VLB ARRAY MEMO No. 2/

PROPOSALS FOR A PRELIMINARY VLA SPECTRAL LINE SYSTEM

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Specification goals for a preliminary spectral line system are as follows: Antennas: 10 Polarizations per antenna: 1 Maximum Bandwidth: 5 MHz (could be higher with less channels, to a maximum of 40 MHz, however, this increases the cost of the delay portion of the system). Sampling level: .3 levels by 3 levels Number of channels at 5 MHz BW: 128 delay channels 64 frequency channels Integration period between dumps to computer: <10 sec Efficiency (observation time - non-integration time): >95% observation time

With the experience gained, on the VLA delay-multiplier prototype system, the above line system could be built in a straightforward manner using similar circuits at an 80 MHz clock rate. It would occupy two racks and would exactly meet the above specifications. Because of the shortage of engineering time to do investigations for this report, and because the above system is not expected to present any problems, an investigation of an alternative 300 MHz method has been made. The cost of the standard 80 MHz system and the alternative 300 MHz system are in the same "ballpark" for the preliminary system; however, the alternative 300 MHz system presents some important advantages, some slight disadvantage and could possibly be cheaper in the final system. The final system price could only be determined after experience has been gained with such high frequency circuits.

The 300 MHz system is at the state of the art. In order to provide a higher possibility of success, certain conservative measures have been taken which result in a new set of specifications:

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Maximum Bandwidth:	4 to	5 MHz	(same	note	applies	as	i
Polarizations per anter	nna:	2					
Antennas: 10							

4 to 5 MHz (same note applies as in 80 MHz system above). NOTE: Maximum clock rate determines BW and this is to be determined by experience with the circuits. A reasonable value at present seems to be between 256 MHz (4 MHz BW) and 320 MHz (5 MHz BW). Sampling level resolution: See number of channels specification Number of Channels at 4 to 5 MHz BW: 2 level by 3 level - 256 delay channels 128 frequency channels Channels can be split 50-50% between polarizations 3 level by 3 level - 128 delay channels 64 frequency channels Integration period between dump to computer: <10 sec Efficiency (observation time - non-integration time): >95% observation time

As can be seen above, the advantages of the 300 MHz system are the greater flexibility in number of channels and their use. For example, if polarization is not important, observation can be made with two two-level by three-level correlators - one on left and one on right polarization - and add them together to obtain a higher sensitivity than is possible with a 3 level by 3 level correlator. Or if the receivers are available, two different one-bit observations could be made simultaneously. It should be made clear that either the 80 MHz or 300 MHz system can be made to provide any number of channels in any type of flexible system within reason. The comparison here is between systems of approximately the same cost. Experience is required on the 300 MHz system before absolute comparison can be made, but one important feature that appears probable with the 300 MHz system is a reduction in the number of components and a corresponding improvement in reliability.

In both systems, oversampling can be provided with the proper choice of bandwidth and number of channels - particularly at the low bandwidths - to provide greater sensitivity. Also, in both systems, the number of channels can be doubled each time the bandwidth is halved to the point where the computer can no longer handle the data.

Table 1 lists some of the bandwidths, number of channels, sensitivities and etc. for the systems. Table 2 is a cost breakdown of the 300 MHz system. This is a very rough conservative figure based on the following:

Prices are as listed in catalogs - not bargains obtained for the 6 antenna delay-multiplier system.

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Prices include all components, labor, testing, non-recurring charges, etc. Prices include the complete system: delay line, correlator, system controller computer, CRT terminal, power supplies and hardware.

Figure 1 is a logic diagram of one cross correlator - 4 channels at 300 Hz - and the necessary drive circuits. Figure 2 is a possible rack layout. Table 3 is a listing of the layout - i.e., grouping of antenna correlators on cards.

	SENSITIVITY & OBSEDNATION TIME						
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3	2 x 3	.718	8/3	1.940	1.573		
. 4	3 × 3	.810	885	1.524	1.277		
5	POLARIZATIONS						
. 6	2 4.12	899	1.048	1.237	.910		
7	2 × 3	1.015	1.150	.971	.756		
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	VLA SPECTRAL LINE SYSTEM - 300 MHZ, - 128 DELAY CHANNELS						
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	Fur 10178	36 36	4.0	144,00	144.00	288.00	2880=
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300 MHZ CRC CORRELATOR

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