Mitigation of Range Velocity Ambiguities

Strategy, current status, further development

Major Activities

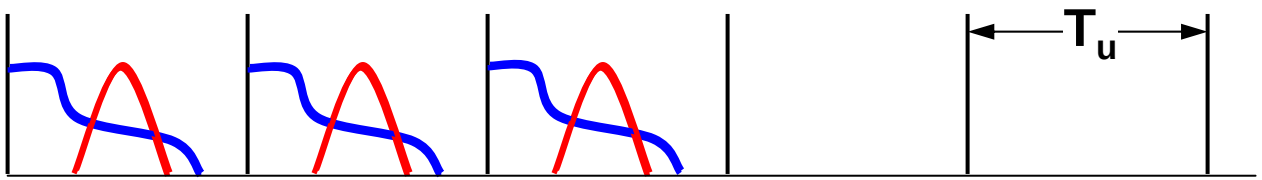
- Investigation of existing schemes, new approaches, theory
- Simulation studies
- Demonstration on time series data and in real time
- Transfer to operations

Mitigation Strategy

- Existing capabilities (speed of volume coverage, accuracy of estimates) should not be compromised
- Use Volume Coverage Patterns (VCP) similar to the existing ones
- Match technique to Volume Coverage Pattern
  - Phase Coding (PC)
  - Staggered Pulse Repetition Time (PRT)

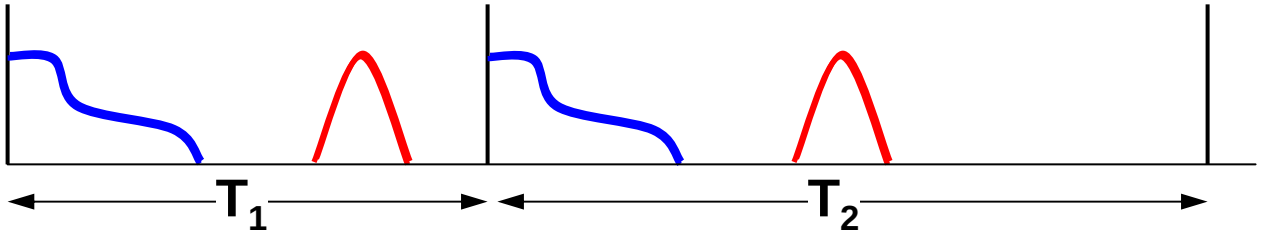
Two Complementary Techniques

Phase Coding



Separation in Frequency

Staggered



Separation in Time

Unambiguous velocity $V_a \sim 1/T_u = 1/(T_2 - T_1)$

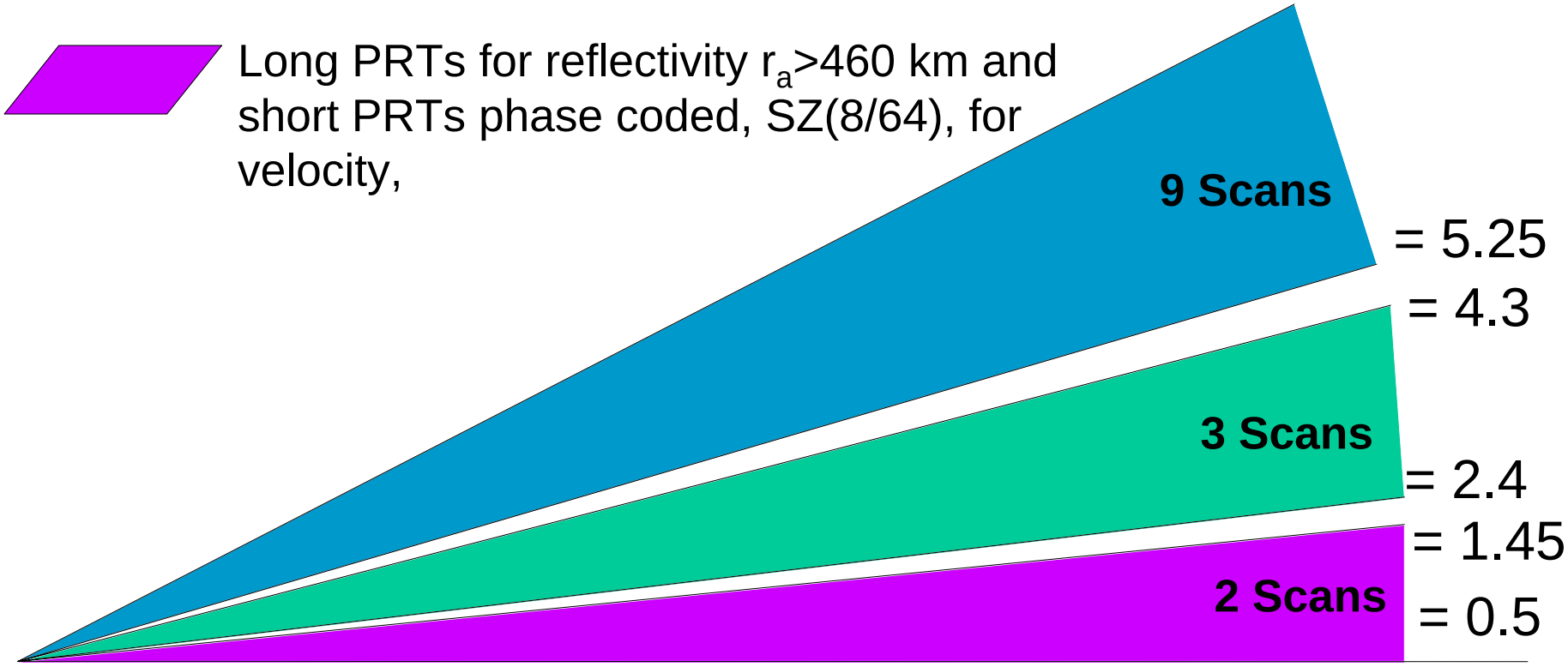
"Cleared range" $R_a \sim 2T_u = T_1$

Mitigation of Ambiguities in a Volume Coverage Pattern for the WSR-88D

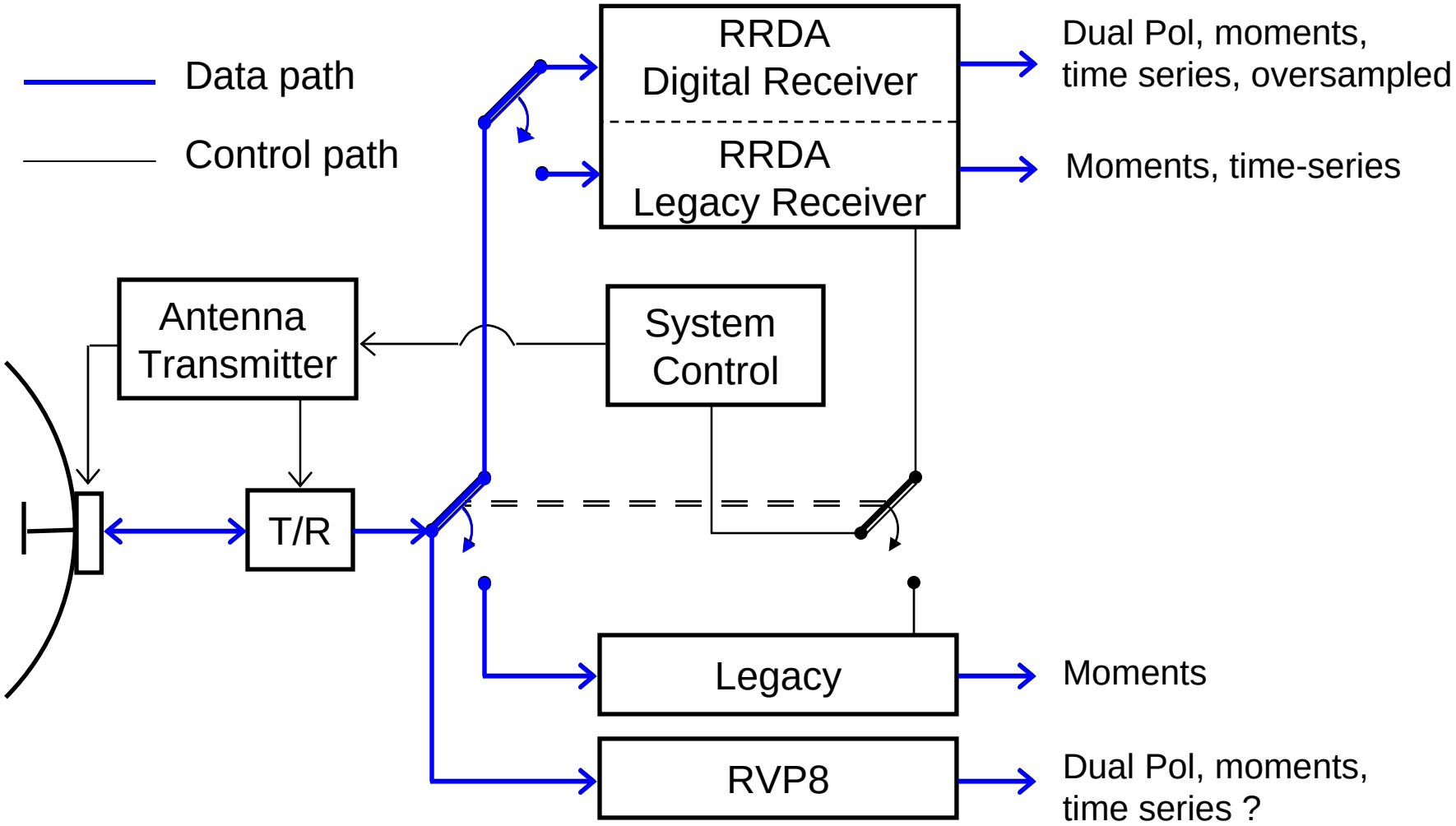
Staggered (2/3) PRTs, v_a > 59 m s^{-1}, 177 km > r_{a1}>108 km

Staggered (2/3) PRTs with one overlay resolution, v_a > 45 m s^{-1},303 km > r_{a1} > 207 km

Long PRTs for reflectivity r_a>460 km and short PRTs phase coded, SZ(8/64), for velocity,



KOUN Radar Block Diagram



Capabilities of the Research RDA (on NSSL's WSR-88D)

- Generate arbitrary scans (VCPs) including RHI
- Unlimited recording of time series data (including dual polarization and over sampled)
- Play back time series data through RRDA
- Phase coding with decoding for 1st trip
- Staggered PRT and multiple PRTs

Time Series Data

- Twelve cases from Feb through June
  - Both Staggered and Phase coded either within the same VCP or alternate VCPs
  - Consist of: 5 storm clusters; 3 Mesoscale Convective Systems; 2 Squall lines; 2 Stratiform
  - Most VCPs contain two or three lowest elevations, two cases have a modified VCP-11
- Three cases: Aug and Oct have only phase coded data

Further Work

- Ongoing
  - Refinements in schemes to filter ground clutter
  - Definition of optimum VCPs
- Integration of R/V mitigation into other WSR-88D improvements
  - Dual Polarization
  - Oversampling
  - Adaptive VCP

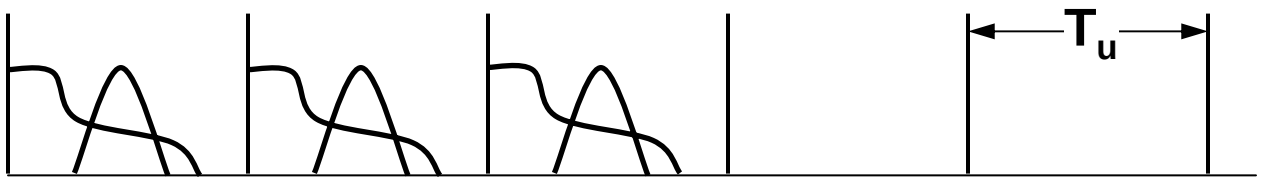
END

Comparison Phase Coding vs Staggered PRT

	Spectral Process	GCF	Implement-ation	Max Ra	Max Va	Echo separation
Phase Coding	2	1	0			
Stagger PRT			0	1	1	1

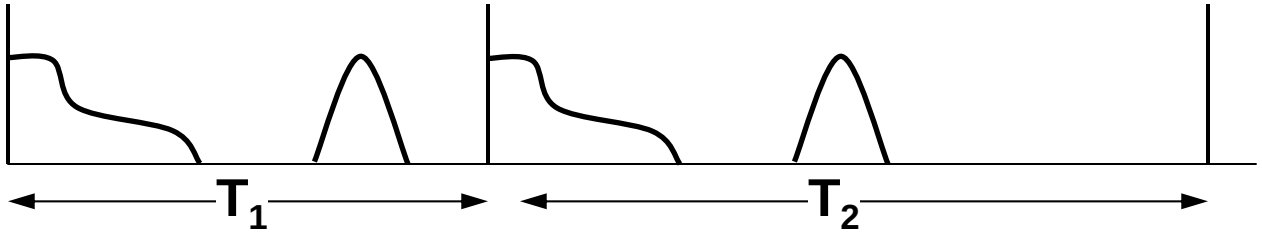
Key: 2 = major advantage; 1 = minor advantage; 0 = neutral

Phase Coded



Separation in Frequency

Staggered



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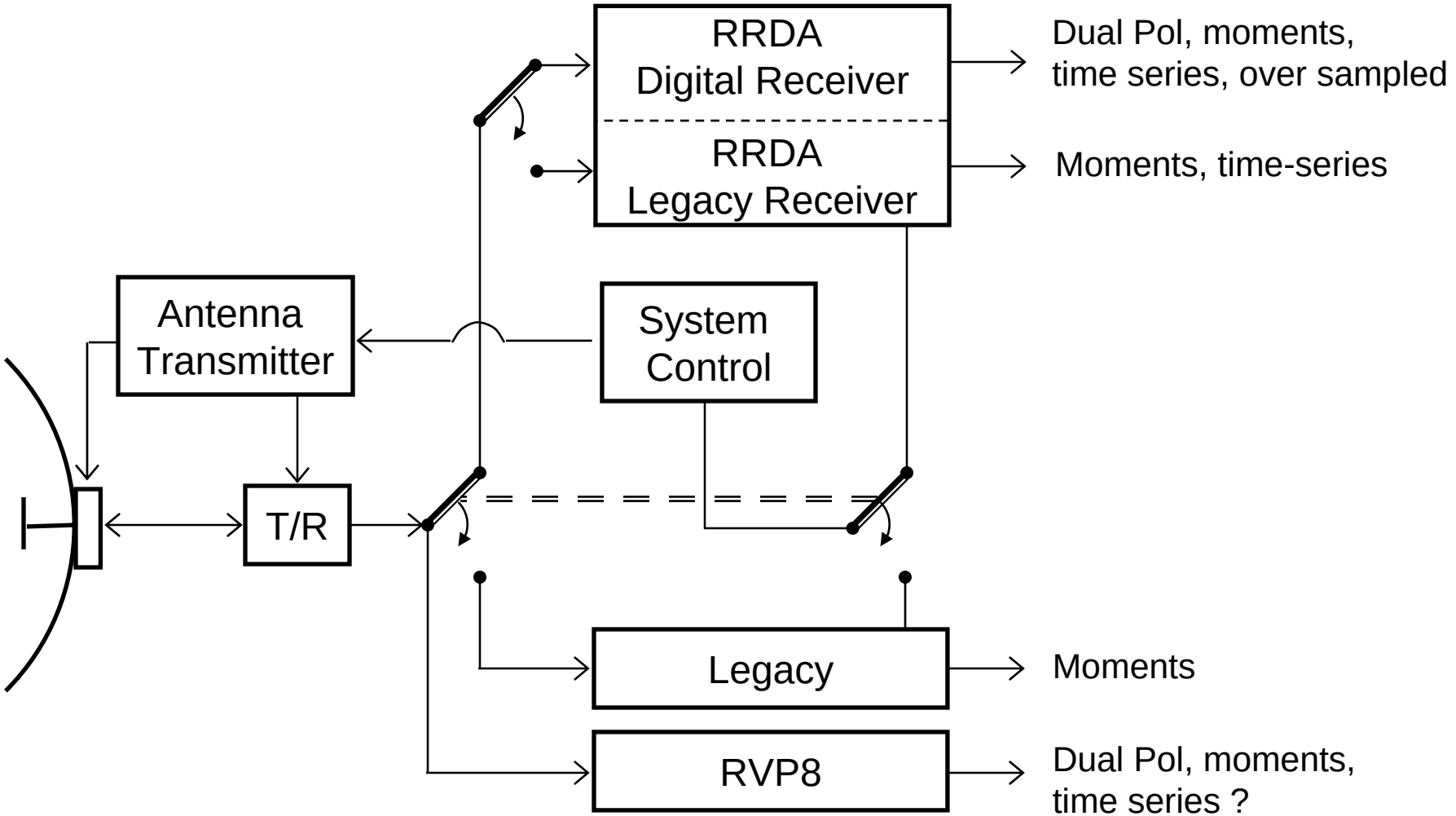
RRDA
Digital Receiver
RRDA
Legacy Receiver
Dual Pol, moments,
time series, over sampled
Moments, time-series
Antenna
Transmitter
System
Control
T/R
Legacy
Moments
RVP8
Dual Pol, moments,
time series ?