# Spatial Filter Component

## Overview

SF is a technology used for discriminating sound sources by virtue of their position in space. This type of spatial discrimination is also known as spatial filtering. It requires the use of an array of microphones to filter sounds coming from different directions even if they have overlapping spectral content. This can be used in the context of noise cancellation, when a desired sound source (speech) and interfering sound (noise) are originating from different positions in space.

The SF component described here supports a 2 microphone linear array with passband in the 70 degrees to 110 degrees. It is compatible with both 8 kHz and 16 kHz sampling.

## Configurable Properties

| Property | Description |
|---|---|
| `MicDist` | Inter-microphone distance selection from dropdown list |

## List of configuration templates for different recommended microphone spacing

| Sampling Frequency | Inter-microphone distance |
|---|---|
| fs (Hertz) | d (meters) |
| 8000/16000 | 0.05 |
| 8000/16000 | 0.06 |
| 8000/16000 | 0.07 |
| 8000/16000 | 0.08 |
| 8000/16000 | (TI Default) 0.084 |

## Microphones Array and Geometry

The SF algorithm is ultimately limited by the inter-microphone distance. Spatial aliasing refers to the phenomenon where sounds arriving from different angles can be misconstrued to be arriving from the same direction. To avoid spatial aliasing the inter-microphone distance is limited by the following relationship:

$$d_{\max} \le \frac{c}{2 f_{\max}}$$

Where fmax is the highest frequency of interest. For example, if the highest frequency of interest was 4000 Hz, the maximum inter-microphone distance would be 0.043 meters, while at 8000 Hz, it would be 0.021 meters.

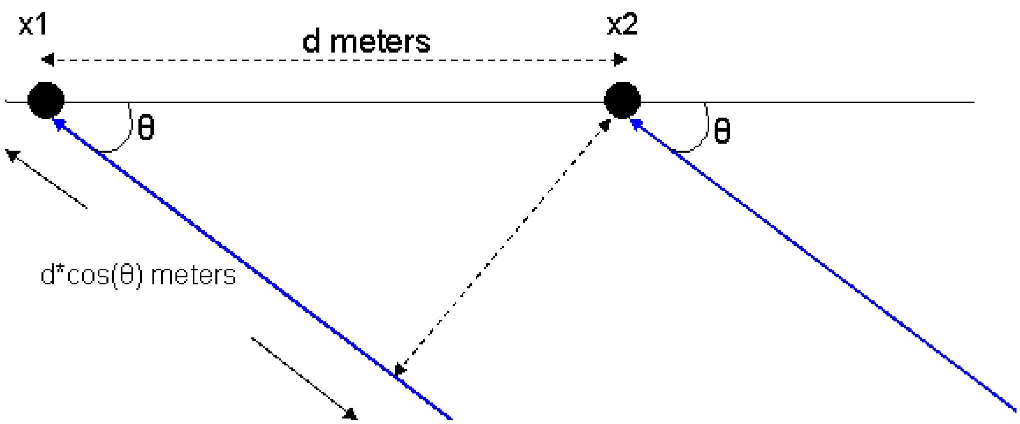


Figure 1. An illustration of a microphone array with 2 microphones and sound waves incident at an angle of θ.

## Example Beampattern for d = 8 cm, fs = 8000 Hz

In figure 2, we illustrate snapshots of the beampatterns at different frequencies. It can be observed that f = 2125 Hz has a well formed beam while any frequency above f = 2125 results in extra beams (sidelobes) due to spatial aliasing. The frequency 2125 is the critical frequency for d = 8 cm.

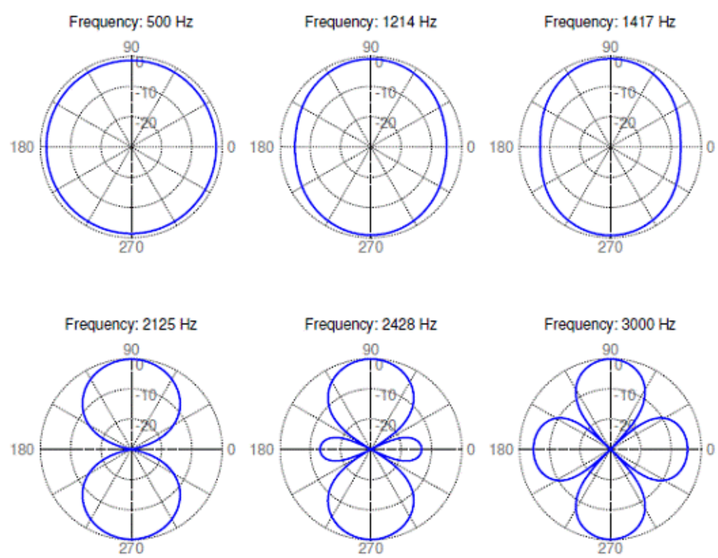


Figure 2. Illustration of beampatterns at various frequencies