

Work in Progress

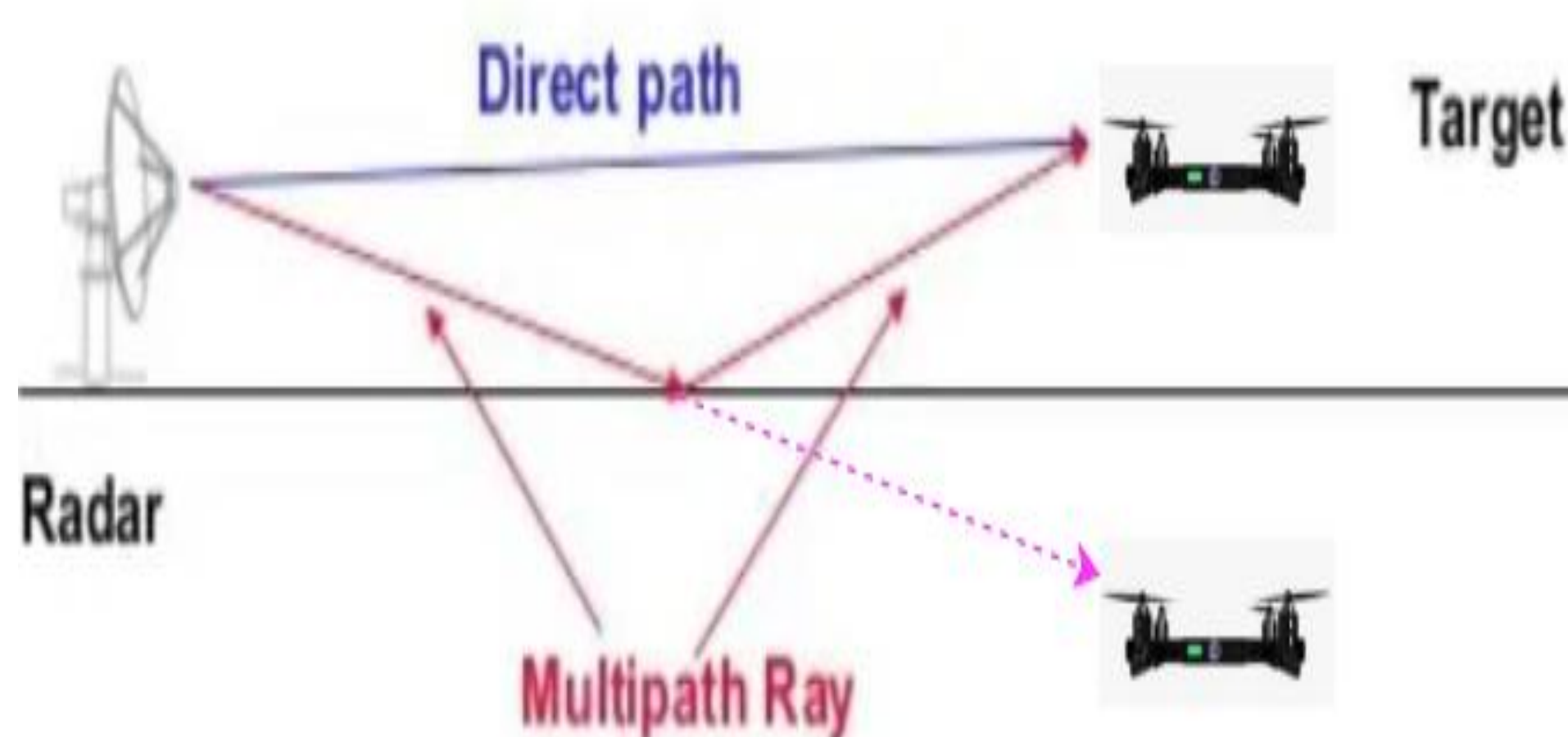
Direction of Arrival Estimation for Radar in Multipath Environment

Or Elia Harush and Shlomi Ben Abu, Supervised by Denis Dikarov

In collaboration with **RADA** ELECTRONIC INDUSTRIES LTD.

Introduction

- DOA (direction of arrival) computation by Radar in multipath environment gives a weak estimation.
- The multipath environment causes the sent signal to arrive from 2 directions resulting in low SNR.
- The multipath environment makes the incoming signals correlative.



Goals

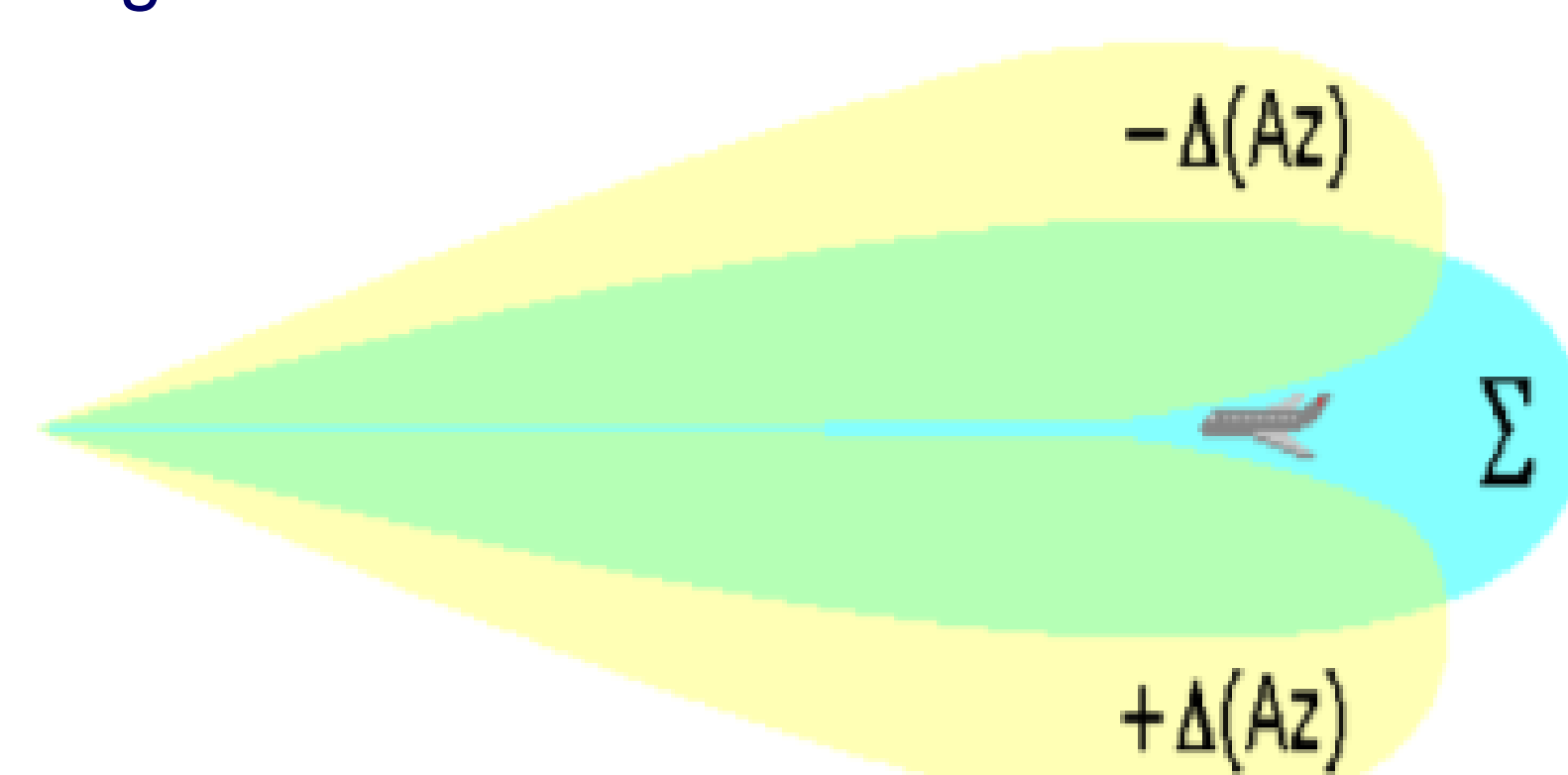
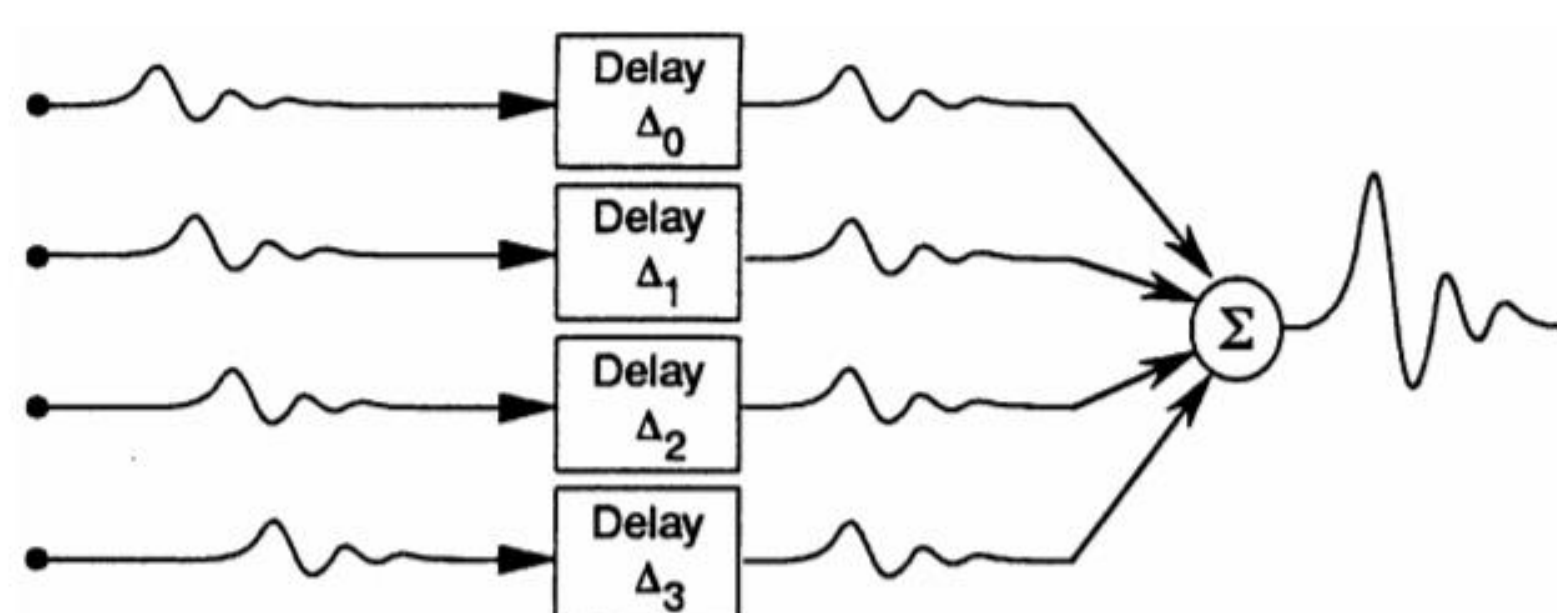
- Estimate the direction of arrival in the presence of multipath.
- Separate between the real target and the "ghost" target in good resolution.

Challenges

- Methods that achieve high resolution (subspace methods) prove to be unsuccessful when the signals are correlative.
- Find a solution to the correlation problem gives an arbitrary array.

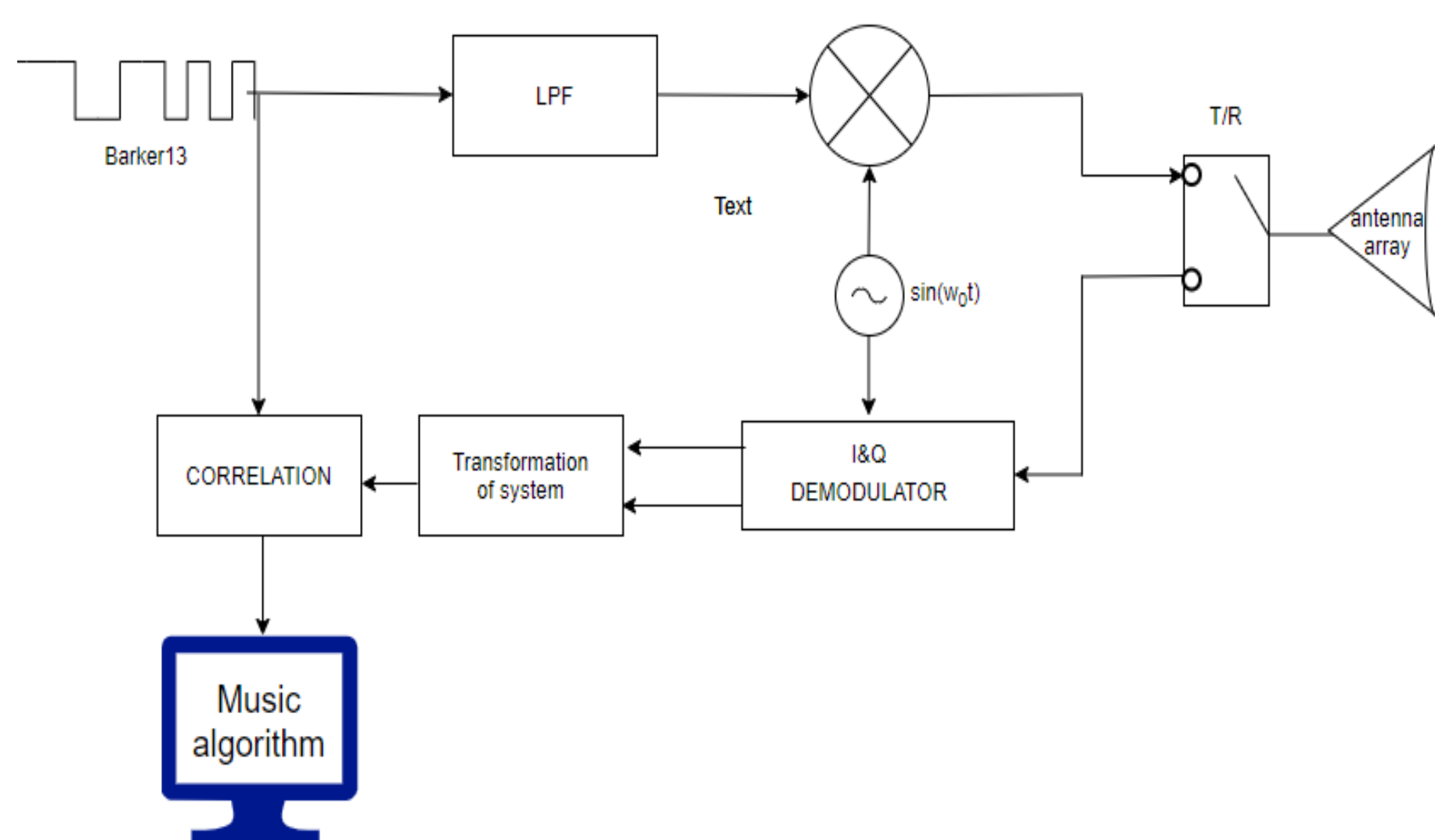
Regular Methods

- Delay & sum
- Sigma-Delta



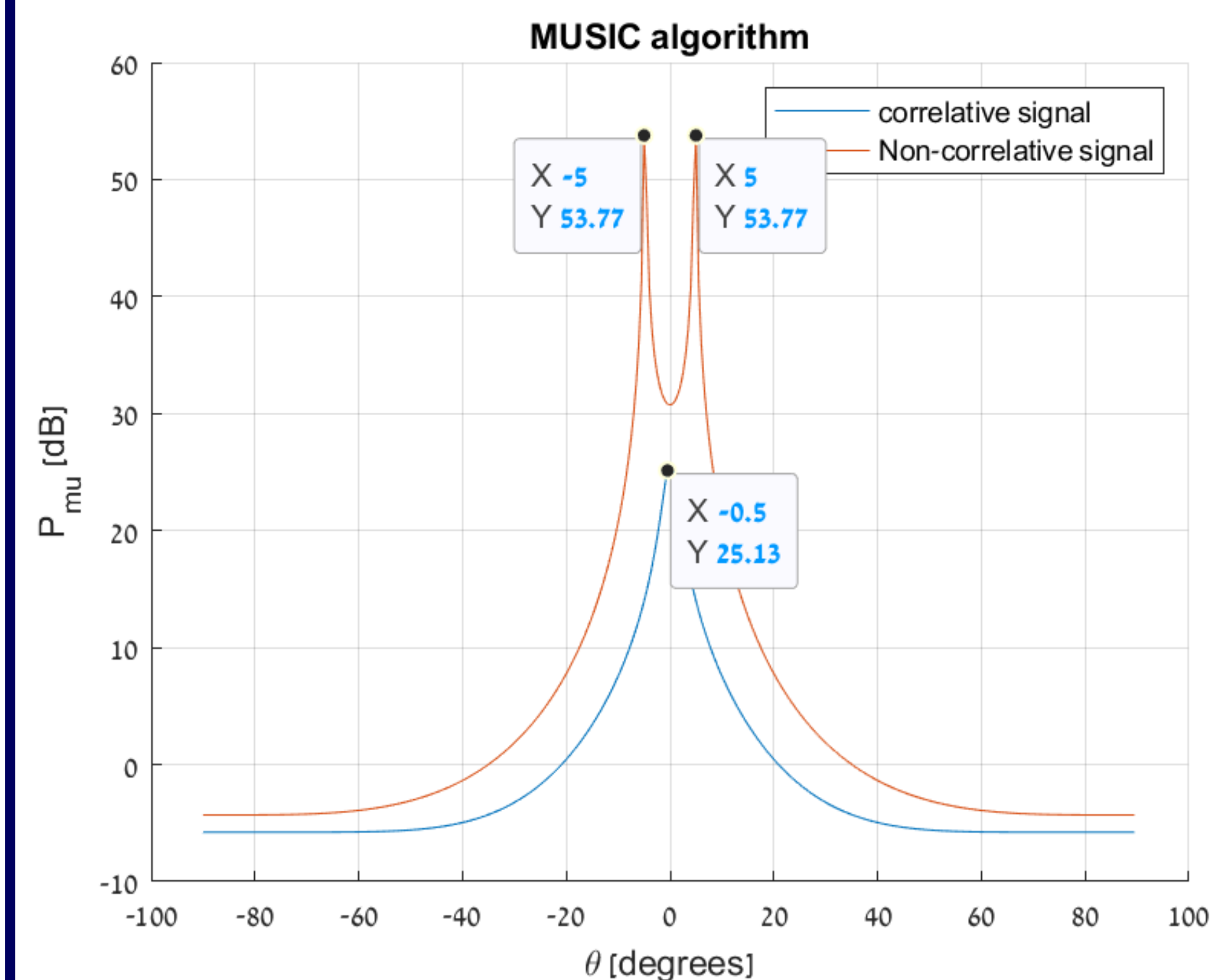
- Regular methods fail to achieve our goal.

Block Diagram



- The above shows our chosen solution corresponding to the radar parameters.
- The last block is also referred as the MUSIC algorithm.

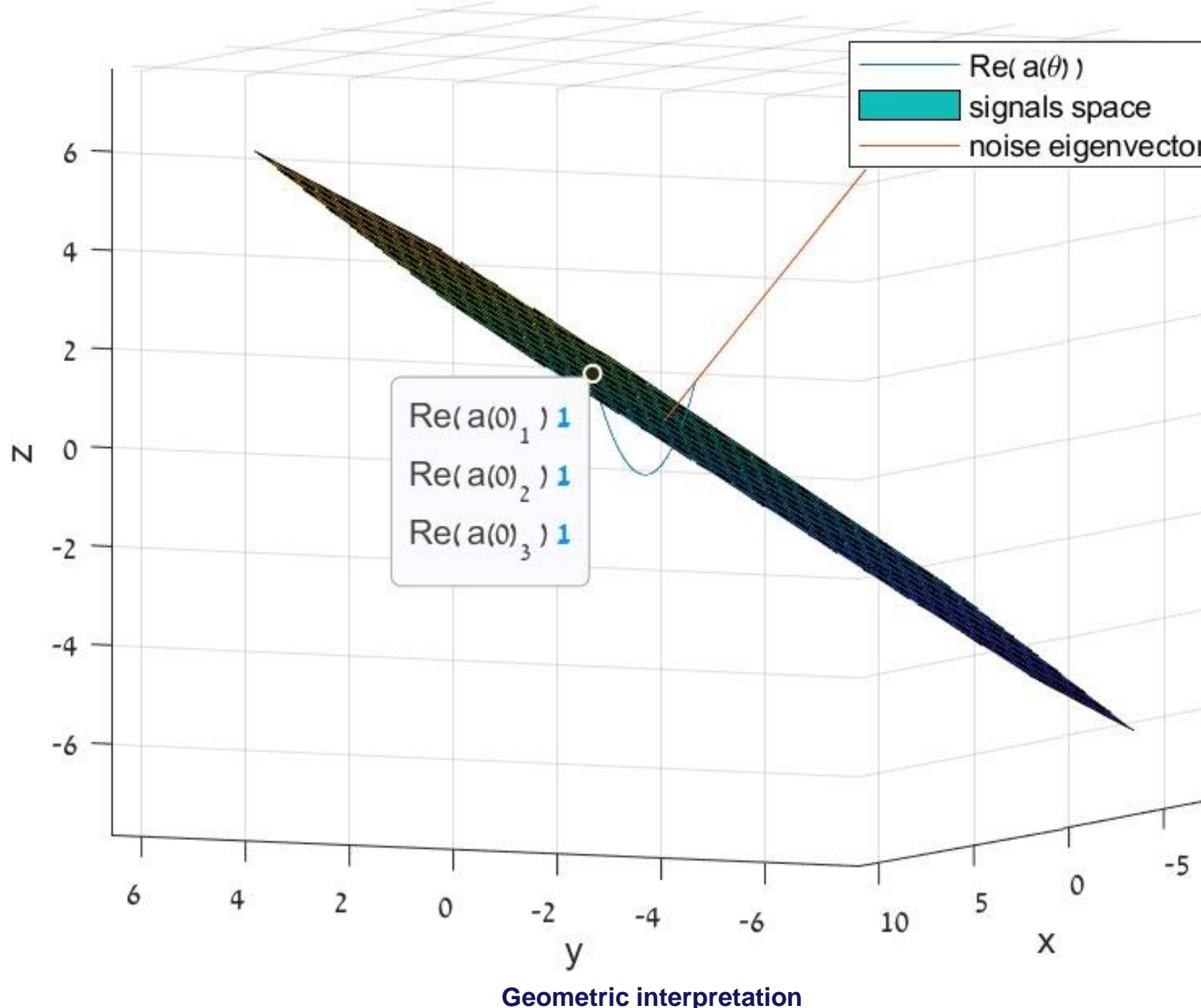
Correlative Signals



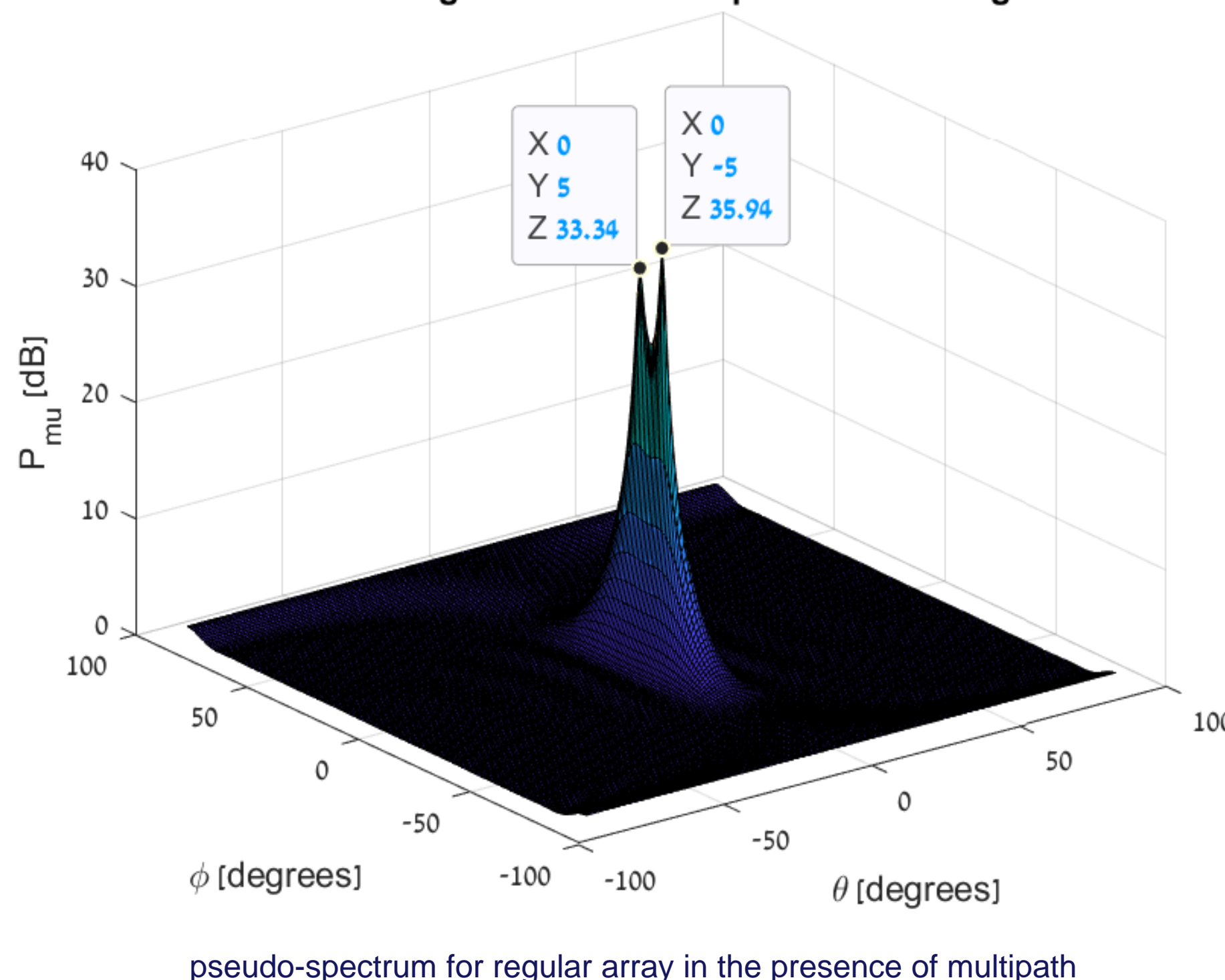
- As mentioned, the subspace fails when the signals are correlative.

MUSIC Algorithm

- Subspace algorithm which achieves high resolution.
- Decompose the covariance matrix to signal space and noise space.
- Search the string vector which is orthogonal to the noise space.
- Calculate the pseudo-spectrum and find the angle at which the pseudo-spectrum gets maximum.



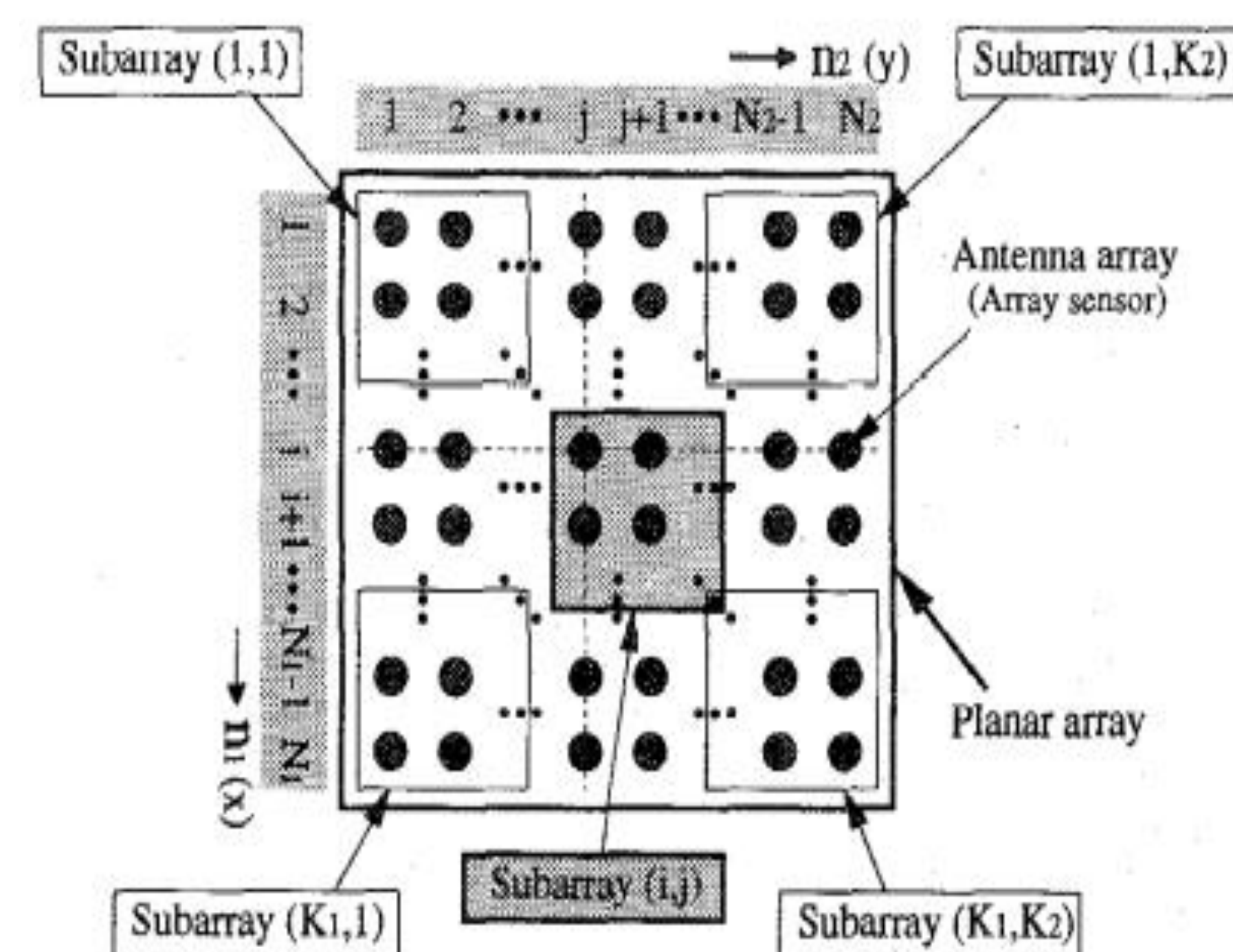
Performance for non-correlative signals



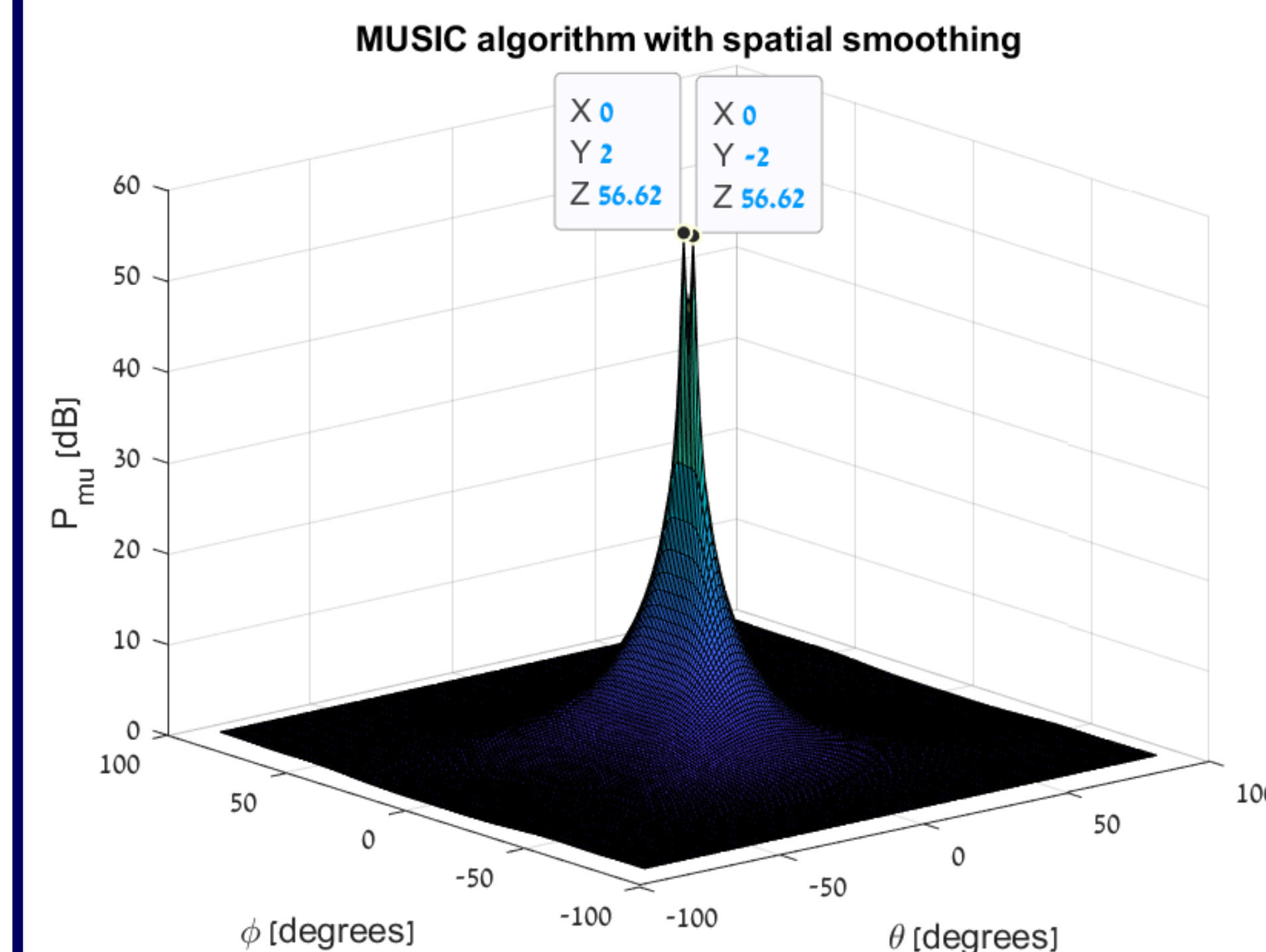
pseudo-spectrum for regular array in the presence of multipath

Spatial Smoothing

- Pre-processing technique which solves the correlation problem and improves the SNR.



Results & Conclusions



- The problem was solved and the goal was achieved (theoretically).
- The next problem is to find a suitable pre-processing technique for an arbitrary antenna array.