Storm-Based
Auto PRF

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ROC Engineering
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Storm-Based Auto PRF

- Background: Currently, the Auto PRF algorithm selects the Doppler PRF that results in the least amount of range folded (purple) data for the entire area within a 230 km radius of the radar.

- Problem: The Auto PRF algorithm does not address the importance of any individual storm.

- Proposed Solution: Implement a Storm-Based Auto PRF function that automatically assigns the best PRF for the most severe storms.

Background Information

- "In a mini-postmortem this morning I learned that forecasters had a difficult time locating the correct storm to warn on because of data quality issues. I examined data from the closest radar, KFDR, and soon discovered that the storm was located near the beginning of the second trip most of the time which resulted in significantly degraded velocity data. The radar was in VCP 12 with auto PRF on. Unfortunately, the auto PRF moved the PRF three times, each time placing the storm in a few miles inside second trip. The answer would be to try VCP212 or set a manual PRF that places the storm back in the first trip. " KTLX SOO Dave Andra.

- Level II data analysis has strongly suggested that a Storm-Based Auto PRF function should reduce the impact of range folded velocity obscuration in many isolated severe storm cases.

Operational Need Addressed by the Storm-Based Auto PRF Concept
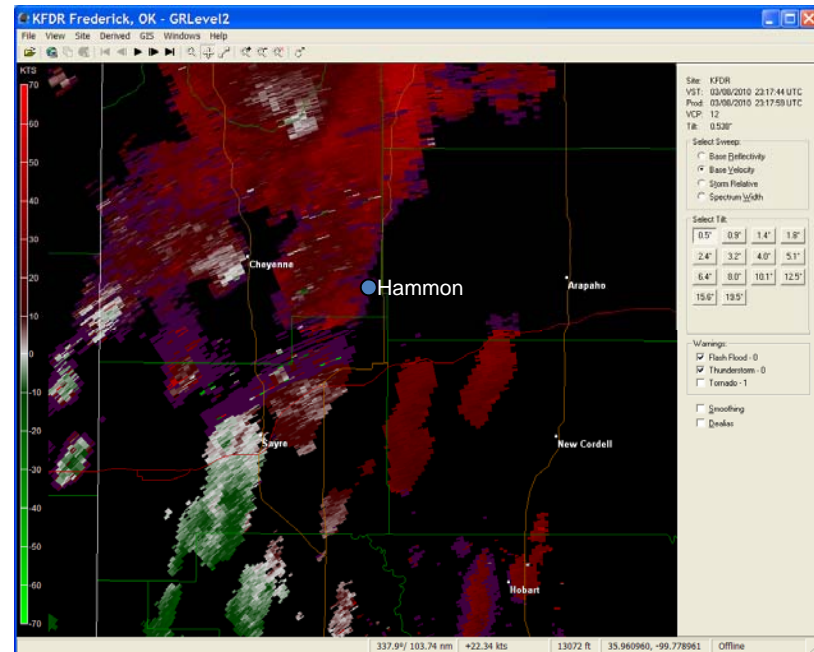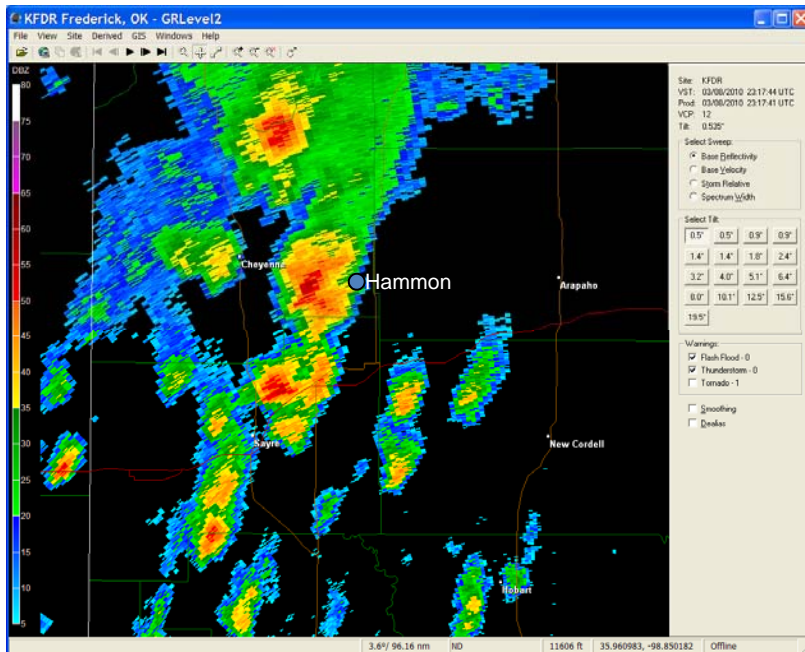
Hammon OK

Data from KFDR

03/08/2010

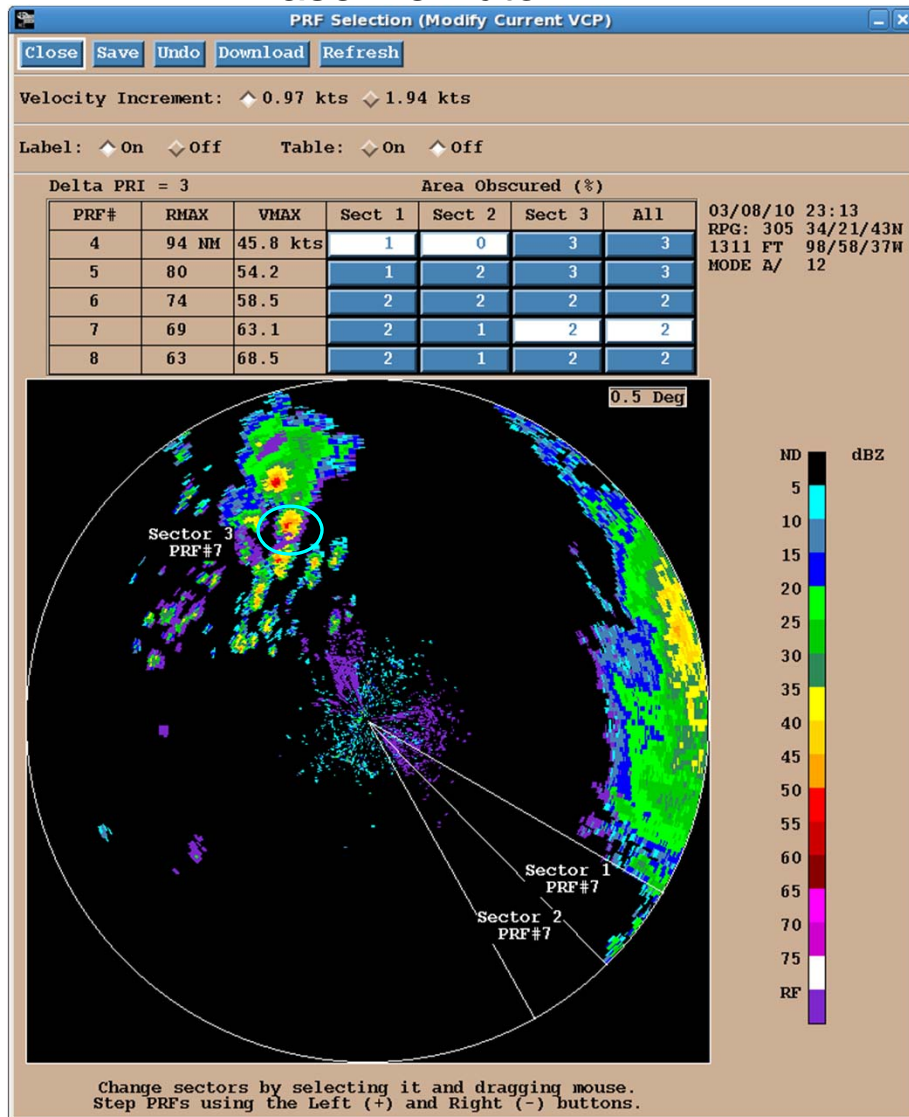# Operational Need Behind the Storm-Based Auto PRF Concept

"In a mini-postmortem this morning I learned that forecasters had a difficult time locating the correct storm to warn on because of data quality issues. I examined data from the closest radar, KFDR, and soon discovered that the storm was located near the beginning of the second trip most of the time which resulted in significantly degraded velocity data. The radar was in VCP 12 with auto PRF on. Unfortunately, the auto PRF moved the PRF three times, each time placing the storm in a few miles inside second trip. The answer would be to try VCP212 or set a manual PRF that places the storm back in the first trip." KTLX SOO Dave Andra

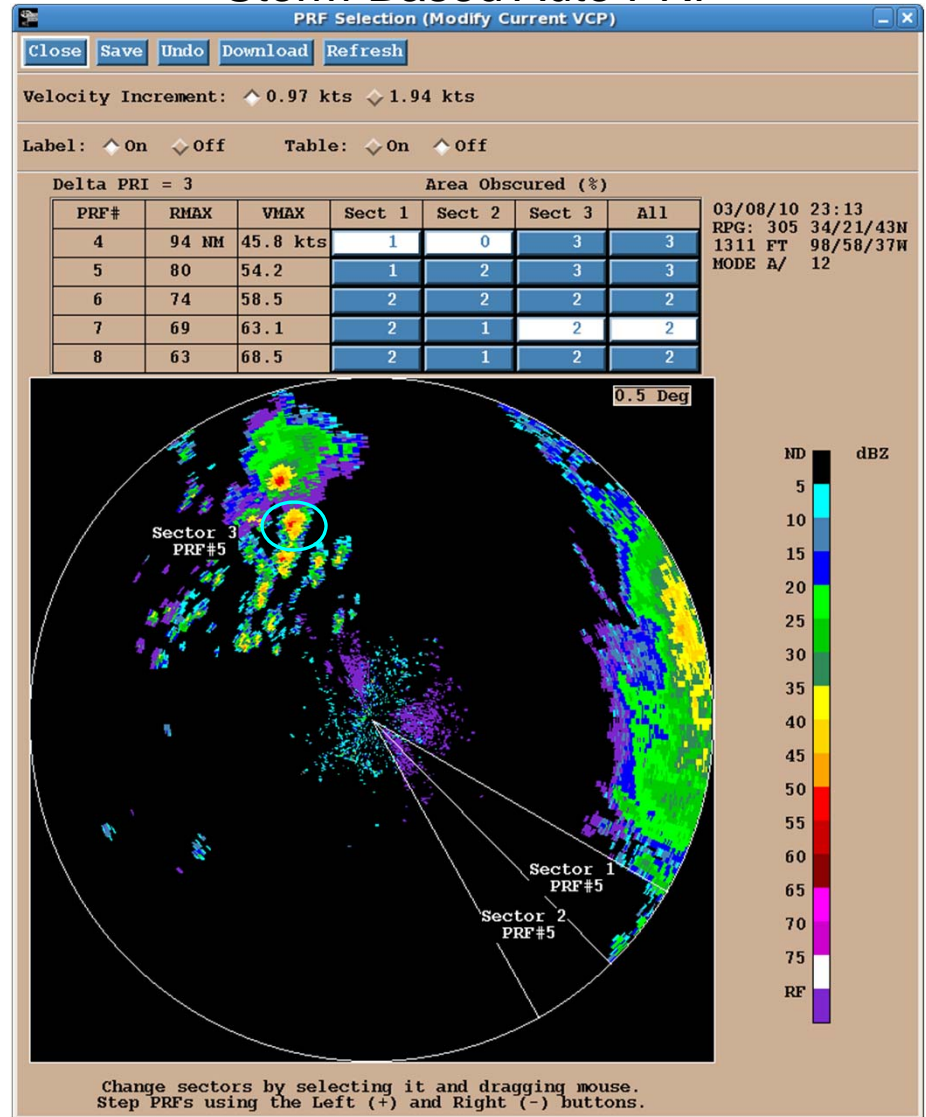## Hammon Oklahoma Tornado March 8, 2010

The Left image shows the expected range obscured bins using PRF 7 as selected by the baseline Auto PRF algorithm. The Right image shows the expected range obscured bins using PRF 5 as selected by the Storm-Based Auto PRF function.
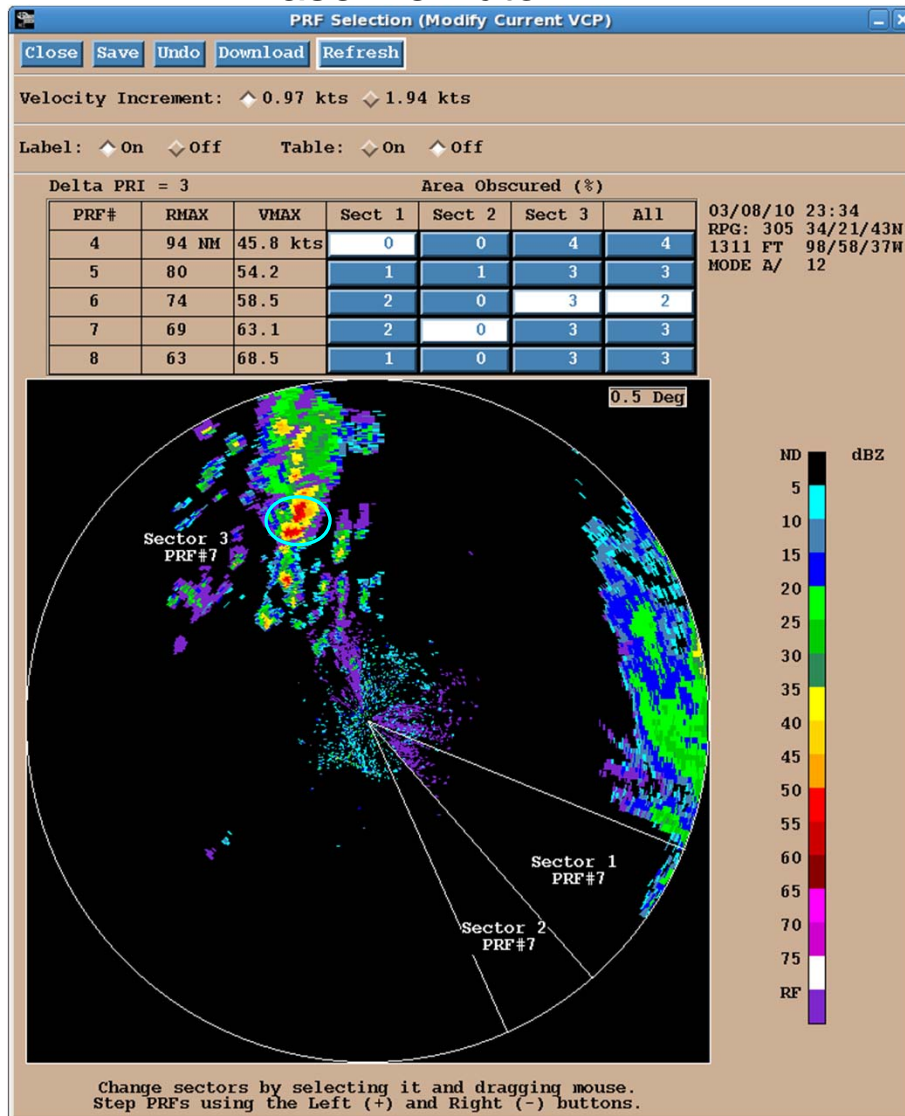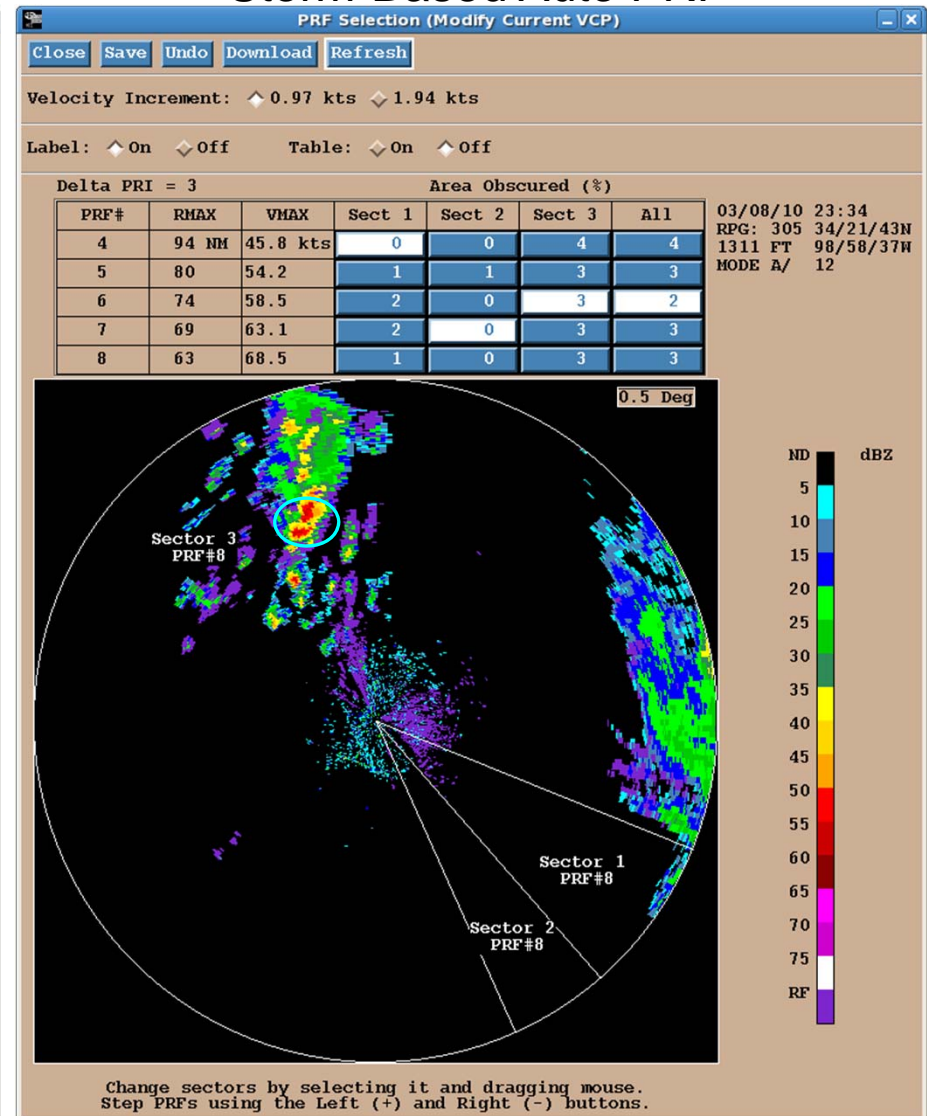
Baseline Auto PRF

Storm-Based Auto PRF

The Left image shows the expected range obscured bins using PRF 7 as selected by the baseline Auto PRF algorithm. The Right image shows the expected range obscured bins using PRF 8 as selected by the Storm-Based Auto PRF function.
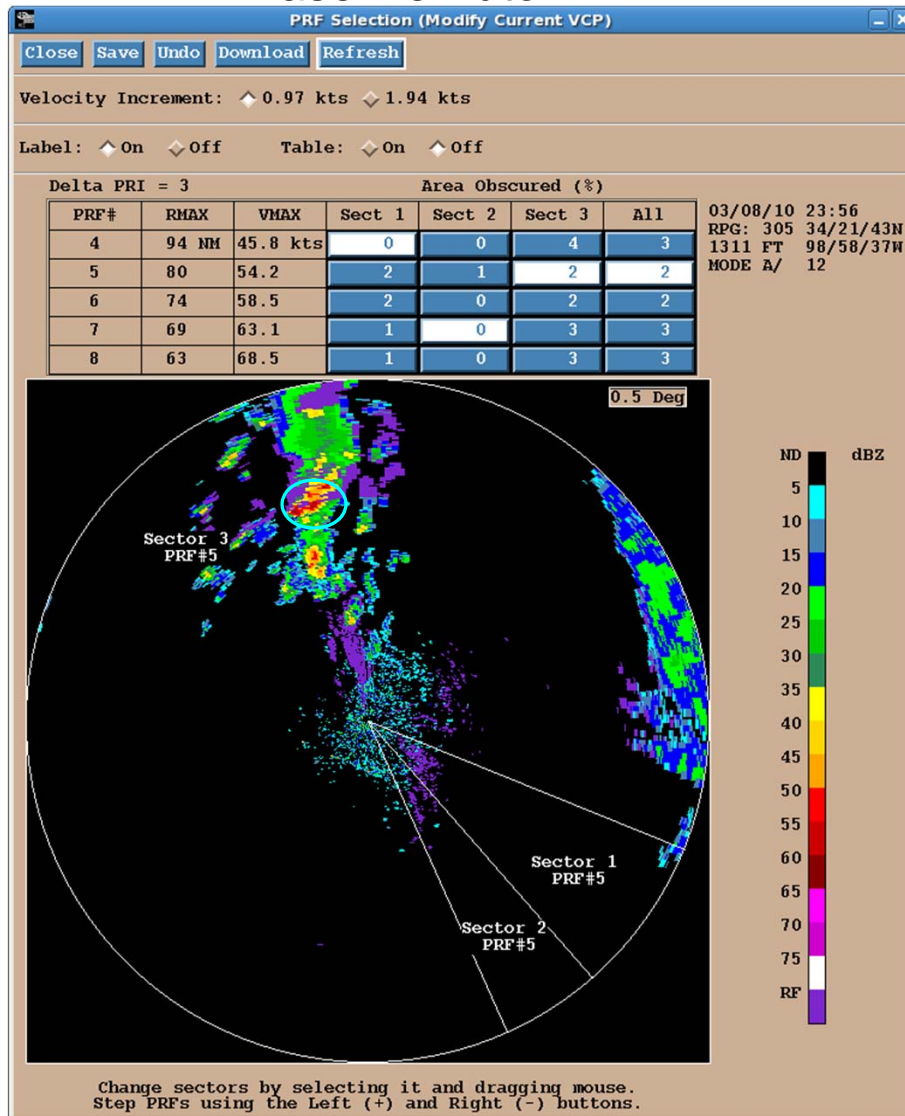
Baseline Auto PRF

Storm-Based Auto PRF

The Left image shows the expected range obscured bins using PRF 5 as selected by the baseline Auto PRF algorithm. The Right image shows the expected range obscured bins using PRF 8 as selected by the Storm-Based Auto PRF function.

Baseline Auto PRF

Storm-Based Auto PRF

Operational Need Addressed by the Storm-Based Auto PRF Concept

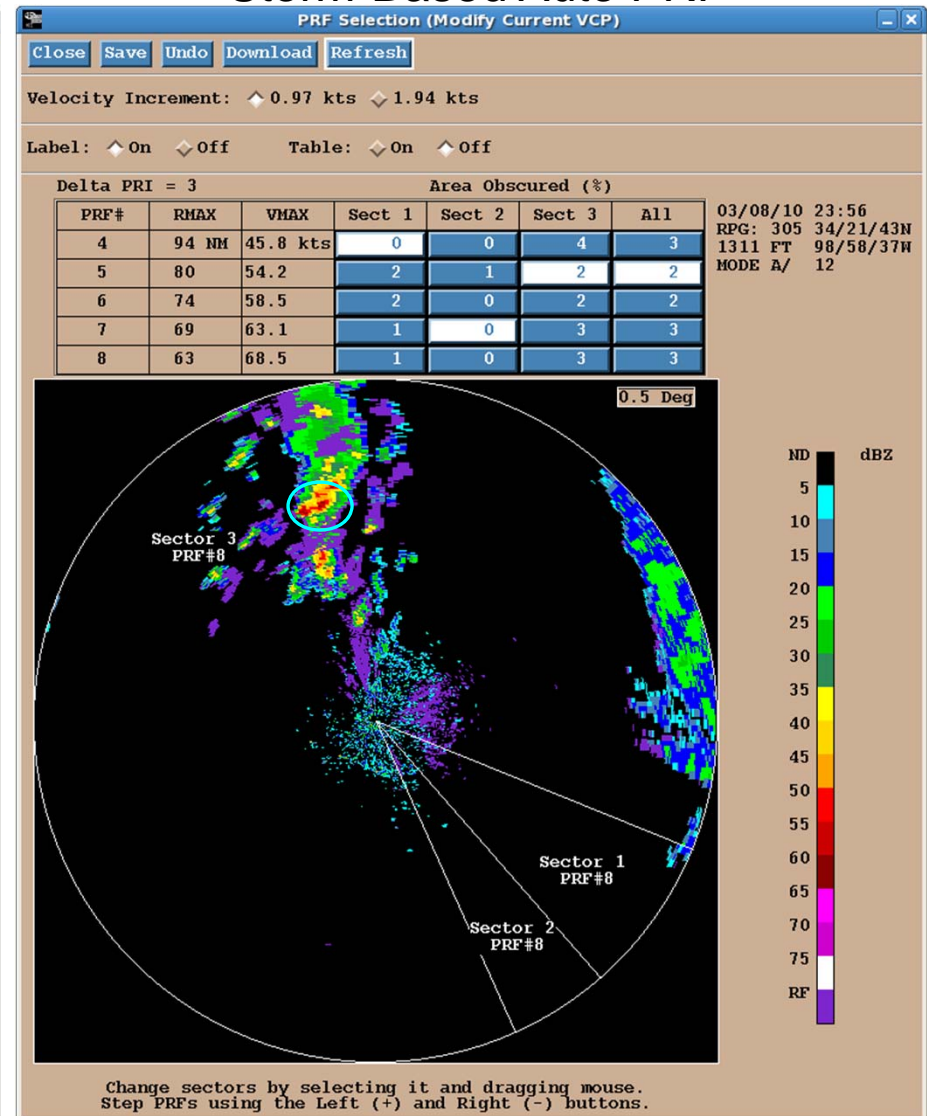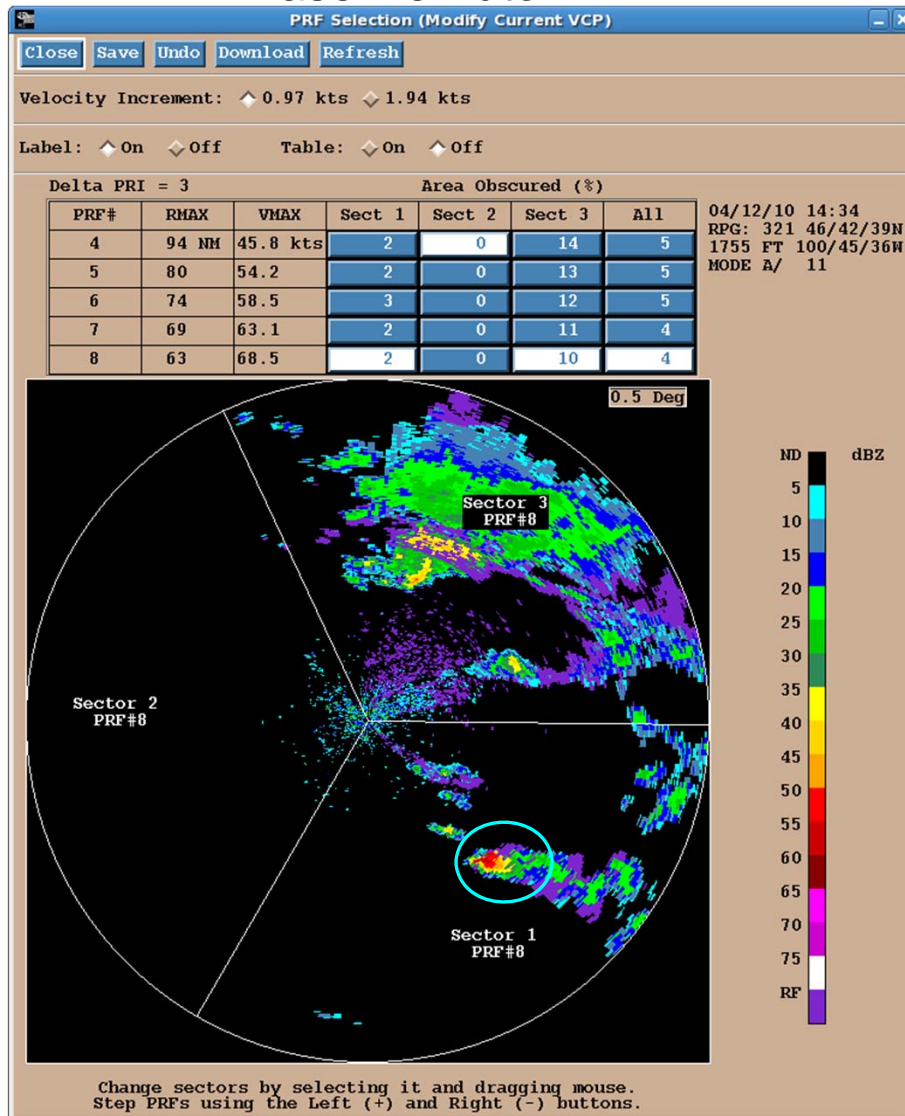## Ashley ND Hailstorm

Data from KBIS

04/12/2010

The Left image shows the expected range obscured bins using PRF 8 as selected by the baseline Auto PRF algorithm. The Right image shows the expected range obscured bins using PRF 5 as selected by the Storm-Based Auto PRF function.
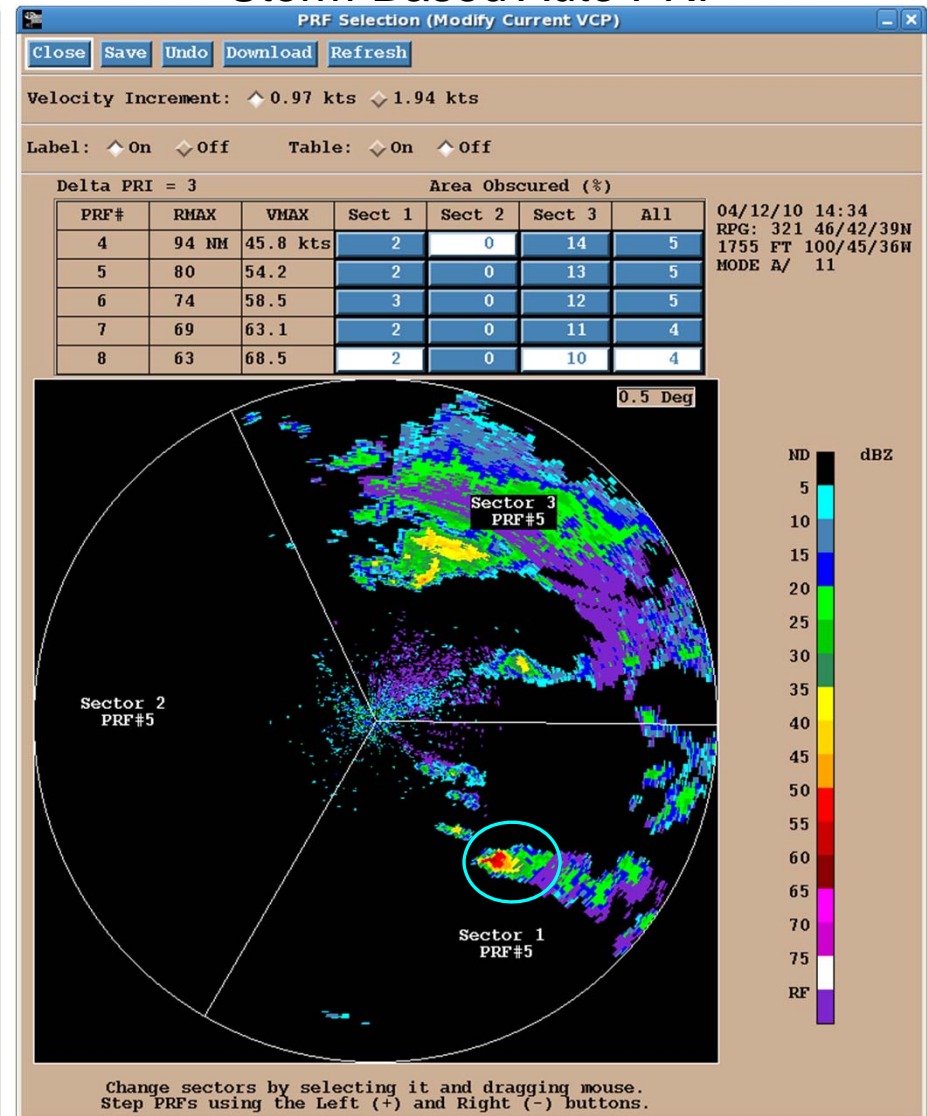
Baseline Auto PRF

Storm-Based Auto PRF

The Left image shows the expected range obscured bins using PRF 8 as selected by the baseline Auto PRF algorithm. The Right image shows the expected range obscured bins using PRF 5 as selected by the Storm-Based Auto PRF function.

Baseline Auto PRF

Storm-Based Auto PRF

Operational Need Addressed by the Storm-Based Auto PRF Concept

Jarrell TX

Data from KFWS

05/27/1997

The Left image shows the expected range obscured bins using PRF 5 as selected by the baseline Auto PRF algorithm. The Right image shows the expected range obscured bins using PRF 8 as selected by the Storm-Based Auto PRF function.
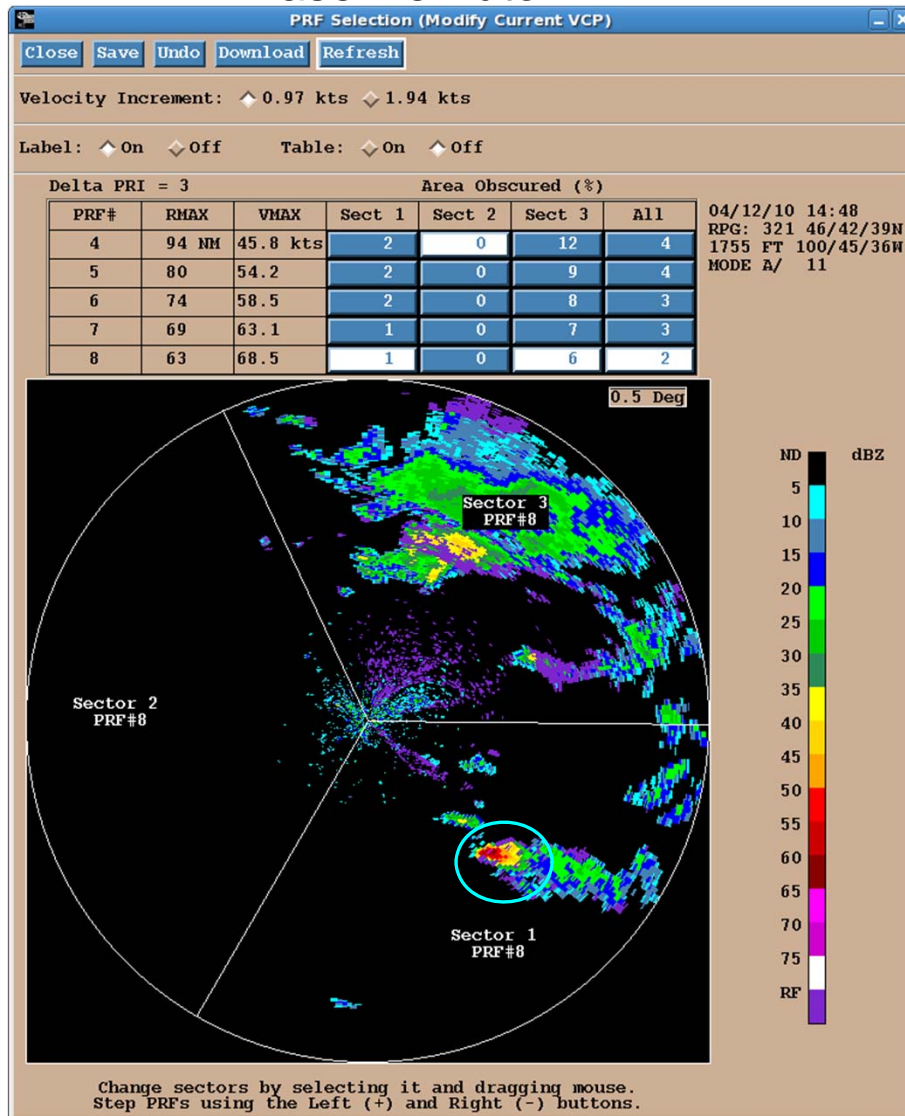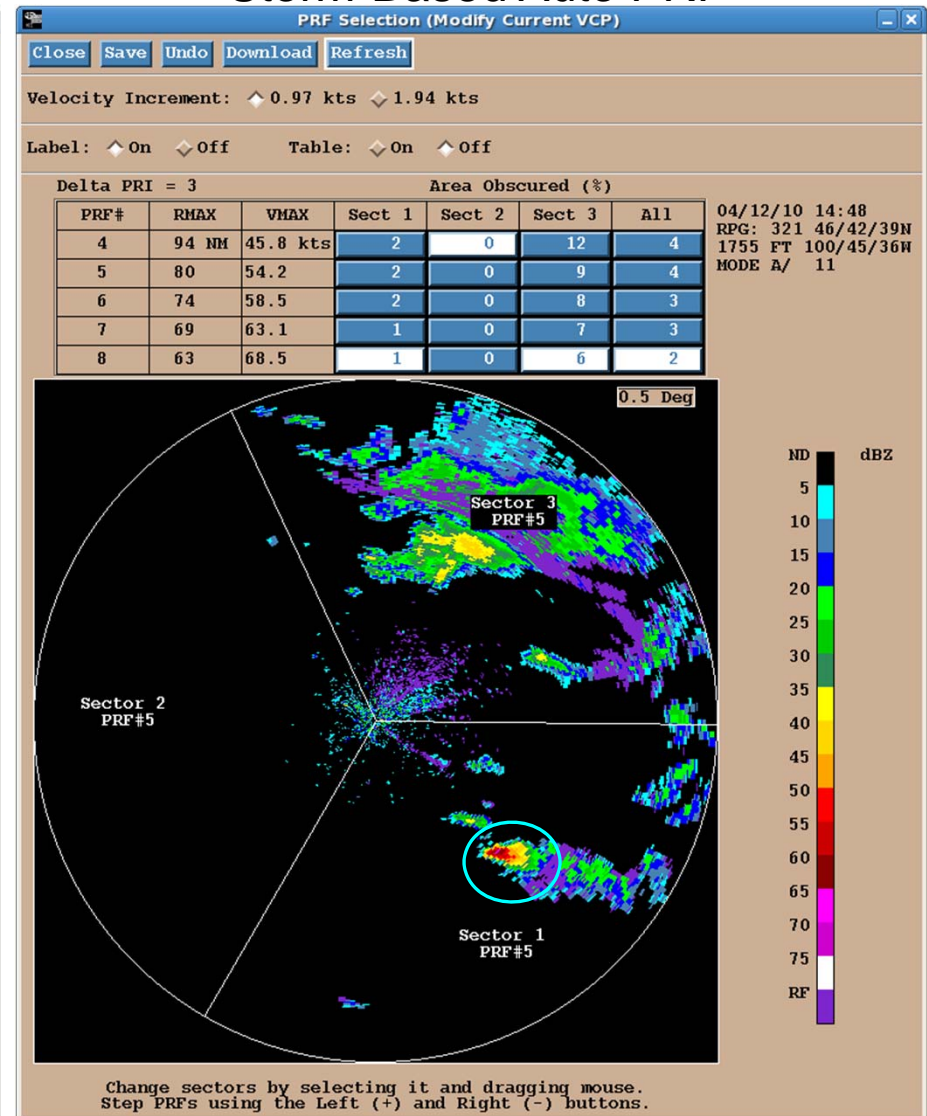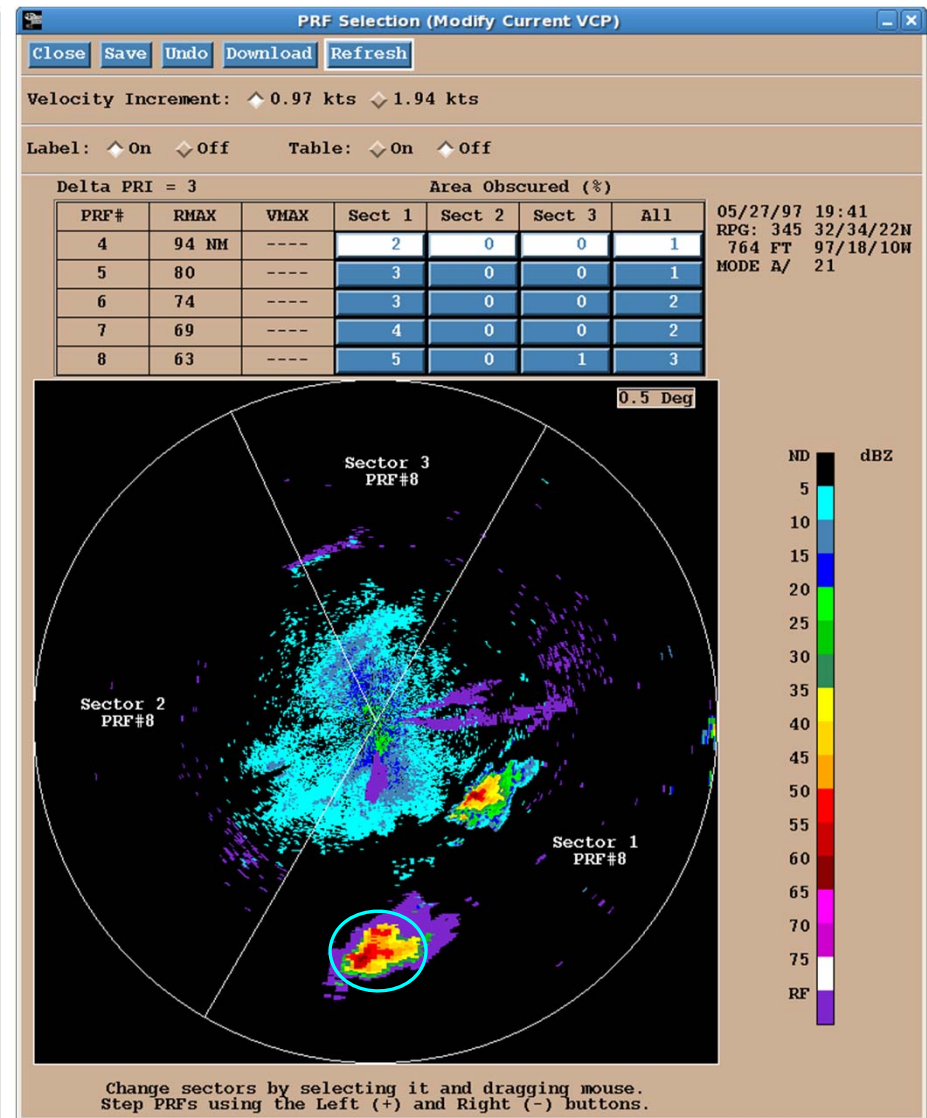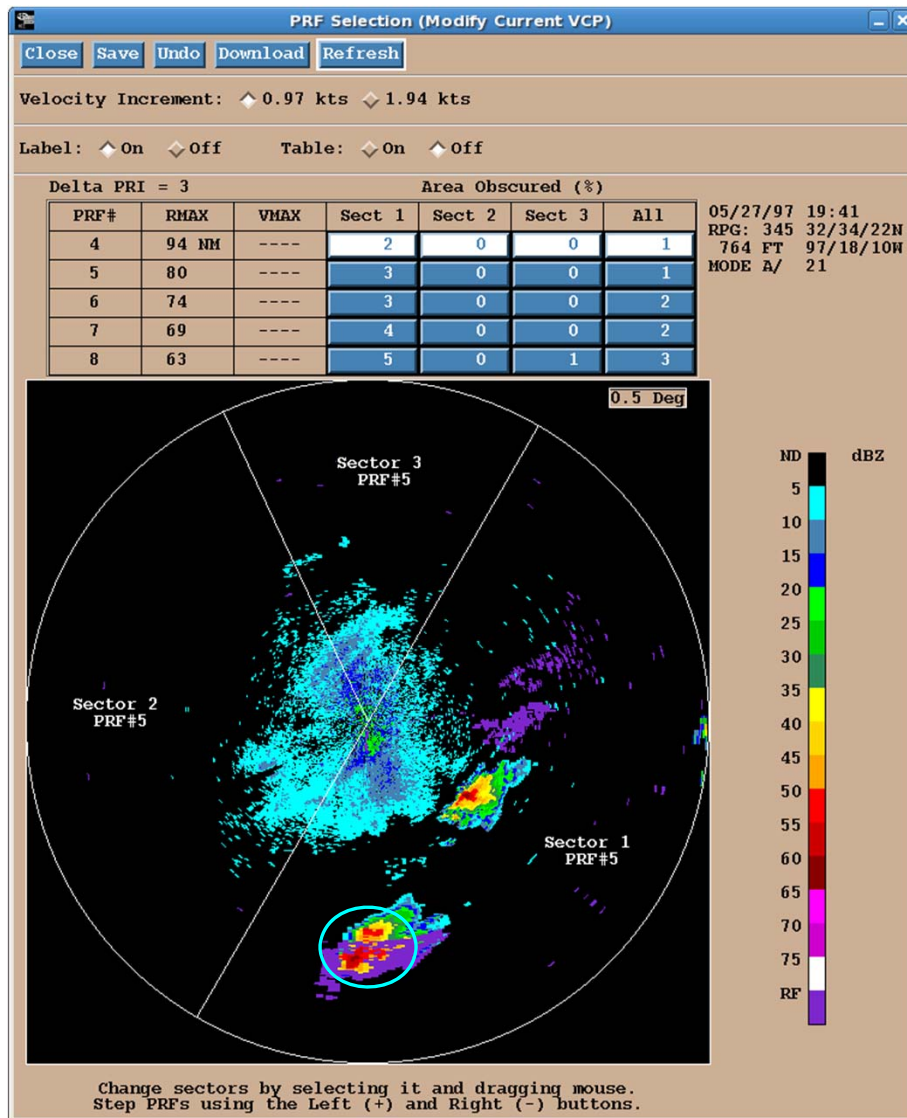
Baseline Auto PRF

Storm-Based Auto PRF

The Left image shows the expected range obscured bins using PRF 5 as selected by the baseline Auto PRF algorithm. The Right image shows the expected range obscured bins using PRF 8 as selected by the Storm-Based Auto PRF function.

Baseline Auto PRF

Storm-Based Auto PRF
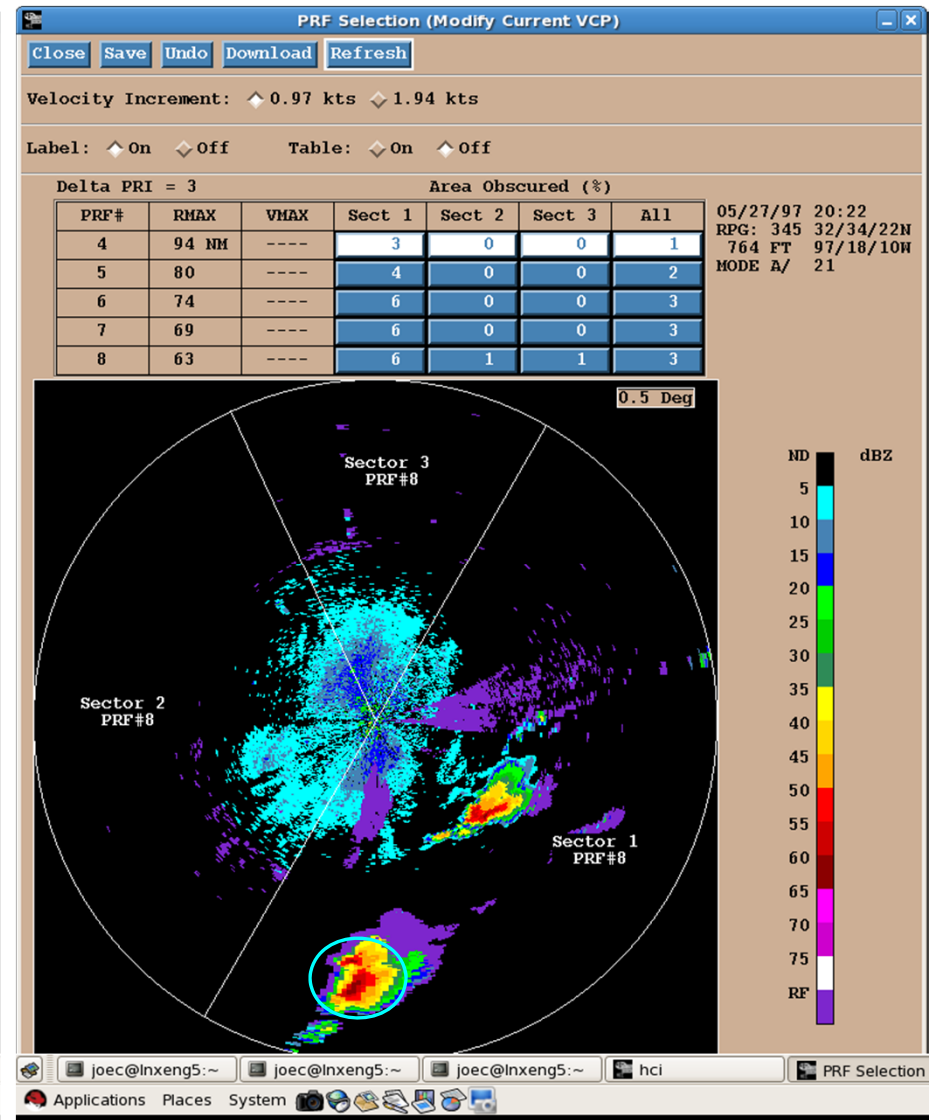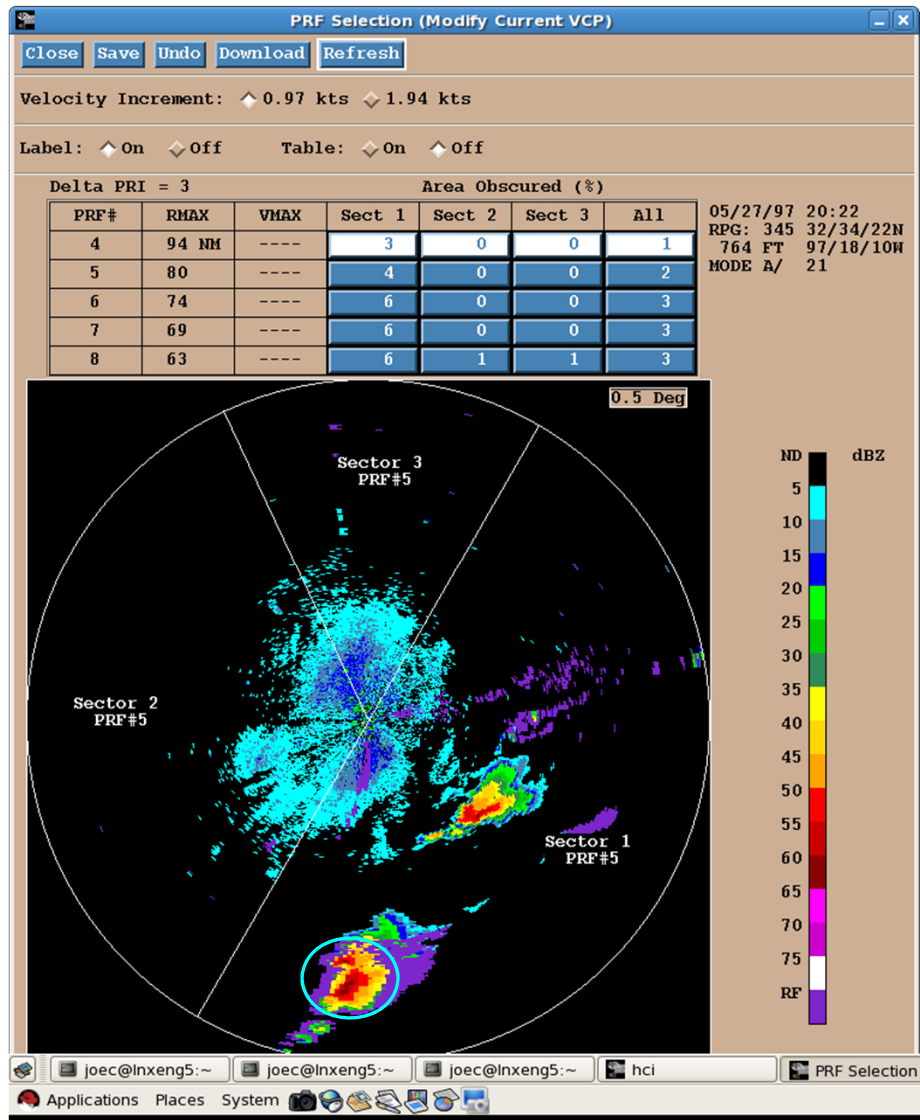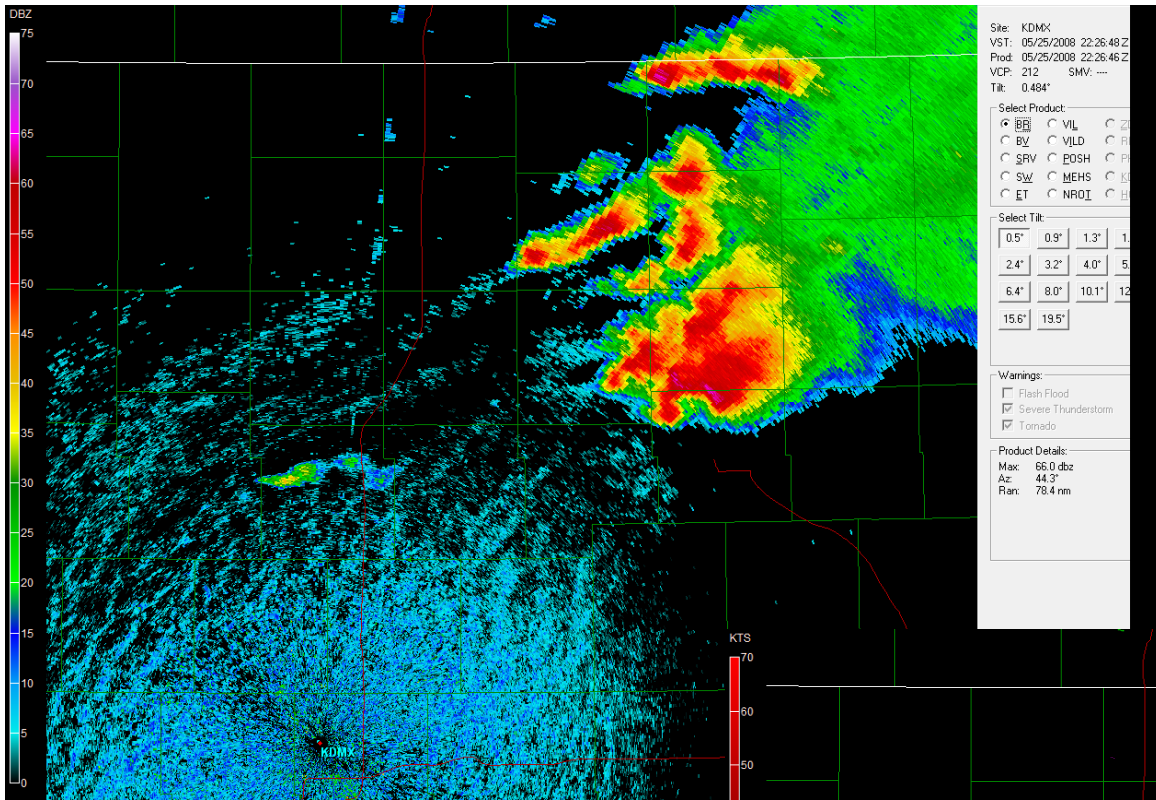
KDMX May 25, 2008
22:26Z

Auto PRF = 6
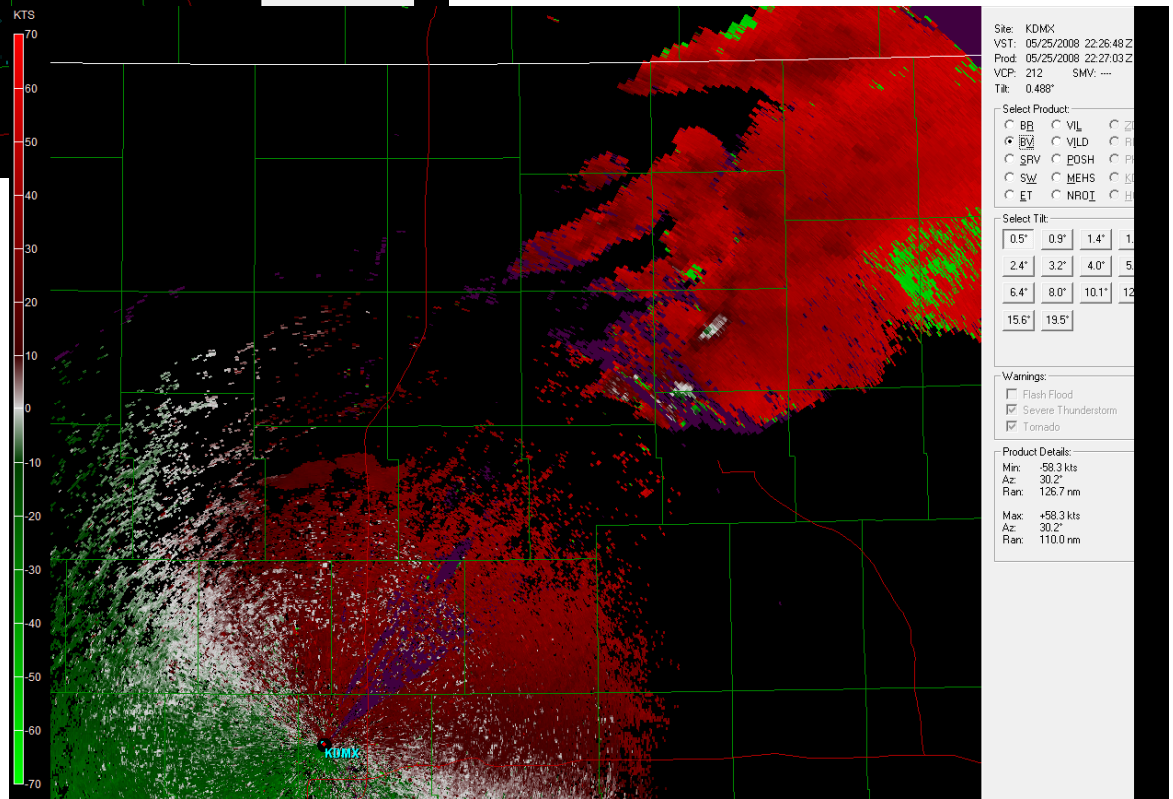
Range Folded Bin Count From Multi-Cell Based PRF
KDMX May 25, 21:32Z – 23:38Z 2008

□ Number RF Gates 1-Storm PRF (4 Storms)　　■ Number RF Gates 2-Storm PRF (4 Storms)
■ Number RF Gates 3-Storm PRF (4 Storms)　　□ Total RF Gates Auto PRF (4 Storms)

Number of RF Bins within Storm Circles

Volume Scans

02:26Z
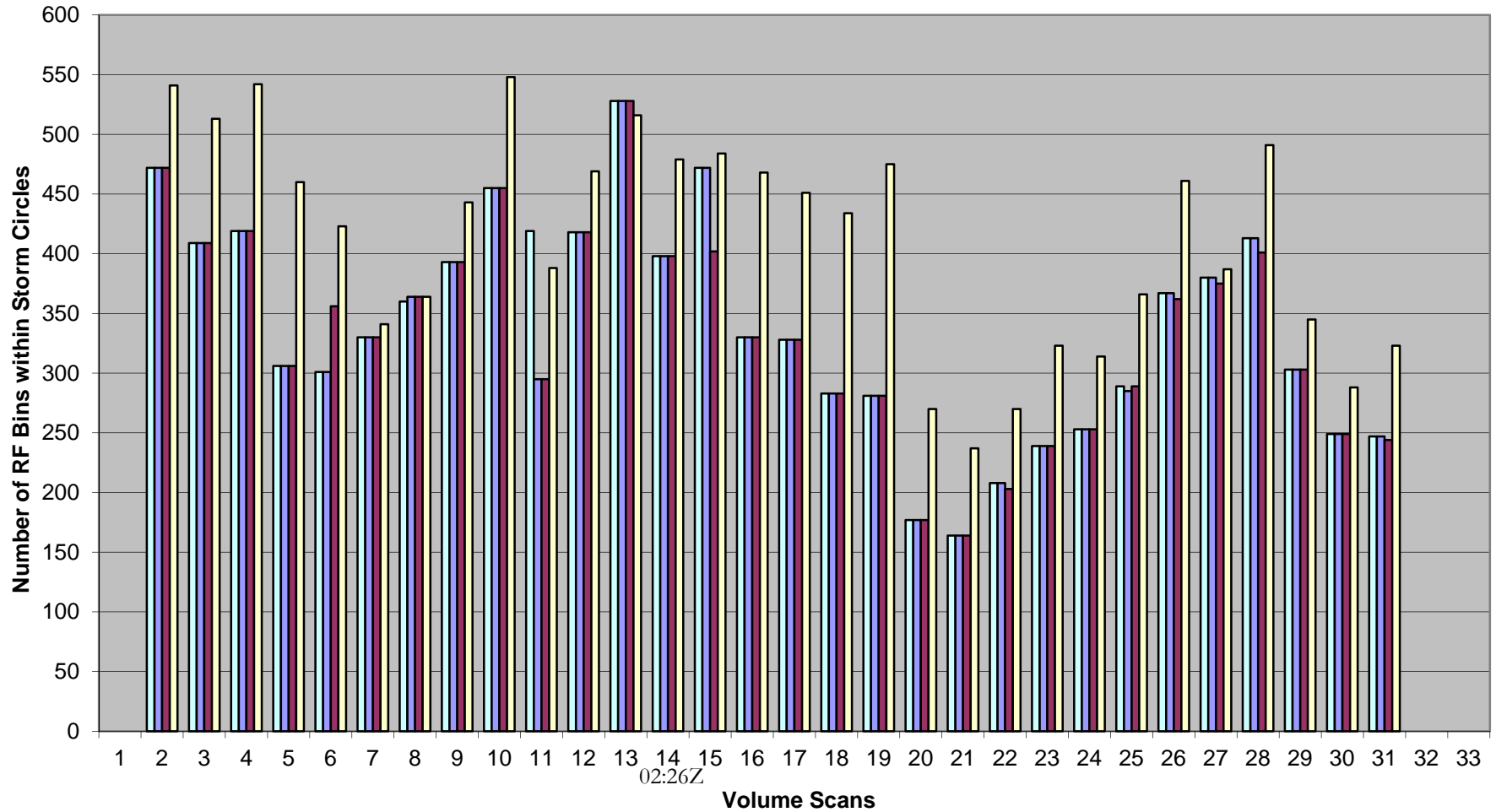
KFDR Apr 23, 2010
03:15Z

Auto PRF = 7
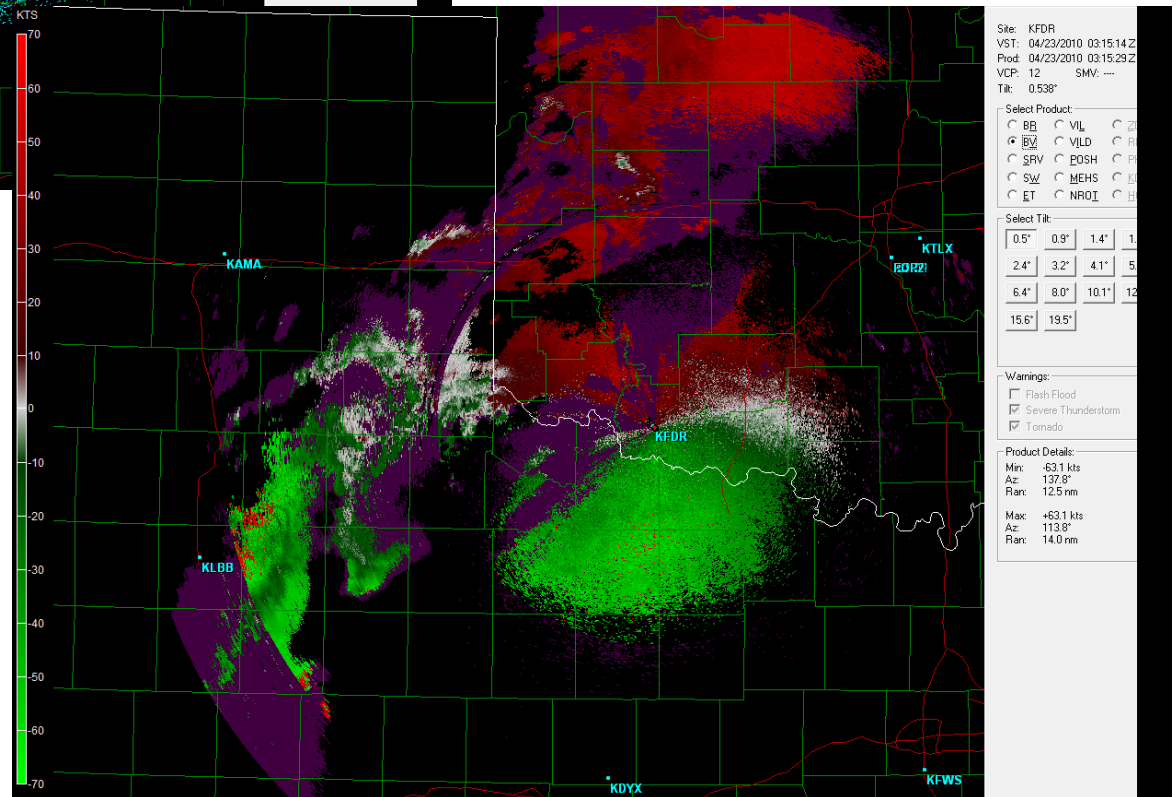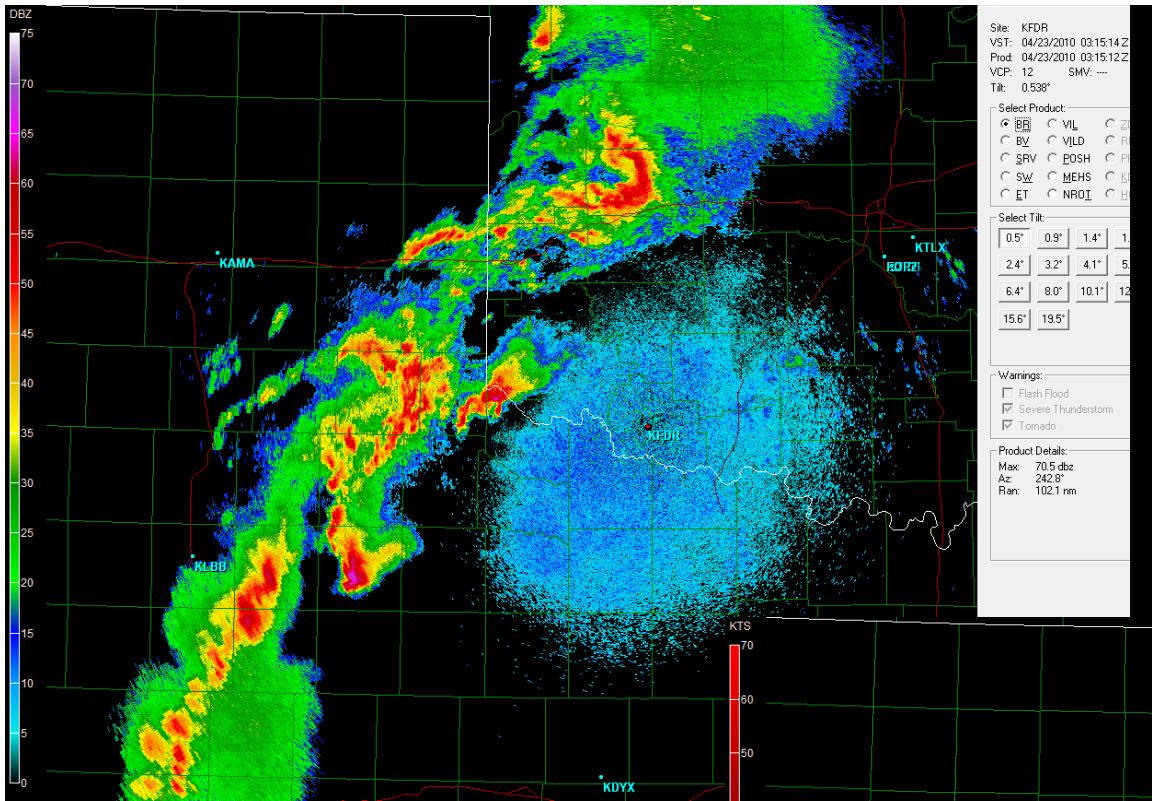
Range Folded Bin Count for 3 Storms
KFDR Apr 23 03:02Z-03:36Z, 2010
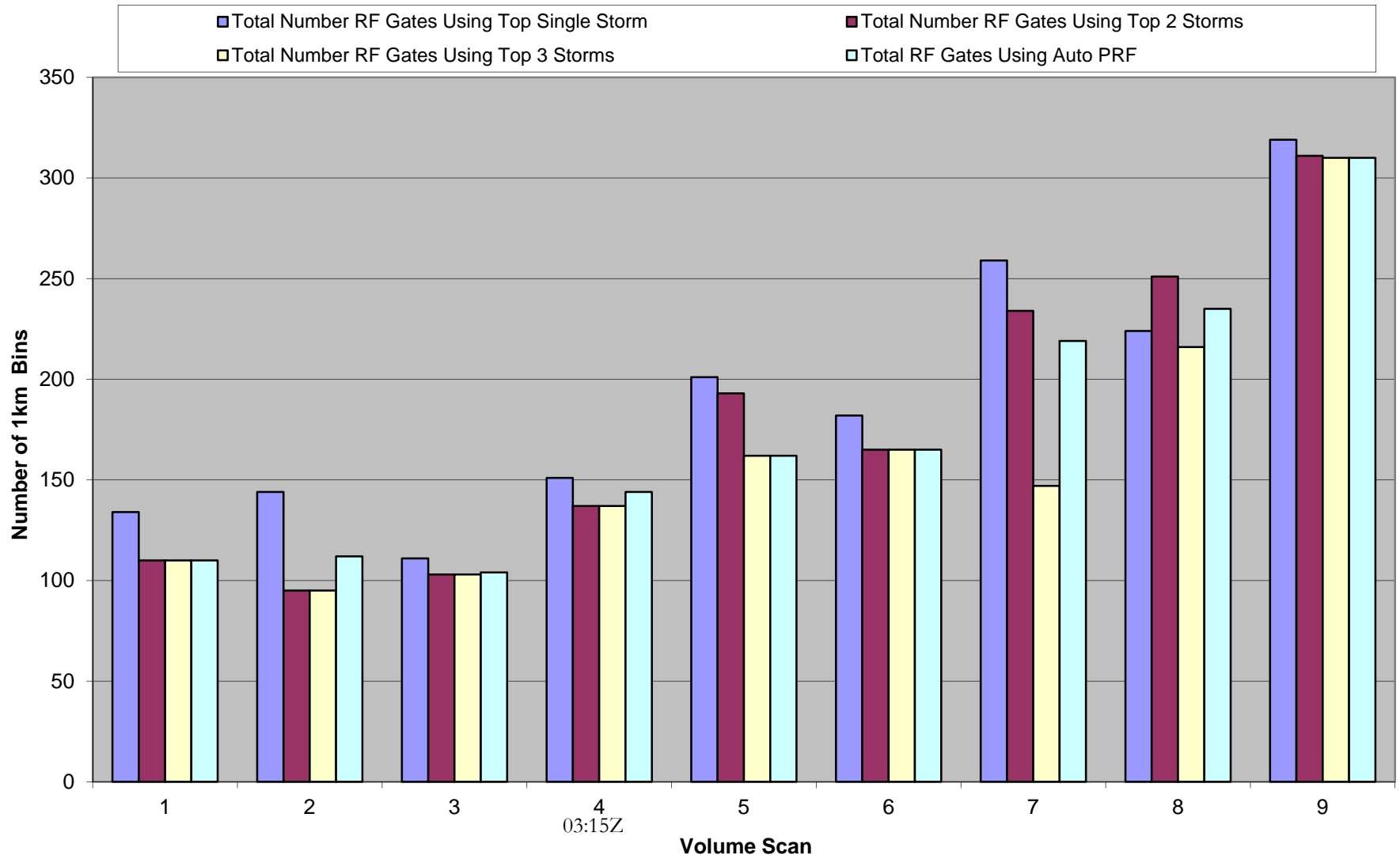
Storm-Based Auto PRF Proposal

Test and Implement two options for the Storm-Based Auto PRF Function

- **Operator-Selected Storm-Based Auto PRF:**
  - The Operator-Selected Storm-Based Auto PRF function will automatically track a selected storm of interest and assign the best PRF for that storm.

- **Fully Automated Storm-Based Auto PRF:**
  - The Automated Storm-Based Auto PRF function automatically tracks the 3 most significant storms (based on Cell-Based VIL) and assigns the PRF that results in the fewest range-obscured 1km range bin for those storms

Operator-Selected Storm-Based Auto PRF Details

- Modify the PRF Selection function to accept a Storm ID

- Use the "forecast position" from SCIT to project where the storm of interest will be next volume scan.

- Using this forecast location, calculate a "storm circle". The "storm circle" is defined as the boundary of a 20km[1] radius circle around the projected storm location.

- Modify the Auto PRF algorithm to:
  - Calculate the number of "obscured" 1km bins within the "storm circle" for each Doppler PRF
  - Select the PRF that results in the fewest obscured 1km bins within the "storm circle"
  - Download the modified VCP to the RDA
  - Each subsequent volume scan, recalculate the "storm circle" based on the new projected location of the storm ID
  - Repeat the above steps until the one of the following conditions are satisfied
    - the operator turns off the Storm-Based Auto PRF option, or
    - the operator selects a different "storm of interest"

- Continue to use this storm ID as the basis for the Auto PRF algorithm until either:
  - the Storm ID moves beyond 230 km from the radar,
  - the particular Storm ID is no longer identified by SCIT

- Note*[1]: The 20km radius was based on the same logic as used in determining the correlation distance for Mesocyclone Detection Algorithm to associate a "Low Core" circulation with a SCIT identified cell location.

Fully Automated Storm-Based
Auto PRF Details

- Modify the PRF Selection Function to select the 3 most significant storms based on the highest storm-based VIL
- Use the "forecast position" from SCIT to project where these storms will be next volume scan
- Using the forecast locations, calculate a "storm circle" for each storm. The "storm circle" is defined as the boundary of a 20km[1] radius circle around the projected storm location
- Modify the Auto PRF algorithm to:
  - Calculate the number of "obscured" 1km bins within each "storm circle" for each Doppler PRF
  - Select the PRF that results in the fewest obscured 1km bins within the "storm circles"
  - Download the modified VCP to the RDA
  - Each subsequent volume scan, select the top 3 storms from the CAT
  - Recalculate the "storm circles" based on the new projected location for each storm
  - Repeat steps 4-6 until the one of the following conditions are satisfied:
    - the operator turns off the Fully Automated Storm-Based Auto PRF option, or
    - there are no storms identified by the SCIT algorithm

- Note*[1]: The 20km radius was based on the same logic as used in determining the correlation distance for Mesocyclone Detection Algorithm to associate a "Low Core" circulation with a SCIT identified cell location.
- Note*[2]: The function will track and process up to 3 storms. If there are fewer than 3 storms then use the number of storms available.

Questions ?

Backup

CCR 09-00085/ECP 0475

- CCR Proposal: Investigate the operational utility of an Auto PRF function that selects the "Best PRF" based on the forecast location of a single storm selected by the operator.
  - This function would accept a storm ID, as input by the operator, and use the Storm Cell Identification and Tracking (SCIT) algorithm to project the location of the selected cell for the next volume scan. Then, for this forecast location, the function would select the PRF that provides the fewest number of obscured 1km bins over the storm of interest. Each subsequent volume scan, it would automatically use the SCIT Storm ID forecast location for the storm of interest and select the "Best PRF" based on this forecast location.
  - The result of this application is a dynamic PRF selection that tracks a storm of interest and continuously assigns the "Best" Doppler PRF for that storm

CCR: NA10-00359

- CCR: STORM-BASED AUTO PRF FUNCTION
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- Problem: Currently, the Auto PRF algorithm selects the Doppler PRF that results in the least amount of range folded (purple) data for the entire area within a 230 km radius of the radar.
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- Proposal: Include the Storm-Based Auto PRF Function as Non-Operational in the baseline RPG software
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- This CCR is a follow-up to CCR 09-00085 and ECP 0475 that initiated an investigation into the operational utility of the Storm-Based Auto PRF Function. The purpose of the CCR is to allow the Storm-Based Auto PRF Function to be included as Non-Operational in the baseline software to support further testing.
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- The Storm-Based Auto PRF Function selects the PRF that provides the fewest number of obscured 1km bins over the storm or storms of interest. (Note: Depending on the selected option, the storm of interest is either designated manually or selected automatically based on the highest cell-based VIL.)
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- The result of this function is a dynamic PRF selection that tracks a storm or storms of interest and continuously assigns the "Best" Doppler PRF.
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- For additional detail see attached document, Storm_Based_Auto_PRF_Details.doc.
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- See related CCR 09-00085/ECP 0475 for investigation and testing results.
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