The Next Generation Very Large Array: Configuration
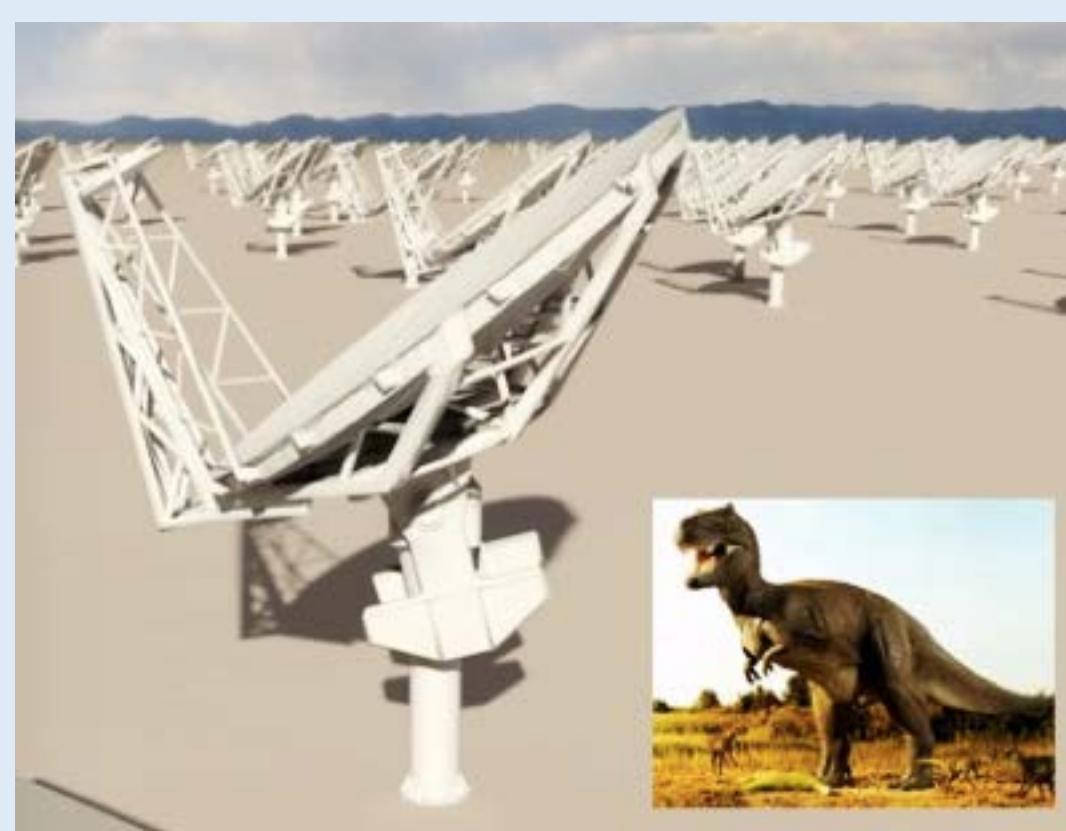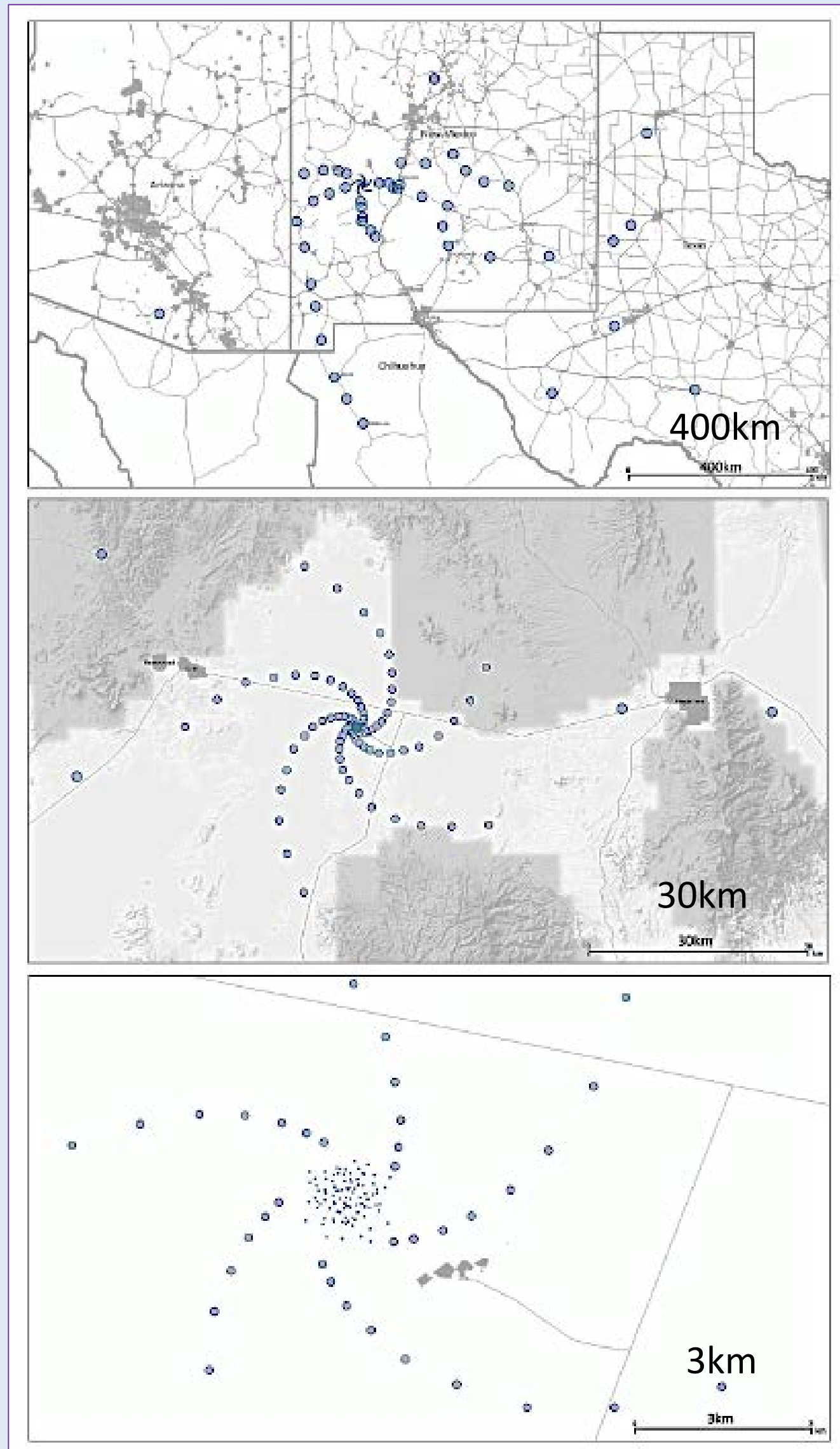
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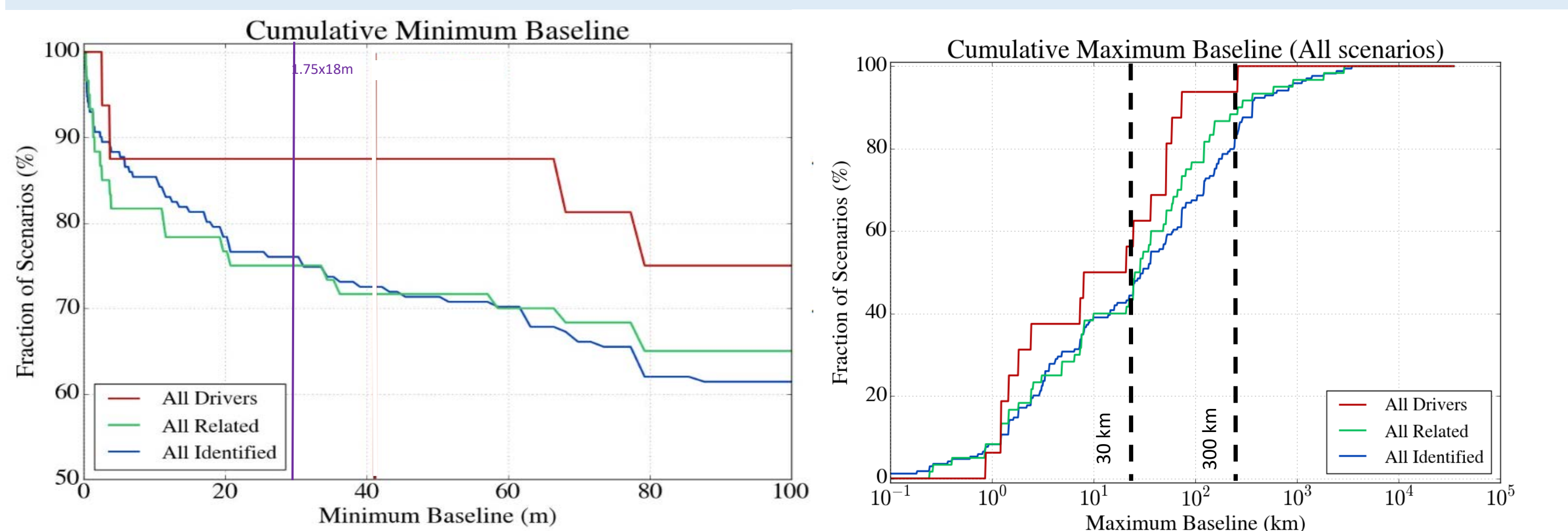
Reference Design

- ➤ Location: U.S. South West, Mexico
- ➤ 214 x 18m offset Gregorian Antennas
- • 45% in 1km core at VLA
- • 30% in 30km spirals on San Augustin Plains
- • 25% to 1000 km in U.S. SW & Mexico
- ➤ Freq. range: 1.2– 116GHz
- ➤ Options under design
- • Long baselines to 8000km
- • Short baselines: 19x 6m array + 4x18m Total Power

SW Array: good 3mm site

- • Elevation = 2200m
- • ALMA Test Facility: good 3mm performance
- • Fast switching phase calibration: Site testing interferometer data over 3 decades
  - ➤ 30sec cycle at 3mm => good coherence on longest baselines over most of the year
  - ➤ Mean separation of calibrators > 25mJy at 3mm ~ 4° => phase noise due to S/N on calibrator is not a limiting factor
- • Developing WVR capability as well
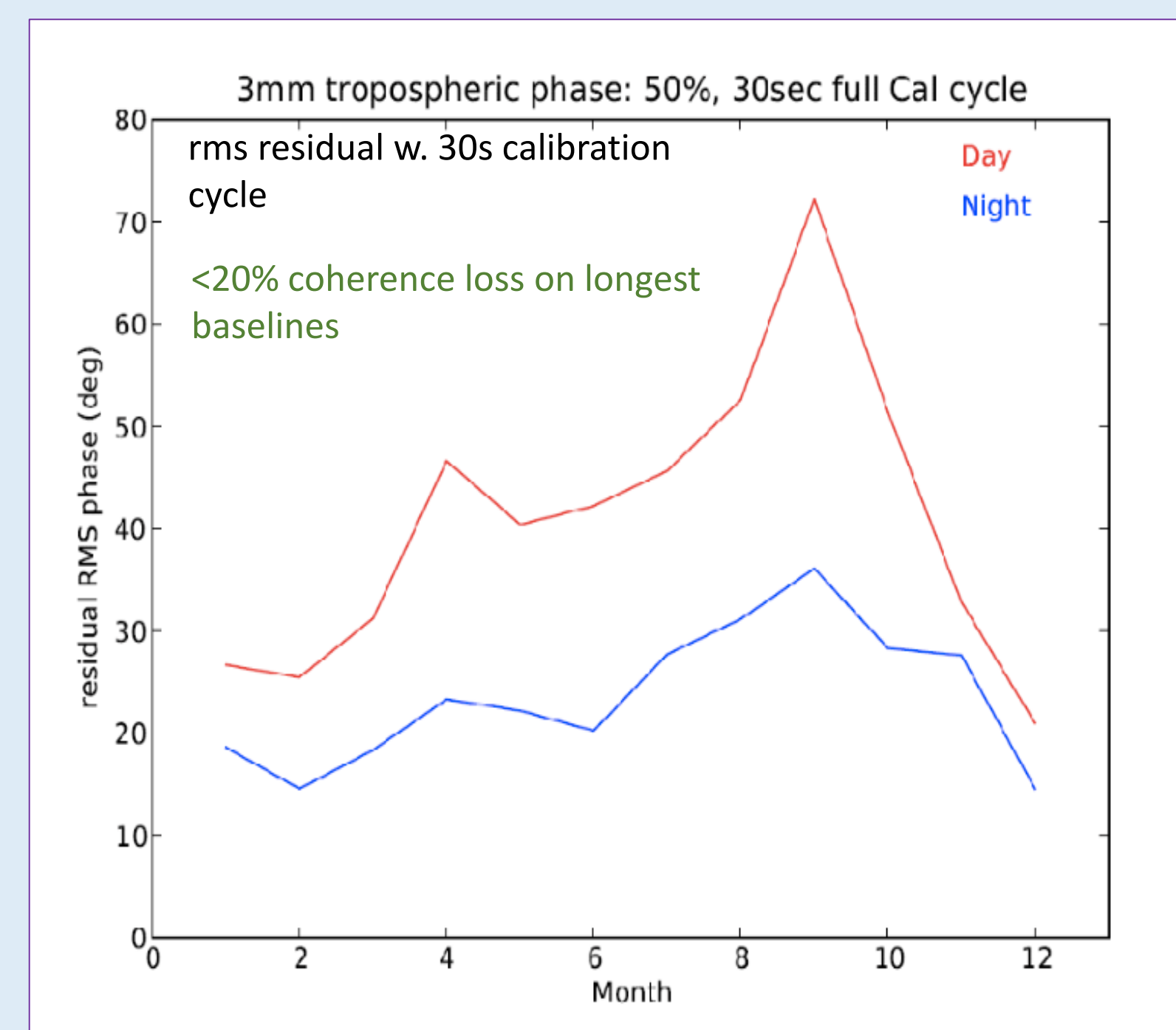
Challenge: Sensitivity vs. Resolution

- ▪ Non-reconfigurable, tri-scale array => tri-scale naturally weighted beam
- ▪ Challenge is to adjust uv-weighting, cell size, taper to get reasonable beam while maintaining reasonable sensitivity
- ▪ Beam quality metric is NOT peak sidelobe, but minimizing broad skirts
- ▪ Array core on north-edge of extended spiral =>
  - ➤ Behavior wrt uv-weighting different than ALMA or VLA
  - ➤ Good sensitivity on long baselines (correlate with full core)

Science Use Case analysis (170 programs)

- ▪ 80% to 90% science can be done with 18m homogeneous array with
- ➤ Shortest spacing = 1.75 x 18m (off-set geometry limit)
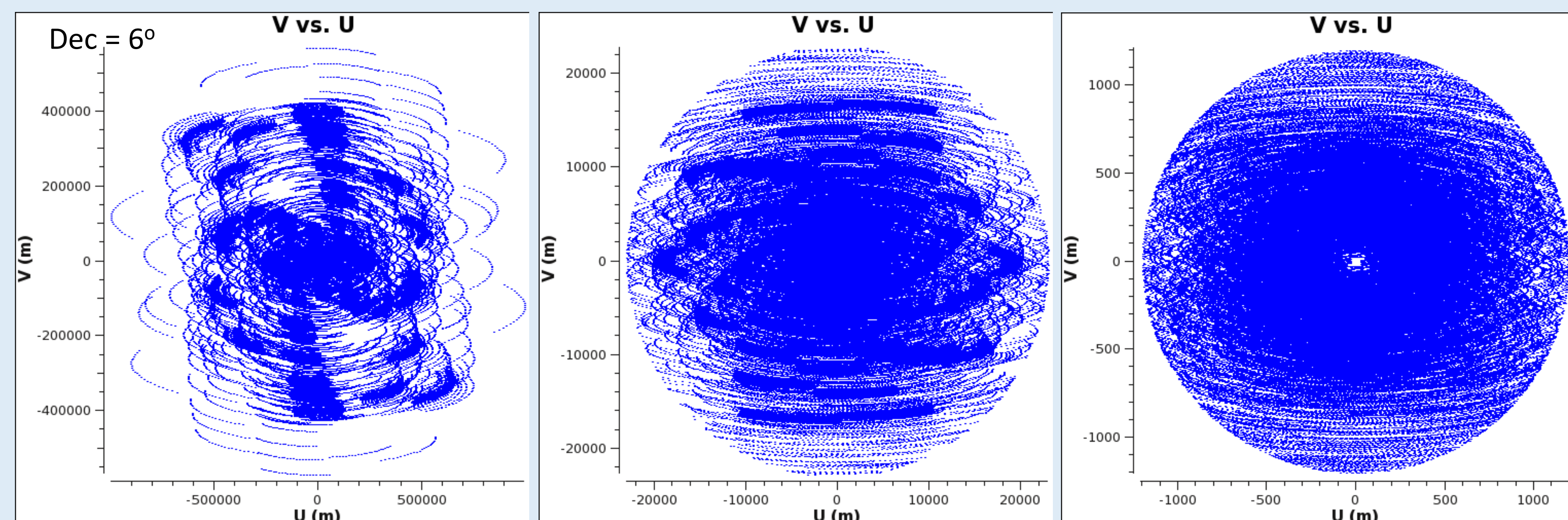- ➤ Maximum spacing ~ 800km

Array simulation tool in CASA

- • Available Configurations
  - ➤ Southwest Configuration (214 x 18m to 1000km)
  - ➤ Core (94 x 18m to 1.5 km)
  - ➤ ngVLA + VLBA + 5x18m in GB (8000km)
  - ➤ Short Baseline Array (19 x 6m)
- • CASA simulator
  - • Simobserve: generate mock.ms from FITS image cubes
  - • Add thermal noise per ngVLA memo 17
  - • Explore imaging capabilities (uv weights, subarrays..)
  - • Explore wide field mosaic

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