



THE SHOWROOM

Each prototype and demonstrator system on display at the CEA Tech Showrooms offers a unique window into the broad range of human and material resources behind CEA Tech's renowned capacity for innovation.

Whether they are products developed by our industrial R&D partners, proof-of-concept prototypes, or models created for teaching purposes, each exhibit has been carefully developed to support CEA Tech's mission of bringing technology closer to users to drive innovation for industry.

CONTENTS

THE CEA TECH TECHNOLOGY SHOWROOMS..... p. 04

KEY FIGURES..... p. 06

PROTOTYPES AND DEMONSTRATOR SYSTEMS p. 08

- 3D NoC 10
- DiamonDisplay 12
- Self-powering roller shutters by Bubendorff..... 14
- Homomorphic cryptocomputing 16
- Flowpad Lab 18
- Frama-C 20
- G-Link 22
- Cytonote by Iprasense 24
- BacRam 26
- Slate by ISKN 28
- Li-Fi 30
- Printed sensors 32
- Gekko by M2M 34
- Silicon micro-needle 36
- Microdisplay by MicroOLED 38
- Sigma Fusion 40
- TV White Space 42



THE CEA TECH
TECHNOLOGY
SHOWROOMS

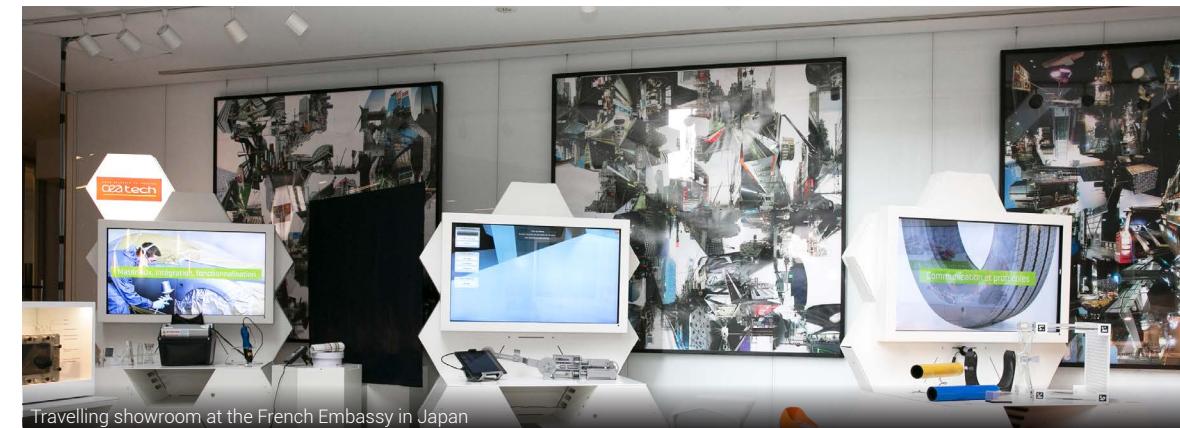
THE CEA TECH
TECHNOLOGY SHOWROOMS

KEY
FIGURES

PROTOTYPES
AND DEMONSTRATOR SYSTEMS



Regional Technology Transfer Platform Showroom, Hauts de France



Travelling showroom at the French Embassy in Japan

CEA Tech currently has eight technology showrooms at the CEA's historic campuses in Grenoble and Saclay and at our Regional Technology Transfer Platforms in Bordeaux, Lille, Metz, Nantes, and Toulouse. CEA Tech

also has a travelling showroom for trade shows. Having a demonstrator at one of the CEA Tech Showrooms is a unique opportunity to reach out to CEA Tech's industrial and institutional partners.

EXHIBITS

OCTOBER 14–15, 2015:

- *Transrail 2015*, Paris



2015-2016:

- *Franco-Japanese Year of Innovation*
French Embassy, Tokyo



SEPTEMBER 27–30, 2016:

- *Micronora*, Besançon



OCTOBER 8–16, 2016:

- *Fête de la science science fair*, Grenoble



OCTOBER 25–27, 2016:

- *Semicon Europa*, Grenoble





KEY FIGURES

THE CEA TECH
TECHNOLOGY SHOWROOMS

KEY
FIGURES

PROTOTYPES
AND DEMONSTRATOR SYSTEMS

KEY FIGURES 2016 – GRENOBLE SHOWROOM

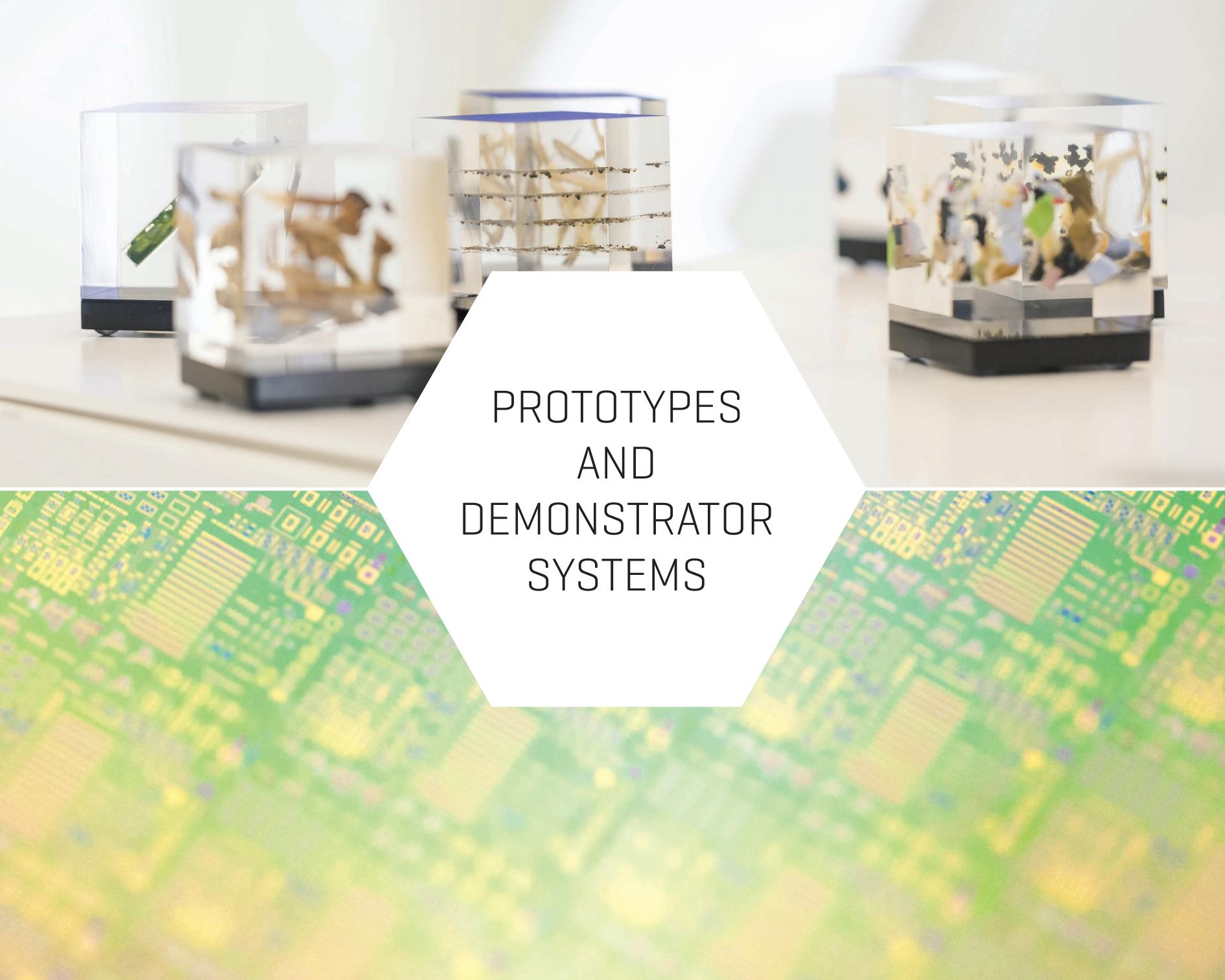
3,809
VISITORS


635
tours


 more
than
100
DEMONSTRATOR
SYSTEMS

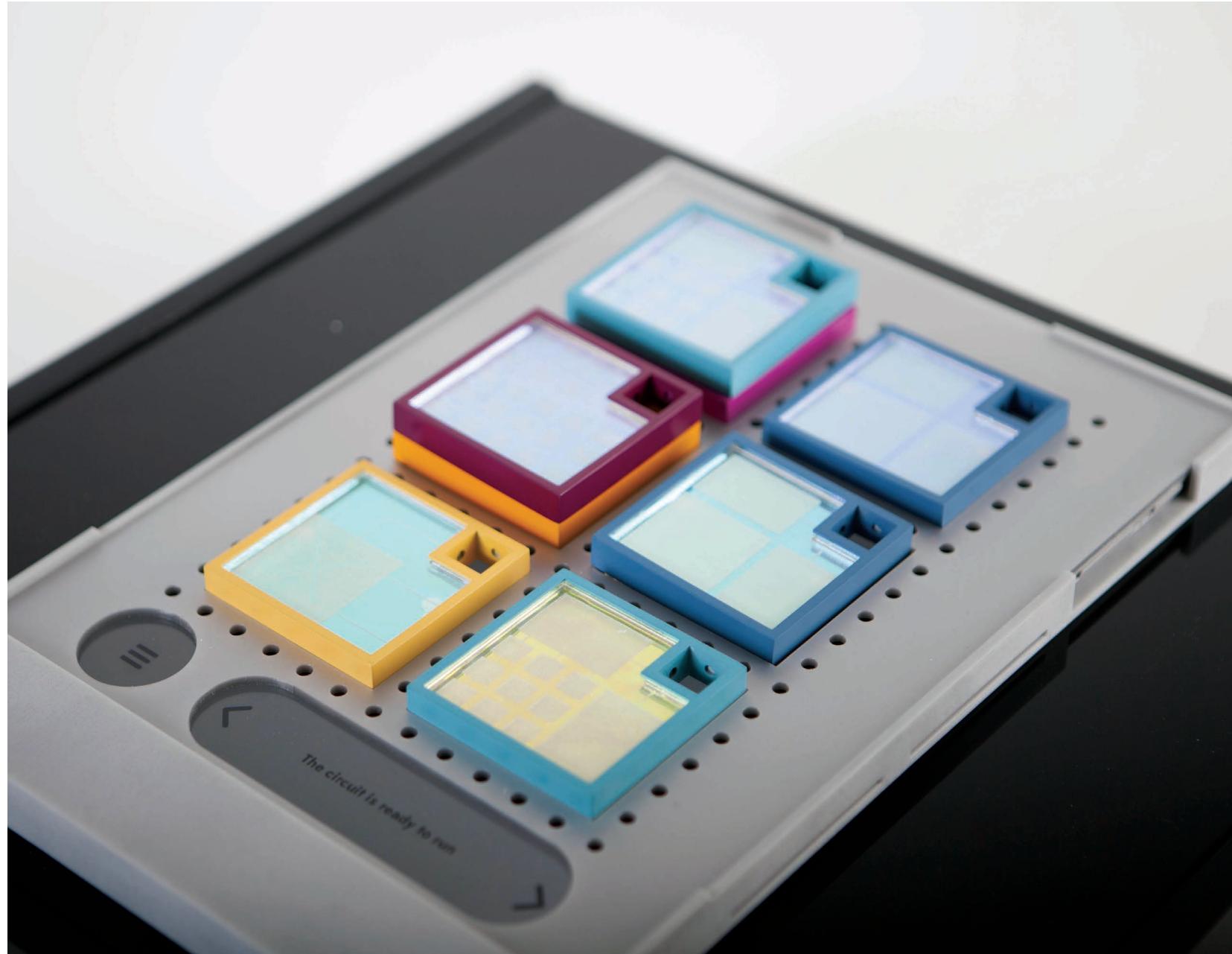
 **25**
NEW
EXHIBITS

 **400 sq.m**
of exhibit space



PROTOTYPES
AND
DEMONSTRATOR
SYSTEMS

**Read on to discover a selection of the prototypes
and demonstrator systems on display at the Grenoble showroom in 2016**



> 3D NOC

Low-power asynchronous 3D circuits

The 3D NoC (Network on Chip) is a demonstrator system that gives showroom visitors a unique opportunity to see the advantages of 3D architectures from an integrated circuit designer's perspective.

The costs of advanced technologies are rising. 3D architectures, which are easier and more cost-effective to produce, give medium-sized companies and fabless manufacturers access to a much broader and more heterogeneous portfolio of integrated circuits.

3D circuits are built on a silicon interposer and broken down

into chiplets specific to given functions such as processing and memory. This makes the circuits modular and easier to design. Chiplets with different functions are simply stacked to meet the needs of the target application (HPC, servers, etc.). Through silicon vias (TSVs), a technology CEA Tech's silicon researchers master completely, link the chiplets and interposer.

Whether they are planar or stacked, 3D circuits are one way for manufacturers to produce cheaper products with smaller chips that have smaller surface areas while delivering enhanced performance and lower energy consumption.



> DiamonDisplay

High-luminance microdisplay

The DiamonDisplay demonstrator system is made up of a GaN LED microdisplay and compact power electronics housed in a single unit. The microdisplay offers truly remarkable luminance of 10 million cd/m², a thousand times higher than today's microdisplays which come in at 1,000 cd/m². Just one or several groups of 29 pixels is all that is required to display an image.

The demonstrator is more than just a display, however. It is a miniature augmented reality system that lets the wearer see

information superimposed on the actual environment. The tiny 3 mm x 2 mm display is not designed to be viewed directly; it requires an optical system to enlarge the image. And, because it is very energy efficient, it is suitable for applications like augmented reality glasses and heads-up displays for aviation and car windshields. It could also be used for very compact micro-video projectors. The research is ongoing; the next step will be to design a more complete display (500,000 pixels instead of 70,000).



> Self-powering roller shutters

Smart energy production and management

CEA Tech partnered with Bubendorff, Europe's leading roller-shutter manufacturer, to develop a completely self-powering roller shutter.

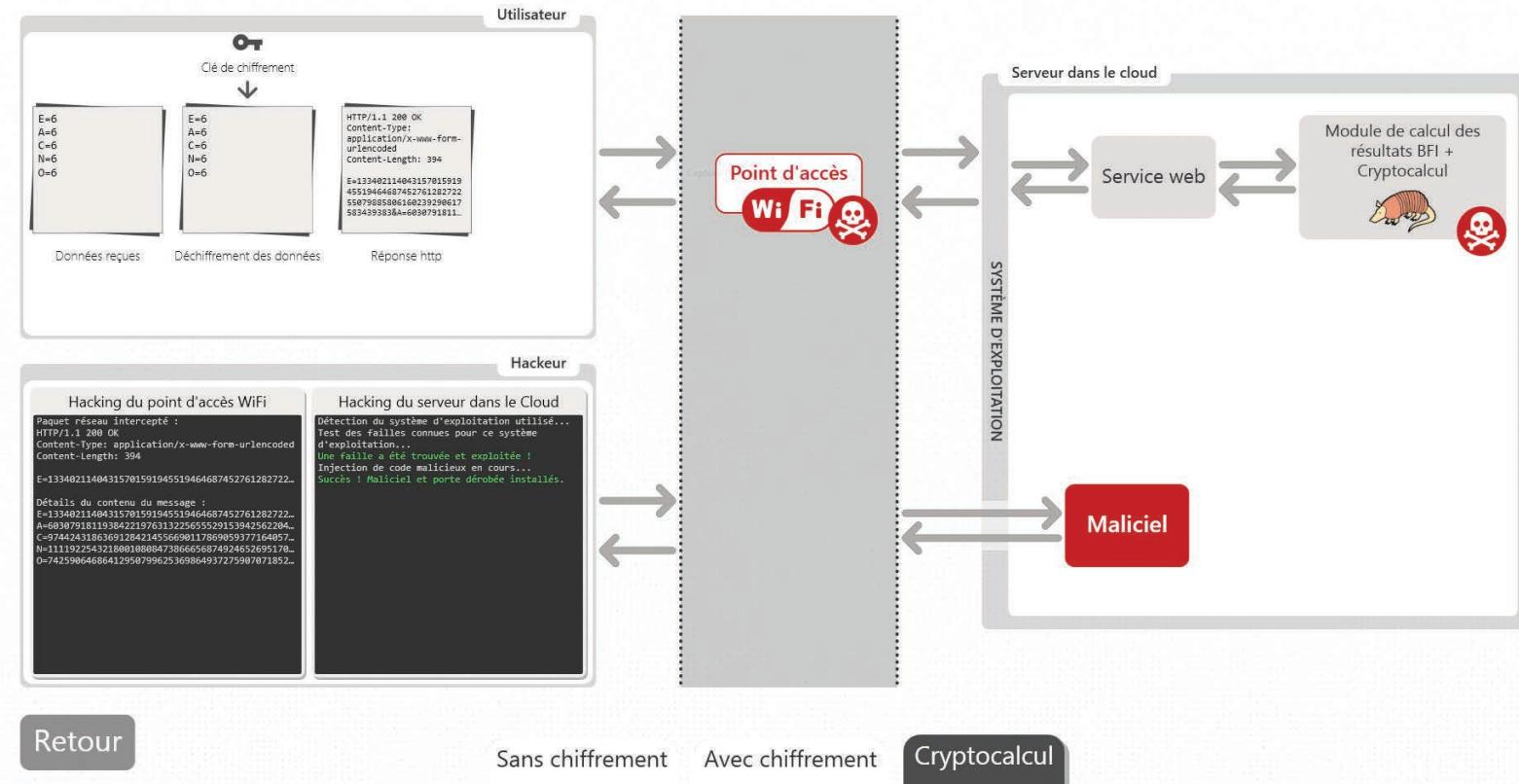
The innovative roller shutter is powered by a battery connected to a compact photovoltaic panel. The battery captures the sun's energy, regardless of sun exposure and obstacles like balconies or roof overhangs. The very energy efficient roller shutter can operate for a month between charges in normal conditions.

A patented algorithm that achieves an optimal balance between overall energy consumption and battery life is responsible for the roller shutter's stellar performance. And, because the roller shutter is completely off-grid, it does not require any wiring, making it extremely easy to install.

The roller shutter will target a very broad market encompassing new construction and building renovation projects.

CRYPTOCALCUL AVEC ARMADILLO

X

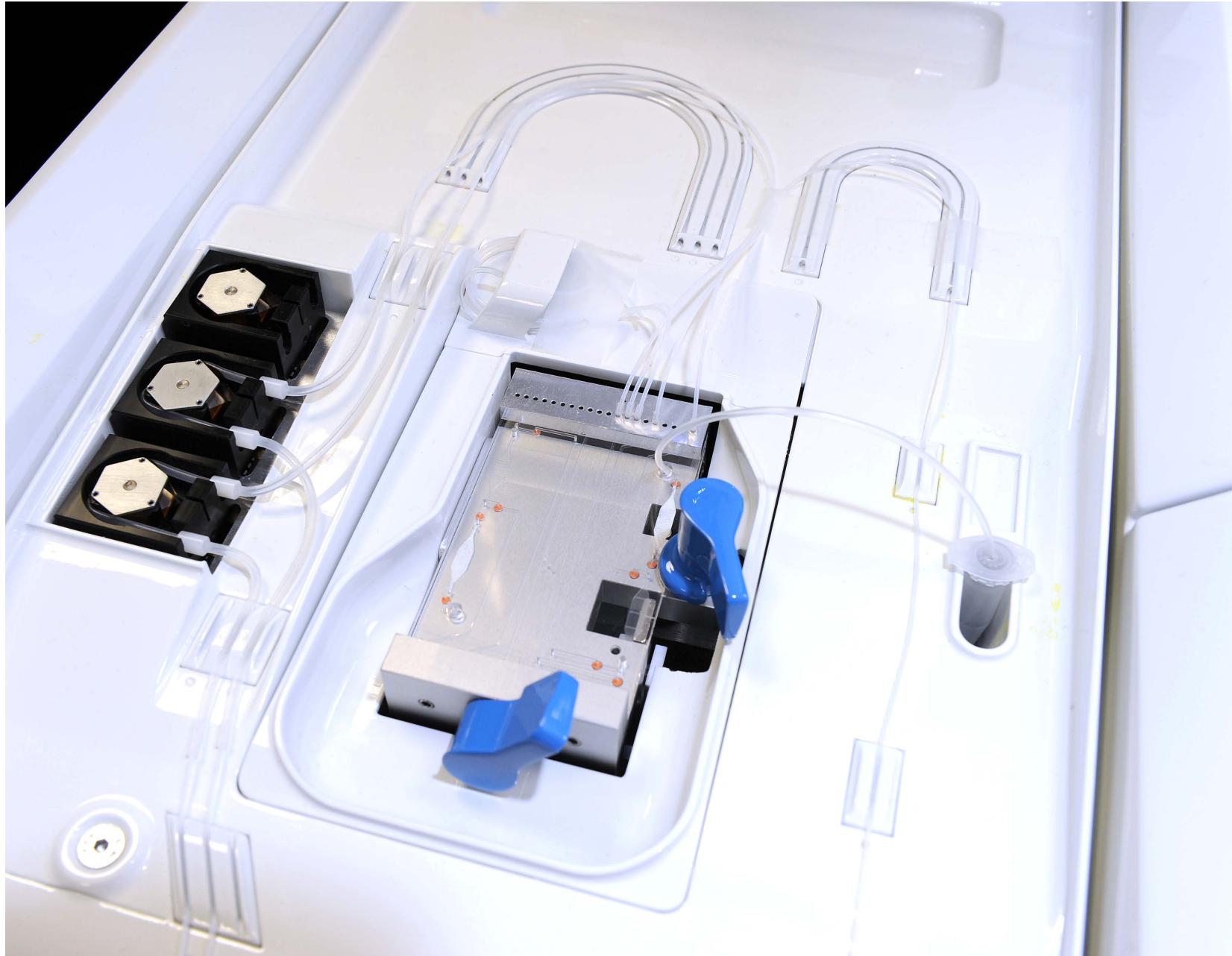


> Homomorphic cryptocomputing

Computing without decryption

Over the past several years, the development of homomorphic cryptosystems has created something of a revolution in the world of cryptography. Ultimately, these systems enable cryptocomputing—randomly complex computing directly on encrypted data—and provide the foundations required to implement data privacy by construction.

Data processed and sent via a server or the cloud is constantly encrypted and computing is done on encrypted data. The very rapid gains in performance made over the past few years have now opened the door to integrating cryptocomputing into early industrial prototypes.



> Flowpad Lab

Testing major microfluidics concepts

Flowpad Lab is a research platform scientists can use to test the basic principles and applications of microfluidics, a new science at the crossroads of chemistry, biology, technology, mechanics, and electronics that emerged in the 2000s. The idea behind microfluidics is to do what can be done in large volumes of fluids in very small volumes. For lab tests, for example, being able to process mere microliters of fluid in sub-millimeter channels would provide a variety of benefits like reducing the amounts of substances used, bringing system sizes down, and boosting reproducibility.

When working at small scales like the micron, physical relationships change. Capillarity becomes vital and surfaces take on new significance given the particularly tiny channel size. Systems must also be simple, self-contained, and easy to use. Steps like blending, recovery, and separation must be automated.

CEA Tech possesses unique know-how integrating all of these steps on a single chip.

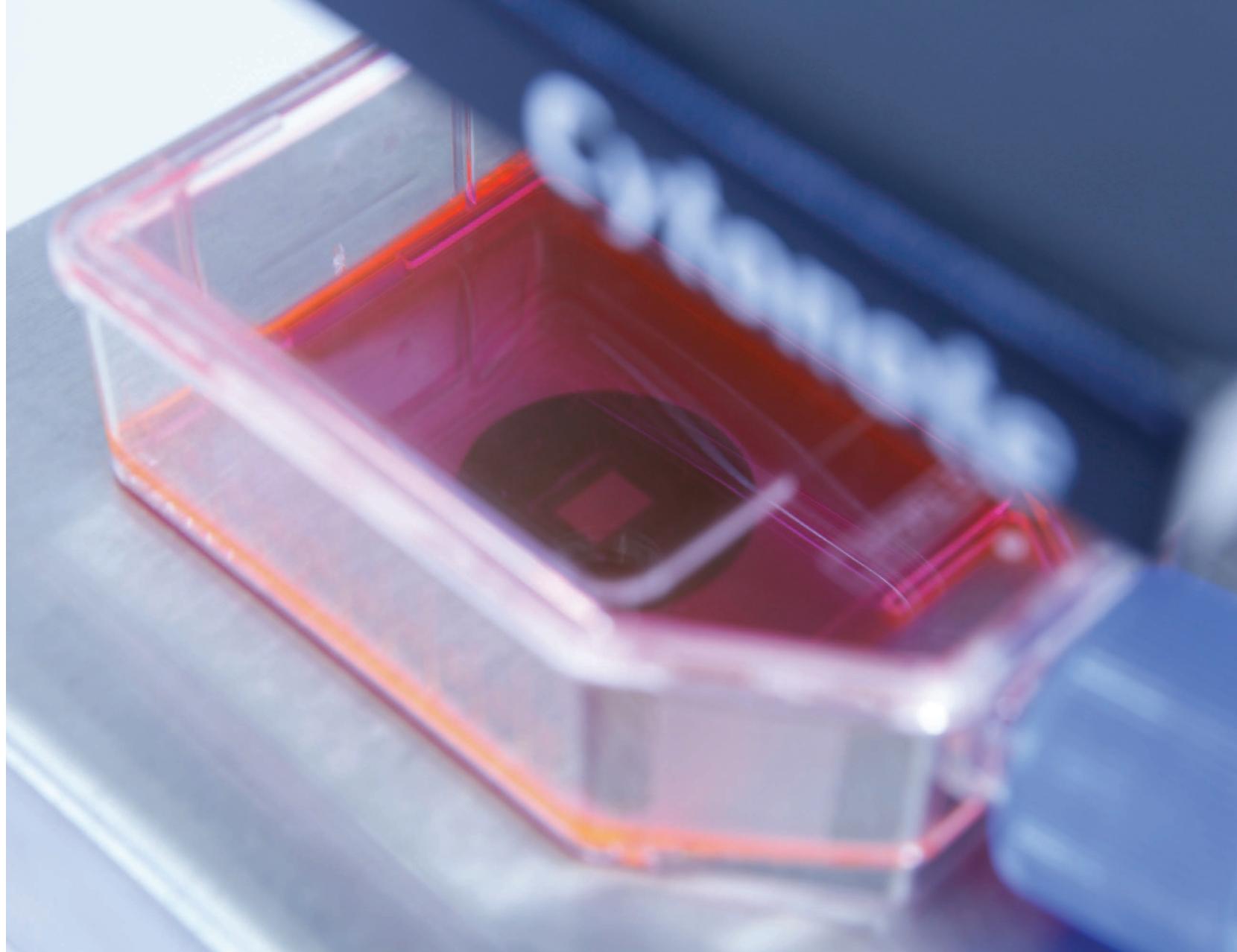


> G-Link

Contactless high-speed data transmission

CEA Tech developed a low-power chip that can transmit gigabits of data at very high speeds (1 Gbit/s currently) between two devices located near each other. The chip, which measures just a few square millimeters, was built by some of the world's top wireless communications and antenna specialists. The circuits operate at high frequency (60 GHz), enabling very high transmission

speeds. The tiny 600-micrometer antennas provide contactless transmission and directivity. Today, the transmission speeds G-Link is capable of delivering are opening the door to further exploration of industrial applications for which connectivity is a must in situations where space for wiring and connectors is at a premium.



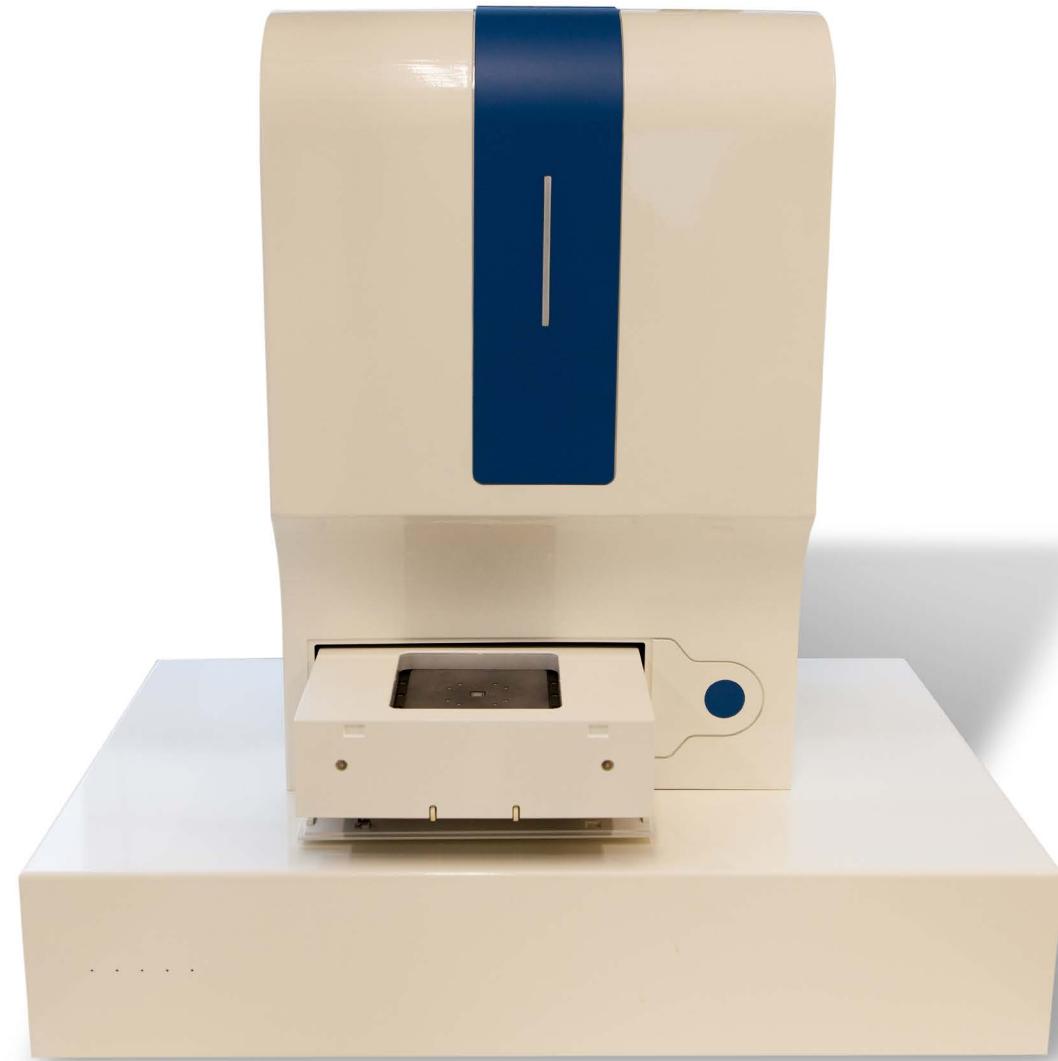
> Cytonote by Iprasense

Thousands of cells at a glance

Cytonote was developed jointly by Leti, a CEA Tech institute, and Iprasense, a company that develops and commercializes cell analyzers for the pharmaceutical industry. Cytonote is a silicon mini-microscope whose optics (the most important part of a traditional microscope) have been eliminated. It takes the form of a digital reader compatible with all types of laboratory beakers and equipped with LEDs and CMOS sensors that generate images and videos of cell activity directly in the cell culture environment. The technology can capture a very large observation field (ten times the area that can be observed by a microscope) without compromising

image resolution and is easy to use (no need to zoom or make other adjustments). The cost is lower than other real-time cell imaging techniques.

Iprasense and Leti are continuing to work on Cytonote under a joint lab. The goal is to increase the number of sensors to enable several analyses to be conducted simultaneously. The research is also focusing on using this type of lensless imaging for 3D cell cultures to replicate the human body as closely as possible.



> BacRam

Spectrometry-based bacterial detection

BacRam is a compact, portable system that can quickly identify pathogenic bacteria. It was developed under the Global Security Research Program and leverages the CEA's know-how in instrumentation, biology, signal analysis, algorithm development, and biological testing design and validation.

The system combines Raman spectrometry, a non-destructive method for identifying bacteria by their molecular signature, and

lensless imaging, a technique to detect the presence of bacteria in a sample without a microscope, in a unique way. The result is a miniature, portable system that delivers the same level of effectiveness as traditional detection systems. BacRam also makes bacterial detection more efficient, eliminating the need to grow cell cultures (to obtain sufficient biological material). The system's classification algorithms can identify bacteria in just fifteen minutes, including the time it takes to prepare the sample.



> Slate by ISKN

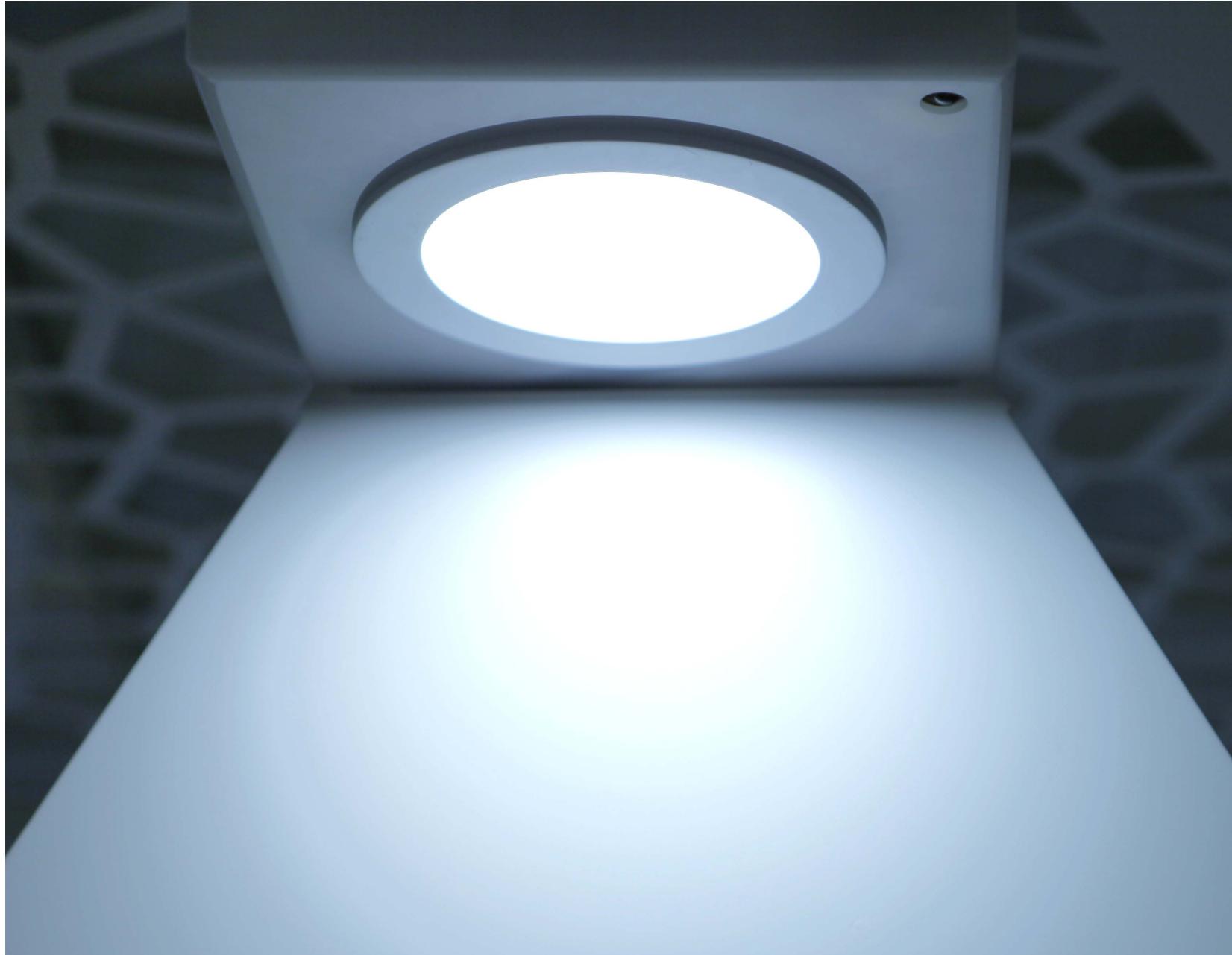
Digital drawing by hand

Slate is for paper-and-pen lovers who would like to access their sketches in digital form as fast as they can draw them.

The product, developed and commercialized by ISKN, leverages a CEA Tech technology. A network of 32 low-power triaxial magnetometers and a simple magnetic ring that slips onto any standard pen let users draw or write on paper as usual while benefitting from the power of digital technology. Each stroke of the

user's pen is sent to a tablet in real time via Bluetooth and can be edited using proprietary software, exported, and shared.

ISKN put the magnetometer, initially developed to measure Earth's magnetic field, to an innovative new use: to capture movement. Today, ISKN is addressing the consumer market and plans to develop new capabilities like character recognition for a notetaking application.



> Li-Fi

High-speed data transmission using visible light

Li-Fi can now successfully transmit data via LEDs used for lighting. Data is converted into an optical signal that causes the LEDs to switch on and off more than a million times per second, a phenomenon that is invisible to the naked eye. CEA Tech and Lucicom developed a Li-Fi modem that offers a distinct advantage over competing solutions: It is bidirectional, which means that it can send data over the optical spectrum and receive data using an infrared sensor.

Because it does not depend on contingencies like frequency

bands and operators, Li-Fi is less expensive than other high-speed networks. In addition, the extra cost of the LED lamps is minimal. It is also more environmentally friendly because no network connection is required. Finally, it is more secure, especially for locations like hospitals that are sensitive to interference: Walls form a barrier to light waves, keeping hackers out.

Li-Fi is ideal for use in addition to Wi-Fi. It can be used to download videos, files, and data in environments that require increasing bandwidth.



> Printed sensors

Low-cost printed electronics

This piano is made of actuators printed on a flexible substrate using semiconducting inks and microelectronic components. The fully-functioning low-cost actuators can be integrated into different materials and environments simply by changing the printing process—spin coating, heliography, flexography, or slot-die printing—to suit the material and substrate. All of these printing processes are available at the CEA Tech large-area

printing platform, a facility dedicated to printed electronics. The microelectronic components (in this case, piezo* switches) are screen printed and then cut out and integrated into a system that sends a signal when a user presses on the actuator.

* The piezoelectric effect generates an electrical charge when mechanical stress is applied to certain crystals (synthetic ceramics in most cases).



> Gekko by M2M

Advanced non-destructive testing

Gekko is a portable multi-element ultrasonic non-destructive testing (NDT) system that leverages market-leading simulation software CIVA (developed by List, a CEA Tech institute).

Multi-element ultrasonic non-destructive testing can be used to confirm the integrity of a structure or material during production, use, or maintenance without altering it. Ultrasonic waves interact

with very small defects so that the defects can be detected, located, and identified. Gekko, developed jointly by List and startup M2M, sets a new standard for quality. The portable system, which is simple enough to be used by any operator, can identify defects in real time and generate high-definition images. It is designed for use in a wide range of industries (aeronautics, automotive, nuclear, and petrochemical, among others).



> Silicon micro-needle

Vaccinations made easy

Debioject, an 800-micron silicon micro-needle leveraging MEMS technology developed by Leti, a CEA Tech institute, was produced based on specifications provided by Debiotech. The needle is formed by a series of deep engravings on a silicon substrate. It can rapidly and painlessly inject precise doses of vaccines or other drugs (from 0.3 ml to 0.5 ml) and promotes healing.

The micro-needle is the result of a partnership between Debiotech and Leti's 3S "Silicon Specialty Solutions" department. A test production run was completed and Debiotech benefited from all of the resources at the CEA Tech microelectronics platform, bringing

the technology to a greater degree of maturity and stabilizing the process to where the company could produce the micro-needles for clinical trials.

Leti's 3S department supports manufacturers of all sizes to overcome challenges with a specific process, build proof-of-concept prototypes, or make small runs of demonstrator systems. 3S has access to Leti's infrastructures, which can be used insofar as they are compatible with the maturity of the technology and can respond to the capacities required. Services are tailored to each manufacturer's unique needs and prototype designs.



> Microdisplay by MicroOLED

High-resolution miniature OLED display

This low-power OLED* microdisplay measures less than 2 cm (diagonal) and offers high-definition images (6.9 million pixels per sq. cm). White balance, grey scale correction, and luminance can be adjusted directly on the screen.

The microdisplay, developed under a joint MicroOLED-CEA Tech lab, has already been integrated into the Panasonic Lumix GH3 camera and will gradually become the display of choice for most digital SLR cameras. The microdisplay is manufactured in a cleanroom and has an active organic semiconductor layer less

than 100 nanometers thick protected by a sealed transparent layer on which colored filters are mounted.

In addition, the microdisplay is easy to integrate into very compact viewfinders and offers a competitive unit cost, making it ideal for consumer and professional-grade applications like video glasses, binoculars, surgeon's glasses, and more.

*OLEDs are organic light-emitting diodes made from a semiconductor that contains oxygen, carbon, hydrogen, and nitrogen.



> Sigma Fusion

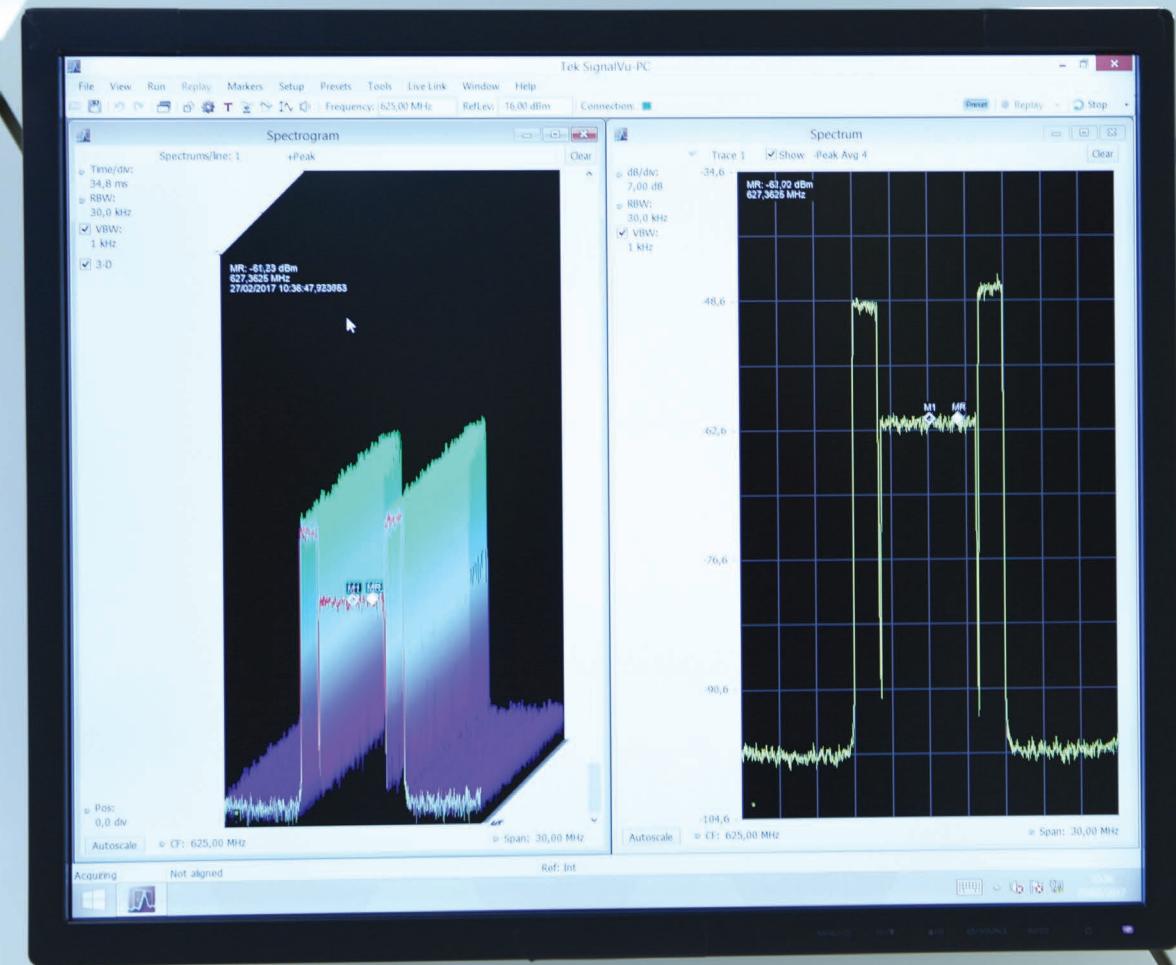
Fusing heterogeneous data for automotive applications

Sigma Fusion is a highly-automated proof-of-concept prototype for the automotive industry. It leverages algorithms to fuse data from heterogeneous sensors on a single circuit board to map the environment in real time.

The environment is partitioned into "cells" (geographical areas). The cells are probed constantly by the algorithm to determine whether they are occupied or not, regardless of the type of obstacle

(object, person, etc.) encountered. The implementation of additional sensors will make real-time obstacle recognition possible within a 100-meter perimeter to within 10 cm accuracy.

The system is more compact than anything developed previously and is compatible with certified automotive equipment. It also offers much lower power consumption than current systems (1 W vs. 100 W).



> TV White Space

Low-cost wireless broadband

In late 2015, Leti built a proof-of-concept prototype, TV White Space, to implement the IEEE 1900.7 standard, which promotes filter bank multi-carrier (FBMC) systems that make it possible to use available radio frequencies once used for analog TV broadcasting with good enough frequency isolation to ensure sufficient spectral efficiency and low interference on adjacent bands.

The technology, which delivers high-speed data transfer over long distances (64 km in theory), is in the running for 5G network rollout. Using available TV broadcasting frequencies leverages the existing infrastructure, an advantage in open, poorly-networked areas (rural or desert regions, for example), and could therefore contribute to closing the digital divide.

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