Atomic clocks realize the SI second

The second is the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom (CGPM 1967).

Any device able to generate the caesium reference signal is a frequency standard.

Devices can fail, the use of an ensemble of clocks and frequency standards helps to ensure reliability, robustness, accuracy, and continuity of a time scale.

Primary frequency standard

Some laboratories operate primary frequency standards. Their uncertainty can be evaluated by examining the different effects

Primary standards calibrate the frequency of the Echelle Atomique Libre (EAL)

The uncertainty of caesium primary fountains can reach $10^{-16}$

3 nanoseconds accumulated in one year

Agreement with the (irregular) rotation of the Earth

When the rotation of the Earth (UT1 time scale) reaches a one second difference with respect to atomic time TAI, one second is added to maintain the reference time scale UTC in agreement with the Earth’s rotation

$\text{UTC} = \text{TAI} + \text{leap seconds}$

Laboratories contributing to UTC

Geographical distribution of the laboratories that contribute to UTC and time transfer equipment (2016)

An approximation called Rapid UTC (UTCr) is calculated weekly and published each Wednesday by the BIPM.


UTC - UTC(k) in BIPM Circular T and the CCTF-K001.UTC

The difference UTC - UTC(k) is computed by the BIPM and published in the monthly Circular T

Contributing laboratories realize local real-time timescales named UTC(k)