NATIONAL RADIO ASTRONOMY OBSERVATORY
Edgemont Road, Charlottesville

13 April 1984

VLB ARRAY MEMO No. 347

TO: Barry Clark

FROM: Alan Bridle

RE: The Washington antenna and the Canadian connection, II.

This will amplify my answer to the question you asked at today's meeting of the VLBA scientific group: i.e., why not replace the VLBA antenna in Washington state by one in New Mexico if the Canadians build a CLBA antenna at Penticton ?

I would very much like to see one (or more) additional VLBA antennas in New Mexico to bridge the VLA/VLBA coverage gap at 50-150 km baselines, but I did not consider moving the Washington antenna to New Mexico because such a move would significantly compromise the VLBA's stand-alone capability on its longer baselines. The Canadians do not propose a full-time partnership with the VLBA if they build their four-antenna option. They would use their antennas

(a) as a stand-alone array (probably with small movable elements) for geodesy,

(b) with the European VLB Network, and possibly other antennas, both for ground-based VLB and as a ground array for QUASAT, and

(c) as a partner for VLBA in a 14-element configuration.

The Canadian antenna at Penticton would therefore not be available to work with the VLBA full-time.

Unfortunately, the coverage of the VLBA at declinations between +20 deg and -20 deg is poor if there is no antenna in the Northwest (compare Figures 1 and 2). This coverage would be unacceptable for many experiments because of the gaps (stripes) at 2000-4000 km. The gaps would not be so serious for observations north of +30 deg, but the CLBA/EVN combination would greatly outperform this modified VLBA at such northerly declinations (see Figure 3), particularly for fields with much weak fine structure. If we were to move the Washington antenna to New Mexico, we would therefore have an inferior instrument for both northerly and equatorial declinations whenever the Canadian antennas were absent. Also, although the Canadians intend eventually to implement most of the VLBA observing frequencies, they are unlikely to bring up all of them by the time the VLBA becomes operational. Having the coverage shown in Figure 1 full-time at some frequencies would also significantly degrade the VLBA's capability.

I had therefore presumed that most VLBA users would consider the benefits on the shorter baselines of an additional antenna in New Mexico inadequate to compensate for these degradations of the high-resolution performance of the VLBA. Memo 336 therefore proposed an adaptation to the new Canadian proposal which leaves our stand-alone performance unaltered but still gets some benefit from adding the Penticton antenna.

I also feel that to fill the VLA/VLBA gap satisfactorily we will need at least three more antennas in New Mexico. Probably we should aim to get such antennas through a new proposal to NSF based on the science which the planned VLA/VLBA combination leaves undone, rather than in a piecemeal fashion at the expense of the long baseline performance of the stand-alone VLBA.

The biggest uncertainty in such discussions may be the fraction of the time that the VLBA would actually be used as a stand-alone instrument. As 18-station VLB network experiments are now being done, even a 10-element dedicated array may have lost some of its present appeal by 1988. If we assumed for example that the VLBA, EVN and CLBA would all be used together as a "world array" at the times when the CLBA joined the EVN, the fraction of the time the VLBA spent in stand-alone mode with the patchy coverage in Figure 1 could be made small. Moving the Washington antenna to New Mexico for better short baseline coverage might then be acceptable. But until now the design thrust has been to optimize the VLBA's stand-alone performance, letting the collaborative chips fall where they may.

Would the VLBA community be ready to accept this sacrifice of VLBA's stand-alone long-baseline performance to obtain a less redundant global configuration if the CLBA was actually funded ?

ARECIBO	18.34	66.75
HSTK	42.43	71.49
IOWA	41.58	91.57
FDVSNEW	30.47	103.95
LASL2	35.81	106.27
PIETOWN	34.33	108.14
KITT	31.96	111.60
OVRO	37.05	118.28
HAWAII	19.80	155.50

Scale in km
kilometers x 10^3)

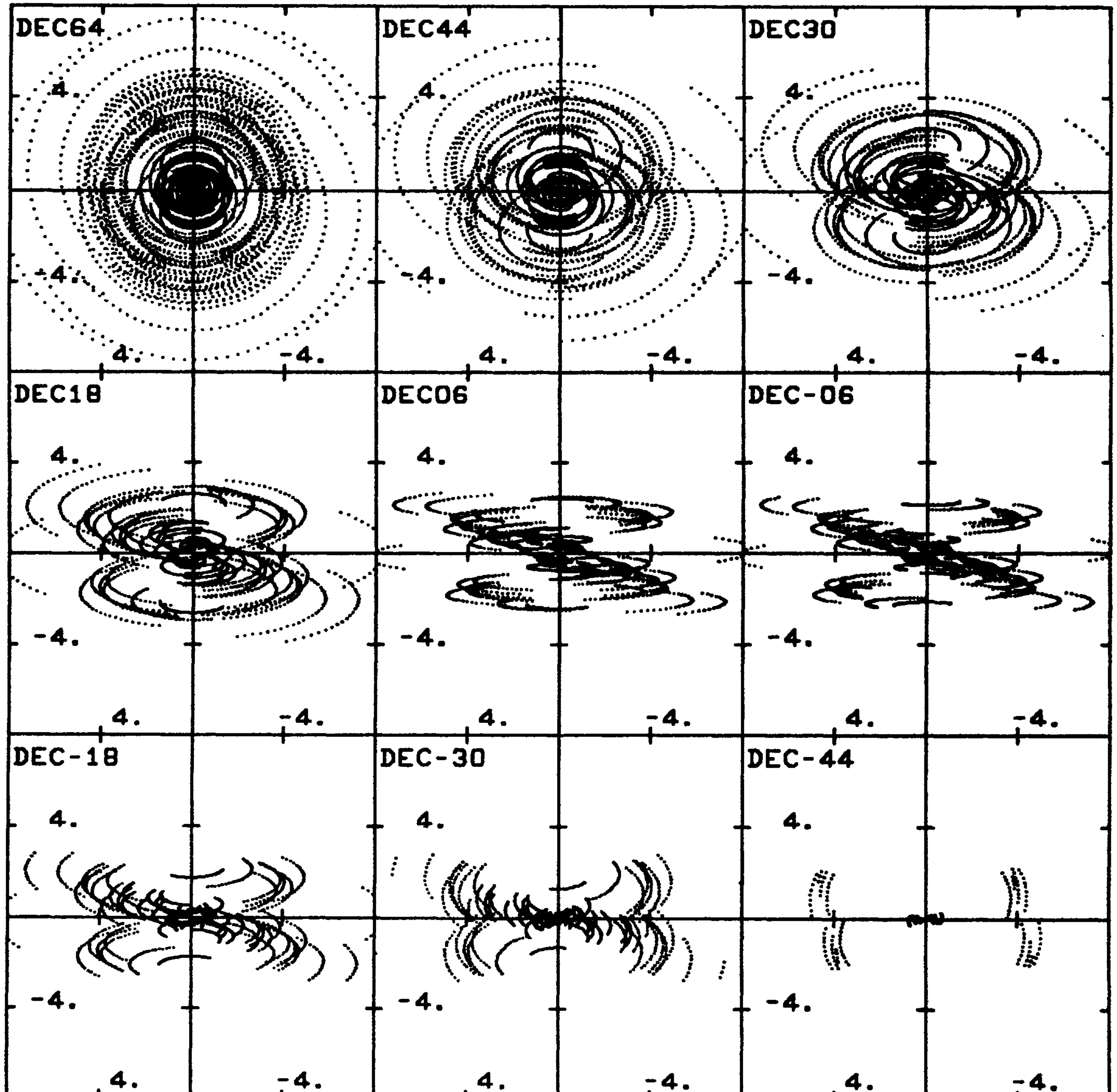

Figure 1

Long-baseline coverage of the VLBA without its Washington antenna

ARECIBO	18.34	66.75
HSTK	42.43	71.49
IOWA	41.58	91.57
FDVSNEW	30.47	103.95
LASL2	35.81	106.27
PIETOWN	34.33	108.14
KITT	31.96	111.60
OVRO	37.05	118.28
BREWST	48.15	119.80
HAWAII	19.80	155.50

Scale in km
kilometers x 10^3)

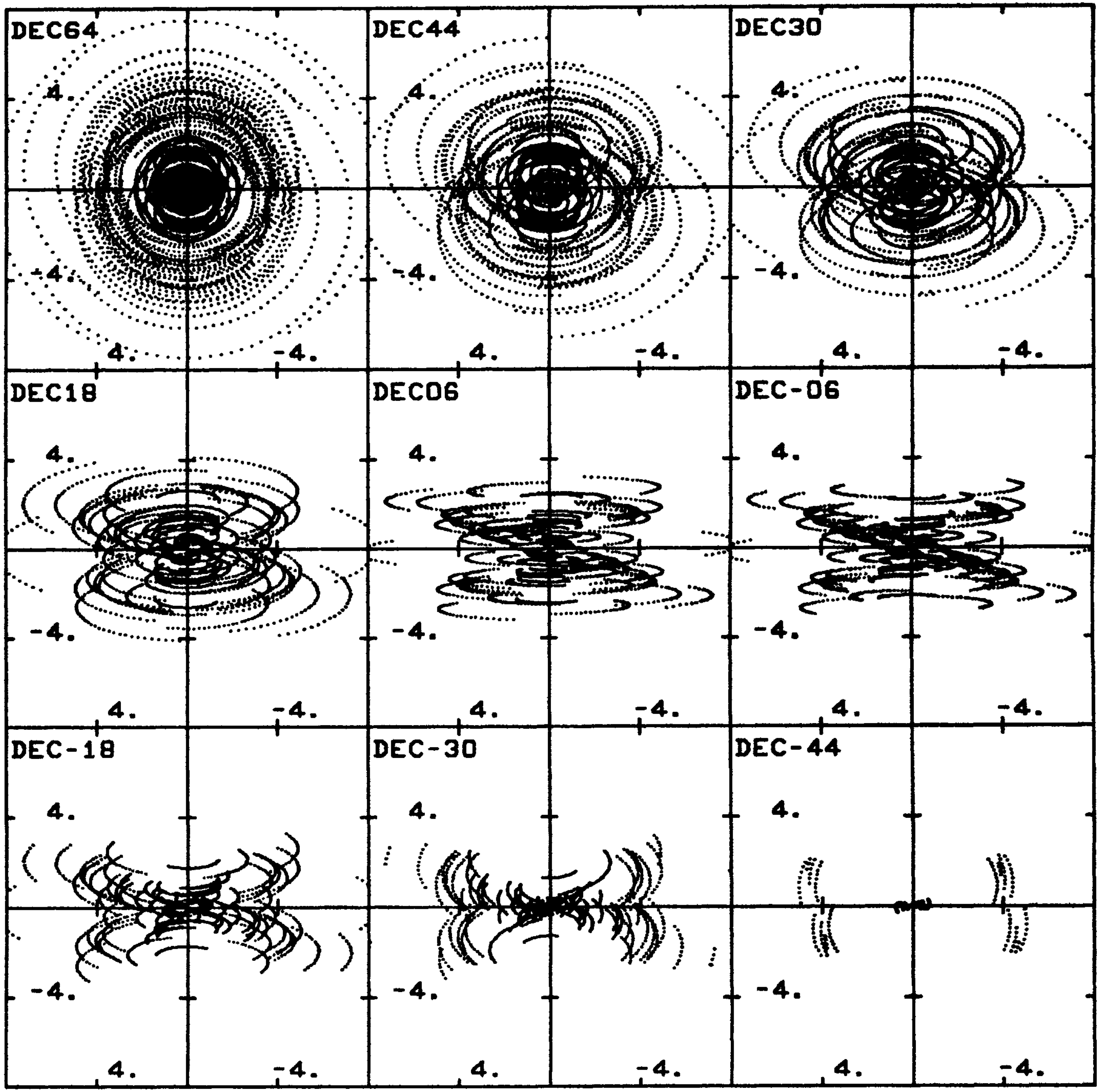

Figure 2

Presently planned long-baseline coverage of the VLBA (using Brewster station)

PENT	49.30	119.60
YELKNF	62.70	114.50
ARO	45.95	78.07
SHOECOVE	47.74	52.72
WSRT	52.92	-6.61
BONN	50.34	-6.88
JODRELL	53.05	2.31
ONSALA	57.22	-11.92
BOLOGNA	44.50	-11.30
NOTO	36.90	-15.00
CRIMEA	44.54	-34.02

Scale in km
kilometers x 10^3)

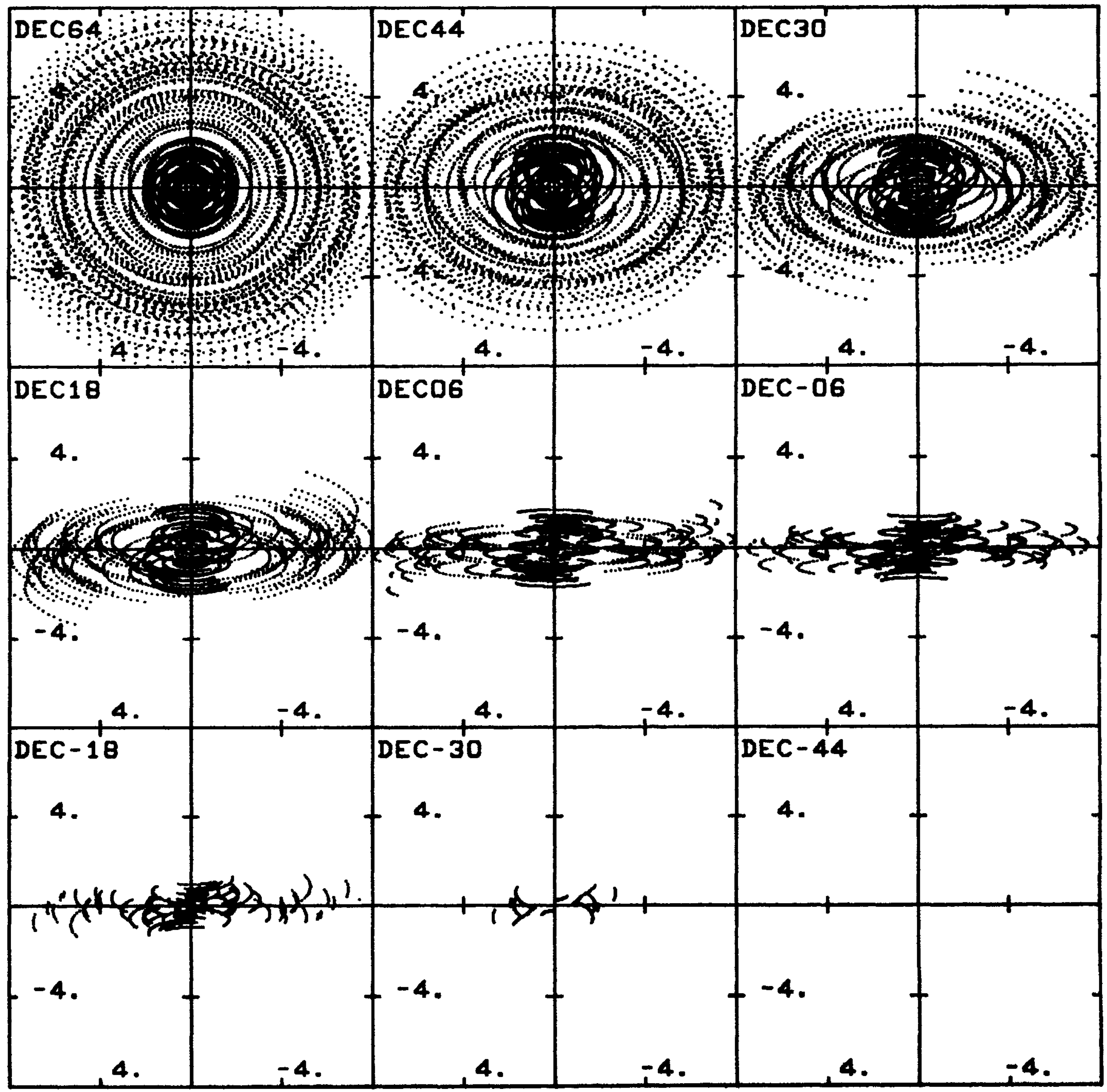

Figure 3

A possible CLBA/EVN Combination – i.e. what Fig. 1 would be comparing with when the CLBA was not linked to the VLBA.