Target Scene Generator

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Agenda

- Need
- Design goals
- Program summary
- General approach
- Block diagram
- Range/Doppler domain
- Validation
- Examples
- Conclusions/path forward

Design Goals

- System capable of demonstrating feasibility using an existing proximity sensor.

Characteristic	Performance	Comments
Sampling rate	1200 Msamples/s	
IF bandwidth	500 MHz	
Number of range cells	512	
Range step	0.125 m	
Range cell size	0.5 m if every 4th delay register 0.25 m if every other delay register	
“Active” Range	256 m if every 4th delay register 128 m if every other delay register	
Passive range	3000 m	Requires time delay = 20 μs
Residual delay (DSP)	17 ns (~2.6 m in height)	Assumes 20 clock pulses
Maximum Doppler frequency	~ 250 kHz	Assumes 4 to 5 times oversampling

Need

- Proximity sensor requirements designed for complex end game scenarios.
- Current HWIL testers provide simple engagements. (Single point reflectors)
- Need for complex engagements to both verify sensor performance and aid in the development of higher performance sensors/algorithms.

Program Summary

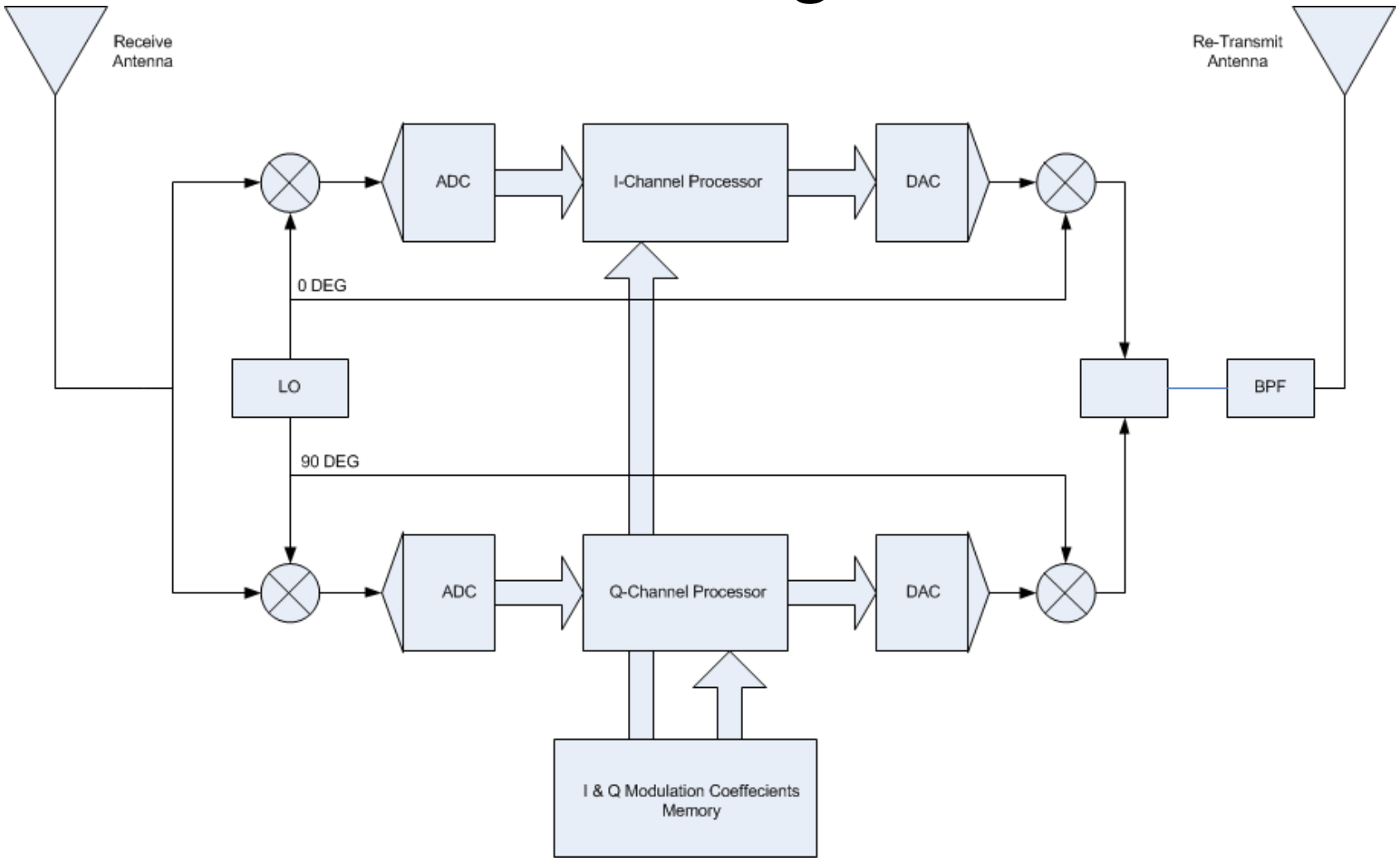
- EDC IRAD:
- Successfully developed topology for a real time multi target simulator.
- Develop hardware to prove concept.

- CRADA:
- Team with ARDEC and University of Florida to leverage current scene generation model to provide coefficients for more complex engagements.

Approach

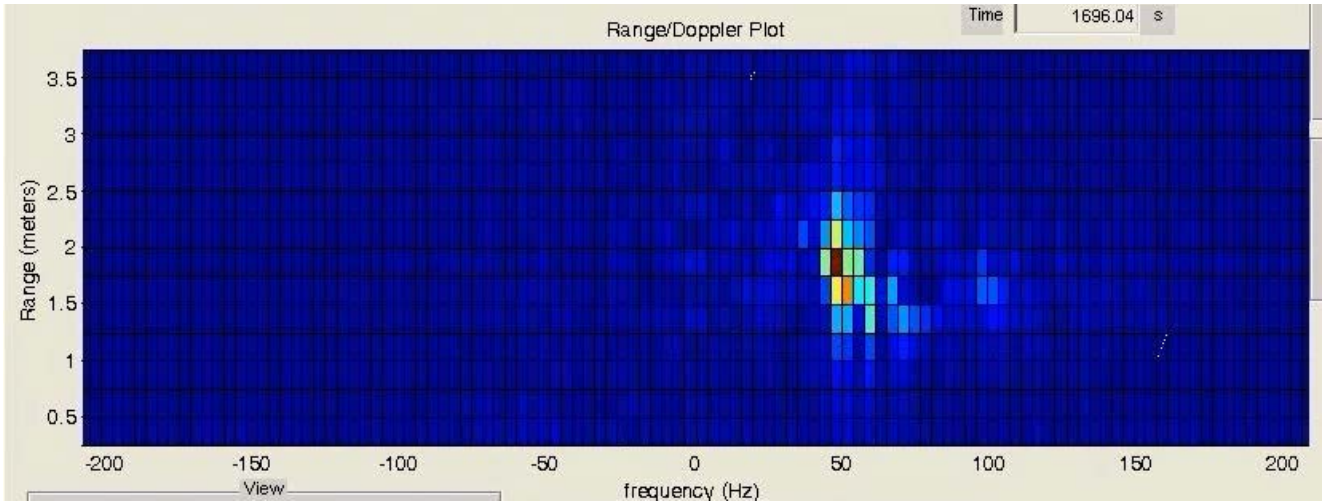
- Scene generator input data is a matrix of range, Doppler and magnitude for each time step.
- The encounter is broken up into cells corresponding to points in space.
- Each cells relative velocity and reflection magnitude is calculated for each time step.
- This data is then loaded into the target scene generator.
- Run encounter with proximity sensor, capture data.

Block Diagram



Range Doppler Domain

- What is it?
  - A matrix of magnitude, range and doppler.



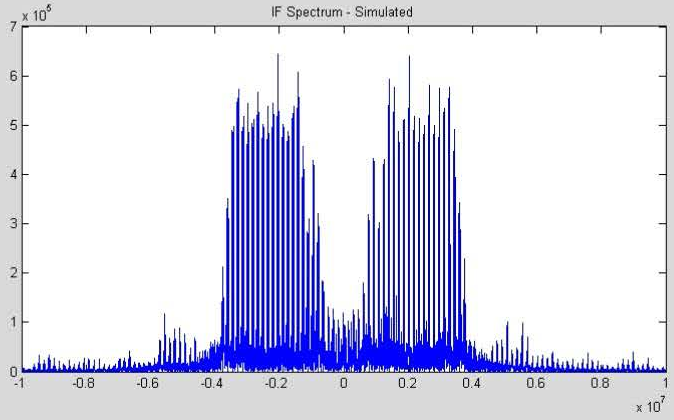
Typical Range Doppler Plot of a Point Reflector

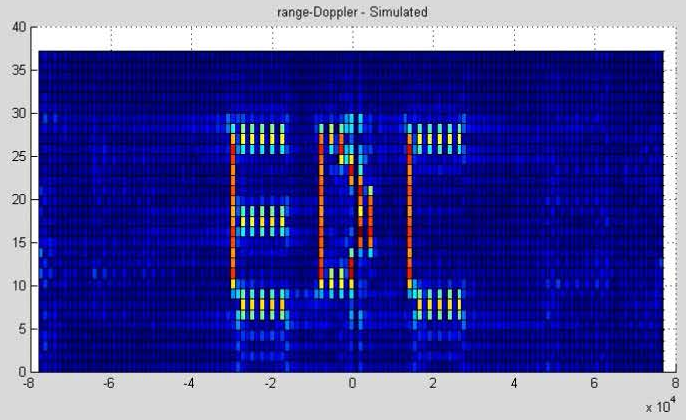
- Why is it useful?
  - Provides a way of reducing a complex target encounter to discrete points vs. time.

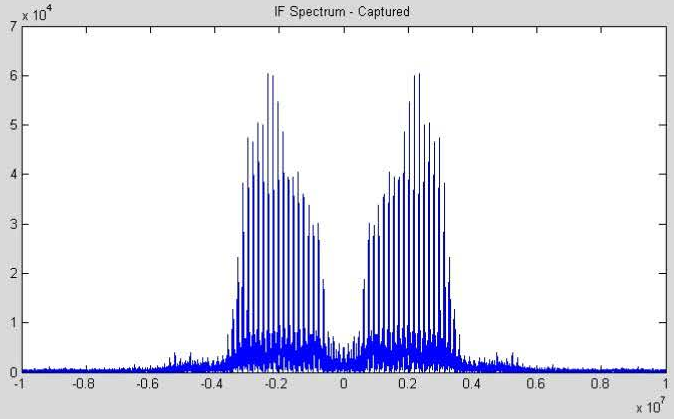
Validation

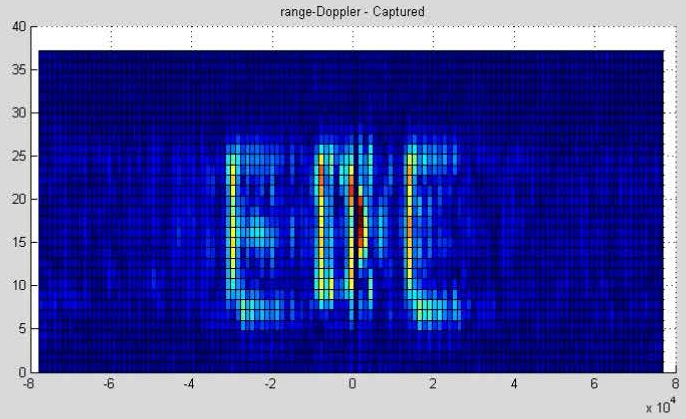
- Process:
  - Choose candidate scene
  - UFL generate coefficient file for scene generator
  - Generate range/doppler data for scene
  - Capture data from a prox sensor tested with TSG
  - Process captured data
  - Compare captured vs generated range doppler data.

Verification









Conclusions / Path Forward

- Successfully demonstrated end to end system.
- Improve hardware to increase performance
  - Increase bandwidth
  - Reduce latency
  - Increase active range
  - Increase range resolution
- Improve user interface