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To: R. Ekers, R. Sramek, and G. Hunt

From: R. Hjellming, D. Bagri, J. Cordes, and M. McKinnon

Subj: Status of Plans for Phased Array Processor at the VLA

On June 5, 1987, and during the following week, we have had fruitful discussions of the specifications for the Phased Array Processor for the VLA. In addition to ourselves, the discussions involved P. Crane and K. Sowinski. The purpose of this memo is to summarize our conclusions, and to determine the main capabililties that we recommend as goals for the project.

First let us summarize the main requirements for the Phased Array Processor or Short Time Constant Processing System. The minimum requirement is sampling at a rate of $\approx$ 1 millisecond in sixteen channels. A 16 channel filter bank would be used, for each of two IFs, to sample channel bandwidths of $\approx$ 3 MHz (optimized for flare star, etc. work) and/or $\approx$ 1 MHz (optimized for pulsar work) from two IFs. The multiplexer will be designed to handle either 32 channels from a single IF or 16 channels from each of two IFs. Eventually an FX correlator of the type being designed for the VLBA could be used to provide a more flexible system; however, only a single dual-filter bank system is considered to be part of the initial project development at the VLA. While faster sampling and more channels are always useful, it was felt that the 16 channel/1ms/2IF capability was significant for most of the major scientific areas where faster sampling is desirable, yet could be obtained for a cost of $\approx$ \$25,000 for hardware. It permits significant capability in the studies of pulsars, flare stars, and other types of short time scale (coherent) emission in which some frequency drift is inherent in either the emitting object or the intervening medium. It is assumed that there will be the usual trade-off between the number of channels and the permissable sampling rate so the single channel sampling rate would be $\approx$ 62 μsec (16 kHz). Depending upon further comments specifications for these parameters may change slightly.

It was agreed that commercially available hardware for PCs should be usable for sampling at this rate. It was also agreed that the computer system should be limited to a fast PC AT or equivalent. It was also agreed that the prime initial objective is to get the 2 X 16 channels written on tape with $\approx$ 1 ms sampling. The initial computer system will therefore have a tape drive, although it may be possible to have data recorded on MODCOMP tapes.

The best current guess for the cost of the hardware for this project is \$ 25,000: \$ 9,000 for power dividers, band-pass filters, detectors, integrators, control circuit board, timing control board, connectors/cables, chassis/enclosure, multiplexer, and A/D converter (based upon preliminary estimates by D. Bagri); \$ 10,000 for tape drive and controller; and \$ 6,000 for the PC AT or equivalent (plus software) with a very high capacity hard disk, preferably 140MB. Each of these three estimates could be shaved or augmented, but represent a compromise between the two extremes that we believe leads to a reasonable total budget.

Mark McKinnon will construct the necessary control boards that are not purchased commercially, will construct the filter bank from purchased components, and will work on system integration and development. It will be an integral part of his New Mexico Tech astronomical/instrumentation thesis in the area of either flare stars or pulsars. D. Bagri will oversee the hardware design and implementation. R. Hjellming will aid in system development with concentration on software and data handling, and will work with Mark on scientific use of the Phased Array Processor. Others, particularly non-NRAO astronomers including Hankins, Cordes, Bookbinder, and Kulkarni, will be involved in an advisory capacity as the system develops.