Test Report of Clock Distributor in Changchun and Beijing

You Zhao[(1)] Peter Sperber[(2)] Tanqiang Wang[(3)] Josef Kolbl[(2)] Cunbo Fan[(1)], Nailing Liu[(3)] Xinwei Han[(1)] Chengzhi Liu[(1)]

[(1)] Changchun Artificial Satellite Observatory, Chinese Academy of Sciences, China
[(2)] Electronic Faculty, Deggendorf University of Applied Sciences, Germany
[(3)] Chinese Academy of Surveying and Mapping, Beijing, China

Abstract This paper presents the test results of a clock distributor which was applied to Changchun and Beijing SLR system. It gives out the ground target calibration results and ranging satellite results. After applying the clock distributor, the precision of calibrating ground targets and ranging satellites has several mm improvement. It also shows the comparison results of standard frequency source provided only by HP58503A GPS receiver and by HP58503A GPS receiver through the clock distributor.

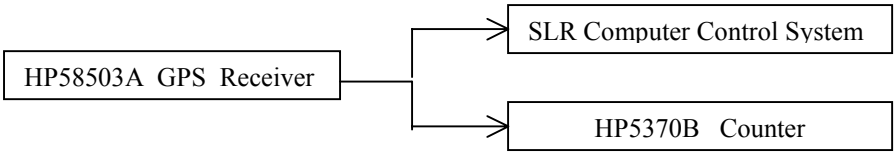
1. Introduction

During the past ten years, with the rapid development of Laser, electronics and optic-electronic detection, the SLR technology has got much improvement in detection ability and quantity. The single shot range precision has achieved better than 2 cm. After the upgrade of SLR system in Changchun station[(1,2)], the data quantity, quality and system stability have got much improved. Now there are 2500 passes per year. The single shot precision is better than 2 cm, and both of the system long-term and shot-term are better than 1 cm and 2 cm separately. But we still want to improve our SLR system to get better observation results, and have done some tests. Here, we introduced the test report of applying clock distributor, which was made by Electronic Faculty of Deggendorf University of Applied Sciences of Germany, in Changchun and Beijing SLR system. The design and working principle of clock distributor please refer to paper (Kolbl and Sperber)[(3)]. We plan to improve the frequency source stability of the system by applying clock distributor, in order to get better results of range precision and system stability.

2. Test methods

(1). Ranging ground target

(a). SLR system in original condition, that is :



The output of HP58503A is 10MHz sine wave. The calibration results are:

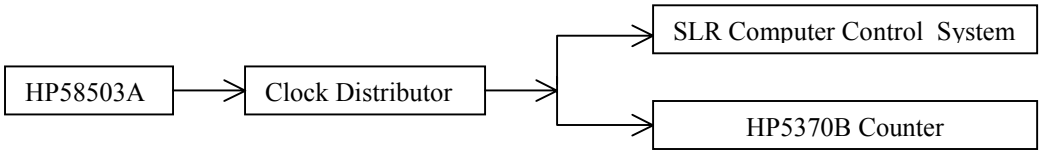
Mean (ns)	σ (mm)
8529.12	15.7
8529.12	13.3
8529.13	13.9
8529.11	16.1
8529.10	12.5

Changchun SLR system

Mean (ns)	σ (mm)
1374.89	15.6
1374.89	14.4
1374.91	16.3
1374.91	15.2

Beijing SLR system

(b). SLR system with clock distributor, that is:



The output from HP58503A goes into the clock distributor. Then the sine wave output of clock distributor provides the 10MHz to counter and computer control system. The results are:

Mean (ns)	σ (mm)
8529.06	9.4
8529.07	9.7
8529.07	9.8
8529.07	8.7
8529.08	9.1

Changchun SLR system

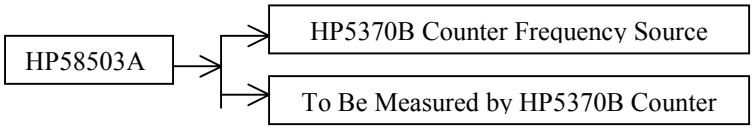
Mean (ns)	σ (mm)
1374.95	14.6
1374.91	14.4
1374.93	15.1
1374.95	13.2

Beijing SLR system

(2). Comparison of 10MHz by with clock distributor and without

This method is just to measure the jitter of 10MHz output from HP58503A by using HP5370B counter with the clock distributor and without it. The counter condition is : period, 1K samples, STD DEV, front trigger.

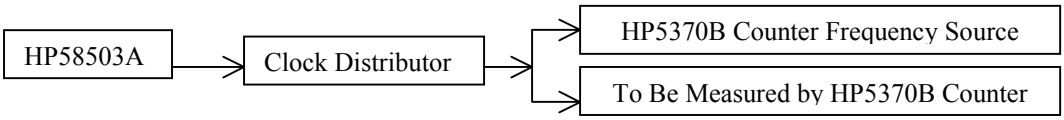
(a). Original condition:



The measured result, or the jitter of the frequency source is:

jitter = 12.1 ps

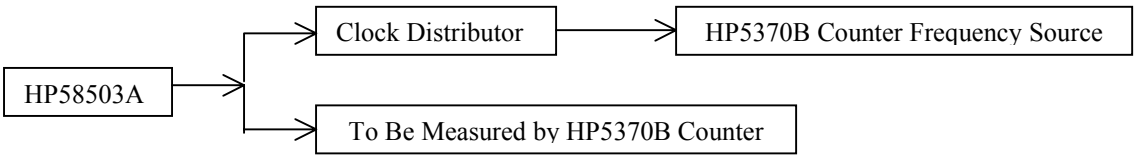
(b) With clock distributor:



The measured result of clock distributor sine wave output by HP5370B counter is:

jitter = 10.0 ps

(c) Without clock distributor:



The measured result of HP58503A 10MHz output by HP5370B counter is:

jitter = 16.3 ps

3. Summary

The clock distributor did "purify" the 10MHz sine wave output of HP58503A and improve the precision of ranging the ground target, but to range satellite, from the feedback of Lageos analysis in the data center, the result is not so clear as to range the ground target. Maybe there are several reasons to affect the results. This is what we want to do some further research in order to improve the ranging precision.

REFERENCE

1. Z. You. Upgrade of Changchun SLR system. Proceedings of 11th International Workshop on Laser Ranging, Deggendorf, Germany, Sep. 20-25, 1998 : 188--196
2. Z. You, H. Kunimori, I. Prochazka etc.. PCS in Changchun Station. Proceedings of 11th International Workshop on Laser Ranging, Deggendorf, Germany, Sep. 20--25, 1998 : 174--180
3. J. Kolbl, P. Sperber. Clock Distribution in SLR Station. Proceedings of 11th International Workshop on Laser Ranging, Deggendorf, Germany, Sep. 20-25, 1998 : 526--529