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June 14, 1982

Dr. Richard J. Fisher
N.R.A.O.
P. O. Box 2
Green Bank, WV 24944

Dear Rick:

I am sorry I do not remember the names of the other persons in the telephone conference on FFT machines that we had some time ago, so I address the letter to you.

I contacted Dr. Noble Powell of General Electric, Syracuse, New York, on building a 64 point real or complex machine without any of the interfaces (which we would supply). Data rate of 8 bit words would be 20 MHz max., settable to lower rates only. Multiplying coefficients would be of 8 bit accuracy. His group built the 10 MHz 1 K FFT transformer that Ivan Linscott used in his controversial experiment. They have now developed a new custom integrated circuit that runs at up to 10-15 MHz. It does one butterfly operation. He parallels a lot of his operations so he is able to run faster. All the 200 IC's of the machine are on one large board. Unfortunately, his asking price ($70 K to $100 K) is too much for us, and I think it is not justified. Most of the cost is in design salaries: he would provide 2 machines for the same price as one (or nearly so). If you are interested we could explore sharing the cost, but I think the design from scratch seems much more attractive, particularly since extending the bandwidth beyond 20 MHz is rather difficult in the G.E. design.

I also promised you some values of delays vs. frequency for some high Dispersion Measure pulsars. Enclosed please find copies of printouts for the two extreme cases: PSR 0950+08 (DM = 3.0 pc cm^{-3}) and PSR 1859+03 (DM = 402.0 pc cm^{-3}), giving the sweep rate (S) (MHz/sec) at each True Center Frequency, and its inverse in Millisec/MHz (which is proportional to the Dispersion Measure). Also given is the delay between two 20 KHz points located at the True Center Frequency (also proportional to the Dispersion Measure). As we discussed over the telephone the most desirable single channel bandwidth for best S/N ratio is equal to:

$$B = S^{1/2} \times 10^{-3}$$

where B is in MHz and S is the sweep rate in MHz/sec. This comes from equating the transit time through one filter bandpass with the risetime of that filter. However, for strong pulsars one may use other bandwidths when studying special events, or other reasons. I hope this information helps you. We will start FFT design work in the late summer. We are interested in keeping a collaboration running with you, so let us know your plans and let us exchange ideas.

Thank you.

Yours,

V. Boriakoff

Valentin Boriakoff

vb/it

cc: Martha Haynes
Mike Balister

enc.

PULSAR=,CP 0950 WITH DISPERSION MEASURE=, 3.000000000PC/CM3

FILTER BANK= 32 FILTERS OF .0200000MHZ EACH FILTER
CENTER FREQUENCY OFFSET FROM 30.0MHZ BY .3500000MHZ

CENTER FREQUENCY MHZ	73.80000	111.50000	196.50000	318.00000	430.00000	606.00000	834.00000	1409.00000	1667.00000	2380.00000
TRUE CENTER FREQ.MHZ	74.15000	111.85000	196.85000	318.35000	430.35000	606.35000	834.35000	1409.35000	1667.35000	2380.35000
MHZ/SECOND	16.37926	56.21716	306.45534	1296.21037	3202.03704	8956.35039	**********	**********	**********	**********
MILLISECONDS/MHZ	61.0528	17.7882	3.2631	.7715	.3123	.1117	.0429	.0089	.0054	.0018
MILLISECONDS/CHANNEL	1.22106	.35576	.06526	.01543	.00625	.00223	.00086	.00018	.00011	.00004

PULSAR=,JP 1858 WITH DISPERSION MEASURE=, 402.000000000PC/CM3

FILTER BANK= 32 FILTERS OF .0200000MHZ EACH FILTER
CENTER FREQUENCY OFFSET FROM 30.0MHZ BY .3500000MHZ

CENTER FREQUENCY MHZ	73.80000	111.50000	196.50000	318.00000	430.00000	606.00000	834.00000	1409.00000	1667.00000	2380.00000
TRUE CENTER FREQ.MHZ	74.15000	111.85000	196.85000	318.35000	430.35000	606.35000	834.35000	1409.35000	1667.35000	2380.35000
MHZ/SECOND	.12223	.41953	2.28698	9.67321	23.89580	66.83844	174.14096	839.29128	1389.74927	4043.69685
MILLISECONDS/MHZ	8181.0755	2383.6139	437.2578	103.3783	41.8484	14.9615	5.7425	1.1915	.7196	.2473
MILLISECONDS/CHANNEL	163.62151	47.67228	8.74516	2.06757	.83697	.29923	.11485	.02383	.01439	.00495