

Progress of Shanghai SLR Station during 1999-2000

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Abstract

The main progress at the Shanghai SLR station during 1999-2000 is described in this paper.

1. Tracking mount

The mount was made by the Changchun Institute of Optics and Precision Mechanics in 1982. The quality is too old to serve for routine operation reliably. The ranging system was down sometimes due to out of order of the electronics of the mount.

The new servo system was made and installed in 1997. A set of new encoder electronics was built and has been adopted for routine operation since October 1998. The new electronics has 23-bit resolution and better tracking capability and reliability.

Two of the coude mirrors were adjusted by PZT motors and can be remotely controlled. The direction of laser beam from the transmitting telescope can be easily adjusted.

2. Receiving system

The first SPAD detector with 0.1 mm diameter chip without cooling device from Czech Technical University was tested at Shanghai station in May-July 1992, and was used for routine operation from August 1994 to October 1997. The second SPAD with 0.2 mm diameter chip with cooling device was installed in October 1997. The third one is C-SPAD, which has the time walk compensation circuit, and has been installed since March 1999. Better ranging precision has been obtained since then. A 20-nsec range gate circuit was built and adopted since December 1998. It is necessary for daylight tracking. In order to protect the detector during the daylight tracking, an automatic sunlight shutter

was added in front of the field stop.

3. Laser

The SFUR mode-locked Nd:YAG laser which was made by the Shanghai Institute of Optics and Fine Mechanics was installed in October 1995. The laser worked pretty well. Nothing has been damaged in the oscillator since then. The pulse selector is upgraded. The amplifier head had been upgraded with two flashlamps pumping for more output energy. A BBO crystal replaced the KTP crystal for higher damage threshold. The output energy in semi-train pulses is 30-40 mJ in 532nm.

4. Software

1) A method of identification of return signal in realtime tracking was developed and more passes and longer tracking arc have been obtained.

2) The Sun position, prediction path of satellite and the telescope pointing position on the celestial sphere are showed on the realtime display. It is convenient and useful for daylight tracking.

3) A new multi-function operation interface was designed for satellite observation schedule, prediction calculation, data preprocessing and star position calculation under the Windows operation system.

5. Short distance calibration

A short distance ground target was set up and has been adopted for routine operation since June 26, 2000. The target is located in front of the telescope in the dome and the distance between the target and the reference point of the SLR telescope is only 2.070 meters. The stability of the calibration is much better.

Calibration to the short distance target (April 2000)

| Calibration (ps) | rms (mm) |
|------------------|----------|
| 80021 | 5.3 |
| 80026 | 4.7 |
| 80021 | 4.2 |
| 80026 | 5.2 |
| 80024 | 4.7 |

6. Upgrade of system performance

1) Better precision: Single shot for Lageos 1.5-1.7cm

2) Better ranging capability:

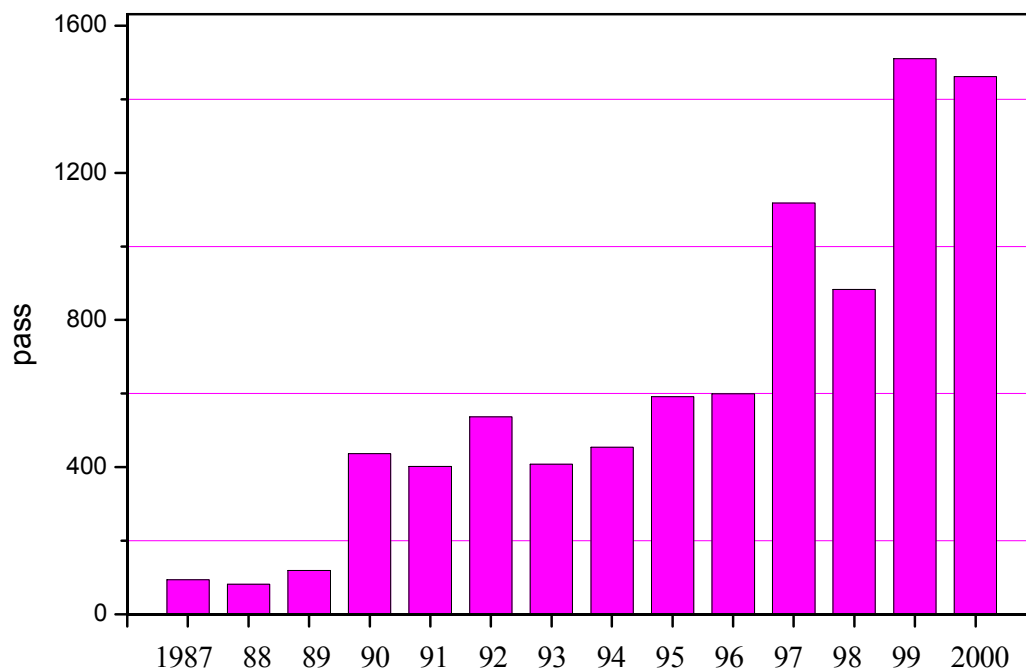
A few passes return from GPS-35

Maximum returns in one pass from Lageos at 5Hz repetition rate: 8072

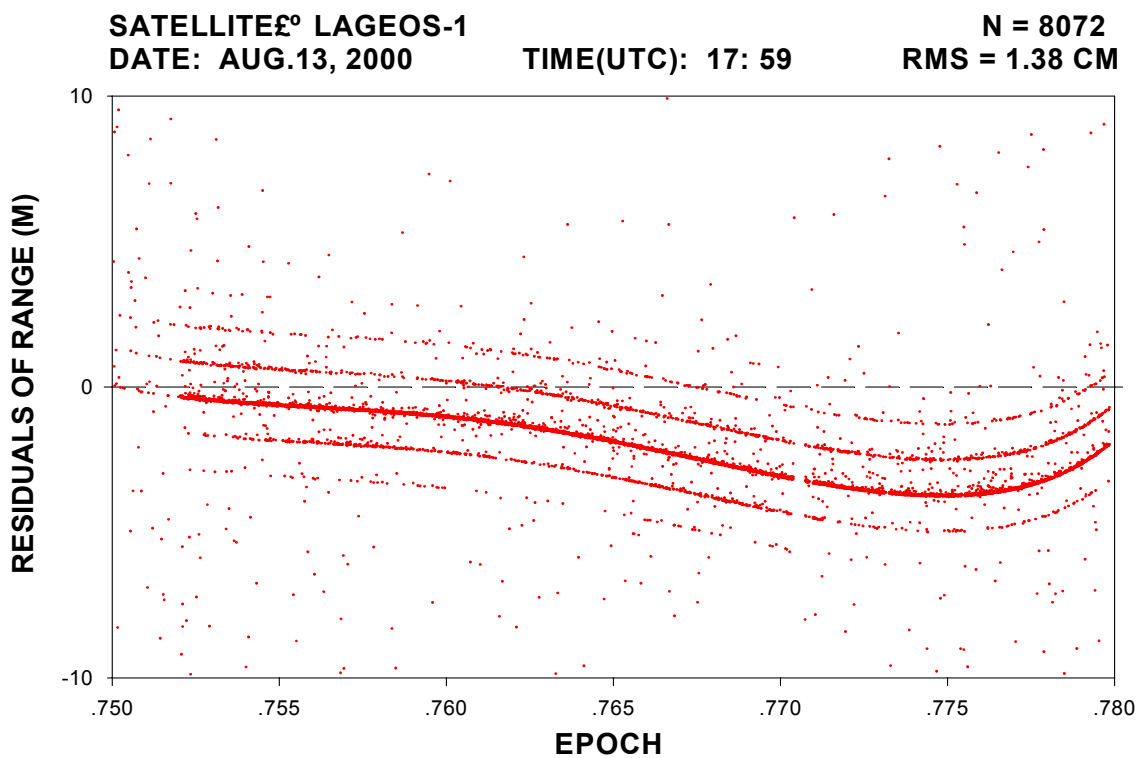
3) Better reliability, less system down

References

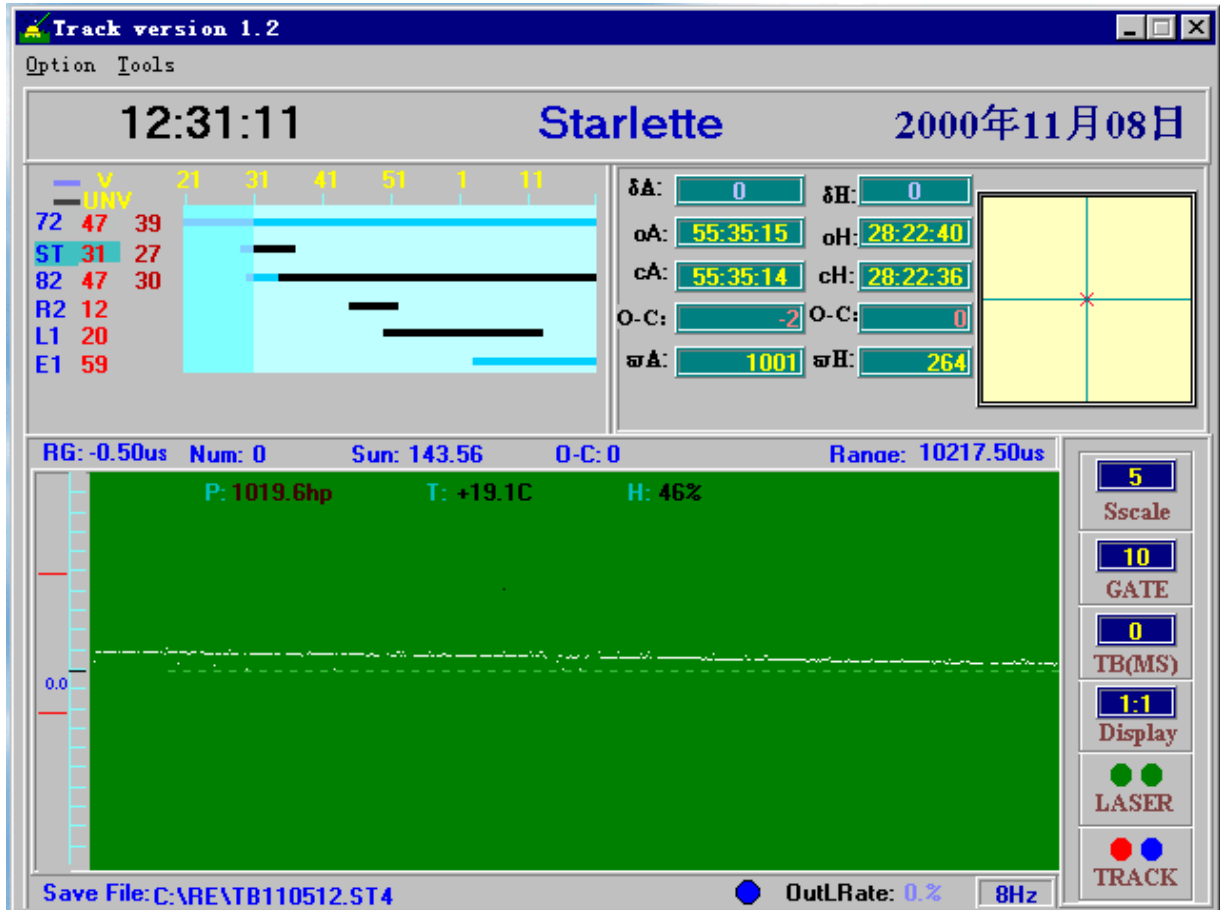
1. Sun Zhan'ao, Yang Fumin, et al, A Compact Modified SFUR Passively Mode-locked Nd:YAG Laser for Satellite Ranging, *Proceedings of 10th International Workshop on Laser Ranging Instrumentation*, 1996, 349-351
2. G.Kirchner, F.Koidl, Short Distance Calibration, *Proceedings of 10th International Workshop on Laser Ranging Instrumentation*, 1996, 431-435
3. G.Kirchner, F.Koidl, Automatic Ranging Software in Graz, *Proceedings of 10th International Workshop on Laser Ranging Instrumentation*, 1996, 554-558
4. Prochazka I, Hamal K, Blazej J. Millimeter Ranging and Echo Signal Strength Monitoring with SPAD Detectors. *Proceedings of 11th International Workshop on Laser Ranging Instrumentation*, 1999, 452-457



Observations of Shanghai SLR



Observation Result of Lageos-1 at Shanghai SLR

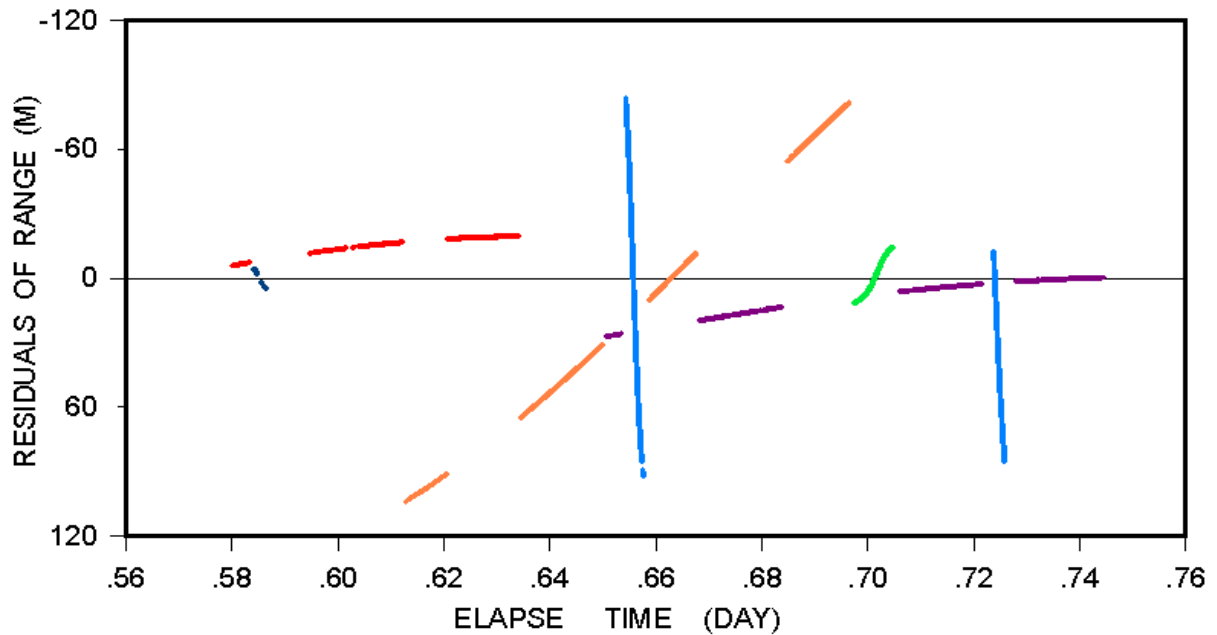


SATELLITE: GN70, WES, GN71, GN69, GEO3, AJI, GEO3

DATE: DEC.16, 98

N: 614, 34, 1478, 1083, 979, 2585, 669

TIME(UTC): 14:42-17:52



MULTI-SATELLITE TRACKING (SHANGHAI STATION 7837)