

ASKAP Phased Array Field of View

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Introduction

Extensive analysis of the chequerboard phased array feed (PAF) designs proposed for ASKAP has been performed. Three configurations have been considered: octagonal, 9x10 array, and 9x10 with corners missing

Octagonal array

ASKAP has very tight timelines and a PAF enclosure was tentatively selected before a full analysis of the array was possible. The initial PAF design aimed at maximally filling the circular area of this enclosure.

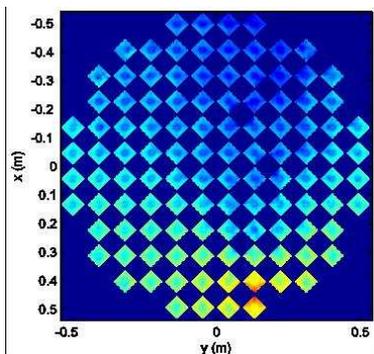


Figure 1: Octagonal array

Each element of the array is differential. The difference is taken after a pair of single-ended LNAs. This mode of operation is referred to as differential single ended (DSE). The sensitivity for all possible beam pointing directions (relative to bore sight) is shown in Figure 2 for a single polarisation. The analysis includes the effect of interelement coupling and realistic LNA impedances and noise. Sensitivity for the orthogonal polarisation is the same as this but rotated 90°.

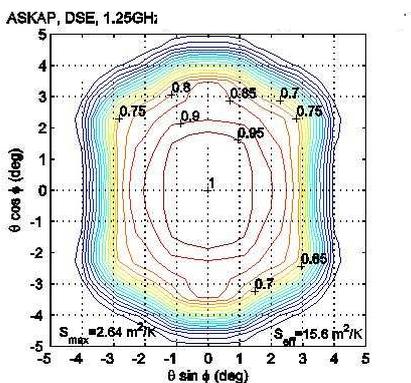


Figure 2: Sensitivity of octagonal array, single polarisation shown.

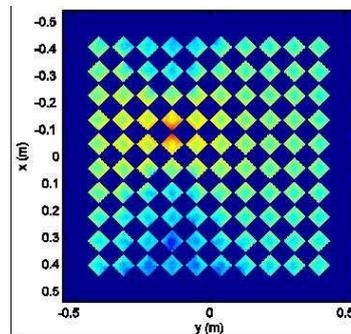


Figure 3: 9x10 array

9x10 array

A 9x10 array is shown in Figure 2. It has 9 elements in the E plane and 10 in the H plane for both polarisations

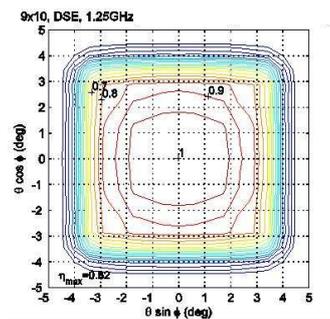


Figure 4: Sensitivity of the 9x10 array.

The 9x10 array does not fit the current PAF enclosure, but inspection of Figure 1 shows a 9x10 with the corners removed will. It is equal to the octagonal array with four edge elements on each side removed. The sensitivity for this array is shown below.

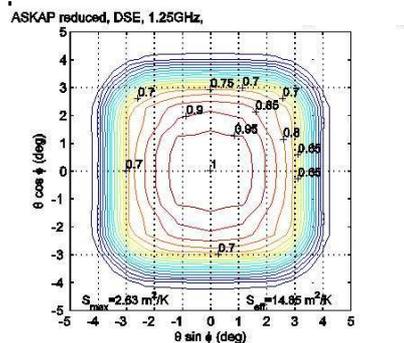


Figure 4: Sensitivity of the 9x10 array with corner elements removed.

Conclusion

Three possible configurations of the ASKAP PAF are shown. The field of view is largest for the octagonal array but it is asymmetrical, and the sensitivity for two polarisations can be different.