

S2. Improving station performance

14 talks
12 posters

Broad range of topics:

- Information and feedback from analysis results
- Reports on new equipment
- Results of recent experiments
- Station development updates
- New concepts for retroreflectors
- ...

Quality of Orbit Predictions for Satellites Tracked by SLR stations

Krzysztof Sosnica

- Analysis of quality of predictions (from SLR solutions and final IGS orbits)
- Several providers: who is right?
- Substantial differences between providers, depending on satellites
 - Large diffs. for Etalon, less than 1 m for LAGEOS
 - Huge discrepancies for Galileo (ESA preds. better than GAL)
 - GLONASS (CODE much better than SGF)
 - LEO: very big along-track errors (solar activity)

Time Bias Service: Latest Status, Implementation and Prediction Quality Analysis

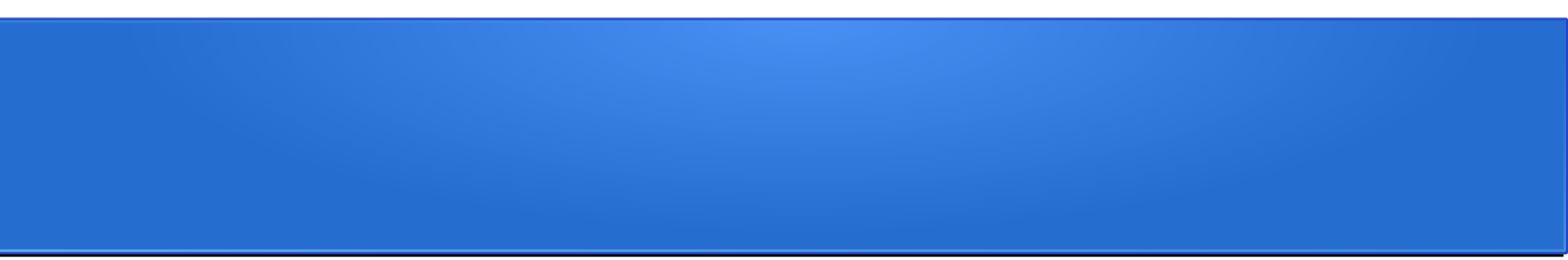
Sven Bauer

- Digos service to predict TB
- Web interface + JSON API for convenient system integration
- Rationale:
 - Quicker target acquisition (less TB hunting)
 - Convenient for automation
 - Initial stages of missions
- Monitoring TB trends:
 - Icesat-2 negative systematic offset
 - IRNSS prediction outage (?!?!)
- Journal of Geodesy SI

Copernicus Sentinel-3 Mission – Orbit Validation and SLR Station Quality Assessm.

Marc Fernández Usón

- GMV POD service
- Passed on ESA's thank you message (“we do use the data”, “it's important for us”)
- Pointed out some unexpected behaviour, e.g. several cases of loss of tracking
 - Would like to know if there's anything they can do/how to communicate (*CB, directly*)
- Presented a Range Bias analysis for all tracking stations and both Sentinel-3 sats.
- Provide annual reports (available from ILRS site)
- Migration to cloud system, would like some testing of new FTP server



An Independent Assessment of T2L2 Results from NASA SLR Network

Van Husson

- T2L2 results provided TB measurements for participating stations
- Comparison of T2L2 TB to MOBLAS and TLRS on-site timing data
- These stations have comprehensive system logs with detailed timing info
- Was able to compute UTC offsets from GPS offsets and the logged data
- Good agreement in general between T2L2 and this exercise:
- Found a few jumps that require attention and further detective work
- Encourage stations to update system logs if components of the timing system changes

Statistical Evaluation of Simulated Normal Points Calculated with a Wiener Filter

Stefan Riepl

- Residual vs NP RMS correlation well known for many stations
- Is there a better data reduction method than iterative rejection?
- Presented Wiener filter results with simulated NP
- Correlation between NP residual and NP centroid much reduced
- Correlation between NP residual and NP RMS reduced
- Slightly different behaviour for different targets, but in general trends observed in empirical data reproduced

INSAR Corner Cube at GRSM

Mourad Aimar

- GRSM (SLR/LLR, 2xGNSS, DORIS)
- Since recently an INSAR cube too!
 - Monitoring of local ties
 - Local ground displacement
 - Seasonal hydrological loading
 - Possible complement for tide gauges
- SAR images for free from ESA (Sentinel-1A/B)
- Target designed, built and deployment location optimised



Effects of Reference Frequency Stability to SLR Measurement Errors

Vyacheslav Ivanov

- Study on the requirements of frequency stability needed to achieve mm accuracy for our various targets (different for e.g. LAGEOS and GNSS)
- Current accuracy goals require improvement in the short-term frequency stability
- eg. $10e-12$ requirement for 1 mm LAGEOS

Status of Laser Timing at Stafford, Virginia

Jake Griffiths

- Engineering station at Stafford
- Various system development updates
- NOAA National Geodetic Survey developed techniques to determine various critical local distances
- First tracks to LAGEOS and Ajisai
- POD of Ajisai, bias analysis

Lunar Laser Ranging Research and Experiment in Yunnan Observatories

Yuqiang Li

- LLR @ Yunnan
- Performed multiple upgrades
 - Optics
 - Telescope servos
 - New detector
 - New laser
- LLR successful: 58 NPs
- Next: precision (new laser)

Two Way Ranging on Lunar Reconnaissance Orbiter at Grasse Meo Station

Herve Mariey

- LRO has a retroreflector array...
- but it's very small : (
- Why?
 - time transfer
 - Comparison of retroreflector state between Apollo and LRO
- Reported how they managed to close the link and obtain returns

SRC PAS Borowiec Second Satellite Tracking System

Tomasz Suchodolski

- Refurbished pre-existing 2nd SLR system
- New motors and encoders (now 1" resolution)
- Various system development items (low cost approach)
 - Inexpensive ADSB system
 - Meteo station based on open source software (name?). Good sensor quality, inexpensive
 - Weather balloon tracking
- Khz laser in one or two years?

Smart Transmit Telescope

Georg Kirchner

- Cute design for a transmit telescope
 - COTS lenses
 - 70 mm beam
- Rotatable $\frac{1}{2}$ waveplate + polarising beam splitter → continuous energy control
- Energy monitoring
- LIDAR ($\frac{1}{4}$ waveplate to extract LIDAR photons) → good cloud detector

New SPAD Detector Package for SLR and Laser Time Transfer

Ivan Prochazka

- Old diodes no longer available, alternative found
- Compact package with absolute minimum number of components
- No temperature sensor: tricky temp. stabilisation, needs calibration choosing desired behaviour for specific application
- NO CFD :)
- Stability +/- 500 fs/day; TDEV 60 fs @ hours
- Multi-photon? No C-SPAD, but up to 50% return rate response is flat
- 35% QE @ 532 nm, 18 ps RMS

BLITS-M & Preliminary Results of Ground Tests Over the Ring Array

Andrey Sokolov

- New blits-like target designed, built and tested
 - 16.7 Kg
 - Visible magnitude ~11-12
 - 10 turns / minute spin rate
 - Launch date: 25th December
- New design for GLONASS LRA (designed, built, mechanical testing)
 - Bigger retroreflectors (36 CCR)
 - x1.5 cross section, less ranging error, optimised thermal behaviour
 - Will produce 2 distinctive peaks in detection distribution (RMS ~8 mm)

Posters

- An SLR Receiver to Discriminate Single- from Multiphoton Events. **Hausler S.**
- Upgrade Hardware & Software Golosiiv Station 1824. **Medvedskyy M.**
- Raspberry Pi-based Laser Beam Profiler. **Mourlon T.**
- Processing of SLR Data to GNSS Satellites at IGiG WUELS. **Sosnica K.**
- San Fernando Laser Station Updates and New Improvements. **Sánchez Piedra M.**
- The Performance of 1 m Apperture SLR Telescope in Wuhan JiuFeng station. **Zhang J.**
- Continuous Sky Clarity Monitoring at Riga and Metsahovi: Jan-2018 / Jun-2019. **Del Pino J.**
- Accuracy of Single Measurements in a Laser Location. **Ignatenko I.**
- And Array of Compact Cheap CCRs for High-elliptical Navigation Spacecraft. **Sokolov A.**
- All Sky Camera Concept. **Gunther E.**
- Mount Model of 1.2 m Telescope at Kunming Station. **Li R.**