MINATEC® NEWSLETTER

MINA-NEWS

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Top news

Fire-damaged area of building 41.01 back to business as usual

Any visitor touring the cleanrooms in building 41.01 would have a hard time believing that the building was ravaged by fire less than a year ago. The fire-damaged area of the building reopened in December after four and a half months of repairs and the installation of new equipment to replace equipment damaged in the fir

Leti's first priority was, of course, safety. Filtration units in the clean room ceilings had been damaged in the fire. The cleanrooms' deposition and heat treatment equipment had to be inspected before either being moved or set up for operation on site with new protective shields. At the same time the process to replace severely damaged equipment was initiated.

Little disruption to the building's other activities

The area damaged by the fire—especially the ceilings and resin filtration systems—was then dismantled and reconstruction commenced in June. New partition walls, pressurized supply plenums, extractor ducts, recyclers, electrical wiring, and filtering resins were installed. Several hundred technicians employed by specialized subcontractors worked on the job.

One of the major challenges of the reconstruction project was to disrupt the 41.01 building's other activities as little as possible. Temporary partition walls were put up to isolate the area. A "clean tunnel" was also set up so that employees could get to the cleanroom without coming into contact with the area under construction.

The CEA served as prime contractor on the job, managing this cleanroom reconstruction project in an unusually urgent situation that demanded truly unique solutions—a challenge they pulled off masterfully!

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Innovation

Shape affects magnetization reversal

Magnetic objects of the same composition but with different geometries demonstrate different magnetization reversal behavior. Researchers at INAC have discovered that the shape and direction of the wires (in systems made of aluminum oxide and cobalt wires and platinum) determined the spatial distribution of spin-orbit coupling in the object, and therefore the angular momentum required to reverse magnetization.

The researchers were able to characterize the relationship between shape and magnetic properties. They then made bipolar switches for memory as well as irreversible switches. Their concept can be applied to many materials. The shape of the system can be determined at the lithography stage; good news because lithography is the simplest and most flexible fabrication process.

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Tomorrow's 5G antennas will be thinner

Researchers at Leti have reduced the thickness of antennas for satellite communications and tomorrow's 5G network access points by half. Their secret? They replaced the single focal point of today's antennas with a four-source focal network. A 30 GHz antenna leveraging the innovation measures just 10 cm x 10 cm and is just 3 cm thick. The achievement marks a milestone that took ten years of research during which three patents were filed. The so-called "transmitter network, beam reconfigurable antennas" offer state-of-the-art efficiency, bandwidth, fabrication costs, and reconfiguration capacities. However additional work is needed to make the antennas even smaller.

The focus of the research has now shifted to proving the technology's effectiveness for the 27.5 GHz–31.5 GHz bandwidth, which is already in use for satellite communications and a prime candidate for tomorrow's 5G networks.

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Very-high-speed RFID for electronic passports

Researchers at Leti have developed a reader and ASIC for RFID data reception at speeds up to 27.12 Mb/s required by the ISO 14443-amd5 standard. The new technology could be used for electronic passports, which will store more and more information, from biometric data to secure protocols. Tomorrow's fourth-generation electronic passports could even be used to store visas right on the passports' chips.

The main obstacles the researchers had to overcome were caused by the receiver's linearity at the required transmission speeds: state-of-the-art signal processing techniques were used to ensure the quality of communications. The research was published in an international journal and two patents are currently pending.

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Innovation

Coupled characterization provides insights into phase transitions

Researchers at the nano characterization platform (PFNC) have coupled X-ray diffraction and X-ray diffusion to observe a chalcogenide thin layer during annealing. Their goal was to gain a deeper understanding of what happens to the morphology and structure of PCRAM materials when they transition from an amorphous state to a crystalline state. The X-ray diffraction and X-ray diffusion datasets were combined, revealing a variation in volume of around 5% that generates substantial stress in the material.

The experiments were conducted on a diffractometer equipped with a temperature chamber with a range of up to 1,200°C. The main challenge was to establish optimal data acquisition conditions, striking the best balance between measurement dynamics and crystallization kinetics. This coupled characterization technique can be used on other types of samples.

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Heterogeneous materials: combining 3-D chemical and morphological analysis

Leti researchers working at the nano characterization platform (PFNC) have combined two 3-D characterization methods—X-ray tomography and TOF-SIMS—to analyze the morphology and chemistry of very heterogeneous samples. They used the two methods to better understand the diffusion, degradation, and aging mechanisms affecting microprocessor interconnects, lithium-ion battery electrodes, and fuel-cell electrolyzers. They examined the materials at scales ranging from 100 nm to 100 microns.

The two techniques the researchers used offer state-of-the-art spatial resolution and sensitivity. The method entails substantial 3-D alignment of the two datasets, and can be used on other samples such as organic materials and dendrites.

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Telecommunications: III–V/silicon tunable laser

Solid indium phosphide (In_P) tunable lasers for telecommunications networks are costly to manufacture and ill-suited to integration with other photonic and electronic components. Researchers from Leti and the III–V Lab have now produced a tunable laser on a silicon substrate coupled with a III–V material.

This hybrid monomode laser boasts a novel waveguide system coupled with two thermo-optically-controlled rings for a tuning range of 35 nm. The system, which enables the allocation of 80 wavelengths in the International Telecommunications Union (ITU) standard wavelength plan, is intended for metropolitan and long-distance telecommunications networks.

The researchers are now working on integrating the hybrid lasers with other optical functions with the goal of producing complete transmitters suitable for telecommunications and data centers.

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Superconducting single-photon detectors at the state of the art

INAC, KTH (Sweden's Royal Institute of Technology), and Dutch startup Single Quantum have teamed up to produce superconducting single-photon detectors (SSPD) that set a new state of the art with 85% collection yields. Current SSPDs offer yields of 35%.

The key to the ultra-high yields? The superconducting nanowire that detects the photons is placed in an optical cavity, enabling it to collect much more light. SSPDs' main competitors, silicon-based avalanche diodes, struggle to reach yields of 40%; plus the spectral range they cover is limited.

And, to push yields above the 90% bar, the researchers have developed another innovation that makes the SSPDs independent from the incident polarization; a patent is pending. The astronomical yields more than offset the disadvantages of having to cool the detectors to 4 K.

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Liquid crystals could make lithium-ion batteries safer

Researchers from INAC and Liten have developed a new-generation solid electrolyte based on thermotropic ionic liquid crystals. The purpose of the research was to improve lithium-ion battery safety and performance. The crystals self-organize into nanometric strips and help prevent the charge buildup and thermal runaway that can cause liquid-electrolyte batteries to catch on fire or explode.

The new electrolyte material transports ions effectively and offers good thermal and electrochemical stability. The high-temperature ion conductivity also looks promising, as does the material's performance in actual batteries.

The research is ongoing under a Ph.D. research project project and a joint project with CEA Nanosciences, a cross-cutting CEA programTwo patent applications have been filed.

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BigDFT code makes front-page news

BigDFT, an open-source code used to simulate solids and molecules, has made front-page news in two chemistry journals in the space of a few weeks. INAC's L–Sim team, which has been developing the code for years, should be proud: in 2015 the team demonstrated the robustness of a system simulation at 30,000 atoms and plans to achieve 50,000 atoms this year.

The code simulates large systems with state-of-the-art precision and linear scaling of calculation time. Competing codes require cubic scaling, which means that calculation times are eight times longer for systems twice as large.

In the coming years the researchers plan to use the code to simulate DNA in water, molecular films in OLEDs, and gas-phase molecules.

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Double quantum wells on a PMOS nanowire transistor

The R&D partnership on advanced CMOS transistors between STMicroelectronics, IBM, and Leti has produced some impressive results. Two silicon-germanium (SiGe) quantum wells separated by a thin layer of silicon have been produced on a PMOS transistor with a grid unit length of 15 nm. The combination of SiGe and silicon results in a 1.5% deformation of the grid unit in the nanowire. This core-shell transistor offers 60% more current capacity than traditional silicon-canal transistors.

The major hurdle in this pioneering R&D was the epitaxial growth of SiGe layers just nanometers thick on a 10 nm silicon core. The research was published in the journal *IEEE Electron Transactions on Electron Devices* and received the Paul Rappaport Award for the publication's best article of the year.

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Innovation

Silicon photonics: new speed record set

Just one year ago, researchers at Leti built an 80 Gb/s data switch demonstrator; today, they have set a new speed record with a switch prototype that works at 128 Gb/s or 256 Gb/s. And, once again, the results are the fruit of a multi-partner project involving Alcatel-Lucent and the III–V Lab. The system will be of interest to the telecommunications market.

The researchers tripled the switch's speed by replacing the former version's transmissive system with a reflective system. The light signals are carried by sixteen optical channels and then reflected back by mirrors, meaning they pass twice through an optical attenuator. The components of the system—which has just one multiplexer—were integrated on to a mere 3 mm^2 of silicon. The research won a Best Paper Award at ECOC 2015.

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A video encoder that uses just 19.1 mW of power

The future of low-power design just got a little brighter. The H.264 video encoder developed by researchers from Leti and Vietnam National University (VNU) uses just 19.1 mW total power; products currently on the market use between 30 mW and 600 mW.

The research was conducted as part of a jointly-supervised Ph.D. thesis. The team focused on factors like data encoding and decoding, industrial design, and frequency control to reduce power consumption. They also divided the encoder into several voltage/frequency domains to suit the workloads of the different modules of the architecture. VNU has already sent a circuit to foundry and is pursuing work on the encoder, which should have a promising future!

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Day by day

Heterogeneous reactors and reactions class to be held on March 13–18

A special winter session on heterogeneous reactors and reactions will be held on March 13–18 at Alpine ski resort Les Houches. The program, offered by Codegepra (the region's process engineering development committee), will feature a review of basic concepts as well as numerous business cases on fuel cells, lithium-ion batteries, biomass gasification, CO_2 capture, water treatment, automotive catalyzers, and more.

The slate of speakers will feature professionals from research organizations and industry (Solvay and Total, among others). The winter session should bring in around 50 attendees. Due to the advanced science that will be covered, the program is open to Ph.D., post-doc, academic science faculty, and practicing industrial R&D professionals with strong STEM backgrounds. LEPMI, the Laboratory of Electrochemistry and Physico-chemistry of Materials and Interfaces (which operates under the aegis of Grenoble Institute of Technology and other partners) will be represented on the scientific committee and will also have several speakers on the program.

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Register here: http://goo.gl/n53ByU

MIT and Leti partnership continues to produce results

Leti delivered its first suspended microresonators to MIT in 2014, following suit with a new generation of the component in 2015. The microresonators still deliver femtogram precision—but they now also boast a network of sensors for even faster analysis and redundant measurements. The microresonators are being used in the US where they help medical professionals measure tumor cells present in patient tissue samples.

The partnership between MIT and Leti has been extended with a third order for the microresonators and could be expanded as the two institutes shift from a subcontracting agreement to a joint development model in the form of an R&D contract and the co-filing of patents. The partners are currently seeking out potential government grants.

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Day by day

CCL building completed ten weeks ahead of schedule

Construction on MINATEC's new CCL (software design center) building was completed in January 2016—less than a year after breaking ground and an impressive ten weeks ahead of schedule. The building meets France's stringent thermal efficiency regulations and offers 2,900 sq. m of floor space on four levels. The ground floor will be used exclusively for events managed by Maison MINATEC; the offices and shared workspaces are on the upper floors. Around 140 employees will soon be moving in to the new building.

INRIA will occupy the first and second floors: the move will bolster cooperation on software between INRIA and the CEA. The third floor will be home to Leti's Design Architectures and Embedded Software Division (DACLE). The CCL building will serve as a hub for the hardware-software ecosystem, from design through to integration, generating synergies and offering customers a single point of contact.

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Challenge First Step supports four innovative projects

The judges in the Challenge First Step competition selected four of the six projects presented at the end of 2015 to receive financial support. The projects are: Wimagine (Leti/Clinatec), a long-term brain activity monitoring system for patients suffering from epilepsy and head injuries; Sensing the World (Leti/DSIS), a structural deformation monitoring service for bridges, dams, and other major structures; Moon Plug (Liten/DTS), a charger for tablets and mobile phones that can adjust charging time to the device's actual needs; and Butterfly (LITEN/DTS), an algorithm-driven building energy management system soon to be tested on an actual building at solar-energy research center INES.

The four projects will receive up to €280K over the next six months and could be eligible to receive additional support if the milestones in their development plans are reached.

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Aselta's photolithography software just got better

Startup Aselta's Inscale photolithography software has come through the validation phase with flying colors, positioning it to become the go-to software for MDP (mask data preparation, sometimes called "fracture") at Leti. Improvements made to the software under a joint lab between Aselta and Leti have placed Inscale on a par with the current market leader.

Next on the software development roadmap? The joint Leti-Aselta lab, founded in 2012 and renewed in 2015, will be very busy developing additional features to meet new mask fabrication needs at Leti, in particular for photonics, density maps to detect process constraints early on, and the verification of new design rules.

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Interview

Pierre Benech,
Director, Grenoble Institute of Technology's Phelma Engineering School

"Student entrepreneurs innovate at Phelma"

How does Phelma help student entrepreneurs?

Our first two students to have obtained "student entrepreneur" status—a French government program—are Pierre Schefler and Nicolas Schoemaker. During the 2014–2015 academic year they set up their company on top of their third-year course load. Support came in the form of a flexible class schedule, assistance starting their business, and approval to replace the usual six-month internship and culminating project with their startup.

They have graduated, but still have student entrepreneur status: now enrolled at business school IAE Grenoble, they are continuing to grow their business. They still have an office and lab at Phelma.

What kind of results is the program getting?

It's still too early to tell. But the program does appear to offer a number of benefits. Starting a business in your garage is the stuff of legend. But there are more practical—and effective—ways of doing it! Student entrepreneurs can get their student benefits (health coverage, subsidized public transportation fares, etc.) extended, a definite plus!

Has the program encouraged you to promote student entrepreneurship more?

Helping student entrepreneurs is part of how we at Phelma support innovation. However, we don't want to put students on a path that might not be right for them. You're either an entrepreneur or you're not, and we have to be very cautious not to turn potential entrepreneurs off—possibly for good.

Learn more about Phelma student businesses:
OXBERN https://goo.gl/uxpaOz
FOODY https://goo.gl/TCk9xg
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Day by day

INAC is restructured

Since January 1, 2016, the Institute for Nanoscience and Cryogenics (INAC) has counted five laboratories rather than six. The new labs' names are: PHELIQS (photonics, electronics, and quantum engineering); MEM (materials modeling and exploration); and SYMMES (molecular systems and nanomaterials for energy and healthcare). Spintec has been expanded and SBT remains unchanged.

The purpose of the restructuring plan was to better align INAC's activities with its current partnerships and research programs, with new energy technologies, spintronics, and numerical simulation at the forefront. Today, INAC works extensively with Leti, Liten, and a number of Grenoble-Alpes University laboratories. Some 460 people currently work at INAC, including more than 160 Ph.D. candidates and post-docs.

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CEA: Stéphane Siebert appointed Director of Technological Research

On January 1, 2016, Stéphane Siebert succeeded Jean Therme as Director of Technological Research of the French Alternative Energies and Atomic Energy Commission (CEA). After earning a degree from the Ecole Centrale de Paris, he spent eight years at the CEA's Grenoble campus, first conducting Ph.D. research and then in a staff research position. He spent the next six years founding and developing Corys, a CEA spinoff. He later held several administrative positions for the City of Grenoble, France, which he served for twelve years.

Mr. Siebert returned to the CEA in 2007, working on major projects like setting up MINATEC and GIANT and rolling out the CEA Tech regional tech transfer office initiative. He plans to pursue the development strategy initiated by his predecessor, Jean Therme, who will serve as Special Advisor to the Director of Technological Research in addition to his ongoing responsibilities as Deputy Director for Renewable Energies reporting to the CEA Chairman.

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Horizons

PCR DNA analysis gets prehistoric samples talking

Part of an archaeologist's work involves identifying 30,000-year-old animal droppings. And they need to know what species—hyena, wolf, or fox?—they are dealing with as soon as possible. Now they can thanks to a Leti prototype called Microprep that rapidly prepares samples for PCR DNA analysis. The prototype was successfully tested at the Maldidier cave site in southwestern France last fall, telling archaeologists what they needed to know—to keep digging or not—in just two hours. Traditional lab DNA analysis takes from two to six months.

The Leti scientists behind the innovation set out to prove that the technology is robust in the field. And it is: Microprep can extract the DNA needed for PCR analysis in less than ten minutes. The user simply changes a disposable cartridge depending on the type of sample being prepared. Several testing equipment manufacturers are interested.

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Horizons

Phelma to host 32 international students at 2016 Summer School

With five weeks of nanotech classes, introductory French lessons, tours of scientific facilities like ESRF, the CEA Tech showroom, and Institut Néel, cultural excursions, and just plain fun, the 14th annual Summer School should be a memorable one. The Summer School is organized by Grenoble Institute of Technology at Phelma's MINATEC campus from June 6 to July 8. Classes are taught in English by faculty from Phelma and Grenoble-Alpes University Joseph Fourier School of Science, as well as lecturers from foreign universities. The 32-student cohort is distinctly international, with participants from China, South Korea, the US, and Italy. Applicants are all undergrads enrolled at top-tier universities, many of which are partners of Grenoble Institute of Technology.

Some of the sessions' "time off" activities will be run jointly with the GIANT International Internship Programme, a great way for students to interact with people from around the world.

Learn more at: http://goo.gl/FDuahh
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Leti ramps up international programs with the Instituts Carnot

Leti plans to use some of its Instituts Carnot matching funds to pay for exchange programs with foreign labs and market Leti internationally, with the overriding objective of working with top-tier partners around the globe. The institute will set up chairs and researcher exchange programs each year, starting in 2016. These activities will strengthen ties to partners abroad and raise the institute's international profile, positioning Leti to better support its industrial partners' international strategies.

Specifically, Leti will strengthen existing partnerships like the HTA Alliance (with CSEM, VTT, and Fraunhofer) in Europe; programs with Caltech, MIT, and Stanford in the US; and Tsukuba in Japan. The institute will also reach out to new partners and will pursue its work with the Instituts Carnot on international events and targeted communications campaigns.

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Phelma library now has "women in science" collection

On March 11, 2016—just three days after International Women's Day—the Grenoble Institute of Technology-Phelma library will cut the ribbon on a new "women in science" collection to be followed by a series of lectures and a Midi MINATEC brown bag lunch on the same topic.

The project, initiated and financed by France's APMST (association for gender equality in science and technology), will help counter the popular belief about science's "gender." The collection contains biographies, works on education and diversity, scientific publications in fields like the cognitive sciences and neuropsychology, and sociological research on the role and social status of women in science throughout history. About half the collection, which will ultimately contain around a hundred works, will be in the stacks in February.

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Second Minalogic Business Meetings to be distinctly international

The second Minalogic Business Meetings will be organized by Minalogic and its partners at Grenoble's World Trade Center on April 14, 2016. A total of 60 large corporations and 60 solutions providers—many of them international—will gather to meet the perfect match for their micro and nanoelectronics, photonics, and software needs.

In addition to the one-on-one business meetings popular with Minalogic members, the day-long event will also feature eight talks on hot tech and market topics. The first Minalogic Business Meetings in December 2014 logged nearly 1,200 face-to-face meetings, with some attendees scheduling as many as seventeen! Representatives from Sony, Total, Schneider Electric, Dura Automotive, and Swatch have already registered for this year's event.

Learn more and register at: www.minalogicbusinessmeetings.com
Contact: constance.motte@minalogic.com

Live from MINATEC

Third Innovation Marketing Day to be held on April 5

Come and discover the latest trends in high-tech/innovation marketing and the best practices behind the success stories at the third Innovation Marketing Day to be held at Maison MINATEC on April 5, 2016. You will also learn about how the innovation process works for startups, small and mid-sized companies, and large corporations.

The event, co-organized by CEA Tech Grenoble Ecole de Management, will feature testimonials from companies like Serge Ferrari, Terradona, Docapost, Decathlon, Solvay, and Alstom. Innovation expert Marc Giget and designer Nicolas Nova will facilitate the day's sessions. Some 300 attendees are expected.

The day will offer up a mix of theoretical and hands-on workshops, on topics ranging from demonstrator systems and prototypes to innovation business models. The event will wrap up with a tour of the CEA Tech showroom (advance registration required).

Learn more at: http://rencontresmti2016.insight-outside.fr

Grenoble Institute of Technology Open House

Grenoble Institute of Technology will hold an open house for high school, preparatory school, and college (undergrad) students on March 5, 2016. The event will be held in the Pluriel building (where the Institute's own preparatory classes are held) on the St. Martin d'Hères campus. The program includes ten lectures (on the Institute's preparatory and college programs) and "career day" style Q&A sessions with recent Grenoble Institute of Technology grads. Visitors can tour the schools' exhibit booths and stop in at the campus life forum to learn about extracurricular activities.

The open house is held during school vacation on the same day as the Polytech Grenoble open house to make it convenient for families vacationing in the Alps, who don't generally attend the traditional college fairs, to stop in at both events. In 2015, more than 800 visitors (130 from Provence-Alpes-Côte d'Azur and Île-de-France) turned out.

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EnWireS targets the Li-ion battery market

Startup EnWireS, founded this year by an INAC researcher (who also happens to be a former INAC post-doc), is developing a breakthrough chemical process for making silicon nanowires. The startup plans to release its first products—innovative composite materials to boost the capacity and lifespan of lithium-ion batteries—in 2017. The materials will be more competitively-priced than the current international market leaders.

EnWireS is already providing labs with custom silicon nanowires for R&D use—the first service of its kind on the market. EnWireS is currently located at INAC and has licensed three CEA patents. CEA Investissement is a founding shareholder.

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Live from MINATEC

Thespians to bring drama to JSIAM 2016

The Junior Scientist and Industry Annual Meeting (JSIAM) gives GIANT campus' young scientists a valuable opportunity to learn about careers in industry and chat with practicing professionals. The eighth annual JSIAM will be held on March 4, 2016, at Maison MINATEC and will offer up something new in the form of a novel Midi MINATEC brown bag lunch facilitated by 3pH, a participatory theater company. The interactive session will explore ways for young scientists to "fit in" in non-academic workplaces in several acts, from the first day on the job to the first time running a meeting, and more. And the audience will be asked to pitch in, of course!

The morning will feature testimonials from professionals working in the fields of innovation and industry, with ample time for questions and answers. The afternoon will be devoted to hands-on roundtables on entrepreneurship and CV writing. The entire event will be conducted in English.

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Agenda

March 4,
Maison MINATEC
Eighth Junior Scientist and Industry Annual Meeting (JSIAM)
http://www.jsiam-giant-grenoble.org/

March 5,
Stᵉ. Martin d'Hères campus
Grenoble Institute of Technology Open House
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March 11,
Phelma library
"Women in science" collection – ribbon-cutting ceremony
celine.ternon@cea.fr

March 13–18,
Les Houches
Codegepra Winter School: Heterogeneous reactors and reactions
http://goo.gl/n53ByU

April 5,
Maison MINATEC
Third Innovation Marketing Day
The power of high-tech/innovation marketing to create value in a changing world.
http://rencontresmti2016.insight-outside.fr

April 14,
World Trade Center, Grenoble
Minalogic Business Meetings – International
http://goo.gl/jK9qlm

May 9–10,
MINATEC
Ninth PESM Seminar Plasma Etch and Strip in Microtechnology
http://pesm2016.insight-outside.fr/

June 6–July 8,
MINATEC
2016 Grenoble Institute of Technology-Phelma Summer School
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MINA-NEWS >

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