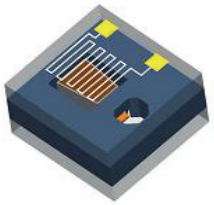
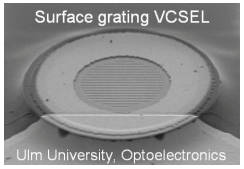
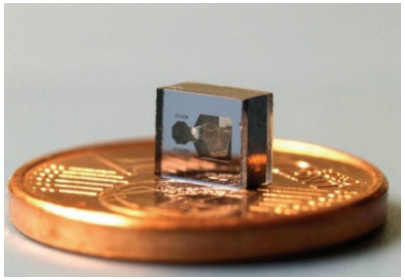
Key technologies and know-how

- Filling of cesium cells
- MEMS and MOEMS technologies
- Anodic bonding
- Anti-collision layers
- Beam shaping
- Thermal management
- VCSEL manufacturing
- Miniaturized electronics
- Low-power and low-noise electronics
- Precision atomic spectroscopy and metrology



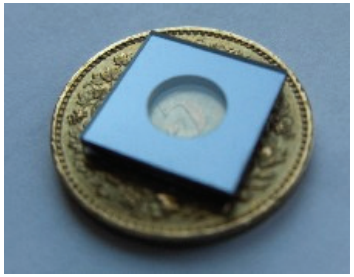


Preliminary achievements



FEMTO-ST

Cs micro-cell



UniNE

Rb micro-cell

Consortium :

UFC Université de Franche-Comté — femto-st sciences & technologies — cnrs — ensmm — utbm

http://www.femto-st.fr

Université de Neuchâtel — unine

http://www2.unine.ch/ltf

EPFL École Polytechnique Fédérale de Lausanne

http://www.epfl.ch

Wrocław University of Technology

http://www.pwr.wroc.pl

ulm university — universität ulm

http://www.uni-ulm.de/opto

VTT

http://www.vtt.fi

cea leti

http://www-leti.cea.fr

saes getters

http://www.saesgetters.com

ASULAB — A DIVISION OF THE SWATCH GROUP RESEARCH AND DEVELOPMENT LTD

http://www.asulab.ch

OSCILLOQUARTZ — SWATCH GROUP ELECTRONIC SYSTEMS

http://www.oscilloquartz.com

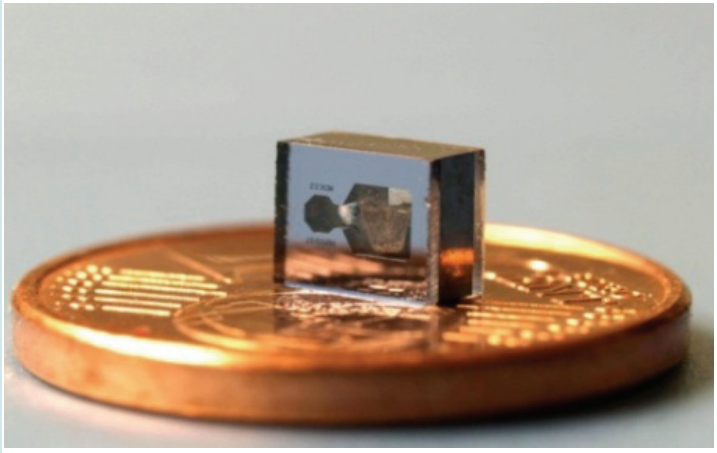
Collaborative project

MAC-TFC

ICT-2-3.6 / Micro and Nanosystems

MAC-TFC

MEMS Atomic Clocks for Timing, Frequency Control and Communications



1 Sept. 2008 – 31 Aug. 2011

SEVENTH FRAMEWORK PROGRAMME

Consortium

Coordinator

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  Institut FEMTO-ST, Dr. C. Gorecki

Partners

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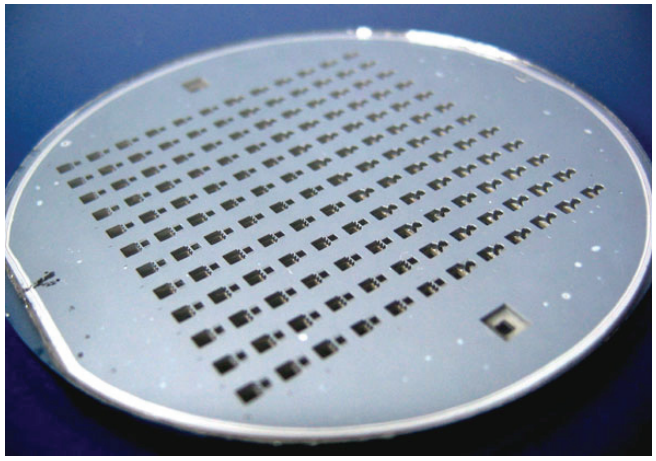
SEVENTH FRAMEWORK PROGRAMME

MAC-TFC approach

The performance of electronic systems is in some cases limited by the accuracy and stability of the clocks or frequency references they use. For example, the ability and speed with which a GPS receiver can lock on a GPS satellite's signal and obtain position is dependent heavily upon how well synchronized its internal clock is to that of the satellite. Here, the better the internal clock, the higher the probability and the faster the synchronisation. The best current frequency references with stability better than 10^{-11} over one hour (e.g., atomic clocks, oven stabilized crystal oscillators) are often too large and consume too much power to be used in portable applications. This situation forces us to keep the best electronic systems on tabletops and out of the hands of the users, who must then access them through sometimes unreliable remote channels. Indeed, a technology capable of miniaturisation and lowering the power consumption of timekeepers and frequency standards to the point of allowing development into portable applications would be most welcome in such global positioning receivers or wireless communications devices.

In this regard, the technology of Micro Electro Mechanical Systems (MEMS), with its ability to shrink mechanical features and mechanisms down to micron scales, already provides substantial size and power reduction for applications spanning wireless communications, sensors, and fluidic systems, and is now emerging to provide similar advantages for frequency and timing references.



MAC-TFC objectives

- Develop and demonstrate all the necessary technology to achieve a MEMS Cs atomic clock, presenting a short-term stability of $5x10^{-11}$ over 1 hour while operating on the power of an AA battery (< 200 mW).
- The MEMS atomic clock will include a fully customised semiconductor laser, an innovative approach for filling the clock cell with alkali vapour, low-power ASIC RF electronics and LTCC packaging of the physical elements in two alternative configurations of the atomic resonator.
- Pre-industrialisation for potential applications such as wireless network synchronisation.
- Offering the first European version for integrated portable atomic frequency references.

MAC-TFC