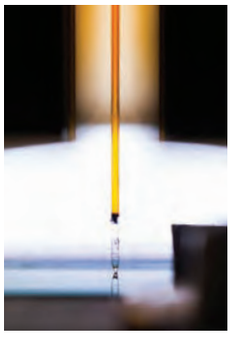
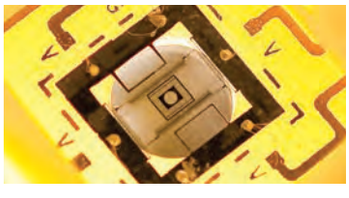
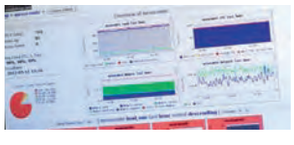




RESEARCH INSTITUTE

femto-st
SCIENCES & TECHNOLOGIES

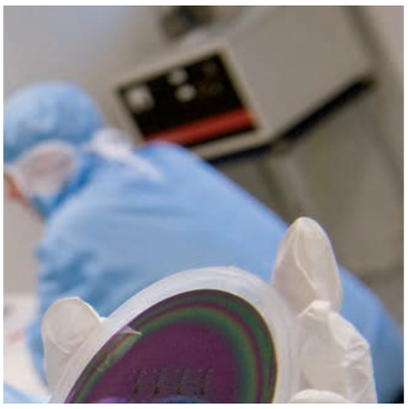
Cultivating innovation,
from basic research
to industrial partnerships

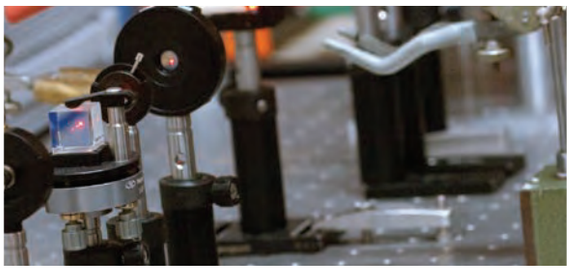
UFC · cnrs · ensmm · utbm

The FEMTO-ST institute

A research institute of international standing








The general aim of the FEMTO-ST institute is to master micro and nanotechnologies, develop new devices and systems, optimise their performances, find new functions for them and make them "smart".

Identity

FEMTO-ST performs multidisciplinary research in Franche-Comté in a range of fields including engineering science, information and communication technology, with the dual aim of advancing knowledge and generating socio-economic impacts. The institute was created in 2004 and constitutes a mixed research unit attached to 3 educational institutions and 1 research body:

- The University of Franche-Comté (UFC)
- The CNRS (National Centre for Scientific Research)
- The ENSMM (National Engineering Institute in Mechanics and Microtechnologies)
- Belfort-Montbéliard University of Technology (UTBM)

It has premises in Besançon*, Belfort and Montbéliard.

Scope

The projects undertaken at the institute range from fundamental research to industrial applications, in fields such as energy and transport, healthcare, telecommunications and the space industry, instrumentation and metrology, watchmaking and jewellery.

Strengths

- Internationally recognised scientific and technological skills, based on regional industrial tradition
- Multidisciplinary research projects founded on scientific excellence. A+ ranked research laboratory (highest score awarded by the French Ministry of Higher Education and Research)
- Active participation in the high level training provided by the educational institutions it depends on (e.g.: Masters degree and graduate school of engineering)
- Support of several technology platforms, including a leading French microfabrication centre: MIMENTO
- A proactive policy of transferring the technology that comes out of research (industrial partnerships, spin-offs)

Partnerships

FEMTO-ST is an actor of several French government stimulus initiative projects (Investments Program for the future):

- 2 planned "Laboratories of Excellence" under the university modernisation plan ("ACTION" for smart systems and "FIRST-TF" for time & frequency)
- 3 "Equipments of Excellence" (OSCILLATOR-IMP, REFIMEVE+ and ROBOTEX)
- 1 technological research institute (IRT M2P)
- 1 competitiveness cluster backbone project (Open Food System)

FEMTO-ST is also a major player in the regional competitiveness clusters, "Microtechniques" and "Véhicule of the future", but also the "Plastipolis", "Vitagora" and "Pôle Nucléaire de Bourgogne".

The institute is involved in several joint research programs in France and abroad:

- International collaborative projects with a number of prestigious research centres (IBM, CalTech, CUDOS, GIT, etc.)
- Mixed academic-industrial R&D teams
- The SMYLE international collegium on Smart Systems with the EPFL (Switzerland)
- The FC LAB research federation (Belfort) on fuel cell systems
- The OSU THETA research federation in the field of time and frequency metrology
- The Georgia-Tech (USA)-CNRS international joint unit working in the field of acoustics & optoelectronics

FEMTO-ST is also behind the creation of more than 15 spin-offs based on the institute's know-how.

Key figures

- 700 employees
- 7 science departments
- Operating budget: 15 million Euros (in 2014)
- Consolidated budget: 39 million Euros
- Around 200 annual research contracts (industry, Europe, ANR, etc.)

Reputation and Awards

FEMTO-ST is the 2010 national laureate of INPI Trophies for Innovation and the "laureate of laureates" in 2011.

Different members have been awarded by:

- The European Research Council: ERC grants
- CNRS silver and bronze medals

They have also endorsed key responsibilities in national and international scientific institutions:

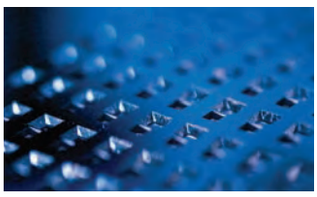
- Members of the Institut Universitaire de France
- Fellows of prestigious international learned societies
- Presidency of the European Physical Society
- Members of the board of directors of the SPIE society.

Science departments









Automatic controls and micromechatronic systems

Micro/nanomanipulation robots for industry and biomedical uses, control and design of microsystems equipment fault prognostics.

- Prognostics & health management
- Micro/nanorobotics for biomedical applications
- Perception strategies and characterisation at the micro and nanoscopic scales
- Design and control of micromechatronic systems

Energy

Studies of systems for producing, converting and storing thermal and electrical energy.

- Design and construction of non-conventional thermal and electrical machines
- Metrology and instrumentation in energetics
- Hybrid systems and fuel cell systems

Complex systems in computer science

Modelling, development, validation and optimisation of complex systems (distributed, smart) for the security, safety and reliability of information and communications systems, e-health and mobility services.

- Distributed digital algorithms
- Distributed systems and networks
- Multiscale mobility networks
- Verification and validation of software and embedded systems

Applied mechanics

From the heart of the material to innovative integrated technologies. Functionalising, optimising and controlling materials, microsystems and structures.

- Communicating and controlled structures
- Integrated material-process-product development

Micro/nanosciences and systems

Innovative acoustic, optical or biomedical devices and microsystems in the field of functional surfaces and materials.

- Multiphysical microsystems
- Micro instrumentation, nanosciences and waves
- Micro/nanomaterials and surfaces

Optics

New concepts in light propagation, light-matter interaction and advanced optical functions contributing to the design of ultra-miniature components, light sources, photonic systems and instruments.

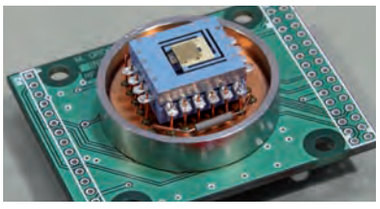
- Nonlinear optics
- Optoelectronics
- Photonics for medical instrumentation
- Nano-optics

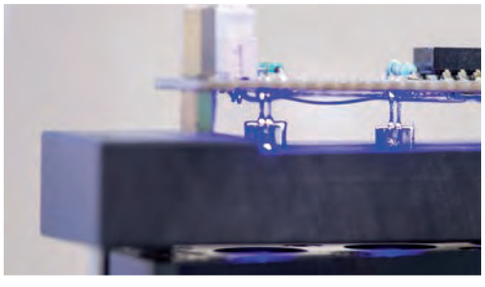
Time & frequency

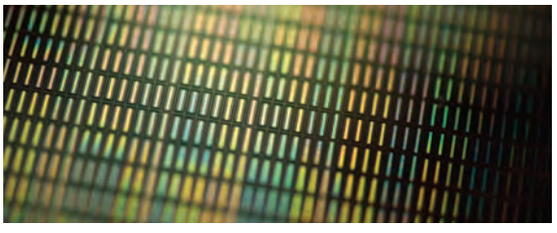
Ultrastable devices (oscillators and clocks) for measuring time and frequencies, surface acoustic wave sensors for the environment.

- Ultrastable frequency sources (oscillators and clocks from RF to optics)
- Acoustic wave sensors
- Time and frequency metrology
- Accredited frequency source calibration service

Areas of innovation







Energy and transport

- Fuel cell and hydrogen systems
- Electric and hybrid drivetrains
- Heat engines, micro cogeneration
- Energy storage
- Noise and vibration control
- Composite and hybrid materials and structures
- Software for shared mobility systems
- Automatic test generation for embedded systems

Healthcare

- Smart medical devices
- Medical microrobotics
- Bio-computing and e-health
- Bio-microsystems
- Clinical proteomics

Luxury goods, watchmaking and jewellery

- High precision machining
- Hybrid microfabrication and microassembly
- Advanced materials
- Functional surfaces and coatings
- Smart mechanical components
- Product life monitoring

Telecommunications, space, defence

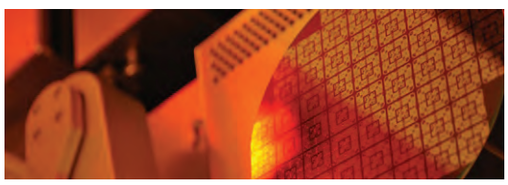
- Ultrastable oscillators and clocks
- Nanophotonic and telecom components
- Optical and optoelectronic information processing systems
- Information security and reliability, quantum information
- Complex photonic processors and computers
- Communication security and reliability

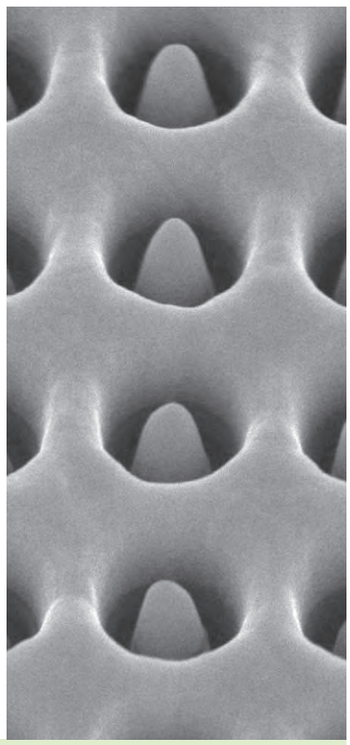
Metrology, instrumentation

- High resolution instruments for T&F metrology
- Piezoelectric materials and transducers
- Photonic instrumentation
- Advanced laser sources
- System prognostics and diagnostics
- MEMS and MOEMS microsensors and sensor networks

Technology platforms

A technology centre with a European reach





The technology platforms set up by FEMTO-ST are intended to support research carried out within the institute. They are also open to its industrial and academic partners and to Education. They are jointly funded by the European Commission, the French Government, the Regional Council of Franche-Comté and other local authorities as well as by the different research projects contracted by the institute.

Technology centre for clean room micro & nanofabrication: MIMENTO

FEMTO-ST technology centre develops new technologies through research projects in micro/nano-acoustics, micro/nano-optics and micromechanics.
As a member of RENATECH, the national network formed by the major technology centres belonging to the CNRS, FEMTO-ST has benefited since 2004 from the Basic Technological Research program (BTR).
MIMENTO is composed of 3 complementary modules: **a module conducting fundamental research in nanotechnologies, a clean room microfabrication module** which has several complete lines producing microdevices and **a shared R&D and industrial innovation module** (an industrial production line for the fabrication of piezo micro/nano components in batches)

Main technological resources

- Lithography (UV and electron-beam, laser photomask generator)
- Thin film deposition (spray-coating, evaporation, PECVD, electroplating)
- Dry etching (RIE, DRIE, FIB)
- Packaging (wafer bonding, wire bonding, flip chip technology, precision dicing cutting...)
- Characterisation (SEM, AFM, ellipsometry, XPS...)

Industrial microfabrication line (R&D)

- Stepper lithography and automatic coating lines
- Deposition cluster (AlN) and evaporator
- Characterisation (X-ray fluorescence, SEM)

Contact

mimento@femto-st.fr
www.femto-st.fr/MIMENTO

Clean room technology

- 1360 m² of clean rooms, including 865 m² classified ISO 5 to 7
- €15M invested in high tech equipment
- 15 engineers and technicians
- Materials: quartz, lithium niobate, silicon...

Hybrid microfabrication centre: MIFHYSTO

This centre develops new technologies in mechanical microfabrication, surface functionalisation and hybridisation with clean room processes for producing components with dimensions or characteristic details at the submillimetric scale.
mifhysto@femto-st.fr

Time & frequency metrology centre: OSCILLATOR-IMP

This facility benefits from the "French Government Investment Program for the Future" and is dedicated to the characterisation of short-term frequency stability (from 1 ms to 1 day). This tool uses the best frequency references currently available covering a wide frequency spectrum (from RF to optics) and state-of-the-art comparative measuring instruments.
This plateform significantly improves the measurement resolution for both the accredited service activities (calibration) and the research and development needs.
oscillator-imp@femto-st.fr

FUEL CELL SYSTEMS centre

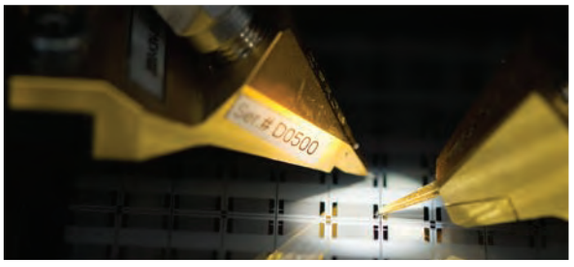
The FCLAB research federation provides an experimentation platform for testing fuel cell systems, in particular the durability of energy sources for electric and hybrid vehicles and for stationary applications.
contact@fclab.org

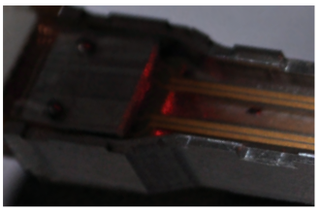
Micro/nanorobotics centre: µROBOTEX

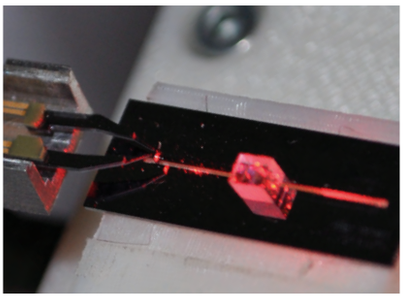
This centre is part of a national network of 5 robotics excellence centres officially recognised by the "Government Investment Program for the Future".
It offers services in micro/nanocomponents, characterisation, manipulation and micro-assembly.
microrobotex@femto-st.fr

Industrial partnerships

Innovation serving industrial partners

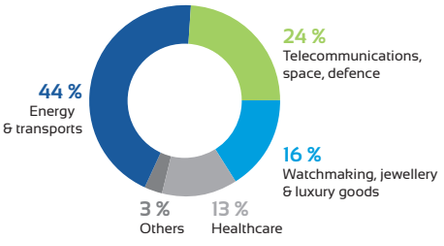






FEMTO-ST's commitment and expertise in developing partnerships with industry has earned it several national awards.
The French intellectual property institute (INPI) in particular has praised the scientific quality of the research conducted by FEMTO-ST as well as its technology transfer policy, which has strongly bebefited SMEs and is based on a genuine industrial property culture.

Markets



The result for the regional economic field has been the emergence of high tech companies exploiting the innovations patented by FEMTO-ST.
FEMTO-ST is behind the creation of several spin-offs over a 10-year period:

- Aurea Technology (optical instrumentation)
- Share&Move (software for alternative mobility and transport systems)
- Crystal Device Technology (electro-optic micromodulators)
- Frec'n'sys (piezoelectric components)
- Percipio Robotics (microrobotics and microassembly)
- Expertisens (touch sensitive systems)
- Mahytec (hydrogen storage solutions)
- Mesurtek (thermal measurements and advanced methods)
- Covalia (telemedicine)

Numerous forms of collaboration

Partnerships with FEMTO-ST and its technology development centre "FEMTO Engineering" can take different forms covering the entire TRL (Technology Readiness Level) scale of technology maturity, ranging from the initial concept to the creation of products and/or industry-ready processes:

- **expert assessment and consultation, scientific monitoring**
- **scientific and technical training**
- **technological development**
- **research contracts**

These are research and R&D projects conducted in partnership with public bodies or companies. The latter can obtain tax relief for such projects (research tax credit).

Intellectual property rights are negotiated within a very open framework: patenting, granting of licences, sharing of know-how...

Particular emphasis is placed on:

- **PhD under the CIFRE program**
  FEMTO-ST is able to provide scientific supervision for PhD students in partnership with companies.
- **joint laboratories with companies**
  FEMTO-ST wishes to further develop long lasting collaborative research and development projects with companies.

A dedicated industrial partnership department

To reinforce its relations with the industrial world, the institute has a specific industrial partnership department which is committed to responsiveness, professionalism, confidentiality and measuring satisfaction.
sri@femto-st.fr

Some of our trusted partners

AIR LIQUIDE, AIRBUS, ALCATEL-LUCENT, ALSTOM, CNES , EDF, ESA, EUROCOPTER, GDF-SUEZ, HORIBA, IBM, ORANGE, PSA, RENAULT, SAFRAN, SNECMA, THALES, TURBOMECA...

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