CCU meeting, 8-9 Oct. 2019

Bureau International des Poids et Mesures

REPORT FROM CCTF

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CCTF report to CCU

CCTF perimeter covers time scales, primary and secondary frequency standards, time and frequency transfer techniques, and their applications

9 Working Groups (1 CCL-CCTF join working group)

CCTF Working Groups and Sub-Group:
CCL-CCTF Frequency Standards Working group (CCL-CCTF-WGFS)
CCTF Working Group on Coordination of the Development of Advanced Time and Frequency Transfer Techniques (CCTF-WGATFT)
CCTF Working Group on GNSS Time Transfer (CCTF-WGGNSS)
CCTF Working Group on Primary and Secondary Frequency Standards (CCTF-WGPSFS)
CCTF Working Group on Strategic Planning (CCTF-WGSP)
CCTF Working Group on TAI (CCTF-WGTAI)
CCTF Working Group on the CIPM MRA (CCTF-WGMRA)
CCTF Working Group on Time Scale Algorithms (CCTF-WG-ALGO)
CCTF Working Group on Two-Way Satellite Time and Frequency Transfer (CCTF-WGTWSTFT)

CCTF

- 21st CCTF meeting: 8-9 June 2017.
- New CCTF president elected by CIPM in March 2019
- 22nd CCTF meeting: 29-30 oct 2020 at BIPM + during the same week: CCTF WG meetings and workshop on optical time scales

Join workshop CCU – CCTF / WG ATFT on “Advanced Time and Frequency Transfer: the ultimate frontier for remote comparison methods” (10 Oct. 2019)

Important role CCTF WG on strategic planning (2 meetings per year: 26 June 2019, 11 Oct. 2019, next in April 2020):

- Reports from chairs of CCTF WG
- Core team to organize reflections on important identified subjects, to prepare efficiently CCTF meeting

Work in progress within CCTF scope

Major subjects:

- Redefinition of SI second (including scientific / practical aspects and potential impact for stakeholders and end users)
- Increasing role of secondary frequency standards in the construction of atomic time scales, emergence of optical time scales (dedicated workshop in Oct. 2020)
- Leap seconds
- Promotion of the important benefits of the unique reference time UTC to the international scientific and industrial communities.
- GNSS time scales and traceability to UTC
- Capacity builiding

Primary and secondary frequency standards in UTC

Primary and secondary standards reported to the BIPM

- 2017: 54 reports from 7 fountains + 2 optical lattices
- 2018: 84 reports from 10 fountains + 2 optical lattices

UTC steering also on secondary optical standards:

Syrte Sr (March 2017),

NICT Sr (Nov. 2018),

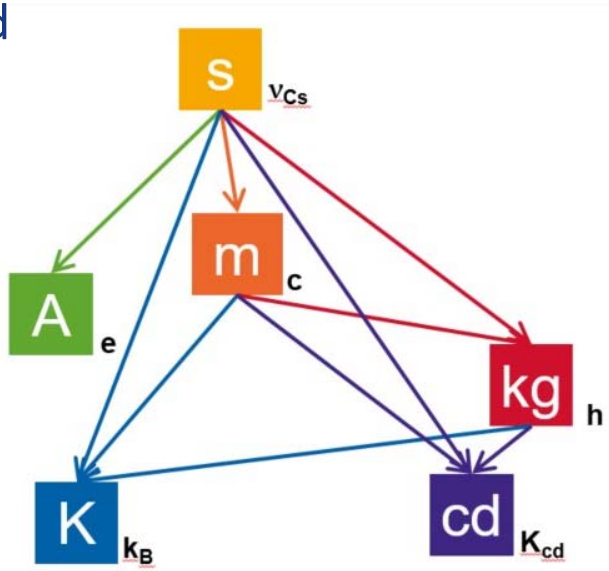
NIST Yb (Feb. 2019)

Primary Standard	Type /selection	Type B std. Uncertainty / 10^{-15}	Operation	Comparison with	Number/typical duration of comp.
IT-CsF2	Fountain	0.17	Discontinuous	H maser	2 / 10 d to 15 d
METAS-FOC2	Fountain	2.01	Discontinuous	H maser	3 / 15 d to 25 d
NIM5	Fountain	0.9	Discontinuous	H maser	3 / 15 d to 25 d
PTB-CS1	Beam /Mag.	8	Continuous	TAI	12 / 25 d to 35 d
PTB-CS2	Beam /Mag.	12	Continuous	TAI	12 / 25 d to 35 d
PTB-CSF1	Fountain	0.28 to 0.40	Nearly continuous	H maser	8 / 10 d to 30 d
PTB-CSF2	Fountain	0.18 to 0.21	Nearly continuous	H maser	11 / 10 d to 30 d
SU-CsFO2	Fountain	0.24	Nearly continuous	H maser	10 / 10 d to 30 d
SYRTE-FO1	Fountain	0.32 to 0.43	Nearly continuous	H maser	11 / 15 d to 35 d
SYRTE-FO2	Fountain	0.20 to 0.31	Nearly continuous	H maser	11 / 15 d to 35 d
SYRTE-FOM	Fountain	0.63 to 1.13	Discontinuous	H maser	4 / 30 d
Secondary Standard	**Type /selection**	**Type B std. Uncertainty / 10^{-15}**	**Operation**	**Comparison with**	**Number/typical duration of comp.**
SYRTE-FORb	Fountain	0.24 to 0.30	Nearly	H maser	12 / 15 d to 35 d

Redefinition of the second: CCTF/CCU complementary roles

CCTF:

Redefinition of SI second, realization of the definition and dissemination of the unit towards users, including, for instance, the impact of relativity on atomic frequency standards and Time & Frequency transfer techniques
→ See the statement provided by CCTF president to CCU



CCU:

Impact of a new definition of the second on the other SI units, including, for instance, the impact of relativity on the connections between the units (ex: special relativity underlying the definition of SI meter from the second)

Statement from CCTF President to CCU on the role of relativity in time & frequency metrology

Today, it is recognized that general relativity is a correct framework for T/F Metrology. It is properly managed in scientific and industrial applications.

The present implementations are designed to provide uncertainty of 1×10^{-18} in frequency (for clocks) and 1 ps in time (for time transfer).

The validity beyond this level has still to be studied and the improvements on the theoretical sides will be of course linked to the improvements of clocks and transfer techniques.