

ESSCIRC/ESSDERC 2023
SiNANO-ICOS Workshop

“European Strengths and Gaps in Emerging Semiconductor Technologies”

Introduction of the Workshop

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Introduction

- ICOS Project starts in January 2023 for three years, it is funded by the Horizon Europe research program.

- Coordinator



- Technical co-Coordinator



- An ambitious project in the framework of the European strategy for semiconductors "EU Chips Act"

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CONTEXT

Semiconductors & Semiconductor-based photonics are pivotal technologies for almost all existing industrial sectors, as demonstrated by the recent chips shortages

In particular, semiconductors essential enablers for **digital and green transitions** and for SDGs

OBJECTIVES

- ❑ **International cooperation** is key for speeding up technological innovation (e.g. ITRS/IRDS, IPSR-I)
 - ❑ To build **balanced semiconductor partnerships** with like-minded countries
 - ❑ To set out cooperative framework on *initiatives of mutual interest*
 - ❑ To identify and support the establishment of the **most promising scientific international collaborations**
 - ❑ To support the growth of the European Semiconductor industry through **focused research alliances** based on awareness of advanced research activities
 - ❑ To strengthen **Europe's position** in global value chains in this area
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A brief history of semiconductor technology

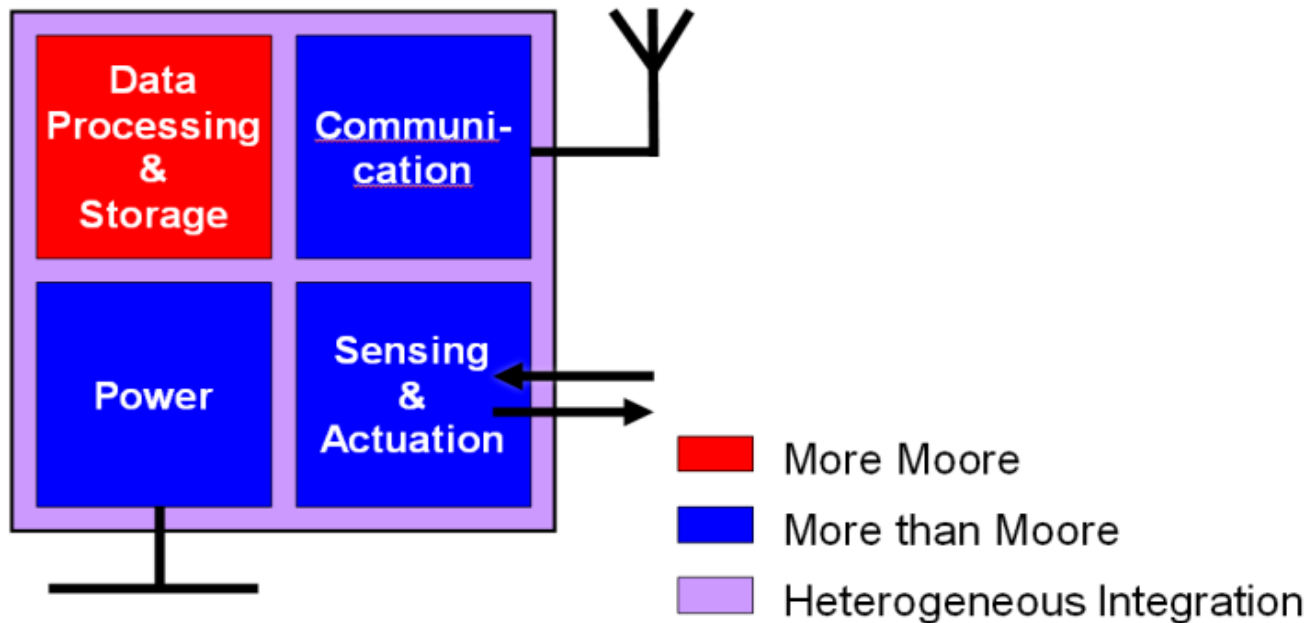
75th anniversary of the transistor

- *Point-contact transistor* by J. Bardeen and W. Brattain in Dec. 1947 (Ge)
- *Bipolar junction transistor* by W. Shockley in Jan. 1948
- *First Si Transistor* in 1958 (TI)
- *Integrated Circuit* in 1958 (J. Kilby)
- *MOS Transistor* by D. Kahng and M. Atalla in 1960 (Si)
- *Microprocessor* in 1971 (Intel)
- *> 1B Transistors per die* beginning 21st century



=> **Many innovations accelerated by international collaborations**

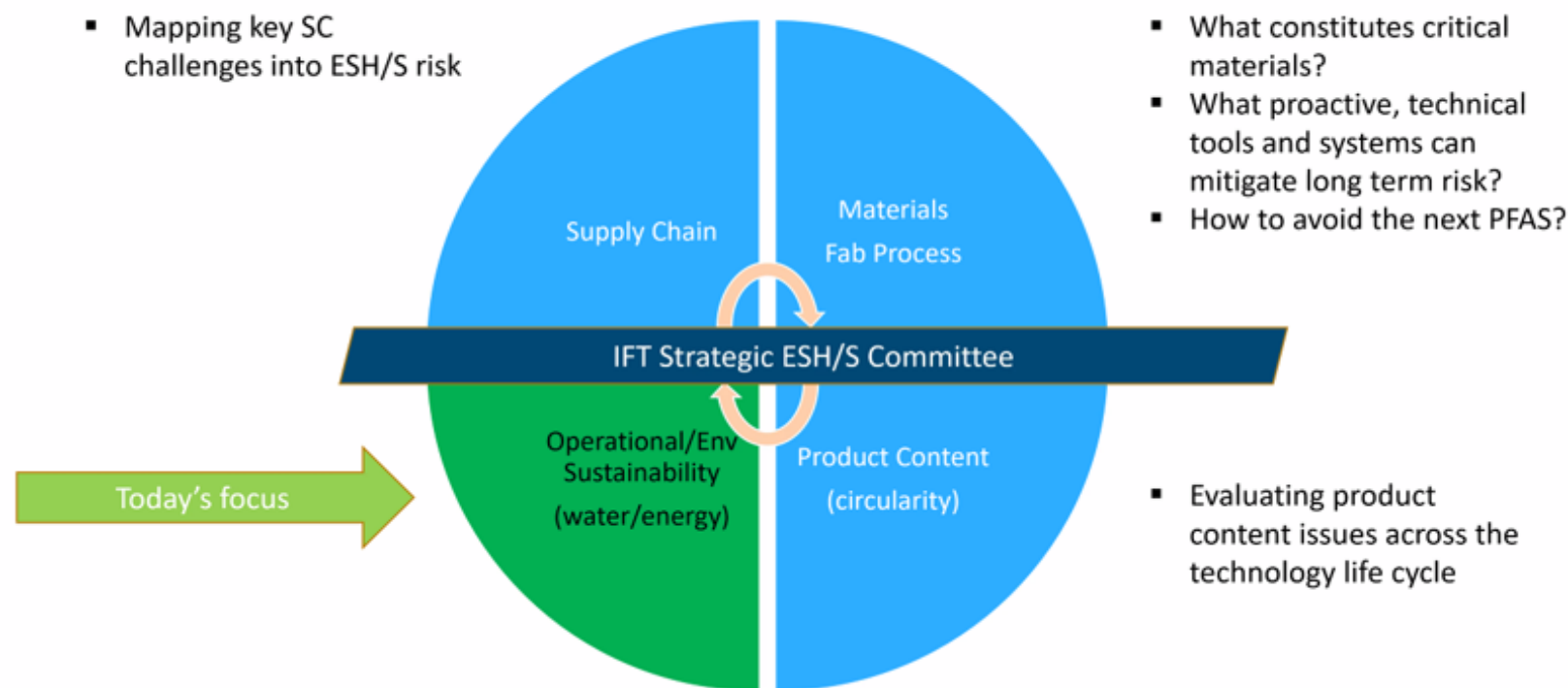
Main scientific topics



Advanced computing & Advanced functionalities (sensing, RF & optical communications, optical devices, energy harvesting, power devices...)

Taking into account Technology sustainability, in line with the Green Deal

ESH/S IFT Team Structure



IMPLEMENTATION

EXHAUSTIVE ANALYSIS OF SEMICONDUCTORS' VALUE CHAINS, FOR ELECTRONICS & PHOTONICS

Identification of :

- EU's economic and industrial strengths & weaknesses
- Strategic dependencies
- Market and cooperation opportunities

IDENTIFICATION OF RESEARCH AREAS FOR INTERNATIONAL COOPERATION

Identification of next generation & emerging technologies, especially in advanced computation and functionalities.

DETERMINATION OF MOST INTERESTING COUNTRIES FOR INTERNATIONAL COOPERATION

Identification of challenges for which international cooperation is critically important.

AGENDA FOR AND INITIATION OF INTERNATIONAL COOPERATIONS

- Dialogue with actors of existing cooperation
- International collaboration with non-EU national authorities
- Define standardisation needs and activities
- Support the European Commission

OUTCOME & IMPACT

OUTCOME & IMPACT

- **Raise awareness of the advanced research activities** inside and outside Europe
- **Reduction of the gaps & Increase European Leadership** in Semiconductor & Semiconductor-based photonics
- **Facilitate the European industry in the realization of emerging technologies:** advanced computation & advanced functionalities
- **Reinforce the position of the European industry** through new standards
- **Contribute to the European Strategic Autonomy** through balanced partnership with like-minded leading countries
- Contribute to other European initiatives in this sector : **European Chips Act & Digital Agenda.**
- **Contribute to the realization of the Green Deal:**
 - Digitalisation of many domains to reduce footprint
 - Electronics monitoring targeting societal challenges (energy, health, environment, etc.)
 - Sustainable electronics (energy consumption, critical materials, etc)



2nd Workshop



SiNANO/ICOS WORKSHOP



Main objectives of this Workshop :

- Review of the main EU & non-EU **semiconductor ecosystems and semiconductor value chains**
- Review of the main **EU & International activities** and most promising technologies in the field of Advanced Computing and Functionalities

These reviews will allow to **highlight the strengths of the main leading Institutions in each country** (Universities, RTO, Industry) in each technological area and the most **promising technologies for possible international collaborations**

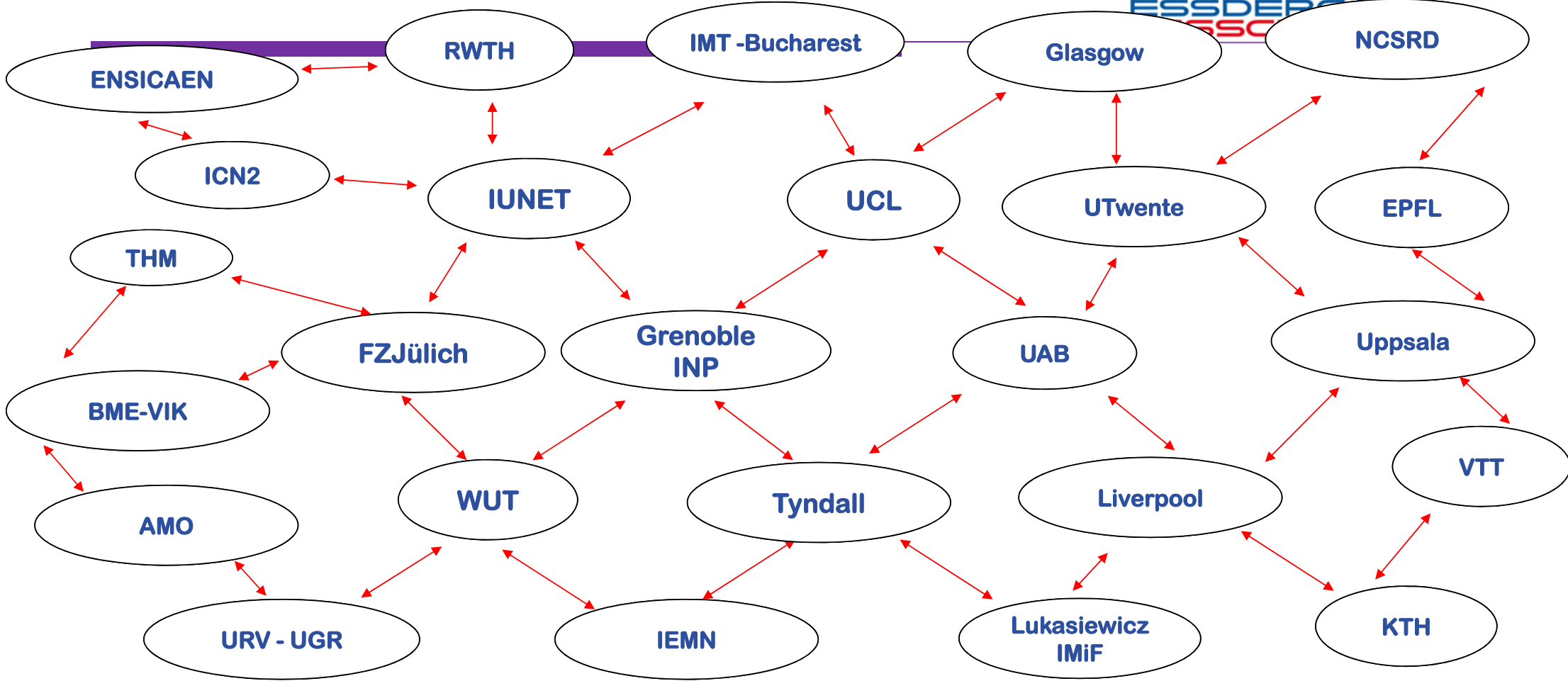
SiNANO Institute

*European Academic and Scientific Association for
Nanoelectronics*



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Members of the SiNANO Institute



=> Association open to other Members

Presentation of the SINANO Institute



- Establish a durable **EU Network of researchers** from European Scientific and Academic Community to form a distributed Centre of Excellence in the Nanoelectronics field (>2008)
- Carry out a role of **representation and coordination** of associated Organizations
=> strengthen the efficiency and increase the impact of Academia/Universities
- Explore science and technology aspects for **long term horizon** using joint flexible technology/ characterization and modelling platforms to identify the most promising topics for future ICT and speed up technological innovation

Activities from **Materials to Systems**, taking into account **technology sustainability**:

- **More Moore** (Logic Nanodevices, Embedded and non-charge based memories, Very low power devices, High temperature electronics)
- **Beyond CMOS** (novel devices for ultra low power, small slope switches-NW/TFET/NEMS, 1D, Alternative materials-2D layers, Neuromorphic computing, New bottom-up processes)
- **More than Moore** (micro-nano-bio sensors & systems, RF devices, Energy harvesting, Flexible & printed electronics, Power electronics)
- **Smart Systems & System design**
- **Quantum Technologies & Very low temperature Electronics**

Presentation of the SINANO Institute



- Perform :
 - ❑ Training activities
 - ❑ University curricula
 - ❑ **Workshops** (e.g. ESSDERC-ESSCIRC), Conferences (e.g. EUROSOI-ULIS, INC/ISRDS) to develop high competence levels in Europe
 - ❑ Participate in **Roadmap** definition (e.g. NEREID)
 - ❑ Technology transfer to Start-ups and Industry
 - ❑ Launch ambitious **European Projects** (e.g. ICOS)
 - ❑ Write **position papers** for EC WPs (e.g. Edge Intelligence for Horizon Europe, Chips Act)
- Play **important role in European structuring and programs**, in collaboration with Research Institutes and Industry, and strengthen the overall efficiency of European research in Nanoelectronics
- **SINANO is the official European Representative for IRDS** « *International Roadmap for Devices and Systems*» replacing ITRS



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Thank you for your attention

Francis Balestra

www.icos-semiconductors.eu

www.sinano.eu