

TM137 BIPM TAI Time Link Comparison on ftp

Version 12 : Last edit 26/02/2024 by AH ; use of LLmo identifier

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This is the Read Me file of the FTP site on the TAI time link results calculated by the BIPM Time Section. The comparison results since January 2005 are published each month after the BIPM Circular T in <https://webtai.bipm.org/ftp/pub/tai/publication/timelinks/lkc>

Warning: The monthly LkC directories are intended to provide all links computed on a given month, as Gif plots (*.gif) and corresponding data files (*.dat). The links and their calibration information, or alignments required for their use in UTC are listed in Circular T section 5.

Warning: Similarly long solutions that can be assembled by stacking monthly files are not certified to be continuous, depending on possible alignments application necessary for TAI computation.

Introduction and directory structure

Results can be accessed automatically using following protocols :

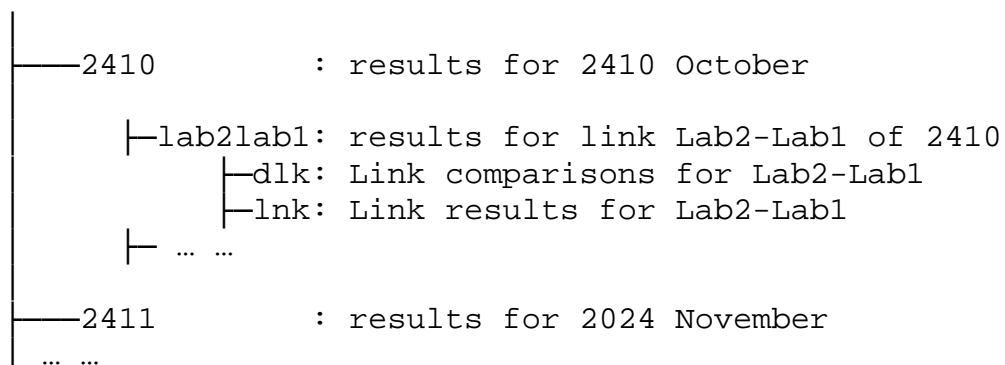
- FTP at <ftp://ftp2.bipm.org/pub/tai/publication/timelinks/>
- HTTP(s) at <https://webtai.bipm.org/ftp/pub/tai/timelinks/lkc/> (for web browsing)

The monthly comparisons are in /lkc/YYMM where YYMM corresponds to the year and month of the calculated Circular T, for example, 2410 is for 2024 October. They contain plots and data files for link values and link comparisons for all measurement dates. See section 2.

The general directory tree looks like:

<https://webtai.bipm.org/ftp/pub/tai/timelinks/lkc/>

ReadMe



A link representing $[UTC(Lab2)-UTC(Lab1)]$, is identified as “lab2lab1” or “llmo1llmo2” for GNSS receivers use.

Here *Lab1* is usually the so called pivot laboratory and *Lab2* is the compared laboratory. LLmo1 and LLmo2 stands for the identification of the GNSS receivers of each of *Lab1* and *Lab2* (if applicable).

The list of existing *Lab* and *LLmo* can be found at <https://webtai.bipm.org/database/gnss.html>.

A comparison of links is always defined as $dLink = Link1 - Link2$
By default, the unit for all the tables and plots is 1 ns.

In each monthly sub-directory of /lkc/YYMM/lab2lab1/, there are two sub-directories:

- *lnk/* subdirectory contains the Link files and (Section 1)
- *dlk/* subdirectory contains the dLink (link comparisons) files (Section 2)

1. Files naming convention

The Link files are ASCII data files with the names :

- **lab2lab1.abcdt.dat** (for official links and non-GNSS links)
- **LLmo2LLmo1.abcdt.dat** (for all GNSS links)

and plots in Gif format with the name :

- **lab2lab1.abcdt.gif** (for official links and non-GNSS links)
- **LLmo2LLmo1.abcdt.gif** (for all GNSS links)

using following extension identifiers :

Time Links identification rules for <u>single links</u>		
<i>Type of link</i> (as in explanatory supplement of Circular T)	<i>Extension</i> 'abcdt'	Extension for link comparisons 'efgh' ('eg' if link1, 'fh' if link2)
GPSPPP	333a_	3G
GPS P3	pppa_	P3
GPS MC	mma_	MC
GALP3	eeea_	EZ
BDSP3	ccca_	CZ
GLN MC	rrrc_	RC
TWSTFT	tttt_	T_
TWSSDR	ttts	Ts
TWSRS	tttr	Tr

GPS IPPP	ttti	Ti
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Table 1 : Identifiers used for Single Time Links. “*Link extensions*” (center) and “*Link comparison identifier*” (right)

Time Links identification rules for <u>combined links</u>		
<i>Type of link</i> (as in explanatory supplement of Circular T)	Extension for links 'abcdt'	Extension for link comparisons 'efgh' ('eg' if link1, 'gh' if link2)
TWGPPP	t3b3_	B3
GPSGLN	grb1_	B1

Table 2 : Identifiers used for Combined Time Links. “Link extensions” (center) and “Link comparison identifier” (right)

2. Link files (lnk/)

Index of /ftp/pub/tai/timelinks/lkc/2412/opptb/lnk














Name	Last modified	Size	Description
 Parent Directory		-	Time links
 opptb.333a_.dat	2025-01-06 14:34	461K	GPS PPP
 opptb.333a_.gif	2025-01-10 12:49	60K	GPS PPP
 opptb.mmma_.dat	2025-01-06 14:33	139K	GPS MC
 opptb.mmma_.gif	2025-01-10 12:49	65K	GPS MC
 opptb.pppa_.dat	2025-01-06 14:32	141K	GPS P3
 opptb.pppa_.gif	2025-01-10 12:49	70K	GPS P3
 opptb.t3b3_.dat	2025-01-06 15:10	21K	TWSTFT+PPP
 opptb.t3b3_.gif	2025-01-10 12:49	43K	TWSTFT+PPP
 opptb.tttt_.dat	2025-01-06 14:36	54K	TWSTFT
 opptb.tttt_.gif	2025-01-10 12:49	43K	TWSTFT
 opptb.tttts.dat	2025-01-06 14:36	406K	TWSTFT SDR
 opptb.tttts.gif	2025-01-10 12:49	53K	TWSTFT SDR

Fig. 1: Directory of link files for the link OP-PTB for December 2024, available at <https://webtai.bipm.org/ftp/pub/tai/timelinks/lkc/2412/opptb/lnk/> , with explanatory notes on the filenames.

2.1 Gif Plot files' description

As illustration in Figure 2, the plot contains 4 figures :

- the **top figure** represents the link measured values (ns) with red numbers indicating the link values computed on the standard TAI dates. A 'UTC link' flag, when existing mentions that the link was used for the TAI computation of the concerned month.
By default, the links are computed without any time or receiver jumps introduced, in case of a constant alignment applied to the link, the information about the amount of the constant applied can be found in the plot: reported with the flag "**CLBxxxx**____", where xxxxx is the applied alignment expressed in 0.1ns.
For a IPPP link, the mention « IPPP reset » indicates that there is no intrinsic connection between the sections before and after the reset. In this case the two sections have been connected using external information, usually another available link.
- the **middle figure** represents the residuals = measured - smoothed: For GNSS 'smoothed' is the result of Vondrak smoothing. For TW, it is the linear interpolation of the two adjacent point.
- the **bottom left figure** : the Modified Allan Deviation of the link measured values.
- the **bottom right figure** : the Time Deviation of the link measured values.

Description of the legends in the plots :

- **Bottom line of the top figure** indicates, the type of the link, the year and month, the two laboratories and their TAI codes, the total number of points and the time and date of the processing.
- **Bottom line in the middle figure** indicates the maximum value and the standard deviation of the residuals, and (for GNSS links) the power of the Vondrak smoothing.
- **Top line of the bottom figures** indicates Tau0, the averaging time for the first point of the deviations, and Scale, the unit for the indicated values.
- **Bottom line of the bottom figures**, d/8, d/4 and d/2 stand for day/8, day/4 and day/2; dd and ddd stand for 2 and 3 days; wk means a week

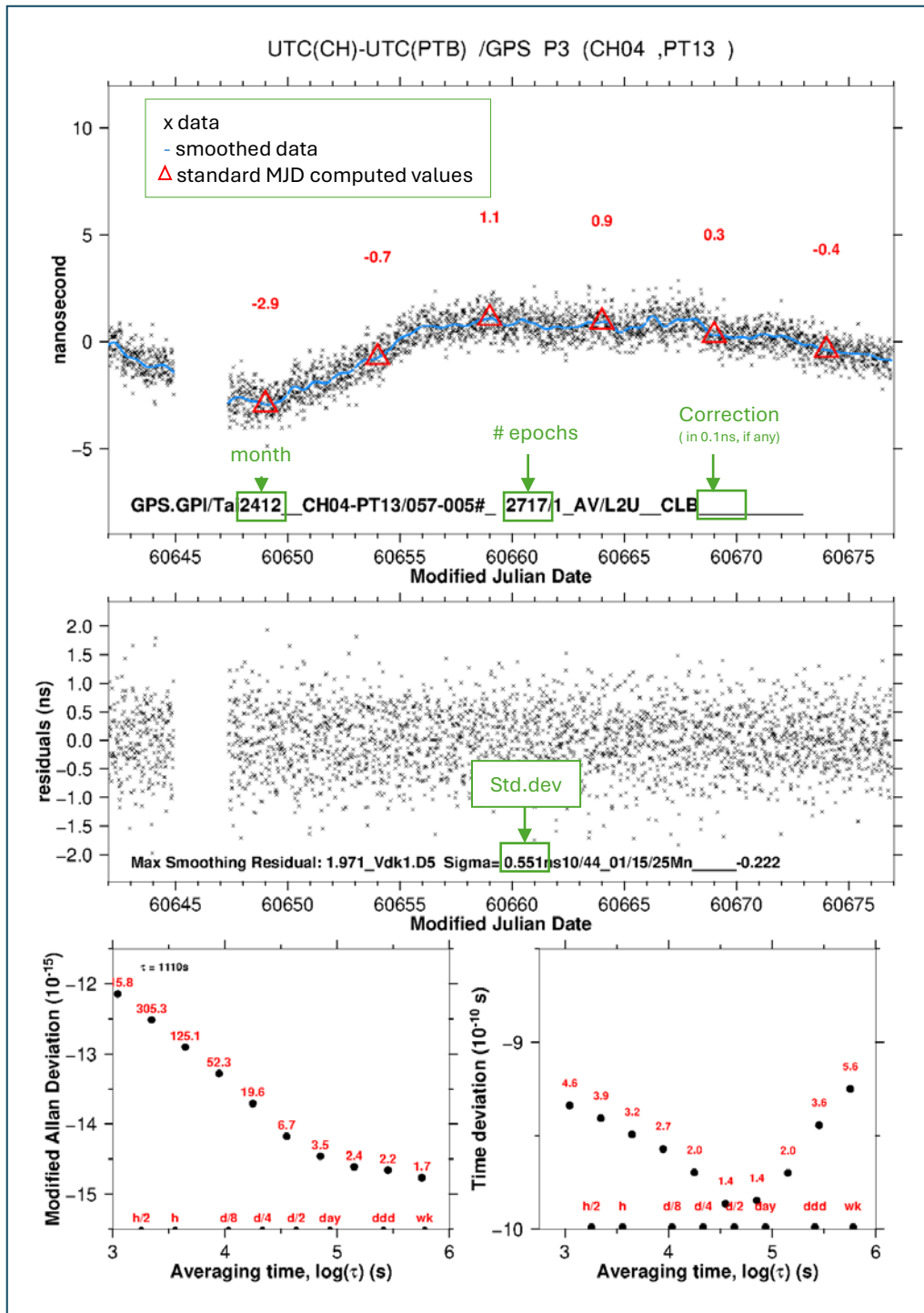


Fig. 2: Plot of the GPS P3 link of CH-PTB for December 2024, available at <https://webtai.bipm.org/ftp/pub/tai/timelinks/lkc/2412/chptb/lnk/> . See section 2.1 for details.

2.2 Link data files

A GNSS link data file **lab2lab1.abcd.dat** has three parts: the header, the link data body and the plot data body. We ignore here the first and the 3rd parts. The link data body has four columns: MJD, link value, Vondrak smoothing value and their difference, as displayed in the table below.

MJD	Link	Smth	Resid
54552.00000	91.820	92.140	0.320
54552.00347	91.942	92.167	0.225
54552.00694	91.980	92.195	0.215
54552.01042	92.075	92.224	0.149
54552.01389	92.083	92.254	0.171
54552.01736	92.157	92.285	0.128
54552.02083	92.313	92.316	0.003
54552.02431	92.378	92.348	-0.030

3. Link comparisons files (dlk/)

The *dLink* (link comparison) files are data in ASCII format and plots in Gif format. The file name is **Lab2Lab1.efgh5** for a data file and **Lab2Lab1.efgh5.gif** for a plot file, where Link comparison identifiers (“eg” and “fh”) are corresponding to the 2-characters identifiers in column 3 of Tables 1 and 2.

Index of /ftp/pub/tai/timelinks/lkc/2412/opptb/dlk













Name	Last modified	Size	Description
 Parent Directory		-	
 opptb.p3aa5	2025-01-10 12:32	434K	[GPS P3]-[GPS PPP]
 opptb.p3aa5.gif	2025-01-10 12:36	66K	[GPS P3]-[GPS PPP]
 opptb.t3ta5	2025-01-10 12:32	59K	[TWSTFT]-[GPS PPP]
 opptb.t3ta5.gif	2025-01-10 12:36	43K	[TWSTFT]-[GPS PPP]
 opptb.tbs35	2025-01-10 12:32	445K	[TWSTFT SDR]-[TWSTFT+GPS PPP]
 opptb.tbs35.gif	2025-01-10 12:37	48K	[TWSTFT SDR]-[TWSTFT+GPS PPP]
 opptb.tbt35	2025-01-10 12:32	58K	[TWSTFT]-[TWSTFT+GPS PPP]
 opptb.tbt35.gif	2025-01-10 12:37	41K	[TWSTFT]-[TWSTFT+GPS PPP]
 opptb.tpta5	2025-01-10 12:32	59K	[TWSTFT]-[GPS P3]
 opptb.tpta5.gif	2025-01-10 12:37	43K	[TWSTFT]-[GPS P3]
 opptb.ttts5	2025-01-10 12:32	55K	[TWSTFT]-[TWSTFT SDR]
 opptb.ttts5.gif	2025-01-10 12:37	41K	[TWSTFT]-[TWSTFT SDR]

Fig. 3: Directory of link comparison files for the link OP-PTB for December 2024, available at <https://webtai.bipm.org/ftp/pub/tai/timelinks/lkc/2412/opptb/dlk/> , with explanatory notes on the filenames.

3.1 The plot of a link comparison (dLink)

As illustration, the plot contains 4 figures (see Figure 5)

- the **top figure** represents the measured values (ns) of the two links to be compared Link1(black crosses) and Link2(blue circles). If the maximum absolute value of the difference dLink exceeds 100 ns, the mean value of dLink (shown in the middle figure) will be subtracted from the Link1 before plotting and the keyword “MeanRmved” will appear.
- The **middle figure** is the differences $dLink = Link1 - Link2$. Note that the red numbers represent real points chosen "at random" to indicate the order of magnitude of the values and their variations. They are not intended to represent special points.
- the **bottom left figure** : the Modified Allan Deviation of the dLink values.
- the **bottom right figure** : the Time Deviation of the dLink values.

Description of the legends in the plots

- **Bottom line of the top figure** indicates the year and month, the name of the dLink data file, the total number of points. MeanRmved appears if the mean value has been removed.
- **Bottom line in the middle figure** indicates the maximum, minimum and average value of dLink and its standard deviation.
- **Legends in the bottom figures** are similar to the Link plot.

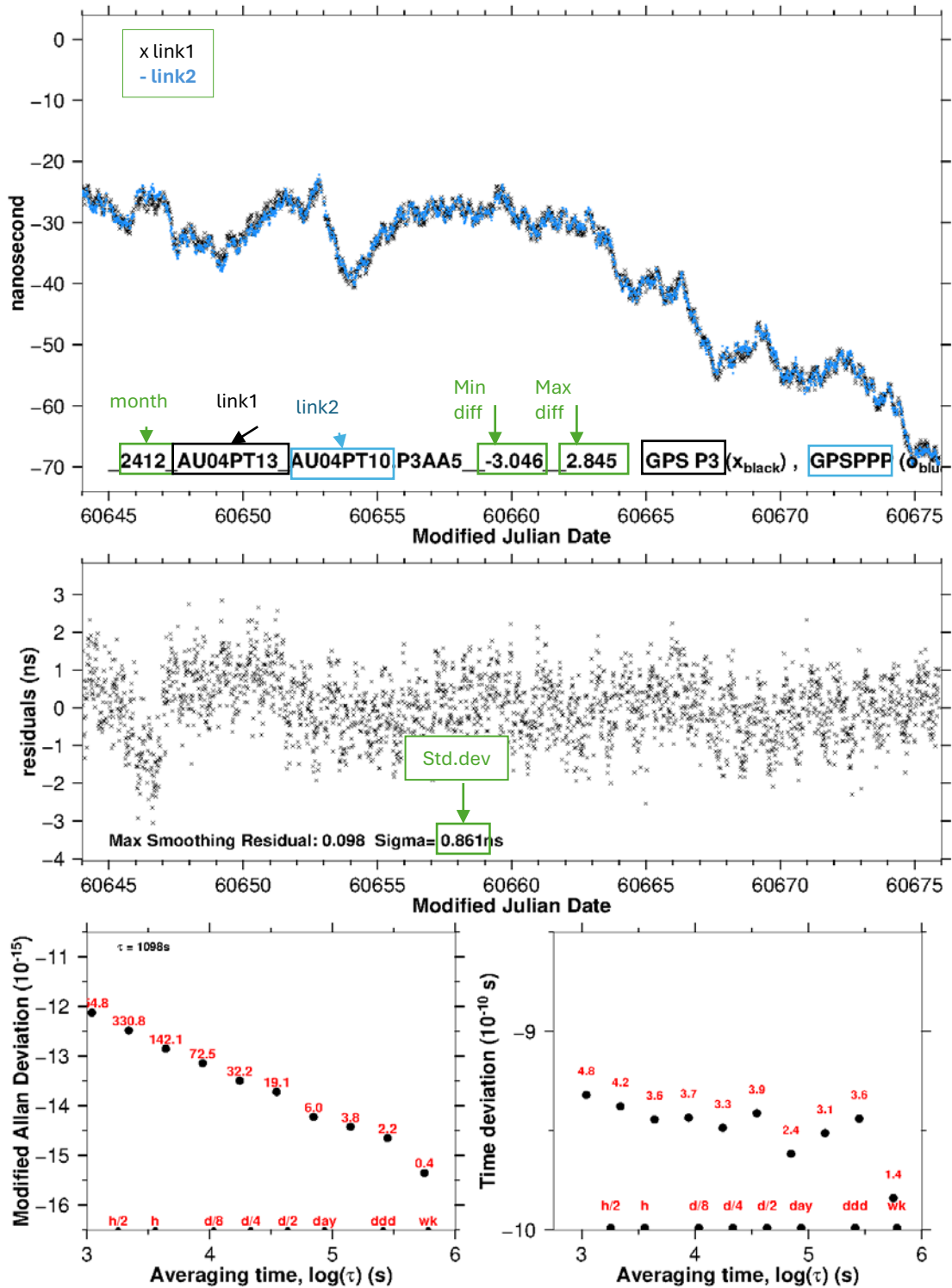


Fig. 4: Plot of the link comparison between AUS-PTB GPS P3 (link1, black) w.r.t AUS-PTB GPSPPP (link2, blue) for December 2024, available at <https://webtai.bipm.org/ftp/pub/tai/timelinks/lkc/2412/ausptb/dlk/> . See section 3.1 for details.

3.2 Link comparison data files

An example of link comparison data is shown below, the comparison between the TW link (Link1) and GPS single channel CV link (Link2): NISTPTB.TSTC5.

!	0502	Mjd	Link1	Link2	dLink	Jump1	Jump2	dLink_
	1	53397.0347	-5.879	7.420	-13.299	0.000	0.000	-13.299
	2	53397.3680	-6.051	7.264	-13.315	0.000	0.000	-13.315
...
	130	53430.6180	-0.170	12.480	-12.650	0.000	0.000	-12.650
	131	53430.7014	-0.703	12.371	-13.074	0.000	0.000	-13.074
!	Combined dLink Statis. NISTPTB.TSTC5 :							
	N,Min,Max,Mean,RMS,SD=	131	-15.539	-10.240	-12.850	12.896	1.085	

Data lines are numbered consecutively and contain

Mjd = Date of measurement

Link1, Link2 = Link values

dLink = Link1 - Link2

Jump1, Jump2 : optional time correction applied to Link1 or Link2

dLink_ = (Link1+Jump1) - (Link2+Jump2)

Information in the last line:

N = total number of measurements

Min = minimum value of dLink

Max = maximum value of dLink

Mean = mean value of dLink

RMS = Root Mean Square of the dLink values

SD = Standard Deviation of the dLink values

The values following this line are only used to produce the corresponding stability plots and are not described here.

In general, the first link is chosen as the less dense and the denser second link is interpolated to the epochs of the first link.

Historical changes :

Version 1: Oct. 2004 by ZJ

Version 6 Last edit: 27 May 2005 by AF/GP

Version 7 Last edit: 26 May 2008: Comparison including GPS PPP by GP

Version 8 Last edit: 10 June 2009: Comparison including GLONASS by ZJ,

Version 9 Last edit: 21 Jan. 2011 by ZJ: Link combinations: GPS+GLN, TW+PPP/P3:
ftp://tai.bipm.org/TimeLink/LkC/ReadMe_LinkComparison_ftp_v9.doc

Version 10 Last edit 17 March 2016 by GP.

Version 11 Last edit 19 January 2018 by GP;

Version 12 Last edit 28 November 2024 by A.Harmegnies : Enable possibility to publish several links from same receiver type and for same lab.

Changes:

Version 6 is characterized by the comparisons of the time transfer methods: GPS common view and all in view.

Version 7 is characterized by the comparisons between TW and **GPS PPP** for TAI and non-TAI time links. Important modifications vs. version 6 are in red colour. Version 7 is mis en pratique since TAI 0804. The monthly GPS PPP computation solutions are on <https://webtai.bipm.org/ftp/pub/tai/publication/timelinks/taippp>

Starting with version 7, neither mean value nor slope will be removed in the plots as was the case in the version 6. Cf. TM151 for details:

https://webtai.bipm.org/ftp/pub/tai/timelinks/lkc/tm151_twcalib.doc

Version 8 is based on the version 7 and characterized by including **GLONASS** and long term (yearly) data comparisons. SU-PTB GLN has been used in UTC since Nov. 2009.

Version 9 includes the link combinations of GPS+GLN and TW+GPSPPP. Cf. TM185: https://webtai.bipm.org/ftp/pub/tai/timelinks/lkc/tm185_new-in-tsoft_lnkcombination.doc , and the Figures 7, 8, 9 and 10 in the end of this doc. Combined links have been used in UTC for SU, UME, CH, NIST, OP and SP since Jan. 2011

Version 10 includes optical fiber links, as of January 2016 the two links AOS-PL and BEV-TP. It also includes experimental computation of GPS PPP with integer ambiguities (IPPP) which, as of January 2016, concerns the link AOS-PL. Although the principle of IPPP is equivalent to the classical GPS PPP, its results are presently computed and treated by the BIPM software as if they were two way links. Therefore they are classified below, and they appear in the ftp site, as TW links.

Version 11 incorporates the possibility to publish TW SDR links and link comparisons, as well as Galileo (GAL) and BeiDou (BDS) dual frequency links and link comparisons. It also clarifies the presentation in section 2 and provides new accompanying figures.

Version 12 has the new feature to publish the GNSS links using the “LLmo” receiver BIPM ID (list can be found here : <https://webtai.bipm.org/database/gnss.html>) .

The official links used to generate Circular T are still identified using the 'LAB' names as always done until now, this version is retro compatible for time links for the users. For time link comparisons, the new file names for single technique links are more explicit to allow identifying directly the concerned GNSS receiver.