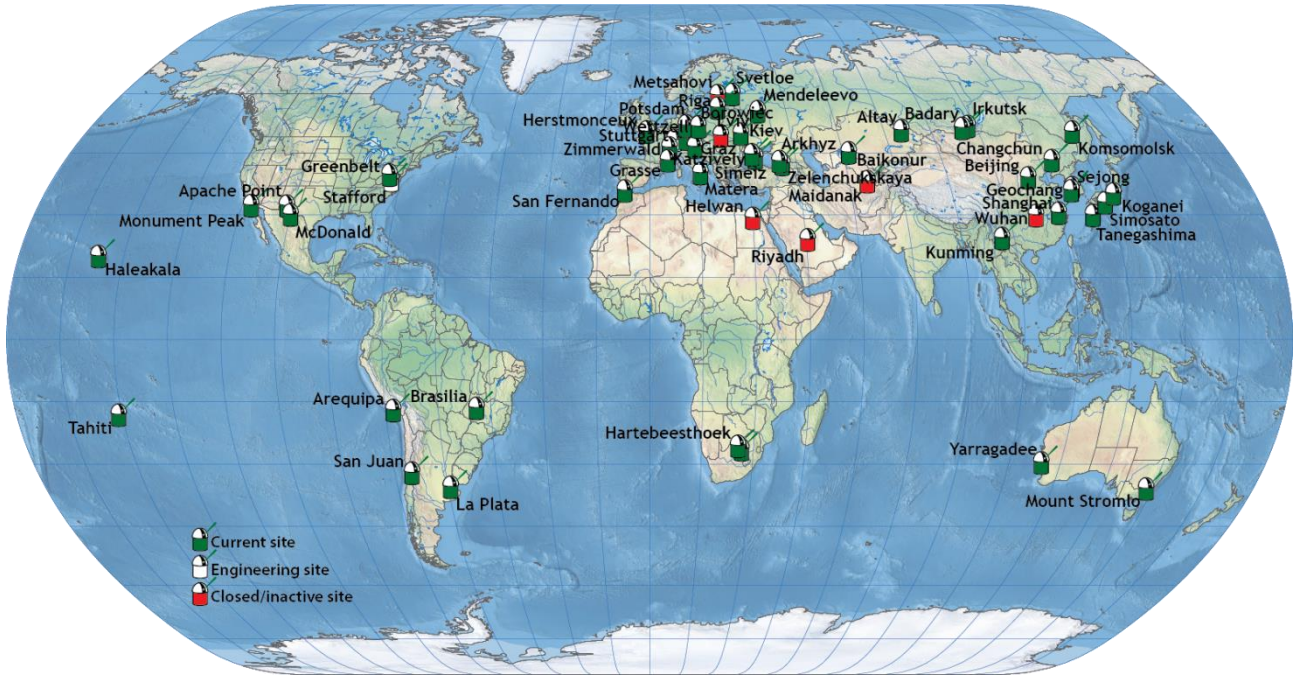
The miniSLR system

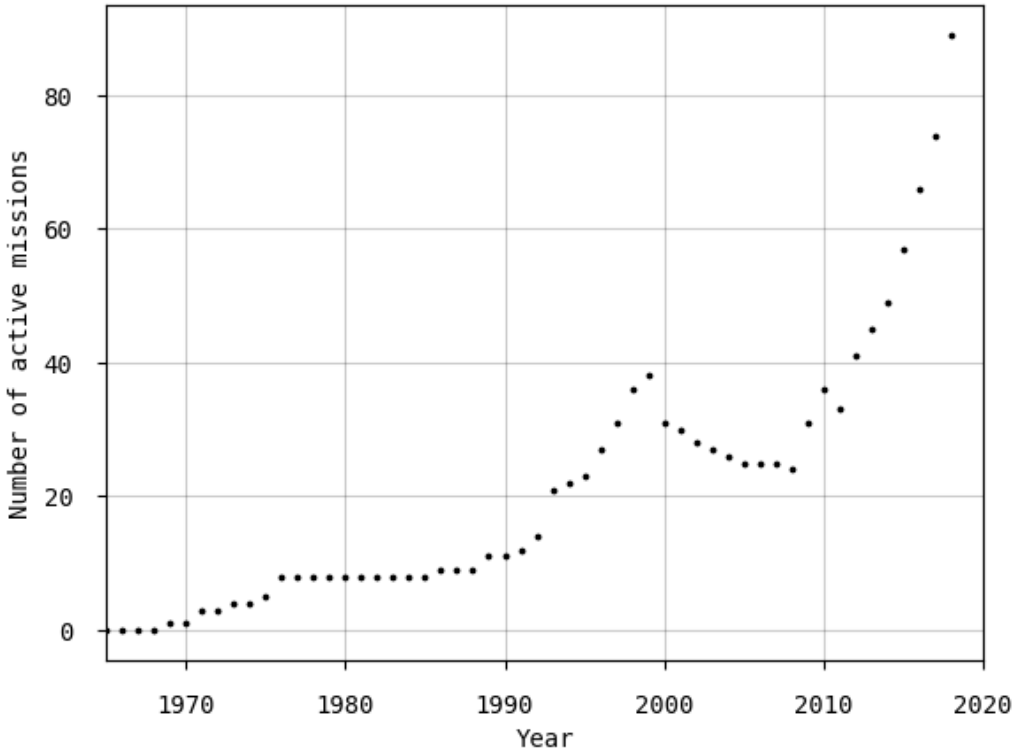
A standardized solution for routine SLR observations

Daniel Hampf
ILRS Technical Workshop 2019

New SLR stations are needed…

- More missions
- New tasks
- Still huge gaps in global coverage





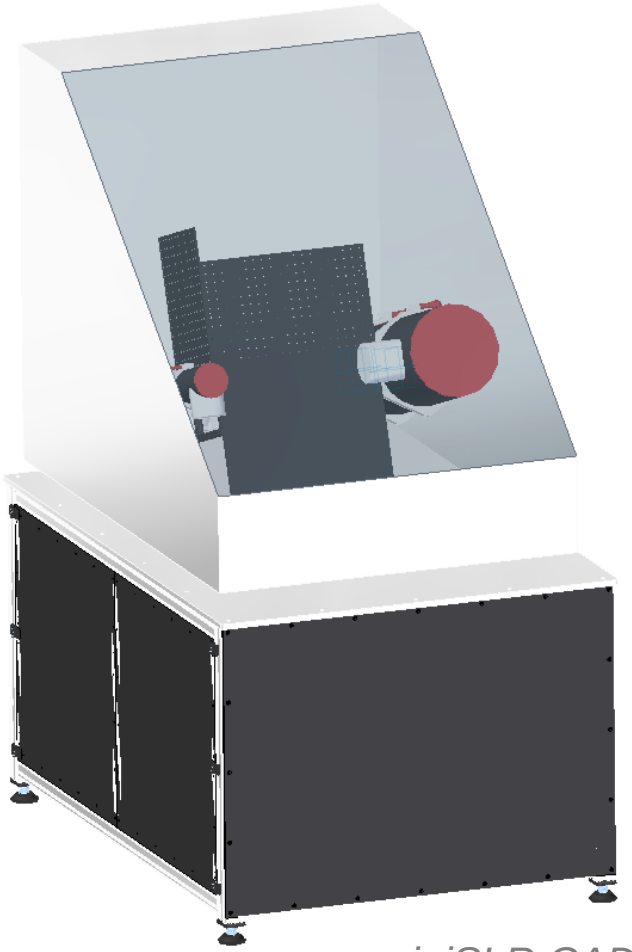
Number of SLR missions (Data: ILRS website)

Goals of the miniSLR project

- Routine ranging to
  - LEO satellites
  - Lageos
  - navigation satellites

…with sub-cm accuracy and stability

- Simple design
- Inexpensive hardware
- Easy maintenance
- Automated operation
- Small footprint
- Transportable
- Sealed and weather-proofed for use in harsh environments
- Inherently eye-safe to avoid need for aircraft surveillance



miniSLR CAD drawing (April 2018, U. Nesper)

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A simple system for the simple tasks

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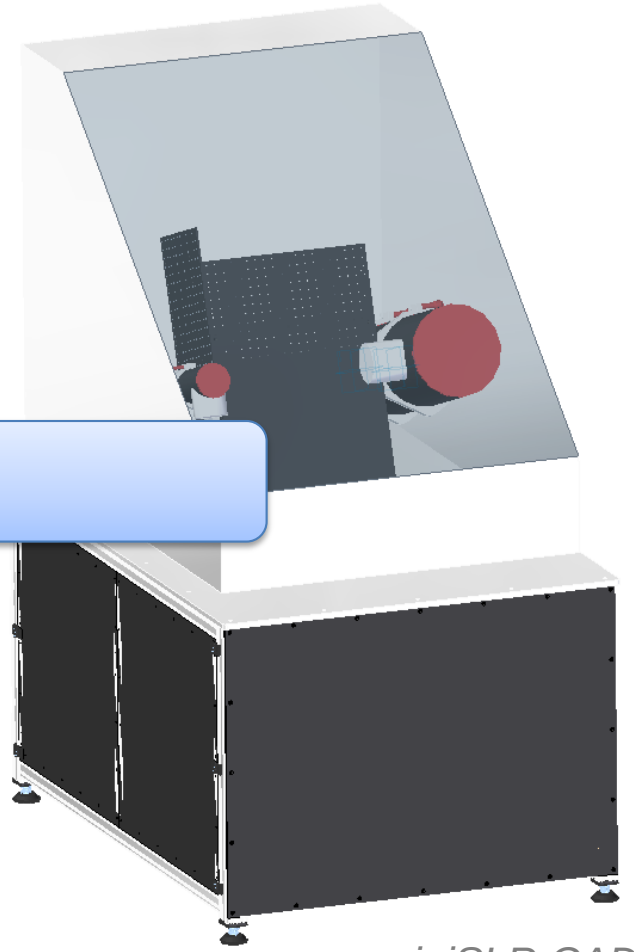
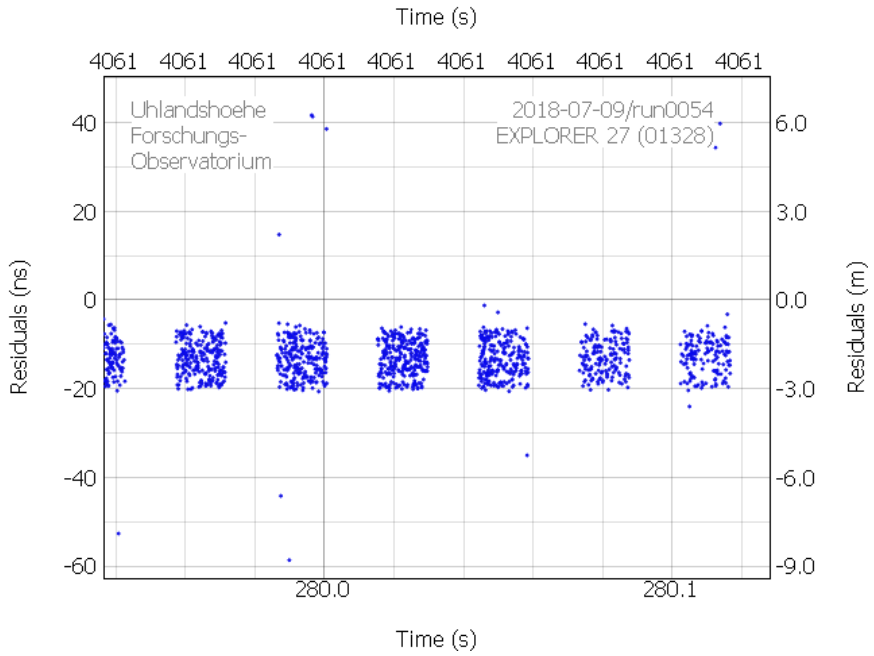


miniSLR CAD drawing (April 2018, U. Nesper)

UFO legacy

- First SLR station in Stuttgart
  - UFO (Uhlandshöhe-Forschungs-Observatorium)
  - First returns in Dec 2015
  - ILRS Engineering station since 2017

- Features:
  - 100 kHz repetition rate
  - Fibre coupled transmitter (no coudé path)
  - Ranging at 1064 nm



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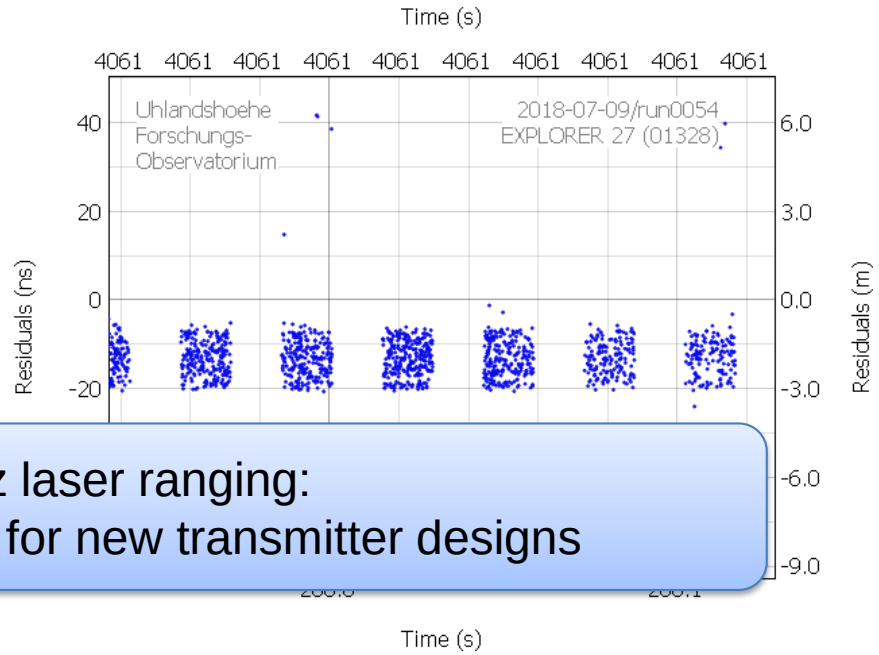
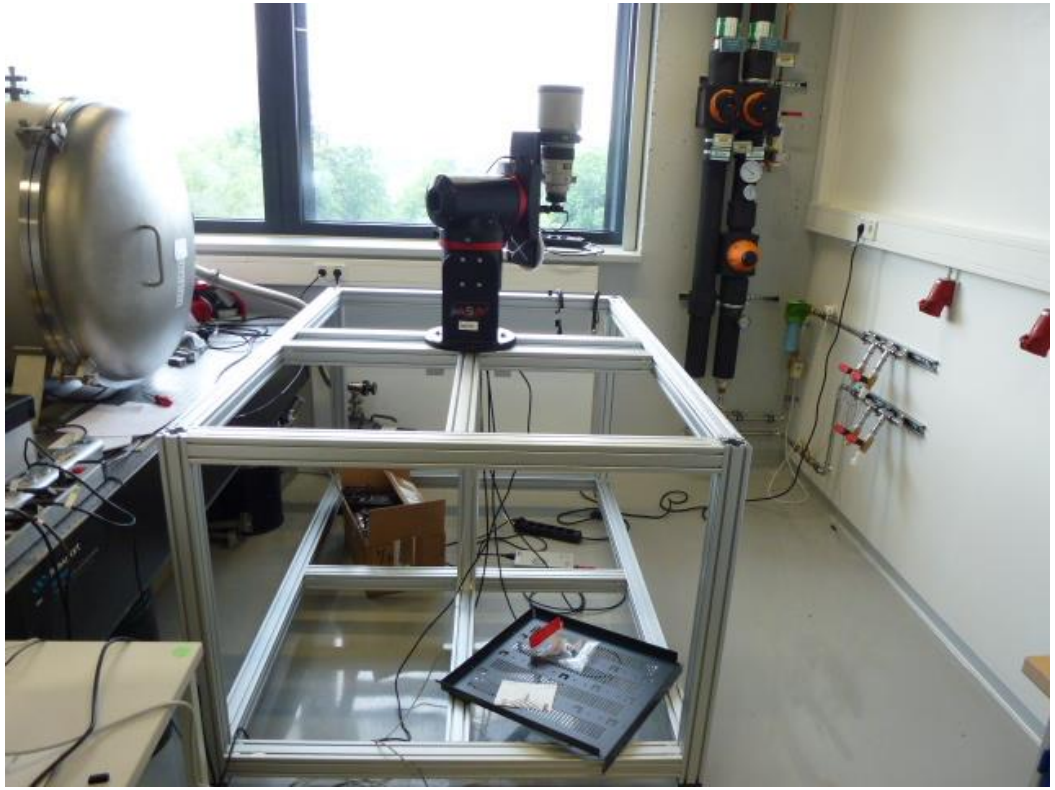


100 kHz laser ranging:
Enabling technology for new transmitter designs

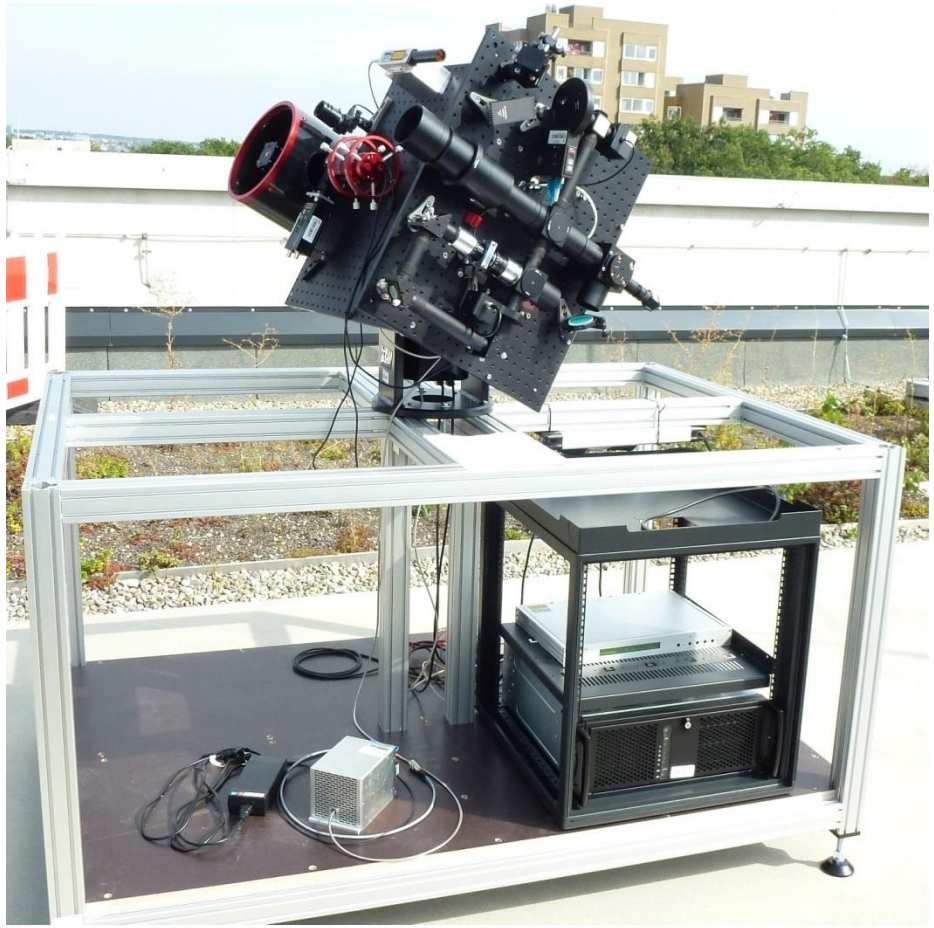
miniSLR construction

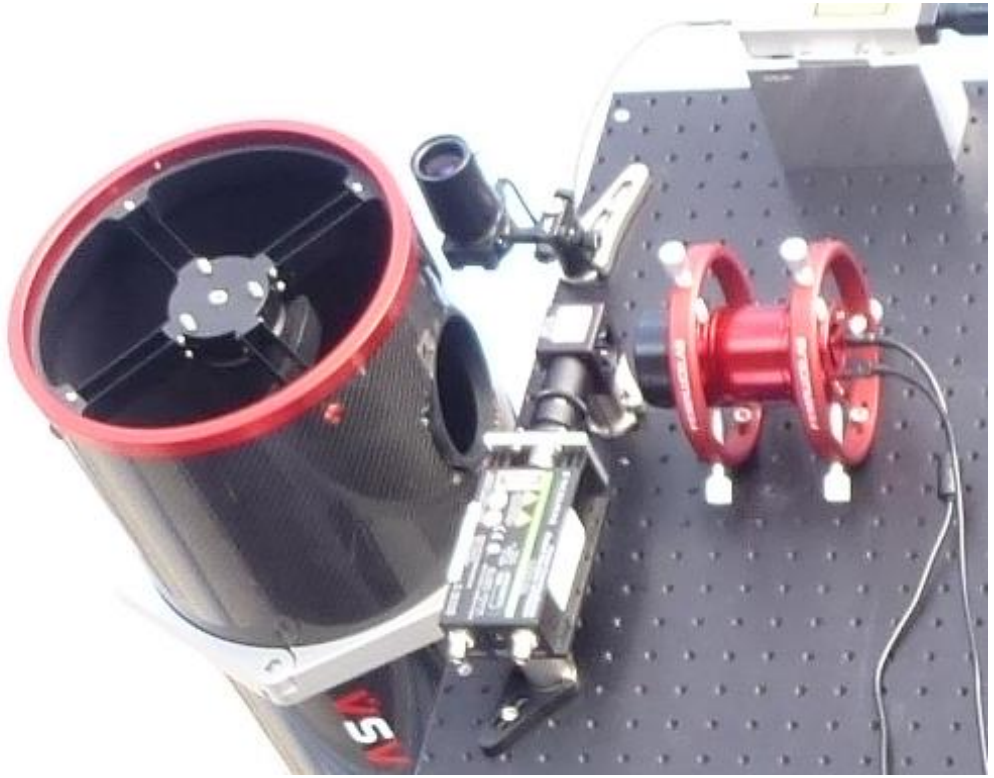


May 2018

June 2018

Transmitter and receiver





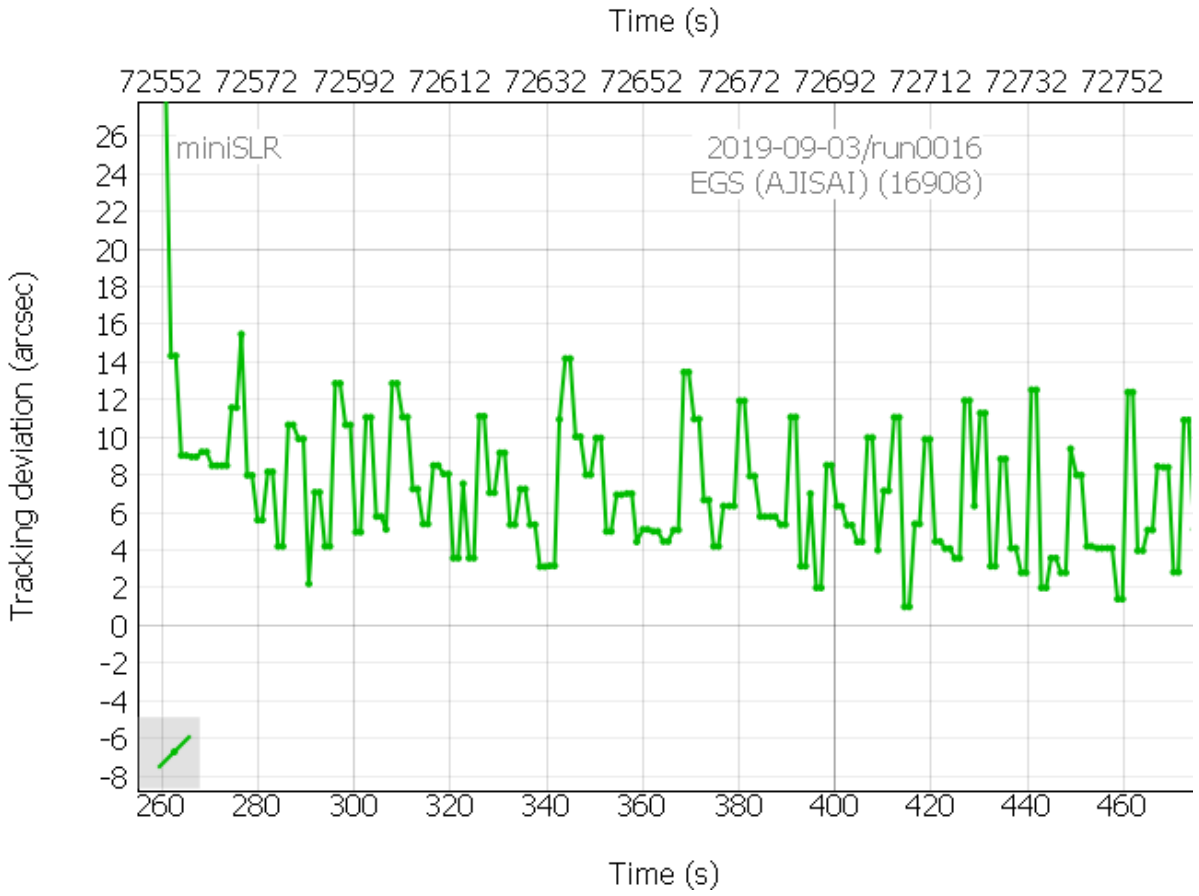
September 2018

The first winter…

January 2019

Tracking tests

SL-16 RB

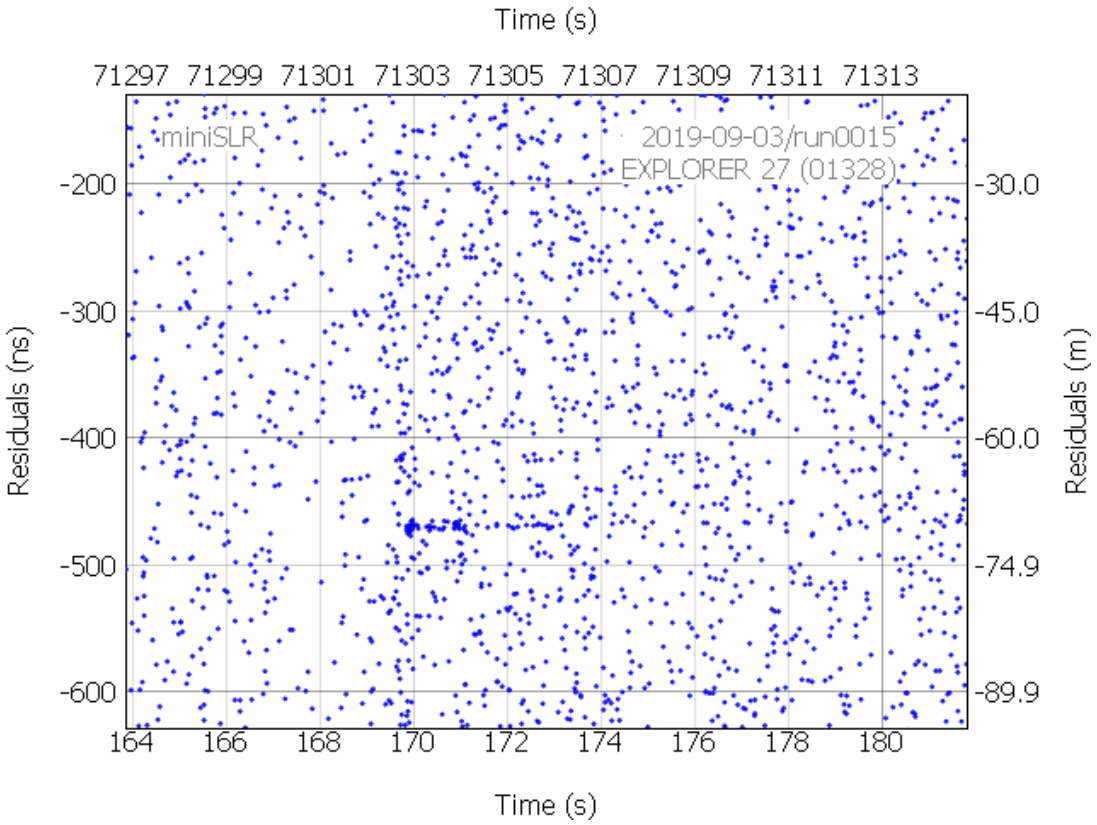


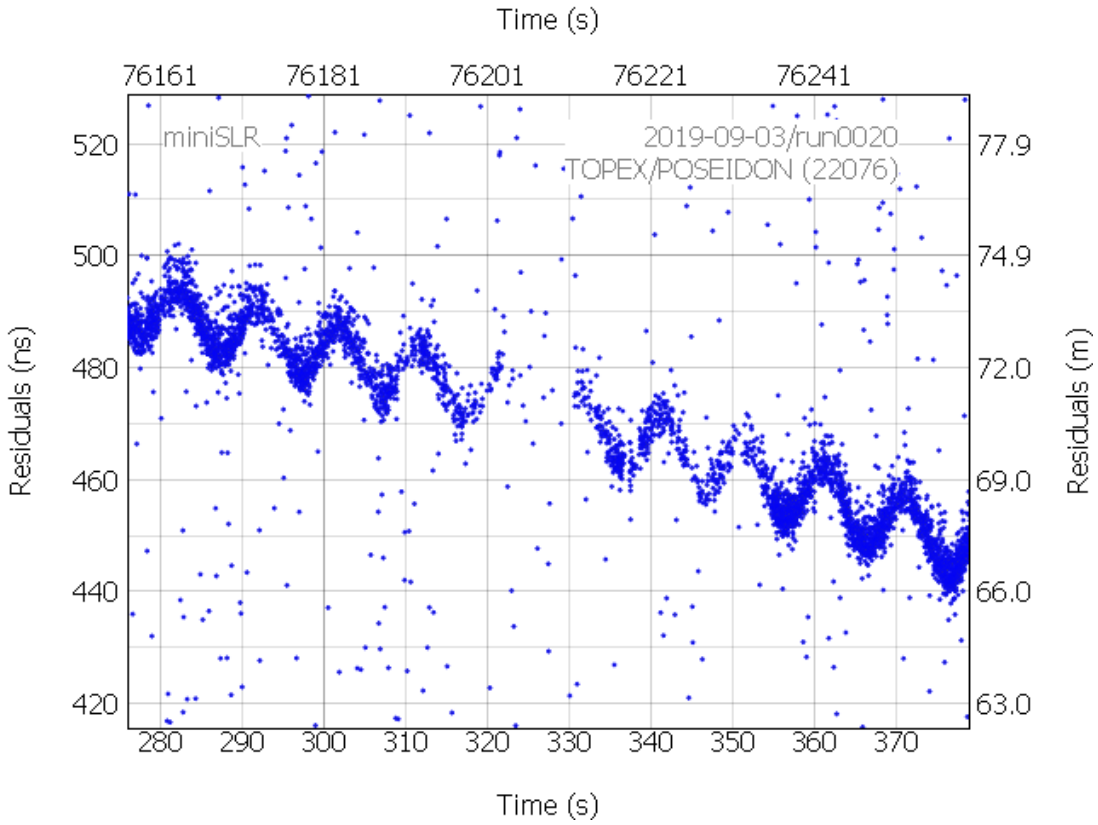
Ready to range…

July 2019

September 2019

First returns



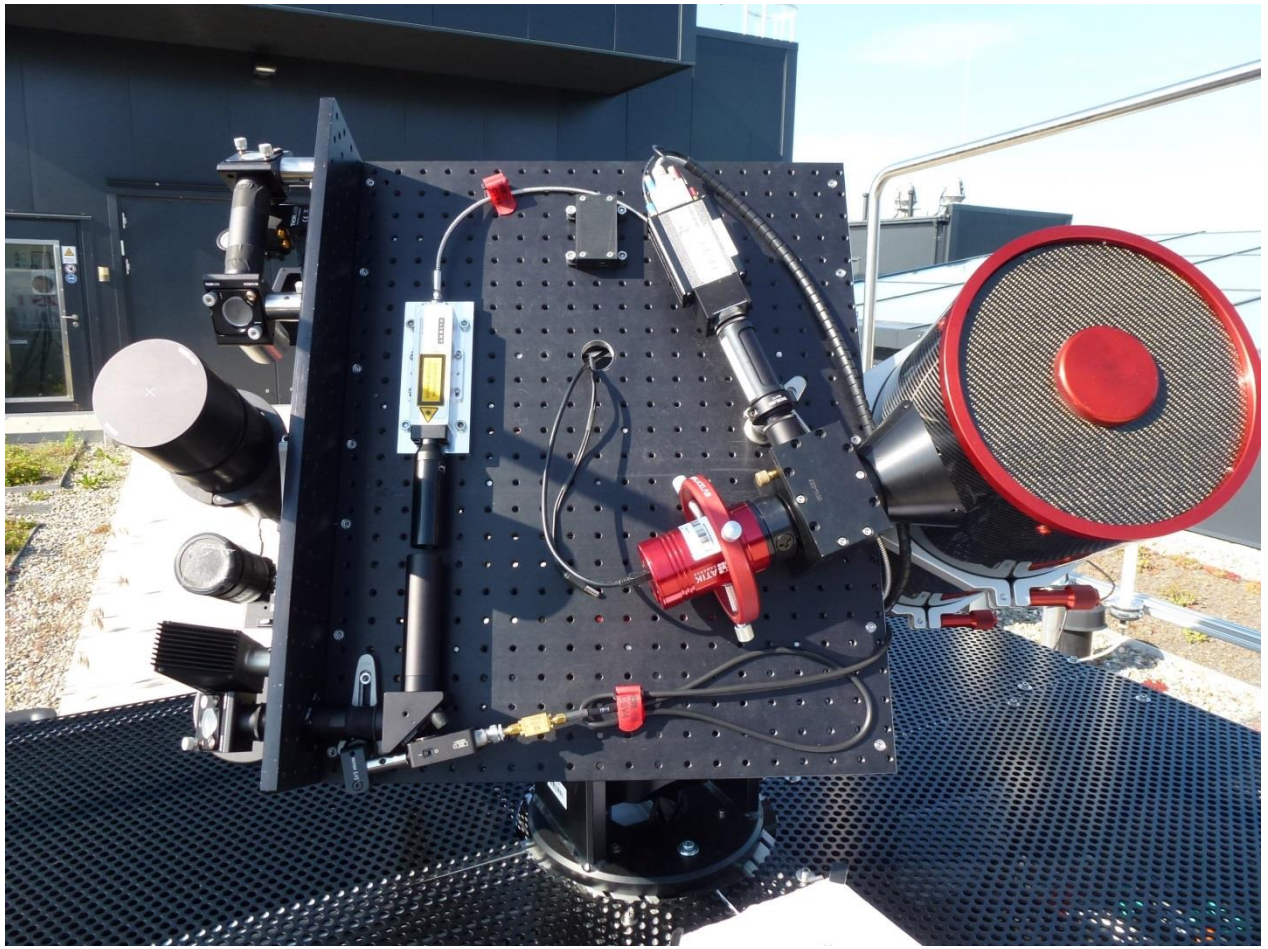


September 3rd, 2019

Specs of current system

- System components are not yet optimised
  - Not yet eye-safe
  - No good calibration yet
  - Some mechanical instabilities

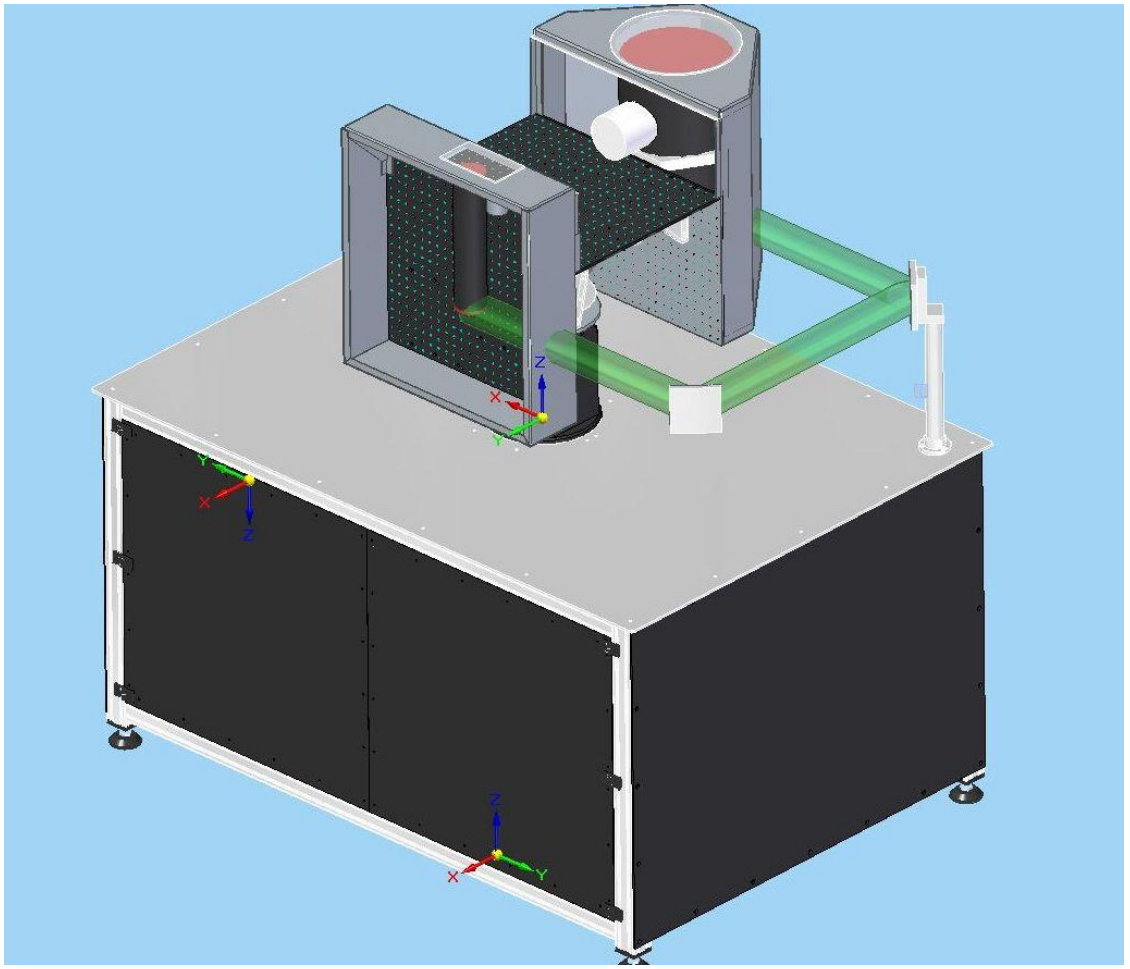
Repetition rate	27 kHz
Average power	2.2 W
Pulse duration	4.5 ns
Wavelength	1064 nm
Divergence	50 µrad
Accuracy	??
Range	Lageos (at least)



Planned upgrades

- Weather proofing / air-conditioning
- Set-up calibration target(s)
- Improve blind tracking
- Replace laser and detector (go to 1550 nm)

Repetition rate	200 kHz
Average power	10 W
Pulse duration	5 ns
Wavelength	1550 nm
Divergence	< 50 µrad
Accuracy	< 1 cm (NP)
Range	> 25 000 km



We invite for collaboration!

- We value comments / ideas / challenges from the community
- Let us know what you think (at the exhibition room)
- We’re happy to share ideas / plans / software