
| 6. San Francisco 1 - 9 Feb | | Photonics West | 43. Zurich | 7-8 Oct | EPIC BoD Meeting |
| 7. Neuchatel | 13-14 Feb | Outreach | 44. Coventry | 8-9 Oct | Photonex UK |
| 8. Karlsruhe | 17-18 Feb | Outreach | 45. Almelo | 10-11 Oct | EPIC Meeting on High Power Laser Systems |
| 9. Torino | 19-20 Feb | EPIC Board of Directors Meeting | 46. Stuttgart | 17-18 Oct | EPIC Meeting on VCSELs Technology and Applications |
| 10. Limoges | 20-22 Feb | EPIC Meeting on Specialty Fiber | 47. Christchurch | 23-25 Oct | Outreach New Zealand (Quantum Presentations) |
| 11. Wetzlar | 24-27 Feb | W3+ Fair + Visit Gottingen | 48. Auckland | 23-35 Oct | Outreach New Zealand (Quantum Presentations) |
| 12. San Diego | 1-8 Mar | OFC | 49. Den Haag | 29 Oct | Inside Quantum Technology |
| 13. New York | 9 Mar | Outreach Chiral Photonics | 50. Eindhoven | 30-31 Oct | EPIC Meeting on LIDAR Technology and Applications |
| 14. Toulouse | 11-13 Mar | Quantum Optronics and Captech Meeting | 51. Boxmeer | 4 Nov | Visit Marel Poultry |
| 15. Liege | 20 Mar | Outreach visit UPMT Wielandts and LASEA | 52. Neuchatel | 7-8 Nov | EPIC Meeting on Wafer Level Optics |
| 16. Mainz | 20-22 Mar | EPIC Meeting at Huber+Suhner | 53. Abu Dhabi | 12 Nov | EPIC Meeting on Fiber Sensing for Oil and Gas at ADIPEC |
| 17. Brussels | 25-27 Mar | PIC International | 54. Tokyo | 13-15 Nov | Outreach Hitachi |
| 18. Aachen | 27-29 Mar | NILIndustry Days | 55. Dusseldorf | 18-21 Nov | EPIC Techwatch at MEDICA |
| 19. Glasgow | 7-13 Apr | EPIC AGM | 56. Amsterdam | 11-12 Dec | EPIC Meeting on Cancer Diagnostic and Treatment |
| 20. Eindhoven | 16-17 Apr | PIXAPP Consortium meeting | | | |
| 21. Ghent | 24 Apr | ECIO 2019 | | | |
| 22. Gottingen | 1-3 May | EPIC Meeting on Industrial Lasers | | | |
| 23. Nuremberg | 6-7 May | SMT Connect | | | |
| 24. Munich | 7-8 May | Dinner in Munich with CEO AMS Technologies | | | |
| 25. Jena | 13-15 May | Optecnet + Outreach | | | |
| 26. Nice | 20-22 May | DCI & NGON | | | |
| 27. Regensburg | 22-24 May | EPIC Meeting on Automation for Manufacturing | | | |
| 28. Glasgow | 28-29 May | Visit to University of Glasgow | | | |
| 29. Barcelona | 4-6 Jun | EPIC Quantum Summit | | | |
| 30. Berlin | 12-14 Jun | WTMF | | | |
| 31. Silicon Valley | 16-21 Jun | ISUPT/SSPhF Napa + Outreach | | | |
| 32. Munich | 23-27 Jun | Laser World of Photonics | | | |
| 33. Berlin | 1-2 Jul | Autonomous Machines World | | | |
| 34. Pisa | 2-3 Jul | ePIXfab Summer School | | | |
| 35. Munich | 15-16 Jul | EPIC Munich B2Run | | | |
| 36. Warsaw | 16-18 Jul | Outreach | | | |
| 37. Berlin | 27-30 Aug | EPIC World Photonics Technology Summit | | | |



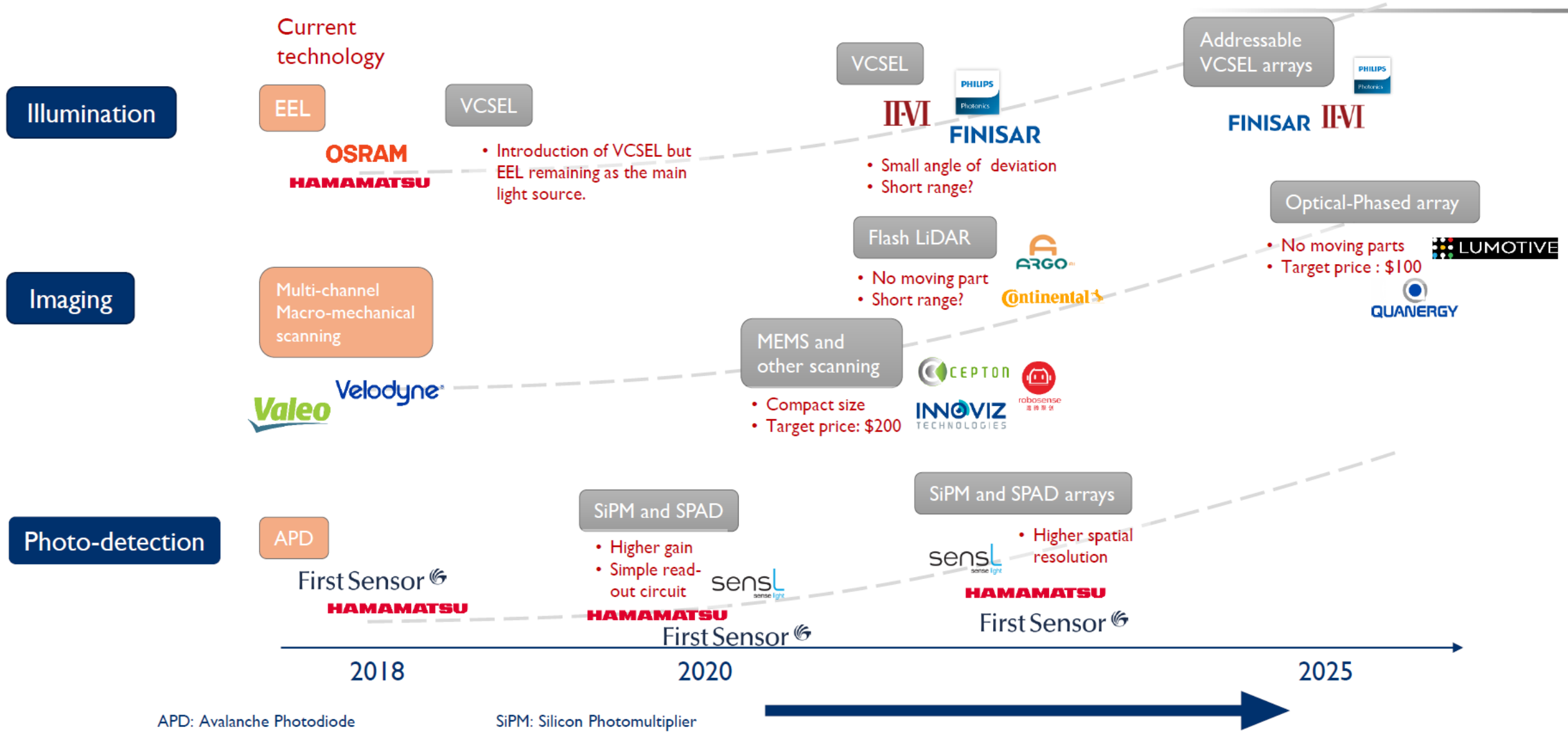
Special report on
**LiDAR for
Automotive and
Industrial
Applications**

*Technology, Industry
and Market Trends
for EPIC*



TIME-TO-MARKET ANALYSIS

Introduction of new automotive LiDAR technologies



APD: Avalanche Photodiode

EEL: Edge-Emitting Laser

MEMS: Micro-Electro-Mechanical System

PD: Photodiode

SiPM: Silicon Photomultiplier

SPAD: Single-Photon Avalanche Diode

VCSEL: Vertical Cavity Surface-Emitting Laser

**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
for EPIC*



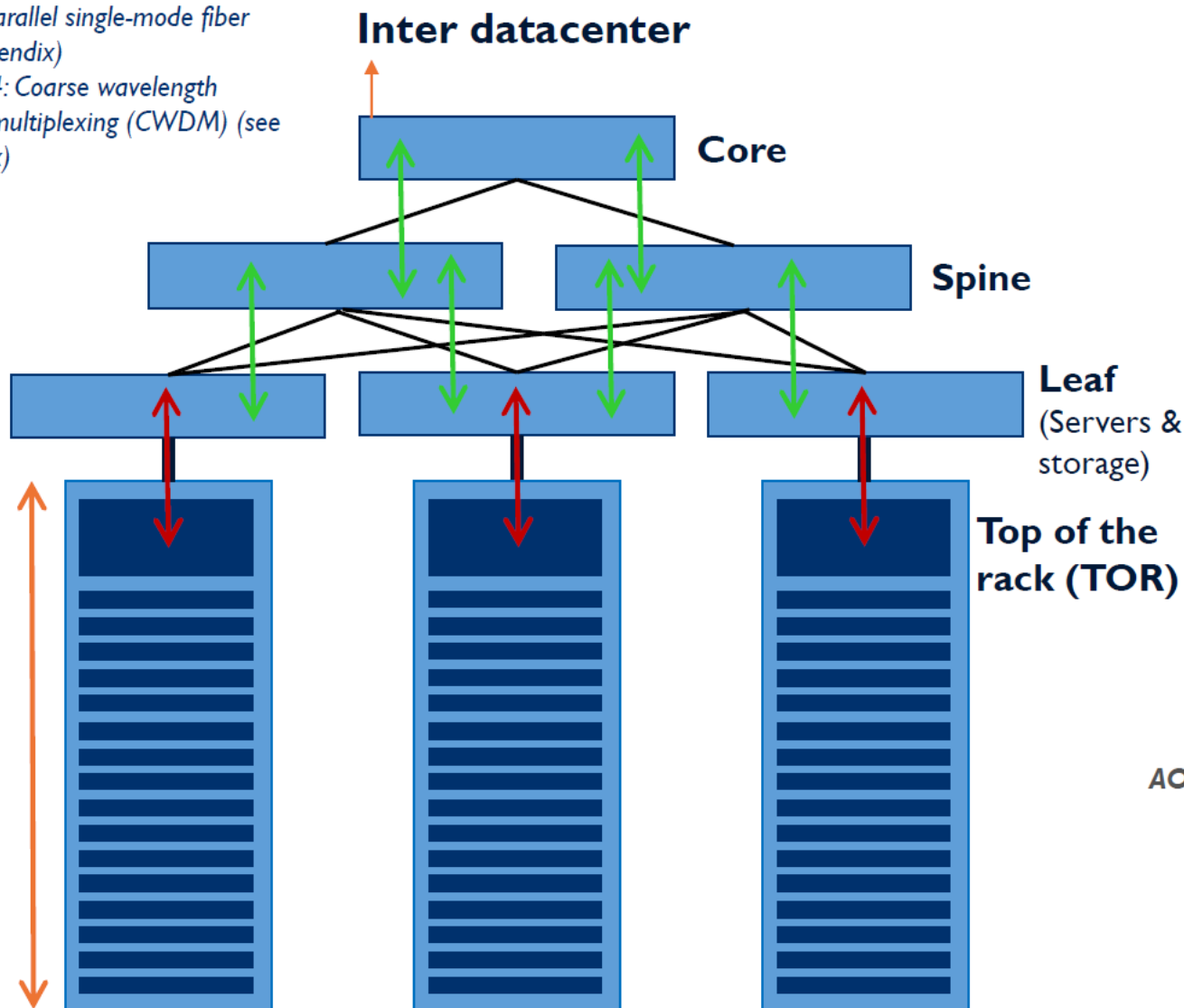
DATA CENTERS - ARCHITECTURE AND DATA RATE

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

InP

InP

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
for EPIC*

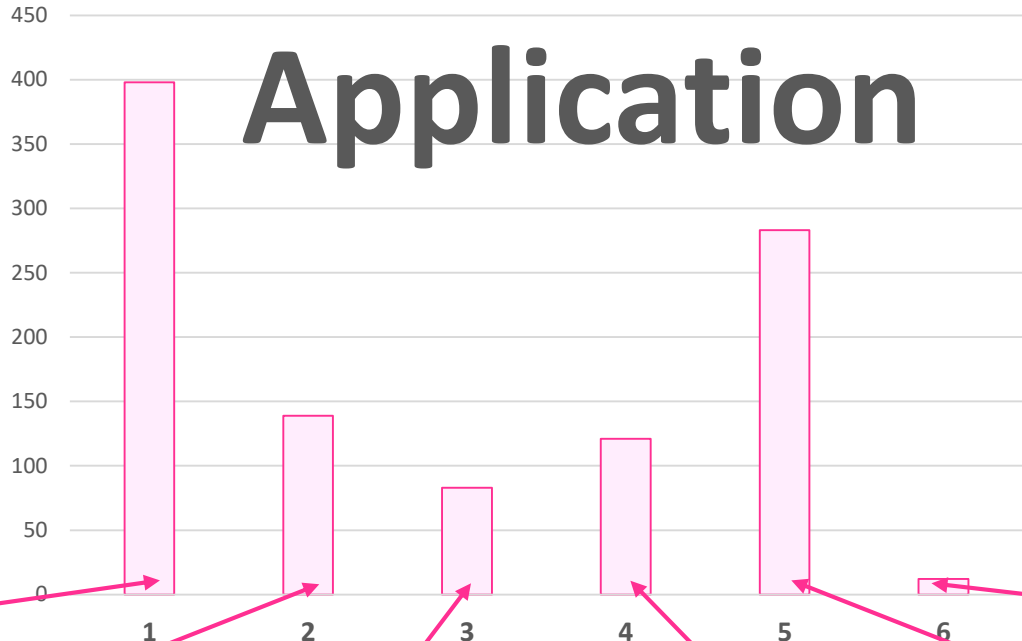


THE DIFFERENT PIC PLATFORMS AND POSSIBLE FUNCTIONS

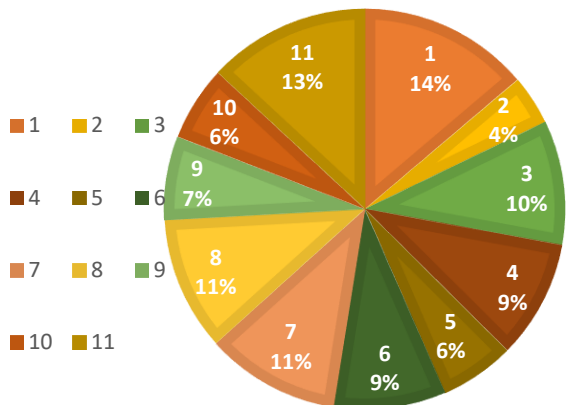
Table below shows which optical functions can be integrated into a PIC die (green).

		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

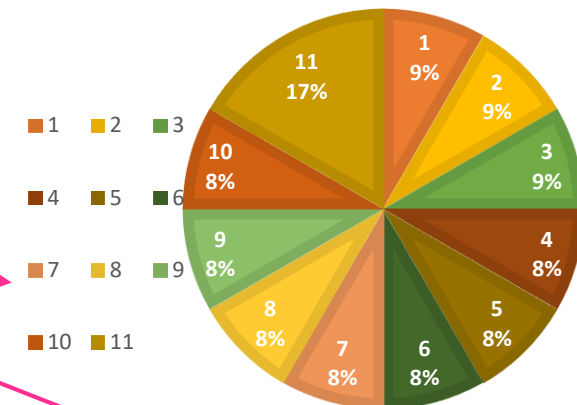
Application



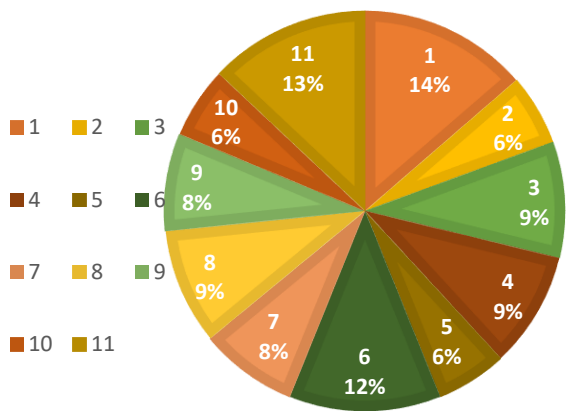
COMPONENTS



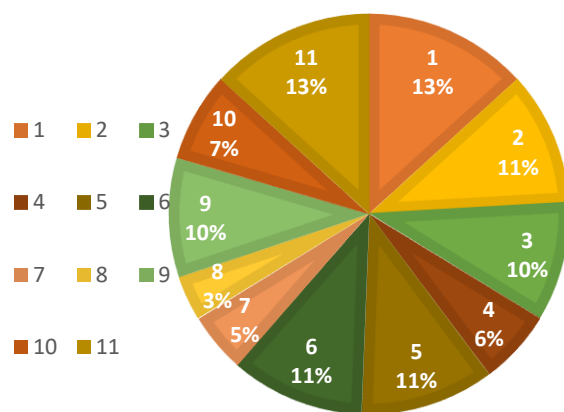
USER



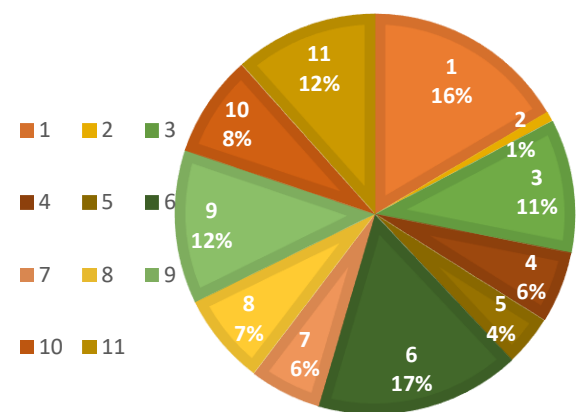
MODULE



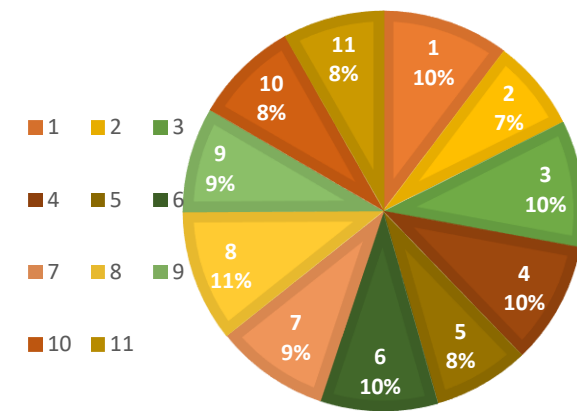
INSTRUMENT



SYSTEM



SERVICE



Components manufacturers

Optics

SCHOTT
glass made of ideas



TNO innovation for life

DIOPTRIC

SYNOPSYS



ECLIPSE



Zemax



a:etris
Company of the Leister Group



surrey nanosystems



Light Sources

modulight

Astrum LT



eblanaphotonics

Detectors



ICFO

Scanning elements



umec

SAND MicroSystems

Integrated Chips



PhotonDelta
Gateway to Integrated Photonics

LIGENTEC



Materials, assembly and equipment



LIDAR market analyst



LIDAR manufacturers



HYBRID LIDAR SYSTEMS AG



LeddarTech

ALTRAN

3D sensors



Ladimo

First Sensor

Tier1 Suppliers/OEMs



veoneer



Hitachi High-Tech

Autoliv

This presentation was presented at EPIC Meeting on LIDAR Technologies for Automotive 2019

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