

PROGRESS FOR DAYLIGHT TRACKING IN CHANGCHUN SLR SYSTEM

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Abstract

In this paper, first it briefly summaries the Changchun SLR data quality and quantity from data analysis centers: single shot rms, NP rms, long and short—term stability, data percentage and its rank in ILRS after the system improvement. Second it introduces the problems and difficulties facing this system for daylight tracking—mount model, the separation of emitting and receiving parts of the telescope, control range gate, installing narrower filter. Third it presents some work which were done in the system for daylight tracking: system stability improvement, laser stability improvement, mount model adoption, control system, etc. From these analysis and work which have been done, daylight tracking in Changchun SLR system will be possible in the near future.

Upgrade history

In 1998, a upgrade of SLR system in Changchun took place. A new C-SPAD detector with high quantum efficiency, low work voltage, low jitter and time walk compensated, and Met3 meteorological sensor were installed. More accurate meteorological data can be obtained and to be used to correct the data. Also three near ground targets were set up to be used to compare the old ground target. A PCS was used to collocate to find the system time bias and range bias^(1,2,3). After that, during the following years, the system was kept in a good condition by taking following ways:

1. Changing new Laser power supply to keep and improve the Laser stability
2. Keeping to change and maintain Laser rod and other laser accessories in good condition
3. Improving the computer control system to make it more convenient and easy to use and to check the system
4. Paying more attention to maintain system, several technicians to check and adjust the system regularly
5. Checking other parts in regular time^(4,5).

The Data quantity and quality during the year from Jan-2003 to Dec-2003 in following figure1⁽⁶⁾:

Data quantity:

- Whole 2003 year: 4696 passes
- Ranked No.9 of 40 stations in the global SLR

Data quality:

- Single shot precision: 1cm (Fourth quarter of 2003)
- NP rms: <1cm
- System long and short-term stability: < 2cm (year of 2003)
- Data percentage: >95%

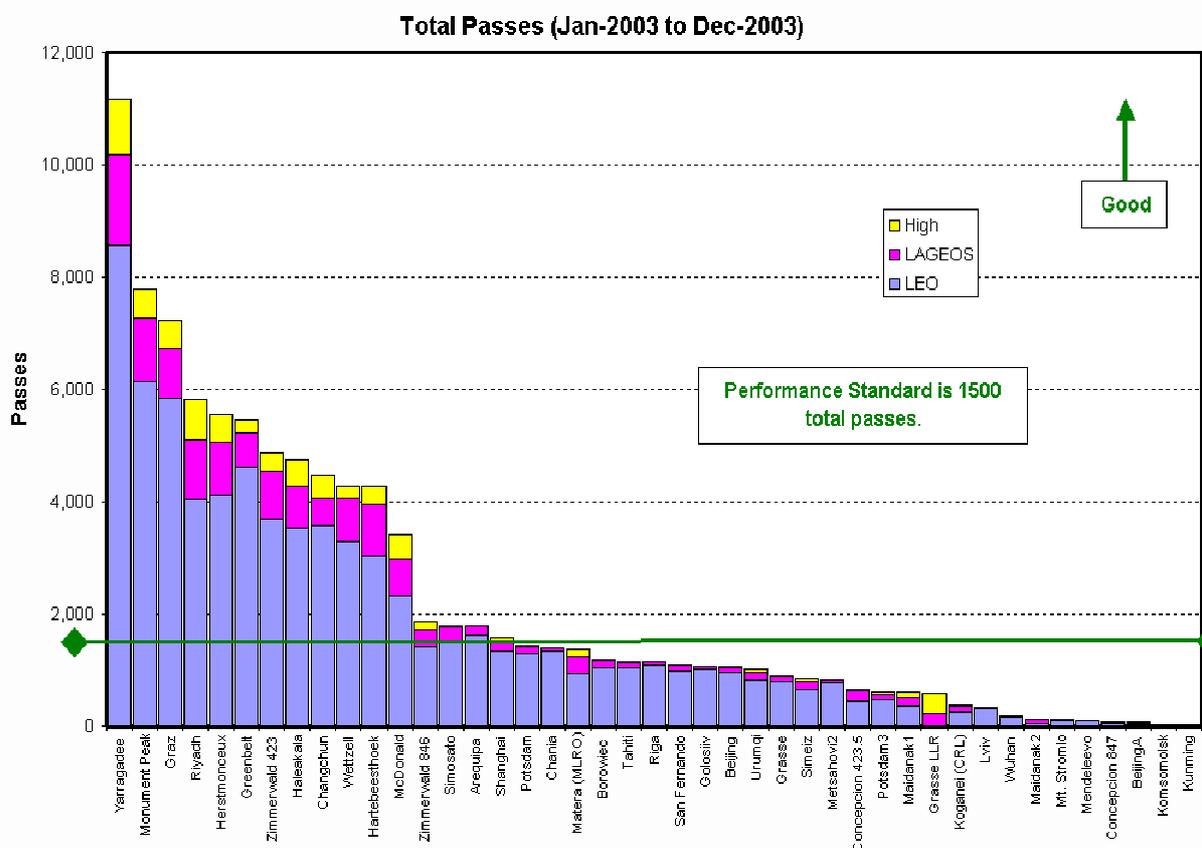


Figure 1. Total passes from Jan-2003 to Dec-2003

Daylight tracking for Changchun SLR

The daylight tracking is necessary and the tendency of SLR in the future. Many stations in the world can take the daylight observations. Because this is necessary and also there are many advantages, such as increasing the number of passes and number of observations, finding systematic errors in products easily, having shorter gaps in orbit coverage, etc. Following is figure 2 to show ILRS stations which can track daylight or not. Compared to above figure 1

and following figure 2, we find that the passes Changchun station got rank about 9 during last year, but no daylight tracking passes. This is a pity and also a loss for such an important station, and its contribution to ILRS and global is limited. The problems or difficulties for Changchun daylight tracking are:

- Bad pointing of the telescope
- Mount model problem for the telescope
- Separation of emitting and receiving parts of the telescope
- Generating control range gate narrower
- Installing narrower filter in the telescope
- Detector on the front of telescope^(7,8).

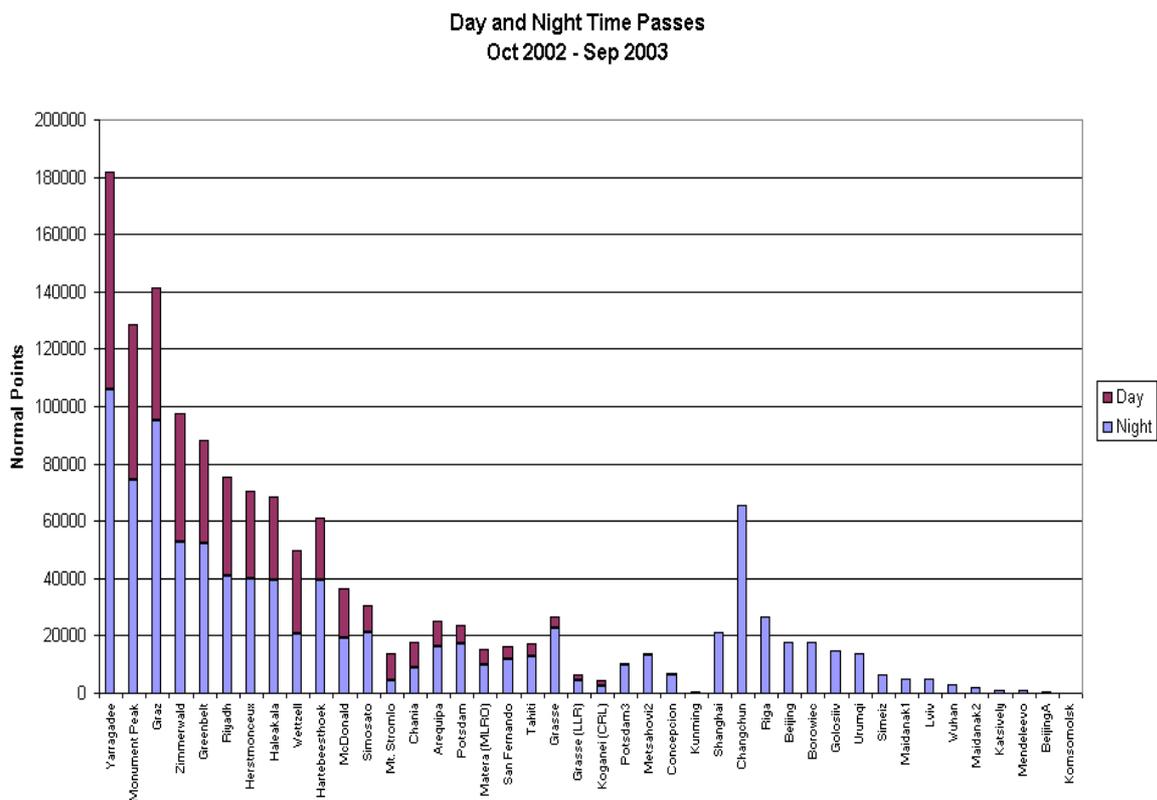


Figure 2. Day and night passes

Work done

Even there are so many difficulties, we still have done some work to try to fulfill daylight tracking, such as system stability improvement, laser stability improvement, mount model adoption, control system, etc. In order to improve the system stability, a new control system has been adopted, including an industrial control computer, data collecting board and counter card for timing and range gate. Control and data preprocessing software are also updated so that all work can be done automatically. For laser stability, the room is air conditioned. The cooling system is also improved for its liable working, including some system protections. In order to

improve the pointing accuracy, mount model correction is also adopted in the satellite prediction. A spherical harmonics pointing model was built by using astronomical observation at our telescope system. It is proved that the pointing model is an effective correction to the system error. This makes the pointing bias become very small in most position. But the result is not good enough for daylight observation. More efforts must be made in the near future.

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