



# Spectratime, Spectracom & T4Science Overview 6-2018

## The Global Leader in Resilient PNT

Providing the world's most critical applications real-time, accurate, reliable positioning, navigation, and timing data.

Safety, Security and Reliability



[www.spectratime.com](http://www.spectratime.com)

[www.t4science.com](http://www.t4science.com)

[www.spectracom.com](http://www.spectracom.com)





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#### About Us

Founded in 2006 in Neuchatel, Switzerland, T4Science is a leading designer and manufacturer of a full range of advanced, cost-effective and high-performance maser clock solutions. Its products are used in a wide variety of scientific applications and in the time and frequency industry.

# PRODUCTS OVERVIEW (Q2 2018):

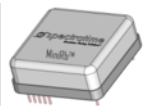
## COMPONENTS

### iSource+®

#### Rb Oscillators



**NEW**



### iSpace+™

#### Low SWaP Oscillators



OCXO

**NEW**



MiniRb



Rb



PMs

### iSync+®

#### GPS/GNSS Rb OCXO Oscillators



GPS-locked Rb



GPS Rb or OCXO



GPS-locked Rb  
& LN OCXO

**NEW**



AntiVibe

### iReference+®

#### GPS/GNSS Rb OCXO Standards



GPS-locked Rb



GPS Rb & LN OCXO

A/P Masers 



### iTest+®

#### Clock Instruments



1ps ADEV



GPS Rb & 1ps ADEV



100fs Synthesizer

# HYDROGEN MASER PRINCIPLE

## MASER

**M**icrowave **A**mplification by **S**timulated **E**mission of **R**adiation

Oscillator based on quantum transitions of Hydrogen atoms

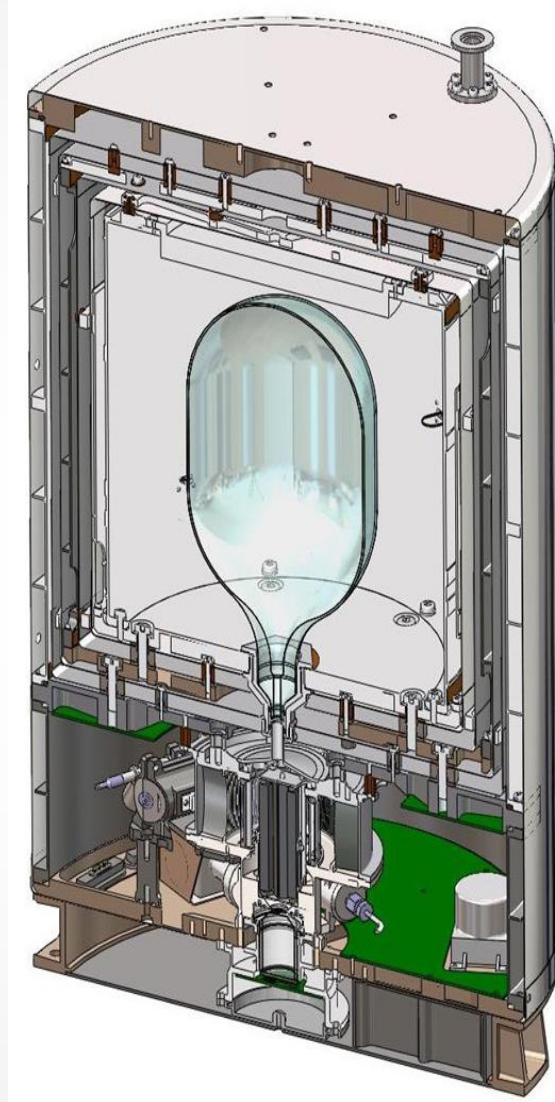
## HIGH ATOMIC QUALITY FACTOR

(  $> 1\text{E}+9$  )

## CAVITY FACTOR

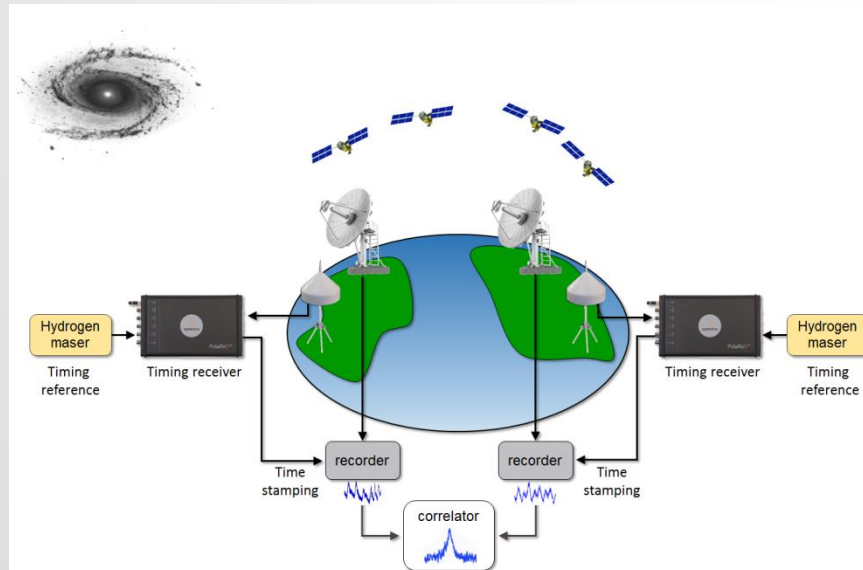
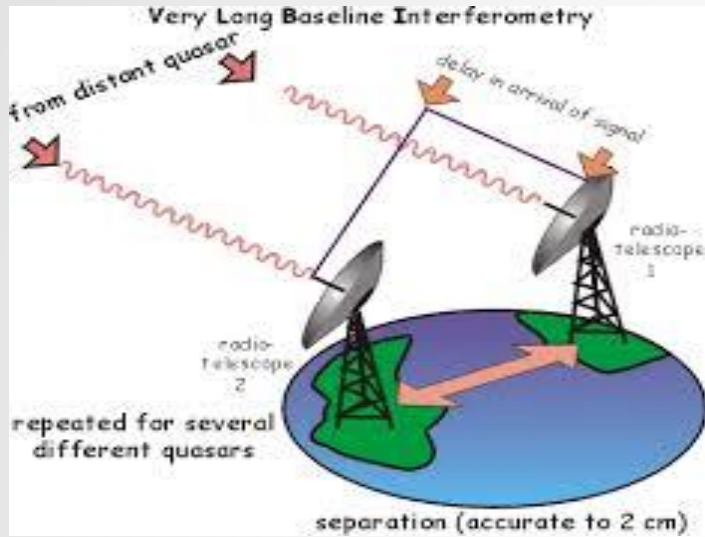
$Q_{\text{cav}} > 30000$  Active

$Q_{\text{cav}} < 30000$  Passive



# APPLICATION

## VLBI / Earth Observation



– Deep space tracking

- ESA Station



– Timing/Frequency Station

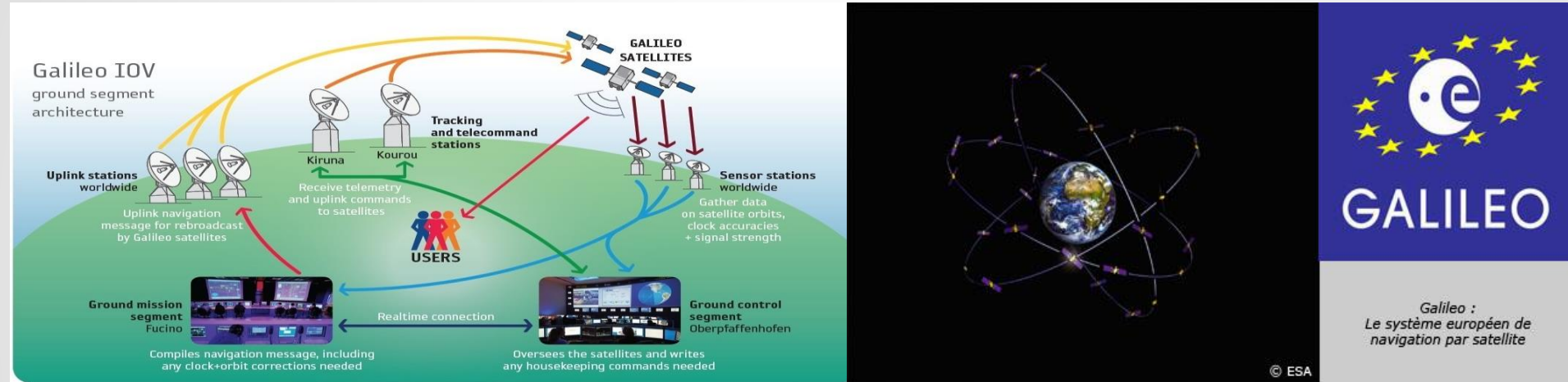
- National (CH/INRIM/Tw/SA...)



# APPLICATION

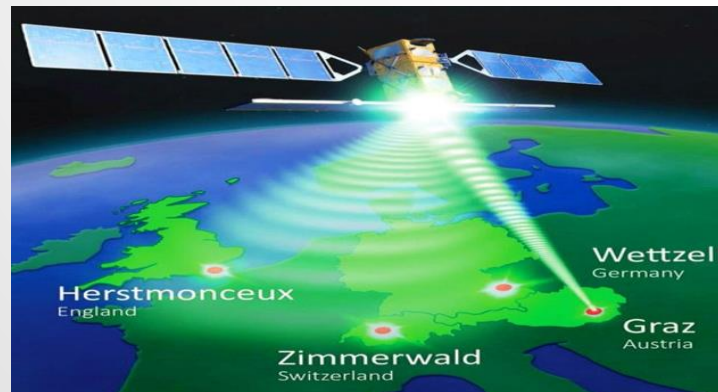
## Navigation Programs (Ground Station)

- Galileo, India, China, Japan ...



## Electronic

- SLR / Radar



# T4 SCIENCE CUSTOMER & LOCATION

37 years operations

More than 120 masers operating!

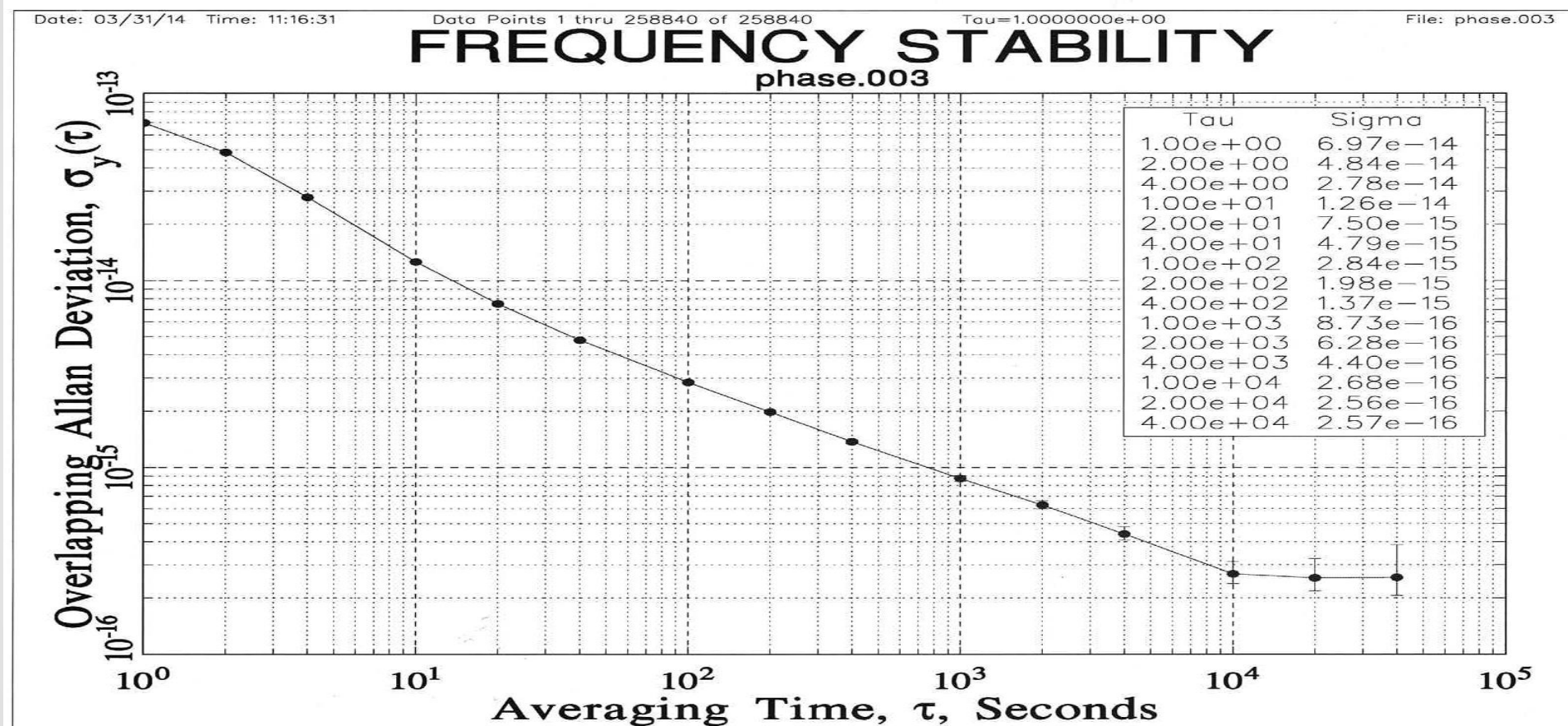
Worldwide customers on all continents

Solution for all environments (including installation and services)

- 5000 m altitude
- Isolated Island
- South/North poles
- 2 MASER Units successfully installed in Meerkat

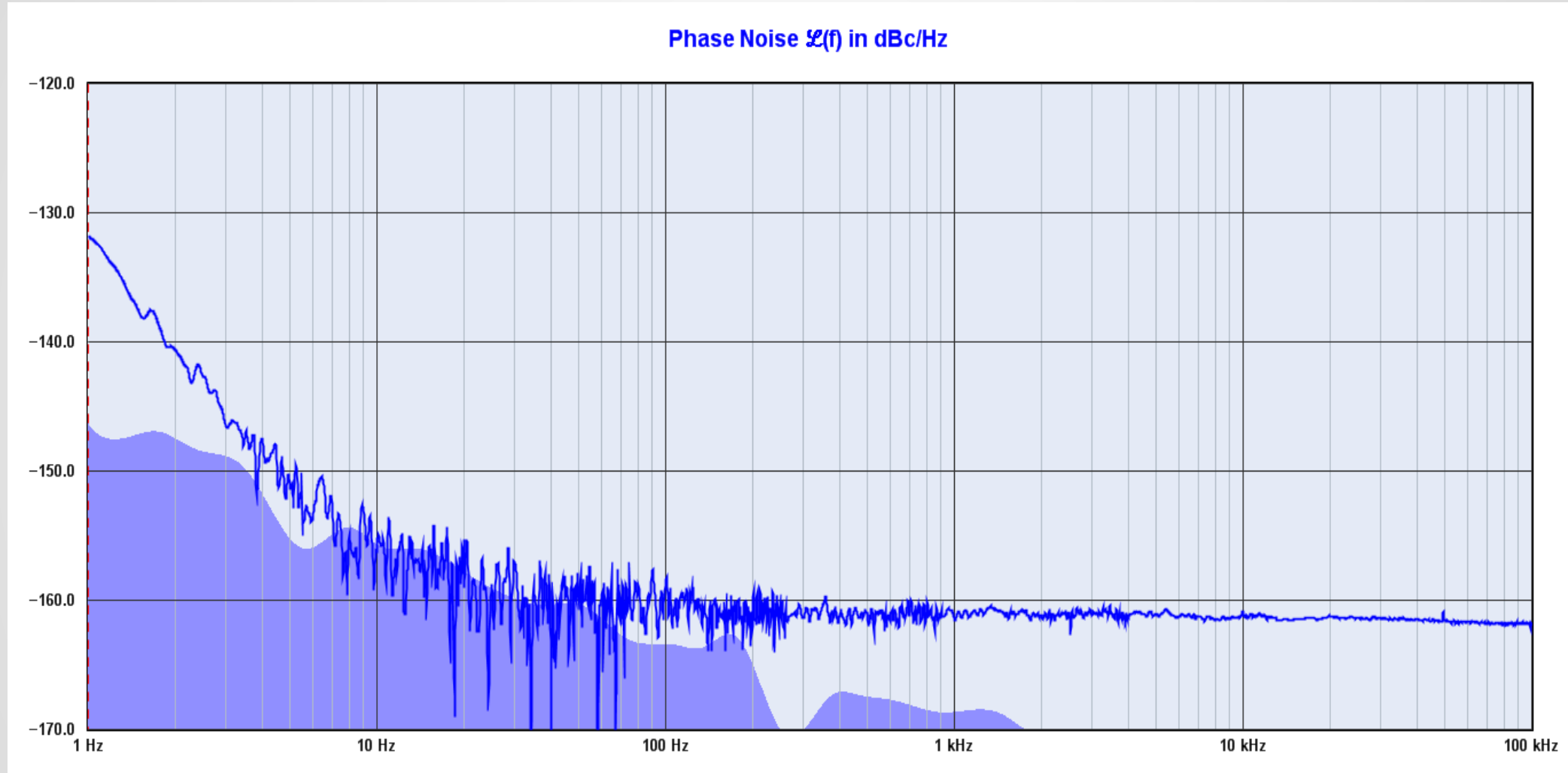


# TYPICAL PERFORMANCE AHM +HCB+ FEMTOSTEPPER



New Short term at **6E-14** @ 1s available!!!

# NEW PERFORMANCE AHM



New Phase noise at 5MHz **1 Hz: -132** and floor at **-162 dBc**

# MAINTENANCE / SERVICE

LIFETIME > 20 YEARS

EFOS 1 still operating in WETTZELL for 35 years

MTBF > 20 YEARS

>500 years of cumulative operation

FAST MAINTENANCE

SUPPORT AVAILABLE WOLDWIDE



# APPLICATIONS & ACCOUNT REFERENCES



## Communications Network

>Smart rubidium clocks for telecom and wireless networks



## Defense

>Rugged MIL rubidium clocks for avionics & comms systems



## Navigation

>High precision GPS clocks for positioning & location



## Broadcasting

>GPS clock references for IP/DVD/HDTV systems



## Instrument

>Low noise clock sources for precise tests & measurements



## Space

Master clocks for GPS/GNSS satellite navigation systems



# A LARGE PORTFOLIO FOR HIGH DEMANDING APPLICATIONS

Time & Frequency Reference System

High performance Synchronization Solutions

High reliable T&F Distribution

Network Time Servers

GNSS Master Clock

PTP Grandmaster

UTC traceability and real-time reporting software

Resilient PNT Solutions

Defense, Air, Land and Maritime

Critical Infrastructure Systems

Enterprise Network Timing

Big Data

Automotive Navigation

Financial Services

Unmanned Systems

