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| VLBA CORRELATOR MEMORANDUM NO. VC 018 |
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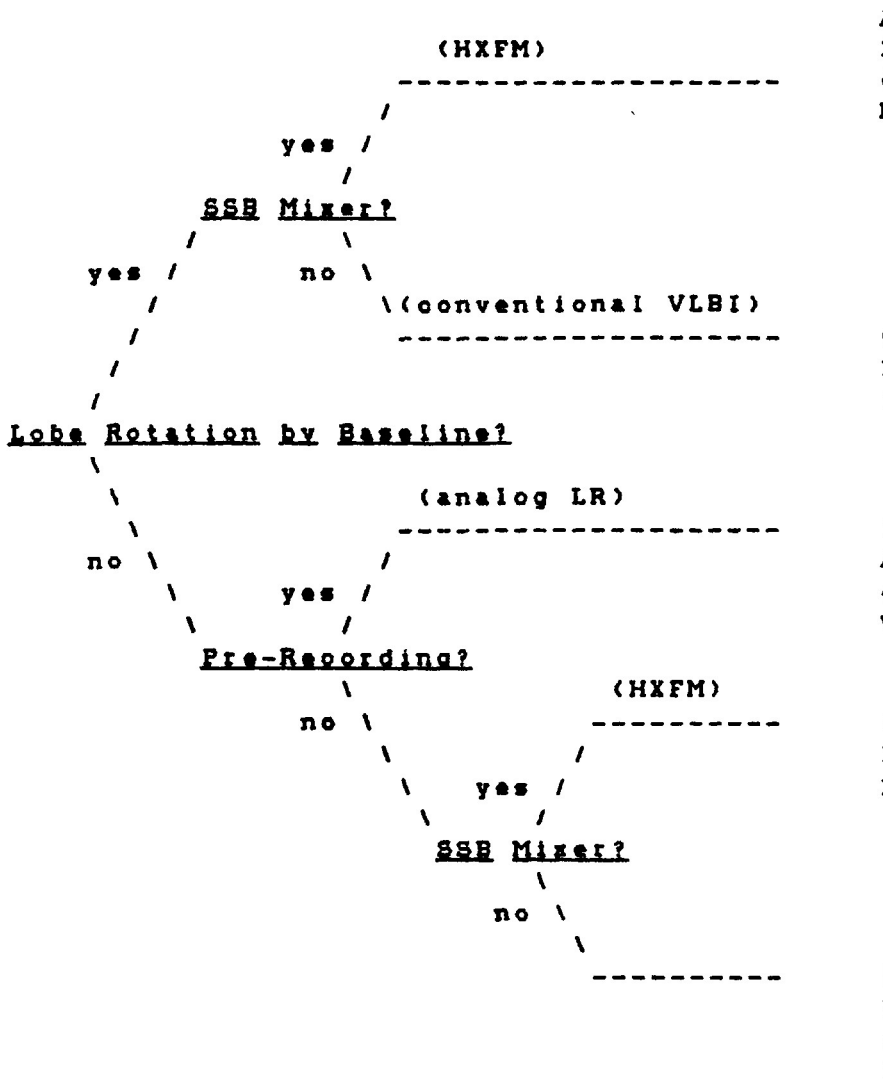
To: VLBA Correlator Group Date: 9 Feb 1984
From: Martin S. Ewing

Subject: Lobe Rotator Options

I would like to describe the various options we face on how to deal with the VLBA lobe rotation function. I have tried to make a decision tree and to outline the consequences, as I see them.



	ANT ---- IC COUNT ----			
	LO?	ACCUM	L.R.	HXFM	TOT
(HXFM)	0	3K	7K	3K	13K
	HXFM losses				
(conventional VLBI)	0	6K	7K	0	13K
	Excess Accumulators, 3-level sin/cos loss				
(analog LR)	1	3K	0	0	3K
	Antenna complexity, compatibility with non-VLBA stations.				
(HXFM)	0	3K	3K	1K	7K
	Phase Cal. Intermod, Double HXFM Loss				
	0	6K	3K	0	9K
	Excess accumulators, phase cal. intermod, Double 3-level sin/cos loss				

HXFM = Digital (discrete) Hilbert Transform
SSB Mixer = Digital SSB mixer using HXFM

The IC counts are very rough estimates based on the following assumptions: 10 ICs per lobe rotator; 1/16 IC per accumulator; 4 ICs per HXFM. An accumulator IC is more expensive than the other types, but occurs in regular connection arrays.

N.B: Regardless of LR technique, the correlator will need fast dump rates, up to about 60 Hz. The dump rate is determined by the need to handle multiple simultaneous phase centers within the primary antenna beam.

Strictly from the correlator viewpoint, the antenna-based analog lobe rotation (with multiphase sampling) is clearly preferred. Not only is the circuitry simplified, but several loss factors are avoided: the fractional bit shift loss, the 3-level digital "LO" loss, and, possibly, the digital HXFM loss.

Non-correlator considerations include: complexity of antenna electronics, interoperability with non-Array antennas, and Array communications demands.

Further work is needed to understand the HXFM options. What are the losses and calibration problems? How complicated a filter is required?

The station-oriented post-recording LR options are not so much better (in hardware terms) than the baseline-oriented choices because 19 antennas is not so much less than 45 baselines. (Actually, the requirements of the station-oriented design are probably overstated, since the full 16 channels cannot be processed at once in half and quarter modes.)

Note that the accumulator-saving SSB lobe-rotation options all require a considerable redesign or relayout of the VLSI circuit. It is likely that the VLBA would have to bear the full manpower cost of this effort.