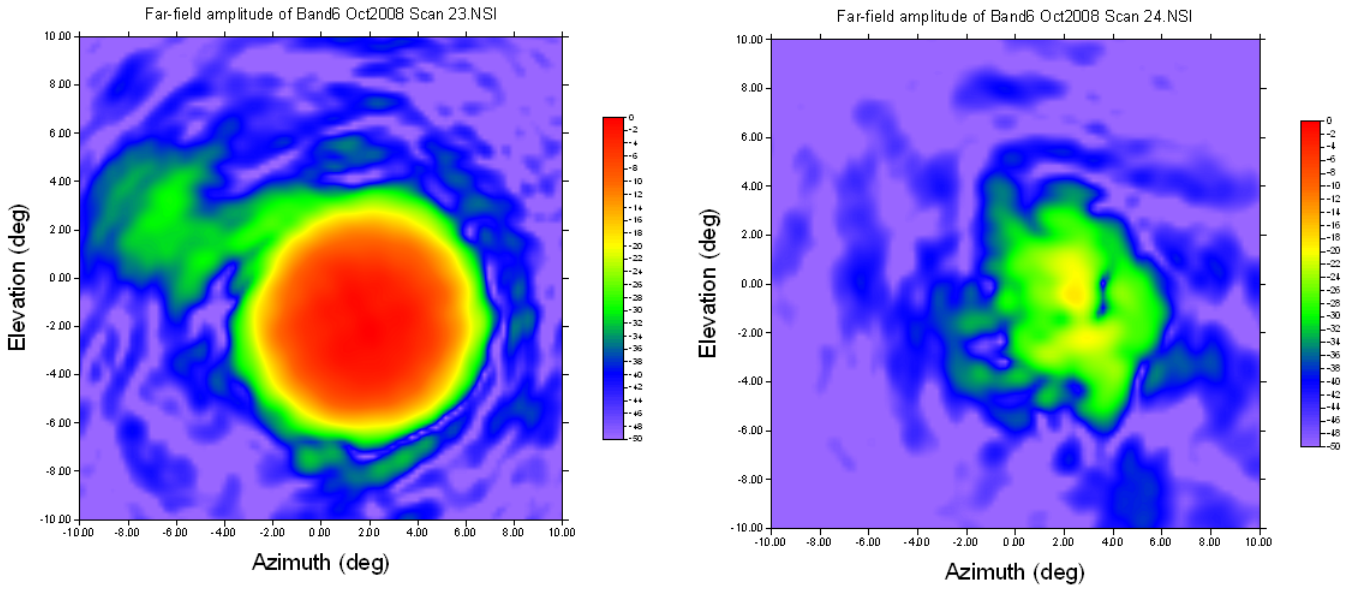
## Status of the NA FEIC beam measurement and analysis

1) The system basically works and can take data that appear to represent the real beams reasonably well. As far as the co-polar beams are concerned it seems that we are probably measuring the coupling efficiency to about 1%, which is probably good enough for the purposes of the FEIC. We also get reasonable numbers for beam squint and focus.

The quality if the data is however not good compared to that obtained by other groups. See for example the attached pictures from ALMA-J, which were included in the recent reports on the ACA 7m optics. In retrospect it is a great pity that what those groups were doing was not taken as the starting point for the FEIC installation. I suspect that a good deal could still be gained by leaning from them.

2) We have not yet demonstrated that the cross-pol data is meaningful at the level required. It seems to me that we need to show that the instrumentation is good down to at least -30dB if we are dealing with specs of -23 or -26dB. As an example if we repeat the measurements below, which show co-pol on the left and cross-pol on the right, but with a grid in front of the window aligned so as to remove the residual cross-pol, what do we get?




3) Concerning the analysis of the data, the original errors that were producing completely erroneous values of the coupling efficiency, etc., were found more or less straight away. Since then a lot of time has been spent nailing down details. Much effort went into to checking against Andre Baryshev's program and we do get now get good agreement – the difference that took the most time to resolve was in fact him not handling the case with an even number of rows correctly. The only real error in the NIS software we identified is in the processing of the pairs of maps to remove (well reduce) the effects of reflections from the source and its mount.

4) The original measurements were made with horns on the source which had quite high gain. It should be possible to correct for these but we have not succeeded in doing this and getting consistent results. The current approach of using open ended waveguide is OK but the standing waves are at present still excessive, so the details of that need to be cleaned up.

5) We have not demonstrated that the system can measure changes in the receivers as a result of tilting. Or even demonstrate that there are none at the level required. Personally I think it is very unlikely that it will be possible to make meaningful measurements with the present mechanical design.

6) We have not demonstrated that the scanner can be used to align the warm optics on band 3 in a satisfactory manner.

Richard Hills 31st Oct 2008

Band 4 measurements made by ALMA-J

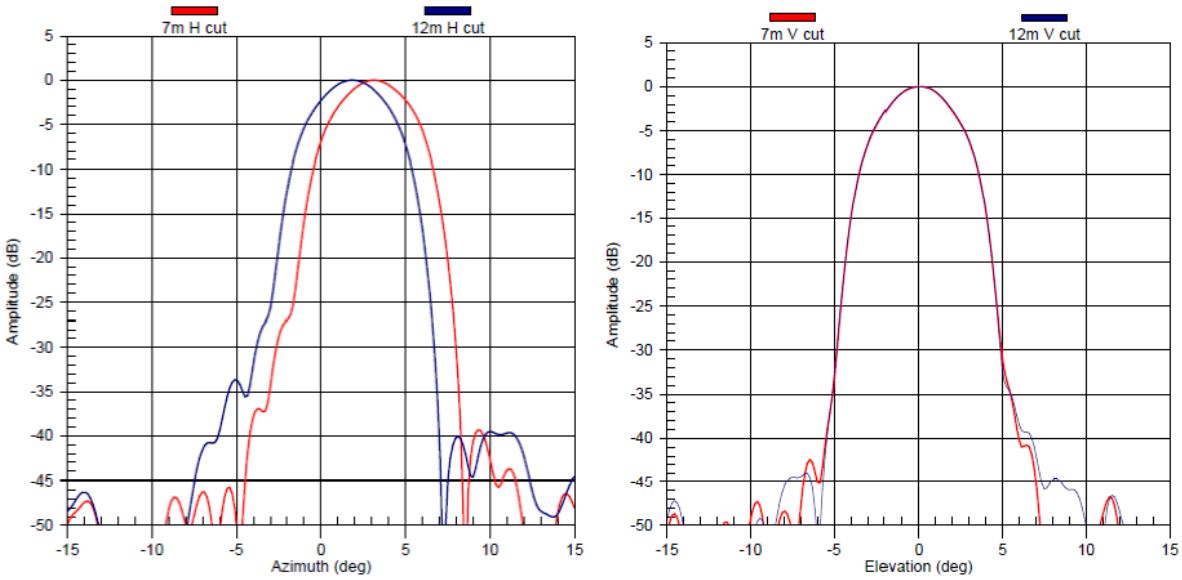



**Figure 3: Cross sectional views of co-polar beam patterns in the asymmetric and symmetric plane along with the beam axis.**

Band 6

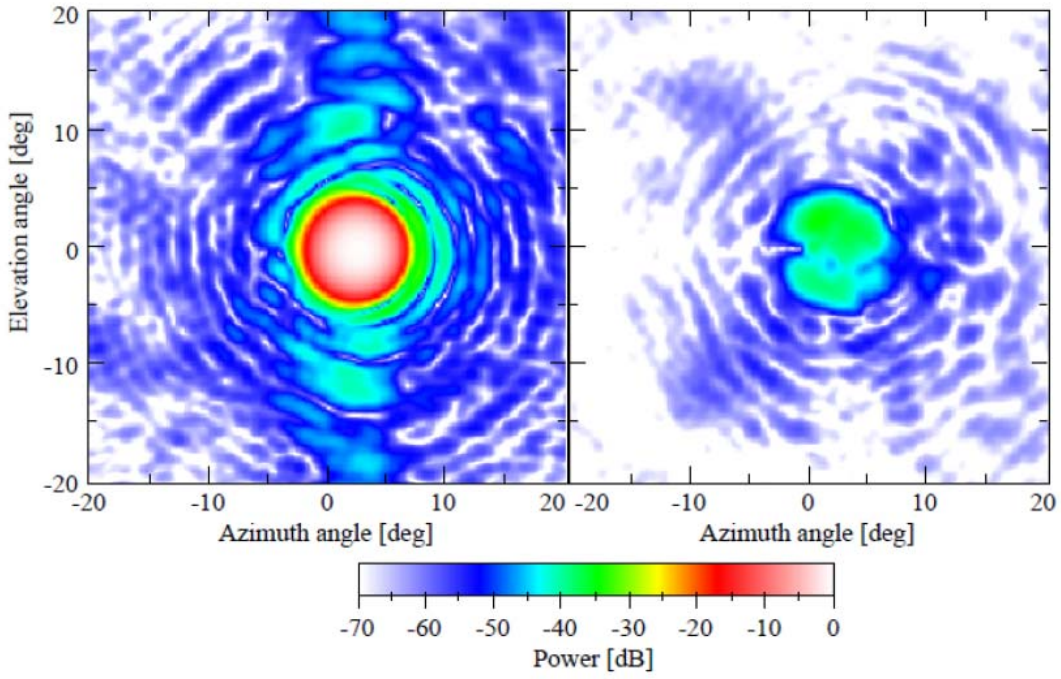



**Figure 5: 2D plots of band 6 beam without ACA mirror at 252 GHz. Left and right figures correspond co-polar and cross-polar beam patterns.**