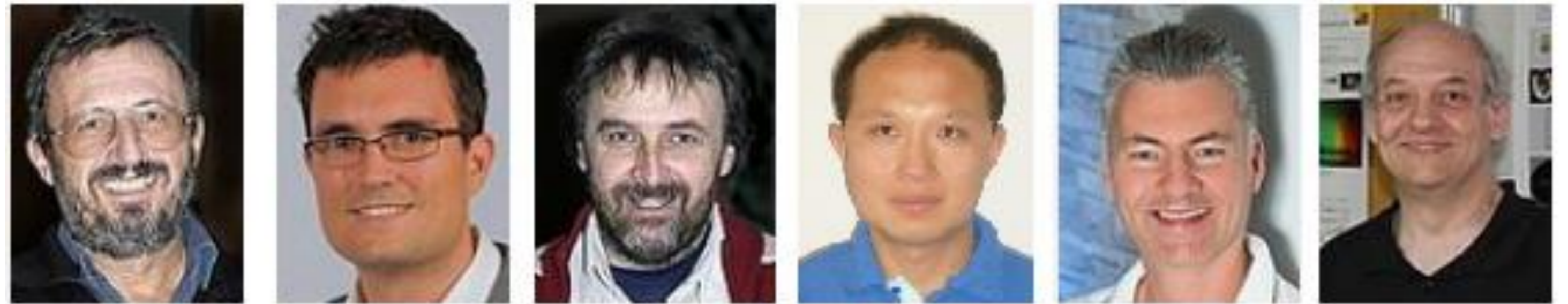


The satellite laser ranging station Graz currently employs six full-time personnel, three scientists, three engineers. Our field of work and expertise covers various different aspects ranging from geodesy, physics, astronomy, optics, mechanics, programming or electronics. In general we follow a hands-on approach allowing us to build, redesign and repair every aspect of our station. Graz SLR station is using a 2 kHz/10ps laser combined with a single-photon avalanche diode detector. Simultaneously to satellite laser ranging sunlight reflected from the satellite is gathered to record light curves also utilizing a single-photon detector with a temporal resolution of down to 20 μ s. We are currently involved in a number of different projects related to e.g. space debris, attitude determination, quantum cryptography, designing and setting up a new ESA SLR facility, or the build-up of an expert coordination center. Recently we successfully mounted a space debris laser directly on our telescope without any need of a Coudé-path.



Our team:



- Georg Kirchner: Group leader, Scientist, Electronics, Programming
- Michael Steindorfer: Scientist, Physics, Astronomy, Geodesy
- Franz Koidl: Technician, Mechanics, Electronics, Physics
- Peiyuan Wang: Scientist, Programming, Electronics
- Christian Graf: Technician, Daylight observations
- Reinhard Stieninger: Technician, Mechanics, Electronics

New IQOQI / ASA telescope on the roof in Graz

New telescope system

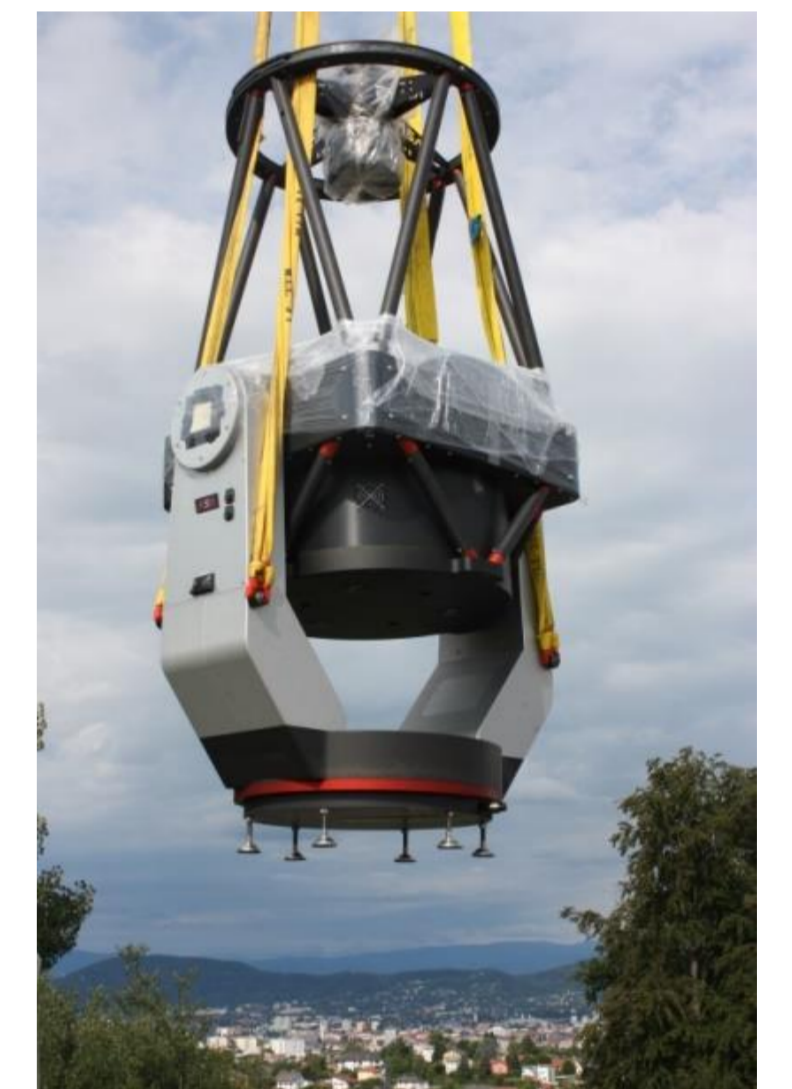
- Ritchey–Chrétien
- 80 cm diameter
- Belongs to IQOQI
- On roof of Graz building
- 4 Nazmyth foci
 - Fast switching
 - Mount modeling



New ASA / IQOQI dome



SLR dome; New dome; Astronomy dome

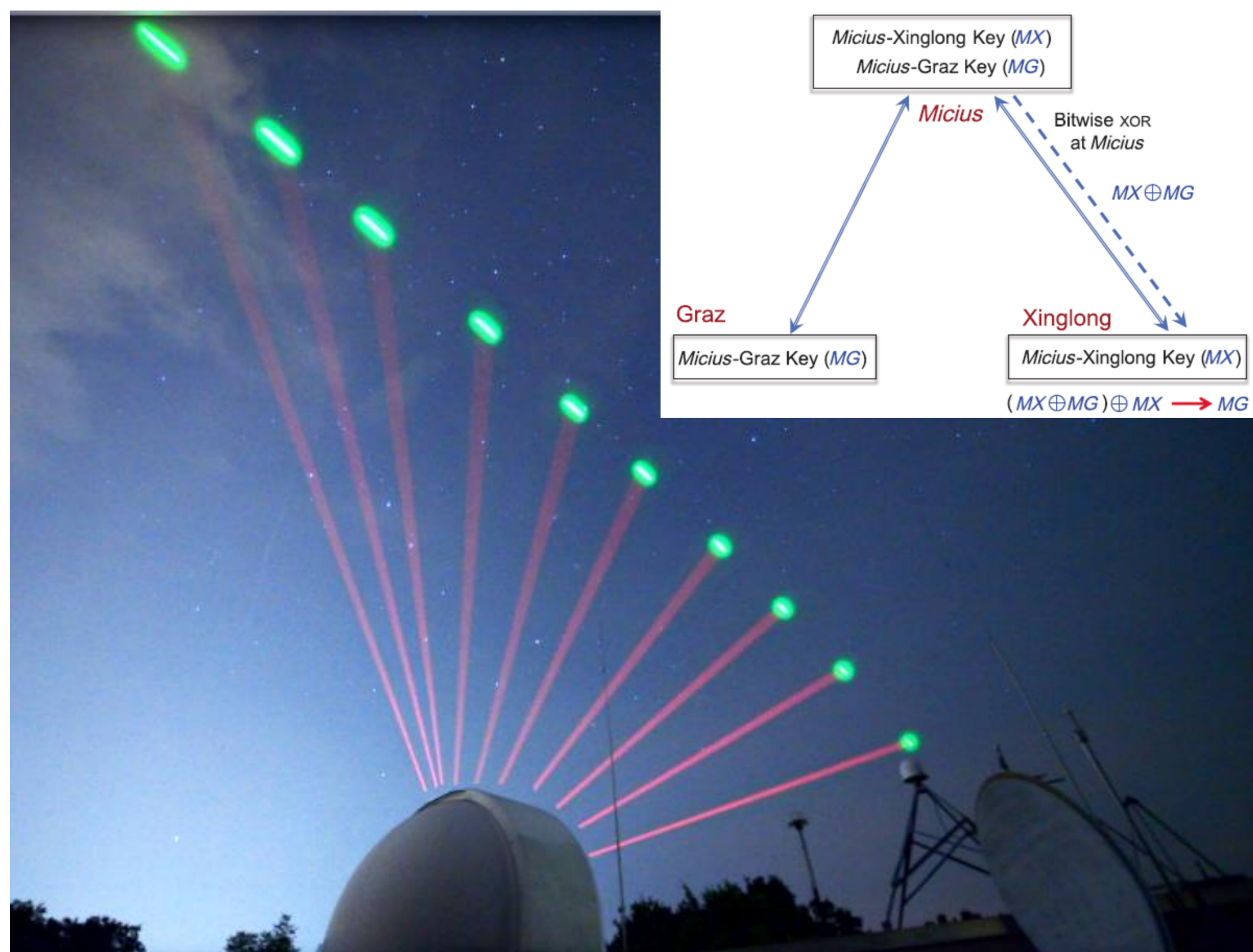


Flying over Graz

Quantum cryptography // Alcantara: Galileo attitude determination

Quantum cryptography

- Cooperation with IQOQI Vienna [1, 2]
- Uplink: orange laser, Downlink: green laser
- Public key, Graz key, Xinglong key, Bitwise xor
- Single photon detector, detects entangled photons

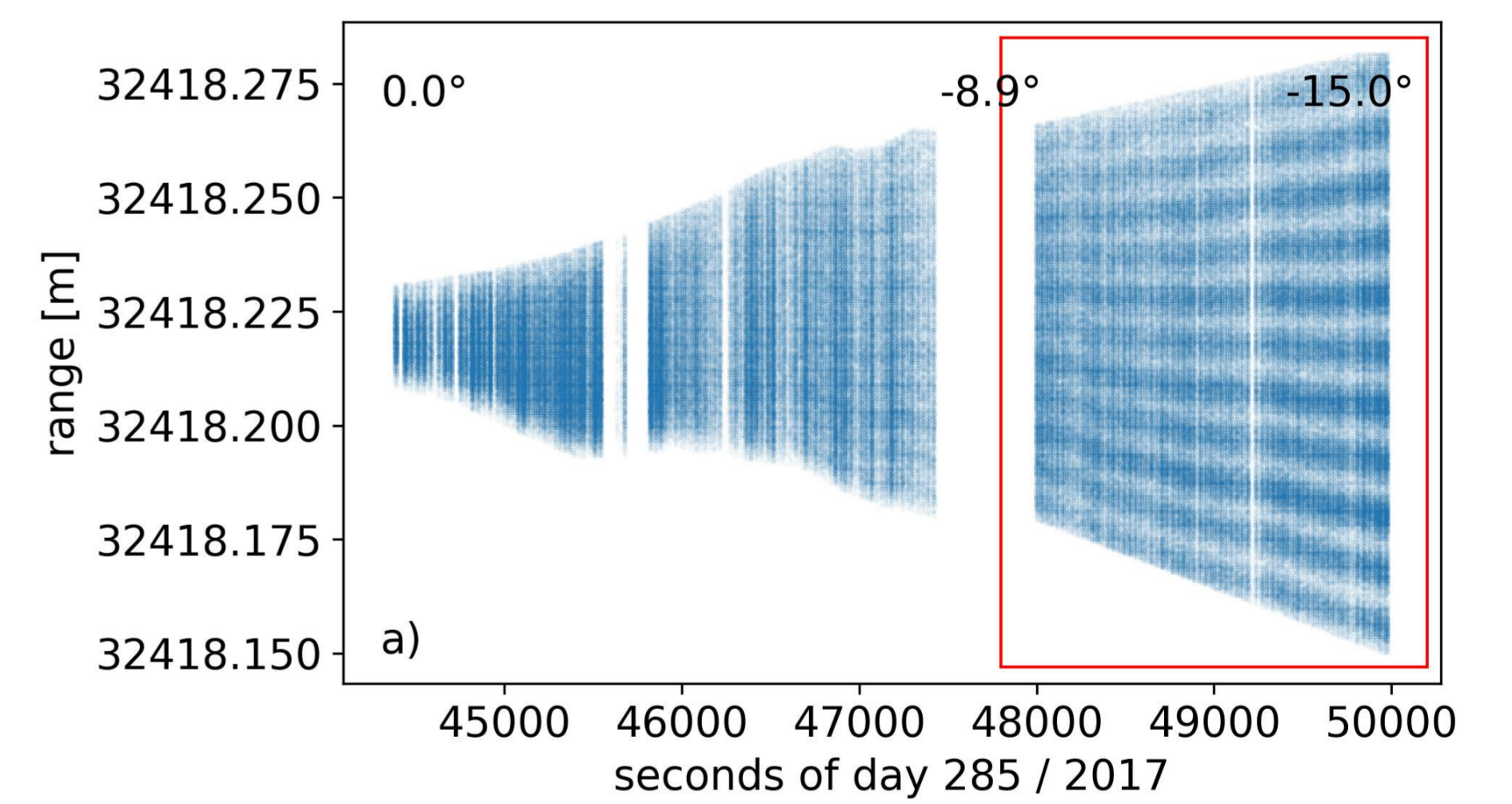


Alcantara project

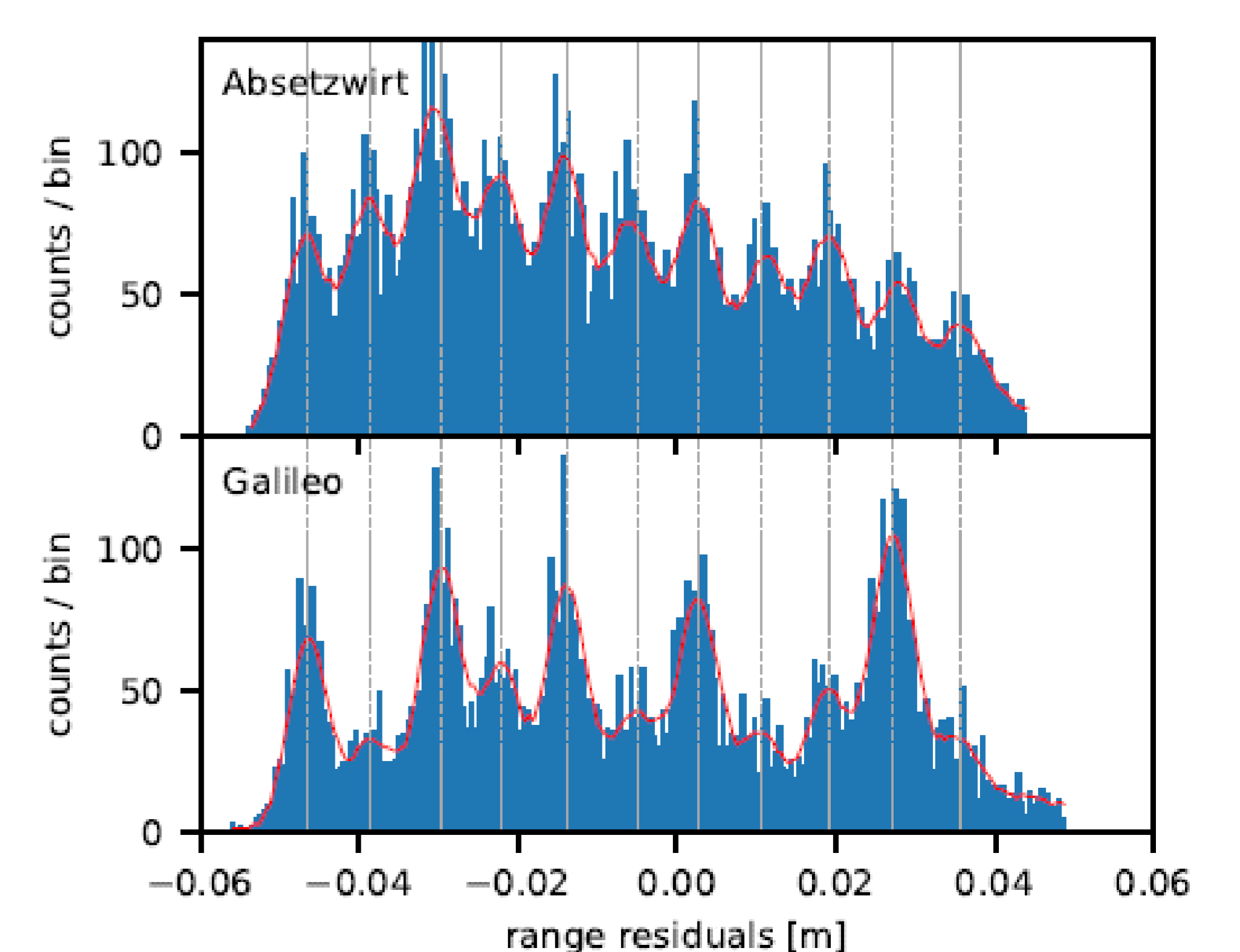
- Influence of laser beam polarization
- Attitude determination of Galileo
- High resolution kHz SLR
- Individual SLR columns identifiable
- Spare panel from ESA (32 km distance)
- Attitude determinable within 0.1°
- Comparison ground-based with Galileo



Panel @ Absetzwirt: Range vs. time



Panel @ Absetzwirt vs. Galileo 103



REFERENCES

- (1) Liao, Cai, Handsteiner, et al., Satellite-Relayed Intercontinental Quantum Network, Physical Review Letters 120, 030501 (2018)
- (2) IQOQI, Institute for Quantum Optics and Quantum Information

