SKADS White Paper - Technologies -

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http://webmail.jb.man.ac.uk/skadswiki/SkadsWhitePaper
What is it........?

SKADS Deliverables
Developments
Demonstrators

SKA Intl. Requirements
Science
Precursors

Existing Knowledge
History
Current Telescopes
Other work

SKADS White Paper

Our ‘Final’ Deliverable
Preparing principal deliverable of

SKADS – The White Paper

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Aperture Arrays for the SKA: the SKADS White Paper

1. Abstract
2. Executive Summary
3. Introduction
   International context
4. Scientific Requirements
   AA science opportunity
5. Specification Overview
6. SKADS design
   Design architecture
   Overall costs
   Cost Scaling
   Power usage
   Operational aspects
7. Technology readiness
   TRL
   Technology roadmap
8. Design and costing methodology & tools
   Design Block descriptions
   Cost tool
9. Demonstrators & Results
   EMBRACE
   2-PAD
   BEST
10. Design trade-offs
   Summary detailed results
   Analysis of results
   Implementation Strategy
   Manufacturability of Aperture Arrays
   Maintainability
   Configuration and RFI
   Reliability
   Risk mitigation
   Upgradeability
11. From SKADS to SKA
   PrepSKA
   SKA Phase 1
   SKA Phase 2
12. References
13. Appendices
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This is a big job.....

• Meetings, Telecoms with schedules produced
• A draft is in progress: on the Wiki
• Some contributions from the various authors have been received
• A draft was planned to be circulated at the Conference
• We are running late.....

It must be produced before end of Year
Science Requirements....

The Design Reference mission

http://www.skatelescope.org/PDF/091001_DRM_v0.4.pdf
2. Resolving AGN and Star Formation in Galaxies

3. Protoplanetary disks

4. Cosmic Magnetism

5. Wide Field Polarimetry - 1

6. Continuum deep field

7. Deep HI Field

8. HI EoR

9. Galactic centre pulsars

10a, 13a. Pulsar search

10b, 13b. Pulsar timing

11. Galaxy Evolution via HI Absorption

12. HI BAO

Sensitivity Requirements

- Specified sensitivity
- Derived survey speed

Proposed Dish Envelope: 3,000 @ 15m
Survey Speed Requirements

- 5. Wide Field Polarimetry
- 6. Continuum deep field
- 7. Deep HI Field
- 8. HI EoR
- 9. Galactic centre pulsars
- 10a. AGN and Star Formation in Galaxies
- 10b. Pulsar timing
- 11. Galaxy Ev. via HI Abs’n
- 12. HI BAO
- 13a. Pulsar search
- 13b. Proposed AA system envelope
- 3,000 @ 15m

Survey Speed m^4 K^-2 deg^2 vs Frequency GHz

- Specified survey speed
- Derived from sensitivity
Optimisation of technology boundaries will take place based on science performance and cost.

*Time axis not shown*
Modelling: Design and Costing Tool

Also tracks Power & data rate
Costs not Included:
- Development work
- Non-recoverable expenses
- Civil works
- Power installation
- Operational Costs
- Project Management

Collectors:
- 250 x 57m dia AA-hi
- 250x220m dia AA-lo
- 2400 x 15m dishes
- Wideband SP Feeds

WBF + dense AA Scenario
- AA-lo & hi: 18%
- Dish + SPF: 40%
- Wide area comms: 7%
- Processing + correlator: 35%

AA-lo & hi
- AA-hi arrays: 62%
- AA-lo arrays: 28%
- Station processors: 10%

~€1.48Bn

SKA Memos: 111 and 93 for D&C-1
**AA-hi Arrays (not inc. station proc.)**

- **Core AA-hi Breakdown**
  - Element cost: 28%
  - Analogue data transport: 27%
  - Infrastructure: 30%
  - Signal Processing: 15%
  - Calibration source: 0%

  ~€1.5M each array, NPV

**Analogue Data Transport:**
- Connection to PCBs = no. of cables
- Preparation of cables
- Cable - total length reqd per station
- Male plugs
- PCB Outlet plugs (i.e. PCB inputs to first processor)
- Install cables in field

~€11 each element, 2011

**Element Cost**
- Dual Pol Antenna element (aluminium)
- LNA
- Diff driver+filter+reg
- Passives
- Small feed board
- Assembly

**Infrastructure:**
- Cover membrane
- Steels for Antenna Support Structure
- Cable Support Poles
- Velcro Cable Ties
- Foundations: building poles
- Civil Engineering
- Cooling
- Power Supplies
- Racking
- Trenches
- Infrastructure Build – 3 man years
- Bunkers

November 2009  SKADS Conference  White Paper
Scenarios planning

SKADS ➔ PrepSKA ➔ Phase 1 ➔ Phase 2

A major input to the Concept
Design Reviews: CoDR
The messages are:

- AAs can be achieved at acceptable cost and power for the SKA
- AAs can be tailored to meet SKA science requirements <1.4GHz
- AAs make the SKA central processing tractable & affordable
- There is a solid basis of engineering for AA development
- AAs are capable of achieving SKA performance requirements

An SKA scenario including AAs is the only way of meeting the science goals