VLBA Acquisition Memo # 37

NORTHEAST RADIO OBSERVATORY CORPORATION

HAYSTACK OBSERVATORY

WESTFORD, MASSACHUSETTS 01886

3 April 1985

Area Code 617
692-4764

To: VLBA Acquisition/Recorder Group

From: Alan E.E. Rogers

Subject: Some suggestions on RF-Pulse Phase and Delay Calibration

1] Usefulness

If VLBA receivers are delay stable and I.F. cables can be calibrated the RF-pulse calibrator may not be needed. However, it provides a very useful check on system performance. For example if there is a jump in the residual delays (after fitting baselines, source positions, UT1, etc) which is the result of an intermittent fault in the maser electronics the receiver electronics may be blamed. With the RF-pulse calibrator any instrumental delay jump can be localized. In this example the lack of jump in the receiver delay, indicated by continuity in the calibration tone phases, would point the blame at the maser. Furthermore, since the calibration tone phases yield phase and group delay jumps in local oscillator phase, which effect only phase delay, can be distinguished from jumps in receiver delay which effect phase and group delay.

2] RF-pulse hardware

RF-pulse hardware could be an upgraded version of the MKIII hardware at a "nominal" cost of about 5K/station. While it may be a problem to obtain sufficient pulse energy at 88 GHz this hardware should work satisfactorily at 43 GHz and lower.

3] Phase calibration detection at the stations

With no additional hardware the phase calibration amplitude and phases can be monitored by software analysis of data segments captured by the data buffer. (This is presently done in MKIII using PCALR)

4] Phase calibration detection at the processor

Phase calibration tone phases can be extracted at the processor without additional hardware by using standard cross-correlation/fringe rotation hardware, setting "y" input to a fixed "1" and applying a constant fringe rate equal to the calibration tone frequency. It would be very desirable if this could be achieved without multiple tape passes by utilizing the excess correlators available in most continuum experiments.

5] Analysis

In MKIII the calibration tone phases and phase delay rate are used to correct the interferometric phases for a given coherent integration period. These are derived at the processor simultaneously with the cross-correlation functions. The VLBA corrrelator could perform a similar task - unless it costs additional hardware - in which case the job could be done at the stations and sent to the correlator or post processing system along with other monitor/calibration data (WVR, pressure, temp, etc.).