

Requirements for participation in UTC

Aurélie Harmegnies
BIPM Time Department

Bureau
International des
Poids et
Mesures



Outline

- ◆ Advantages of contributing to UTC
- ◆ Administrative requirements
- ◆ Technical requirements
- ◆ Some CCTF recommendations to participating laboratories

Advantages of contributing to UTC

Get direct access to UTC through your local realization of UTC, so called 'UTC(k)'

- via the BIPM *Circular T* monthly publication: differences $[UTC-UTC(k)]$ are published, with time spacing of 5 days.

CIRCULAR T 400 ISSN 1143-1393
 2021 MAY 11, 07h UTC

BUREAU INTERNATIONAL DES POIDS ET MESURES
 THE INTERGOVERNMENTAL ORGANIZATION ESTABLISHED BY THE METRE CONVENTION
 PAVILLON DE BRETEUIL F-92312 SEVRES CEDEX TEL. +33 1 45 07 70 70 tai@bipm.org

The contents of the sections of BIPM Circular T are fully described in the document "Explanatory supplement to BIPM Circular T" available at https://webtai.bipm.org/ftp/pub/tai/other-products/notes/explanatory_supplement_v0.4.pdf

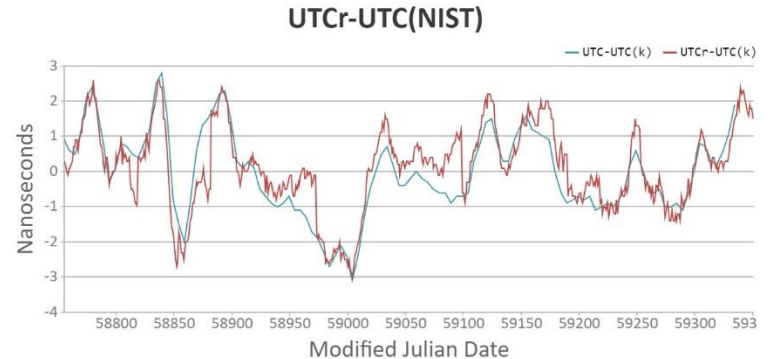
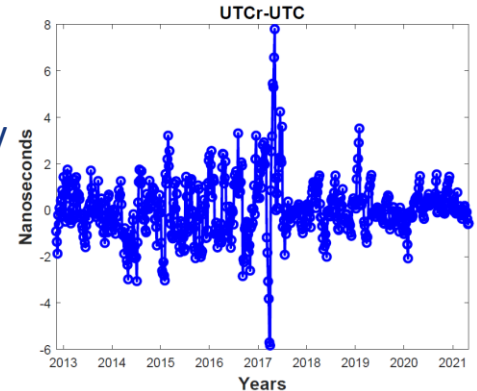
1 - Difference between UTC and its local realizations UTC(k) and corresponding uncertainties.
 From 2017 January 1, 0h UTC, TAI-UTC = 37 s.

Date 2021	0h UTC	MAR 31	APR 5	APR 10	APR 15	APR 20	APR 25	APR 30	Uncertainty/ns Notes		
MJD		59304	59309	59314	59319	59324	59329	59334	uA	uB	u
Laboratory k		[UTC-UTC(k)]/ns									
AOS (Borowiec)		-1.5	-1.8	-1.8	-2.1	-2.2	-2.4	-2.4	0.3	2.9	2.9
APL (Laurel)		-0.9	-1.0	-0.4	-0.2	0.1	0.5	0.9	0.3	19.6	19.6
AUS (Sydney)		-472.8	-476.6	-468.6	-476.5	-474.9	-491.6	-498.3	0.3	11.2	11.2
BEV (Wien)		11.4	16.1	16.7	14.2	9.6	6.5	11.2	0.3	3.3	3.3
BFKH (Budapest)		-	-	2401.8	2425.2	2457.7	2482.7	-	1.5	20.0	20.1
BIM (Sofiya)		14443.4	14468.8	14474.6	14496.2	14532.1	14575.1	14585.9	0.7	7.1	7.2
BIRM (Beijing)		-7.7	-10.0	-8.3	-9.7	-8.0	-6.9	-3.6	0.7	2.8	2.9
BOM (Skopje)		-4388.2	-4398.2	-4414.0	-4419.2	-4413.9	-4410.2	-	5.0	7.5	9.1
BY (Minsk)		0.1	0.7	0.9	0.6	0.8	1.2	1.1	1.5	12.1	12.2
CAO (Cagliari)		-26534.0	-26647.1	-26755.3	-26863.4	-26975.3	-27080.6	-27196.8	1.5	20.0	20.1

Advantages of contributing to UTC

Additional services to monitor your local realization of UTC:

- a **rapid UTC** ($UTCr$) computation is weekly computed to provide a daily comparison [$UTCr - UTC(k)$].
Typical variations between $UTCr$ and UTC are below 2ns.
- results [$UTC - UTC(k)$] and [$UTCr - UTC(k)$] are accessible through **machine readable** data on the web, for possible automatization of monitoring in laboratories



Advantages of contributing to UTC

- Available products can be accessed through BIPM website:
 - clocks rates, drifts, weights in UTC
 - time links and their differences
 - time scales differences (UTC, UTC(k), GNSS Time scale, UTCr, TT,...)
 - calibration status and results

BUREAU INTERNATIONAL DES POIDS ET MESURES

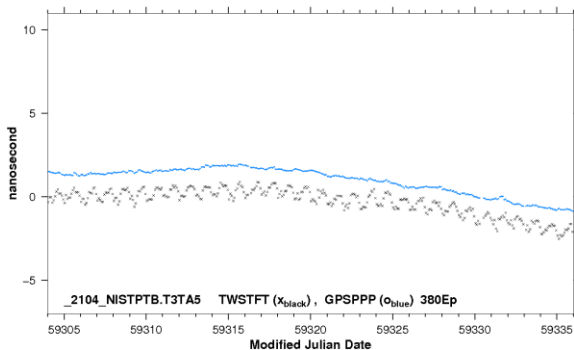
INTERNATIONAL ATOMIC TIME

RELATIVE WEIGHTS (IN PERCENT) OF THE CLOCKS FOR INTERVALS OF ONE MONTH ENDING AT THE GIVEN DATES

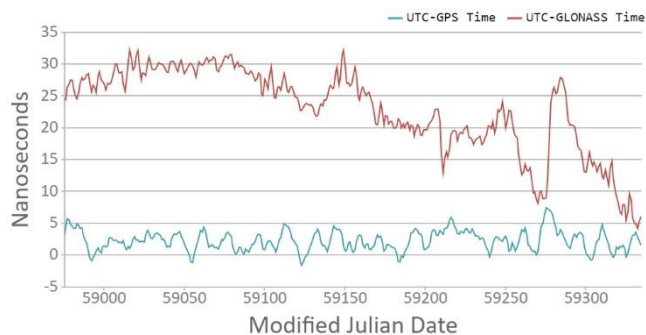
(***** DENOTES THAT THE CLOCK WAS NOT USED)

LAB.	CLOCK	59179	59214	59244	59269	59304	59334
APL	35 1264	0.021	0.025	0.028	0.029	0.029	0.024
APL	35 1791	0.083	0.073	0.089	0.072	0.072	0.061
APL	35 3842	0.039	0.040	0.049	0.050	0.055	0.055
APL	40 3107	0.363	0.472	0.593	0.628	0.740	0.760
APL	40 3108	1.031	0.302	0.380	0.372	0.300	0.224

UTC(NIST)-UTC(PTB)



UTC-GNSS Time



Bureau International des Poids et Mesures

BIPM Time Department Data Base

Participation guidelines | Participants | Lab, equipment | Clocks | Calibrations | Interactive pdf

Status of ongoing, planned, requested and past GNSS calibration exercises

Ongoing, planned and requested GNSS calibration exercises					
CAL_ID	Author	Comment/report	Type of trip	Creation date	
I201-2021	PTB	JV	G2 Golden	2021-03-02 12:53:43	
1014-2021	NIST	AGGO-SONA-INTI-ONBA	G2	2021-05-06 15:31:28	
1013-2021	PTB	TP	G2	2021-04-30 12:37:53	
1012-2021	LINE-SYRTE	CNES-ILNAS	G2	2021-01-22 10:51:24	
I201-2020	ROA	SMD	G2 Golden	2020-09-14 14:27:10	

Past GNSS calibration exercises			
CAL_ID	Author	Comment/report	Validation date
1101-2021	ROA	1101-2021_GSP3C1-GALE3_ROA-TC_V1-0.pdf	2021-03
1011-2021	PTB	1011-2021_GSP3-GALE3_INRBM_V1-1.pdf	2021-03
1106-2020	Internal TC	1106-2020_GSP3_SP-TC_V1-0.pdf	2020-09

Administrative and technical requirements

Requirements are described in CCTF Guidance documents

from the WG on MRA :

- Guideline 6: Requirements for participation in the computation of UTC at the BIPM
- Guideline 8: Technical requirements for the time laboratories for the participation in UTC

Administrative requirements: Guideline 6

All interested institutes should send by email to the Director of the BIPM Time Department a **letter of application** requesting participation in UTC.

- ✓ This letter includes :
 - ◆ a **description** of the time laboratory **equipment**;
 - ◆ the contact details of the recommended **contact person**;

- ✓ NMIs or Designated Institutes of Member States in T/F have no other administrative requirement

Administrative requirements: Guideline 6

- ✓ For other institutes in States Member of the BIPM or Associate of the General Conference additional requirements are:
 - statement explaining the **motivation** for maintaining a local realization of UTC
 - the relevant NMI should provide a **written statement of support**

- ✓ For International Organizations participating in the CIPM MRA
 - statement explaining the **motivation** for maintaining a local realization of UTC

... If the Director of the BIPM Time Department considers the application as acceptable, communication will be established with the designated person

Technical requirements: Guideline 8

- ✓ Laboratories willing to participate in the calculation of UTC should be equipped of :

- one or more **atomic clocks** (not disciplined for a UTC contribution)
- instruments to allow **remote clock comparisons**.

Current recommended equipments :

- ♦ Timing GNSS receivers : Multi channel, dual-frequency, code and phase measurements, compatible with multi-constellation and providing CGGTTS and RINEX files (to be submitted to the BIPM)
- ♦ Two-way satellite time and frequency transfer (TWSTFT) station (need arrangements with TWSTFT working group)

Redundant systems are encouraged for continuous participation

- ✓ Then fill dedicated form and send to tai@bipm.org

Technical requirements: data reporting

- ✓ Contributing laboratories must have the capacity to submit data to the BIPM on a regular basis (automatization should be considered)
- ✓ Guidelines on the type of data requested and their submission rules :
http://webtai.bipm.org/database/documents/ReadMe_guidelines.pdf
- ...
- ✓ The BIPM Time Department will evaluate the data submitted over a trial period of approximately three months before taking the decision to include (or not) the Institute in the calculation of UTC.



Some CCTF recommendations to participating laboratories

- It is recommended by the CCTF to keep UTC(k) close to UTC for a better worldwide time coordination (difference smaller than 100ns) *CCDS recommandation S 5 (1993)*
- It is recommended to provide all data from at least two independent GNSS systems
Recommandation CCTF 4 (2017)
- Concerning the calibration of equipment, it is recommended to RMOs or laboratories contributing to RMOs to :
 - organize periodically calibration trips for Group 2 laboratories,
 - follow BIPM calibration guidelines
 - organize calibration trips in collaboration with the BIPM for a complete coverage.*Recommandation CCTF 3 (2015)*
 - ...for calibration of equipments contributing to UTC, contact your RMO Technical Chair

Thank you for your attention

... hoping to see you later in UTC 😊

Contact : tai@bipm.org

Bureau
International des
Poids et
Mesures

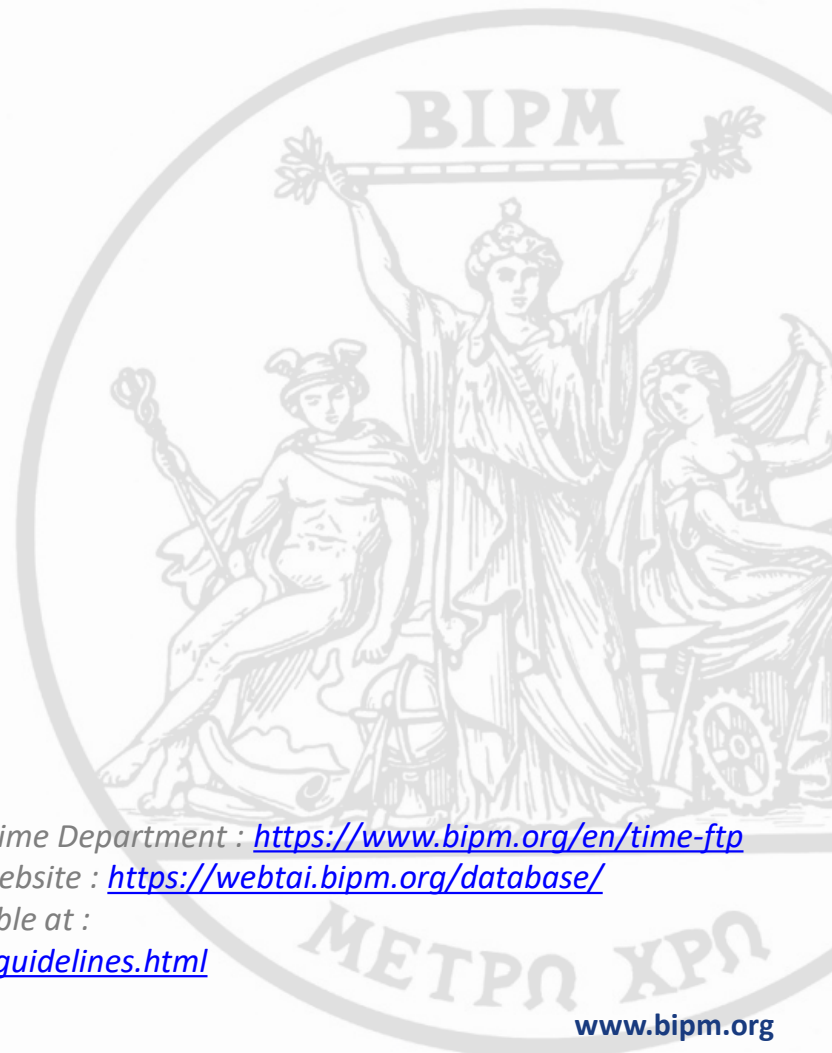
Useful links:

BIPM website access to FTP of the Time Department : <https://www.bipm.org/en/time-ftp>

BIPM Time Department database website : <https://webtai.bipm.org/database/>

Full technical documentation available at :

<https://webtai.bipm.org/database/guidelines.html>



www.bipm.org