The CIWRO/NSSL Phased-Array Meteorological Studies Team (PAMST)

PAMST Team Members:

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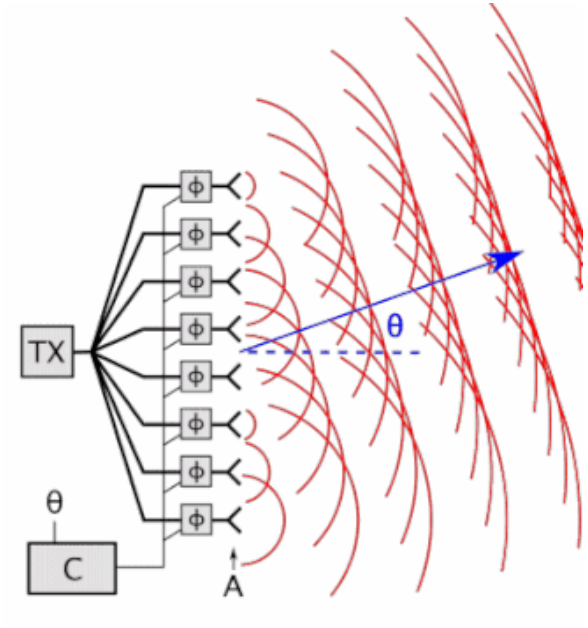
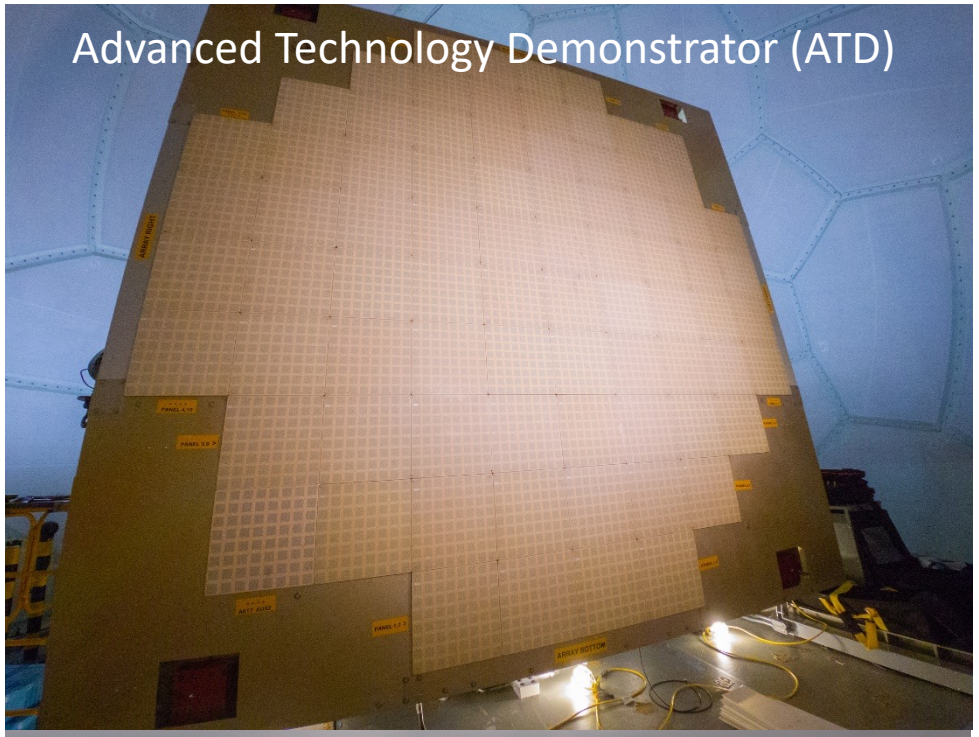




NOAA needs a radar replacement strategy for beyond WSR-88D Service Life Extension Program (SLEP)

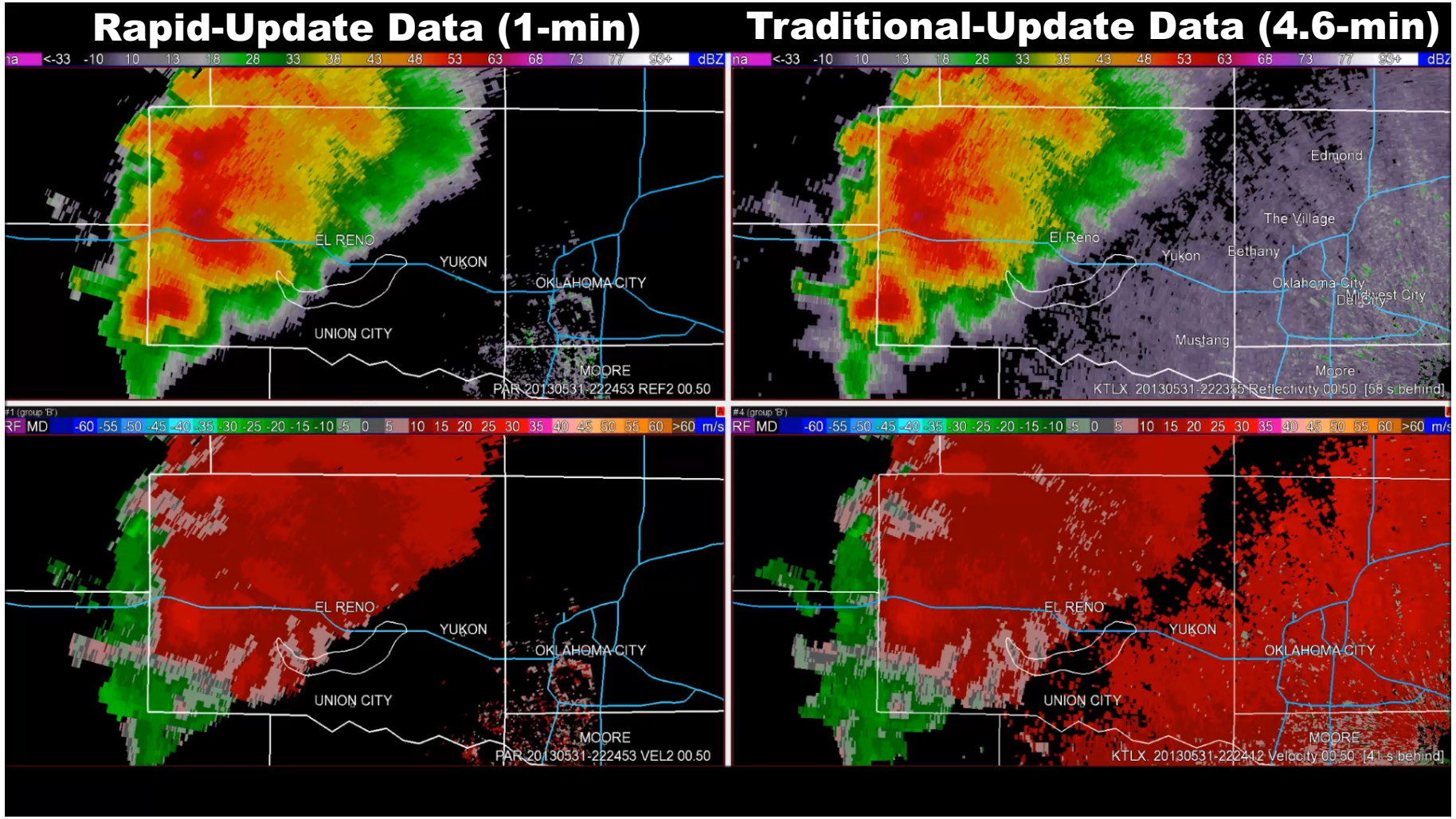
Requires a Go/No-Go decision in early 2030s to have a replacement ready to be fielded by late 2040

Why Phased Array Radar?

Phased array radar allows us to not only electronically steer the radar beam, but also gives us the flexibility to develop a scanning strategy that can be customized for each weather hazard.

Rapid-update radar benefits for emergency managers and forecasters:

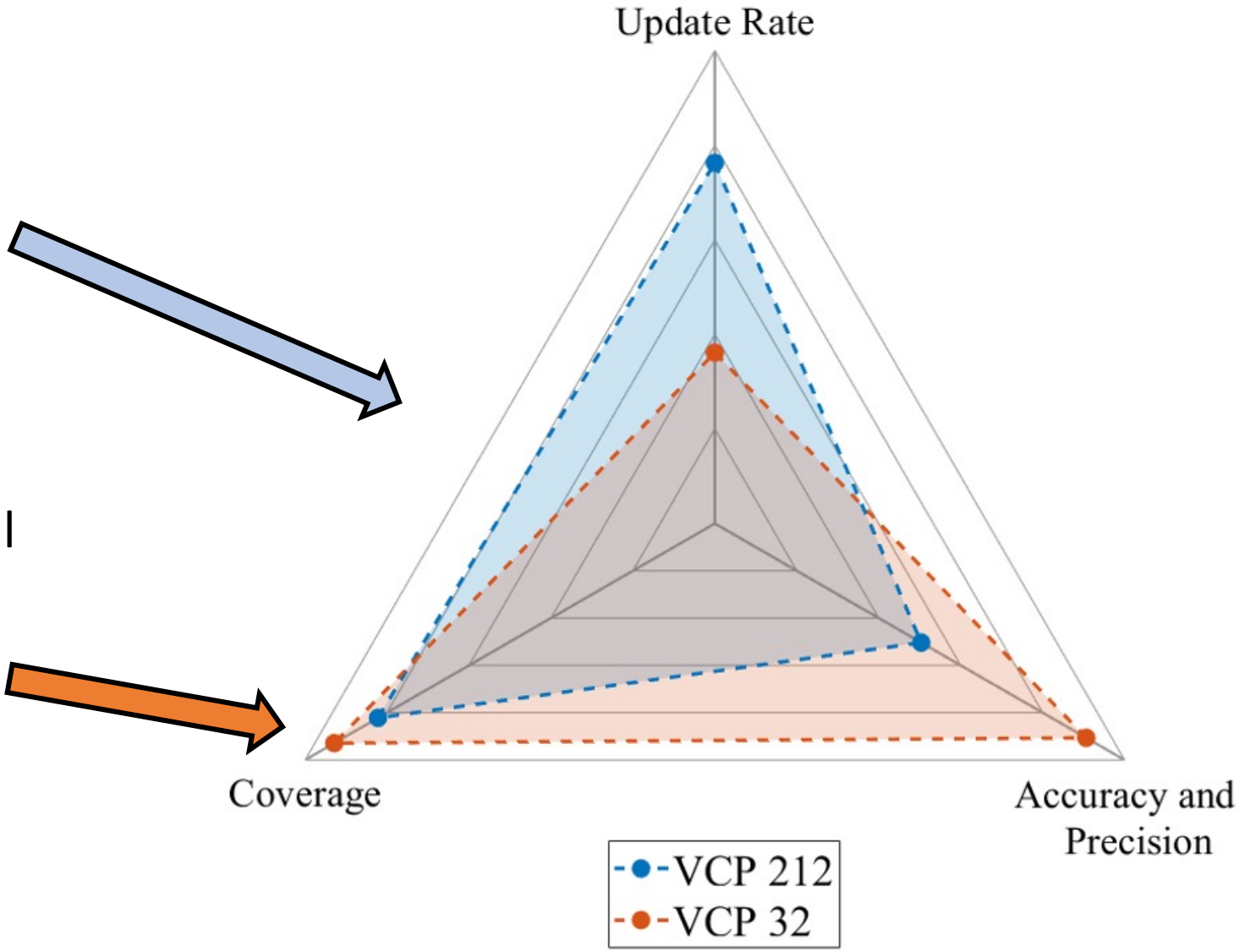
Tornado location and updraft intensity



May 31, 2013 El Reno supercell

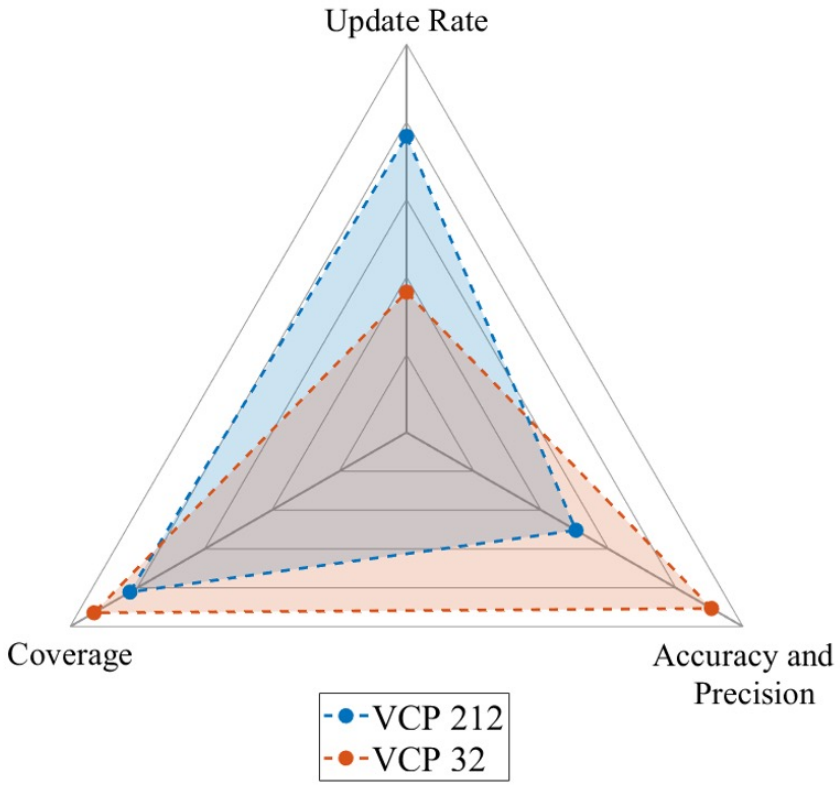
Trade-Off Triangle Applied to WSR-88D

- VCP 212 (for elevations scanned):
  - Faster update rate: 15 pulses/radial
  - ➢Coverage: lower sensitivity
  - ➢Lower Accuracy & Precision
- VCP 32 (for elevations scanned):
  - Slower update rate: 64 pulses/radial
  - ➢Coverage: higher sensitivity
  - ➢Higher Accuracy & Precision



WSR-88D “Trade-Offs”

- Trade-offs are managed through VCP choice
- Within chosen VCP, constant
  - Antenna pattern (beamwidth & sidelobe levels)
  - Azimuthal sampling
  - Sequence of complete PPI scans within a VCP
- Highest performance applied all the time
  - Super-res for stratiform rain?
  - Same sidelobe levels for clear air vs. severe convection?



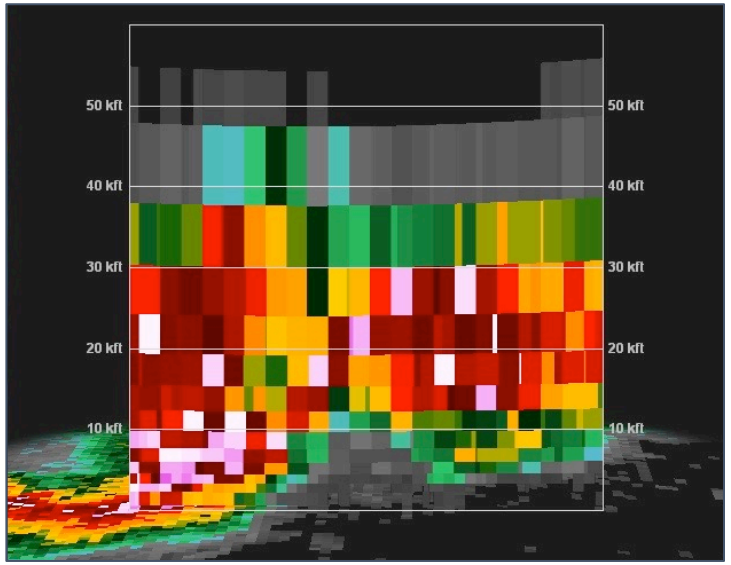
PAR “Trade-Offs” Potentially Much Different

- Greater scanning flexibility horizontally and vertically

- Within same volume, different
  - Antenna pattern (beamwidth & sidelobe levels)
  - Azimuthal sampling
  - Flexible elevations within a “VCP”
  - Flexible sequence of PPIs and RHIs
  - And more…

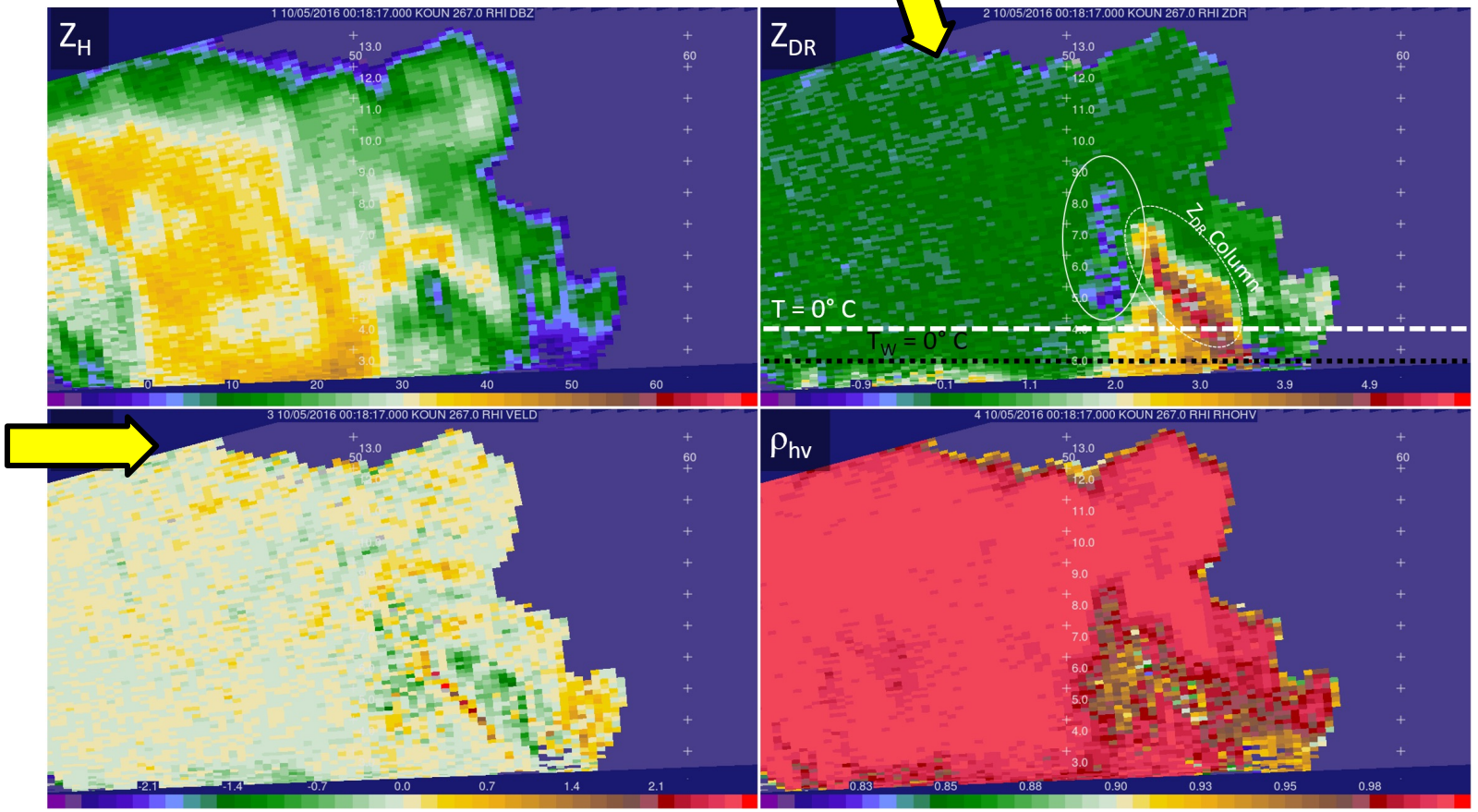
PAR can provide data you need when and where you need it

What a PAR Can Do that a Dish Can Not



KOUN - NSSL
Research WSR-88D
7-9 seconds
transition time

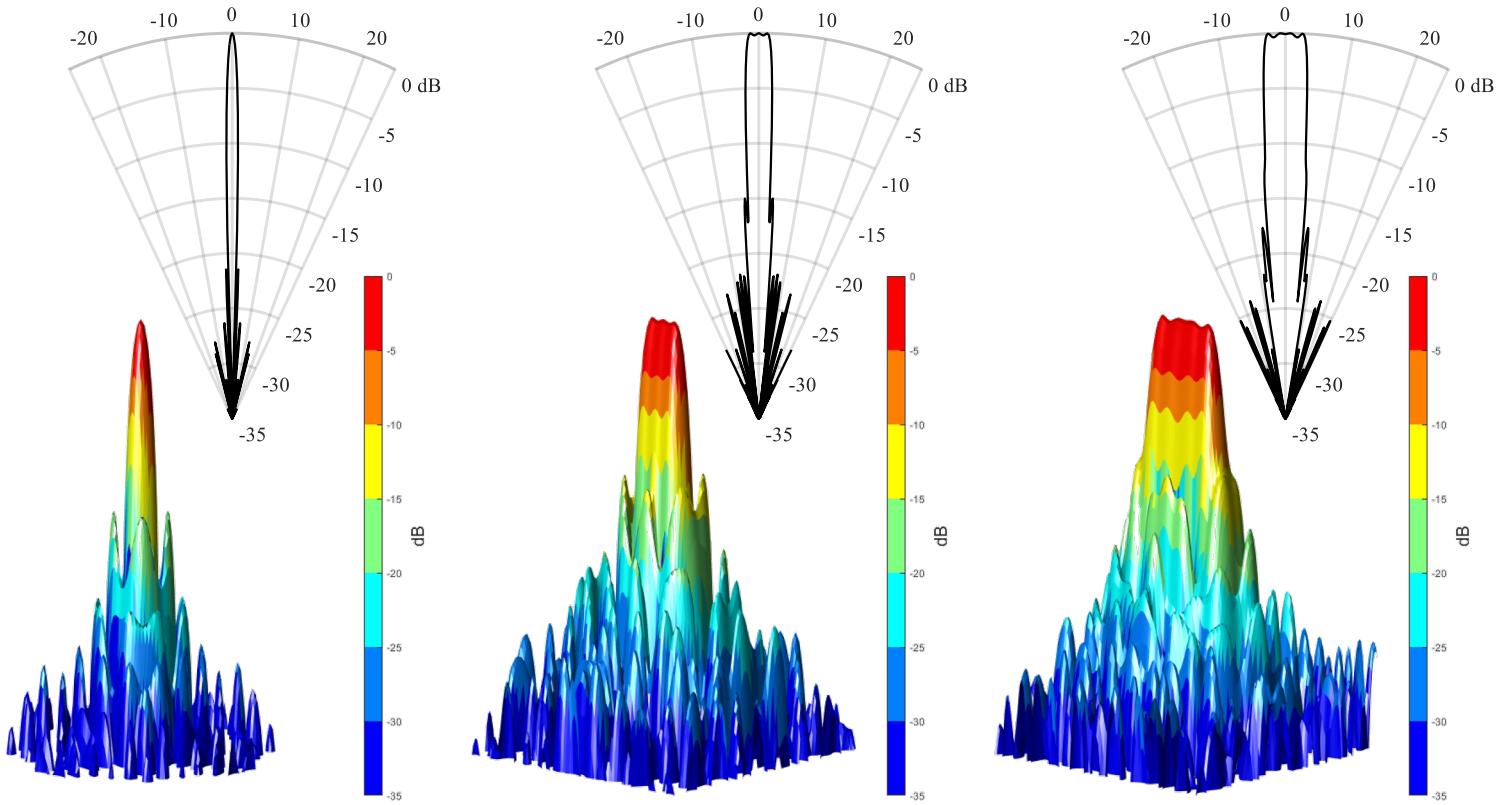
- Range Height Indicator (RHI)
  - Smooth vertical resolution



What a PAR Can Do that a Dish Can Not

- Transmit “spoiled beams” for faster updates
  - Compared to the pencil beam, spoiling reduces sensitivity & raises sidelobes

A possibility:



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Future Work and Opportunities for Collaboration:

- Design experiments and data collection strategies and lead the collection of both KOUN and ATD and radar data.
- Conduct research to evaluate how rapidly- and adaptively- scanned, dual-polarization radar observations advance our understanding of severe storm structure and evolution.
- Assess the ability of rapidly- and adaptively- scanned, dual-polarization radar observations to improve warning performance for severe weather hazards.
- Continue work to understand tradeoffs between update rate, spatial sampling, and data quality for each unique severe weather hazards.

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Future Work and Opportunities for Collaboration:

- Investigate how existing radar algorithms can best take advantage of the ATD's rapid- and adaptive- scanning capabilities.

- Collaborate with NSSL and CIMMS scientists in the FRDD and WRDD to evaluate how rapidly- and adaptively- scanned radar observations can best be integrated into future forecast and warning paradigms that are likely to include advanced numerical models and probabilistic warnings for severe weather hazards.

- Plan and execute an operational demonstration to evaluate the use of dual-polarization phased-array radar data and products in an operational environment.

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A PAR system has much greater scanning flexibility compared to a parabolic-reflector antenna such as the WSR-88D's. The WSR-88D is designed for the "best performance all the time", while a PAR system offers the paradigm shift to "the radar you need when and where you need it".

- Jami Boettcher

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