SLR Station 1884 Riga
Upgrading the Station Calibration Procedures

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General Background

The SLR station 1884, Riga uses a calibration optical path which is different from the tracking optical path. A small fraction of the outgoing laser beam is extracted, feed to an optical fiber with sufficient length (>25m) to avoid ET “dead time”, and injected into receiver path using a small prism just before the FOV diaphragm.

In order to measure and apply the system delay correction when the calibration laser pulse pass through the SLR telescope, only the distance between the SLR Invariant Point to the calibration target \((D_{IP-LRR})\) has to be known.

In our configuration, we need to know only the length difference between the calibration path \((d_{IP})\) and the Invariant Point distance correction \((d_{OF})\).

The length difference \((IP_{DC} - d_{IP})\) can be determined experimentally.

The goal was to improve calibration accuracy and stability, improve station workflow and to introduce additional QC procedures.

Hardware Upgrades

- Several software applications are used to monitor the system stability.
- Observer’s biases are eliminated by using calibration data automatic filtering.
- The calibration drift is applied now, using pre-and post-pass calibrations done in a 1-hour time window.
- All the generated data is archived automatically for further analysis.
- Several software applications are used to monitor the system stability.

Determining The Riga System Delay Parameters: The Theory

If we define as:

\[
\Delta t_{IP} \quad \text{time of flight using the optical fiber path.}
\]

\[
\Delta t_{OF} \quad \text{time of flight using the LRR @ SLR Telescope path.}
\]

\[
\Delta t_{EE} \quad \text{the electronic processing time.}
\]

\[
 d_{IP-LRR} \quad \text{the} \ A_\text{announced} \text{distance Invariant Point-LRR prism.}
\]

\[
 d_{IP} \quad \text{the Calibration Path Length.}
\]

\[
 D_{IP} \quad \text{the Invariant Point distance correction.}
\]

Assuming that \(\Delta t_{IP} = \Delta t_{IP} + \Delta t_{EE} + \Delta t_{OF}\)

\[
\Delta t_{EE} = \Delta t_{IP} + \Delta t_{OF} + \Delta t_{of} \]

then, the Riga system delay correction parameter can be found as:

\[
(IP_{DC} - d_{IP}) = (\Delta t_{IP} - \Delta t_{OF} - D_{IP-LRR})
\]

Determining The Riga System Delay Parameters: The Experimental Setup

Determining The Riga System Delay Parameters: Results

Experimental Results

Normalization to mean and max bin

Range bias after implementing the April 2016 \((IP_{DC} - d_{IP})\) value.

Determining The Riga System Delay Parameters: The Next Steps

In 2016, the potential new sites for additional geodetic reference points were surveyed, marked as a green and red dots in the plan.

The places marked as green dots, will serve also as new external calibration targets.

Once the new external targets will be available and new \(D_{IP-LRR}\) values will be known, we will compare the results with the previous calibration results.

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