

Array configurations and artificial-sky simulations; suggestions on how to proceed

This summarizes the outcome of initial ad-hoc working group discussions in the JB SKA workshop on 03/08/00 including subsequent comments (drafted by Arnold van Ardenne/Astron).

(i) A technology gap was indicated between available/suitable software (all packages) and the possibility to adequately simulate e.g. dynamic range issues, time varying phenomena and multibeam observations. The simulation issue is in all areas of algorithms, the software (infrastructure) and suitable computing platforms i.e. available computing power for personalized massive data handling. These issues need to be addressed specifically before reliable, systematic results will be arrived at.

(ii) Several issues related to configurations have been discussed. These can be summarized as the dependence of antenna configuration on science related, technical, cost and other e.g. political issues.

With regard to the science(goals), the optimum configuration relates to e.g.

- resolution ($1/\text{baseline} \times \text{frequency}$),
- sidelobe level minimization e.g. around the primary beam or elsewhere,
- snapshot mode dynamic range,
- dynamic range, calibratability (e.g. redundancy vs. # stations/ uv crossovers) and frequency (i.e. sidelobe confusion). The last situation is worse toward lower frequencies and amplifies the argument as function of frequency e.g. to separate SKA in a low(est) frequency array (configuration) and a higher frequency configuration.

Other issues are subsequently the configuration dependence vs.

- required technical infrastructure and technical costs,
- extendability/upgradability
- (available or specific) siting issues e.g. as related to potentially available geomorphological, ecological, RFI etc. and political considerations e.g. cost vs. availability, outreach etc.

Other considerations are more generic e.g. assuming unweighted science cases dictating the resolution, the density of correlations/ km^2 is proportional to $1/\text{baseline}^2$, effectively resulting in a collecting area equal to half the total at all resolutions. Assuming a compact core leads to efficient array configurations that are a-symmetric configuration and it provides higher sensitivity over continental distances.

(iii) Work and thinking done so far, indicate that the #stations are on the hundreds (say: 300) rather than tens level with baselines reaching out from a "core" to a few thousand (say: 3000) km while maintaining a reasonable uv-coverage.

(iv) As the impact of the most desirable configuration on systemlevel design, cost and science is considerable, cost vs. configuration relationships and options for science evaluation need to be developed. It was recognized that some preliminary strawman configuration should be arrived at asap. on the basis of an updated [Scientific(=User)] Requirement Document and interaction with prioritized science drivers is required.

(v) To support this process, it was considered useful to have a forum of discussions. For example to open a Webbased discussion page and e-mail exploder asap. allowing relatively free flowing ideas regarding configuration issues and supported by own (simulation and other) work. The objectives are to cover and address all key issues, to improve the level of understanding and interdependency of arguments with the aim to prioritize the options and to result in a preliminary optimized strawman configuration early 2002 (about 18 months).

(vi) The next phase (2002-2004) should be used to arrive from the strawman design to a final design based on improved and educated understanding acquired during that period.

(vii) To guide the process, the activities are coordinated by a taskforce group consisting of a core group i.e. Jan Noordam, Colin Lonsdale, Bruce Thomas, Mark Wieringa (suggested in his absence), Tony Willis, Andrew Gray (suggested in his absence), Mike Garrett and Douglas Bock most of whom commented on this draft document. The group may/will be supported by John Bunton, Jaap Bregman and possibly others. It is advisable to seek a chairperson e.g. a considerate, experienced radio astronomer) but no names were mentioned.