P149

Designing a Detection Scan for Adaptive Weather Sensing

David A. Warde, Igor Ivic and Eddie Forren
Cooperative Institute for Mesoscale Meteorological Studies, The University of Oklahoma, and NOAA/OAR National Severe Storms Laboratory, Norman, Oklahoma

Motivation

ADAPTS effectively address the interest of meteorologists for faster updates by providing spatially focused weather observations to reduce volumetric scanning times and increase overall dwell times in regions of interest.

ADAPTS III introduces an autonomous detection scan which provides fast volume coverage and allows for the use of independent scanning strategies for both weather and detection beams.

Requirements

- Detect significant weather (>10 dBZ)
- *Minimum scan time*
- *Minimize false alarms*
- *Mitigate ground clutter*

Trade-offs/Result

- Small dwell time
  - Unbiased estimate with decreased data quality
  - Over sample in range
  - Range average
- Coarsely scanned volume in azimuth and elevation
  - Unmatched weather beams
  - Nearest neighbor
- Zero-isodop loss
  - New Filter design needed

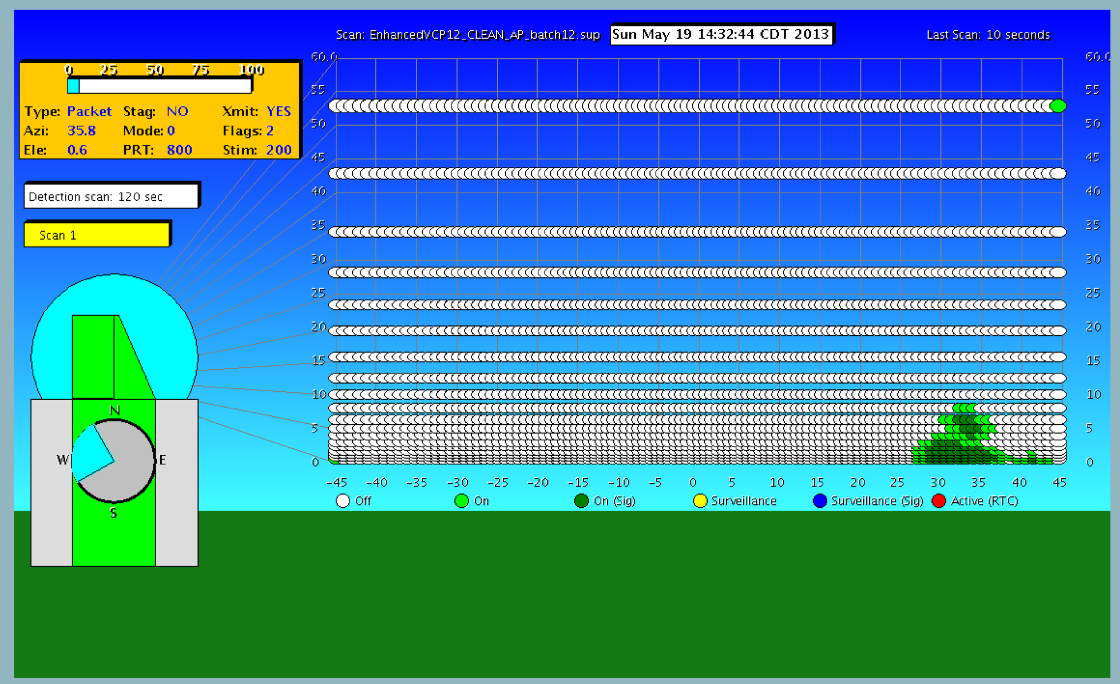
Detection Scan

- 90 degree azimuthal sector (1 PAR panel)
- 0.5° – 60 ° elevation (36 elevations)
- 54 beams per elevation
- 4 samples per beam
- 7.5 s to complete full scan
- User select update rate (default 60 s)

NWRT PAR ADAPTS GUI

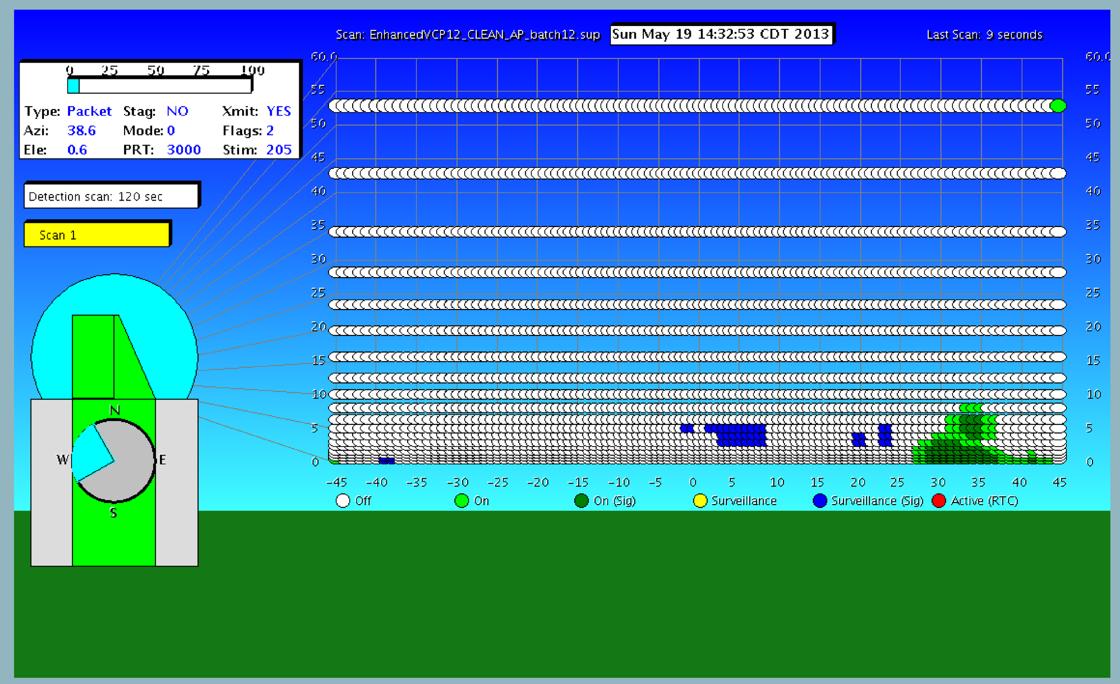
Weather Scan 14:32:44 CDT

Weather beams that are activated by significant weather (dark green) or neighborhood rules (light green) are tracking previously detected storms. The white indicates that no transmission occurred in these beam positions. (Image provided by David Preignitz)



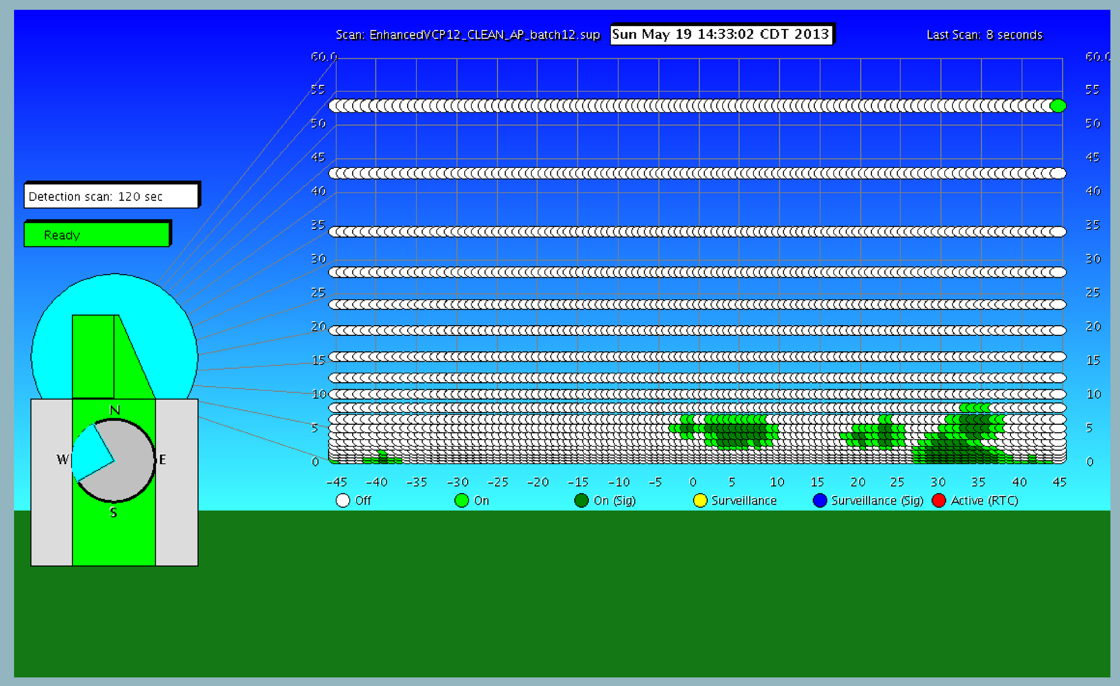
Weather Scan 14:32:53 CDT

Weather beams that are active for significant weather (dark green) or neighborhood rules (light green) are tracking previously detected storms; while additional weather beams (blue) activated by detection mode indicate formation of new storms. The white indicates that no transmission occurred in these beam positions. (Image provided by David Preignitz)

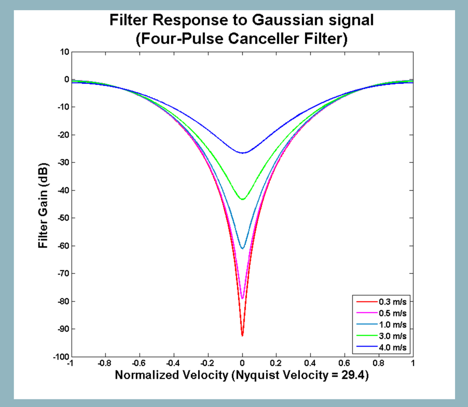


Weather Scan 14:33:02 CDT

Weather beams that are active for significant weather (dark green) or neighborhood rules (light green) are tracking previously detected storms which now includes the newly formed storms. The white indicates that no transmission occurred in these beam positions. (Image provided by David Preignitz)

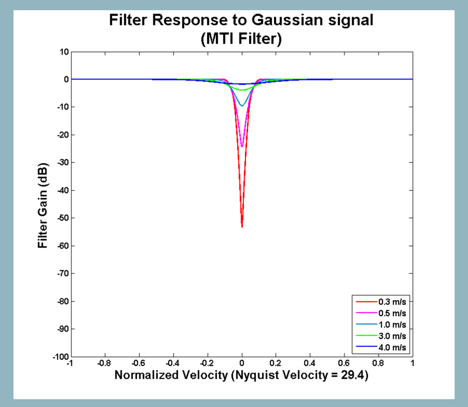


Ground Clutter Mitigation



Four-pulse Canceler

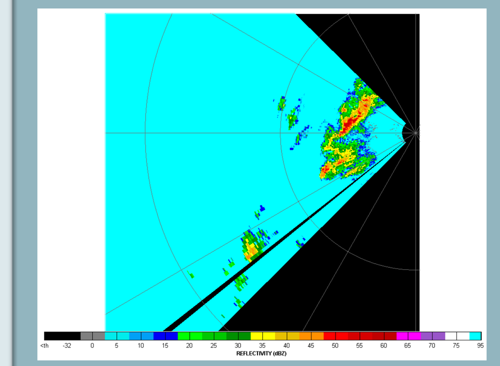
Filter Response to Gaussian signal reveals that filter has large notch width and biases signals throughout Nyquist. Wide spectrum signals impacted negatively.



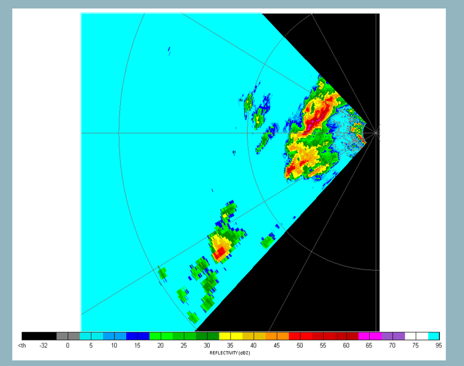
New MTI Filter

Filter Response to Gaussian signal reveals small notch around zero velocity with good clutter rejection (i.e.: passes wide spectrum signals).

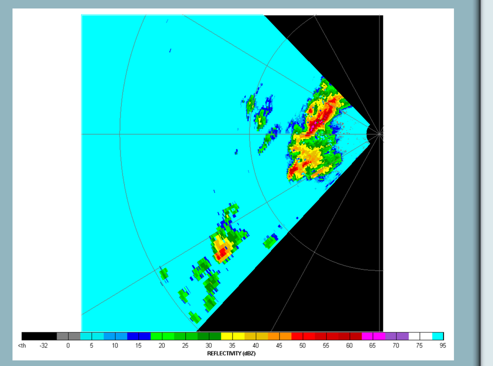
Detection Mode Reflectivity (Not provided to users)



Four-pulse Canceler



Unfiltered



MTI Filtered

Comparison of Four-pulse Canceler and MTI Filter

Both the 4-pulse canceler and the MTI filter provide adequate clutter mitigation as seen by low reflectivity value near the radar (right side of image) for left (4-pulse canceler) and right (MTI filter) images, and high reflectivity values near the radar in the unfiltered (middle) image. Note, however, that less biases are exhibited by the MTI filter which translates into better weather detection. This can be seen in the left image as a wedge in the reflectivity PPI where the 4-pulse canceller did not detect any significant weather.

Future Upgrades

- Maximum range from detection mode can be used to adjust the unambiguous range of weather mode to reduce scanning times
- Near range detection can be used to adjust neighborhood rules for near and far range detection

September 2013 – 36th Conference on Radar Meteorology – Breckenridge, CO