


NATIONAL RADIO ASTRONOMY OBSERVATORY

MEMORANDUM

June 13, 1968

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You may be interested in this brief comparison of autocorrelation and filter receivers that I have written in reply to seven questions from E. Raimond of Leiden Observatory.

- 1) Are there any advantages in autocorrelation other than the obvious one of flexibility in bandwidth?

Flexibility is the biggest advantage. Stability is no longer an advantage since very stable filter receivers can be constructed. Another small advantage is that the spectrum can be computed at as many points as you wish. The limitation is that the ratio of bandwidth analyzed to half-power resolution is fixed at approximately $0.8 \times$ number of autocorrelation points. The spacing of the equivalent filter bank can be as close as you want.

- 2) Which are the disadvantages?

The disadvantage is a factor of 1.39 reduction in sensitivity and higher cost if a small number of bandwidths are desired.

- 3) Is NRAO, after having experience with the present one, going to stick to this system and, if so, why?

The new 413-channel receiver seems to be well accepted and I think we will continue building both types of receivers.

- 4) Would you also do it if there was a problem in getting sufficient computer time?

I believe a small, on-line, computer is needed with an autocorrelation receiver. The computer helps with integration of autocorrelation functions, performs the Fourier transforms, and displays data.

- 5) Would you consider this system also for an interferometer?

The correlation method fits quite naturally in an interferometer since cross-correlation requires little additional hardware from autocorrelation. On the other hand, a filter receiver will require a multiplier for each channel.

- 6) What are the approximate costs of the autocorrelation receiver, preferably compared with those of a conventional receiver with similar properties and say two different bandwidths?

I will illustrate the costs with an example of a 100-channel autocorrelation receiver vs. two 100-channel filter receivers.

100-Channel Autocorrelation Receiver

Fixed digital cost -----	\$ 5,000
\$100 per channel -----	10,000
On-line computer with X-Y recorder and paper tape punches -----	25,000
Frequency-translation equipment for 10 bandwidths -----	<u>10,000</u>
	\$50,000

100-Channel Filter Receiver — Two Bandwidths

Filter-band cost at \$50 per channel x 2 -----	\$10,000
100 Synchronous detectors -----	10,000
Scanner, A/D converter, X-Y recorder, and paper-tape punch -----	<u>10,000</u>
	\$30,000

These costs do not include labor, are U.S. prices, and may be 50% off.

- 7) Are there any other comments to be made?

A most important factor is the training and experience of the people available to design and maintain the equipment.

SW/cjd