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TO: VLBA Processor Group
FROM: Alan E. E. Rogers
SUBJECT: Number of Channels for VLBA: Comparison of 2 Schemes

I have compared two possible video channel schemes for the VLBA.

The schemes are as follows:

- A) 4 12.5 MHz (25Mbits/sec) channels as per VLBA program description (May 1982)
- B) 14 4 MHz (8 Mbits/sec) channels

Table 1 summarizes the characteristics and requirements of the schemes. Scheme A has the advantage of requiring only 4 video converters, the simplicity of fewer channels and has sample rate compatible with the VLA. Scheme B is well suited for bandwidth synthesis needed for precision astrometry and geodesy. It has sample rates compatible with the MK III and has advantages for low frequency pulsar observations.

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TABLE 1

	<u>A</u>	<u>B</u>	<u>NOTE</u>
# VIDEO CONVERTERS REQUIRED	4	14	
LOCAL OSCILLATOR SWITCHING TIME REQUIRED	1 ms	1 sec	1
ACCUMULATION PERIOD	200 ms	10 sec	2
DISPERSION ACROSS BAND FOR PULSAR	500 ms	160 ms	3
DELAY WINDOW	1.28 μ sec	8 μ sec	4

NOTES

1. Bandwidth synthesis for astrometry and geodesy needs approximately 7 frequency channels at each of two bands. Two bands are required to correct for the ionosphere (S&X are used by project POLARIS and the NASA crustal dynamics project). About 7 frequency channels are needed to adequately span the several hundred MHz of available r.f. bandwidth. The number of frequency channels can be increased by sequentially switching the local oscillator. When the frequency switching method is employed the cycle time should be as short as possible, in practice about 1 second is adequate to ensure enough cycles within a 1 minute scan. Scheme A requires frequency switching for BW synthesis while B does not; hence there is no requirement for a rapid settling of the local oscillator.

2. When frequency switching is employed the correlator accumulators must be dumped at the switching rate so that the data can be binned by frequency channel in the post processor. This requires a relatively short accumulation period for the A scheme.

3. When high dispersion measure pulsars are observed at low frequencies there will be substantial smearing of the pulse across the band. The numbers in Table 1 assume $DM = 400 \text{ cm}^{-3} \text{ parsec}$ and $f = 300 \text{ MHz}$. The pulse smearing degrades SNR (in the pulse gated mode) and pulse profile resolution.

4. For fixed number of cross-correlation lags the delay window decreases with wider bandwidth. The table assumes 32 complex lags.