Simulations of Different Antenna Velocities in VLBI Networks

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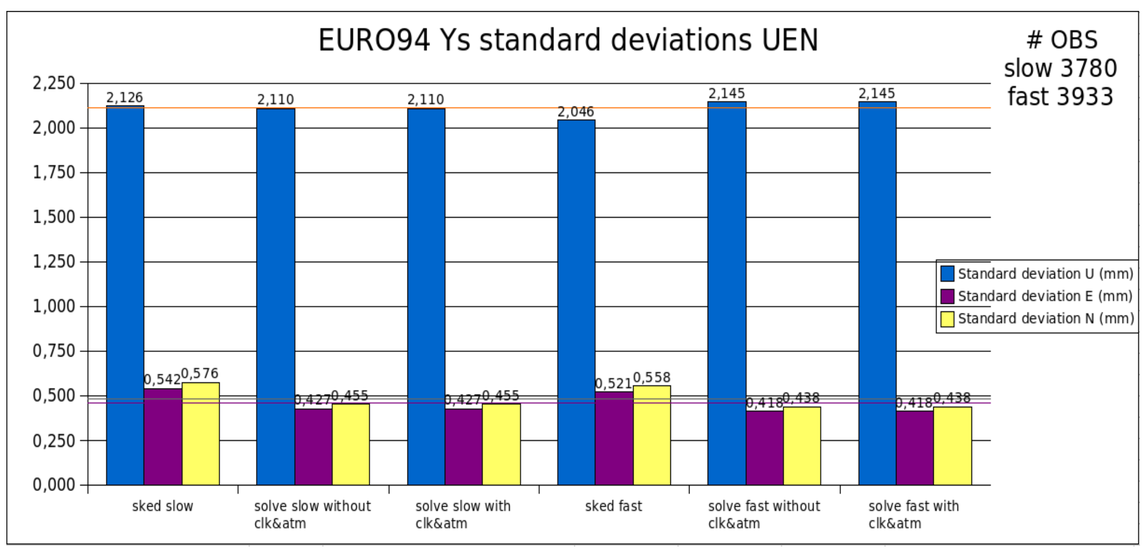
During 2008 the new 40-m radiotelescope at Yebes (Ys) started to participate in IVS geodetic VLBI sessions. It was necessary to decide the most suitable antenna velocity in azimuth and elevation for the site itself and the network performance. To evaluate the impact of different telescope velocities on geodetic results we used the scheduling software SKED and created schedules with different antenna velocities for Ys. We focused on the two sessions EURO94 and R1331, introducing Ys station as a new participant station, and analyzed the schedules with SKED itself, and with the VLBI analysis software SOLVE, both with and without introducing simulated atmosphere and clock contributions.



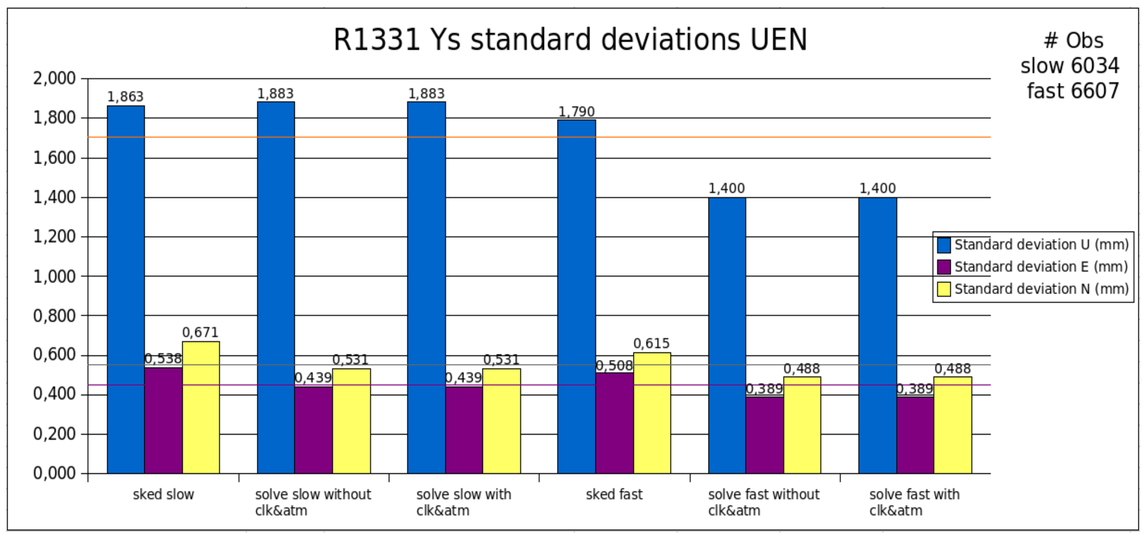


Fig. 1 Standard deviations of the Yebes 40-m UEN position derived from simulated schedules with a fast or slow Ys-antenna in a typical EURO- and R1-session using the scheduling software SKED and VLBI analysis software SOLVE.

We found that the schedules with a fast Ys antenna (3 º/s in azimuth and elevation) give slightly better results than the ones with a slow Ys antenna (1 º/s in azimuth and elevation). For the studied EURO-session the standard deviation of the estimated topocentric U-component for Yebes is similar for a fast and slow antenna. For the R1-session the standard deviations of all three topocentric station components improve for a fast antenna.

The SKED-only results appear to be too optimistic, while the SOLVE results show more realistic estimates for the UEN components and sigmas. We found no significant difference in the UEN sigmas with or without introducing simulated atmospheric and clock contributions, although the WRMS fit becomes slightly worse.

Table 1 shows the percentage of time for observation and idle time for Yebes40m station in each configuration. The the fast Ys station the idle time increases more than the observation time, indicating that the fast Ys-telescope has to wait a lot for the other slower telescopes in the network.

The participating stations for the simulated EURO94 session were: Crimea (Sm), Effelsberg (Eb), Metsähovi (Mh), Noto (Nt), Onsala60 (On), Wettzell (Wz) and Yebes40m (Ys). The stations for the simulated R1331-session were: Badary (Bd), Hobart26 (Ho), Kokee Park (Kk), Ny Ålesund (Ny), Tsukuba (Ts), Westford (Wf), Wettzell (Wz), Yebes40m (Ys) and Zelenchukskaya (Zc).

	sked slow or fast	# stations in the session	Ys Observation time	Ys Idle time	Total # OBS	Ys Scans	Ys # scans/hour
EURO94	sked slow	7	19%	35%	3780	299	13
	sked fast	7	24%	45%	3933	327	14
R1331	sked slow	9	16%	26%	6034	317	13
	sked fast	9	19%	39%	6607	368	15

Table 1. Percentage of observation and idle time for a slow and a fast Yebes40m (Ys) station in the simulated EURO94 and R1331 sessions.

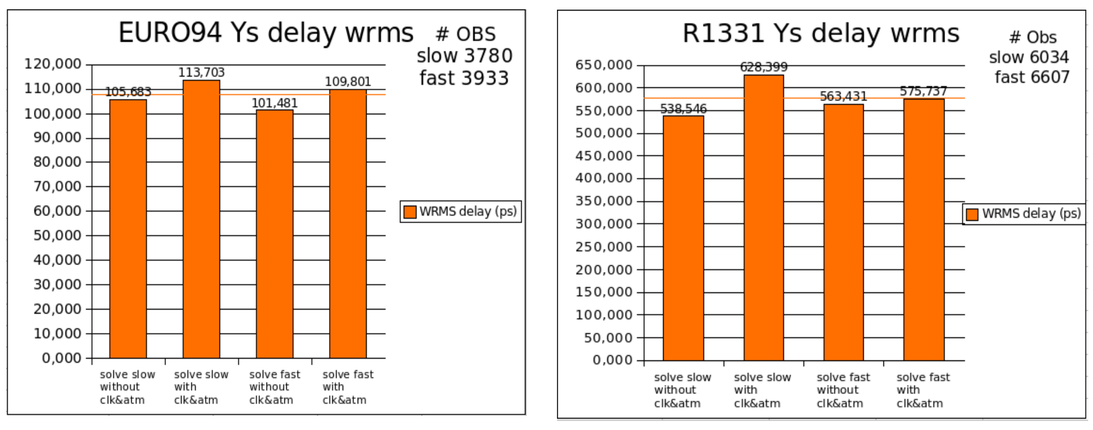


Fig. 2 Values of the wrms delay for a slow and a fast Yebes40m telescope in typical EURO- and R1-sessions, using VLBI analysis software SOLVE with and without simulated clock and atmosphere contributions.

Summary

- We have quantified the advantages of including a new slow (1º/sec) or fast (3º/sec) antenna into a typical geodetic VLBI schedule. The goal is to check whether it is worth to increase the slewing speed of the new 40-m antenna at Yebes (Spain), which also increases the stress on its structure, to achieve a higher number of observations and/or a lower standard deviations of the antenna position.
- A fast antenna improves the estimated topocentric components.
- The performance of an existing VLBI network does not really improve just by adding a new fast antenna because this new antenna will wait for all the others in the network increasing its idle time.

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