VLTI Horizons -- JMMC

Conference Aims

- Discover the next big ESO project post ELT
- Present currently impossible science cases
- Present what facilities would be needed

Science Cases

Topic

- **Universe origin**
  - Distance ladder calibration
  - Stellar evolution, IMF
  - SMBH masses, galaxy evolution
- **Life Origins**
  - ISM
  - YSOs
  - Exoplanet spectroscopy
  - Exomoons
- **Fundamental physics**
  - Cosmology AGN
  - Galactic centre (GR)
  - Hubble tension
  - Accretion physics
  - Weak gravity in wide binaries
  - Standard candle sources
  - ΛCDM

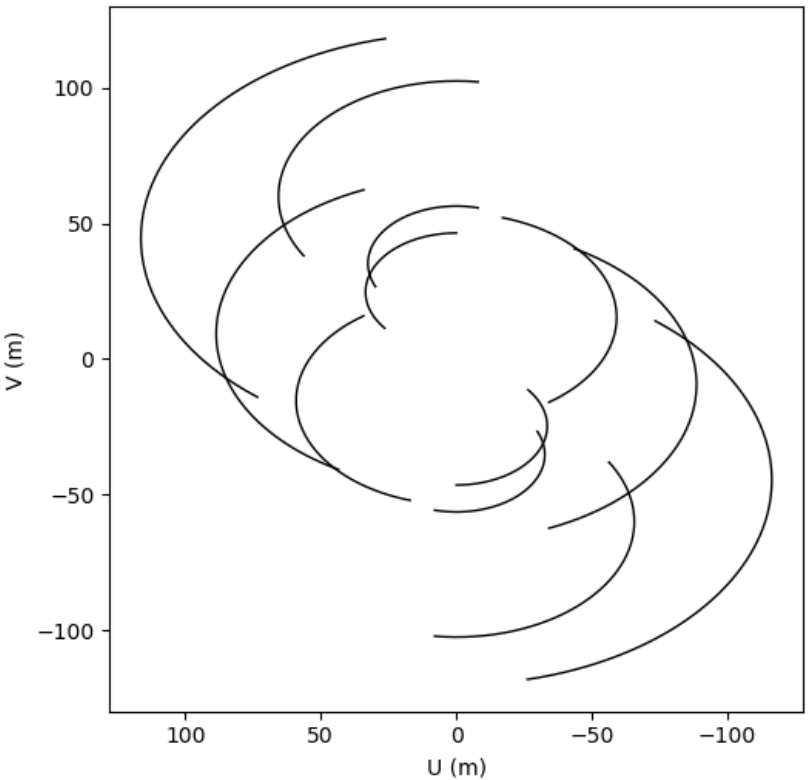
Requirements

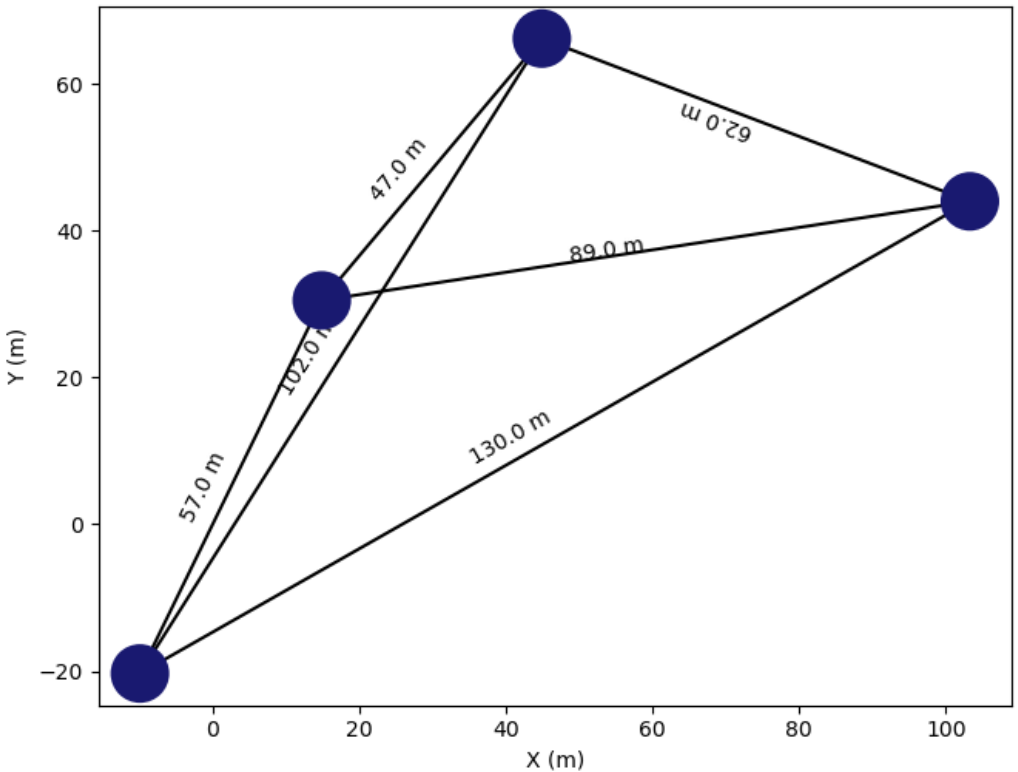
- Ang Resolution
- Spectral coverage
- Sensitive
- Imaging/uv coverage
- Polarisation
- Shorter/longer wavelengths
- New users
- Nulling

Solutions

- Space
- New telescopes
- Throughput
- New instruments
- Reduced products
- Easier modelling
- Instrument characterisation

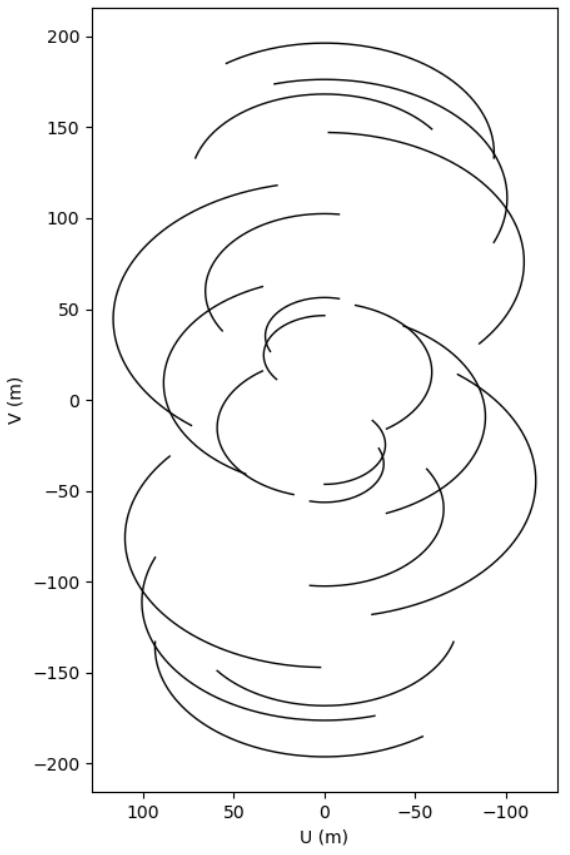
VLTI Current

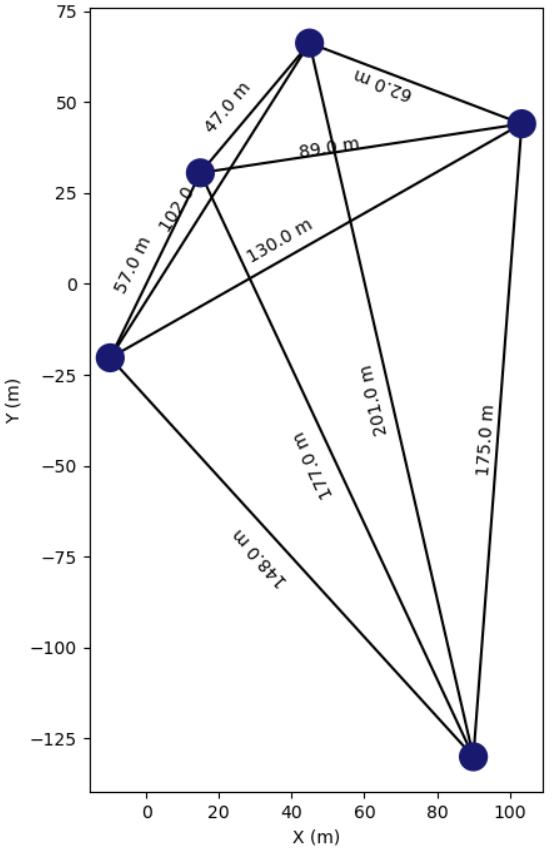




Imaging array

- 5/6 Baselines
- Minimum implementation:
  - UT5 to fill gap
- Larger implementation:
  - 4-6 UTs on rails
- Also talk of new ATs

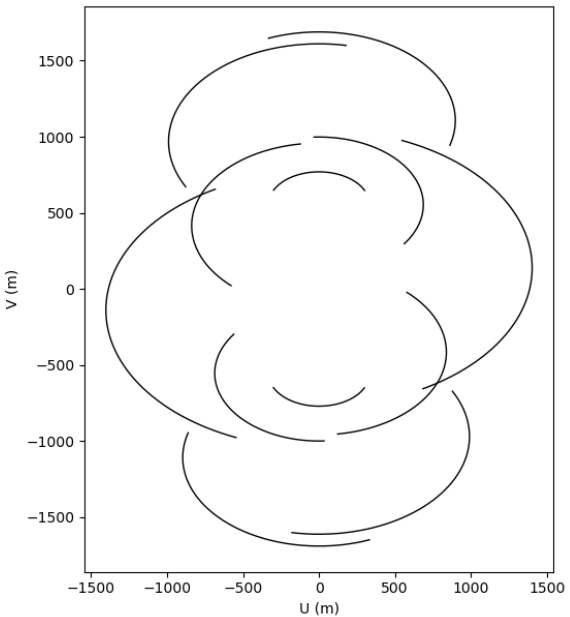


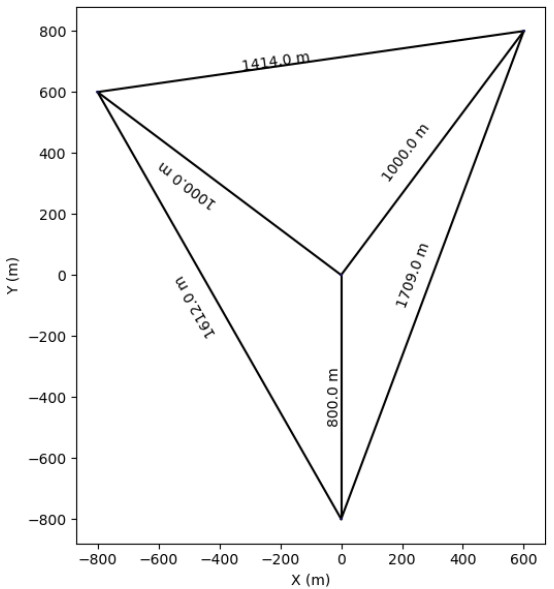


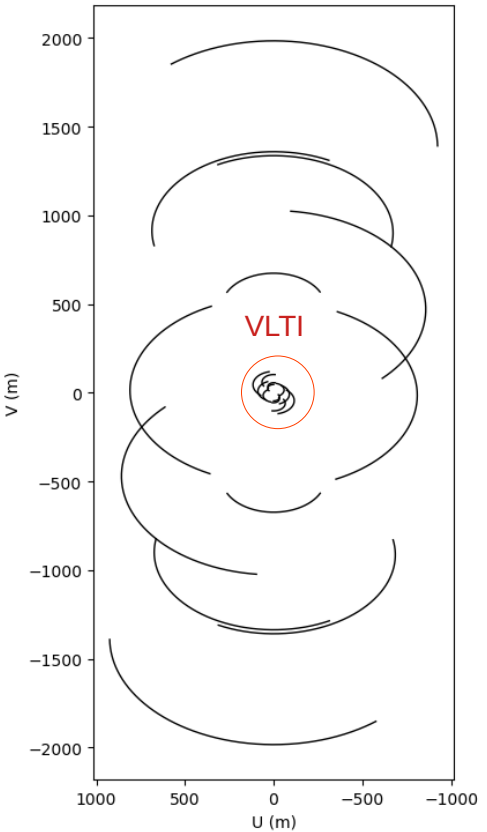
VLTI + UT5

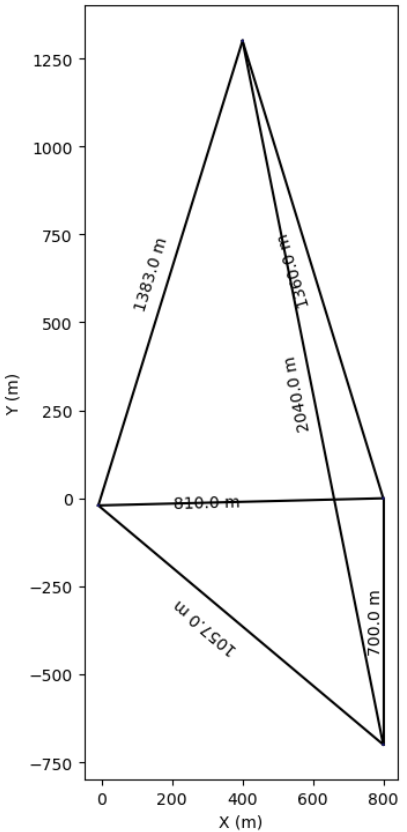
Kilometre baseline

- Better angular resolution
- Models only









Science Cases

Topic

- **Universe origin**
  - Distance ladder calibration
  - Stellar evolution, IMF
  - SMBH masses, galaxy evolution
- **Life Origins**
  - ISM
  - YSOs
  - Exoplanet spectroscopy
  - Exomoons
- **Fundamental physics**
  - Cosmology AGN
  - Galactic centre (GR)
  - Hubble tension
  - Accretion physics
  - Weak gravity in wide binaries
  - Standard candle sources
  - ΛCDM

Requirements

- Ang Resolution
- Spectral coverage
- Sensitive
- Imaging/uv coverage
- Polarisation
- Shorter/longer wavelengths
- **New users**
- **Nulling**

Solutions

- Space
- **New telescopes**
- Throughput
- **New instruments**
- **Reduced products**
- **Easier modelling**
- Instrument characterisation

JMMC Relevant Products

- New Instruments / telescopes
  - Aspro instrument simulator
    - Exposure time calculators
- Reduced products
  - Phase 3 progress
  - Helpdesk
- Accessible modelling
  - Modelling tools
  - Helpdesk
- New users
  - Planning tools
    - Badcal / searchcal
  - Imaging tools

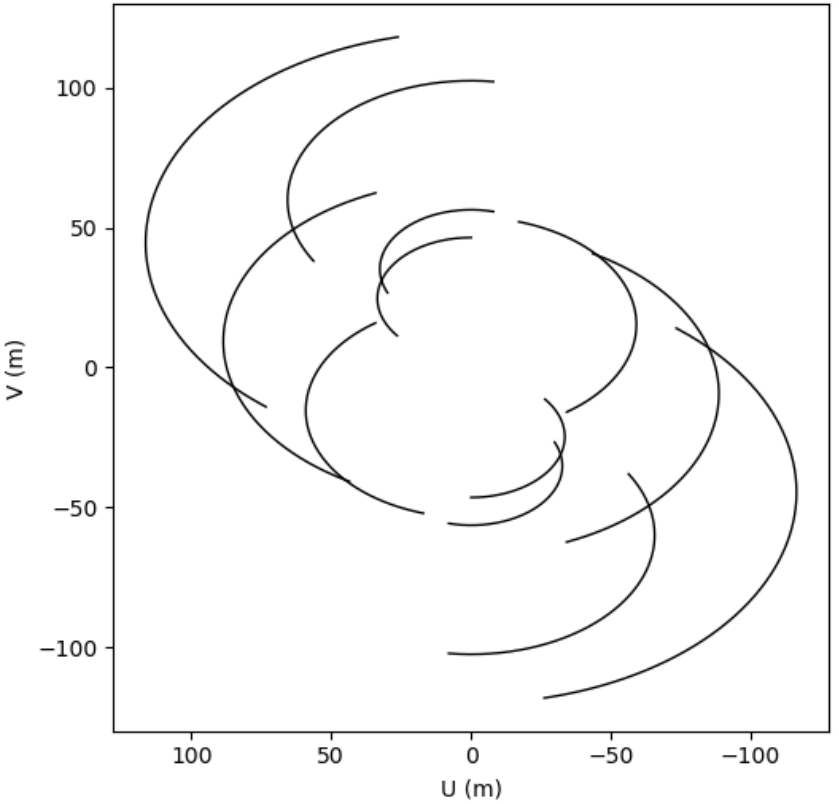
JMMC Tools to be developed

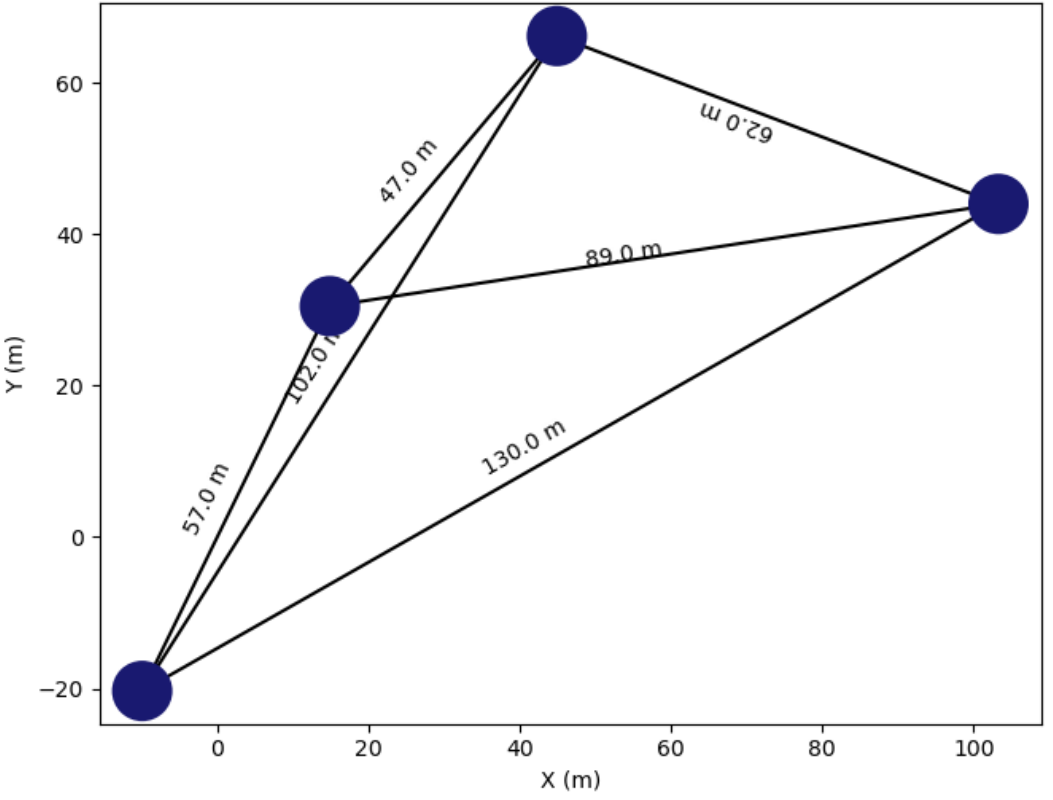
- More accessible simulator?
  - Expansion of Aspro’s simulator and ETC
- Onboarding resources for new users
  - First steps guide / compliment to schools
    - Videos
    - Workbooks
    - E.g. JWST pipeline resources
- Extend modelling tools
  - Nulling / polarisation as they become available
- Continued maintenance of databases of calibrators with changes in resolution / sensitivity
  - E.g. better resolution requires better diameters
- Phase 3 OIDB continued upkeep

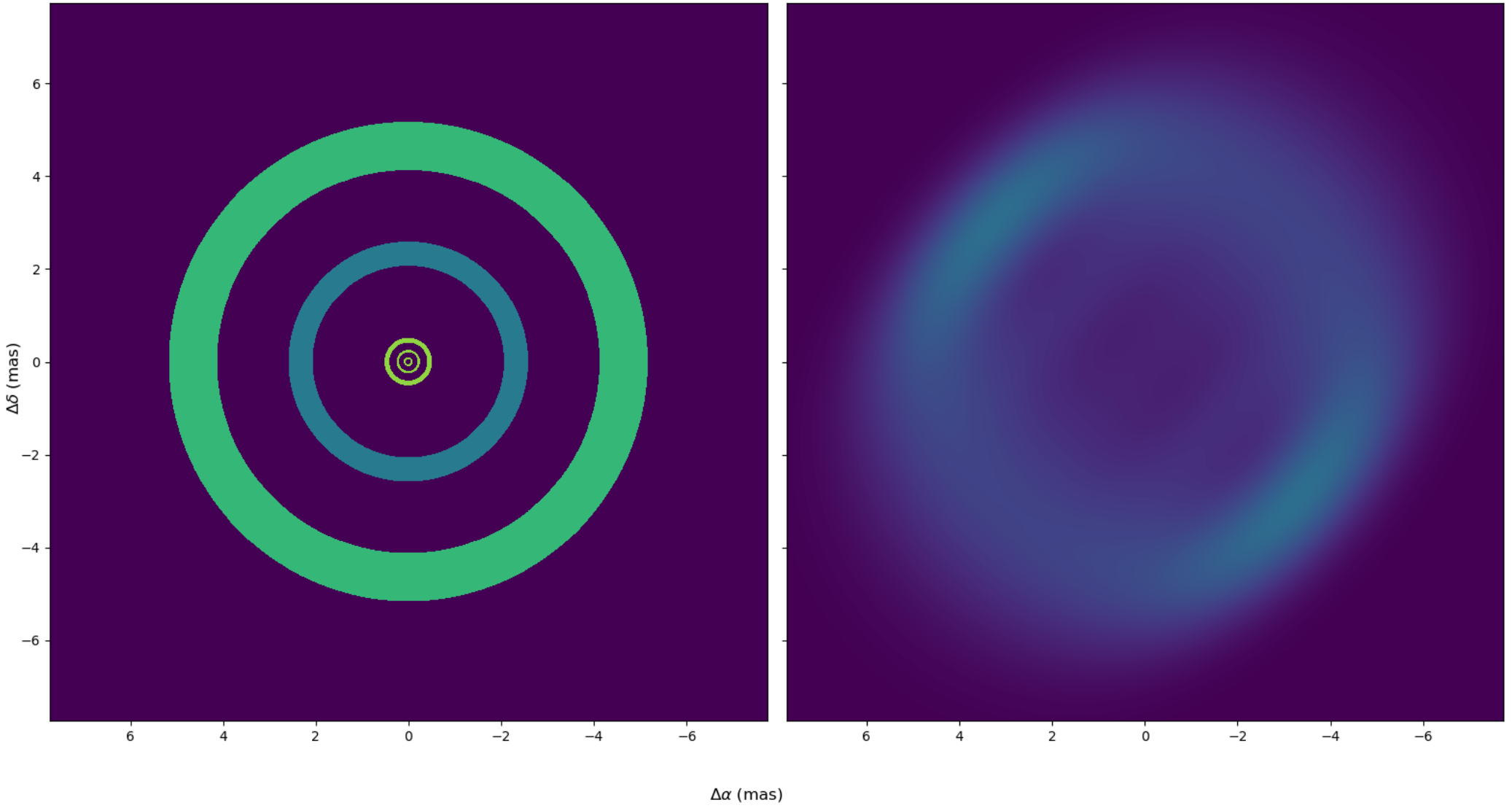
Appendix

Current VLTI (UTs only)

- 4 8m telescopes

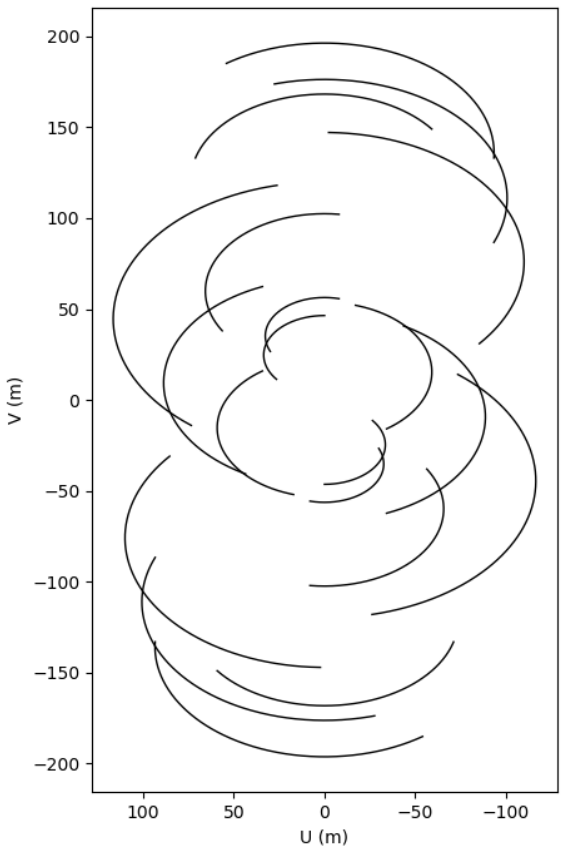


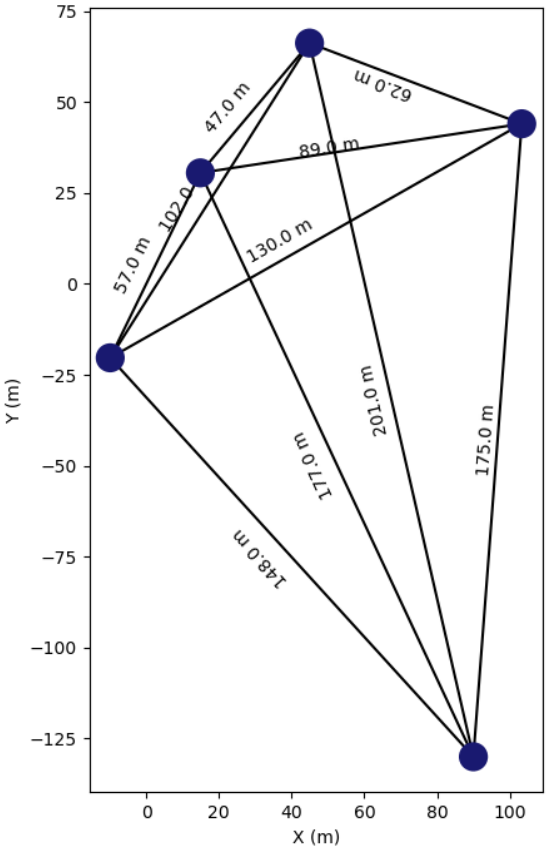



6
4
2
0
−2
−4
−6
Δδ (mas)
6
4
2
0
−2
−4
−6
Δα (mas)

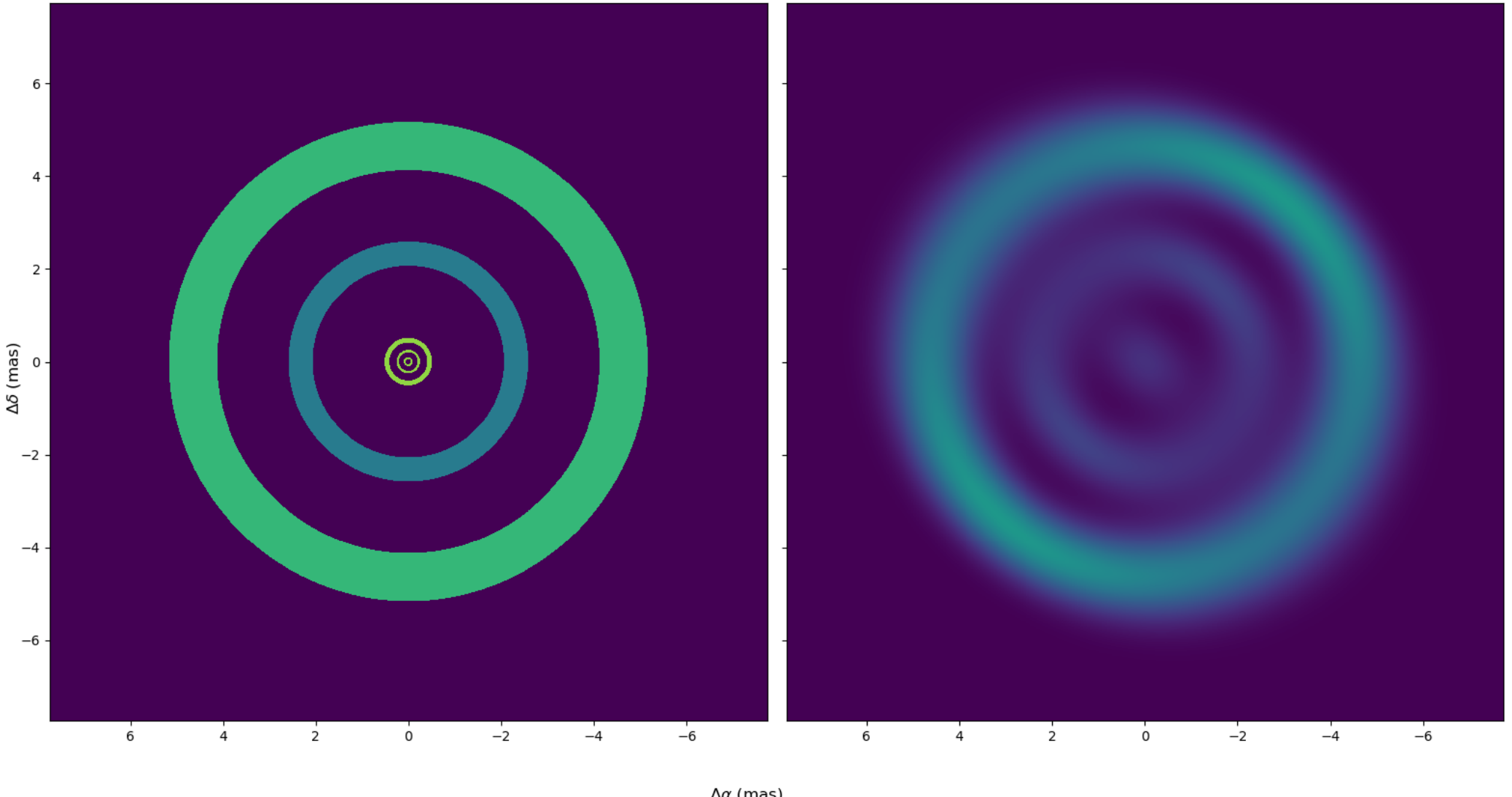
Imaging array

- 5/6 Baselines
- Minimum implementation:
  - UT5 to fill gap
- Larger implementation:
  - 4-6 UTs on rails



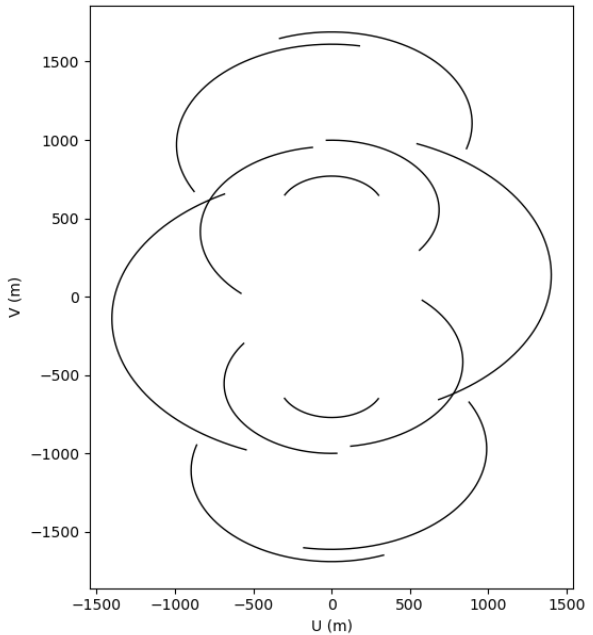


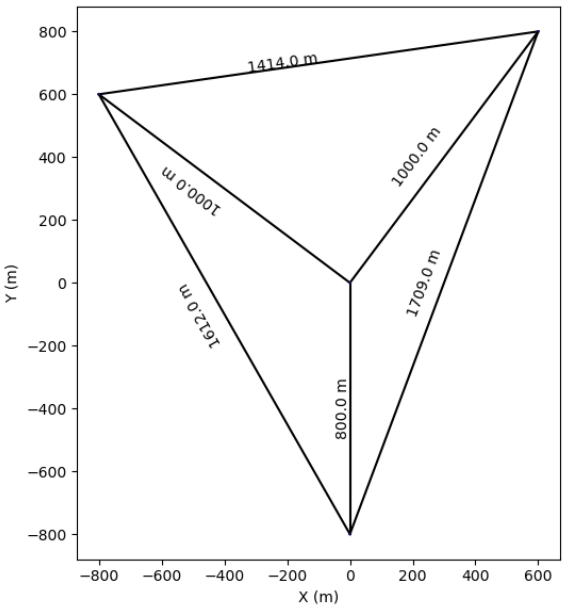
VLTI + UT5


6
4
2
0
−2
−4
−6
Δδ (mas)
6
4
2
0
−2
−4
−6
6
4
2
0
−2
−4
−6
Δα (mas)

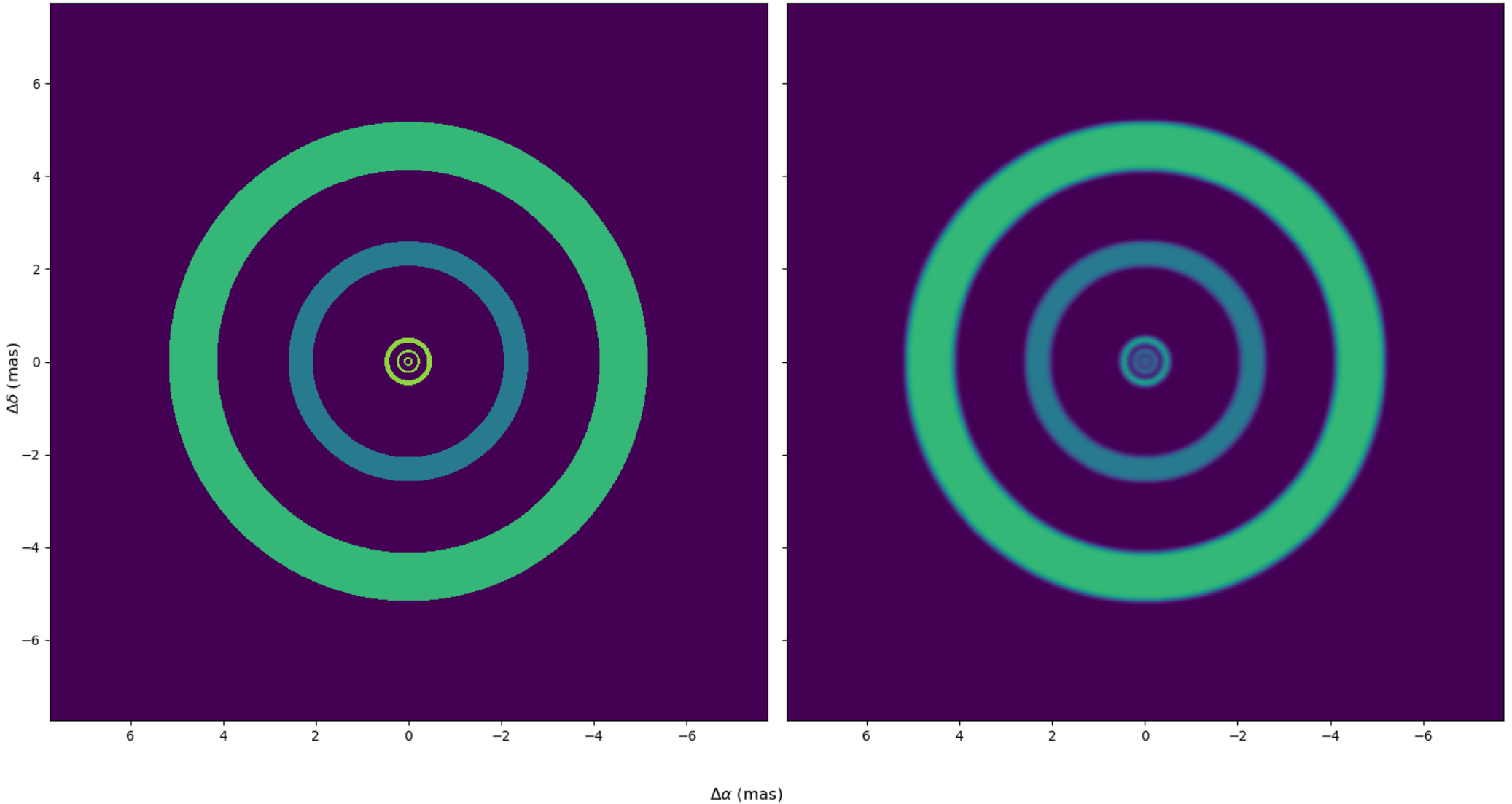
Very Long Baseline(s)

- 1-10 km baselines
- No imaging
- 4/8/16m dishes
- Can be made piecewise
- Can be demonstrated with VLTI



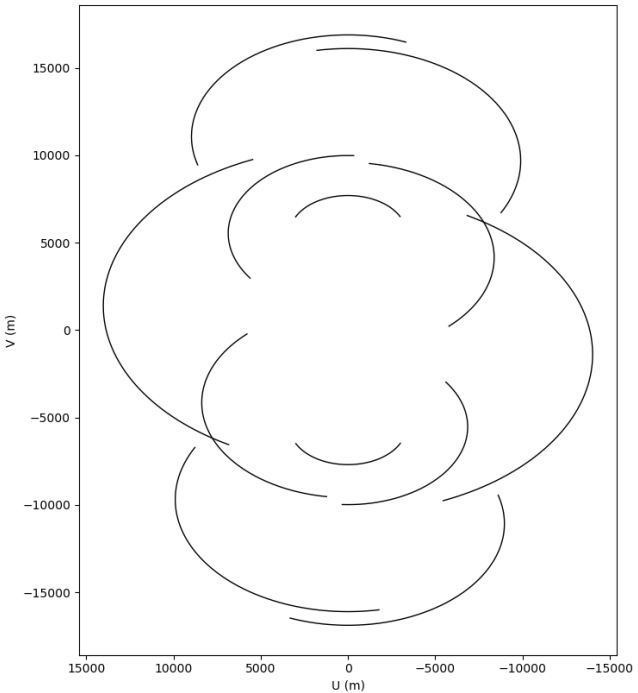


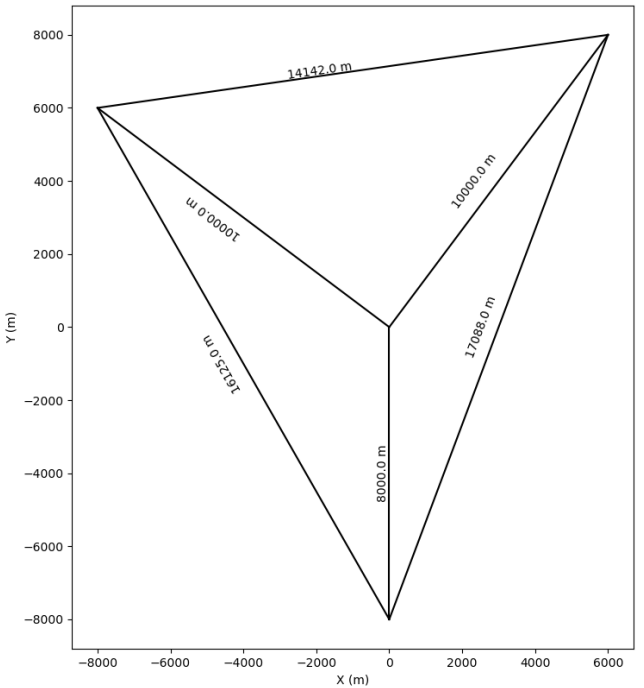
“Small” version


6
4
2
0
−2
−4
−6
Δδ (mas)
6
4
2
0
−2
−4
−6
Δα (mas)

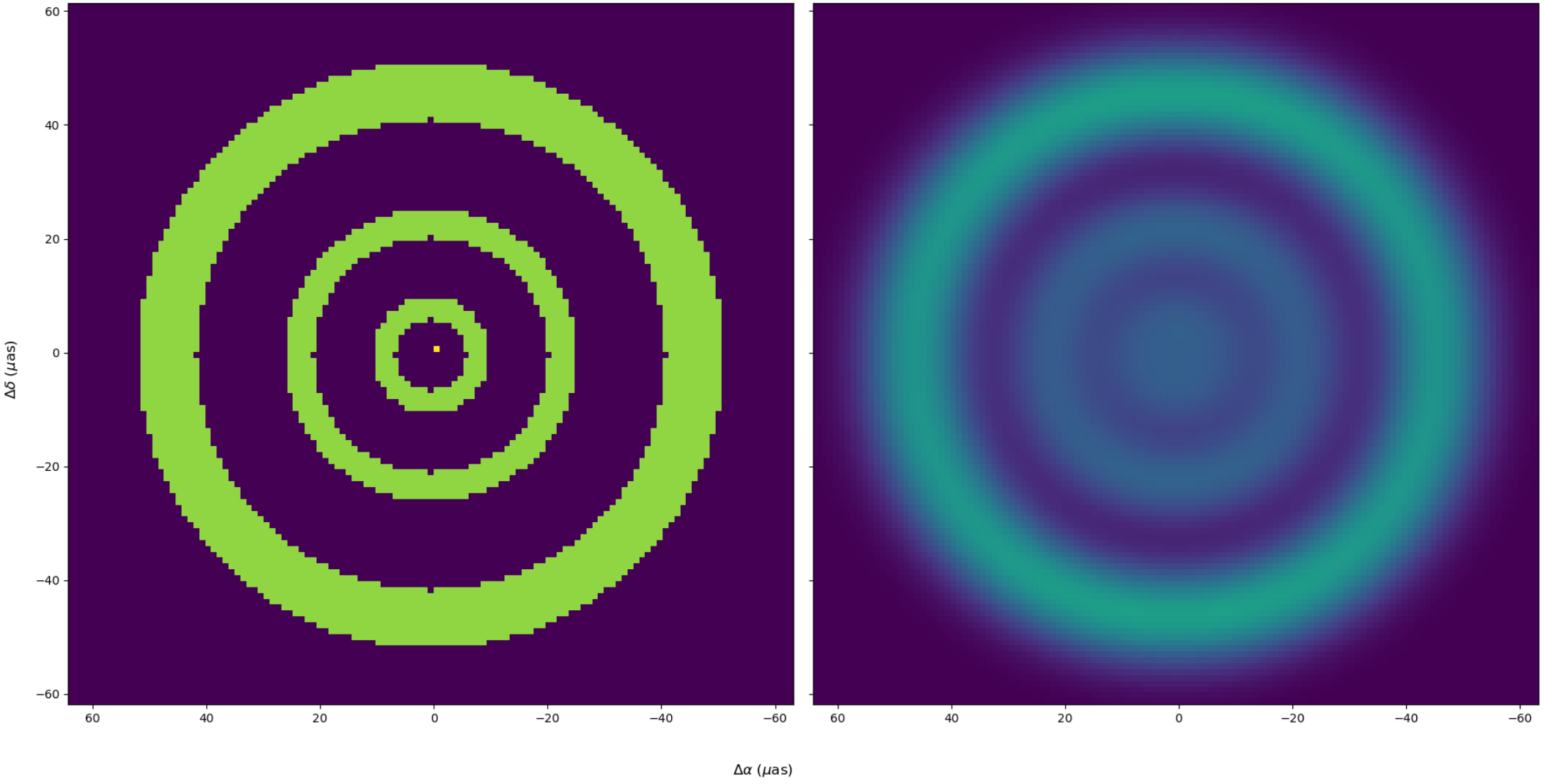
Very Long Baseline(s)

- 1-10 km baselin
- No imaging
- 4/8/16m dishes
- Can be made piecewise
- Can be demonstrated with VLTI





10km version


60
40
20
0
−20
−40
−60
Δδ (μas)
60
40
20
0
−20
−40
−60
Δα (μas)

Imaging + long baselines

- VLTI + km “satellites”
- VISTA UT
- East UT
- South-East UT