Report: EVLA Servo/ACU/FRM mini-PDR Report

The following is a summary of important points from a short PDR (Preliminary Design Review) of plans for updating the VLA Servo, ACU (Antenna Control Unit), and FRM (Focus and Rotation Mechanism) to improve performance as required by EVLA specifications, and to interface existing drives with the new M&C MIB to be provided with the EVLA. The PDR was a top level presentation of the design plans conducted on April 9 at Socorro. The purpose of the review was to answer 3 principal questions:

1. Are the top level performance requirements complete and adequate?
2. Have the correct design solutions been selected for study and development during the EVLA design phase: Are there important alternate solutions that are not being studied?
3. Has an adequate procurement plan been identified for the subsystem?

No formal review panel was appointed.

Bob Broilo summarized the requirements and action planned as follows:

1. The required minimum sample rate for the absolute position encoders for OTF observing is 40 Hz, and the encoders must be able to keep up with a maximum tracking speed of 7.3 deg/sec. The two requirements are easily met by the 1.6 kHz sampling rate and 20 deg/sec maximum speed for the new encoder electronics.
2. Target positioning times of 2 arcseconds in less than 1 minute and 4 arcseconds in less that 2 1/2 minutes, nor reduction in settling time will be addressed with the servo system planned for the test antenna. Ramping up, ramping down, and trajectory calculations will not be part of the servo work on the test antenna. Instead, the new servo system will duplicate the function of the existing servo with a PID controller, but use programmable parts which can be updated with new parameters at a future date.
3. The new encoder electronics provide 25 bits of position data per axis. The new servo system data path to the M&C system is 32 bits so that whatever number of bits from the encoder proves to be useful can be used by the real time operating system. The current encoding is 20 bits/axis now. It appears the encoders may have the accuracy to support the additional resolution; the additional resolution may help pointing and tracking.
4. No stiffening of the antenna structure is planned; however, the gain parameter will be accessible so that response to wind may be improved if the gain can be increased without decreasing stability. Again, no parameter adjustments are planned for the

test antenna.

5. The new servo system will continue to use tachometers in the velocity loop to improve the settling time. However, the tachs are not neccessary to point the antenna.

6. Though the existing ACU and Servo system could be modified to work with the new MIB, the new servo system is expected to cost only $1k/antenna. The new servo system will be highly configurable unlike the hard-wired system currently in use, and will address several obsolescence and maintenance issues. It is expected that production costs will be offset by reduced maintenance costs.

7. Currently, anti-backlash can be turned off under high motor loads so that both motors push in the same direction. Since the switch is based on motor currents, not speed, the switching occurs only under heavy wind loading. In any case, there is currently no plan to change the logic conditions for turning off anti-backlash.

8. New drives and motors would cost $10k per axis. There is currently no plan to do so though the new servo system will have the proper hooks for a standard industrial drive to provide future compatibility. The new servo system will continue to provide a current command to the existing drives and motors.

9. Eventually, a new translator for FRM control will be installed at the apex. For now, the goal is to run fiber optics communication and power to the apex for reliability and RFI concerns.

10. Bob expects to implement the PID software in C.

Comments from reviewers:

1. Remote E-stop and power reset could be included in new servo/ACU.

2. Portions of the ACU implementation could be done in the MIB.

3. To address obsolescence issues, select the controllers from reputable vendors, pick popular chips, buy lots of spares.

For the panel,

Clint