LSM - Workshop

October 18-19, 2023

CNRS

Institut des sciences de l’ingénierie et des systèmes

KEY FIGURES

INSIS key figures

110
Research units
within 5 UPR, 95 UMR, 8 UAR, 2 EMR

21
Federation of research units (FR)

40
Research networks (GDR)

6
International research laboratories

16 500
Total staff units

966 C
882 IT
Permanent staff

8.4 %
INSIS permanent staff in CNRS total permanent staff

20%
CNRS permanent staff in units total permanent staff

21 M€
Budget for research units

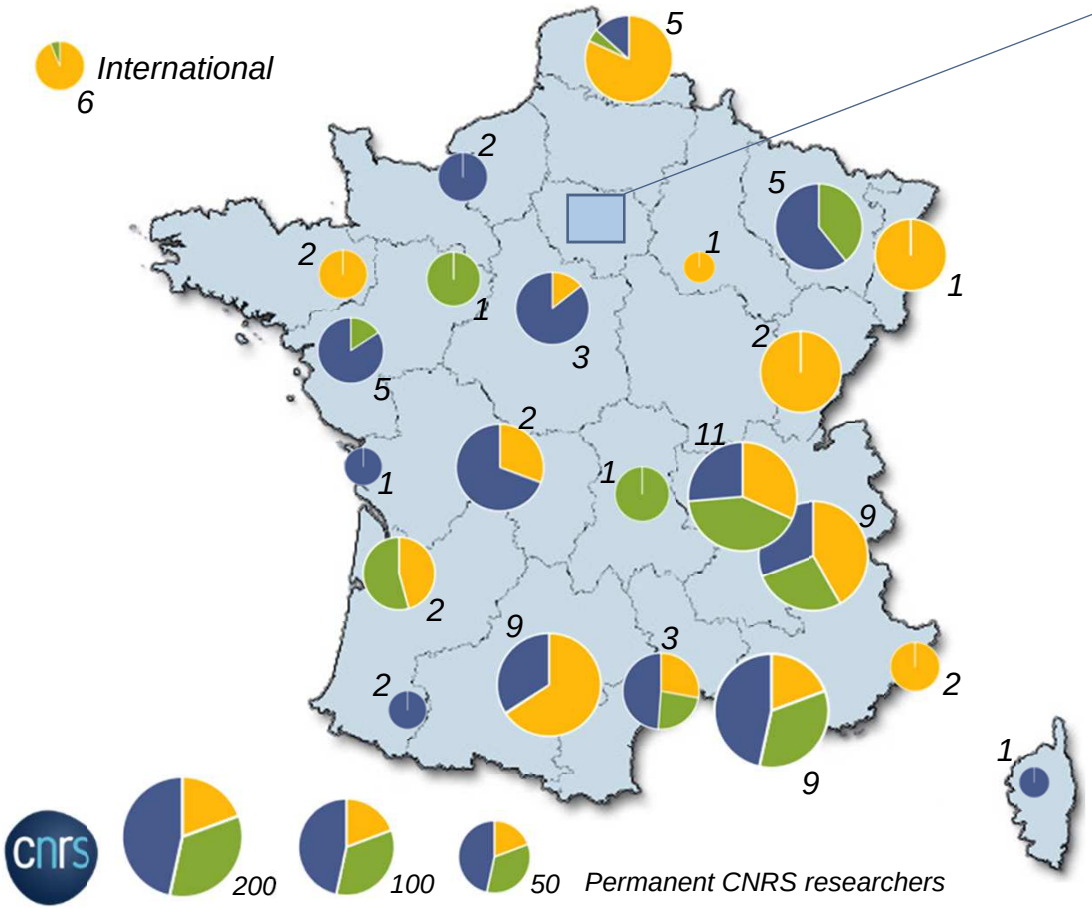
19 %
Share of budget to support the INSIS strategy (excluding infrastructurures)

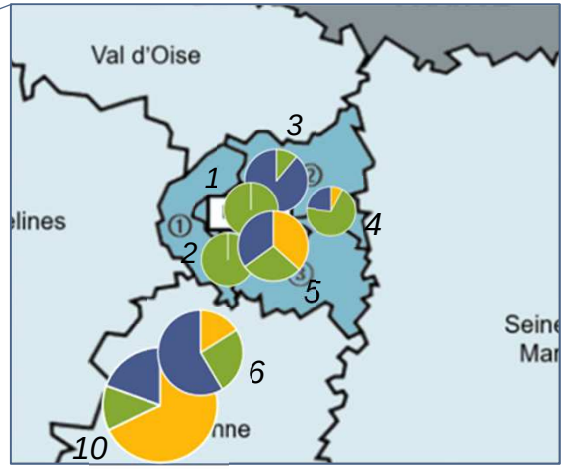
400 k€
To support emerging projects

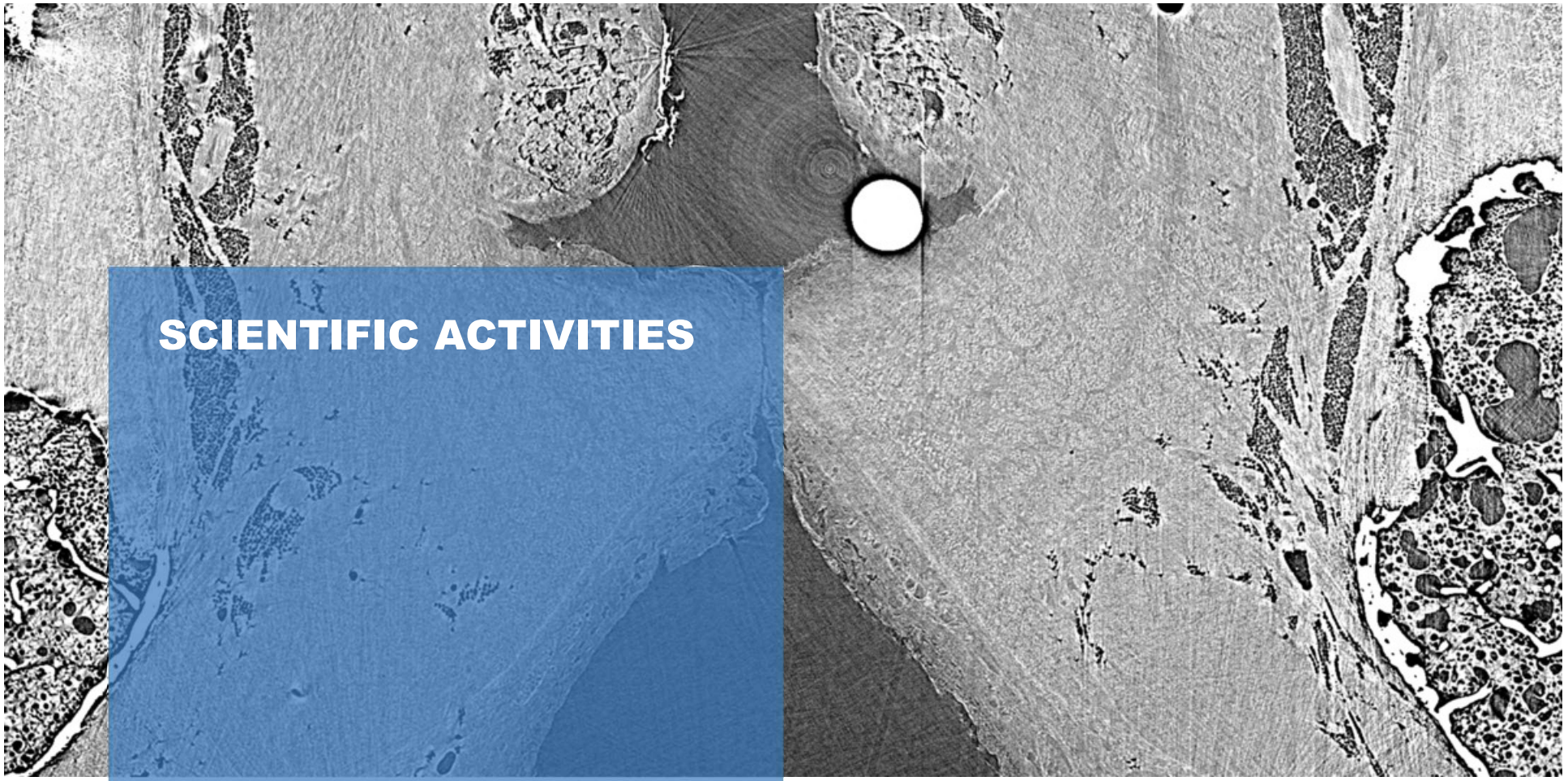
200 k€
To support projects between research teams

10 k€
Welcome support for junior researchers

Map of INSIS forces in France and abroad



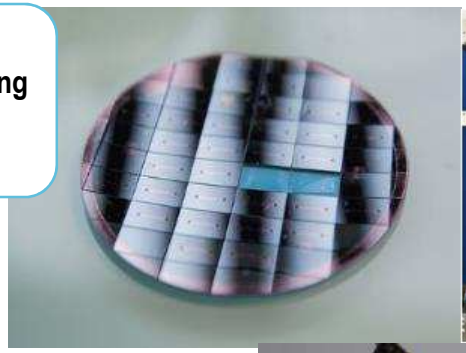


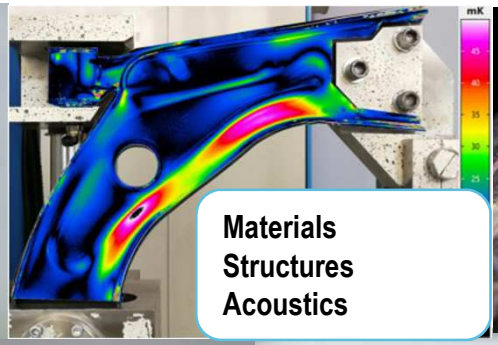


SCIENTIFIC ACTIVITIES

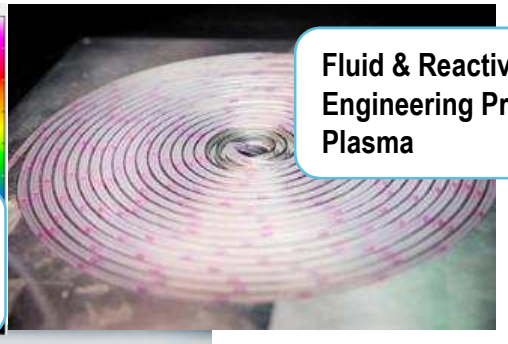
INSIS' scientific fields and their domains of application

Photonics
Electrical Engineering
Electronic
Nanotechnologies





Materials
Structures
Acoustics



Fluid & Reactive Media
Engineering Process
Plasma

Automatics &
Robotics

Technologies For Health
Bio engineering

Domains of application: Transport, Energy & Environment, Health, Construction, Information & Communication, Security/ Safety/ Defense

3 portfolios

Micro- and nanotechnologies, photonics, electrical engineering

Research and development of new functionalities, based on electron/photon engineering, in order to design and develop new components, sensors, microsystems or systems

- Main topics: electrical & electronic engineering, photonic engineering, electromagnetism, microsystems, nanoscience & nanotechnology

Mechanics of materials and structures, acoustics, bio-engineering & biomedical imaging, robotics

Research on high-performance and sustainable materials and structures, more efficient diagnosis and repair, in connection with the major current societal challenges such as energy, transportation, defense, environment and health

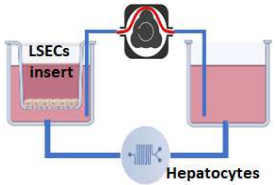
- Main topics: acoustics, bioengineering and biomedical imaging, civil engineering, mechanical engineering, mechanics of materials, solid and structural mechanics

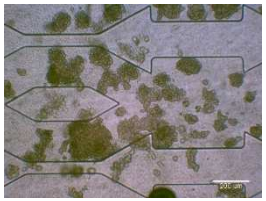
Fluid, processes, plasmas, transfers

Development of the expertise necessary to address all phenomena related to fluid and reactive media, transfers and multiphysical couplings, at all scales

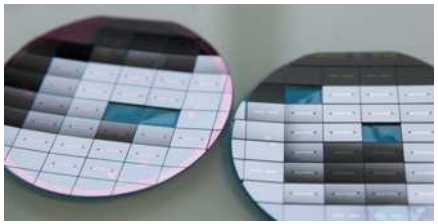
- Main topics: aerodynamics, hydrodynamics, combustion, processes, biomechanics, microfluidics, cold and fusion plasmas, nano- and macro-thermics, soft matter, rheology, mass and heat transfer

Transversal topic: Engineering sciences for health innovation





Organ on chip for metabolic syndrome follow-up



Silicon chips for DNA concentration and separation

Global objectives

- Shifting the health paradigm towards a more preventive, personalized/individualized, precise, economically sustainable and respectful medicine for the individual
- Deciphering and preventing health-environment interdependency

Interdisciplinary approaches targeting health issues

- fundamental understanding of disease mechanisms
- development of advanced concepts for health monitoring and therapy (diagnosis, personalized medicine, drug discovery, …)
- drug (bio)production

Key topics

- Mechanics of and for the living, mechanics for bioengineering, biomechanics
- New approaches for biomedical imaging, biophotonics
- Lab on chips and organ on chips
- Biomaterials, tissue engineering, material by design and bioprinting
- Integrated systems, wearable systems for diagnosis and therapeutic follow-up
- Modelling and deep learning approaches for diagnosis
- Bioprocess for biotherapies, mass production of drugs

Transversal topic: Engineering sciences for connectivity

Global Objectives

- Enable interoperability of different heterogeneous systems, both terrestrial and non-terrestrial (increase the flow of information, the reliability, the latency, the density of connected objects, for everyone and everywhere, only when needed)
- Develop signal processing algorithms and intelligent hardware architectures minimizing energy consumption and environmental impact, over a very wide frequency range (up to 500 GHz)
- Design of innovative components (Reflection Intelligent Surfaces, sensors, integrated sub-systems, …)
- Innovative transport solutions and clean propulsion

Key topics

- Electronics and Photonics for information processing and quantum technology (hybrid & Si photonics, THz components, holographic antennas, …)
- Micro-energy for IOT: harvesting, micro-storage, PowerMEMS
- Smartgrids
- Materials by design and micro/nano-structure optimization to obtain specific functionalities, metamaterials and engineered materials, wave control
- CAD and Numerical models: HPC, model reduction, machine learning techniques
- Aerodynamics, hydrodynamics, instabilities, turbulence: transports, energy and environment
- Micro and nanothermics, thermics of industrial systems: microsystems, multifunctional exchangers

Transversal Topic: Engineering sciences for environmental issues

Bio-asphalt produced from micro-algae residues

Global objectives

- Development of an **environmental monitoring**: observation of the system and development of precise models with sensor networks capable of supplying them with data
- Development of innovative solutions for the **adaptation and vulnerability** of the environment
- **Mitigation**: Proposition of operational solutions for moving towards low-carbon energy, sustainable mobility and low-energy construction, or develop materials, processes and systems emitting less greenhouse gas

Key topics

- Sensors of the future for intelligent and integrated environmental monitoring
- MEMS/MOEMS and innovative micro-systems
- Numerical models: HPC, model reduction, machine learning techniques, digital twins
- Sustainable and Low carbon building and structures
- Processes for clean-up and remediation of air, soils, water
- Circular economy, recycling, LCA (Life Cycle Assessment)
- Low power electronics, digital world less power consuming

Transversal Topic: Engineering sciences for sustainable energy

Global objectives / INSIS CNRS hosts CNRS Energy Unit

- Contribute to the mitigation of the CO2 emission from the energy demanding sectors (building, industry, transport…)
- Accelerate transition to a sustainable and clean energy
- Develop sustainable materials, processes and devices for applications in energy sectors
- Enhance knowledges in basic sciences for energy

Fuel cell (H2)

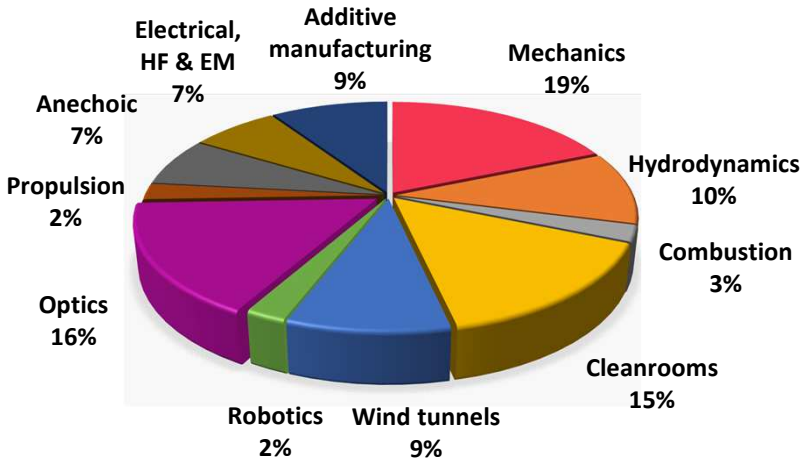
Key topics

- Advanced Materials, concepts and devices for photovoltaics
- Concentrated solar Power for materials modification or for energy production
- Hydrogen production by electrolysis or photo(electro)catalysis, hydrogen storage, hydrogen usage (fuel cells, combustion), hydrogen systems
- Beyond Li batteries (Na based, all solid , organics…) and diagnostics
- Biomass and biofuels
- Energy efficiencies in building and industry
- Electric grid management
- Life cycle analysis and social impact

Transversal Axe: Facilities & Research Infrastructures

More than 150 research facilities that are open to the whole academic and industrial communities.

- Few large size equipment (ex. wind tunnels)
- Many mid-size equipment (ex. characterization)
- Complementarity with INP (nano & optics) & INSB (ex. medical imaging)



RENATECH+ network
(nanofabrication cleanrooms)