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Memo to: VLBA memo series

from: J.M.Moran^{JM} and M.J.Reid^{MR}

topic: Filter bandwidths for VLBA

D'Addario's VLBA memo 298 discusses how the number of filters could be reduced to save money. Before conservation efforts lead to a serious reduction in capability, we would like to restate some of the relevant spectral line requirements.

The basic philosophy is:

(1) The available number of correlator channels is always inadequate or just barely adequate (from all VLA and VLBI experience) and therefore proper filters must be available to match the source spectrum, in order to obtain the best spectral resolution.

(2) Filters are cheap, especially compared to the expense of adding correlator channels. The scheme advocated by the Committee on Sampling and Channels (VLBA memo 196) calls for 11 bandwidths x 16 filters/station/bandwidth x 10 stations = 1760 filters. At \$40 each, the total cost is about \$70K. This cost seems small with regard to the aggravation and expense of having to retrofit stations later (as was done on the MkIII).

We support the design specified in VLBA memo 196. Some of the specifications there exceed spectral line requirements, such as the number of filters at each bandwidth. The most important spectral line requirements are:

1) bandwidths in powers of two from a maximum bandwidth of at least 8 MHz to a minimum bandwidth of 100 KHz or narrower. A bandwidth of about 100 KHz is very important for OH work. Indeed, 62 KHz is probably the most utilized bandwidth for OH work with the Mark II system. We strongly urge that a bandwidth of this order be included. For example, with 512 complex independent channels per baseline (92160 total real multipliers), 100 kHz filters, 4 bands, the resolution would be 0.8 kHz (0.16 km/s at 1.6 GHz) which would give less than two channels per spectral feature on OH masers.

2) At least 8 filters per bandwidth per station. This would allow two polarizations at four transitions to be observed, and would be useful for studying complex water vapor maser spectra.

The compatibility question (whether to adopt the MkII or MkIII filter bandwidths) is a difficult one. In many experiments it will be desirable to use either several VLA antennas or several MkIII equipped Network stations. We note that the narrowest VLA bands don't work well and the narrowest bandwidth is 196 KHz.

In any event there should be a provision for the use of external filters and sampling rates.