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ISTANBUL 2016


# Fraunhofer IZM

# Asaf Avnon

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**This presentation is for**

☐ **Workshop 1** Big Data
X☐ **Workshop 3** Photonics and Micro-and-Nanoelectronics
☐ **Workshop 2** Robotics
☐ **Workshop 4** internet of Things

# Description of the Organization

**Fraunhofer Gesellschaft**

- 67 institutes
- 23,000 employees
- app. 2 billion € turnover
- app. 70% contract research

- Information Technology
- Light & Surfaces
- Life Sciences
- Micro Electronics
- Production
- Defense & Security
- Materials & Components

## Fraunhofer IZM

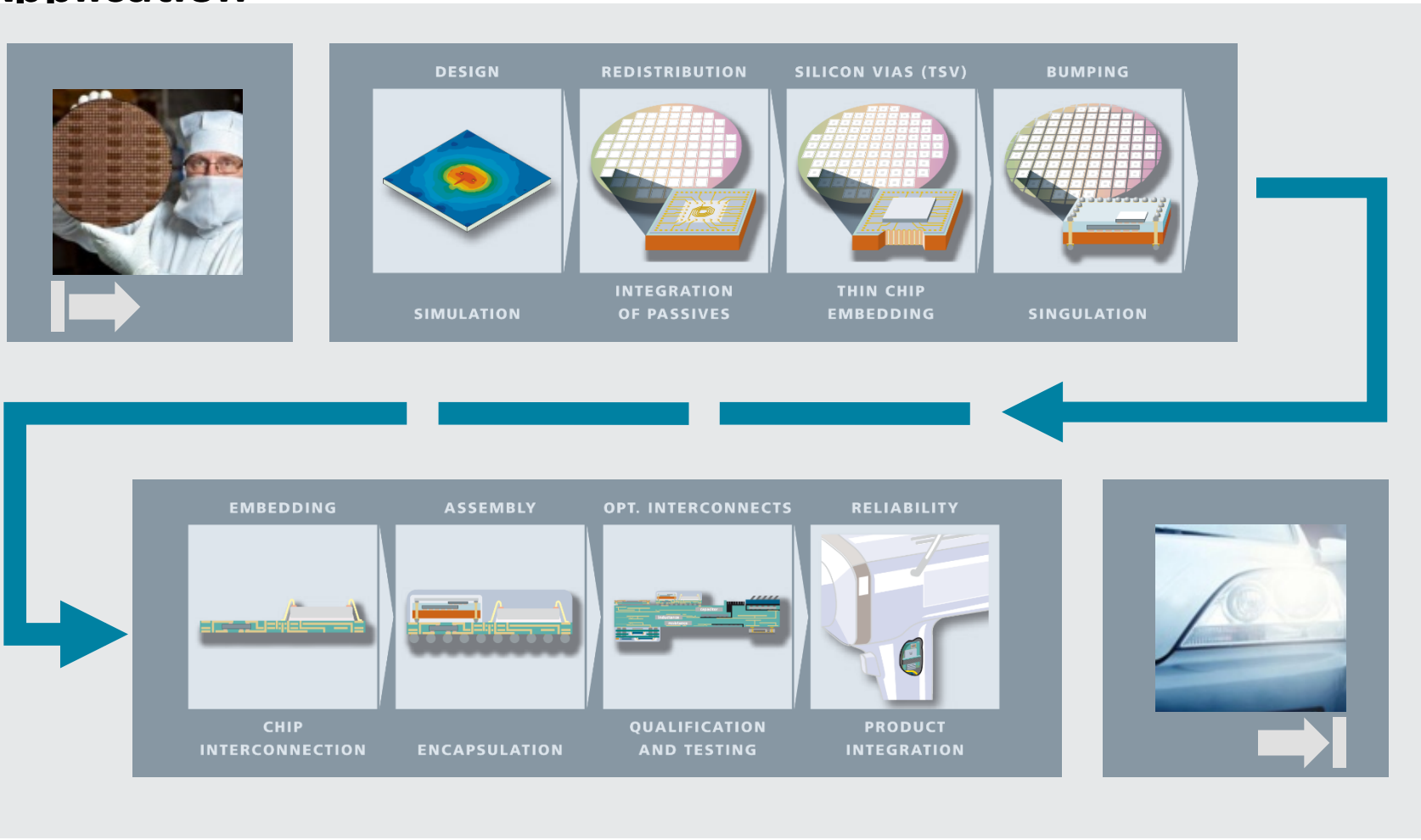
### Figures 2015

- ~ 28 Mio. € turnover
- ~ 80 % contract research
- 354 employees
  (233 full time,
  121 PhD, trainee)

### Locations

- Berlin
- Oberpfaffenhofen
- Dresden

# Mission: Bringing Microelectronics into Application



# Description of the your research interest

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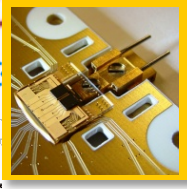
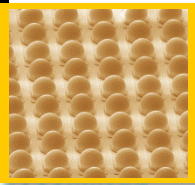
**Automotive/ Transportation**



**Photonics**

**Medical**

**Energy**



**Semiconductors & Sensors**

**Industrial**

# Photonic Interconnects for Data Center

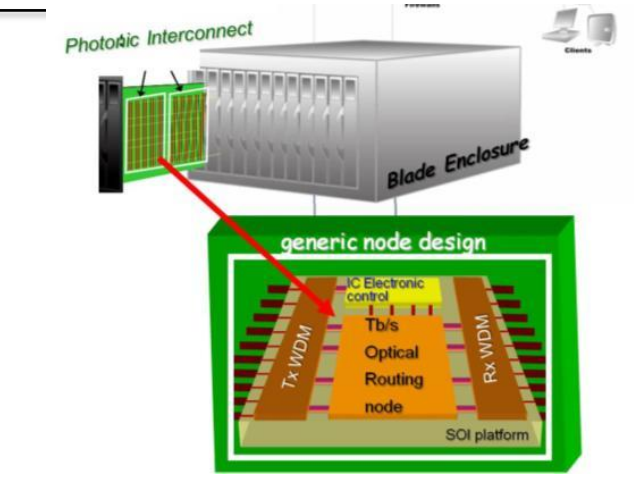
PhoxTroT, a EU flagship project, tackles optical interconnects in a holistic way, synergizing the different technology platforms in order to deploy the optimal "mix&match" technology and tailor this to each interconnect layer.

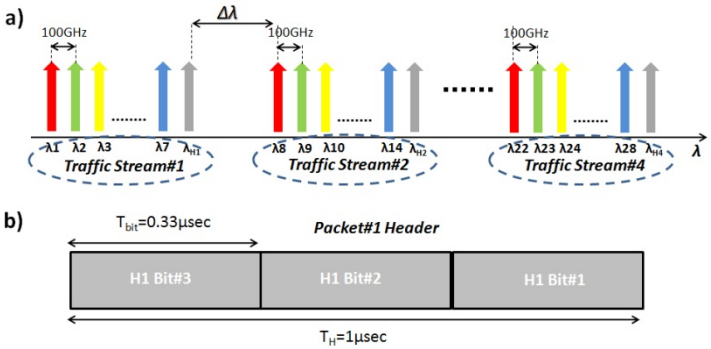
| | | |
|---|---|---|
| PCBs | Polymers | Glass |
| Interfaces | Glass | Plasmonics |
| PICs | Si Photonics | |
| Transceivers | III-V | CMOS electronics |
| Switches & Routers | Si Photonics | CMOS electronics |

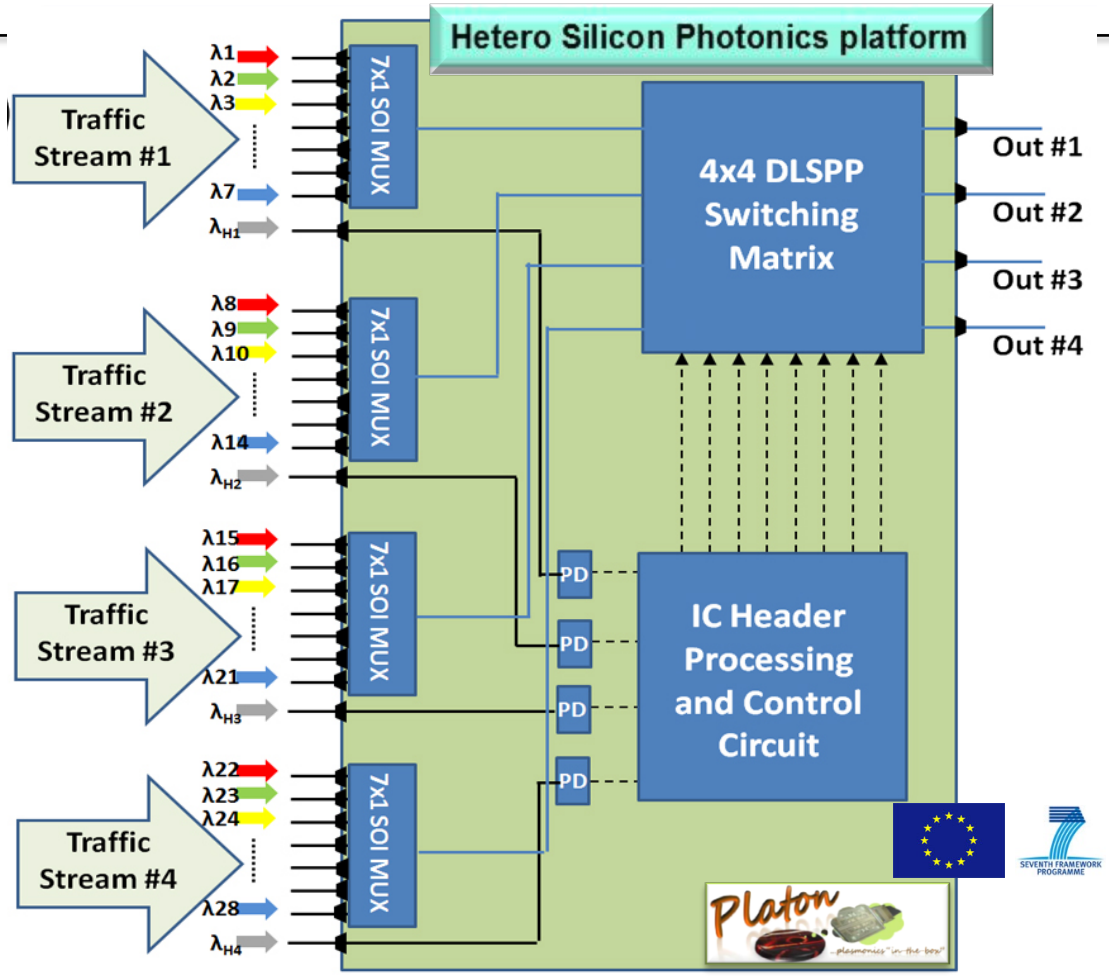
http://www.phoxtrot.eu

# Tb/s Silicon Plasmonic Router





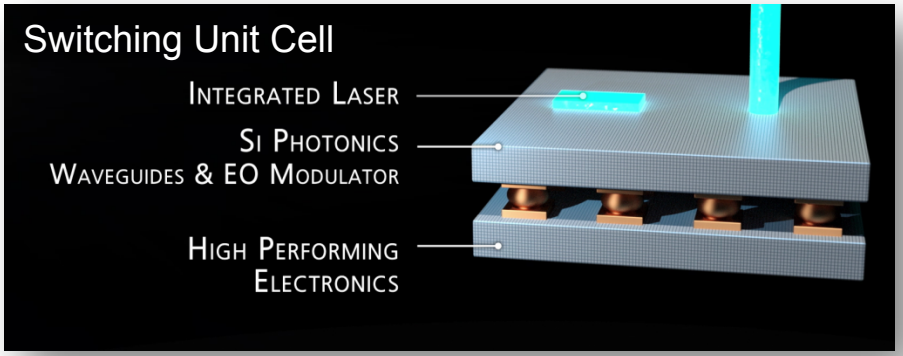




Pleros, N.; Vyrsokinos, K.; Papaioannou, S.; Fitsios, D.; Tsilipakos, O.; Pitilakis, A.; Kriezis, E.; Miliou, A.; Tekin, T.; Baus, M.; Karl, M.; Kalavrouziotis, D.; Giannoulis, I.; Avramopoulos, H.; Djellali, N.; Weeber, J.-C.; Markey, L.; Dereux, A.; Gosciniac, J.; Bozhevolnyi, S.; , "Tb/s switching fabrics for optical interconnects using heterointegration of plasmonics and silicon photonics: The FP7 PLATON approach," *IEEE Photonics Society, 2010 23rd Annual Meeting of the* , vol., no., pp.165-166, 7-11 Nov. 2010
doi: 10.1109/PHOTONICS.2010.5698810

http://www.ict-platon.eu

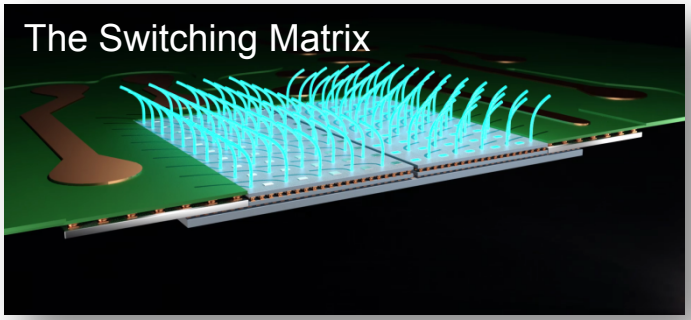
# Large Scale, Low Power and Low Cost Switching Matrix

L3MATRIX
LARGE, LOW POWER AND LOW COST DATA CENTRES




- Dense integration: ASIC with Silicon Photonics
- Embedded III-V laser sources on Silicon
- CMPOS compatible SiPh modulator
- Small cell size: <0.35mm2/channel
- 25Gbaud/channel

- **Large-Scale** - More than 100 channels connected to one ASIC
- **Low-Power** – High integration with Lasers and EO modulators
- **Low-Cost** – CMOS foundry / low cost assembly



# Photonics KET 2017 - ICT-30-2017
# NG-PLATON
# NG-Phox


- Objectives:
  - to develop new photonic technologies for metro and core networks allowing capacities of Pb/s per node, and Tb/s per channel and 100 Tb/s per link over increased transport distances, while supporting network programmability features and fitting network operator requirements and roadmaps.
  - to achieve major advances in chip integration technology, enabling a cost effective volume manufacturing of PICs with significantly enhanced performances (e.g. integration complexity, footprint, energy efficiency, speed, …) or new functions.

- Expected results
  - next generation agile, high-capacity and energy efficient core and metro networks to support the highly connected and communicating society;
  - Industrial volume manufacturing in Europe of PICs with significant competitive advantages in cost/performance and with reduced development costs;
  - New or significantly enhanced integration technology platforms for a more competitive European photonic industry.

# Consortium - required partners

| No | Expertise | Type | Country | Role in the project |
|---|---|---|---|---|
| 01 | | RTD | | |
| 02 | | SME | | |
| 03 | | IND | | |
| 04 | | | | |
| 05 | | | | |
| 06 | | | | |
| 07 | | | | |
| 08 | | | | |

# FRAUNHOFER IZM
# Department WLSI
# Microsensor and –actuator Technology

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## R & D Activities

- Bulk- and Surface Micromachining
  (Anisotropic, Electrochemical Etching, DRIE)
- Microsensors
  (Pressure, Acceleration, Flow, Radiation, Gases)
- Microactuators
  (Printerheads, Micromotors, Microshutters, Micromirrors, Microswitches)
- High Temperature Sensors
  (SOI and SiC)
- Smart Sensors
- Materials Characterization
- Field Assisted and Fusion Bonding
  (Silicon/Pyrex- and Si/Si-Bonding)
- Modeling and Simulation
  (FEM-Simulation)

# Facilities and Equipment



- **Cleanrooms (1000 m², Class 1/10/1000, 100mm-300mm)**
- **Basic Silicon Processes**
  (Oxidation, Annealing, LPCVD, PECVD, Sputtering, Photolithography, Wet and Dry Etching, Testing)
- **Micromachining Laboratory**
  (Anisotropic, Electrochemical Etching, DRIE)
- **Computer Controlled Testsystems for**
  - Pressure Sensors, Accelerometers
  - Temperature Sensors, Radiation Sensors
  - Humidity Sensors, Gassensors
- **Computer Controlled Testsystems for**
  (Si/Glass Bonding)
- **PC based Workstations**
  (FEM Simulation)
- **Analyses**

  **(AFM, Raman, TEM, REM)**

# Summary

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- MAT: Long experience in MEMS, development of microsensors and microactuators

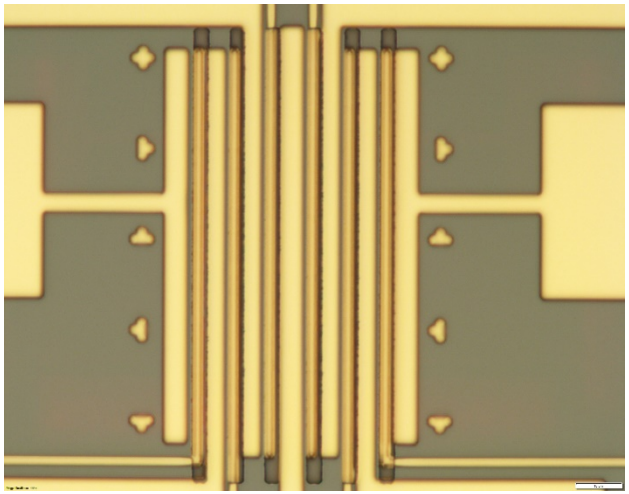
- Physical and chemical microsensors: pressure, acceleration, flow ... gas concentration ...

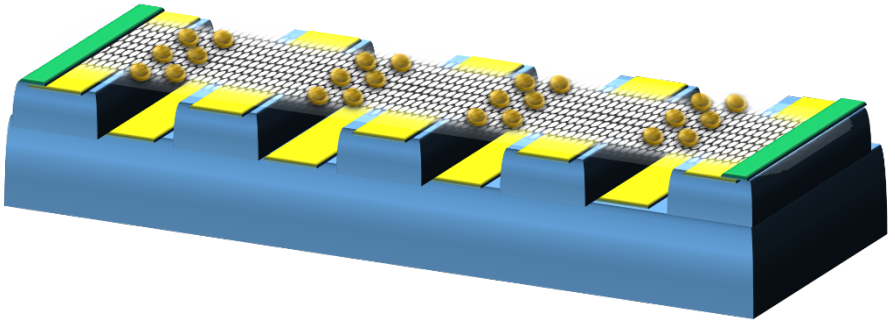
- Microactuators: inkjet heads, micromotors, micro relay, micro mirrors ...

- Further material research: gas sensitive materials, MEMS and sensor materials; development of process technology

- The future: New devices for power mems, micro optics, high temperature applications, aerodynamics research, gas sensing ...

# Graphene based devices on a wafer-scale





- Graphene based sensors – selective gas sensors
- Low-Power consumption ,Low-Cost and scaleable
- Possible to integrate into existing circuits
- A template with possibility to tailor for sensing of different gases
- Active in wide range of temperature and in harsh evironments

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# Recommendations

- The presentation **has to** last up to **4 minutes (maximum)**
- Do not overload your slides
- Provide weblinks to additional material
- Slides should be in English
- Do not use videos etc. – they might be not supported by the Infoday IT system
- Send your presentation in PDF or PPTX format to: ICT@turkeyinH2020.eu **before November 21, 2016.**