

Cours Traitement de Signal et Communication Numérique

CH6: Programmation de la carte **NUCLEO-F401RE** à l'aide de Matlab/Simulink

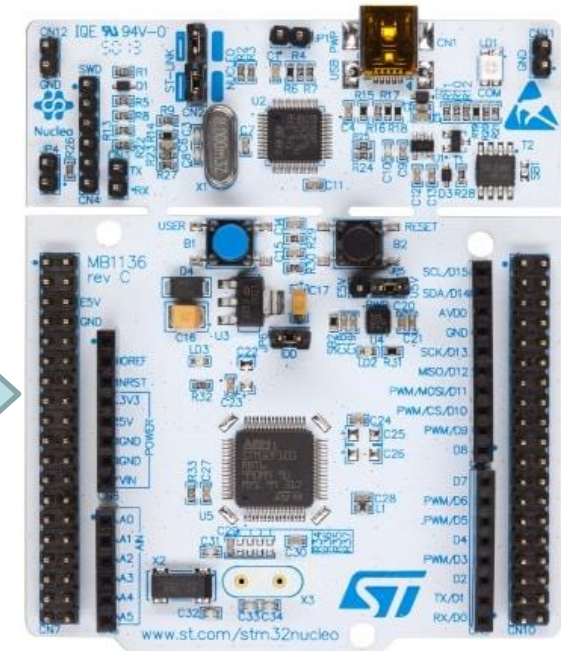
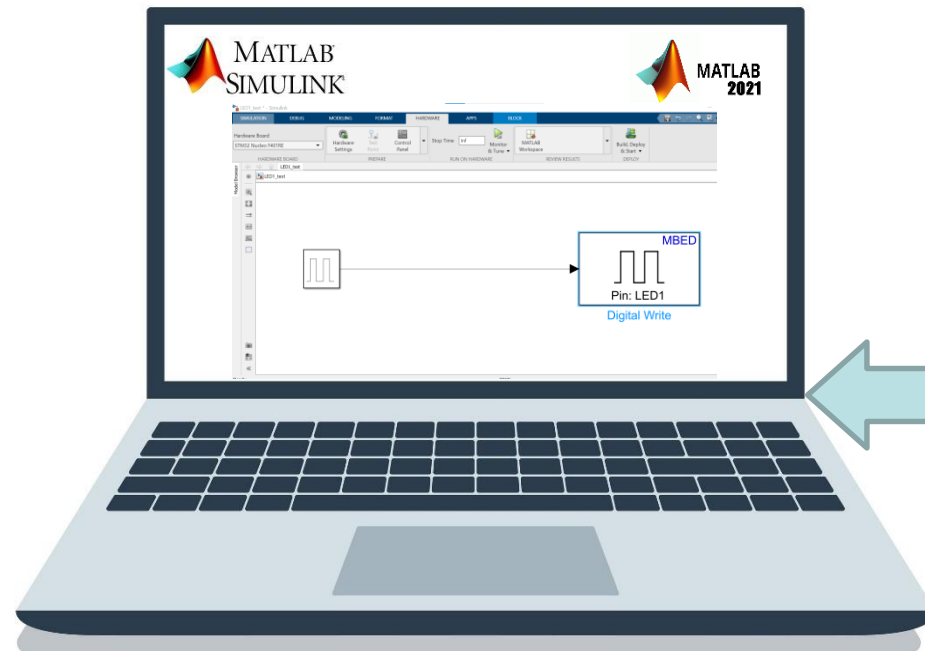
Par:

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1. Objectif

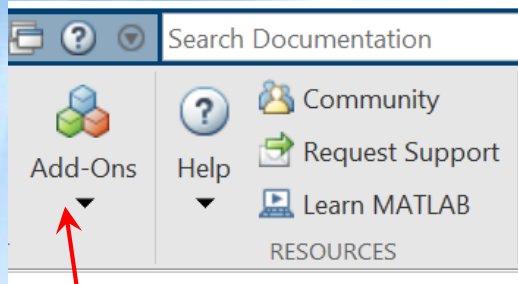
- Dans ce chapitre, nous allons voir comment programmer la carte **NUCLEO-F401RE** à l'aide de logiciel Matlab/Simulink version 2021



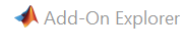
2. Installation des Packages de la carte Nucleo

- Premièrement vous devez installer Matlab/Simulink (Ver. 2021 par exemple) sur votre PC
- Deuxièmement, il faut installer les **packages** de la carte Nucleo: **Simulink Coder Support Package** for STMicroelectronics Nucleo.
- Pour cela, vous devez suivre les étapes suivantes:

2. Installation des Packages de la carte Nucleo (1: Méthode Directe)



- Cliquer sur Add-Ons (module complémentaires: Additions),
- Rechercher le package à installer (exemple taper STM32 ou nucleo)
- Puis installer le package
- Vous devez disposer d'une version de **Matlab Authentique**



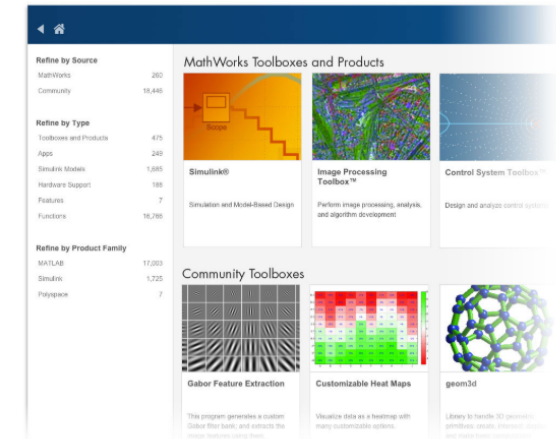
Are you up-to-date on Software Maintenance?

To access the Add-On Explorer, your license must be current on [MathWorks Software Maintenance](#).

Add-On Explorer

Use the Add-On Explorer to find, run, and install add-ons, including apps, toolboxes, support packages, and more.

Add-ons extend the capabilities of MATLAB® by providing additional functionality for specific tasks and applications, such as connecting to hardware devices, additional algorithms, and interactive apps. They encompass a wide variety of resources, including products, apps, support packages, and toolboxes. Add-ons are available from MathWorks and from the global MATLAB user community.



If you believe you have reached this page in error, please contact [Customer Service](#).

Documentation:

<https://www.mathworks.com/hardware-support/stm32.html>

2. Installation des Packages de la carte Nucleo (2: Méthode Indirecte)

Sinon, ce guide vous guidera tout au long du processus d'ajout d'un package de support matériel :

- 1) Visitez le site officiel de MathWorks : <https://www.mathworks.com>.
- 2) Dans la barre de recherche, saisissez le nom de votre matériel, par exemple «nucleo ou STM32».
- 3) Localisez et cliquez sur l'icône représentant le support matériel.

https://www.mathworks.com/matlabcentral/fileexchange/58942-simulink-coder-support-package-for-stmicroelectronics-nucleo-boards?s_tid=srchtitle

The screenshot shows the MathWorks website interface. At the top, there's a navigation bar with links for Products, Solutions, Academia, Support, Community, and Events. A search bar contains the text 'nucleo'. Below the search bar, there are links for 'Contact support' and 'Download products'. The main content area displays 'Results for nucleo (296 results)'. On the left, there's a 'FILTER BY' section with a 'Resource' list. The search results list includes 'STMicroelectronics Nucleo Boards' and 'Simulink Coder Support Package for STMicroelectronics Nucleo Boards'. The latter is highlighted with a red box. It includes a description: 'Generate and deploy code for STMicroelectronics STM32 Nucleo boards', tags: 'stm32, control systems, embedded systems, mbed, motor control, nucleo, prototyping, st, stm, stm nucleo, stmico, stmicroelectronics', and '125 Downloads (30 days)'. An image of a Nucleo board is shown next to the text.

MathWorks® Products Solutions Academia Support Community Events

Search nucleo

Contact support Download products

FILTER BY

Resource

Explore Products & Services 3

Products 3

Solutions 0

Training 0

Consulting 0

Technical Articles 0

Third-party Products & Services 2

Curriculum Resources 0

Results for **nucleo** (296 results)

< Results 1 - 10 of 296 >

STMicroelectronics Nucleo Boards - Generate and deploy code for STMicroelectronics Nucleo boards

Generate and deploy code for STMicroelectronics **Nucleo** boards

Documentation > Simulink Coder > Deployment, Integration, and Supported Hardware > Simulink Coder Supported Hardware

Simulink Coder Support Package for STMicroelectronics Nucleo Boards

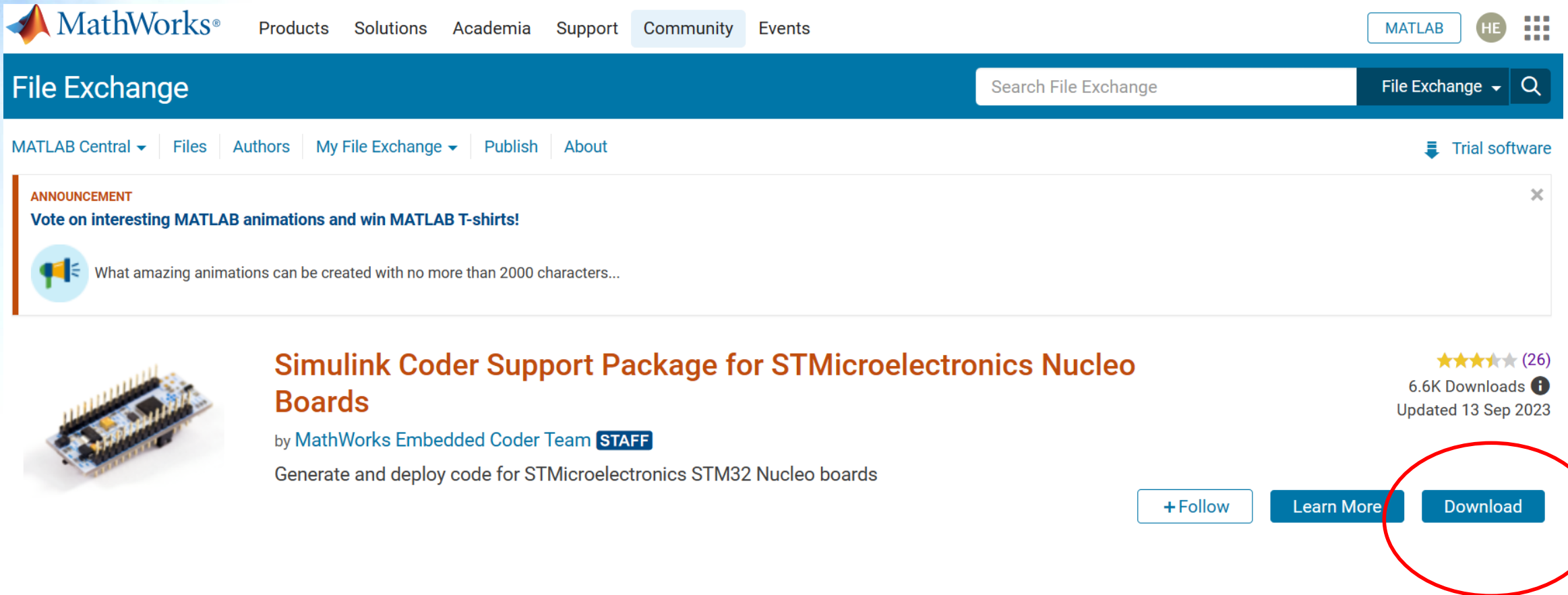
Generate and deploy code for STMicroelectronics STM32 **Nucleo** boards

Tags: stm32, control systems, embedded systems, mbed, motor control, nucleo, prototyping, st, stm, stm nucleo, stmico, stmicroelectronics

125 Downloads (30 days)

2. Installation des Packages de la carte Nucleo (2: Méthode Indirecte)

4) Cliquez sur le bouton « Download ». (Vous devez disposer d'un compte MathWorks)



The screenshot shows the MathWorks File Exchange interface. At the top, there's a navigation bar with links for Products, Solutions, Academia, Support, Community, and Events. A search bar is also present. Below the navigation bar, there's a section for "File Exchange" with a search bar and a dropdown menu. The main content area features an announcement about voting on MATLAB animations and winning T-shirts. Below this, there's a featured package titled "Simulink Coder Support Package for STMicroelectronics Nucleo Boards" by the MathWorks Embedded Coder Team. The package description states it is for generating and deploying code for STM32 Nucleo boards. To the right of the package title, there are star ratings (4.5 stars), a download count of 6.6K, and a last update date of 13 Sep 2023. At the bottom right of the package section, there are three buttons: "+ Follow", "Learn More", and "Download". The "Download" button is circled in red.

MathWorks® Products Solutions Academia Support Community Events

File Exchange Search File Exchange File Exchange

MATLAB Central Files Authors My File Exchange Publish About Trial software

ANNOUNCEMENT
Vote on interesting MATLAB animations and win MATLAB T-shirts!
What amazing animations can be created with no more than 2000 characters...

Simulink Coder Support Package for STMicroelectronics Nucleo Boards
by MathWorks Embedded Coder Team **STAFF**
Generate and deploy code for STMicroelectronics STM32 Nucleo boards

★★★★☆ (26)
6.6K Downloads
Updated 13 Sep 2023

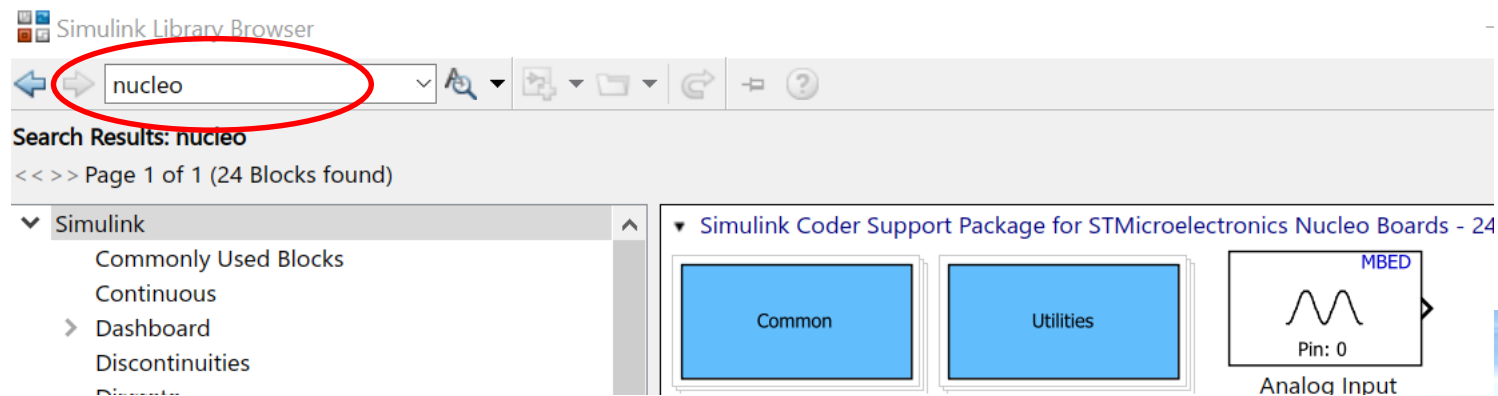
+ Follow Learn More **Download**

2. Installation des Packages de la carte Nucleo (2: Méthode Indirecte)

- 5) Une fois le fichier du package de support téléchargé, **faites-le glisser et déposez-le sur la fenêtre de commande MATLAB** (Command Window).
- 6) Une fenêtre intitulée «**MathWorks Auxiliary Software License Agreement** » apparaîtra. **Cliquez sur "J'accepte" pour continuer.**
- 7) Une autre fenêtre intitulée « **Third-Party Software** » apparaîtra. **Cliquez sur "Suivant" pour continuer.**
- 8) Attendez que les étapes suivantes soient terminées :
 - Downloading Support Package(s)...
 - Downloading Third-Party Package(s)...
 - Installing Support Package(s)...
 - Installing Third-Party Package(s)...
 - Configuring your installation...

2. Installation des Packages de la carte Nucleo (2: Méthode Indirecte)

- 9) Une fois ces étapes terminées, une fenêtre intitulée «**Installation Complete**» apparaîtra. Cliquez sur « **Setup Later** » pour fermer le programme d'installation.
- 10) Une fois le processus d'installation terminé, vous pouvez vérifier si le package de support matériel a été installé avec succès en accédant au navigateur de la **bibliothèque Simulink**. Tapez simplement le nom de votre matériel dans la barre de recherche du navigateur de bibliothèque. Si le package de support matériel a été installé correctement, les blocs de bibliothèque correspondants apparaîtront dans les résultats de la recherche.



3. Programmation de la carte Nucleo à l'aide de Simulink

- On se propose de reprogrammer le clignotement de la LED utilisateur (LED1) à une fréquence désirée en utilisant Simulink.
- Pour cela on suivra les **étapes suivantes**:

1 Ouvrir un **nouveau model Simulink** et réaliser le schéma suivant (utiliser la bibliothèque Simulink)

Parameters

Pulse type: Time based

Time (t): Use simulation time

Amplitude:

1

Period (secs):

2

Pulse Width (% of period):

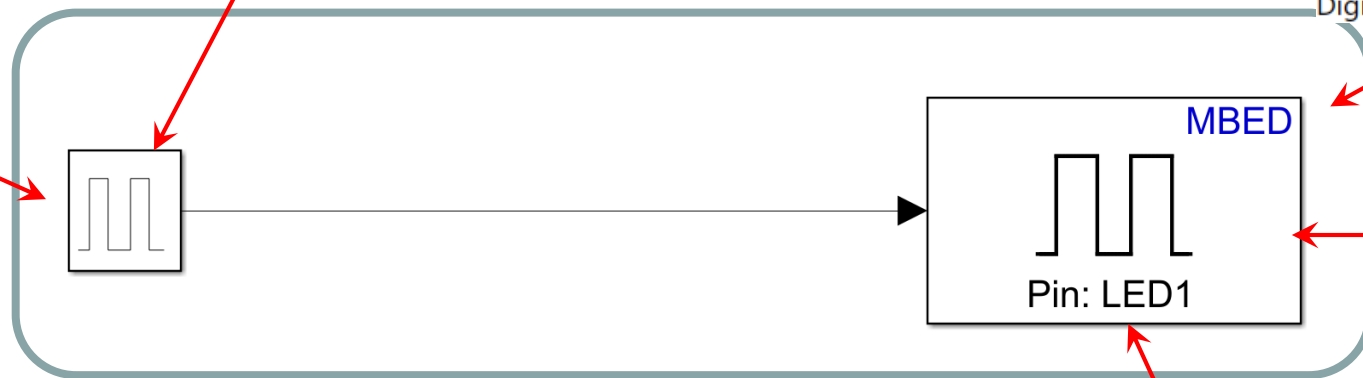
50

Phase delay (secs):

0

☒ Interpret vector parameters as 1-D

**Simulink, Sources,
Pulse Generator**

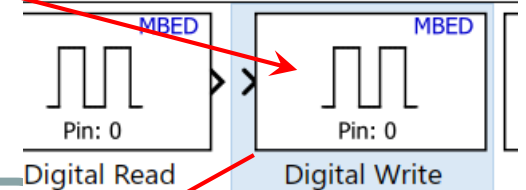


Nommer la pin LED1 ou le N° GPIO de la LED1

Simulink Coders Support Package for STMicroelectronics Nucleo Boards

Common

Utilities



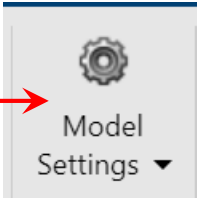
**Simulink Coders Support Package for
STMicroelectronics Nucleo Board**

Common

Digital Write

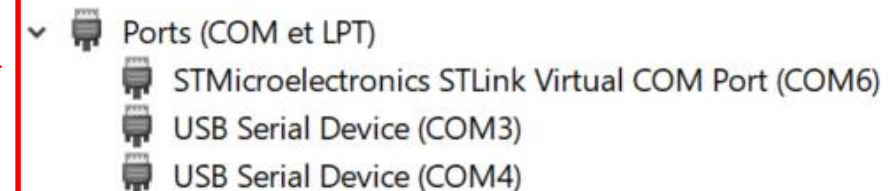
3. Programmation de la carte Nucleo à l'aide de Simulink

- 2 Sauvegarder le fichier, nommer le **LED_test**
- 3 Ouvrez l'onglet "**Modeling**" et appuyez sur CTRL+E pour ouvrir la boîte de dialogue "**Configuration Parameters**"
- 4 Aller à "**Hardware Implementation**"
 - Hardware board: "**STM32 Nucleo F401RE board**"
 - Target hardware resources > "**Build options**" > Build action: "**Build, load and run**"
 - Connected IO > Serial port: **COM6**
 - External mode > Communication interface > Serial port: **COM6**

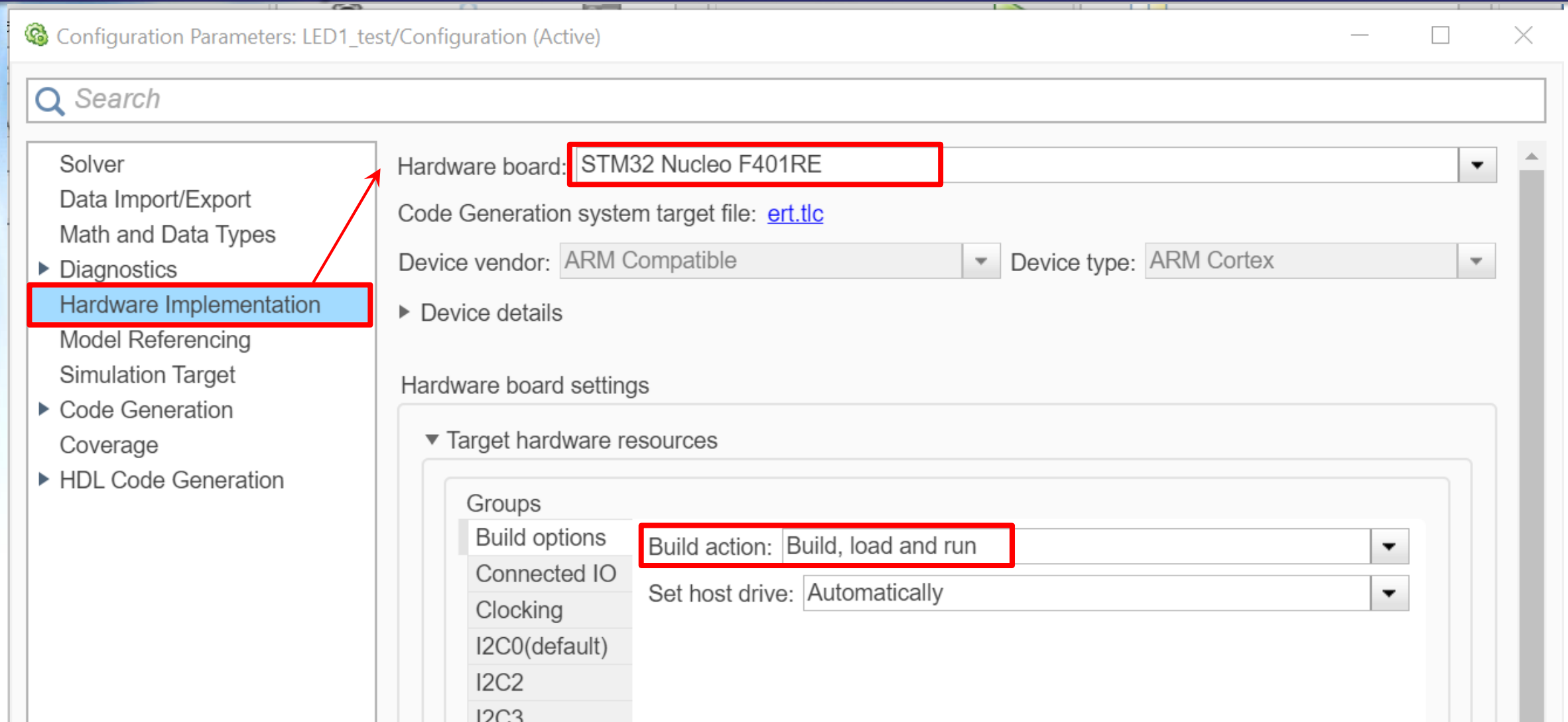


ICI on suppose que la carte est connectée sur le **COM6**

Gestionnaire de périphériques



3. Programmation de la carte Nucleo à l'aide de Simulink



3. Programmation de la carte Nucleo à l'aide de Simulink

▼ Target hardware resources

Groups

Build options ☒ Enable Connected IO

Connected IO Serial port: COM6

Clocking

I2C0(default)

Communication interface: serial

Serial port: COM6

Logging buffer size (in bytes): 2000

☒ Use a dedicated timer to improve time stamp accuracy

☒ Verbose

Groups

Build options

Connected IO

Clocking

I2C0(default)

I2C2

I2C3

SPI0(default)

SPI2

SPI3

SCI1

SCI0(default)

SCI6

PIL

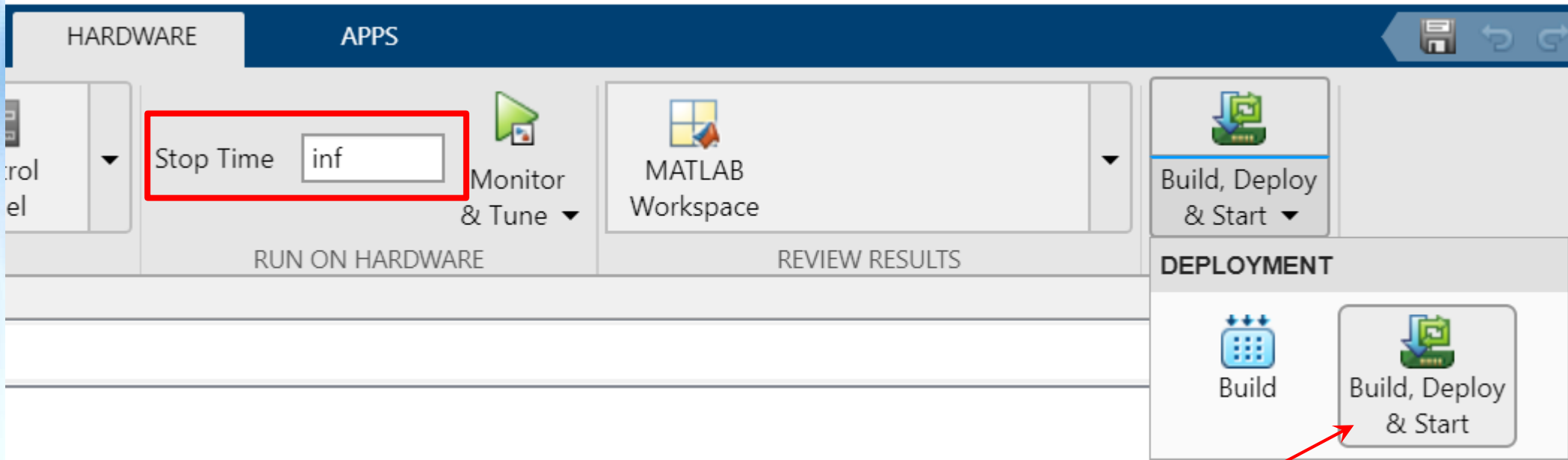
External mode

Connected IO > Serial port : COM6

External mode > Serial port : COM6

5 Appliquer les changements (Apply) et Sauvegarder

3. Programmation de la carte Nucleo à l'aide de Simulink



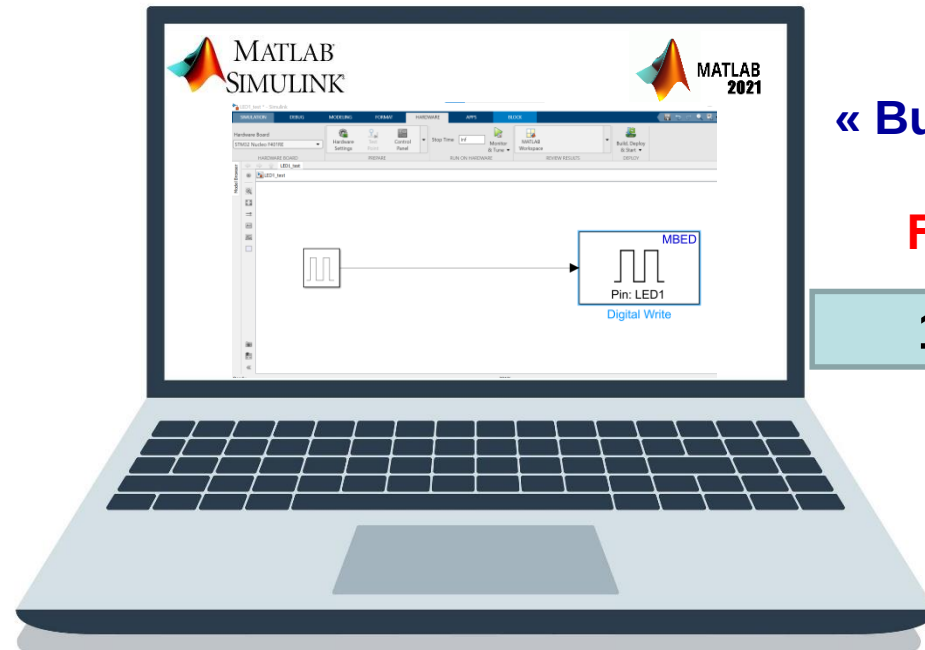
5 Finalement, Vous flasher le code en utilisant « Build, Deploy & Start »

VOUS DEVRIEZ VOIR LA LED VERTE CLIGNOTER !!!

3. Programmation de la carte Nucleo à l'aide de Simulink

REMARQUE:

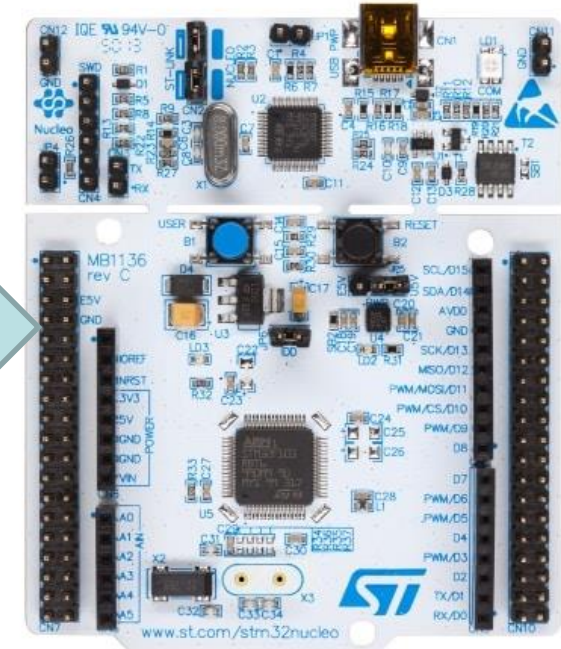
- La méthode « **Build, Deploy & Start** » permet de flasher le code sur le microcontrôleur. C'est-à-dire que même en l'absence de Matlab, le programme continue d'être exécuté dans le microcontrôleur de la carte.



« Build, Deploy & Start »

Flash l'exécutable

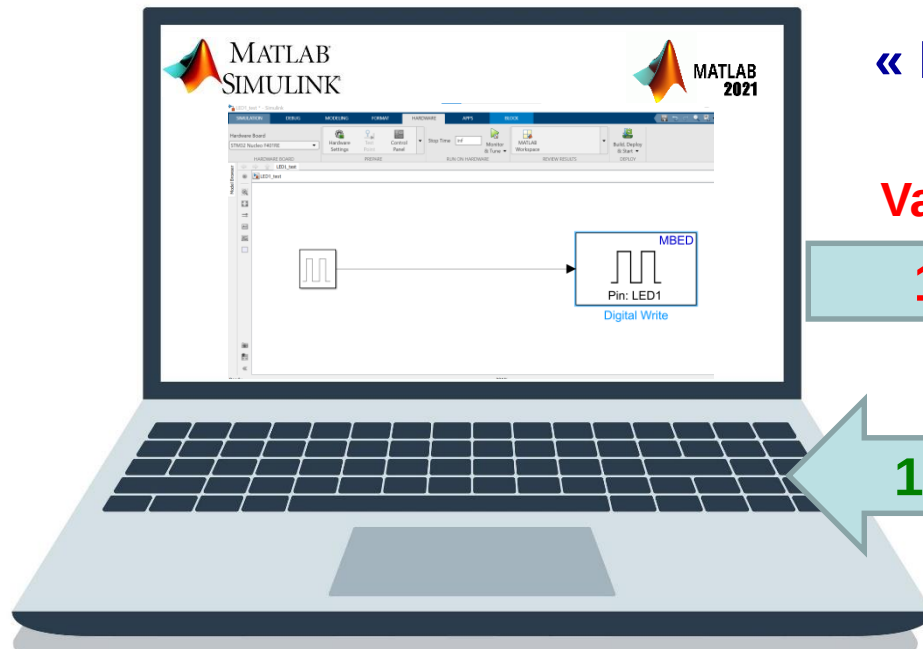
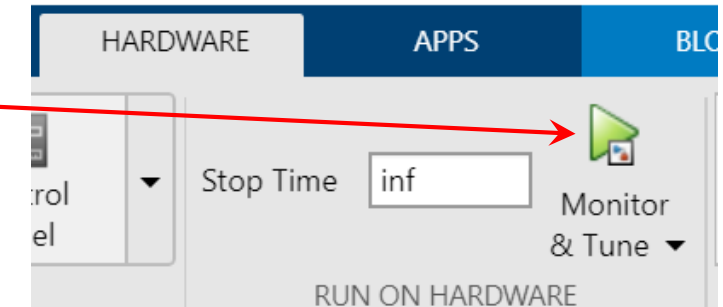
1 0 1 1 1 0 0 1 0 0



3. Programmation de la carte Nucleo à l'aide de Simulink

REMARQUE:

- Il existe une autre façon de flasher le code en interaction avec Simulink. C'est EXTERNAL MODE « **Monitor and Tune** ».
- Avec cette méthode vous pouvez faire varier les paramètres en temps réel et afficher les signaux.



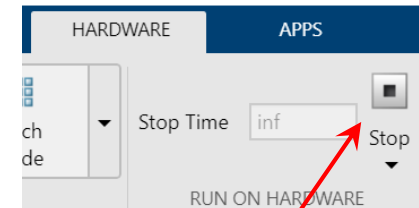
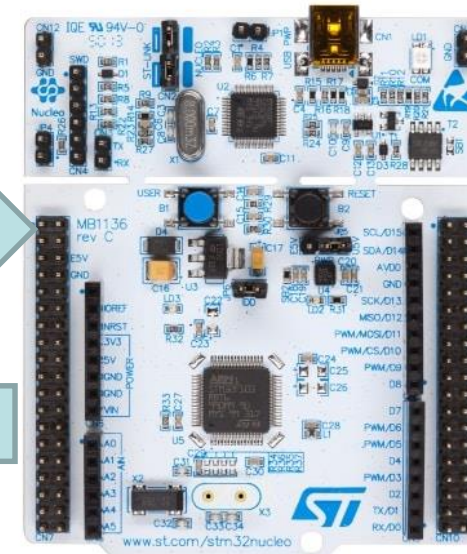
« Monitor & Tune »

Varier les paramètres

1 0 1 1 1 0 0 1 0 0

Afficher les signaux

1 0 1 1 1 0 0 1 0 0



L'appui sur STOP
arrête l'exécution
du programme
dans le
microcontrôleur

3. Programmation de la carte Nucleo à l'aide de Simulink

Documentation:

<https://www.mathworks.com/help/rtw/nucleo/ug/getting-started-with-simulink-coder-support-package-for-stmicelectronics-nucleo-boards.html>

Documentation Examples Functions Blocks Model Settings Apps Videos Answers

Getting Started with Simulink Coder Support Package Using STMICROELECTRONICS Nucleo Boards

R2024b

This example demonstrates how to use the Simulink® Coder™ Support Package for STMICROELECTRONICS® Nucleo Boards to run a Simulink® model on an STMICROELECTRONICS Nucleo board.

Simulink Coder Support Package for STMICROELECTRONICS Nucleo Boards enables you to create and run Simulink models on supported **STMICROELECTRONICS Nucleo** boards. The support package includes a library of Simulink blocks for configuring and accessing STMICROELECTRONICS Nucleo peripherals and communication interfaces.

In this example you will learn how to configure a simple Simulink model to generate code for STMICROELECTRONICS Nucleo F401RE board and run the generated code on the board to periodically turn an LED on and off. You can configure this model for other supported Nucleo boards by browsing to **Configuration Parameters > Hardware Implementation > Hardware board** and selecting the required board.

Available models for this example:

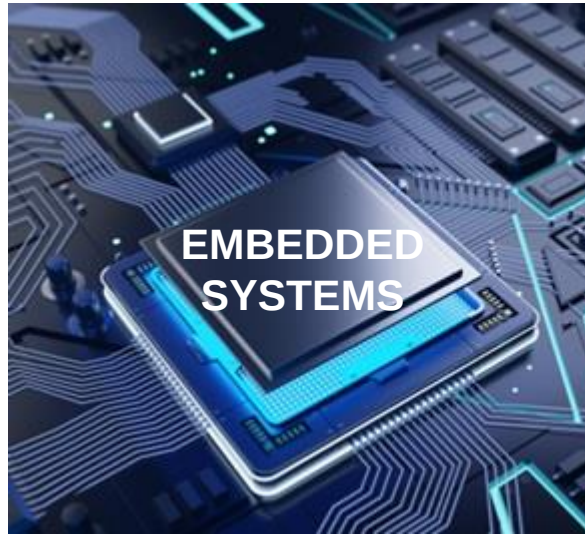
- STM Nucleo: [GettingStartedSTMNucleo.slx](#)

This example uses:

- Simulink Coder Support Package for STMICROELECTRONICS Nucleo Boards
- Simulink Coder
- Simulink

Copy Command

**Copier et coller cette commande dans « Command
Window » de Matlab**



FIN !
Questions ?