



Staggered PRT Status

(Informational Briefing)

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NEXRAD Technical Advisory Committee

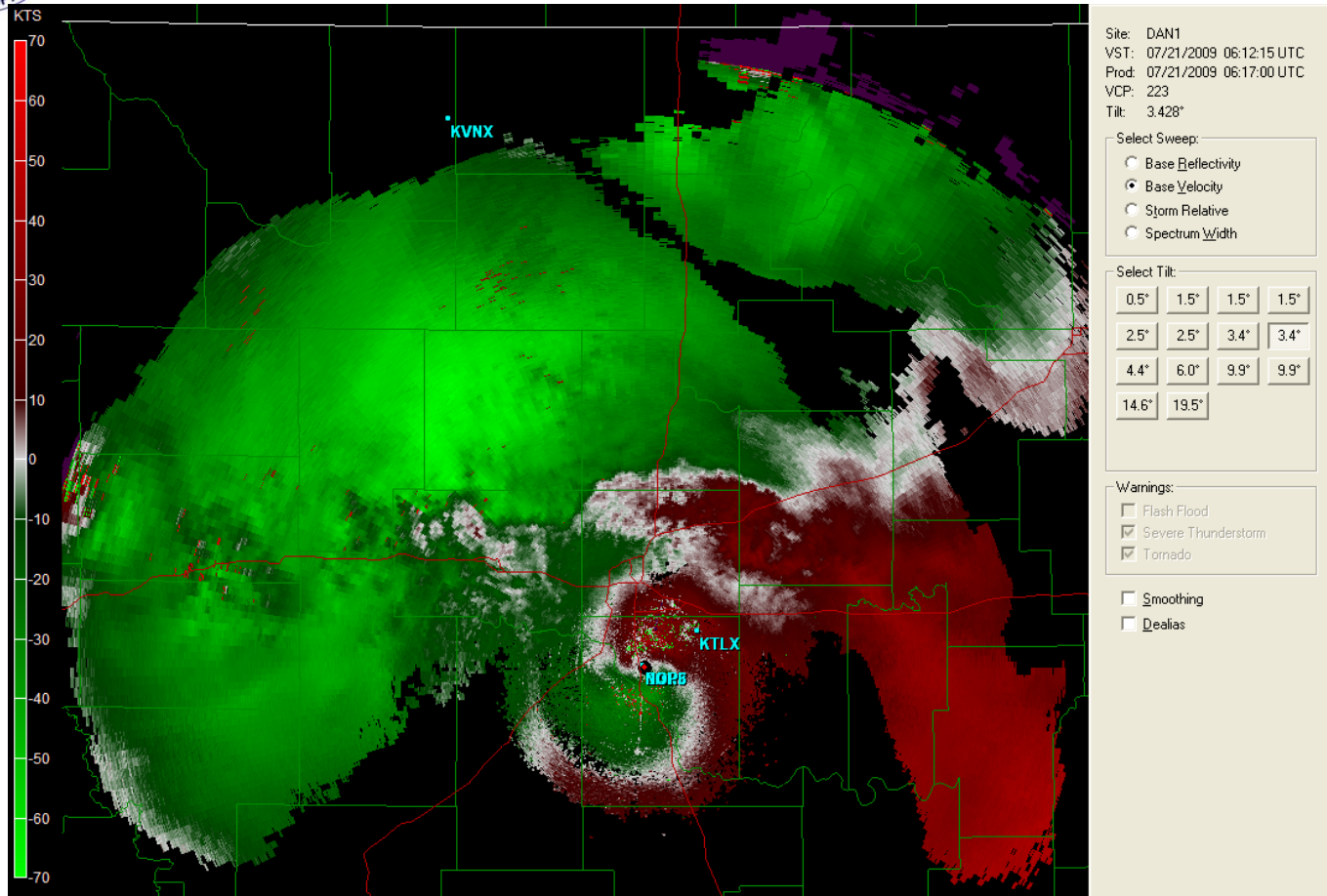


Outline

- Why SPRT?
- Overview of SPRT
- Three Phased Approach
- Status
- Future Plans



Why SPRT?





Why SPRT?

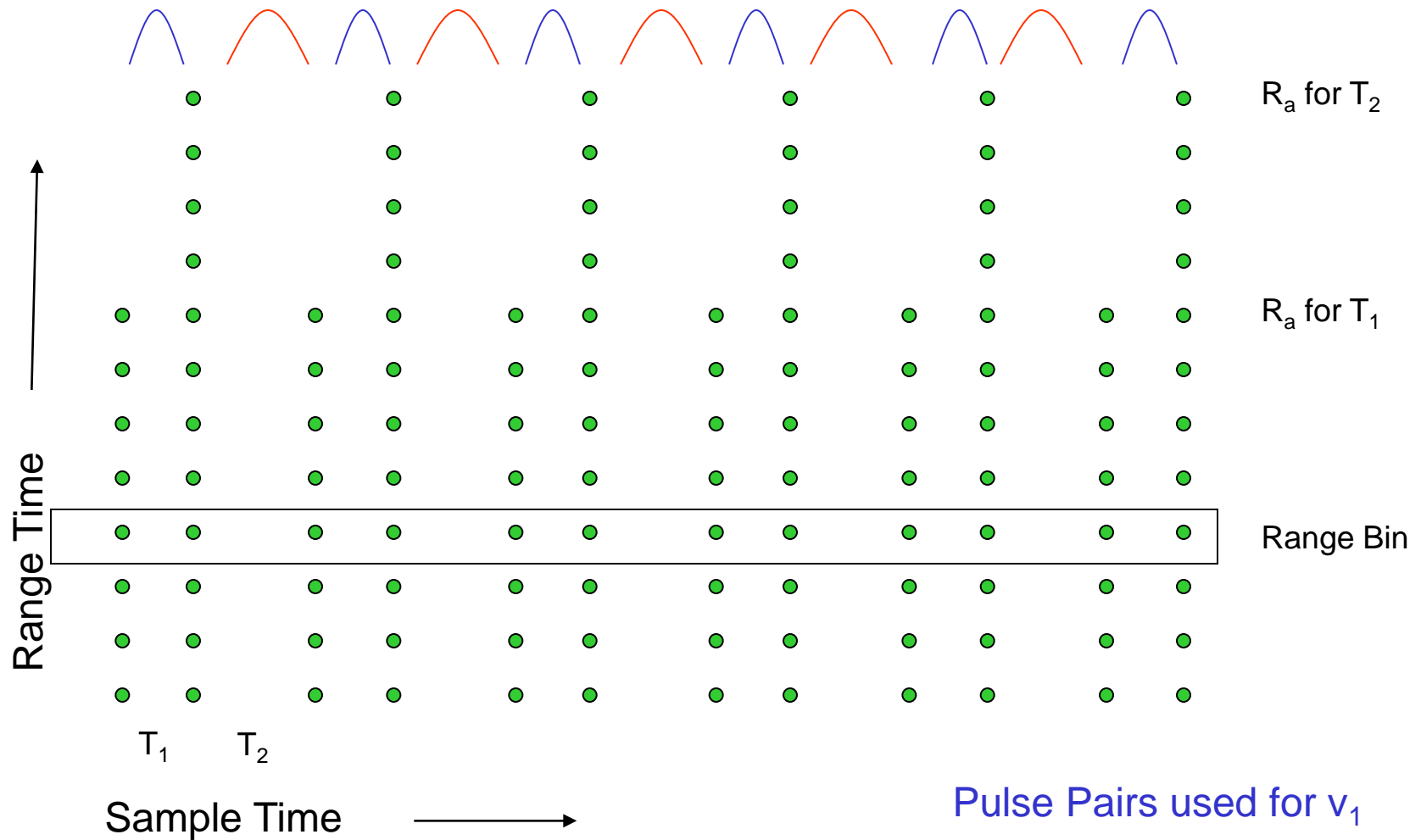
- Recovers higher velocities from longer PRTs
 - Long PRT reduces range folding
 - Staggered PRT provides method to recover aliased velocities
- Replaces Batch and Contiguous Doppler without range unfolding (CDBatch) tilts
 - Less range folding than Batch
 - Can recover higher velocities than CDBatch



SPRT Overview

- Dealiasing Technique
 - Transmits alternating Pulse Repetition Time intervals, T_1 and T_2
 - Employs Pulse Pair Processing equations
 - Calculates a velocity from each time interval
 - Finds the difference between velocities
 - Uses that difference to dealias one of the original velocities
- Utilizes a DC removal clutter filter
 - Only achieves 30 dB suppression

SPRT Time Series Diagram



Example: Scale reflects $\kappa=2/3=T_1/T_2$ and $T_1 < T_2$

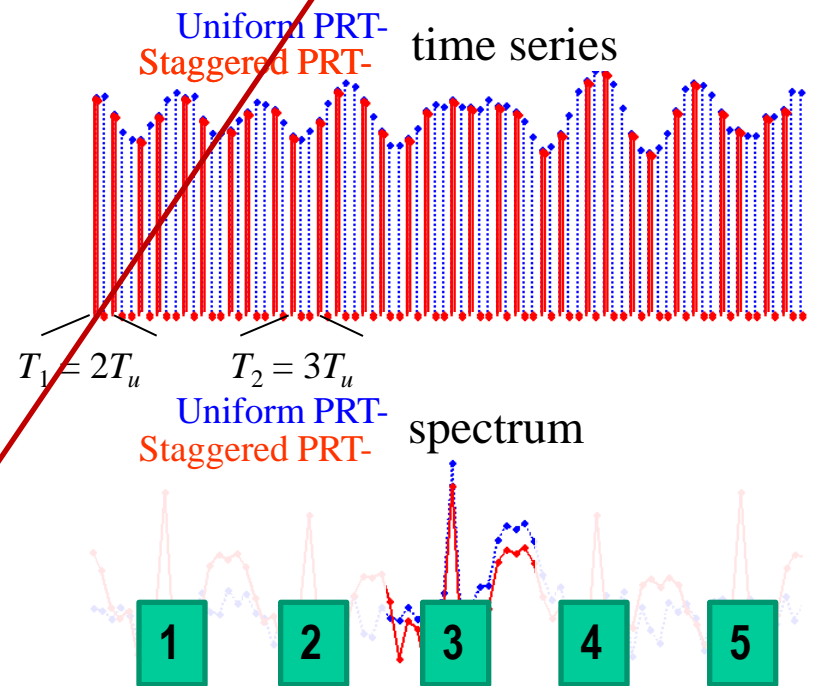


SPRT and Clutter Filtering

- SPRT originally used a DC removal clutter filter
 - Only achieves 30 dB suppression
 - Does not meet requirements
- Why not use GMAP with SPRT?
 - GMAP works in the frequency domain, not time domain
 - Fourier Transform changes from the time domain to the frequency domain
 - The DFT is the commonly implemented Fourier Transform method
 - **The DFT assumes uniformly spaced time samples**
 - SPRT has non-uniformly spaced time samples
- NSSL developed a solution
 - **Spectral Algorithm for Clutter Harmonics Identification and removal (SACHI Filter)**

The SACHI Filter

- **Zero filling** reconstructs uniform PRT sequence (T_u)
- Spectrum is modulated: 5 replicas
- Central portion of spectrum is given to GMAP to **determine notch width**
- **Projections** are used to remove clutter from other 4 replicas
- **Velocity** is estimated from resulting spectrum
 - Higher errors due to replicas
- **Deconvolution** undoes modulation
- **Velocity** is estimated from resulting spectrum
 - Extended Nyquist: $v_a = \lambda/4 T_u$





Three Phased Implementation Approach - Overview

- Phase I – CCR: NA07-10703 NA06-33301
 - Enabled Sigmet's Dual PRT (DPT2) Major Mode
 - Collected Staggered PRT level 1 data
 - Compared Sigmet's DPT2 with NSSL's Staggered PRT (SPRT)
 - Selected NSSL's SPRT
- Phase II – CCR: NA07-10802 NA07-35104
 - Implemented RVP8 Major Mode for NSSL's SPRT
 - Engineering test functionality
 - Utilizing a DC removal clutter filter
 - Continuing data collection and analysis
 - Analyzing SACHI's complex spectral clutter filter (NSSL)
- Phase III – CCR: NA08-21662
 - Add implementation of the SACHI clutter filter
 - Provide operational functionality



Three Phased Implementation Approach – Phase I

- Phase I – Complete
 - Enabled Sigmet's Dual PRT (DPT2) Major Mode
 - Collected Staggered PRT level 1 data
 - Compared Sigmet's DPT2 with NSSL's Staggered PRT (SPRT)
 - Selected NSSL's SPRT



Three Phased Implementation Approach – Phase II

- Phase II – Complete
 - Implemented RVP8 Major Mode for NSSL's SPRT
 - Engineering test functionality
 - Utilizing a DC removal clutter filter
 - Continuing data collection and analysis
 - Analyzing SACHI's complex spectral clutter filter (NSSL)
- Verified SPRT implementation
 - Bin by bin comparison with NSSL
- Applications Branch adjusted the VDA
- RDA Build 11.2 (non-operational)
 - Deployed to the field 23 November 2009



Three Phased Implementation Approach – Phase III

- Phase III – In Progress
 - Implement the SACHI clutter filter
 - Provide operational functionality
- NSSL provided the AEL for the SACHI filter
 - Included recovery of range overlaid signal
- Need for data became apparent
 - For use in unit testing the implementation of the SACHI filter
 - For engineering analysis once implementation is complete
 - SPRT changes transmission of pulses
 - Required collection of data in operational mode
 - Required determining an operational VCP
- Knew that KCRI resource was limited
 - Increased the priority of data collection



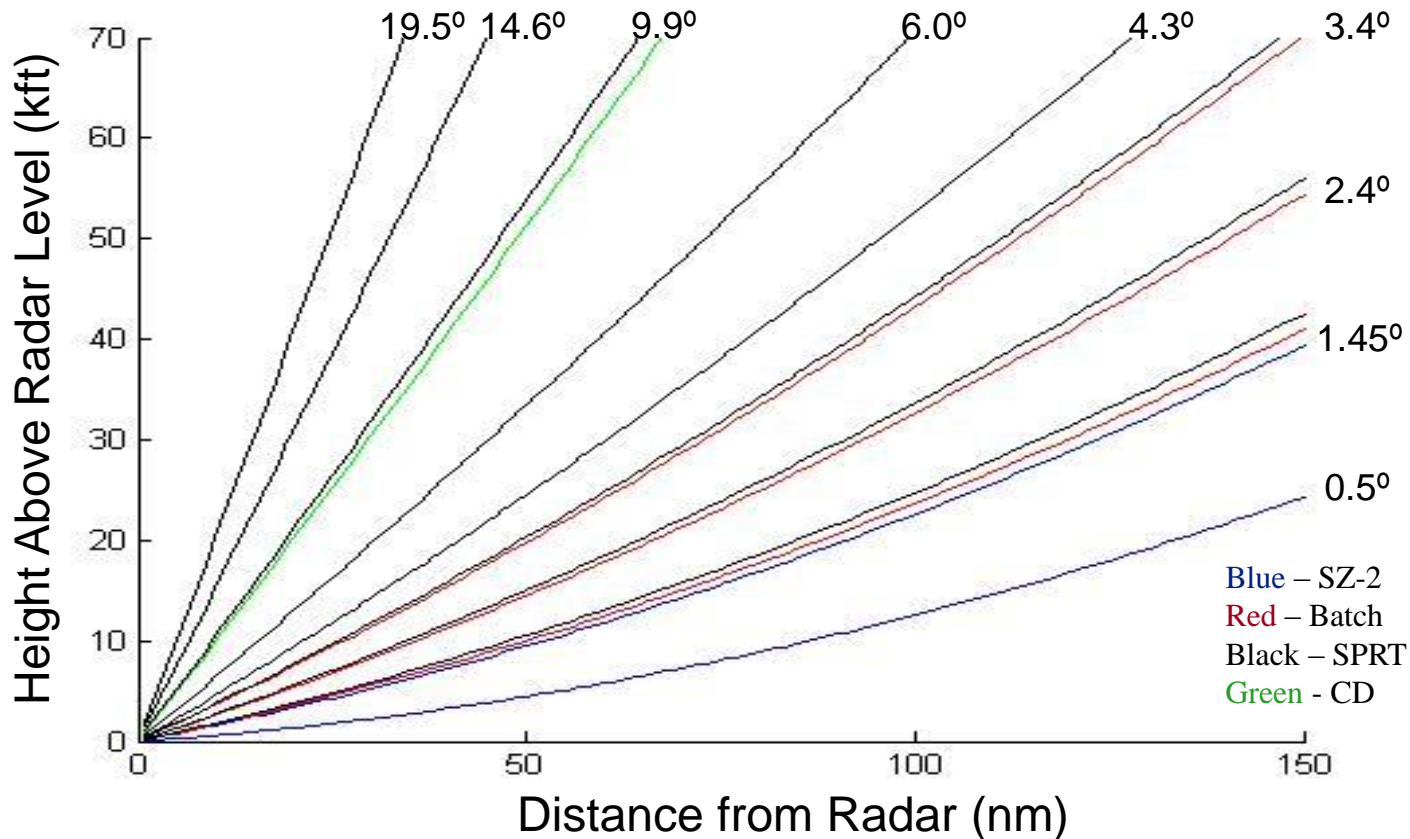
Engineering SPRT VCP

- Create an engineering VCP
 - NSSL provided analysis for optimal PRFs
 - SPRT
 - SACHI filter
 - 2/3 PRT ratio
 - Merged SPRT and VCP 221
 - Proposed operational SPRT VCP, VCP 222
 - Modified VCP 222 to add information for engineering
 - Additional SPRT scan at 1.5° elevation
 - Provides data with clutter contamination
 - Additional Batch scan at 1.5° elevation
 - Multiple sweeps at the same elevation angle
 - 2.4°, 3.4°, and 9.9°
 - Different processing
 - » Batch
 - » SPRT
 - » CD
 - Provides a comparison between processing methods

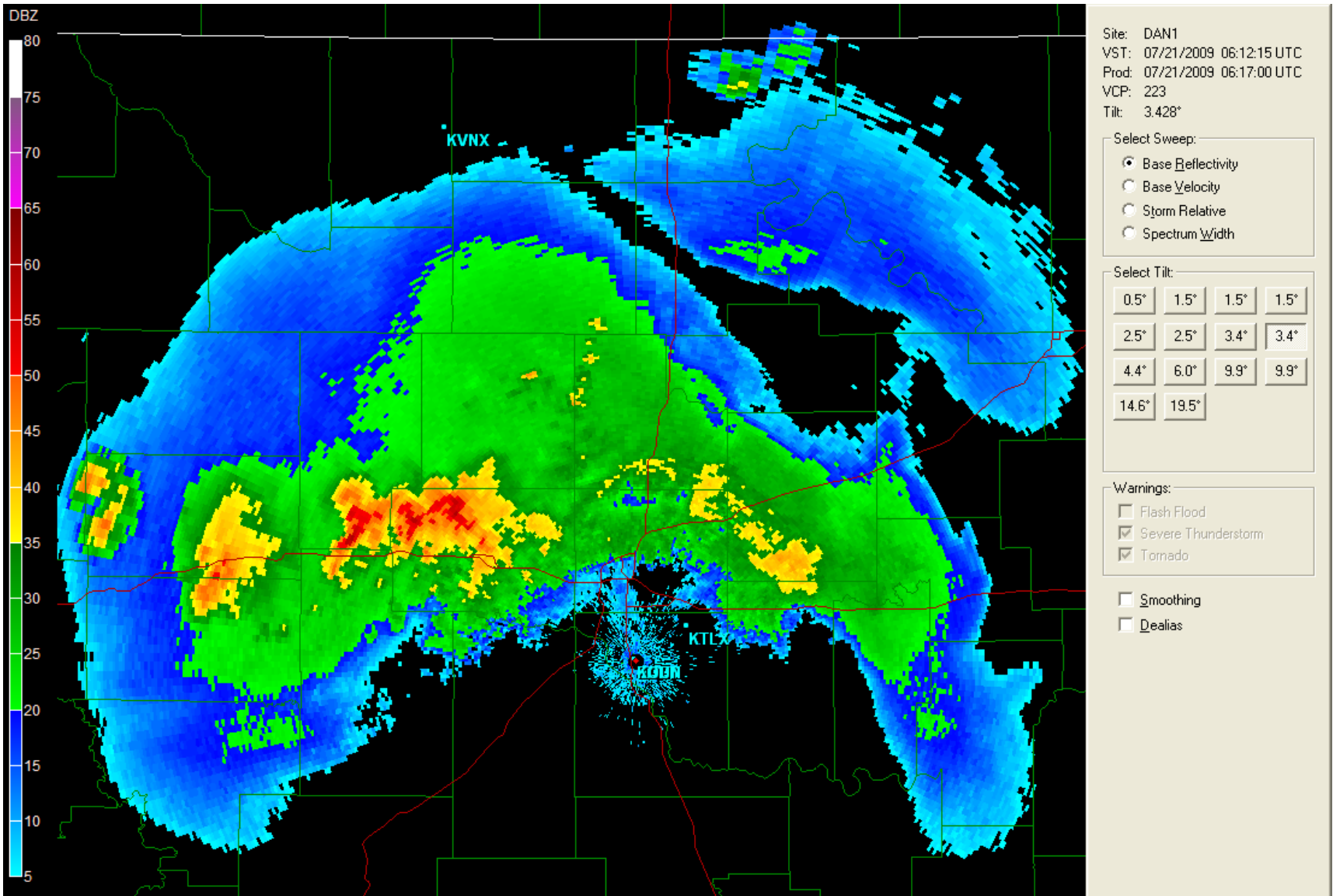


Engineering SPRT VCP

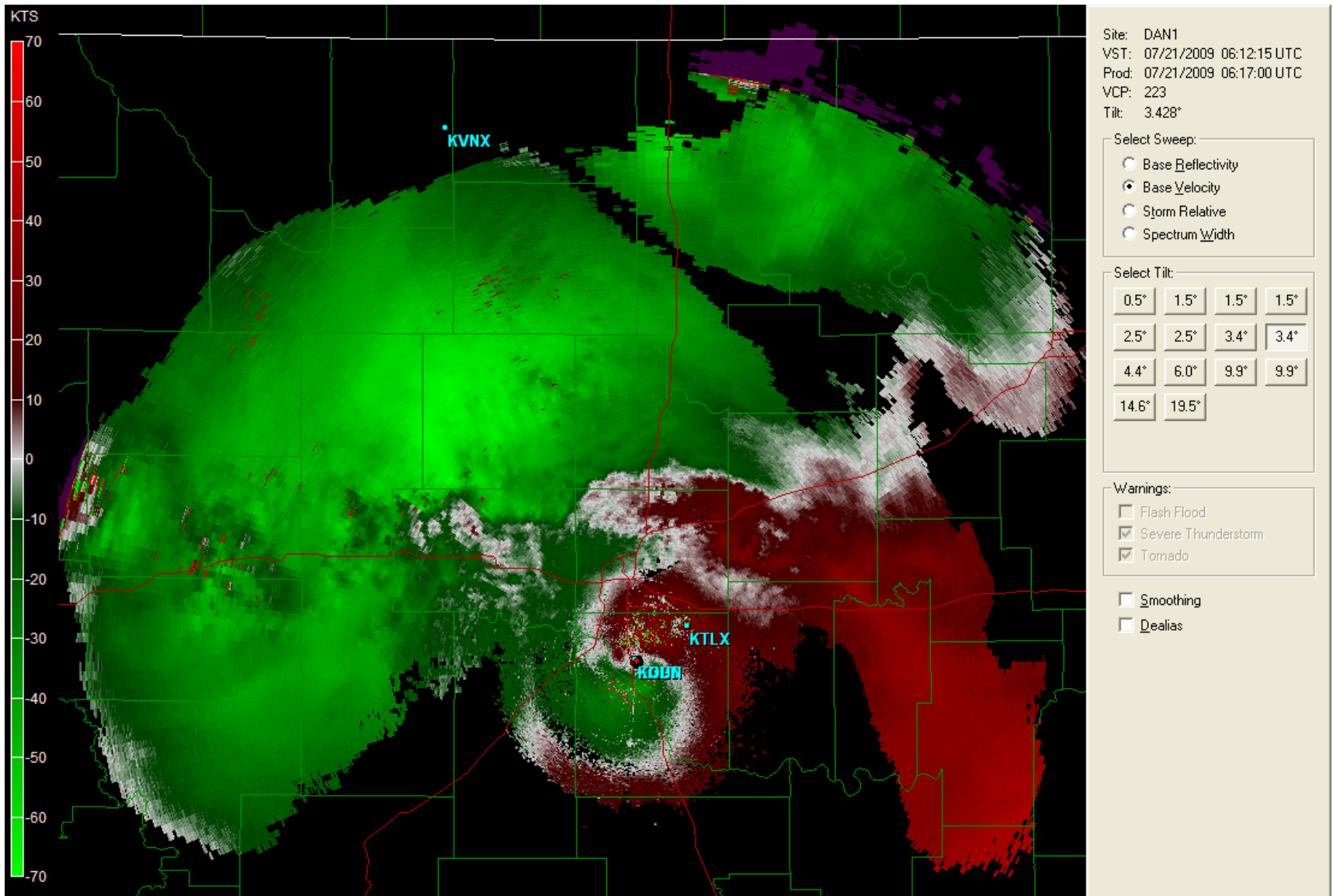
Range vs. Height from WSR-88D Beam Height Equation VCP 223



SPRT Reflectivity



SPRT Velocity





Future Plans

- Continue to implement the SACHI filter
- Risks
 - Dual pol first priority for resources
 - People
 - Testbed
- Build 13 first build after Dual Pol deployment
 - Focus on implementing CMD
 - Fine tuning Dual Pol
- Operational SPRT targeted for Build 14
 - Implemented in Build 13



Questions?

SPRT Spectrum Width

