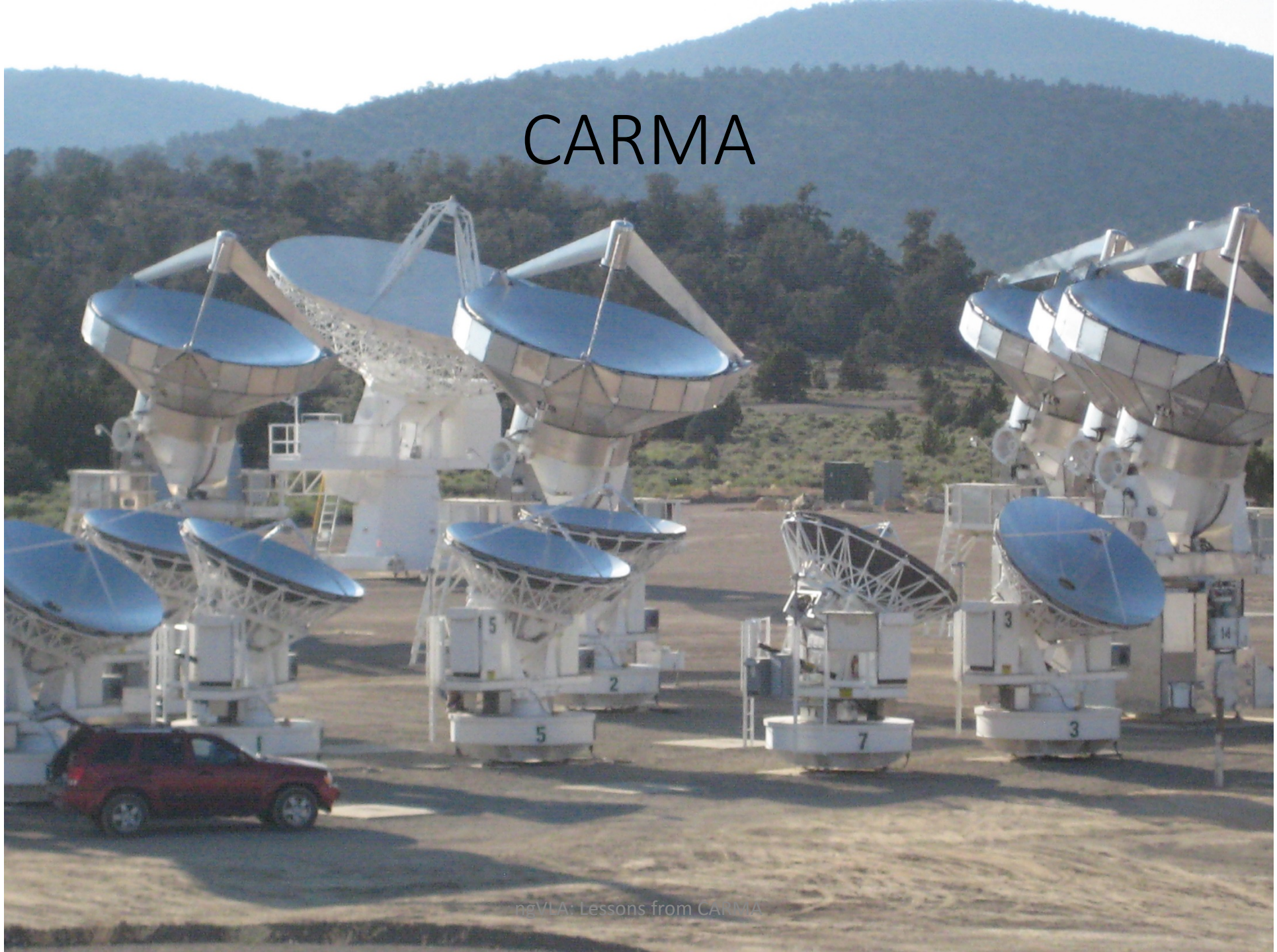
Lessons from CARMA

David Woody

CARMA



CARMA antennas

size	10-m	6-m	3.5-m
optical config.	symmetric bent cass.	**symmetric cass.**	symmetric bent cass.
surface	85 honeycomb hex panels	4 rings of machined cast panels	5 rings of machined cast panels
secondary	XYZ control	Z control	static
rec'r location	**cab outside EL bearings**	cab at cass focus	**box at cass focus**
EL mechanism	**jack screw, screw rotates**	**friction wheel**	**jack screw, worm driven nut**
AZ mechanism	**bull gear, 2 pinions, cycloid reduction, two motors**	**friction wheel, cycloid reduction**	bull gear, 2 pinions, cycloid reduction, 1 motor
motors	**brushed DC**	stepper	**electrically communtated**
metrology	**active tiltmeters, optical camera**	passive tiltmeters, optical camera	passive tiltmeters

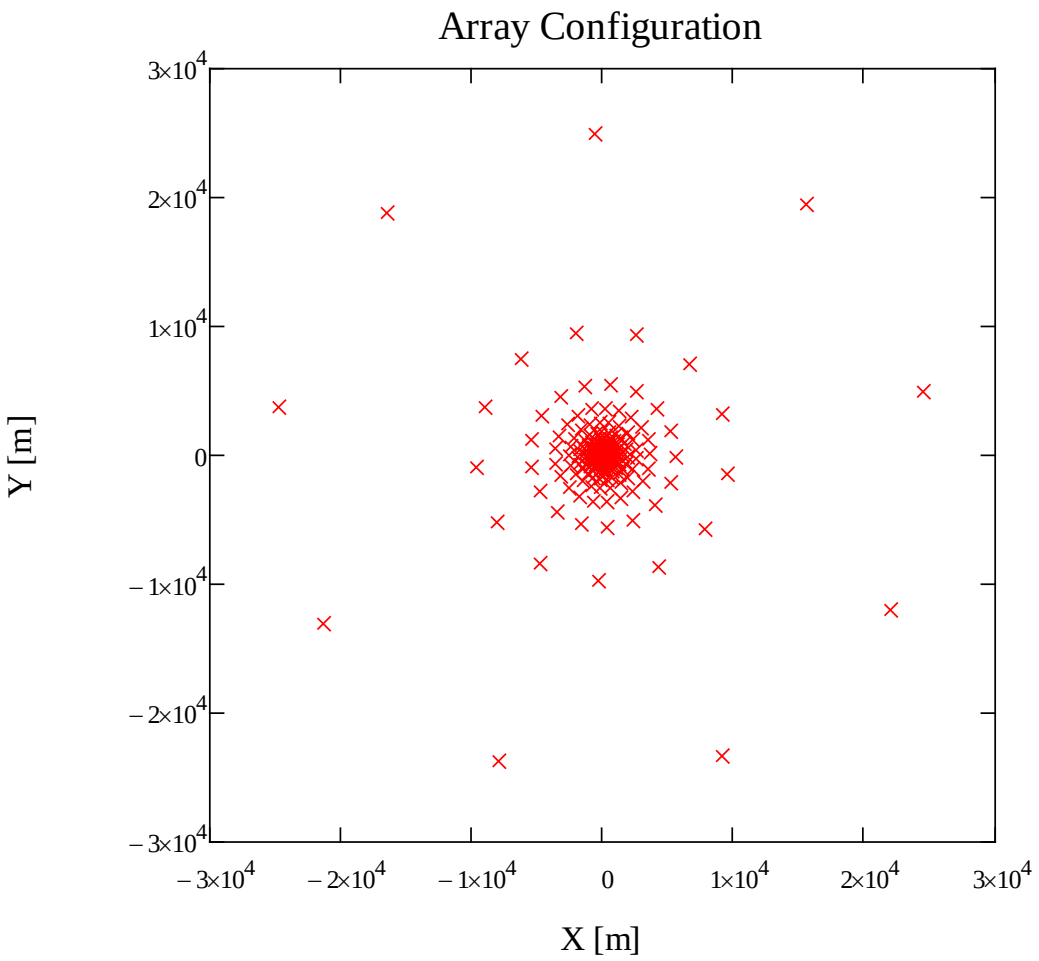
Maintenance strategies

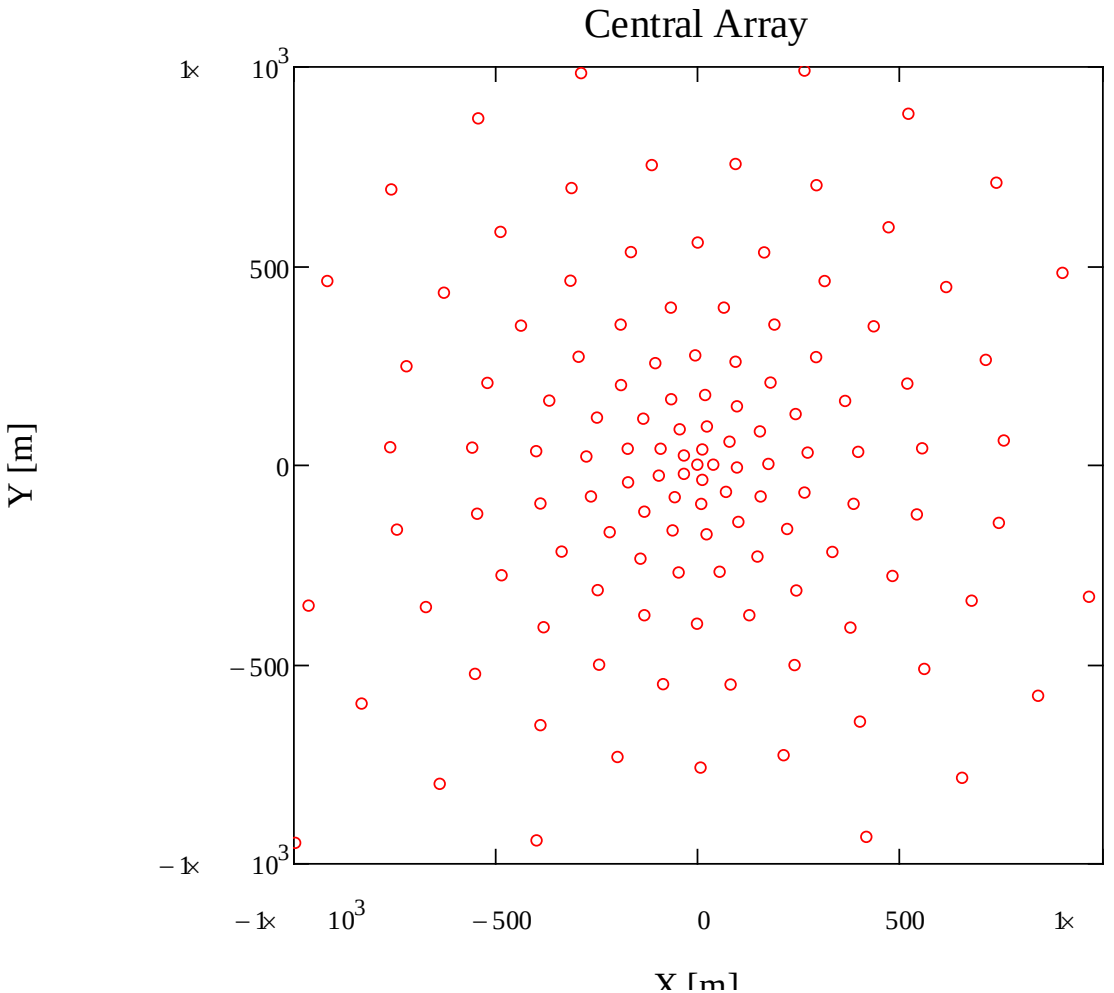
- Easy to change modules
  - All motors, gears and bearings (including AZ and EL bearings)
  - Accessibility with plug and play
- Extensive monitoring
  - Extensive diagnosis and reporting
    - Software is not easy

Concerns

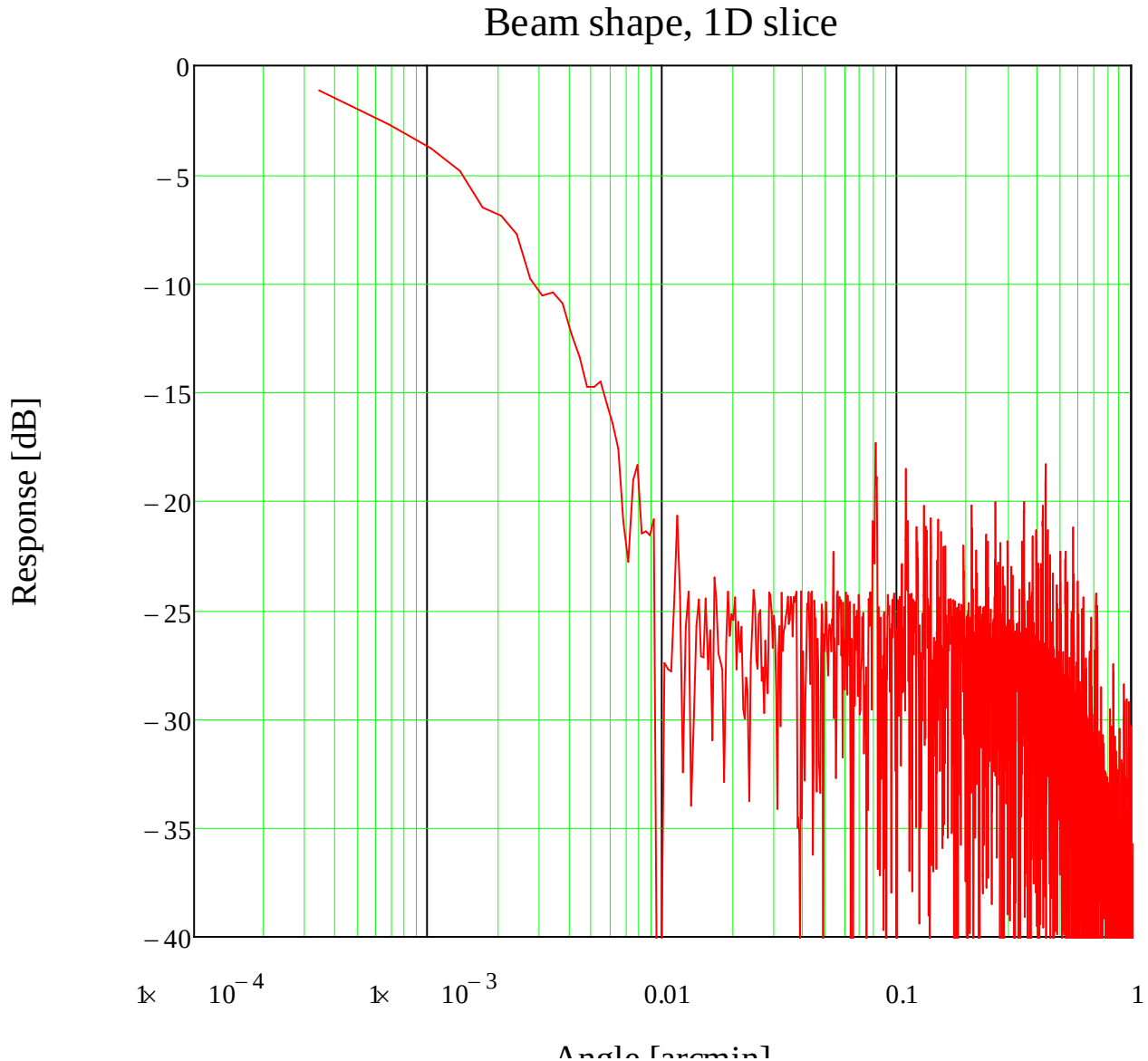
- High slew and tracking speed will be important
- Pointing will be difficult for good 3 mm performance
  - Wide field mapping => fast slewing => dynamic pointing => high f_0
  - High fidelity and dynamic range imaging requires excellent pointing
  - Need tighter specification
- Surface accuracy will be expensive
  - High fidelity and dynamic range imaging requires good stable primary beam
  - Need tighter specifications
- Weather seeing will dominate the high frequency performance
  - Precision conditions for telescope nominal performance are too limited
  - Good seeing is not always correlated with “precision conditions”
- Telescope control code
  - Open source
  - Easy to modify and update
  - Modern interface
  - Complete set of requirements and specifications

Possible array configuration

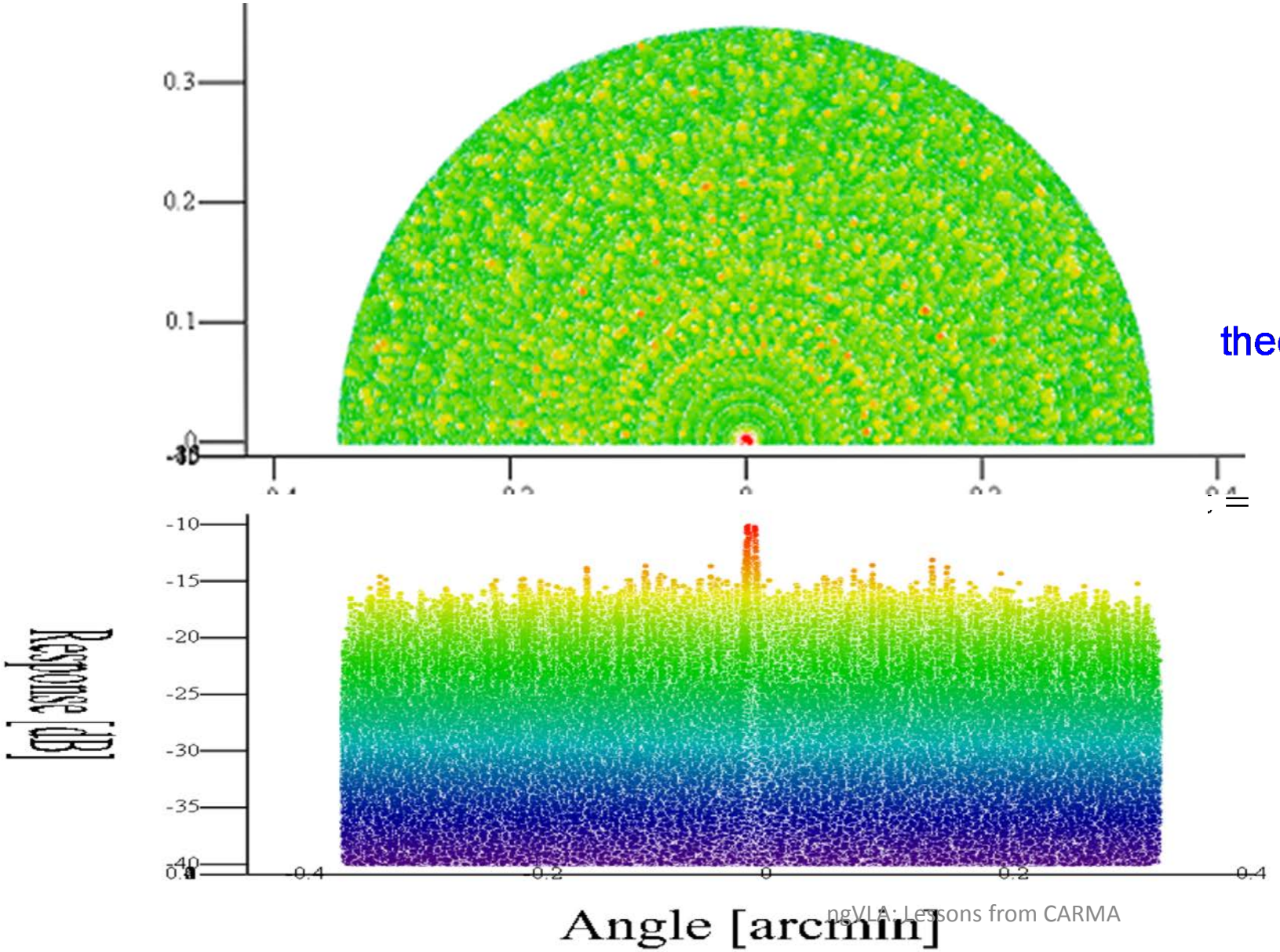




Slice through PSF beam at 3 mm



Snapshot synthesized beam at 100 GHz



$$s_{\max} \approx \frac{2}{N}\ln(mag)$$

$$s_{\max,opt} \approx \frac{1}{N}\left[2\ln(mag) - \ln(N)\right]$$

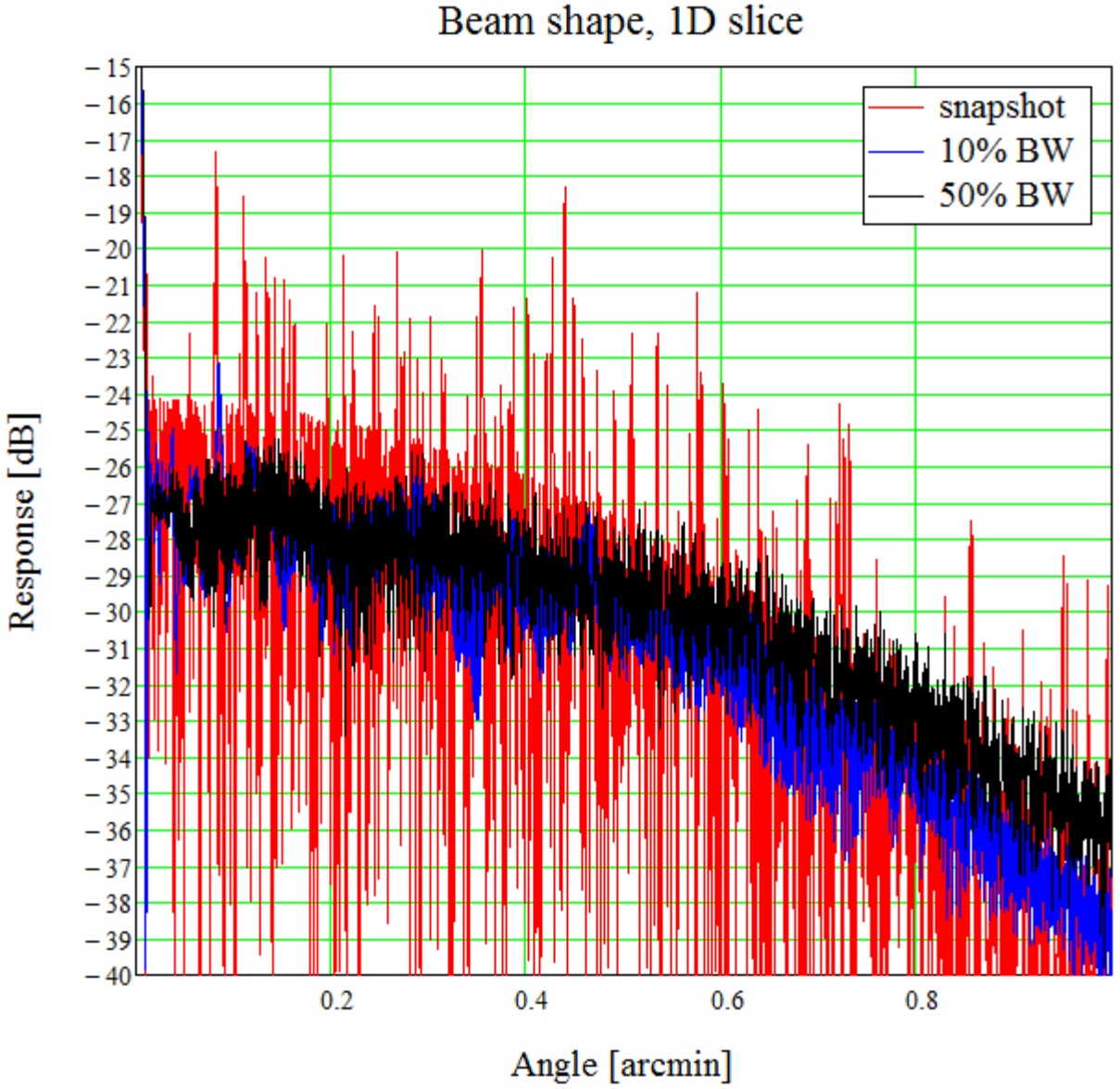
theoretical sidelobes [dB]

−24.116 average

−12.113 peak for random array

−13.985 peak for optimized array

Frequency synthesis for continuum sources



Earth rotation and frequency synthesis will greatly reduce the sidelobe peaks