



Shanghai Astronomical Observatory  
Chinese Academy of Sciences

# The status and plan of the Chinese SLR network

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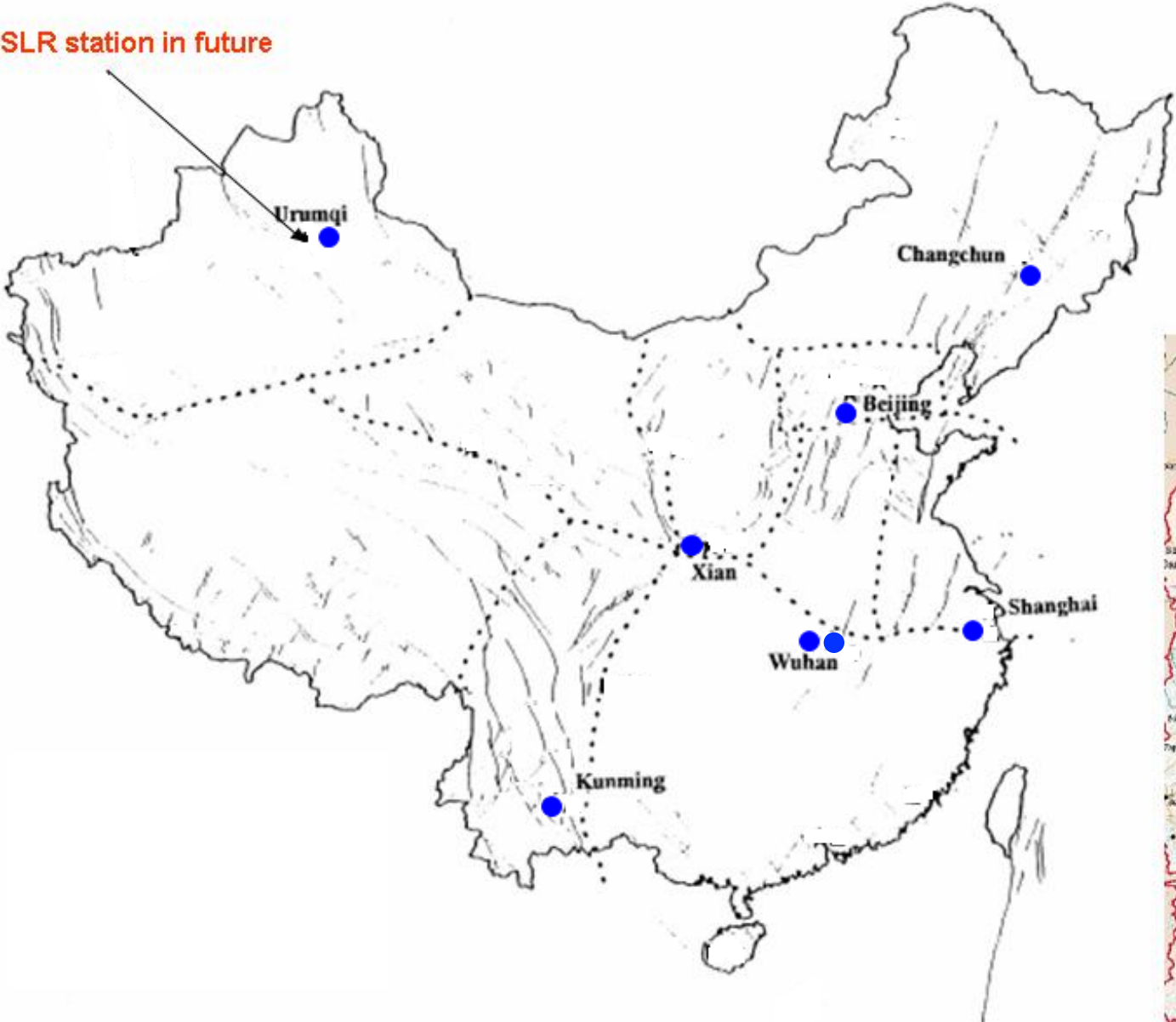
**Chinese SLR network**



## Outline

- 1. The update of the Chinese SLR network**
- 2. SLR measurement of Chinese SLR network**
- 3. Improvement of performances of SLR system**
- 4. Future development**

# Distribution of the Chinese SLR station



San Juan SLR station in Argentina





Shanghai



Kunming



Changchun



Wuhan

**The telescopes of  
the Chinese SLR  
stations**



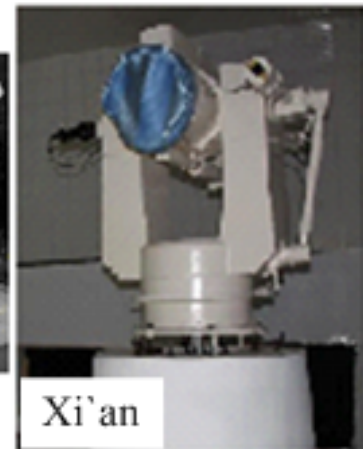
Beijing



SanJuan



Wuhan TROS



Xi'an



## 1. The update of the Chinese SLR network

- **Since 2008, the second stage of the project of Crustal Movement Observation Network of China has been initiated and the Chinese SLR stations are obtained strong supports for improvements.**
- **The SLR stations except for SanJuan in the Chinese network have been upgraded to kHz laser system and daytime tracking capability with kHz repetition rate.**



## 1. The update of the Chinese SLR network

- **Four sets of kHz lasers from Photonics Industrial International Inc. of USA (Shanghai, Changchun, Kunming, Wuhan), One set of kHz laser from High Q laser of Austria for Beijing station, Two sets kHz laser from the domestic institute.**
- **Up to now, five stations track routinely the satellites with kHz laser ranging at nighttime and four ones have realized the daylight tracking.**
- **The SLR station in San Juan will implement kHz laser ranging and daylight tracking at the end of 2015 by using the domestic kHz repetition rate laser.**

# kHz Laser from PI company of US



kHz laser made by Photronics Industries, US



Control/driver

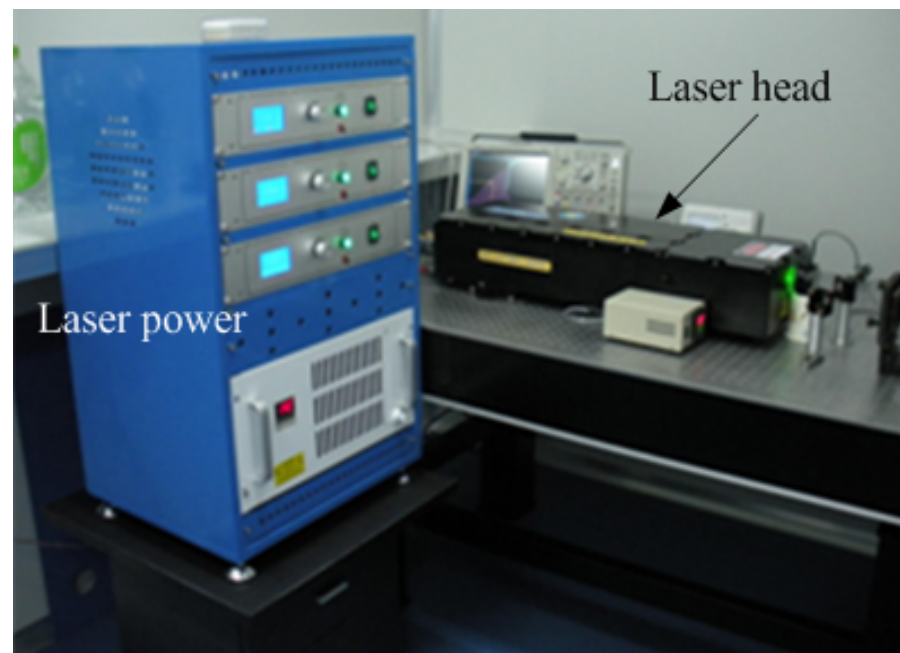
Cooling



# kHz Laser from High Q company



# kHz Laser from Chinese institute



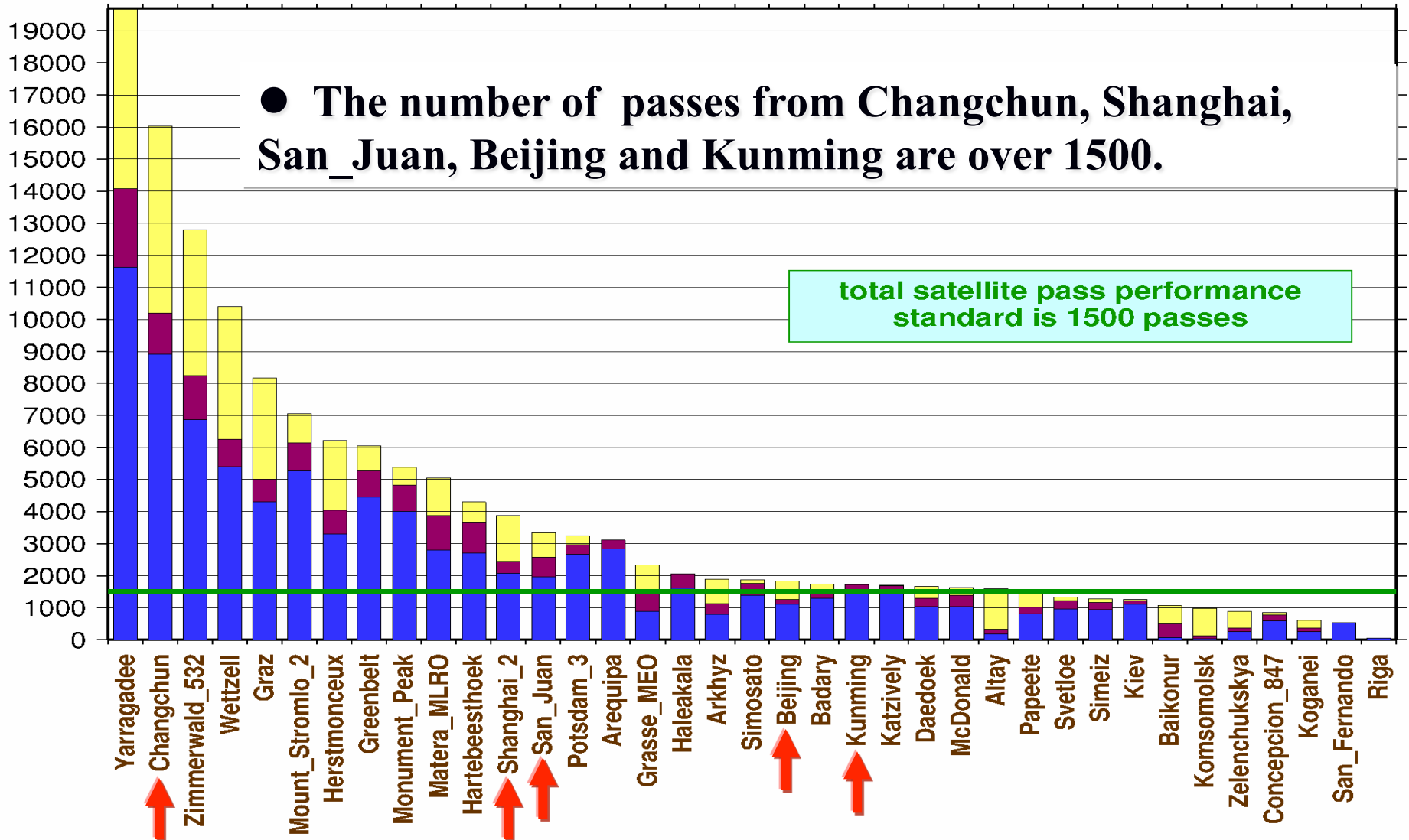
# Upgrading Performances of Chinese SLR Stations

Station	Shanghai	Changchun	Beijing	Wuhan	Kunming	San Juan	Wuhan TROS	Xi'an
Station ID	7821	7237	7249	7236	7820	7406	/	/
Aperture of Receiving telescope	60 cm	60 cm	60 cm	60 cm	120 cm	60cm	100 cm	35cm
Aperture of Transmitter	21 cm	21 cm	10 cm	10 cm	120 cm	10cm	15cm	10cm
Pointing Accuracy	Alt-AZ 5"	Alt-AZ 5"	Alt-AZ 5"	Alt-AZ 5"	Alt-AZ 10"	Alt-AZ 5"	Alt-AZ 5"	Alt-AZ 10"
Pulse Energy (532nm)	1mJ	1mJ	1mJ	1mJ	1mJ	20mJ	1mJ	1.5mJ
Pulse width	50ps	50ps	20ps	50ps	50ps	30ps	50ps	30ps
Repetition rate	1kHz	1kHz	1kHz	1kHz	1kHz	10Hz	1kHz	1kHz
Type of Receiver	C-SPAD	C-SPAD	C-SPAD	C-SPAD	C-SPAD	C-SPAD	C-SPAD	C-SPAD
Timer Interval Unit	Event Timer	Event Timer	Event Timer	Event Timer	Event Timer	SR620	Event Timer	Event Timer
Operation	Since 1983	Since 1992	Since 1994	Since 1988	Since 1998	Since 2006	Since 2010	Since 2000



# 2. SLR measurement of Chinese SLR network

total passes  
from July 1, 2013 through June 30, 2014

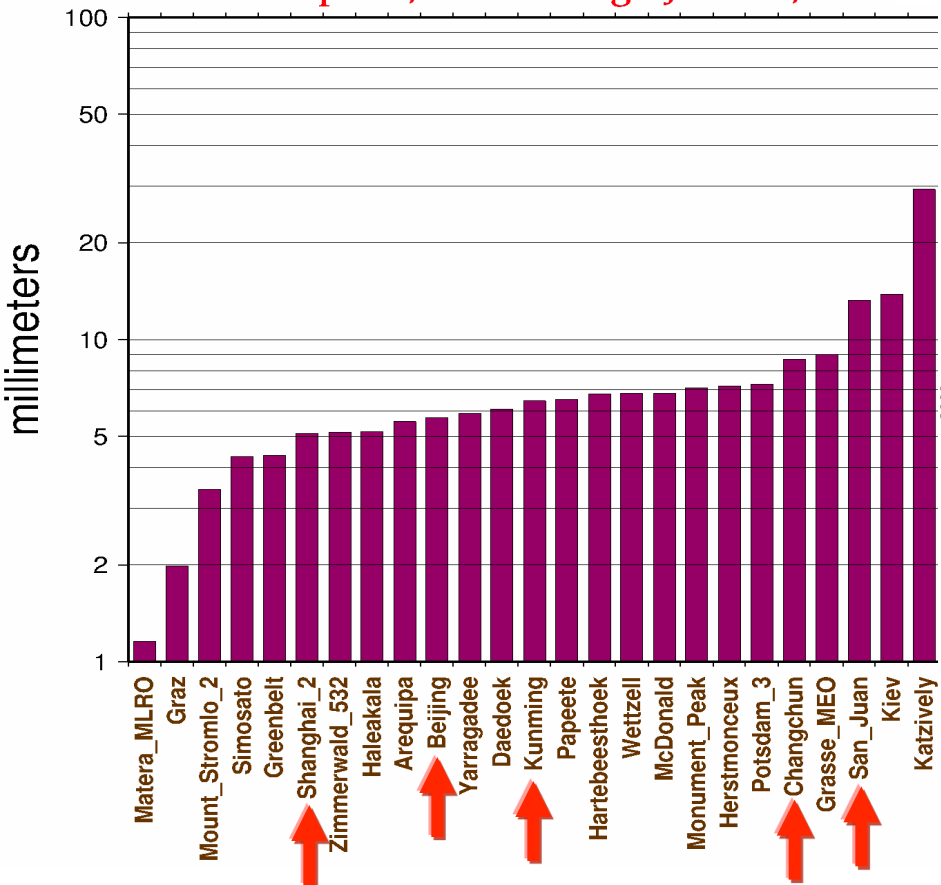




## 2. SLR measurement of Chinese SLR network

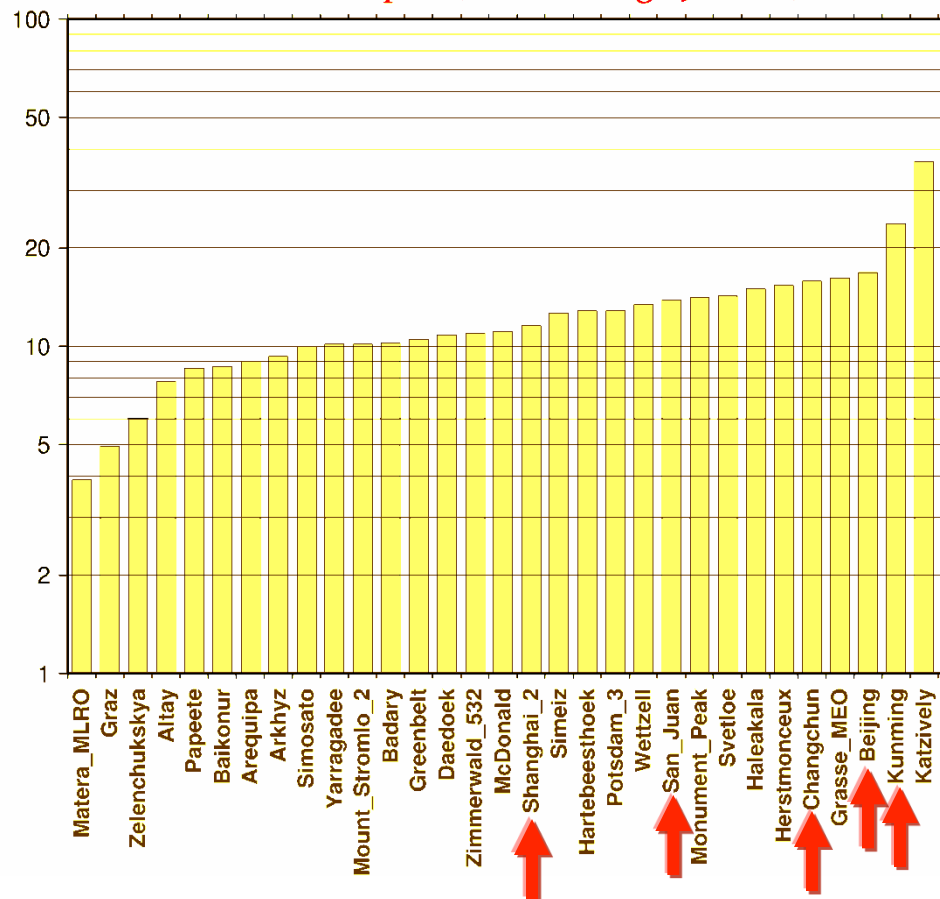
calibration RMS

from April 1, 2014 through June 30, 2014



LAGEOS RMS

from April 1, 2014 through June 30, 2014





## 3. Improvement of performances of SLR system

### ● Daylight track to HEO satellites

- Through updating of SLR system, Shanghai, Changchun, Beijing and Kunming station have the ability of daylight tracking with kHz repetition rate.
- With the development of Satellites Navigation System (Glonass, Galileo, Compass), the daylight tracking to HEO satellites becomes the focus for the Chinese SLR stations to support POD of navigation satellites.
- Improvements of laser, telescope pointing, laser beam monitor, narrow band filter etc., Shanghai and Changchun stations have successfully measured some HEO satellites in daytime and the corresponding work are also undergoing in the Beijing and Kunming stations.



## 4. Future development

- 1) **One-meter level telescope systems with SLR measurement**
  - Under the national projects, two one-meter level telescopes will be developed for SLR measurement in the Changchun and Wuhan station in the two years.
- 2) **Development of a new SLR station**
  - A new SLR station will be developed in Xinjiang Uygur Autonomous Region in the northwest China in the three or four years and will participate in global SLR campaign and the great contributions to Chinese SLR.



## 4. Future development

### 3) Chinese compact SLR systems in the Shanghai

- Compact SLR systems with the characteristics of low cost, maintenance, movable, co-location of VLBI, GNSS sites for space geodesy.
- Development and Promotion of compact SLR systems within Chinese SLR network with the capability of observing MEO satellites.

### 4) Developments and applications of 10kHz SLR technology

- Shanghai has been developing 10kHz SLR technology for one year and the satellites have been measured at nighttime and daytime.



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**Thanks for your attention!**