

The MeerKAT radio telescope is currently being constructed in the Northern Cape Province in South Africa. MeerKAT will be integrated with the Square Kilometer Array Phase 1 (SKA1) MID telescope at the end of its construction phase (estimated to be around 2023/24) and therefore it represents the first phase of SKA construction. MeerKAT will be the largest and most sensitive radio telescope array in the centimeter wavelength regime in the southern skies until the SKA1 MID telescope is operational, and is well on its way to realizing the MeerKAT vision of being a world class instrument that exceeds its original specification.

High sensitivity (A_e/T_{sys}) is achieved by having a large collecting area (A_e) and a low system temperature (T_{sys}). MeerKAT will consist of 64 unshaped offset Gregorian dishes with a projected diameter of 13.5m with a 3.8m composite sub-reflector in the “feed low” position. Seventy percent of the dishes will be deployed in a compact core with radius < 1 km with a shortest baseline of 29m, while the outer antennas will provide baselines of up to 8km. Additional to high sensitivity MeerKAT achieves high dynamic range through the clean optical path provided by the Offset Gregorian configuration, since the low far-out sidelobes provide good rejection of unwanted radio frequency interference from satellites and terrestrial transmitters.

The dishes can be fitted with up to four cryogenically-cooled receivers employing two-stage Gifford-McMahon refrigeration units without compromising the unblocked aperture, while the feed low configuration provides a number of operational advantages. The array will have a point source sensitivity of between 300 and 400 mJy/K over the L-band receiver frequency range (0.9 to 1.67 GHz).

The correlator for Array Release 1 (AR1), consisting of 16 antennas, is based on ROACH2 technology that will be upgraded to SKARAB (ROACH3) for the final deliverable. Control and monitoring is done through a complete in-house developed software solution.

The first images from a commissioned 16 antenna MeerKAT array (AR1) was released in July 2016. It shows unambiguously that even with 16 antennas MeerKAT is already the best radio telescope of its kind in the Southern Hemisphere. In a small patch of sky covering less than 0.01 percent of the entire celestial sphere, the MeerKAT First Light image shows more than 1300 galaxies in the distant Universe, compared to 70 known in this location prior to MeerKAT.

The purpose of this talk is to identify the key telescope specifications, discusses the high-level architecture and current progress to meet the specifications and lastly reports on lessons learnt in the process.