



Radar design and Signal Processing

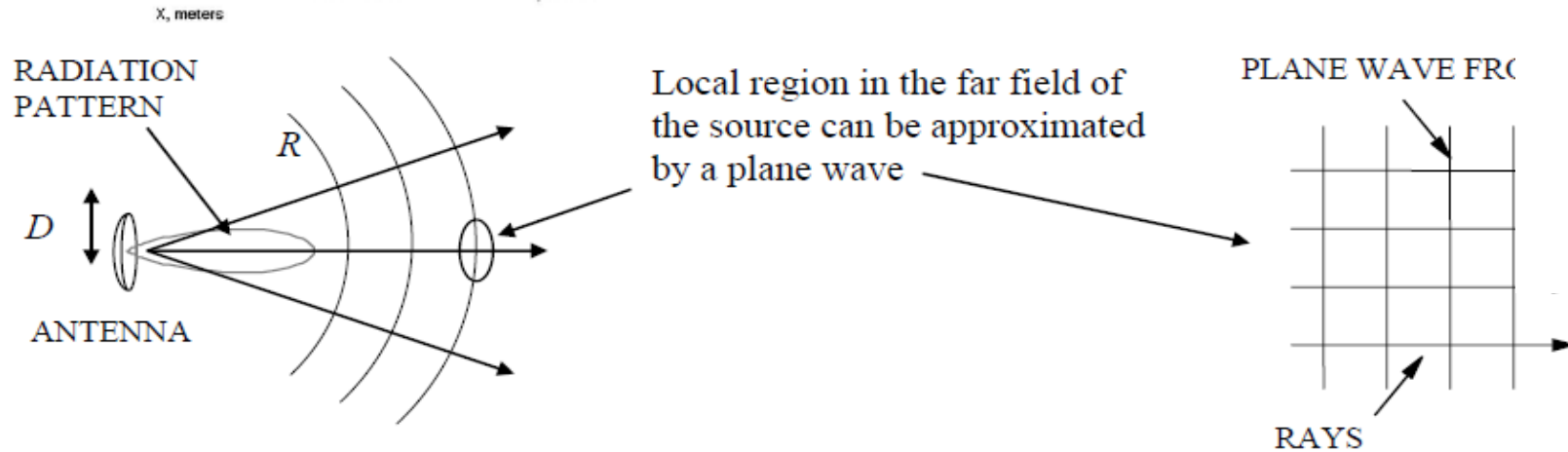
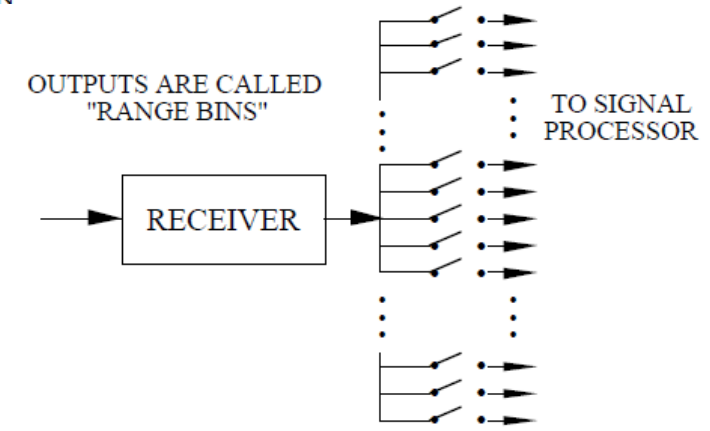
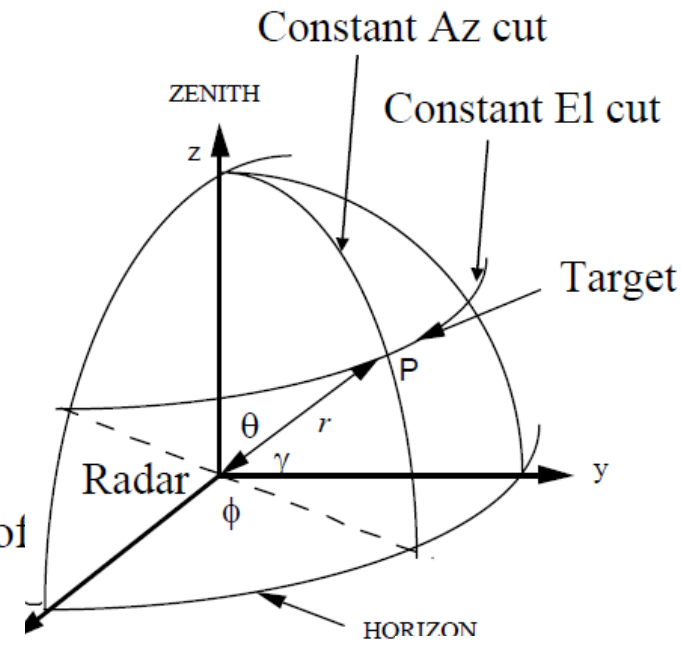
OSGC STUDENT SCHOLAR: ALEXIS
SHEALEY

OSGC STUDENT SCHOLAR
:ALEXANDRA SHEALEY

ADVISOR : NKORNI KATTE PHD
WILBERFORCE UNIVERSITY

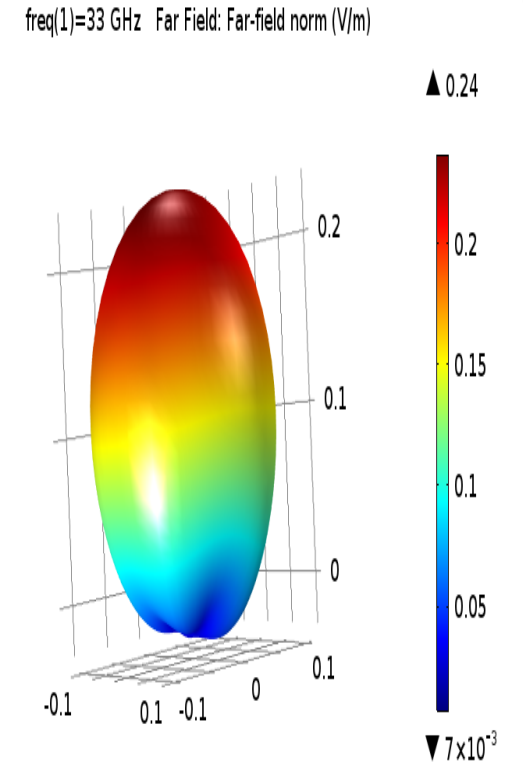
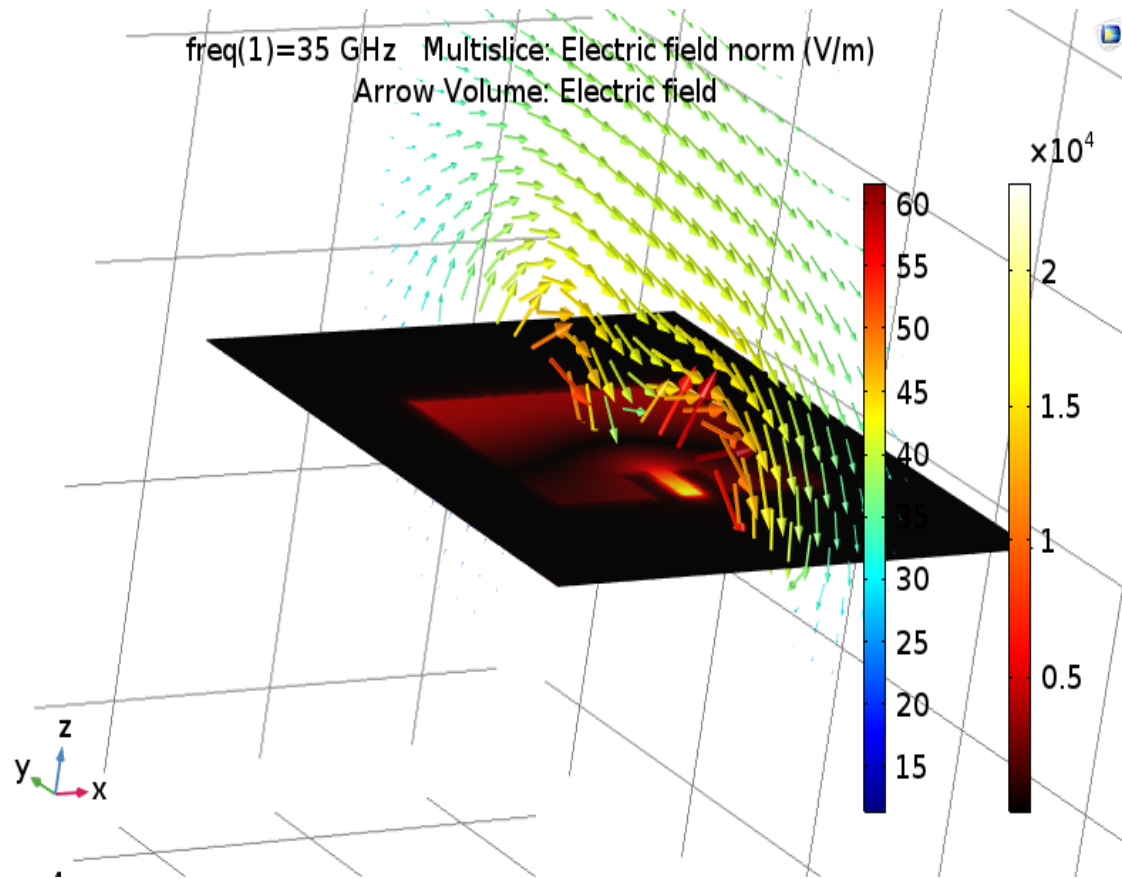
Radar fundamentals

- Normal radar functions:
 1. range (from pulse delay)
 2. velocity (from Doppler frequency shift)
 3. angular direction (from antenna pointing)
- Signature analysis and inverse scattering:
 4. target size (from magnitude of return)
 5. target shape and components (return as a function of direction)
 6. moving parts (modulation of the return)
 7. material composition
- The complexity (cost & size) of the radar increases with the extent of the functions that the radar performs.



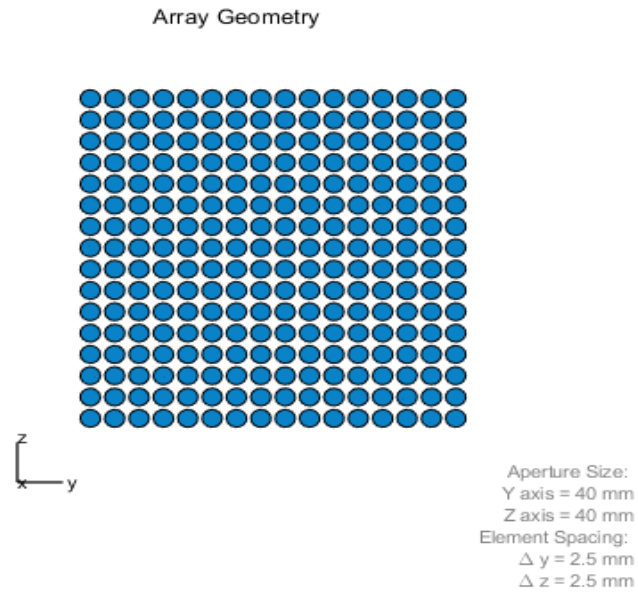
Antenna Design with COMOL

I designed an Antenna that will operate at 5G frequency, which is the next generation domain for communication.

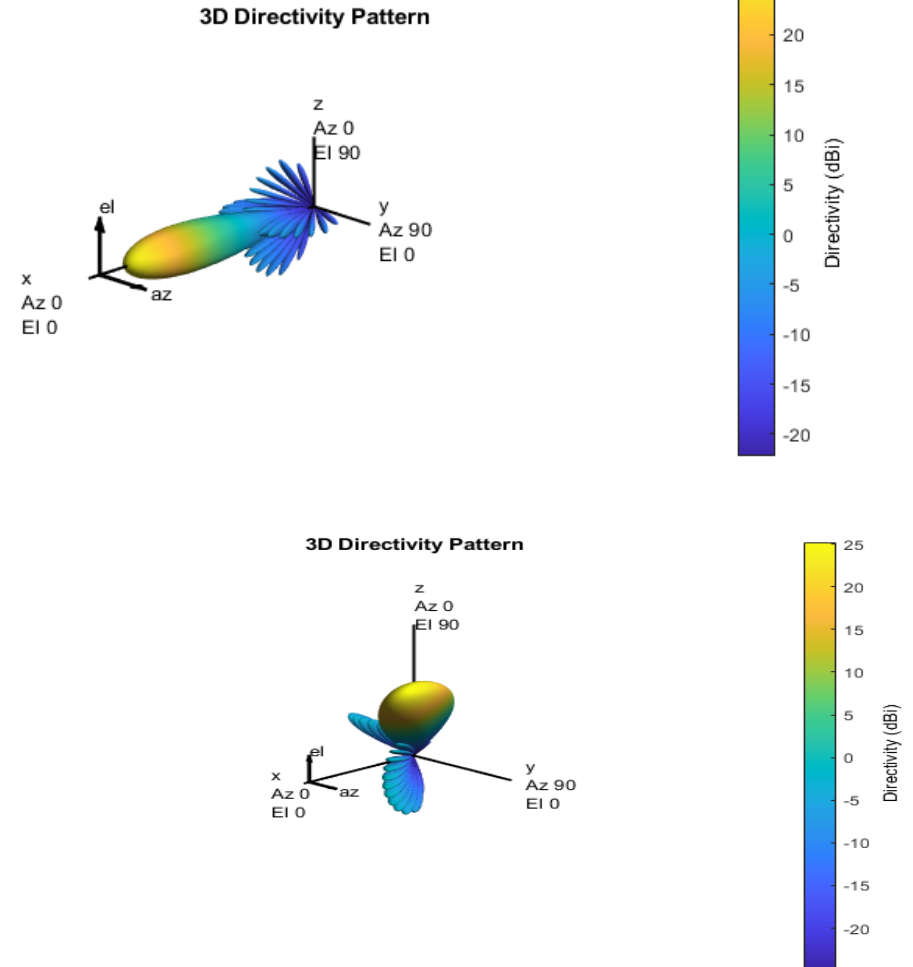


Patch Antenna

Antenna Array with MATLAB

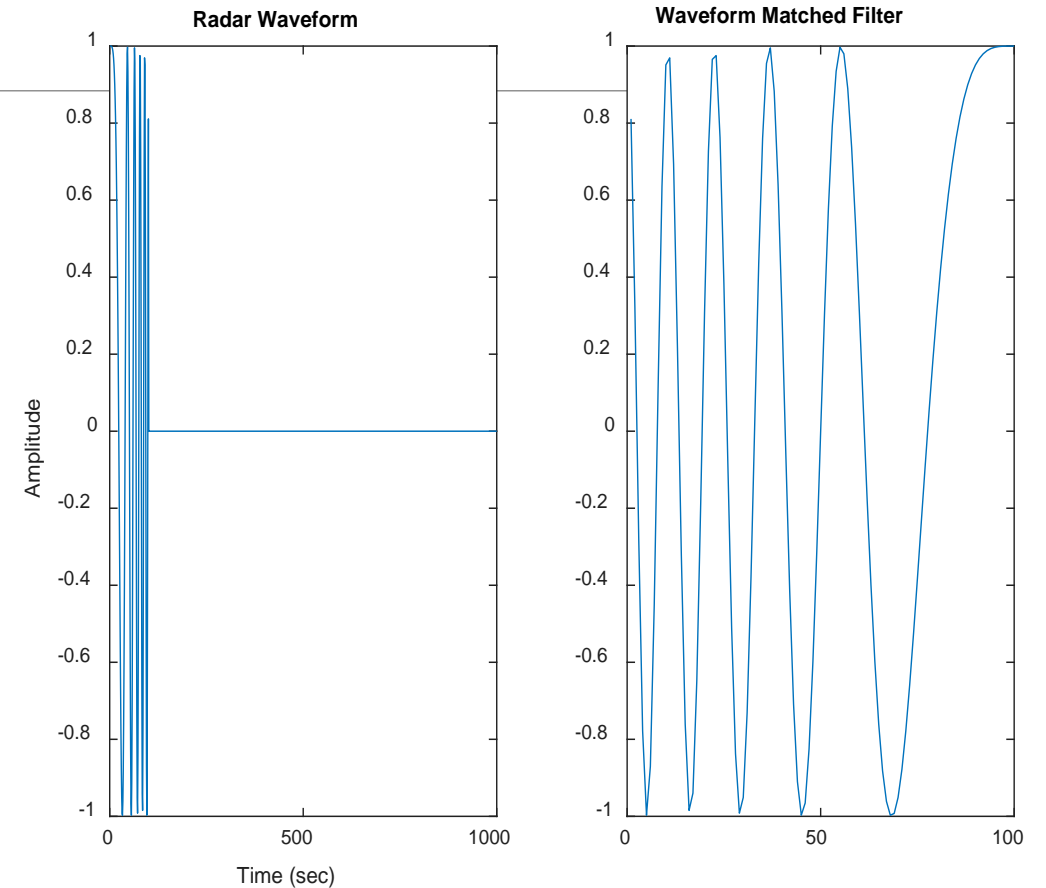


We are interested in “Pencil” sharp directivity



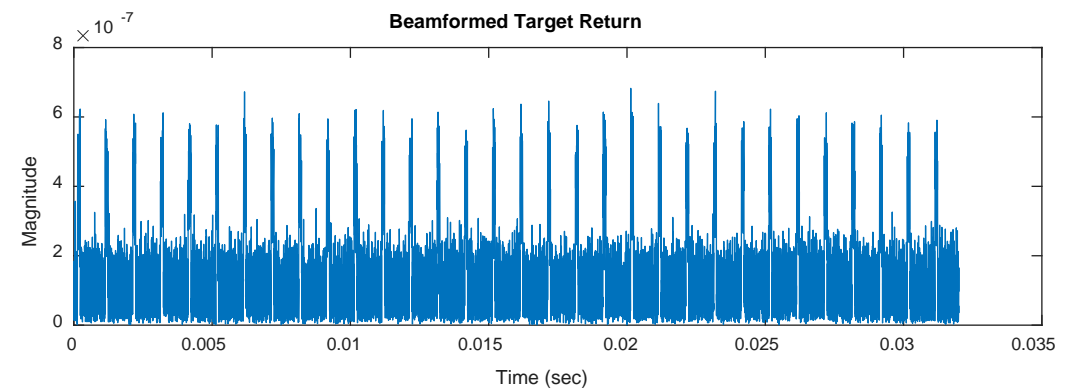
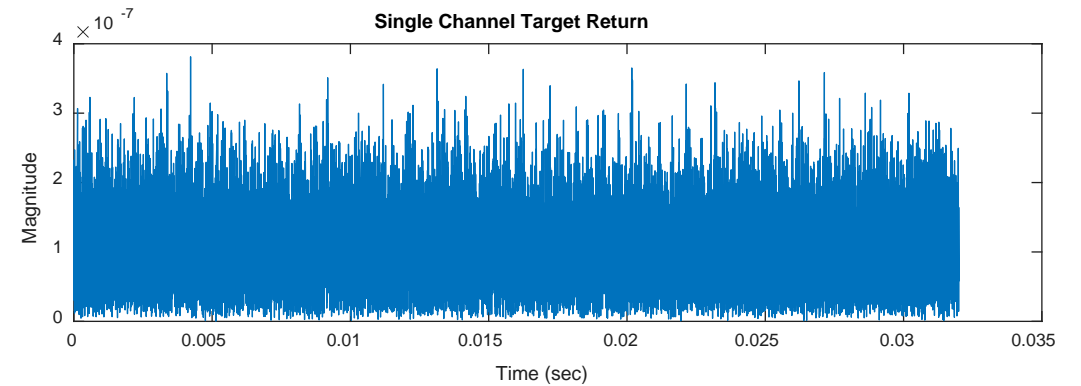
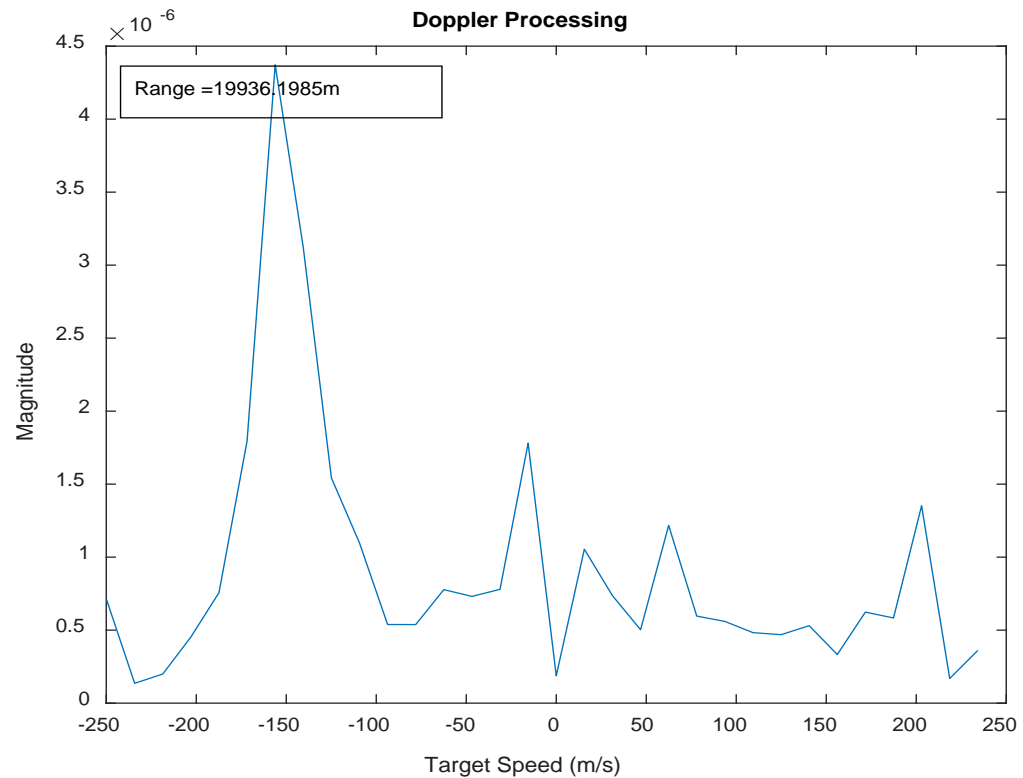
Code from Mathworks : RadarCubePart2

```
...  
Transmitter Specs  
TX=phased.Transmitter('Gain',20);  
  
% Platform Specs  
PlatformModel=phased.Platform;  
PlatformModel.InitialPosition = tgtpos;  
PlatformModel.Velocity = tgtvel;  
  
% Channel Specs  
ChannelModel = phased.FreeSpace;  
ChannelModel.TwoWayPropagation=true;  
  
% Tx ans Rx Specs  
  
txArray = phased.Radiator(...  
    'Sensor',antenna,...  
    'OperatingFrequency',432e6); [2]
```

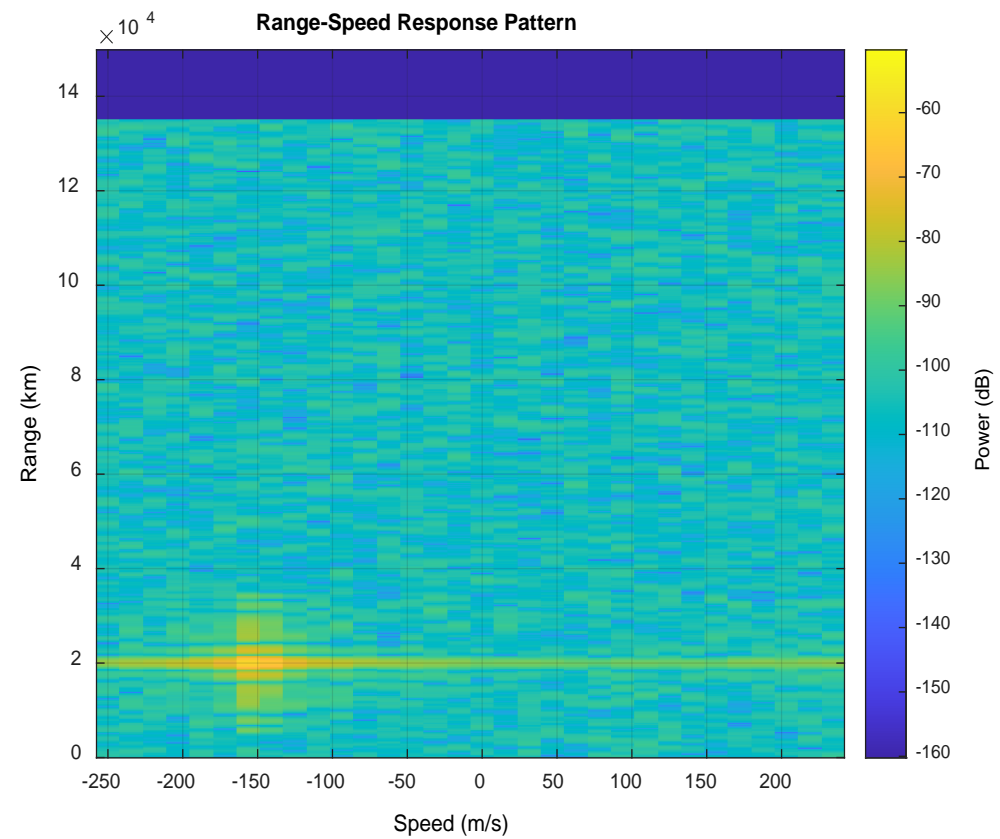
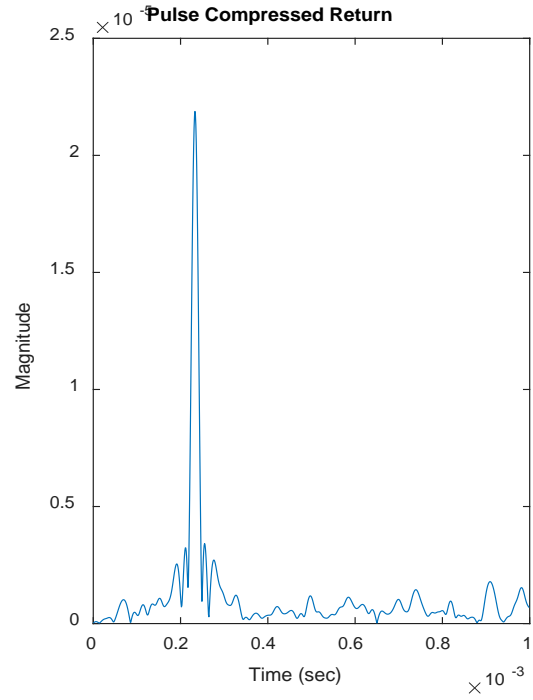
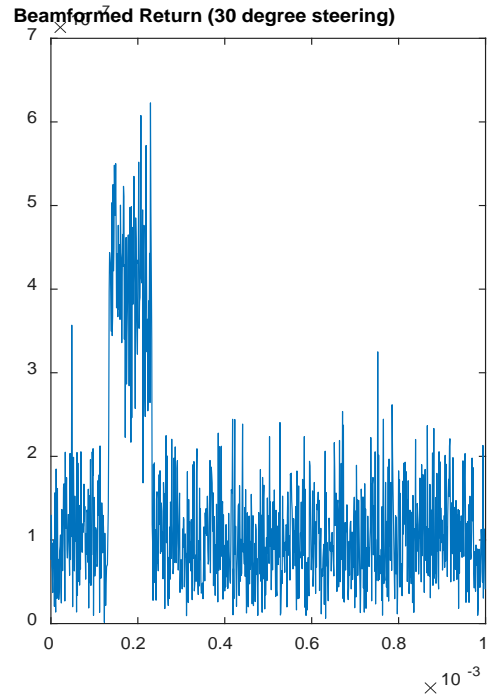


Speed Characteristics

$f=432\text{MHz}$



More Results



Conclusion

- We have shown how smart Antenna are designed at Fundamental level with COMSOL Multiphysics.
- We have assembled these antennas at System level to create arrays which are used for high directivity
- We have outlined analyzed signals from a typical Radar device
- We are interested in addressing issues with Controls for Radar and Lidars

References

- [1] Notes from US Naval school on Radars
- [2] Mathworks (Matlab code)

Acknowledgments

We are very grateful for the continuous support of Ohio Space grant Consortium and for our College of Professional studies who have always supported us to push for quality research and student engagement.