New momentum in semiconductor: Impact of Ecosystems

A European case study

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Semiconductor: the return of industrial policy

A European case study

Redeploying semiconductor production

20B$ - 20A – 2025

12B$ - 5nm – 2024
23B$ (5 fabs overall)

17B$ - 3nm – 2024
174B$ (11 fabs overall)

6,5B$ - 45nm – 2025
23B$ - 4 fabs overall

12B€ - Intel-4 – 2025

5,4B€ - 40nm-18nm – 2024

17B€ - 20A – 2025

10B$ - Intel-4 – 2025

20B$ - 28nm – 2025

7,5B$ - 180nm-28nm – 2025

9B$ - 28nm – 2025

4B$ - nm – 2023

5B$ - 22nm – 2025

20B$ - P4 - 3nm – 2025
283B$ in Korea till 2027

8,6B$ - 28nm-12nm – 2025

34B$ - 2nm – 2025

??B$ - 28nm-7nm – 2024

More than 50 advanced 300mm fabs are under construction thanks to government incentives

Agenda

World semiconductor economy: Europe’s position

CEA Leti, a european R&D Leader, located in a land of innovation

World semiconductor economy:
■ Europe’s position

Europe: a dynamic land

Automotive

36% SC market

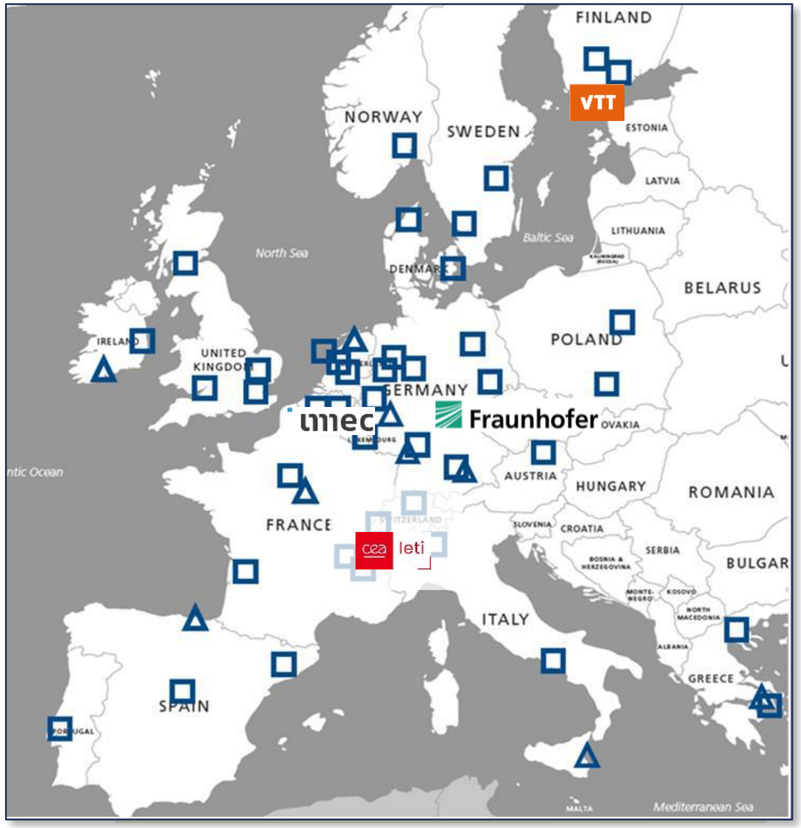
Industry

28% SC market

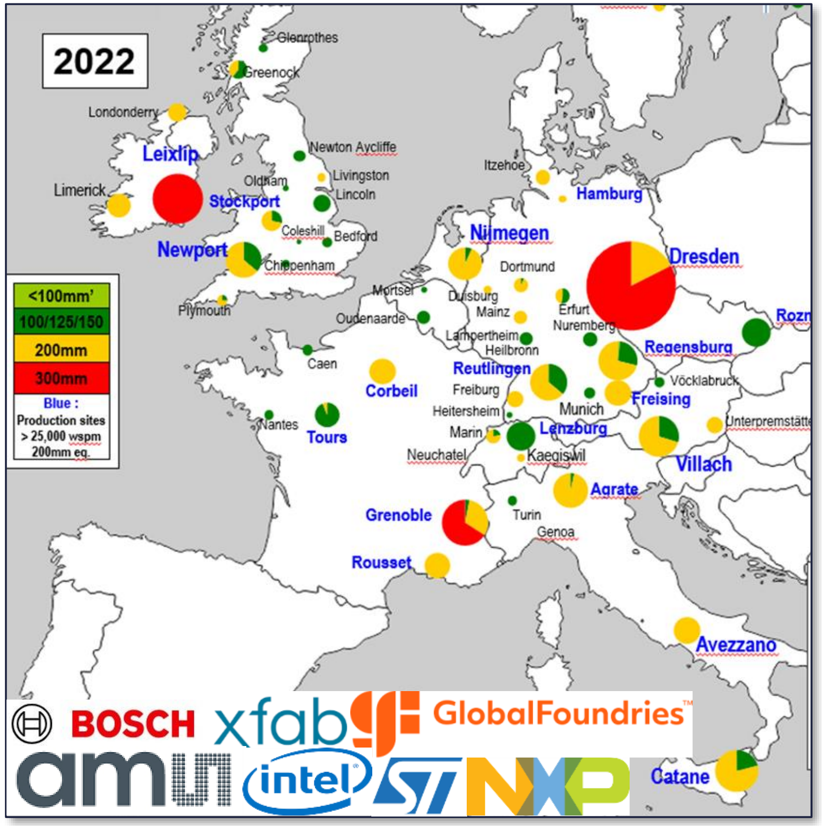
Infrastructures

13% SC market

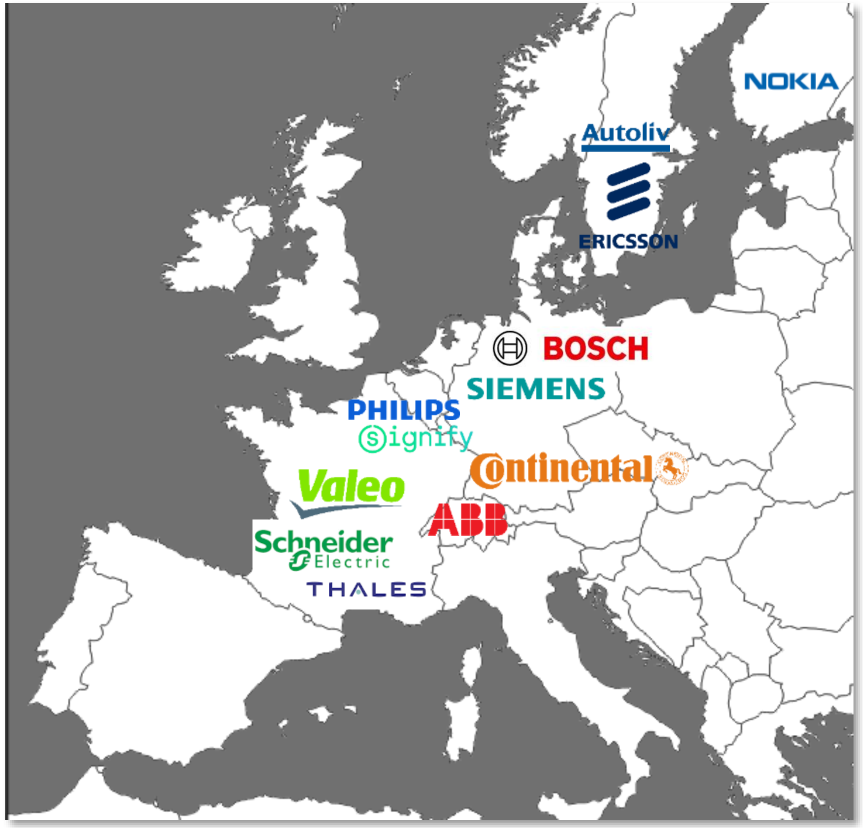
European strength ecosystem:
3 pillars



Top research centers (SC) & High quality education



Semiconductors fabs : mature nodes and focus on mixed signals

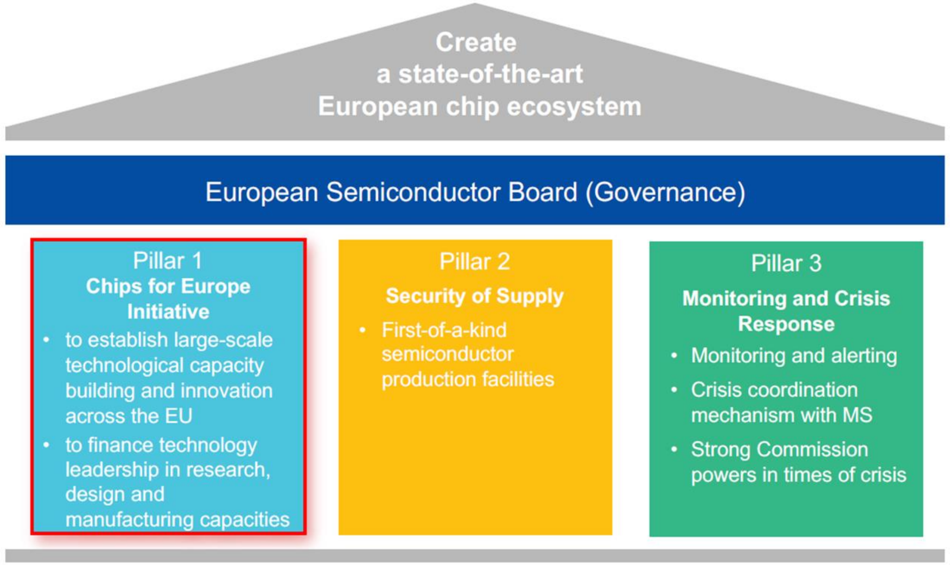


OEM leading their industry

€ Global budget: 43 B€

Chips for Europe Initiative and Security of Supply

Three pillars of the Chips Act



Create
a state-of-the-art
European chip ecosystem

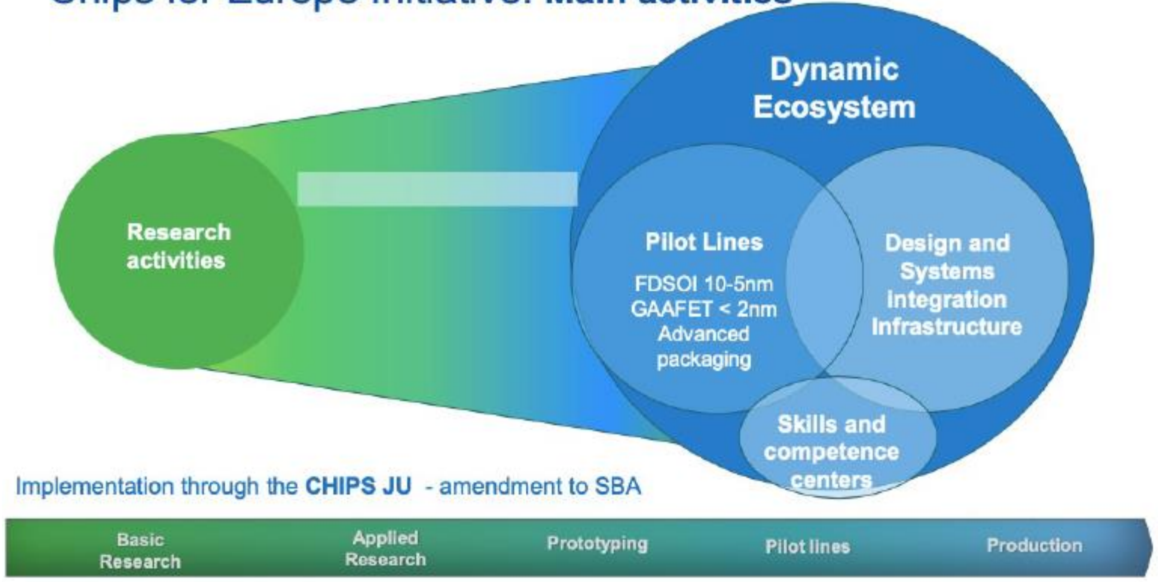
European Semiconductor Board (Governance)

Pillar 1
Chips for Europe Initiative
- to establish large-scale technological capacity building and innovation across the EU
- to finance technology leadership in research, design and manufacturing capacities

Pillar 2
Security of Supply
- First-of-a-kind semiconductor production facilities

Pillar 3
Monitoring and Crisis Response
- Monitoring and alerting
- Crisis coordination mechanism with MS
- Strong Commission powers in times of crisis

Chips for Europe Initiative: **Main activities**



Implementation through the **CHIPS JU** - amendment to SBA

- Bridge the gap from lab to fab by creating large innovation capacity and a resilient and dynamic semiconductor ecosystem (Pillar 1)
- Enhance existing and developing new pilot lines (Pillar 1)
- Increase european production capacity from 6% to 20% of the global market by 2030 and address the skills shortage (Pillar 2)
- Contribute to the security of supply and strengthen the resilience of the semiconductor ecosystem in the Union by supporting first-of-a-kind facilities (Pillar 2&3)

Impact on European ecosystem (1/3)

“Increase european production capacity” (Pillar 2)

Intel Advanced nodes:

Magdebourg Mega-fab

The plans are to invest an initial 17 billion euros into a leading-edge semiconductor fab mega-site in Germany.

- Construction is subject to the EU Commission and the German authorities approving the subsidy.
- With the start of production, we will use our latest transistor technologies for manufacturing and serve the demand of the Foundry customers.
- As part of the investment, Intel will employ around 7,000 construction jobs over the course of the build and will create 3,000 permanent high-tech jobs at Intel, and tens of thousands of additional jobs across suppliers and partners.

Impact on European ecosystem (2/3)

“Increase european production capacity” (Pillar 2)

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GlobalFoundries™

Crolles Mega Fab

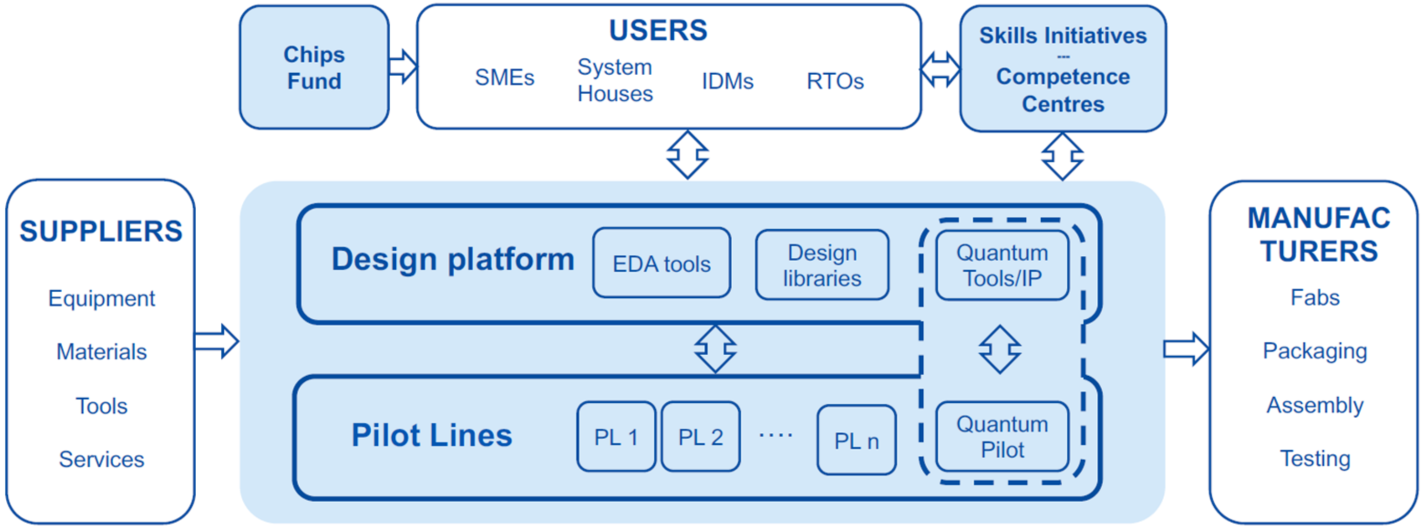
- Extension of STMicroelectronics existing 300mm fab

(up to 1,1M wafers in 2026)

- GlobalFoundries and STMicroelectronics 5,4B€ joint investments with EU CHIPS ACT and France 2030 incentives
- 1000 people hiring and impact on full ecosystem (universities and engineering schools, suppliers, etc)

Impact on European ecosystem (3/3)

Bridging the gap from lab to fab



European Commission

- Reinforce design capacity by providing a virtual design platform
- Enhance existing and developing new pilot lines
- Accelerate the development of quantum chips
- Expand skills and set up a network of competence centres
- Faciliate SME access to equity and loans through a dedicated chips Fund

European RTO alliance

11500
researchers

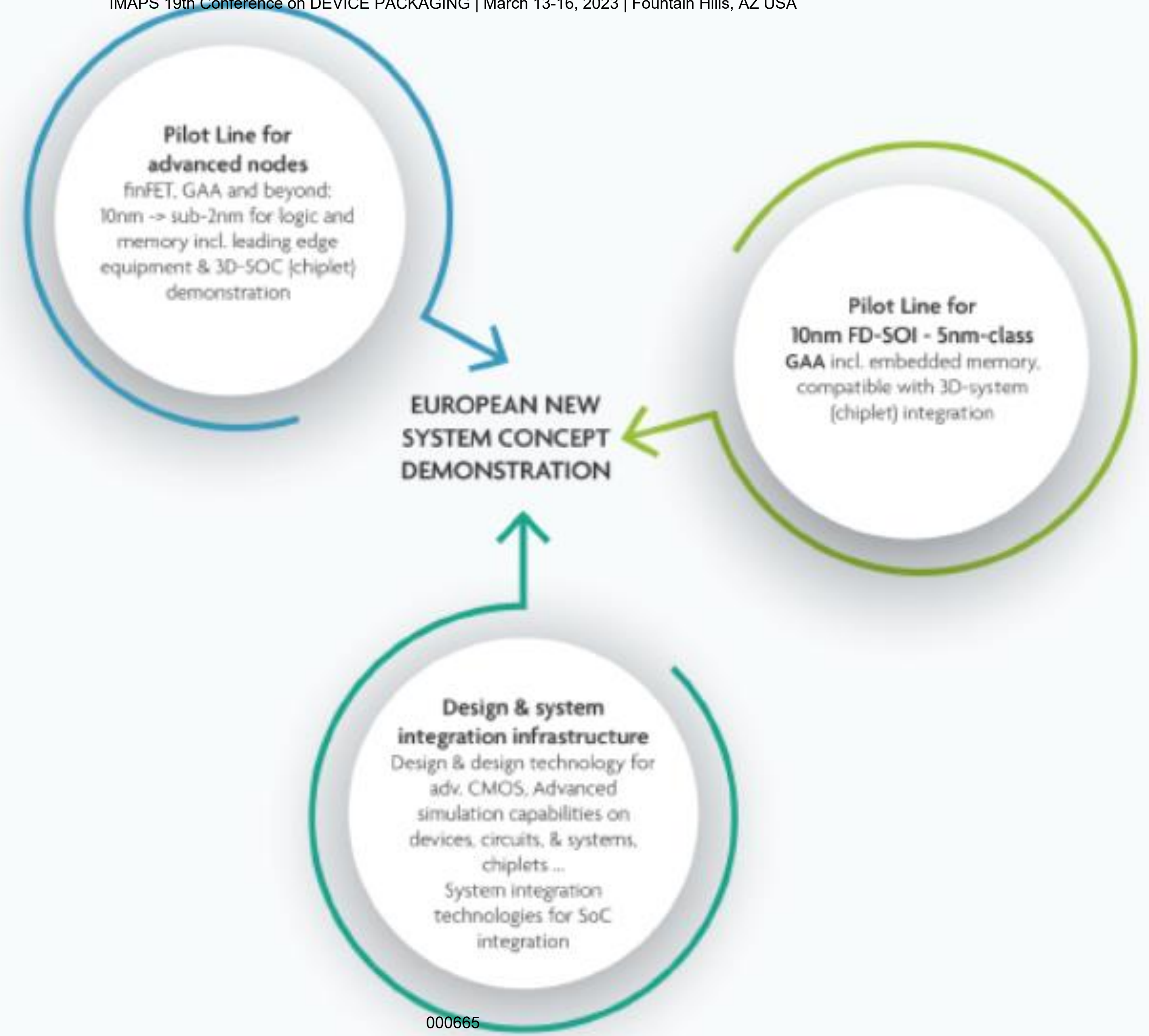
41.500 m2
cleanroom

€1.400 million
annual budget

More than 180
startups created

Pan-**European** alliance
For **European Technology**
and Innovation Leadership

3 Pilot Lines



Pilot Line for advanced nodes
finFET, GAA and beyond:
10nm -> sub-2nm for logic and memory incl. leading edge equipment & 3D-SOC (chiplet) demonstration

Pilot Line for 10nm FD-SOI - 5nm-class GAA incl. embedded memory, compatible with 3D-system (chiplet) integration

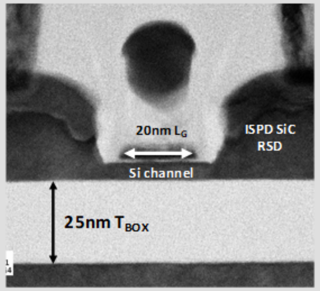
EUROPEAN NEW SYSTEM CONCEPT DEMONSTRATION

Design & system integration infrastructure
Design & design technology for adv. CMOS, Advanced simulation capabilities on devices, circuits, & systems, chiplets ...
System integration technologies for SoC integration

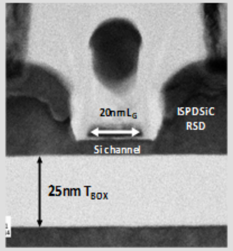
1. FD-SOI NextGen (10-7 nm) pilot line

Current and near-future European FD-SOI offer

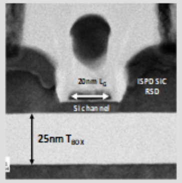
28nm FD-SOI



22nm



18nm



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GlobalFoundries

GF-Leti partnership

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Current markets: MCU, Imagers, 5G/6G, IoT, RF, Wearables

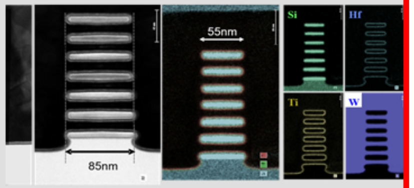
2022-2026
Techno Development FD-SOI 10-7nm

- Strained SOI wafer
- Transistors boosters
- MEOL integration
- Embedded NVM
  - *MRAM by imec, FeRAM by FhG, OxRAM, PCM by Leti…*
- Full benefit of body-biasing
  - *EDA tools and IP*
- Process Design Kits
  - *provided to all European partners who want to assess the technology*

2025-2027
Specific Development for key markets

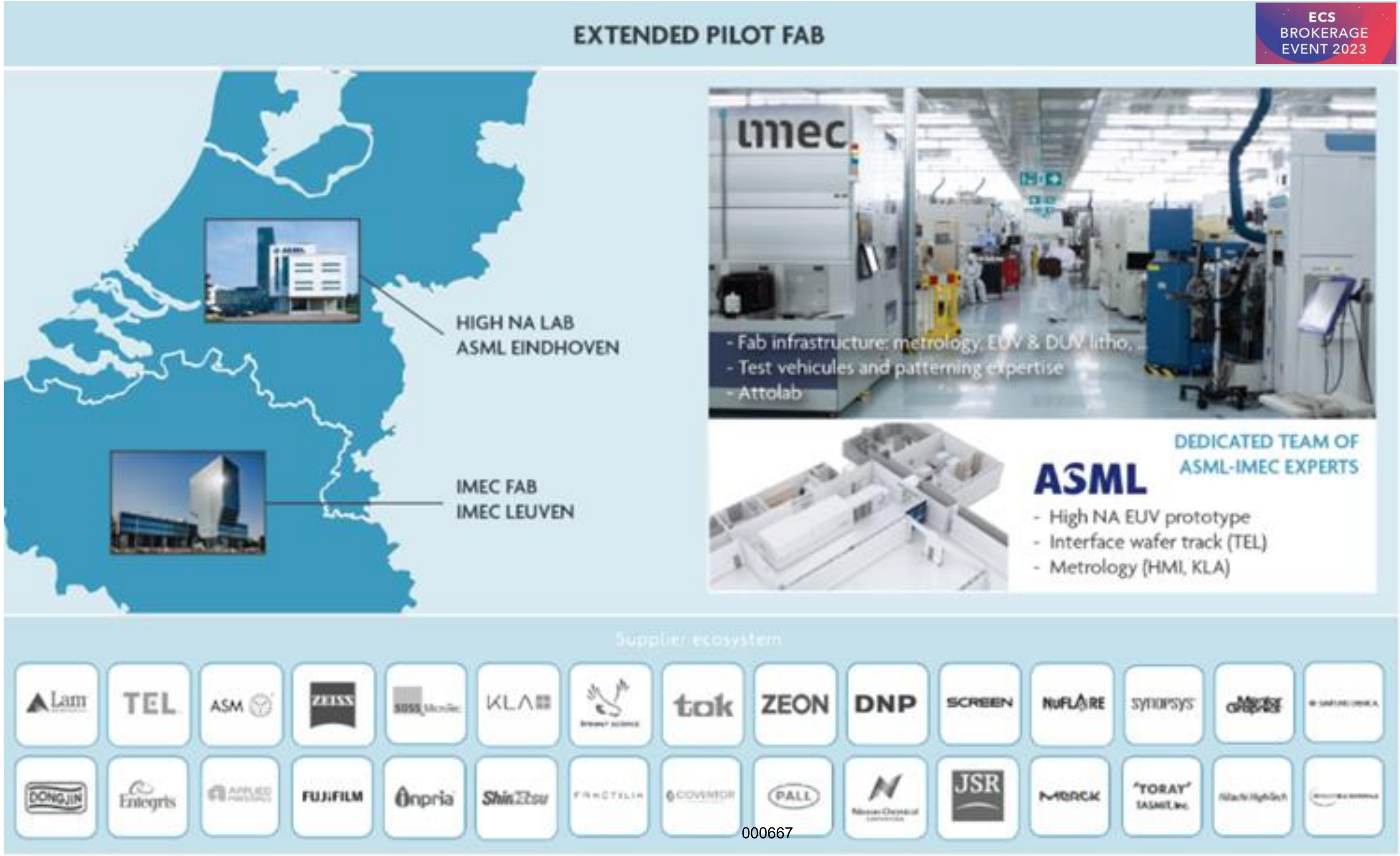
- Computing
  - *MCU*
  - *Data fusion MPU*
  - *Edge AI/ML*
- More-Than-Moore markets
  - *Automotive*
  - *5G/6G chips*
  - *RF Connectivity*
  - *IoT devices*
  - *Smart Imagers*
  - *Smart sensors*
  - *Cybersecurity*
  - *Wearables*
  - *Health devices…*
- Quantum
  - *Qubits on Si*
  - *CryoCMOS*
  - *Trusted IC*
  - *New space devices…*

2026-2030
Breakthrough to nanowire/sheet technology



ECS BROKERAGE EVENT 2023

2. Leading edge and advanced semiconductor equipment technology



EXTENDED PILOT FAB

ECS
BROKERAGE
EVENT 2023

HIGH NA LAB
ASML EINDHOVEN

IMEC FAB
IMEC LEUVEN

imec

- Fab infrastructure: metrology, EUV & DUV litho, ..
- Test vehicules and patterning expertise
- Attolab

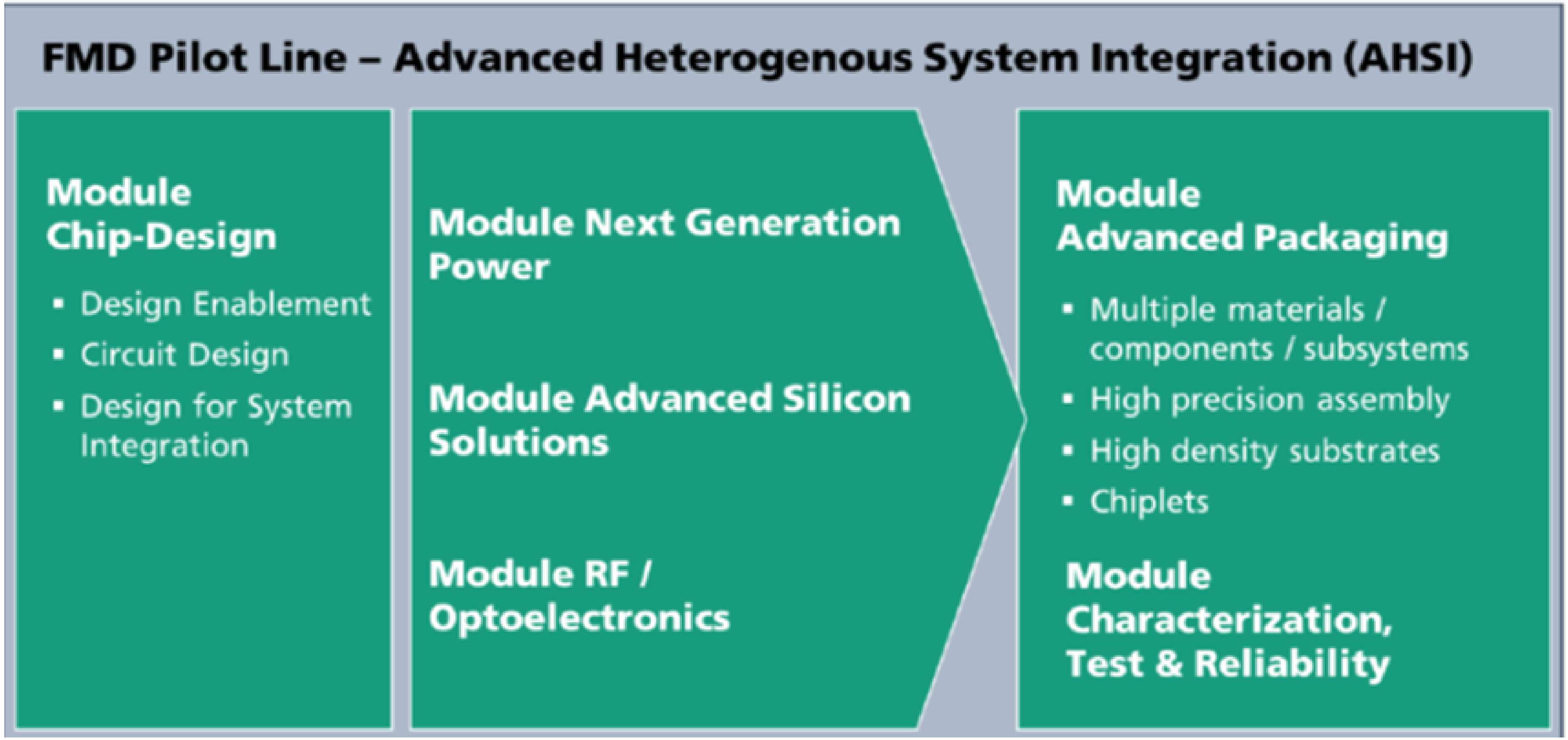
DEDICATED TEAM OF
ASML-IMEC EXPERTS

ASML

- High NA EUV prototype
- Interface wafer track (TEL)
- Metrology (HMI, KLA)

Supplier ecosystem

3. Advanced heterogeneous system integration



FMD Pilot Line – Advanced Heterogenous System Integration (AHSI)

Module Chip-Design
- Design Enablement
- Circuit Design
- Design for System Integration

Module Next Generation Power

Module Advanced Silicon Solutions

Module RF / Optoelectronics

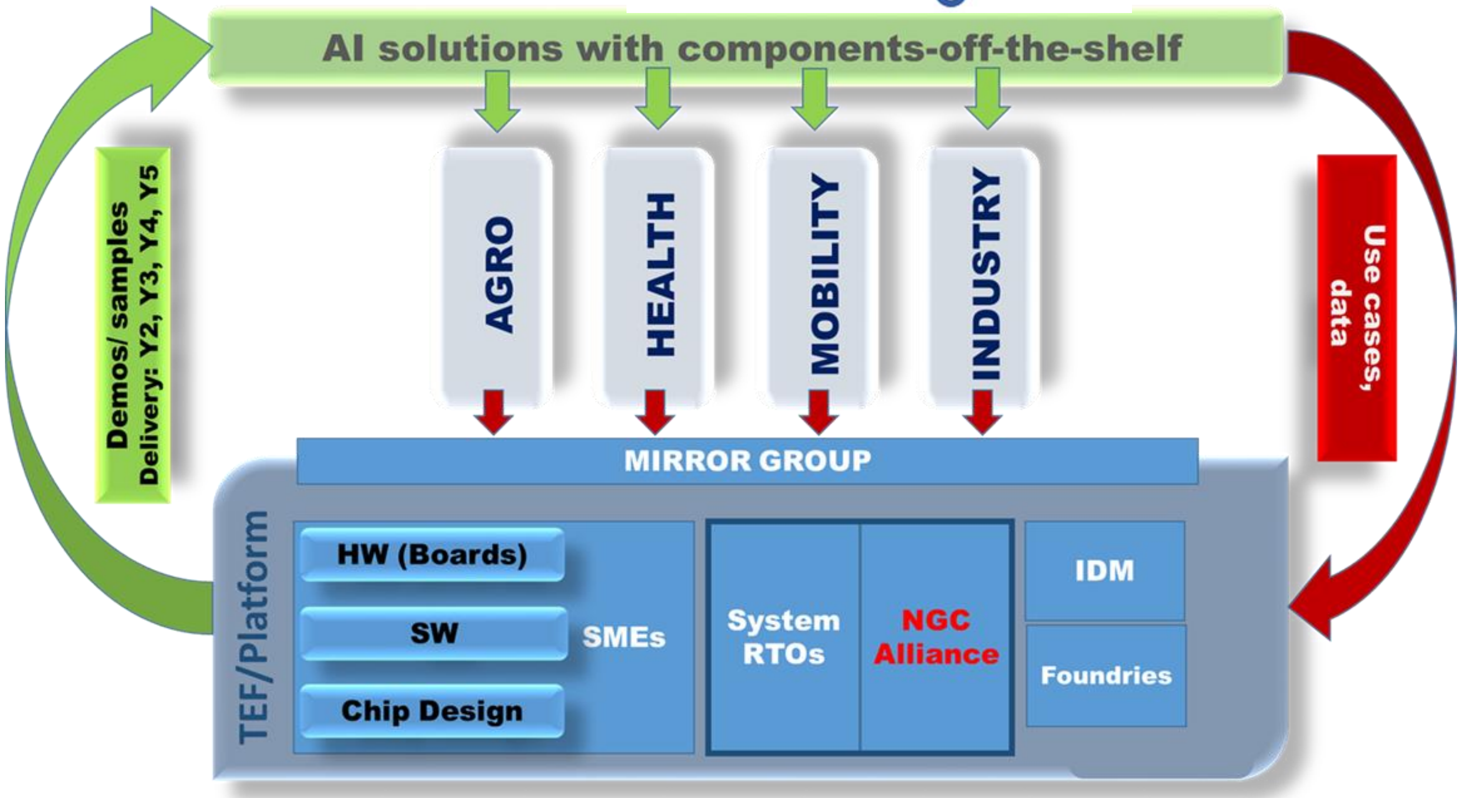
Module Advanced Packaging
- Multiple materials / components / subsystems
- High precision assembly
- High density substrates
- Chiplets

Module Characterization, Test & Reliability

Markets, Customers, Application Industry
- Automotive
- Aerospace
- IDMs and Foundries
- Health
- Energy
- Consumer
- …

ECS BROKERAGE EVENT 2023

Example of PREVAIL project & vision



AI solutions with components-off-the-shelf

Demos/ samples
Delivery: Y2, Y3, Y4, Y5

AGRO

HEALTH

MOBILITY

INDUSTRY

Use cases, data

MIRROR GROUP

TEF/Platform

HW (Boards)

SW

Chip Design

SMEs

System RTOs

NGC Alliance

IDM

Foundries

- The partners in the platform provide a set of 300mm technologies, open to any user, in order to fabricate prototype Edge AI chips (a few units) required by the user for non commercial purposes.
- Proposals are examined by the partners to verify feasibility, cost and delay.
- Proposals can come via DIH, KDT projects, directly.
- The user receives the prototypes and test them in its field of application.

Europe has competitive strengths at the global scale


Technologies

Design

System application

RTO / universities

Technology
Design
System application
RTO / Universities

CEA Leti, a european R&D Leader, located in a land of innovation

3rd Innovative Public Research Organization Worldwide

Derwent World Patents Index, 2012-2023

CEA-Leti European leadership with a strong local implantation

Unique ecosystem: French Silicon Valley

R&D & EDUCATION

- cea leti
- UGA Université Grenoble Alpes
- Inria
- cnrs
- Grenoble INP
- GRENOBLE ECOLE DE MANAGEMENT

TECHNOLOGIES

- ST life.augmented
- TELEDYNE TECHNOLOGIES Everywhereyoulook
- soitec
- microoled INNOVATIVE AMOLED SOLUTIONS
- TRIXELL
- LYNRED
- Aledia
- intel
- TDK

NETWORK CLUSTER & FUNDING

- NANOELEC
- cea investissement AMORÇAGE TECHNOLOGIQUE
- CCI GRENOBLE
- La FRENCH TECH IN THE ALPS
- SILICON EUROPE
- bpifrance
- MINALOGIC

SYSTEM APPLICATION

- Schneider Electric
- orange
- ARaymond
- Hewlett Packard Enterprise
- CORYS
- Atos
- THALES
- HUAWEI
- Radiall
- NAVER
- esri France THE SCIENCE OF WHERE
- open WE EMPOWER YOUR DIGITAL WORLD

DESIGN

- HARDIS GROUP
- pyxalis
- KALRAY
- DOLPHIN DESIGN
- Capgemini

EQUIPMENTS & SW TOOLS

- APPLIED MATERIALS
- TEL
- SYNOPSYS
- SILVACO
- ORACLE
- Mentor Graphics
- Entegris

A long tradition of cooperation: research, education, industry

In the 50's, three men have anticipated and prepared the future

1904-2000

Louis Néel

Nobel prize in Physics

Founder of CEA-Leti Grenoble

1914-1968

Louis Weil

Former Dean of the Grenoble University

1882-1973

Paul-Louis Merlin

Industrial and founder of Merlin-Gérin (Schneider Electric, 1920)

Nature 23/01/19: How Grenoble has mastered industry–academia science collaborations
https://www.nature.com/articles/d41586-023-00109-x

Bring out innovations in Semiconductors:
The example of IRT Nanoelec, a public-private strategic partnerships

Multi-partnership

FRANCE 2030

La Région Auvergne-Rhône-Alpes

+

Public + private

Consortium NANOELEC.

+

Pre-existing Infrastructure

Almae
Aledia
CAP'TRONIC
ESRF
cea
cnrs
iROC
EVG
GRENOBLE ECOLE DE MANAGEMENT
GRENOBLE INP UGA
diabeloop
Inria
LYNRED
NEUTRONS FOR SOCIETY
SIEMENS
MINALOGIC
PROPHESEE
Schneider Electric
seto
soitec
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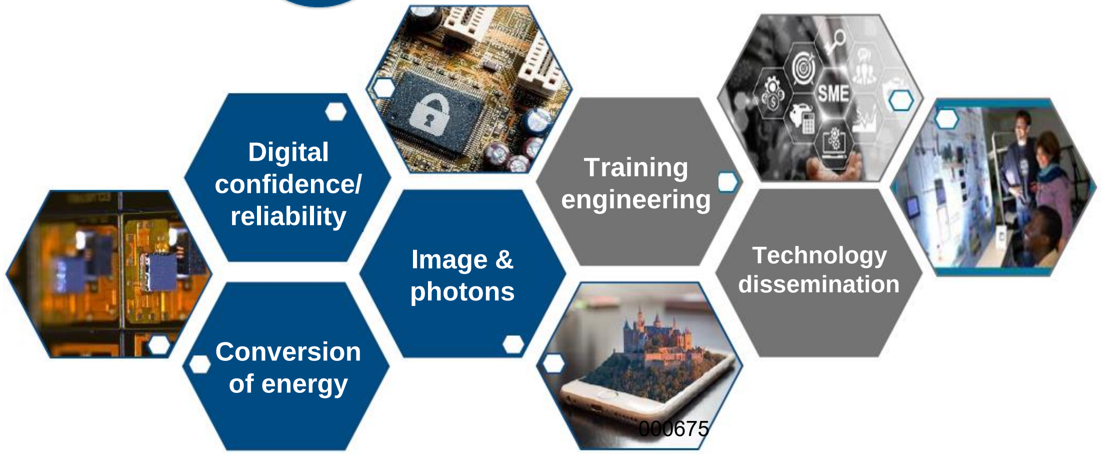
UGA Université Grenoble Alpes

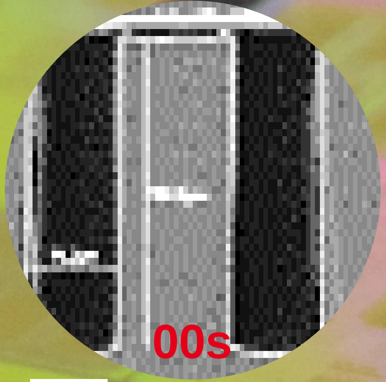
- 12 industrials
- 8 R&D public-private
- 1 cluster
- 1 association

22 core partners and nearly 300 associated partners



NANOELEC.

Examples of lab to fab (3D integration)



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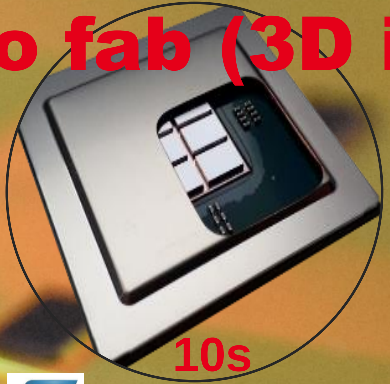

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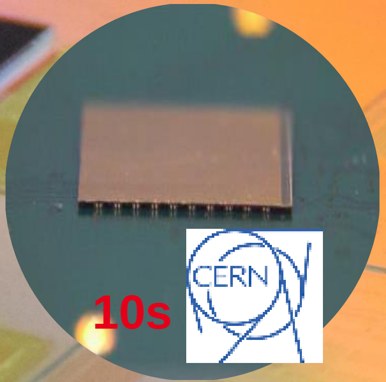

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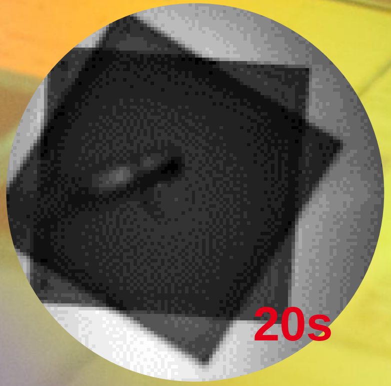
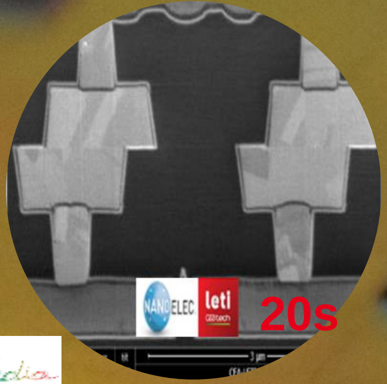
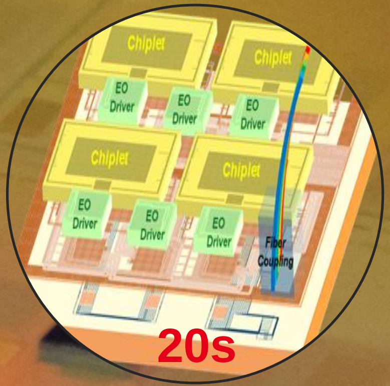
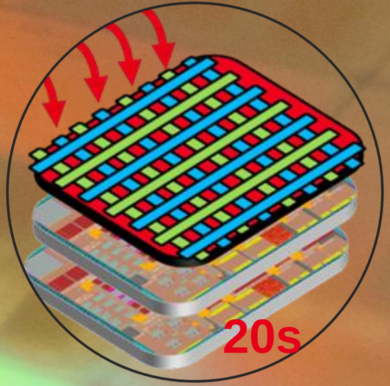


intel

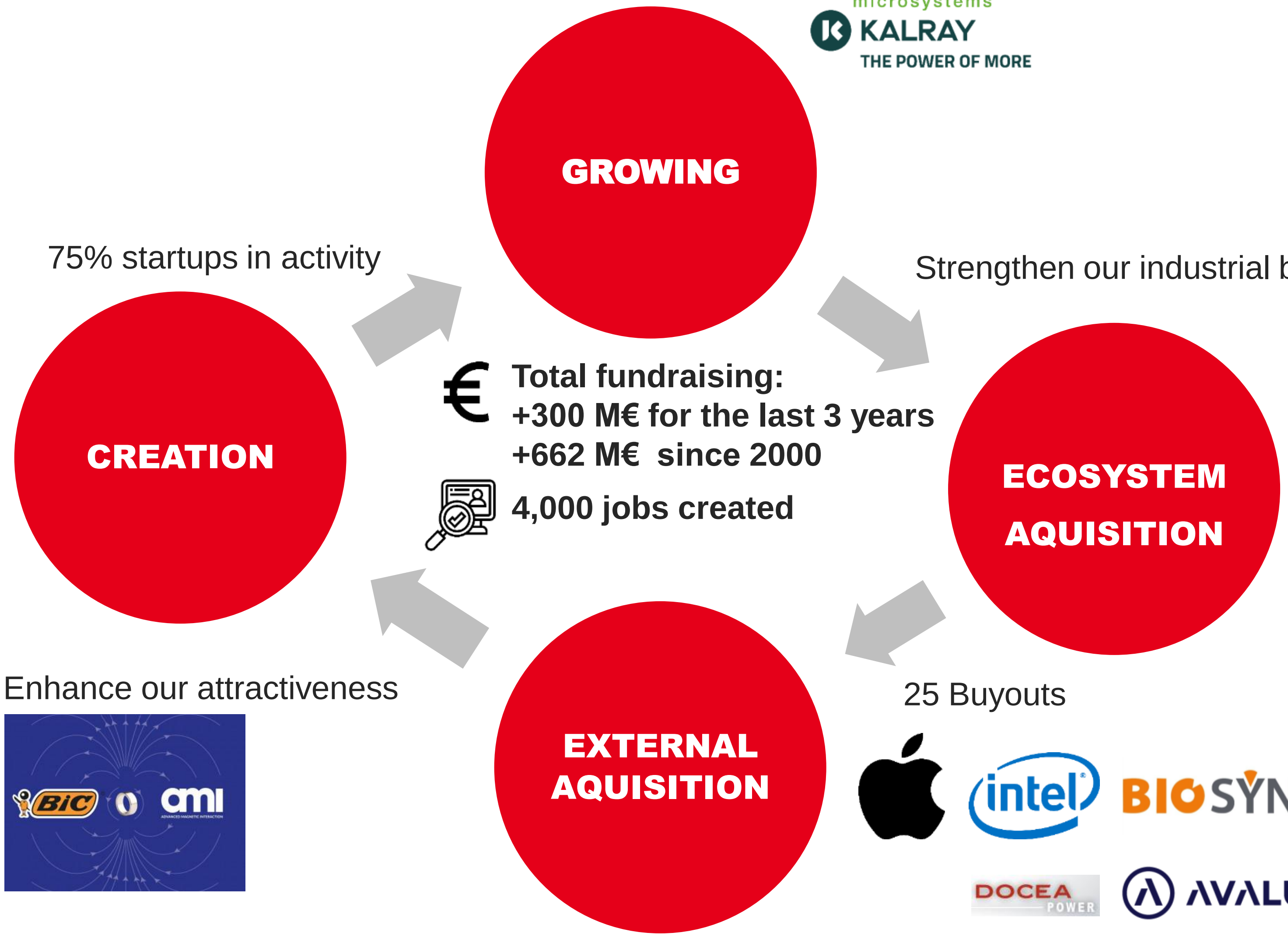


Aledia





Semiconductor @ Leti, a living ecosystem



3 IPO

soitec
tronics microsystems
KALRAY THE POWER OF MORE

75% startups in activity

Strengthen our industrial base

ST life.augmented
BeSpoon
EXAGAN Accelerate Power Transition
APPLIED MATERIALS
aselta NANOGRAPHICS

76 startups incorporated since 1973

Total fundraising:
+300 M€ for the last 3 years
+662 M€ since 2000

4,000 jobs created

Enhance our attractiveness

BIC ami

25 Buyouts

intel
BIOSYNEX
TDK
DOCEA POWER
AVALUN
movea motion is life

GRENOBLE ALPES
AN EXCEPTIONAL QUALITY OF LIFE!










Invest in Grenoble Alpes

> **“The path is arduous, the task is not easy. But together we can do it.”**
>
> *Ursula von der Leyen*

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Thank-you !

Save the date

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Leti Innovation Days

Transformational technologies for your products and our future

June 27-29, 2023 | Grenoble, France

leti-innovation-days.com

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