

# News from Down Under - Auscope VLBI Project

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21.10.2024, IVTW Haystack

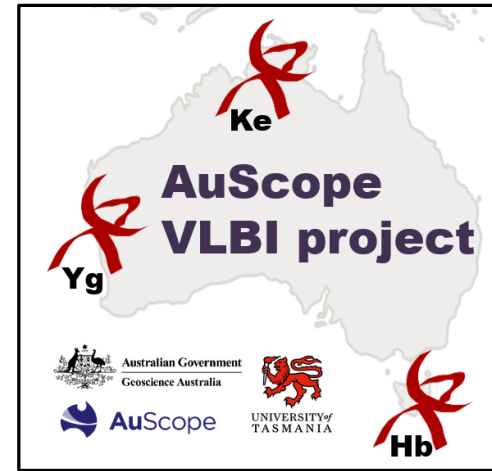


# Content

- ✧ AuScope VLBI project
- ✧ VGOS status
- ✧ Correlation & operations
- ✧ Mixed mode sessions
- ✧ Deformation survey Hobart26
- ✧ VLBI observations to satellites

# AuScope VLBI project

- ✧ funded by Geoscience Australia through the Positioning Australia project.
- ✧ 12m telescopes in Hobart (Hb), Katherine (Ke), Yarragadee (Yg).
- ✧ Equipped with VGOS systems; maintaining sensitivity at s-band allowing for (quasi-) S/X legacy observations.
- ✧ Occasional contribution from Hobart26 legacy telescope.
- ✧ Complete VLBI capability at the University of Tasmania: scheduling, observations, correlation & post-processing, basic analysis.

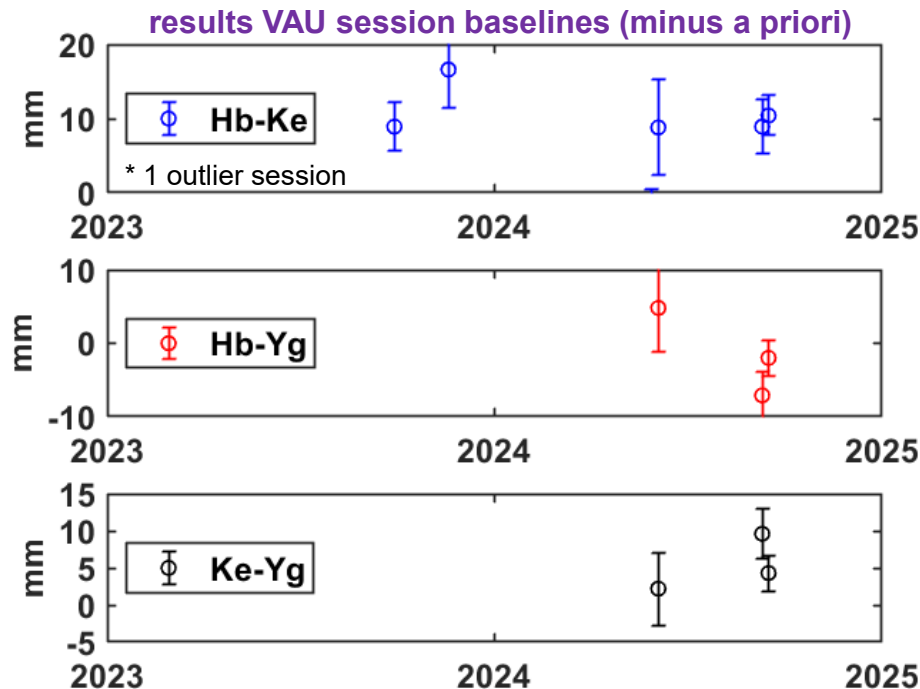


# VGOS status



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- ✖ Slow VGOS telescopes, Callisto sterling-cycle cooled receivers, SEFDs similar to S/X
- ✖ Hb and Ke in VO sessions; variable performance.
- ✖ Yg experienced a major mechanical fault earlier this month.
- ✖ Performance issues with pcal, work in progress.
- ✖ VAU sessions:
  - 6 sessions, 1-4 hrs duration, Hb-Ke (3 sess\*), Hb-Ke-Yg (3 sess)
  - alternative frequencies
  - Correlation in Hobart
  - Processing w and w/o pcal
  - rms postfit residuals ~20-30 ps

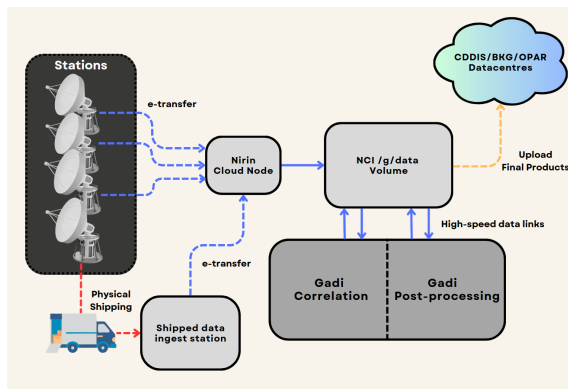


# AuScope operations



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- ✖ All telescopes are remotely operated from Hobart
- ✖ Data recording to FlexBuff system.
  - e-transfer Hb: 2-3 Gbps
  - e-transfer Yg (new in 2024): ~ 2Gbps
  - Shipping from Ke: (e-transfer expected by mid 2025)
- ✖ Correlation at Hobart, TPAC cluster or NCI/Gadi



# Mixed-mode sessions

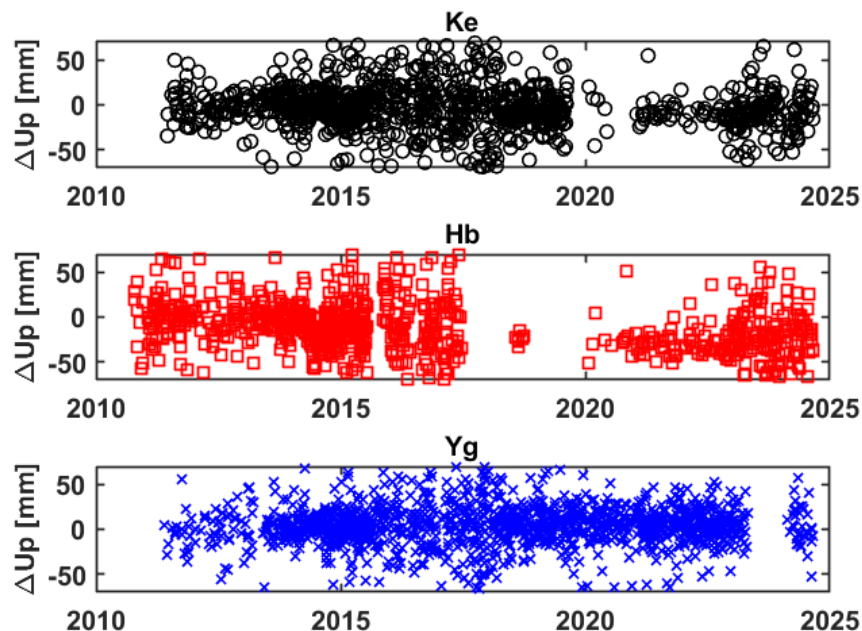
- ✂ Observe S/X legacy VLBI with the VGOS systems – ‘Australian mixed-mode’
- ✂ Developed and tested with AUM sessions (37 24hr sessions)
- ✂ Re-joined the r1/r4 sessions
- ✂ Mode also adopted for Ishioka and NyÅlesund
- ✂ Impact on EOP difficult to assess
- ✂ Definite success for continuation of station time series



## The Australian mixed-mode observing program

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# Perfecting telescope dish accuracy with UAV photogrammetry

Close range surveying with a Phase One P3 mounted on a DJI M350 enables researchers to measure imperfections in radio telescopes to 0.1 mm, so they can calibrate their measurements and achieve greater accuracy.

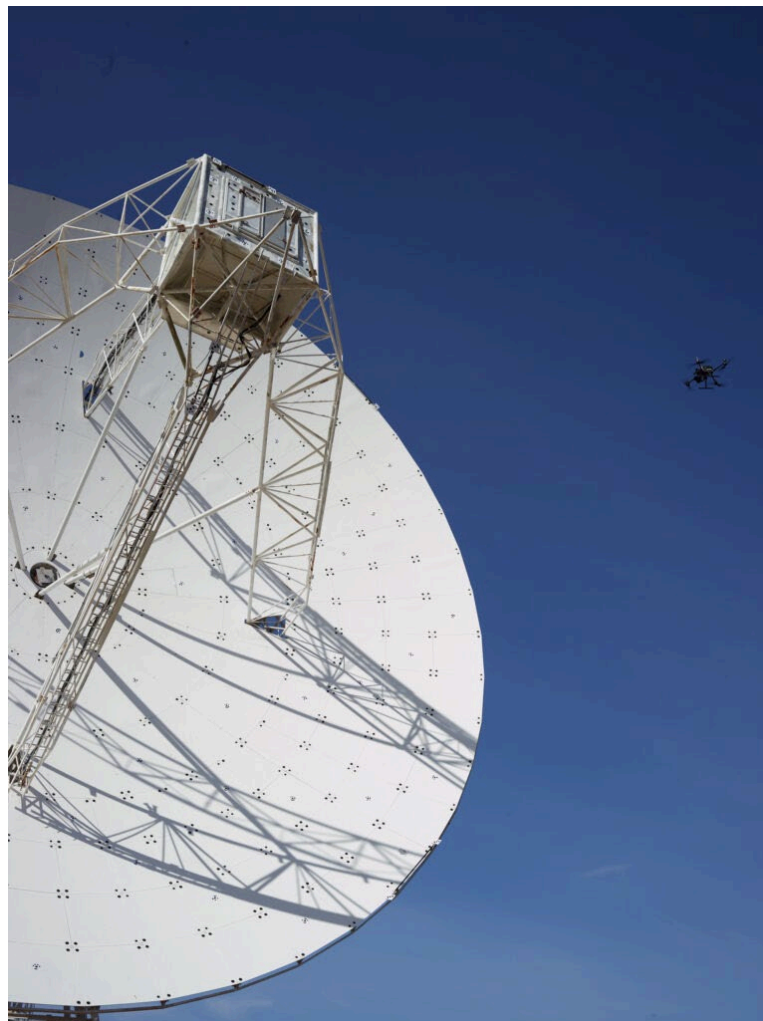
## Hobart 26m dish survey



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- ✖ UAV photogrammetry of Hobart 26
- ✖ Expert team from Germany
- ✖ Local pilots
- ✖ Camera from PhaseOne

**Team: Cornelia Eschelbach, Michael Lösler, Ansgar Greiwe, Boye Zhou**



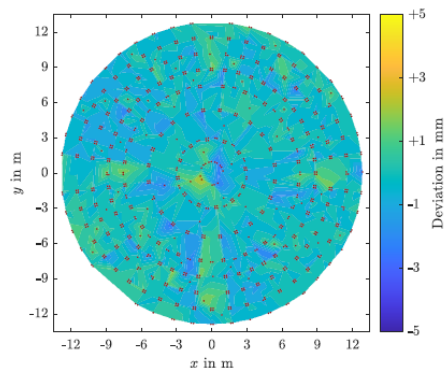
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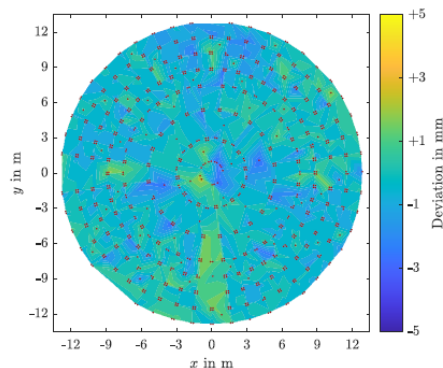
# Hobart 26m dish survey - results



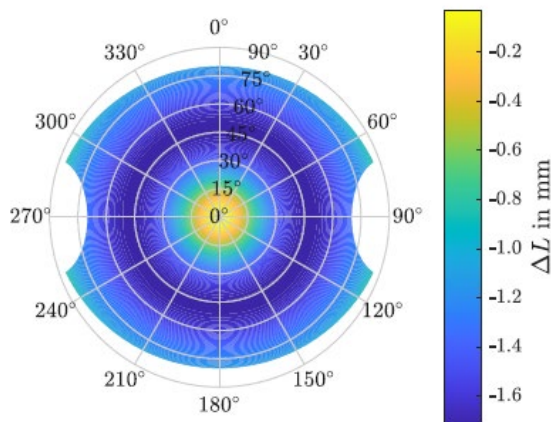
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(c) Zernike approach:  $r_x = 0^\circ$ ,  $r_y = 0^\circ$

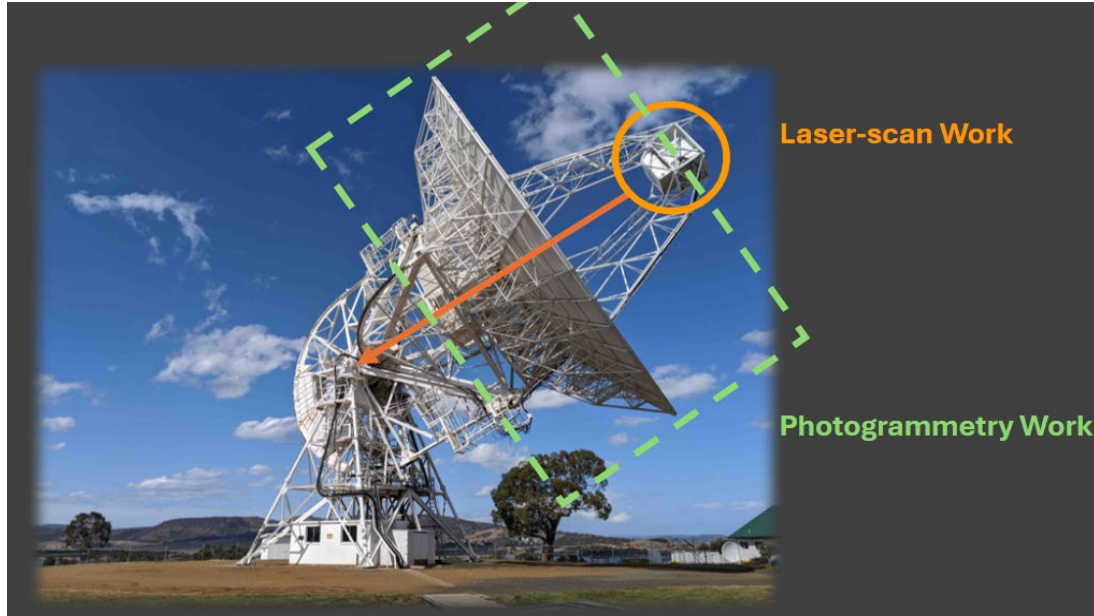


(d) Zernike approach:  $r_x = 80^\circ$ ,  $r_y = -70^\circ$



- ✖ This dish is surprisingly stable
- ✖ Change in focal length <3mm
- ✖ Movement of receiver box (up to 2cm)
- ✖ Total delay change <2mm
- ✖ Publication and model currently under review
- ✖ *Special thanks to **Brian Corey** for finding information about the illumination function*

## Hobart 26m dish survey – part 2



- ✖ Dish deformation & path length variation- part 1
- ✖ A stable reference point IVP (invariant point) – part 2
- ✖ *What if the 8.1901m axis offset changes with telescope position?*

# Hobart 26m dish survey – part 2



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## Results – Point Cloud of 2+ billion points!

### Key Statistics

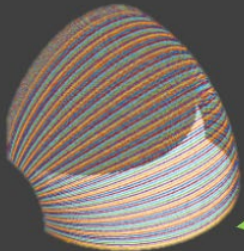
Average Target Error: **3.7 mm**

Merged Bundle Error: **6.3 mm**

### Key Thing to Consider

How to relate the  
measurements to a model?

Theoretical

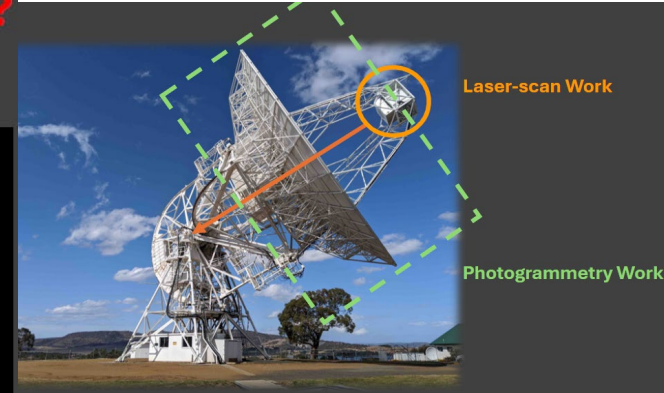
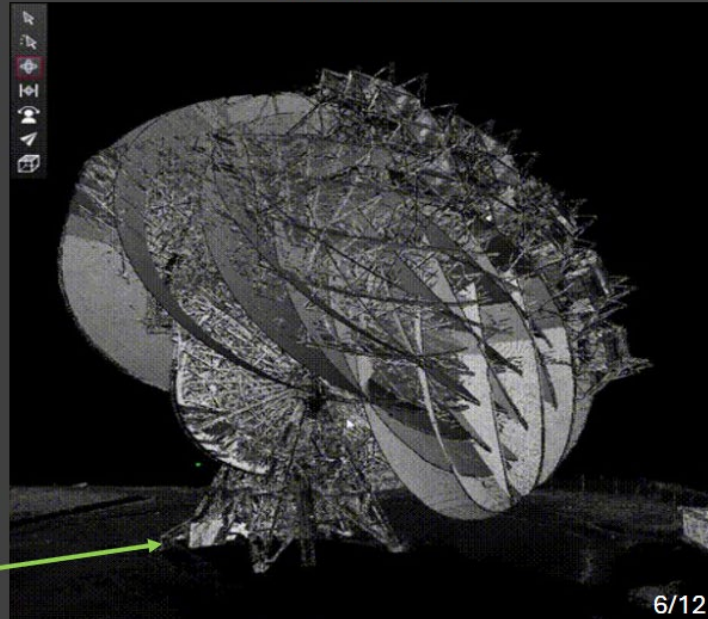


Echidna



?

Observational



Work in progress ...

# VLBI observations to satellites

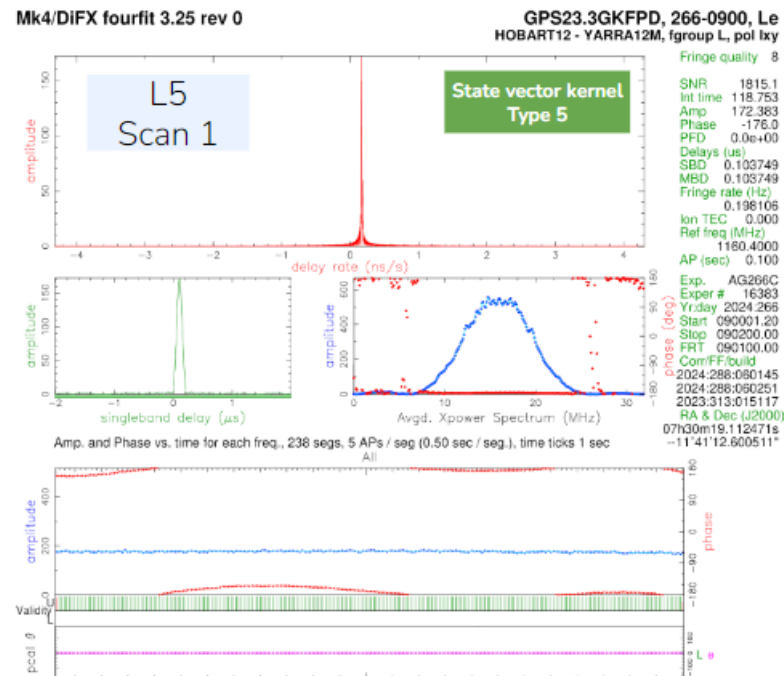


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- Some recent simulation and Genesis visibility studies
- Re-commenced actual observations
  - S-band signal from the NAVIC-IRNSS system (visible from Yg and Ke)
  - L-band sensitivity in L1, L2 and L5 from the whole AuScope array
- Working on entire observing-correlation-processing-analysis chain
- Work towards supporting the Genesis mission







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**Thank you**