

Top news

MRIs could become more accurate and affordable

Researchers from Leti and G2Elab are working to develop a new kind of medical imaging technology, “fast field-cycling MRI” (FFC-MRI). The research is being conducted under the four-year EU IDentIFY project, which kicked off in 2016. The new MRI is expected to be both more accurate and affordable than current technologies.

The concept was developed at the University of Aberdeen, where a prototype was used to demonstrate the technology’s capacity to detect cancer, characterize pre-cancerous areas, and monitor diseased tissues’ response to treatment. FFC-MRI could also be used for the early diagnosis of neurodegenerative diseases like Alzheimer’s and Parkinson’s.

Controlling magnetic fields remains a major challenge

For the technology to one day be brought to patients, researchers will have to come up with a way to control the magnetic fields used—which range from a substantial 0.2 Tesla to levels well under the Earth’s magnetic field. With these very low magnetic fields, the slightest external disruption can modify the field, rendering the measurements taken inaccurate. What is more, the magnetic fields must be stable within a volume equivalent to a 30-cm-diameter sphere.

G2Elab and Leti will develop measurement and active compensation systems to counter disruptions to the magnetic field: G2Elab will focus on magnetic field modelling and measurement, while Leti will develop the correction spools and associated electronic components. A first project milestone is expected to be reached by the end of 2016.

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Innovation

Driverless vehicles: it’s all about the algorithms

The main obstacle to developing tomorrow’s 100% driverless vehicles is the huge processing power required. Today, you would have to virtually fill the vehicles with powerful computers to run them! For the past three years, researchers at Leti have been working on a breakthrough technology to replace today’s algorithms, originally developed for robotics applications, with new algorithms developed specifically for driverless vehicles.

The new algorithms can fuse and interpret data from three different sensor technologies in under 50 milliseconds, using a new, more parsimonious mathematics that slashes processing requirements a hundred fold. The algorithms are protected by two patents and garnered lots of interest when they were presented at DAC 2016 in Texas in June. They will also be presented at the European Forum in Brussels on October 15, and at the Vision trade show in Stuttgart in November.

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Josephson junctions: four terminals make the difference

A traditional Josephson junction has two superconducting terminals. But researchers at Inac* recently looked at the theoretical behavior of four-terminal junctions—and the idea was an excellent one! The researchers predicted that, by applying a different voltage to two of the terminals, they would obtain the alternative current that characterizes the Josephson effect and a totally unexpected direct current.

The direct current’s value can be controlled by applying a low magnetic field to the two other terminals. The quantum states that underlie the effect could be used in future quantum computers.

The predictions—which are theoretical at this stage—were published in *Nature Communications*. Several labs around the world are now working to test their validity.

*in conjunction with a researcher from Delft (the Netherlands)

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Rethinking resistive memory

Resistive memory (ReRAM) is a thousand times faster than flash memory and will likely replace flash in coming years. Leti is already working on ReRAM with industrial R&D partners, and has designed a tool to improve memory performance that calculates the main ReRAM design constraints (some of which are in conflict with others).

The calculator leverages data like the technology node (28 nm, 14 nm, etc.), memory cell write time, current, voltage, and total memory capacity to determine configurations compatible with the target performance. Output includes elementary matrix size, total component surface area, and energy consumption. The tool was used experimentally on a 128-Gb-capacity component with a data rate of 4 Gb/s.

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Innovation

Nanocomputers: skyrmions now within reach

Researchers at Spintec have achieved skyrmions that are stable at ambient temperature and without a magnetic field. The researchers deposited a magnetic layer of cobalt several atoms thick between a layer of platinum and a layer of magnesium oxide. The resulting structure significantly increases the magnetic interaction that underpins the skyrmion's helicoidal structure.

The skyrmion—a quasiparticle measuring just a few nanometers—is the holy grail of researchers in search of very-low-energy memory solutions. However, to date, very low temperatures or strong magnetic fields have been required to observe skyrmions. Spintec is now a step closer to overcoming this hurdle using a cobalt deposition technique already commonly used in the microelectronics industry.

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LMGP takes atomic layer deposition to the next level

At the end of September LMGP presented its new SALD (Spatial Atomic Layer Deposition) reactor to MINATEC. It is the first reactor of its kind in France. It operates at atmospheric pressure, bringing down costs, and can perform atomic layer deposition up to 100 times faster than traditional ALD equipment.

And the resulting layers are both very thin—from a few to a few hundred nanometers—and homogeneous, characteristics that take the lab equipment one step closer to where it needs to be for industrial-scale use.

The new reactor is well-suited for encapsulating systems and for interface engineering (anti-corrosion protection, barrier materials, etc.). INES (France's solar-energy research organization) is using the reactor to deposit electrode materials onto solar cells under the Institut Carnot *Energies du futur* project.

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Lensless imaging: Iprasense releases a new product

The joint lab between Iprasense and Leti has designed a new product, Cytonote Counter. This lensless digital microscope can observe a very large field (30 mm²) and measure cell viability with unrivalled reproducibility and precision. The markerless cell-viability measurement is based on a detailed analysis of the interference figures obtained. This means that marking with Trypan blue is no longer necessary, opening the door to uninterrupted cell observation. Several thousand cells can be observed simultaneously, which gives the measurements their statistical validity.

Cytonote Counter is being marketed to the pharmaceutical industry for use in bioreactors to monitor cell cultures for vaccine and monoclonal antibody production. Three patents have been filed and Iprasense has already made several sales.

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CoolCube® attains more than 10 million 3D contacts/mm²

Leti is extending its 3D integration roadmap with its CoolCube® technology developed in conjunction with several industrial R&D partners including IBM and STMicroelectronics. The technology attains 10 million 3D contacts per mm², a huge increase over the 100,000 contacts delivered by traditional solutions. With CoolCube®, FDSOI transistors are stacked and interconnected with pattern alignment accurate to the nanometer—which is what makes all the difference.

CoolCube® was recently tested in close-to-industrial conditions at cleanrooms here in Grenoble. The technology offers an alternative to reducing circuit dimensions, which is becoming cost-prohibitive. The researchers are now working on making the process more robust and reducing the temperature of certain steps. The goal is to transfer the technology to an industrial partner within two years.

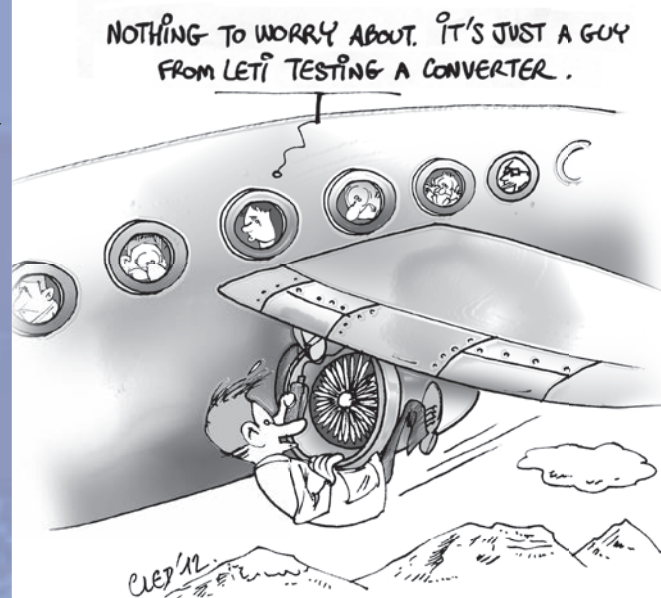
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A power converter that can withstand 200 °C

Researchers at Leti have tested in real-world conditions a power converter capable of operating at an ambient temperature of 200 °C (and up to around 250 °C). High temperatures like these are common in automotive, aeronautics, and oil and gas drilling applications. Leti's technology could also reduce—or eliminate entirely—the need for cooling systems in less-demanding everyday applications like elevator motors, HVAC systems, and residential pumping equipment.

The converter leverages a novel technology: a line driver with adaptive output impedance that adjusts switching speeds from 20 nanoseconds to 200 nanoseconds depending on the use environment and risk of electromagnetic disturbances. Several patents have been filed to protect the innovation.

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Day by day

Inac website features four researcher profile videos

Inac has started publishing video content on its website and on YouTube. The latest additions are the profiles of four basic-science researchers who boldly volunteered to be featured. The short—under four minute—videos are simple and straightforward, showing the people behind the science happening in Inac labs. Inac has also published a video presenting the institute.

The videos were produced and directed by Julien Ridouard, a graduate student in scientific communication completing his internship at the institute. Additional videos starring PhD candidates and experienced research scientists from Inac's five labs are expected to follow.

View videos at <http://inac.cea.fr/> and on Inac's YouTube channel
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Day by day

4,800 runners expected at 8th Grenoble Ekiden marathon

The Grenoble Ekiden relay marathon has become more popular with every passing year. This year, the entire event was overhauled to accommodate even more runners. The race, to be held on Sunday, October 23, will welcome 800 six-runner teams (up from 650 teams in 2015). The new course will circle around the Presqu'île neighborhood.

And there is even a race for kids aged 4–16 (with courses from 400 m to 2 km), free of charge. If you would like to train with other runners from GIANT, sessions will take place from 12 p.m. to 1:30 p.m., on Tuesdays at Grenoble's Paul-Mistral park in front of the Clémenceau sports hall and on Thursdays at the Europole gymnasium. And don't forget to pick up your GIANT bib on Friday, October 21, between 12 p.m. and 2 p.m. at the CEA Grenoble main reception area at 17 rue des Martyrs.

Register until October 10 at <http://www.grenoble-ekiden.fr/> for adults, and, for children, directly at the race. Contact: marie.toussaint@cea.fr

Recommended reading: materials for renewable energy

LMGP's David Muñoz-Rojas co-edited and is one of the authors featured in *Materials for Sustainable Energy Applications*, published in September by Taylor & Francis Group. The book includes contributions from researchers (from France, Turkey, Australia, the United States and other countries) active in the field and recognized by the scientific community. The chapter on solar cells was co-authored by seven LMGP scientists.

The book is intended for graduate students, PhD candidates, and working research scientists. When it comes to renewable energy, making the right materials choices and optimizations are crucial. This book gives a comprehensive presentation of the different materials and associated technologies for renewable energy applications, as well as aspects crucial to developing materials (PV, batteries, condensers, hydrogen storage units, piezoelectricity, thermoelectricity, and superconductivity).

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Learn more: <http://www.panstanford.com/books/9789814411813.html>

BigClouT is inventing smart cities

The Greater Grenoble Area is working with three other urban areas—Tsukuba, Fujisawa, and Bristol—on the BigClouT project, a joint initiative between the EU and Japan that Leti is coordinating. The project aims to develop and test applications for smart cities on an open software platform capable of processing massive amounts of data from sensors (weather, pollution, traffic). The deadline is 2019.

Leti is contributing by improving its sensiNact* middleware, which aggregates smart data and makes it available to the community to create applications for tomorrow's cities. In Grenoble, for example, the goal is to measure the impact on the local economy of trade shows like Semicon Europa and of business and industrial parks. The results will be used to improve local services, from restaurants and shops to transportation.

*Developed and tested under the ClouT project (2013–2016)

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CIME Nanotech gets ion milling equipment

CIME Nanotech recently commissioned an ion-beam milling machine (from scia Systems GmbH) in its clean room. The €500,000 machine was financed in part (50%) by IRT Nanoelec. It will be used for both training and R&D. It has a Hidden spectrometer to track, monitor, and identify the material being etched in multilayer samples.

The ion beam is 218 mm in diameter and can be used to etch magnetic materials for MRAM, metals for contacts, piezoelectric materials, and oxides. The sample holder, which rotates and inclines to prevent particles from being deposited on the substrates, can handle substrates up to 150 mm in diameter.

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Challenge First Step 2016 cohort the best to date

The 2016 edition of the Challenge First Step is the best to date, with ten projects selected in June. The Challenge was set up to identify startup ideas at CEA Tech labs and give the project leaders support taking the crucial first steps from lab to business. This year, Challenge First Step will support projects from Leti and Liten as well as from the CEA Tech regional platforms launched in 2013.

The projects selected will receive ten days of training through October and will also be given personalized sessions with a coach. On November 23 they will go before a panel of judges to vie for financing and approval to use 20% of their work time for their projects. Challenge First Step has resulted in 12 startups, including ISKN, Sublimed, Bag-Era, and Morphosense, since its inception.

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Horizons

Semicon Europa returns to Grenoble

Semicon Europa first came to Grenoble in 2014, attracting record numbers of exhibitors and visitors. Semicon Europa 2016, to be held on October 25–27 at Alpeexpo, has some high standards to live up to. And the pressure is on! A number of other cities in Europe would love the chance to host this leading trade event, which brings in around 6,000 professionals-only visitors.

The number of exhibitors should be the same as in 2014, and booths will be organized by market (imaging, automotive, manufacturing, etc.). Innovation Village will be held just like in 2014, with around 30 to 40 European startups exhibiting. Clusters will also have their own special section, with around ten French and foreign clusters—including Grenoble's Minalogic—exhibiting. Semicon Europa will be held in parallel to another trade event, IoT Planet, which will occupy 4,000 sq. m of exhibit space at the same venue. IoT Planet was founded by a Grenoble-based startup.

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Tomorrow's engineers already entrepreneurs!

In May, three students from Grenoble Institute of Technology's Phelma engineering school won the region's *Campus Création* entrepreneurship award for their innovation: Oria, a ring that creates sound effects to accompany the notes played on a digital musical instrument. Since September, they have gone from idea to startup.

For their senior year at Phelma, students will benefit from a national student-entrepreneur program that allows them to take classes while working full time on their project for six months. Three other engineering students, also in their senior year, will be assigned to the project to help.

The winning trio also has plans to enter additional competitions to have their technology vetted by other experts and raise funds to launch their business. The *Campus Création* award came with funding of €3,500.

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Interview

Jérôme Casas,
Biologist, Tours University

Bio-inspired tech can drive breakthrough advances

In March you took on a new role: heading the Grenoble-based Institut Carnot Chair for Bio-inspired Technology. What's it all about?

I'm a guest researcher, and will be spending at least 20 days per year on site. I'll be helping Leti researchers on several projects that should ultimately produce demonstrator systems. The first two involve an artificial nose and neuromorphic circuits capable of local information processing.

What can biology do for microsystems?

Living organisms present a level of operational efficiency shaped by the instinct to survive and enhanced by thousands of years of natural selection. They are sophisticated and unusual enough to drive breakthrough advances in technology.

For example, I headed an EU project based on the flight system of cockroaches and crickets, which consists of tiny hairs sensitive to air flows at just one tenth of a photon and a "local" brain connected to their back legs. If a cockroach detects danger, its flight system is triggered even before its brain is aware anything is wrong. You can't get much better than that when it comes to distributed processing and control!

And how do you work with technology experts?

It really is a back-and-forth. It's not just about what biology can do for technology. Biological systems are nothing if not coherent. So, what I can help with is a holistic, system-wide picture. The techies come back to me with questions to better understand a system, which is usually quite complex, so they can leverage it for bio-inspired developments. It's an iterative process.

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Horizons

Cross-disciplinary program for Grenoble-Alpes University

Grenoble-Alpes University received around 50 expressions of interest in response to its call for proposals for the IDEX (a French government program to boost cross-disciplinary programs on campuses across the nation) Cross-Disciplinary Program (CDP). In June and July, the university held three days of meetings with leaders of potential projects targeting all of the IDEX CDP disciplines. The projects selected will receive substantial funding (up to €2 million per project over four years).

To ensure the quality of the future CDP, the IDEX set up a panel of international experts to select the projects eligible for funding. The second wave of the call for proposals will take place in 2017. In all, around a dozen projects will be selected from the two waves of applications.

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2016–2017 academic year off to a strong start for Phelma

Phelma's 2016 incoming class has set new records in the common entrance exam rankings, rising between 100 and 200 slots depending on major. The school's 2015 rankings were already remarkable!

The total number of incoming students was similar to 2015. In initial degree programs, Grenoble Institute of Technology's Phelma engineering school admitted 363 first-year students; 272 completed preparatory programs, 39 the INP preparatory program, 40 were admitted based on academic qualifications, and 12 are repeating a year. The alternating work-study program in integrated systems design (microelectronics and telecommunications) admitted 14 students, a figure Phelma would like to see rise to 18 next year. The number of female students also rose once again at 29%, up from 23% in 2015.

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National i-Lab competition recognizes four CEA Tech projects

Once again this year, CEA Tech startups have brought home a bumper crop of awards in the i-Lab national competition for innovative tech startups. A total of €820,000 will go to the following four projects:

- EnWires, founded in 2016, is developing new electrode materials for Li-ion batteries leveraging high-quality-silicon nanowires
- Sublimed, founded in 2015, is working on transcutaneous electrical neurostimulation to treat chronic pain
- Motion Recall, founded in 2016, is developing an action camera with 360-degree and 3D capabilities for consumer-grade virtual reality
- e-PiKure, a planned startup, is working on pain treatment with a system to stimulate the release of intracerebral endorphins

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Grenoble Institute of Technology and STMicroelectronics partner on analog electronics certificate course

Grenoble Institute of Technology's continuing education course on analog electronics, which kicked off on June 1, counts 19 students, all employees at STMicroelectronics' Grenoble and Crolles sites. The program was developed in partnership with STMicroelectronics, and participants will earn a certificate in analog electronics design, a real need for many manufacturers, including STMicroelectronics.

The 126-hour program includes 34 hours of classroom instruction alongside second-year students at Grenoble Institute of Technology's Phelma engineering school. In June 2017, the second session of the course will be open to STMicroelectronics and other interested microelectronics companies. And work is in progress to make the program eligible for funding under the national CPD program.

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Live from MINATEC

Phelma auditorium and extension now an integral part of MINATEC

Grenoble Institute of Technology's Phelma engineering school cut the ribbon on two new buildings—an auditorium and an extension—in June. Used from the start of the new academic year, at Sustainable Mobility Days, and at the *Parvis des Sciences* science fair, it is safe to say that the new facilities are now an integral part of the MINATEC campus. The 500-seat auditorium hosts classes and events; two modular meeting rooms next to the auditorium can hold up to 100 people each.

The extension is home to both lecture and lab classes. Study pods give students a place to work in small groups. The student union is also there, with recreational spaces (pool table and foosball), and student club offices. The sixth floor still has vacant offices (next to INP SA's offices) for any interested entrepreneurs!

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Parvis des Sciences fair growing

The 2016 *Parvis des Sciences*, which coincides with France's 25th annual national Science Week, is expanding considerably this year, with twice as much event space and more than 40 activities, up from 27 in 2015.

October 6 and 7 will be open to school groups only; the general public is welcome to attend the event on Saturday, October 8, from 10 a.m. to 6 p.m. The program will be chock-full of lectures, exhibits, workshops, and more. One day will surely not be enough for die-hard science lovers!

This year's event will also include new topics: energy, light and materials, and biology and healthcare, with a special focus on the brain. Visitors will have a chance to learn about the brain's role in sensory perception and explore brain functions like a neuroscientist using the tools of the trade: MRI and EEG.

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eLichens raises €3 million

Grenoble-based startup eLichens raised more than €3 million in fresh capital from six investors this summer, less than two years after the company was founded. The company specializes in optical microsensors and software to measure and monitor air quality and works with several research labs, including Leti. Backed by a solid patent portfolio, eLichens is targeting markets like manufacturing, smart cities, and IoT.

The company has signed several contracts with key players in these industries—a factor that certainly helped tip the balance when it came to winning over investors. The influx of funds will position eLichens to ship products to its first customers, hire new employees, and pursue R&D efforts to round out its technology portfolio.

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Phelma: new management, same objectives

Anne Vilcot, who took the reins as President of Grenoble Institute of Technology's Phelma engineering school on June 15, 2016, will lead an administration team that remains virtually unchanged with: Alice Caplier (international relations), Saïd Obbade (corporate relations), and Christine Morales (administration). The team's only new member, Patrice Petitclair, is a former project manager for Groupe INP and succeeds Stéphane Pignard as academic dean.

The team's top priority is to continue to ensure quality academic programs despite increasing budgetary constraints by seeking out efficiencies and creating synergies. Phelma will also focus on developing continuing and executive education programs with Grenoble Institute of Technology and through corporate partnerships. Finally, the school aims to recruit a more diverse student body to increase the number of female students and students in alternating work/study programs.

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MINATEC's new website on line

MINATEC's website has been completely overhauled. The responsive web design displays correctly on all devices. The look and feel is lighter and more modern. The new homepage uses eye-catching photography to make finding the right information easy in just one click: from the latest news and events, to PhD, post-doc, and internship opportunities, to the services offered by Maison MINATEC.

MINATEC videos are now available on the MINATEC YouTube channel, which has replaced the former minatec.tv site. YouTube offers all of the features of today's social networks ("likes," comments) and helps boost SEO.

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New student dormitory opens in Presqu'île neighborhood

In September, a new student dormitory opened in the Presqu'île neighborhood, just a five-minute tram ride from Grenoble Institute of Technology's Phelma engineering school and right across from GreEN-ER. The 300-student dorm is named after Geneviève Jourdain, a Grenoble Institute of Technology faculty member who pioneered signal processing and who passed away in 2006.

One thing that makes this dorm unique is the 34 one-bedroom apartments for couples and siblings. There are also studio apartments, three-bedroom apartments for students wishing to live with roommates, as well as handicapped-accessible units. The 260 units are managed by CROUS. The entire dorm is equipped with wireless internet access, has a study room, an outdoor space, a bike room, a gym, and a multipurpose room. Students who don't live there can also use the dorm's student club facilities, cafeteria, and health center.

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EXPERIMENTA fair to feature 20 installations

The EXPERIMENTA art, science, and technology fair, to be held on October 6–8, will feature around 20 installations combining art and technology in truly novel ways. Visitors will get a chance to discover new experiences and performances, from going "inside" a drawing or seeing the pages of a book "grow" to using bacteria to generate light and projecting an avatar of yourself into a virtual dance scene. All thanks to immersive and interactive technologies and advances in energy, optics, AI, and IoT.

More than 60 potential projects were submitted, setting a new record. EXPERIMENTA also offers up talks by artists and scientists, lectures on the topics addressed by the projects on exhibit, as well as workshops, games, and quizzes.

www.experimenta.fr, www.atelier-arts-sciences.eu

Live from MINATEC

Maison MINATEC expands capacity

The 450 sq. m Maison MINATEC extension—now open for business—brings the event facility's total surface area to 1,350 sq. m. and boosts its capacity from 600 to 1,200 people. In 2015 the facility hosted 120 events and received nearly 40,000 visitors, figures that are expected to rise in the short term.

With modular event spaces of various sizes that can be set up to accommodate exhibit booths, lectures, buffets, sit-down meals, and more, Maison MINATEC's service lineup has also expanded. The facility can now host events from a meeting with just a few people to conferences with more than a thousand attendees. The upcoming *Parvis des Sciences-EXPERIMENTA* fair and exhibit will be held at the expanded Maison MINATEC on October 6–8, the perfect occasion to check out the new spaces!

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Agenda

October 6–8, MINATEC EXPERIMENTA

<http://experimenta.fr/>
<http://www.atelier-arts-sciences.eu>

October 6–8, MINATEC Parvis des Sciences

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October 23, Grenoble Grenoble Ekiden relay marathon

<http://www.grenoble-ekiden.fr/ekiden/>

October 25–27, Grenoble Alpexpo Semicon Europa 2016 and IoT Planet

<http://www.semiconuropa.org/>
<http://www.iot-planet.org/>

October 26, Grenoble Alpexpo CARAC2016

<http://semiconuropa.org/carac-2016>

November 7–10, Maison MINATEC Nanosafe 2016

www.nanosafe.org

November 10, Grenoble Institute of Technology auditorium

Phelma Industrial R&D Partners' Day

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November 19, Grenoble Institute of Technology auditorium

Grenoble Institute of Technology Phelma Commencement Ceremony

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December 1, MINATEC PiezoNEMS 2016

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MINA-NEWS >

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