Beam-Steering for SPACE HAUC
Michael Laster
Physics CAPSTONE
Professor Timothy Cook

ADAPTIVE BEAM-STEERING

Search for signal → Determine "DoA"

Generate weights → Steer beam to signal

Search for signal nearby → Generate weights
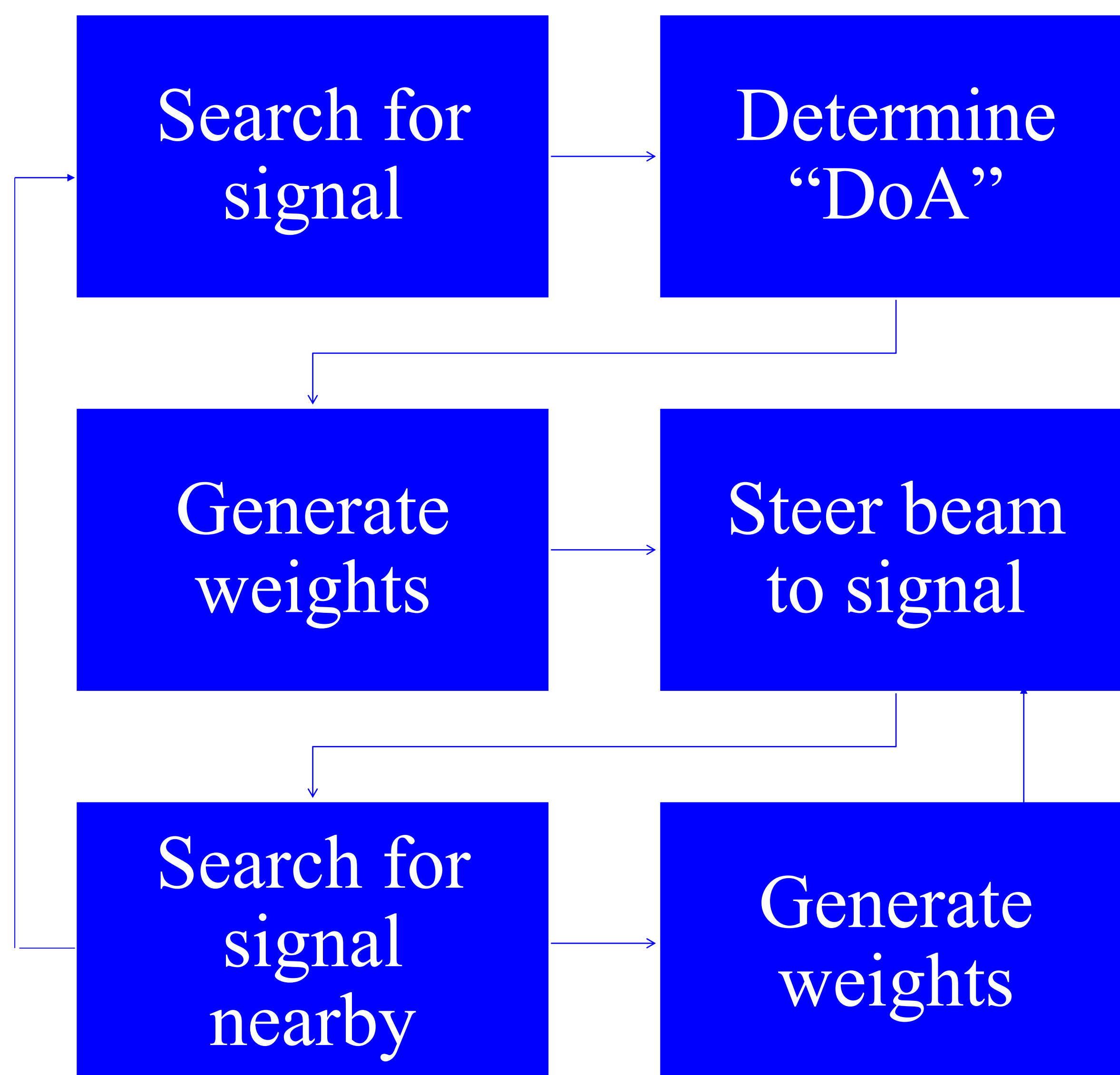
- The weights are computed with a minimum-variance distortionless response (MVDR) algorithm
- Continuously follows the signal by using the previously generated weights.

MOVING FORWARD

- Simulate the signal with a time-varying incident angle to capture the effect of the motion of the CubeSat in orbit
- Convert from MATLAB into C++ so it could be used by the ADRV 9361 on board computer
- Test the code with the hardware before launch

MISSION

SPACE HAUC is an undergraduate led CubeSat mission with the goal of demonstrating the capability to communicate with high data rate transmissions by beam-steering a 4x4 phased patch antenna array.

- X-band communication frequency range (7-10GHz)
- Desired data transmission rates of 50-100 Mbps
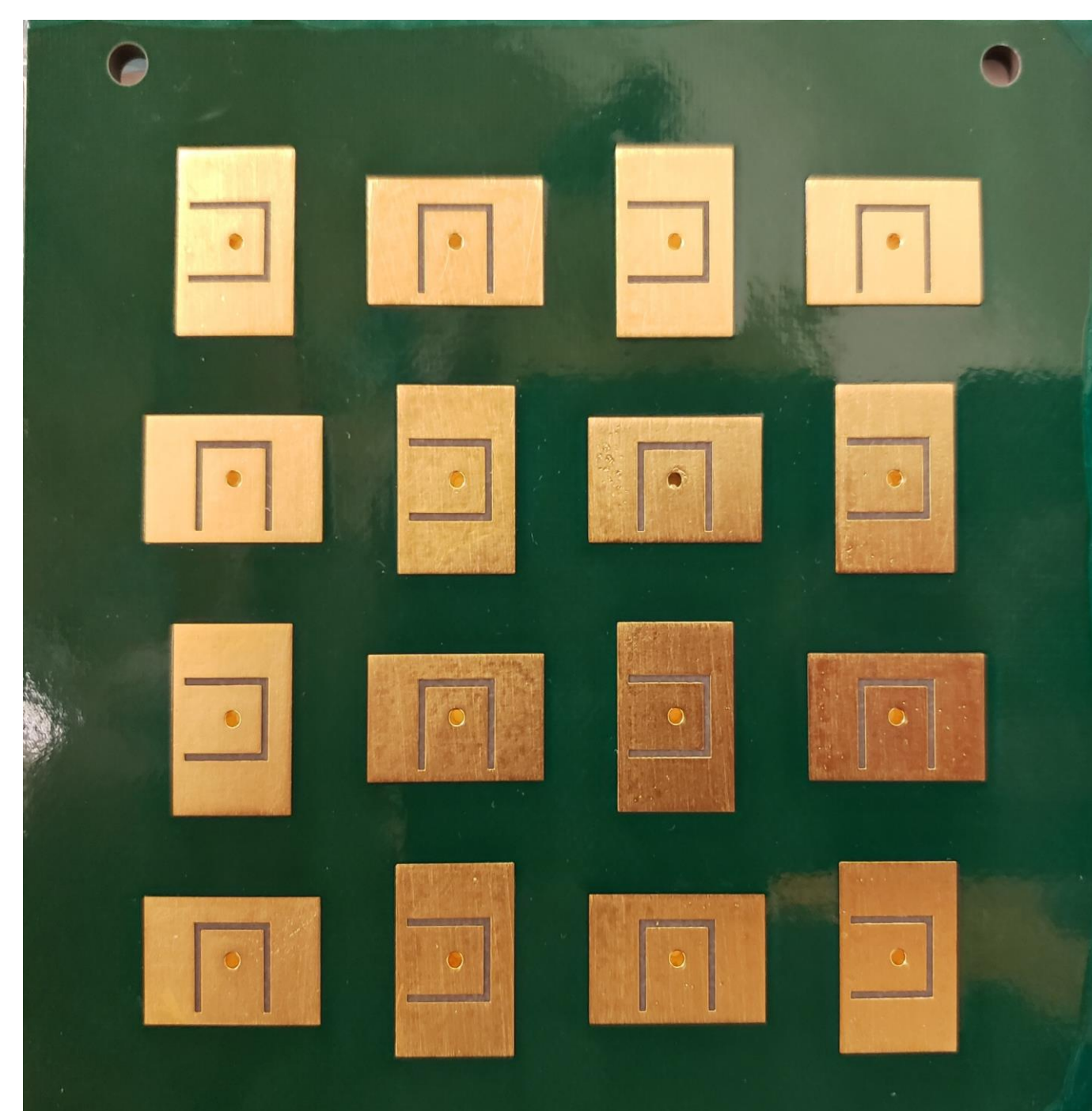
PHASED PATCH ANTENNA ARRAY

A patch antenna is a flat, low-profile patch of conductive metal etched onto a dielectric substrate, a nonconductive insulating material.
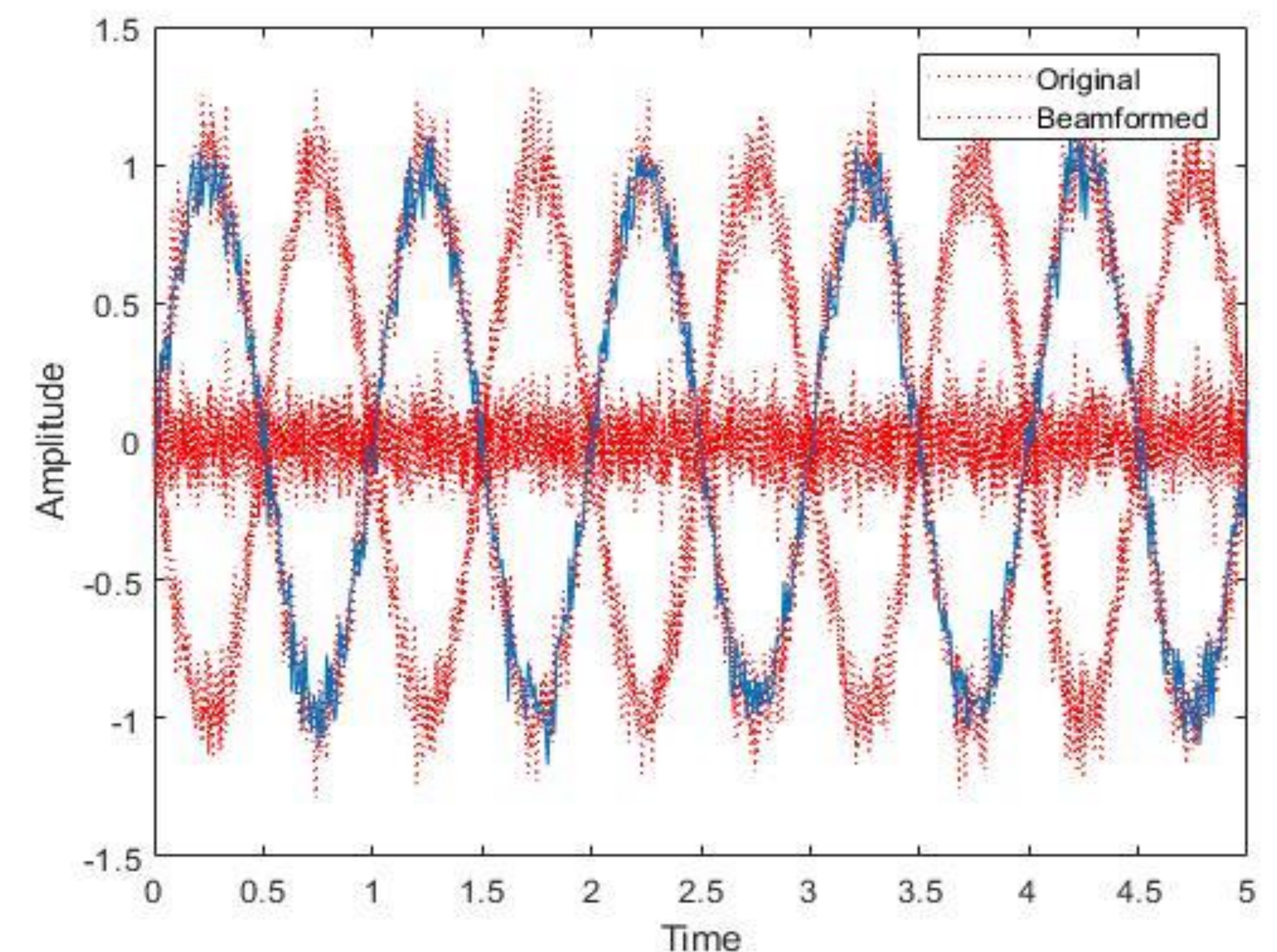
- Alternating linearly-polarized elements to compensate for the circularly polarized signal.

MODELING

3D Directivity Pattern

z
Az 0
El 90

x
Az 0 az
El 0

y
Az 90
El 0
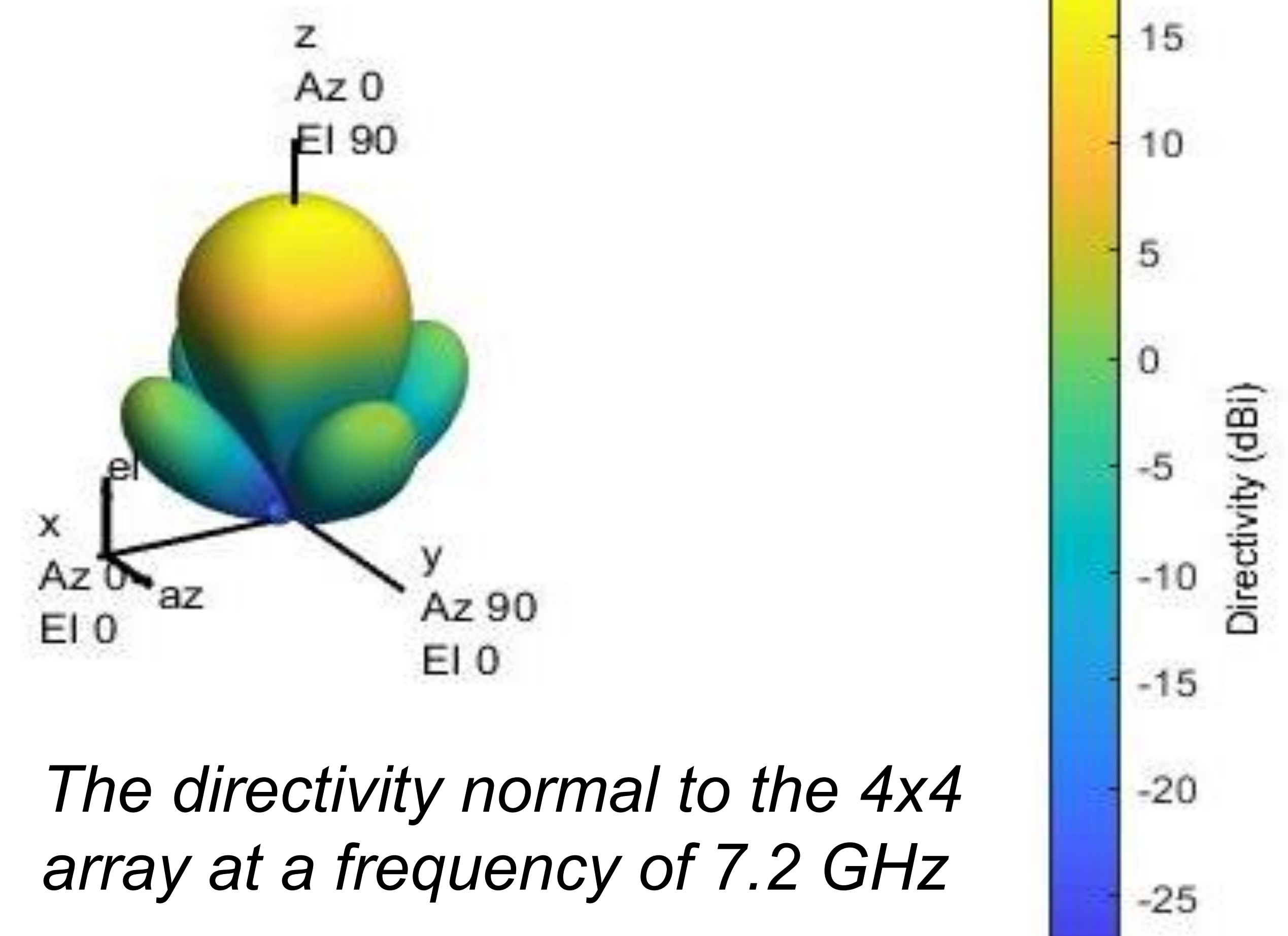
The directivity normal to the 4x4 array at a frequency of 7.2 GHz

The signal from each of the 16 elements and the <u>single</u> beam-steered signal generated pointing in its direction.