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A NEW APPROACH TO COMMON-VIEW TIME TRANSFER USING 'ALL-IN-VIEW' MULTI-CHANNEL GPS AND GLONASS OBSERVATIONS

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Abstract

The combined use of GPS and GLONASS for international time and frequency transfer is feasible despite differences between the two systems. The use of two systems in multichannel mode increases the number of observations by a factor of 20 in comparison to a one-channel one-system mode. This results in an improvement in frequency comparisons. Specially designed receivers for GPS + GLONASS multichannel time and frequency comparisons are described and some initial results are provided.

INTRODUCTION

For the past fifteen years international time transfer has been carried out using one-channel C/A-code GPS receivers and an international common-view schedule of standard 13-minute tracks [1]. Because older receivers have limited memory, no more than 48 tracks per day can be programmed; in practice, however, the useful number is even smaller. For regional time comparisons, within 1000 km, about 40 tracks are usually available, and for intercontinental distances about 10. At present, the estimated uncertainty of operational GPS time transfer is several nanoseconds for a single common-view observation and a few nanoseconds for a daily average, which corresponds to a few parts in 10^{14} in terms of frequency transfer. This performance is barely sufficient for the comparison of current atomic clocks and needs to be improved rapidly to meet the challenge of the clocks now being designed.

For this reason the timing community is engaged in the development of new approaches to remote clock comparison. Among them is the development of multichannel two-system C/A-code GPS and GLONASS receivers, and multichannel P-code GLONASS receivers.

The multichannel C/A-code receivers considered here observe all GPS and GLONASS satellites in view, 'all-in-view' operation, and use standard 13-minute tracks at the standard hours. At present, the standard hours are defined every six months by BIPM international common-view tracking schedules. Instruments which use the 'all-in-view' procedure necessarily observe the international schedule. This greatly simplifies

Questions and Answers

ROBERT WEAVER (UNIVERSITY OF SOUTHERN CALIFORNIA): I did not quite understand your point about the multi-channel accuracy being improved by the use of an oven. Would not those temperature effects occur also for single-channel measures?

WLODZIMIERZ LEWANDOWSKI (BIPM): Of course, but we do not see this because the level of noise is higher; so we do not see this jump, this bump due to temperature.

ROBERT WEAVER: So you're saying that the single-channel performance is limited by the temperature drops.

WLODZIMIERZ LEWANDOWSKI: And other noises. What adds to multi-channels, many noise effects. The stability curves go down, and then we cross through the bump, which we cannot observe with one channel.