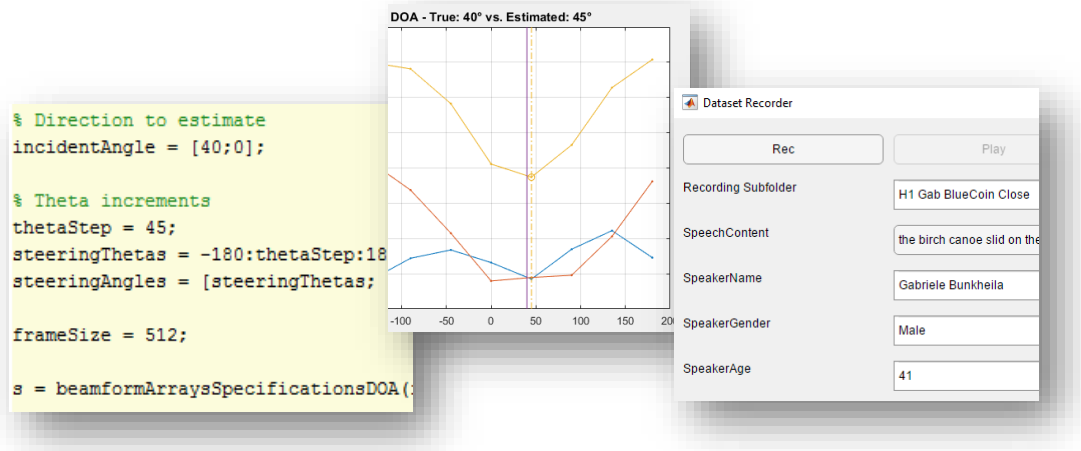
MATLAB EXPO 2018

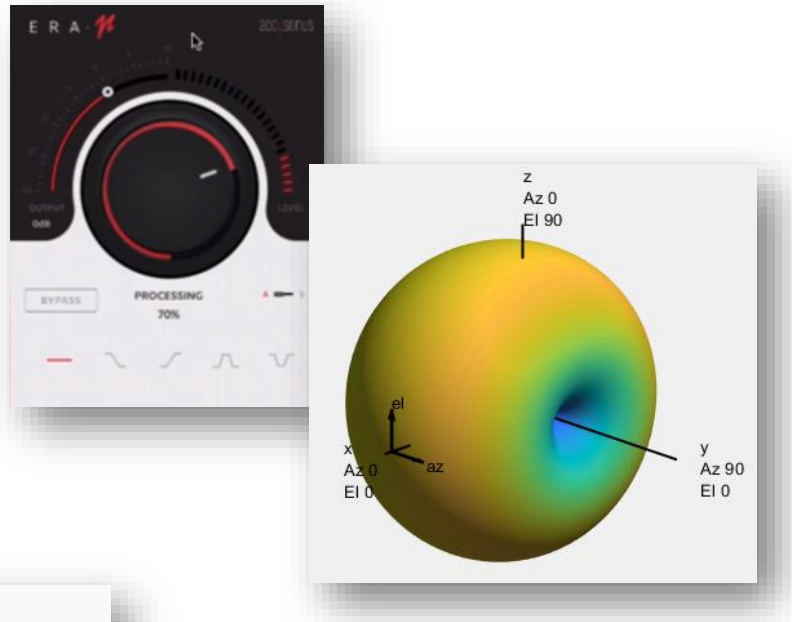
Riutilizzo e prototipazione di codice

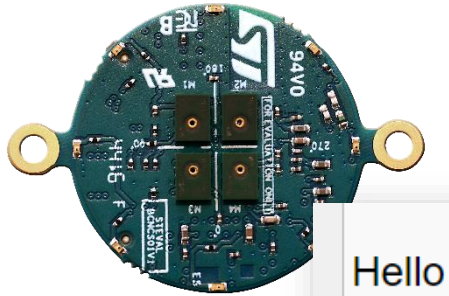
Design of Voice Interfaces for IoT Devices

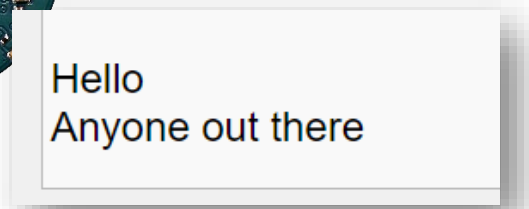
Francesca Perino

- Innovate
- Reuse
- Prototype



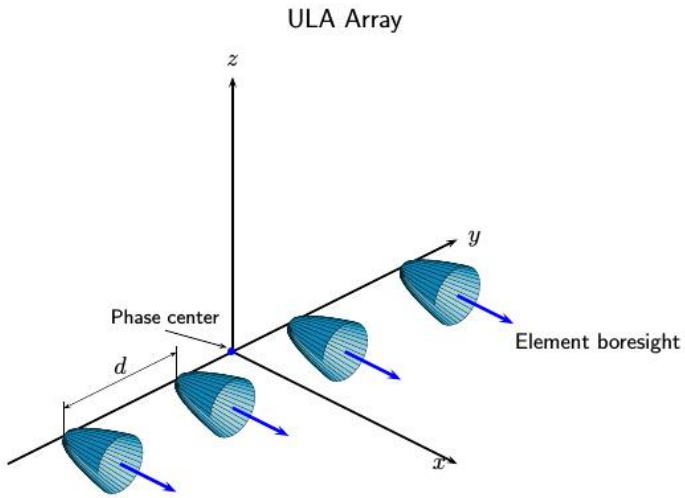


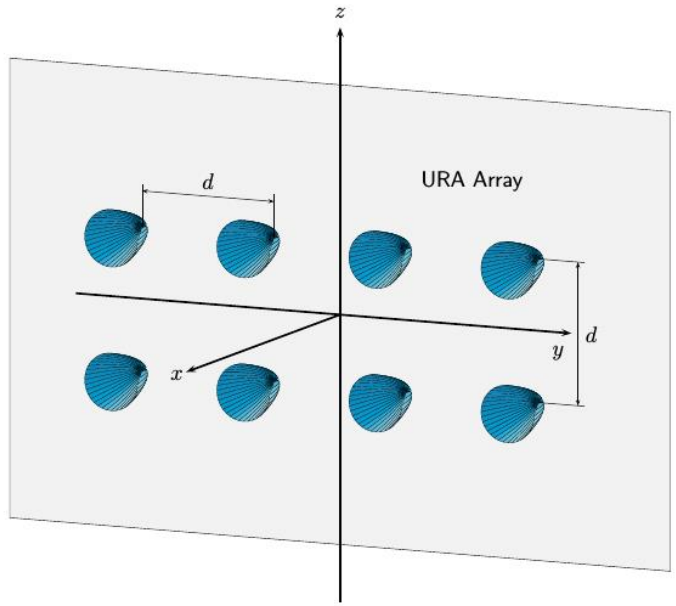


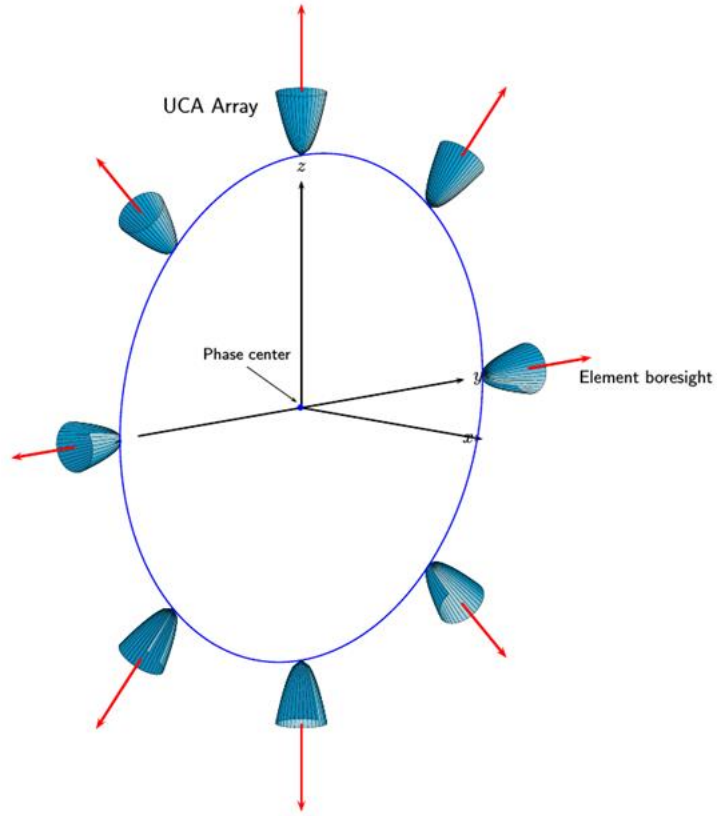


What Device Is This?

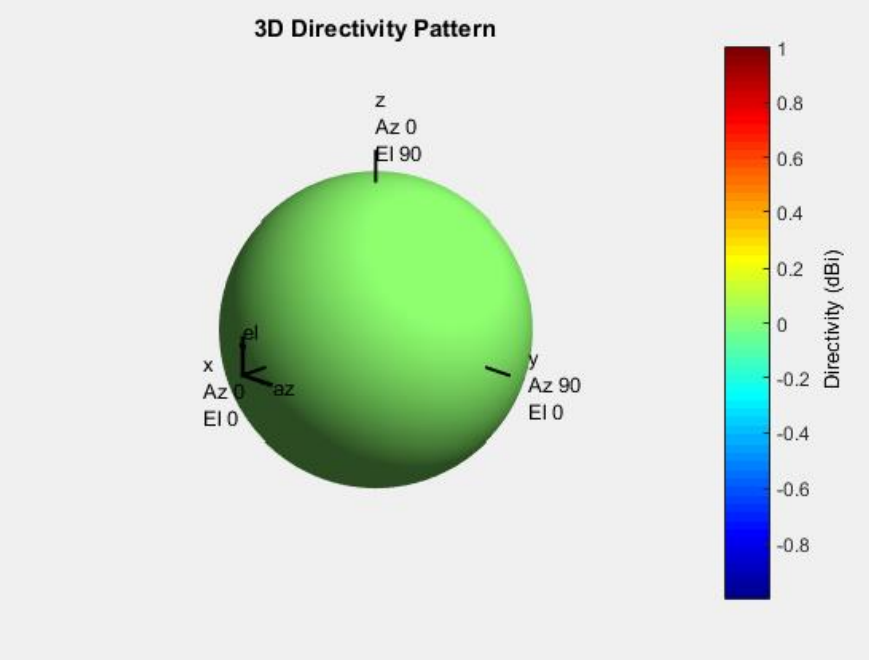
What Are Microphone Arrays?

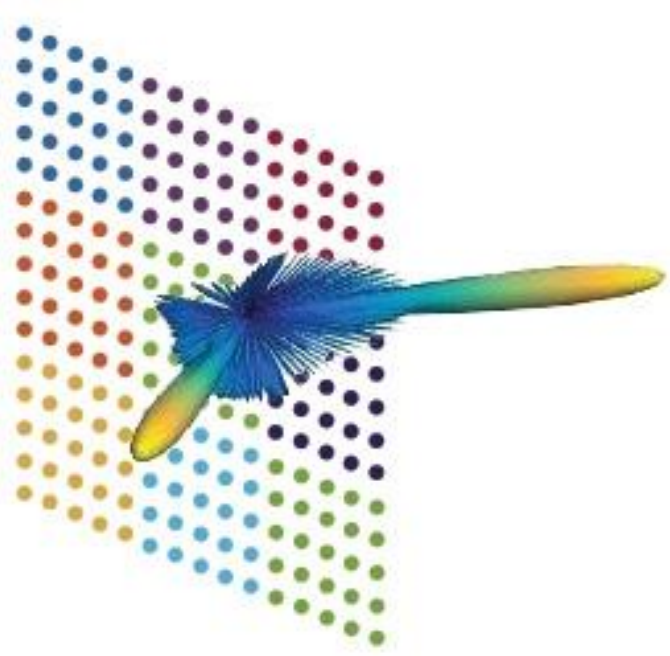




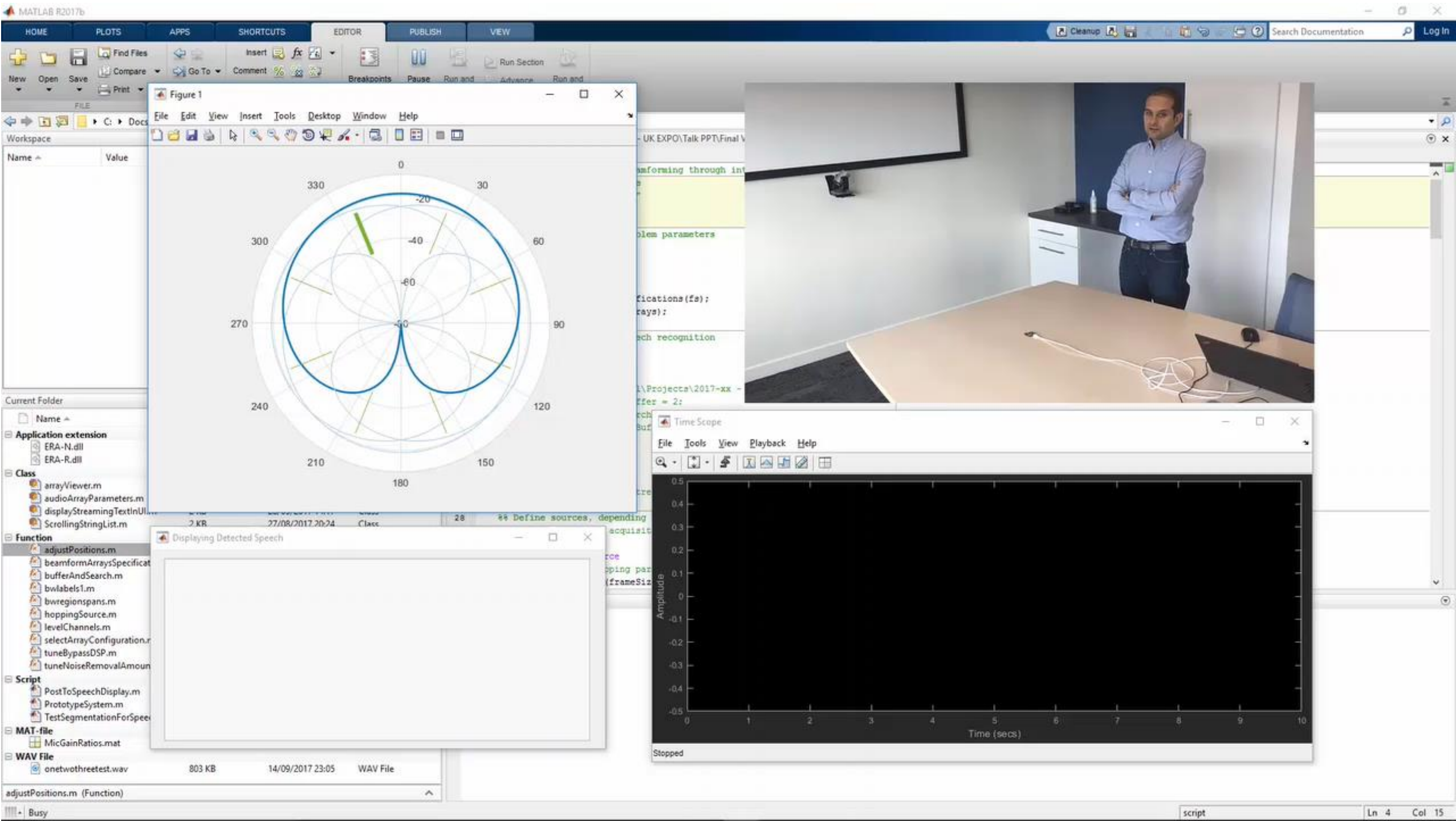


Why Microphone Arrays?






BlueCoin+
CN3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ERA-N.dll
ERA-R.dll
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audioArrayParameters.m
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ScrollingStringList.m
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Figure 1
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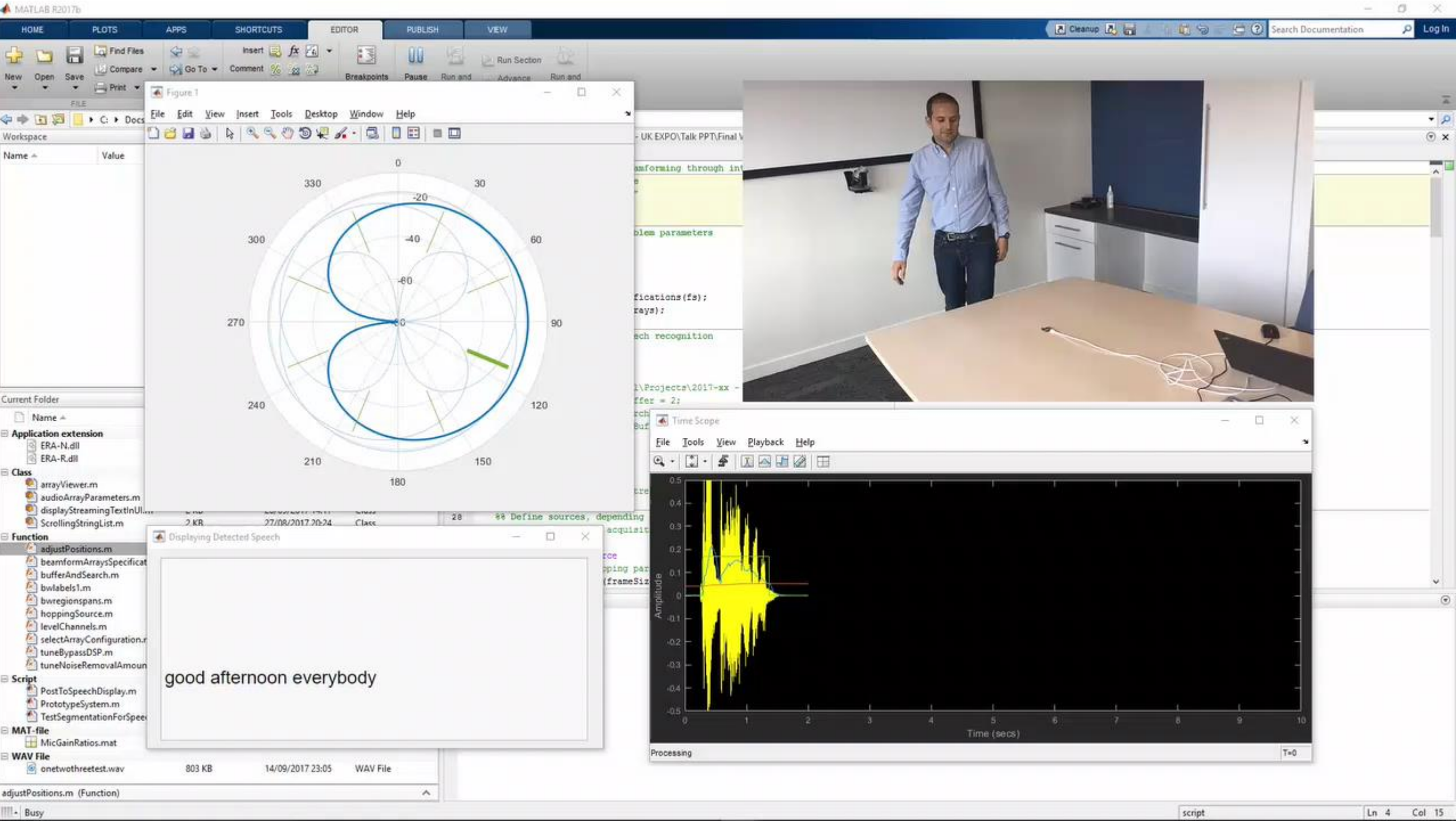
script
Ln 4
Col 15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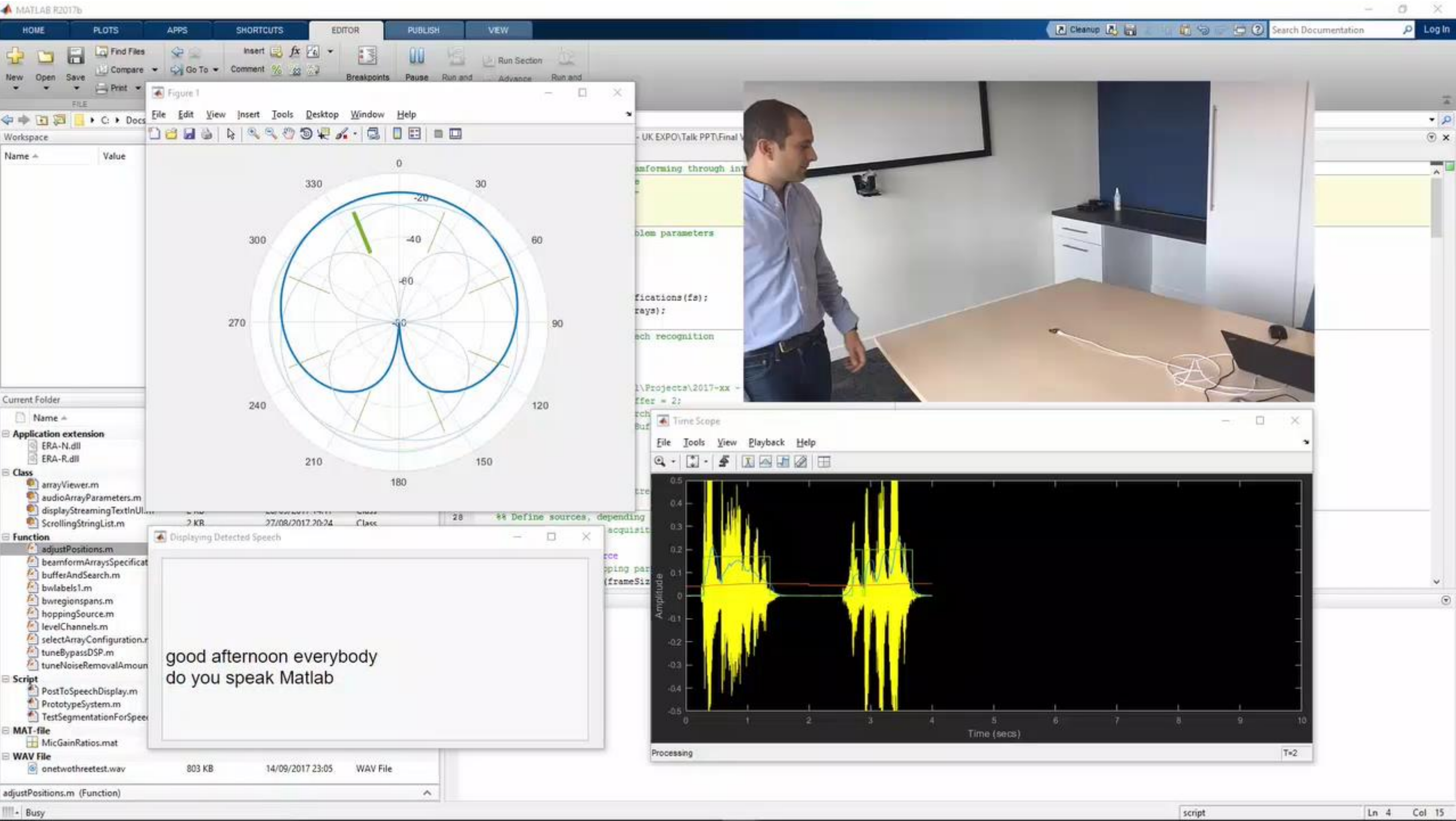
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good afternoon everybody
do you speak Matlab
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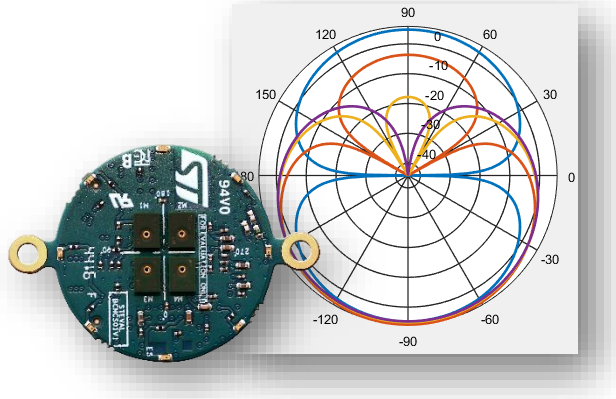
Col 15

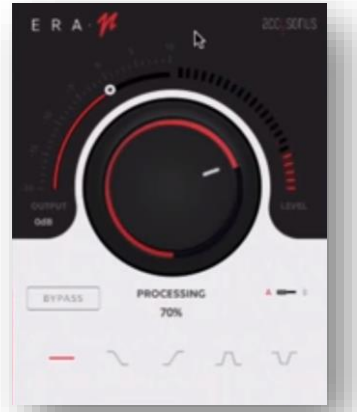
How Can I…

1. Design a microphone array system?



2. Validate my voice interface can work in real-life scenarios?

3. Understand what else can help me improve my performance?



How Can I…

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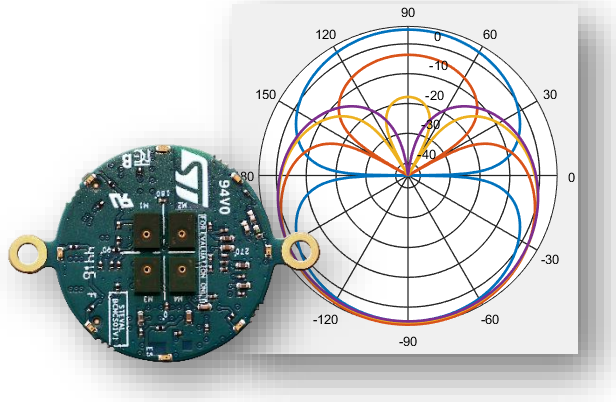

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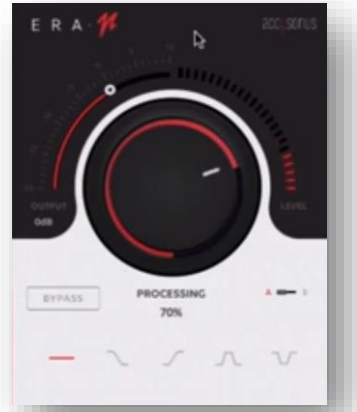
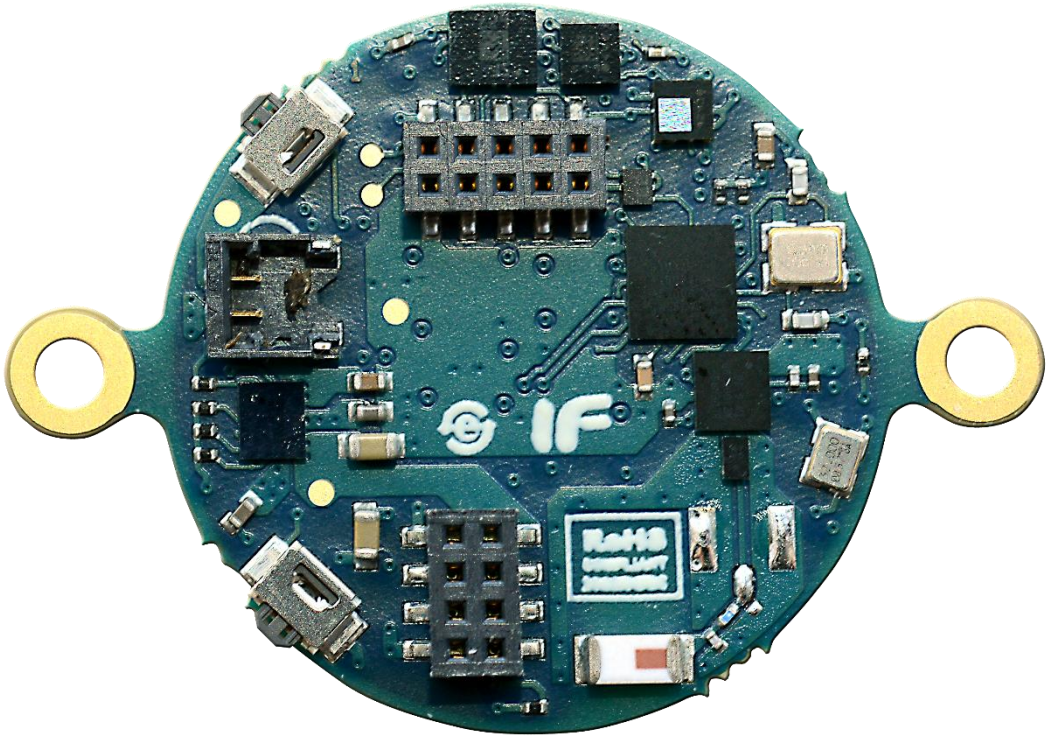
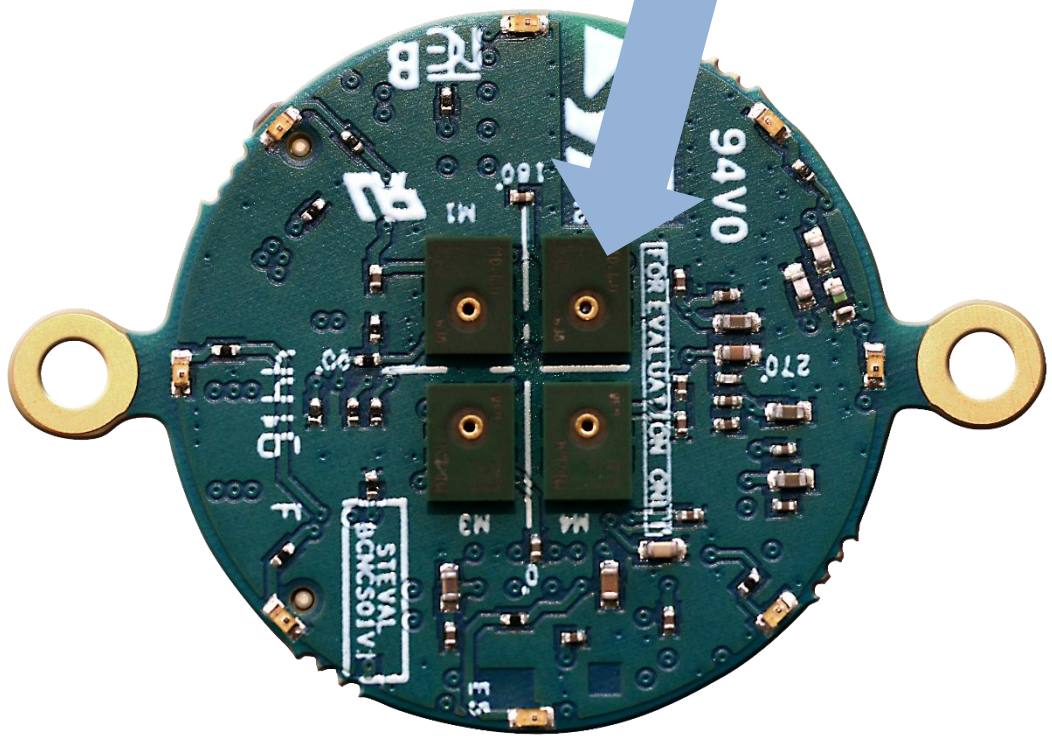


Design a Microphone Array System

…starting from a given array hardware

- BlueCoin from ST Microelectronics





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Analyze Code | Run and Time | Clear Commands — CODE

Simulink — SIMULINK

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C: ▸ Docs ▸ Material ▸ Projects ▸ 2017-10 - UK EXPO ▸ Talk PPT ▸ Final Videos ▸ Code ▸ 2. App-Aided Array Exploration

Workspace

Name | Value

Current Folder | Command History

Name | Size | Date Modified | Type

Details

Command Window

fx >>

Array Settings

Array Type: Uniform Rectangular

Element Type: Isotropic Antenna

BackBaffled: ☐

Size: [2 2]

Element Spacing: [0.003 0.003] m

Signal Frequencies: 1000 Hz

Lattice: Rectangular

Array Normal: x

Propagation Speed: 340 m/s

Steering: ☐

Row Taper: None

Column Taper: None

Apply

Visualization Settings

View: Array Geometry

Show Normals:

Show Index:

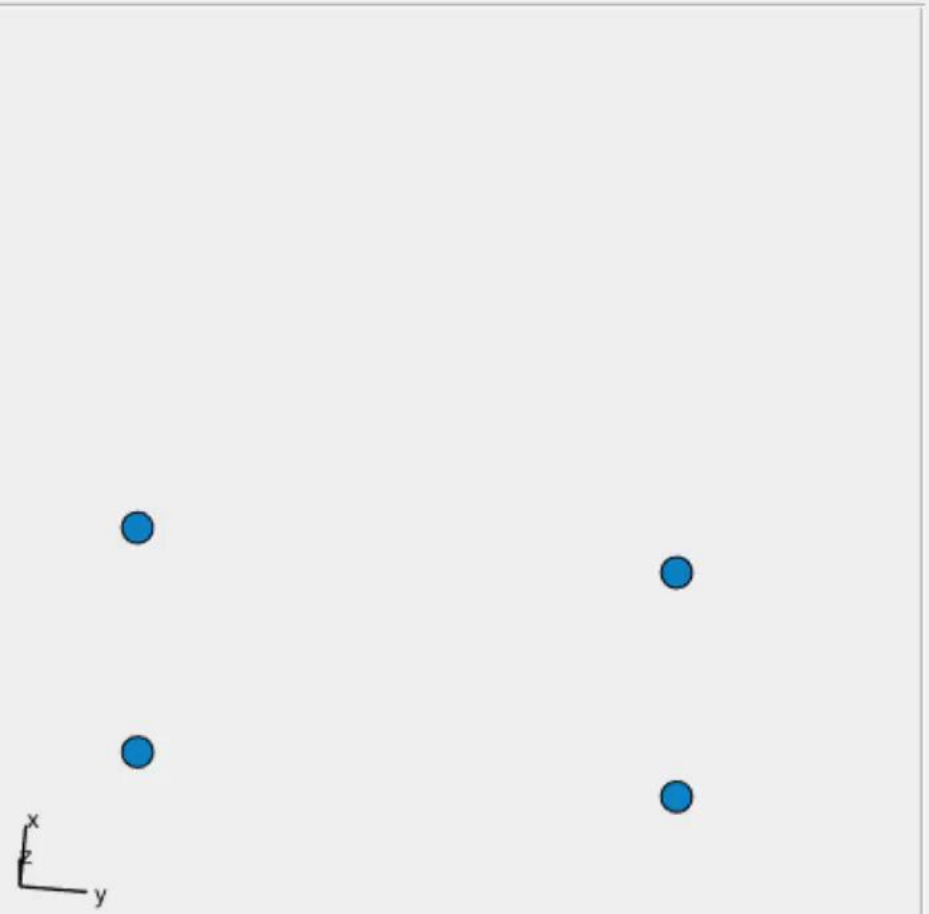
- Array Geometry
- 2D Array Directivity
- 3D Array Directivity
- Grating Lobe Diagram

Array Characteristics

Array Directivity: 0.00 dBi at 0 Az; 0 El

Array Span: x=0 m y=3 mm z=3 mm

Number of Elements: 4



File Help

Array Settings

Array Type: Uniform Linear

Element Type: Isotropic Antenna

BackBaffled: ☐

Number of Elements: 2

Element Spacing: 0.003 m

Array Axis: y

Signal Frequencies: 1000 Hz

Propagation Speed: 340 m/s

Steering: ☐

Taper: None

Apply

Visualization Settings

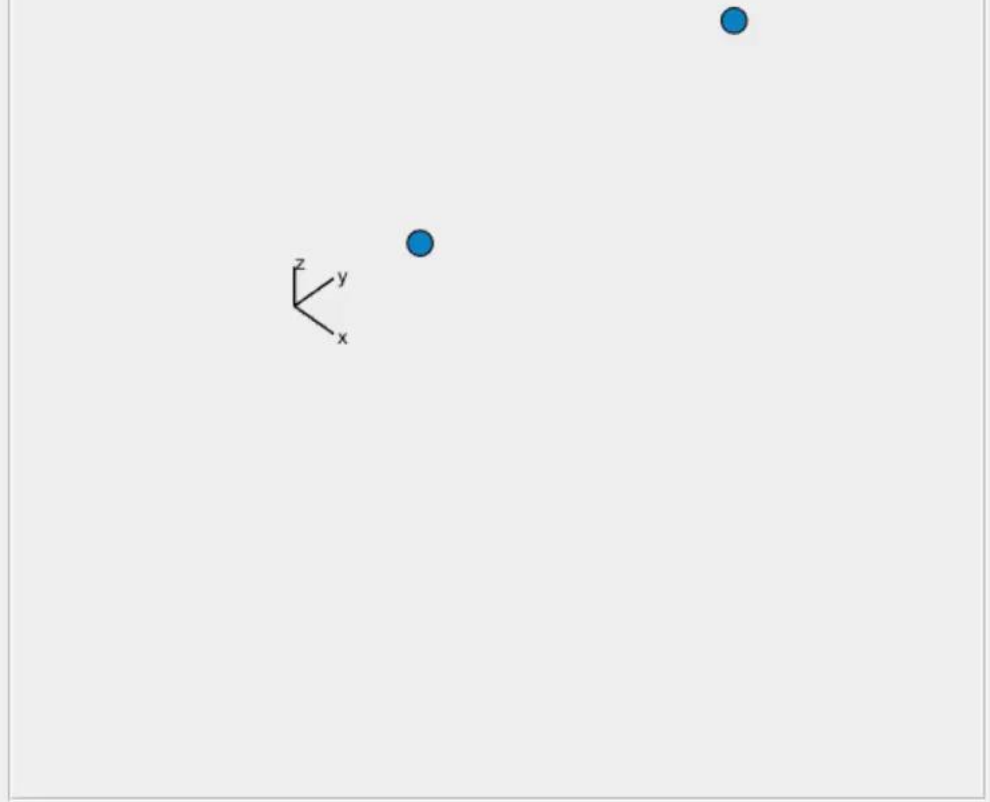
View: Array Geometry

Show Normals: ☐

Show Index: ☐

Array Characteristics

Array Directivity:	0.00 dBi at 0 Az; 0 El
Array Span:	x=0 m y=3 mm z=0 m
Number of Elements:	2



File Help

▼ Array Settings

Array Type: Uniform Linear

Element Type: Isotropic Antenna

BackBaffled: ☐

Number of Elements: 2

Element Spacing: 0.003 m

Array Axis: y

Signal Frequencies: 1000 Hz

Propagation Speed: 340 m/s

Steering: ☑

Steering Angles: [90;0] deg

Phase Shift Quantization: 0 bits

Taper: Custom

Custom Taper: [1, -1]

Apply

▼ Visualization Settings

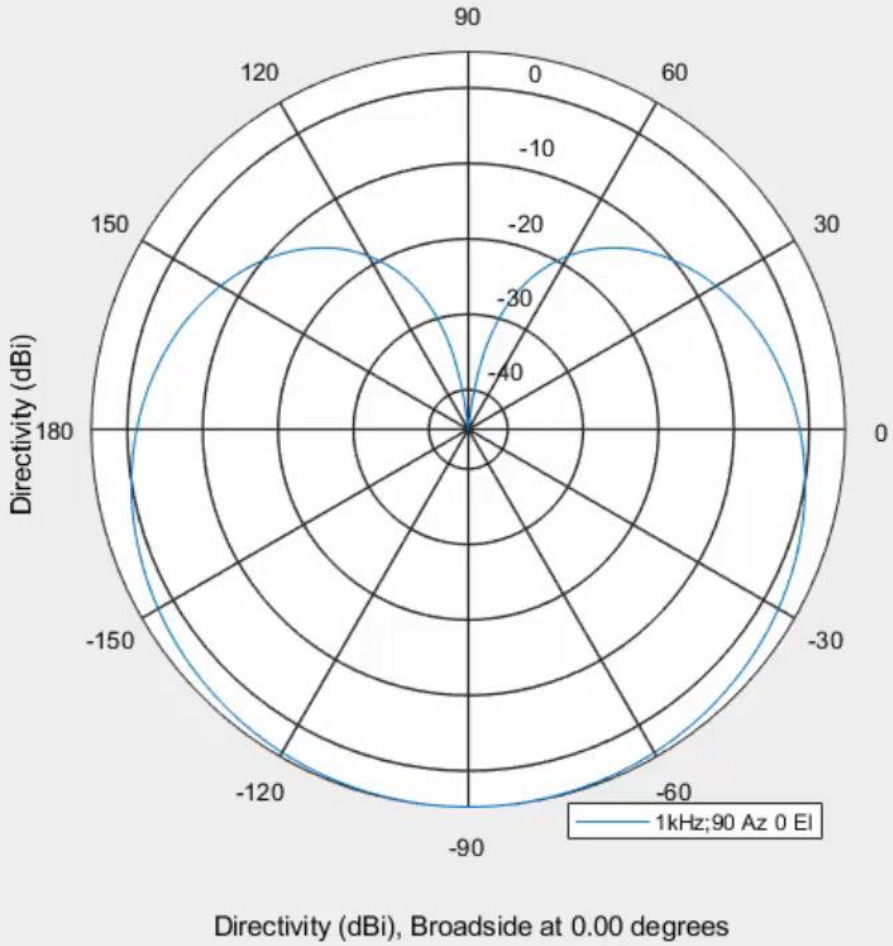
View: 2D Array Directivity

Cut Type: Azimuth Cut-Polar

Cut Value: 0 deg

▼ Array Characteristics

Array Directivity:	-Inf dBi at 90 Az; 0 El
Array Span:	x=0 m y=3 mm z=0 m
Number of Elements:	2



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FILE | NAVIGATE | EDIT | BREAKPOINT

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Workspace

Name	Value
fs	16000
hui	*1x1 Figure*
toTune	*1x1 audioArray...*
viewer	*1x1 steeringArr...*

Current Folder

Name		
Folder		
OLD		
Class		
arrayPatternViewer.m		
audioArrayParameters.m		
pointingArrayViewer.m		
steeringArrayViewer.m		
Function		
adjustPositions.m	1 KB	29/09
beamformArraysSpecifications.m	5 KB	29/09
selectArrayConfiguration.m	1 KB	14/08
tuneParameter.m	1 KB	14/09
Script		
SteerInteractively.m	2 KB	29/09

Details

Figure 1

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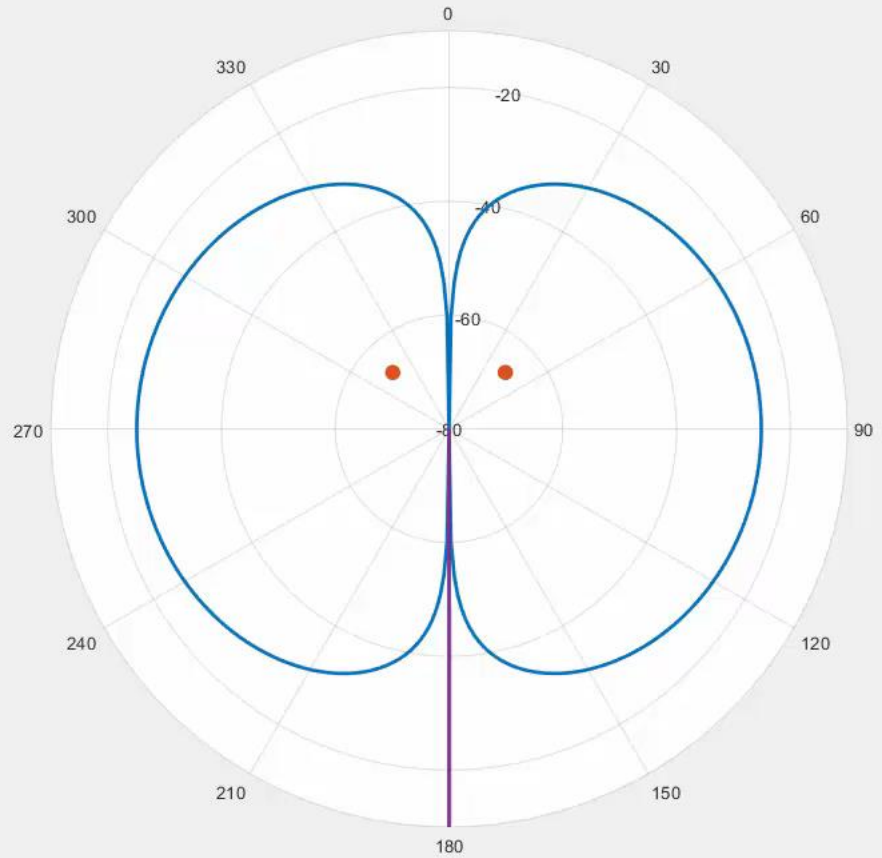

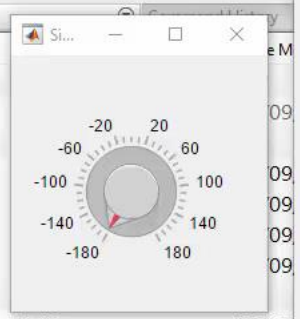

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Workspace

Name	Value
fs	16000
hui	*1x1 Figure*
specs	*1x1 struct*
toTune	*1x1 audioArray...*
viewer	*1x1 pointingArr...*

Current Folder

Name		
Folder		
OLD		
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arrayPatternViewer.m		
audioArrayParameters.m		
pointingArrayViewer.m		
steeringArrayViewer.m		
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adjustPositions.m	1 KB	29/09
beamformArraysSpecifications.m	5 KB	29/09
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SteerInteractively.m	2 KB	29/09

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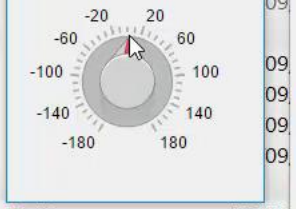
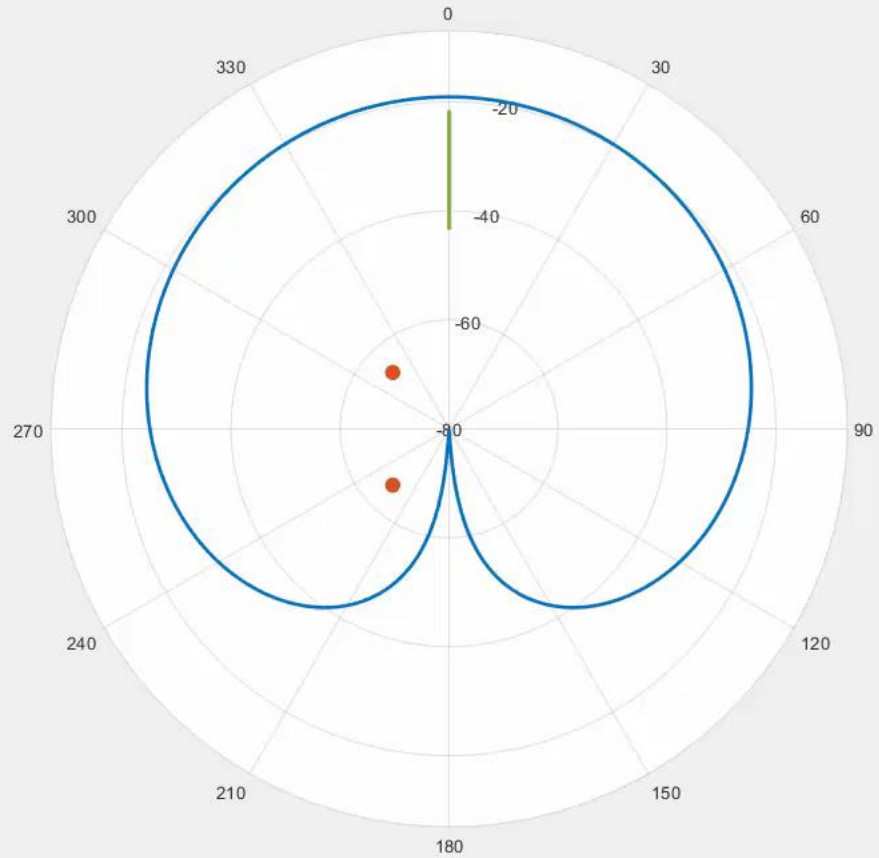


Figure 1

File Edit View Insert Tools Desktop Window Help



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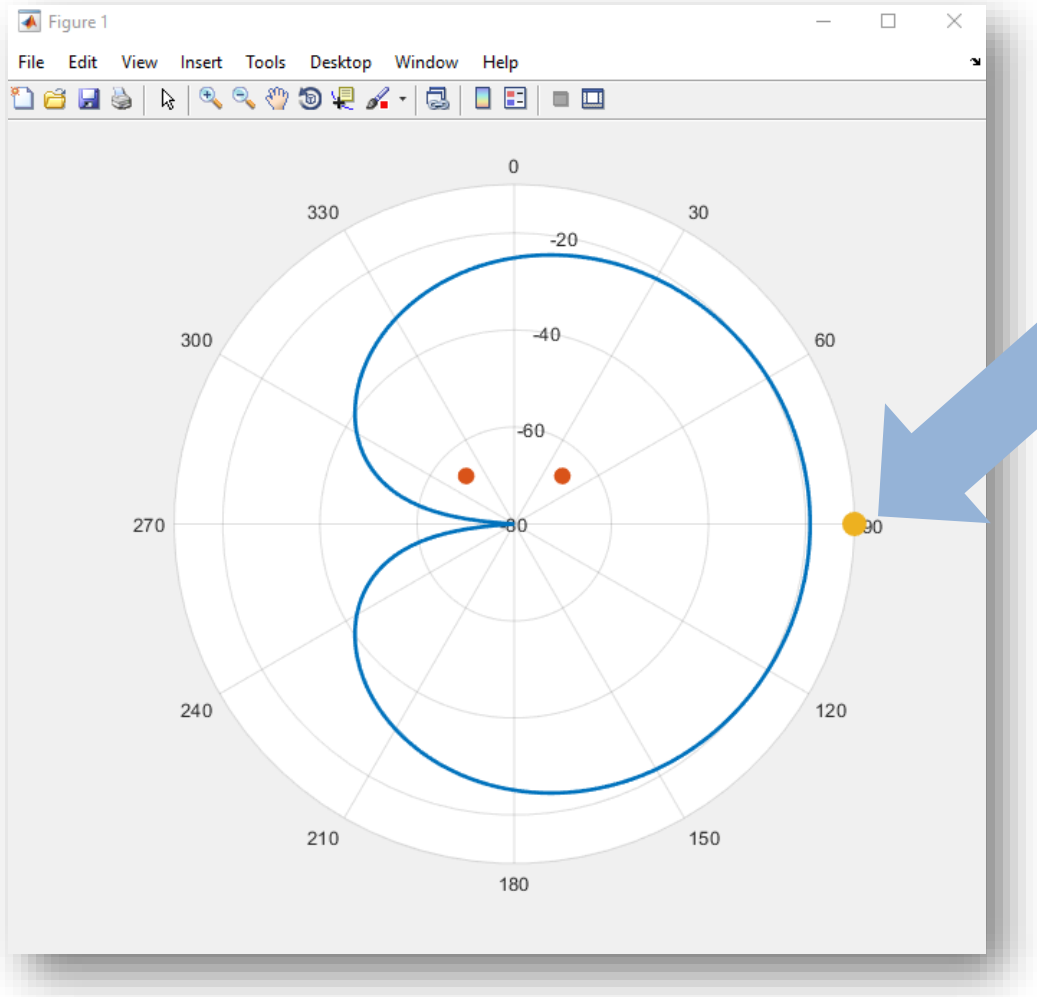
Time Domain Simulation of an Array System



Sound source

- C:\Docs\Material\Projects\2017-10 - UK EXPO\Talk PPT\Final Videos\Code\4. Array Time Domain Simulation\SimulateArrayAcquisition.m

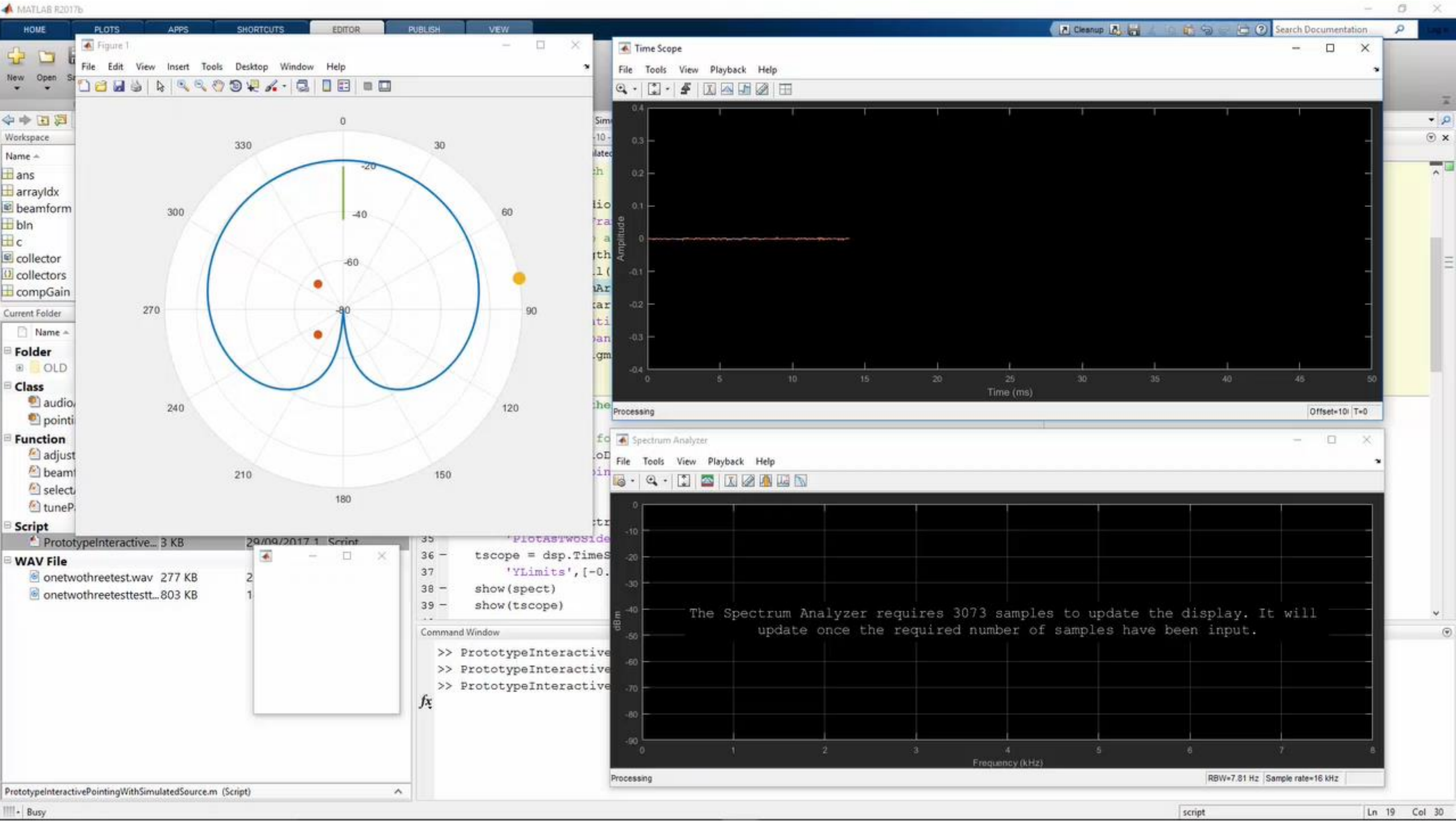

```
toTune = audioArrayParameters(viewer);
toTune.steeringTheta = -90;
toTune.sourceTheta = 90;

% Microphone pair
ula = phased.ULA(2, dx, 'Taper', [1 -1]);

% Acquisition of propagating signal
collector = phased.WidebandCollector('Sensor',ula,...
    'PropagationSpeed',c,'SampleRate',fs,'ModulatedInput',false,...
    'NumSubbands',4096);
incidentAngle = [toTune.sourceTheta;0];

% Beamformer
beamform = phased.TimeDelayBeamformer('SensorArray',ula,...
    'SampleRate',fs,'PropagationSpeed',c,...
    'DirectionSource','Input port','WeightsOutputPort',false);
nullSteeringAngle = [toTune.steeringTheta;0];

% Spectrum analysis
spect = dsp.SpectrumAnalyzer('SampleRate',fs,'PlotAsTwoSidedSpectrum',false,...
    'YLimits',[-50,15], 'ShowLegend', true,...
    'SpectralAverages', 128, 'FrequencyScale', 'Log');
show(spect)
adjustPositions(viewer, spect)
```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Time Scope
File Tools View Playback Help
Amplitude
Time (ms)
Processing
Offset=10
T=0
Spectrum Analyzer
File Tools View Playback Help
The Spectrum Analyzer requires 3073 samples to update the display. It will update once the required number of samples have been input.
dBm
Frequency (kHz)
Processing
RBW=7.81 Hz
Sample rate=16 kHz
Workspace
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beamform
bln
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collector
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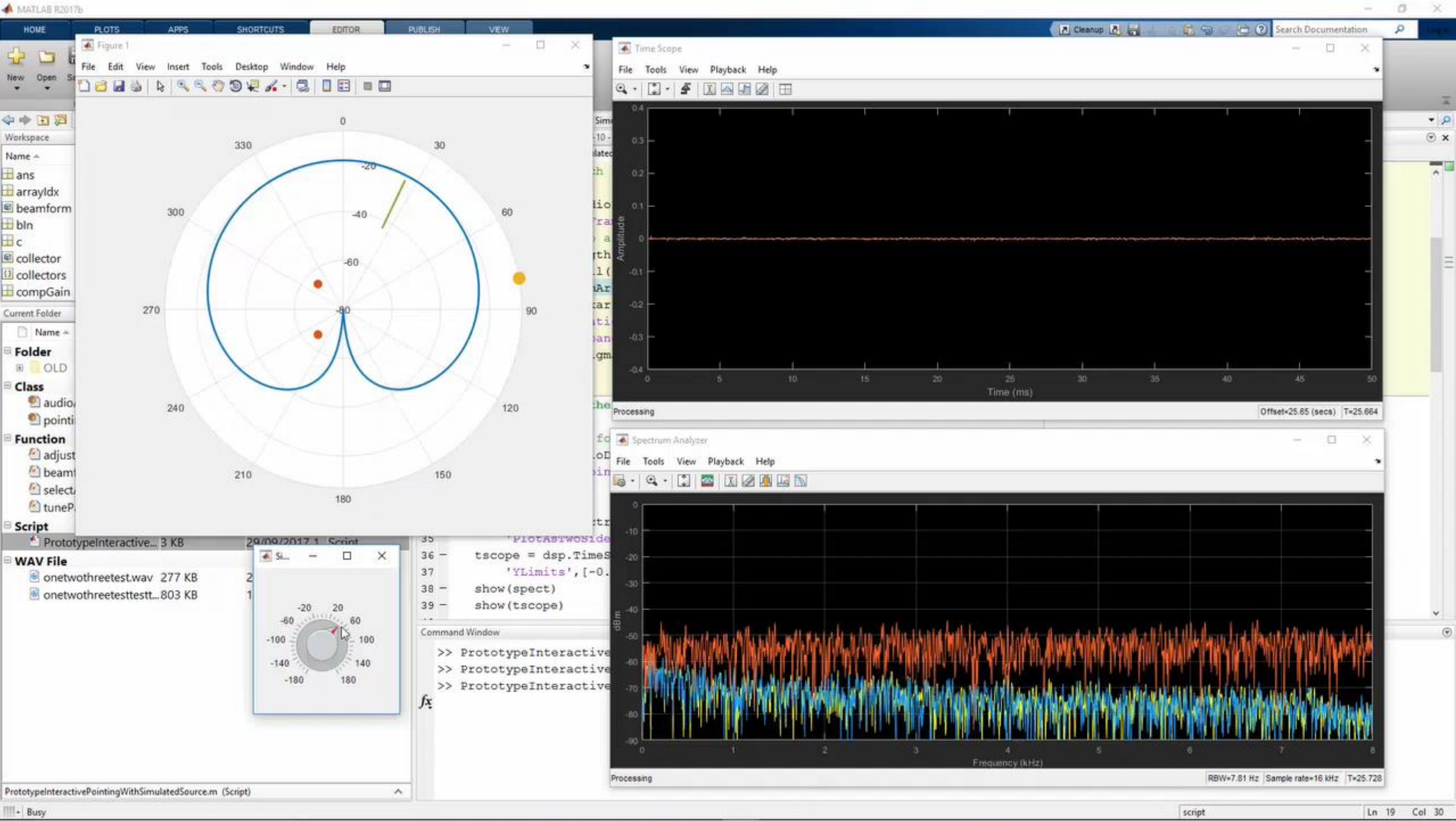
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Time Scope
File Tools View Playback Help
Amplitude
Time (ms)
Processing
Offset=25.65 (secs)
T=25.664
Spectrum Analyzer
File Tools View Playback Help
dBm
Frequency (kHz)
Processing
RBW=7.81 Hz
Sample rate=16 kHz
T=25.728
Workspace
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onetwothreetest.wav 277 KB
onetwothreetesttestt... 803 KB
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>> PrototypeInteractive
PrototypeInteractivePointingWithSimulatedSource.m (Script)
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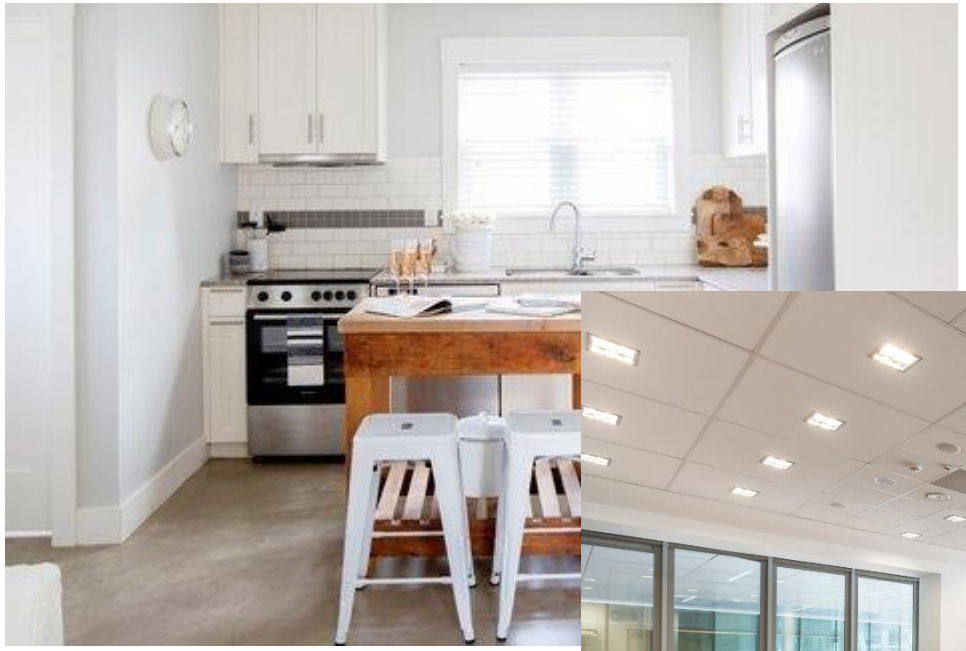
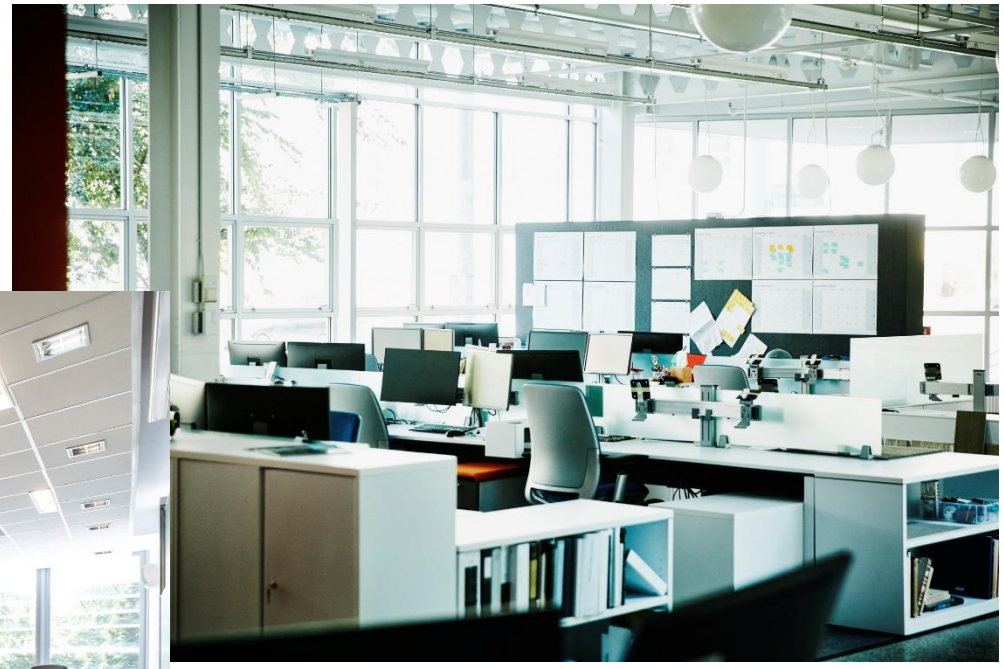
script
Ln 19
Col 30

How Can I ….Validate my voice interface can work in real-life scenarios?

Constrained Simulations vs. Real Life





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Cleanup Search Documentation Log In

Run Run and Advance Run Section Advance Run and Time

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nal Videos ▸ Code ▸ 6. Streaming Audio into MATLAB

Editor - C:\Docs\Material\Projects\2017-10 - UK EXPO\Talk PPT\Final Videos\Code\6. Streaming Audio into MATLAB\LiveStreamAndAcquire.m

LiveStreamAndAcquire.m

```
22 -    release(readaudio)
23
24      %% Stream and visualize live
25
26      % Scope for time-domain visualization
27 -    tscope = dsp.TimeScope('SampleRate',fs,'TimeSpan',0.500,...
28          'YLimits',[-0.5,0.5],'TimeSpanOverrunAction','Scroll');
29
30      % Set shorter block duration
31 -    readaudio.SamplesPerFrame = 1024;
32
33 -    tic
34 -    while toc < 30
35          % Acquire live
36 -        in = readaudio();
37          % Visualize in real-time
38 -        tscope(in);
39 -    end
40
41      %%
42 -    release(readaudio)
```

Command Window

```
  Show all properties

>> readaudio.Device = 'Microphone (STM32 AUDIO Streaming in FS Mode)'
```

MATLAB R2017b

HOME | PLOTS | APPS | SHORTCUTS | EDITOR | PUBLISH | VIEW

Cleanup | Search Documentation | Log In

New | Open | Save | Find Files | Compare | Print | Go To | Find | Insert | Comment | Indent | Breakpoints | Run | Run and Advance | Run Section | Advance | Run and Time

FILE | NAVIGATE | EDIT | BREAKPOINTS | RUN

C: ▸ Docs ▸ Material ▸ Projects ▸ 2017-10 - UK EXPO ▸ Talk PPT ▸ Final Videos ▸ Code ▸ 7. Real-time in MATLAB

Workspace

Name	Value

Current Folder | Command History

Name	Size	Date...	Type
Class			
BeamformingType.m	1 KB	11/...	Class
LevelAndBeamform.m	6 KB	13/...	Class
Function			
beamformArraysSpecificationsCG.m	2 KB	11/...	Fun...
selectArrayConfiguration.m	1 KB	14/...	Fun...
WAV File			
AroundThe ArrayAt0_take1.wav	5.6...	28/...	WA...
AroundThe ArrayAt90_take1.wav	7.8...	28/...	WA...

selectArrayConfiguration.m (Function)

Editor - C:\Docs\Material\Projects\2017-10 - UK EXPO\Talk PPT\Final Videos\Code\7. Real-time in MATLAB\LevelAndBeamform.m

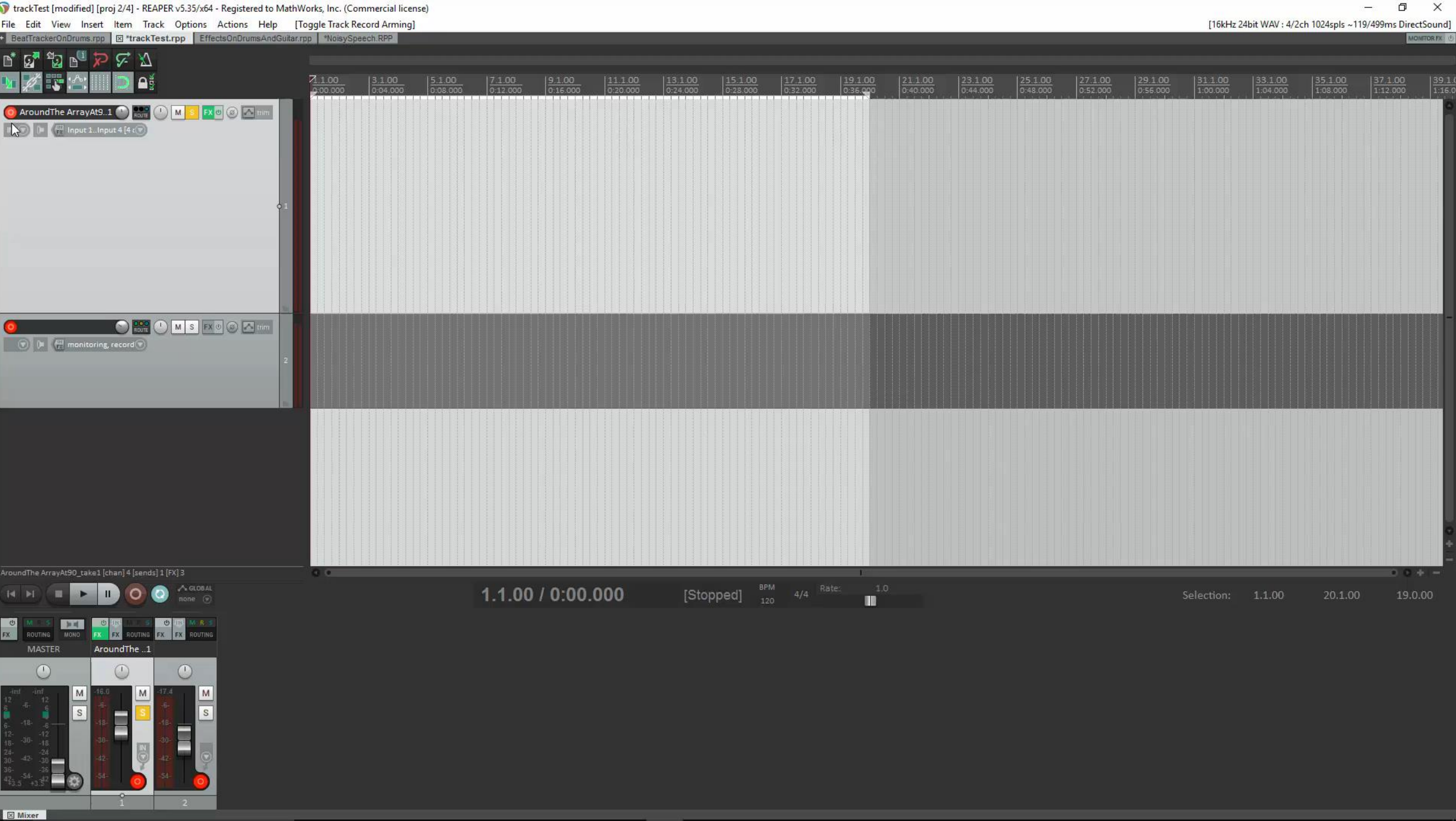
LevelAndBeamform.m

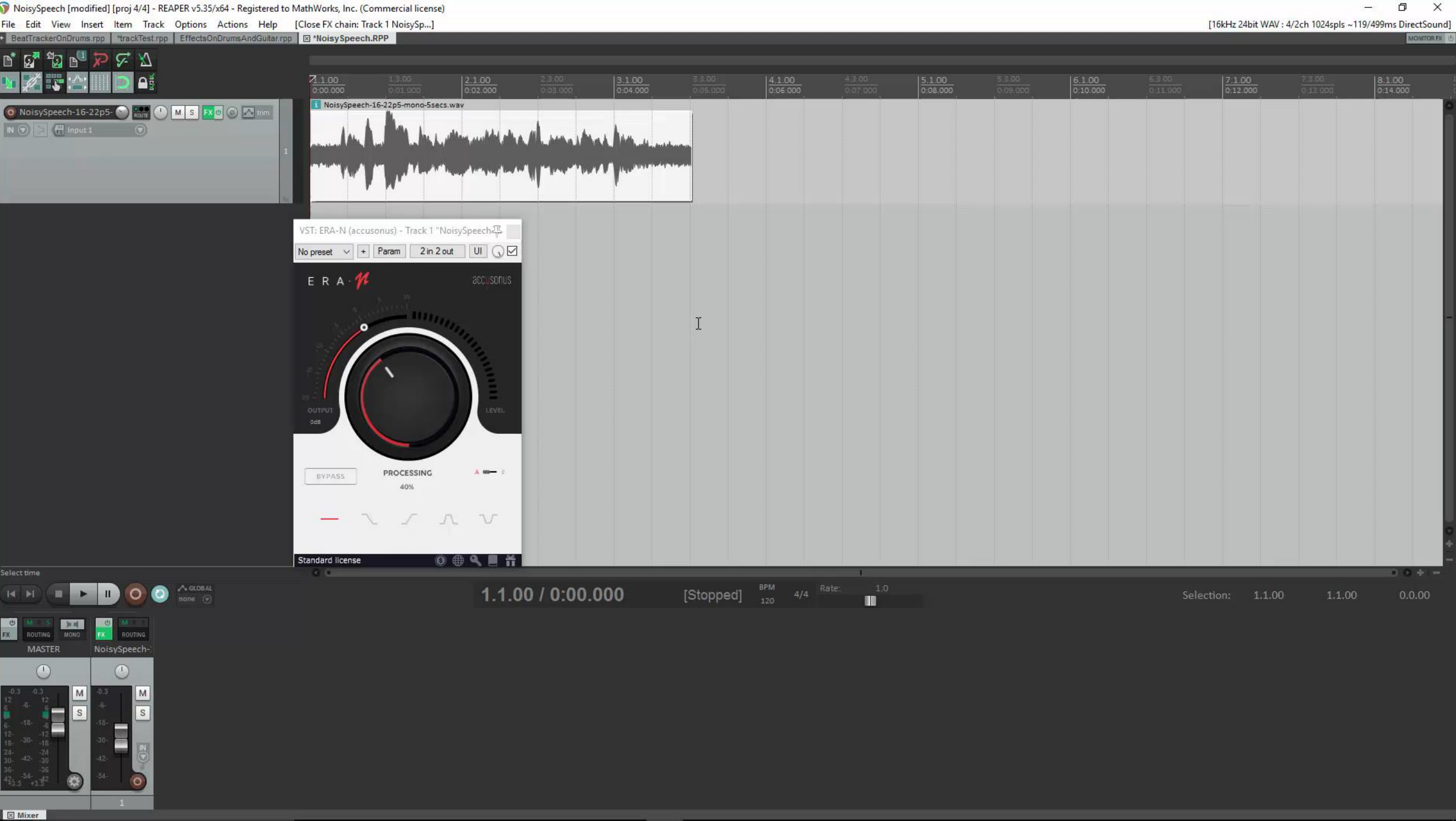
```
1   classdef LevelAndBeamform < audioPlugin
2   %   Copyright 2017 The MathWorks, Inc.
3
4   %#codegen
5       properties
6           % "Looking" direction
7           Theta = 0
8           % Bandpass filter gain (dB) - 0=all bandpassed / -inf=allpass
9           BandpassGain = 0
10          % Beam type
11          Beamtype = BeamformingType.Cardioid
12          % Output Gain (dB)
13          OutputGain = 0
14      end
15
16      properties (Access = private)
17          th = 0
18
19          beamformingType = 3
20
```

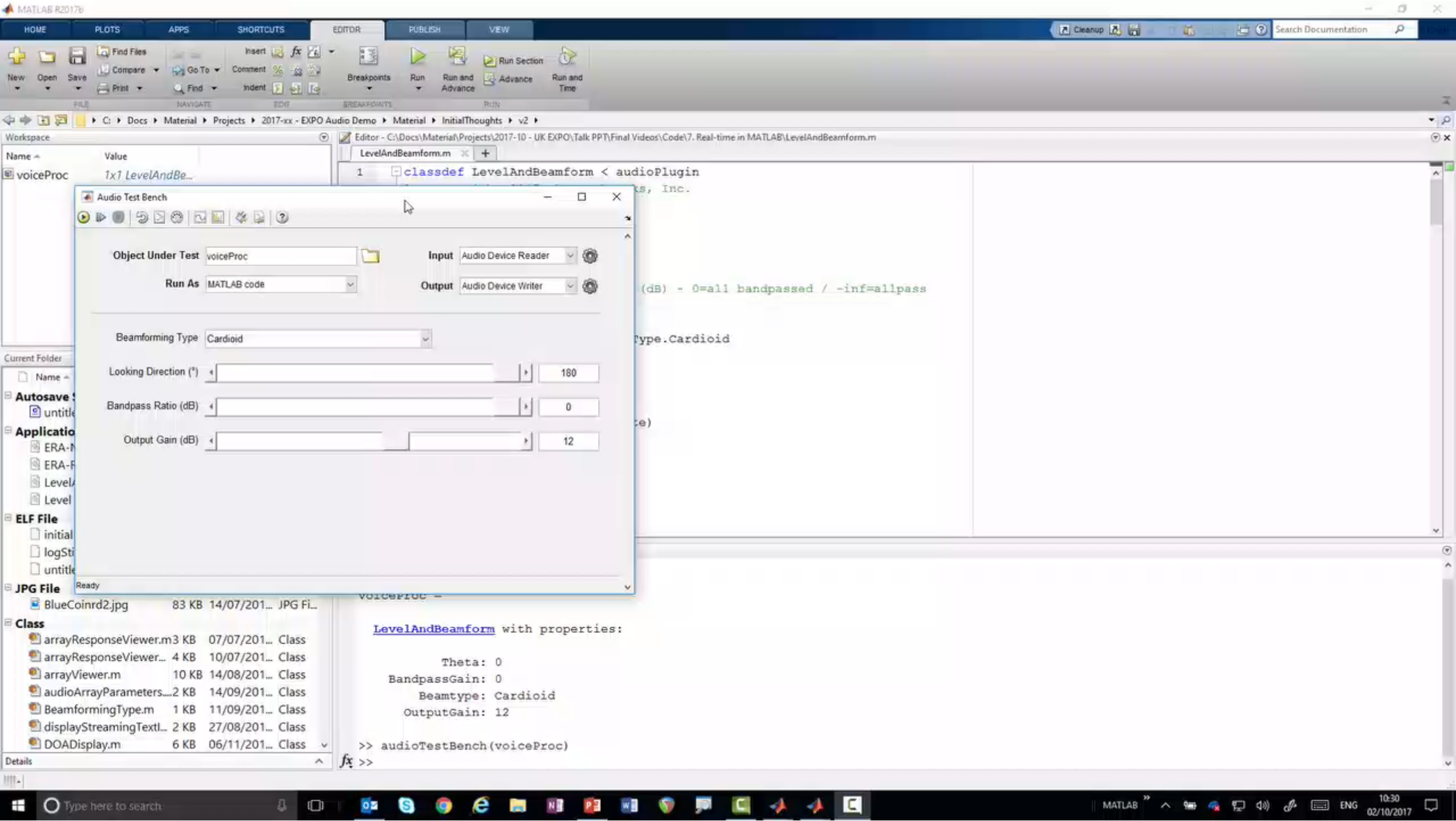
Command Window

fx >>

Type here to search | MATLAB | ENG | 23:37 01/10/2017


trackTest [modified] [proj 2/4] - REAPER v5.35/x64 - Registered to MathWorks, Inc. (Commercial license)
File Edit View Insert Item Track Options Actions Help [Toggle Track Record Arming]
[16kHz 24bit WAV : 4/2ch 1024spls ~119/499ms DirectSound]
BeatTrackerOnDrums.rpp
*trackTest.rpp
EffectsOnDrumsAndGuitar.rpp
*NoisySpeech.RPP
AroundThe ArrayAt9..1
Input 1..Input 4 [4
monitoring, record
AroundThe ArrayAt90_take1 [chan] 4 [sends] 1 [FX] 3
1.1.00 / 0:00.000
[Stopped]
BPM 120
4/4
Rate: 1.0
Selection: 1.1.00 20.1.00 19.0.00
MASTER
AroundThe ..1
Mixer


NoisySpeech [modified] [proj 4/4] - REAPER v5.35/x64 - Registered to MathWorks, Inc. (Commercial license)
File Edit View Insert Item Track Options Actions Help
[Close FX chain: Track 1 NoisySp...]
[16kHz 24bit WAV : 4/2ch 1024spls ~119/499ms DirectSound]
BeatTrackerOnDrums.rpp
*trackTest.rpp
EffectsOnDrumsAndGuitar.rpp
*NoisySpeech.RPP
NoisySpeech-16-22p5-mono-5secs.wav
VST: ERA-N (accusonus) - Track 1 "NoisySpeech"
No preset
Param
2 in 2 out
UI
ERA-N
accusonus
OUTPUT
0dB
LEVEL
BYPASS
PROCESSING
40%
Standard license
Select time
1.1.00 / 0:00.000
[Stopped]
BPM 120
4/4
Rate: 1.0
Selection: 1.1.00 1.1.00 0.0.00
MASTER
NoisySpeech-
Mixer


MATLAB R2017b
HOME
PLOTS
APPS
SHORTCUTS
EDITOR
PUBLISH
VIEW
Search Documentation
New
Open
Save
Find Files
Compare
Print
Go To
Find
Insert
Comment
Indent
Breakpoints
Run
Run and Advance
Run Section
Advance
Run and Time
C: ▸ Docs ▸ Material ▸ Projects ▸ 2017-xx - EXPO Audio Demo ▸ Material ▸ InitialThoughts ▸ v2 ▸
Workspace
Name
Value
voiceProc
1x1 LevelAndBe...
Editor - C:\Docs\Material\Projects\2017-10 - UK EXPO\Talk PPT\Final Videos\Code\7. Real-time in MATLAB\LevelAndBeamform.m
LevelAndBeamform.m
1 classdef LevelAndBeamform < audioPlugin
Audio Test Bench
Object Under Test
voiceProc
Input
Audio Device Reader
Run As
MATLAB code
Output
Audio Device Writer
Beamforming Type
Cardioid
Looking Direction (°)
180
Bandpass Ratio (dB)
0
Output Gain (dB)
12
Ready
Current Folder
Name
Autosave
Application
ELF File
JPG File
BlueCoinrd2.jpg 83 KB 14/07/201... JPG Fi...
Class
arrayResponseViewer.m 3 KB 07/07/201... Class
arrayResponseViewer... 4 KB 10/07/201... Class
arrayViewer.m 10 KB 14/08/201... Class
audioArrayParameters... 2 KB 14/09/201... Class
BeamformingType.m 1 KB 11/09/201... Class
displayStreamingTextI... 2 KB 27/08/201... Class
DOADisplay.m 6 KB 06/11/201... Class
Details
LevelAndBeamform with properties:
Theta: 0
BandpassGain: 0
Beamtype: Cardioid
OutputGain: 12
>> audioTestBench(voiceProc)
>>
Type here to search
MATLAB
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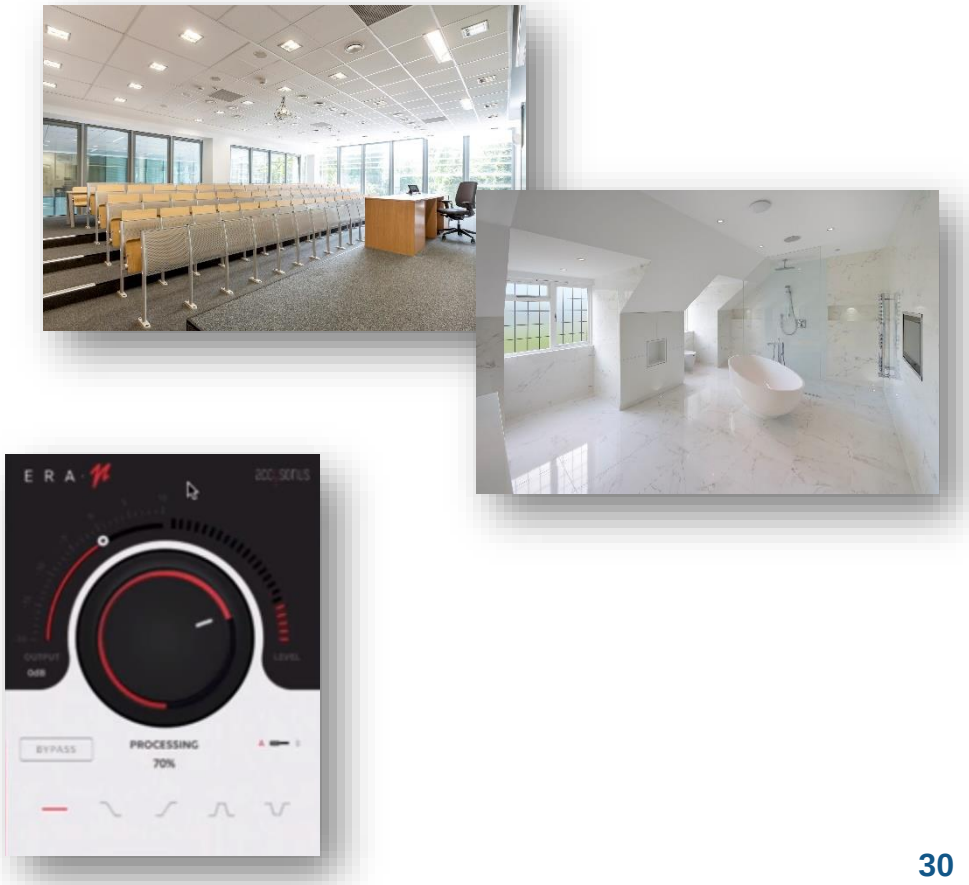
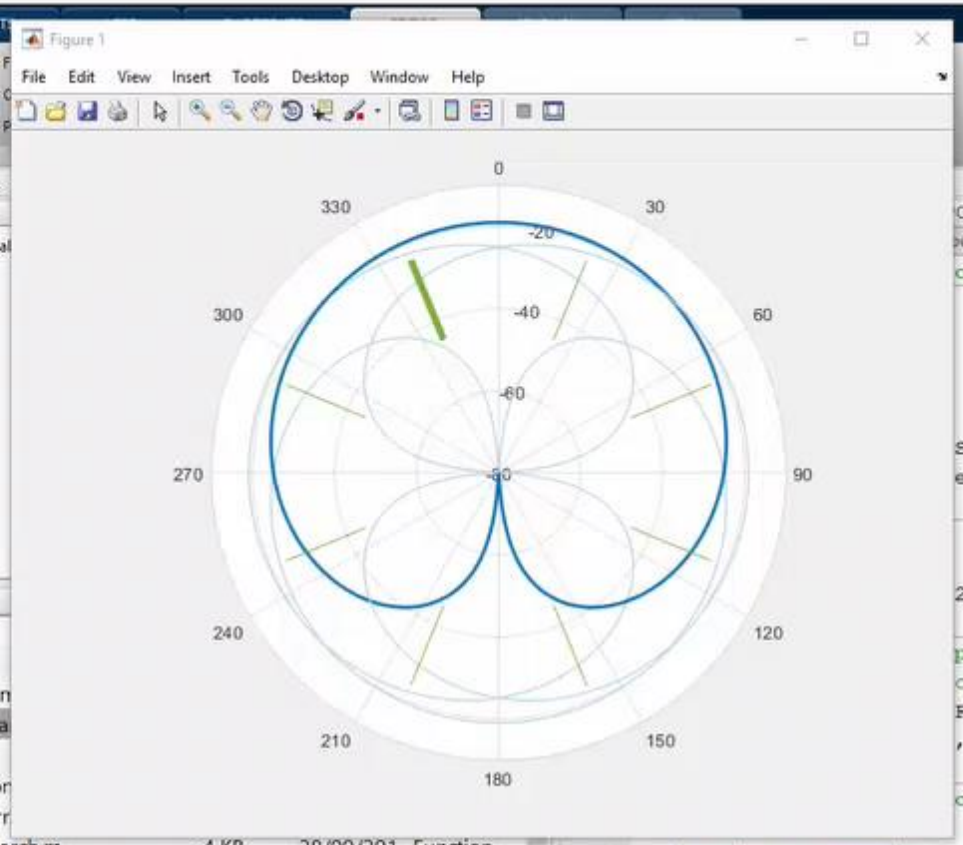
10:30
02/10/2017

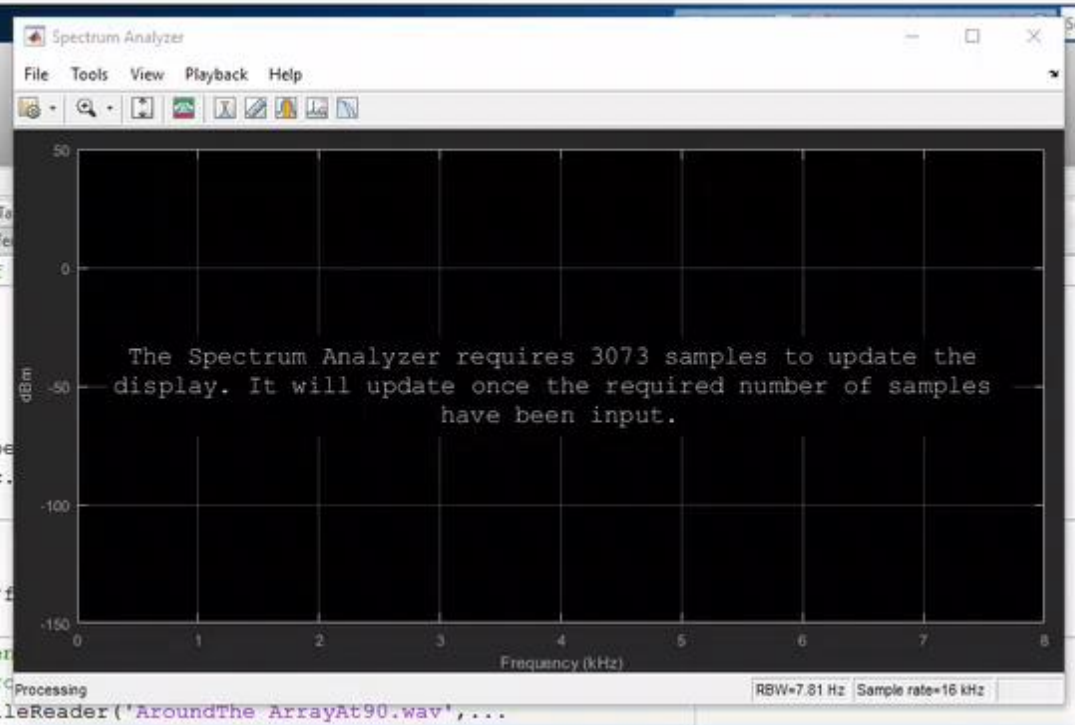
How can I…

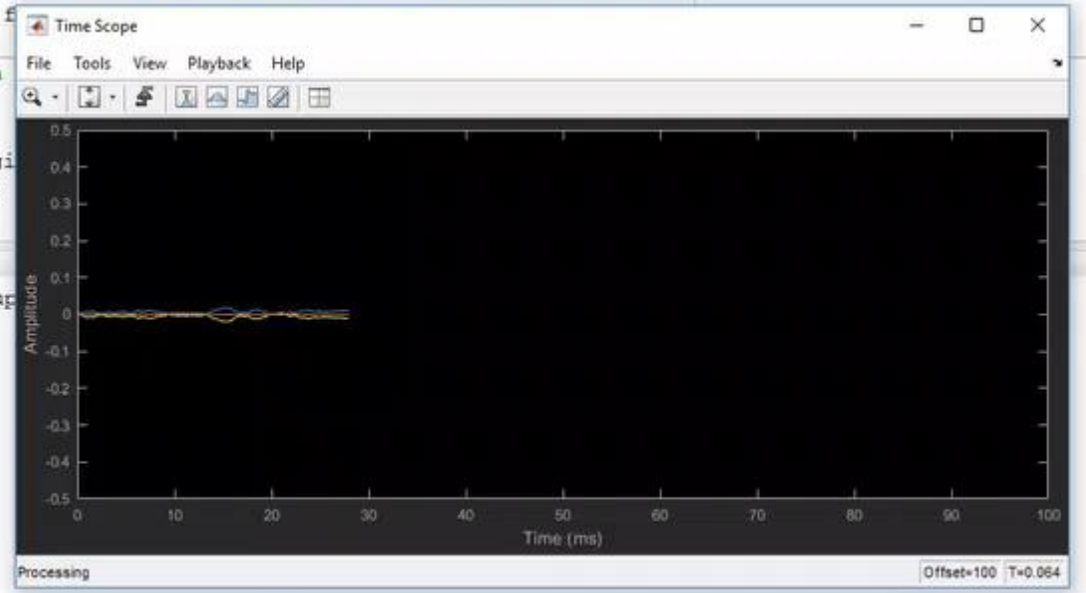
2. Validate my voice interface can work in real-life scenarios?

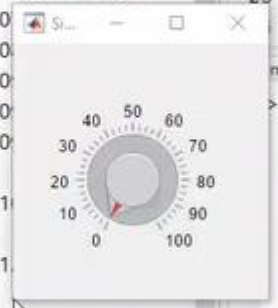
3. Understand what else can help me improve my performance?











MATLAB R2017b

HOME PLOTS

New Open Save

Workspace

Name Val

Current Folder

Name

Class
arrayViewer.m
audioArrayPa

Function
adjustPosition
beamformArr
bufferAndSearch.m 4 KB 28/09/201... Function
bwlabels1.m 1 KB 12/08/201... Function
bwregionspans.m 1 KB 06/12/201... Function
levelChannels.m 1 KB 07/0
selectArrayConfiguration.m 1 KB 14/0
tuneBypassDSP.m 1 KB 28/0
tuneNoiseRemovalAmount.m 2 KB 28/0
tuneParameter.m 1 KB 29/0

Script
PrototypeSystemWithNoiseSupp... 4 KB 02/1

MAT-file
MicGainRatios.mat 1 KB 05/1

WAV File
AroundThe ArrayAt90_take1.wav 7.87 MB 28/09/201... WAV File
AroundThe ArrayAt90.wav 5.86 MB 02/10/201... WAV File

audioArrayParameters.m (Class)

```
21    % Noise suppression
22 -  deNoise = loadAudioPlugi
23 -  deNoise.Processing = 0;
      deNoise.Gain = 10;
```

mand Window

```
>> PrototypeSystemWithNoiseSup
```

FileReader('AroundThe ArrayAt90.wav',...

Search Documentation

Busy

script Ln 81 Col 30

Type here to search

MATLAB ENG 12:40 02/10/2017

Plugin hosting

```
>> noiseRemover = loadAudioPlugin('ERA-N.vst')

noiseRemover =

  VST plugin 'ERA-N'  2 in, 2

    Processing: 40 %
          Gain: 0 dB
          Tilt: 'NoTilt'
        Bypass: 0
```

https://accusonus.com/products/era-n

```
>> noiseRemover.Processing = 60;
>> noiseRemover.Gain = 3;
>> y = process(noiseRemover, x)
```

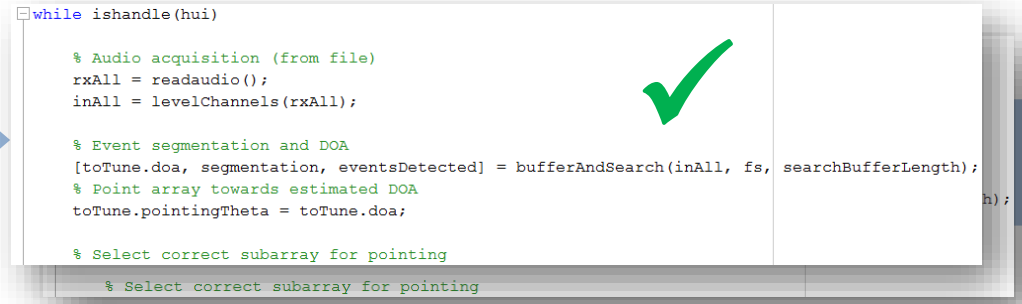
How To Measure Performance?

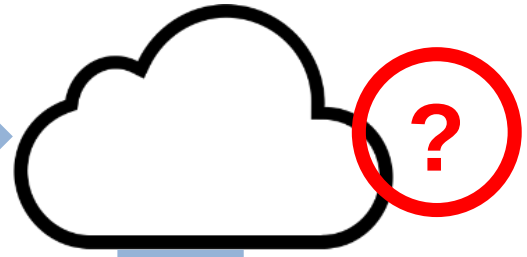
```
while ishandle(hui)

    % Audio acquisition (from file)
    rxAll = readaudio();
    inAll = levelChannels(rxAll);

    % Event segmentation and DOA
    [toTune.doa, segmentation, eventsDetected] = bufferAndSearch(inAll, fs, searchBufferLength);
    % Point array towards estimated DOA
    toTune.pointingTheta = toTune.doa;

    % Select correct subarray for pointing
```

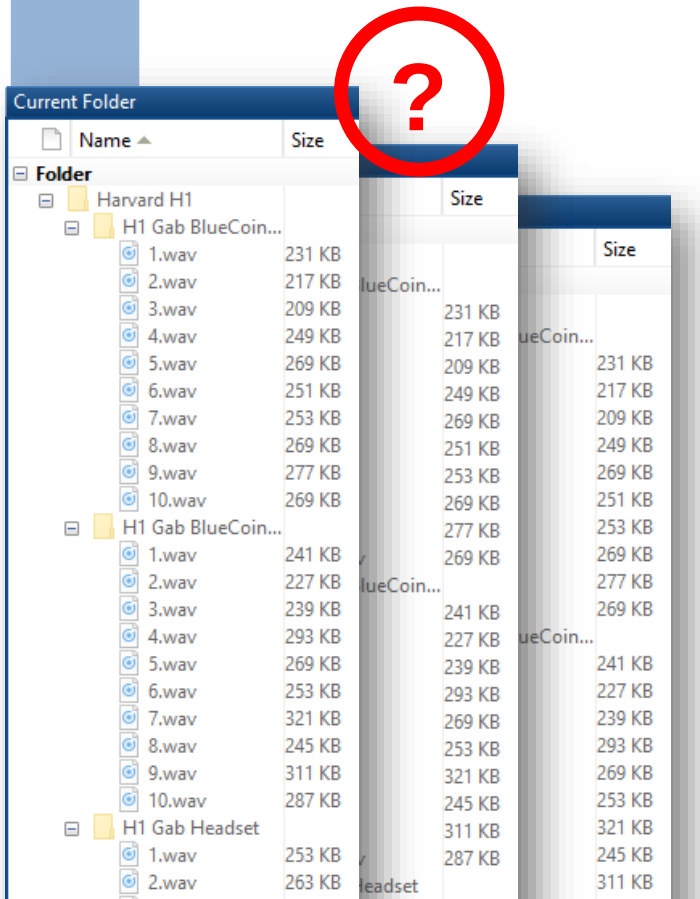
Output audio "sounds good"

True	Guessed
e slid on the smooth planks"	"the birth canal we sl
in stockings is hard to sell"	"a large size in stock
to the dark blue background"	"blue the sheet to the
ll the depth of a well"	"it's easy to tell the
hicken leg is a rare dish"	"these days a chicken
served in round bowls"	"rice is often served

"91.5% of spoken sentences correctly converted"





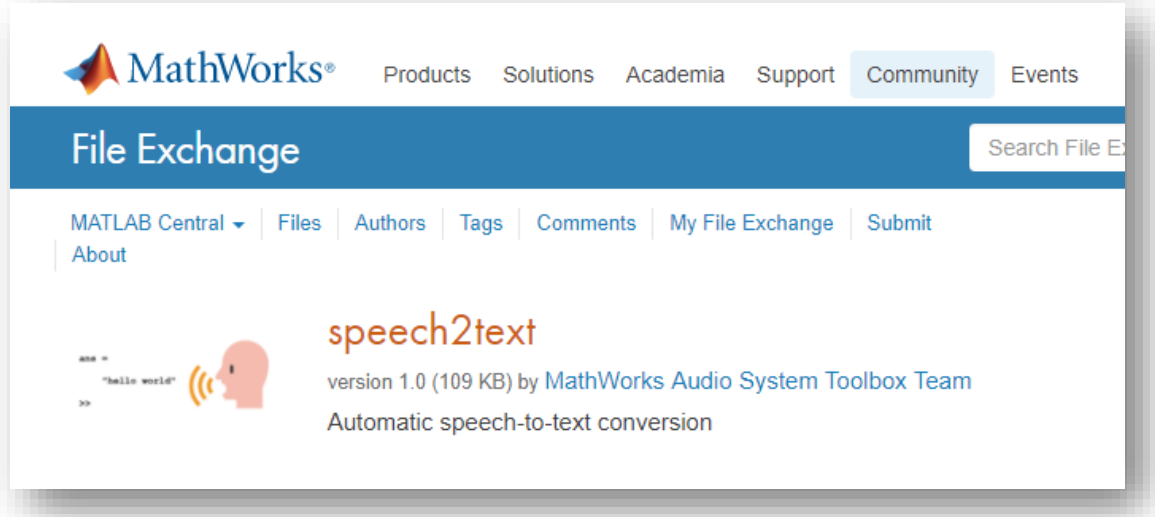


True	GuessedBaseline	ConfidenceBaselir
"the birch canoe slid on the smooth planks"	"the birth canal we slid on the smooth planks"	0.74933
" a large size in stockings is hard to sell"	"a large size in stockings is hard to sell"	0.9366
"glue the sheet to the dark blue background"	"blue the sheet to the dark blue background"	0.95009
"its easy to tell the depth of a well"	"it's easy to tell the depth of a well"	0.97403
"these days a chicken leg is a rare dish"	"these days a chicken leg is a redfish"	0.86686
"rice is often served in round bowls"	"rice is often served in rum balls"	0.95946
"the juice of lemons makes fine punch"	"the cheese of lemons makes flying punch"	0.79089
"the box was thrown beside the parked truck"	"the box was thrown beside the box truck"	0.82796
"the hogs were fed chopped corn and garbage"	"the Hawks were fed chops corn and garbage"	0.81863
"four hours of steady work faced us"	"4 hours of study world fastest"	0.82947

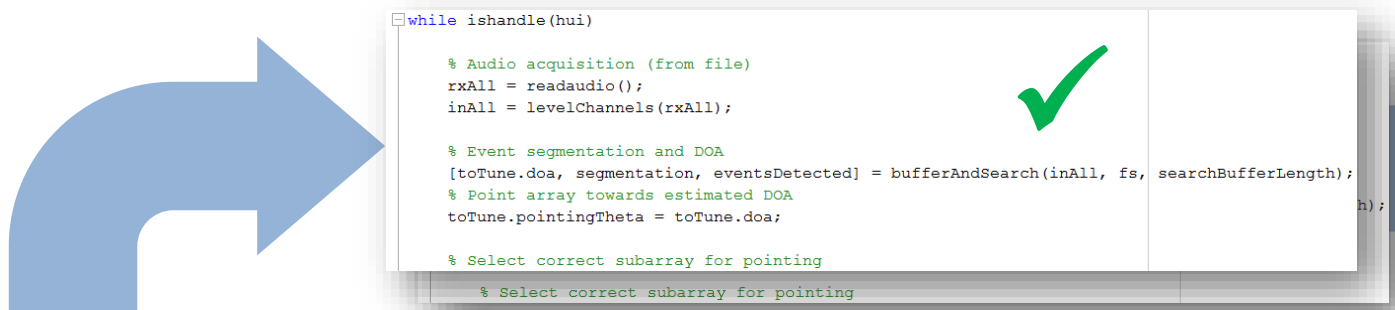

New Tab

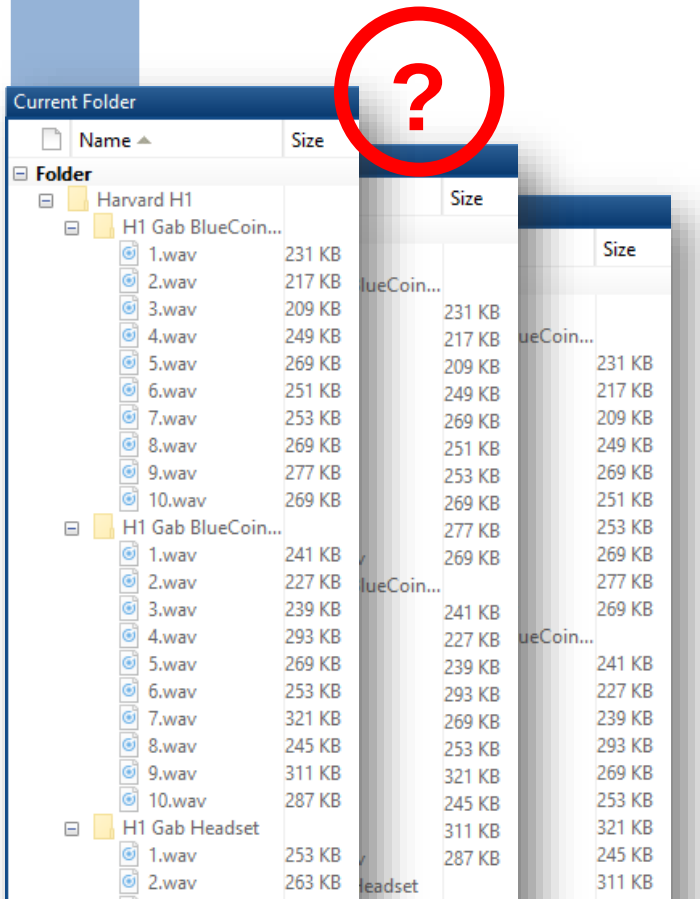
Test performance with speech-to-text services

```
>> [samples, fs] = audioread('helloaudioPD.wav');
>> soundsc(samples, fs)
>> speechObject = speechClient('Google','languageCode','en-US');
>> outInfo = speech2text(speechObject, samples, fs);

>> outInfo.TRANSCRIPT =

ans =
    'hello audio product Developers'

>> outInfo.CONFIDENCE =

ans =
    0.9385
```



https://www.mathworks.com/matlabcentral/fileexchange/65266-speech2text





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"its easy to tell the depth of a well"	"it's easy to tell the depth of a well"	0.97403
"these days a chicken leg is a rare dish"	"these days a chicken leg is a redfish"	0.86686
"rice is often served in round bowls"	"rice is often served in rum balls"	0.95946
"the juice of lemons makes fine punch"	"the cheese of lemons makes flying punch"	0.79089
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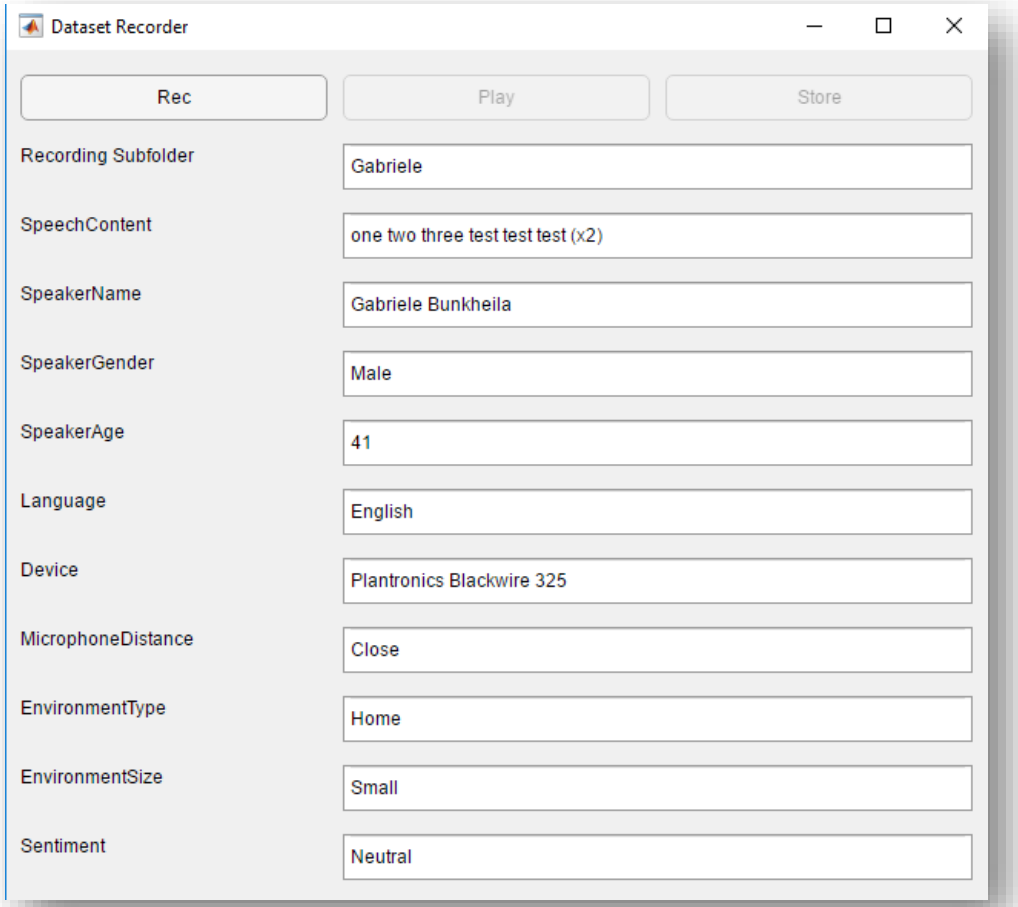
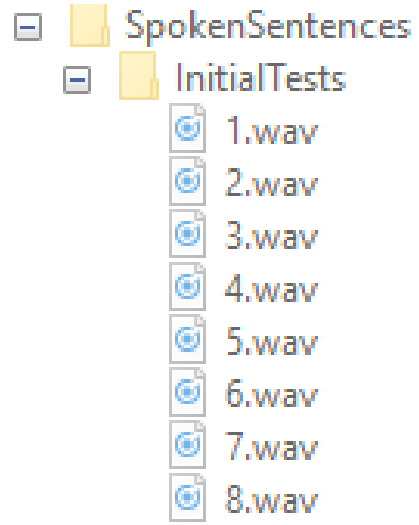
"the hogs were fed chopped corn and garbage"	"the Hawks were fed chops corn and garbage"	0.81863
"four hours of steady work faced us"	"4 hours of study world fastest"	0.82947

Building a small speech dataset quickly





Sentiment	Filename	SampleRate	NumChannels	NumSamples	DateRecorded
"Neutral"	"Neutral\1.wav"	16000	2	73728	11-Sep-2017 11:59:57
"Neutral"	"Neutral\2.wav"	16000	2	62976	11-Sep-2017 12:00:22
"Neutral"	"Neutral\3.wav"	16000	2	1.1674e+05	11-Sep-2017 12:01:00
"Neutral"	"Neutral\4.wav"	16000	2	1.0701e+05	11-Sep-2017 12:01:22
"Neutral"	"Neutral\5.wav"	16000	2	60416	11-Sep-2017 12:01:41
"Neutral"	"Neutral\6.wav"	16000	2	1.9251e+05	11-Sep-2017 12:02:30
"Neutral"	"Neutral\7.wav"	16000	2	1.3107e+05	11-Sep-2017 12:03:04
"Neutral"	"Neutral\8.wav"	16000	2	64512	11-Sep-2017 12:03:23

Building a small speech dataset quickly

How to accelerate speech content labelling?

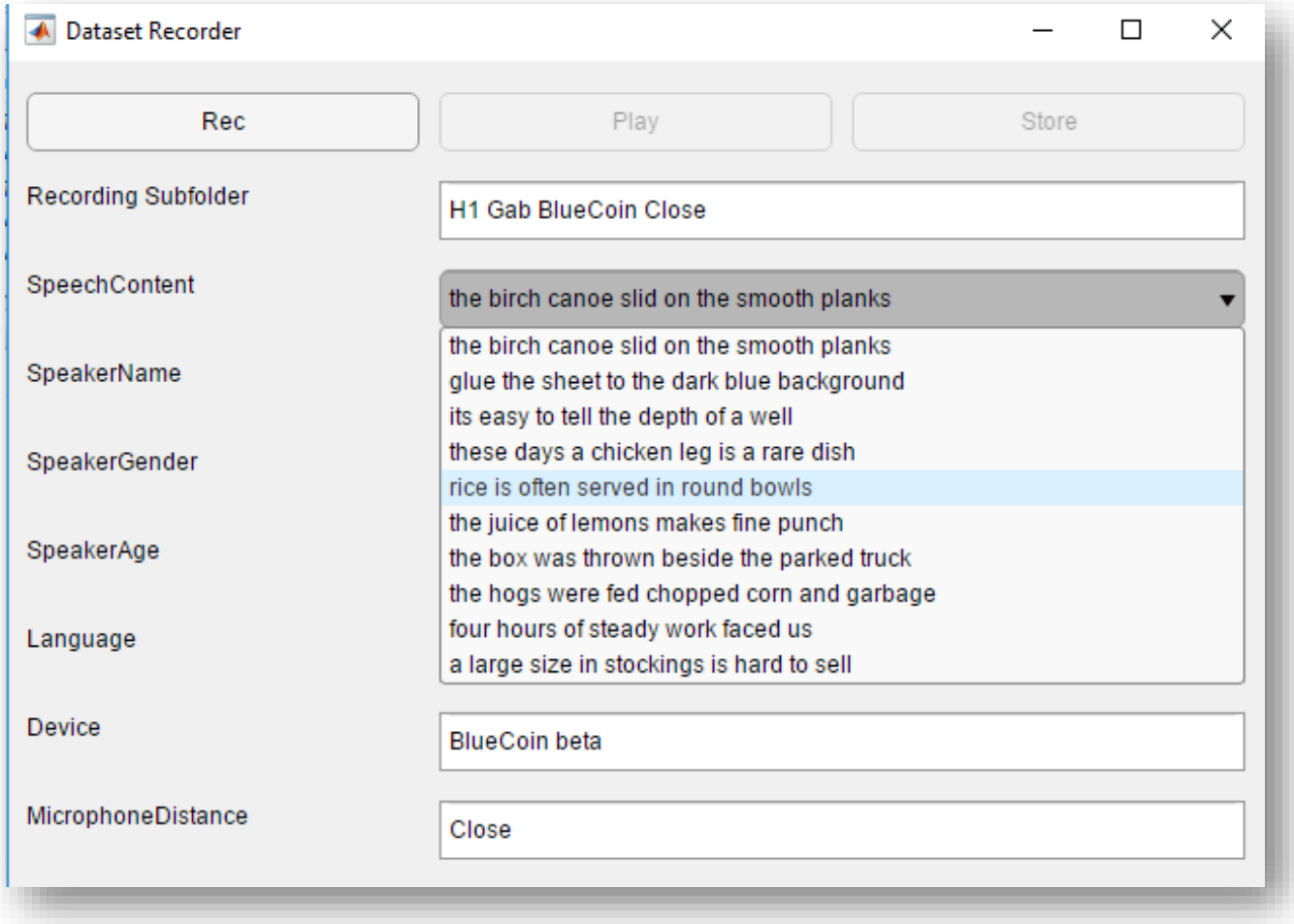
```
H1 Harvard Sentences
 1. The birch canoe slid on the smooth planks.
 2. Glue the sheet to the dark blue background.
 3. It's easy to tell the depth of a well.
 4. These days a chicken leg is a rare dish.
 5. Rice is often served in round bowls.
 6. The juice of lemons makes fine punch.
 7. The box was thrown beside the parked truck.
 8. The hogs were fed chopped corn and garbage.
 9. Four hours of steady work faced us.
10. A large size in stockings is hard to sell.
H2 Harvard Sentences
 1. The boy was there when the sun rose.
 2. A rod is used to catch pink salmon.
 3. The source of the huge river is the clear spring.
 4. Kick the ball straight and follow through.
 5. Help the woman get back to her feet.
 6. A pot of tea helps to pass the evening.
 7. Smoky fires lack flame and heat.
 8. The soft cushion broke the man's fall.
 9. The salt breeze came across from the sea.
10. The girl at the booth sold fifty bonds.
H3 Harvard Sentences
 1. The small pup gnawed a hole in the sock.
 2. The fish twisted and turned on the bent hook.
 3. Press the pants and sew a button on the vest.
 4. The swan dive was far short of perfect.
 5. The beauty of the view stunned the young boy.
 6. Two blue fish swam in the tank.
 7. Her purse was full of useless trash.
 8. The colt reared and threw the tall rider.
 9. It snowed, rained, and hailed the same morning.
10. Read verse out loud for pleasure.
H4 Harvard Sentences
 1. Hoist the load to your left shoulder.
 2. Take the winding path to reach the lake.
 3. Note closely the size of the gas tank.
 4. Wipe the grease off his dirty face.
 5. Mend the coat before you go out.
```

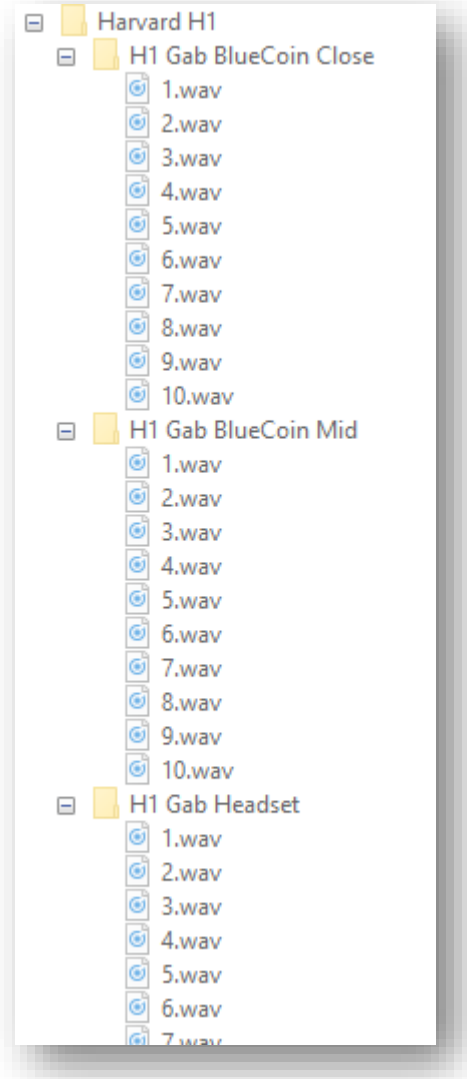
```
>> harvard{1}

ans =

  10×1 string array

    "the birch canoe slid on the smooth planks"
    "glue the sheet to the dark blue background"
    "its easy to tell the depth of a well"
    "these days a chicken leg is a rare dish"
    "rice is often served in round bowls"
    "the juice of lemons makes fine punch"
    "the box was thrown beside the parked truck"
    "the hogs were fed chopped corn and garbage"
    "four hours of steady work faced us"
    " a large size in stockings is hard to sell"
```

http://www.cs.cmu.edu/afs/cs.cmu.edu/project/fgdata/OldFiles/Recorder.app/utterances/Type1/harvsents.txt

Building a small speech dataset quickly

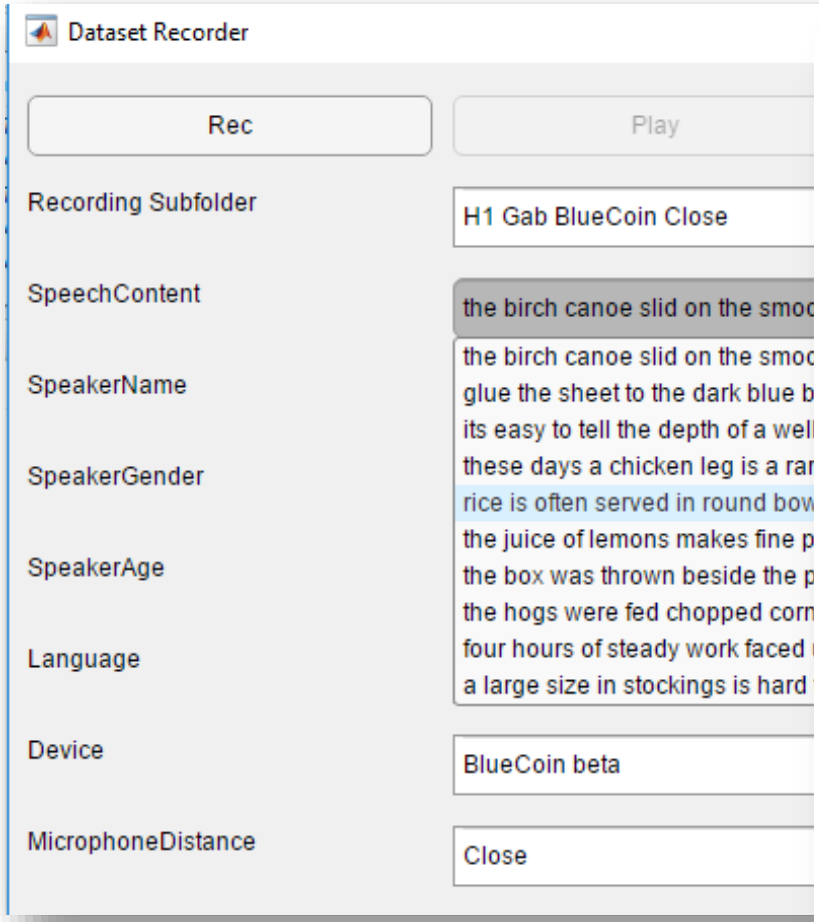
Example: an App with automated content labelling

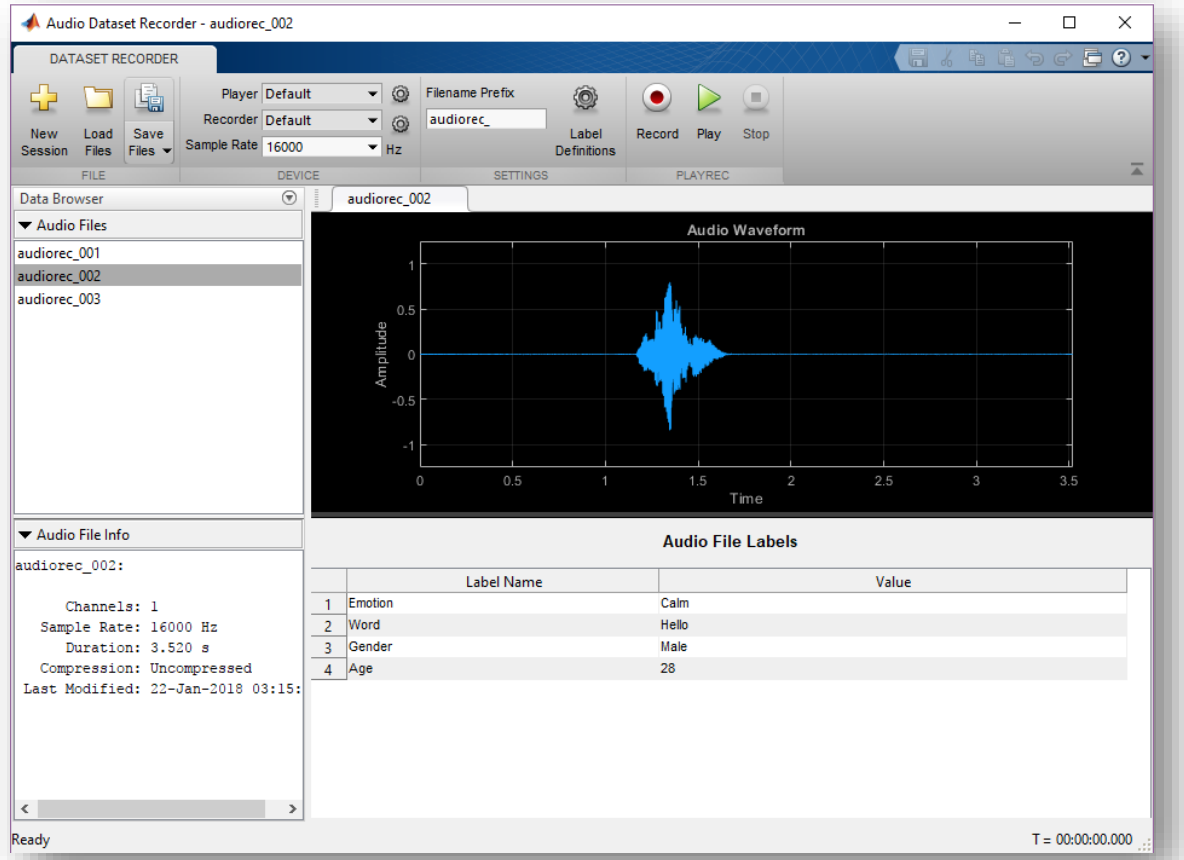




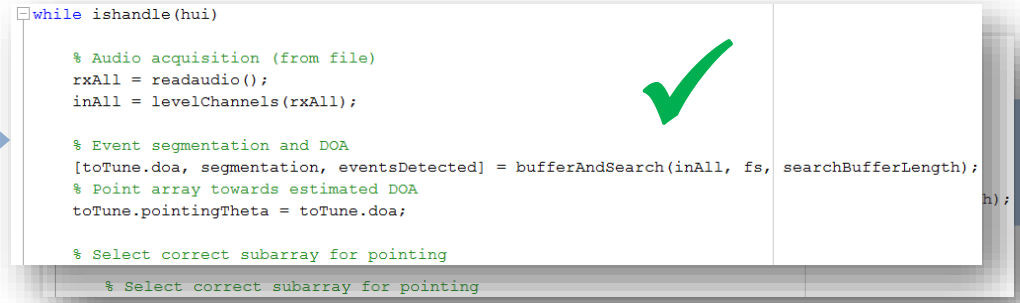
Building a small speech dataset quickly

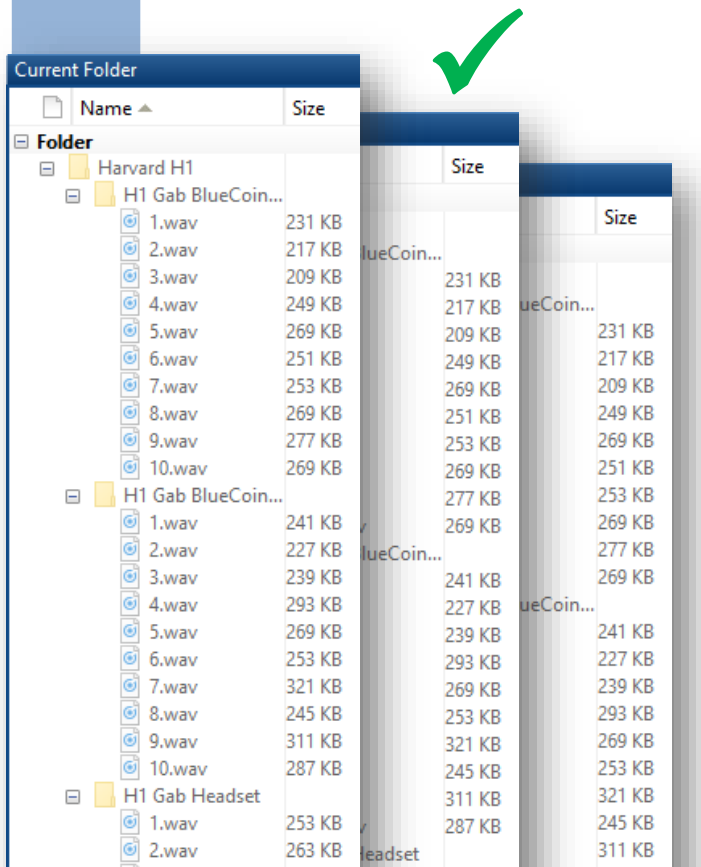
Example: an App with automated content labelling*





See also Dataset Recorder App prototype in example "Record Audio Datasets" (From R2018a in Audio System Toolbox)





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"its easy to tell the depth of a well"	"it's easy to tell the depth of a well"	0.97403
"these days a chicken leg is a rare dish"	"these days a chicken leg is a redfish"	0.86686
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"the box was thrown beside the parked truck"	"the box was thrown beside the box truck"	0.82796
"the hogs were fed chopped corn and garbage"	"the Hawks were fed chops corn and garbage"	0.81863
"four hours of steady work faced us"	"4 hours of study world fastest"	0.82947

MATLAB R2017b

HOME | PLOTS | APPS | SHORTCUTS | EDITOR | PUBLISH | VIEW

New | Open | Save | Find Files | Compare | Print | Go To | Find | Insert | Comment | Indent | Breakpoints | Run | Run and Advance | Run Section | Advance | Run and Time

C: ▸ Users ▸ gbunkhei ▸ Desktop ▸ AES Material ▸ Booth Demos ▸ Background ▸ Voice Interface with BlueCoin ▸ 10. Test With Google Speech ▸ Ref ▸

Workspace | Command History | Current Folder

Name	Size	Type	Date M...
Harvard H1		Folder	13/1...
H1 Gab BlueC...		Folder	13/1...
1.wav	231 KB	WAV File	13/0...
2.wav	217 KB	WAV File	13/0...
3.wav	209 KB	WAV File	13/0...
4.wav	249 KB	WAV File	13/0...
5.wav	269 KB	WAV File	13/0...
6.wav	251 KB	WAV File	13/0...
7.wav	253 KB	WAV File	13/0...
8.wav	269 KB	WAV File	13/0...
9.wav	277 KB	WAV File	13/0...
10.wav	269 KB	WAV File	13/0...
H1 Gab BlueC...		Folder	13/1...
1.wav	241 KB	WAV File	13/0...
2.wav	227 KB	WAV File	13/0...
3.wav	239 KB	WAV File	13/0...
4.wav	293 KB	WAV File	13/0...
5.wav	269 KB	WAV File	13/0...
6.wav	253 KB	WAV File	13/0...
7.wav	321 KB	WAV File	13/0...
8.wav	245 KB	WAV File	13/0...
9.wav	311 KB	WAV File	13/0...
10.wav	287 KB	WAV File	13/0...
H1 Gab Head...		Folder	13/1...
1.wav	253 KB	WAV File	13/0...
2.wav	263 KB	WAV File	13/0...
3.wav	271 KB	WAV File	13/0...

Details

Editor - assessSpeechRecognitionPerformance.m

assessSpeechRecognitionPerformance.m

```
15    %% Cycle through recordings
16    % Init arrays to store results
17 -  numFiles = length(ds.Files);
18 -  k = 0;
19
20 -  conf = zeros(1,numFiles);
21 -  trueStrings = repmat("",1,numFiles);
22 -  guessedStrings = repmat("",1,numFiles);
23
24 -  while hasdata(ds)
25        % Read audio file content
26 -      entry = read(ds);
27 -      x = entry.samples;
28
29 -      fprintf('Sending "%s"...\n',entry.labels.SpeechContent)
30
31        % Send ORIGINAL audio to cloud service and get transcription
32 -      [outString, outInfo] = speech2text(x(:,1) , entry.fs);
33
34        % Store reults
35 -      k = k + 1;
36 -      conf(k) = outInfo.confidence;
37 -      trueStrings(k) = entry.labels.SpeechContent;
38 -      guessedStrings(k) = outString;
39
40 -  end
41
42 -  tResults = table(trueStrings', guessedStrings', num2str(conf'),...
43        'VariableNames', {'True', 'Guessed', 'Confidence',...
```

Command Window

script | Ln 13 | Col 23

MATLAB R2017b

HOME PLOTS APPS SHORTCUTS

New Script | New Live Script | New | Open | Find Files | Compare | Import Data | Save Workspace | New Variable | Open Variable | Clear Workspace | Analyze Code | Run and Time | Clear Commands | Simulink | Layout | Preferences | Set Path | Parallel | Add-Ons | Help | Community | Request Support | Learn MATLAB

C: ▸ Users ▸ gbunkhei ▸ Desktop ▸ AES Material ▸ Booth Demos ▸ Background ▸ Voice Interface with BlueCoin ▸ 10. Test With Google Speech ▸ Rec ▸

Current Folder

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1.wav	231 KB	WAV File	13/0...
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H1 Gab Head...		Folder	13/1...
1.wav	253 KB	WAV File	13/0...
2.wav	263 KB	WAV File	13/0...
3.wav	271 KB	WAV File	13/0...

Details

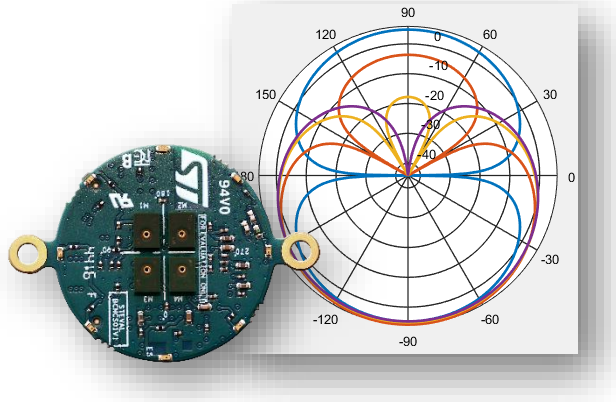
Command Window

"its easy to tell the depth of a well"	"it's easy to tell the depth of a well"
"these days a chicken leg is a rare dish"	"please days a chicken leg is a red dish"
"rice is often served in round bowls"	"rice is often served in round balls"
"the juice of lemons makes fine punch"	"the juice of lemons makes wine punch"
"the box was thrown beside the parked truck"	"the box was thrown beside the parked truck"
"the hogs were fed chopped corn and garbage"	"the Hogs were fat chops corn and garbage"
"four hours of steady work faced us"	"4 hours of steady work faces"
"the birch canoe slid on the smooth planks"	"the first canoe slid on the smooth planks"
" a large size in stockings is hard to sell"	"a large size in stockings is hard to sell"
"glue the sheet to the dark blue background"	"do the sheets to the dark blue background"
"its easy to tell the depth of a well"	"excuse me to tell the depth of a well"
"these days a chicken leg is a rare dish"	"these things of chicken leg is a redfish"
"rice is often served in round bowls"	"price is often served in ramen bowls"
"the juice of lemons makes fine punch"	"but use of lemons makes fine punch"
"the box was thrown beside the parked truck"	"the box was thrown beside the parts truck"
"the hogs were fed chopped corn and garbage"	"Bogs Boots at Shopko in garbage"
"four hours of steady work faced us"	"4 hours of study worth-based office"
"the birch canoe slid on the smooth planks"	"the birth canal we slid on the smooth planks"
" a large size in stockings is hard to sell"	"a large size in stockings is hard to sell"
"glue the sheet to the dark blue background"	"glue the sheet to the dark blue background"
"its easy to tell the depth of a well"	"it's easy to tell the depth of a well"
"these days a chicken leg is a rare dish"	"these days a chicken leg is a red dish"
"rice is often served in round bowls"	"Ross is often served in round balls"
"the juice of lemons makes fine punch"	"the Jews of lemons make spine punch"
"the box was thrown beside the parked truck"	"the box was thrown the side in the park truck"
"the hogs were fed chopped corn and garbage"	"the Hawks were fed shop score and garbage"
"four hours of steady work faced us"	"4 hours of steady work phase dust"

fx >>

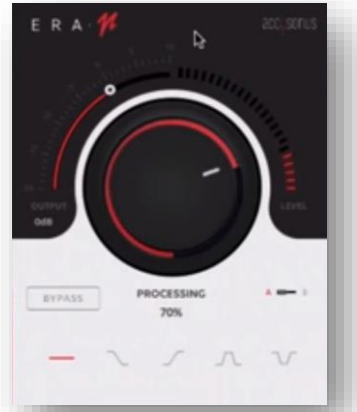
How Can I…

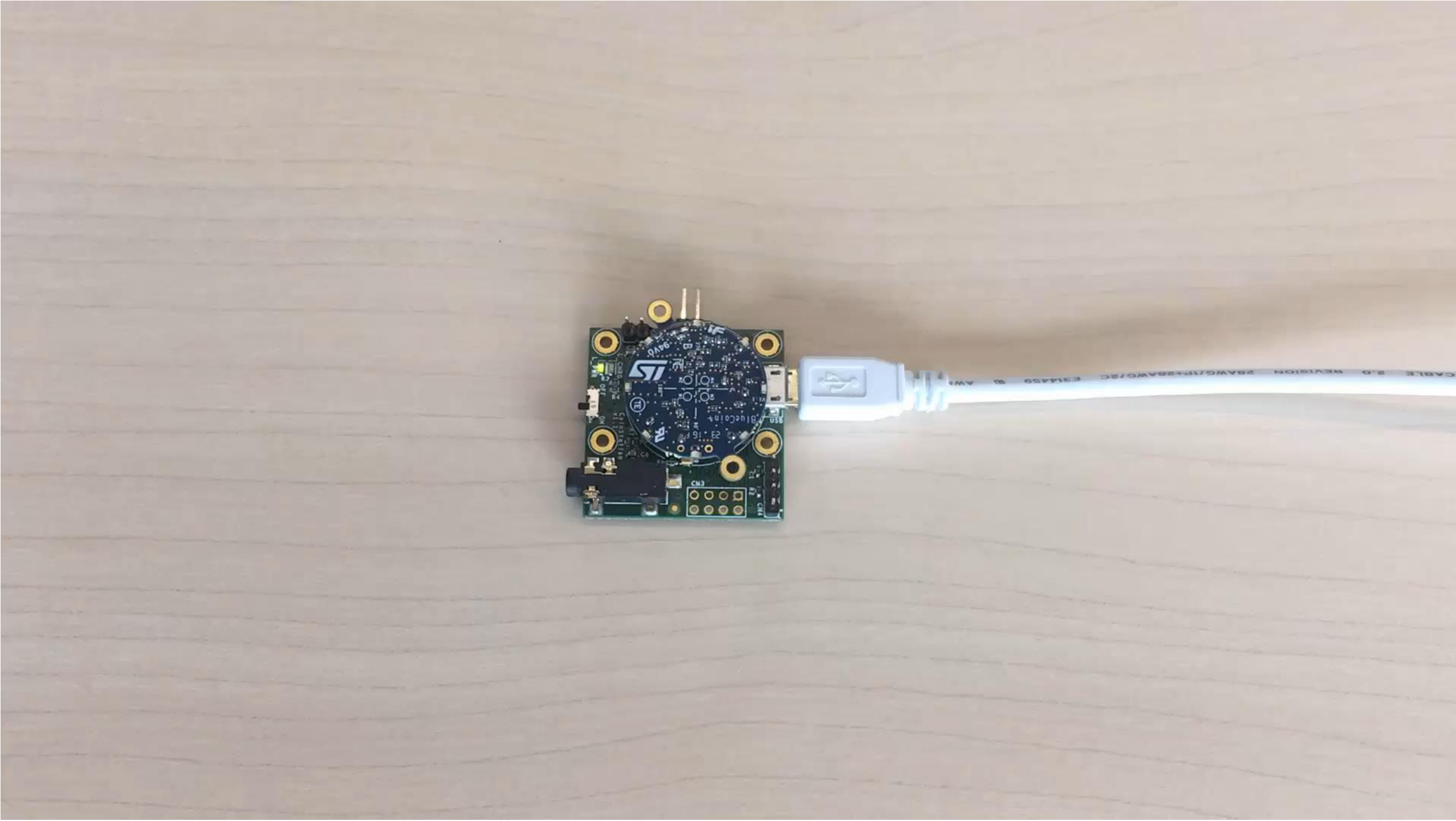
1. Design a microphone array system?



2. Validate my voice interface can work in real-life scenarios?

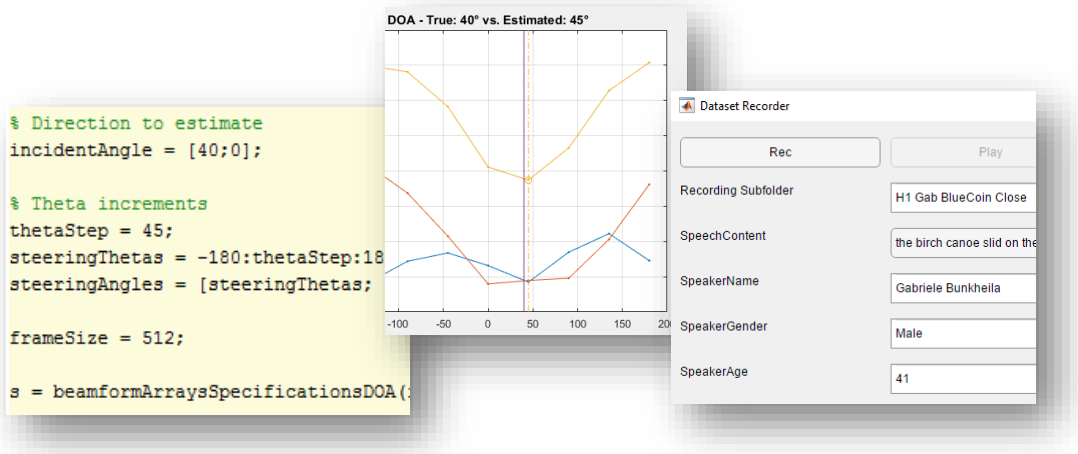
3. Understand what else can help me improve my performance?

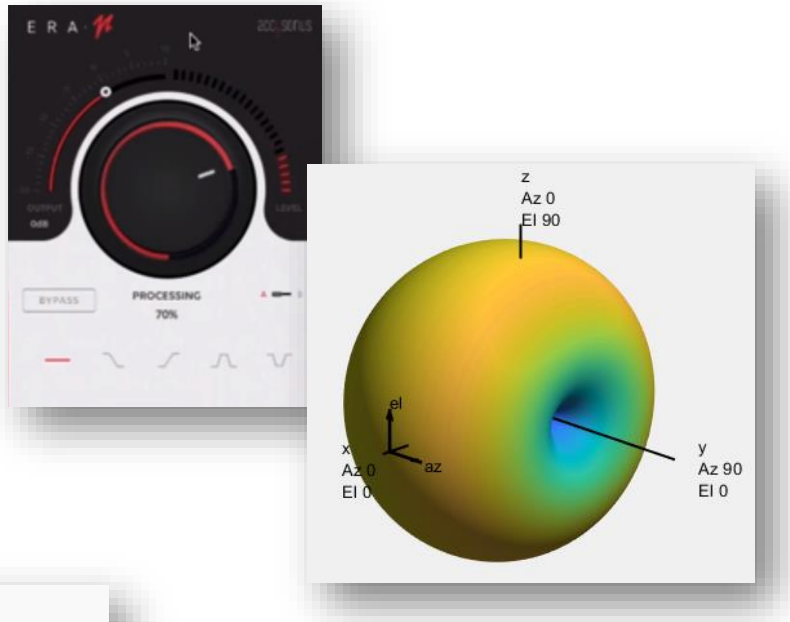


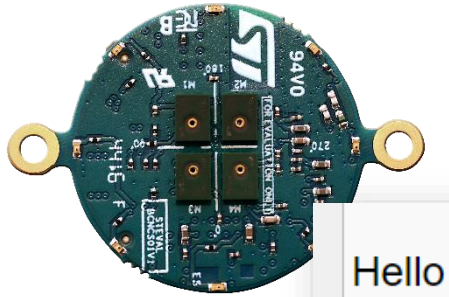

CN3

Summary

- Innovate
- Reuse
- Prototype







Hello
Anyone out there