



life.augmented

ST Sensors:

Main trends and new products

EMEA - MEMS Product Marketing

Focus applications and macro trends in Industry 4.0

Predictive Maintenance



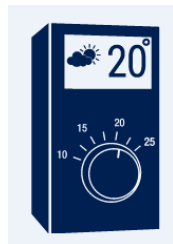
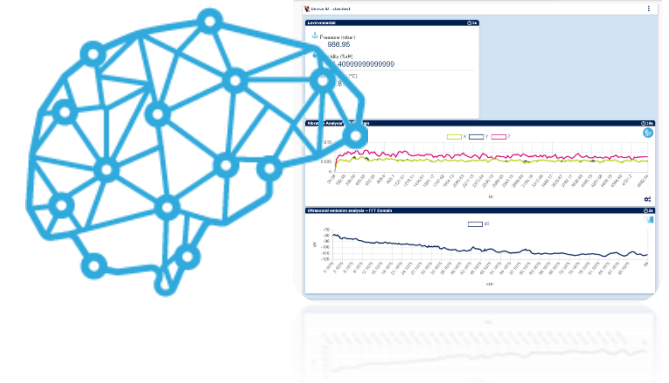
Asset Tracking



Inclination and health structural monitoring



Artificial Intelligence



Sensors Nodes for Environmental monitoring



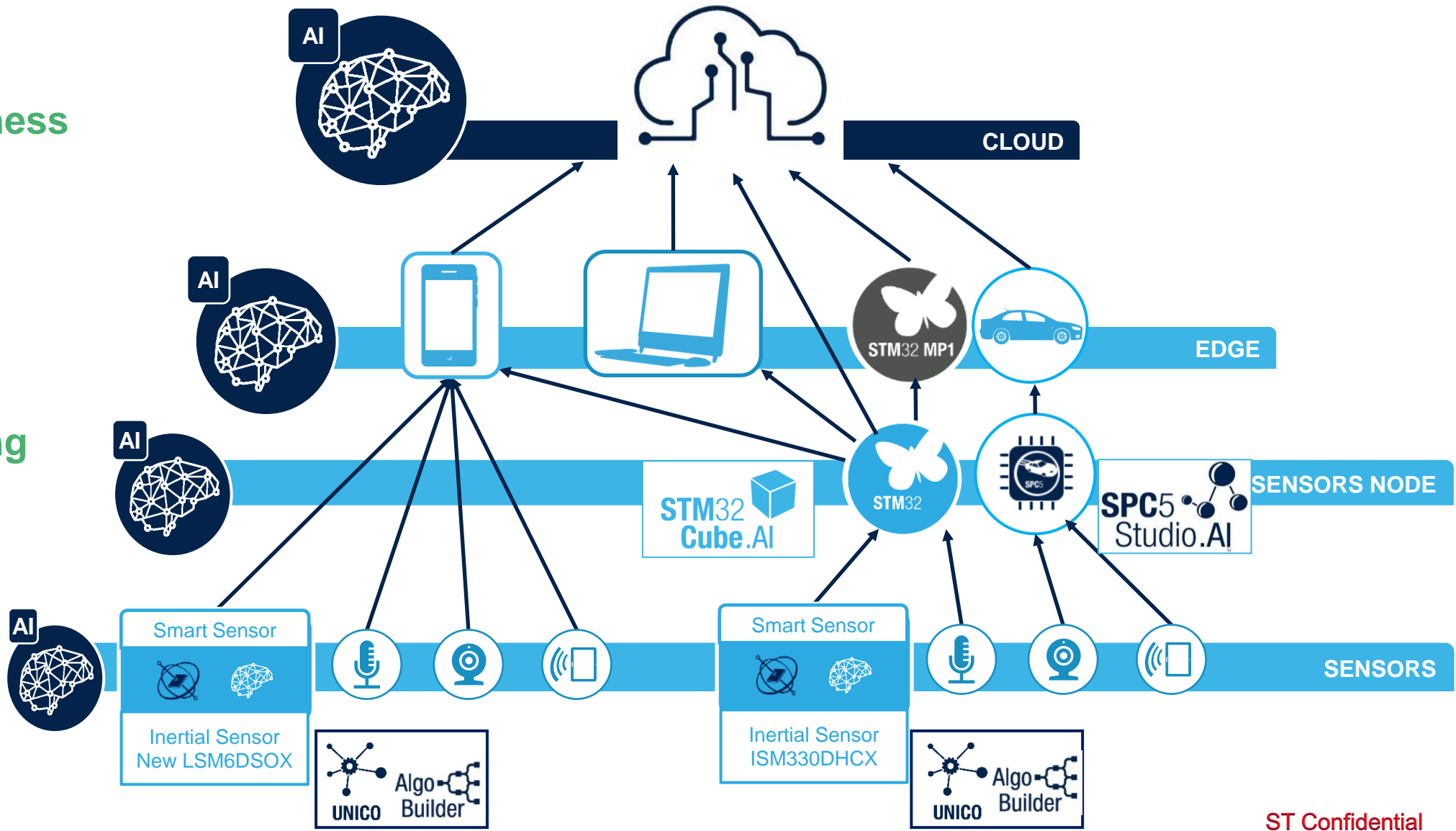
Audio (noise, voice and ultrasound)

and Cloud integration

Artificial Intelligence and Smart Edge

Artificial Intelligence @ the deep edge inside ST Sensors enables Distributed Artificial Intelligence

- ↑ Responsiveness
- ↓ Bandwidth
- ↑ Privacy
- ↑ Security
- ↑ Energy Saving



LSM6DSO/X Sensors with MLC & Improved Performance

Improved accuracy, optimized system power

High accuracy

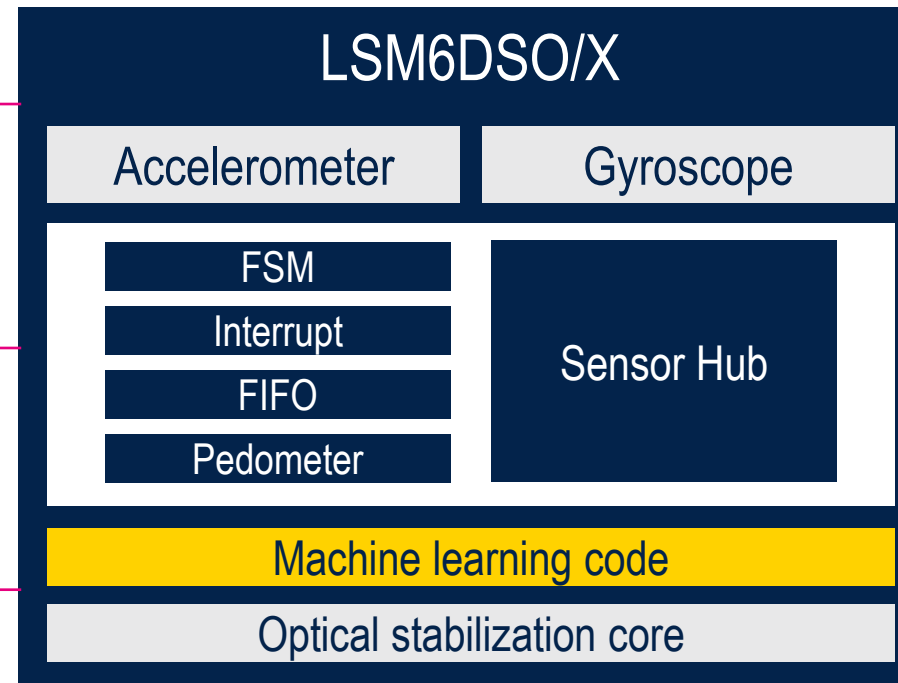
Noise: Gyro 3.8 mdps/ $\sqrt{\text{Hz}}$
Accelerometer 70 $\mu\text{g}/\sqrt{\text{Hz}}$

Low current consumption

0.55 mA HP combo
-15% vs. LSM6DSL/M gen.

New Ultra low power accelerometer only mode

9.5 μA @ 52 Hz ODR
14 μA @ 100Hz ODR



Accelerometer + Gyroscope

Finite State Machine & Machine Learning Core

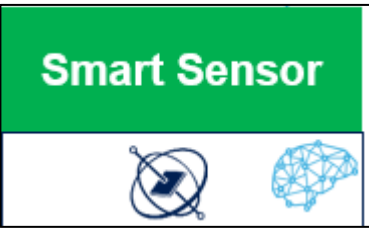
New standard protocol
I³C / I²C / SPI

Sensor HUB
& compressed 9kB FIFO

Embedded Pedometer 2.x
WeChat Compliant
OIS Stabilization Core



2.5x3x0.86 mm



ST sensors with machine learning embedded

Marked with X at the end of the part number

Consumer

Industrial & Medical

Automotive



LSM6DSO/32/X LSM6DSRX

- Activity recognition
 - Gym activity recognition
- Airplane Mode detection

User daily context

ISM330DHCX and IIS2ICLX(*)

- Moving/Still
- Structural Health Monitoring
- Motion Intensity Detection

Asset Tracking and IOT context

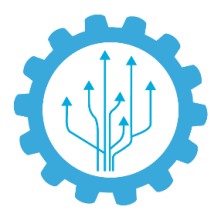
ASM330LHHX (coming soon)

- Vehicle Stationary/Moving
- Vehicle driving detection
- Driver quality Monitoring

Vehicle/Driver context



(*) high performance inclinometer <math><0.5^\circ</math> accuracy over temp & time



Sophisticated movement detection More intelligence examples with embedded Machine Learning Core

Get inspired by MLC examples!

Personal Electronics



Activity recognition

Gym activity recognition

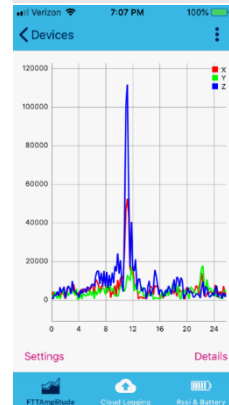
Head gestures

Sleep monitoring

Yoga pose recognition

Man Down

Industrial & IoT



Motion intensity

Orientation detection

Vibration monitoring

Tilt angle

Drilling machine (under preparation)

Automotive and Asset tracking



Vehicle stationary motion detection

Boats tracker

Airplane mode detection



MLC examples are available online at dedicated [GitHub project](#) for Machine Learning Core



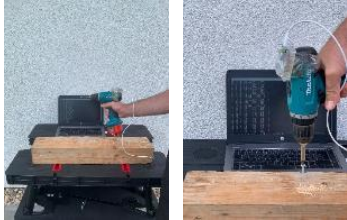
by STWIN
development Kit
including 6-axis
IMU with MLC



Machine Learning Core in power tools, drilling machine as intelligence example

Classes/Classification:

Idle



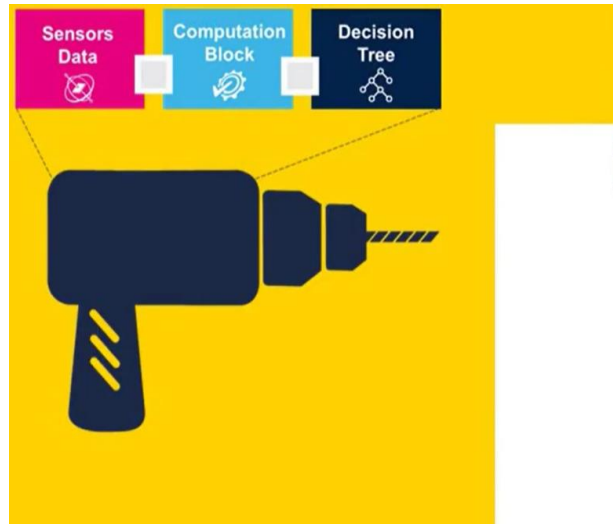
Tightening screw



Drilling



Loosening screw



Three classes are defined
in the Machine Learning Core

IDLE	DRILLING	SCREW DRIVING
1	5	9

• Implementation details

- STWIN board attached to a drilling equipment sensing movements / vibration (AXL, IMU)
- Programmable embedded decision tree detects different drill operations / screwing

• Benefits in real application

- Auto adjust of drill setup based on current utilization of the tool
- Better user experience (no need to readjust drill manually)
- Power consumption optimization - longer battery life

Put your own
Decision Tree



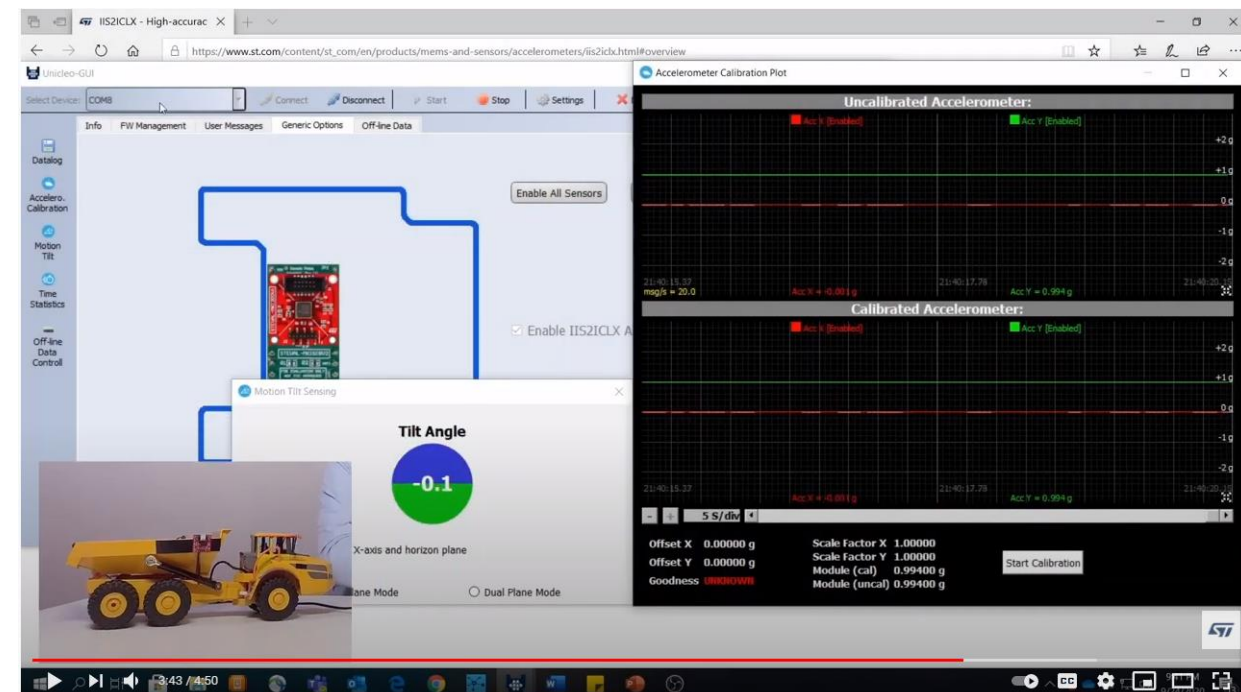
Other equipment: electric saws, cutters, screwdrivers, wrenches, grinders, ...

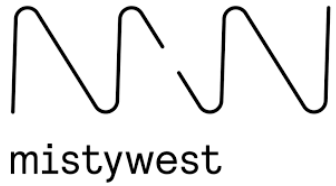


Machine Learning Core example in Tilt sensing

Accuracy and embedded digital capabilities to detect positions and movements (i.e. moving up and down).
DEMO: IIS2ICLX with STM32 Nucleo board and Unicleo GUI (CES 2021)

4 – Fully Open Bed

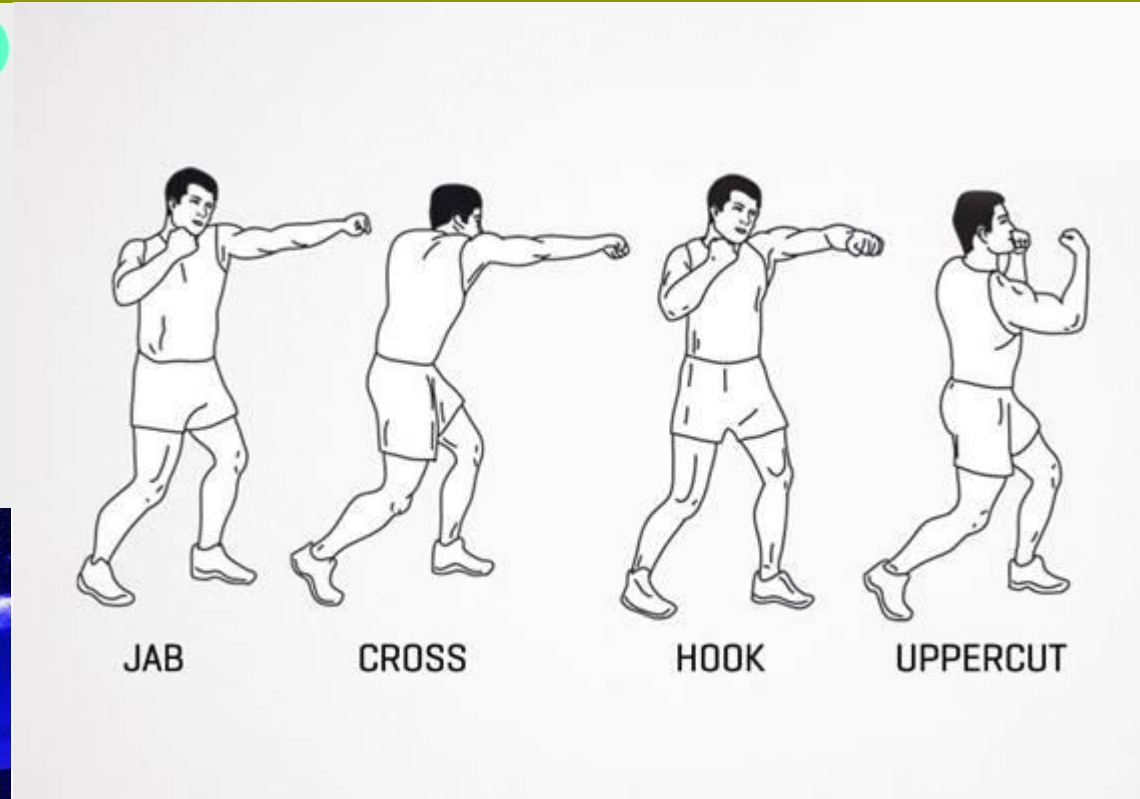
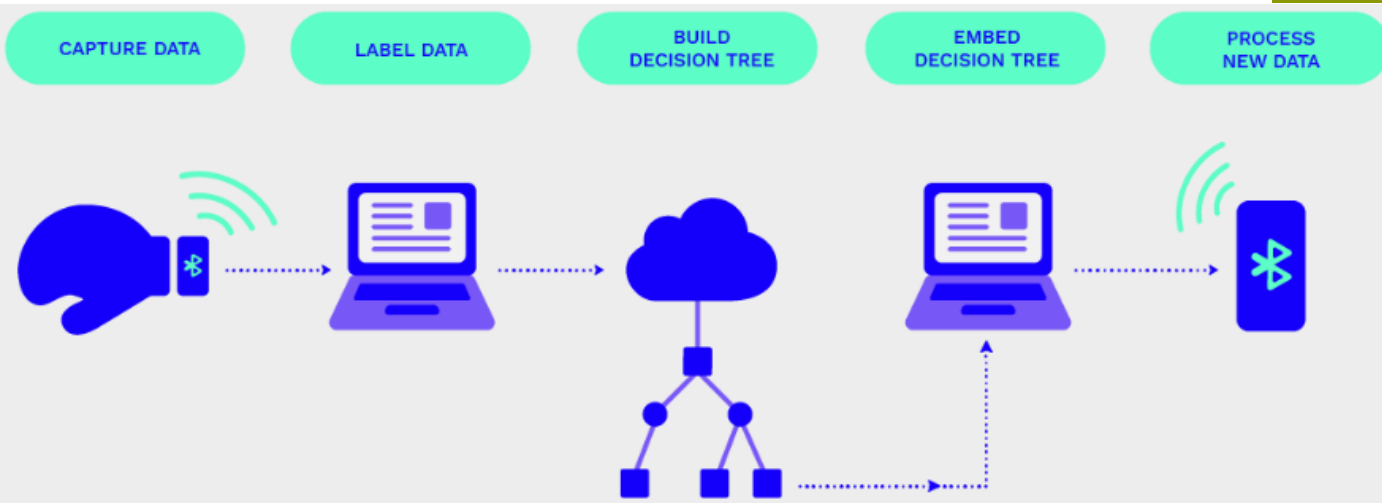




Machine Learning Core in SensorTile.box inside sport wearable

A low powered wearable is trained to individual users' habits and capabilities using ST's Machine Learning Core.

Recognition of boxing specific movements



MLC able to recognize a punch in a boxing environment by using ST MLC capabilities

13 uA – current consumption for this algorithm with MLC

Machine learning configuration flow

Definition of the classes to be recognized: running, walking, car, ... Capture data ...



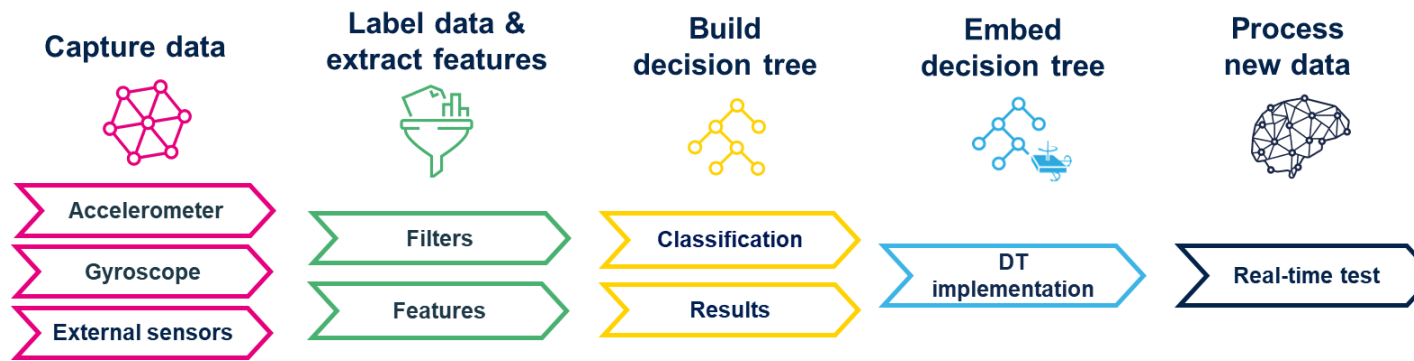
1 User defines **Classes** to be recognized

2 Collect data **Logs** for each class and **label** data

3 Select **Features** that best characterize the identified classes

4 **Machine Learning tools** generate program for LSM6DSOX based on **Logs** and **Features**

5 Run the application



Machine Learning process with ST tools

Rapid prototyping environment



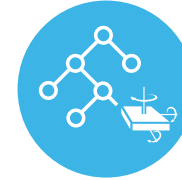
Capture data



Label data & extract features



Build decision tree



Embed decision tree



Process new data



Unico GUI → PC tool for MLC development



AlgoBuilder → PC tool for graphical development of algorithms



Unicleo-GUI → PC tool for STM32 Nucleo with MEMS expansion board



ST BLE Sensor → Mobile App for SensorTile.box

Inside SensorTile.box Sensing, processing and connectivity



The Board
Micro USB connector

Motion sensors
IMU, Inclinometer
and low power
Accelerometer,
Magnetometer

BLE module

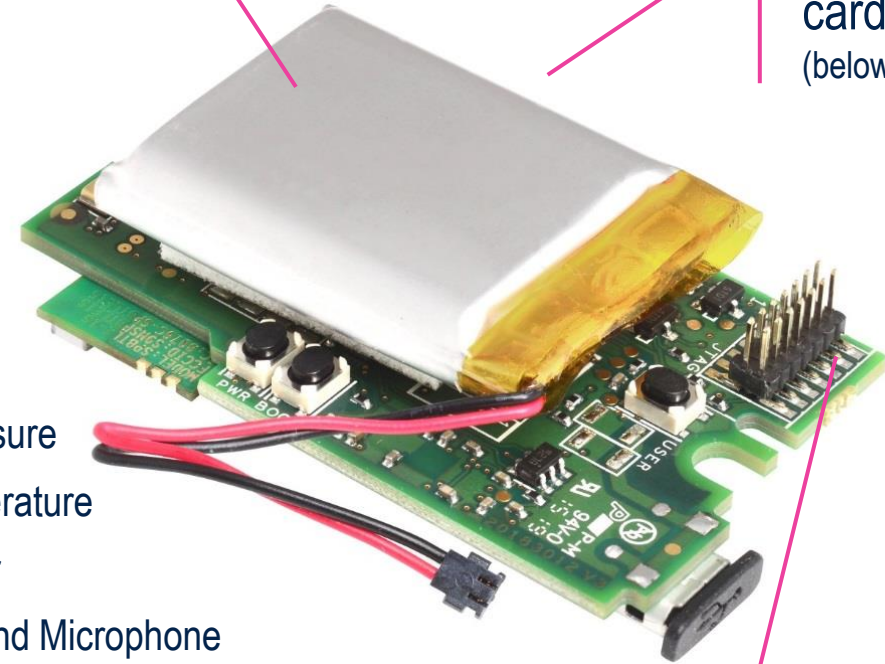
STM32L4+
MCU

Altimeter / Pressure
Accurate Temperature
Humidity sensor
Analog wide-band Microphone

Environmental
sensors

500 mA-h
Li-Po battery

microSD
card socket
(below battery)



STLink V3
connector

Machine learning accuracy ?

Accuracy and Low current consumption

Confusion Matrix of Activity Recognition in LSM6DSOX



Detected as ->	Stationary	Walking	Fast Walking	Jogging
Stationary	99.1%	0.9%	0.0%	0.0%
Walking	0.0%	99.4%	0.2%	0.0%
Fast Walking	0.0%	3.7%	95.9%	0.2%
Jogging	0.0%	0.6%	0.7%	98.5%

.. and Current consumption improvement

Very low power Internet of Things (IoT) applications

Only 4uA additional current consumption to run Activity Recognition in MLC

- Activity recognition library (MotionAR) running in Software

LSM6DSOX Sensor		Sensor Current consumption
Sensors		15 μ A
MLC – not used		0 μ A

by MLC

MCU	Wake-up rate	MCU Current consumption
STM32F401RE	1/16 = 63ms	91 μ A
STM32L152RE	1/16 = 63ms	82 μ A
STM32L476RG	1/16 = 63ms	51 μ A

by MCU

Additional Current Consumption required to run the application

Running on:	[μ A]
Cortex-M4 low power STM32L476RG	51
MLC on LSM6DSOX	5

- Activity recognition algorithm running inside MLC

LSM6DSOX Sensor		Sensor Current consumption
Core		15 μ A
MLC		4 μ A

MCU	Wake-up rate	MCU Current consumption
STM32F401RE	1 s	9.27 μ A
	30 s	3.02 μ A
	100 s	2.8 μ A
STM32L152RE	1 s	3.24 μ A
	30 s	1.46 μ A
	100 s	1.4 μ A
STM32L476RG	1 s	2.8 μ A
	30 s	0.65 μ A
	100 s	0.59 μ A

Asset Tracking



Asset tracking categories

Emerging applications

VIDEO

Discover ST's range of asset tracking solutions

Logistics:

- Supply Chain Quality Control, from manufacturing to end user.
- Transportation and Storage Handling monitor (object dropping, vibration etc...)



Things tracking

Find your things/location tracking



Animal tracking

Activity, Temperature, location data monitoring



People tracking

Smart band for concerts/entrance/payment/amusement parks/cruise ships



Retails

Storage/Shelf life, Temperature & Humidity, beacons



Perishable Goods:

Exp. date alert, Shelf/Storage Life Calculation/Condition of goods



Smart Packaging:

Temperature, Vibration Use, ID



Asset Tracking



Asset Tracking ST Main Components

Accelerometer



Vibration
Orientation
Free Fall detection
Shocks (high-g)

Temperature sensor



Shipping Environment
Goods Status

Pressure sensor



Take off and landing detection
Seal detection

Analog



Including Signal Conditioning, Protections, ...

STM32



Computation by STM32 Family

BLE



Bluetooth Low Energy Connectivity to gateway/tablet

Sub-1GHz



Long Range Connectivity to base stations/Sigfox

NFC



Short Range Connectivity To handheld devices

Battery



DCDC, LDO, Battery Charger, Fuel Gauge...

Accelerometers LIS2DW12 or LIS2DTW12?

The LIS2DTW12 delivers the same high performances as the LIS2DW12. Differently from the LIS2DW12 the LIS2DTW12 is factory calibrated to ensure a narrower accuracy relieving the customer from the need of a costly calibration along the manufacturing line.

Fan Condition Monitoring



THE CASE

Servers run multiple fans to ensure the proper temperature operating conditions. When a fan wears out the server has to be stopped with the consequent machine down cost.



THE NEED

Anticipating the failure by monitoring both the fan vibrations and the air flow temperature is key to reduce the machine down time.



THE PERFECT FIT
LIS2DTW12

Asset Trackers



THE CASE

Delivery services monitor the parcel to ensure no high-g shock or thermal shock occurred to the goods in package.



THE NEED

An integrated low power solution (axl + temperature sensor) is the ideal solution to contain the application BOM and size



THE PERFECT FIT
LIS2DTW12



Asset Tracking

READY Solutions

Outdoor Real-Time Monitoring

Containers, livestock monitoring, e-bike,

Fleet management, pet, tools management

Industrial Logistic

Pallets, racks, indoor / outdoor location

Good Guarantee

Cold chain, food, medical, smart parcels

Disposable

Letters, packages, parcels



STEVAL-STRKT01
B-L072Z-LRWAN1
X-NUCLEO-GNSS1A1
X-NUCLEO-IKS01A2
FP-ATR-LORA1*
Cayenne/TagIO*
DSH-ASSETTRACKING*



STEVAL-SMARTAG1
NUCLEO-L053R8+
X-NUCLEO-NFC04A1+
X-NUCLEO-IKS01A2
FP-SNS-SMARTAG1*
ST NFC Sensor*
DSH-ASSETTRACKING *



STEVAL-MKSBOX1V1
FP-ATR-BLE1*
ST Asset Tracking*
DSH-ASSETTRACKING *



NUCLEO-F401RE
P-L496G-CELL02 LTE
FP-ATR-TOMTOM1*
FP-ATR-LTE1*
DSH-ASSETTRACKING *

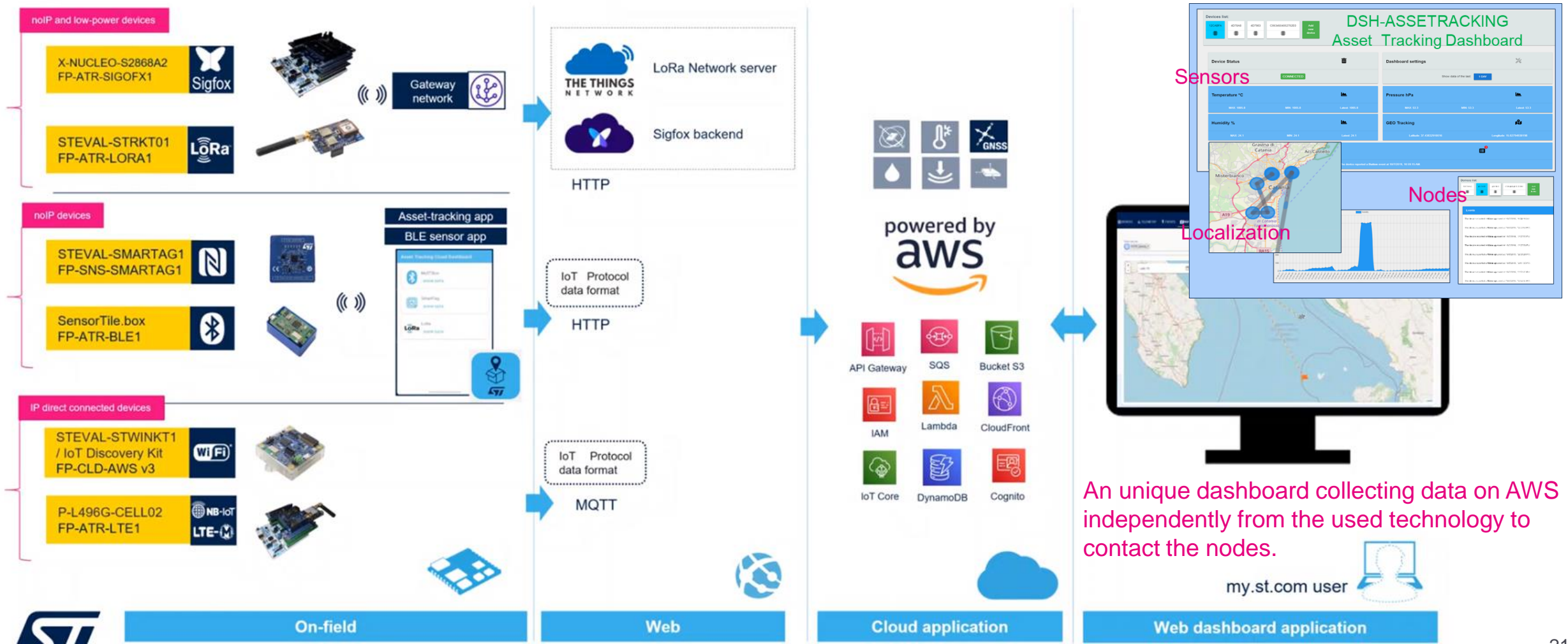


NUCLEO-L053R8 /L476RG
X-NUCLEO-S2868
X-NUCLEO-IKS01A3
X-NUCLEO-GNSS1
FP-ATR-SIGFOX1*
ST Asset Tracking*
DSH-ASSETTRACKING *



End-to-end Architecture

Data ingestion flow from sensor to dashboard



An unique dashboard collecting data on AWS independently from the used technology to contact the nodes.

Asset tracking ST @ CES

13 Asset Tracking

Asset Tracking demonstration with STM32 MCU-based solutions, including NFC, Bluetooth® Low Energy and LPWAN with SigFox and LoRa®, GNSS for positioning, environmental and motion sensors with Machine Learning.

- Ready solution for: NFC, Bluetooth® Low Energy, LoRa®, SigFox with cloud AWS or Tago-I0 dashboard
- Wide range of asset-tracking solutions with GNSS positioning, geo-fencing, and LPWAN connectivity
- IMU with Machine Learning Core for Asset Tracking using SensorTile.box
- ST Parts: ST25DV, STM32WB, BlueNRG-2, STM32LO LoRa® module, S2-LP, LSM6DSOX, LPS22HH, LIS2DW12, STTS751, LIS2MDL, STTS22H, HTS221, TESEO-LIV3

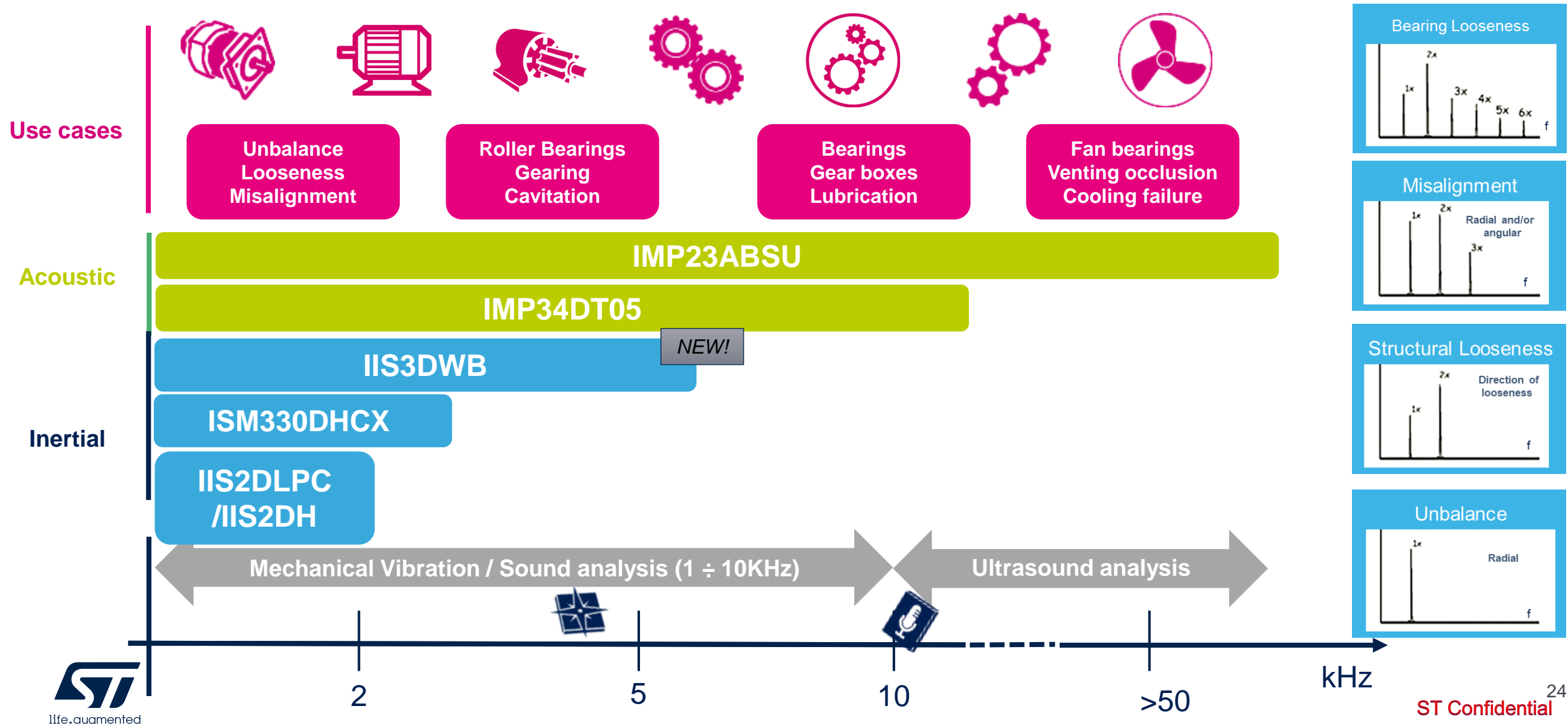


Predictive Maintenance



MEMS for Vibration Analysis

Sensors and defects over bandwidth





IIS3DWB

Ultra Wide Bandwidth, Low Noise 3-Axes Digital Accelerometer for Vibration Monitoring

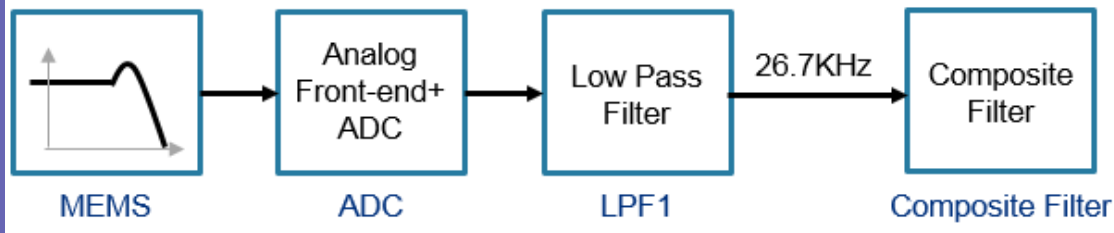


Pin2pin compatible with ISM330x/LSM6DSx devices

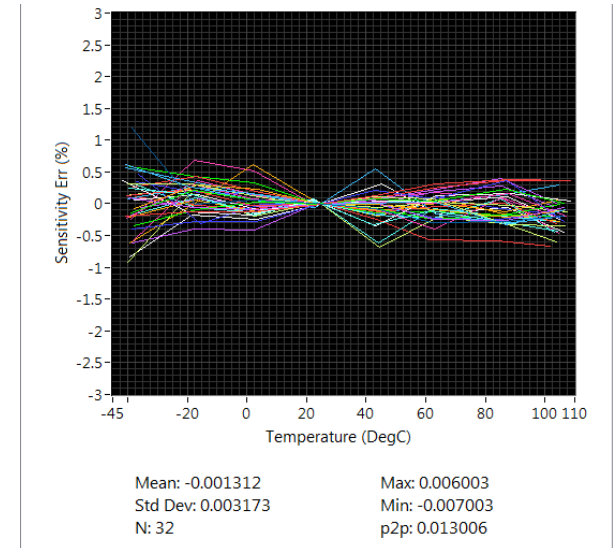
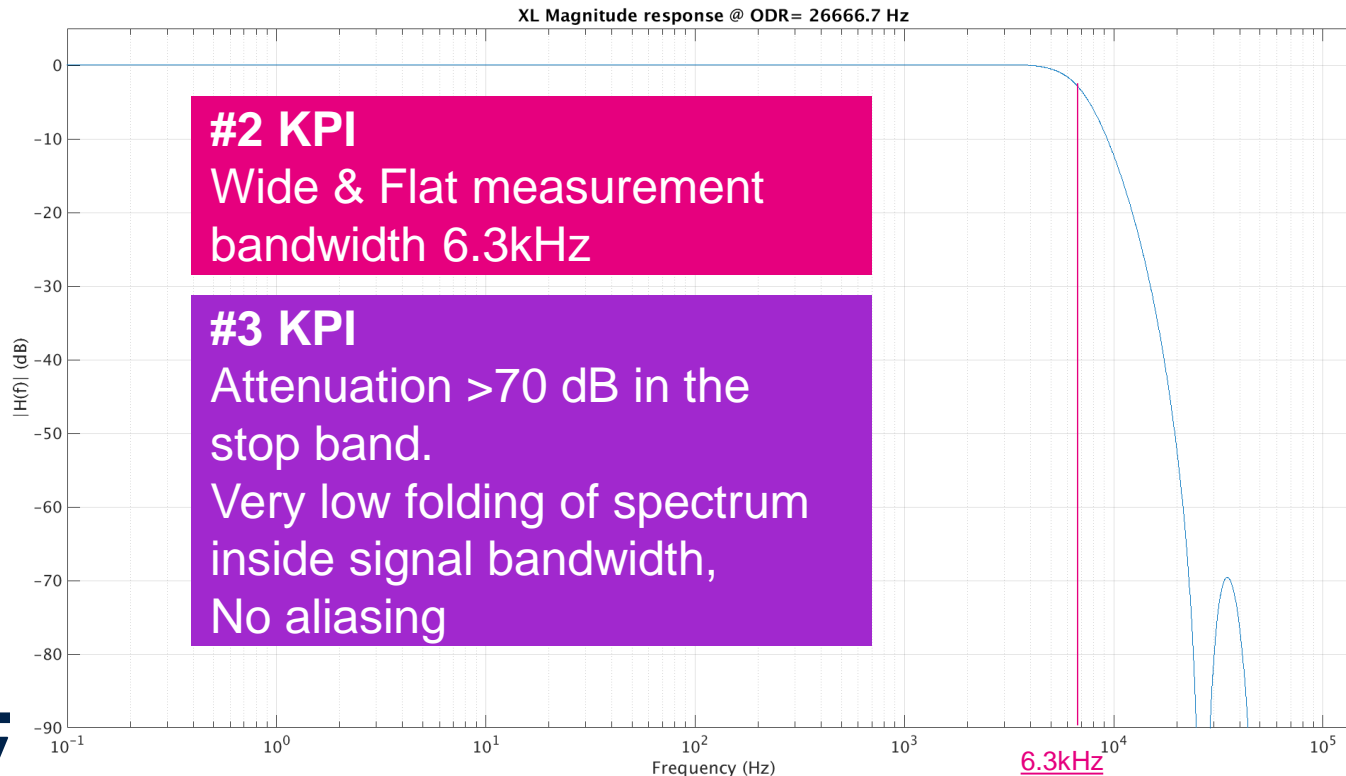
Parameter	Value
N. of axis	3-axis
Full Scale [g]	$\pm 2/\pm 4/\pm 8/\pm 16$
Output i/f	Digital: SPI
Bandwidth (-3dB) [kHz]	6.3
ODR [kHz]	26.7
Noise Density [$\mu\text{g}/\sqrt{\text{Hz}}$]	75 (60 in single axis mode)
Current Consumption [mA]	1.1
Features	FIFO (3kbyte) Programmable HP Filter Interrupts Temp. Sensor Embedded Self Test
Operating Temp [$^{\circ}\text{C}$]	-40 ; +105
Operating Voltage [V]	2.1 ÷ 3.6
Package [mm3]	LGA 2.5x3x0.83 14Lead

IIS3DWB Key Performance Indicators for condition monitoring

#1 KPI Filtering chain and Low noise levels

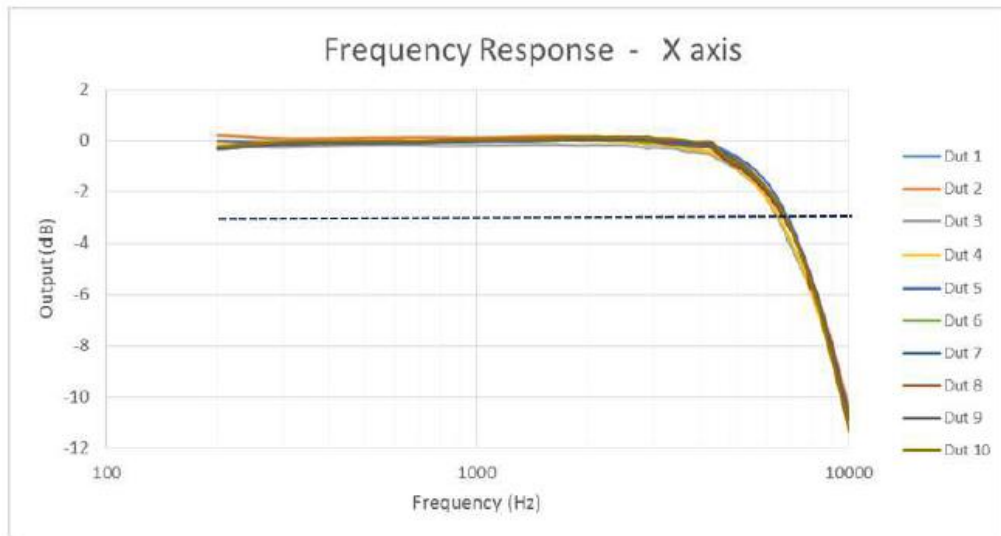


		Typ.	Max.		
An	Acceleration noise density 3 axes enabled ⁽⁶⁾	X-axis	75	110	μg/√Hz
		Y-axis	75	110	
		Z-axis	110	190	
	Acceleration noise density only 1 axis enabled ⁽⁶⁾	X-axis	60	90	
		Y-axis	60	90	
		Z-axis	80	130	

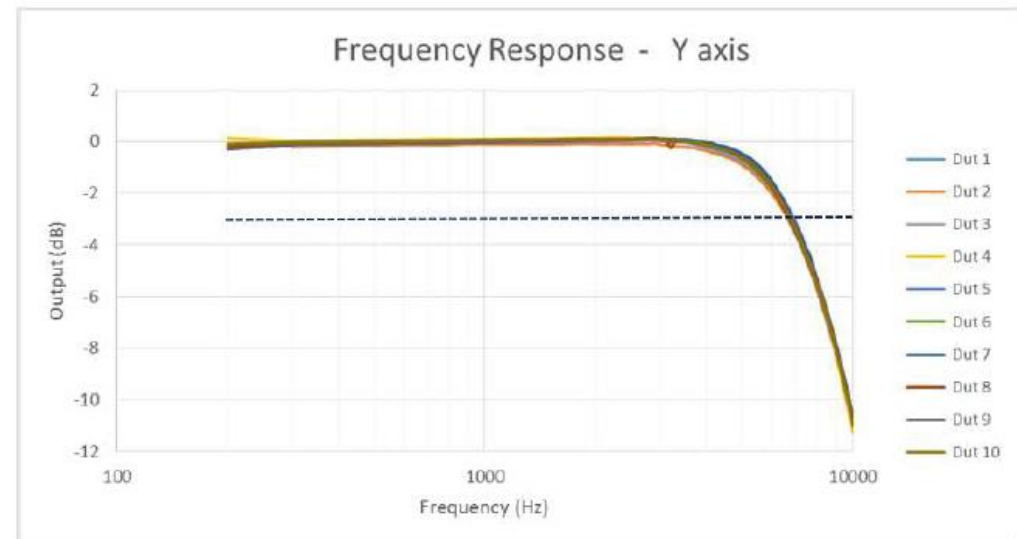
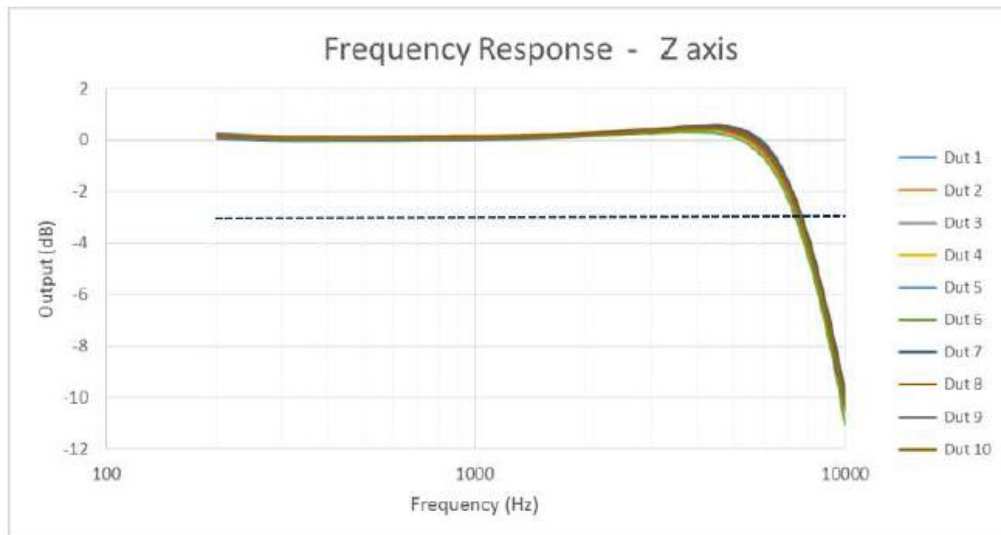


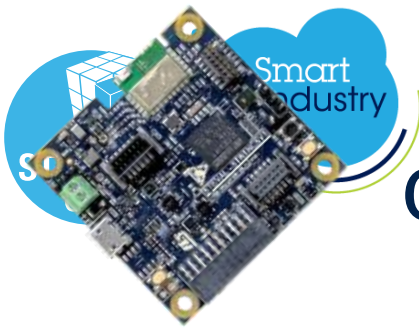
#4 KPI
Stable thermal behavior over extended temperature range

IIS3DWB details and repeatability



- **>6 kHz Bandwidth** (@ -3dB)
- Frequency response with **Flat Pass Band**, **Steep roll-off (>90dB/dec)**, high **Stop Band attenuation (>70dB)**
- **Low Noise**

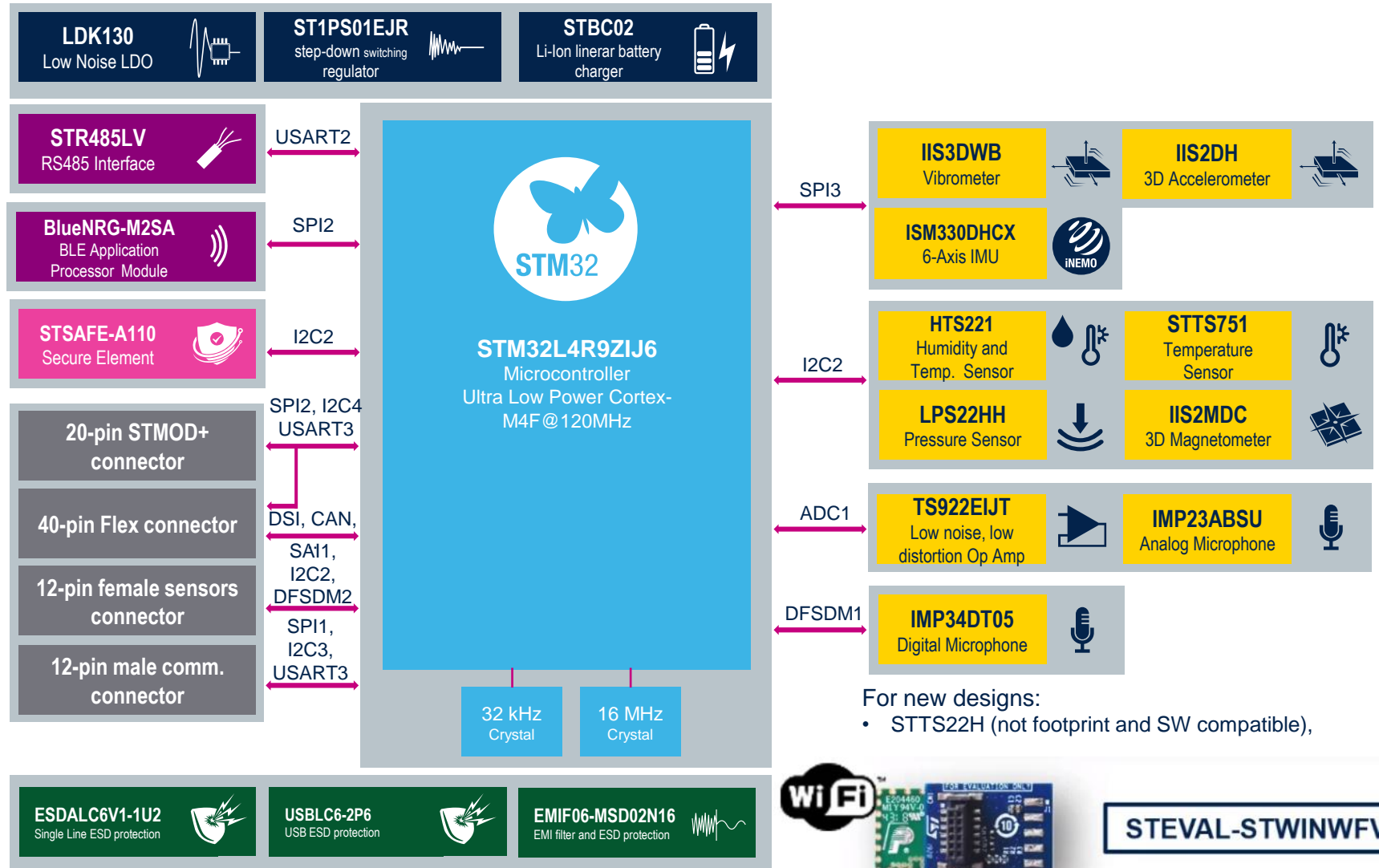




STEVAL-STWINKT1B

diagram, ICs and STM32CUBE Function Packs

- Best-in-class Industrial Grade Sensors
- Multiple algorithms running on the STM32L4+
- Secure Connection and Authentication with STSAFE-110
- Out-of-the-box BLE Connectivity
- Connectivity and sensor expansions support
- Smart Power to increase battery life (Li-Po battery, USB or ext. 5V)
- **FP-IND-PREDMNT1** IoT sensor node for condition monitoring
- **FP-CLD-AZURE1** connect an IoT sensor node to Microsoft Azure
- **FP-SNS-DATALOG1** High speed Datalog
- **FP-AI-NANOEDG1** AI Condition monitoring application



Tilt/Inclination and health structural monitoring





ST Inclinometers in Industrial applications

Pointing, levelling and stabilization



Antenna pointing, platform leveling and stabilization

Robotics and IIoT



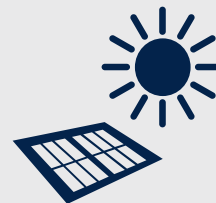
Robotics and Industrial automation

Inclinometers for industrial vehicle



High accuracy inclinometers for industrial vehicles, forklift, construction machines

Equipment installation and monitoring



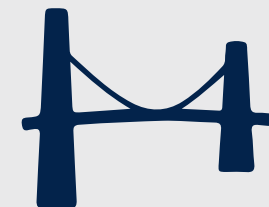
Installation and monitoring of equipment, tracker for solar panels

Leveling instruments



Precise leveling instruments

Structural health monitoring



Building and infrastructure condition monitoring (inclination and low frequency vibration)

Inclinometers accurately measure a tilt angle under static or quasi-static conditions.
To measure angles of objects in highly dynamic conditions, see also
Dynamic Inclinometer using 6-axis IMU in st.com

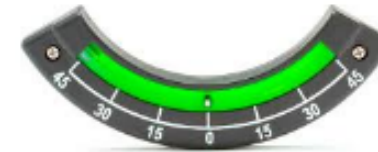


NEW

IIS2ICLX 2-axes ultra accurate, ultra low power digital inclinometer

Parameter	Value
N. of axis	2-axis
Full Scale [g]	± 0.5/1.0/2.0/3.0
Output i/f	I ² C/SPI digital output interface
Bandwidth [Hz]	25/50/200
Noise Density [$\mu\text{g}/\sqrt{\text{Hz}}$]	15
Offset change vs Temp [mg/°C]	0.05
Current Cons. [mA]	0.4 - with 2 axes delivering full performance
Operating Temp [°C]	-40 ; +105
Package [mm ³]	Ceramic Cavity LGA 5x5x1.7 16Lead

2-axis Digital
High resolution
High Accuracy (<0.5° over Temp. and Time)
Ultra Low Power
105°C Operating Temp



- | Applications |
|--|
| • IMU for precise positioning and navigation |
| • Precision Inclinometer |
| • Antenna pointing and platform leveling |
| • Structural health monitoring |
| • Leveling Instruments |

Programmable MLC integrates AI algorithms and reduce power consumption at system level

Programmable Finite State Machine can also process data by **Sensor HUB** to efficiently collect data from external sensors

Smart embedded **FIFO** up to 3 kbytes








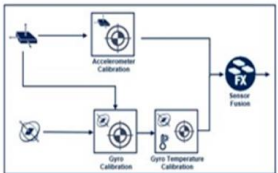








Learn more →



Tilt sensing with Industrial Sensors

Technical Material, libraries and documentation support

Accuracy/Calibration	Measuring
   	 <div style="background-color: yellow; padding: 2px; display: inline-block;">Availability Q3/Q4 2020</div> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>MotionTL</p> <ul style="list-style-type: none"> • Static Tilt measure: 1/2/3 axis inclinometers • Inclinometer calibration </div> </div> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>MotionDI</p> <ul style="list-style-type: none"> • Accelerometer Calibration (six point calibration) • Gyroscope calibration • 6-axis sensor fusion accurate orientation angles in presence of vibrations and motion </div> </div> 
  	  

- Tilt Sensing with ST's Industrial sensors
 - Technical presentation about tilt sensing to show the theory behind and introduce our industrial sensor portfolio and HW and SW tools
- Tilt sensing using MLC (IIS2ICLX)
 - Describes new MLC example for tilt sensing with IIS2ICLX, presents available tools and shows how to use these tools



Structural Health Monitoring

Not only accurate tilt for SHM Applications

IIS2ICLX measures with **very high resolution** the **vibrations in the low frequency range (up to 260 Hz)**, which are essential for **vibration-based monitoring (VBM) of structures**, an important method of assessing the condition and the safety of vulnerable structures



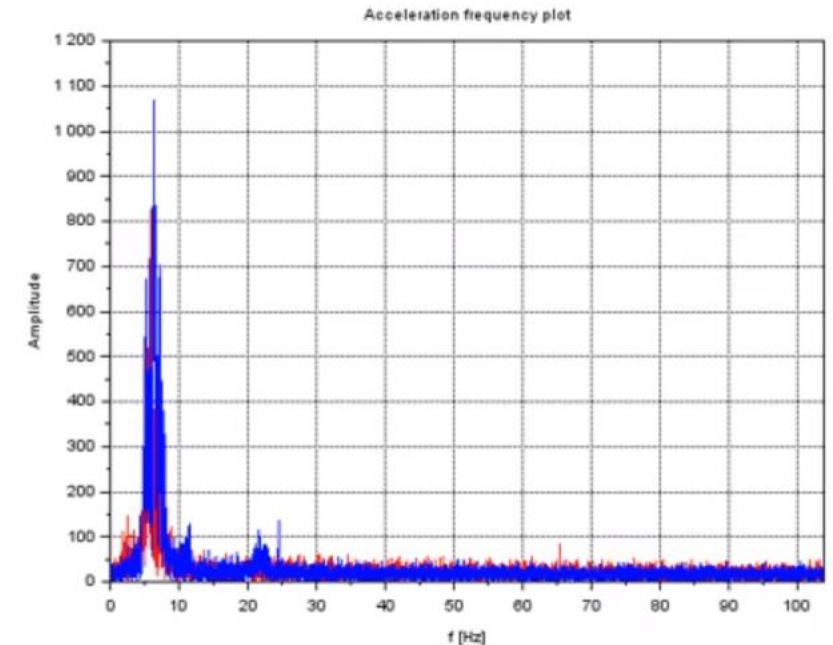
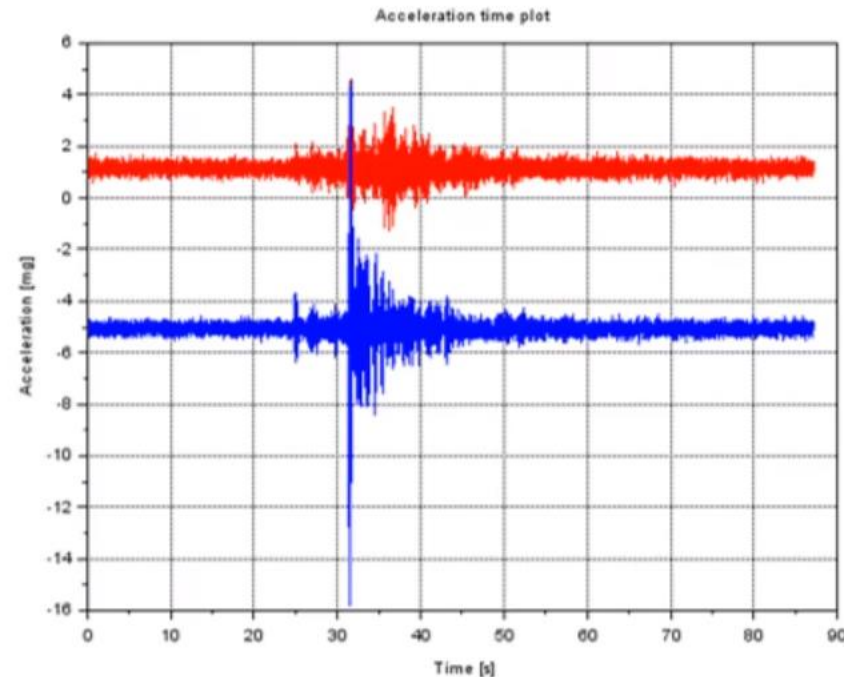
Milan earthquake

December, 17th at 16:59 CET

Magnitude **MI 3.9**

Epicenter 4 km from Milan
Hypocenter 56 km depth

Recorded with IIS2ICLX at
ST@Corenaredo
(6km from the epicenter)



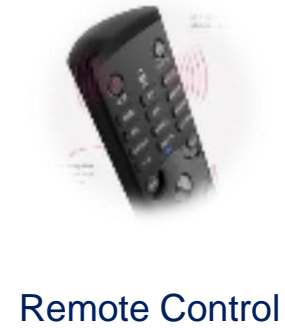
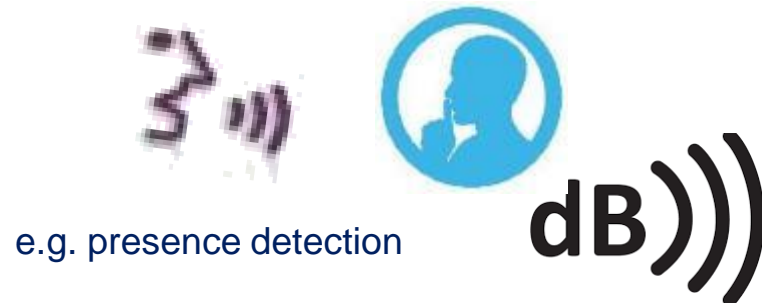
life.augmented

Audio (noise, voice and ultrasound)



Microphone Applications

Voice interaction, sound and noise capture



Voice is convenient for HMI: Simple & Easy



Failure detection in ultrasonic BW measurement



e.g. predictive maintenance

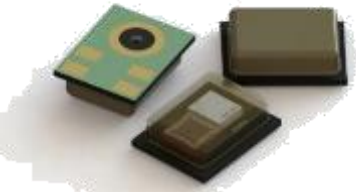


Smart Industry

ST MEMS microphones for Industry 4.0

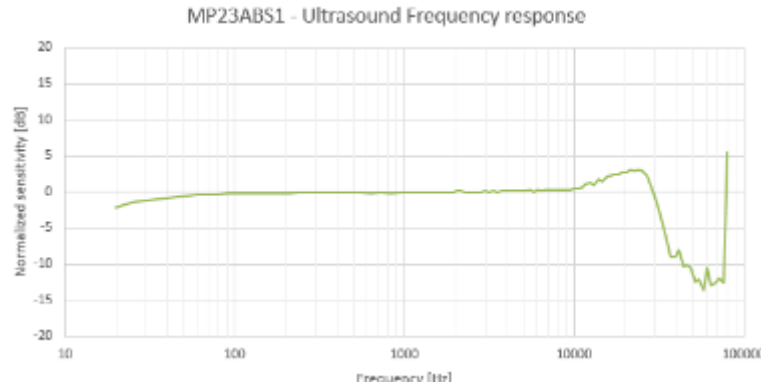
The Right Sensor for Every Predictive Maintenance Need

RHLGA 5LD
3.5x2.65x0.98 mm



IMP23ABSU Analog

- Main parameters
 - Sensitivity : 38dB ±1dB
 - SNR: 64dB(A) (min)
 - AOP: 130dBSPL
- Wide Acoustic Bandwidth (up to 80 kHz)



FEATURES / BENEFITS

- Wide Dynamic range Analog single ended microphone
- Analog device enabling ultra wide bandwidth for ultrasonic detection (predictive maintenance)**
- Ultra low power device for battery operated applications

HCLGA 4LD
3x4x1 mm



IMP34DT05 - DIGITAL

- Main parameters
 - Sensitivity : 26dB ±3dB
 - SNR: 64dB(A) (typ)
 - AOP: 122.5dBSPL
- High ESD protection ±15KV



FEATURES / BENEFITS

- High acoustic overload point to avoid sensor saturation due to loud sound detection
- Top port high robustness organic package (CbM)
- Digital output (PDM) is the optimal solution for complexity, cost and reliability



life.augmented

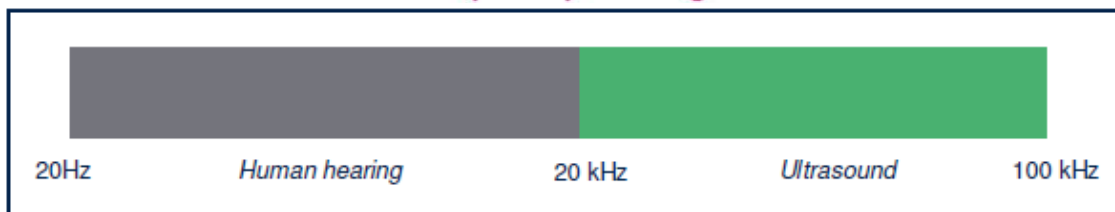
ST Confidential

IMP23ABSU

High performance microphone up to 80 kHz

Key Features

- Analog single-ended interface
- Supply 1.52-3.6V
- High Acoustic Overload Point of 130 dB SPL
- Nominal sensitivity -38dBV \pm 1dB @ 94 dB SPL
- 64 dB SNR
- Up to 80kHz of ultrasound bandwidth for predictive maintenance
- -40 to 85 deg temperature
- 3.5x2.65x0.98mm bottom port package



"Acoustic sound within the human hearing range.

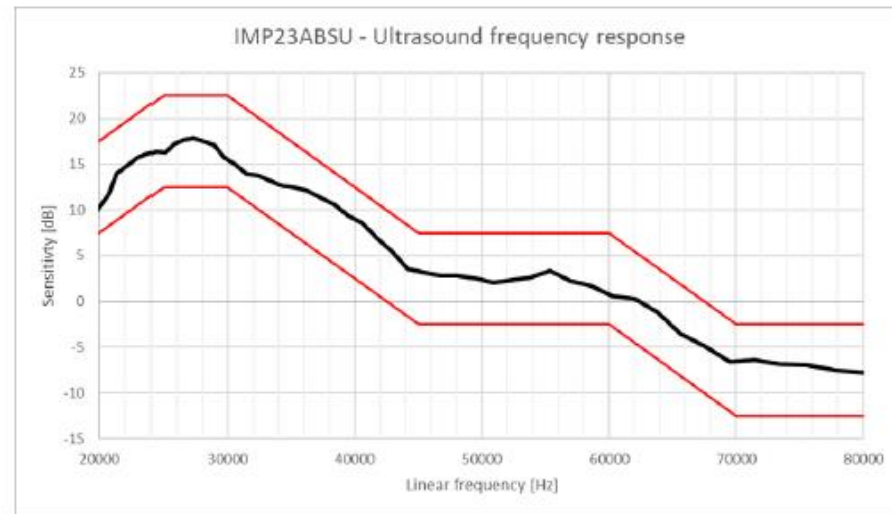
Most background noise in plants and other industrial facilities, including turbines, motors, and compressors, falls within this frequency range" *

"Acoustic sound beyond the human hearing range.

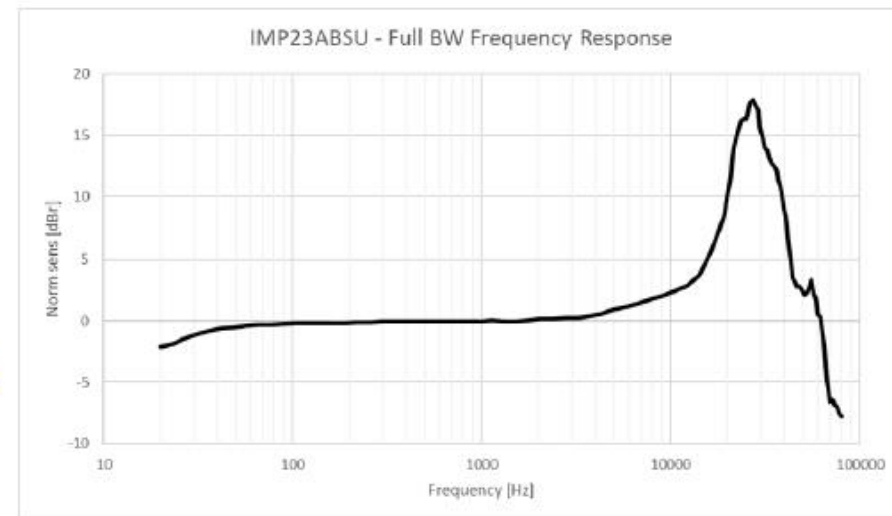
Very few background noise will occur on this area. Leaking gas produces acoustical sound within this range" *

*) Reference AZOsensors.com

See [AN5522](#) for more details



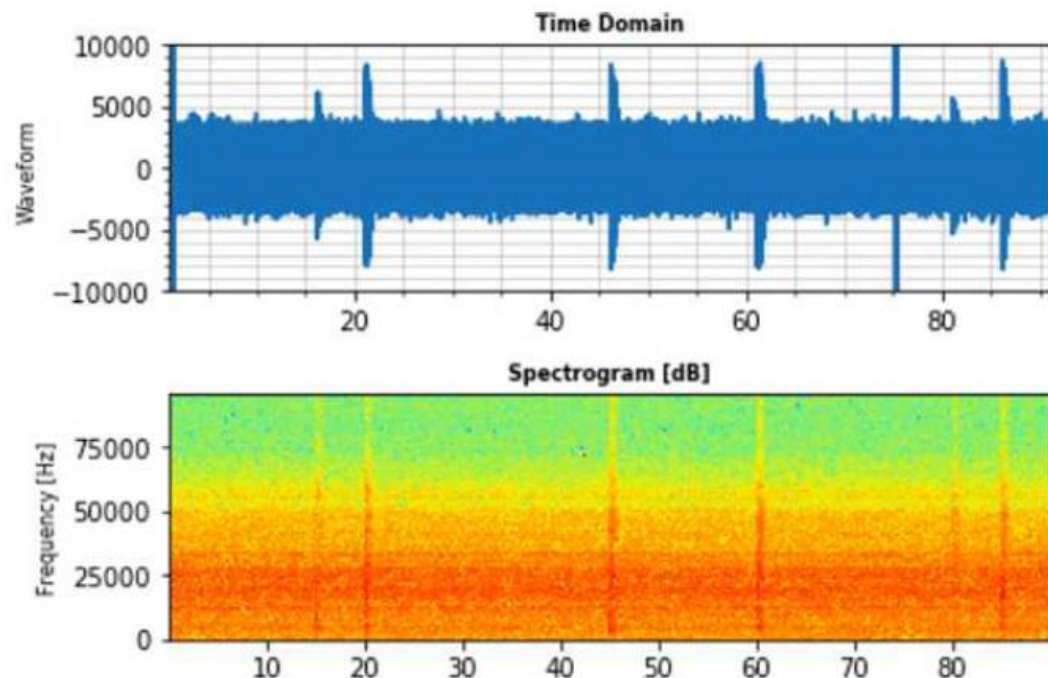
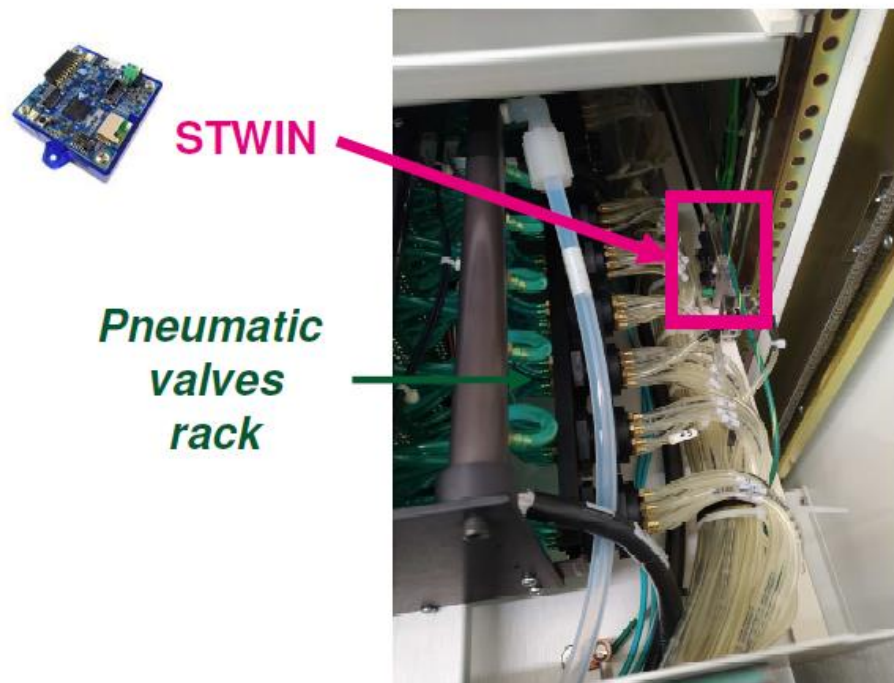
Ultrasound frequency response



Full frequency response in logarithmic scale

Ultrasound microphone for air and gas leakages

- N2 or air leaks are common on tools with large number of pneumatic valves
- Widely used in chemical process industry where the presence of chemical vapor harms valves functionality, keeping under control every valve is very challenging
- Gas leak detector with ultra-sound microphone is an “non-intrusive” monitoring method



Sensors Nodes for Environmental monitoring



New Temperature sensor STTS22H in brief

Technology evolution

TARGET SPECIFICATIONS

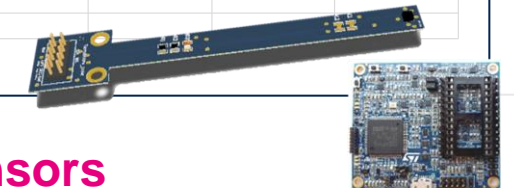
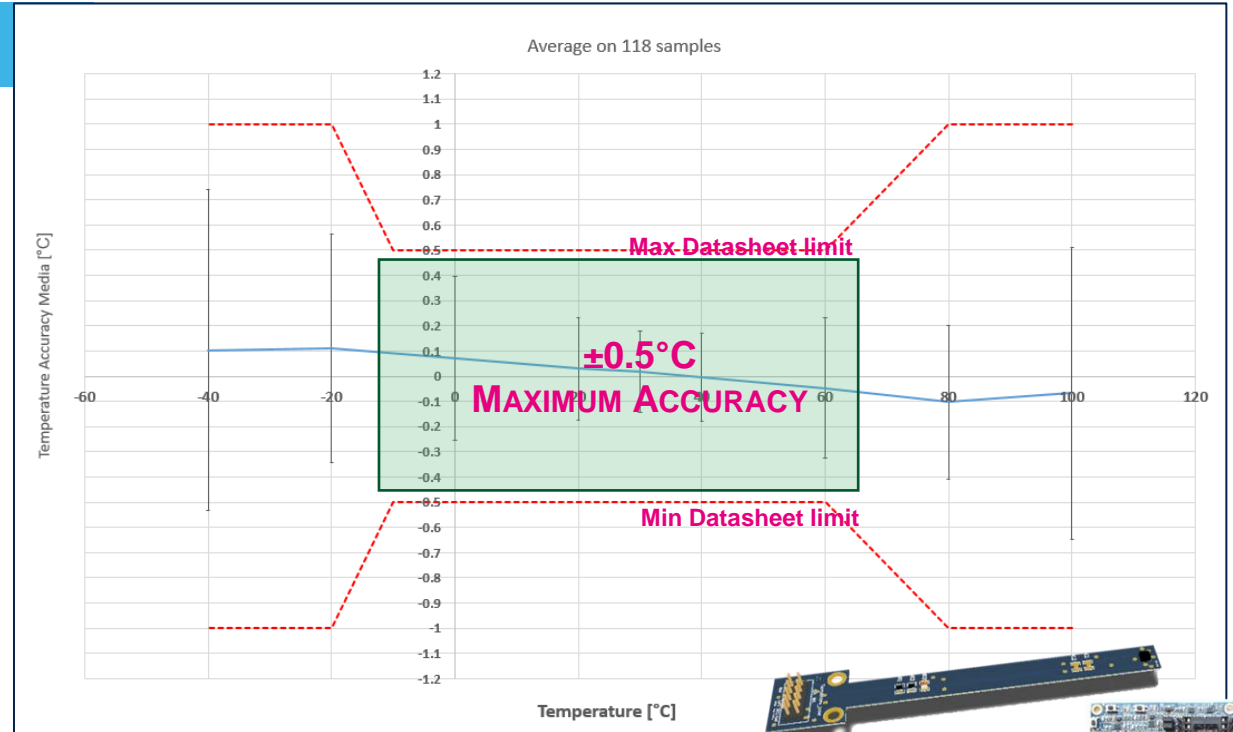
- Supply voltage: **1.5V – 3.6V**
- Current consumption: **1.7uA** in one shot mode
- Output interface: I2C / **SMBus 3.0**
- Programmable **interrupt / threshold**
- SMBus **ALERT support**
- Programmable I2C address (up to 4)
- Operating temperature range -40 °C to +125 °C
- Accuracy: **±0.5°C (max) [-10°C – 60°C]**

Selectable ODR (down to 1Hz)

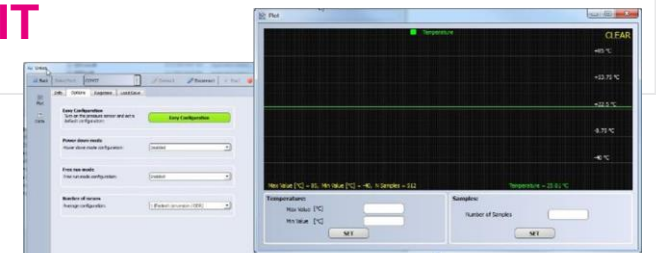
One shot reading mode

Package: UDFN-6L 2.0 x 2.0 x 0.5mm with **exposed pad down** for better temperature matching with external environment.

Shortest time/latency
Exposed pad to
measure temperature



**Temperature Sensors
Demo KIT**



NIST certification available
10-years longevity commitment



life.augmented

ST Confidential

New Products

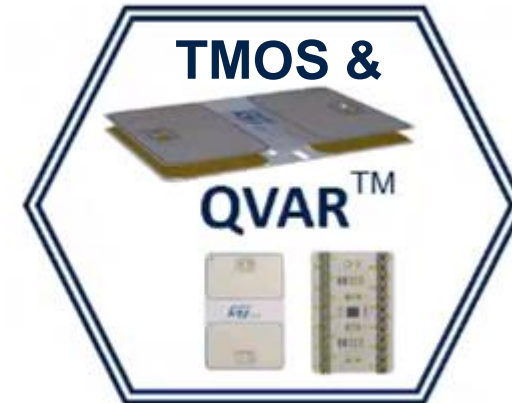
New Products Plans

High Pressure monitoring



- Altitude monitoring for optimized 5G Antenna set-up
105°C required
- Combustion optimization for gardening tools
- Gas meters & Boilers
- Automation pick and place required fast ODR& low latency

Presence Detection

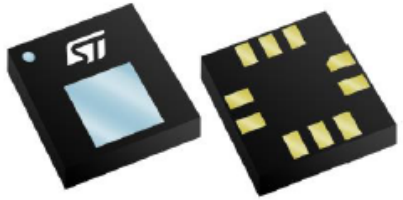


- Short distance detection (wake-up & Content detection)
- Presence detection in Home (Light control, display HMI..)
- Collaborative environment

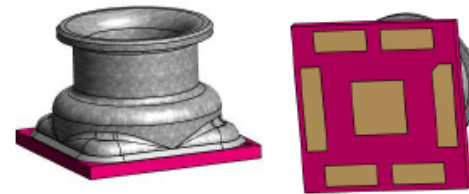
New ST Pressure Sensors ILPS22QS and ILPS28QSW

1st Dual Full scale (up to 4Bar) Pressure sensor enable to cover a wide spectrum of industrial applications

Sample Available
MP : Q1-22



QVAR Enabled



Water Proofing
Package up to 10Bar

Wider Full Scale up to
4Bar

Ultra low power
consumption

Robustness PKG to
mechanical stress of
10Bar Water proofing

ILPS22QS

Dual Full Scale Barometer

- ✓ Dual FS : ~ 1.26Bar / ~ 4Bar
- ✓ High performance with low power
- ✓ Absolute Accuracy = $\pm 0.5\text{hPa}$ (-20~80°C)
- ✓ Power consumption : 3.6uA [LP] / 9.2uA[HP]
- ✓ Noise RMS [UHP] = 0.3Pa
- ✓ 1.2V I3C Digital Interface
- ✓ LGA 2 x 2 x 0.73 mm³
- ✓ Extended Operating Temperature: -40°C +105°C

ILPS28QSW

Dual Full Scale WP Pressure Sensor

- ✓ Dual FS : ~ 1.26Bar / ~ 4Bar
- ✓ Power consumption : 3.6uA [LP] / 9.2uA[HP]
- ✓ Noise RMS [UHP] = 0.3Pa
- ✓ Superior robustness to ESD
- ✓ Robustness PKG to mechanical stress.
- ✓ Small Soldering Drift
- ✓ CLGA 2.85 x 2.85 x 1.95 mm³
- ✓ Extended Operating Temperature: -40°C +105°C

How to go further in Industrial Applications and Key customers identification

Enabled by new generation of ST Pressure Sensors



Industrial use cases

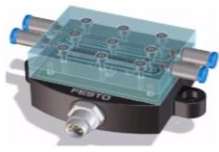
Gas Meters and Boilers



Gas monitoring in Waters and Domestic Boilers / new electric injection generation

Gas metering Boilers Gas tank

Industrial measurements



Differential measurements, Pick and place machines, Tools

Industrial measurements

Water Meters and Faucets



Flow rate and Leakage detection

Water meter Faucets & irrigation

Pumps, Pools and Lifts



Altitude and Depth

Pumps Pool Robot Lifts manufacturers

Airplane mode detection



Recognize take-off and landing to set the radio/GPS signal

Asset Tracking SMART Filter

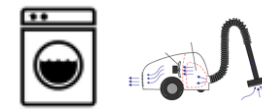
Air Flow and Monitoring



Air flow detection

HVAC Condition Monitoring

Home Appliances



Water level and Air flow detection

Washing Machine Dish Washer Vacuum Cleaner Cooking chamber Laundry dryer filter

Motors/Liquids and Batteries



Sensor comes in direct contact with liquids, water, gasoline, diesel, oil .. checking the height

Motors as chainsaw and lawnmower Liquids level

Medical



Monitoring of atmospheric pressure and in the patient's airways during insufflation of air and oxygen

Ventilators

Introducing new category of sensors: Qvar™ and TMOS

QVAR: Sensing Electrostatic charge variation (1-2 meters)

Qvar stands for Electric Charge (**Q**) Variation (**var**):

Enabled sensors detect the differential electric potential variation induced on the **electrodes** connected on

TMOS: Infrared Radiation Sensing (5-10 meters)

STHS34PF80 is the first of a family Presence/Motion detection by absolute temperature from embedded IR technology

Electrodes on body

(In contact/Not in contact with human skin)



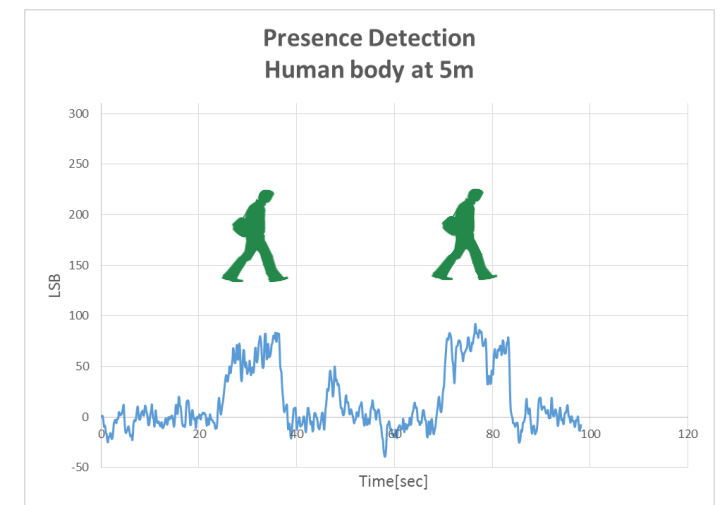
Improved Activity Detection

Electrodes in proximity

(Radar function)



Presence Sensing



Also to detect static presence (no movement)
Compete with PIR sensor

Qvar™ enabled sensors

Combined with Motion and Pressure

Sensors fusion to improve user experience

QVar only available at ST

Samples available

Motion MEMS + Qvar



6x IMU

QVAR™
engine

- Presence detection
- Contact & Proximity check
- E-Button
- Human body motion

Pressure Sensor + Qvar

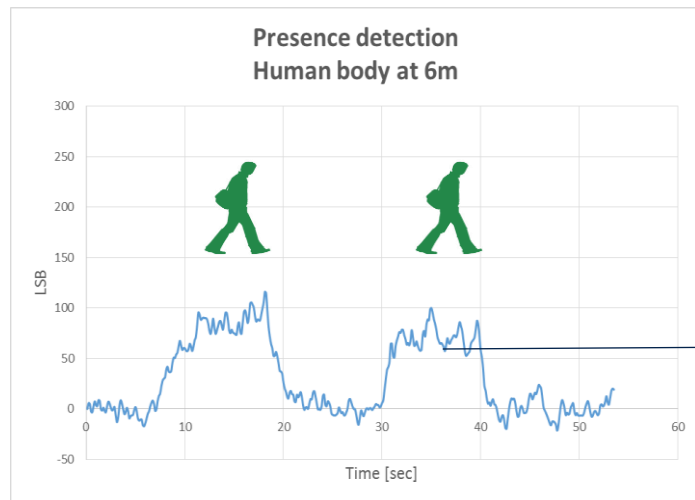
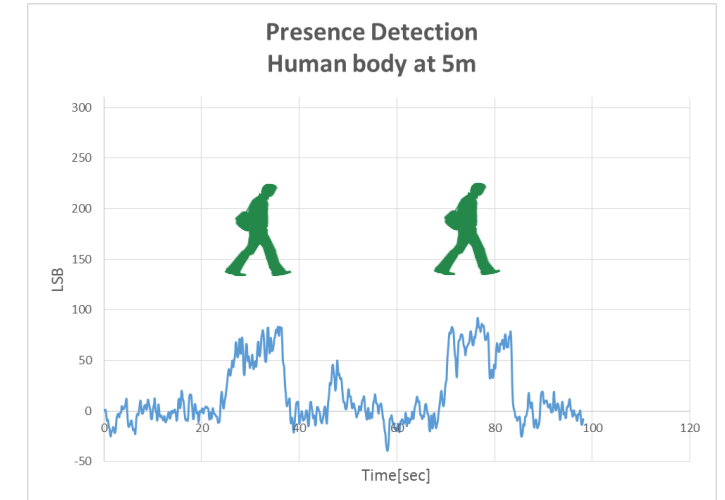
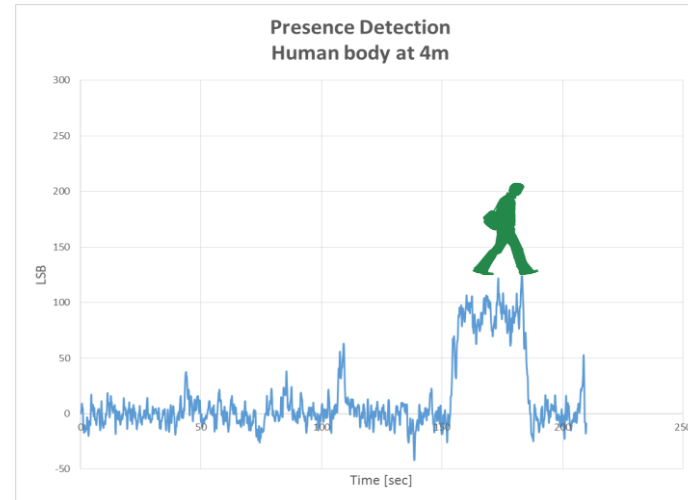
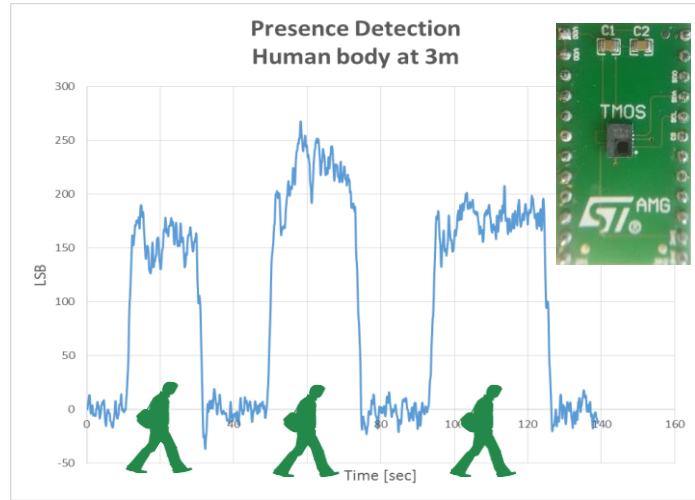


Pressure

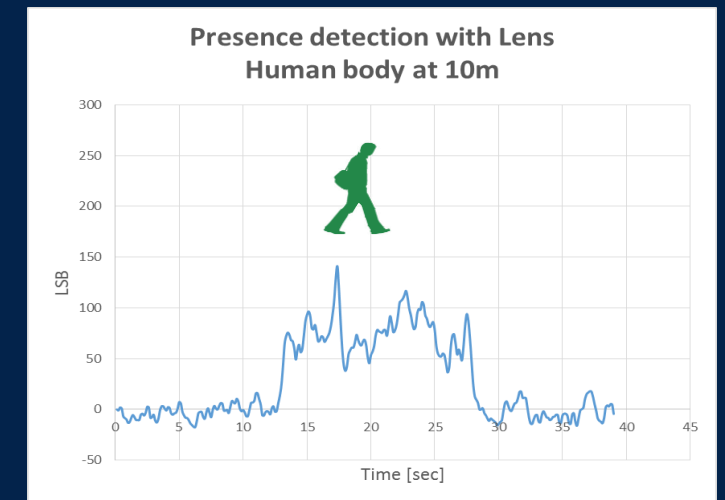
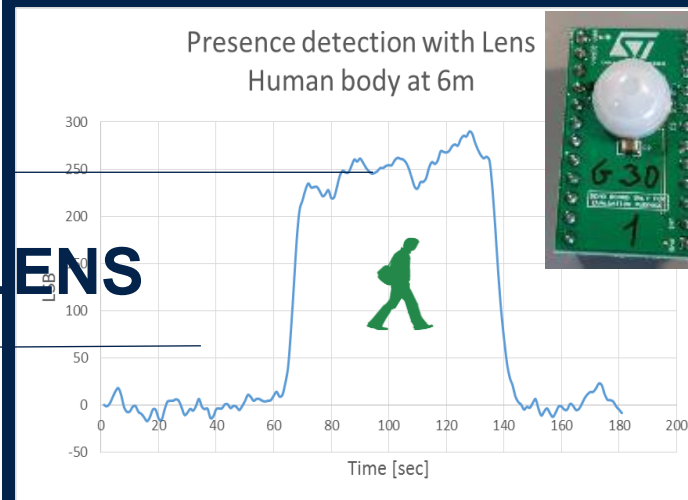
QVAR™
engine

- Presence detection
- Contact & Proximity check
- Floor level detection
- In liquid detection
- User activity detection

TMOS Human Presence detection



↑
LENS



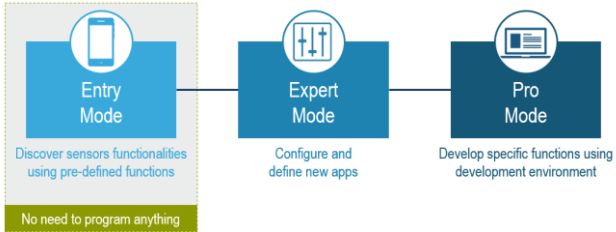
**Test With Additional LENS: reach is improved
STHS34PF80 gain sensitivity**

Something to proceed together ..

Hardware devices

Software

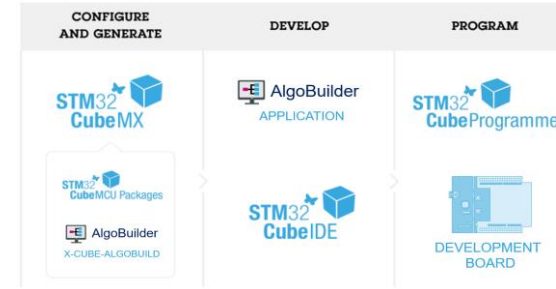
Most Useful tools to have in mind



SensorTile.box



STWIN



for the graphical design of algorithms

AlgoBuilder Suite

for Android and iOS



Display, program and sensor data push to Clouds

ST BLE Sensor App

Consumer sensors X-NUCLEO-IKS01A3 Industrial sensors X-NUCLEO-IKS02A1

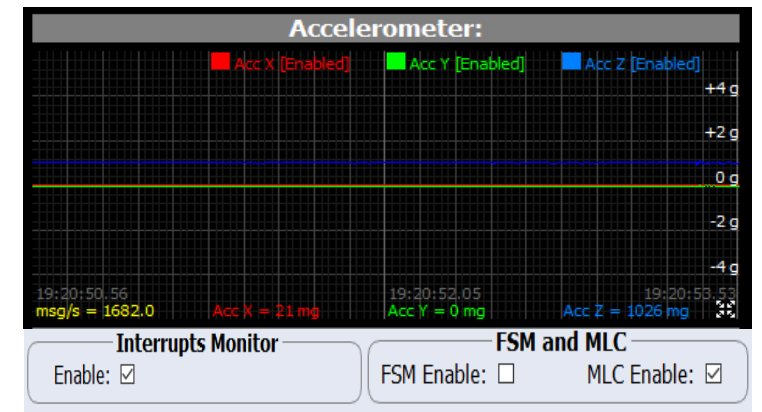


Evaluate All ST sensors through DIL24 adapter

STEVAL-MKI109V3

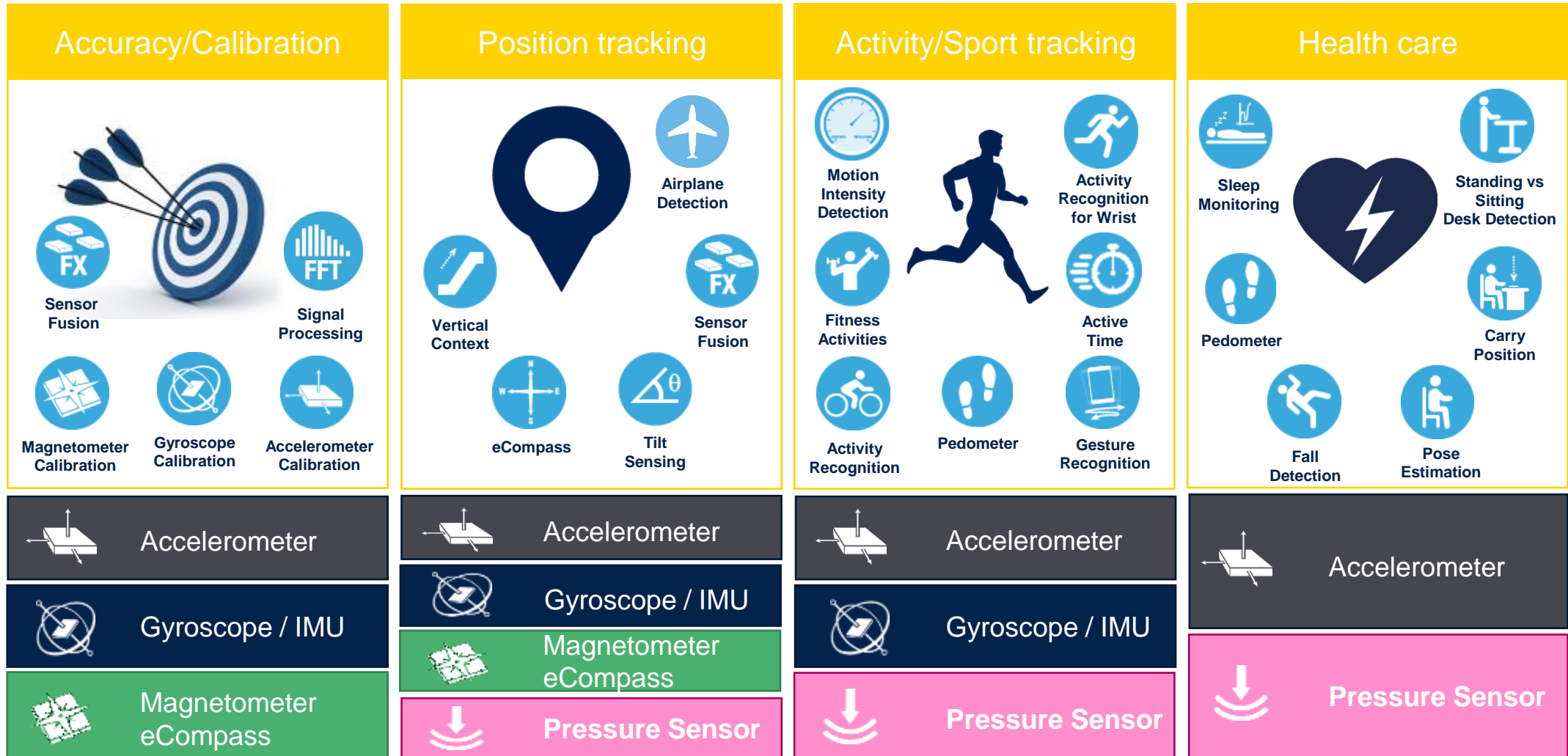
Profi MEMS tool

for Linux, Mac OSX and Windows



Unico & Unicleo - GUI

The right SW for your Sensors



These libraries are available free of charge in [X-CUBE-MEMS1](#) and [X-CUBE-MEMS-XT1](#) packages.



Open position at STMicroelectronics

Company: STM - Global semiconductor leader serving customers across the spectrum of electronics applications
<https://www.st.com>

Position: **Technical Product Marketing** (junior)

We are searching an engineer interested to support the customers to build complete solutions and involved in the promotion of ST products.

Electronical competences are important in the interaction with colleagues and to bring to customers the value of ST products.

Products area: ST MEMS Sensors, RF Connectivity and Power Management.

Location: Settimo Milanese (Milano)

Reference: antonio.cirone@st.com – 366-6325260

Thank you

© STMicroelectronics - All rights reserved.

The STMicroelectronics corporate logo is a registered trademark of the STMicroelectronics group of companies. All other names are the property of their respective owners.



life.augmented