musée international d'horlogerie

PRESS RELEASE

MIH UNVEILS A NEW EXHIBITION SPACE DEDICATED TO THE QUADRILLIONTH OF A SECOND

To the nearest femtosecond!

How long does one second last? Who decides what time it is? The scholarly quest for precision has been at the heart of watchmaking innovation since the 17th century. Oscillators are key to developments in this field: the pendulum, the spring balance and, later, quartz, have all increased timekeeping accuracy. From the Second World War, physicists took over from astronomers and horologists in the pursuit of accurate time measurement. From 1967, the second was no longer defined via astronomical observations such as the passage of the sun across the zenith, but by measuring a microscopic phenomenon: the oscillation of caesium atoms.

The new MIH exhibition space, which will be open to the public from 8th June, is entitled *To the nearest femtosecond!* A femtosecond, or 0.000000000000001 of a second, corresponds to the imprecision in the ticking of a modern atomic clock. That equates to one second every 3 million years!

A fun, scientific approach to precision

The exhibition on display within the architectural extensions to MIH, the Gallery and the Belfry, looks at the theme of extreme precision from three different angles:

1. the evolution of **precision** from mechanical clocks to atomic clocks, via electromechanical pendulum and quartz clocks. The exhibition explores the tension between two definitions of time — on the one hand, astronomical, symbolised by the great Meridian telescope at the Neuchâtel Observatory, and, on the other, atomic, symbolised by the Oscillatom caesium clock developed by Oscilloquartz in Neuchâtel — and the leap which marks the passage between the two.

2. the **operation** of the various types of atomic clocks. Through its display of atomic clocks using caesium, hydrogen and rubidium from the 1970s to modern times, the exhibition uses diagrams and deconstructed objects to explain the constituent parts and the operating principles behind the atomic clocks which are essential components of telecommunications systems and satellites.

3. the various **applications** of these clocks in daily life, and in the field of scientific research, symbolised by a model of the Galileo satellite, spanning four metres and suspended ten metres above the ground. While the degree of accuracy of atomic clocks (10^{-15}) is impossible for mere mortals to perceive, it has become a crucial part of how our human society is organised: geolocation, navigation, transport and telecommunications systems can only perform so well thanks to the extreme accuracy of the clocks that govern them.

To mark the opening of this new exhibition space, MIH has revamped the reception for this benchmark exhibition. Visitors will now be able to enjoy commentary — of a more or less insightful nature... — from **Father Time** himself! In two clips, each lasting three minutes, this special guide provides the keys to understanding the history and mechanics of timekeeping, and atomic clocks in particular.

Audio guide and kids' trails

As the quadrillionth of a second is such a complex and abstract subject, MIH has developed different ways of presenting it to its target audiences. In addition to the standard trilingual texts (fr-de-en) with differentiated reading levels, the visitor can also use an audio guide in five languages (fr-de-en-it-es) designed to provide clear yet detailed information on the complex objects on display.

The younger public and their families are also catered for. Kids can get into character by slipping on a physicist's white coat and following the exhibition using a guide designed as a textbook.

An NPR project

The exhibition organised by MIH – a City of La Chaux-de-Fonds institution – is supported by the Canton of Neuchâtel and the Swiss Confederation through its new regional policy known as the NPR. The NPR helps the Alpine regions, other rural regions, and the border regions of Switzerland to sustainably improve their competitiveness by promoting initiatives, programmes or projects based on the region's potential for development. More than just a themed exhibition, this new space also provides an additional cultural and tourist attraction to draw in both international visitors and the many locals working in the fields of research, development, industrialisation and commercialisation of atomic clocks in Neuchâtel (Laboratoire Temps-Fréquence, University of Neuchâtel, Centre Suisse d'Electronique et de Microtechnique CSEM, Oscilloquartz, Spectratime, T4Science).

Symposium dedicated to time on Mars

As a mark of the current interest in this hot topic, the 18th European Mars Convention, organised by the Mars Society Switzerland in 2018, will take place from 26th to 28th October at MIH on the theme of *Robots and Man on Mars - the role of time*. This event will provide the public with an opportunity to hear from astronaut Claude Nicollier.

Key info

- Public opening event: Thursday 7th June at 18:00, with a specially commissioned musical performance
- Public opening: 8th June at 10:00, standard MIH opening hours (Tues-Sunday, 10:00-17:00)
- Entrance to the *To the nearest femtosecond!* exhibition is included in the museum entrance price
- Audio guides and kids' guides are available free of charge

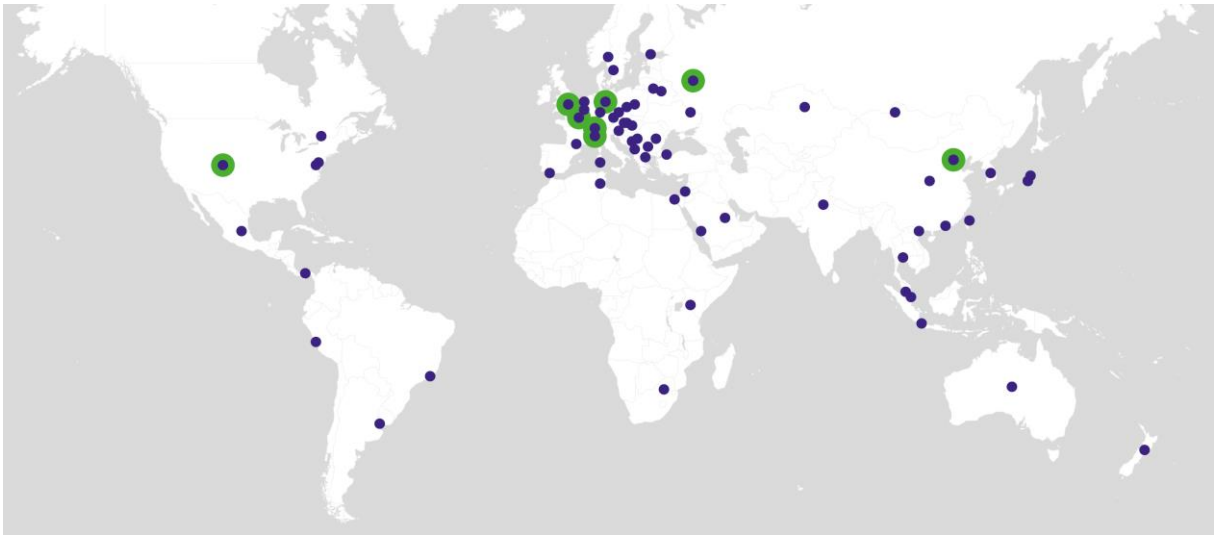
La Chaux-de-Fonds, 4th June 2018

Photos

Astronomical time *versus* atomic time

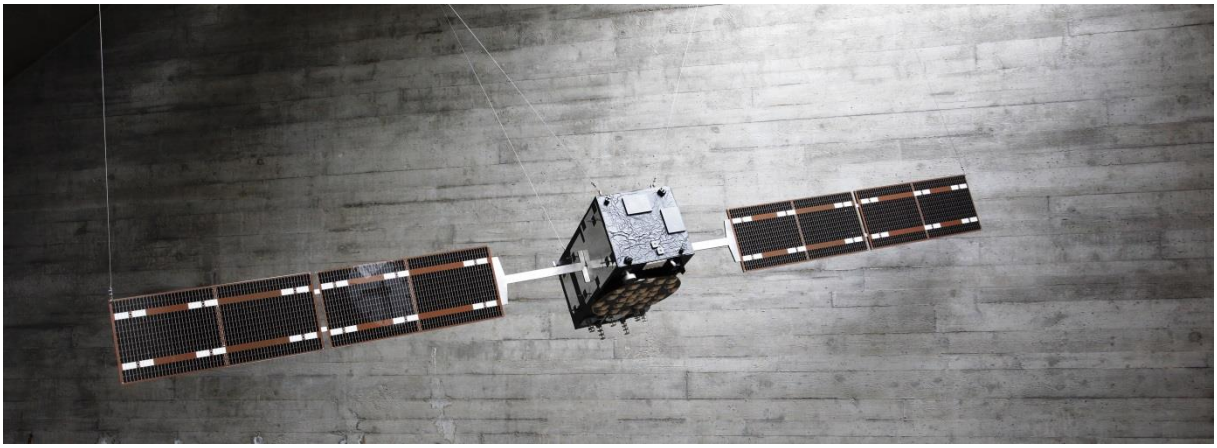
Meridian telescope from the Neuchâtel Observatory, 1913

OSCILLATOM Caesium atomic clock
Oscilloquartz SA, Neuchâtel, 1970

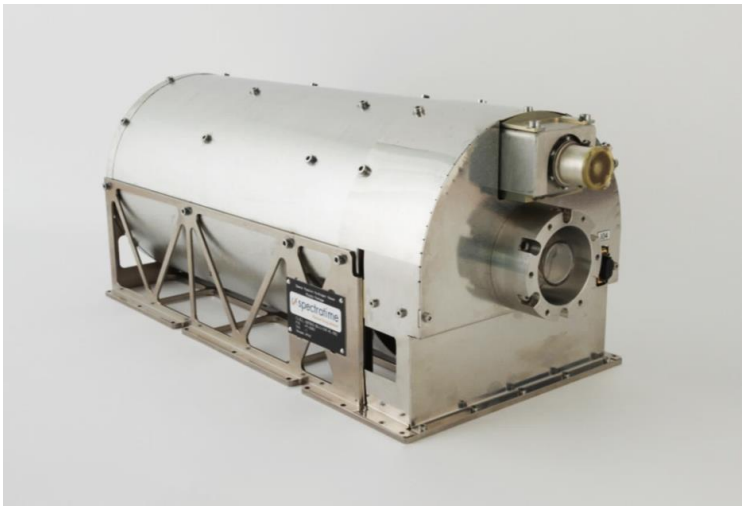


Laboratories that contribute to International Atomic Time

Space clocks



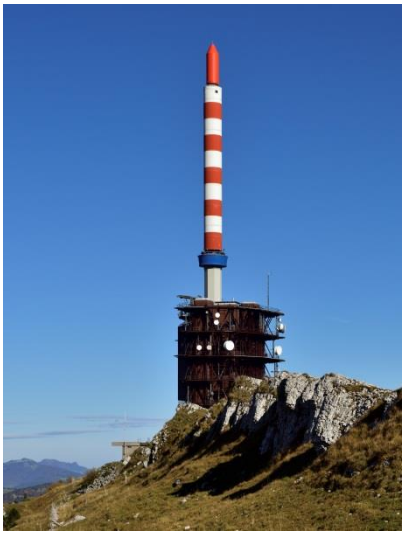
Galileo satellite at MIH belfry



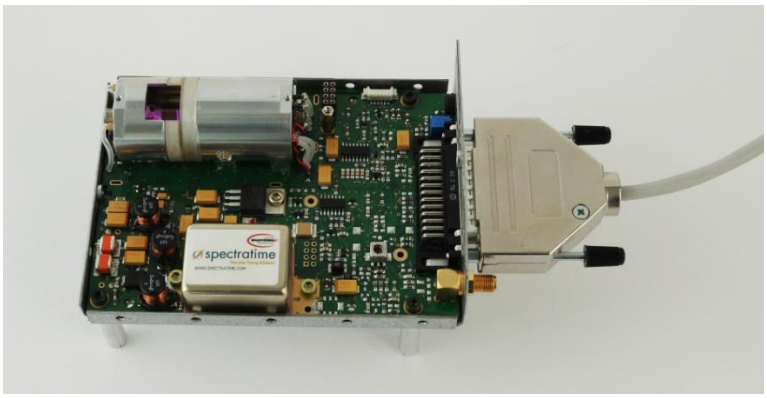
Hydrogen maser on board the Galileo satellites
Spectratime, Neuchâtel

Rubidium atomic clock developed at the Neuchâtel Observatory for the European Space Agency between 1989 and 1994. The clock has been flying since 2011 on the Russian space mission RadioAstron. CSEM, Neuchâtel

Land applications



Mobile phone network antenna (Chasseral)
© Keystone/M. Jegerlehner



Low Noise Rubidium Clock, Spectratime, Neuchâtel
Compact terrestrial rubidium atomic clock
present in numerous telecommunications antennas

Récepteurs d'hier et d'aujourd'hui…

Garmin GPS 45 personal navigation system, 1994

iPhone 8, Apple, 2018
The first mass market mobile phone to feature geolocation
using combined GPS and Galileo satellites

Miniature atomic clock, CSEM, Neuchâtel, 2017
Miniature atomic clock prototype less than 5 mm thick developed by the Centre Suisse d'Electronique et de Microtechnique for the European Space Agency