

## Actuality and futurity of San Juan SLR Station

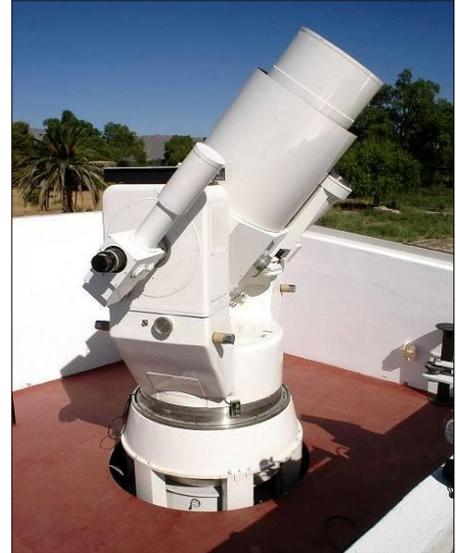
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### Abstract

San Juan 7406 SLR station is operated by National Astronomical Observatories of Chinese Academy of Sciences (NAOC) and Observatorio Astronomico Felix Aguilar (OFA) of National University of San Juan of Argentina. The SLR station began to operate in the end of February of 2006. Due to the colleagues of the SLR team work hard and the lot of clear nights in San Juan region, San Juan SLR station obtained excellent results in the past two years and more. Our SLR team has established an upgrade plan on the SLR system. We hope that the SLR system can implement daylight tracking and kHz operating, also improve the precision of observations. According to the suggestion of ILRS, we will soon install a GPS receiver collocated with the SLR system.



### Site

The San Juan 7406 SLR station is located in the Observatorio Astronomico Felix Aguilar of National University of San Juan of Argentina (OFA), about 10km from San Juan city. The San Juan city is situated on the east side of Andes, 1300km northwest of Buenos Aires, the capital of Argentina. OFA has approximately 300 nights for SLR observation a year. The geographic position of the site is 31° 30' 31.050" S, 68° 37' 23.377" W and 727.22m elevation.

### Operations

The San Juan station began routine operations on February 23, 2006. Due to the excellent work of the observers from NAOC and OFA, and a lot of clear nights in the region, the total passes kept continuously and exceeded by 7500 passes, especially for high satellites passes exceeded by 1200 passes, during 2007 to 2008. We are cooperating with Beijing SLR station to perform some experiments of daylight tracking, and our previous the AZ-EL inductosyns system will be replaced by a new optical angle encoder system in order to make preparations for daylight tracking.



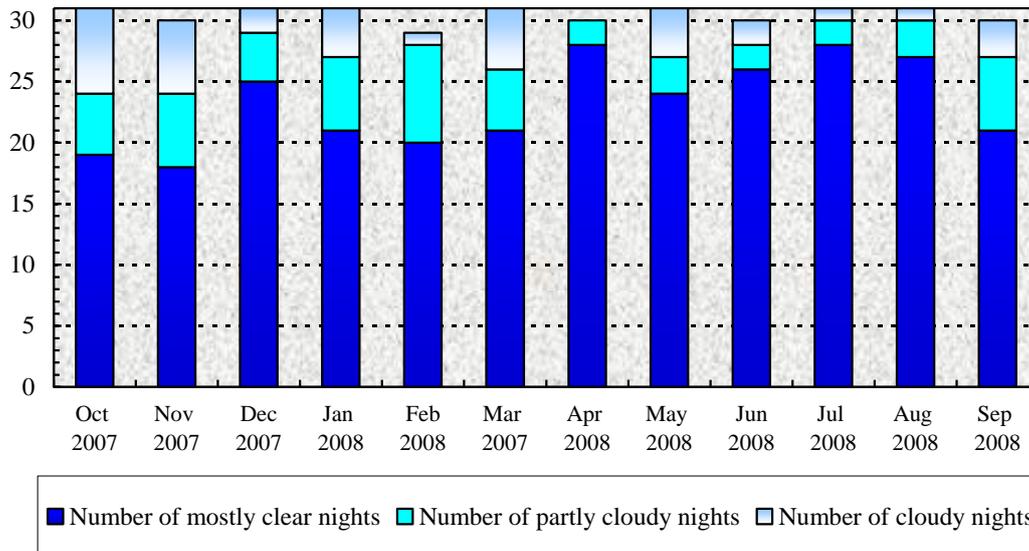
Dual Readheads angle encoder

## Laser

Due to the unstable laser, it is very difficult that the San Juan SLR system to keep and improve the single-shot accuracy for the LAGEOS and calibration, as well as the measure of short term bias stability. As a result of long-time operation, in order to keep the system to work properly, the maintenances of the laser become both very trouble and difficult. Therefore we need the laser which is very stable, more or less maintenance free.

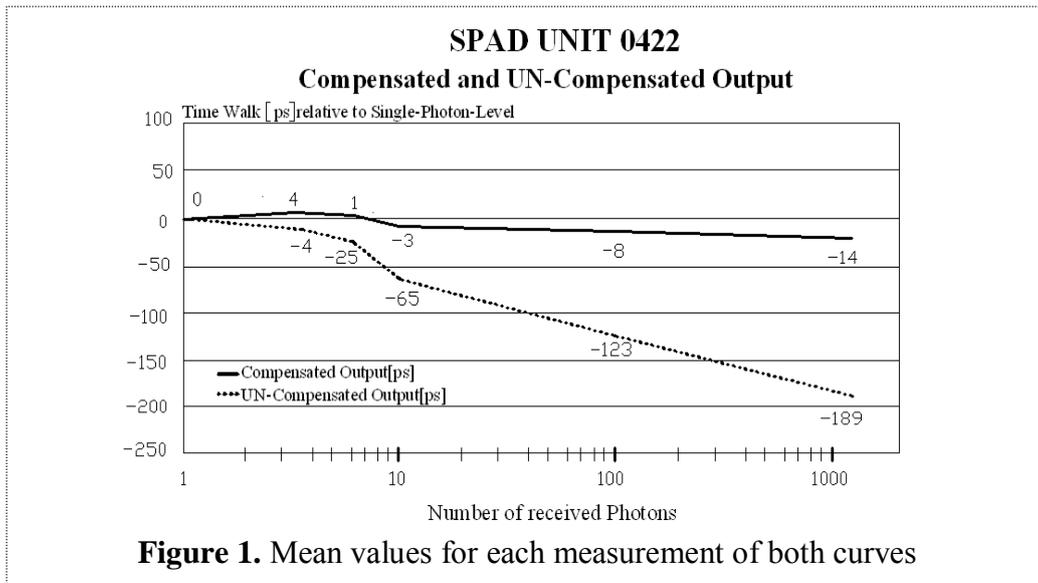
**Weather:** Approximately 330 nights for SLR observation from Oct 2007 through Sep 2008

Stat. of night weather in San Juan during Oct 2007-Sep 2008



## System calibration

When usually ranging to Lageos, the received energy is vary from single photon up to multi photons (about 10 photons, the levels obtainable from LAGEOS with San Juan SLR parameters), so that the received energy for ranging to the calibration target should be correspond to Lageos. We can refer to the Fig.1 (curves of C-SPAD characteristic both compensated and uncompensated), use the C-SPAD characteristic of time walk uncompensated output (relative to single-photon-level) that vary evidently with the increase of received photons. First, measure the time intervals (T1, RMS values, mean value of several times measurements) of calibration target of uncompensated output by single photon (Semi Train < 20% return quote), and then select a suitable reference value (e.g. time walk uncompensated is -25ps), adjust the received energy at SPAD by adjusting the filter or controlling laser energy, measure the time intervals (T2) of uncompensated output, and calculate the D-value of T1 and T2. Now we can know which the received energy is right or not, simultaneously measure the time intervals of the compensated output (single to multi photon), and compare the time intervals whether it meets the requirement. In this way we can know definitely the received energy for ranging to target. We think of selecting suitable photon number range for ranging to the calibration target that decrease the times of ranging to the target, reduce the error by the jitter, and improve the single-shot accuracy of calibration target.



### A Future Plan

The NAOC and Oafa will continue the cooperation in the San Juan SLR system. At the same time we will also enhance the related research. Our SLR team has established an upgrade plan on the SLR system. The first step will to change the laser system to a semiconductor pumped laser and thus bring the system to high repetition rate and daylight ranging capabilities. We hope that the SLR system can implement routine daylight tracking and high repetition rate operating, also improve the precision of observations in order to obtain more high-quality data for the ILRS. According to the suggestion of ILRS, we will soon install a GPS receiver collocated with the SLR system.

### References

- [1] Han Yanben et al., Successful operation of a cooperative SLR station of China and Argentina in San Juan, Chinese Science Bulletin, 53(16):2417-2420, 2008.
- [2] Zhao You, Han Xingwei, Fan Cunbo, Dai Tongyu. Fulfillment of SLR daylight tracking of Changchun station[C]. Proc. of 15th Int. Workshop on Laser Ranging. Canberra, 10/2006; <http://cddis.gsfc.nasa.gov/lw15/index.html>.
- [3] G. Kirchner, F. Koid. Graz KHz SLR System: Design, Experiences and Results[C]. Proc. of 14th Int. Workshop on Laser Ranging, San Fernando, Spain, 06/2004; <http://cddis.gsfc.nasa.gov/lw14/index.html>.
- [4] Yu. Artyukh, E. Boole, V. Vedin. Instrumentation for Creating KHz SLR Timing Systems[C]. Proc. of 15th Int. Workshop on Laser Ranging. Canberra, 10/2006; <http://cddis.gsfc.nasa.gov/lw15/index.html>.

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