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Quick Start Guide

SensorTile.box PRO: the new programmable wireless box kit flexible to your expertise

Agenda

1. Hardware and Software overview
2. Setup & Demo Application
3. Documents & Related Resources
4. STM32Cube Ecosystem: Overview

1- Hardware and Software overview

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Sense, process and connect

Motion sensors

- 6-axis inertial measurement unit **LSM6DSV16X**
- 3-axis low-power accelerometer **LIS2DU12**
- 3-axis magnetometer **LIS2MDL**

Processing & memory

- Ultra-low-power with FPU Arm Cortex-M33 with Trust Zone **STM32U585AI**
- Micro SD card slot

Motion sensors

- Low-voltage local digital temperature sensor **STTS22H**
- Altimeter / pressure sensor **LPS22DF**
- Digital microphone / audio sensor **MP23DB01HP**

Connectivity

- Bluetooth Low Energy 5.2 SoC **STM32WB07**
- NFC tag on board **ST25DV04K**

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Power options and user interface

Power options

- USB-C charging port
- Wireless charging
- 480 mAh long life battery

User interface

- 4 Programmable LEDs
- 2 Programmable buttons + Reset button
- Programmable Audio Buzzer
- Qvar sensor electrodes

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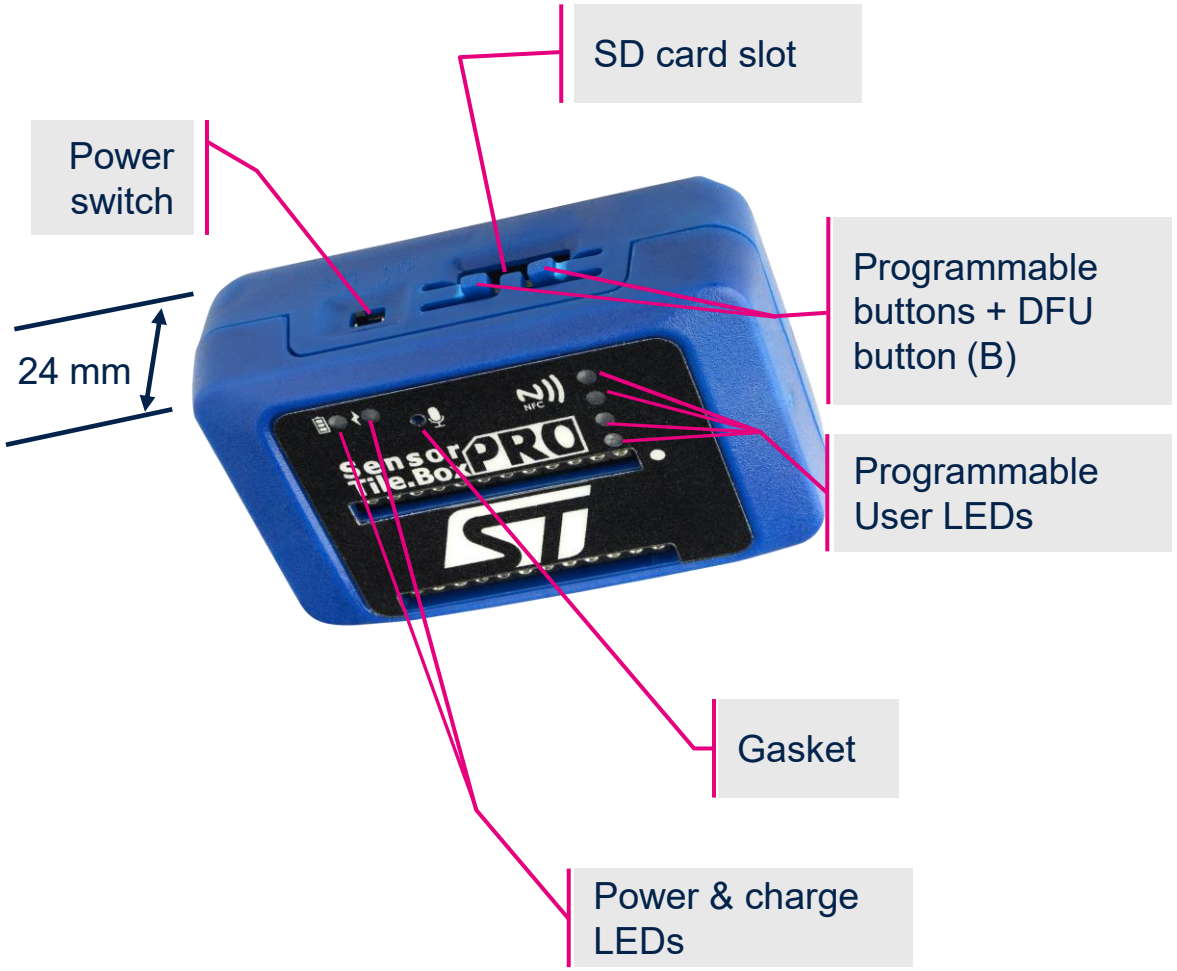
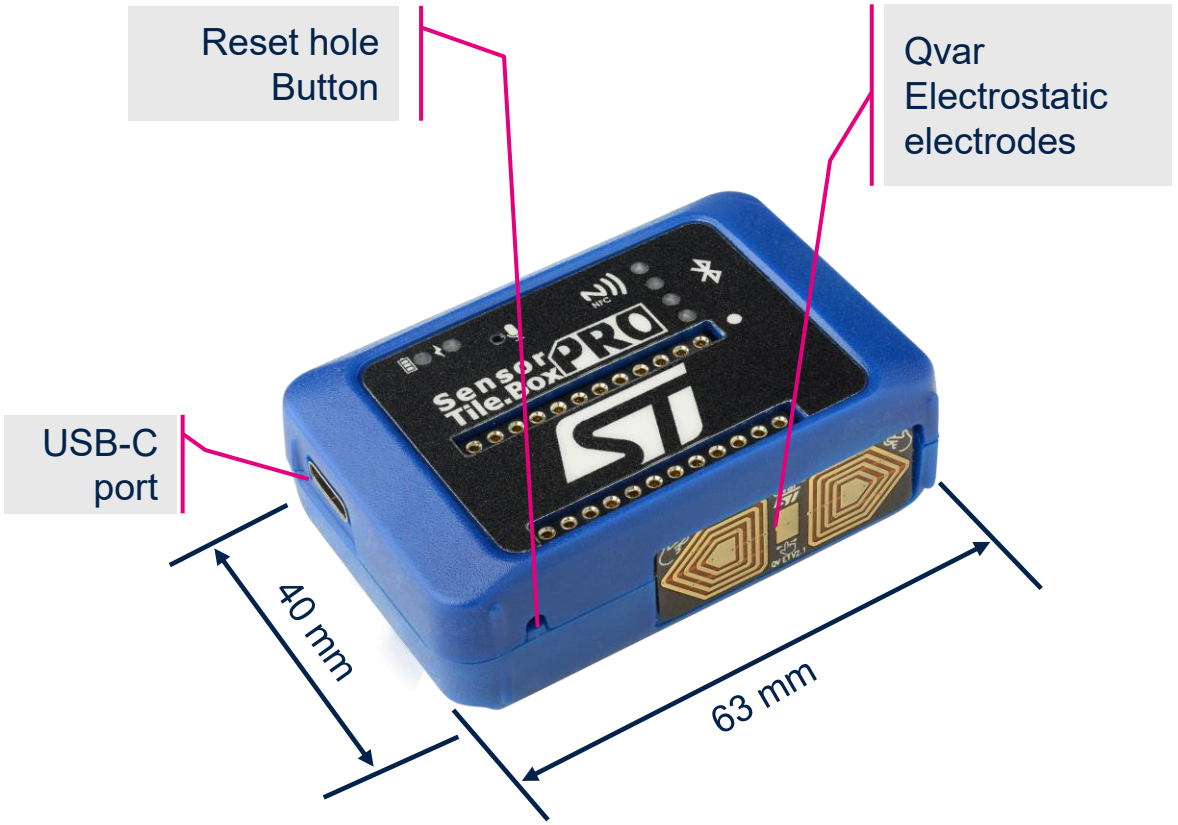
Meeting the SensorTile.box PRO from the outside





Order Code: STEVAL-MKBOXPRO

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Meeting the SensorTile.box PRO from the inside

Accelerometer (LIS2DU12)

Bluetooth reset button

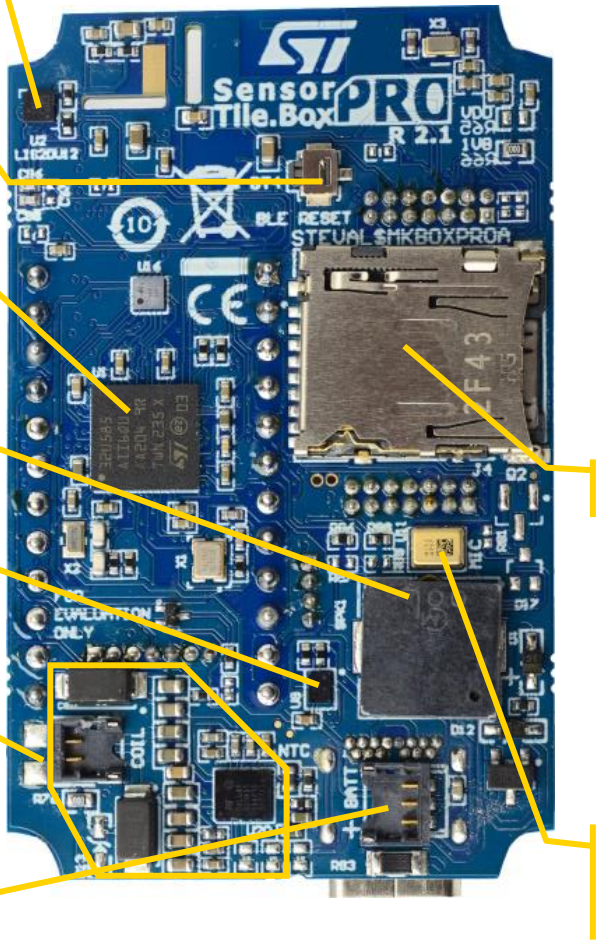
MCU STM32U585AI

Audio Buzzer

Battery Gas gauge

5W wireless charger system

Battery connector



BLE antenna

Temperature sensor (STTS22H)

Bluetooth Low Energy STM32WB07

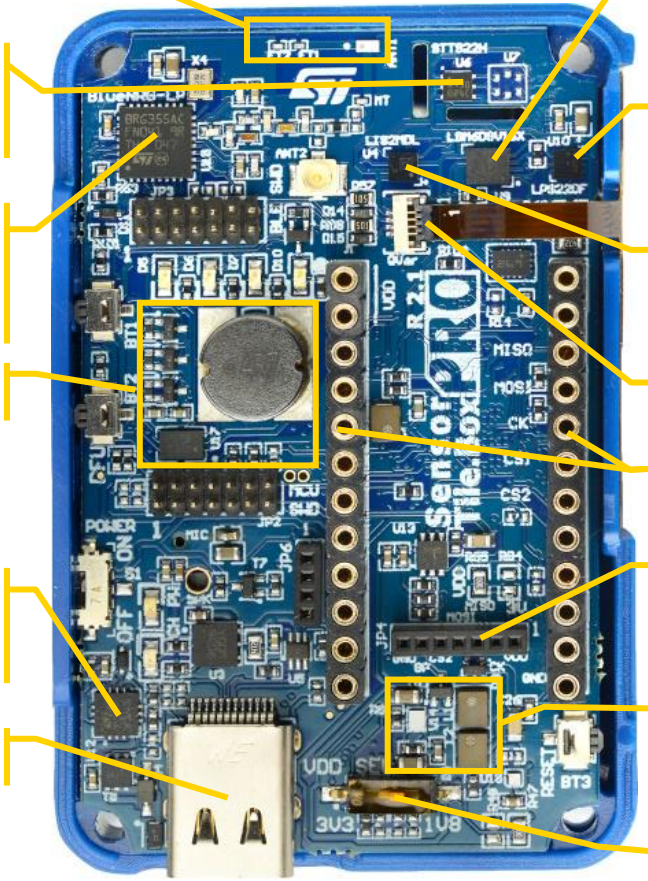
NFC tag

MicroSD Slot

USB-C power protection

USB-C port

Audio Sensor MP23DB01HP



6-axis IMU (LSM6DSV16X)

Pressure sensor (LPS22DF)

Magnetometer (LIS2MDL)

Qvar connector

DIL24 Adapter

Additional connector

Power supply circuit

Power supply (V) switch selector

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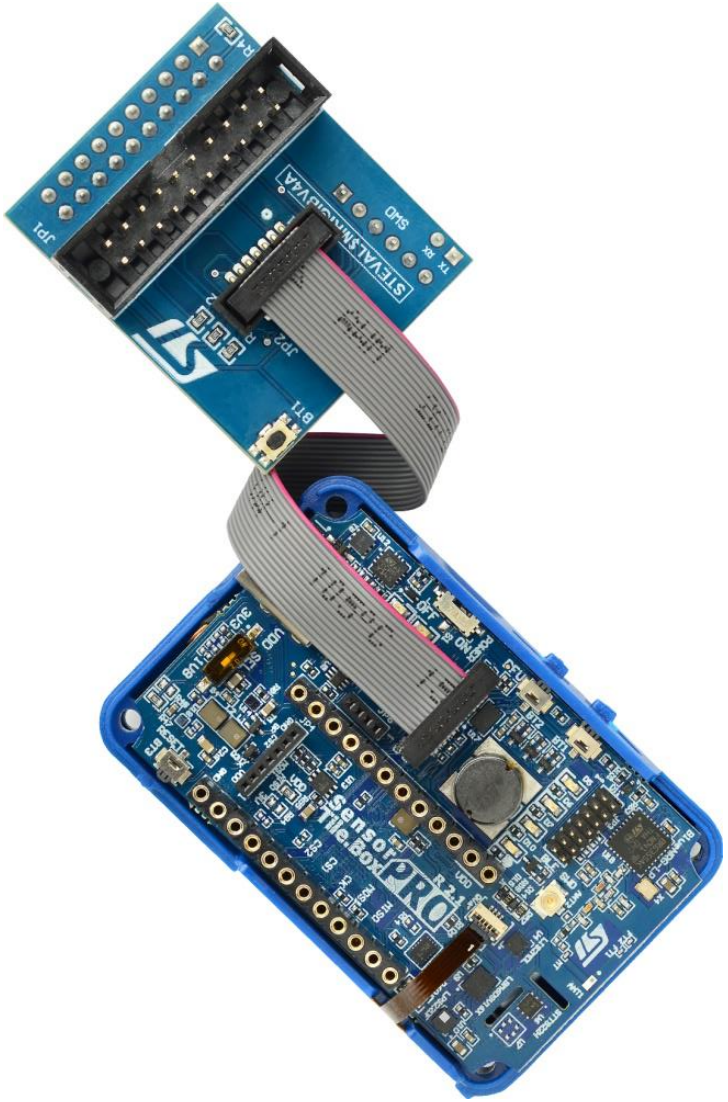
The kit overview: all with you!

Blister with quick starting guide

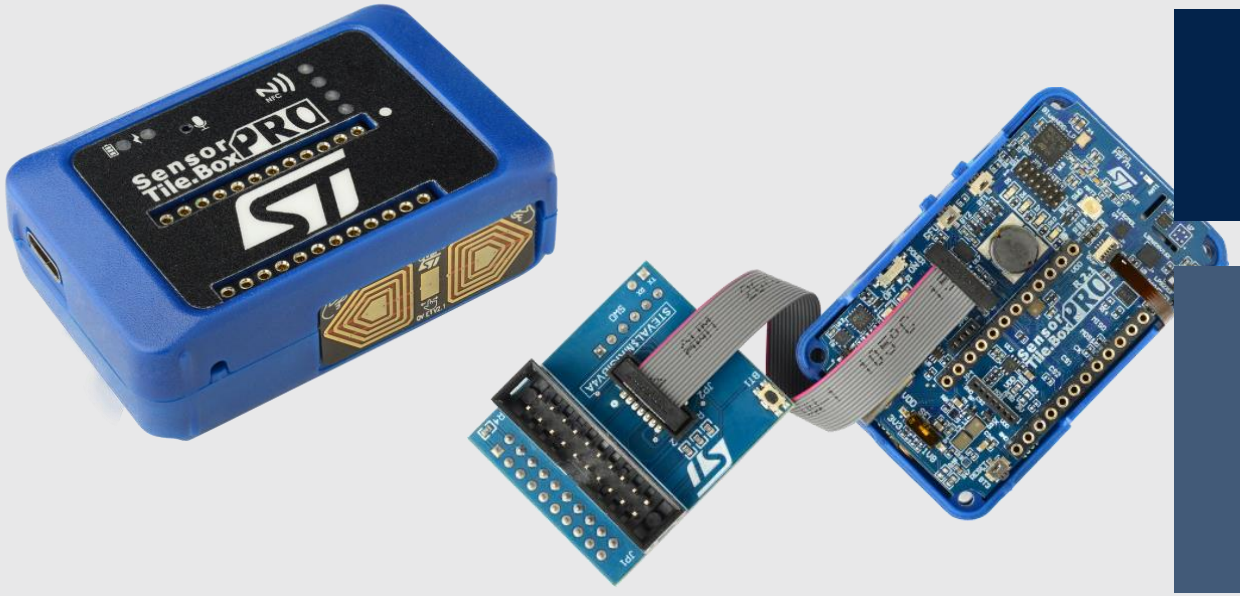
STEVAL-MKIGIBV4 STLINK adapter with programming cable

SensorTile.box PRO



ST ecosystem supporting learning and prototyping

SensorTile.box PRO ready-to-go IoT node



STEVAL-MKBOXPRO

40 x 63 x 20 mm (L x l x h)

www.st.com/sensortileboxpro

Firmware

- **STSW-MKBOXPRO-FS**
- **STSW-MKBOX-BLEDK**

Pre-integrated application example

- **FP-SNS-DATALOG2**
- **FP-ATR-BLE1**
- **FP-SNS-BLEMESH1**
- **FP-SNS-STBOX1**

BLE applications

- **ST BLE Sensor**
- **ST asset tracking**

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2- Setup & Demo Applications

Setup
HW prerequisites

- **STEVAL-MKBOXPRO**
- **ST BLE Sensor Application** for Android/iOS to be downloaded from Google Play Store / App Store.

Android™/iOS™ smartphone with ST BLE Sensor application

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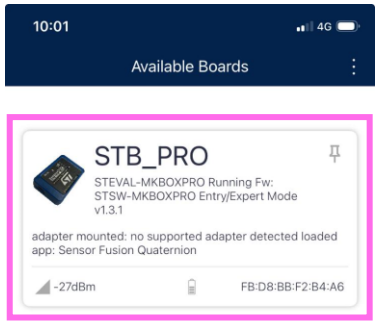
Setup
Pair the board with your device

- The required PIN for pairing the default firmware with the app is **123456**.

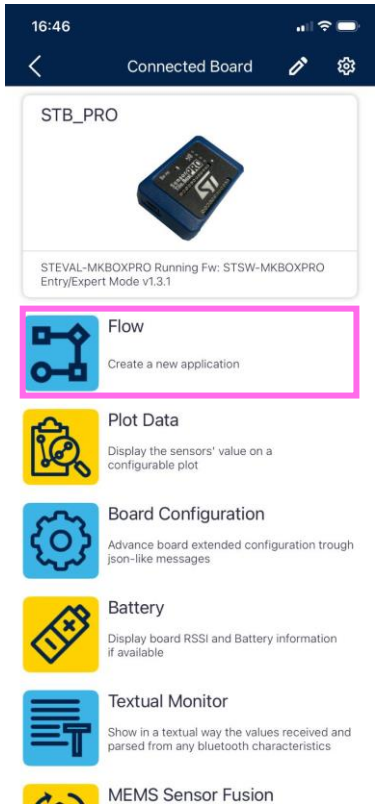
Android™/iOS™ smartphone with ST BLE Sensor application

Demo 1: Sensor Fusion – Quaternion

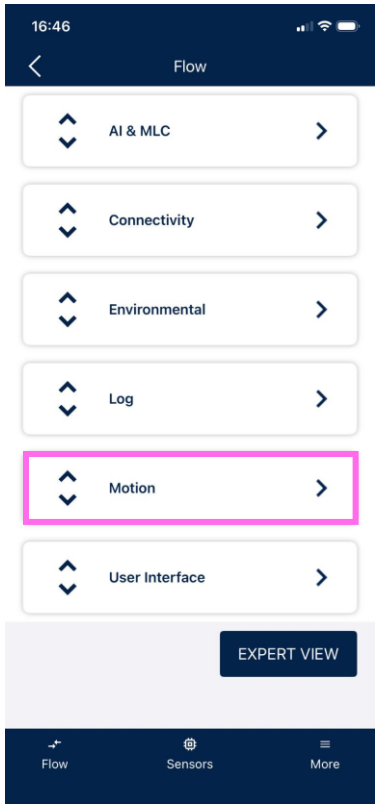
Entry mode (1/3)



Let's switch on the board [1], green LED switches on [2]. Open ST BLE Sensor app on your smartphone. From the main page of the app, click on your SensorTile.box PRO to connect to it [3].



Click on Flow



A list of Example Apps Categories appears, select for example Motion.

Demo 1: Sensor Fusion – Quaternion

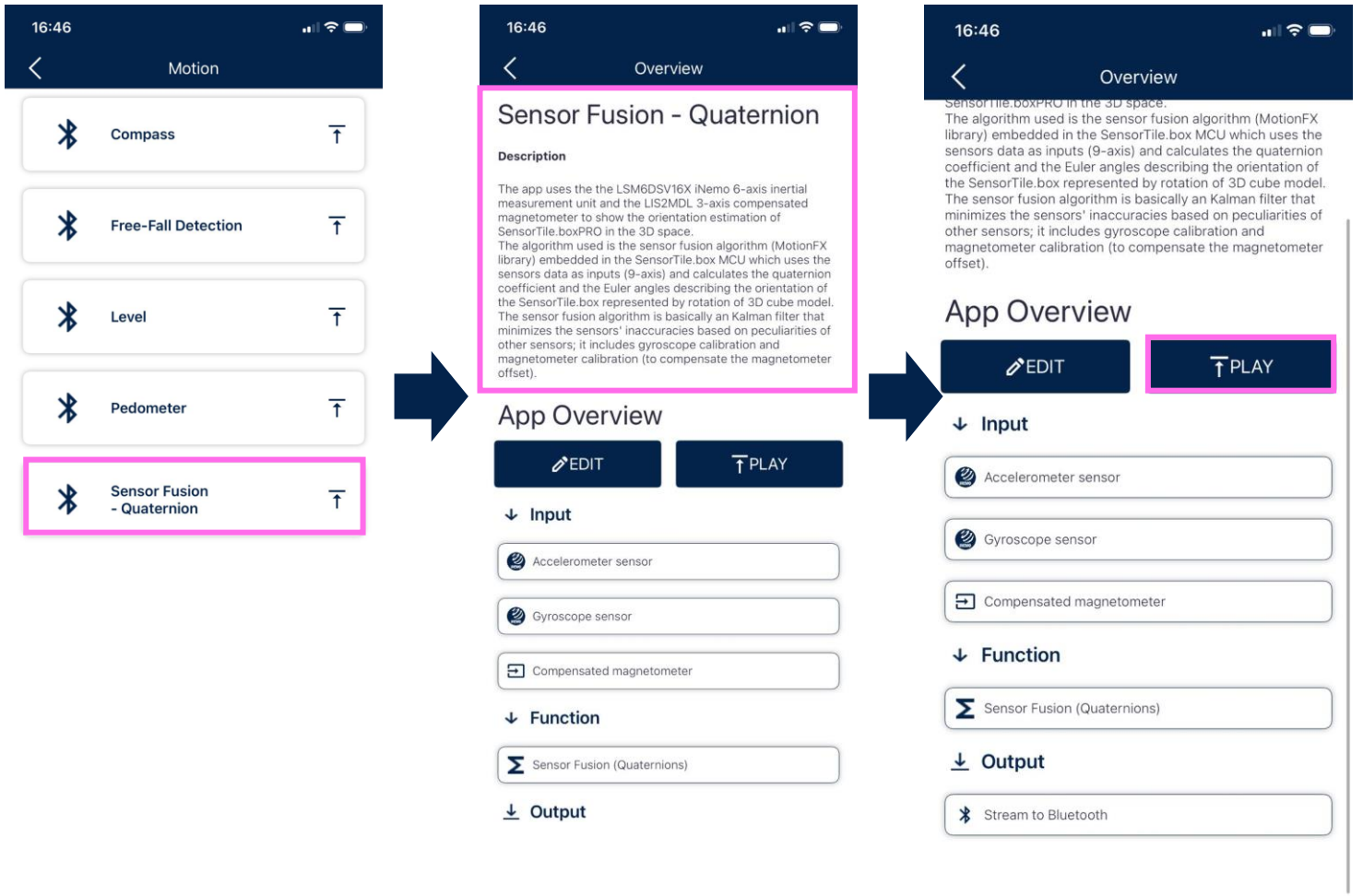
Entry mode (2/3)

Then select Sensor Fusion – Quaternion among the Example applications.

A brief description of the application and an app overview, schematized as application input, function, output, are provided for each example application.

If we focus on The Sensor Fusion – Quaternion application, the LSM6DSV16X iNemo 6-axis inertial measurement unit and the LIS2MDL 3-axis compensated magnetometer are used to show the orientation estimation of SensorTile.box PRO in the 3D space. If we look at the block diagram of this app, the accelerometer sensor, the gyroscope sensor and the compensated magnetometer are present. The Sensor Fusion (Quaternion) function is applied to this input data and the output is streamed to Bluetooth.

Now click on Play button, available in the application overview section.



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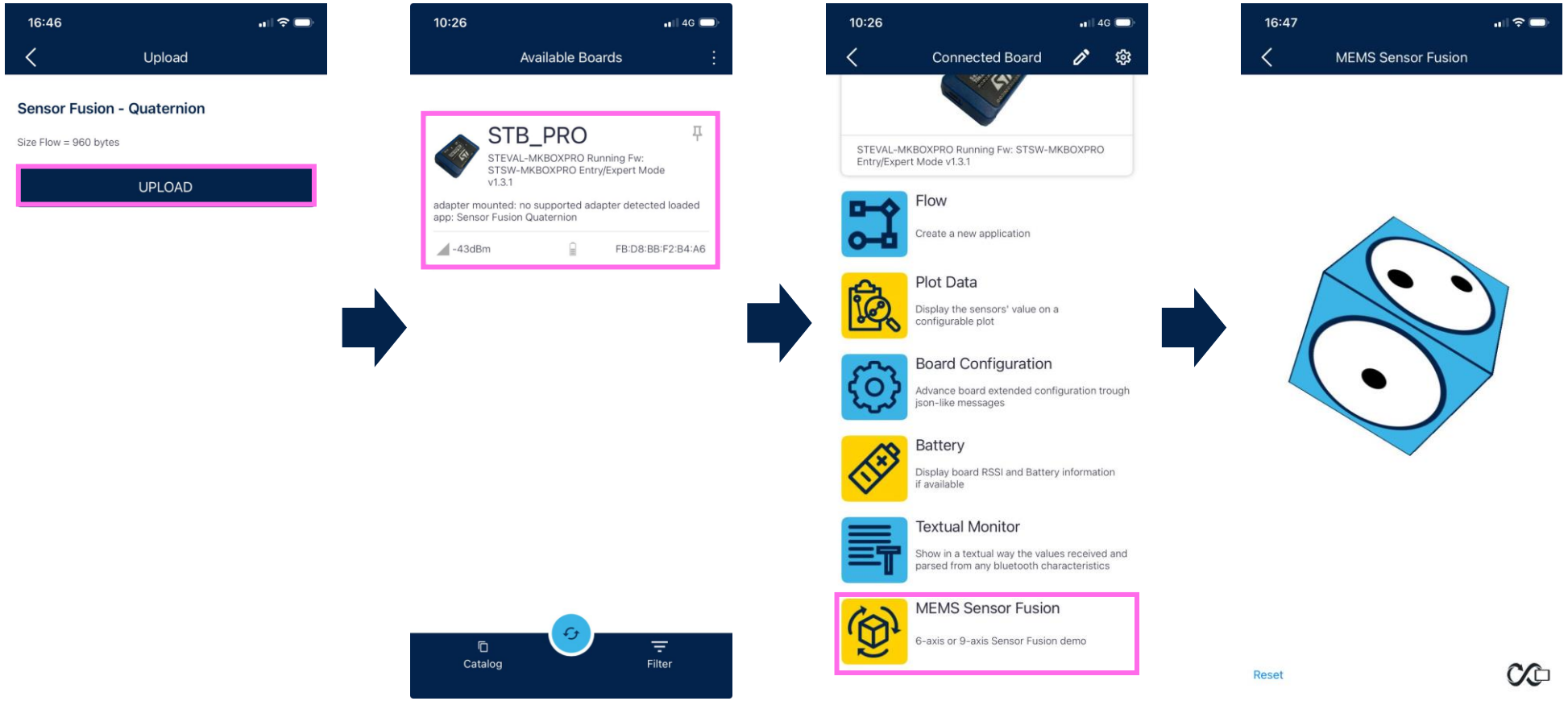
Demo 1: Sensor Fusion – Quaternion

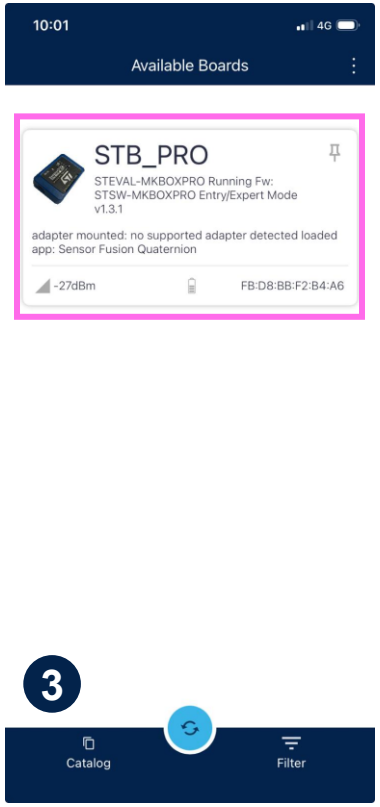
Entry mode (3/3)

Click on Upload.
A pop-up window called Overwrite Board opens: to load the current application on the board, substituting the old one already present, click OK.
The application is loaded: a pop-up window appears, if you click on OK, you can go to the list of the available boards, select yours and reconnect to it.
Click on MEMS Sensor Fusion section: if you move the SensorTile.box PRO, the dice is moving accordingly.



Demo 2: FFT

Expert mode (1/5)



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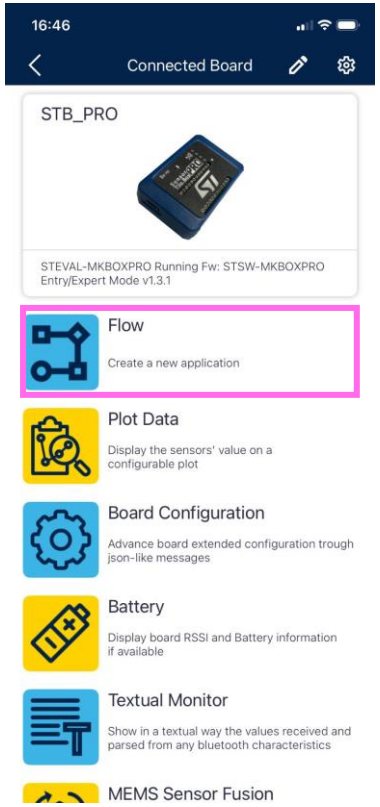
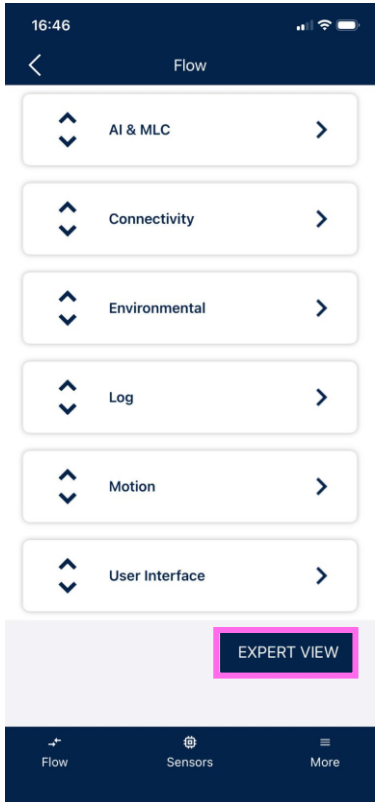
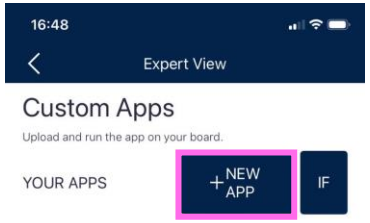


Click on Flow



A list of sample application categories appears; click Expert View to create a new application.



Click New App.

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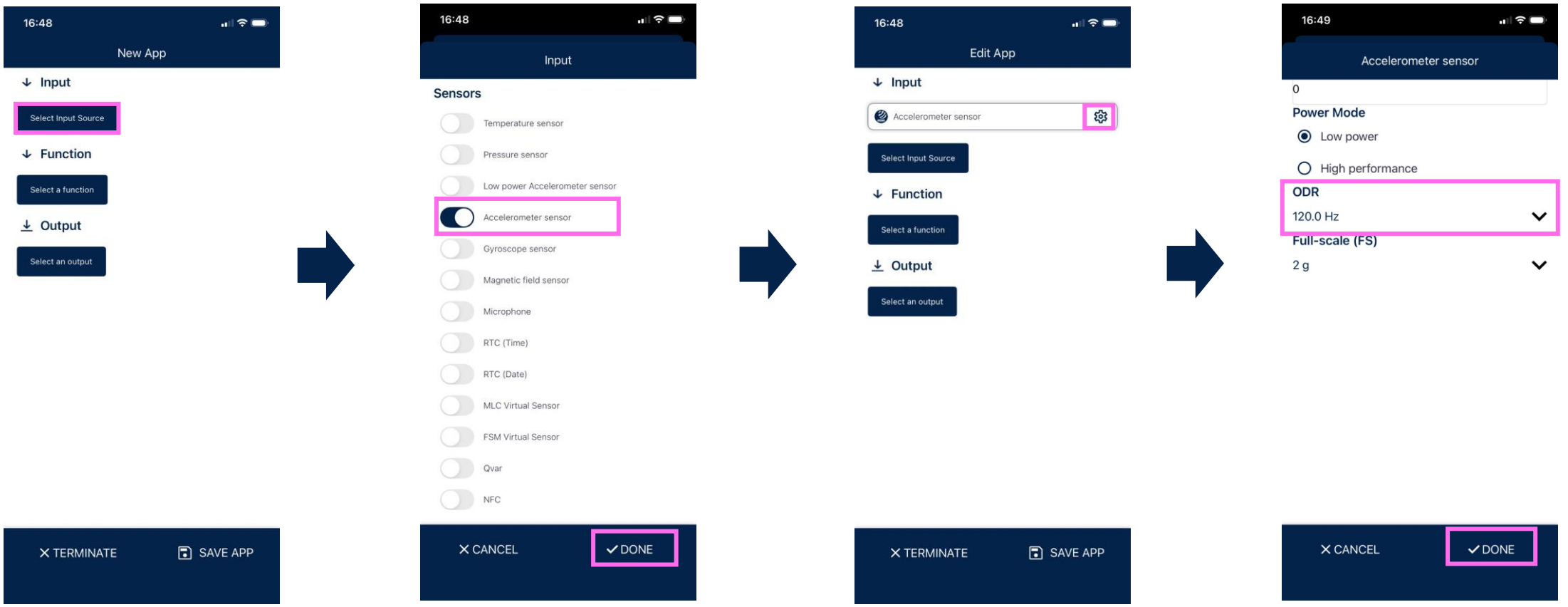
Demo 2: FFT

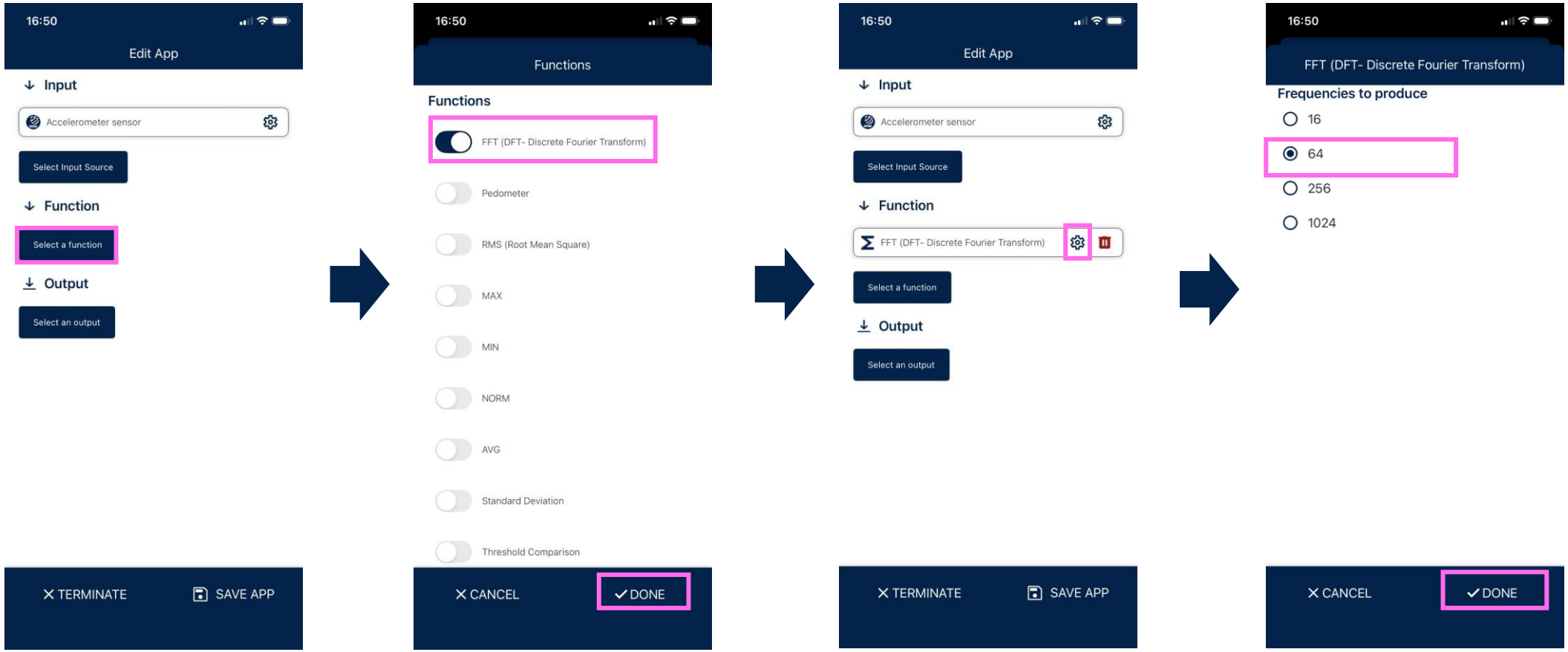
Expert mode (2/5)



Select the accelerometer sensor as the input source and click Done. Now click on the gear to the right of the input section to change its parameters: for example, change the output data rate by setting it to 120 Hz. Click Done.

Demo 2: FFT

Expert mode (3/5)



In the Functions section, click Select a function, choose FFT (DFT - Discrete Fourier Transform) and click Done. By clicking on the gear on the right, you can change the number of frequencies to be produced. Here it is set to 64 and save it by clicking Done.

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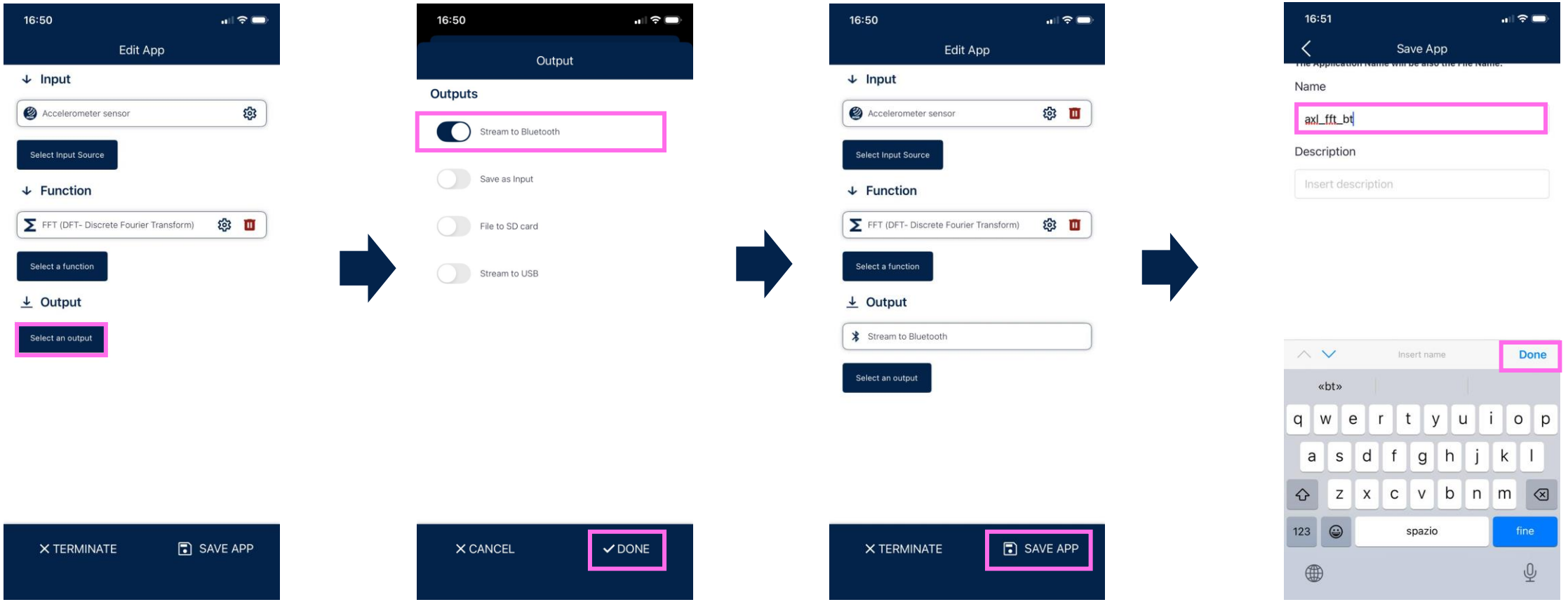
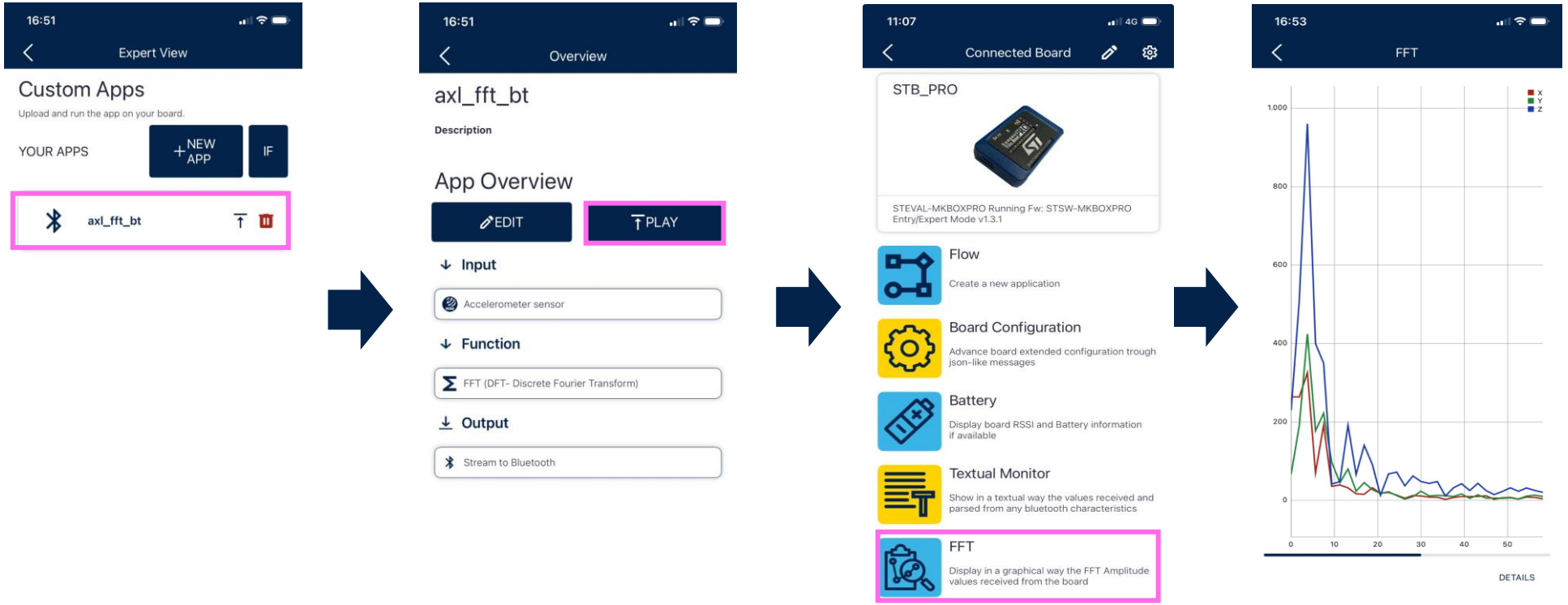
Demo 2: FFT

Expert mode (4/5)



At this point, click Select output and select Stream to Bluetooth as the available output method: in this way, the data will be visible directly on the ST BLE Sensor app. Click Save app, assign a name to the app, e.g. axl_fft_bt (i.e. Bluetooth FFT accelerometer) and click Finish.

Demo 2: FFT
Expert mode (5/5)



The saved app is available in the list of custom apps. Now, click either the upload button or the name of the application and then the Play button to load the application on your SensorTile.box Pro. Click ok to overwrite the previously uploaded application. When the application has finished the uploading, reconnect to your SensorTile.box Pro board in the Available Boards view, then go to FFT section. You can now try the new application by, for example, moving the board at 5Hz to stimulate the Z-axis of the accelerometer. The corresponding signal is plotted accordingly on the app.

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Troubleshooting for STEVAL-MKBOXPRO

When the board starts, for all the examples that use Bluetooth, the board will use the blinking of the Blue LED for showing that everything is well initialized and it's in discovery mode waiting the connection from ST BLE Sensor Android/iOS application.

In some rare situation, the board makes one automatic connection to the Smartphone, and so it' not visible during the board discovery procedure of ST BLE Android/iOS application. In this situation the Blue LED is not working because the board is already connected to the phone.

If it happens, close the ST BLE sensor application and Switch off and Switch on the phone Bluetooth in order to close the connection with the board, in this way the Blue LED will start blinking and it will be possible to reconnect to the board using the ST BLE Sensor Android/iOS application.

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3- Documents & Related Resources

Resources

Here are the main resources for SensorTile.box PRO

st.com/sensortileboxPRO

DB, UM

CAD resources (Gerber files, BOM, schematics)

Tools & Software (MCU Embedded Software, App)

Featured Videos and tutorials and ST MEMS & Sensors community

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4- STM32Cube Ecosystem: Overview

STM32Cube Ecosystem

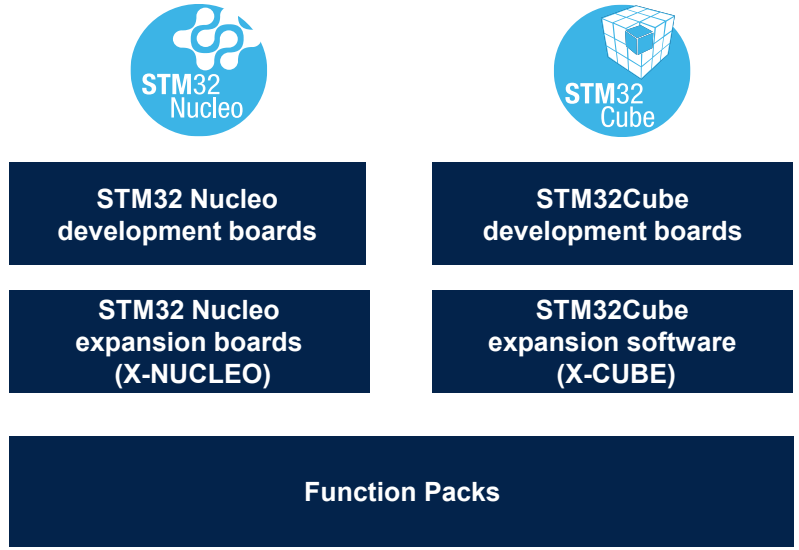
FAST, AFFORDABLE PROTOTYPING AND DEVELOPMENT

STM32Cube is a key enabler for developers, empowering them to reach greater success. Providing a comprehensive suite of professional development tools and embedded software components, STM32Cube enables developers to better differentiate their product, streamline design cycles, and save costs. It enables fast prototyping with leading-edge components combining STM32 32-bit microcontroller family with other leading-edge ST components connected via expansion boards.

The STM32Cube Ecosystem includes the following five elements:

- STM32 Nucleo development boards. A comprehensive range of affordable development boards for all STM32 microcontroller series, with unlimited unified expansion capability, and with integrated debugger/programmer
- STM32 Nucleo expansion boards. Boards with additional functionality to add sensing, control, connectivity, power, audio or other functions as needed. The expansion boards are plugged on top of the STM32 Nucleo development boards. More complex functionalities can be achieved by stacking additional expansion boards
- STM32Cube software. A set of free-of-charge tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer, middleware and the STM32CubeMX PC-based configurator and code generator
- STM32Cube expansion software. Expansion software provided free of charge for use with STM32 Nucleo expansion boards, and compatible with the STM32Cube software framework
- STM32Cube Function Packs. Pre-integrated application SW package including a set of key building blocks used in most popular application domains such as cloud, wearables, IoT, and home and building automation. Built by leveraging the modularity and interoperability of STM32 Nucleo development boards and expansions, with STM32Cube software and expansions.

The Ecosystem is compatible with a wide range of development environments including STM32CubeIDE, IAR EWARM, Keil MDK-ARM, and GCC/LLVM-based IDEs, with the possibility to integrate various tools such as STM32CubeMX, STM32CubeProgrammer or STM32CubeMonitor.



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Thank you

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