



CEA 
Startup
PORTFOLIO 





Supporting startups

The CEA, a France-based research organization that is among the most innovative in the world, is known for its active startup policy. By supporting the creation and growth of companies to develop and commercialize its technologies, the CEA nurtures disruptive innovations, helps industrial companies become more competitive, and—by helping new ventures gain a foothold in key industrial value chains—drives job growth.

The first CEA startup was founded in 1972; its first employee startup program launched in the late 1980s. Today, the CEA continues to pioneer new approaches to supporting startups so they can **make a positive impact on the economy and society**. Services include help from CEA technology experts, the use of its state-of-the-art R&D facilities, access to its proven experience in innovation, and introductions to the CEA’s network of financiers. Finally, the CEA offers the startups it supports a gateway to some of France’s flagship industries through its regional technology transfer offices.

The startups that develop and commercialize CEA technologies mainly address markets like low-carbon energy, health, and digital systems, licensing the CEA’s patents and playing a pivotal role in getting CEA technologies to the market.

The CEA has its own venture capital fund, CEA Investissement, and created deep tech fund Supernova Invest with Amundi. With a total of around 100 investments and more than 70 companies in its portfolio, Supernova Invest now enjoys a unique track record in deep tech, resulting in 30 successful exits and six IPOs.

You will find a selection of the CEA’s startups in this booklet.



The numbers

LEADING RESEARCH ORGANIZATION BY NUMBER OF **PATENTS FILED**, WITH MORE THAN **700 ANNUALLY**

Represented among the **TOP 100 MOST INNOVATIVE COMPANIES IN THE WORLD** FOR MORE THAN 10 YEARS

Strong entrepreneurial momentum, with more than **250 STARTUPS** CREATED SINCE 1972

EXCELLENT SUPPORT FOR STARTUP PROJECTS TO ENSURE THEIR LONG-TERM SUCCESS: **10-YEAR SURVIVAL RATE > 80%**

Over **1 billion EUROS** raised by CEA startups in the LAST 15 YEARS

8 INITIAL PUBLIC OFFERING

6,000+ JOBS CREATED in future-oriented sectors by CEA startups

2023 figures. Sources: INPI and EPO 2022 data for patents, Clarivate data



Startups are only the beginning

Sovereign industrial capacities in key sectors also paramount

Startups are not the only kinds of companies born at the CEA. Joint ventures and corporate subsidiaries are also vehicles for bringing CEA innovations into France's sovereign enterprises. Cogema (now Orano) was created to develop the CEA's uranium production activities in 1976, for example. Genvia (hydrogen) and STMicroelectronics (semiconductors) have similar histories. These CEA spinoffs have what it takes to support a sovereign industrial economy in France that can create jobs and drive growth domestically while competing economically in Europe and beyond.

Genvia



In September 2020, the French government unveiled a green hydrogen plan that underscored the necessity to invest in hydrogen to help accelerate the energy transition and establish a sovereign domestic hydrogen industry. The purpose of the plan was to ensure France didn't miss out on the opportunities, both at home and across Europe, presented by the nascent hydrogen market.

Genvia was created on March 1, 2021 in response to this major challenge with the CEA, via its venture capital arm, CEA Investissement; Schlumberger (now SLB); VINCI Construction; Vicat; and the Occitanie regional government's investment vehicle, Agence Régionale Energie Climat Occitanie, as its founding investors. The company will ratchet up R&D on a CEA-developed SOEC (solid oxide electrolyzer cell) technology. SOECs are currently deemed to be the most efficient way to produce green hydrogen at a cost that will allow the technology to be scaled up and successfully commercialized.

Genvia is not a startup, but rather a joint venture with SLB, whose know-how will be critical to bringing the technology to the market. The investors are committed to Genvia remaining in France.

Whether it is in Europe or globally, green hydrogen technologies like Genvia's are top of mind. Genvia is one of France's main beneficiaries of the EU's Important Project of Common European Interest (IPCEI) on hydrogen, an offensive strategy to boost green hydrogen market ramp-up. This latest-generation SOEC could play a major role in decarbonizing key industrial sectors. Genvia is planning to release its solution in 2030 with the ambition of becoming Europe's market leader.

Semiconductors: from startups to global leaders

Since 1972, some 76 startups have been created to develop and commercialize CEA-Leti technologies. An impressive 60 of these ventures are still in operation or have achieved successful exits or IPOs (2022 figures). CEA-Leti startups are technology providers to innovation-intensive industries in virtually all sectors of the economy. The entrepreneurial momentum generated by these companies has snowballed into a strong "three valley" semiconductor ecosystem in and around the city of Grenoble, in the French Alps.

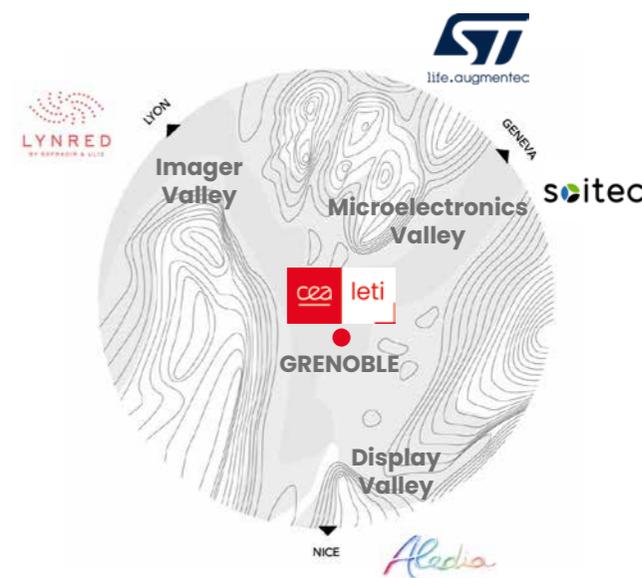
Soitec, founded in 1992 by four CEA-Leti employees, is located in the valley that runs east from Grenoble to Geneva. The company's SmartCut™ technology has propelled it to the top of the global semiconductor materials market. In 2023, Soitec cut the ribbon on a new plant to manufacture its SmartSiC™ wafers.

Chip industry heavyweight STMicroelectronics is located right up the road from Soitec. The company was created in 1972 as Efcis, then a CEA-Leti subsidiary and the first-ever CEA spinoff. A joint STMicroelectronics-GlobalFoundries megafab under construction next to the existing STMicroelectronics plant will reach full capacity by 2026 to become a pillar of Europe's sovereign chip industry. In 2023, Soitec and STMicroelectronics employed more than 9,000 people in the Grenoble area.

The valley that runs to the north from Grenoble to Lyon is home to LYNRED, a CEA-Leti spinoff formed from the merger between infrared detector manufacturers Sofradir and Ulis. LYNRED currently employs around 1,000 people.

Aledia, which was founded in 2012, chose the valley that runs south from Grenoble towards Nice as its home. The company's R&D center employs 230 people, and a new plant slated to go online in 2024 will add 500 more employees to Aledia's headcount.

These CEA-Leti spinoffs have created more than 10,000 direct jobs in the Grenoble area. The presence of these companies has also attracted manufacturers like Applied Materials and Thales (with its 2,000 employees) to the area.



Source: *Se réinventer au XXI^e siècle* by Benoît Ployoust for Le Dauphiné Libéré in partnership with CEA Grenoble

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AIHERD

Smart livestock monitoring

■ AI to automatically detect pathologies and behaviors of interest in dairy cows and suckler cattle

With AiHerd, intensive and semi-intensive dairy and cattle farms can now automatically detect pathologies like mastitis or lameness and behaviors of interest such as heat or imminent calving. This unique technology, the only one of its kind worldwide, improves animal welfare, is practical and convenient for farmers, and can increase productivity by up to several hundred euros per head per year, depending on the size and type of farm.

AiHerd is powered by an AI-enabled computer vision technology that keeps a constant watch over individual and herd activity, tracking things like feeding and resting, distances covered, and movements characteristic of certain states. The AI automatically picks up the unique signatures of important events like heat, imminent calving, or the onset of disease. AiHerd's correct identification rate is superior to that of competing solutions.

This automated decision-assistance solution lightens the farmer's workload, supports animal welfare, and boosts productivity. AiHerd is fully configurable for each farm's unique layout and organization. Users can block off restricted areas, create groups of cattle, and configure rules and alerts, all via a very simple interface.

AiHerd was founded by a veterinarian specializing in herd health. He turned to the CEA and Thales to help develop the high-performance, AI-enabled video surveillance technology that makes AiHerd possible. The company currently has an R&D contract with the CEA.

30%
ANNUAL PER-HEAD
**PRODUCTIVITY
INCREASE**

Year founded
2020

Key markets
• Dairy farms
• Suckler farms

Technology
• Artificial-intelligence-enabled computer vision
• Data analytics

DIGITAL ■





ALEDIA

3D microLEDs for next-generation displays

■ Smartphone displays that are 5x brighter and 2x more energy efficient than conventional displays at the same price

Aledia's brighter and more energy-efficient 3D microLEDs are ushering in a new era in backlighting for displays of all kinds, from virtual reality headsets to video walls.

Aledia, founded in 2011, offers 3D lighting devices for displays of all sizes. With brightness up to 2,000 times higher than OLEDs and LCDs, better image quality, increased contrast, and low production costs, the company's products are unique on the global market. The 3D microLEDs are protected by 250 patent families, making Aledia the number-one French startup for the number of patents filed.

The company, which was housed by the CEA until 2019, today employs 230 people at its own 4,000 m² R&D center. It is also building a production plant that will total 52,000 m². Collaboration with the CEA continues through a joint laboratory that develops advanced technologies.

The brightness and energy efficiency of Aledia's 3D microLEDs will eventually reduce the battery requirements of a smartphone or laptop by half. Not only will this facilitate outdoor use, but it will also reduce dependence on strategic metals like lithium, cobalt, and manganese. Aledia also targets many other markets, from microdisplays for virtual reality headsets to huge video walls.



www.aledia.com

ALEDIA'S
3D MICROLEDs ARE
2,000x
BRIGHTER THAN
OLEDs OR LCDs

Year founded
2011

Key markets

- Video walls
- Large television displays
- Premium smartphones
- PCs
- Virtual reality headsets

Technology

- Gallium nitride nanowires
- Epitaxial growth on 8" or 12" (200 mm or 300 mm) silicon wafers



ALKALEE

Specialized software company in real-time embedded systems engineering

■ Ultra-high-performance software suite to enhance the agility of mobility industry

New use cases, trends like the development of systems including autonomy functions, and a changing regulatory landscape are driving a profound transformation in the mobility industry. And software is at the heart of it all. Alkalee was founded to help mobility stakeholders make this strategic shift. The company's innovative software solution centralizes all of mobile object functions on a single compact and flexible high-performance computer and ensures the operating safety of all on-board electronics.

Alkalee was founded in 2020 to develop joint research by car maker Renault and the CEA. The partners tasked their top experts with accelerating the automotive electronics revolution and helping create a new mobility experience. The result is a slate of solutions that enable smooth, ultra-customizable, and safe operation.

CEA scientists brought their expertise in formal methods and model-driven engineering tools to the table. Their multidisciplinary approach spanning on-board software, electronics, and design tools was decisive in the development of Alkalee's solutions. The startup is now tackling cybersecurity and the integration of its software into its customers' environments.

20%
REDUCTION
IN SYSTEM
VALIDATIONS

Year founded
2020

Key markets

- Mobility industry: UAVs, automotive, etc
- Construction
- Agricultural vehicles
- Defense

Technology

- Formal methods,
- Model-driven systems engineering



www.alkalee.fr



ARCURE

Smart on-vehicle pedestrian detection system

■ Life-saving AI-powered pedestrian detection system for safer, less accident-prone industrial vehicles

Arcure's Blaxtair® systems prevent collisions between moving vehicles and pedestrians in industrial environments and on construction sites. Two-thirds of the company's business comes from export sales.

Contact between moving industrial and construction vehicles and pedestrians causes 10,000 serious accidents per year in Europe. Blaxtair® intelligent vision systems prevent these collisions and save lives. They detect all pedestrians, whether they're standing, squatting, or partially hidden by an obstruction—even in extreme temperatures, dust, low lighting, and other challenging conditions.

Blaxtair® is built on a particularly robust and reliable detection technology that avoids false alarms and nuisance alerts so that operators can work safely and confidently. Because they know the system will alert them to dangerous situations and automatically stop the vehicle in the event of an emergency, operators can concentrate on

the task at hand. Plus, the data collected feeds hazard maps, which can be used for targeted preventive measures.

Arcure is present in virtually all industries, including recycling and construction. It is based in Paris and opened a Chicago subsidiary in 2019.

Its technology is protected by eight patents. Together with the CEA, it has created a joint laboratory where it develops new image processing algorithms.

ARCURE
BLAXTAIR®

www.blaxtair.com

A BLAXTAIR® SYSTEM TAKES
200 milliseconds
TO DETECT A PEDESTRIAN IN THE VICINITY OF A MOVING VEHICLE

Year founded
2009

Frequently-equipped vehicles

- Forklifts
- Loaders
- Excavators
- Bulldozers

Technology

- 3D vision and image processing algorithms
- Deep learning on the Edge



ARYBALLE

Artificial nose with a digital sense of smell

■ Simple odor analysis system with high reproducibility and reliable measurement for industrial use cases

Aryballe's artificial nose detects odors and compares them with references in an odor library, helping manufacturers develop new products and carry out quality controls.

Founded in 2014, the startup Aryballe offers its NeOse Advance odor sensor worldwide. It has a portfolio of 40 patents (including five CEA patents) and an exceptional database of 250,000 olfactory signatures.

Identifying odors is difficult—factors like humidity, the number of odorous molecules, and variations in concentrations can skew the data. Measuring less than a cubic centimeter, Aryballe's bio-inspired electronic nose meets industry standards of reliability and reproducibility and can discern hundreds of odors. The startup also offers services like remote analysis dashboards, odor studies, and more.

Based in Grenoble, Aryballe has subsidiaries in New York and Seoul and invests heavily in R&D. The company's joint laboratory with the CEA is working on more compact and efficient silicon sensors, as well as on selecting new biosensors.

THE ARYBALLE DATABASE HAS
250,000
DIFFERENT
OLFACTORY SIGNATURES

Year founded
2014

Key markets

- Cosmetics and perfumes
- Automotive
- Agriculture & food systems
- Household appliances
- Healthcare

Technology

- Silicon photonic sensors compatible with biosensor grafting
- Olfactory database and machine learning tools

aryballe
The Digital Olfaction Company

www.aryballe.com



ASYGN designs advanced analog circuits for sensors, radio frequency communications, and artificial intelligence.

ASYGN's microelectronics and analog circuit technologies, protected by seven patents, underpin the company's catalog of high-value-added fabless solutions for niche markets like satellite telecommunications and high-performance inertial sensors. The company can also develop ASICs and have them volume manufactured, in the millions of units. ASYGN circuits offer advantages like very low power consumption, precision measurement, and very low noise.

Integrators seeking ASICs more specific than what is available on the broader market turn to ASYGN. For example, the company has combined sensors with RFID to enable self-powering on-demand remote measurement, and designed energy-efficient neural networks for real-time image processing for its customers.

ASYGN was founded in 2008 by a team of four from the CEA and STMicroelectronics—two of whom are still managing the company. Funding its own growth at every stage, ASYGN has blossomed into a company with 45 employees with subsidiaries in the United States and Denmark.

ASYGN generates 50% of its revenue from international sales and is a partner of choice for startups seeking ASICs and custom circuit designs.

ASYGN

www.asygn.com

ASYGN

High-performance circuits for sensors, telecommunications, and AI

■ Custom circuits for very specific use cases optimized for individual customers' needs

O Joule

ASYGN SENSORS ARE **SELF-POWERING**: THEY RUN SOLELY ON THE ENERGY SENT BY THE REMOTE RFID READER

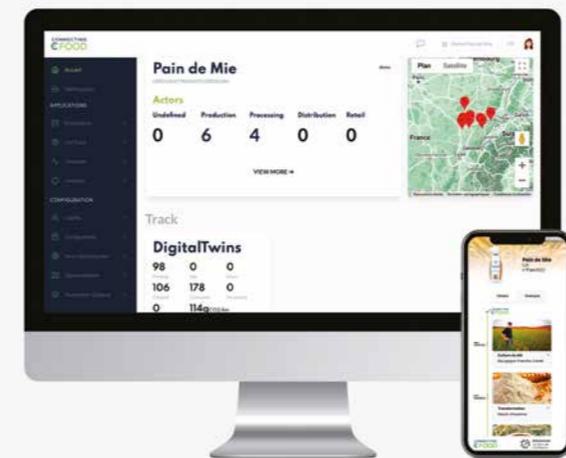
Year founded
2008

Key markets

- Industrial metrology
- Telecommunications satellites
- Artificial intelligence
- Autonomous vehicles & navigation systems

Technology

- Ultra-low-power analog circuits
- Radio frequency circuits for electronic scanning antennas
- RFID-enabled passive sensor circuits
- Interface circuits for high-performance inertial MEMS



Connecting Food is a SaaS supply chain management solution that food industry stakeholders can use to manage, verify, and visualize in real-time all product-related data from end to end of the supply chain.

With Connecting Food, manufacturers can turn their data into actionable information about product traceability, quality, and sustainability—everything they need to reduce risk and effectively respond to any crises that occur. Manufacturers will be able to prove they are keeping their promises to consumers and gather consumer feedback.

Connecting Food's unique, product-centered approach was developed specifically for the complexities of food industry supply chains. The solution is built on three main pillars:

- Digital twins: An unlimited amount of data can be collected for each batch throughout the product's life cycle, aggregated, updated, and displayed in real time.

- Live audits: Digital audits and real-time alerts ensure the data and underlying products are compliant.
- Blockchain: Contributors own their own data, privacy is guaranteed, and access to data is configurable.

Connecting Food has been working with the CEA since 2018 to improve the technology. The rapidly-growing company sells its solution in several European countries, the United States, and in Asia.



www.connecting-food.com

CONNECTING FOOD

Blockchain-based platform managing food supply chains and transparency

■ A solution that enables food players to manage and authenticate product data from farm to fork

6 855

FOOD-INDUSTRY STAKEHOLDERS REGULARLY **ENTER DATA INTO THE CONNECTING FOOD PLATFORM**

Year founded
2016

Key markets

- Food manufacturing
- Retail
- Industries sourcing from agriculture (food, textile, cosmetics, leather goods, nutraceuticals)

Technology

- Blockchain
- Digital twin
- Graph theory
- Machine learning



DIAMSENS

In situ water quality monitoring

■ *More reliable testing and lower operating costs thanks to the unique properties of diamonds*

Diamond-quality water monitoring is what Grenoble-based startup Diamsens has created, with an innovative new range of electrochemical sensors that leverage the unique properties of diamonds. The high performance, durable, and low maintenance solution is manufactured using standard semiconductor processes, so it is also affordable. Synthetic diamonds offer a range of benefits for both industrial users and consumers.

The Diamsens continuous water quality monitoring solution will satisfy the needs of both BtoC and BtoB markets. In the swimming pool market, individuals will soon be able to simply and accurately measure the chlorine content of their pool in real time, a luxury only municipal swimming pools could previously afford. On a larger scale, the Diamsens solution will appeal to manufacturers who want to reduce sensor maintenance costs—the diamond sensor surfaces can clean themselves using a patented electrical technique.

To develop its innovative testing system, Diamsens built on the expertise of CEA laboratories to synthesize its diamonds and develop a proof-of-concept prototype. The partners intend to pursue their collaboration for the long haul, giving the startup access to the CEA's unrivalled fabrication and characterization resources.



www.diamsens.com

MAINTENANCE COSTS DIVIDED BY

5 COMPARED TO CONVENTIONAL SENSORS

Year founded
2022

Key markets

- Swimming pools
- Drinking water and sewage treatment
- Agriculture: fertilizer concentration control, water reuse
- Environment: monitoring of natural environments
- Industry: effluent control, water reuse

Technology

- Synthetic diamond
- Electrochemical sensors



ELICHENS

Greenhouse gas detection and monitoring

■ *Lower carbon emissions, better occupational safety, and fewer costly gas leaks*

eLichens miniaturized, connected, ultra-low-power, high-performance sensors continuously measure the levels of carbon dioxide (CO₂) and methane (CH₄) in the air.

Startup eLichens has developed particularly innovative gas sensors in partnership with the CEA. Dedicated to the detection of carbon dioxide and methane, two of the main greenhouse gases, these sensors are six times smaller than their direct competitors, consume ten times less energy, and remain drift-free over their entire fifteen-years lifespan.

The infrared sensors are coupled with data fusion and analysis tools to detect the presence of gases, measure their concentrations, and issue alerts if necessary. The objective is threefold: to guarantee health and safety at work and at home, to reduce the cost of leaks (e.g. on distribution networks), and to limit environmental impacts.

With a portfolio of 59 patents (including 19 CEA patents), eLichens generates 90% of its revenue from exports. It is developing even more sensitive gas micro-leak sensors in a joint laboratory with the CEA. For methane alone, these leaks represent losses of several thousand tons per year.



www.elichens.com

ELICHENS GAS SENSORS CONSUME

10x less THAN COMPETING PRODUCTS FOR **EXCEPTIONALLY LONG BATTERY LIFE**

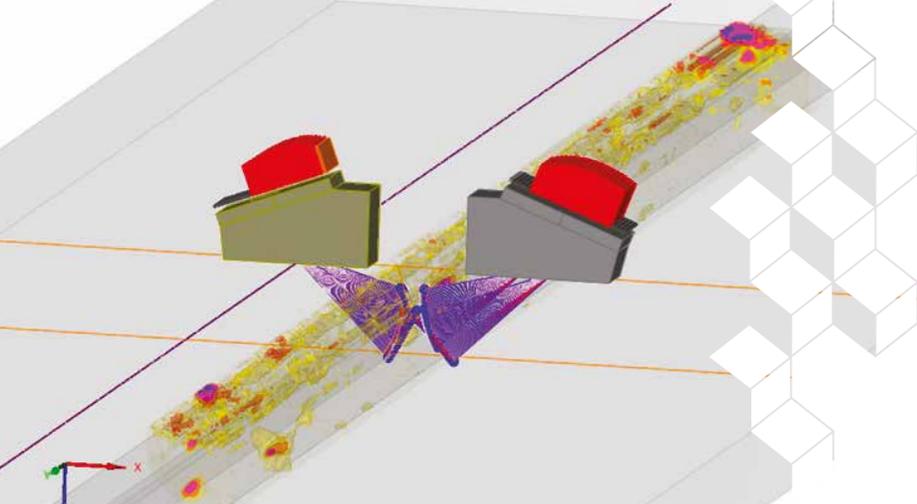
Year founded
2014

Key markets

- Industrial safety
- Natural gas supply and distribution
- Indoor air quality monitoring

Technology

- Very low power NDIR (Non-Dispersive Infrared Detection) gas sensors
- Data fusion and analysis software
- IoT devices



EXTENDE

CIVA
non-destructive
testing software
training

- Helping industrial companies harness the full potential of the world's most widely used NDT simulator

Extende trains users on CIVA non-destructive testing (NDT) software and offers custom engineering and R&D services.

The CEA has been developing CIVA since the 1990s. Today, the software covers the most commonly used non-destructive testing and structural health monitoring (SHM) techniques, including ultrasound, eddy current, radiography, guided wave testing, and thermography. The CIVA suite also has Script and Data Science modules to further improve the user experience. Today, some 350 companies in 41 countries representing the energy, aeronautics, transportation, petrochemical, and other industries use CIVA to simulate and optimize their future inspections. CIVA helps these companies improve defect detection and analysis while keeping inspection costs down.

Extende, the exclusive distributor of CIVA software, trains around a hundred engineers every year on CIVA and NDT reliability. The company is also the creator of TrainDE, the world's first-ever simulator for field training

on ultrasound and radiography testing.

Finally, Extende brings its customers support and engineering services and can also help them draw up NDT specifications, demonstrate the performance of NDT protocols, prepare for NDT qualification, and determine probability of detection (PoD). The company's R&D activities, designed to constantly improve the available NDT tools, span both in-house projects and projects with and for external partners.

Feature requests can be sent to Extende, which submits them to the CEA's 30-strong team of CIVA developers and engineers. Extende is located in the Greater Paris area, and has a subsidiary in the United States and distributors in China, Japan, India, and South Korea.

EXTENDE
CIVA

www.extende.com

EXTENDE SERVES

350
USER
COMPANIES
IN 41 COUNTRIES
WORLDWIDE

Year founded
2010

Key markets

- Nuclear
- Oil & Gas
- Rail
- Aeronautics
- Aerospace

Technology

- CIVA software



ISORG

Large-area
image sensors
on plastic and glass

- A large-area sensor technology that enables silicon-equivalent optical performance at a competitive cost

Isorg transforms plastic and glass into interactive surfaces that can identify people, objects, and movements. Fingerprint sensors are the main target market.

Isorg's optical sensors are made from innovative organic materials printed onto glass or plastic, bypassing the need for vacuum or high-temperature processes. The sensors are fully recyclable at the end of their useful life.

They deliver the optical performance of silicon sensors but, due to the much larger surface area, are more cost effective. This is especially true for fingerprint sensors, the startup's main target market.

Isorg products are used in smartphones, where they transform entire screens into fingerprint scanners. They also lend themselves to police, security, and controlled access applications. Isorg fingerprint modules are so reliable that two are certified by the FBI.

Isorg's technologies are protected by more than 80 families of patents. The CEA hosts and jointly operates an R&D pilot line for the development of sensor manufacturing processes with Isorg.

ISORG IS FRANCE'S
SECOND-LEADING SMB
FOR PATENTS

WITH MORE
THAN **80**
FAMILIES

Year founded
2010

Key markets

- Smartphones
- Security, biometrics, and identification
- Automotive

Technology

- Organic materials deposited as liquids onto large glass or plastic surfaces
- High-throughput printing

isorg
www.isorg.fr



ISYBOT

Cobots
for industrial
sanding

■ Quality reproducible sanding for more productive factories, and higher-skilled factory jobs with fewer repetitive manual tasks

Lightweight, easy-to-program, and safe robots that can either work independently or assist a human operator: Isybot is reinventing jobs like sanding, polishing, and grinding.

Thanks to the CEA's force-sensor-free actuation technologies protected by seven patents, Isybot's cobots (collaborative robots) are simple, precise, lightweight, and safe for the operators they assist. Their initial setup takes only two hours. To program a new task, all the operator needs to do is carry it out manually; the cobot will memorize the movements and control the direction and intensity of the tasks to be replicated. The operator can also designate a rectangular area for the cobot to sand exclusively within.

In just a few years, Isybot has gained a glowing reputation for large-surface industrial sanding, particularly in aeronautics, rail, and shipbuilding. Its cobots improve productivity, reduce the arduousness of manual tasks, and achieve reproducibly

high-quality sanding. They also help make jobs that are hard to fill more attractive.

The startup is working in a joint laboratory with the CEA to develop a new heavy-load cobot (20 kg, compared to the current 10 kg model) and evaluate other use cases, like non destructive testing.



www.isybot.com

A TECHNICIAN CAN
LEARN TO USE THE
ISYBOT COBOT IN
2 hours

WITHOUT THE NEED FOR
SPECIAL TRAINING OR THE
AID OF A ROBOTICS EXPERT

Year founded
2016

Key markets

- Large-area industrial sanding
- Polishing
- Grinding
- Non-destructive testing

Technology

- Ball ramp, screw, and cable actuators
- Force measurements via motor currents



IUMTEK

Real-time
in situ industrial
chemical
analyzers

■ Real-time industrial process quality and safety monitoring for better, faster, cleaner, and cheaper production

iUMTEK analyzers identify the chemicals present in a liquid, solid, or gas 10 to 30 times faster than laboratory analysis and with results that are more representative of the medium being tested.

The startup iUMTEK employs an analytical technique that NASA uses for its Mars rovers: LIBS, or laser-induced breakdown spectroscopy. Based on more than 25 years of R&D by the CEA and Orano, iUMTEK is helping industrial customers test liquids, solids, and gases.

No sampling or sample preparation is necessary to do a test, and the results are more representative of the medium being tested than laboratory analysis. The analyzer works at distances of up to several meters and in a range of configurations: above a molten bath, through a window, or even inside a vessel. Each chemical present is identified and quantified, so that the exact composition of the medium can be known.

iUMTEK has sold several devices to research centers for diagnostic use. At the same time, it is developing a solution for in-line industrial process monitoring. One potential use would be for companies that use recycled raw materials in their manufacturing processes to check the composition of the materials upline from the process.

iUMTEK is developing this technology for new use cases as part of an R&D agreement with the CEA. It also holds licenses to five CEA LIBS patents.



www.iumtek.com

THE IUMTEK ANALYZER IS
THE ONLY ONE CAPABLE OF
IDENTIFYING THE

118

ELEMENTS OF THE
MENDELEEV PERIODIC TABLE
USING THE SAME INSTRUMENT,
REGARDLESS OF THE PHASE OF
THE MATERIAL ANALYZED

Year founded
2017

Key markets

- Government and private-sector research centers
- Small Modular Reactors (SMR/MSR)
- Metallurgy
- Recycling

Technology

- Laser ablation of liquid, solid, or gaseous material
- Emission spectroscopy analysis
- Artificial intelligence



KALRAY

Hardware and software solutions for intensive, high-performance data-centric computing, from Cloud to Edge

- For smarter, better performing, and more energy efficient data-intensive applications and infrastructures

Decades-old processors can't always cope efficiently with today's huge data volumes. Kalray is responding to this new landscape with processors, accelerator cards and software designed to deliver exceptional performance.

It's a CEA spin-off that's already proven itself a pioneer in intelligent processors, with its MPPA® DPU processor—currently Europe's only high-performance, lowpower DPU processor dedicated to intensive data processing and one that offers one of the most competitive performance per dollar/watt ratios around. Protected by 30 patent families, it is an 80-core processor that can manage several applications simultaneously with guaranteed processing times and performance.

This DPU processor only consumes a few dozen watts. It is programmable with standard languages, offers high-speed interfaces, and delivers real-time, on-the-fly data processing. It is integrated onto Kalray's K200-LP™ accelerator card.

Kalray also offers software-defined solutions for data storage and management.

The French company has operations in France, Germany, the United Kingdom, the United States and Japan.

Its partnership with the CEA continues through collaborative projects, particularly on ultrahigh-performance processors.



www.kalrayinc.com

THE KALRAY PROCESSOR IS

**UP TO 5x
MORE EFFICIENT**

(PERFORMANCE PER DOLLAR/WATT)
VERSUS COMPETING SOLUTIONS IN
SOME CUSTOMER USE CASES

Year founded
2008

Key markets

- Data centers
- 5G infrastructure
- Edge computing (automotive, industry 4.0, etc.)

Technology

- DPU processors, based on a massively parallel 80-core MPPA® architecture
- High-performance programmable accelerator cards, incorporating Kalray DPU processors
- Software-defined solutions for data storage and management



KENTYOU

Data intelligence for smarter cities

- Tools to help communities navigate digital transformation

Kentyou helps cities harness digital technology to build smarter, more sustainable urban environments. This Grenoble startup develops digital twins based on open-source technologies and offers IoT solutions for simple, transparent connectivity with existing systems.

Cities are sitting on mountains of data—IoT devices and open data platforms being the main sources. Kentyou's mission is twofold: firstly, to facilitate data access, unification, and processing. Secondly, to help communities obtain actionable information for decision-making. Kentyou's philosophy is open source: The technology leverages an interoperable platform (sensiNact) that supports twenty different IoT communications protocols (ZigBee, LoRa, Sigfox, etc.). Any one of these protocols can be used to remotely access unified data sources, and new data sources can be integrated in less than 10 minutes. The number of use cases is staggering, from city traffic optimization to pollution and climate data applications.

Kentyou's innovation is the result of nearly ten years of CEA research in the fields of artificial intelligence and data platforms. Partnering with the CEA allowed the startup to connect with many municipalities around the world. Today, its solution is being rolled out in fifteen cities in Europe, South Korea, and Japan.



www.kentyou.com

**10
minutes**
THE AVERAGE TIME
IT TAKES
TO INTEGRATE
A NEW DATA SOURCE

Year founded
2020

Key markets

- Transportation and mobility
- Buildings
- Government

Technology

- AI and sensiNact data platform



KRONO-SAFE

Automated development of real-time embedded applications

- Faster, cheaper development of safe-by-construction real-time applications

Krono-Safe's Asterios® software automates the development of real-time applications, guarantees their safety, and helps keep projects on schedule. Customers include Safran, which chose Asterios® as its companywide solution, as well as Alstom, Aptiv, and Schneider Electric.

The Krono-Safe Asterios® software suite is the result of fifteen years of R&D at the CEA in operating safety in the nuclear and automotive industries. Protected by six patents, the software automates the spatio-temporal integration of real-time embedded applications. Advantages for users include shorter design cycles, sustained high performance, reliable and reproducible application behavior, and more.

Operating safety and adherence to a given application's time constraints are guaranteed by construction. Users also benefit from a simulation environment and 30% to 40% faster integration into hardware platforms.

The time savings are even more significant when porting existing applications to multi-core processors—down to just a few weeks from a year with conventional tools. These advantages have attracted many customers, including Safran, which has made Asterios® its companywide solution for real-time embedded systems.

In January 2022, the American automotive equipment manufacturer Aptiv acquired Krono-Safe Automotive.



www.krono-safe.com

SAFRAN REDUCED THE TIME IT TAKES TO DEVELOP ITS REAL-TIME EMBEDDED APPLICATIONS BY

40%

THANKS TO KRONO-SAFE TOOLS

Year founded
2011

Key markets

- Aeronautics and space
- Defense
- Automotive
- Industrial IoT

Technology

- Automated development of real-time embedded applications
- Safe by construction
- Porting existing applications to multi-core processors



MICROOLED

Miniature OLED displays and modules

- Crisp, sharp images and long battery life for augmented reality and other innovative applications

With high image quality, very low power consumption, and competitive cost, Microoled's miniature displays and modules are equipped to stand up to the global display industry's leading products. Augmented reality is their prime target market.

Thanks to an OLED technology originally developed by the CEA, startup Microoled has made waves in the market for microdisplays—tiny screens measuring less than 2 cm diagonally. High luminance, stellar image quality, and very low power consumption have earned Microoled a slot as the second-largest supplier in the world behind Sony.

The company has expanded its offering to ultra-light (7-gram) microdisplay modules for connected sports eyewear. Users can view heart rate, speed, distance, elevation gain, and other performance data collected by their smartphone or watch. The microdisplays are also ideal for augmented reality for GPS navigation and

access to train schedules or tourist information, for example. Microoled offers an open development platform to facilitate the creation of applications compatible with its products.

The startup is collaborating with the CEA on high-luminance color microdisplays and holds licenses to several CEA patents.

AT JUST **1 MILLIWATT**, MICROOLED'S ACTIVELOOK DISPLAY **CONSUMES 30X LESS ENERGY** THAN THE COMPETITION

Year founded
2007

Key markets

- Binoculars and scopes
- Cameras
- Connected sports eyewear for augmented reality

Technology

- High-luminance, ultra-low power OLED displays
- Microdisplay modules for augmented reality



www.microoled.net



PRIMO1D

RFID tags
in textile threads

■ Digital identification
for inventory management
and the circular economy

Primo1D replaces rigid RFID tags measuring several square centimeters with miniaturized devices that can be integrated into textile threads and that are resistant to washing, chemicals, and high temperatures.

Primo1D miniaturizes the RFID tag almost to the point of invisibility—the startup’s chip can be integrated into textile fibers, car tires, wires and cables, and more. Its read performance is close to 100%, for example during on-the-fly scanning of clothing stored in boxes. In addition, it can withstand the common mechanical, chemical, and thermal stresses it may be subjected to during its useful life.

Also targeted are the car tire and wire and cable markets, where it could provide product traceability and help manage maintenance and repairs.

Primo1D has a portfolio of 24 patents, including eight CEA patents under exclusive license. The company continues to work with CEA laboratories to characterize new RFID tags as needed.

The startup has a production capacity of several million units per year. Its top market is apparel, where it helps manage inventories and support the development of the circular economy—by facilitating the sale of second-hand clothing, clothing rental, and end-of-life recycling.



www.primoid.com

PRIMO 1D RFID
TAGS CAN WITHSTAND

100 MACHINE WASHINGS

Year founded
2013

Key markets

- Apparel
- Automotive tires
- Electrical wire and cable

Technology

- E-Thread™ technology with miniaturized, thread-integrated RFID tags



QUOBLY

Silicon Qubit-based
Quantum Computer

■ The transformational
potential of quantum

With the capacity to solve problems that are currently intractable—even by the world’s most powerful supercomputers—the quantum computer could bring unprecedented benefits to all industries.

Quobly was founded to develop and, ultimately, commercialize the first million-qubit quantum computer. The startup’s strategy is to use proven semiconductor technologies to bring this operable quantum computer to the market.

The technology leverages the physical properties of semiconductors to fabricate quantum dots—the basis for top quality quantum bits (qubits). But Quobly brings an additional asset to the mix: deep expertise in proven semiconductor industry processes that have already been used to manufacture chips with billions of transistors. The startup’s technology plus this clear path to manufacturability will lead to quantum accelerators that deliver truly revolutionary performance.

Quobly’s disruptive innovation expected to make a huge impact, including on France’s technological sovereignty. And all industries will be concerned. Among the early adopters will be industrial companies with strong demand for high-performance computing—especially in the pharmaceutical, energy, and transportation industries.

Created in 2022, Quobly is built on joint research between the CEA and the CNRS and has already generated a portfolio of about 40 patent families. Its three co-founders, from the CEA and CNRS, bring complementary skills essential to the creation of a quantum computer.

1 MILLION QUBITS

POTENTIAL FOR
INTEGRATION ON
A SINGLE CHIP

Year founded
2022

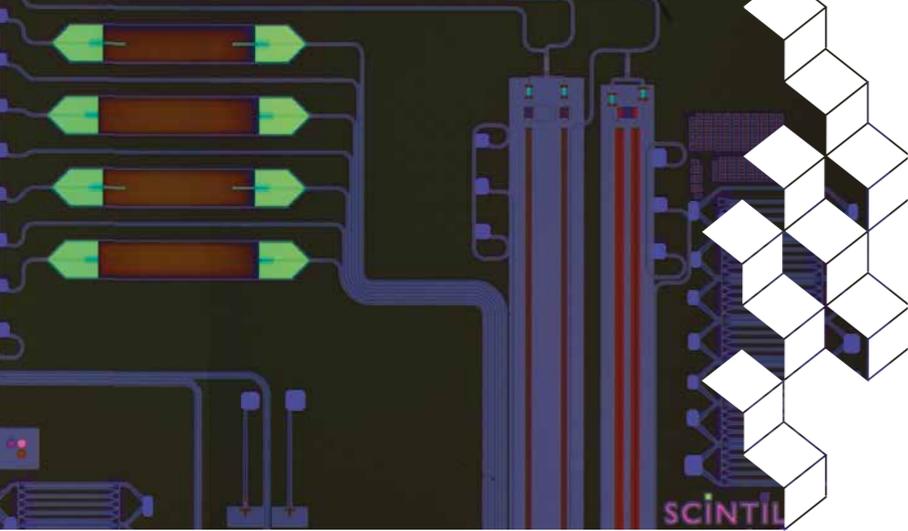
Key markets

- All industries, including health, energy, and transportation

Technology

- FD-SOI semiconductor technology





SCINTIL PHOTONICS

Integrated
silicon photonic
laser sources

■ Volume-manufacturable
integrated photonic circuits
with optimal optical connectivity

Based in Grenoble and Toronto, Scintil Photonics designs and supplies advanced silicon photonic circuits with integrated lasers and optical amplifiers. A breakthrough technology developed by Scintil Photonics paves the way for ultra-fast, compact optical connectivity—key to reducing the power consumption of specialized processors and meeting the exponential computing and data transmission needs of an increasingly connected world.

With its silicon photonic integrated circuits, the startup intends to significantly improve connectivity in high-performance systems and processors. Scintil Photonics develops single-chip solutions that integrate active and passive components manufactured using standard semiconductor industry CMOS silicon photonics processes. This unique, single-chip integration, including lasers and optical amplifiers, enables extremely compact ultra-high-speed communications, from 800 Gbit/s to 3,200 Gbit/s.

Scintil Photonics' technology, which leverages more than fifteen years of CEA laser and silicon photonics research and development, is ideal for data centers and high-performance computing (HPC).

SCINTIL
PHOTONICS

www.scintil-photonics.com

3.2 TERABITS
DATA TRANSMISSION
SPEED TARGET FOR
PHOTONIC INTEGRATED
CIRCUITS

Year founded
2018

Key markets

- Data centers
- Deployment of AI and machine learning in the cloud

Technology

- Integrated silicon photonic laser sources



SNOWPACK

Data anonymity
and security

■ A solution that makes users
invisible on the Internet,
protecting their data,
equipment, and services

Snowpack, with offices in Paris and Vienna, has developed a network invisibility technology that gives users the ultimate in anonymity and security, eliminating the need for trusted third parties on the Internet.

Conventionally, data is exchanged over the internet in the form of packets. The packets include the payload that contains the information of interest, of course, plus the metadata needed to get the payload to its destination. Encryption can shield the useful information from prying eyes, but not the metadata, which can still be used to exploit software and infrastructure vulnerabilities.

Snowpack's unique Virtual & Invisible Private Network (VIPN) technology guarantees a level of security unmatched by existing solutions, without the need to use trusted third parties. The company has solutions to protect access, infrastructure, and web services. Snowpack's breakthrough technology was developed and proof-of-concept demonstrations completed at the CEA.

The solution makes users' access, infrastructure, and services invisible for best-in-breed protection from hackers and mass network surveillance technologies and drastically reduces attack surface.

4 EXCLUSIVE
CYBERSECURITY
PATENTS

Year founded
2021

Key markets

- Cybersecurity software companies
- Organizations that gather online information, in particular law enforcement agencies and cyberthreat intelligence companies
- Businesses and organizations, especially critical infrastructure and service operators

Technology

- VIPN that turns IP packets into "snowflakes" (i.e. anonymous random noise) traveling on separate, anonymously-built circuits over the Internet

snowpack

www.snowpack.eu



SPORT QUANTUM

Connected interactive electronic shooting targets

■ Fun, interactive targets with score sharing and analysis to revolutionize shooting sports

Paper shooting targets will become a thing of the past with electronic displays that offer up not only interchangeable targets, but training and competition management features, too. Shooting sports enthusiasts of all levels are raving about Sport Quantum.

Since 2017, Sport Quantum has been revolutionizing shooting sports by replacing paper targets and mechanical cable devices with an electronic display connected to a tablet. The system electronically locates impacts, calculates scores, and transmits them live.

The screen can display conventional targets, fun patterns, or training targets to improve skills like control or concentration, making it attractive to beginners, experienced practitioners, and top athletes alike. A system that detects shock waves on the polycarbonate plate that protects the display locates impacts to within 100 µm, the precision required in official competitions.

Sport Quantum is growing fast and opened a subsidiary in Germany in 2022. It holds exclusive licenses to four CEA patents and works with the CEA through a joint laboratory to improve the solution's measurement accuracy, the robustness of the target, the operating safety of the competition scoring software, and more.



www.sportquantum.com

SPORT QUANTUM TECHNOLOGY LOCATES THE IMPACTS OF PELLETS AND ROUNDS AT AN ACCURACY OF UP TO

0.1 mm

thanks to **four sensors**

Year founded
2017

Key markets

- Sport shooting clubs
- Official competitions

Technology

- High-brightness screen protected by a polycarbonate plate
- Location of impacts by four piezoelectric sensors
- Collection, processing, and sharing of shooting score data



SteerLight

STEERLIGHT

A new generation of LiDAR sensors

■ Reliable, three-dimensional optical sensors to protect people and goods in motion

SteerLight is a deep tech startup founded in 2022. It has developed a new generation of LiDAR: laser-based optical systems that can perceive the environment in 3D with unparalleled precision and resolution. The quality of these systems translates into decisive advantages in a range of use cases, including guaranteeing that autonomous vehicles and robots can move around safely.

The SteerLight solution is based on a disruptive coherent infrared LiDAR architecture. The LiDAR is fully integrated onto silicon photonic chips using standard microelectronics processes and does not have any moving mechanical parts. Long-range, high-resolution SteerLight LiDAR-on-chip is compact, robust, and—because it is volume-manufacturable—affordable.

It is the result of fifteen years of research in CEA laboratories in the fields of silicon photonics, electronics, and embedded computing. The roadmap for the next few years is packed: the startup will be designing its first product and fundraising to initiate the pre-industrialization phase.

INTEGRATED SENSOR VOLUME
<20 cm³

Year founded
2022

Key markets

- Logistics and manufacturing: mobile autonomous robots
- Urban transportation: people and goods
- Urban security: securing dangerous areas

Technology

- Silicon photonic FMCW architecture

SteerLight

www.steerlight.com



TRUSTINSOFT

Quality and security for C & C++ software

■ Dramatically faster, cheaper verification for guaranteed software reliability and robustness to cyberattacks

TrustInSoft helps software developers achieve source code reliability and immunity to known types of cyberattacks, a unique offering available worldwide.

Using the Frama-C source code analyzer developed by CEA and Inria, TrustInSoft has developed a full suite of C & C++ software analysis tools and services. They provide mathematical evidence of their reliability (zero bugs) and immunity from known types of cyberattacks.

These tools make software validation much, much simpler. Usually, software is validated by performing an array of test attacks, with no way to guarantee that all possible scenarios have been covered. TrustInSoft runs a single analysis and provides guarantees to its customers. In aeronautics industry use cases, software validation time and cost have been reduced by 75%.

The startup holds a license to a CEA patent. Initially focused on critical applications (nuclear, aeronautics), it now focuses on the automotive and consumer electronics industries. It generates 70% of its revenue from exports, 50% from sales to customers in the United States.

TRUST  SOFT

www.trust-in-soft.com

TRUSTINSOFT TOOLS CURRENTLY **57 million** **SECURE** **ELECTRONIC DEVICES,** IN ENERGY, GAMING AND TELECOMS

Year founded
2013

Key markets

- Critical industrial systems
- Automotive
- Consumer electronics

Technology

- Comprehensive analysis of C and C++ source code
- Mathematical proof of code security and reliability



WIN MS

Real-time cable monitoring and diagnostics

■ Expert cable network monitoring for high-uptime production, transportation, and building management equipment

Expert cable network monitoring for high-uptime production, transportation, and building management equipment

The startup WiN MS has built a reputation both in France and internationally on the performance of its fault detection and location solutions for cable networks. The company's technology works with all types of cables: electrical, data, radio, and fiber optic. Its electric arc detection solution, with its extremely low false alarm rate, is, along with several other WiN MS solutions, unique on the market.

These user-friendly solutions are designed for non-experts in the aeronautics, automotive, air transportation, and defense industries. In aeronautical maintenance, for example, they cut troubleshooting time by 80%.

WiN MS solutions can be used for the entire equipment lifecycle, including during service life, making systems and infrastructures more reliable. Arc detection and power

distribution network monitoring provide increased safety. As electric mobility and microgrids gain traction, the opportunities for WiN MS will continue to grow.

The startup has a portfolio of nine patents, including five exclusive CEA patent licenses. WiN MS is present in 20 countries, with subsidiaries in the United States and Singapore.

WIN MS GENERATES **75%** OF ITS REVENUE FROM **EXPORTS**

Year founded
2012

Key markets

- Aeronautics manufacturing and airlines
- Automotive
- Renewable energy, microgrids

Technology

- Detection and localization of faults via reflectometry
- Arc detection



www.win-ms.com



WISE INTEGRATION

Innovative
power electronics

- Chargers that are simpler to use without sacrificing performance

Created in 2020, the startup Wise Integration is offering a disruptive technology that enables industrial customers to manufacture more compact and energy-efficient chargers. It's based on a GaN (gallium nitride) technology developed at the CEA. The properties of this material, leagues ahead of silicon, improve energy conversion performance significantly.

Wise Integration combines a GaN-based integrated circuit with a high-performance control software architecture for much more compact power supply units. Myriads of use cases come to mind, not least of which are consumer electronics—mobile phones, laptops, e-bikes, electric scooters, and more. However, Wise Integration solutions also have a role to play in manufacturing and data centers, allowing them to drastically reduce their energy consumption. The company has international ambitions, particularly in Asia, as demonstrated by the opening of a sales office in Taiwan.

Wise Integration uses WiseGan™ GaN device, a breakthrough developed in CEA laboratories over more than ten years and protected by numerous patents. After the development of a proof-of-concept prototype, the company scaled up the technology for manufacturing and began commercializing its solutions in 2022.



wise-integration.com

CHARGERS

3x
more **COMPACT**
& more **EFFICIENT**

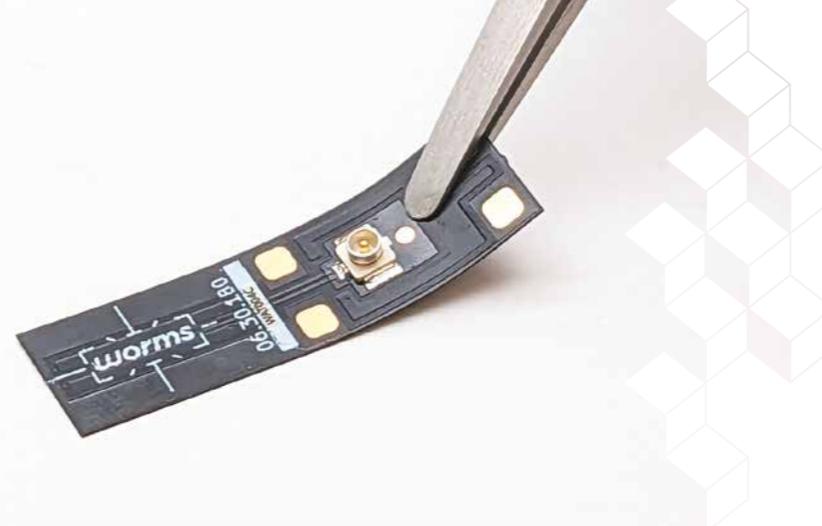
Year founded
2020

Key markets

- Mobile phones/laptops
- Electric mobility (e-bikes, electric scooters, etc.)
- Manufacturing plants and data centers

Technology

- WiseGan™ GaN device
- WiseWare™ digital controller



WORMSENSING

A new sensor for a
revolution in vibration
measurement

- A sensor that can measure vibrations on all types of assets with potential use cases in all industries

Wormsensing has made the first major advance in vibration measurement in over 70 years with sensors that are as sensitive as they are easy to integrate and use.

Today's vibration sensors generally use strain gauges or accelerometers. Wormsensing sensors are 1,000 times more accurate than strain gauges and 10,000 times smaller than accelerometers. The patch-like sensors are no thicker than a human hair, making them quick and easy to apply to virtually any surface in any environment.

Wormsensing sensors are the ideal solution for virtually any industry. Huge structures like wind turbines can be equipped with the sensors for structural health monitoring. The sensors can also slip into tight spaces like the inside of a car door handle to create new user interfaces. Quality and process control can also benefit from these sensors, which can be integrated into machine tools and complex,

technologically-advanced industrial equipment.

The company currently offers an off-the-shelf sensor, Dragonfly®, as well as custom sensors designed to OEM specifications.

Wormsensing was founded by two CEA scientists and is located near the CEA in Grenoble's scientific district, where it operates a pilot line capable of manufacturing up to two million units per year. The company is pursuing its R&D with the CEA through a joint laboratory.

worms

www.wormsensing.com

AT JUST

**150
MICRONS**

WORMSENSING'S
VIBRATION SENSOR IS NO
THICKER THAN A HUMAN HAIR
AND CAN BE USED ANYWHERE

Year founded
2020

Key markets

- Monitoring, Structural Health Monitoring (SHM), Condition Based Maintenance (CBM)
- Event detection
- Vibration analysis
- Quality and process control
- Dynamic weighing and force measurement
- Human-machine interfaces

Technology

- Thin-film (10 μm) piezoelectric ceramic sensing element
- Flexible, conformable electronic substrate



ADEQUABIO

Photosynthetic bacteria to treat agricultural effluents

■ A simple, effective, robust, and maintenance-free solution for the treatment of agricultural effluents containing pesticides

Adequabio uses evaporation and biodegradation in a liquid medium to remove pollution from agricultural effluents. The solution works on its own—no energy-hungry machines or human intervention required.

Adequabio's solution encapsulates more than 25 years of research on photosynthetic bacteria and their capacity to degrade pollutants. Phytobarre, the company's process for treating effluents containing pesticides, is easy to use.

Unlike ozone treatment, light is the only source of energy the bacteria used in Phytobarre need. Plus, the bacteria can be used on any volume of effluent, in any climate, and for any kind of crop. The "set it and forget it" treatment stations do not involve manual operation or maintenance of any kind other than the addition of a fresh batch of bacteria once a year.

The concept has been proven on pesticides, but, given the ability of photosynthetic bacteria to degrade a wide range of organic

pollutants, there is potential for other use cases, especially in the chemical industry. Adequabio is partnering with the CEA, with its advanced bioinformatics and other resources, on research to identify new bacteria candidates.

The company has commissioned around 30 agricultural effluent treatment stations, each serving one or more farms, since 2018. After focusing on the French market in its early years, Adequabio is now gearing up to commercialize its solution across Europe.

ADEQUABIO REMOVES MORE THAN

95%

OF POLLUTION FROM EFFLUENTS

Key markets

- Treatment of agricultural effluents containing pesticides
- Treatment of chemical industry effluents

Technology

- Selection and culture of non-genetically modified photosynthetic bacteria
- Design and installation of treatment plants

HEALTH



www.adequabio.fr



ADMIR

High-speed spectroscopic imaging

■ Faster, simpler, more secure medical diagnostics

ADMIR designs, develops, and manufactures a particularly innovative ultra-fast spectroscopic infrared imaging system that makes bioanalysis more reliable and, above all, 100 times faster. The technology is revolutionizing public health.

ADMIR's instruments, designed for pathologists, biologists, and biochemists, are breaking new ground in cancer, infectious disease, and microplastics screening. The technology developed by the startup turns results around in just one hour vs. the several days needed by current bioanalysis technologies. In addition, it does not require reagents, dyes, biomarkers, or other chemicals, and is more reliable than conventional testing.

Today, ADMIR leverages the CEA's know-how in infrared technology through a portfolio of twelve patents. Its software suite combining instrumentation and artificial intelligence is on track to address new markets other than health.



www.admir-analysis.com

100x
FASTER
BIOANALYSIS

Year founded
2022

Key markets

- Health: Oncology, microbiology, and analysis of microplastics in the body

Technology

- Spectroscopic infrared imaging
- Machine learning



AJELIS

High-performance industrial pollution filters

■ New-generation filters for air and water depollution and strategic metal recycling

Startup Ajelis is the fruit of a partnership between the CEA and Paris-Saclay University. Its new-generation polymer fiber filters are designed for the depollution of liquid and gaseous industrial effluents. The company also offers specialized fibers for the recovery and recycling of metals. This breakthrough innovation is built on a selectively sorbent fiber technology developed at the CEA.

This new generation of filter medium, capable of filtering both pollutants and metals, outperforms conventional activated carbon or resin filter media. First, it can absorb lower metal concentrations, giving users a head start on increasingly stringent environmental standards. Second, fiber selectivity can be adapted to different target metals. Finally, treatment speed is at least ten times faster than that of conventional materials, at one-tenth the treatment cost. And, because the fibers are easy to regenerate, they are more sustainable.

The startup's solutions found success with many industrial customers in France and other European countries practically on day one. This efficient, economically-viable, and more environmentally-friendly technology from Ajelis helps customers create their Factories of the Future.



www.ajelis.com

200

WATER TREATMENT AND METAL RECYCLING PROJECTS SUCCESSFULLY COMPLETED WITH FRENCH AND EUROPEAN CUSTOMERS

Year founded
2014

Key markets

- Depollution of liquid industrial effluents
- Air purification
- Decontamination of nuclear effluents
- Recycling of critical metals
- Mobile treatment units

Technology

- Selectively sorbent polymer nanofibers for toxic and strategic metals



« RAVE HT », by SanaVascular, Tx

Thrombosis is a major complication of percutaneous arterial interventions to open up arteries in the brain and heart. AlchiMedics has developed a coating technology named “Electrografting”, delivering covalently bonded nanometric polymer brushes, that accelerates healing and reduces thrombosis.

AlchiMedics’ grafted polymer coating accelerates the migration of healing endothelial cells from the inner walls of the arteries while inhibiting the proliferation of smooth muscle cells likely to cause occlusion, accelerating the healing of arteries inevitably wounded after a percutaneous intervention. The polymer is electrografted on to the surface of the medical device in a very thin layer (just 150 nanometers thick).

The risks of acute and late stent thrombosis are virtually eliminated once the endothelium is formed, and Dual Anti-Platelet Therapy (DAPT) can be safely interrupted at 6 months (the Pioneer IV trial in Europe is presently assessing safety with 1 month DAPT). The technology has made brain and heart stent intervention safer for

the 1.5 million patients in eleven countries who have already benefited from this technology.

AlchiMedics’ technology is protected by 225 patents, 150 of which belong to the CEA. The company has been commercializing its solution on the Chinese market since 2011 (and has earned CFDA approval), in Europe since 2019 (with the CE marking for its HT Supreme stent), targeting approval in the United States in 2023 (with FDA premarket approval for the RAVE HT stent). AlchiMedics is continuing to improve its coating technologies to bring patients even greater levels of safety and, ultimately, eliminate the need for blood thinners.



ALCHIMEDICS

Electrografted coatings for interventional neurology and cardiology

■ Better arterial healing and a lower risk of thrombosis after percutaneous neurological and coronary interventions

1.5 MILLIONS

PATIENTS WORLDWIDE HAVE STENTS COATED USING ALCHIMEDICS’ TECHNOLOGY

Year founded
2007

Key markets

- Interventional neurology: active stents and flow diverters for intracranial stenosis and the treatment of aneurysms
- Interventional cardiology: coronary and peripheral stents, heart valves

Technology

- Electrografting polymers that promote healing on implantable medical devices
- A biodegradable polymer for the controlled release of the active ingredient
- Biomimetics



AVALUN

A connected, portable biological testing lab

■ Anytime, anywhere biological testing from a single drop of blood

Avalun is the startup behind the LabPad® Evolution, a pocket-sized lab that can perform multiple biological analyses from just a finger prick of blood.

A miniature, automated microscope built from two CMOS sensors is what allows the LabPad® to perform multiple lab-quality measurements. The reagents required for the tests take the form of consumable micro-cartridges. Blood tests can be done anywhere from a single finger prick, and the results are sent via Bluetooth to a smartphone or tablet.

Avalun’s device, widely distributed in France and other European countries, facilitates point-of-care testing in hospitals, and is also of interest to biology laboratories, general practitioners, nurses, nursing homes, and other healthcare stakeholders.

It can measure blood clotting time in patients on anticoagulants, C-reactive protein to detect viral or bacterial infections, and D-dimer if cardiac embolism is suspected.

Founded by two CEA engineers, Avalun’s IP portfolio includes nine CEA patents. In 2021, the startup was acquired by Biosynex.

AVALUN OFFERS THE **LIGHTEST** BIOLOGICAL ANALYSIS DEVICE ON THE MARKET AT ONLY

300 grams

COMPARED TO 1.5 KILOGRAMS FOR ITS CLOSEST CONTENDER

Year founded
2013

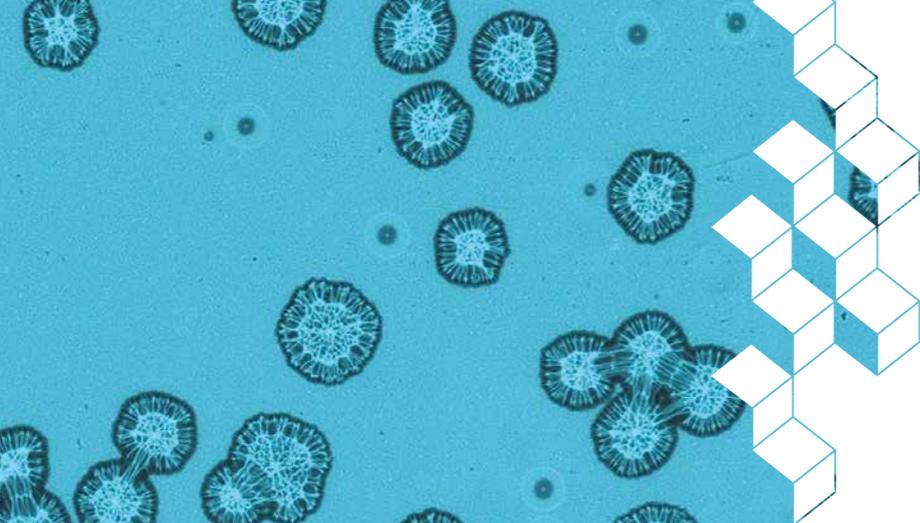
Key markets

- Hospitals
- Outpatient medicine
- Medical offices
- Home care

Technology

- Lensless microscopy
- Microfluidics
- Rapid reading of fluorescent optical measurements
- Transmission of results via Bluetooth





BAIO-DX

Rapid bacteria identification using holographic imaging and AI

■ Antibiotic sensitivity screening results in a quarter of the usual time

BAIO-DX is developing a new medical diagnostic tool that leverages artificial intelligence and lensless holographic imaging. The company's augmented microbiological analyses can identify the bacteria responsible for infection, and then rapidly and automatically indicate the best antibiotic.

To determine which antibiotics will be effective against an infection, biological samples are cultured, and then the bacteria present are identified using MALDI-ToF mass spectrometry. The BAIO-DX lensless holographic imaging device, coupled with artificial intelligence algorithms, accelerates this step. It continuously observes the Petri dish, detects bacteria as soon as they appear, and identifies them without sampling. It then performs an antibiotic sensitivity test.

analysis laboratories, as well as the traceability and reliability of their operations.

BAIO-DX, created in January 2022, conducts tests on patient samples with a prototype in use at the Grenoble Alpes University Medical Center as part of a partnership. The startup, founded by one CEA researcher and one CNRS researcher, holds licenses to four CEA patents.

With this technology, which can be integrated into existing lab processes, healthcare professionals are improving patient care by prescribing better-targeted antibiotics more quickly and slowing the onset of antibiotic resistance. Process automation increases the productivity of

baio-dx

www.baio-dx.com

ACCORDING TO THE WHO, **ANTIMICROBIAL RESISTANCE** COULD CAUSE AROUND

10 million DEATHS WORLDWIDE BY 2050

Year founded
2022

Key markets

- Hospitals
- Private analysis labs

Technology

- Lensless holographic imaging
- Artificial intelligence algorithms



CELL&SOFT

In vitro culture plates for drug discovery

■ Faster, cheaper, more successful drug discovery

Cell&Soft develops flexible, textured culture plates that mimic human tissues for more realistic *in vitro* trials and faster drug discovery.

In vitro cell cultures are plagued by a lack of predictability: 98% of promising results obtained *in vitro* turn out to be clinical failures. The low success rate is due in part to the plastic culture plates used in labs. A million times stiffer than human tissues and organs, the plates subject cells to a very different environment than that of their original organs, skewing the results.

Cell&Soft's hydrogel culture plates mimic the physiological rigidity of the lungs, heart, brain, and other organs and tissues. Several academic research laboratories have confirmed that the cellular models developed on these plates are more realistic, providing *in vivo* conditions for the testing of new drug candidates for cancer, inflammatory diseases, fibrosis, and myopathies.

The startup has developed an initial line of eleven products and co-develops custom plates with biotech companies. The CEA saw the potential of these technologies at an early stage and financed the first market studies.

TODAY, ONLY **1% TO 2%** OF DRUG CANDIDATES TESTED *IN VITRO* ARE **EFFECTIVE IN CLINICAL TRIALS**

CELL&SOFT'S GOAL

10% IS TO INCREASE THIS FIGURE TO

Year founded
2018

Key markets

- Oncology
- Development of stem cells for personalized medicine

Technology

- Synthetic hydrogels designed using microelectronic techniques
- Photopolymerization through lithography masks enables local rigidity representative of a given organ

Cell&Soft
Let's reinvent cell culture!

www.cellandsoft.com



CERES BRAIN THERAPEUTICS

A drug candidate for a rare neurometabolic disease

■ Treatment for a previously untreatable disease to improve quality of life for children, caregivers, and families

Ceres Brain Therapeutics is developing a drug candidate for a rare neurological disease that causes severe intellectual disabilities, autistic behaviors, and seizures. The drug could be made available by 2027.

X-linked creatine transporter deficiency is an inherited disease linked to a genetic mutation on the X chromosome that prevents creatine (an amino acid that provides energy to cells) from reaching neurons. With an initial clinical trial scheduled for 2024, Ceres Brain Therapeutics is currently the company in the world closest to developing a drug for this disease.

Ceres Brain Therapeutics has a portfolio of six patents, including four CEA patents. As part of an R&D agreement with the CEA, the startup is deepening its understanding of the mechanism of its drug candidate and developing new candidates targeted at other rare neurological diseases.

The drug, CBT101, is a pro-creatine that, thanks to a chemical vector graft, can cross the blood-brain barrier, supplying neurons with creatine. Animal tests have shown very significant improvement in cognitive behavior.



www.ceres-brain.com

16,000

ESTIMATED NUMBER OF CHILDREN WORLDWIDE AFFECTED BY CONGENITAL CREATINE TRANSPORTER DEFICIENCY

Year founded 2019

Technology

- Active ingredient coupled with a chemical vector to cross the blood-brain barrier and neuronal membrane
- Nasal administration to reach the brain via the olfactory and trigeminal nerves



DIABELOOP

Interoperable self-learning diabetes management solutions

■ Better blood sugar regulation, a lighter mental load, and improved quality of life for people living with diabetes

Diabeloop's first-of-its-kind solution for automated type 1 diabetes treatment calculates the insulin doses patients need throughout the day and administers them in an automated and personalized manner. The solution is already in use in seven European countries.

People living with type 1 diabetes are constantly at risk of either hypoglycemia or hyperglycemia. To manage the disease, they must perform countless insulin dose calculations every day. And, depending on metabolism, physical activity, and diet, the doses can vary by a factor of three. Diabeloop's DBLG1 System lightens this mental load by continuously monitoring the patient's glucose level, calculating the right insulin dose, and automatically administering it.

Fifteen clinical studies have validated the effectiveness of this device, which improves the regulation of blood sugar levels and patients' quality of life. It obtained CE certification in 2018 and France's national health insurance provider approved the

device for reimbursement in 2021. Diabeloop's product is already available in seven European countries, and the company is now accelerating its international development.

The technology is protected by a portfolio of 21 patents, including ten CEA patents. And, as part of a joint laboratory with the CEA, Diabeloop is continuing to improve its AI algorithm to further refine insulin dose calculation based on each patient's specific needs.



www.diabeloop.com

ONE YEAR AFTER LAUNCH, MORE THAN

10,000

people in Europe

HAVE BEEN EQUIPPED WITH THE DIABELOOP DBLG1 SYSTEM

Year founded 2015

Technology

- Dexcom glucose monitor
- Diabeloop technology compatible with multiple insulin pumps
- Artificial intelligence algorithm for glycemic management: prevention of hypoglycemia, adaptation to carbohydrate and fat intake from meals, physical activity, correction bolus in case of hyperglycemia



DIRECT ANALYSIS

For better food safety

- Detecting microbial contamination four times faster

Detecting bacteria like *Salmonella*, *Listeria* and *E. coli* as quickly as possible on production lines is a major challenge for food manufacturers. The technology developed by startup Direct Analysis cuts PCR test time by 75%. Rapid testing is vital to keeping consumers healthy and limiting product recalls and the associated food waste.

The Direct Analysis detection system is based on state-of-the-art DNA extraction and microfluidics technologies CEA labs have been developing for over ten years. The startup's lab-on-chip makes microbial analysis faster, easier, and more secure.

Direct Analysis has a portfolio of ten patents, including exclusive licenses to CEA patents.

The company's first detection system was commercialized in a simplified version in 2022 and will be ready for large-scale deployment in 2024.



www.direct-analysis.com

DETECTS BACTERIA

4x
faster than
conventional
tests

Year founded
2021

Key markets

- Food manufacturing and farming: production plants and analysis laboratories

Technology

- Microfluidics
- DNA extraction
- Biomolecule detection (PCR)



ECLYPIA

Non-invasive continuous glucose monitoring

- Reliable real-time blood glucose monitoring without painful finger pricks

Eclypia is revolutionizing diabetes care with a non-invasive subcutaneous measurement solution that uses laser illumination to monitor blood glucose.

Painless continuous glucose monitoring could soon replace finger pricks and spot checks for people with diabetes, thanks to a technology developed by Eclypia and protected by 25 patents, including several either co-owned with or under license from the CEA.

The company's wearable solution is placed on the patient's wrist, where the subcutaneous tissue is illuminated by quantum cascade lasers (QCL). The signal produced varies according to the glucose content in the tissue. AI algorithms then process this information to calculate a blood glucose measurement, factoring in not only variations for a single patient, but also from one patient to another.

Eclypia has been working on this solution since 2021, conducting some of its research through a

joint lab with the CEA. The main focus of the company's R&D has been to dramatically lower QCL manufacturing costs and improve the devices' thermal and electronic stability in embedded systems. Eclypia is targeting a product price comparable to existing glucose monitoring systems.

The company's main market will be type 2 diabetes care. However, it will also support lifestyle changes for patients with pre-diabetes and address the health and wellness market, bringing individuals who want to compare their blood sugar levels with dietary choices and physical activity a new solution.

ECLYPIA'S TECHNOLOGY, WHICH DOES AWAY WITH UP TO TEN DAILY FINGER PRICKS, IS PROTECTED BY

25
patents

Year founded
2021

Key markets

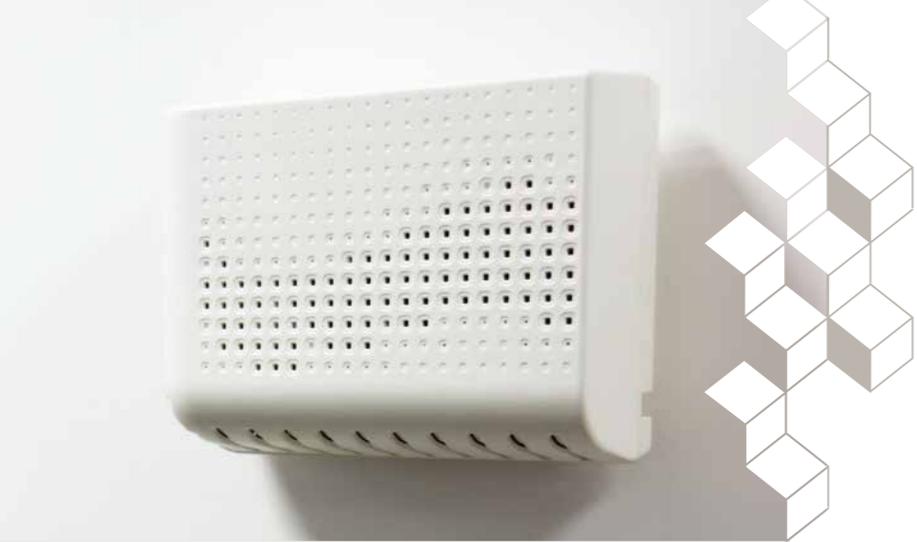
- Type 2 diabetes care
- Pre-diabetes prevention
- Health and wellness

Technology

- System-on-chip with integrated quantum cascade lasers and photoacoustic cell
- AI algorithms for signal processing

ECLYPIA

www.eclypia.com



ETHERA

Air quality monitoring sensors

■ Solutions for controlling both indoor air quality and building energy use

Ethera's compact, accurate, and easy-to-maintain sensors continuously monitor indoor air pollutant concentrations so that building operators can take action.

Building occupants are chronically subjected to air pollutants like formaldehyde, fine particles, nitrogen dioxide, ozone, carbon monoxide, and volatile organic compounds, to name a few. Ethera has developed sensors and measuring stations to detect them, quantify them, and report any readings that exceed regulatory thresholds.

In particular, these services help optimize building ventilation strategies to guarantee air quality without letting more heat out of the building than necessary.

The startup, a SEB company, holds exclusive licenses to two CEA patents.

These miniaturized, energy-efficient devices achieve the same level of sensitivity (one microgram/m³) as laboratory measurements—and they do it in real time, on-site, and at a much lower cost.

Ethera combines these solutions with services for collecting, managing, displaying, sharing, and post-processing data.



www.ethera-labs.com

ETHERA SENSORS

DETECT formaldehyde, the primary indoor air pollutant, at a **record sensitivity** of **7 ppb**

Year founded
2010

Key markets

- Commercial buildings
- Smart buildings
- Schools
- Swimming pools and sports facilities

Technology

- Porous materials functionalized to react to pollutants
- Data collection, processing, and provision
- Post-processing of data to control air purifiers, ventilation systems, etc.



FLUOPTICS

Fluorescence imaging for surgery

■ Image-guided surgery for improved patient care and fewer complications

Fluoptics imaging systems highlight features like the exact locations of the parathyroid glands or tissue vascularization during procedures, making it a valuable tool for surgeons.

Surgeons conventionally rely on diagnostic imaging done in advance to prepare for their procedures. Fluoptics provides them with additional real-time information invisible to the naked eye: its cameras detect contrast media circulating in the vascular or lymphatic systems or accumulating in a lymph node or vessel.

This allows surgeons to operate with even greater precision, for far more effective procedures and a vastly reduced risk of damage to healthy tissues. Fluoptics technologies were developed and validated by clinicians across the globe and are currently sold in more than 20 countries.

Fluoptics is the result of more than 10 years of research in CEA laboratories. Today the startup is a world leader in fluorescence imaging for thyroid surgery. It is also active in breast reconstruction surgery. Acquired in 2022 by the Swedish company Getinge, Fluoptics possesses a portfolio of 20 patents, including ten CEA patents for which it has exclusive licenses.

SINCE ITS INCEPTION IN 2009, **FLUOPTICS** HAS COMMISSIONED MORE THAN **500** IMAGING SYSTEMS

Year founded
2009

Key markets

- Thyroid surgery
- Reconstructive surgery
- Lymphatic surgery

Technology

- Fluorescence imaging
- Detection of contrast media through biological tissues
- Images as accurate as X-ray



www.fluoptics.com



MAG4HEALTH

More affordable
magnetoencephalography

■ A powerful, competitive new neuroimaging technology to improve the treatment of brain conditions

Magnetoencephalography is a powerful brain imaging technique, but it is not helping as many patients as it could due to its high cost. Mag4Health is democratizing MEG scans with a device that is more versatile and just as powerful as conventional machines but at one-third the cost.

Mag4Health utilizes a magnetometry technology developed over two decades of CEA space research. The startup is bringing this twelve-times-patented innovation to healthcare, where it is reshaping magnetoencephalography.

Mag4health's quantum sensors operate at ambient temperature, replacing conventional sensors that need to be cooled to -269 °C with a cryostat. The magnetic shielding required is ten times lighter, which means that the sensors can be placed on a helmet, in contact with the patient's skull, for better brain signal reception. The simplicity of the device opens the door to many use cases, including image acquisition on moving patients or children.

The total purchase and maintenance cost of these machines is one third that of conventional machines for the same level of performance. Mag4Health has now eliminated the main obstacle to the development of the only imaging technology that can record and locate all brain activity. Currently there are only around 150 MEG scanners in the world, and just five in France. The startup plans to ship its first products at the end of 2023.



www.mag4health.com



REMEDEE LABS

Endorphin
stimulation for
chronic pain relief

■ A customizable, drug-free long-term pain treatment solution for better quality of life

Remedee Labs has developed the first millimeter-wave-emitting bracelet that stimulates the production of endorphins, the body's natural analgesics. It also offers an online service platform to bring patients multidisciplinary pain management backed by personalized support.

Millimeter-wave treatment was used successfully on millions of pain patients in the 1970s. Over time, however, the treatment, which could only be administered in hospitals due to the large equipment used, has been replaced by pain medication. Remedee Labs is putting millimeter-wave technology at everyone's fingertips with a simple bracelet equipped with a microelectronic chip that stimulates natural endorphin production.

Two clinical studies have confirmed the effectiveness of this solution with patients suffering from fibromyalgia and osteoarthritis, at Grenoble University Medical Center. The goal is to obtain medical device approval for the bracelet in 2024.

The startup is offering an initial non-medical bracelet, Remedee Well, to improve users' day-to-day well being. The package includes the bracelet plus access to the online platform.

Remedee Labs is collaborating with the CEA on imaging-based brain evaluation of the physiological effects of its technology.



www.remedeelabs.com

12 MILLION PEOPLE IN FRANCE SUFFER FROM CHRONIC PAIN, AND

70% OF THEM DO NOT RECEIVE APPROPRIATE TREATMENT

Year founded
2016

Possible uses (clinical trials in progress)

- Fibromyalgia
- Osteoarthritis
- Chronic migraines

Technology

- 2 cm² miniaturized electronic module integrated into a bracelet
- 60 GHz millimeter-wave-emitting silicon chip



SUBLIMED

Relieving osteoarthritis knee pain via neurostimulation

- Pain relief for a rapid return to normal activities and better quality of life

Sublimed relieves chronic pain associated with osteoarthritis of the knee using a discreet and flexible transcutaneous neurostimulation patch. It is available in France and several European countries.

Transcutaneous electrical neurostimulation has been used for 30 years to fight chronic pain. It inhibits pain signals and triggers the secretion of endorphins, the body's natural analgesics. However, conventional equipment is cumbersome and impractical; 40% of patients give up using it for practicality reasons.

The startup Sublimed, born from the meeting between a CEA engineer and a pain center doctor, now offers a lightweight, miniaturized, and discreet device controlled via smartphone. A clinical study carried out on 110 patients confirmed its effectiveness for osteoarthritis of the knee, a result that led France's national health insurance provider to approve the device for reimbursement. Thanks to a web

platform, the patient can find their neurostimulation data and track quality of life indicators like sleep and resumption of walking and other daily activities.

Sublimed is based on a portfolio of six patents, including five CEA patents under license. It is collaborating with university medical centers to improve its technology and has been FDA-approved for the US market since 2021. The startup was acquired by Expanscience laboratories in 2023.


SUBLIMED
www.subli-med.fr

MORE THAN
35,000
PATIENTS
 IN FRANCE HAVE ALREADY
 USED THE **ACTITENS**
 SOLUTION DEVELOPED BY
 SUBLIMED

Year founded
 2015

Prescribed for
 • Osteoarthritis of the knee

Technology
 • Slim, conformable pulse generator patch
 • Miniaturized, wireless skin electrodes
 • Remote electronic control



THERANEXUS

Treatment for rare neurological diseases

- Innovative drug candidates for devastating and currently-untreatable neurological diseases

Theranexus is an innovative biopharmaceutical company born from the CEA. It is developing what is currently the most advanced drug candidate in the world to slow the progression of Juvenile Batten disease, a neurodegenerative disorder that affects children starting at the age of four. The drug could be made available in 2026.

Batten disease is a genetic disorder that affects children as young as four. It results in loss of vision, motor and cognitive impairment, and seizures. There is no treatment available, and the disease is fatal after 20–25 years on average.

Batten-1, the drug candidate developed by Theranexus in partnership with the US-based Beyond Batten Disease Foundation, addresses this condition by targeting both neurons and astrocytes, non-neuronal brain cells. It acts on the process that recycles toxic molecules from cells, which the disease disrupts. Theranexus will begin a pivotal clinical trial in 2023, with the hope of getting the drug onto the market in 2026.

Beyond this flagship project, Theranexus, a startup created by two CEA researchers, is working collaboratively with the CEA to discover other innovative therapy drugs. Possible future avenues include targeting one or more of the 40 rare neurological conditions close to Batten disease.

RARE NEUROLOGICAL
 DISEASES FOR WHICH
NO TREATMENT EXISTS
 AFFECT
350 MILLION
PEOPLE WORLDWIDE

Year founded
 2013

Prescribed for
 • Treatment of Batten disease

Technology
 • Proprietary pharmaceutical specialty
 • Action mechanism: prevents brain cell death by blocking glycosphingolipid accumulation and neuroinflammation
 • Method of administration: oral solution


THERANEXUS
www.theranexus.com



V4CURE

Treatment of
cardio-renal
pathologies with
animal toxins

■ *Develop a new class of drugs for millions of patients suffering from cardio-renal diseases without a therapeutic solution*

V4Cure is based on CEA research into the use of animal toxins as therapeutic molecules. The start-up is focusing its efforts on one of them, V4C-232, which could be used for two cardio-renal diseases.

V4C-232 is derived from a toxin contained in the venom of the mamba, a sub-Saharan African snake whose bite is fatal to humans. The CEA has established and validated through preclinical studies the efficacy of this molecule on two pathologies, hyponatremia and polycystic kidney disease.

V4Cure is primarily developing the indication of hyponatremia, which is manifested by a low level of sodium in the blood. The neurological symptoms of this condition can lead to seizures, coma and even death. V4C-232 can provide a safe and effective response to control the concentration of sodium in the blood (natraemia).

The start-up is conducting pharmacological development studies and will then launch phase 1 and 2 clinical studies. At the same time, it is pursuing R&D work with the CEA on the use of V4C-232 in the treatment of polycystic kidney disease, a chronic genetic disorder currently considered incurable; it affects one person in 1,000.

V4Cure was created by three founders, including one from the CEA. Two patents have been filed by the CEA to date.

10 MILLIONS

NUMBER OF **PATIENTS**
IN WESTERN COUNTRIES
FOR WHOM THE DRUG
CANDIDATE WOULD PROVIDE
A **THERAPEUTIC RESPONSE**

Year founded
2023

Indications

- Hyponatremia resistant to current treatments
- Polycystic kidney disease

Technology

- Active ingredient: peptide
- V4C-232 is derived from a toxin extracted from mamba venom
- Dosage form: injection

v4cure

www.v4cure.com





APIX ANALYTICS

In situ analysis of industrial gases and liquids

■ *Real time, in-process measurement for higher yields and better product quality*

Apix Analytics is bringing industrial gas and liquid analysis to a wide market with its miniaturized gas chromatography modules. They are half the price and ten times the resolution of laboratory equipment.

Apix Analytics leverages advanced silicon technologies developed by the CEA and Caltech and protected by 25 patents to produce miniaturized gas chromatography modules of less than a liter. With the company's continuous on-site analysis solution, users no longer need to send samples to a lab and wait for the results to come back—they can optimize their processes in real time.

The startup's analyzers are simple enough to be used by anyone. They detect all gases and liquids, from hydrogen to heavy oils—a versatility unmatched on the market.

These compact and competitive analyzers can carry out quality controls, verify the correct level of odorization of natural gas, or calculate caloric value for pricing purposes.

Apix Analytics is developing new generations of multi-gas detectors with the CEA. Its customers include major energy companies such as Air Liquide, Engie, and TotalEnergies.

APIX ANALYTICS
HAS ALREADY DEPLOYED
500
SYSTEMS
TO INDUSTRIAL SITES
WORLDWIDE

Year founded
2014

- Key markets**
- Renewable natural gas (RNG) production
 - Natural gas production
 - Hydrogen energy industry

- Technology**
- Nano electromechanical systems (NEMS)
 - Miniaturization and integration of the gas chromatography chain into a 0.7-liter module

ENERGY ■



www.apixanalytics.com



DISTRICTLAB

Optimized thermal grid design and operation

■ Software to detect and eliminate 100% of avoidable energy losses on thermal grids for lower costs and reduced environmental impacts

DistrictLab is developing and commercializing a novel thermal grid design and optimization software application. The software, initially developed at the CEA, can be used on all district thermal grids, regardless of size, generation of technology, or renewable energy penetration rate.

District thermal grids are becoming more and more complex and the penetration of “non-manageable” sources is increasing. Unfortunately, the available management software has not kept up with these trends. DistrictLab is filling the gap with its design and optimization software. Two of France’s three largest thermal grids (Grenoble and Metz) and a grid in Switzerland (Lausanne) are already putting the software to use.

DistrictLab’s solution allows users to rapidly deploy a digital twin of the grid during design or operation. Known or possible operating conditions are reproduced in the simulation so that the software can calculate the best configurations for financial profitability and energy-efficiency.

Thermal grid operators can reduce thermal input power, forecast peak demand, curtail the use of

additional generators, integrate more renewable energy, prepare for new customer hookups, simulate extreme temperatures, and more. In terms of financial savings, operators can lower costs by as much as 15% at the design stage, and between 2% and 6% during operation when the software is deployed on existing grids.

One of DistrictLab’s two founders is from CEA. The company is now commercializing its Districtlab-H solution and is developing new features through an R&D contract with CEA and a corporate partner. Initially, DistrictLab will target Europe and, in particular France, where 1,300 district thermal grids are expected to be commissioned or their capacity increased by 2035.



www.districtlab.eu

DISTRICTLAB CAN **REDUCE THE COST OF BUILDING A THERMAL GRID** BY UP TO

15%

Year founded
2023

Key markets

- Independent thermal grids
- Large thermal grid operators
- Engineering firms

Technology

- Physics simulation software
- Extensive scenario and analytics features



EXTRACTHIVE

A recycled carbon fiber that’s easy on the environment

■ An eco-friendly, competitively-priced, high performance product for a more secure carbon fiber supply chain

Extracthive recovers carbon fiber from used composite parts and gives it a second life in new parts. An initial industrial demonstrator will launch in 2023.

Carbon-fiber composites are booming, with an 11% CAGR expected over the next decade. However, producing new carbon fibers generates 20 tons to 40 tons of carbon dioxide (CO₂) per ton produced. Extracthive is developing a process for recycling carbon-fiber-containing composite materials. Called solvolysis, the process, which reduces CO₂ emissions by 80%, separates the matrix from the fiber with a heated solvent.

The recovered fiber does not cost any more than new fiber and achieves 98% of its fracture toughness and tensile strength. It is compatible with multiple polymer matrices.

Tests are underway with sporting goods, boat, and aeronautics manufacturers to validate its performance under representative conditions.

Extracthive is based on more than ten years of CEA R&D and continues to collaborate with CEA researchers on lifecycle analysis (LCA), fiber characterization, and degraded polymer resin recycling. In 2023, it will launch an initial industrial demonstrator in France, where its customers are. At the same time, it is developing new recycling processes for lithium batteries and silicon carbide, used in chemistry and metallurgy.



www.extracthive-industry.com

THROUGHOUT ITS USEFUL LIFE, EXTRACTHIVE’S **RECYCLED CARBON FIBER PRODUCES**

80%
LESS GREENHOUSE GASES THAN NEW FIBER

Year founded
2015

Key markets

- Boating
- Sports and recreation
- Electric vehicles

Technology

- Solvolysis of end-of-life composite parts
- Matrix depolymerization, carbon fiber recovery
- Solvent regeneration and reuse



FLUIIDD

Industrial process fluid monitoring

- A solution that minimizes costly downtime and makes processes more energy efficient

Fluidd detects anything that can disrupt industrial process fluid flows—from air bubbles to foreign bodies, agglomerates, fouling, and clogging—at a fraction of the cost of X-ray tomography.

An early-career scientist at the CEA founded Fluidd to make industrial process fluid monitoring available to the masses. The company's high-performance detection solution—electrodes integrated into the pipework, an electronic circuit, and an embedded artificial intelligence—is easy to deploy.

The solution reconstructs images of the cross-section of the pipe and fluid flow, and then flags anything abnormal. Operators can use the information to make informed decisions like whether an emergency shutdown is needed, or, if the problem has been located, schedule a shutdown later.

The solution can detect air bubbles indicative of leaks, as well as foreign bodies, agglomerates (clumps of solid materials), build-up of material on pipe walls, clogging, and plugging.

It also takes density measurements in multi-phase flows. In the future, Fluidd will also help make processes more energy efficient, alerting operators to clogs that cause pressure drops and abnormally high electricity consumption.

The solution, built on electrode and signal processing technologies protected by five CEA patents, can be used in all kinds of industrial facilities, even in extreme conditions. It has been tested at 600 °C and 250 bar and reconstructs images at fluid flow rates greater than 1,000 kph. Fluidd is pursuing R&D to further improve the solution through a joint lab with the CEA.



www.fluidd.com

THE FLUIIDD SYSTEM CAN CAPTURE UP TO

31 250

IMAGES PER SECOND, sufficient to monitor fluids moving at 300 meters per second

Year founded
2023

Key markets

- Farming and food manufacturing
- Pharmaceuticals and cosmetics
- Water treatment and distribution
- Process industries in general

Technology

- Low-current industrial scanner
- Innovative electrodes integrated into the pipe wall
- Artificial intelligence



HELIUP

Ultralight roof-mounted photovoltaic panels

- Rooftops that generate revenue and secure electricity rates for 20 years

HELIUP is a startup specializing in the development and production of lightweight photovoltaic panels for large roofs on existing buildings.

The roofs of many industrial and commercial buildings are not compatible with conventional solar photovoltaic panels, which, with their supporting structures, weigh 15 kg/m². A Heliup innovation reduces PV panel weight by more than 60% without sacrificing profitability. The electricity generated can be used by the building or fed back into the grid for income.

The reduced weight is made possible by ultra-thin glass that provides both mechanical and physicochemical protection for the PV cells. This innovation is protected by two CEA patents for which Heliup holds exclusive licenses. This innovative technology has obtained the various levels of certification essential for its intended application.

The startup, which is investing in a 100 MWp/year production line, will bring the product to market in the second half of 2023, targeting large construction and energy companies. The company has signed a collaboration agreement with the CEA to further improve the panel's performance and industrialize it.

HELIUP ROOF-MOUNTED PHOTOVOLTAIC PANELS WEIGH

5 KG/M², COMPARED TO **15 KG/M²** FOR CONVENTIONAL PANELS INCLUDING THE MOUNTING STRUCTURE

Year founded
2022

Key markets

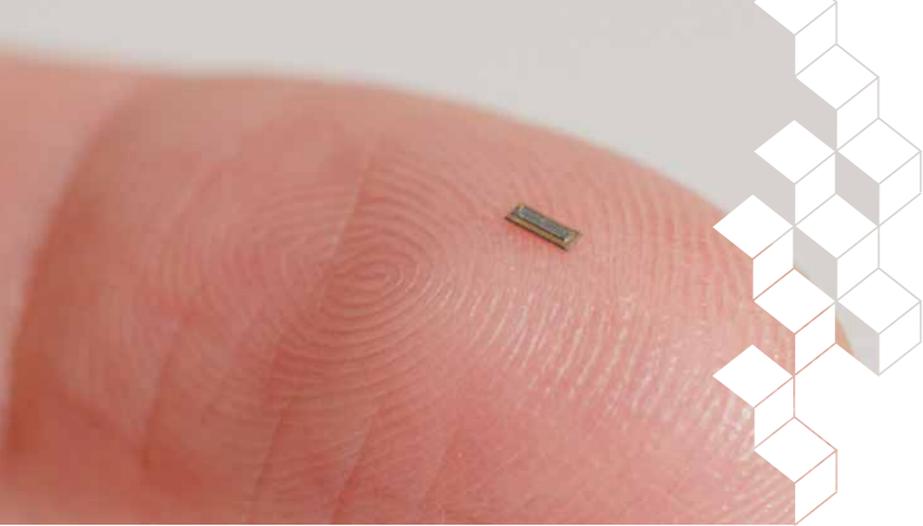
- Industrial and commercial buildings
- Warehouses
- Retail
- Agricultural buildings

Technology

- Lightweight, high-strength glass capable of protecting photovoltaic cells
- Innovative roofing systems for flat and sloped roofs



www.heliup-solar.com



INJECTPOWER

A new generation of microbatteries for implantable medical devices

- Non-invasive continuous intraocular, intracranial, and blood pressure monitoring

Today, one of the major challenges for implantable medical devices is battery size. Injectpower is addressing this challenge with a new generation of rechargeable microbatteries for longer-lasting, less invasive medical devices.

Injectpower is revolutionizing the microbattery market by offering ultra-miniaturized, high-energy-density batteries that are easier to integrate than ever before. The rechargeable microbatteries have a lifetime of more than ten years, opening the door to new medical applications that require continuous measurement. Implantable eye-pressure monitors could finally make the effective treatment of glaucoma a reality. Innovations in continuous post-stroke monitoring and blood pressure monitoring could dramatically improve the management of neurological and cardiovascular disease.

The startup Injectpower is the result of more than eighteen years of microbattery R&D at the CEA—a long scientific adventure that has generated more than 40 patent families. The company holds an exclusive license to a CEA patent for the medical field.


www.injectpwr.com

10x THINNER ENERGY DENSITY
10-YEAR LIFESPAN

Year founded
2020

Key markets

- Ophthalmology
- Neurology
- Cardiology

Technology

- Microbatteries, solid thin-film technology



INOCEL

Compact, very-high-power, high-performance fuel cells

- A faster transition from fossil fuels to efficient and clean energy to decarbonize mobility and stationary energy storage

Inocel, with its PEMFC (proton exchange membrane fuel cell) technology, is removing hurdles to the widespread adoption of fuel cells. The company's fuel cell, which offers unrivalled power for its size, will be available in a 300 kW format in 2024.

Inocel's very-high-power PEMFC is based on two years of research and development conducted by 30 scientists and engineers. The company holds licenses to fifteen CEA patents on the technology, which has set a new state of the art in terms of power for a fuel cell this compact. At just 100 kg and 110 liters for the 300 kW version, the fuel cell is three times more powerful for its size than the solutions currently on the market.

Several modules can be combined to build systems from 300 kW to 3 MW, with the latter packaged in a standard shipping container. The fuel cell achieves efficiencies of 60% and a lifespan that puts it at the state of the art.

And it is also very responsive, ramping up to full power in just 1.5 seconds.

The startup, which has set up shop in at 2,000 m² facility in Grenoble, has 35 employees, and continues to work with the CEA on R&D, taking advantage of the organization's advanced development and testing capabilities to optimize the technology.


www.inocel.com

FOR ITS SIZE, INOCEL'S FUEL CELL IS **3x** MORE POWERFUL THAN OTHER FUEL CELLS ON THE MARKET

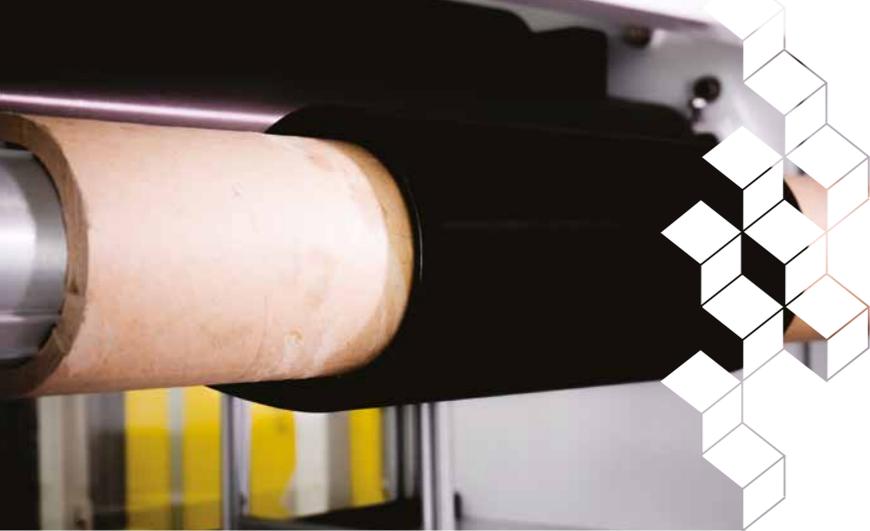
Year founded
2022

Key markets

- Maritime transportation
- Heavy land vehicles: trucks, buses, construction vehicles
- Stationary applications: commercial buildings, multi-unit residential buildings

Technology

- High-power PEMFC
- Integration into all kinds of energy systems



NAWA TECHNOLOGIES

Environmentally friendly batteries to combat climate change

- Faster, more sustainable, and more ethical energy storage

NAWATEchnologies is a deep tech startup tackling climate change head on with a new generation of batteries. The company is developing and commercializing batteries with higher capacities, faster charging speeds, and longer lifespans. Its electrode material made from aligned carbon nanotube mats is helping revolutionize batteries.

A novel manufacturing process guarantees top performance for phones, IoT devices, vehicles, and more. The material is solvent-free, made from CO₂ captured from the atmosphere, recyclable, and can be bio sourced, making it an excellent contributor to the fight against climate change and the preservation of natural resources.

NAWATEchnologies is leveraging a technology developed over 20 years of CEA research conducted in collaboration with Cergy Paris and Tours Universities, mainly on the development of a carbon nanotube-based material that packs in more than 300 billion nanotubes per cm². This innovation makes NAWATEchnologies a world pioneer in this type of material.

NAWA
TECHNOLOGIES

www.nawatechnologies.com

CARS CHARGED
IN LESS THAN

**10
minutes**

Year founded
2013

Key markets

- IoT
- Power tools: cordless handheld tools

Technology

- Carbon nanotube materials



POWERUP

Safer Li-ion batteries, longer battery lifespans, and better asset management

- Software that optimizes the safety, performance, and lifespan of the leading battery technology in operation, Li-ion

As the electrification of the economy takes hold, lithium-ion batteries have emerged as a pillar of the energy transition. PowerUp software monitors lithium-ion batteries during operation, providing actionable insights on battery safety, health, and performance.

The patented algorithms at the heart of PowerUp's software were developed over fifteen years of CEA research with the goal of calculating and monitoring key battery safety, health, and performance indicators while the battery is in use. The solution, proven in hardware implementations, is now available in a non-intrusive SaaS edition backed by expert support, as well as in an on-chip version.

The idea is to help battery-powered equipment owners and operators get the most out of their batteries and minimize downtime throughout the battery's lifetime. PowerUp mainly serves customers in electric mobility and stationary energy storage.

The company's technology is protected by a portfolio of more than ten patents, including several

under exclusive license from the CEA. With a margin of error of just 1% to 2% for battery health indicators, PowerUp's software, backed by the company's unique understanding of battery degradation mechanisms, is much more accurate than conventional BMSs, at 10% on average. More accurate data enables more informed decisions at every stage of the battery lifecycle, from dimensioning and determining optimal operating conditions to preventive maintenance and evaluating the feasibility of second-life applications at the end of a battery's first life.

PowerUp
Manage & extend batteries life

www.powerup-technology.com

POWERUP
EXTENDS BATTERY
LIFESPANS BY AN
AVERAGE OF
2 years

Year founded
2017

Key markets

- Stationary storage for electricity grids
- Electric vehicle fleets

Technology

- Calculation of safety, health, and residual life indicators
- Cloud platform for battery data processing
- Software embedded in customer hardware



STEADYSUN

Solar and wind energy production and weather forecasting

- A reliable solar forecasting service to help energy producers to reduce costs and risks associated with meteorological variability

Steadysun's software predicts solar and wind power plant production with a high degree of precision—anywhere in the world and for any type of solar photovoltaic panel technology and wind turbine. It also provides weather forecasting services.

Solar and wind energy are intermittent and difficult to predict, and therefore does not easily lend itself to production forecasts. Still, power plant operators, grid managers, and electricity traders need it to optimize their operations and maximize profits.

The company, present worldwide, is one of the global leaders in solar forecasting. As part of an R&D agreement with the CEA, it is adapting its tools to tomorrow's panel and networks technologies. Since 2022, it has diversified into weather forecasts, with a service that is 20% more reliable than that of the main players in the field.

Steadysun provides subscription-based forecasting services adapted to customers' particular facilities and prediction needs, with time horizons ranging from a few minutes to two weeks. The software is the result of ten years of CEA R&D and delivers some of the most reliable forecasts in the world calculated from pictures of the sky, satellite images and data, weather forecasts, and site production measurements.



www.steady-sun.com

STEADYSUN'S SOLAR FORECASTING SOFTWARE TRACKS MORE THAN

14,000
PHOTOVOLTAIC PRODUCTION SITES
WORLDWIDE IN 25 COUNTRIES

Year founded
2013

Key markets

- Grid managers
- Plant operators
- Energy traders
- Energy microgrids

Technology

- Statistical approach
- Physical approach
- Artificial intelligence



SYLFEN

Local energy storage and production with a single piece of equipment

- Locally-produced clean energy at a price that competes with major utilities

The same piece of Sylfen equipment can produce hydrogen, electricity, or heat depending on energy prices and user needs. It's a competitive and extremely flexible solution.

The Sylfen Smart Energy Hub is the result of more than twelve years of R&D conducted at the CEA and is protected by nine patents. It is a fully reversible high-temperature electrolyzer that can also be used as a fuel cell. It is available in several versions, from a few dozen to several hundred kilowatts.

In electrolyzer mode, it converts electricity into hydrogen. In fuel cell mode, it produces electricity. Generated heat is recovered as well, which translates to overall efficiency much higher than that of conventional equipment. Battery hybridization allows short-term electricity storage.

User needs determine the appropriate mode of operation: storing renewable energy, powering hydrogen vehicles, recharging batteries, or heating buildings. Sylfen meets user needs by modulating local energy production and consumption and adapting to major utilities' price fluctuations.

SYLFEN IS ONE OF 20 FRENCH STARTUPS ON THE 2022

"FRENCH TECH GREEN20"
LIST

Year founded
2015

Key markets

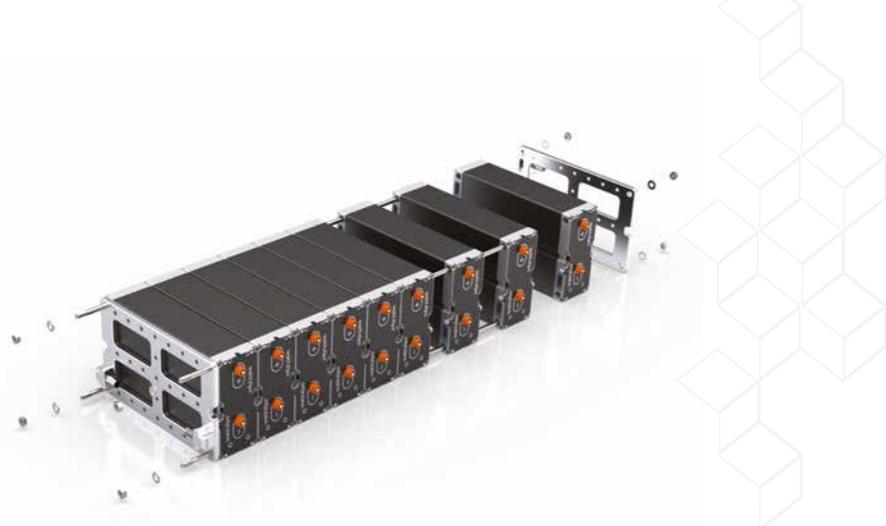
- Public and industrial buildings
- Logistics facilities
- Subsidized housing

Technology

- High temperature electrolyzer (700 °C–800 °C), reversible for fuel cell use



www.sylfen.com



WATTALPS

Energy storage solutions

■ *Safe, high-performance batteries for industrial vehicle electrification*

More efficient, less expensive, and safer—the innovative lithium-ion batteries developed by WattAlps are electrifying a wide range of industrial vehicles, a major technological breakthrough that boosts productivity and profitability. Cleaner, quieter work sites mean that WattAlps batteries are good for the environment and for workers, too.

WattAlps three founders have brought their diverse experiences to a company that has managed to create a breakthrough innovation in only a few years: a modular, immersion-cooled lithium-ion battery. Designed for small and medium series, it offers manufacturers the key advantages of adaptability, performance, and safety. Not to mention savings—the battery's development cost is 20 times lower than that of conventional high-performance batteries.

WattAlps batteries are reusable and recyclable, evidence of the company's commitment to the energy transition.

Two of the three founders of the startup came from the CEA, where they developed and patented the technologies exclusively reserved for today's WattAlps solution.

wattalps

www.wattalps.com

BATTERY FORM FACTORS UP TO

2

MORE COMPACT

Year founded
2018

Key markets

- Industrial and construction vehicles
- Agricultural machinery
- Logistics
- Maritime
- Niche vehicles: sports cars, vintage cars, etc.

Technology

- Lithium-ion batteries with immersion cooling

DIGITAL

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