

<i>3rd BIPM TWSTT Monthly Report</i>

To: TWSTT Participating Stations

Dear Colleagues,

Please find enclosed the third monthly report on the handling of TWSTT data at the BIPM.

Some selected TWSTT links are computed and compared to GPS at the time of preparation of *Circular T* but are not yet used for the construction of TAI. The results of the computation of seven links for June 1999 are provided in Tables 1 to 7 in the Appendix to this report. We have introduced two new links: VSL/PTB and NPL/NIST.

Below we briefly report on the status of the TWSTT Participating Stations and provide calibration of some TWSTT links.

1. Status of Participating Stations and data collection at the BIPM

TWSTT files are collected on an operational basis from the following stations: DTAG, NPL, NIST, PTB, TUG, USNO and VSL. Most of these files fulfil requirements for standard format and data quality, but some of them still exhibit some anomalies, which complicate or prevent computation of some links. We are currently trying to resolve these problems.

The IEN, OCA and ROA stations are approaching operational status.

2. Calibration of TWSTT links

We stress the need for the calibration of TWSTT links by transportation of a TWSTT station, transportation of a GPS or GLONASS receiver, or at least by values published in *Circular T*. Calibrations should be undertaken between pairs of stations.

Several laboratories have calibrated their TWSTT links with USNO by *Circular T* before MJD = 50779, when USNO GPS data used for *Circular T* was inaccurate. We have recomputed the calibration coefficients (CALR) for these laboratories using *Circular T* over the MJD period 51287-51317. The results are provided in the table below.

TWSTT link	CALR/ns	Calib. ID	Calib. Switch	Calib. information for TWSTT File Header		
				Type	MJD	Est. Uncert. /ns
USNO/PTB	720.989	46	1	Circular T	51302	5
PTB/USNO	-720.989	46	1	Circular T	51302	5
USNO/TUG	537.880	47	1	Circular T	51302	5
TUG/USNO	-537.880	47	1	Circular T	51302	5
USNO/VSL	515.143	48	1	Circular T	51309	5
VSL/USNO	-515.143	48	1	Circular T	51309	5
USNO/DTAG	815.190	45	1	Circular T	51287	5
DTAG/USNO	-815.190	45	1	Circular T	51287	5

We suggest that DTAG, PTB, TUG, USNO and VSL introduce these updated CALR values into their TWSTT files starting with MJD = 51389 (30 July 1999).

Due to some misunderstanding concerning calibration the VSL TWSTT data were not used in last report. Following further discussions with the VSL we now publish in this report the VSL/PTB TWSTT link calibrated by *Circular T*. We have also calibrated two other VSL TWSTT links by *Circular T*. The results are provided in the table below.

TWSTT link	CALR/ns	Calib. ID	Calib. Switch	Calib. information for TWSTT File Header		
				Type	MJD	Est. Uncert. /ns
VSL/NIST	-550.219	08	1	Circular T	51309	5
NIST/VSL	550.219	08	1	Circular T	51309	5
VSL/NPL	-206.174	33	1	Circular T	51304	5
NPL/VSL	206.174	33	1	Circular T	51304	5

We suggest that VSL, NIST and NPL introduce these updated CALR values into their TWSTT files starting with MJD = 51389 (30 July 1999).

3. Introduction of TWSTT links into TAI

As previously announced, the TUG/PTB TWSTT link will be introduced into the computation of TAI, starting with the *Circular T* issue covering July 1999.

The GPS link between these two laboratories will be computed as a check and kept as reserve data.

Further links will be introduced into TAI as soon as their reliability is proved.

We will be pleased to receive your comments on this report.

With our best regards,

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Appendix
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TWSTT links computed at the BIPM

Because the TWSTT data are unevenly spaced by intervals of 2 or 3 days, they are linearly interpolated to give the data for the TAI standard dates at intervals of 5 days.

Table 1. TUG/PTB link

BIPM Report No.	Date 1999 (MJD)	[UTC(TUG) – UTC(PTB)] /ns		
		TWSTT	<i>Circular T</i> (GPS)	TWSTT – <i>Circular T</i>
1	1 April (51269)	110	132	–22
	6 April (51274)	112	133	–21
	11 April (51279)	112	135	–23
	16 April (51284)	129	148	–19
	21 April (51289)	156	180	–24
	26 April (51294)	177	197	–20
2	1 May (51299)	* 193	217	* –24
	6 May (51304)	196	217	–21
	11 May (51309)	205	231	–26
	16 May (51314)	222	242	–20
	21 May (51319)	236	258	–22
	26 May (51324)	248	271	–23
	31 May (51329)	266	288	–22
3	5 June (51334)	286	307	–21
	10 June (51339)	293	314	–21
	15 June (51344)	308	331	–23
	20 June (51349)	320	341	–21
	25 June (51354)	331	352	–21
	30 June (51359)	342	368	–26

Note: The TUG/PTB TWSTT link was calibrated by the transportation of a TWSTT station. *Circular T* GPS data for TUG was calibrated by an outdated value and the last GPS differential calibration between TUG and PTB was not taken into account; this is the reason for the offset of about –22 ns between the two techniques. If the last differential GPS calibration results had been applied, the difference between the two techniques would have been within a few nanoseconds.

* This value replaces the incorrect value given in the 2nd Report.

Table 2. PTB/NIST link

BIPM Report No.	Date 1999 (MJD)	$[UTC(PTB) - UTC(NIST)] / ns$		
		TWSTT	<i>Circular T</i> (GPS)	TWSTT – <i>Circular T</i>
1	1 April (51269)	41	41	0
	6 April (51274)	38	37	1
	11 April (51279)	36	36	0
	16 April (51284)	30	33	-3
	21 April (51289)	19	16	3
	26 April (51294)	10	12	-2
2	1 May (51299)	* 3	3	* 0
	6 May (51304)	1	3	-2
	11 May (51309)	2	1	1
	16 May (51314)	-3	-4	1
	21 May (51319)	-4	-6	2
	26 May (51324)	* -7	* -9	* 2
	31 May (51329)	* -10	* -11	* 1
3	5 June (51334)	-9	-9	0
	10 June (51339)	-3	-5	2
	15 June (51344)	-1	-3	2
	20 June (51349)	3	2	1
	25 June (51354)	4	2	2
	30 June (51359)	8	7	1

Note: The PTB/NIST TWSTT link was calibrated by *Circular T*.

* These values replace incorrect values given in the 2nd Report.

Table 3. NPL/USNO link

BIPM Report No.	Date 1999 (MJD)	[UTC(NPL) – UTC(USNO)] /ns		
		TWSTT	Circular T (GPS)	TWSTT – Circular T
* 2	26 April (51294)	82	–46	128
	1 May (51299)	83	–48	131
	6 May (51304)	81	–48	129
	11 May (51309)	81	–48	129
	16 May (51314)	77	–51	128
	21 May (51319)	75	–52	127
	26 May (51324)	74	–53	127
	31 May (51329)	72	–54	126
3	5 June (51334)	† 61	–58	† 119
	10 June (51339)	† 39	–59	† 98
	15 June (51344)	† 59	–61	† 120
	20 June (51349)	† 27	–61	† 88
	25 June (51354)	† 29	–63	† 92
	30 June (51359)	† 27	–65	† 92

Note: The NPL/USNO TWSTT link is not calibrated.

* TWSTT data published in the 2nd Report were corrected twice for the earth rotation correction. We provide here the properly corrected data.

† Hardware and automation problems have rendered USNO TWSTT data since MJD = 51334 unreliable. These data will be checked at the USNO and updated in the next report.

Table 4. USNO/PTB link

BIPM Report No.	Date 1999 (MJD)	[UTC(USNO) – UTC(PTB)] /ns		
		TWSTT	<i>Circular T</i> (GPS)	TWSTT – <i>Circular T</i>
2	26 April (51294)	–11	–33	22
	1 May (51299)	–7	–28	21
	6 May (51304)	–4	–27	23
	11 May (51309)	–8	–25	17
	16 May (51314)	4	–19	23
	21 May (51319)	8	–16	24
	26 May (51324)	12	–11	23
	31 May (51329)	15	–7	22
3	5 June (51334)	† 25	–6	† 31
	10 June (51339)	† 43	–10	† 53
	15 June (51344)	† 21	–9	† 30
	20 June (51349)	† 49	–12	† 61
	25 June (51354)	† 46	–10	† 56
	30 June (51359)	† 45	–12	† 57

Note: The USNO/PTB TWSTT link was calibrated using *Circular T* of May 1997. At this time the USNO GPS time-receiving equipment was inaccurate by about 23 ns, which explains the offset between the TWSTT data and the *Circular T* data observed in this table.

† See note for Table 3.

Table 5. PTB/DTAG link

BIPM Report No.	Date 1999 (MJD)	[UTC(PTB) – UTC(DTAG)] /ns		
		TWSTT	<i>Circular T</i> (GPS)	TWSTT – <i>Circular T</i>
2	26 April (51294)	22	–2	24
	1 May (51299)	–	–15	–
	6 May (51304)	–	–11	–
	11 May (51309)	–1	–22	21
	16 May (51314)	–8	–22	14
	21 May (51319)	–14	–42	28
	26 May (51324)	–33	–57	24
	31 May (51329)	–39	–61	22
3	5 June (51334)	–49	–67	18
	10 June (51339)	–46	–65	19
	15 June (51344)	–	–82	–
	20 June (51349)	–	–104	–
	25 June (51354)	–	–102	–
	30 June (51359)	–	–99	–

Note: The PTB/DTAG TWSTT link was calibrated by the transportation of a TWSTT station. The observed discrepancy between the TWSTT data and the *Circular T* values in this table might be explained by an inaccuracy of the DTAG GPS time-receiving equipment.

Table 6. VSL/PTB link

BIPM Report No.	Date 1999 (MJD)	[UTC(VSL) – UTC(PTB)] /ns		
		TWSTT	<i>Circular T</i> (GPS)	TWSTT – <i>Circular T</i>
3	6 May (51304)	–66	–67	1
	11 May (51309)	–77	–73	–4
	16 May (51314)	–79	–78	–1
	21 May (51319)	–83	–80	–3
	26 May (51324)	–84	–82	–2
	31 May (51329)	–83	–80	–3
	5 June (51334)	–78	–77	–1
	10 June (51339)	–77	–74	–3
	15 June (51344)	–85	–84	–1
	20 June (51349)	–85	–85	0
	25 June (51354)	–86	–81	–5
	30 June (51359)	–	–67	–

Note: The VSL/PTB TWSTT link was calibrated by *Circular T*.

Table 7. NPL/NIST link

BIPM Report No.	Date 1999 (MJD)	[UTC(NPL) – UTC(NIST)] /ns		
		TWSTT	<i>Circular T</i> (GPS)	TWSTT – <i>Circular T</i>
3	26 April (51294)	225	–67	292
	1 May (51299)	222	–73	295
	6 May (51304)	221	–72	293
	11 May (51309)	221	–72	293
	16 May (51314)	222	–74	296
	21 May (51319)	222	–74	296
	26 May (51324)	222	–73	295
	31 May (51329)	223	–72	295
	5 June (51334)	223	–73	296
	10 June (51339)	222	–74	296
	15 June (51344)	223	–73	296
	20 June (51349)	222	–71	293
	25 June (51354)	222	–71	293
	30 June (51359)	224	–70	294

Note: The NPL/NIST TWSTT link is not calibrated.