The "Important Project of Common European Interest" (IPCEI) in Microelectronics

-

A new path for investment in research, development and innovation by Europe's semiconductor industry

Klaus Pressel (Infineon), Rainer Pforr (Zeiss), and Michael Offenberg (Bosch)

Outline

- History and motivation
- The five technology fields
- Investment in Europe
- Modelling and simulation: Enablers to improve technology
- Conclusions

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History of IPCEI

In 2012 the European Commission defined the Key Enabling Technologies (KETs)

This KETs-based product is defined by the European Commission Communication (COM (2012) 341) as follows (European Commission 2012c):

a) an enabling product for the development of goods and services enhancing their overall commercial and social value

b) induced by constituent parts that are based on nanotechnology, micro-/nanoelectronics, industrial biotechnology, advanced materials and/or photonics and, but not limited to

c) produced by advanced manufacturing technologies

History of IPCEI

=> Micro-/Nanoelectronics was identified as one of the key enabler

- ECSEL JU was founded - focuses on Research & Development & Innovation and on pilot lines **(access to technology),** but, during ramp up a lot of issues need to be addressed
  e.g. stability of processes, understanding of small effects and their impact on reliability, quality and yield

- Thus, starting from 2014 the new funding tool **"Important Project of Common European Interest (IPCEI)"** has been introduced in Europe **(first industrial deployment, FID)**

- A first project has been launched by the European semiconductor industry in early 2017

- After notification by the European Commission end of 2018 this project type is now in place and the accompanying companies push this further throughout Europe

Motivation

Microelectronics is a key technology for meeting challenges of the application domains in a CO_2 neutral and digital society

Application

- Power Smart Grid
- Transport & Mobility
- Smart Home Smart Cities
- Industry 4.0
- IoT
- Health

Requirements

CO2 neutral, Always connected, Ubiquitous sensing, Edge intelligence, Extreme reliability, high power density, energy efficiency, Security

Electronic Products

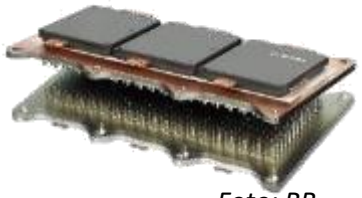


Foto: RB

Power electronics

System on Chip

Embedded computing

Security modules

Sensors

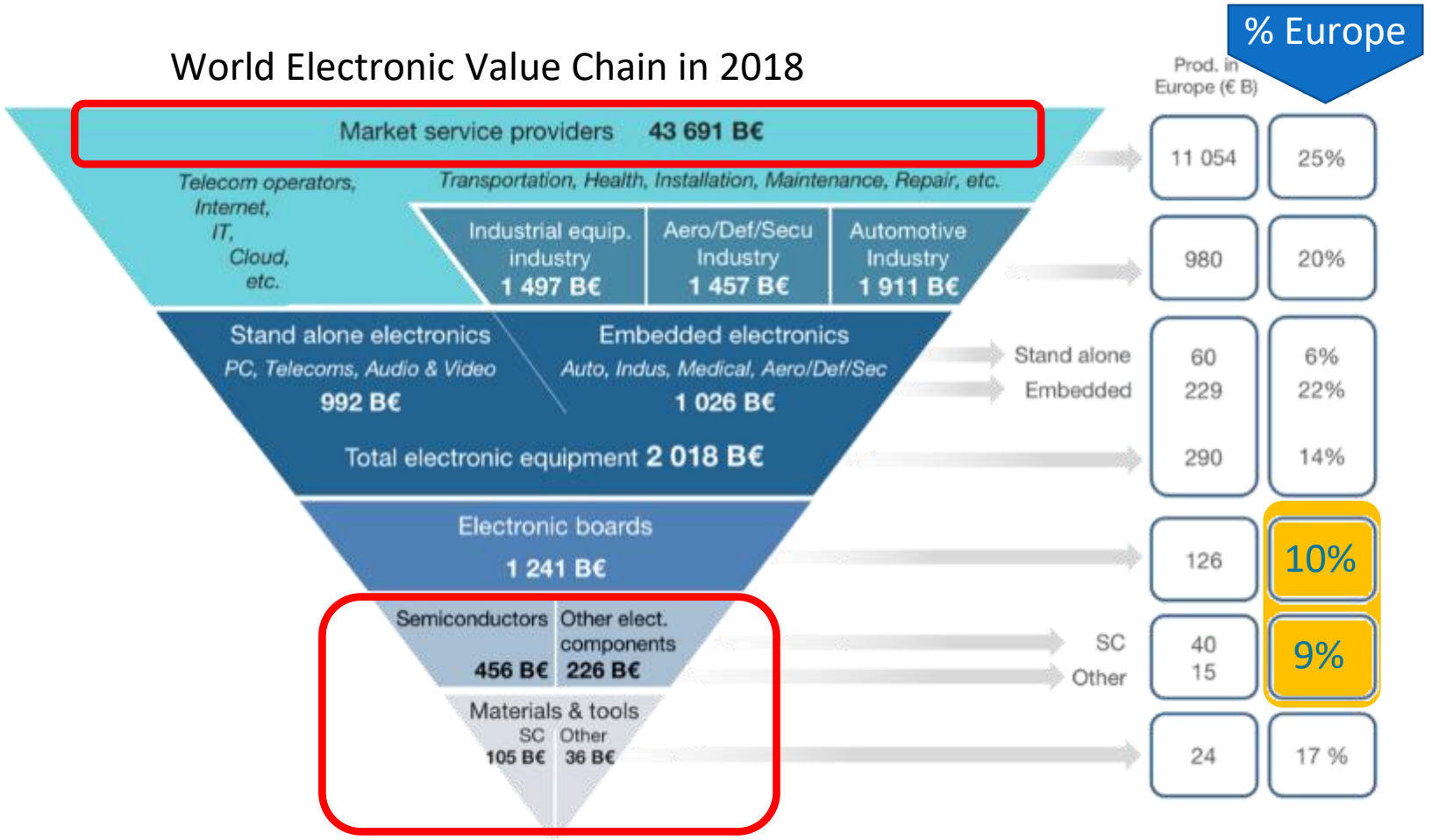
Semiconductor Technology and Production

Materials, Technologies

Equipment

Production and Supply Chain

Motivation



European strengths (examples)

Vehicles, Industry, **Medical** Equipment

Automotive systems, Medical, Industry

SoC, smart power, sensors, security, µC

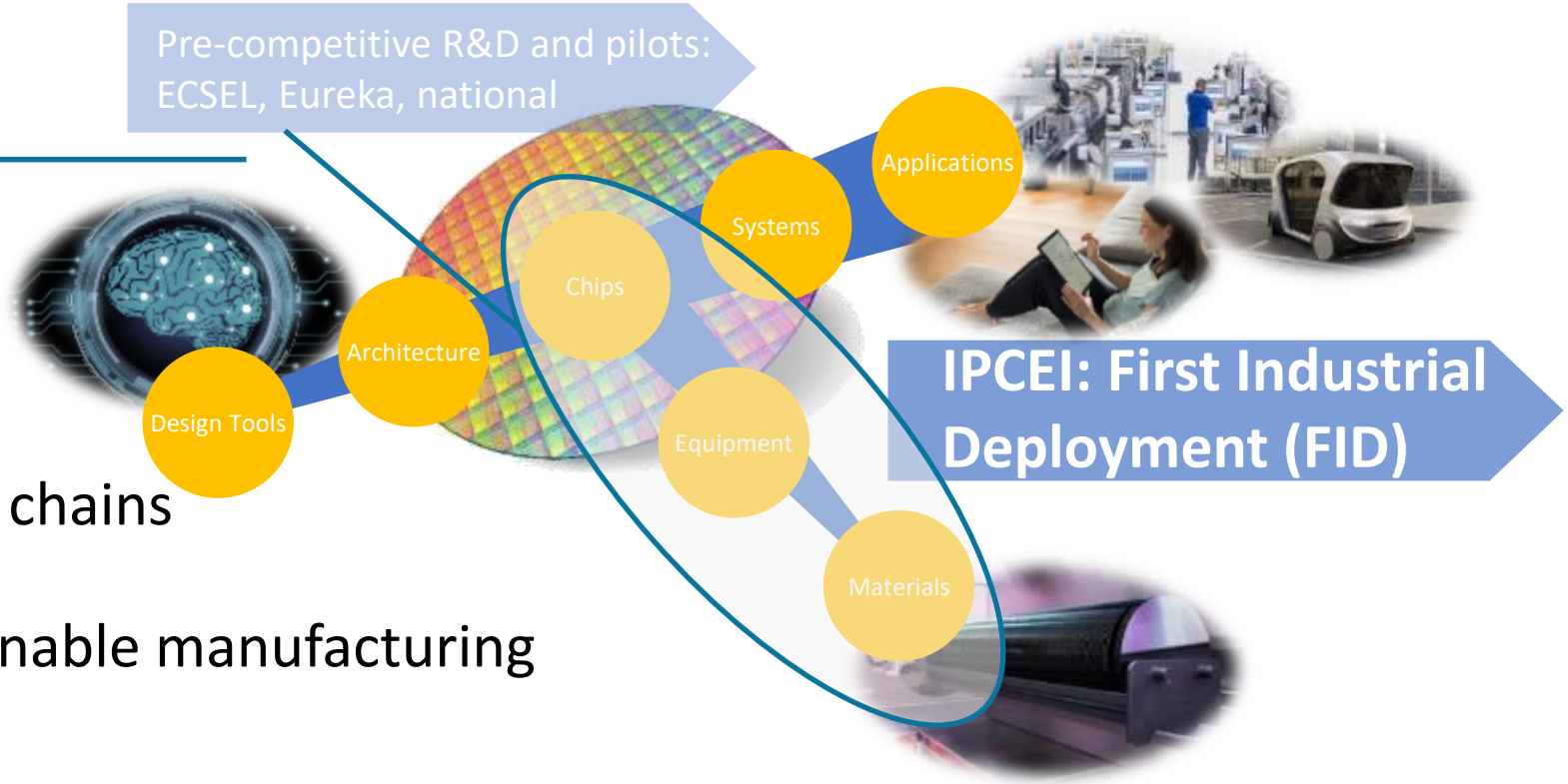
Manufacturing mixed signal >22nm, Special (MEMS, SiC, Power)

Tools, Lithography, Automation

Source : DECISION for the study: Emerging Technologies in Electronic Components and Systems - Opportunities Ahead (DG CONNECT, 2019)

Motivation

IPCEI 2017 – 2020 (2022)



Objectives

- Enabling strategic European value chains
- R&D, innovation and strong sustainable manufacturing
- Global competitiveness
- Trustability and sovereignty

Sources: Bosch, deposit photos

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The five technology fields

The 5 “Technology Fields” of the IPCEI for Microelectronics

1. Energy efficient chips (e.g. ultra-low power FDSOI and embedded digital technologies)

2. Power Semiconductors (e.g. innovative silicon as well as new materials (GaN, SiC), assembly & packaging)

3. Smart Sensors (e.g. mm-wave sensors for autonomous driving and sensors for IoT applications)

4. Advanced Optical Equipment (e.g. leading edge optics for More Moore devices)

5. Compound materials (e.g. next generation lighting systems applying LEDs)

The five technology fields

* Now Lynred

+ 4 EU countries

+ 27 project partners

+ Focus on 5 Technology Fields

+ Projects costs >/= 6bn€

+ Total funding about 1.75bn€

+ Funding per national government only

The five technology fields

* Now Lynred

11 presentations in this EuroSimE

8 partners involved

All technology fields involved

Introduction to importance of modelling and simulation in IPCEI

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First Industrial Deployment in Europe: Some Highlights

Fab extension at Soitec Crolles

ST at Crolles

ST at Agrate

Fab extension at Zeiss Oberkochem

IPCEI on Microelectronics

New Bosch fab at Dresden

Infineon at Warstein

Fab extension Infineon at Regensburg

Globalfoundries at Dresden

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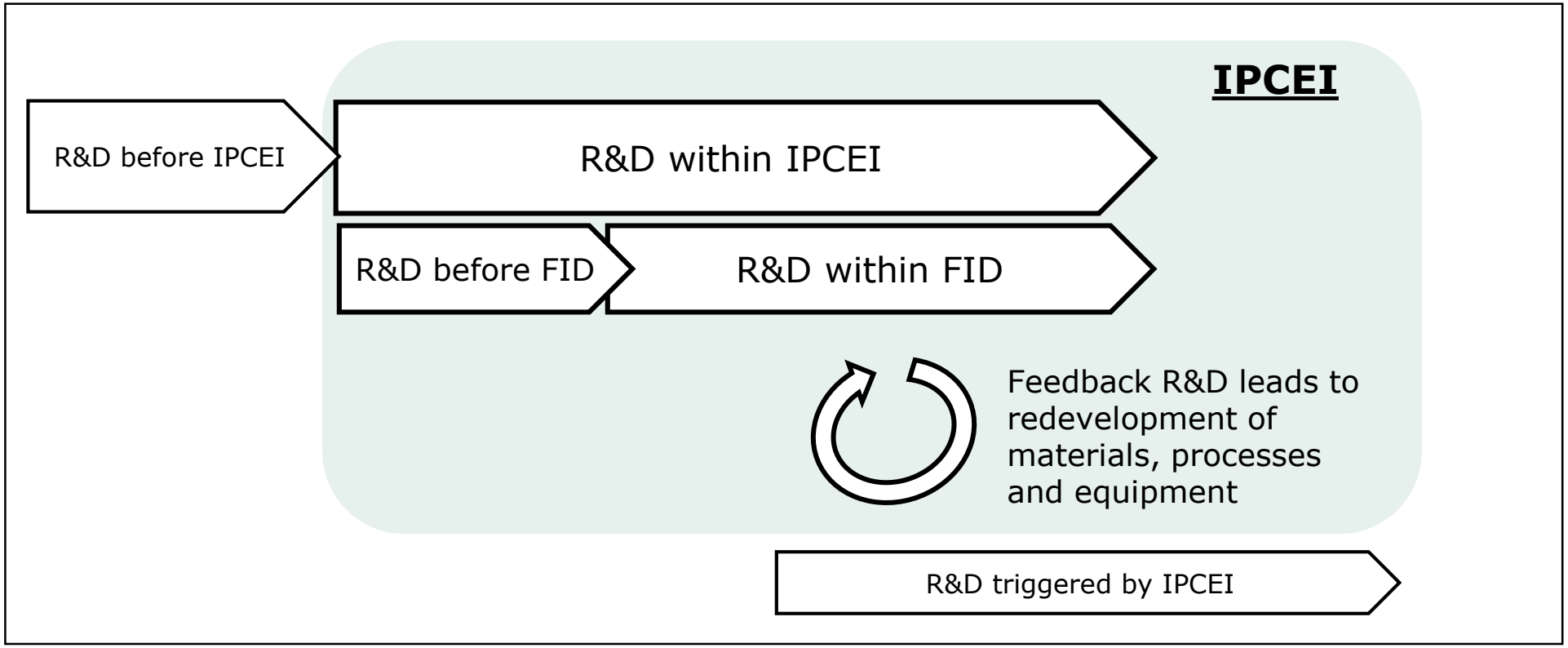
The need for ever more R & D & I in FID



Examples for new R & D & I projects initiated by IPCEI

- FA4.0 – innovative Failure Analysis (German-French EUREKA Euripides/Penta – Project),
  driven especially by IPCEI partners Infineon, Bosch, ST-F, ...

- iRel40 - Intelligent Reliability (76 partners from 13 European countries in one ECSEL JU project drive reliability along the value chain),
  driven especially by IPCEI partners Infineon, Bosch, XFAB, Elmos, ...

10 technical presentations from five technology fields

* Now Lynred

1 overview presentation

10 techncial presentations in this EuroSimE

8 partners involved

All technology fields involved

Target of this session

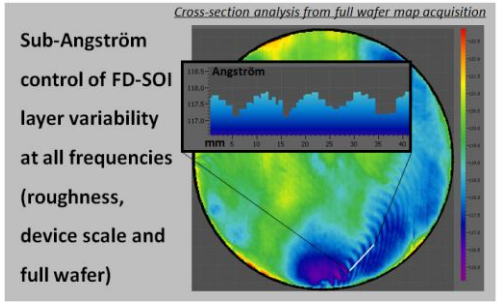
Introduction to importance of modelling and simulation in IPCEI

Agenda: Introduction of 10 technical presentations

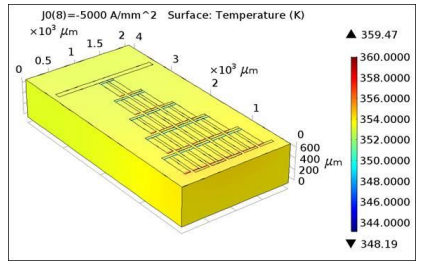
"Introduction to the Important Project of Common European Interest (IPCEI) – A new path for investment in research, development and innovation by Europe's semiconductor industry", (# 107)

Corresp. author: Klaus Pressel (Infineon), Rainer Pforr (Zeiss), Michael Offenberg (Bosch)
Email: klaus.pressel@infineon.com

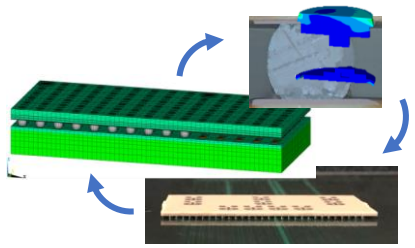
Technology Field 1: Energy Efficient Chips



"Differential Réflective Metrology: An innovative variability measurement for advanced FDSOI material" (# 108)
Corresp. author: Jean-Michel Billiez, Walter Schwarzenbach (Soitec, France)
Email: jean-michel.billiez@soitec.com

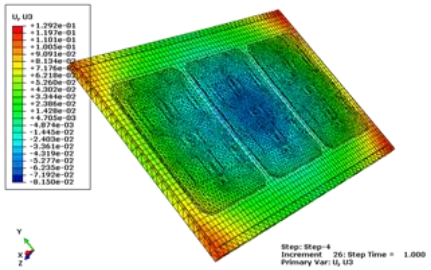


"Thermal-electric modelling of thermoelectric and electrocaloric on-chip cooling devices" (# 109)
Corresp. author: Caroline Schwinge, Sabine Kolodinsky, Maciej Wiatr, M. Wagner-Reetz, W. Weinreich (Fraunhofer IPMS and GLOBALFOUNDRIES Dresden)
Email: caroline.schwinge@ipms.fraunhofer.de



"Finite Element Simulation for High Frequency Automotive Package Developments" (# 110)
Corresp. author: *Karsten Meier, L. Wambera, C. Götze, M. Wieland, K. Bock*
(Techn. Univ. Dresden and GLOBALFOUNDRIES Dresden)
Email: karsten.meier@tu-dresden.de

Technology Field 2: Power Semiconductors



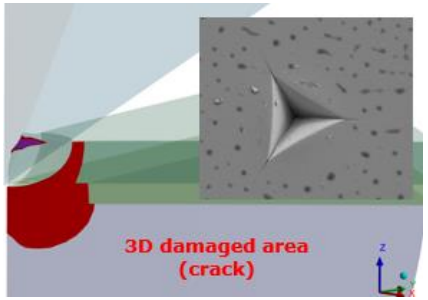
AMB substrate out of plane displacement and the interaction with assembly

"Power Module Ceramic Substrates: mechanical characterization and modeling" (# 111)
Corresp. author: Michele Calabretta (STMicroelectronics Italy)
Email: michele.calabretta@st.com

"Reliability Requirements of Advanced Packaging in the Era of Electrified, Automated and Connected Driving" (# 112)
Corresp. author: Przemyslaw Gromala (Bosch)
Email: PrzemyslawJakub.Gromala@de.bosch.com

"FEM simulation applied to Thermal Laser Separation (TLS) with Deep Scribe for Silicon Wafer Dicing" (# 114)
Corresp. author: Christian Belgardt (3D-Micromac AG)
Email: belgardt@3d-micromac.com

Reliable method for determination of fracture properties allows to avoid over-engineering in design of robust micro-electronic structures (Ananiev et al)



Technology Field 3: Smart Sensors

"Determination of Fracture Properties of Thin Dielectric Films by Nanointendation" (# 113)
Corresp. author: Sergey Ananiev , P. Altiere-Weimar (both Infineon), C. Sander, A. Clausner (both FhG IKTS)
Email: Sergey.Ananiev@infineon.com

"Trends and future challenges in designing and simulating high performance MEMS" (# 115)
Corresp. author: Mirko Hofmann (Bosch)
Email: Mirko.Hofmann@de.bosch.com

Technology Field 4 Optical Equipment

"Transient Thermoelastic Structure Analysis to quantify the Thermal Stability of Extreme-Ultraviolet (EUV) Projection Systems" (# 116) Corresponding author: Timo Laufer (Zeiss)

Email: timo.laufer@zeiss.com

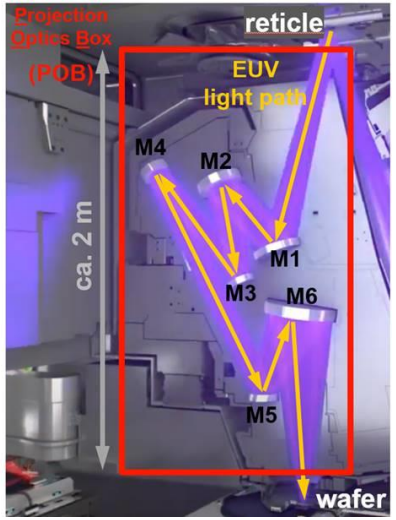
Heat impact on **P**rojection **O**ptics **B**ox (POB) about **90 W**.

Dimension mirror support structure (POB-frame) about **2 m**.

The **thermal stability** of the mirror support structure must guarantee an image drift on wafer level of less than **1 nm** within the exposure of one wafer (within about **1 min**).

→ ***Stability Requirement:***

Image drift on wafer level < 1 nm / min !!!



Technology Field 5: Compound Materials

"*Innovative relaxed InGaN engineered substrates for RGB Micro-LEDs" (# 117)*

Corresponding authors: David SOTTA (SOITEC) and Amelie DUSSAIGNE (CEA-LETI)
Email: david.sotta@soitec.com

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Conclusions: IPCEI drives EC microelectronics

- IPCEI on Microelectronics is a great success for the European Semiconductor Industry !
  - Stimulating substantial investment
  - Jobs and Know-How in Europe
- International challenges remain, have even increased
- Europe has strong opportunities in emerging microelectronics technologies needed to serve megatrends and achieve societal goals
- IPCEI Microelectronic served as a blueprint for follow-up IPCEIs: European Battery Alliance and Clean Hydrogen Alliance

IPCEI is an important tool to bring technology to the level of First Industrial Deployment and should be pushed and further developed.

Thank you

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IPCEI on Microelectronics

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for making this EuroSimE session happen

And now enjoy the 10 presentations on modelling and simulation from the five IPCEI technology fields