

BIPM CALIBRATIONS OF GPS TIME EQUIPMENT

16th CCTF, 1-2 April 2002

BIPM differential calibrations of GPS time equipment

Uncertainty 3 ns (1 σ)

- In 2001/2004 seven campaigns were carried out
 - 2001: OP, AOS, GUM, LT, TP
 - 2002: OP, NPL, VSL, OCA
 - 2002: OP, IEN, ROA, PTB, USNO, NIST, VSL, NPL
 - 2002: OP, NTSC, CRL, NMIJ, TL, NML
 - 2003: OP, IEN, PTB, NPL, VSL
 - 2003: OP, PTB, AOS, KRIS, CRL, NIST, USNO and APL
 - 2003: OP, CH
- In total 20 laboratories out of the 50 that participate in TAI have been calibrated



Some past GPS calibrations between NIST and OP

d is the differential time correction to be added to $[UTC(NIST) - UTC(OP)]$, and $u(d)$ is the estimated uncertainty for the period of comparison

Date	d/ns	$u(d)/ns$
July 1983	0	2
Sept 1986	1	2
Octo 1986	-1	2
Jan 1988	-4	3
Apr 1988	1	3
Mar 1995	-4	1
May 1996	-1	2
May 2002	-5	3
July 2003	-6	2
Dec 2003	-5	3

USNO

Date	UTC(i)–UTC(j)	Differential correction /ns	Estimated uncertainty /ns	Author
Dec. 84	UTC(USNO)–UTC(OP)	+32	10	Buisson
Oct. 86	UTC(USNO)–UTC(OP)	+25	2	Lewandowski, Weiss
Apr. 87	UTC(USNO)–UTC(OP)	+16	5	Oaks
91	UTC(USNO)–UTC(OP)	–14	?	NRL (inf. from Miranian)
Jun. 94	UTC(USNO)–UTC(OP)	–13	2	Lewandowski
Sep. 94	UTC(USNO)–UTC(OP)	–9	1	Weiss
Dec. 94	UTC(USNO)–UTC(OP)	–8	1	Weiss
Mar. 95	UTC(USNO)–UTC(OP)	–20	2	Lewandowski
Jul95–Jun96	UTC(USNO)–UTC(OP)	–14	2	Lewandowski, Moussay
Feb 97	Receiver delay corrected by	+14		
April 02	UTC(USNO) –UTC(OP)	+9	3	Rapport BIPM –2002/02
December 03	UTC(USNO) –UTC(OP)	+2	3	Rapport BIPM –2004/06



IEN

Date	UTC(i)–UTC(j)	Differential correction /ns	Estimated uncertainty /ns	Author
Oct 86	UTC(IEN) –UTC(OP)	–18	2	Lewandowski, Weiss
Feb 95	UTC(IEN) –UTC(OP)	–20	2	Lewandowski, Moussay
July 97	UTC(IEN) –UTC(OP)	–17	3	Lewandowski, Moussay
Dec 97	UTC(IEN) –UTC(OP)	–15	2	Lewandowski, Moussay
Mar 98	UTC(IEN) –UTC(OP)	–21	2	Lewandowski, Moussay
May 98	UTC(IEN) –UTC(OP)	–23	3	Lewandowski, Konate
July 99	Receiver delay corrected by +18			
March 02	UTC(IEN) –UTC(OP)	+6	3	Rapport BIPM –2002/02
June 03	UTC(IEN) –UTC(OP)	–2	3	Rapport BIPM –2003/05

PTB

Date	UTC(i)–UTC(j)	Differential correction	Estimated uncertainty	Author
		/ns	/ns	
Oct 86	UTC(PTB) –UTC(OP)	+9	2	Lewandowski, Weiss
Oct 94	UTC(PTB) –UTC(OP)	+4	2	Lewandowski, Baumont
July 97	UTC(PTB) –UTC(OP)	+2	3	Lewandowski, Moussay
Nov 97	UTC(PTB) –UTC(OP)	+4	2	Lewandowski, Moussay
Mar 98	UTC(PTB) –UTC(OP)	–6	2	Lewandowski, Moussay
June 98	UTC(PTB) –UTC(OP)	+5	3	Lewandowski, Konate
June 03	UTC(PTB) –UTC(OP)	–5	4	Rapport BIPM –2003/05
August 03	UTC(PTB) –UTC(OP)	0	3	Rapport BIPM –2003/06

NPL

Date	UTC(i)–UTC(j)	Differential correction /ns	Estimated uncertainty /ns	Author
Oct 86	UTC(NPL) –UTC(OP)	+24	2	Lewandowski, Weiss
Mar 94	UTC(NPL) –UTC(OP)	+6	2	Thomas, Moussay
Oct 94	UTC(NPL) –UTC(OP)	0	3	Lewandowski, Baumont
Jun 97	UTC(NPL) –UTC(OP)	–4	3	Lewandowski, Moussay
Nov 97	UTC(NPL) –UTC(OP)	–2	2	Lewandowski, Moussay
Mar 98	UTC(NPL) –UTC(OP)	+4	2	Lewandowski, Moussay
July 98	UTC(NPL) –UTC(OP)	–	–	Lewandowski, Konate
June 02	UTC(NPL) –UTC(OP)	–6	4	Rapport BIPM –2003/04
May 03	UTC(NPL) –UTC(OP)	–10	3	Rapport BIPM –2003/06

VSL

Date	UTC(i)–UTC(j)	Differential correction /ns	Estimated uncertainty /ns	Author
Oct 86	UTC(VSL) –UTC(OP)	–17	2	Lewandowski, Weiss
Oct 94	UTC(VSL) –UTC(OP)	+3	2	Lewandowski, Baumont
May 95	UTC(VSL) –UTC(OP)	+5	2	Lewandowski
Jun 97	UTC(VSL) –UTC(OP)	–2	3	Lewandowski, Moussay
Nov 97	UTC(VSL) –UTC(OP)	–23	2	Lewandowski, Moussay
Feb 98	UTC(VSL) –UTC(OP)	–20	2	Lewandowski, Moussay
July 98	UTC(VSL) –UTC(OP)	–	–	Lewandowski, Konate
June 02	UTC(VSL) –UTC(OP)	+16	4	Rapport BIPM –2003/04
June 03	UTC(VSL) –UTC(OP)	+8	3	Rapport BIPM –2003/95

CRL

Date	UTC(i)–UTC(j)	Differential correction /ns	Estimated uncertainty /ns	Author
Nov 96	UTC(CRL) –UTC(OP)	–2	3	Lewandowski, Moussay
Aug 02	UTC(CRL) –UTC(OP)	–14	4	Rapport BIPM –2003/05
Nov 03	UTC(CRL) –UTC(OP)	+5	3	Rapport BIPM–2004/06

ROA

Date	UTC(i)–UTC(j)	Differential correction /ns	Estimated uncertainty /ns	Author
Apr 98	UTC(ROA)–UTC(OP)	–8	2	Lewandowski, Moussay
June 98	UTC(ROA)–UTC(OP)	–6	3	Lewandowski, Konate
March 02	UTC(ROA)–UTC(OP)	–2	3	Rapport BIPM –2002/02

CONCLUSION

- **BIPM will continue its GPS calibration campaigns; a new temperature-stabilized receiver is now dedicated for this purpose.**
- **A new trip in South and North Americas involving ten laboratoies is now beginning.**
- **BIPM is helping to organize GPS calibration campaigns by the regional metrology organizations.**