
Getting started with projects based on dual-core STM32H7 microcontrollers in STM32CubeIDE

Introduction

This application note describes how to get started with projects based on dual-core microcontrollers in the STM32H7 Series in STMicroelectronics [STM32CubeIDE](#) integrated development environment.



1 General information

STM32CubeIDE supports STM32 32-bit products based on the Arm® Cortex® processor.

Note: Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

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1.1 Prerequisites

The following tools are prerequisites for understanding the tutorial in this document and developing an application based on the STM32H7 Series:

- STM32CubeIDE 1.1.0 or newer
- STM32Cube_FW_H7_V1.5.0 or newer
- STM32CubeMX 5.4.0 or newer

Users are advised to keep updated with the documentation evolution of the STM32H7 Series at www.st.com/en/microcontrollers-microprocessors/stm32h7-series.html.

1.2 The use cases in this document

In the STM32CubeIDE context, users have different ways to explore and get started with the development of projects based on the STM32H7 Series. From the list below, select the description that best fits the use case considered and refer to the corresponding section in this application note:

- I already have an SW4STM32 project with an ioc file:
Refer to [Section 2.2 Import an SW4STM32 project with an ioc file](#)
- I already have an SW4STM32 project without an ioc file:
Refer to [Section 2.3 Import an SW4STM32 project without an ioc file](#)
- I want to learn with and explore example projects:
Refer to [Section 2.5 Import a project from the STM32CubeH7 MCU Package](#)
- I want to start a first STM32H7 project:
 - Empty project – No STM32CubeMX support for maximum flexibility.
Refer to [Section 2.4 Create an empty project based on the template in the STM32CubeH7 MCU Package](#)
 - STM32CubeH7 project – STM32CubeMX-managed project.
Refer to [Section 2.1 Create a new STM32 project](#)

1.3 Specific features of dual-core microcontrollers in the STM32H7 Series

The most obvious feature of a dual-core STM32H7 device is its significant performance boost that comes from the addition of a Cortex®-M4 core besides the Cortex®-M7 core. Dual-core STM32H7 devices are also very flexible. This application note is a simple getting-started guide to get up and running with a debug session when both cores are running. It does not cover such additional features as the flexibility of being able to boot on either core or the fact that each core can exist in an independent power domain to optimize energy consumption.

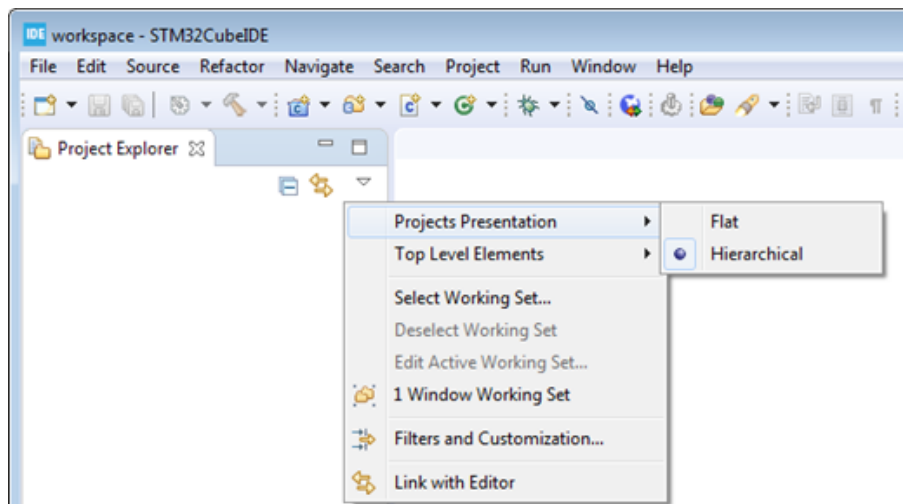
1.3.1 Dual-core STM32H7 project structure

When a dual-core STM32H7 project is created, its structure is automatically made hierarchical. The project structure for single-core projects is flat. On the contrary, in a multi-core project, the hierarchical project structure is used. When the user creates or imports a dual-core STM32H7 project, it consists of one root project together with sub-projects, referred to as MCU projects, for each core.

The MCU projects are real CDT projects that can contain both build and debug configurations. On the contrary, the root project is a simple container that allows sharing common code between the cores. The root project can contain neither build nor debug configurations.

If the project is not shown in a hierarchical structure, this can be changed as shown in [Figure 1](#).

Figure 1. Setting the project hierarchical view



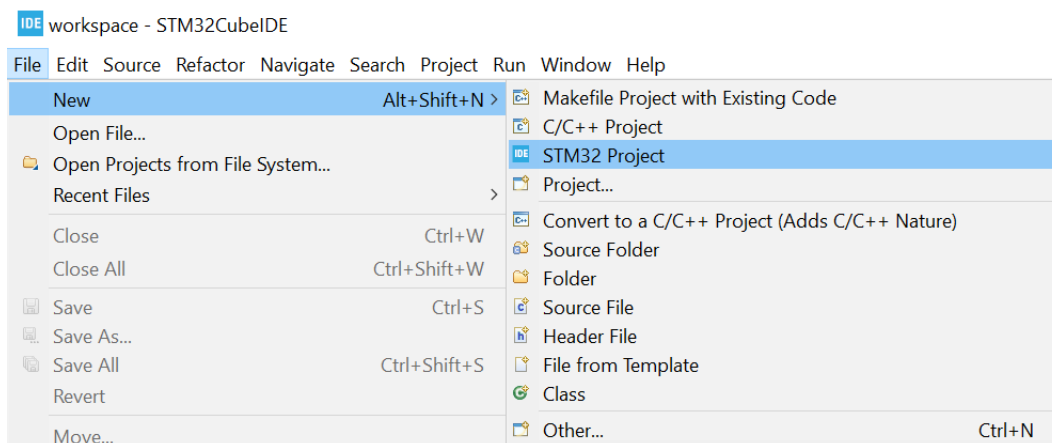
2 Create and import projects

This chapter describes how to create or import projects for dual-core microcontrollers in the [STM32H7 Series](#).

2.1 Create a new STM32 project

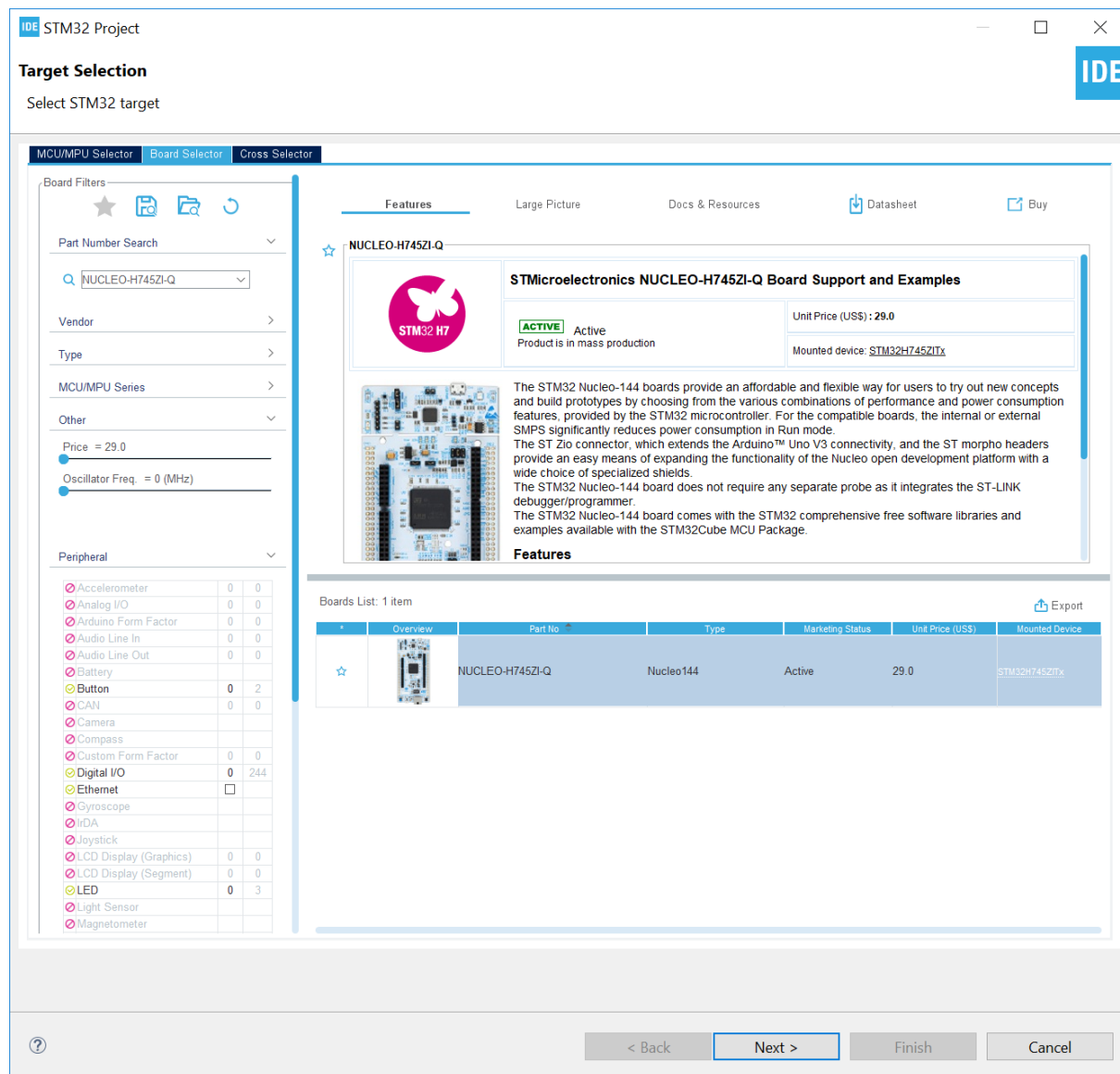
To start a new project, go to **[File]>[New]>[STM32 Project]** as shown in [Figure 2](#).

Figure 2. New STM32 project



Select the desired MCU or board. In the example illustrated in Figure 3, the selected board is the **NUCLEO-H745ZI-Q**. Click on **[Next >]**.

Figure 3. Target selection



After the target selection comes the project setup step shown in Figure 4. The *Targeted Project Type* setting determines whether the project gets generated by STM32CubeMX or not. An *Empty* project is a skeleton of a project that needs building upon while *STM32Cube* indicates an STM32CubeMX-managed project.

Figure 4. Project setup

IDE STM32 Project

Project Setup

Setup STM32 project

Project Name: NUCLEO-H745ZI-Q

☒ Use default location

Location: C:/Users/.../STM32CubeIDE/workspace Browse...

Options

Targeted Language

☒ C ☐ C++

Targeted Binary Type

☒ Executable ☐ Static Library

Targeted Project Type

☒ STM32Cube ☐ Empty

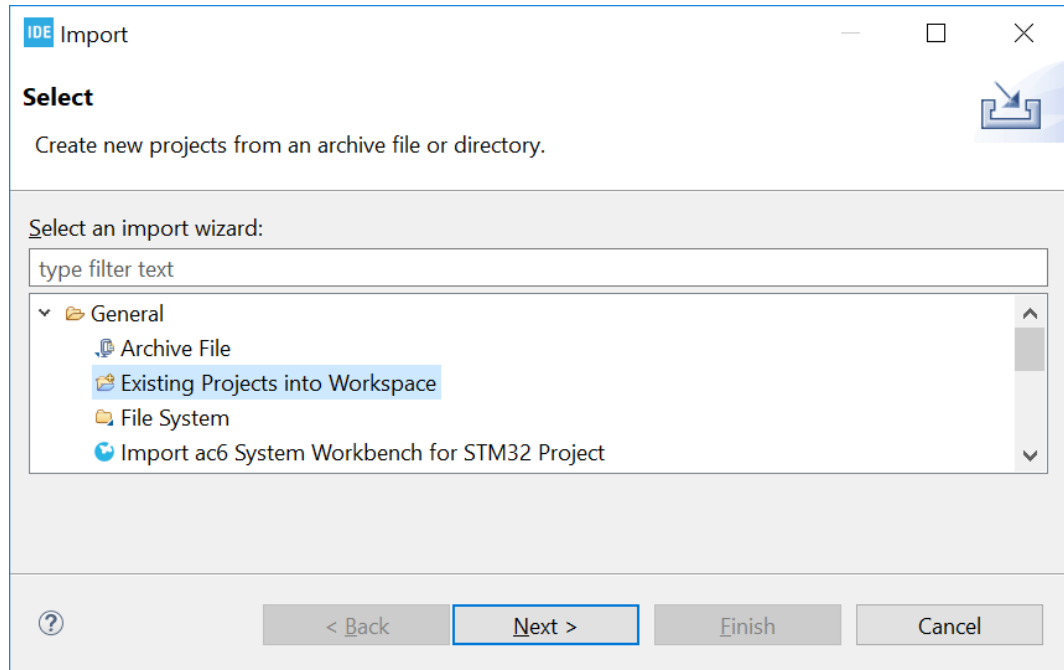
? < Back Next > Finish Cancel

2.2 Import an SW4STM32 project with an ioc file

If the project already contains an ioc file, the easiest way to import the project into a working STM32CubeIDE environment is to copy it and open the copy through STM32CubeMX stand alone, then, in the *Project Manager*, change the *Toolchain / IDE* to STM32CubeIDE and regenerate the project.

After the project is regenerated, go to **[File]>[Import...]** and choose to import it as an *Existing projects into workspace* as shown in Figure 5.

Figure 5. Import an existing project with an ioc file



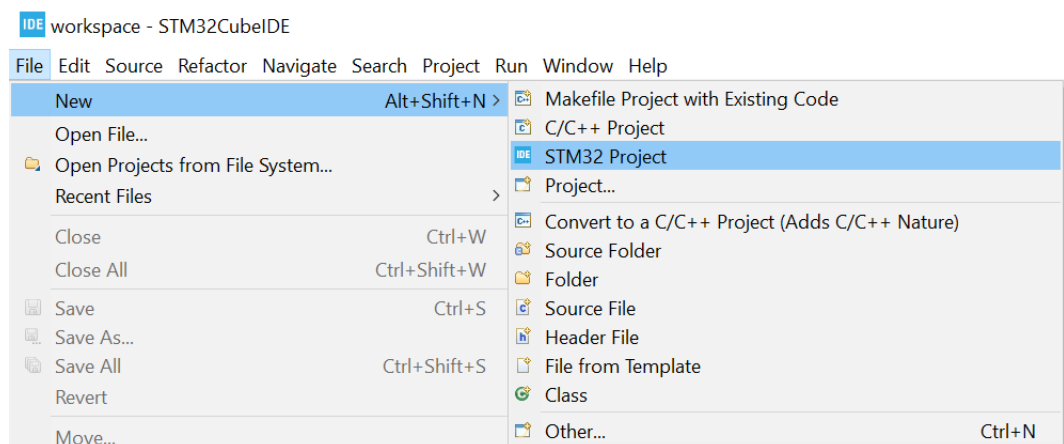
Then copy the code inside the different `/* USER CODE BEGIN */` blocks that exist in the project into the new STM32CubeIDE environment.

2.3

Import an SW4STM32 project without an ioc file

To make sure the project gets a hierarchical structure, the recommended way is to go to **[File]>[New]>[STM32 Project]** as shown in Figure 6.

Figure 6. New STM32 project



Select the device for the project being imported and click on **[Next >]**.

When setting up the project as shown in , make sure the *Targeted Project Type* is set to *Empty* and click on [Finish].

Figure 7. Project setup

STM32 Project

Project Setup

Setup STM32 project

Project Name: NUCLEO-H745ZI-Q

☒ Use default location

Location: C:/Users/.../STM32CubeIDE/workspace Browse...

Options

Targeted Language

☒ C ☐ C++

Targeted Binary Type

☒ Executable ☐ Static Library

Targeted Project Type

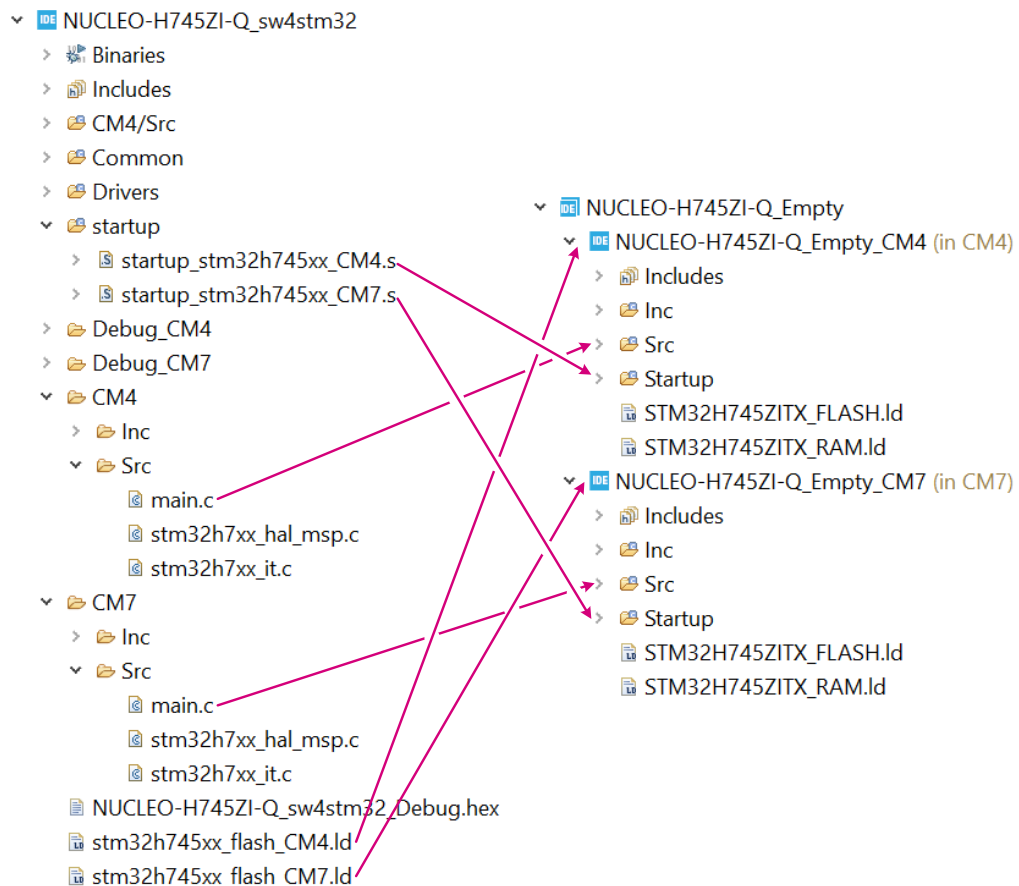
☐ STM32Cube ☒ Empty

? < Back Next > Finish Cancel

After the empty hierarchical project is generated:

1. Go to [File]>[Import...]
2. Import the SW4STM32 project as *Import ac6 System Workbench for STM32 Project*
3. Copy and paste the project files and resources into the sub-project of the empty project as shown in Figure 8

Figure 8. Copy project content to empty sub-project



Note: *It is not recommended to import the .cproject, .project or .settings files.*

It is important to remember to configure also the same build settings used previously while the project was in the SW4STM32 environment. If the project contains linked resources, these need to be updated to point to the correct resource in the file system.

This process is necessary because, when importing without any special treatment a project from SW4STM32 that does not have an ioc file, it is imported into STM32CubeIDE with a flat project structure.

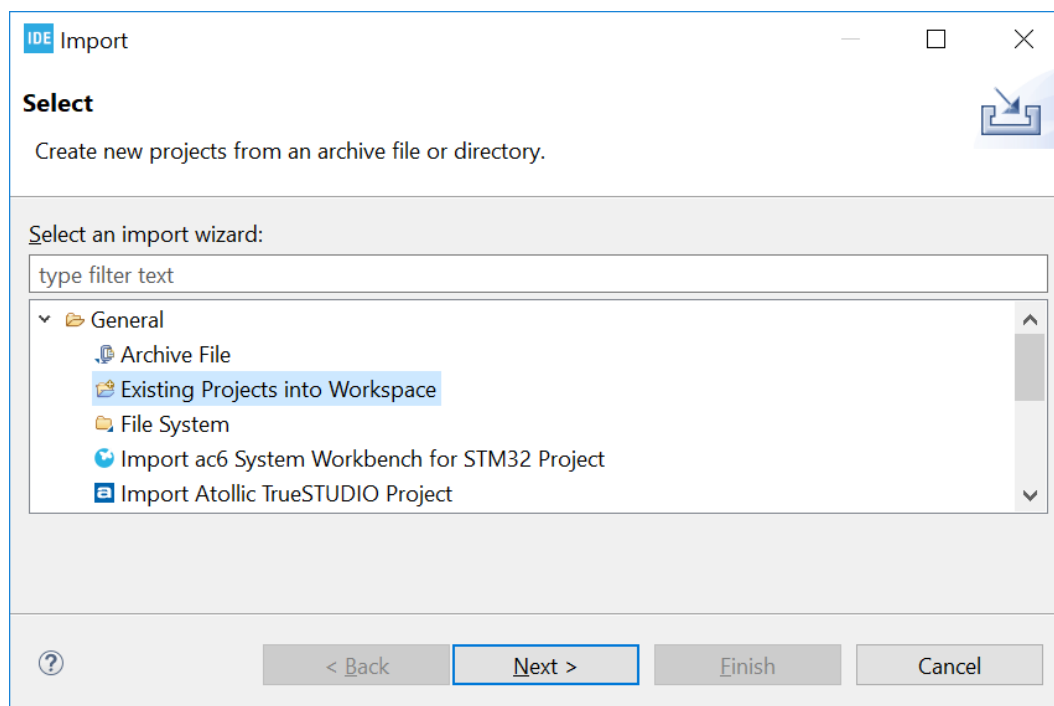
2.4 Create an empty project based on the template in the STM32CubeH7 MCU Package

Follow the same steps as in Section 2.3 Import an SW4STM32 project without an ioc file but use STM32Cube_FW_H7 firmware in the STM32CubeH7 MCU Package as input.

2.5 Import a project from the STM32CubeH7 MCU Package

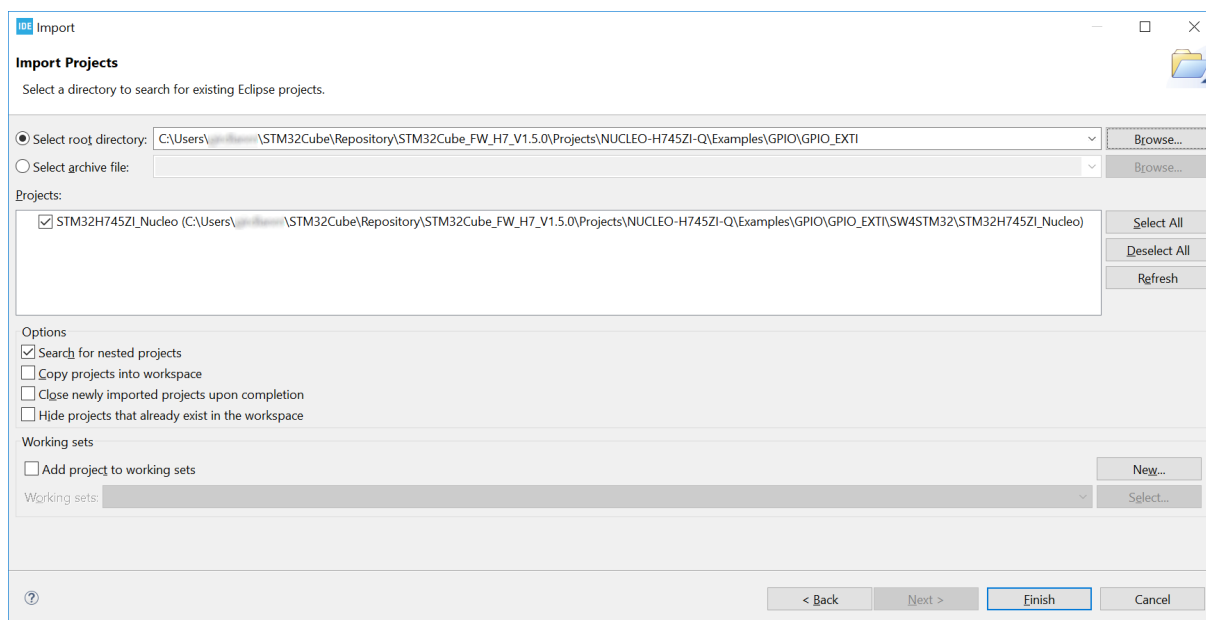
In order to import the STM32Cube firmware project into STM32CubeIDE, go to [File]>[Import], select *Existing Projects into Workspace* as shown in Figure 9, and click on [Next >].

Figure 9. Import of firmware project into STM32CubeIDE



Then select the correct project. A project example is by default located at `$HOME\STM32Cube\Repository\STM32Cube_FW_H7_VX.X.X\Projects\NUCLEO-H745ZI-Q\Examples\GPIO\GPIO_EXTI`.

Figure 10. Firmware project selection



After selecting the project, click on **[Finish]** to import and build the project.

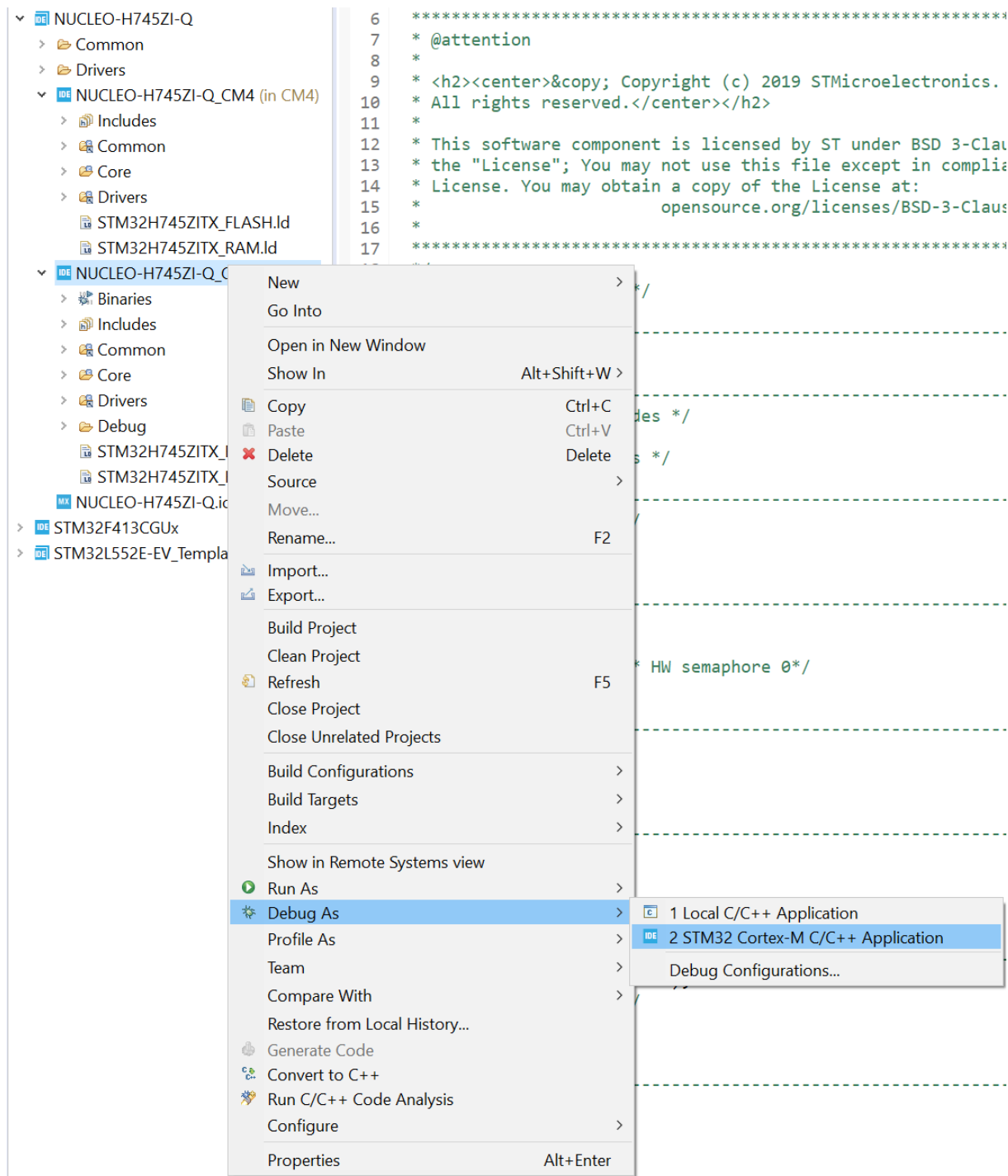
3 **Debugging**

This chapter highlights some of the points to bear in mind while debugging a device in the STM32H7 Series. In the next two sub-sections, this application note covers the configurations needed to start debug sessions with ST-LINK GDB server and OpenOCD.

3.1 Setting up with ST-LINK GDB server

To start configuring the launch of the debug session, right click the sub-project (in this example, the Cortex®-M7) and select **[Debug As]>[STM32 Cortex-M C/C++ Application]** as shown in Figure 11.

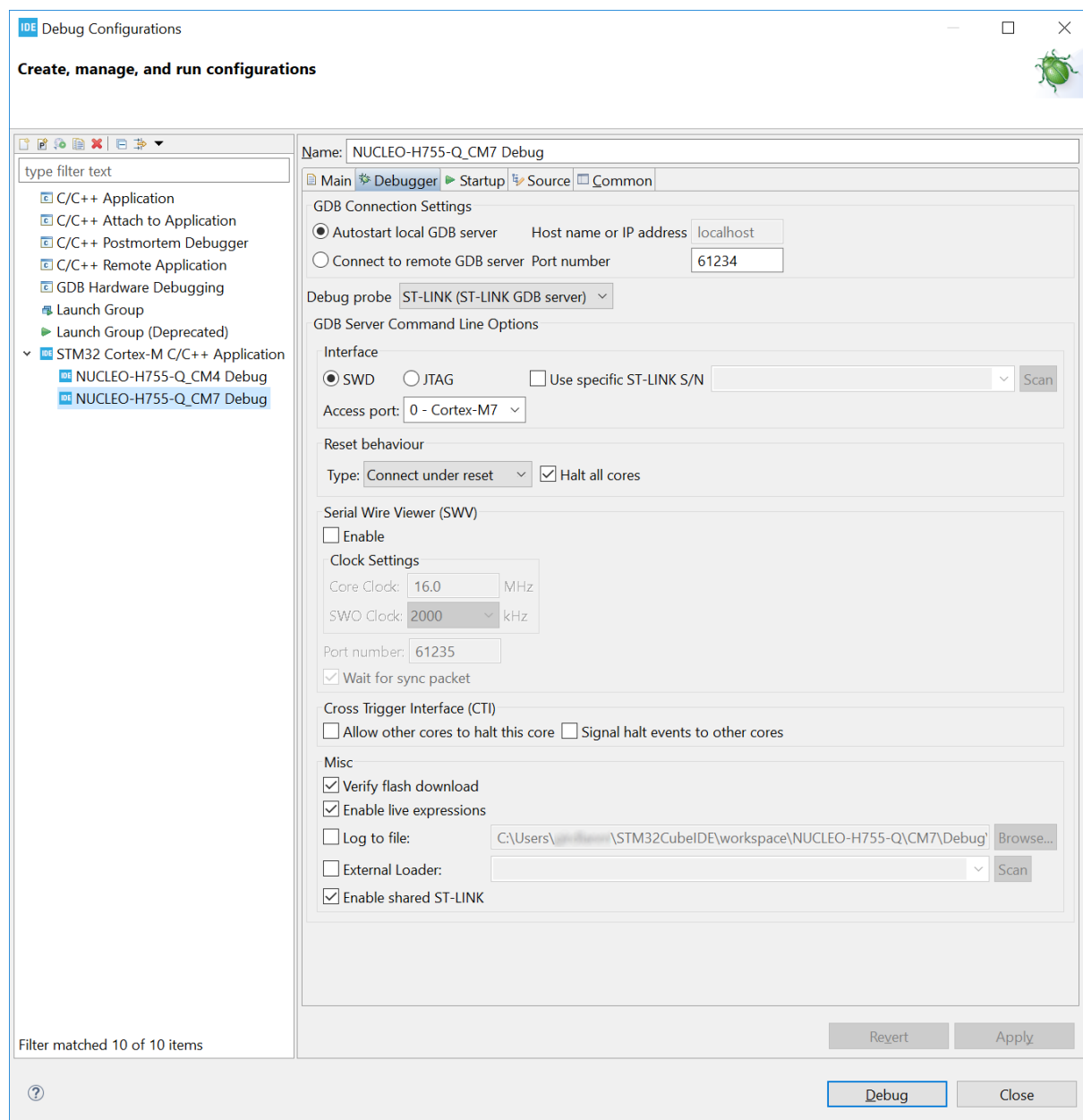
Figure 11. ST-LINK GDB server debug configuration (1 of 6)



Note: For the rest of this section, examples are based on the NUCLEO-H755ZI-Q board.

Since the STM32CubeMX default project puts the Cortex®-M4 in the DeepSleep mode, the **[Reset behaviour]** field must be set to *Connect under reset* to be able to communicate with the CPU (refer to [Figure 12](#)). Make sure to check the *Halt all cores* option next to it to prevent the Cortex®-M4 from starting to execute the code and end up in the DeepSleep mode in this example. In the debug configuration, select *Enable shared ST-LINK*, switch to the *Startup* tab and select **[Add...]**.

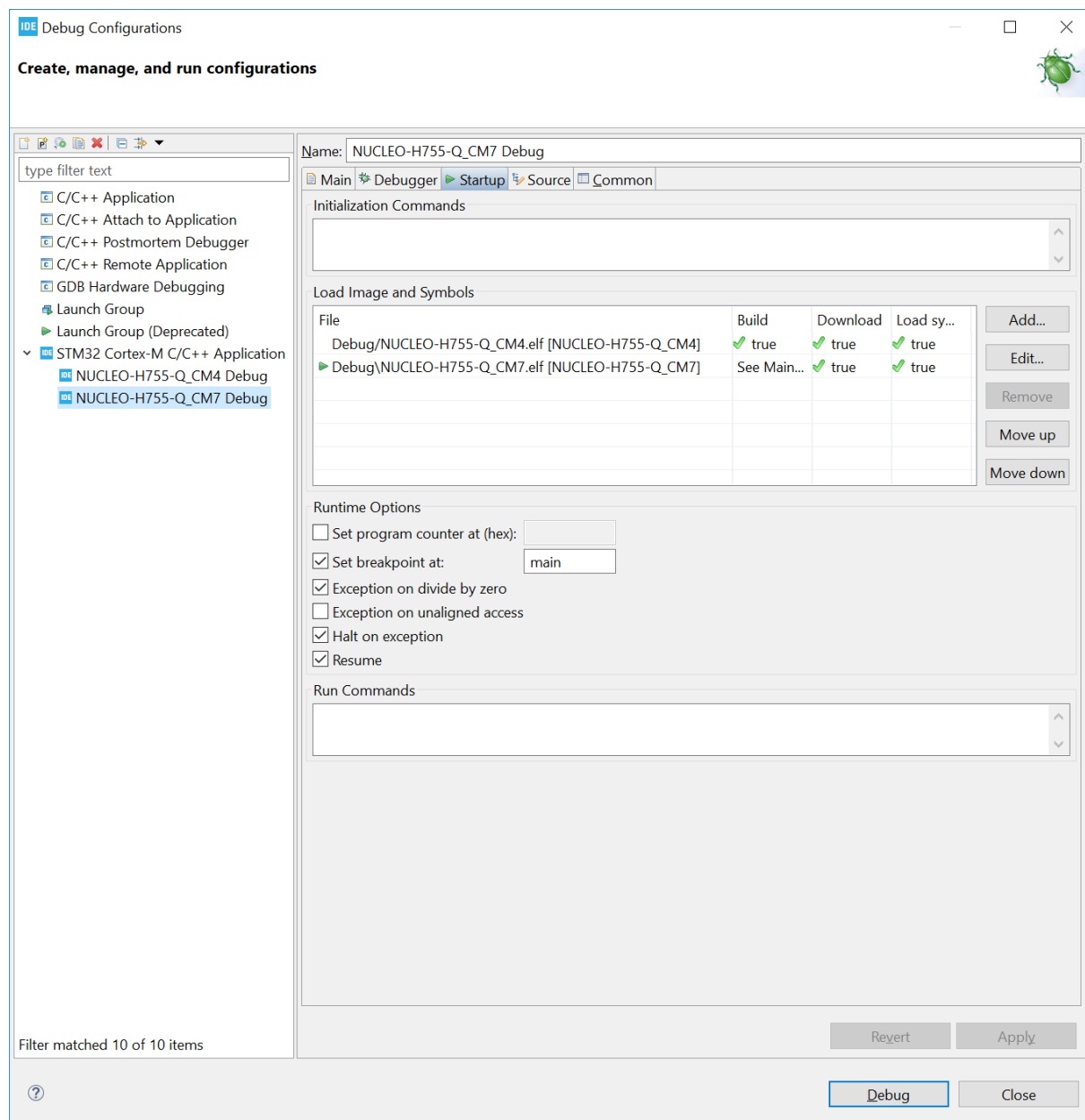
Figure 12. ST-LINK GDB server debug configuration (2 of 6)



Startup tab - Cortex®-M7

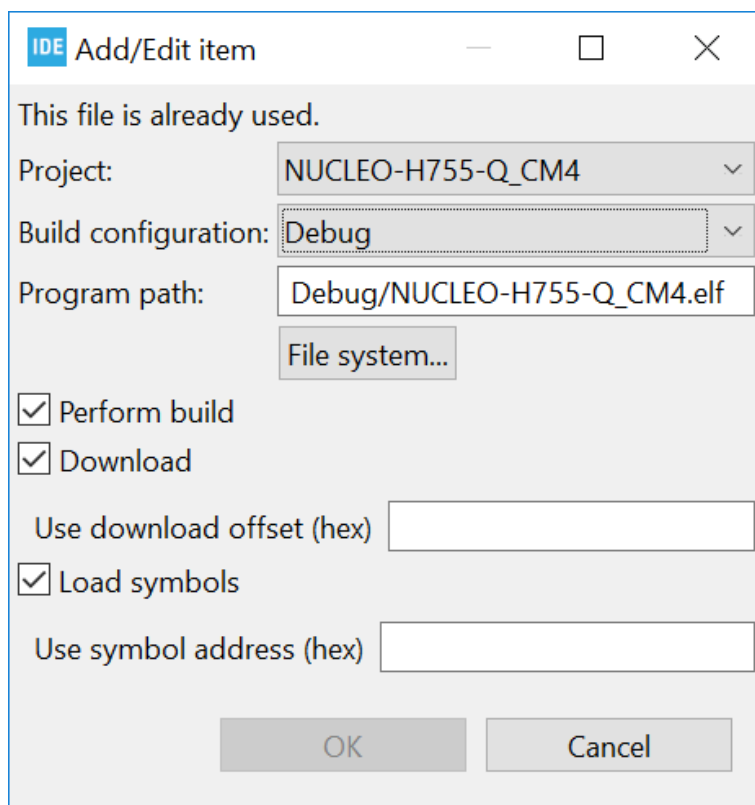
The Cortex®-M7 debug configuration is responsible for loading both the Cortex®-M7 and Cortex®-M4 images. Go to the *Startup* tab to do this as shown in Figure 13:

Figure 13. ST-LINK GDB server debug configuration (3 of 6)



To also download the Cortex®-M4 image, click **[Add...]**, browse the correct project and build the configuration. The result is shown in [Figure 14](#).

Figure 14. ST-LINK GDB server debug configuration (4 of 6)



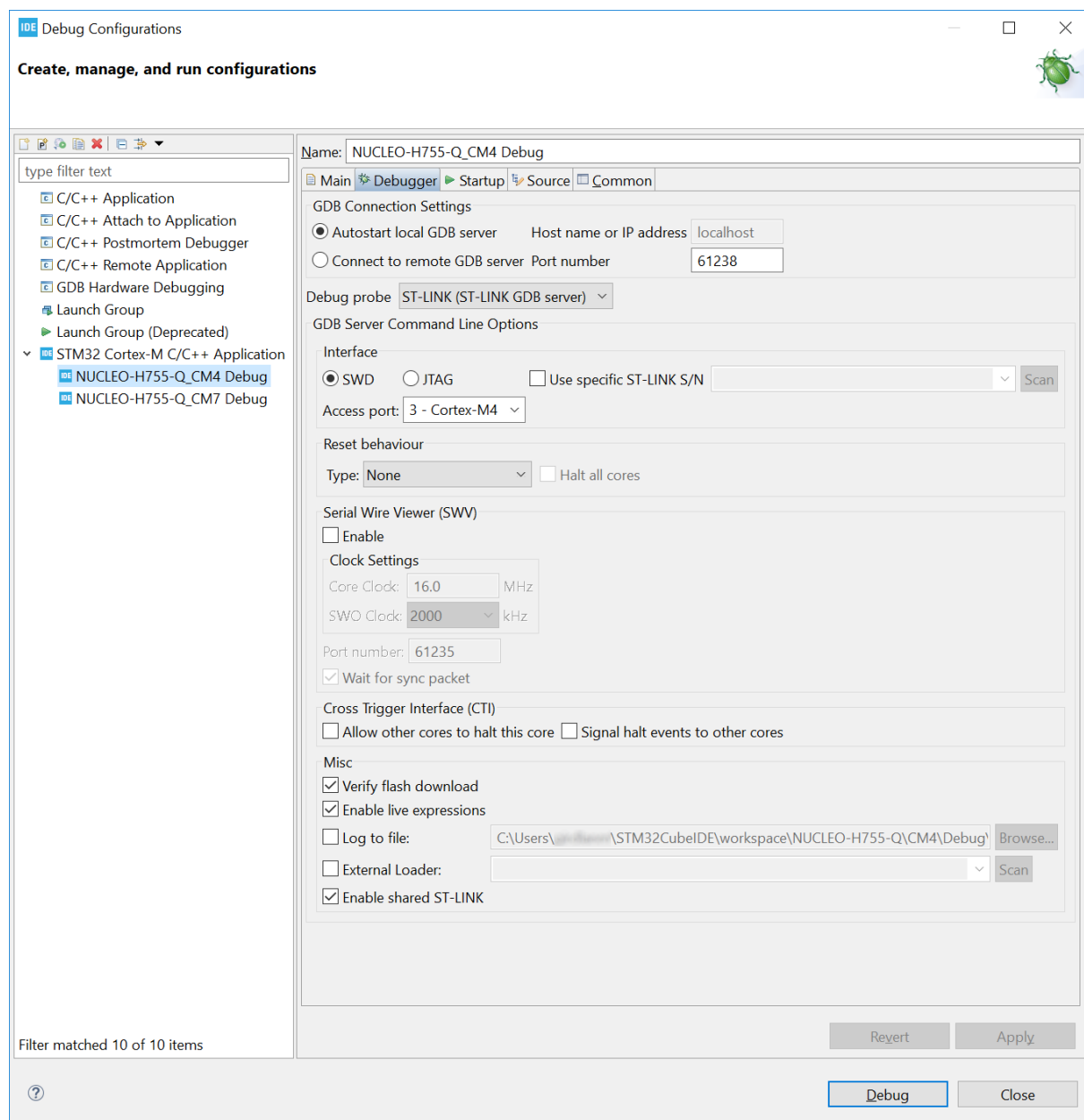
The order in the load list is very important. The last entry in the list, marked by a green arrow (refer to [Figure 13](#), is the image debugged with this debug configuration; Consequently, the debugger fetches the program counter value (PC) from this image.

Startup tab - Cortex®-M4

As shown in Figure 15:

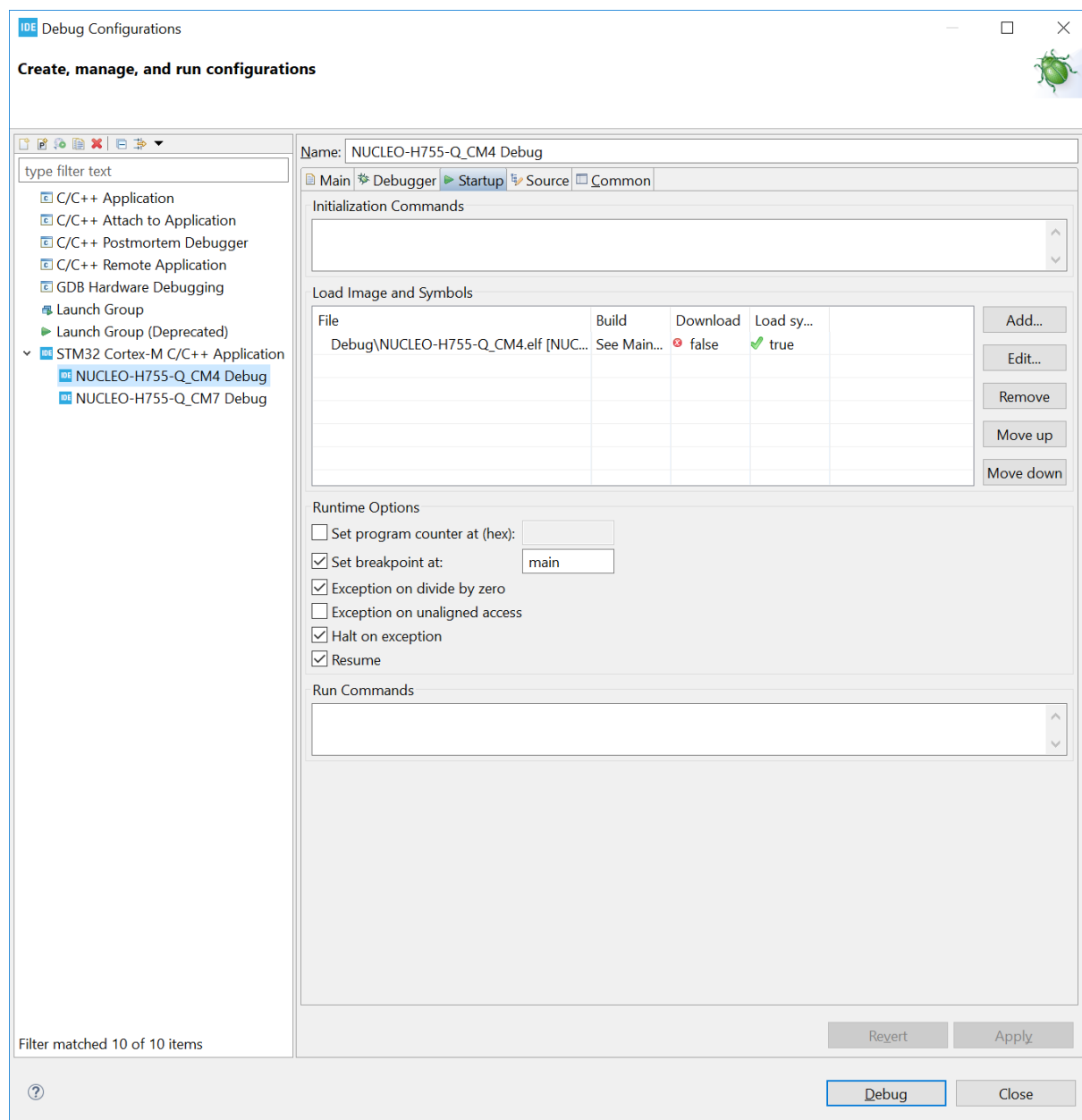
- Make sure that the *Port number* exceeds the value of the previous debug configuration by at least 3 (61238 in this example)
- Select 3 – Cortex-M4 for [Access port]
- Select None for [Reset behaviour]
- Select *Enable shared ST-LINK*

Figure 15. ST-LINK GDB server debug configuration (5 of 6)



Go to the *Startup* tab and select **[Edit...]>[Disable Download]**. This is required since the download is already performed by the Cortex[®]-M7 configuration (refer to [Figure 16](#)).

Figure 16. ST-LINK GDB server debug configuration (6 of 6)

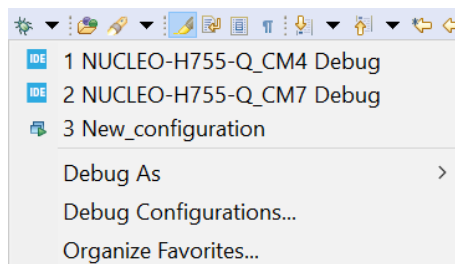


The configuration is complete.

3.1.1 Launching the configurations

1. Launch the Cortex[®]-M7 configuration to download both the Cortex[®]-M4 and Cortex[®]-M7 images
2. Set the Cortex[®]-M7 core running so that the HSEM semaphore is released and Cortex[®]-M4 wakes up from Stop mode
3. Launch the Cortex[®]-M4 configuration using the arrow next to the debug icon. It is in the running mode and the user can halt it.

Figure 17. ST-LINK GDB server debug configuration launch

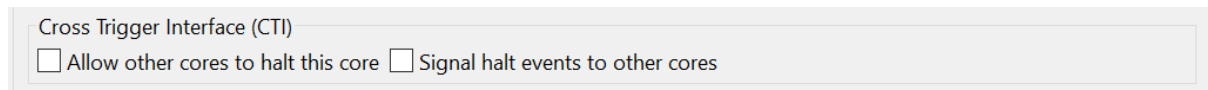


3.1.2 Cross-trigger Interface

The cross-trigger interface is used to send halt signals from one core to the other. To enable the Cortex[®]-M4 to halt the Cortex[®]-M7, apply the following configuration:

- In the Cortex[®]-M4 debug configuration: select *Signal halt events to other cores*
- In the Cortex[®]-M7 debug configuration: select *Allow other cores to halt this core*

Figure 18. ST-LINK GDB server debug cross-trigger interface

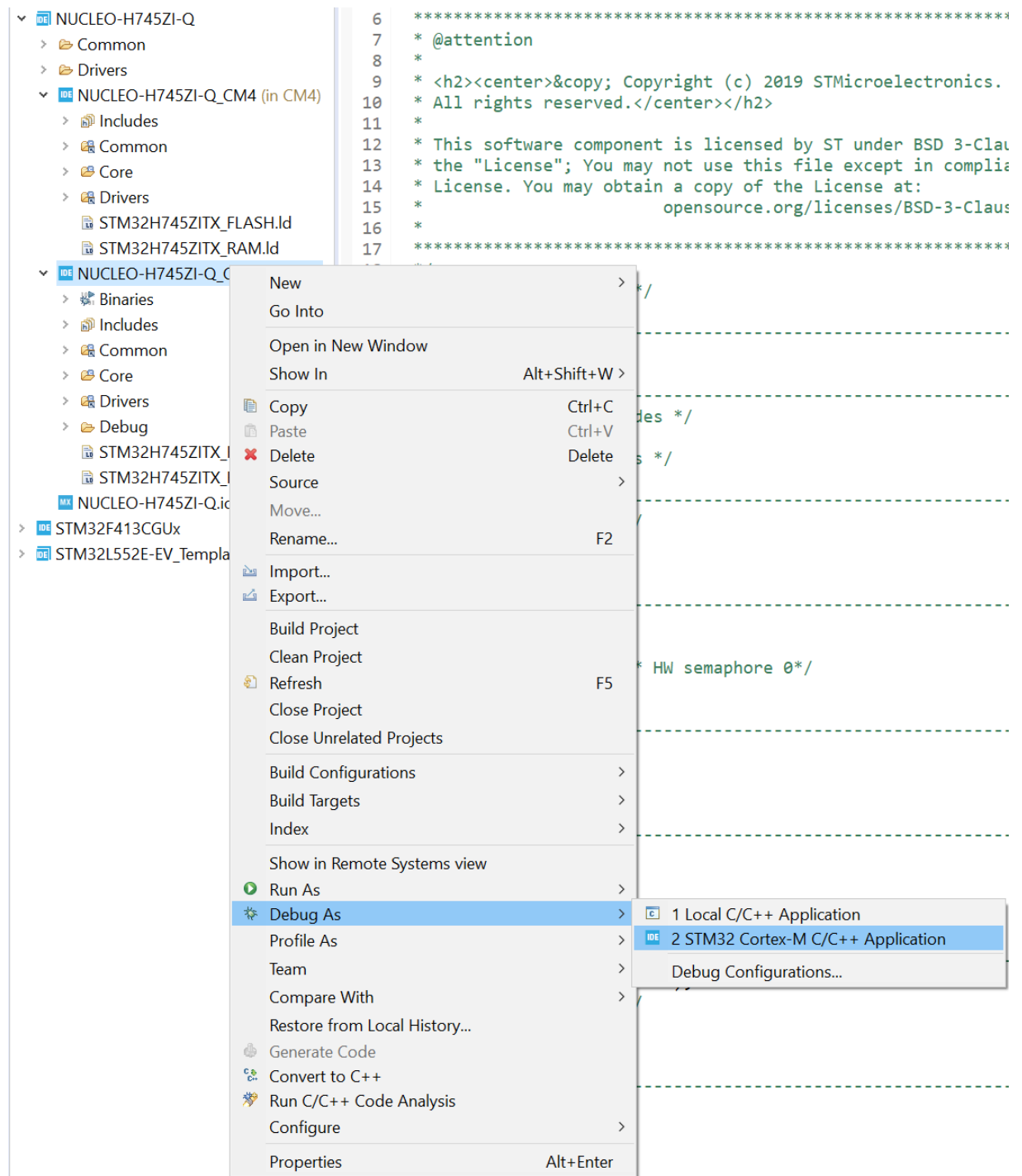


Note: Checking both checkboxes in both debug configurations enable both cores to halt each other.

3.2 Setting up with OpenOCD

To start configuring the launch of the debug session, right click the sub-project (in this example, the Cortex®-M7) and select **[Debug As]>[STM32 Cortex-M C/C++ Application]** as shown in Figure 19.

Figure 19. OpenOCD debug configuration (1 of 3)

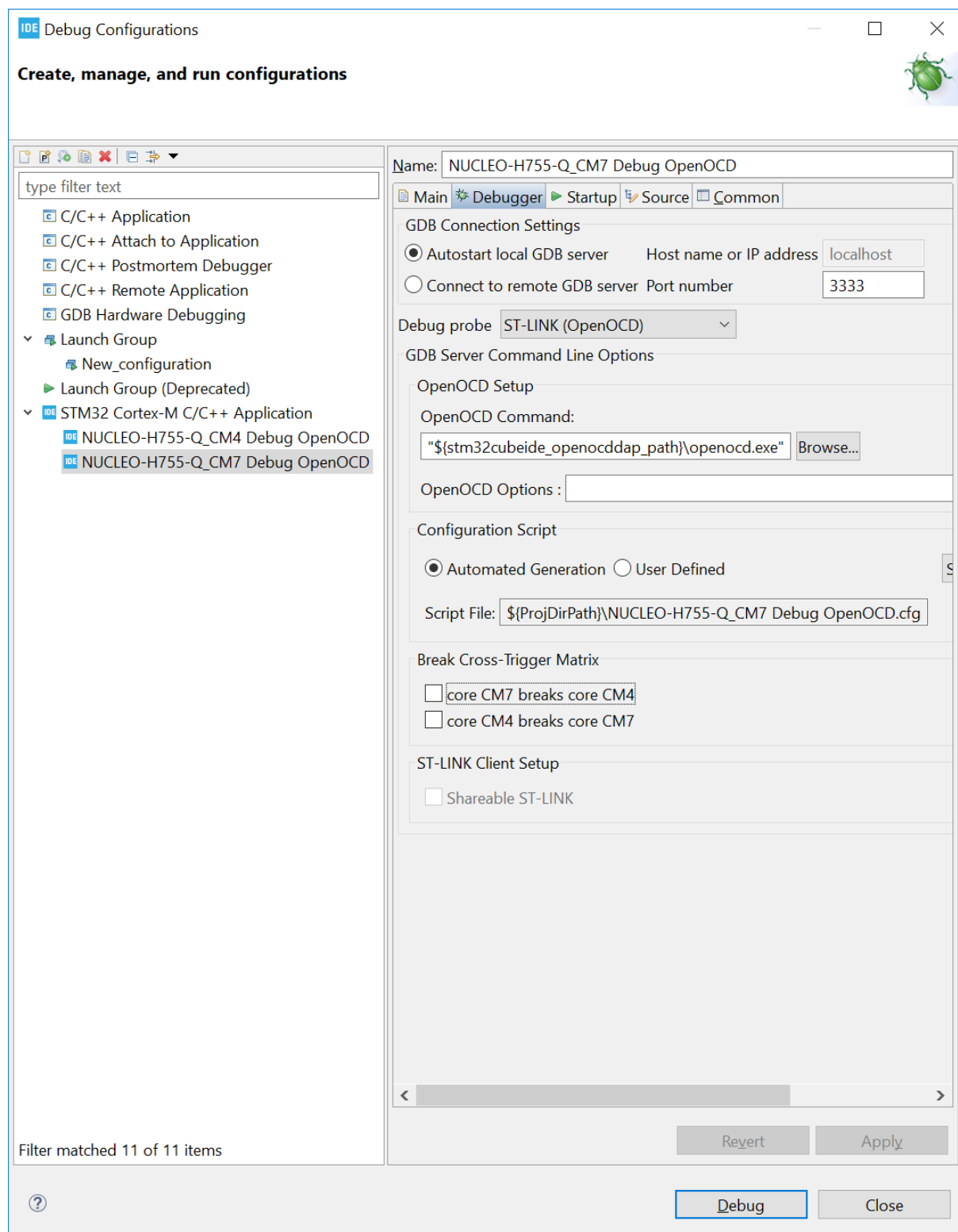


Note: Make sure, when using [STM32CubeIDE v1.1.0](#), that the Cortex®-M7 launches the Cortex®-M4. This limitation does not apply to later versions.

Note: For the rest of this section, examples are based on the NUCLEO-H755ZI-Q board or STM32H757 microcontrollers.

Select **ST-LINK (OpenOCD)** as the **[Debug probe]**. Select **Autostart local GDB server** for the configuration that launches first, which is the Cortex®-M7 in the example in [Figure 20](#).

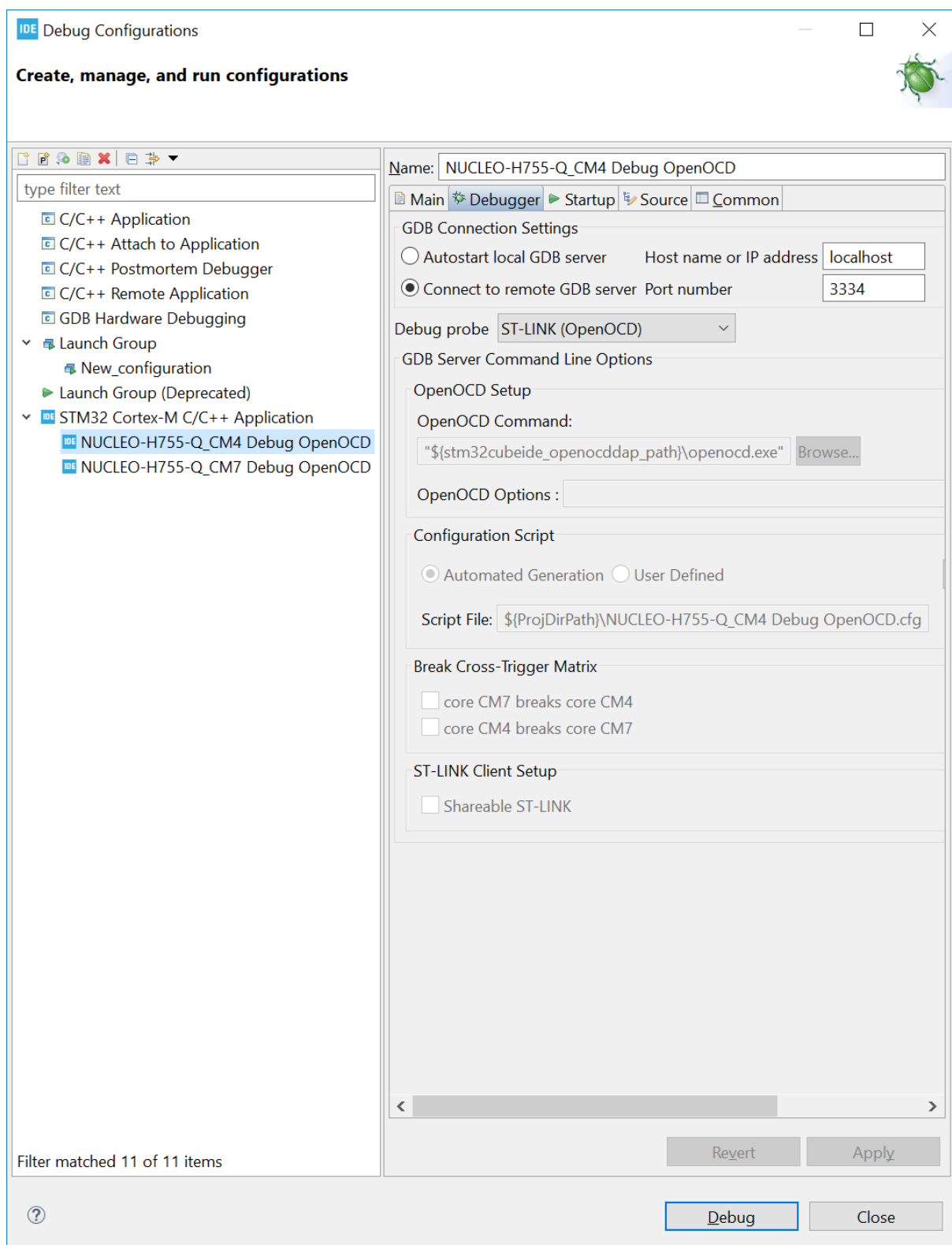
Figure 20. OpenOCD debug configuration (2 of 3)



Create the debug configuration for the other core, which is the Cortex[®]-M4 in the example in [Figure 21](#):

- Select *ST-LINK (OpenOCD)* as the **[Debug probe]**
- Select *Connect to remote GDB server*
- Make sure that the *Port number* exceeds the value of the previous debug configuration by at least 1 (3334 in this example)

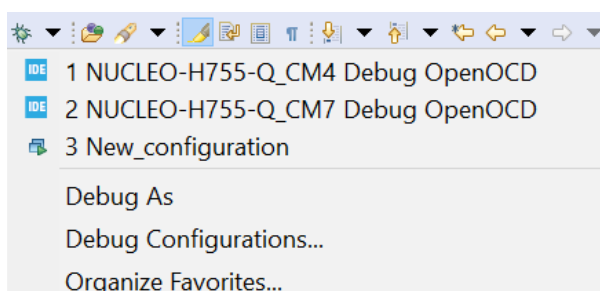
Figure 21. OpenOCD debug configuration (3 of 3)



3.2.1 Launching the configurations

After both debug configurations are set up, save them and click on the arrow next to the debug icon to make sure launching the autostarting local GDB server first (the Cortex[®]-M7 in this example). After this first launch, click on the same arrow again and launch the other configuration.

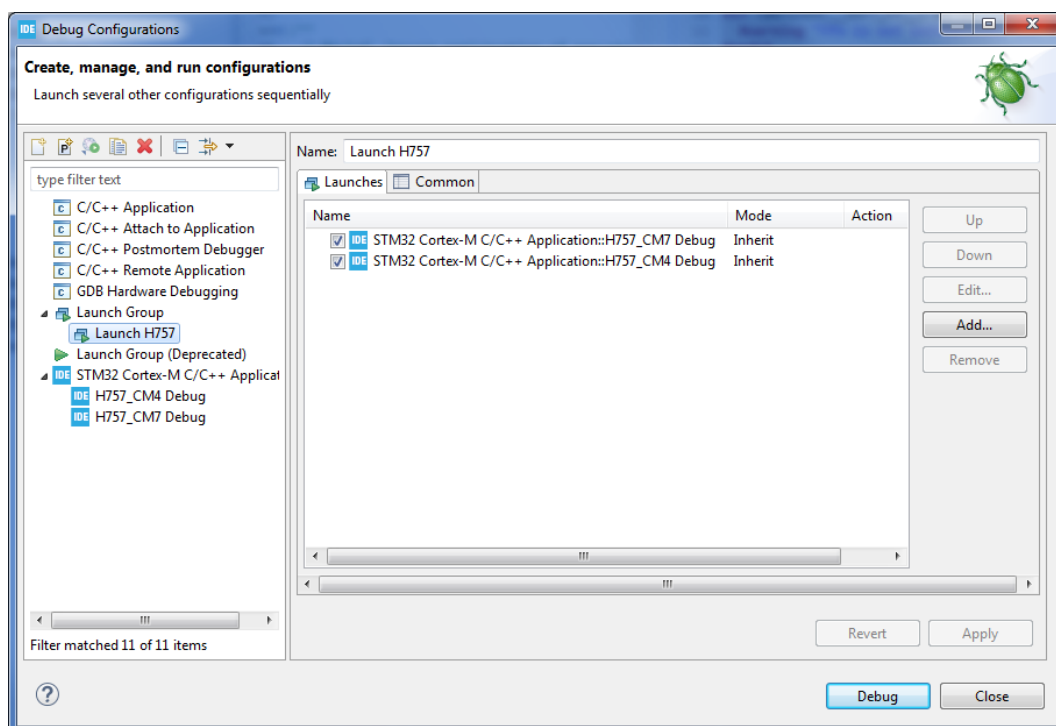
Figure 22. OpenOCD debug configuration launch



When debugging an STM32H7 device with OpenOCD, it is possible to create a launch group, which offers the following advantages:

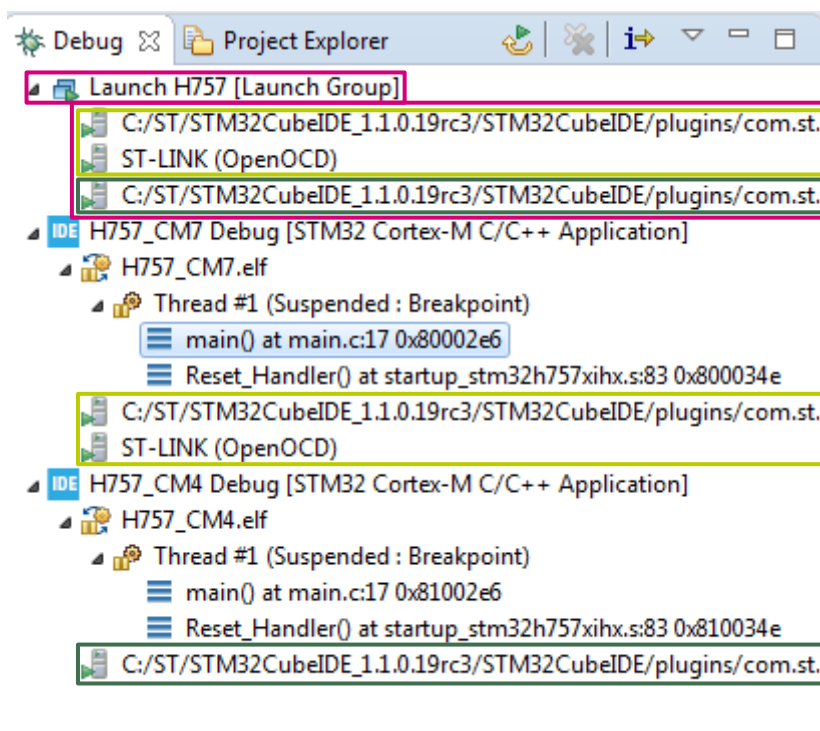
- The user can launch the debug session on both cores with only one launch configuration.

Figure 23. Launch OpenOCD debug on both cores



- The user can stop both cores using the launch group. This avoids having to manually terminate both debug sessions individually. In Figure 24, the launch group in pink handles each of the cores in green.

Figure 24. Stop OpenOCD debug on both cores



3.2.2 Cross-trigger interface

The cross-trigger matrix is configurable in the debug configuration of the core that launches OpenOCD. Contrary to the ST-LINK GDB server, there is only one instance of OpenOCD for both cores. This makes it possible to configure the cross-trigger matrix from just one of the debug configurations (refer to section *Break Cross-Trigger Matrix* in Figure 25). There are three possible configurations:

- Each core breaks all cores
- Only one core can break the other
- No core breaks any other

Figure 25. OpenOCD debug cross-trigger interface

The screenshot shows a configuration window titled "H757_CM7 Debug". It has tabs for "Main", "Debugger", "Startup", "Source", and "Common". The "Debugger" tab is active. Under "GDB Connection Settings", "Autostart local GDB server" is selected with "localhost" as the host and "3333" as the port. "Connect to remote GDB server" is unselected. The "Debug probe" is set to "ST-LINK (OpenOCD)". Under "GDB Server Command Line Options", the "OpenOCD Setup" section shows the "OpenOCD Command" as "\${stm32cubeide_openocddap_path}\openocd.exe" and "OpenOCD Options" as an empty field. The "Configuration Script" section has "Automated Generation" selected, with a "Script File" of "\${ProjDirPath}\H757_CM7 Debug.cfg". The "Break Cross-Trigger Matrix" section, highlighted with a red box, contains two checkboxes: "core CM7 breaks core CM4" (checked) and "core CM4 breaks core CM7" (unchecked). The "ST-LINK Client Setup" section at the bottom has "Shareable ST-LINK" unchecked.

Revision history

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21-Nov-2019	1	Initial release.

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