The Next Generation Very Large Array: Configuration

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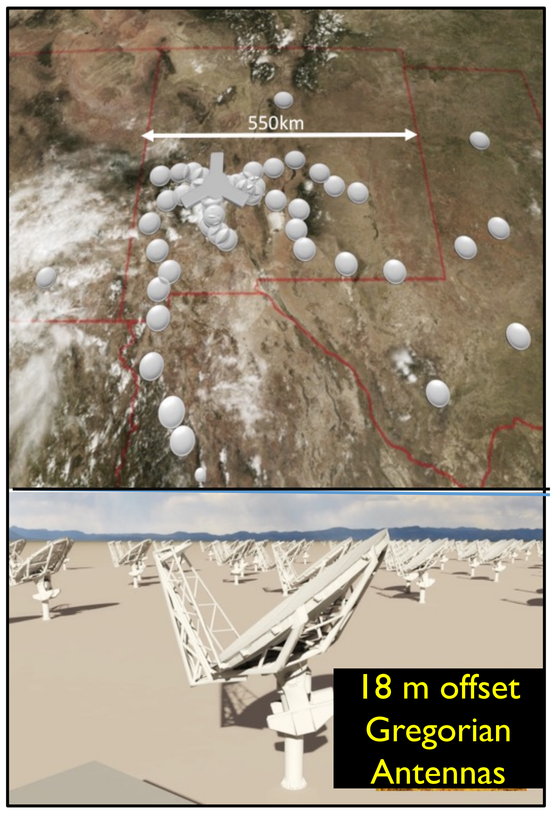
https://ngvla.nrao.edu

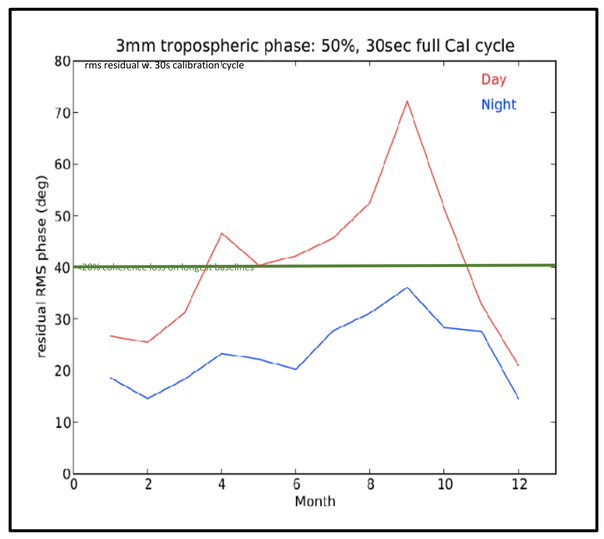
Reference Design

- Location: U.S. South West, Mexico
- 214 x 18m array
- (~10x effective area JVLA & ALMA)
  - 50% in 2km core at VLA
  - 30% over San Augustin Plains to 30 km
  - 20% to ~ 800km in U.S. Southwest & Mexico (~10x resolution JVLA & ALMA)
- Freq. range: 1.2– 116GHz
- Possible Future Options
  - Long baselines (>1000km) TX/MX to VLBA
  - Short baselines: [45m dish + FPA] or [5m array + 18m total power?]



1. SW Array: good 3mm site

- Elevation Plains of San Augustin = 2200 m
- ALMA Test Facility: good 3 mm testing conditions
- Fast switching phase calibration: Site testing interferometer data over 3 decades
  - 30 sec cycle at 3 mm => reasonable coherence on longest baselines over most of the year, except Summer day time
  - Calibrator density: Typical separation of calibrators (>25 mJy at 3 mm) ~ 4° => adequate to ensure phase noise due to S/N on calibrator is not a limiting factor

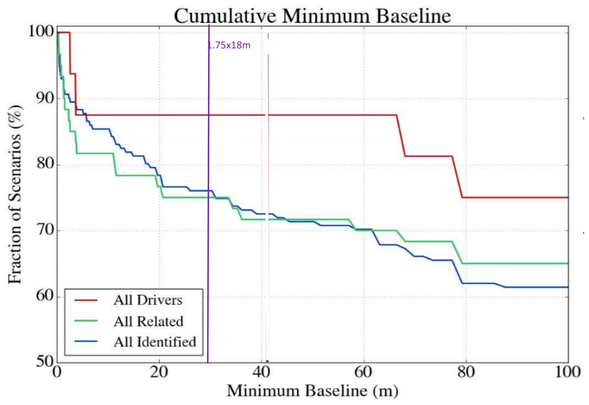


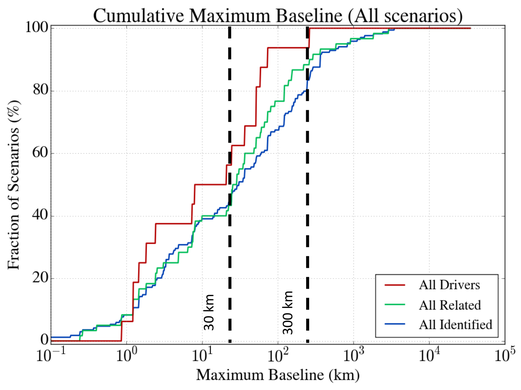
Challenge: Sensitivity vs. Resolution

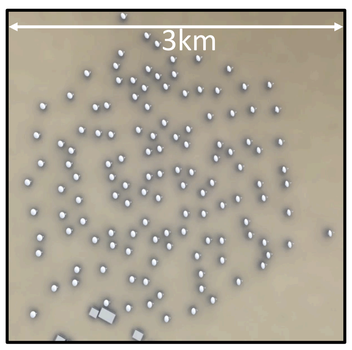
- Non-reconfigurable, tri-scale array => tri-scale naturally weighted beam
- Challenge is to adjust uv-weighting, cell size, taper to get reasonable beam while maintaining reasonable sensitivity
- Beam quality metric is NOT peak sidelobe, but minimizing broad skirts
- Array core on north-edge of extended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

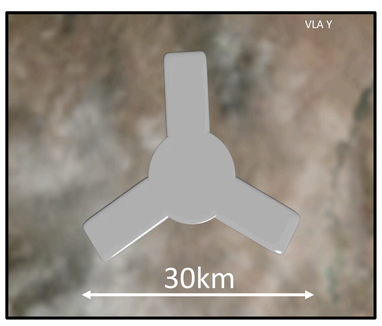
Science Use Case Analysis (170 programs)

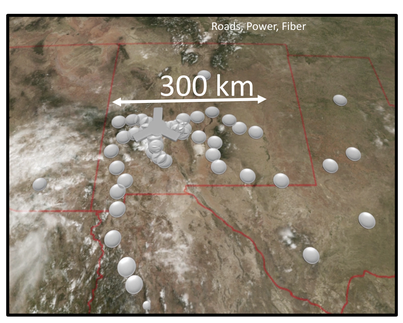
- 80% to 90% of identified science cases can be done with an 18 m homogeneous array with:
  - Shortest spacing = 1.75 x 18m (off-set geometry limit)
  - Maximum spacing ~ 800 km

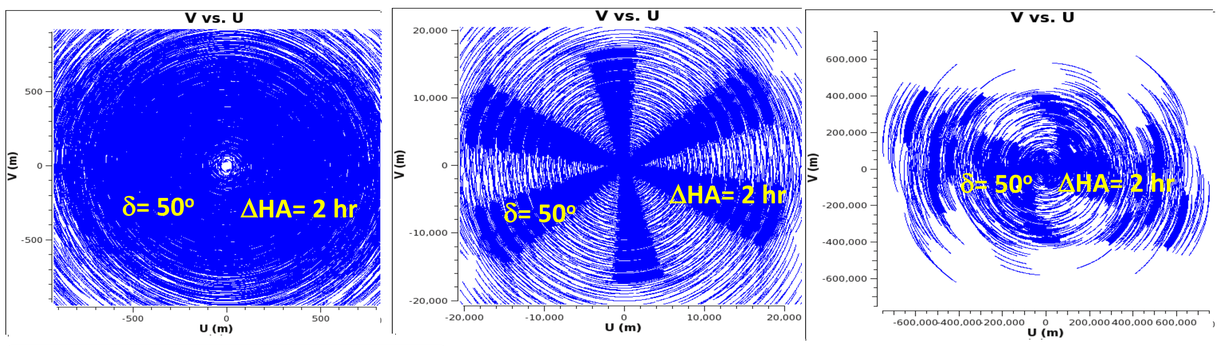






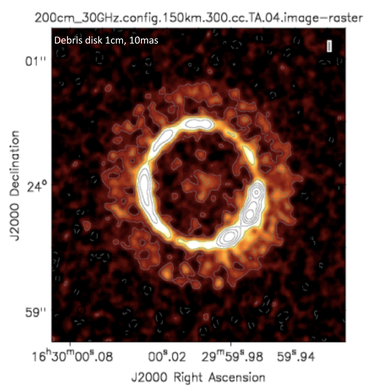


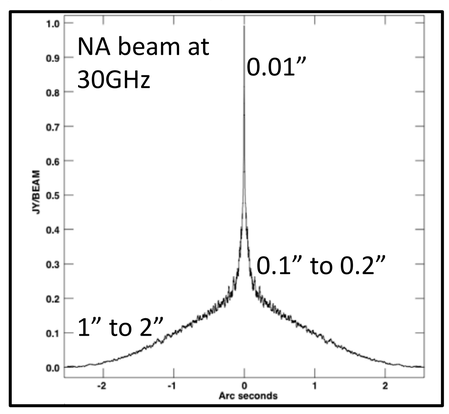


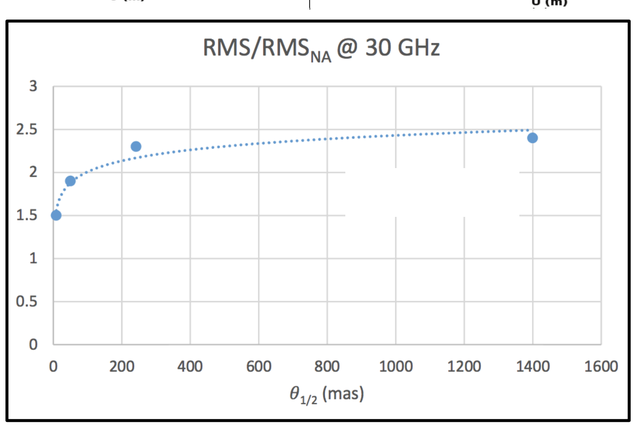


Array Simulation Tool in CASA

- Configurations
  - Southwest Configuration (214 x 18m)
  - Add outer TX, CA, AZ (1000km)
  - Add VLBA (4,000km)
  - Short baseline array
- CASA simulator
  - Simobserve: generate mock.ms from FITS image cubes
  - Add thermal noise
  - Explore imaging capabilities (uv weights, subarrays..)
  - Explore wide field mosaic







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