



VIENNA UNIVERSITY OF TECHNOLOGY
DEPARTMENT OF GEODESY
AND GEOINFORMATION



UNIVERSITY *of*
TASMANIA

OBSERVING WITH SIBLING AND TWIN TELESCOPES

Lucia Plank¹ ▪ Jim Lovell¹ ▪ Jamie McCallum¹ ▪ David Mayer²

¹ University of Tasmania, Australia

² Technische Universität Wien, Austria

FWF Der Wissenschaftsfonds.
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SIBLING VERSUS TWIN



- Co-located legacy and VGOS antennas
- Large & slow vs. small and fast



- Two VGOS antennas
- Identical capabilities

MOTIVATION

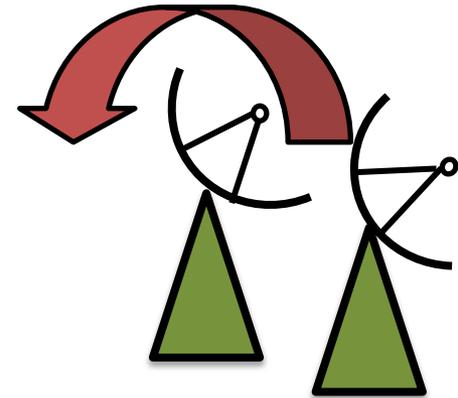
- VGOS-twins are built
 - (e.g. Wettzell, Onsala, NyÅlesund)

- VGOS antennas are often co-located with a legacy-antenna
 - HartRAO, Hobart, Yebes, Wettzell, Kashima, etc.
 - Local tie, overlapping period
 - Legacy needed to maintain the ICRF

- How to schedule and observe?

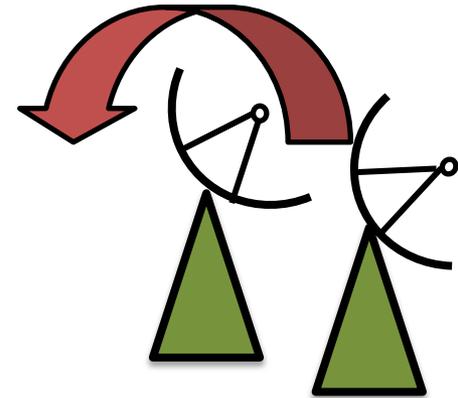
WHY TWINS?

- One observes, one slews



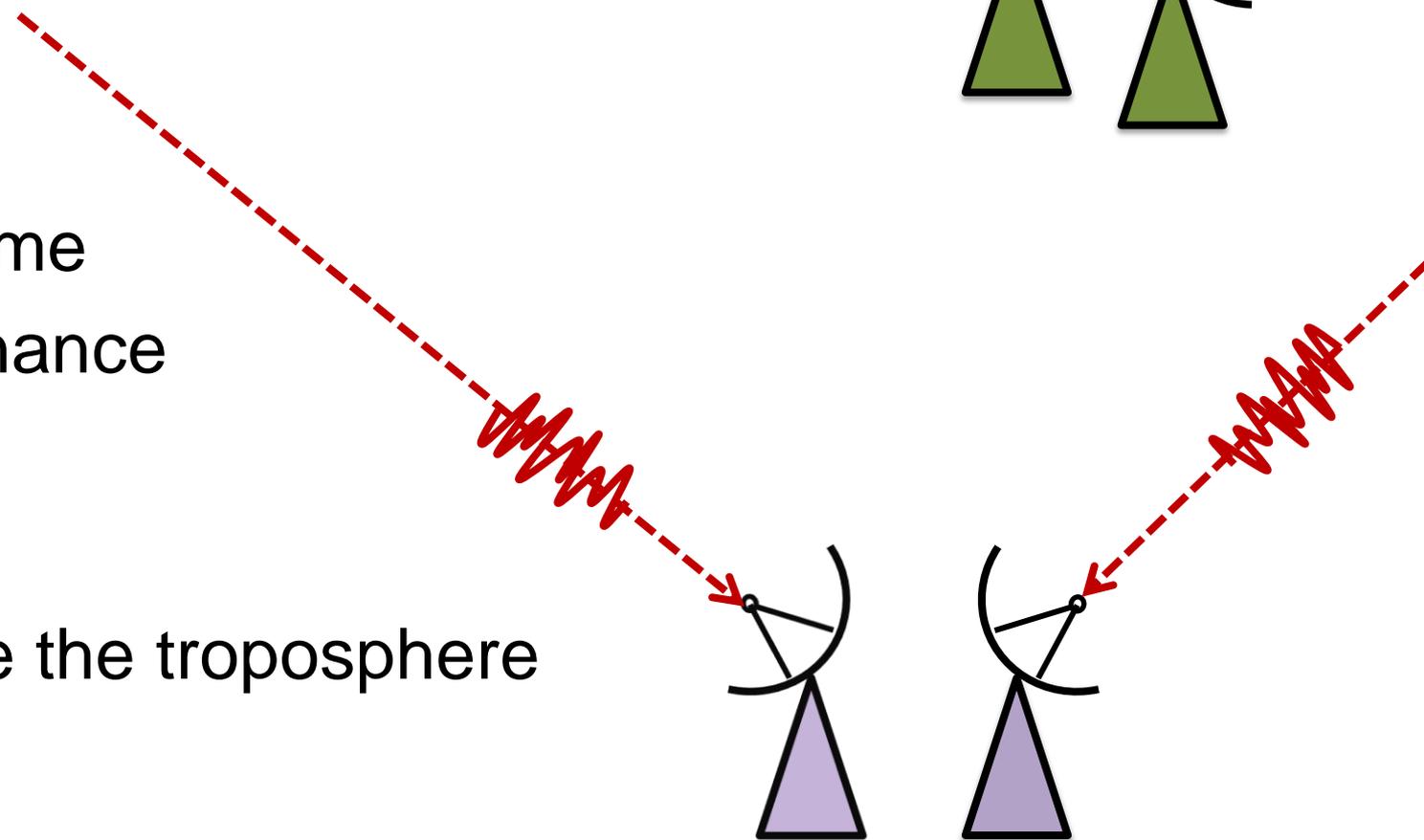
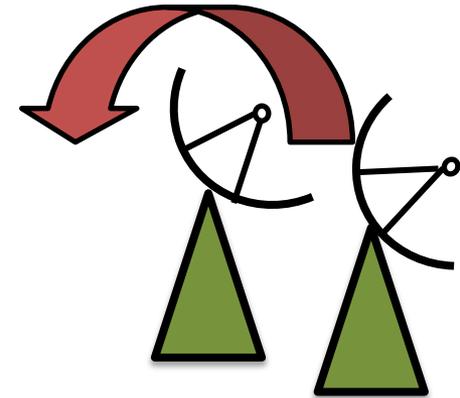
WHY TWINS?

- One observes, one slews
- Overcome maintenance



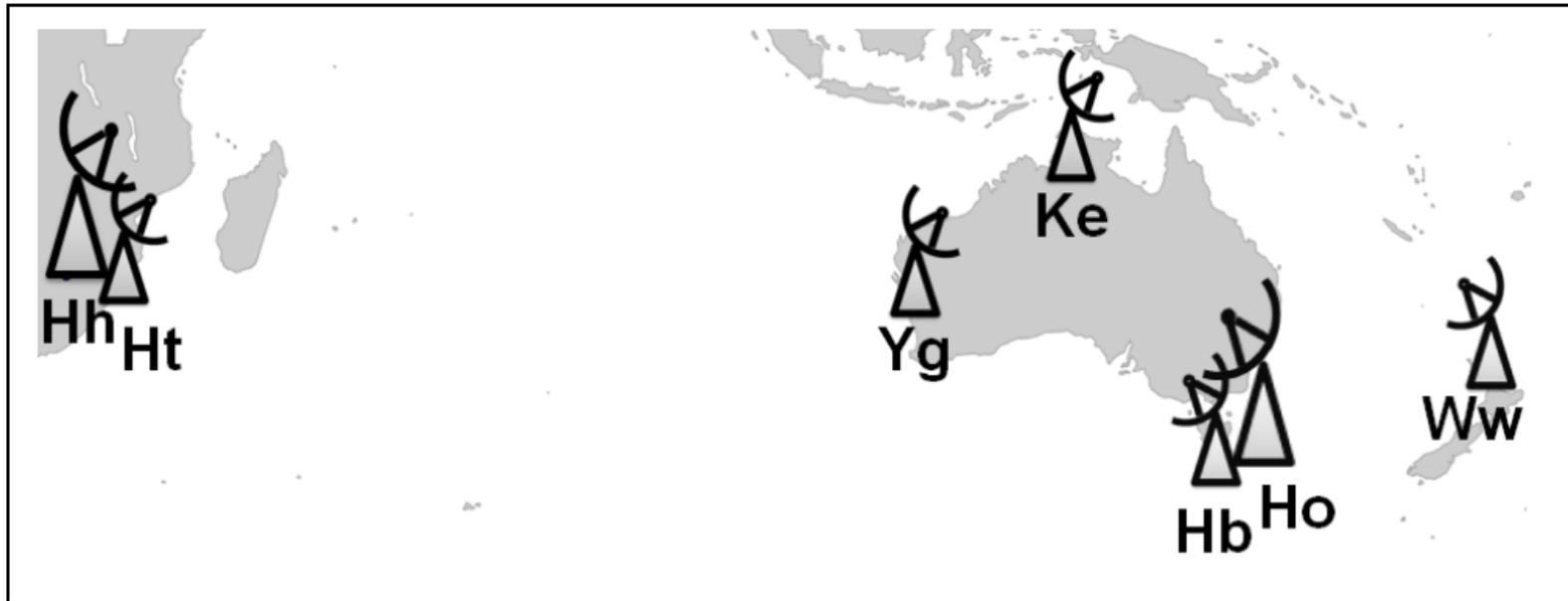
WHY TWINS?

- One observes, one slews
- Overcome maintenance
- Resolve the troposphere



AUSTRAL NETWORK

- 12(15)m identical small antennas + 2 legacy
- Common S/X legacy receiving system



SCHEDULING - THEORY

- Scan length
 - < for large antennas

$$\left(\frac{\text{target SNR}}{\text{source flux}} \right)^2 \times \left(\frac{\text{sensitivity ant1 * ant2}}{\text{recording bandwidth}} \right)$$

- Slew times
 - < for small antennas

- Scheduling strategy
 - sky coverage
 - # of scans
 - special sources

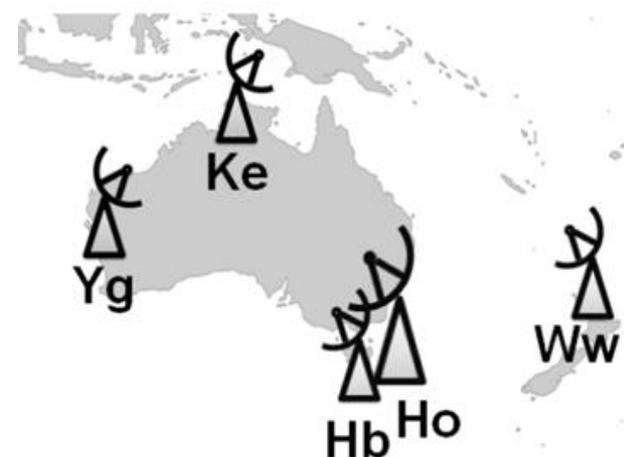
- VieVS (Vienna VLBI Software)
 - Sun, 2013



AUSCOPE NETWORK

- AUSTRAL mode (1Gbps)

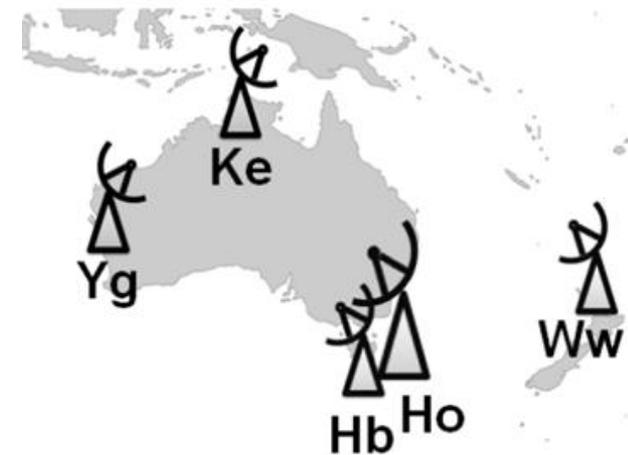
# scans/h	AuScope	Ho
HbKeWwYg	37	-
+ Ho	24 (45% idle)	23



AUSCOPE NETWORK

- AUSTRAL mode (1Gbps)

# scans/h	AuScope	Ho
HbKeWwYg	37	-
+ Ho	24 (45% idle)	23
+ Ho new mode	37	16

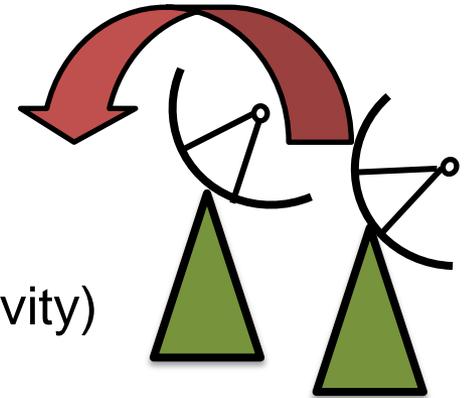


- New tag-along mode

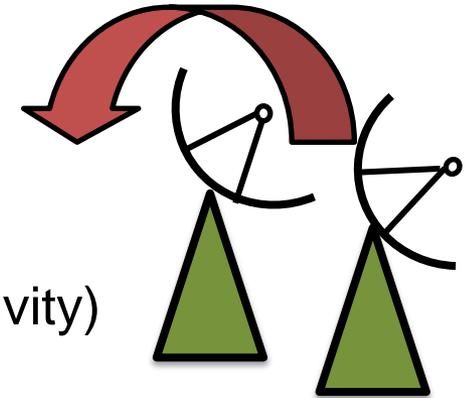
- Do not wait for Ho when determining start time
 - Better than „tag-along“, as Ho is still included in optimisation criteria

TWIN MODE

- Hb-Ho twin
- Maintain individual capabilities (slew speeds, sensitivity)
- Antenna with shorter slewing observes the scan
- Now implemented in VieVS



TWIN MODE



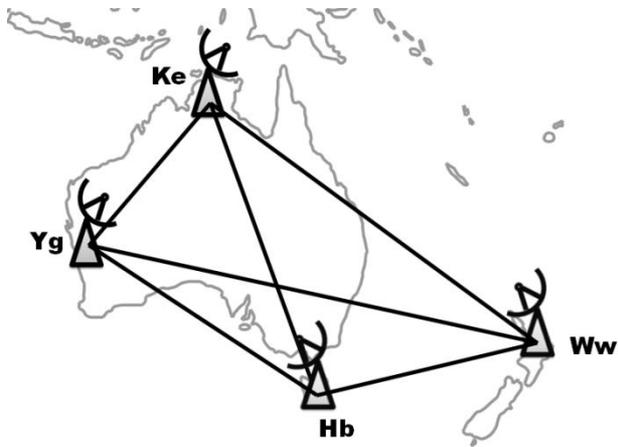
- Hb-Ho twin
- Maintain individual capabilities (slew speeds, sensitivity)
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- No use in network of identical antennas (AUSTRAL)
- Tested for VGOS network
 - Full VGOS speeds for Ke, Yg (12° & $6^\circ/s$ in az & el)
 - Actual speeds for Hb & Ho (5° & $1.25^\circ/s$)
- Twin mode can compensate for slower antenna

# scans/h	AuScope
3 slow	49
3 fast	58
2 fast + Hb	51
2 fast + Hb + Ho	58

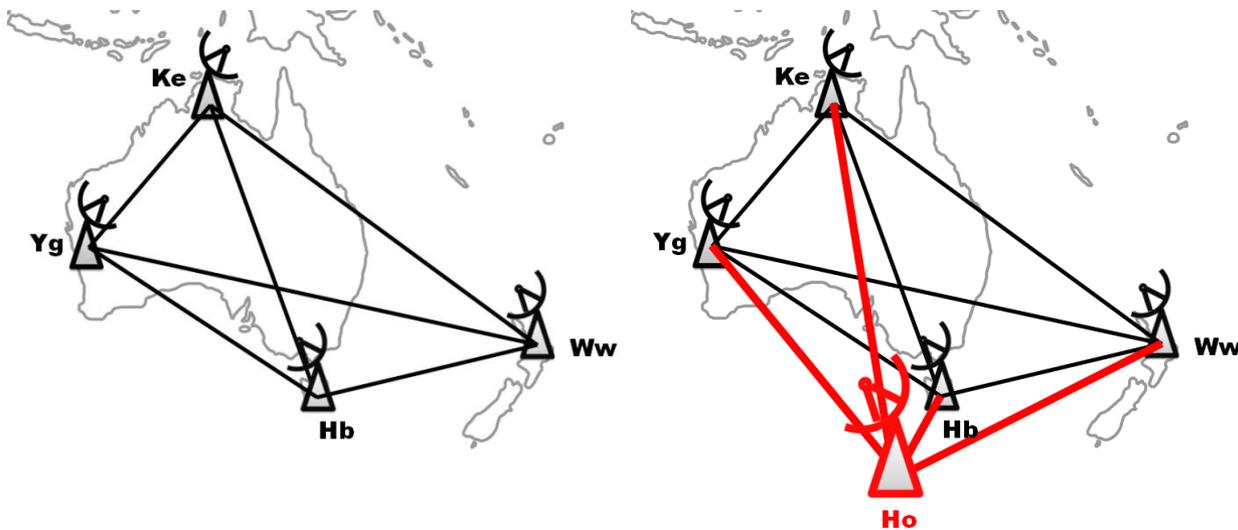
ASTRO MODE

- Idea: Use the higher sensitivity of Ho to observe weak sources



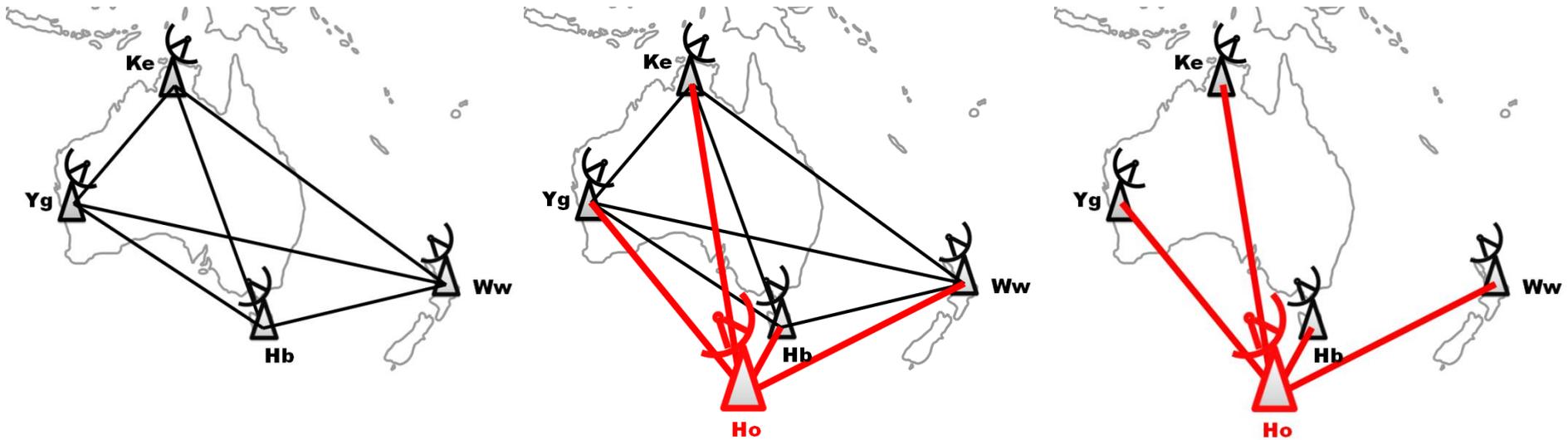
ASTRO MODE

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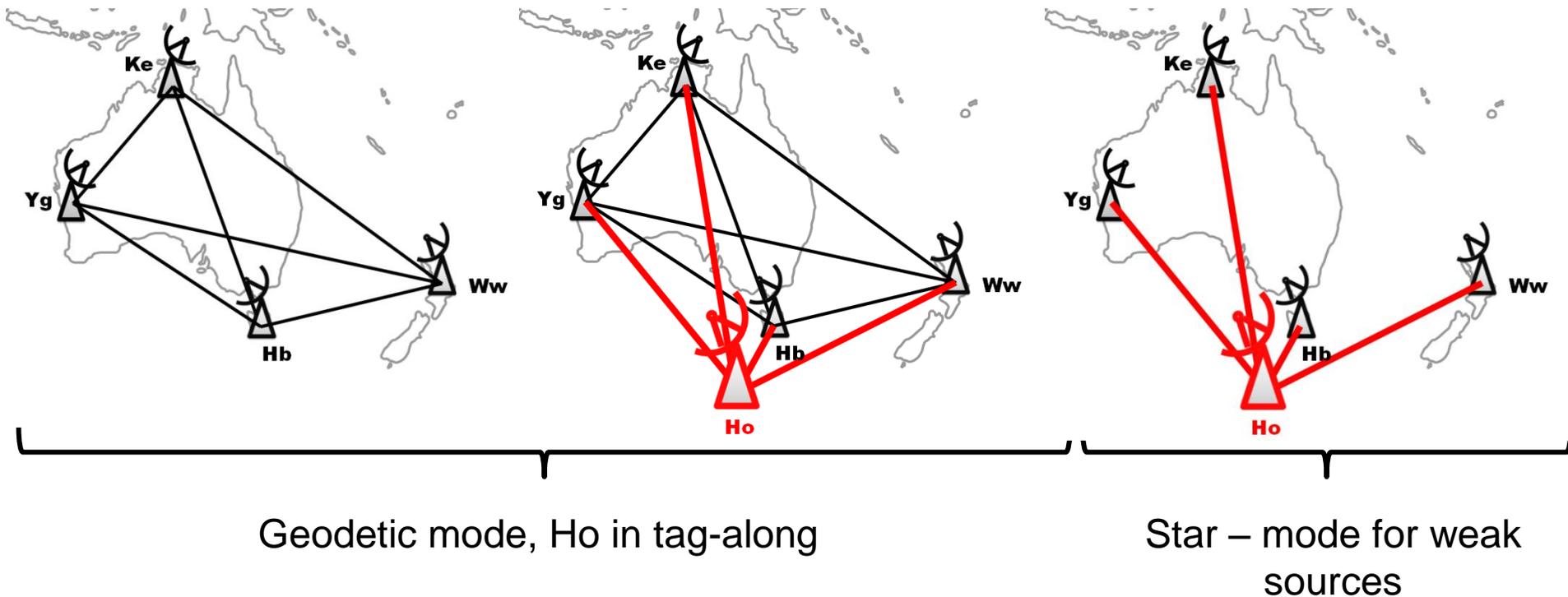
ASTRO MODE

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ASTRO MODE

- Idea: Use the higher sensitivity of Ho to observe weak sources



AUA009

- Observed on Feb23
- HbKeWwYg+Ho
- List of 7 weak sources
 - scanlengths of 20-60 min (or more)
reduced 1-10 min
- Geodetic mode with 12m, Ho in tag-along
- Every 13th scan to special source

	X	S
0244-470	0.4	0.25
0212-620	0.4	0.3
0758-737	0.15	0.20
0918-534	0.16	0.5
1334-649	0.2	0.2
1941-554	0.2	0.2
2333-528	0.4	1.0

# scans	AuScope	Ho	Special sources
aug009	34 / h	12 / h	~10 / 24h

- Sky-coverage for Ho not considered yet
- Semi-automated

SUMMARY



- **New observing modes** for twin and sibling telescopes **were implemented in VieVS.**
 - New tag-along
 - Twin mode
 - Astro-mode
- New **ASTRO mode** allows for astrometric usage of AUSTRAL sessions.



SUMMARY



- **New observing modes** for twin and sibling telescopes **were implemented in VieVS**.
 - New tag-along
 - Twin mode
 - Astro-mode
- New **ASTRO mode** allows for astrometric usage of AUSTRAL sessions.

OUTLOOK

- Future work will concentrate on **tie-mode**, i.e. how to observe to measure the local tie with VLBI. → connect with **simulations**
- Treatment of multiple twin/sibling telescopes.



THANK YOU FOR YOUR ATTENTION!

