Slewing the Elevation Axis with xPC Target
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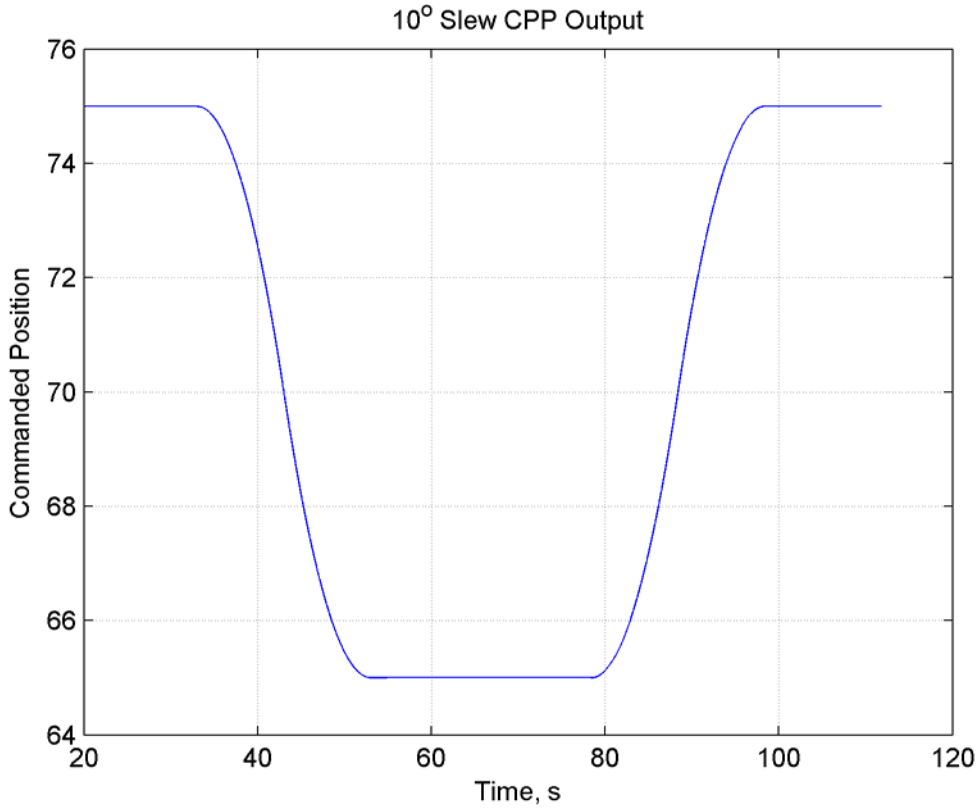
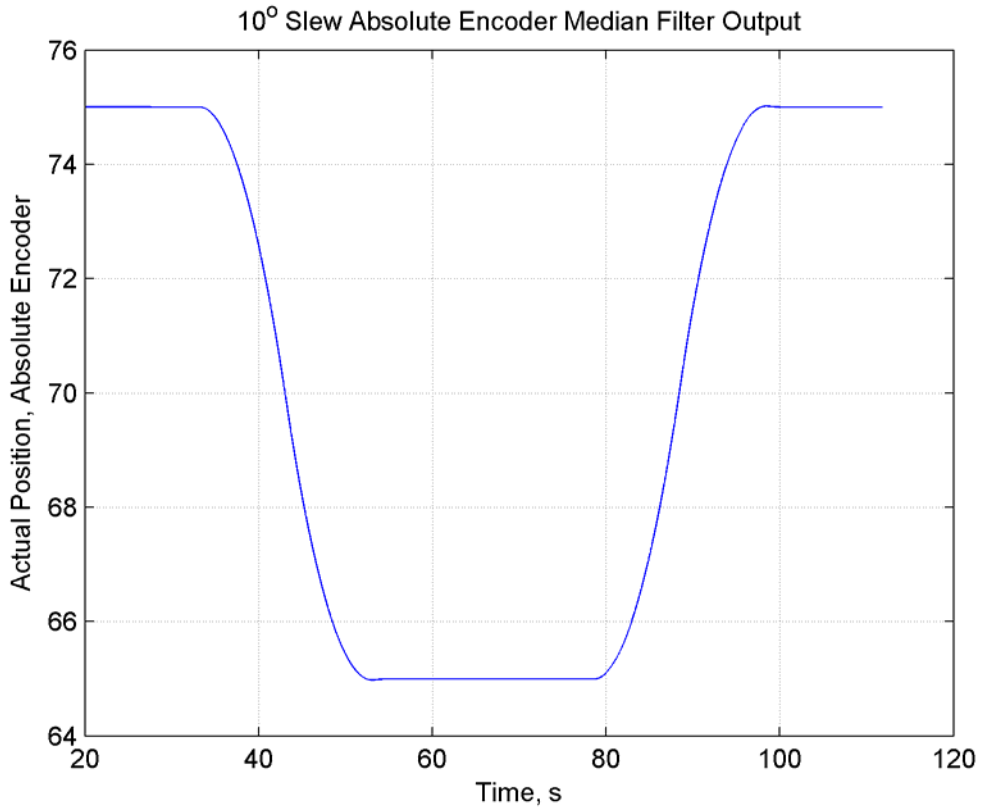
D. Clark

Data collected with the VwWorks servo controller earlier has us concerned about the controller's slew behavior. Quickly mining the data archive for various xPC Target tests, we have these set of reference plots that show the relevant signals during a 10° slew. Longer slews have been done with the xPC Target system, but the data are not as readily available. The plots below, expanded to longer motion trajectories, should be quite similar, and can be used to quickly determine if the VxWorks system is behaving as expected.

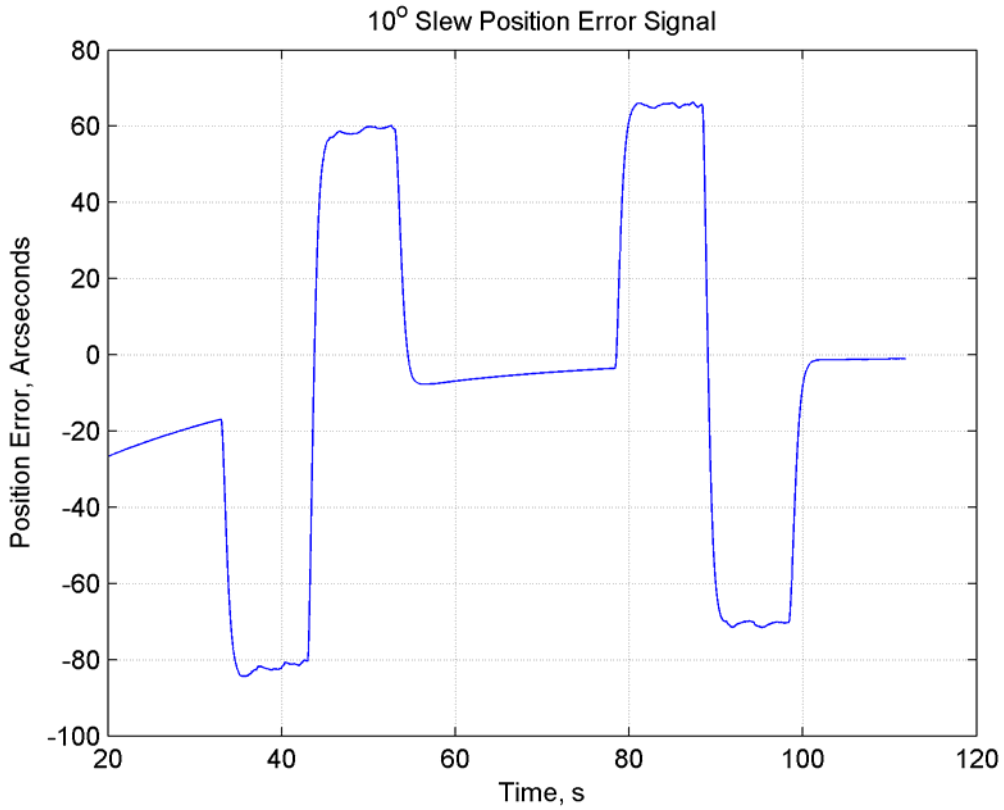
This is the commanded position trajectory for a ±10° slew command from the command pre-processor, which shapes the step command signal to one that has the proper maximum velocity and acceleration.



Next, we have the actual position of the telescope from the median filter used on the absolute encoder position data. Not surprisingly, it follows the commanded signal.

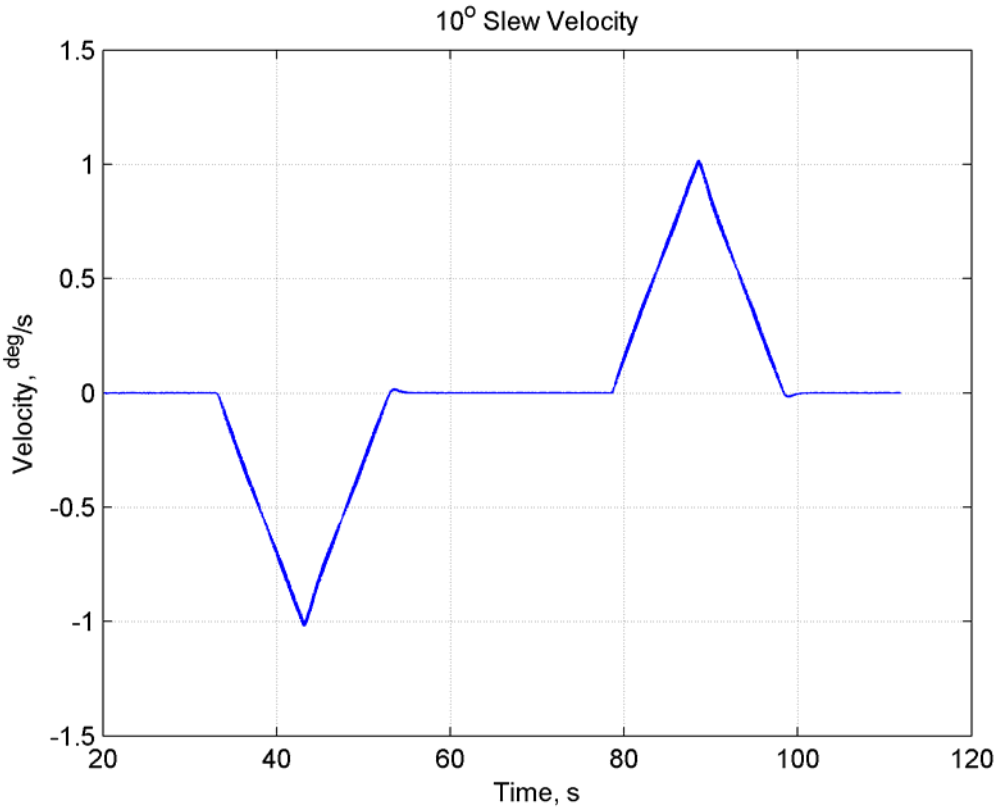


But it's more illuminated to observe the position error signal during the motion. Here it is, in arcseconds:



Note that since the command pre-processor has shaped the command signal, the telescope easily follows the trajectory with little following error, and as you'd expect, it changes sign when decelerating to the target position. Also, note that when the acceleration phase is over, the error signal is tending to a constant, which again, you would expect during a constant-velocity portion of a motion profile.

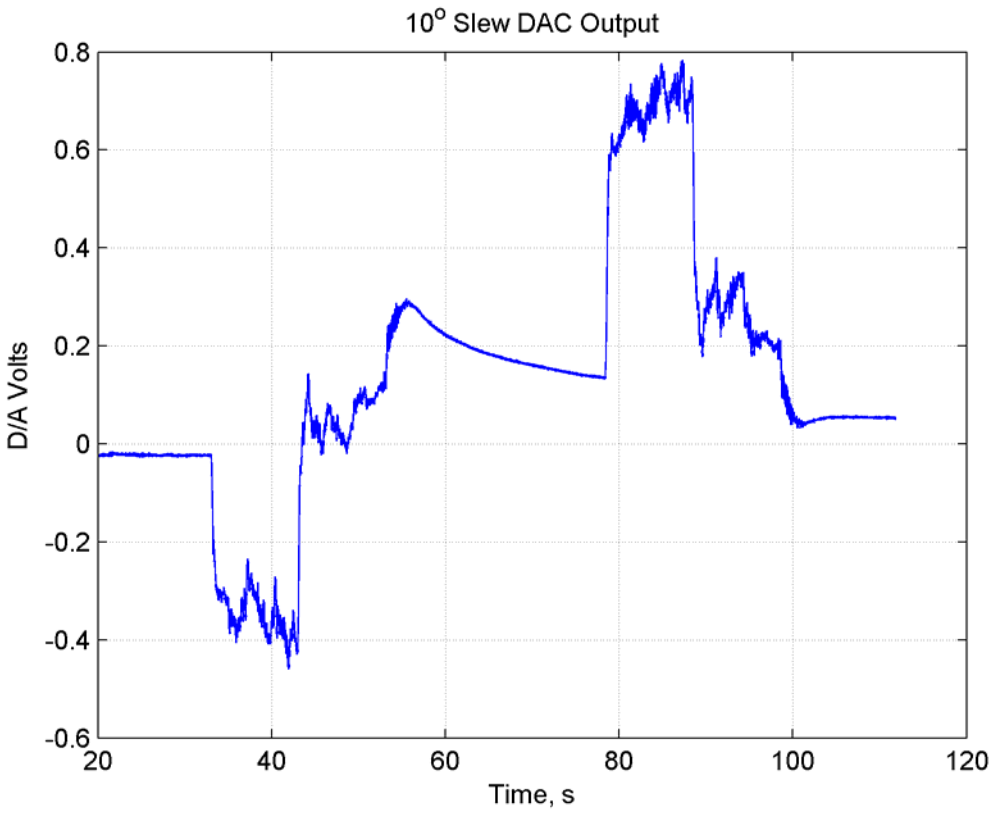
The velocity signal, in degrees per second, is below. This shows that we achieved the maximum allowed velocity of 1°per second, but didn't really stay there. A longer slew would show flat peaks while the telescope slewed at a constant rate.



Finally, we have the DAC signal, which has the expected behavior of increasing during acceleration, remaining constant, then switching sign to decelerate the telescope. There is also flexible-body modal energy present, but the servo loop notch filters are working to minimize this unwanted behavior.

Deviations from the reference plots should be cause for concern, particularly when the DAC signal saturates with no corresponding acceleration from the telescope axis. Another way to look at it is to note a saturated DAC signal, along with an increasing position error value, is indicative of a problem somewhere in the drive system. Unexpected controller behavior, of any kind, is intolerable with millions of dollars of optics, equipment, and personnel at risk.

More testing with long slews should be done to fully document the servo loop signal set for future reference. Understanding the strange results seen with the VxWorks controller would be extremely valuable as well.


10° Slew DAC Output
D/A Volts
Time, s
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
20
40
60
80
100
120