



JATC GPS Link Calibration Report

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Abstract

This report is a record of calibration result of JA01, the site of JATC. During the 9 to 18 July, 2018, the data of NTP1, which was calibrated by BIPM in 2016, and JA01 were collected for the calibration of JA01 receiver.

1 Setup of GNSS Receivers

Both NTP1 and JA01 are Septentrio PolaRX 4TR receivers and there is an internal link between UTC(JATC) and UTC(NTSC) since 1980s. Table 1 provides the receiver information and Figure 1 shows the diagram of the receivers' setup at Lintong.

Table 1 JA01 and NTP1 receivers

Information on the system		
	Receiver for UTC(NTSC)	Receiver for UTC(JATC)
4-character BIPM code	NTP1	JA01
• Receiver maker and type:	SEPT POLARX4TR	SEPT POLARX4TR
Receiver serial number:	3002043	3009580
1 PPS trigger level /V:	1	1
• Antenna cable maker and type:	-	-
Phase stabilised cable (Y/N):	-	-
Length outside the building /m:	About 20m	About 30m
• Antenna maker and type:	SEPCHOKE_MC	SEPCHOKE_MC
Antenna serial number:	5312	-
Temperature (if stabilised) / °C	23 ± 0.5 °C	23 ± 0.5 °C
Data used for the generation of JA01 CGGTTS files		
• Coordinates reference frame:		ITRF 2008
Latitude or X /m:		-1735234.40
Longitude or Y /m:		4976845.76
Height or Z /m:		3580528.39
General information for JA01		
• Rise time of the local UTC pulse:		3.2ns
• Is the laboratory air conditioned:		yes
Set temperature value and uncertainty:		23 ± 0.5 °C
Set humidity value and uncertainty:		55% ± 3%

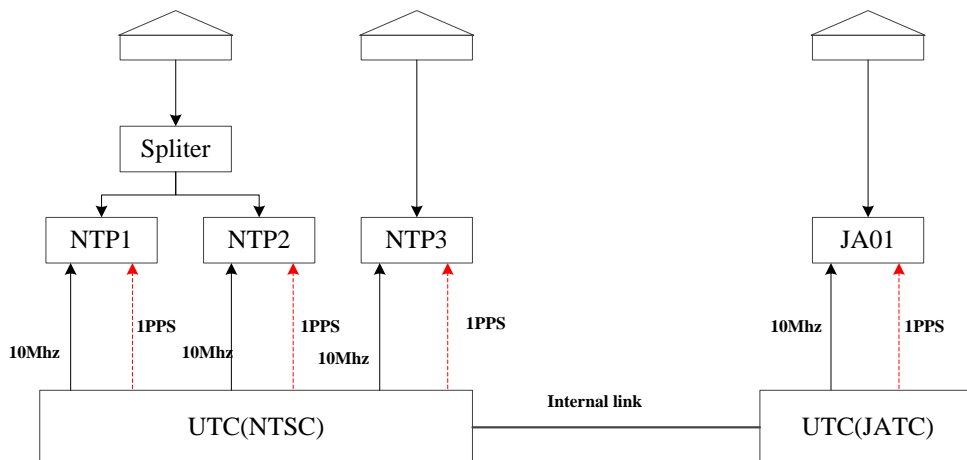


Figure 1 NTP1 and JA01 setup in Lintong during the calibration campaign

2 Time difference between UTC(NTSC) and UTC(JATC)

The data of NTP1, which was calibrated by BIPM in 2016^[1], and JA01 were collected for the calibration of JA01 receiver between 9 and 18 July, 2018 (MJD 58308-MJD 58317). The time difference was obtained by two different ways between UTC(NTSC) and UTC(JATC), i.e. GPS P3 Common View (CV) and internal link. Figure 2 and Figure 3 are the comparison result by different methods.

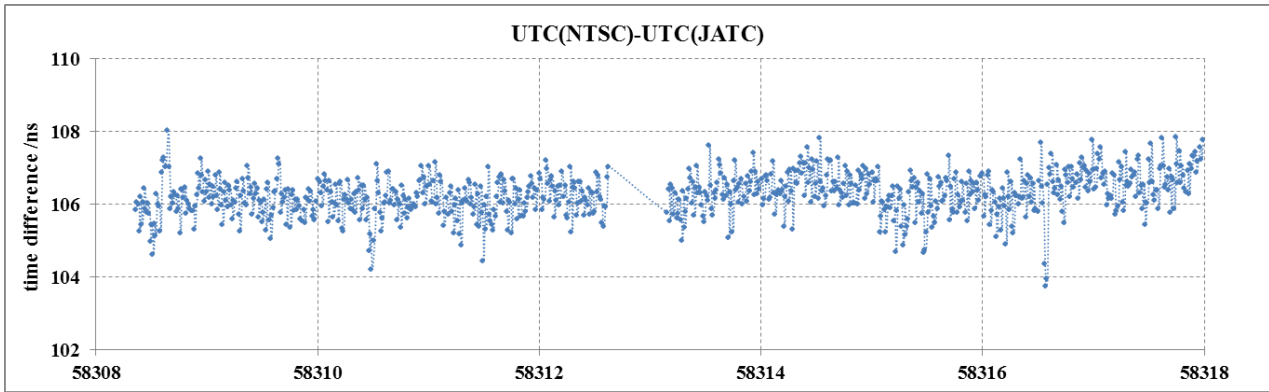


Figure 2 Time difference between UTC(NTSC) and UTC(JATC) by GPS P3 common view

Note: The delay of NTP1 is subtracted and the gap is attributed to a JA01 crash in Figure 2.

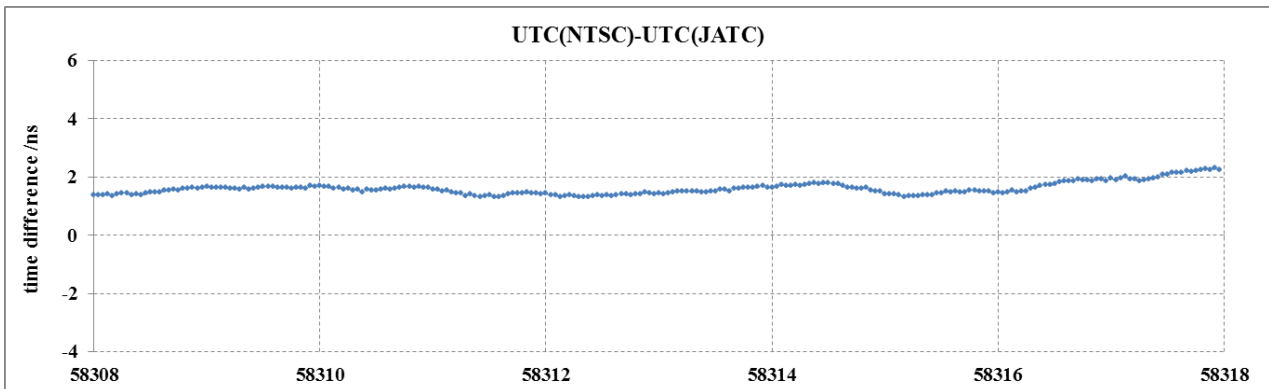


Figure 3 Time difference between UTC(NTSC) and UTC(JATC) by internal link

Note: The cable delay of internal link was subtracted in Figure 3 and the internal link also was calibrated in 2017^[2].

3 Calibrated Result

The internal link was as the reference link. GPS P3 common view link was calibrated via the reference link. The subdelay of NTP1 and JA01 were presented in Table 2.

Table 2 The subdelay of NTP1 and JA01 receivers

BIPM code	Year	INTDLY P1	INTDLY P2	INTDLY C1	REFDLY	CABDLY	TOTDLY P3	SYSDLY P3
NTP1	2016	55.7ns	55.1 ns	57.4 ns	373.8 ns	209.0 ns	-108.2 ns	
JA01	2018	*	*	*	341.8 ns	*	-104.6 ns	237.2ns

The calibration result was show in Figure 4.

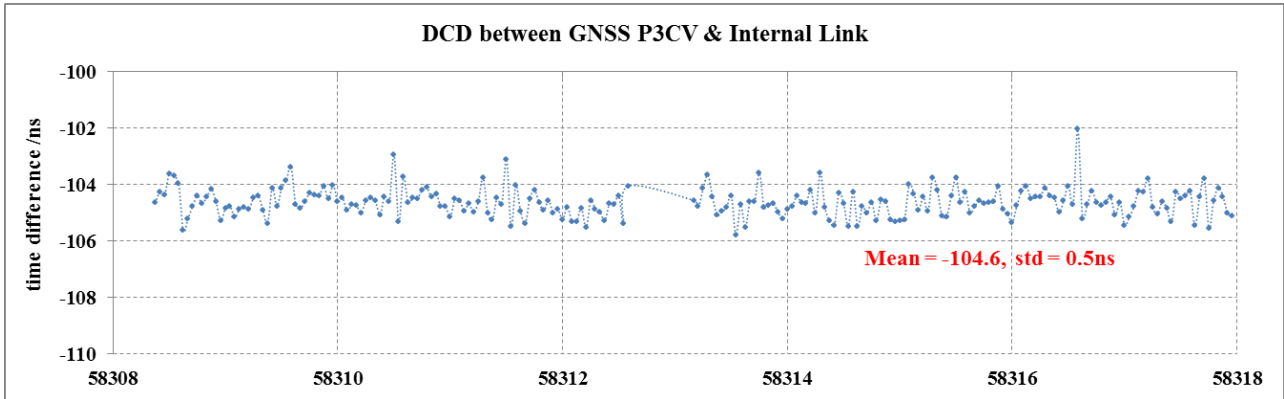


Figure 4 the calibration result for GPS P3 total delay of JA01

From Figure 4, we can conclude that the GPS P3 total delay of JA01 is -104.6 and its STD is 0.5ns. The calibration result is stable.

4 Uncertainty estimates

The uncertainties, both statistical and systematic, are show in Table 3.

Table 3 The uncertainties of calibration

Uncertainty	Value
U_{NTP1}	$2.2ns^{[1][3]}$
$U_{internal\ link}$	$1.0ns^{[2]}$
$U_{GPS\ P3\ CV}$	$0.5ns$
Total	$2.5ns$

5 Summary

During the 9 to 18 July, 2018, the data of NTP1 and JA01 were collected for the calibration of JA01 receiver. The internal link was as the reference link and we successfully obtain the GPS P3 total delay of JA01 receiver. The Total delay is -104.6 ns and its uncertainty is 2.5ns. The REF DLY and SYS DLY (GPS P3) is 341.8 ns and 237.2 ns respectively.

Reference

- [1] BIPM. TM 266 Continuity of GPS “INTDLY” values of Group 1 geodetic receivers in successive Group 1 trips, 2016.
- [2] BIPM. CAL_ID 3001-2017, Time link calibration between UTC(JATC) and UTC(NTSC), 2017.
- [3] BIPM. Cirt-366, 2018.