Optimising SKA1-Mid Scale-Dependent Sensitivity

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Abstract

In this report we study the scale dependent sensitivity of the SKA1-Mid baseline design. We also propose changes to the baseline design that enhance the sensitivity at smaller angular scales (e.g. 0.4-1 arcsec at 650MHz) without compromising the performance at larger scales. The changes we propose are guided by the SKA1-Mid level-zero science requirements [2], which suggest that very long baselines (> 150km) are not necessary to achieve the SKA1-Mid science objectives. In particular, we show that a 254 dish layout with a maximum baseline of 120km improves the SKA1-Mid survey speed by more than 55% and is 3.4 times faster than SKA-SUR (see Table 13) on angular scales 0.4-1 arcsec (over 650-1000MHz), without compromising the performance at larger scales. Such an improvement on these scales could be transformational for other sciences, such as cosmology with weak lensing. Furthermore, this layout spans significantly less space which could potentially reduce trenching and data transport costs. We also show that with a conservative addition of 12 dishes the SKA1-Mid survey speed can be improved by up 67% on the smaller angular scales.

1 Introduction

The SKA at mid frequencies (SKA-Mid) will be built in two phases, SKA-Mid phase one (SKA1-Mid) and phase two (SKA2-Mid) in South Africa, and SKA survey (SKASUR) in phase 1 in Australia. The key science goals for SKA1-Mid include the study of the history and role of neutral hydrogen in the Universe from the dark ages to the present-day, the use of pulsars as probes of fundamental physics [1] and continuum and Hɪ surveys to pin down the cosmological model. The large emphasis on key science projects is outlined in several SKA memos, as the baseline design has emerged. It should however be noted that changes which do not compromise the key science cases are possible and such changes could be transformational for other science cases.

In this document, we attempt to gauge the scale-dependent sensitivity of the mid-frequency array described in the *SKA1 System Baseline Design* (BD) document [1]. The performance of this configuration is then compared to two alternative configurations and the SKASUR configuration.

The rest of this document is laid out as follows: in subsection 1.2 we discuss the science requirements for SKA1-Mid, then in subsection 1.3 we describe the layouts that we consider. In section 2 we describe our simulation techniques and the metrics we generated from the experiment. Finally, the results and concluding remarks are in section 3.

1.1 SKA1-Mid Baseline Design

The mid-frequency array described in the BD is a 254 dish array with about 36% of the dishes within a radius of 400m (core), 40% of the dishes are between 400m and 4km (outer-core) and the remaining 24% are in 3 three spiral arm-like structures starting from about 2km and stretching out to a radius of around 100km. Figures 1 and 2 show the BD layout and baseline distribution histogram (log_{10} space). With about 200 fifteen metre dishes (bar the 64 13.5 metre MeerKAT dishes) within a radius of 4km, this array promises high sensitivity, with noise values around 63μJy beam^{-1} hr$^{1/2}$ [1]. However, with three distinct dish-density regions, the resulting full sensitivity (natural weighting) point spread function (PSF) has two pedestals corresponding to the abrupt changes in dish densities from the core to the outer-core and from the outer-core to the spiral arms (see Appendix A). With such a configuration, a uv-weighting that tends towards uniform is required to obtain high resolution and uv-tapering might be also be required to get a well behaved PSF. Leading to significantly lower sensitivity due to the down-weighting of baselines[1]. It is therefore important to quantify the scale-dependent sensitivity of

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[1] uniform uv-weighting down-weights the uv-points corresponding to shorter baselines, and hence gives better resolution, while a uv-taper down-weights the edges of the uv-coverage (longer baselines) to decrease sidelobe levels

this configuration, i.e., what is the sensitivity at different angular scales.

1.2 SKA1-Mid science requirements

In this subsection we outline the scientific rationale for a change in the baseline design, which we believe is as cost neutral as possible given the information we received from the SKA office and which gives a direction which is different for the configuration of SKA-MID. We have based the propositions in this document upon the assessment workshop for the Cosmology working group where extensive discussion have taken place with the pulsar and transient senior scientists, along with direct communication with the Continuum Science SWG, plus several informal discussions between the Cosmology members and the HI/continuum members.

1.2.1 Highlights of requirements of each science area

Pulsar science: The pulsar search science is mainly dependent on the core of SKA-MID. One of the key factor being the instantaneous sensitivity which depends on the number of antennas in the core. Furthermore if the antennas are moved out of the core, the synthesised beam would be reduced which increases the pulsar search time. During the discussions in the SWG, it was our understanding that an increase of the core area of around 10% would be a minor perturbation in the overall pulsar search, although one in which computation costs increase (see Pulsar SWG for more details).

Cosmology: In what concerns the baseline distribution in this document we have four aspects which we would like to highlight: Cosmology with continuum and Hi galaxy surveys, weak gravitational lensing and intensity mapping.

- **Cosmology with HI surveys**: The key requirement for Hi surveys for cosmology is to have a large survey speed coupled with baselines which do not resolve out the flux of the galaxies being observed. Given the sizes of galaxies and the fact that we would like a significant amount of the flux not to be resolved out, the baselines of most interest are baselines below around 5km. Hence an outer core is the most important aspect of a telescope for such science. However losing a small amount of sensitivity compared to the baseline design in this region of uv space is not critical and was discussed at the Cosmology science assessment workshop, and in fact we find that we do not lose any sensitivity in this regime for out preferred configuration.

- **Cosmology with weak lensing**: Here the main aspect is a high sensitivity at scales which can measure the structure and shape of the galaxies in continuum. Given the size of galaxies, this requires significant sensitivity at scales which correspond to 0.5 to 1 arcsec. The current baseline design has a natural sensitivity very close to the JVLA at the scales of interest, something that will only damage the scientific reputation of the SKA. For these reasons having a larger number of antennas in the spiral arms out to around 70-80 km is beneficial for this science and the lack of those baselines would simply make such a survey unfeasible. Such studies also have to be done with SKA-MID as SKA-SUR does not have enough antennas to produce reliable maps as the number of UV tracks is much lower than SKA-MID. This is intrinsically due to the fact that the sensitivity of SKA-SUR is coming from PAFs and not from extra collecting area.

- **HI and continuum morphologies**: In the current baseline design there is a lack of sensitivity in the baselines which one would need to study morphologies of the detected continuum and HI galaxies. The baselines needed for morphological studies of galaxies are similar to the baselines needed for the weak lensing experiment with weak lensing, and therefore should be advantageous for galaxy evolution studies which are central to the goals of the Hi and Continuum SWGs.

- **Cosmology with intensity mapping surveys**: Intensity mapping requires very short baselines and would benefit from having several clusters of antennas placed either in the core or in the outer core. This arrangement is not incompatible with the configuration proposed here and is briefly discussed below.

1.2.2 General rationale

Cost Neutral proposal: We propose here a baseline change outlined in this document. The scientific rationale is that baselines larger than $\sim 80 - 90$km are expensive given that the signal needs significant boosting to reach the main correlator, and the extra trenching and the key fact that none of the main science goals are directly affected by a modest reduction of the maximum baseline (the science case that we believe to have the most stringent requirement for high resolution is the 40mas at ν 14GHz for the Cradle of Life) . This cost saving should allow for extra antennas to be placed in the spiral arms. We have estimated (after informally enquiring with individuals at the SKA office) this cost saving to allow for an extra 12 antennas.

We also note here that we have assumed an approximate cost neutrality for the SKA-Mid in isolation. If we were to consider a solution where the whole of the mid-frequency SKA1 as cost neutral (i.e. not interfering

with SKA-Low baseline costing) then a significant number of additional dishes could be distributed within our proposed configurations which would substantially increase the imaging capability, the survey speed and the sheer volume of science that could be carried out with the SKA at mid-frequencies, but which could not be carried out with a separate site solution for SKA-Mid. We assume such studies will be incorporated into the new science case for the SKA, but do not consider them here.

A proposal that should be encompassing of all science cases: The rationale that the array has significant UV coverage all the way up to 70-80 km baselines to cover the above science cases would suggest a smooth transition form the core to the outer core to the spiral arms. This is obtained by a slight puffing up of the core as suggested it be possible by the pulsar/transient team. The number of antennas in the core is preserved in our proposal. This transitions to the outer core which is slightly reduced as the main science for the outer core is the HI detection for cosmology and galaxy evolution. We propose this sacrifice as the science loss here is minimal for a loss of around 9 antennas. We further propose to reduce the spiral arms as no science directly needs those large baselines and instead move the spiral arms with the extra 21 antennas which were sacrificed from the outer core (9) plus the antennas which could be purchased from a cost effective reduction of the maximum baseline.

This arrangement is very beneficial for HI and continuum morphological studies, furthermore it produces a survey speed which allows weak lensing experiments to be possible with SKA-1. It does not strongly affect HI and pulsar science as a whole and allows for better imaging capabilities with SKA-MID. We believe that this is beneficial for the project compared to the baseline design. Furthermore we suggest that several clusters of around 6 antennas, depending on the exact masking of roads/environments, be placed in the core/outer core as to increase the sensitivity for intensity mapping. We do not investigate this here as we belive it will only cause a minor perturbation in the survey speed and sensitivities that we discuss here.

1.2.3 Specific layout implementation:

The general scientific requirements for SKA1[2] (level zero science requirements document; SRD) published by the SKA project office (SPO) in March 2014 suggest that (at least for SKA1-Mid), an array with a maximum baseline of around 100km is required. Therefore, we seek a layout with the shortest possible maximum baseline that does at least as well as the "second generation" baseline design in the resolution range 0.4-1 arcsec over 650, 800 and 1000MHz while not significantly compromising the performance at the larger angular scales. Moreover, as stated previously, having a layout which performs just as well as (or better) than the baseline layout but which covers significantly less space translates to a reduction in trenching and data transport costs, which presents an opportunity to re-invest the funds somewhere else, therefore we consider the conservative addition of 12 dishes. However, we note that improvements on the scales of interest are still possible without these 12 additional dishes. In the next section we present two alternative layouts, these layouts have maximum baselines of 120km. The scale dependent sensitivity of these layouts is compared to the SKA1-Mid and SKASUR baseline layouts in section 2.

1.3 Background on Layouts

The following SKA1-Mid layouts are under consideration here:

V8A100B155 The SKA-Mid "Second-generation" layout (254 dishes) produced by Robert Braun (May 2014)[2]. This layout has a maximum baseline of 155km. In this report we also refer to this layout as V8.

W8-iCjBl This is the V8 layout with i dishes added to the spiral arms and j dishes moved the core to spiral arms. The spacing in the arms is then optimised to get more sensitivity on the longer (> 50km) baselines (See baseline distribution histograms in Figure 2). This layout has maximum baseline length is about l kilometres.

SKASUR The SKA survey layout (96 dishes) released by the SPO (March 2013). This layout has maximum baseline of 50km. In this report we also refer to this layout as SKASUR.

SKASUR75 This is an unofficial SKA survey layout (96 dishes) produced by Robert Braun (September 2013). This forms the basis of the SKA Imaging Performance Memo (cite). This layout has maximum baseline of 75km.

The details of the layouts are tabulated in Table 1, and Figure 1 shows the layouts and Figure 2 shows the baseline distribution histogram for the different layouts. Figure 3 shows the uv-coverage for the different layouts at 1.1GHz for declinations -50,-30,-10 degrees and for 8hr tracks. At this point no optimisation has been done on the antenna distributions and we emphasise that further improvements can be and should be made.

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[2]We assume this to be the baseline layout.

Table 1: Breakdown of the SKA1-Mid layouts under consideration.

REF2A100B173 [254 dishes]	SKA dishes	Legacy dishes	Both	%
Core	70	30	100	39.4
Outer-core	60	34	94	37.0
Spiral-arms	60	0	60	23.6
W9-0A72B120 [254 dishes]				
Core	70	30	100	39.4
Outer-core	51	34	85	33.5
Spiral-arms	69	0	69	27.1
W9-12A60B120 [266 dishes]				
Core	70	30	100	37.6
Outer-core	51	34	85	32.0
Spiral-arms	81	0	81	30.4

Table 2: Breakdown of the SKA survey layouts under consideration.

SKASUR [96 dishes]	SKA dishes	Legacy dishes	Both	%
Core	18	36	54	56.25
Spiral-arms	42	0	42	43.75
SKASUR75 [96 dishes]				
Core	24	36	60	62.5
Spiral-arms	36	0	36	37.5
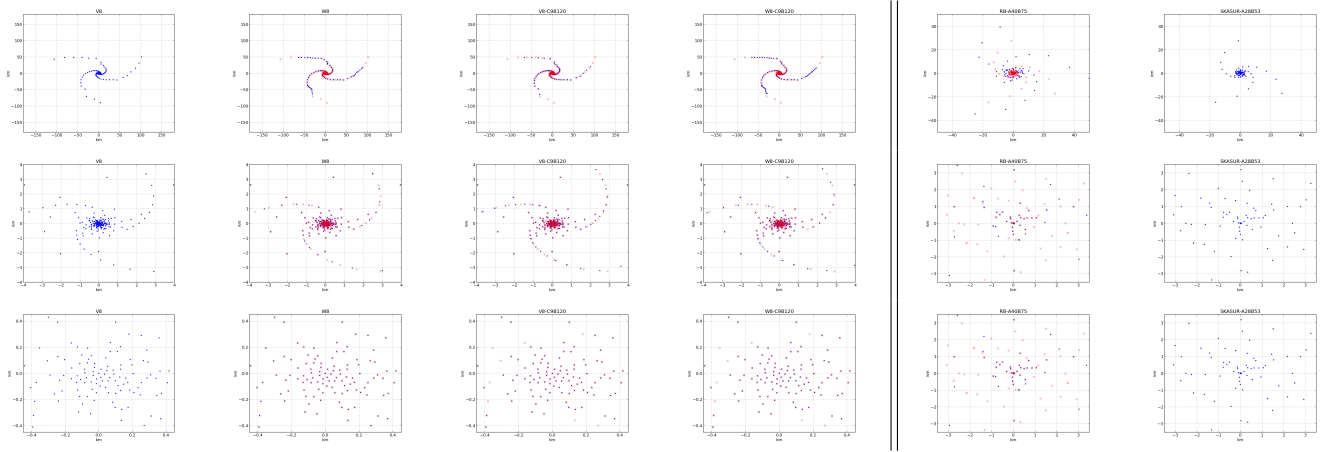
Figure 1: Antenna layouts, REF2 plotted as a reference (red crosses) for SKA1-Mid layouts, and SKASUR plotted as reference for the RB-A40B75 layout. The vertical lines separate SKA1-Mid and SKA survey layouts.
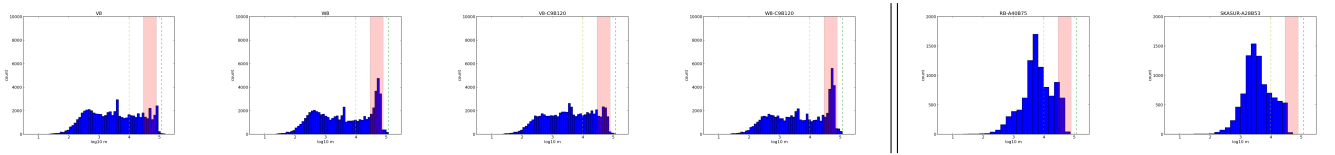
Figure 2: Baseline distribution with the uv-distance in log_{10} km . Yellow and green dashed lines mark 10 and 120 kilometres respectively, and the pink strip represents baselines from 30-80km.
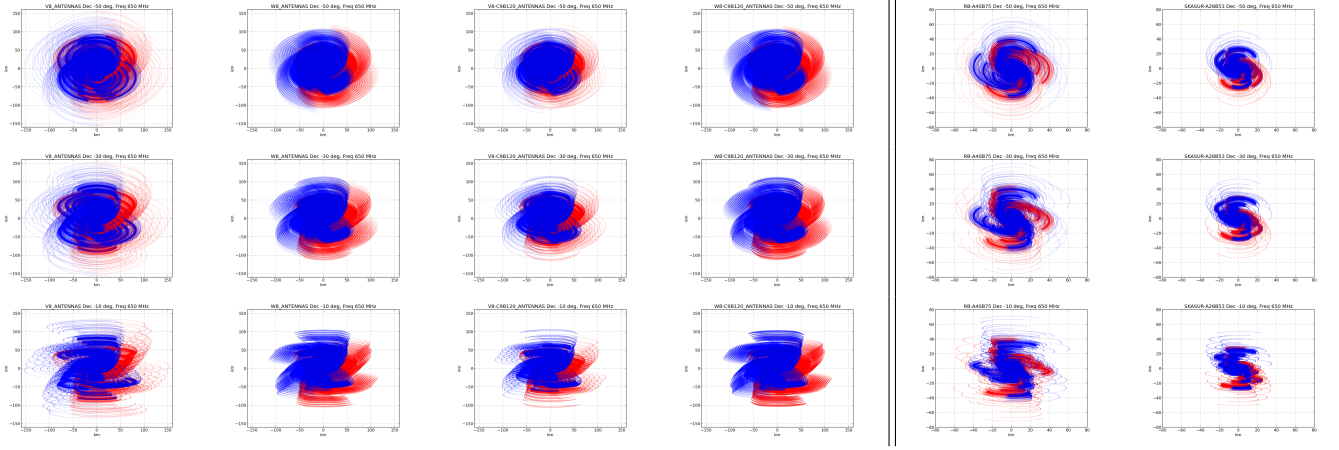
Figure 3: UV-Coverage for 8-hr tracks at 650MHz (50MHz bandwidth) at declinations -50,-30,-10 for the different layouts. Blue indicates uv-points, red indicates conjugate uv-points. The vertical lines separate SKA1-Mid and SKA survey layouts.

2 The Experiment

Our aim is to investigate the scale-dependent sensitivity of the layouts described in the previous section. We use the `makems` tool to make simulated measurement sets (MS) of 8hr tracks with a 60s integration time for declinations -50, -30 and -10 degrees, at frequencies of 650, 800 and 1000MHz, with a single 50MHz channel. The expected rms noise per real and imaginary part for each visibility is calculated as

$$\sigma_{\mathrm{vis}} = \frac{\mathrm{SEFD}}{\sqrt{2\Delta t \Delta \nu}}. \tag{1}$$

We use the baseline design's SEFD values for the SKA and legacy dishes. The noise for visibilities corresponding to baselines between SKA and legacy dishes is calculated using $\mathrm{SEFD}_{\mathrm{MIX}} = \sqrt{\mathrm{SEFD}_{\mathrm{SKA}} \times \mathrm{SEFD}_{\mathrm{LEGACY}}}$. The MS is then filled with random Gaussian noise using the computed value of the noise for a given integration and bandwidth. We then use the (CASA-derived) `lwimager` tool to make naturally weighted maps of the PSF as well as dirty maps of the noise. The following metrics were generated:

Note: These metrics are generated at different angular scales, this is done by applying an inner-taper[3] to taper out baselines that do not fall within a given resolution range, i.e., we only consider uv-points that correspond to a given resolution.

- PSF full width at half maximum (FWHM) size (mean of the FWHM dimensions). This was measured by making high-resolution images of the PSF (0.05 arcsec resolution), and fitting a Gaussian to the PSF. (Table 4). A catalog of PSF cross-sections (full uv-coverage) is provided in Appendix A.

- PSF symmetry (PSF size parameters are obtained as explained above). As a measure of PSF symmetry, we define $\mathrm{PSF}_{sym} = 1 - \mathrm{FWHM}_{min}/\mathrm{FWHM}_{maj}$, then $\mathrm{PSF}_{sym} = 0$ is perfect symmetry, and the symmetry degenerates as $\mathrm{PSF}_{sym} \to 1$ (Table 5).

- Rms pixel noise at different angular scales for 50kHz, 50MHz and 166MHz wide bands (Tables 6 - 8).

- SNR for a 10μJy source at 1000MHz with a spectral index of -0.7 after 8hrs for a 166MHz band (Table 9).

- Average SNR over frequencies 650, 800 and 1000MHz (166MHz band) after 8 hours, for a 10μJy source at 1000MHz with a spectral index of -0.7. $\overline{\mathrm{SNR10}} = \sqrt{\frac{1}{3}(\mathrm{SNR10}_{650}^2 + \mathrm{SNR10}_{800}^2 + \mathrm{SNR10}_{1000}^2)}$ (Table 10).

- Hours required to reach a mean SNR of 10 (Table 11).

- Survey Speed. These values are calculated using the FOV values in the SRD (band 1 for SKA1-Mid and band 2 PAF FOV for SKASUR) and the values in Table 9. Note that unlike the SKASUR FOV, the SKA1-Mid FOV changes across the band ($\mathrm{FOV}_{\mathrm{Mid}} \sim \nu^{-2}$). $\mathrm{SS}_{\mathrm{Freq}} = \mathrm{FOV}_{\mathrm{Freq}} \times \mathrm{SNR}^2$.

- Average survey speed. $\overline{\mathrm{SS}} = \sqrt{\frac{1}{3}(\mathrm{SS}_{650}^2 + \mathrm{SS}_{800}^2 + \mathrm{SS}_{1000}^2)}$ (Table 13).

In appendix B the above mentioned metrics are presented for a 2.5GHz band at 8, 12 and 13.8GHz, at a declination of -30 degrees.

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[3]The weights for the taper are generated using a Butterworth function.

Table 3: FWHM PSF sizes (in arcsec) for the different layouts at different angular scales. These values are generated at 650, 800 and 1000MHz for angular scales {0.4-1, 0.4-2, 1-2, 2-3, 3-4, 3-10, 600-3600} arcsec and are labelled *resbin* {1, 2, 3, 4, 5, 6, 7} respectively. This is done for natural weighting at declinations -10, -30 and -50 degrees. For each column the intensity of the colour increases with the value.

(a) DEC=-10, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	0.7	0.9	1.3	2.4	3.4	5.0	818.8	0.6	0.8	1.4	2.3	3.3	5.0	798.4	0.6	0.8	1.3	2.3	3.4	5.2	781.5	0.6	0.8	1.3	2.3	3.4	5.3	727.6
SKA1W8	0.8	1.0	1.2	2.4	3.4	4.9	818.8	0.7	0.9	1.3	2.3	3.3	5.0	798.4	0.6	0.7	1.3	2.3	3.3	5.2	781.5	0.5	0.6	1.3	2.3	3.3	5.3	727.6
SKA1V8-C9B120	0.8	1.1	1.3	2.4	3.3	4.9	820	0.7	1.0	1.4	2.3	3.3	5.0	797.8	0.6	0.9	1.3	2.3	3.3	5.1	781.4	0.6	0.8	1.3	2.4	3.4	5.2	726.5
SKA1W8-C9B120	0.8	1.0	1.2	2.4	3.4	5.0	820	0.7	0.8	1.3	2.3	3.3	5.1	797.8	0.6	0.7	1.3	2.3	3.4	5.2	781.4	0.5	0.6	1.3	2.4	3.3	5.3	726.5
SKASUR	1.2	1.9	1.9	2.5	3.4	5.4	1029	1.0	1.7	1.6	2.3	3.4	5.5	943.3	1.0	1.4	1.4	2.4	3.4	5.6	914.7	0.9	1.1	1.3	2.4	3.4	5.5	776.1
SKASUR75	0.9	1.5	1.5	2.4	3.3	5.4	1072	0.9	1.3	1.4	2.4	3.4	5.6	984.2	0.8	1.2	1.3	2.3	3.4	5.3	948.6	0.7	0.9	1.3	2.4	3.4	4.9	793.4

(b) DEC=-30, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	0.7	0.9	1.3	2.4	3.3	4.9	814.6	0.6	0.8	1.4	2.3	3.3	5.1	791.7	0.6	0.8	1.3	2.3	3.4	5.3	776.2	0.6	0.8	1.3	2.3	3.3	5.2	716.2
SKA1W8	0.8	1.0	1.2	2.4	3.4	4.9	814.6	0.7	0.8	1.3	2.3	3.4	5.1	791.7	0.6	0.7	1.3	2.3	3.3	5.3	776.2	0.5	0.6	1.3	2.3	3.3	5.3	716.2
SKA1V8-C9B120	0.8	1.1	1.3	2.3	3.3	4.9	815.3	0.7	1.0	1.3	2.3	3.4	5.1	790.8	0.6	0.8	1.3	2.3	3.3	5.2	776.2	0.6	0.8	1.3	2.4	3.3	5.2	714.5
SKA1W8-C9B120	0.8	1.0	1.2	2.3	3.4	5.0	815.3	0.7	0.8	1.3	2.3	3.4	5.1	790.8	0.6	0.7	1.3	2.3	3.4	5.2	776.2	0.5	0.6	1.3	2.4	3.3	5.2	714.5
SKASUR	1.3	2.0	1.9	2.5	3.4	5.3	1097	1.0	1.7	1.6	2.3	3.4	5.4	973.7	1.0	1.4	1.4	2.4	3.3	5.5	903.9	0.9	1.2	1.4	2.4	3.3	5.5	751.3
SKASUR75	1.0	1.5	1.5	2.4	3.3	5.6	1167	1.0	1.3	1.4	2.4	3.4	5.6	1019	0.8	1.2	1.3	2.4	3.4	5.3	933.8	0.7	0.9	1.3	2.4	3.4	4.8	758.7

(c) DEC=-50, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	0.7	0.9	1.3	2.4	3.3	5.0	815.1	0.6	0.8	1.4	2.3	3.3	5.1	793.8	0.6	0.8	1.4	2.3	3.4	5.2	775	0.6	0.8	1.3	2.4	3.3	5.2	717.4
SKA1W8	0.8	1.0	1.2	2.3	3.3	4.9	815.1	0.7	0.8	1.3	2.3	3.4	5.1	793.8	0.6	0.7	1.3	2.3	3.3	5.3	775	0.5	0.6	1.3	2.3	3.3	5.3	717.4
SKA1V8-C9B120	0.8	1.1	1.3	2.4	3.3	5.0	816	0.7	1.0	1.4	2.3	3.4	5.1	792.9	0.6	0.8	1.4	2.3	3.3	5.2	774.5	0.6	0.8	1.3	2.4	3.3	5.1	715.5
SKA1W8-C9B120	0.8	1.0	1.2	2.3	3.3	5.0	816	0.7	0.8	1.3	2.3	3.4	5.2	792.9	0.6	0.7	1.3	2.3	3.4	5.2	774.5	0.5	0.6	1.3	2.4	3.3	5.2	715.5
SKASUR	1.4	2.0	1.9	2.4	3.4	5.2	1031	1.1	1.7	1.6	2.4	3.3	5.3	962.8	1.0	1.5	1.4	2.4	3.4	5.4	936.8	0.9	1.2	1.4	2.4	3.3	5.5	761.8
SKASUR75	0.9	1.5	1.5	2.4	3.4	5.5	1051	0.9	1.3	1.4	2.4	3.4	5.5	975.9	0.8	1.2	1.3	2.4	3.4	5.2	948.3	0.7	1.0	1.3	2.4	3.4	4.9	753.2

Table 4: FWHM PSF sizes (in arcsec) for the different layouts at different angular scales. These values are generated at 650, 800 and 1000MHz for angular scales {0.4-1, 0.4-2, 1-2, 2-3, 3-4, 3-10, 600-3600} arcsec and are labelled *resbin* {1, 2, 3, 4, 5, 6, 7} respectively. This is done for natural weighting at declinations -10, -30 and -50 degrees. For each column the intensity of the colour increases with the value.

(a) DEC=-10, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	0.7	0.9	1.3	2.4	3.4	5.0	818.8	0.6	0.8	1.4	2.3	3.3	5.0	798.4	0.6	0.8	1.3	2.3	3.4	5.2	781.5	0.6	0.8	1.3	2.3	3.4	5.3	727.6
SKA1W8	0.8	1.0	1.2	2.4	3.4	4.9	818.8	0.7	0.9	1.3	2.3	3.3	5.0	798.4	0.6	0.7	1.3	2.3	3.3	5.2	781.5	0.5	0.6	1.3	2.3	3.3	5.3	727.6
SKA1V8-C9B120	0.8	1.1	1.3	2.4	3.3	4.9	820	0.7	1.0	1.4	2.3	3.3	5.0	797.8	0.6	0.9	1.3	2.3	3.3	5.1	781.4	0.6	0.8	1.3	2.4	3.4	5.2	726.5
SKA1W8-C9B120	0.8	1.0	1.2	2.4	3.4	5.0	820	0.7	0.8	1.3	2.3	3.3	5.1	797.8	0.6	0.7	1.3	2.3	3.4	5.2	781.4	0.5	0.6	1.3	2.4	3.3	5.3	726.5
SKASUR	1.2	1.9	1.9	2.5	3.4	5.4	1029	1.0	1.7	1.6	2.3	3.4	5.5	943.3	1.0	1.4	1.4	2.4	3.4	5.6	914.7	0.9	1.1	1.3	2.4	3.4	5.5	776.1
SKASUR75	0.9	1.5	1.5	2.4	3.3	5.4	1072	0.9	1.3	1.4	2.4	3.4	5.6	984.2	0.8	1.2	1.3	2.3	3.4	5.3	948.6	0.7	0.9	1.3	2.4	3.4	4.9	793.4

(b) DEC=-30, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	0.7	0.9	1.3	2.4	3.3	4.9	814.6	0.6	0.8	1.4	2.3	3.3	5.1	791.7	0.6	0.8	1.3	2.3	3.4	5.3	776.2	0.6	0.8	1.3	2.3	3.3	5.2	716.2
SKA1W8	0.8	1.0	1.2	2.4	3.4	4.9	814.6	0.7	0.8	1.3	2.3	3.4	5.1	791.7	0.6	0.7	1.3	2.3	3.3	5.3	776.2	0.5	0.6	1.3	2.3	3.3	5.3	716.2
SKA1V8-C9B120	0.8	1.1	1.3	2.3	3.3	4.9	815.3	0.7	1.0	1.3	2.3	3.4	5.1	790.8	0.6	0.8	1.3	2.3	3.3	5.2	776.2	0.6	0.8	1.3	2.4	3.3	5.2	714.5
SKA1W8-C9B120	0.8	1.0	1.2	2.3	3.4	5.0	815.3	0.7	0.8	1.3	2.3	3.4	5.1	790.8	0.6	0.7	1.3	2.3	3.4	5.2	776.2	0.5	0.6	1.3	2.4	3.3	5.2	714.5
SKASUR	1.3	2.0	1.9	2.5	3.4	5.3	1097	1.0	1.7	1.6	2.3	3.4	5.4	973.7	1.0	1.4	1.4	2.4	3.3	5.5	903.8	0.9	1.2	1.4	2.4	3.3	5.5	751.3
SKASUR75	1.0	1.5	1.5	2.4	3.3	5.6	1167	1.0	1.3	1.4	2.4	3.4	5.6	1019	0.8	1.2	1.3	2.4	3.4	5.3	933.8	0.7	0.9	1.3	2.4	3.4	4.8	758.7

(c) DEC=-50, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	0.7	0.9	1.3	2.4	3.3	4.9	815.1	0.6	0.8	1.4	2.3	3.3	5.1	793.8	0.6	0.8	1.4	2.3	3.4	5.2	775	0.6	0.8	1.3	2.4	3.3	5.2	717.4
SKA1W8	0.8	1.0	1.2	2.3	3.3	4.9	815.1	0.7	0.8	1.3	2.3	3.4	5.1	793.8	0.6	0.7	1.3	2.3	3.3	5.3	775	0.5	0.6	1.3	2.3	3.3	5.3	717.4
SKA1V8-C9B120	0.8	1.1	1.3	2.4	3.3	5.0	816	0.7	1.0	1.4	2.3	3.4	5.1	792.9	0.6	0.8	1.4	2.3	3.3	5.2	774.5	0.6	0.8	1.3	2.4	3.3	5.1	715.5
SKA1W8-C9B120	0.8	1.0	1.2	2.3	3.3	5.0	816	0.7	0.8	1.3	2.3	3.4	5.2	792.9	0.6	0.7	1.3	2.3	3.4	5.2	774.5	0.5	0.6	1.3	2.4	3.3	5.2	715.5
SKASUR	1.4	2.0	1.9	2.4	3.4	5.2	1031	1.1	1.7	1.6	2.4	3.3	5.3	962.8	1.0	1.5	1.4	2.4	3.4	5.4	936.8	0.9	1.2	1.4	2.4	3.3	5.5	761.8
SKASUR75	0.9	1.5	1.5	2.4	3.4	5.5	1051	0.9	1.3	1.4	2.4	3.4	5.5	975.9	0.8	1.2	1.3	2.4	3.4	5.2	948.3	0.7	1.0	1.3	2.4	3.4	4.9	753.2

Table 5: PSF symmetry (see section 2) for the different layouts at different angular scales. These values are generated at 650, 800 and 1000MHz for angular scales {0.4-1, 0.4-2, 1-2, 2-3, 3-4, 3-10, 600-3600} arcsec and are labelled *resbin* {1, 2, 3, 4, 5, 6, 7} respectively. This is done for natural weighting at declinations -10, -30 and -50 degrees. For each column the intensity of the colour increases with the value.

(a) DEC=-10, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	0.08	0.07	0.04	0.09	0.05	0.00	0.02	0.08	0.07	0.03	0.06	0.01	0.02	0.01	0.05	0.05	0.06	0.06	0.1	0.04	0.02	0.05	0.05	0.06	0.08	0.04	0.05	0.02
SKA1W8	0.04	0.05	0.09	0.1	0.09	0.01	0.02	0.07	0.05	0.04	0.06	0.05	0.01	0.01	0.05	0.05	0.07	0.05	0.1	0.02	0.02	0.09	0.09	0.06	0.09	0.02	0.06	0.02
SKA1V8-C9B120	0.00	0.01	0.03	0.09	0.05	0.01	0.01	0.02	0.02	0.03	0.04	0.01	0.02	0.00	0.01	0.02	0.06	0.04	0.1	0.03	0.02	0.04	0.04	0.06	0.1	0.04	0.03	0.02
SKA1W8-C9B120	0.06	0.06	0.06	0.1	0.08	0.01	0.01	0.07	0.06	0.06	0.07	0.05	0.00	0.00	0.06	0.06	0.06	0.04	0.07	0.01	0.02	0.07	0.08	0.05	0.07	0.01	0.04	0.02
SKASUR	0.6	0.4	0.4	0.3	0.06	0.1	0.3	0.5	0.4	0.4	0.1	0.2	0.1	0.2	0.4	0.3	0.4	0.1	0.2	0.04	0.2	0.4	0.3	0.1	0.2	0.05	0.09	0.03
SKASUR75	0.3	0.3	0.3	0.2	0.1	0.01	0.3	0.3	0.2	0.2	0.2	0.02	0.03	0.3	0.3	0.2	0.2	0.06	0.1	0.03	0.2	0.3	0.2	0.1	0.07	0.02	0.02	0.2

(b) DEC=-30, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	0.2	0.1	0.05	0.07	0.07	0.08	0.01	0.1	0.1	0.07	0.05	0.08	0.07	0.01	0.07	0.08	0.1	0.07	0.1	0.06	0.03	0.07	0.08	0.08	0.1	0.07	0.01	0.02
SKA1W8	0.1	0.1	0.05	0.05	0.06	0.07	0.01	0.1	0.1	0.07	0.05	0.1	0.07	0.01	0.1	0.1	0.08	0.06	0.1	0.06	0.03	0.1	0.1	0.08	0.07	0.1	0.01	0.02
SKA1V8-C9B120	0.1	0.09	0.05	0.08	0.05	0.07	0.00	0.09	0.09	0.06	0.07	0.06	0.07	0.01	0.08	0.09	0.1	0.07	0.08	0.06	0.03	0.08	0.09	0.08	0.09	0.06	0.02	0.02
SKA1W8-C9B120	0.2	0.1	0.02	0.07	0.06	0.07	0.00	0.1	0.1	0.06	0.05	0.1	0.06	0.01	0.1	0.1	0.08	0.07	0.1	0.05	0.03	0.08	0.08	0.08	0.06	0.05	0.02	0.02
SKASUR	0.6	0.5	0.5	0.2	0.1	0.09	0.4	0.5	0.4	0.4	0.06	0.2	0.06	0.3	0.5	0.4	0.4	0.1	0.1	0.03	0.2	0.5	0.3	0.09	0.1	0.00	0.1	0.01
SKASUR75	0.4	0.3	0.3	0.2	0.02	0.00	0.4	0.4	0.3	0.2	0.2	0.08	0.01	0.3	0.3	0.3	0.2	0.01	0.09	0.01	0.2	0.3	0.3	0.2	0.07	0.1	0.07	0.1

(c) DEC=-50, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	0.1	0.1	0.06	0.07	0.04	0.05	0.00	0.1	0.1	0.03	0.06	0.03	0.05	0.00	0.07	0.07	0.06	0.02	0.1	0.05	0.02	0.06	0.07	0.08	0.05	0.08	0.01	0.03
SKA1W8	0.1	0.1	0.07	0.05	0.03	0.06	0.00	0.1	0.1	0.04	0.07	0.02	0.05	0.00	0.09	0.09	0.07	0.04	0.09	0.04	0.02	0.08	0.09	0.07	0.05	0.07	0.01	0.03
SKA1V8-C9B120	0.07	0.07	0.07	0.07	0.04	0.05	0.00	0.08	0.07	0.02	0.07	0.04	0.05	0.00	0.07	0.07	0.05	0.04	0.06	0.05	0.02	0.06	0.07	0.07	0.07	0.09	0.03	0.03
SKA1W8-C9B120	0.1	0.1	0.05	0.07	0.03	0.06	0.00	0.1	0.1	0.01	0.08	0.03	0.04	0.00	0.09	0.09	0.07	0.04	0.06	0.04	0.02	0.07	0.07	0.07	0.05	0.06	0.03	0.03
SKASUR	0.7	0.4	0.4	0.1	0.06	0.07	0.2	0.5	0.3	0.3	0.09	0.05	0.04	0.2	0.4	0.3	0.3	0.06	0.2	0.01	0.2	0.4	0.2	0.05	0.2	0.02	0.1	0.02
SKASUR75	0.3	0.3	0.3	0.2	0.08	0.03	0.3	0.2	0.3	0.3	0.02	0.05	0.00	0.2	0.2	0.2	0.2	0.1	0.04	0.03	0.2	0.3	0.2	0.04	0.06	0.09	0.07	0.1

Table 6: Noise (in μJy) for a 50kHz band after an 8hr synthesis with a 60s integration for the different layouts at different angular scales. These values are generated at 650, 800 and 1000 MHz, at angular scales {0.4-1, 0.4-2, 1-2, 2-3, 3-4, 3-10, 600-3600} arcsec and are labelled *resbin* {1, 2, 3, 4, 5, 6, 7} respectively. This is done for natural weighting at declinations -10, -30 and -50 degrees. For each column the intensity of the colour increases with the value.

(a) DEC=-10, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	110	79.0	110	150	190	88.0	290	100	73.0	110	150	180	86.0	350	96.0	70.0	110	150	180	84.0	450	58.0	43.0	68.0	91.0	110	52.0	400
SKA1W8	96.0	68.0	90.0	160	200	100	290	81.0	65.0	110	170	200	97.0	350	74.0	63.0	120	170	200	97.0	450	45.0	39.0	77.0	100	130	58.0	400
SKA1V8-C9B120	140	83.0	110	130	170	81.0	290	110	74.0	100	140	170	80.0	350	99.0	71.0	100	140	170	79.0	450	53.0	40.0	64.0	85.0	110	48.0	410
SKA1W8-C9B120	95.0	67.0	87.0	160	200	94.0	290	78.0	61.0	110	160	200	93.0	360	72.0	60.0	110	170	190	90.0	460	45.0	38.0	76.0	97.0	120	55.0	420
SKASUR	5200	460	560	510	620	270	2600	2800	390	460	500	630	250	2900	750	230	260	350	400	160	3300	360	210	270	340	360	150	3700
SKASUR75	1500	330	370	460	540	220	2500	650	300	350	440	540	210	2700	300	180	240	310	320	140	2900	230	160	240	270	310	150	3200

(b) DEC=-30, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	110	79.0	120	150	180	89.0	310	100	73.0	110	150	180	86.0	370	97.0	72.0	110	150	180	84.0	480	58.0	45.0	70.0	93.0	110	52.0	440
SKA1W8	89.0	66.0	93.0	160	200	100	310	80.0	65.0	110	170	200	97.0	370	72.0	62.0	120	170	200	93.0	480	46.0	39.0	76.0	110	130	58.0	440
SKA1V8-C9B120	130	78.0	100	140	170	81.0	300	110	74.0	100	140	170	80.0	380	96.0	69.0	100	140	160	77.0	480	53.0	40.0	64.0	84.0	110	48.0	440
SKA1W8-C9B120	84.0	63.0	92.0	160	200	95.0	300	76.0	62.0	110	170	200	92.0	370	70.0	60.0	120	170	190	89.0	490	45.0	38.0	77.0	99.0	120	54.0	440
SKASUR	5300	480	570	550	610	260	2800	2700	400	470	500	590	240	3000	650	240	260	340	370	160	3500	350	200	260	320	350	140	3800
SKASUR75	1300	320	370	440	560	210	2700	640	290	350	460	560	200	2800	300	180	230	310	310	140	3100	240	160	240	270	290	150	3300

(c) DEC=-50, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	110	78.0	110	150	180	88.0	300	99.0	74.0	110	150	190	86.0	370	96.0	72.0	110	150	180	83.0	480	58.0	43.0	69.0	92.0	110	51.0	430
SKA1W8	91.0	66.0	90.0	160	200	100	300	78.0	64.0	110	170	200	96.0	370	75.0	63.0	120	170	200	94.0	480	46.0	38.0	77.0	110	130	58.0	440
SKA1V8-C9B120	130	80.0	100	130	170	81.0	310	110	73.0	100	140	170	78.0	370	96.0	69.0	100	140	170	78.0	480	54.0	40.0	64.0	86.0	110	49.0	440
SKA1W8-C9B120	86.0	63.0	90.0	160	200	94.0	310	76.0	63.0	110	170	200	92.0	370	71.0	61.0	120	170	190	89.0	480	45.0	38.0	76.0	97.0	120	54.0	440
SKASUR	7100	480	620	540	580	260	2900	3200	400	500	480	550	240	3100	860	240	270	330	370	160	3600	380	200	260	310	350	150	4100
SKASUR75	1600	330	370	470	550	210	2700	710	300	350	470	510	200	2900	320	190	230	310	300	140	3300	240	160	240	260	300	150	3400

Table 7: Noise (in μJy) for a 50MHz band after an 8hr synthesis with a 60s integration for the different layouts at different angular scales. These values are generated at 650, 800 and 1000 MHz, at angular scales {0.4-1, 0.4-2, 1-2, 2-3, 3-4, 3-10, 600-3600} arcsec and are labelled *resbin* {1, 2, 3, 4, 5, 6, 7} respectively. This is done for natural weighting at declinations -10, -30 and -50 degrees. For each column the intensity of the colour increases with the value.

(a) DEC=-10, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	3.6	2.5	3.6	4.6	5.9	2.8	9.1	3.2	2.3	3.6	4.7	5.6	2.7	11.0	3.0	2.2	3.5	4.8	5.6	2.6	14.0	1.8	1.4	2.2	2.9	3.6	1.6	13.0
SKA1W8	3.0	2.1	2.9	5.1	6.4	3.2	9.1	2.6	2.0	3.4	5.4	6.4	3.1	11.0	2.4	2.0	3.7	5.4	6.3	3.1	14.0	1.4	1.2	2.4	3.3	4.2	1.8	13.0
SKA1V8-C9B120	4.3	2.6	3.3	4.2	5.3	2.6	9.2	3.6	2.4	3.3	4.4	5.3	2.5	11.0	3.1	2.2	3.3	4.4	5.2	2.5	14.0	1.7	1.3	2.0	2.7	3.3	1.5	13.0
SKA1W8-C9B120	3.0	2.1	2.8	4.9	6.5	3.0	9.2	2.5	1.9	3.3	5.2	6.4	2.9	11.0	2.3	1.9	3.6	5.4	6.0	2.9	15.0	1.4	1.2	2.4	3.1	3.8	1.7	13.0
SKASUR	160	15.0	18.0	16.0	20.0	8.5	82.0	87.0	12.0	15.0	16.0	20.0	7.8	92.0	24.0	7.4	8.2	11.0	13.0	5.0	100	11.0	6.6	8.5	11.0	11.0	4.6	120
SKASUR75	49.0	10.0	12.0	14.0	17.0	7.0	81.0	21.0	9.5	11.0	14.0	17.0	6.5	87.0	9.6	5.7	7.4	9.7	10.0	4.5	92.0	7.3	5.1	7.5	8.6	9.75	4.6	100

(b) DEC=-30, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	3.5	2.5	3.6	4.6	5.7	2.8	9.7	3.2	2.3	3.5	4.8	5.7	2.7	12.0	3.1	2.3	3.6	4.8	5.7	2.7	15.0	1.8	1.4	2.2	2.9	3.6	1.6	14.0
SKA1W8	2.8	2.1	2.9	5.1	6.2	3.1	9.7	2.5	2.0	3.4	5.3	6.2	3.1	12.0	2.3	2.0	3.8	5.3	6.4	3.0	15.0	1.5	1.2	2.4	3.3	4.0	1.8	14.0
SKA1V8-C9B120	4.1	2.5	3.2	4.3	5.3	2.5	9.6	3.4	2.3	3.3	4.3	5.3	2.5	12.0	3.0	2.2	3.3	4.4	5.2	2.4	15.0	1.7	1.3	2.0	2.7	3.4	1.5	14.0
SKA1W8-C9B120	2.7	2.0	2.9	5.1	6.2	3.0	9.6	2.4	2.0	3.4	5.4	6.2	2.9	12.0	2.2	1.9	3.7	5.3	5.9	2.8	15.0	1.4	1.2	2.4	3.1	3.8	1.7	14.0
SKASUR	170	15.0	18.0	17.0	19.0	8.2	90.0	86.0	13.0	15.0	16.0	19.0	7.6	96.0	20.0	7.5	8.4	11.0	12.0	5.0	110	11.0	6.3	8.3	10.0	11.0	4.6	120
SKASUR75	42.0	10.0	12.0	14.0	18.0	6.8	85.0	20.0	9.2	11.0	15.0	18.0	6.4	89.0	9.5	5.6	7.3	9.9	9.8	4.4	97.0	7.4	5.2	7.5	8.4	9.3	4.7	100

(c) DEC=-50, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	3.5	2.5	3.6	4.7	5.8	2.8	9.6	3.1	2.3	3.6	4.7	5.9	2.7	12.0	3.0	2.3	3.6	4.9	5.7	2.6	15.0	1.8	1.4	2.2	2.9	3.6	1.6	14.0
SKA1W8	2.9	2.1	2.9	5.0	6.4	3.2	9.6	2.5	2.0	3.5	5.2	6.4	3.0	12.0	2.4	2.0	3.7	5.4	6.4	3.0	15.0	1.4	1.2	2.4	3.4	4.1	1.8	14.0
SKA1V8-C9B120	4.2	2.5	3.3	4.2	5.2	2.6	9.7	3.3	2.3	3.3	4.3	5.4	2.5	12.0	3.0	2.2	3.3	4.5	5.2	2.5	15.0	1.7	1.3	2.0	2.7	3.3	1.5	14.0
SKA1W8-C9B120	2.7	2.0	2.9	5.0	6.4	3.0	9.7	2.4	2.0	3.5	5.2	6.4	2.9	12.0	2.3	1.9	3.7	5.4	5.9	2.8	15.0	1.4	1.2	2.4	3.1	3.8	1.7	14.0
SKASUR	220	15.0	20.0	17.0	18.0	8.1	91.0	100	13.0	16.0	15.0	17.0	7.6	100	27.0	7.4	8.6	10.0	12.0	4.9	120	12.0	6.3	8.2	9.9	11.0	4.7	130
SKASUR75	50.0	11.0	12.0	15.0	17.0	6.6	85.0	23.0	9.5	11.0	15.0	16.0	6.2	91.0	10.0	5.9	7.3	9.7	9.4	4.4	100	7.5	5.1	7.4	8.2	9.5	4.7	110

Table 8: Noise (in μJy) for a 166MHz band after an 8hr synthesis with a 60s integration for the different layouts at different angular scales. These values are generated at 650, 800 and 1000 MHz, at angular scales {0.4-1, 0.4-2, 1-2, 2-3, 3-4, 3-10, 600-3600} arcsec and are labelled *resbin* {1, 2, 3, 4, 5, 6, 7} respectively. This is done for natural weighting at declinations -10, -30 and -50 degrees. For each column the intensity of the colour increases with the value.

(a) DEC=-10, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	2.0	1.4	2.0	2.5	3.2	1.5	5.0	1.8	1.3	2.0	2.6	3.1	1.5	6.1	1.7	1.2	1.9	2.6	3.0	1.5	7.8	1.0	0.8	1.2	1.6	2.0	0.9	7.0
SKA1W8	1.7	1.2	1.6	2.8	3.5	1.7	5.0	1.4	1.1	1.8	2.9	3.5	1.7	6.1	1.3	1.1	2.0	3.0	3.5	1.7	7.8	0.8	0.7	1.3	1.8	2.3	1.0	7.0
SKA1V8-C9B120	2.4	1.4	1.8	2.3	2.9	1.4	5.1	2.0	1.3	1.8	2.4	2.9	1.4	6.1	1.7	1.2	1.8	2.4	2.9	1.4	7.8	0.9	0.7	1.1	1.5	1.8	0.8	7.2
SKA1W8-C9B120	1.6	1.2	1.5	2.7	3.6	1.6	5.1	1.3	1.1	1.8	2.8	3.5	1.6	6.2	1.2	1.0	2.0	3.0	3.3	1.6	8.0	0.8	0.7	1.3	1.7	2.1	0.9	7.2
SKASUR	90.0	8.0	9.8	8.9	11.0	4.7	45.0	48.0	6.8	8.0	8.7	11.0	4.3	51.0	13.0	4.1	4.5	6.1	7.0	2.8	57.0	6.2	3.6	4.7	5.8	6.2	2.5	64.0
SKASUR75	27.0	5.7	6.5	7.9	9.4	3.8	44.0	11.0	5.2	6.1	7.6	9.5	3.6	48.0	5.3	3.1	4.1	5.3	5.6	2.5	51.0	4.0	2.8	4.1	4.7	5.3	2.5	56.0

(b) DEC=-30, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	1.9	1.4	2.0	2.5	3.1	1.5	5.3	1.7	1.3	1.9	2.6	3.1	1.5	6.5	1.7	1.3	2.0	2.7	3.1	1.5	8.3	1.0	0.8	1.2	1.6	2.0	0.9	7.6
SKA1W8	1.6	1.1	1.6	2.8	3.4	1.7	5.3	1.4	1.1	1.9	2.9	3.4	1.7	6.4	1.3	1.1	2.1	2.9	3.5	1.6	8.3	0.8	0.7	1.3	1.8	2.2	1.0	7.6
SKA1V8-C9B120	2.3	1.4	1.8	2.4	2.9	1.4	5.3	1.9	1.3	1.8	2.4	2.9	1.4	6.6	1.7	1.2	1.8	2.4	2.9	1.3	8.3	0.9	0.7	1.1	1.5	1.8	0.8	7.6
SKA1W8-C9B120	1.5	1.1	1.6	2.8	3.4	1.6	5.3	1.3	1.1	1.9	3.0	3.4	1.6	6.5	1.2	1.0	2.0	2.9	3.3	1.5	8.4	0.8	0.7	1.3	1.7	2.1	0.9	7.8
SKASUR	91.0	8.3	9.9	9.5	11.0	4.5	49.0	47.0	7.0	8.1	8.7	10.0	4.1	53.0	11.0	4.1	4.6	5.9	6.5	2.7	60.0	6.1	3.5	4.5	5.5	6.1	2.5	66.0
SKASUR75	23.0	5.6	6.4	7.7	9.8	3.7	47.0	11.0	5.0	6.1	8.0	9.8	3.5	49.0	5.2	3.1	4.0	5.4	5.4	2.4	53.0	4.1	2.8	4.1	4.6	5.1	2.6	58.0

(c) DEC=-50, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	1.9	1.4	2.0	2.6	3.2	1.5	5.3	1.7	1.3	2.0	2.6	3.2	1.5	6.4	1.7	1.3	2.0	2.7	3.1	1.4	8.3	1.0	0.8	1.2	1.6	2.0	0.9	7.5
SKA1W8	1.6	1.1	1.6	2.7	3.5	1.7	5.3	1.4	1.1	1.9	2.9	3.5	1.7	6.4	1.3	1.1	2.0	3.0	3.5	1.6	8.3	0.8	0.7	1.3	1.9	2.3	1.0	7.7
SKA1V8-C9B120	2.3	1.4	1.8	2.3	2.9	1.4	5.3	1.8	1.3	1.8	2.4	3.0	1.4	6.5	1.7	1.2	1.8	2.5	2.9	1.4	8.4	0.9	0.7	1.1	1.5	1.8	0.8	7.7
SKA1W8-C9B120	1.5	1.1	1.6	2.8	3.5	1.6	5.3	1.3	1.1	1.9	2.9	3.5	1.6	6.4	1.2	1.1	2.0	3.0	3.2	1.5	8.4	0.8	0.7	1.3	1.7	2.1	0.9	7.7
SKASUR	120	8.3	11.0	9.4	10.0	4.5	50.0	55.0	7.0	8.6	8.3	9.5	4.2	55.0	15.0	4.1	4.7	5.6	6.4	2.7	63.0	6.6	3.5	4.5	5.5	6.1	2.6	71.0
SKASUR75	27.0	5.8	6.4	8.2	9.6	3.6	47.0	12.0	5.2	6.0	8.1	8.8	3.4	50.0	5.6	3.2	4.0	5.3	5.2	2.4	57.0	4.1	2.8	4.1	4.5	5.2	2.6	59.0

Table 9: SNR after 8 hours relative to a 10μJy source at 1000Hz (166 MHz band) with a spectral index of -0.7 for the different layouts. These values are generated at 650, 800 and 1000 MHz, at angular scales {0.4-1, 0.4-2, 1-2, 2-3, 3-4, 3-10, 600-3600} arcsec and are labelled *resbin* {1, 2, 3, 4, 5, 6, 7} respectively. This is done for natural weighting at declinations -10, -30 and -50 degrees. For each column the intensity of the colour increases with the value.

(a) DEC=-10, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	6.8	9.8	6.9	5.3	4.2	8.9	2.7	6.7	9.2	5.9	4.6	3.8	7.8	1.9	6.0	8.2	5.2	3.8	3.3	6.9	1.3	7.9	10.5	6.7	5.0	4.0	8.8	1.1
SKA1W8	8.1	11.5	8.6	4.8	3.9	7.8	2.7	8.3	10.4	6.4	4.0	3.4	6.9	1.9	7.8	9.2	5.0	3.4	2.9	6.0	1.3	10.1	11.8	5.9	4.3	3.4	7.8	1.1
SKA1V8-C9B120	5.7	9.4	7.4	5.9	4.7	9.6	2.7	5.9	9.1	6.4	4.8	4.0	8.4	1.9	5.8	8.1	5.5	4.1	3.5	7.3	1.3	8.6	11.4	7.1	5.3	4.3	9.4	1.1
SKA1W8-C9B120	8.2	11.6	8.9	5.0	3.8	8.3	2.7	8.7	11.0	6.4	4.1	3.3	7.2	1.9	8.0	9.6	5.0	3.4	3.0	6.4	1.2	10.2	12.1	6.0	4.7	3.8	8.3	1.1
SKASUR	0.1	1.7	1.4	1.5	1.3	2.9	0.3	0.2	1.7	1.5	1.3	1.1	2.7	0.2	0.8	2.5	2.2	1.6	1.4	3.6	0.2	1.3	2.2	1.7	1.4	1.3	3.1	0.1
SKASUR75	0.5	2.4	2.1	1.7	1.4	3.5	0.3	1.0	2.2	1.9	1.5	1.2	3.3	0.2	1.9	3.2	2.5	1.9	1.8	4.1	0.2	2.0	2.8	1.9	1.7	1.5	3.1	0.1

(b) DEC=-30, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	7.0	9.9	6.8	5.3	4.3	8.8	2.5	6.7	9.2	6.0	4.4	3.7	7.8	1.8	5.9	8.0	5.1	3.8	3.2	6.8	1.2	7.8	10.2	6.5	4.9	4.0	8.8	1.0
SKA1W8	8.7	11.8	8.4	4.8	4.0	7.8	2.5	8.4	10.4	6.2	4.0	3.4	6.9	1.8	8.0	9.3	4.8	3.4	2.9	6.2	1.2	9.9	11.7	6.0	4.3	3.6	7.9	1.0
SKA1V8-C9B120	6.0	9.9	7.6	5.8	4.7	9.7	2.6	6.3	9.1	6.5	4.9	4.0	8.5	1.8	6.0	8.3	5.6	4.1	3.5	7.5	1.2	8.5	11.3	7.2	5.4	4.3	9.4	1.0
SKA1W8-C9B120	9.3	12.4	8.5	4.8	4.0	8.2	2.6	8.9	10.9	6.2	4.0	3.4	7.3	1.8	8.2	9.7	4.9	3.4	3.1	6.5	1.2	10.1	12.0	5.9	4.6	3.8	8.4	1.0
SKASUR	0.1	1.6	1.4	1.4	1.3	3.0	0.3	0.2	1.7	1.4	1.4	1.1	2.8	0.2	0.9	2.4	2.2	1.7	1.5	3.6	0.2	1.3	2.3	1.7	1.4	1.3	3.1	0.1
SKASUR75	0.6	2.4	2.1	1.8	1.4	3.6	0.3	1.0	2.3	1.9	1.5	1.2	3.3	0.2	1.9	3.2	2.5	1.9	1.9	4.1	0.2	1.9	2.8	1.9	1.7	1.6	3.1	0.1

(c) DEC=-50, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	7.0	10.0	6.9	5.3	4.2	8.9	2.6	6.8	9.1	5.9	4.5	3.6	7.8	1.8	6.0	8.0	5.1	3.7	3.2	6.9	1.2	7.8	10.5	6.6	5.0	4.0	8.9	1.1
SKA1W8	8.5	11.8	8.6	5.0	3.8	7.8	2.6	8.6	10.6	6.2	4.1	3.3	7.0	1.8	7.7	9.2	5.0	3.4	2.9	6.1	1.2	9.9	11.9	5.9	4.3	3.5	7.8	1.0
SKA1V8-C9B120	5.9	9.7	7.5	5.8	4.7	9.6	2.5	6.4	9.2	6.4	4.9	4.0	8.4	1.8	6.0	8.4	5.6	4.1	3.5	7.4	1.2	8.5	11.3	7.2	5.3	4.3	9.3	1.0
SKA1W8-C9B120	9.0	12.3	8.6	4.9	3.9	8.3	2.5	8.8	10.7	6.2	4.1	3.3	7.3	1.8	8.1	9.5	4.9	3.4	3.1	6.5	1.2	10.2	12.1	6.0	4.7	3.8	8.4	1.0
SKASUR	0.1	1.6	1.3	1.4	1.3	3.0	0.3	0.2	1.7	1.4	1.4	1.2	2.8	0.2	0.7	2.5	2.1	1.8	1.6	3.7	0.2	1.2	2.3	1.8	1.4	1.3	3.1	0.1
SKASUR75	0.5	2.3	2.1	1.6	1.4	3.7	0.3	0.9	2.2	1.9	1.4	1.3	3.4	0.2	1.8	3.1	2.5	1.9	1.9	4.2	0.2	1.9	2.8	1.9	1.8	1.5	3.1	0.1

Table 10: SNR after 8 hours relative to a 10μJy source at 1000Hz (166 MHz band) with a spectral index of -0.7 averaged over 650,800 and 1000MHz, for the different layouts at different angular scales. These values are generated for angular scales {0.4-1, 0.4-2, 1-2, 2-3, 3-4, 3-10, 600-3600} arcsec and are labelled *resbin* {1, 2, 3, 4, 5, 6, 7} respectively. This is done for natural weighting at declinations -10, -30 and -50 degrees. For each column the intensity of the colour increases with the value.

(a) DEC=-10, natural weighting

resbin	1	2	3	4	5	6	7
SKA1V8	6.9	9.5	6.2	4.7	3.8	8.1	1.9
SKA1W8	8.6	10.8	6.6	4.2	3.4	7.2	1.9
SKA1V8-C9B120	6.6	9.6	6.7	5.1	4.1	8.7	1.9
SKA1W8-C9B120	8.8	11.1	6.8	4.3	3.5	7.6	1.8
SKASUR	0.8	2.0	1.7	1.5	1.3	3.1	0.2
SKASUR75	1.5	2.7	2.1	1.7	1.5	3.5	0.2

(b) DEC=-30, natural weighting

resbin	1	2	3	4	5	6	7
SKA1V8	6.9	9.3	6.1	4.6	3.8	8.1	1.8
SKA1W8	8.8	10.9	6.5	4.2	3.5	7.2	1.8
SKA1V8-C9B120	6.8	9.7	6.8	5.1	4.1	8.8	1.8
SKA1W8-C9B120	9.2	11.3	6.5	4.2	3.6	7.7	1.8
SKASUR	0.8	2.0	1.7	1.5	1.3	3.2	0.2
SKASUR75	1.5	2.7	2.1	1.7	1.5	3.6	0.2

(c) DEC=-50, natural weighting

resbin	1	2	3	4	5	6	7
SKA1V8	7.0	9.4	6.2	4.7	3.8	8.2	1.8
SKA1W8	8.7	10.9	6.5	4.2	3.4	7.2	1.8
SKA1V8-C9B120	6.8	9.7	6.7	5.1	4.1	8.7	1.8
SKA1W8-C9B120	9.1	11.2	6.6	4.3	3.5	7.7	1.8
SKASUR	0.7	2.0	1.7	1.5	1.4	3.2	0.2
SKASUR75	1.4	2.7	2.1	1.7	1.6	3.6	0.2

Table 11: The hours required to reach a mean SNR of 10 (average over 650,800 and 1000MHz), relative to a 10μJy source at 1000MHz with a spectral index of -0.7 for the different layouts at different angular scales. These values are generated for angular scales {0.4-1, 0.4-2, 1-2, 2-3, 3-4, 3-10, 600-3600} arcsec and are labelled *resbin* {1, 2, 3, 4, 5, 6, 7} respectively. This is done for natural weighting at declinations -10, -30 and -50 degrees. For each column the intensity of the colour increases with the value.

(a) DEC=-10, natural weighting

resbin	1	2	3	4	5	6	7
SKA1V8	16.9	8.9	20.8	36.1	54.4	12.1	230.7
SKA1W8	10.8	6.9	18.3	46.1	69.4	15.7	231.1
SKA1V8-C9B120	18.2	8.7	18.0	31.1	46.6	10.5	234.5
SKA1W8-C9B120	10.3	6.5	17.6	42.6	64.9	13.8	237.8
SKASUR	1399	192.3	270.1	373.1	497.5	82.6	1.692e+04
SKASUR75	362.4	110.2	181.1	274.6	354.1	65.0	1.502e+04

(b) DEC=-30, natural weighting

resbin	1	2	3	4	5	6	7
SKA1V8	16.8	9.2	21.3	37.1	54.8	12.2	261.2
SKA1W8	10.4	6.8	19.0	45.7	65.8	15.3	259.6
SKA1V8-C9B120	17.3	8.4	17.5	31.0	46.8	10.3	260.6
SKA1W8-C9B120	9.5	6.3	18.8	44.6	62.1	13.7	262.4
SKASUR	1260	194.3	273.4	365.4	456.5	79.8	1.926e+04
SKASUR75	362.3	108.8	177.3	276.8	347.9	63.3	1.637e+04

(c) DEC=-50, natural weighting

resbin	1	2	3	4	5	6	7
SKA1V8	16.6	9.0	21.2	36.8	55.3	12.0	257.1
SKA1W8	10.5	6.7	18.7	45.4	69.7	15.3	257.9
SKA1V8-C9B120	17.4	8.5	17.7	31.1	46.7	10.5	262
SKA1W8-C9B120	9.8	6.4	18.6	43.3	64.4	13.6	261.6
SKASUR	1641	191.8	290.7	344.7	431.8	79.7	2.038e+04
SKASUR75	398.1	113	176.9	281	326	61.1	1.703e+04

Table 12: Relative (w.r.t SKASUR75 at 800MHz) survey speeds for the different layouts, calculated using the FOV (using PAF FOV for SKASUR) values given in the SRD [2] and the values in table 9. These values are generated at 650, 800 and 1000MHz for angular scales {0.4-1, 0.4-2, 1-2, 2-3, 3-4, 3-10, 600-3600} arcsec and are labelled *resbin* {1, 2, 3, 4, 5, 6, 7} respectively at declinations -10, -30 and -50 degrees. For each column the intensity of the colour increases with the value.

(a) DEC=-10, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	3.9	1.8	1.2	1.1	1.0	0.7	10.9	2.5	1.0	0.6	0.5	0.5	0.3	3.6	1.3	0.5	0.3	0.2	0.3	0.2	1.0	1.2	0.4	0.2	0.2	0.2	0.1	0.4
SKA1W8	5.8	2.4	1.8	0.9	0.9	0.5	10.9	3.9	1.3	0.7	0.4	0.4	0.3	3.5	2.2	0.6	0.3	0.2	0.2	0.1	1.0	1.8	0.5	0.2	0.2	0.1	0.1	0.4
SKA1V8-C9B120	2.8	1.6	1.4	1.3	1.2	0.8	10.9	2.0	1.0	0.7	0.6	0.6	0.4	3.5	1.2	0.5	0.3	0.3	0.3	0.2	1.0	1.4	0.5	0.3	0.2	0.2	0.2	0.4
SKA1W8-C9B120	5.8	2.4	2.0	0.9	0.9	0.6	10.9	4.3	1.4	0.7	0.4	0.4	0.3	3.5	2.3	0.7	0.3	0.2	0.2	0.1	1.0	1.9	0.6	0.2	0.2	0.2	0.1	0.4
SKASUR	0.02	0.6	0.5	1.0	1.0	0.8	1.5	0.06	0.6	0.6	0.7	0.8	0.7	0.9	0.6	1.2	1.4	1.1	1.3	1.3	0.5	1.5	1.0	0.8	0.8	1.0	0.9	0.2
SKASUR75	0.2	1.1	1.2	1.2	1.4	1.2	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.4	2.1	1.7	1.5	2.1	1.6	0.6	3.7	1.7	1.0	1.2	1.4	0.9	0.3

(b) DEC=-30, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	4.0	1.6	1.1	1.2	1.2	0.7	10.0	2.4	0.9	0.6	0.6	0.6	0.3	3.5	1.2	0.5	0.3	0.3	0.3	0.2	1.0	1.1	0.4	0.2	0.2	0.2	0.1	0.4
SKA1W8	6.0	2.4	1.6	1.0	1.0	0.5	11.0	3.8	1.2	0.6	0.4	0.5	0.3	3.6	2.1	0.6	0.2	0.2	0.2	0.1	1.0	1.7	0.5	0.2	0.2	0.2	0.1	0.4
SKA1V8-C9B120	3.0	1.6	1.4	1.4	1.3	0.8	11.0	2.1	0.9	0.7	0.7	0.7	0.4	3.4	1.2	0.5	0.3	0.3	0.3	0.2	1.0	1.3	0.5	0.3	0.3	0.2	0.2	0.4
SKA1W8-C9B120	7.0	2.6	1.8	1.0	1.0	0.6	11.0	4.2	1.3	0.6	0.4	0.5	0.3	3.5	2.3	0.7	0.2	0.2	0.2	0.1	1.0	1.8	0.5	0.2	0.2	0.2	0.1	0.4
SKASUR	0.02	0.5	0.5	1.0	1.2	0.8	1.4	0.06	0.5	0.6	0.9	0.9	0.7	0.9	0.7	1.1	1.3	1.3	1.7	1.2	0.5	1.5	1.0	0.8	1.0	1.2	0.9	0.3
SKASUR75	0.3	1.1	1.2	1.5	1.3	1.2	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.3	2.0	1.6	1.6	2.4	1.5	0.6	3.4	1.4	1.0	1.4	1.7	0.8	0.3

(c) DEC=-50, natural weighting

resbin	650MHz							800MHz							1000MHz							1400MHz						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
SKA1V8	5.0	1.8	1.1	1.2	0.9	0.6	11.2	3.1	1.0	0.5	0.6	0.5	0.3	3.7	1.6	0.5	0.3	0.3	0.2	0.2	1.0	1.3	0.4	0.2	0.2	0.2	0.1	0.4
SKA1W8	7.5	2.5	1.8	1.1	0.8	0.5	11.2	5.0	1.3	0.6	0.5	0.4	0.3	3.7	2.5	0.6	0.2	0.2	0.2	0.1	1.0	2.2	0.5	0.2	0.2	0.1	0.1	0.4
SKA1V8-C9B120	3.5	1.6	1.4	1.5	1.2	0.7	10.2	2.8	1.0	0.6	0.7	0.5	0.4	3.6	1.6	0.5	0.3	0.3	0.3	0.2	1.0	1.6	0.5	0.3	0.3	0.2	0.1	0.4
SKA1W8-C9B120	8.1	2.7	1.8	1.1	0.8	0.5	10.2	5.2	1.3	0.6	0.5	0.4	0.3	3.6	2.8	0.7	0.2	0.2	0.2	0.1	1.0	2.2	0.6	0.2	0.2	0.2	0.1	0.4
SKASUR	0.01	0.5	0.4	1.0	1.0	0.8	1.3	0.05	0.6	0.5	0.9	0.9	0.7	0.8	0.5	1.2	1.2	1.5	1.4	1.1	0.5	1.6	1.0	0.8	1.0	1.0	0.8	0.2
SKASUR75	0.3	1.1	1.2	1.3	1.2	1.2	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.6	1.9	1.6	1.7	2.2	1.5	0.6	4.2	1.6	1.0	1.5	1.4	0.8	0.3

Table 13: Relative (w.r.t SKASUR75) average survey speeds for the different layouts, calculated using the FOV (PAF FOV for SKASUR) values given in the SRD [2] and the values in table 9. These values are generated for angular scales {0.4-1, 0.4-2, 1-2, 2-3, 3-4, 3-10, 600-3600} arcsec and are labelled *resbin* {1, 2, 3, 4, 5, 6, 7} respectively. This is done for natural weighting at declinations -10, -30 and -50 degrees. For each column the intensity of the colour increases with the value.

(a) DEC=-10, natural weighting

resbin	1	2	3	4	5	6	7
SKA1V8	1.0	0.7	0.6	0.5	0.4	0.3	5.7
SKA1W8	1.4	0.9	0.8	0.4	0.3	0.2	5.6
SKA1V8-C9B120	0.8	0.6	0.6	0.6	0.5	0.4	5.6
SKA1W8-C9B120	1.5	0.9	0.9	0.4	0.3	0.3	5.5
SKASUR	0.3	0.6	0.7	0.7	0.7	0.8	0.9
SKASUR75	1.0	1.0	1.0	1.0	1.0	1.0	1.0

(b) DEC=-30, natural weighting

resbin	1	2	3	4	5	6	7
SKA1V8	1.0	0.7	0.5	0.5	0.4	0.3	5.6
SKA1W8	1.6	0.9	0.7	0.4	0.3	0.3	5.7
SKA1V8-C9B120	0.8	0.7	0.7	0.6	0.5	0.4	5.7
SKA1W8-C9B120	1.8	1.1	0.8	0.4	0.3	0.3	5.7
SKASUR	0.4	0.6	0.7	0.8	0.7	0.8	0.9
SKASUR75	1.0	1.0	1.0	1.0	1.0	1.0	1.0

(c) DEC=-50, natural weighting

resbin	1	2	3	4	5	6	7
SKA1V8	1.1	0.7	0.5	0.5	0.4	0.3	5.8
SKA1W8	1.7	1.0	0.8	0.4	0.3	0.2	5.8
SKA1V8-C9B120	0.9	0.7	0.6	0.6	0.5	0.4	5.8
SKA1W8-C9B120	1.8	1.1	0.8	0.4	0.3	0.3	5.8
SKASUR	0.3	0.6	0.7	0.8	0.7	0.8	0.9
SKASUR75	1.0	1.0	1.0	1.0	1.0	1.0	1.0

3   Conclusions

The metrics we have used suggest that the science goals (at least those listed in the SRD in addition to cosmology with weak lensing and HI surveys) can be met by a layout which covers significantly less space compared to the baseline layout. The SKA1-W9-0A72B120 layout performs significantly better at smaller angular scales, up to a 42% improvement in terms of the noise properties and a 55% improvement in survey speed, without compromising the larger scales. Moreover, the SKA1-Mid performance can be further enhanced by adding a handful of dishes in the spiral arms as can be seen with the SKA1W9-12A72B120 layout.

Bringing in the dishes from the longer baselines translates to a greater sensitivity on the relevant (to the science goals of SKA1-Mid) smaller scales, as can be seen in Tables 6-11. Even more encouraging is the fact that this doesn't compromise the size or the symmetry of the PSF as seen in Tables 4 and 5, as well as in Appendix A. **We proffer the SKA1W9-0A72B120 configuration as a solution which allows for weak lensing, HI and continuum source morphology characterisation for galaxy evolution studies, as well as the other science cases detailed in the SRD. Although we note that such a configuration also needs to be analysed by other SWGs, in particular the HI SWG.**

References

[1] http://www.skatelescope.org/wp-content/uploads/2013/05/SKA-TEL-SKO-DD-001-1_BaselineDesign1.pdf

[2] https://www.skatelescope.org/wp-content/uploads/2014/03/SKA-TEL_SCI-SKO-SRQ-001-1_Level_0_Requirements-1.pdf

A PSF cross-sections

B Band 5 Scale-Dependent Sensitivity

The Tables below were generated using the BD's SEFD value of 528Jy for band 5. We make simulated measurement sets of 8hr tracks at a declination of -30 degrees at frequencies 8, 12 and 13.8GHz with a single 2.5GHz band and 60s integration time. MeerKAT do not have receivers at these frequencies, therefore the MeerKAT dishes were not considered for these simulations.