

Comparisons between Time Transfer Techniques and Methods

-- The BIPM ftp site for monthly time link comparisons

Z. Jiang


Time, Frequency and Gravimetry Section



Summary

- Time transfer **data available** at BIPM
- **Comparisons** of the Time transfer techniques
- **Comparison results on the BIPM ftp site**

Time link data available at BIPM

- 3 techniques : GPS, GLN and TW
- 29 labs over 68 have ≥ 2 techniques 
- All labs have GPS with 25 GPS PPP
- 20 labs have GLN
- 20 labs have TW
- Time/frequency transfer Strategy is primary link : use either TW or GPS and when both available use TW
- Single-technique-single-link

<u>Lab</u>	<u>GPS</u>	<u>GLN</u>	<u>TW</u>
<u>AOS</u>	YES	YES	YES
AUS	YES		YES
CH	YES		YES
<u>IT</u>	YES	YES	YES
KIM	YES	YES	
<u>KRIS</u>	YES	YES	YES
KZ	YES	YES	
LDS	YES	YES	
MIKE	YES	YES	
NICT	YES		YES
NIM	YES		YES
NIS	YES	YES	
<u>NIST</u>	YES	YES	YES
NMIJ	YES		YES
NPL	YES		YES
<u>NRL</u>	YES	YES	YES
NPLI	YES	YES	
NTSC	YES		YES
OP	YES	YES	YES
<u>PTB</u>	YES	YES	YES
ROA	YES	YES	YES
<u>SG</u>	YES	YES	YES
SP	YES		YES
SU	YES	YES	
TL	YES		YES
UME	YES	YES	
<u>USNO</u>	YES	YES	YES
<u>VSL</u>	YES	YES	YES
ZA	YES	YES	

BIPM Annual Report 2007/8

Comparison of TW and GPS (GNSS)

Terms	TW	GPS
Calibration	~1ns	~ 5ns
Long-term stability	Yes	?
Transfer limit	baseline	global
Distance	dependent	~independent
Atmosphere effects	~free	corrections
Diurnals	yes	free
Data processing	simple/independ.	complex/depend.
Cost	expensive	less

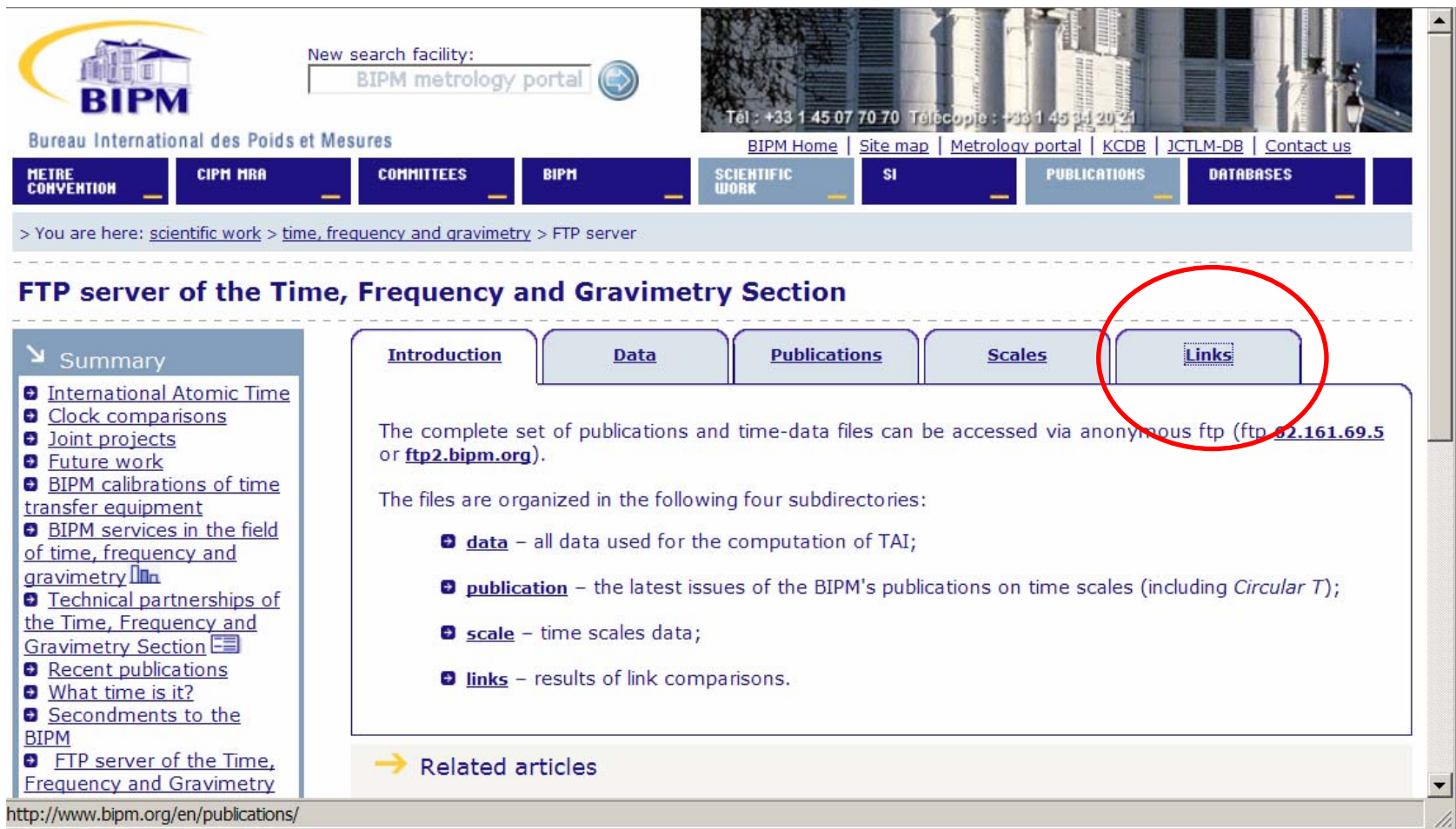
Making the time link **Comparisons**



- Goals: ¹ **Verify** the quality; ² **Differential calibration**; ³ **Study** new techniques;
- **Between GPS**: C/A-PPP and P3-PPP
- **Between TW**: KU vs. X bands; Satre vs. Nict modems
- **Between GPS and TW**: TW-GPS C/A; TW-GPS P3 and TW-GPS PPP
- Results monthly published through BIPM ftp site

Result of the time link Comparisons on ftp

1. address: <ftp://tai.bipm.org/TimeLink/LkC/>
2. Time link
3. Time link comparison

Result of the time link Comparisons



 New search facility: 

Bureau International des Poids et Mesures

Tel : +33 1 45 07 70 70 | Télécopie : +33 1 45 94 20 24



[BIPM Home](#) | [Site map](#) | [Metrology portal](#) | [KCDB](#) | [JCLM-DB](#) | [Contact us](#)

[METRE CONVENTION](#) | [CIPM MRA](#) | [COMMITTEES](#) | [BIPM](#) | [SCIENTIFIC WORK](#) | [SI](#) | [PUBLICATIONS](#) | [DATABASES](#)

> You are here: [scientific work](#) > [time, frequency and gravimetry](#) > FTP server

FTP server of the Time, Frequency and Gravimetry Section

Summary

- International Atomic Time
- Clock comparisons
- Joint projects
- Future work
- BIPM calibrations of time transfer equipment
- BIPM services in the field of time, frequency and gravimetry 
- Technical partnerships of the Time, Frequency and Gravimetry Section 
- Recent publications
- What time is it?
- Secondments to the BIPM
- FTP server of the Time, Frequency and Gravimetry

[Introduction](#) | [Data](#) | [Publications](#) | [Scales](#) | [Links](#)

The complete set of publications and time-data files can be accessed via anonymous ftp (ftp [52.161.69.5](ftp://52.161.69.5) or [ftp2.bipm.org](ftp://ftp2.bipm.org)).

The files are organized in the following four subdirectories:

- data** – all data used for the computation of TAI;
- publication** – the latest issues of the BIPM's publications on time scales (including *Circular T*);
- scale** – time scales data;
- links** – results of link comparisons.








→ Related articles

<http://www.bipm.org/en/publications/>

Get in the directory: LkC

Index of ftp://tai.bipm.org/TimeLink/LkC/











[Up to higher level directory](#)

	<u>Name</u>	<u>Size</u>	<u>Last Modified</u>
YYMM	 0501		12/07/2005 00:00:00
	 0502		20/07/2005 00:00:00
		
	 0901		12/02/2009 16:31:00
	 0902		13/03/2009 14:57:00
	 0903		10/04/2009 12:41:00
	 0904		15/05/2009 14:49:00
		
	 LongTerm		10/04/2009 12:44:00
	BIPM_LKC_CFS-PTTI2005.doc	285 KB	07/10/2005 00:00:00
	ReadMe_LinkComparison_ftp_v7.doc	181 KB	29/05/2008 00:00:00

Get in the directory: **YYMM**

Index of ftp://tai.bipm.org/TimeLink/LkC/0904/

Up to higher level directory

		<u>Name</u>			
Baseline		<u>AOSPTB</u>			
		<u>CHPTB</u>			
		<u>DLRPTB</u>			
			
		<u>KRIS NICT</u>			
		<u>KRIS PTB</u>			
		<u>NICTPTB</u>			
			
		<u>NTSCNICT</u>			
		<u>USNO PTB</u>			
		<u>Dlk</u>		15/05/2009 14:49:00	→ difference of links
		<u>Lnk</u>		15/05/2009 14:49:00	→ Links

**Index of
ftp://tai.bipm.org/TimeLink/LkC/0904/USNOPTB/**

Up to higher level directory

Name Size Last Modified





Get in the directory of the baseline: USNO-PTB

File types:
Plot in Gif
data in Ascii

Link techniques:
GPS C/A
GPS P3
GPS PPP
TW KU band
TW X band
... ..

Index of
<ftp://tai.bipm.org/TimeLink/LkC/0904/USNOPTB/>

[Up to higher level directory](#)

<u>Name</u>	<u>Size</u>	<u>Last Modified</u>
 Dlk		15/05/2009 14:49:00
 Lnk		15/05/2009 14:49:00

Link comparison

Link

- USNOPTB.TGT35
- USNOPTB.TGT35.Gif
- USNOPTB.TMTA5
- USNOPTB.TMTA5.Gif
- USNOPTB.TPTA5
- USNOPTB.TPTA5.Gif
- USNOPTB.TTTX5
- USNOPTB.TTTX5.Gif
- USNOPTB.333A_.Gif
- USNOPTB.333A_.dat
- USNOPTB.MMMA_.Gif
- USNOPTB.MMMA_.dat
- USNOPTB.PPPA_.Gif
- USNOPTB.PPPA_.dat
- USNOPTB.TTTT_.Gif
- USNOPTB.XXXT_.Gif

Before Oct. 2006 (0610),
there are comparisons between
All in View and Common View



Examples: ASCII Link and link comparison data

USNO-PTB 0904 GPS PPP link:

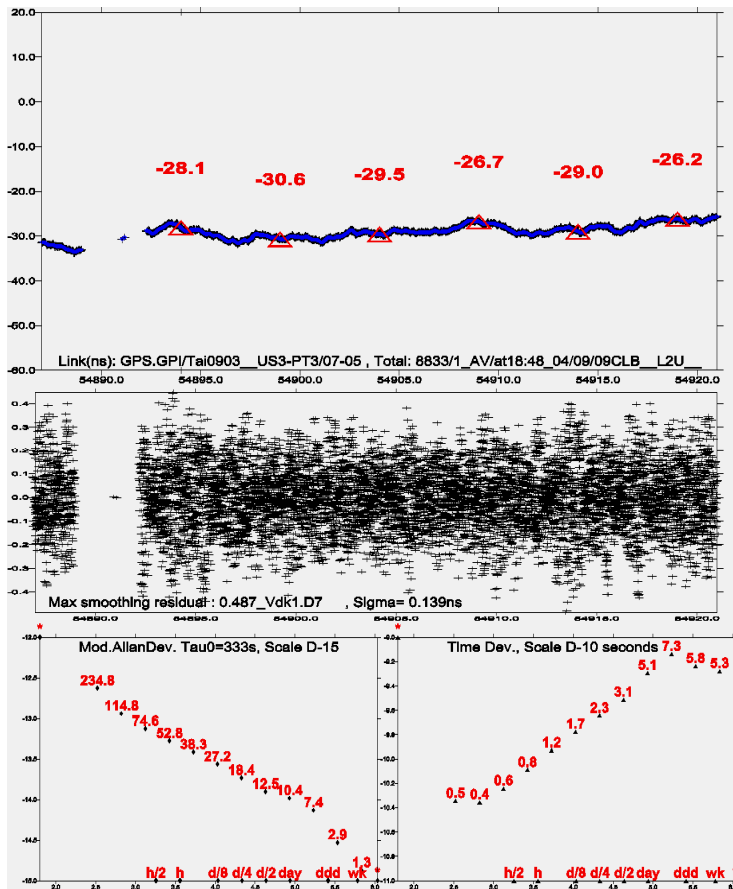
```
GPS.GPI/Tai0904__US3-PT3/07-05      0.429_Vdk1.D7  6878/1_AV/at10:42_05/15/09
      CLB__L2U__      0.134ns StdMjd Tau0=      427s LogAllVar TimeVar LogTime
54917.00000      -27.411      -27.223      0.188
54917.00347      -27.402      -27.192      0.210
54917.00694      -27.293      -27.163      0.130
54917.01042      -27.352      -27.134      0.218
54917.01389      -27.337      -27.107      0.230
... ..
```

USNO-PTB 0904 link comparison between GPS PPP and TW Ku:

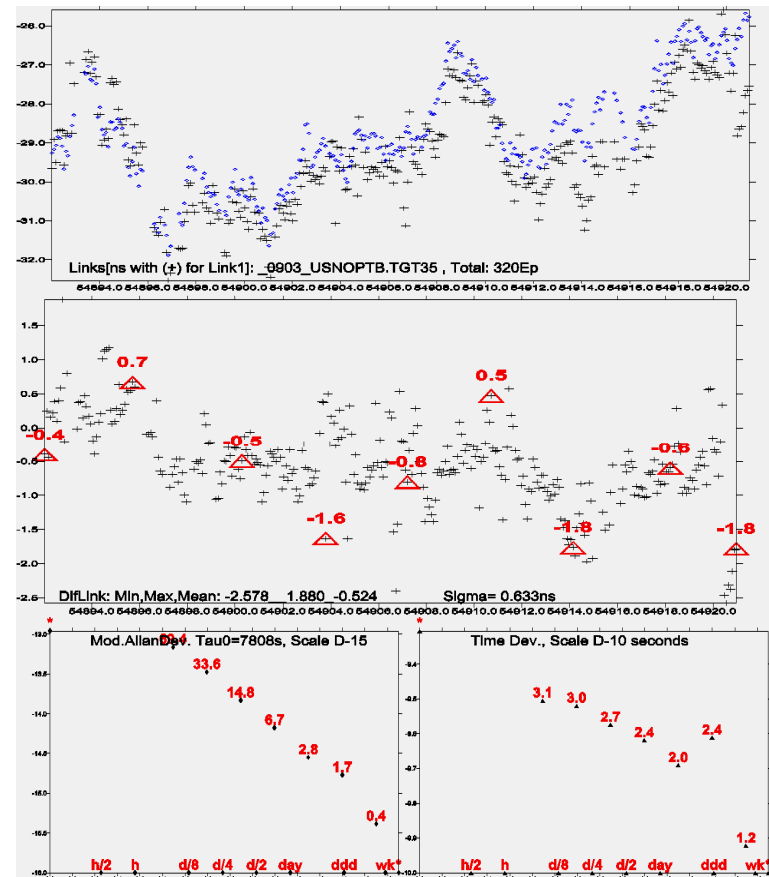
! 0904	Mjd	Link1	Link2	dLink	Jump1	Jump2	dLink_
1	54919.0326	-27.021	-26.276	-0.745	0.000	0.000	-0.745
2	54919.1160	-27.150	-26.370	-0.780	0.000	0.000	-0.780
3	54919.1993	-27.218	-26.314	-0.904	0.000	0.000	-0.904
4	54919.2826	-27.367	-26.736	-0.631	0.000	0.000	-0.631
5	54919.3660	-27.066	-26.508	-0.558	0.000	0.000	-0.558
...	...						

Examples: Plots of Link and link comparison

USNO-PTB 0903 GPS PPP **Link:**



USNO-PTB 0903 **Link comparisons** between GPS PPP and TW Ku:



Welcome to the BIPM LkC site:

<ftp://tai.bipm.org/TimeLink/LkC>

Thanks

Advantages of TW and GPS

• TW

- Calibration and reproducibility ≈ 1 ns
- Long term stability
- Atmosphere delay free symmetric trajectories
- μ A: 0.2~0.5 ns when diurnals off

• GPS

- World-wide transfer without geometric limit
- Hardware-manpower less cost
- μ A: ≈ 0.3 ns when PPP

disAdvantages of TW and GPS

• TW

- Diurnals (dominant error source)
- Baseline fixed (geometric limit)
- Hardware-manpower cost

• GPS

- Less accurate calibration vs. TW
- Receiver-Navigation-system instability ?
- Complex data treatment-Software