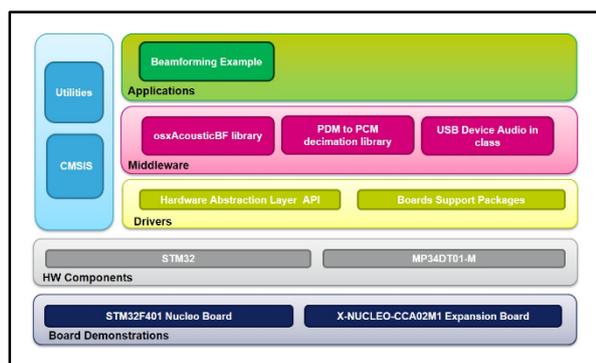


## Real-time beamforming software expansion for STM32Cube

Data brief



### Description

osxAcousticBF software provides an implementation for a real-time adaptive beamforming algorithm: using the audio signals acquired from two digital MEMS microphones, it creates a virtual directional microphone pointing to a fixed direction in space.

Several configuration of the algorithm are available, allowing the user to find the best tradeoff between audio output quality and resource consumption. Parameters and modalities can be modified at runtime, to grant adaptation to the varying ambient conditions.

The osxAcousticBF library is provided in binary format, integrated in a software package providing implementation examples running on the X-NUCLEO-CCA02M1, when connected to a NUCLEO-F401RE.

The sample package is designed as an add-on for X-CUBE-MEMSMIC1 package; the library can be easily ported to any STM32F4 microcontroller with an FPU unit. The software is based on STM32Cube technology. Information regarding STM32Cube is available on [www.st.com](http://www.st.com) at <http://www.st.com/stm32cube>.

### Features

- Real-time beamforming algorithm (under OpenSoftwareX license) based on 2 digital microphones audio signals
- PDM or PCM input
- Different configurations to determine the right tradeoff between audio quality and resources consumption
- Parameters editable at runtime
- Complete middleware to build applications on top of X-CUBE-MEMSMIC1
- Easy portability across different MCU families, thanks to STM32Cube
- Sample implementation available on X-NUCLEO-CCA02M1 board, mounted on the NUCLEO-F401RE

### What is STM32Cube?

STM32Cube™ represents the STMicroelectronics initiative to make developers' lives easier by reducing development effort, time and cost. STM32Cube covers the STM32 portfolio.

STM32Cube version 1.x includes:

- STM32CubeMX, a graphical software configuration tool that allows the generation of C initialization code using graphical wizards.
- A comprehensive embedded software platform specific to each series (such as the STM32CubeF4 for the STM32F4 series), which includes:
  - the STM32Cube HAL embedded abstraction-layer software, ensuring maximized portability across the STM32 portfolio
  - a consistent set of middleware components such as RTOS, USB, TCP/IP and graphics
  - all embedded software utilities with a full set of examples

### How does this software complement STM32Cube and X-CUBE-MEMSMIC1?

This software library package is based on the X-CUBE-MEMSMIC1 software expansion that extends STM32Cube by providing a board support package (BSP) for the microphones expansion board and certain middleware components performing PDM to PCM decimation and USB audio streaming to a host PC. These features simplify microphone data acquisition and assist in the integration of additional packages performing audio analysis and DSP operation.

osxAcousticBF is an add-on software package for X-CUBE-MEMSMIC1, implementing a real-time beamforming algorithm that, from the data acquired by two digital MEMS microphones, creates a virtual directional microphone pointing in a fixed direction in space. Several configurations are available to allow the user to experiment with optimizing the tradeoff between audio output quality and resource consumption. Parameters and operating modes can be modified at runtime, to aid adaptation to the ambient conditions.

The osxAcousticBF package includes a sample application that developers can use to experiment with the code and use a starting point for building customized applications. The examples use the signals from the two microphones soldered on the X-NUCLEO-CCA02M1 board to perform beamforming. The processed data is streamed to a host PC together with one omnidirectional, unprocessed microphone given as a reference.

## Revision history

Table 1: Document revision history

Date	Version	Changes
26-Oct-2015	1	Initial release.

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