





The Satellite Laser Ranging System of AGGO



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GGRF Workshop Buenos Aires, 20.09.2019



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Geodetic data is always available...



... but where does it come from?







Overview

AGGO-SLR System:

- System Setup
- Operation History
- Capacity Building and Knowledge Transfer







Laser and detection system

Laser pulse generation



Detection system





SPAD



- Passively mode coupled Ti:Sa Oscillator
- Primary wavelength 847 nm above first water vapour absorption bands Secondary wavelength 423.5 nm for two colour measurements
- 40 ps pulse width, 100 Hz repetition rate
- Single Photon detection; precision: few mm
- Robust and precise system suitable for \rightarrow environments with high humidity

System Setup: Laser and detection







Telescope



- Galilean Refractor: Sealed, easy to align
- 50 cm aperture, 10 m focal length
- Coudé-type optical path
- Monostatic system with Alt/Az mount
- Fast mount: 15°/s Azimuth, 10°/s Elevation
- Azimuth Platform: Air cushion on polished granite block
- Compact, robust, precise and fast telescope
 Field maintenance possible

System Setup: Telescope







Operation in Wettzell and Concepción



- 1998: Delivery to Wettzell First measurements as 7594
- 2000: Upgrade of Telescope Control Unit from Transputer to Real Time Linux PC
- 2002: Transfer to Concepción 7405
- 2006: Upgrade of Laser System: from 10 Hz to 100 Hz





Operation history: Early Years







2008: Replacement of Coudé Prisms in the Field



Operation history: System Maintenance







27.02.2010: MW 8.8 Earthquake







- 80 km distance to epicentre while SLR-system in operation
- > 3 m jump towards S-W
- No damage in telescope/laser
- Operation resumed after only 6 weeks

Operation history: Earthquake





AGGO

2011: First SLR measurements to Galileo 101 and 102





Protocol of first SLR measurements on 27.11.2011

Aktuelles – Satellitenbahn Verifikation mit TIGO SLR

accepted

returns

21462





Operation history: Galileo









2016-19: Lifetime extension by decades

- 2015: Move from Concepción to La Plata, 3500 km crossing the Andes and ٠ Argentina; System arrives without major damage; AGGO SLR: 7408
- Overhaul project: Extend lifetime 2 decades ۲
 - Overhaul Elevation Gearbox
 - Develop Remote Control Unit
 - Overhaul cart and cabling
 - Overhaul Telescope Control Unit (TCU)
- Install new TCU: End of 2019
- **Resume Operation: Early 2020**













2018-19: Elevation Gearbox Overhaul in the Field



- No sophisticated tools needed
- Telescope tube remains sealed
- Clear alignment procedure







Capacity Building and Knowledge Transfer: Elevation Gearbox Overhaul







Remote Control Unit (RCU) Development



- Implement cutting edge technology on industry standard basis; modular and extendible
- Software and Hardware Development
- Guarantee future maintenance knowledge

Capacity Building and Knowledge Transfer: RCU / Software Development







Optical analysis of the System with ZEMAX



Capacity Building and Knowledge Transfer: Optic Design







SLR in Latin America





2nd Latin American SLR Workshop, Mendoza, 12/2017

- Linking the Latin American SLR stations
- Improving the network performance: Short Arc, Local Ties, Sharing Operation Experience
- Building up Analysis capacities
- 3rd LA SLR-Workshop in 11/2019

Capacity Building and Knowledge Transfer: SLR Network









Conclusions

- Need a robust, well designed system capable for field maintenance with a "hay bale wire".
- Need experts, a good team and strong support from home base.
- Capacity Building and Knowledge transfer is essential for continuous operation.
- Need for interchange with other stations (ILRS workshops, SIRGAS, ...).
- Be prepared to adapt to the local conditions (earthquake, power outage, custom delays, ...).







iMuchas gracias!



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