VLBA Correlator Memo No. 97

Interoffice

National Radio Astronomy Observatory
Charlottesville, Virginia

1990 March 20

To: (see Distribution)

From: J. D. Romney

Subject: VLBA Correlator Power Requirements

The VLBA correlator system will consume nearly 40 kW of electrical power when it is installed and completed at the AOC in Socorro. By "correlator system" is meant here the combination of the correlator proper, and its playback subsystem, which consists in turn of 24 playback drive (PBD) / playback interface (PBI) pairs. The playback elements are assigned formally to the VLBA recording and playback system, but are integrated operationally with the correlator, and in fact account for more than $\frac{2}{3}$ of the total system's power requirements.

One can distinguish two different degrees of regulation of the raw line power, as detailed in Table 1. *Protected* power is protected only against transient and/or stable overvoltage conditions, to preclude destruction of expensive components. The necessary protection is certainly available through the AOC's motor-generator, but *might* be achieved as well by sufficiently robust (and possibly more expensive) power supplies operating on raw line power.

The entire correlator system should be afforded this degree of protection. In particular, the FFT and MAC modules contain the semi-custom 'FX' chips which would be quite difficult to replace if numbers approaching or exceeding the 20% planned sparing were damaged.

Stabilized power is regulated further, buffered to ride through relatively short dropouts or sags which would require re-initialization of computers and microprocessors. This level of regulation is important for operational efficiency, to minimize the down time lost to frequent restarts. The necessary stabilization requires either a motor-generator or an "uninterruptible" system.

Equipment requiring stabilized power consists of: the digital sections of the PBDs, and the PBI modules, which together include 144 embedded microprocessors; and the correlator control computer system, assumed here to include a Sun server and two additional workstations, plus two VME chassis containing the real-time computers.

This arrangement requires that power routing be split within the PBDs to provide separate supplies to the 5-v digital power supply and to all the remaining power distribution. Such a scheme is not implemented in the two units already constructed, but a preliminary investigation indicates it could be introduced straightforwardly.

Table 1. VLBA Correlator Power Requirements

Component	Units in Correlator System	Power Consumption Unit [W]	Protected [kW]	Stabilized [kW]
PBDs — general	24	662	15.9	–
PBDs — digital	24	276	–	6.6
PBI Modules	24	125	–	3.0
PB subtotal			15.9	9.6
FFT Modules	40	55	2.2	–
MAC Modules	60	52	3.1	–
Computers			–	6.7
Cx subtotal			5.3	6.7
TOTAL			21.2	16.3

The preceding recommendations are based in part on the power distribution planned at VLBA stations, and on the experience of other correlator systems. VLBA recording drives, for instance, operate on uninterruptible power. These recorders may be more difficult to reset due to their remote location, of course, but conversely the correlator will have an order of magnitude more units.

In the VLA correlator, the control computer and system controller are supplied with stabilized power from a motor-generator. The bulk of the correlator operates on unregulated power, protected only through its internal power supplies. There have been only occasional incidents of component damage in which power transients were the suspected cause.

The two Mark 3 correlators in the U. S. apparently are subject to rather different raw power conditions. Haystack does not regulate line power beyond the protection integrated into the power supplies; the Washington correlator at USNO, in contrast, has found it necessary to install an uninterruptible system similar to that at VLBA stations.

Finally, since the AOC apparently may not have adequate stabilized power capacity to implement these recommendations, a note on priorities may be appropriate. I suggest that the VLBA array control system and VLBA correlator should have together the highest priority for our best-regulated power. These are the only two completely "unbuffered" links in the VLBA pipeline: time lost in either area cannot be made up elsewhere (as can, for instance, off-line image processing). One or the other of these two VLBA systems will pace the overall throughput of the Array at various times, and both should operate as reliably as possible.

R. Escoffier, G. Peck, and D. Wells provided the data compiled in Table 1, and suggested several important topics incorporated in this memorandum. I am pleased to acknowledge other valuable inputs from C. Broadwell, R. Cappallo, K. Kingham, J. Oty, A. Rogers, D. Sramek, J. Webber, and A. Whitney.

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