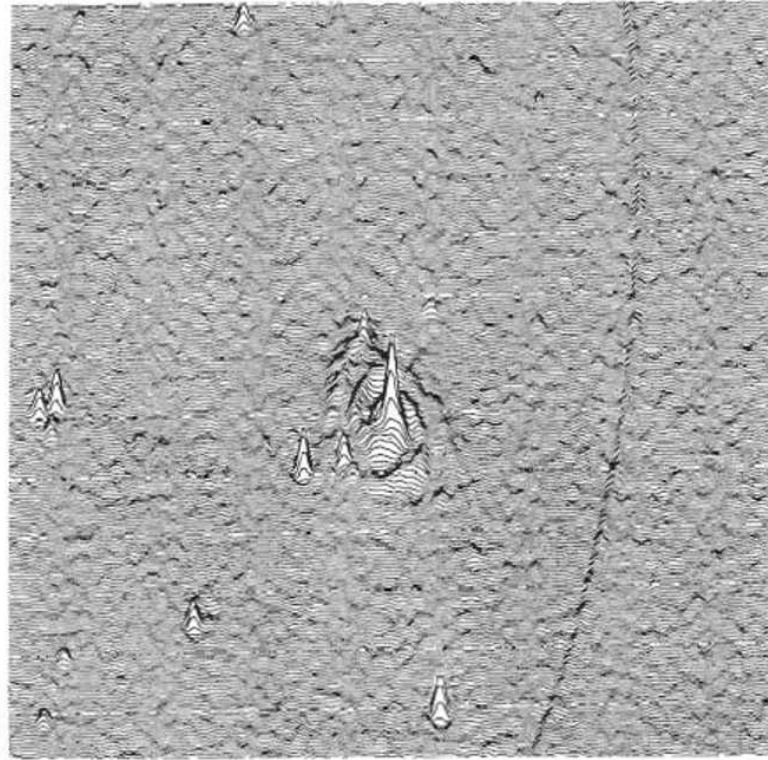# Antenna Beams and the SKA: How to Select a Dish Design?

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- 1970 WSRT image of M51

- Original WSRT had receivers with approximately 250K system temperature

- With the exception of strong 3C sources, most instrumental effects hidden in the noise

- Continuum receivers had a single channel with a few MHz bandwidth
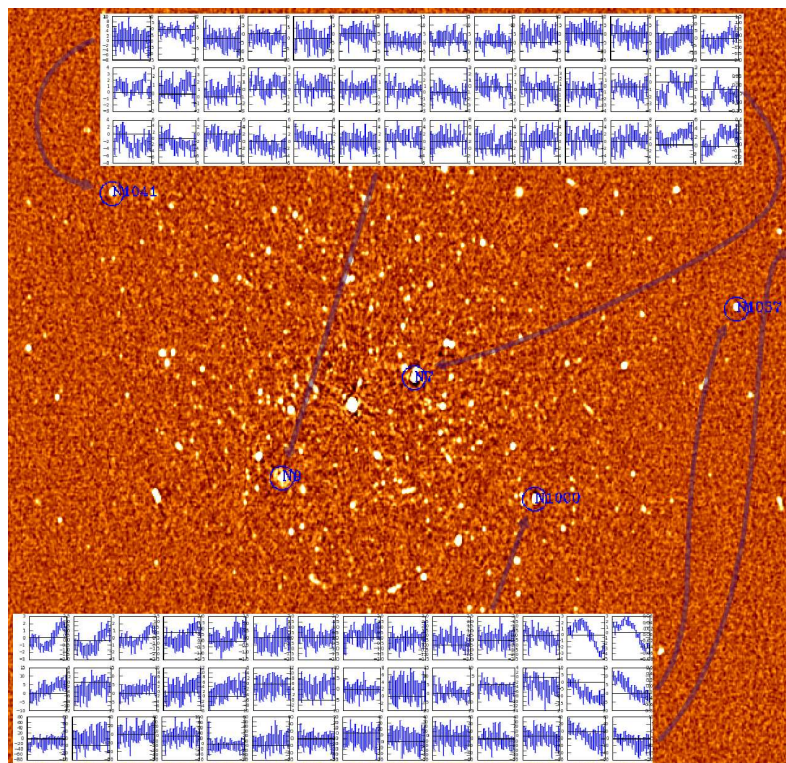
- Direction dependent effects - see the AJDI of 23-02-2010 for a detailed explanation

- Receiver temperatures have dropped by a factor 8 or so

- Many instrumental effects can be routinely seen above the noise

- Continuum receivers may have broadband multi-GHz bandwidths and produce data with thousands of channels

40 years WSRT (1970 – 2010)
Celebratory mini Symposion
22 Oct 2010 (at the site)

Stichting radiostraling van zon en melkweg

jaarverslag 1969

- Receivers, correlators, backends, electronics, computers, all come and go but the dishes seem to survive largely unchanged.

Possible Dish Designs

- Azimuth-Elevation mount with 3rd 'sky-rotation' Axis (ASKAP)

- Offset Gregorian design (Allen Telescope Array, GBT)

- Equatorial mount has not been ruled out but polar axis orientation could be a problem at low latitudes of the SKA sites (WSRT)

- new 'Eureka' design?

Basic Dish with Azimuth-Elevation Mount
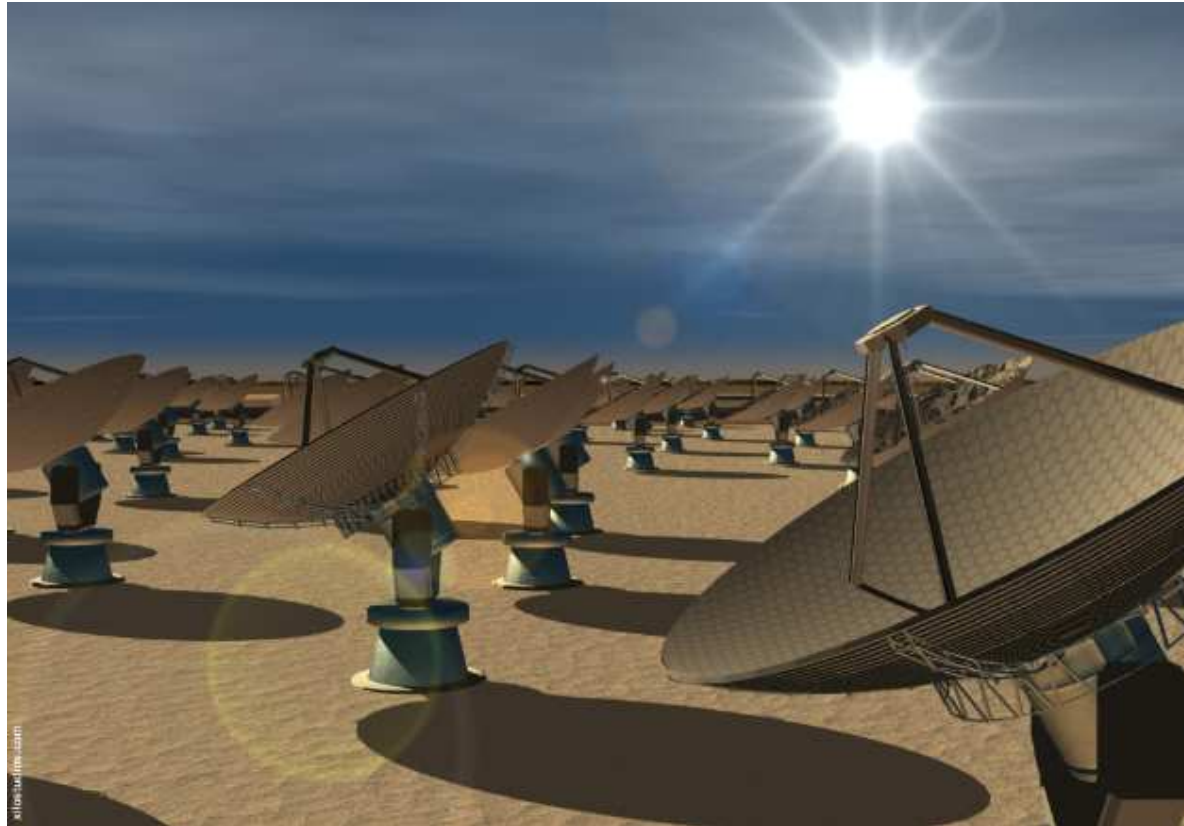
- One of the Original SKA dish designs had a simple Azimuth-Elevation mount structure

- This design has been rejected at the SKA dish CoDR in July 2011 because of the sky rotation with respect to dish orientation

■ Dish with Azimuth-Elevation mount and third 'sky-rotation' axis - ASKAP

■ Images show celebration at testing of first ASKAP antenna at factory in China - note dish rotation between first and second images

■ possible issues - scattering off struts, central feed blockage

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- disadvantage? Can offset Gregorians accomodate Phased Array Feed systems for SKA phase 2?

How to quantitatively select between different SKA dish designs?

- At present - just a bunch of 'My dish is better than your dish' opinions

- We need a to provide a quantitative way to distinguish between dish designs

- Simulation can be an important part of this process. It can also help antenna designers refine their designs

- We should learn a lot about the beam pattern behaviour of various antennas at this workshop

- MeqTrees is as far as I know, the only data processing system which can easily 'observe' a sky model with a wide variety of potential beam patterns

  - ☐ We need to select a model sky (something from the SKADS mdel skies developed at Oxford?)

  - ☐ Select the various effects which will be included in the simulations besides the beam characteristics

  - ☐ Define the characteristics of the array which would be used for the simulated observations (maximum size, range of frequency, number of channels, number of dishes etc)

- Do simulations and provide feedback to the dish designers as they optimize designs.

- Produce a report where weighted evaluations are given to different designs

- Who's driving that vehicle that seems to appear in all SKA simulations? RTS? PED?

■ SKA Project Director testing a method of transportation applicable to both Australian and South African SKA sites