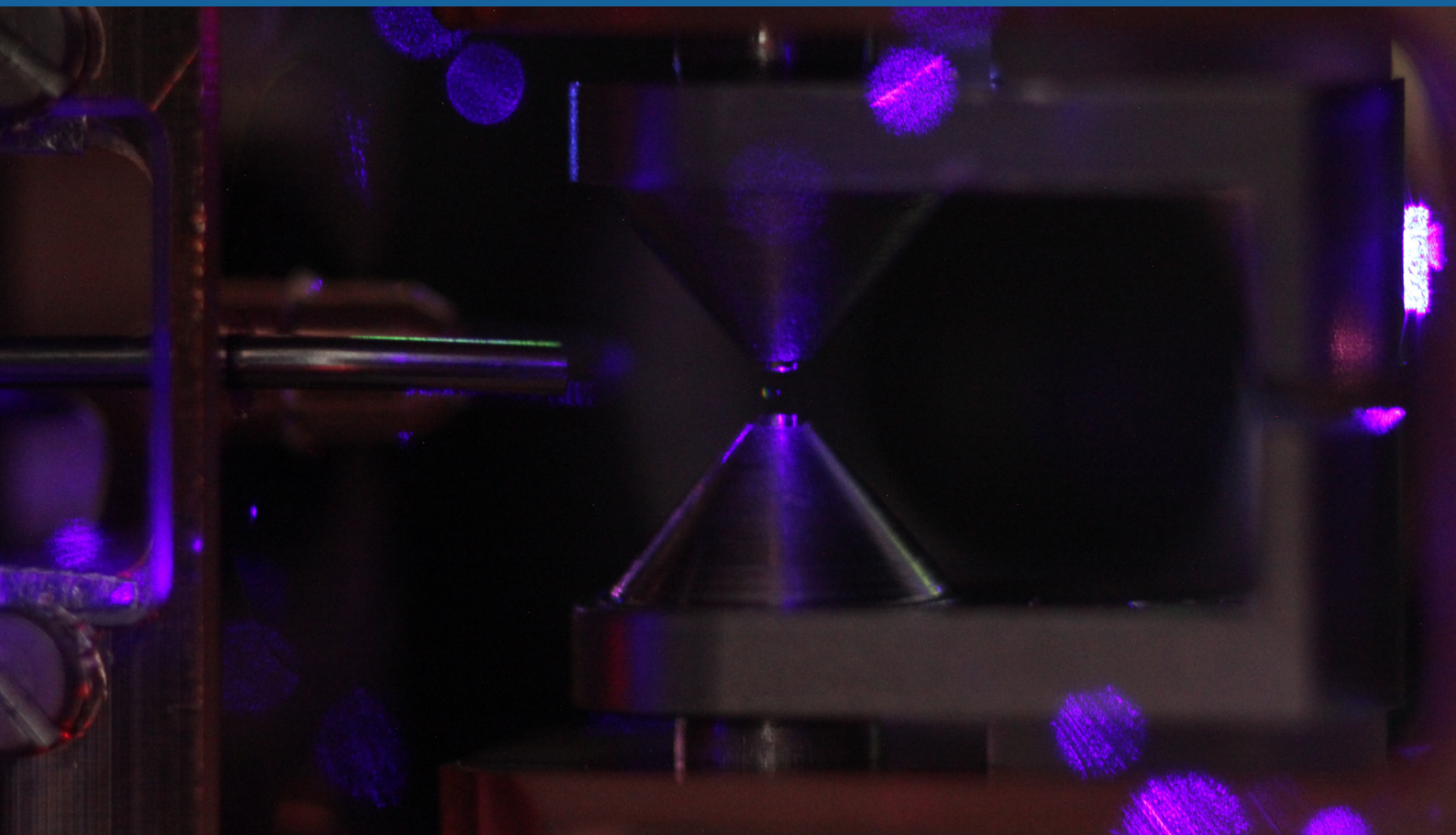


# Precision Time Protocol time- services

beyond the obvious





Hydrogen glow from  $H_2$  dissociator, from one of VTT MIKES active hydrogen masers.

## Does your business need secure, reliable and accurate time synchronisation?

There is a growing need for accurate and traceable time synchronisation in our digital society within telecommunication and broadcasting, computer networks, energy and smart grids, R&D, time-stamping of financial and e-commerce transactions, and GNSS-independent positioning and navigation.

GNSS (e.g. GPS and Galileo) is commonly used as a time-source, but suffers from vulnerabilities that can potentially lead to disruption of business and critical services (see e.g. Satellite-derived time and position: [Blackett review - GOV.UK, www.gov.uk](#) and [GPS-häirintä, Yle Uutiset, yle.fi](#)).

## Time from VTT MIKES

VTT MIKES maintains the national time-scale, UTC(MIKE), based on an ensemble of atomic clocks.

We participate in a continuous key-comparison organised by the BIPM, resulting in traceability to Coordinated Universal Time UTC via both weekly UTCr reports and monthly Circular-T reports (figure 1).

The accuracy of UTC(MIKE) meets or exceeds the strictest ITU ePRTC performance standards, as shown by historical Circular-T records for more than 10 years. (figure 1)

The national time-scale is GNSS independent, and does not suffer from direct vulnerabilities due to jamming or spoofing. The use of dedicated optical fiber time-links ensures high resilience and security, with continuous round-trip-time monitoring giving a basic level of validation for the time service. For demanding use cases further validation via loopback-monitoring or GNSS post-processing products can be provided.

For less demanding users we also provide NTP time-service over the public internet or private dedicated connections. ●

## PRECISION TIME PROTOCOL (PTP)

- PTP or [IEEE 1588-2019](#) is a protocol for clock synchronisation between computer systems with a typical accuracy of sub  $\mu\text{s}$
- The PTP High Accuracy (or White Rabbit) profile allows synchronisation at nanosecond level, [potentially over 1000 km as shown by VTT.](#)
- PTP time-links are typically established over dedicated optical fiber connections (or optical channels in larger networks). Bidirectional single-fiber links are preferred due to their predictable delay asymmetry.
- PTP is adopted for time synchronisation within 5G networks, Smart Grids and digital substations, finance and e-commerce, and broadcast industries.

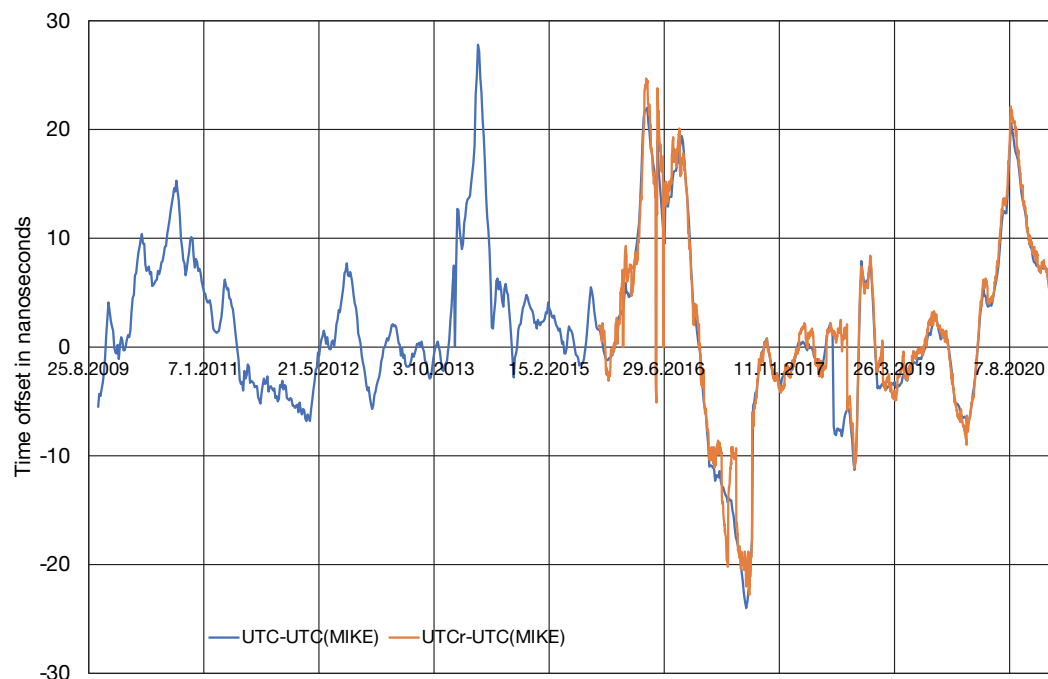


Figure 1. Time offset between UTC and Finnish national time-scale from 2009 to 2020, as reported by the BIPM.

VTT is a visionary research, development and innovation partner. We drive sustainable growth and tackle the biggest global challenges of our time and turn them into growth opportunities. We go beyond the obvious to help the society and companies to grow through technological innovations. VTT is at the sweet spot where innovation and business come together.

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