GPS Newsletter – General

A Newsletter On System 500 GPS, Vol. 02, No. 01.

Introduction

In support, we frequently receive questions about the treatment of **Phase Centre Offsets** and **Phase Centre Variations** (**PCV**). Various PCV correction models from different sources make the correct use of such models complicated. Beside the most commonly used relative calibration models (National Geodetic Survey NGS, International GPS Service IGS), absolute calibration models are becoming more and more standard in some regions.

This newsletter is a follow up of newsletter Vol. 01, No. 12, where **relative and absolute PCV** calibration methods have been explained. Additionally, it was reported when relative PCV correction models derived from different calibrations can and cannot be mixed.

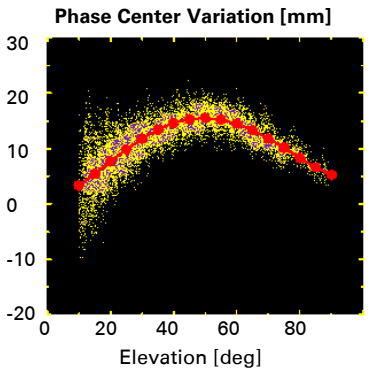
The influence of the PCV on the final result is often underestimated and the **incorrect treatment of the PCV could be the reason for unresolved ambiguities**.

Some network providers now start to correct the broadcasted GPS reference station data for absolute antenna phase correction values. When using such corrected reference station data, some considerations need to be done in order to ensure a seamless operation and maximum performance with Leica System 500 equipment. This is discussed in detail in this newsletter.

Corrected reference station data

The question may come up how reference station data is actually corrected for absolute antenna phase correction values and what the advantage is within a network by applying this correction.

The figure below shows the L1 scatter diagram of the PCV of a state-of-the-art antenna versus the elevation angle. When correcting reference station data for absolute phase correction values, the correction of each observation by the absolute PCV depends on the elevation angle. For example, according to the figure below, an L1 observation at 50° elevation would be corrected by 15mm.



The decisive advantage of corrected reference station data is that there is no need to know which antenna has been used on the reference. After applying the corrections to the reference station data, the phase centre is reduced to a virtual, ideal point – to a so-called "Nullantenna".

Definition "Nullantenna"

The **Nullantenna** has absolute and isotopic characteristics. A Nullantenna is realised by an actual antenna corrected by absolute PCV with its associated standard deviations. Hence, the Nullantenna has **no PCV**. The PCV are reduced to an antenna reference point (ARP) in order to avoid problems arising from a mean phase centre (i.e. dual frequency antenna).

The absolute phase centre offsets and PCV for a Null-antenna are, corresponding to the definition, zero. For more information:
http://www.ife.uni-hannover.de/~web/AOA_DM_T/nullant.html

How to use data corrected for absolute PCV ("Nullantenna") with System 500

There are two possibilities to use the reference station data corrected for absolute antenna phase correction values with System 500.

The first method allows the utilisation of the **corrected GPS data in conjunction with the standard Leica System 500 antenna models**. The standard Leica System 500 antenna models are all relative models with respect to a JPL Dorne Margolin Choke Ring antenna Model T (AOAD/M_T). Therefore, the Leica models can be mixed with relative calibration models referring to the same calibration standards (e.g. IGS-standard).

As a consequence of using the standard Leica System 500 (relative) antenna models, the reference station data at the rover site have to be corrected for compatibility reasons. To achieve this, an antenna type Nullantenna has to be applied which has been generated for that purpose only. The user simply chooses his standard antenna model (e.g. AT502) for the rover. The reference antenna model for an antenna type Nullantenna can be downloaded from the following web page:
http://www.ife.uni-hannover.de/~web/AOA_DM_T/download.html

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Either the PCV are entered manually in the antenna management or the downloaded file can be directly imported into SKI-Pro after a slight modification of the header. The header must meet the header definition of the NGS antenna calibration file.

Using the Sensor Transfer in SKI-Pro, the model can then be transferred to the sensor. This antenna can then be selected as usual.

A second method makes use of absolute antenna calibration results. These absolute antenna calibration results can be downloaded from the NGS web site http://www.ngs.noaa.gov/ANTCAL/Files/ant_info.abs .

This file contains absolute antenna calibrations where all the relative antenna offsets and PCV that the NGS has computed have been added to the absolute values for the AOAD/M_T antenna.

Instead of using the standard Leica System 500 antenna models, an antenna model referring to an absolute calibration has to be used. The antenna file containing absolute antenna calibrations has to be imported into SKI-Pro and transferred to the sensor. The rover antenna must be changed from the standard Leica System 500 antenna to an antenna model, which is derived from an absolute calibration.

Because of the fact that the correction data from the reference are already corrected for absolute antenna phase correction values, the chosen reference antenna has to be an antenna where all phase center offsets and PCV are set to zero. To ensure that no additional corrections are applied, a new antenna should be defined with no offsets and this antenna should then be chosen as reference antenna.

Leica follows the world standard

It needs to be emphasised that the correction of GPS phase observations using the absolute antenna is marking the phase observations as being measured with an ideal point antenna. It should not be confused with an antenna having zero offsets and no elevation dependent correction. **Leica is following the world standard** for antenna phase centre correction models. Therefore the factory defaults refer to correction models used by the IGS scientific community in their daily computations.

However with the **flexible concept of treating antenna models**, both PCV correction models estimated in relative field calibrations as well as absolute calibration models are supported by System 500 and SKI-Pro.

Remember

- Check with the service provider for the antenna manufacturer and correction model type.
- When mixing antenna types, you should always make sure to use the correct PCVs.
- Never mix correction models, which refer to different reference antennas.
- Never mix correction models that refer to an absolute and a relative calibration.
- Neglecting to use the correct antenna models may dramatically reduce the system performance.

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