CDR Response
February 26, 2009

The KFPA project team acknowledges the recommendations presented in the final CDR document and will make every effort to address each concern. These comments are insightful and an integral to the process of producing this important scientific instrument. We shall continue the transparency of the project by validating each design decision, with data and reasoning available on the NRAO wiki.

Mechanical Design

Thermal analysis is complete and mechanical constraints understood. The high-priority mechanical design, which supports the seven pixels within the dewar and provides thermal paths to the cold head cylinder, is being modeled in Inventor. Although various aspects of the design were considered during single-pixel construction, the completion of testing frees resources to work on design details. The seven-pixel design is unique, but commonality with other receivers and our experience with these designs minimize risk, with expected completion within the confines of the schedule. Also, thermal lift capability of the model 350 refrigerator is sufficient for phosphor bronze wire, eliminating the need for the delicate Manganin wire. Experiments with each type will continue, providing valuable experience for larger arrays.

Baseline Stability

Since the review, an analysis of the sliding waveguide has yielded improvements in the return loss, but not significant enough to eliminate the need for isolators on the HEMT amplifier outputs. The improvements will be incorporated and isolators purchased for each channel. Any stability issues of the sliding waveguide are under review of how to test for potential problems. More time on the GBT, with various elevation scans, has the greatest chance of uncovering instabilities, but uncertain weather conditions and time from other programs make this proposition impractical. Instead, a continuum measurement system with higher sampling speeds to improve the sensitivity to gain perturbations is being developed. This will allow long, undisturbed measurements in a laboratory environment over various dewar orientations.

Users of Mustang, Q-band, and Ka-band receivers have not had issues with Gore-Tex feed coverings. Mustang did experience problem with vibrations from feed defrosters, but this is not related to mismatches from the radome. Considering the feeds must be kept dry, our working assumption is that a pressurized Gore-Tex radome will be adequate for the KFPA.

Monitor and Control

Two software engineers are assigned to the project for the duration of the control software development. Commercial hardware for prototyping the M&C block diagram is purchased. Like the thermal design, this is a high priority item requiring attention to progress and early prototyping for uncovering potential problems with the hardware interface. A program written by the electronics group for local control of the receiver independent of the network computers is being investigated. This would be based on

Labview, or a similar package run on a laptop computer, allowing hardware tests independent of the network-based software.

Pipeline

Production of images from on-the-fly data remains the top priority of the KFPA pipeline. A set of use-cases is being written to better prioritize the pipeline development and to ensure that user expectations match the initial pipeline. Our first concrete planning session was devoted to data visualization and editing needs. Additional work along those lines will follow from the specific-use cases. Four feeds from the existing K-band receiver will be used to generate simulated KFPA data by taking real data and editing the resulting data set, after the fact, to resemble an expected KFPA data set. We are exploring options to use the existing M&C simulator to do more complete KFPA data simulations.

A short-term software engineering position, to be based in Charlottesville, has been advertised. This position will double the available resources for KFPA pipeline programming. We are also working with the UVA Computational Science & Engineering (UVACSE) organization on design for high performance, which will help us evaluate and select pipeline tools and techniques that are most appropriate and relevant to the KFPA pipeline. While parallel computing isn't required for the 7-element KFPA, it is imperative for any larger array. It is important that we try to anticipate that need, where possible, to avoid substantial rewriting and rethinking of the pipeline when parallel computations are required.