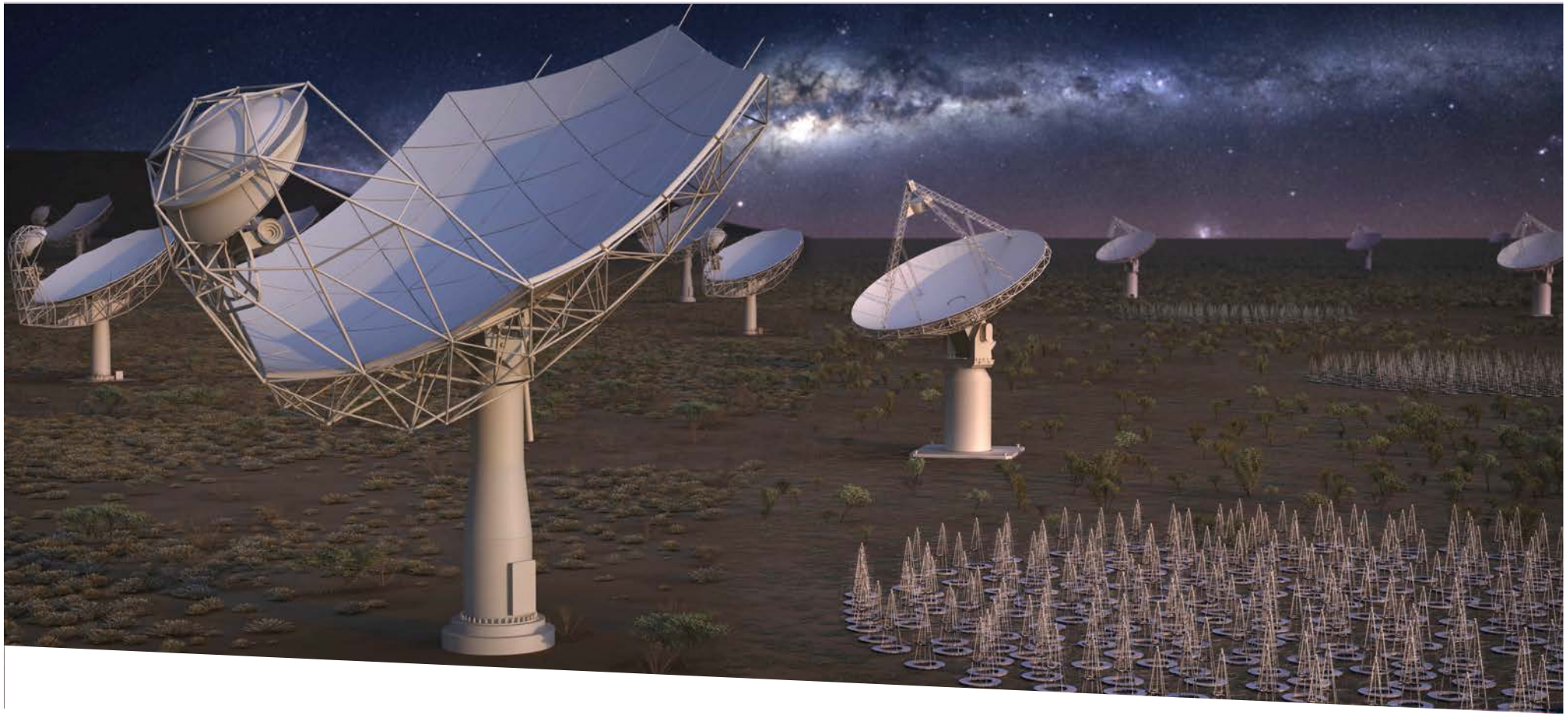
SKA SWG Update



SQUARE KILOMETRE ARRAY

Exploring the Universe with the world's largest radio telescope

Robert Braun, Science Director

17 Sept 2019

Science Activity Updates

- High Frequency Science Case (Jeff)
- Science Data Challenges (Anna, Philippa, RB)
- MeerKAT and ASKAP News
- Round table SWG updates (All)
- SKA related meetings
- AOB

Update to the high frequency science case

- The high frequency science case update is proceeding, with about 60 SWG members contributing:

http://beyondb5.pbworks.com/w/page/133133820/SKA1%20Beyond%20Band%205

- Aim is to support the design work of the advanced single pixel feeds and receivers (ASPFR) group, who are designing receivers for MID above 15 GHz

- This work does not detract from SKA1 design work or construction funding. Data from dish prototypes to be available next year

- Aim is to have advanced drafts of chapters by the end of September

Data Challenges, Moving forward…..

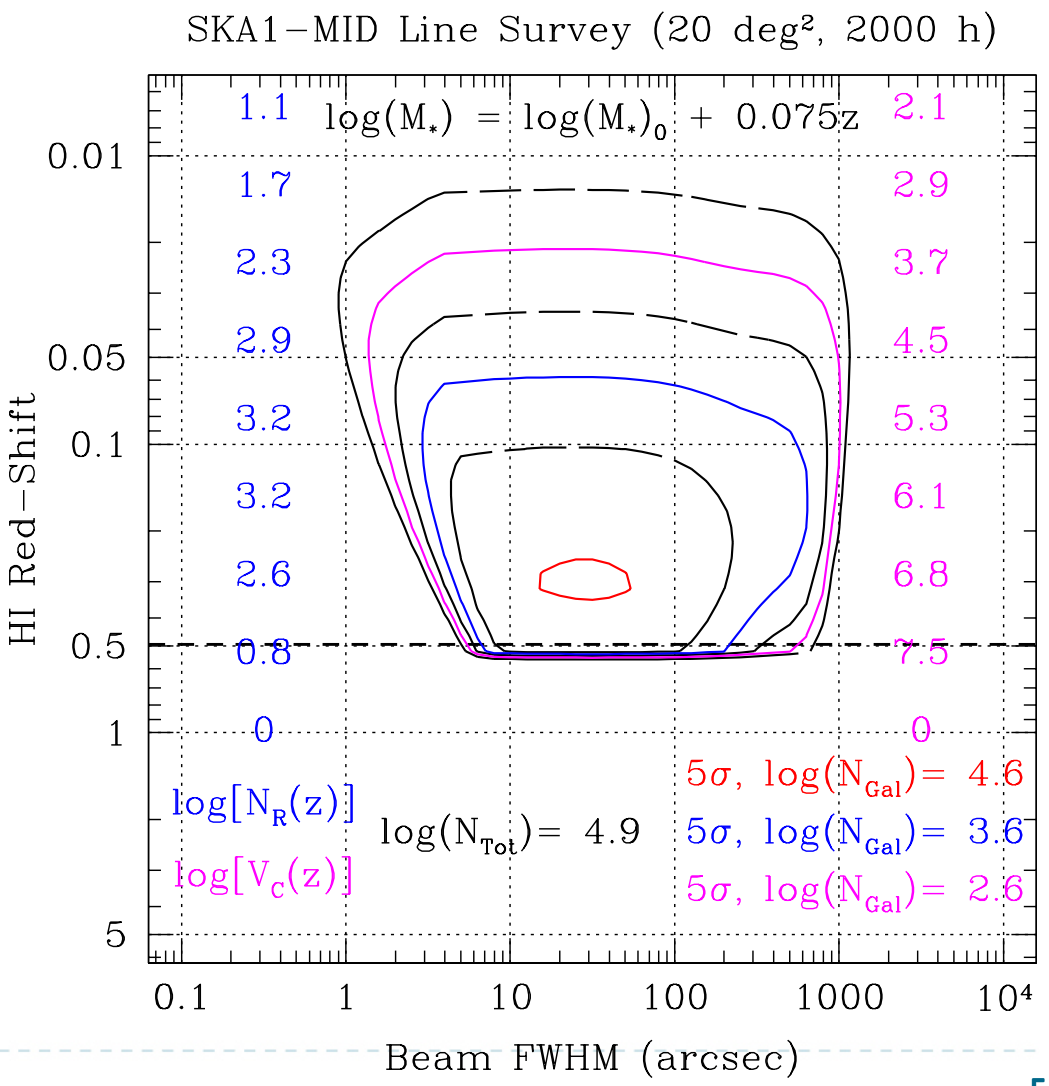
- Suggestions for SDC2 –
  - Transients
    - One sub-band image: Low (200 MHz) and Mid (1.4 GHz), cadence of once(?) per day for entire calendar year(?)
    - Various populations with time constants of days to months
  - **HI Emission/Absorption**
    - **Red-shift / Sky coverage: z = 0(?) – 6(?) / N(?) deg^2**
    - **Resolved plus unresolved targets**
  - Polarisation
    - Introduce plausible Q,U signatures into continuum sky model and generate (I,Q,U) cubes N(?) deg^2 with suitable frequency sampling (Freq_Max, Freq_Min, Delta_Freq)?
  - Foregrounds
    - Explore foreground removal effectiveness for EoR and Intensity Mapping applications

SDC2 Update, possible specs.

- Use variants of some “generic” surveys for illustration
  - Eg. Mid-C, Low-A

Table 1. Basic parameters of five suggested generic surveys.

Survey	Freq (MHz)	Area (deg2)	Time (hours)
Mid-A	950 – 1760	31000	8000
Mid-B	950 – 1760	500	4000
Mid-C	950 – 1760	20	2000
Mid-D	4600 – 13800	480/Gal	2000
Low-A	50 – 350	31000	10000



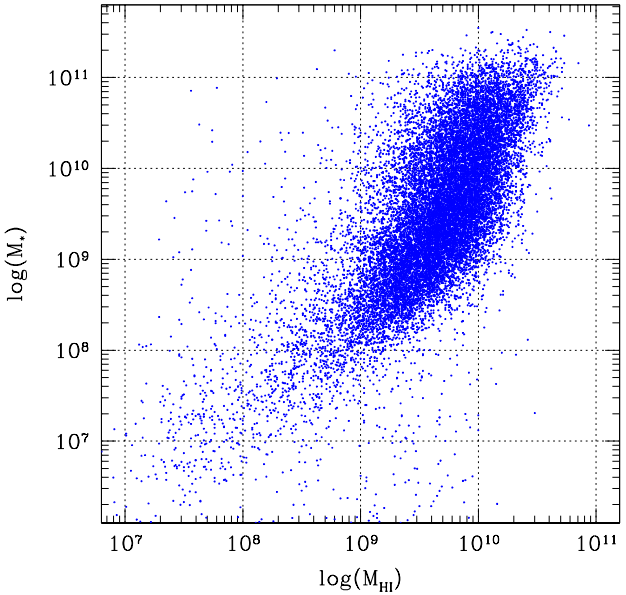
SDC2 Update, possible specs.

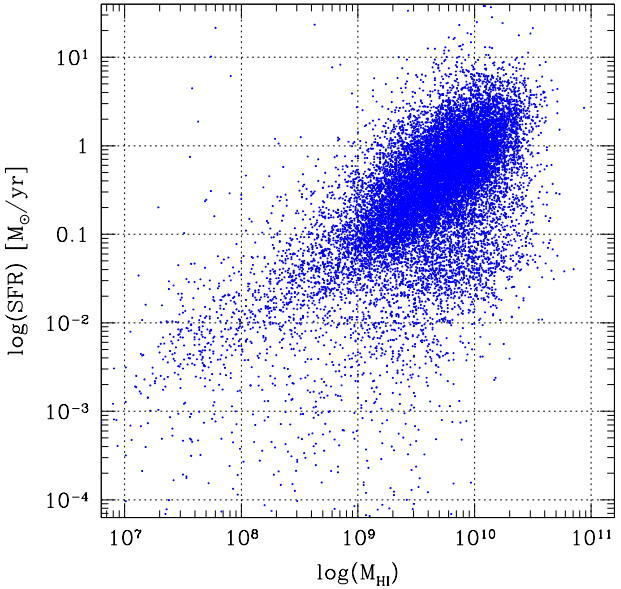
- SKA1-Low
  - 150 – 350 MHz
  - θ = 10 arcsec, $\Delta\nu/\nu \sim 3\ 10^{-5}$
  - 100 deg^2, 2000^h
  - HI absorption signatures: associated plus intervening
- SKA1-Mid
  - 950 – 1420 MHz
  - θ = 5 arcsec, $\Delta\nu/\nu \sim 10^{-4}$
  - 20 deg^2, 2000^h
  - HI absorption signatures: associated plus intervening
  - HI emission signatures: resolved plus unresolved
- Errors
  - Residual RFI
  - Imperfect continuum subtraction

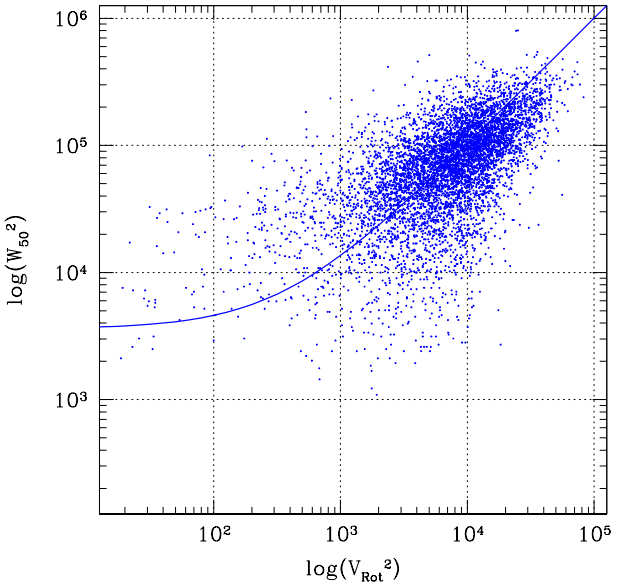
SDC2 Update, possible specs.

- Extend T-RECS model with new neutral gas “module”
  - Each continuum source has DM halo “home” with suitable stellar population and morphology
  - DM halos populated with HI consistent with stellar pop and assumed HIMF(z)
- HI absorption signatures: associated plus intervening
  - Use atlas of observed high s/n spectra plus assumed distribution function (with z dependence) rescaled as needed
- HI emission signatures: resolved plus unresolved
  - Use ALFALFA atlas of (high s/n) spectra rescaled as needed
  - Use HALOGAS, THINGS cubes
    - Random PA and Inclination (velocity re-scaling plus spatial (de-) compression)
    - Modulate Emission(Velocity) using ALFALFA spectra to diversify

SDC2 Update, possible specs.

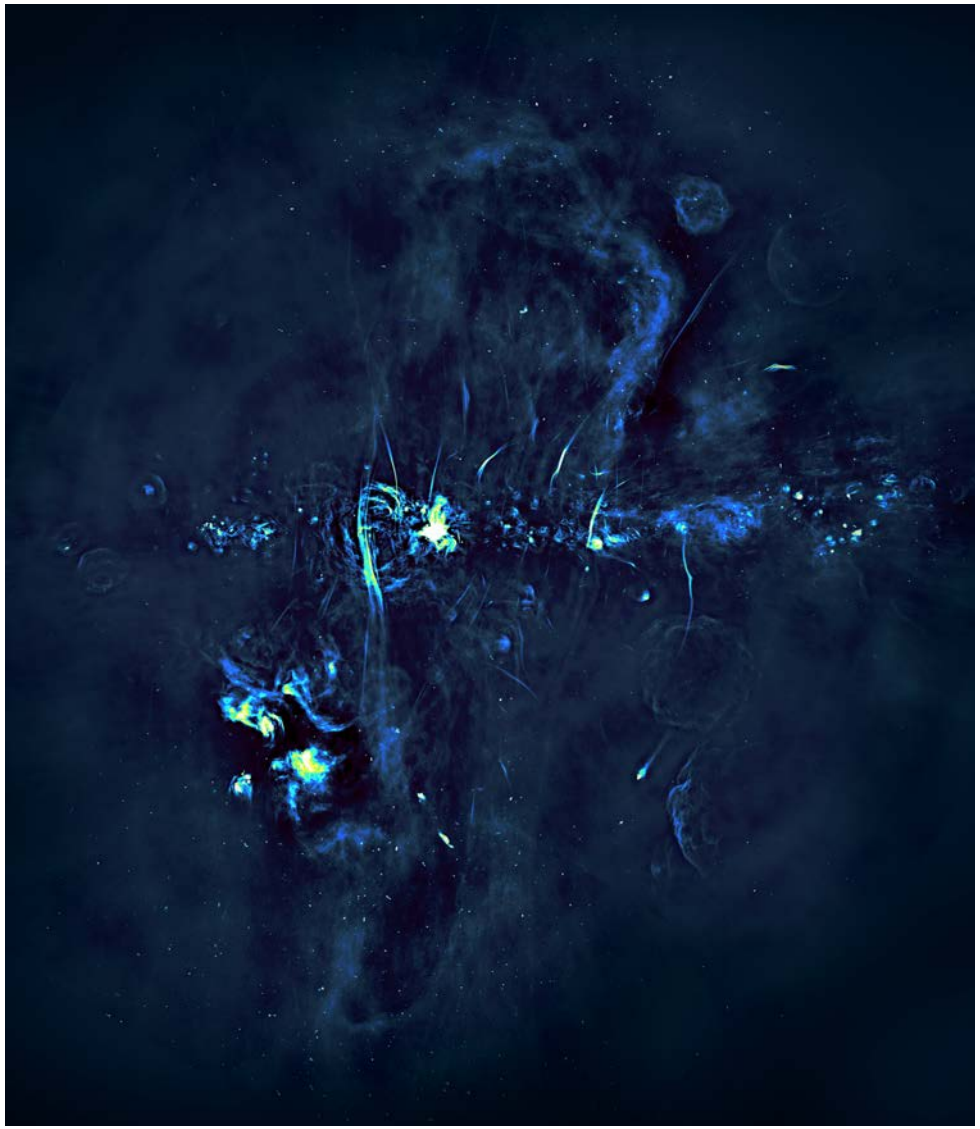






- HI emission signatures: resolved plus unresolved
  - Use ALFALFA atlas of (high s/n) spectra and optical counterparts
  - Connected to optical morphology and inclination with WND-CHARM and 2MASS (Kuminski & Shamir 2016, Skrutskie et al 2006)
  - Connected to M_* and SFR via galSpec within SDSS DR14 (Kauffmann et al. 2003, Brinchmann et al. 2004)

MeerKAT News



MeerKAT

GBT

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Inflation of 430-parsec bipolar radio bubbles in the Galactic Centre by an energetic event

I. Heywood, F. Camilo, W. D. Cotton, F. Yusef-Zadeh, T. D. Abbott, R. M. Adam, M. A. Aldera, E. F. Bauermeister, R. S. Booth, A. G. Botha, D. H. Botha, L. R. S. Brederode, Z. B. Brits, S. J. Buchner, J. P. Burger, J. M. Chalmers, T. Cheetham, D. de Villiers, M. A. Dikgale-Mahlakoana, L. J. du Toit, S. W. P. Esterhuyse, B. L. Fanaroff, A. R. Foley, D. J. Fourie, R. R. G. Gamatham, S. Goedhart, S. Gounden, M. J. Hlakola, C. J. Hoek, A. Hokwana, D. M. Horn, J. M. G. Horrell, B. Hugo, A. R. Isaacson, J. L. Jonas, J. D. B. L. Jordaan, A. F. Joubert, G. I. G. Józsa, R. P. M. Julie, F. B. Kapp, J. S. Kenyon, P. P. A. Kotzé, H. Kriel, T. W. Kusel, R. Lehmensiek, D. Liebenberg, A. Loots, R. T. Lord, B. M. Lunsky, P. S. Macfarlane, L. G. Magnus, C. M. Magozore, O. Mahgoub, J. P. L. Main, J. A. Malan, R. D. Malgas, J. R. Manley, M. D. J. Maree, B. Merry, R. Millenaar, N. Mnyandu, I. P. T. Moeng, T. E. Monama, M. C. Mphego, W. S. New, B. Ngcebetsha, N. Oozeer, A. J. Otto, S. S. Passmoor, A. A. Patel, A. Peens-Hough, S. J. Perkins, S. M. Ratcliffe, R. Renil, A. Rust, S. Salie, L. C. Schwardt, M. Serylak, R. Siebrits, S. K. Sirothia, O. M. Smirnov, L. Sofeya, P. S. Swart, C. Tasse, D. T. Taylor, I. P. Theron, K. Thorat, A. J. Tiplady, S. Tshongweni, T. J. van Balla, A. van der Byl, C. van der Merwe, C. L. van Dyk, R. Van Rooyen, V. Van Tonder, R. Van Wyk, B. H. Wallace, M. G. Welz & L. P. Williams - Show fewer authors

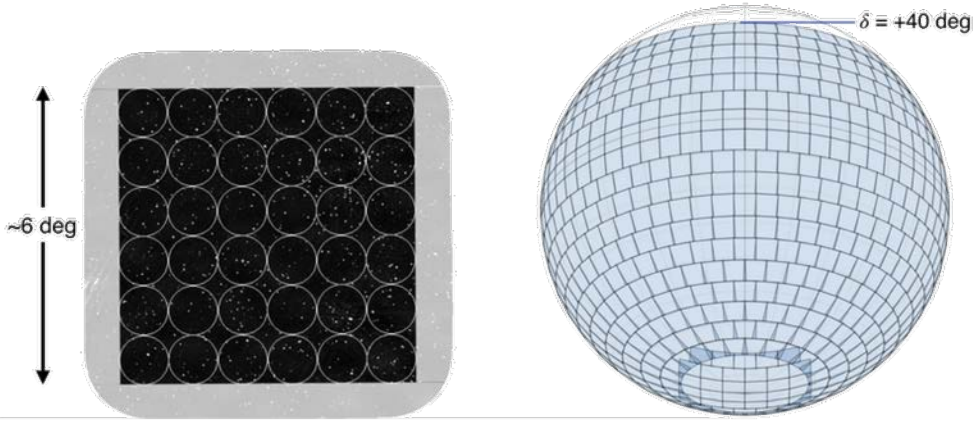
Nature **573**, 235–237 (2019) | Download Citation

- Beautiful imagery of Galactic circum-nuclear bubbles/chimney

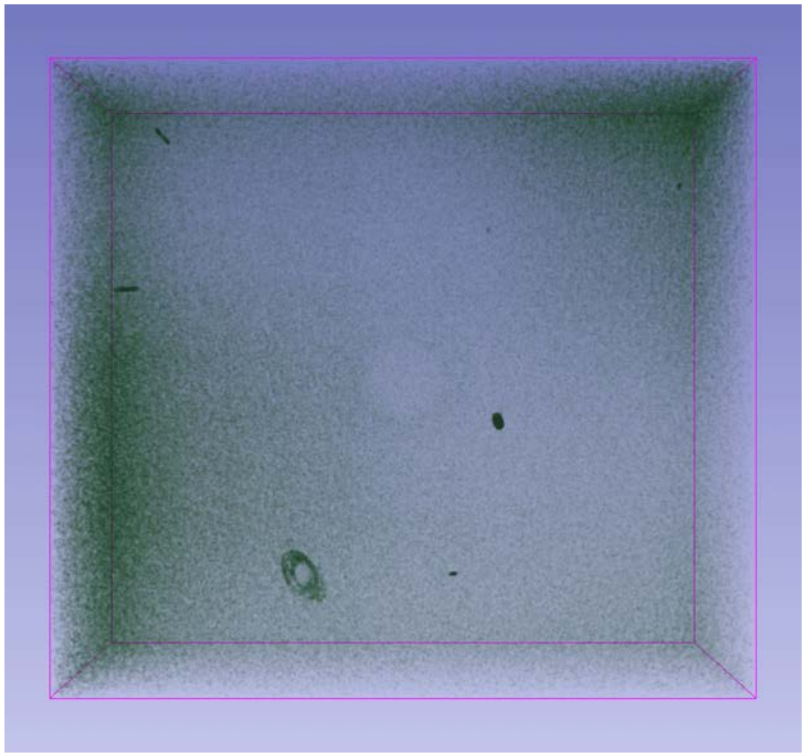
ASKAP News (Aug/Sept)

The main properties of the RACS survey:

Baselines	22m - 6400m	All 36 antennas
Resolution	15 arcsec	
Frequencies	700-1800 MHz	288 MHz bandwidth
Integration	15 minutes	
Polarization	I, Q, U, V	
Image noise	~250 μJy	
Sky coverage	-90° < δ < +40°	903 tiles



- Rapid ASKAP Continuum Survey kicks off



- WALLABY commissioning data reduced with ASKAPSoft

Upcoming SKA-related Meetings

- VLBI Workshop, 14 – 18 October, SKA HQ
  https://indico.skatelescope.org/event/539/
- SKA Eng. and Ops. Meeting, 25 – 28 Nov Shanghai
  https://indico.skatelescope.org/event/551/

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