

femto  
ENGINEERING

from science to society





# AN EXPERTISE CENTER FOR YOUR R&D

FEMTO Engineering, a technology center in the region of Franche-Comté, France, is an extension of the FEMTO-ST institute. **It takes research out of the institute and into companies of the industrial sector to fulfill their needs for innovation.**

FEMTO Engineering undertakes technological developments in 5 areas of innovation:

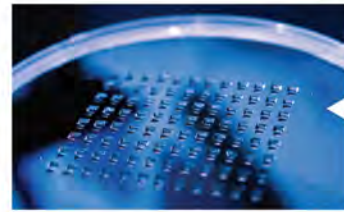


# AN INTERNATIONAL RECOGNITION

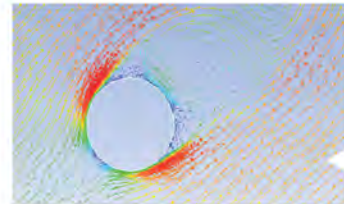
**Stability world record:**  
an ultra-stable cryocooled sapphire oscillator.



**Micromachining world record:**  
high form factor nanomachining with femtosecond laser.



**Microfabrication in clean room facilities:**  
micro reflective cell wafer.



**Fluid mechanics:**  
CFD modeling



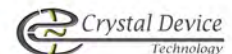
# A STRONG PARTNER


**FEMTO-ST, one of the largest French public research labs for engineering sciences.**

Its general aim is to master micro and nanotechnologies, develop new devices and systems, optimise their performances, find new functions for them and make them "smart".


- 700 employees
- Locations in: Besançon, Belfort and Montbéliard
- 7 science departments:  
Automatic controls and micromechatronic systems, Applied mechanics, Complex systems in computer science, Energy, Micro/nanosciences and systems, Optics, Time & Frequency.

THEY HAVE CONFIDENCE IN US





**Hybrid microfabrication in clean room facilities:**  
coating, etching, lithography, characterization



**Two world records  
in space and  
microtechnology**



**From lab validation  
to prototype in the  
operating environment**

## INNOVATIVE SOLUTIONS

**For you to remain competitive or to conquer new markets, FEMTO Engineering offers you innovative industrial solutions:**

- Technological feasibility study in contact with your R&D team,
- Developments to internalize new processes,
- Preproduction,
- Technological services / Tests / characterization of pieces or devices

**FEMTO Engineering meets your demands, thanks to an expertise relying on four areas of innovation and on FEMTO-ST Institute's know-how and technological resources:**

- Technology center for clean room micro & nanofabrication with national standing (a 1400 m<sup>2</sup> clean room)
- Femtosecond laser
- Uliss : an ultra-stable cryocooled sapphire oscillator
- Electrical, magnetic, thermal modeling
- PHIL Platform (Power Hardware In the Loop)
- Fuel cells platform
- Proteomics platform CLIPP
- MIPHYSTO platform: microfabrication for miniaturization, functionalization and hybridization of microtechnical systems

## MARKETS

- **Energy, transportation**
- **Luxury watch manufacturing & jewelry**
- **Health**
- **Telecom, space, defense**





## CLEAN ROOM MICROTECHNOLOGIES



Control of  
multiphysics  
approaches and  
nanobiosciences

**FEMTO Engineering undertakes R & D studies in micro-mechanics, micro-nano-optics and micro-nano-acoustics leading to the design and production of MEMS, MOEMS and NEMS devices.**

The team works within the technology center for clean room micro & nanofabrication. With a 1400 m<sup>2</sup> clean room, MIMENTO (Microfabrication for Mechanics, Electronics, Nano-sciences, Thermal science and Optics) offers high technology facilities.

## BIOMEDICAL

### Design and fabrication of biochips

#### Design of plasmonic chips:

- Chips manufacturing compatible with SPR/SPRi
- Custom made micro and nanostructured chips
- Functionalization for bioanalysis in complex fluids (blood, plasma, cell extracts)
- Grafting strategy of biomolecules on chip

#### Analysis of biological interactions on biochip:

- Studies and kinetic analysis of interactions in ideal media
- Molecules Screening at low and medium density
- Detection and assay of molecules of interest in biological fluids
- SUPRA-MS analysis: detection and identification of target protein by coupling biochips with mass spectrometry (proteomics platform CLIPP)



Biochips for  
diagnostic  
of diseases.

## OPTICS



### Micro- and nano-machining by femtosecond laser

**Machining by femtosecond laser can structure any type of material, on its surface or in depth, with a unique surface state quality.**

This innovative technology is applied in the telecommunication, automobile, watchmaking or biomedical fields, for example:

- the manufacture of integrated components for the telecommunications of the future
- the inscription of motifs invisible to the naked eye used in the struggle against counterfeiting



Aspect ratio more than 2000:  
Machining of a nano-channel  
with a sub-wavelength diameter  
of 200nm and a length of 400µm  
in LiNbO<sub>3</sub> sample

Biochips for  
diagnostic  
of diseases.

## TIME & FREQUENCY

- An expertise in development and characterization of systems and Time & Frequency references.
- High skill in digital electronic development.

**That expertise allow us to work on heterogeneous systems with a global approach and a single contact.**



**ULISS, the best cryogenic sapphire oscillator currently available on the market, ensures a relative stability of less than  $3 \times 10^{-15}$**



## ENERGY

### Electric, magnetic and thermal modeling

**FEMTO Engineering offers to industry its engineering in:**

- Electro-magnetic and thermal modeling for electric machines
- Help in designing electric machines
- Experimental characterization of electric machines of a power less than 10 kW.

### Management of electrical energy - Hydrogen energy

**FEMTO Engineering develops technological solutions:**

- Development of dedicated test benches for hydrogen energy and for storage components of electrical energy
- Characterization of electrical energy sources (fuel cells, batteries, double-layer capacitors)
- Modeling of electrical systems (with integrated devices for energy generation, distribution, conversion and storage)
- Digital models to simulate the functioning of these complex systems and/or emulation on a PHIL platform (Power Hardware In the Loop)
- Sizing of effective energy sources dedicated to embedded and stationary systems
- Optimised management of electrical energy with smart hybridization for embedded and stationary systems

## MECHANICS



**Answering requests on following expertise skill fields:**

- Numerical simulation and prototyping
- Vibration analysis
- Mechanical tests
- Materials manufacturing
- Surfaces characterization
- Structure optimization





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Founding member:



Financial support:

