



International
Centre for
Radio
Astronomy
Research

Options for



Lister Staveley-Smith



Outline

- GLEAM
 - Survey and science goals
- Limitations
 - Resolution
 - Short spacings
- GLEAM-X simulations
 - Nominal 4, 8 and 10 km extended arrays
 - Supertile



Outline

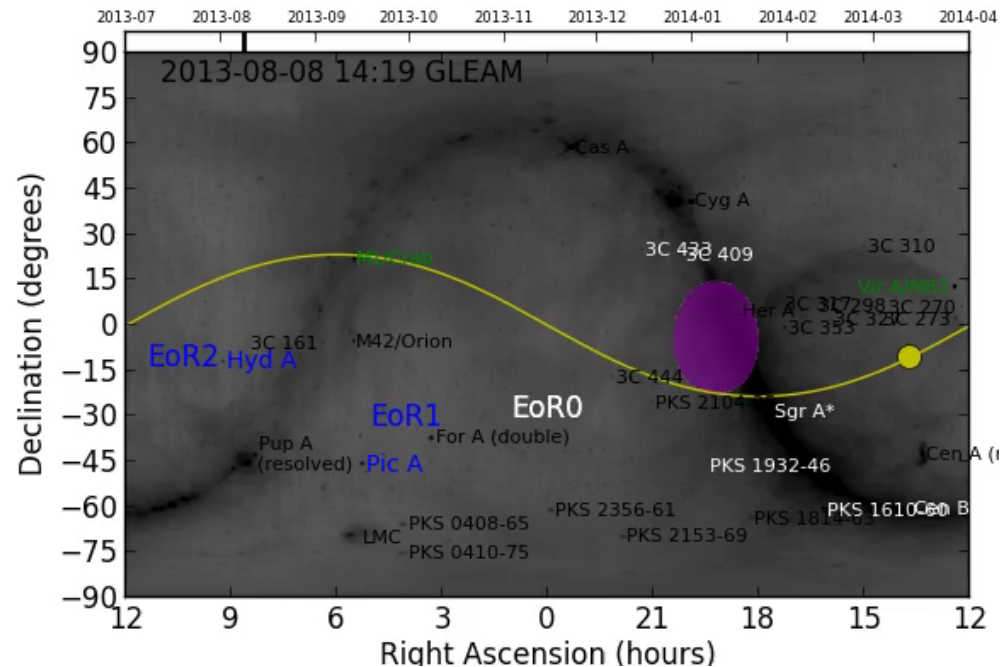
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Summary of GLEAM (yr 1+2) observations:

- 80 to 230 MHz; southern sky -80° to $+30^\circ$ Decl.
- 800 hrs of meridian scans; full polarimetry
- 7 mJy rms at 150 MHz (confusion-limited goal)
- 2 to 5 arcmin resolution
- \sim few $\times 10^5$ sources

Science goals:

- Radio relics; clusters
- Radio galaxies; AGN
- Galactic magnetic field
- Supernova remnants
- Recombination lines
- Magellanic Clouds and nearby galaxies



David Kaplan



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Improvements?

1. Angular resolution:

- GLEAM is limited by classical source confusion
- Ambiguous optical ID of most sources
- Source structure absent
- (see Nick's talk)

2. Short spacings:

- Errors on largest scales (Galactic Plane)

3. Frequency range, resolution and continuity

- Spectral line detection hampered by limited frequency range, poor frequency resolution and discontinuous frequency coverage (and low sensitivity).



Improvements?

3. Frequency range – contd

- Ionospheric calibration limited by 30 MHz bandwidth
- Sensitivity for transients limited by bandwidth

4. Primary beam:

- GLEAM is limited by sidelobe confusion (sources outside primary beam).
- GLEAM has flux scale uncertainties due to poor primary beam definition.

5. Dynamic range

- No tile beam calibration
- No polarimetric calibration
- No T_{sys} calibration
- Drifting analog components
- Finite DDG capability



Outline



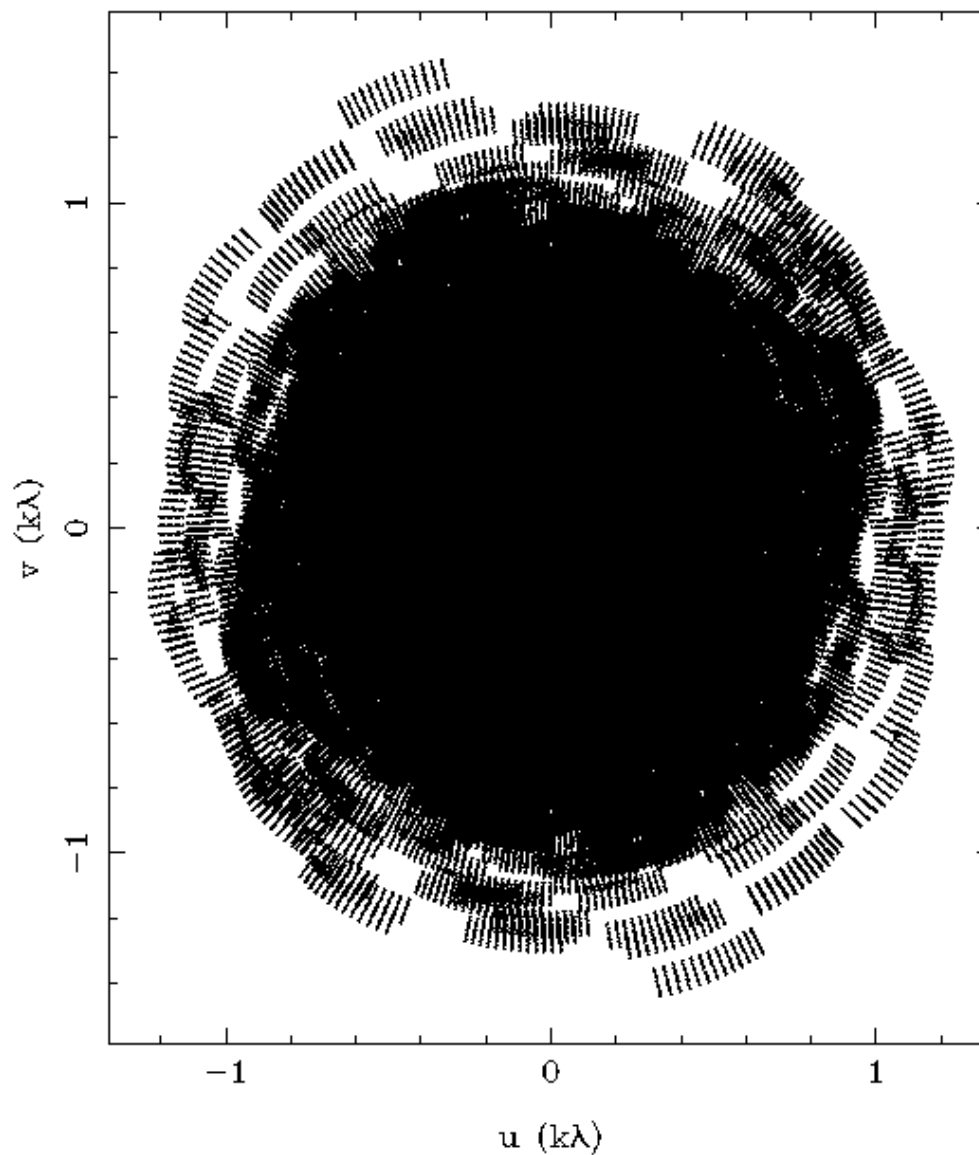
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Survey:

- 128T + 64 additional (outer) tiles = 192T
- Frequency range/bandwidth: 80-230 MHz / 30 MHz
- Observing time: 170 hrs
- Meridian survey HA \pm 1 hr
- $24 < \text{RA} < 0$ hrs; $-80^\circ < \text{Decl.} < +30^\circ$

Imaging parameters:

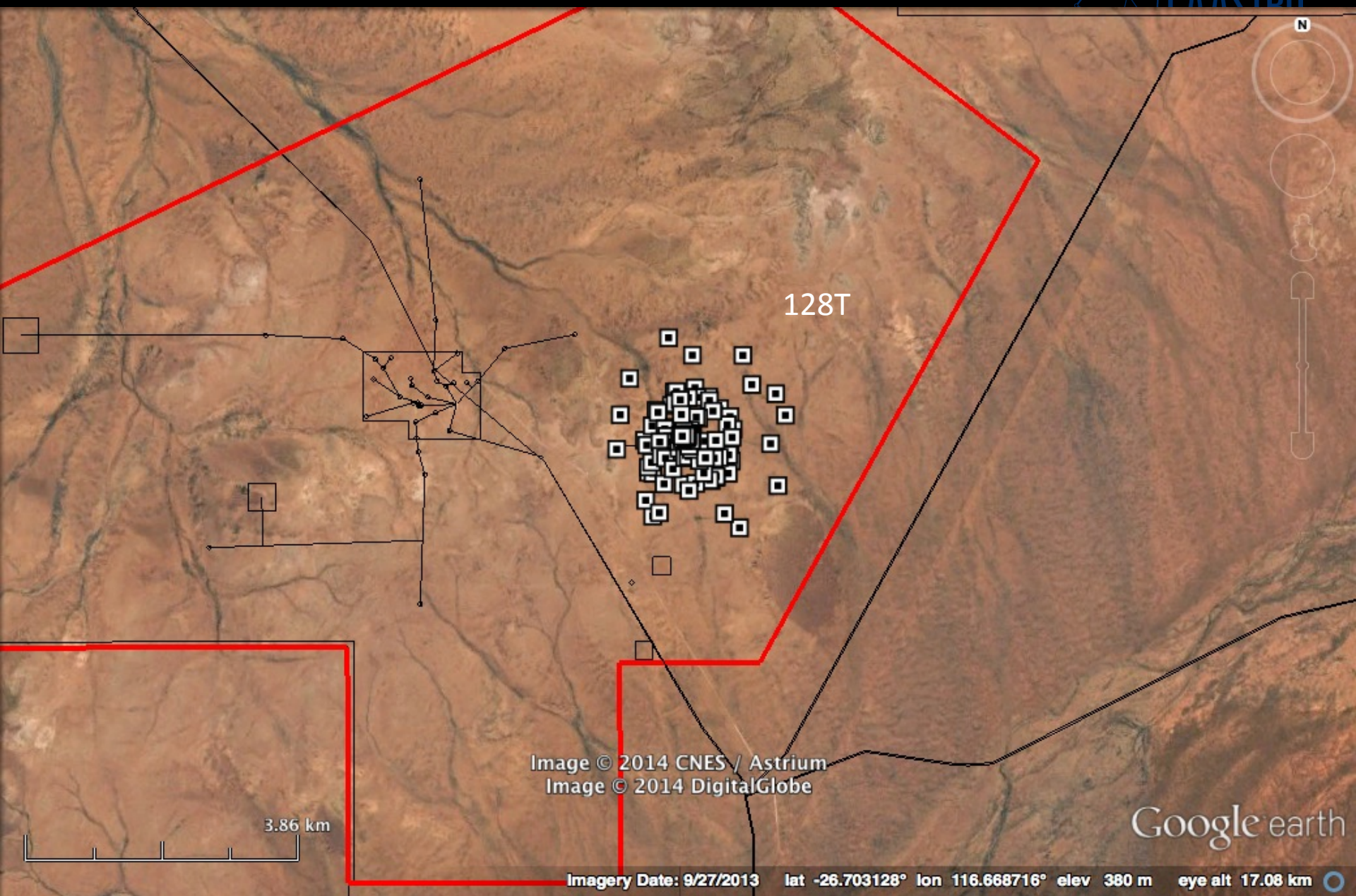
- Central frequency: 150 MHz
- Bandwidth: 10 MHz
- Declination: -30°
- T(sys): 400 K
- Tile gain: 128 Jy/K
- Weighting: robust -1 (+ pb suppression)





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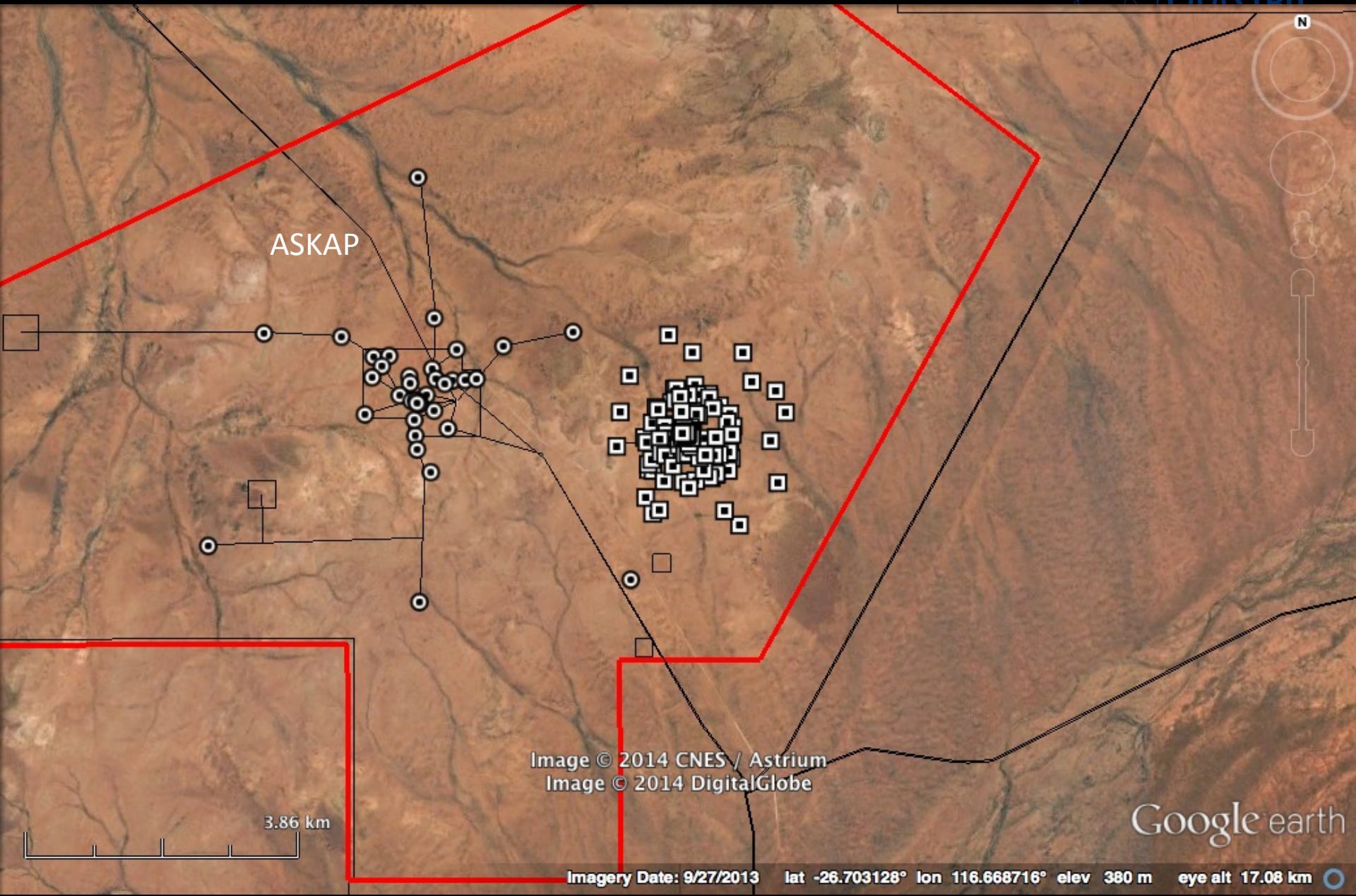
128T

Image © 2014 CNES / Astrium
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3.86 km

Google earth

Imagery Date: 9/27/2013 lat -26.703128° lon 116.668716° elev 380 m eye alt 17.08 km



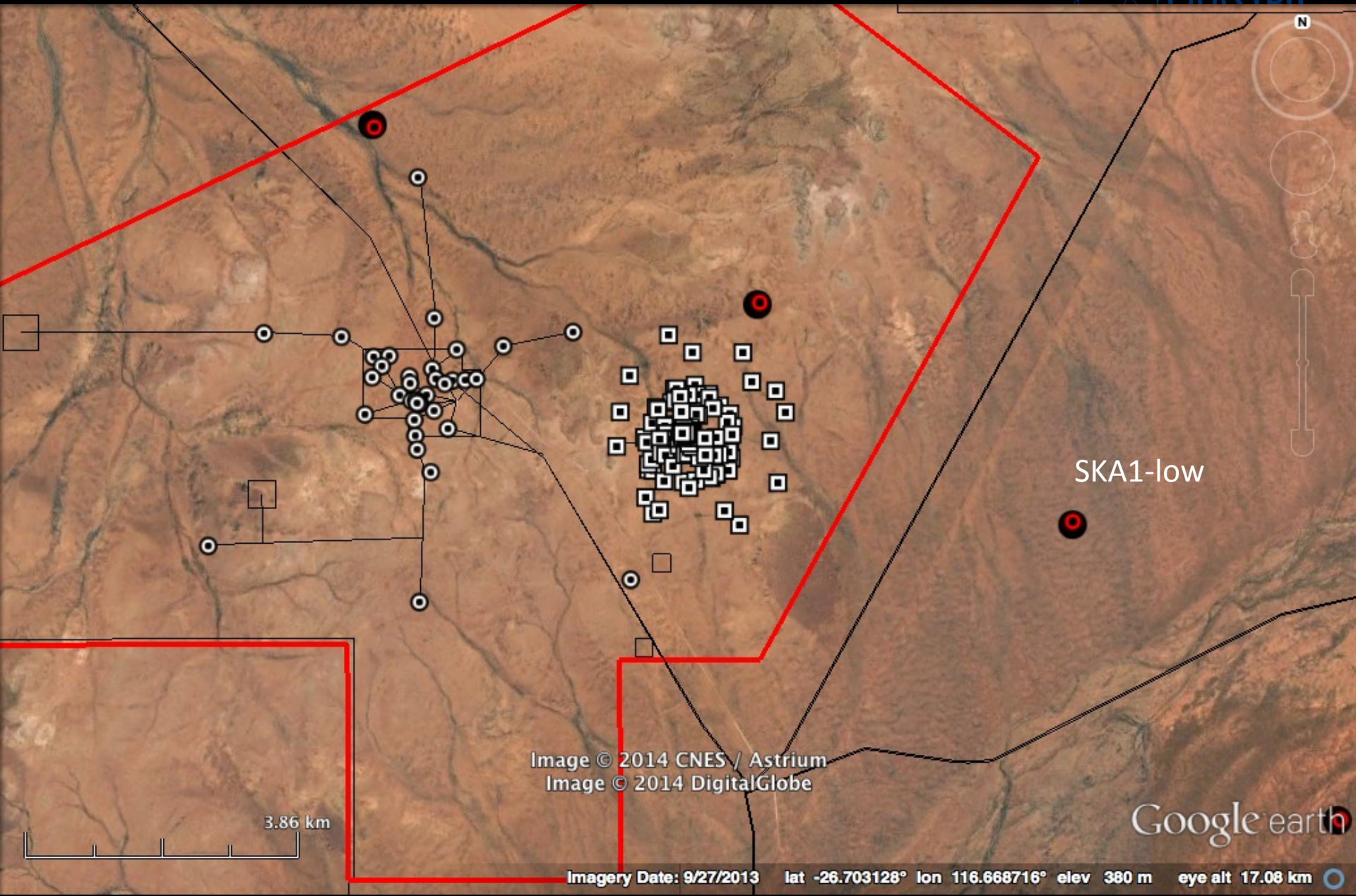
ASKAP

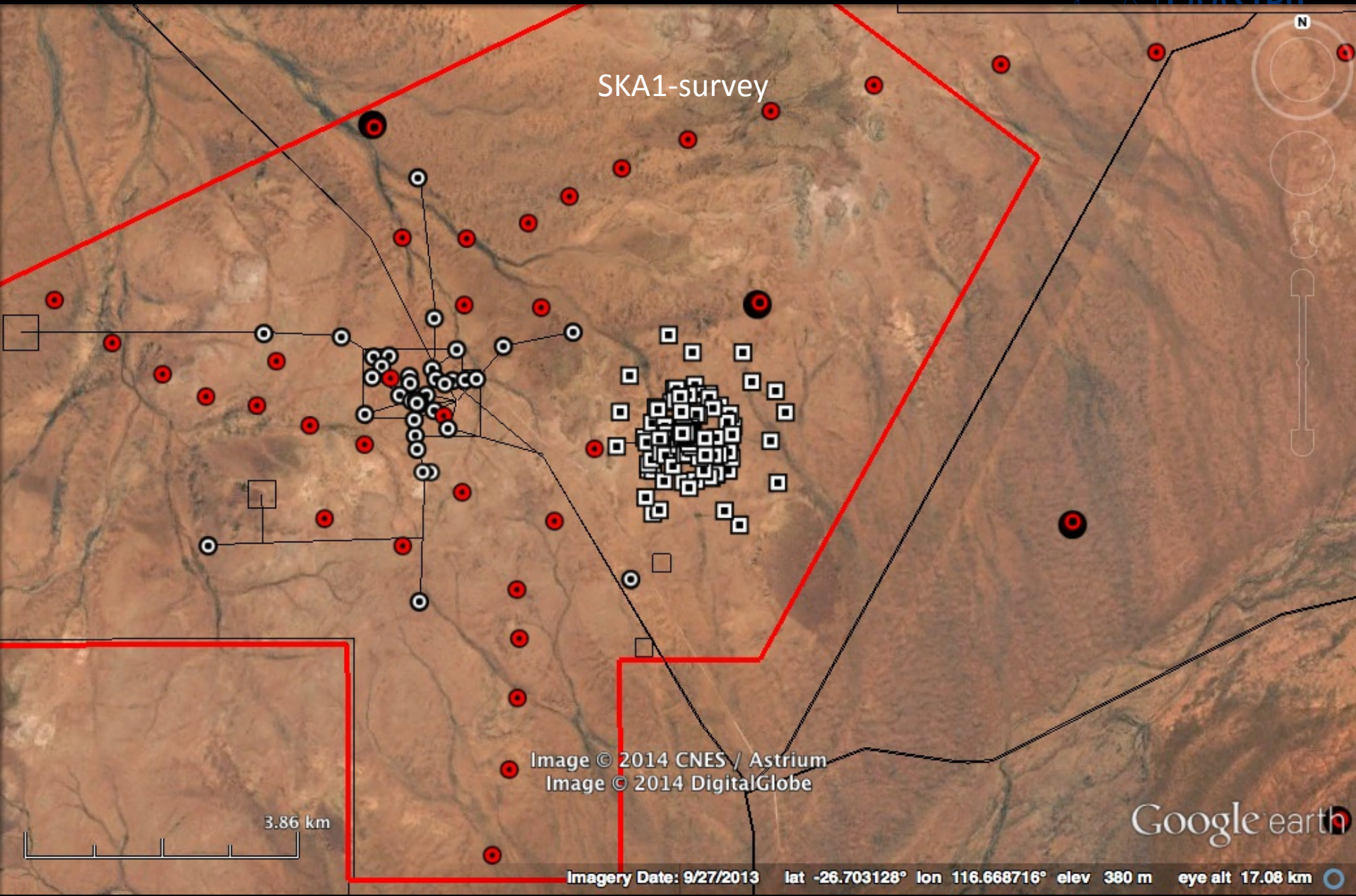
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3.86 km

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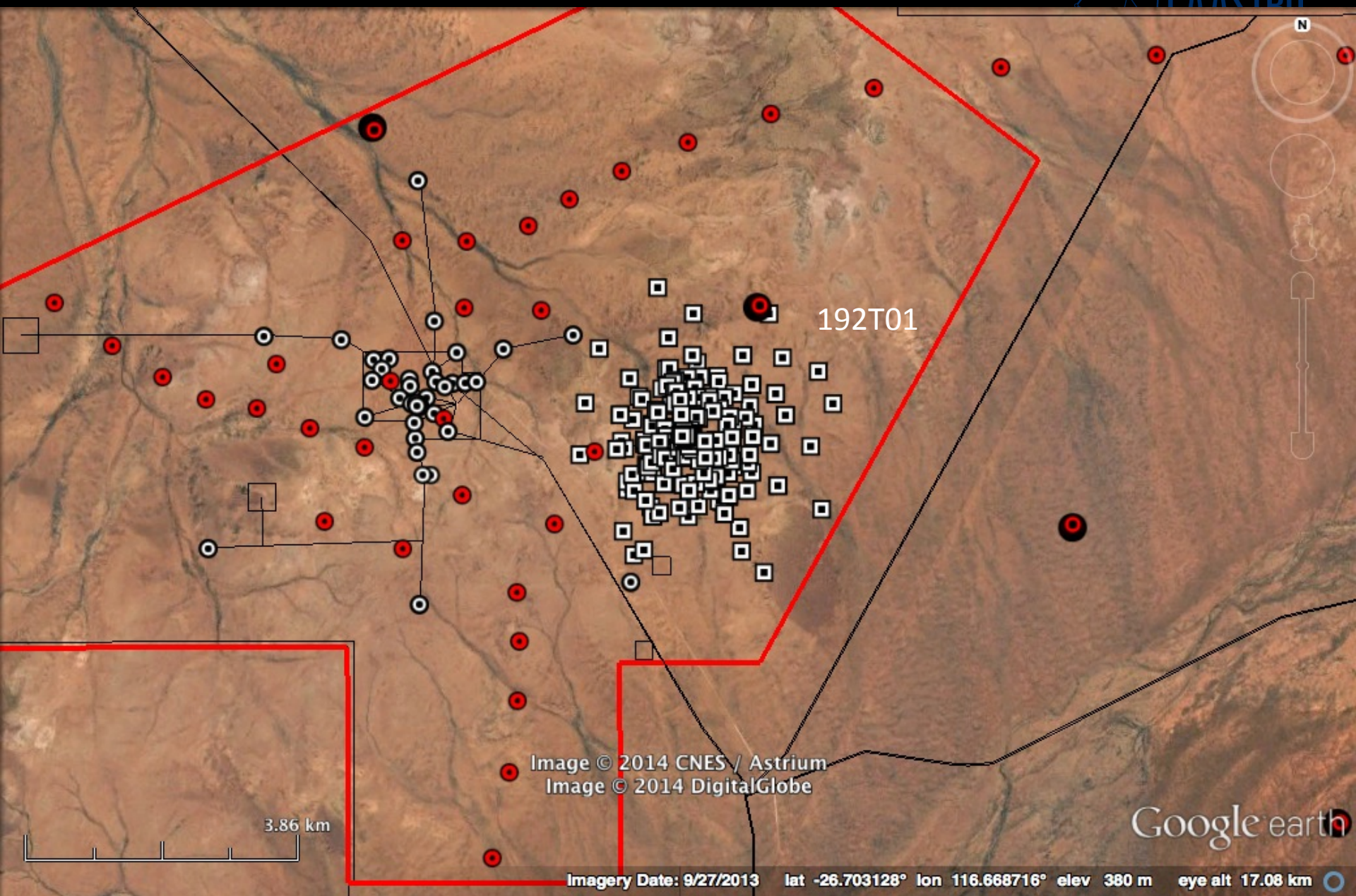
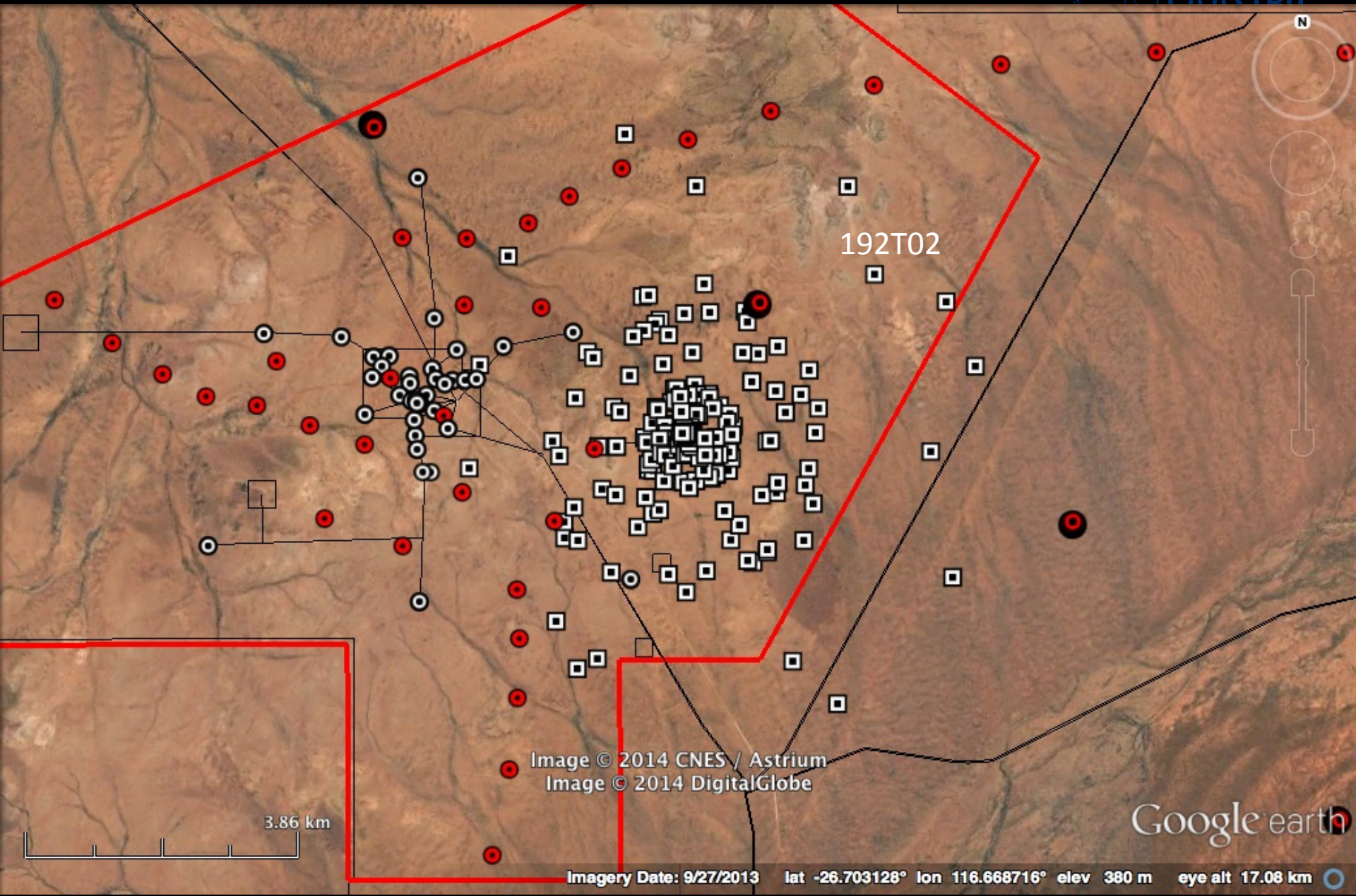


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192T01

3.86 km

Imagery Date: 9/27/2013 lat -26.703128° lon 116.668716° elev 380 m eye alt 17.08 km



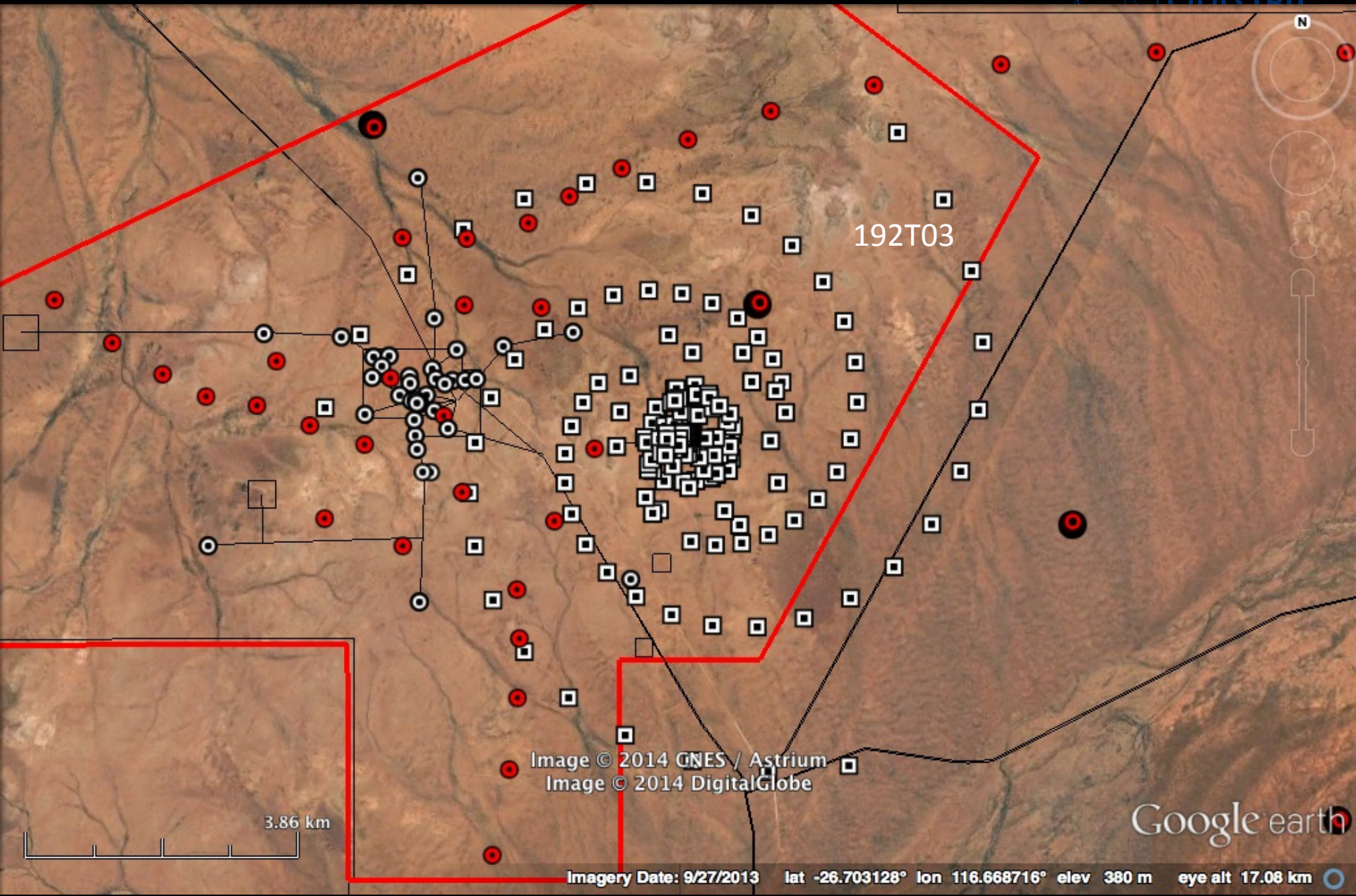
192T02

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3.86 km

Google earth

Imagery Date: 9/27/2013 lat -26.703128° lon 116.668716° elev 380 m eye alt 17.08 km



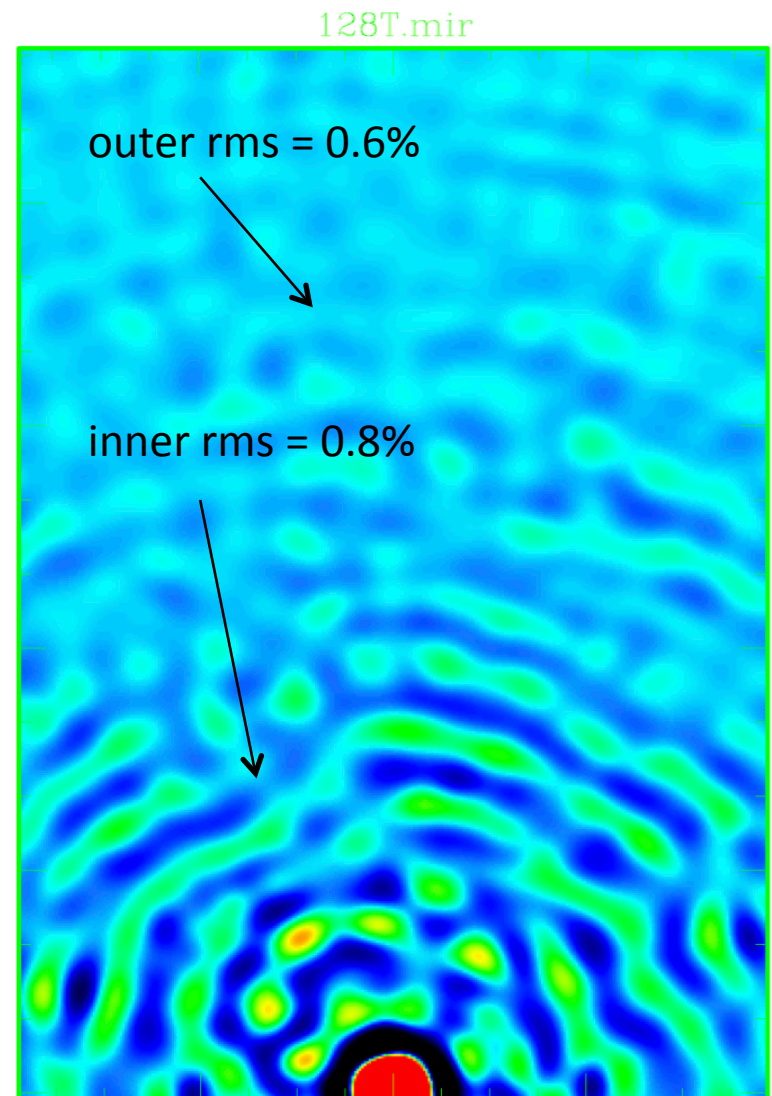
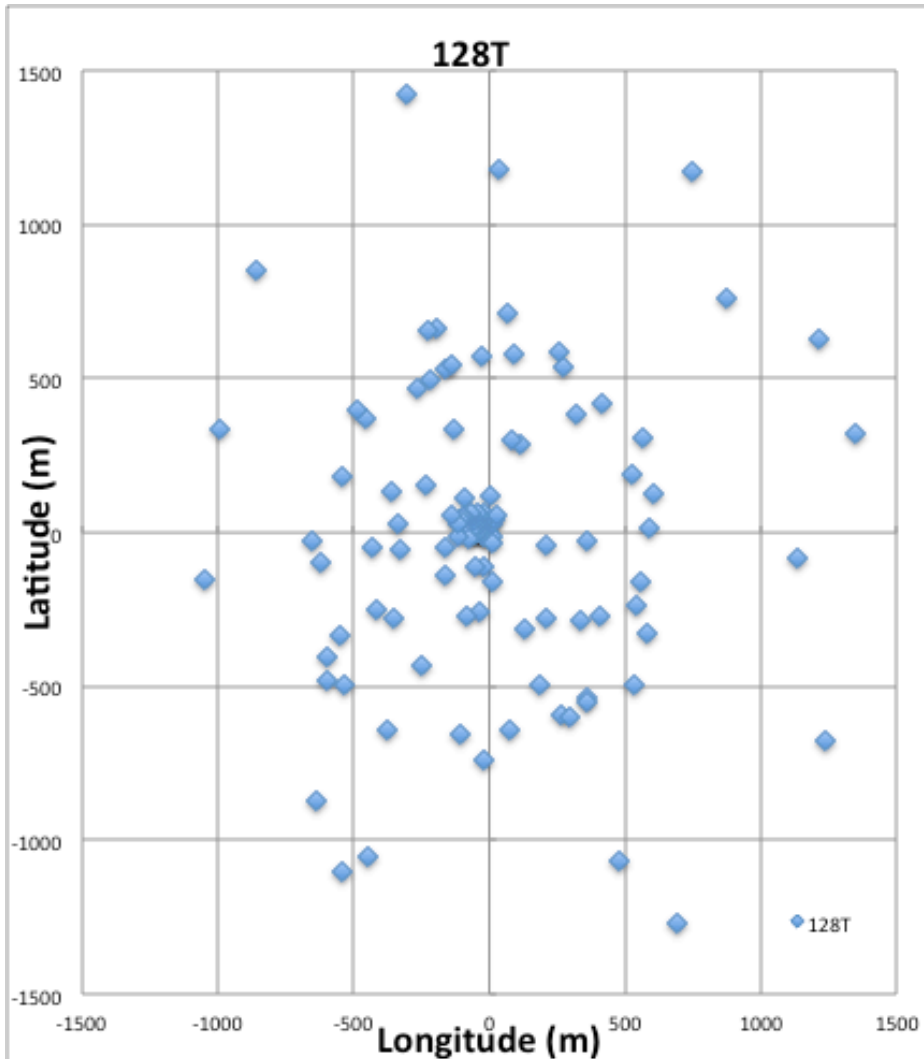
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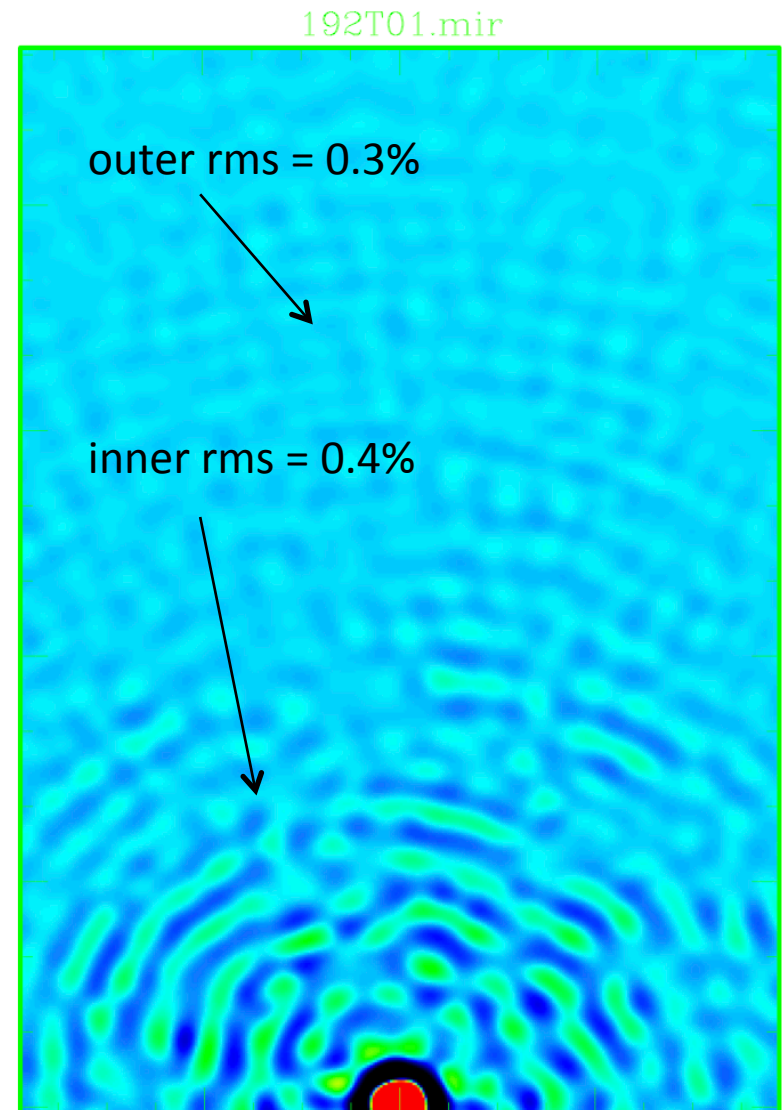
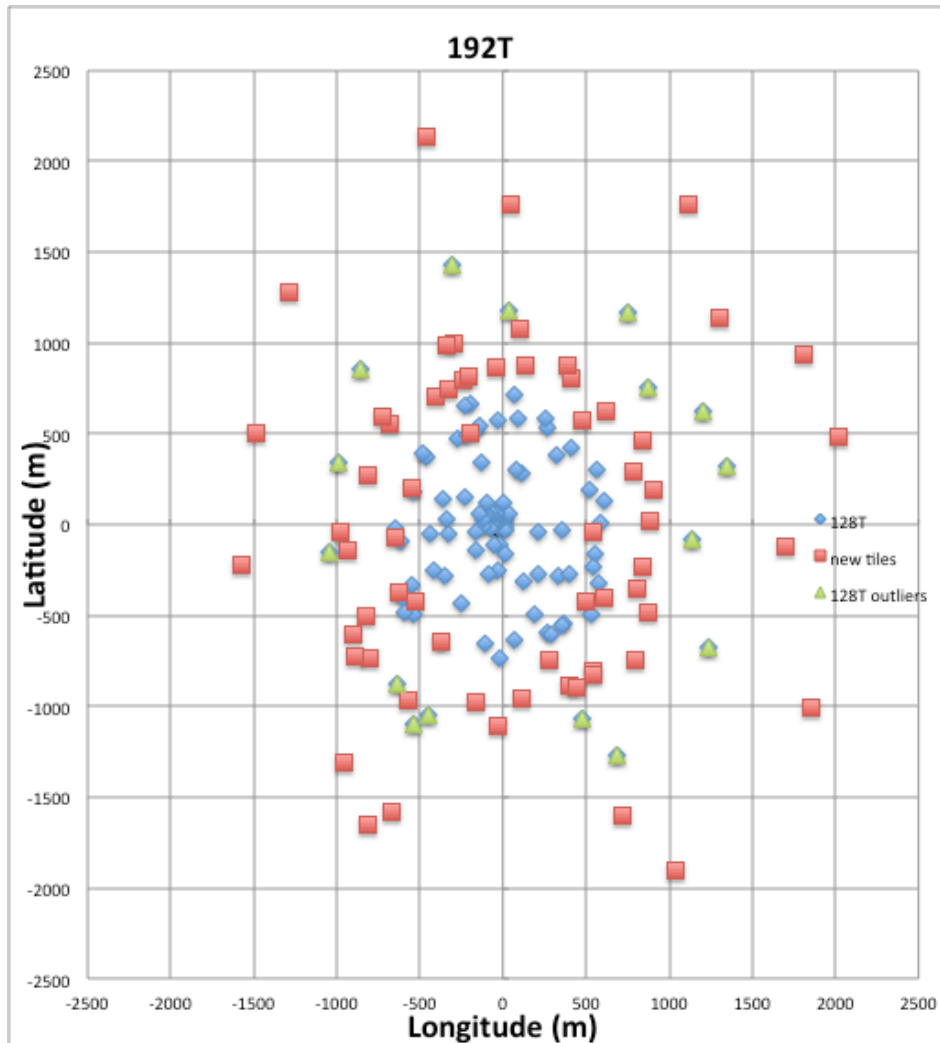
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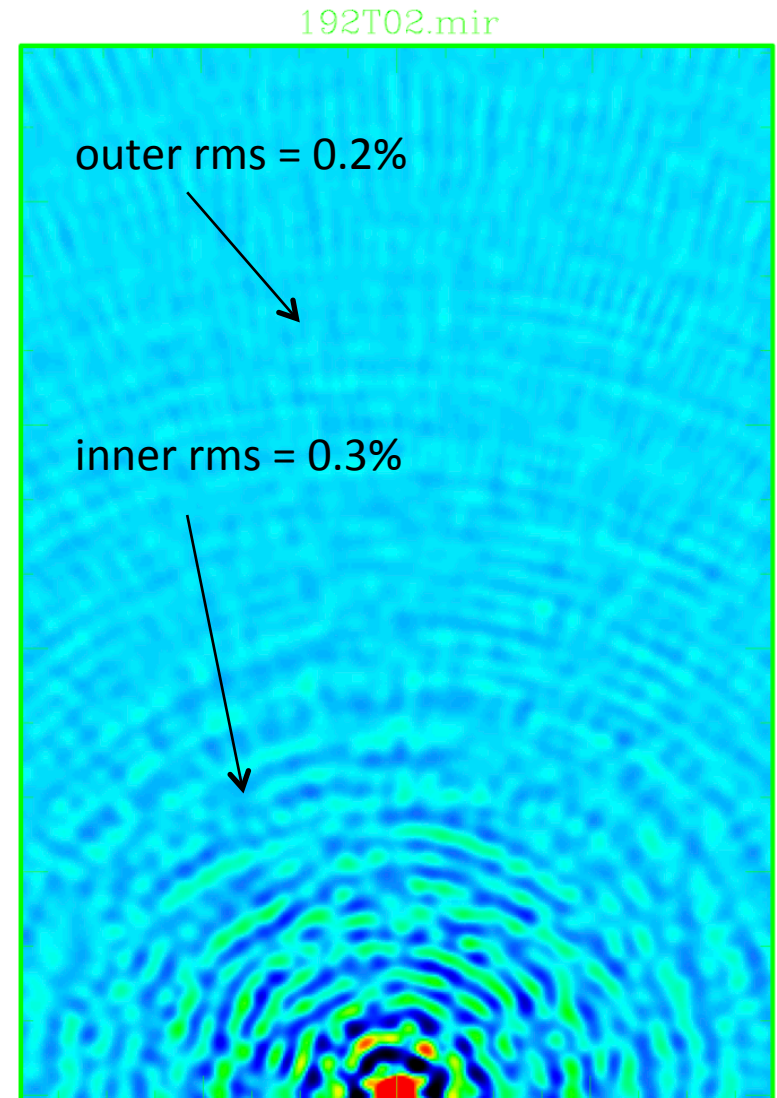
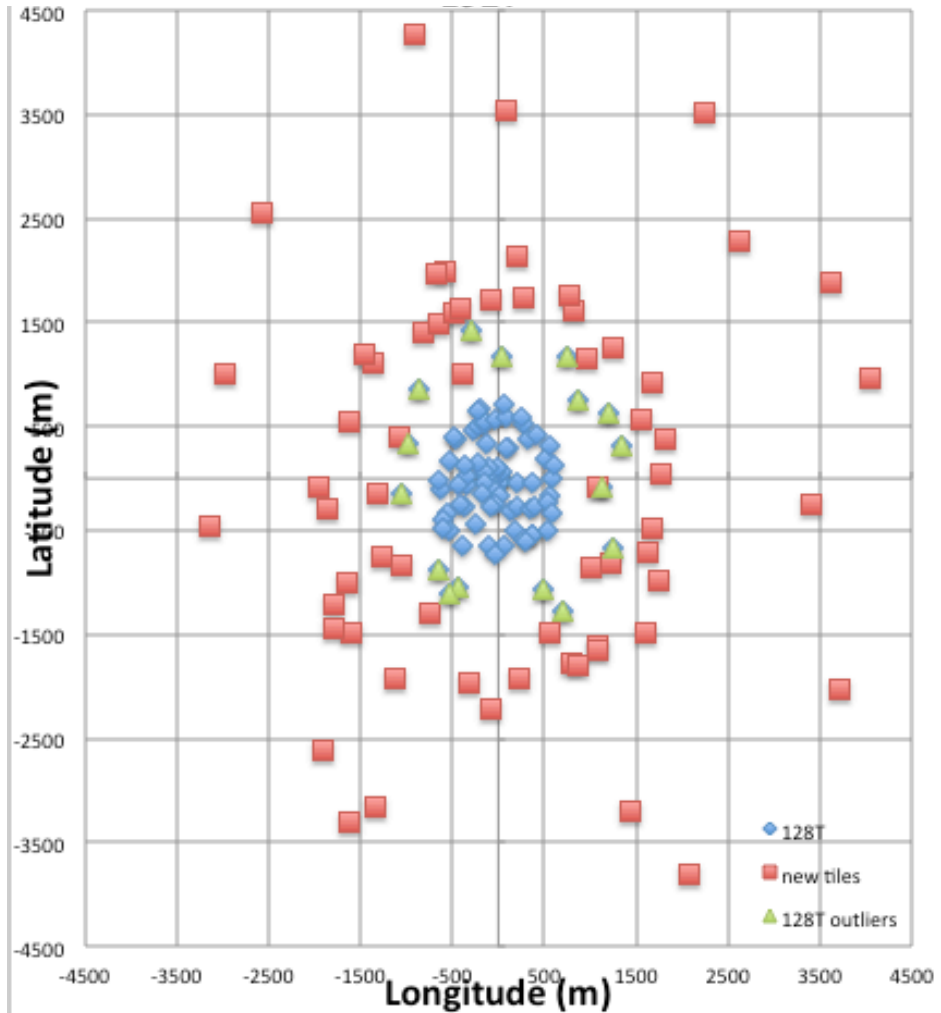
3.86 km

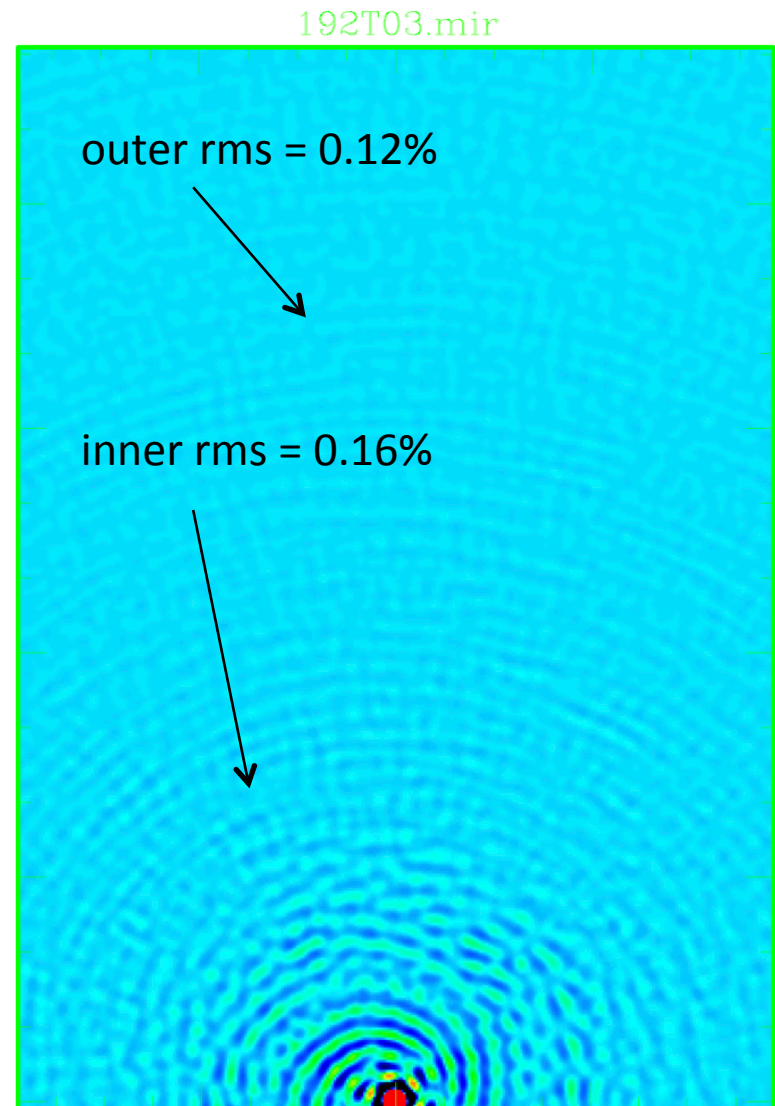
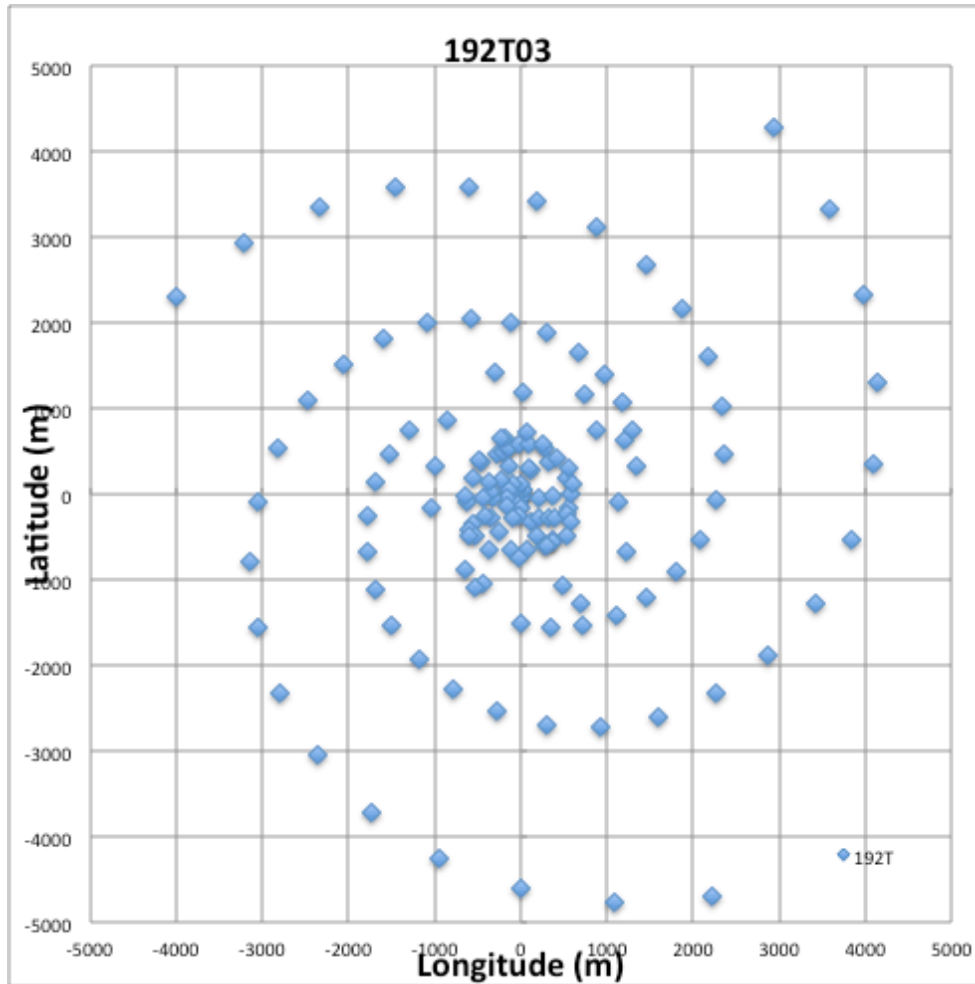
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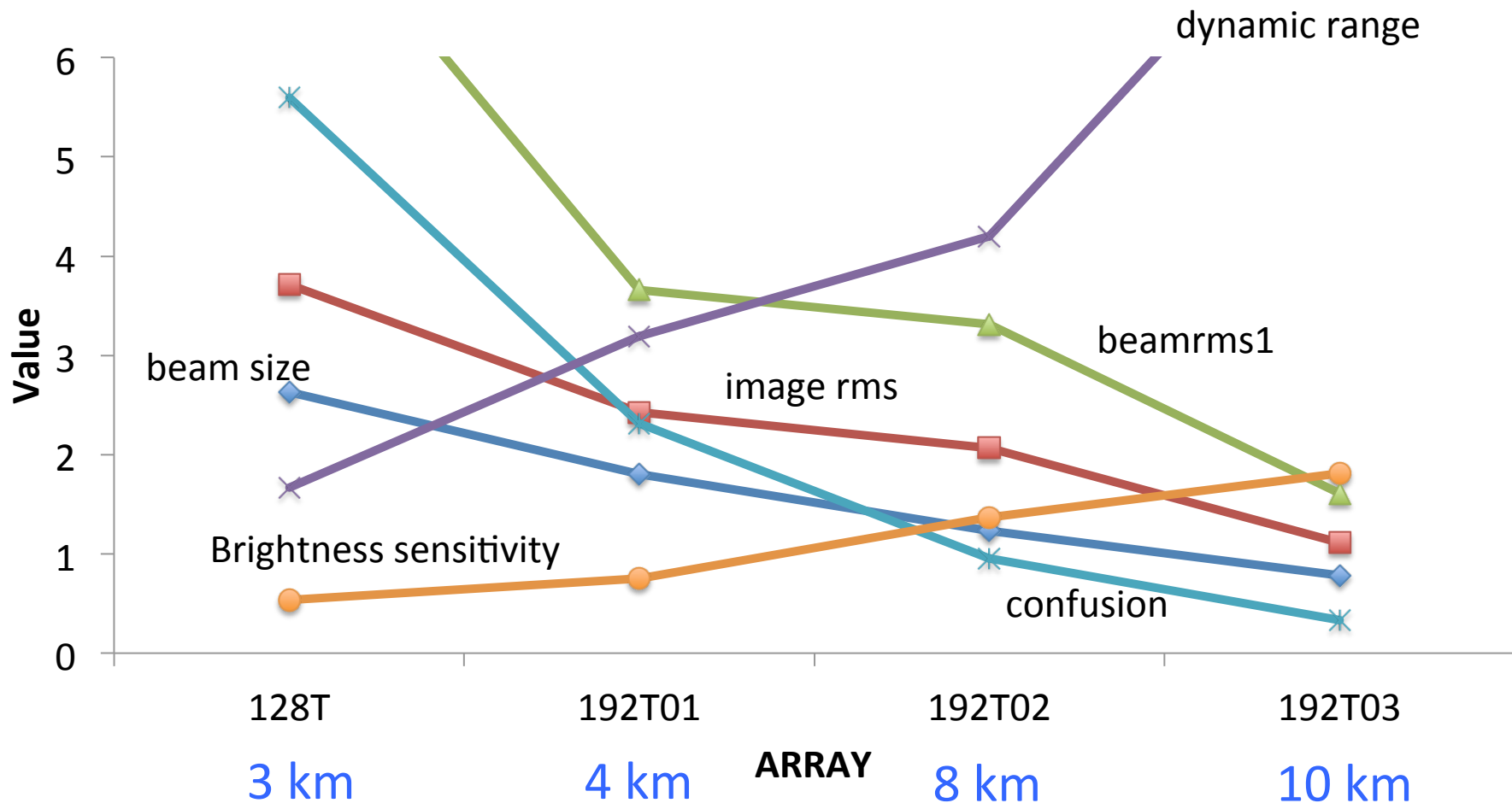
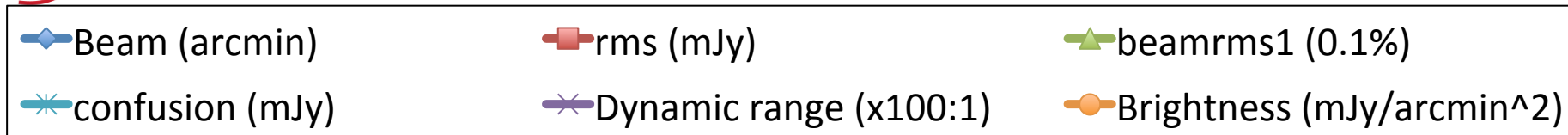
Google earth













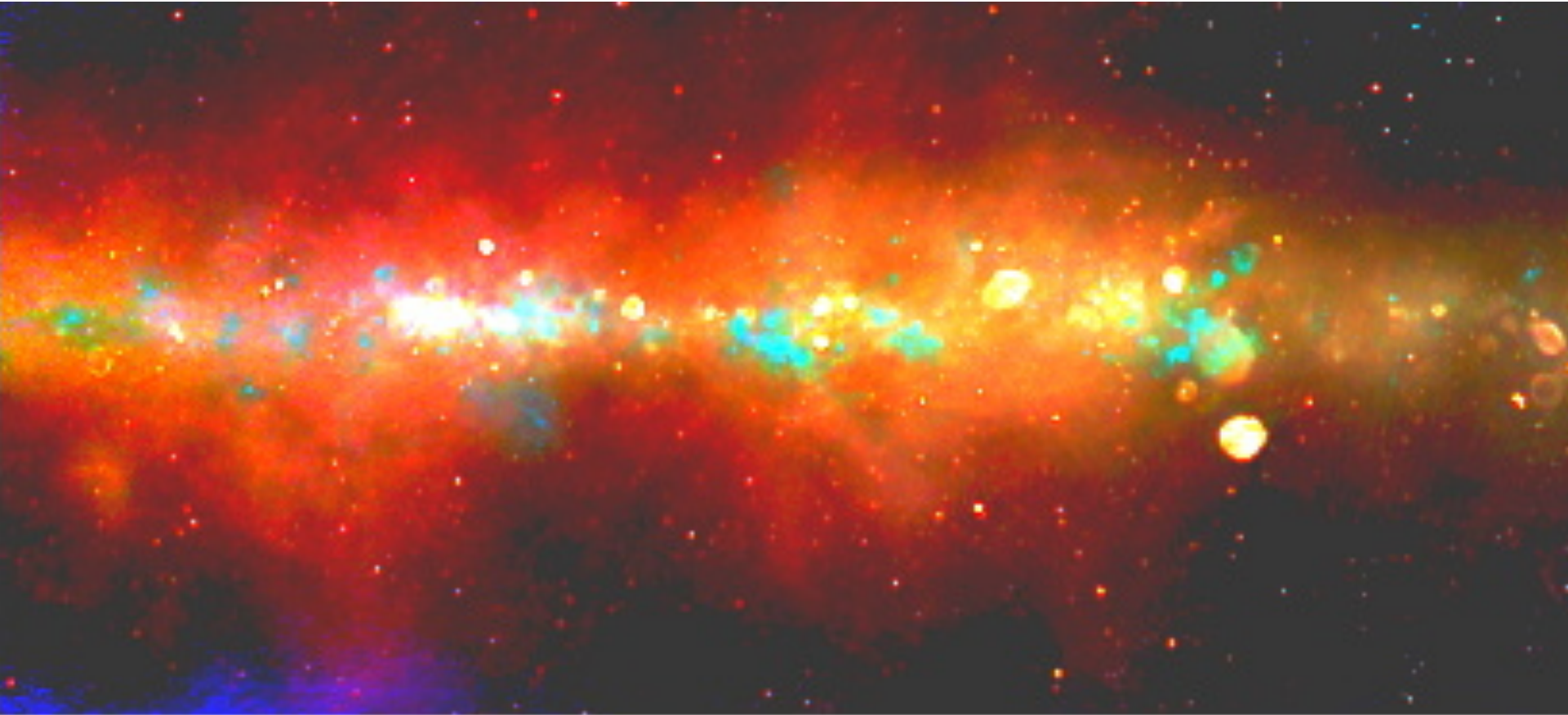
Outline



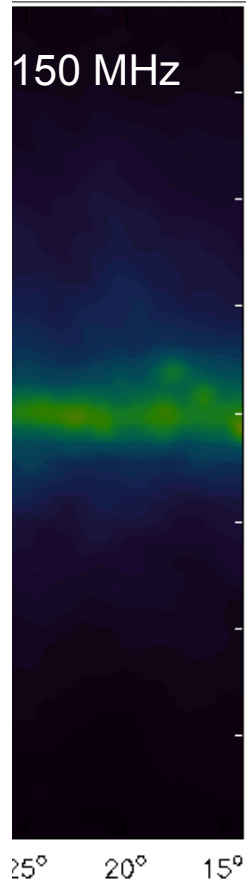
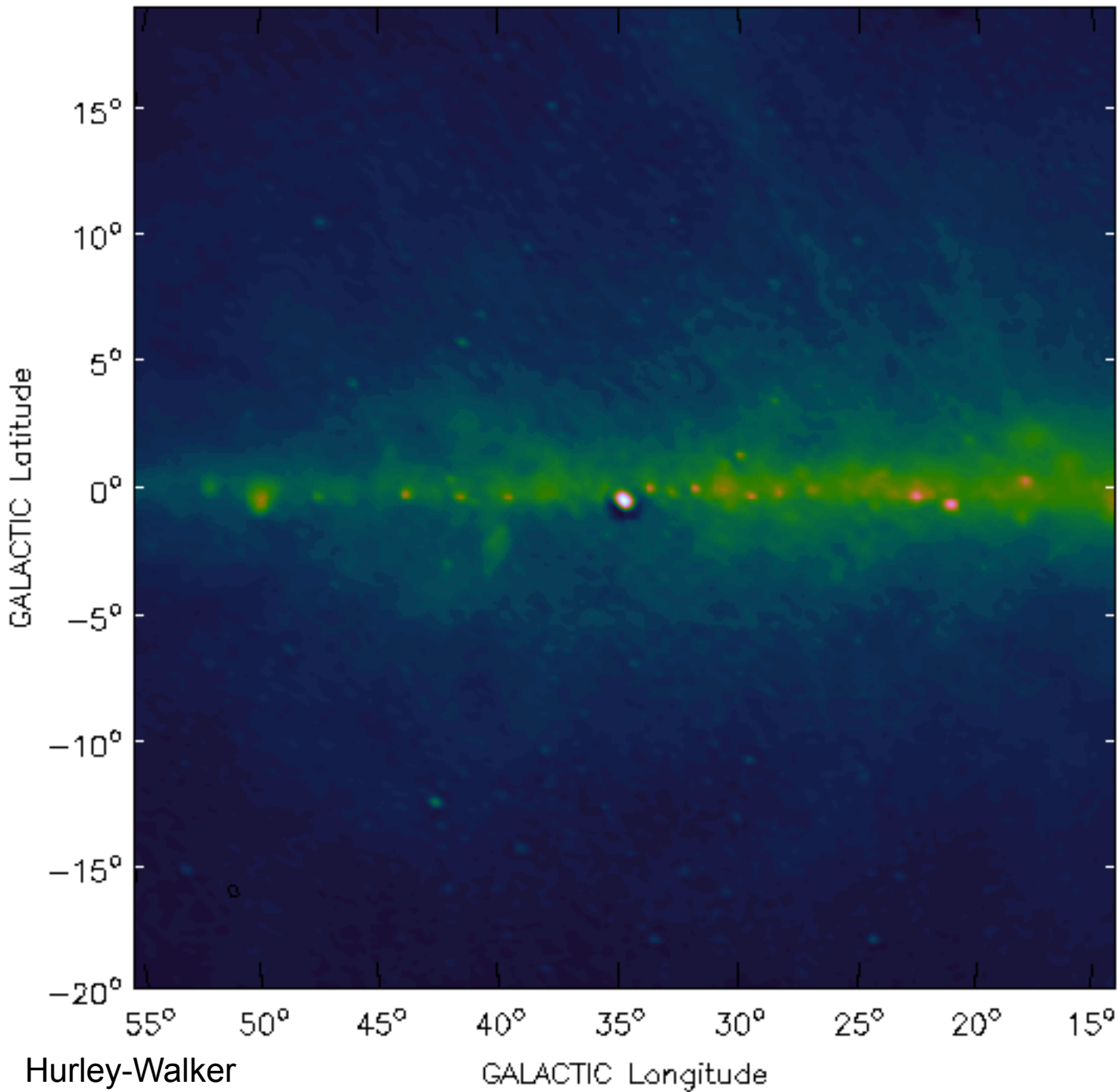
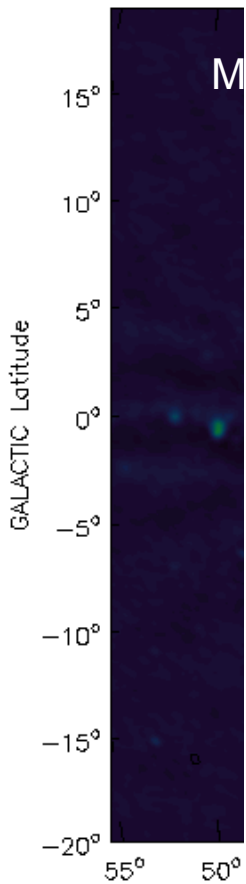
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GLEAM Galactic Plane

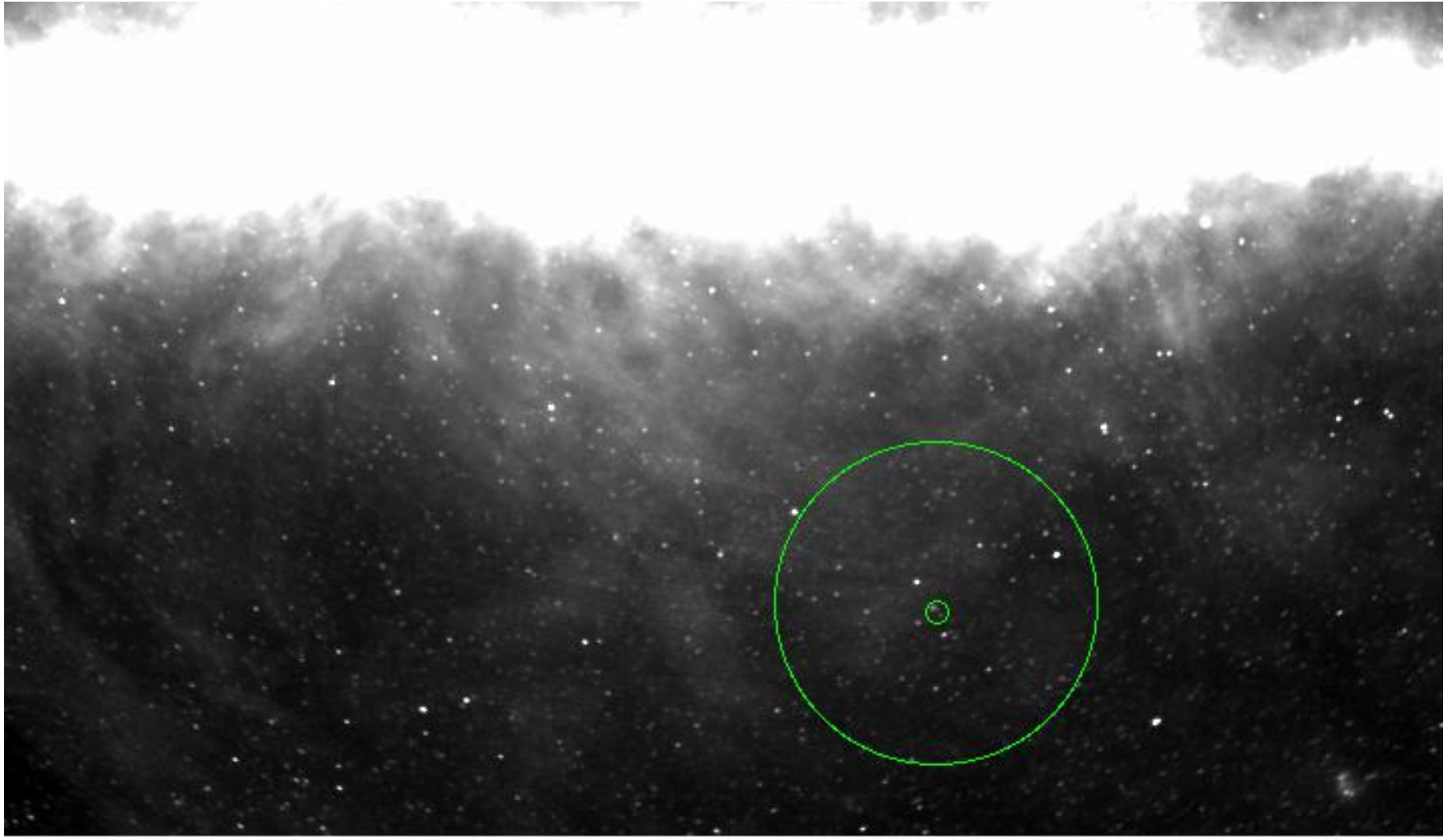


Luke Hindson

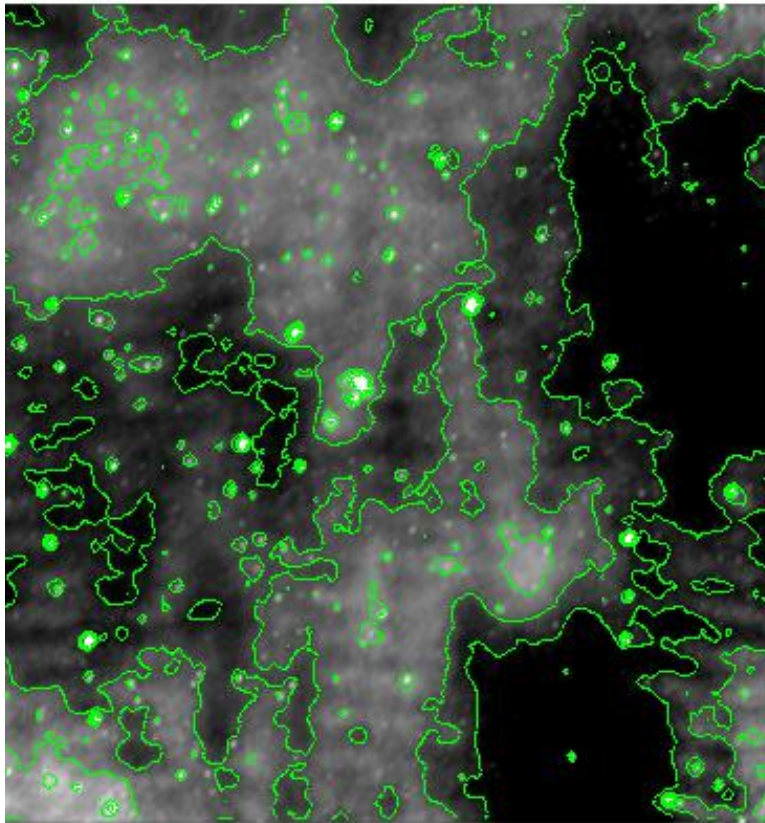


Hurley-Walker

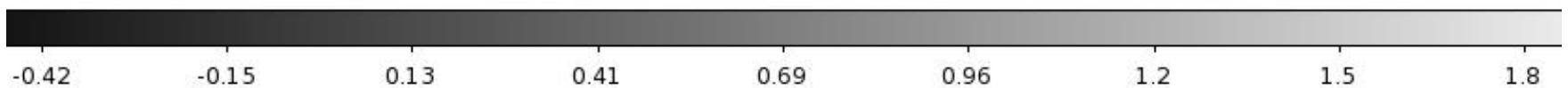
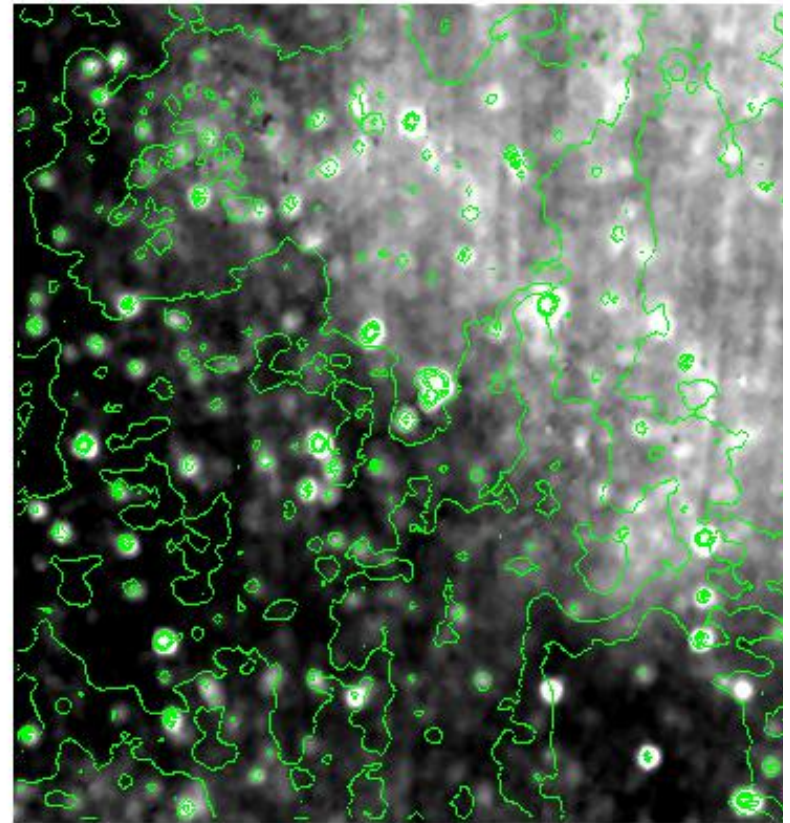
GALACTIC Longitude

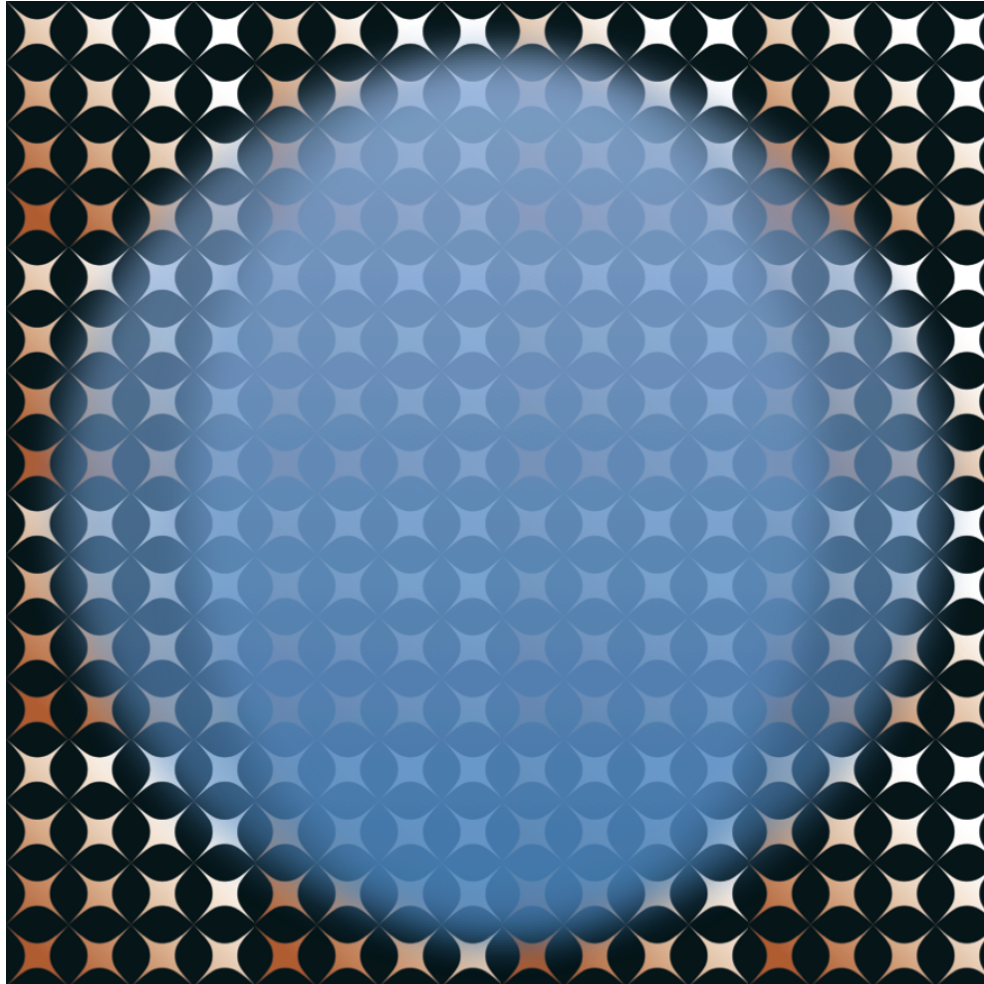


128T



CHIPASS

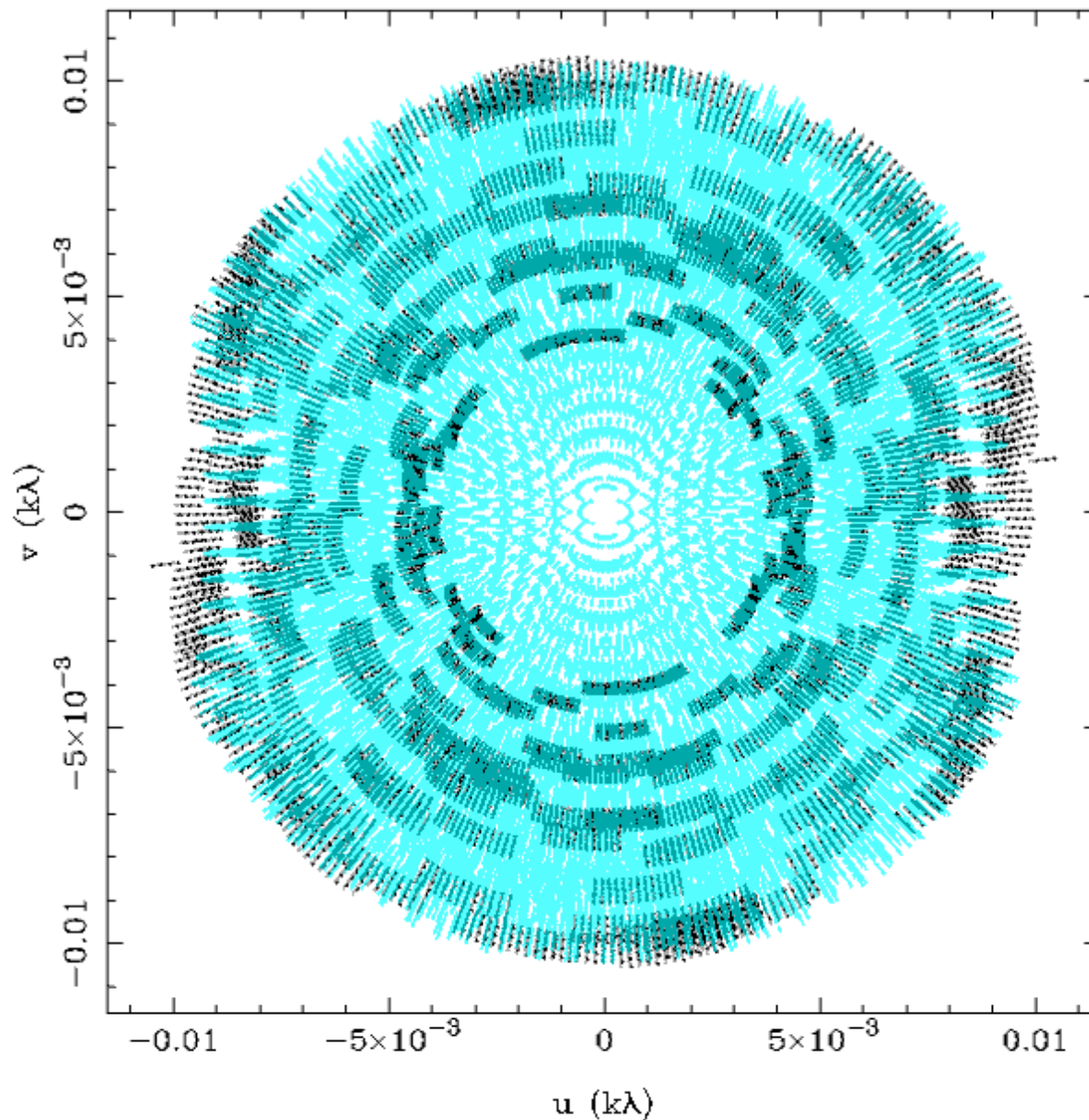




- Correlate 256 elements, not 16 tiles; true aperture tile; FFT spectrometer? Apodise.
- Angular resolution 6 deg at 150 MHz; min spacing 1.2 m; FoV 10,000 sq.deg.

MWA

Supertile



Simulated additional 64 tiles with max baseline 4 - 10 km. Compared with 128T (at 150 MHz):

- Sensitivity increases 1.5 - 2.3 times
- Beam size decreases from 2.6 arcmin to 0.8 - 1.8 arcmin
- Confusion decreases from 6 mJy to 0.3 - 2 mJy
- No optimisation or site masks

Short spacing information can be added with a supertile:

- 256 individual dipoles
- True apodised aperture array
- Better Galactic Plane imaging and diffuse polarimetry



Thank you



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