

GPS Time and Frequency Transfer Activities at NIST

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Code-Based Common-View

- Secondary method for contributing NIST time scale to the computation of TAI and UTC
- Time and frequency comparison network in the Inter-American Metrology System (SIM)
- Synchronization of clocks in radio stations WWV/WWVB, and WWVH to UTC(NIST)
- Global Time Service
- Time Measurement and Analysis Service (TMAS)

Code-Based One-Way

- Frequency Measurement and Analysis Service (FMAS)
- GPS Disciplined Oscillator and GPS One-Way Receiver Calibration Service
- NIST GPS Data Archive

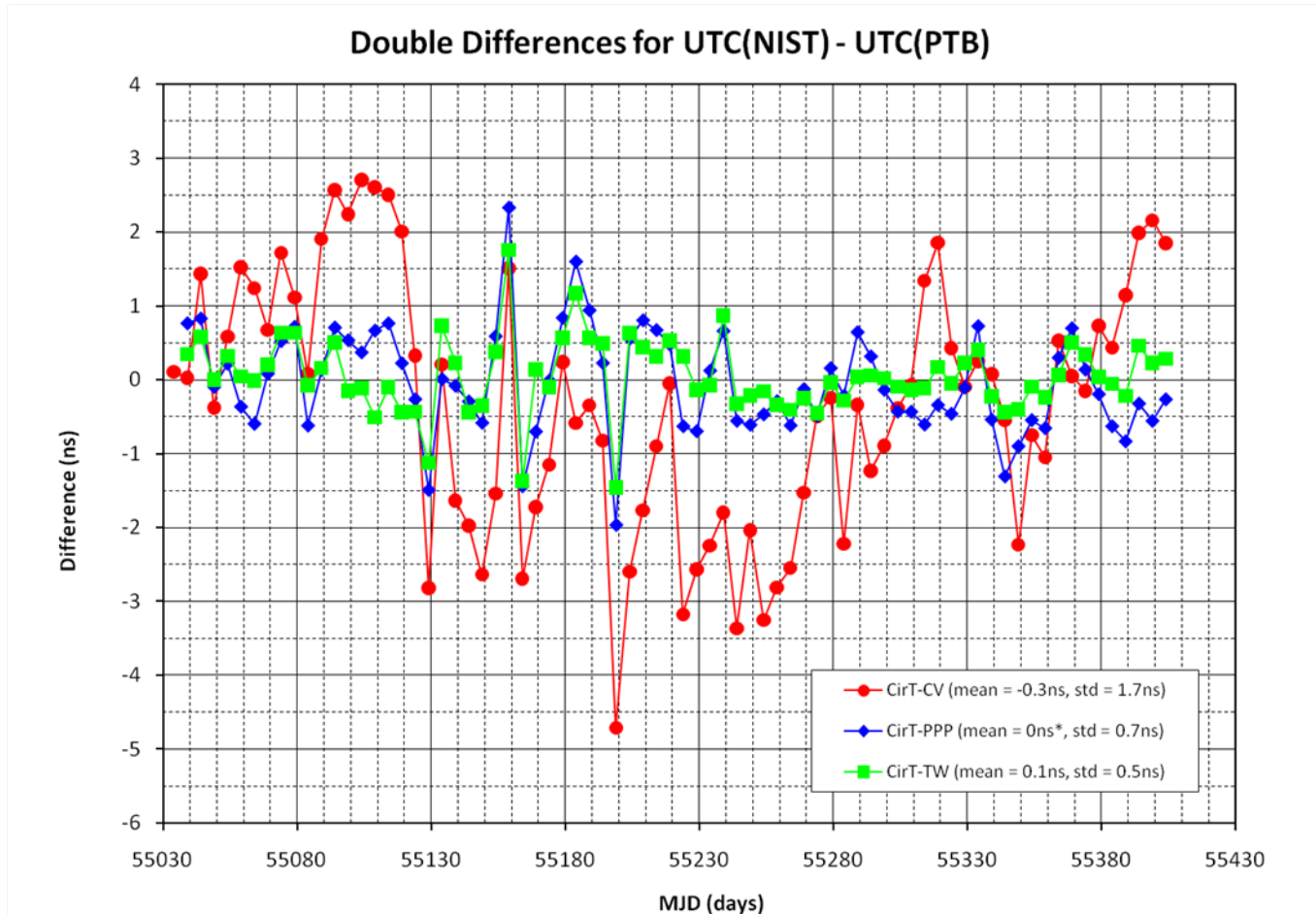
Carrier-Phase

- Participate in the IGS tracking network
- Remote clock comparison with the IGS clock products
- Remote clock comparison with the BIPM TAI PPP results

Primary GPS Timing Receiver – *NIST*

- Dual frequency, multi-channel receiver
- Receiver calibrated with respect to the previous primary receiver (*NBS10*, last calibrated by the BIPM travel receiver in December 2003)
- Receiver produces
 - Code-based common-view data (in GGTTTS format)
 - RINEX files
 - Ionosphere-free (P3) code-based common-view data
 - Carrier-phase (IGS Clock Products and TAIPPP) data
 - IGS products

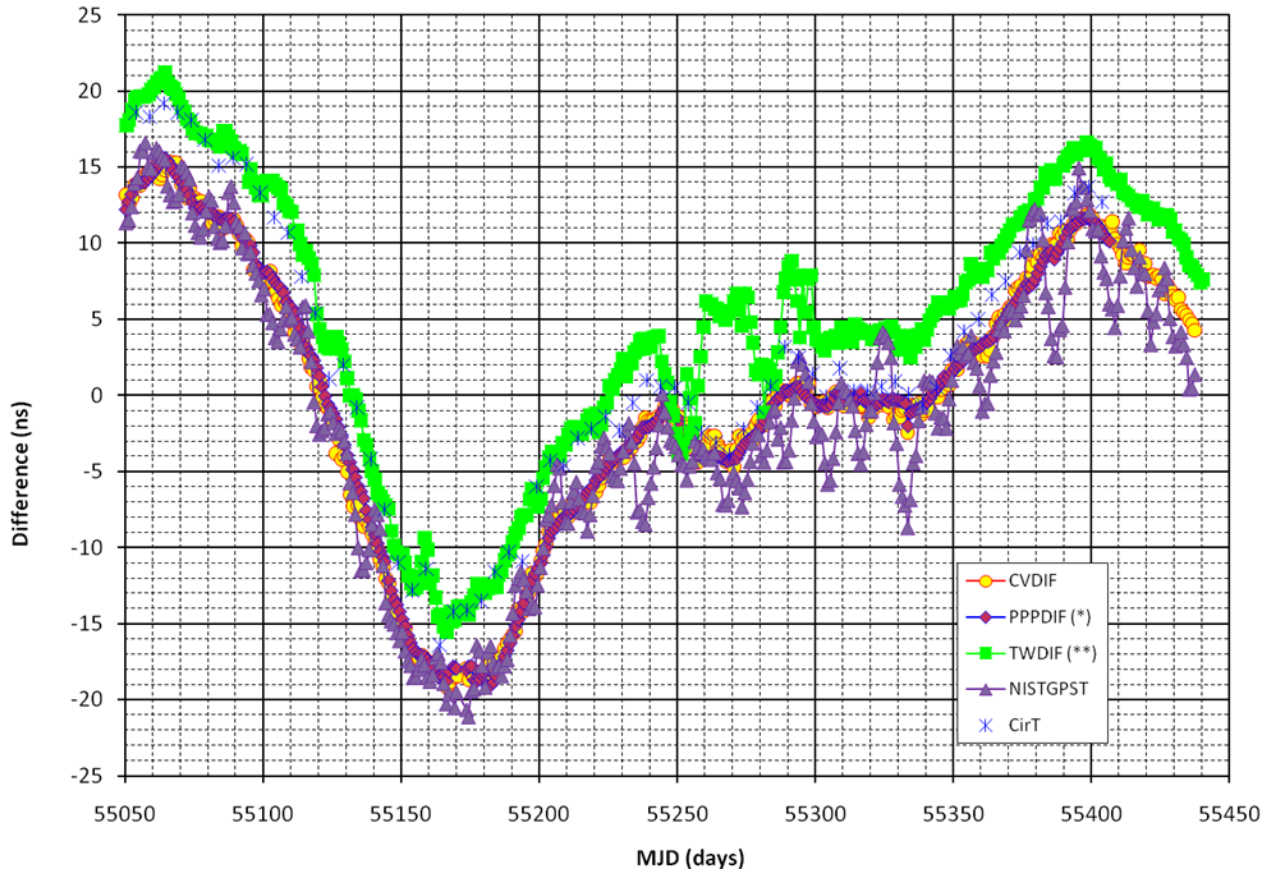
Primary Receiver Performance



* A 14.2ns time step on MJD 55173 and a 415ns bias are removed from the TAIPPP results

Primary Receiver Performance

UTC(NIST) - UTC(USNO) and UTC(NIST) - GPST

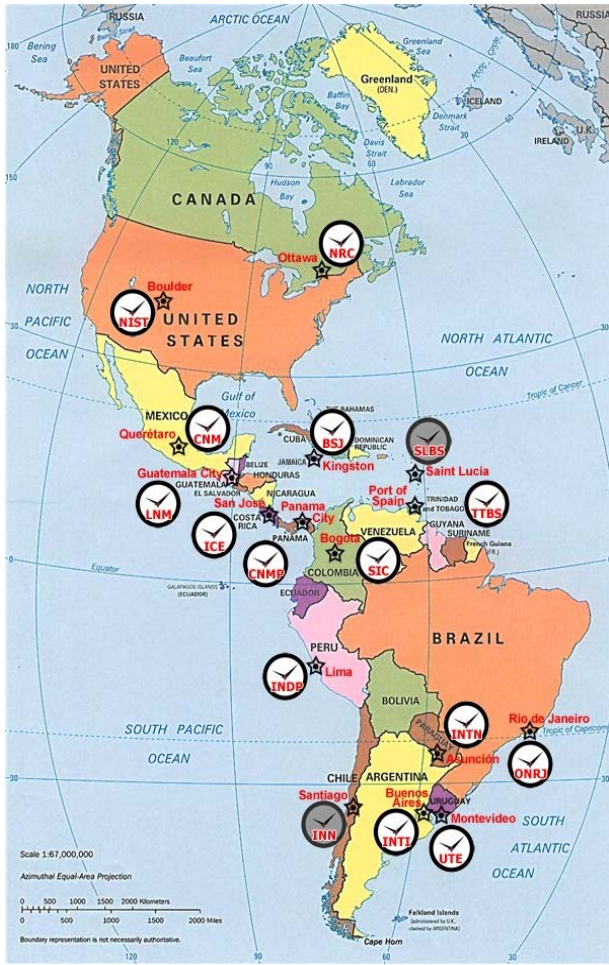


* A 14.2ns time step on MJD 55173 and a 106ns bias are removed from the TAIPPP results

** The NIST/USNO TWDIF is obtained from $[UTC(NIST)-UTC(PTB)]_{TWDIF} - [UTC(USNO)-UTC(PTB)]_{TWDIF}$



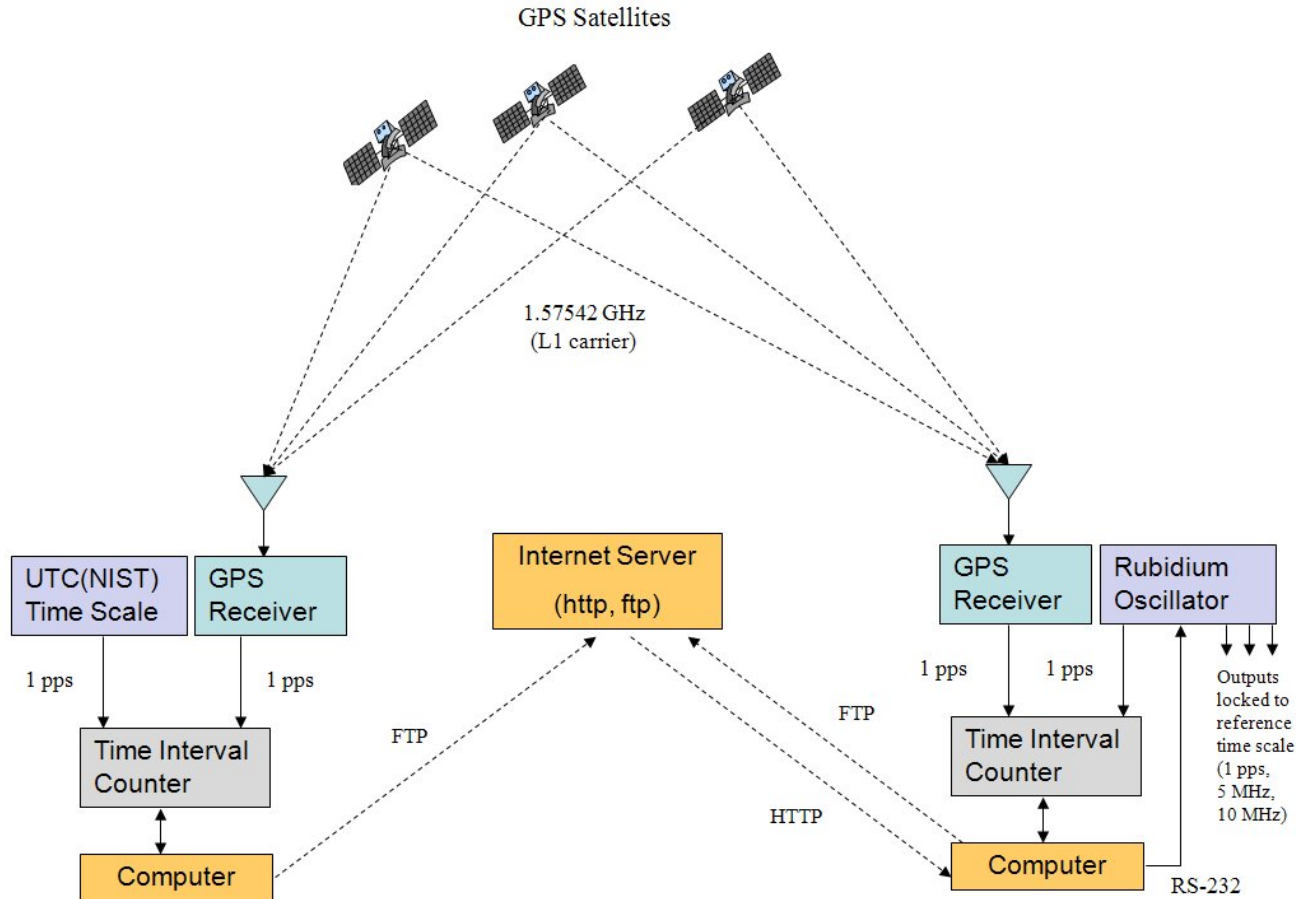
Time and Frequency Comparison Network in the Inter-American Metrology System



Laboratory and Country	Date of Operation	Reference Clock
NIST (U.S.A)	2005	UTC(NIST)
CNM (Mexico)	April 2005	UTC(CNM)
NRC (Canada)	May 2005	UTC(NRC)
CNMP (Panama)	October 2005	UTC(CNMP)
ONRJ (Brazil)	September 2006	UTC(ONRJ)
ICE (Costa Rica)	January 2007	Cesium
SIC (Colombia)	February 2007	Cesium
INTI (Argentina)	July 2007	UTC(INTI)
LNM (Guatemala)	August 2007	GPSDO
BSJ (Jamaica)	January 2008	Cesium
UTE (Uruguay)	September 2008	Disciplined Rubidium
INTN (Paraguay)	September 2008	Rubidium
INDECOPI (Peru)	August 2009	Rubidium
TTBS (Trinidad & Tobago)	August 2009	GPSDO
SLBS (St. Lucia)	June 2010	Rubidium
INN (Chile)	Late 2010	Rubidium



NIST Disciplined Oscillator (1)



For details about the NISTDO, Contact Michael Lombardi: michael.lombardi@nist.gov

NIST Disciplined Oscillator (2)

The screenshot displays the NIST Time Measurement and Analysis Service interface. It features several data tables and control panels.

Station Information:

- Latitude: 39° 59 min 43.725 s N
- Longitude: 105° 15 min 44.552 s W
- Altitude (m): 1653.27
- Samples: 62317
- Last Reading: 17.77
- Min Reading: -17.28
- Max Reading: 33.73
- Range: 51.01
- Mean Value: 9.90
- Midpoint: 8.23
- Mean Diff: 0.00
- STDEV Diff: 3.40

Date and Time:

- Date: 2010-08-23
- Time: 17:18:39
- Filename: 20100823.002
- Sawtooth: 5
- Visible Sats: 9
- Sats In Use: 8
- Rx Temp.: 25 °C
- Range: Position Sent
- Rx Code: 8
- Pos. Hold: ON

PRN and Signal Data Table:

PRN	TD (ns)	Seconds Tracked	ELV Ang.	AZM Ang.	PRN	TD (ns)	Seconds Tracked	ELV Ang.	AZM Ang.
01					17	0	4240	10	93
02	7	16352	10	87	18	3	20770	10	114
03	0	16138	43	70	19	-4	10632	44	115
04	-5	9765	10	65	20	9	17137	10	189
05	-3	17329	10	58	21	-7	23423	10	151
06	-7	19485	30	56	22	8	24266	10	133
07	-4	9554	62	324	23	-6	18286	38	158
08	-4	2931	25	289	24	-3	18527	11	186
09	-6	15849	10	36	25				
10	15	21927	21	279	26	-2	11263	28	46
11	-13	11524	11	241	27	0	9964	24	51
12	-13	17798	10	41	28	6	910	20	235
13	-7	13691	68	172	29	-9	20437	15	173
14	1	21365	10	97	30	7	24510	10	37
15	-4	12981	24	46	31	-3	20020	10	68
16	-7	23864	13	49	32	3	18969	16	178

PRN and Signal Data Table (continued):

PRN	LO Phase	dBm	
CH1	3	787962	-124
CH2	13	787969	-123
CH3	6	787969	-128
CH4	28	787956	-132
CH5	10	787947	-129
CH6	19	787966	-125
CH7	8	787966	-124
CH8	8	787968	-125

NIST Disciplined Oscillator Control Panel:

- Date: 08-23-2010
- Time: 17:18:39
- LO Status: Locked
- Proportional: 0.0635
- Integral: -75.1351
- Derivative: -0.0061
- Last TD (ns): -2.54 / 10 min
- Last Steer: -75
- Time of Steer: 08-23-2010 / 17:10:31
- URL: /scripts/cvdiff.exe?020621
- TDEV, last 20: 0.81
- TDEV, last 10: 0.46
- Integral Lockout: 100.0
- Buttons: Enter 1 PPS Offset Value, Auto Sync 1 PPS from TD

1 PPS Synchronization Buttons:

(these do not adjust the Rb frequency, use only to sync and/or reduce PID lock time)

Table:

MJD	Date	UTC	UTC(NIST) - NISTDO II
55431.7153	2010-08-23	17:10	2.54
55431.7083	2010-08-23	17:00	1.02
55431.7014	2010-08-23	16:50	2.17
55431.6944	2010-08-23	16:40	3.54
55431.6875	2010-08-23	16:30	4.89
55431.6806	2010-08-23	16:20	4.84
55431.6736	2010-08-23	16:10	4.89
55431.6667	2010-08-23	16:00	5.58
55431.6597	2010-08-23	15:50	6.78
55431.6528	2010-08-23	15:40	8.33
55431.6458	2010-08-23	15:30	5.52

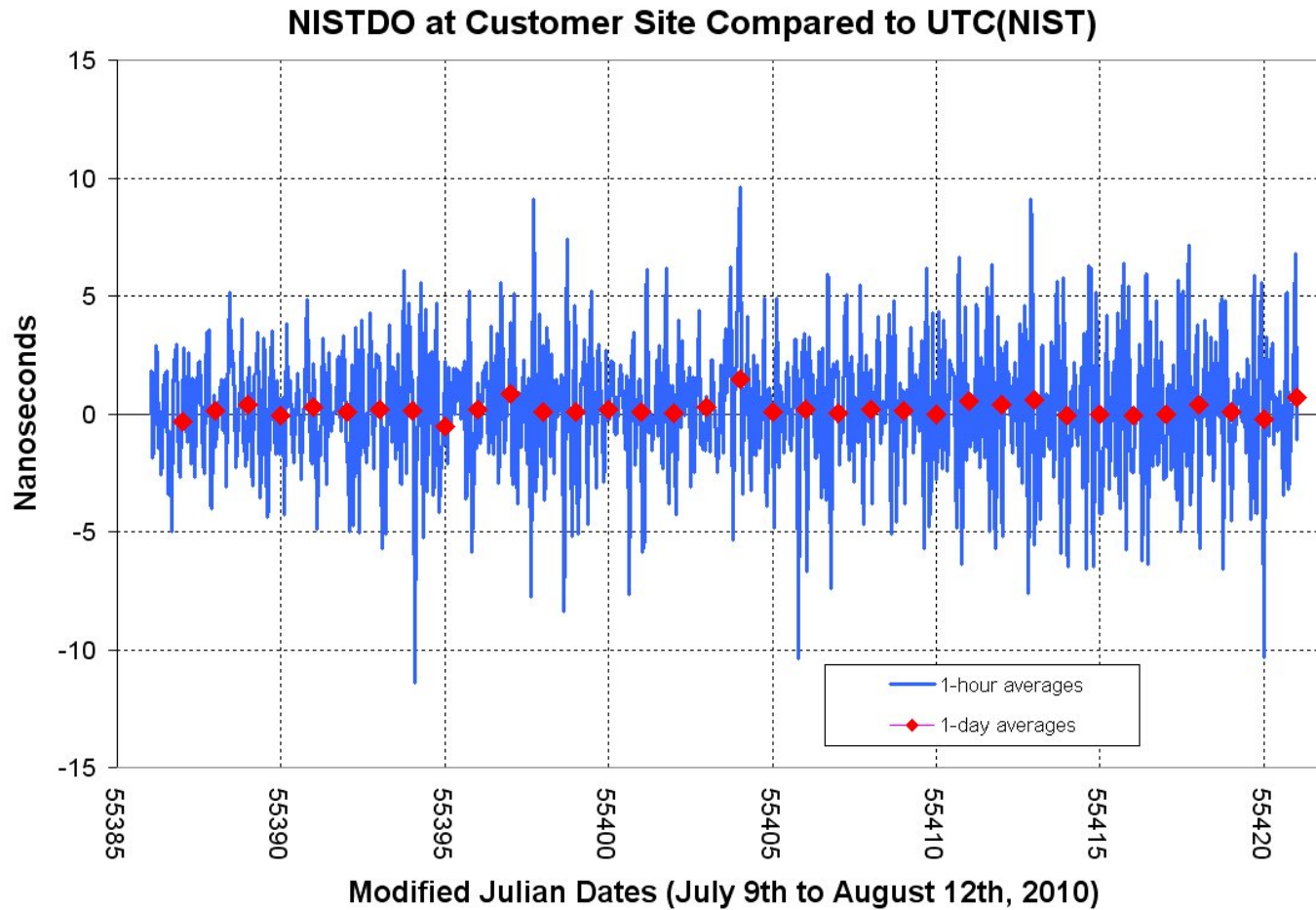
NIST Logo:

Time Measurement and Analysis Service

Buttons: FTP, Y, YMA Survey, Coordinates, TIC Calibration, Quit

Taskbar: Start, NIST Time Measurement..., NIST File Transfer, NIST Disciplined Oscill..., 5:18 PM

NIST Disciplined Oscillator (3)



NIST GPS Time and Frequency Transfer Service

- Frequency Measurement and Analysis Service (FMAS)
(*Service ID#76100S*)
- Time Measurement and Analysis Service (TMAS)
(*Service ID#76101S*)
- Global Time Service (*Service ID#76110S*)
- Characterization of Global Positioning System (GPS) Satellite Receivers (*Service ID#76120S*)

http://ts.nist.gov/ts/htdocs/230/233/calibrations/time_freq/broadcast.htm

GPS Data Archive [GPS - UTC(NIST) all-in-view]

<http://tf.nist.gov/service/gpstrace.htm>