Important Project of Common European Interest on Microelectronics and Communication Technologies (IPCEI ME/CT)

Bavarian Chip Alliance

Munich, Germany; 3rd of June 2024

Bernhard Mueller / AMAT
Martin Strassburg / ams-OSRAM
Thomas Fleischmann / Bosch
Thomas Merkle / Ericsson
Fabiola Bermudez-Elsinger / Infineon
Marc Bohn / Nokia
Ferdinand Bell / NXP
Uwe Bäder / R&S
Jens Mueller / Semikron-Danfoss
Michael Bünnig / Wacker
Sascha Dern / Wolfspeed
Stefan Hain / ZF

CONTENT

IPCEI Microelectronics and Communication Technologies

Acknowledgement

IPCEI Microelectronics and Communication Technologies

Special thanks:

Bayerisches Staatsministerium für
Wirtschaft, Landesentwicklung und Energie

Dr. Patricia Callies, Referatsleiterin

Regionale Maßnahmen und industriepolitische Standortfragen, Bauwirtschaft, Keramik-, Glas- und Nahrungsmittelindustrie, Elektroindustrie

Dr. Stefan Doetsch,

Digitalisierungsforschung und -technologie

Gefördert durch

Bayerisches Staatsministerium für
Wirtschaft, Landesentwicklung und Energie

gefördert durch das Bayerische Staatsministerium für Wirtschaft, Landesentwicklung und Energie

Gefördert im Rahmen des IPCEI ME/KT

IPCEI Microelectronics and Communication Technologies

Gefördert durch:

Bundesministerium für Wirtschaft und Klimaschutz

aufgrund eines Beschlusses des Deutschen Bundestages

Gefördert durch

Bayerisches Staatsministerium für Wirtschaft, Landesentwicklung und Energie

gefördert durch das Bayerische Staatsministerium für Wirtschaft, Landesentwicklung und Energie

Finanziert von der Europäischen Union

NextGenerationEU

Motivation for IPCEI

IPCEI Microelectronics and Communication Technologies

- IPCEIs strengthen important European value chains and contribute to political priorities of the Union (e.g. Green Deal, Digital Strategy) and its sovereignty,
- are complementary to R&D programs like Horizon Europe or ECSEL/KDT by also involving “First Industrial Deployment” (FID) activities on top of R&D&I,
- address critical “key enabling technologies” like microelectronics/communication, battery technologies, hydrogen, low carbon industries,
- are funded by national authorities of the member states, but approval from the EC is needed, as it is an exception to state-aid rules.

This exception is made due to **high-risk activities** involving **market failure** mechanisms and coordination problems, and due to the significant **additional value** IPCEIs bring to **European industry and society** by cooperation, dissemination and spill-over activities.

IPCEI ME/CT – Important Project of Common European Interest Microelectronics and Communication Technologies

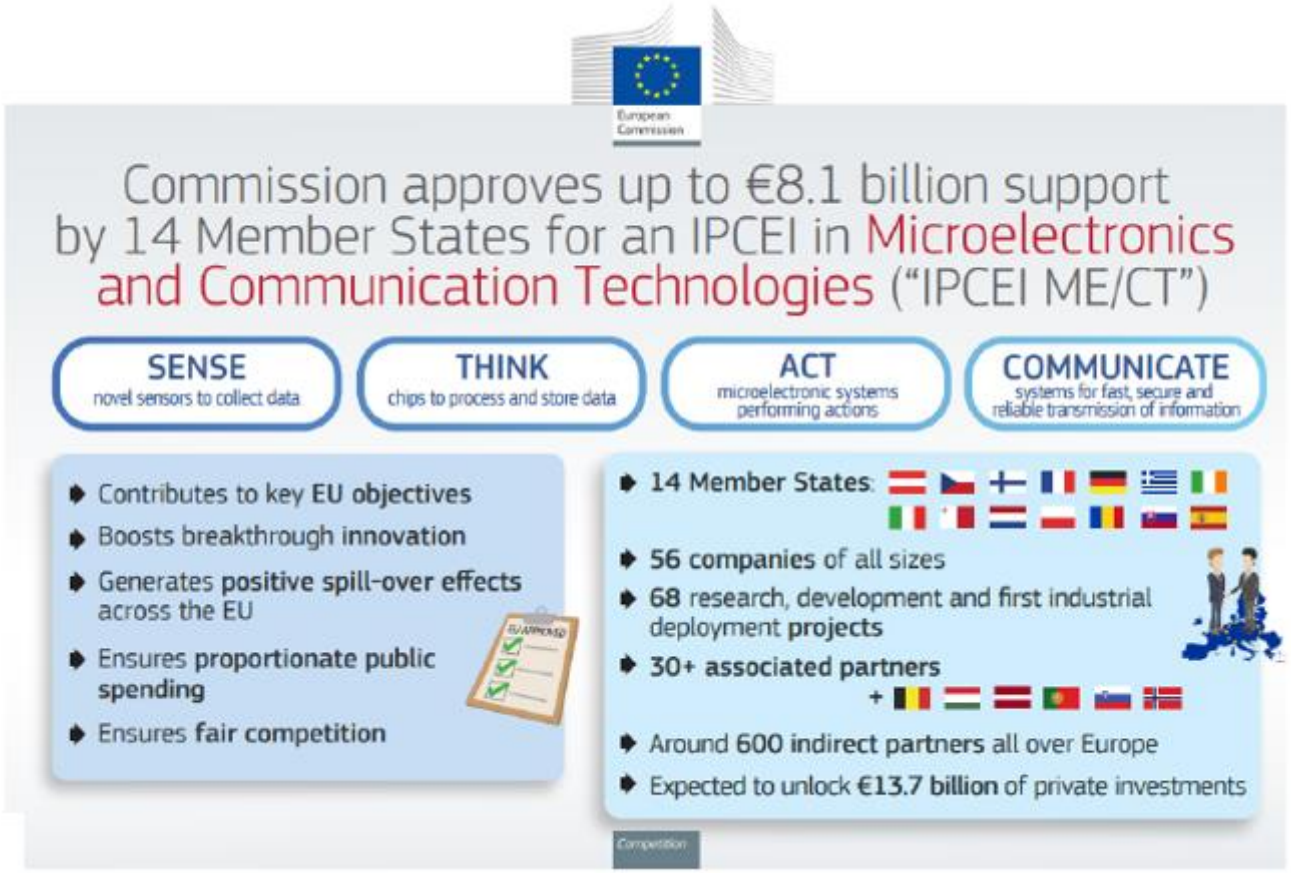
IPCEI at a glance:

~ **€22** billion program (biggest IPCEI ever):

~ **€8** billion public funding

~ **€14** billion private investments

- 14 member states + 6 associated member states
- > 56 direct partners
- > 30 associated partners
- > 600 indirect partners



Strategic Pillars | Overall Challenges

PILLAR 1

Enable the digital transformation

PILLAR 2

Energy and resource efficiency to support the Green Deal

PILLAR 3

Standardization to increase resilience in data and cybersecurity

PILLAR 4

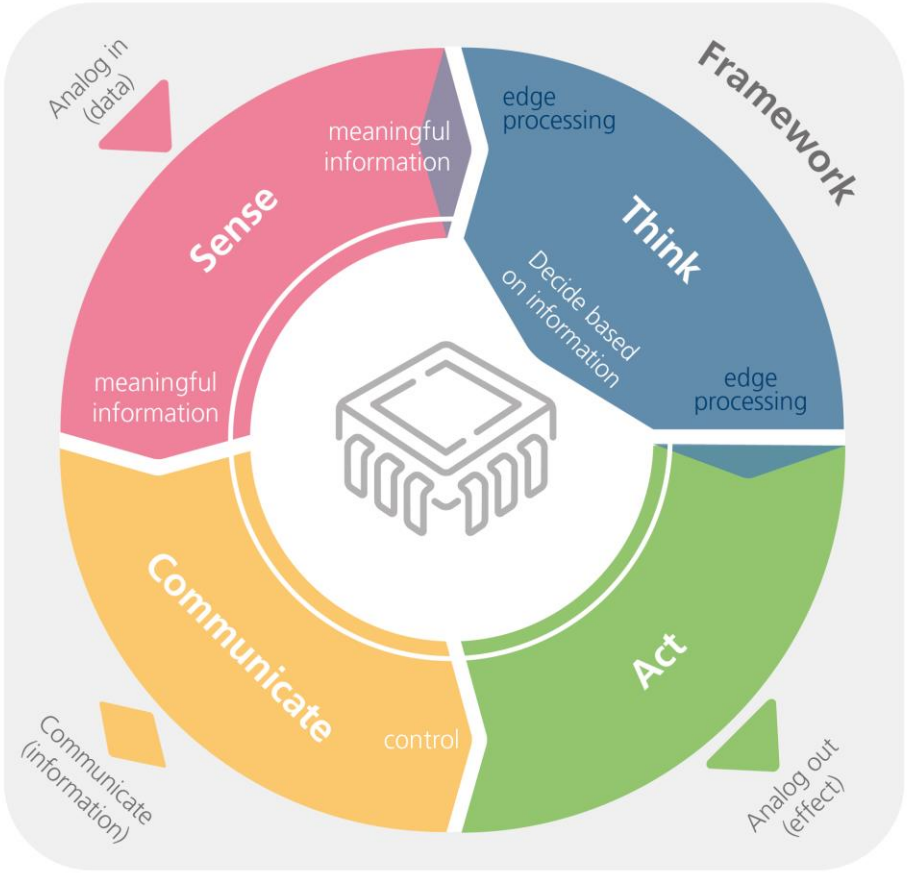
Counter market failures & reinforce the value chain to increase resilience and sovereignty

PILLAR 5

Increase the European manufacturing footprint

Project description in the Chapeau document
Four Workstreams defined

IPCEI Microelectronics and Communication Technologies



Four work-streams corresponding to the **complementary** technical objectives along the microelectronics value chain.

- **SENSE** addresses the *organs of perceptions* which generate the data to be processed.
- **THINK** addresses processors and memory as the *brain* of a computer.
- **COMMUNICATE** addresses the *strong nerve pathways* which network with the brain.
- **ACT** addresses the *body and muscles* of an electronic system.

Each workstream is further structured into four workpackages corresponding to the **(common)** microelectronic value chain .

Direct Participants of the IPCEI ME/CT

Bavaria: key player in European IPCEI ME/CT

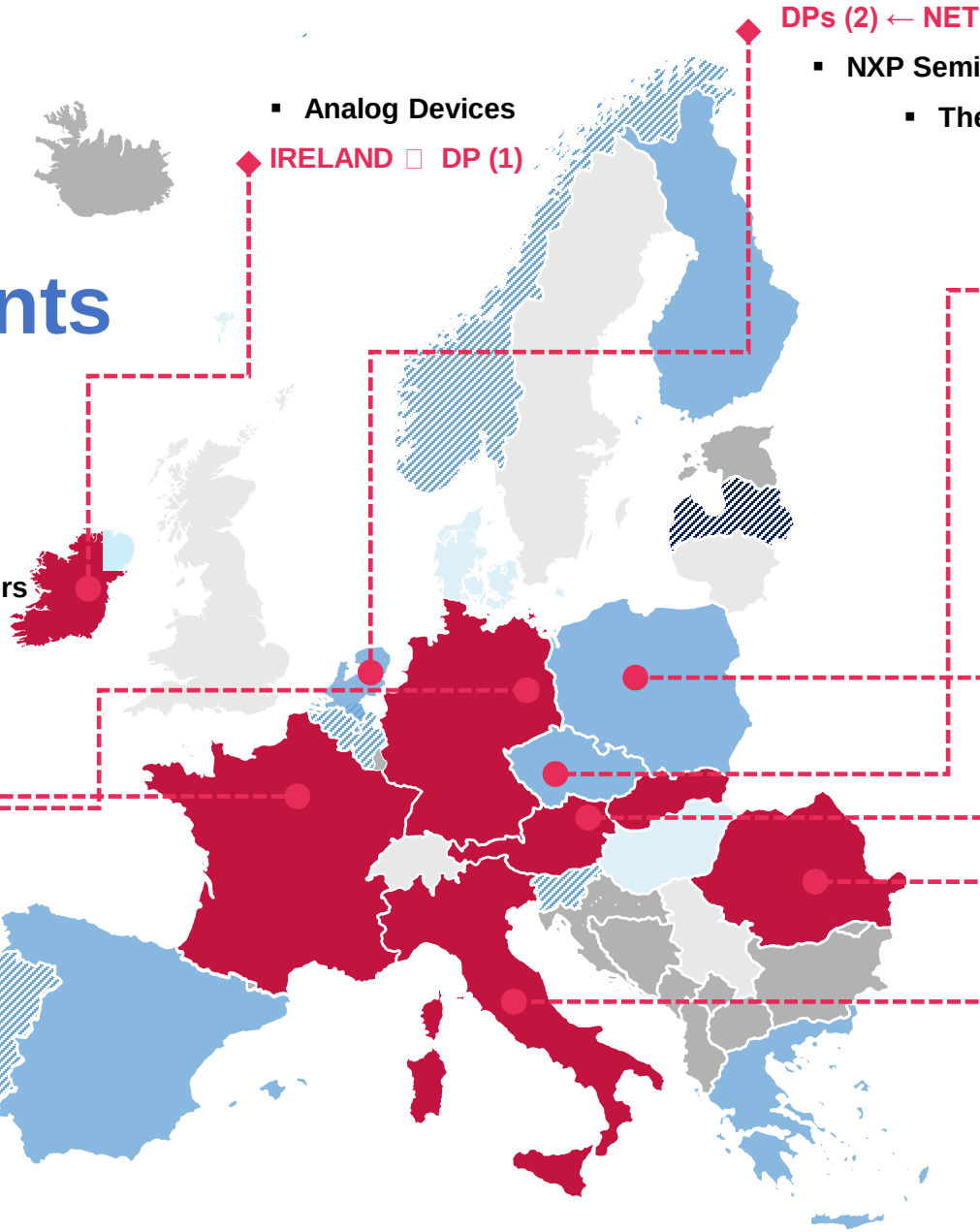
IPCEI Microelectronics and Communication Technologies

IPCEI: initiated in Munich in 2020 (Bosch, IFX, GF, xFab, NXP)	ADVA	APPLIED MATERIALS make possible	ams OSRAM
BOSCH	ERICSSON	Infineon	NOKIA
NXP	RS	SEMIKRON DANFOSS	WACKER
ZF	Wolfspeed	**Facilitation group:** lead by Martin Strassburg (ams-Osram) & Ferdinand Bell (NXP)	**Transform group:** lead by Angelika Iberl (IFX)

SENSE

IPCEI Microelectronics and Communication Technologies

Direct Participants



DPs (2) ← NETHERLANDS
- NXP Semiconductors
- Thermo Fisher

- Analog Devices

IRELAND DP (1)

DP (1) ← POLAND
- VIGO System

DP (1) ← CZECH REPUBLIC
- Mycroft Mind

DPs (2) ← AUSTRIA
- AVL List
- NXP Semiconductors

DPs (3) ← ROMANIA
- Robert Bosch
- Continental
- NXP Semiconductors

- Robert Bosch
- Elmos
- Ferroelectric Memory
- Global Foundries
- Infineon Germany
- NXP Semiconductors
- ams-OSRAM
- Wacker Chemie
- TRUMPF-Photonic
- X-FAB Germany

GERMANY DPs (9)

FRANCE DPs (3)
- LYNRED
- STMicroelectronics (France)
- X-Fab France

DPs (3) ← ITALY
- MEMC Electronic Material
- MEMC Electronic Materials
- STMicroelectronics (Italy)

SENSE

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Cooperations

Work stream leads	Pype, Patrick	NXP	Netherlands
	Thomas Fleischmann	Robert Bosch GmbH	Germany

Total: 131

Intra-Workstream: 60

Inter-Workstream: 71

WS ACT: 17

WS THINK: 27

WS COMMUNICATE: 27

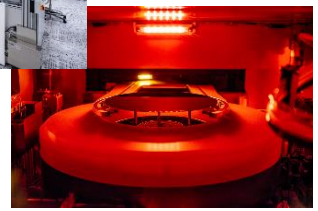
Furthermore, for WS SENSE, **200** collaboration are planned with the broader IPCEI consortium (other indirect participants).

Project scope

- Technology platform with system solutions for future MEMS and sensors
- Novel component architectures and challenging complex process developments

Key innovations

- Leading edge in characteristic performance indicators and robustness
- Realization of innovative concepts through processing and first-time integration of new material systems
- Intelligent, efficient and high-quality implementation of manufacturing requirements in innovative automation solutions



Impact

- The Bavarian locations (Regensburg, Munich) will reinforce its role as important players in maintaining and improving the local network of private industry and research institutes to strengthen the regional and also the European innovation ecosystem

Spill over / dissemination

- Publications and presentations at conferences based on project results (e.g. EUROSIME 2024 in Catania), university contacts, student visits, internships, theses, internal and external events

- **Project scope**

  Innovative semiconductors for cutting-edge functions and systems

  Semiconductor technology, Chip Design, integration in smart systems

- **Key-Innovations**

  Semiconductor technologies for sensors and power electronics

  Innovative AR platform modules

  Systems for highly automated driving and E/E vehicle architecture

- **Activities in Bavaria**

  Design for advanced SoCs and sensor ASICs (Munich)

  Pilot lines for sensor systems (Ansbach and Blaichach)

- **Strong collaboration within the semi-related ecosystem**

ams OSRAM

OptoSuRe

Efficient Optoelectronics for a Sustainable and Resilient European Semiconductor Ecosystem

R&D for innovative compound semiconductor products from Regensburg

What is the breakthrough?

Pixelated LED-chips for smart & efficient headlamps

UV-C LEDs for disinfection & water treatment

Resource- and energy efficient components and highly automated, AI-supported production processes enabling

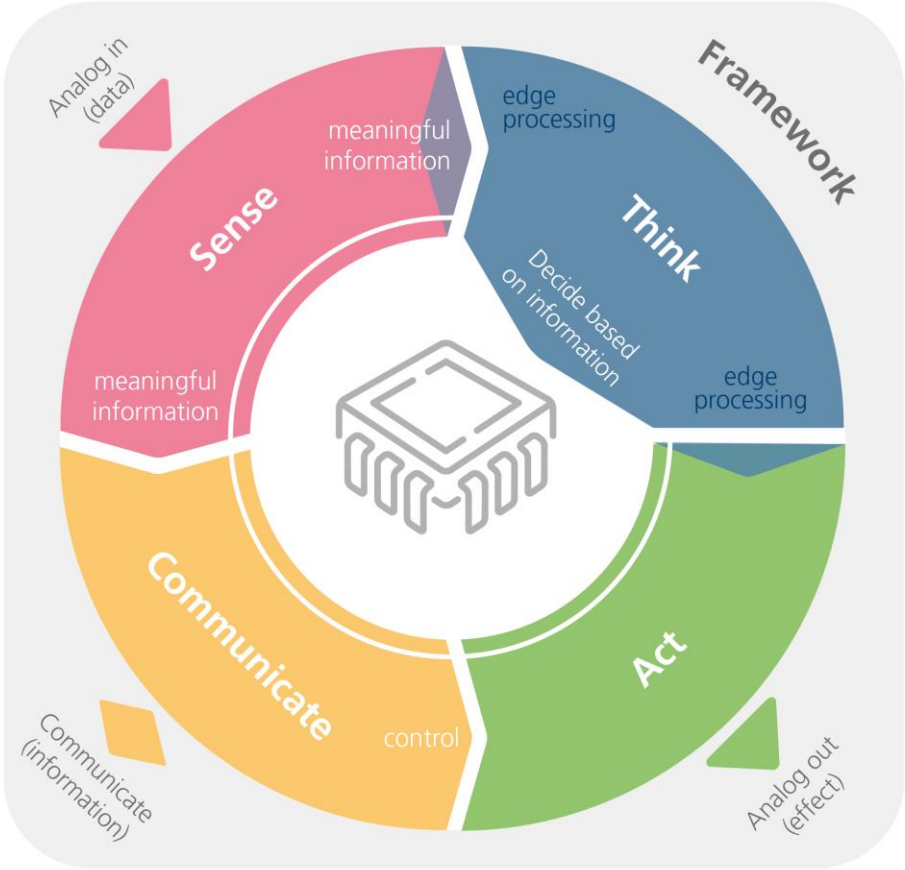
- **Products with lower power consumption**
- **Products with longer lifetime**
- **Resource efficient production**
- **Digital Transformation & European Green Deal**

Impact for Bavaria/Germany/Europe

Reinforce technological sovereignty, strengthen European supply chain security, and create new high-tech jobs in Regensburg

Benefits for EU semiconductor ecosystem and the broader society through positive spillover effects such as Conferences, Fellowships, Summer Schools, Entrepreneurship Programs, ...

From SENSE to THINK



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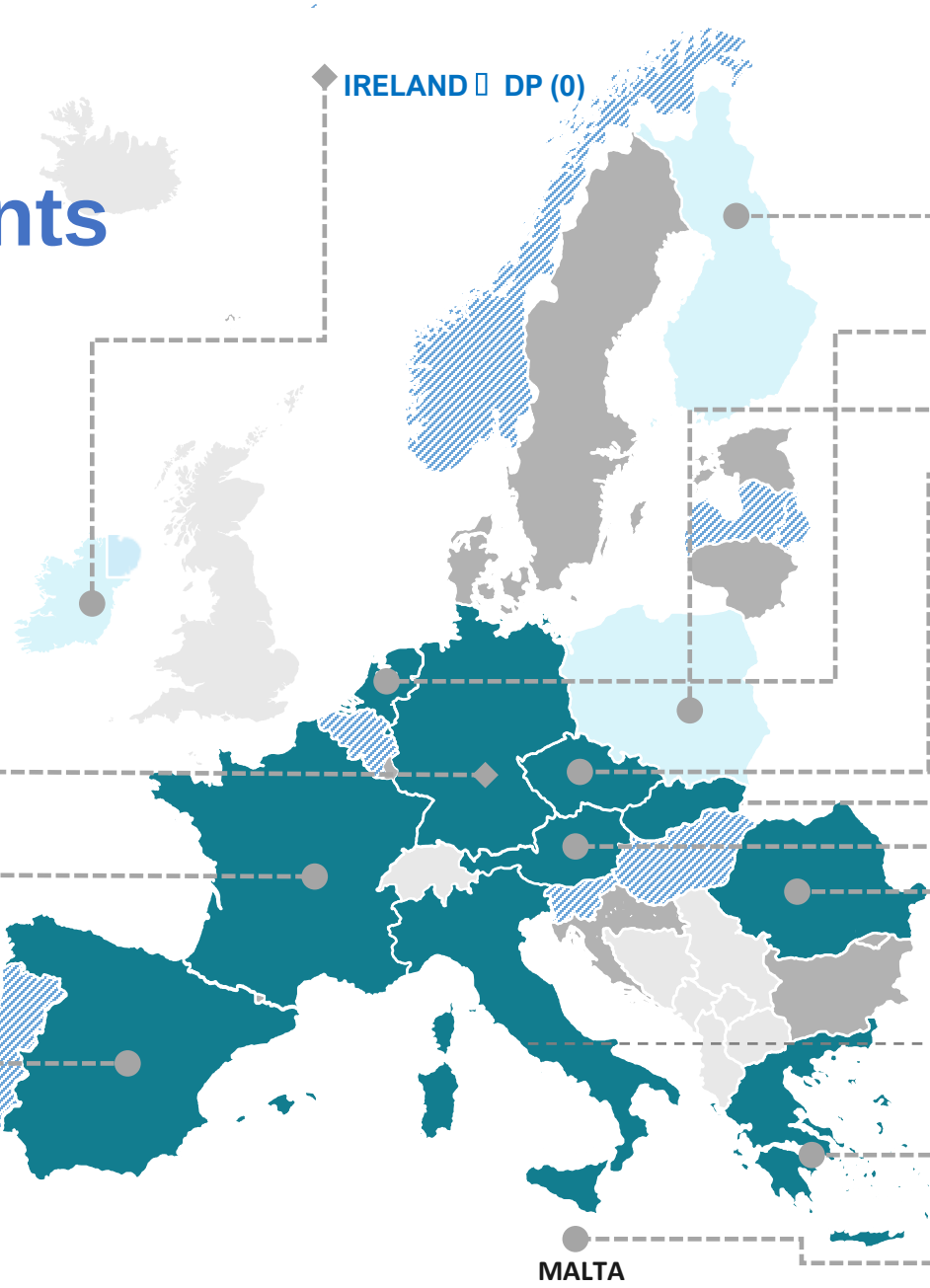
THINK

Direct Participants



IRELAND — DP (0)

FINLAND — DP (0)

- ASML
- Nearfield Instruments

THE NETHERLANDS — DPs (2)

POLAND — DP (0)

- Codasip
- MycroftMind

CZECH REP. — DPs (2)

- Black Semiconductor
- Robert Bosch
- Cologne Chip
- Elmos Semiconductor
- Ferroelectric Memory
- GlobalFoundries Dresden Module One
- Infineon Germany
- NXP Semiconductors Germany
- Wacker Chemie
- Carl Zeiss SMT

GERMANY — DPs (10)

SLOVAKIA — DPs (3)

- Bizzcom
- Continium Technologies
- Tachyum

AUSTRIA — DPs (2)

- AT&S AT
- NXP AT

FRANCE — DPs (5)

- Continental
- Soitec
- STMicroelectronics (France)
- Teledyne e2V Semiconductors
- X-FAB France

ROMANIA — DPs (2)

- Robert Bosch with Bosch Automotive
- NXP Semiconductors Romania

ITALY — DPs (2)

- MEMC Electronic Material
- STMicroelectronics (Italy)

GREECE — DPs (1)

- Sunlight

SPAIN — DPs (2)

- Openchip
- Semidynamics Technology Services

MALTA

MALTA — DP (1)

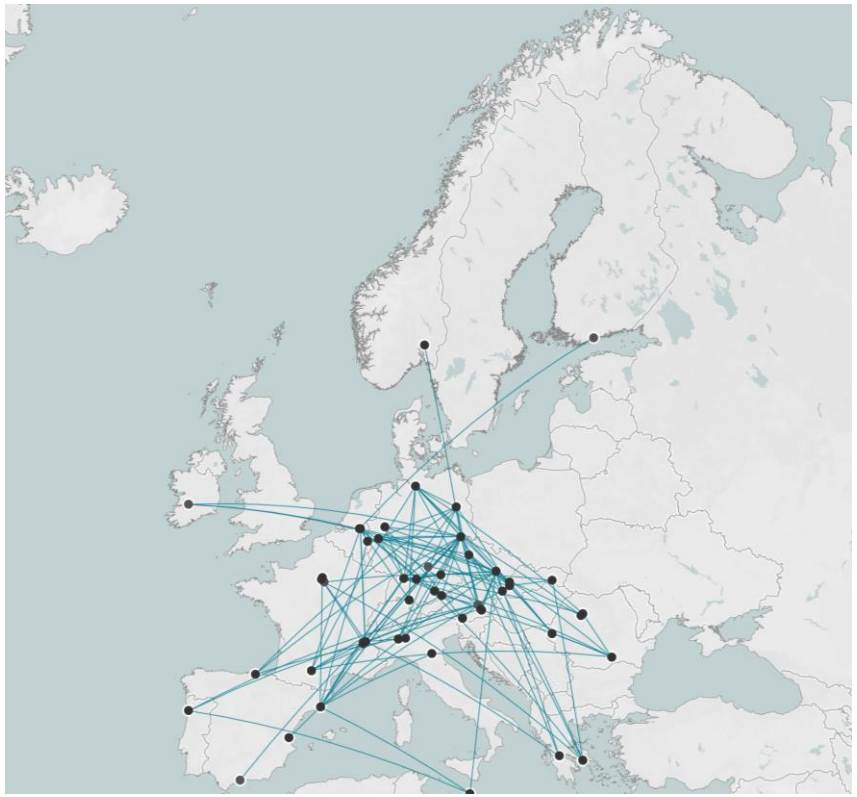
- STMicroelectronics (Malta)

THINK

IPCEI Microelectronics and Communication Technologies

Cooperations

Work stream leads	Gerhard Döll	Carl Zeiss	Germany
	Sandra Eger	AT & S Austria AG	Austria



Total: 150

Intra-Workstream: 80

Inter-Workstream: 70

WS ACT: 18

WS SENSE: 27

WS COMMUNICATE: 25

Furthermore, for WS THINK **227** collaborations are planned with the broader IPCEI consortium (other indirect participants).

WACKER

What?

Polysilicon with very high purity and very low contamination.

What is the breakthrough?

Enable leading edge node devices which composed of billions of transistors on a single chip. Virtually no impurities are required in the polysilicon to achieve the highest chip performance for future chip technologies.

Impact for Bavaria/German/Europe

- Industrial resilience and technology sovereignty
- Climate-neutral transformation of industry and green technologies
- More than 100 new and future orientated jobs

Spill over /dissimilation

- Papers and presentations on conferences
- Internal & External Events
- Funding of Master and PhD Thesis

Polysilicium → Wafer → Mikrochip

Empowering European Innovation and Semiconductor Sovereignty

NXP Brighter Together

FUTURE ME

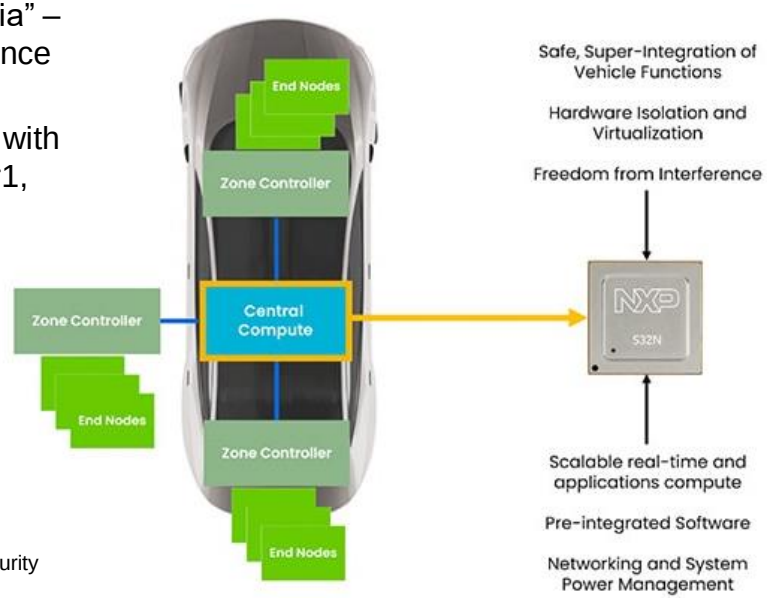
Scalable Processors, Super-Integrates Vehicle Functions for Tomorrow's **Software Defined Vehicles**

What is the breakthrough?

- Support the transition to future software defined vehicles
- Super-integrate vehicle functions into a single chip in a central compute ECU
- Design and offer lighter and more energy-efficient vehicles
- Design in automotive leading edge technology (5nm)

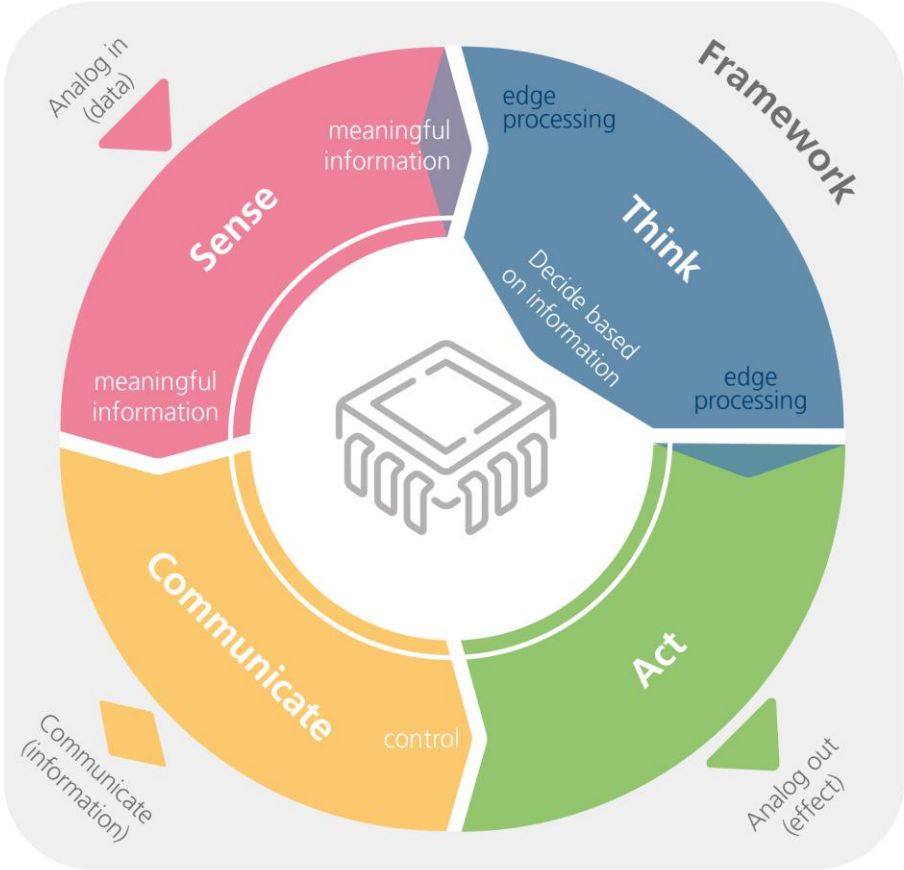
Impact for Bavaria/German/Europe

- Design is "made in Bavaria" – Includes Artificial Intelligence and Security
- Strong local partnerships with key automakers and Tier1, universities and SMEs



Functional Safety (ISO 26262) and security (ISO/SAE 21434) certified

From THINK to COMMUNICATE



COMMUNICATE

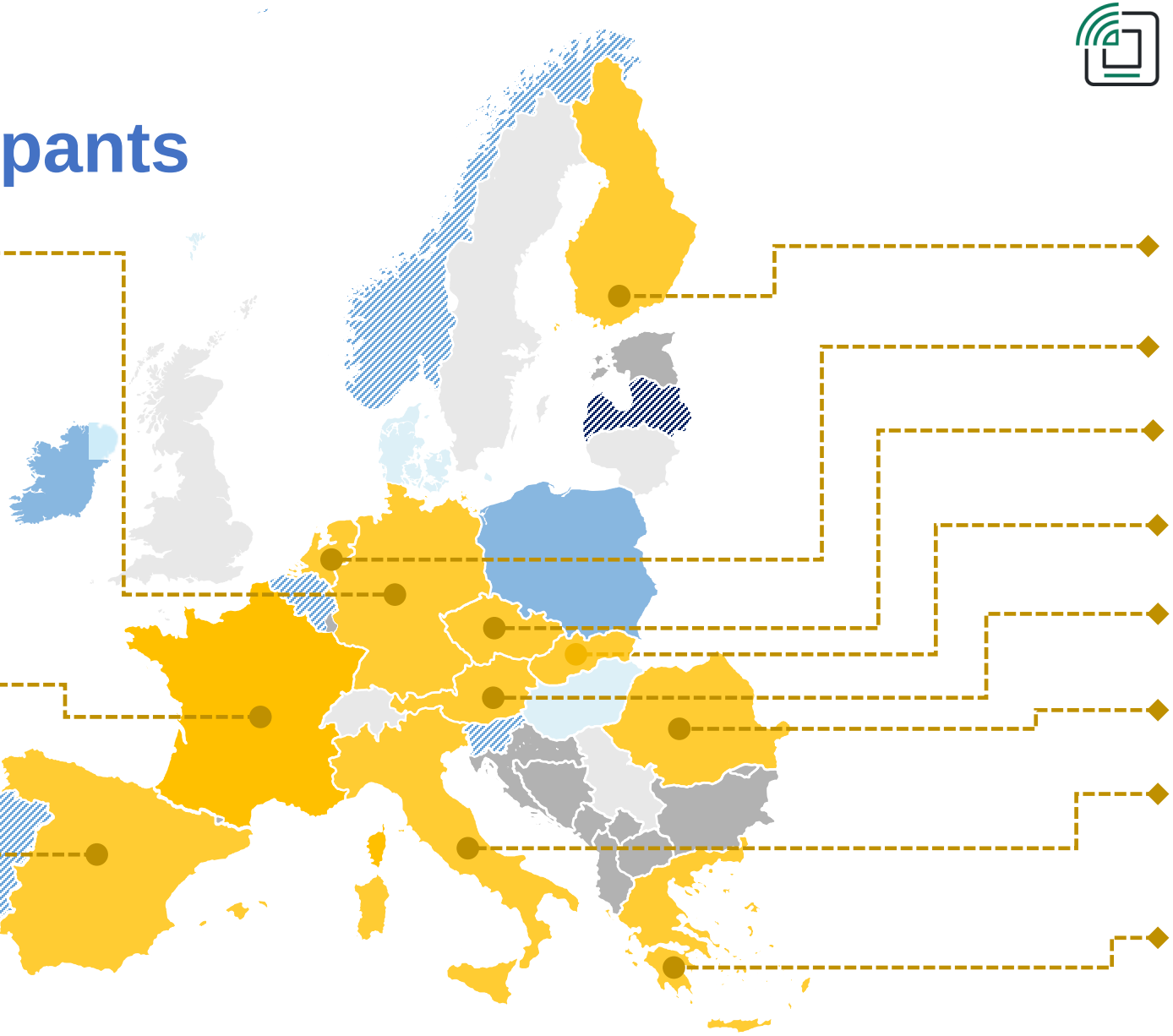
IPCEI Microelectronics and Communication Technologies

Direct Participants

GERMANY (12)
- Adtran Networks
- Freiberger Compound Materials
- GlobalFoundries Dresden Module One
- Infineon Germany
- Ericsson Antenna Technology
- Nokia Solutions and Networks
- NXP Semiconductors Gemany
- Rohde & Schwarz
- TRUMPF Photonic Components
- United Monolithic Semiconductors
- Wacker Chemie
- X-FAB Germany

FRANCE (5)
- Airbus
- Orange
- Soitec
- STMicroelectronics
- X-FAB France

SPAIN (2)
- Innova IRV Microelectronics
- Knowledge Development POF



FINLAND (1)
- Nokia Oyj

THE NETHERLANDS (1)
- NXP Semiconductor NL

CZECH REP. (1)
- Codasip

SLOVAKIA (1)
- Continium Technologies

AUSTRIA (1)
- AVL List

ROMANIA (1)
- NXP Semiconductors RO

ITALY (3)
- MEMC Electronic Material
- SIAE Microelettronica
- STMicroelectronics

GREECE (1)
- Cognitive Innovations

Cooperations

Work stream leads	Uwe Bäder	Rohde & Schwarz GmbH	Germany, Munich
	Francois Brunier	SOITEC	France

Total: 134

Intra-Workstream: 78

Inter-Workstream: 56

WS SENSE: 27

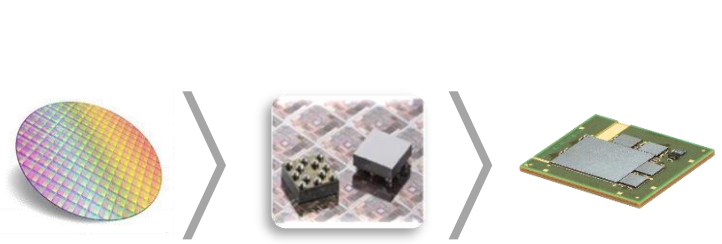
WS THINK: 25

WS ACT: 4

Furthermore, for WS COMMUNICATE, **287** collaboration are planned with the broader IPCEI consortium (other indirect participants).

Nokia Solutions and Networks

- **What?**
  - Chip Design for Optical Networks – Development of high-capacity coherent optical transponders
- **What is the breakthrough?**
  - Multi-chip integration platform for advanced coherent DSP and high data rate electro-optic components
- **Impact for Bavaria/German/Europe**
  - Expanding know-how of ASIC, substrate and module design in Bavaria applying latest silicon technologies and electro-optic packaging
  - Working with eco system on German/European level
- **Spill over /dissemination**
  - University contacts – student visits, internships, thesis



Chip design

Chip Processing

Multi-Chip Assembly

Module design & integration

Ericsson Antenna Technology Germany GmbH

European Microelectronics and Communication Technologies for 6G

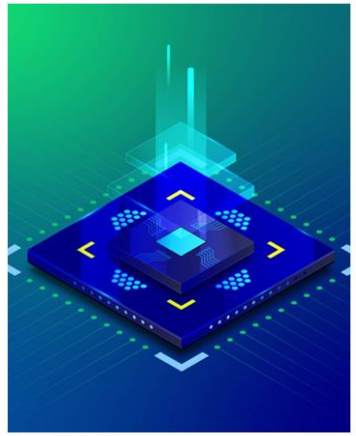
- **What?**

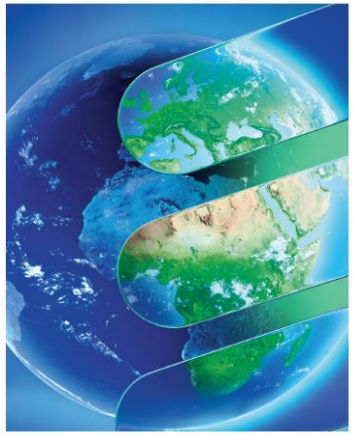
  Establish early technology development of critical microelectronics and communication technologies for energy-efficient Massive MIMO radios
- **What is the breakthrough?**

  Drive semiconductor technology advancements and foundation needed
- **Impact for Bavaria/German/Europe**

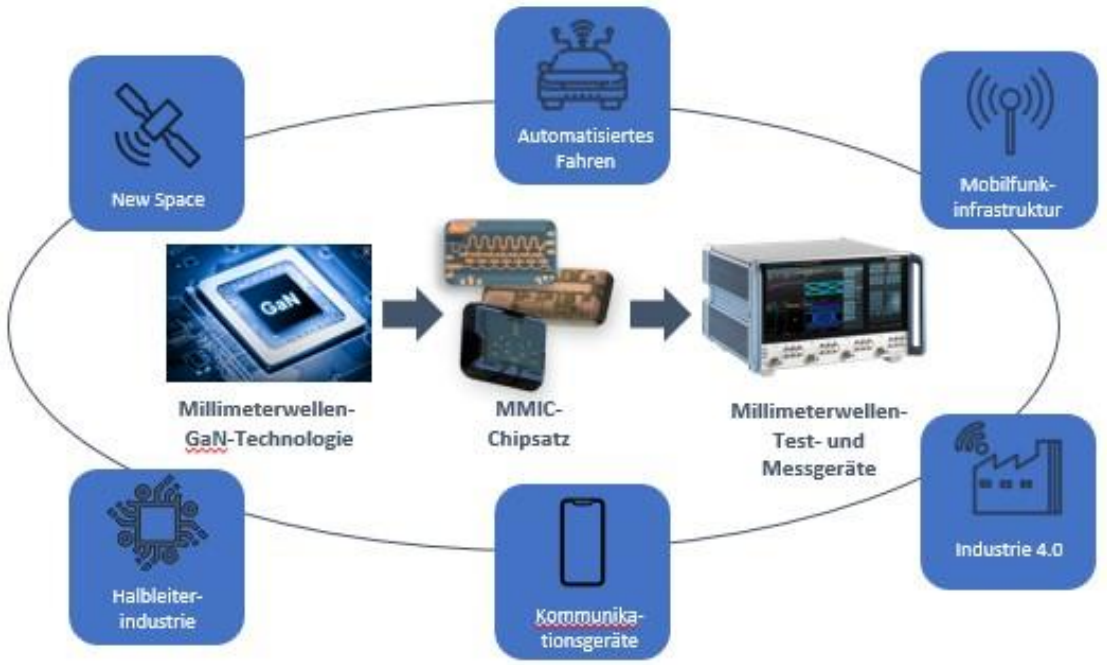
  Ericsson's R&D site in Rosenheim plays an important role in building competencies in microelectronics for Massive MIMO radios and the semiconductor industry in Germany.
- **Spill over /dissemination**

  The partner collaboration will contribute to a stronger ecosystem and the evolution of semiconductor technologies in Europe.





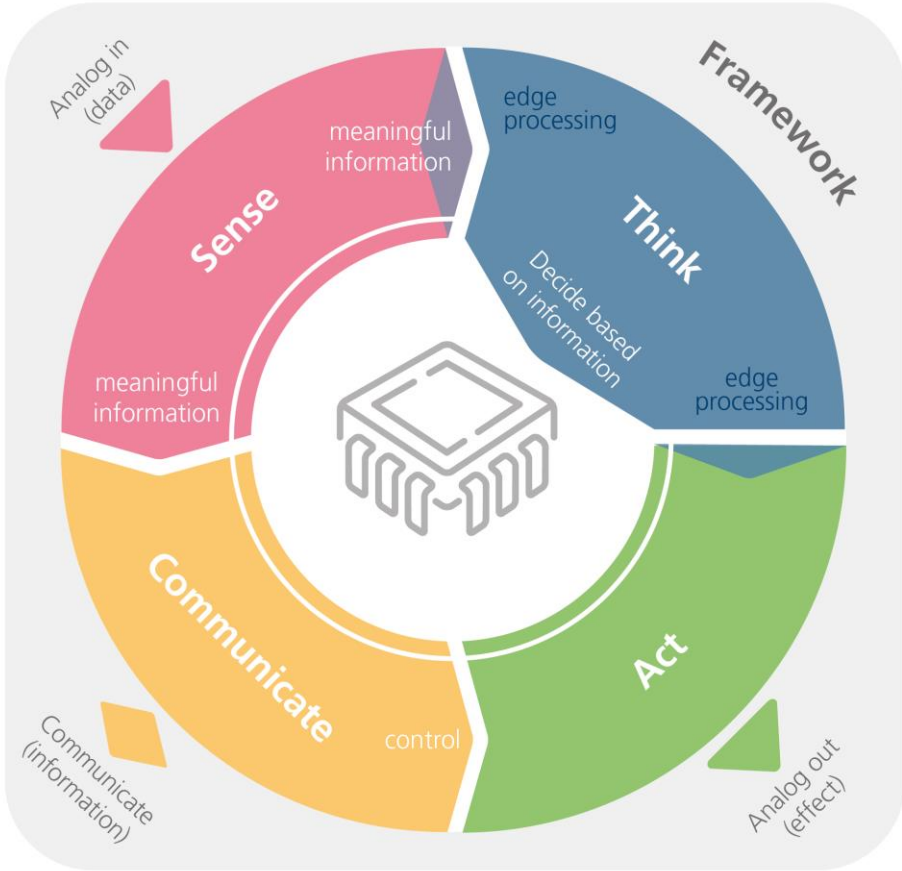
Rohde & Schwarz GmbH & Co. KG



- In diesen Schlüsseltechnologien werden **höhere Frequenzen** benötigt (sog. Millimeterwelle).
- Im IPCEI-Projekt **GANYDEM170** entwickelt Rohde & Schwarz eine europäische **GaN Halbleiter-Technologie** für Anwendungen im Frequenzspektrum der Millimeterwelle.
- Diese GaN-Technologie wird in MMIC Chipsets genutzt, welche wiederum in der **Test & Messtechnik** Anwendung findet.

GaN: Gallium Nitrid
MMIC: Monolithic Microwave Integrated Circuit

From COMMUNICATE to ACT



ACT

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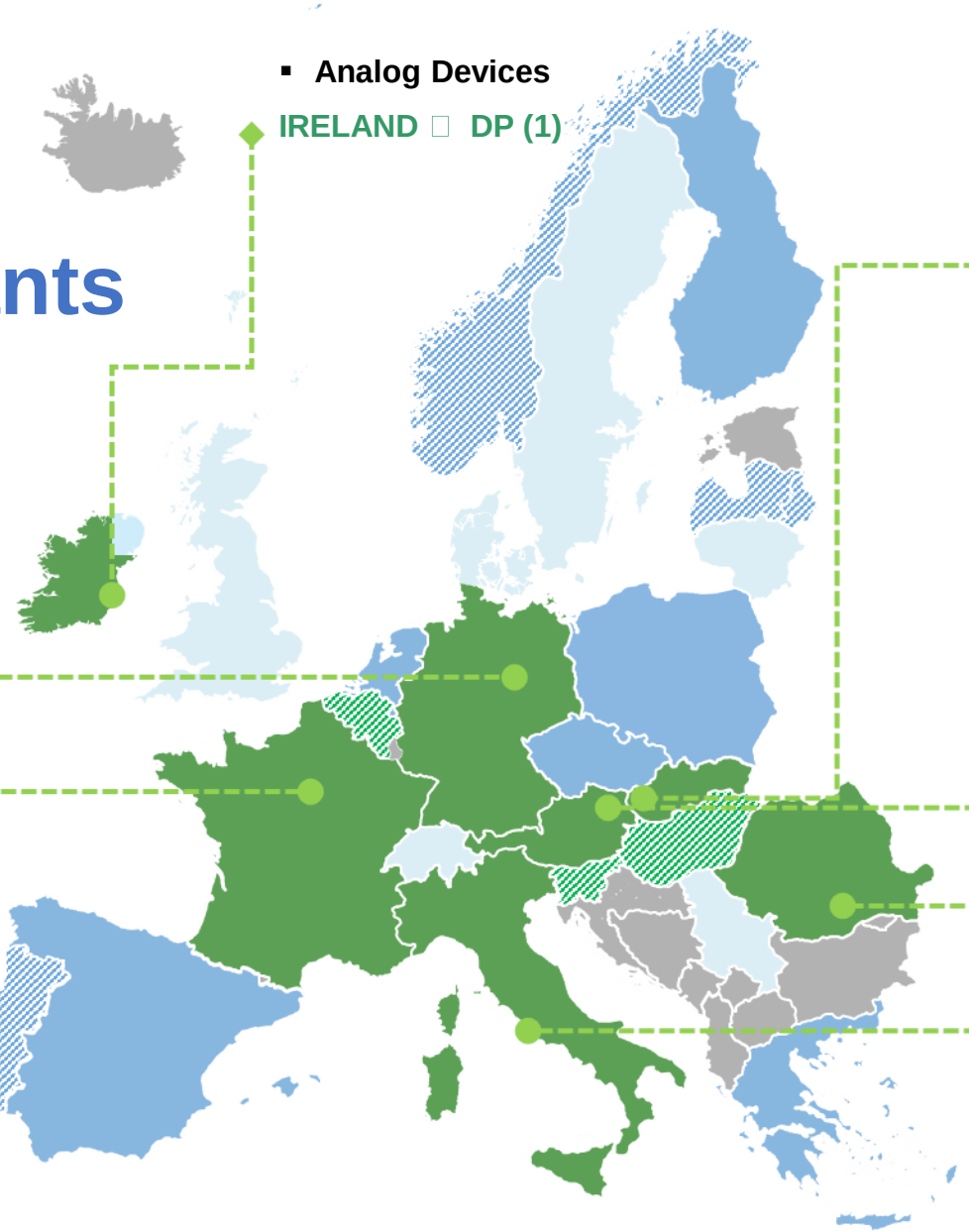
Direct Participants



- Analog Devices

IRELAND □ DP (1)

(1) DP ← SLOVAKIA

- Semikron Danfoss

(3) DPs ← AUSTRIA

- AVL List
- EEMCO
- Infineon AT

(2) DPs ← ROMANIA

- Robert Bosch with Bosch Automotive
- Continental Automotive with Continental Automotive Systems

(2) DPs ← ITALY

- MEMC Electronic Material
- STMicroelectronics (Italy)

- Robert Bosch
- Freiberger Compound Materials
- GlobalFoundries Dresden Module One
- Infineon Germany
- mi2-factory
- SGL Carbon
- Semikron Danfoss
- ZF NewCo IV with Wolfspeed Germany

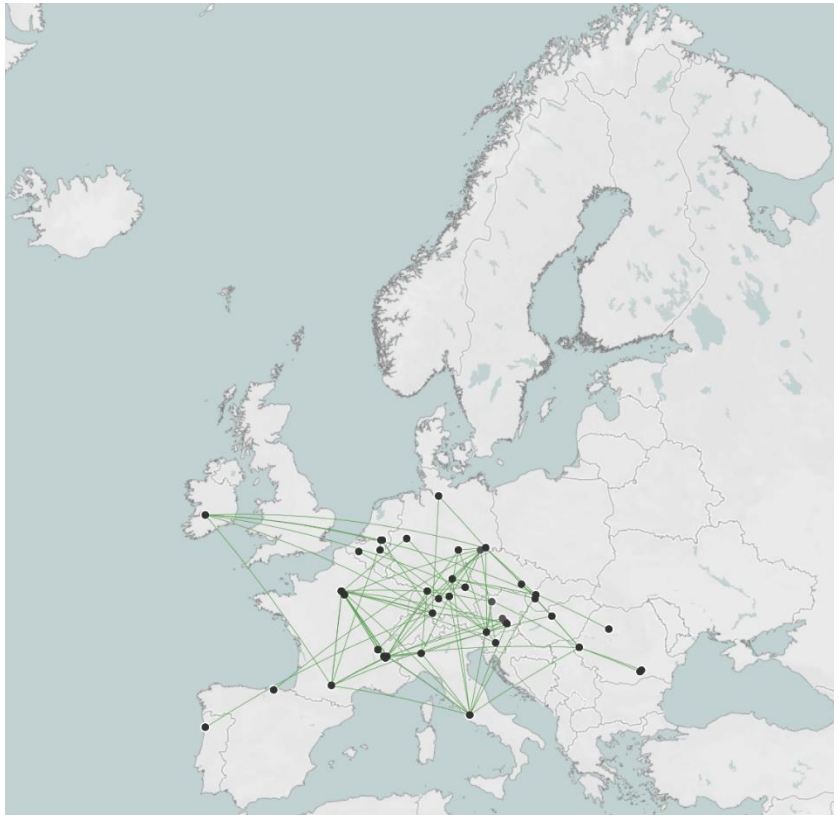
GERMANY □ DPs (8)

FRANCE □ DPs (8)

- Aledia
- Continental
- Renault
- Soitec
- STMicroelectronics (France)
- Valeo + Valeo-Siemens eAutomotive
- Vitesco
- X-FAB France

Cooperations

Work stream leads	Musca, Cosimo	ST Microelectronics	Italy
	Batisson, Cathy	Renault	France



Total: 112

Intra-Workstream: 73

Inter-Workstream: 39

WS SENSE: 17

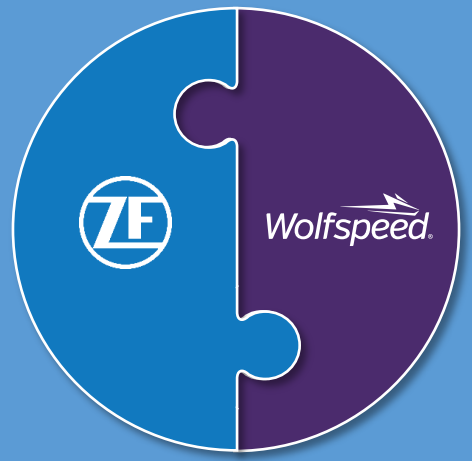
WS THINK: 18

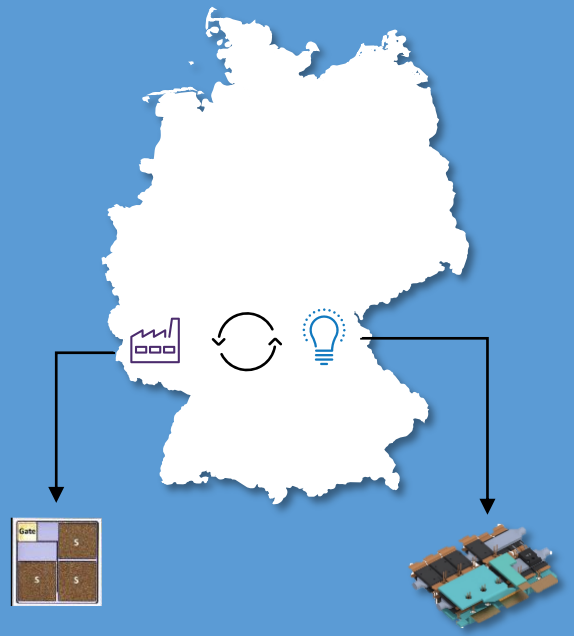
WS COMMUNICATE: 4

Furthermore, for WS ACT, **148** collaborations are planned with the broader IPCEI consortium (other indirect participants).

ZF NewCo IV GmbH with Wolfspeed Germany GmbH

- Build up of new advanced 200mm SiC Fab in combination with a new SiC R&D Center
- Joint Venture leads to a perfect match between chip, power module and inverter
- Bring beyond state-of-the-art SiC technology to Bavaria
- Boost SiC chip and module development





200mm SiC Fab
in **Ensdorf, Saarland**

R&D Center
in Metropolregion
Nürnberg

SEMIKRON DANFOSS

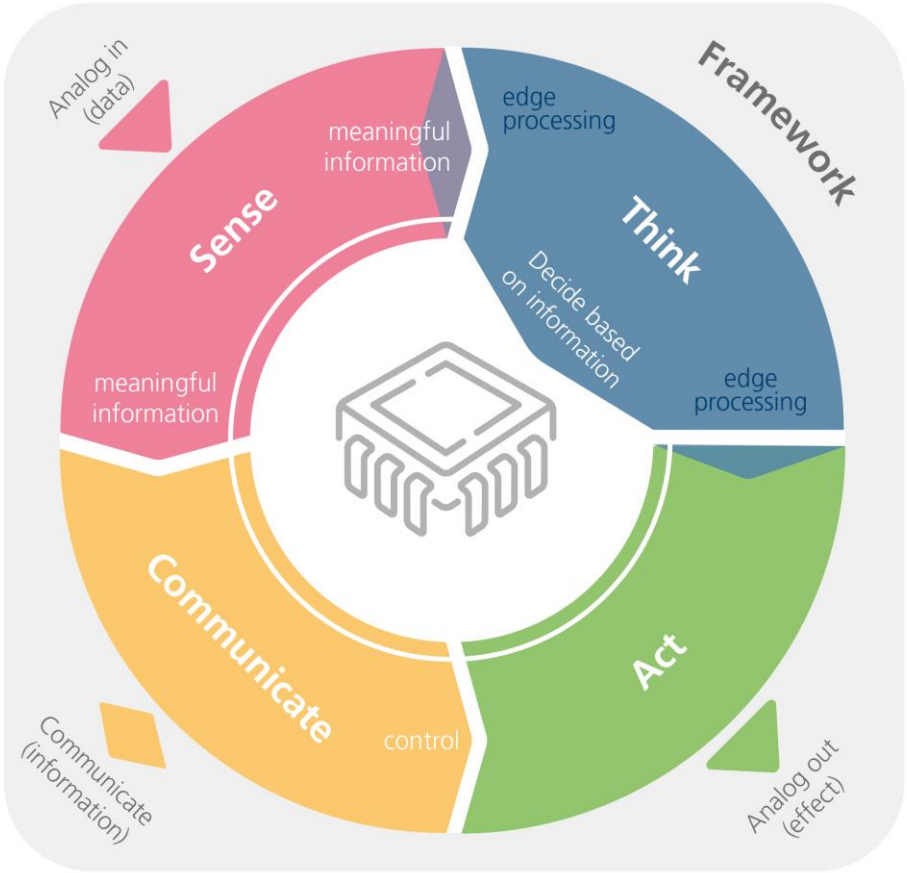
Nuremberg

ERLE - Highly-efficient and robust power electronics

- **What?**
  - High voltage Si diode design & process technologies
  - Automotive SiC power modules design & process technologies
- **What is the breakthrough?**
  - Highly efficient energy conversion
  - Increased lifetime and robustness

- **Impact for Bavaria/German/Europe**
  - Local cooperation(s): e.g. with ams-OSRAM, Infineon and wider power electronics ecosystem along the supply chain
- **Spill over /dissemination**
  - Publications/presentations and contribution to standardization based on project results

From SENSE, THINK, COMMUNICATE and ACT to Spill-over



High Foucus on Spill-over Activities

IPCEI Microelectronics and Communication Technologies

Work stream leads	Defregger, Stefan	EEMCO	Austria
	Alain Filipowicz	Conti	France

IPCEI Communication defined the following:

[…]

2. IPCEIs can make a very **important contribution** to sustainable **economic growth, jobs, competitiveness and resilience** for industry and the economy […] and with **positive spill-over effects** on the internal market and the **society as a whole**.

[…]

18. The benefits of the project must **not be limited to the undertakings** or **to the sector concerned** but must be of **wider relevance and application** to the economy or society in the Union through **positive spill-over effects** […] which are clearly defined in a concrete and identifiable manner.

[…]

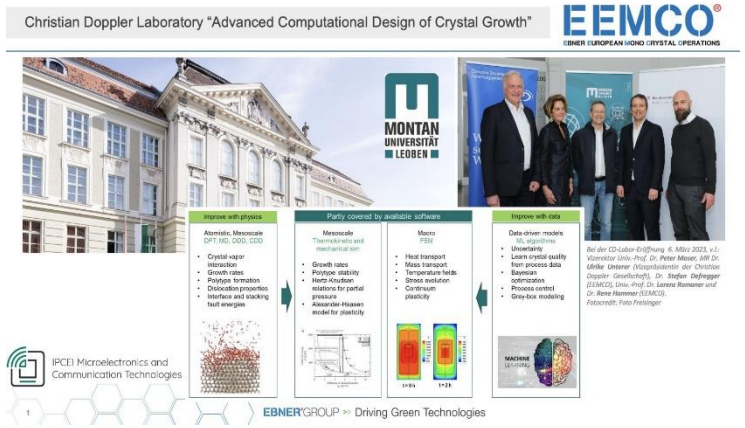
Examples for recent IPCEI ME/CT spill-over events

Common presentation and booth at EUROSIME 2024 in Catania organized by ST-I, Infineon, Bosch and AT&S

WWRF Huddle 2024: Uwe Bäder to share information about the European Project IPCEI ME/CT to enable sub-THz / D-band communication.

AT&S : Groundbreaking Event of advanced IC substrate facility and R&D line

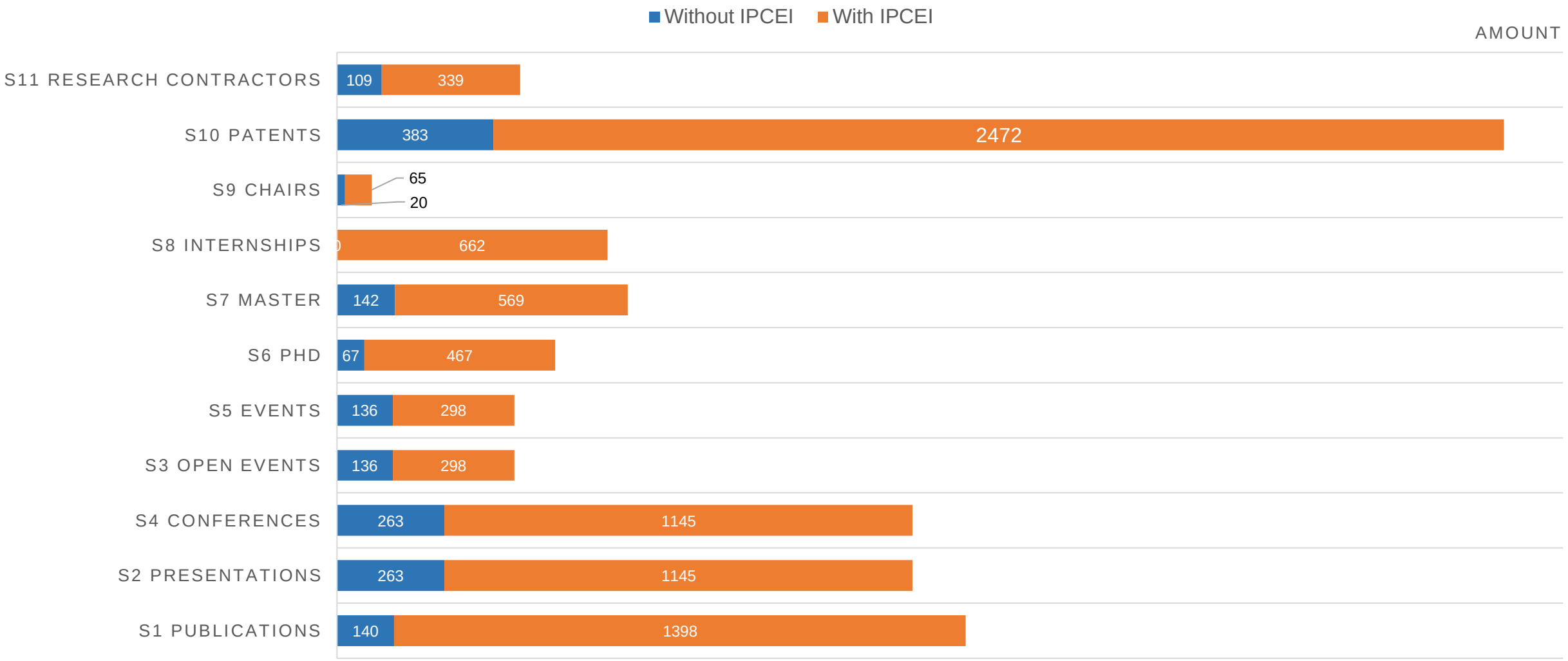
Chips JU R&I programme; Brussels Dec 2023; Panel session: Ferdinand Bell as speaker of the industrial IPCEI consortium



EEMCO at ICSCRM Conference

Spill-over Key Performance Indicators

IPCEI Microelectronics and Communication Technologies



Summary

IPCEI Microelectronics and Communication Technologies

- Projects and Key Performance Indicators on track!
- Collaborations in progress with many spill-over activities and disseminations!
- Important hiring ongoing (proved by KPIs and linkedin offers)!
- High amount of innovative and leading edge acitivities in Bavaria and beyond!
- Happy to share progress in upcoming events!