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Industrial Summit 2021
Shenzhen, China
POWERING YOUR INNOVATION

X-CUBE-MCSDK Update

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Agenda

1 STM32 for Motor Control

2 X-CUBE-MCSDK Update

3 X-CUBE-MCSDK 5.Y.3 Demo

4 Highlights on X-CUBE-MCSDK

5 Q&A

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STM32 for Motor Control

COUPLING CONTROL & POWER BOAR

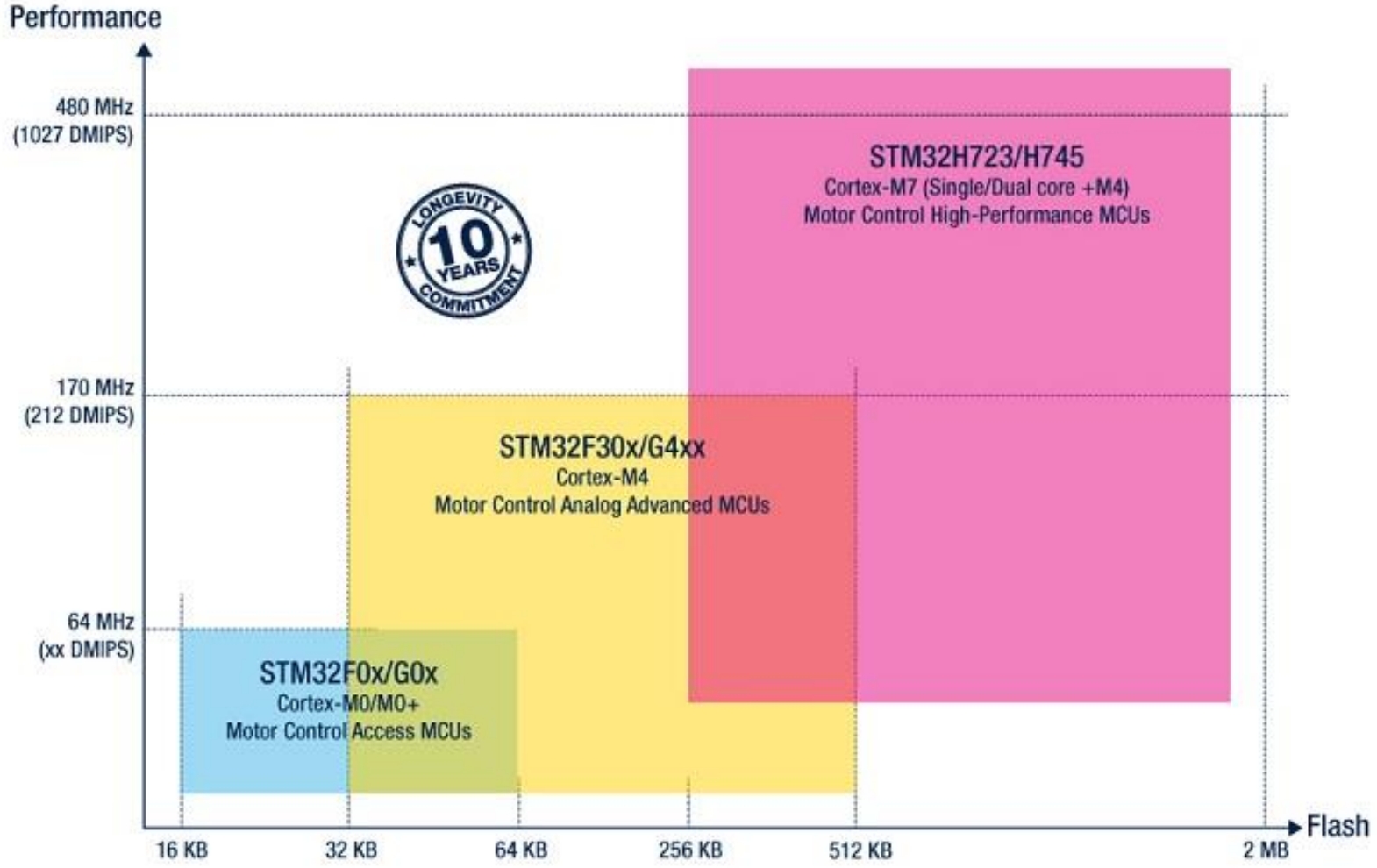
Control Board

MC Connector

Power Board

All our boards are listed in the **ST-MC-SUITE** tool

STM32 for Motor Control



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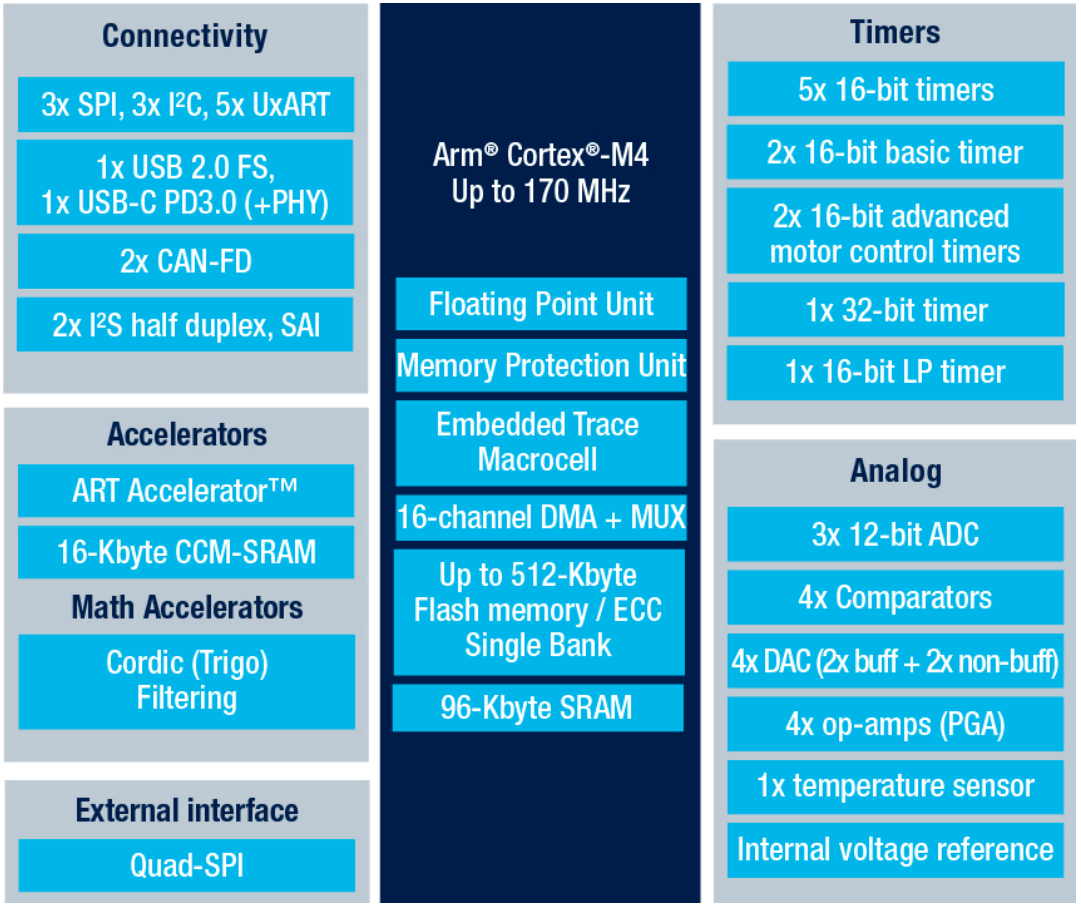
STM32G491 Block Diagram

Access line [32KB .. 512KB]

- 32-bit Arm Cortex-M4 core with FPU
- ART + CCM-SRAM + Mathematic Accelerators
- Single Bank Flash with ECC
- SRAM with Parity bit
- +/- 1% internal clock
- 1.72 to 3.6V power supply
- Up to 125°C



- Advanced Motor Control timers
- Rich Advanced Analog
- CAN Flexible Data rate
- USB-C Power Delivery3.0
- Advanced Security and Safety features
- Robustness: highest level 5 / FTB/ESD - IEC 61000-4-4

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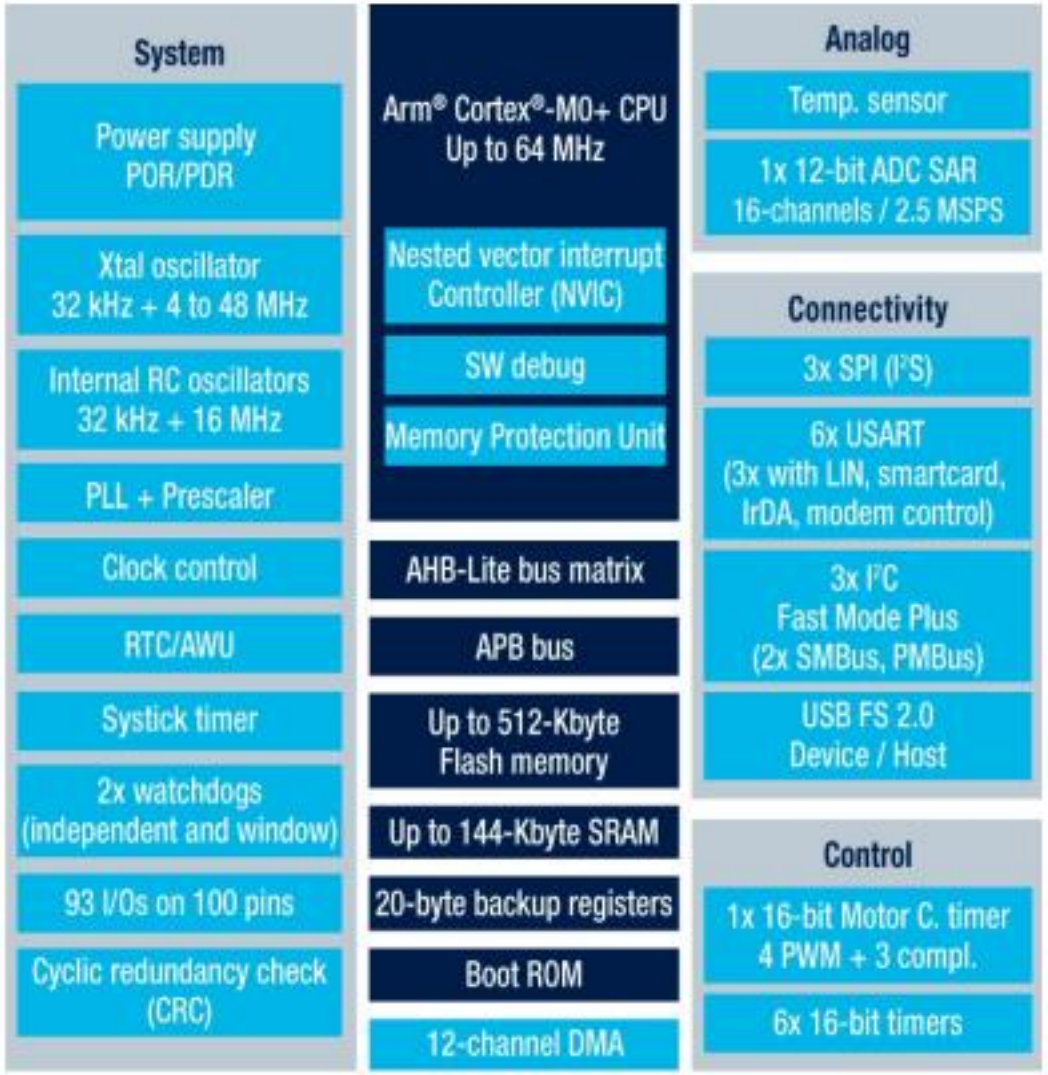
STM32 G0 Value Line-STM32G030

- 32-bit Arm Cortex-M0+ core
- 2.0 to 3.6V power supply
- RAM maximization
- 1% internal clock
- Direct Memory Access (DMA)
- Communication peripherals



- Timers
- Real-time Clock
- I/O ports maximization
- 12-bit Ultra-fast ADC
- Safety features

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STM32H7 Features for Motor Control

Features	STM32H723/733/725/735/730	Benifit
Core	Cortex M7	Performance and efficiency
FPU	yes	Performance and efficiency
MPU	yes	Safety
Freq CPU max	550MHz	Performance and efficiency
DMIPS	1177	Performance and efficiency
Flash / SRAM data size	128kB to 1MB/564kB	Performance and integration/cost
Including: ICTM/DCTM RAM	Up to 256kB(configurable) / 128kB	Performance and efficiency
Error Code Correction	SECDED on full memory map	Safety
ADC SAR	2x16bit 3.6Msps, 1x12bit 5Msps	Efficiency
Other Analog	2xcomp, 2xPGA, 2xDAC, 1xDFSDM	Integration/cost
Advanced Motor Control Timer	2x(275MHz)	Performance and efficiency
Cache and Accelerator	32kB+32kB L1 cache Graphic, CORDIC,FMAC,Cypro*	Performance and efficiency
Security Services (SFI and SB-SFU)	Yes*	System Integrity
Package	VFQFPN68 LQFP100/144/176 BGA100/144/169/176 WLCSP11	Cost/Integration/flexibility
Max Temperature range °C	[-40 .. +125] Tj max 140°C	Integration and cost

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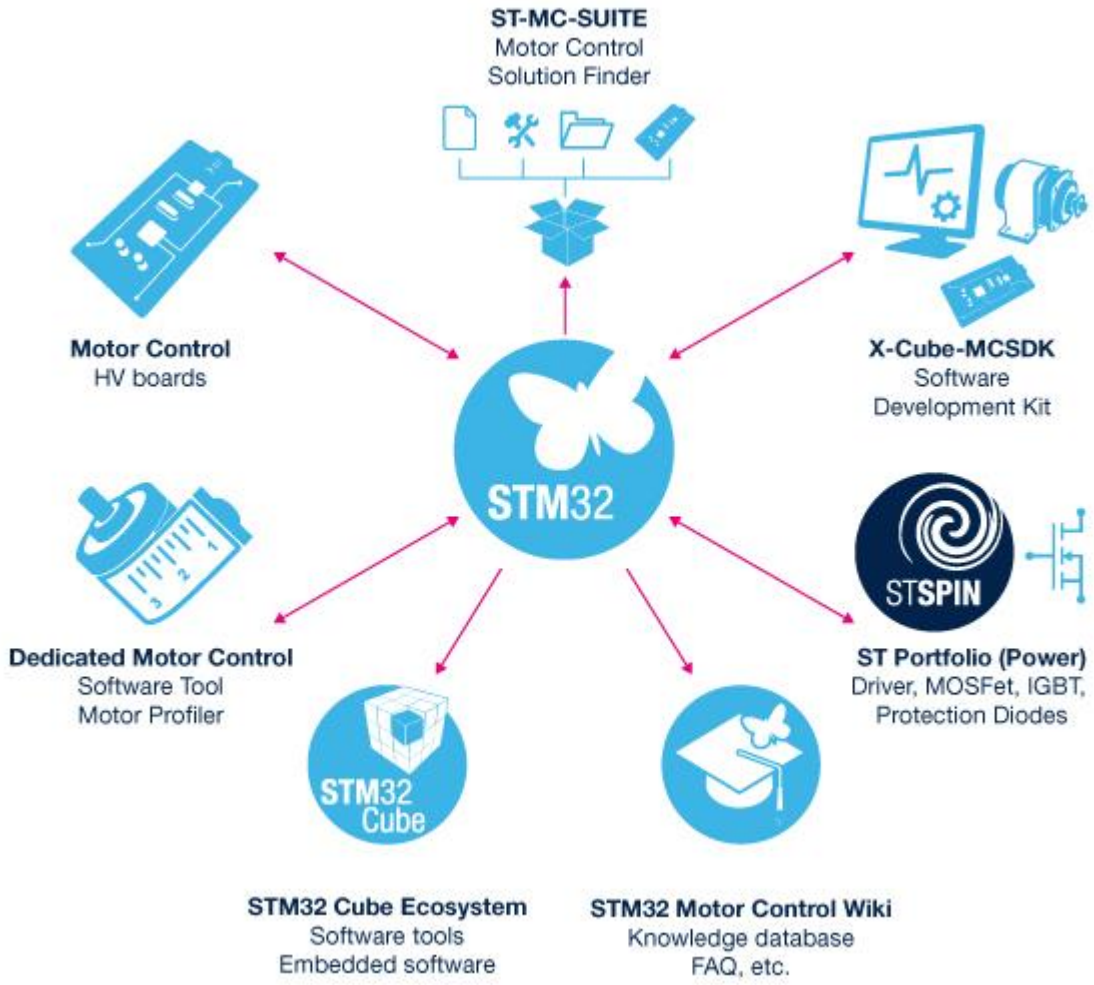
X-CUBE-MCSDK Update

STM32 Ecosystem for Motor Control



- X-CUBE-MCSDK
- ST-MC-SUITE
- Motor Profiler
- STM32 Cube Ecosystem
- STM32 Motor Control Wiki

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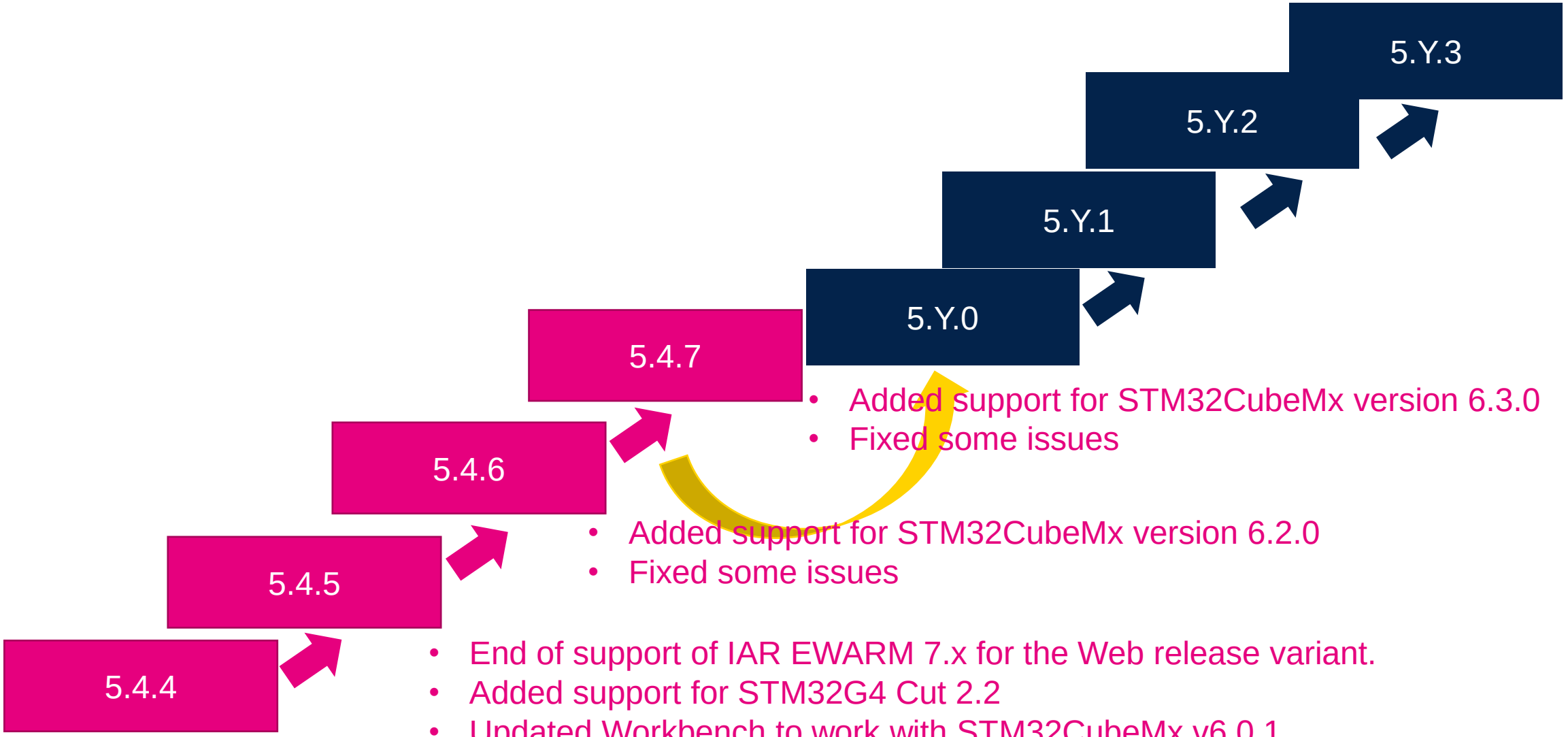
Update information since X-CUBE-MCSDK5.4.4



- Added support for STM32CubeMx version 6.3.0
- Fixed some issues

- Added support for STM32CubeMx version 6.2.0
- Fixed some issues

- End of support of IAR EWARM 7.x for the Web release variant.
- Added support for STM32G4 Cut 2.2
- Updated Workbench to work with STM32CubeMx v6.0.1
- Added support for new power boards
- Fixed some issues

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X-CUBE-MCSDK 5.Y(1/2)

- Introduced a version of ST Motor Pilot, the new monitoring tool of the X-CUBE_MCSDK.
- Removed the legacy Monitor from the Workbench
- A brand new communication protocol has been implemented and replace the legacy version.

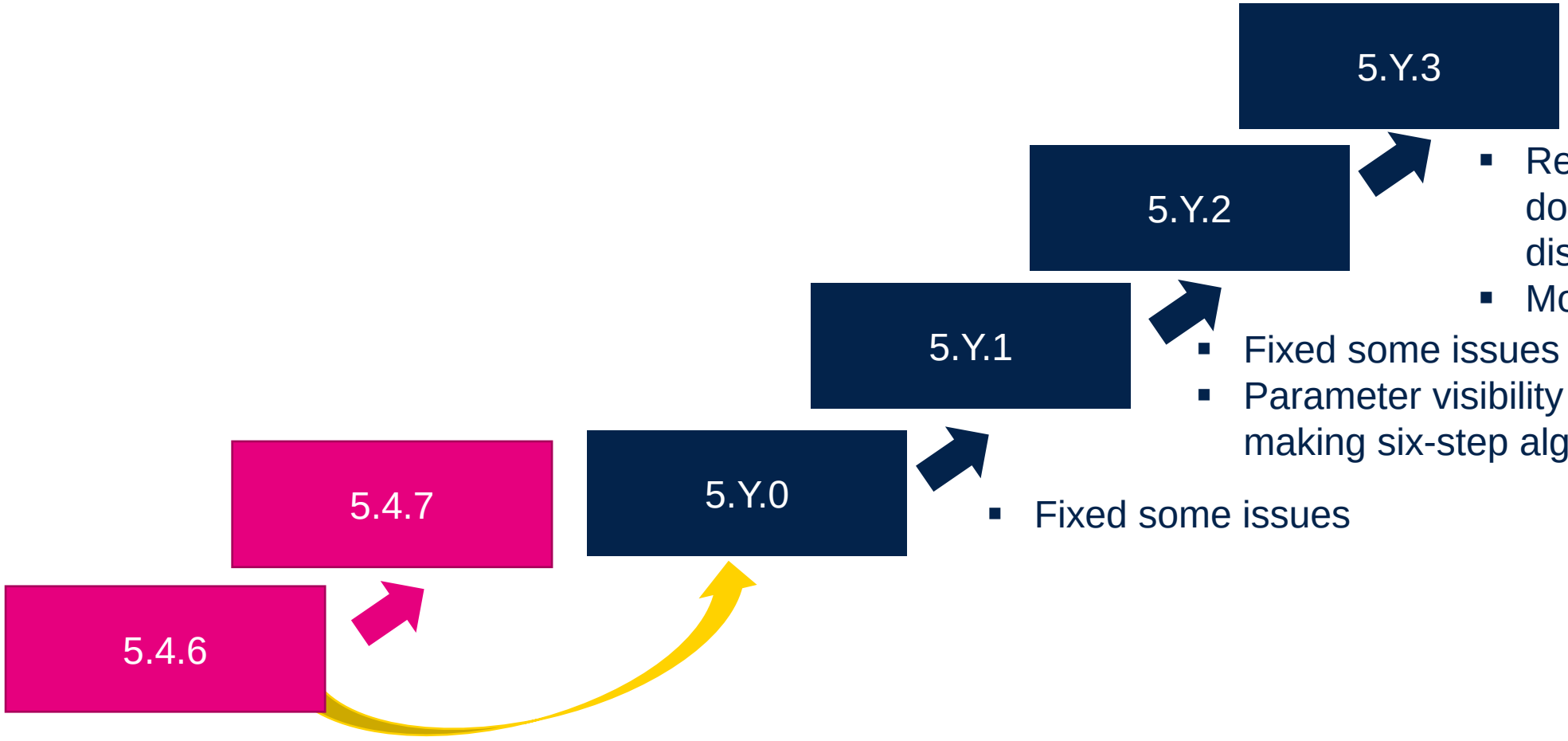
For PMSM/BLDC Motors:

- Discontinuous PWM (aka. Two-phase modulation)
- Over Modulation can be activated from the Workbench, in the Firmware Drive Management / Additional Features tab
- Single Shunt with Phase Shift.
- Circle Limitation VD, a better variant of the circle limitation algorithm
- Added support for the STSPIN32G4 devices
- Added support for new boards
- Added support for the EVALSTDRIVE101 power board
- Added support of the HSI clock source for STM32L452 and STM32L476 devices.
- **Removed support for the STM32F1 devices series.(PFC using F1 is not supported anymore accordingly)**
- Six Step examples improvements

For Asynchronous Motors:

- ACIM motors are supported as two examples featuring FOC sensorless and V/f (scalar) modes. A graphical PC tool is delivered wit the SDK to help configuring this example: ACIM GUI. The two examples are designed for NUCLEO-G431RB + STEVAL-IHM023V3 configurations.

X-CUBE-MCSDK 5.Y(2/2)

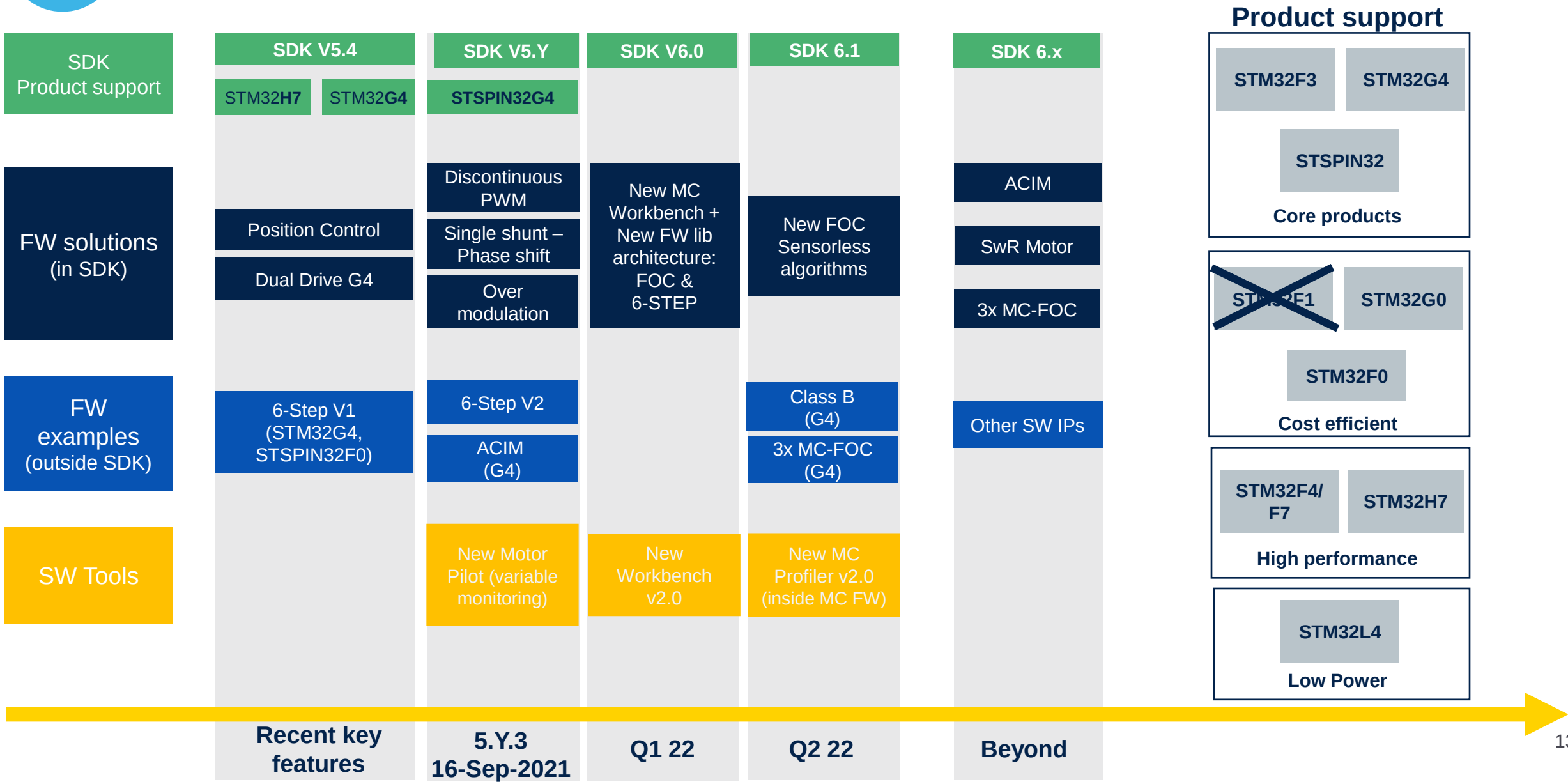


- Fixed some issues

- Fixed some issues
- Parameter visibility in STM32CubeMx for making six-step algorithm configurable

- Reintroduced pdf documentations that had disappeared in 5.Y.2.
- Motor Pilot improvement

Motor Control – SDK Roadmap at a glance



Reference documents

Doc Number	Title
UM2374	Getting started with STM32 motor control SDK v5.0
UM2392	STM32 motor control SDK5.x - Firmware
UM2380	STM32 motor control SDK v5.2 tools
AN5143	How to migrate motor control application software from SDK v4.3 to SDK v5.x
AN5166	Guidelines for control and customization of power boards with STM32 MC SDK v5.0

X-CUBE-MCSDK 5.Y.3 Demo

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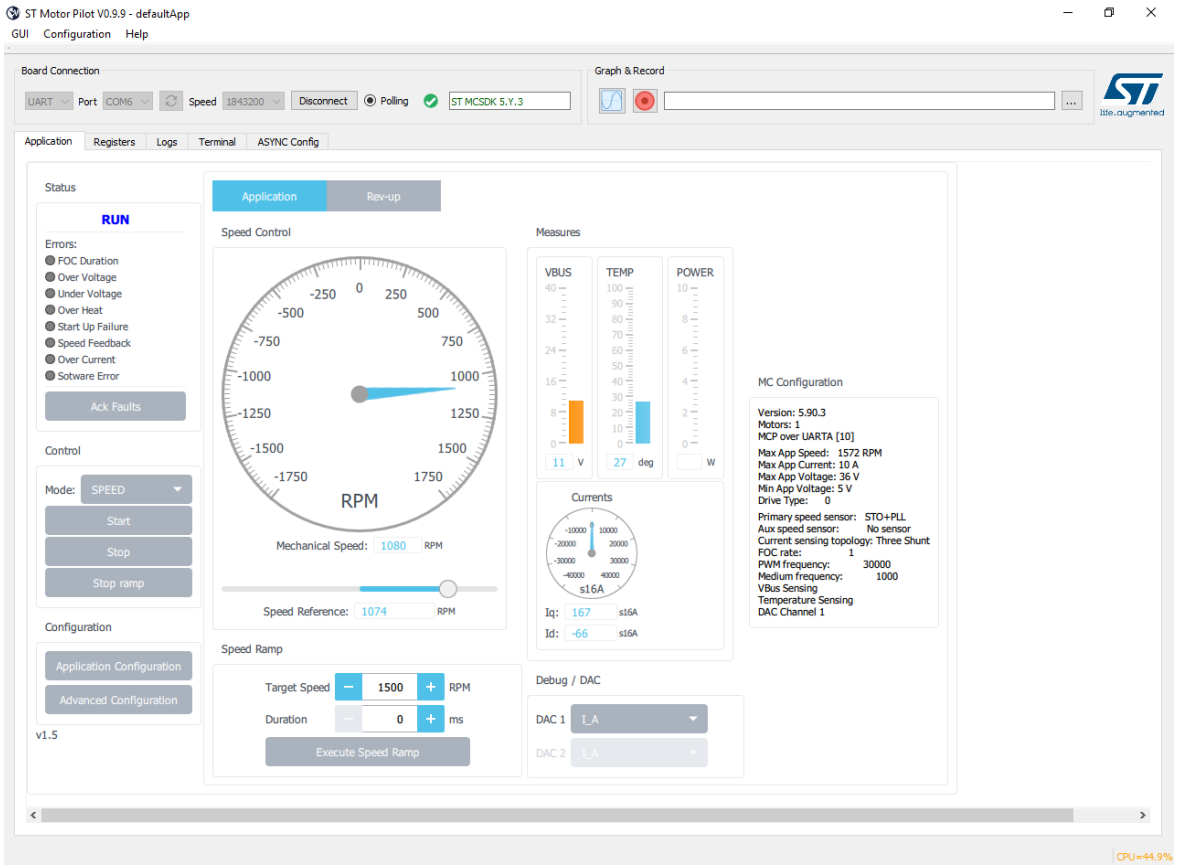
STM32 MC Motor Pilot

Monitoring tool for STM32 motor-control applications



- Connects to MC applications built with the UI module through the serial port.
- Allows for controlling, monitoring, and tuning MC applications.
- Will replace the monitor part of STM32 MC workbench.

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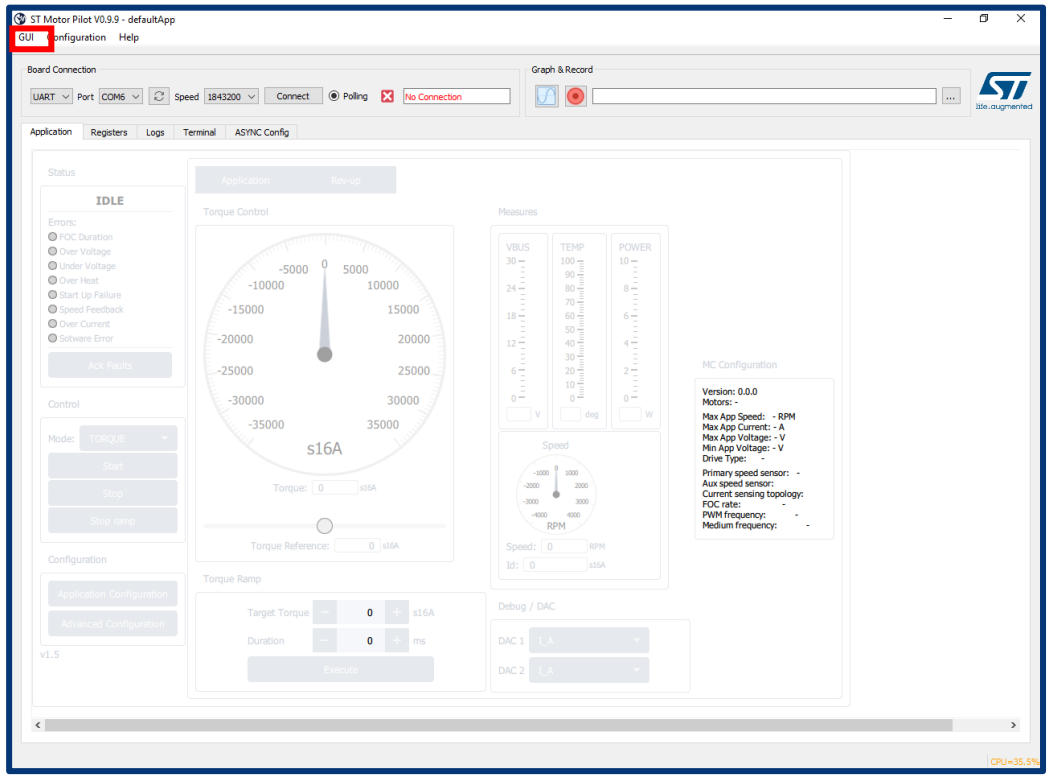
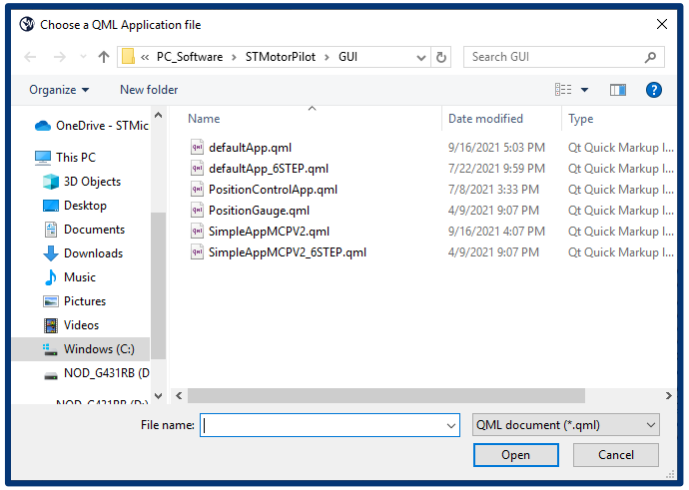
Added values

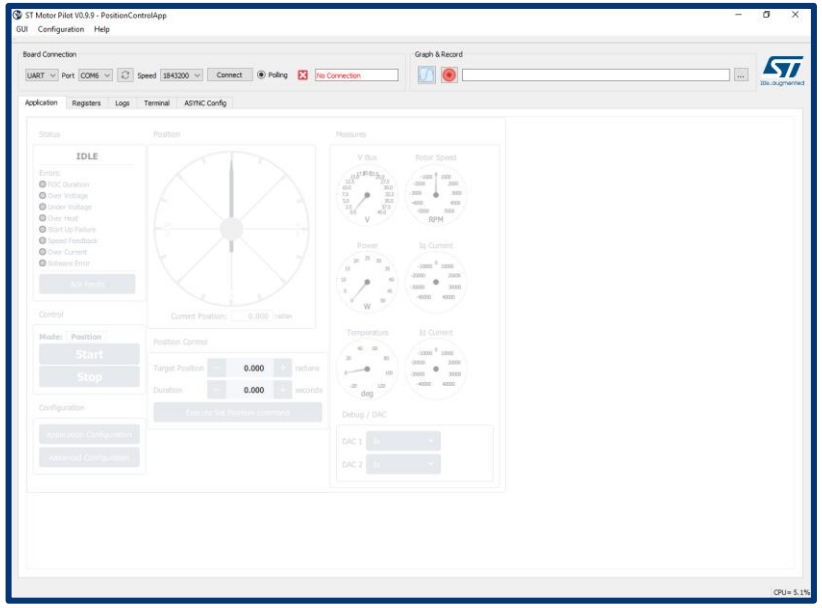
Runs on all three MCD target platforms: Windows, Mac, and Linux

- Enhanced plotting feature: the user can now plot most registers
- The user can easily customize GUI
  - To fit specific needs or to experiment with new firmware features
- Solid foundation to support future firmware features
  - ACIM, 6-Step, Sensorless Zero speed, enhanced debug features

Several Motor Pilot applications







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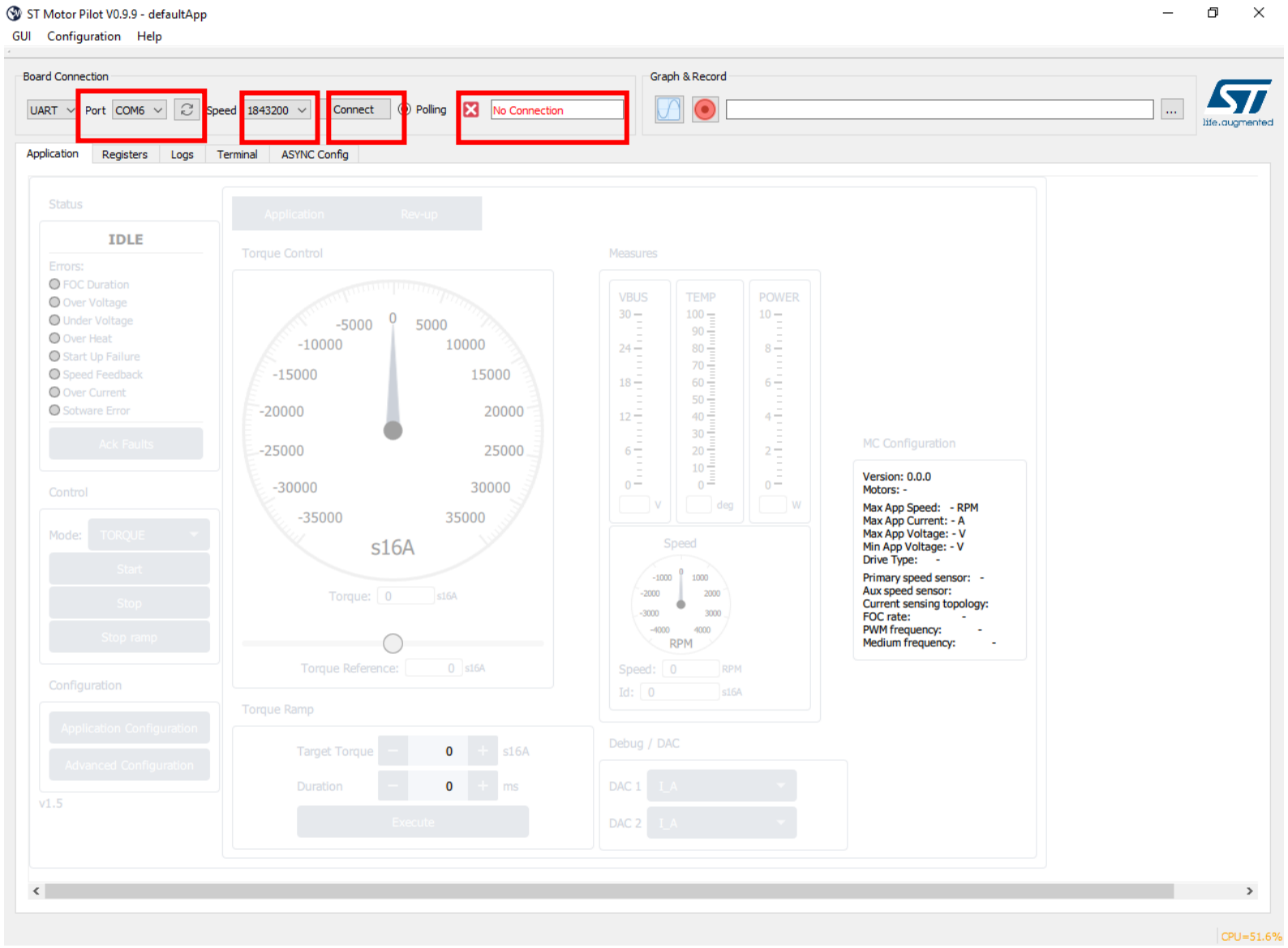
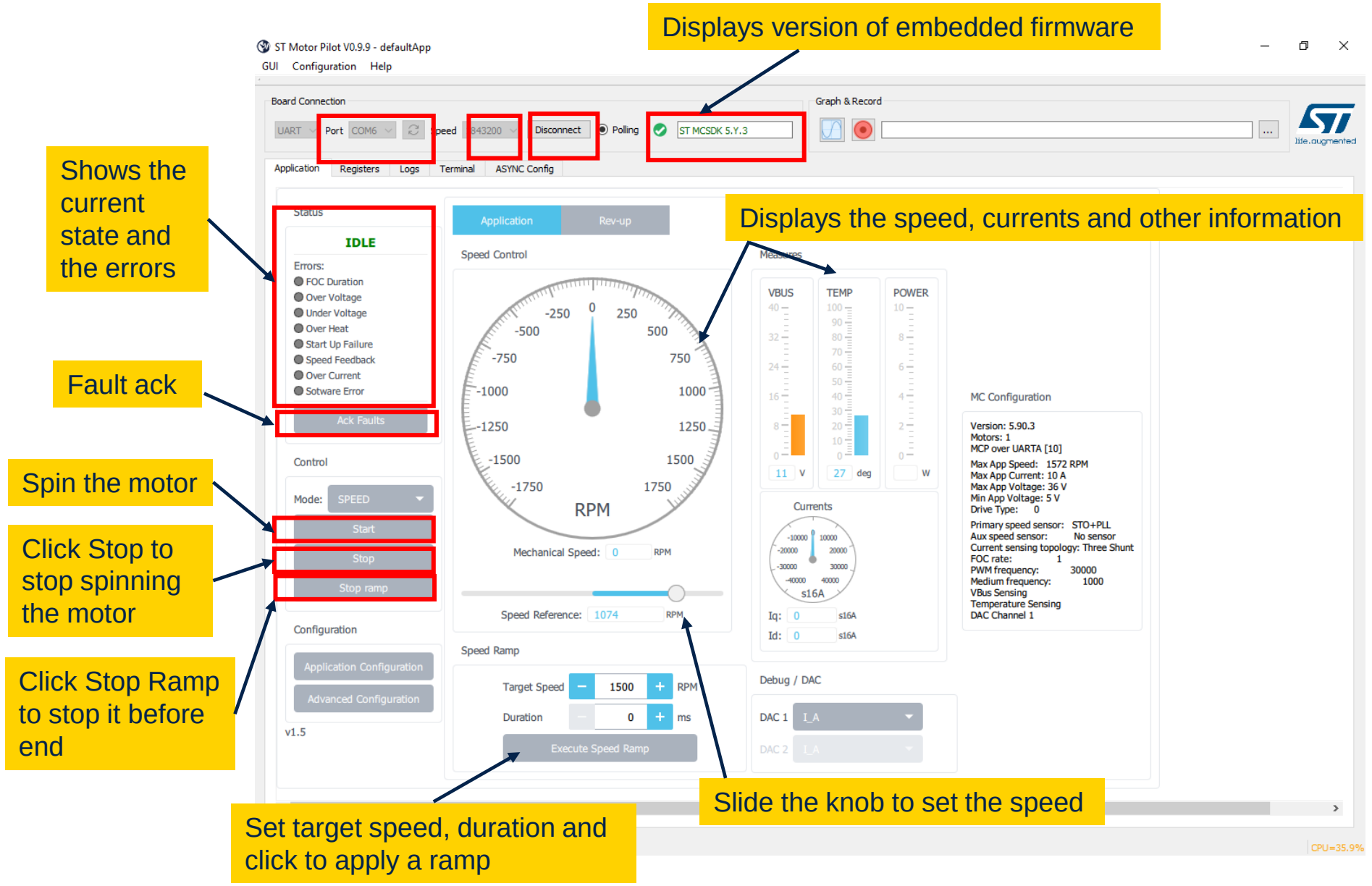
Quick start-up

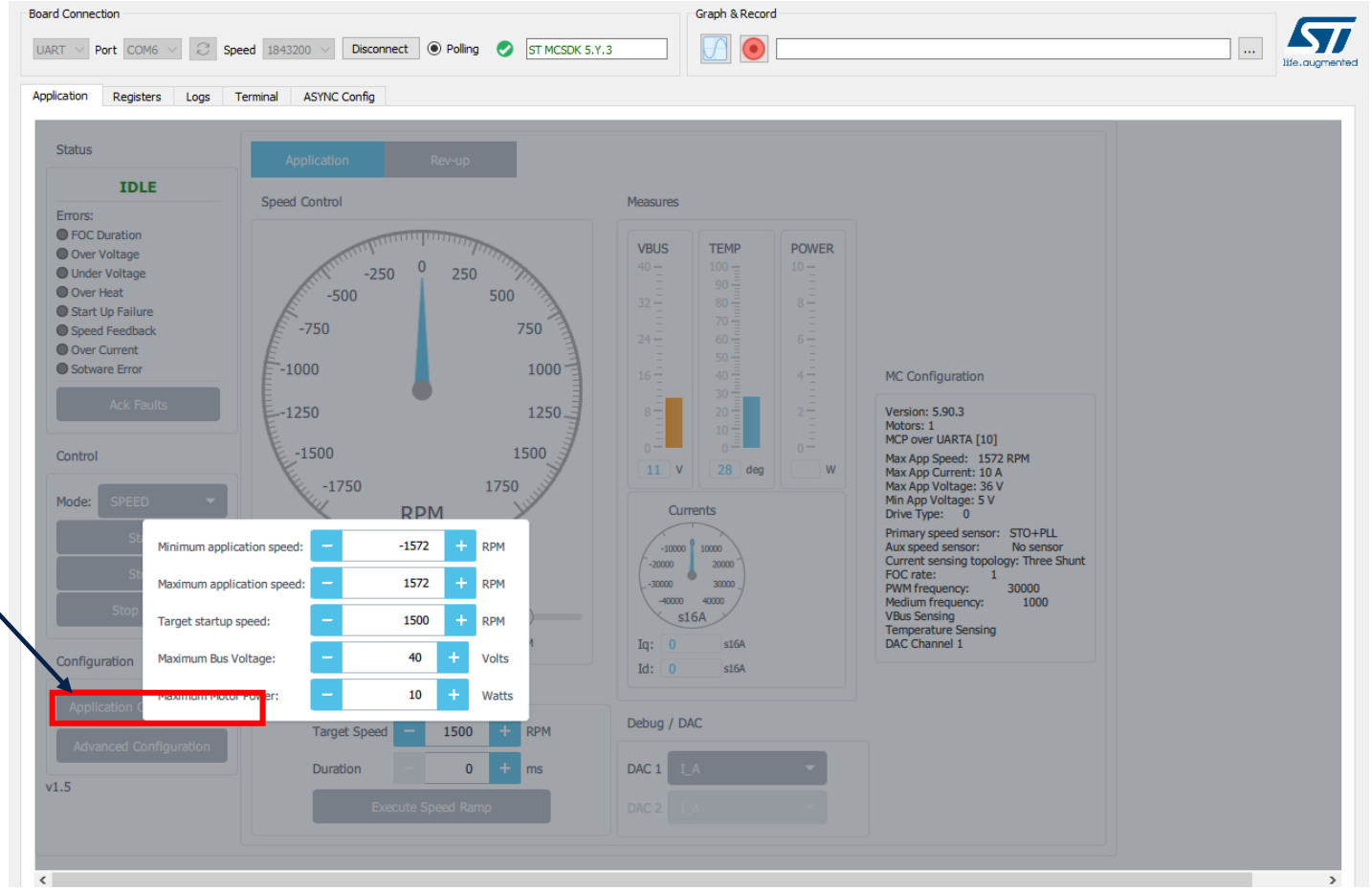


Control the motor



MC application parameters

STM32 MC Motor Pilot gets MC application parameters from the board and adapts widgets to them

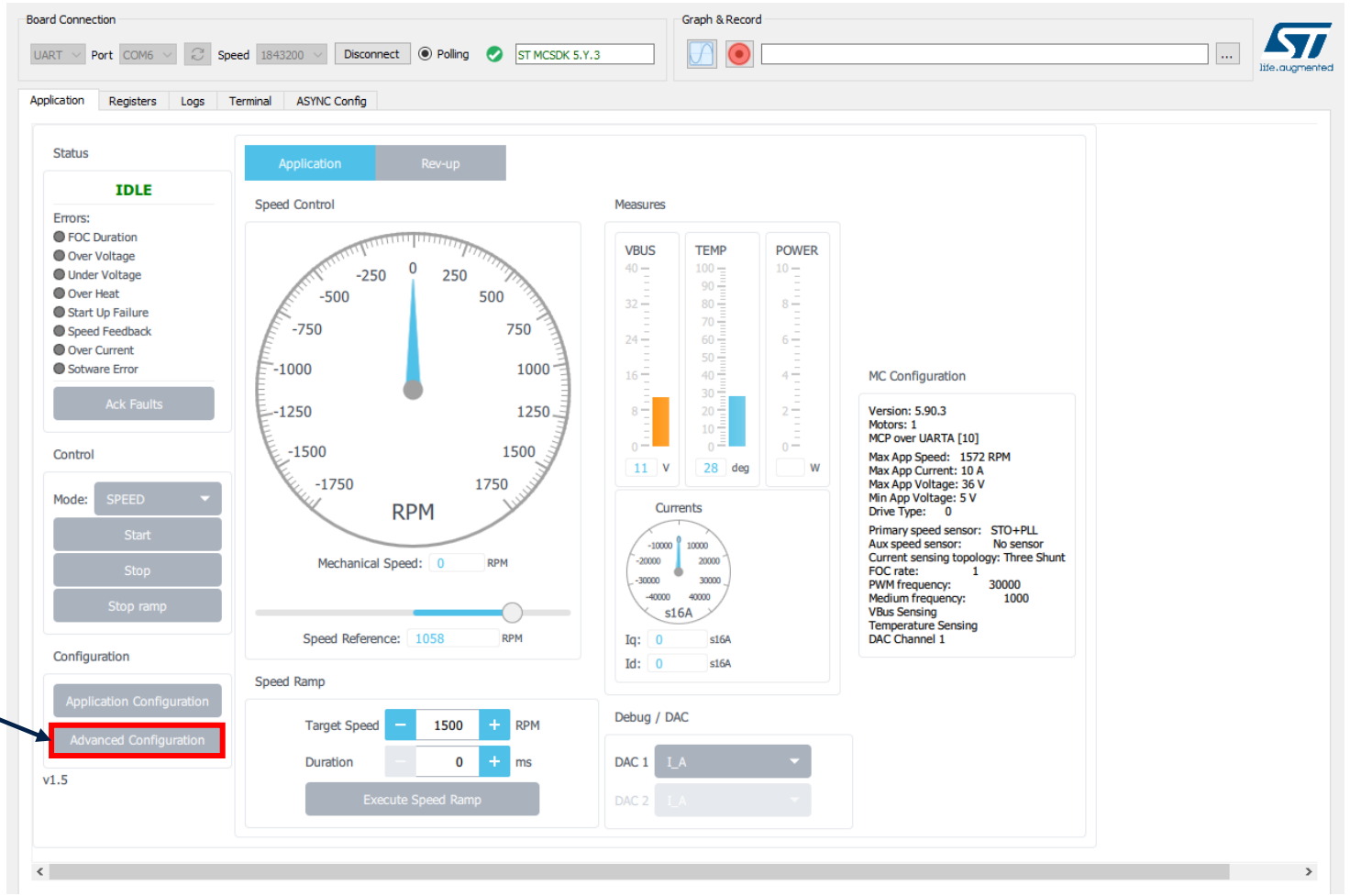


MC application parameters

MC application advanced settings(1)

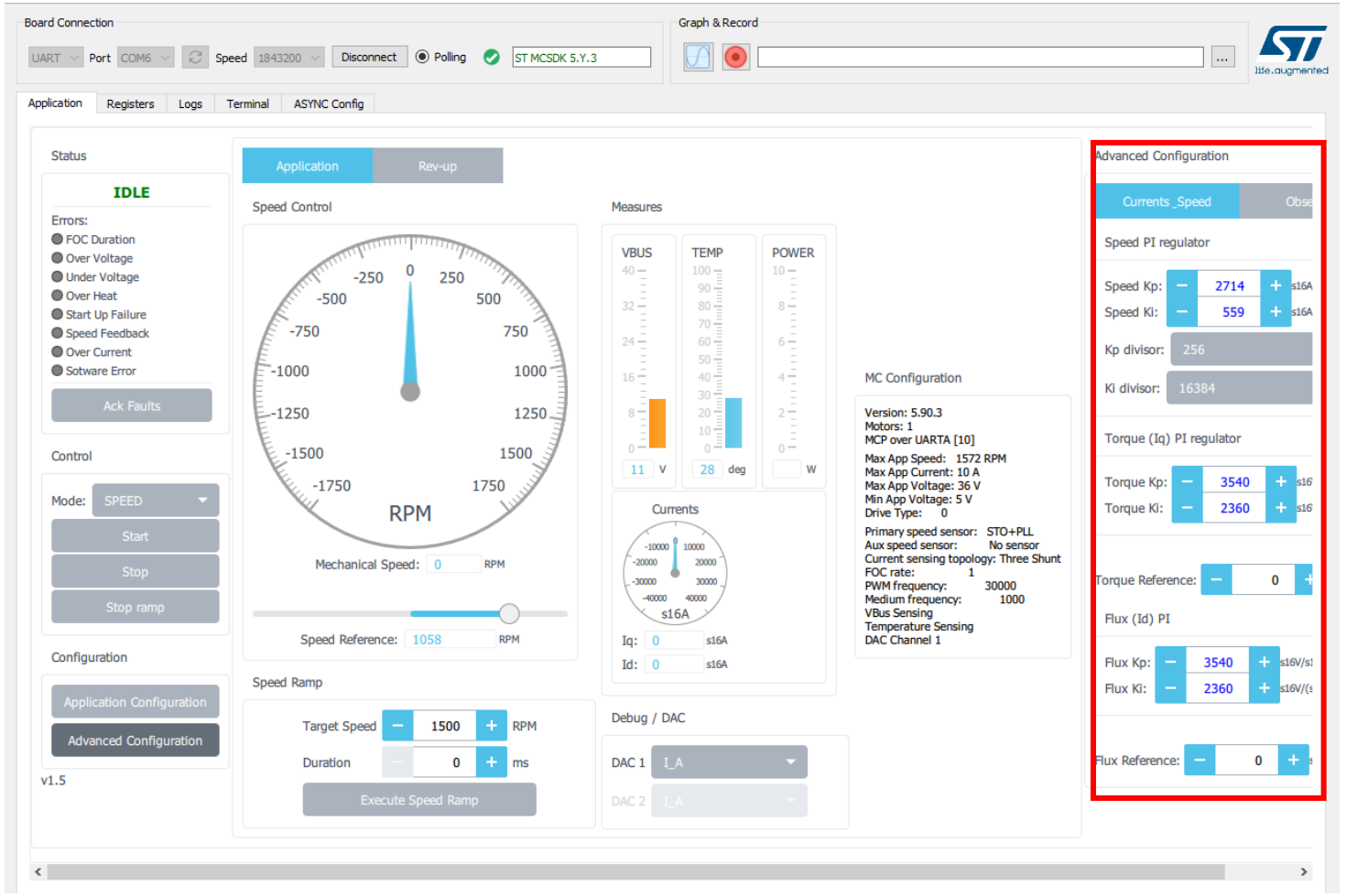
Speed PID, Toque PID, Flux PID and Flux reference

Click Advanced Configuration



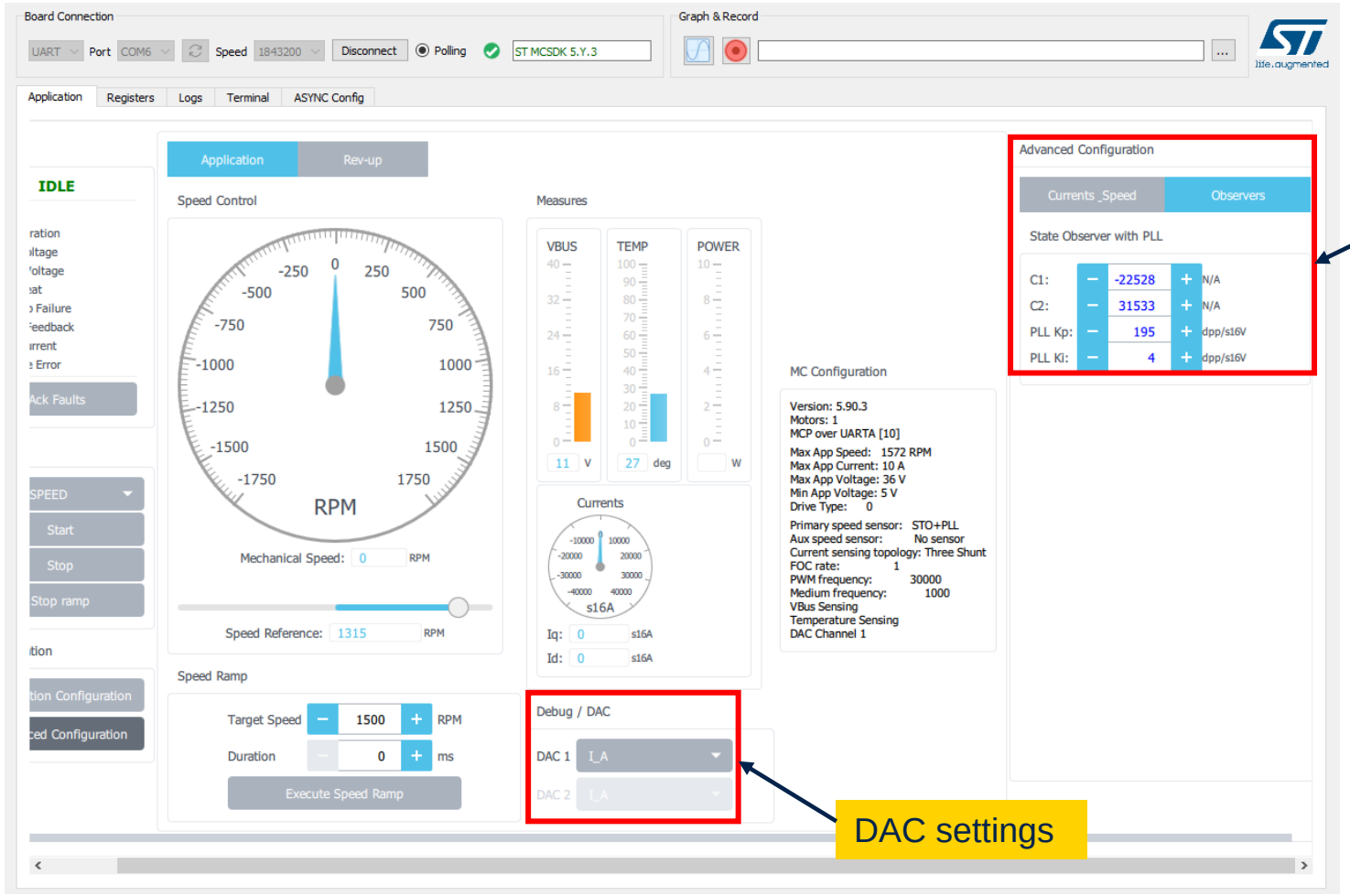
MC application advanced settings(2)

Speed PID, Toque PID, Flux PID and Flux reference



MC application advanced settings(3)

State Observer, PLL parameters, CORDIC parameters and DAC settings

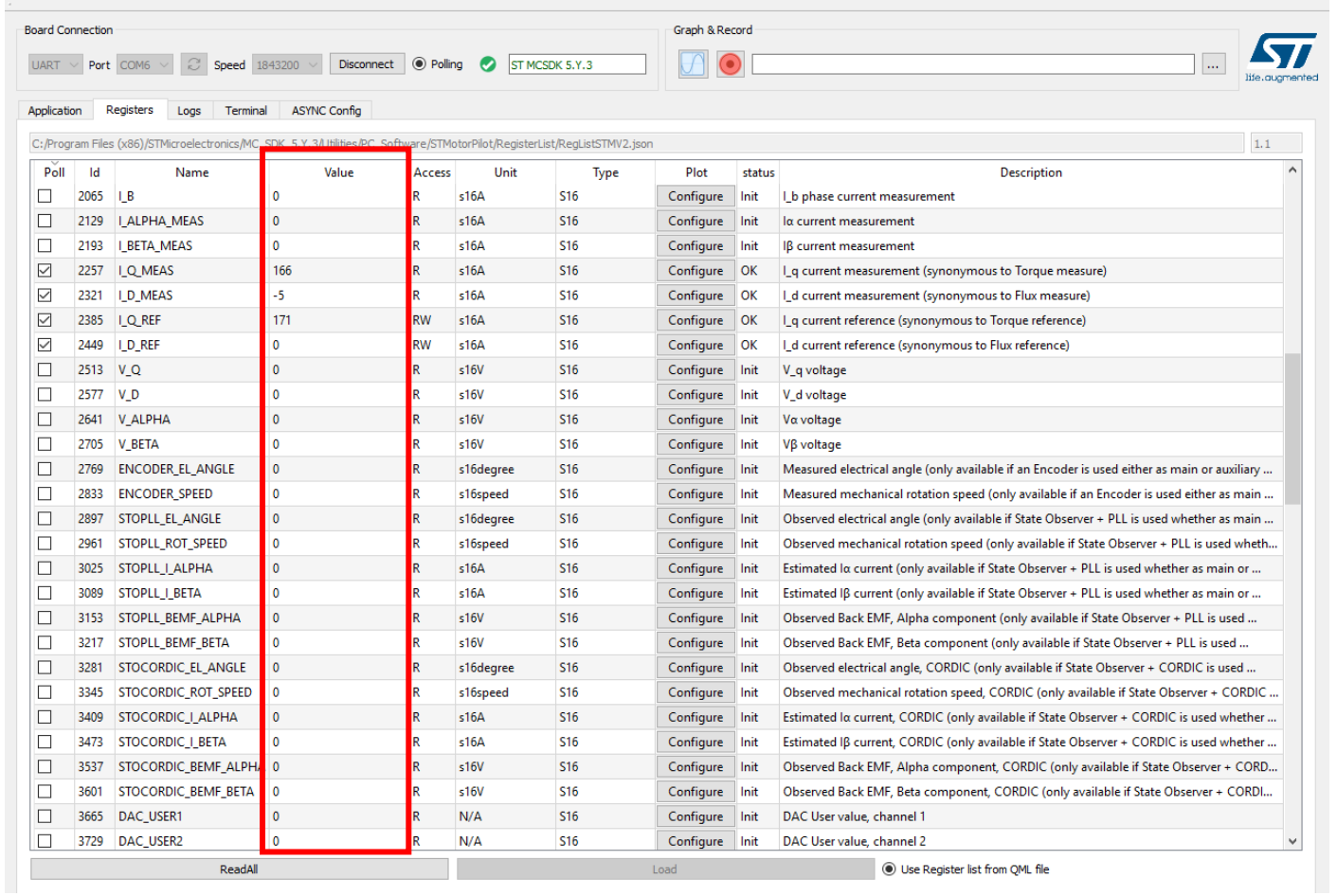


State Observer + PLL parameters
State Observer + CORDIC parameters

DAC settings

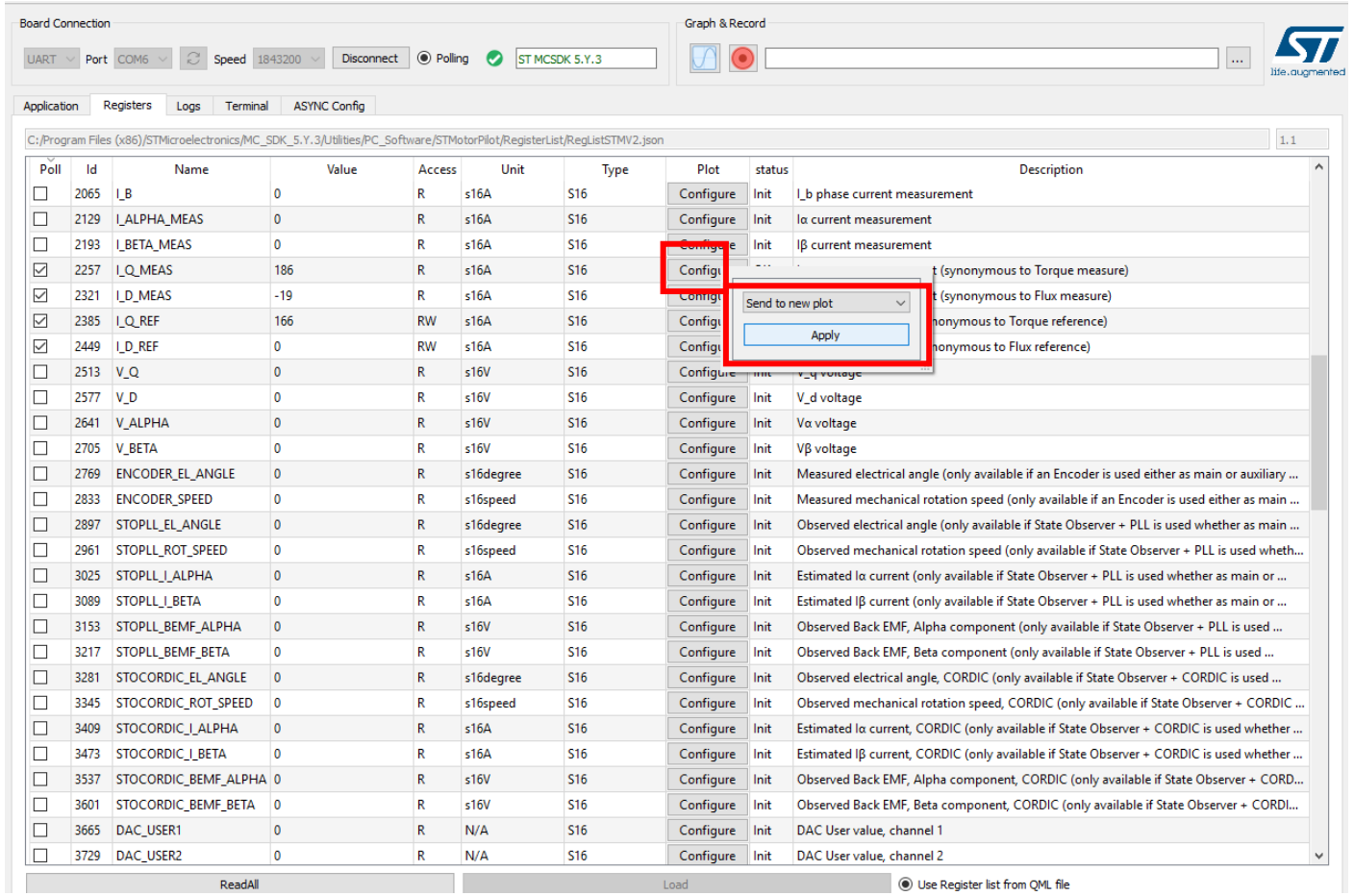
Viewing registers by pooling (low-speed plotting)

Clicking the Registers tab displays the list of all the registers, which can be streamed to the Pilot



Plotting registers by pooling (low-speed plotting)

Register selection for ASYNC plot available



Poll	Id	Name	Value	Access	Unit	Type	Plot	status	Description
☐	2065	I_B	0	R	s16A	S16	Configure	Init	I_b phase current measurement
☐	2129	I_ALPHA_MEAS	0	R	s16A	S16	Configure	Init	Iα current measurement
☐	2193	I_BETA_MEAS	0	R	s16A	S16	Configure	Init	Iβ current measurement
☑	2257	I_Q_MEAS	186	R	s16A	S16	Configu		t (synonymous to Torque measure)
☑	2321	I_D_MEAS	-19	R	s16A	S16	Configu		t (synonymous to Flux measure)
☑	2385	I_Q_REF	166	RW	s16A	S16	Configu		nonymous to Torque reference)
☑	2449	I_D_REF	0	RW	s16A	S16	Configu		nonymous to Flux reference)
☐	2513	V_Q	0	R	s16V	S16	Configure		V_q voltage
☐	2577	V_D	0	R	s16V	S16	Configure	Init	V_d voltage
☐	2641	V_ALPHA	0	R	s16V	S16	Configure	Init	Vα voltage
☐	2705	V_BETA	0	R	s16V	S16	Configure	Init	Vβ voltage
☐	2769	ENCODER_EL_ANGLE	0	R	s16degree	S16	Configure	Init	Measured electrical angle (only available if an Encoder is used either as main or auxiliary ...
☐	2833	ENCODER_SPEED	0	R	s16speed	S16	Configure	Init	Measured mechanical rotation speed (only available if an Encoder is used either as main ...
☐	2897	STOPLL_EL_ANGLE	0	R	s16degree	S16	Configure	Init	Observed electrical angle (only available if State Observer + PLL is used whether as main ...
☐	2961	STOPLL_ROT_SPEED	0	R	s16speed	S16	Configure	Init	Observed mechanical rotation speed (only available if State Observer + PLL is used wheth...
☐	3025	STOPLL_I_ALPHA	0	R	s16A	S16	Configure	Init	Estimated Iα current (only available if State Observer + PLL is used whether as main or ...
☐	3089	STOPLL_I_BETA	0	R	s16A	S16	Configure	Init	Estimated Iβ current (only available if State Observer + PLL is used whether as main or ...
☐	3153	STOPLL_BEMF_ALPHA	0	R	s16V	S16	Configure	Init	Observed Back EMF, Alpha component (only available if State Observer + PLL is used ...
☐	3217	STOPLL_BEMF_BETA	0	R	s16V	S16	Configure	Init	Observed Back EMF, Beta component (only available if State Observer + PLL is used ...
☐	3281	STOCORDIC_EL_ANGLE	0	R	s16degree	S16	Configure	Init	Observed electrical angle, CORDIC (only available if State Observer + CORDIC is used ...
☐	3345	STOCORDIC_ROT_SPEED	0	R	s16speed	S16	Configure	Init	Observed mechanical rotation speed, CORDIC (only available if State Observer + CORDIC ...
☐	3409	STOCORDIC_I_ALPHA	0	R	s16A	S16	Configure	Init	Estimated Iα current, CORDIC (only available if State Observer + CORDIC is used whether ...
☐	3473	STOCORDIC_I_BETA	0	R	s16A	S16	Configure	Init	Estimated Iβ current, CORDIC (only available if State Observer + CORDIC is used whether ...
☐	3537	STOCORDIC_BEMF_ALPHA	0	R	s16V	S16	Configure	Init	Observed Back EMF, Alpha component, CORDIC (only available if State Observer + CORD...
☐	3601	STOCORDIC_BEMF_BETA	0	R	s16V	S16	Configure	Init	Observed Back EMF, Beta component, CORDIC (only available if State Observer + CORDI...
☐	3665	DAC_USER1	0	R	N/A	S16	Configure	Init	DAC User value, channel 1
☐	3729	DAC_USER2	0	R	N/A	S16	Configure	Init	DAC User value, channel 2

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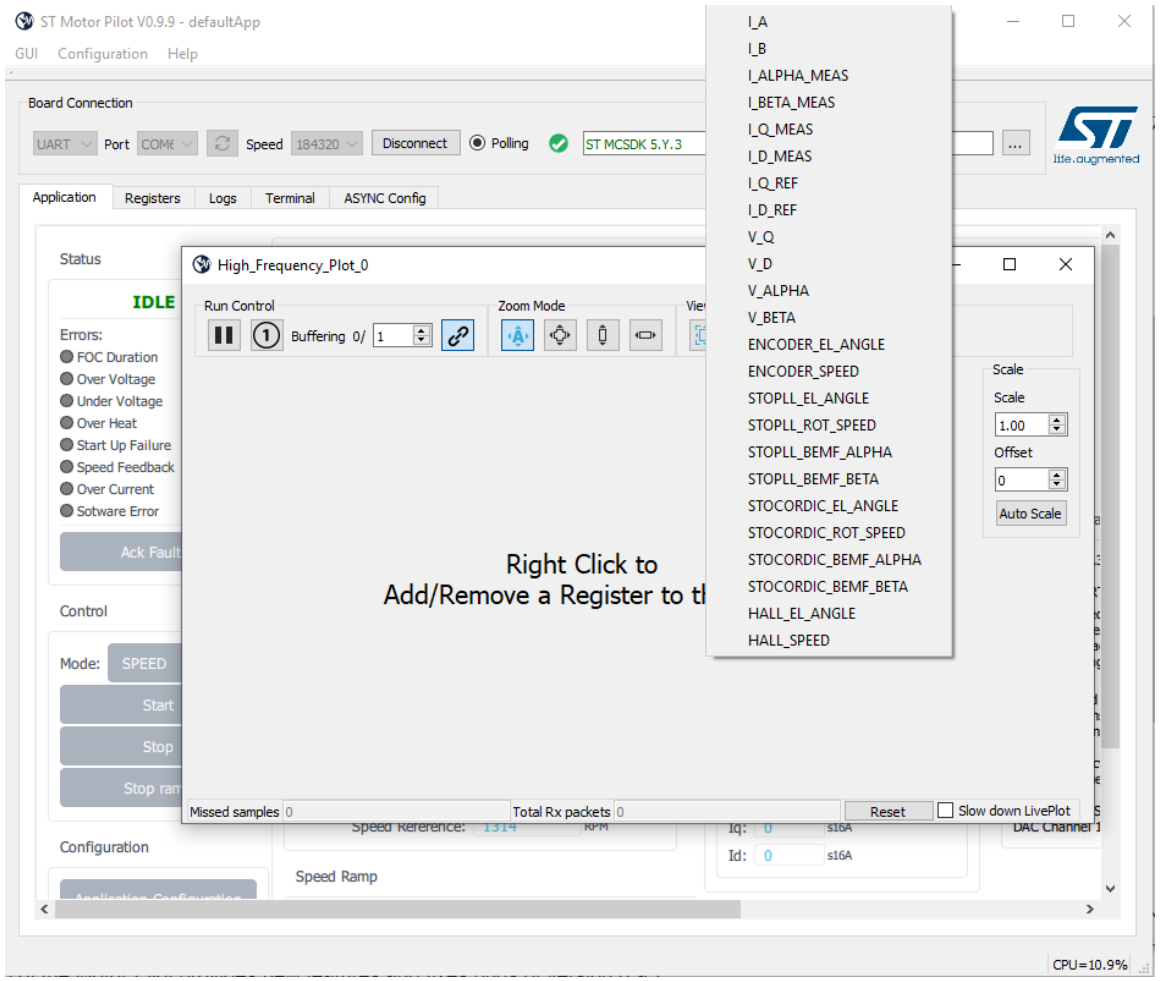
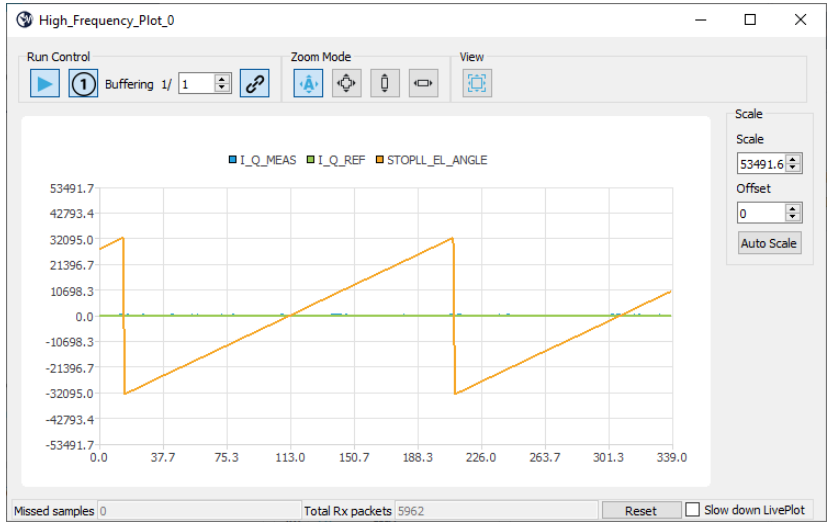
Plotting registers by pooling (low-speed plotting)

Datalog Service

Provides an oscilloscope-like display to plot high frequency tasks





Highlights on X-CUBE-MCSDK

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Highlights (1)

Driving one or two different motors simultaneously (one for 6-Step)

- A PC software application to automatically measure electromechanical parameters of PMSM motors (STM32F30x and STM32F4xx only);
- LCD screen on EVAL boards not supported;
- Development Toolchains:
  - IAR Embedded Workbench for ARM (IAR Systems AB) v8.20.2. (no support for v7.x.x)
  - µVision® IDE for Arm® (Keil® MDK) v5.24.2
  - STM32CubeIDE v1.6.1
  - STM32CubeProgrammer 2.6.0

Highlights (2)

X-CUBE-MCSDK version 5.Y is released to provide insight on the directions that the development of the Motor Control SDK is following

- STM32F1 Family is not supported by X-CUBE-MCSDK version 5.Y. If you are using a STM32F1 MCU, please keep on using X-CUBE-MCSDK 5.4.x versions.
- Dual Drive is not supported by current X-CUBE-MCSDK version 5.Y. If you are using dual drive, please keep on using X-CUBE-MCSDK 5.4.x versions.
- Projects generated with previous X-CUBE-MCSDK versions will not load with the version 5.Y. Please stay with versions 5.4.x if you want to keep the compatibility.
- X-CUBE-MCSDK version 5.Y is not intended to reach the same level of maturity as legacy X-CUBE-MCSDK version 5.4.6

Highlights (3)

SPEED_UNIT (from release v5.4.0)

previous speed unit used by API functions that expect or return a speed (e.g., MC_ProgramSpeedRampMotor1() or MC_GetMecSpeedAverageMotor1())

- 01Hz (a tenth of a Hertz)

It is now possible to use other units for these functions. With release 5.4.0, the two new speed units are made available:

- RPM (Revolution Per Minute)
- 001Hz (a hundredth of a Hertz)

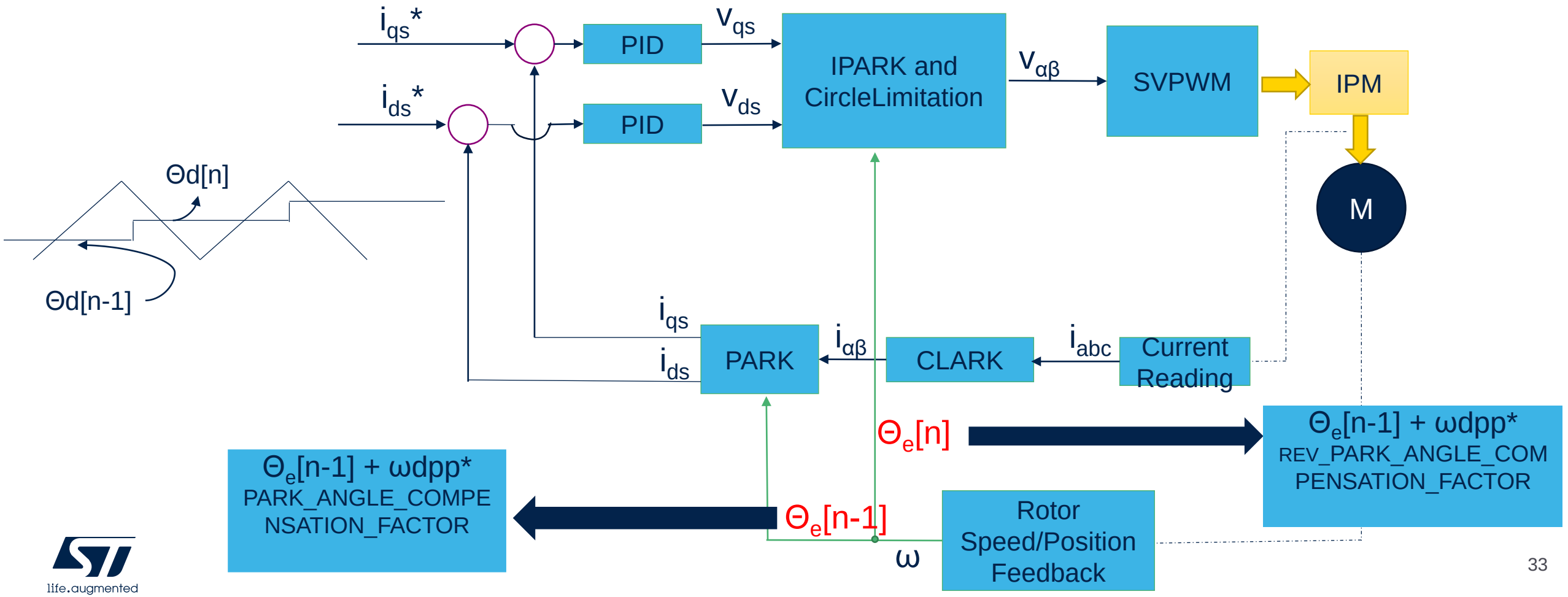
The choice of the speed unit is made at compile time by setting the SPEED_UNIT symbol to the proper value in file mc_stm_types.h:

- _RPM
- _001HZ
- _01HZ

The SPEED_UNIT define is placed in a User Section and retained after project regeneration.

Highlights (4)

Electric Angle Estimation Compensation for Sensorless (from release v5.4.0)



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