



CHALMERS

Twin Telescopes at Onsala and Wettzell and their contribution to the Very Long Baseline Interferometry Global Observing System

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VGOS

- VLBI(2010) Global Observing System
- Motivation:
 - Limitations of the current VLBI system
 - New technology
 - Enhanced requirements

VGOS – Goals & Realisations

- Accuracy of station position of 1 mm
- Continuous observations for station coordinates and earth orientation parameters
- Calculation and distribution of products in less than 24 hours (Petrachenko et al., 2009)

	Current	VGOS
data transfer	usually ship disks, some e-transfer	e-transfer, e-VLBI, ship disks when required

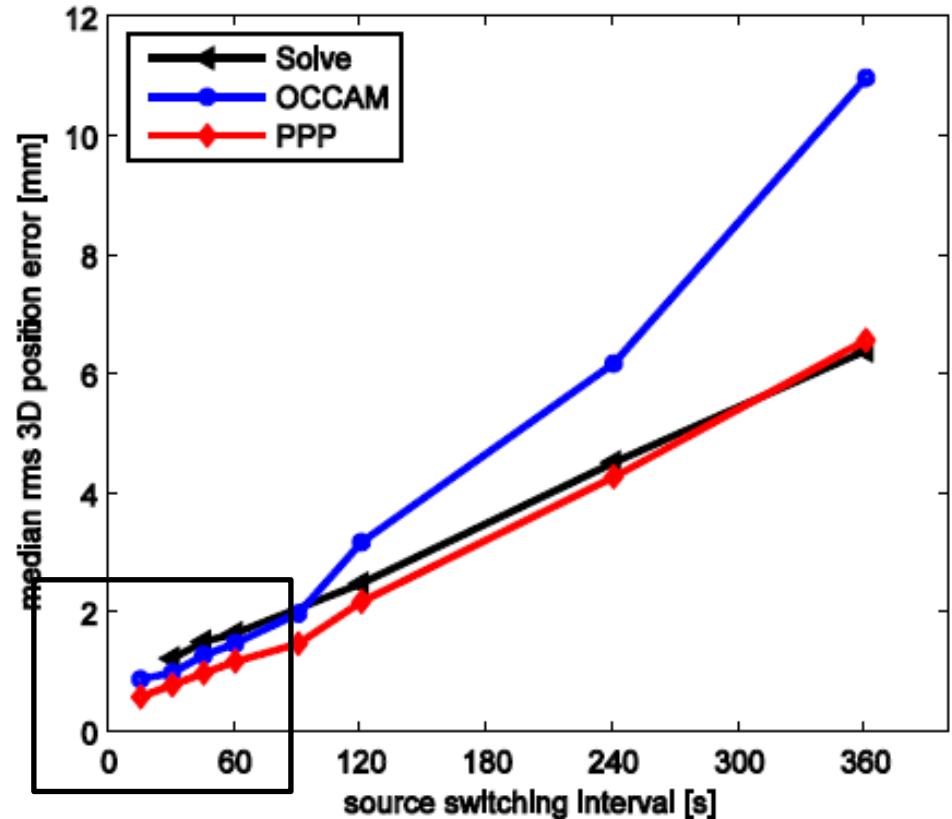
Source Switching Interval

Atmospheric turbulence is the limiting factor for geodetic VLBI

(Nilsson & Haas, 2010)

Goal

Improved sampling of the atmosphere



(Petrachenko et al., 2009)

Source Switching Interval (2)

- Reduction of slewing time

	Current	VGOS
slew speed	~ 20 - 200 deg/min	≥ 360 deg/min
antenna size	5 - 100 m dish	~ 12 m dish
sensitivity	200 - 15 000 SEFD	≤ 2 500 SEFD

Smaller and faster telescopes + twin telescopes

- Reduction of on-source time

frequency range	S/X band	~ 2 - 14 GHz
recording rate	128 - 512 Mbps	8 - 16 Gbps

Broadband observations

Twin Telescopes

- Pair of identical VLBI antennas
- Local tie vector is accurately known
- Same clock
- Same atmosphere
- Twin Telescopes in
 - Wettzell, Germany
 - Onsala, Sweden
 - Ny-Ålesund, Norway



courtesy of Dr. Alexander Neidhardt, TUM

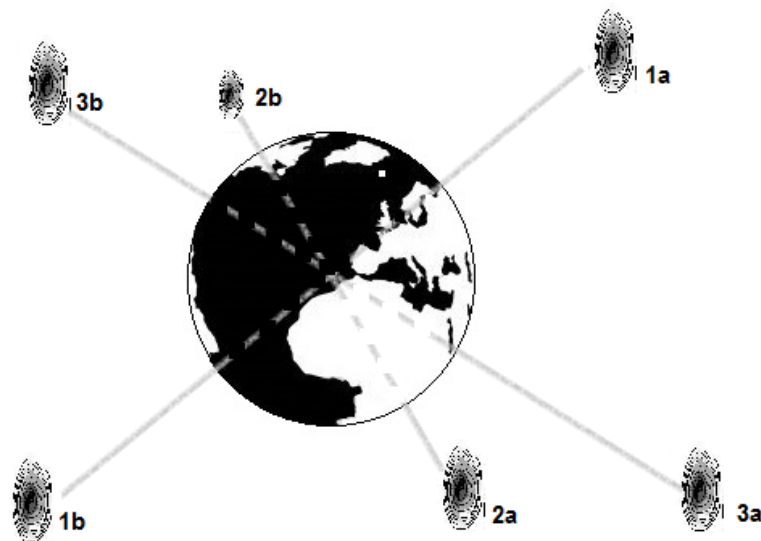
Approach

- CONT11 campaign
 - Replacing the 20 m antennas at Onsala and Wettzell with VGOS twin telescopes
- Vienna VLBI Software (VieVS)
 - Scheduling: 1 day
 - Simulation: 25 times
 - Wet troposphere
 - Clocks
 - White noise
 - Parameter estimation

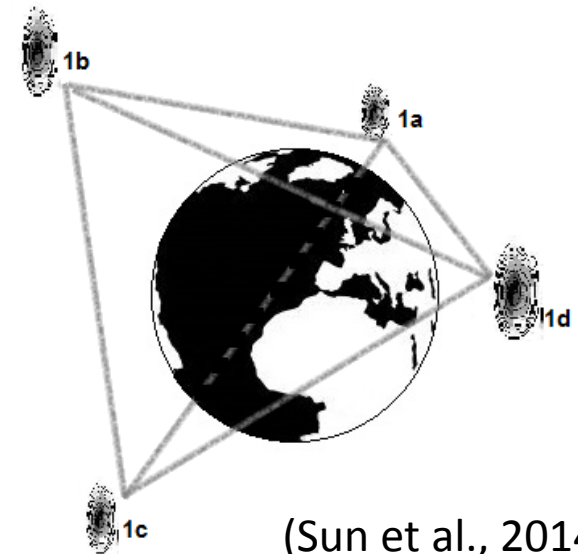


Scheduling: Source-based strategy

2 Sources at a time (2 SAAT)



4 Sources at a time (4 SAAT)

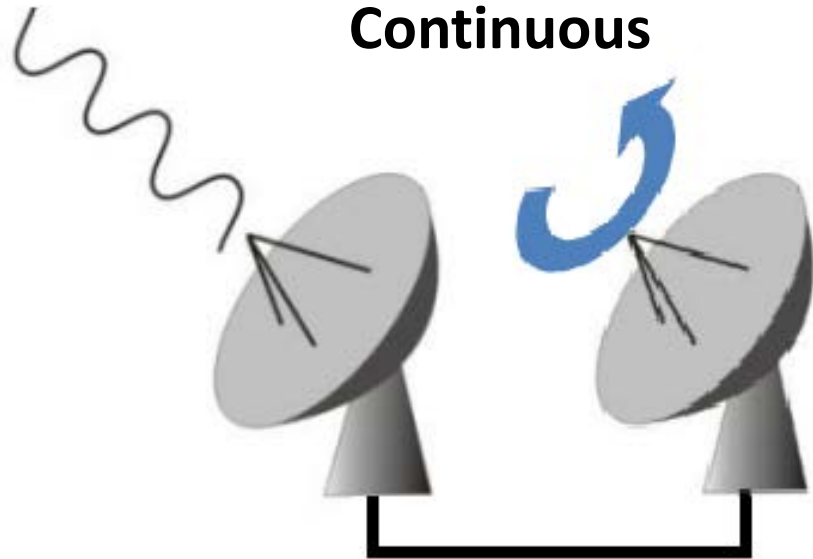


(Sun et al., 2014)

Sources are selected without considering the effects on individual stations

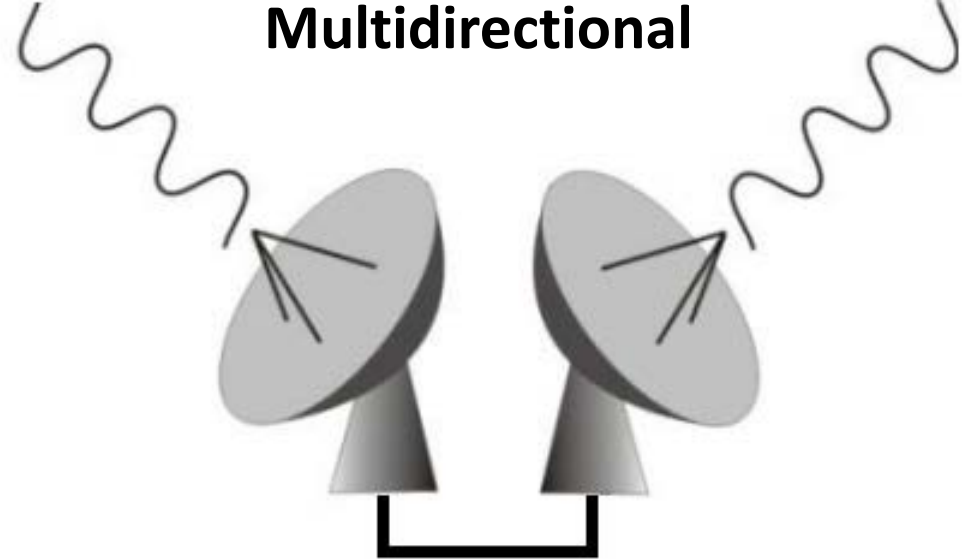
Additional observing modes for TT

Continuous



1st: observes
2nd: slews

Multidirectional

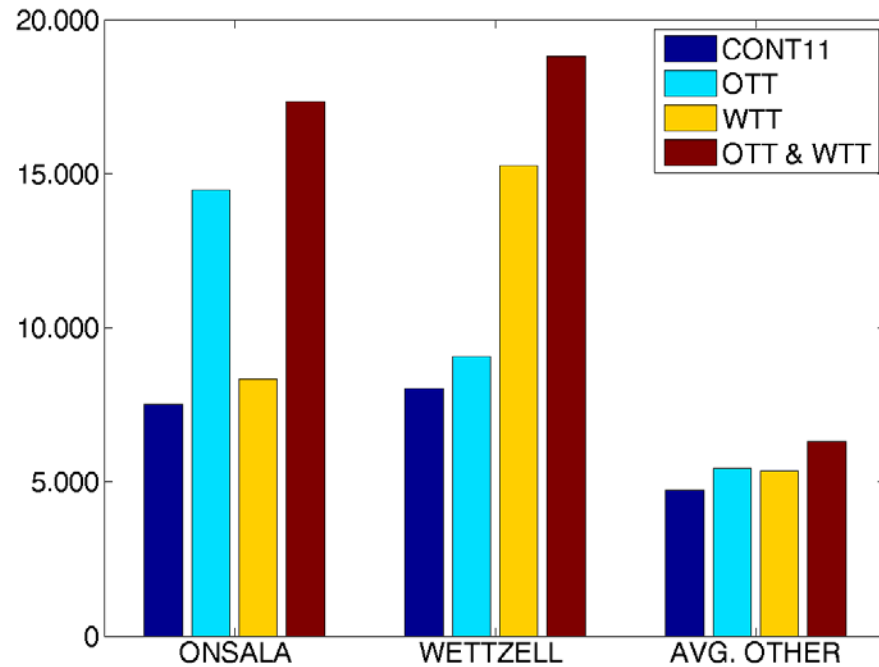


Both observe at
the same time

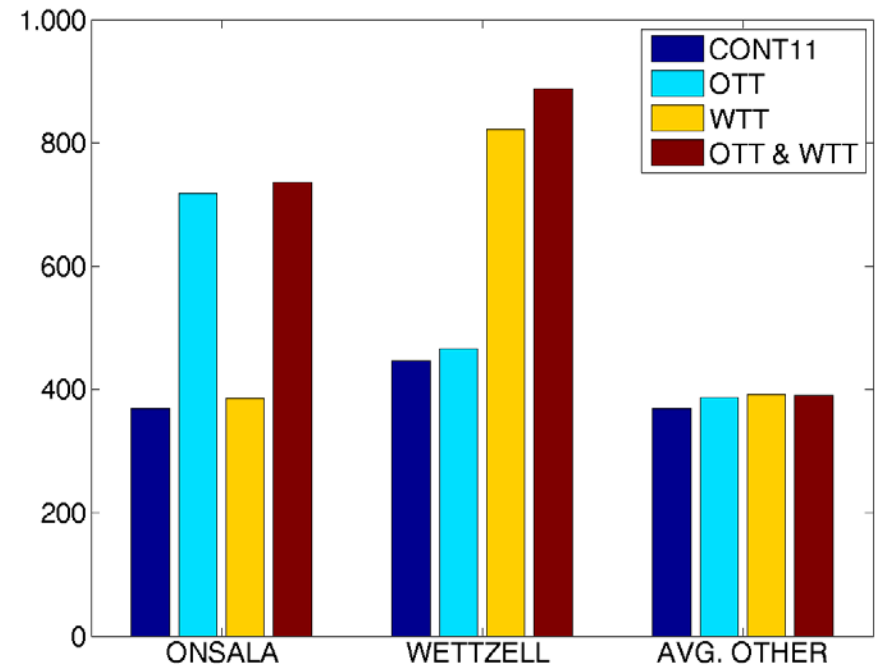
More observations and scans are expected

Number of observations & scans

Observations

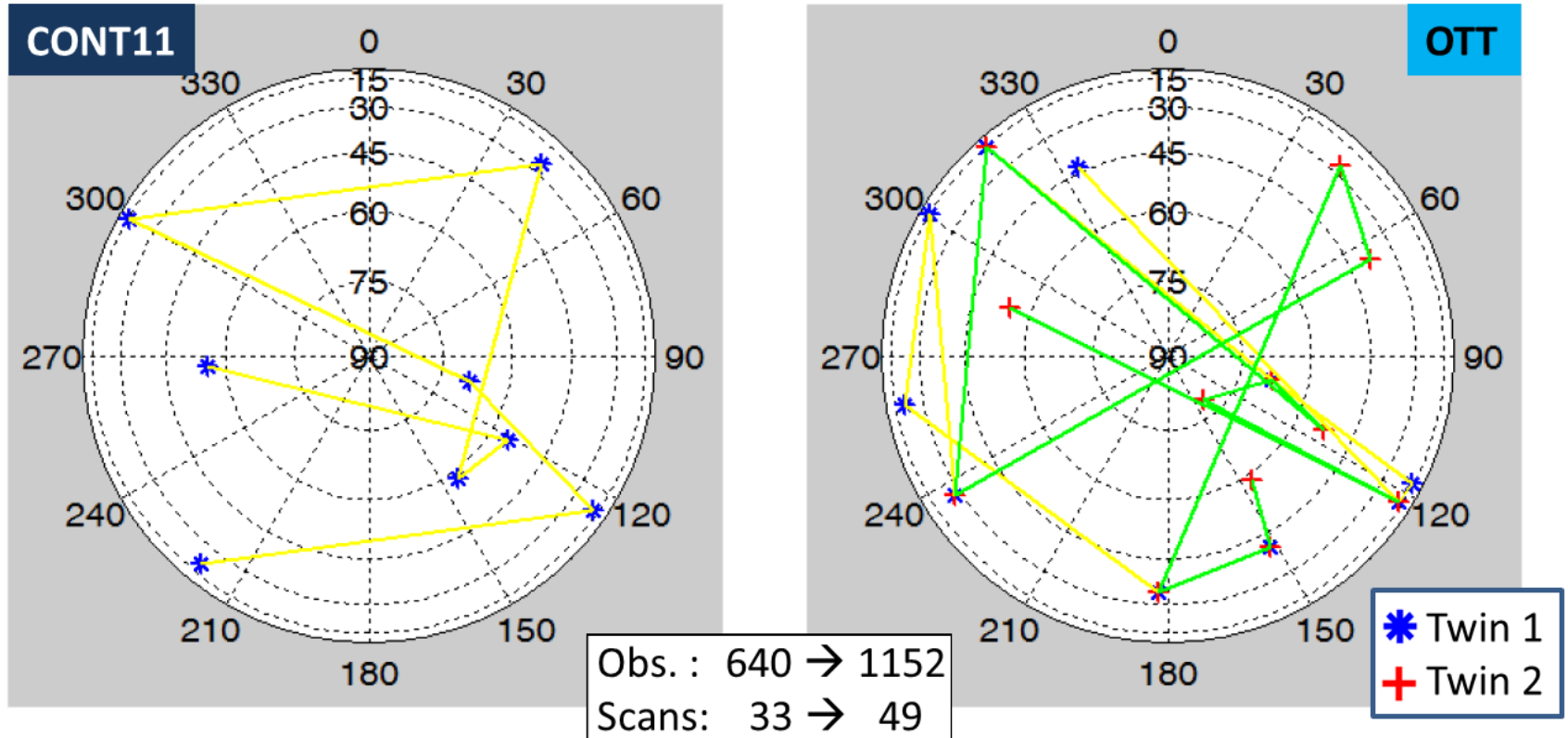


Scans



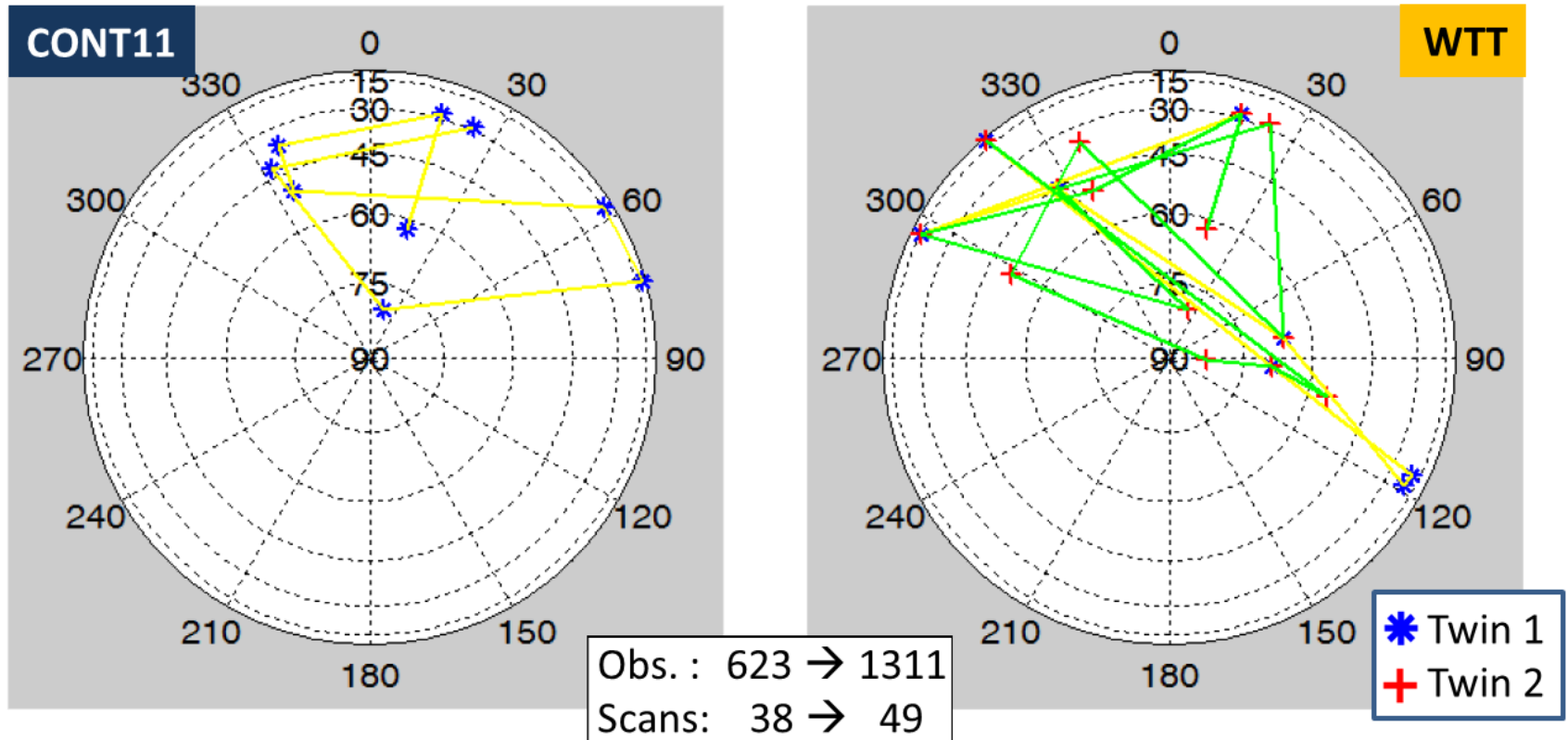
More observations and scans with twin telescopes

Sky plot at Onsala; 00:00 – 02:00



Improved sky coverage with twin telescopes

Sky plot at Wettzell; 00:00 – 02:00



Still room for improvement

Effects on ZWD estimations

Estimation interval:

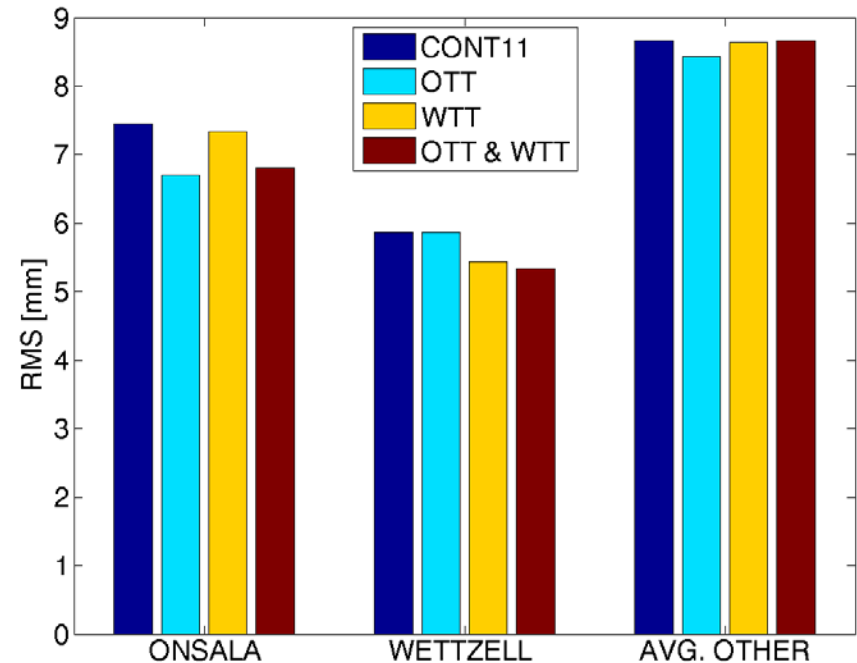
ZWD: 10 min

N/EGR: 15 min

Constraints:

ZWD: 1.5 cm / 10 min

N/EGR: 0.05 cm / 15 min



Improved ZWD estimations with twin telescopes

Baseline length repeatability

So far, no significant improvement was found and further investigations are ongoing

Conclusion & Outlook

- Twin Telescopes
 - Increasing number of observations & scans
 - Better sky coverage
 - Better ZWD estimations
- Plan: Optimized Scheduling for VLBI Twin Telescopes