

Top news

Science Fair and EXPERIMENTA

MINATEC celebrates science

The 2015 MINATEC “*Parvis des Sciences*” Science Fair and fifth annual EXPERIMENTA Art, Science, and Technology Fair will be held on the MINATEC campus from October 8–10, with plenty of science-related activities for everyone, from hardcore science enthusiasts to the general public. MINATEC held its first “*Parvis des Sciences*” in 2007, and the event’s appeal has continued to grow, especially among school groups. The two-in-one event brought in more than 4,000 visitors in 2014.

This year attendees can choose from an impressive 30 activities—three times more than last year—including nine interactive tours. New Science Fair partners including Grenoble’s large scientific instruments helped make the expanded offering possible this year.

For the first time ever, the exhibit booths will be set up at the new Grenoble Institute of Technology auditorium. Visitors will also be able to enjoy the Science Fair bookstore and food concession.

As always, the Science Fair is held during France’s National Science Week, which is dedicated to light this year. But the Science Fair will also address an eclectic range of other topics, from the human brain to ocean currents, with activities covering the full spectrum from biology and nanotechnology to microelectronics and from basic science to demonstrators—including those at the CEA Tech traveling showroom—highlighting recent technological advances.

The Experimenta Art, Science, and Technology Fair, organized by the Atelier Arts-Sciences with support from local science education center La Casemate, will be hosted by Maison MINATEC, right next door to the Grenoble Institute of Technology auditorium. EXPERIMENTA will feature exhibits highlighting around 20 projects involving artists, scientists, and manufacturers and a full program of talks about new technologies and related issues.

View the program at <http://experimenta.fr>
For information about the MINATEC “*Parvis des Sciences*” Science Fair, contact: thibaut.david@cea.fr
And for information about EXPERIMENTA, contact: marie.perrier@theatre-hexagone.eu

Innovation

60 GHz with good spectral quality? Check!

A phase-locked loop (PLL) is the best way to generate the high frequencies—around 60 GHz—required for tomorrow’s 5G telecommunications and Wi-Fi. However, the higher the frequency, the lower the spectral quality—and transmission speeds. PhD candidate Clément Jany (who has since obtained a research position at Leti) set out to overcome this hurdle. And his solution is nothing short of brilliant!

Jany developed a programmable frequency multiplier capable of multiplying the initial frequency by 30—compared to 2 or 4 for the best known systems currently available. The signal generated is based on a reference frequency of 2 GHz offering high spectral quality. A patent application has been filed for the proof-of-concept, which has already been leveraged for two EU research projects in which Leti is involved.

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“Valleytronics” make spintronics even better

An international team led by researchers from INAC recently demonstrated that, in SOI transistors, electronic spin alignment under an outside magnetic field is much easier when restricted to a single “valley.” The valley index is a quantum number that shows the relationship between the energy and amount of electron movement within the silicon on a curve characterized by two minimums known as valleys. The valley index is well-known to researchers; however, it had not been used since the invention of the transistor in 1947.

With the emergence of so-called “valleytronics,” spintronics could now have a very handy new tool for controlling spin. The research was published in *Nature Communications*.

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Deforming germanium to emit more light

A team of researchers from INAC and Leti are exploring a variety of processes to deform germanium as much as possible to dope the material’s light-emitting capacity, paving the way for use in laser emission. The team’s latest article focused on the use of a constrained silicon nitride layer to deform germanium nanowires. The nanowires are deposited and then the supporting area ablated to transform the nanowires into suspended structures. The constraint is thus transferred from the silicon nitride to the nanowires. ESRF’s X-ray diffraction capabilities and optical spectrometry were used to measure the deformation of these nanowires at 1.5%. The result is expected to improve substantially thanks to germanium-on-insulator research in progress under the CEA technological research and materials science divisions’ flagship projects Laser Ge and Operando.

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MINATEC NEWS

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Innovation

Self-monitoring goniometer antennas

Goniometer antennas could soon have embedded monitoring capabilities to make sure that their performance continues to align with factory specifications even after the devices have been installed on a drone or other vehicle.

The system, developed under a PhD research project at Leti, uses a network of photodiodes to probe the antennas' immediate environment. The diodes' backscattered signals are picked up by the goniometer antennas and, if the antenna response is compromised due to temperature, aging, or false echoes, for example, the signals will deviate from the factory reference, triggering an alert.

A patent application has been filed for the innovative system, which could be used by regulators to enhance their surveillance of the frequencies used by mobile telephone and other operators.

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Auger nanoprobe for nanometric elementary quantitative analysis

Researchers from Leti, CNRS, LTM, and LPN recently used an Auger probe for the elementary quantitative analysis of a silicon-germanium heterostructure nanowire. But first, they had to develop new spectroscopy and profilometry protocols, which they validated by comparing the results with previous X-ray diffraction and TEM results. The Auger nanoprobe offers several advantages over X-ray diffraction and TEM. Sample preparation is simple, and the probe can be used on 3D samples and achieves a lateral resolution of 50 nm.

The researchers are leveraging their successful use of the probe on Si-Ge nanowires with diameters under 100 nm for other nanostructures, such as those grown on III-V substrates.

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Miniaturization record for single-electron CMOS transistor

Single-electron transistors (SETs) measuring just a few nanometers have been made by several teams of researchers around the world. However, none had managed to do it on CMOS and achieve operation at ambient temperature. Researchers from Leti and INAC have been successful on both fronts, with a transistor inside a 3.4 nm diameter silicon nanowire that operates from low up to ambient temperatures.

The research, which was published in *Nanoletters*, is crucial in that single-electron transistors have the potential to slash circuit energy consumption and could even be used for quantum processors. The researchers are currently working on reducing the variability of their transistor, even if that means compromising on miniaturization.

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Gentle metallization for porous silicon

Metallizing porous silicon no longer requires a physical process or CVD. Researchers from the CEA and the nanochemistry lab at CPE Lyon have developed a gentle metallization method using a process that is more effective and less costly than current solutions.

The porous silicon is immersed in an ionic liquid bath containing an organometallic precursor. The liquid is soaked up by the material and the precursor precipitates the nanoparticles, which are deposited inside the material's pores. Metallization takes place at temperatures between 50°C and 100°C.

The process was used successfully with copper, cobalt, palladium, and platinum, and is mature enough for work to begin on integrating metallized porous silicon into processes. The method could potentially be used for chromatography microcolumns, gas sensors, and fuel-cell membranes.

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Magnetic tunnel junctions no longer a mystery

Scientists have known for a long time that the current in a magnetic tunnel junction (MTJ) depends heavily on the spin states at the interfaces between the ferromagnetic and insulating layers. Some states promote the flow of current, while others don't. However, what scientists didn't fully understand was why. Until now!

An international team that included researchers from INAC has just unlocked this mystery, using low-frequency noise spectroscopy to detect the band-edge energy at the interfaces. Noise anomalies can be used to assess the degree to which the spin-dependent states and different symmetries within the crystalline structure blend. The origin of this blend is the spin-orbit coupling. The same spectroscopy technique could also be used to characterize the physical purity of a MTJ.

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Biologically-inspired copper chelates prove effective

Patients suffering from Wilson's disease—which causes copper to accumulate in the liver—could soon benefit from a new, more effective treatment with minimal side effects. Researchers at INAC and DSM (the CEA's materials science division) have synthesized molecules capable of targeting liver cells to trap the copper. The molecules use coordination sites, much like small proteins known for their copper-trapping ability.

Preclinical testing began over a year ago in conjunction with iRTSV and DSV (the CEA's life science division). The researchers recently published their results with a new molecule with the same architecture. This time, they sought their inspiration in a more complex protein, whose role is to promote the entry of copper into the cell. And once again, the molecule was proven effective as a copper chelate.

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Day by day

Cinatec expands imaging capabilities with SPECT/CT

The Siemens SPECT/CT system installed in late 2013 at Cinatec has been fully operational since May 2015, following a permitting and compliance process that lasted more than a year. The system combines a CT scanner and gamma camera for simultaneous anatomical and functional imaging. The system will be used for Cinatec's research on targeted delivery of radiolabeled cancer drugs.

The system is exactly like the ones that can be found on several oncology floors of the Grenoble University Medical Center. And it is held to the same standards, especially in terms of collecting and treating the radioactive liquid waste from patient procedures in radioactive decay tanks. The tanks were received in late May, allowing Cinatec to begin using the system.

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Day by day

The Internet of Things heads to the beach

This summer, the first group of women to test a connected swimsuit equipped with a miniature UV sensor were spared the unpleasant experience of a sunburn. The swimsuit—the first of its kind—sends a “use sunscreen” warning to the wearer’s smartphone when the sun gets a bit too hot!

Spinali Design, a startup based in France’s Alsace region, worked with Leti on this IoT innovation. Encouraged by the warm reception the product received around the globe, the startup will now work with Leti to make the sensor even smaller—integrating it right into the swimsuit fabric. The company is scaling up the swimsuit technology for manufacturing and would like to diversify into other textile products.

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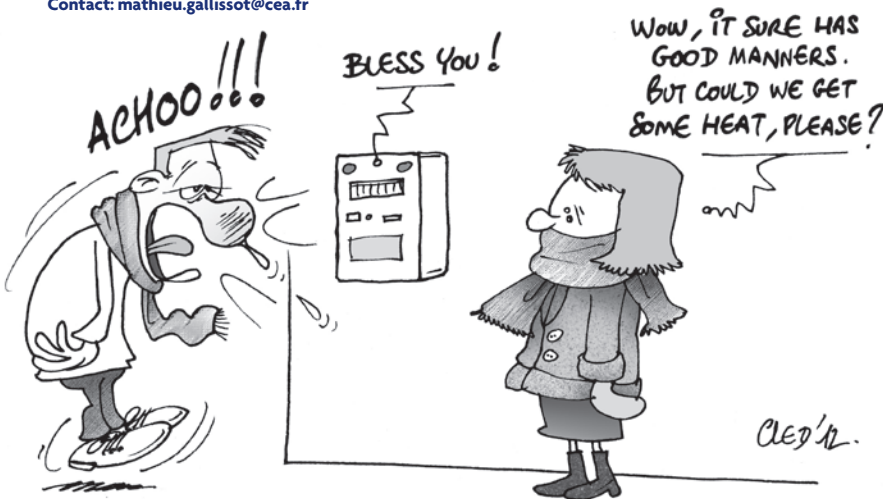
Connected home heating, French style!

Researchers at Leti have come up with a way to connect a home’s electric heating system to France’s national grid, letting homeowners take advantage of off-peak utility rates without sacrificing comfort. This smart-grid solution comes in the form of a dedicated circuit board with its own microcontroller.

The circuit board collects data like peak and off-peak hours, load curves, and planned load-shedding from the grid and “learns” occupant habits. All of this data is used to control the home’s heating system via the pilot wire, selecting the frost-protection, economy, comfort, or off settings—standard for electric heating systems in France—as needed.

Research to develop the solution was made possible by IRT Nanoelec. Talks are underway with several manufacturers.

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IMEP-LAHC gets the Rolls-Royce of network analyzers

In June, IMEP-LAHC signed a renewable nine-month contract with Anritsu to use the manufacturer’s state-of-the-art very wideband network analyzer. The analyzer can measure systems from 70 kHz to 145 GHz in a single sweep, achieving never before seen levels of performance and accuracy. The analyzer also has a four ports under probe configuration, offering unparalleled on-wafer characterization capabilities.

This innovative analyzer, which sells for €750,000, is a step up from test benches of the same type, which are limited to 110 GHz. Researchers at IMEP-LAHC are using it to examine new interconnect structures and integrated circuit topologies at very high frequencies and across a very wide band.

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Phelma’s freshman cohort better than ever

The 2015–2016 school year is the best yet for Grenoble Institute of Technology’s Phelma engineering school. The school moved up the CCP admissions rankings between 60 and 230 slots, depending on the major. The CCP is a common entrance exam for France’s polytechnic institutes.

The incoming freshman class size is similar to the 2014–2015 class, with 358 students in initial degree programs and 12 in the integrated micro and nanoelectronics system design work-study program. A total of 258 freshmen (70% of the class) were admitted from preparatory programs, 46 came from the INP preparatory program, and 24 were admitted based on their previous degrees (bachelor’s or two-year technical degrees). In terms of gender parity, the situation remains virtually unchanged, with 23% women engineering students, down slightly from 26% in last year’s freshman cohort.

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CIME Nanotech gets new CVD equipment

CIME Nanotech now has a new CVD (chemical vapor deposition) machine. The machine will be used for microelectronics, photovoltaics, and spintronics courses and will also be available for use by academic research labs.

The machine can be used to deposit thin layers onto four-inch silicon wafers and smaller samples. Worth noting is the fact that it has two chambers—one for metals and another for dielectric and magnetic materials—to reduce the risk of cross-contamination.

One of the chambers also has an oxygen inlet for oxidized deposition.

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Horizons

With HAP2U, touch screens get touchable texture

After going home with the Forum 5i trophy in May, the startup HAP2U, located at CIME-Nanotech and cofounded by Cédric Chappaz (formerly from STMicroelectronics), is enjoying remarkable success. The company’s multi-patented technology, which gives texture to touch screens, could potentially help fuel e-commerce. The innovation leverages the “air layer” effect, where ultrasound waves create a layer of air between the user’s finger and the screen. As the frequency varies, so does the texture perceived by the user.

HAP2U is working with Leti on the activation of thin-layer piezoelectric materials for a future product development kit that is nearly ready for scale-up. The company plans to send out about one hundred of these kits at the beginning of 2016 and collect user feedback that will enhance the development of future applications for the technology.

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Interview

Alain Briand,
head of business
creation support:

**€96 million
in eighteen
months for
CEA Grenoble's
startups**

Is this an exceptional era for startups based in Grenoble?

Sixteen startups from our research environment raised the record sum of €96 million from some 40 investors in just eighteen months. Aledia raised over €28 million, in addition to the €19 million raised by Crocus Technologies, €5.7 million by Exagan, €6.4 million by Isorg, €3.7 million by Apix Analytics, and €3 million by Primo 1D, as well as funds raised by ISKN, Enerbee, and Avalun. Almost all of these companies are operating out of MINATEC and more specifically the BHT.

Why this surge in investments?

We are developing some of the world's highest-quality technology. And our startups are benefiting from sharp growth in investment in startups, both in Europe and worldwide. In other words, international-caliber investors are placing their bets on Grenoble's technology.

We are also seeing an uptick in local investment, especially from angel investor networks, which tend to put between €1 million and €3 million on the table. They increasingly figure among the top investors in our startups' capital-raising campaigns.

What role can the CEA play in sustaining this level of investment?

It all starts in the laboratories. Without top-notch technical projects there can be no ambitious startups and, consequently, no interest from investors.

We need to continue to promote our research achievements. This means talking to investors and showing them our most promising work. But it is up to the startups themselves to find capital—something they have shown they're very good at!

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Horizons

FDSOI design: Promising start for Silicon Impulse

Where can you design, prototype, and actually manufacture small runs of FDSOI circuits? Only at Leti's Silicon Impulse design center! Whether you want to test a technology or scale it up for manufacturing, the center has everything you need. Founded in March 2015, Silicon Impulse has already drawn attention from numerous manufacturers and academic laboratories in France and worldwide. Next February, Silicon Impulse's first multi-project wafer will be made using STMicroelectronics' 28 nm FDSOI technology; the circuits of various different partners will be found on the wafer.

FDSOI 28 nm is gaining traction on the Internet of Things and in low- and very-low-energy trends. Silicon Impulse, which is already backed by STMicroelectronics, is also in advanced-stage negotiations with Global Foundries, another international foundry giant, in an effort to reach the 22 nm FDSOI node.

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Atomic layer deposition (ALD) seminar to come to Grenoble

Atomic layer deposition, or ALD, will be the central topic at RAFALD, a three-day workshop organized from November 16–18 by several Grenoble-based ALD experts. On the docket: materials, equipment, processes, and simulation—all for an audience of professionals from industry and academia plus students enrolled in engineering programs. 50 to 100 attendees are expected.

ALD is used extensively in microelectronics and Grenoble, home to some top-notch equipment and facilities, has become one of France's major ALD centers. The organizers are planning to build on this workshop—the first national event of its kind in France—to launch a national network dedicated to ALD. The new network could reach beyond microelectronics, attracting professionals from the energy, textile, biology, and organic electronics sectors.

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Close to 60% of Phelma graduates work in energy and ICTs

Six months after graduation, 90% of the 2014 Grenoble Institute of Technology-Phelma graduates who responded to a career placement survey by a French higher-education consortium (*Conférence des grandes écoles*) reported having found a job.

The majority of these engineers work in industry, and—for 50% of them—in R&D. The top industries employing graduates are energy (31%), ICTs (26%), and the auto, aerospace, naval, and rail industries (16%). The responses also indicated that over 50% of respondents were hired by the company where they did their graduation projects, that 80% are on permanent contracts, and that the average gross annual salary of the graduates is around €36,000. Research, however, continues to set Phelma apart from other schools: almost one-third of graduates reported having enrolled in a PhD program.

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With Fahrenheit2451, Arnano targets the consumer market

Grenoble-based startup Arnano, which has traditionally addressed the B2B market, raised more than €45,000 for its Fahrenheit2451 project from 329 donors in 22 countries on Kickstarter, putting its name on the map in consumer markets. A 2009 spinoff of Leti, Arnano manufactures and engraves sapphire memory capable of withstanding all sorts of abuse, including temperatures of up to 1,300°C (2,451°F). Now the company is reaching out to individual consumers with its 2.5 cm to 10 cm diameter sapphire "nanofoms," upon which text, photographs, and other images can be engraved.

This project, which also provided valuable market insights, supports Arnano's plans to speed up its development. The company is now working on delivering the Kickstarter orders to Fahrenheit2451 subscribers before Christmas.

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Website: www.fahrenheit2451.fr

Horizons

CEA-INAC PhD candidate wins two international awards in “My 180-second Dissertation” competition

What does love have to do with electrical conductivity? Grenoble’s very own Alexandre Artaud served up a particularly engaging—not to mention entertaining—explanation in the second annual “My 180-second Dissertation” competition. Alexandre’s presentation won him the top slot in the national finals and two awards (second overall and the audience’s choice award) at the international finals held on October 1 at the Sorbonne.

Alexandre is a PhD candidate in basic physics at CEA-INAC, a lab specializing in quantum electron transport and superconductivity. He presented his PhD research on how graphene can be given superconducting properties when coupled with rhenium. His dissertation addresses using a nanocharacterization method, very-low-temperature tunnel spectroscopy, to explore the electronic and superconducting properties of graphene-on-rhenium.

Watch a video of the international finals: mt180.fr (Alexandre Artaud at 43:00)
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Live from MINATEC

National Inno’Cup Jr Championship: Grenoble hosts the high-caliber finals

MINATEC played host to the fourteen finalist teams in the Inno’Cup Jr—a competition for innovators aged fifteen to eighteen—arriving from all over France this past summer to present their work.

From a device that transforms walking energy into electricity, to antiseptic chewing gum, to a double bass the size of a ukulele, the teams’ innovations dazzled the jury. But the grand prize went to the team that presented a pioneering pair of connected glasses that use echolocation and geolocation to generate an audio guide to help the visually-impaired to explore their environment and find their way more easily.

The two sixteen-year-old grand prize winners, who attend the high school in Bourgoin-Jallieu, will fly to California on October 24–31 to visit major US research centers and corporations.

To watch a video of the grand-prize-winning innovation: <https://goo.gl/sh9kts>
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Next stop for CEA Tech’s traveling showroom: Tokyo

October will mark the arrival of the CEA Tech showroom in Tokyo, in celebration of the Year of Franco-Japanese Innovation. The foyer of the French Embassy in Japan will host the traveling exhibit for at least six months. The CEA Tech Japan office will take advantage of the showroom’s presence to promote its innovation expertise to Japanese manufacturers.

A second traveling showroom has been built and will be exhibited at numerous events in France in the coming months, including COP21, the 70th anniversary of the CEA, the 10th anniversary of the *Instituts Carnot*, and the IoT World and BioFIT trade shows. CEA Tech is also looking into the possibility of a traveling European showroom.

On the topic of CEA Tech showrooms, two permanent exhibits with a range of demonstrators are already on display in Toulouse and Metz, and three others will be built in Nantes, Bordeaux, and Lille by April 2016.

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Live from MINATEC

Five CEA Tech startups win national awards

The annual i-Lab startup competition organized by France’s Ministry of Higher Education and Research has become a rite of passage for new businesses. And once again this year CEA Tech startups brought home an impressive number of awards, confirming Grenoble’s strong capacity to develop innovative solutions for industry.

The five award-winning CEA Tech startups are:

- eLichens, which commercializes a technology developed by Leti (sensors and services for air quality monitoring)
- e-SIMS, a Liten spinoff, which develops intermittent energy and electrochemical storage management software
- MedPrint (a Clinatec project in the pre-startup phase), for silicon components for neurological exploration
- mirSense, a Leti spinoff, which develops infrared lasers for chemical trace analysis
- EnWireS (an INAC project in the pre-startup phase), for silicon nanowires for lithium-ion energy-storage batteries

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GEPHY 2015: Success for INAC’s energy storage tour!

This summer, INAC once again welcomed a group of high-school and preparatory-program physics and chemistry teachers for the 2015 edition of its Grenoble Physics School (GEPHY). The participating teachers were offered six tours. INAC’s new tour on materials and devices for energy storage garnered well-deserved attention, and the initial group of ten participants quickly grew to fifteen.

The teachers were taken from one site to another on an electric shuttle bus, learning about the capabilities of the Hybrid-EN and NanoS platforms and the research being carried out there. They were introduced to in situ observation of battery electrodes, the uses of graphene, and the growing attraction of silicon nanowires. They also discovered how traditional material production methods are now being “recycled” for new purposes.

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7th annual Grenoble Ekiden marathon sold out

The registration deadline for the 7th Ekiden marathon, originally October 5, has been moved forward by more than two weeks; the race reached its maximum capacity on September 17 at 650 teams (that’s 3,900 runners). The relay marathon will be held in Grenoble on Sunday, October 18, 2015. This year, runners will be able to pick up their GIANT bibs on October 16 between 12 p.m. and 2:30 p.m. at the Canopea building. On race day, runners can check in at tables in front of MINATEC and at the Grenoble Institute of Technology’s new auditorium.

Pre-race training sessions will be offered until October 15, from 12 p.m. to 1:30 p.m. on Tuesdays at Parc Paul Mistral (meet in front of the Halle Clémenceau) and Thursday evenings on the Presqu’île (meet in the Europole gymnasium). Last year, the best team ran a time of 2:13. Are you up to the challenge?

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Agenda

**October 8–10,
MINATEC**
**2015 “Parvis des Sciences”
Science Fair and EXPERIMENTA**
Art, Science, and Technology Fair
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**October 13,
MINATEC**
Third national IRT
(Technology Research Institute) Forum
on the IRTs’ crucial role in overcoming
tomorrow’s challenges
Register here: www.irtnanoelec.fr/inscriptions/

**October 15,
Phelma 2 Building**
6th Phelma Partners’ Day
Said.obbade@grenoble-inp.fr

**October 18,
Presqu’île scientifique**
7th Ekiden Marathon
Contact: giant.info@cea.fr

**October 20,
Tokyo**
11th Leti Days in Japan
[http://www-leti.cea.fr/fr/
Prochain-evenement/A-venir/Leti-Day-TOKYO-2015](http://www-leti.cea.fr/fr/Prochain-evenement/A-venir/Leti-Day-TOKYO-2015)

**November 16–18,
Maison MINATEC
and Campus-East**
RAFALD workshop on thin atomic
layer deposition
www.rafald.org

**November 21,
Grenoble Institute of Technology
auditorium**
**Phelma commencement
ceremony**
<http://phelma.grenoble-inp.fr/accueil-phelma/>

**December 1–4,
Maison MINATEC**
**11th Symposium on X-ray and
Matter**
<http://www.rayonsxetmatiere.org>

**December 7– 8, ILL
CARAC2015,**
Grenoble characterization instruments
open house for businesses
[http://www.ill.eu/press-and-news/events/
carac-2015/](http://www.ill.eu/press-and-news/events/carac-2015/)

**December 7–9,
Maison MINATEC**
**European Nanomedicine Meeting
2015**
[http://www.sfnano.fr/european-nanomedicine-
meeting-2015-conference-fee/](http://www.sfnano.fr/european-nanomedicine-meeting-2015-conference-fee/)

**December 7–10,
CNRS campus**
Dautreppe Seminar 2015:
Generating, Controlling,
and Detecting Light
<http://dautreppe.photonique.grenoble.cnrs.fr/>

**December 16–17,
CNRS campus**
Physics & Nanoelectronics 2015
[http://www.fondation-nanosciences.fr/RTRA/
fr/976/151216-pne_workshop.html](http://www.fondation-nanosciences.fr/RTRA/fr/976/151216-pne_workshop.html)

Contacts

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