Current situation and future of cooperative San Juan SLR station between China-Argentina

Liu Weidong, Wang Hongqi, Han Yanben,Yin Zhiqiang, Tian Lili, Wang Zheng, Zhao You, Li Jinzeng, Huang Dongping, Wang Rui
(National Astronomical Observatories Chinese Academy of Sciences, Beijing, China);
R.Podesta, A. Pacheco, A.Ester, E. Actis
(Astronomical Observatory Felix Aguilar National University of San Juan, Argentina)

ABSTRACT

San Juan 7406 SLR station is operated by the National Astronomical Observatories of Chinese Academy of Sciences (NAOC) and the Observatorio Astronomico Felix Aguilar (OAFA) of National University of San Juan of Argentina. Now, San Juan SLR station has obtained excellent results and become an important station in ILRS network, especially in the southern hemisphere. Our SLR team is carrying out the upgrade project on the SLR system. We hope that the SLR system can implement daylight tracking and kHz operating, also improve the precision of observations. A new project of ~40-meter radio telescope started to be performed in the beginning of this year, the station will fulfill collocated measurements with multiple techniques in the future.

1 Introduction

San Juan 7406 SLR station is operated by the National Astronomical Observatories of Chinese Academy of Sciences (NAOC) and the Observatorio Astronomico Felix Aguilar (OAFA) of National University of San Juan (UNSJ) of Argentina. The SLR station began to operate in the end of February of 2006. Due to the colleagues of the SLR team hard works and the lot of clear nights in San Juan region, San Juan SLR station obtained excellent results in the past years. At present, we are updating the SLR system on daytime tracking and kHz laser. In this year, a new collaboration project about ~40-meter radio telescope between NAOC and UNSJ just begin to carry out both astrometric and astrophysics works in the future. San Juan station will become a comprehensive station include multiple techniques such as SLR, GPS and VLBI.

2 Progress of Upgrading works

KHz repetition Satellite Laser Ranging with the advantages of fast target acquisition, large amount of returns, high measuring accuracy and high normal point data density, has become the trend of international laser ranging technology. In the end of 2009, we started upgrading work of kHz and daylight tracking in order to improve the precision of observations and obtain more high-quality data for the ILRS. The scheme design of the system upgrading was completed in early 2010. In the year, a company in China started to make a new kHz laser for the SLR system. We emphasize maintainability of the laser, set up multiple test points in the laser, and request easy replacement of devices. The main peremeters of the new Laser are exhibited in Table 1. Now, the design of photoelectric conversion receiver has finished. The upgrades of control and operating system are developed by the cooperation between NAOC and Changchun Station in 2011. An A033-ET event timer will be used for kHz operations, the Start and C-SPAD Stop Pulse adopt a set of the Pulse Distribution Module (design by Graz Station) and their output NIM logic Pulse is for A033-ET, to utilize a set of pco.1600 camera for night and daylight tracking, a set of steel grating encoders instead of old AZ-EL inductosyns. The system integration and test is being done via the cooperation with Changchun and Beijing stations. First trial observation of the laser was carried out during March, 2011. Observations of LARETS satellite showed the r.m.s is 25.8mm, the r.m.s of target is about 7mm (see figure 1). But serious multi-pulse phenomena appeared in the first time laser testing.

Table 1: Specification of the new laser

wavelength	532 nm	divergency	1 mrad
frequency	500Hz-1KHz	diameter of beam	2 mm
pulse energy	2.5 mJ at 1kHz	polarization	horizontal
pulse to pulse instability	2% RMS (8 hours)	beam point instability	<50 urad
pulse width	<15 PS	operating temperature	15-30 ºC

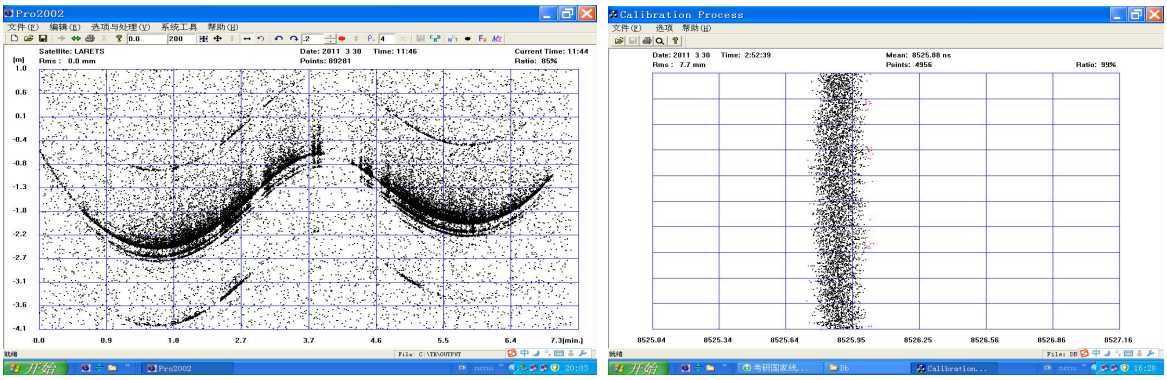

Figure 1 Laser testing (first time, at Changchun SLR Station)

The second time laser testing was carried out at Beijing SLR Station. We adjusted electro-optic switch to filter multi-pulse, replaced KTP with LBO (frequency doubling crystal), reduced the divergence angle to about 0.5mrad. The r.m.s is about 10-20 mm on the LEO satellites observations and target accuracy (r.m.s) is about 5-6 mm with diffuse surface target (see figure 2). The subsequent laser testing is carried out at Changchun SLR Station still. After completion of the preparation, the equipments will be delivered to San Juan Station and the upgrading will be completed in 2012.

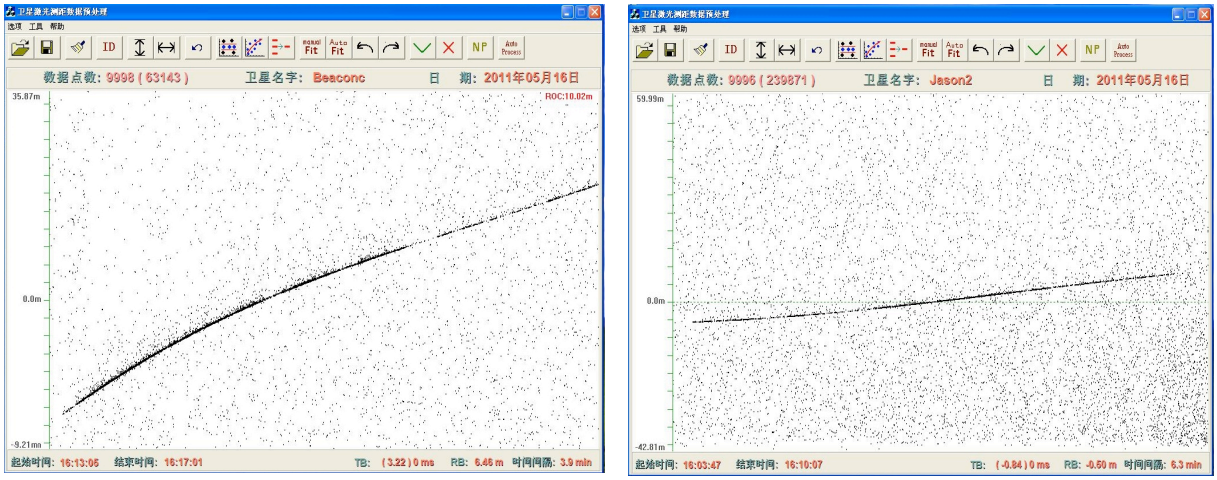

Figure 2 Laser testing (second time, at Beijing SLR Station)

3 Observation status in 2009-2010

Observations of Sun Juan SLR system were kept the good status in 2009. However the SLR station met some problems in 2010. Examine and maintenance of the power supply of the observatory led to a halt of observation in one month and more, a variety of equipment failure began to appear, the supply of dichloroethane encountered a serious problem. We also met bad

weather in San Juan in the whole 2010. All of these caused significant reduction of observational days. The equipment failures of the SLR have been solved in 2011 and its operation is normal now.

4 Future Development of San Juan Station

The SLR system in San Juan will realize routine observation of kHz and daylight tracking in 2012. In the end of 2010, the 40-meter radio telescope cooperative project (VLBI) between NAOC and UNSJ has been approved by the both sides. We hope that the station will have GPS and VLBI collocated with the SLR system in coming years.

Acknowledgements

This work was supported by the Foundation of International Science and Technology Cooperation (2009DFB00130, 2010DFB53100), the External Cooperation Program of the Chinese Academy of Sciences (GJHZ200813).

Correspondence

Liu Weidong
National Astronomical Observatories, Chinese Academy of Sciences
20A Datun Road, Chaoyang District,
Beijing, 100012, China

wdliu@nao.cas.cn