

The Transient Array Radio Telescope



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BIUST (Botswana) TART final calibration.



- 1 Origins
- 2 Instrument Design
- 3 Calibration Imaging & Data
- 4 This TART Workshop



SKA, MeerKAT, ASKAP, VLA & GMRT

- Incredibly sensitive, narrow field of view
- Total cost: billions
- Running cost: millions
- A long queue of eager astronomers...

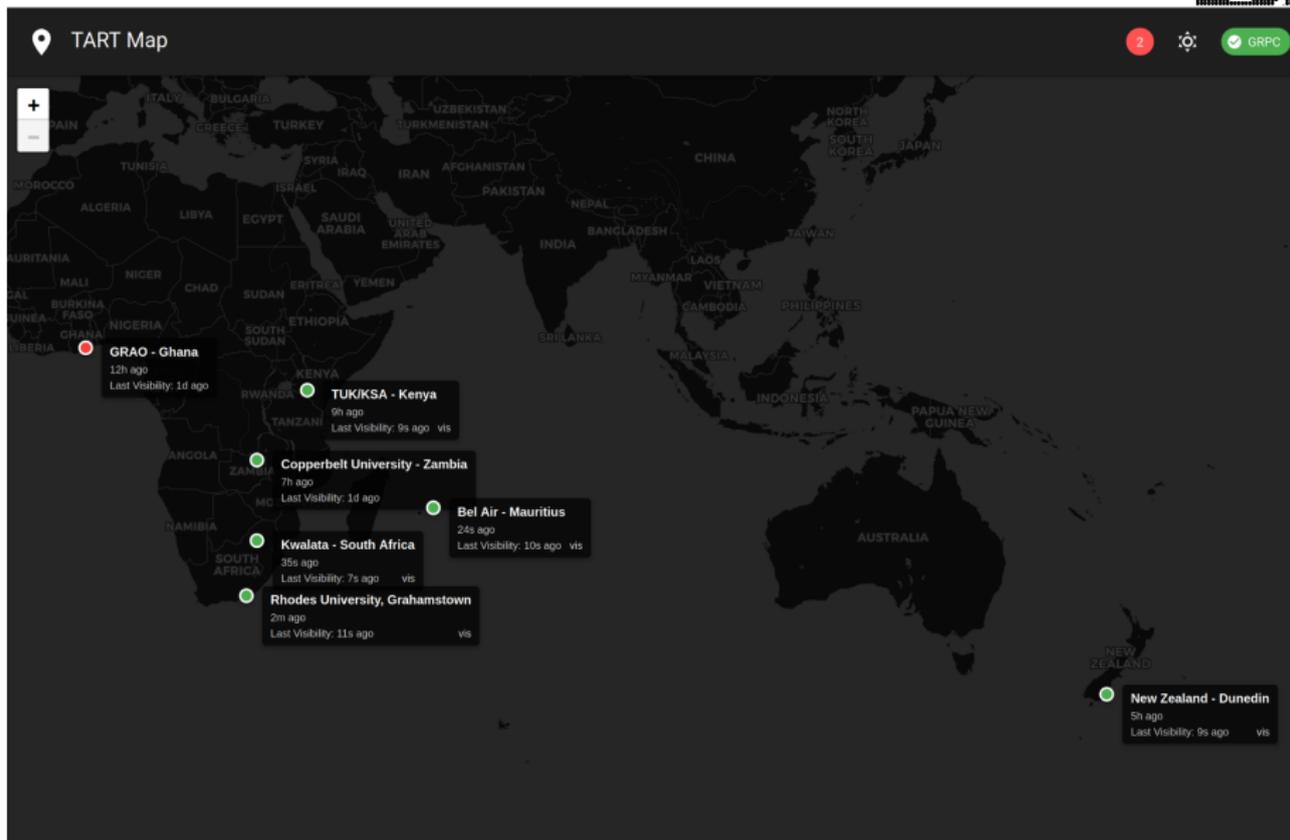
TART

Massive field of view. Look everywhere at once. Transients.

TART: Early Prototype



TART: The network







1 Origins

2 Instrument Design

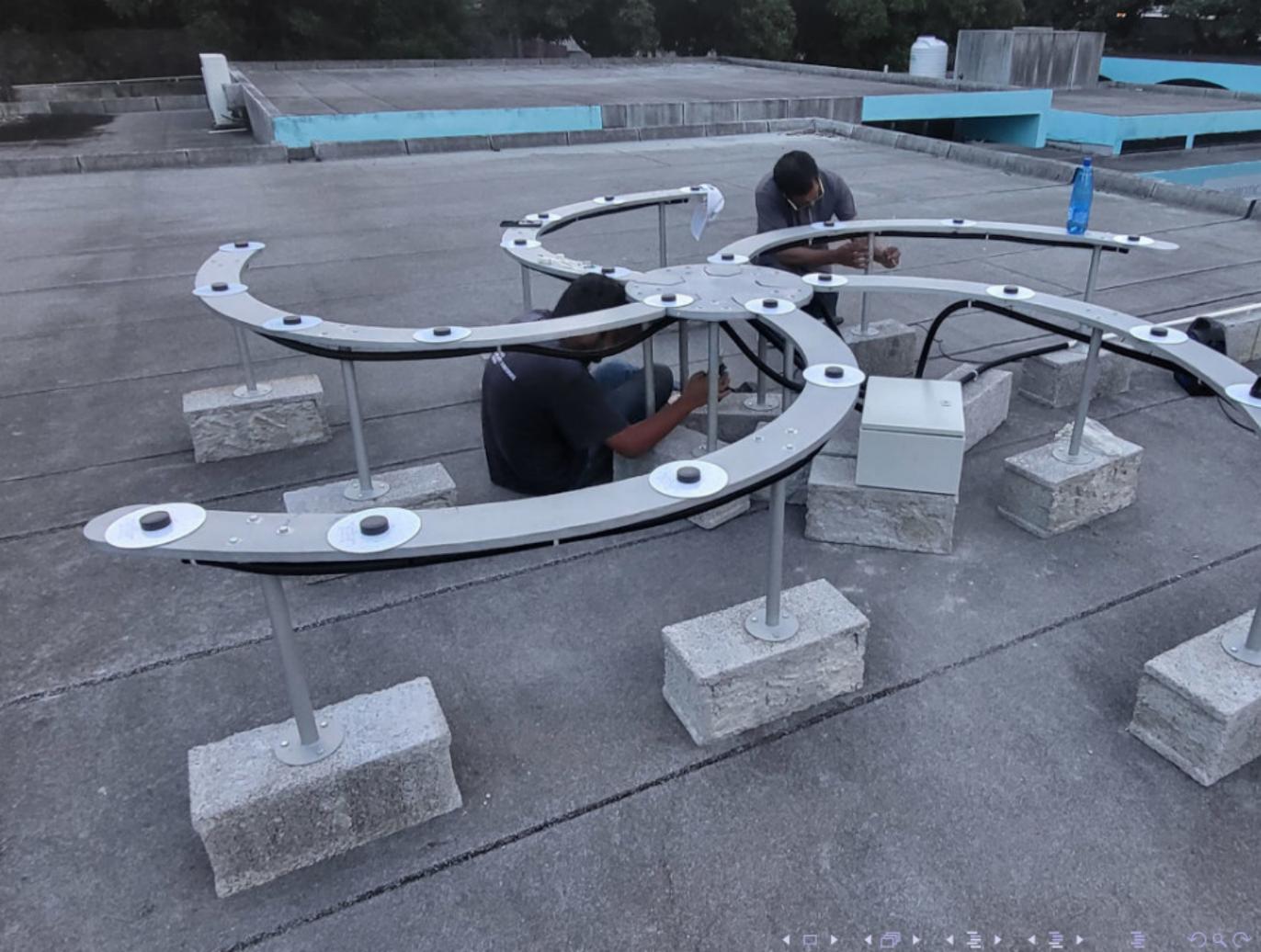
3 Calibration Imaging & Data

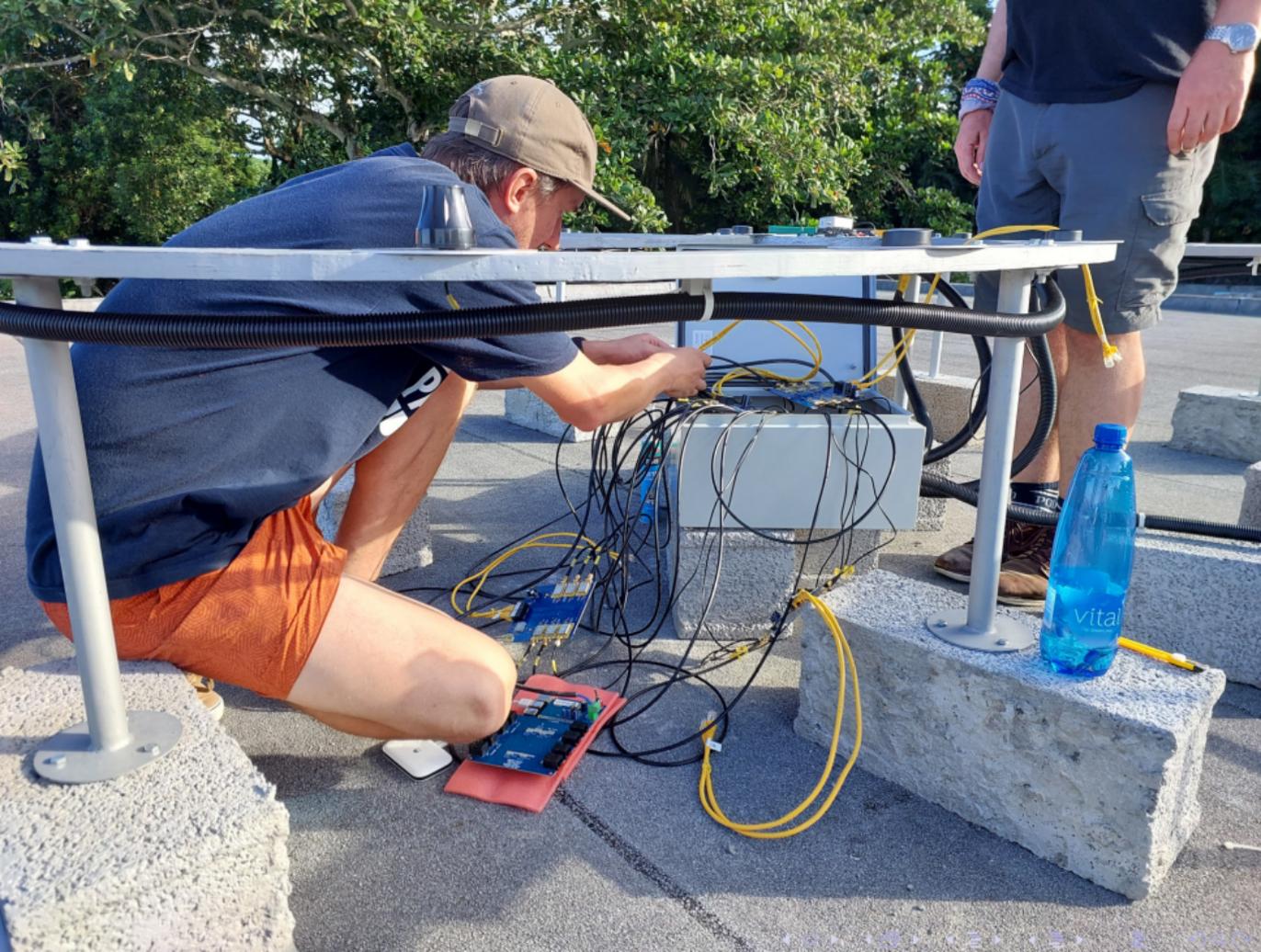
4 This TART Workshop

TART: Overview

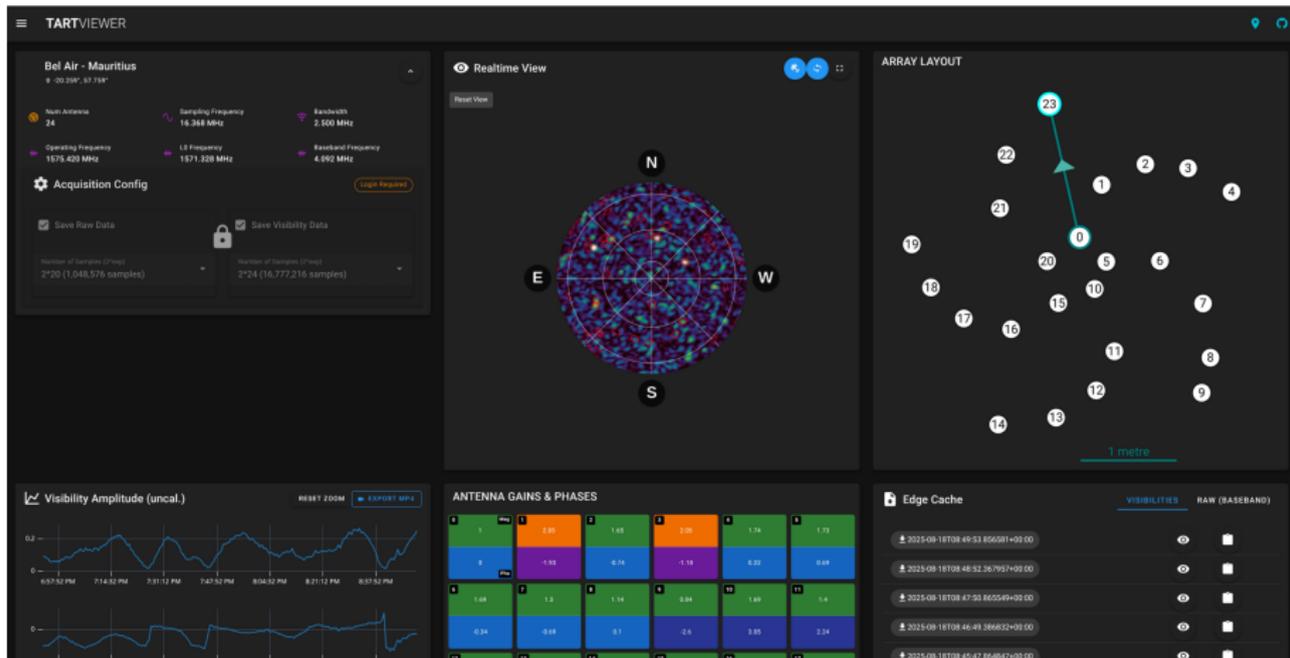


all-sky · 24 antennas · real-time · open-source · imaging interferometer





Real-time, all-sky radio telescope



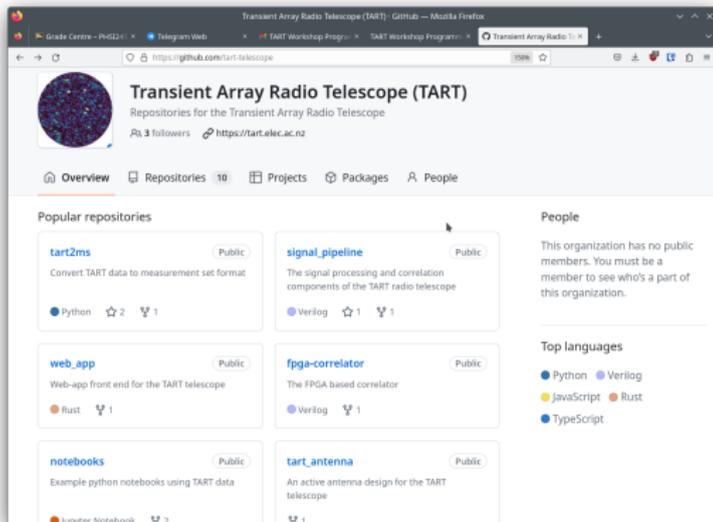


<https://github.com/tart-telescope>

- Designed for Research
- Github: Hardware
- Github: Software
- Github: Documentation

Contributors:

- Dunedin, NZ
- Rhodes, ZA
- Stellenbosch, ZA
- SARA0, ZA
- EMSS Antennas, ZA





TART Features



- 24-Radio Receivers
- Correlator works in real time!
- Each radio: 2.5 MHz bandwidth
- Real-time visibilities
- Stored in the cloud



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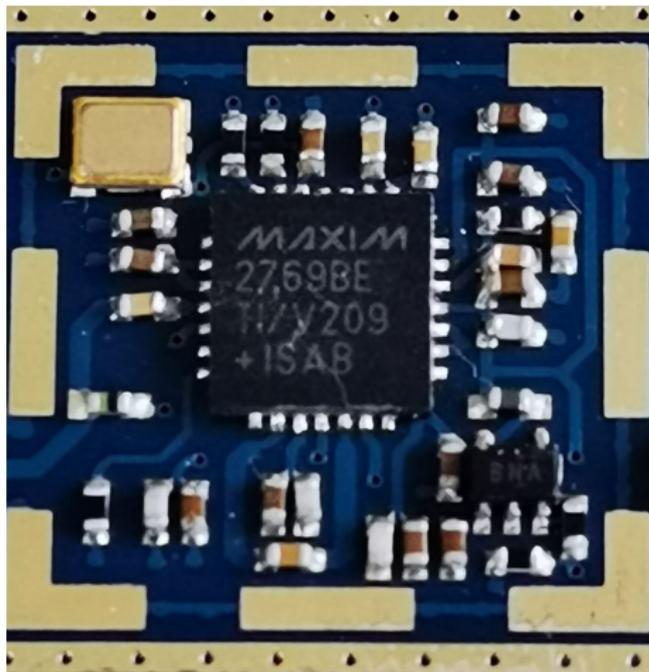


Field of View

20 thousand square degrees.

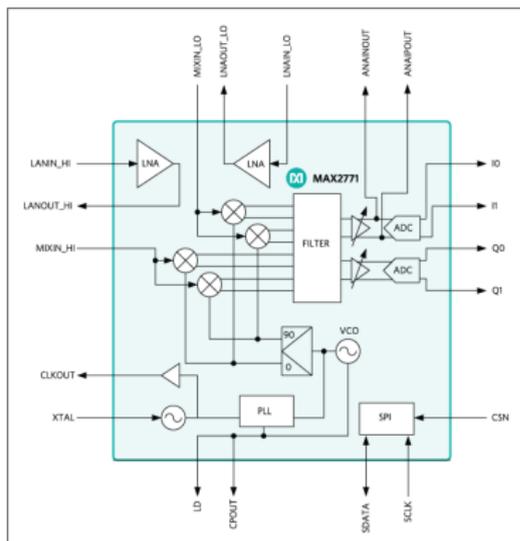
New Developments

The hardware is constantly being developed.



GPS silicon devices in TART:

- Operates at 1575 MHz (19cm)
- Low-cost, widely available
- 2.5 MHz bandwidth
- 16 millions bits per second



New Radio Front End.

- 10x bandwidth (26 MHz)
- Zero IF operation
- 1160-1290 MHz and 1525-1610 MHz bands
- New radio module, will plug into existing TARTs.

New Array Layouts





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The Calibration Sources



- Position known to millimeters
- > 20000 km away (point sources)
- Signal is 'noise-like'

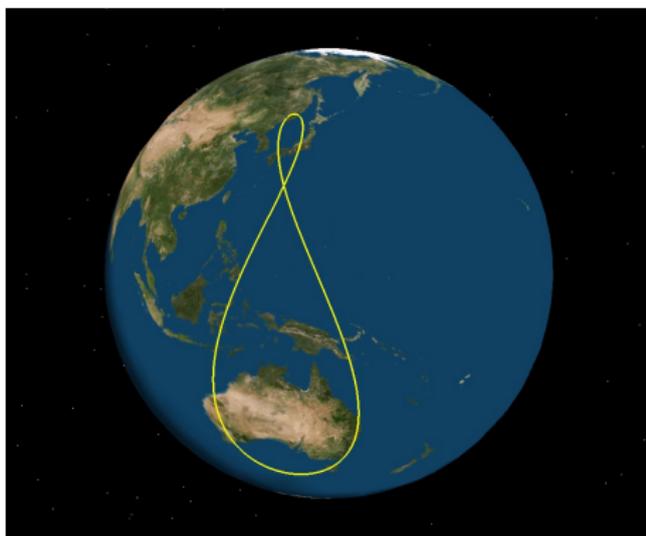


Image: JAXA



TARTVIEWER

Bel Air - Mauritius
9° 00' 29N, 47° 71W

Main Antenna 24 **Sampling Frequency** 16.368 MHz **Bandwidth** 2.500 MHz

Operating Frequency 1575.420 MHz **L1 Frequency** 1571.328 MHz **Baseband Frequency** 4.092 MHz

Acquisition Config [Login Required](#)

Save Raw Data Save Visibility Data

Number of Samples (1700) Number of Samples (1700)
2*20 (1,048,576 samples) 2*24 (16,777,216 samples)

Realtime View

Reset View

ARRAY LAYOUT

Visibility Amplitude (uncal.)

RESET ZOOM EXPORT MP3

ANTENNA GAINS & PHASES

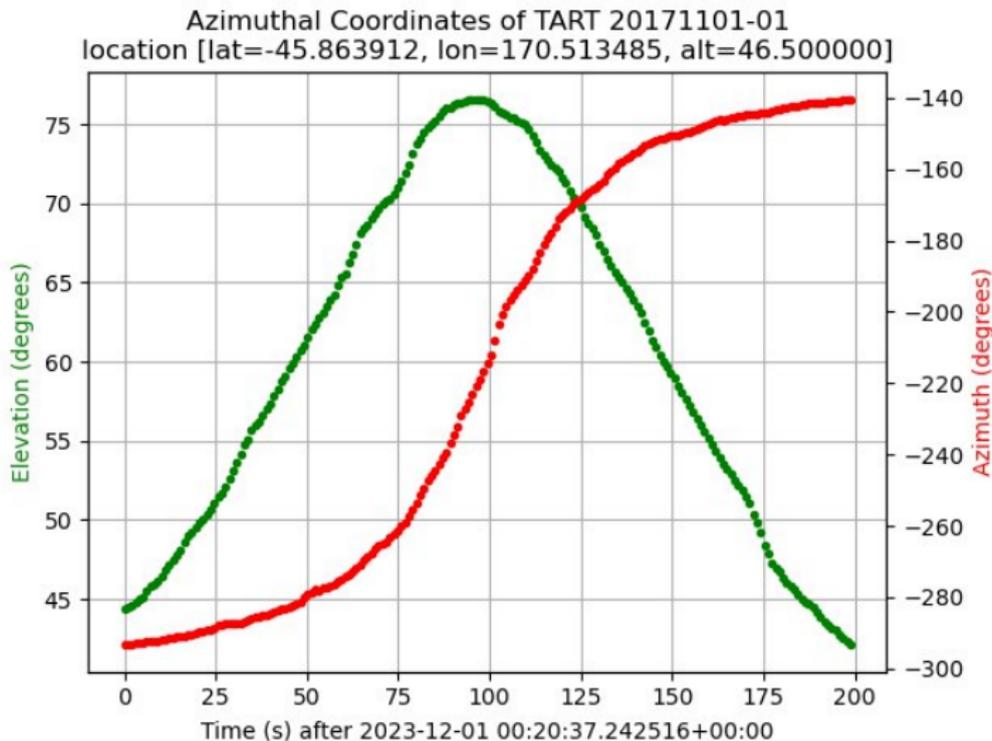
1	2.95	1.45	2.05	1.74	1.73	
8	-1.03	0.74	-1.18	0.20	0.09	
5	1.58	1.3	1.14	0.84	1.00	1.6
0	0.38	-0.08	0.1	-0.5	3.05	2.14
19	13	12	18	15	14	17

Edge Cache

VISIBILITIES RAW (BASEBAND)

- 2025-09-18T08:49:53.856581+00:00
- 2025-09-18T08:46:32.367937+00:00
- 2025-09-18T08:47:50.862549+00:00
- 2025-09-18T08:46:49.386825+00:00
- 2025-09-18T08:45:47.864847+00:00

Fast Unknown Compact Radio Sources



Consistent with something in low-earth orbit.



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Workshops: Building the TART Community



- Week-long workshop
- Mornings: Lectures on radio astronomy
- Afternoons: Building a TART
- Seed Collaborations
- Work with TART data



**BREAKTHROUGH
LISTEN**



MEERTIME



What the future holds



- TART 4.0?
- Transient event detection. Lightning, cosmic rays.
- More workshops! Bangladesh, Morocco, Malta, Oxford, Cambridge, Berkeley, Burkina Faso, Malawi, Rarotonga.
- Automatic tracking of near earth objects
- New Array Designs
- New imaging algorithms (Gridless, Direct from Data)



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Thank You!