

FFT PROCESSOR AS A DIGITAL LENS IN GRID ARRAY VLBI

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ABSTRACT. Correlator type processors have been currently used in VLBI, in which the number of correlators increases as $N(N-1)/2$ where N is the number of antennas. In a large elements VLBI array in future, this will introduce difficulty in constructing the processor. If we took the grid array configuration of antenna, FFT processor could be used in VLBI processing instead. FFT processor is used as a digital lens for a directional finding facility of the arrival waves. In FFT, the number of multiplications increases only as $N \log N$. Although it gives maximum redundancy of Fourier components, the next step of the research on crustal motion will require measuring the velocities as a vector fields. Higher S/N ratio is also obtained in the VLBI maps.

The present processor, which was originally constructed for a pilot system of the radio patrol camera at Waseda University, is formed by a FFT Processor and eight Complex Amplitude Equalizers(1,2). When it is used as an VLBI processor, phase and amplitude fluctuations due to local oscillators and/or propagation effects are absorbed by the quick control of the Complex Amplitude Equalizers.

Here, we show examples of the computer controlled phase adjustment using the Equalizers(3). Our telescope is an 8 elements Very Short Baseline Interferometer(only 2m) at 10 GHz. Fig.1 is the block diagram of the present system. In VLBI system the recording facilities should exist between A/Ds and the Equalizers. The FFT processor is an error free ideal lens, and from the sampling theorem it makes eight independent beams in our system. Fig.2 is the dirty beams before removing phase errors, and Fig.3 the beams after the error removed. Both are 180 deg beam switched, while non switched in Fig.4.

Parameters of the processor are follows.

FFT Processor and Complex Amplitude Equalizers

Input/Output	8 complex
Dynamic range	8 bit
Band width	20 MHz/antenna (-10MHz to +10MHz)
Clock	20 MHz
Multipliers	CMOS LSI (SONY CX7997)

531

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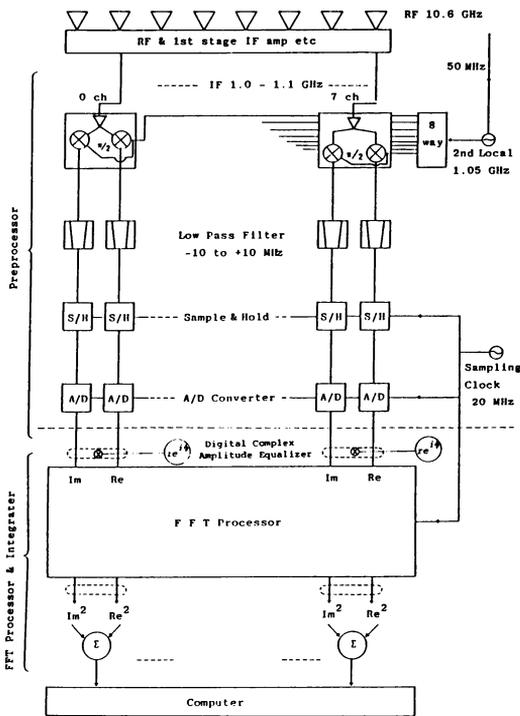


Fig.1 Block Diagram

Fig. 2,3,4 are obtained by scanning the sun. Channels 0-7 indicate the outputs of eight independent beams, which are used for the observations of CMB and transient radio sources.

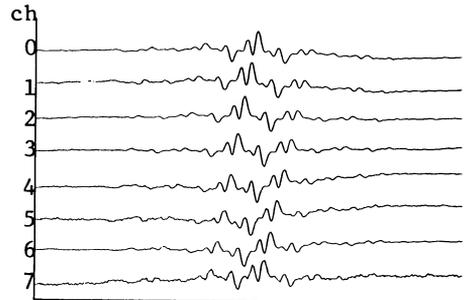


Fig.2 HA

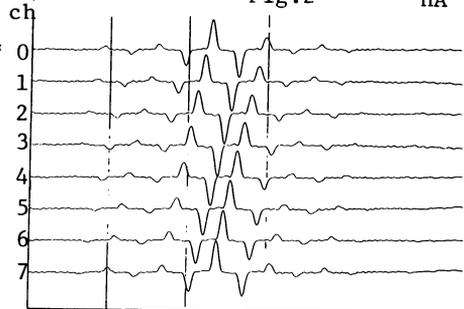


Fig.3 HA

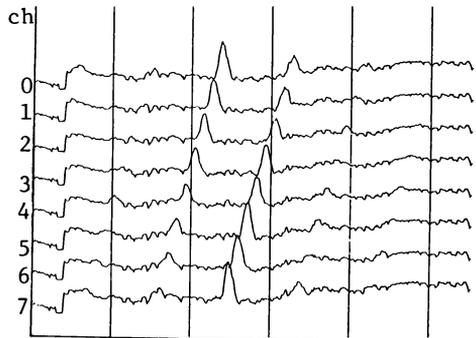


Fig.4 HA

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2. Daishido, T., Asuma, K., Ohara, H., Komatsu, S., and Nagane, K., 1986, IEEE/ICASP86, Tokyo, 53.4.1, 2855
3. Asuma, K., et al., 1987(in preparation)