

VLBA TEST MEMO #70: VLBA SLEW RATES

Craig Walker May 4, 2010

The VLBA slew rates are specified to be 90°/min in azimuth and 30°/min in elevation. These rates are set in the Antenna Control Units (ACU) and are adjusted occasionally during maintenance. A recent investigation of why the predictions by SCHED of the duration of some scans was significantly in error led to the determination that the Fort Davis azimuth slew rate was out of spec and all of the others are lower than the nominal numbers. This can matter if users are doing long slews and short scans, as is common for geodetic segments in astrometric projects and for actual geodesy projects. To get a sense of the significance, a 1°/min difference between the expected and actual slew rate makes a difference of 2.7 seconds over a full turn in azimuth or 4.8 seconds over a 70° elevation range.

I have written a simple program called SLEWTEST that reads the on-line flags produced by TSM, which tell when the data becomes good after a slew, and the *sch* files from SCHED to get the length of each slew. It subtracts a constant from the total slew time to account for acceleration and settling, then determines the slew rate for each slew. Then it determines an average rate for the longer slews being careful to use only those dominated by the azimuth slew to get the azimuth rate and those dominated by the elevation slew to get the elevation rate. The data points and averages are then plotted. The program is rudimentary, but allowed results from all slews from a number of projects to be investigated. The shape of the plotted results, for the shorter slews, turns out to be very sensitive to the added time. An adjustment of even one second is very easily visible. This made it clear that the added number depends on the axis, with the settling being a few seconds faster for azimuth slews than elevation slews.

Prior to adjustment, the Fort Davis azimuth slew rate was about 75°/min, which means that a prediction based on 90°/min would be off by 48 seconds for a full wrap – easily enough to wipe out a scan in common cases. This issue arose during a maintenance visit to Fort Davis. It was discovered that the slew rate under manual control, which is how the timing was done to set the rate, is different from the rate under computer control. Once adjustments were made based on the computer controlled rate, the slew rate matched other antennas. Thanks to Eric Carlowe for spearheading the debugging at FD.

I used the program to determine the rates of all of the VLBA antennas using data from 2010 projects BW093A, BW093B, BW093C, BM308AF, BR145D1, BR145AO, and BB269E. The last two followed the FD changes. The rates are shown below with azimuth first then elevation in degrees/min. The added time is also shown. Note that 2 seconds of the added time is understood as due to acceleration while the rest is presumably settling. All azimuth rates are between 80.8 and 86.8°/min. At 83°/min, a full wrap in azimuth takes 20 seconds longer than would be predicted using the nominal 90°/min rate, so these are significantly different from the nominal rates for real observations. I have installed these rates in the SCHED station catalog that will be available with the next release (9.4).

Station	Az Rate	Az Add	El Rate	El Add	Station	Az Rate	Az Add	El Rate	El Add
	Deg/Min	Sec	Deg/Min	Sec		Deg/Min	Sec	Deg/Min	Sec
SC	84.5	9	28.5	8	PT	82.3	4	29.3	7
HN	81.3	6	26.7	8	KP	80.8	4	29.4	8
NL	82.5	6	28.7	8	OV	84.5	6	28.7	8
FD	84.3	5	30.5	8	BR	83.6	6	29.0	8
LA	82.0	5	29.5	7	MK	86.8	4	28.3	7

