

Report: EVLA Fiber Optics Subsystem PDR Review Panel

This is a report on the findings of the EVLA Fiber Optics Subsystem PDR Review Panel based on a top level presentation of the design plans conducted on December 5, at Socorro. The purpose of the review was to answer three 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?

Members of the Review Panel attending were the following:

John Dreher, Allen Telescope Array
Richard Prestage, GBT Project
Dick Thompson, NRAO CDL
Steve White, GBT Project
Anthony Willis, Herzberg Institute
Rick Perley, Project Scientist
Jim Jackson, Hardware Systems Engineer
Gareth Hunt, Software Systems Engineer
Brent Carlson, Correlator Task Leader
Terry Cotter, LO/IF Task Leader
Steve Durand, Fiber Optics Task Leader
Paul Lilie, substituting for Dan Mertely, Receivers/Feeds Task Leader
Bill Sahr, Monitor and Control Task Leader

The Review report is divided into three parts: I) Comments from the Panel Review, II) Comments during the open meeting presentation, and III) Conclusions.

Part I. Comments from the Panel Review

- ! 6 dB margin for fiber operation seems difficult to achieve. Consider a backup plan for A configuration like higher launch power or additional EDFA amplifiers for last stations on each arm.
- ! Consider an in-place test of fiber performance, especially for temperature variations.
- ! Develop a consensus for location of patch panels.
- ! Would packets be easier than frame format?
- ! Decide 6 vs. 12 fiber per cable issue.
- ! Decide on loose tube or other scheme for above-ground fiber.
- ! Select LO transmission at a frequency channel near the zero-dispersion frequency.

Part II. Comments from the open meeting

- ! Will a cable wrapup for the LO cable be necessary to reduce cable flexure?
- ! Round trip phase measurement will correct for most fiber variation, but determining when the LO slips a cycle should be the criterion for the upper threshold.
- ! Sacrificing armor to lightning strikes may prove unacceptable. Is the expected heat dissipation from a lightning strike sufficient to damage the armor? If so, should a protective measure be selected?
- ! What is the impact of frost heaves? To what depth does the ground freeze? Is the fiber subject to freezing soil temperatures and if so, what is the impact on performance?
- ! Parts of the arms can be below water for extended periods. What will be the impact on the fiber cable of immersion in water for weeks at a time?

- ! What are the provisions to minimize temperature variations of the fiber cable above ground; e.g., on the antenna?
- ! Should patch panels for telephone, LO, data, and M&C be located in one place for ease of identification, or be distributed for ease of testing?
- ! The frame format should include antenna, Pad, and IF Ids.
- ! Should the frame format be the same as ALMA or is the CRC code planned by ALMA unnecessary for EVLA?
- ! Use Data Valid bit in frame format for real-time RFI flagging?
- ! What are the provisions for maintaining sync when the data include long strings of 1's and 0's? Long strings should be expected for lower frequency bandwidths where data are effectively oversampled.
- ! Consider remote power control to eliminate need to reset antenna power breakers.
- ! Is the sync word too short or the overhead too big?
- ! Will the test equipment include directional couplers? Will the test equipment be left connected and, if so, is the equipment included in the loss budget?
- ! Consider grouping outputs of the patch panels in groups of four for ease of connection and identification.
- ! The LO cable can be identified by having the facility to turn off individual LO transmitters.
- ! Will the burial cairns planned for crossings provide for a uniform burial depth of 1 m? Are there adequate provisions for arroyo crossings? Will the burial depth be maintained in sandy spots which are subject to wind erosion?
- ! The master pad will have fiber optic cable run to it, but the maintenance pad will not. The reason is that the maintenance pad is unusable. Instead, the "master" pad is now used for maintenance.
- ! Run fiber to the pad at the AAB for at least the M&C to facilitate testing of modules. However, some thought must be given as to whether or not M&C fibers would be useful without the LO & IF fibers.

Perhaps the entire set of fibers should be run to the barn.

III. Conclusions:

The top level performance requirements for the EVLA Fiber Optics subsystem design are complete and adequate as long as it is accepted that the broadband data are to be transmitted digitally.

Correct design solutions have been selected though a consensus on issues such as patch panel location, 6 vs. 12 fiber, cable housings to reduce temperature effects, performance of cable under adverse conditions all remain to be developed.

The procurement plan for the fiber cable is covered in the fiber cable Acquisition CDR.

For the Review Panel,

Clint