

(860310)

NATIONAL RADIO ASTRONOMY OBSERVATORY
Socorro, New Mexico

To: VLBA Science Group
From: R. C. Walker
Subject: Construction order.

If the antenna contract needs to be renegotiated to slow down the construction, it will be possible to change the construction order to enhance the quality of the science that can be done with the partially completed VLBA. Thanks to the very slow rate of funding that we expect for the next few years, such a renegotiation is expected. The current antenna contract calls for the construction of 3 antennas per year. Interim science was considered when the order was chosen, but season of assembly and the ability to have some of the difficult sites (eg Hawaii) ready on time also influenced the order. There was little concern about the order within the annual groups of three because they would effectively arrive at about the same time. If the contract is renegotiated to a rate of 2, or even 1, antenna per year, the partial arrays will last longer and the order becomes more significant.

A couple of months ago, on very short notice, I produced a revised order that might be used if the construction rate were slowed to 2 antennas per year or slower. Since then, it has been decided to stay with 3 antennas authorized in 1986. However unless funding is very different from expected in 1987, the rate will have to be slowed next year. My revised order had some sites constructed as early as possible under the 2 per year assumption. Specifically, Hawaii was placed 6 th in the order, which would place it as the earliest authorized antenna in 1988, the same year that it would be authorized at the 3 per year rate. Now with 3 authorized in 86, Hawaii would be authorized in 87 under my revised order if 2 are authorized that year. That is probably too soon according to Cam Wade. Also there was some discussion of the order in the last Science committee meeting in which there were suggestions that the Virgin Islands and Fort Davis be moved to before Hawaii. This memo discusses the possible orders.

There seems to be general agreement that the first 5 antennas should be as in the revised schedule (the first 4 are the same as the contract order). Also there is agreement that Owens Valley and the Northeast should be last because of the presence of good existing telescopes. Therefore the only variants are in the order of antennas 6, 7, and 8 which will be Hawaii, Virgin Islands, and Fort Davis, not necessarily in that order. Somehow this group seems small enough to me that the order within it is not extremely important. However people seem concerned so this memo presents some u-v coverages for the possibilities.

The proposed orders are listed below. 'Contract' is the order now in the antenna contract. 'Walker 1' is the order presented to management recently as a possibility for 2 antennas per year (sometimes known as the 'New Order' - although Cam points out unfortunate historical meanings of that term). 'Walker 2' swaps the Virgin Islands

and Hawaii to reflect the possibility that, if 2 antennas are authorized in 1987, the Hawaii site is unlikely to be ready in time. 'CIT' is the order proposed on the spur of the moment during the last Science Committee meeting by the Caltech group led by Marshall Cohen.

Contract	Walker 1	Walker 2	CIT
1. Pie Town	Pie Town	Pie Town	Pie Town
2. Kitt Peak	Kitt Peak	Kitt Peak	Kitt Peak
3. Los Alamos	Los Alamos	Los Alamos	Los Alamos
4. Brewster	Brewster	Brewster	Brewster
5. Fort Davis	Iowa	Iowa	Iowa
6. Virgin Is.	Hawaii	Virgin Is.	Virgin Is.
7. Iowa	Virgin Is.	Hawaii	Fort Davis
8. Owens Valley	Fort Davis	Fort Davis	Hawaii
9. Hawaii	Owens Valley	Owens Valley	Owens Valley
10. Northeast	Northeast	Northeast	Northeast

The attached u-v plots show some of the partial arrays. For most, the coverage of the partial array used in conjunction with an existing network consisting of Bologna, Bonn, Haystack, Green Bank, Owens Valley, the VLA, and NRL (collectively called NUG below) is shown. Note that all of the existing antennas used in the plots work reasonably well at 1.35 cm. I have not included lower frequency antennas such as Fort Davis, Hat Creek, Iowa, and Arecibo. I have also only included 2 out of a much larger number of European antennas. The plots are:

- 1.) NUG plus the first 4 antennas of the VLBA. This is the starting point common to all of the above orders.
- 2.) Same as 1 with Fort Davis added. Fort Davis adds to the short baselines and is important for the final array, but for interim operations with NUG, I maintain that both Hawaii and Virgin Islands are more useful. Therefore I recommend building Fort Davis 8th, especially since there is an antenna at that site that can be used at the lower frequencies. Remember that there will be antennas at Kitt Peak, Pie Town, the VLA, and Los Alamos, all in the region traditionally covered by Fort Davis in early NUG experiments.
- 3.) Same as 1 plus Iowa and Hawaii. Iowa fills the 'Midwest gap', Hawaii fills the 'Atlantic gap'.
- 4.) Same as 1 plus Iowa and Virgin Islands. The trade between Hawaii and the Virgin Islands is one between uniformity of coverage plus high frequency capability vs. north-south coverage. Either one adds a lot and I suggest that we let logistical factors determine their order.
- 5.) NUG plus full VLBA. This is what we get in the end if the NUG telescopes survive. Actually, we get a lot more because I have only included 2 antennas of the European Network.

My recommendation is that we stick with the 'Walker 1' order if we can only authorize 1 antenna in 1987 and that we use the 'Walker 2' order if we can authorize 2 that year.

BGNA	44.50	-11.30
BONN	50.34	-6.88
HSTK	42.43	71.49
NRAO	38.25	79.84
OURO	37.05	118.28
VLA	34.08	107.62
NRL	38.37	77.23
VLBA_PT	34.30	108.12
VLDA_KT	31.96	111.61
VLBA_LA	35.78	106.25
VLBA_WA	48.13	119.68

Scale in km
(kilometers x 10³)

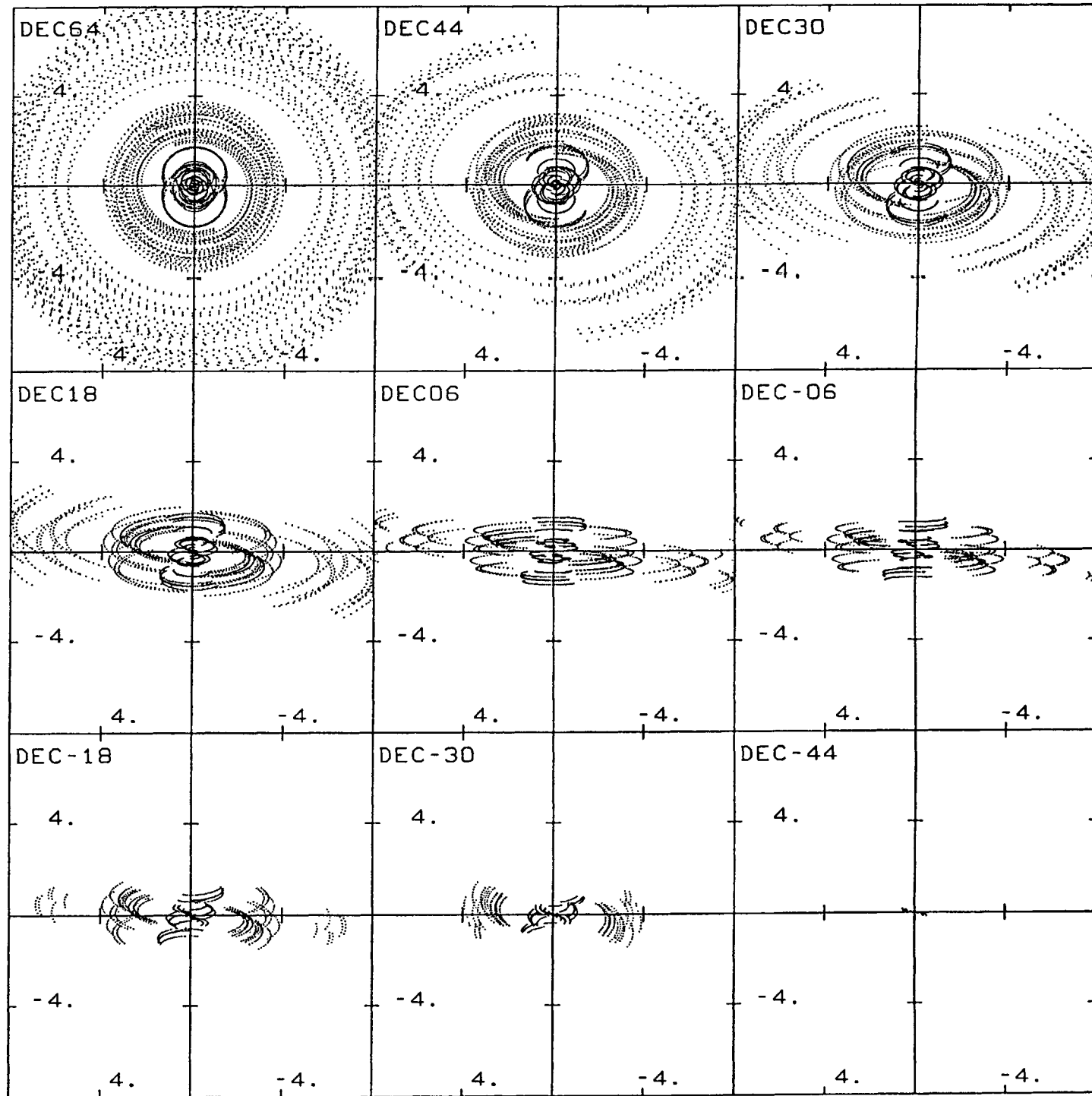
✓

4

NUG + 4 VLBA

Antennas common
to all orders.

Fig 1



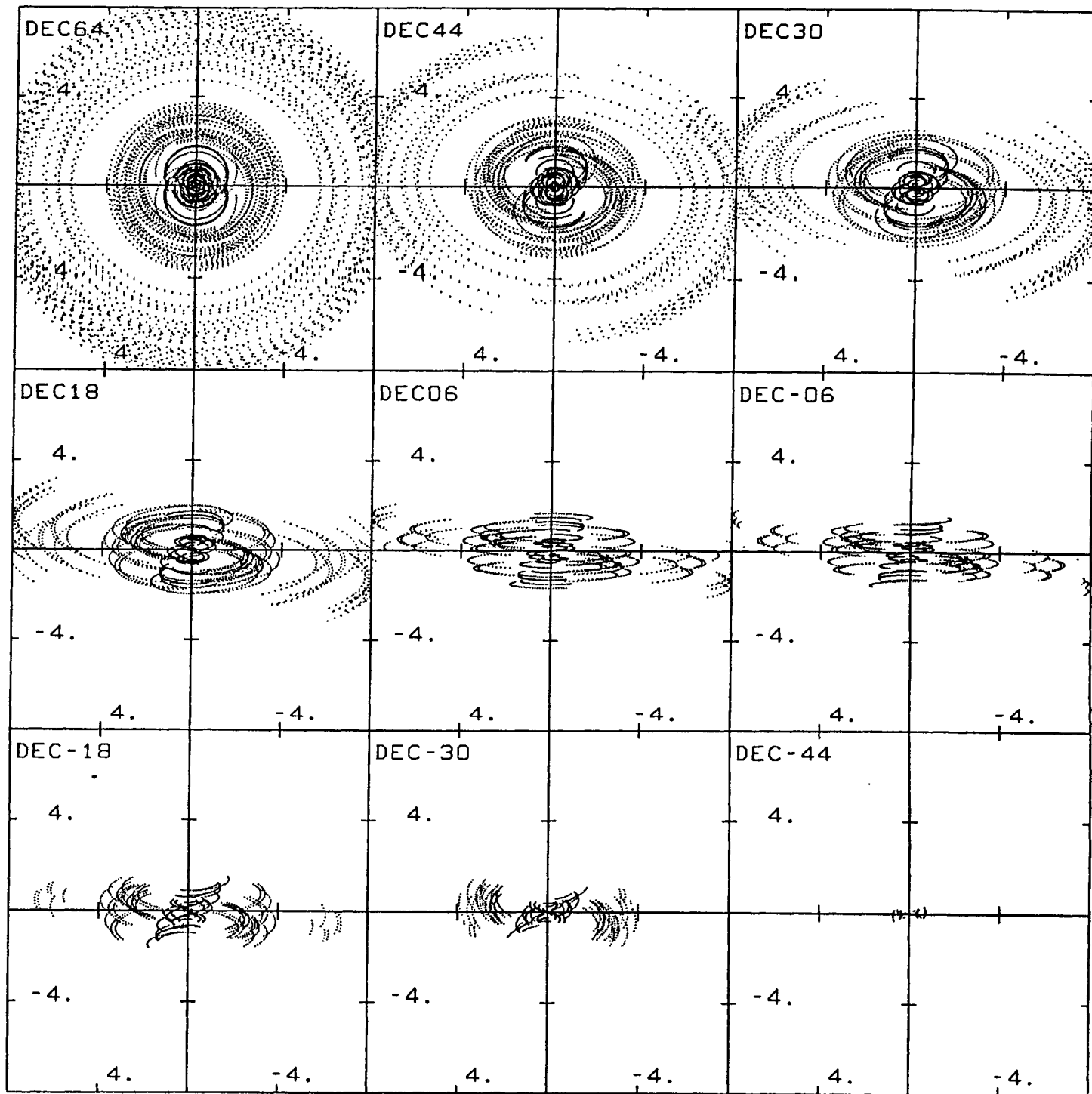
BGNA	44.50	-11.30
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VLA	34.08	107.62
NRL	38.37	77.23
VLBA_PT	34.30	108.12
VLBA_KT	31.96	111.61
VLBA_WA	48.13	119.68
VLBA_FD	30.63	103.95
VLBA_LA	35.78	106.25

Scale in km
(kilometers x 10³)

5

NKG + 5 VLBA
including ~~Los Jima~~
Fort Davis

Fig 2



BGNA	44.50	-11.30
BONN	50.34	-6.88
HSTK	42.43	71.49
NRAO	38.25	79.84
OURO	37.05	118.28
VLA	34.08	107.62
NRL	38.37	77.23
VLBA_PT	34.30	108.12
VLDA_KT	31.96	111.61
VLBA_LA	35.78	106.25
VLBA_WA	48.13	119.68
VLBA_IA	41.77	91.55
VLBA_HI	19.54	155.58

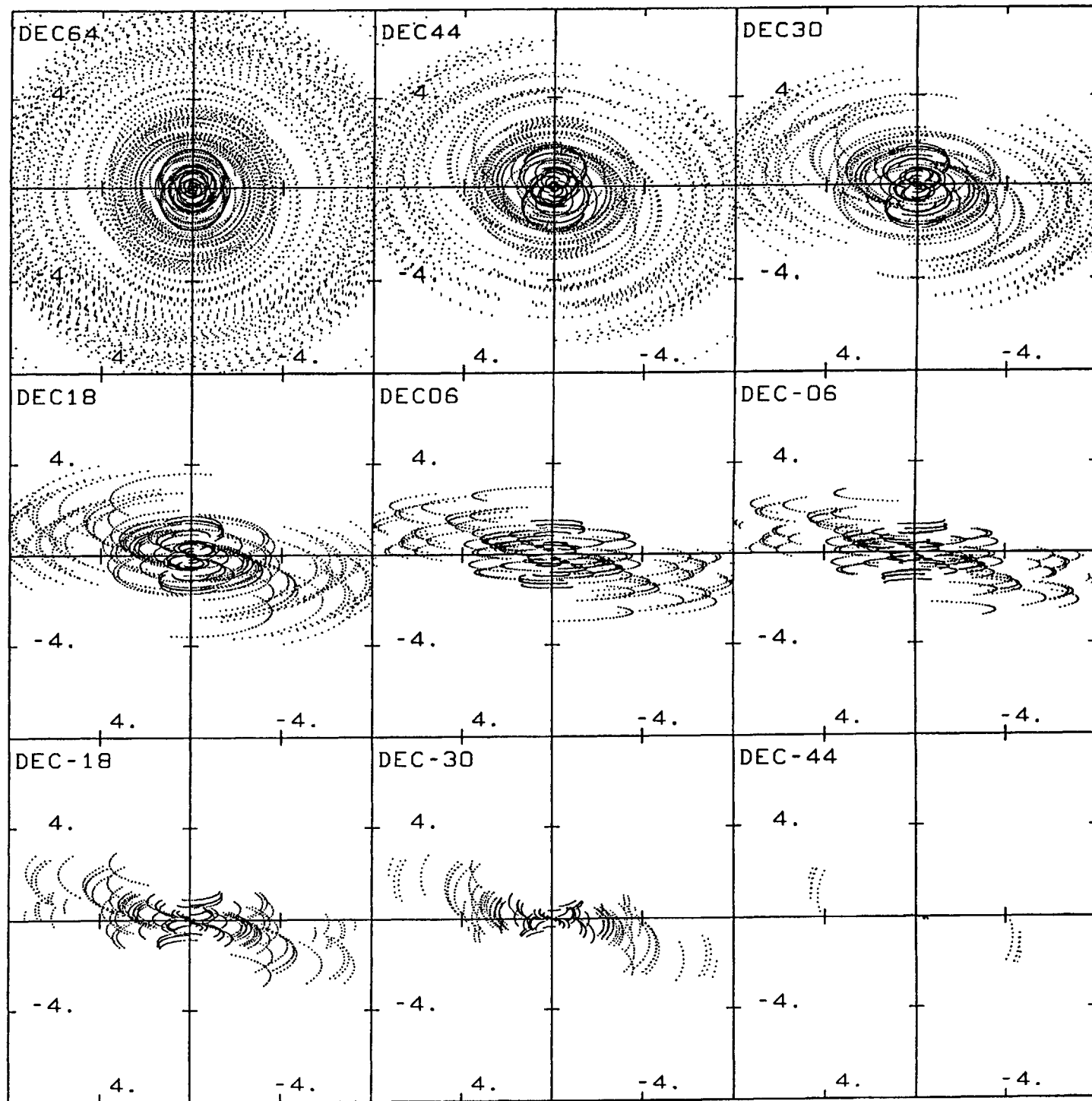
Scale in km
(kilometers x 10³)

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6

NUG + 6 VLBA
incl. Iowa
Hawaii.

Fig 3



ULBA_PT	34.30	108.12
ULBA_KT	31.96	111.61
ULBA_LA	35.78	106.25
ULBA_WA	48.13	119.68
ULBA_VI	17.75	64.60
ULBA_IA	41.77	91.55
HSTK	42.43	71.49
NRAO	38.25	79.84
OURO	37.05	118.28
NRL	38.37	77.23
ULA	34.08	107.62
BONN	50.34	-6.88
BGNA	44.50	-11.30

Scale in km
(kilometers x 10³)

6

~~Contrast order~~

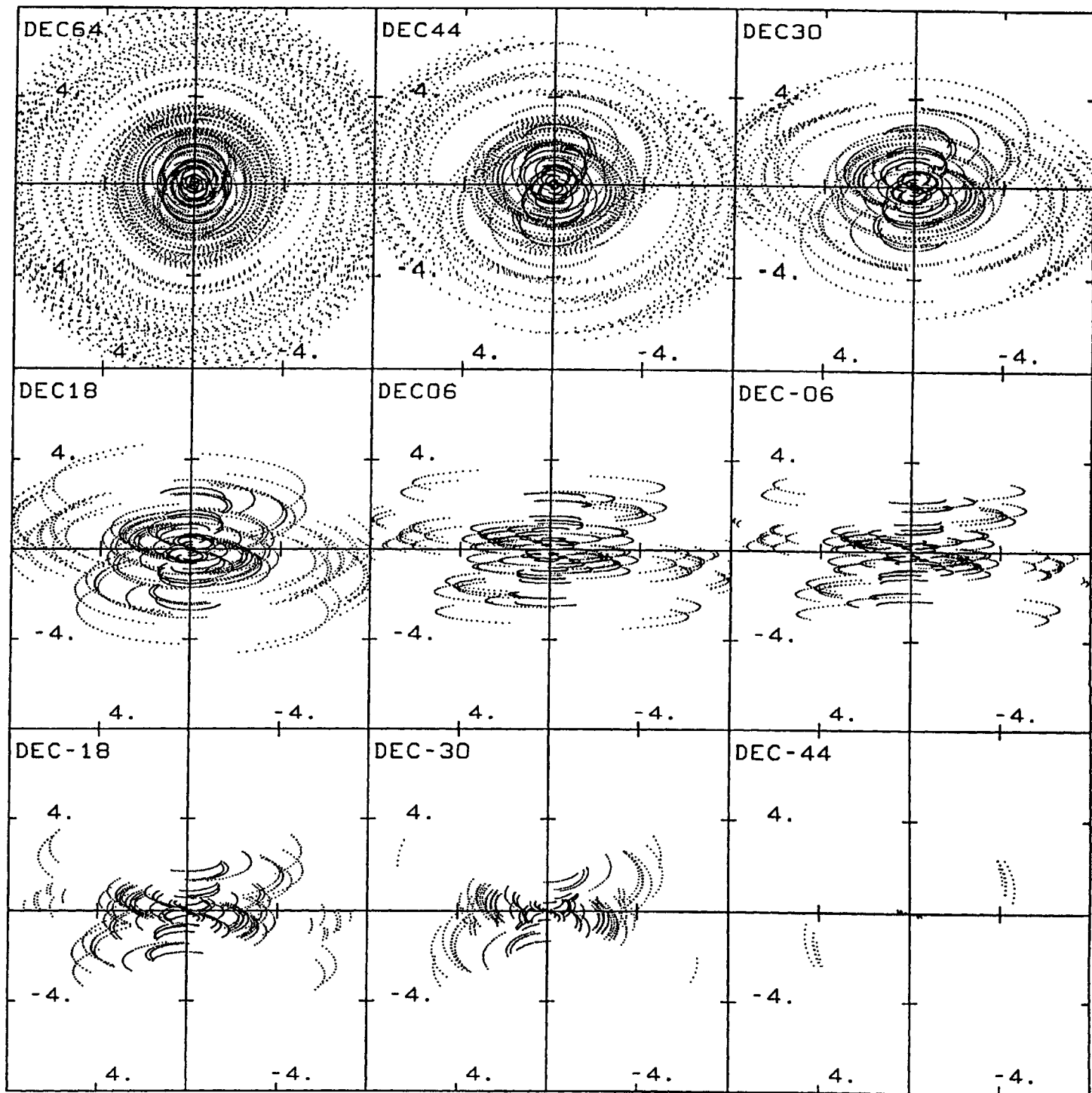
New Order

except V.I.

instead of Hawaii

incl Iowa

Fig 4



BGNA	44.50	-11.30
BONN	50.34	-6.88
HSTK	42.43	71.49
NRAO	38.25	79.84
OURO	37.05	118.28
VLA	34.08	107.62
NRL	38.37	77.23
VLBA_PT	34.30	108.12
VLBA_KT	31.96	111.61
VLBA_LA	35.78	106.25
VLBA_WA	48.13	119.68
VLBA_IA	41.77	91.55
VLBA_HI	19.54	155.58
VLBA_VI	17.75	64.60
VLBA_FD	30.63	103.95

Scale in km
(kilometers x 10³)

✓

8

actually includes all
VLBA sites since OURO
and HSTK or NRAO are
#s 9+10

Fig 5

