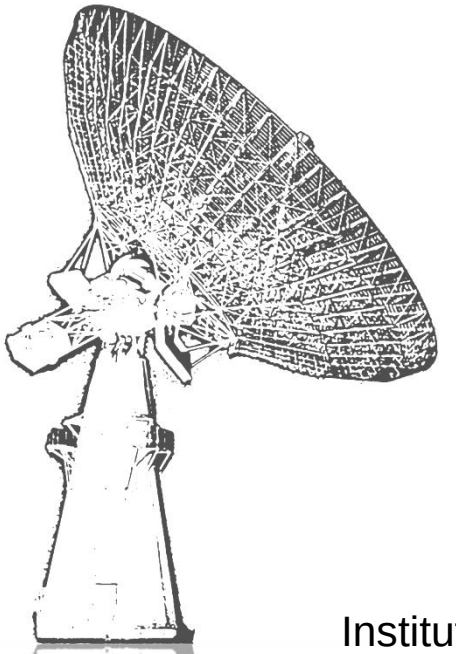
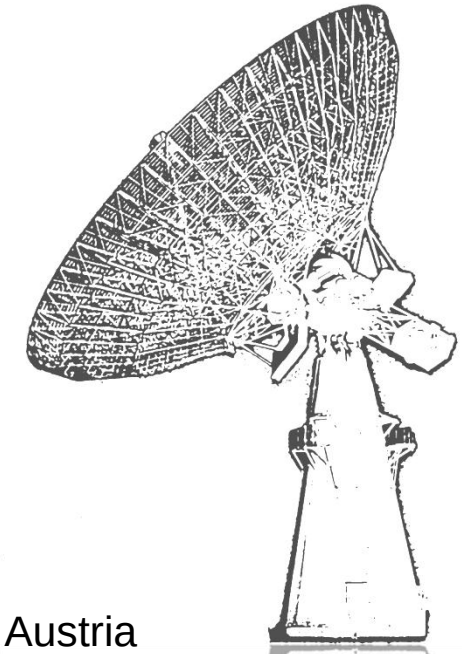
VLBI2010 Simulations at IGG Vienna





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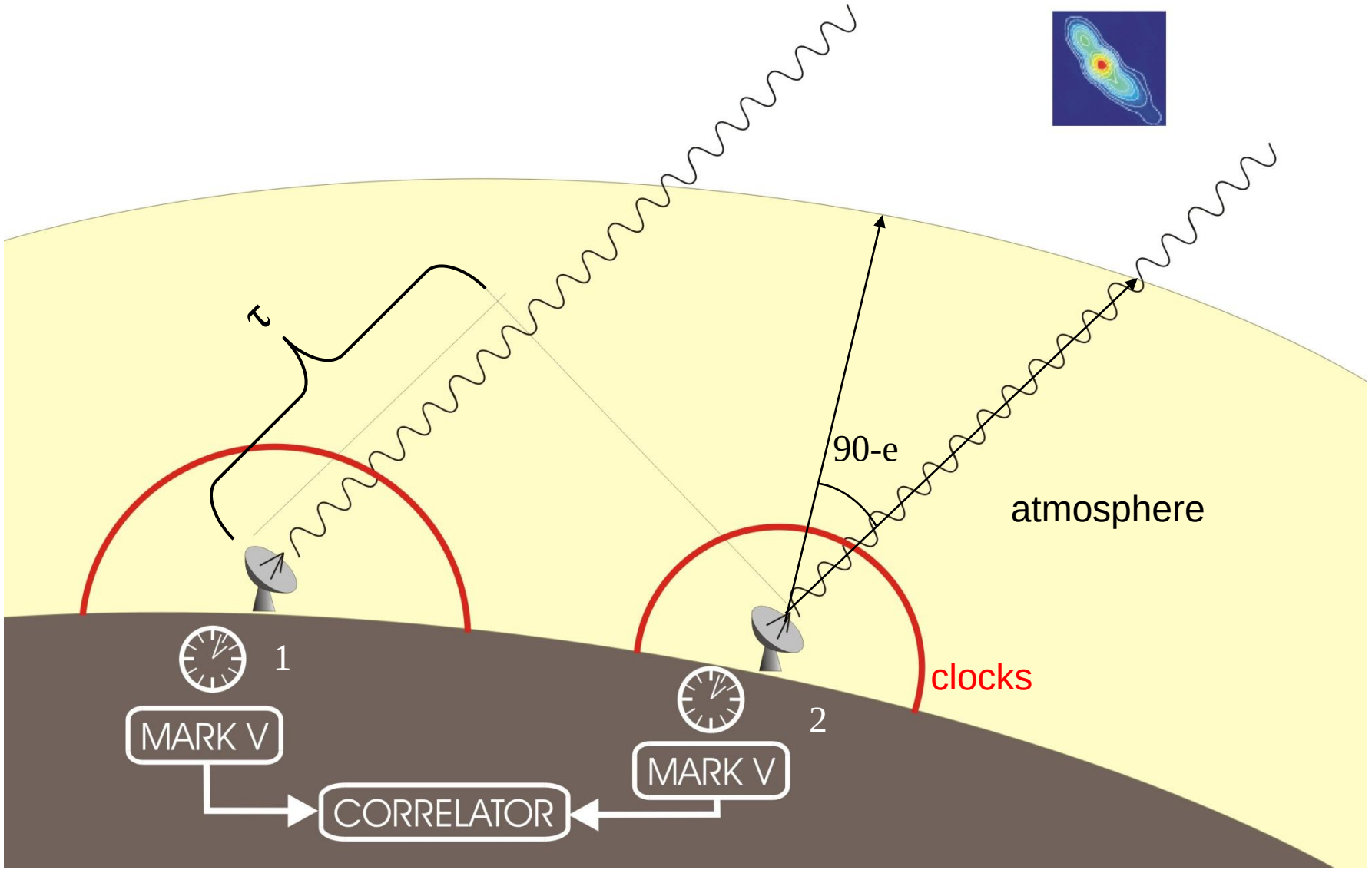
19th European VLBI for Geodesy and Astrometry (EVGA) Working Meeting,
March, 24 - 25,
Bordeaux, France

Introduction

- Monte Carlo Simulator
- Evaluation of the Simulator with CONT05
- Network studies
- Slew speed studies for antenna specifications
- Uniform sky scheduling
- Conclusions

Monte Carlo simulation

zwd & clocks are stochastic processes → simulate for station 1 and 2



Simulation of zwd and clock parameters

$$o - c = (zwd_2 \cdot mfw_2(e) + cl_2) - (zwd_1 \cdot mfw_1(e) + cl_1) + wn_{bsl}$$

Simulate the equivalent wet zenith delay

turbulence model
(by Tobias Nilsson, OSO)

fast turbulence model
(Vienna)

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Simulate the clocks

random walk + integrated random walk
ASD: 2·10-15@15min
1·10-14@50min

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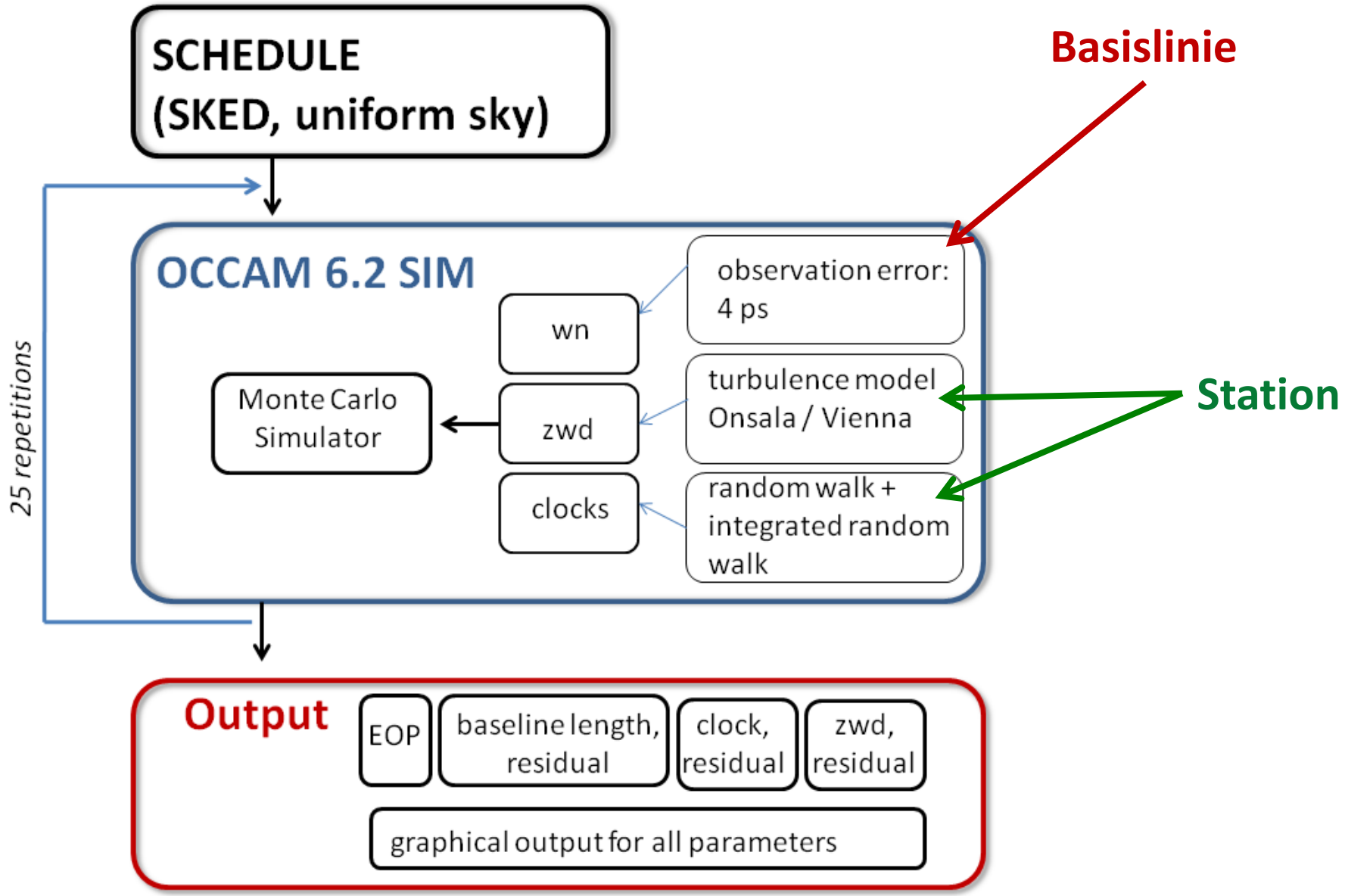
Simulate the clocks

random walk + integrated random walk
ASD: 2·10-15@15min
1·10-14@50min

Simulate observation errors

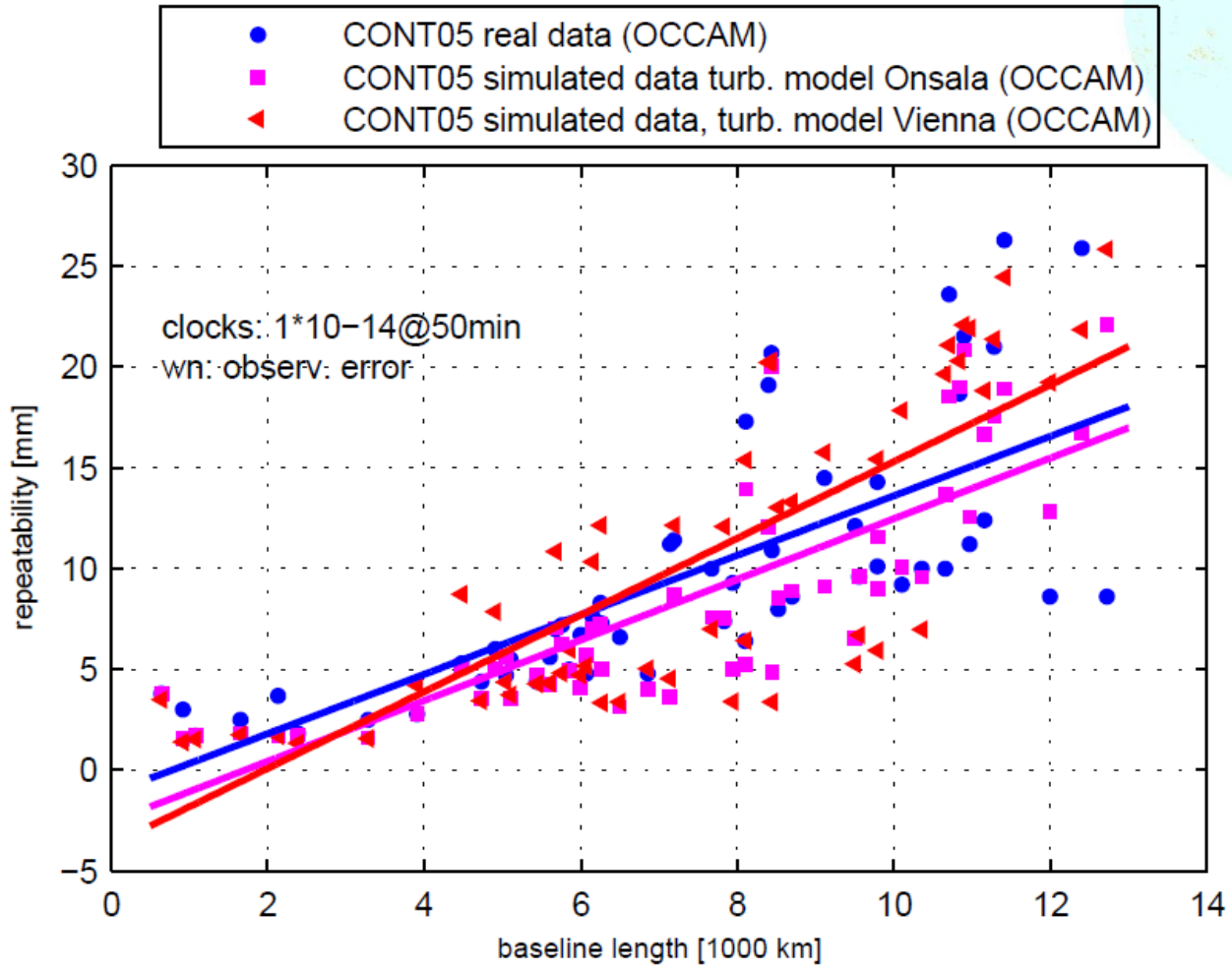
white noise: 4 ps / bsl

Monte Carlo Simulator



Comparison with CONT05

Baseline length repeatability



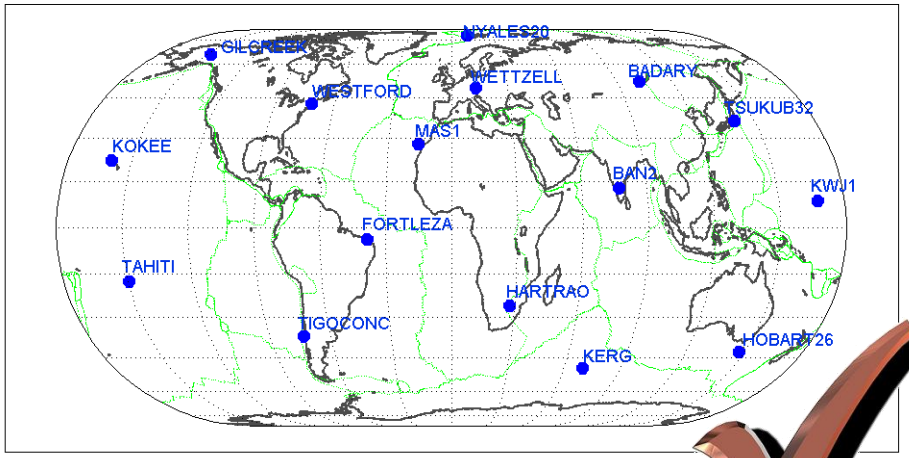
zwd: turbulence model (Onsala & Vienna)

clocks: $1 \cdot 10^{-14}$@50 min

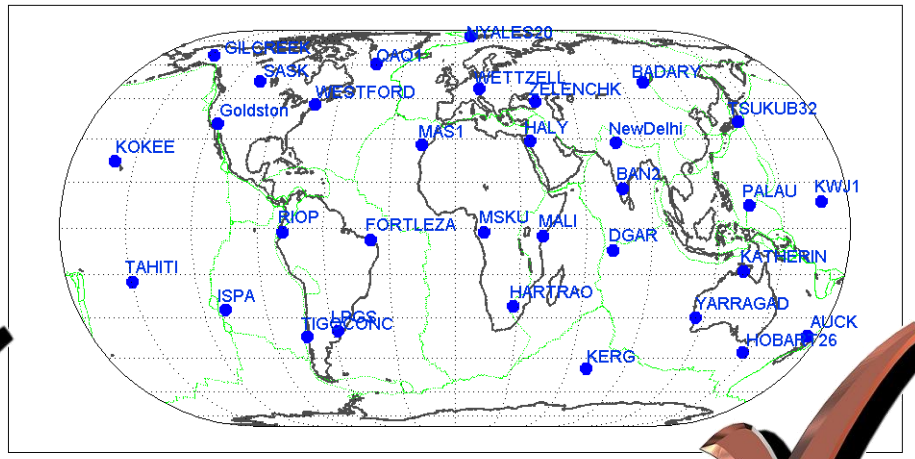
wn: formal errors of observables

Simulation Networks

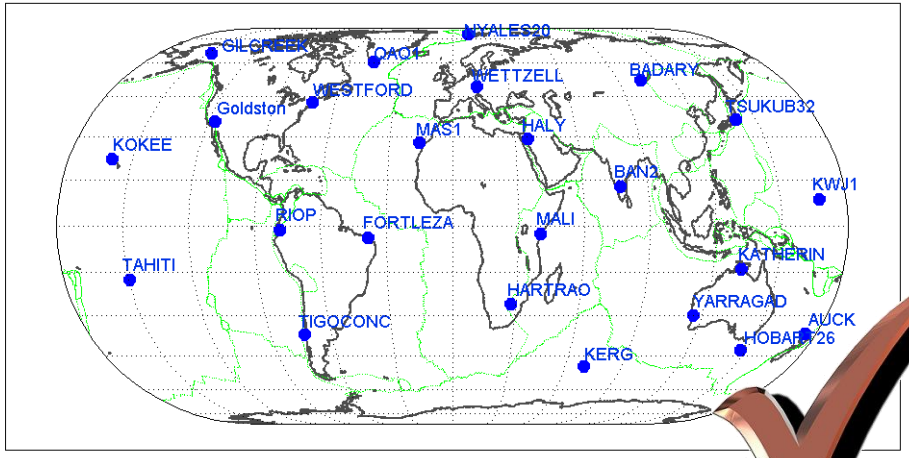
simulation - 16 stns origin(lon,lat) [0 0]



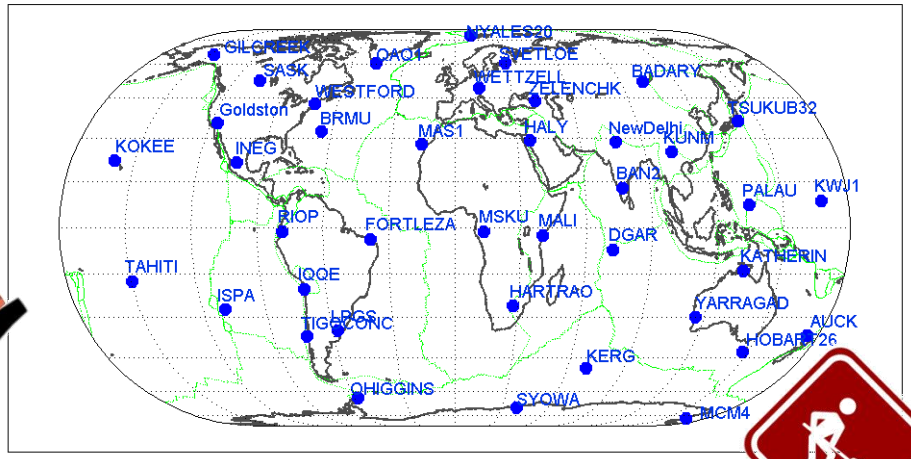
simulation - 32 stns origin(lon,lat) [0 0]



simulation - 24 stns origin(lon,lat) [

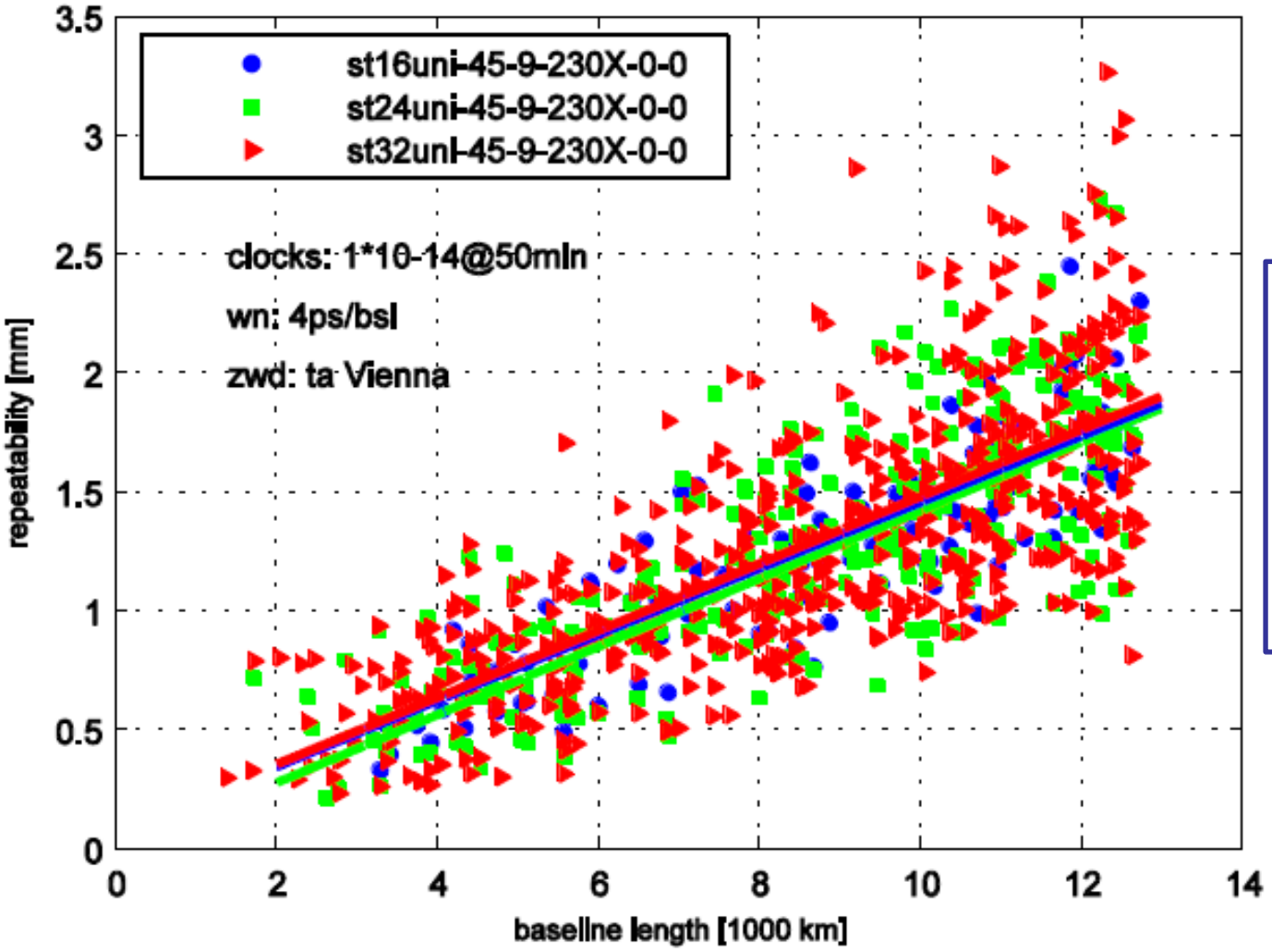


simulation - 40 stns origin(lon,lat) [



Simulation Networks

Baseline length repeatability for 16, 24 and 32 station



zwd: turbulence model -Vienna

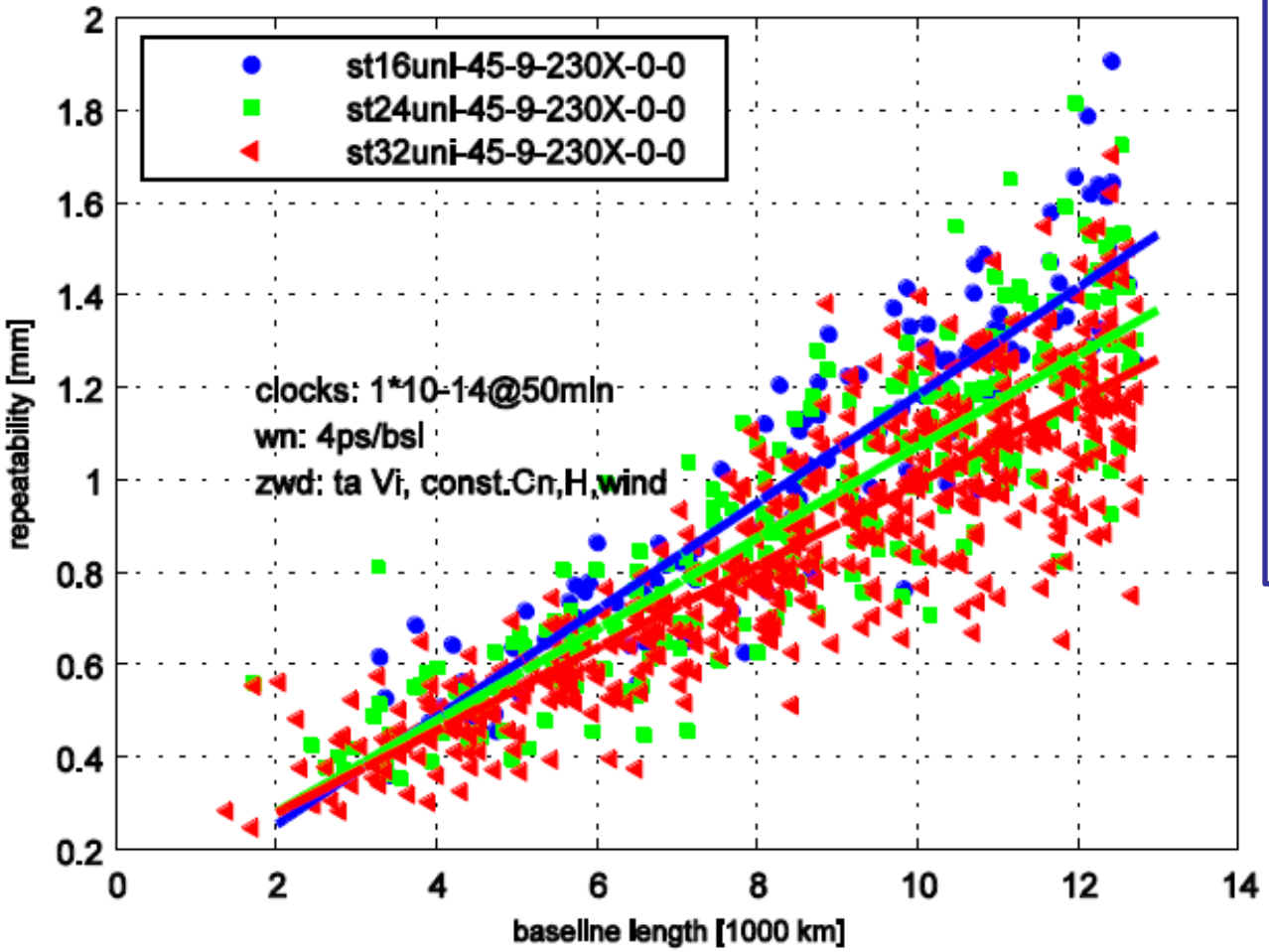
clocks: $1 \cdot 10^{-14}$@50min

wn: 4ps/bsl

Simulation Networks

Baseline length repeatability for 16, 24 and 32 station

turbulence model uses constant Cn, H and wind speed/direction



zwd: turbulence model – Vienna

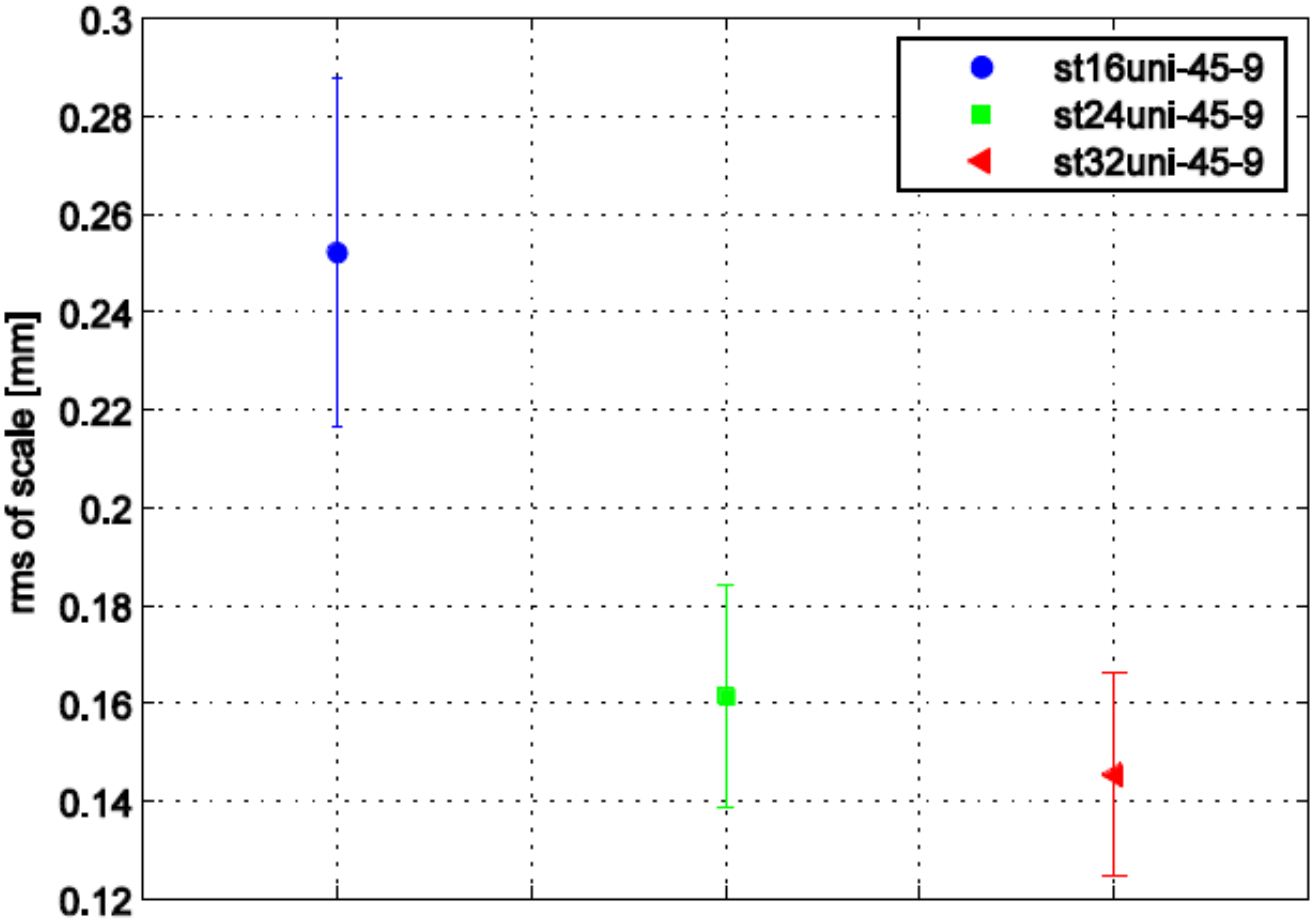
- Cn = $2.4 \cdot 10^{-7}$ $m^{-1/3}$
- H = 1 000 m
- wind = 8 m/s East

clocks: $1 \cdot 10^{-14}$@50min

wn: 4ps/bsl

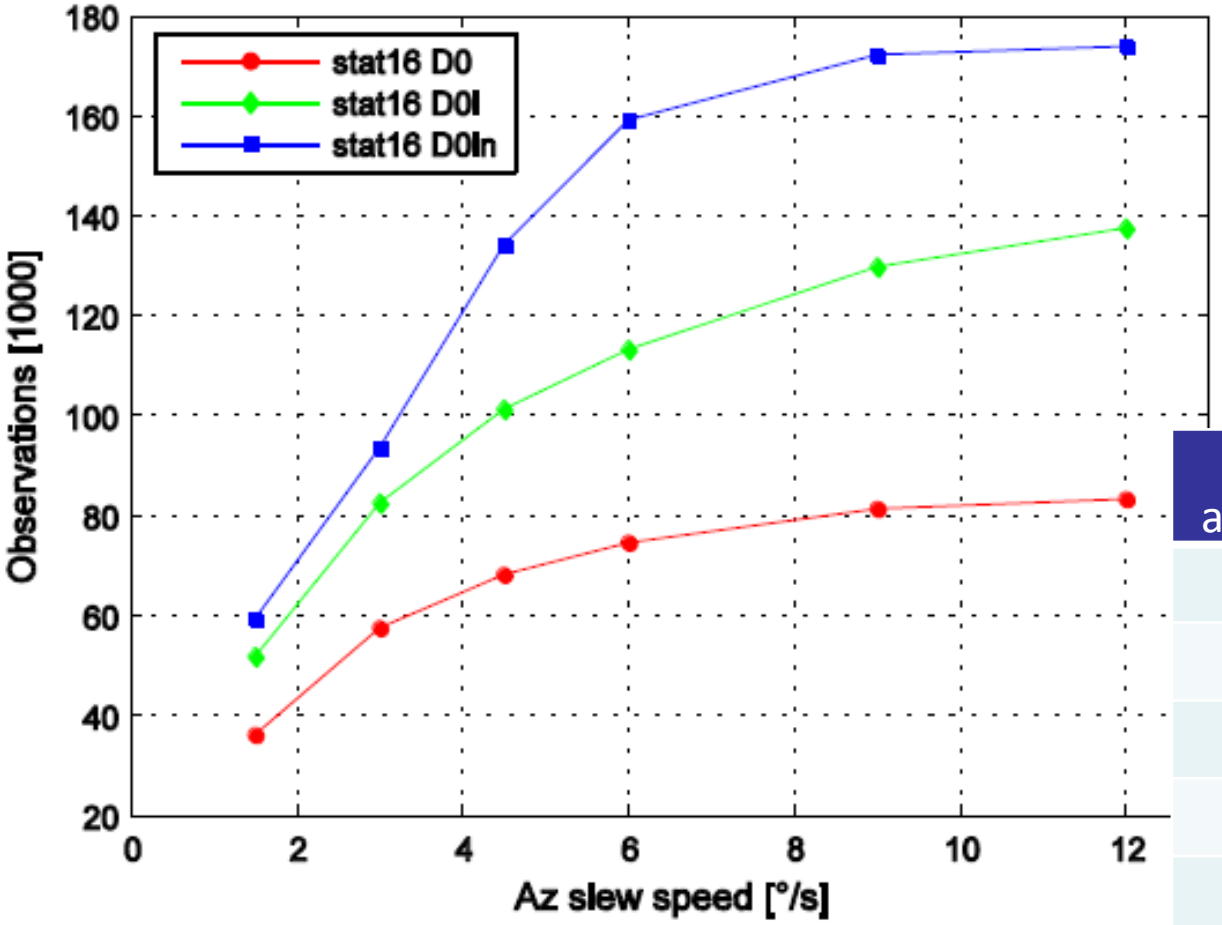
Simulation Networks

rms of scale of the 7 parameter Helmert Transformation



Slew rate tests

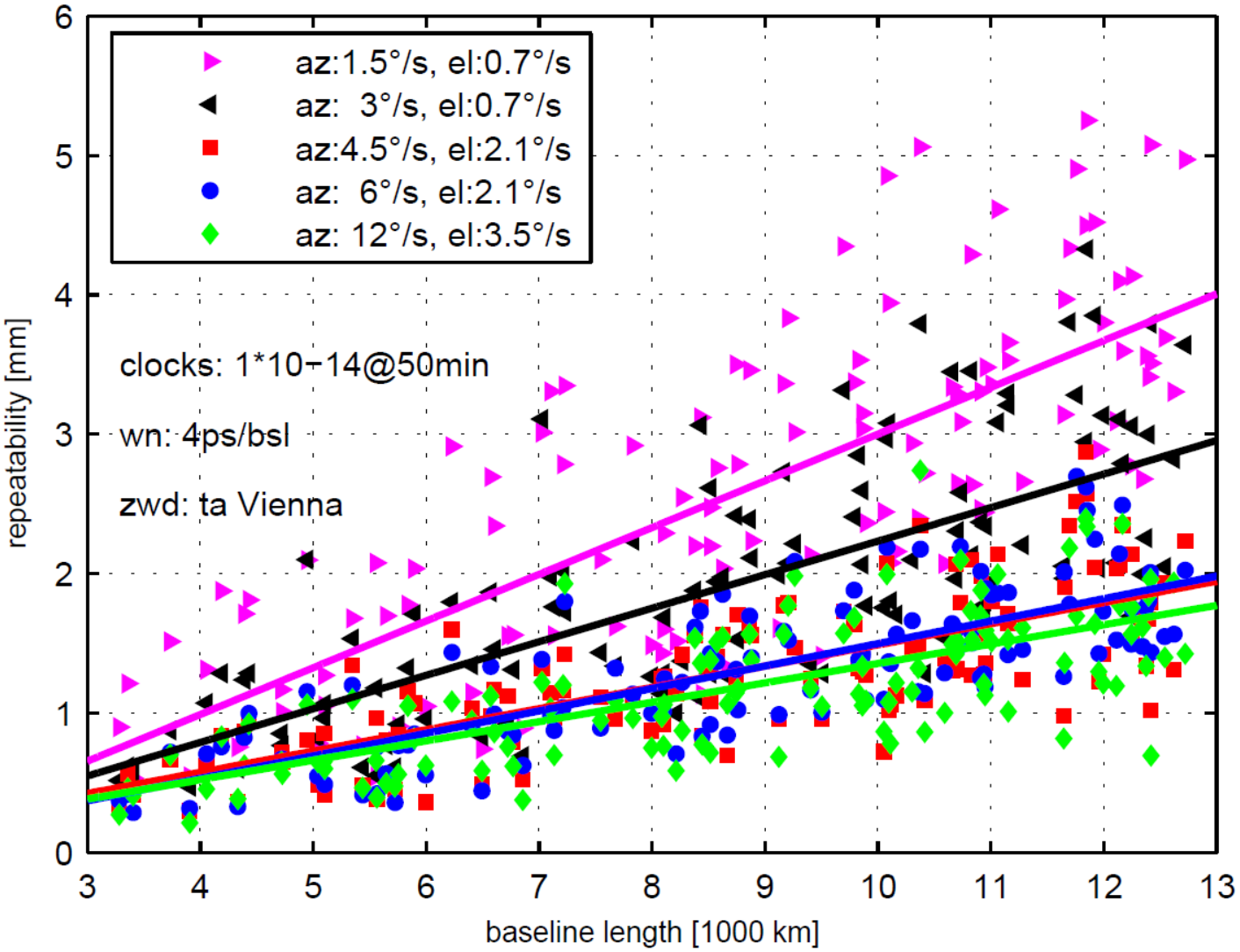
D0: geodetic source catalogue, standard optimization
D0l: 230 radio sources, standard optimization
D0ln: 230 radio sources, new optimization



slew speed az [°/sec]	slew speed el [°/sec]	no. of obs.
12.0	3.5	173831
6.0	2.1	159088
4.5	2.1	134134
3.0	0.7	83149
1.5	0.7	59392

Slew rate tests

Baseline length repeatability

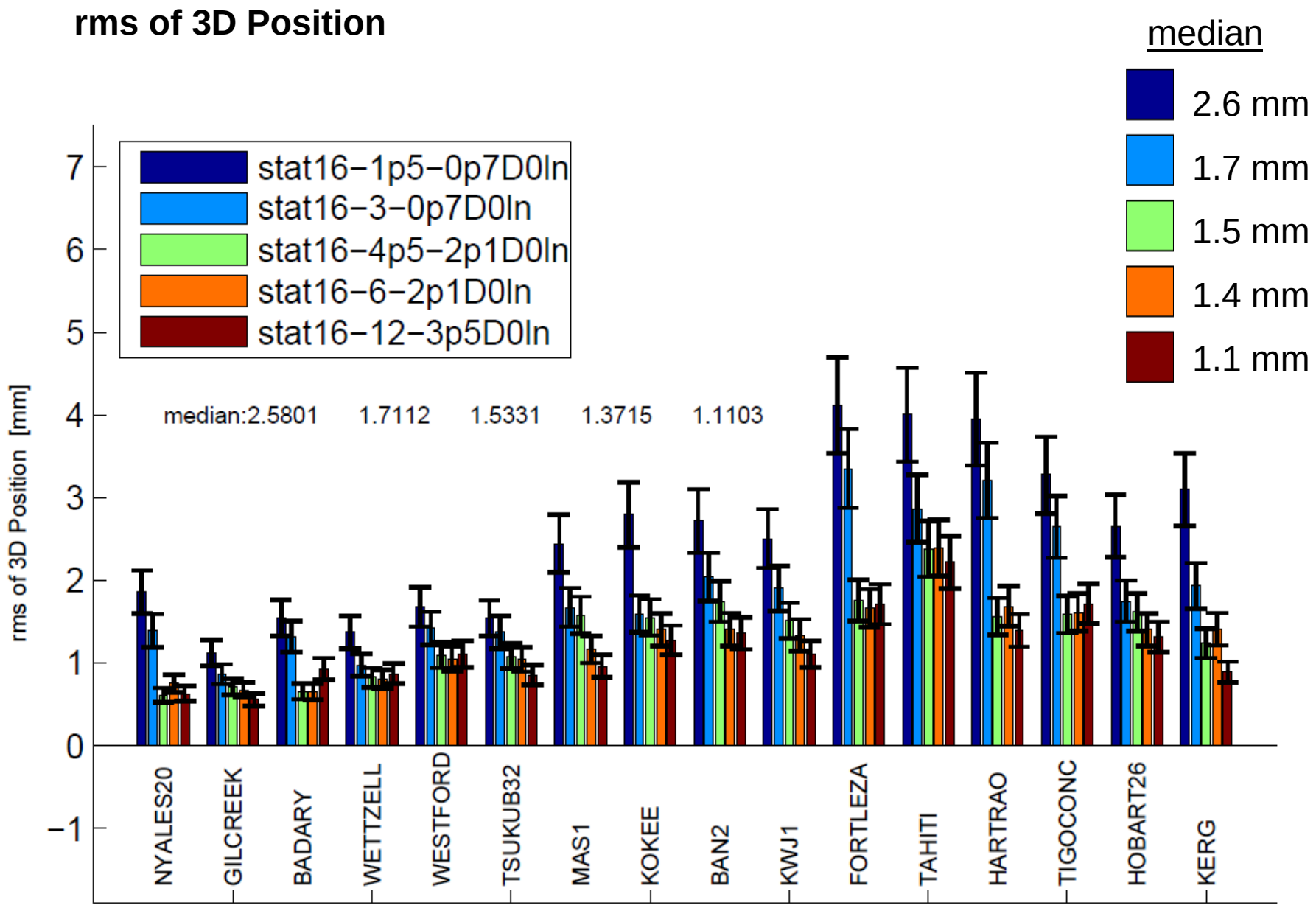


wzd: turbulence model -Vienna

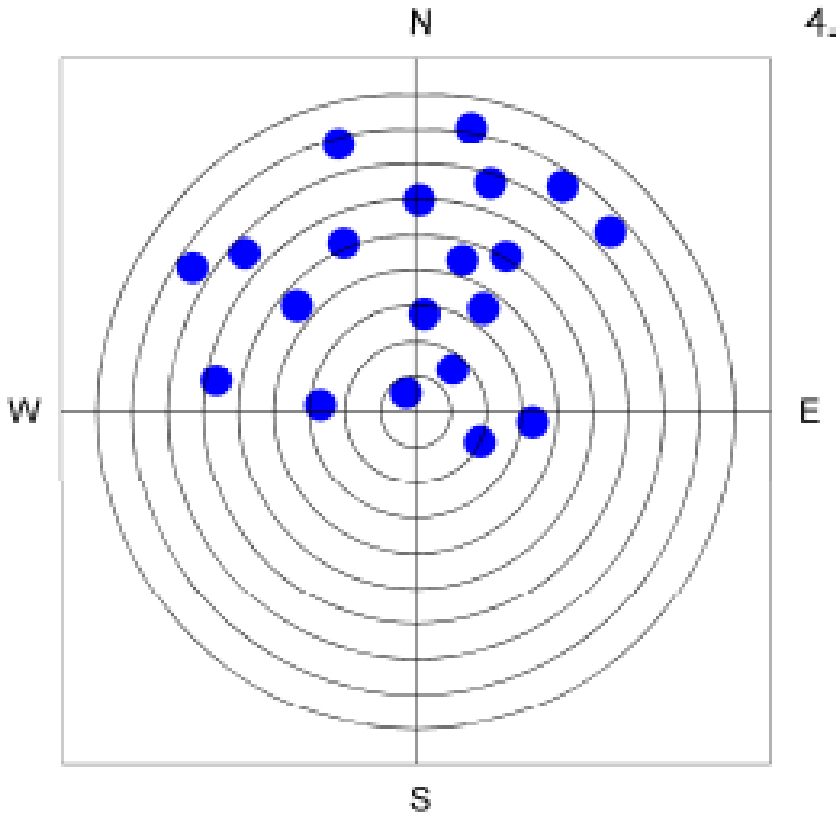
clocks: $1 \cdot 10^{-14}$@50 min

wn: 4ps/bsl

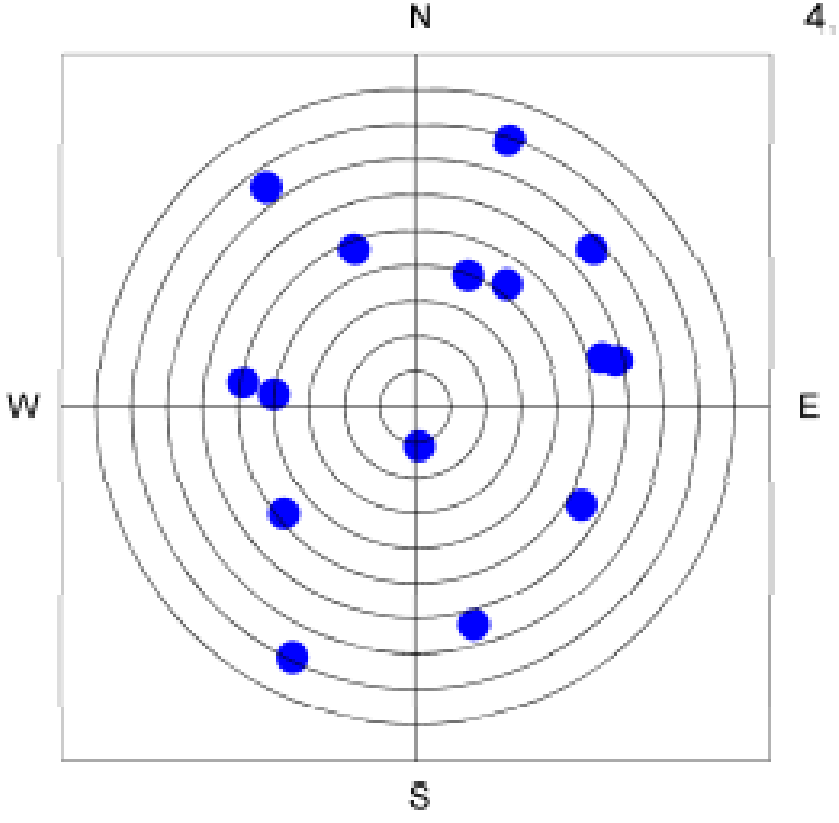
Slew rate tests



Different scheduling strategies



6 min



D0In schedules
observations often clustered

uniform sky schedules
observations well distributed

Uniform sky schedules

Station	switching intervall [sec]	uniform sky [min]	slew speed az [°/s]	slew speed el [°/s]	no. of obs
16	15	3	32(**)	8	278 830
16	30	6	12 (*)	3.2	139 564
16	45	9	7.3	1.8	93 231
16	60	12	4.8	1.1	69 708

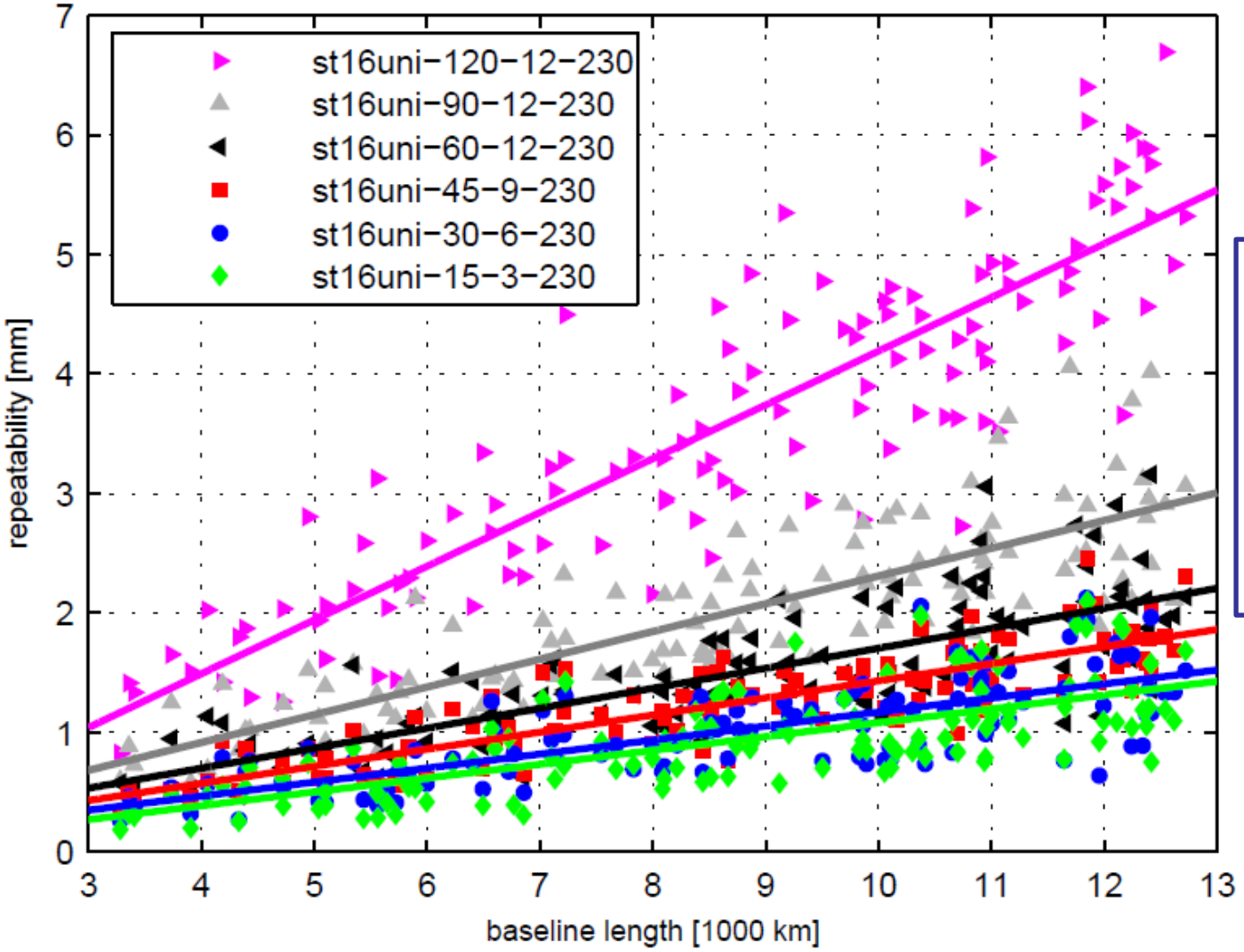
acceleration: 1.3 °/s²

* *3 °/s²*

** *8 °/s²*

Uniform sky schedules

Baseline length repeatability

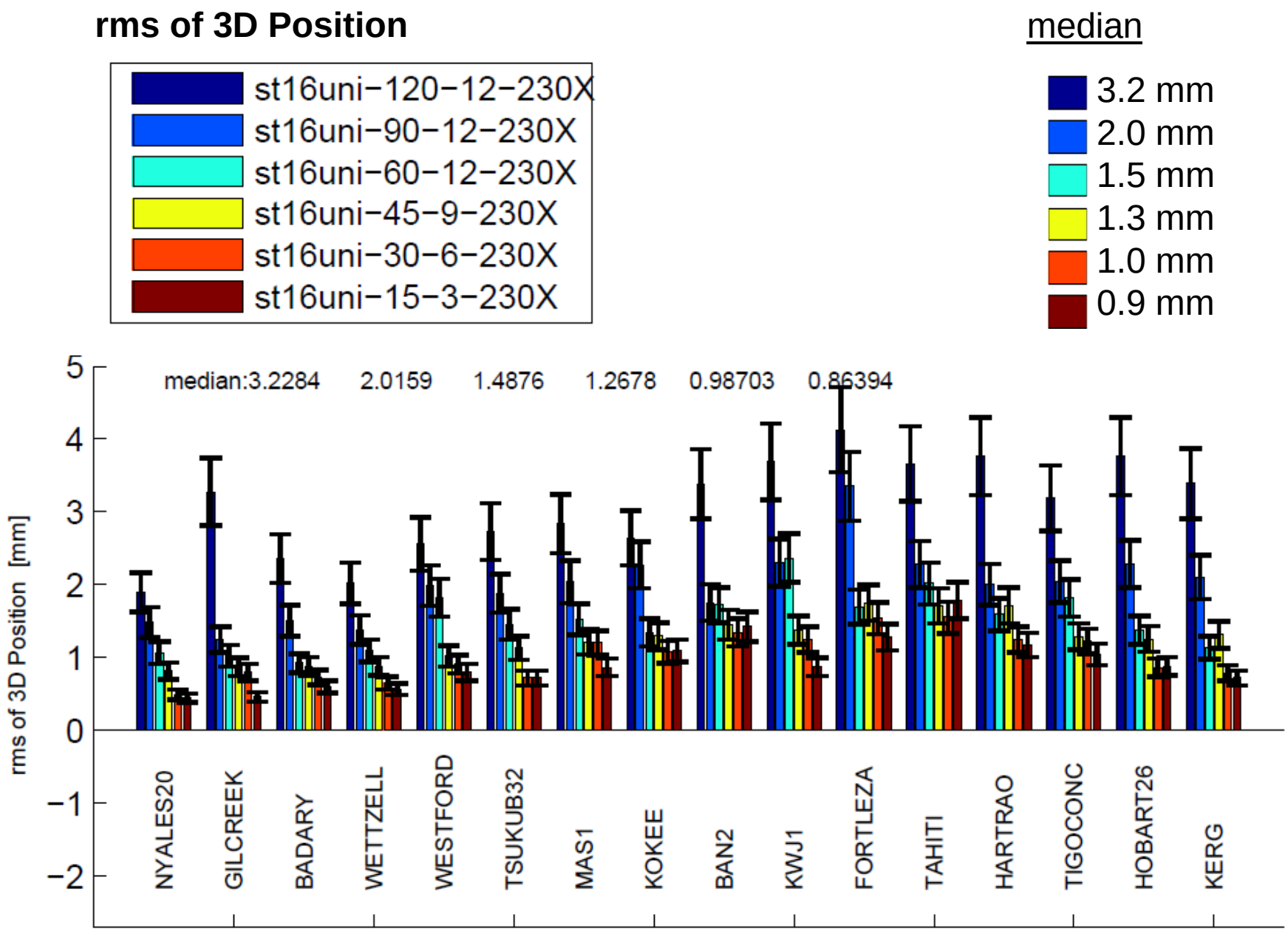


wzd: turbulence model -Vienna

clocks: $1 \cdot 10^{-14}$@50min

wn: 4ps/bsl

Uniform sky schedules



Uniform sky schedules

Comparing uniform sky schedule and D0ln schedule

Station	switching intervall [sec]	uniform sky [min]	slew speed az [°/sec]	slew speed el [°/sec]	no. of obs
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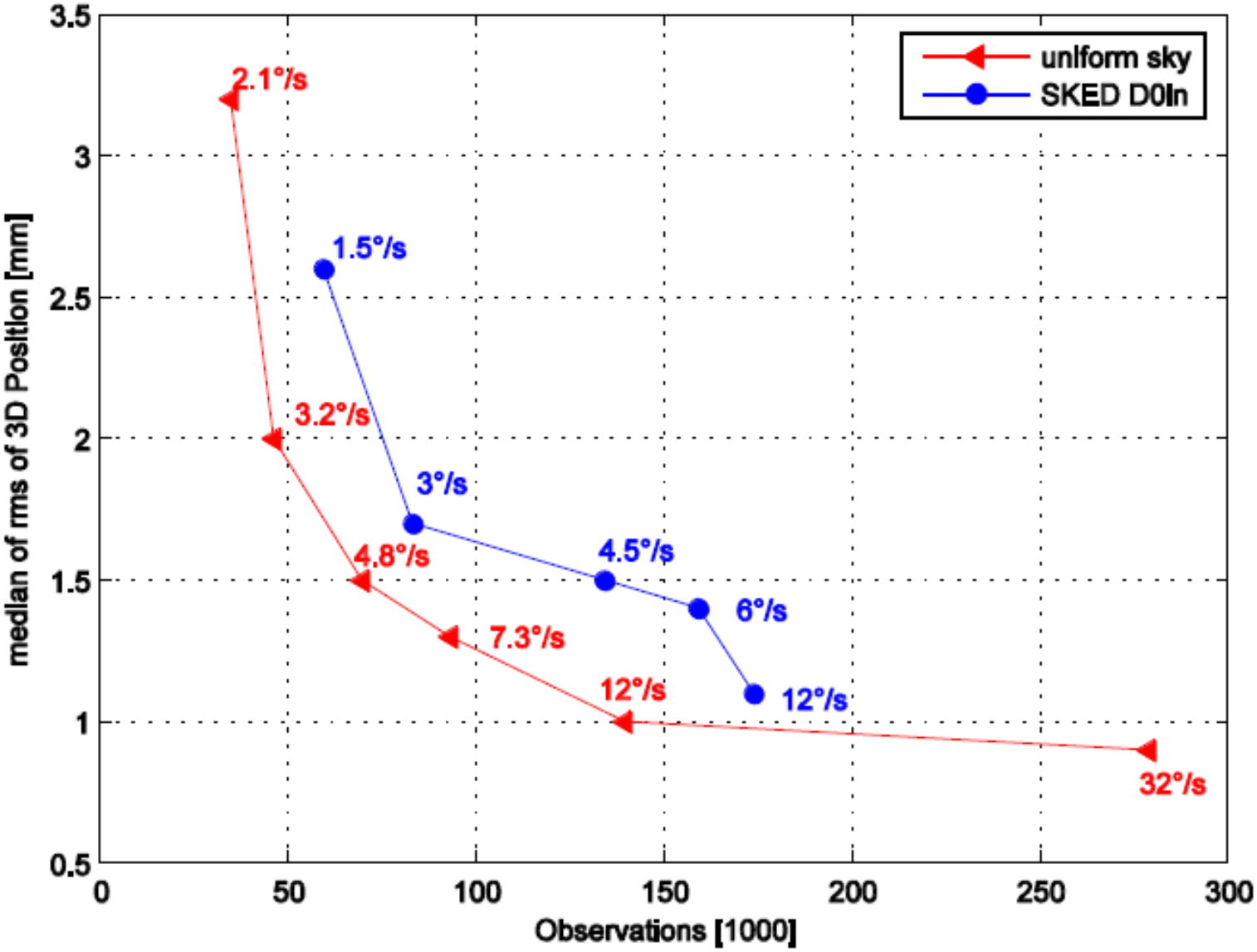
16	30	6	12 (*)	3.2	139 564
16	45	9	7.3	1.8	93 231
16	60	12	4.8	1.1	69 708

D0ln

slew speed az [°/s]	slew speed el [°/s]	no. of obs.
12.0	3.5	173 831
6.0	2.1	159 088
4.5	2.1	134 134
3.0	0.7	83 149
1.5	0.7	59 392

SKED and uniform sky schedules



Conclusions

- The Monte Carlo Simulator shows a good agreement with the CONT05 data.
- The network geometry is important
- The estimation of the zwd is the limiting factor
- The slew rate tests show big improvement for fast antennas > 6 °/s
- The uniform sky scheduling needs fast antennas (> 6 °/s)
- The median of the rms value of 3D position is < 1 mm for the uniform sky schedule with the shortest switching interval


Thank you for your attention!