National Radio Astronomy Observatory
Charlottesville, Virginia

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MEMORANDUM

To: All Interferometer Observers

From: W. J. Altenhoff and W. Webster

Subj: On the Selection of Pointing Calibrators

The automatic pointing program of the interferometer allows the use of calibration sources which are about 5 f.u. or more. The previously used position calibrators (Cas A, Cyg A, Vir A, Or A, M17, Cent A, Tau A) are all quite strong, but are also quite extended and their positions are known only to a fraction of an arc minute. There are, on the other hand, several sources with fluxes greater than 5 f.u. and positions accurate to a second of arc. Based on observations, we want to answer the question whether or not one can make use of the better positional accuracy of the weak position calibrators.

Six sources were selected, 3C 309.1 being very weak, 3C 161 and 3C 286 being of about average intensity for the weak calibrators, and 3C 274, the weakest of the strong calibrators. Each source was observed for 30 minutes, resulting in four or five pairs of RA and DEC errors. The biggest difference of errors in each coordinate was noted as peak-to-peak (PTP) fluctuation. The PTP fluctuations in the following table were obtained as an average over about ten periods of 30 minutes of observations. From that we can estimate the rms value of a single measurement, and the rms of the mean value of 30 minutes observing time (see the following table).

		PTP		rms		rms(mean)	
Source	f.u.	RA	DEC	RA	DEC	RA	DEC
3C 309.1	5	8.1	2.9	2.7	1.0	1.6	0.6
3C 161	10	2.1	1.6	0.7	0.5	0.4	0.3
3C 286	10	1.5	1.6	0.5	0.5	0.3	0.3
3C 274	140	0.4	0.6	0.1	0.2		
3C 405	800	0.4	0.4	0.1	0.1		
Cas A	1500	0.3	0.4	0.1	0.1		

I think we can assume that the positional accuracy of the old (strong) position calibration sources is of the order of 1' in RA and 15" in DEC. Then it is obvious that one single pair of observations with the old calibrators yields at least the same accuracy as about 30 minutes observations with the weak calibrators. We can consequently expect a better representation of the pointing by the strong calibrators assuming equal observing time.

It also should be noted (as one can see from any plot of older pointing data) that the change in pointing with HA is often not linear. So combining of data into a mean value for periods of 30 minutes or so can introduce systematic errors, probably of the same order as the systematic errors of the strong sources. So it seems preferable to give any single pair of RA and DEC errors to the computer for the least square fit by the MERDEl-program.

If one mixes pointing data of strong and weak calibrators, one might however consider averaging the data on the weak calibrator in order that the points used for the least square fit have about the same weight.

One other reason in favor of the strong calibrators is that their data, drawn up on graph paper, gives an easy visual check on the behaviour of the pointing. They also are helpful for tracing back the history of pointing.

For DEC greater than 70° the teletype prints out wrong values of apparent DEC. There is the claim that this is only wrong on the teletype. But for the teletype printout of pointing data it was found that there are also errors in the pointing: the difference between ERROR minus CHANGE (equal to predicted pointing) jumped several times by about 10'. So I feel there is a danger of using pointing data of sources higher than 70° DEC -- as long as it is not known what is causing this problem.

List of Pointing Calibrators

Name	RA	DEC	Ref
3C 144	05 31 30.5	21 59 02	CalTech
3C 145	05 32 51.5	-05 25 16	CalTech
3C 274	12 28 17.6	12 39 56	DEH & CalTech
Cent A	13 22 34.8	-42 45 00	CalTech
M17	18 17 36.6	-16 12 15	JS and WJA
3C 405	19 57 44.5	40 35 46	CalTech
3C 461	23 21 06.8	58 32 47	CalTech

0521-36	05 21 12.4	-36 30 15