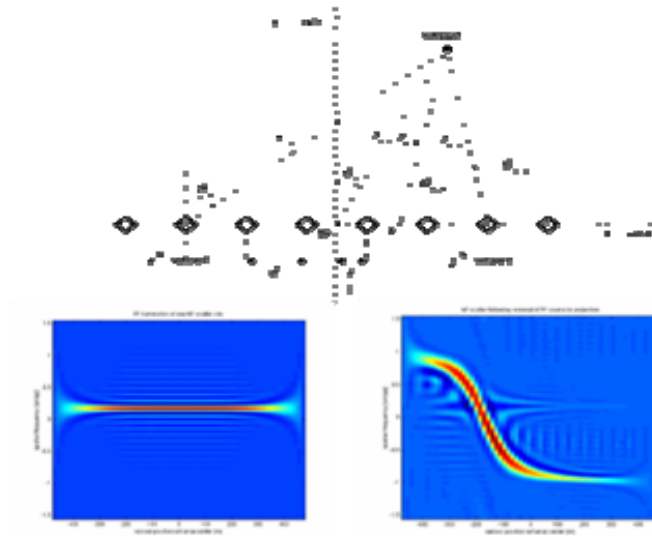


# Near-Field Scattering Characterization



## Project Summary

- Practical arrays of sensors require calibration to ensure narrow beams and low beam sidelobes.
- Sensor-angle distribution (SAD) is a joint variable distribution that represents the power of the received signal as a function of the angle at each sensor in the array.
- Power received from different near-field scatter sites have differing angle at each sensor.
- Developed a method to illuminate and then characterize near-field scatter environments using the SAD.

## Projects Description

This research focuses on multi-sensor array receivers of source signals with both time-varying spectral and spatial characteristics. Linear and nonlinear transforms of time, frequency, and space are employed for source detection and discrimination. For both one and higher dimensional arrays, auto- and cross- bilinear distributions as well as the source joint-variable quadratic distributions exploited to improve source separation and angle of arrival estimation.

The array sensor-angular distribution (SAD) obtained by computing the Wigner distribution or Cohen's class of time-frequency distributions TFDs, over the array sensors is used for far- and near- field processing. This distribution, equipped with proper methods for instantaneous frequency and bandwidth estimation, provides means to accurately measure the source position, range, and spatial spread. Fast implementations of SAD are performed through parallel computations of fast Fourier transforms of subarray data vectors. The information gained in the joint-variable domain is used to design local scatter mitigation beamformers that are relatively immune to mutual coupling.

Another important component of the proposed research is to devise new statistical models of random-amplitude polynomial-phase and spatially spread sources based on unrestrictive physics-based assumptions on the environment. These models are used to obtain robust and computationally efficient statistical array processing methods for estimating the number and parameters of multiple signals in multi-sensor array antennas.