MINA-NEWS
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MINATEC
NEWSLETTER
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TOP NEWS

Clinatec's innovative neuroprosthesis and exoskeleton protected by eighteen patents

Clinatec's Brain-Computer Interface (BCI) project was recently featured in *The Lancet Neurology and has appeared in the media worldwide. This groundbreaking project shows just how powerful the Clinatec model—medical doctors and technology experts working side-by-side under one roof—is at driving innovation.**

The WIMAGINE® implantable medical device is the first technology brick in Clinatec's BCI project. And, with a level of performance never seen before, WIMAGINE® is truly unique. The 64-channel system measures and digitizes brain signals and transmits them wirelessly and in real time with low noise and remarkable precision.

The algorithms used to decode the brain signals and translate them into the patient's intentions of movement and into commands to control the exoskeleton form the second technology brick of the BCI project. These machine learning algorithms are the focus of the majority of the eighteen patents filed to protect the innovations developed as part of this project.

Last, but not least, the exoskeleton itself is built on existing technology bricks developed for prior CEA robotics programs. The battery-operated four-limb exoskeleton has two integrated computers to ensure the command-control functions. There is nothing else like it anywhere in the world.

Most of the images picked up by the media showed the patient standing. The images may not be as spectacular, but detecting the patient's intentions of movement of the arm and wrist—eight degrees of freedom—is actually much more complicated from a technical standpoint. The BCI project has overcome these challenges and will continue to drive new advances that will help make patients' lives better.

**The research published in* The Lancet Neurology *was co-authored by Alim-Louis Benabid (first author) and 23 other scientists from Leti, List, and Grenoble-Alpes University Medical Center.*

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INNOVATION

Spin-charge conversion: What could be simpler?

An international team that included researchers from IRIG recently presented a simple, yet effective system for converting a spin current into an electrical current. They deposited aluminum onto a strontium titanate ($SrTiO_3$) substrate at room temperature. The aluminum "pumps" the oxygen contained in the substrate and makes it conductive. The spin built up in the 2D electron gas that forms on the surface of the substrate can then be converted into an electrical current. The conversion is modulated using a simple electrostatic grid.

But perhaps what makes the phenomenon truly remarkable is that no ferromagnetic materials are involved. In addition, the conversion factor is between 10 and 100 times higher than with known high-performance materials like platinum. This advance should open the door to the development of new memory and transistor concepts.

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NeoLED heralds new era of transformerless LEDs

You no longer need a power converter to run LEDs directly off of a conventional wall outlet thanks to Leti's new NeoLED distributed architecture. The LEDs are organized into clusters of eight and are constantly reconfigured (in series or parallel) to align their voltage with the voltage delivered by the outlet.

NeoLED does away with the need for high-voltage transistors and chemical capacitors (whose lifespans are much shorter than those of the LEDs themselves). With NeoLED, LED systems are much, much more compact, affordable, and reliable. Plus, it is easy to scale up for high-power applications like public lighting, agricultural greenhouses, and UV water treatment by resizing the low-voltage transistors—the architecture remains exactly the same. Leti has filed a patent to protect this innovation and is currently seeking a manufacturing company to scale up and commercialize the technology.

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Accessing a material's topological electronic properties could get easier

Is it possible to show that the wave function of the electrons in graphene has a unique structure that makes the material so exceptional? The winners of the 2010 Nobel Prize in Physics did it using a simple electrical resistance measurement—which required ultra-pure graphene and a very strong magnetic field.

An international team that included researchers from IRIG recently published their discovery of a new and complementary technique in *Nature*. They used a scanning tunneling microscope (STM) to observe the reorganization of electrons in the vicinity of a hydrogen atom deposited on the surface of the graphene. They observed dislocations in the electronic density that reflect the unique topological structure. This method could provide deeper insights into the properties of materials.

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Wine, cheese, and raspberries on the olfactory biosensor menu

Researchers at IRIG joined forces with a team from Dijon to develop olfactory biosensors capable of fixing and recognizing the aromatic compounds in cheese (hexanoic acid), wine (hexanal), and raspberries (ß-ionone). The researchers designed and tested several genetic variants of proteins from the rat olfactory system for the biosensors. Although their research is still at the proof-of-concept stage, it does bode well for future developments.

The biosensors developed offer the advantages of a very low detection threshold, high selectivity, and good measurement reproducibility. New variants of the proteins could be used to identify other VOCs—a capability that could be useful for industrial and domestic applications. The human nose is very easily "saturated" by VOCs, which makes it difficult for humans to effectively smell these substances.

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The winning duo for surface functionalization

Leti and Liten have combined the performance of silicon and the flexibility of printed electronics to functionalize any planar or curved surface, from window glass and smartphone cases to wristbands and robot fingers. The researchers began work on these advances under a Carnot-funded project. Leti made a test vehicle (a silicon chip thinned to 40 microns, encapsulated, and electrically connected to a polymer die in its cleanrooms). The test vehicle was used to validate the concept, which is now protected by three patents.

They are now preparing an operational demonstrator for the end of 2019. It includes a RFID chip and silicon strain sensor integrated into a die, which will be connected to an antenna printed by Liten on a substrate.

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Measuring stress in children using an exoskeleton

Leti, in research conducted as part of the EU Motion project, which kicked off in September 2019, will develop a method for measuring the stress experienced by children who cannot walk due to neurological disorders when they are in an upright position with the support of an exoskeleton.

Most of the project partners are focusing on the children's exoskeleton. Leti, however, is tackling data fusion. The goal is to combine the physiological data—heart and respiratory rates and electrical conductivity of the skin—measured while the child is using the exoskeleton to create a stress model that shows what the child is feeling (comfort, discomfort, confidence, fear of falling, etc.). Ultimately, the model will power a feedback loop that will adapt the movement (speed, range of motion) of the exoskeleton according to the level of stress felt by the child.

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SOT-MRAM memory now denser

SOT-MRAM is more reliable over the long term and faster than STT-RAM. The problem with SOT-MRAM, however, is that it is bulky. This is because SOT-MRAM typically has two transistors (one read and one write) as opposed to STT-MRAM's single transistor. Researchers from Leti and Spintec have recently partially overcome this challenge with a network of SOT-MRAM memory with a unidirectional diode instead of a read transistor. The result is a 20% increase in density with no adverse effects on speed or endurance.

The majority of the research focused on developing and testing the architecture—especially for the read phase. The researchers are determined to further increase memory density and are currently working on an even more compact architecture.

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Proteomics and the p-value trap

Proteomics researchers are not generally well-trained in statistical methods—which often leads them to use the methods incorrectly, resulting in flawed conclusions. Researchers at IRIG are working on a solution to this problem, and their investigations led to four articles in international journals in 2018 and 2019. In particular, the researchers are looking at the risk of incorrectly interpreting the p-value, which indicates how significant a result is depending on the sample studied.

Proteomics is especially vulnerable to this type of error. Due to advances in spectrometry, proteomics researchers must manipulate growing volumes of data that are becoming more and more complicated to analyze. The IRIG team is raising proteomics researchers' awareness of several issues, from understanding statistics terminology to designing protocols that make it easier to control sample analyses.

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DFT methods boost the design of new enzymes

How can DFT (density functional theory) and small-angle neutron scattering be combined to create new enzymes? The answer is in an article published by an international team that included researchers from IRIG and ILL. The researchers pointed out that DFT, originally used for systems of tens of atoms, can now attain—or even surpass—100,000 atoms. This was made possible by an approach that entails calculating a system's electronic structure from the structure of smaller blocks (like each of a protein's amino acids).

The memory size required and the execution times are kept down to very reasonable levels using this approach. IRIG, which published four articles on wavelet-based DFT methods this year, is working on the topic with researchers from Boston and Kobe (Japan).

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DAY BY DAY

Orphée Cugat wins CNRS innovation medal

G2E Lab research director and magnetic microsystems expert Orphée Cugat will receive the CNRS (France's national center for scientific research) innovation medal on December 12. "The award is being given in my name, but it is the result of the work of an entire team," said Cugat, who hopes that the win will draw attention to the work being done at his lab. Most notably, Cugat and his team contributed to the design and development of products commercialized by MagIA (a portable and ultra-rapid immunological testing kit for infectious diseases) and Enerbee (an energy harvesting system). Cugat is co-founder and scientific advisor to both startups but remains committed to his career as a CNRS researcher. "Our work is at the crossroads of several disciplines and is at scales that are favorable to magnetic forces—an area in which innovation knows no limits."

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Morphosense heads offshore

Morphosense was founded in 2016. Since then, Neuron, the company's sensor-based structural health monitoring solution, has been used on land. Today, the solution, which provides 3D deformation and thee-axis vibration measurements, is ready for offshore applications. Morphosense will respond to the monitoring needs of offshore oil and gas drilling platforms—many of which are nearing the end of their theoretical lifespan of 35 to 50 years. To be able to continue using the platforms, operators must be able to demonstrate that the structures are in good health at all times.

The Neuron system recently obtained ATEX Z1 and Z21 certifications for use in potentially explosive atmospheres, a must for the oil and gas industry. Morphosense, which holds licenses to three Leti patents, is still addressing structures on land and finished equipping at 630-meter-long bridge in Taiwan in June.

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Scintil Photonics levels up with new round of fundraising

Scintil Photonics was founded in 2018 and won the French national i-Lab innovation competition that same year. This year, the Grenoble-based startup is leveling up with a €4 million fundraising round. The influx of funds will push the company from four to thirteen employees by mid-2020 and support the research it is doing under a joint lab with Leti. Scintil Photonics will also build its first prototypes, which it will test with strategic potential customers.

The company holds licenses to around fifteen Leti patents and develops very-high-speed (800 Gbit/s) optical transmitters for the data center market. The devices, including their III-V lasers, are made entirely using wafer-level processes to facilitate volume manufacturing and are three times more cost-effective, energy-efficient, and compact than competing solutions.

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French Academy of Science recognizes Catherine Picart

Catherine Picart (a Grenoble Institute of Technology-Phelma faculty member, LMGP researcher, and, since September 1, director of healthcare research at IRIG) won the French Academy of Science 2019 Émilia Valori award on October 15. The award recognizes a significant contribution to a field likely to have technological applications.

Picart's research definitely fits that description: she specializes in self-assembling polyelectrolyte films for bone regeneration, cancer treatment, and high-throughput in vitro cellular screening. "I hope that this research will one day bring benefits to patients and create jobs," said Picart, who had previously won the CNRS (France's national center for scientific research) silver medal in 2016.

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Jean-Eric Michallet appointed new CEO of Minalogic

Jean-Eric Michallet succeeded Isabelle Guillaume as CEO of Minalogic effective October 1. Michallet previously worked for IBM and has spent the past decade in the regional innovation ecosystem, including at Leti, which he joined in 2013.

His roadmap for Minalogic is to implement the strategy announced last spring when the cluster's government certification was renewed. Specifically, Michallet will coordinate initiatives at the regional level (to ensure Minalogic's presence across the entire region and engage in joint projects with other clusters), at the national level (to support the development of the electronics industry in partnership with digital technology stakeholders), and at the EU level (to submit project proposals and obtain EU certification for the cluster). The ties between Minalogic and MINATEC run deep: Minalogic's Grenoble offices are located at MINATEC and several Minalogic member startups are housed on the MINATEC campus.

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Remedee raises €11 million to develop pain management solution

Remedee, a Grenoble-based startup, is developing a pain management solution based on stimulating the secretion of pain-relieving endorphins. The company recently announced that it had completed a second round of fundraising, bringing in €8.5 million*. Remedee's solution leverages a 1 sq. mm chip developed with Leti that emits very-high-frequency (60 GHz) waves when it comes in contact with the skin, boosting the secretion of endorphins. The solution can do away with the need for analgesics for patients suffering from low to moderate chronic pain.

Since Remedee was founded in late 2016, it has stayed under the radar while completing the development of its system and starting clinical trials. The safety of the technology has been confirmed, and the company is now testing it on post-surgical pain, arthritis, and migraines. The solution is expected to reach the market in 2022.

**The company had previously raised €2.5 million in bootstrapping funds in an unannounced fundraising round in 2017.*

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Diabeloop's artificial pancreas for children earns kudos from EIT

Grenoble-based startup Diabeloop won the European Institute of Innovation & Technology (EIT) InnovEIT award in October for its D4Kids project to develop an automated diabetes-management system for children suffering from type 1 diabetes. The future system will improve patients' quality of life and reduce the occurrence of hypo- and hyperglycemia. The system's graphical user interface was designed to ensure that children can easily understand the data.

The company recently completed three clinical trials at pediatric medical centers in Belgium and France, including Necker Medical Center in Paris. In other news, Diabeloop is waiting for France's healthcare authority to approve the DBLG1 System for adults for coverage under the national healthcare insurance system.

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Lancey Energy Storage raises €8 million

Lancey Energy Storage, which was founded in 2016 and which moved to MINATEC in 2017, raised €8 million this summer. The Grenoble-based startup is developing a smart electric radiator with an integrated storage battery. The product will target the residential and commercial markets. Its lithium-ion battery and electronic regulation system can effectively store the energy from solar panels, help optimize energy production, and reduce heating bills by up to 50%.

This major influx of capital will position the company to scale up its solution for manufacturing and speed up business development in France and other countries. The company's 2020 targets include selling 5,000 units, and then increasing its manufacturing capacities before addressing retail markets in 2021.

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Grenoble Institute of Technology-Phelma faculty member Nadine Commenges-Bernole is a certified Non-violent Communication coach. She coordinates a student support center at the school.

"Our mission is to provide emotional support to the students who need it."

MINA-NEWS: Tell us about the student support center Phelma opened at the beginning of the academic year.
Nadine Commenges-Bernole: As faculty, we often encounter students dealing with emotional challenges. The idea is to support them by giving them a safe space to talk about whatever they are struggling with. Often, they also need to gain clarity on what is really going on for them. The school encouraged this initiative, which is complementary to what is already offered in terms of academic guidance and support.

MINA-NEWS: How does it work?
NC-B: I gave a presentation to each class at the beginning of the school year. We also provided information on the school's website. Students can request an appointment by sending an email to a dedicated address. When the academic dean meets with a student struggling academically, he can also recommend that the student contact us. Appointments are held on campus and last around 90 minutes.

MINA-NEWS: You have met with around ten students since the beginning of the year. What kinds of issues are they dealing with?
NC-B: The students come in because they are feeling lonely or disconnected, or because of personal, family, or money problems. The fact that I am a "neutral" party makes it easier for them to open up. I am neither a school administrator nor a "shrink." I am just there to listen, and everything we talk about is confidential. Of course, if I feel that the student could benefit from more personalized support, I tell them where they can find it.

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Hughes Metras takes over as director of IRT Nanoelec

Hugues Metras has succeeded the soon-to-retire Michel Wolny as director of IRT Nanoelec. Metras came from Leti, where he was in charge of strategic international partnerships.

Metras' arrival coincides with the start of Phase 2 of IRT Nanoelec's development plan. IRT Nanoelec's business model will evolve as government funding for its projects decreases. The next IRT Nanoelec roadmap, for the 2021-2025 period, will focus on three main applications: images, energy conversion, and digital trust. IRT Nanoelec's objective is to develop, for each application, partnerships upstream and downstream from the electronic components to strengthen the ties between the technologies developed and their market applications.

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A chair at the crossroads of materials and artificial intelligence

Designing new materials has never been more complex. Researchers have to consider a mind-boggling array of factors, from chemical composition and processes to costs, environmental impacts, and the target properties—and they don't always have the tools they need to do so. The Machine Learning for Material Design & Efficient Systems Chair led by MIAI* will provide a response. The Chair involves five industrial partners, which include ArcelorMittal and Total, and three government research labs, including Grenoble Institute of Technology-Phelma's SIMaP lab and LIG**.

The four-year Chair will encompass several PhD and post-doc research projects, develop course content for students and Grenoble Institute of Technology's Phelma engineering school, and collaborations with the industrial partners on utilizing the data from instrumented manufacturing processes and on promising materials for massive carbon capture.

**Multidisciplinary Institute in Artificial Intelligence, Grenoble*
***Grenoble IT lab*

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Cryostats moved to new building: So far, so good

The Pheliqs labs, which use cryogenics in their research, are moving from building C1 to building 10.05. The first sixteen cryostats were moved in June and October and are now working fine in their new home. Cryostats are fragile equipment, which makes moving them complicated. Each cryostat weighs in at around 250 kg and must be completely stabilized before moving. The moving company built special chassis for the cryogenic vessels and large padded crates for the inserts. The six remaining cryostats in building C1 will be moved in January.

Over in building 10.5, researchers are enjoying an improved setup with less vibration and better helium recovery. They also have a built-in helium supply network that eliminates the need to handle helium tanks.

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No more plastic water bottles at *Midi MINATEC* lunch talks

The brown-bag lunches provided at the *Midi MINATEC* lunch talks no longer come with bottled water. The new measure came into force on September 20 and will eliminate 7,000 single-use plastic bottles per year! While this may seem tiny on a planetary scale, every little bit helps.

To raise awareness of this environmentally-responsible initiative, 1,000 reusable glass water bottles with neoprene sleeves emblazoned with the MINATEC name will gradually be given out to attendees and—of course—speakers.

As you are probably aware, the Grenoble area has exceptionally high quality drinking water and 95% of local inhabitants trust the local water supply. With that in mind, there's no reason not to fill up on the go!

*Source: *Grenoble-Alpes Métropole magazine,* September-October 2019

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Scooter experiment to keep rolling through March

Scooters are allowed on the CEA campus as part of a test that began in April 2019. The first six months—which ended in September—were a success. Not a single accident was reported, and feedback was unanimously positive. The team in charge of the CEA Mobility Plan decided to extend the test until March 31, bringing its total duration to one year, including a complete winter season. Around 40 test users provide regular feedback on their experiences on CEA roadways. And their feedback is useful in several ways. For example, scooter users are more likely to notice problems with or damage to road surfaces and other structures.

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Graphene 2020 conference to feature three Nobel Laureates

Graphene 2020—next year's incarnation of Europe's leading conference on 2D materials—will take place from June 2 to 5 in Grenoble. The event is expected to bring 800 participants, mainly from research and industry, to the MINATEC campus and Europole congress center. Three winners of the Nobel Prize in Physics will give plenary talks: Klaus von Klitzing (1985), Albert Fert (2007), and Andre Geim (2010).

This exceptional event is being orchestrated by a local organizing committee with members representing the CNRS, CEA, Grenoble Institute of Technology, Grenoble-Alpes University, and the University of Lyon. Graphene 2020 will provide the regional ecosystem with a prime opportunity to showcase its expertise. An industrial form will also be held during the two-day event. Researchers working on graphene and 2D materials have until the end of January to submit papers.

http://www.grapheneconf.com/2020/index.php

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Grenoble team does well at iGEM

A team of engineering students from Grenoble headed to Boston in late November compete in the International Genetically Engineered Machine (iGEM) competition. The team, which included four students from Grenoble Institute of Technology-Phelma, entered their invention, the Neurodrop teardrop test kit for Parkinson's disease, into the contest.

Neurodrop was nominated for track awards in three categories: Best Diagnostic Project, Best Composite Part, and Best Software Tool. It was also one of 163 projects out of a total of 340 to win a gold medal for effectively responding to all contest specifications.

The team from Grenoble is not currently planning to develop its technology further. However, the team has published its research online, providing open access to anyone that would like to do so.

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New CEA Tech showroom to open on January 20

The CEA Tech showroom, which welcomes 4,000 visitors per year, is getting a complete overhaul and moving to the Y.SPOT building. The current showroom will close its doors on December 16, and the new one will open on January 20.

The new showroom was created by the same exhibition designer behind the Chauvet prehistoric cave painting site in France's Ardèche region. Here, however, the theme is networking and collaboration. The 600 sq. m space takes visitors on a chronological timeline through three separate areas where they will discover yesterday's success stories, today's technologies, and the CEA's strategy for addressing the challenges of tomorrow, from the digital transition to energy conversion and medicine. Visitors can also experience the exhibit in a variety of ways, with industry-specific tours, events, and immersive, interactive activities.

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HORIZONS

A year of flipped classrooms at Phelma

A first-year electronics course at Grenoble Institute of Technology's Phelma engineering school has been taught using a "flipped classroom" approach for a year now. The goal was to find more time in the curriculum for students to play an active role in their learning. The initiative was put forward by

Fanny Poinsotte and Nicolas Ruty, who spent a substantial amount of time creating videos explaining the theoretical aspects of the approach, promoting them, and creating the lesson plans.

The feedback from both students and faculty has been positive. The atmosphere in the classroom is pleasant and promotes interaction. The students are motivated and are making progress faster. Faculty have more bandwidth to identify students who may be struggling and offer them extra support.

In terms of grades, students in flipped classrooms did better than those in conventional classrooms, and the difference is significant, at 0.8 points on a scale of 20.

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Leti to showcase four innovative technologies at CES 2020

For the fifth year running, Leti will exhibit at CES (Consumer Electronics Show) in Las Vegas in January 2020. This year, the institute will unveil four technologies. The first is a miniaturized lensless microscope for cellular analysis and point-of-care diagnostics. Coupled with AI, this lensless technology delivers a fast, simple, and effective preliminary diagnosis. The second technology is the world's first smart, interference-free Li-Fi communication (high-speed data transmission using LEDs) manager. The third is a 100 watt universal IoT charger that is more compact and better performing than today's 15 watt chargers. It was designed by Wise Integration, a Leti spinoff. Finally, Leti will showcase a compact integrated antenna for GNSS navigation and positioning developed by startup Anteneo, another Leti spinoff.

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SiC pilot line coming soon to the Substrate Innovation Center

The Soitec-Leti Substrate Innovation Center will open a SiC (silicon carbide) pilot line in 2020 as part of a joint development program recently announced by Soitec and Applied Materials. The partners will develop solutions for electric vehicles, telecommunications, and other markets. SiC is already a leading material for these applications. However, it is less common for industrial applications due to its high cost and low fabrication yields.

Soitec will leverage its Smart Cut™ technology, which the company uses for its SOI products.

Applied Materials will contribute materials engineering know-how. Audi, which has made EVs one of its top priorities, will be just one of the companies keeping a close eye on the new pilot line.

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Changes to Grenoble Institute of Technology SICOM major

The SICOM (Signal, Image, Communication, and Multimedia) major common to Grenoble Institute of Technology schools Phelma and Ense³ prepares future engineers capable of developing projects that involve signal processing, electronics, and IT.

The curriculum, which has been around for a decade, was recently updated to incorporate additional course content on data science and artificial intelligence. Two new modules have been created: Data Science for Image, Multimedia, Audio & Communication (in French for the time being) and Data Science for Energy, the Environment & Healthcare (in English).

The new courses reflect the program's unique positioning, with an approach "from sensor to decision" that is much more holistic than conventional programs, which tend to focus on IT and math only. SICOM gives students a big-picture view that responds to the real-world needs of industrial companies.

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AGENDA

December 12 [Lyon]
MINALOGIC ANNUAL CONFERENCE
www.minalogic.com/fr/evenement/journee-annuelle-du-pole

December 13
[CEA, Dautreppe Auditorium]
LECTURE: BETTER DISSEMINATION OF INFORMATION THROUGH STANDARDS
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January 7 to 10 [Las Vegas]
CES (THE CONSUMER ELECTRONICS SHOW), with a large delegation from Grenoble exhibiting
www.ces.tech/

January 31
SUBMISSION DEADLINE FOR PAPERS FOR THE GRAPHENE 2020 CONFERENCE (GRENOBLE, JUNE 2 TO 5)
www.grapheneconf.com/2020/deadlines.php

February 12 [Grenoble Institute of Technology Auditorium]
EXPÉRIMENTA CONFERENCE
Exploring new paradigms in response to climate change and artificial intelligence.
https://experimenta-journeepro.mapado.com/

February 13 [MINATEC]
FIRST SESSION OF INNOTECH 2020
Nathalie.Mathieu@phelma.grenoble-inp.fr

February 15 [Grenoble Institute of Technology Phelma and Ense³]
ANNUAL OPEN HOUSE
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