Extending the u,v capabilities of VLTI

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Context

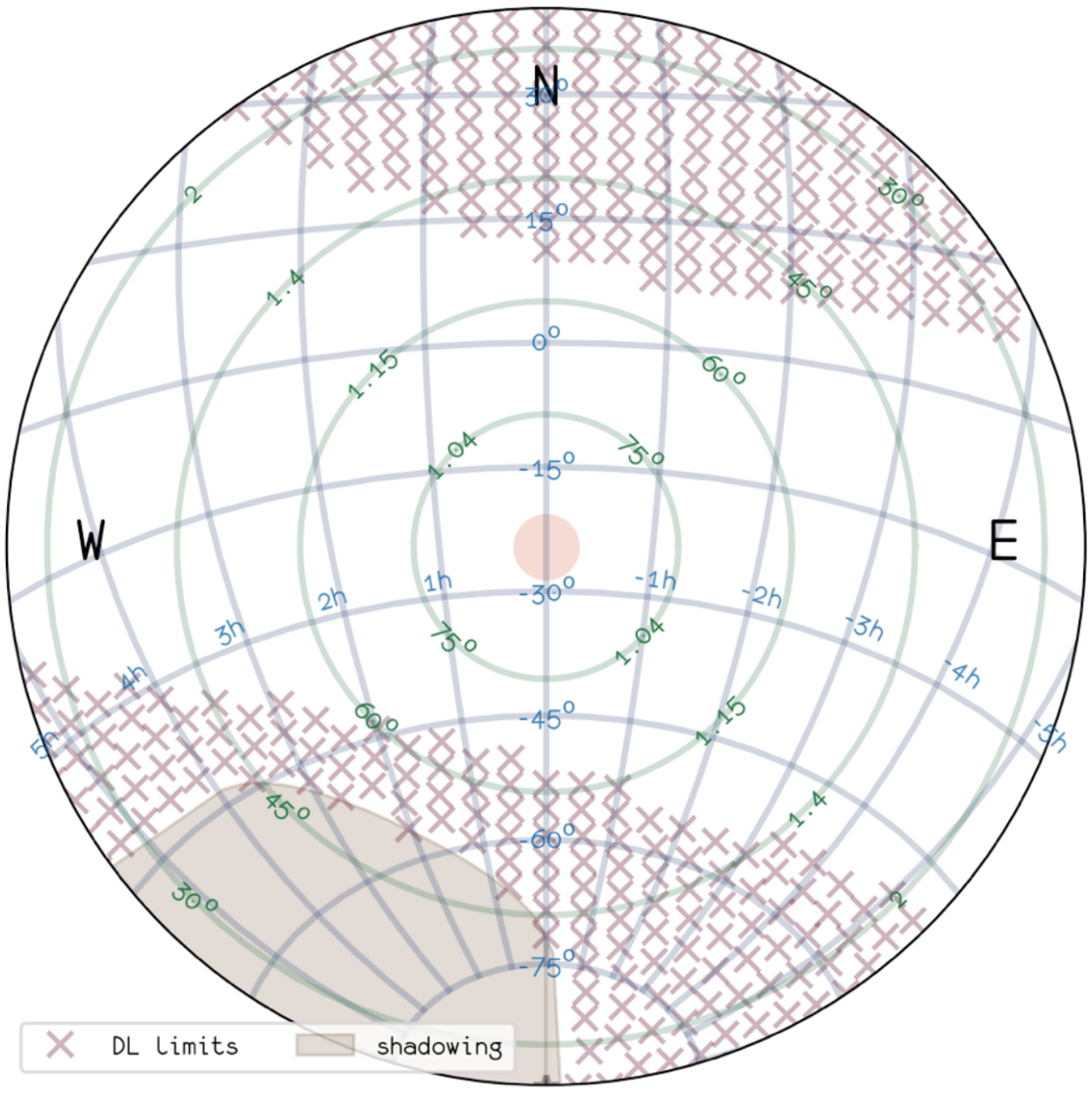
- VLTI AT maximum offered baseline is 132m, only 65% of the maximum possible (202m)

- VLTI imaging capability rely on offering several configurations and relocating from one to another

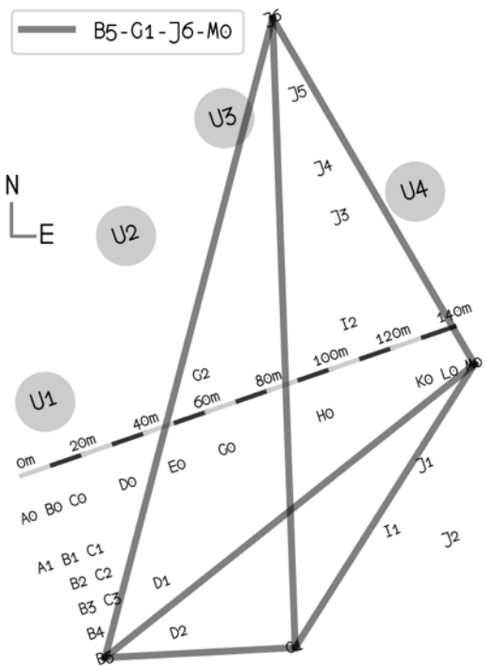
- How to support the best imaging capability 4T deserve?

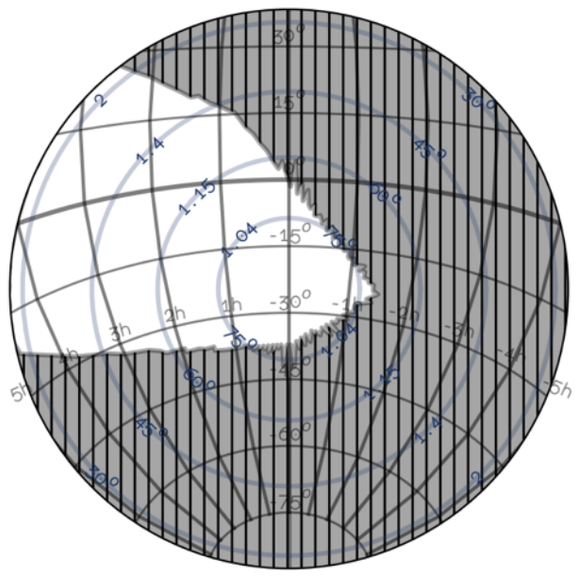
The long-running story

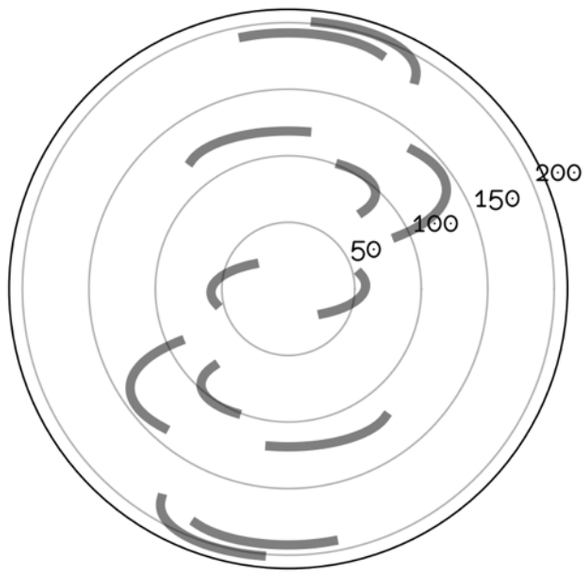
- The 202m baseline (B5-J6) is not offered
- prior to AT-STS installation, the field of view was <<1” due to insufficient pupil re-imaging capability
- the sky coverage is poor (-50<dec<5)

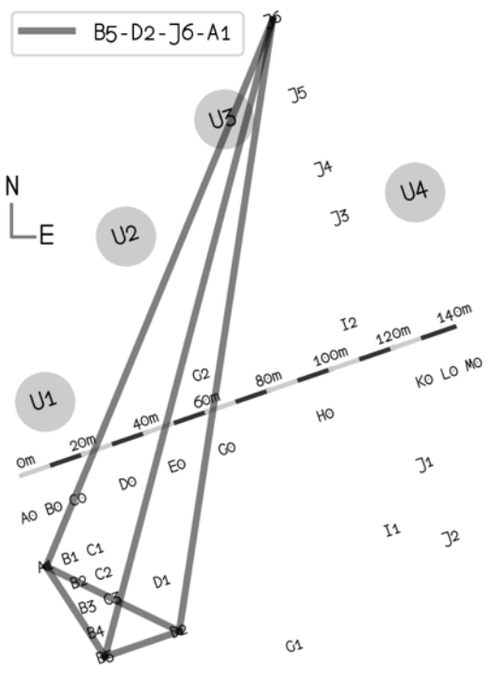


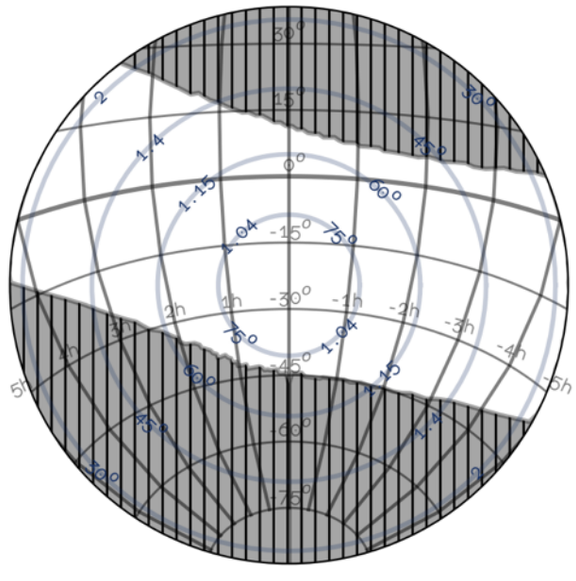
Unpractical for quadruplets

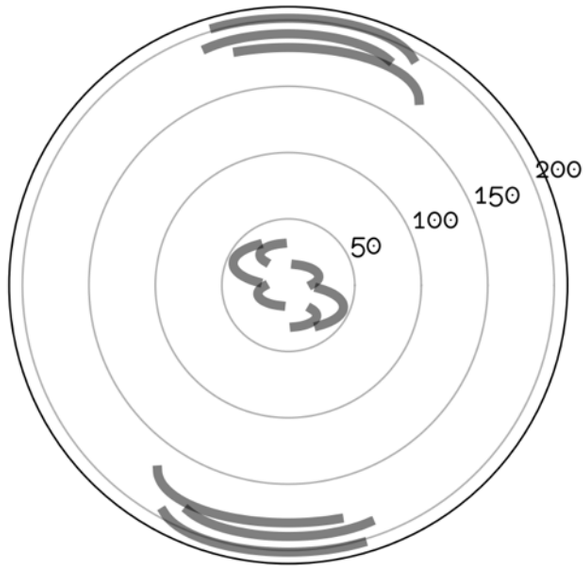






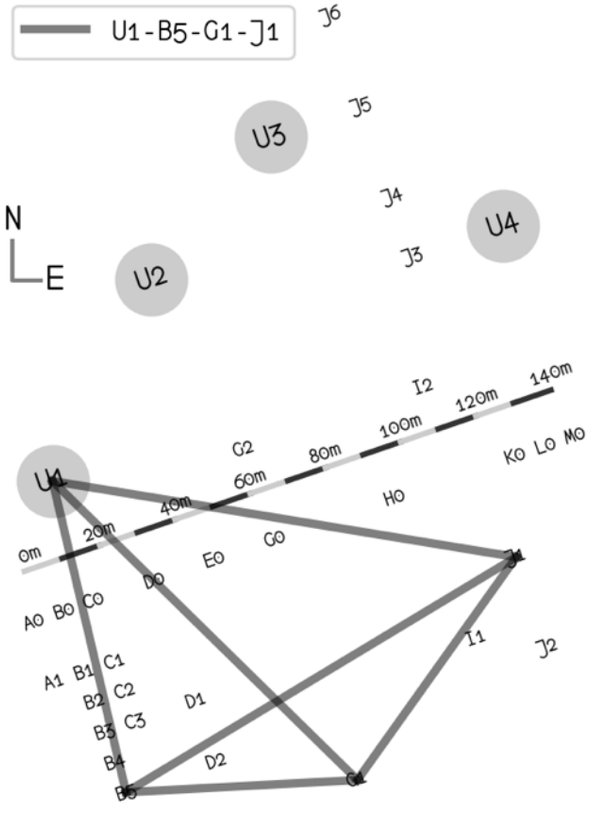


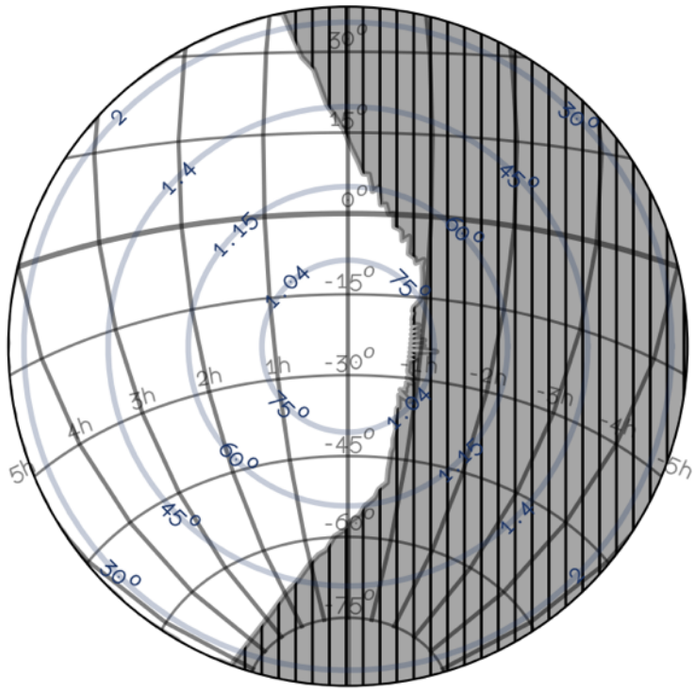


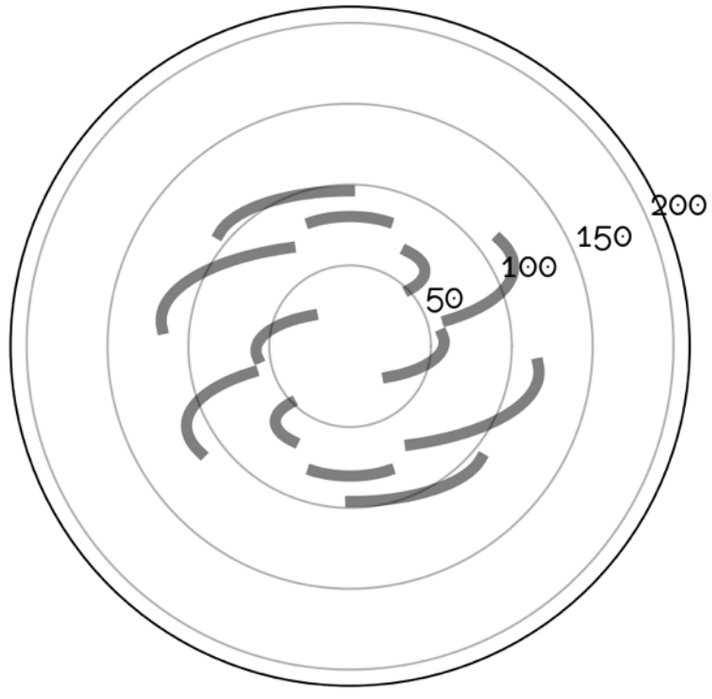


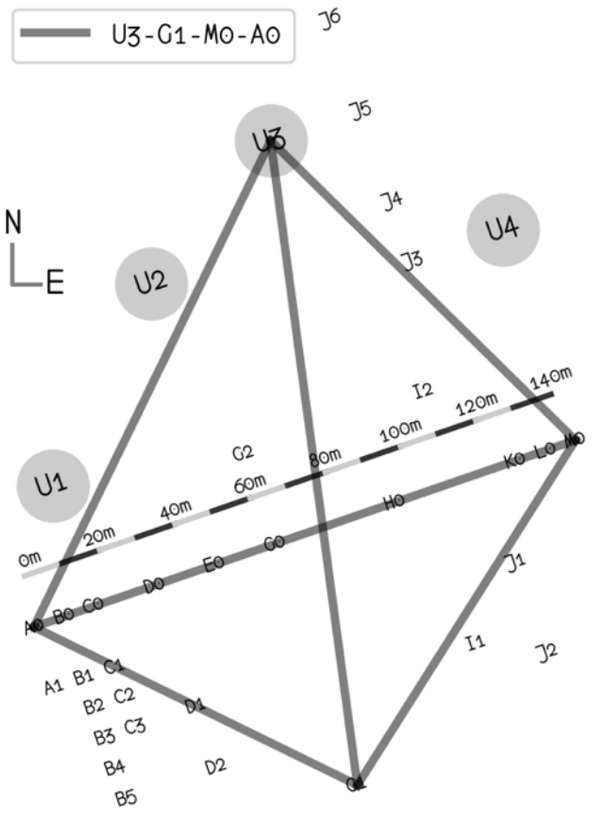
UT-AT combination

- Can be used to increase u,v coverage of faint objects
- 6T combination without new telescopes
- Was done twice successfully using MIDI
- Strong issues with polarisation
- … Poor sky coverage because UT are much higher than ATs (additional OPL)


U1-B5-G1-J1
J6
J5
U3
J4
U4
J3
N
E
U2
I2
140m
120m
100m
80m
G2
60m
40m
20m
0m
U1
Ko Lo Mo
Ho
Go
Eo
Do
Ao Bo Co
A1 B1 C1
B2 C2
B3 C3
B4
B5
D1
D2
J1
I1
J2


sky shadowing
30°
15°
0°
-15°
-30°
-45°
-60°
-75°
45°
60°
75°
90°
1.4
1.15
1.04
2
1h
2h
3h
4h
5h


[u,v], dec=-24.0
50
100
150
200


U1-G1-M0-A0
J6
J5
U3
J4
U4
J3
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U2
I2
140m
120m
100m
80m
G2
60m
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Go
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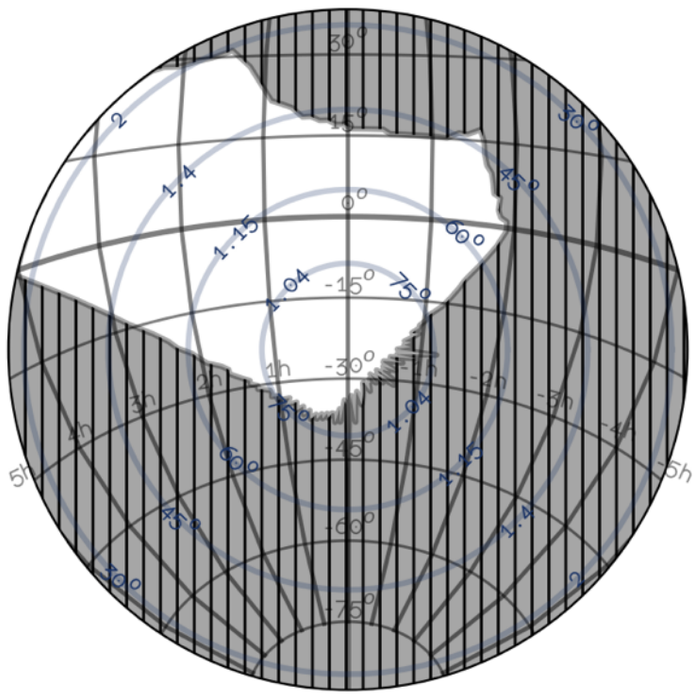
B4
B5
D1
D2
J1
I1
J2


sky shadowing
30°
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2
1h
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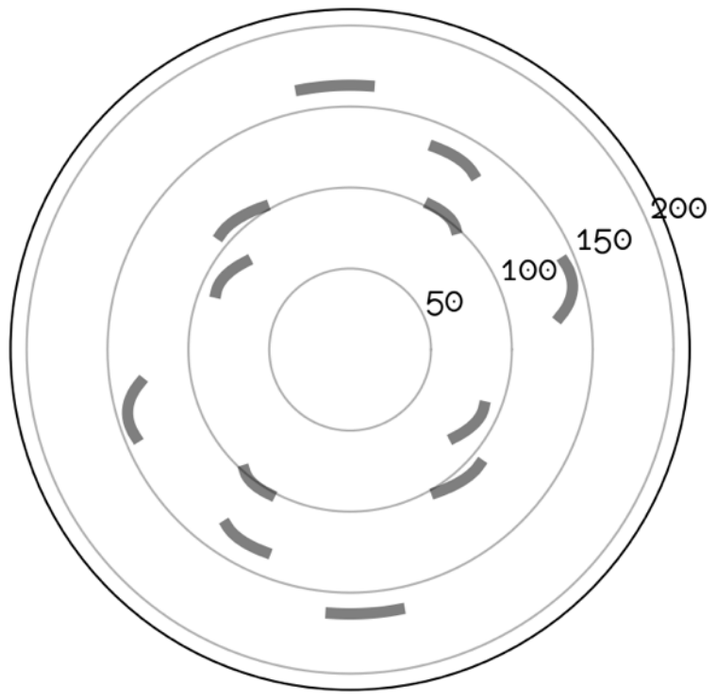
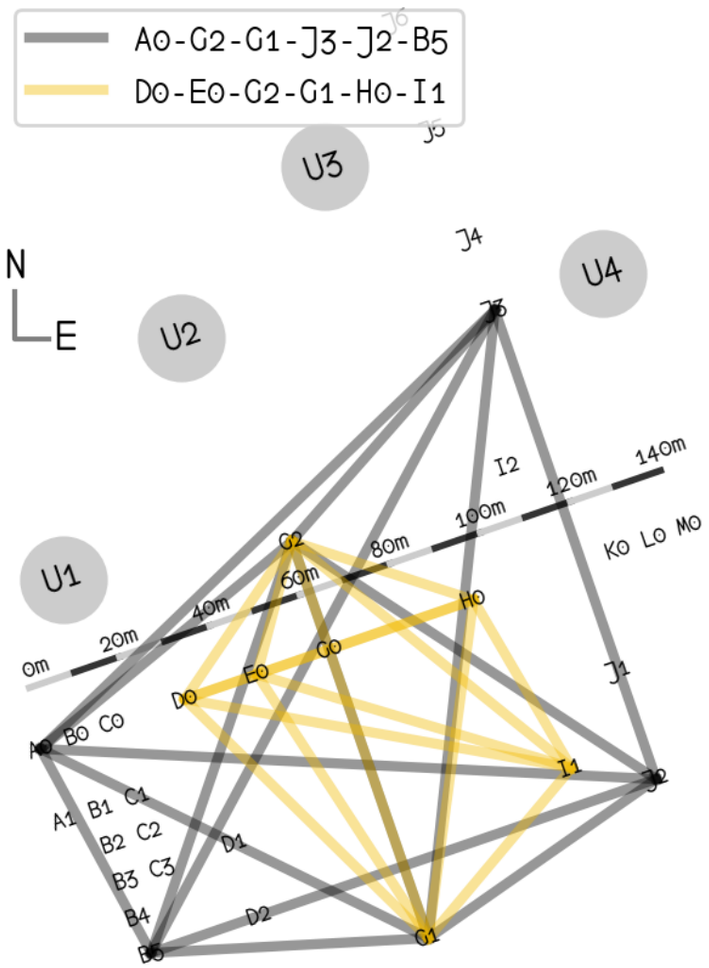
3h
4h
5h

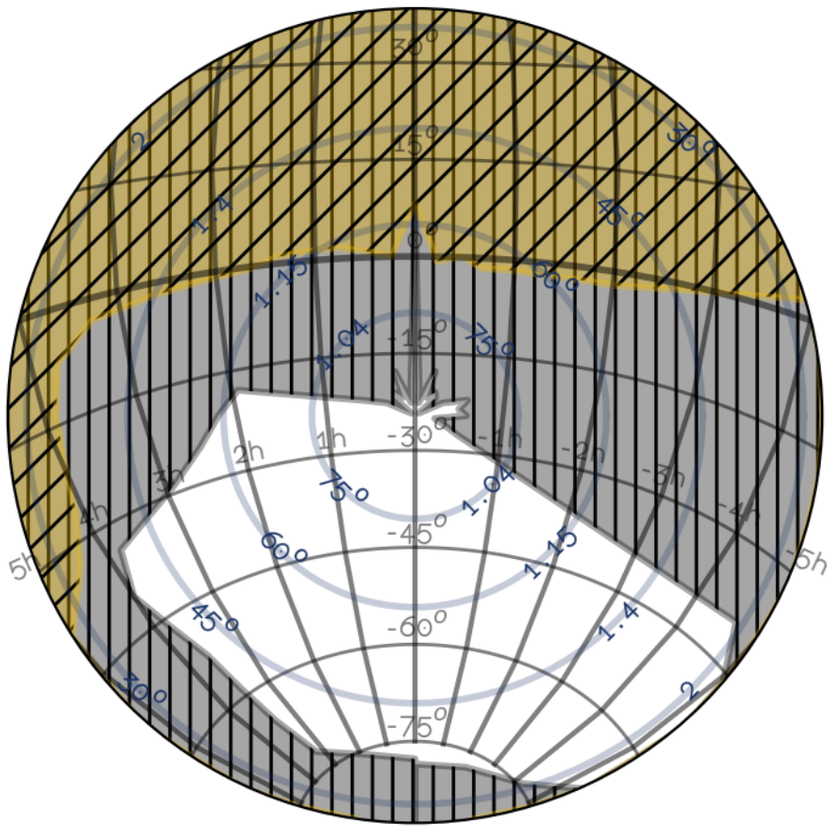

[u,v], dec=-24.0
50
100
150
200

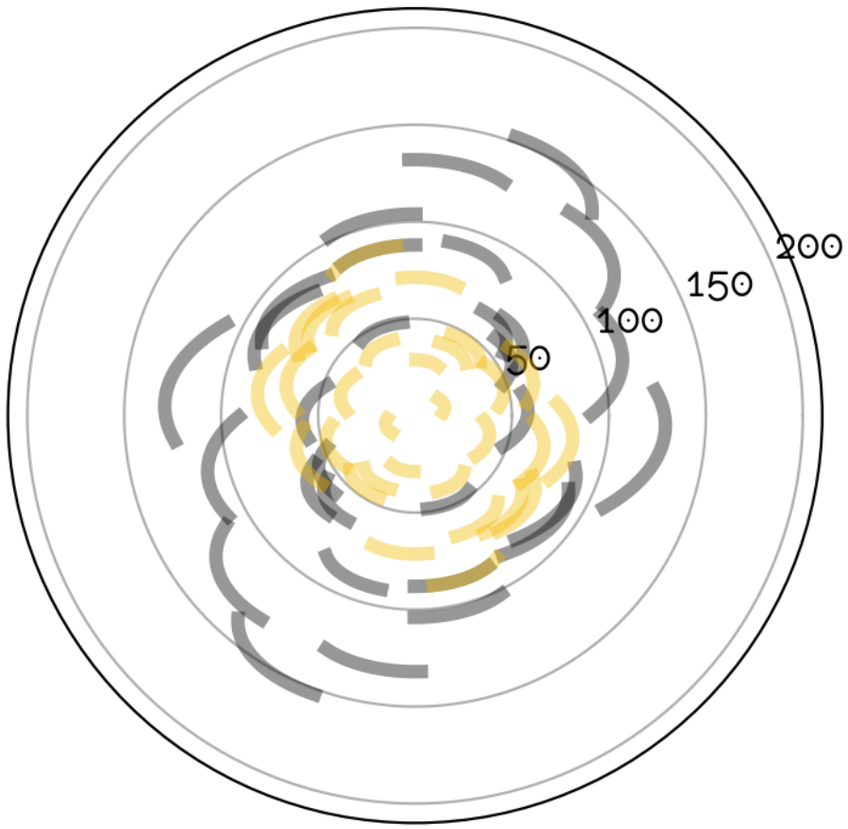
Adding new ATs

- 6 ATs would offer more flexibility for 4T instruments
- We already have 6 DL: 4 for West telescopes, 2 for East
- 6T offers 2.5x more information
- New ATs could be **non-relocatable** to lower cost (but would require modification of the station)
- Cost yet to estimate

Sky coverage







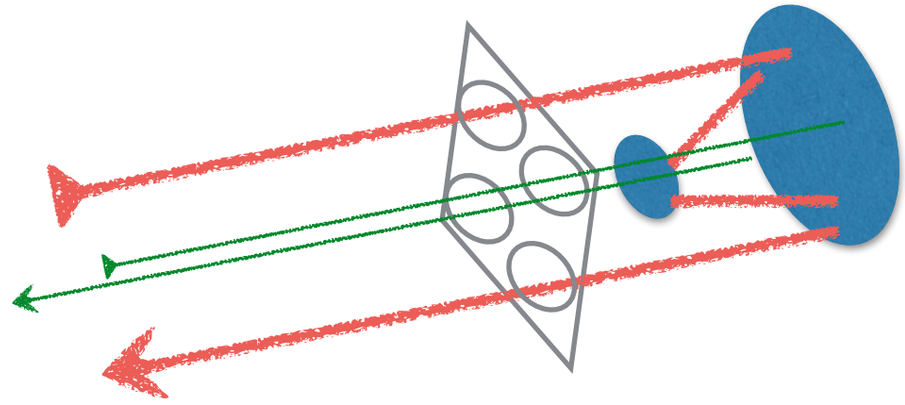
4T in west and 2T in east is a strong limitation here

Perspective

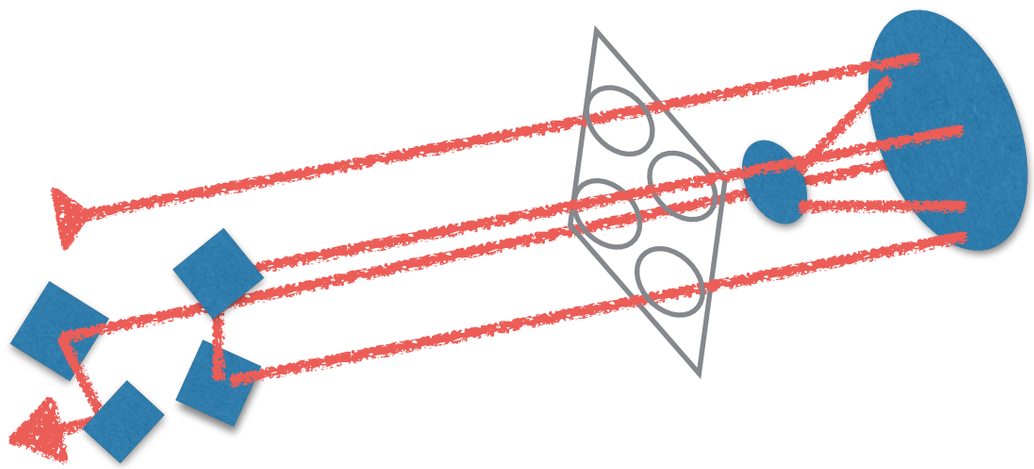
- We operate close to optimally within constraints
- Most (all) ideas seem to have limited usability
- The main limitation is **sky coverage**, i.e. delay line stroke

Extend DL stroke?

- The VLTI line can accommodate 2 beams
- This is inherited from PRIMA and its dual field capability

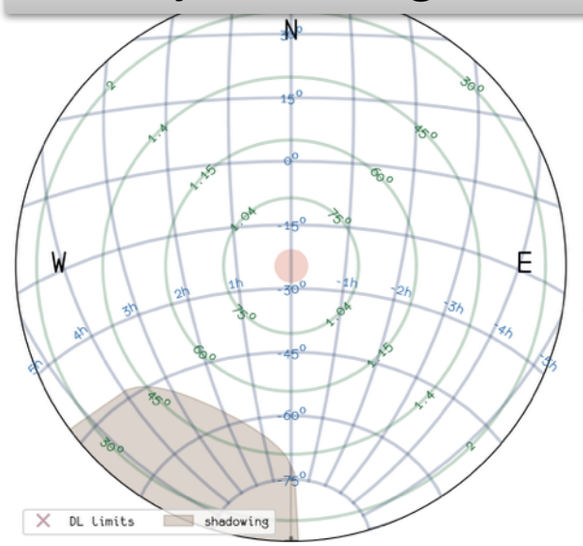


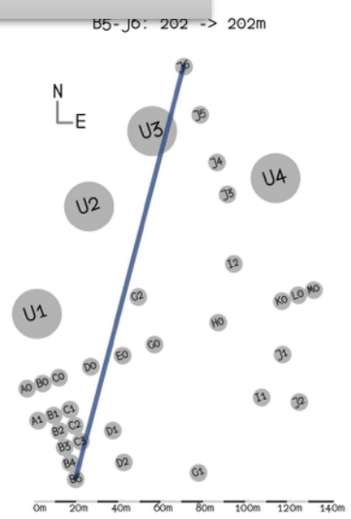
- The second beam could be used to fold the first
- This **doubles the stroke**
- …at the cost of 7 additional reflections



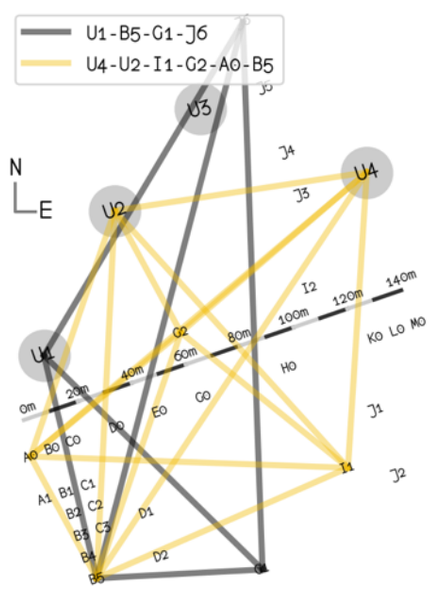
What 200m stroke gets us

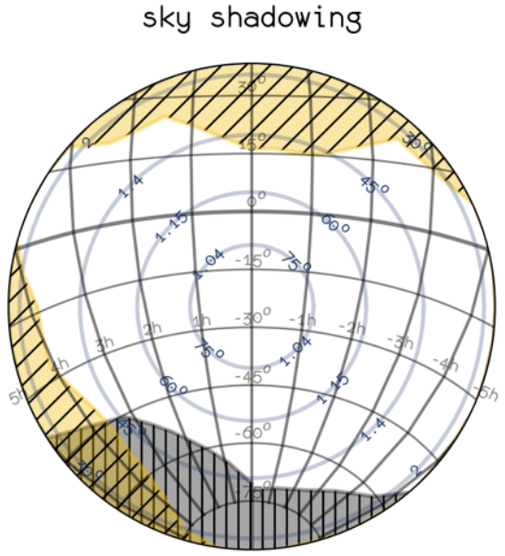
full sky coverage with B5-J6

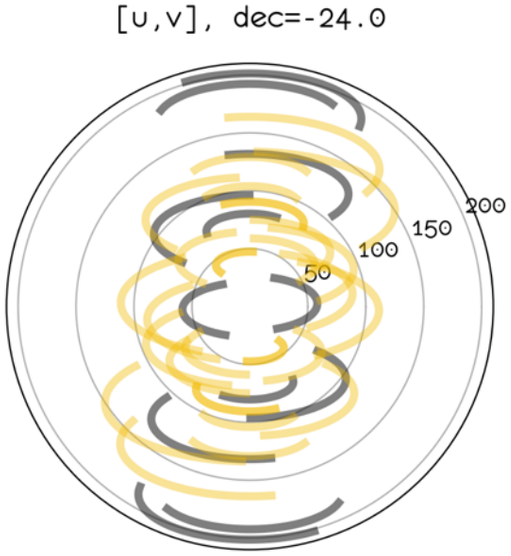




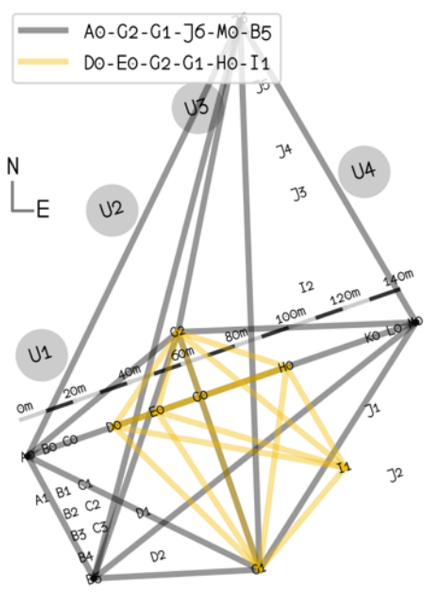
AT+UT becomes realistic

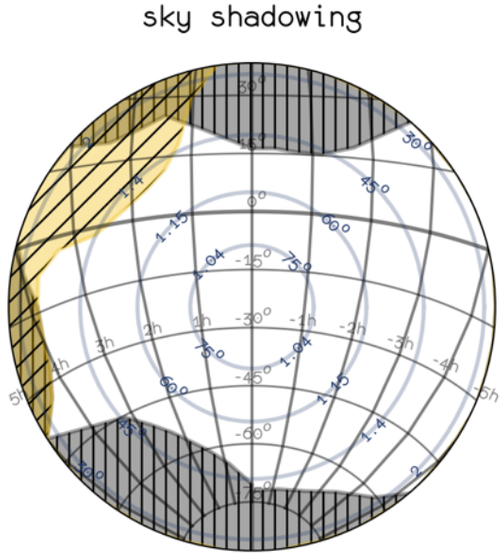


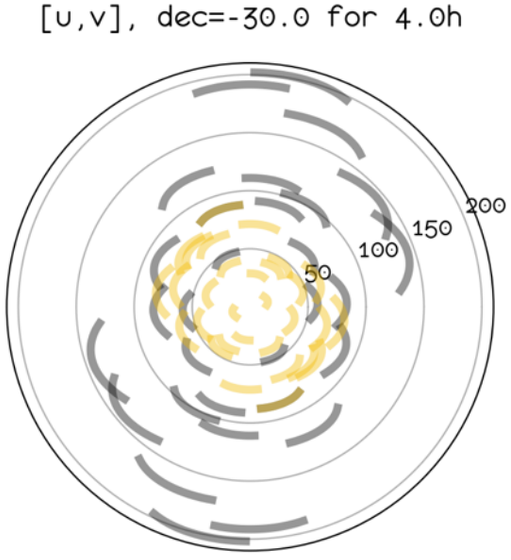




6AT becomes realistic







B~250m
are practical
(if new AT stations
are added)

Conclusions

- Additional telescopes will come at a cost: new telescopes design? modified station? new delay lines?

- Any array extension should start by doubling the stroke of DL

- The current array benefits from doubling the stroke: 202m baseline, AT+UT

- Operation scheme offer the cheapest opportunities to offer imaging capability (u,v diversity)