PROCEEDINGS OF SCIENCE

A report on KAT7 and MeerKAT status and plans

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This is a short memo on the current status of the KAT-7 test array and current planning for MeerKAT (as of September 2010)

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[1] Speaker

PoS(10th EVN Symposium)069

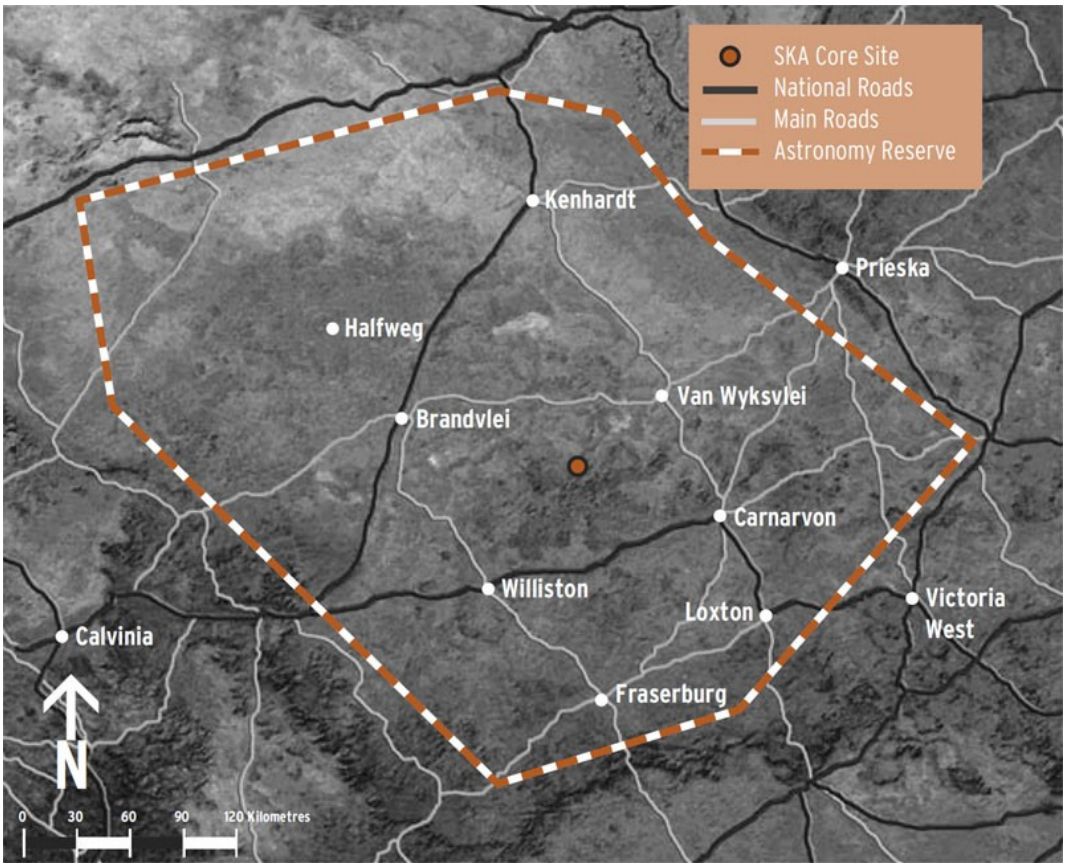
1. Introduction

MeerKAT, the SKA precursor array in South Africa will be built in the Karoo, and the KAT-7 array is being built as a demonstrator of many of the innovative technologies involved. The design and commissioning office is in Cape Town.

2.The Team

3. The Site with respect to South Africa

The site is in the Northern Cape province, about 600km by road from Cape Town. The last 80km is off tarmac roads, and the Radio Astronomy Reserve is centred at 30.71°S, 21.44°E, in a sheep farming area of low population density.



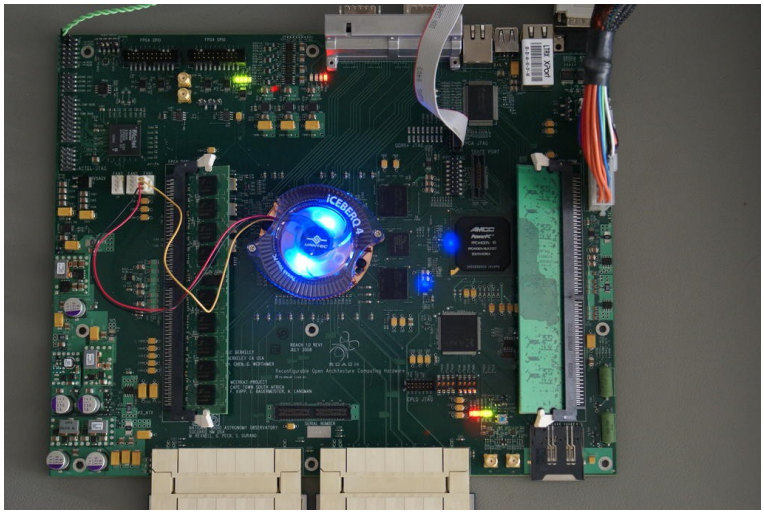
4. What is currently there

The 7 telescopes of the KAT-7 are all present, and the initial 4 have uncooled receivers. These will be replaced by cryogenic receivers from October 2010 through to the start of 2011. The dish construction shed is 4km away behind the Losberg mountain.

The seven 12m dishes are made of a composite material with embedded mesh surface and have an alt-azimuth mount with an L-band receiver (1.2-1.95GHz) at prime focus.

The IF system currently has a 256MHz instantaneous bandwidth, and RF is transmitted over optical fiber to the initial (Fringe Finder) correlator. It (and all other

digital signal processing) is situated in Faraday Cages inside LOFAR type containers. This (and all other planned correlators) are based on the ROACH design and has an FX architecture.



We will be using the SPEAD (Streaming Protocol for Exchange of Astronomical Data) protocol for digital data transmission. The next generation KAT-7 correlator will arrive late in 2010 or early in 2011 and have 16 inputs (8 telescopes in 2 polarizations) and produce all auto and cross correlations, have fringe and delay stopping and support 8192 channels across the band). There will also be a tied array mode for VLBI and Pulsar observing. This array will be used for some science in addition to commissioning the system.

At the time of the presentation we were switching from diesel generators to mains power, and the first cryogenic receiver would be installed after this was completed[1]. At this time also the communication was all taking place with low-bandwidth VSAT satellite links, but there was an initial 10Mbps line coming soon and a final 10Gbps planned for early 2011.

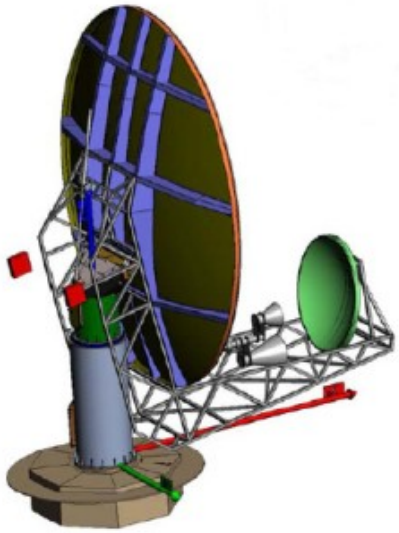
In the Reserve there are also a C-bass dish and southern PAPER experiment.

5. Plans for MeerKAT

The original plan was to have 80 12m dishes with a design almost identical to that used for the KAT-7, but the current plan is to have 64 composite dishes of 13.5x12m with offset Gregorian optics. Initally there would be an Lband (0.5-2GHz) receiver and the final stage would add an 8-14GHz receiver. The correlator will be based on a mixture of ROACH2 and GPU signal processing, possibly with an FFX architecture. As the higher frequency is added we would go from 1 to 2 to 4GHz bandwidths.

[1] This has since been done

An inital straw-man design for the new dishes has been done:



The reduced number of baselines does have an consequent reduction in the uv coverage, but it is still good for the planned 8hr typical observing. The modified design will delay MeerKAT until 2015. A final spur out to 60km is planned to come last to give improved resolution to avoid confusion on ultra-deep fields.

6.VLBI

MeerKAT will be used for VLBI, but the 15º minimum elevation limit envisaged will preclude doing VLBI with the VLA (although there remains a good overlap to the north with the EVN and to the south with the LBA). As proposed there is space for more feeds, but none are budgeted for. The main VLBI mode will be eVLBI, as there are now many existing (and planned) high-speed fiber links to Europe, partly as a spin-off from the FIFA 2010 World Cup, and partly as part of a general development of internet in Africa.

The KAT-7 array is also planned to be used as a tied-array for VLBI, mainly to test the modes we will use in MeerKAT, but in itself it will be equivalent to a 30m class dish. Initial tests are planned with Hartebeesthoek and the Australian LBA, with the very first test being done with a single dish at 18cm with 64MHz bandwidth (with dual polarization and FTP-VLBI) in 2010 or early in 2011 and a tied array test late in 2011. At present we are limited by having only a Rb atomic clock and no recorder, and a fiber connection will only come in late 2010-early 2011. We also observe with linear polarizations. Before regular observing is done we will need a way to convert VEX format schedules to our local format and convert SPEAD digital data to VDIF format. The Rb clock should be adequeate for Lband observing, and we note that the Mark5C VLBI recorder is based on the ROACH technology we are using.