Aliasing symptoms

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This is a summary of my findings on aliasing. Don't expect any new revelations - it is intended to be a list of symptoms, without offering a diagnosis.

Unless otherwise specified, this is based on B-array L-band data taken early January. Its main purpose was to study the effects of aliasing on noise in a blank field, but the 5 scans on 0137+331 allowed me to characterize true aliased signal. Bandpass calibration was applied excluding the aliased EVLA - EVLA baselines. In all cases, the total bandwidth was 0.78 MHz.

The effect on amplitude is that aliasing adds a fraction of the signal outside the band to the signal in the band. That fraction can lie anywhere in the interval `[-1,+1]`.

The symptoms:

1 - There is no obvious correlation between w and the degree of aliasing on any baseline

Plotting the aliasing as a function of frequency for all EVLA-EVLA baselines shows no obvious correlation between the amplitude or the sign of the effect and w. Even when selecting baselines with (almost) identical w, the full spectrum of aliasing possibilities, from 'up' through 'mostly level', to 'down', is seen. See the following two baselines, shown in Figures 1a and 1b, with almost identical w, plotted over the same 6 minute interval:

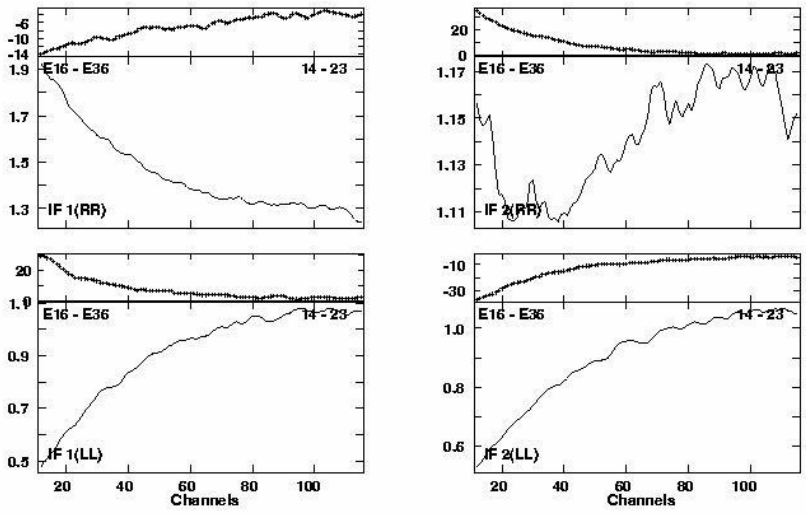

Figure 1a - the aliased spectra averaged over a 6 minute interval for baseline 14 - 23, with w = 18.6 kλ Both IFs and Stokes are shown.

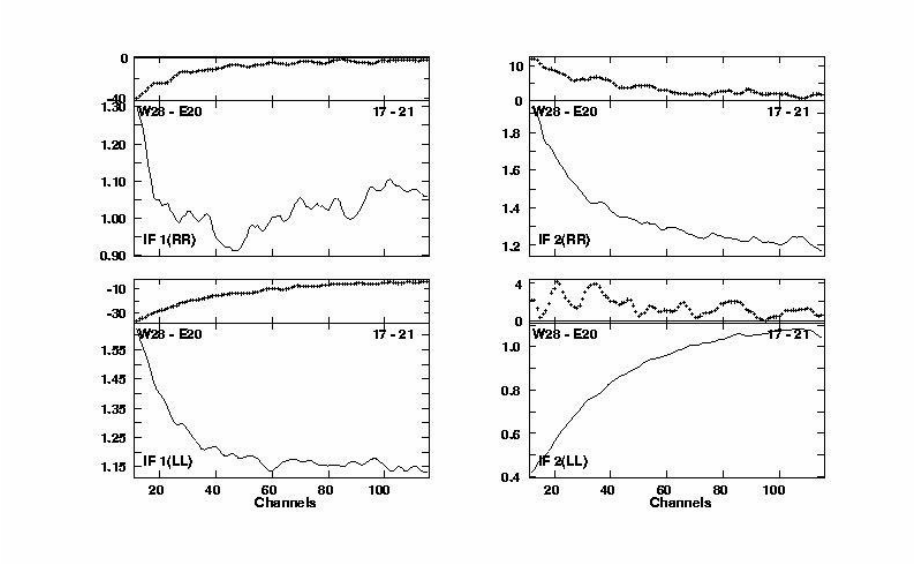

Figure 1b - the aliased spectra averaged over a 6 minute interval for baseline 17 - 21, with w = 18.9 kλ. Note the difference with Figure 1, in spite of the almost identical value of w.

2 - On the same baseline, at the same time, the degree of aliasing is different for different IFs and Stokes

On a given baseline, the sign and amplitude of the aliasing does not correlate with IFs or Stokes. This is already clear in Figures 1a and 1b; see Figure 2 for another example.

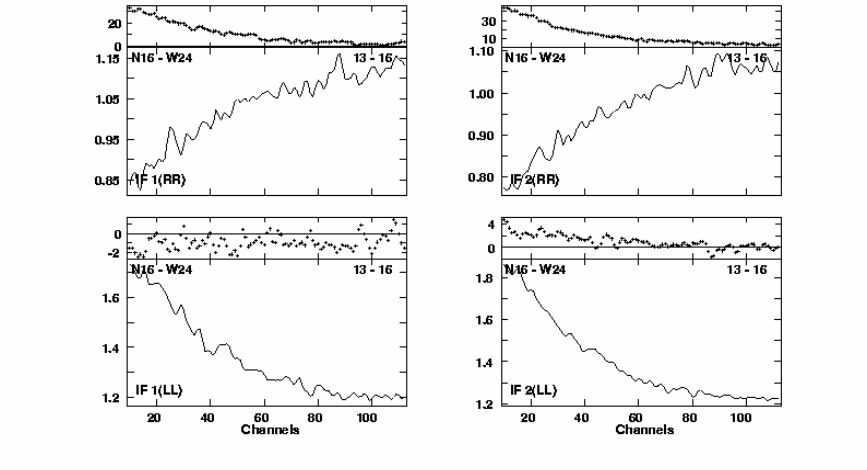

Fig 2: Aliasing on baseline 13 - 16 (EVLA - EVLA) for both IFs and Stokes RR and LL. Note the different signatures. The similarity between the two RR and LL plots is incidental, and is often not there at other baselines

3 - *Aliasing varies only slowly (hours) with time*

Aliasing on a given baseline, IF, and Stokes does not vary strongly with time. The sign and amplitude of the effect remains largely the same over a period of one hour. See Figures 3a and 3b for an example of how aliasing on one baseline changes with time.

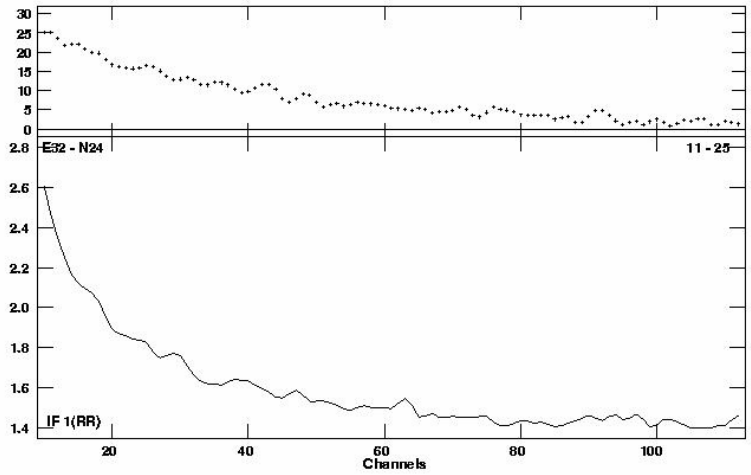

Figure 3a: Aliasing on baseline 11-25, averaged over one 6 minute scan, at time 05:20. At this time, w = -19.8 kλ

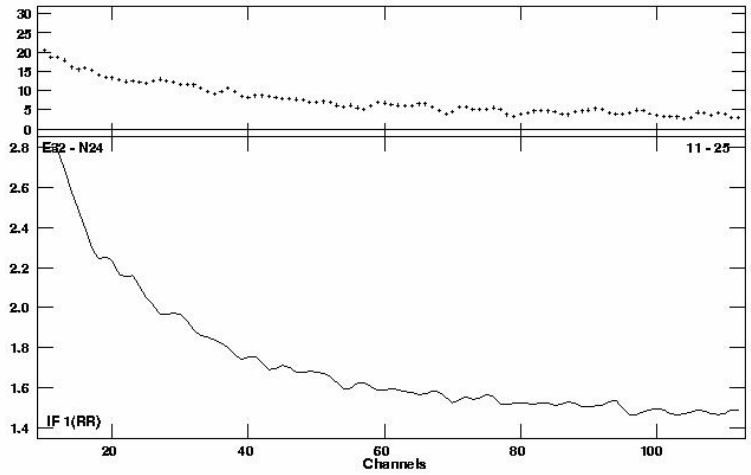

Figure 3b: Aliasing on the same baseline, averaged over one 6 minute scan, but one hour later, at time 06:15. At this time, w = -24.8 kλ

3 - Even at small w, aliasing occurs in all its variations

At Barry's suggestion, I recently did a similar experiment in C-array, observing 3C286 close to the zenith, in order to ensure w was small. In this case, too, all kinds of aliasing occur (up, down, level). Examples at two baselines are shown in Figures 4a and 4b.

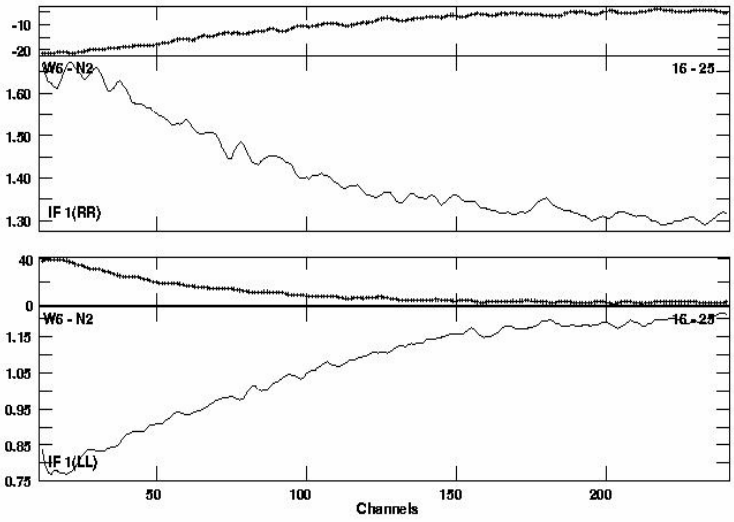

Figure 4a: Aliasing on baseline 16-25 for both Stokes. w = 0.12 kl

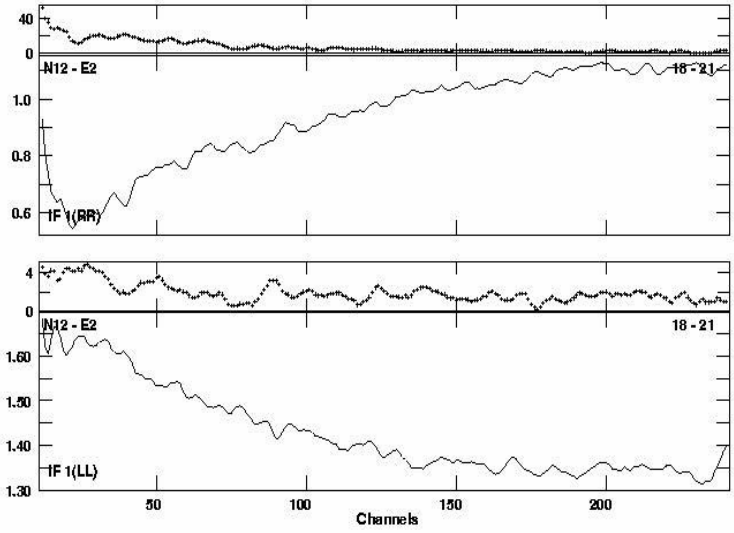

Figure 4b: Aliasing on baseline 18-21 for both Stokes. Here w = -0.25 kλ