Highlights 2024

Research for industrial innovation

cea leti

HEALTH

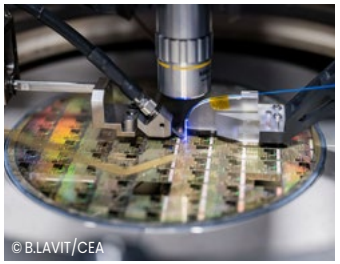
CES 2024: WIMAGINE wins the Innovation Award

A world first, this digital bypass was made public in the spring of 2023. It combines a device in the brain that uses WIMAGINE technology with a spinal cord implant, and has allowed a paraplegic patient to walk again. It was made possible thanks to the expertise of the CEA and of its partners.

OPTICS

Photonics West 2024: CEA-Leti reports progress in achieving a microLED bandwidth and improved efficiency

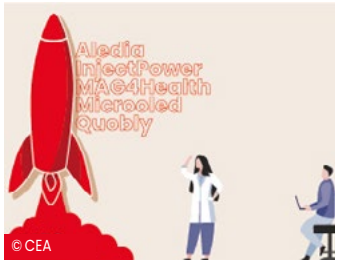
CEA-Leti will present two papers on advances in microLED technology at Photonics West 2024: making LED matrices with increased data-rate density, and strategies for reducing a loss of efficiency with small sizes.



STARTUP

€172 million were raised by CEA-Leti incubated startups in 2023

These operations specifically fund building or extending production lines, in turn making disruptive technologies accessible to consumers and companies.



MICROELECTRONICS

Barosense, a revolution in barometric pressure sensors

This miniaturized, low-power barometric sensor (<2 mm²) is manufactured using silicon technology. Designed to operate in pressure environments ranging from one bar to several thousand bars, it is extremely sensitive and can measure differences in altitude to within a centimeter.

› **Eclypia: 2024 CES Innovations Award Honoree**
Congratulations to Eclypia for being a 2024 Innovations Award Honoree at the Consumer Electronics Show.

› **2024 Leti Photonics Workshop: Photonics applications to boost the microelectronics industry**
Discover new breakthroughs in imaging and next-generation displays.
Click to learn more!

› **How can blood testing become more accessible?**
CEA-Leti researchers have developed technology that does not require a mass spectrometer, reagents, or a qualified technician to use it. Watch the video to find out more!


© CEA

MICROELECTRONICS

Insulated recessed gate GaN power transistors enable promising normally-OFF architecture

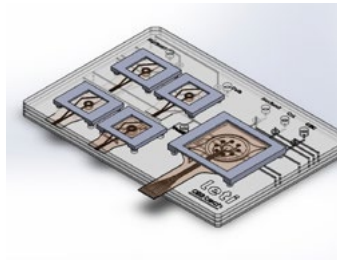
CEA-Leti and STMicroelectronics made advances on an insulated recessed-gate GaN (gallium nitride) power transistor that will improve device reliability.


© CEA; DELL/ADOBESTOCK

SCIENTIFIC EXCELLENCE

IoT Awards: Congratulations to Tristan Caroff and Rossignol teams for winning the IoT Lab prize

Following a 'lab to fab' model, teams from CEA-Leti and Groupe Rossignol achieved their goal of anticipating future ski market needs in light of the challenges of more sustainable practices.



HEALTH

New in vitro methods for assessing chemical toxicity

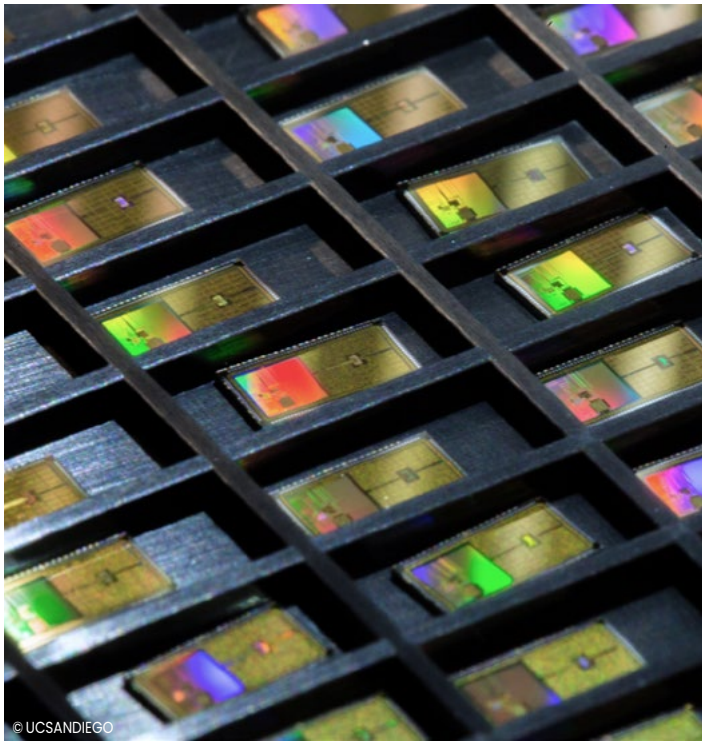
CEA-Leti is proud to be one of the core partners who launched the new EU-funded Toxbox project aimed at developing novel methods of assessing toxicity and ecotoxicity.


© GORODENKOFF/ADOBESTOCK

OPTICS

How to map instantaneously depth and speed at the same time?

Current commercial depth mapping solutions rely on time-of-flight or structured-light imaging, which require lasers to illuminate a landscape. The downsides are sensitivity to harsh lighting and an inability to measure the instantaneous speed of moving objects at video frame rates. CEA-Leti's 3D FMCW imager solves these problems. Watch this video to learn how!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MICROELECTRONICS

UC San Diego and CEA-Leti report the first IC for piezoelectric resonator DC-DC conversion capable of achieving a loss reduction of 310%

UC San Diego and CEA-Leti scientists have developed a groundbreaking piezoelectric-based DC-DC converter that increases power density by combining all power switches on a single chip.

EDGE AI

CEA-Leti develops a novel architecture for spotting keywords in voice-activated edge-AI systems that stay switched on

CEA-Leti has developed a system for spotting keywords that dramatically improves accuracy in voice-activated Edge-AI systems that stay on. With a much smaller silicon footprint compared to current technology, it also consumes less power.


© FOLIENFEUER/FOTOLIA

SCIENTIFIC EXCELLENCE

Congratulations to Jules Tillement for winning the Best Student Paper prize!

Reducing the size of photosensitive elements makes it possible to integrate a higher pixel density in resulting sensors. This manufacturing process is compatible with a CMOS process, thereby allowing high-volume production.


© CEA

EDGE AI

EU consortium developing next-gen edge-AI technologies is accepting design proposals

CEA-Leti, Fraunhofer, imec, and VTT anchoring multi-hub platform to create designs by EU companies, researchers, and chip developers.


© A.AUBERT/CEA

› **Optical transmission on organic micro-LED exceeding gigabit/s**

Micro-LEDs provide a visible light communication system that improves performance in terms of speed, density, and power consumption. Watch the video!

› Innovative materials for new applications

For several years now, the field of microelectronics has studied phase change materials, most of which are chalcogenides. At CEA-Leti, we have added a fourth element to germanium, antimony, and tellurium. Can you guess which one? Watch the video to find out!


© CONNECT WORLD/ADOBESTOCK

MICROELECTRONICS

Piezoelectric materials may enable more compact, efficient power converters

Alongside an academic research partner, CEA-Leti has been investigating how to harness their remarkable properties for power conversion, using a new inductor-free power converter concept based on mechanical, rather than magnetic, energy storage.


© YELLOW-BOAT/ADOBESTOCK

TELECOMMUNICATIONS

Private 5G networks: a solution for connected ports

Late 2023, CEA-Leti performed a real-scale validation of private 5G network elements capable of offering a data rate of at least 20 Mbps at a 30 km distance. Intended for port operations, it could be adapted to other uses when public networks fail to achieve the required performance.


© A.AUBERT/CEA

MICROELECTRONICS

A new model for optimizing high-energy-density micro-batteries used in IoT devices

CEA-Leti is pushing back the frontiers of on-device energy storage with innovative battery performance optimization tools.


© KAM PROD/CEA

HEALTH

International research team reports first complete vascularization of organoids on a microfluidic chip

The breakthrough was reported in the February issue of *Nature Communications* in the paper, "A microfluidic platform integrating functional vascularized organoids-on-chip."


© KINEIS

TELECOMMUNICATIONS

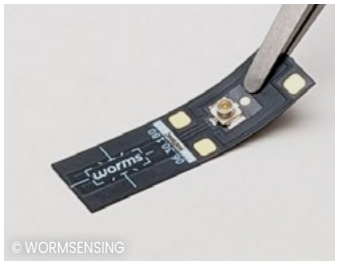
Ultra-miniaturized antennas for satellite to IoT connections

CEA-Leti and the startup Kineis recently developed ultra-miniaturized antennas that significantly improve communication between earth-based objects and satellites.

MICROELECTRONICS

Innovative vibration sensors: Wormsensing ready for mass production

Four years after its launch, the CEA-Leti startup Wormsensing has invested in a production line capable of manufacturing two million vibration sensors a year.



© WORMSENSING

CYBERSECURITY

Exceptional results for the European ExFiles project

Developing new methods for extracting encrypted data from cell phones and assist with criminality or terrorism matters: such was the purpose of the European ExFiles project, which was under the technical coordination of CEA-Leti from 2020 to 2023.


© JCHIZHE/ADOBESTOCK

SCIENTIFIC EXCELLENCE

Olivier Faynot named IEEE fellow

The IEEE has recognized the achievements of Olivier Faynot, Director of CEA-Leti's Silicon Components Department, for his exceptional achievements with advanced CMOS components.


© UTOPIKPHOTO/CEA

› Discover the CEA center in Grenoble

Watch a new presentation of the CEA center in Grenoble and dive behind the scenes of a research and innovation center and its many features, including a range of actors, a campus, different research fields and applications, brought together in a single place. Watch the video!

› Medical micro-batteries: InjectPower is building a 3,500 m² plant

A specialist in ultra-miniature rechargeable batteries for medical devices, the startup InjectPower is acquiring an industrial site located 15 km from CEA-Leti. It will ultimately employ 50 people. Volume manufacturing is to begin late 2026.

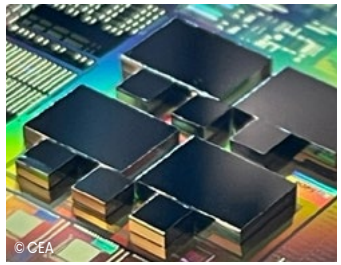
› **2024 Leti Innovation Day Taiwan: Next-generation semiconductor technologies & emerging trends**

The third edition of the Leti Innovation Days in Hsinchu was a resounding success and brought together over 100 key players from the vibrant Taiwanese Semiconductor industry. This successful event marks a significant step in the collaborative efforts of France and Taiwan in the crucial field of semiconductors. Click to learn more!

MICROELECTRONICS

CEA-Leti presents advances in transferred SiC substrates for electronics and photonics

With four presentations at ICSCRM 2023 that showcased pioneering advances in transferred silicon carbide substrates for electronics and photonics, CEA-Leti continues to lead the way in silicon carbide and thin film transfer technologies.



MICROELECTRONICS

Optimizing performance and power consumption

To support European ambitions for the semiconductor industry, CEA-Leti has established partnerships with other European research and technology organizations (RTOs), including imec, Fraunhofer Institute, and Tyndall.

TELECOMMUNICATIONS

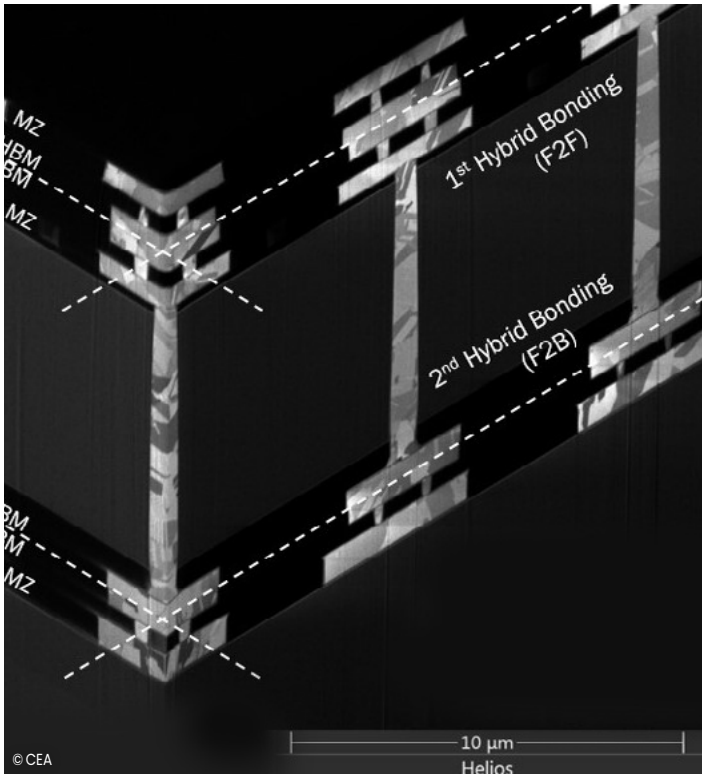
Developing ‘first-class’ 6G capabilities and contributing to standardization

CEA-Leti has been chosen to coordinate two projects as part of the European Union’s drive to support a multifaceted approach to addressing 6G challenges and promises.

REPORT

CEA-Leti 2023 scientific report: a must-read for technology enthusiasts, business leaders, and researchers

Discover an array of research developments, spanning fields such as energy-efficient computing, sensors, and displays. Significant breakthroughs in Edge AI, quantum computing, telecommunications, 3D integration, and advancements in digital healthcare stand out prominently.



EDGE AI

ECTC 2024: CEA-Leti reports a breakthrough in three-layer integration for AI-embedded CMOS image sensors

This work demonstrates the feasibility of combining hybrid bonding and high-density through-silicon vias.

OPTICS

Algorithm-architecture co-design for compact representation of ToF pixel data

CEA-Leti combined its hardware and software expertise to investigate the benefits of new signal processing approaches to conventional Time-of-Flight (ToF) histogram acquisition schemes.

CYBERSECURITY

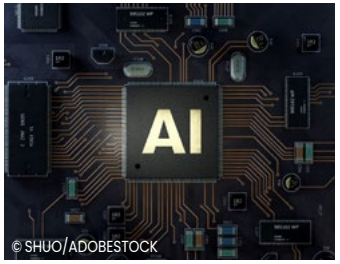
Embedded artificial intelligence: how to increase security for industrial systems

As a partner in the European InSecTT project, CEA-Leti developed innovative solutions to authenticate intelligent systems and protect them from cyberattacks.

EDGE AI

Evaluating the robustness of embedded neural network models for more secure edge AI in a physical world

CEA-Leti has made a major breakthrough in tackling the often overlooked physical threats to AI systems, by demonstrating a robust evaluation method on a common IoT use case.

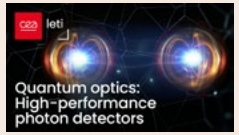


› Is your job all about finding the Next Big Thing?

The Semiconductor Deep Tech Day, hosted at the Plug and Play Tech Center, brought together 150 passionate industry professionals for a day filled with groundbreaking discussions and innovative advancements.
Click to learn more!

› **High-performance photon detectors for quantum optics**

With years of expertise in silicon photonics, CEA-Leti researchers have developed two complementary approaches for high-performance photon detectors. This innovative technology meets the needs of disruptive applications in a variety of sectors such as Free Space Optics for telecoms, quantum computing and quantum cryptography.
Click to learn more!




© CEA

SCIENTIFIC EXCELLENCE

Congratulations to Antoine Ronco for his Best Student Presentation Award at AVS 2023!

As they support the future of electronics, quantum transistors can deliver more powerful, economical, and secure computers. But their integration is turning out to be a major technological challenge.


© NUVIA

OPTICS

High-sensitivity gamma imaging for radiation protection

The fruitful collaboration between NUVIA and CEA-Leti continues with the development of NuVISION-MAX, a compact gamma camera that significantly improves sensitivity.

© CEA

SCIENTIFIC EXCELLENCE

CEA ranked No. 1 worldwide for innovation in public research

In the latest Clarivate ranking of the world's top 100 innovators, CEA is ranked 31st and first among public research organizations.

© A.AUBERT/CEA

MICROELECTRONICS

CEA-Leti announces launch of FAMES pilot line as part of EU Chips Act initiative

CEA-Leti is proud to announce the kick-off meeting today of the FAMES Pilot Line, a pioneering project aimed at advancing semiconductor technologies in Europe. This initiative aligns with the ambition of the EU Chips Act, which seeks to bolster EU semiconductor capabilities and to ensure technological sovereignty.

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EVENT

2024 Leti Innovation Days: Innovate, integrate, elevate, your lab-to-fab fast track

With more than 1,100 attendees from 25 countries, and 120 keynote speakers and panelists who provided amazing tech content, CEA-Leti's flagship event was once again a unique opportunity to make connections that will foster innovations from lab to fab. Watch the video to relive its best moments.

PARTNERSHIP

NY CREATES and CEA-Leti announce a strategic research partnership

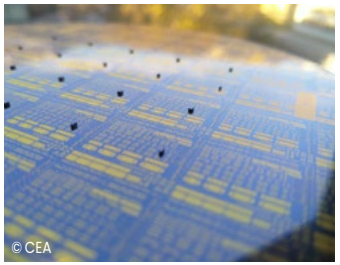
The transatlantic collaboration will start with a focus on enabling next-gen magnetic memory devices at the 300 mm wafer scale.


© UTOPIKPHOTO

MICROELECTRONICS

CEA-Leti presents complementary developments in 3D integration technologies

Three papers presented at VLSI Conference, detailing CEA-Leti's progress on 3D integration technologies, which are a promising approach to designing More than Moore systems, especially radio frequency integrated systems.


© CEA

OPTICS

X-ray diffraction: introducing a new era for threat detection

In collaboration with Smiths Detection, CEA-Leti developed an innovative detection module for small-angle X-ray diffraction. This module is part of a new type of airport baggage-scanner.


© SMITH DETECTION

› **Curious about the pivotal role young minds play in shaping science for the world of tomorrow?**

Season 4 of CEA-Leti's PhD Generation offers an in-depth look into groundbreaking research. From microfluidic advancements and hyperdimensional computing to revolutionary quantum breakthroughs, this season promises to captivate aspiring PhD candidates. Watch the videos!

› **2024 Leti Semicon Workshop: R&D prototyping pilot line to bolster value creation**

The Leti Semicon Workshop brought together 90+ passionate industry professionals for a workshop and networking reception at the Semicon West in San Francisco.
Click to learn more!


© A.AUBERT/CEA

MICROELECTRONICS

Flexible services for your journey from lab to fab

Irrespective of your advanced IC needs, you can count on the CEA to work with you in a confidential project environment to prepare your new technology and related processes for your fab.


© PAOLO GOGLIO/FOTOLIA

HEALTH

Lowering the cost of air quality analysis

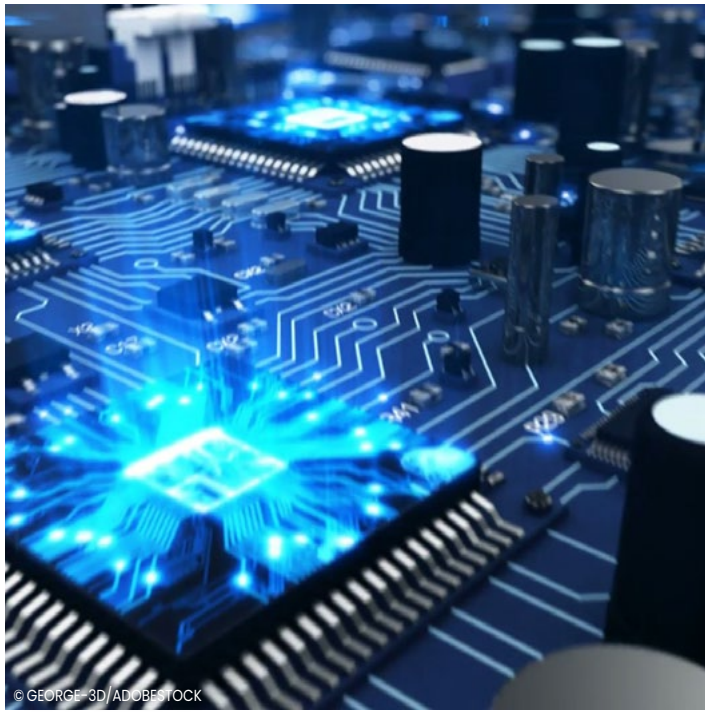
CEA-Leti is developing several sensor technologies, including high-performance and low-cost photoacoustic sensors, that would make it possible to increase the number of monitoring devices in the field.


© OPEN COSMOS

TELECOMMUNICATIONS

NanoMagSat: nanosatellites to study Earth's magnetic field

Having completed the risk assessment phase, the ESA has launched the NanoMagSat mission, which aims to map Earth's magnetic field. CEA-Leti is actively involved in this project, since it is responsible for developing on-board magnetometers for future satellites, and for their entire payload.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MICROELECTRONICS

Lab-to-fab integrated circuit services from the CEA

From startups to established corporations, companies of all types and sizes can work with the CEA and leverage the expertise of both CEA-List and CEA-Leti to develop next-generation integrated circuits for consumer electronics, automotive systems, medical devices, and other tech-intensive products. Watch the video to learn how CEA experts are helping companies quickly and efficiently take their product innovations from lab to fab.


© A.AUBERT/CEA

MICROELECTRONICS

Dive into CEA-Leti's world-class semiconductor cleanroom

CEA-Leti's experts support the semiconductor industry in its quest towards even smaller high-performance devices, using next-generation materials and equipment. More importantly, the institute fast-tracks innovation projects. Watch the video!

SCIENTIFIC EXCELLENCE

Congratulations to Kevin Hector for his Best Paper Award at the 2023 SECAI Workshop!

Kevin's research project aims to study the so-called physical vulnerabilities of neural networks embedded on microcontrollers.

© SHUO/ADOBESTOCK – CEA

HEALTH

Record mmW radar performance to support remote contactless vital sign detection

CEA-Leti has developed a new radar technology that could enable low-power, high-performance on-chip radar transceivers for contactless measurement of vital signs in automotive in-cabin systems and medical devices.


© SYNTHEXUA/ADOBESTOCK

HEALTH

Blood pressure monitoring without the doctor's office

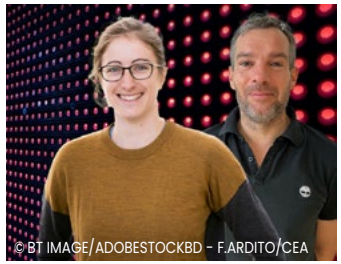
Hypertension impacts 1.28 billion people worldwide and is a major cause of premature death worldwide. To monitor patients on a continuous basis, CEA-Leti is developing a wearable device to measure blood pressure without needing the inflatable cuff used by current blood pressure monitors.


© A.AUBERT/CEA

› **CEA-Leti's 3D integration efforts featured on the cover of Chip Scale Review**
Achieving 3-layer stacking integration for future smart imagers. Discover CEA-Leti's latest advances.

› **Discover fan-out wafer-level packaging**

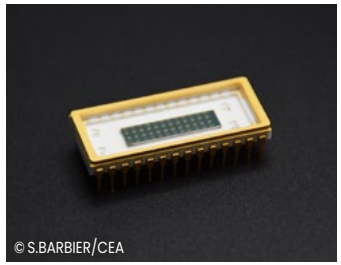
CEA-Leti offers a competitive fan-out wafer-level packaging technology using 8" wafers. Based on the reconstruction of substrates around individual chips, this technology has become an iconic part of any "More than Moore" strategy. Watch the video!


© BT IMAGE/ADOBESTOCKBD - F.ARDITO/CEA

OPTICS

Congratulations to Lou and Frédéric for their ICNS-14 awards!

Lou and Frédéric are devoting their research to improving components that will shape the LED technologies of tomorrow. Applications for their work are very different from the Cathode-ray tube monitors some may remember from childhood.


© S.BARBIER/CEA

HEALTH

Innovative sensors to improve ultrasound scans

CEA-Leti is working on new miniaturized ultrasound sensors that could lead to smaller, more portable ultrasonic systems. This innovative system could be used without gel, for example as a patch.


© MISSISSIPPI UNIVERSITY FOR WOMEN / TRAVIS HAGEY

MICROELECTRONICS

Congratulations to Auriane Despax-Ferreres for earning an award at EMPC conference!

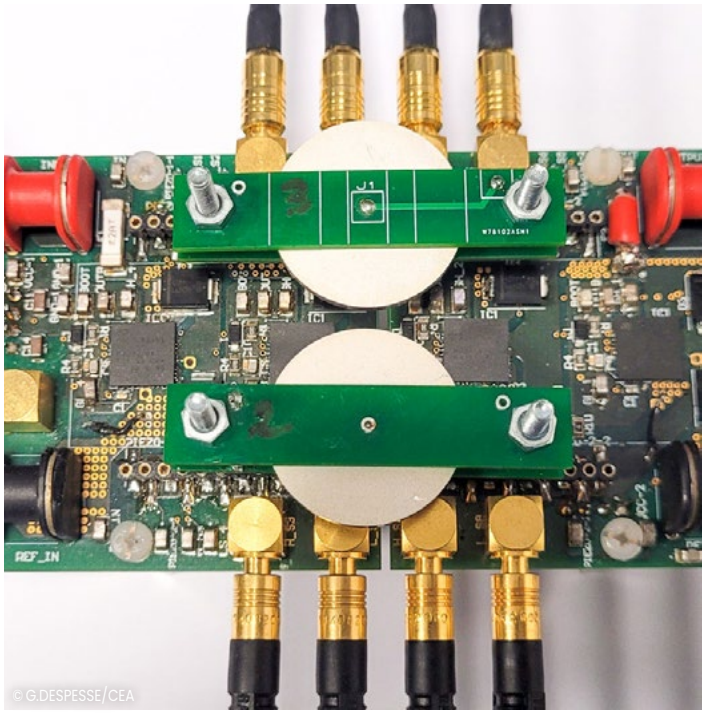
Inspired by the extraordinary adhesive power of geckos, Auriane Despax-Ferreres explores during her thesis the design of surface microstructures that can compete with the conductive performance of classical methods.


© KWANCHAIFT/ADOBESTOCK

PARTNERSHIP

A hydrogenator to capture energy from irrigation systems

Solem Irrigation and CEA-Leti have once again joined forces to create a device capable of capturing energy from irrigation water, while limiting losses in pressure. Solem is now marketing a hydrogenator that can be integrated into its connected irrigation solution.



MICROELECTRONICS

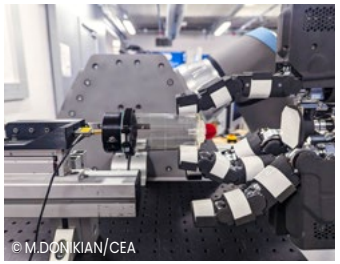
New CEA-Leti technology boosts DC-DC converter efficiency, enabling transformer-free piezoelectric converters

CEA-Leti's researchers have recently paved the way to isolating piezoelectric converters without transformers, with a new topology of dual-bridge isolated piezoelectric resonator converter (DB-IPRC) that provides isolation using two independent piezoelectric resonators.

SENSORS

Artificial touch technology that gives robots a human-like sense of touch

TactilePatch is a thin, flexible, adaptable multi-touch sensing device developed by CEA-Leti to give robotic grippers enhanced perception.



HEALTH

Assessing the efficacy of anticancer drugs using high-precision weighing

Ultra-high-precision weighing measures small changes in tumor cell mass to assess treatment sensitivity. This process relies on the Suspended Micro Resonator (SMR), a cutting-edge technology manufactured by CEA-Leti.

MICROELECTRONICS

A breakthrough in non-destructive characterization of SiC devices

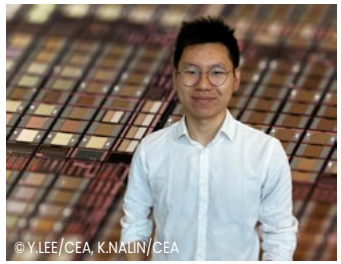
A research team from CEA-Leti earned a presentation slot at ISPSD 2024 for their pioneering work on the silicon carbide (SiC) devices characterization, underscoring the institute's excellence in SiC R&D at this prestigious semiconductor power devices conference.

› iNGage wins state innovation competition in the I-Lab category

iNGage is developing and industrializing high-performance sensors for autonomous mobility. These sensors are designed to enable operation even without GPS availability.

› 2024 Leti Innovation Days Tokyo

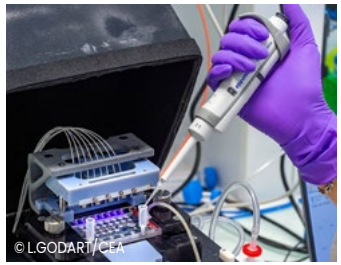
Leti Innovation Days Tokyo was held at the Residence of the Ambassador, in the presence of H.E. Mr. Philippe Setton and a wide range of high-level representatives from the Japanese semi-conductor industry. CEA-Leti presented its "lab-to-fab fast track", supporting its industrial partners to turn an innovation efficiently and quickly into a commercial product. Click to learn more!


© Y.LEE/CEA, K.NALIN/CEA

SCIENTIFIC EXCELLENCE

Congratulations to Laurent Xu on his Best Poster Contribution at MAM 2024

Laurent, a PhD student, has made significant advancements in p-GaN contacts. His work is contributing to the development of more efficient and powerful microelectronics.


© L.GODART/CEA

HEALTH

Detect bacteria and allergens in a matter of hours

Quickly detecting contaminants in food products is a major issue for public health and industrial efficiency. With lab-on-a-chip systems that deliver results within hours, CEA-Leti is significantly outpacing traditional methods that take days.


© A.AUBERT/CEA

HEALTH

CEA's BCI technology transfer to Onward Medical

CEA transfers its Wimagine® brain machine interface (BCI) technology to Onward Medical, to integrate into their ARC-BCI™ system, aimed at restoring thought-controlled human body movements after paralysis.


© PABLO-LAGARTO/ADOBESTOCK

CYBERSECURITY

CEA-Leti launches OpenTRNG, an open-source project for true random number generators

CEA-Leti has launched an open-source project to produce physical True Random Number Generators (TRNG) using ring-oscillator-based architectures. The OpenTRNG initiative's comprehensive toolkit includes reference designs, emulation tools and analytical tools to facilitate development and characterization of hardware TRNG implementations.


© F.ARDITO/CEA

MICROELECTRONICS

Renovation of a 40-year-old historic CEA-Leti building leads to new cleanrooms

Backed by local authorities, CEA-Leti has renovated a 1984 building to accommodate cutting-edge equipment, addressing the growing demands of its expanding activities at a crucial time for the booming semiconductor industry. The project prioritizes sustainability, reducing waste and environmental impact, while delivering state-of-the-art cleanrooms.

SCIENTIFIC EXCELLENCE

IRPS 2024: Congratulations to Julie Laguerre for her "People's Choice Award for Best Paper"

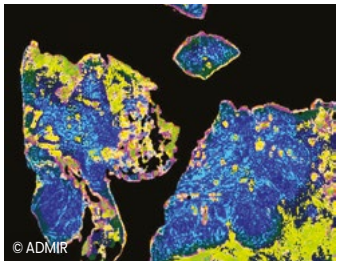
Julie Laguerre's research on ferroelectric memories (FeRAM), as a PhD student at CEA-Leti, holds significant promise for the future of data storage.


© B.LAVIT/CEA, ZDYMA4/FOTOLIA

HEALTH

Detecting cancer 100 times faster

It currently takes up to three weeks to diagnose cancer by analyzing biological tissues. In the near future, multispectral infrared imaging will reduce analysis time to only one hour, at equivalent levels of reliability. This innovation will speed up patient care and increase chances of survival.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PARTNERSHIP

A MoU between INT and CEA-Leti focused on microelectronics and microsystems

The signed MoU marks a new chapter of collaboration and commitment to revitalize interactions in the future.

© CEA

› **Photonics and gas chromatography: Pomme Hirschauer's journey**

Meet Pomme Hirschauer, a PhD student at CEA-Leti who is innovating in the field of gas chromatography using integrated photonics. Watch the video!

› **2024 Leti Devices Workshop: From materials to system innovations, shapping the future of global connectivity**

Connectivity is one of the main driving forces behind every connected and intelligent system. Deep innovations are required in terms of materials, devices and systems in order to to ensure efficiency, sustainability and low power consumption.

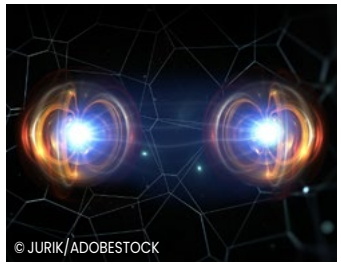
Click to learn more


© IURII/SHUTTERSTOCK

SENSORS

A new generation of sensors to monitor methane leaks

CEA-Leti and eLichens are developing high-performance, miniature optical sensors for industrial methane leak detection. This project is part of the two organization's long-term partnership.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OPTICS

Integrated silicon photonics: making the quantum future a reality

Decades of expertise in the field of integrated silicon photonics technology at CEA-Leti supports the development of key on-chip state-of-the-art quantum photonic components.


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HEALTH

The challenges of measuring stress

Stress is a multifaceted phenomenon that varies from person to person and affects 35% of the world's population. It can contribute to illnesses such as hypertension and diabetes. CEA-Leti is designing wearable devices that combine a variety of measurement factors in order to better characterize this phenomenon.

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PARTNERSHIP

CEA-Leti and ASML collaborate to develop sub-nanometer chip technologies

ASML and CEA-Leti have strengthened their partnership thanks to a new immersion scanner that offers unprecedented performance for a European research laboratory environment. This equipment will enable research teams to pursue their work on next-generation, sub-10nm architectures that use advanced bonding technologies. CEA-Leti will support this research as part of the renewed joint laboratory agreement between the two organizations.


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PARTNERSHIP

Valeo and CEA renew their partnership for more sustainable, autonomous and connected mobility

Valeo, the key technology partner of mobility players, and the CEA, Europe's most innovative research organization, have announced a 4-year collaboration to anticipate future technological advances and encourage exchanges within the French and European research ecosystems.

OPTICS

CEA-Leti device combines light sensing & modulation for scalability, compactness, and easy alignment

CEA-Leti researchers have unveiled a groundbreaking device that combines light sensing and modulation in a single system—using just a liquid crystal cell and a CMOS image sensor.


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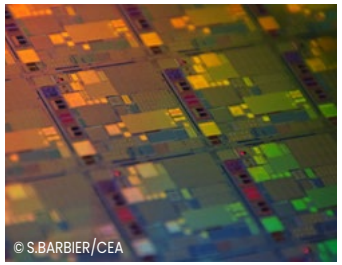
MICROELECTRONICS

CEA-Leti demonstrates embedded FeRAM platform compatible with 22 nm FD-SOI node

CEA-Leti has achieved a breakthrough in ferroelectric memory technology that significantly boosts scalability for embedded applications and ferroelectric RAM(FeRAM) positions as a competitive memory solution for advanced nodes.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