

Top news

Chipless RFID tag wins €2 million European Research Council Consolidator Grant

Etienne Perret, a faculty member at Grenoble Institute of Technology and a research scientist at LCIS, an FMNT lab based in Valence, has just won a €2 million European Research Council Consolidator Grant for his chipless RFID tags.

The grant will allow Perret to hire PhD candidates and post-docs and purchase antenna characterization equipment. The bar-code-sized tags are printed with conductive ink. The target properties and cost price are situated somewhere between barcode and conventional RFID tag technologies. The chipless tags have been in development for eight years and are protected by two patents.

Erasable, rewritable tags can be read at 30 cm

Because the tags can be read at distances of up to 30 cm—even through opaque objects—using an ultra-wideband technology, the physical appearance of the item tagged is not altered in any way. But the lab does not plan to stop there. The new features on the drawing board include totally erasable tags—an advantage for RFID, which is sometimes criticized for making it possible to monitor consumers. The tags will also be rewritable, something that barcodes cannot offer. And, by adding silicon nanowires, the tags will be able to serve as low-cost temperature and/or humidity sensors. Another, longer-term possibility will be the capacity to recognize movements or actions to serve as an interface between a user and a machine. A company interested in the tags is already working with the researchers. A startup has also been created to scale the technology up for manufacturing and commercialize the product.

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Live from MINATEC

EXPERIMENTA 2018: panel talks not to be missed

The Experimenta 2018 art and science fair will be held at Maison MINATEC on February 8–10, 2018. A total of 23 systems designed by scientists and artists will be on display this year and are expected to bring in the usual crowds. Visitors will also be able to take advantage of ten panel talks: three on Wednesday, February 7 (professionals only) and Thursday, February 8 will address artificial intelligence and its effects on society.

Another hot topic, world domination by the four global tech giants Google, Apple, Facebook, and Amazon (“GAFA”), will be addressed on the morning of Saturday, February 10. Also on Saturday—and not to be missed—will be a “blended reality” short-film screening featuring two live dancers in a mysterious virtual world. The director and dancers will be on hand to recount how the unusual project started and reveal a few of the secrets behind the breathtaking production.

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Innovation

Drones get 360-degree collision protection

Leti showed off its anti-collision-system prototype for drones at CES 2018. The system is the world’s first to provide 360-degree protection from stationary and moving obstacles. Infrared laser sensors detect obstacles, while an algorithm implemented on a commercially-available microcontroller fuses the data and corrects the drone’s trajectory.

The complete system weighs in at less than 40 grams and its response time, already under a second, will get even shorter with the next generation of laser sensors.

The number of drones in service is increasing, and this system will help protect people and improve flight safety. The technology is covered by three patents and a fourth is in the works. The next step in the project could be to equip an entire fleet of drones with the system.

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MINATEC NEWS

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Innovation

Breakthrough in magnetoencephalography from outer space

Researchers at Leti replaced SQUID* sensors with optically-pumped magnetometers used in space applications with the goal of slashing the cost of magnetoencephalography (MEG) machines fivefold by 2022. In research conducted under a European project, the team was able to successfully demonstrate the new magnetometers' performance.

MEG is a neuroimaging technique used to record the magnetic fields produced by the brain's electrical activity. A total of five of the machines have been installed in France, at neurology research centers. The switch to optically-pumped magnetometers will eliminate the need to cool the SQUIDS to 4K and lighten the weight added by the machine's magnetic shielding. In addition, the signals obtained will be natively vector-based, providing more detailed images of brain activity.

*Superconducting quantum interference device

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Better Wi-Fi service on board Falcon jets

Making sure that the Wi-Fi on board a Falcon jet is working properly before the jet is delivered can be a challenge. Keeping one of the corporate jets on the ground just to check the network is a hard business decision to justify. Researchers at Leti took physical measurements on board one of the jets to create a statistical model of the radiofrequency propagation channel. They then worked in 100% virtual mode using a propagation channel emulator purchased with the support of IRT Nanoelec and configured using the model.

Dassault Aviation, the Falcon's manufacturer, was able to assess the new method for ensuring optimal Wi-Fi on board its jets. The method can be used for any type of plane to test the Wi-Fi network quality offered to passengers at the cabin design stage—and without grounding the aircraft.

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MRAM radiation-induced error correction improves

Spintec recently came up with a new asynchronous MRAM circuit structure that is more robust in space environments. Generally, the risk of errors induced by ionizing particles is managed by tripling the chains of functional blocks and by using a "majority vote" of the three results of the three identical circuits.

Spintec has brought the three circuits down to two by using asynchronous techniques. If the results of the two circuits are different, the circuit is put on "pause" only at the location where the error is detected. The affected block repeats the calculation until the error dissipates and the two results are similar. The lag time is compatible with the properties of asynchronous circuits. A patent was filed to protect the innovation, which is the fruit of a PhD research project at CEA/CNES.

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CMOS 300 mm qubits can take the heat

Following the excellent results obtained in 2017 on CMOS 300 mm qubits, INAC and Leti continue to push the envelope in research conducted under a new European project coordinated by the CEA, MOS-QUITO.* The challenge is now to improve the CMOS qubit by using two electrons placed in two opposite corners of a square-profiled nanowire. The researchers will also attempt to operate the qubit at 1 K instead of at 0.1 K to boost the cryogenic power.

The very-long-term goal would be to produce and manipulate thousands (or millions, even) of qubits at cold temperatures. In the shorter term, MOS-QUITO will provide an assessment of the benefits of the CMOS qubit compared to other options (SiGe, superconductor, photons, cold atoms, etc.). At this stage, all are still in the running for tomorrow's quantum computers.

*SISPIN, the previous project, won a Stars of Europe Award

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Tomorrow's microdisplays will be curved

Why is it that the tiny screens on electronic devices like cameras and binoculars are flat when the devices' lenses are curved? Researchers at Leti have been investigating the issue under the H2020 LOMID project. The goal is to come up with a one-inch-diagonal OLED display with a 45 mm curve radius by June.

The team was successful with a 0.4-inch-diagonal display in 2017. The challenge was not so much making the circuit thinner (less than 100 μm) to make it flexible as it was handling it and protecting it from damage during the thinning processes. A protective varnish previously developed for a project with the DGA (France's Directorate General for Armaments) was tested and proved effective. Additionally, the varnish appears to be a viable replacement for the glass cap generally used to protect OLEDs.

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Tungsten pumps up STT-RAM

Researchers at INAC have substantially improved the properties of a magnetic tunnel junction (MTJ) by inserting a layer of tungsten 0.2 nm to 0.3 nm thick into the MTJ's upper electrode. Tungsten, a refractive material, is a good alternative to the tantalum currently used, ensuring thermal stability of the stack during annealing at temperatures up to 570 °C. This improves the junction's crystallinity, tunnel magnetoresistance (by around 30%), and magnetic anisotropy and, thus, memory retention.

MTJs are the basic building blocks of STT-RAM memory, which will benefit directly from this advance, opening up new opportunities for automotive applications with their operating temperature requirements of up to 150 °C.

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Could tin oxide replace indium tin oxide (ITO) in transparent electrodes?

Tin-oxide-doped indium oxide (ITO) is an excellent material for the transparent electrodes used in smartphone displays, OLED lighting, and other products. However, the material's scarcity and high cost are problematic. Researchers at Leti are looking for an alternative material, and the early results of their investigations show that tin oxide (SnO_2) could be a viable candidate. The material remains stable during microfabrication processes like dry and wet etching. And, it is applied using atomic layer deposition (ALD), which means that the thickness of the layers can be more accurately controlled than with the spray process used for ITO.

These factors make tin oxide ideal for OLEDs, for example. The researchers are continuing to assess the material's potential for the fabrication of so-called "reverse" OLEDs, which offer longer lifespans than conventional OLEDs.

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Innovation

Telecommunications: BF-OFDM rolled out in the Orkney Islands

Bringing high-speed internet access to sparsely-populated rural areas can be a challenge when you only have access to non-contiguous frequency bands—unless you have Leti's BF-OFDM technology, that is*! Leti just rolled out the technology in Scotland's Orkney Islands on a test basis, where it was a success. Compared to the OFDM waveforms used in 4G communications, BF-OFDM adds a pre-distortion stage and subsequent frequency filtering. In the Orkney Islands, Leti's prototype delivered data transfer speeds of 30 Mbit/s at ranges of up to 20 km using 4 MHz channels separated by 4 MHz "blanks".

The fact that frequency bands are less and less available and increasingly fragmented makes this advance all the more significant. A telecommunications company has expressed interest in the patented technology, which is compatible with OFDM receivers.

**Block-Filtered Orthogonal Frequency Division Multiplexing*

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Wristband diagnoses sleep apnea at home

The indicators used to diagnose sleep apnea—heart and respiratory rates, stress, blood oxygen level—can now be measured at home with a simple wristband. Leti showcased the innovative device at CES 2018 and is working with manufacturing partners to get the product out to medical professionals.

The complete solution includes the wristband (with optical and electrical sensors) and data interpretation software. The results are saved to memory and sent to the patient's doctor via a smartphone or PC. A preliminary study of 60 patients conducted in conjunction with Grenoble University Medical Center and INSERM demonstrated that 90% of significant respiratory events could be detected by the bracelet—sufficient for a preliminary sleep apnea diagnosis.

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UV and IR photodetectors offer unrivalled performance

A team of researchers from INAC and Institut Néel developed UV and IR photodetectors offering unrivalled performance. The devices are based on a single gallium nitride nanowire. The first, which detects UV B rays, is three times more responsive than the current state of the art. The second can detect IR rays in 100 femtoseconds in the 1.5 μm band used for fiber optic telecommunications. This record performance makes the detector compatible with data transfer speeds of around a terabit per second.

The innovations were made possible by new GaN/AlN heterostructures that make up the nanowire; quantum phenomena confined to the structures' conduction band provide the nanowires' photodetection capabilities. When placed on a silicon nitride membrane the nanowires can be observed individually by TEM.

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Why nanowire beats thin film for piezoelectric potential

Why would a semiconductor material like zinc oxide (ZnO) offer better piezoelectric properties in nanowire form than as a thin film? Researchers at IMEP-LaHC have come up with an explanation. The tip and sides of the nanowire trap the Fermi level, repelling the free carriers in the material, thus eliminating the typical piezoelectric screening effect.

The researchers conducted simulations combining mechanical, piezoelectric, and semiconductor properties to arrive at their conclusion, which also explains other laboratory observations, which, until now, had never been demonstrated theoretically. For IMEP-LaHC, which designs piezoelectric components, the potential applications for the research include mechanical sensors and energy harvesting devices.

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Graphene ultracapacitor achieves record performance

Researchers at INAC doped sheets of graphene with nitrogen in an ECR-CVD reactor,* obtaining a record atomic concentration of 17% nitrogen. The graphene sheets were then used to make a button-battery-format ultracapacitor. The ultracapacitor offers state-of-the-art power and energy levels, is very stable, and can power a LED for seven minutes on just a twenty-second charge. Plus, the system only requires a few micrograms of graphene.

The sheets are grown, and then doped with nitrogen in the same reactor. The graphene sheets, porous and perpendicular to the silicon substrate, provide an ideal exchange surface, which explains the ultracapacitor's excellent performance.

**Electron cyclotron resonance-chemical vapor deposition*

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Day by day

Stevie Wonder a fan of the Enhancia connected ring

Grenoble startup Enhancia's connected ring was a hit with international music icon Stevie Wonder, who tried it on at CES Las Vegas. When a musician playing a keyboard or synthesizer wears the ring, it produces additional sound effects according to preconfigured hand movements. "I like it. I love it," said Wonder.

Enhancia's four founders, all 2017 graduates of Grenoble Institute of Technology-Phelma, made the trip to CES—where they received a warm welcome—to promote their product in the run-up to a Kickstarter presale campaign scheduled to begin in March. The ring's nine integrated sensors and motion-recognition algorithm have been patented and the product is slated for release in late 2018.

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€676 K awarded to five projects in First Step Challenge 2017

At the end of November the First Step Challenge jury selected five startups to receive funding. A total of €676,000 was awarded to the five projects, with individual amounts determined according to the maturity of the project and the needs expressed. Additional support could be awarded within three to six months.

In 2016 the projects selected to receive support focused mainly on software and services. This year's First Step Challenge cohort is predominantly high-tech. Leti spawned four projects: optical transceivers with InP/Si lasers and integrated lenses for data centers (Scintil); an ultra-thin, low-cost microbattery (Thin Power); a touch information sensor (XSens); and a miniature power supply module (Ganips). The fifth project, submitted by a researcher from Liten, addresses complex microfluidic systems (Fluid'IC) leveraging a Leti technology.

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Interview

Guillaume Jubien, a student at Grenoble Institute of Technology-Phelma and participant in the iGEM 2017 International Genetically Engineered Machine Competition:

We can detect cholera with a lens, two filters, and a smartphone

Tell us about SnapLab, the project that originated in Grenoble and that won a gold medal at the iGEM finals at MIT.

SnapLab is a portable and very easy-to-use cholera test kit that can detect a sequence of nucleic acid in a stool sample and emit fluorescence if the bacteria responsible for cholera are present. SnapLab delivers results as reliable as those obtained with a spectrometer with only a lens, two filters, and a smartphone!

Does the project end here?

The members of our team have gone their separate ways, so we can't take the project any further as a group. However, we have made our work available on an open source basis, which means that students can use it for their graduation projects, for example. The next step in developing SnapLab would be to reduce the size and cost. It is a low-tech system that would be very useful in places like Africa where cholera is a huge problem.

What did you take away from the experience?

I, like the rest of the team, am proud of our gold medal, even if that isn't necessarily what matters most. The fact that we competed in such a high profile event will be a great addition to our CVs.

Plus, in addition to the science and technology aspects of the project, we learned how to do a lot of other things, like applying for grants, setting up a crowdfunding campaign, and doing a website. But first and foremost we learned to work as a team, communicate with each other, and get past any disagreements to reach our goals. It is an experience I will never forget!

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Day by day

Leti researcher wins Helmholtz International Fellow Award

Jean-Michel Hartmann, Director of Research at Leti, recently won the Helmholtz International Fellow Award in recognition of more than a decade of cooperation with German research institute Forschungszentrum Jülich (FZJ) that has resulted in nearly 70 joint publications and numerous nanoelectronics and photonics research projects.

Most notably, Leti supplied FZJ with multiple Si/SiGe stacks on silicon and SOI for the fabrication of field-effect and tunnel-effect transistors, as well as germanium sheets used as substrates for GeSn/SiGeSn heterostructures that enabled the fabrication of laser structures emitting in the mid-infrared range (2.5 μm –3.1 μm), for example.

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The secret to great skin? Put down your mobile phone!

The artificial light from mobile phone displays has a damaging effect on the mitochondrial networks of dermal fibroblasts, according to a two-year study conducted by Gattefossé, a manufacturer of cosmetic excipients and other ingredients, and Grenoble-based biotech company Cytoo, headquartered at MINATEC.

Cytoo used its micropatterning technology to explore the architecture of the skin cells. Video microscopy was used to observe the cells, which had been exposed to an illuminator developed by Gattefossé that reproduces the effects of a year of exposure to a screen in just one day. The study concluded that the skin cells were stressed and had lost their mobility and responsiveness, as if they were exhausted. Based on these results, Gattefossé developed a new active ingredient that protects skin from the light from screens.

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Biomimetic thin films enter maturation phase

Could a startup be in the future for LMGP's BioactiveCoatings research project? One positive sign is that the project has now entered an eighteen-month maturation phase at Grenoble's incubator and technology transfer specialist, Linksum. LMGP research scientist Catherine Picart, who is leading the project, plans to hire an engineer for the proof of concept: bone mini-tissue formation *in vitro*.

The project's main innovation is the deposition of biomimetic films in the wells of microplates generally used for cell cultures using a patented automated process. The resulting surfaces offer close-to-physiological conditions for stem-cell culture and mini-tissue formation. The ultimate goal is to enhance *in vitro* diagnostics for bone disease and cancer.

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APIX Analytics ready to take on US and Asian markets

Startup APIX Analytics raised €8 million in late 2017 to speed up its development on international energy and environmental markets. The company, which currently does 60% of its business outside of France, opened an office in Beijing early this year and plans to open a US office by the end of June.

The influx of capital will also position APIX Analytics to develop new, miniaturized analysis solutions, in particular through its joint R&D lab with Leti. The future systems will—like the company's previous generation of products—include key gas chromatography capabilities. They will address the laboratory accessory and high-temperature analysis markets. In other news, APIX Analytics acquired a controlling stake in its partner nCx, which scales up and manufactures APIX Analytics products.

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Horizons

3D-Oncochip: LMGP helps create microtumors

The IMBM research team led by Catherine Picart (LMGP) has built a strong reputation for the development of bioactive materials for bone reconstruction. Picart's work on breast cancer, however, is not as well known. The scientist recently joined the three-year, €2.2 million 3D-Oncochip project, which is backed by the French Single Interministerial Fund and led by Lyon-based CTIBiotech. CTIBiotech specializes in the fabrication of 3D microtumors, which are human biological models of real tumors. The company would now like to scale up its production to several hundred chips.

The next step will be to design the structure that will contain the cancer cells and coat it with a material that will promote the growth and stability of the resulting microtumors. LMGP's polyelectrolytes will play this role.

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A gap year in the Amazon rainforest

Grenoble Institute of Technology-Phelma student Yoann Rey-Ricord, age 23, took a gap year in the Amazon rainforest to participate in a volunteer project run by AKUU, the nonprofit group he cofounded in 2016. The group supports projects in the fields of energy, tourism, waste management, and biodiversity in the Amazon rainforest.

Yoann has been living in Puerto Miguel, Peru, since October. He and around ten other students also taking gap years are currently building a community center that will house educational and awareness-raising activities and provide accommodation for volunteers—both local and international—who wish to get involved in environmentally-responsible development projects. The 50 or so active members of AKUU are mostly students, but everyone is eligible to join!

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Live from MINATEC

The art and science of innovation marketing

Turning a complex technology into a product that meets real-world customer needs and finding a business model that actually makes money is no mean feat. CEA and GEM will address this vast topic at the 4th Innovation Marketing Day to be held on March 15 at Maison MINATEC. The event is designed for professionals from all kinds of industries. The morning will feature a plenary session with speakers representing companies from startups to major names like Michelin and Vinci. The afternoon will be devoted to breakout sessions on market intelligence, experimentation, and leveraging data to create value.

Professionals from industrial companies will share their own experiences during a panel talk and visitors can also sign up for a tour of the CEA Tech showroom. The 2016 edition of the event brought in 200 participants.

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92 teens expected for *Scientifique, toi aussi!* science career day

On February 8, all CEA centers will host the 7th *Scientifique, toi aussi!* [You, too, can be a scientist!] open house on careers in science. In Grenoble, nearly 80 high-school students from science tracks and youth participating in a special outreach program will spend the day at Phelma.

The traditional speed-networking meetings, very well received at previous years' events, will once again be on the program. The day's young participants will have an opportunity, in groups of five, to chat with a diverse range of CEA staffers. A buffet will provide additional time for more informal cross-generational conversation. The afternoon will be reserved for lab, clean room, and showroom tours.

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Live from MINATEC

GreEn-Er students try their hand at beekeeping 2.0

Did you know that the roof of the GreEn-Er building has been home to two beehives since the spring of 2016? The bees are currently resting for the winter under close surveillance—because the hives are connected! The high-tech hives were built and equipped with instruments by Grenoble Institute of Technology-Ense³ students for a class project. The idea is to monitor the bees' activity levels and health in real time. The hives are outfitted with temperature, humidity, weight, and noise sensors and could soon get their own webcams.

Bee Green, a nonprofit group, was set up in late 2016 to support this form of urban beekeeping "2.0", an approach that couples innovation and the preservation of biodiversity. Last July the student beekeepers collected 15 kg of honey.

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Pierre Benech appointed Grenoble Institute of Technology President through 2020

Pierre Benech will succeed Brigitte Plateau as President of Grenoble Institute of Technology following Plateau's appointment to a position with the French Ministry of Higher Education, Research, and Innovation. Benech was named to the post in late November for a term that will last until February 2020. Bernard Penz was voted in as Vice Chairman of the Board of Directors.

The rest of the school's administrative team remains unchanged and will pursue the projects already underway and, especially, the construction of the Grenoble University campus. The team will also continue to support France's Institutes of Technology (*Groupe INP*) as evidenced by a partnership signed in December with Toulon's SeaTech engineering school.

In related news, the name of the entrance exam has been changed to the Institutes of Technology Common Entrance Exam—a move that makes sense given that the exams, created by the Institutes of Technology, are 100% managed by the 34 schools in the consortium.

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Agenda

February 8, Phelma and CEA Grenoble Auditorium

7th annual “You, too, can be a scientist!” day
(Scientifique, toi aussi !)

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February 8–10, Maison MINATEC EXPERIMENTA.

Arts, Science, and Technology Fair
<https://www.experimenta.fr>

February 14, Grenoble Institute of Technology Auditorium

Lecture on the state of the art and outlook for gene therapy to treat Parkinson’s disease

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March 8, Grenoble Institute of Technology-Phelma

Inn.Otech high-school outreach program on microelectronics

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March 3, Grenoble Institute of Technology-Phelma Phelma and ENSE³ Open House

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March 15, Maison MINATEC Innovation Marketing Conference

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<http://rencontresmti2018.web-events.net/>

March 16, Maison MINATEC JSIam: 10th Junior Scientist and Industry Annual Meeting

<http://www.jsiam-giant-grenoble.org/>

June 21–22, Maison MINATEC French American Workshop

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July 4–5, CEA Grenoble Leti Innovation Days

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MINA-NEWS >

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