

FROM RESEARCH TO INDUSTRY

cea tech

> **CEA Tech**
TECHNOLOGY
PLATFORMS

speeding innovation
for industry



CEA TECH TECHNOLOGY PLATFORMS: SPEEDING INNOVATION FOR INDUSTRY

The 32 CEA Tech technology platforms, located on the CEA Grenoble-Chambéry and Paris-Saclay campuses, make some of the most advanced know-how, software, and equipment in Europe available to manufacturing and other industrial companies under R&D partnerships.

The CEA Tech technology platforms help manufacturing and other industrial companies develop powerful, innovative products and shorten time to market. All innovations are protected by robust intellectual property and confidentiality policies. Our scientists and engineers can support industrial partners from the initial concept demonstrator through to test production runs at our facilities. The platforms are currently engaged in more than 400 R&D partnerships and can address the needs of companies in a wide range of industries:

- ICTs and data processing
- Renewable energy
- The factory of the future
- Healthcare and the silver economy
- Materials and characterization
- Open and collaborative innovation

CEA Tech regional technology-transfer platforms target the unique needs of France's regional manufacturing economies.

In 2013 CEA Tech began gradually implementing its regional technology-transfer platforms, bringing the number of CEA Tech sites to a total of eight across France. These facilities were set up with the support of the concerned local governments and were designed to bring local businesses the CEA Tech technologies that meet their unique innovation needs. The regional platforms round out the scientific, technological, and economic development resources already in place in each region; they also liaise between the CEA Tech institutes and industrial partners in the regions.

The regional technology-transfer platforms have also expanded CEA Tech's R&D line up to include industry-specific resources for companies seeking support on materials, electronics and miniaturized components, optronics, information and communication systems, non-destructive testing, energy production and storage, building-integrated energy systems, collaborative robotics, and advanced manufacturing.

INFORMATION & COMMUNICATION TECHNOLOGIES & DATA PROCESSING

- 006 Integrated circuit design
- 008 Embedded systems design
- 010 Cybersecurity
- 012 Large-area printing
- 014 Software and systems engineering
- 016 Ambient intelligence
- 018 200 mm et 300 mm microsystems
- 020 300 mm nanoelectronics
- 022 Photonics
- 024 Sensor networks and communicating objects

RENEWABLE ENERGY

- 028 Batteries
- 030 Bio-based energy
- 032 Building energy
- 034 Micro energy sources
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- 038 Fuel cells
- 040 Hydrogen production and storage
- 042 Heat networks and thermal storage
- 044 Photovoltaic solar
- 046 Smart grid systems

THE FACTORY OF THE FUTURE

- 050 Non-destructive testing
- 052 Nuclear instrumentation for energy
- 054 Virtual reality
- 056 Collaborative robotics

HEALTHCARE & THE SILVER ECONOMY

- 060 Clinathec
- 062 DOSEO radiotherapy and medical imaging
- 064 Nano-biotechnology

MATERIALS & CHARACTERIZATION

- 068 Nanocharacterization
- 070 Nanosafety
- 072 Poudr'Innov 2.0

OPEN & COLLABORATIVE INNOVATION

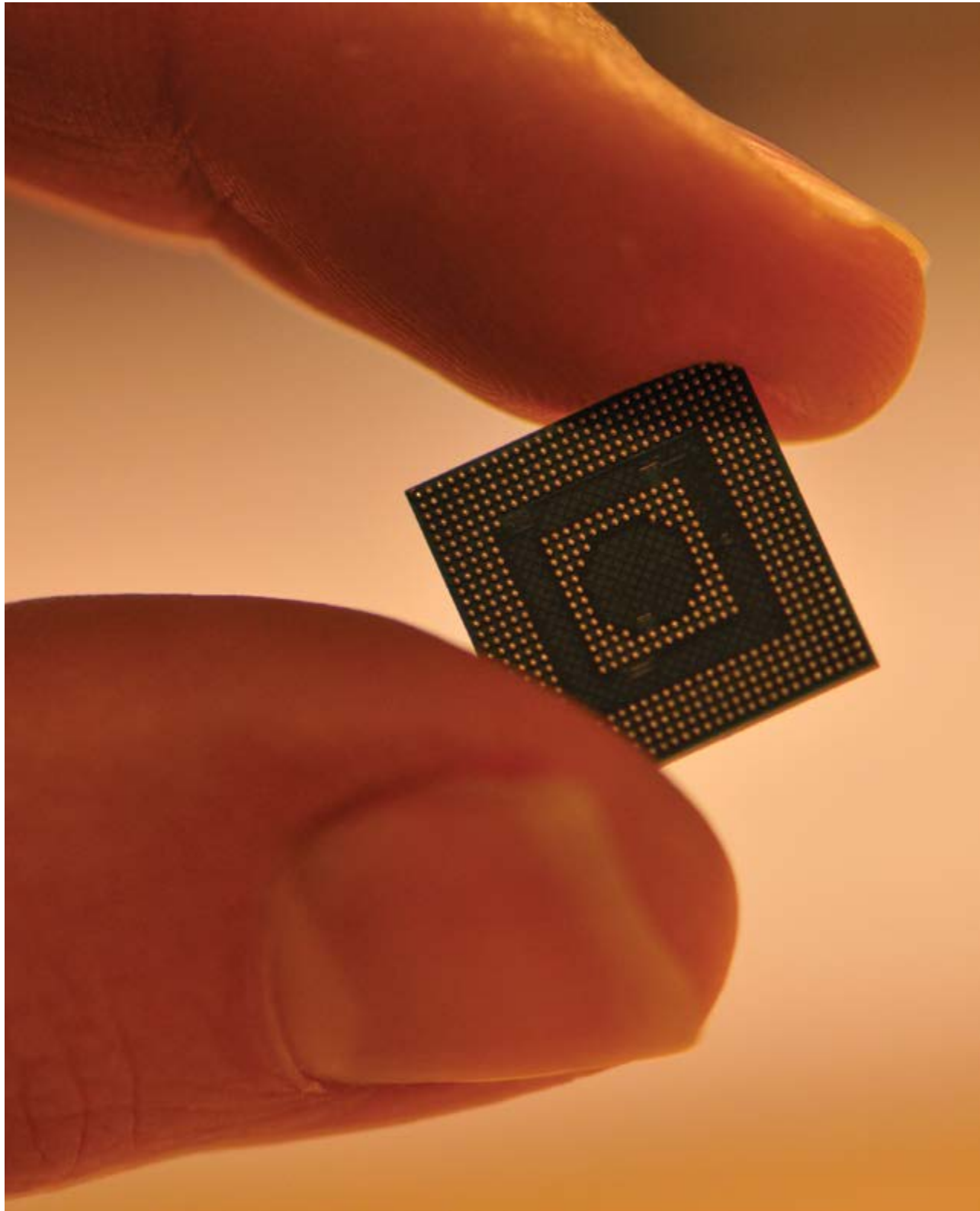
- 076 User-centered open innovation
- 078 Technological innovation showroom

information

**INFORMATION &
COMMUNICATION
TECHNOLOGIES
AND DATA
PROCESSING**

communication

- 006 Integrated circuit design
- 008 Embedded systems design
- 010 Cybersecurity
- 012 Large-area printing
- 014 Software and systems engineering
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- 018 200 mm et 300 mm microsystems
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INTEGRATED CIRCUIT DESIGN PLATFORM

THE ONLY IC DESIGN CENTER OF ITS KIND IN EUROPE

The integrated circuit design platform is one of Europe's leading technological research centers specializing in digital, analog, mixed-signal, and radiofrequency component design.

The components developed at the platform offer lower energy consumption, lower noise, and higher performance than commercially-available circuits, making them suitable for use in demanding applications in the aeronautics, automotive, healthcare, IoT, manufacturing, and other industries.

The platform uses advanced simulation and emulation to predict component performance

from the initial design phase and develops complete circuits, right up to the demonstrator or prototyping stage. The platform can also integrate innovative functions onto existing circuits. Finally, the platform's Silicon Impulse service lineup includes design, fabrication (at external foundries), and testing of circuits leveraging some of the most advanced technologies available, such as FD-SOI. Foundries, design firms, fabless manufacturers, and systems integrators turn to the platform to design highly-complex circuits with integrated sensors, computing, and wireless communications capabilities.

R&D AREAS

Digital, analog, mixed-signal, and radiofrequency circuit design, demonstrator development, and prototyping

NOTABLE EQUIPMENT

CAD toolchain, Verigy 9300 tester, Mentor Graphics Veloce 2 emulator, function library (IP)

KEY FIGURES

- 180 employees
- 2,500 sq. m of facilities
- €20 million in equipment
- 35 patents filed per year, portfolio of 250 patents

PARTNERS

More than 50 industrial partners

LOCATION

Leti (Grenoble)

EMBEDDED SYSTEMS DESIGN PLATFORM

OVERCOMING THE CHALLENGES OF HARDWARE-SOFTWARE INTEGRATION

The embedded systems design platform possesses unrivalled know-how in hardware-software integration. The platform designs systems that respond to high reliability and security demands for Big Data servers, IoT, transportation, energy, manufacturing, and other industries. The R&D conducted at the platform falls into two categories: hardware and software solutions to optimize system design and integration; and integrating electronic and computing modules into existing systems. However, both types of R&D share the objective of enhancing overall system operation and use

through smaller form factors, more memory, better energy efficiency, lower cost, and greater security and reliability.

The platform's advanced simulation resources are used to validate target systems in environments representative of the applications in which they will be used. This unique capacity to simultaneously address design and the final specifications of the target application has attracted more than 40 industrial partners, including a number of small- and mid-sized companies.

R&D AREAS

Embedded systems design to optimize form factor, power consumption, cost, and security

NOTABLE EQUIPMENT

CAD tools for hardware and software simulation, Synopsys ZeBu embedded system emulation system, test benches replicating severe environments (high temperature, radiation, etc.)

KEY FIGURES

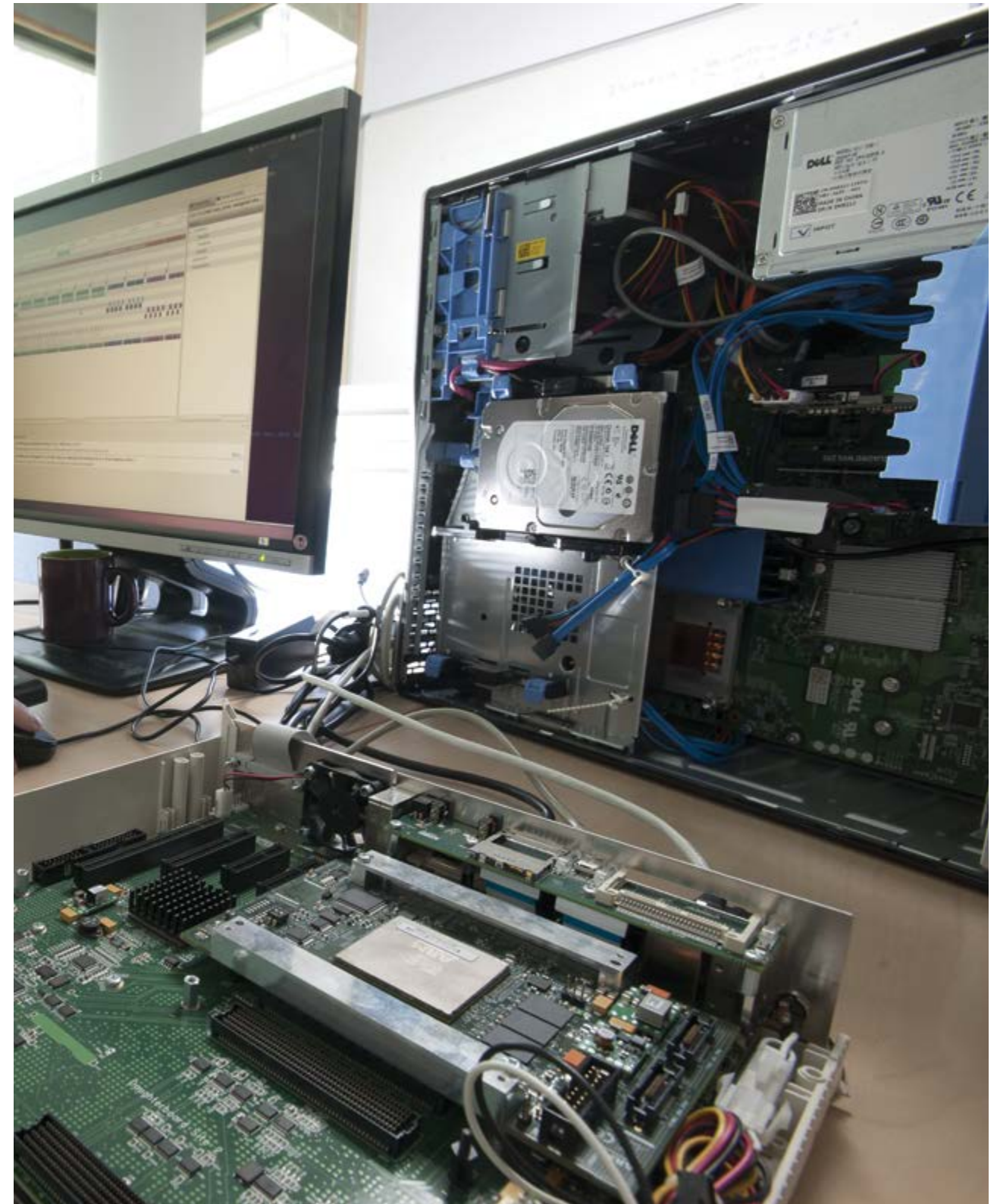
- 120 employees
- 2,000 sq. m of facilities
- €2 million in equipment
- 15 patents filed per year, portfolio of 180 patents

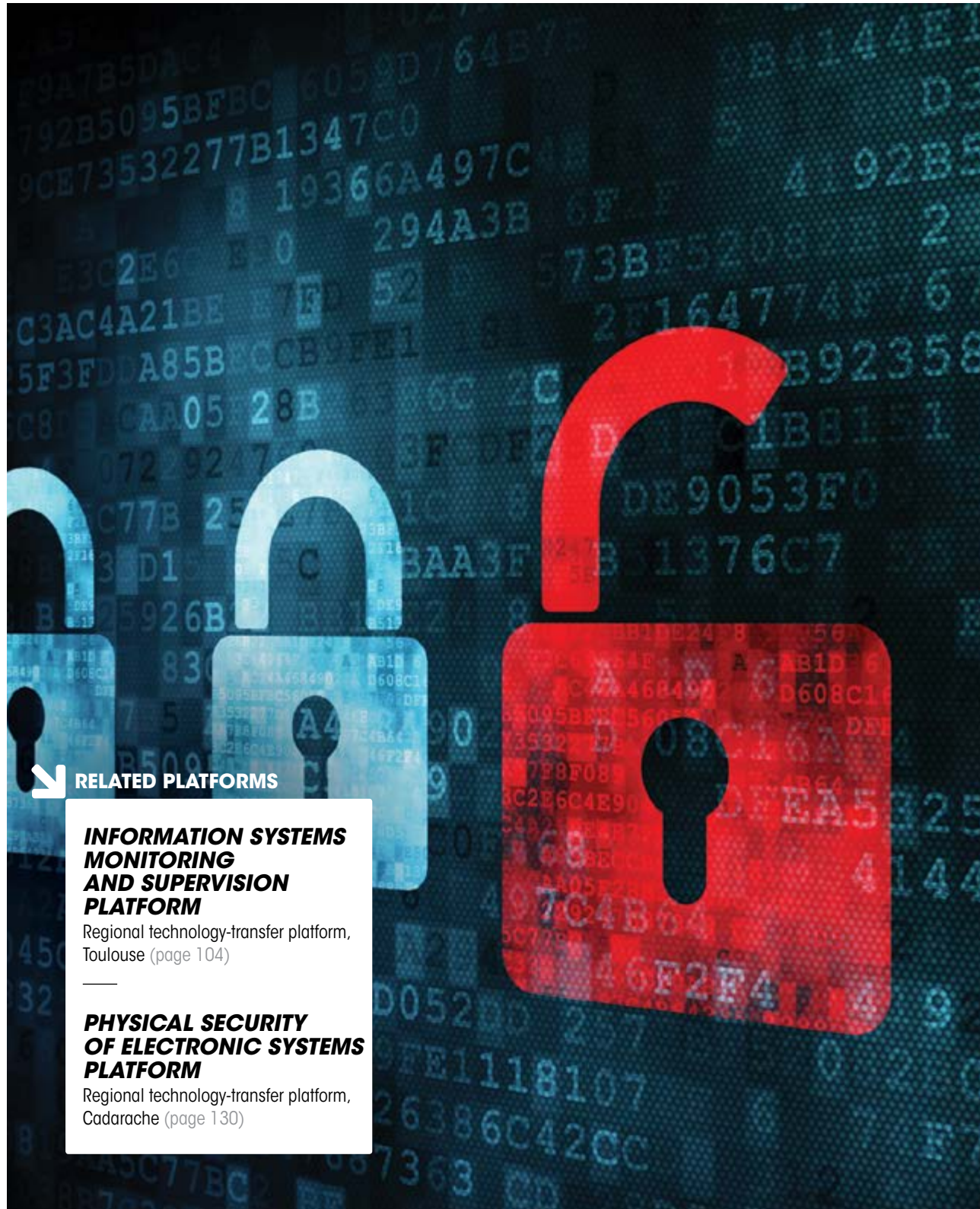
PARTNERS

More than 40 industrial partners

LOCATION

List (Paris-Saclay)





CYBERSECURITY PLATFORM

PROTECTING HARDWARE AND SOFTWARE FROM THREATS

The cybersecurity platform is staffed by more than 100 experts in protecting integrated circuits, mobile electronic devices like smartphones, and embedded systems and their software from threats. The platform is used to identify product vulnerabilities and come up with innovative ways to protect both hardware and software from cyber-attacks.

The platform uses some of the most advanced tools available (source-code analysis software like Frama-C, hardware platform simulators, test benches capable of replicating physical attacks against electronic components, fault generators, and emission spectrum analyzers) to pinpoint

vulnerabilities. It is home to one of France's three official commercial hardware security evaluation centers (CESTI).

The techniques employed to ensure hardware and software security are based on innovative technologies like secure communications platforms for sensor networks, secure hardware and software cryptography implementation, crypto calculation for direct application processing of encrypted data, and more. No other cybersecurity center in Europe is as large or covers as broad a scope as the platform. The platform's partners include some 30 manufacturing and other industrial companies, as well as research organizations in Europe and the United States.

RELATED PLATFORMS

INFORMATION SYSTEMS MONITORING AND SUPERVISION PLATFORM

Regional technology-transfer platform, Toulouse (page 104)

PHYSICAL SECURITY OF ELECTRONIC SYSTEMS PLATFORM

Regional technology-transfer platform, Cadarache (page 130)

R&D AREAS

Cyber protection of software, integrated circuits, and embedded systems

NOTABLE EQUIPMENT

CAD toolchain, Verigy 9300 tester, Mentor Graphics Veloce 2 emulator, function library (IP)

KEY FIGURES

- 1,300 sq. m of facilities
- 100 employees
- €3.5 million in equipment

PARTNERS

Some 30 industrial partnerships in industries like transportation, energy, healthcare, banking, and telecommunications

LOCATIONS

Leti and List (Grenoble and Paris-Saclay)

LARGE-AREA PRINTING PLATFORM

PUSHING BACK THE FRONTIERS OF ELECTRONICS

The Pictic large-area printing platform develops smart plastics, papers, and textiles produced by printing electronic functions directly on flexible, 320 mm x 380 mm surfaces. The applications for these flexible circuits are complementary to those addressed by silicon-based technologies, and include human-machine interfaces, smart lighting, interactive displays, and environmental monitoring. The platform is Europe's only specialized R&D facility to bring together all of the necessary printing techniques—screen printing, inkjet, gravure, flexography, and slot-die—under one roof.

The platform also has characterization, assembly, encapsulation, and other equipment. The platform develops formulations for electronic inks, scales up printing processes for industrial rollout, and manufactures prototypes and test runs, working with corporations worldwide, as well as with startup Isorg. The processes developed at the platform stand out for their precision and competitive pricing. Electronic functions are deposited on the substrate in a single step, eliminating the need to use lithography and other subtractive processes.

R&D AREAS

High-precision processes: alignment of electronics layers to within 10 microns; uniform deposition thicknesses

NOTABLE EQUIPMENT

Slot-die printing, gravure, and flexography; sheet-fed printing

KEY FIGURES

- 600 sq. m of clean rooms
- €9 million in equipment
- 50 research scientists and technicians
- Portfolio of 50 patents

LOCATION

Liten (Grenoble)





SOFTWARE AND SYSTEMS ENGINEERING PLATFORM

FOR MORE EFFICIENT DESIGN AND VALIDATION

The focus of the software and systems engineering platform is to improve the software and systems design and validation processes to achieve cost savings, ensure higher quality, boost performance, and increase safety and security. The platform drives rapid, controlled advances in development techniques. The solutions developed at the platform can be used to enhance embedded software and systems for electronic payment, automotive, avionics, and telecommunications network applications, as well as for large-scale distributed systems in energy supervision, manufacturing, and financial transaction

management. The platform boasts state-of-the-art resources covering the entire development cycle, from specifications and design to verification, validation, and implementation. Close ties are maintained with hardware designers at every stage in the process. The platform's activities cover three areas: development of solutions with and for industrial partners; studies, assessments, audit, and training; and the development of business-specific tools. The platform is like no other facility in France's academic research landscape.

R&D AREAS

Embedded software and systems engineering methods

NOTABLE EQUIPMENT

Papyrus and Frama-C open-source software; commercial software (Scade Suite, MaTeLo, TIS Analyser); computing resources

KEY FIGURES

- 1,000 sq. m of facilities
- €2 million annual investment
- 110 engineers and technicians

PARTNERS

More than 20 industrial partners

LOCATION

List (Paris-Saclay)

AMBIENT INTELLIGENCE PLATFORM

BUILDING BRIDGES BETWEEN THE PHYSICAL AND VIRTUAL WORLDS

The ambient intelligence platform develops technologies to enable new forms of interaction between people and their digital environment. The platform's Big Data R&D entails mining huge databases of multilingual text, images, videos, signals, and digital data to generate targeted, easy-to-understand search results. The platform's human-machine interface R&D produces simple, intuitive tools from touch screens to haptic feedback and vibration systems that increase ease-of-use. Both areas of research cover the entire design cycle.

The platform can also develop secure, high-quality communication protocols with remote-management capabilities for connected objects with little available processing power and energy. A new 160 sq. m lab at the platform is being used to develop new services in areas like smart homes, assisted living, and collaborative tools for meetings.

R&D AREAS

Big Data, human-machine interfaces, communication protocols

KNOW-HOW

Statistical analysis, multimedia search, vision systems, mechatronics, decision assistance, protocol design

KEY FIGURES

- 150 employees
- 1,000 sq. m of facilities
- 20 patents filed per year
- More than €5 million in equipment

PARTNERS

50 industrial partners, including Schneider Electric, Biomérieux, Bureau Veritas, Ant'Inno, and Diotasoft

LOCATION

List (Paris-Saclay)



RELATED PLATFORMS

MECHATRONICS FOR BETTER PROCESSES AND PRODUCTS PLATFORM

Regional technology-transfer platform, Metz (page 86)



200 mm & 300 mm MICROSYSTEMS PLATFORM

A WORLD-CLASS R&D FACILITY

The 200 mm and 300 mm microsystems platform develops sensors, switches, RF components, components for photonics and IR applications, power components, and integrated packaging solutions. The platform's highly-qualified staff, equipment, and international activities make it the world's leading center for microsystems R&D. The objectives of the R&D conducted at the platform are to reduce component cost and energy consumption while increasing performance and reliability. The microsystems developed target the mobile telephony, medical, automotive, aeronautics, and other industries.

The platform has 25 ongoing strategic partnerships with component and systems manufacturers and end users. Its activities cover the entire component-development chain, from simulation, design, and technology development to demonstrator systems and industrial scale-up. Other activities include advanced morphological and electrical characterization and reliability studies. Finally, the platform investigates new materials, validates innovative technologies, develops non-volatile memory, and studies 3D integration.

RELATED PLATFORMS

MECHATRONICS FOR BETTER PROCESSES AND PRODUCTS PLATFORM

Regional technology-transfer platform,
Metz (page 86)

R&D AREAS

200 mm and 300 mm
microsystems simulation,
development, demonstrators,
and tech transfer

NOTABLE EQUIPMENT

400 pieces of major equipment

KEY FIGURES

- Open 24-7
- 4,500 sq. m of clean rooms
- 340 research scientists and technicians
- 45 patents filed per year
- €12 million annual investment

LOCATION

Leti (Grenoble)

300 mm NANO ELECTRONICS PLATFORM

HIGH-ADDED-VALUE MODULES AND INTERNATIONAL R&D PARTNERSHIPS

The 300 mm nanoelectronics platform develops advanced transistors, integrated circuits, and non-volatile memory. It is also where FD-SOI—today used to mass-produce chips worldwide—was born. The platform also conducts 3D integration R&D.

The platform's scope covers simulation, technology development, demonstrators and prototyping, advanced characterization, and reliability testing. The platform can also conduct short-loop proof-of-concept testing with wafer manufacturing sites. Foundries, fabless manufacturers, integrators, and materials and equipment manufacturers that partner with the platform benefit from high-

added-value modules offering excellent energy consumption, speed, and frequency—ideal for the microcontrollers used in the automotive and medical industries and for smart cards, for example. The platform is one of the world's top five 300 mm nanoelectronics R&D centers, and counts fifteen strategic partnerships with organizations in the US and Europe. The platform is also home to advanced know-how in e-beam lithography, a potential alternative to optical lithography in achieving ultimate resolution.

R&D AREAS

300 mm front-end modules and 3D integration

NOTABLE EQUIPMENT

100 heavy machines and instruments

KEY FIGURES

- Open 24-7
- 3,300 sq. m of clean rooms
- 200 research scientists and technicians
- 70 patents filed per year
- €25 million annual investment

LOCATION

Leti (Grenoble)



↓ RELATED PLATFORMS

POWER COMPONENT TESTING PLATFORM

Regional technology-transfer platform, Toulouse (page 108)



PHOTONICS PLATFORM

EXCELLENCE IN INNOVATIVE OPTICAL SYSTEMS

The photonics platform is France's largest R&D center for the development, characterization, and simulation of optoelectronic systems and components. The platform's activities range from system and component design through to component fabrication, integration into systems, and packaging and cover III-V and II-VI semiconductor technologies.

The technologies developed can be applied to lighting, microdisplays, optical transmission, visible and IR imaging, astrophysics systems, and more. The platform is home to 1,500 sq. m of characterization facilities, 300 sq. m of packaging

labs, 1,500 sq. m of materials research space, and 900 sq. m of clean rooms dedicated to III-V and II-VI semiconductor technologies. These resources round out the equipment available at the 300 mm nanoelectronics platform and the 200 mm and 300 mm microsystems platform.

With a staff of 300, more than 300 instruments and machines, a broad scope of R&D, and high-quality research results (60 patents filed per year), the platform is the R&D partner of choice of more than 40 companies, including STMicroelectronics, Alcatel-Lucent, Thales (via III-V Lab), Sofradir, Aledia, MicroOLED, and others.

RELATED PLATFORMS

OPTOELECTRONIC SYSTEMS INTEGRATION PLATFORM

Regional technology-transfer platform, Bordeaux (page 96)

R&D AREAS

Development of innovative optoelectronic systems like LEDs, microdisplays, optical sensors, integrated photonics, and imagers

NOTABLE EQUIPMENT

More than 300 pieces of equipment; €5 million to €6 million annual investment

KEY FIGURES

- 12,600 sq. m of facilities
- €45 million in equipment
- 300 engineers and technicians
- 60 new patents filed per year, portfolio of 400 patents

LOCATION

Lefi (Grenoble)

SENSOR NETWORKS AND COMMUNICATING OBJECTS PLATFORM

FROM IDEA TO MANUFACTURING PLANT

The sensor networks and communicating objects platform helps manufacturers build innovative features into their products and services. The platform covers the entire R&D cycle, from idea to demonstrator systems, and also offers support conducting experiments and scaling up technology for industrial rollout. It is the only R&D center in France to offer such a comprehensive range of services. The platform's services are designed to meet manufacturers' need for performance, agile project management, and responsiveness. Mid-sized companies like Radiall, Pomagalski, and Bubendorff and major corporations like Michelin, Renault, Oxyane, Schneider Electric, and Invensense turn to the platform for their R&D needs.

With a broad portfolio of technologies that includes sensors, wireless and contactless technologies, and energy harvesting, the platform is poised to take a "system" approach to manufacturers' needs, designing features that respond to the demands of tomorrow's digital world—IoT, smart cities, communicating vehicles, and digital factories—to give traditional manufacturing companies an opportunity to add value to products, whether they are made from glass, paper, textile, or concrete. These features are integrated and analyzed in the lab, and then tested and evaluated in either the actual environment in which they will be used or in representative environments using functional demonstrators.

R&D AREAS

Development and integration of innovative features for high-added-value products and services

LOCATION

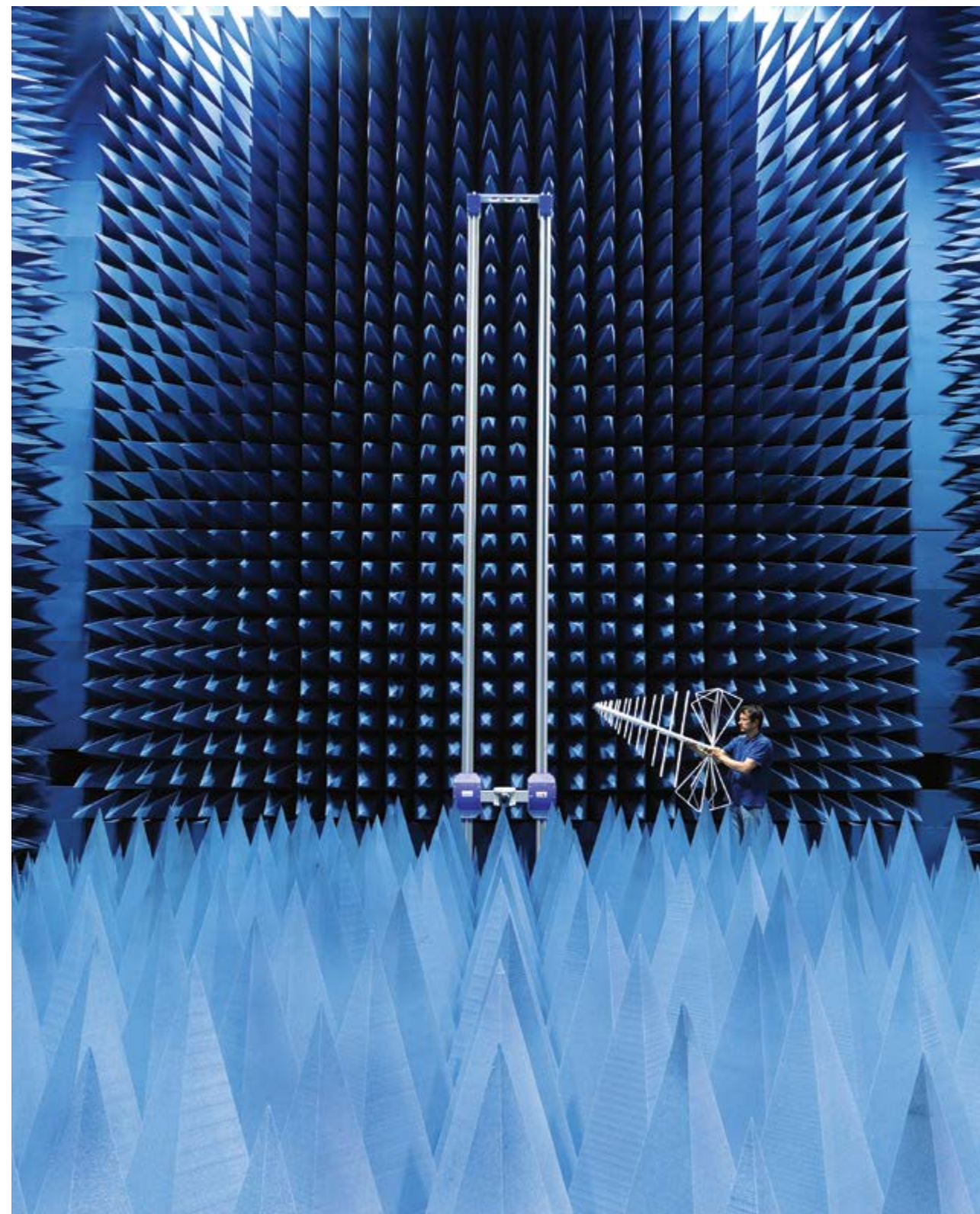
Leti (Grenoble)

NOTABLE EQUIPMENT

Anechoic chambers, magnetic characterization site, life-sized smart city lab, software integration lab, fast-prototyping equipment

KEY FIGURES

- 5,000 sq. m of lab and office space, 3,000 sq. m of instrumented outdoor space
- 200 engineers
- Nearly 50 new patents filed per year, portfolio of 400 patents
- Nearly 200 industrial partners



renewable

energy

RENEWABLE ENERGY

- 028 Batteries
- 030 Bio-based energy
- 032 Building energy
- 034 Micro energy sources
- 036 Electric mobility
- 038 Fuel cells
- 040 Hydrogen production and storage
- 042 Heat networks and thermal storage
- 044 Photovoltaic solar
- 046 Smart grid systems



BATTERY PLATFORM

FOR BETTER LITHIUM-ION BATTERIES OF ALL SIZES

The battery platform boasts all of the know-how and heavy equipment required to develop and produce small runs of lithium-ion batteries. R&D at the platform starts with identifying and synthesizing materials to optimize battery performance, and encompasses manufacturing the various components (such as battery electrodes and electrolytes), assembling the battery packs, and integrating them into complete systems. Battery safety and performance are assessed via a range of tests that include total destruction of the battery. The platform has around 20 pieces of heavy

equipment, including coating and filling machines and a test assembly line. The platform's work focuses on lithium-ion batteries and battery packs of all sizes, from tiny hearing-aid batteries weighing in at just a few grams to 300-kg electric-bus batteries. The platform's size and scope make it unique in Europe. With a strong commitment to industrial R&D partnerships, the platform works with around 30 manufacturers, including Renault, Prayon, Umicore, and Solvay (on battery materials).

RELATED PLATFORMS

ENERGY SYSTEMS RELIABILITY PLATFORM

Regional technology-transfer platform,
Bordeaux (page 94)

MARINE ENERGY SYSTEMS PLATFORM

Regional technology-transfer platform,
Nantes (page 118)

R&D AREAS

Design, development, small-run production, and integration of lithium-ion batteries of all sizes

NOTABLE EQUIPMENT

Industrial-grade coating machine, test assembly line

LOCATIONS

Liten (Grenoble and Chambéry)

KEY FIGURES

- 3,000 sq. m of facilities, including 1,000 sq. m of anhydrous chambers
- 200 research scientists and technicians
- €40 million in equipment

BIO-BASED ENERGY PLATFORM

CONVERTING BIOMASS TO ENERGY

The bio-based energy platform conducts R&D to convert organic matter (biomass) into energy, developing high-yield processes to eliminate waste and limit emissions of heavy metals, sulfur, and other hazardous substances. The platform is France's only bio-based energy R&D center with as broad a scope, covering grinding, torrefaction, pyrolysis, hydrothermal liquefaction, and gasification and research ranging from analysis through to 100 kg/h processes that can be scaled up for industrial rollout. The platform's equipment includes grinders, a torrefactor, and rapid pyrolysis and gasification

reactors. Researchers at the platform investigate traditional biomass (wood, farming and forestry residues) as well as industrial and household waste, wastewater treatment sludge, micro-algae, and other potential sources of energy. They typically transform these types of waste into syngas and molecules of interest produced during the processes used. The platform conducts R&D with around fifteen industrial partners with a view to developing viable biomass-to-energy processes.

R&D AREAS

Drying, grinding, injection, pressurization, torrefaction, pyrolysis, gasification, and hydrothermal liquefaction

PARTNERS

Around fifteen industrial partners (Engie, CMI, Michelin, and others)

KEY FIGURES

- 800 sq. m of facilities
- €7 million in equipment
- 40 engineers and technicians
- 6 to 8 new patents filed per year, portfolio of 20 patents

LOCATION

Liten (Grenoble)

NOTABLE EQUIPMENT

The Genepi lab (funded by the French government's economic stimulus package) boasts an 11-meter-high, 3.5-meter-diameter torrefactor; a high pressure, high-temperature gasification reactor; and hydrothermal liquefaction test reactors



RELATED PLATFORMS

MICRO-ALGAE PLATFORM

Regional technology-transfer platform, Cadarache (page 128)



BUILDING ENERGY PLATFORM

REDUCING ENERGY CONSUMPTION WHILE INCREASING OCCUPANT COMFORT

The building energy platform develops solutions to help homebuilders and construction materials and building systems manufacturers improve building energy performance and occupant comfort. Research areas include new construction methods and approaches, opaque and glass wall solutions, materials, insulating stuccoes, doors and windows, innovative ventilation systems, solar sensors, and heat storage. The solutions developed at the platform in conjunction with industrial partners are tested and validated in real-world conditions in the platform's four 100 sq. m instrumented homes. The presence of occupants is simulated, with scenarios that replicate the human metabolism, open and close

windows, pump water, and ensure other building system operation.

These experimental homes are made from different materials (wood, vibrated concrete, concrete blocks, and brick, respectively). They are also equipped with more than 1,000 sensors that produce data for modelling. No other experimental facility in France offers these capabilities. The platform works with more than 20 industrial partners, including several multinational corporations. The average project runs for two to three years. The ultimate goal of all projects is to achieve the best possible compromise between energy performance and occupant comfort.



RELATED PLATFORMS

MEDITERRANEAN BUILDING PLATFORM

Regional technology-transfer platform, Cadarache (page 124)

R&D AREAS

Development and testing in real-world conditions of solutions to enhance building energy performance

LOCATION

Liten (Chambéry)

NOTABLE EQUIPMENT

Four experimental homes (100 sq. m; total interior volume of 240 cu. m) instrumented with 1,000 sensors; building facade testing units, instrumented rooftops

KEY FIGURES

- 40 employees
- €1.5 million in equipment
- Portfolio of 25 patents

MICRO ENERGY SOURCE PLATFORM

BATTERIES AND FUEL CELLS

The micro energy source platform brings together at a single location all of the resources necessary to design power supply systems for smart cards, sensors, laptop computers, and more. The 1,000 sq. m platform is home to around 30 pieces of equipment suitable for scaling up these technologies for industrial manufacturing. The platform develops micro batteries and micro fuel cells, with a sharp focus on enhancing materials to improve performance. The platform leverages technologies like thin-layer deposition for batteries and investigates ways to improve

fuel-cell catalyst and collector performance and lifespans.

The advanced equipment available at the platform includes a five-PVD chamber unit capable of depositing a series of thin layers. The platform can develop processes through to industrial scale-up and works with two major partners, STMicroelectronics on micro batteries measuring around a hundred microns thick, and Intelligent Energy on fuel-cell chargers for mobile electronic devices.

R&D AREAS

Micro batteries (from a few μ Wh to 100 mWh) and micro fuel cells (from 5 W to 100 W)

LOCATION

Leti and Liten (Grenoble)

NOTABLE EQUIPMENT

Around 30 pieces of equipment, including PVD-CVD

KEY FIGURES

- 1,000 sq. m of clean rooms
- €20 million in equipment
- 50 engineers and technicians
- 30 patents filed per year



RELATED PLATFORMS

OPTOELECTRONIC SYSTEMS INTEGRATION PLATFORM

Regional technology-transfer platform, Bordeaux (page 96)



ELECTRIC MOBILITY PLATFORM

ON THE ROAD TO SUSTAINABLE MOBILITY

Electric and hybrid-electric vehicles are about more than just batteries (or fuel cells). The battery or fuel cell must be integrated into the powertrain and tested in real-world conditions. The test results must then be analyzed so that further improvements can be made. The electric mobility platform does all of these things, developing solutions for automotive applications as well as for all other types of land, air, and sea vehicles and vessels.

The platform possesses a complete set of equipment that includes a motor bench, solar charging stations, and instrumentation capabilities.

The platform can perform one-off testing (up to 60,000 km for an electric vehicle) and continuous monitoring of fleets of up to 30 vehicles. For the platform's industrial partners, these testing capabilities provide valuable feedback so that they can improve product quality and reliability and even launch totally new products on a still-emerging market.

PARTNERS

Around ten industrial partners, including Renault (electric vehicles) and Zodiac Aerospace (fuel cells)

NOTABLE EQUIPMENT

300 kW electric motor bench, solar charging stations for electric vehicles, fast charging station for electric buses

R&D AREAS

Design, development, and integration of batteries and fuel cells into vehicles of all types; electric powertrain testing, modeling, simulation, and optimization; development of services for drivers and fleet managers

LOCATIONS

Liten (Grenoble and Chambéry)

KEY FIGURES

- 1,500 sq. m of facilities
- €4 million in equipment
- 20 engineers and technicians

FUEL CELL PLATFORM

FOR MOBILITY AND STATIONARY APPLICATIONS

With €6 million in equipment and a staff of 40 engineers and technicians, the fuel cell platform takes a truly unique approach to designing and improving fuel cells. It is the only center in the world to cover materials, membrane-electrode assemblies, stacks, testing, modelling, and characterization. Around ten manufacturers from around the world—including Symbio FCell and Areva Energy Storage—conduct R&D at the platform. The platform's missions are to speed the transfer of new fuel-cell technology to transportation and stationary applications and build a strong intellectual property portfolio, adding around 10–20 new patents per year.

The platform builds demonstrators for testing in real-world conditions. For example, the hydrogen-powered Zero CO₂ vessel has been sailing since 2010, and the EPICEA and PROSPAC generators are producing 5 kW of useable electricity. The platform also has specific equipment like a roll-to-roll electrode manufacturing machine for membrane-electrode assemblies and a stack-assembling machine.

The fuel cells produced by the platform are at the international state of the art in terms of performance, lifespan, and form factor, all benefits that should open the door to niche market applications in the near future.

R&D AREAS

A comprehensive approach from materials to systems integration

LOCATION

Liten (Grenoble)

NOTABLE EQUIPMENT

Around 20 test benches for fuel cells from 10 W to 50 kW; an electrode printing line, and a membrane-electrode assembly line

KEY FIGURES

- 500 sq. m of facilities
- €6 million in equipment
- 40 engineers and technicians
- 10 to 20 patents filed per year





HYDROGEN PRODUCTION AND STORAGE PLATFORM

GETTING THE MOST OUT OF A NEW SOURCE OF ENERGY

The mission of the hydrogen production and storage platform is to develop innovative hydrogen production, conversion, and storage processes so that hydrogen can be effectively used as a source of energy.

The platform develops and tests demonstrators of significant size in partnership with manufacturing companies. The platform's hydrogen-production research focuses on high-energy yield, high-temperature (700°C to 800°C) water-vapor electrolysis, and has resulted in the development of an operational hydrogen-production system

offering yields of 99%. The other applications for this technology include power-to-gas conversion via water-vapor/carbon-dioxide electrolysis. The electrolyzers can also operate in reversible solid oxide fuel cell (SOFC) mode powered by hydrogen or other gases (such as natural gas and biogas). Cogeneration is currently the priority application for SOFCs. The platform is also working on low-pressure solid-hydrogen storage processes for stationary and transportation applications.

NOTABLE EQUIPMENT

Electrolyzer lifespan and performance testing equipment, hydrogen tanks and production chains up to the tens of kW; representative-scale demonstrators

LOCATION

Liten (Grenoble)

KEY FIGURES

- 700 sq. m of facilities and a 120 sq. m outdoor testing area
- €6 million in equipment
- 40 research scientists and technicians
- 7 new patents filed per year, portfolio of 45 patents

PARTNERS

Around ten industrial partners, including Sylfen and McPhy Energy

HEAT NETWORKS AND THERMAL STORAGE PLATFORM

PRODUCING, STORING, AND USING THERMAL ENERGY

The heat networks and thermal storage platform is the largest R&D facility of its kind—both in size and in scope—in Europe. The platform develops innovative thermal energy management, recovery, and storage technologies for three purposes: storing thermal energy for later use, making efficient use of thermal energy in industrial applications; and distributing thermal energy via heat networks like heat pumps, boilers, and heat exchangers. Around 50 industrial partners—including major corporations like Alcen, Engie, Saint Gobain, and Total—work with the platform

on R&D projects that contribute to improving component and system energy efficiency through more optimal heat transfer, thermal storage, and conversion machines.

The platform is home to advanced simulation and modelling capabilities and a truly unique array of equipment for the testing of systems and components in real-world conditions and at scales representative of actual use. It is home to around ten instrumented test loops, storage demonstrators, and thermodynamic solar production units.

R&D AREAS

Thermodynamic CSP, thermal storage, thermal energy systems (desalination, fouling, compact exchanger, cooling, etc.)

LOCATIONS

Liten (Grenoble, Chambéry, and Cadarache)

NOTABLE EQUIPMENT

The Cadarache CSP plant (1,300 sq. m of mirrors) coupled with a steam turbine with three-stage thermal storage; 1.4 MW gas loop at 1,250°C; 120 bar steam loop at 500°C

KEY FIGURES

- 1,500 sq. m of facilities and a 5-hectare demonstrator park
- €15 million in equipment
- 75 engineers and technicians
- 15 new patents filed per year, portfolio of 60 patents



↓ RELATED PLATFORMS

SOLAR THERMAL ENERGY PLATFORM

Regional technology-transfer platform, Cadarache (page 132)



PHOTOVOLTAIC SOLAR PLATFORM

AN INDUSTRY RIPE FOR GROWTH

The photovoltaic solar platform's mission is to contribute to the development of a solar industry in France. And, with more than 200 employees and 100 industrial partners from SMBs to corporations, the platform is one of Europe's largest PV R&D facilities. The platform's silicon R&D focuses on materials and cells, with the particular goal of yield enhancement; it's solar module research aims to optimize performance. Later-stage R&D takes place at experimental PV facilities and at reduced-scale and life-sized solar power plants.

The platform also works on scaling up the technologies developed for industrial rollout. The platform runs its Heterojunction LabFab—a pilot production line capable of manufacturing heterojunction PV cells—under a European partnership with leading equipment manufacturer Meyer Burger. The platform also helps France-based solar-energy SMBs develop their export sales and build turnkey PV solar plants.

R&D AREAS

PV solar materials, equipment, and processes

LOCATION

Liten (Chambéry)

NOTABLE EQUIPMENT

Heterojunction LabFab, materials platform, RESTAURE cell platform, PV module platform, CPV platform, organic PV platform, and outdoor experimentation platform

KEY FIGURES

- 15,000 sq. m of facilities, including 2,000 sq. m of clean rooms
- 200 research scientists and technicians
- €100 million in equipment
- 30 new patents filed per year, portfolio of more than 100 patents

RELATED PLATFORMS

MEGASOL PLATFORM

Regional technology-transfer platform, Cadarache (page 126)

SMART GRID SYSTEMS PLATFORM

DIMENSIONING AND OPERATING NEW ENERGY SYSTEMS

The smart grid systems platform works with 50 industrial partners on energy system architecture, dimensioning, operation, and optimization for individual homes, buildings, neighborhoods, and entire communities.

These energy systems can be connected to a variety of energy sources, including renewables (PV, generator, micro hydro) and electricity storage systems—all of which must be managed optimally to ensure that electricity is available when needed. R&D work at the platform encompasses modelling,

virtual and physical component testing, software development, and equipment selection.

The platform leverages a real-time grid simulator, converters, rooftop PV panels, and various electricity-storage systems (batteries, flywheel, hydrogen). The simulator can be used to test different grid configurations, determine operation strategies, and optimize profits. The platform's industrial partners include energy-industry leaders like RTE, Alstom, Alcen, SRD, Sorea, and Urbasolar.

R&D AREAS

Energy-system dimensioning and management optimization encompassing production, storage, and use for both off-grid and grid-connected systems

LOCATION

Liten (Chambéry)

NOTABLE EQUIPMENT

Remotely-managed 85 kW/160 kWh Li-ion batteries, flywheel, 160 kW PV capacity, four instrumented homes for testing, 350kW hookup, digital model-based design platform, 45 kW power HIL

KEY FIGURES

- 300 sq. m of facilities, 4,000 sq. m outdoor testing area
- €2 million in equipment
- 100 engineers and technicians
- 7 new patents filed per year, portfolio of 30 patents



factory

of the future

THE FACTORY OF THE FUTURE

- 050 Non-destructive testing
- 052 Nuclear instrumentation for energy
- 054 Virtual reality
- 056 Collaborative robotics



NON-DESTRUCTIVE TESTING PLATFORM

PROCESSES AND METHODS FOR MANUFACTURED PARTS INSPECTION

The Gerim non-destructive testing platform in Gif-sur-Yvette (near the CEA Tech Paris-Saclay campus) boasts a staff of 80 people dedicated to developing new testing processes and methods, sensors, instrumentation, and processing algorithms to identify defects on various kinds of manufactured parts. Gerim offers some of the most cutting-edge equipment and software available in the field of NDT and draws on know-how in contactless inspection, adaptive ultrasonic imaging, and robotics to come up with advanced methods for inspecting areas of parts that would

be inaccessible using traditional methods. The platform is home to a robotized multiresolution X-ray tomography unit that can be used to inspect very large parts with complex geometries. The platform is used for PhD research and other R&D projects. Its industrial partners come from a diverse range of industries—nuclear, petrochemical, aeronautics, rail—and include Areva, Dassault, EADS, EDF, Extende, SNECMA, and Technip. The platform's CIVA NDT simulator, developed by CEA Tech institute List, is used by more than 250 companies in 41 countries.

RELATED PLATFORMS

ROBOTIZED X-RAY TOMOGRAPHY NDT PLATFORM

Regional technology-transfer platform, Nantes (page 116)

R&D AREAS

Processes, methods, sensors, instrumentation, and algorithms for NDT

NOTABLE EQUIPMENT

Robotized X-ray tomography unit, laser ultrasonic unit, EMAT and CMUT ultrasonic sensors, electromagnetic sensors, multielement ultrasonic instrumentation

KEY FIGURES

- 80 employees
- 500 sq. m of facilities
- €2 million in equipment
- Portfolio of 45 patents

PARTNERS

Around 10 industrial partners

LOCATION

List (Paris-Saclay)

NUCLEAR INSTRUMENTATION FOR ENERGY PLATFORM

SERVING NUCLEAR POWER PLANT OPERATORS AND EQUIPMENT MANUFACTURERS

The nuclear instrumentation for energy platform works with nuclear power plant and waste-treatment plant operators and equipment manufacturers to develop measurement systems for operations, monitoring, safety, and decommissioning for current and future generations of reactors.

R&D at the platform focuses on sensors, organic scintillators, and fiber-optic systems, as well as on the electronic architectures and embedded data processing algorithms that drive measurement systems. The systems developed measure ionizing radiation, temperature, and deformation. The platform works with around ten industrial partners,

including EDF, Areva, Saphymo, and Canberra, and runs around 60 R&D projects per year.

The platform is like no other facility in France, and delivers targeted know-how in areas like ultra-rapid nuclear measurement chains, distinguishing between different types of radiation in noisy environments, gamma-ray imaging, and radioactive waste package inspection. The platform is using regenerated fiber Bragg gratings to develop a measurement solution that is operable at the high temperatures (up to 1,000°C) in future generations of reactors.

R&D AREAS

Measurement systems for nuclear operations, safety, and decommissioning

NOTABLE EQUIPMENT

Linear electron accelerators, chemistry labs, laser beam for Bragg gratings

KEY FIGURES

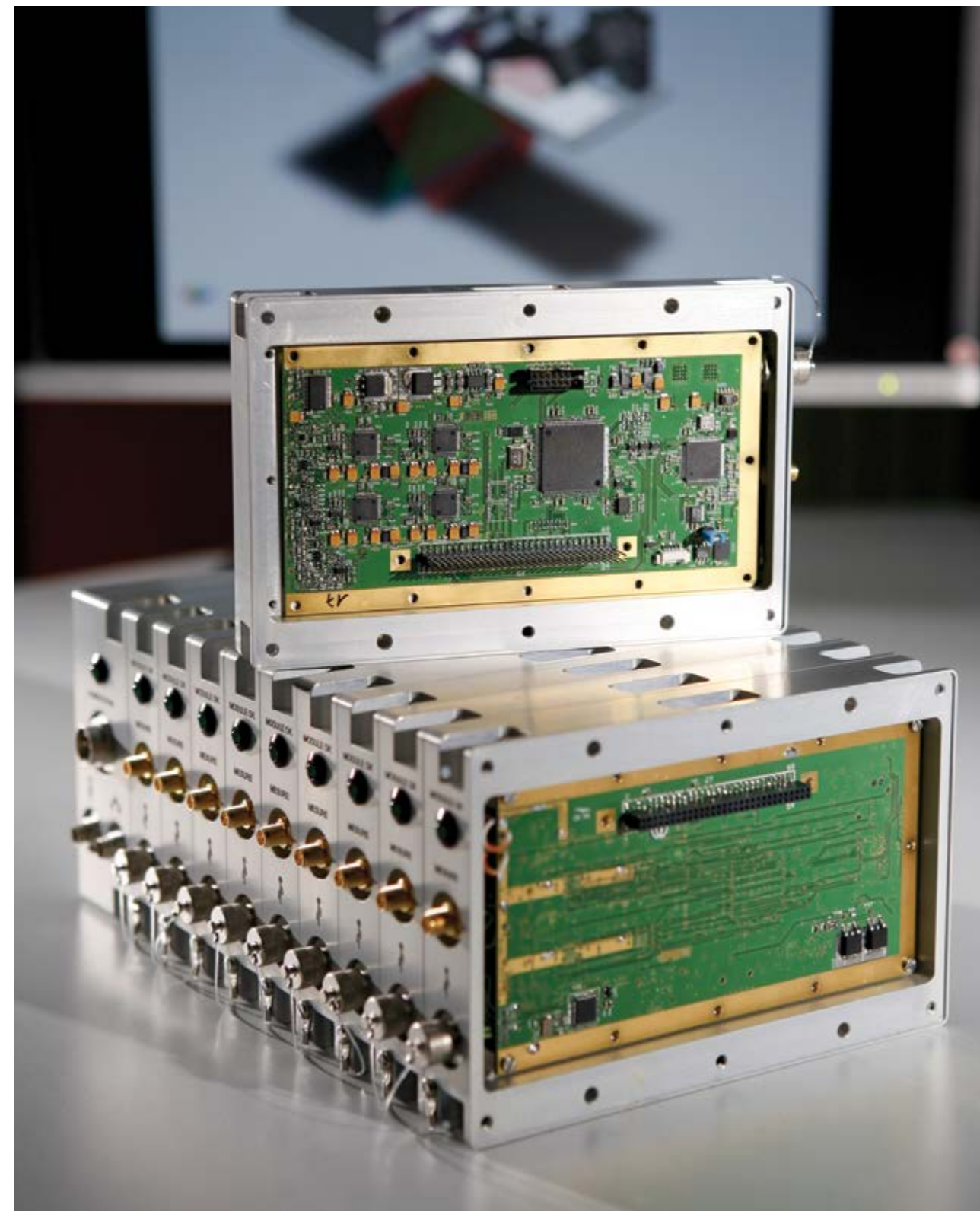
- 29 employees
- €5 million in equipment
- 60 R&D projects and 7 patents filed per year

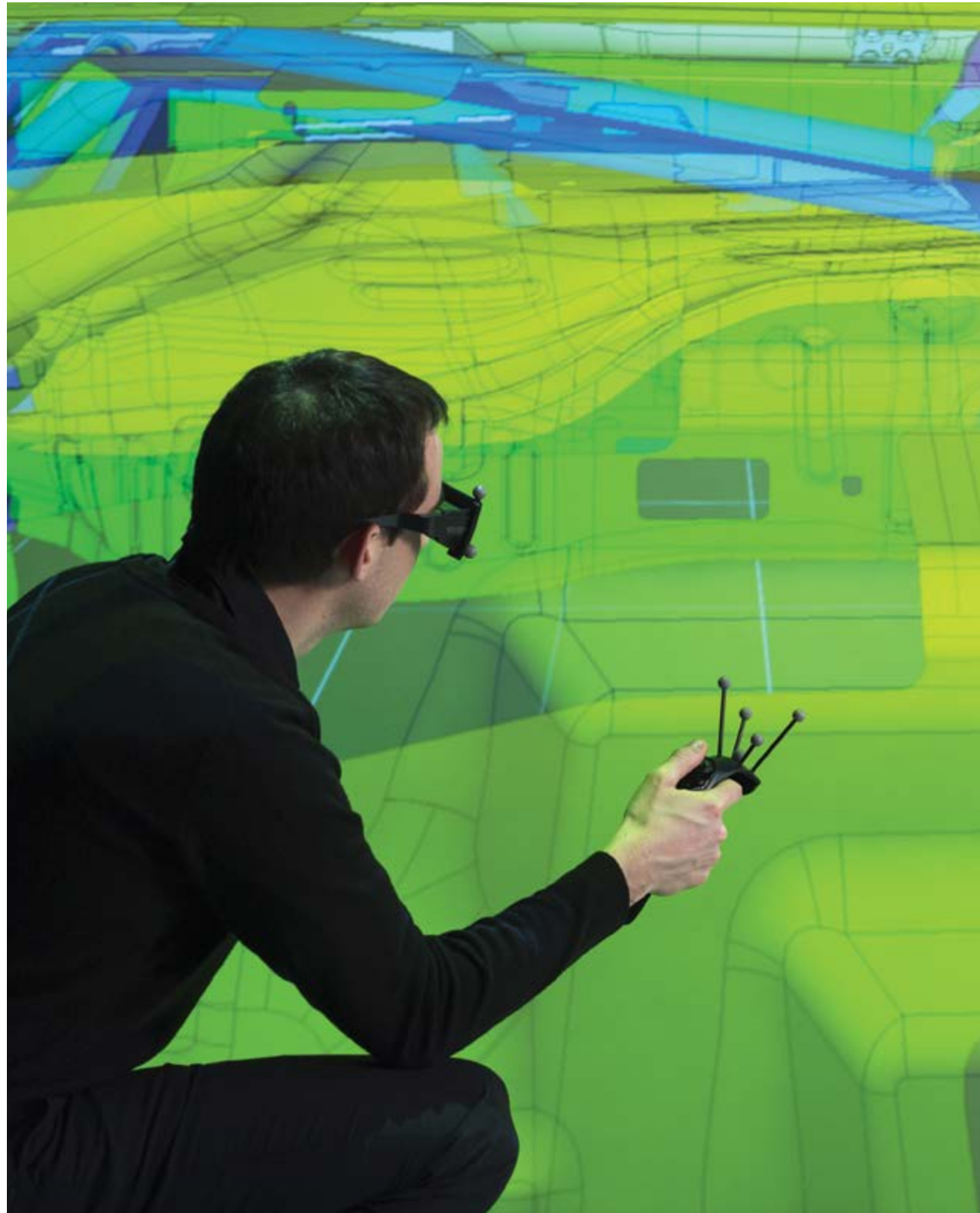
PARTNERS

Around 10 industrial partners

LOCATION

List (Paris-Saclay)





VIRTUAL REALITY PLATFORM

FOR ADVANCED MANUFACTURING AND THE FACTORY OF THE FUTURE

The virtual reality platform offers its industrial partners access to a battery of equipment that is unique in France to overcome their technology challenges and create or validate new concepts. The platform uses both virtual reality and blended simulation techniques.

The R&D conducted at the platform covers production lines, workstation ergonomics, collaborative robotics for operator assistance, training, and collaborative work technologies for advanced manufacturing and the factory of the future.

The platform's industrial partners include integrators (HRV, Oreka Solutions, Haption) and end users

in the automotive, aeronautics, petrochemical, pharmaceutical, and other industries.

An 18 cu. m immersive environment—the platform's flagship resource—offers high-resolution displays, laser projectors, eight motion capture cameras, and two haptic interfaces. It is used for interactive multi-physics simulations for R&D projects, demonstrations, or case studies.

The platform also has a two-sided immersive system, mobile equipment like virtual reality headsets and mobile tracking devices, and computing resources for real-time numerical simulation.

R&D AREAS

Virtual reality and blended simulation for industrial R&D

NOTABLE EQUIPMENT

Five-sided immersive environment, laser projectors, IR motion capture cameras, 1:1 haptic arm, computing clusters

KEY FIGURES

- 20 employees
- 350 sq. m of facilities
- €2 million in equipment
- 20 R&D projects per year
- 20 industrial and academic license agreements for the XDE simulation engine

PARTNERS

Around 10 industrial partners

LOCATION

List (Paris-Saclay)

COLLABORATIVE ROBOTICS PLATFORM

NEW FORMS OF COLLABORATION BETWEEN HUMAN OPERATORS AND ROBOTS

The collaborative robotics platform is home to joint research and development between the CEA and its industrial partners on systems like cobots and exoskeletons that aim to make manual tasks easier, improve operator precision, and increase productivity. The systems developed are either stationary, mobile, or remotely-operated for use in hostile environments.

The platform evaluates potential applications for these breakthrough technologies and explores emerging uses that could potentially respond to the needs of the large manufacturing corporations that use the platform. The platform's other research—conducted in partnership with

equipment manufacturers—drives innovations in human-robot interaction.

The platform's know-how in force-controlled robots—and, in particular, very-low-friction actuators offering excellent rigidity, light weight, and low inertia—has earned it a leading position in the European R&D landscape. These technologies enable extremely precise force control and, as a result, enhanced safety for operators working nearby.

The platform's industrial partners include Areva, PSA Peugeot Citroën, Technip, RB3D, Haption, and Sarrazin Technologies.

R&D AREAS

Cobots and exoskeletons for specific uses

NOTABLE EQUIPMENT

Collaborative robots for industrial processes and inspection, exoskeletons, AGVs (automatic guided vehicles), remote operation systems

KEY FIGURES

- 50 employees
- 1,500 sq. m of facilities
- €2 million in equipment
- 12 patents filed per year

PARTNERS

Around 20 industrial partners

LOCATION

List (Paris-Saclay)



RELATED PLATFORMS

ROBOT-ASSISTED MOVEMENT PLATFORM

Regional technology-transfer platform, Nantes (page 114)

OPTOELECTRONIC SYSTEMS INTEGRATION PLATFORM

Regional technology-transfer platform, Bordeaux (page 96)

TELEROBOTICS FOR INDUSTRIAL PROCESSES AND NDT PLATFORM

Regional technology-transfer platform, Bordeaux (page 98)

FACTORY OF THE FUTURE PLATFORM

Regional technology-transfer platform, Metz (page 88)

the healthcare core

**HEALTHCARE,
& THE SILVER
ECONOMY**

silver econ

- 060 Clinatec
- 062 DOSEO radiotherapy and medical imaging
- 064 Nano-biotechnology



CLINATEC PLATFORM

TECHNOLOGICAL INNOVATION FOR BETTER PATIENT OUTCOMES

The Clinatec biomedical research center is like no other facility in the world. R&D is conducted by the CEA and the Grenoble University Medical Center oversees clinical trials. Clinatec develops new treatments, diagnostics, and research methods for applications in oncology, neurodegenerative disease, and spinal-cord injury. A multidisciplinary team made up of clinical practitioners, biologists, mathematicians, and engineers in micro and nanotechnology and signal processing has been set up at the platform to drive innovation in micro and nanosystems for healthcare. The platform's unique approach—bringing together a broad range of know-how at a single location—fosters the emergence of novel solutions and speeds up proof-of-concept testing and the transfer of

new technologies to manufacturers. The ultimate goal is to get new solutions to as many patients as possible. Clinatec possesses a broad range of equipment and leverages the know-how and advances of the MINATEC campus.

An open project center provides access to Clinatec's resources. Partners can assign their staff to or house their projects at Clinatec for predetermined periods of time. This open-access policy helps attract young, talented professionals and drives the diversification of research topics addressed at Clinatec. Clinatec's current research includes near-infrared neurostimulation to stop degeneration, an exoskeleton and brain-computer interface to help tetraplegics walk again, and biomarkers for brain tumors.

KEY FIGURES

- 6,000 sq. m of facilities
- 100 employees
- €27 million in equipment

PARTNERS

Grenoble University Medical Center, INSERM, Grenoble-Alpes University

NOTABLE EQUIPMENT

Systems design and integration labs, a preclinical testing center, an operating room with intraoperative MRI, and various medical imaging resources (SPECT-CT, MEG)

SPONSOR

The Edmond J. Safra Foundation

LOCATION

Leti (Grenoble)

DOSEO RADIO THERAPY AND IMAGING PLATFORM

FOR SAFER RADIO THERAPY TREATMENTS

The DOSEO platform was created to enhance radiotherapy equipment and train radiotherapy professionals with the ultimate goal of making radiotherapy treatments safer. The platform was founded in cooperation with France's national testing and metrology lab (LNE) and the French National Cancer Center (INCA) with funding from the French government, the European Union, and local governments. The 2,400 sq. m facility is home to a comprehensive range of equipment and employs 35 radiation-dose metrology, simulation, calculation, and optimization specialists. The platform is entirely dedicated to training and research, giving clinical practitioners and manufacturers an alternative to conducting their research at a clinical center; the platform also rounds out the facilities available

at traditional clinical centers. DOSEO's training programs, provided in conjunction with France's nuclear science and technology center (INSTN), target medical physicists, radiology technicians, engineers, radiotherapists, general practitioners, and any other professional that prescribes or works with radiotherapy techniques. The hands-on research at the platform is conducted on commercially-available equipment; earlier stage research leverages the platform's lab facilities. Some of the topics addressed are dose simulation coupled with virtual reality, real-time in vivo dose control, and dose optimization. Partners can also work with the platform to test equipment, improve upon protocols before they are commercialized, and perform remote calculations.

R&D AREAS

Training and research in radiotherapy using dedicated equipment

PARTNERS

Partnerships with manufacturers (Elekta, esprime) and around ten clinical centers

KEY FIGURES

- 35 employees
- 2,400 sq. m of facilities
- €18 million in equipment

LOCATION

List (Paris-Saclay)

NOTABLE EQUIPMENT

A comprehensive range of equipment, including radiotherapy accelerators, medical imaging equipment, tomography equipment, brachytherapy sources, and a cobalt-60 irradiator





NANO-BIOTECHNOLOGY PLATFORM

R&D FOR ALL BIOTECHNOLOGY APPLICATIONS

The 5,500 sq. m nano-biotechnology platform is home to a complete range of medical-systems development know-how, from sample surface preparation, biological analysis, and substrate functionalization through to packaging, microfluidics, microsystems, biological detection systems, and component readers. The platform's R&D benefits scientific researchers, hospitals, and biomedical companies. With X-ray, gamma-ray, fluorescence, visible, and lensless imaging solutions, the platform can be used to study living organisms, tissues, cells, and bacteria.

The platform's microsystems meet the new needs of personalized medicine, nanomedicine, and remote diagnostics and can be implemented in vivo, embedded, and implanted into medical devices. The platform is located next to Clinatec and the Bioscience and Biotechnology Institute of Grenoble (BIG) and leverages BIG's basic research. The platform files around 35 patents per year, including for solutions developed under R&D contracts with some 30 industrial partners.

NOTABLE EQUIPMENT

25 pieces of heavy equipment: X-ray measurement chambers, screen-printing machines, stamping and machining equipment, etc.

LOCATION

Leti (Grenoble)

PARTNERS

Around 30 industrial partners, including Fluoptics, Trixell, and Horiba

KEY FIGURES

- 5,500 sq. m of facilities, including 2,500 sq. m of labs and clean rooms
- €6 million in equipment
- 200 employees
- 35 patents filed per year

materials & characterization

MATERIALS & CHARACTERIZA- TION

068 Nanocharacterization

070 Nanosafety

072 Poudr'Innov 2.0

NANOCHARACTERIZATION PLATFORM

WORLD-LEADING MICROSCOPY CAPABILITIES

The nanocharacterization platform houses around 40 pieces of heavy research equipment operated by a staff of experienced researchers and technicians. The platform studies samples for CEA research programs and conducts research on characterization techniques and protocols to prepare appropriate responses to tomorrow's characterization needs. The platform possesses certain equipment that exists at just a handful of other locations worldwide—this is the case for the platform's Titan Ultimate transmission electron microscope, which offers resolutions of 50 picometers.

Researchers at the platform can characterize a material's morphological, physico-chemical, and electrical properties, depending on partners' needs, providing 2D and, increasingly, 3D images of the materials studied. These tests provide valuable insight into nanomaterials and nanocomponents. The platform also works with large research instruments ESRF and ILL, leveraging their synchrotron and neutron capabilities. The platform is used by scientific equipment manufacturers that wish to improve their products, as well as by other manufacturers from startups to corporations like IBM and STMicroelectronics.

R&D AREAS

Nanocharacterization for micro- and nanotechnology, nanomaterials, materials for energy applications, and more

LOCATION

Leti, Liten, and Inac (Grenoble)
Collaboration with the large European instruments ESRF and ILL

NOTABLE EQUIPMENT

40 pieces of heavy equipment: ion-beam and X-ray beam, surface analysis, near-field electron microscopy, optical characterization, magnetic resonance, and sample preparation

KEY FIGURES

- 3,000 sq. m of facilities
- 80 research scientists and technicians
- €30 million in equipment





NANOSAFETY PLATFORM

HANDLING AND USING NANOMATERIALS SAFELY

The nanosafety platform focuses on protection, health, and safety issues related to the handling and use of nanomaterials. Housed in a brand-new, 5,000 sq. m building and staffed by a team of 150, the platform has two main activities: R&D, with five major focus areas: toxicology, ecotoxicology, the integration of nanomaterials into industrial processes and nanomaterials lifecycle analysis; industrial health and safety, and characterization and methods. BtoB services: training of prevention and emergency response personnel, consulting, workstation auditing and design, occupational

health consulting, and 24-7 incident-response services. The platform's partners come from all industries (inks, paints, cosmetics, food), and also include prevention and testing organizations like INERIS, INRS, Institut Pasteur de Lille, and the French National Testing Laboratory.

EQUIPMENT

FFF-ICP-MS (for nanoparticle analysis in complex matrices), cryogenic transmission electron microscope, and a full range of equipment for the measurement of nanoparticles in aerosols and colloids

KEY FIGURES

- 5,000 sq. m of facilities, including 2,000 sq. m of labs
- €17 million in equipment
- 150 employees: research scientists, engineers, technicians, doctors, biologists
- Portfolio of 4 patents

LOCATION

Grenoble

POUDR'INNOV 2.0 PLATFORM

HIGH-ADDED-VALUE COMPONENTS

The Poudr'Innov 2.0 platform develops high-added-value components from metal, ceramic, semiconductor, and magnetic powders with applications on the energy, connector, lighting, electronics, mechanical parts, healthcare, fine chemicals, and other markets. R&D at the platform focuses on powder preparation processes designed to optimize the end components' properties—and create new properties that would be impossible if the materials were used in solid form. These include tiny components with complex shapes, lightweight hollow structures, dielectric components with high thermal conductivity, high-performance magnets, multi-material assemblies, and energy-harvesting systems. The platform mainly uses additive processes, including 3D printing, for

parts that are virtually identical to specifications, eliminating the need for machining.

The platform is the only R&D center in Europe to possess a complete range of semi-industrial and industrial equipment and is capable of completing the entire component production process under one roof, from formulating and blending powders to injection molding, compression, and printing; debinding and sintering; and characterization. The platform leverages several decades of powder metallurgy research conducted by the CEA and files around 20 patent applications per year. R&D at the platform is currently at the international state of the art.

R&D AREAS

Powder preparation; injection and printing of polymers and polymers charged with metals and magnetic materials; hot isostatic metal pressing; sintering; characterization

PARTNERS

Several dozen industrial partners of all sizes from around the globe

LOCATION

Liten (Grenoble)

KEY FIGURES

- 1,400 sq. m of facilities, including a 220 sq. m ISO7 clean room
- €12 million in equipment
- 50 research scientists and technicians



RELATED PLATFORMS

MECHATRONICS FOR IMPROVED PRODUCTS AND PROCESSES PLATFORM

Regional technology-transfer platform, Metz (page 86)

MATERIALS IMPLEMENTATION PLATFORM

Regional technology-transfer platform, Toulouse (page 106)

Open & Collaborative Innovation

OPEN & COLLABORATIVE INNOVATION

- 076 User-centered open innovation
- 078 Technological innovation showroom



USER-CENTERED OPEN INNOVATION PLATFORM

GIVING USERS A SAY

The user-centered open innovation platform brings a variety of cultures together to innovate and create new solutions, using proven methods to keep the focus on the end user. The platform's approach is centered on people, with contributions from researchers from fields like history, ergonomics, and the cognitive sciences; visual artists, designers, and musicians also provide unique insights. The platform aims to develop innovations with the capacity to transform a given type of product or service—or an entire market. One major focus is the motion capture technology currently used in smartphones, medical devices, and video games. A team trained in using creativity techniques to

explore new ideas and the use of open labs offering a range of approaches—IDEAs Laboratory® where groups of people come together to dream up tomorrow's products and services; Atelier Arts-Sciences, which gives artists complete freedom to use technology to create new works; and Alps Design Lab, a residency program bringing together design students and professionals—round out the platform's resources. Organizations like Engie, Bouygues, Leroy Merlin, Air Liquide, the CEA, the Isère General Council, and the Hexagone national theater work with the platform.

MAJOR DEVELOPMENTS

Motion capture for communicating objects; augmented reality for smartphones; handwritten note-taking on a tablet; the Experimenta arts and sciences expo

KEY FIGURES

- 15 CEA employees
- 1,200 sq. m of facilities
- 50 projects per year
- More than 200 participants (students, employees, future users) contribute to the platform's projects each year

PARTNERS

More than 10 partners

LOCATION

Grenoble

THE TECHNOLOGICAL INNOVATION SHOWROOM

60 INTERACTIVE EDUCATIONAL DEMONSTRATORS

The technological innovation showroom highlights the latest technologies developed by the four CEA Tech institutes: Leti, Liten, List, and the CEA Tech regional tech-transfer platforms. The Grenoble showroom, for example, boasts 60 demonstrators in an interactive, educational exhibit that is updated regularly. This 400 sq. m showroom welcomes 4,000 visitors per year, from industrial and institutional decision-makers to the general public. The demonstrators show how the latest innovations could be integrated into products in industries as diverse as healthcare, in-home technologies, mobility, and energy. Tours vary in length and technical difficulty depending on the group of visitors. Professionals from industry can

end their tour with a creativity session facilitated by innovation experts. A multidisciplinary team builds the demonstrators and designs the exhibits, leveraging know-how in mechanical engineering, electronics, 3D prototyping, design, and user-centered innovation to make the technologies accessible to a broad audience. The showroom also showcases startups created by CEA Tech researchers and the results of successful joint R&D projects with industrial partners. Since 2014 the Grenoble showroom has run off-site exhibits across France and internationally to provide an even broader audience of businesses with access. A travelling showroom has also been created for trade shows.

EQUIPMENT

60 demonstrators illustrating the technologies developed by CEA Tech; 20% new demonstrators per year

KEY FIGURES

(Grenoble showroom)

- 400 sq. m of exhibit space
- €2 million invested
- Nearly 4,000 visitors per year from around the globe; 40% of visitors are potential industrial partners

LOCATIONS

Grenoble (2005); travelling showroom, Paris-Saclay (2014) ; Metz, Toulouse, Tokyo (2015) ; Bordeaux, Nantes, and Lille (2016)



METZ: ALSACE CHAMPAGNE-ARDENNE LORRAINE

- 084 Regional technology-transfer platform, Metz
- 086 Mechatronics for improved products and processes
- 088 Factory of the future

BORDEAUX: AQUITAINE LIMOUSIN POITOU-CHARENTES

- 092 Regional technology-transfer platform, Bordeaux
- 094 Energy systems reliability
- 096 Optoelectronic systems integration
- 098 Telerobotics for industrial processes and NDT

TOULOUSE: LANGUEDOC-ROUSSILLON MIDI-PYRÉNÉES

- 102 Regional technology-transfer platform, Toulouse
- 104 Information systems monitoring and supervision
- 106 Materials implementation
- 108 Power component testing

NANTES: PAYS DE LA LOIRE

- 112 Regional technology-transfer platform, Nantes
- 114 Robot-assisted movement
- 116 Robotized X-ray tomography NDT
- 118 Marine energy systems

CADARACHE: PROVENCE ALPES CÔTE D'AZUR

- 122 Regional technology-transfer platform, Cadarache
- 124 Mediterranean building
- 126 Mégasol
- 128 Micro-algae
- 130 Physical security of electronic systems
- 132 Solar thermal

Alsace

Champagne

**METZ: ALSACE
CHAMPAGNE-
ARDENNE
LORRAINE**

- 084 Regional technology-transfer platform, Metz
- 086 Mechatronics for improved products and processes
- 088 Factory of the future



CEA TECH REGIONAL TECHNOLOGY-TRANSFER PLATFORM, METZ

KEY FIGURES

- Date opened: Spring 2014
- 8 employees, including 2 business developers, 5 engineers, and an administrative manager (2015)
- 10 industrial R&D contracts signed
- 12 technology-oriented PhD and post-doc research projects in progress

LOCATION

Metz Technology Park

FINANCING

Lorraine Regional Council, the French government, industrial R&D contracts

The CEA Tech regional technology-transfer platform in Metz serves the Alsace-Champagne-Ardenne-Lorraine region. The platform was set up as part of a contract between the French government and the Lorraine regional government. Located at the Metz Technology Park, the platform offers 2,500 sq. m of facilities. During the platform's first year in operation, meetings were held with more than 150 companies and around a dozen R&D contracts were signed. The platform also hosts around a dozen PhD and post-doc projects in conjunction with academic institutions (the Jean-Lamour Institute of the University of Lorraine, ENIM, ENSAM, Georgia Tech, and Centrale-Supélec).

The platform's first industrial R&D partnerships cover a broad range of topics: quality control with Arcelor Mittal, solar thermal energy with Viessmann, medical imaging with Cibio, and thermomechanical modelling with Solsi. The first year also provided the platform with an opportunity to lay the foundations for two application-oriented units, the first, for use by manufacturing companies, focuses on collaborative robotics for the factory of the future; the second, still under development, will focus on mechatronics. The platform has a 250 sq. m showroom with 30 technology demonstrators.

MECHATRONICS FOR IMPROVED PRODUCTS AND PROCESSES PLATFORM

ADDING SMART CAPABILITIES TO TOOLS, MACHINES, AND PRODUCTS

The mechatronics for improved products and processes platform helps its partners integrate communicating sensors into tools, machines, and parts to give smart capabilities to their end products. The technologies developed include feedback loops for tools, process monitoring and maintenance for machines, and value-added innovation for end products.

The platform can help integrate all kinds of sensors, including pressure, vibration, voltage, acceleration, optical, and RFID. R&D projects typically last for six months to one year, and can cover all stages of the development process from selecting a commercially-available sensor or developing custom sensors, joint

mechatronic design, topological enhancements (particularly for parts manufactured using additive methods), prototyping and tests in actual use environments, signal processing, and data analysis.

The platform leverages the know-how of the three CEA Tech institutes and of local organizations like Solsi (specializing in thermomechanical simulation), CIRTES (which developed the Stratoconception® additive manufacturing process), and other partners across the region. At end-2015, the platform had signed R&D contracts with five industrial partners and was in talks with some ten additional potential partners.

RELATED PLATFORMS

AMBIENT INTELLIGENCE PLATFORM

Paris-Saclay
(page 16)

POUDR'INNOV 2.0 PLATFORM

Grenoble
(page 72)

200 mm AND 300 mm MICROSYSTEMS PLATFORM

Grenoble
(page 18)

KEY FIGURES

- Date opened: under development
- 300 sq. m of facilities, 3 employees
- €2 million invested (50% from the Lorraine Regional Council, 50% from the French government)

NOTABLE EQUIPMENT

Thermomechanical test benches replicating severe environments, optical and electron microscopes, traction-testing micromachines

LOCATION

Metz Technology Park, CEA Tech regional technology-transfer platform, Metz

FACTORY OF THE FUTURE PLATFORM

FOR MORE FLEXIBLE, PRODUCTIVE, AND SAFER FACTORIES

The factory of the future platform develops and tests in actual operating conditions digital technologies for the factory of the future. The platform is organized around four R&D units addressing virtual reality, load-handling robots, human-robot cooperation, and smart logistics and assemblies. The solutions developed aim to help bring manufacturing plants greater flexibility, productivity, and safety while facilitating connectivity and interoperability between production and information systems. The platform is located at a PSA Peugeot Citroën plant with 3,400 employees—a unique setup for this type of application-specific R&D center. Around ten industrial

companies from across the Lorraine region have been identified as potential R&D project partners. R&D projects typically last between six months and one year. The platform leverages commercially-available technologies or technologies developed by CEA Tech institute List in its solutions. All technologies are tested with manufacturing operators, improved, and integrated into systems with the goal of fast transfer to industry. And, to ensure that the solutions developed are quickly adopted by plant workers, safety and ergonomics play an important role in the R&D conducted at the platform.

KEY FIGURES

- Date opened: Q1 2016
- 1,000 sq. m of facilities, 3 employees at start-up
- €4 million invested (50% from the Lorraine Regional Council, 50% from the French government)

NOTABLE EQUIPMENT

Movement capture system on site, haptic interface, and Sybot, Kuka, and UR robotic arms

LOCATION

PSA Peugeot Citroën plant, Trémery



RELATED PLATFORMS

COLLABORATIVE ROBOTICS PLATFORM

Paris-Saclay
(page 56)

Aquitaine

Limousin

**BORDEAUX:
AQUITAINE
LIMOUSIN
POITOU-
CHARENTES**

- 092 Regional technology-transfer platform, Bordeaux
- 094 Energy systems reliability
- 096 Optoelectronic systems integration
- 098 Telerobotics for industrial processes and NDT



CEA TECH REGIONAL TECHNOLOGY-TRANSFER PLATFORM, BORDEAUX

KEY FIGURES

- Date opened: February 2013
- 17 employees, including 5 business developers and 12 engineers and technicians (2015)
- 40 industrial R&D contracts signed
- 5 technology-oriented PhD and post-doc research projects in progress

LOCATION

Pessac Photonics Park

FINANCING

Aquitaine regional government, industrial R&D contracts

The CEA Tech regional technology-transfer platform, Bordeaux occupies 600 sq. m at the Pessac Photonics Park and serves the Aquitaine-Limousin-Poitou-Charentes region. The platform is currently in talks with more than 250 companies from the region and has already signed some 40 R&D contracts with companies in the energy, electronics, and healthcare industries. Some of the platform's industrial partners include Dassault Aviation, EVTronic, Greenfield, and Babcock Wanson; the platform also works with startups like Symbiose. One of the more innovative projects underway is taking place in conjunction with industrial EVTronic and aims to develop a stationary electricity storage concept that would enable the individual operation of each cell in a battery pack. The

platform also conducts research with academic labs (IMS, ICMCB, Bordeaux University Medical Center); PhDs and post-doc students are involved in these projects. A showroom has been created to showcase the platform's technology demonstrators, and is a key resource in the platform's relationships with businesses. The platform's optoelectronic systems integration unit works on integrating innovative components developed by the CEA into industrial partners' products for prototyping, testing, and validation. The platform also has two application-specific R&D units, one for telerobotics for industrial processes and NDT, the other for energy systems reliability.



ENERGY SYSTEMS RELIABILITY PLATFORM

FOR MORE EFFICIENT ENERGY PRODUCTION AND STORAGE

The energy systems reliability platform specializes in energy systems maintenance and reliability, with a particular focus on self-consumption and the storage of renewables like PV, marine-current, and biomass energy. The capacities studied range from a few kilowatts to the tens of kilowatts. The platform's programs are aligned with the self-consumption strategy launched by the Aquitaine regional government in 2013 and the associated energy-plus community initiatives across the region. The platform gathers and analyzes system performance data in actual operating conditions

with the goal of identifying areas for improvement, using advanced management algorithms and traditional and switched-cell storage architectures. The platform also develops agile operating and predictive maintenance rules. CEA Tech institutes Lefi and Lifen, located in Grenoble and Chambéry, contribute know-how and technology to projects run at the platform. The platform's main industrial partners are EVTronic, IGC, and CNIM. The platform is engaged in the EMR STOCK thermal-energy storage project with Babcock Wanson and works with R&D organizations like CATIE (on Big Data) in the Aquitaine region.

KEY FIGURES

- Date opened: implementation in progress
- 200 sq. m of facilities
- 5 employees planned
- €2.1 million invested (Aquitaine regional government, ERDF)

NOTABLE EQUIPMENT

Smart switched-cell battery demonstrator, mobile instrumentation kit, electrical and physical measurement instruments, supervision system

LOCATION

Pessac Photonics Park

RELATED PLATFORMS

BATTERY PLATFORM

Grenoble and Chambéry
(page 28)

OPTOELECTRONIC SYSTEMS INTEGRATION PLATFORM

OPTICAL COMPONENTS FOR VALUE-ADDED PRODUCTS

The optoelectronic systems integration platform provides its industrial partners with opportunities to bring their products innovative optical components developed by CEA Tech institute Leti (in Grenoble). The platform is divided into three R&D units offering short-loop prototyping, demonstrators, testing in operating environments, and industrial scale-up strategies for CEA Tech solutions. The platform's R&D targets applications like IR and terahertz imaging, visible and IR sensors, lighting systems, and new optical and photonic systems for healthcare, with the goal of helping manufacturers add value to their

products and penetrate new markets. The platform recently worked on a terahertz camera integrating an innovative component. The camera can be used in the security (detection), healthcare (melanoma diagnosis), materials (quality control), and food (moisture measurements) industries.

KEY FIGURES

- Date opened: December 2015
- 120 sq. m of facilities
- €1.3 million invested (financed by the regional government)

NOTABLE EQUIPMENT

IR and terahertz optical testing, optical systems software, immersion workshop, 3D printing

LOCATION

Pessac Photonics Park



RELATED PLATFORMS

MICRO ENERGY SOURCES PLATFORM

Grenoble
(page 34)

PHOTONICS PLATFORM

Grenoble
(page 22)

COLLABORATIVE ROBOTICS PLATFORM

Paris-Saclay
(page 56)



TELEROBOTICS FOR INDUSTRIAL PROCESSES AND NON-DESTRUCTIVE TESTING PLATFORM

MAKING OPERATORS' WORK EASIER AND SAFER

The telerobotics for industrial processes and non-destructive testing platform dimensions and manages remotely-operated robotic systems for industrial processes, testing, and inspection; the solutions developed are tested in real-world conditions. Telerobotic systems free up workers to focus on their unique skills while letting the robot manage environmental constraints and access issues. The platform's activities meet the needs of industrial companies surveyed during the regional government's Factory of the Future project. The platform also develops non-destructive testing techniques to verify

the work completed. The platform's three R&D units cover virtual reality scenarios, robotics demonstrators, and non-destructive testing. The solutions developed leverage key technologies from CEA Tech institute List and can assist operators with tasks like sanding, coating, welding, drilling, and riveting. The R&D services available can benefit any industrial company seeking new sources of added value and increased operator safety. The platform has attracted R&D partnerships with companies in the aeronautics and nuclear industries.

KEY FIGURES

- Date opened: implementation in progress
- 200 sq. m of facilities
- 5 employees planned
- €1.8 million invested (Aquitaine regional government, ERDF)

NOTABLE EQUIPMENT

Industrial robotic arms, a force-controlled Sybot cobot, haptic-feedback grip system, testing equipment

LOCATION

Pessac Photonics Park

RELATED PLATFORMS

COLLABORATIVE ROBOTICS PLATFORM

Paris-Saclay
(page 56)

Languedoc
Midi-Pyrénées

**TOULOUSE:
LANGUEDOC-
ROUSSILLON
MIDI-PYRÉNÉES**

- 102 Regional technology-transfer platform, Toulouse
- 104 Information systems monitoring and supervision
- 106 Materials implementation
- 108 Power component testing



CEA TECH REGIONAL TECHNOLOGY-TRANSFER PLATFORM, TOULOUSE

KEY FIGURES

- Date opened: March 2013
- 20 employees (2015)
- 35 industrial partners
- 8 technology-oriented PhD and post-doc projects completed or in progress

LOCATION

INSA, Toulouse

FINANCING

Regional Council, Regional Prefecture, ERDF, industrial R&D contracts

The CEA Tech regional technology-transfer platform, Toulouse serves the Languedoc-Roussillon-Midi-Pyrénées region. The 1,000 sq. m facility is located at INSA's Toulouse campus. In the two years since it opened, the platform has held meetings with 250 companies and signed R&D contracts with 35 companies of all sizes from industries like aeronautics, IT, electronics, healthcare, and energy. Its industrial partners include MHComm, SNAM, Nanolike, and Sopra-Steria. The platform has also co-supervised three PhD dissertations and five post-doc research projects with local labs (including CNRS lab LAAS)

under technology-oriented joint research projects. The platform offers its industrial partners support for their innovation strategies through three R&D units: power-component testing, information systems testing and monitoring, and materials implementation. The platform also has an 80 sq. m showroom with 40 technology demonstrators to aid in the development of new concepts and an integration lab where industrial partners in the electronics and software industries can have demonstrators or prototypes made to validate a new technology.

INFORMATION SYSTEMS MONITORING AND SUPERVISION PLATFORM

EXTRACTING RELEVANT INFORMATION AND FACILITATING DECISION-MAKING

The proliferation of data has raised significant challenges in areas like cybersecurity, industrial supervision, urban surveillance, and e-healthcare. The information systems monitoring and supervision platform conducts R&D on the software and hardware aspects of managing huge amounts of data.

The platform is located on the INSA campus in Toulouse, and works with companies from across the region. The R&D conducted at the platform leverages technologies from List, a CEA Tech institute, to extract relevant information, facilitate decision-making, and support collaborative work

with large volumes of heterogeneous, shared data. The platform's software R&D focuses on methods for displaying huge volumes of data in a way that is usable; managing multimedia content including text, images, and video; and detecting abnormal events and weak signals. Hardware R&D includes novel human-machine interfaces—touch-enabled tables, display walls, multi-location projection systems, and augmented reality—to facilitate collaborative work; an experimental control room is also available at the platform to test the solutions developed.

KEY FIGURES

- Date opened: May 2015
- 100 sq. m of facilities
- €400K invested (Midi-Pyrénées Regional Council through ERDF instruments)

NOTABLE EQUIPMENT

Experimental war room for collaborative responses to cyberattacks based on simulated scenarios

LOCATION

Toulouse



RELATED PLATFORMS

CYBERSECURITY PLATFORM

Grenoble and Paris-Saclay
(page 10)



MATERIALS IMPLEMENTATION PLATFORM

CREATING NEW PARTS FROM CERAMIC AND METAL POWDERS

Companies operating in industries as diverse as air and land transportation, energy, and healthcare all share the same goal: to make lighter-weight, better-performing, and more cost-effective products. The materials implementation platform gives component manufacturers access to a new technology—3D-printed or compression-molded ceramic and/or metal powders. Some of the powders used are developed by CEA Tech institute Liten.

The platform is home to a wide range of R&D equipment: debinding and sintering furnaces for parts manufacturing; an ultrasonic NDT lab to detect faults

on parts with complex compositions and geometries; and controlled temperature and hygrometry testing chambers for accelerated aging tests.

Companies from the region that decide to partner with the platform can validate the entire parts manufacturing process on small production runs, ensuring that the parts offer the robustness and reliability required by today's market applications.

KEY FIGURES

- Date opened: May 2015
- 100 sq. m of facilities
- €1.2 million invested (Midi-Pyrénées Regional Council, Regional Prefecture)

NOTABLE EQUIPMENT

Debinding and sintering furnaces, ultrasonic NDT, accelerated aging chambers

LOCATION

Toulouse

RELATED PLATFORMS

POUDR'INNOV 2.0 PLATFORM

Grenoble
(page 72)

POWER COMPONENT TESTING PLATFORM

CHARACTERIZING INNOVATIVE ENERGY CONVERSION SYSTEMS

The Midi-Pyrénées region's many aeronautics, automotive, and rail industry manufacturers can use the power component testing platform to find solutions to the challenge of integrating efficient, cost-competitive energy conversion systems into their products. The platform can test components from the tens to the hundreds of kilowatts. Traditional silicon technologies (IGBT, MOSFET) are currently being supplanted by innovative power components made from new materials like gallium nitride and silicon carbide. And new materials require new testing methods, which the platform can develop and

validate using advanced equipment to characterize components of various formats (from as-cut wafers to assembled modules) in conditions that closely replicate the end application. The power component testing platform is the only facility of its kind in France, and possibly in Europe. The platform's partners include startups aPSI3D and Exagan, both of which completed successful rounds of fundraising in 2015.

KEY FIGURES

- Date opened: May 2015
- 80 sq. m of facilities
- €1.2 million invested (Midi-Pyrénées Regional Council, Regional Prefecture)

NOTABLE EQUIPMENT

Industrial-grade power testers, robotic KGD sorter

LOCATION

Toulouse



RELATED PLATFORMS

**300 mm
NANOELECTRONICS
PLATFORM**

Grenoble
(page 20)

Pays

de la Loire

**NANTES:
PAYS
DE LA LOIRE**

- 112 Regional technology-transfer platform, Nantes
- 114 Robot-assisted movement
- 116 Robotized X-ray tomography NDT
- 118 Marine energy systems



CEA TECH REGIONAL TECHNOLOGY-TRANSFER PLATFORM, NANTES

KEY FIGURES

- Date opened: February 2013
- 21 employees (60% technical, 40% sales; 2015 headcount)
- 35 industrial R&D contracts signed
- 6 technology-oriented PhD and post-doc research projects in progress
- 20 technology demonstrators in the showroom

LOCATION

Bouguenais, near Nantes

FINANCING

Loire regional government, industrial R&D contracts

The CEA Tech regional technology-transfer platform, Nantes, occupies 2,200 sq. m of facilities on two sites at the Technocampus Océan technology park in Bouguenais. The platform runs R&D projects with companies from the Loire region's major industries: naval, renewable marine energy, aeronautics, food, materials, and professional-grade electronics. Industrial partners include Valéo, Bénéteau, Diana Food, and Lemer Pax. One of the platform's more innovative projects, in conjunction with Holvia Porc, is to develop a robot to assist operators in the company's meat-packing plants.

The platform also runs several technology maturation projects with local academic research labs ECN, EMN, IMN, University of Nantes, IFSTTAR, and IETR, and has a collaborative robotics unit. By mid-2016 the platform will also have a robotized X-ray tomography NDT unit for inspecting large manufactured parts, and a marine energy systems unit focusing on cycling, aging, prototyping, and grid integration. By mid-2016 the platform will also have a showroom with 20 demonstrators to facilitate the emergence of new ideas in cooperation with industrial partners.



ROBOT-ASSISTED MOVEMENT PLATFORM

COBOTS TO MAKE INDUSTRIAL OPERATORS' WORK EASIER

The robot-assisted movement platform, located at TechnoCampus Composites, possesses the necessary technologies to capture operator movements, positions, and force and reproduce operator tasks in interactive simulated environments. These capabilities are used to determine the difficulty of a workstation and assess the benefits of new concepts like collaborative robots ("cobots") to assist operators in their movements, making job tasks easier and boosting overall productivity, regardless of industry. The data used at the platform, which is part of the CEA Tech regional technology-transfer platform, Nantes,

are compatible with the analysis methods available at List, the CEA Tech's institute in Paris-Saclay, where the cobots are designed and built. Final testing and operator training are provided at the platform; the cobots are then evaluated by operators on-site at the plant.

KEY FIGURES

- Date opened: November 2015
- 350 sq. m of facilities
- Financed by the Loire regional government

NOTABLE EQUIPMENT

Mobile, multi-camera motion capture system; force and inertial sensors; 3D scanner; 3D environment reconstruction software; haptic interface

LOCATION

Bouguenais, near Nantes

RELATED PLATFORMS

COLLABORATIVE ROBOTICS PLATFORM

Paris-Saclay
(page 56)

ROBOTIZED X-RAY TOMOGRAPHY NDT PLATFORM

3D INSPECTION AND CHARACTERIZATION OF COMPLEX MANUFACTURED PARTS

The robotized X-ray tomography NDT (non-destructive testing) platform is like no other facility in France, offering 3D inspection and characterization of manufactured parts with complex geometries measuring up to 8 cu. m; traditional equipment can handle parts up to 500 cu. cm. The platform's services support the development of high-potential technologies and emerging processes.

The platform's innovative equipment combines robotics and X-ray instrumentation, resulting in multi-resolution imaging tailored to the part being inspected. The benefits include shorter image-acquisition times and longer equipment lifespans. Defects like cracks,

delamination, porosity, and irregular density can be detected with spatial resolutions of 50 microns. Located at TechnoCampus Océan, the platform is of interest to aeronautics-industry manufacturers for the inspection of winglets, footboards, and composite assemblies; and for the renewable marine energy industry for wind turbine blades and metal assemblies. The platform works closely with the Gerim 2 NDT platform at CEA Tech institute List in Paris-Saclay. Other industries can also benefit from the platform's services: the automotive and electronics industries for contactor testing; the composite materials and textile industries; 3D additive manufacturing; food; and art.

KEY FIGURES

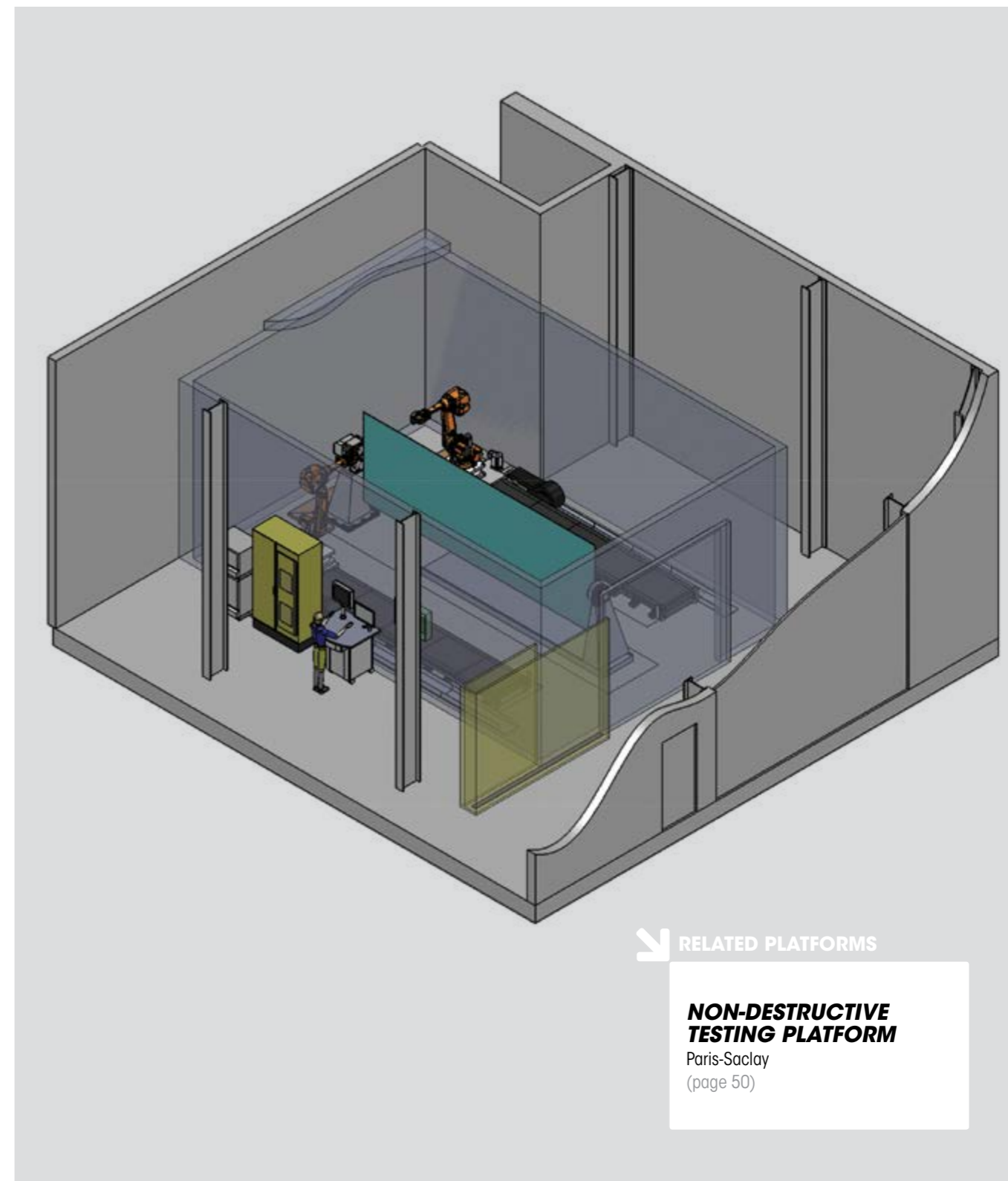
- Date opened: implementation in progress
- 150 sq. m of facilities
- Financed by the Loire regional government

NOTABLE EQUIPMENT

9 m x 6 m x 4.5 m lead-lined chamber, 225 kV microfocus X-ray generator, high-resolution imager detectors, two six-axis cooperative robots, laser tracker

LOCATION

Bouguenais, near Nantes



RELATED PLATFORMS

NON-DESTRUCTIVE TESTING PLATFORM

Paris-Saclay
(page 50)



MARINE ENERGY SYSTEMS PLATFORM

PROMOTING THE DEVELOPMENT OF RENEWABLE MARINE ENERGY

The marine energy systems platform is located at TechnoCampus Océan, where it possesses a comprehensive range of equipment to assess and optimize the behavior of renewable marine energy systems—wave-energy conversion systems, marine turbines, and offshore wind turbines—and batteries in actual operating conditions. The platform can also characterize products like metal structures, doors and windows, and building framing. The platform possesses three main pieces of equipment:

- High-power (up to 800 kW) battery cycling bench to test the batteries that will equip future generations of ships and marine energy storage systems; the platform is also studying land-based applications for these batteries

- Salt spray is used in conjunction with the battery cycling bench to test resistance to salt-induced corrosion under controlled temperature, hygrometry, and salt concentrations
- Prototyping and grid integration lab to optimize marine energy storage system design, dimensioning, and management

The platform's services support the Loire regional government's strategy to lead the way in rolling out renewable marine energy. The platform works with CEA Tech institute Liten in Grenoble, which offers battery test benches up to 300 kW.

RELATED PLATFORMS

BATTERY PLATFORM

Grenoble and Chambéry
(page 28)

KEY FIGURES

- Date opened: implementation in progress
- 300 sq. m of facilities
- Financed by the Loire regional government

NOTABLE EQUIPMENT

Battery cycling bench, salt spray, real-time grid simulator (10 kW generator)

LOCATION

Bouguenais, near Nantes

Provence

Côte d'Azur

**CADARACHE:
PROVENCE
ALPES
CÔTE D'AZUR**

- 122 Regional technology-transfer platform, Cadarache
- 124 Mediterranean building
- 126 Mégasol
- 128 Micro-algae
- 130 Physical security of electronic systems
- 132 Solar thermal



CEA TECH REGIONAL TECHNOLOGY-TRANSFER PLATFORM, CADARACHE

KEY FIGURES

- Date opened: January 2013
- 30 employees, including 2 business developers and 28 engineers and technicians (2015)
- 40 industrial partners
- 12 technology-oriented PhD and post-doc research projects completed or in progress

LOCATION

Cadarache and Gardanne

FINANCING

Communauté des pays d'Aix intermunicipal authority, Bouches-du Rhône and Alpes de Haute Provence district councils, Provence-Alpes-Côte d'Azur regional government, French government, ERDF, industrial R&D contracts

The CEA Tech regional technology-transfer platform, Cadarache (with an additional location in Gardanne), works with around 40 companies of all sizes from across the Provence-Alpes-Côte d'Azur region. The platform's energy-industry R&D partners include Atoll Energy, Helioclim, and Canal de Provence, which turned to the platform for a groundbreaking project to install 36 kW of solar panels on a portion of the canal the company operates. The platform also works with microelectronics-industry leaders Gemalto and STMicroelectronics. The platform's other R&D

partners come from the software, building thermal performance, micro-algae, and other industries. Companies engaged in R&D with the platform benefit from the resources of five application labs: PV electricity production, solar thermal energy, energy optimization for Mediterranean buildings, micro-algae for industry, and electronic equipment safety. The platform also hosts technology-oriented post-doc research projects in conjunction with Aix-Marseille University.

MEDITERRANEAN BUILDING PLATFORM

IMPROVING OCCUPANT COMFORT IN SUMMER AND EVACUATING HEAT

The Mediterranean building platform in Cadarache studies Mediterranean buildings in their actual climate—high temperatures and winds—to develop ways to improve occupant comfort in summer and evacuate heat: Mediterranean buildings use more energy for cooling in summer than they do for heating in winter. The R&D conducted at the platform covers insulation, glazing, earth tubes, natural ventilation, and other building systems, and leverages an instrumented house and rotating climatic units so that solutions can be tested under various degrees of sun and wind exposure. The platform also investigates ways to improve the thermal and acoustical performance of

shipping containers—which could potentially serve as temporary housing or technical facilities, for example. R&D contracts, which run for eighteen months on average, can be signed with a single company; partners can also engage in multi-partner projects. R&D projects are run in conjunction with CEA Tech institute Liten's facilities in Grenoble and Chambéry. The platform has seven industrial partners, mainly homebuilders or construction equipment and materials manufacturers, such as Trecobat, Atlantic, and Velux.

KEY FIGURES

- Date opened: November 2014
- 1.5-hectare site
- €2 million invested by the Provence-Alpes-Côte d'Azur regional government, Communauté des pays d'Aix intermunicipal authority, Bouches-du Rhône and Alpes de Haute Provence district councils, ERDF, private-sector financiers

NOTABLE EQUIPMENT

Instrumented test house, rotating climatic units, thermal performance measurement systems

LOCATION

Cadarache



RELATED PLATFORMS

BUILDING ENERGY PLATFORM

Chambéry
(page 32)



MEGASOL PLATFORM: PHOTOVOLTAIC SOLAR PRODUCTION AND ELECTRO- CHEMICAL STORAGE

AN EXPERIMENTAL PV PLANT HOOKED UP TO THE LOCAL GRID

The Mégasol platform, an experimental PV power plant in Cadarache, boasts 12 MW of installed PV power and 4 MW of electrochemical storage. The plant is hooked up to the local electricity grid, which serves consumers over a large geographical area (in the tens of kilometers).

R&D partners can use the platform to run industrial-scale experiments to investigate a variety of topics related to grid-integrated PV production (daily production peaks, curtailment, demand management, off-peak storage, etc.). The platform can also operate in a closed loop. R&D is conducted with CEA Tech

institute Liten's photovoltaic solar, battery, and smart grid platforms in Grenoble and Chambéry.

The platform also works with the Capenergies cluster to conduct equipment audits in actual operating conditions for energy producers, run battery charge-discharge cycling tests in conditions representative of actual use for storage systems manufacturers, and help develop strategies for achieving a more balanced grid for specialized service providers.

RELATED PLATFORMS

PHOTOVOLTAIC SOLAR PLATFORM

Chambéry
(page 44)

KEY FIGURES

- Date opened: implementation in progress
- 34-hectare site
- €6 million invested by the Provence-Alpes-Côte d'Azur regional government, Communauté des pays d'Aix intermunicipal authority, Bouches-du Rhône and Alpes de Haute Provence district councils, ERDF, private-sector financiers

NOTABLE EQUIPMENT

Traditional PV panels, CSP systems, electrochemical storage systems, grid hookup, grid-balancing systems

LOCATION

Cadarache

MICRO-ALGAE PLATFORM

SCALING UP MICRO-ALGAE PRODUCTION AND ENSURING GREATER RELIABILITY

The micro-algae platform in Cadarache develops and conducts proof-of-concept testing of industrial micro-algae production processes for applications like biofuel, dietary supplements, animal feed, plant-based chemicals, and water and stack depollution. The platform has twelve photo-bioreactors, algal biomass harvesting and pretreatment systems, and physico-chemical fractioning and analysis resources. Depending on the desired properties and target use, the platform's specialists select the most suitable micro-algae, advancing step-by-step from laboratory production to small industrial production runs of

around 1,000 liters containing from 3 kg to 30 g of micro-algae. Particular attention is given to the effects of scaling up production on the micro-algae's final properties.

The platform works with companies like Microphyt, Flowersep, Prodibio, and Spiruline de la Côte bleue. Several patents have been filed to protect extraction techniques and solar micro-algae dryers developed at the platform.

KEY FIGURES

- Date opened: September 2014
- €1.5 hectare site
- €3 million invested by the Provence-Alpes-Côte d'Azur regional government, Communauté des pays d'Aix intermunicipal authority, Bouches-du Rhône and Alpes de Haute Provence district councils, ERDF, private-sector financiers

NOTABLE EQUIPMENT

Tubular and flat-panel photobioreactors, experimental harvesting process (centrifuges; coagulation, flocculation, decantation, and aerofloatation equipment; continuous belt filter press)

LOCATION

Cadarache



RELATED PLATFORMS

**BIO-BASED
ENERGY PLATFORM**

Grenoble
(page 30)



PHYSICAL SECURITY OF ELECTRONIC SYSTEMS PLATFORM

ANALYZING THE IMPACT OF PHYSICAL ATTACKS ON COMPONENTS

The physical security of electronic systems platform, in Gardanne, was set up in conjunction with engineering school École des Mines de Saint-Etienne. Research at the platform investigates how physical attacks on electronic components like smartcards and mobile phones can be used to access data or take control of the devices. The platform has 32 employees (12 from the CEA) and has very advanced equipment that includes a pico-to-nanosecond laser pulser, an electromagnetic pulse attack test bench, and an energy-consumption analysis bench. The platform also has advanced component-preparation equipment. The experimental systems available at the platform are used to reproduce actual attacks

that have been observed and predict new types of attacks. The platform determines which physical mechanisms contribute to creating vulnerabilities; the results of the research conducted are used by CEA Tech institutes Leti (in Grenoble) and List (in Paris-Saclay) to develop innovative hardware and software solutions to increase security. The platform is engaged in several national and EU research projects, and also works directly with manufacturers to identify and correct product vulnerabilities, increase security, and prepare for high-level security certifications.

KEY FIGURES

- Date opened: 2009
- 200 sq. m of facilities
- Several million € invested

NOTABLE EQUIPMENT

Picosecond laser pulser, electromagnetic pulse attack testing equipment

LOCATION

Gardanne

RELATED PLATFORMS

CYBERSECURITY PLATFORM

Grenoble and Paris-Saclay
(page 10)

SOLAR THERMAL ENERGY PLATFORM

PRODUCING, STORING, AND REUSING SOLAR THERMAL ENERGY

The solar thermal energy platform in Cadarache experiments with the coordinated operation of solar thermal energy production and storage equipment and the reuse of stored energy for cooling, hydrogen production, domestic hot water, and desalination. The energy produced can be reused for up to four production cycles. Experiments are conducted on industrial-scale equipment.

The platform's research is coordinated with research at CEA Tech institute Liten, and leverages work at Liten's heat networks and thermal storage and building energy platforms in Grenoble and Chambéry.

Companies that manufacture heating equipment (solar thermal and other types), storage systems, equipment that uses thermal energy, command-control systems, and thermal regulation systems can work with the platform on their R&D projects. The platform investigates a broad range of technologies including cylindro-parabolic solar concentrator, vacuum tube, generators, Fresnel lens, hot water tank, gravel layer, salts, and refractory-brick storage. It currently counts five industrial partners: Alsolen, Atoll Energy, Exosun, McPhy Energy, and Schneider Electric.

KEY FIGURES

- Date opened: July 2014
- 4-hectare site
- €4 million invested by the Provence-Alpes-Côte d'Azur regional government, Communauté des pays d'Aix intermunicipal authority, Bouches-du Rhône and Alpes de Haute Provence district councils, ERDF, private-sector financiers

NOTABLE EQUIPMENT

450 kW and 1 MWth heat plants, thermal storage units, solar cooling, desalination, hydrogen production

LOCATION

Cadarache



RELATED PLATFORMS

HEAT NETWORKS AND THERMAL STORAGE PLATFORM

Grenoble and Chambéry
(page 42)

The CEA Tech technology platforms were set up

WITH THE SUPPORT OF



IN PARTNERSHIP WITH



ON THE FOLLOWING CAMPUSES



ED CIRCUIT DESIGN BATTER
NANOCHARACTERIZATION U
SYSTEMS DESIGN MECHATR
CESSES BIO-BASED ENERGY
R INSTRUMENTATION FOR EN
NG AND SUPERVISION DOSI
ROBOT-ASSISTED MOVEMENT
NG CYBERSECURITY FACTO
OPTOELECTRONIC SYSTEMS
IMPLEMENTATION NANO-BIO
HY NDT POUDR'INNOV 2.0
GY SOURCES TELEROBOTICS
ABORATIVE ROBOTICS POW
STEMS MICROALOE SOFTV
C MOBILITY PHYSICAL SECU



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