International Laser Ranging Service (ILRS)

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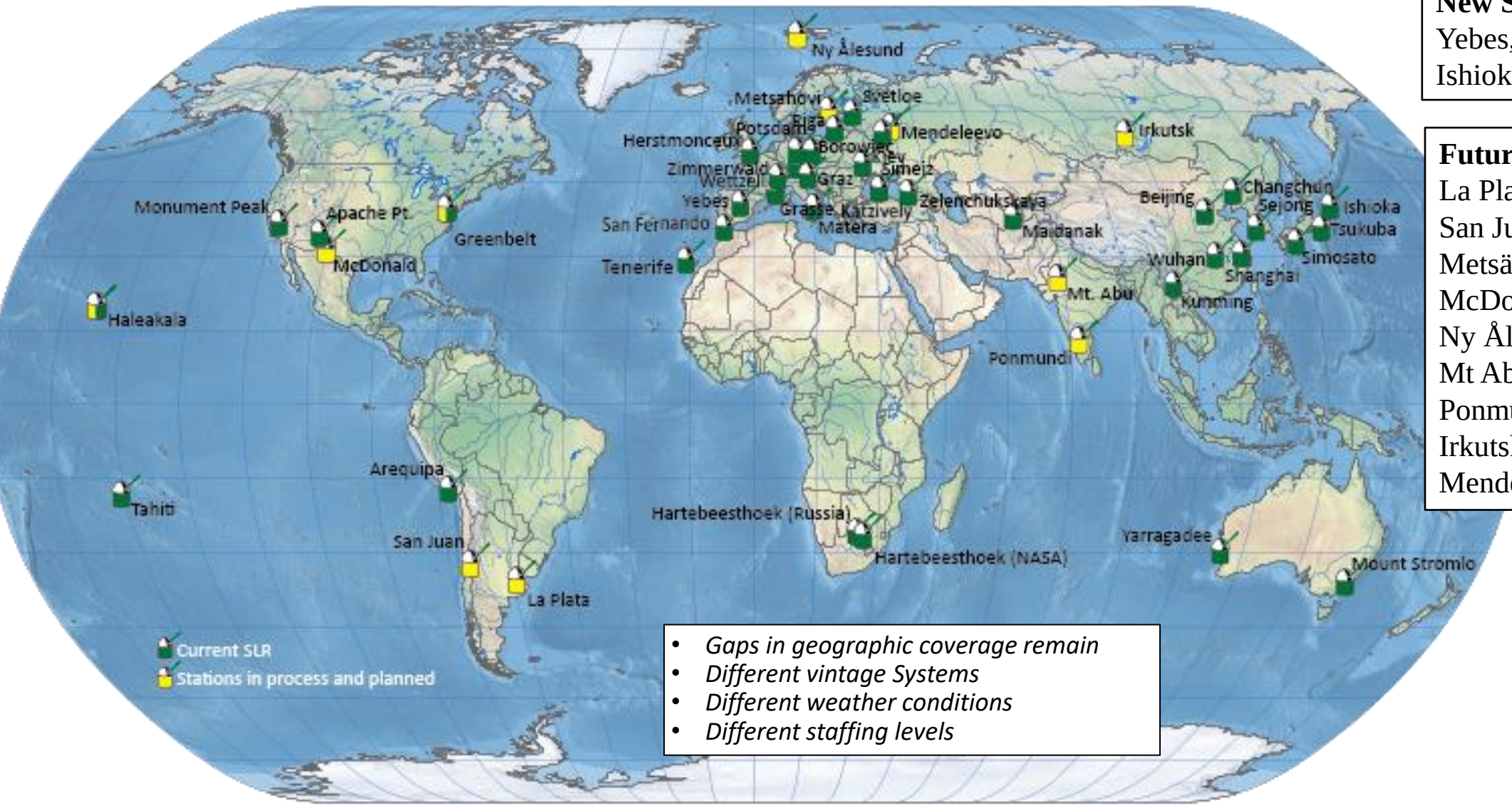
GGOS Days 2024

October 10th and 11th, 2024

Potsdam, Germany

ILRS – GGOS Days Report - Network

Current and Planned ILRS Network



- *Gaps in geographic coverage remain*
- *Different vintage Systems*
- *Different weather conditions*
- *Different staffing levels*

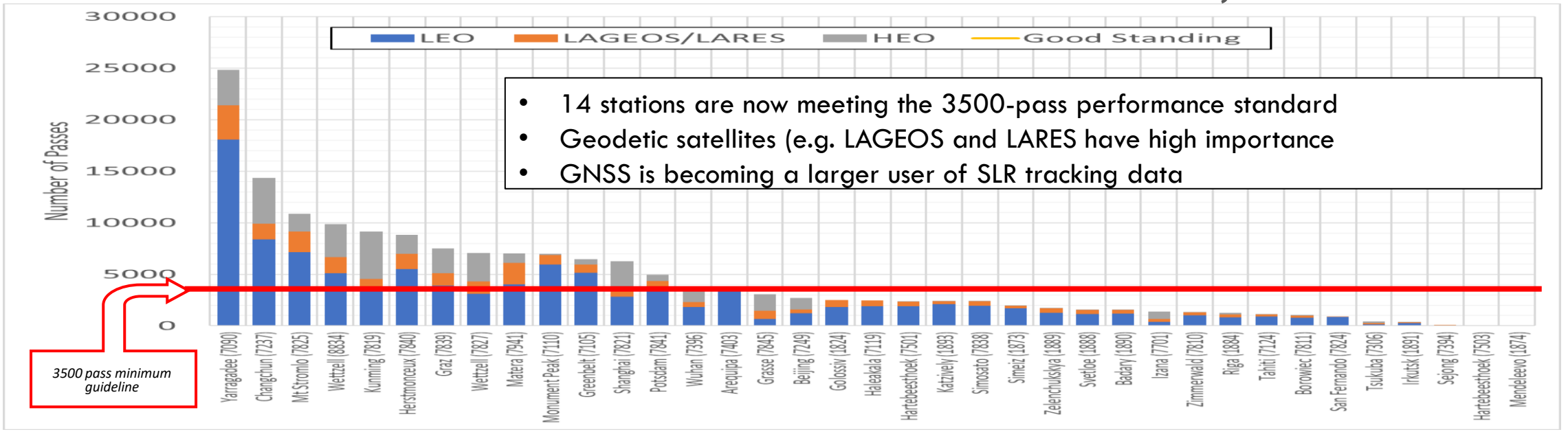
New Stations (2023-2024)
Yebes, Spain
Ishioka, Japan

Future Stations (2024-2027)
La Plata, Argentina
San Juan, Argentina
Metsähovi, Finland
McDonald, TX, USA
Ny Ålesund, Norway
Mt Abu, India
Ponmundi, India
Irkutsk (Tochka), Russia
Mendeleevo (Tochka), Russia

ILRS – GGOS Days Report - Network

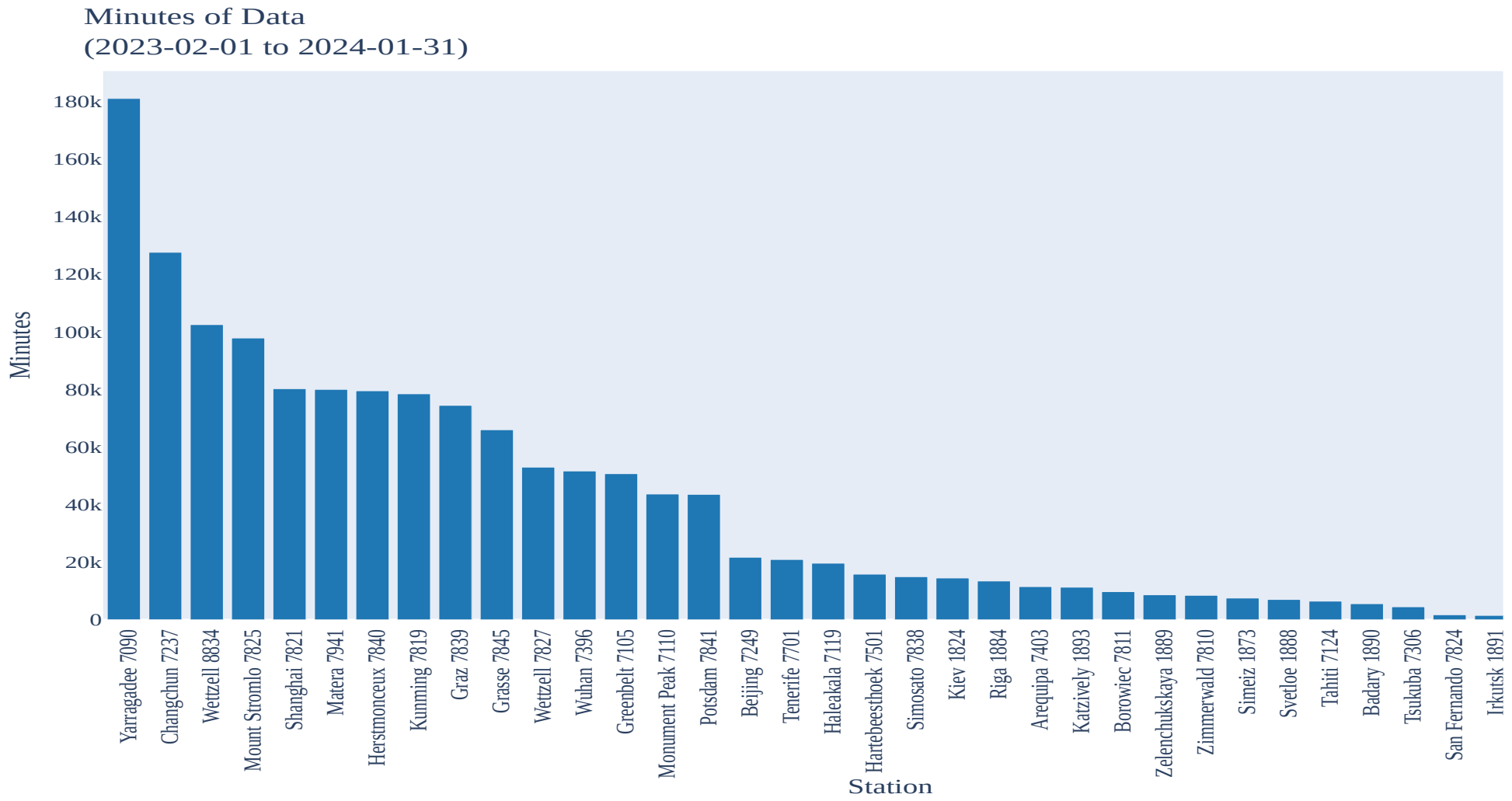
- JAXA developed a new SLR station in the Tsukuba Space Center (7306, Ibaraki, Japan), it has been operating since June 2023. Ranging precision is less than 1 cm for LAGEOS, it has recently passed quarantine; Mt. Stromlo (7825, Australia) has been qualified after some repair/upgrade. Yebes (7217, Spain) has passed quarantine. Ishioka (Japan) has ranged to SARAL in Dec., 2023 and Starlett in Sept., 2024). Several new stations in process. Irkutsk and Mendeleevo are candidates for the new Russian Tochka station.
- Ny-Ålesund, Norway SLR station will be installed between the two VLBI telescopes. The dome was installed in April 2022, and the gimbal and telescope in February 2024. Operations are planned for early 2026.
- San Fernando Station upgrade is underway; operations is expected to resume in early 2025.
- ILRS CB is beginning to evaluate 'Station Survey and Plans' survey results sent from the first group of 10 underperforming stations to better understand their operational challenges.

ILRS Network Performance - Total Orbital Passes, 2023



ILRS – GGOS Days Report - Network

➢ **Network Performance in minutes (2023):**



Omni-SLR

Omni-SLR ISHIOKA 7317

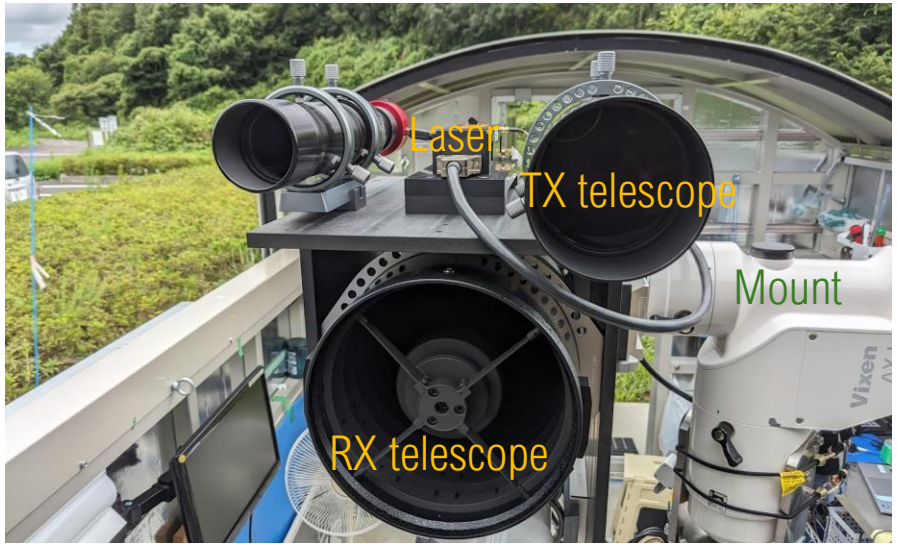
HITOTSUBASHI UNIVERSITY

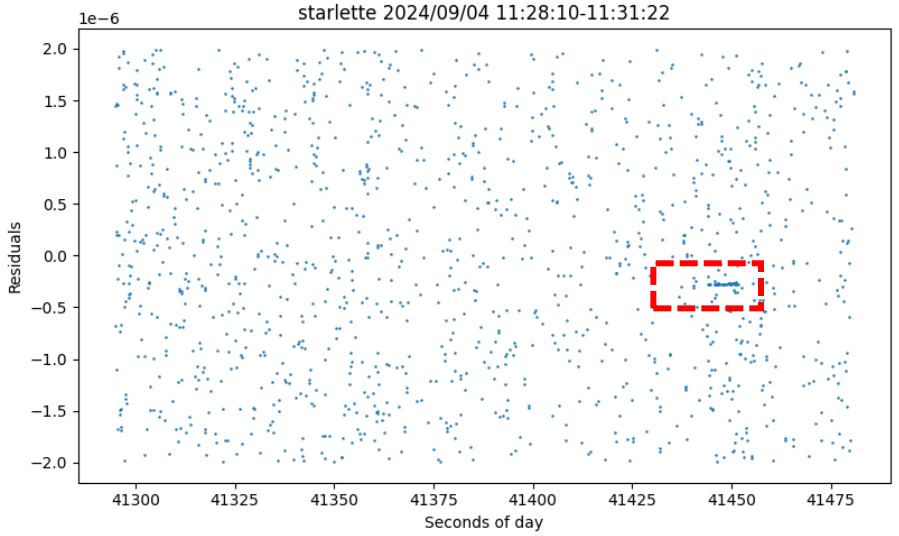
THE UNIVERSITY OF TOKYO

NAOJ National Astronomical Observatory of Japan

being supported by other institutes and companies.

1 ns pulse width, 10 kHz, 532 nm, 6 microJ CryLAS laser; Vixen AXJ mount; 20 cm RX telescope; Hamamatsu MPPC SPAD module; Swabian Time Tagger event timer, etc





Basic Concepts

Very Compact

Very Low-cost

Multi-purpose

More stations, More data!

Approved as an engineering station of ILRS with the CDP Pad Number "7317".

Plans and Visions

- To function as an SLR station (ex. Eccentricity vector measurements, CRD data generation, daytime operation, etc.).
- To evaluate its quality and stability.
- To be collocated with VLBI & GNSS at Ishioka.
- To explore applications (T&F, communications, etc.).
- To test it at Syowa@Antarctica (early 2027).
- To expand the worldwide SLR network.

ILRS – GGOS Days Report - Missions

- Galileo for Science Campaign underway, focused on elliptical orbit satellites (201 and 202). New Galileo-225 and -227 added to ILRS roster.
- The JAXA ALOS-4 advanced Earth observation satellite, launched on June 30th, 2024 will be supported by ILRS with restricted tracking. The satellite will be observing the Earth's surface using its onboard phased array type L-band synthetic aperture radar (SAR). Tracking campaign planned for early November.
- Launch of the Ekagaku-1 satellelite has been delayed to 2025.
- New lunar retroreflectors on NASA's Commercial Lunar Payload Services (CLPS) and Artemis missions are being prepared for deployment over the next few years. The Next Generation Lunar Retroreflector NGLR is anticipated to be on the moon in early 2025; its ILRS support request is being reviewed.
- QZS-5/6/7 from JAXA missions will be requiring support from the ILRS. Satellites have slightly different features and parameters than the other QZS satellites in the constellation.
- JAXA has been developing a Precision Orbit Determination (POD) algorithm called "PPP in Space" that realizes real-time PPP in orbit using MADOCA-PPP transmitted from the QZSS L6E signal. They plan to demonstrate this mission on the QPS-SAR satellite, a LEO small-satellite, in 2025. The mission is targeting centimeter-level orbit determination and requires a high precision reference and will be seeking tracking support from the ILRS.
- "Missions Tracking Reports" were requested from selected LEO missions supported. All currently under review by the ILRS. The intention here is to begin developring summary reports for general distribution.

ILRS – GGOS Days Report – Missions (cont.)

- WESTPAC tracking campaign is underway by selected stations (lead by the NEWG). WESTPAC may be resurrected if it is deemed useful for the geodetic constellation.
- ESA GENESIS Mission co-locates in space all four of the Space Geodesy measurement techniques currently used for ITRF. Clément Courde (Observatoire de la Côte d'Azur, Nice, France) is the Chair of Satellite Laser Ranging Working Group (SLR WG); Mathis Blossfeld (TUM, Germany) is the Deputy. Missions, Networks and Engineering, Data Format & Procedures, Analysis Standing Committies and ILRS CB members participate in the SLR WG. The first meeting to define requirements was held early in September 2024. Follow up meetings will continue discussions on requirements and simulations to support them.
- Lunar Laser Ranging and Transponder activities: there are 6 lunar ranging Analysis Centers. Lunar ranging Stations include: Apollo (USA), Grasse (France), Matera (Italy), Wettzell (Germany) and stations in progress in China, Russian, and South Africa.

5 reflectors on the Moon and new reflectors in a near future (2024-2025) on the Moon & on orbiter:

- NASA-NGLR-1&2
- ESA-MoonLIGHT & Lunar Pathfinder
- CNSA-Tiandu-1 & CAS-1

Science and application with Transponders:

Ongoing:

- CSS-LTT (2022, underway) 2-way asynchronous

Upcoming:

- ACES-ELT: European Laser Timing (ELT) experiment, part of the ESA's Atomic Clock Ensemble in Space (ACES) mission, launch in early 2025.
- LTT on CAS-1

ILRS – GGOS Days Report - Analysis

- ILRS contribution to the ITRF2020 update (2021-2023) provided at the end of April 2024.
- A new Analysis Center, CNES (Toulouse), has joined the ILRS and has been routinely submitting the official products since May 2024.
- Inclusion of LARES-2 as the fifth satellite in the Geodtic Constellation is underway.
- Reprocessing of the 30 years (1993-2023) of SLR data using ITRF2020 is underway using a fully consistent time series of coordinates, EOPs and orbits.

ILRS – GGOS Days Report – News and Events

News:

- Contributed to the IAG Geodesist Handbook (July 2024).
- ILRS GB news: Krzysztof Sośnica (Institute of Geodesy and Geoinformatics, Wrocław University of Environmental and Life Sciences, Poland) is a new appointed member of the ILRS GB (Representative of IAG Commission 1); we thank Urs Hugentobler (Technische Universität München, Germany) for his service to the ILRS.

Events:

- Hosted the Virtual 2023 International Workshop on Laser Ranging (IWLR) during the week of October 16th-20th, 2023 (https://ilrs.gsfc.nasa.gov/lw23/index.html). Sessions on Missions & Applications, New technology/Systems and Operations, Analysis, Lunar Laser Ranging (LLR) and Space Debris were attended by more than 200 participants from 25 countries.
- The 23rd International Workshop on Laser Ranging (IWLR) will be hosted in Kunming, China, during the week of October 20th-26th, 2024 (https://23rdworkshop.casconf.cn/).
- The ILRS Specialized Workshop will be hosted in Arequipa, Peru, in 2025, dates TBD.
- The Argentinean CONICET and German BKG (AGGO) in Argentina are possible hosts for 24th IWLR in 2026.It will be proposed at the 23rd IWLR in Kunming, China. CONICET offered the venue in the center of Buenos Aires, the Argentine capital.